REPORT
issued by an FCC listed Laboratory Reg. no. 93866.
The test site complies with RSS-Gen, IC file no: 3482A-2
Contact person
Martin Theorin
Electronics
+46 10 516 58 85
Martin.Theorin@sp.se

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1002 ISO/IEC 17025

Ericsson AB
Klaes Holm
PDU HW
164 80 Stockholm

Radio measurements on mRRUS 12 B4 1700/2100 MHz radio equipment with FCC ID: TA8AKRC161326 and IC: 287AB-AS161326

(9 appendices)

Test object

Product name: mRRUS 12 B4
Product number: KRC 161 326/X, see appendix 1 for details.

Summary

Standard		Compliant	Appendix
FCC CFR 47 / IC RSS-139 ISSUE 2			
2.1046 / RSS-139 6.4	RF power output conducted	Yes	2
2.1046 / RSS-139 6.4	RF power output radiated	Yes	3
2.1049 / RSS-Gen 4.6.1	Occupied bandwidth	Yes	4
2.1051 / RSS-139 6.5	Band edge	Yes	5
2.1051 / RSS-139 6.5	Spurious emission at antenna terminals	Yes	6
2.1053 / RSS-139 6.5	Field strength of spurious radiation	Yes	7
2.1055 / RSS-139 6.3	Frequency stability	Yes	8

Note: Above RSS-139 items are given as cross-reference only. Measurements were performed according to ANSI procedures referenced by FCC and covered by SP's accreditation.

SP Technical Research Institute of Sweden
Electronics - EMC

Performed by

Martin Theorin

Examined by

Christer Karlsson

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Appendix 1

Description of the test object

Equipment:	Product name: mRRUS 12 B4, supporting WCDMA Product number: KRC 161 326/1, 110-240VAC internal antenna Product number: KRC 161 326/2, -48VDC internal antenna Product number: KRC 161 326/3, 110-240VAC no internal antenna Product number: KRC 161 326/4, -48VDC no internal antenna FCC ID TA8AKRC161326 IC 287AB-AS161326 IC model numbers: IC MODEL NO: AS1613261 IC MODEL NO: AS1613262 IC MODEL NO: AS1613263 IC MODEL NO: AS1613264	
Antenna ports:	2 TX/RX ports	
RF configurations:	Single carrier, multi carrier and MIMO 2x2	
Frequency bands:	TX: 2110 – 2155 MHz RX: 1710 – 1755 MHz	
Nominal output power per antenna port:	Single carrier: Multi carrier:	1x 37.0 dBm (1 x 5W) 2 x 34.0 dBm (2 x 2.5W) 3 x 32.2 dBm (3 x 1.67W) 4 x 31.0 dBm (4 x 1.25W)
Modulations:	QPSK, 16QAM and 64QAM	
Channel bandwidth:	4.2 to 5 MHz (configurable in steps of 100/200 kHz)	
Channel spacing:	4.4 to 5 MHz (configurable in steps of 100/200 kHz)	
Nominal power voltage:	-48VDC 110-240 VAC	

Operation mode during measurements

WCDMA, single RAT

Measurements were performed with the test object transmitting test models as defined in 3GPP TS 25.141. Test model 1 (TM1) was used to represent QPSK. Test model 5 (TM5) to represent 16QAM modulation and Test model 6 (TM6) to represent 64QAM modulation.

The settings below were deemed representative for all traffic scenarios when settings with different modulations, channel bandwidths, number of carriers and RF configurations has been tested to find the worst case setting.The settings below were used for all measurements if not otherwise noted.

MIMO mode single carrier
TM5: 8 HS-PDSCH at 240 ksps + 30 DPCH:s at 30 ksps (SF=128)

MIMO mode multi carrier, 2 carriers
TM5: 8 HS-PDSCH at 240 ksps +30 DPCH:s at 30 ksps (SF=128)

Channel bandwidth 5 MHz

All measurements were performed with the test object configured for the maximum transmit power applicable for the tested configuration.

Conducted measurements

The test object was supplied with -48 VDC by an external power supply.
Frequency stability measurements were also tested using 120VAC.
Additional connections are documented in the set-up drawings below.
All measurements were made RF A and additional measurements on RF B to verify that the ports were electrical identical, as declared by the client.

Radiated measurements

Test object was powered with -48 VDC. All measurements were performed with the test object configured for maximum transmit power

Purpose of test

The purpose of the tests is to verify compliance to the performance characteristics specified in applicable items of FCC CFR 47 and Industry Canada RSS-139 and RSS-Gen.

References

Measurements were done according to relevant parts of the following standards:

ANSI 63.4-2009
ANSI/TIA/EIA-603-C-2004
CFR 47 part 2, October 1st , 2012
CFR 47 part 27, October 1st, 2012
3GPP TS 25.141, version 11.4.0
RSS-Gen Issue 3
RSS-139 Issue 2

Appendix 1

Measurement equipment

	Calibration Due	SP number
Semi anechoic chamber, Edison	2014-01	504 114
Test site Tesla	2014-01	503 881
R&S FSIQ 40	2013-07	503 738
R&S ESU 26	2013-09	901 553
R&S ESU 26	2013-12	902 210
R&S FSQ 40	2014-03	504 143
R&S ESIB 26	2013-07	503 885
R&S ESI 26	2013-07	503 292
R&S FSW 43	2013-10	902 073
R&S SMB 100A	2013-07	900 120
EMC 32 ver. 8.52.0	-	503 745
Control computer with R&S software EMC32 version 8.52.0	-	503 889
EMC 32 ver. 8.52.0	-	503 745
High pass filter	2013-07	901 501
High pass filter	2013-07	901 502
High pass filter	2013-07	504 199
High pass filter	2013-08	901 373
High pass filter	2014-08	503 739
High pass filter	2013-07	503 740
RF attenuator	2013-07	504 159
RF attenuator	2013-09	900 233
RF attenuator	2013-08	900 691
RF attenuator	2013-12	901 508
Chase Bilog Antenna CBL 6111A	2014-10	503 182
Antenna Schaffner CBL 6143	2013-04	504 079
Flann STD Gain Horn Antenna 20240-20		503 674
Horn Antenna EMCO 3115	2014-01	502 175
Horn Antenna EMCO 3115	2014-01	501 548
Horn Antenna EMCO 3115	2013-10	902 212
Std.gain horn FLANN model 20240-20	2014-03	503 674
µComp Nordic, Low Noise Amplifier	2014-04	901 545
µComp Nordic, Low Noise Amplifier	2013-08	504 160
Schwarzbeck preamplifier BBV 9742	2014-03	504 085
MITEQ Low Noise Amplifier	2013-08	503 285
Temperature and humidity meter, Testo 635	2014-06	504 203
Temperature Chamber	-Note [1)]	503 360
Multimeter Fluke 87	2013-08	502 190

Note [1)]: The temperature and humidity meter testo 635 SP number 504 203 was used to monitor the temperature.

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”SP-QD 10885”. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence).
Compliance evaluation is based on a shared risk principle with respect to the measurement uncertainty.

Reservation

The test results in this report apply only to the particular test object as declared in the report.

Delivery of test object

The test object was delivered 2013-04-22.

Manufacturer’s representative

Christer Gustavsson, Ericsson AB.

Test engineers

Andreas Johnson, Tomas Lennhager, Tomas Isbring, Kexin Chen, Jörgen Wassholm and Martin Theorin, SP

Test participant

Samir Catic

Test frequencies during measurements

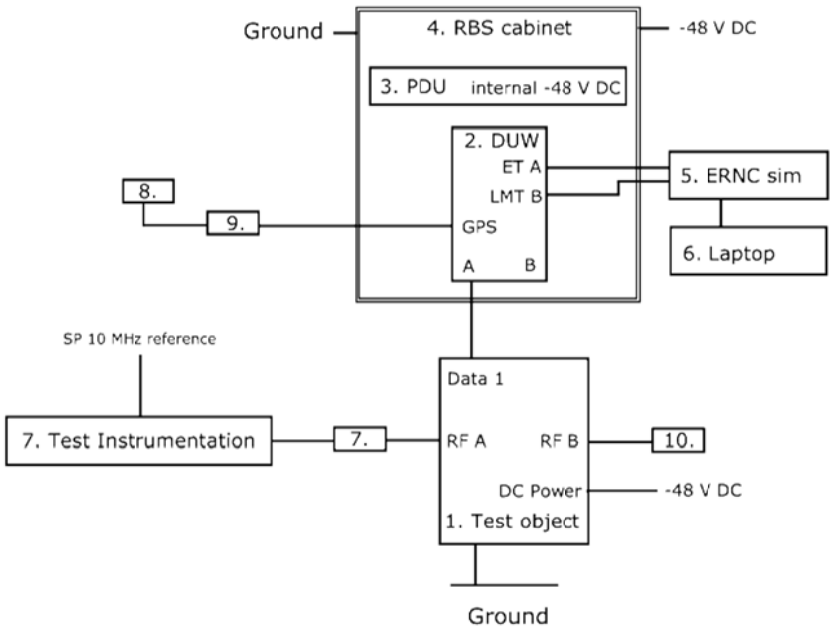
Single RAT TX test frequencies

UARFCN Downlink	Frequency [MHz]	Symbolic name	Comment
1537	2112.4	B	Single carrier TX bottom frequency
1537 1562	2112.4 2117.4	B2	2 carrier TX band bottom constellation
1537 1587	2112.4 2122.4	B3	2 carrier TX band bottom constellation
1638	2132.6	M	Single carrier TX band mid frequency
1638 1663	2132.6 2137.6	M2	2 carrier TX band mid constellation
1613 1638 1663 1688	2127.6 2132.6 2137.6 2142.6	M4	4 carrier TX band midconstellation
1738	2152.6	T	Single carrier TX top frequency
1713 1738	2147.6 2152.6	T2	2 carrier TX band top constellation
1688 1738	2142.6 2152.6	T3	2 carrier TX band top constellation

All RX frequencies were configured 400 MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

Appendix 1

Test set-up conducted measurements



Test object:

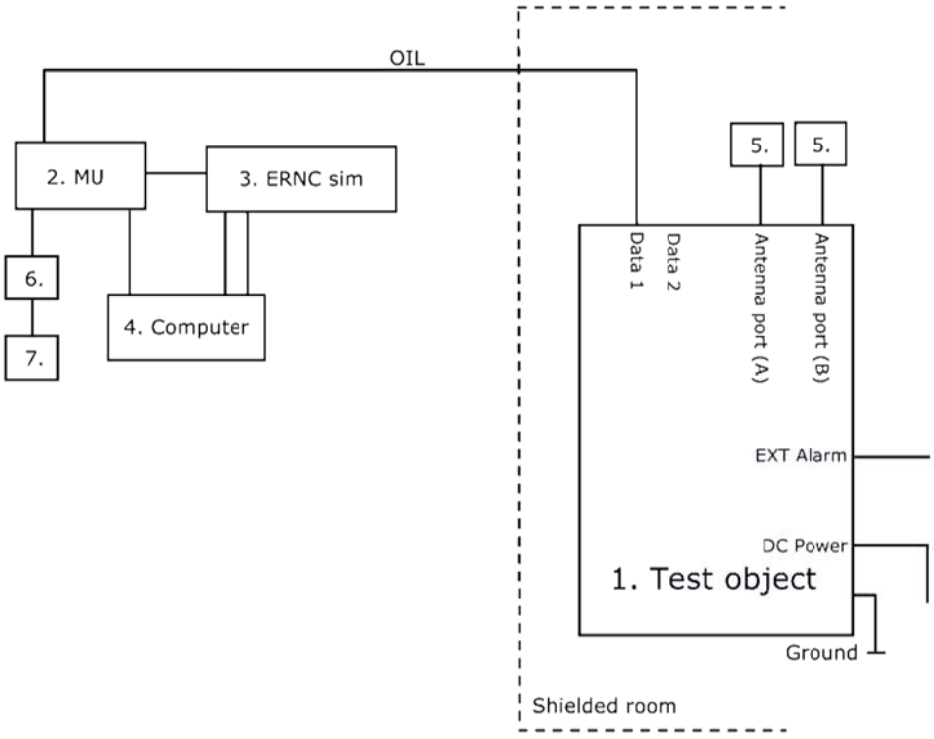
1.	mRRUS 12 B4, KRC 161 326/4, revision R1A, S/N: C826922101 working software CXP 901 3268/9, Rev. R51MD06 with FCC ID TA8AKRC161326 and IC 287AB-AS161326

Functional test equipment

2.	DUW 41 01, KDU 127 174/4, rev:R2C, s/n: A402005488
3.	PDU 0202, BMG 980 336/5, revision R1E, S/N: C941030896
4.	RBS 6202 cabinet, BAMS 1000961945 PFU 0202, KFE 101 1162/3, revision R1B, S/N: R80954554 SCU 0301, BGM 136 1006/3, revision R1A, S/N: C823563230
5	ERNC Sim 127, BAMS – 1000660988 Netgear Switch FS726T
6.	Controlling laptop HP Elitebook 8560w, BAMS 1001236854 running software MOSHELL V9.0u
7.	SP Test Instrumentation according to measurement equipment list
8.	GPS Active Antenna, KRE 101 2082/1
9.	GPS 02 01, NCD 901 41/1, rev. R1D, s/n: TU8K474887
10.	Terminator, 50 ohm

Appendix 1

Test set-up radiated measurements



Test object:

1.	mRRUS 12 B4, KRC 161 326/2, rev. R1A, s/n: C826925910 working software CXP 901 3268/9, Rev. R51MD06 with FCC ID TA8AKRC161326 and IC 287AB-AS161326

Functional test equipment:

2.	DUW 41 01 KDU 127 174/4 R2C, s/n: A402007255, hosted in SUP 6601 1/BFL 901 009/4, rev. R1D, s/n. BW98450216
3.	ERNC-SIM 130, BAMS – 1000660991 Netgear Switch FS726T
4.	Computer HP Elitebook 8560w, BAMS – 1001236856
5.	Terminator
6.	GPS 02 01, NCD 901 41/1, rev. R1D, s/n: TU8K356428
7.	GPS Active Antenna, KRE 101 2082/1

Interfaces:	**Type of port:**
Power: -48 VDC	DC Power
Data 1, optical interface	Signal
Data 2, optical interface, not used in this configuration	Signal
Ext Alarm, unshielded multi wire	Signal
Ground wire	Ground

RBS software:

Software	**Revision**
CXP 902 171/9	R1CA23

Appendix 2

RF power output measurements according to CFR 47 §27.50 / IC RSS-139 6.4, conducted

Date	Temperature	Humidity
2013-04-23	23 °C ± 3 °C	29 % ± 5 %
2013-04-24	20 °C ± 3 °C	26 % ± 5 %

Test set-up and procedure

The test object was connected to a signal analyzer measuring peak and RMS output power in CDF mode. A resolution bandwidth of 50 MHz was used.

Measurement equipment	SP number
R&S FSQ 40	504 143
R&S FSW 43	902 073
RF attenuator	901 508
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 1.1 dB

Results

MIMO mode, single carrier

Rated output power level at RF connector 1x 37 dBm Total nominal RF power 40 dBm.

Tested configuration	Transmitter power RMS (dBm)		
BW and frequency	Port RF A	Port RF B	Total power[1)]
5 MHz, B	37.16 (Diagram 1)	37.23 (Diagram 4)	40.21
5 MHz, M	37.18 (Diagram 2)	37.20 (Diagram 5)	40.20
5 MHz, T	37.05 (Diagram 3)	37.07 (Diagram 6)	40.07

[1)]: summed output power according to FCC KDB662911 D01Multiple transmitter output v02

Note: The diagrams are shown on the following pages and provide Peak to Average Ratio (PAR). The highest single carrier PAR measured was 6.64 dB (0.1%). For multi-carrier constellations the measured "PAR" is informative only as to the definition of Peak to Average Ratio per carrier.

MIMO mode, multi carrier

Rated output power 2 x 34 dBm per RF port.Total nominal RF power 40 dBm

Tested configuration Bandwidth and frequency	Transmitter power RMS (dBm)		
	Port RF A	Port RF B	Total power[1)]
5 MHz, B2	36.97 (Diagram 7)	37.07 (Diagram 8)	40.03
5 MHz, M2	36.94 (Diagram 9)	37.01 (Diagram 10)	39.99
5 MHz, T2	36.95 (Diagram 11)	36.96 (Diagram 12)	39.97

[1)]: Summed output power according to FCC KDB662911 D01 Multiple transmitter output v02

Limits

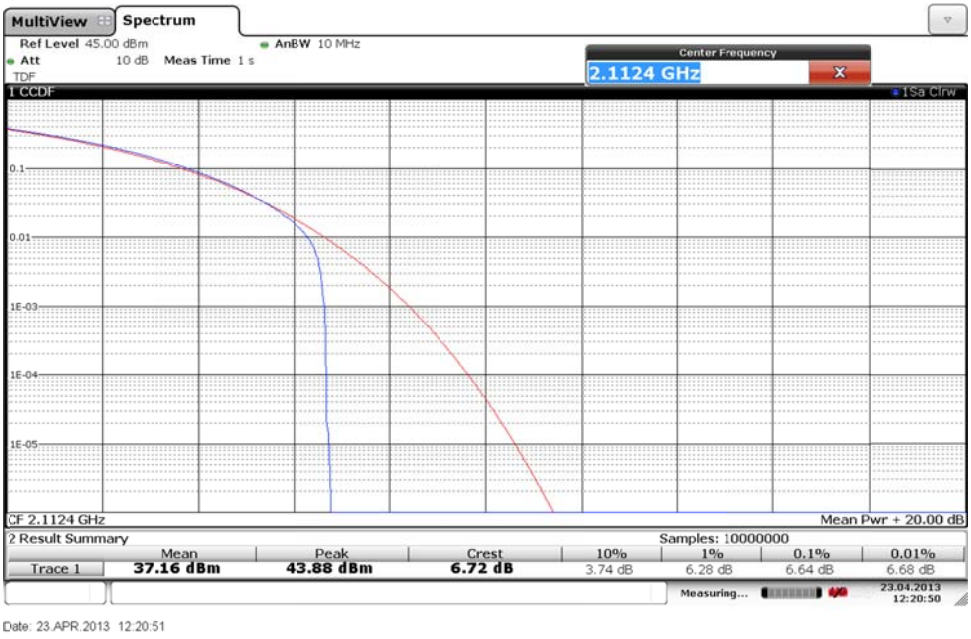
§27.50: The maximum output power may not exceed 1640 W (EIRP)/ MHz. The Peak to Average Ratio (PAR) may not exceed 13 dB.

RSS-139 6.4: The average equivalent isotropically radiated power (e.i.r.p.) limits in SRSP-513 apply, resulting in a maximum EIRP of 1640 W/ MHz for the scope of this report. The peak-to-average ratio of the power shall not exceed 13 dB.

Complies?	Yes

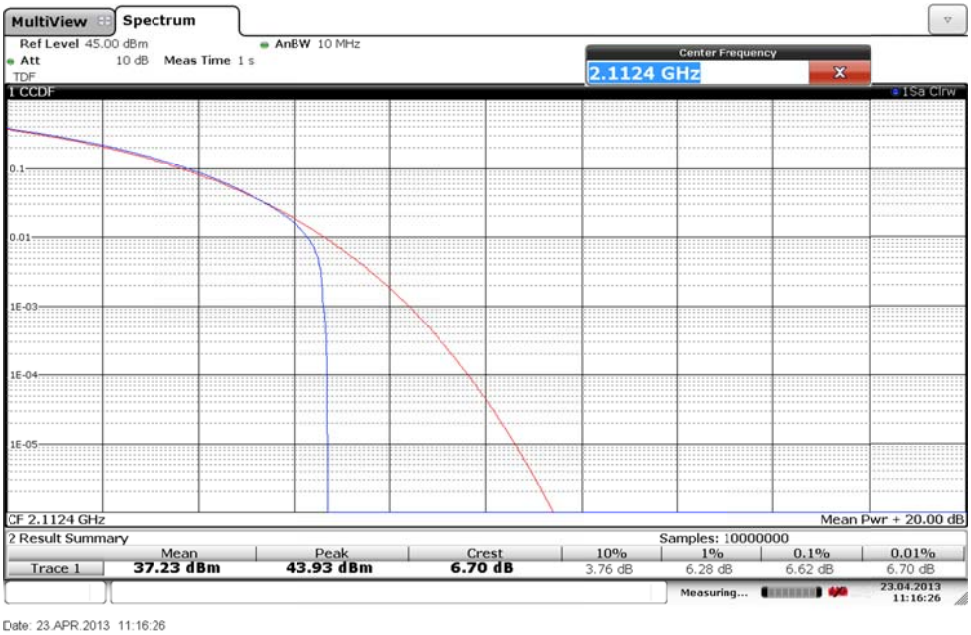
Appendix 2

Diagram 1:



Date: 23.APR.2013 12:20:51

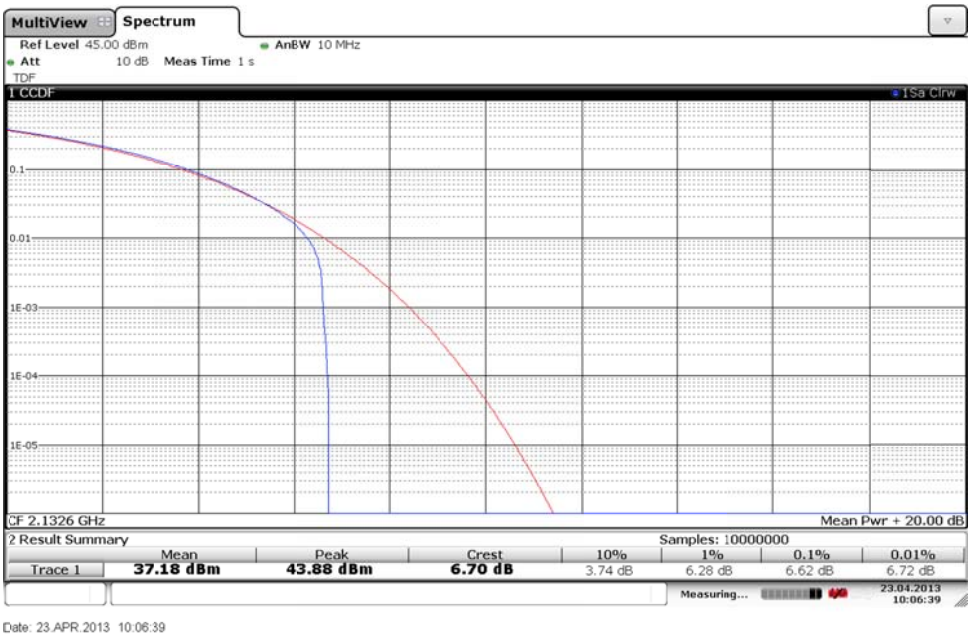
Diagram 2:



Date: 23.APR.2013 11:16:26

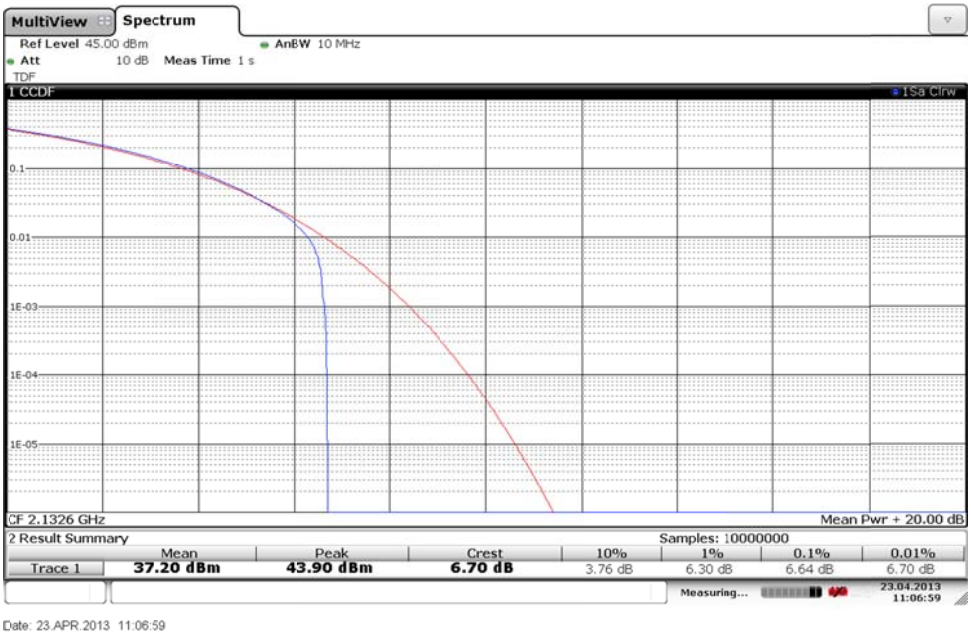
Appendix 2

Diagram 3:



Date: 23.APR.2013 10:06:39

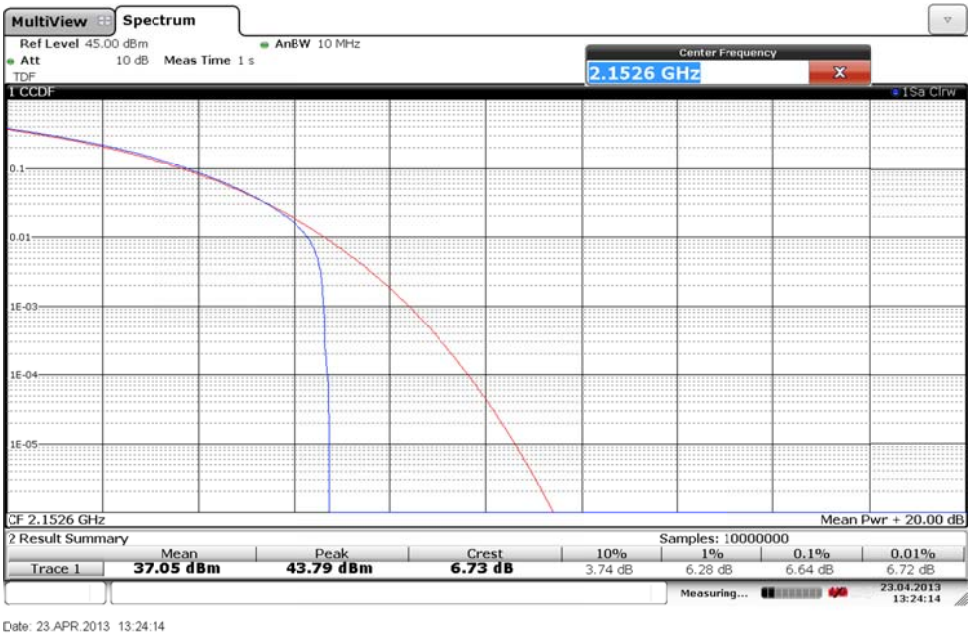
Diagram 4:



Date: 23.APR.2013 11:06:59

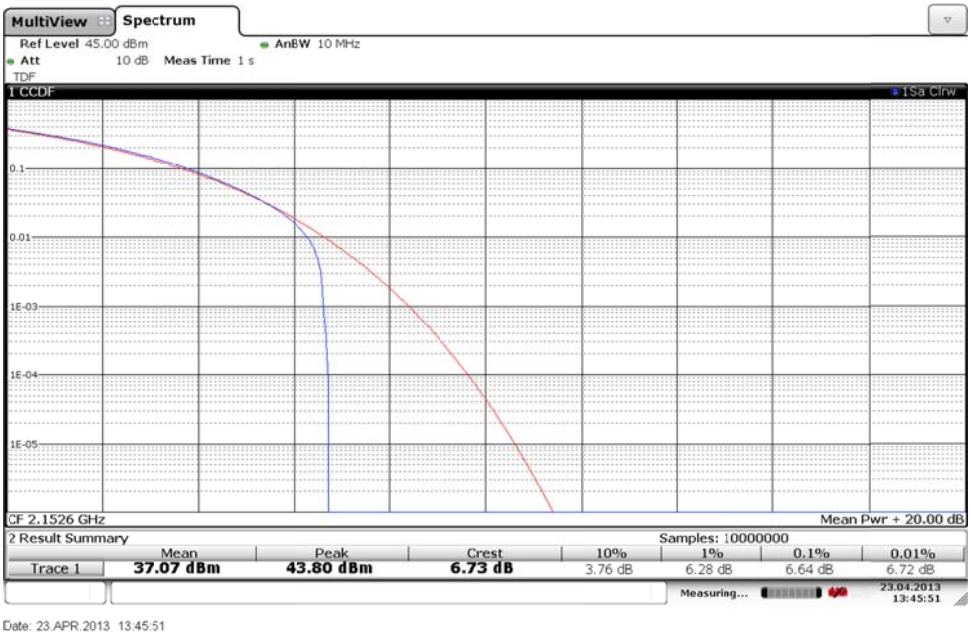
Appendix 2

Diagram 5:



Date: 23.APR.2013 13:24:14

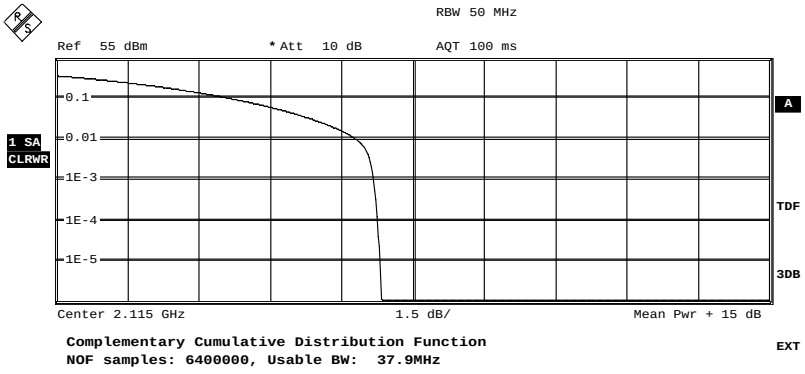
Diagram 6:



Date: 23.APR.2013 13:45:51

Appendix 2

Diagram 7:

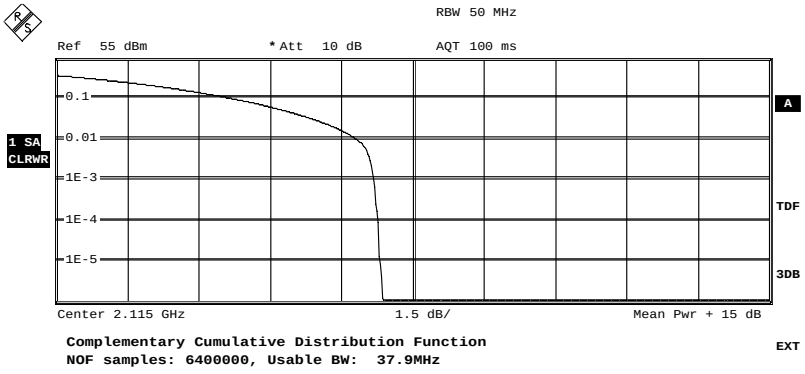


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.97 dBm
Peak	43.79 dBm
Crest	6.82 dB
10 %	3.73 dB
1 %	6.30 dB
.1 %	6.68 dB
.01 %	6.75 dB

Date: 24.APR.2013 09:05:23

Diagram 8:



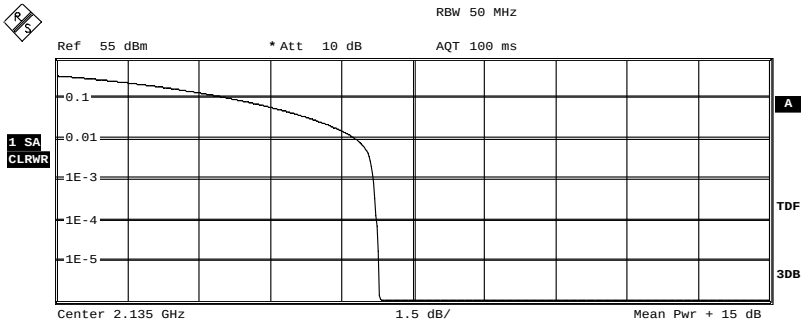
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	37.07 dBm
Peak	43.94 dBm
Crest	6.86 dB
10 %	3.73 dB
1 %	6.30 dB
.1 %	6.68 dB
.01 %	6.78 dB

Date: 24.APR.2013 09:02:04

Appendix 2

Diagram 9:

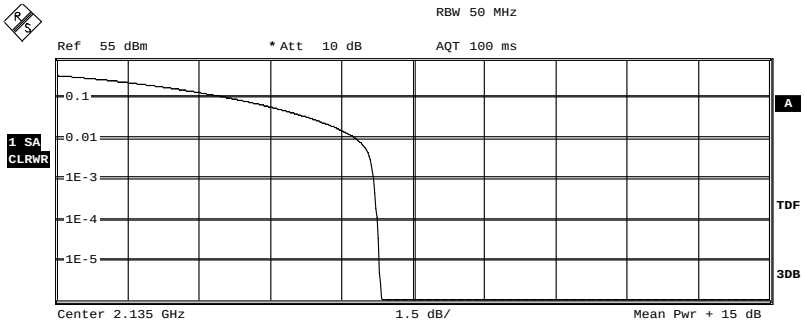


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.94 dBm
Peak	43.79 dBm
Crest	6.85 dB
10 %	3.73 dB
1 %	6.30 dB
.1 %	6.68 dB
.01 %	6.73 dB

Date: 24.APR.2013 10:43:22

Diagram 10:



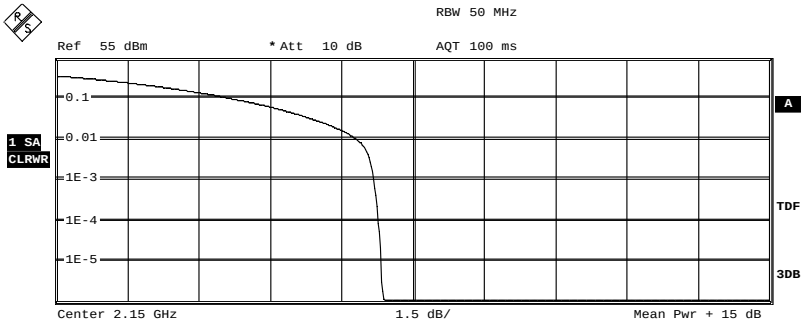
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	37.01 dBm
Peak	43.86 dBm
Crest	6.85 dB
10 %	3.73 dB
1 %	6.32 dB
.1 %	6.68 dB
.01 %	6.75 dB

Date: 24.APR.2013 10:41:36

Appendix 2

Diagram 11:

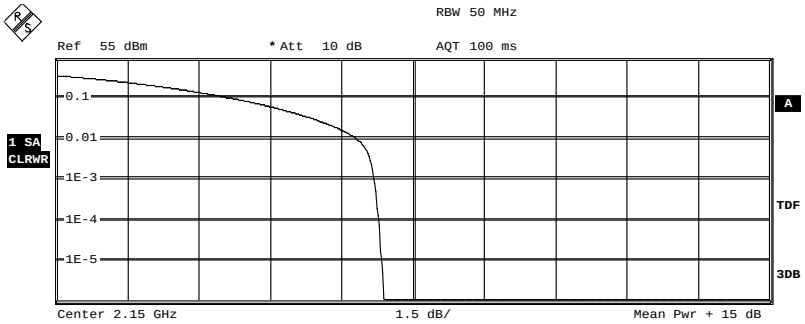


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.95 dBm
Peak	43.85 dBm
Crest	6.90 dB
10 %	3.73 dB
1 %	6.30 dB
.1 %	6.68 dB
.01 %	6.78 dB

Date: 24.APR.2013 10:29:35

Diagram 12:



Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.96 dBm
Peak	43.85 dBm
Crest	6.88 dB
10 %	3.75 dB
1 %	6.32 dB
.1 %	6.68 dB
.01 %	6.78 dB

Date: 24.APR.2013 10:32:28

Appendix 3

RF power output measurements according to CFR 47 §27.50 / IC RSS-139 6.4, radiated

Date	Temperature	Humidity
2013-05-08	23°C ± 3°C	30 % ± 5 %
2013-05-22	23°C ± 3°C	47 % ± 5 %
2013-06-10	23°C ± 3°C	40 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.4-2009.

The test was performed with continuous transmission.

The test of radiated emission was performed in a semi anechoic chamber. The measurements were performed with both horizontal and vertical polarizations of the antenna. The antenna distance was 3.0 m.

The fundamental was scanned with PEAK-detector with the antenna height was varied between 1-4 m and the turntable was rotated between 0-360 degrees for maximum response. The carrier power was measured with RMS- detector activated with a RBW of 1 MHz. The output power was verified with the substitution method .The antenna distance during the measurements was 3.0 m

Measurement equipment

Measurement equipment	SP number
Semi anechoic chamber	503 881
R&S ESU 26	901 553
EMC 32 ver. 8.52.0	503 745
EMCO Horn Antenna 3115	502 175
EMCO Horn Antenna 3115	902 212
R&S SMB 100A	900 120
Attenuator	504 159
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty:

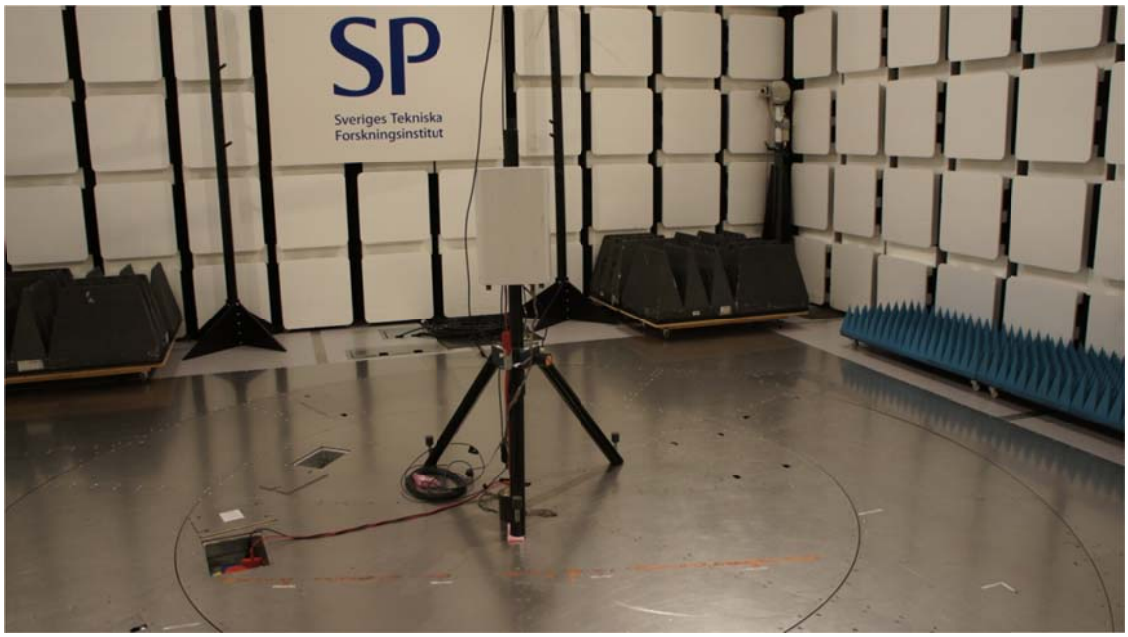
3.2 dB

The test set-up during the spurious radiation measurements is shown in the pictures below, upright mounted with Semi-Integrated Omni Antenna KRE 101 2024/1

Side mounted with Semi-Integrated Omni Antenna KRE 101 2024/1

Appendix 3

The test set-up during the spurious radiation measurements is shown in the pictures below, upright mounted with internal antenna



Side mounted with internal antenna

Results

Internal antenna, upright mounted

Bandwidth configuration (MHz)	Tested frequency B		Tested frequency M		Tested frequency T	
	Horizontal/ Vertical RMS power		Horizontal/ Vertical RMS power		Horizontal/ Vertical RMS power	
	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz
5	37.1/ 42.6	5.1/ 18.2	34.5/ 41.8	2.8/ 15.1	33.7/ 41.8	2.3/ 15.1

Internal antenna, side mounted

Bandwidth configuration (MHz)	Tested frequency B		Tested frequency M		Tested frequency T	
	Horizontal/ Vertical RMS power		Horizontal/ Vertical RMS power		Horizontal/ Vertical RMS power	
	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz
5	41.1/ 37.1	12.9/ 5.1	40.7/ 35.2	11.7/ 3.3	41.2/ 34.1	13.2/ 2.6

External antenna, upright mounted

Bandwidth configuration (MHz)	Tested frequency B		Tested frequency M		Tested frequency T	
	Horizontal/ Vertical RMS power		Horizontal/ Vertical RMS power		Horizontal/ Vertical RMS power	
	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz
5	28.5/ 37.9	0.7/ 6.2	28.3/ 38.8	0.7/ 7.6	27.7/ 38.0	0.6/ 6.3

External antenna, side mounted

Bandwidth configuration (MHz)	Tested frequency B		Tested frequency M		Tested frequency T	
	Horizontal/ Vertical RMS power		Horizontal/ Vertical RMS power		Horizontal/ Vertical RMS power	
	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz
5	26.5/ 36.9	0.4/ 4.9	26.3/ 36.9	0.4/ 4.9	25.3/ 37.0	0.3/ 5.0

Limits

§27.50: The maximum output power may not exceed 1640 W (EIRP)/ MHz. The Peak to Average Ratio (PAR) may not exceed 13 dB.

RSS-139 6.4: The average equivalent isotropically radiated power (e.i.r.p.) limits in SRSP-513 apply, resulting in a maximum EIRP of 1640 W/ MHz for the scope of this report. The peak-to-average ratio of the power shall not exceed 13 dB.

Complies?	Yes

Occupied bandwidth measurements according to 47 CFR 2.1049 / RSS-Gen 4.6.1

Date	Temperature	Humidity
2013-04-23	23 °C ± 3 °C	29 % ± 5 %
2013-04-24	20 °C ± 3 °C	26 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §2.1049. The output was connected to a signal analyzer with the RMS detector activated. The signal analyzer was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	901 508
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

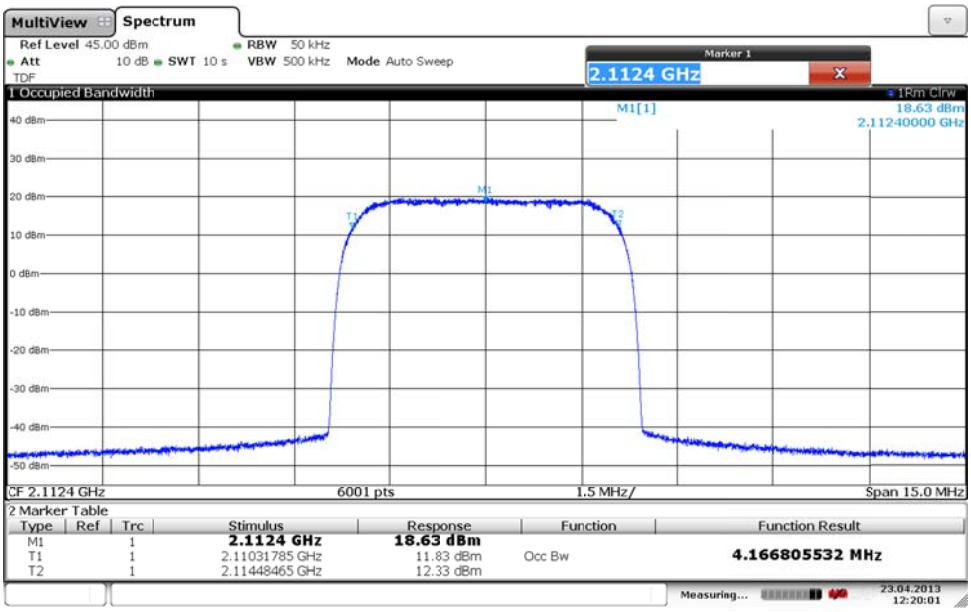
Results

MIMO mode, single carrier

Diagram	BW configuration	Tested frequency	Tested Port	Occupied BW (99%) [MHz]
1	5 MHz	B	RF A	4.17
2	5 MHz	B	RF B	4.16
3	5 MHz	M	RF A	4.17
4	5 MHz	M	RF B	4.16
5	5 MHz	T	RF A	4.17
6	5 MHz	T	RF B	4.16

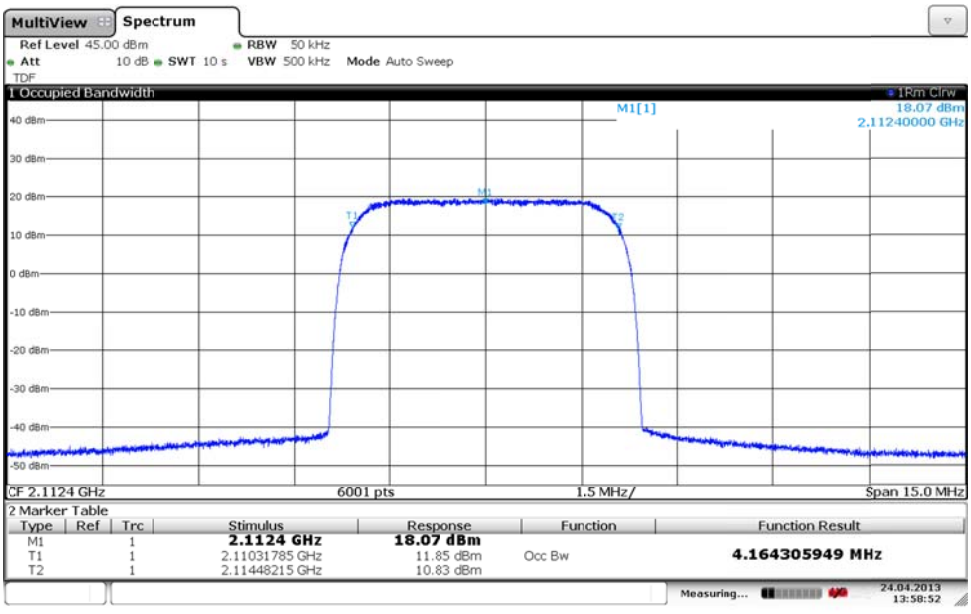
Appendix 4

Diagram 1:



Date: 23.APR.2013 12:20:01

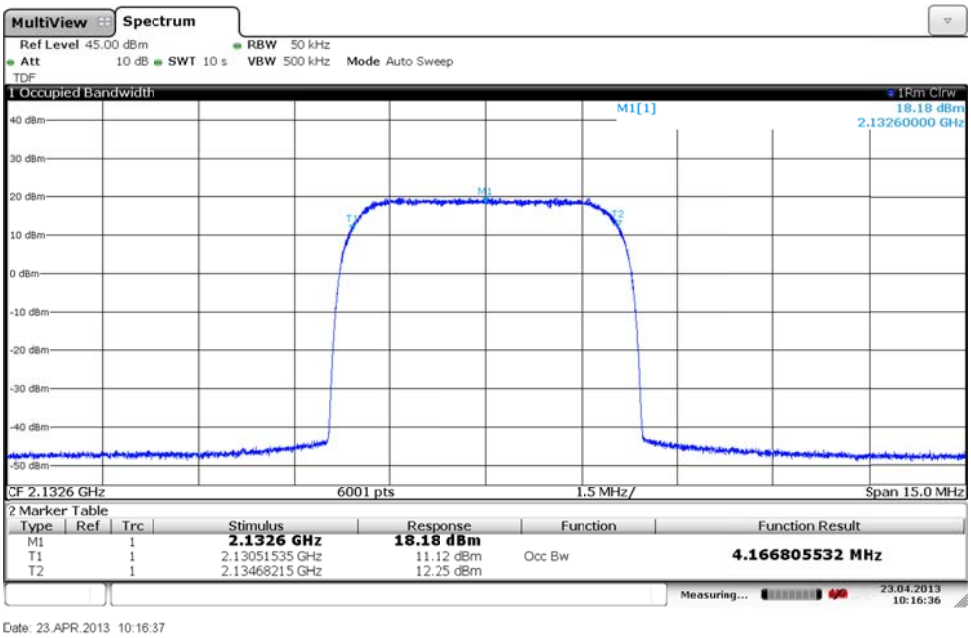
Diagram 2:



Date: 24.APR.2013 13:58:52

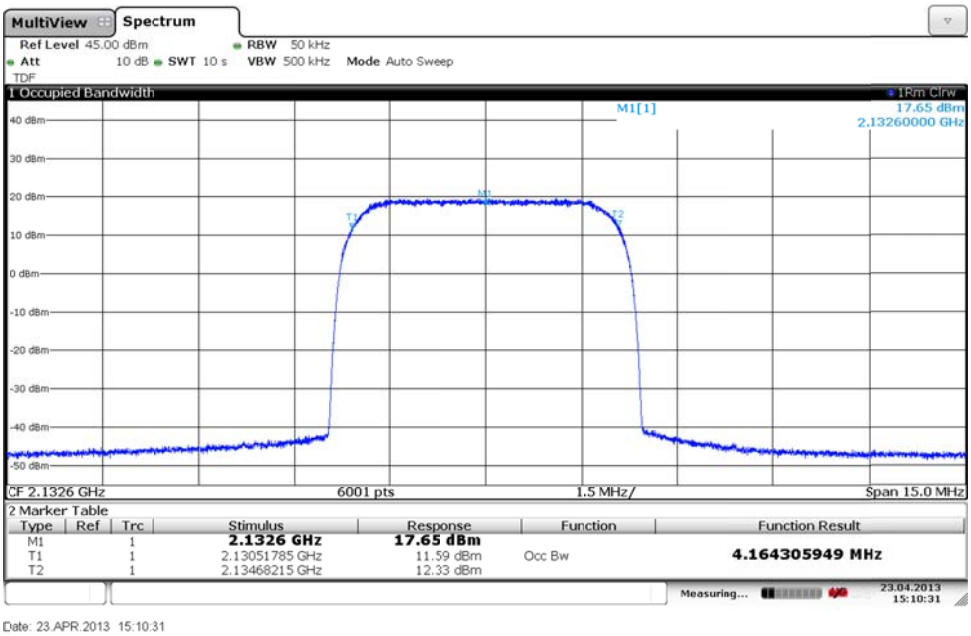
Appendix 4

Diagram 3:



Date: 23.APR.2013 10:16:37

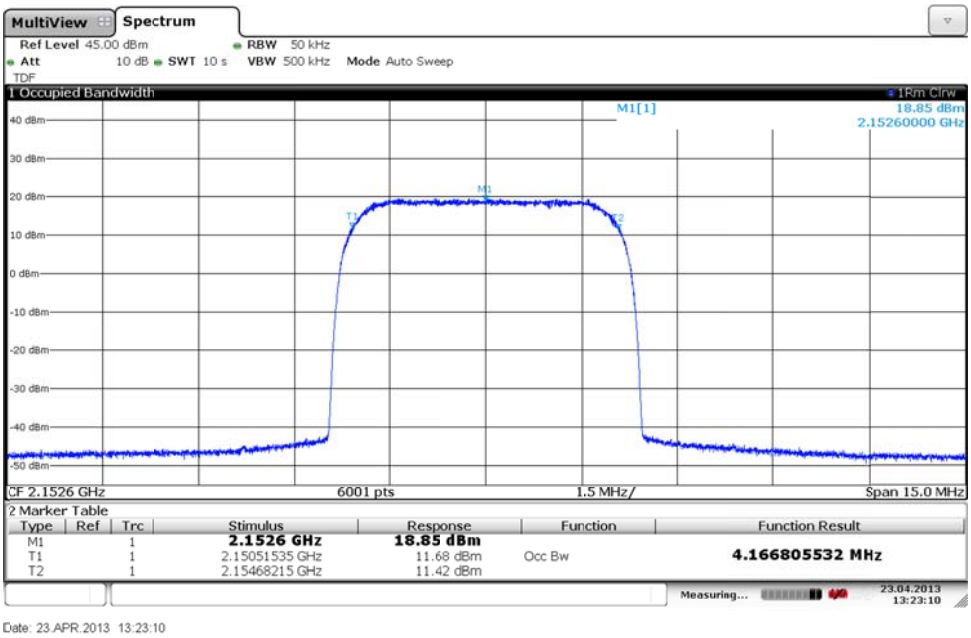
Diagram 4:



Date: 23.APR.2013 15:10:31

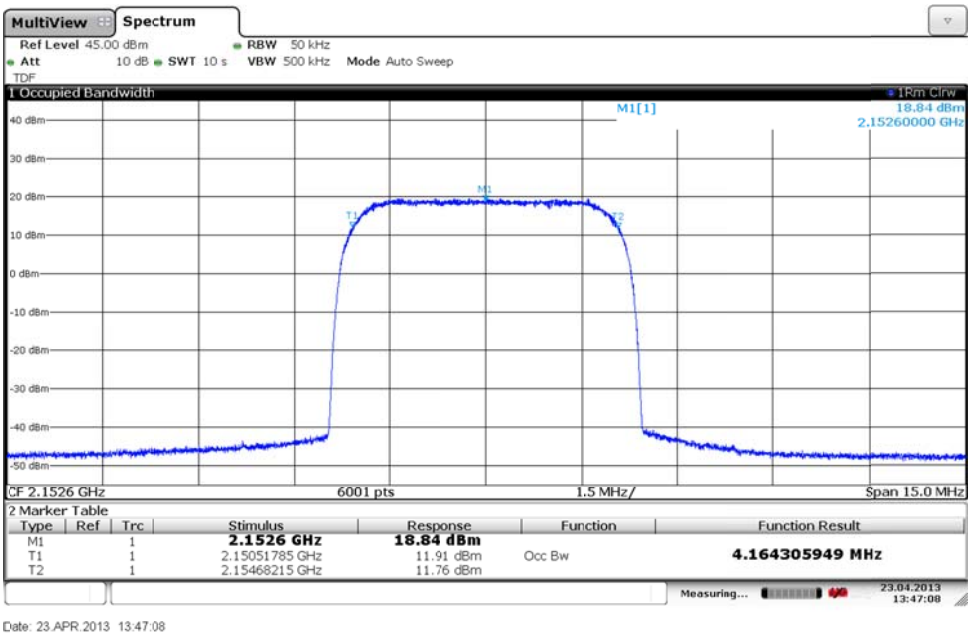
Appendix 4

Diagram 5:



Date: 23.APR.2013 13:23:10

Diagram 6:



Date: 23.APR.2013 13:47:08

Appendix 5

Band edge measurements according to CFR 47 §27.53(h) / IC RSS-139 6.5

Date	Temperature	Humidity
2013-04-23	23 °C ± 3 °C	29 % ± 5 %
2013-04-24	20 °C ± 3 °C	26 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §27.53(h). The test object was connected to a spectrum analyzer with the RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

FCC rules specify a RBW of at least 1% of the fundamental emission bandwidth (EBW) for offsets up to 1 MHz from the band edge and a RBW of 1 MHz for measurements of emissions more than 1 MHz away from the band edges.
A resolution bandwidth of 200 kHz was used 1 MHz to 6 MHz away from the band edges, to compensate for the reduced resolution bandwidth the limit was adjusted by 7 dB to -20 dBm.

Before comparing the results to the limit, 3 dB [10 log (2)] should be added according to method E), 3), (iii) “measure and add 10 log(N_{ANT})” of FCC KDB662911 D01 Multiple Transmitter Output v01r02

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	901 508
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

MIMO mode, single carrier

Diagram	Tested frequency	Tested port
1 a-c	B	RF A
2 a-c	B	RF B
3 a-c	T	RF A
4 a-c	T	RF B

MIMO mode, multi carrier

Diagram	Tested frequency	Tested port
5 a-c	B2	RF A
6 a-c	T2	RF A

Note: Measurements were made on port RF A only due to the measurement result in single carrier mode that shows that the ports are identical as declared by the client.

Limits

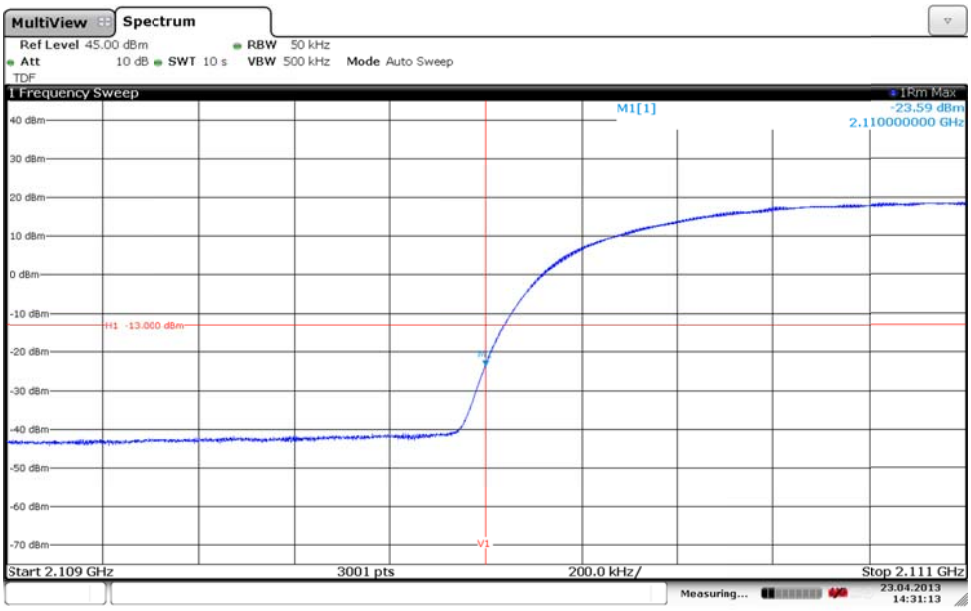
CFR 47 §27.53(h) and RSS-139 6.5

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm.

Complies?	Yes

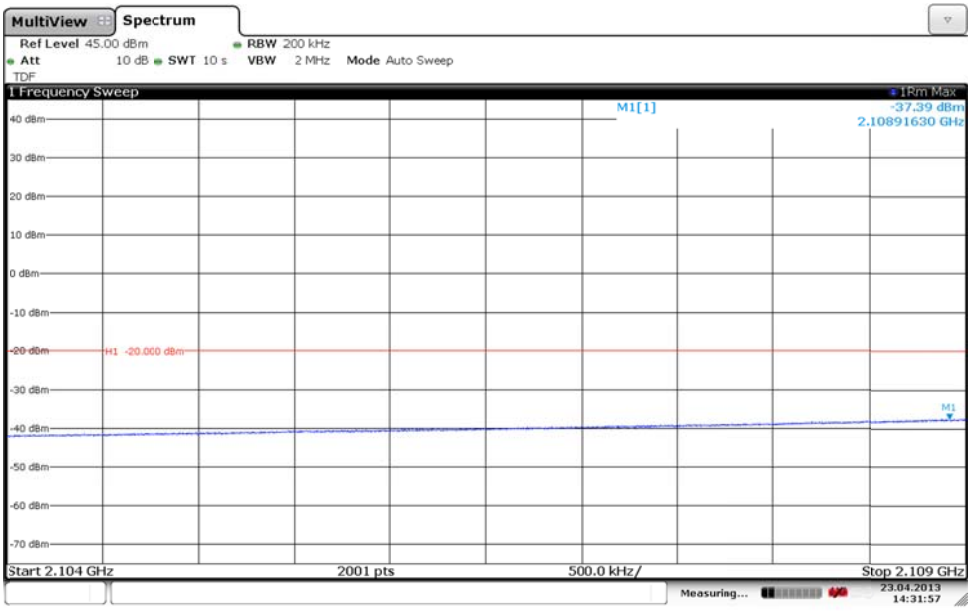
Appendix 5

Diagram 1a:



Date: 23.APR.2013 14:31:14

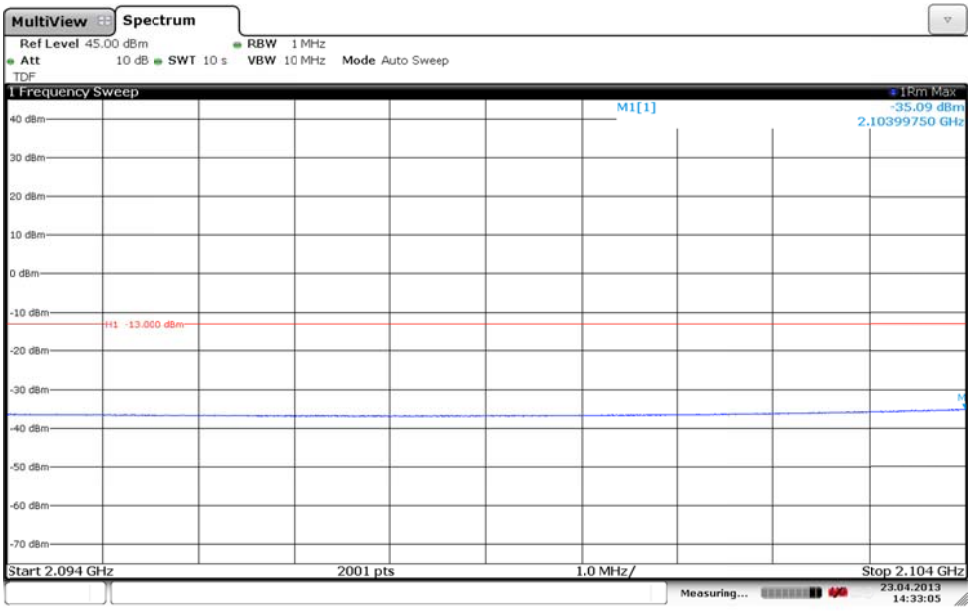
Diagram 1b:



Date: 23.APR.2013 14:31:57

Appendix 5

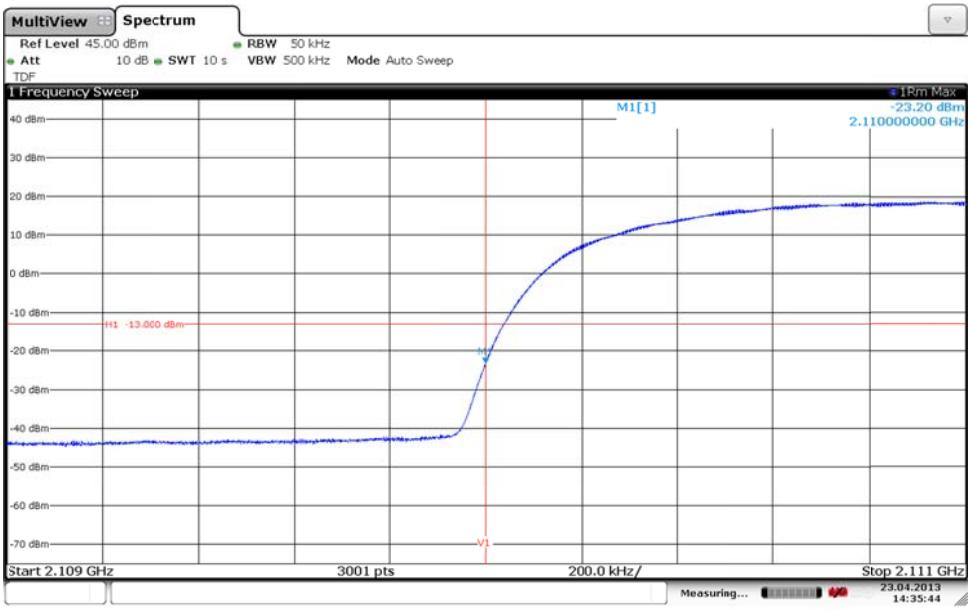
Diagram 1c



Date: 23.APR.2013 14:33:05

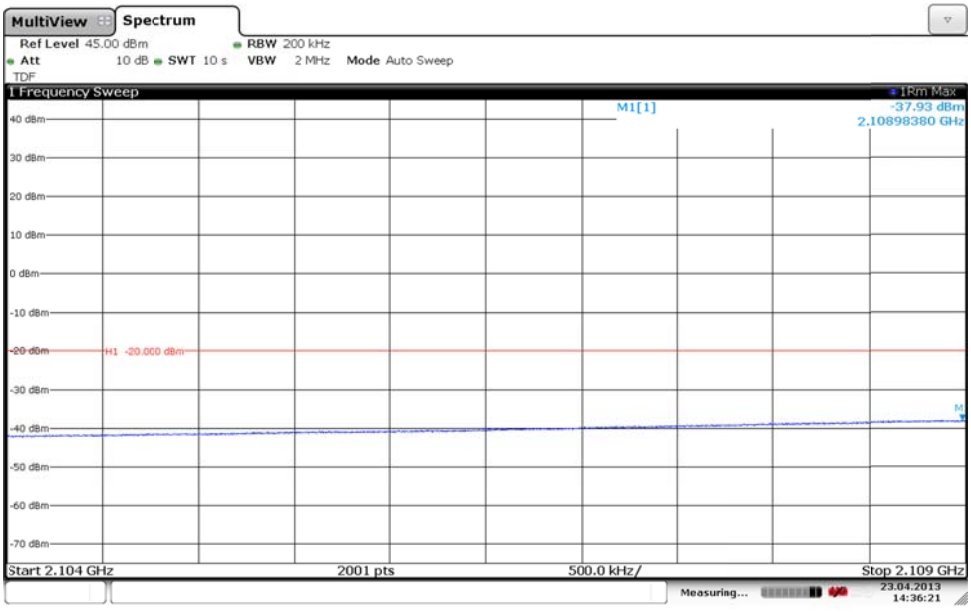
Appendix 5

Diagram 2a:



Date: 23.APR.2013 14:35:44

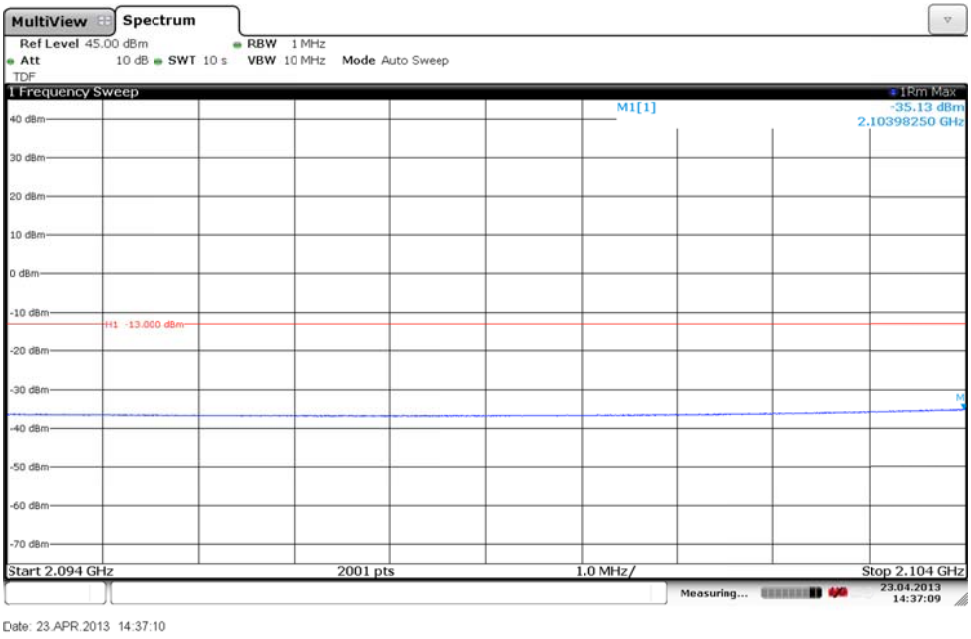
Diagram 2b:



Date: 23.APR.2013 14:36:20

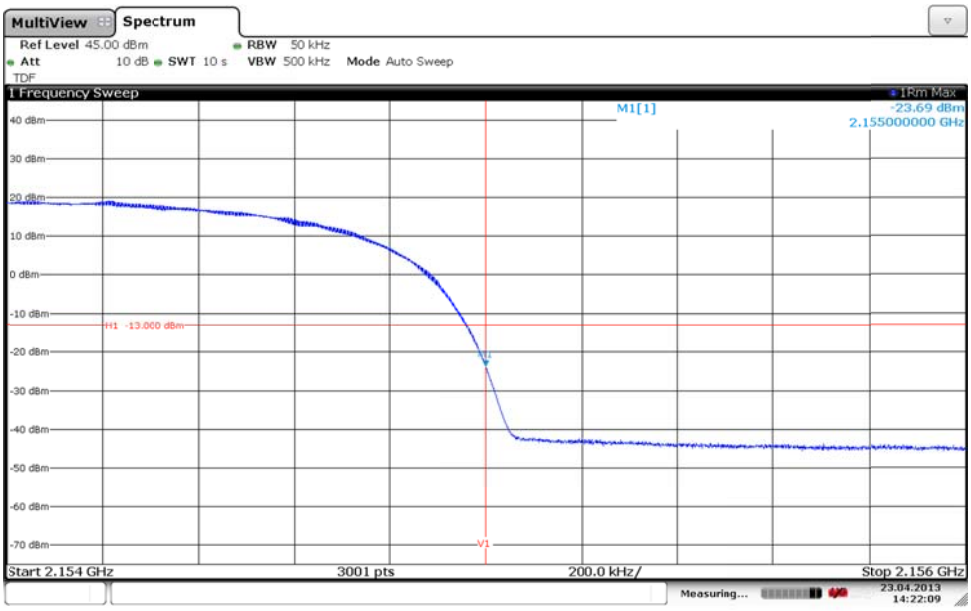
Appendix 5

Diagram 2c:



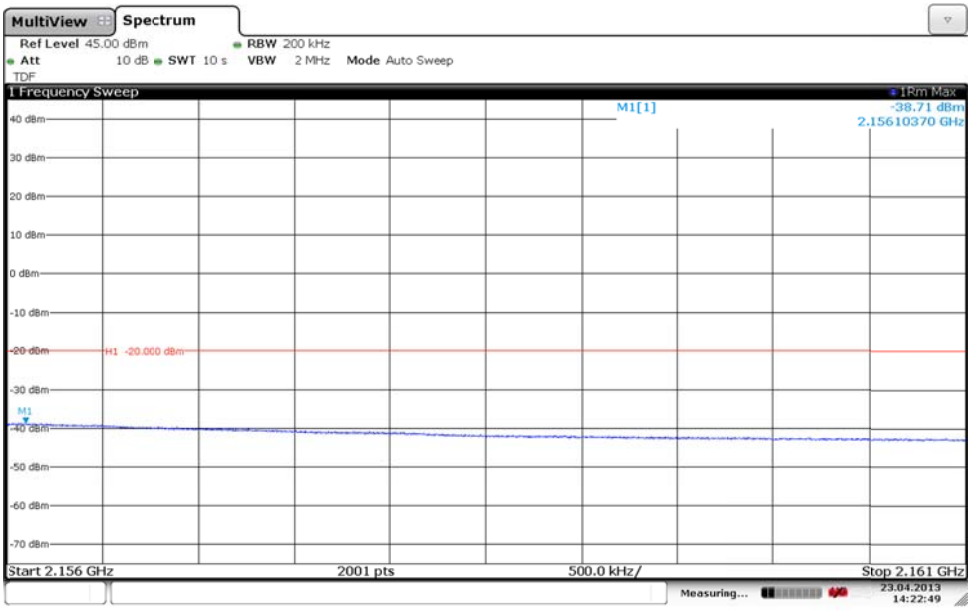
Appendix 5

Diagram 3a:



Date: 23.APR.2013 14:22:09

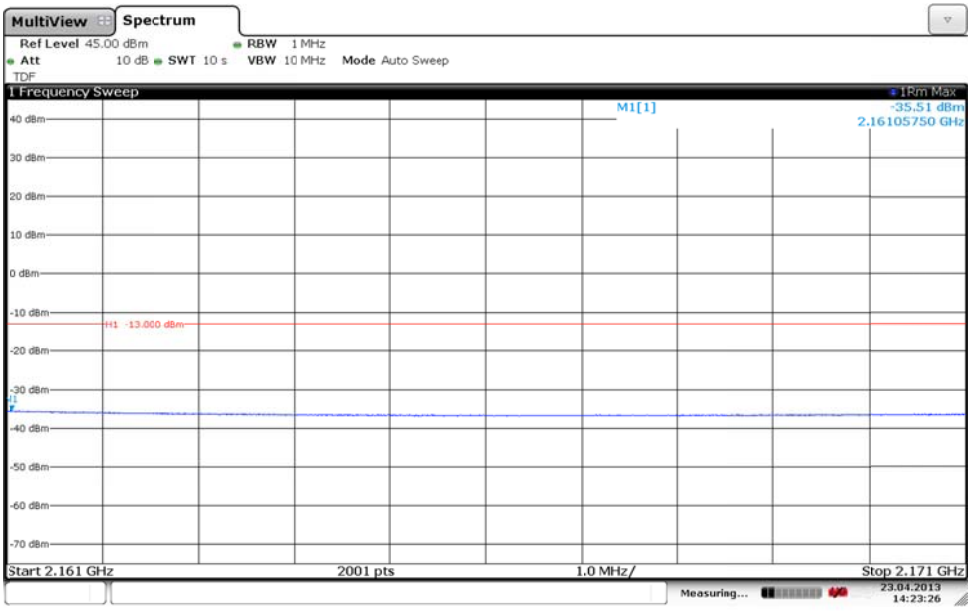
Diagram 3b:



Date: 23.APR.2013 14:22:50

Appendix 5

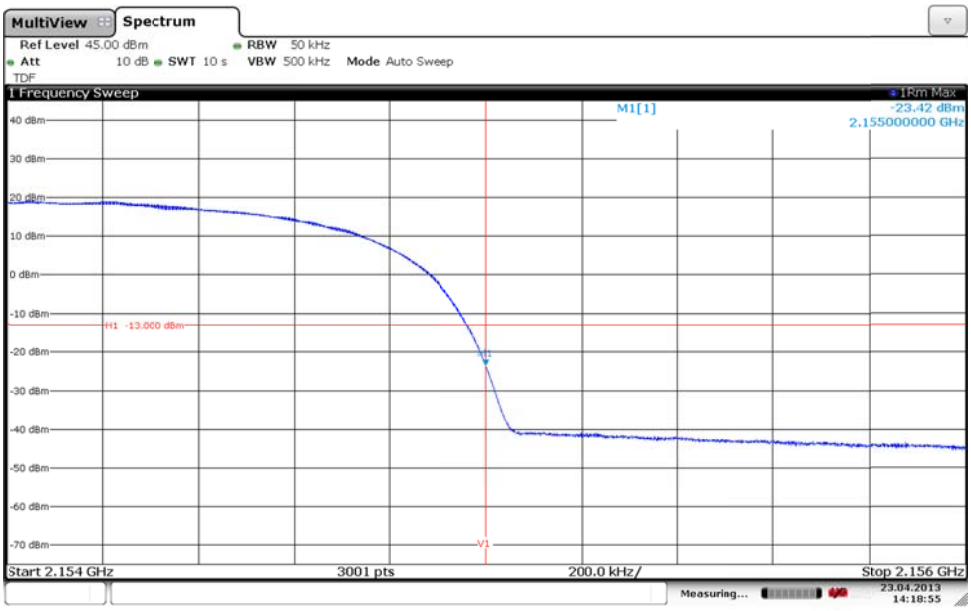
Diagram 3c:



Date: 23.APR.2013 14:23:26

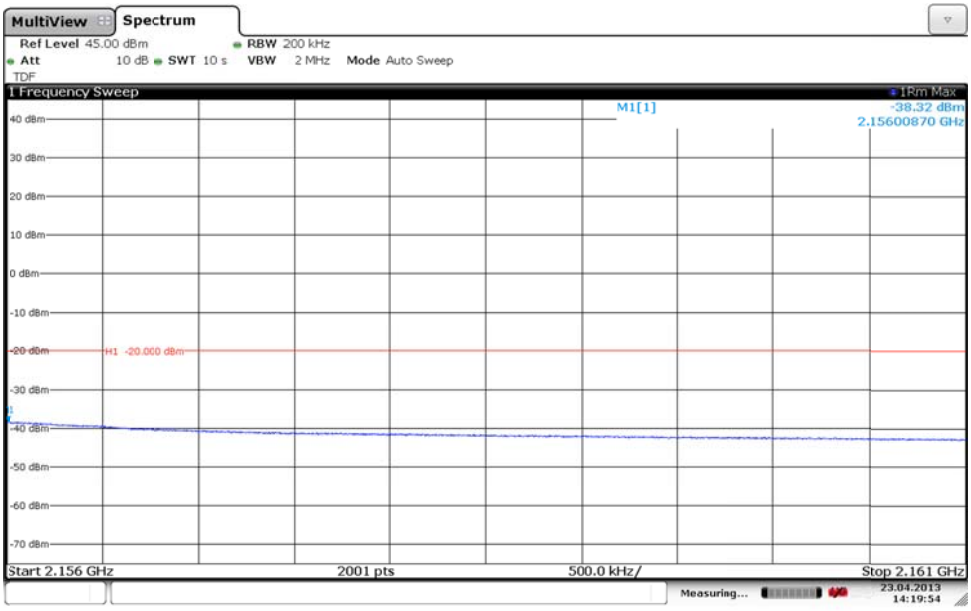
Appendix 5

Diagram 4a:



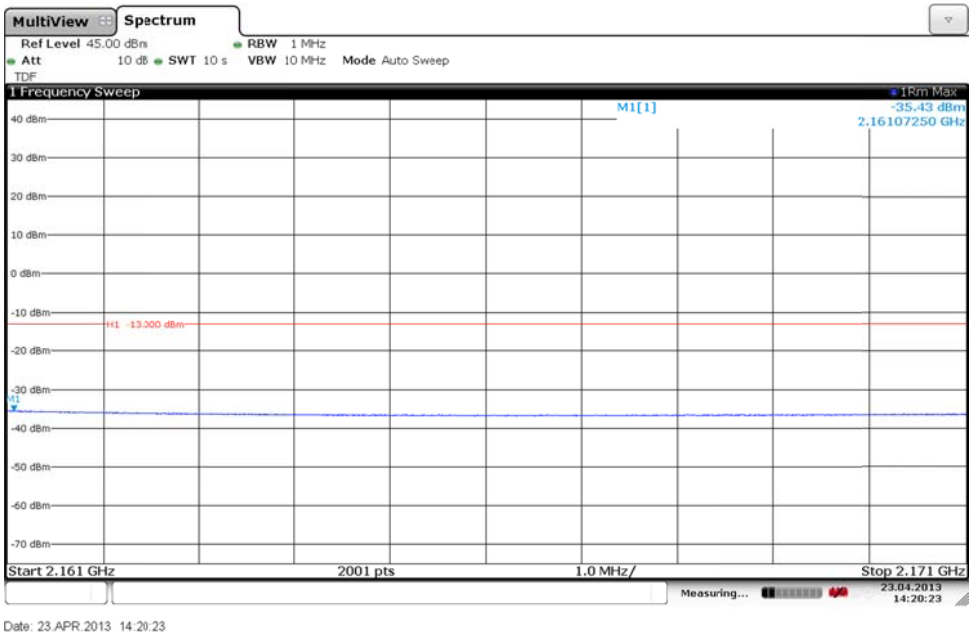
Date: 23.APR.2013 14:18:55

Diagram 4b:



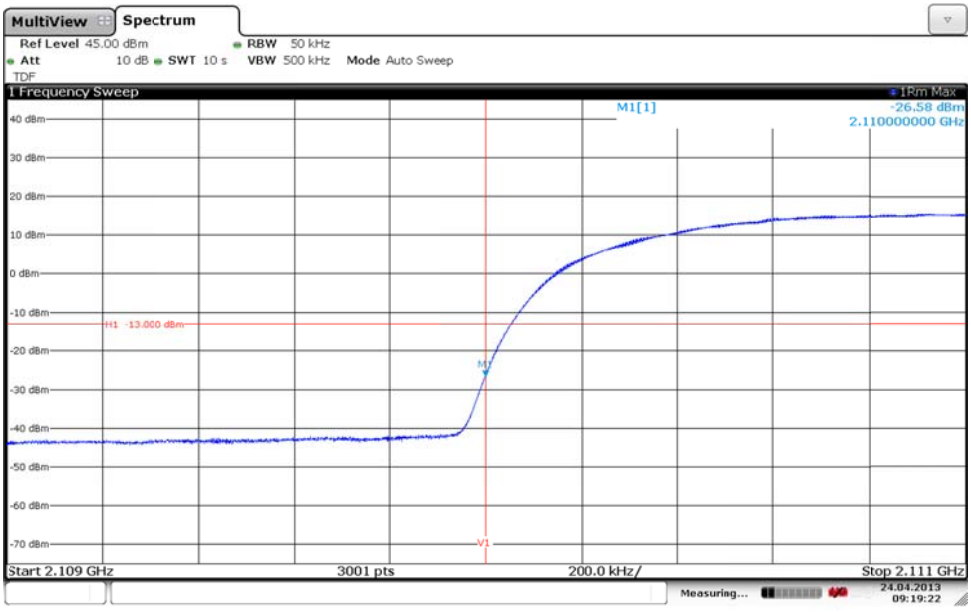
Date: 23.APR.2013 14:19:54

Diagram 4c:


MultiView
Spectrum
Ref Level 45.00 dBm
RBW 1 MHz
Att 10 dB SWT 10 s VBW 10 MHz Mode Auto Sweep
TDF
1 Frequency Sweep
1Rm Max
M1[1]
-35.43 dBm
2.16107250 GHz
40 dBm
30 dBm
20 dBm
10 dBm
0 dBm
-10 dBm
H1 -13.000 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
Start 2.161 GHz
2001 pts
1.0 MHz/
Stop 2.171 GHz
Measuring...
23.04.2013
14:20:23
Date: 23.APR.2013 14:20:23

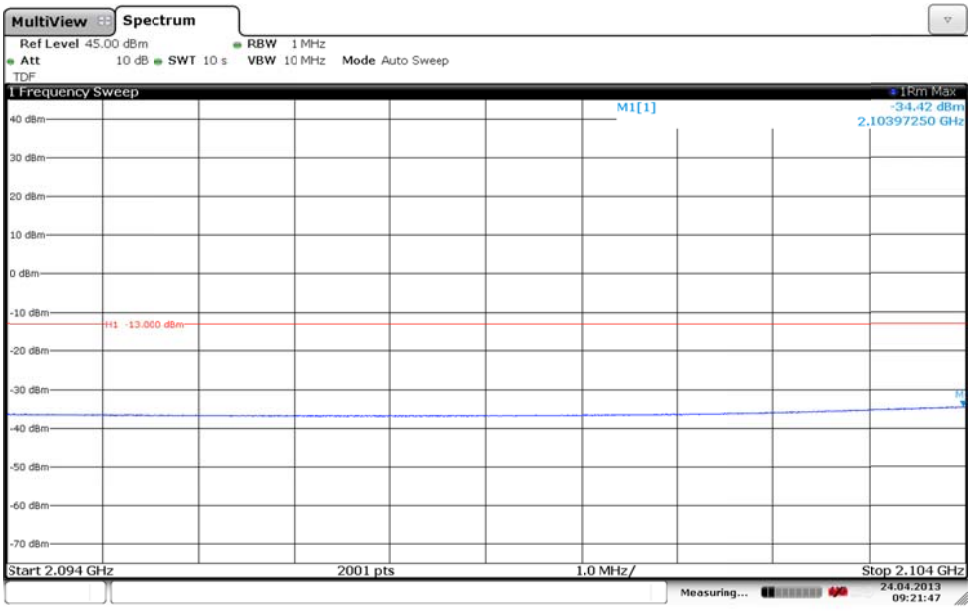
Appendix 5

Diagram 5a:



Date: 24.APR.2013 09:19:22

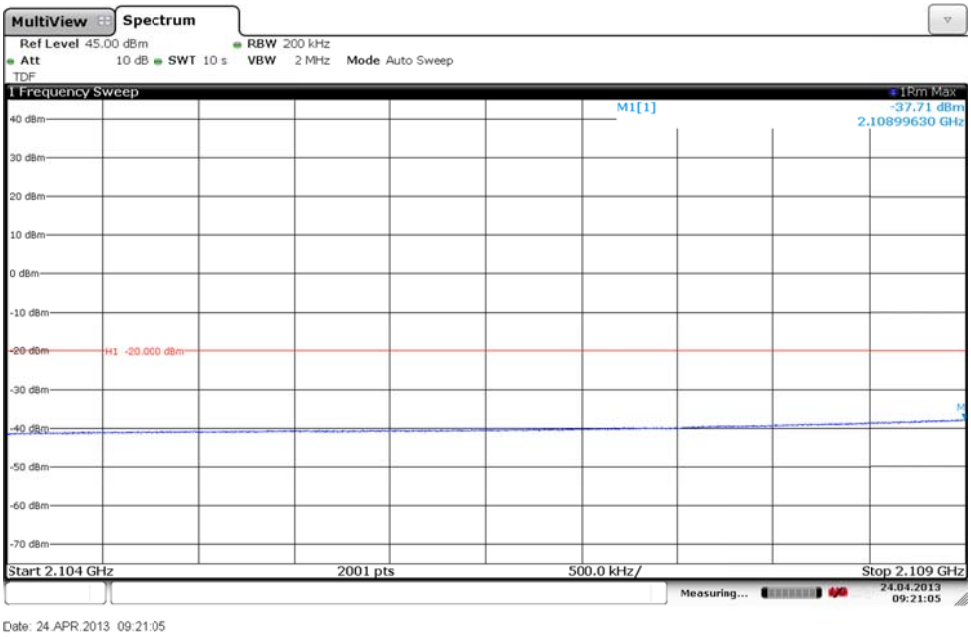
Diagram 5b:



Date: 24.APR.2013 09:21:47

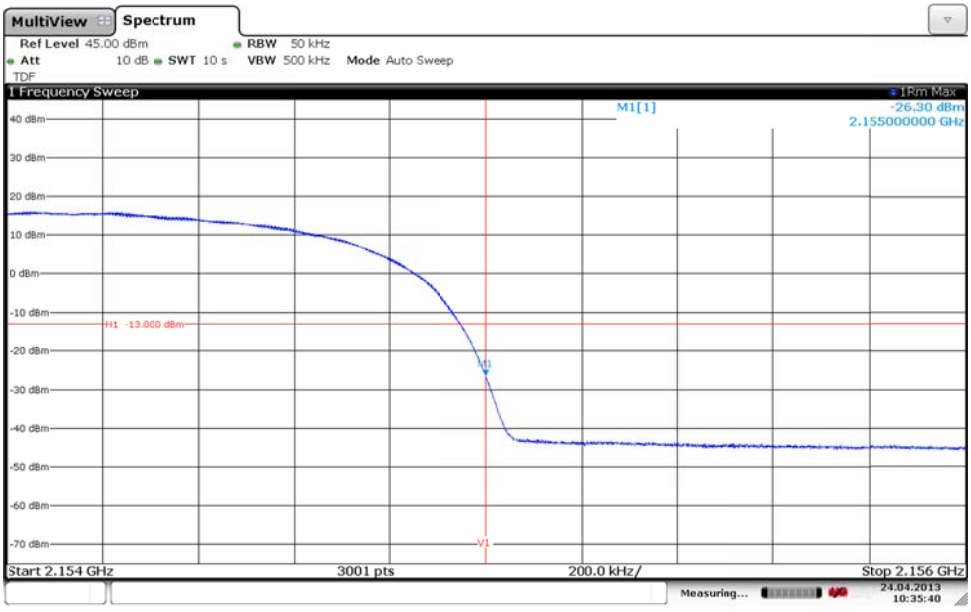
Appendix 5

Diagram 5c:



Appendix 5

Diagram 6a:



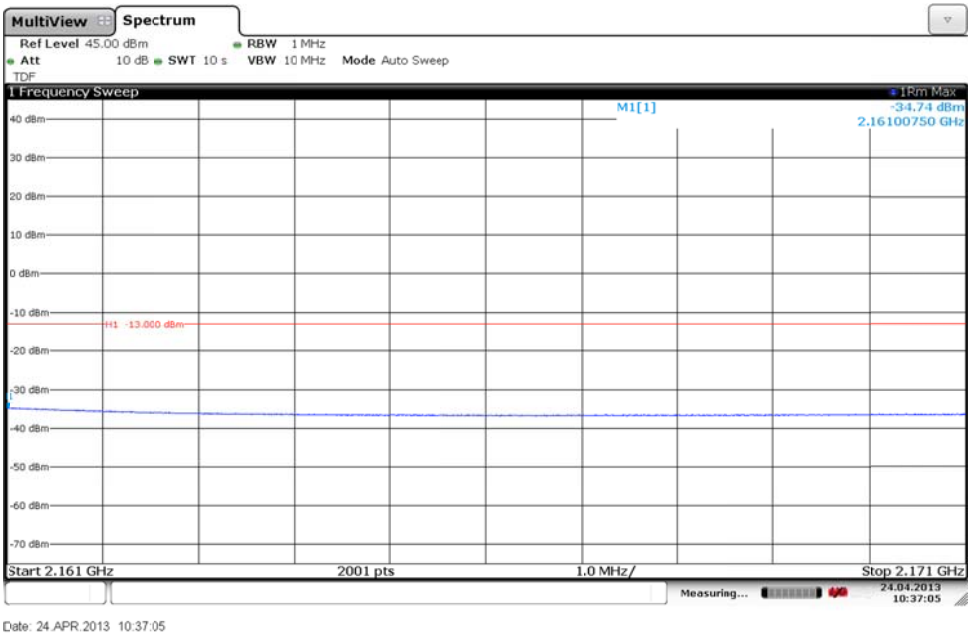
Date: 24.APR.2013 10:35:39

Diagram 6b:

Date: 24.APR.2013 10:36:27

Appendix 5

Diagram 6c:



Conducted spurious emission measurements according to CFR 47 §27.53(h)/ IC RSS-139 6.5

Date	Temperature	Humidity
2013-04-23	23 °C ± 3 °C	29 % ± 5 %
2013-04-24	20 °C ± 3 °C	26 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §27.53(h). The output was connected to a spectrum analyzer with a RBW setting of 1 MHz and RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

Before comparing the results to the limit, 3 dB [10 log (2)] should be added according to method E), 3), (iii) “measure and add 10 log(N_{ANT})” of FCC KDB662911 D01 Multiple Transmitter Output v01r02

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	901 508
High pass filter	901 502
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

MIMO mode, single carrier

Diagram	BW configuration	Tested frequency	Tested Port
1 a+b+c+d	5 MHz	B	RF A
2 a+b+c+d	5 MHz	B	RF B
3 a+b+c+d	5 MHz	M	RF A
4 a+b+c+d	5 MHz	M	RF B
5 a+b+c+d	5 MHz	T	RF A
6 a+b+c+d	5 MHz	T	RF B

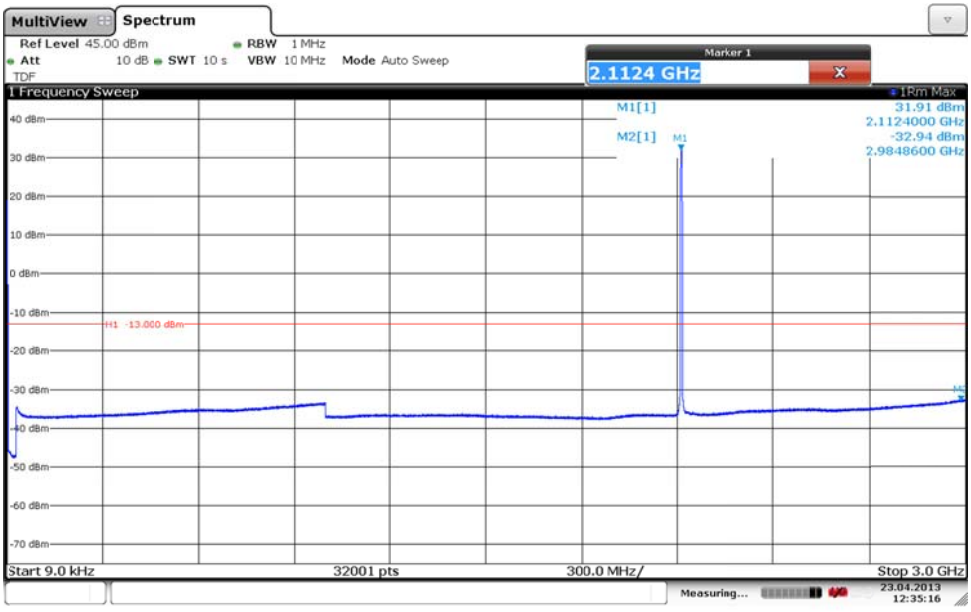
MIMO mode, multi carrier

Diagram	BW configuration	Tested frequency	Tested Port
7 a+b+c+d	5 MHz	B3	RF A
8 a+b+c+d	5 MHz	T3	RF A

Note: Measurements were limited to port RF A due to the measurement result in single carrier mode that shows that the ports are electrical identical as declared by the client.

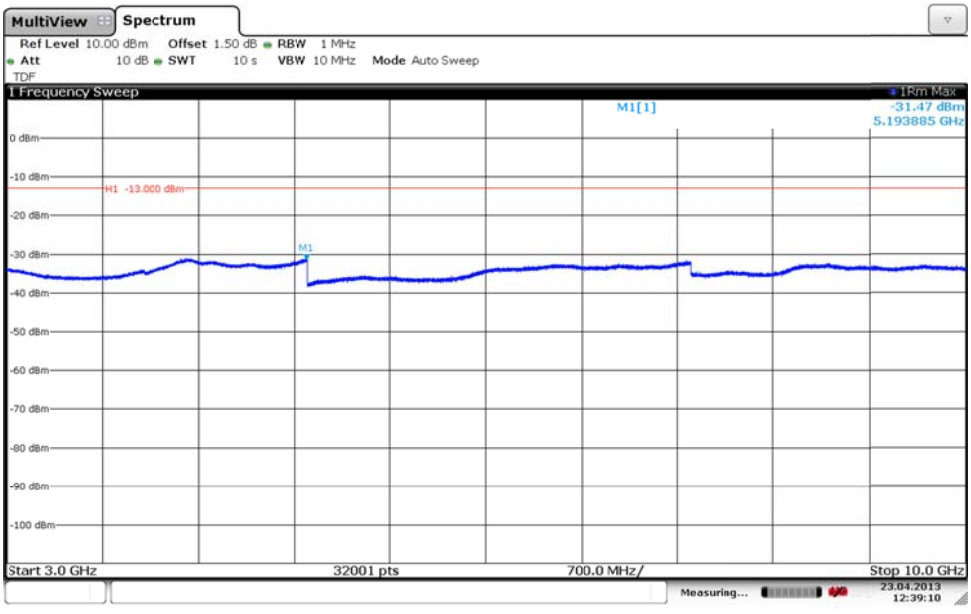
Appendix 6

Diagram 1a:



Date: 23.APR.2013 12:35:17

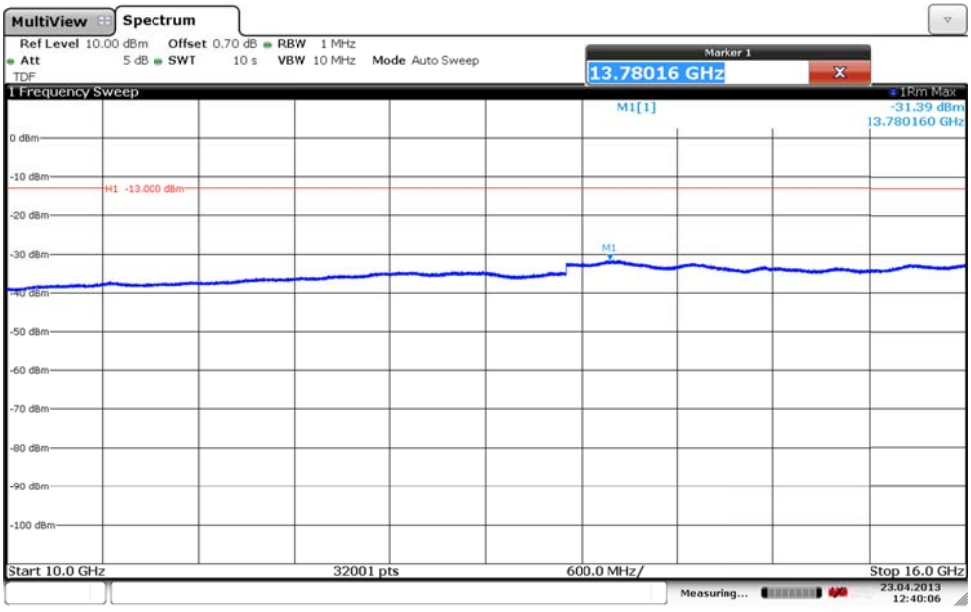
Diagram 1b:



Date: 23.APR.2013 12:39:10

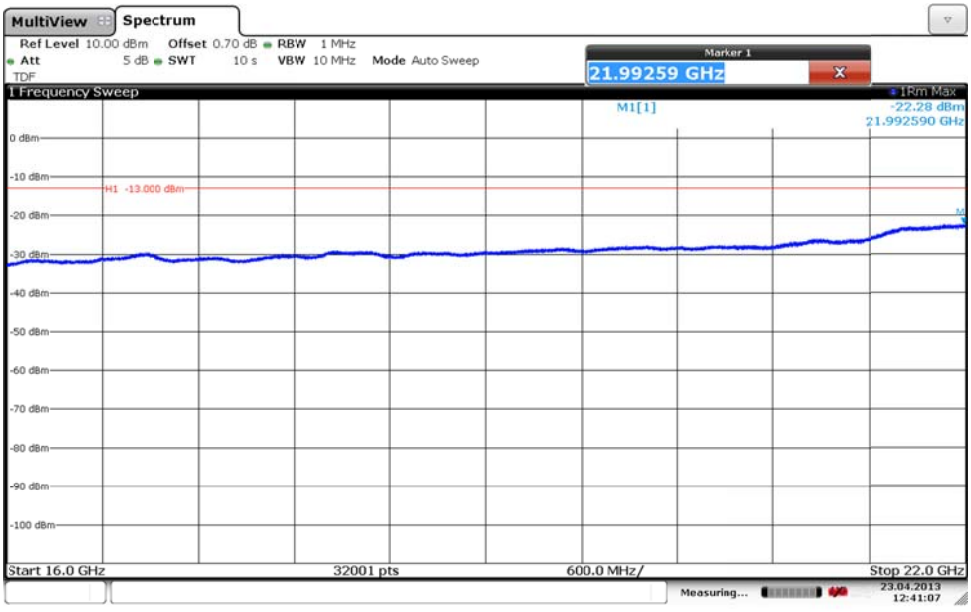
Appendix 6

Diagram 1c:



Date: 23.APR.2013 12:40:07

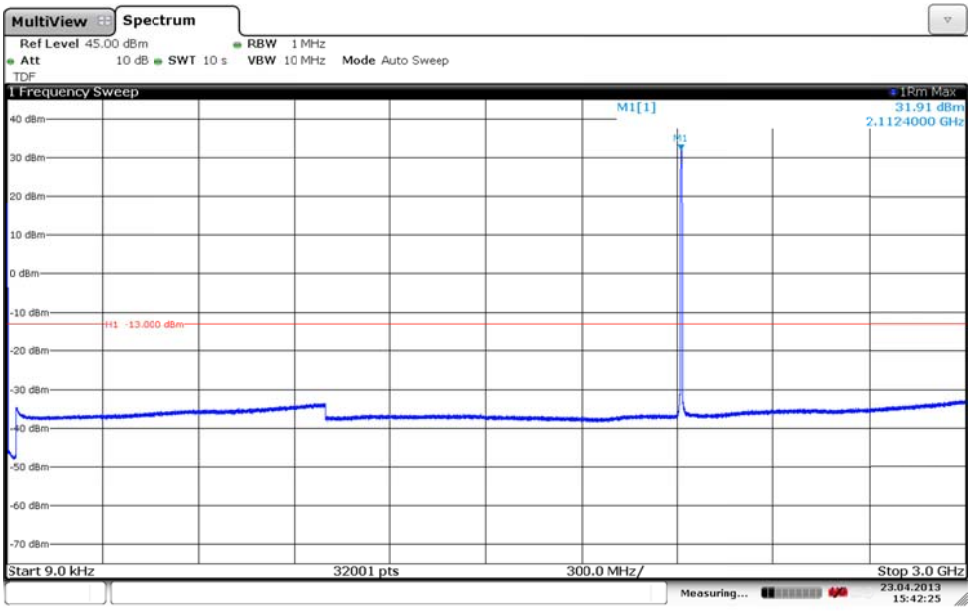
Diagram 1d:



Date: 23.APR.2013 12:41:07

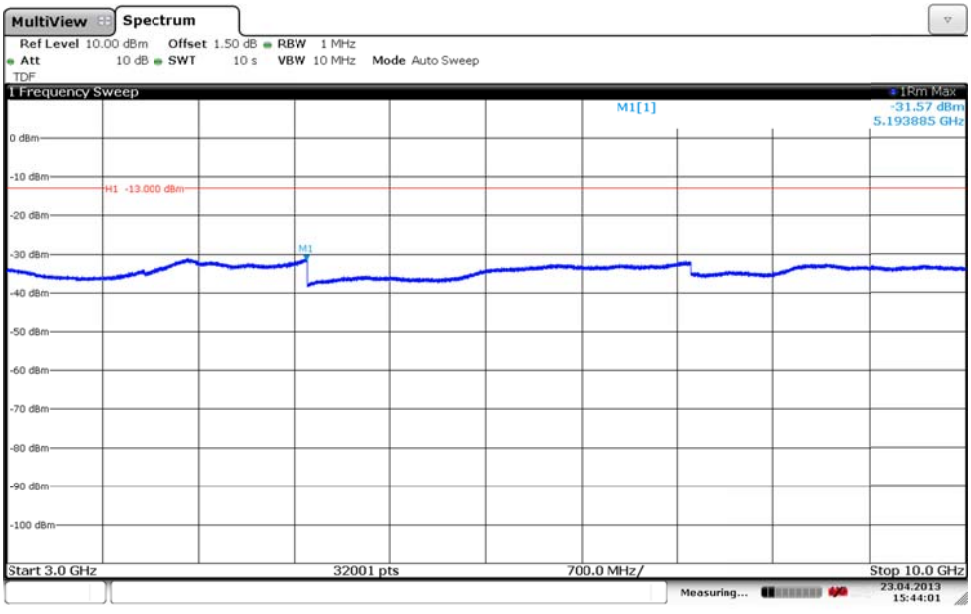
Appendix 6

Diagram 2a:



Date: 23.APR.2013 15:42:25

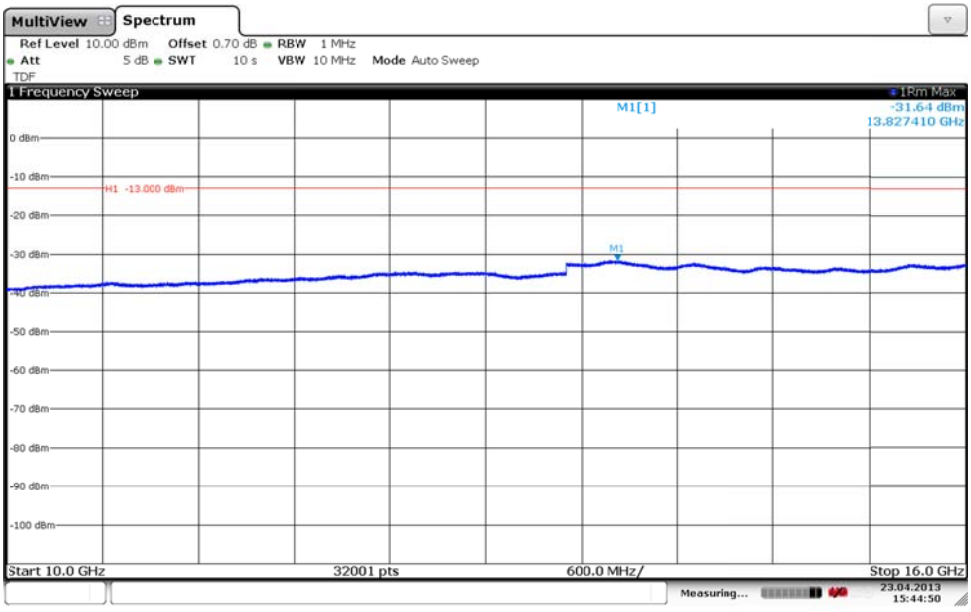
Diagram 2b:



Date: 23.APR.2013 15:44:00

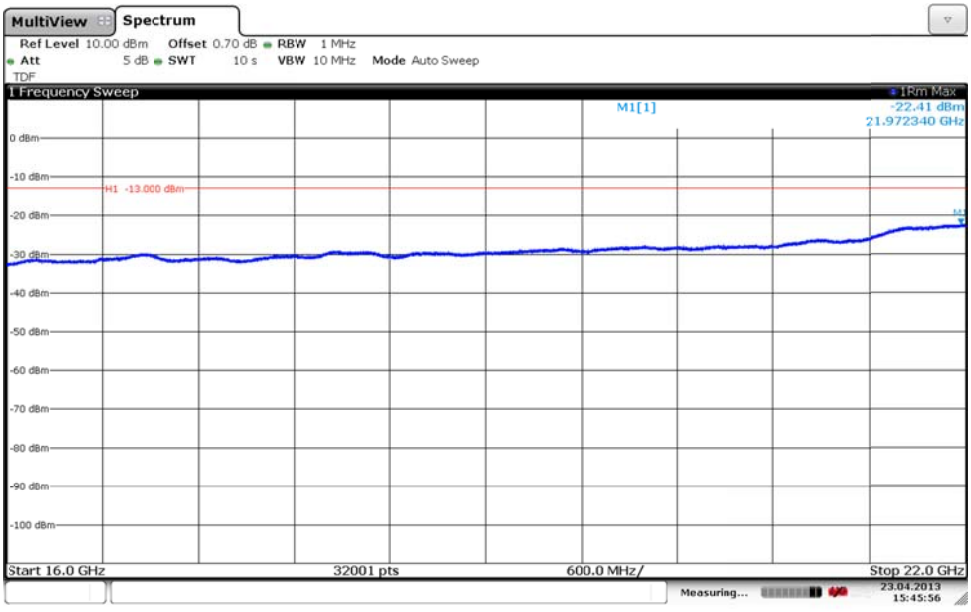
Appendix 6

Diagram 2c:



Date: 23.APR.2013 15:44:50

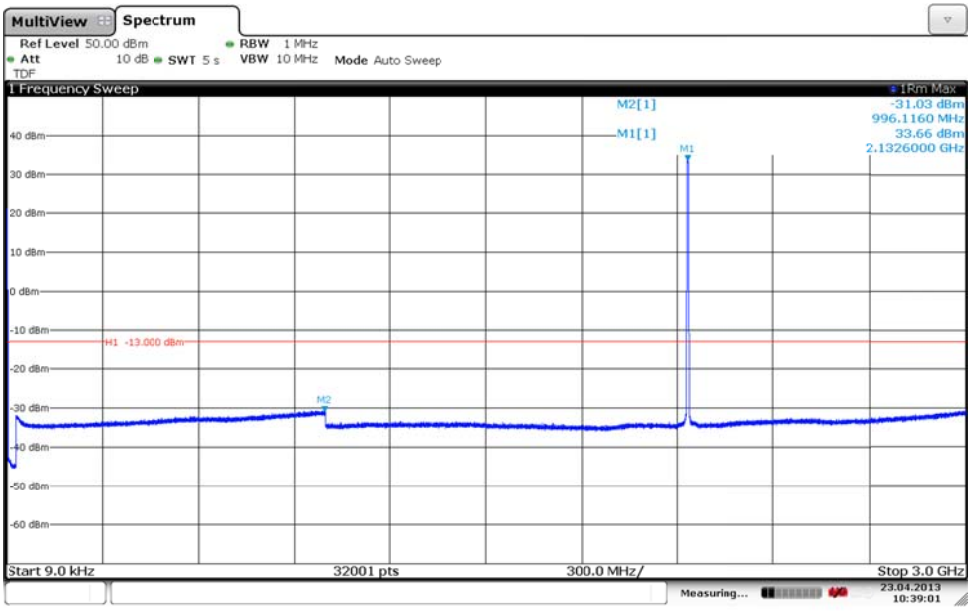
Diagram 2d:



Date: 23.APR.2013 15:45:56

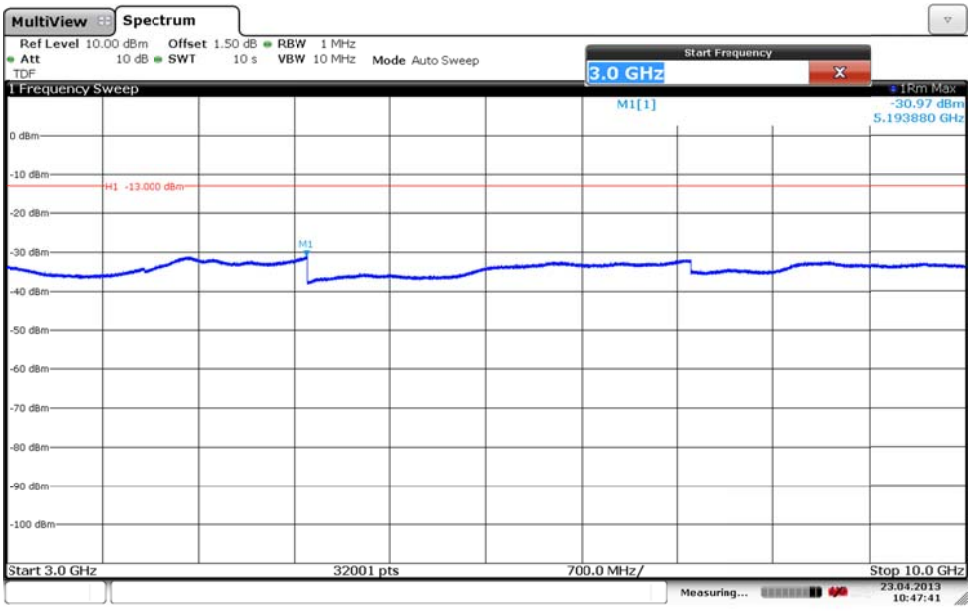
Appendix 6

Diagram 3a:



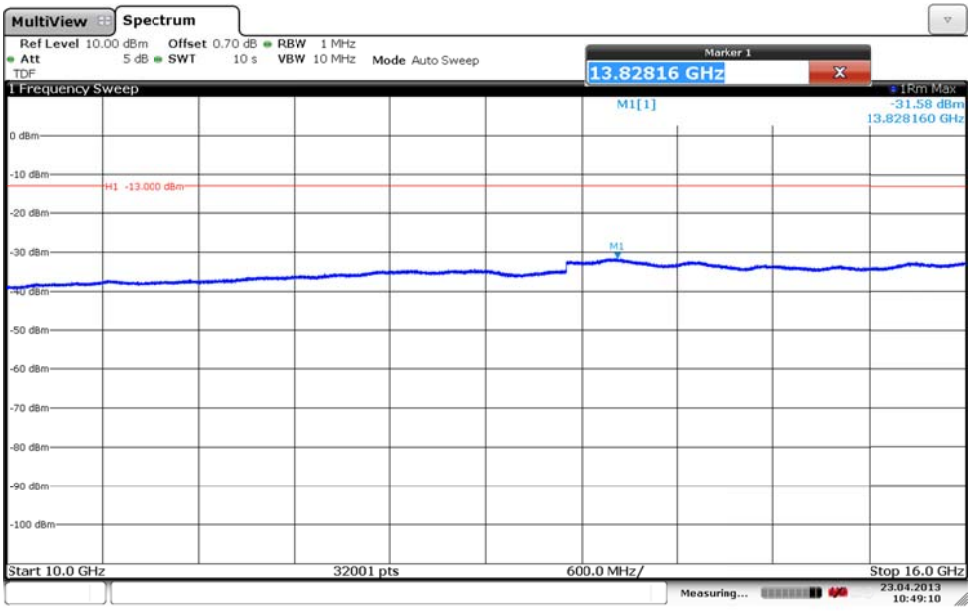
Date: 23.APR.2013 10:39:01

Diagram 3b:



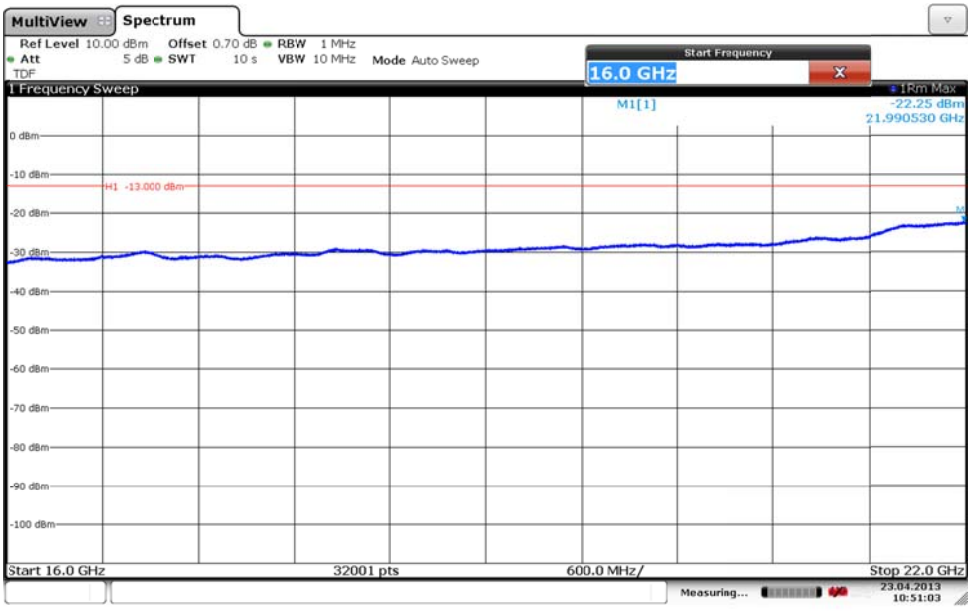
Date: 23.APR.2013 10:47:41

Diagram 3c:



Date: 23.APR.2013 10:49:10

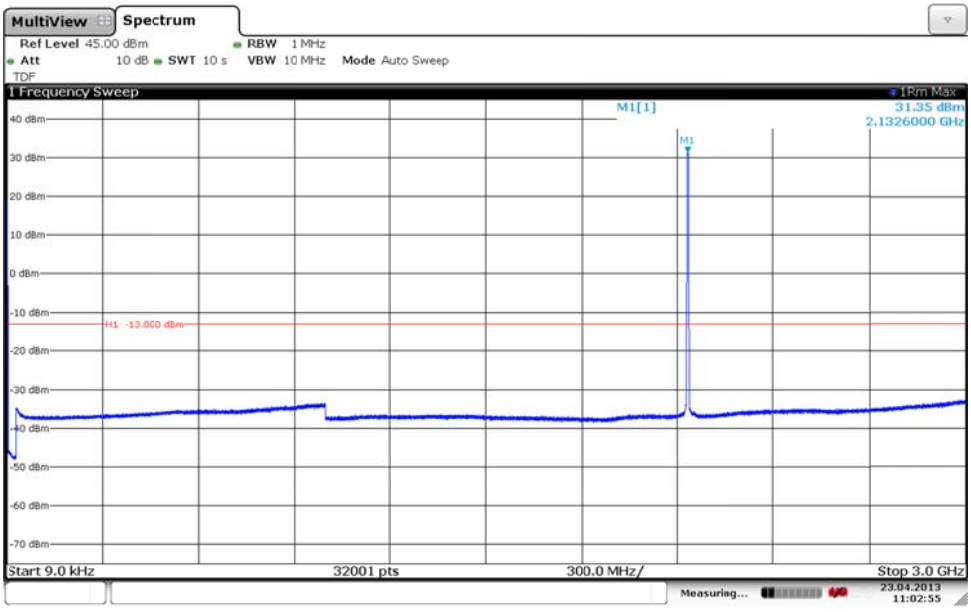
Diagram 3d:



Date: 23.APR.2013 10:51:03

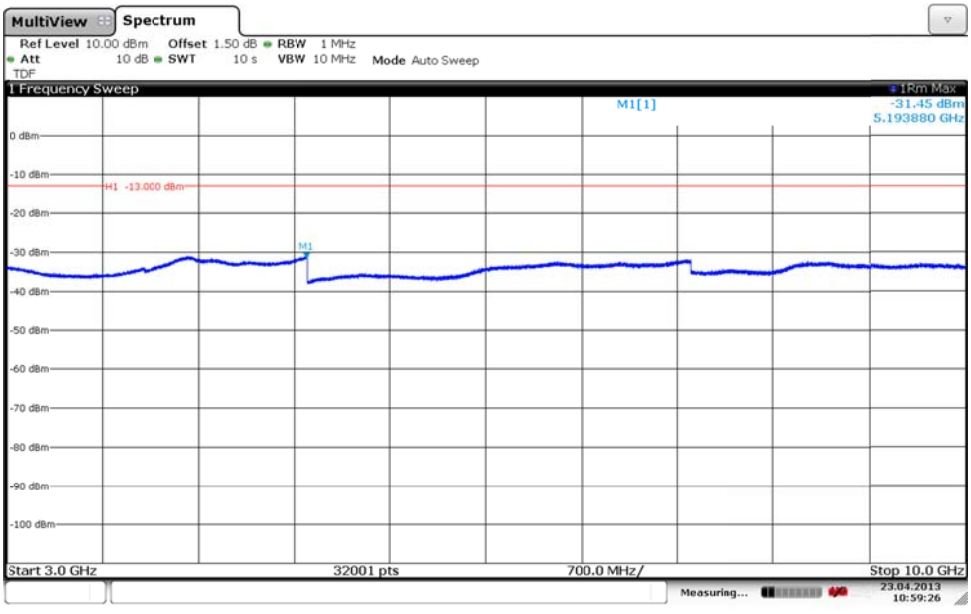
Appendix 6

Diagram 4a:



Date: 23.APR.2013 11:02:55

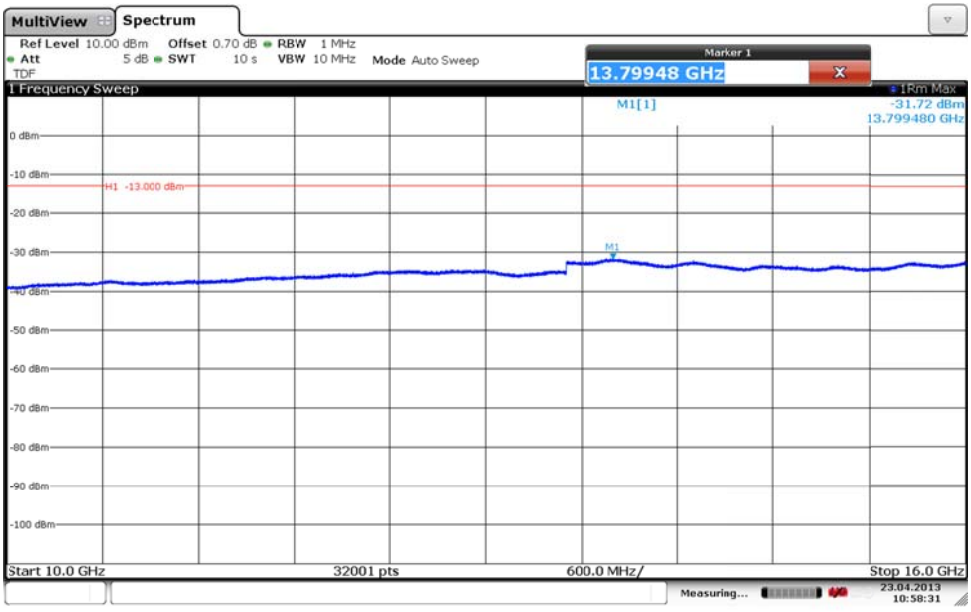
Diagram 4b:



Date: 23.APR.2013 10:59:26

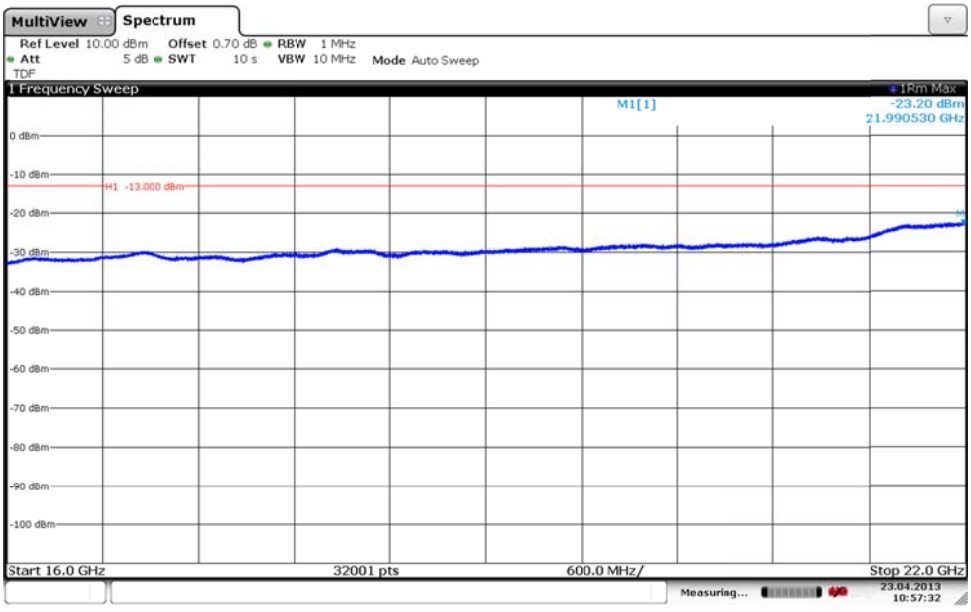
Appendix 6

Diagram 4c:



Date: 23.APR.2013 10:58:31

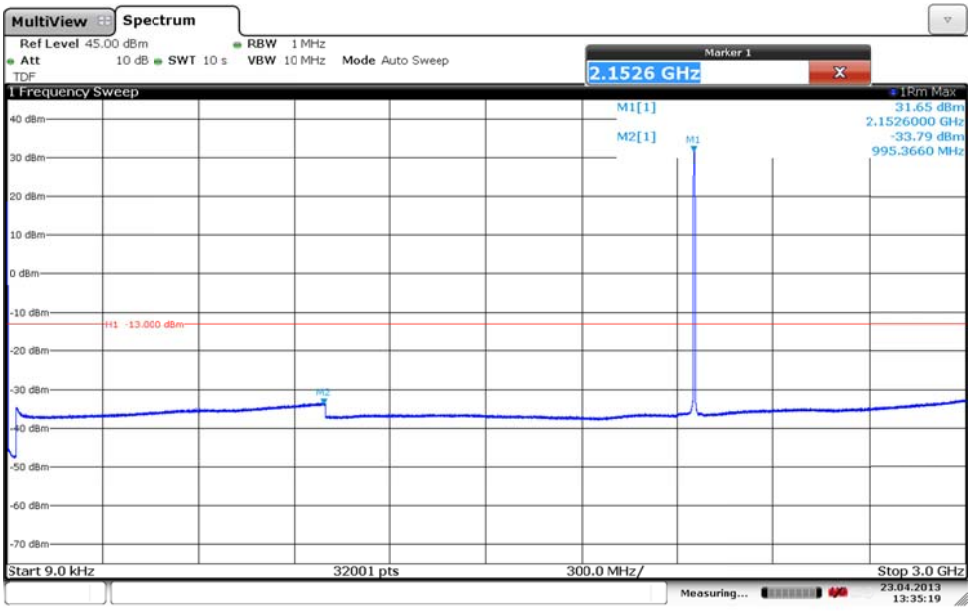
Diagram 4d:



Date: 23.APR.2013 10:57:32

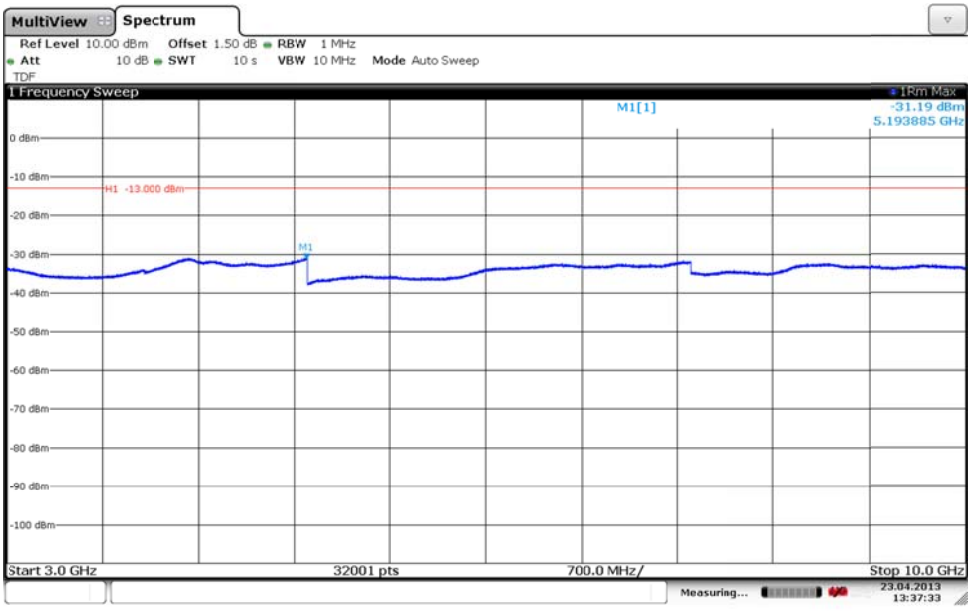
Appendix 6

Diagram 5a:



Date: 23.APR.2013 13:35:19

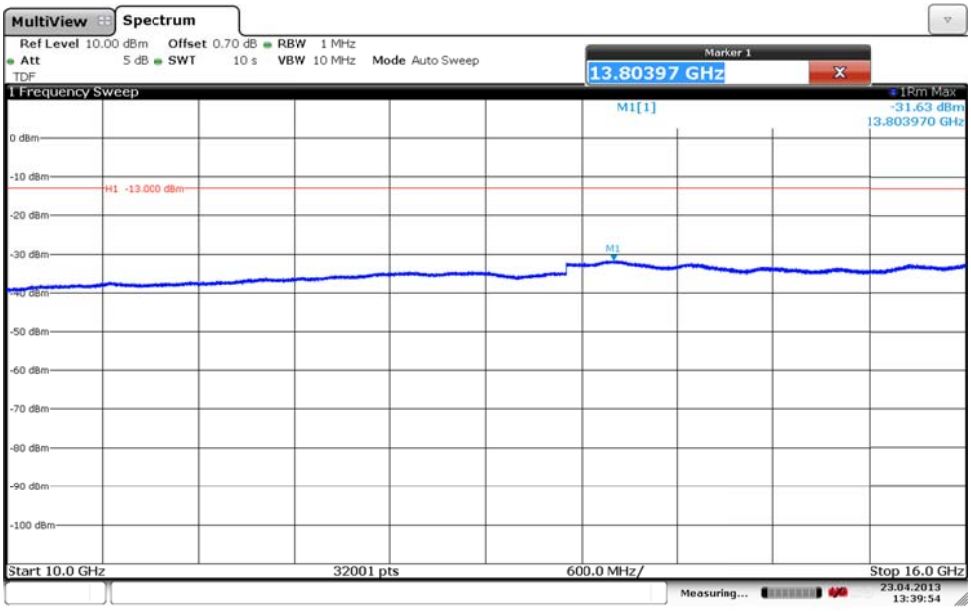
Diagram 5b:



Date: 23.APR.2013 13:37:33

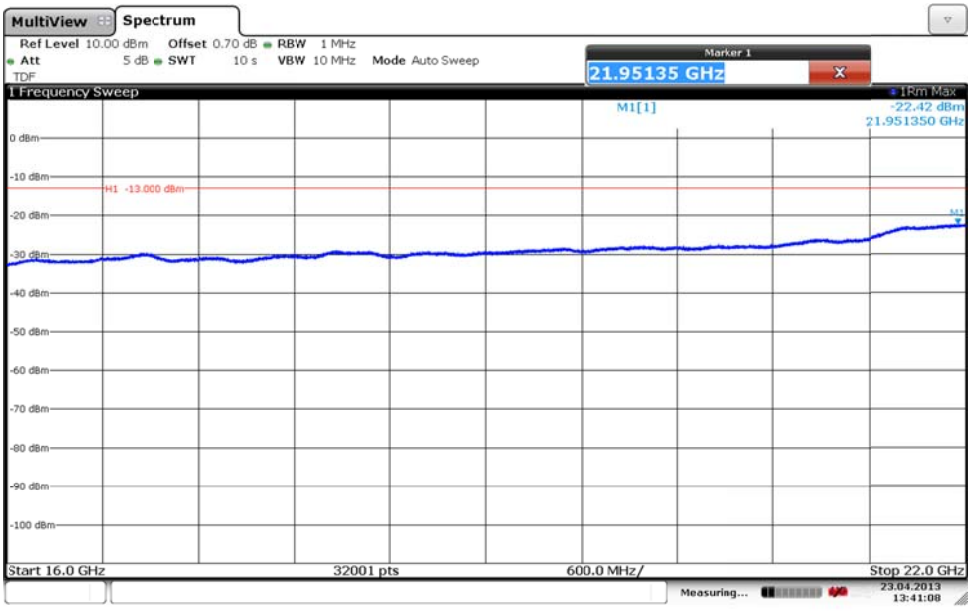
Appendix 6

Diagram 5c:



Date: 23.APR.2013 13:39:53

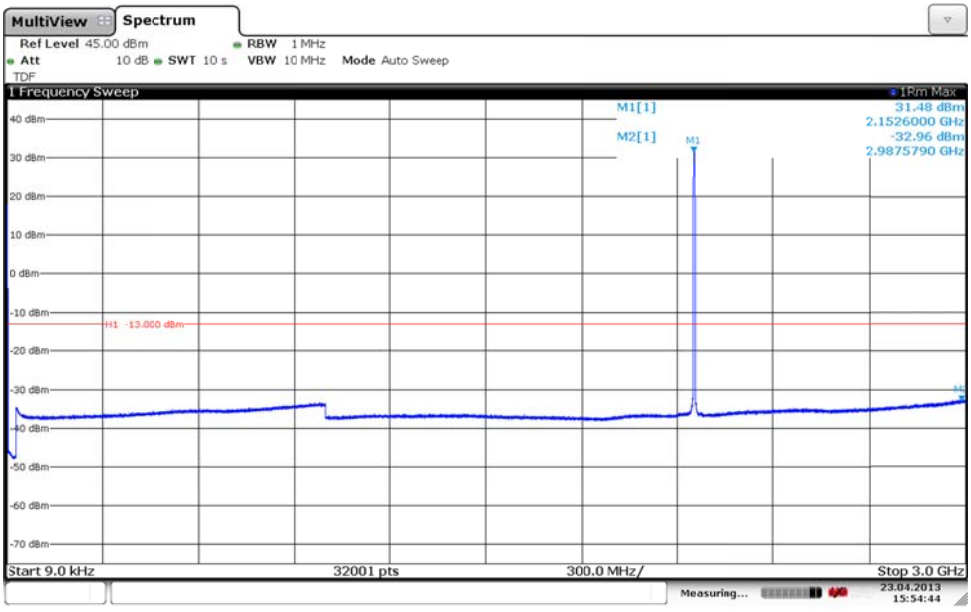
Diagram 5d:



Date: 23.APR.2013 13:41:08

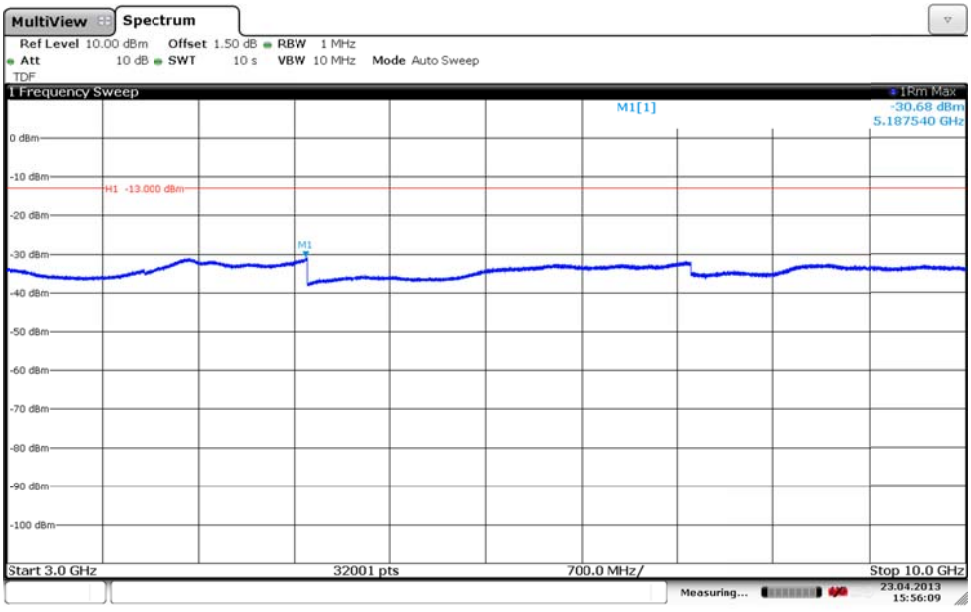
Appendix 6

Diagram 6a:



Date: 23.APR.2013 15:54:43

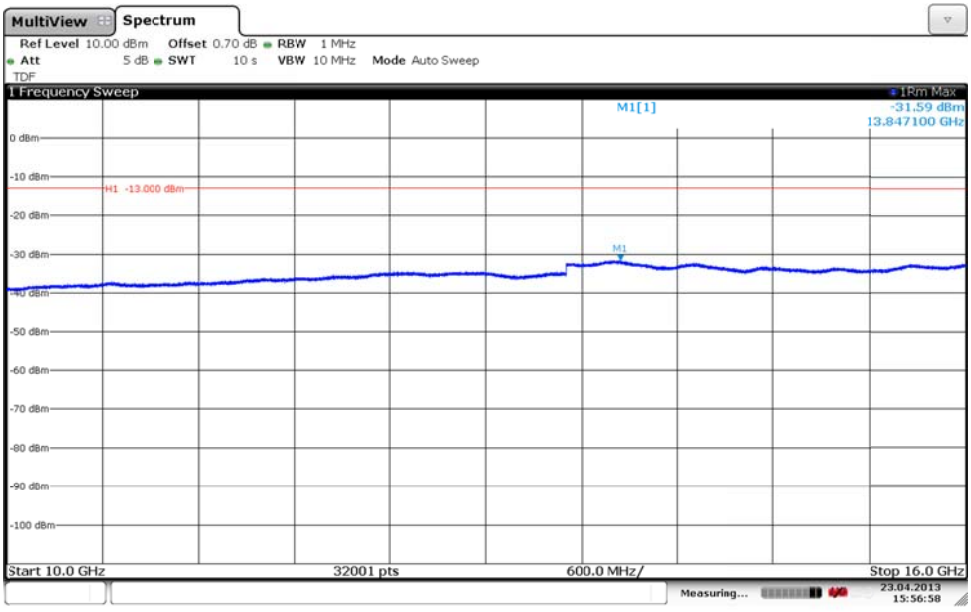
Diagram 6b:



Date: 23.APR.2013 15:56:09

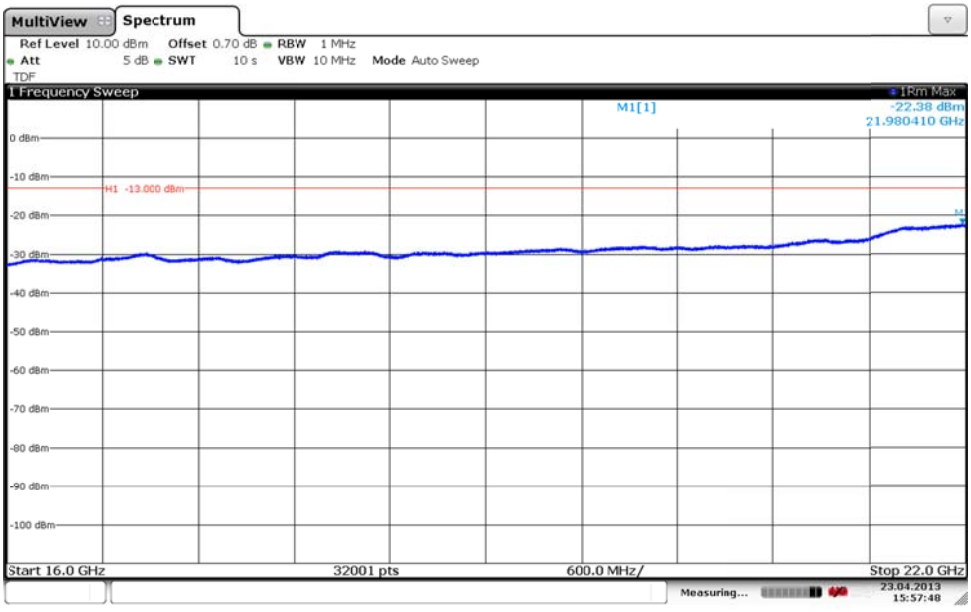
Appendix 6

Diagram 6c:



Date: 23.APR.2013 15:56:58

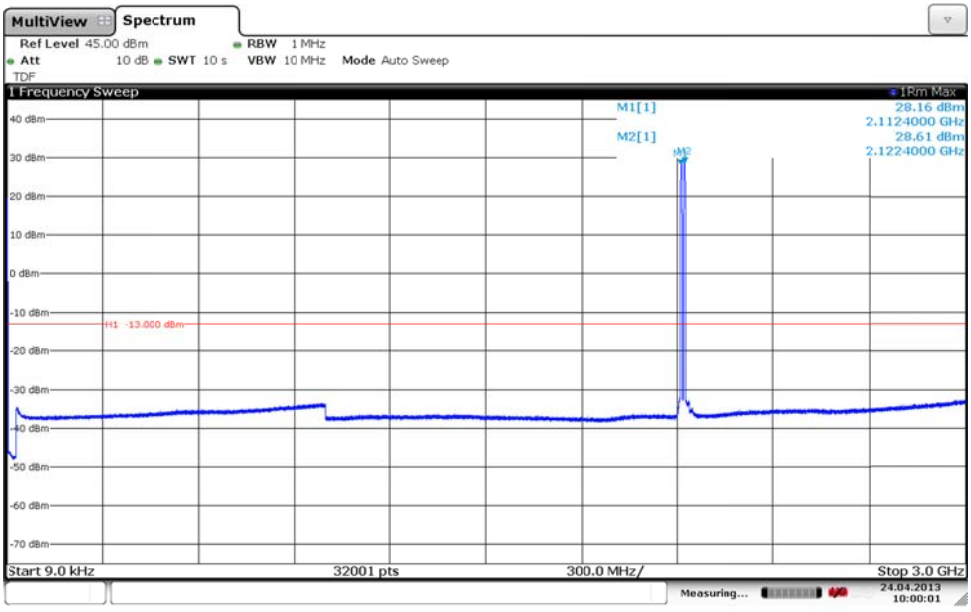
Diagram 6d:



Date: 23.APR.2013 15:57:48

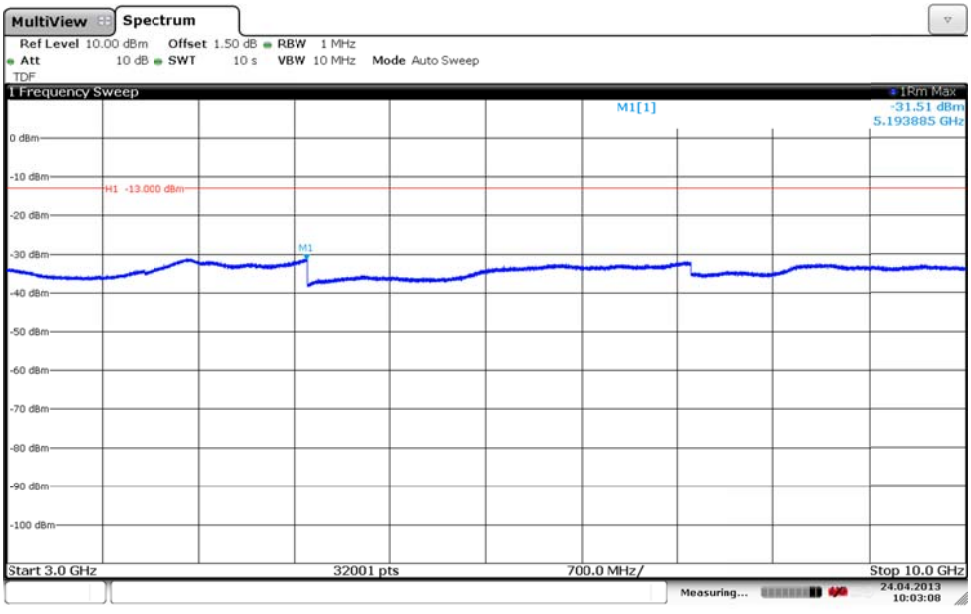
Appendix 6

Diagram 7a:



Date: 24.APR.2013 10:00:01

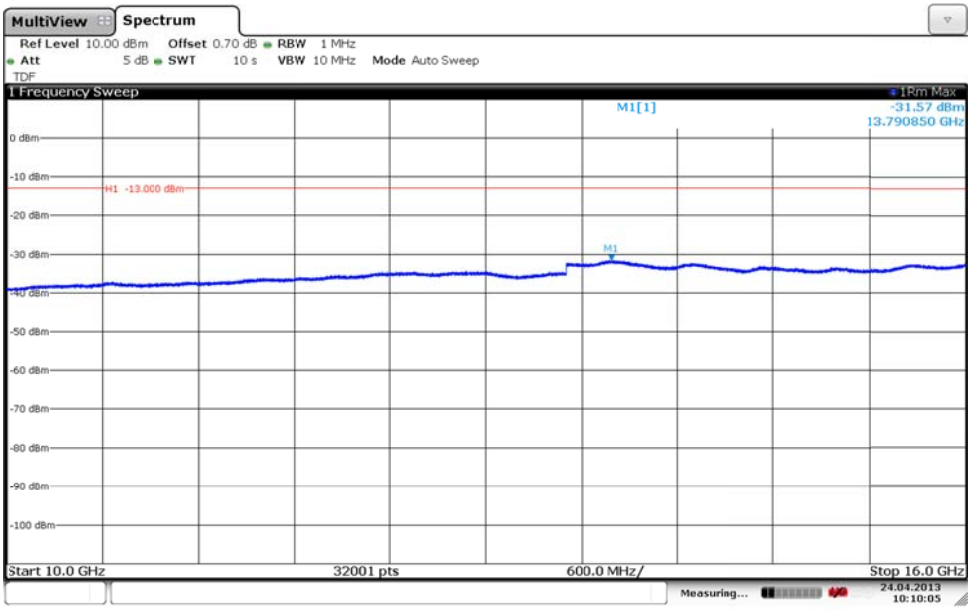
Diagram 7b:



Date: 24.APR.2013 10:03:07

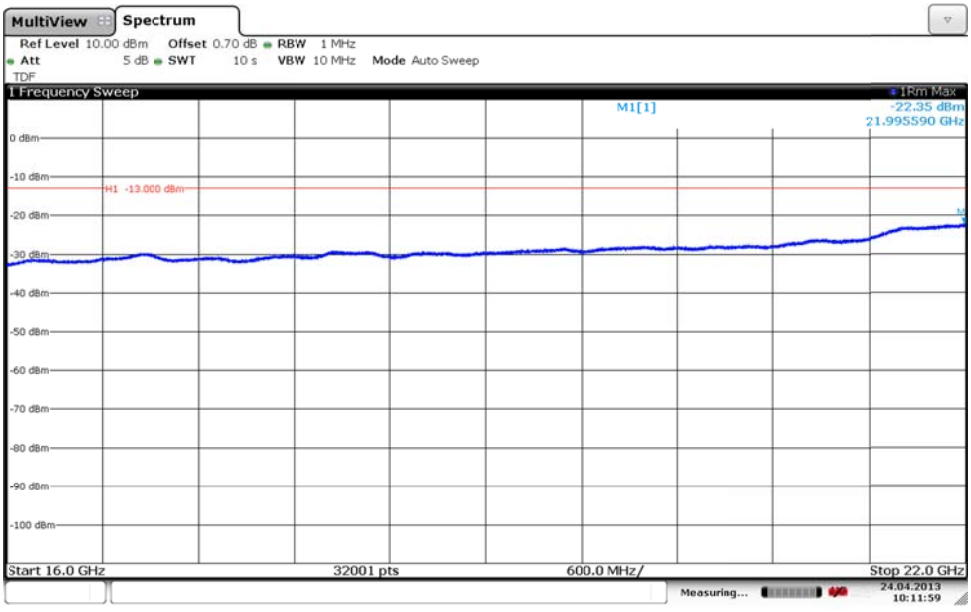
Appendix 6

Diagram 7c:



Date: 24.APR.2013 10:10:06

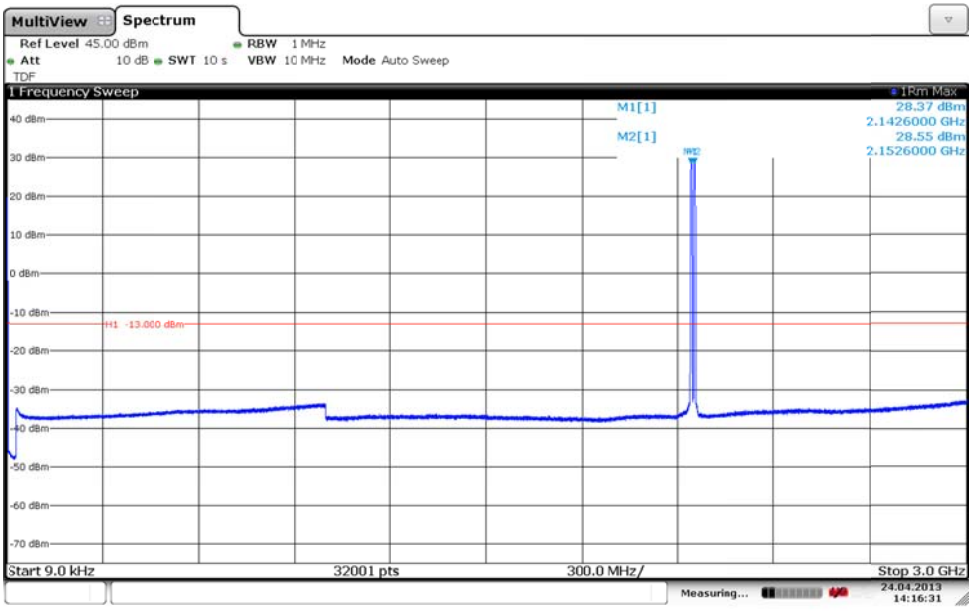
Diagram 7d:



Date: 24.APR.2013 10:11:59

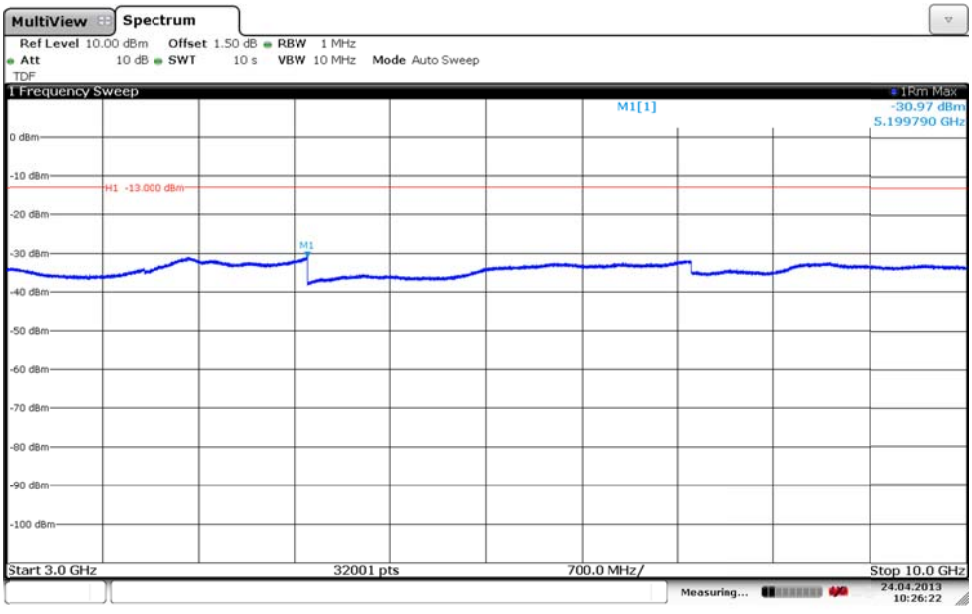
Appendix 6

Diagram 8a:



Date: 24.APR.2013 14:16:31

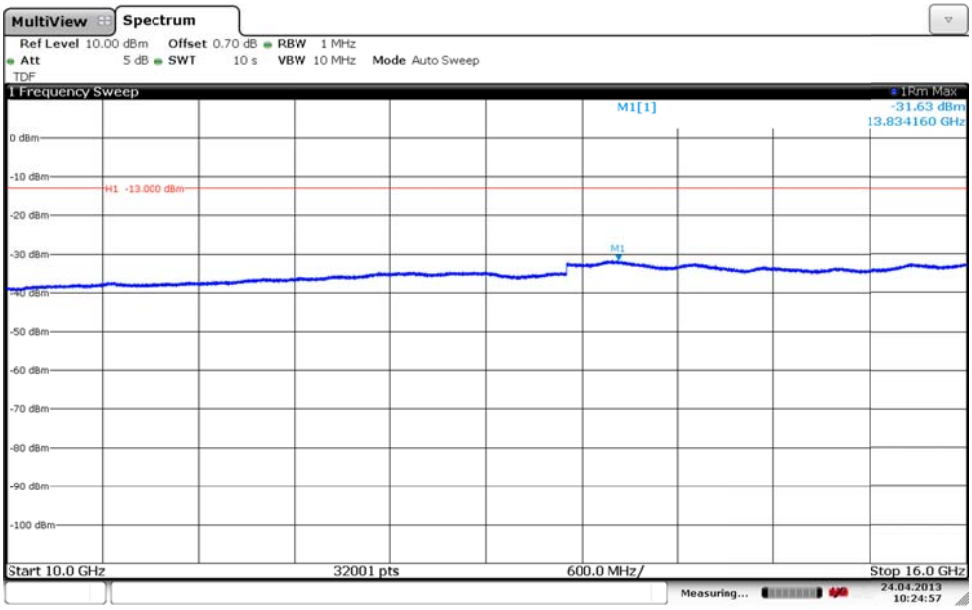
Diagram 8b:



Date: 24.APR.2013 10:26:22

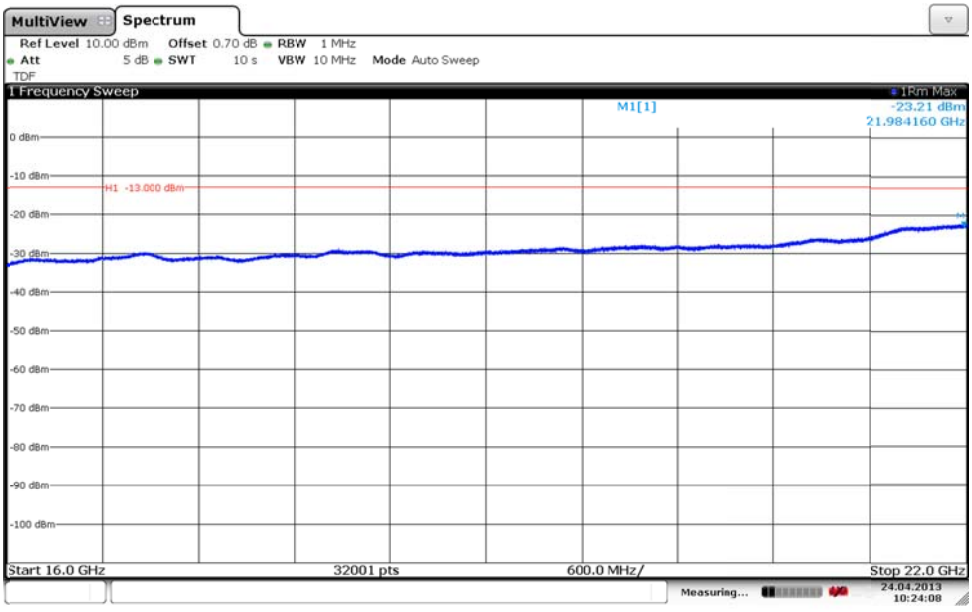
Appendix 6

Diagram 8c:



Date: 24.APR.2013 10:24:56

Diagram 8d:



Date: 24.APR.2013 10:24:08

Remark

The emission at 9 kHz on the plots was not generated by the test object. A complementary measurement with a smaller RBW showed that it was related to the LO feed-through.

The highest fundamental frequency is 2.155 GHz. The measurements were made up to 22 GHz (10x2.155 GHz = 21.55 GHz).

Limits

§27.53(h) and RSS-139 6.5

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm per 1 MHz RBW.

Complies?	Yes

Appendix 7

Field strength of spurious radiation measurements according to 47 CFR 27.53 (h) / IC RSS-139 6.5

Date	Temperature	Humidity
2013-04-22	23°C ± 3°C	30 % ± 5 %
2013-04-23	22°C ± 3°C	32 % ± 5 %
2013-04-24	22°C ± 3°C	28 % ± 5 %
2013-04-25	23°C ± 3°C	28 % ± 5 %

Test set-up and procedure

The test sites are listed at FCC, Columbia with registration number: 93866. The test site complies with RSS-Gen, Industry Canada file no. 3482A-2.

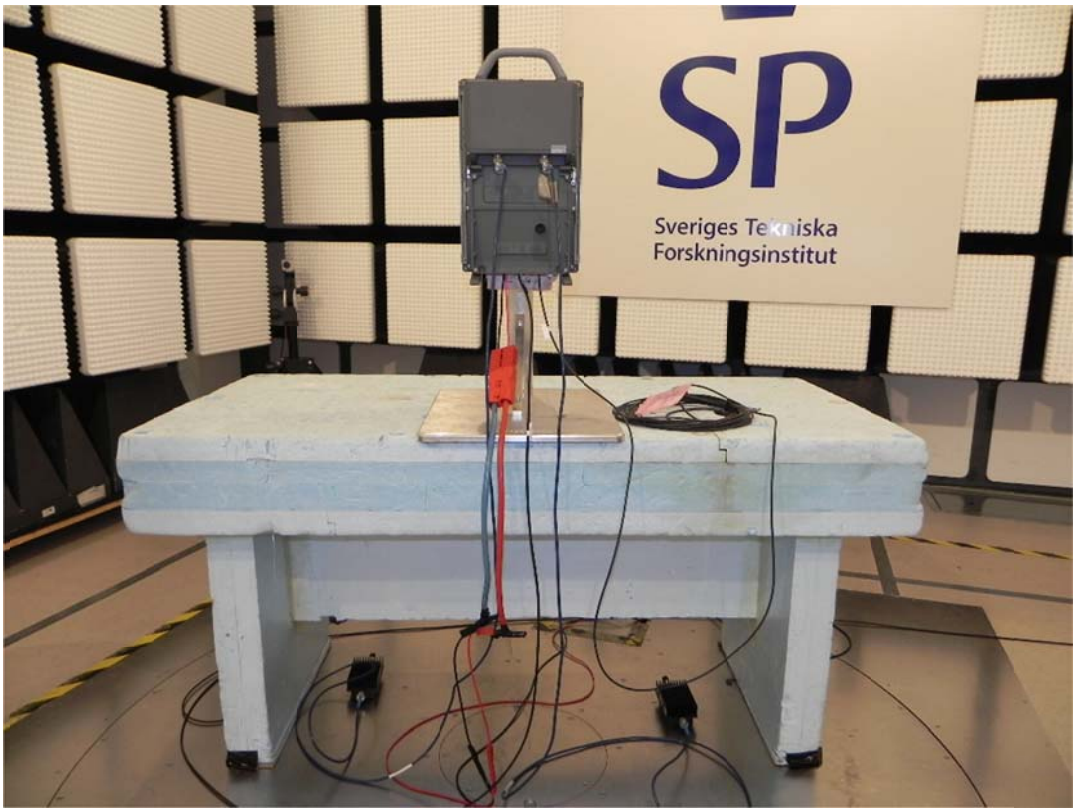
The measurements were performed with both horizontal and vertical polarization of the antenna. The antenna distance was 3 m in the frequency range 30 MHz – 18 GHz and 1m in the frequency range 18 - 22 GHz.

In the frequency range 30 MHz – 22 GHz the measurement was performed in power with a RBW of 1 MHz. A propagation loss in free space was calculated. The used formula was $\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.

The measurement procedure was as the following:

1. The pre-measurement was first performed with peak detector. The EUT was measured in eight directions and with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m.
2. Spurious radiation on frequencies closer than 20 dB to the limit in the pre-measurement is scanned 0-360 degrees and the antenna is scanned 1- 4 m for maximum response. The emission is then measured with the RMS detector and the RMS value is reported. Frequencies closer than 10 dB to the limit when measured with the RMS detector were measured with the substitution method according to the standard.

The test set-up during the spurious radiation measurements is shown in the picture below:



Measurement equipment

Measurement equipment	SP number
Semi anechoic chamber, Edison	504 114
R&S ESU 26	902 210
EMC 32 ver. 8.52.0	503 745
Antenna Schaffner CBL 6143	504 079
EMCO Horn Antenna 3115	502 175
Flann STD Gain Horn Antenna 20240-20	503 674
High pass filter, RLC Electronics	503 739
Miteq, Low Noise Amplifier	503 285
Schwarzbeck preamplifier BBV 9742	504 085
µComp Nordic, Low Noise Amplifier	504 160
Temperature and humidity meter, Testo 635	504 203

Tested configurations

B
M
T
B3
T3

Results, representing worst case

M, Diagram 1 a-c

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-22 000	All emission > 20 dB below limit	All emission > 20 dB below limit

Measurement uncertainty:

3.2 dB up to 18 GHz, 3.6 dB above 18 GHz

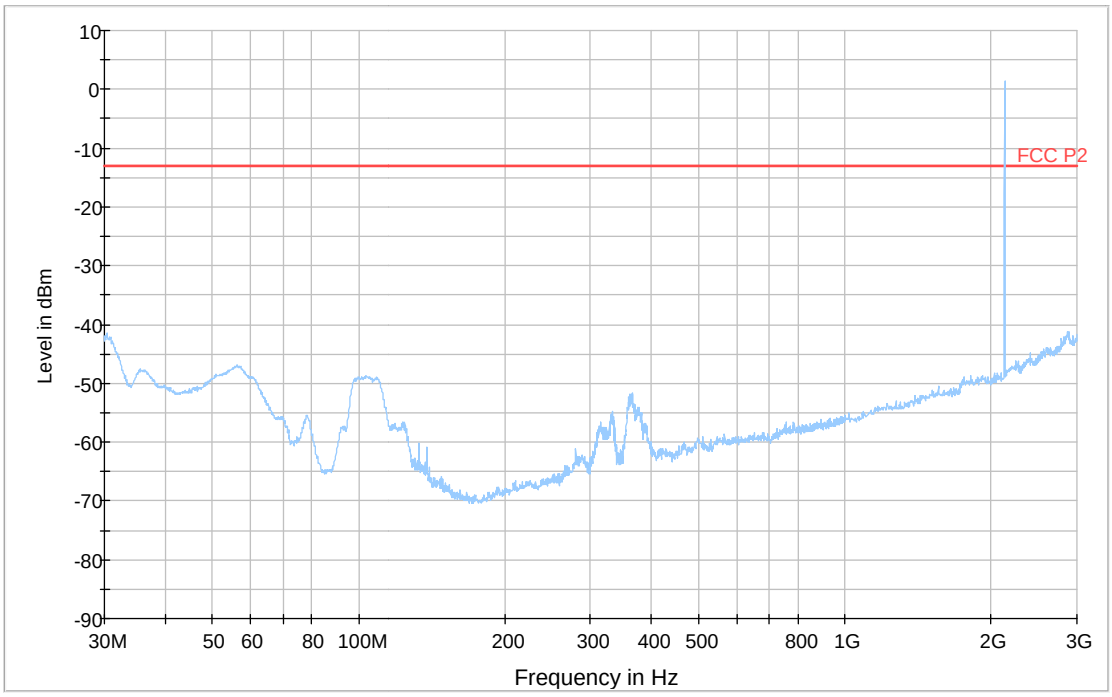
Limits

§27.53(h) and RSS-139 6.5

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm per 1 MHz RBW.

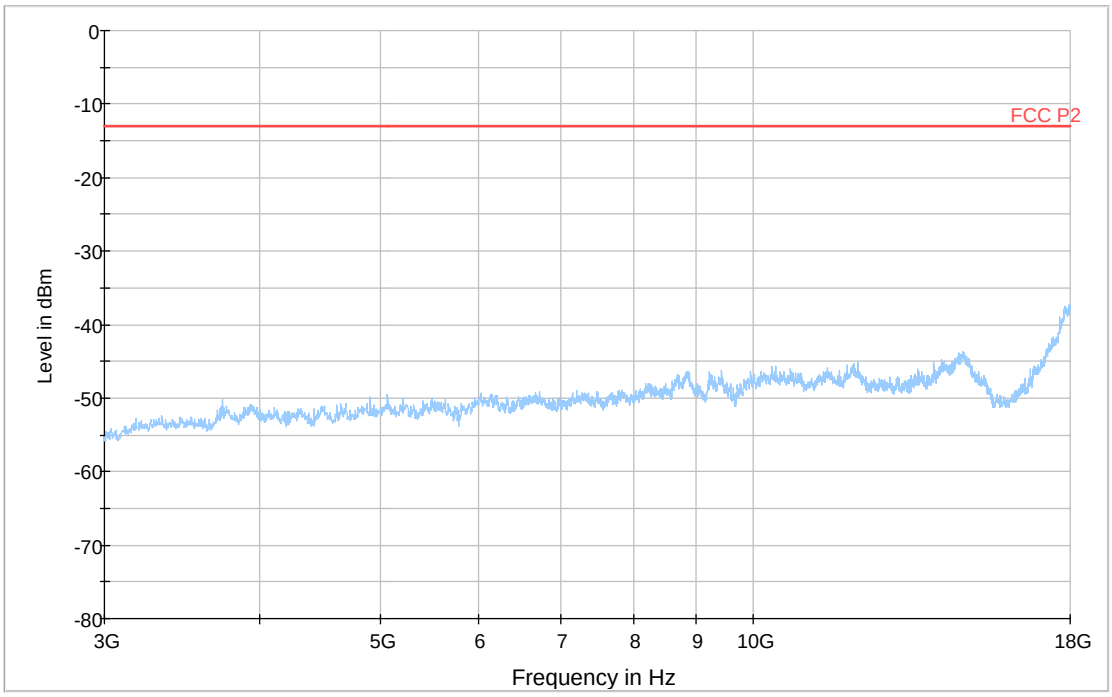
Complies?	Yes

Diagram 1a:



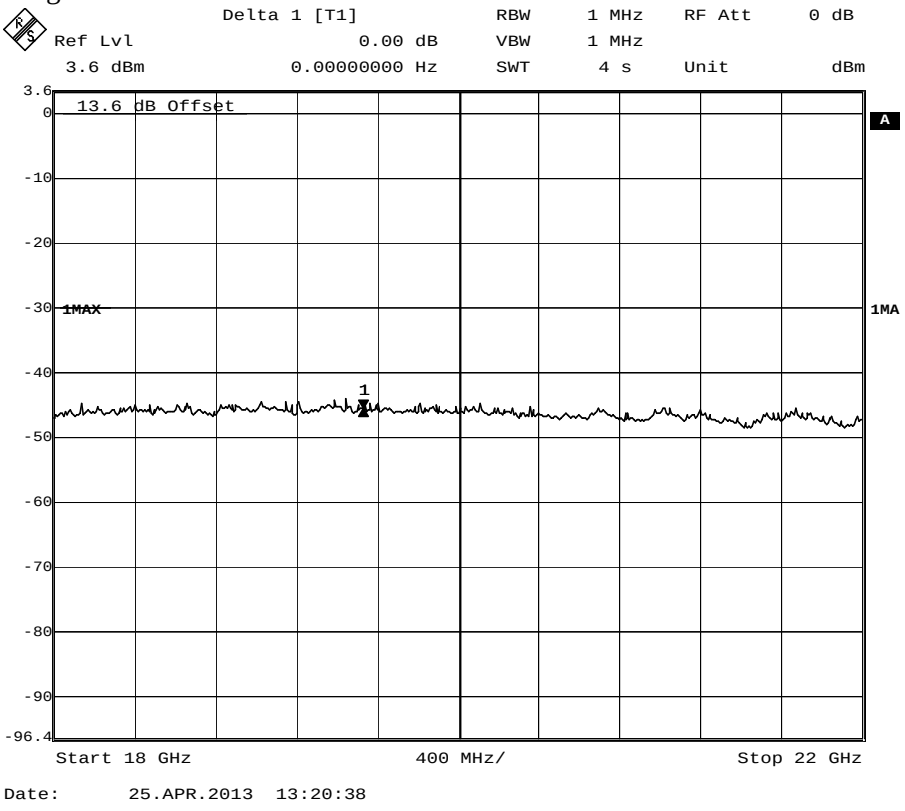
Note: The emission at 2132.6 MHz is the carrier frequency and shall be ignored in the context.

Diagram 1b:



Appendix 7

Diagram 1c:



Appendix 8

Frequency stability measurements according to CFR 47 §27.54 / IC RSS 139 6.3

Date	Temperature (test equipment)	Humidity (test equipment)
2013-05-06	23 °C ± 3 °C	29% ± 5 %
2013-05-07	23 °C ± 3 °C	27% ± 5 %
2013-05-08	23 °C ± 3 °C	42% ± 5 %

Test set-up and procedure

The measurement was made per 3GPP TS 25.141. The output was connected to a spectrum analyzer. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
R&S FSQ 40	504 143
RF attenuator	900 233
RF Terminator	-
Temperature Chamber	503 360
Testo 635, temperature and humidity meter	504 203
Multimeter Fluke 87	502 190

Results

Nominal Voltage -48 V DC

Maximum output power at mid channel (M)

Channel Bandwidth 5MHz

Test conditions		Frequency error (Hz)
Supply voltage DC (V)	T (°C)	
-48.0	+20	+6
-55.2	+20	+4
-40.8	+20	+7
-48.0	+30	+6
-48.0	+40	-6
-48.0	+50	+6
-48.0	+10	-7
-48.0	0	-5
-48.0	-10	+8
-48.0	-20	+5
-48.0	-30	-7
Maximum freq. error (Hz)		8
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Results

Nominal Voltage -120 V AC

Maximum output power at mid channel (M)

Channel Bandwidth 5MHz

Test conditions		Frequency error (Hz)
Supply voltage AC (V)	T (°C)	
102.0	+20	-8
120.0	+20	+7
138.0	+20	+8
Maximum freq. error (Hz)		8
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Remark

Measurements was performed on test object mRRUS 12 B4, KRC 161 326/3, revision R1A, S/N: C826984844

Limits

Limit according to 3GPP TS 25.141:

The frequency error shall be within ± 0.05 PPM ± 12 Hz (±106.63Hz).

§27.54

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

RSS-139 6.3 Frequency:
The frequency stability shall be sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

Complies?	Yes

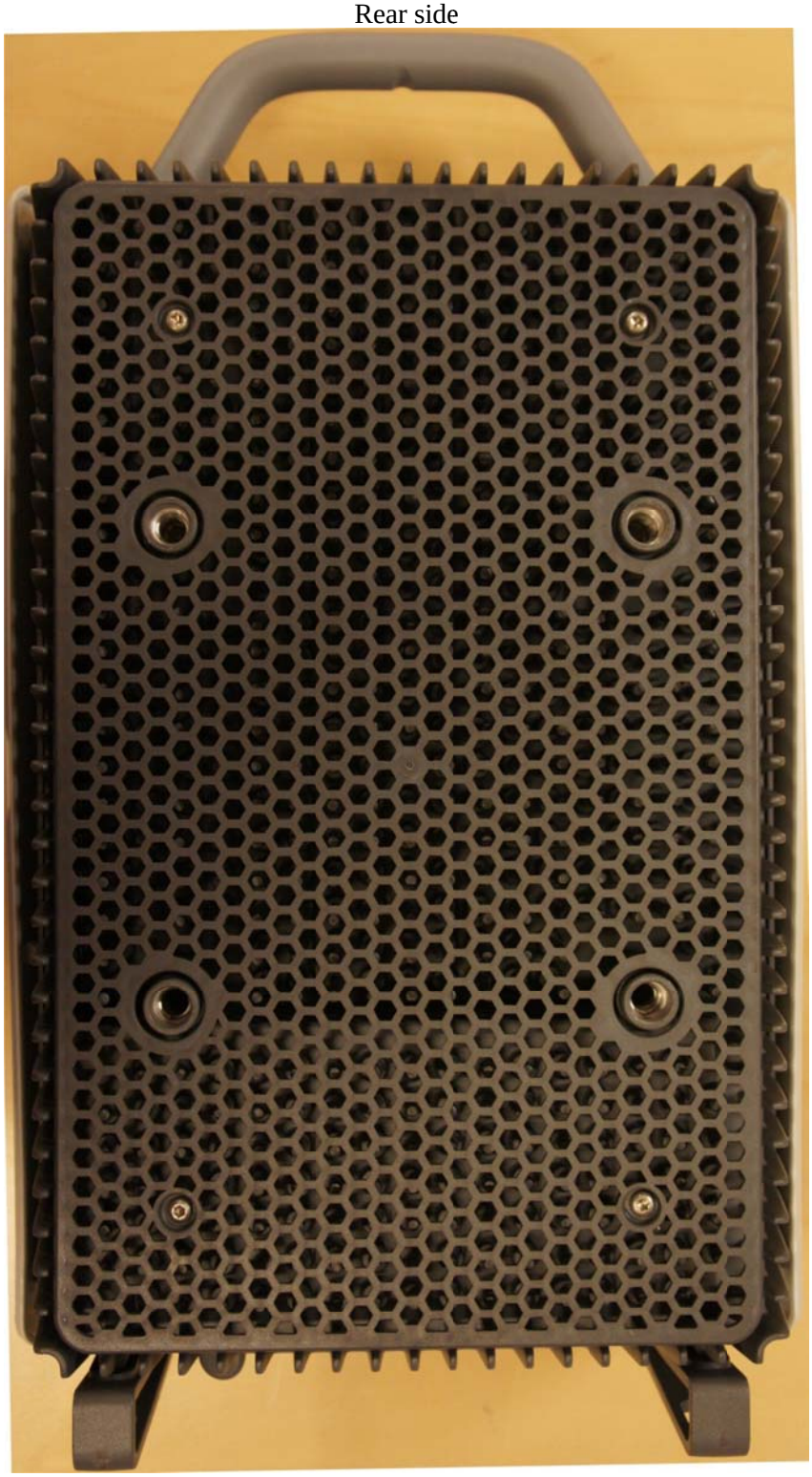
Appendix 9

External photos

Front side

Appendix 9

Rear side



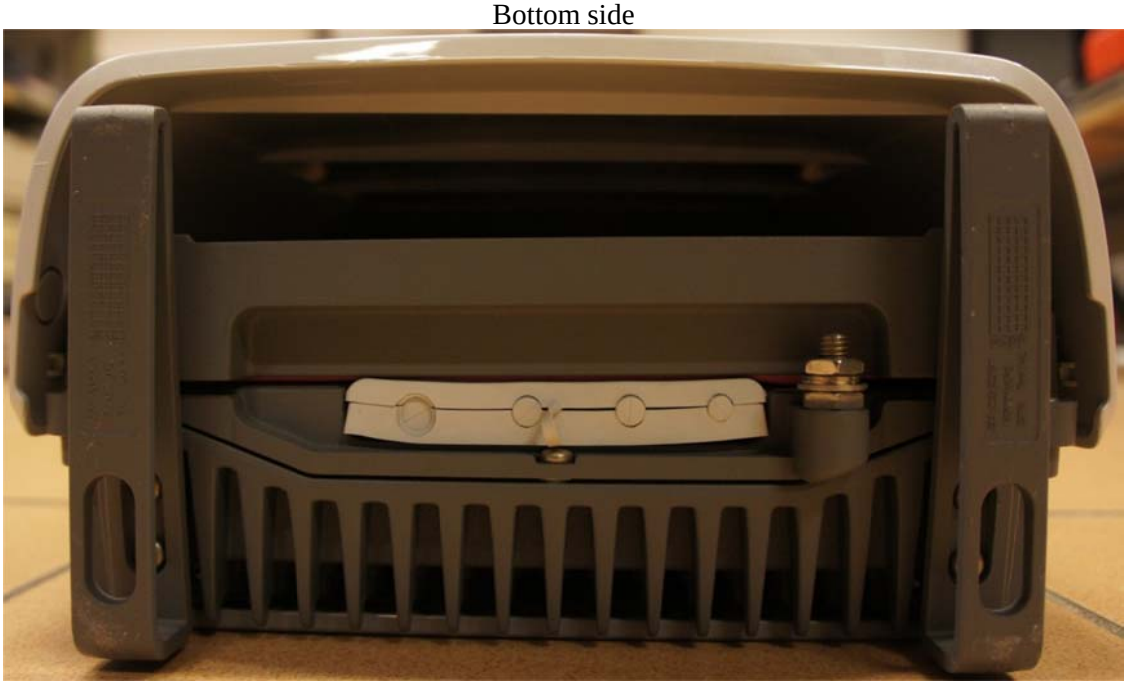
Appendix 9

Left side

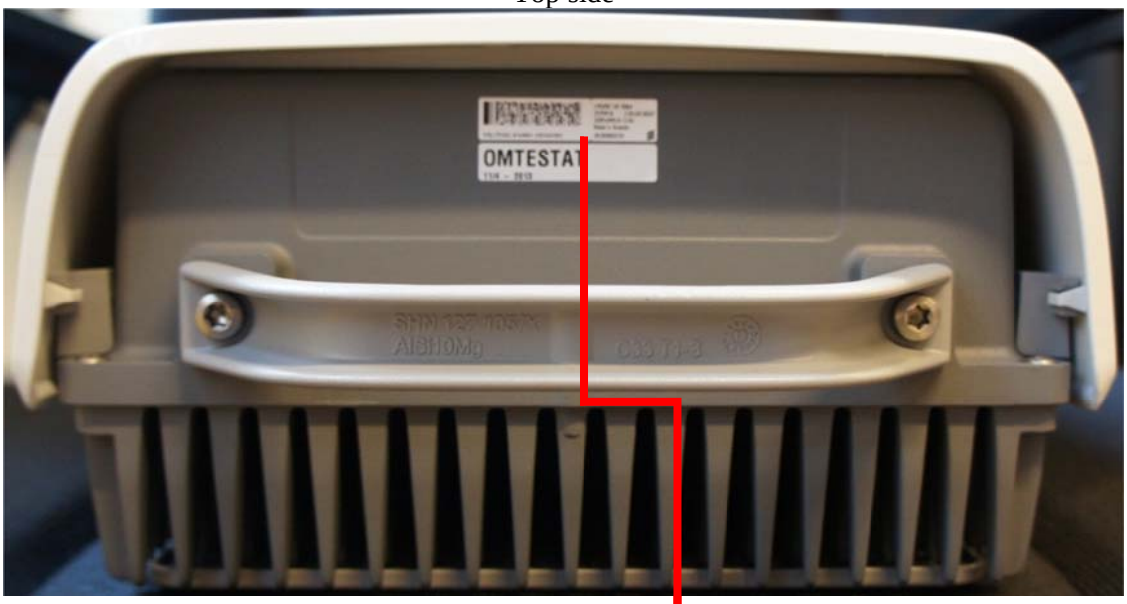
Right side

Appendix 9

Bottom side



Top side



Product label