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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 LTE 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, TX diversity and MIMO 2x2
Frequency bands:	TX: 2110 – 2155 MHz RX: 1710 – 1755 MHz
Nominal output power per antenna port:	Single carrier: 1x 37.0 dBm (1 x 5W) Multi carrier: 2 x 34.0 dBm (2 x 2.5W)
Modulations	QPSK, 16QAM and 64QAM
Channel bandwidth	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz
Nominal power voltage:	-48VDC 110-240 VAC

Operation mode during measurements

LTE Single RAT, MIMO mode

Measurements were performed with the test object transmitting test models as defined in 3GPP TS 36.141. Test model E-TM1.1 was used to represent QPSK, test model E-TM3.2 to represent 16QAM and test model E-TM3.1 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: E-TM1.1

MIMO mode multi carrier: 2 carriers, E-TM1.1

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 on RF A and additional measurements on RF B to verify that the ports were electrical identical, as declared by the client.

Radiated measurements

The 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 36.141, version 11.4.0
RSS-Gen Issue 3
RSS-139 Issue 2

Measurement equipment

	Calibration Due	SP number
Test site Tesla	2014-01	503 881
R&S FSIQ 40	2013-07	503 738
R&S ESU 26	2014-05	901 553
R&S ESI 26	2013-07	503 292
R&S FSQ 40	2014-03	504 143
R&S FSW 43	2013-10	902 073
R&S SMB 100A	2013-07	900 120
Control computer with R&S software EMC32 version 8.52.0	-	503 479
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
EMCO Horn Antenna 3115	2014-01	502 175
EMCO Horn Antenna 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
Schwarzbeck preamplifier BBV 9742	2014-03	504 085
MITEQ Low Noise Amplifier	2013-08	503 285
Multimeter Fluke 87	2013-08	502 190
Temperature and humidity meter, Testo 635	2014-06	504 203
Temperature Chamber	-Note [1)]	503 360

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

Test participant

None

Appendix 1

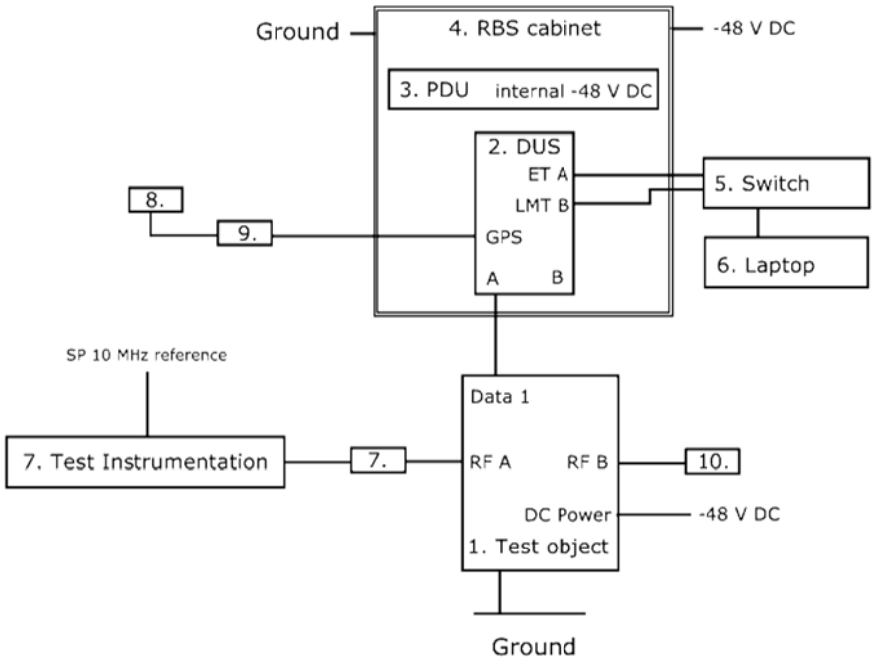
Test frequencies during measurements

Single RAT TX test frequencies

EARFCN Downlink	Frequency [MHz]	Symbolic name	Comment
1957	2110.7	B	TX bottom frequency in 1.4 MHz BW configuration
1957 1972	2110.7 2112.2	B2	2 carrier TX band bottom constellation 1.4 MHz BW configuration
1965	2111.5	B	TX bottom frequency in 3 MHz BW configuration
1975	2112.5	B	TX bottom frequency in 5 MHz BW configuration
2000	2115.0	B	TX bottom frequency in 10 MHz BW configuration
2025	2117.5	B	TX bottom frequency in 15 MHz BW configuration
2050	2120.0	B	TX bottom frequency in 20 MHz BW configuration
2175	2132.5	M	TX band mid frequency all BW configurations
2175 2190	2132.5 2134.0	M2	2 carrier TX band mid constellation 1.4 MHz BW configuration
2393	2154.3	T	TX bottom frequency in 1.4 MHz BW configuration
2385	2153.5	T	TX bottom frequency in 3 MHz BW configuration
2375	2152.5	T	TX bottom frequency in 5 MHz BW configuration
2350	2150.0	T	TX bottom frequency in 10 MHz BW configuration
2325	2147.5	T	TX bottom frequency in 15 MHz BW configuration
2300	2145.0	T	TX bottom frequency in 20 MHz BW configuration
2378 2393	2152.8 2154.3	T2	2 carrier TX band mid constellation 1.4 MHz BW configuration
1980 2022	2113.0 2117.2	Bim1	2 carrier TX band 1.4 MHz BW configuration
2328 2370	2147.8 2152.0	Tim1	2 carrier TX band 1.4 MHz BW configuration
2100 2262	2125.0 2141.2	Bim2	2 carrier TX band 1.4 MHz BW configuration
2088 2250	2123.8 2140.0	Tim2	2 carrier TX 1.4 MHz BW configuration

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

Test set-up conducted measurements



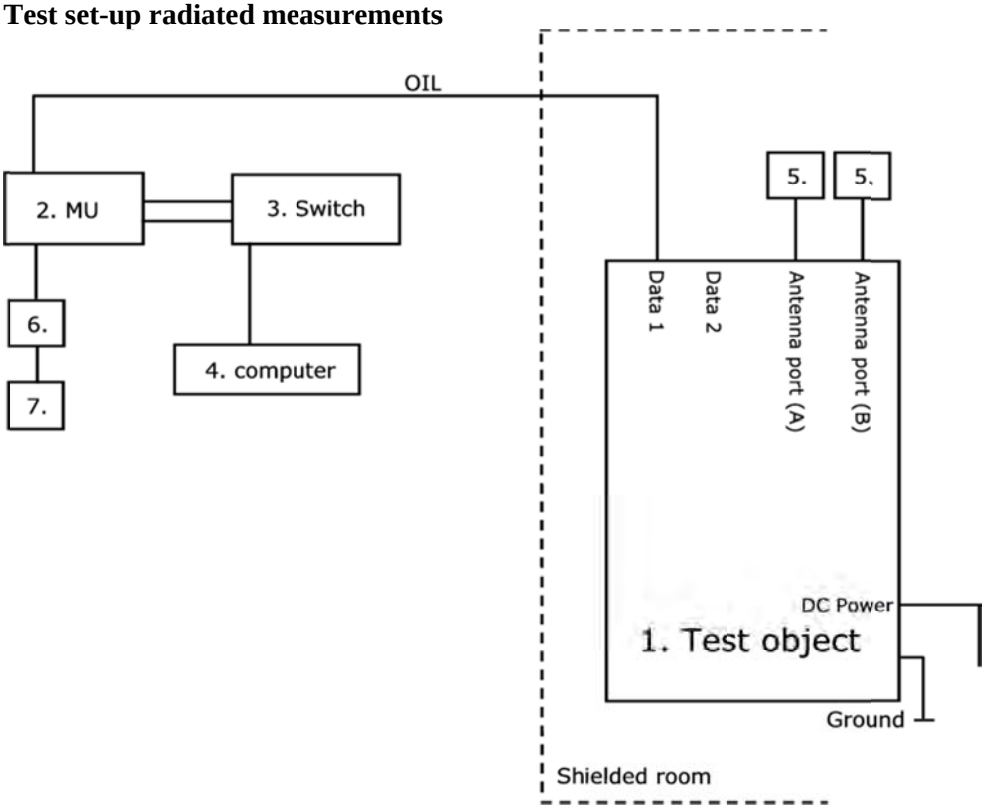
Test object

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.	DUS 40 01, KDU 137 624/1, Rev R5A, S/N: D165724696
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	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

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.	DUS 41 01 KDU 137 624/1 R5A, s/n: D165724698, hosted in SUP 6601 1/BFL 901 009/4, rev. R1D, s/n. BR82081105
3.	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 1, optical interface, not used in this configuration	Signal
Ext Alarm, unshielded multi wire	Signal
Ground wire	Ground

RBS software:

Software	**Revision**
CXP 102 151/18	R25Y

Appendix 2

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

Date	Temperature	Humidity
2013-04-25	23 °C ± 3 °C	24 % ± 5 %
2013-04-26	23 °C ± 3 °C	24 % ± 5 %

Test set-up and procedure

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

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

Measurement uncertainty: 1.1 dB

Results

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)]
1.4 MHz, B	36.74 (Diagram 1)	36.77 (Diagram 2)	39.77
20 MHz, B	36.78 (Diagram 3)	36.80 (Diagram 4)	39.80
1.4 MHz, M	36.87 (Diagram 5)	36.71 (Diagram 6)	39.80
3 MHz, M	36.81 (Diagram 7)	36.81 (Diagram 8)	39.82
5 MHz, M	36.95 (Diagram 9)	36.82 (Diagram 10)	39.90
10 MHz, M	36.83 (Diagram 11)	36.82 (Diagram 12)	39.84
15 MHz, M	36.83 (Diagram 13)	36.81 (Diagram 14)	39.83
20 MHz, M	36.78 (Diagram 15)	36.80 (Diagram 16)	39.80
1.4 MHz, T	36.60 (Diagram 17)	36.83 (Diagram 18)	39.73
20 MHz, T	36.76 (Diagram 19)	36.92 (Diagram 20)	39.85

[1)]: summed output power according to FCC KDB662911 D01 Multiple 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 6.85 dB (0.1%). For multi-carrier constellations the measured “PAR” is informative only as to the definition of Peak to Average Ratio per carrier.

Multi Carrier

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

Tested configuration	Transmitter power RMS (dBm)		
BW and frequency	Port RFA	Port RFB	Total power[1)]
1.4 MHz, B2	36.93 (Diagram 21)	36.85 (Diagram 22)	39.90
1.4 MHz, M2	36.79 (Diagram 23)	36.87 (Diagram 24)	39.84
1.4 MHz, T2	36.71 (Diagram 25)	36.72 (Diagram 26)	39.73

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

Limits

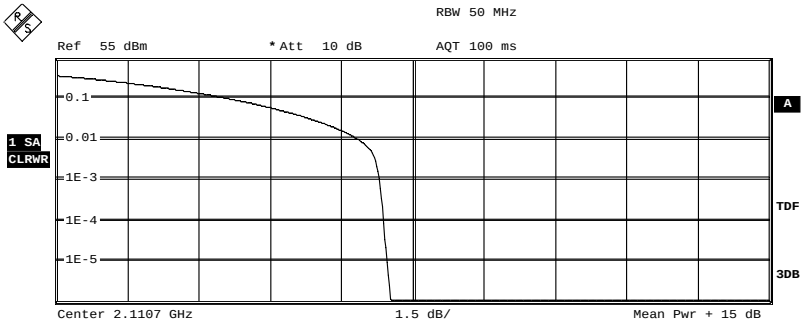
§27.50: The maximum output power may not exceed 1640 W (EIRP)/ MHz. The Peak to Average Ratio (PAR) may not exceed 13 dB.

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 PAR of the power shall not exceed 13 dB.

Complies?	Yes

Appendix 2

Diagram 1:

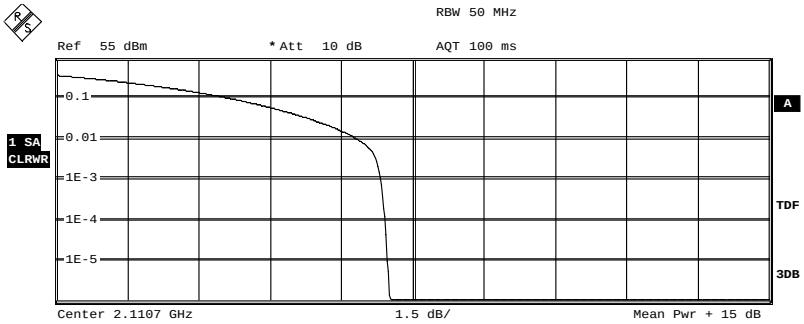


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.74 dBm
Peak	43.78 dBm
Crest	7.04 dB
10 %	3.68 dB
1 %	6.35 dB
.1 %	6.80 dB
.01 %	6.90 dB

Date: 25.APR.2013 12:18:35

Diagram 2:



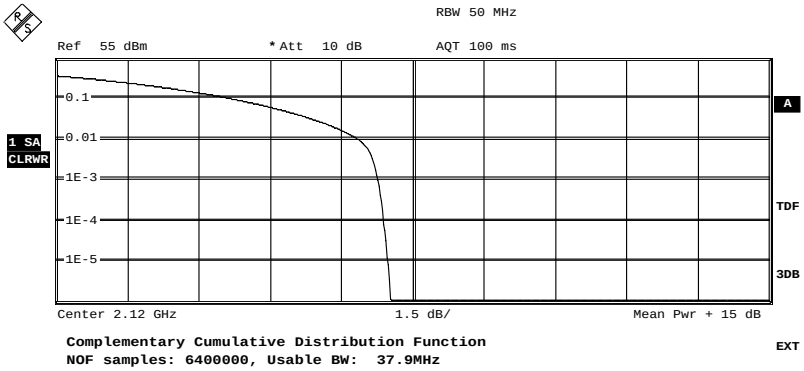
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.77 dBm
Peak	43.78 dBm
Crest	7.02 dB
10 %	3.70 dB
1 %	6.32 dB
.1 %	6.83 dB
.01 %	6.92 dB

Date: 25.APR.2013 12:20:38

Appendix 2

Diagram 3:

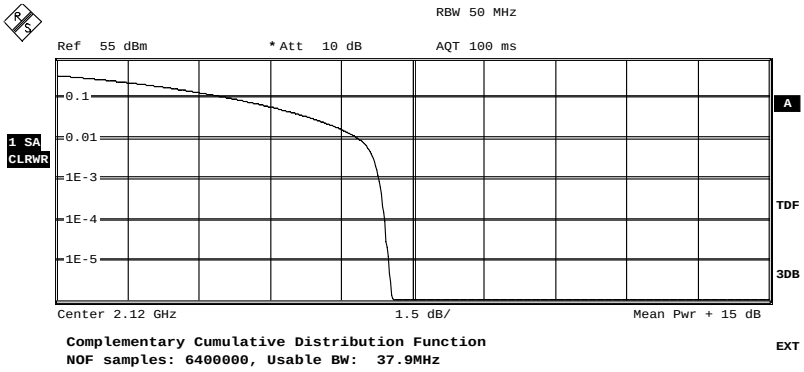


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.78 dBm
Peak	43.81 dBm
Crest	7.03 dB
10 %	3.73 dB
1 %	6.35 dB
.1 %	6.78 dB
.01 %	6.90 dB

Date: 25.APR.2013 14:31:28

Diagram 4:



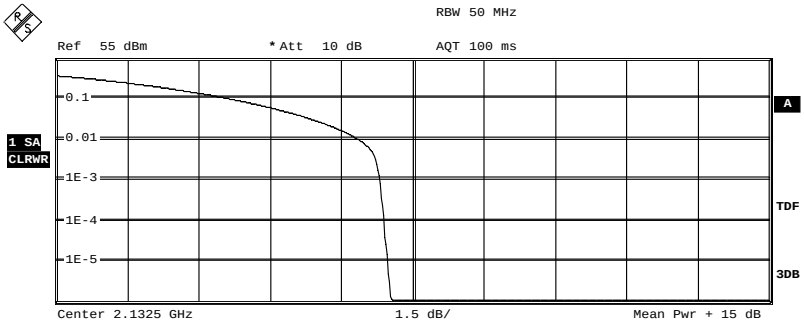
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.80 dBm
Peak	43.88 dBm
Crest	7.08 dB
10 %	3.73 dB
1 %	6.37 dB
.1 %	6.80 dB
.01 %	6.92 dB

Date: 25.APR.2013 15:41:52

Appendix 2

Diagram 5:

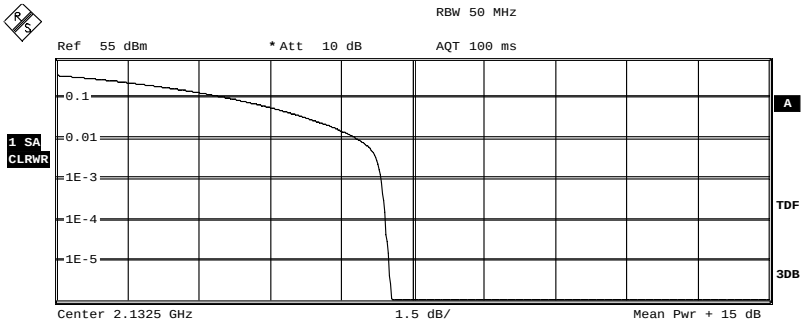


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.87 dBm
Peak	43.92 dBm
Crest	7.05 dB
10 %	3.68 dB
1 %	6.35 dB
.1 %	6.80 dB
.01 %	6.90 dB

Date: 25.APR.2013 07:51:25

Diagram 6:



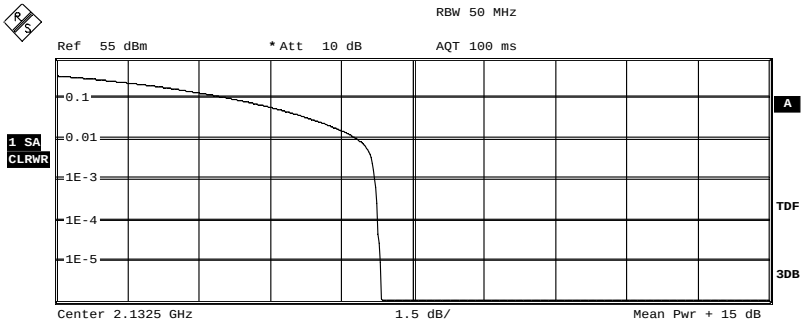
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.71 dBm
Peak	43.78 dBm
Crest	7.07 dB
10 %	3.70 dB
1 %	6.35 dB
.1 %	6.85 dB
.01 %	6.92 dB

Date: 25.APR.2013 07:53:23

Appendix 2

Diagram 7:

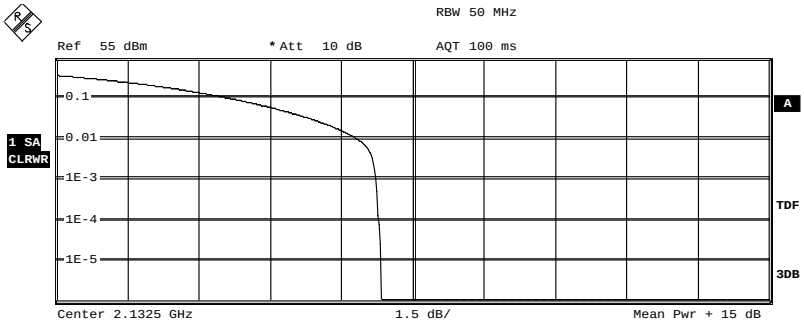


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.81 dBm
Peak	43.64 dBm
Crest	6.83 dB
10 %	3.73 dB
1 %	6.32 dB
.1 %	6.71 dB
.01 %	6.78 dB

Date: 25.APR.2013 08:03:52

Diagram 8:



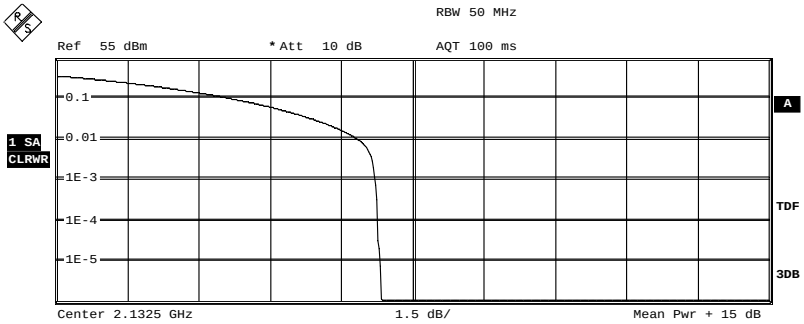
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.81 dBm
Peak	43.71 dBm
Crest	6.90 dB
10 %	3.70 dB
1 %	6.32 dB
.1 %	6.73 dB
.01 %	6.78 dB

Date: 25.APR.2013 08:06:19

Appendix 2

Diagram 9:

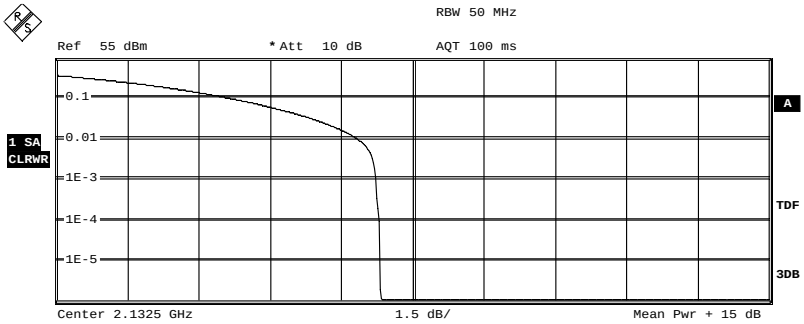


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.95 dBm
Peak	43.78 dBm
Crest	6.83 dB
10 %	3.73 dB
1 %	6.35 dB
.1 %	6.71 dB
.01 %	6.78 dB

Date: 25.APR.2013 07:42:00

Diagram 10:



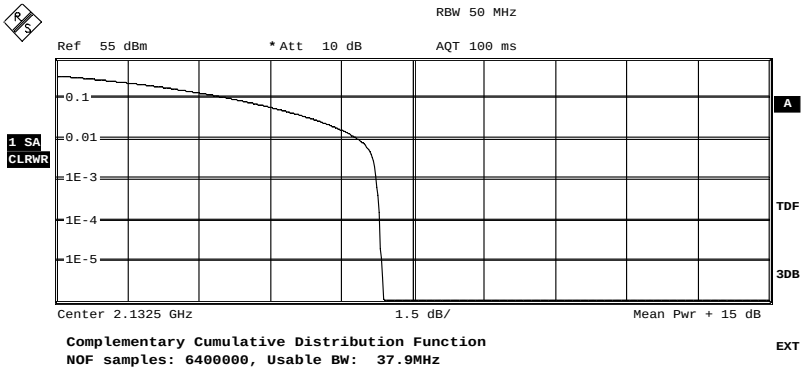
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.82 dBm
Peak	43.71 dBm
Crest	6.89 dB
10 %	3.70 dB
1 %	6.35 dB
.1 %	6.73 dB
.01 %	6.80 dB

Date: 25.APR.2013 08:23:43

Appendix 2

Diagram 11:

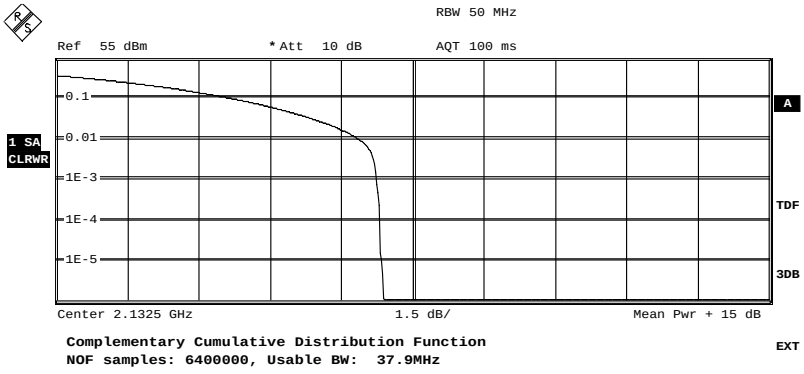


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.83 dBm
Peak	43.71 dBm
Crest	6.88 dB
10 %	3.73 dB
1 %	6.35 dB
.1 %	6.73 dB
.01 %	6.80 dB

Date: 25.APR.2013 08:45:32

Diagram 12:



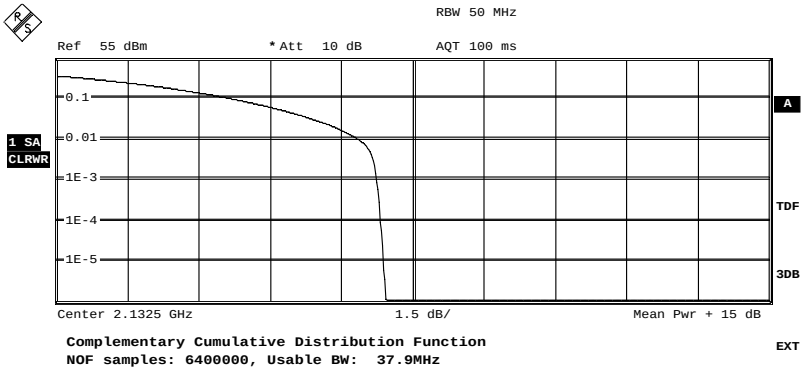
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.82 dBm
Peak	43.71 dBm
Crest	6.88 dB
10 %	3.73 dB
1 %	6.35 dB
.1 %	6.75 dB
.01 %	6.83 dB

Date: 25.APR.2013 08:43:52

Appendix 2

Diagram 13:

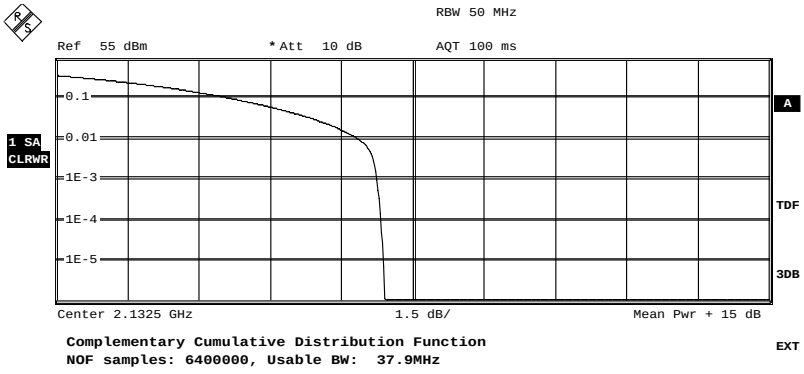


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.83 dBm
Peak	43.78 dBm
Crest	6.95 dB
10 %	3.73 dB
1 %	6.35 dB
.1 %	6.75 dB
.01 %	6.83 dB

Date: 25.APR.2013 08:50:48

Diagram 14:



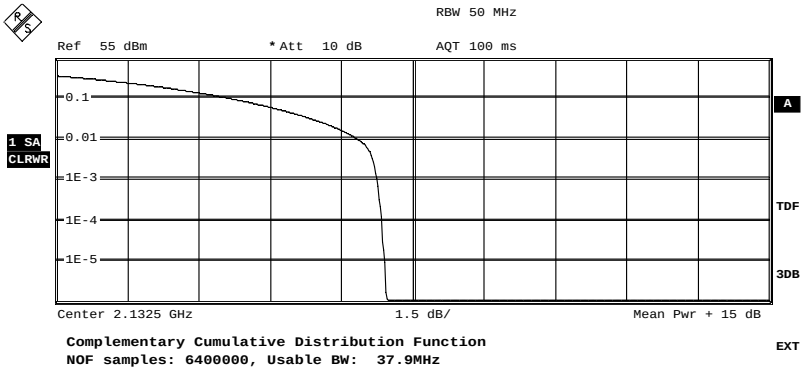
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.81 dBm
Peak	43.78 dBm
Crest	6.97 dB
10 %	3.73 dB
1 %	6.35 dB
.1 %	6.75 dB
.01 %	6.83 dB

Date: 25.APR.2013 08:52:04

Appendix 2

Diagram 15:

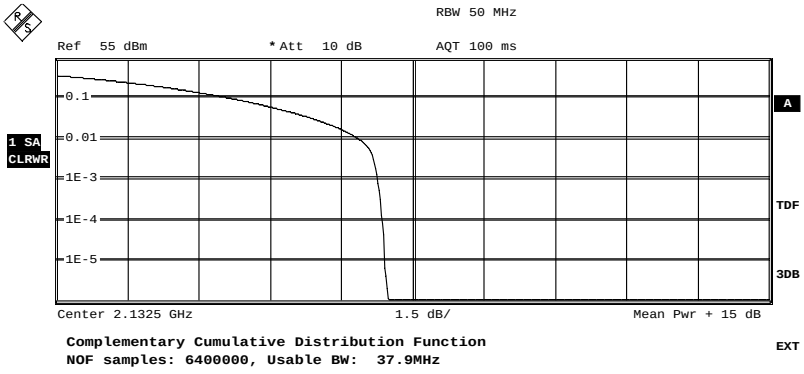


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.78 dBm
Peak	43.78 dBm
Crest	7.00 dB
10 %	3.73 dB
1 %	6.35 dB
.1 %	6.75 dB
.01 %	6.85 dB

Date: 25.APR.2013 08:57:57

Diagram 16:



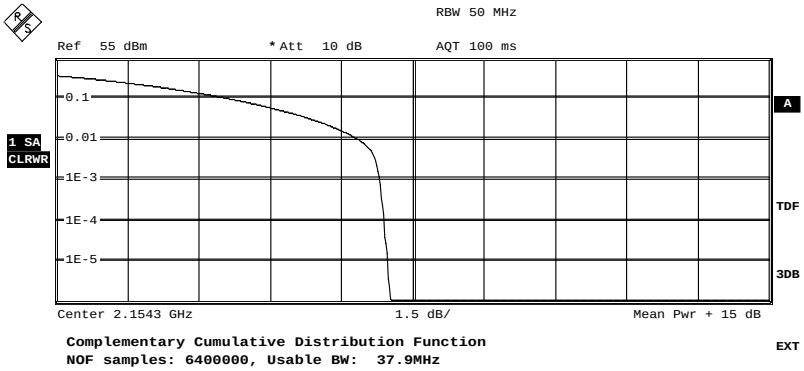
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.80 dBm
Peak	43.78 dBm
Crest	6.98 dB
10 %	3.73 dB
1 %	6.37 dB
.1 %	6.78 dB
.01 %	6.85 dB

Date: 25.APR.2013 08:56:32

Appendix 2

Diagram 17:

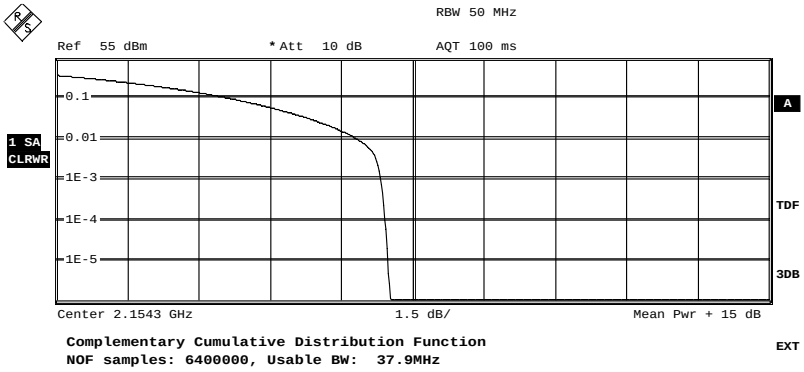


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.60 dBm
Peak	43.66 dBm
Crest	7.05 dB
10 %	3.68 dB
1 %	6.35 dB
.1 %	6.80 dB
.01 %	6.90 dB

Date: 26.APR.2013 08:53:15

Diagram 18:



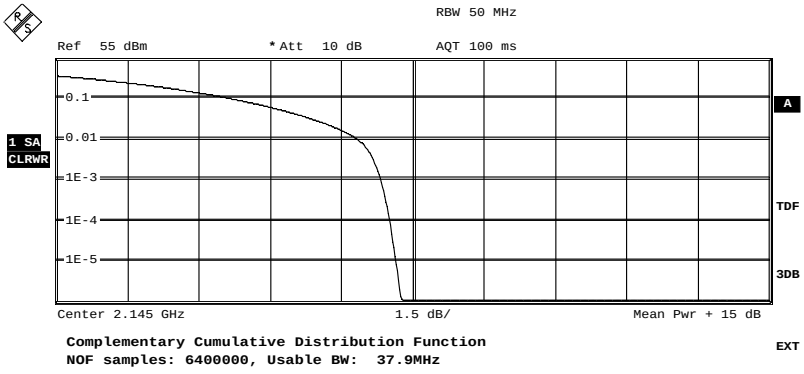
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.83 dBm
Peak	43.87 dBm
Crest	7.04 dB
10 %	3.70 dB
1 %	6.32 dB
.1 %	6.83 dB
.01 %	6.92 dB

Date: 26.APR.2013 07:44:09

Appendix 2

Diagram 19:

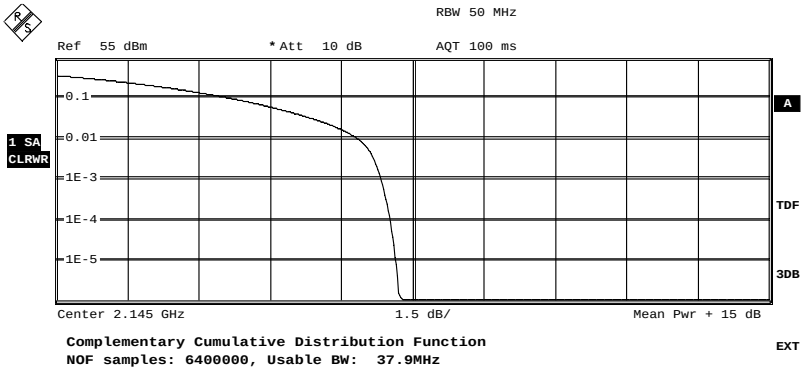


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.76 dBm
Peak	44.11 dBm
Crest	7.35 dB
10 %	3.73 dB
1 %	6.35 dB
.1 %	6.83 dB
.01 %	7.02 dB

Date: 26.APR.2013 08:17:00

Diagram 20:



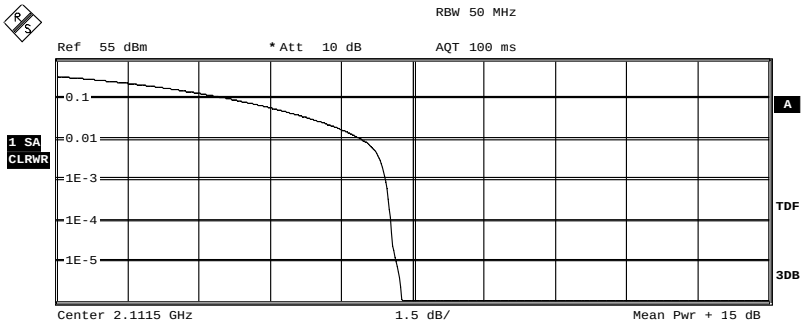
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.92 dBm
Peak	44.32 dBm
Crest	7.40 dB
10 %	3.73 dB
1 %	6.35 dB
.1 %	6.85 dB
.01 %	7.04 dB

Date: 26.APR.2013 08:09:08

Appendix 2

Diagram 21:

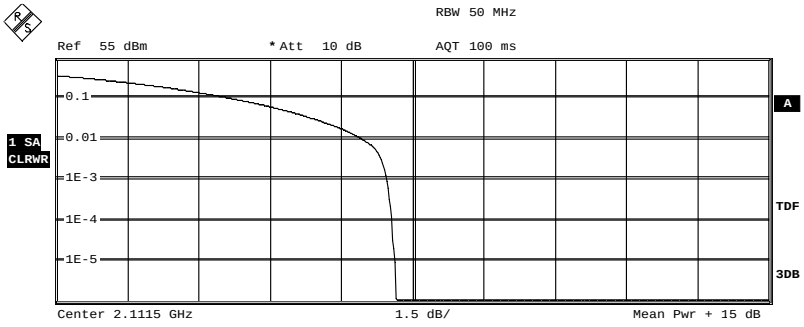


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.93 dBm
Peak	44.28 dBm
Crest	7.35 dB
10 %	3.73 dB
1 %	6.44 dB
.1 %	6.95 dB
.01 %	7.04 dB

Date: 29.APR.2013 10:06:58

Diagram 22:



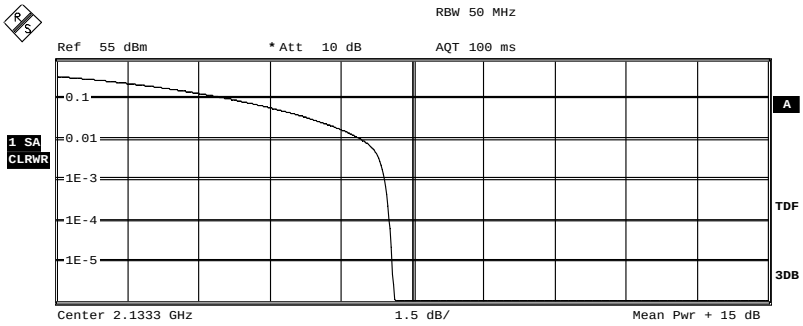
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.85 dBm
Peak	44.00 dBm
Crest	7.15 dB
10 %	3.73 dB
1 %	6.44 dB
.1 %	6.97 dB
.01 %	7.07 dB

Date: 29.APR.2013 10:24:15

Appendix 2

Diagram 23:

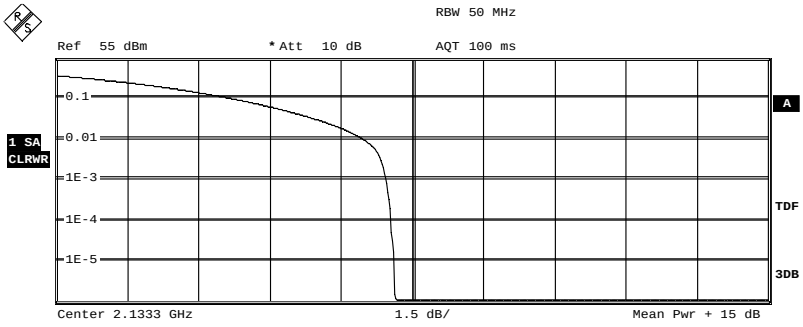


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.79 dBm
Peak	43.92 dBm
Crest	7.14 dB
10 %	3.73 dB
1 %	6.44 dB
.1 %	6.92 dB
.01 %	7.02 dB

Date: 29.APR.2013 11:38:39

Diagram 24:



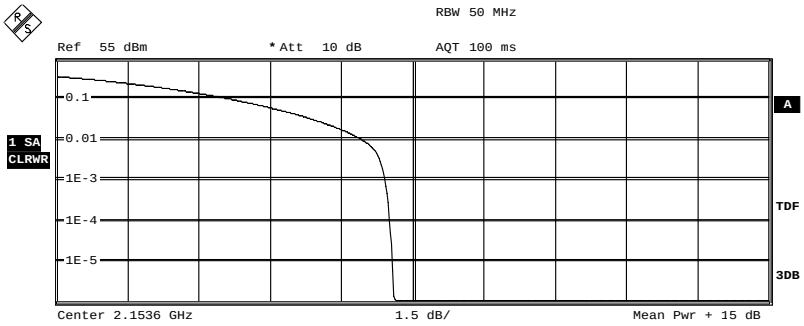
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.87 dBm
Peak	44.06 dBm
Crest	7.20 dB
10 %	3.73 dB
1 %	6.47 dB
.1 %	6.95 dB
.01 %	7.07 dB

Date: 29.APR.2013 11:36:55

Appendix 2

Diagram 25:

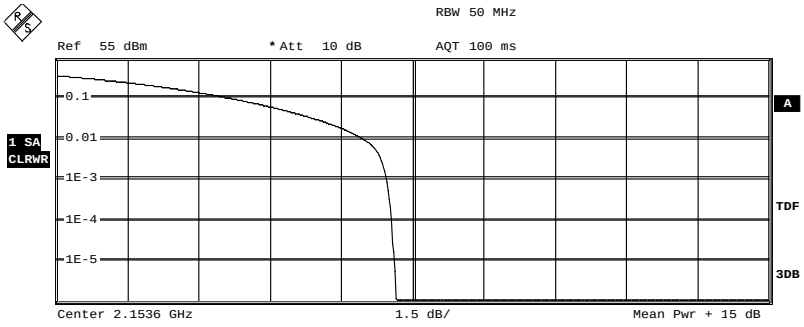


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	36.71 dBm
Peak	43.86 dBm
Crest	7.15 dB
10 %	3.73 dB
1 %	6.44 dB
.1 %	6.92 dB
.01 %	7.02 dB

Date: 29.APR.2013 11:57:37

Diagram 26:



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

	Trace 1
Mean	36.72 dBm
Peak	43.86 dBm
Crest	7.14 dB
10 %	3.73 dB
1 %	6.47 dB
.1 %	6.95 dB
.01 %	7.07 dB

Date: 29.APR.2013 11:59:15

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 %
2013-06-19	23°C ± 3°C	37 % ± 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

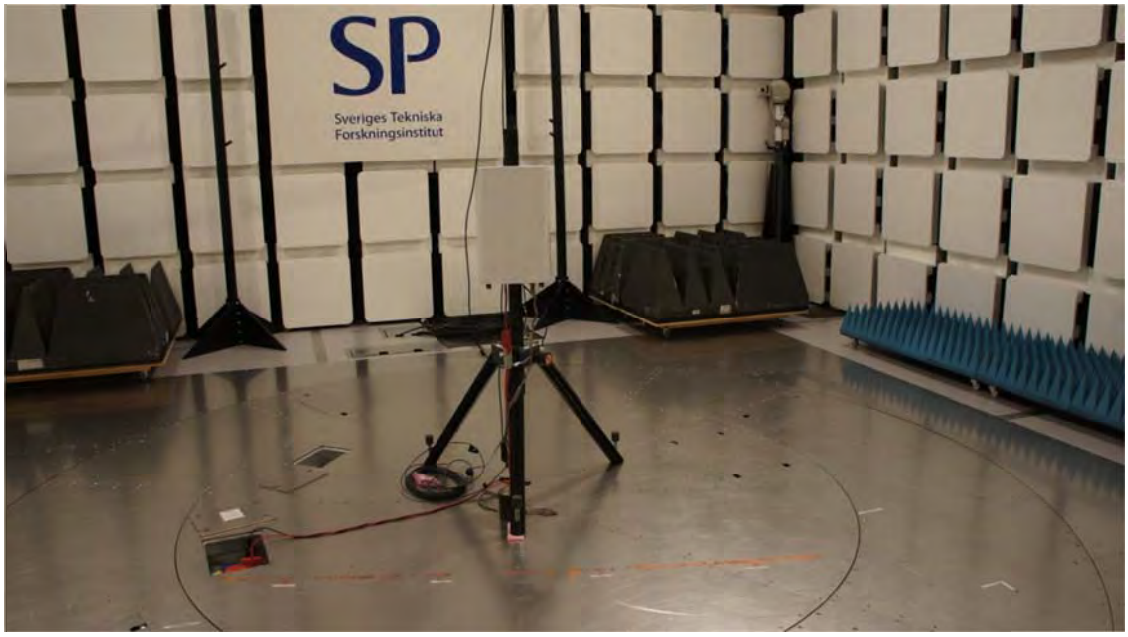
Measurement uncertainty:

3.2 dB

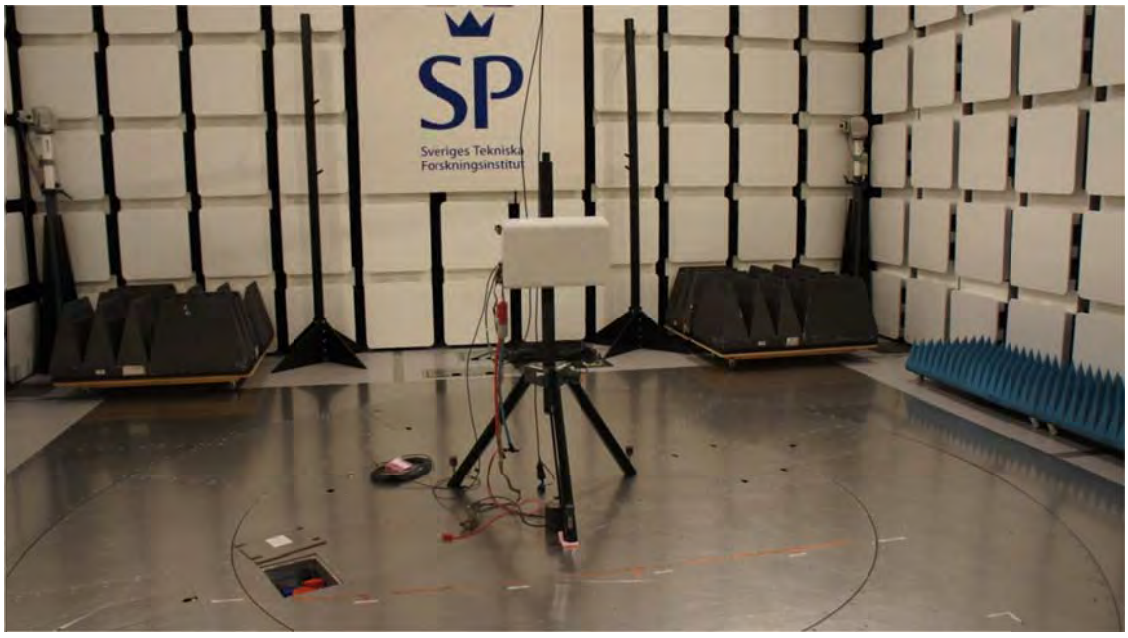
The test set-up during the spurious radiation measurements is shown in the pictures below, upright mounted with Semi-Integrated Omni Antenna KRE 101 2024/1

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

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
1.4	41.3/ 43.0	13.5/ 20.0	41.2/ 42.2	13.2/ 16.6	41.3/ 42.8	13.5/ 19.1
3	37.4/ 40.3	5.5/ 10.7	-	-	-	-
5	35.6/ 38.2	3.6/ 6.6	-	-	-	-
10	33.5/ 35.2	2.2/ 3.3	-	-	-	-
15	31.0/ 33.5	1.3/ 2.2	-	-	-	-
20	30.6/ 32.3	1.1/ 1.7	-	-	-	-

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
1.4	42.8/ 41.4	19.1/ 13.8	42.7/ 40.9	18.6/ 12.3	42.9/ 40.8	19.5/ 12.0

External antenna, upright mounted (Semi-Integrated Omni Antenna KRE 101 2024/1)

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
1.4	29.9/ 39.5	1.0/ 8.9	31.5/ 39.9	1.4/ 9.8	30.6/ 38.6	1.1/ 7.2
3	-	-	29.2/ 36.7	0.8/ 4.7	-	-
5	-	-	27.9/ 35.3	0.6/ 3.4	-	-
10	-	-	23.8/ 31.9	0.2/ 1.5	-	-
15	-	-	23.5/ 31.9	0.2/ 1.5	-	-
20	-	-	21.4/ 29.2	0.1/ 0.8	-	-

External antenna, side mounted (Semi-Integrated Omni Antenna KRE 101 2024/1)

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
1.4	26.6/ 38.3	0.5/ 6.8	27.9/ 37.9	0.6/ 6.2	27.5/ 37.7	0.6/ 5.9

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
2013-04-25	23 °C ± 3 °C	24 % ± 5 %
2013-04-26	23 °C ± 3 °C	24 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §2.1049. The output was connected to a signal analyser with the RMS detector activated. The signal analyser 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

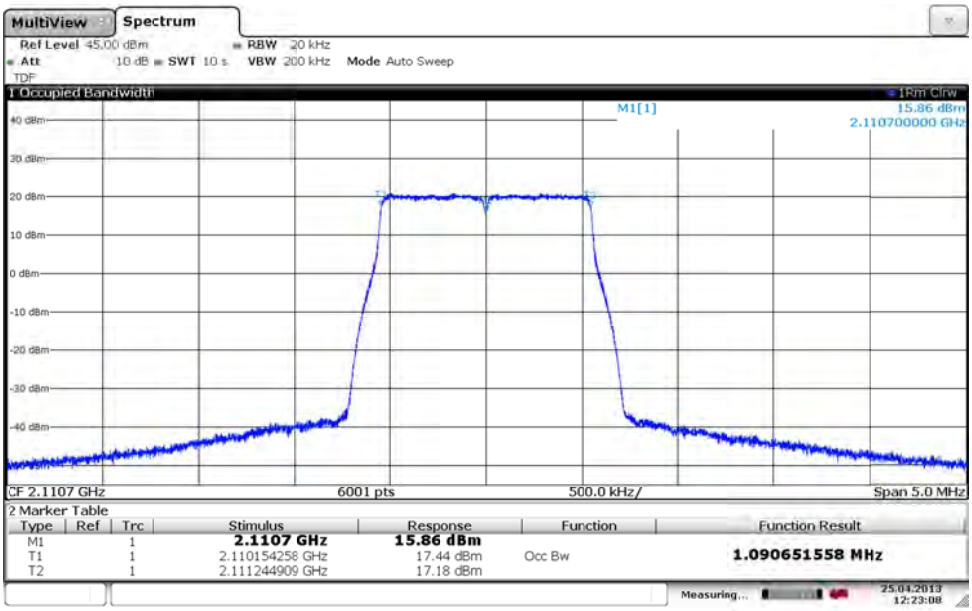
Results

Single carrier

Diagram	BW configuration	Tested frequency	Tested Port	Occupied BW (99%) [MHz]
1	1.4 MHz	B	RF A	1.09
2	20 MHz	B	RF A	17.86
3	1.4 MHz	M	RF A	1.09
4	1.4 MHz	M	RF B	1.09
5	3 MHz	M	RF A	2.69
6	5 MHz	M	RF A	4.48
7	10 MHz	M	RF A	8.94
8	15 MHz	M	RF A	13.41
9	20 MHz	M	RF A	17.85
10	20 MHz	M	RF B	17.85
11	1.4 MHz	T	RF A	1.09
12	20 MHz	T	RF A	17.86

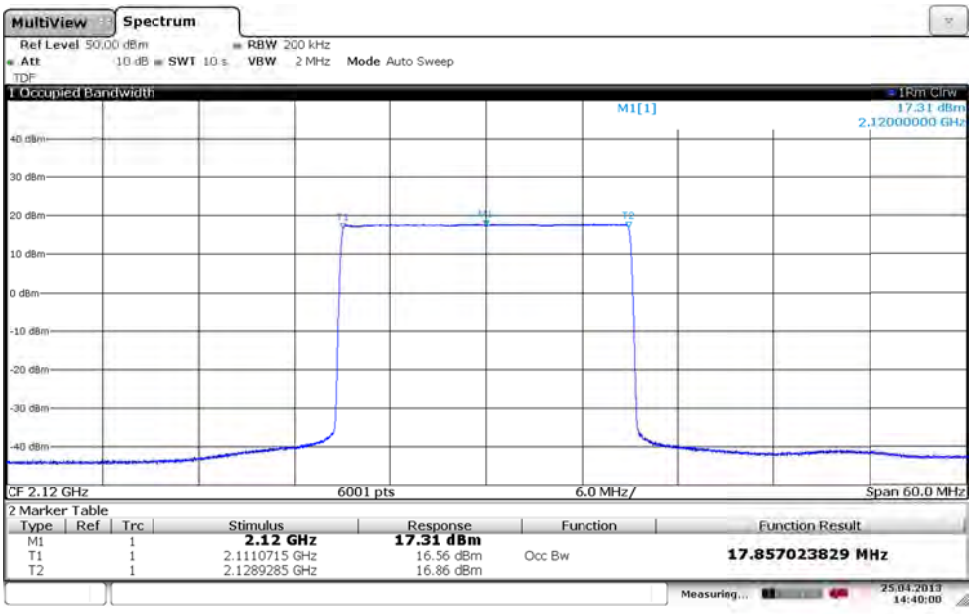
Appendix 4

Diagram 1:



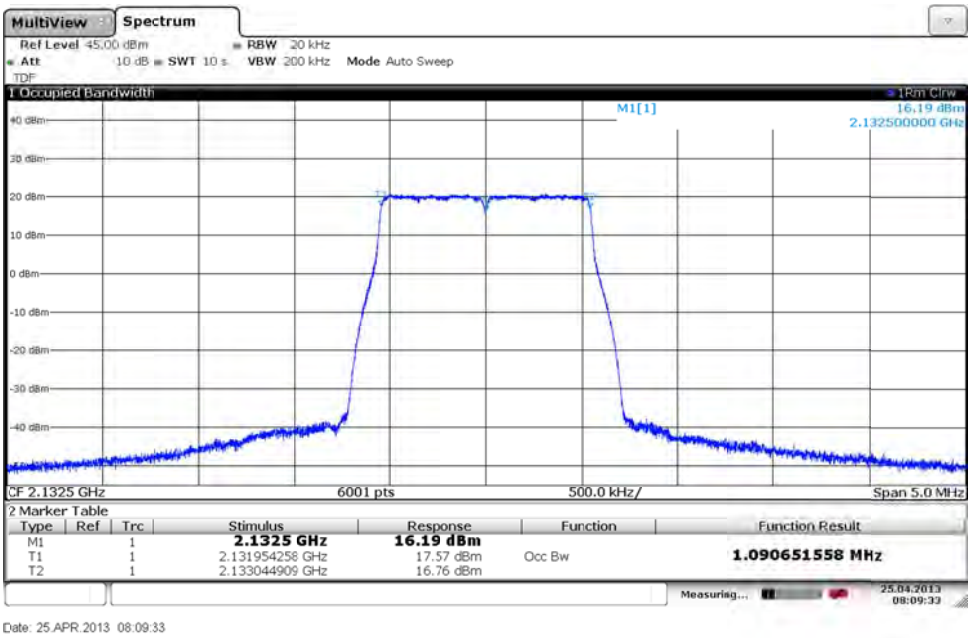
Date: 25.APR.2013 12:23:09

Diagram 2:



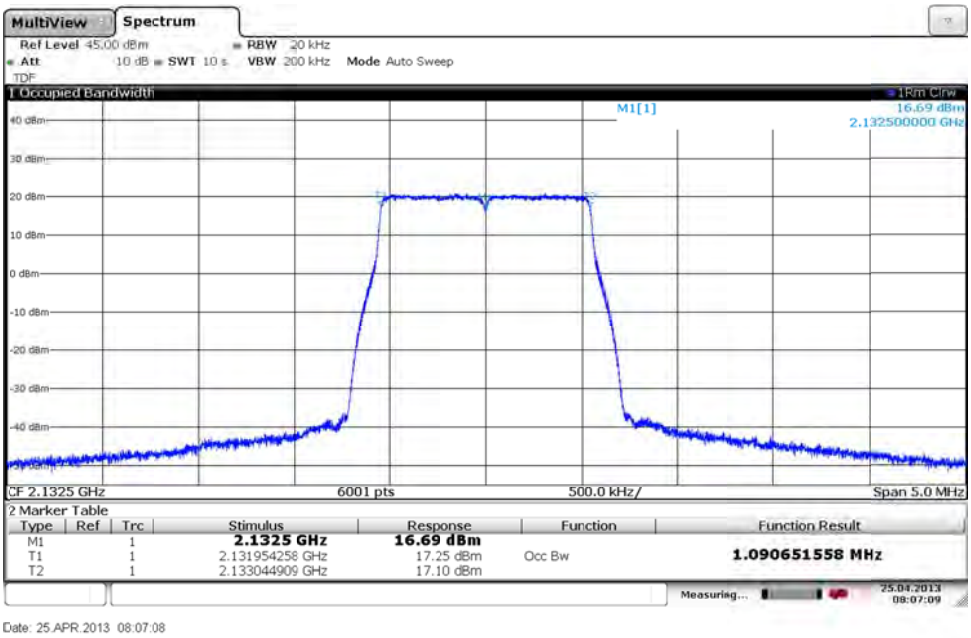
Date: 25.APR.2013 14:39:59

Diagram 3:



Date: 25.APR.2013 08:09:33

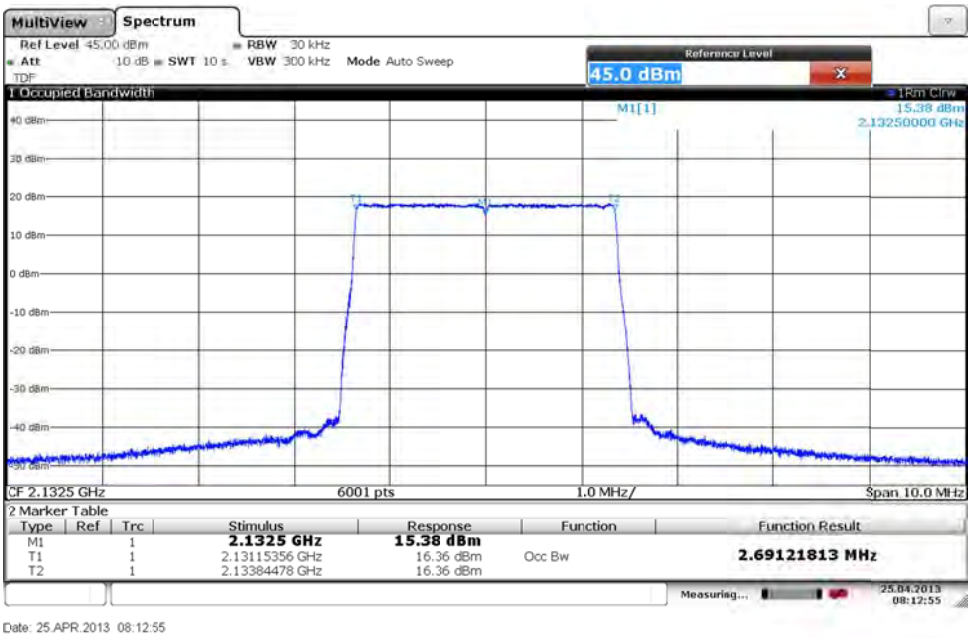
Diagram 4:



Date: 25.APR.2013 08:07:08

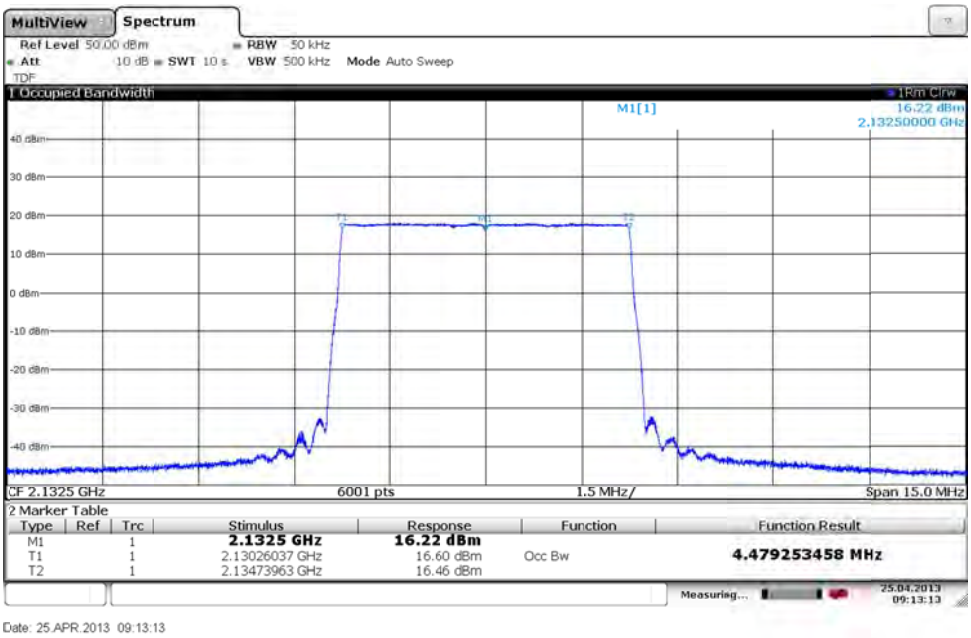
Appendix 4

Diagram 5:



Date: 25.APR.2013 08:12:55

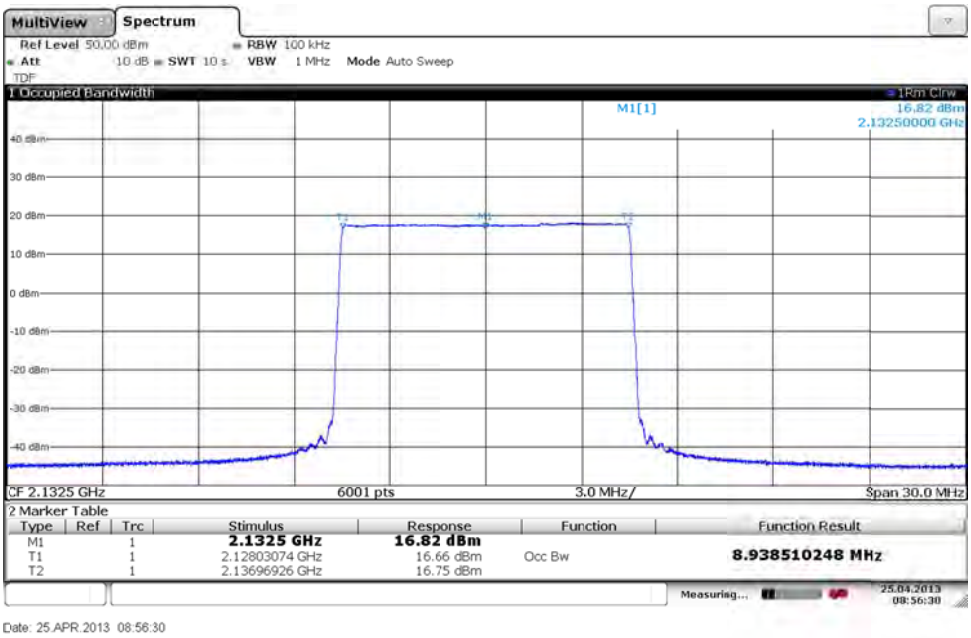
Diagram 6:



Date: 25.APR.2013 09:13:13

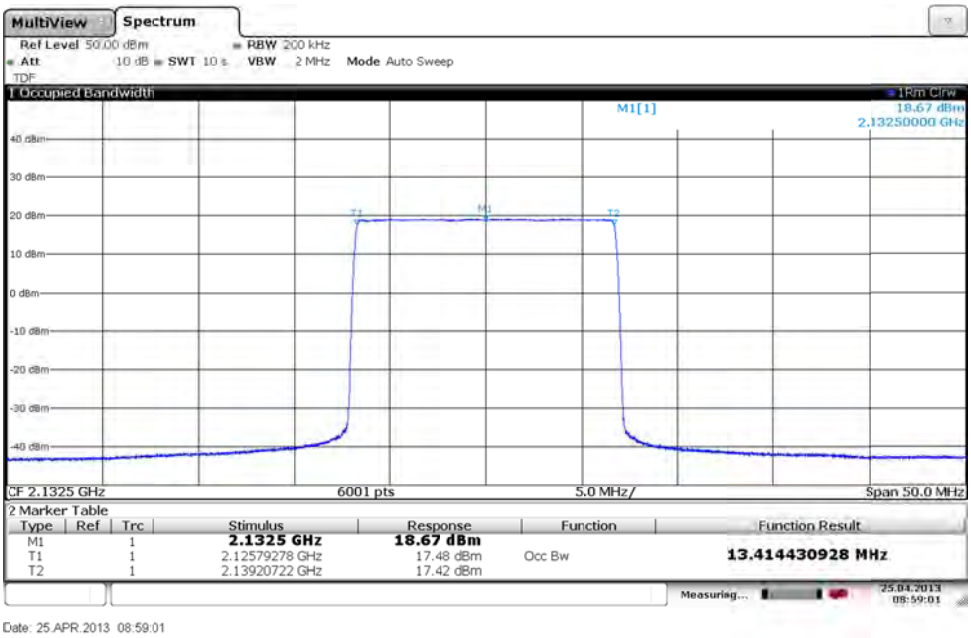
Appendix 4

Diagram 7:



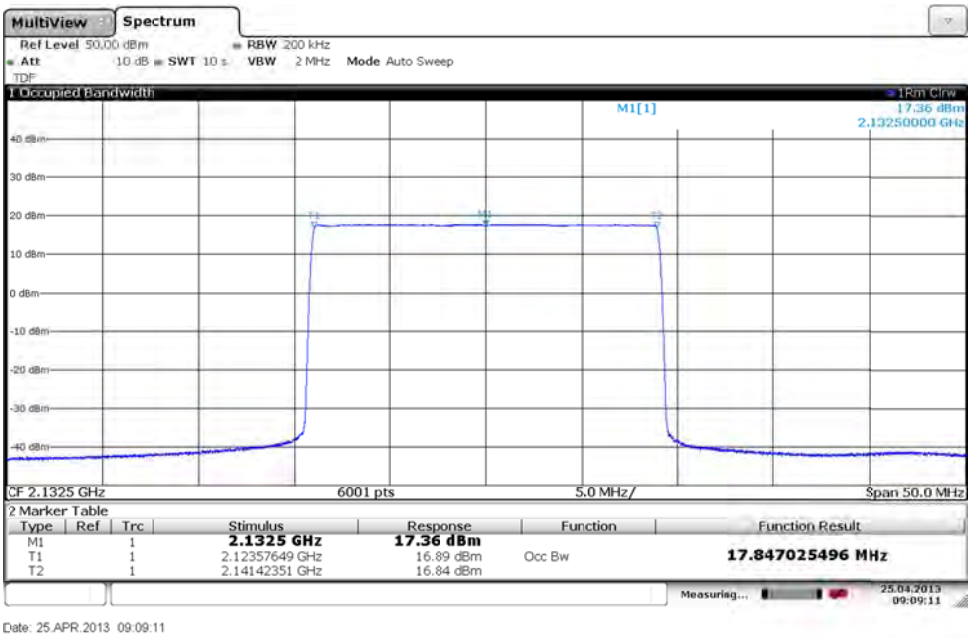
Date: 25.APR.2013 08:56:30

Diagram 8:



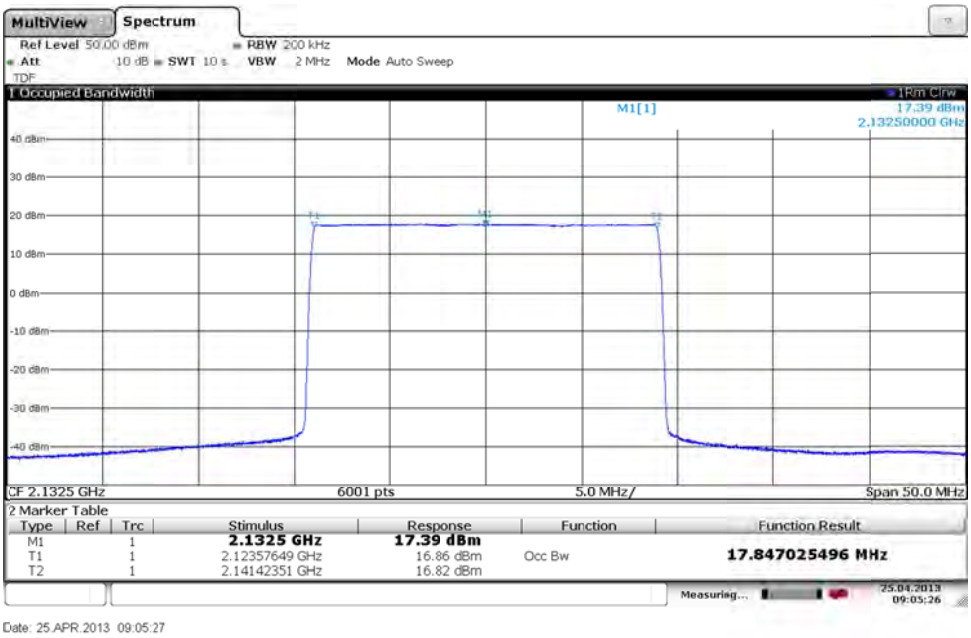
Date: 25.APR.2013 08:59:01

Diagram 9:



Date: 25.APR.2013 09:09:11

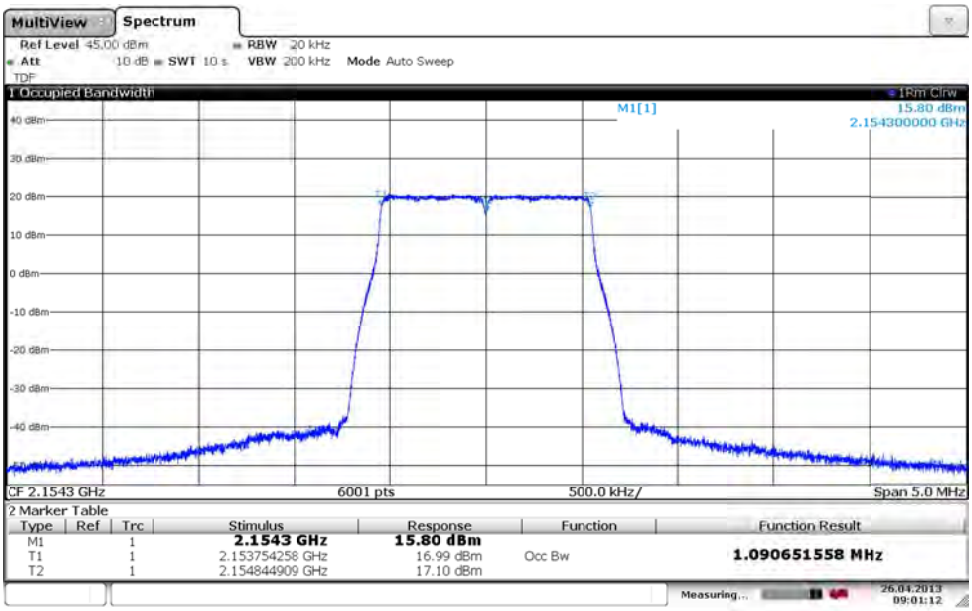
Diagram 10:



Date: 25.APR.2013 09:05:27

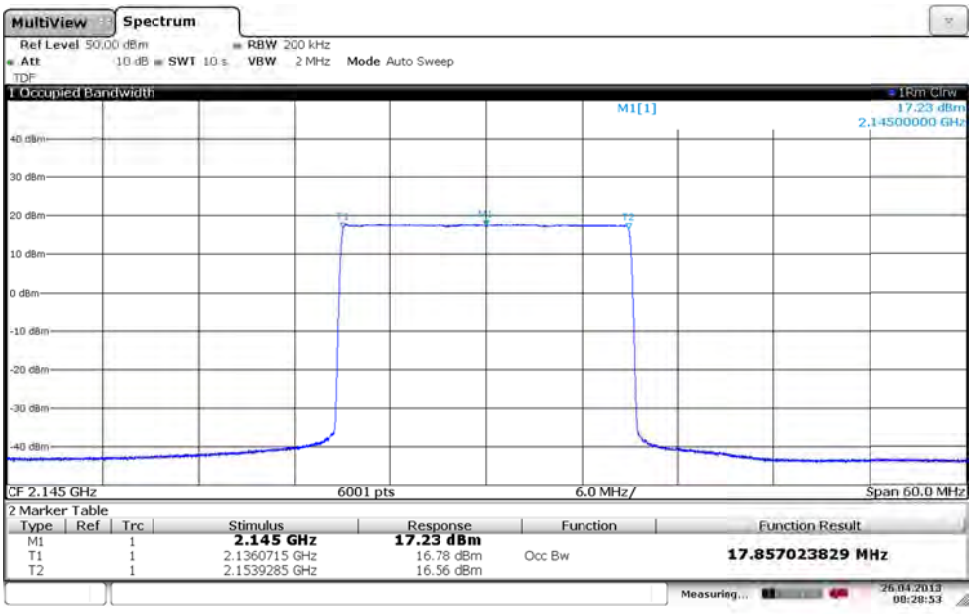
Appendix 4

Diagram 11:



Date: 26.APR.2013 09:01:12

Diagram 12:



Date: 26.APR.2013 08:28:53

Appendix 5

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

Date	Temperature	Humidity
2013-04-25	23 °C ± 3 °C	24 % ± 5 %
2013-04-26	23 °C ± 3 °C	24 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §27.53(h). The test object was connected to a spectrum analyser with the RMS detector activated. The spectrum analyser 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 v02.

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

Single carrier

Diagram	BW configuration	Tested frequency	Tested Port
1 a+c	1.4 MHz	B	RF A
2 a+c	3 MHz	B	RF A
3 a+c	3 MHz	B	RF B
4 a+c	5 MHz	B	RF A
5 a+c	10 MHz	B	RF A
6 a+c	15 MHz	B	RF A
7 a+c	20 MHz	B	RF A
8 a+c	1.4 MHz	T	RF A
9 a+c	3 MHz	T	RF A
10 a+c	3 MHz	T	RF B
11 a+c	5 MHz	T	RF A
12 a+c	10 MHz	T	RF A
13 a+c	15 MHz	T	RF A
14 a+c	20 MHz	T	RF A

Multi carrier

Diagram	BW configuration	Testedfrequency	Tested Port
15 a+c	1.4 MHz	B2	RF A
16 a+c	1.4 MHz	T2	RF A

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

Limits

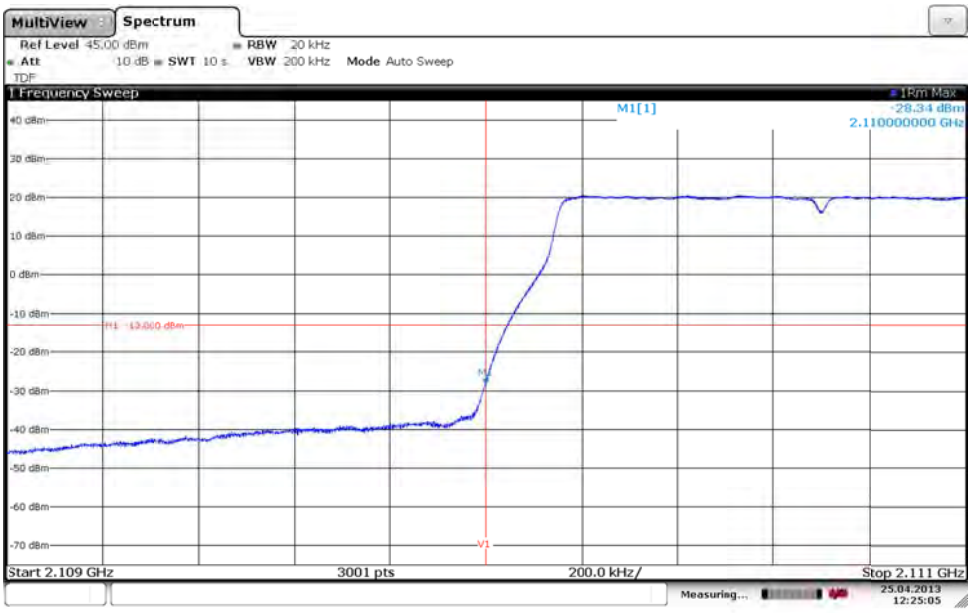
CFR 47 §27.53(h) and RSS-139 6.5

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

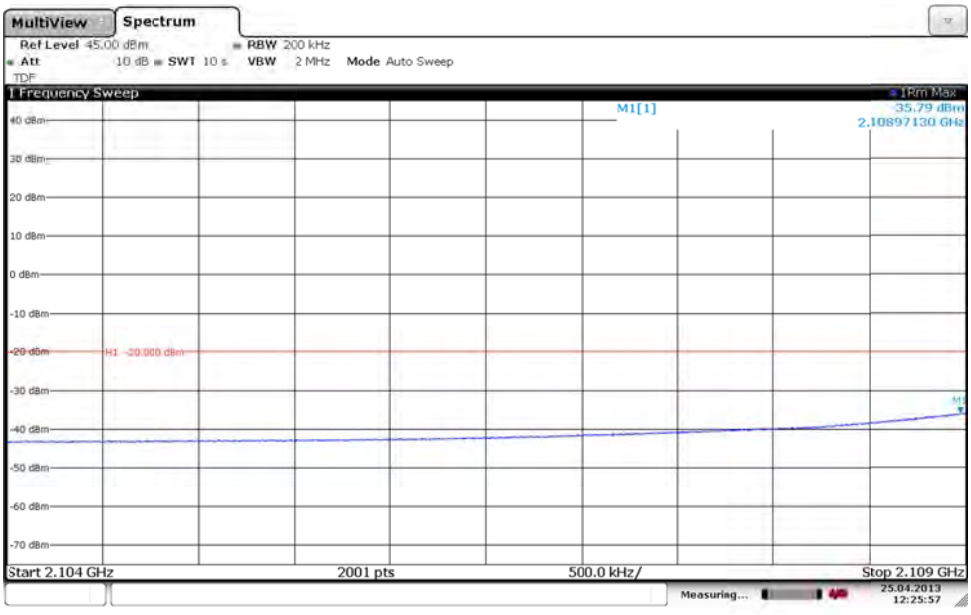
Appendix 5

Diagram 1a:



Date: 25.APR.2013 12:25:05

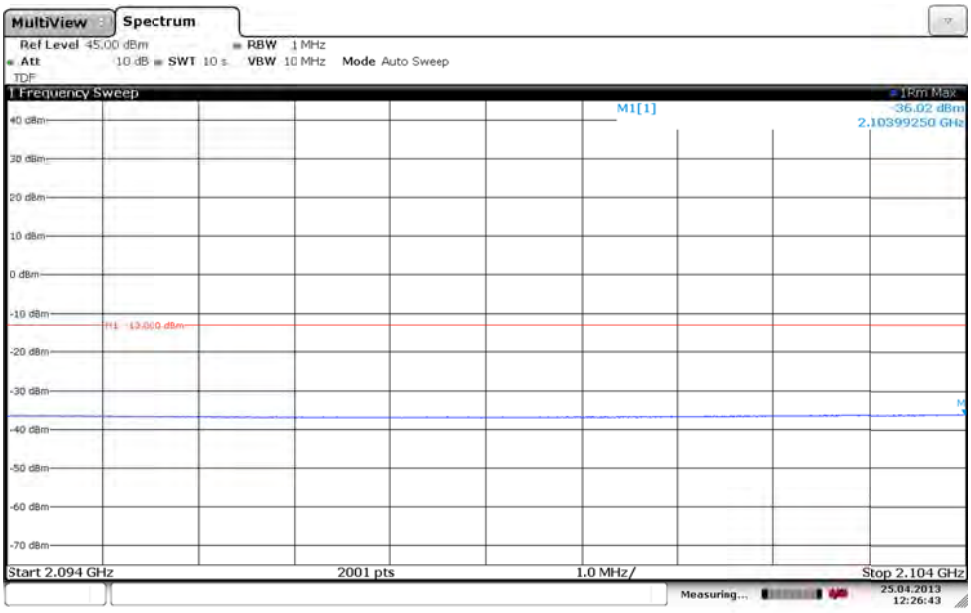
Diagram 1b:



Date: 25.APR.2013 12:25:57

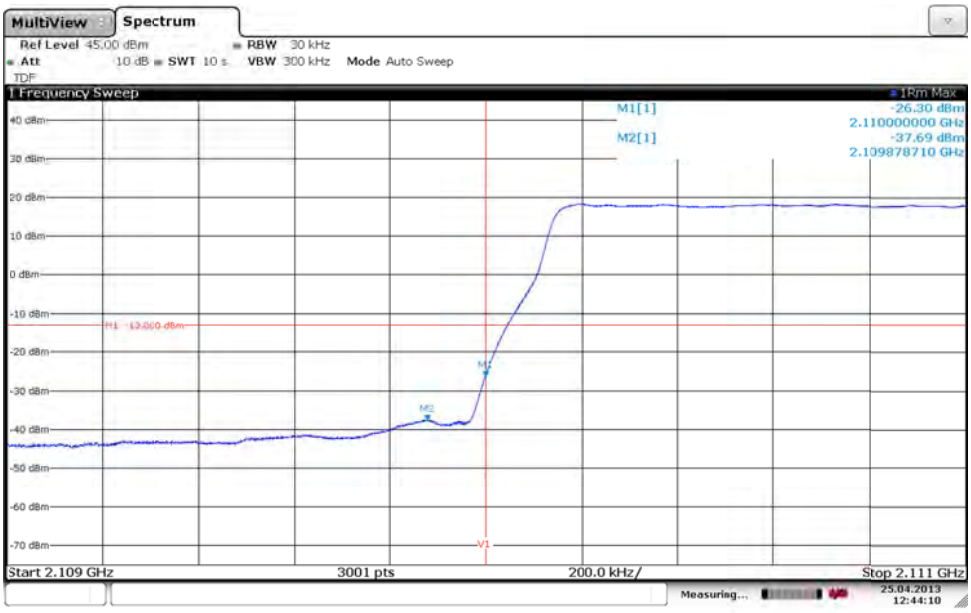
Appendix 5

Diagram 1c



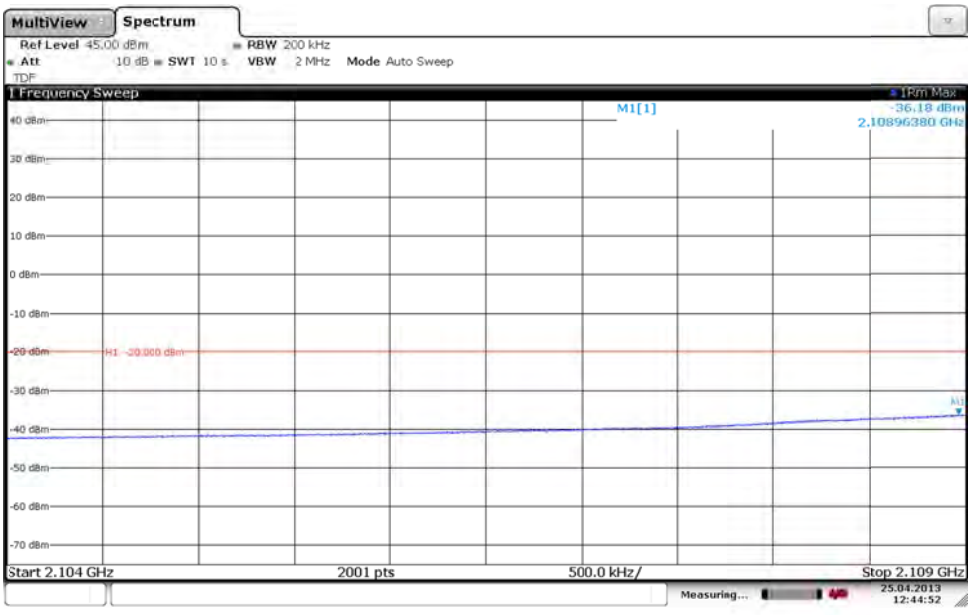
Appendix 5

Diagram 2a:



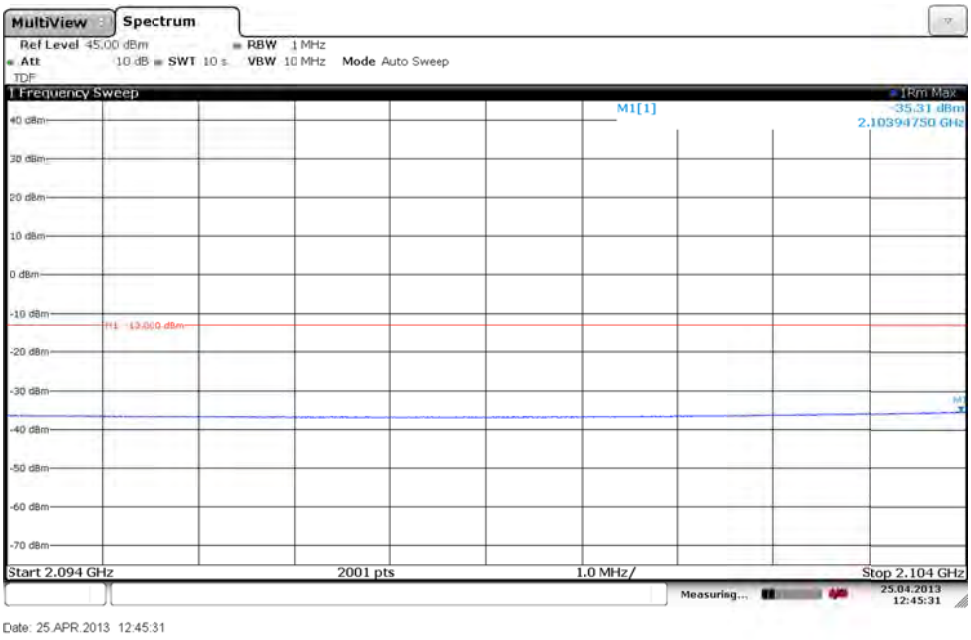
Date: 25.APR.2013 12:44:09

Diagram 2b:



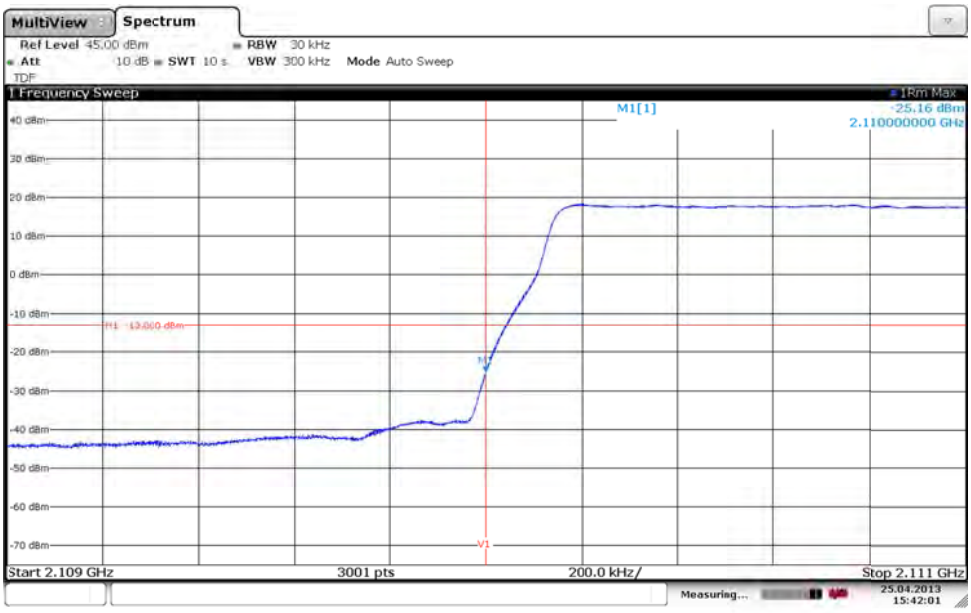
Date: 25.APR.2013 12:44:52

Diagram 2c:


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]
-35.31 dBm
2.10394750 GHz
40 dBm
30 dBm
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
Start 2.094 GHz
2001 pts
1.0 MHz/
Stop 2.104 GHz
Measuring...
25.04.2013
12:45:31
Date: 25.APR.2013 12:45:31

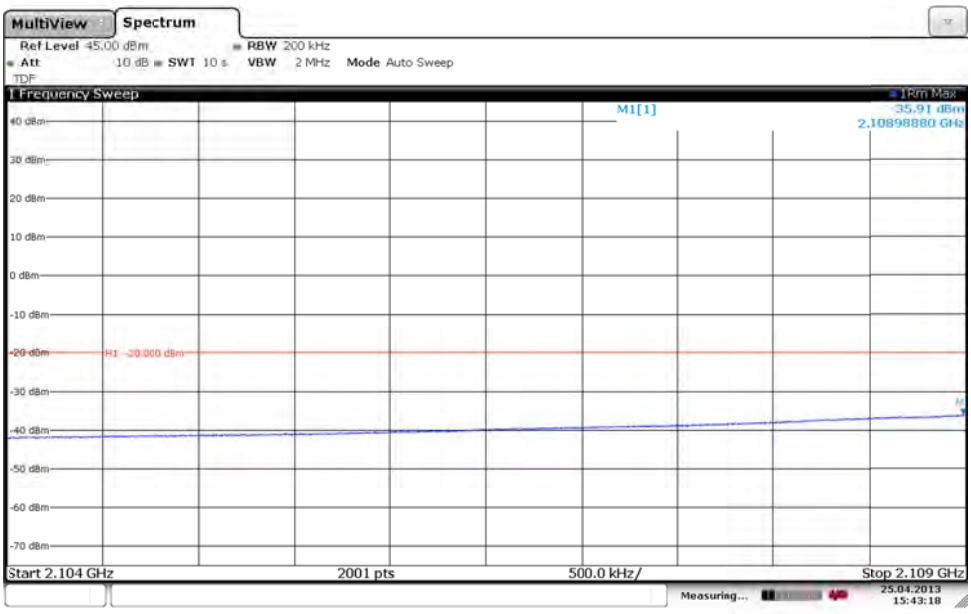
Appendix 5

Diagram 3a:



Date: 25.APR.2013 15:42:00

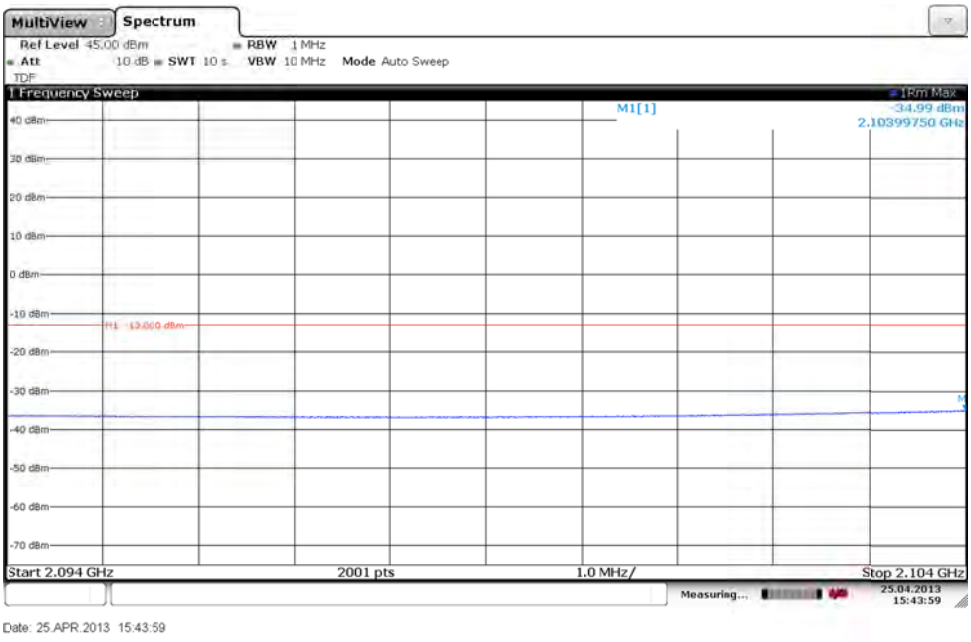
Diagram 3b:



Date: 25.APR.2013 15:43:18

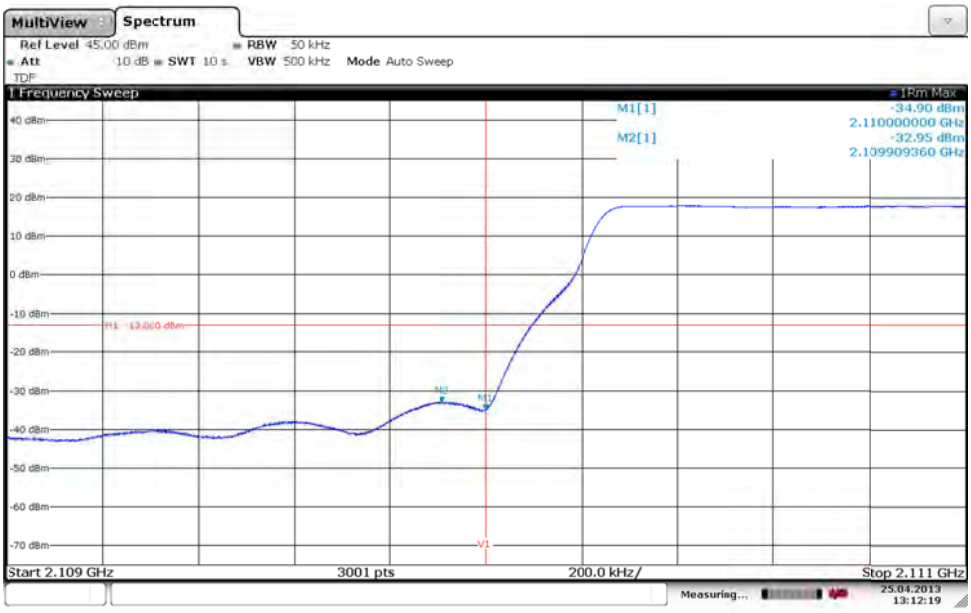
Appendix 5

Diagram 3c:



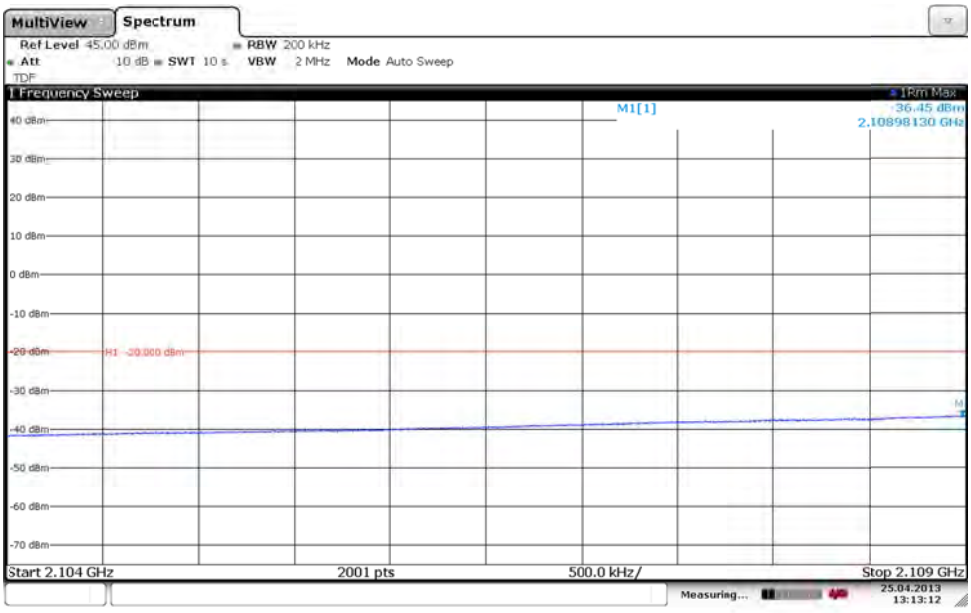
Appendix 5

Diagram 4a:



Date: 25.APR.2013 13:12:19

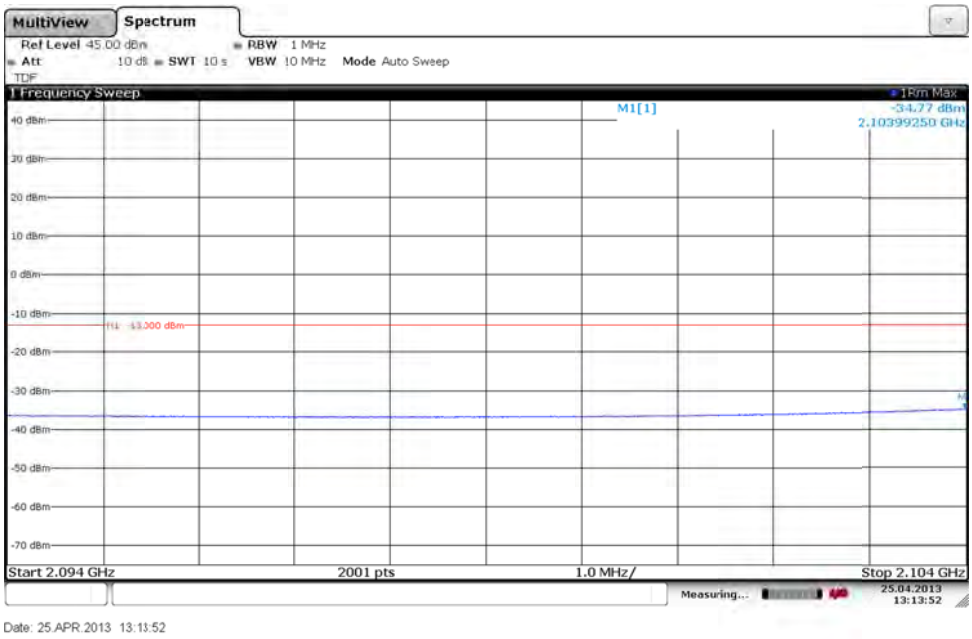
Diagram 4b:



Date: 25.APR.2013 13:13:12

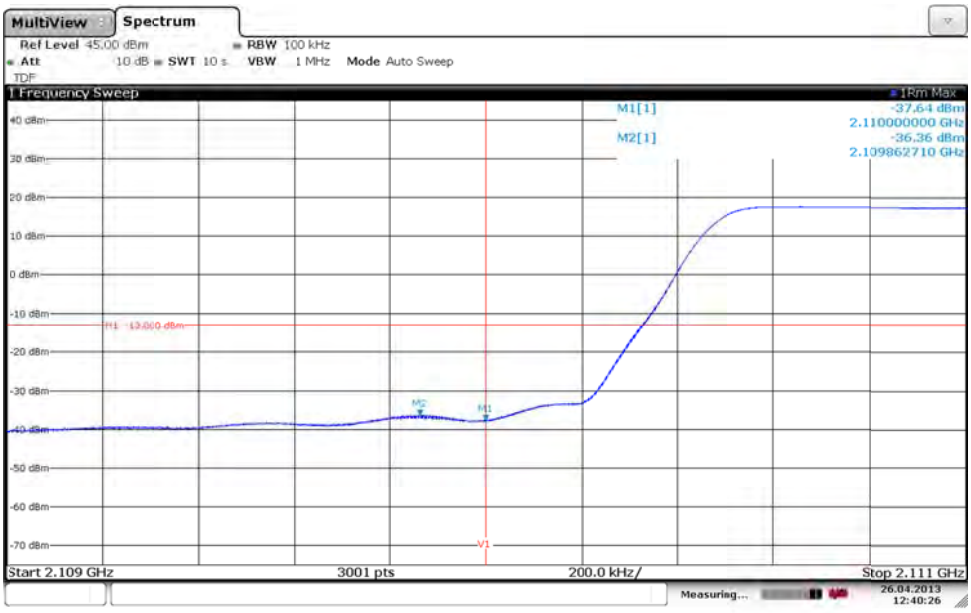
Appendix 5

Diagram 4c:



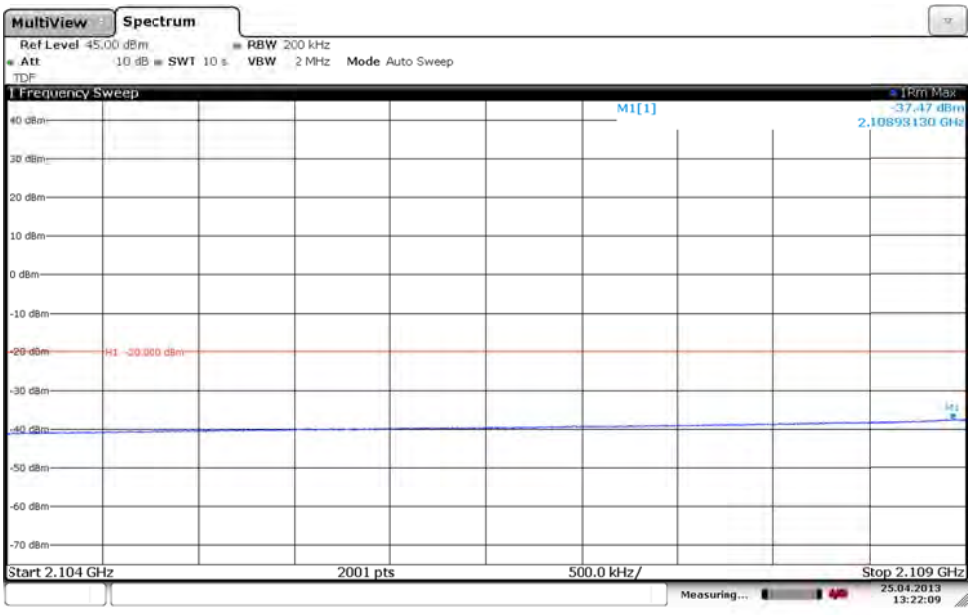
Appendix 5

Diagram 5a:



Date: 26.APR.2013 12:40:26

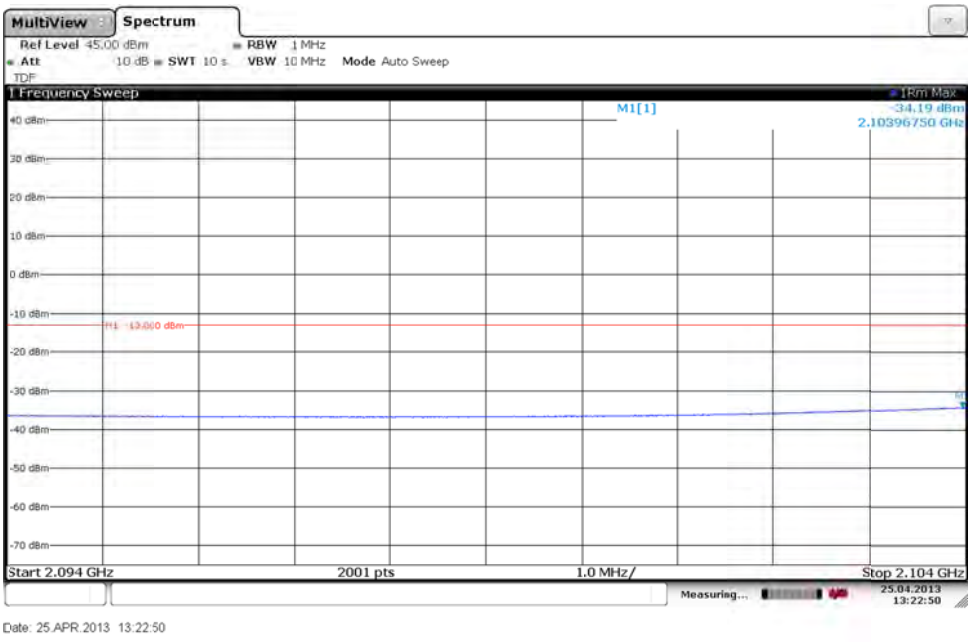
Diagram 5b:



Date: 25.APR.2013 13:22:09

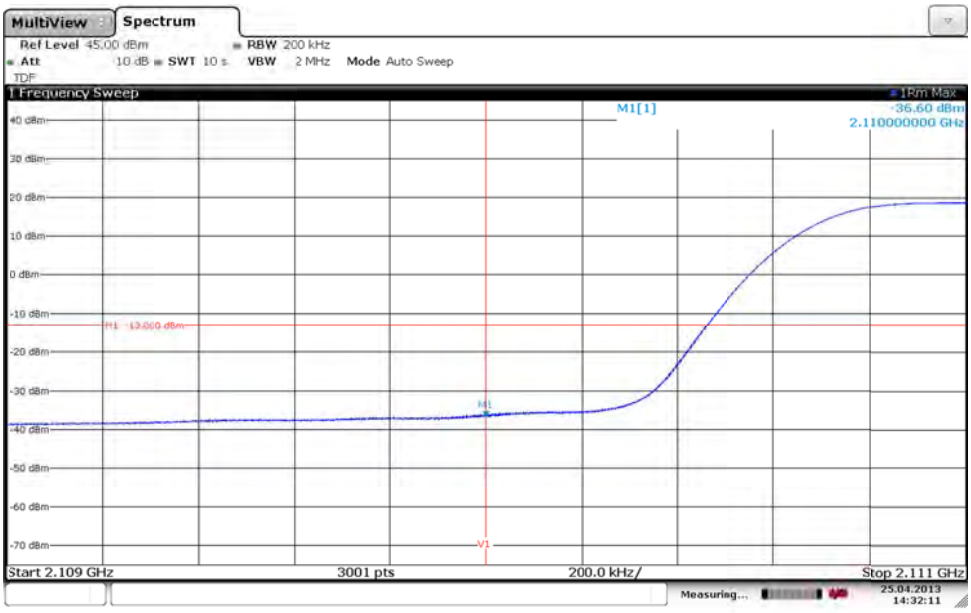
Appendix 5

Diagram 5c:



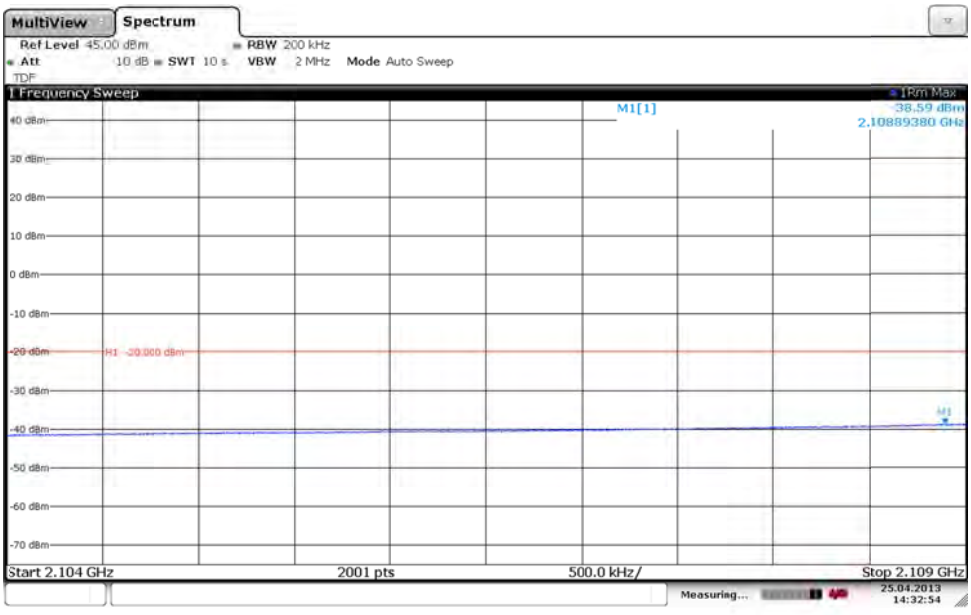
Appendix 5

Diagram 6a:



Date: 25.APR.2013 14:32:11

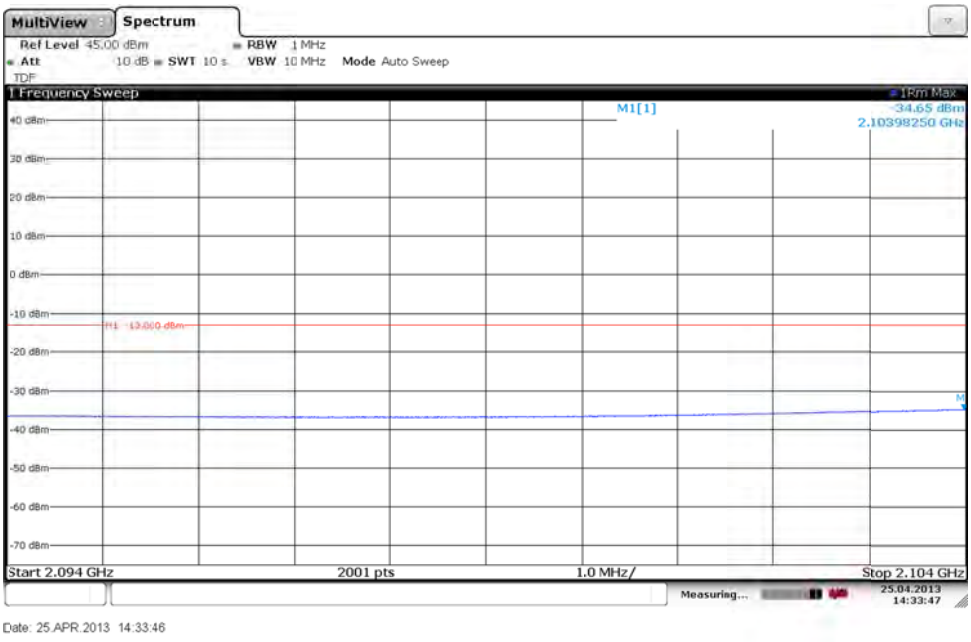
Diagram 6b:



Date: 25.APR.2013 14:32:54

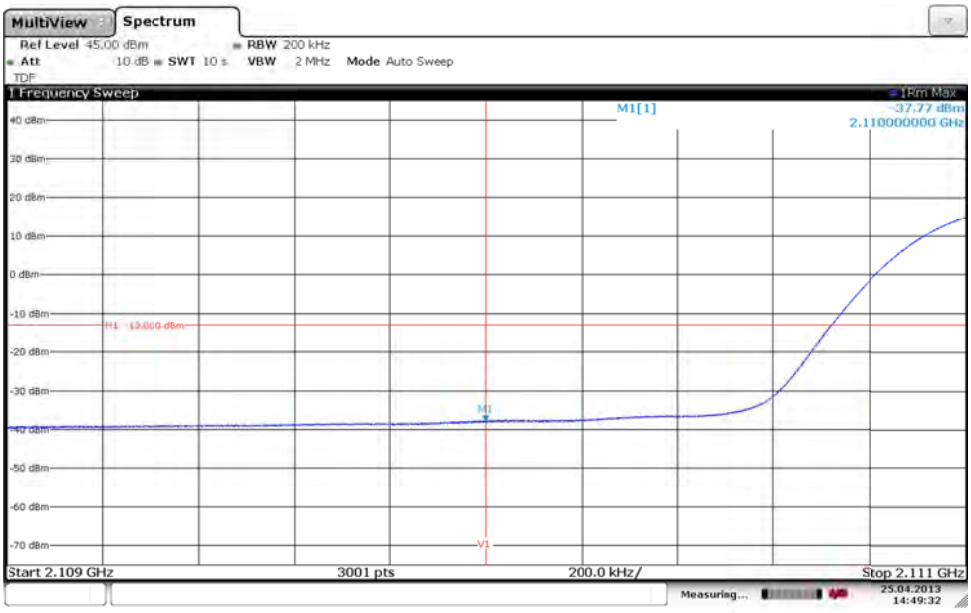
Appendix 5

Diagram 6c:



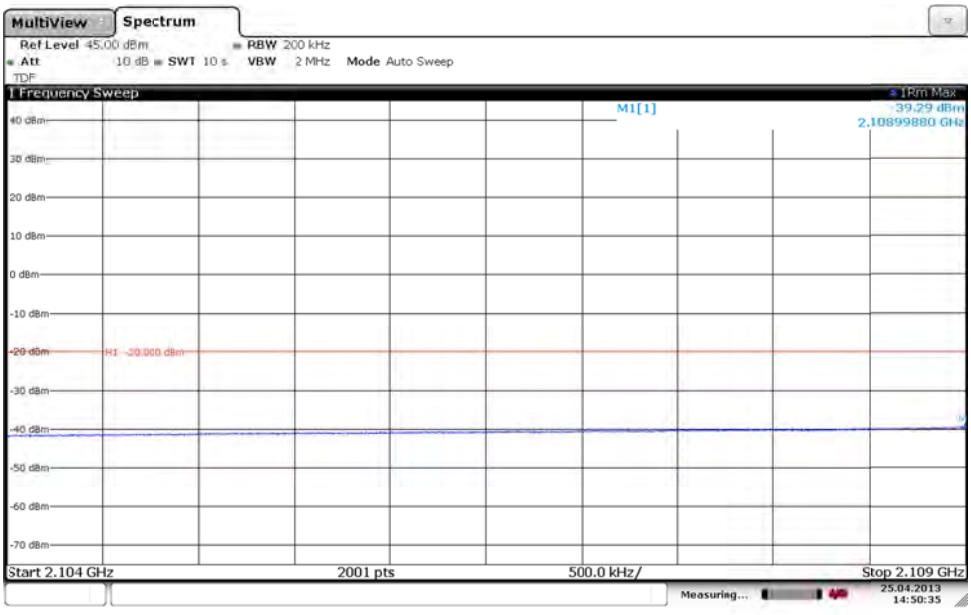
Appendix 5

Diagram 7a:



Date: 25.APR.2013 14:49:33

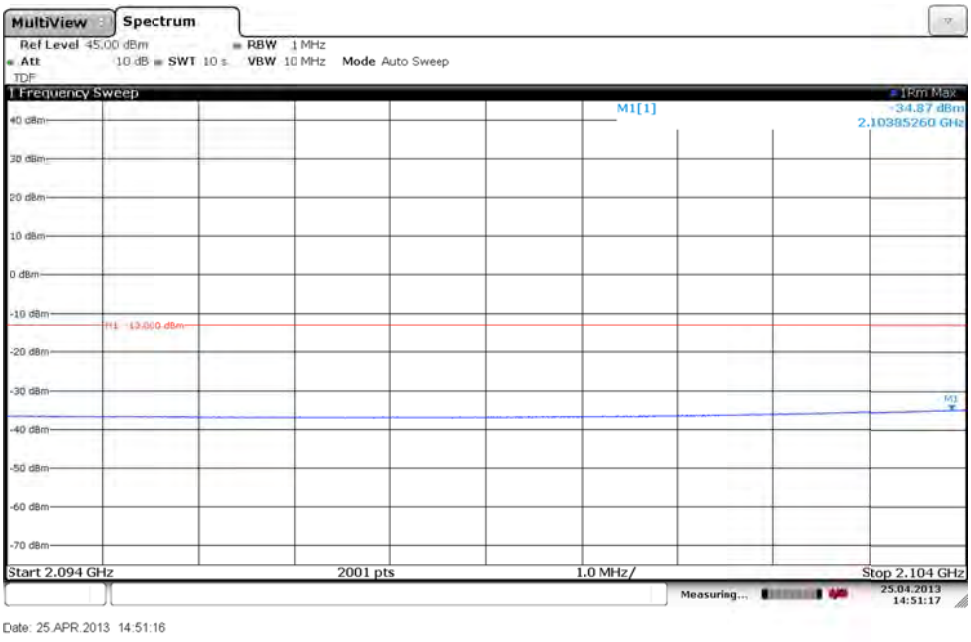
Diagram 7b:



Date: 25.APR.2013 14:50:35

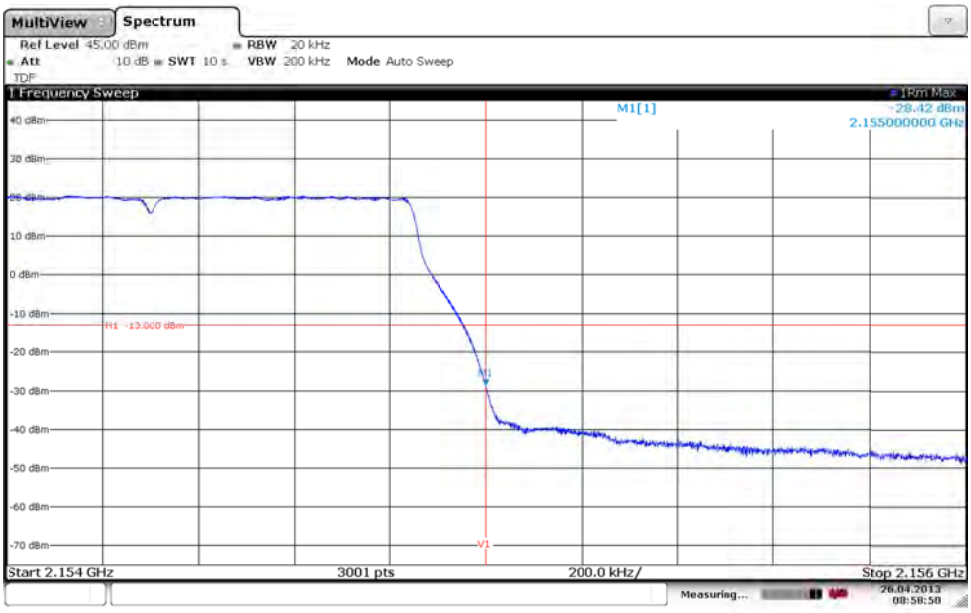
Appendix 5

Diagram 7c:



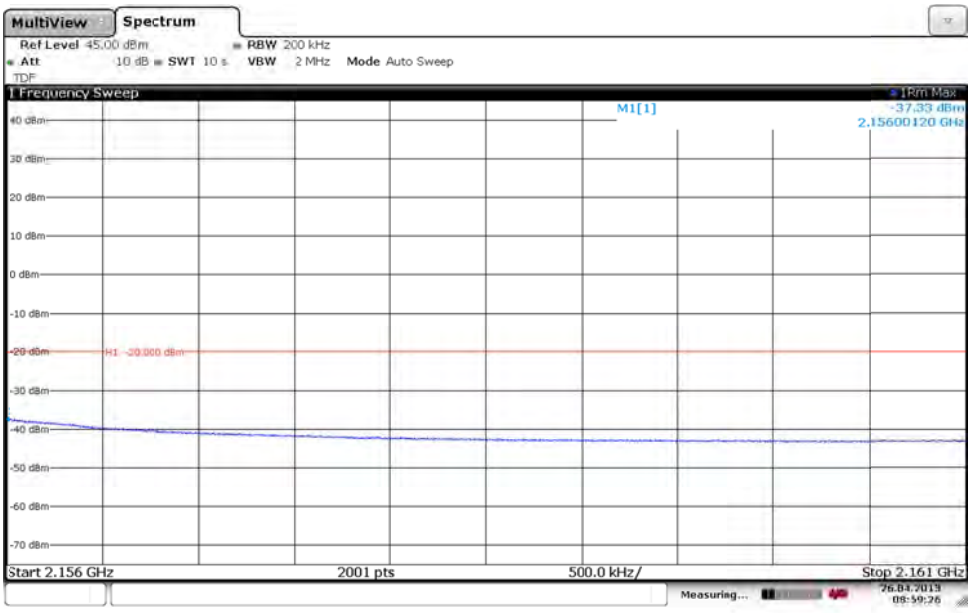
Appendix 5

Diagram 8a:



Date: 26.APR.2013 08:58:50

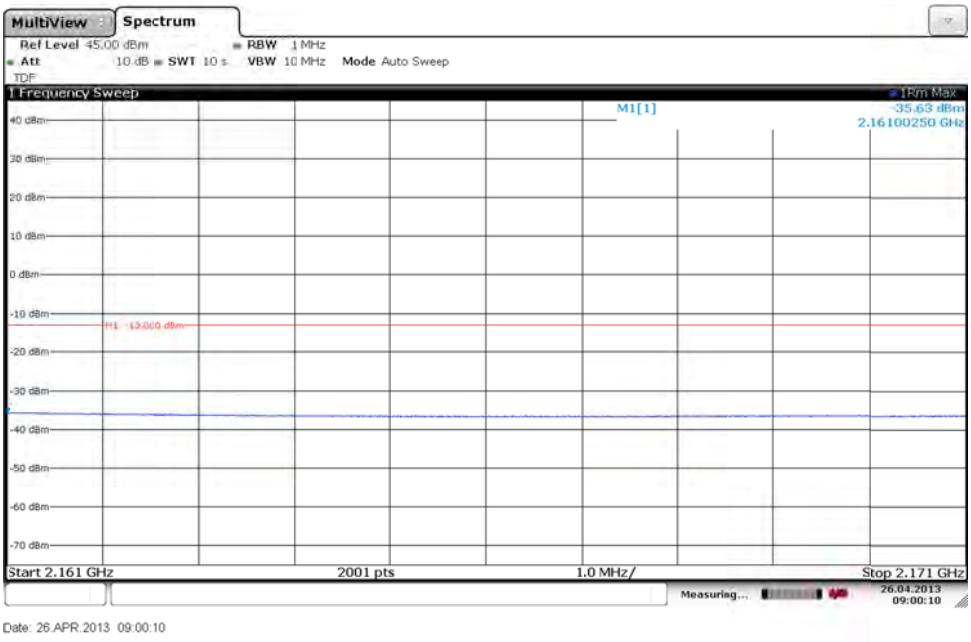
Diagram 8a:



Date: 26.APR.2013 08:59:25

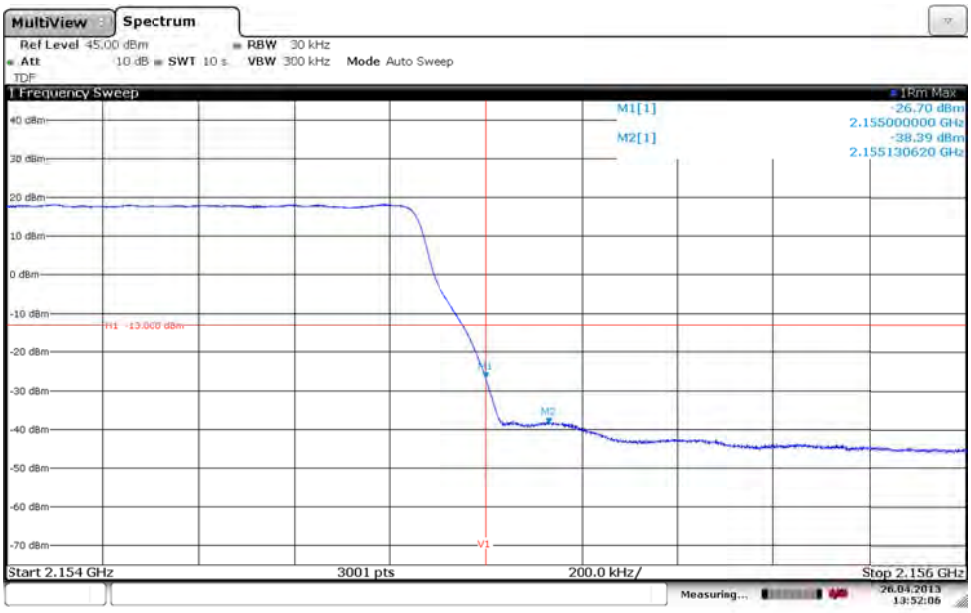
Appendix 5

Diagram 8c:



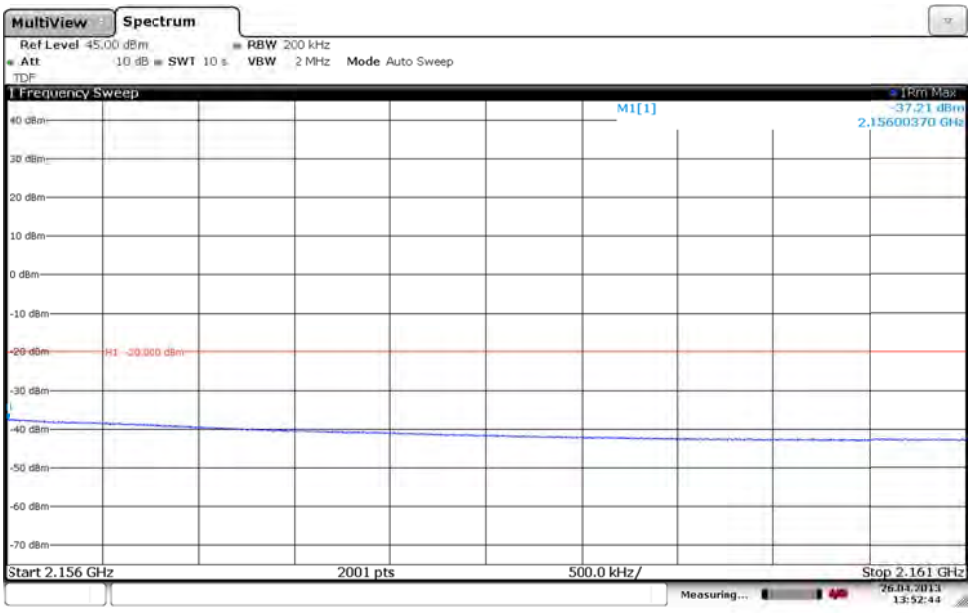
Appendix 5

Diagram 9a:



Date: 26.APR.2013 13:52:06

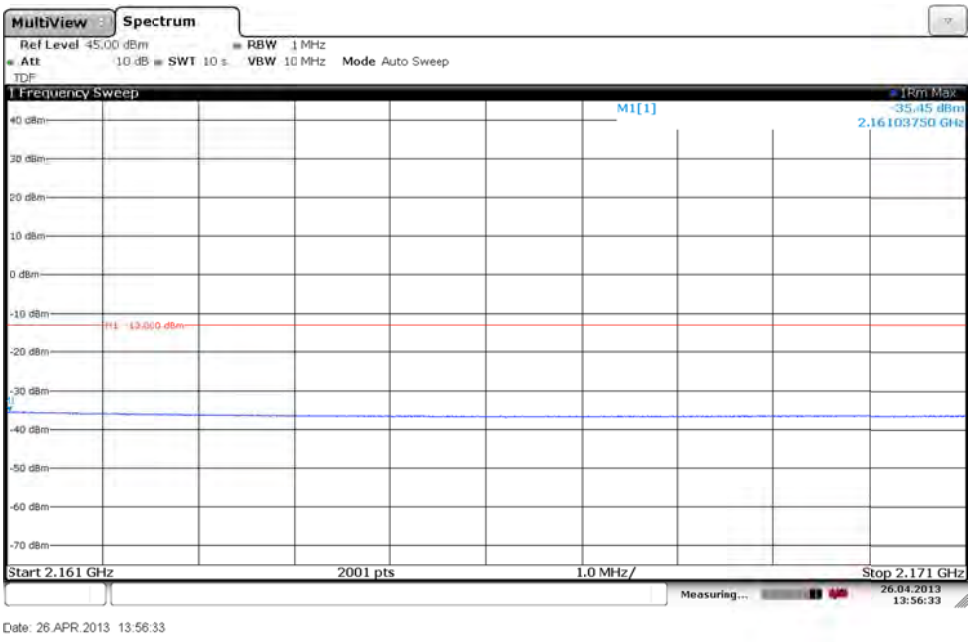
Diagram 9b:



Date: 26.APR.2013 13:52:44

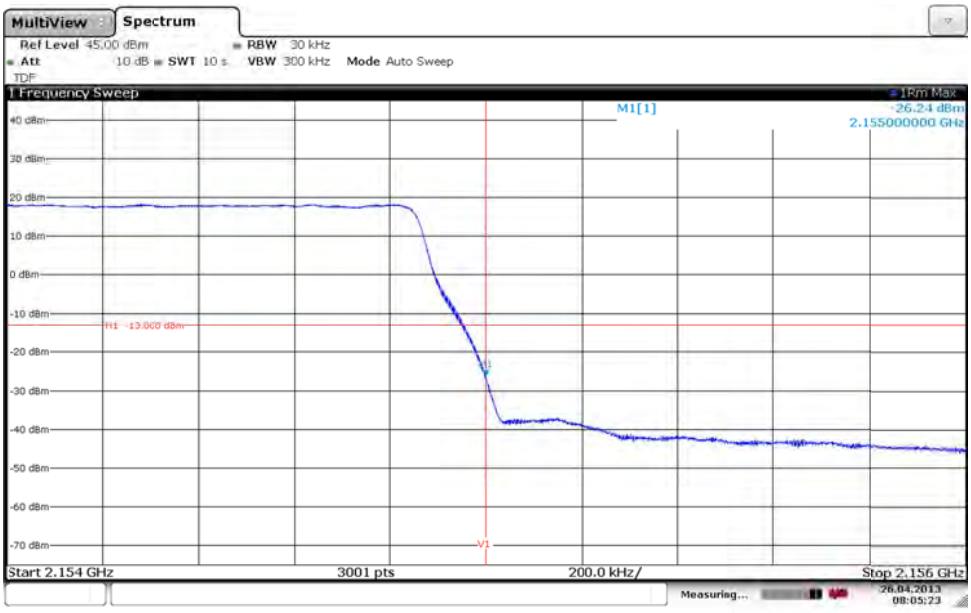
Appendix 5

Diagram 9c



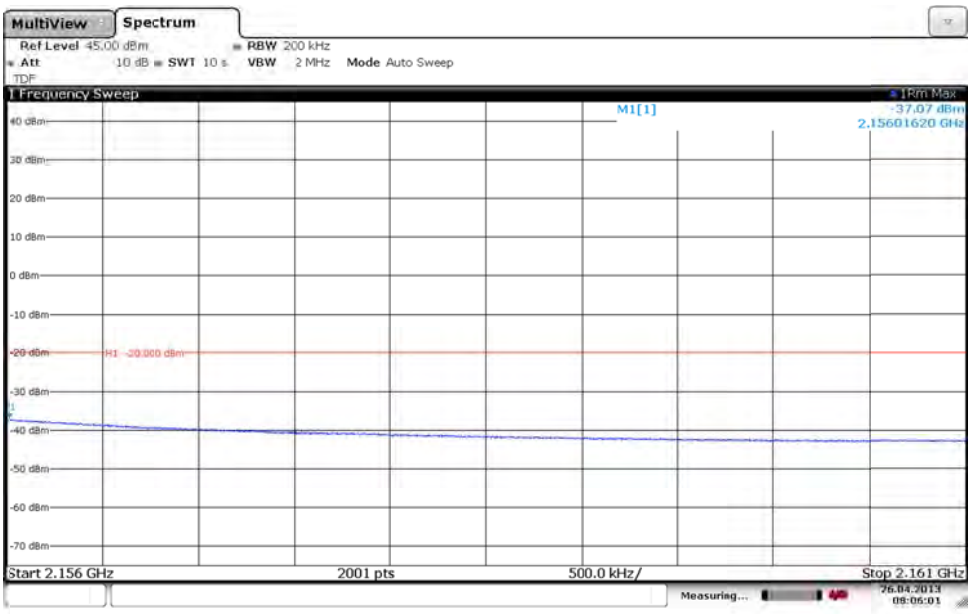
Appendix 5

Diagram 10a:



Date: 26.APR.2013 08:05:23

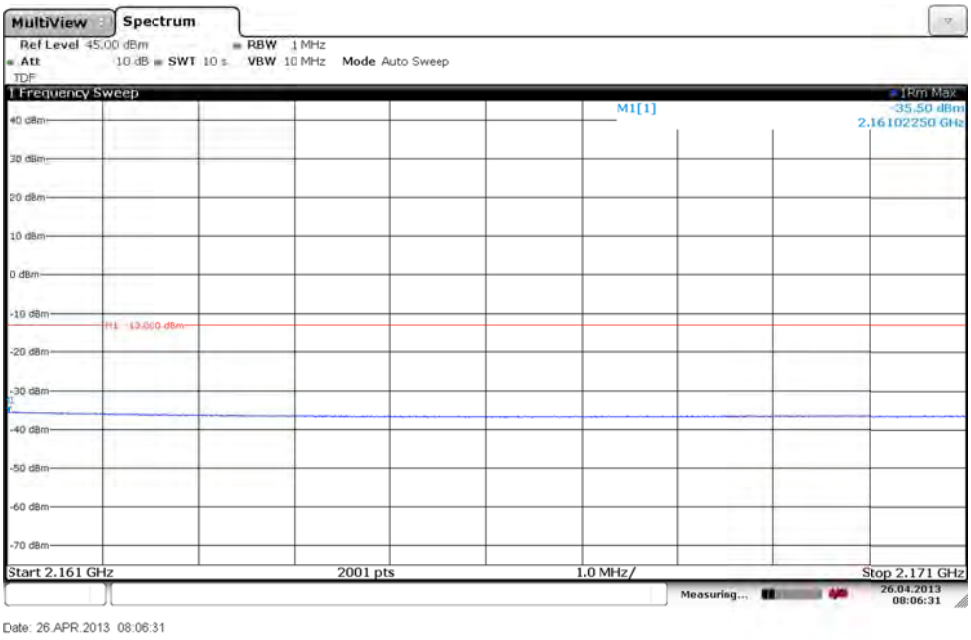
Diagram 10b:



Date: 26.APR.2013 08:06:02

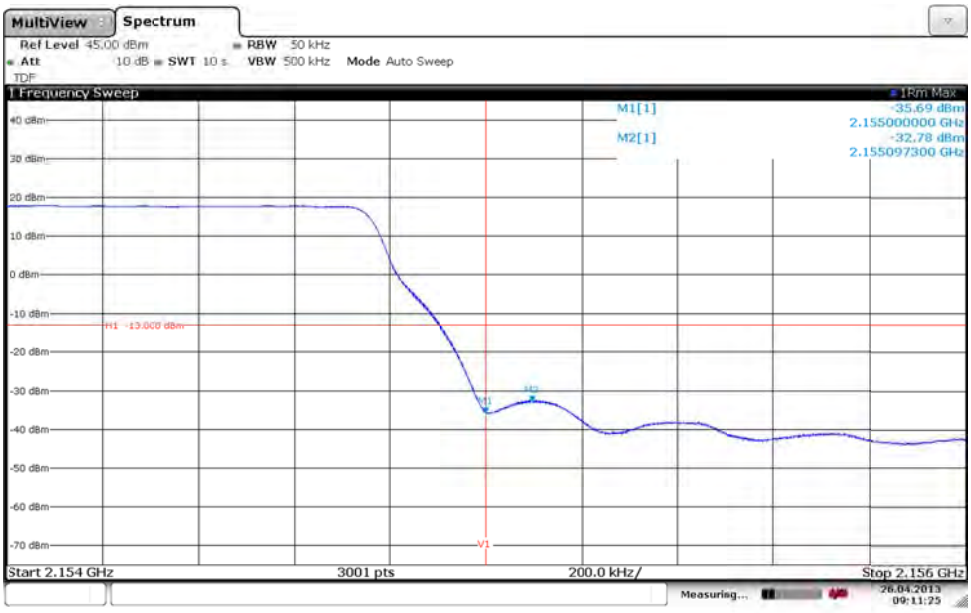
Appendix 5

Diagram 10c:



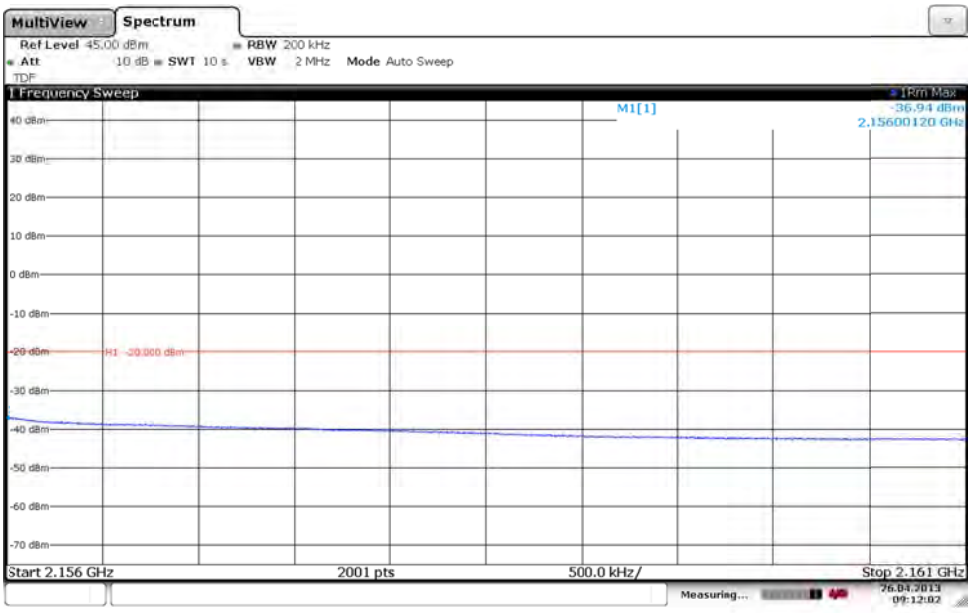
Appendix 5

Diagram 11a:



Date: 26.APR.2013 09:11:25

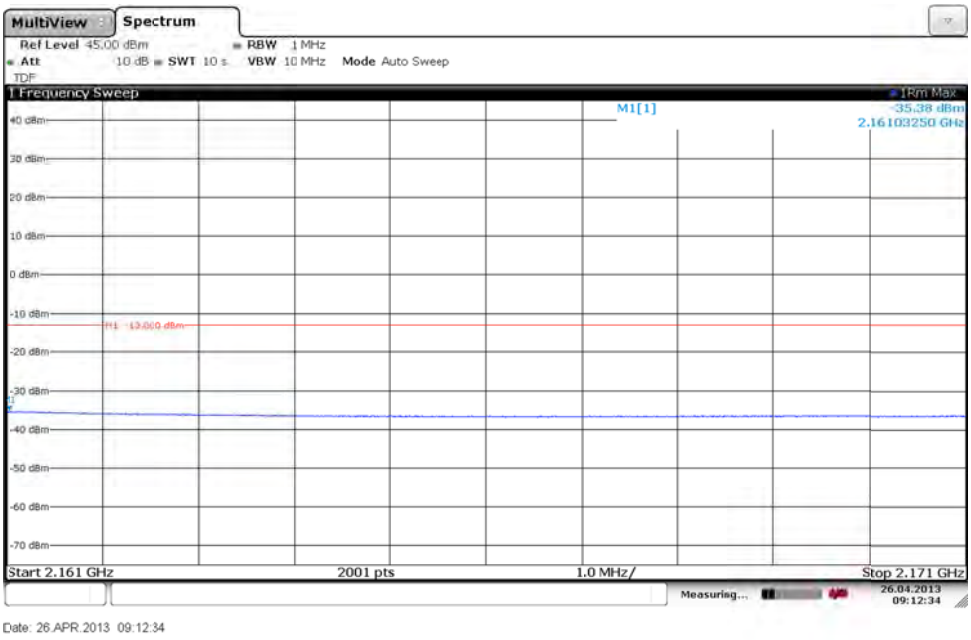
Diagram 11b:



Date: 26.APR.2013 09:12:03

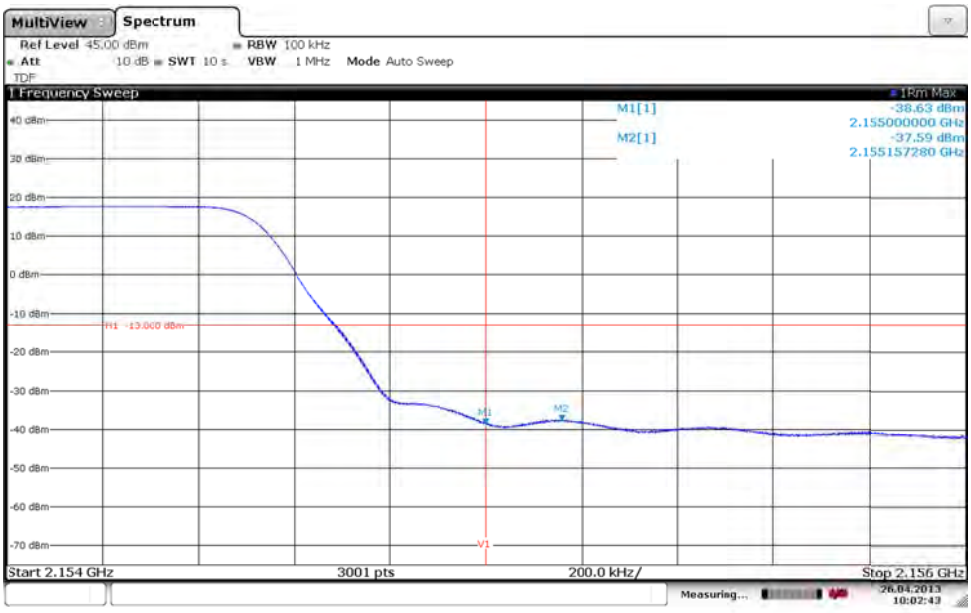
Appendix 5

Diagram 11c:



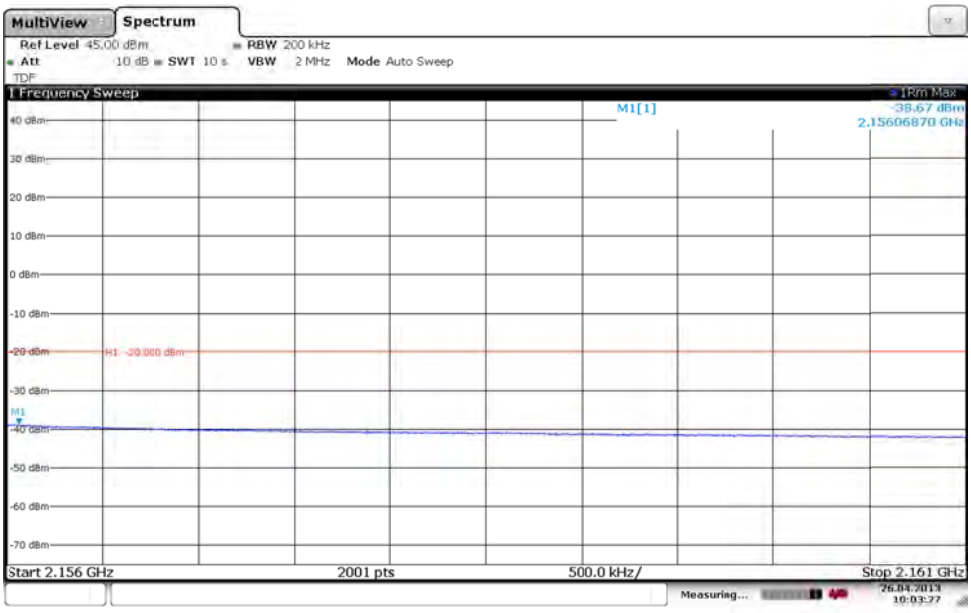
Appendix 5

Diagram 12a:



Date: 26.APR.2013 10:02:44

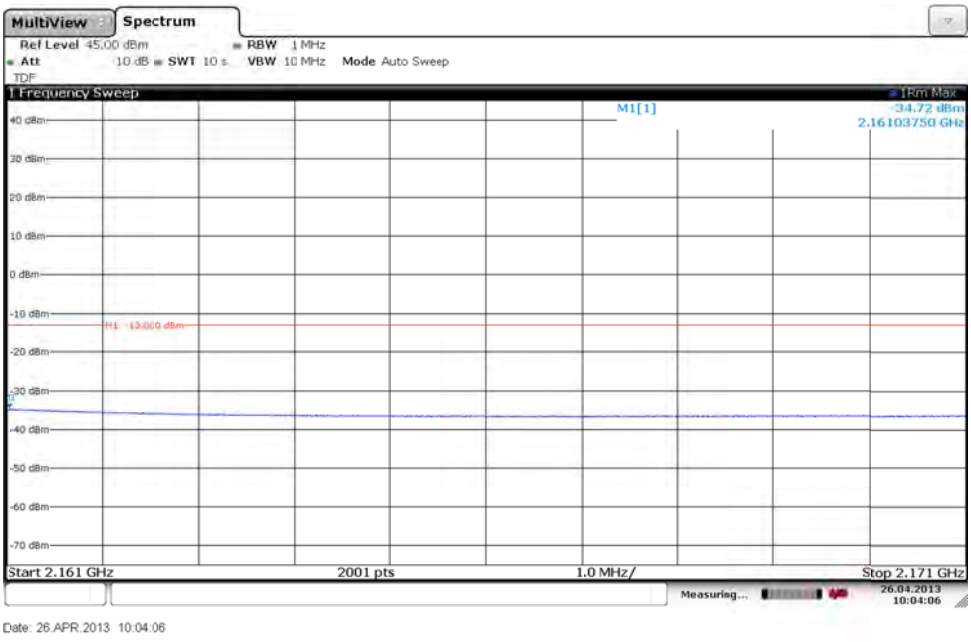
Diagram 12b:



Date: 26.APR.2013 10:03:27

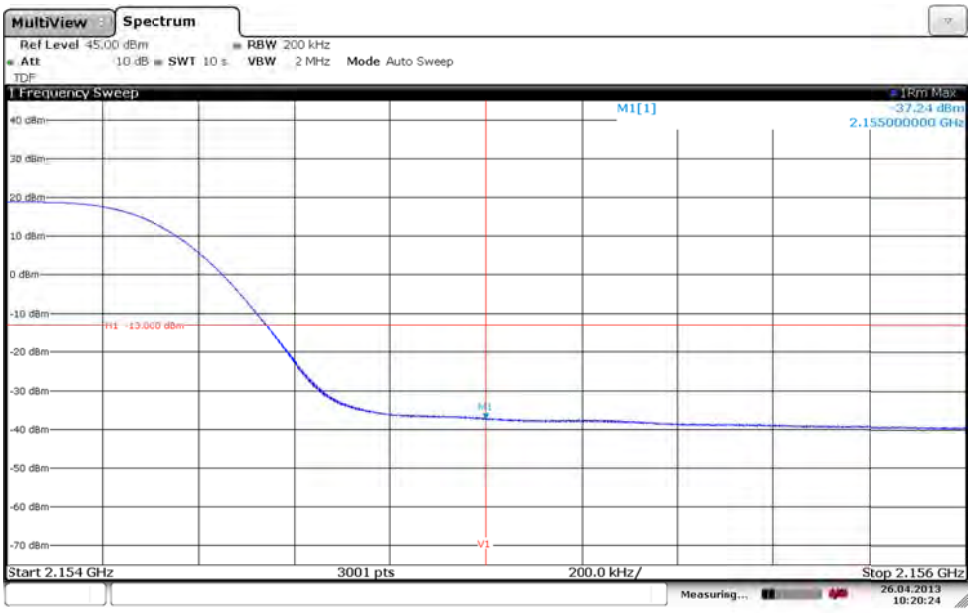
Appendix 5

Diagram 12c:



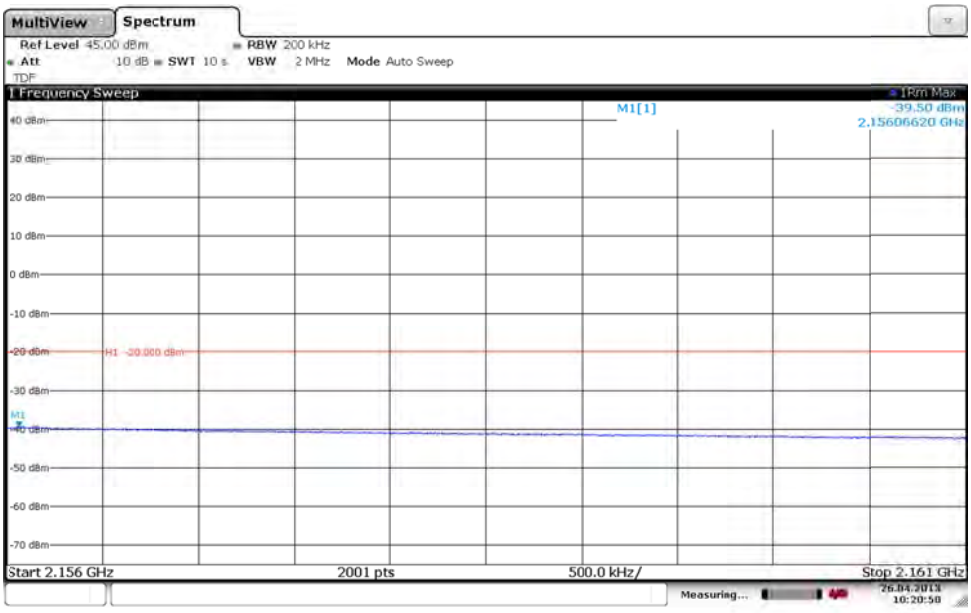
Appendix 5

Diagram 13a:



Date: 26.APR.2013 10:20:24

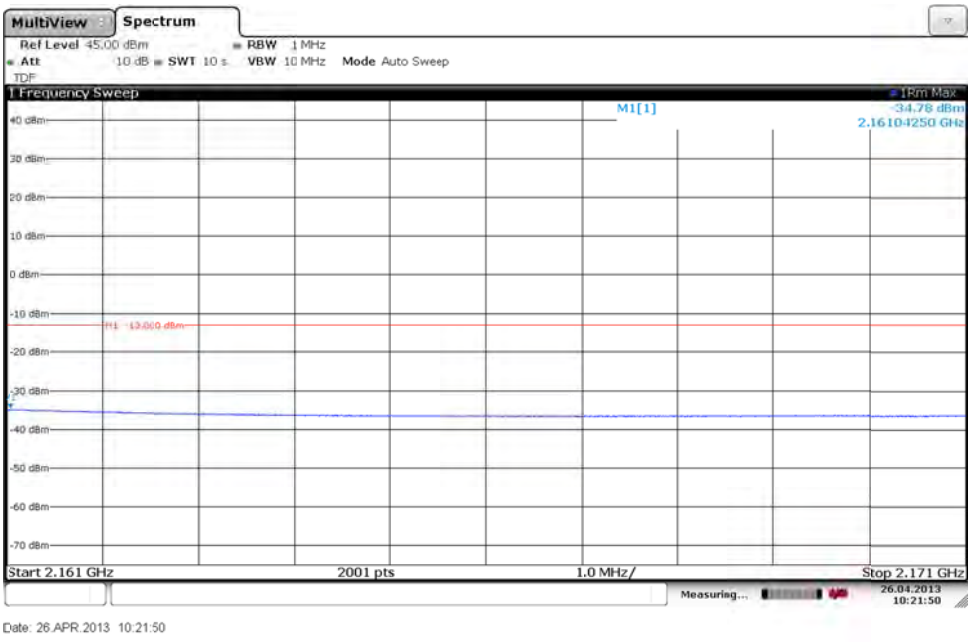
Diagram 13b:



Date: 26.APR.2013 10:20:59

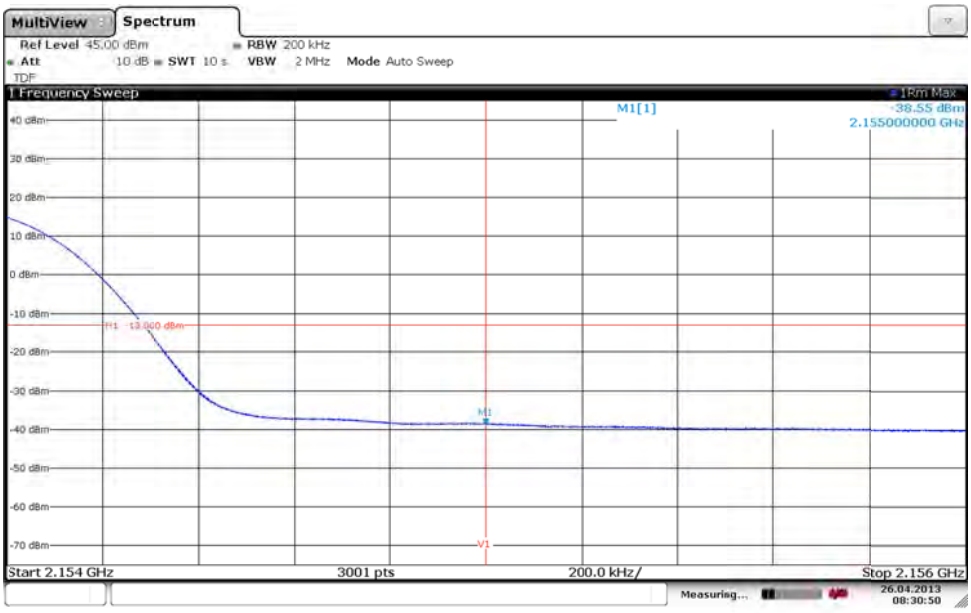
Appendix 5

Diagram 13c:



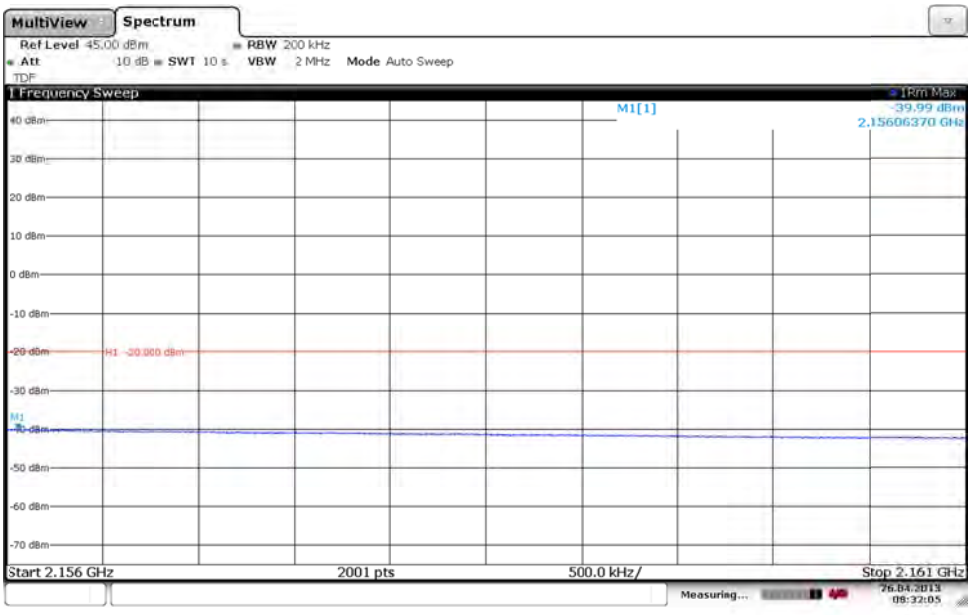
Appendix 5

Diagram 14a:



Date: 26.APR.2013 08:30:50

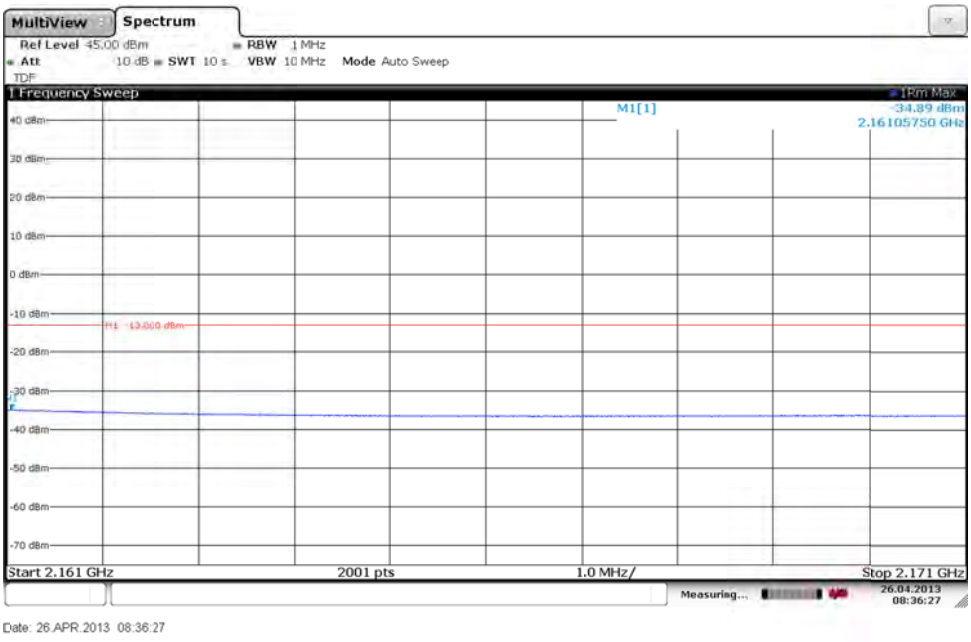
Diagram 14b:



Date: 26.APR.2013 08:32:05

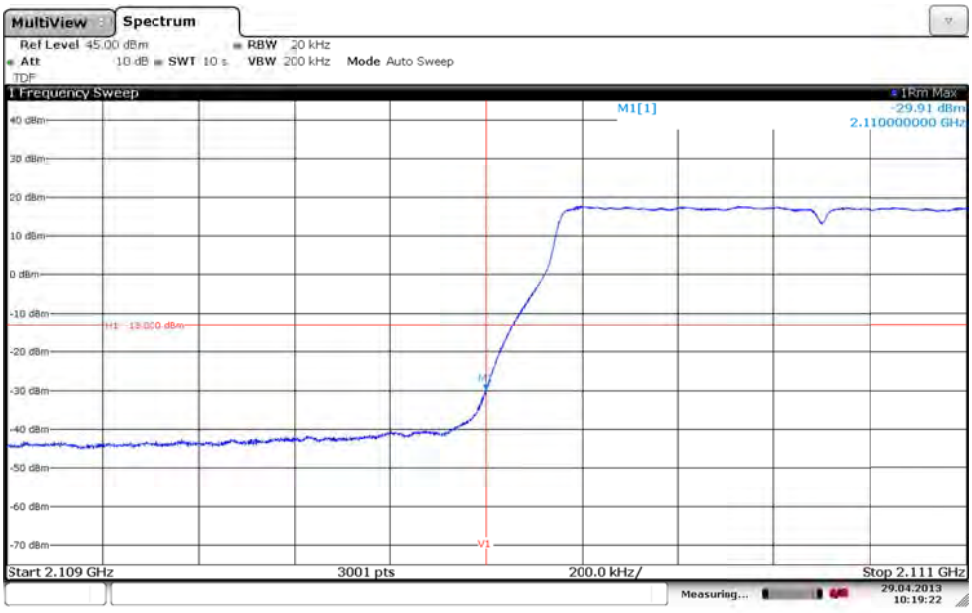
Appendix 5

Diagram 14c:



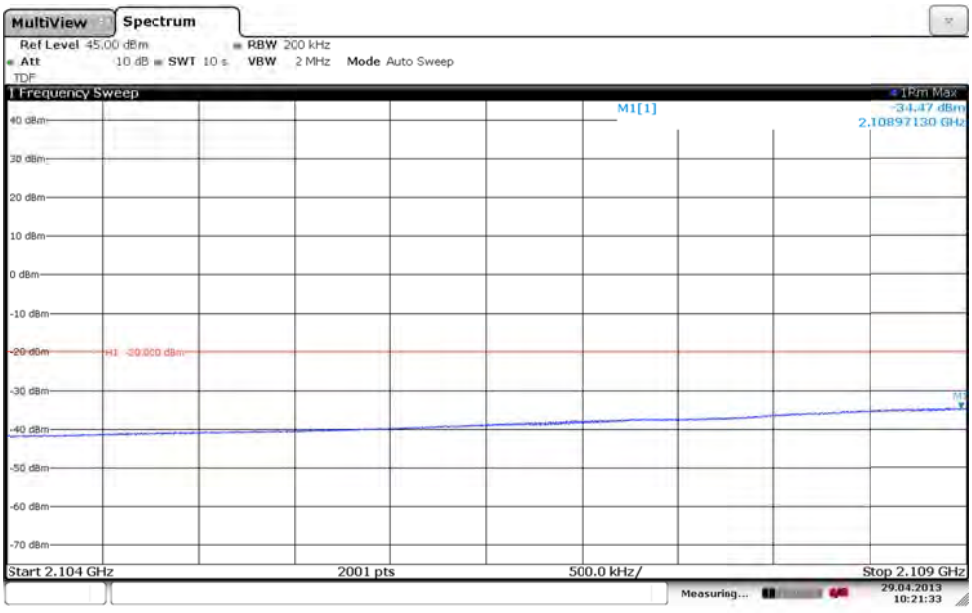
Appendix 5

Diagram 15a:



Date: 29.APR.2013 10:19:22

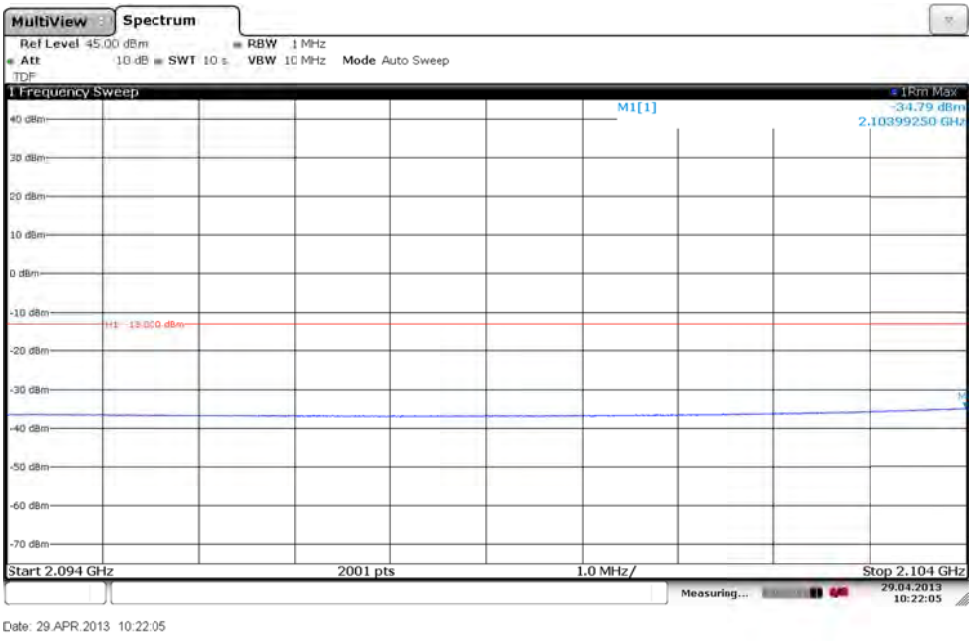
Diagram 15b:



Date: 29.APR.2013 10:21:33

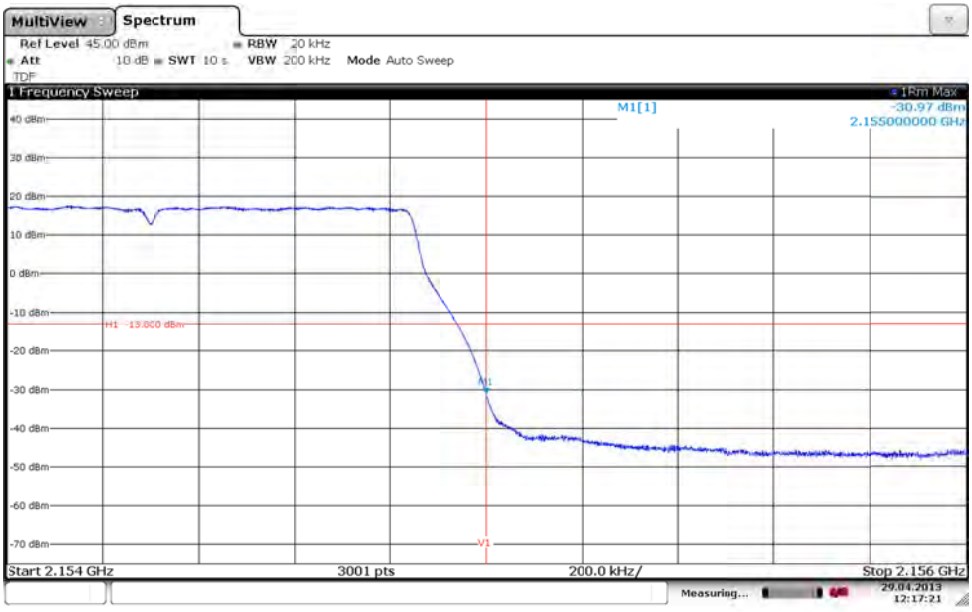
Appendix 5

Diagram 15c:



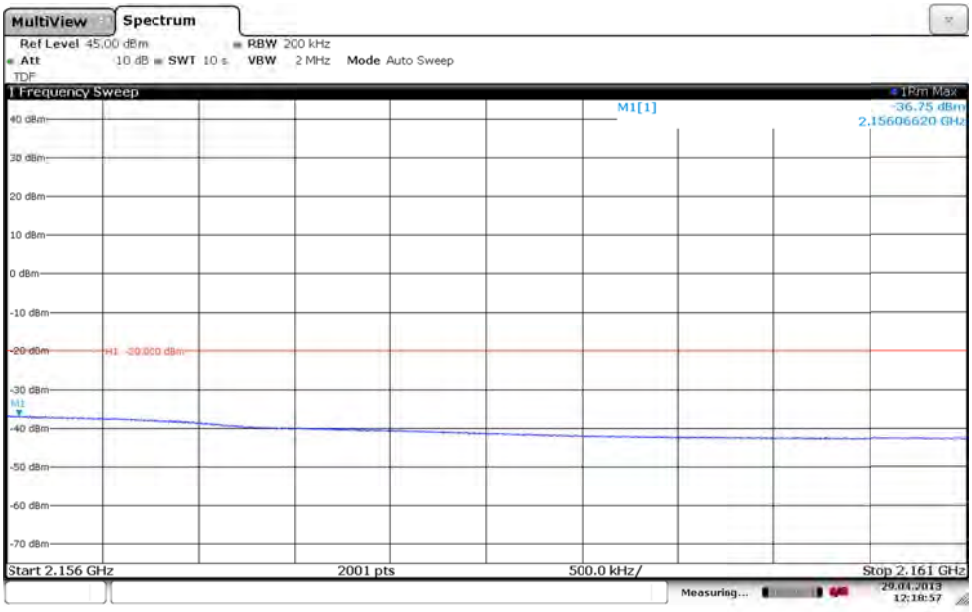
Appendix 5

Diagram 16a:



Date: 29.APR.2013 12:17:21

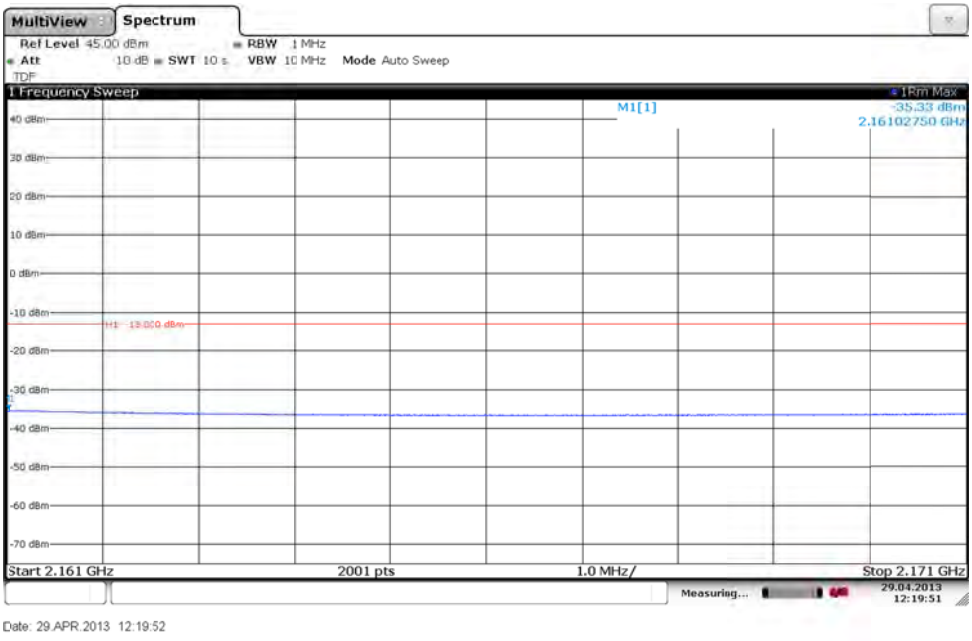
Diagram 16b:



Date: 29.APR.2013 12:18:57

Appendix 5

Diagram 16c:



Appendix 6

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

Date	Temperature	Humidity
2013-04-25	23 °C ± 3 °C	24 % ± 5 %
2013-04-26	23 °C ± 3 °C	24 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §27.53(h). The output was connected to a spectrum analyser with a RBW setting of 1 MHz and RMS detector activated. The spectrum analyser 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 v02.

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

Measurement uncertainty: 3.7 dB

Results

Single carrier

Diagram	BW configuration [MHz]	Tested frequency	Tested Port
1 a+b+c+d	1.4 MHz	B	RF A
2 a+b+c+d	20 MHz	B	RF A
3 a+b+c+d	1.4 MHz	M	RF A
4 a+b+c+d	1.4 MHz	M	RF B
5 a+b+c+d	3 MHz	M	RF A
6 a+b+c+d	5 MHz	M	RF A
7 a+b+c+d	10 MHz	M	RF A
8 a+b+c+d	15 MHz	M	RF A
9 a+b+c+d	20 MHz	M	RF A
10 a+b+c+d	20 MHz	M	RF B
11 a+b+c+d	1.4 MHz	T	RF A
12 a+b+c+d	20 MHz	T	RF A

Multi carrier

Diagram	BW configuration	Tested frequency	Tested Port
13 a+b+c+d	1.4 MHz	B2	RF A
14 a+b+c+d	1.4 MHz	M2	RF A
15 a+b+c+d	1.4 MHz	T2	RF A
16 a+b+c+d+e	1.4 MHz	Tim2	RF A

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

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

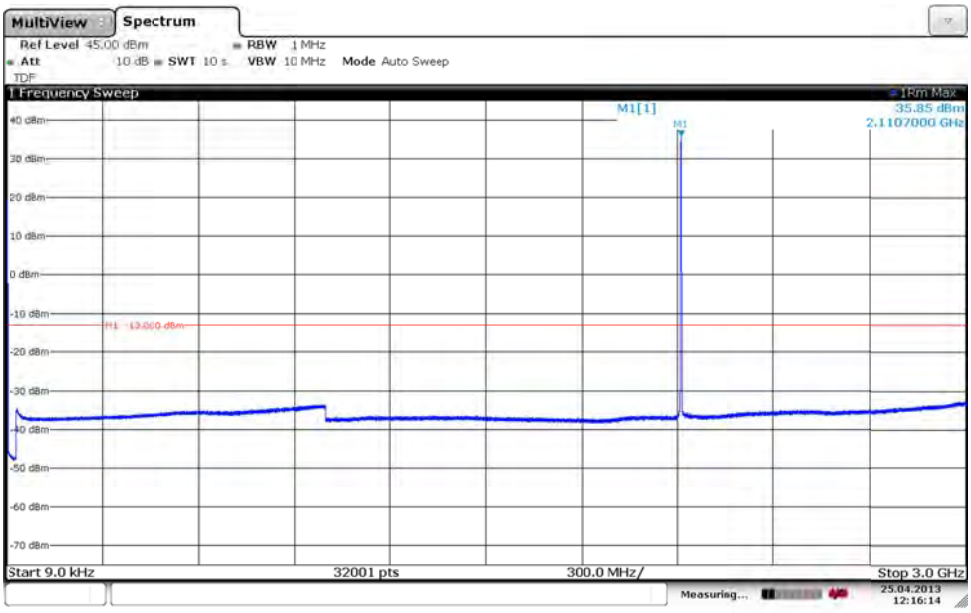
§27.53(h) and RSS-139 6.5

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

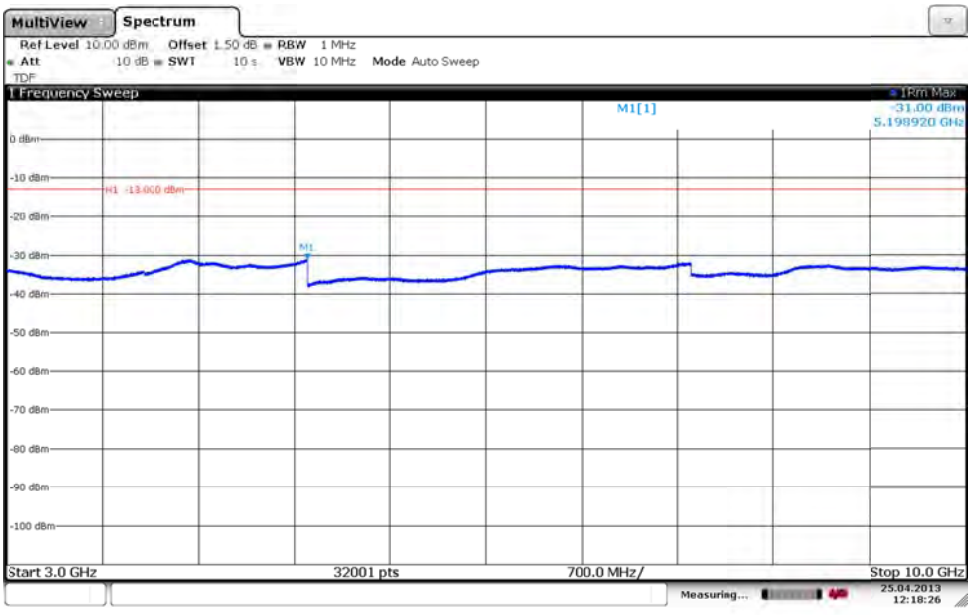
Appendix 6

Diagram 1a:



Date: 25.APR.2013 12:16:15

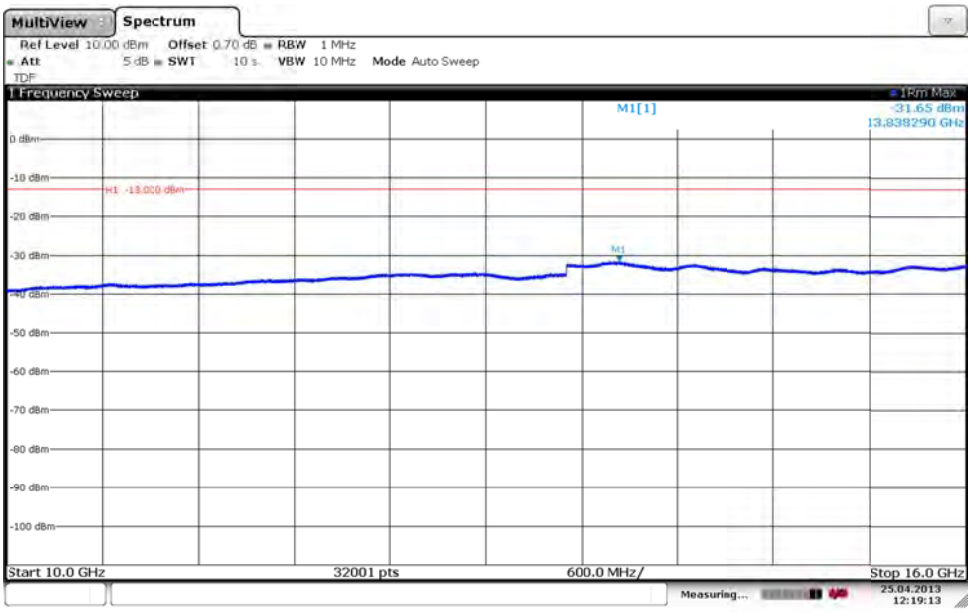
Diagram 1b:



Date: 25.APR.2013 12:18:26

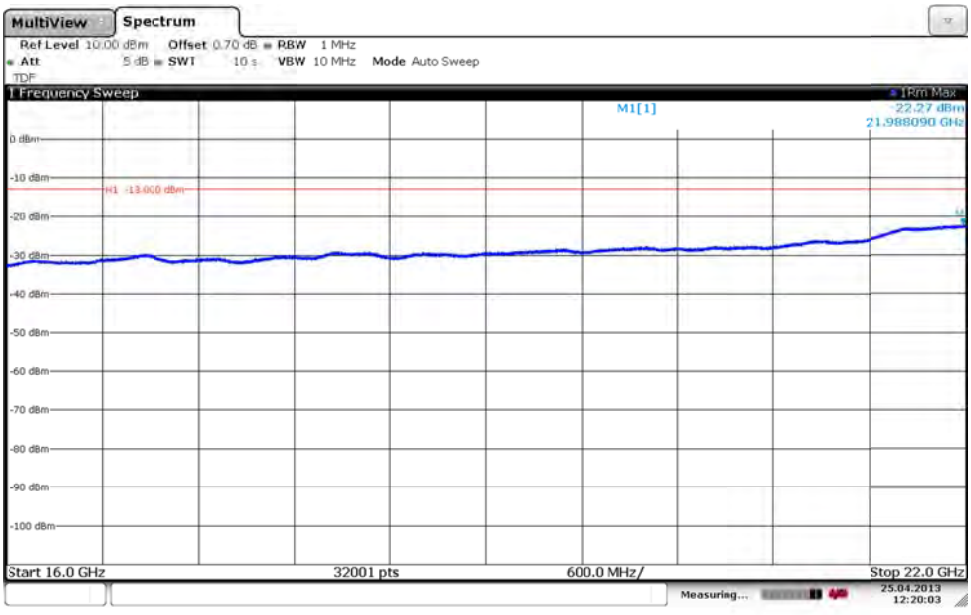
Appendix 6

Diagram 1c:



Date: 25.APR.2013 12:19:13

Diagram 1d:



Date: 25.APR.2013 12:20:02

Appendix 6

Diagram 2a:

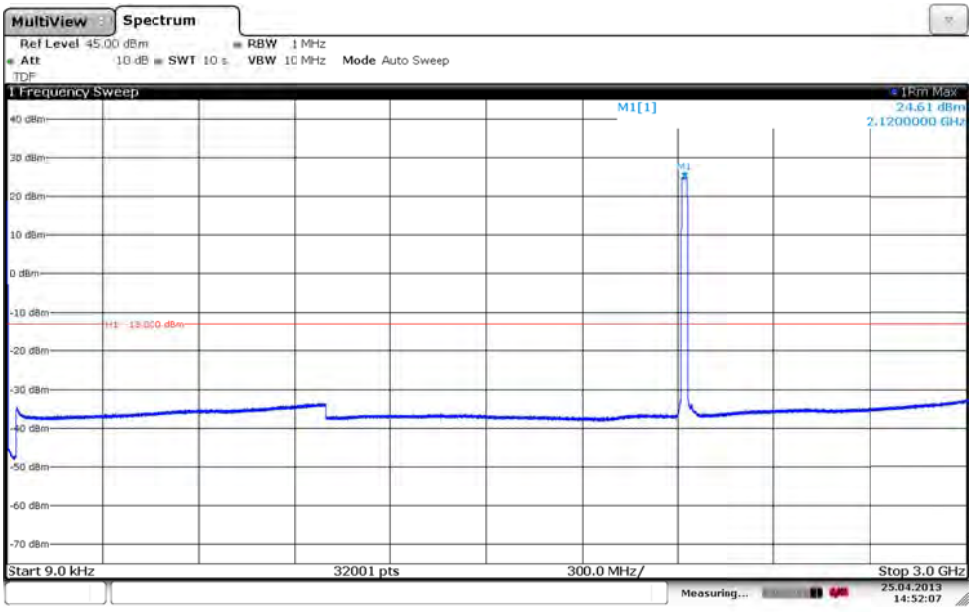


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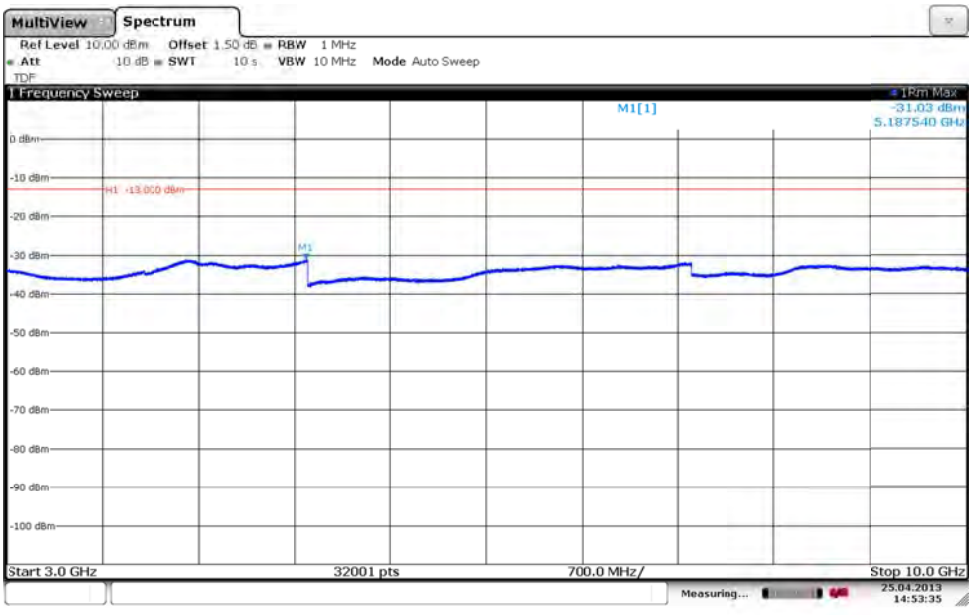
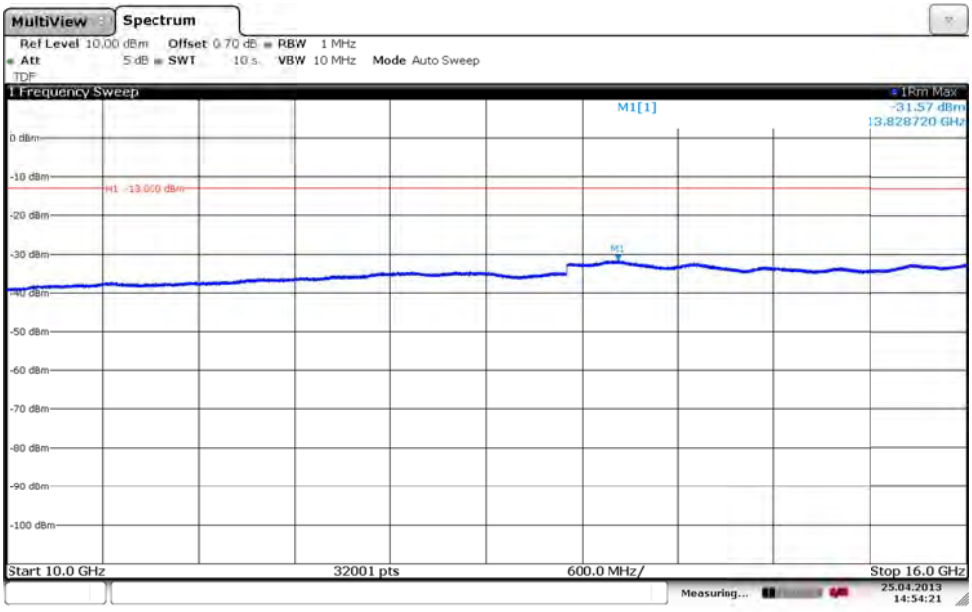
Diagram 2b:



Date: 25.APR.2013 14:53:34

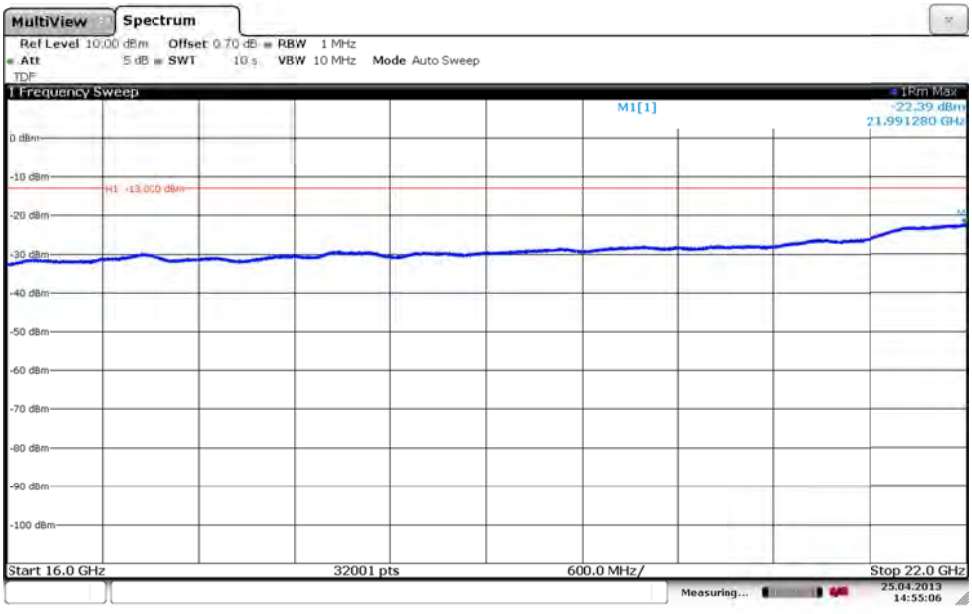
Appendix 6

Diagram 2c:



Date: 25.APR.2013 14:54:20

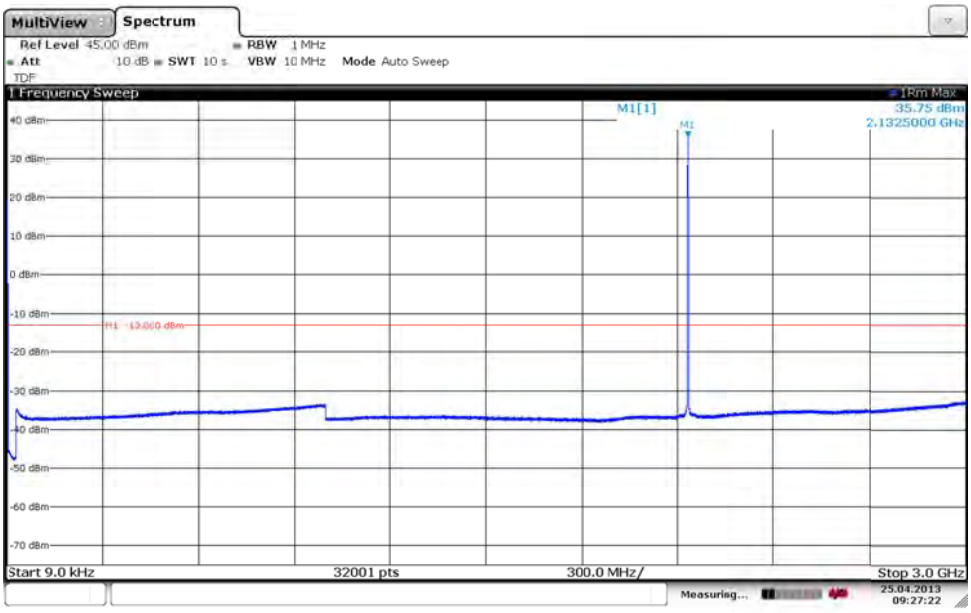
Diagram 2d:



Date: 25.APR.2013 14:55:06

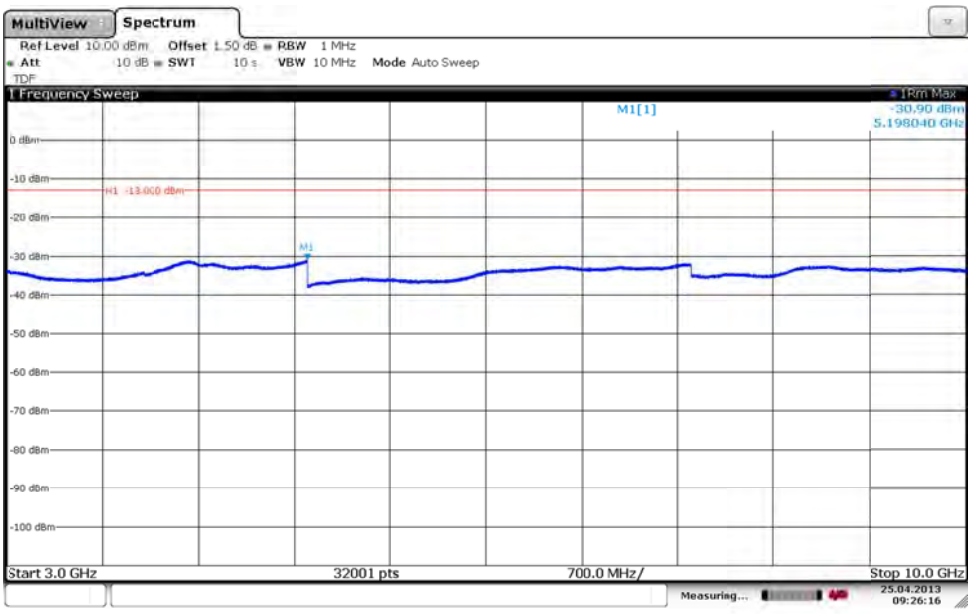
Appendix 6

Diagram 3a:



Date: 25.APR.2013 09:27:23

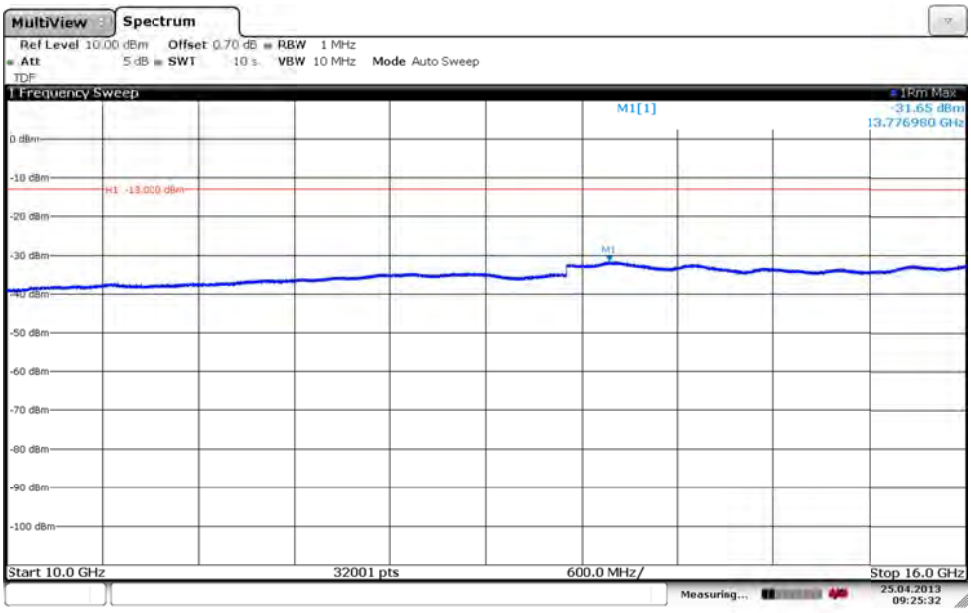
Diagram 3b:



Date: 25.APR.2013 09:26:15

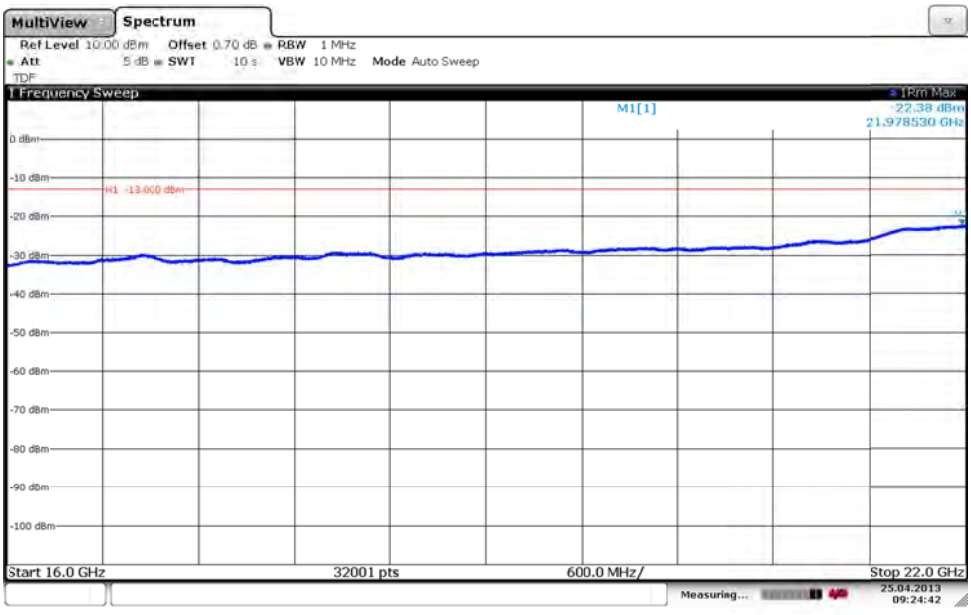
Appendix 6

Diagram 3c:



Date: 25.APR.2013 09:25:31

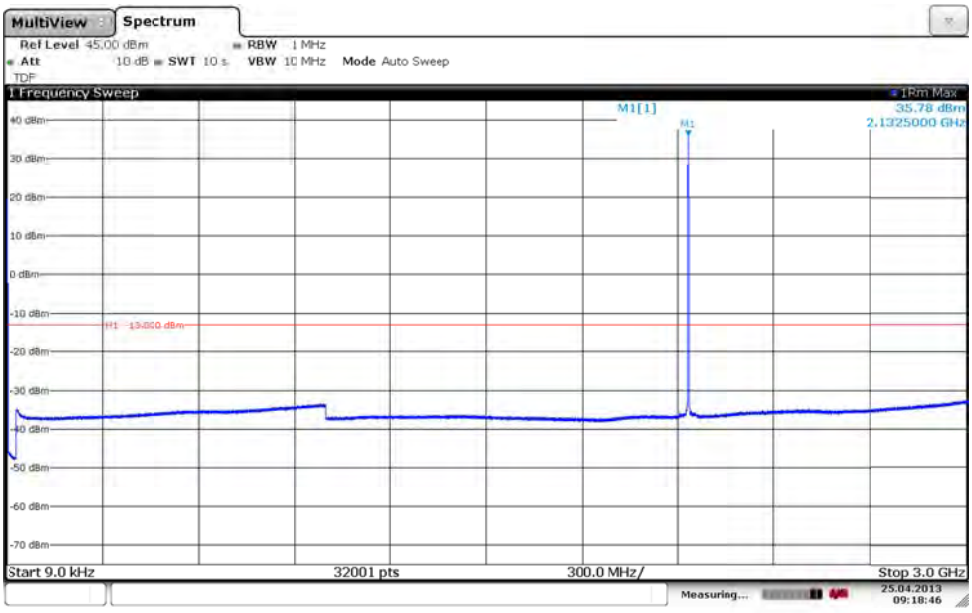
Diagram 3d:



Date: 25.APR.2013 09:24:43

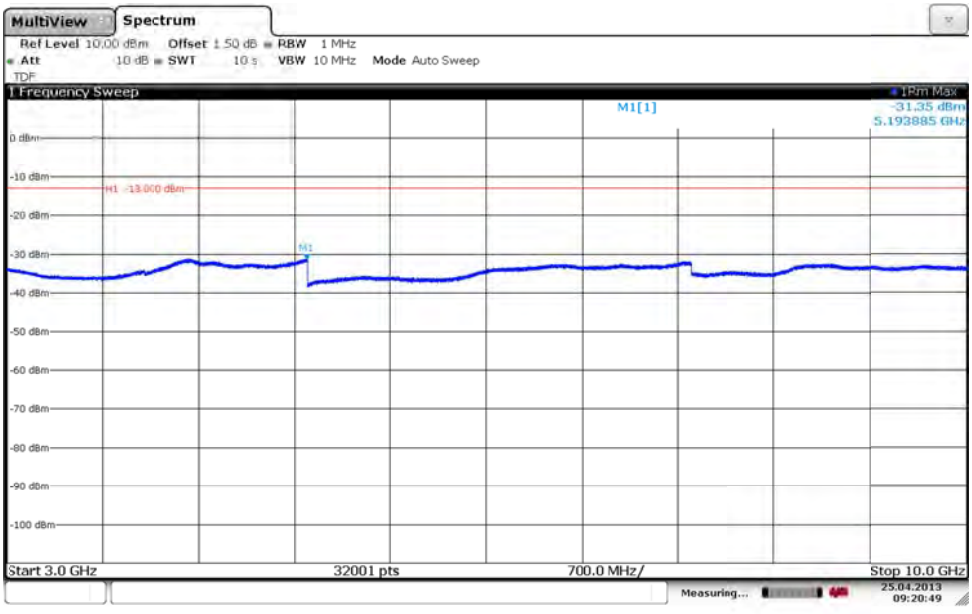
Appendix 6

Diagram 4a:



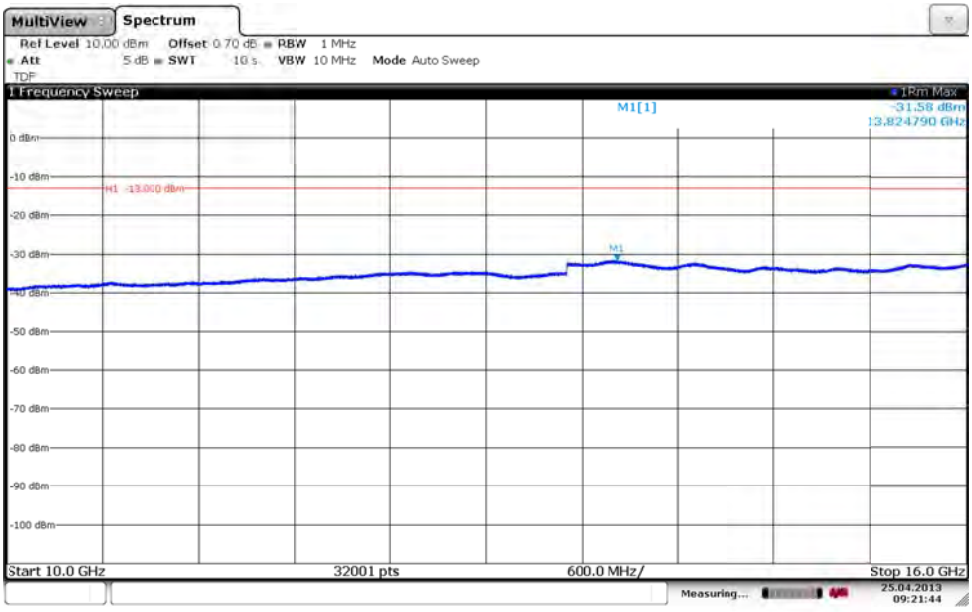
Date: 25.APR.2013 09:18:47

Diagram 4b:



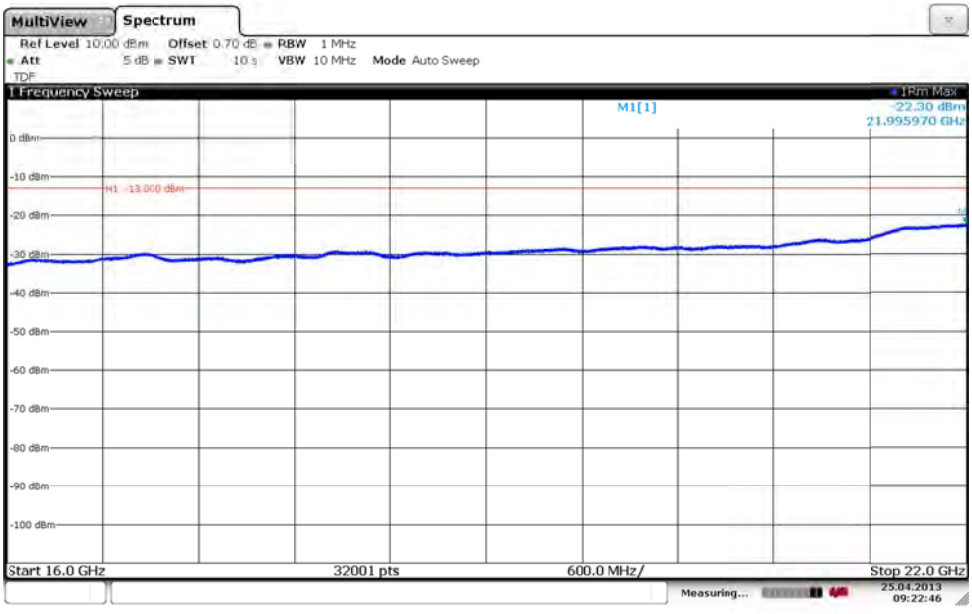
Date: 25.APR.2013 09:20:49

Diagram 4c:



Date: 25.APR.2013 09:21:44

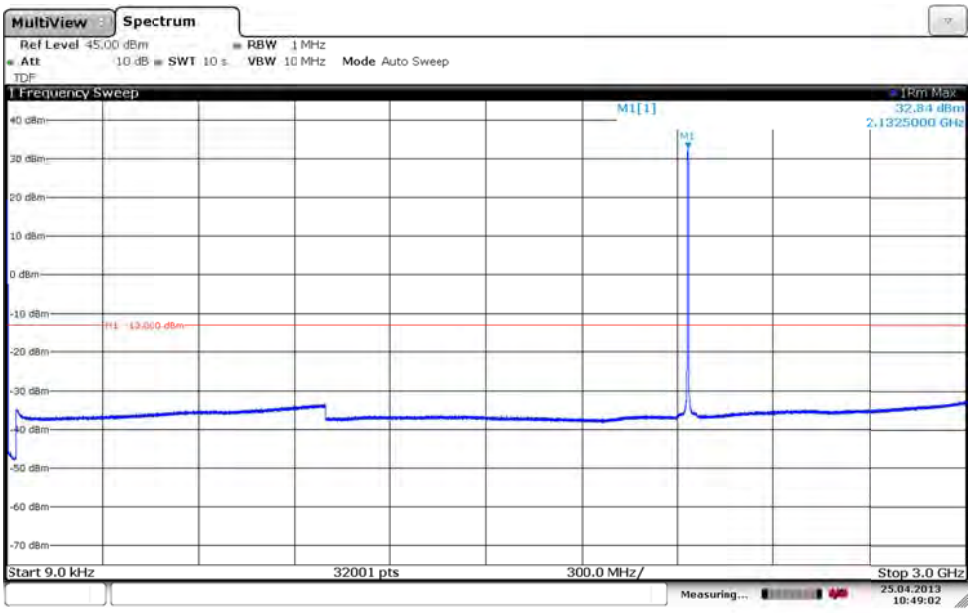
Diagram 4d:



Date: 25.APR.2013 09:22:45

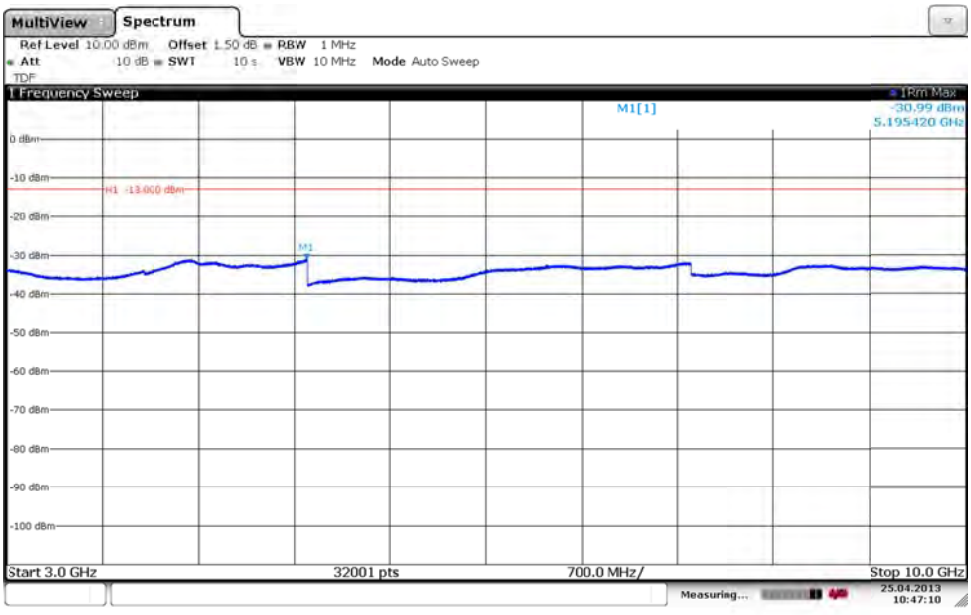
Appendix 6

Diagram 5a:



Date: 25.APR.2013 10:49:02

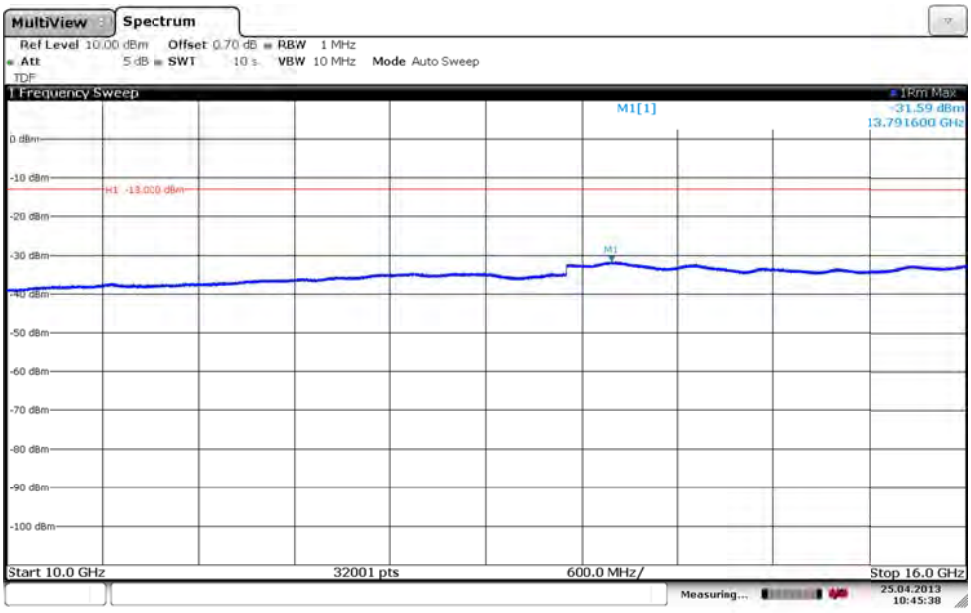
Diagram 5b:



Date: 25.APR.2013 10:47:09

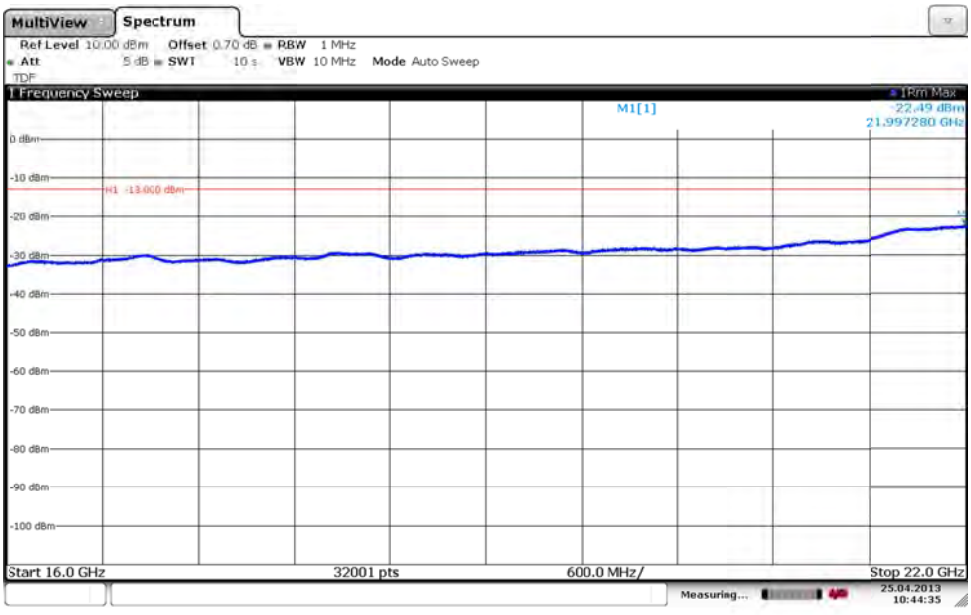
Appendix 6

Diagram 5c:



Date: 25.APR.2013 10:45:38

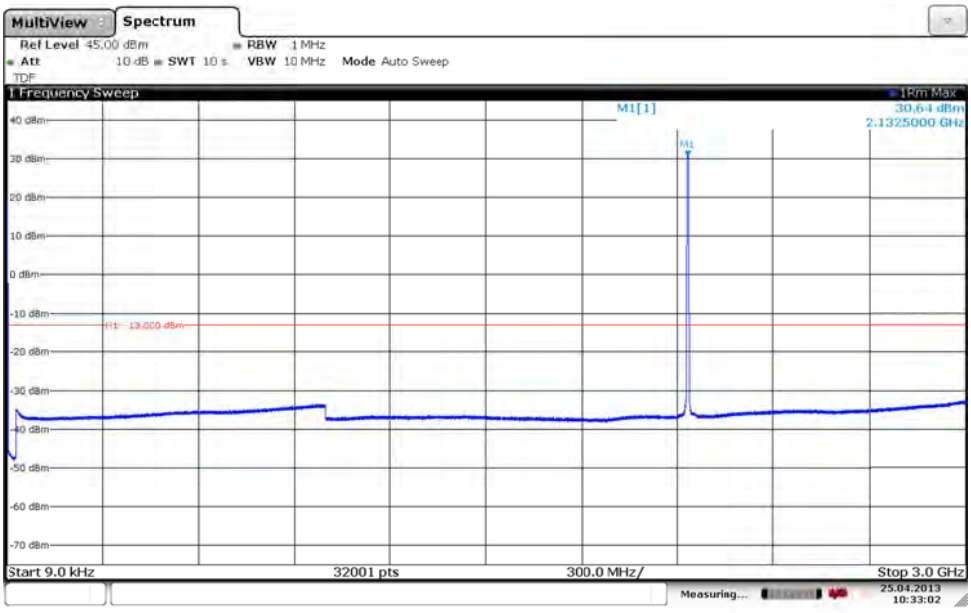
Diagram 5d:



Date: 25.APR.2013 10:44:35

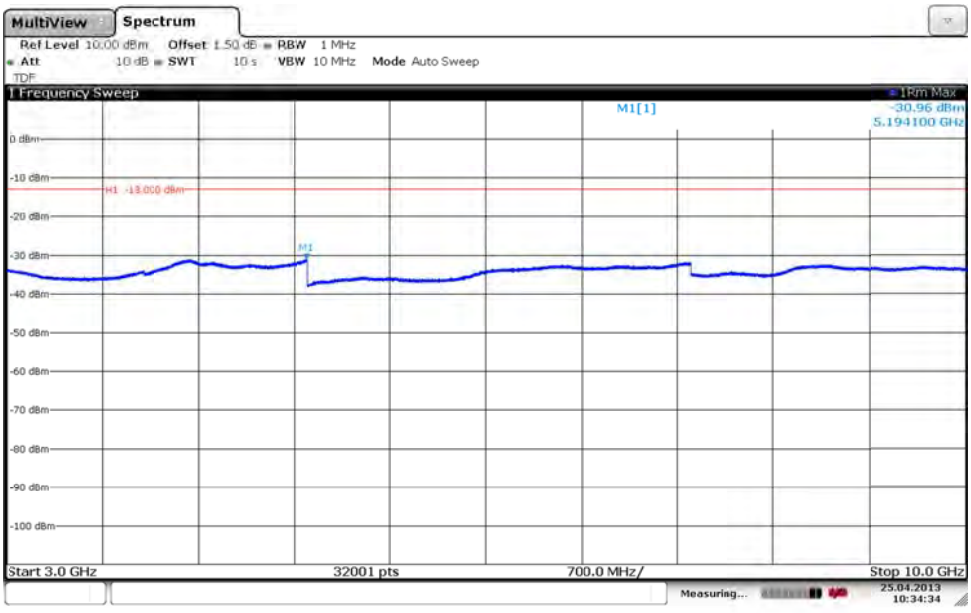
Appendix 6

Diagram 6a:



Date: 25.APR.2013 10:33:02

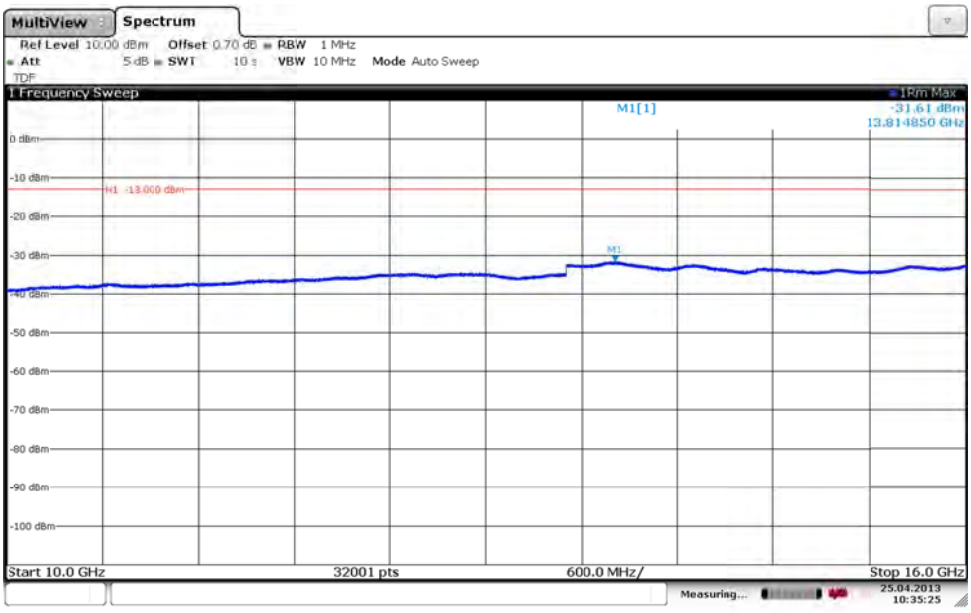
Diagram 6b:



Date: 25.APR.2013 10:34:34

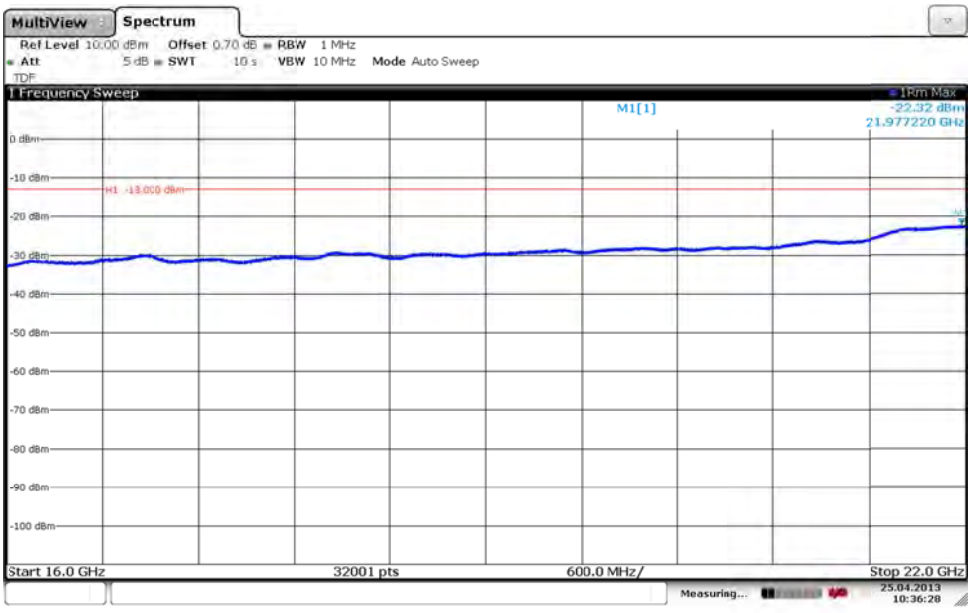
Appendix 6

Diagram 6c:



Date: 25.APR.2013 10:35:25

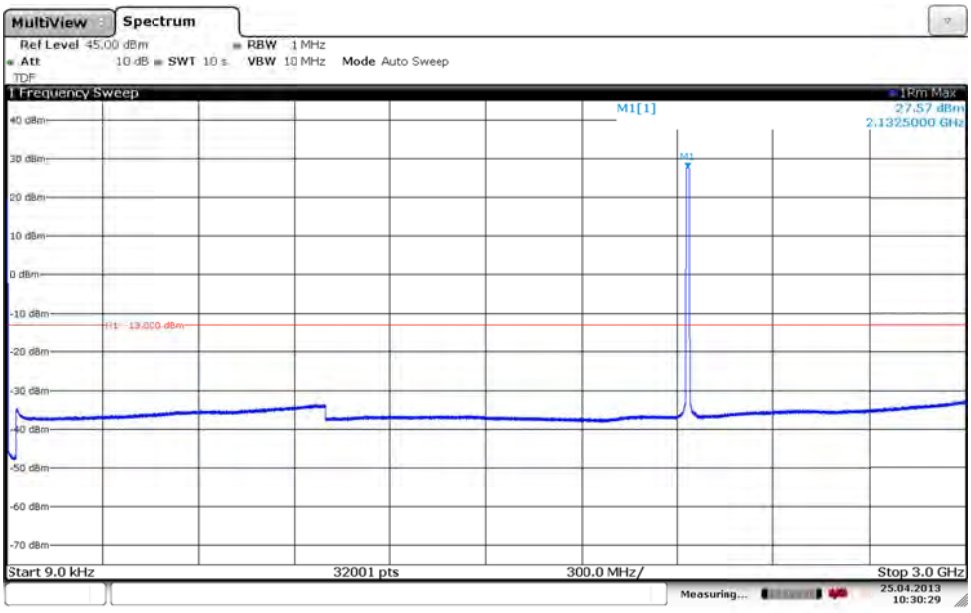
Diagram 6d:



Date: 25.APR.2013 10:36:27

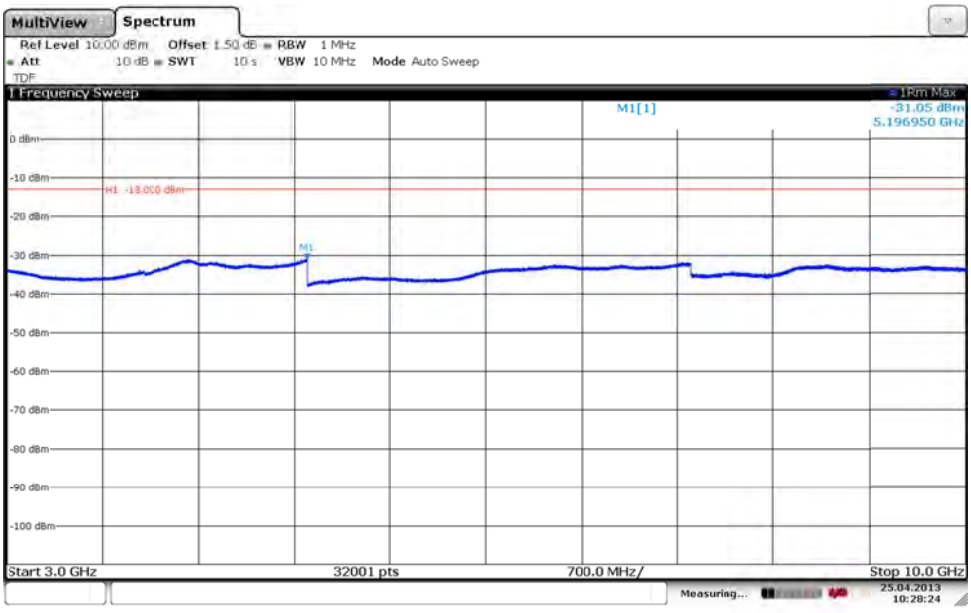
Appendix 6

Diagram 7a:



Date: 25.APR.2013 10:30:28

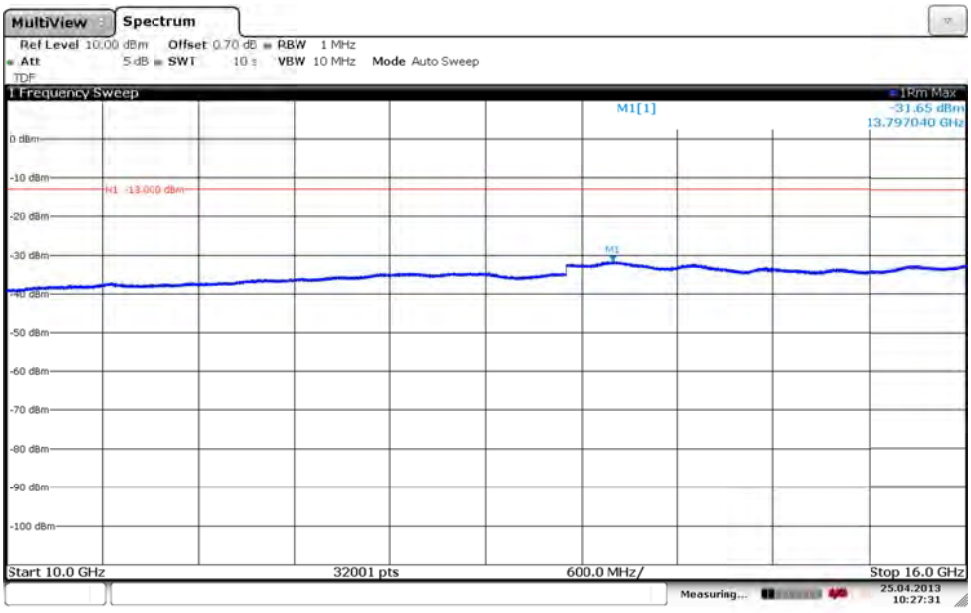
Diagram 7b:



Date: 25.APR.2013 10:28:24

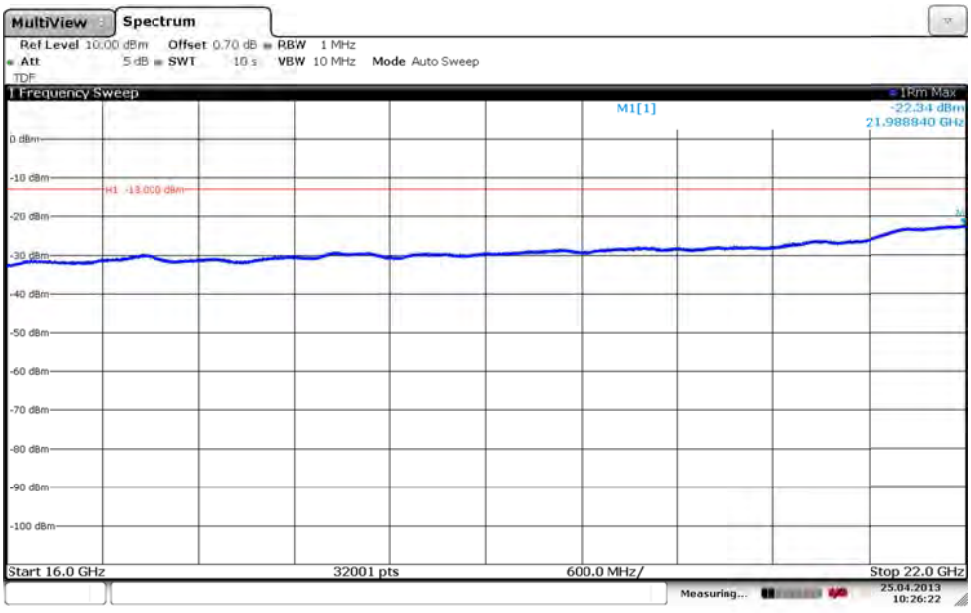
Appendix 6

Diagram 7c:



Date: 25.APR.2013 10:27:32

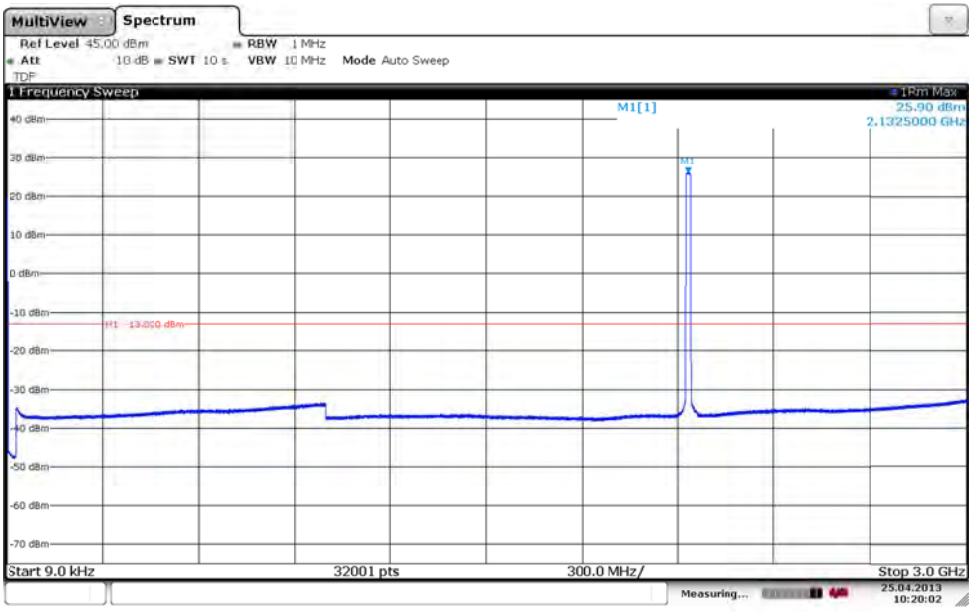
Diagram 7d:



Date: 25.APR.2013 10:26:23

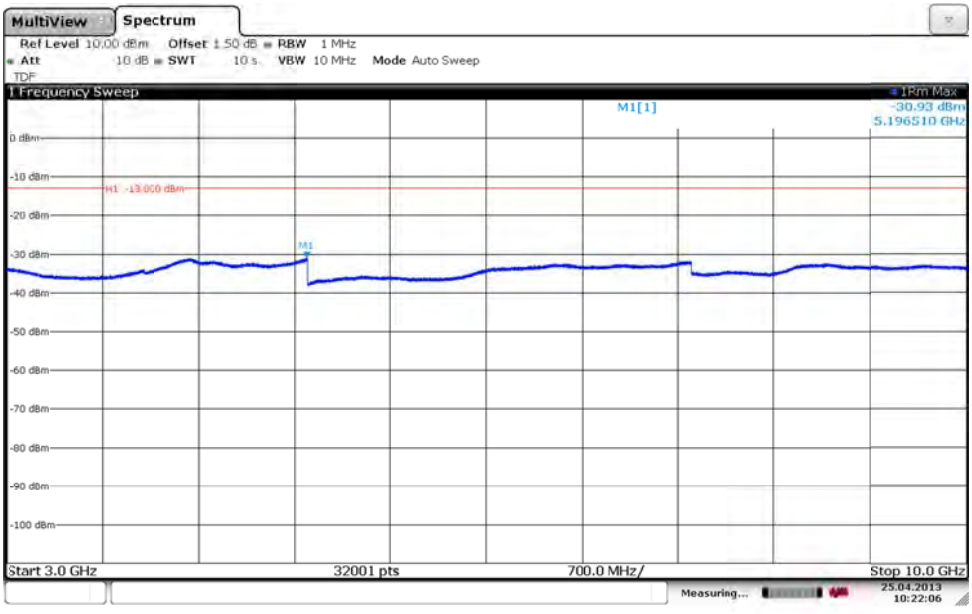
Appendix 6

Diagram 8a:



Date: 25.APR.2013 10:20:02

Diagram 8b:



Date: 25.APR.2013 10:22:06

Appendix 6

Diagram 8c:

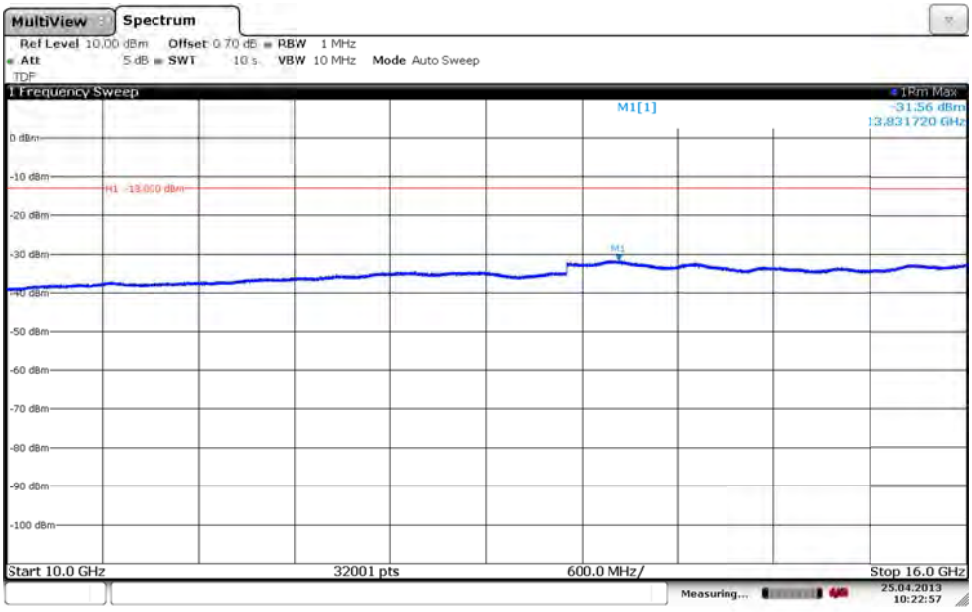


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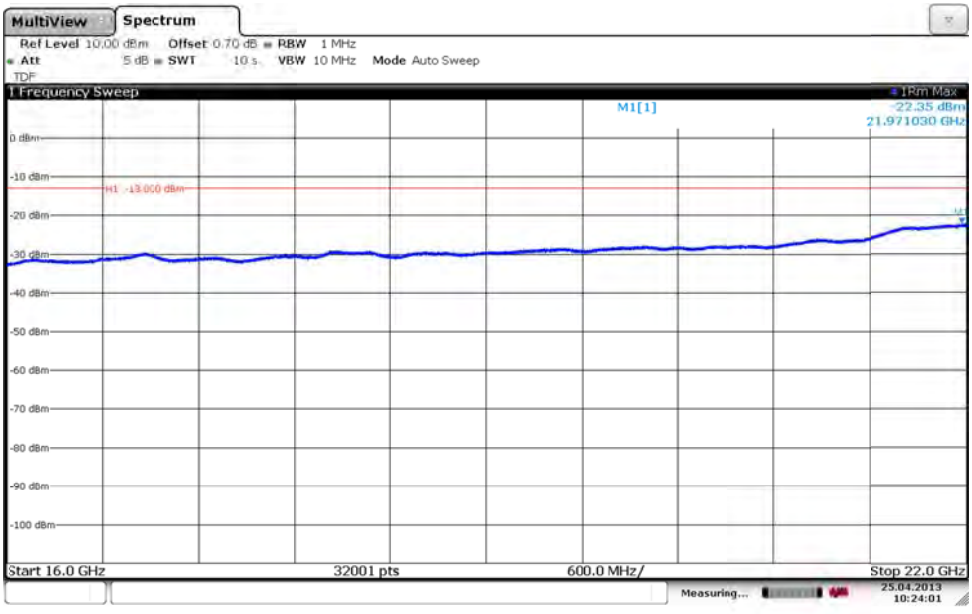
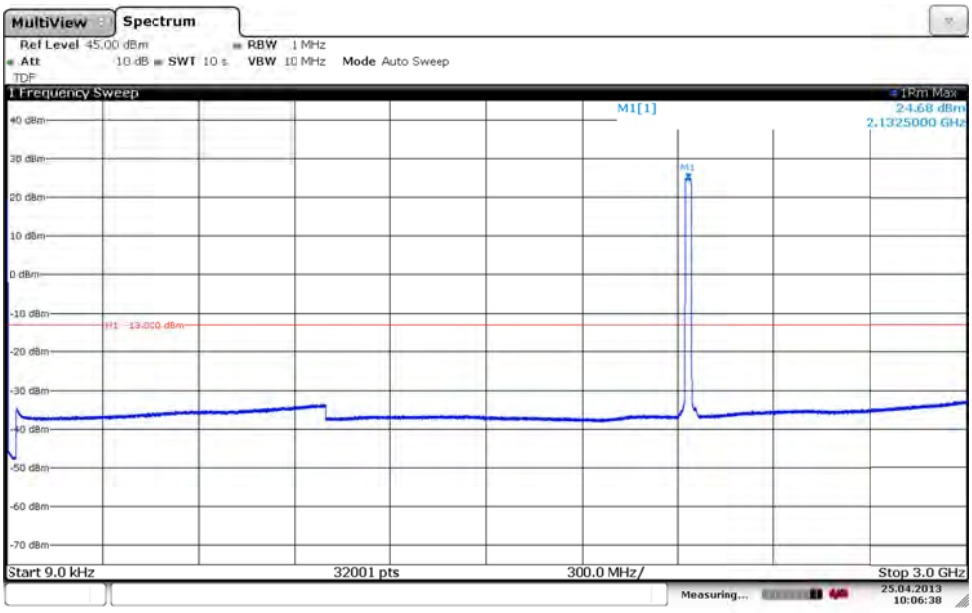
Diagram 8d:



Date: 25.APR.2013 10:24:01

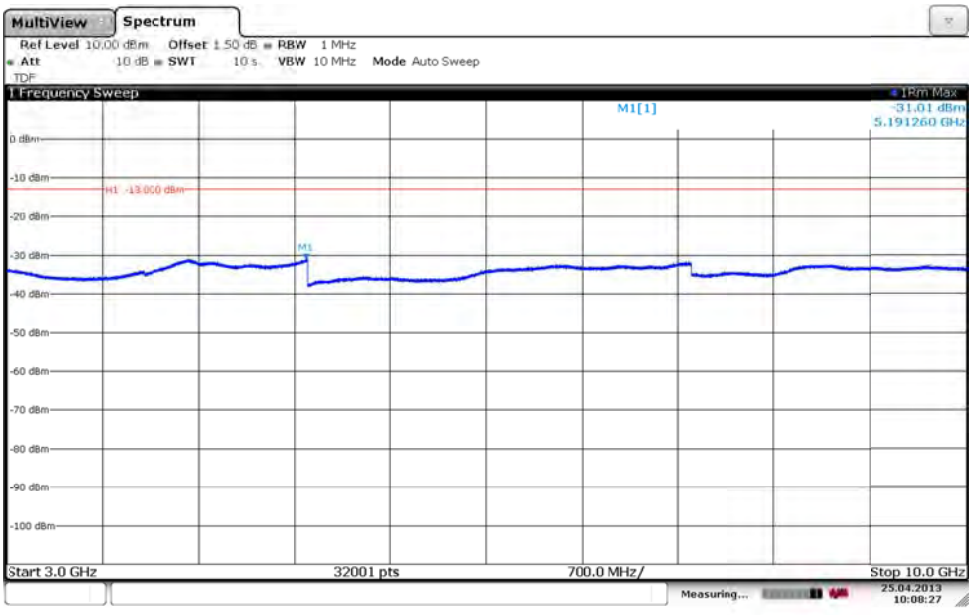
Appendix 6

Diagram 9a:



Date: 25.APR.2013 10:06:38

Diagram 9b:



Date: 25.APR.2013 10:08:26

Appendix 6

Diagram 9c:

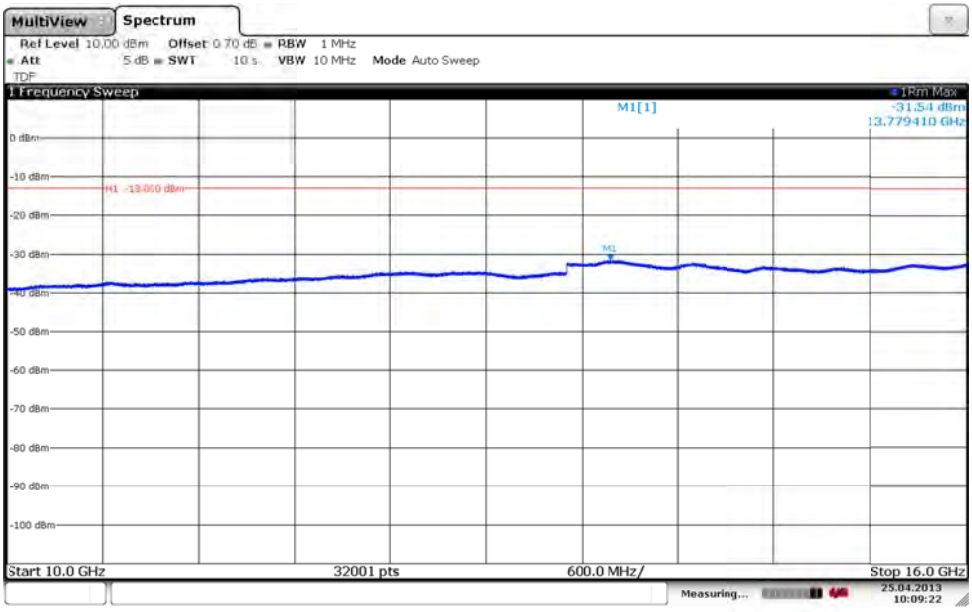


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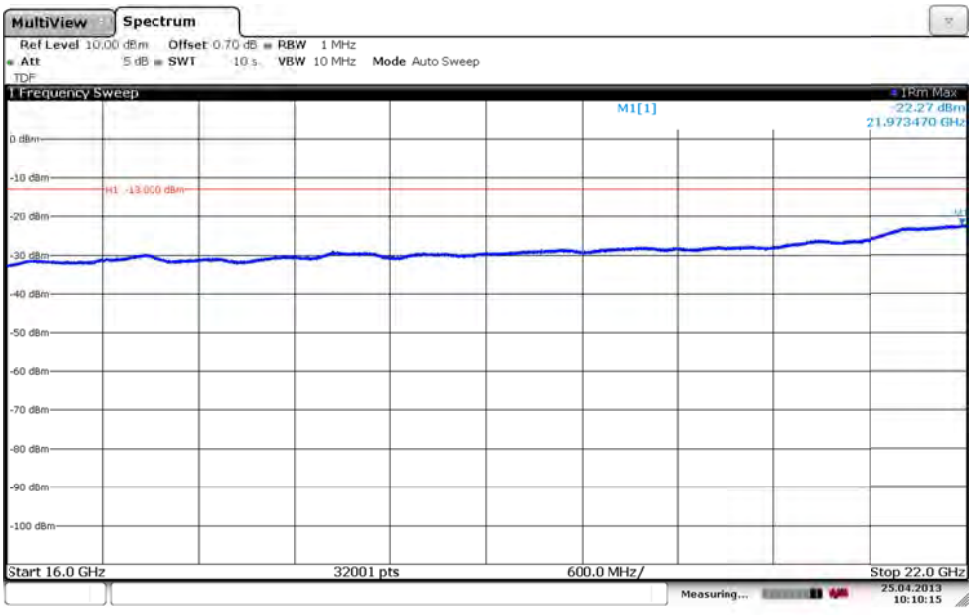
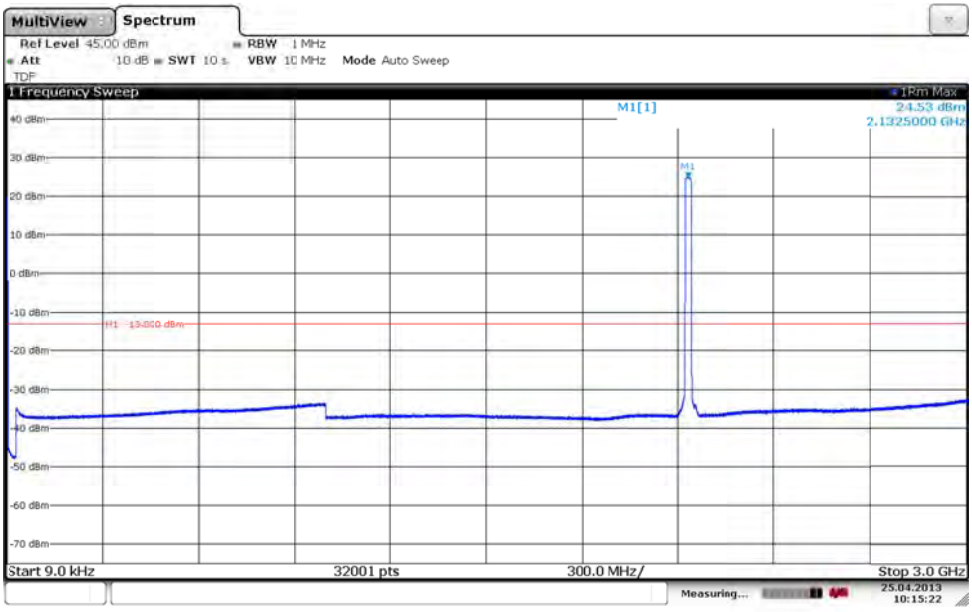
Diagram 9d:



Date: 25.APR.2013 10:10:15

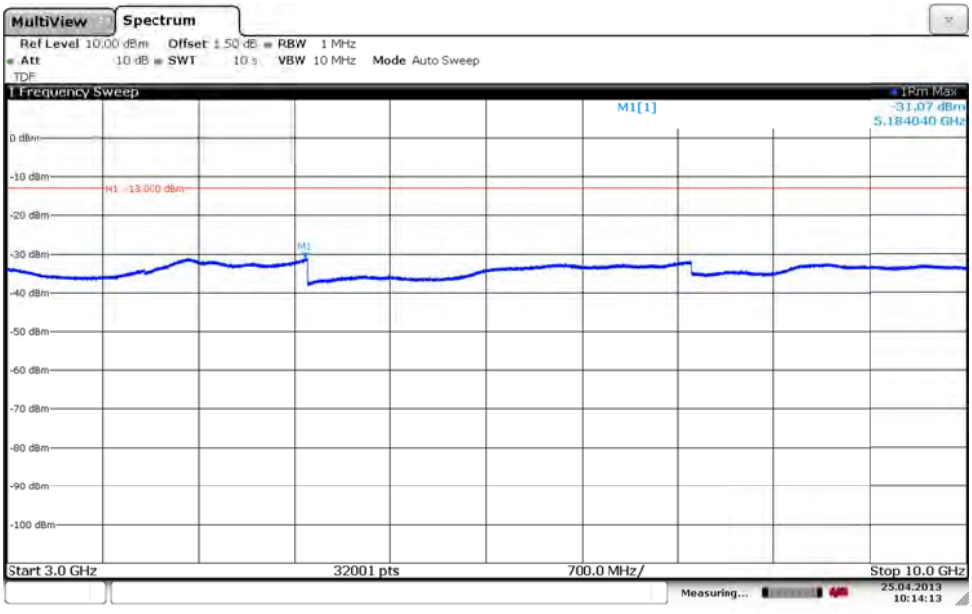
Appendix 6

Diagram 10a:



Date: 25.APR.2013 10:15:22

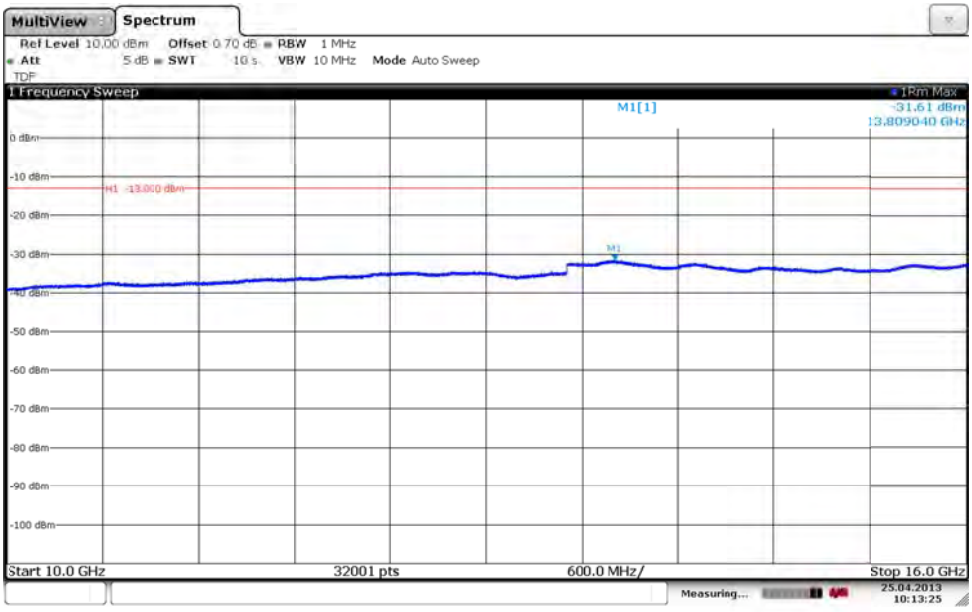
Diagram 10b:



Date: 25.APR.2013 10:14:13

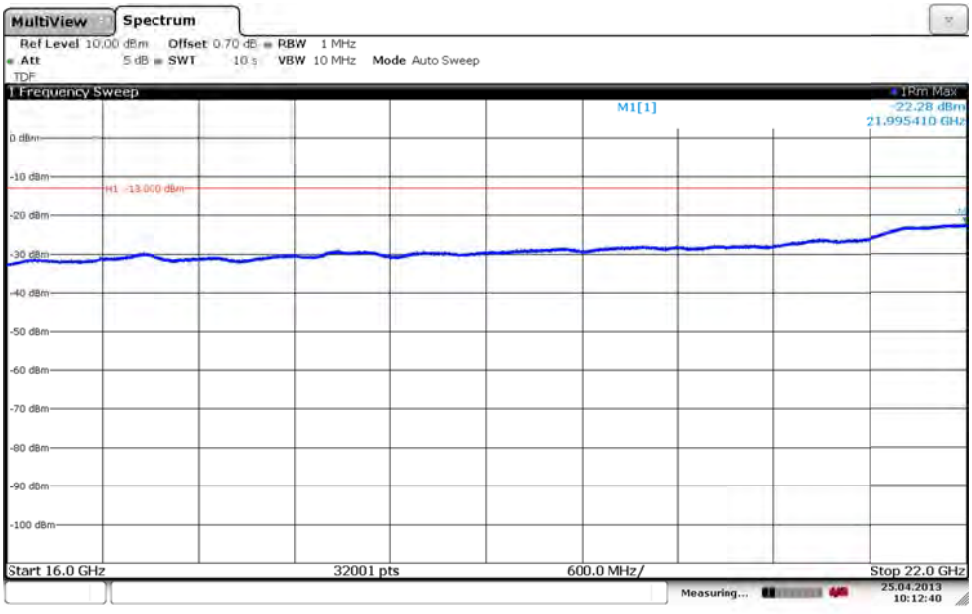
Appendix 6

Diagram 10c:



Date: 25.APR.2013 10:13:24

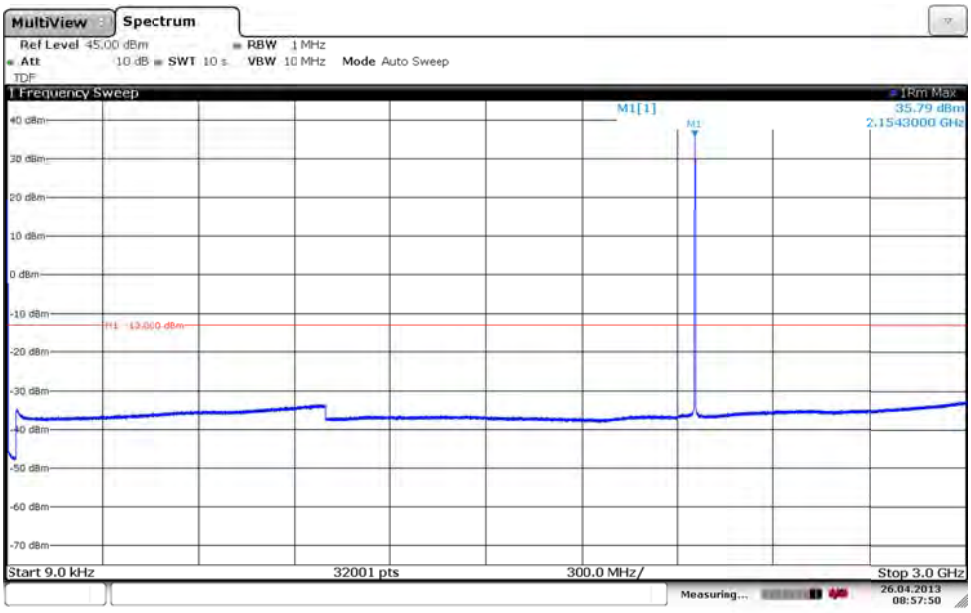
Diagram 10d:



Date: 25.APR.2013 10:12:40

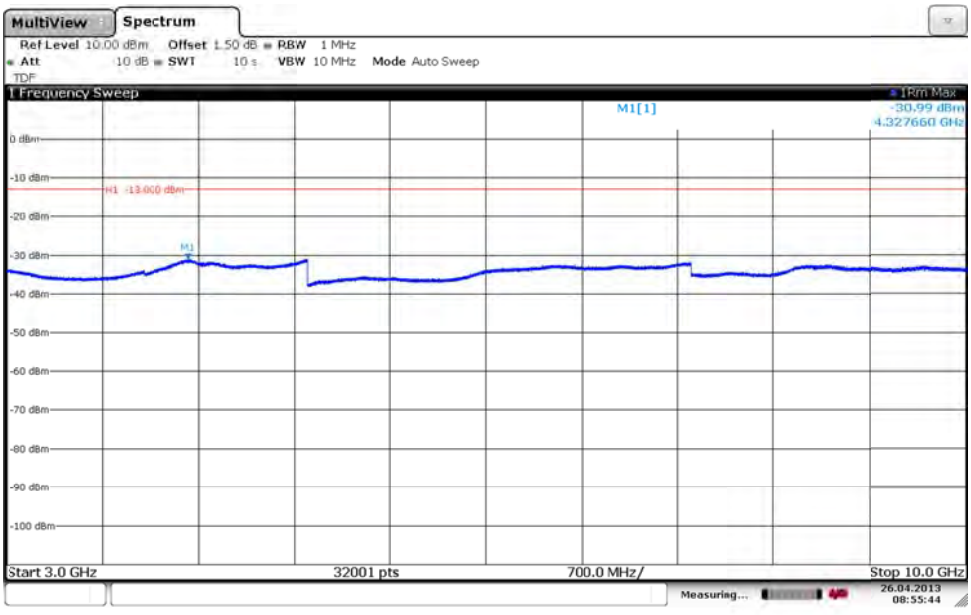
Appendix 6

Diagram 11a:



Date: 26.APR.2013 08:57:51

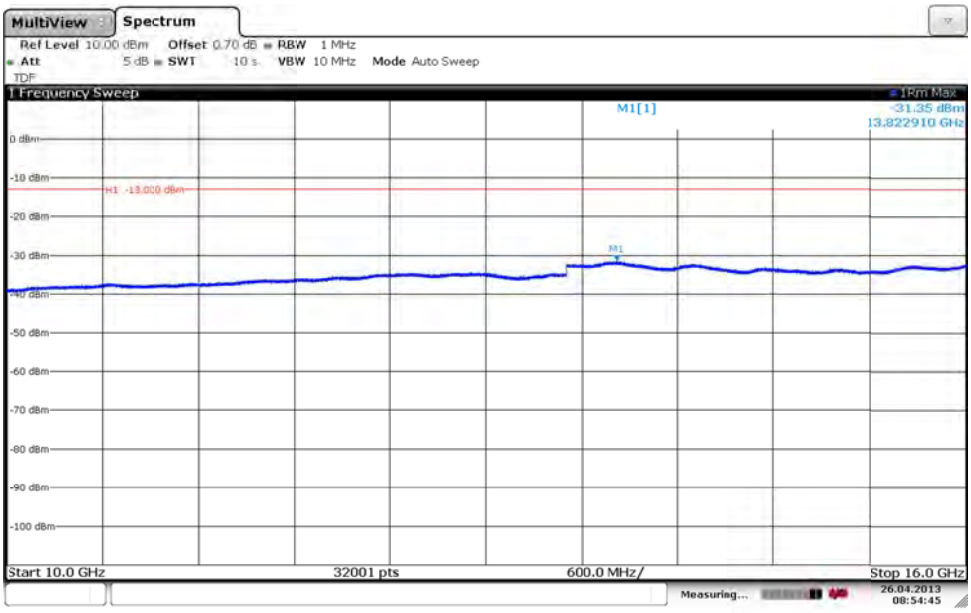
Diagram 11b:



Date: 26.APR.2013 08:55:44

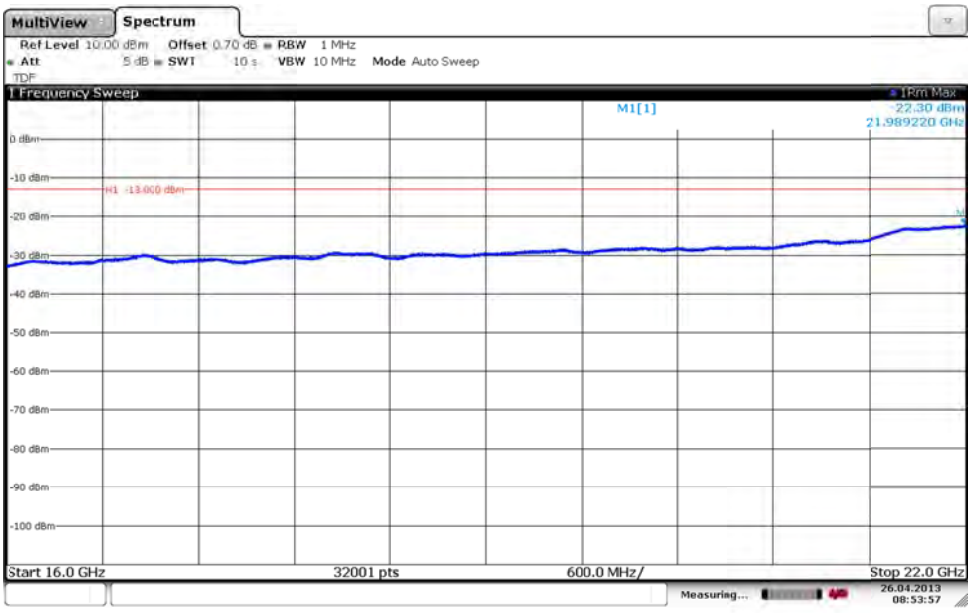
Appendix 6

Diagram 11c:



Date: 26.APR.2013 08:54:45

Diagram 11d:



Date: 26.APR.2013 08:53:57

Appendix 6

Diagram 12a:

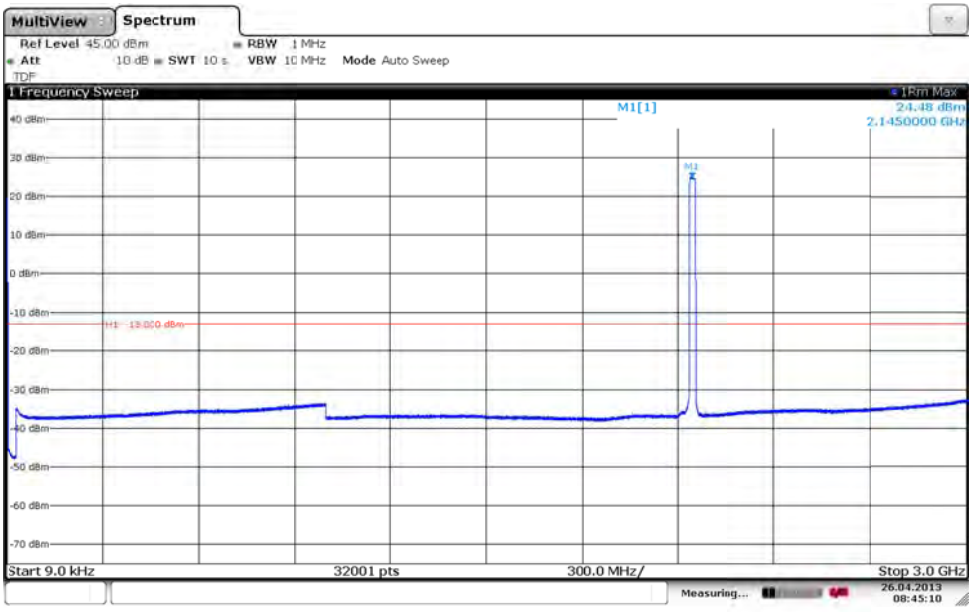


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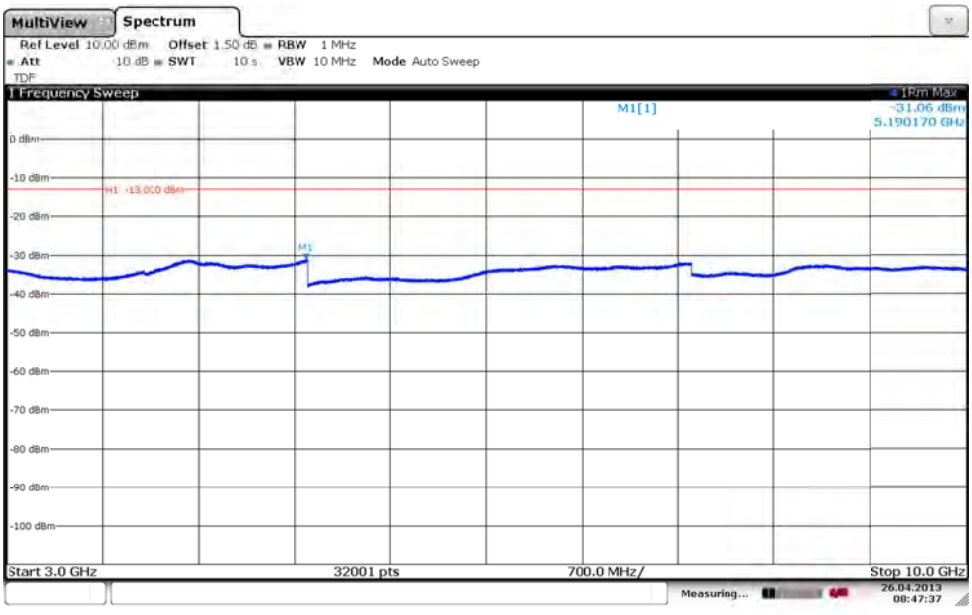
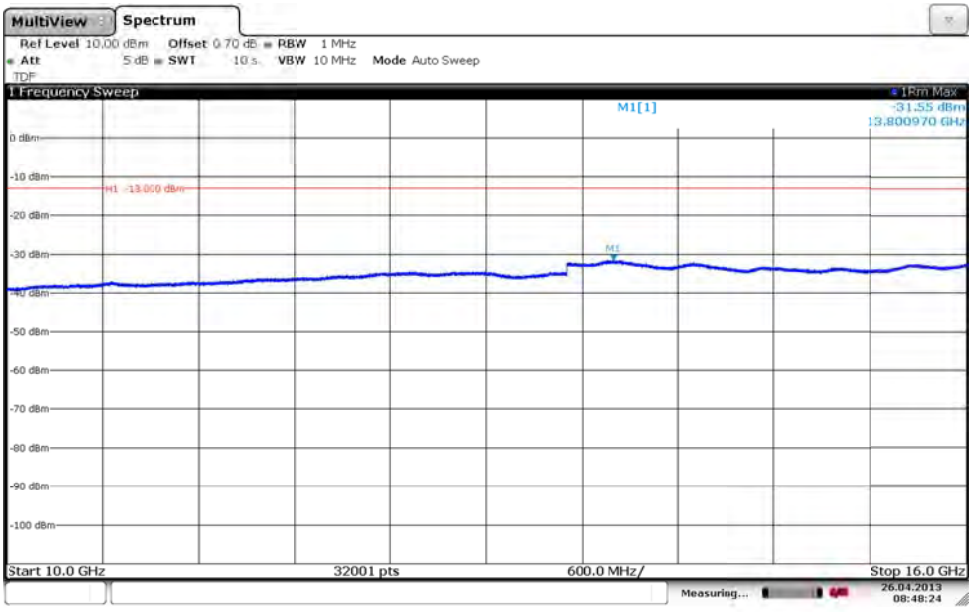
Diagram 12b:



Date: 26.APR.2013 08:47:37

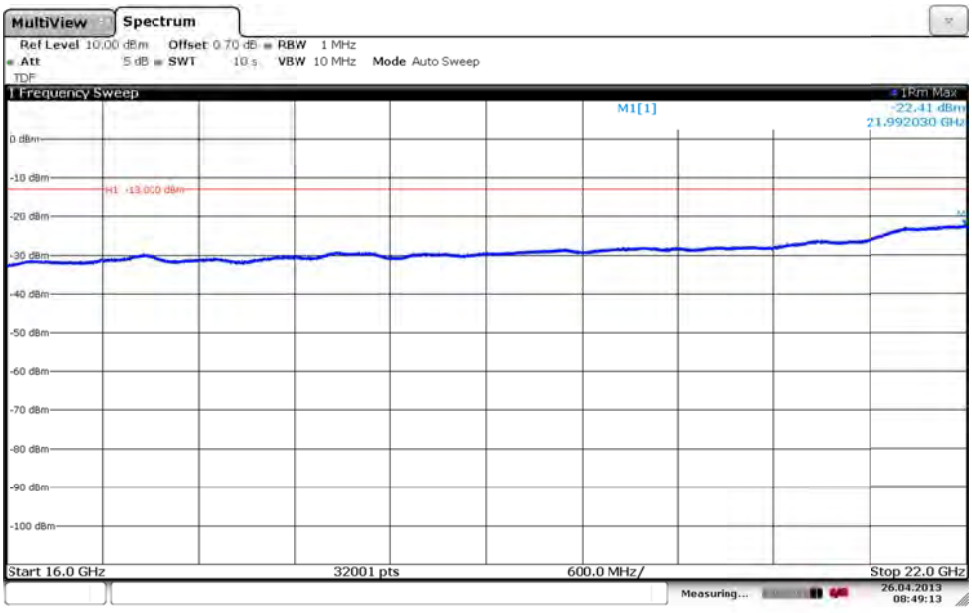
Appendix 6

Diagram 12c:



Date: 26.APR.2013 08:48:23

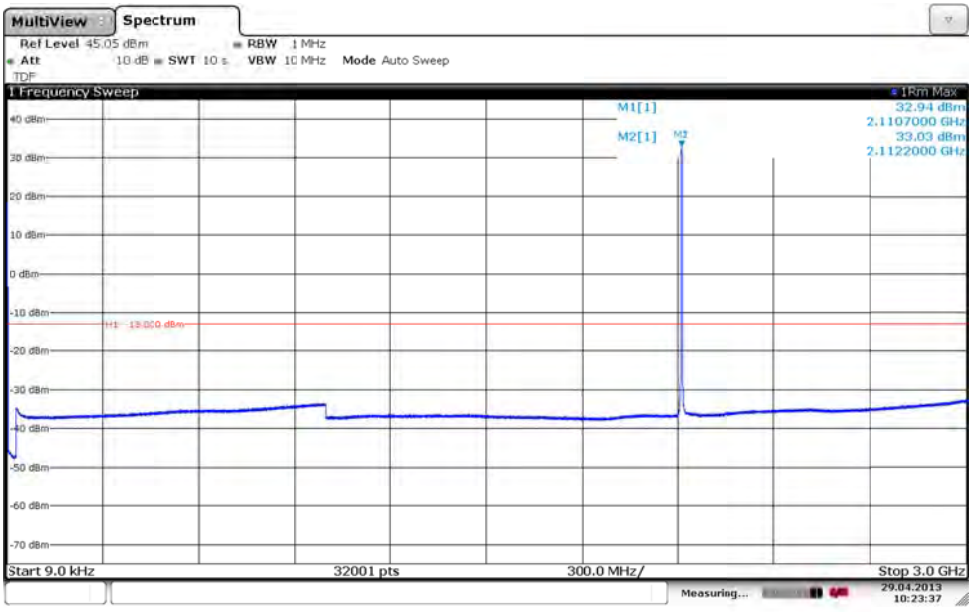
Diagram 12d:



Date: 26.APR.2013 08:49:13

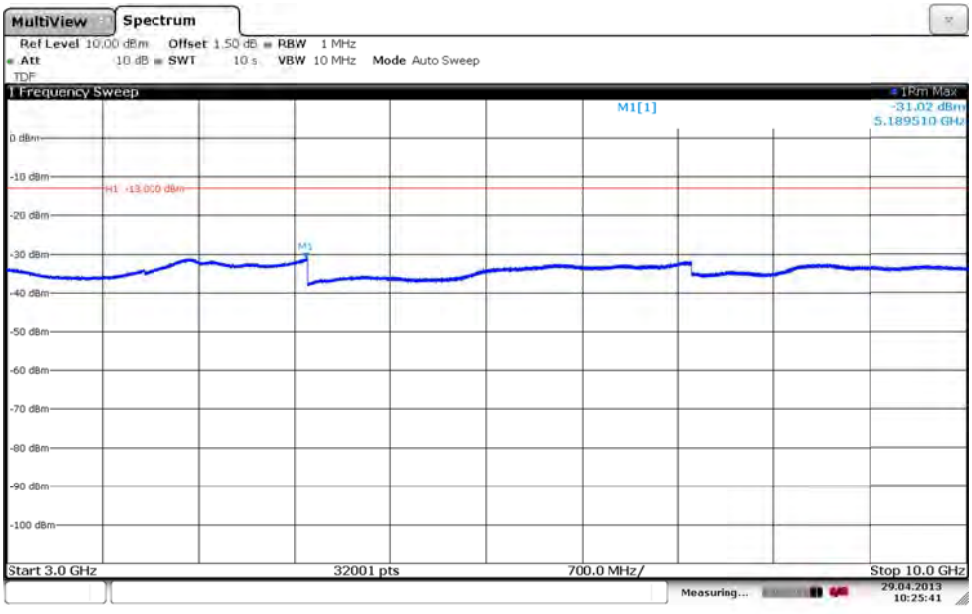
Appendix 6

Diagram 13a:



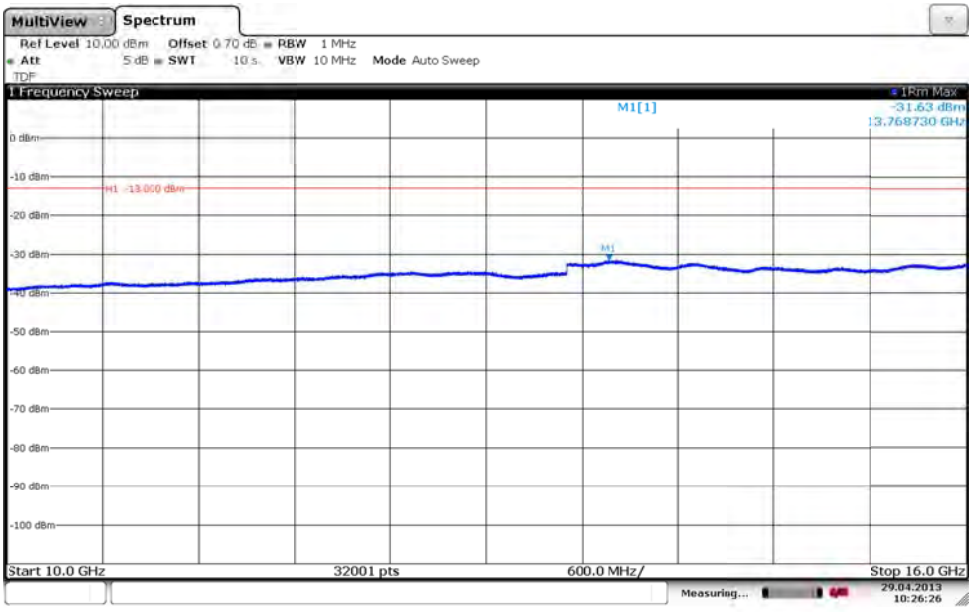
Date: 29.APR.2013 10:23:37

Diagram 13b:



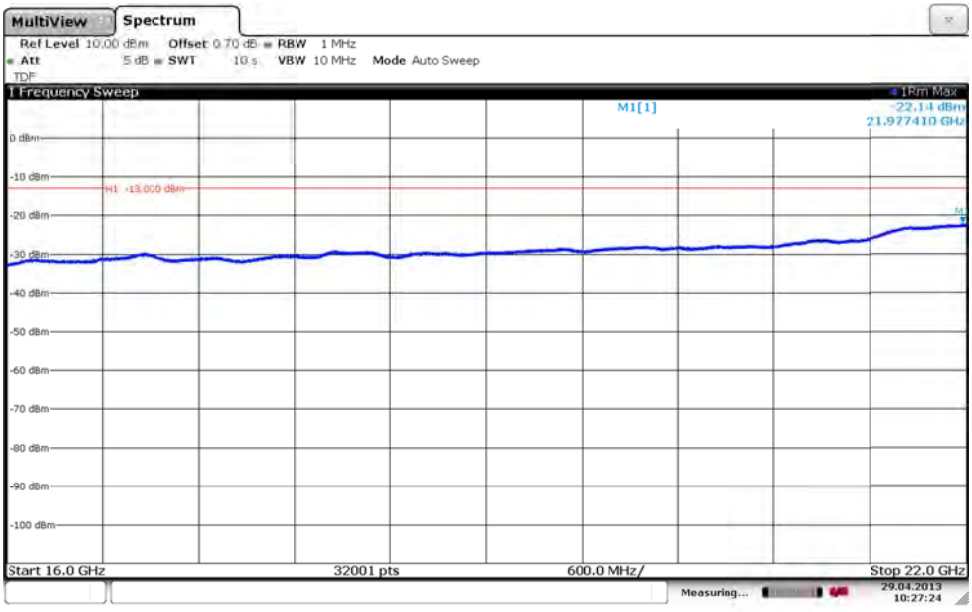
Date: 29.APR.2013 10:25:41

Diagram 13c:



Date: 29.APR.2013 10:26:26

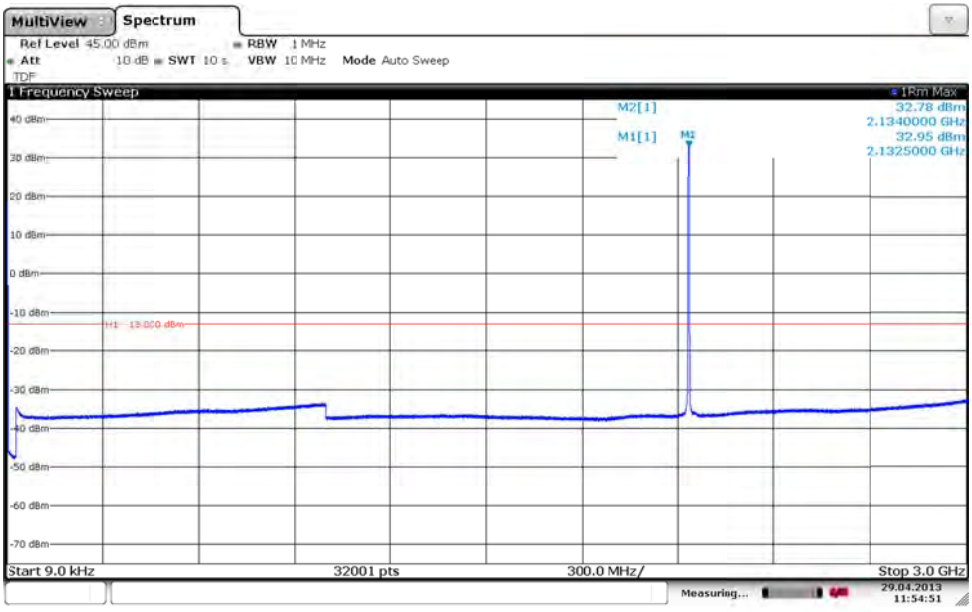
Diagram 13d:



Date: 29.APR.2013 10:27:24

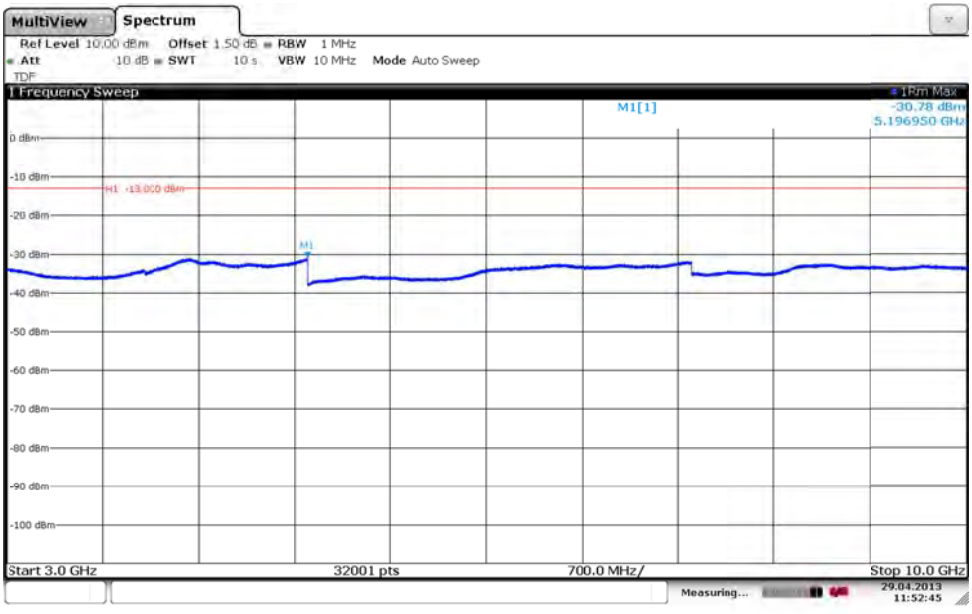
Appendix 6

Diagram 14a:



Date: 29.APR.2013 11:54:51

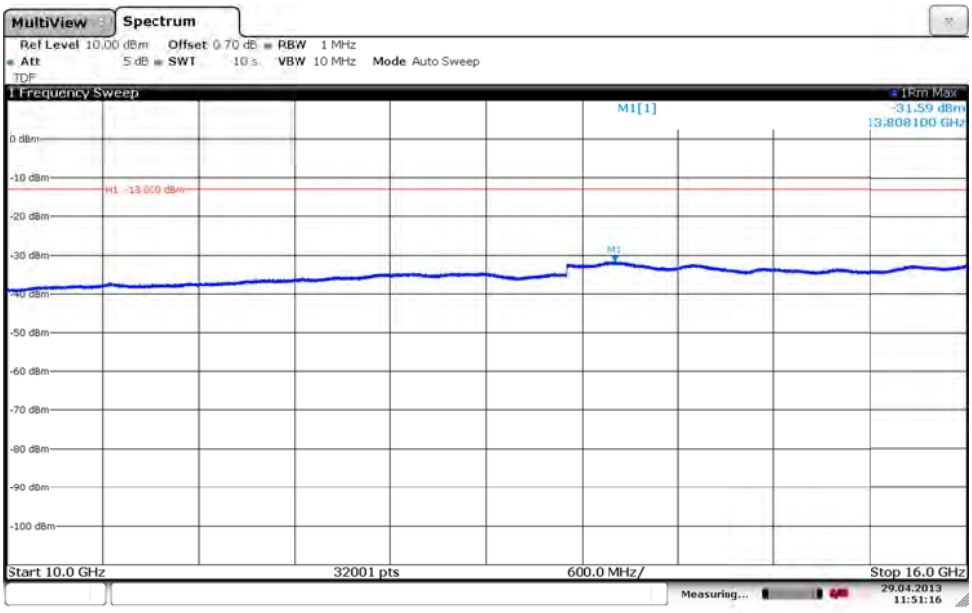
Diagram 14b:



Date: 29.APR.2013 11:52:44

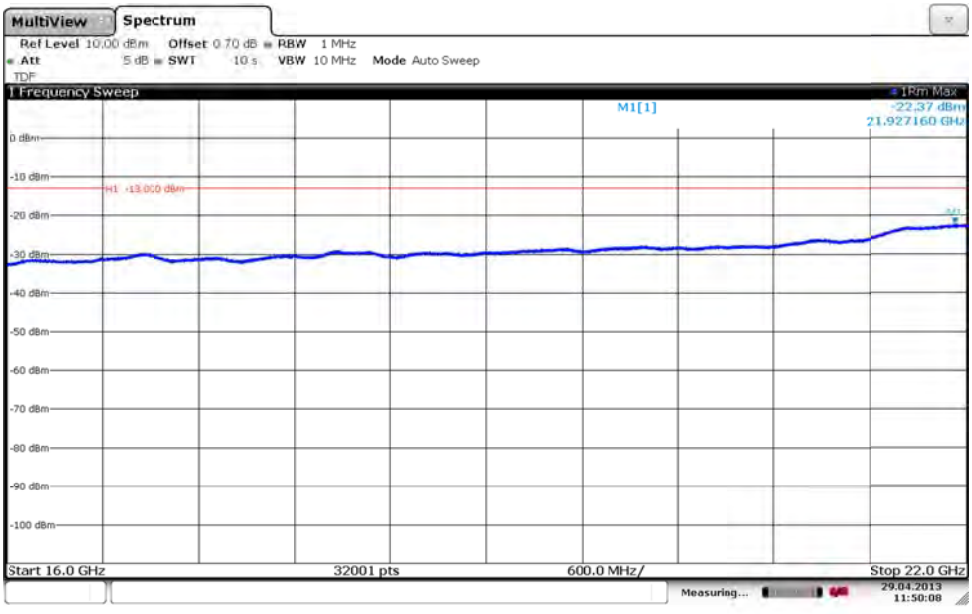
Appendix 6

Diagram 14c:



Date: 29.APR.2013 11:51:16

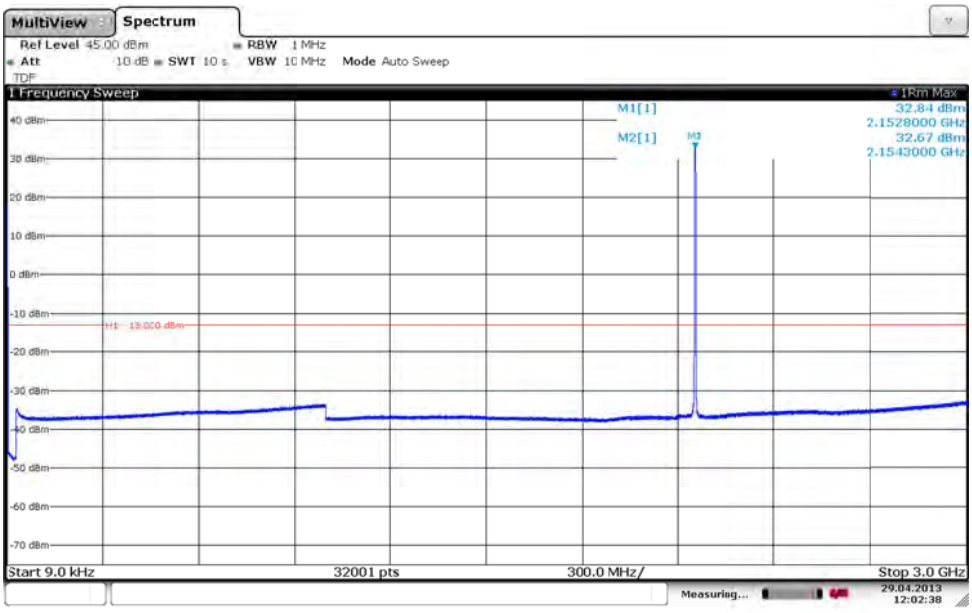
Diagram 14d:



Date: 29.APR.2013 11:50:08

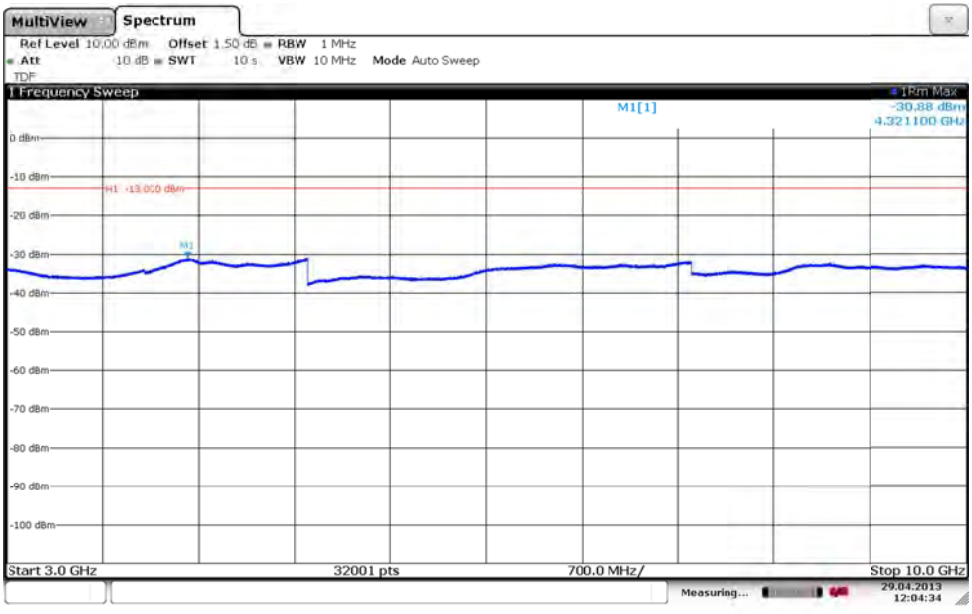
Appendix 6

Diagram 15a:



Date: 29.APR.2013 12:02:38

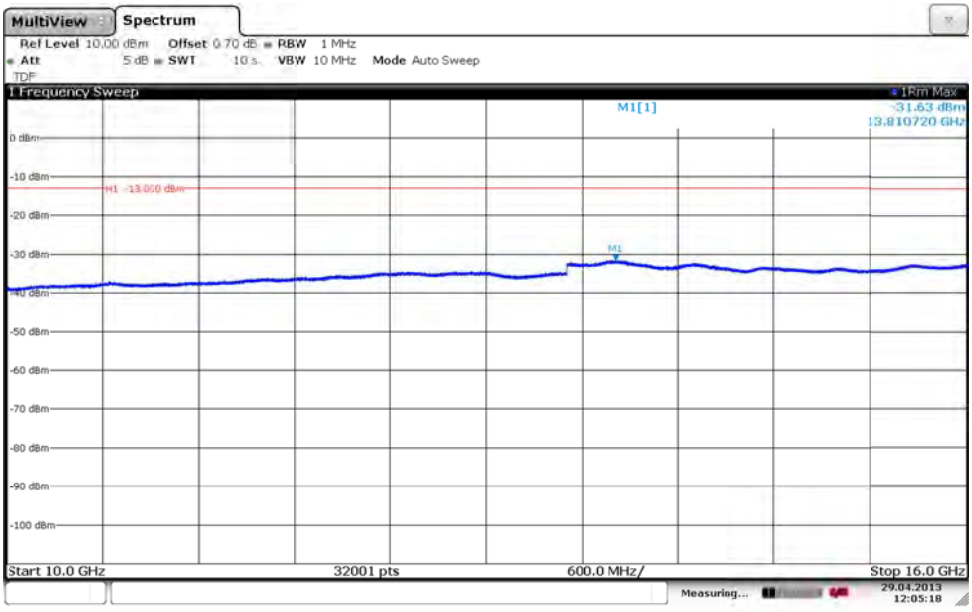
Diagram 15b:



Date: 29.APR.2013 12:04:34

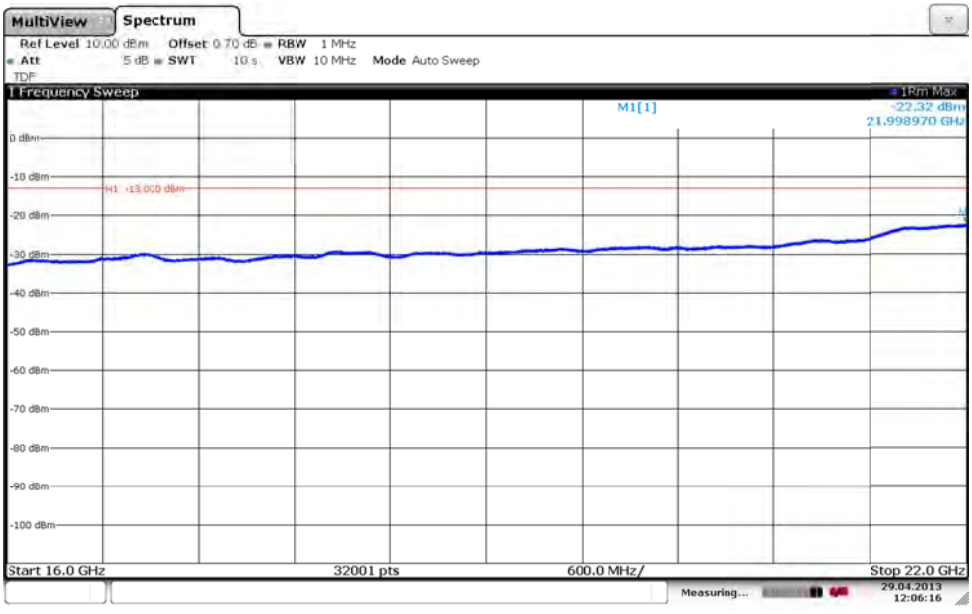
Appendix 6

Diagram 15c:



Date: 29.APR.2013 12:05:18

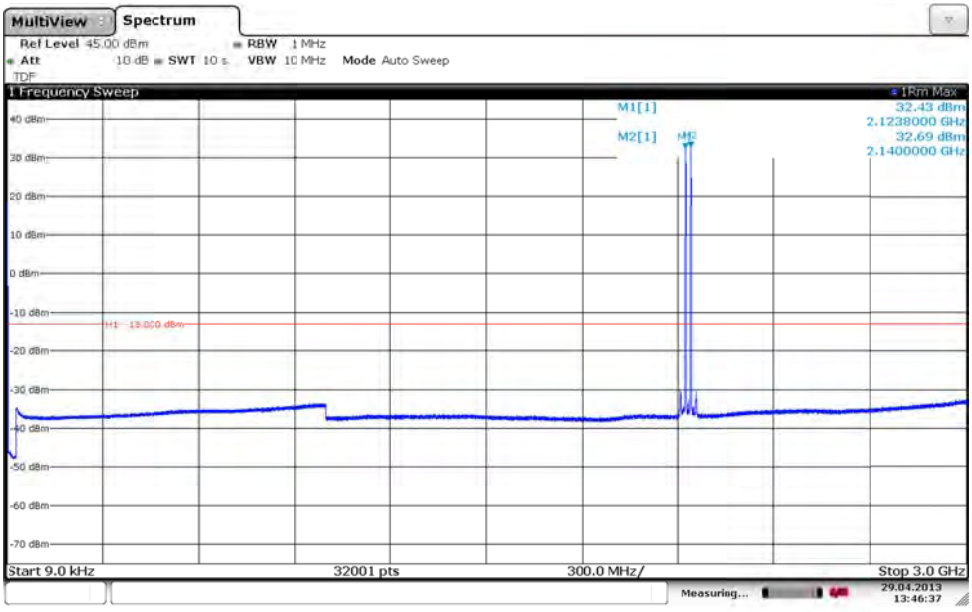
Diagram 15d:



Date: 29.APR.2013 12:06:16

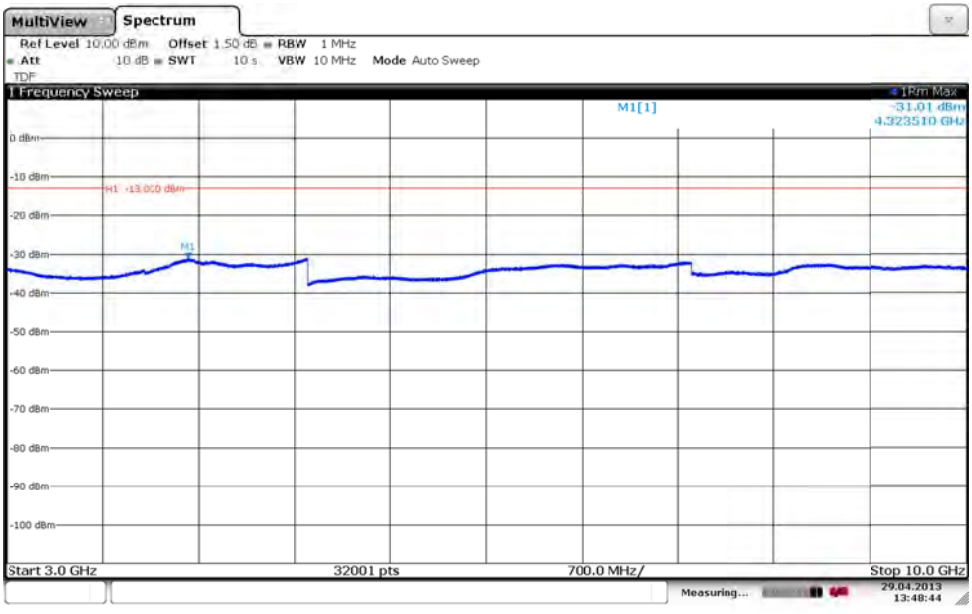
Appendix 6

Diagram 16a:



Date: 29.APR.2013 13:46:37

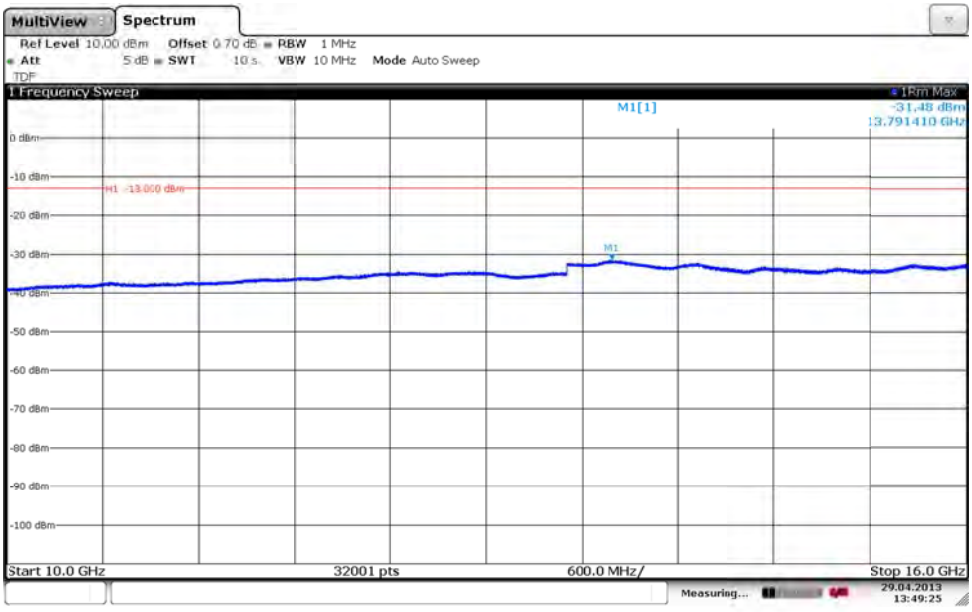
Diagram 16b:



Date: 29.APR.2013 13:48:43

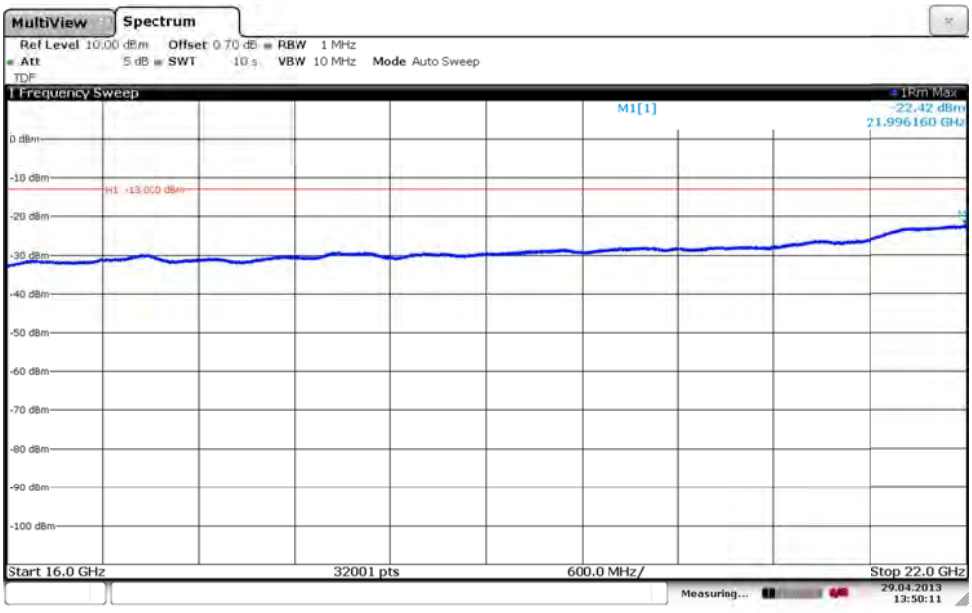
Appendix 6

Diagram 16c:



Date: 29.APR.2013 13:49:24

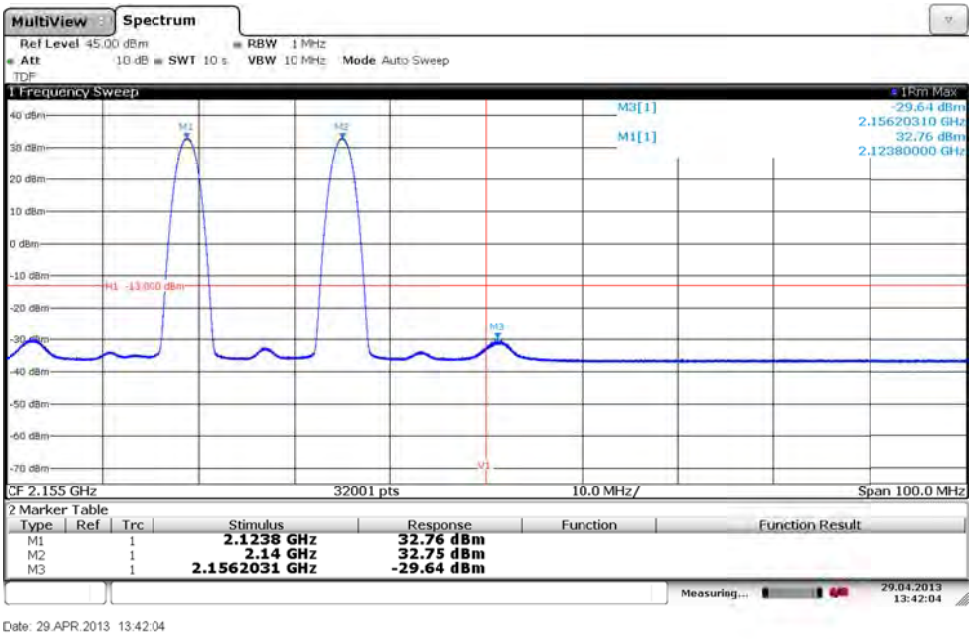
Diagram 16d:



Date: 29.APR.2013 13:50:11

Appendix 6

Diagram 16e:



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

Date	Temperature	Humidity
2013-04-26	23°C ± 3°C	30 % ± 5 %
2013-04-29	22°C ± 3°C	29 % ± 5 %
2013-04-30	22°C ± 3°C	30 % ± 5 %
2013-05-06	22°C ± 3°C	34 % ± 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-1.

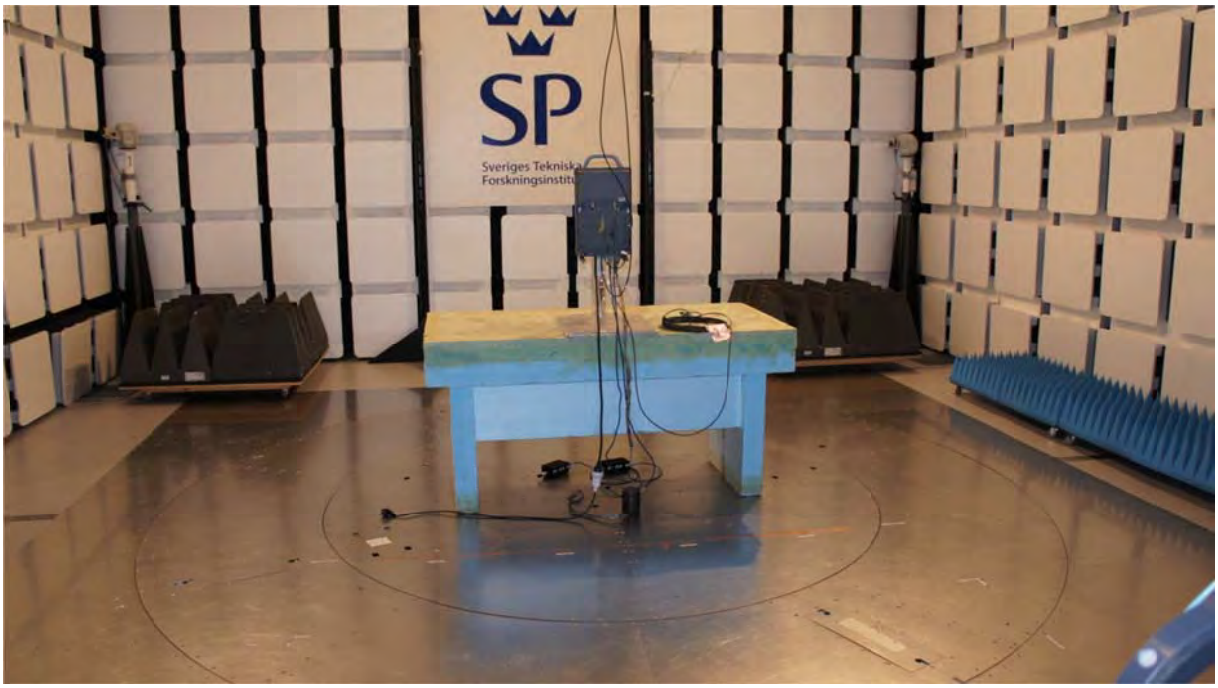
The measurements were performed with both horizontal and vertical polarization of the antenna. The antenna distance was 3 m in the frequency range 30 MHz – 18 GHz and 1m in the frequency range 18 – 22 GHz.

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	503 881
R&S ESI 26	503 292
EMC 32 ver. 8.52.0	503 745
Chase Bilog Antenna CBL 6111A	503 182
EMCO Horn Antenna 3115	502 175
Flann STD Gain Horn Antenna 20240-20	503 674
High pass filter, RLC Electronics	901 373
Schwarzbeck preamplifier BBV 9742	504 085
Miteq, Low Noise Amplifier	503 285
µComp Nordic, Low Noise Amplifier	901 545
Testo 635 temperature and humidity meter	504 203

Tested configurations

B
M
T
M2

Results, representing worst case

M, BW: 1.4 MHz Diagram 1 a-d

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

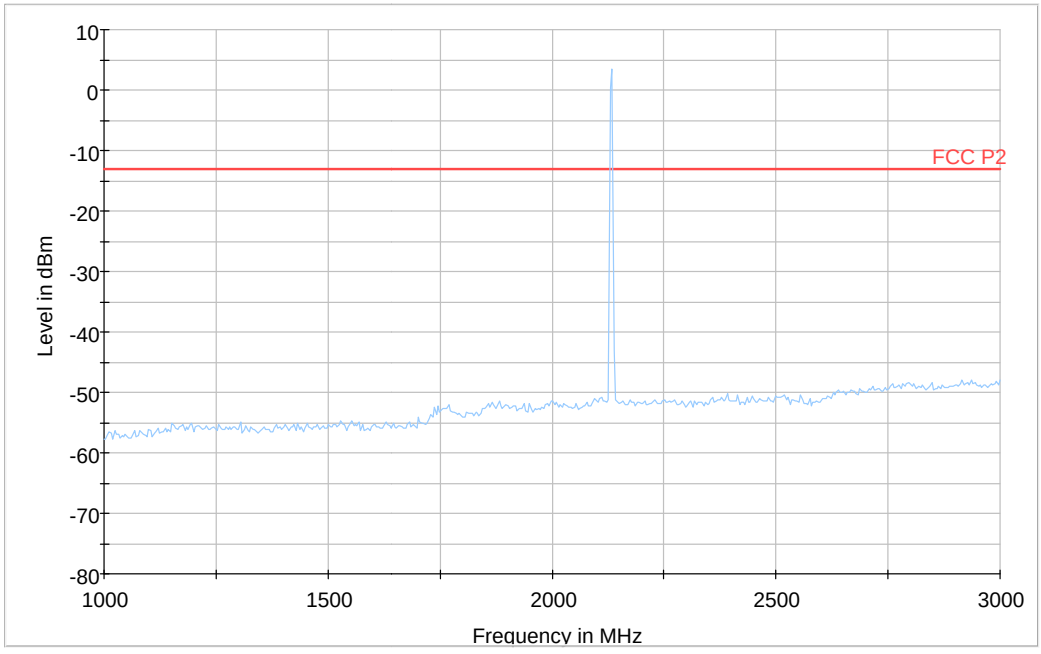
Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm per 1 MHz RBW.

Complies?	Yes

Appendix 7

Diagram 1a:

Diagram 1b:



Note: The emission at 2132.5 MHz is the carrier frequency and shall be ignored in the context.

Appendix 7

Diagram 1c:

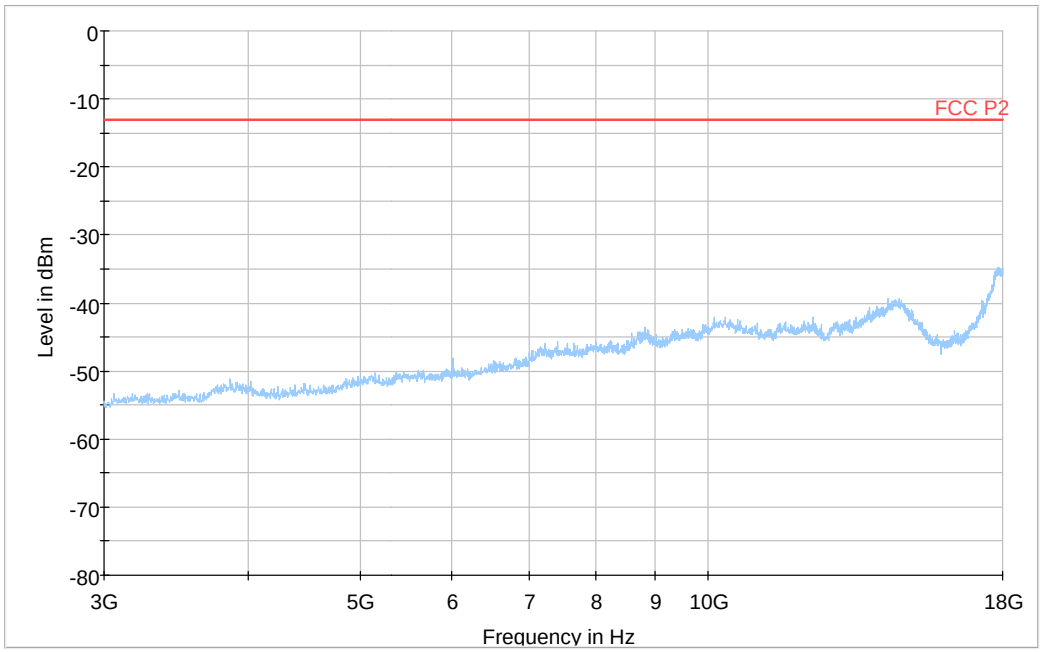
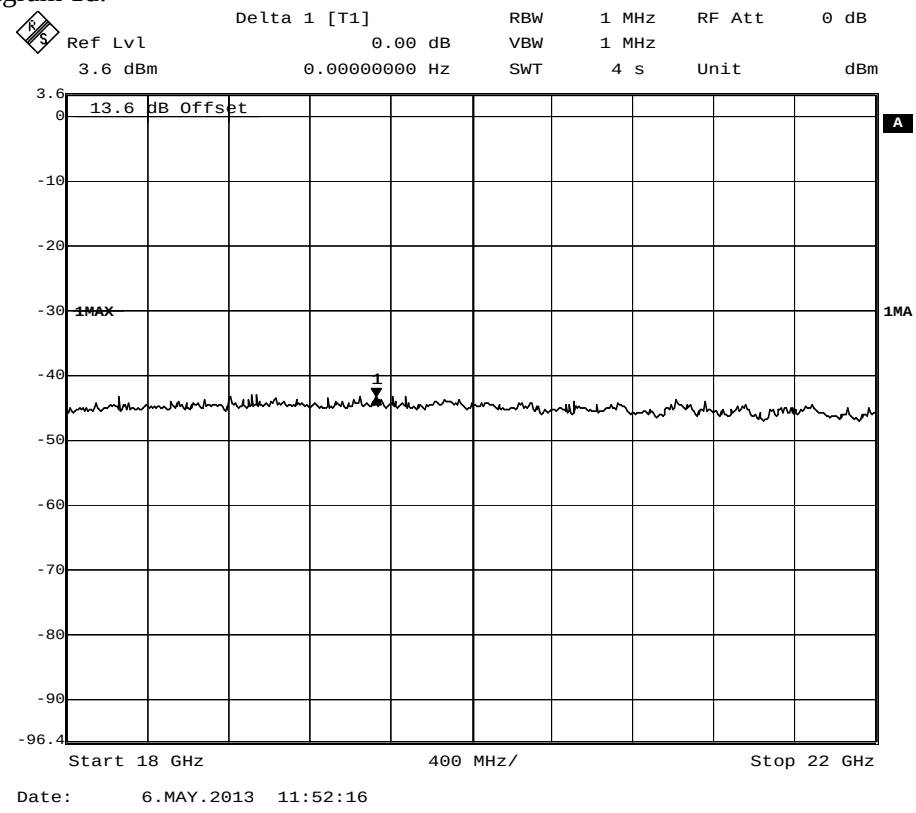


Diagram 1d:



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 36.141. The output was connected to a spectrum analyser. The spectrum analyser 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 1.4MHz

Test conditions		Frequency error (Hz)
Supply voltage DC (V)	T (°C)	Test model E-TM1.1
-48.0	+20	-3
-55.2	+20	-3
-40.8	+20	-3
-48.0	+30	-2
-48.0	+40	+2
-48.0	+50	+2
-48.0	+10	+2
-48.0	0	-3
-48.0	-10	+2
-48.0	-20	-3
-48.0	-30	-3
Maximum freq. error (Hz)		3
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Results

Nominal Voltage 120 V AC, 60 Hz

Maximum output power at mid channel (M)

Channel Bandwidth 1.4MHz

Test conditions		Frequency error (Hz)
Supply voltage AC (V)	T (°C)	Test model E-TM1.1
102.0	+20	-4
120.0	+20	+3
138.0	+20	+4
Maximum freq. error (Hz)		4
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

It was deemed sufficient to test one combination of TX frequency, channel bandwidth configuration and test model (modulation), as all combinations share a common internal reference to derive the TX frequency from.

Limits

Limit according to 3GPP TS 36.141:

The frequency error shall be within ± 0.05 PPM ± 12 Hz (±106.625Hz).

§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

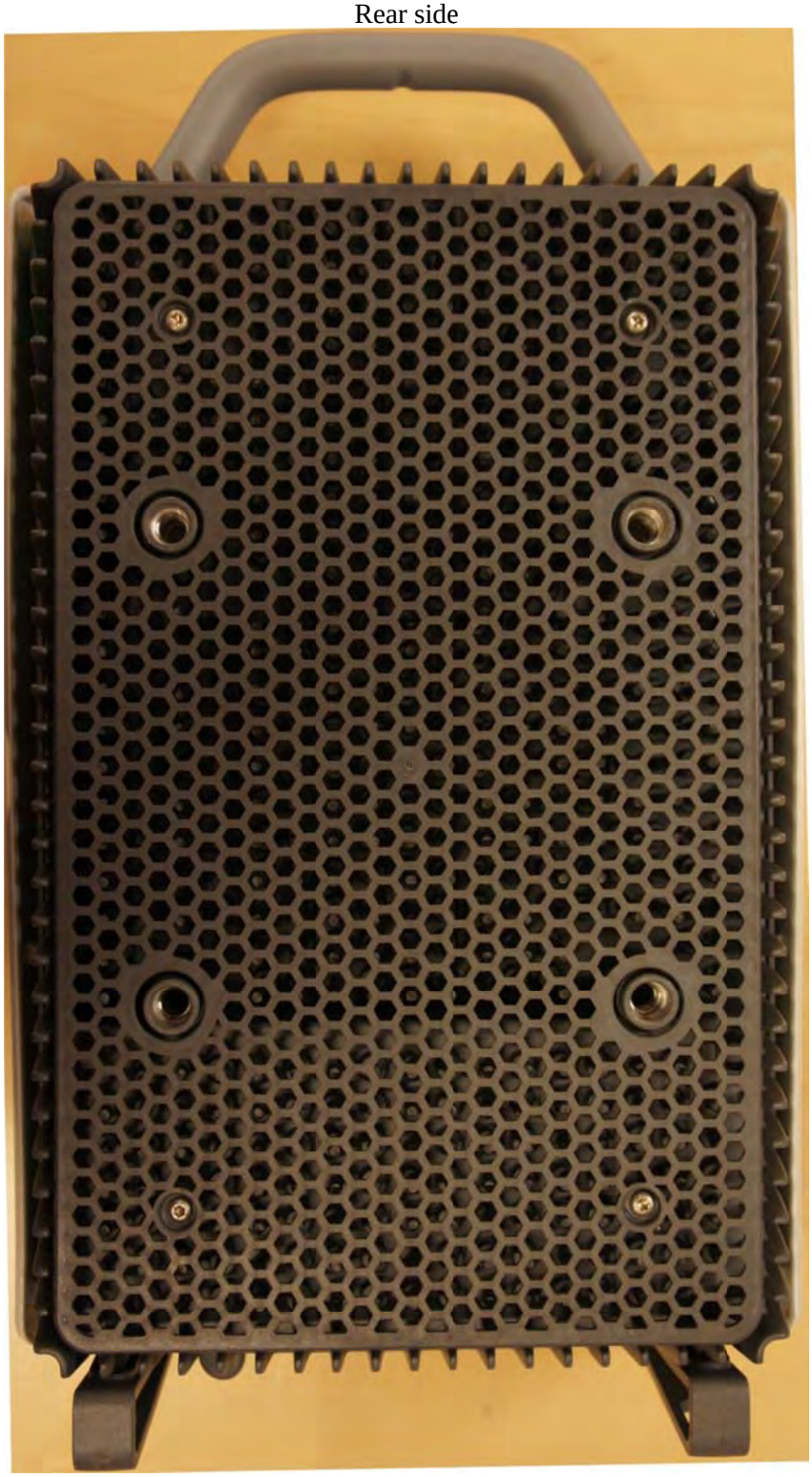
Appendix 9

External photos

Front side

Appendix 9

Rear side



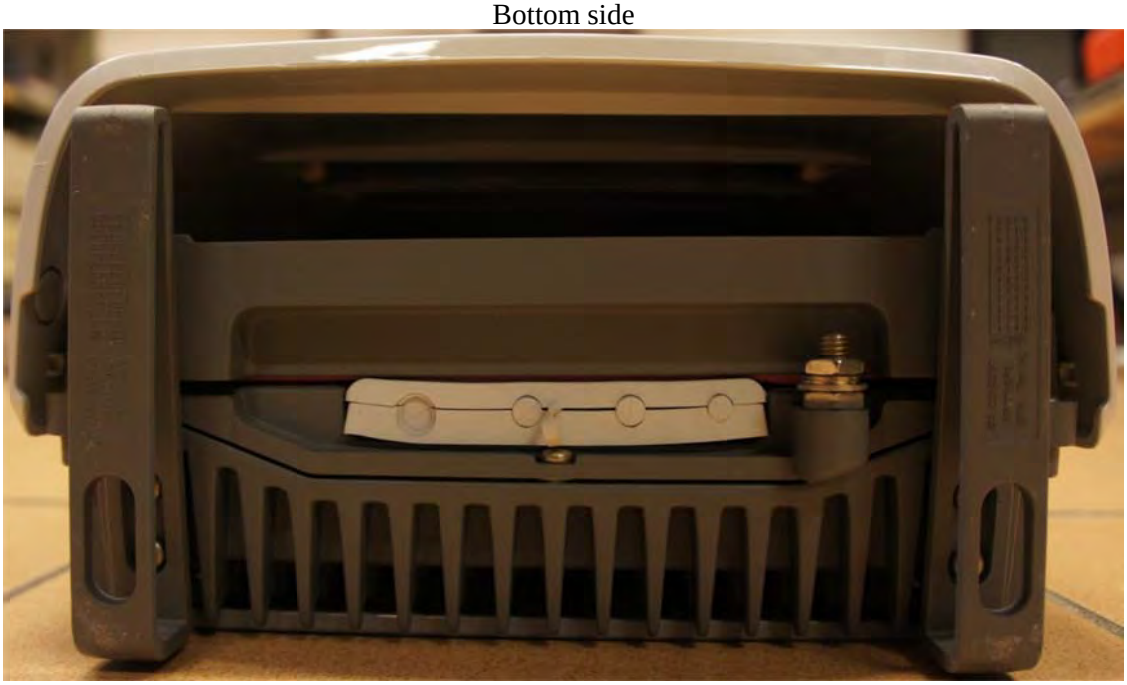
Appendix 9

Left side

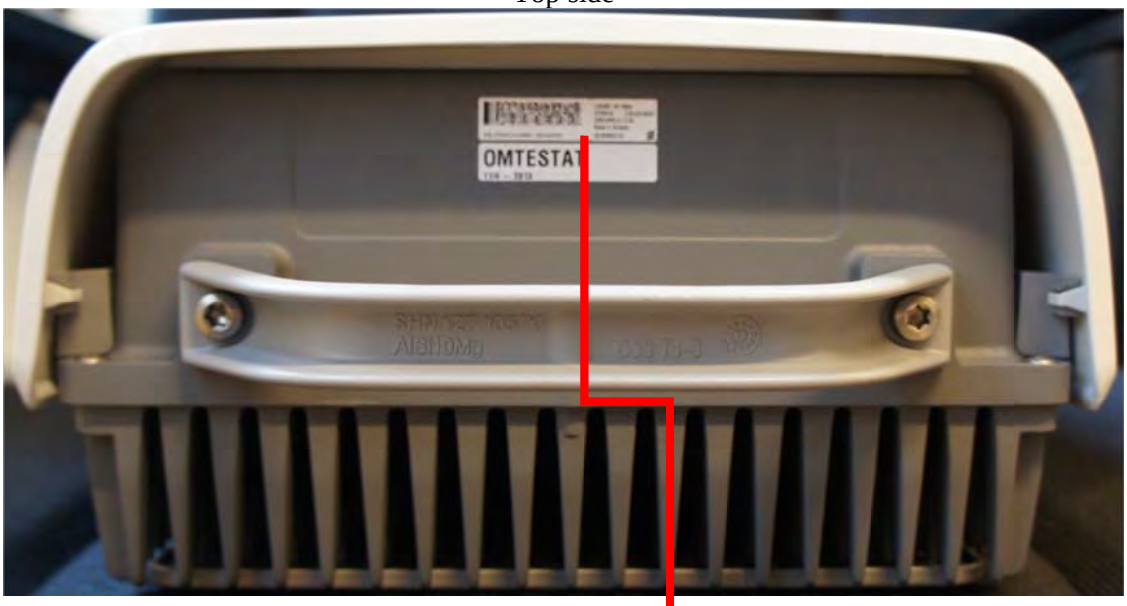
Right side

Appendix 9

Bottom side



Top side



Product label