

**TEST REPORT CONCERNING THE COMPLIANCE OF A
DIGITAL TRANSMISSION SYSTEM OPERATING IN THE
FREQUENCY BAND 2400 – 2483.5 MHz,
BRAND TRIMBLE, MODEL RC603**

**WITH 47 CFR PART 15 (10-1-09 Edition)) AND THE
REQUIREMENTS OF INDUSTRY CANADA:
RSS-GEN (ISSUE 3, DECEMBER 2010) AND
RSS-210 (ISSUE 8, DECEMBER 2010).**

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June 20, 2012**

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VCCI Registered : R-1518, C-1598
R&TTE, LVD, EMC Notified Body : 1856

**TUV Rheinland EPS B.V.
P.O. Box 37
9350 AA Leek (NL)
Eiberkamp 10
9351 VT Leek (NL)**

Telephone: +31 594 505005
Telefax: +31 594 504804

Internet: <http://www.tuv-eps.com>
E-mail: info@tuv-eps.com

MEASUREMENT/TECHNICAL REPORT

Trimble Germany GmbH
Model : RC603

FCC ID: PWR-RC60X
IC: 4131A-RC60X

This report concerns: Original grant/certification Class 2 change Verification	
Equipment type: Part 15 Low Power Communication Device Transmitter	
Report prepared by:	Name : Onno Hoekstra Company name : TÜV Rheinland EPS B.V. Address : Eiberkamp 10 Postal code/city : 9351 VT Leek (NL) Mailing address : P.O. Box 37 Postal code/city : 9350 AA Leek (NL) Country : The Netherlands Telephone number : + 31 594 505 005 Telefax number : + 31 594 504 804 E-mail : info@tuv-eps.com

The data taken for this test and report herein was done in accordance with 47 CFR Part 15 (10-1-09 Edition), RSS-GEN, RSS-210 and the measurement procedures of ANSI C63.4-2009. TÜV Rheinland EPS B.V. at Leek, The Netherlands, certifies that the data is accurate and contains a true representation of the emission profile of the Equipment Under Test (EUT) on the date of the test as noted in the test report. I have reviewed the test report and find it to be an accurate description of the test(s) performed and the EUT so tested.

Date: June 20, 2012

Signature:



R. van der Meer
Test Engineer TÜV Rheinland EPS B.V.

Summary

The device under test does:

- fulfill the general approval requirements as identified in this test report
- not fulfill the general approval requirements as identified in this test report

Description of test item

Test item : Digital Transmission System operating in the range 2400-2483.5 MHz
Manufacturer : Trimble Germany GmbH
Brand : Trimble
Model(s) : RC603
Serial number(s) : n.a.
Revision : n.a.
FCC ID : PWR-RC60X
IC : 4131A-RC60X

Applicant information

Applicant's representative : Mr. U. Ohler
Company : Trimble Germany GmbH
Address : Am Sportplatz 5
Postal code : 67661
City : Kaiserslautern
Country : Germany
Telephone number : +49 (0)6301 7114 52
Telefax number : +49 (0)6301 32213
Email : info@trimble.com

Test(s) performed

Location : Leek
Test(s) started : April 25, 2012
Test(s) completed : May 1, 2012
Purpose of test(s) : Equipment Authorization (Original grant/certification)

Test specification(s) : 47 CFR Part 15 (10-1-09 Edition) and
RSS-GEN (ISSUE 3, DECEMBER 2010) AND
RSS-210 (ISSUE 8, DECEMBER 2010)

Test engineer(s) : O.H. Hoekstra

Report written by : O.H. Hoekstra



Report date : June 20, 2012

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The test results relate only to the item(s) tested.

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1 General information.

1.1 Product description.

1.1.1 Introduction.

The Digital Transmission System, brand Trimble, model RC603 (hereafter referred to as EUT), is designed to operate in the 2.4 GHz frequency band (2400 MHz to 2483.5 MHz). It has 3 working frequencies: 2408 MHz, 2416 MHz and 2424 MHz. It is a hand-held radio remote control for a Laser Slope Reference Meter, that allows you to send operational commands to the laser from a remote location.

The content of this report and measurement results have not been changed other than the way of presenting the data.

1.2 Related submittal(s) and/or Grant(s).

1.2.1 General.

This test report supports the original grant/certification in equipment authorization files under FCC ID: PWR-RC60X and IC: 4131A-RC60X.

1.3 Tested system details.

Details and an overview of the system and all of its components, as it has been tested, may be found below.

Test item	:	Radio remote control
Manufacturer	:	Trimble Germany GmbH
Brand	:	Trimble
Models	:	RC603
Serial number	:	n.a.
Voltage input rating	:	2.0 to 4.0 Vdc
Antenna	:	Internal
Remarks	:	--



Figure 1. EUT

1.3.1 Description of input and output ports.

No input and output ports.

1.4 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (10-1-09 Edition), sections 15.31, 15.109, 15.207, 15.209 and 15.249, RSS-GEN (ISSUE 3, DECEMBER 2010) RSS-210 (ISSUE 8, DECEMBER 2010)..

The test methods, which have been used, are based on ANSI C63.4: 2009.

Radiated emission tests above 30 MHz were performed at a measurement distance of 3 meters.
Radiated emission tests below 30 MHz were performed at a measurement distance of 3 meters.

The receivers are switching automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. The antenna factors are programmed in the test receiver. The receiver automatically calculates the appropriate correction factor for the utilized antenna and also the appropriate antenna factor for the cable loss. The total correction is automatically added to the measured value.

1.5 Test facility.

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland EPS B.V., located in Leek, 9351 VT TL Eiberkamp 10, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948 (10-1-06 edition).

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 90828. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The description of the test facilities has been filed to Industry Canada under registration number 2932G-1. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

1.6 Test conditions.

Normal test conditions:

Temperature (*)	: +15°C to +35°C
Relative humidity(*)	: 20 % to 75 %
Supply voltage	: Internal batteries
Air pressure	: 950 – 1050 hPa

When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately.

2 System test configuration.

2.1 Justification.

The system was configured for testing in a typical situation as a customer would normally use it.

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.4: 2009.

2.2 EUT mode of operation.

The EUT has been tested while connected to the Laser Slope Reference Meter, continuously transmitting and receiving messages in a test mode intended for testing the radio link. The intentional radiator tests have been performed with a complete functioning EUT and interconnections and AUX1 connected and operational.

2.3 Special accessories.

No special accessories are used and/or needed to achieve compliance.

2.4 Equipment modifications.

No modifications have been made to the equipment in order to achieve compliance.

2.5 Product Labeling

The product labeling information is available in the technical documentation package.

2.6 Block diagram of the EUT.

The block diagram is available in the technical documentation package.

2.7 Schematics of the EUT.

The schematics are available in the technical documentation package.

2.8 Part list of the EUT.

The part list is available in the technical documentation package.

3 Radiated emission data.

3.1 Radiated field strength measurements Receive mode (frequency range 30 MHz – 25 GHz, E-field), Average (Av), Quasi Peak (QP) and Peak (Pk) values

3.1.1 Radiated field strength measurements (frequency range 30 MHz – 25 GHz, E-field), EUT's RX Frequency 2408 MHz

Frequency (MHz)	Measurement results @3m Vertical (dBµV)	Measurement results @3m Horizontal (dBµV)	Detector	Correction factor (dB)	Results after correction Vertical (dBµV/m)	Results after correction Horizontal (dBµV/m)	Limits @3m (dBµV/m)	Pass /Fail
45.0	-5.1	-5.2	QP	10.7	5.6	5.5	40.0	Pass
200.0	-5.4	-5.4	QP	10.1	4.7	4.7	43.5	Pass
800.0	-4.3	-4.7	QP	25.3	21.0	20.6	46.0	Pass
1377.0	-0.6	5.5	Pk	25.0	24.4	30.5	54	Pass
2754.0	10.3	19.4	Pk	29.2	39.5	48.6	54	Pass

Table 1a Radiated emissions of the EUT at 2408 MHz Av, QP and Pk levels

See notes on page 10.

3.1.2 Radiated field strength measurements (frequency range 30 MHz – 25 GHz, E-field), EUT's RX Frequency 2416 MHz

Frequency (MHz)	Measurement results @3m Vertical (dBµV)	Measurement results @3m Horizontal (dBµV)	Detector	Correction factor (dB)	Results after correction Vertical (dBµV/m)	Results after correction Horizontal (dBµV/m)	Limits @3m (dBµV/m)	Pass /Fail
45.0	-5.1	-5.2	QP	10.7	5.6	5.5	40.0	Pass
200.0	-5.4	-5.4	QP	10.1	4.7	4.7	43.5	Pass
800.0	-4.3	-4.7	QP	25.3	21.0	20.6	46.0	Pass
1381.8	-0.1	6.0	Pk	25.0	24.9	31.0	54	Pass
2763.6	10.7	19.5	Pk	29.2	39.9	48.7	54	Pass

Table 1b Radiated emissions of the EUT at 2416 MHz Av, QP and Pk levels

See notes on page 10.

**3.1.3 Radiated field strength measurements (frequency range 30 MHz – 25 GHz, E-field),
EUT's RX Frequency 2424 MHz**

Frequency (MHz)	Measurement results @3m Vertical (dBµV)	Measurement results @3m Horizontal (dBµV)	Detector	Correction factor (dB)	Results after correction Vertical (dBµV/m)	Results after correction Horizontal (dBµV/m)	Limits @3m (dBµV/m)	Pass /Fail
45.0	-5.1	-5.2	QP	10.7	5.6	5.5	40.0	Pass
200.0	-5.4	-5.4	QP	10.1	4.7	4.7	43.5	Pass
800.0	-4.3	-4.7	QP	25.3	21.0	20.6	46.0	Pass
1386.5	0.2	6.1	Pk	25.0	25.2	31.1	54	Pass
2773.0	10.8	19.7	Pk	29.2	40.0	48.9	54	Pass

Table 1c Radiated emissions of the EUT at 2424 MHz Av, QP and Pk levels

See notes on page 10.

The results (Quasi Peak and Average values) of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.109 and RSS-GEN (ISSUE 3, DECEMBER 2010) with the EUT operating in receive mode are depicted in Table 1a,1b and 1c.

Notes:

1. Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.
2. The peak levels of the emissions are far below the average limits. Therefore, only peak measurements of the emissions have been performed.
3. Measurement uncertainty is ± 5.0 dB
4. The reported field strength values are the worst case values at the indicated frequency. The EUT was varied in three positions, the antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
5. The EUT was tested on the lowest frequency (2408 MHz), a middle frequency (2416 MHz) and the highest frequency (2424 MHz) in the 2408 – 2424 MHz band wherein it operates.
6. A Quasi-peak detector was used with a resolution bandwidth of 120 kHz, except for frequencies above 1000 MHz where an Average detector and Peak detector was used with a resolution bandwidth of 1 MHz.

3.1.4 Test equipment used (for reference see test equipment listing).

15633	15667	99606	99608	99609	99733	99734
99742	99847	99852	99855	99858	99861	

Test engineer

Signature :



Name : O.H. Hoekstra

Date : May 1, 2012

3.2 Radiated field strength measurements Transmit mode (frequency range 30 MHz – 25 GHz, E-field), Average (Av), Quasi Peak (QP) and Peak (Pk) values

3.2.1 Radiated field strength measurements (frequency range 30 MHz – 25 GHz, E-field), EUT's TX Frequency 2408 MHz

Frequency (MHz)	Measurement results @3m Vertical (dBµV)	Measurement results @3m Horizontal (dBµV)	Detector	Correction factor (dB)	Results after correction Vertical (dBµV/m)	Results after correction Horizontal (dBµV/m)	Limits @3m (dBµV/m)	Pass /Fail
45.0	-5.1	-5.2	QP	10.7	5.6	5.5	40.0	Pass
200.0	-5.4	-5.4	QP	10.1	4.7	4.7	43.5	Pass
800.0	-4.3	-4.7	QP	25.3	21.0	20.6	46.0	Pass
2408 (fundamental)	64.6	65.1	Av	28.5	93.1	93.6	94	Pass
2408 (fundamental)	64.9	65.4	Pk	28.5	93.4	93.9	114	Pass
4816 (h)	14.8	16.1	Pk	33.8	48.6	49.9	54	Pass
7224 (h)	16.7	17.6	Av	36.0	52.7	53.6	54	Pass
7224 (h)	21.8	22.7	Pk	36.0	57.8	58.7	74	Pass
9632 (h)	10.6	13.5	Pk	37.5	48.1	51.0	54	Pass
12040 (h)	4.0	4.0	Pk	39.3	43.3	43.3	54	Pass
14448 (h)	5.0	5.0	Pk	40.0	45.0	45.0	54	Pass
16856 (h)	8.0	8.0	Pk	41.3	49.3	49.3	54	Pass

Table 2a Radiated emissions of the EUT at 2408 MHz Av, QP and Pk levels

See notes on page 14.

**3.2.2 Radiated field strength measurements (frequency range 30 MHz – 25 GHz, E-field),
 EUT's TX Frequency 2416 MHz**

Frequency (MHz)	Measurement results @3m Vertical (dB μ V)	Measurement results @3m Horizontal (dB μ V)	Detector	Correction factor (dB)	Results after correction Vertical (dB μ V/m)	Results after correction Horizontal (dB μ V/m)	Limits @3m (dB μ V/m)	Pass /Fail
45.0	-5.1	-5.2	QP	10.7	5.6	5.5	40.0	Pass
200.0	-5.4	-5.4	QP	10.1	4.7	4.7	43.5	Pass
800.0	-4.3	-4.7	QP	25.3	21.0	20.6	46.0	Pass
2416 (fundamental)	64.6	65.1	Av	28.5	93.1	93.6	94	Pass
2416 (fundamental)	64.9	65.4	Pk	28.5	93.4	93.9	114	Pass
4832 (h)	12.9	15.8	Pk	33.8	46.7	49.6	54	Pass
7248 (h)	15.2	17.6	Av	36.0	51.2	53.6	54	Pass
7248 (h)	20.3	22.7	Pk	36.0	56.3	58.7	74	Pass
9664 (h)	8.9	14.2	Pk	37.5	46.4	51.7	54	Pass
12080 (h)	4.0	4.0	Pk	39.3	43.3	43.3	54	Pass
14496 (h)	5.0	5.0	Pk	40.0	45.0	45.0	54	Pass
16912 (h)	8.0	8.0	Pk	41.3	49.3	49.3	54	Pass

Table 2b Radiated emissions of the EUT at 2416 MHz Av, QP and Pk levels

See notes on page 14.

**3.2.3 Radiated field strength measurements (frequency range 30 MHz – 25 GHz, E-field),
 EUT's TX Frequency 2424 MHz**

Frequency (MHz)	Measurement results @3m Vertical (dBµV)	Measurement results @3m Horizontal (dBµV)	Detector	Correction factor (dB)	Results after correction Vertical (dBµV/m)	Results after correction Horizontal (dBµV/m)	Limits @3m (dBµV/m)	Pass /Fail
45.0	-5.1	-5.2	QP	10.7	5.6	5.5	40.0	Pass
200.0	-5.4	-5.4	QP	10.1	4.7	4.7	43.5	Pass
800.0	-4.3	-4.7	QP	25.3	21.0	20.6	46.0	Pass
2424 (fundamental)	64.5	64.9	Av	28.5	93.0	93.4	94	Pass
2424 (fundamental)	64.8	65.2	Pk	28.5	93.3	93.7	114	Pass
4848 (h)	14.1	14.7	Pk	33.8	47.9	48.5	54	Pass
7272 (h)	16.1	16.7	Av	36.0	52.1	52.7	54	Pass
7272 (h)	21.2	21.8	Pk	36.0	57.2	57.8	74	Pass
9696 (h)	9.0	14.2	Pk	37.5	46.5	51.7	54	Pass
12120 (h)	4.0	4.0	Pk	39.3	43.3	43.3	54	Pass
14544 (h)	5.0	5.0	Pk	40.0	45.0	45.0	54	Pass
16968 (h)	8.0	8.0	Pk	41.3	49.3	49.3	54	Pass

Table 2c Radiated emissions of the EUT at 2424 MHz Av, QP and Pk levels

See notes on page 14.

The results (Quasi Peak and Average values) of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209 and 15.249 and RSS 210 Section A2.9 with the EUT operating in transmit mode are depicted in Table 2a, 2b and 2c.

Notes:


7. Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.
8. (h) indicates harmonic component of the fundamental
9. Measurement uncertainty is ± 5.0 dB
10. The reported field strength values are the worst case values at the indicated frequency. The EUT was varied in three positions, the antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
11. The EUT was tested on the lowest frequency (2408 MHz), a middle frequency (2416 MHz) and the highest frequency (2424 MHz) in the 2408 – 2424 MHz band wherein it operates.
12. A Quasi-peak detector was used with a resolution bandwidth of 120 kHz, except for frequencies above 1000 MHz where an Average detector and Peak detector was used with a resolution bandwidth of 1 MHz.

3.2.4 Test equipment used (for reference see test equipment listing).

15633	15667	99606	99608	99609	99733	99734
99742	99847	99852	99855	99858	99861	

Test engineer

Signature :



Name : O.H. Hoekstra

Date : May 1, 2012

3.2.5 Emissions at the band edges

The plots below show compliance with the 47 CFR Part 15 section 15.209(d) and RSS 210 Section A2.9, this section requires the emissions at the 2400 and 2483.5 MHz band edges to be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209, whichever is the lower attenuation. For this application the emissions are compared to the general radiated emission limits in section 15.209 and RSS 210 Section A2.9.

Frequency (MHz)	Level Av (dBµV/m)	Limit 15.209 Av (dBµV/m)	Level Pk (dBµV/m)	Limit 15.209 Pk (dBµV/m)	Pass / Fail
2399.6	--	54	42.0	--	Pass
2483.7	--	54	40.3	--	Pass

Table 5 emissions at the band edges.

Notes:

1. The peak levels of the emissions are far below the average limits. Therefore, only peak measurements of the emissions have been performed.
2. The EUT was tested on the lowest frequency (2408 MHz) for measurements at and near the lower band edge and the highest frequency (2424 MHz) at and near the higher band edge.

3.2.6 Test equipment used (for reference see test equipment listing).

15633	15667	99606	99608	99609	99733	99734
99742	99847	99852	99855	99858	99861	

Test engineer

Signature :



Name : O.H. Hoekstra

Date : May 1, 2012

3.3 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field).

Frequency (MHz)	(a) Measurement results (dB μ V)	Detector	(b) Antenna factor	(c) Cable loss	(d) Distance Extrapolation factor	Measurement results (calculated a+b+c-d)	Limits
	3 meters		dB	dB	dB	dB(μ V)/m	dB(μ V)/m
0.170	25.1	Av	20.1	1	80	-33.8 @300m	22.96 @300m
0.240	23.0	Av	20.1	1	80	-35.9 @300m	20.00 @300m
0.329	18.9	Av	20.1	1	80	-40.0 @300m	18.88 @300m
0.401	16.4	Av	20.1	1	80	-42.5 @300m	17.86 @300m
1.420	25.3	Qp	20.7	1	40	7.0 @30m	29.5 @30m
1.588	24.8	Qp	20.7	1	40	6.5 @30m	29.5 @30m
6.032	26.6	Qp	20.5	1	40	8.1 @30m	29.5 @30m

Table 3 Radiated emissions of the EUT.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209 with the EUT operating in receive mode and continuous transmit mode are depicted in Table 3.

Notes:

1. Calculated measurement results are obtained by using the 40 dB/decade correction factor and the antenna factor and cable loss is included.
2. Frequency range:
except for a. and b. below a Quasi-Peak detector was used during testing.
 - a. 9- 90 kHz Average detector used during measurements
 - b. 110-490 kHz Average detector used during measurements
3. A resolution bandwidth of 200 Hz and 9 kHz was used during testing
4. Field strength values of radiated emissions at frequencies not listed in Table 3 are more than 20 dB below the applicable limit
5. The EUT was varied in three positions, the loop antenna was varied in horizontal and vertical orientations and also around its axis. The reported value is the worst case found at the reported frequency.
6. The EUT was tested on the lowest frequency (2408 MHz), a middle frequency (2416 MHz) and the highest frequency (2424 MHz) in the 2408 – 2424 MHz band wherein it operates. Maximum values noted.
7. Measurement uncertainty is ± 5.0 dB

3.3.1 Test equipment used (for reference see test equipment listing).

15453	15667	99070	99847			

Test engineer

Signature :



Name : O.H. Hoekstra

Date : May 1, 2012

4 Conducted emission data.

4.1 Conducted emission data of the EUT.

Not applicable as the EUT is battery powered

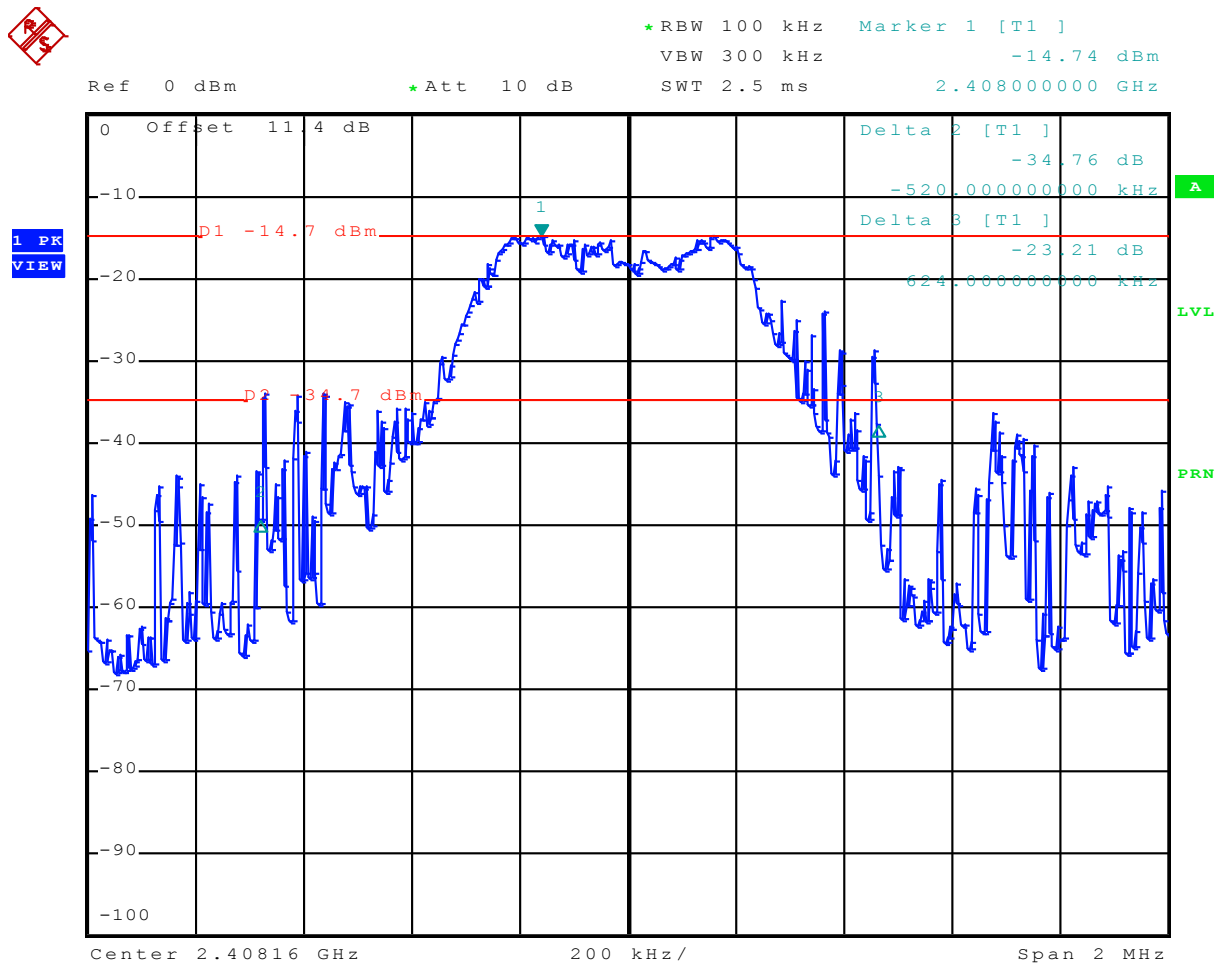
5 Plots of the emissions

5.1 Conducted emissions

Not applicable as the EUT is battery powered

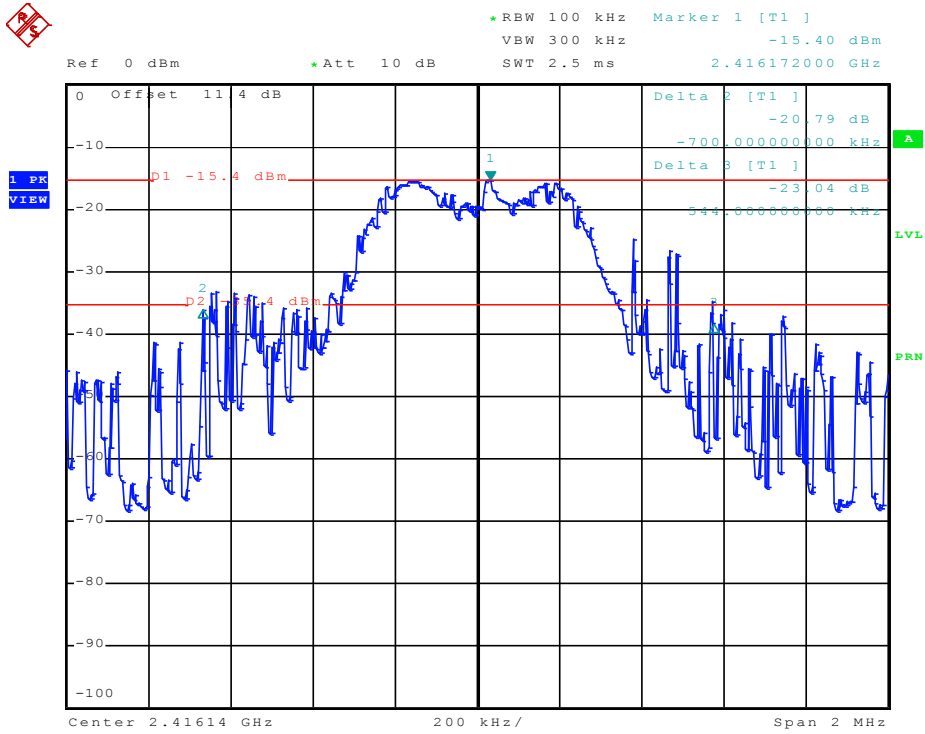
6 Bandwidth of the emission

The plots below show compliance with the 47 CFR Part 15 section 15.215(c), this section requires the 20 dB emission bandwidth is within the frequency band designated in section 15.249.



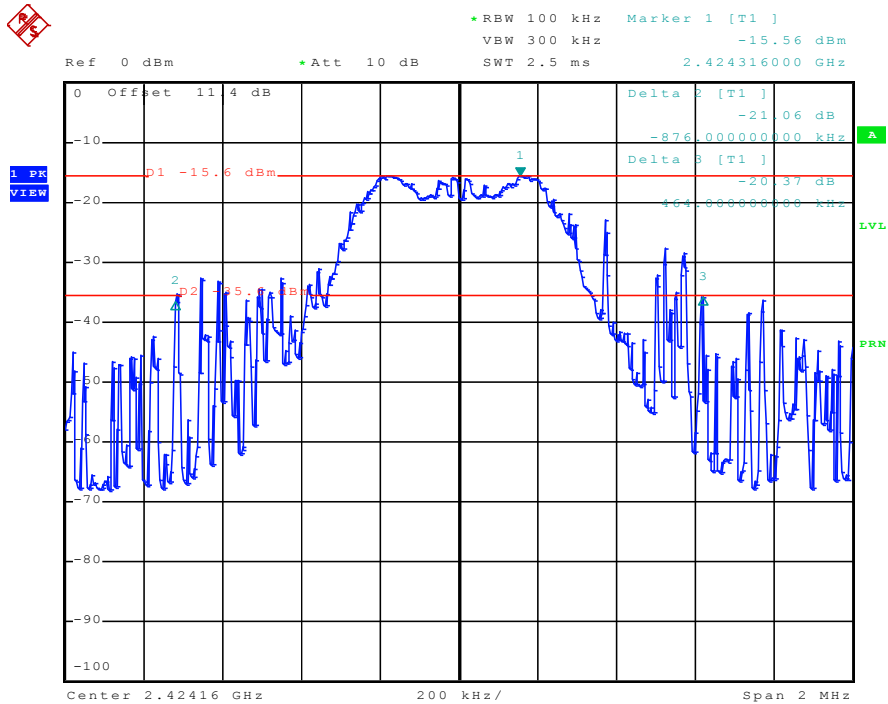
Date: 18.JUN.2012 11:45:13

Plot 1a : low channel 20 dB emission bandwidth



Date: 18.JUN.2012 11:36:27

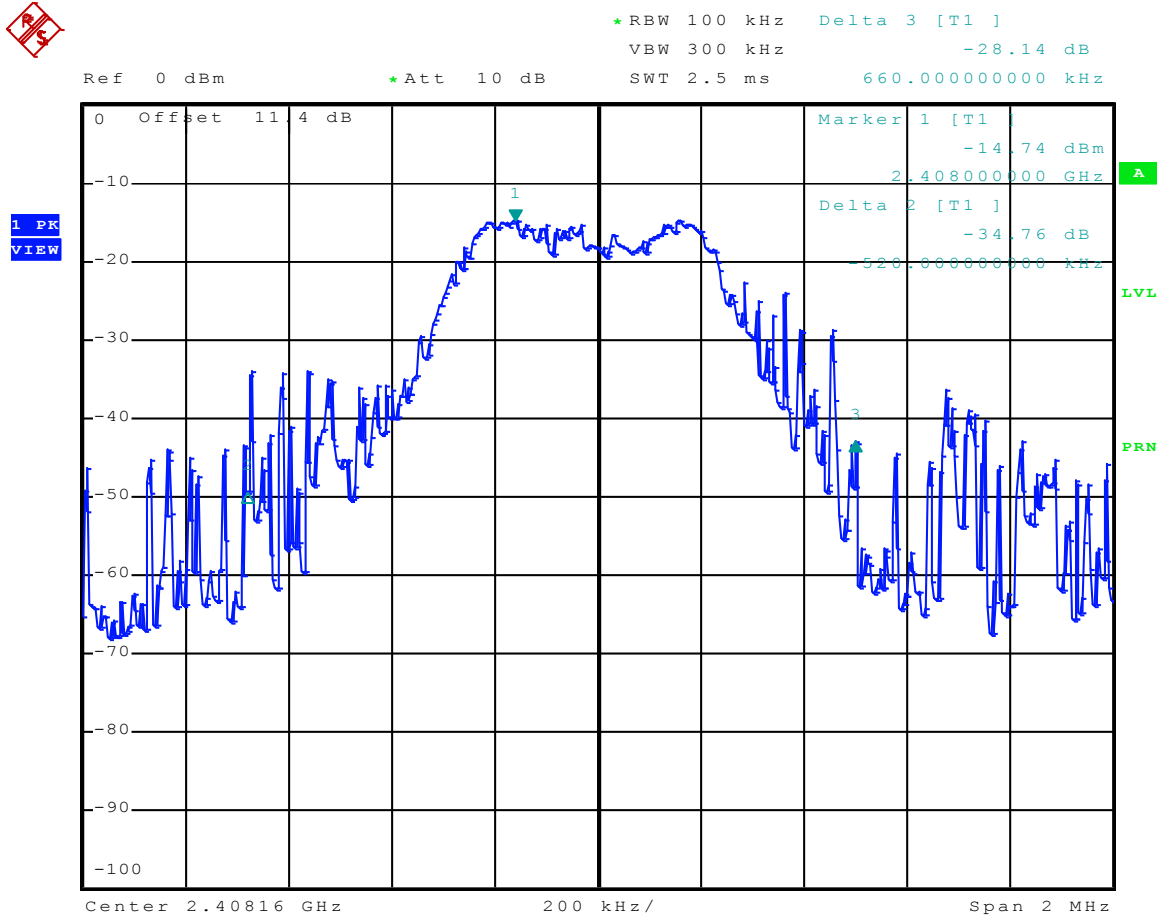
Plot 1b : mid channel 20 dB emission bandwidth



Date: 18.JUN.2012 11:50:56

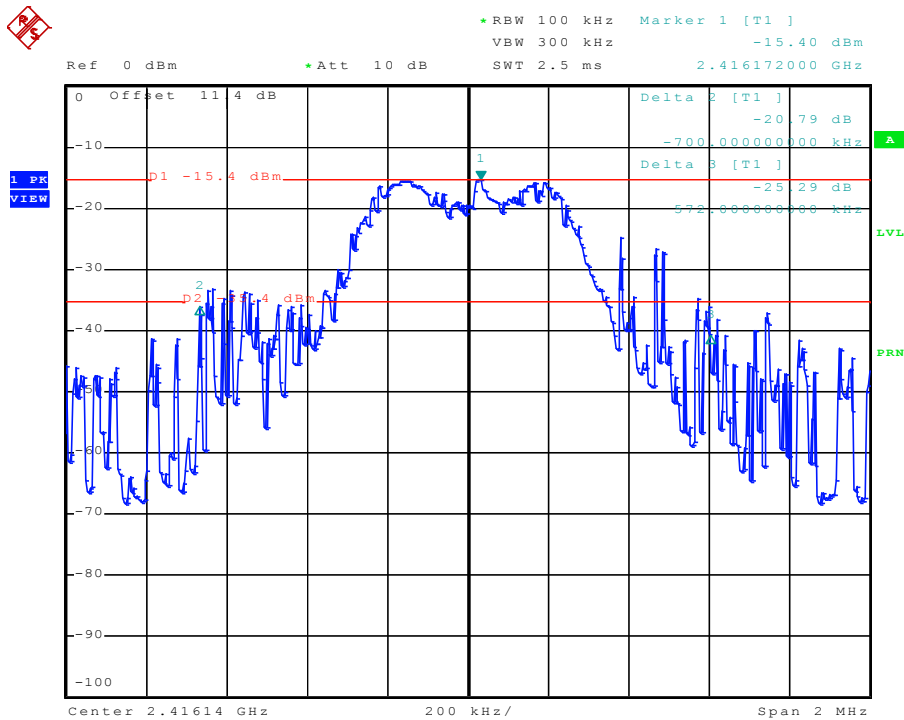
Plot 1c : high channel 20 dB emission bandwidth

The plots below show compliance with the RSS-GEN section 4.6.3, this section requires the 99% emission bandwidth is within the designated frequency band.



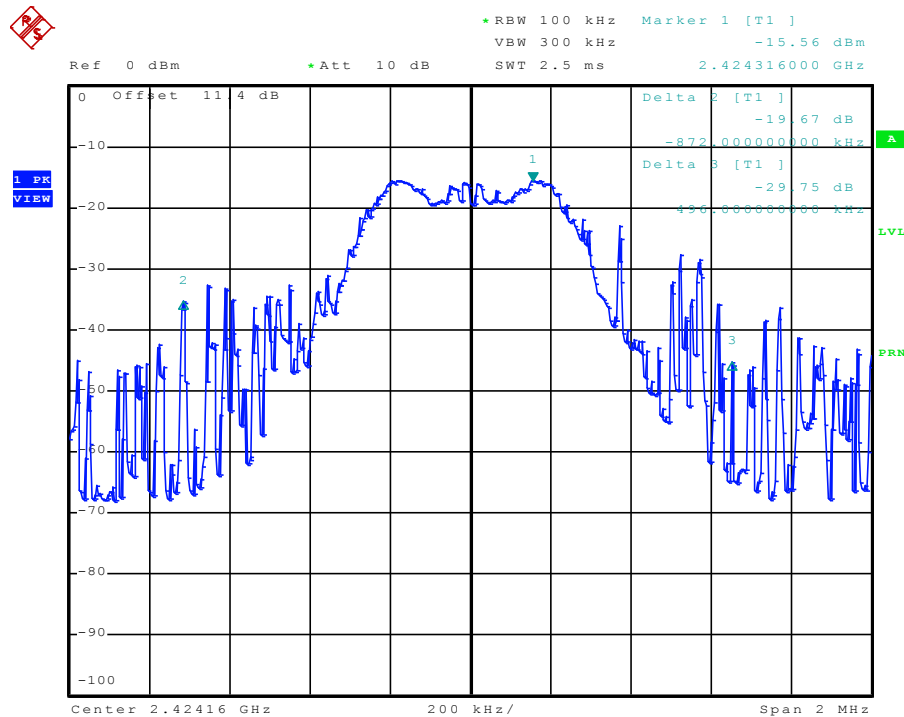
Date: 18.JUN.2012 11:46:35

Plot 2a: low channel 99% occupied bandwidth



Date: 18.JUN.2012 11:37:54

Plot 2b: mid channel 99% occupied bandwidth



Date: 18.JUN.2012 11:52:24

Plot 2c: high channel 99% occupied bandwidth

7 List of utilized test equipment.

Inventory number	Description	Brand	Model	Last cal.	Next cal.
12479	Passive loop antenna	EMCO	6509	NA	NA
12512	LISN	EMCO	3625/2	01/2012	01/2013
13313	Pulse Limiter	R&S	ESH3-Z2	02/2012	02/2013
15453	Active loopant. 60 cm	Chase	HLA6120	05/2011	05/2012
15633	Biconilog Testantenna	Chase	CBL 6111B	02/2012	02/2013
15667	Measuring receiver	R&S	ESCS30	06/2011	06/2012
99070	Coax 15m RG213	NMi Certin B.V.	Cable 15M	10/2011	10/2012
99107	Controller	Heinrich Deisel	4630-100	NA	NA
99120	DC supply 0-30V/1,2A	Voltcraft	TNG30	NA	NA
99161	Variac 250V 6A	RFT	LTS006	NA	NA
99606	Test Setup Emission	EMCS	RFS06S	10/2011	10/2012
99608	Controller	EMCS	DOC202	NA	NA
99609	Antenna mast	EMCS	AP-4702C	NA	NA
99651	Variac	NA	--	NA	NA
99733	Spectrum Analyzer	R&S	FSV30	06/2011	06/2012
99734	Cable RF	Huber + Suhner	Sucotest 18/Sucoflex 102	04/2012	04/2013
99742	Cable RF	Huber + Suhner	Sucotest 18/Sucoflex 102	04/2012	04/2013
99847	S-AR	Siepel	FCC listed: 90828	02/2012	02/2015
99852/ 99855	Humidity/Temperature Datalogger	Extech	SD500	02/2012	02/2013
99858	Cable S-AR	Gigalink	APG0500	01/2012	01/2013
99861	Controller S-AR	Maturo	SCU/088/8090811	NA	NA

NA= Not Applicable