REPORT

issued by an FCC listed Laboratory Reg. no. 93866.
The test site complies with RSS-Gen, IC file no: 3482A

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Date	Reference	Page
2013-06-04	3P03539-01-F27	1 (2)

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Radio measurements on RRUS 12 B4 1700/2100 MHz radio equipment with FCC ID: TA8AKRC161349-2 and IC: 287AB-AS1613492

(8 appendices)

Test object

Product name: RRUS 12 B4
Product number: KRC 161 349/2

Summary

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

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

Bengt Andersson

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Appendix 1

Description of the test object

Equipment:	Radio equipment RRUS 12 B4 supporting LTE
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 47.8 dBm (1 x 60W) Multi carrier: 2 x 44.8 dBm (2 x 30W)
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

Operation mode during measurements

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. 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 8.4.0
RSS-Gen Issue 3
RSS-139 Issue 2

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 2013-05-06.

Manufacturer’s representative

Mihai Simon, Ericsson AB.

Test engineers

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

Test participant

None

Measurement equipment

	Calibration Due	SP number
Test site Tesla	2014-01	503 881
R&S FSIQ 40	2013-07	503 738
R&S ESI 26	2013-07	503 292
R&S FSQ 40	2014-03	504 143
Control computer with R&S software EMC32 version 8.52.0	-	503 479
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	2013-01	901 384
RF attenuator	2013-12	901 508
Chase Bilog Antenna CBL 6111A	2014-10	503 182
EMCO Horn Antenna 3115	2014-01	502 175
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
Temperature and humidity meter, Testo 635	2013-06	504 203
Temperature and humidity meter, Testo 625	2013-06	504 188
Temperature Chamber	2013-11	501 031
Datascan 7321	2013-11	502 698
Multimeter Fluke 87	2013-08	502 190

Appendix 1

Test frequencies during measurements

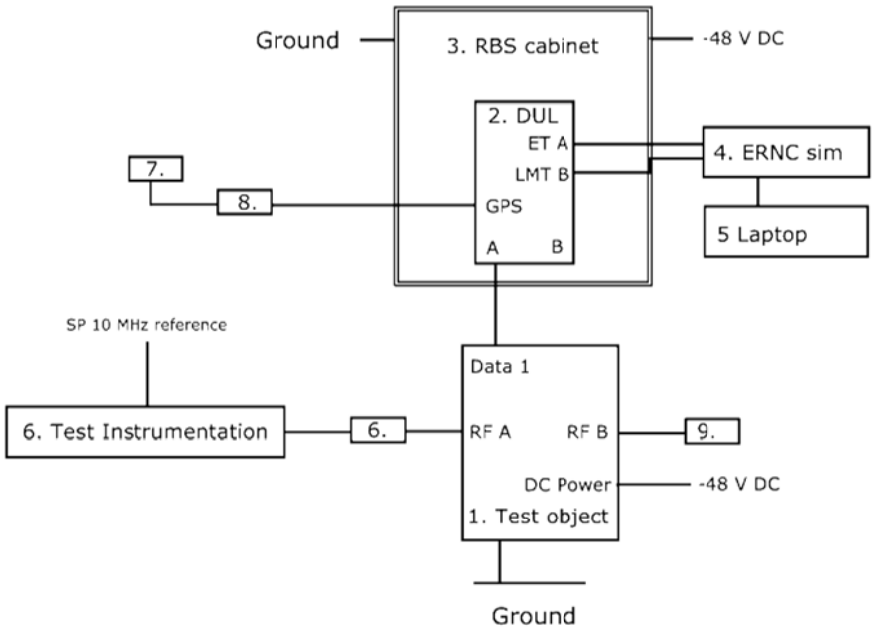
Single RAT TX test frequencies

EARFCN Downlink	Frequency [MHz]	Symbolic name	Comment
1957	2110.7	B	TX bottom frequency in 1.4 MHz BW configuration
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
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
1980 2022	2113.0 2117.2	Bim1	2 carrier TX band top constellation 1.4 MHz BW configuration
2328 2370	2147.8 2152.0	Tim1	2 carrier TX band top constellation 1.4 MHz BW configuration
2100 2262	2125.0 2141.2	Bim2	2 carrier TX band top constellation 1.4 MHz BW configuration
2088 2250	2123.8 2140.0	Tim2	2 carrier TX band top constellation 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.

Appendix 1

Test set-up conducted measurements



Test object:

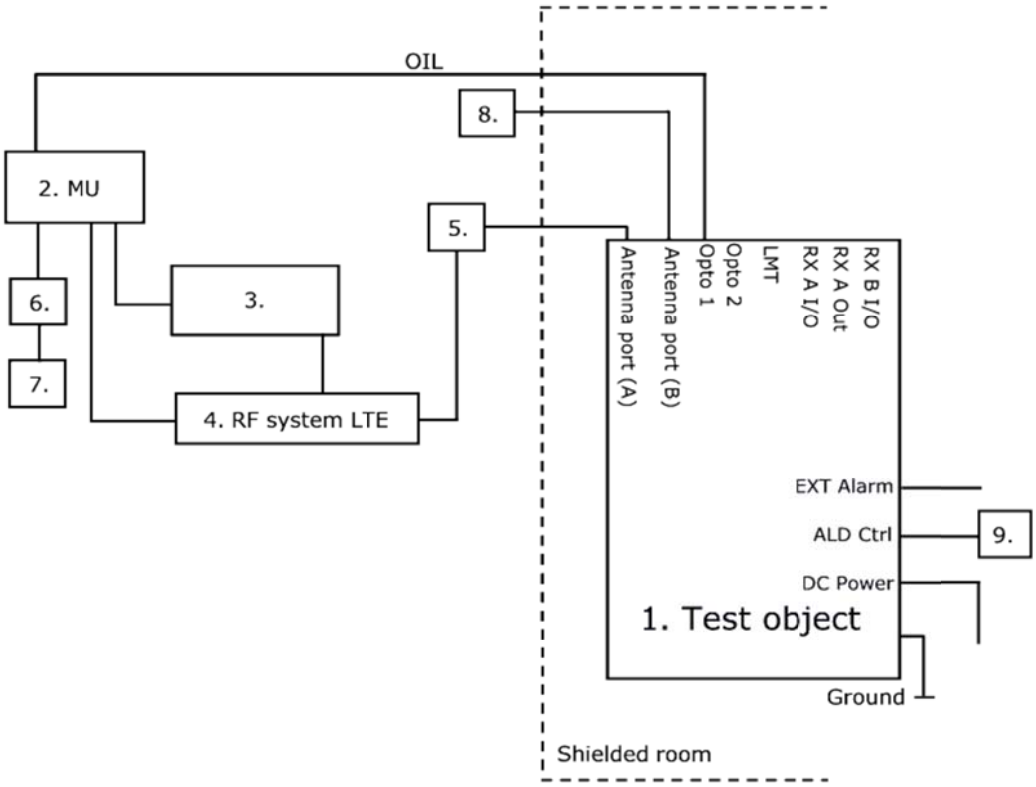
1.	RRUS 12 B4, KRC 161 349/2, revision R1B, S/N: C827003190 working software CXP 901 7316/2, Rev. R49EG

Functional test equipment

2.	DUL 20 01, KDU 137 533/4, Rev R1C, S/N: C824321475
3.	SUP 6601 1/BFL 901 009/1, rev. R3B, s/n. BR881078499
4	ERNC Sim 072, BAMS – 1000579045 Fast Ethernet switch, Netgear GSM7224, BAMS – 1001252309
5.	Controlling computer SUN ULTRA 27, BAMS 1000758346
6.	SP Test Instrumentation according to measurement equipment list
7.	GPS Active Antenna, KRE 101 2082/1
8.	GPS 02 01, NCD 901 41/1, rev. R1D, s/n: TU8K474887
9.	Terminator

Appendix 1

Test set-up radiated measurements



Test object:

1.	RRUS 12 B4, KRC 161 349/2, rev. R1B, s/n: C827003180 working software: CXP 901 7316/2, rev: R49EG

Functional test equipment:

2.	Main Unit SUP 6601, 1/BFL 901 009/1, rev. R3B, s/n: BR80989745 DUL 20 01, KDU 137 533/4, rev. R1C, s/n: C824484447
3.	Switch Netgear GSM 7224, BAMS – 1000850751
4.	RF system LTE Computer, w-ultra27-06 standalone, BAMS – 1000861874 Anritsu MS2691A, BAMS – 1000698363 Switch Netgear GSM7224, BAMS – 1000850754
5.	Directional Coupler, BAMS – 1000739626
6.	GPS 02 01, NCD 901 41/1, rev. R1D, s/n: TU8K356490
7.	GPS Active Antenna, KRE 101 2082/1
8.	Terminator
10.	RET – Remote Electrical Tilt unit, KRY 121 67/2, rev. R1N

Appendix 1

Interfaces:	**Type of port:**
Power: -48 VDC	DC Power
Antenna port (A), 7/16 connector, terminated	Antenna
Antenna port (B), 7/16 connector, terminated	Antenna
Opto 1, Optical Interface Link, single mode opto fibre	Telecom
Opto 2, Optical Interface Link, single mode opto fibre, not in use	Telecom
LMT, for maintenance use only	Telecom
RX A Out, no cable attached	Antenna
RX A I/O, no cable attached	Antenna
RX B I/O, no cable attached	Antenna
EXT Alarm, shielded multi-wire	Signal
ALD Ctrl, shielded multi-wire	Signal
Ground wire	Ground

RBS software:

Software	**Revision**
CXP 102 051/18	R25Y

Appendix 2

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

Date	Temperature	Humidity
2013-05-07	23 °C ± 3 °C	30 % ± 5 %
2013-05-08	22 °C ± 3 °C	35 % ± 5 %
2013-05-13	22 °C ± 3 °C	38 % ± 5 %
2013-05-20	22 °C ± 3 °C	43 % ± 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	504 143
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 47.8 dBm. Total nominal RF power 50.8 dBm.

Tested configuration	Transmitter power RMS (dBm)		
BW and frequency	Port RF A	Port RF B	Total power[1)]
1.4 MHz, B	47.07 (Diagram 1)	46.94 (Diagram 2)	50.02
20 MHz, B	47.48 (Diagram 3)	47.30 (Diagram 4)	50.40
1.4 MHz, M	47.41 (Diagram 5)	47.21 (Diagram 6)	50.32
3 MHz, M	47.46 (Diagram 7)	47.39 (Diagram 8)	50.44
5 MHz, M	47.42 (Diagram 9)	47.29 (Diagram 10)	50.37
10 MHz, M	47.56 (Diagram 11)	47.30 (Diagram 12)	50.44
15 MHz, M	47.46 (Diagram 13)	47.41 (Diagram 14)	50.45
20 MHz, M	47.45 (Diagram 15)	47.46 (Diagram 16)	50.47
1.4 MHz, T	46.86 (Diagram 17)	46.90 (Diagram 18)	49.89
20 MHz, T	47.42 (Diagram 19)	47.41 (Diagram 20)	50.43

[1)]: summed output power according to FCC KDB662911 Multiple transmitter output v01r02

Note: The diagrams are shown on the following pages and provide Peak to Average Ratio (PAPR). The highest single carrier PAPR measured was 6.97 dB (0.1%). For multi-carrier constellations the measured “PAPR” is informative only as to the definition of Peak to Average Ratio per carrier.

MIMO mode, multi Carrier

Rated output power 2 x 44.8 dBm per RF port.Total nominal RF power 50.8 dBm

Tested configuration	Transmitter power RMS (dBm)		
BW and frequency	Port RFA	Port RFB	Total power[1)]
1.4 MHz, Bim1	47.30 (Diagram 21)	Not tested[2)]	50.30
1.4 MHz, Bim2	47.43 (Diagram 22	Not tested[2)]	50.43
1.4 MHz, Tim1	47.25 (Diagram 23)	Not tested[2)]	50.25
1.4 MHz, Tim2	47.34 (Diagram 24)	Not tested[2)]	50.34

[1)]: Since port B isn't measured 3dB has been added to the result on port RFA.
[2)]: 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

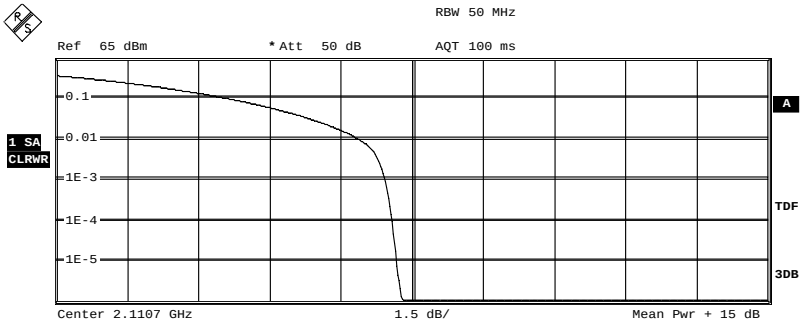
§27.50: The maximum output power may not exceed 1640 W (EIRP)/ MHz. The Peak to Average Ratio (PAR) may not exceed 13 dB.

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:

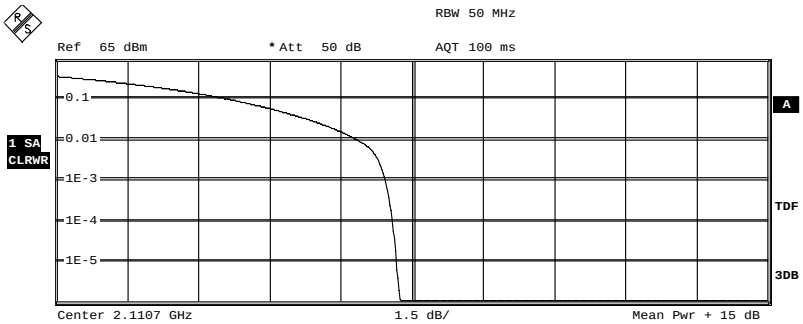


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.07 dBm
Peak	54.46 dBm
Crest	7.39 dB
10 %	3.68 dB
1 %	6.37 dB
.1 %	6.92 dB
.01 %	7.09 dB

Date: 13.MAY.2013 10:37:40

Diagram 2:



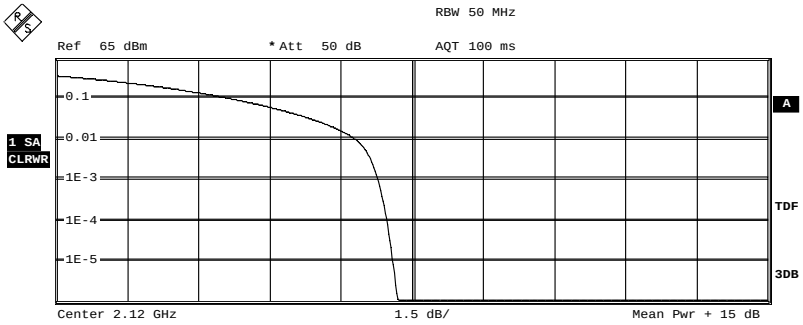
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	46.94 dBm
Peak	54.32 dBm
Crest	7.38 dB
10 %	3.70 dB
1 %	6.35 dB
.1 %	6.95 dB
.01 %	7.09 dB

Date: 13.MAY.2013 12:51:56

Appendix 2

Diagram 3:

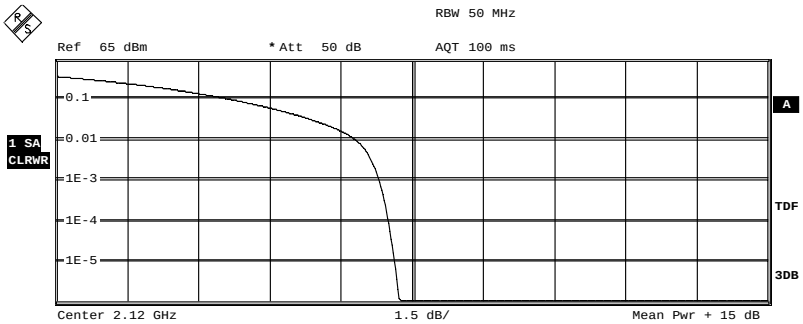


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.48 dBm
Peak	54.70 dBm
Crest	7.22 dB
10 %	3.73 dB
1 %	6.30 dB
.1 %	6.78 dB
.01 %	6.97 dB

Date: 13.MAY.2013 11:40:25

Diagram 4:



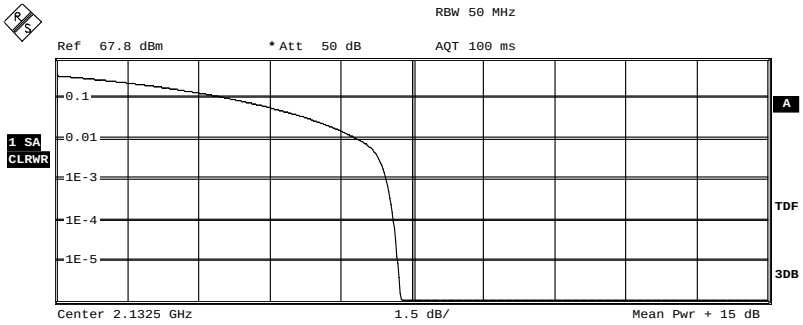
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.30 dBm
Peak	54.63 dBm
Crest	7.33 dB
10 %	3.73 dB
1 %	6.32 dB
.1 %	6.80 dB
.01 %	7.00 dB

Date: 13.MAY.2013 13:07:18

Appendix 2

Diagram 5:

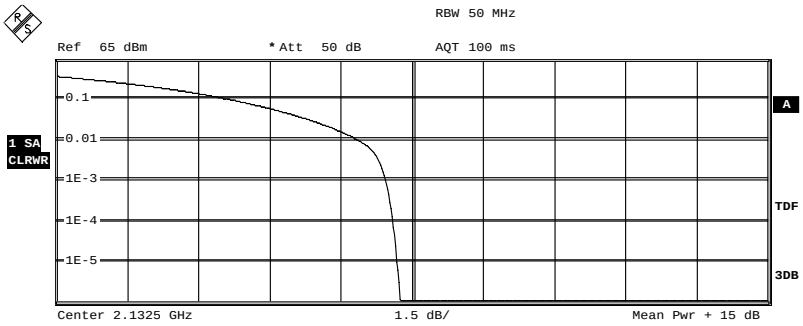


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.41 dBm
Peak	54.79 dBm
Crest	7.38 dB
10 %	3.70 dB
1 %	6.37 dB
.1 %	6.97 dB
.01 %	7.12 dB

Date: 8.MAY.2013 12:27:55

Diagram 6:



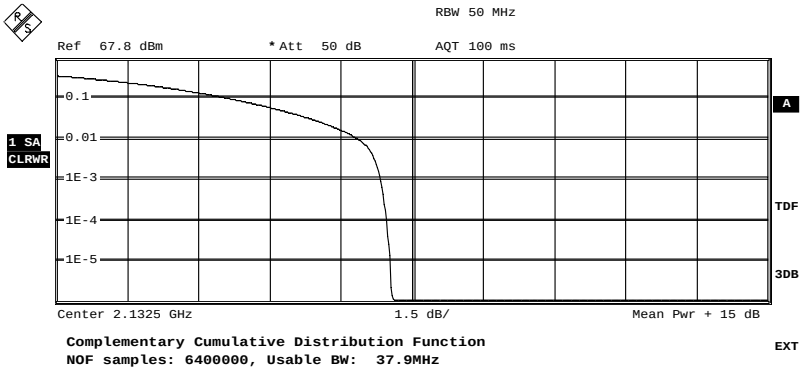
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.21 dBm
Peak	54.52 dBm
Crest	7.31 dB
10 %	3.70 dB
1 %	6.35 dB
.1 %	6.95 dB
.01 %	7.09 dB

Date: 13.MAY.2013 09:40:21

Appendix 2

Diagram 7:

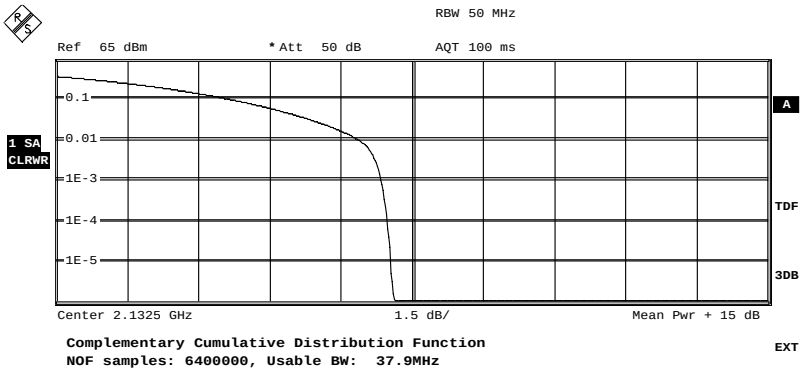


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.46 dBm
Peak	54.65 dBm
Crest	7.19 dB
10 %	3.70 dB
1 %	6.37 dB
.1 %	6.85 dB
.01 %	6.97 dB

Date: 8.MAY.2013 09:10:02

Diagram 8:



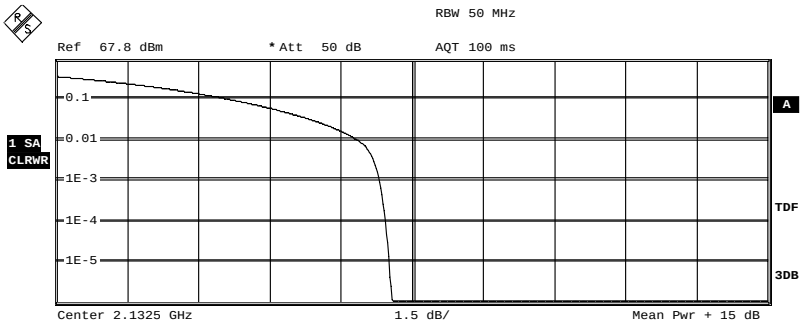
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.39 dBm
Peak	54.52 dBm
Crest	7.13 dB
10 %	3.70 dB
1 %	6.37 dB
.1 %	6.85 dB
.01 %	7.00 dB

Date: 13.MAY.2013 09:50:17

Appendix 2

Diagram 9:

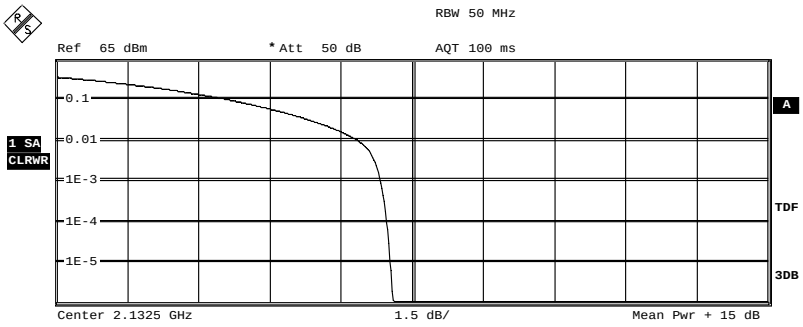


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.42 dBm
Peak	54.51 dBm
Crest	7.09 dB
10 %	3.70 dB
1 %	6.35 dB
.1 %	6.83 dB
.01 %	6.95 dB

Date: 7.MAY.2013 15:17:06

Diagram 10:



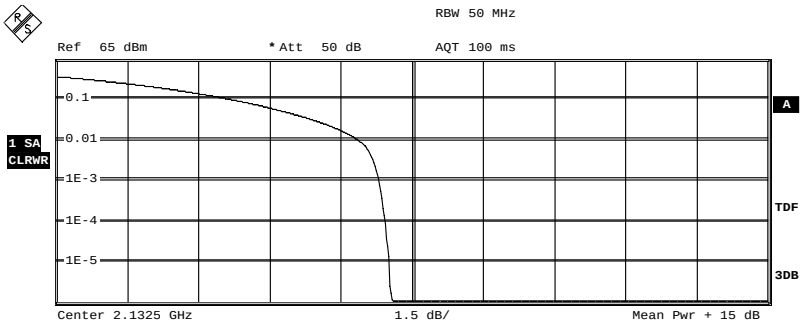
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.29 dBm
Peak	54.38 dBm
Crest	7.09 dB
10 %	3.70 dB
1 %	6.37 dB
.1 %	6.85 dB
.01 %	6.97 dB

Date: 13.MAY.2013 09:52:47

Appendix 2

Diagram 11:

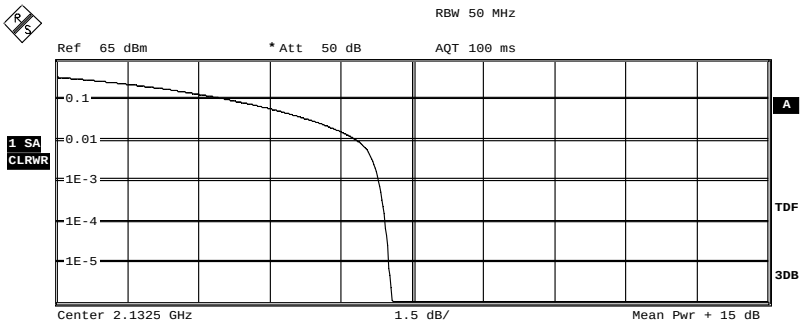


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.56 dBm
Peak	54.66 dBm
Crest	7.10 dB
10 %	3.73 dB
1 %	6.37 dB
.1 %	6.80 dB
.01 %	6.95 dB

Date: 8.MAY.2013 12:42:57

Diagram 12:



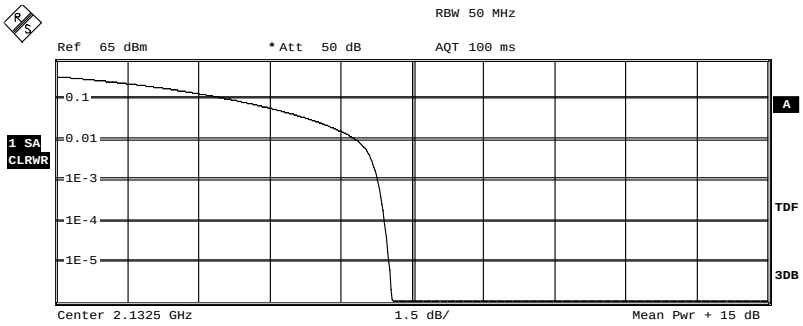
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.30 dBm
Peak	54.45 dBm
Crest	7.15 dB
10 %	3.70 dB
1 %	6.35 dB
.1 %	6.80 dB
.01 %	6.95 dB

Date: 13.MAY.2013 10:28:30

Appendix 2

Diagram 13:

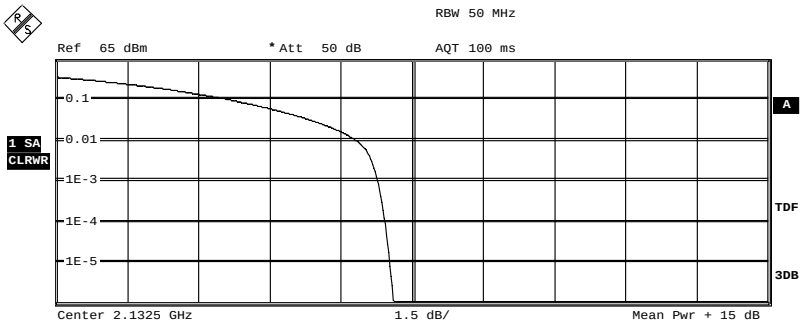


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.46 dBm
Peak	54.59 dBm
Crest	7.13 dB
10 %	3.73 dB
1 %	6.32 dB
.1 %	6.78 dB
.01 %	6.92 dB

Date: 8.MAY.2013 13:18:01

Diagram 14:



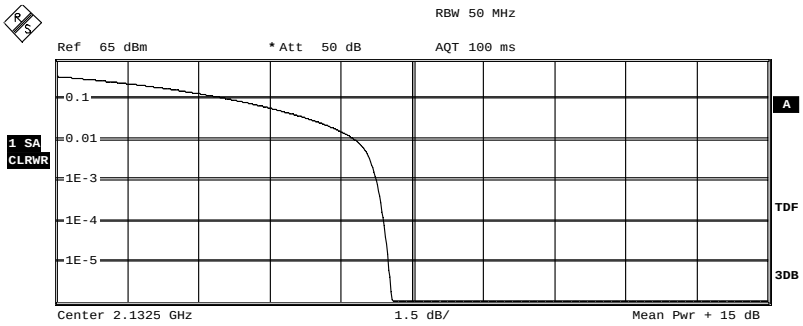
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.41 dBm
Peak	54.59 dBm
Crest	7.18 dB
10 %	3.73 dB
1 %	6.32 dB
.1 %	6.78 dB
.01 %	6.95 dB

Date: 13.MAY.2013 10:29:59

Appendix 2

Diagram 15:

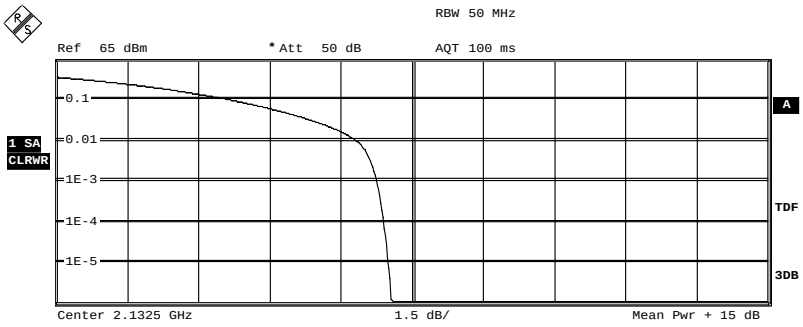


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.45 dBm
Peak	54.66 dBm
Crest	7.21 dB
10 %	3.73 dB
1 %	6.30 dB
.1 %	6.75 dB
.01 %	6.90 dB

Date: 8.MAY.2013 13:29:54

Diagram 16:



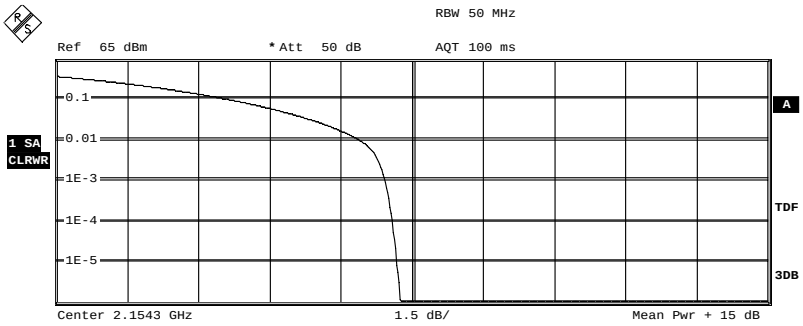
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.46 dBm
Peak	54.59 dBm
Crest	7.13 dB
10 %	3.73 dB
1 %	6.32 dB
.1 %	6.75 dB
.01 %	6.90 dB

Date: 8.MAY.2013 14:22:39

Appendix 2

Diagram 17:

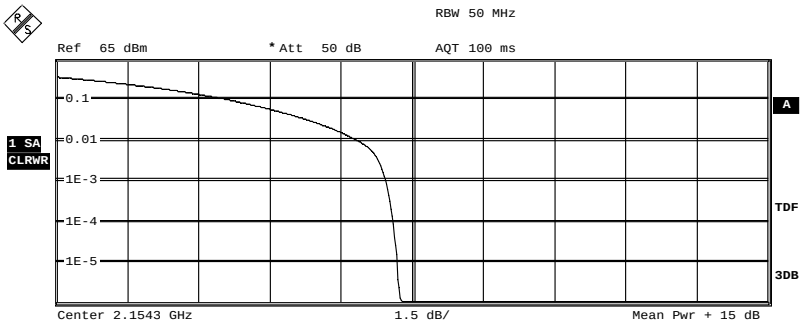


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	46.86 dBm
Peak	54.17 dBm
Crest	7.32 dB
10 %	3.68 dB
1 %	6.39 dB
.1 %	6.95 dB
.01 %	7.09 dB

Date: 13.MAY.2013 13:48:54

Diagram 18:



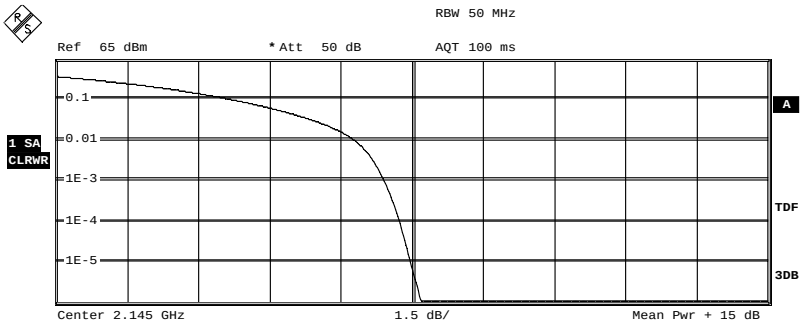
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	46.90 dBm
Peak	54.24 dBm
Crest	7.34 dB
10 %	3.70 dB
1 %	6.35 dB
.1 %	6.95 dB
.01 %	7.12 dB

Date: 13.MAY.2013 13:22:08

Appendix 2

Diagram 19:

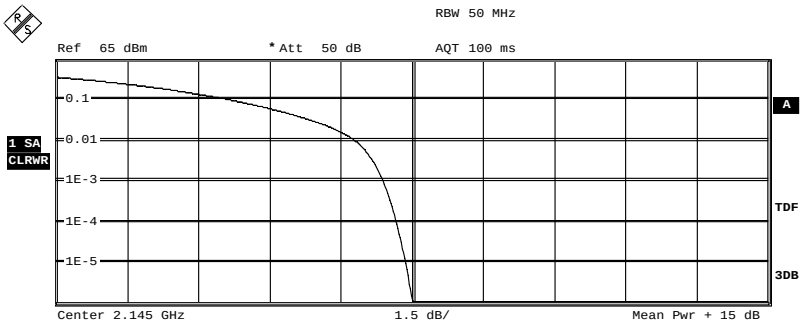


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.42 dBm
Peak	55.20 dBm
Crest	7.78 dB
10 %	3.73 dB
1 %	6.27 dB
.1 %	6.92 dB
.01 %	7.24 dB

Date: 13.MAY.2013 14:03:53

Diagram 20:



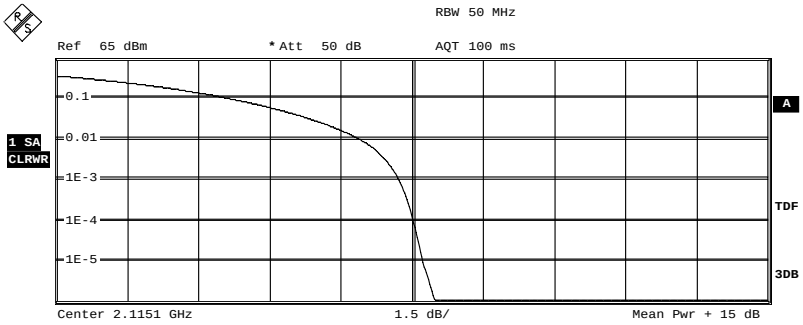
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.41 dBm
Peak	55.06 dBm
Crest	7.65 dB
10 %	3.73 dB
1 %	6.30 dB
.1 %	6.90 dB
.01 %	7.16 dB

Date: 13.MAY.2013 13:15:45

Appendix 2

Diagram 21:

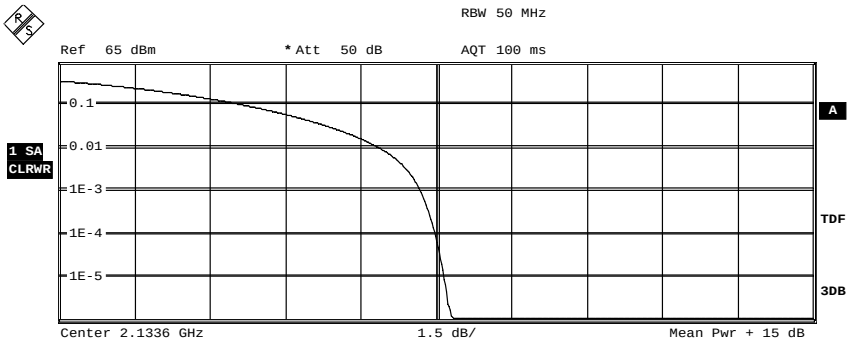


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.30 dBm
Peak	55.53 dBm
Crest	8.23 dB
10 %	3.70 dB
1 %	6.39 dB
.1 %	7.24 dB
.01 %	7.52 dB

Date: 13.MAY.2013 15:41:24

Diagram 22:



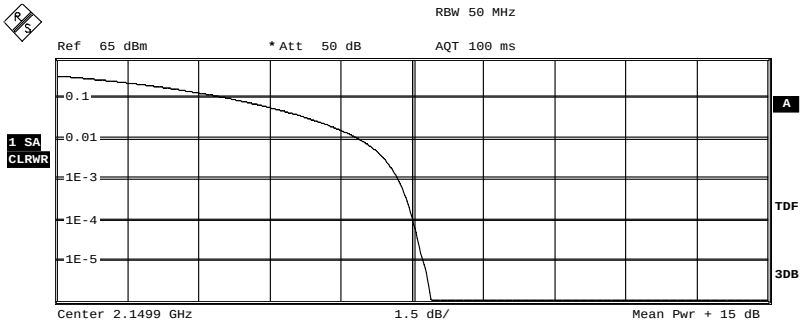
Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.43 dBm
Peak	55.37 dBm
Crest	7.94 dB
10 %	3.70 dB
1 %	6.37 dB
.1 %	7.19 dB
.01 %	7.48 dB

Date: 20.MAY.2013 09:07:19

Appendix 2

Diagram 23:

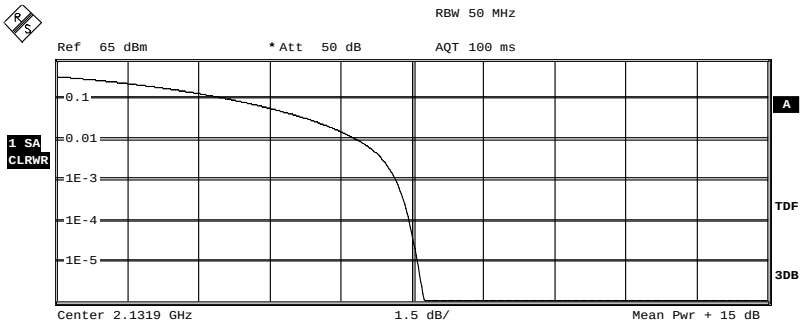


Complementary Cumulative Distribution Function
NOF samples: 6400000, Usable BW: 37.9MHz

	Trace 1
Mean	47.25 dBm
Peak	55.28 dBm
Crest	8.04 dB
10 %	3.73 dB
1 %	6.39 dB
.1 %	7.21 dB
.01 %	7.52 dB

Date: 13.MAY.2013 16:20:39

Diagram 24:



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

	Trace 1
Mean	47.34 dBm
Peak	55.22 dBm
Crest	7.88 dB
10 %	3.73 dB
1 %	6.35 dB
.1 %	7.16 dB
.01 %	7.45 dB

Date: 13.MAY.2013 16:39:42

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

Date	Temperature	Humidity
2013-05-07	23 °C ± 3 °C	30 % ± 5 %
2013-05-08	22 °C ± 3 °C	35 % ± 5 %
2013-05-13	22 °C ± 3 °C	38 % ± 5 %
2013-05-17	22 °C ± 3 °C	45 % ± 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 FSQ	504 143
RF attenuator	901 508
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

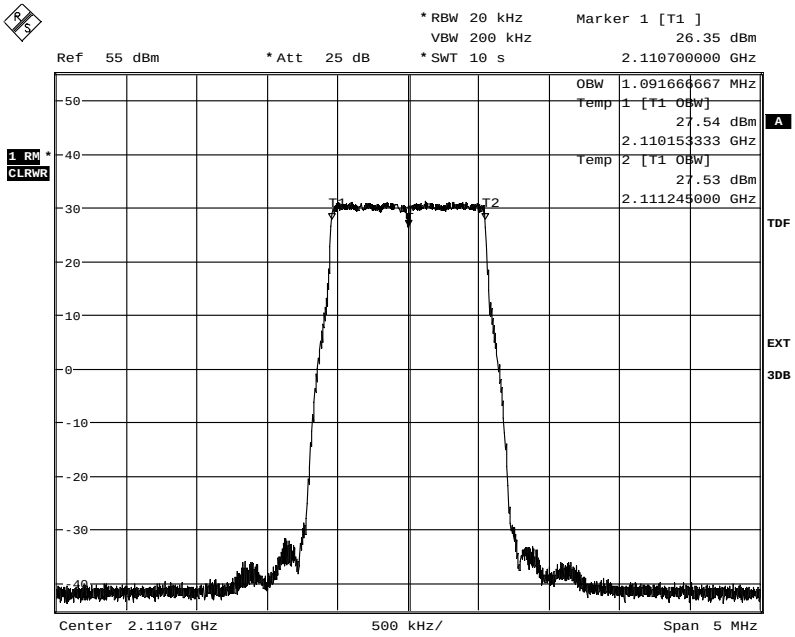
Results

MIMO mode, single carrier

Diagram	BW configuration	Tested frequency	Tested Port	Occupied BW (99%) [MHz]
1	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	13.43
9	20 MHz	M	RF A	17.86
10	20 MHz	M	RF B	17.86
11	1.4 MHz	T	RF A	1.09
12	20 MHz	T	RF A	17.86

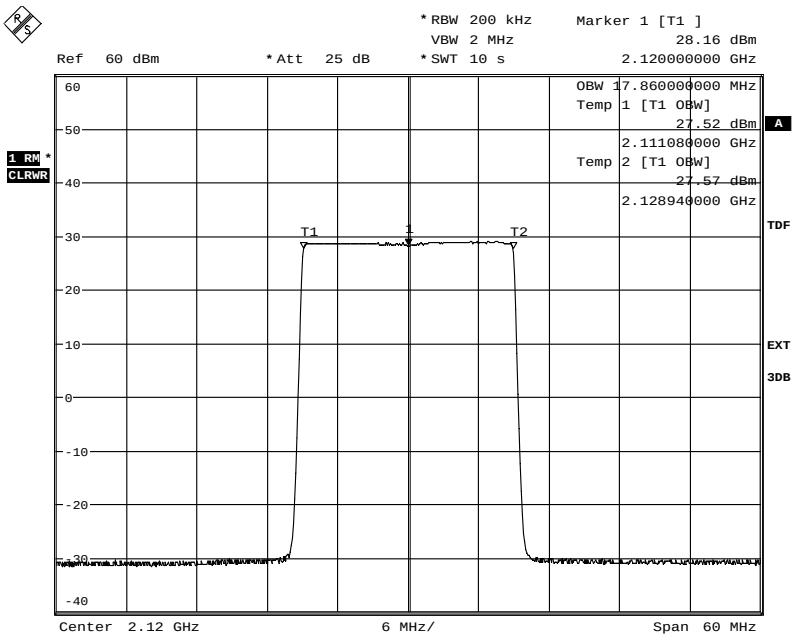
Appendix 3

Diagram 1:



Date: 13.MAY.2013 10:41:32

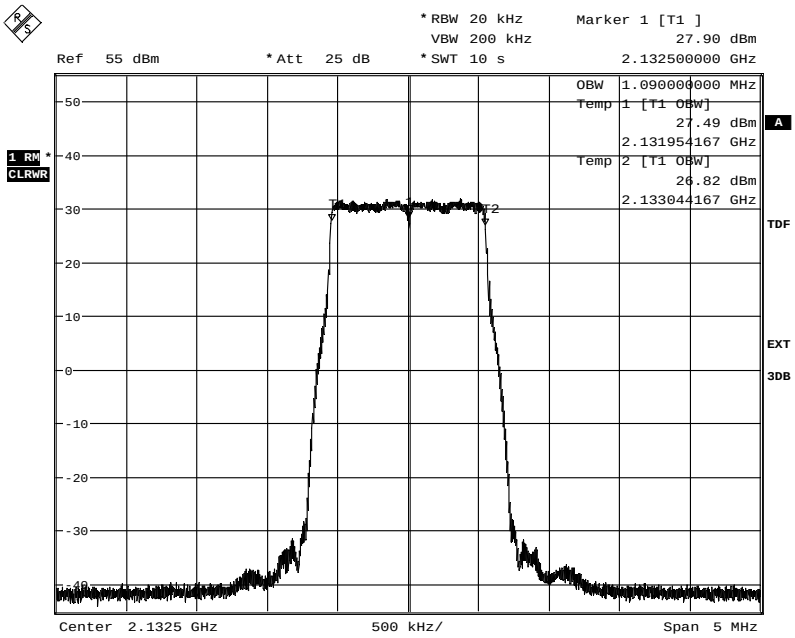
Diagram 2:



Date: 13.MAY.2013 11:38:39

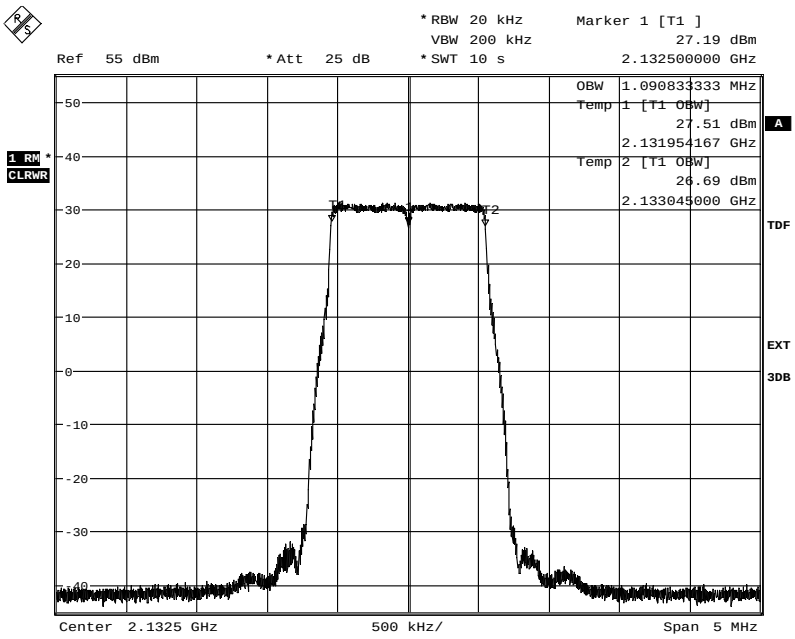
Appendix 3

Diagram 3:



Date: 8.MAY.2013 12:29:35

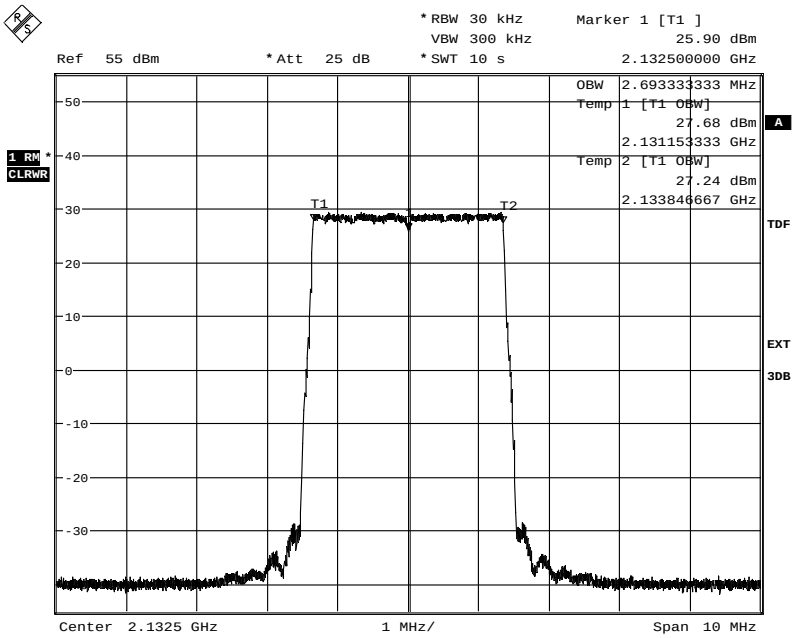
Diagram 4:



Date: 13.MAY.2013 09:36:49

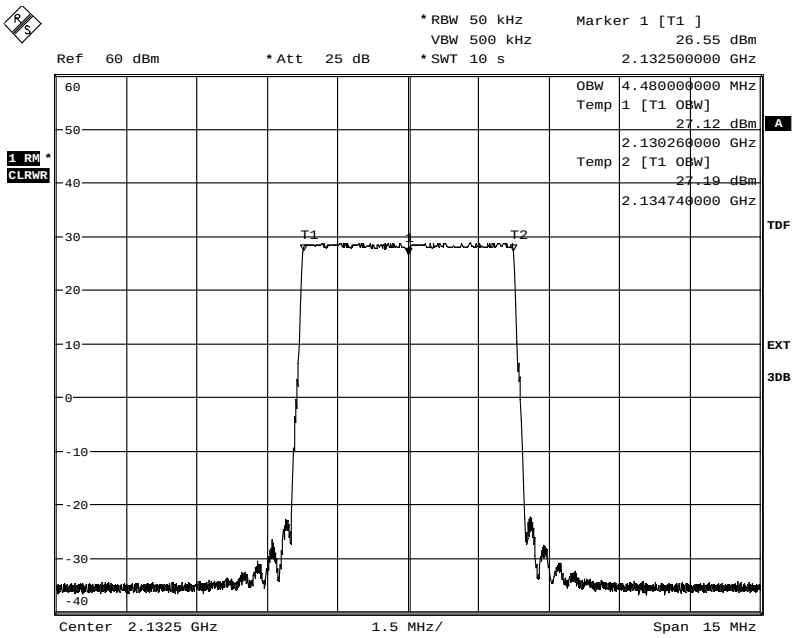
Appendix 3

Diagram 5:



Date: 8.MAY.2013 09:13:26

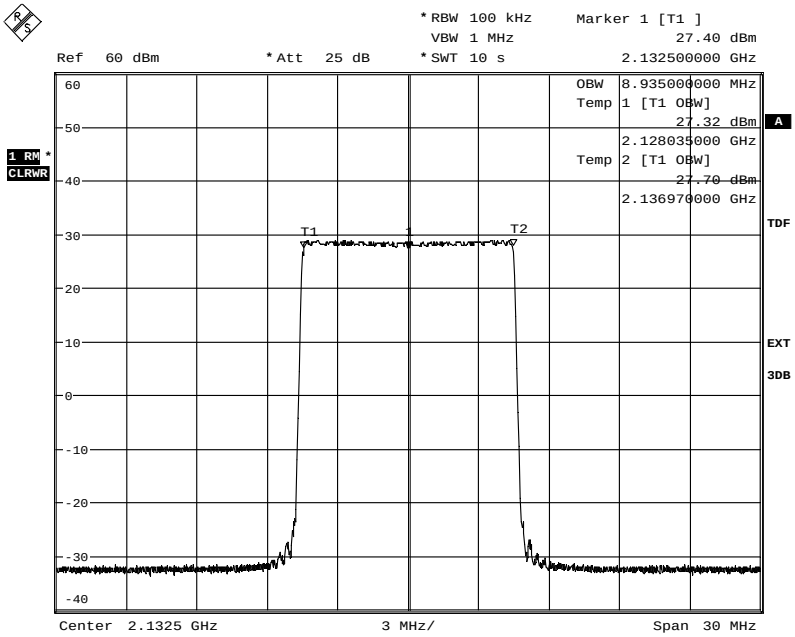
Diagram 6:



Date: 17.MAY.2013 14:30:43

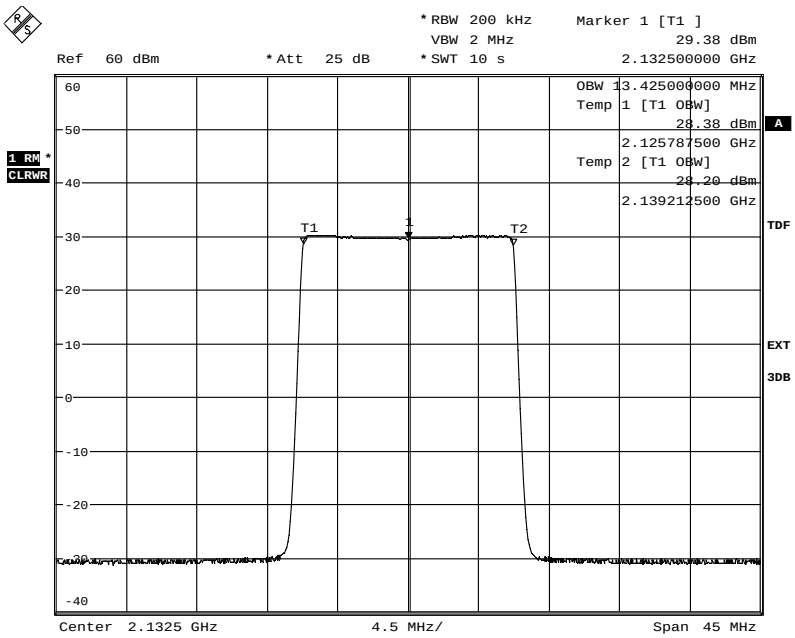
Appendix 3

Diagram 7:



Date: 8.MAY.2013 12:45:10

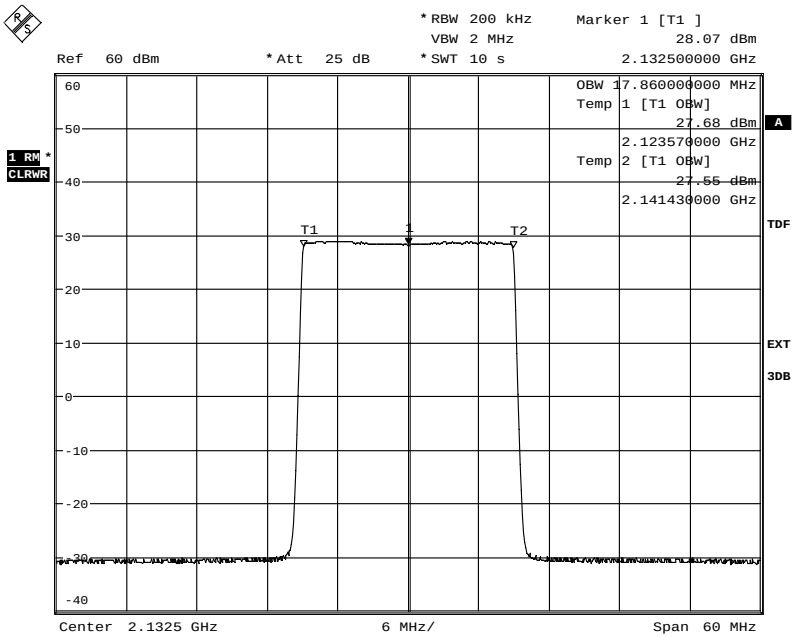
Diagram 8:



Date: 8.MAY.2013 13:32:02

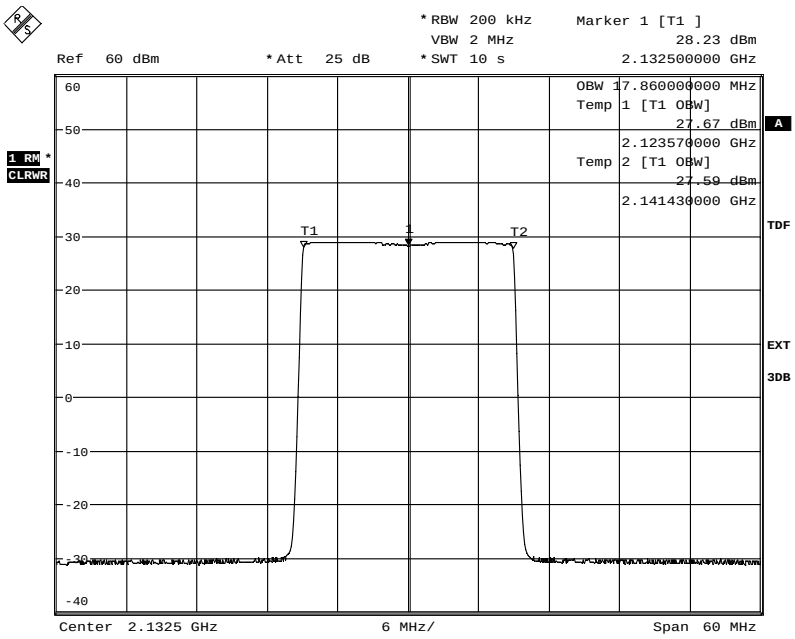
Appendix 3

Diagram 9:



Date: 8.MAY.2013 13:28:50

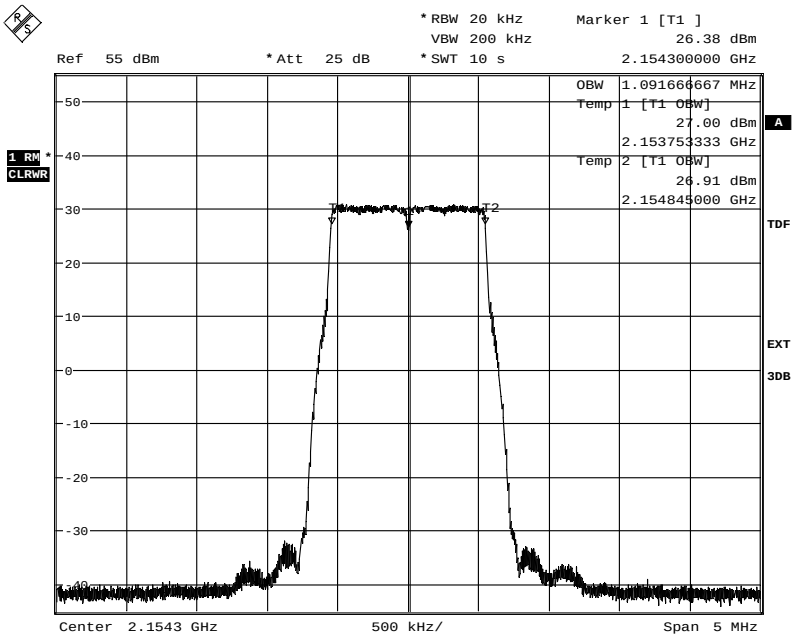
Diagram 10:



Date: 13.MAY.2013 09:14:50

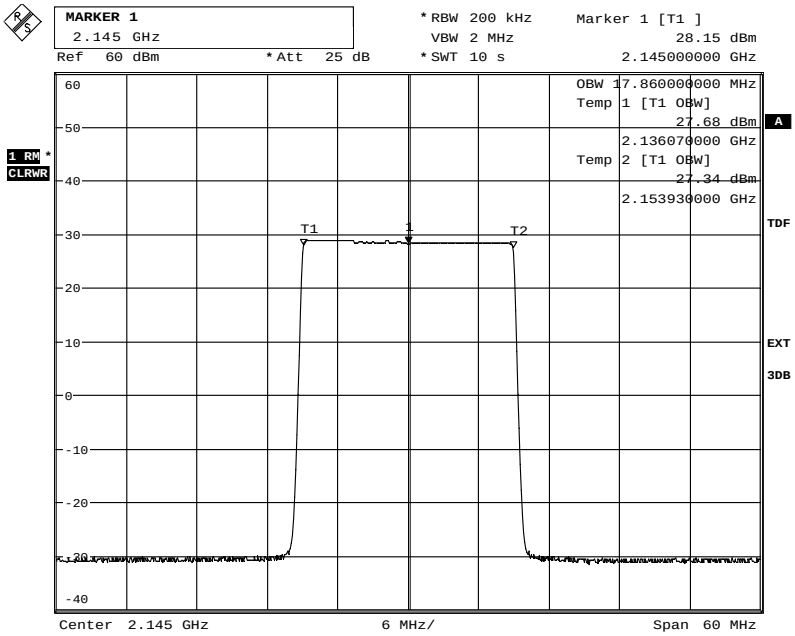
Appendix 3

Diagram 11:



Date: 13.MAY.2013 13:51:31

Diagram 12:



Date: 13.MAY.2013 14:05:39

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

Date	Temperature	Humidity
2013-05-13	22 °C ± 3 °C	38 % ± 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.
Where a smaller RBW was used as compared to the rules the limit in the plot is adjusted by 10*log(RBWused/RBW1%EBW) [dB].

BW configuration	Emission BW [MHz]	RBW used	Adjusted limit [dBm]
1.4 MHz	1.12	10 kHz	-13.50
3 MHz	2.73	20 kHz	-14.40

A resolution bandwidth of 100 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 10 dB to -23 dBm.

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

Measurement equipment	SP number
R&S FSQ	504 143
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
1 a+c	1.4 MHz	B	RF A
2 a+c	1.4 MHz	B	RF B
3 a+c	3 MHz	B	RF A
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	1.4 MHz	T	RF B
10 a+c	3 MHz	T	RF A
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

Limits

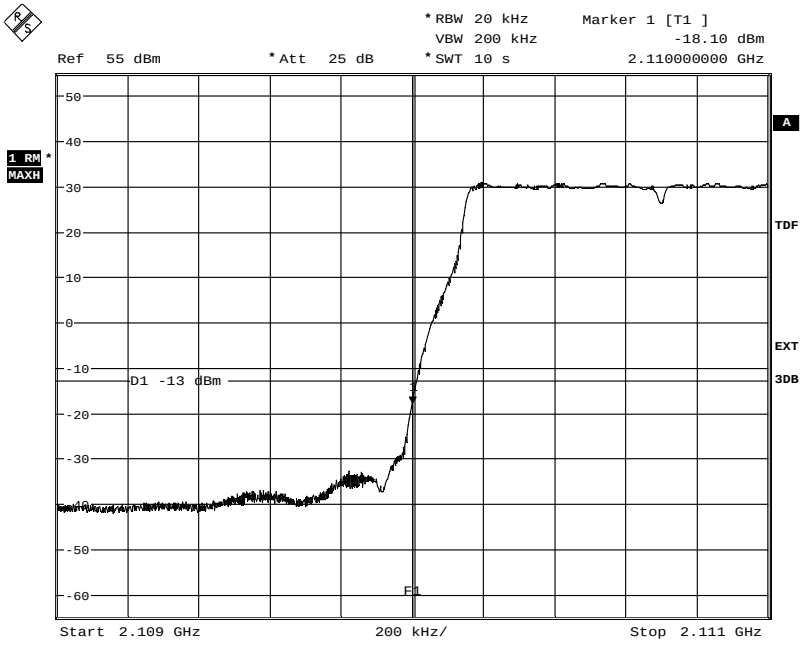
CFR 47 §27.53(h) and RSS-139 6.5

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

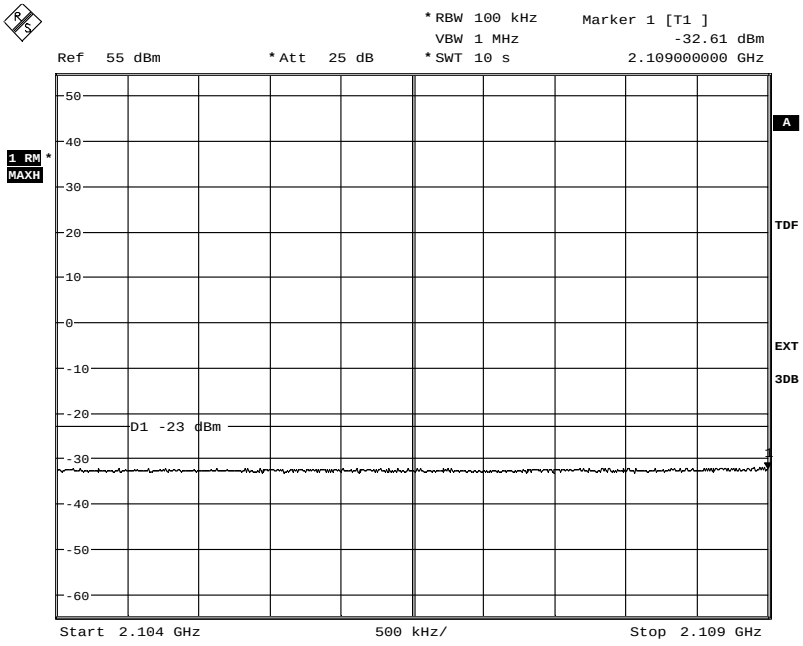
Appendix 4

Diagram 1a:



Date: 13.MAY.2013 10:45:45

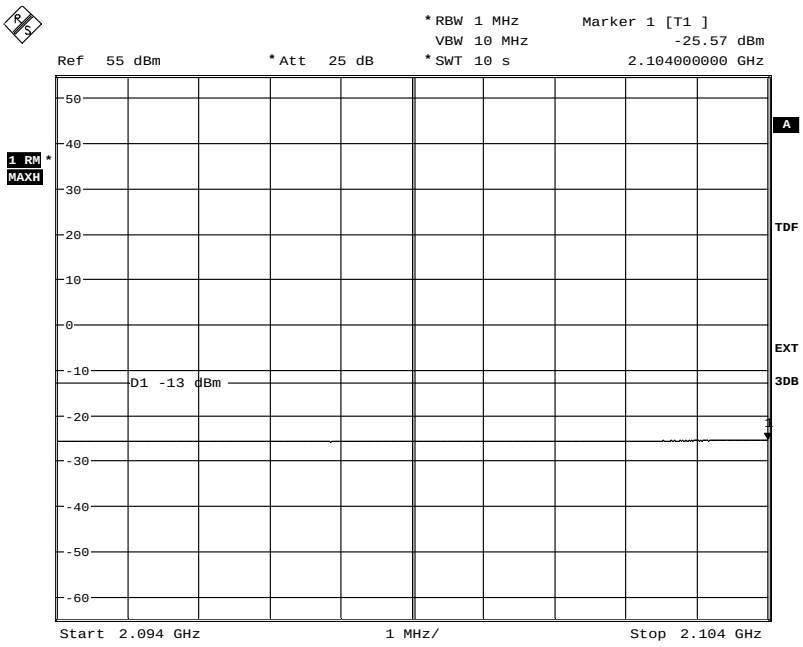
Diagram 1b:



Date: 13.MAY.2013 10:46:56

Appendix 4

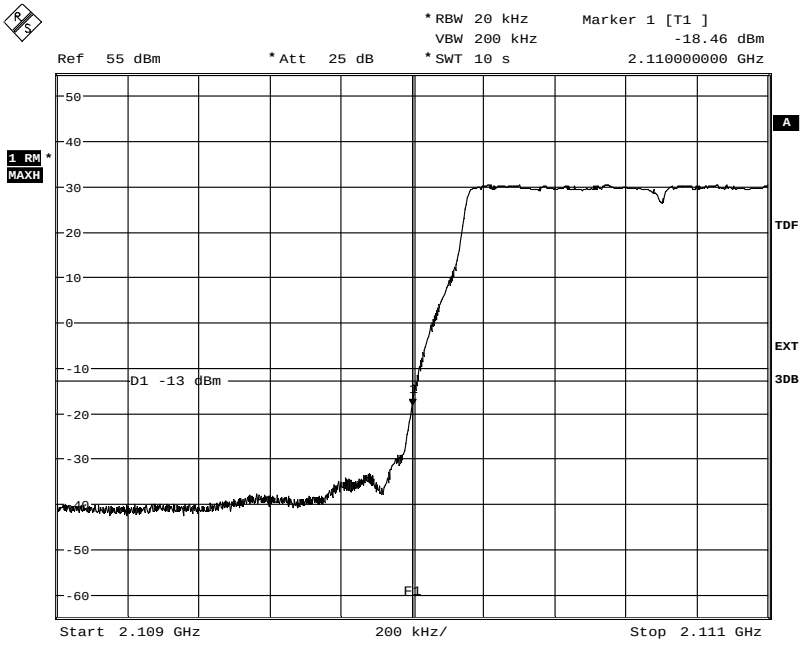
Diagram 1c



Date: 13.MAY.2013 10:48:04

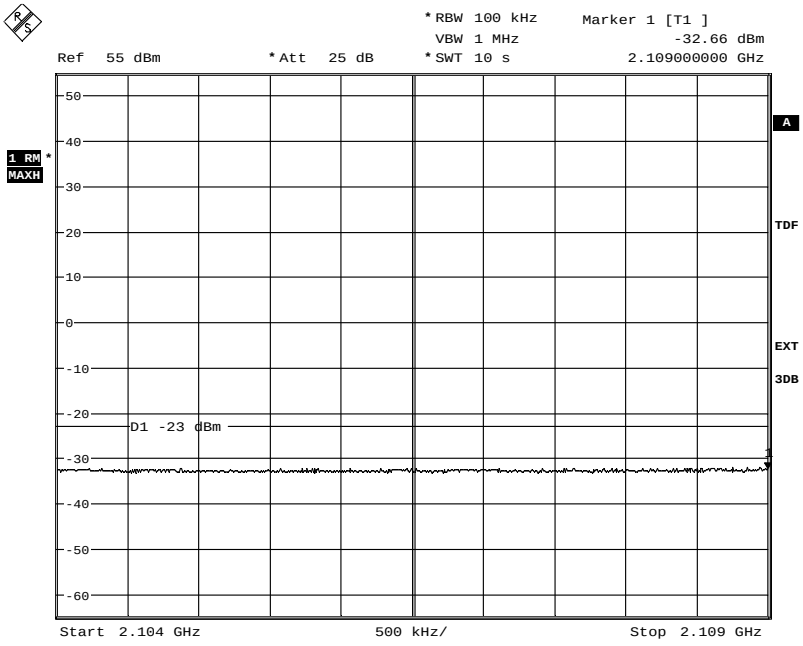
Appendix 4

Diagram 2a:



Date: 13.MAY.2013 12:54:00

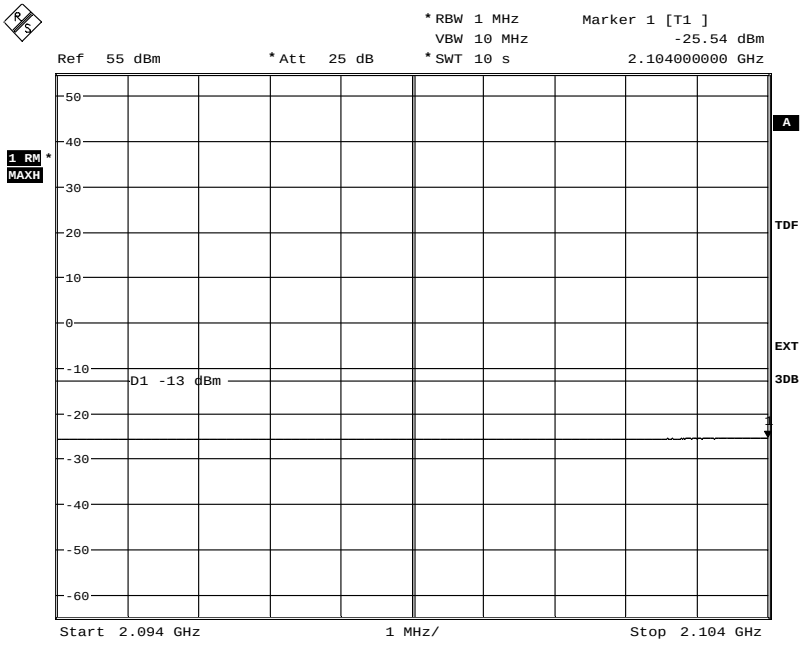
Diagram 2b:



Date: 13.MAY.2013 12:55:06

Appendix 4

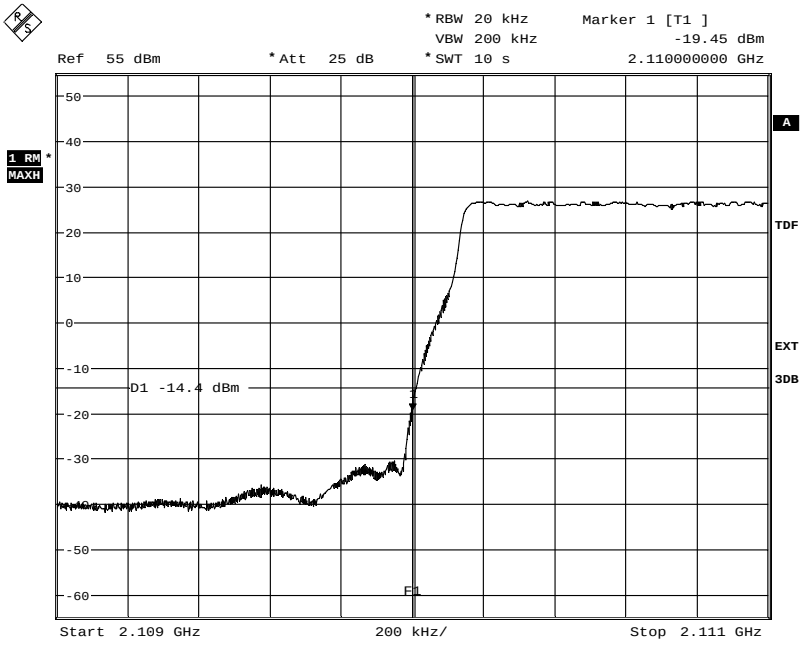
Diagram 2c:



Date: 13.MAY.2013 12:55:57

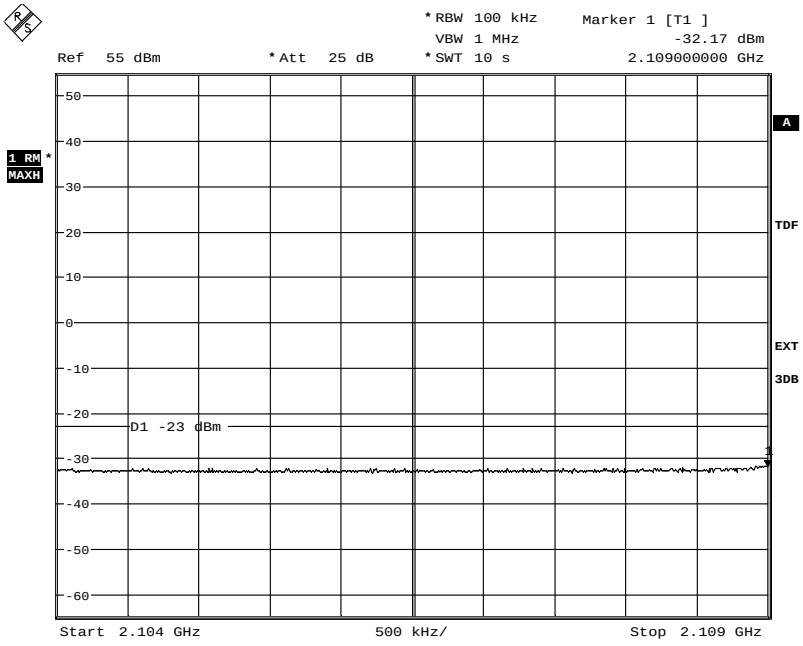
Appendix 4

Diagram 3a:



Date: 13.MAY.2013 11:59:01

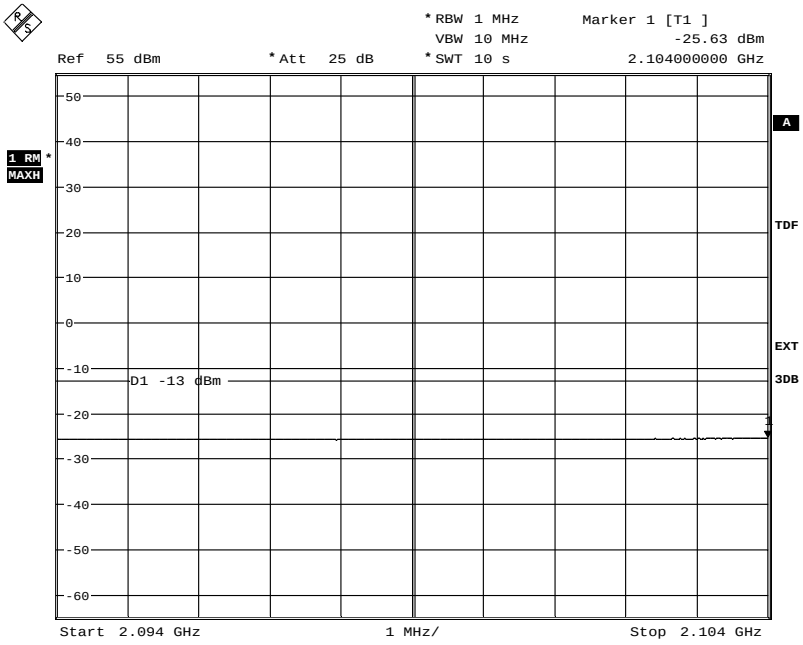
Diagram 3b:



Date: 13.MAY.2013 12:00:51

Appendix 4

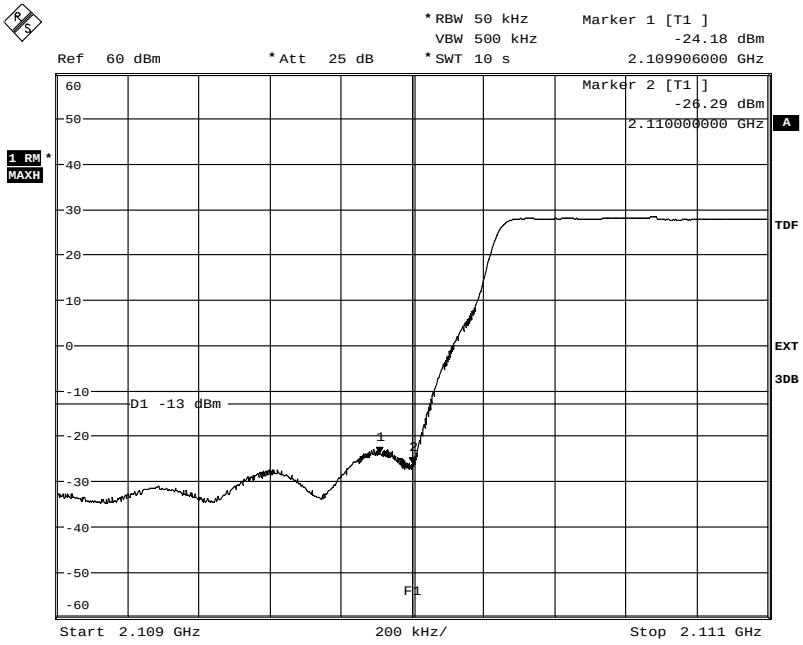
Diagram 3c:



Date: 13.MAY.2013 12:01:39

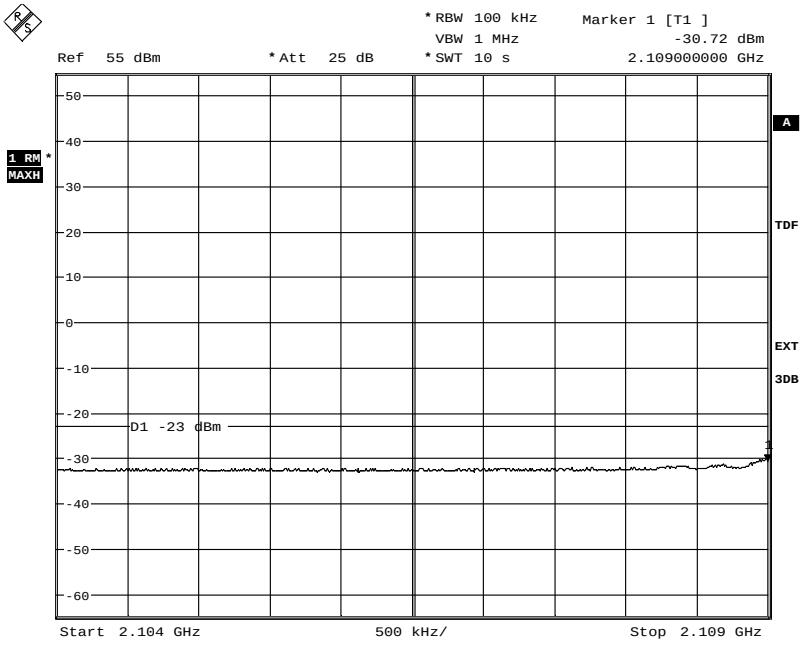
Appendix 4

Diagram 4a:



Date: 13.MAY.2013 12:06:50

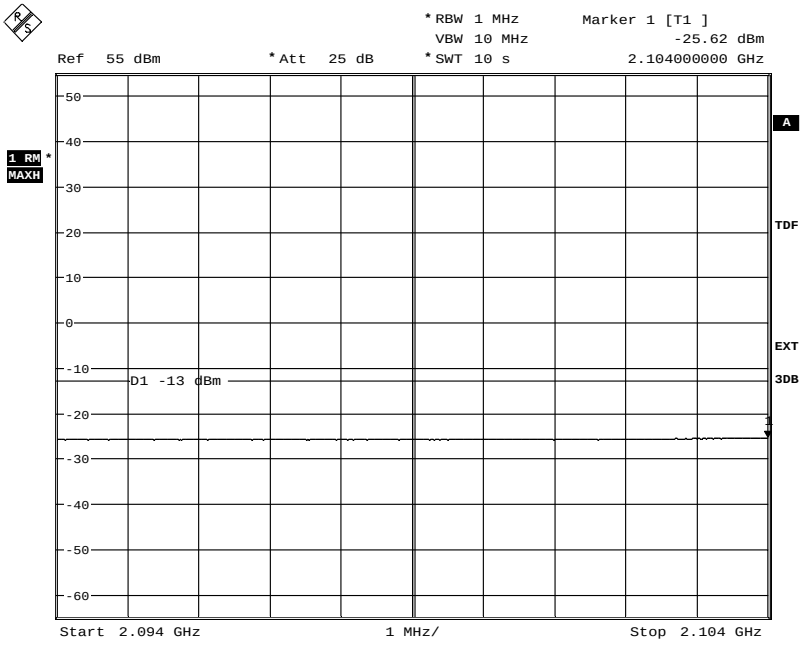
Diagram 4b:



Date: 13.MAY.2013 12:04:44

Appendix 4

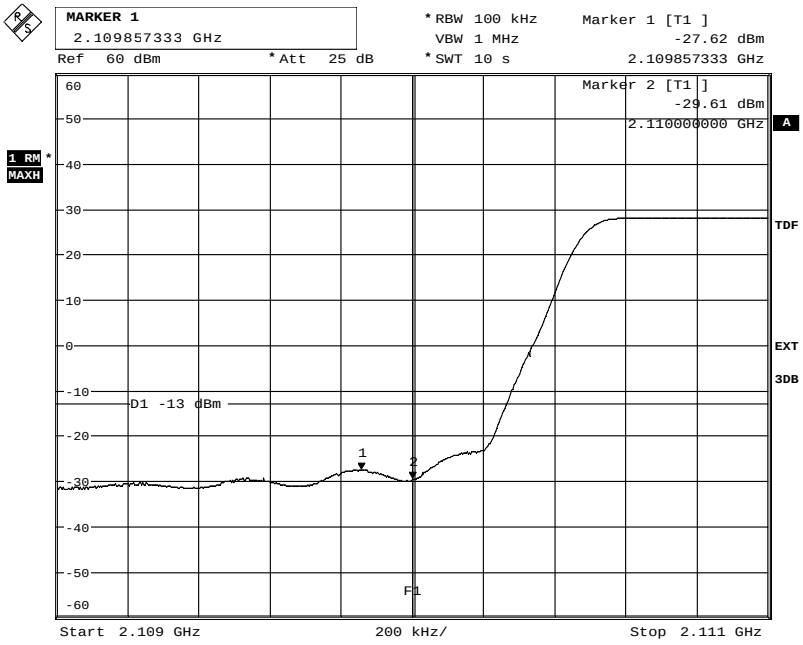
Diagram 4c:



Date: 13.MAY.2013 12:03:34

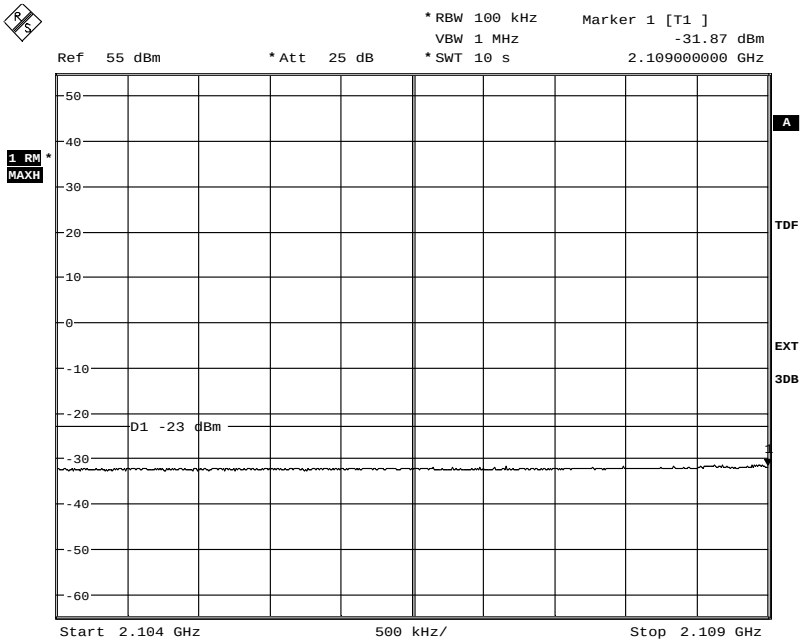
Appendix 4

Diagram 5a:



Date: 13.MAY.2013 12:27:28

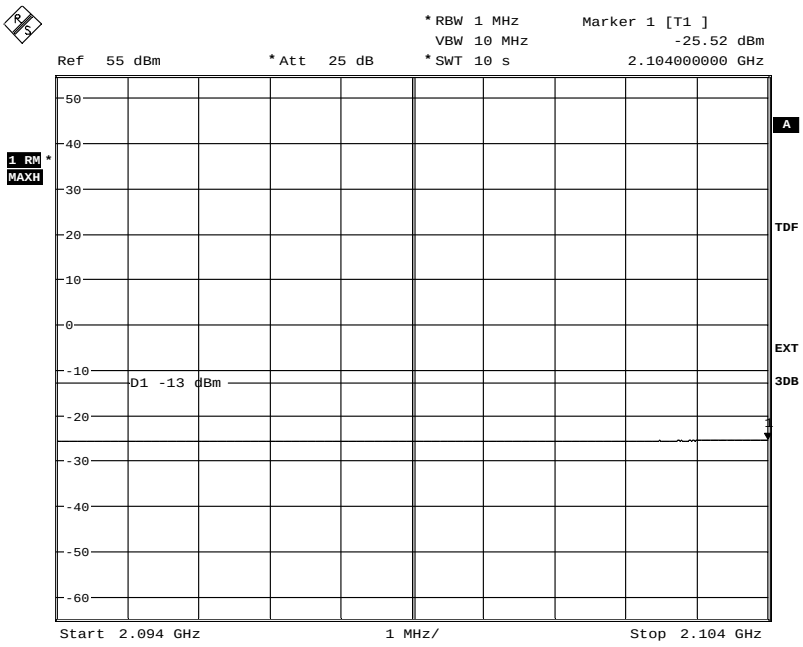
Diagram 5b:



Date: 13.MAY.2013 12:35:16

Appendix 4

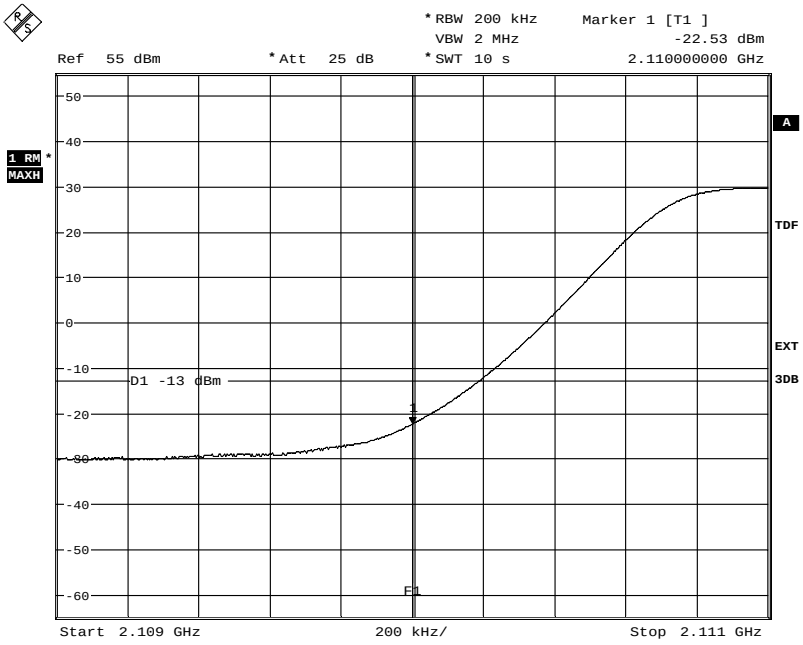
Diagram 5c:



Date: 13.MAY.2013 12:40:36

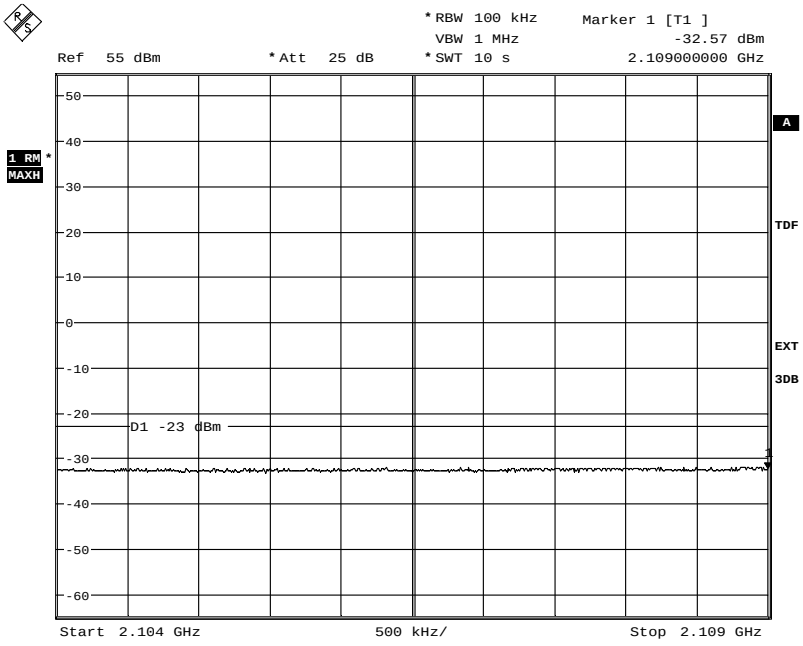
Appendix 4

Diagram 6a:



Date: 13.MAY.2013 12:44:39

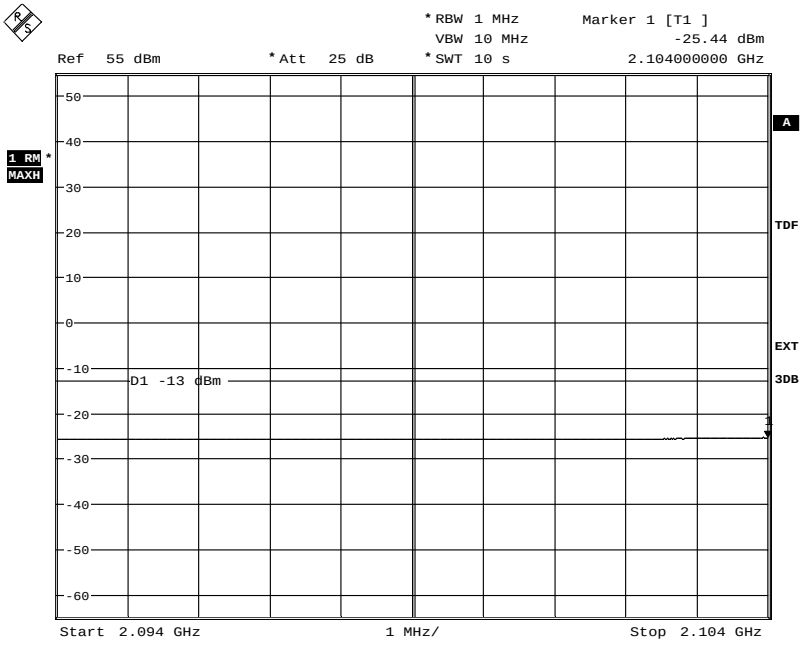
Diagram 6b:



Date: 13.MAY.2013 12:43:36

Appendix 4

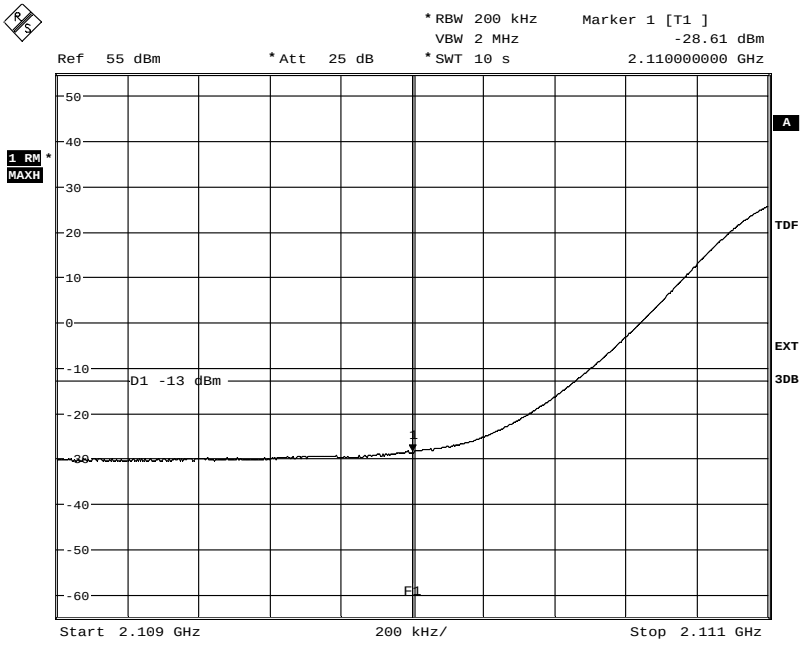
Diagram 6c:



Date: 13.MAY.2013 12:42:41

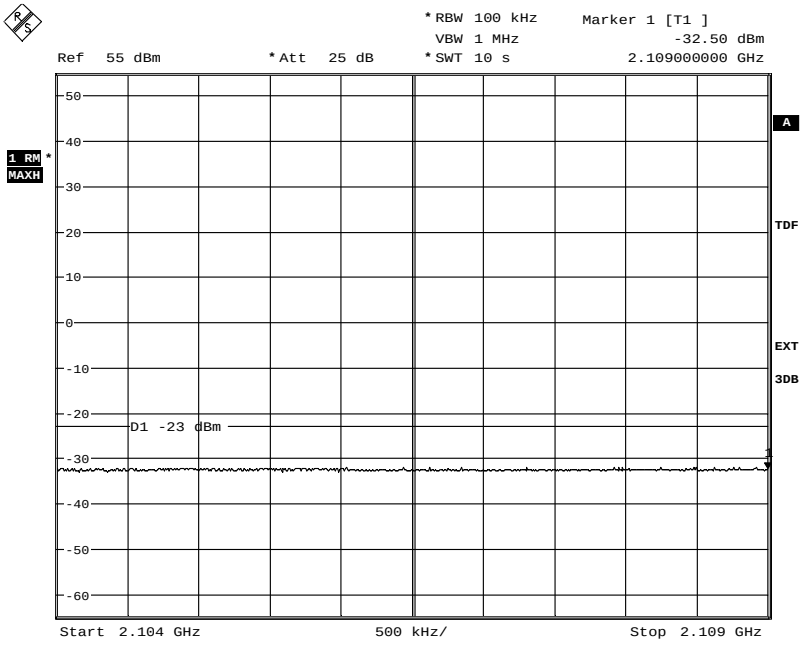
Appendix 4

Diagram 7a:



Date: 13.MAY.2013 11:01:04

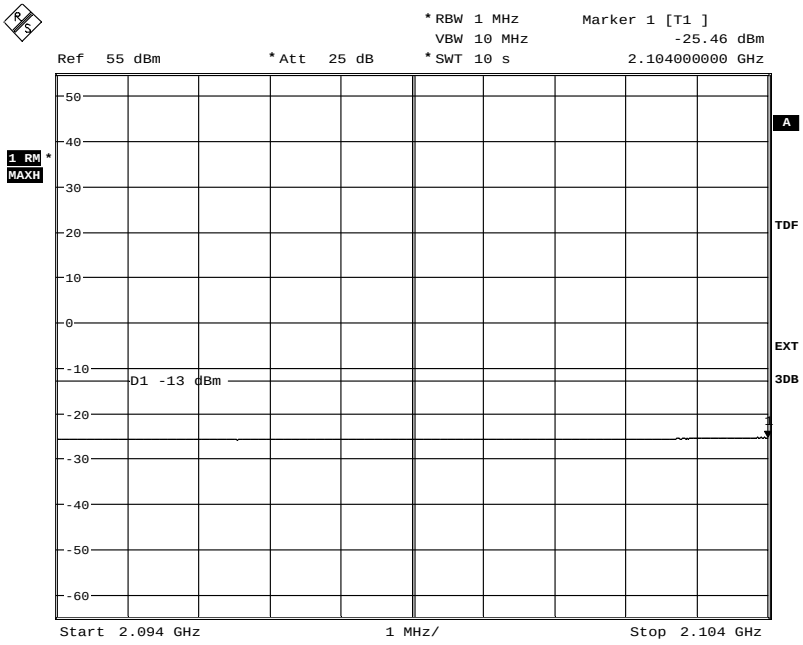
Diagram 7b:



Date: 13.MAY.2013 11:02:08

Appendix 4

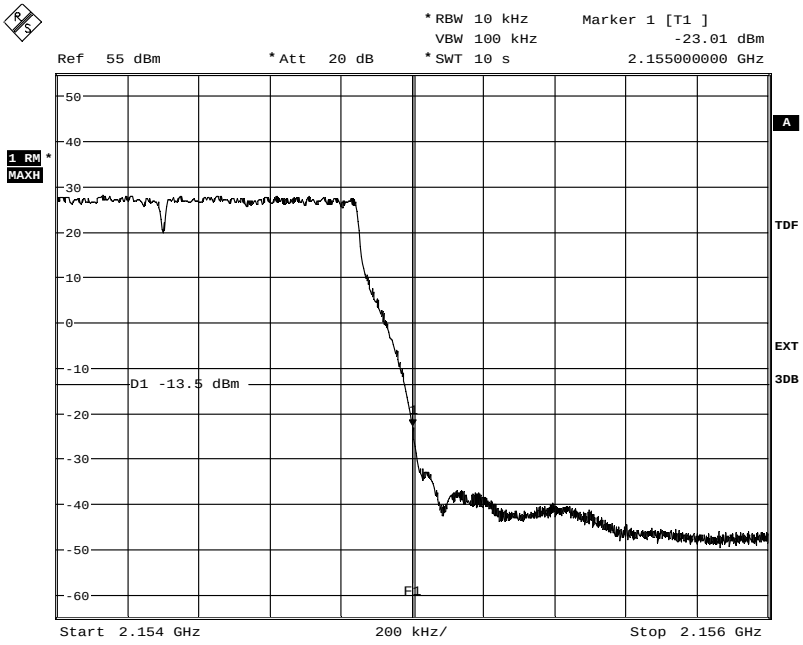
Diagram 7c:



Date: 13.MAY.2013 11:03:14

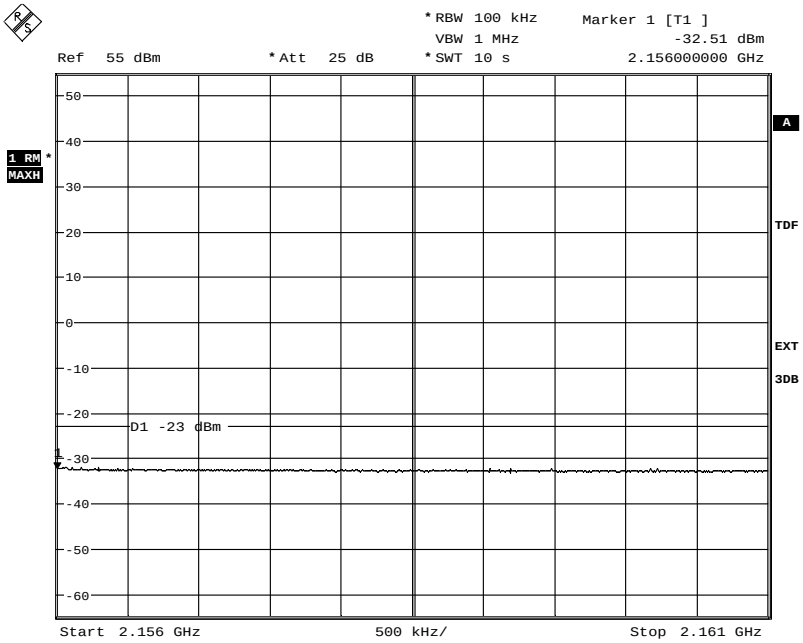
Appendix 4

Diagram 8a:



Date: 13.MAY.2013 13:45:27

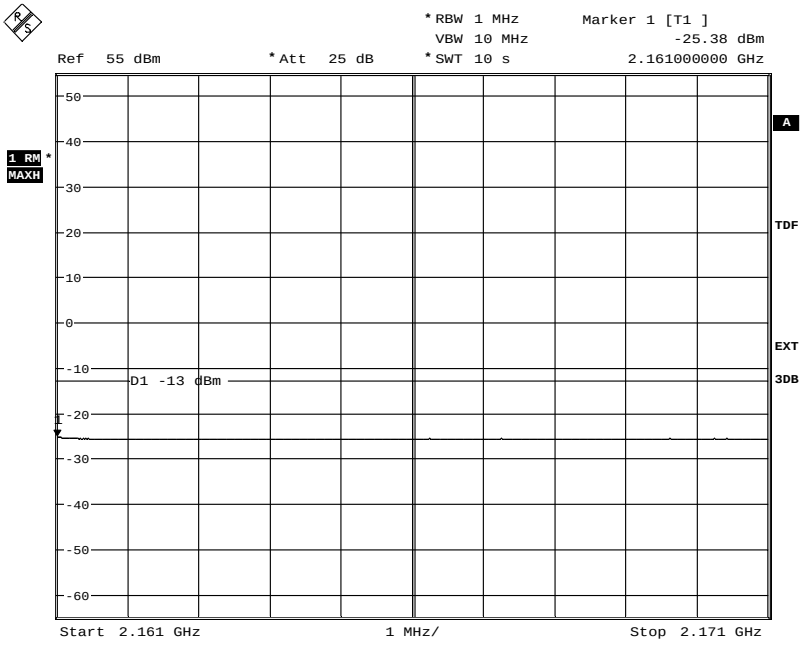
Diagram 8a:



Date: 13.MAY.2013 13:46:32

Appendix 4

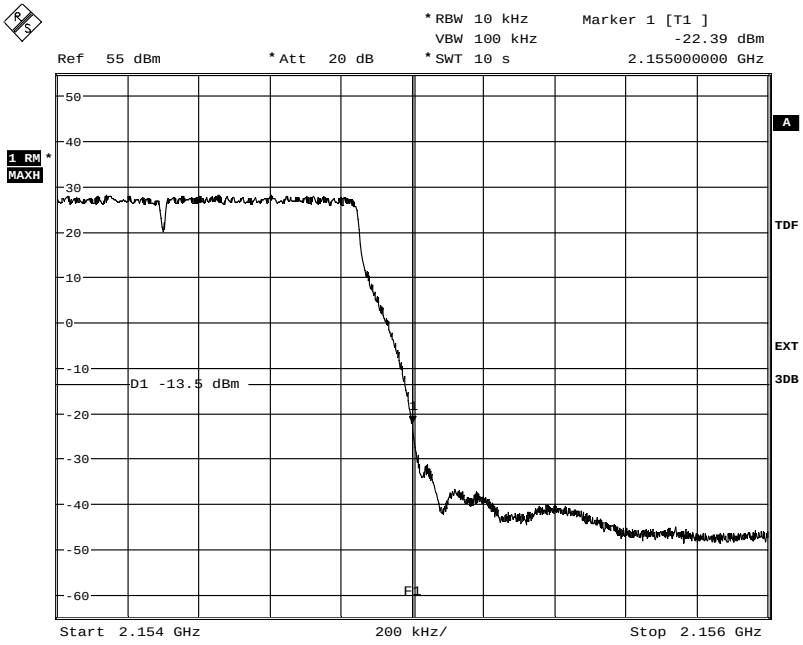
Diagram 8c:



Date: 13.MAY.2013 13:47:30

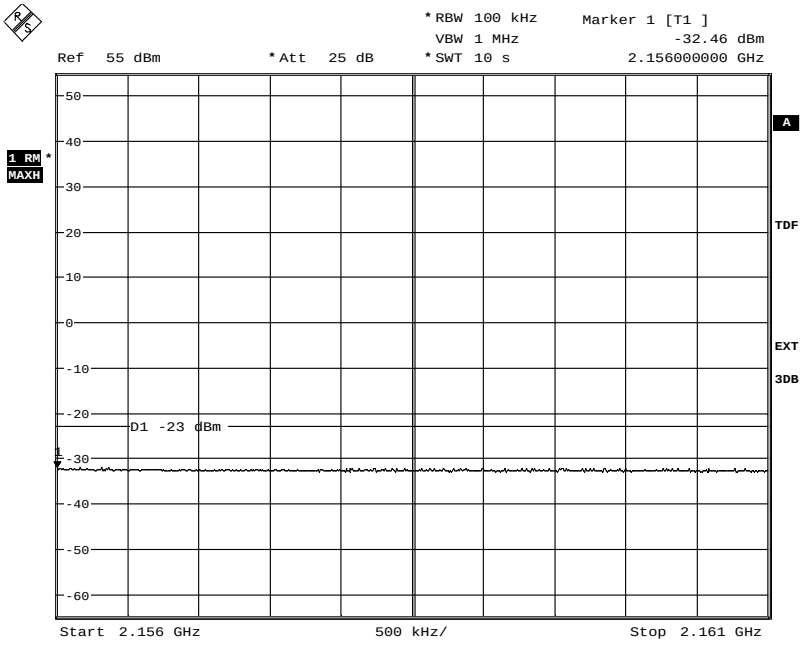
Appendix 4

Diagram 9a:



Date: 13.MAY.2013 13:28:01

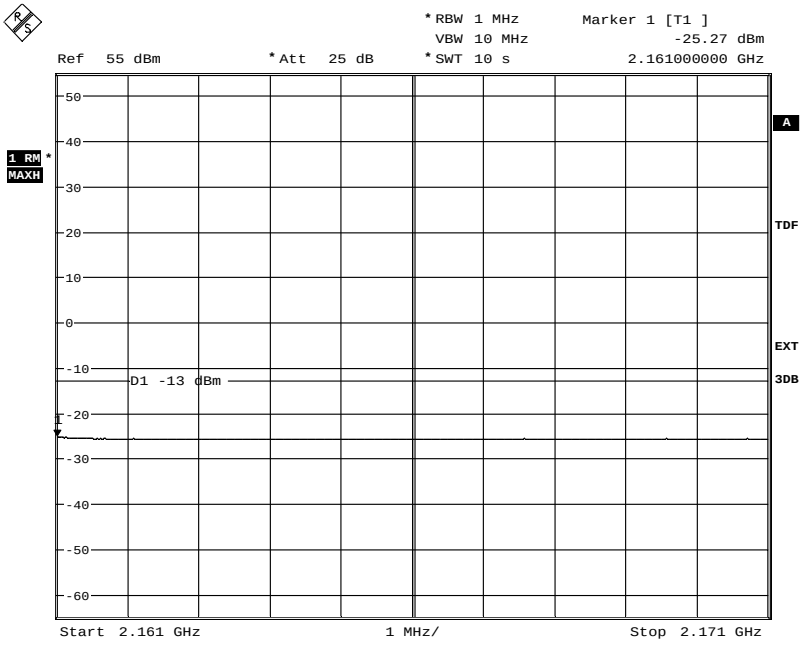
Diagram 9b:



Date: 13.MAY.2013 13:29:09

Appendix 4

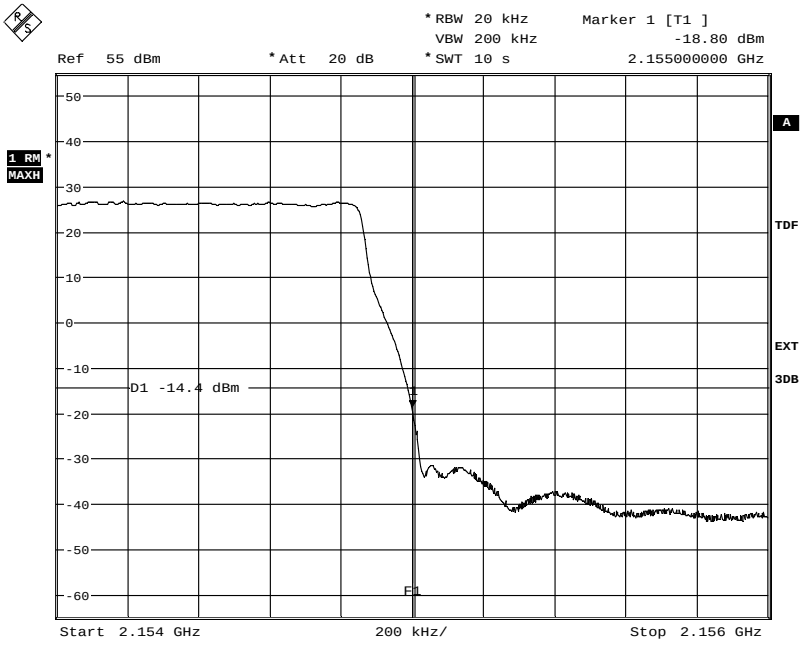
Diagram 9c



Date: 13.MAY.2013 13:30:29

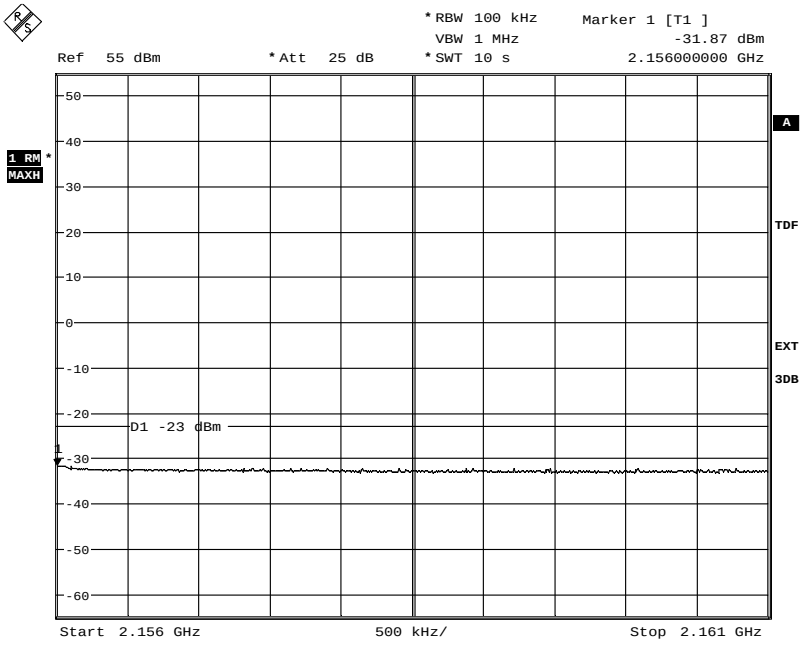
Appendix 4

Diagram 10a:



Date: 13.MAY.2013 13:40:08

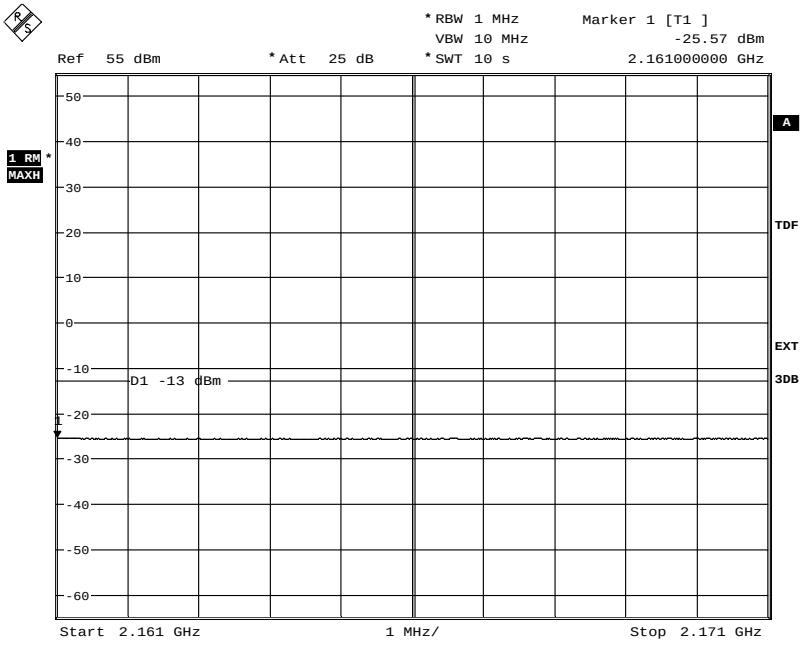
Diagram 10b:



Date: 13.MAY.2013 13:41:04

Appendix 4

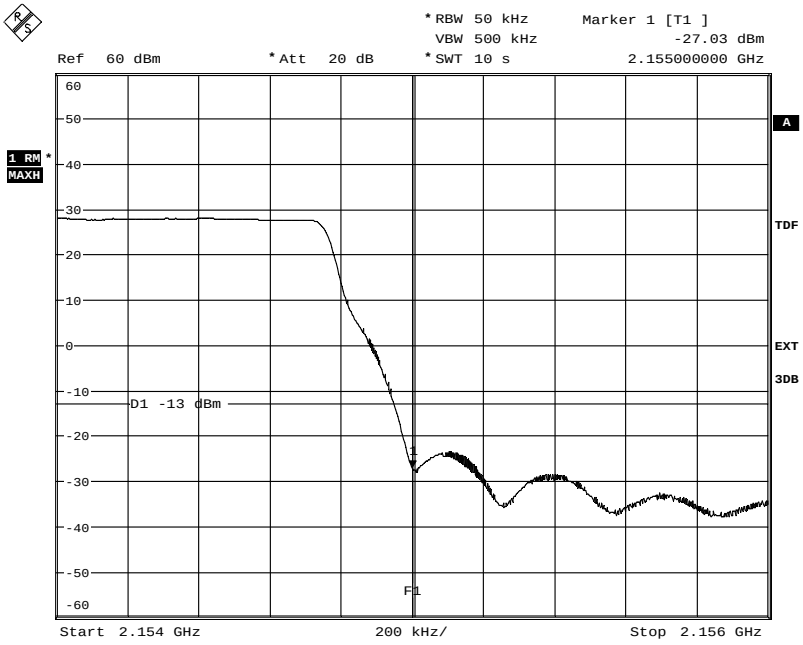
Diagram 10c:



Date: 13.MAY.2013 13:41:57

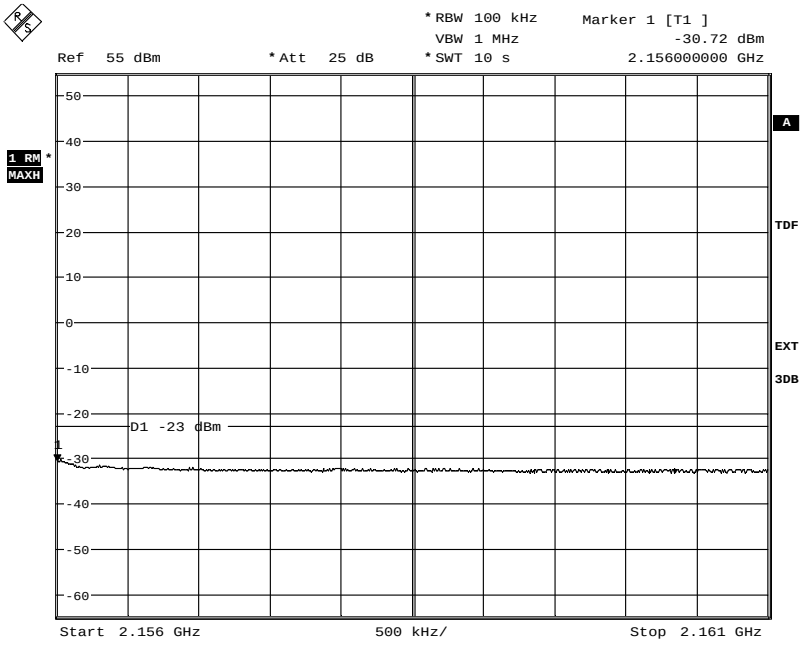
Appendix 4

Diagram 11a:



Date: 13.MAY.2013 14:37:49

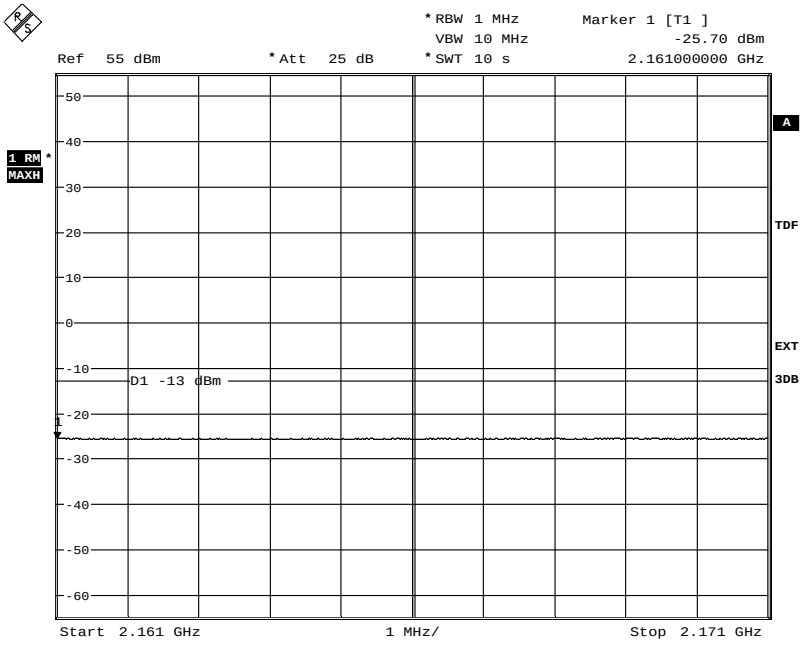
Diagram 11b:



Date: 13.MAY.2013 14:38:41

Appendix 4

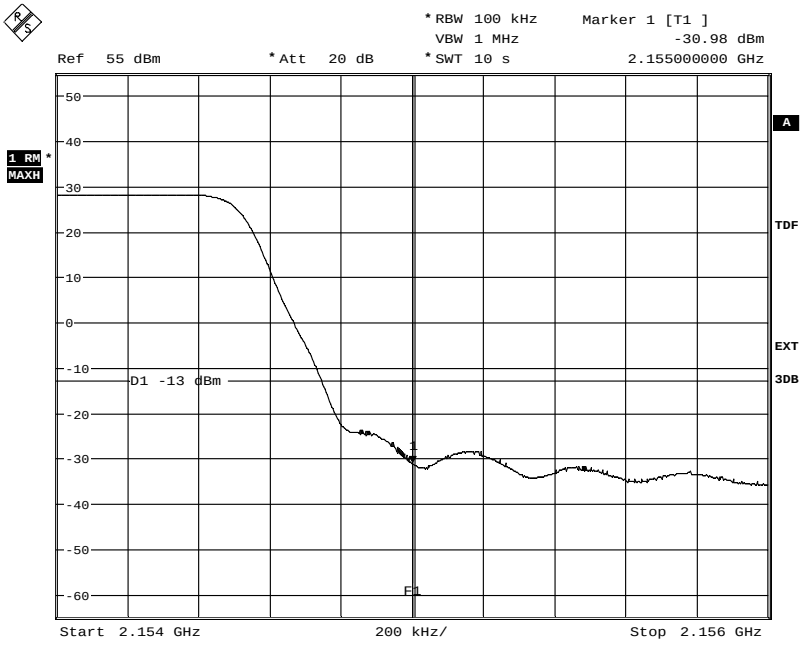
Diagram 11c:



Date: 13.MAY.2013 14:39:38

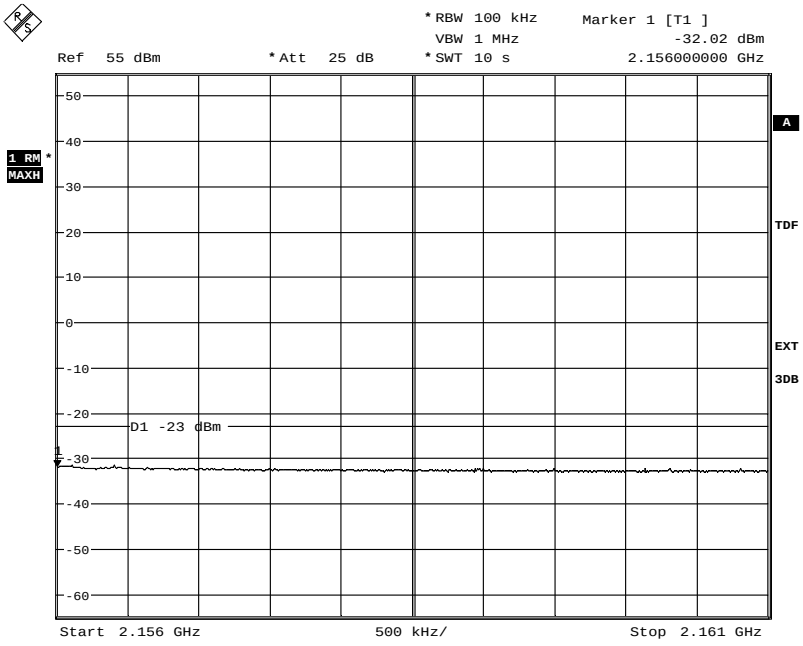
Appendix 4

Diagram 12a:



Date: 13.MAY.2013 14:32:42

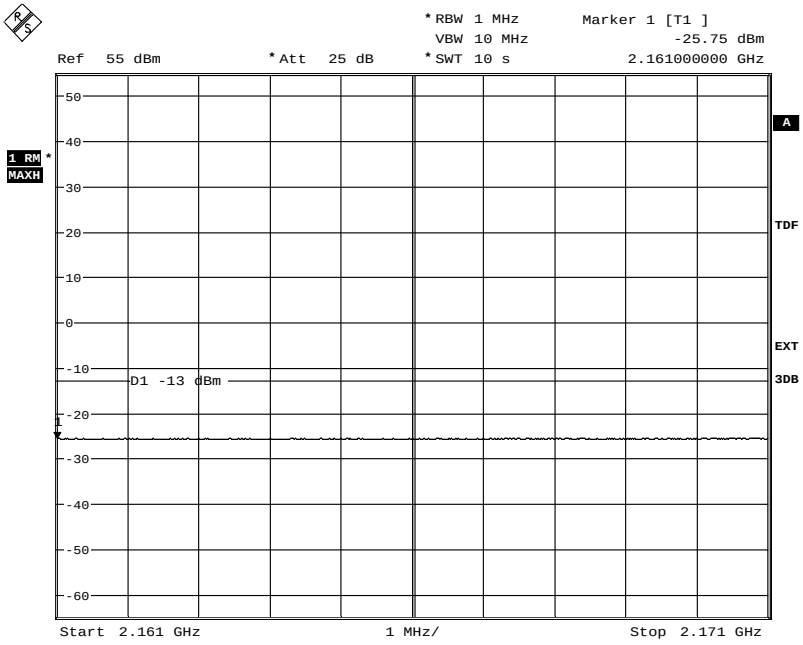
Diagram 12b:



Date: 13.MAY.2013 14:33:37

Appendix 4

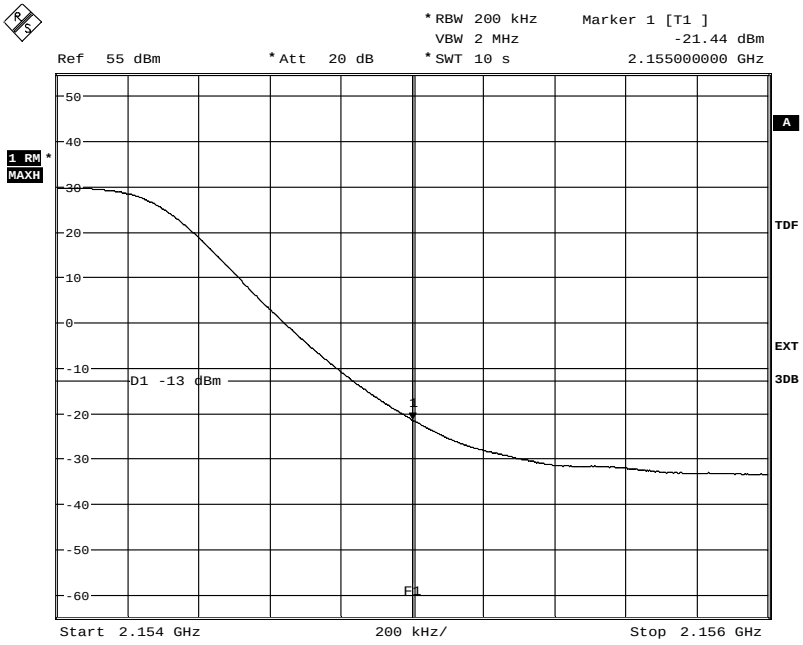
Diagram 12c:



Date: 13.MAY.2013 14:34:35

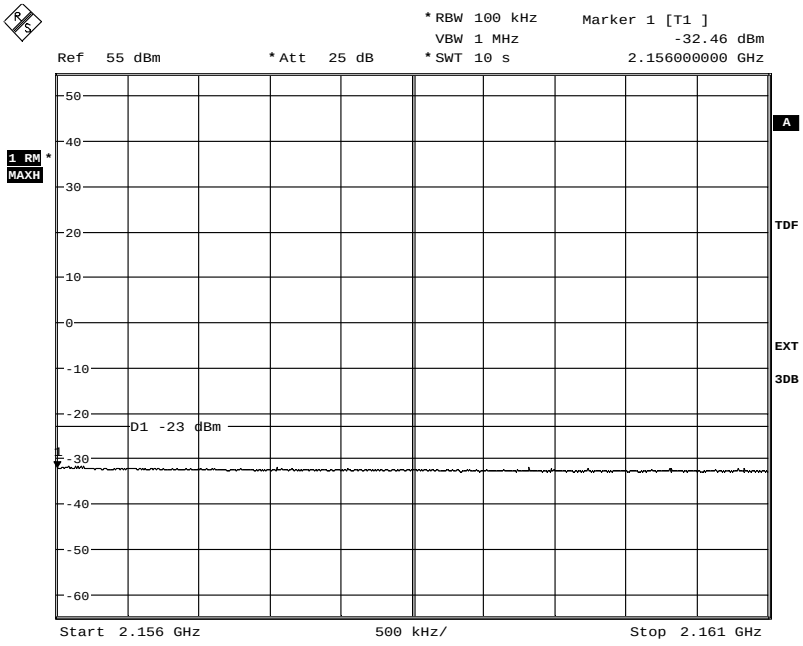
Appendix 4

Diagram 13a:



Date: 13.MAY.2013 14:30:23

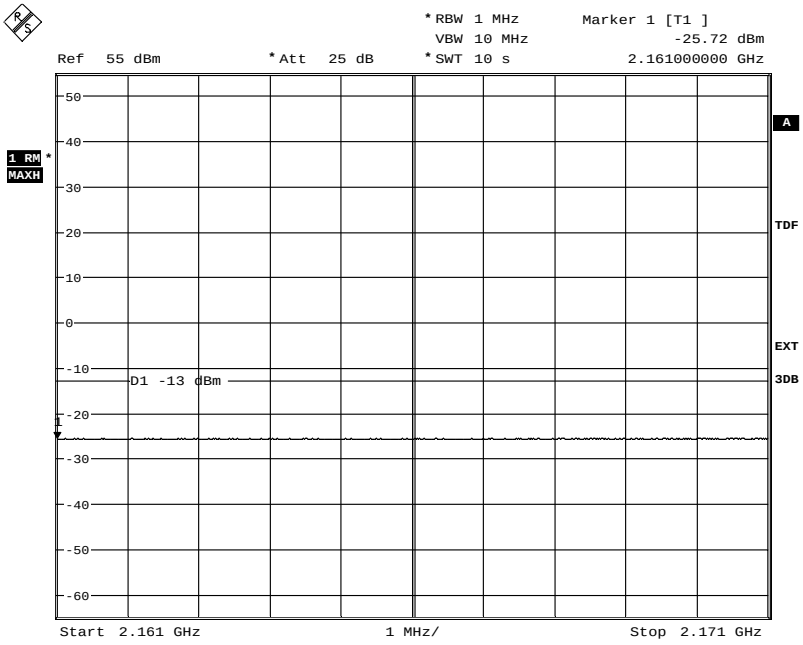
Diagram 13b:



Date: 13.MAY.2013 14:29:05

Appendix 4

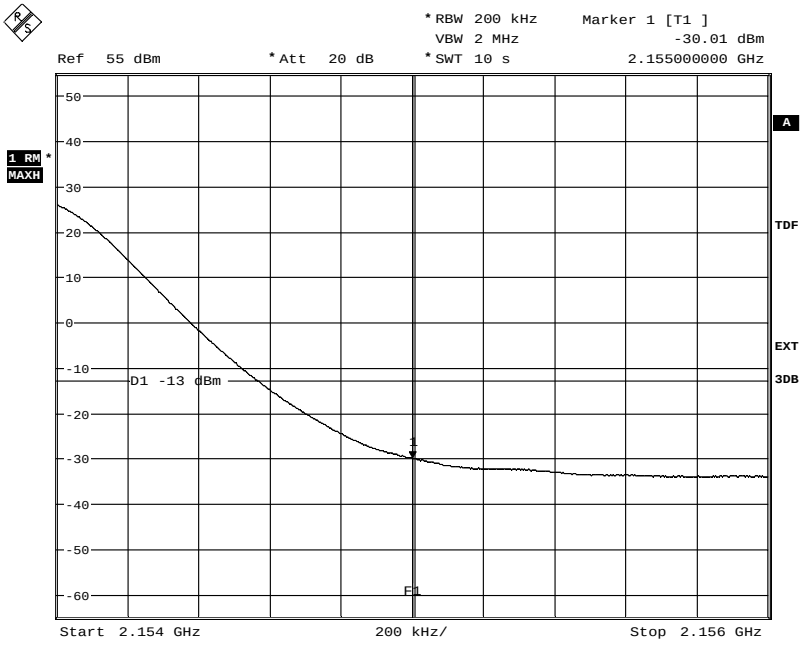
Diagram 13c:



Date: 13.MAY.2013 14:28:11

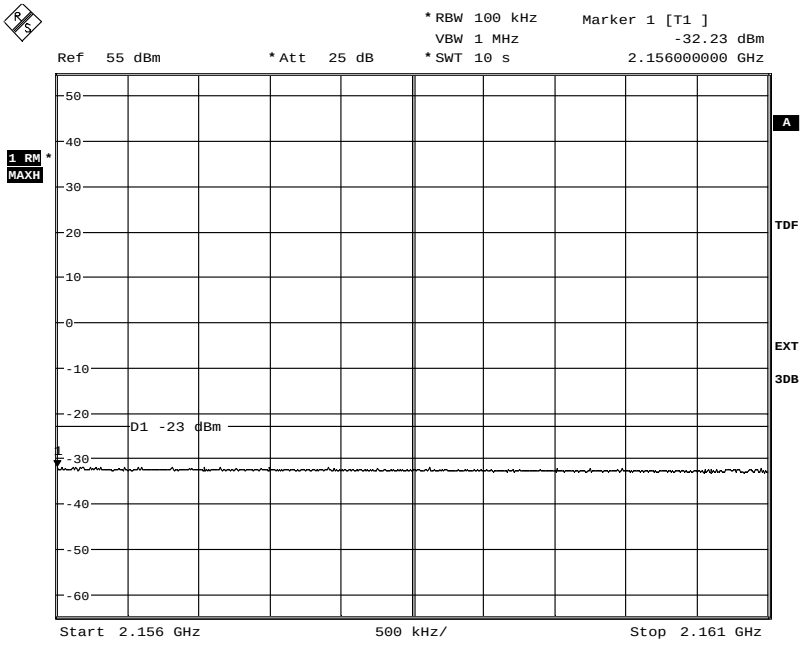
Appendix 4

Diagram 14a:



Date: 13.MAY.2013 14:24:13

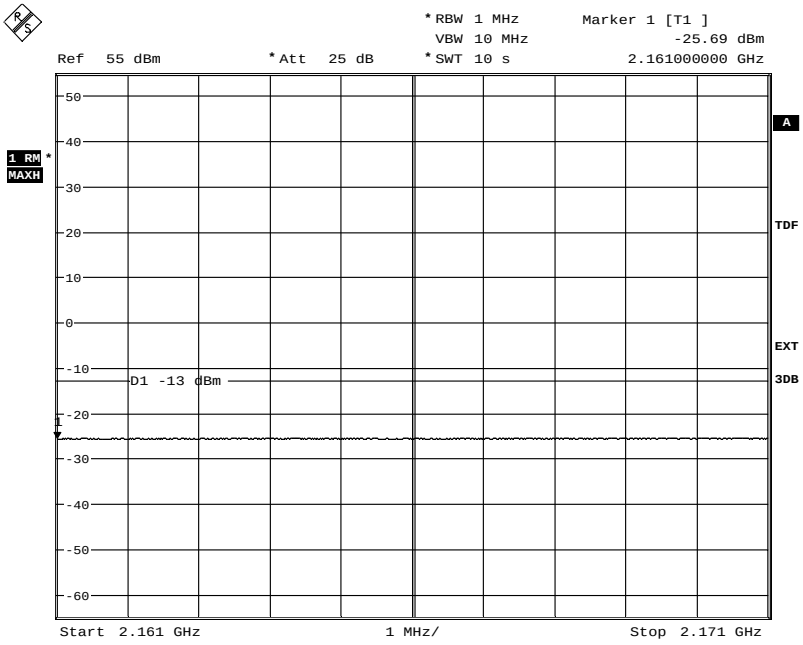
Diagram 14b:



Date: 13.MAY.2013 14:25:19

Appendix 4

Diagram 14c:



Date: 13.MAY.2013 14:26:13

Appendix 5

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

Date	Temperature	Humidity
2013-05-07	23 °C ± 3 °C	30 % ± 5 %
2013-05-08	22 °C ± 3 °C	35 % ± 5 %
2013-05-13	22 °C ± 3 °C	38 % ± 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 2 “measure and add 10 log(N_{ANT})” of FCC KDB662911 D01 Multiple Transmitter Output v01r02

Measurement equipment	SP number
R&S FSQ	504 143
RF attenuator	901 508
HP filter	901 502
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

MIMO mode, 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

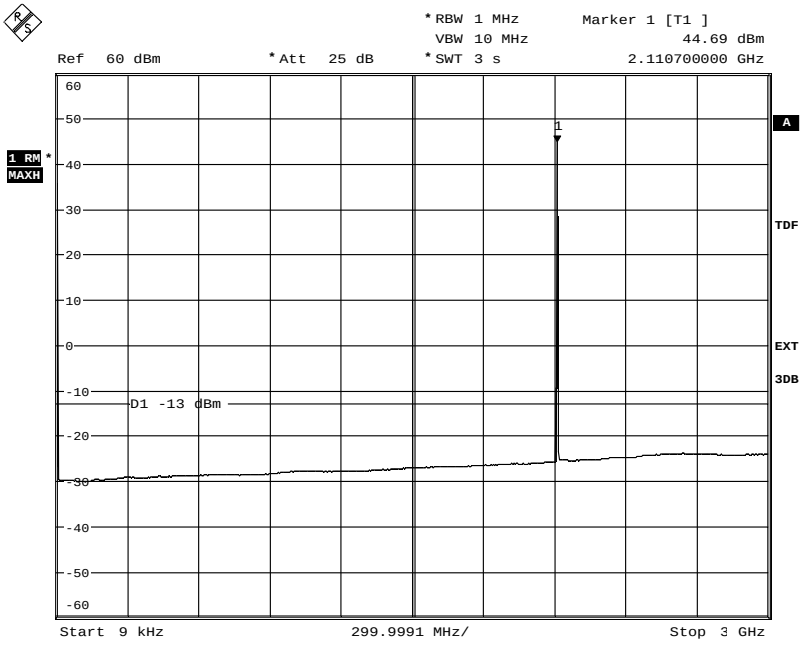
MIMO mode, multi carrier

Diagram	BW configuration	Tested frequency	Tested Port
13 a+b+c+d+e	1.4 MHz	Bim2	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.

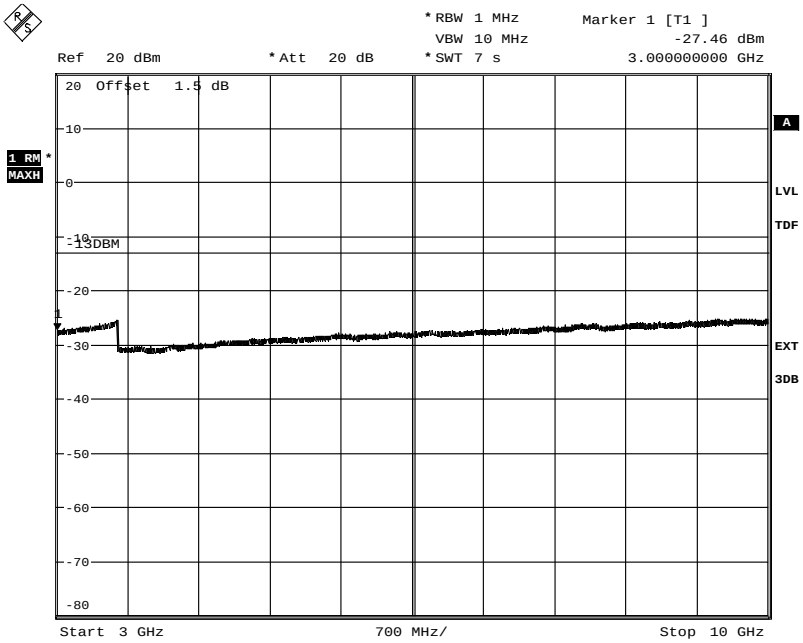
Appendix 5

Diagram 1a:



Date: 13.MAY.2013 10:49:03

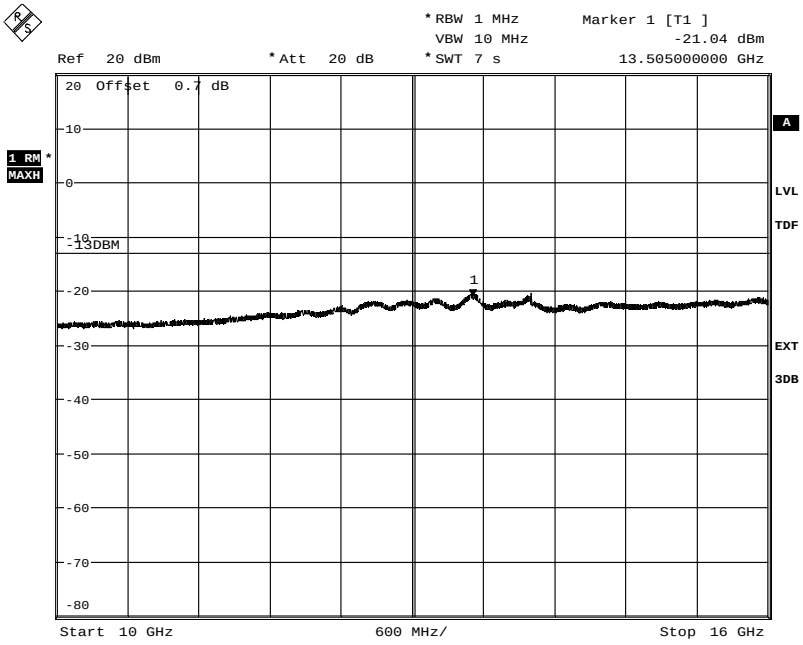
Diagram 1b:



Date: 13.MAY.2013 10:50:26

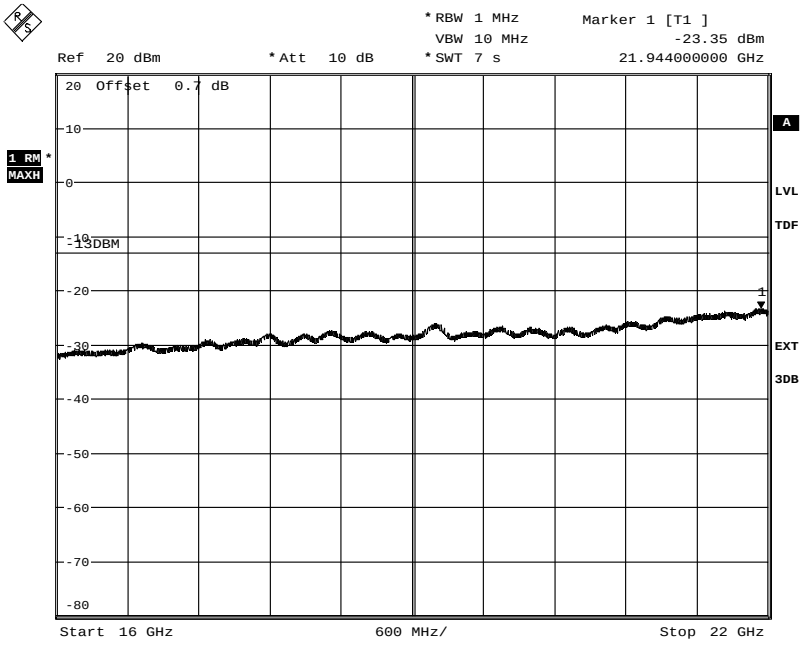
Appendix 5

Diagram 1c:



Date: 13.MAY.2013 10:51:19

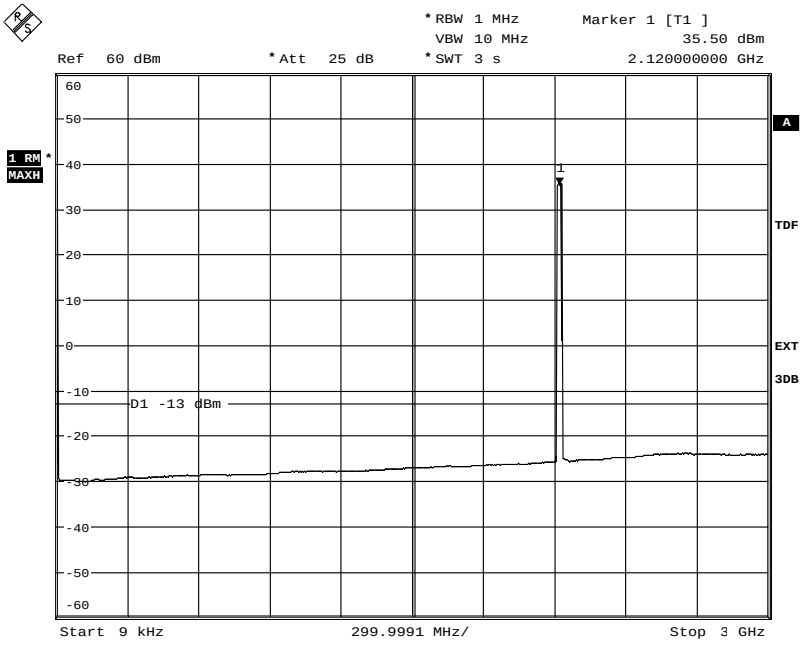
Diagram 1d:



Date: 13.MAY.2013 10:52:37

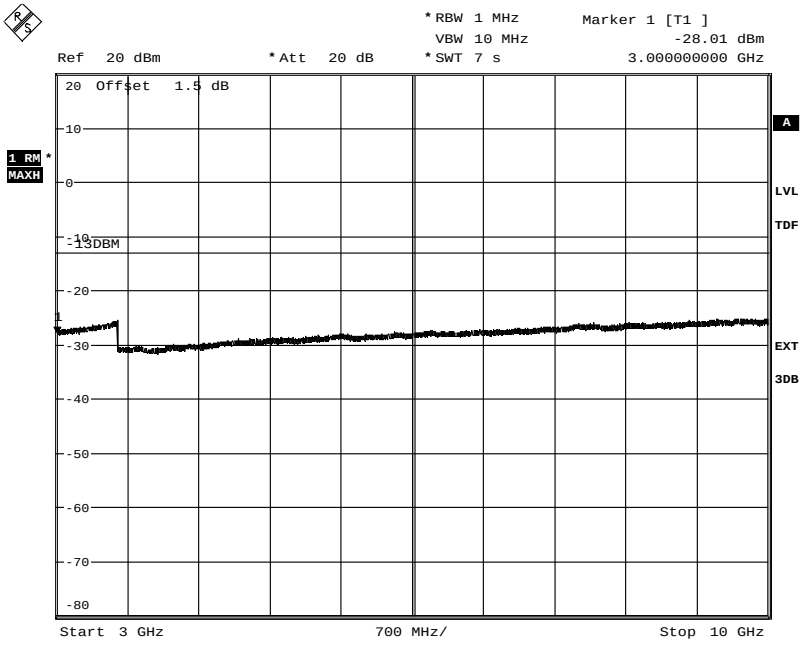
Appendix 5

Diagram 2a:



Date: 13.MAY.2013 10:58:31

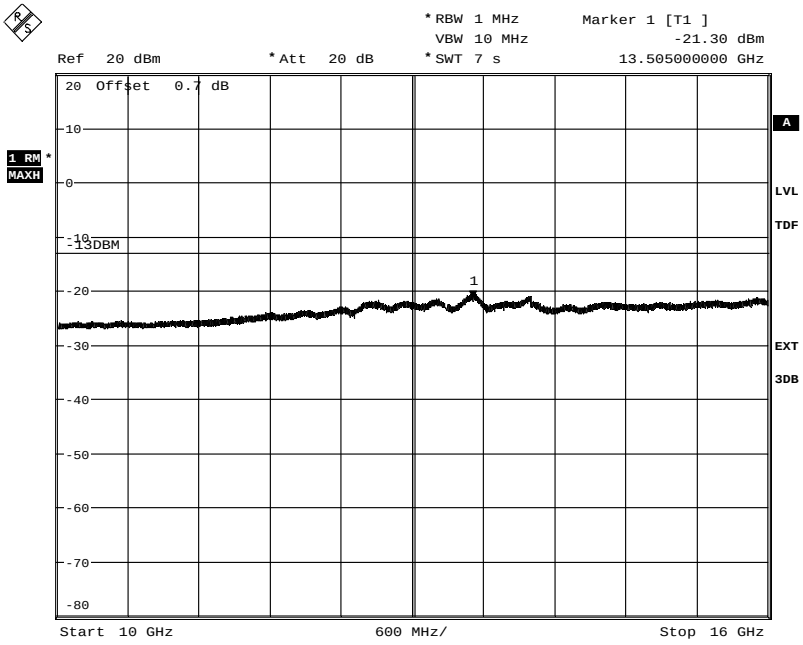
Diagram 2b:



Date: 13.MAY.2013 10:57:05

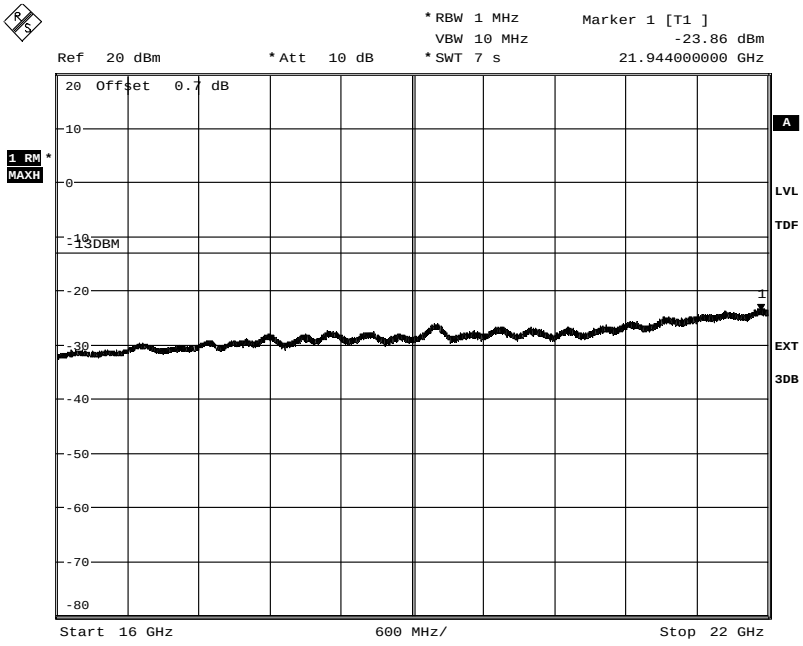
Appendix 5

Diagram 2c:



Date: 13.MAY.2013 10:56:12

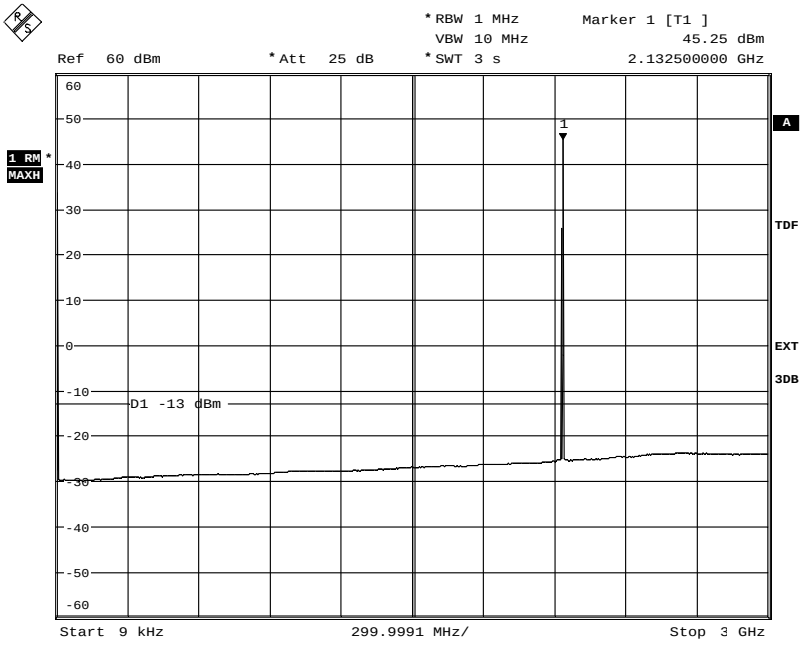
Diagram 2d:



Date: 13.MAY.2013 10:55:16

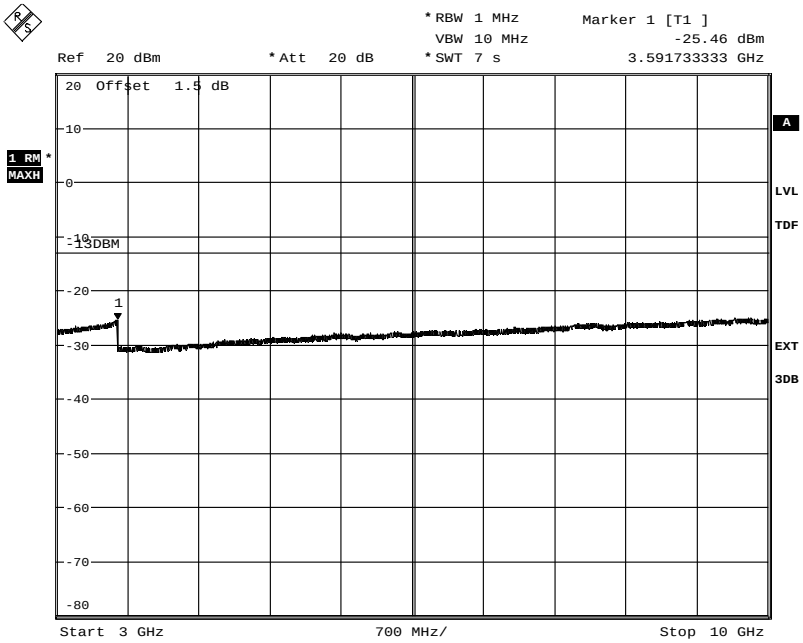
Appendix 5

Diagram 3a:



Date: 8.MAY.2013 12:31:16

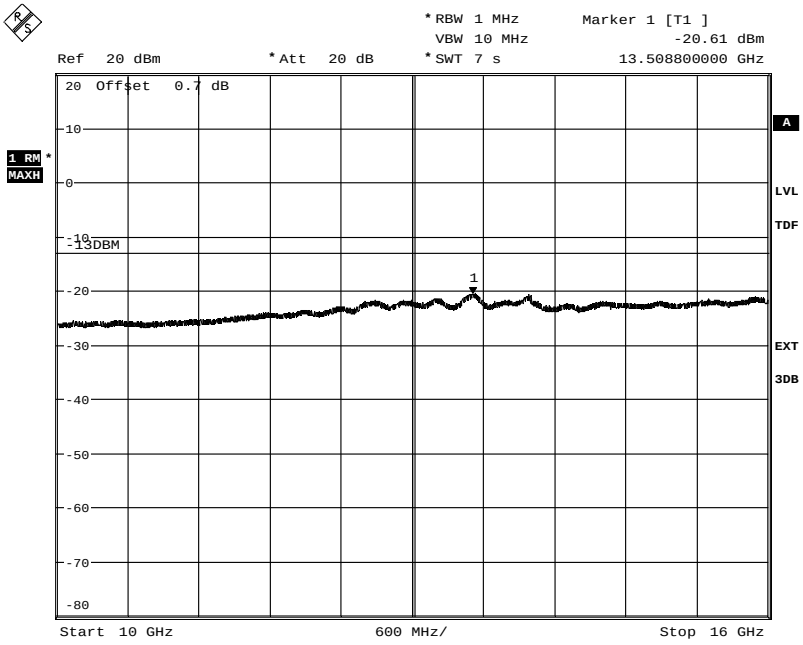
Diagram 3b:



Date: 8.MAY.2013 12:33:02

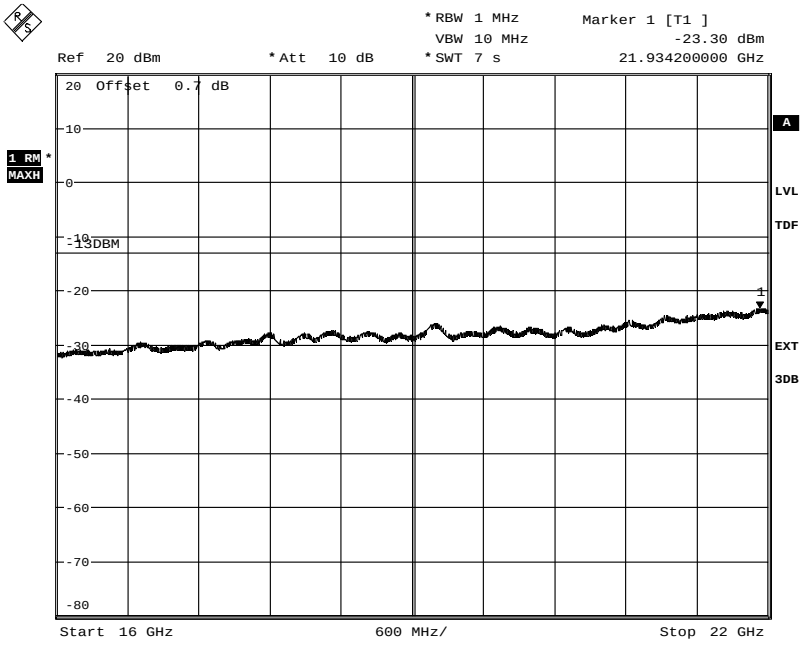
Appendix 5

Diagram 3c:



Date: 8.MAY.2013 12:34:05

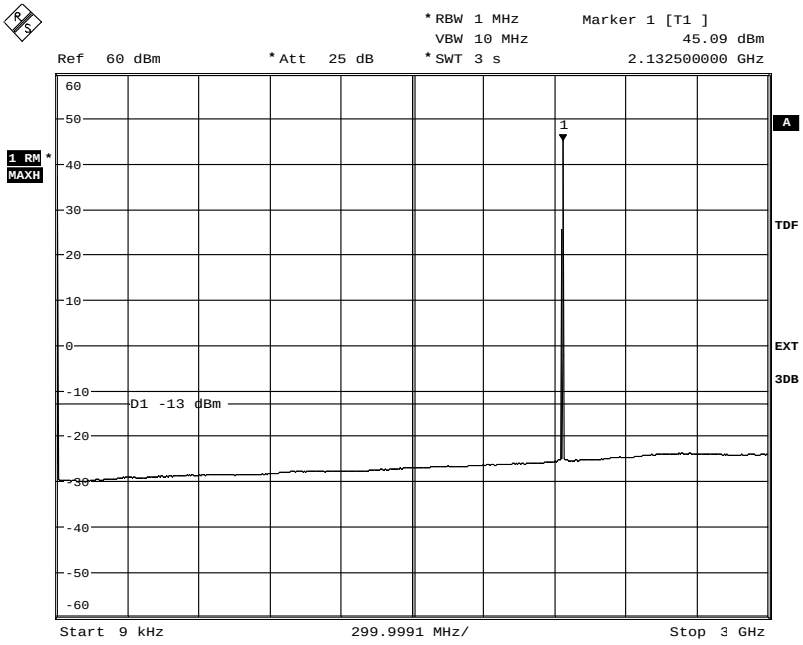
Diagram 3d:



Date: 8.MAY.2013 12:35:01

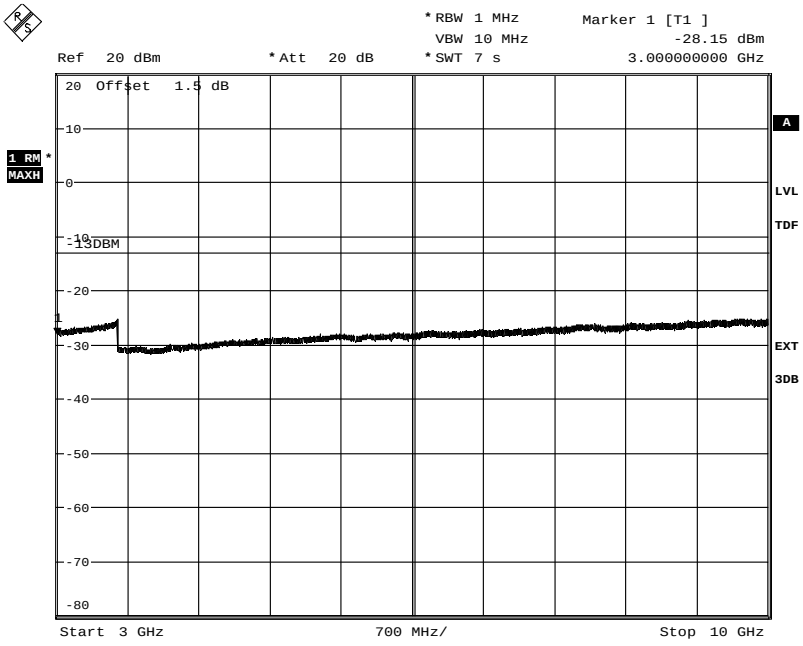
Appendix 5

Diagram 4a:



Date: 13.MAY.2013 09:34:09

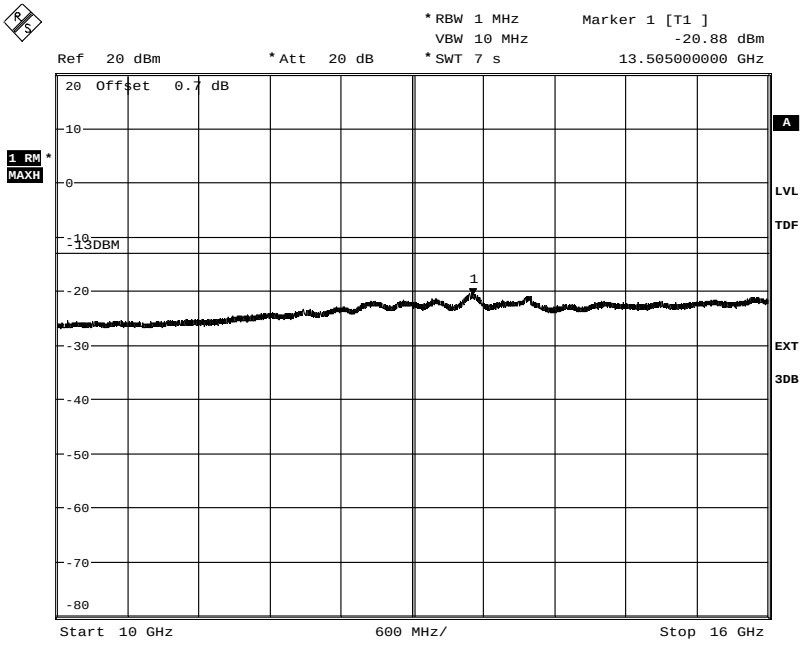
Diagram 4b:



Date: 13.MAY.2013 09:32:32

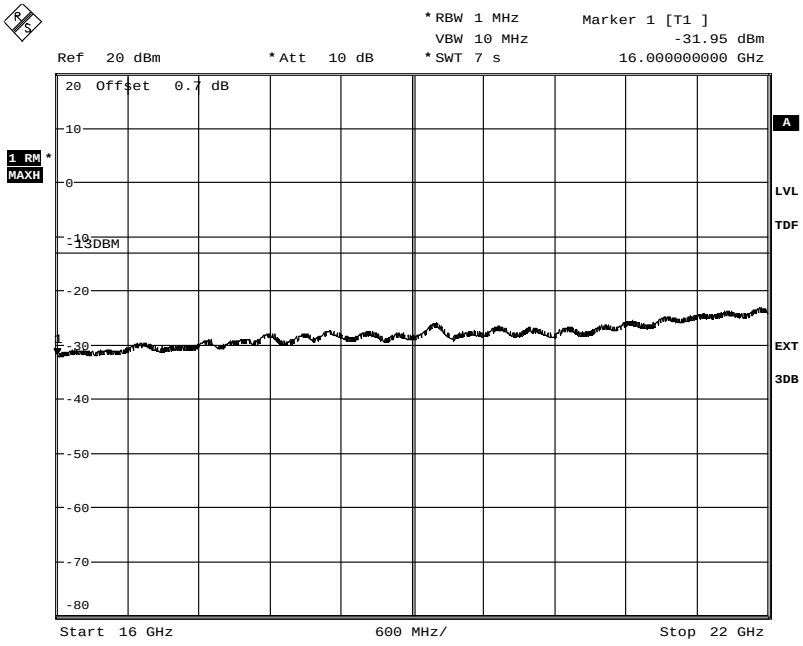
Appendix 5

Diagram 4a:



Date: 13.MAY.2013 09:31:11

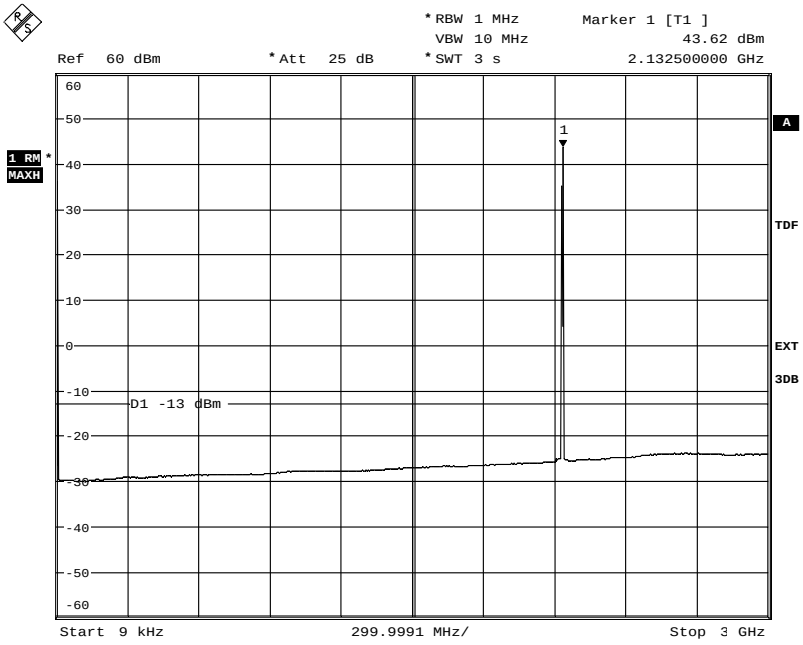
Diagram 4b:



Date: 13.MAY.2013 09:29:55

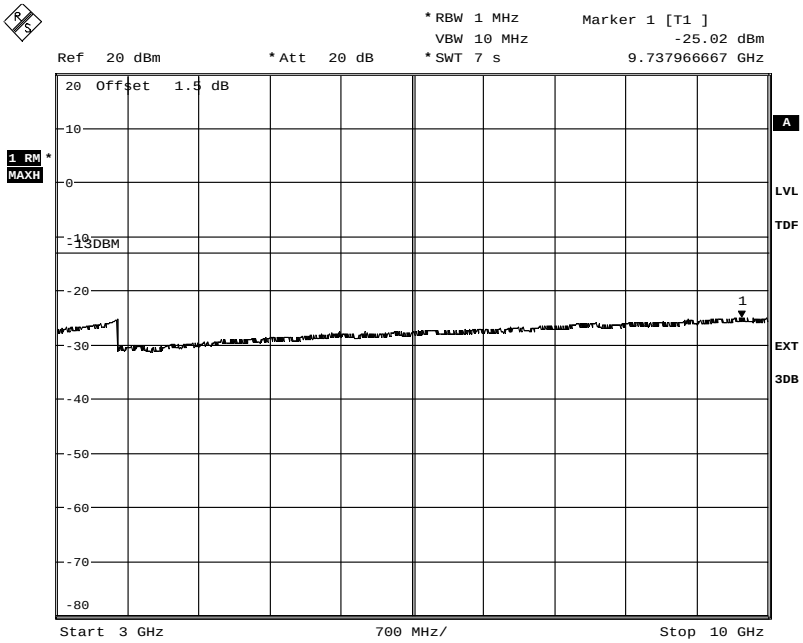
Appendix 5

Diagram 5a:



Date: 8.MAY.2013 09:09:06

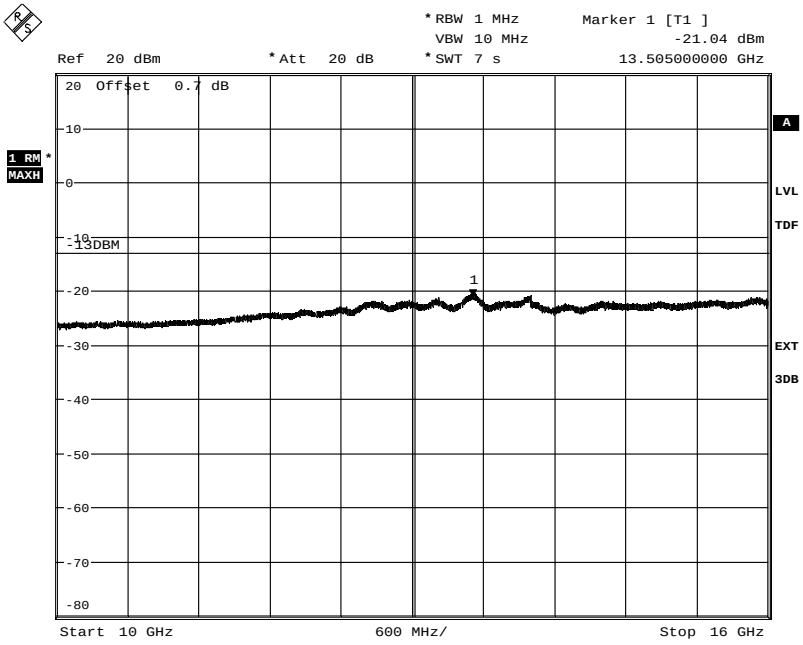
Diagram 5b:



Date: 8.MAY.2013 09:07:21

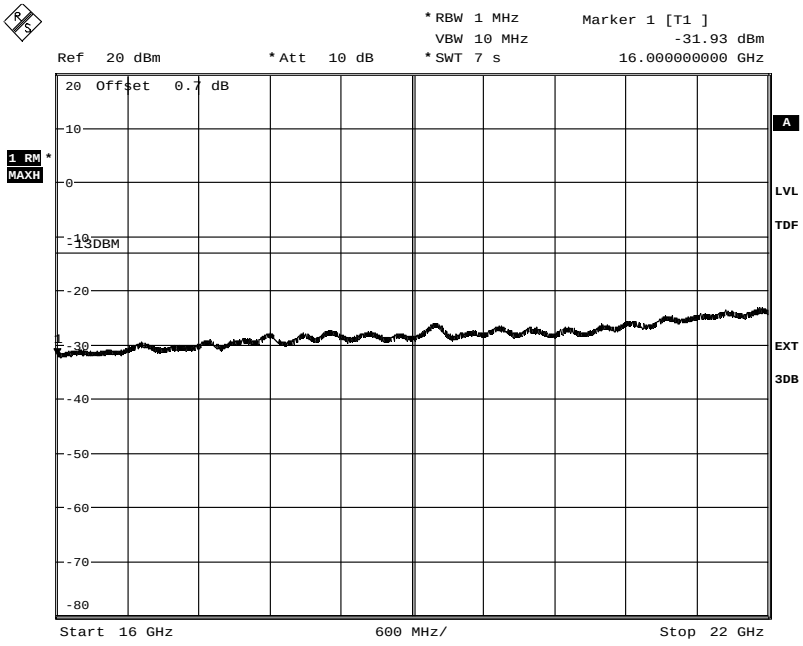
Appendix 5

Diagram 5c:



Date: 8.MAY.2013 09:04:56

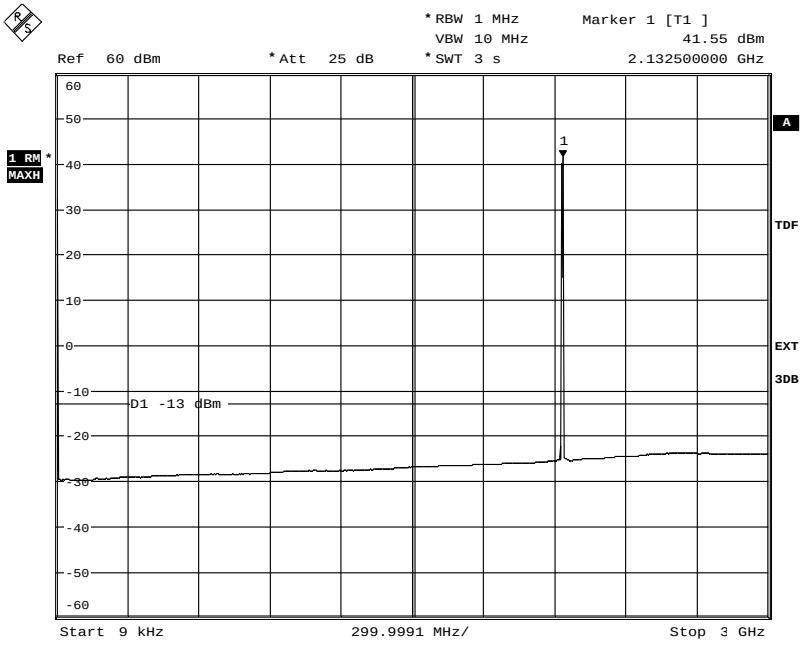
Diagram 5d:



Date: 8.MAY.2013 09:03:53

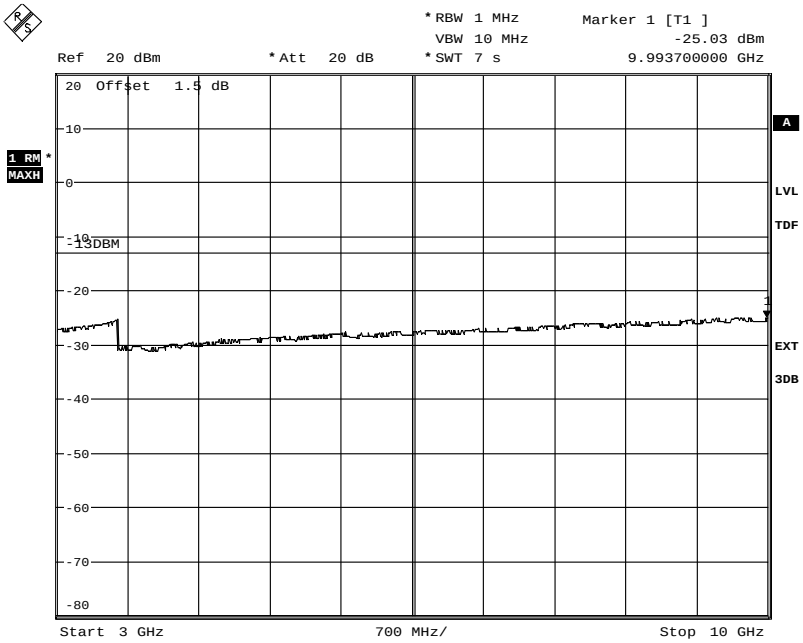
Appendix 5

Diagram 6a:



Date: 7.MAY.2013 15:34:16

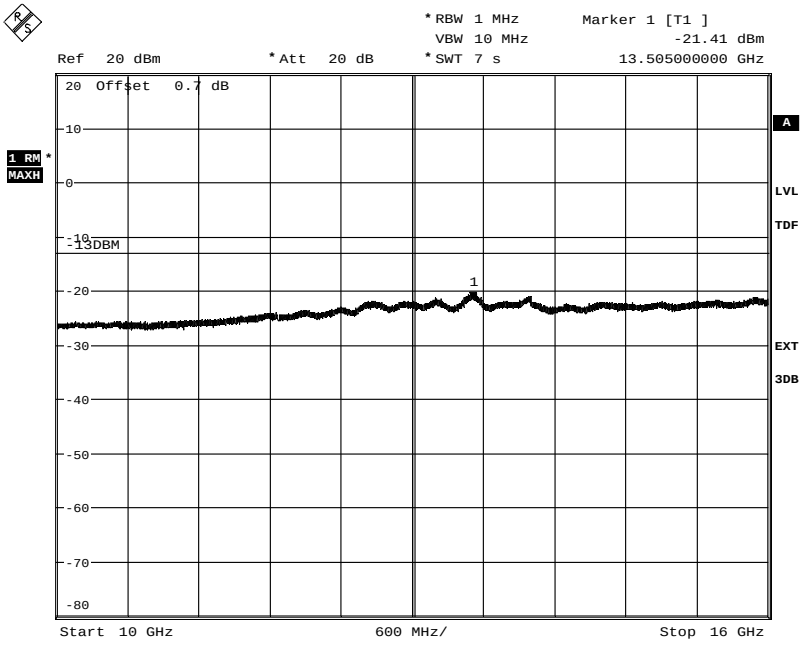
Diagram 6b:



Date: 8.MAY.2013 07:48:36

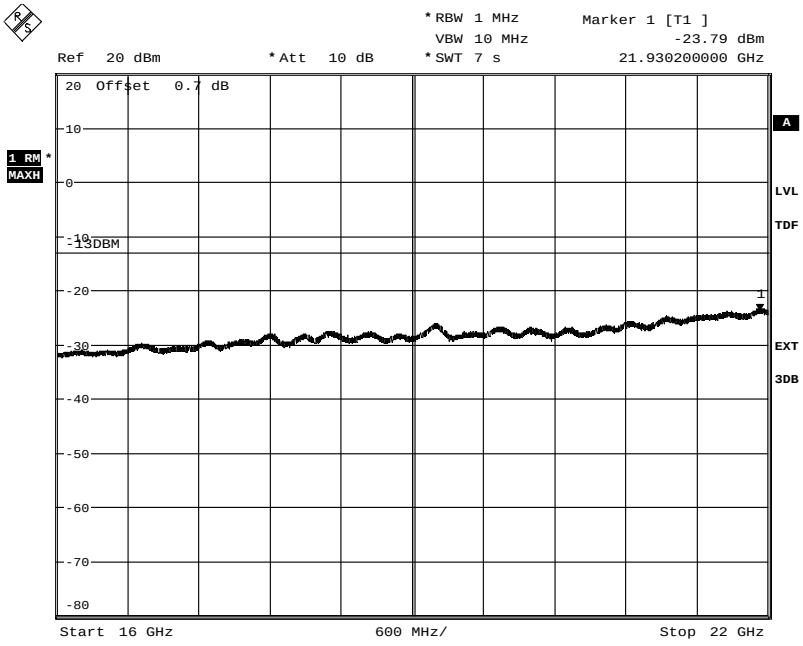
Appendix 5

Diagram 6c:



Date: 8.MAY.2013 07:49:44

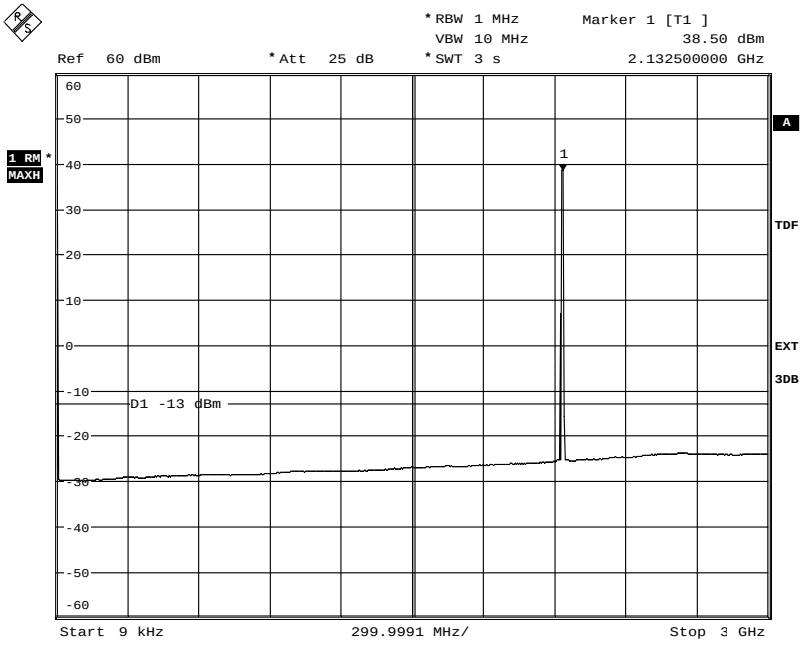
Diagram 6d:



Date: 8.MAY.2013 07:50:42

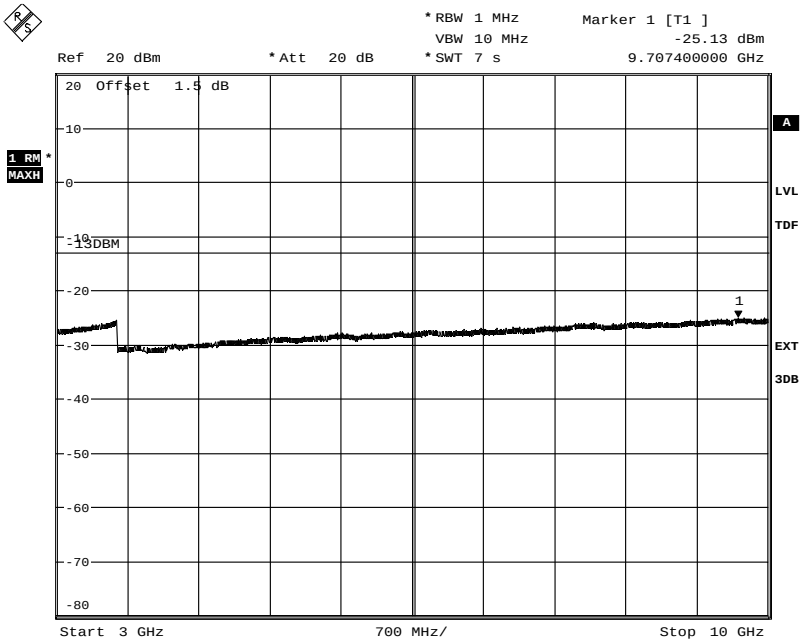
Appendix 5

Diagram 7a:



Date: 8.MAY.2013 12:41:16

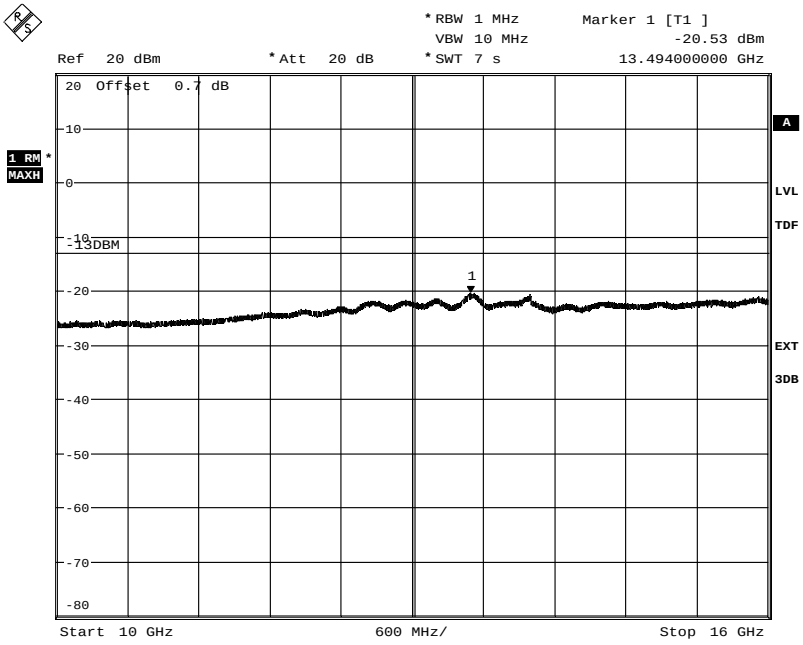
Diagram 7b:



Date: 8.MAY.2013 12:39:43

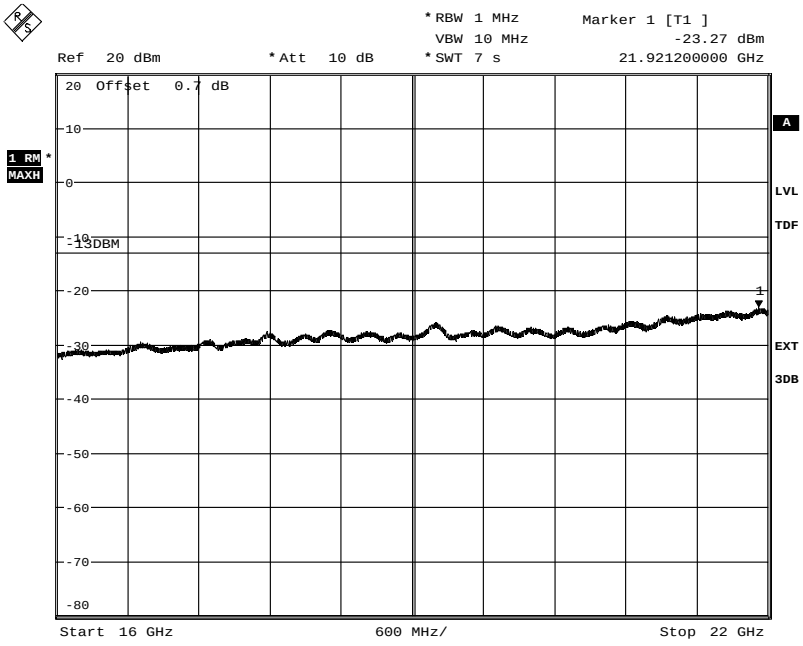
Appendix 5

Diagram 7c:



Date: 8.MAY.2013 12:38:42

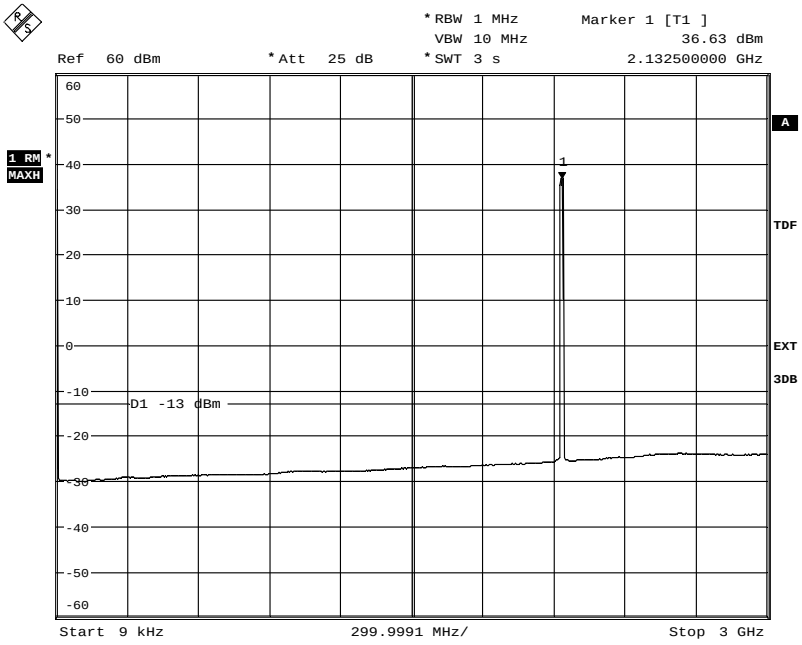
Diagram 7d:



Date: 8.MAY.2013 12:37:55

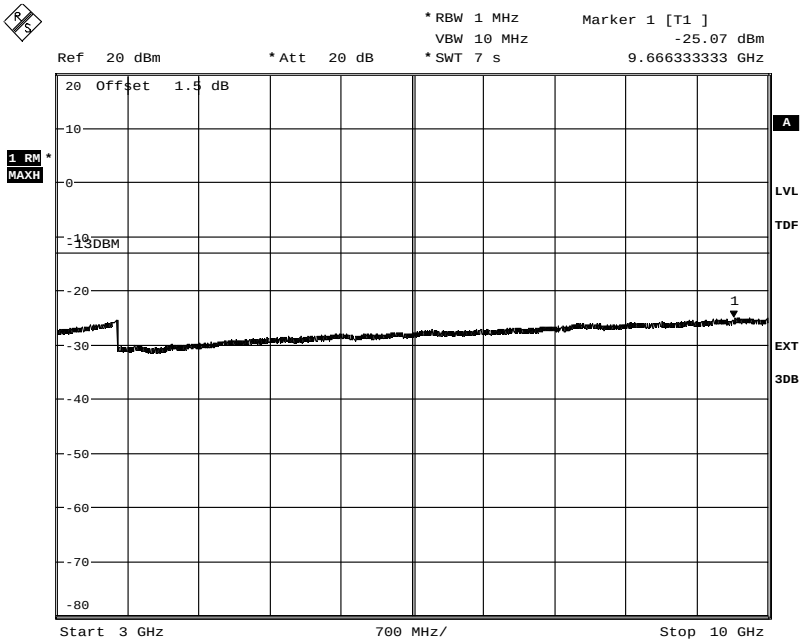
Appendix 5

Diagram 8a:



Date: 8.MAY.2013 13:17:13

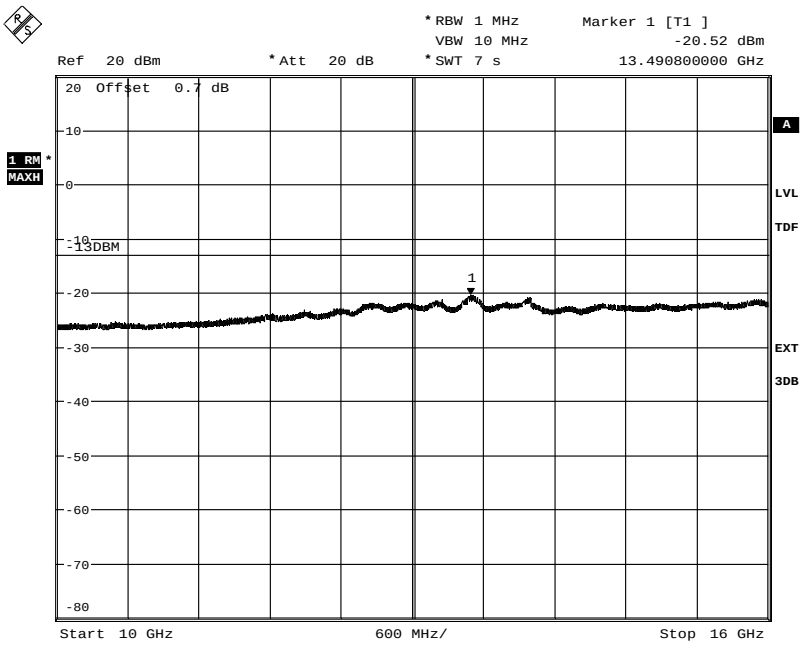
Diagram 8b:



Date: 8.MAY.2013 13:19:35

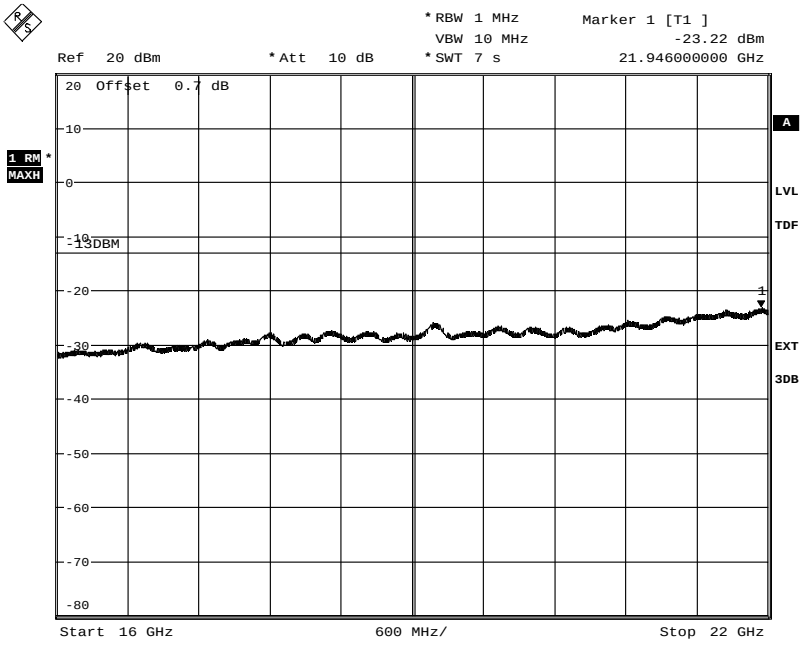
Appendix 5

Diagram 8c:



Date: 8.MAY.2013 13:20:34

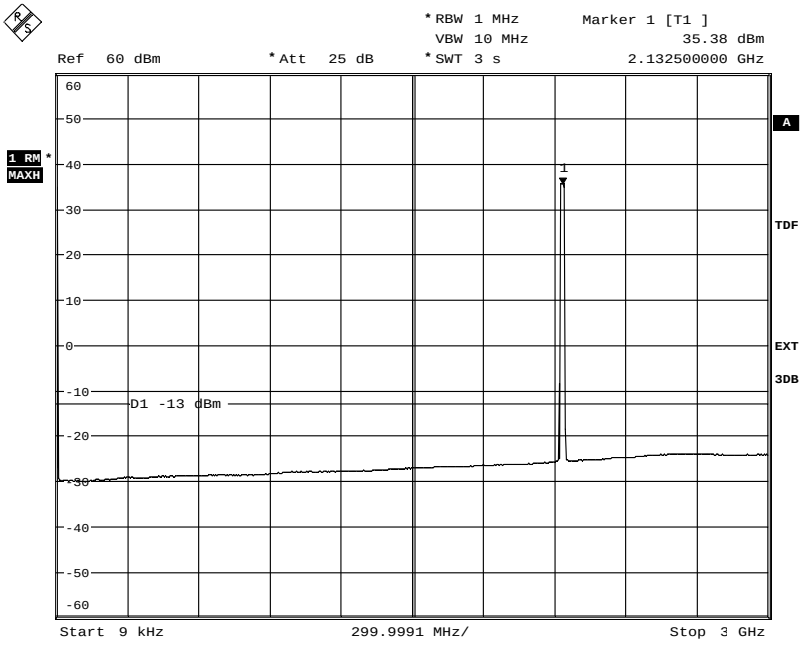
Diagram 8d:



Date: 8.MAY.2013 13:21:22

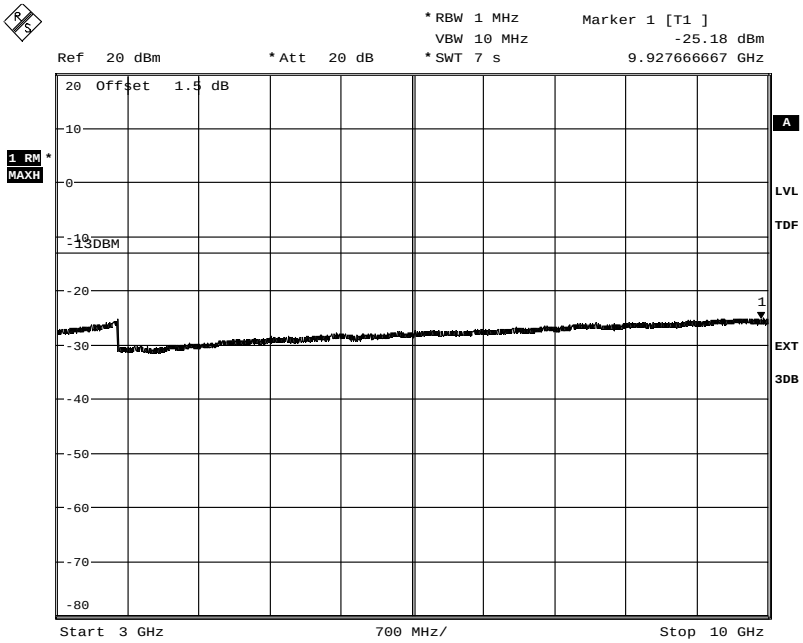
Appendix 5

Diagram 9a:



Date: 8.MAY.2013 13:27:35

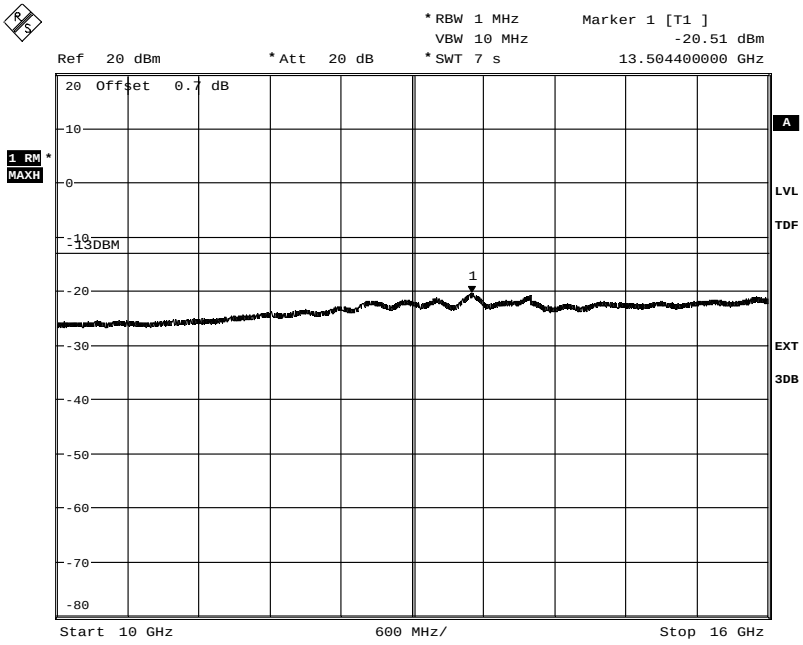
Diagram 9b:



Date: 8.MAY.2013 13:25:47

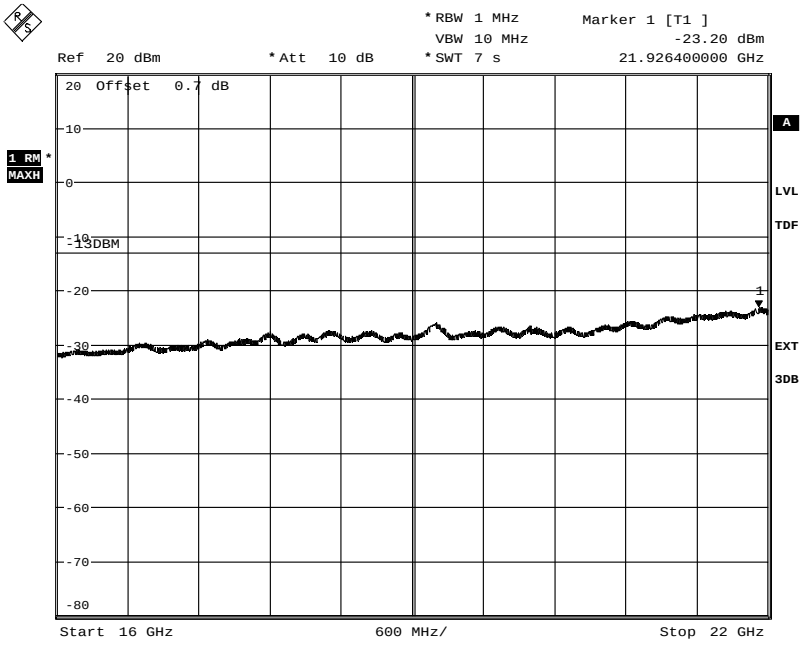
Appendix 5

Diagram 9c:



Date: 8.MAY.2013 13:24:42

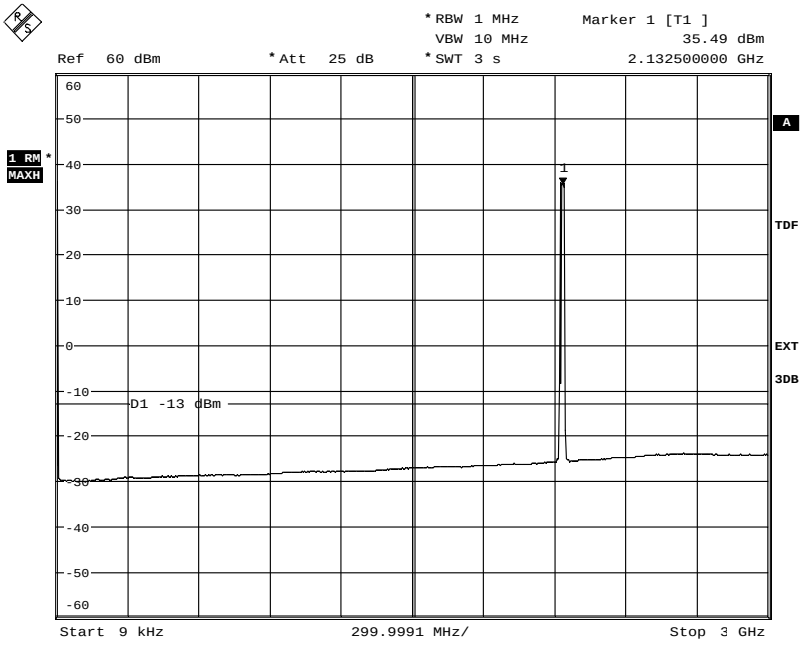
Diagram 9d:



Date: 8.MAY.2013 13:23:52

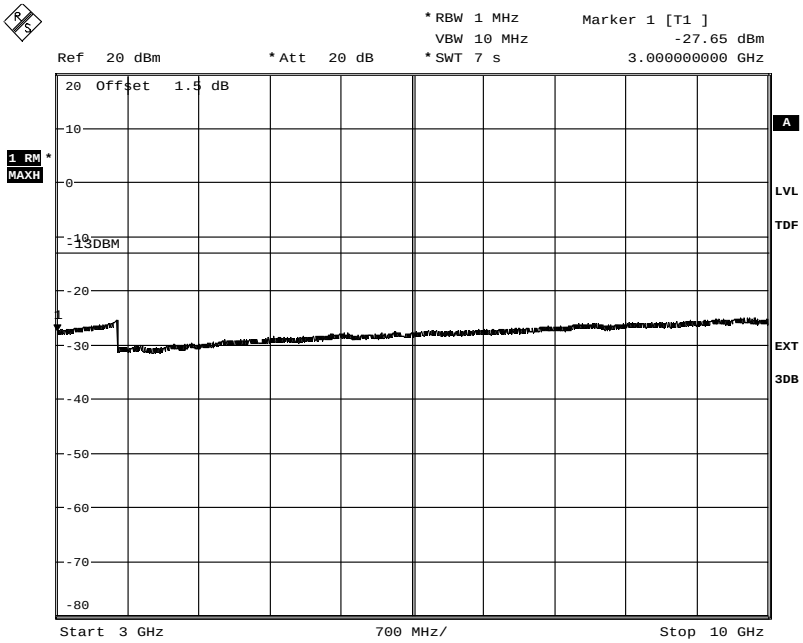
Appendix 5

Diagram 10a:



Date: 13.MAY.2013 09:19:33

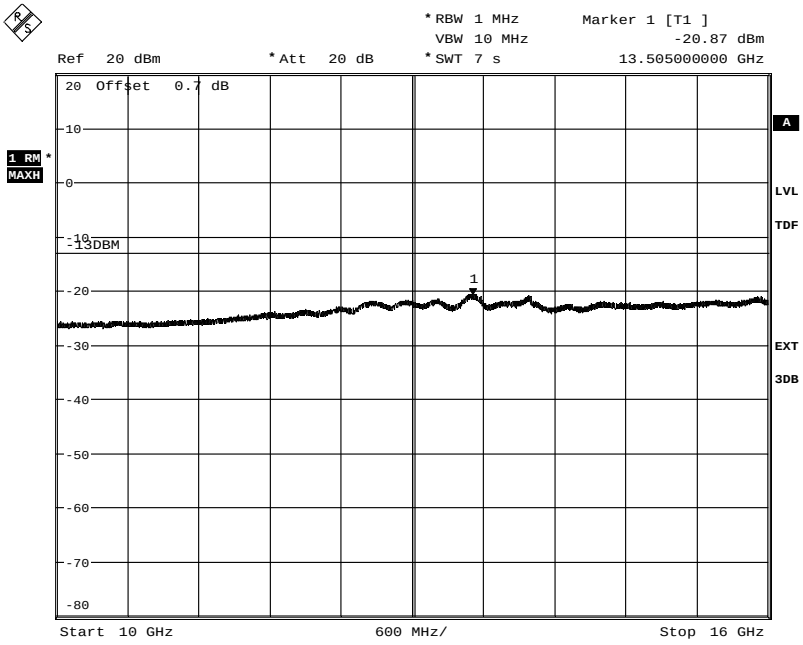
Diagram 10b:



Date: 13.MAY.2013 09:20:51

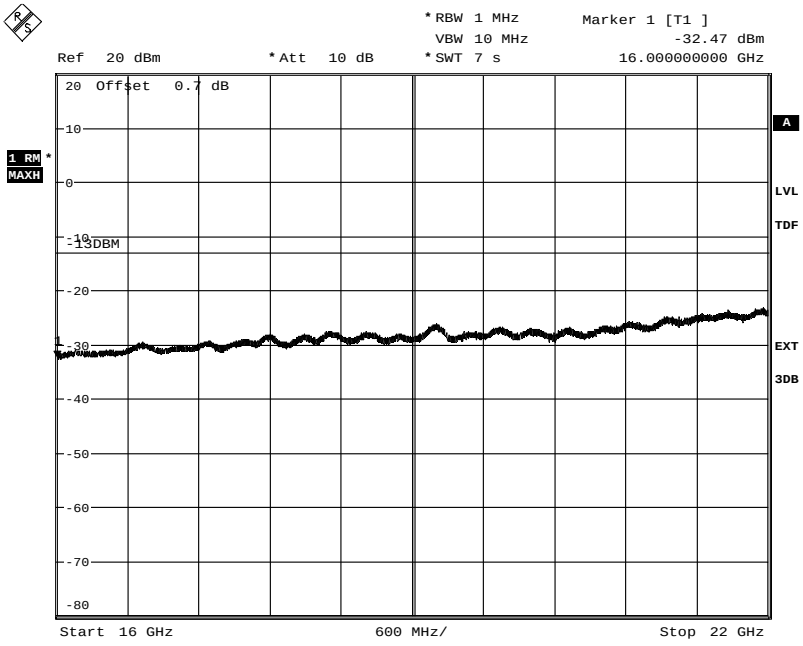
Appendix 5

Diagram 10c:



Date: 13.MAY.2013 09:23:37

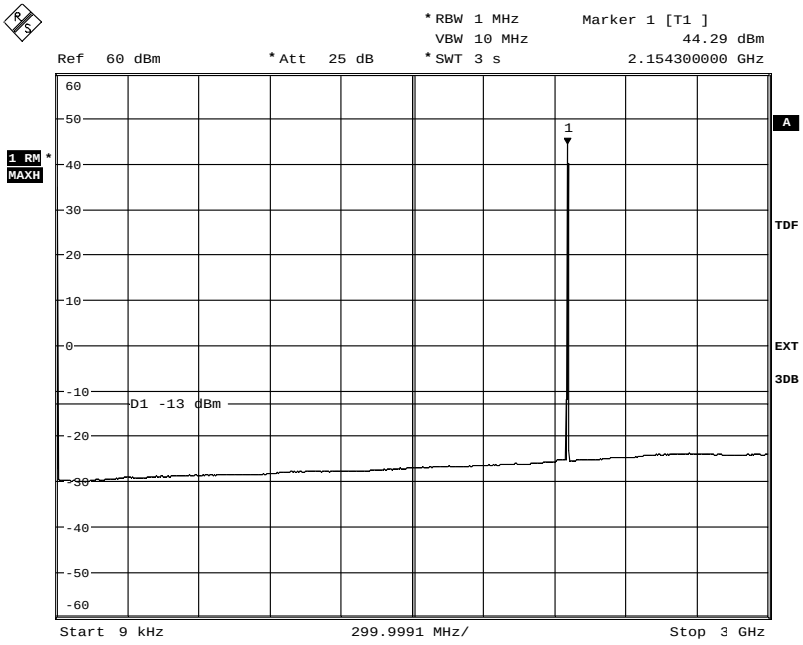
Diagram 10d:



Date: 13.MAY.2013 09:25:04

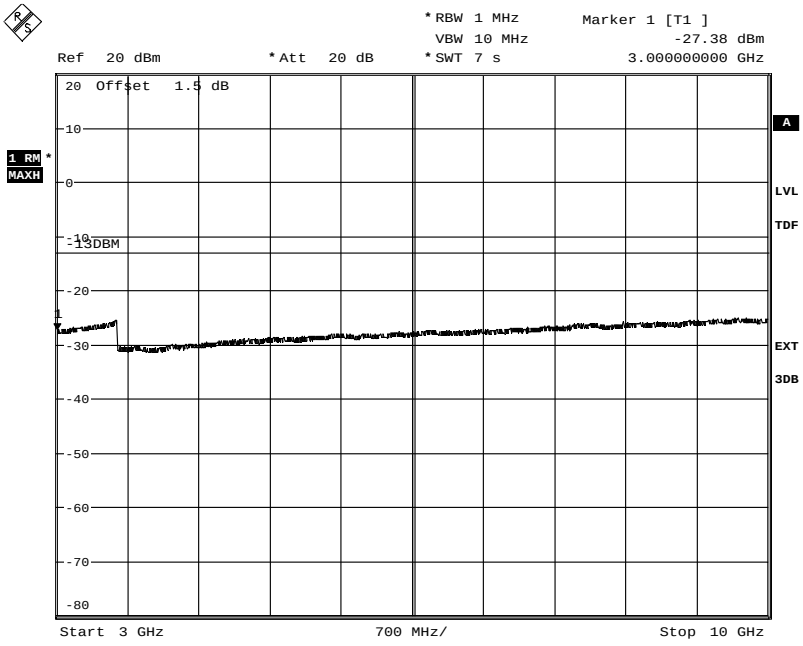
Appendix 5

Diagram 11a:



Date: 13.MAY.2013 13:53:12

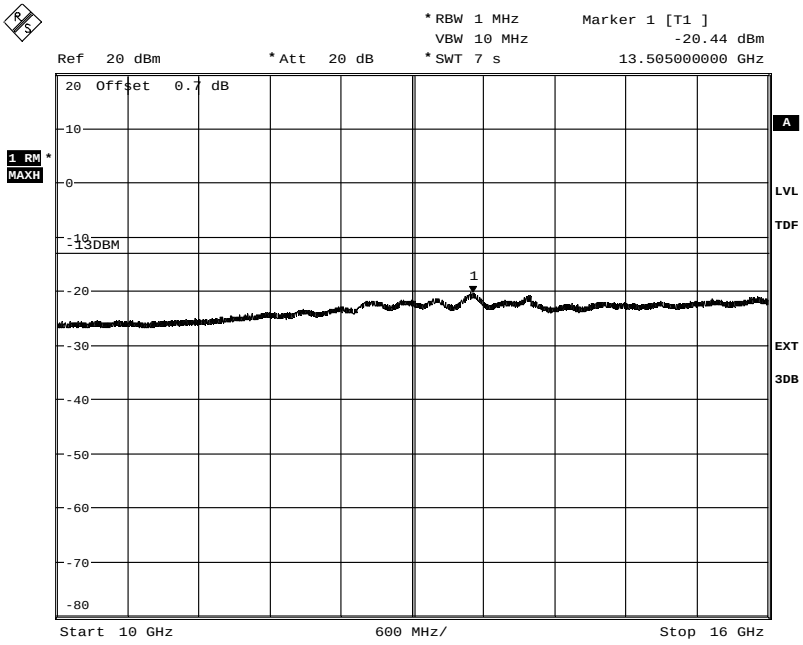
Diagram 11b:



Date: 13.MAY.2013 13:54:45

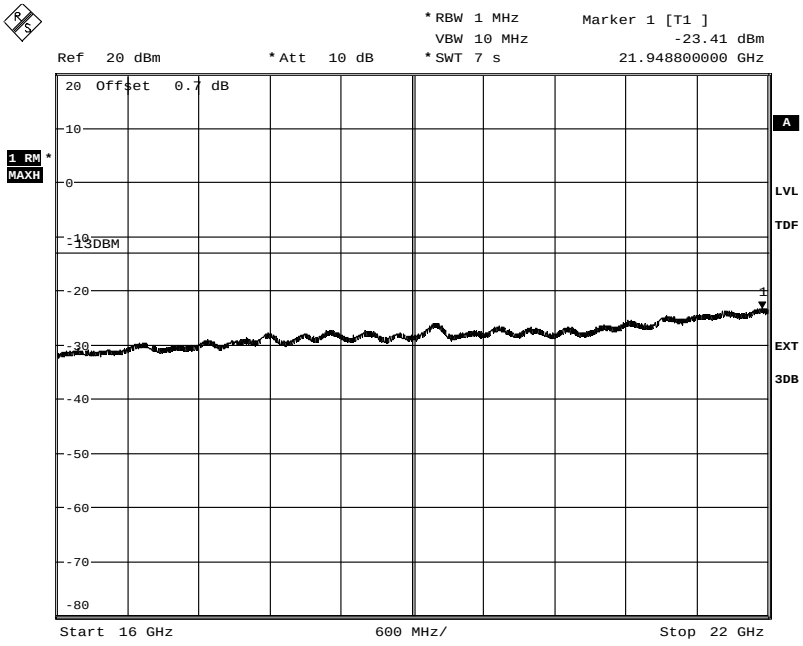
Appendix 5

Diagram 11c:



Date: 13.MAY.2013 13:55:36

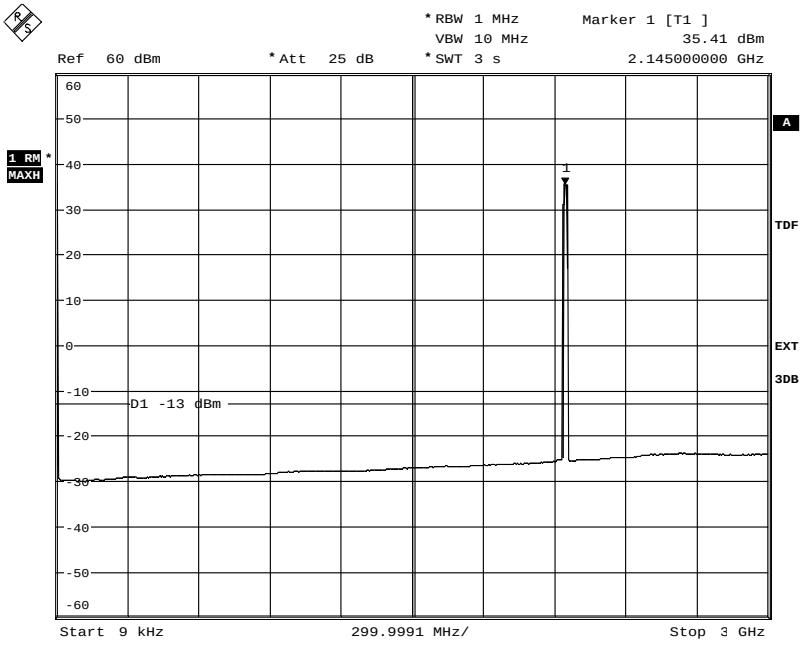
Diagram 11d:



Date: 13.MAY.2013 13:56:32

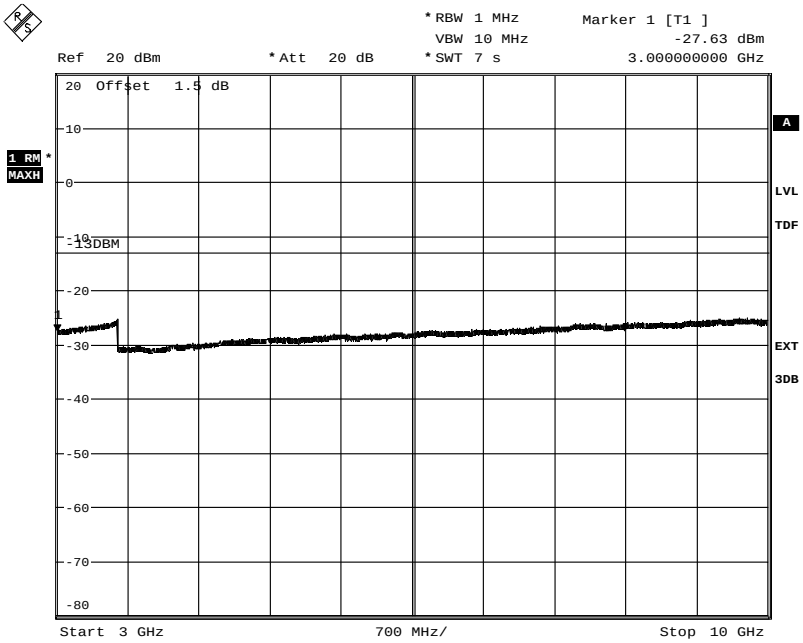
Appendix 5

Diagram 12a:



Date: 13.MAY.2013 14:02:09

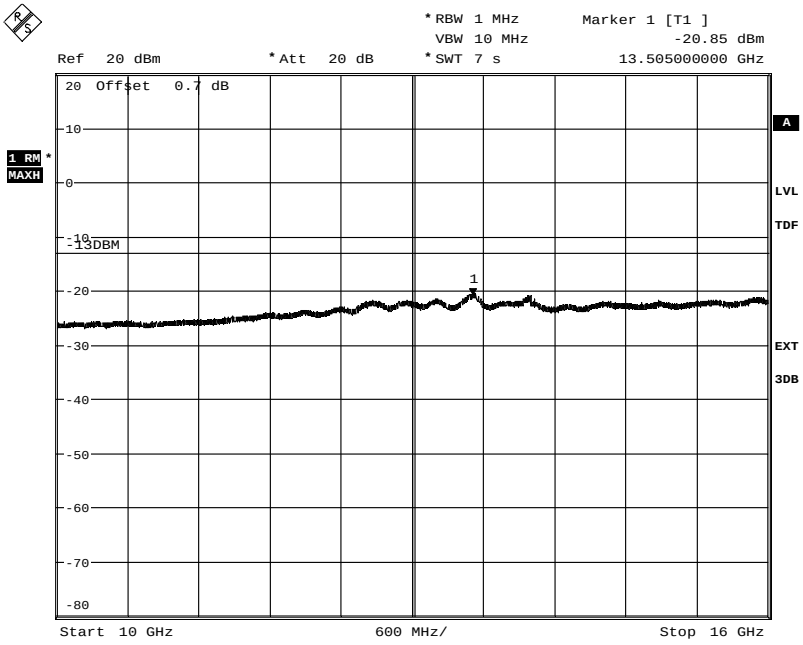
Diagram 12b:



Date: 13.MAY.2013 14:00:29

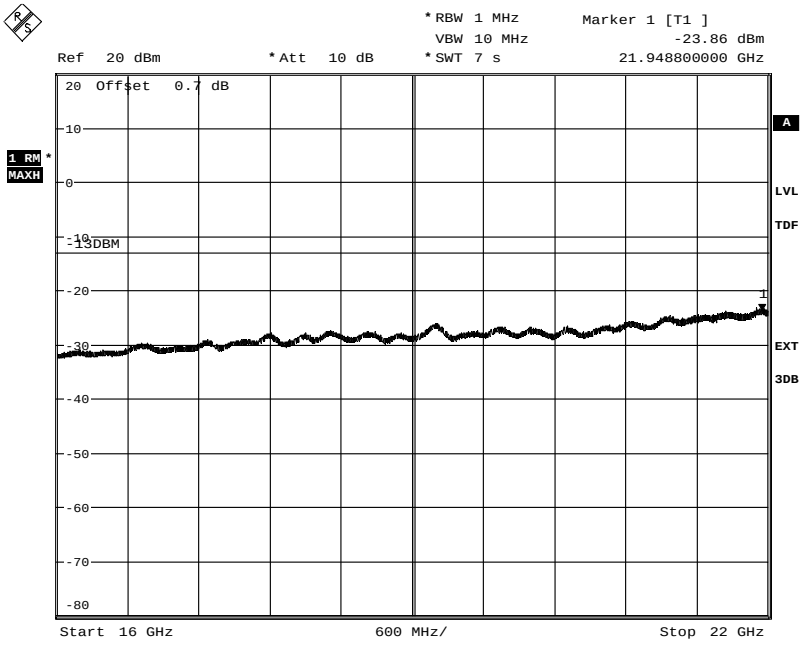
Appendix 5

Diagram 12c:



Date: 13.MAY.2013 13:59:31

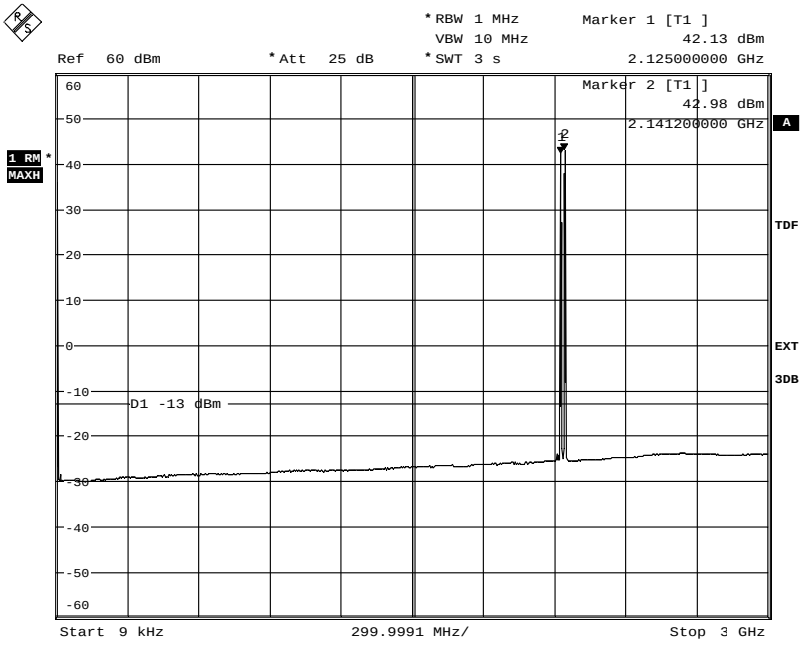
Diagram 12d:



Date: 13.MAY.2013 13:58:40

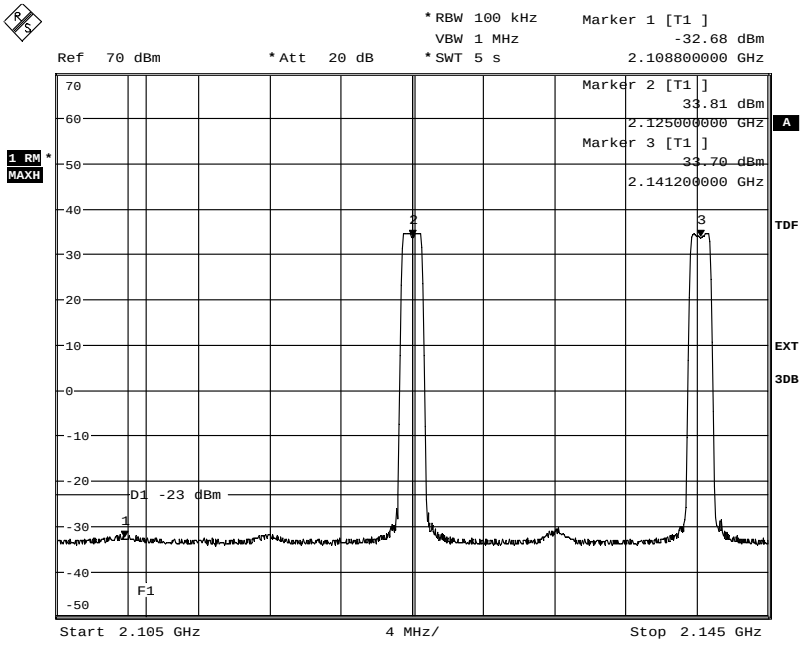
Appendix 5

Diagram 13a:



Date: 13.MAY.2013 16:02:14

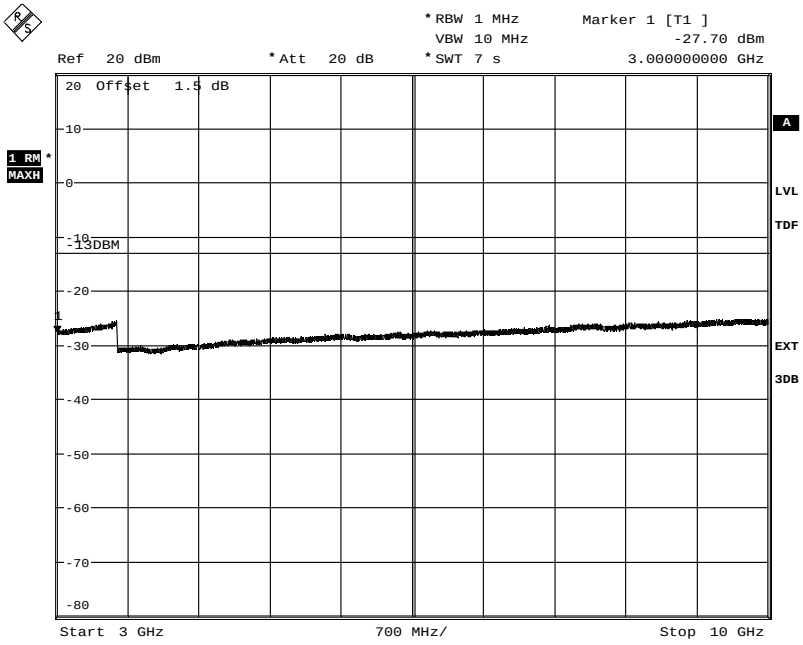
Diagram 13b:



Date: 13.MAY.2013 16:45:26

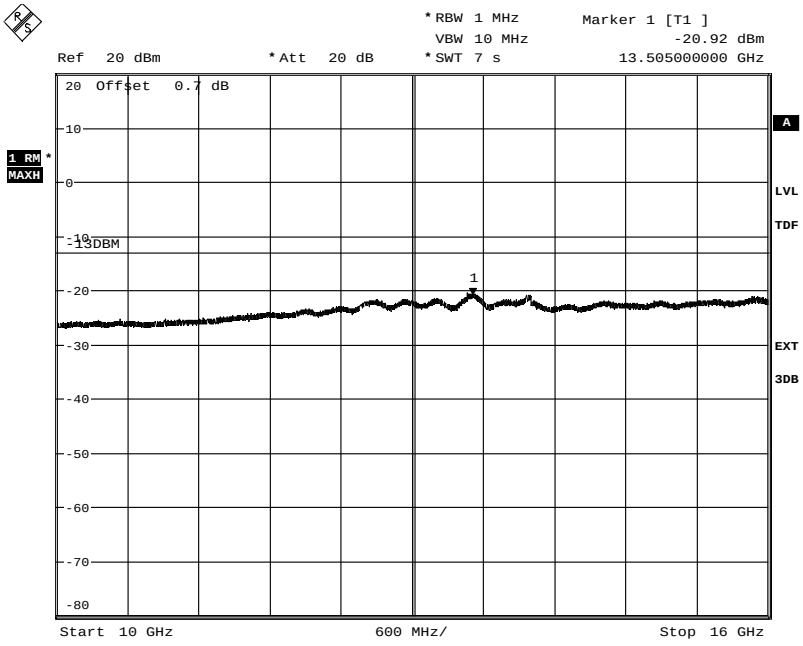
Appendix 5

Diagram 13c:



Date: 13.MAY.2013 16:00:29

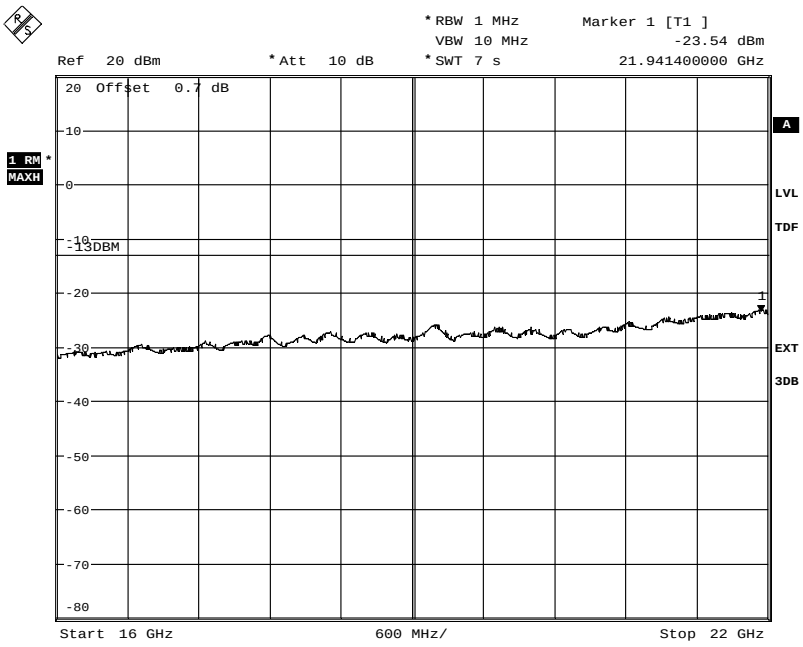
Diagram 13d:



Date: 13.MAY.2013 15:59:53

Appendix 5

Diagram 13e:



Date: 13.MAY.2013 15:58:34

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

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

Date	Temperature	Humidity
2013-05-13	22°C ± 3°C	32 % ± 31 %
2013-05-14	21°C ± 3°C	29 % ± 34 %

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.

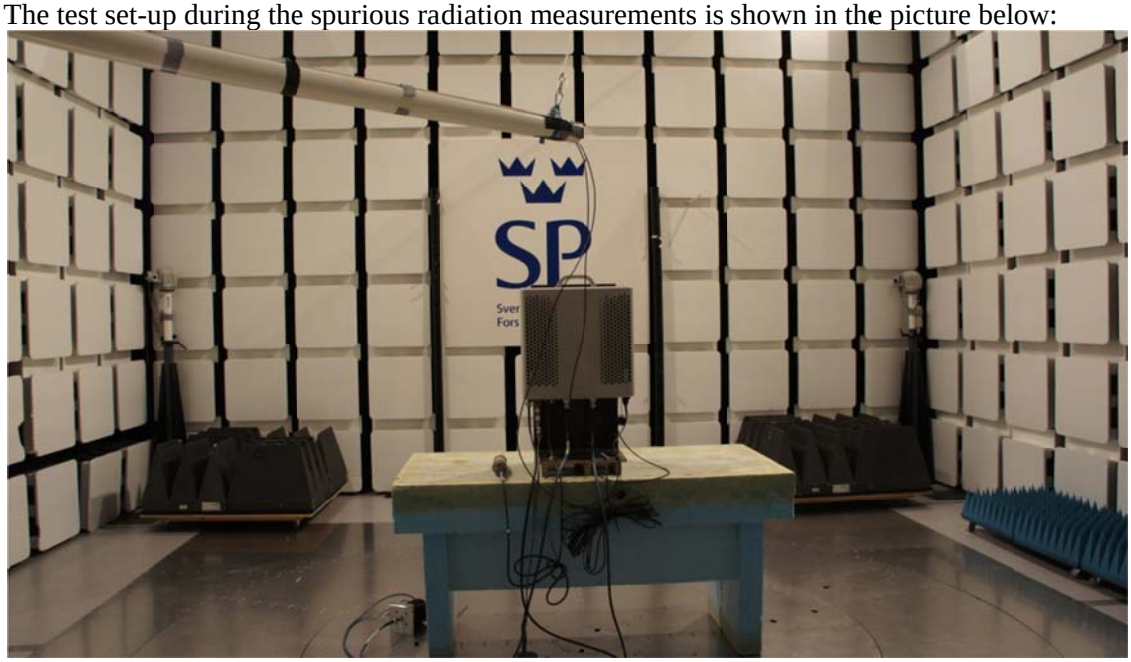
The measurements were performed with both horizontal and vertical polarization of the antenna. The antenna distance was 3 m in the frequency range 30 MHz – 18 GHz and 1m in the frequency range 18 - 22 GHz.

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	502 181
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
µComp Nordic, Low Noise Amplifier	901 545
Temperature and humidity meter, Testo 625	504 188

Tested configurations

B
M
T
Bim2
Tim2

Results, representing worst case

Bim2: 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 6

Diagram 1a:

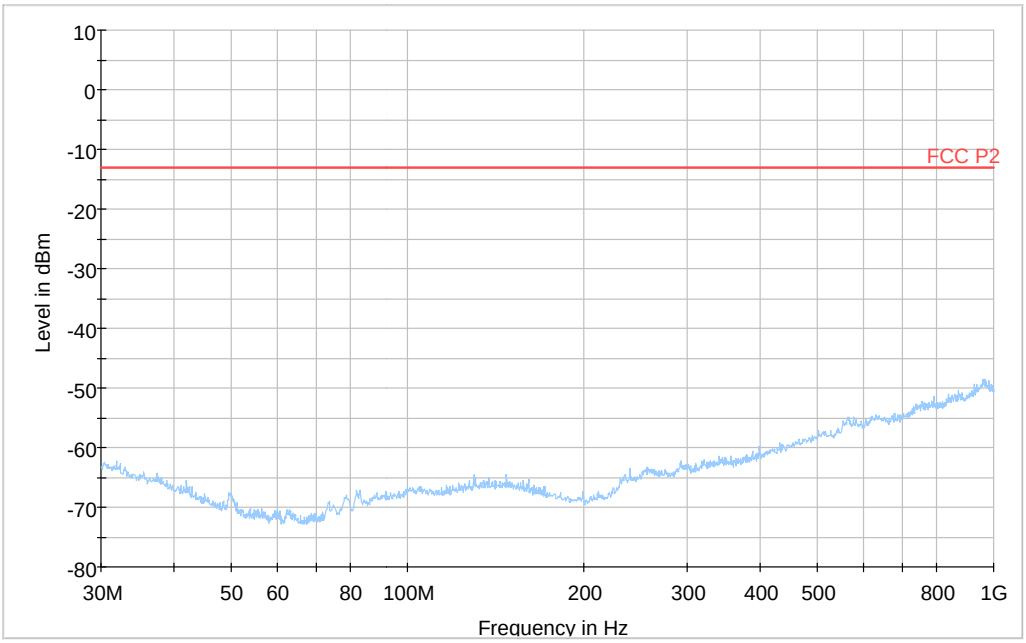
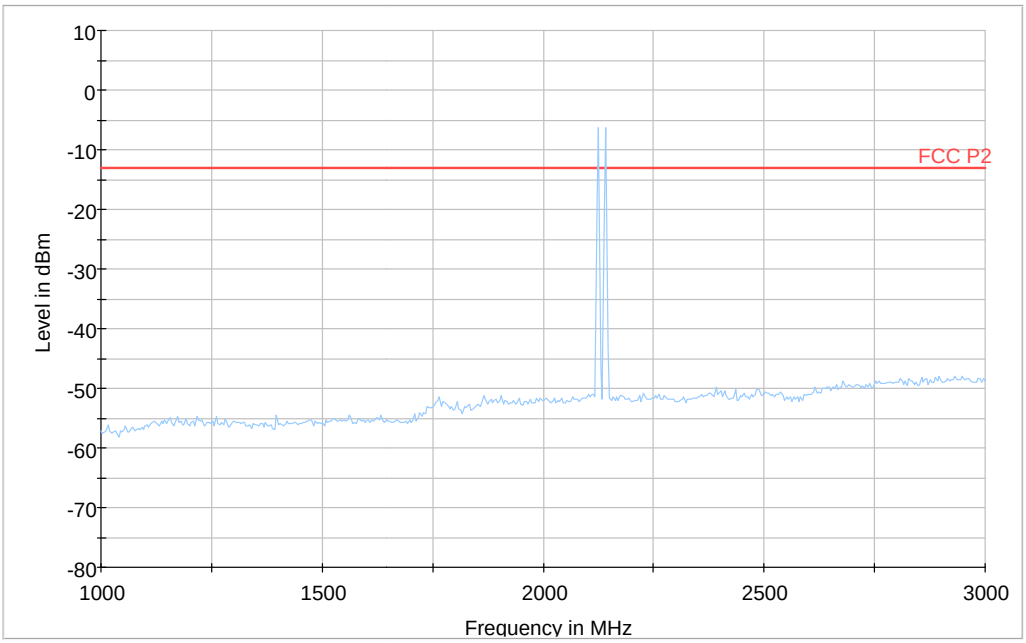


Diagram 1b:



Note: The emission between 2110 MHz and 2155 MHz are the carrier frequencies and shall be ignored in the context.

Appendix 6

Diagram 1c:

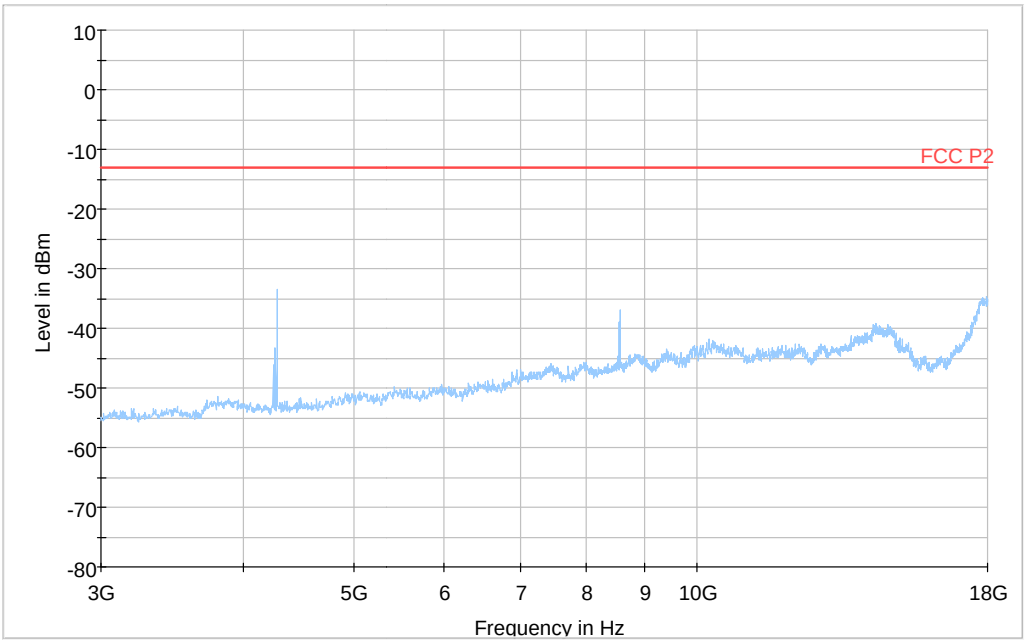
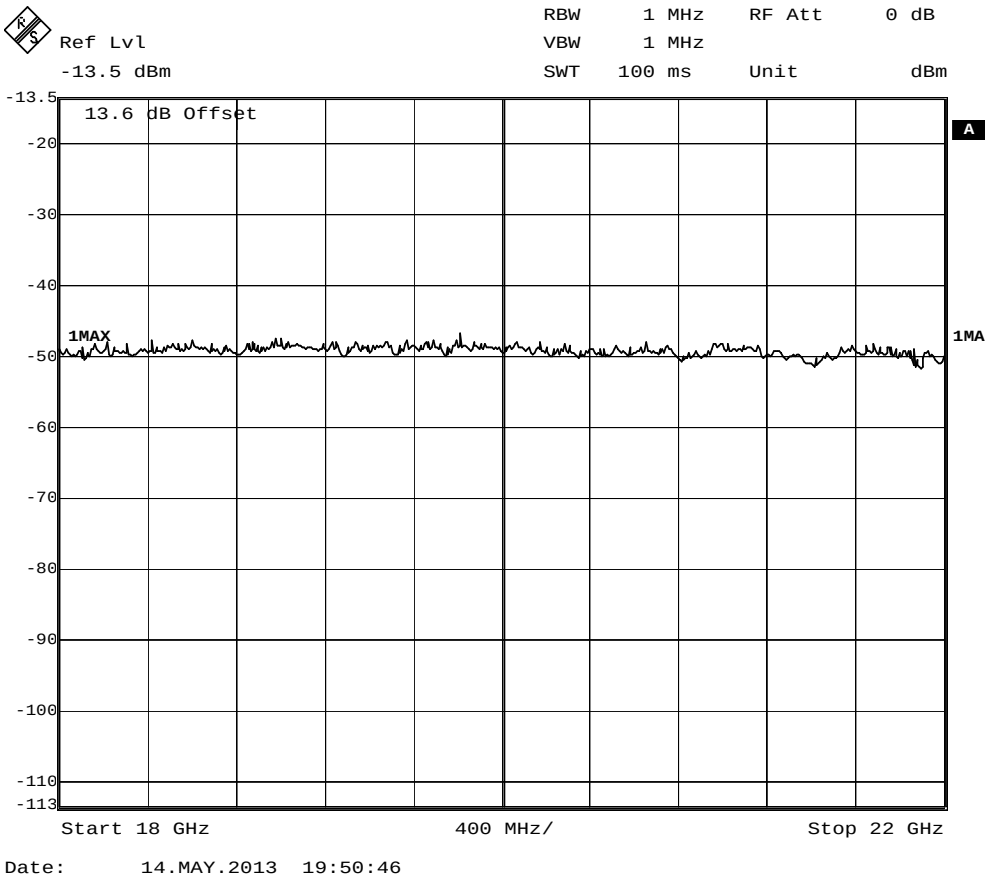


Diagram 1d:



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

Date	Temperature (test equipment)	Humidity (test equipment)
2013-05-16	23 °C ± 3 °C	37% ± 5 %
2013-05-17	22 °C ± 3 °C	45% ± 5 %
2013-05-21	22 °C ± 3 °C	43% ± 5 %

Test set-up and procedure

The measurement was made per 3GPP TS 36.141. 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	504 143
RF attenuator	900 233
RF attenuator	901 384
Temperature Chamber	501 031
Datascan 7321	502 698
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	-5
-55.2	+20	+7
-40.8	+20	+6
-48.0	+30	-7
-48.0	+40	+7
-48.0	+50	+8
-48.0	+10	+8
-48.0	0	+8
-48.0	-10	-7
-48.0	-20	-7
-48.0	-30	+8
Maximum freq. error (Hz)		8
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Remark

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 8

External photos

Front side

Appendix 8

Rear side

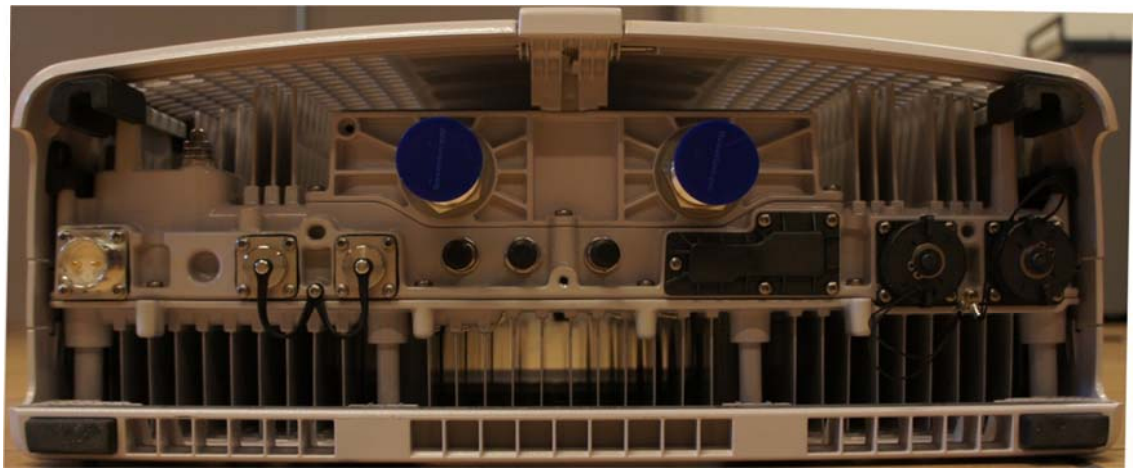
Appendix 8

Left side

Right side

Appendix 8

Bottom side



Top side

Product Label