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Radio measurements on AIR 21 B4A B12P B8P 1700/2100 MHz radio equipment with FCC ID: TA8AKRC118056-1 and IC: 287AB-AS1180561 (8 appendices)

Test object

Product name: AIR 21 B4A B12P B8P
Product number: KRC 118 056/1, R1A

Summary

See appendix 1 for general information and appendix 8 for external photos.

Standard	Compliant	Appendix
FCC CFR 47 / IC RSS-139 Issue 2		
2.1046 / RSS-139 6.4 RF power output conducted	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.

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Appendix 1

Description of the test object

Equipment:	Product name: AIR 21 B4A B12P B8P Product number: KRC 118 056/1, R1A FCC ID TA8AKRC118056-1 IC 287AB-AS1180561 IC MODEL NO: AS1180561
Frequency bands:	TX: 2110 – 2155 MHz RX: 1710 – 1755 MHz
Antenna ports:	2 TX/RX ports, (internally connected to integrated Cross-Polarized antenna elements)
RF configuration:	Single carrier, multi carrier and MIMO 2x2
Nominal output power per antenna port:	Single carrier: 1x 44.8 dBm (1 x 30W) Multi carrier: 2 x 41.8 dBm (2 x 15W)
Antenna type:	Cross- polarized antenna
Antenna gain:	18 dBi
Channel bandwidths:	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz
Modulations:	QPSK, 16QAM and 64QAM
Nominal supply voltage:	-48VDC

Appendix 1

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 represent QPSK modulation, test model E-TM3.2 represent 16QAM modulation and test model E-TM3.1 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. All measurements were performed with the test object configured for maximum transmit power. 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

Conducted measurements

The test object was pole mounted and powered with -48 VDC by an external power supply, unless noted otherwise. All TX parameters were measured at port RF A with port RF B terminated into 50 ohm. Complete measurements were made on RF A with additional measurements on RF B to verify that the ports are identical.

Radiated measurements

The test object was pole mounted and powered with -48 VDC by an external power supply. Both RF ports were terminated into 50 ohm.

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 IC RSS-139 and IC RSS-Gen.

References

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

ANSI 63.4-2009

ANSI/TIA/EIA-603-C-2004

3GPP TS 36.141, version 11.4.0

CFR 47 part 2, October 1st, 2012

CFR 47 part 27, October 1st, 2012

RSS-Gen Issue 3

RSS-139 Issue 2

Appendix 1

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 2013-10-10.

Manufacturer's representative

Christer Gustavsson, Ericsson AB.

Test engineers

Andreas Johnson, Kexin Chen, Hyder Khalaf, Tomas Lennhager, Tomas Isbring, Jörgen Wassholm and Rolf Kühn, SP.

Test participant

None.

Appendix 1

Measurement equipment

	Calibration Due	SP number
Test site Tesla	2014-01	503 881
R&S FSIQ 40	2014-07	503 738
R&S ESU 26	2014-05	901 553
R&S FSQ 40	2014-03	504 143
Control computer with R&S software EMC32 version 8.52.0	-	503 899
High pass filter	2014-07	901 501
High pass filter	2014-07	901 502
High pass filter	2014-07	504 199
High pass filter	2014-09	901 373
High pass filter	2014-09	503 739
High pass filter	2014-07	503 740
RF attenuator	2014-07	504 159
RF attenuator	2014-07	900 233
RF attenuator	2014-07	900 691
RF attenuator	2014-07	901 384
RF attenuator	2013-12	901 508
Chase Bilog Antenna CBL 6111A	2014-10	503 182
EMCO Horn Antenna 3115	2015-09	502 175
Std.gain horn FLANN model 20240-20	-	503 674
µComp Nordic, Low Noise Amplifier	2014-04	901 545
Miteq Low Noise Amplifier	2014-09	503 285
Schwartzbeck preamplifier BBV 9742	2014-14	504 085
Temperature and humidity meter, Testo 635	2014-06	504 203
Temperature and humidity meter, Testo 625	2014-06	504 188
Temperature Chamber	2013-11	501 031
Multimeter Fluke 87	2014-08	502 190

Appendix 1

Test frequencies used for conducted and radiated measurements

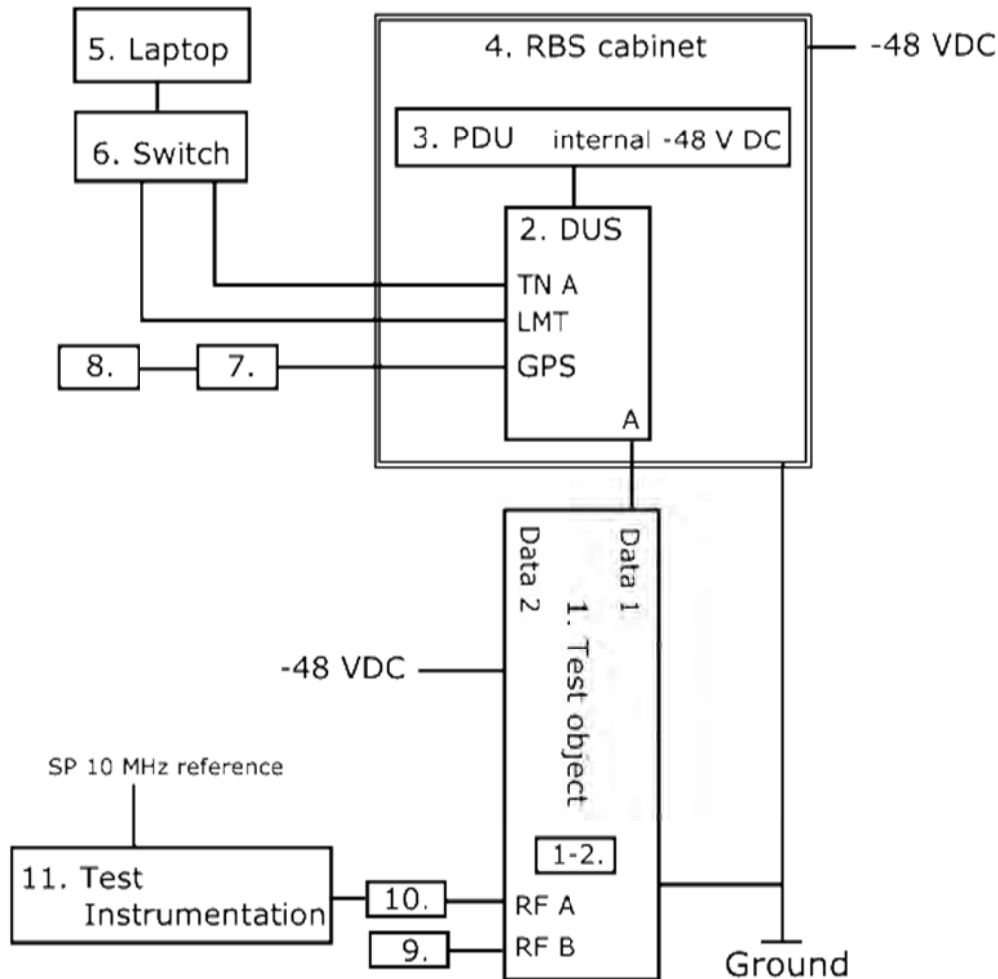
TX test frequencies

EARFCN Downlink	Frequency [MHz]	Symbolic name	Comment
1957	2110.7	B	TX bottom frequency in 1.4 MHz BW configuration
1957	2110.7	B2-1.4	2 carrier TX band bottom constellation
1971	2112.1		1.4 MHz BW configuration
1965	2111.5	B2-3	2 carrier TX band bottom constellation
1995	2114.5		3 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
2168	2131.8	M2	2 carrier TX band mid constellation
2182	2133.2		1.4 MHz BW configuration
2393	2154.3	T	TX top frequency in 1.4 MHz BW configuration
2385	2153.5	T	TX top frequency in 3 MHz BW configuration
2375	2152.5	T	TX top frequency in 5 MHz BW configuration
2350	2150.0	T	TX top frequency in 10 MHz BW configuration
2325	2147.5	T	TX top frequency in 15 MHz BW configuration
2300	2145.0	T	TX top frequency in 20 MHz BW configuration
2379	2152.9	T2-1.4	2 carrier TX band top constellation
2393	2154.3		1.4 MHz BW configuration
2385	2153.5	T2-3	2 carrier TX band top constellation
2355	2150.5		3 MHz BW configuration
1980	2113.0	Bim1	2 carrier TX band 1.4 MHz BW configuration
2022	2117.2		
2328	2147.8	Tim1	2 carrier TX band 1.4 MHz BW configuration
2370	2152.0		
2100	2125.0	Bim2	2 carrier TX band 1.4 MHz BW configuration
2262	2141.2		
2088	2123.8	Tim2	2 carrier TX 1.4 MHz BW configuration
2250	2140.0		

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

Appendix 1

Test setup conducted measurements



Test object

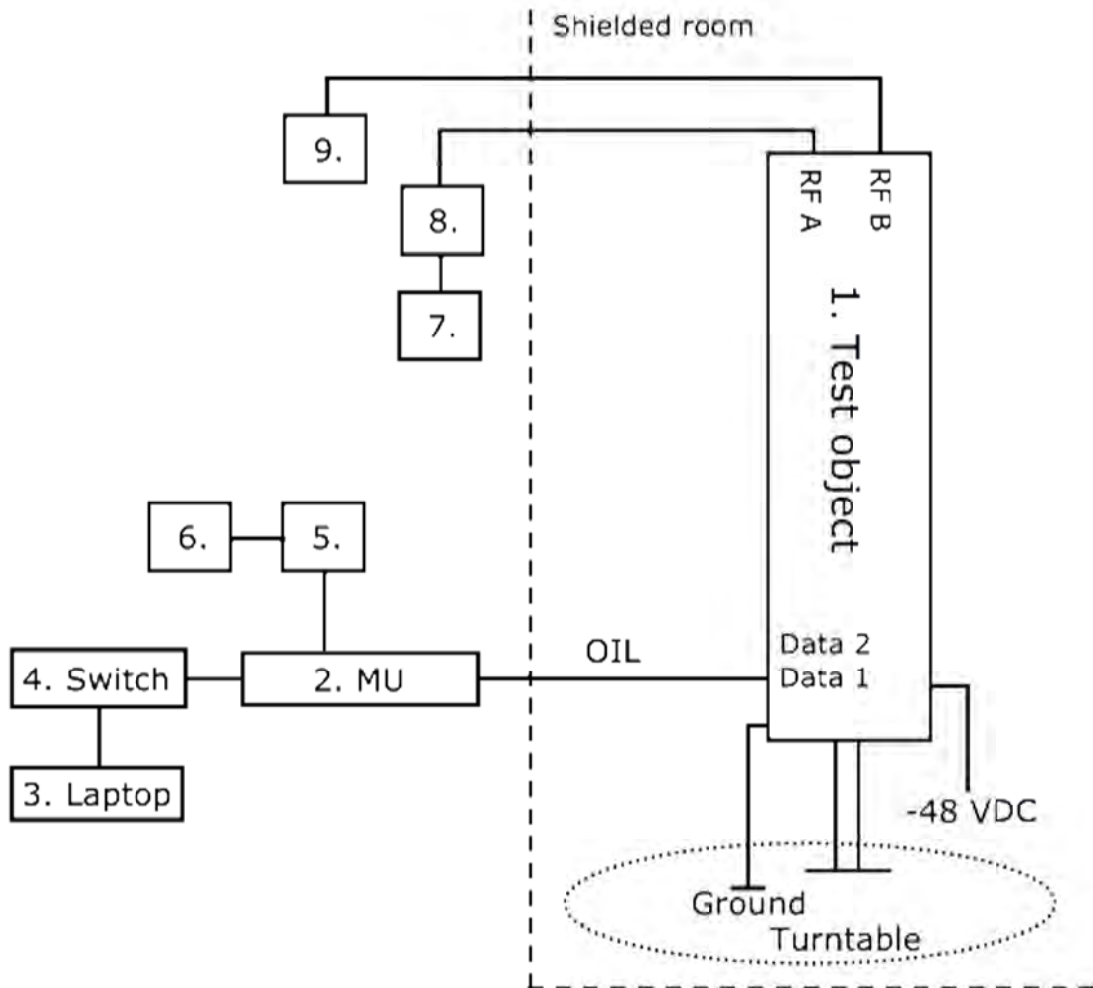
1.	AIR 21 B4A B12P B8P, KRC 118 056/1, revision R1A, s/n: CQ30112763 (FCC ID TA8AKRC118056-1 and IC 287AB-AS1180561) with software: CXP 901 3268/6, revision R51NE 1-2. Transciever, ARUS B4 1/KRC 118 046, revision R1C
----	--

Functional test equipment

2.	DUS 41 01, KDU 137 624/1, revision R6A, s/n: A401981392
3.	PDU 02 01, BMG 980 336/4, revision R2A, s/n: BJ31528316
4.	RBS 6201 cabinet, BAMS – 1000778792
5.	Controlling laptop HP Elitebook 8560w, BAMS 1001236856 running software MOSHELL V9.0z
6.	Fast Ethernet switch, Netgear FS726T
7.	GPS 02 01, NCD 901 41/1, revision R1D, s/n: TU8K475230
8.	GPS Active Antenna, KRE 101 2082/1
9.	Terminator, 50 ohm
10.	Attenuator, according respective appendix
11.	SP Test Instrumentation according to measurement equipment list

Appendix 1

Test setup radiated measurements



Test object:

1.	AIR 21 B4A B12P B8P, KRC 118 056/1, revision R1A, s/n: CQ30112763 (FCC ID TA8AKRC118056-1 and IC 287AB-AS1180561) Software: CXP 901 3268/6, revision R51NE Transceiver, ARUS B4 1/KRC 118 046, revision R1C
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Functional test equipment:

2.	Main Unit SUP 6601, 1/BFL 901 009/4, revision R1E, s/n: BR88236818 DUS 41 01, KDU 137 624/1, revision R6A, s/n: A401981869
3.	Computer, HP Elitebook 8560w, BAMS – 1001236854
4.	Switch Netgear FS108
5.	GPS 02 01, NCD 901 41/1, revision R1D, s/n: TU8K357393
6.	GPS Active Antenna, KRE 101 2082/1
7.	R&S ESI 26 SP 503 738, for supervision purpose only.
8.	Attenuator
9.	Terminator 50 ohm

Appendix 1

Interfaces:

	Type of port:
Power: -48 VDC	DC Power
Antenna port (A), (passive antenna), 7/16-connector	Antenna
Antenna port (B), (passive antenna), 7/16-connector	Antenna
Data 1, Optical Interface Link, single mode opto fibre	Signal
Data 2, Optical Interface Link, single mode opto fibre, not in use	Signal
Ground wire	Ground

RBS software:

Software	Revision
CXP 102 051/19	R22EU

Appendix 2

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

Date	Temperature	Humidity
2013-11-05	22 °C ± 3 °C	30 % ± 5 %
2013-11-06	22 °C ± 3 °C	29 % ± 5 %
2013-11-25	24 °C ± 3 °C	16 % ± 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

MIMO mode, single carrier

Rated output power level at RF connector 1x 44.8 dBm.

Carrier BW [MHz]	Symbolic name	[RMS dBm/ PAR dB]		
		Port RF A	Port RF B	Total power ¹⁾
1.4	B	44.59/ 7.19	44.37/ 7.21	47.49
20	B	44.80/ 7.36	44.60/ 7.36	47.71
1.4	M	44.67/ 7.19	44.67/ 7.21	47.68
3.0	M	44.80/ 7.26	44.73/ 7.28	47.78
5.0	M	44.79/ 7.33	44.73/ 7.36	47.77
10.0	M	44.74/ 7.28	44.63/ 7.28	47.70
15.0	M	44.76/ 7.28	44.61/ 7.28	47.70
20.0	M	44.78/ 7.28	44.60/ 7.31	47.70
1.4	T	44.58/ 7.19	44.45/ 7.21	47.53
20	T	44.77/ 7.38	44.62/ 7.38	47.71

¹⁾: Summed output power according to FCC KDB662911 Multiple transmitter output v02r01.

Note: The PAR value is the 0.1 % Peak to Average Ratio.

Appendix 2

MIMO mode, multi carrier

Rated output power level at RF connector 2x 41.8 dBm.

Carrier BW [MHz]	Symbolic name	[RMS dBm/ PAR dB]		
		Port RF A	Port RF B	Total power ¹⁾
1.4	B2-1.4	44.52/ 6.97	44.55/ 7.00	47.55
1.4	M2	44.67/ 6.97	44.56/ 6.97	47.63
1.4	T2-1.4	44.58/ 6.97	44.58/ 7.00	47.59

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

Note: The PAR value is the 0.1 % Peak to Average Ratio.

MIMO mode, single carrier

Measured output power per 1 MHz.

Carrier BW [MHz]	Symbolic name	[RMS dBm]		Total power ¹⁾ [RMS dBm]
		Port RF A	Port RF B	
1.4	B	43.57	43.70	46.70
20	B	33.05	33.16	36.16
1.4	M	43.96	43.80	46.96
3.0	M	41.12	41.05	44.12
5.0	M	39.11	38.91	42.11
10.0	M	36.04	35.86	39.04
15.0	M	34.50	34.34	37.50
20.0	M	32.78	32.99	35.99
1.4	T	43.69	43.82	46.82
20	T	33.19	33.14	36.19

¹⁾: Measured according to FCC KDB662911 D01 Multiple Transmitter Output v02r01. Method E), 2), c). "Measure and add 10 log(N_{Ant})".

Appendix 2

Limits

§27.50:

There is no maximum output power specified for base stations transmitting in the 2110-2155 MHz band. However, a licensee operating a base or fixed station in the 2110-2155 MHz band utilizing a power greater than 1640 watts EIRP and greater than 1640 watts/MHz EIRP must coordinate such operations in advance with the parties addressed in the rules.

In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

RSS-139 6.4:

There is no power limit specified for base station equipment in the RSS-139.

EIRP compliance is addressed at the time of licensing, as required by the responsible IC Bureau. Licensee's are required to take into account the antenna gain to get the maximum usable power settings to prevent the radiated output power to exceed the ERP/EIRP limits specified in SRSP-513

When the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

Complies?	Yes
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Appendix 3

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

Date	Temperature	Humidity
2013-11-04	19 °C ± 3 °C	35 % ± 5 %
2013-11-05	22 °C ± 3 °C	30 % ± 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	902 282
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	17.85
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	17.86
10	20 MHz	M	RF B	17.86
11	1.4 MHz	T	RF A	1.09
12	20 MHz	T	RF A	17.85

Appendix 3

Diagram 1:

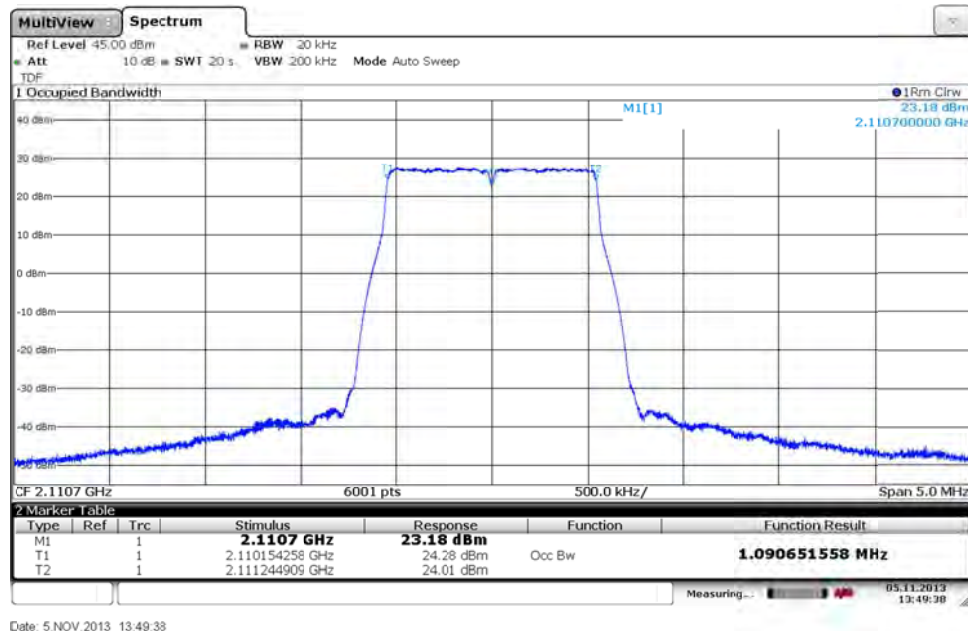
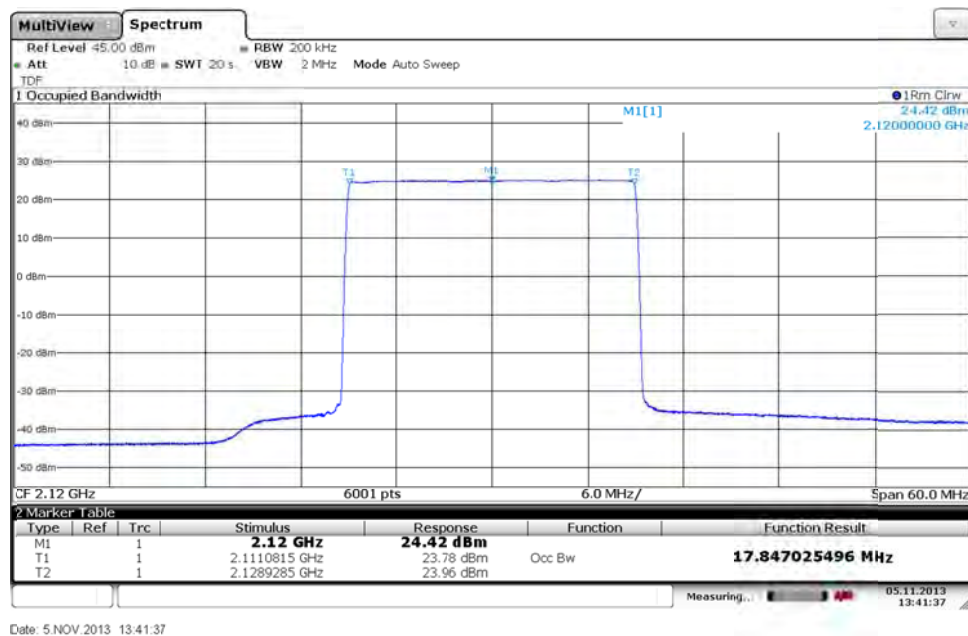
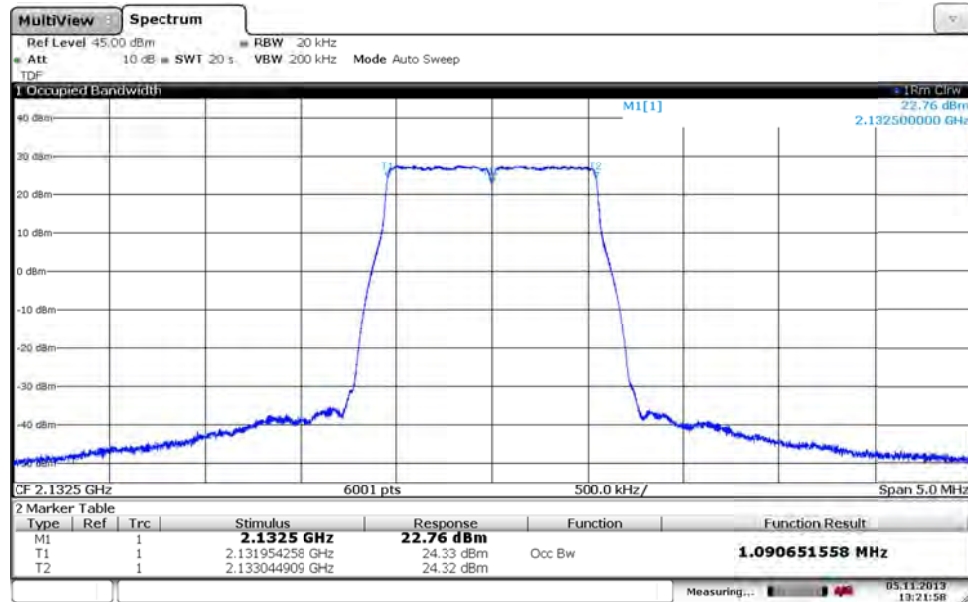


Diagram 2:



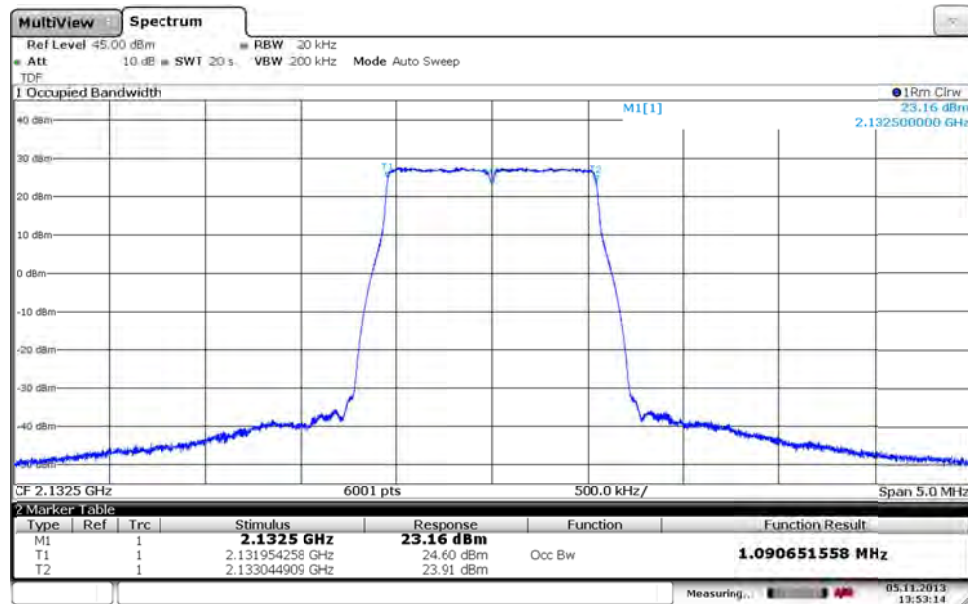
Appendix 3

Diagram 3:



Date: 5 NOV 2013 13:21:57

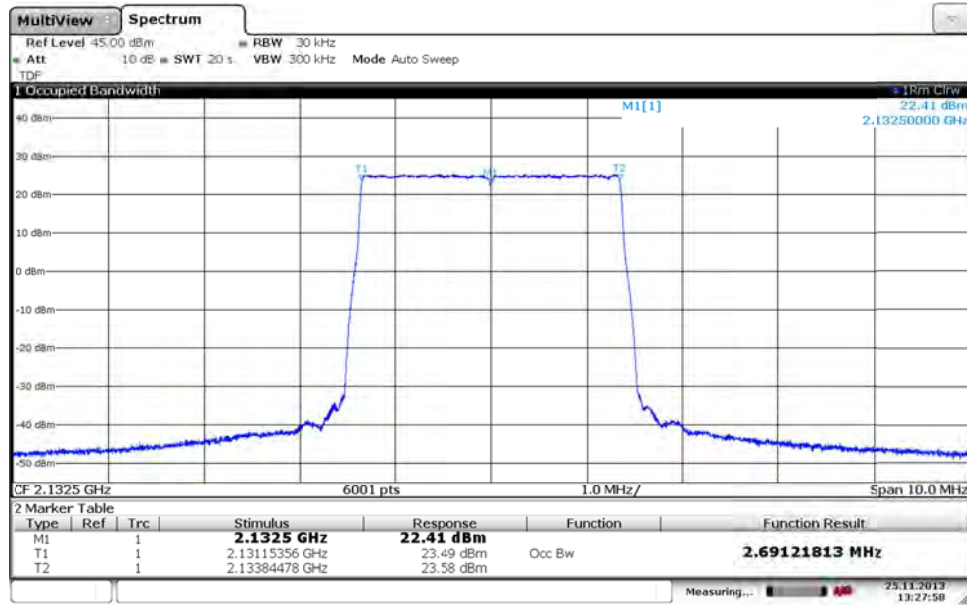
Diagram 4:



Date: 5 NOV 2013 13:53:14

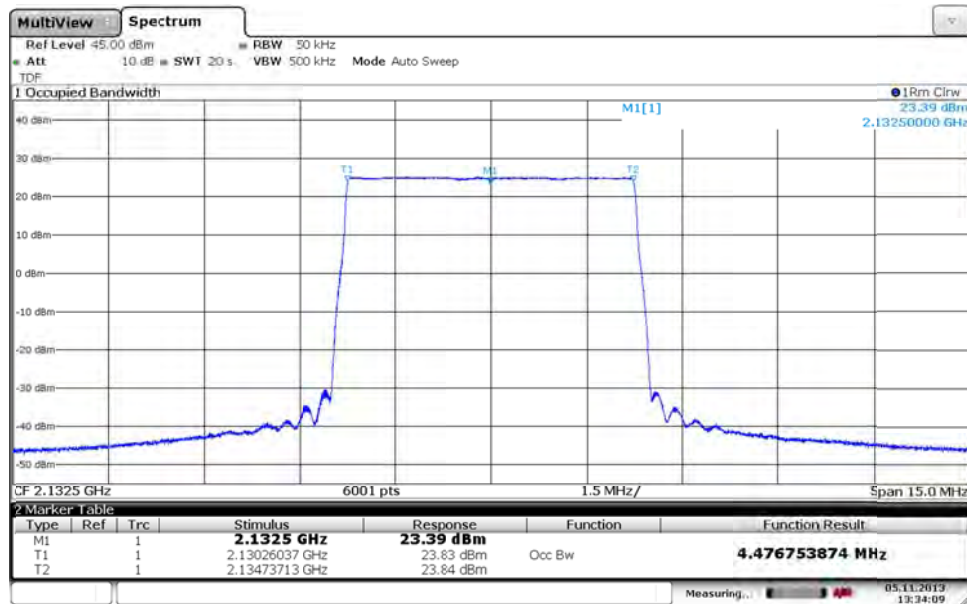
Appendix 3

Diagram 5:



Date: 25 NOV 2013 13:27:59

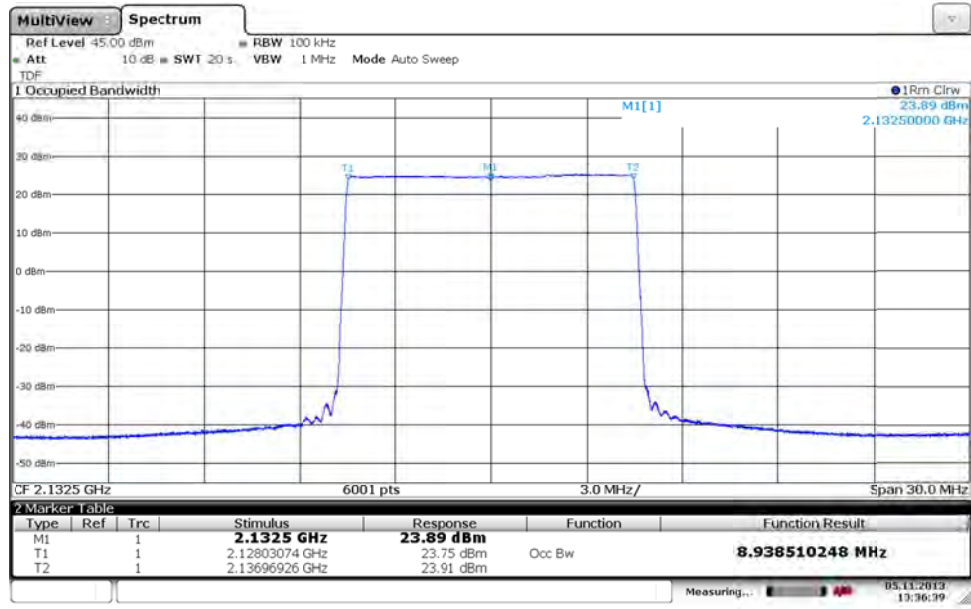
Diagram 6:



Date: 5 NOV 2013 13:34:09

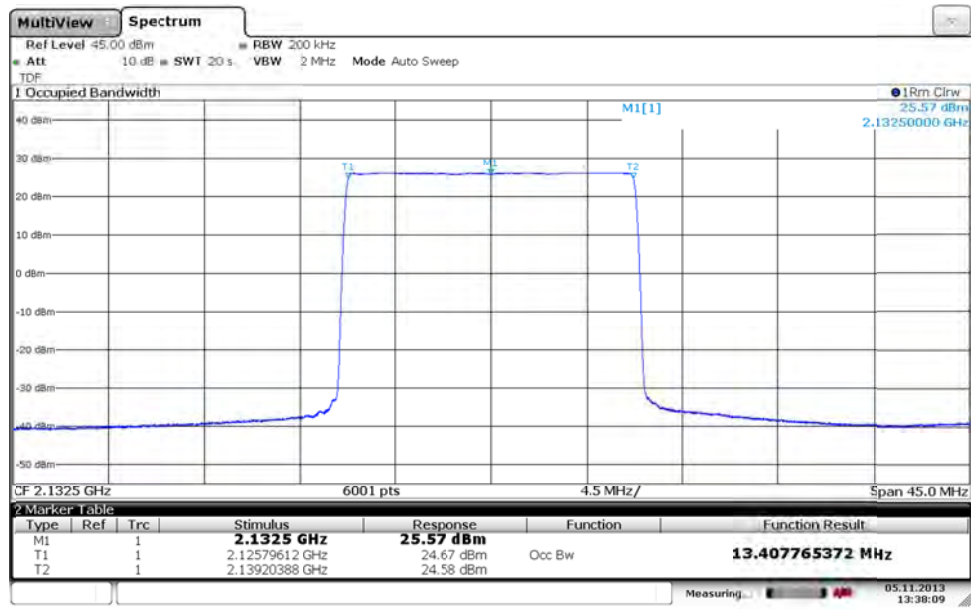
Appendix 3

Diagram 7:



Date: 5 NOV 2013 13:36:33

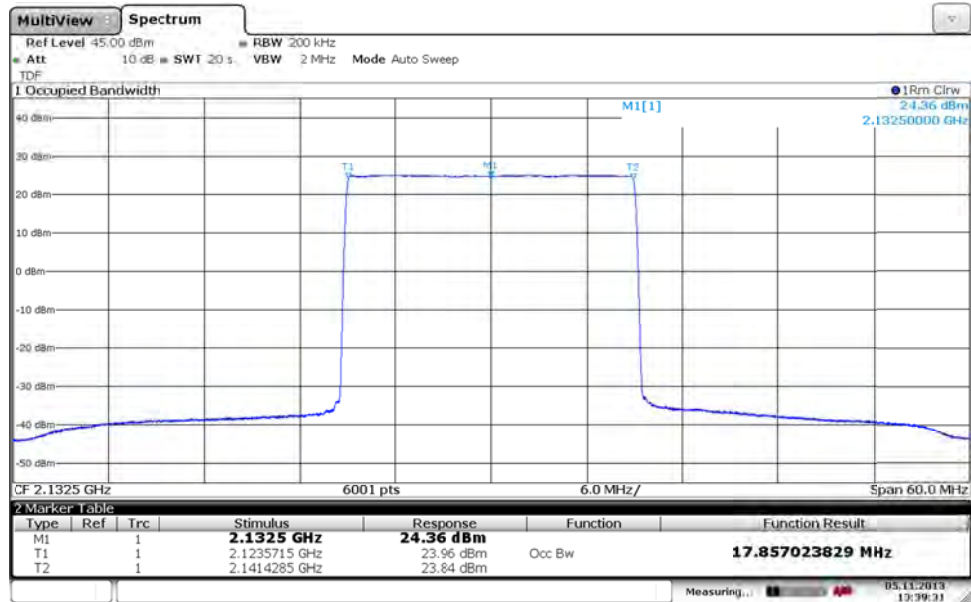
Diagram 8:



Date: 5 NOV 2013 13:38:09

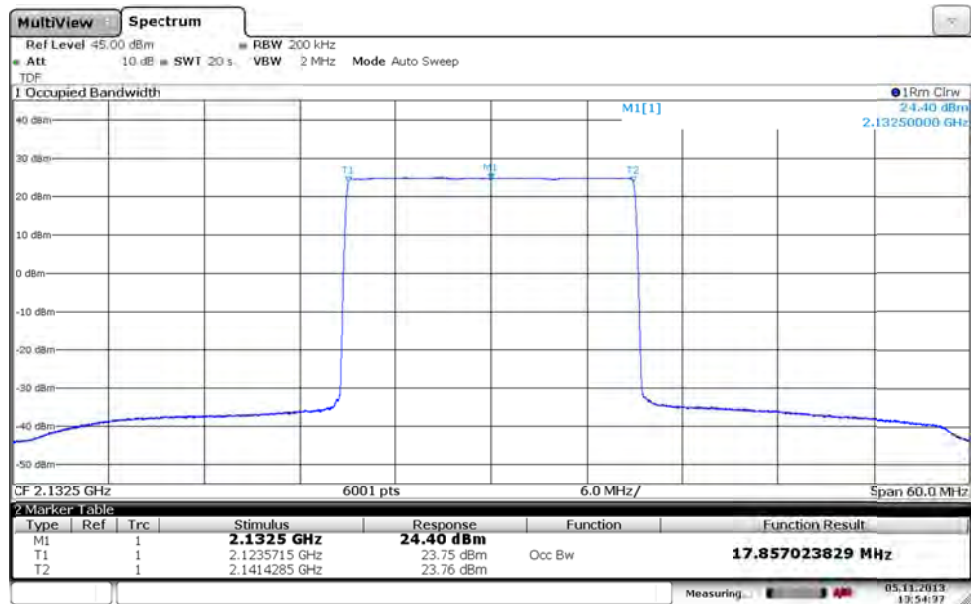
Appendix 3

Diagram 9:



Date: 5 NOV 2013 13:39:31

Diagram 10:



Date: 5 NOV 2013 13:54:37

Appendix 3

Diagram 11:

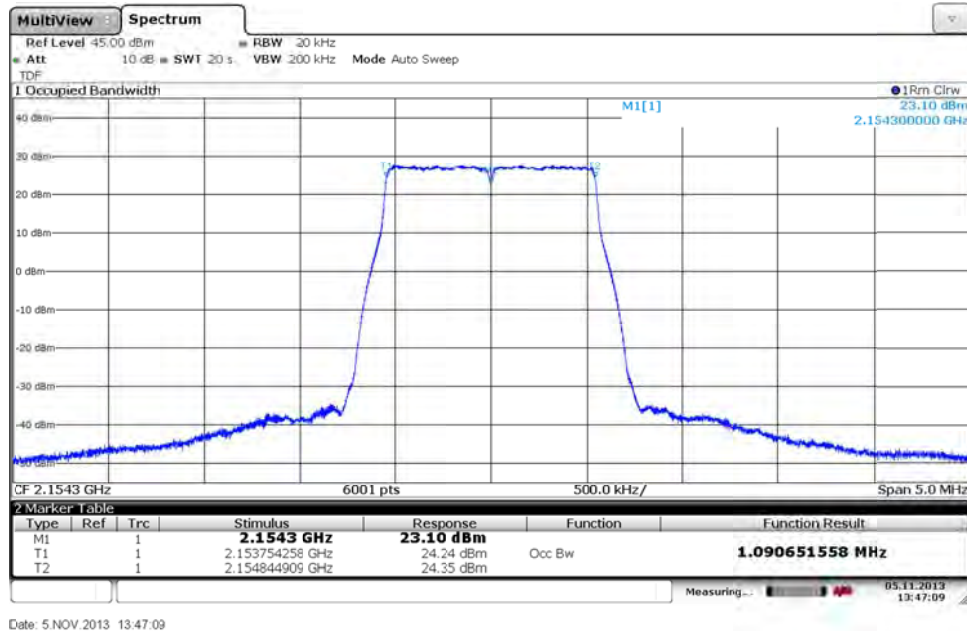
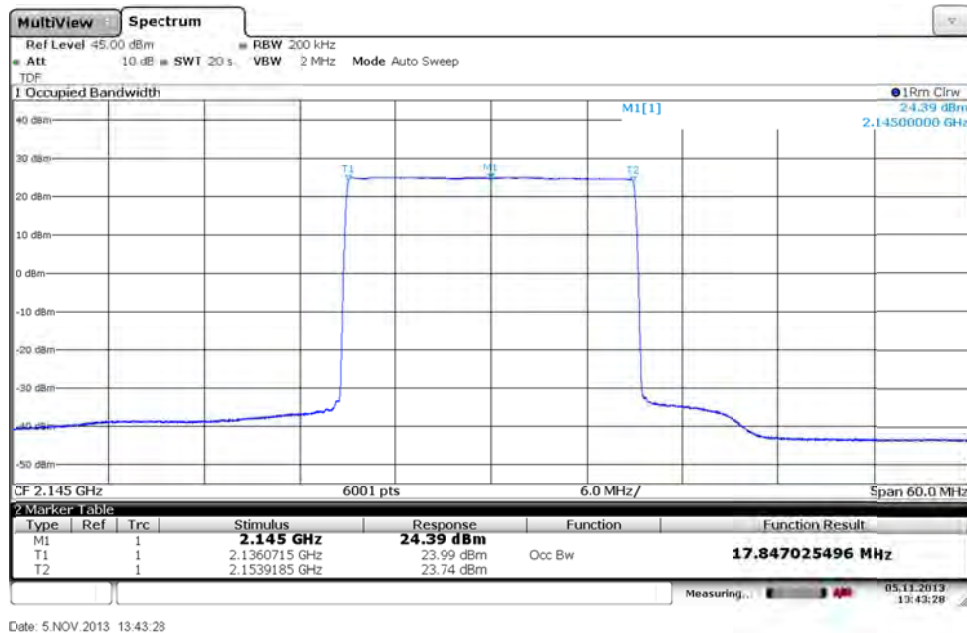


Diagram 12:



Appendix 4

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

Date	Temperature	Humidity
2013-11-04	19 °C ± 3 °C	35 % ± 5 %
2013-11-05	22 °C ± 3 °C	30 % ± 5 %
2013-11-06	22 °C ± 3 °C	29 % ± 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.

Beyond the 1st MHz off the band edges the limit was adjusted to compensate for reduced measurement bandwidths pursuant to the FCC rules, specifying a RBW of at least 1% of the fundamental emission bandwidth up to 1 MHz away from the band edges 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), a), (iii) Measure and add 10 log(N_{ANT})” of FCC KDB662911 D01 Multiple Transmitter Output v02r01.

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	902 282
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Appendix 4

Results

MIMO mode, 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

MIMO mode, multi carrier

Diagram	BW configuration	Tested frequency	Tested Port
15 a-c	1.4 MHz	B2-1.4	RF A
16 a-c	3 MHz	B2-3	RF A
17 a-c	1.4 MHz	T2-1.4	RF A
18 a-c	3 MHz	T2-3	RF A

Limits

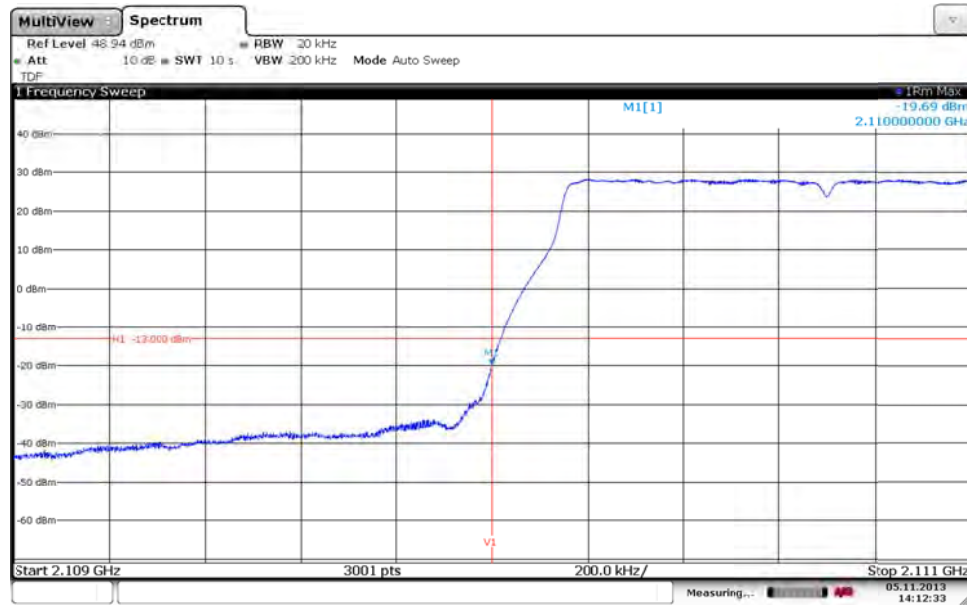
CFR 47 §27.53(h) and RSS-139 6.5

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
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Appendix 4

Diagram 1 a:



Date: 5 NOV. 2013 14:12:33

Diagram 1 b:



Date: 5 NOV. 2013 14:13:22

Appendix 4

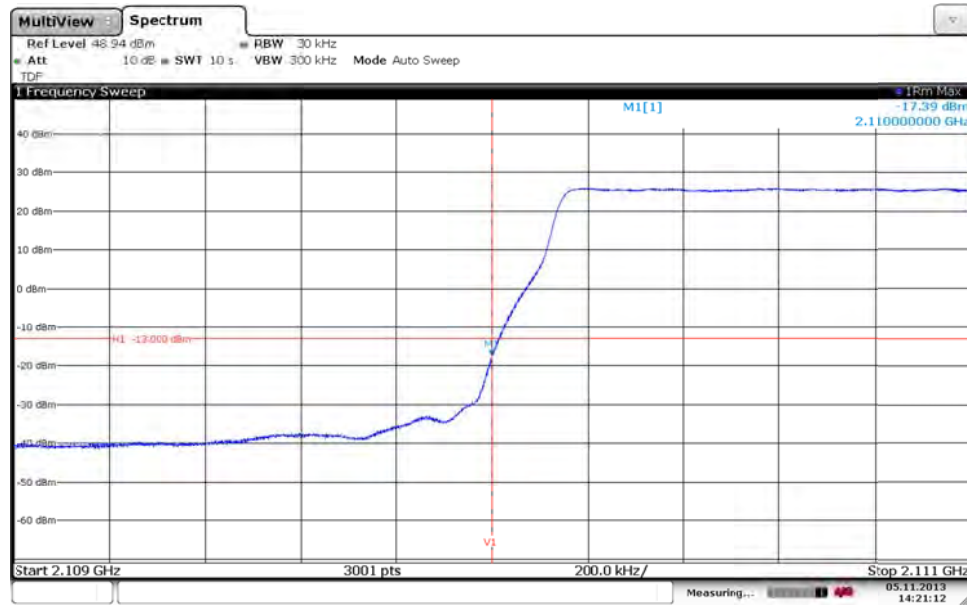
Diagram 1 c:



Date: 5 NOV. 2013 14:14:05

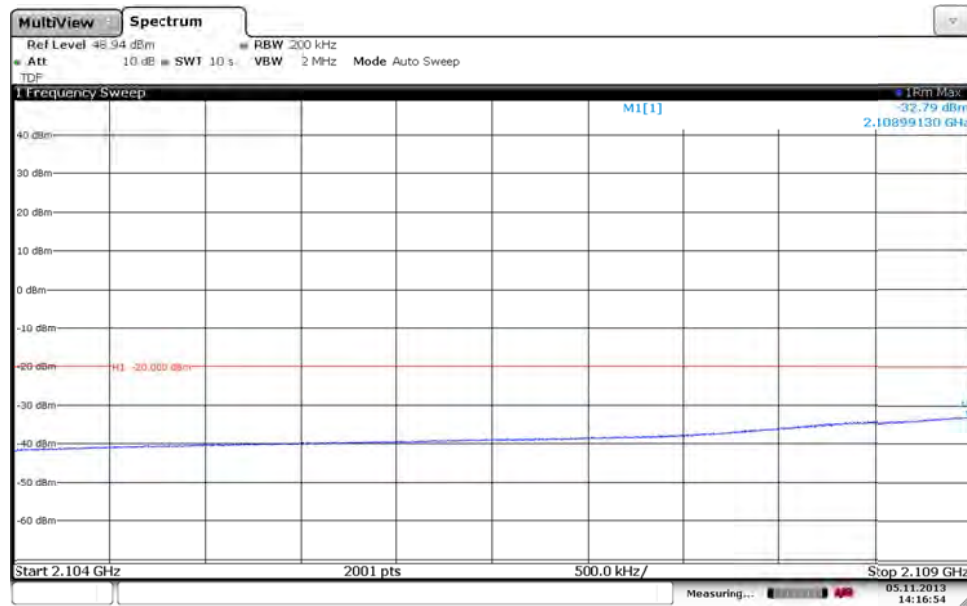
Appendix 4

Diagram 2 a:



Date: 5 NOV. 2013 14:21:12

Diagram 2 b:



Date: 5 NOV. 2013 14:16:55

Appendix 4

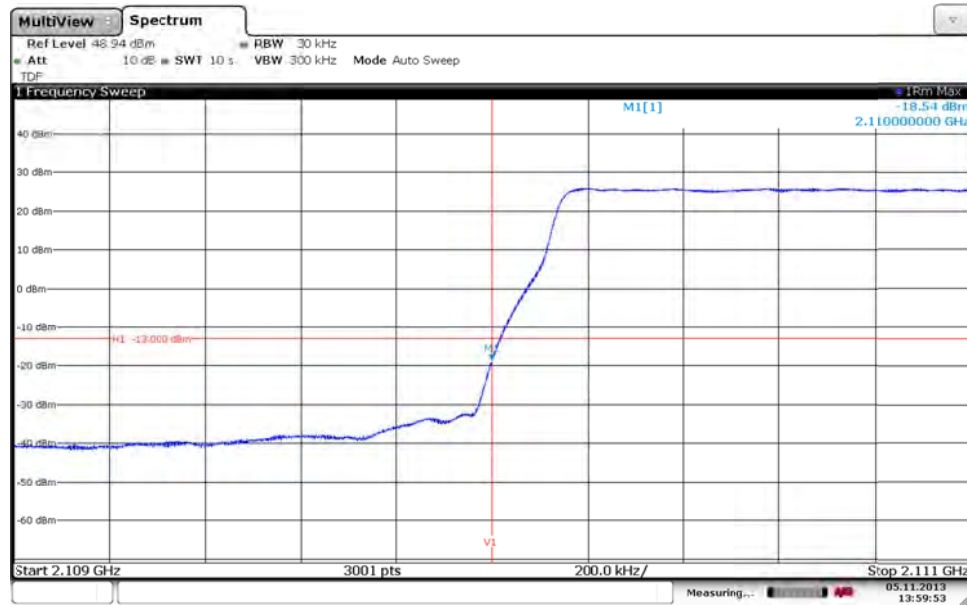
Diagram 2c:



Date: 5 NOV. 2013 14:16:04

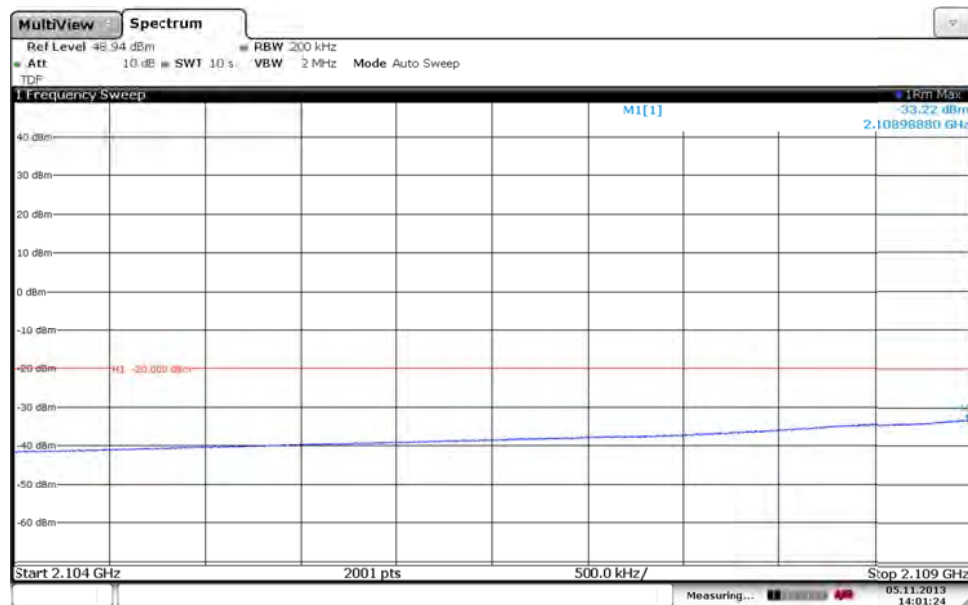
Appendix 4

Diagram 3 a:



Date: 5 NOV. 2013 13:59:54

Diagram 3 b:



Date: 5 NOV. 2013 14:01:25

Appendix 4

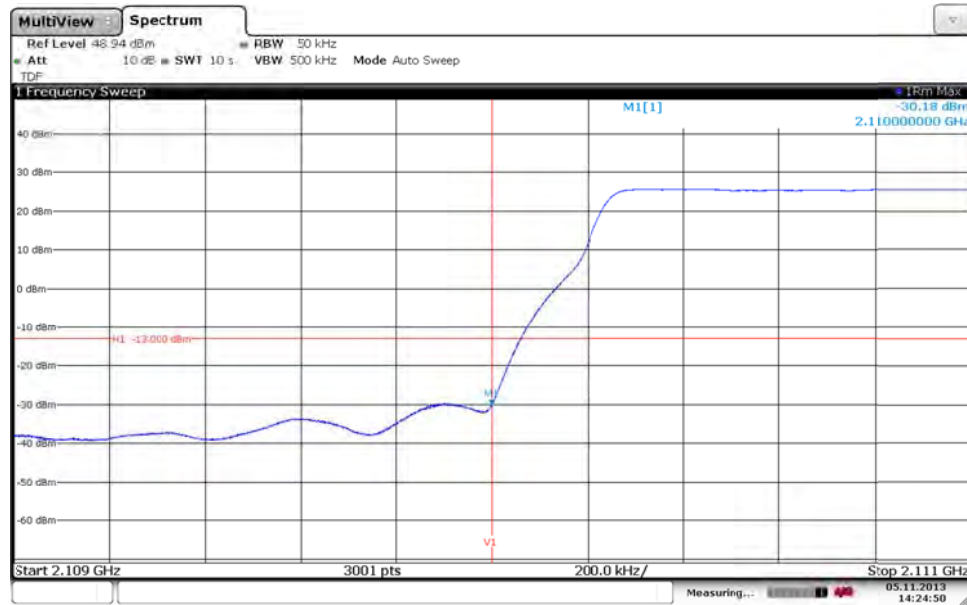
Diagram 3 c:



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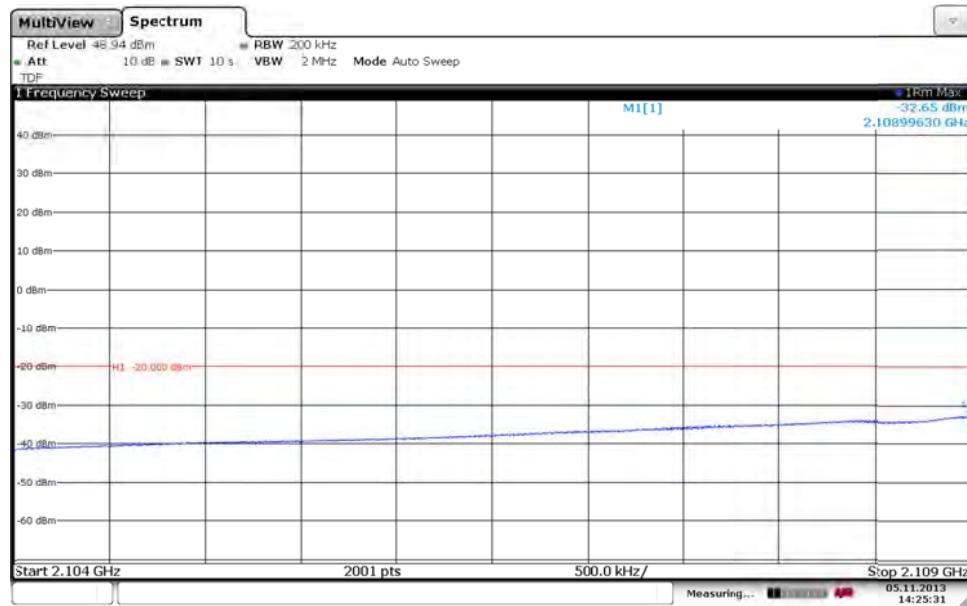
Appendix 4

Diagram 4 a:



Date: 5 NOV. 2013 14:24:49

Diagram 4 a:



Date: 5 NOV. 2013 14:25:31

Appendix 4

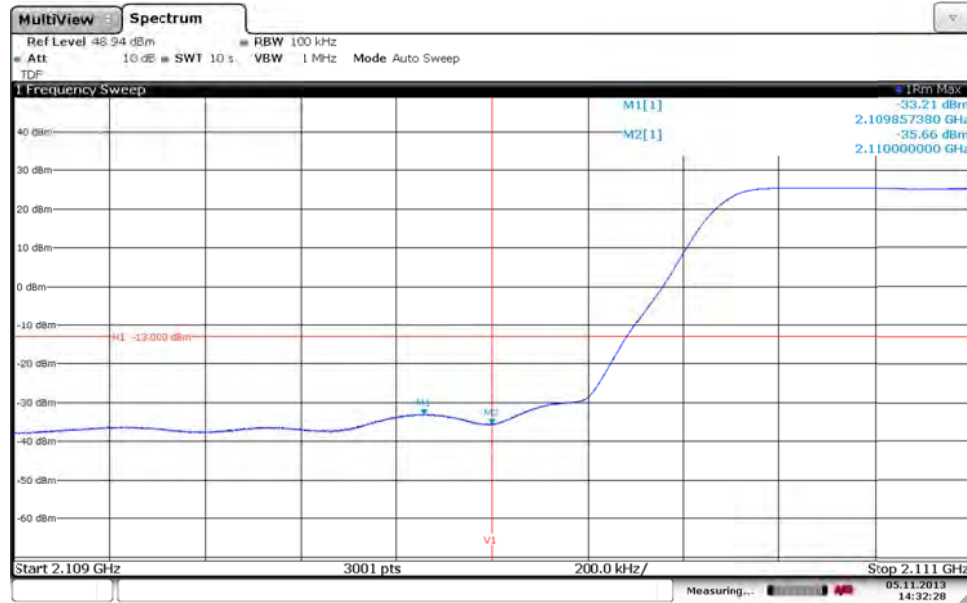
Diagram 4 c:



Date: 5 NOV 2013 14:26:23

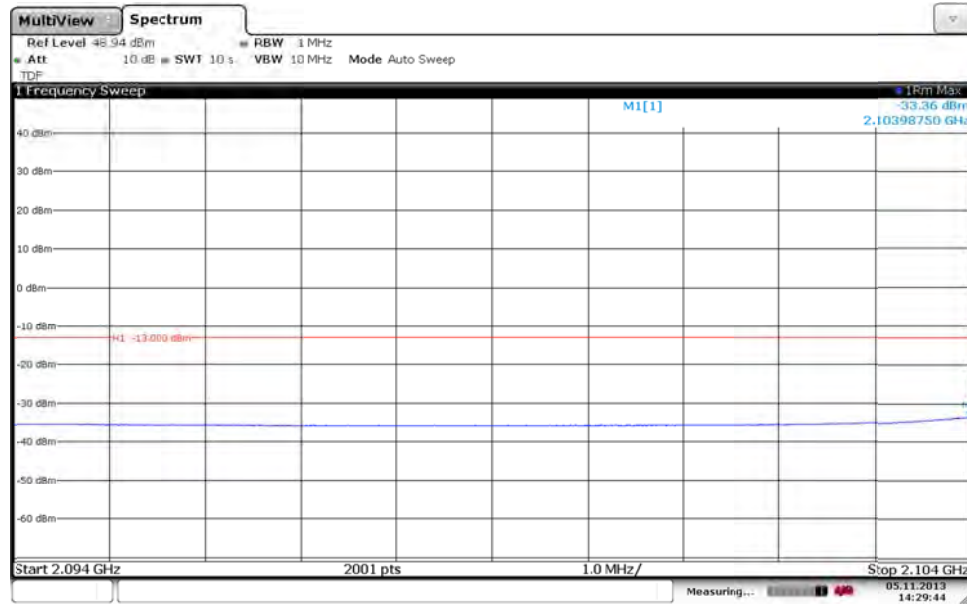
Appendix 4

Diagram 5 a:



Date: 5 NOV 2013 14:32:29

Diagram 5 b:



Date: 5 NOV 2013 14:29:44

Appendix 4

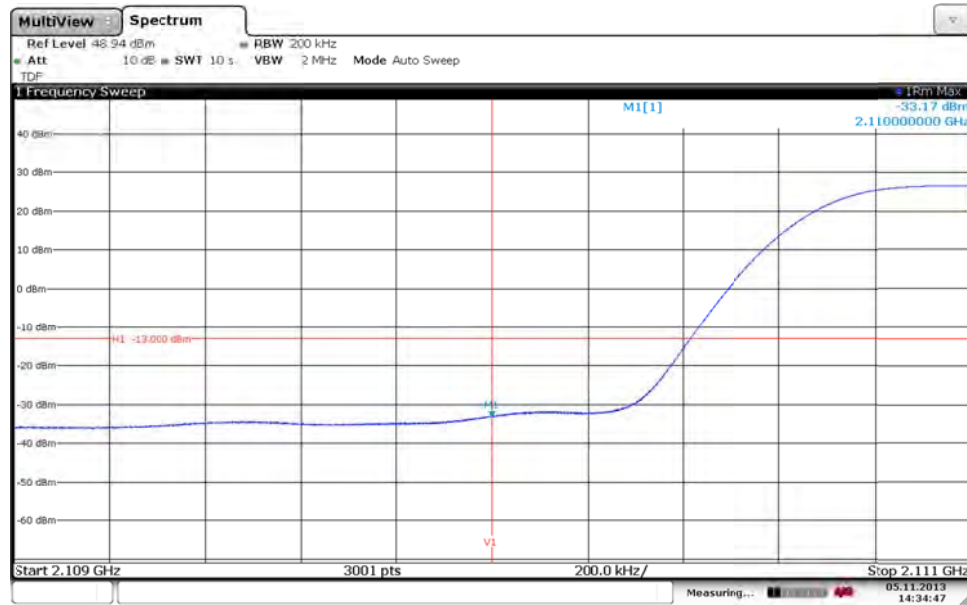
Diagram 5 c



Date: 5 NOV 2013 14:29:04

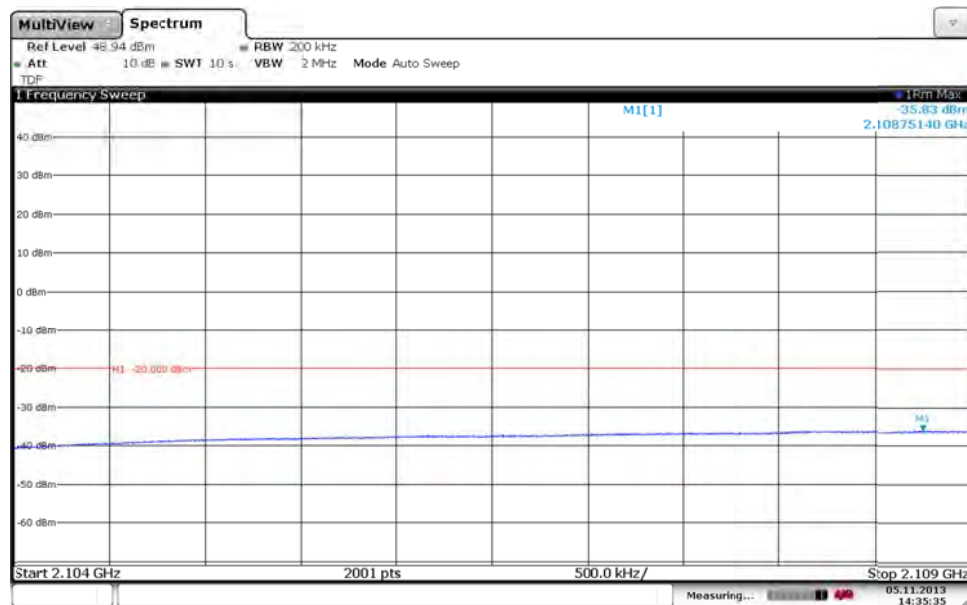
Appendix 4

Diagram 6 a:



Date: 5 NOV. 2013 14:34:43

Diagram 6 b:



Date: 5 NOV. 2013 14:35:35

Appendix 4

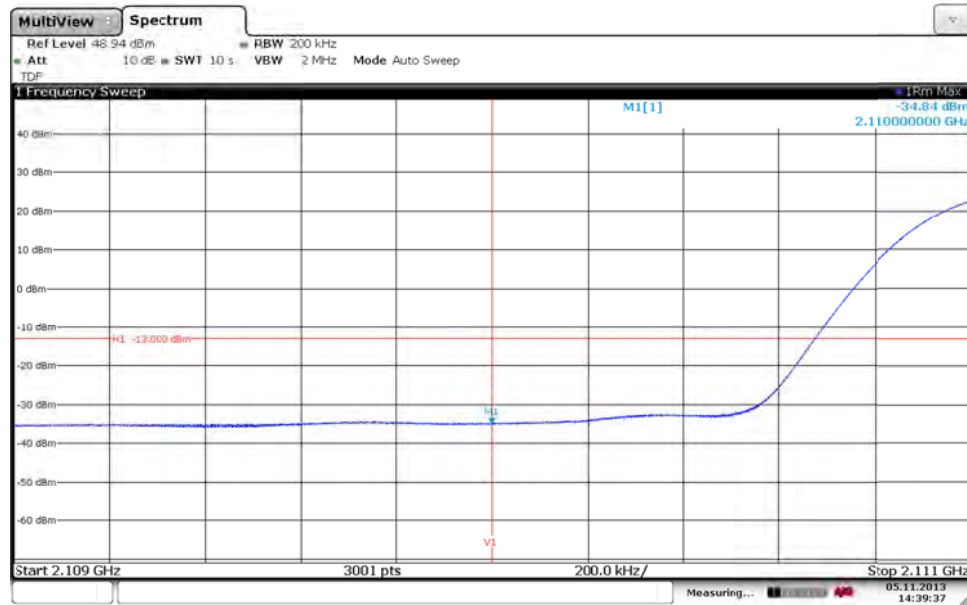
Diagram 6 c:



Date: 5 NOV. 2013 14:36:21

Appendix 4

Diagram 7 a:



Date: 5 NOV. 2013 14:39:37

Diagram 7 b:



Date: 5 NOV. 2013 14:38:35

Appendix 4

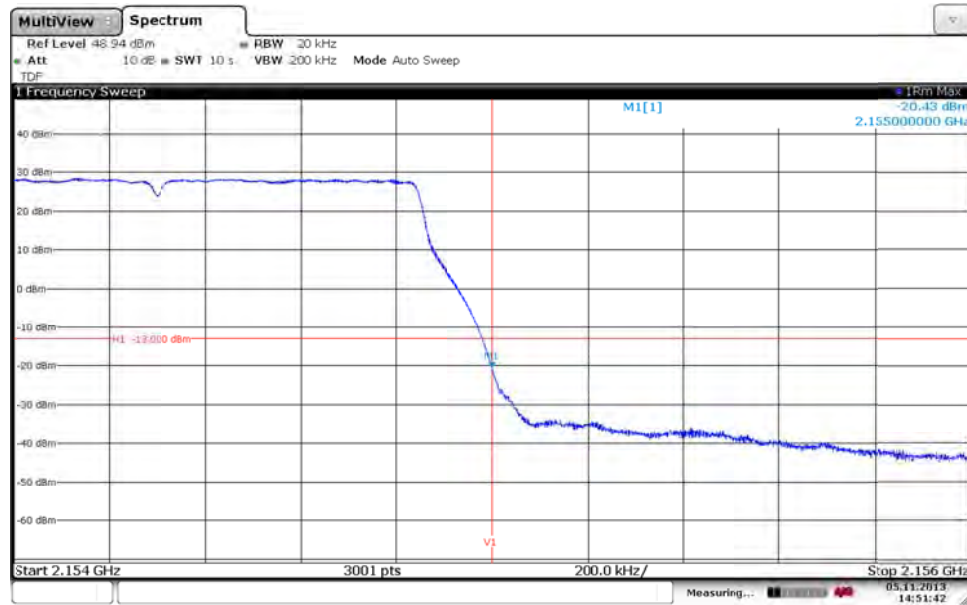
Diagram 7 c:



Date: 5 NOV. 2013 14:37:45

Appendix 4

Diagram 8 a:



Date: 5 NOV. 2013 14:51:42

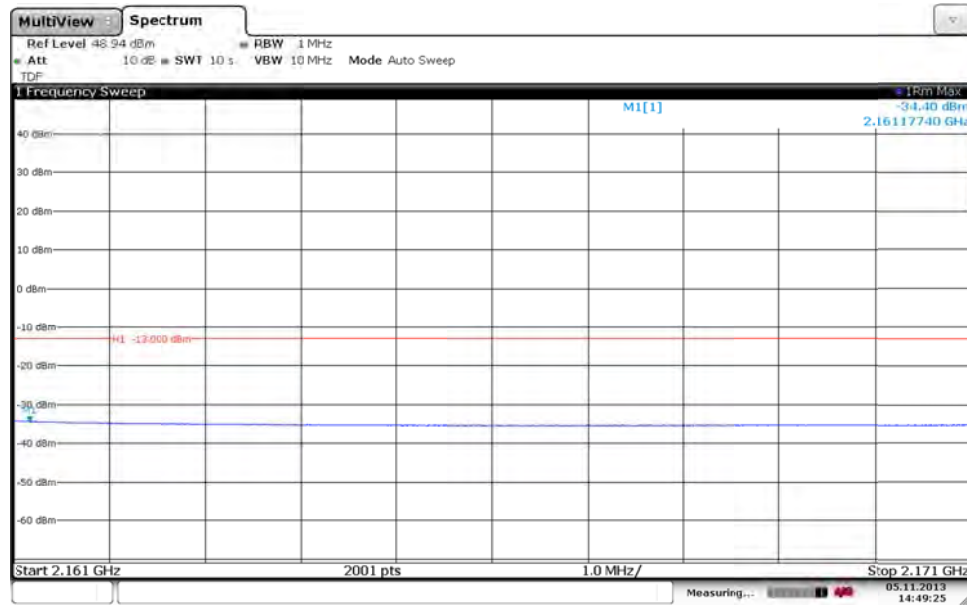
Diagram 8 b:



Date: 5 NOV. 2013 14:50:02

Appendix 4

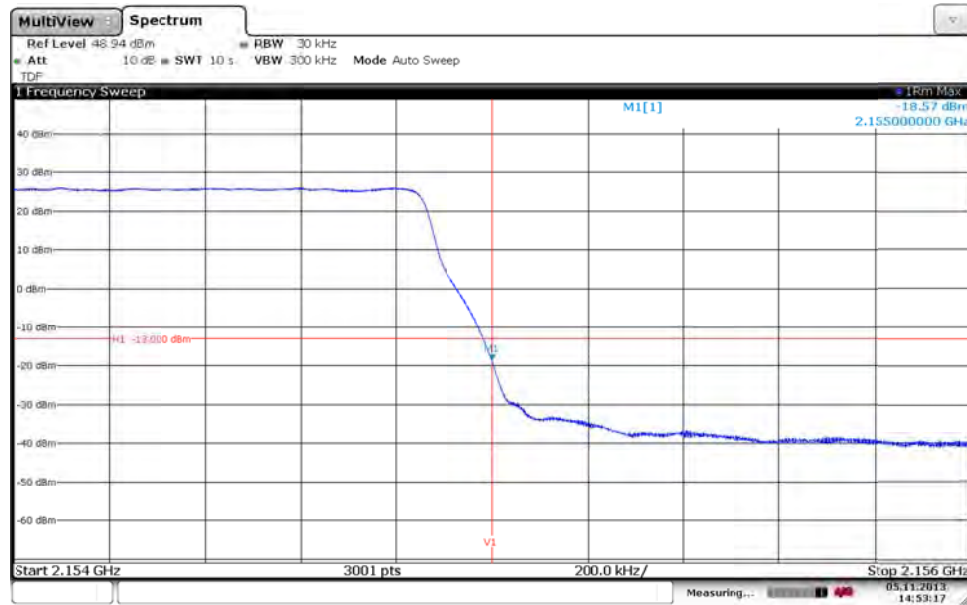
Diagram 8 c:



Date: 5 NOV 2013 14:49:25

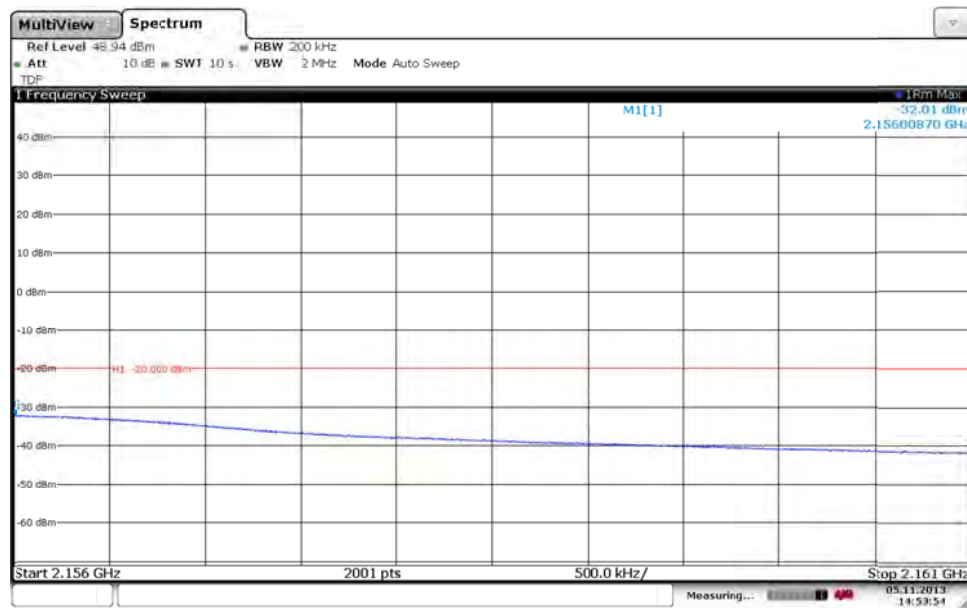
Appendix 4

Diagram 9 a:



Date: 5 NOV. 2013 14:53:13

Diagram 9 b:



Date: 5 NOV. 2013 14:53:54

Appendix 4

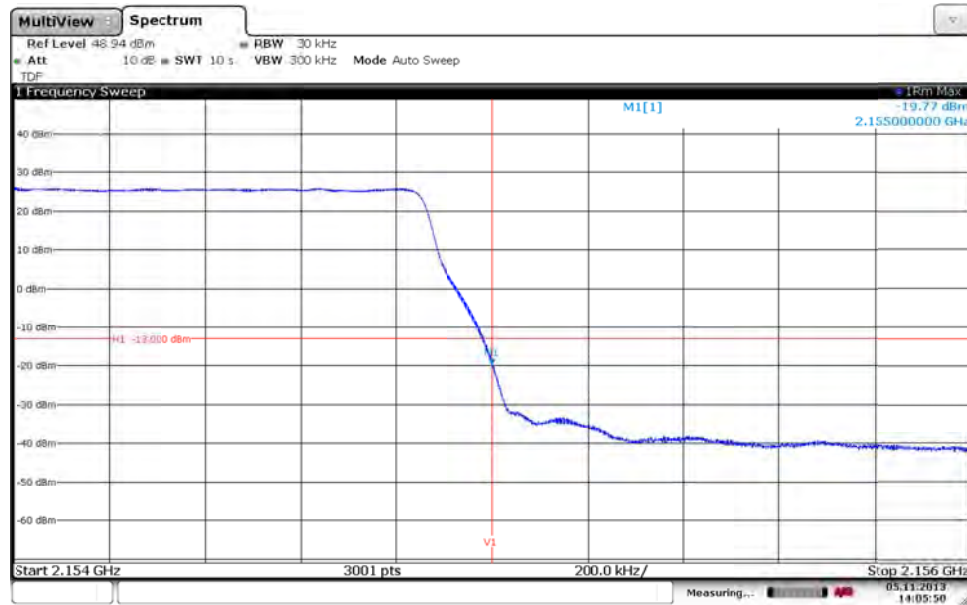
Diagram 9 c:



Date: 5 NOV. 2013 14:54:43

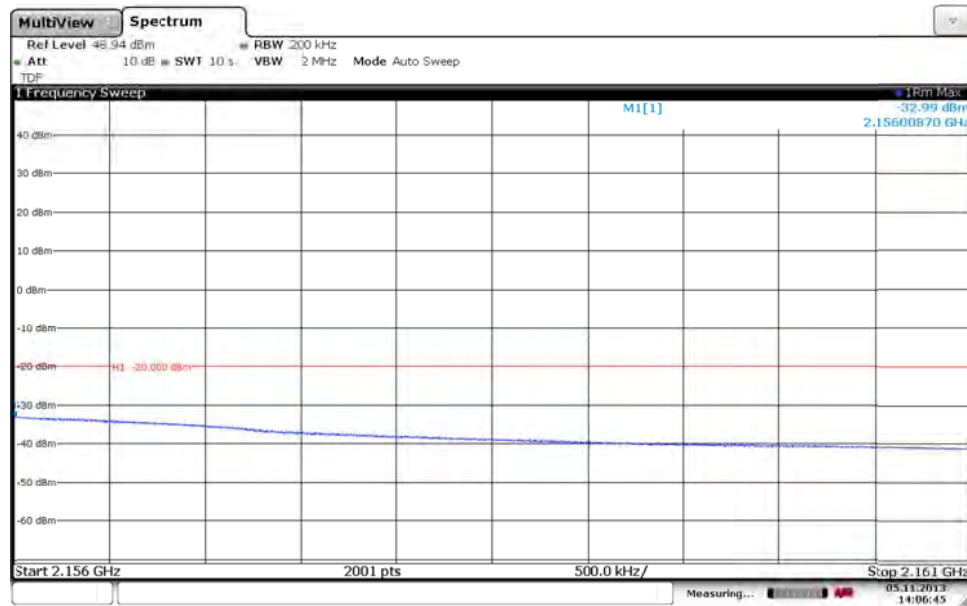
Appendix 4

Diagram 10 a:



Date: 5 NOV 2013 14:05:50

Diagram 10 b:



Date: 5 NOV 2013 14:06:44

Appendix 4

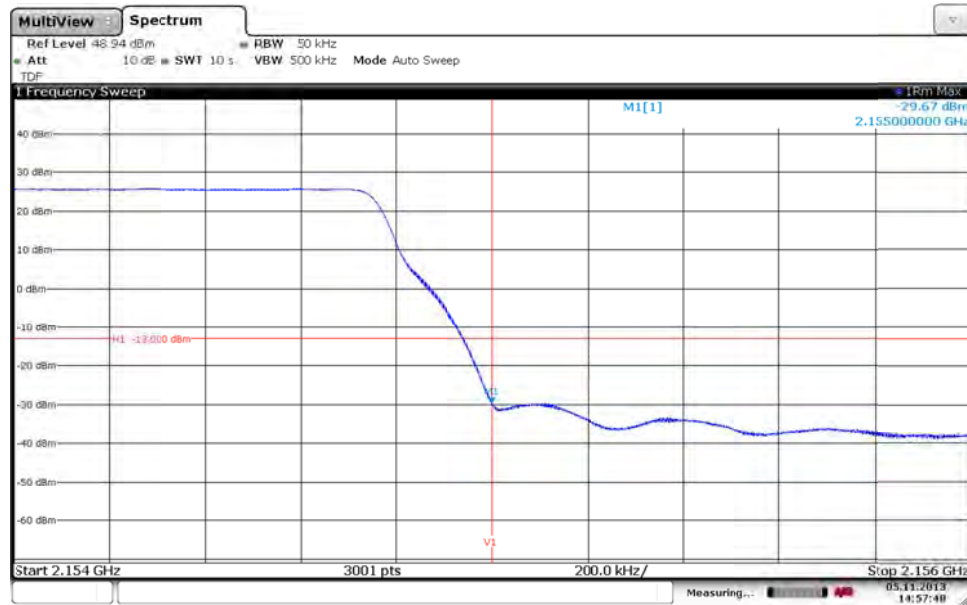
Diagram 10 c:



Date: 5 NOV. 2013 14:07:35

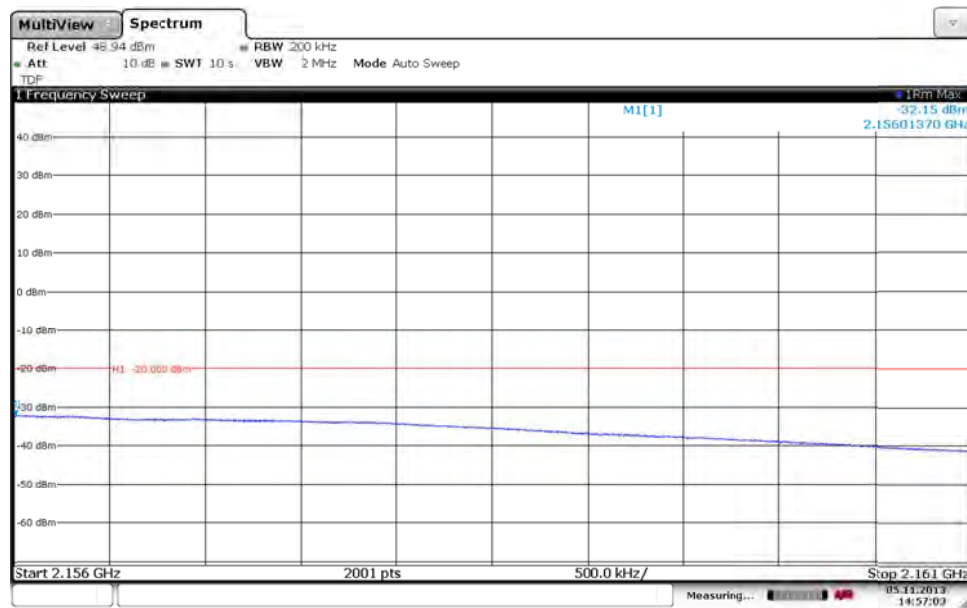
Appendix 4

Diagram 11a:



Date: 5 NOV. 2013 14:57:43

Diagram 11 b:



Date: 5 NOV. 2013 14:57:02

Appendix 4

Diagram 11 c:



Date: 5 NOV. 2013 14:56:35

Appendix 4

Diagram 12 a:

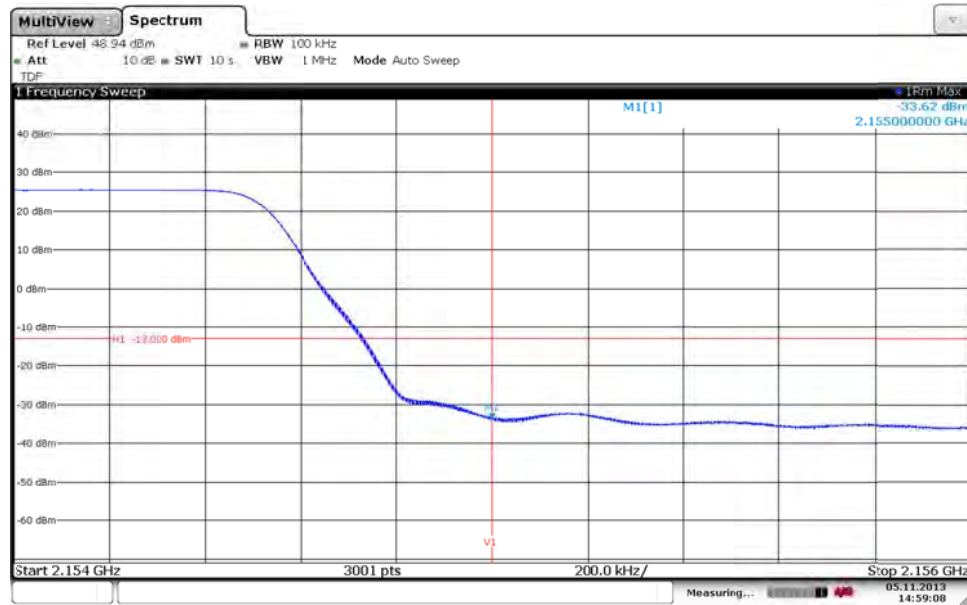
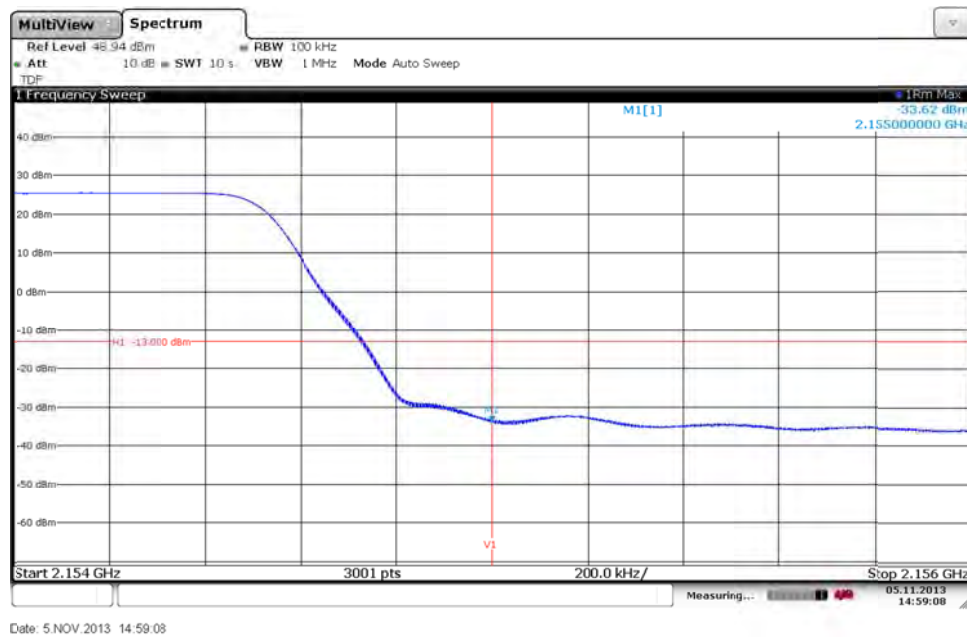


Diagram 12 b:



Appendix 4

Diagram 12 c:



Appendix 4

Diagram 13a:

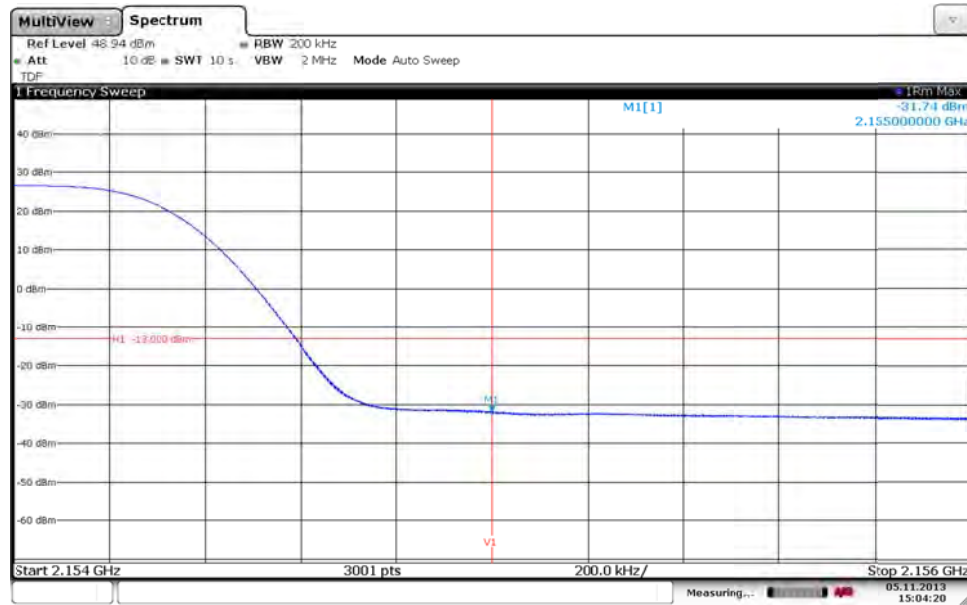
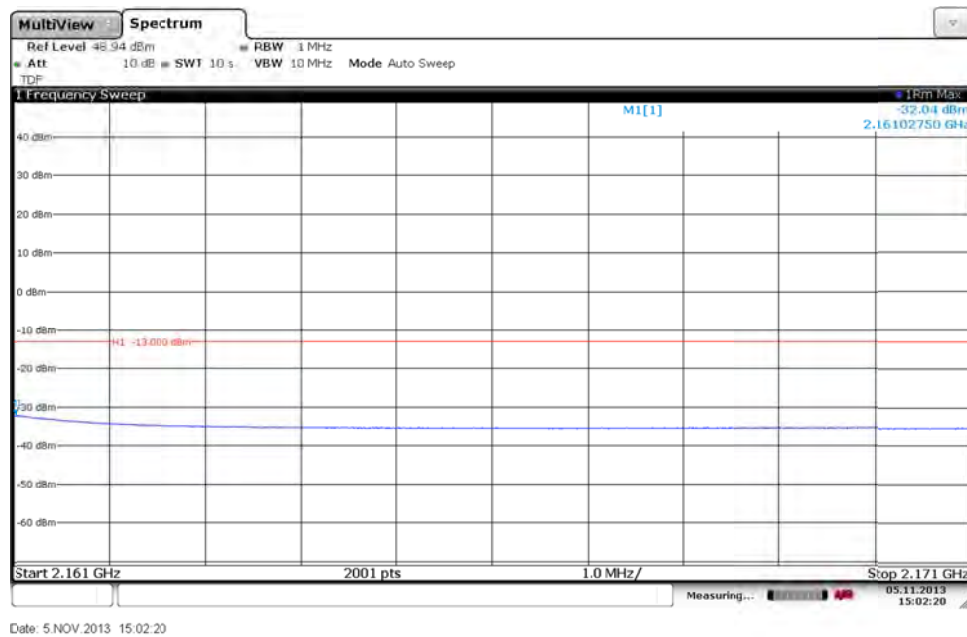
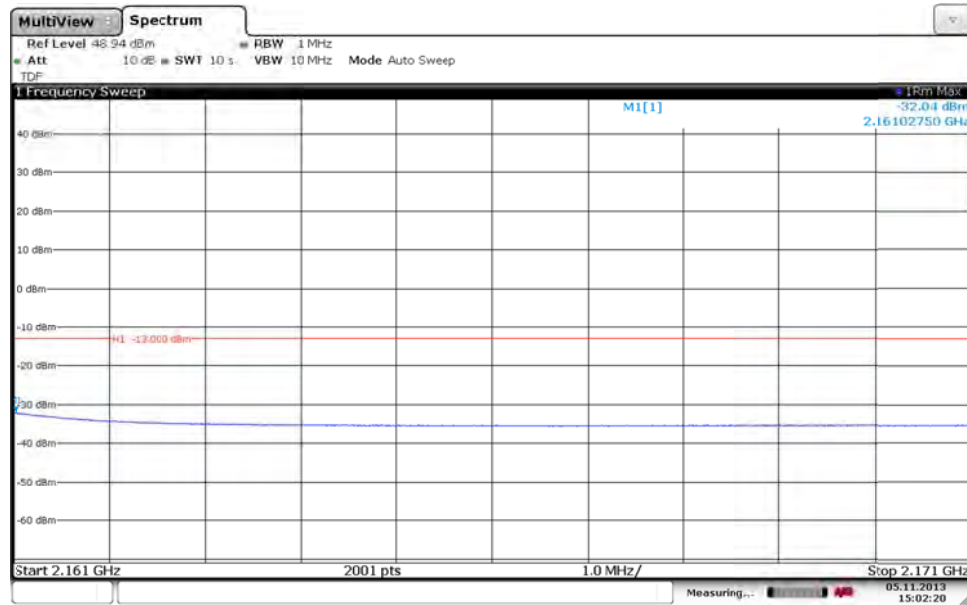


Diagram 13 b:



Appendix 4

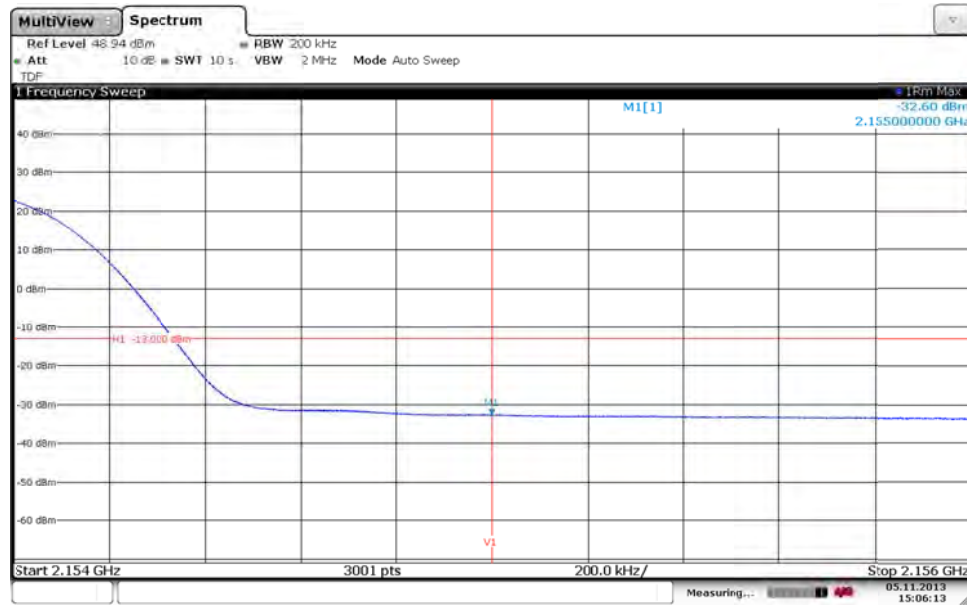
Diagram 13 c:



Date: 5 NOV 2013 15:02:20

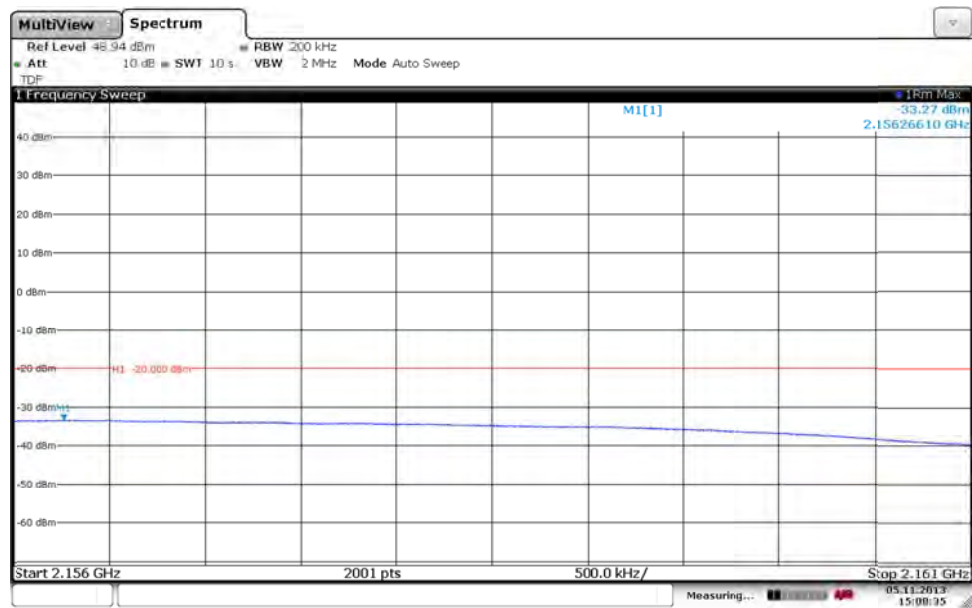
Appendix 4

Diagram 14 a:



Date: 5 NOV. 2013 15:06:13

Diagram 14 b:



Date: 5 NOV. 2013 15:08:35

Appendix 4

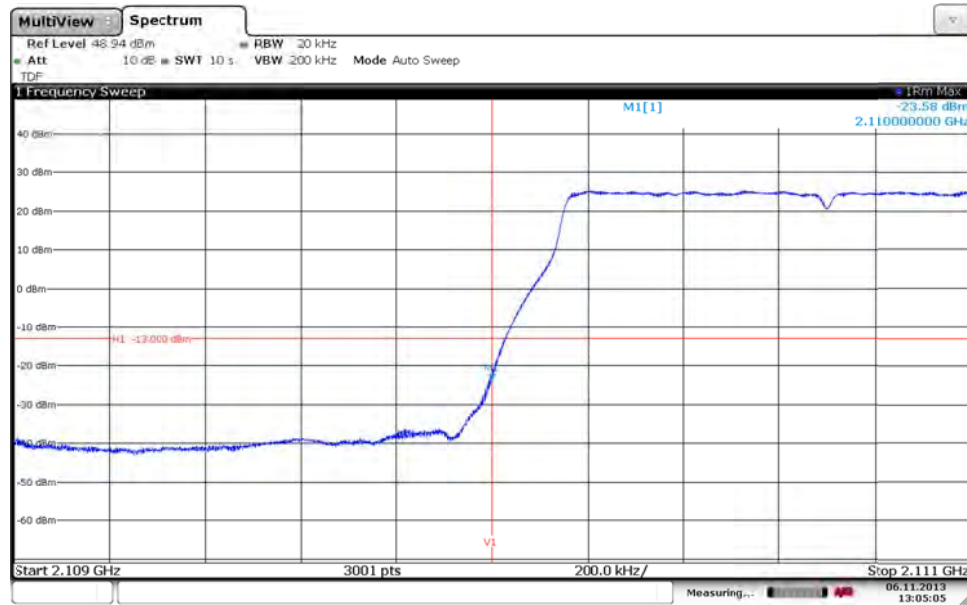
Diagram 14 c:



Date: 5 NOV. 2013 15:09:15

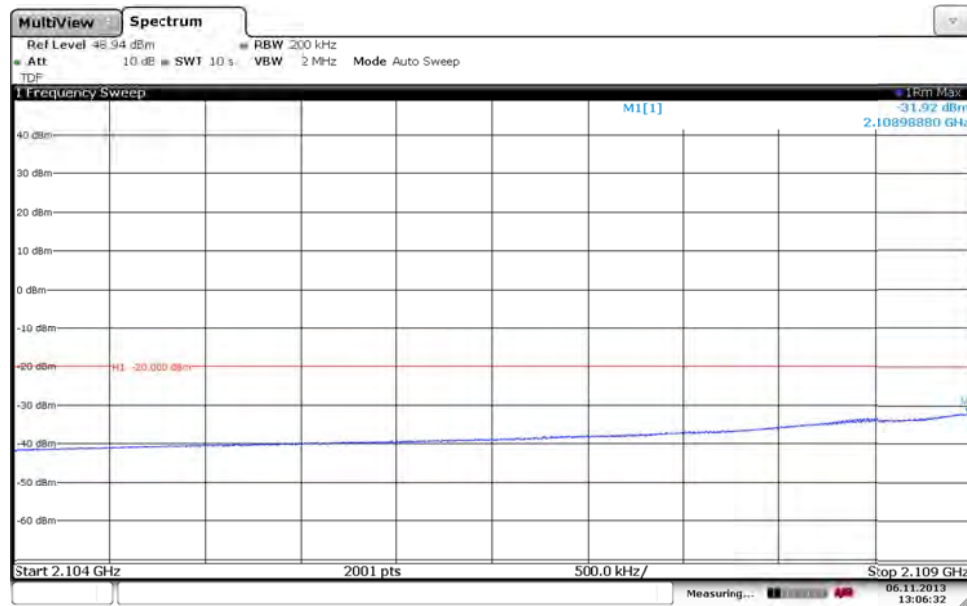
Appendix 4

Diagram 15 a:



Date: 6 NOV 2013 13:05:05

Diagram 15 b:



Date: 6 NOV 2013 13:06:32

Appendix 4

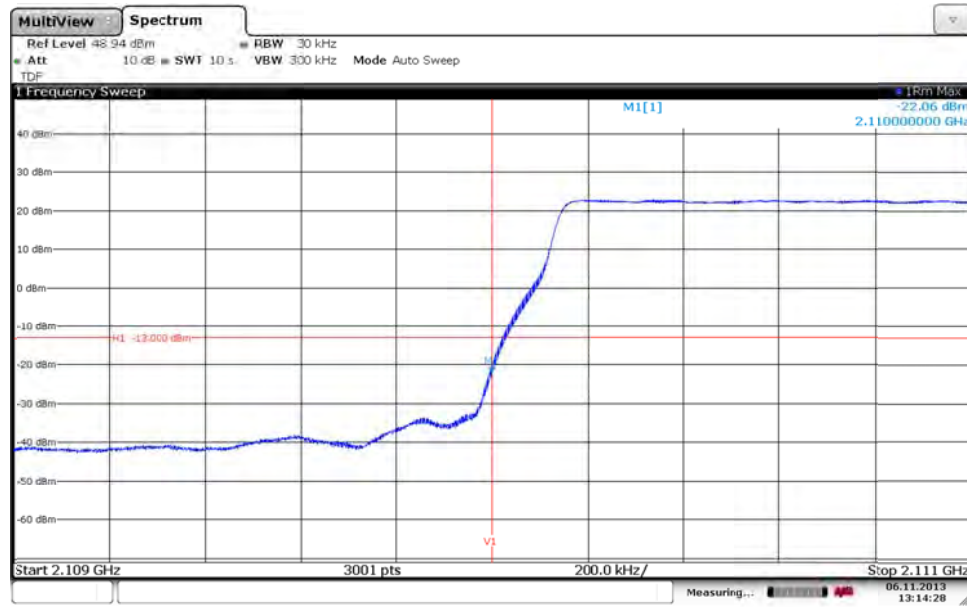
Diagram 15 c:



Date: 6 NOV. 2013 13:07:40

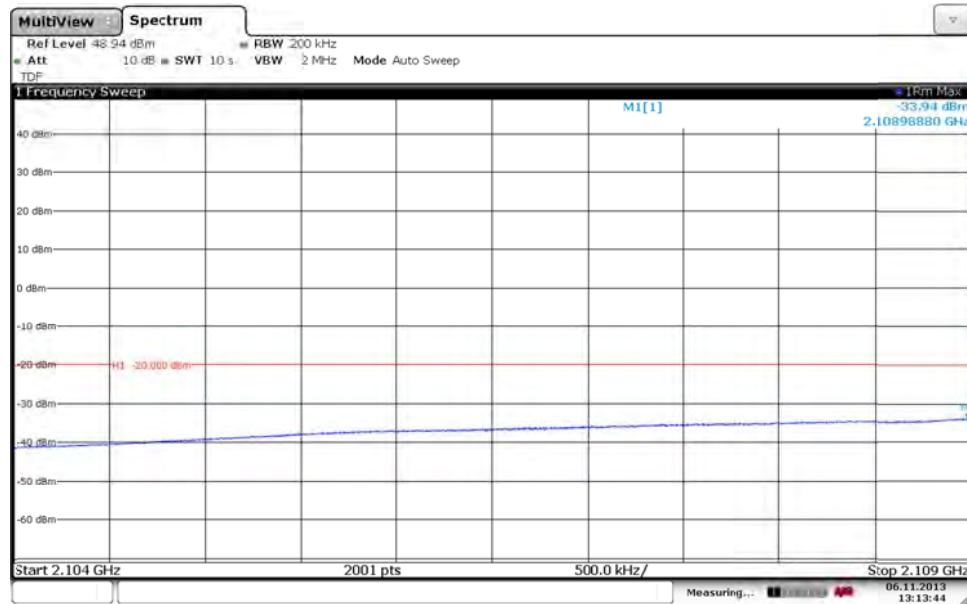
Appendix 4

Diagram 16 a:



Date: 6 NOV 2013 13:14:28

Diagram 16 b:



Date: 6 NOV 2013 13:13:44

Appendix 4

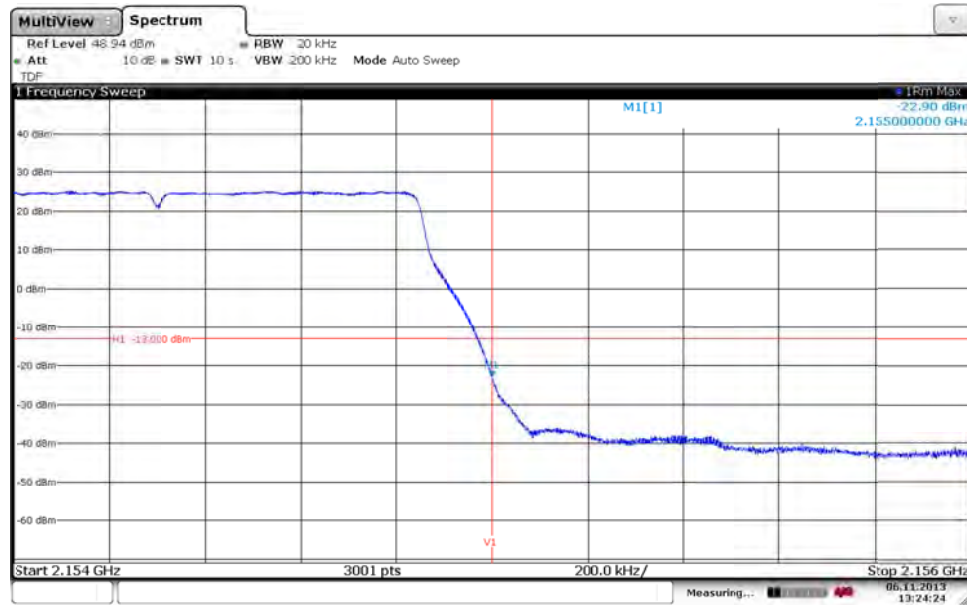
Diagram 16 c:



Date: 6 NOV. 2013 13:13:13

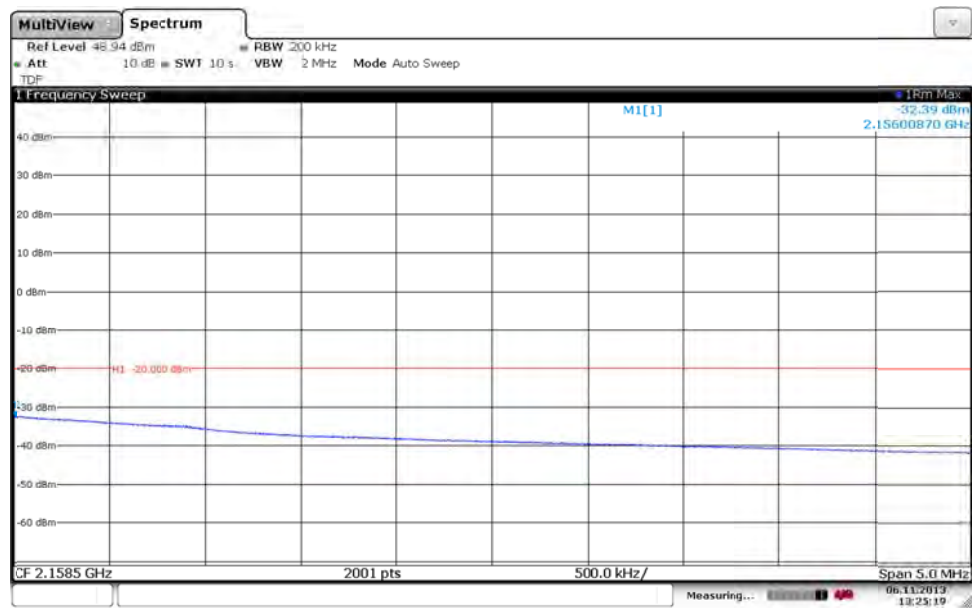
Appendix 4

Diagram 17 a:



Date: 6 NOV. 2013 13:24:25

Diagram 17 b:



Date: 6 NOV. 2013 13:25:19

Appendix 4

Diagram 17 c:



Date: 6 NOV 2013 13:26:01

Appendix 4

Diagram 18 a:

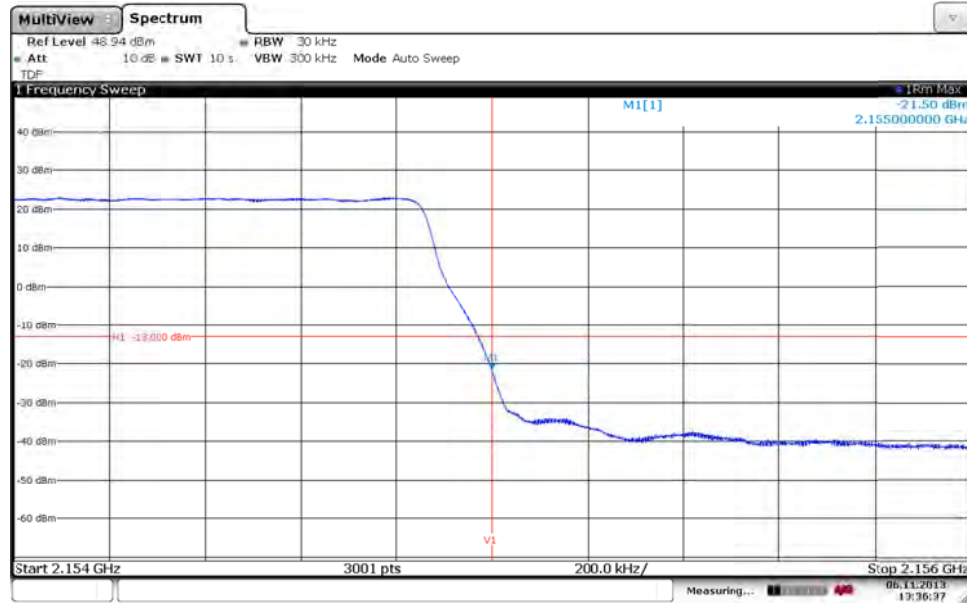


Diagram 18 b:



Appendix 4

Diagram 18 c:



Date: 6 NOV. 2013 13:35:19

Appendix 5

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

Date	Temperature	Humidity
2013-11-04	19 °C ± 3 °C	35 % ± 5 %
2013-11-06	22 °C ± 3 °C	29 % ± 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 v02r01.

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	902 282
HP filter	901 502
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Appendix 5

Results

MIMO mode, single carrier

Diagram	BW configuration / [MHz]	Symbolic name	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	Symbolic name	Tested Port
13 a+b+c+d+e	1.4 MHz	B2im1	RF A
14 a+b+c+d+e	1.4 MHz	B2im2	RF A
15 a+b+c+d	1.4 MHz	M3	RF A
16 a+b+c+d+e	1.4 MHz	T2im1	RF A
17 a+b+c+d+e	1.4 MHz	T2im2	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

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 ($10 \times 2.155 \text{ GHz} = 21.55 \text{ GHz}$).

Limits

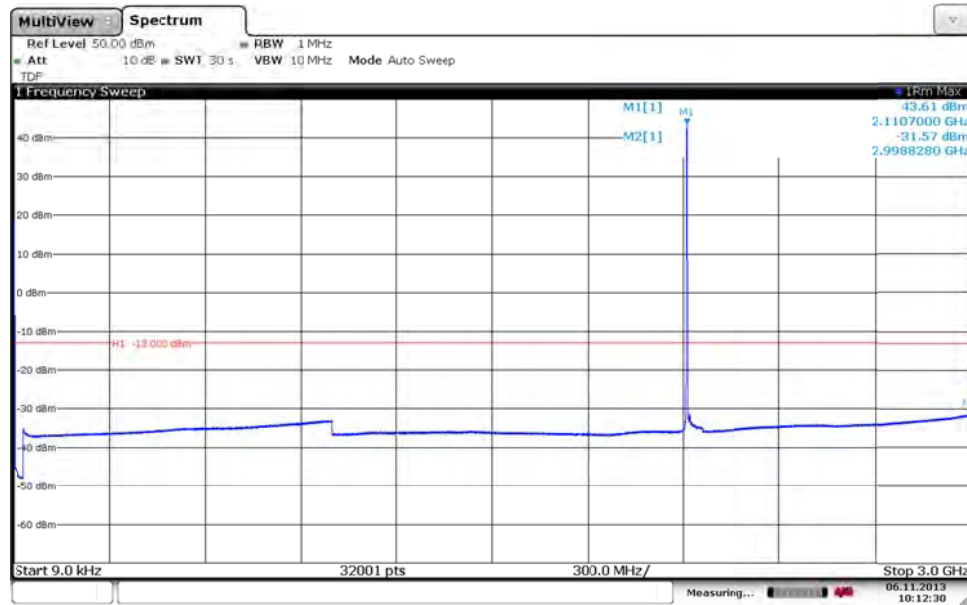
§27.53(h) and RSS-139 6.5

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
-----------	-----

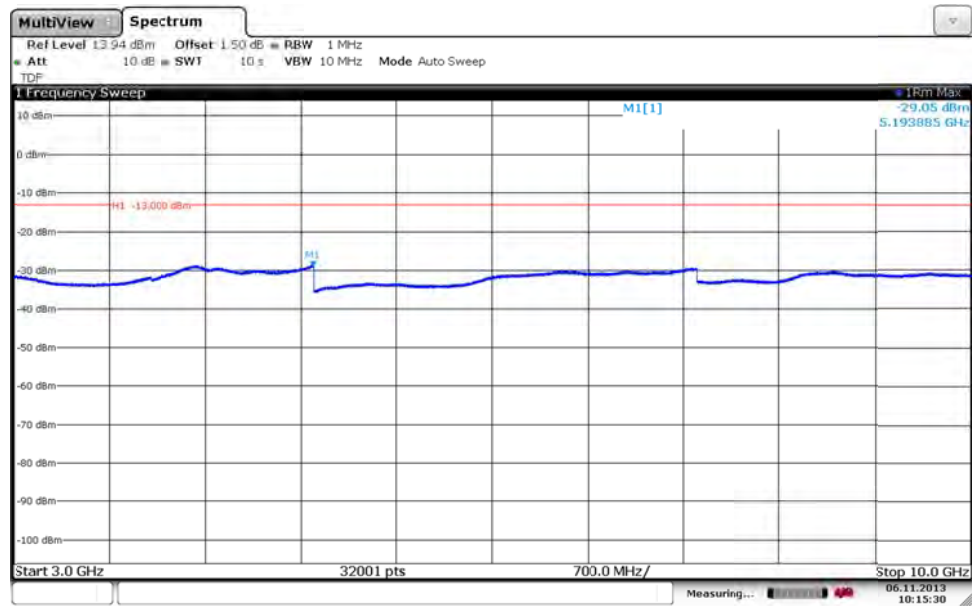
Appendix 5

Diagram 1 a:



Date: 6 NOV. 2013 10:12:31

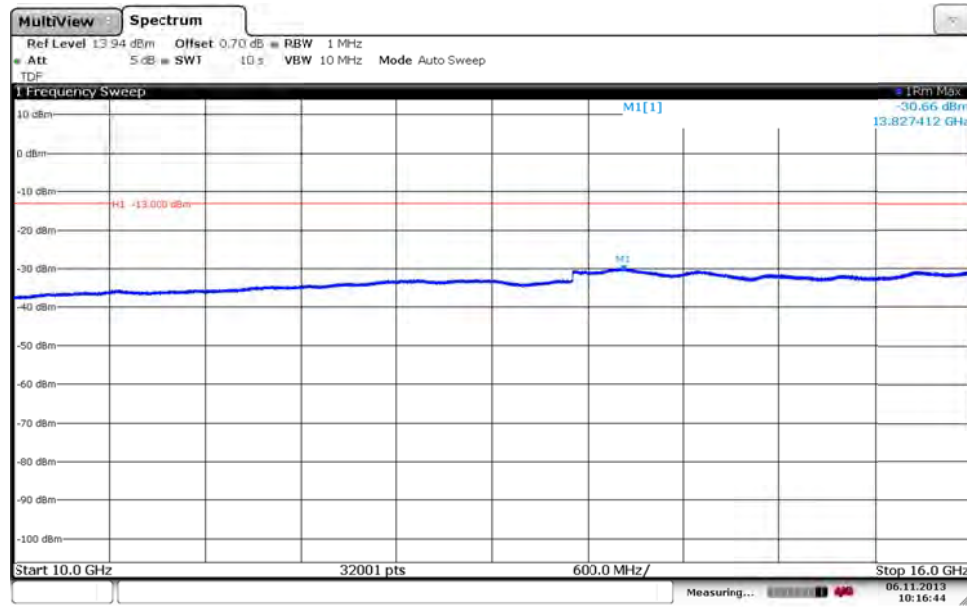
Diagram 1 b:



Date: 6 NOV. 2013 10:15:30

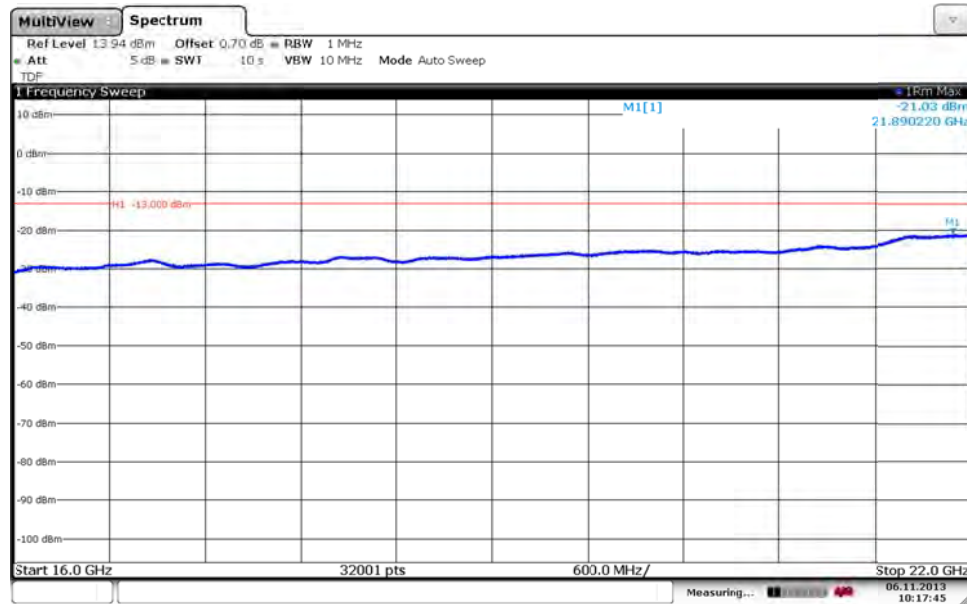
Appendix 5

Diagram 1 c:



Date: 6 NOV 2013 10:16:44

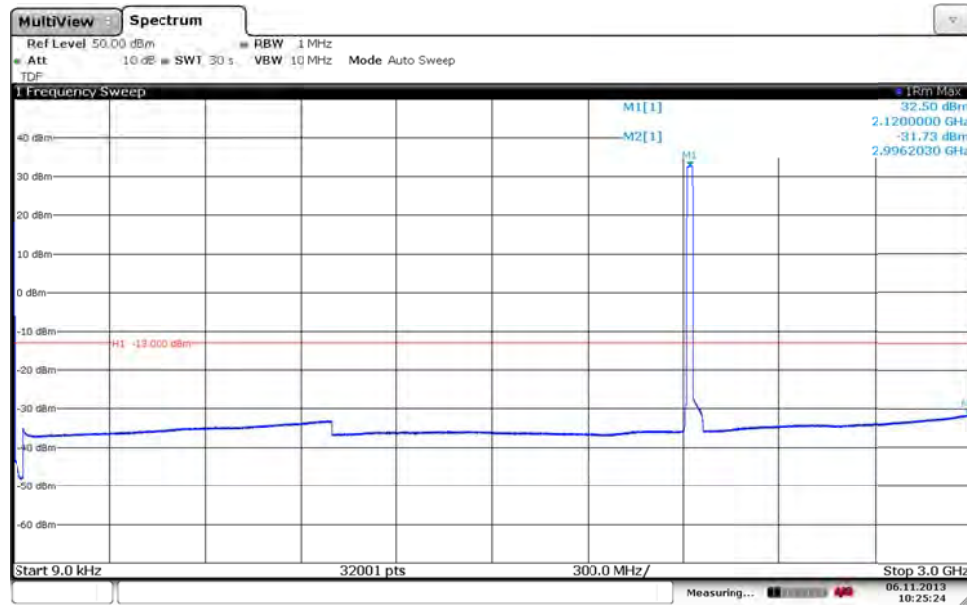
Diagram 1 d:



Date: 6 NOV 2013 10:17:44

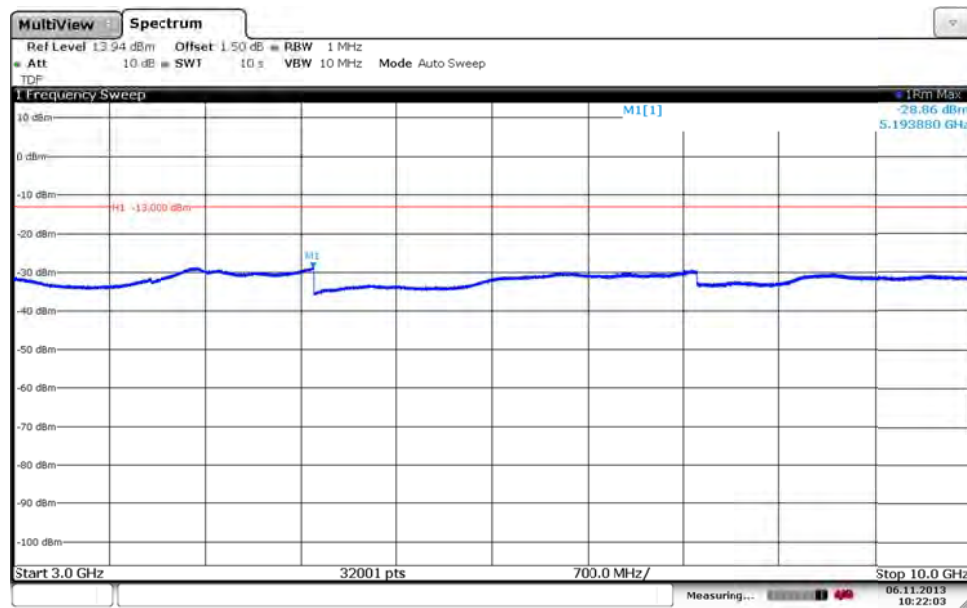
Appendix 5

Diagram 2 a:



Date: 6 NOV. 2013 10:25:24

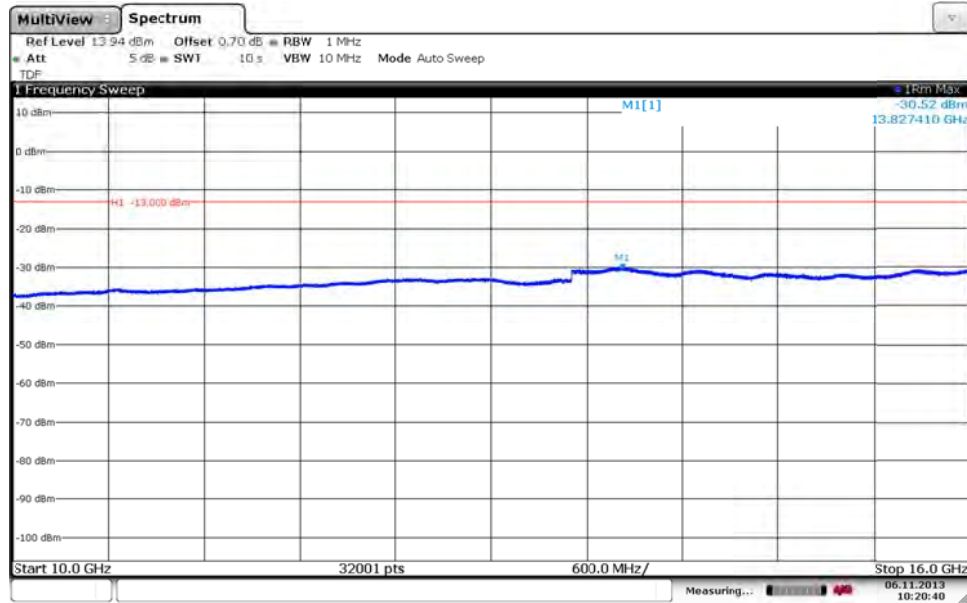
Diagram 2 b:



Date: 6 NOV. 2013 10:22:03

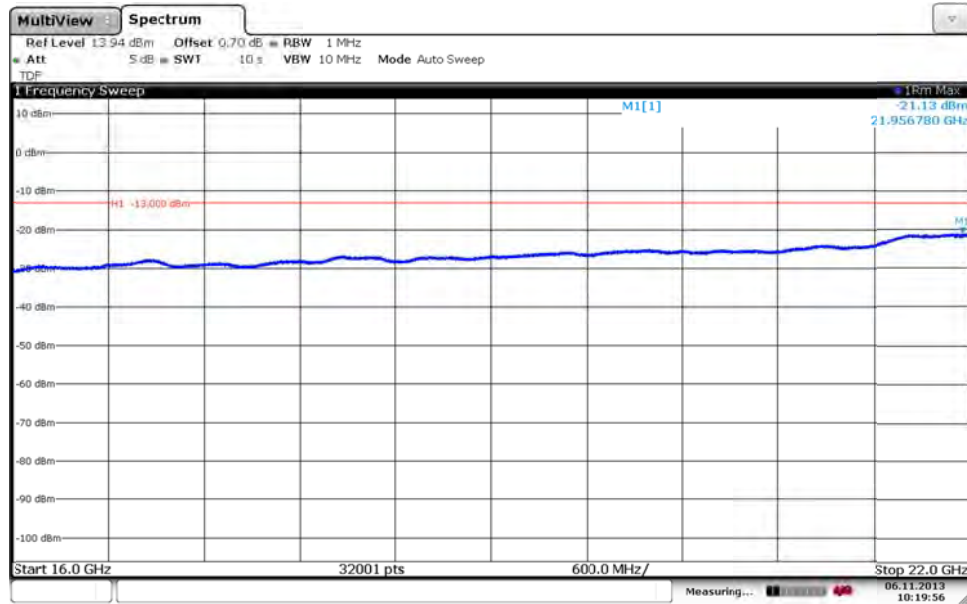
Appendix 5

Diagram 2 c:



Date: 6 NOV. 2013 10:20:43

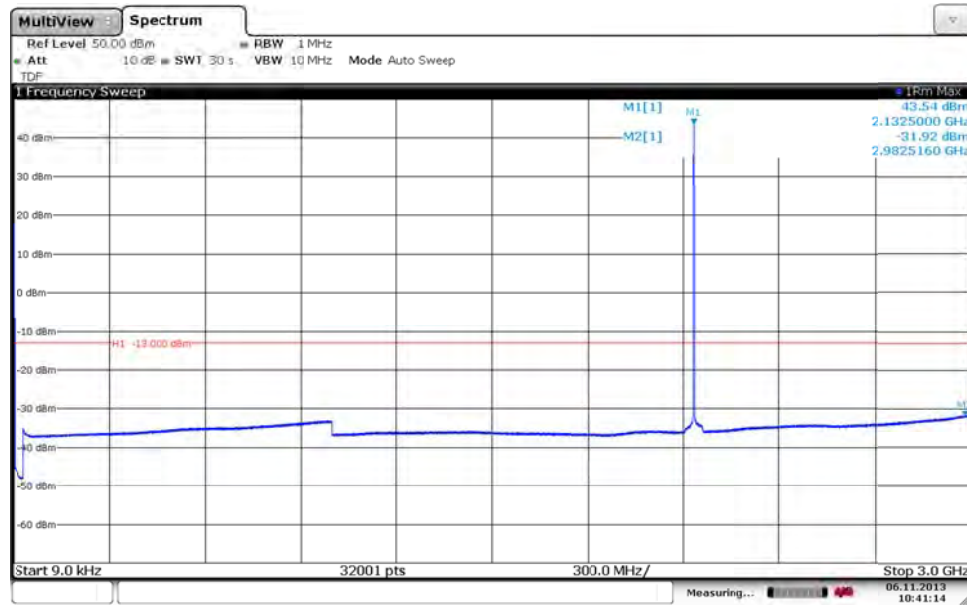
Diagram 2 d:



Date: 6 NOV. 2013 10:19:57

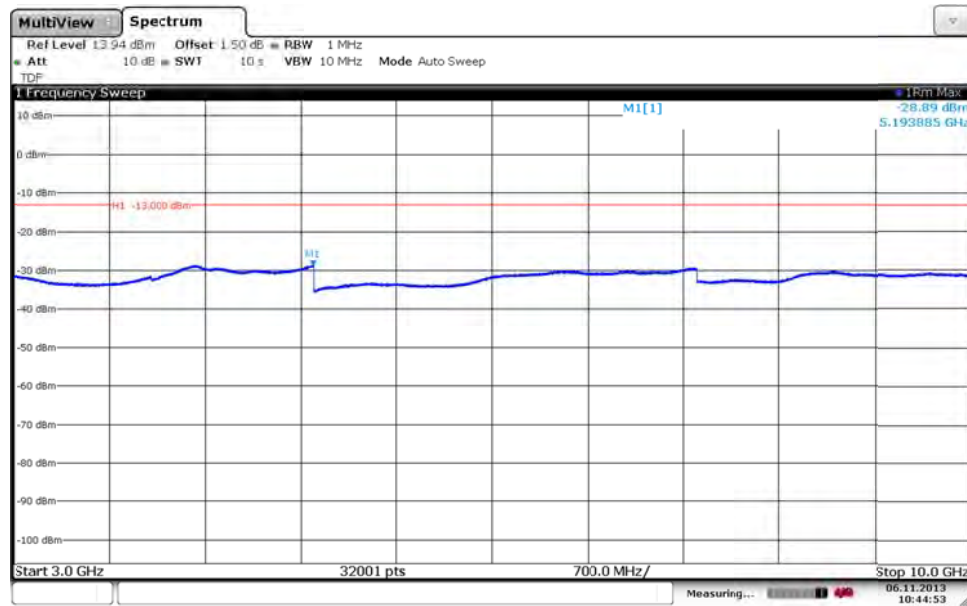
Appendix 5

Diagram 3 a:



Date: 6 NOV. 2013 10:41:14

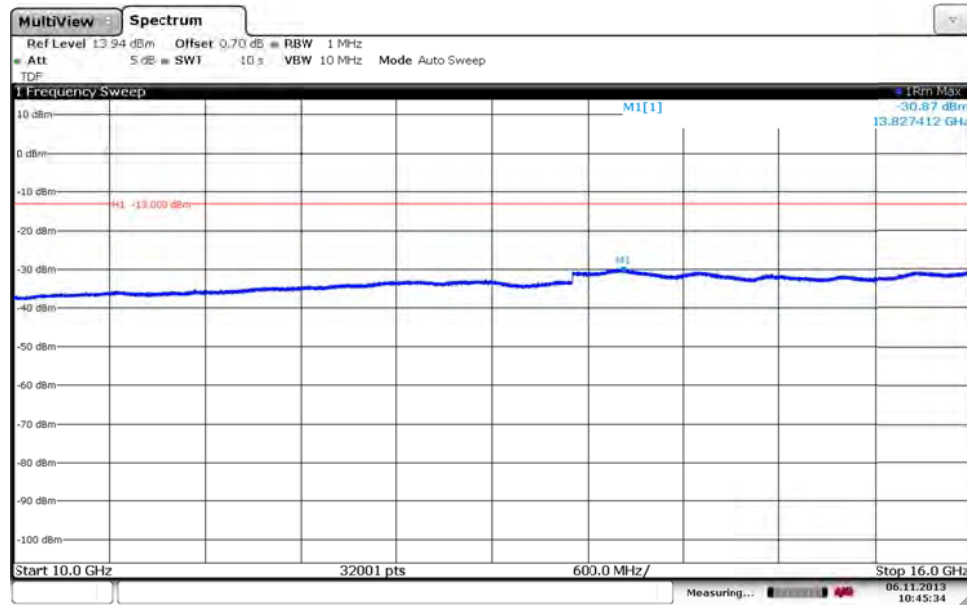
Diagram 3 b:



Date: 6 NOV. 2013 10:44:53

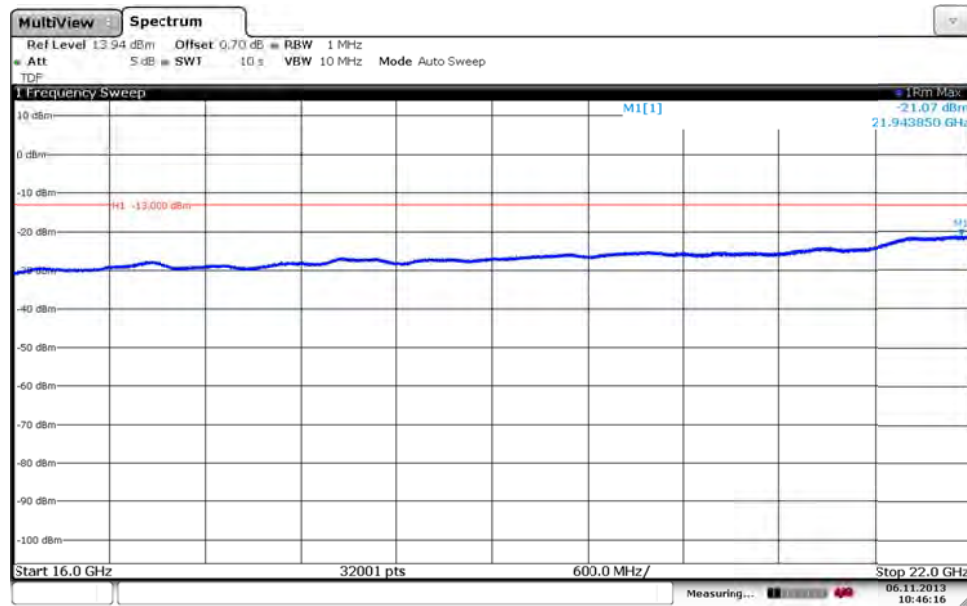
Appendix 5

Diagram 3 c:



Date: 6 NOV. 2013 10:45:34

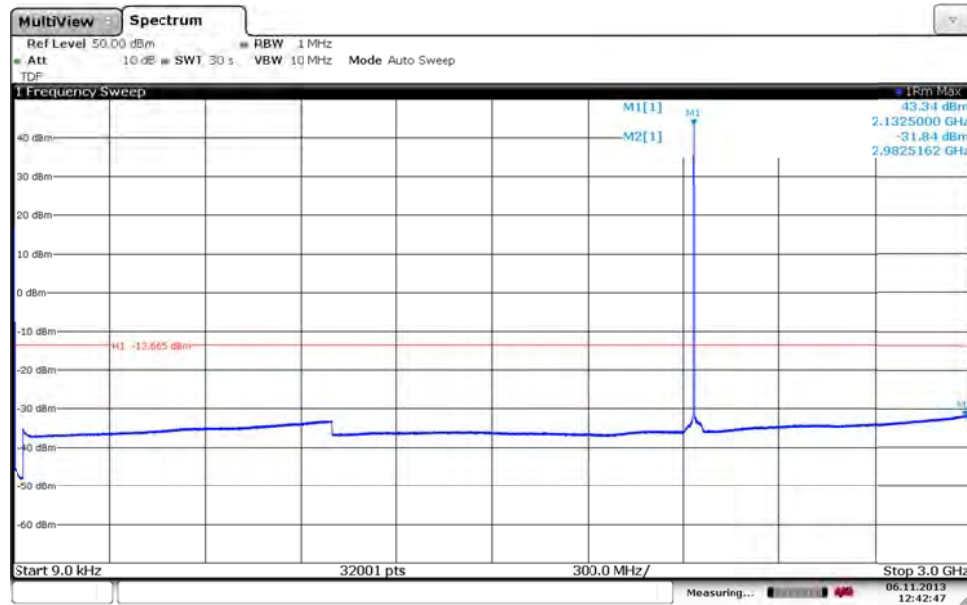
Diagram 3 d:



Date: 6 NOV. 2013 10:46:16

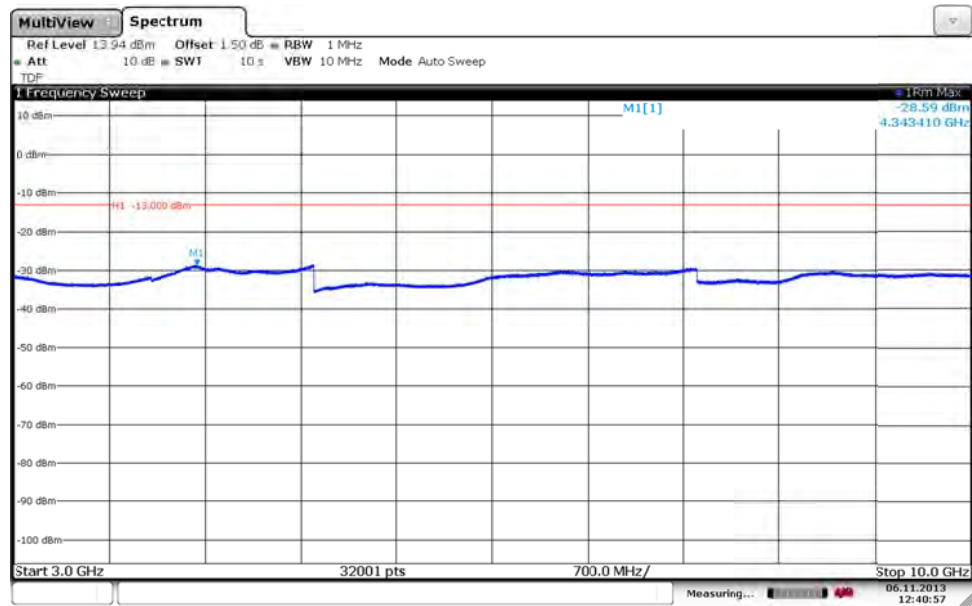
Appendix 5

Diagram 4 a:



Date: 6 NOV. 2013 12:42:43

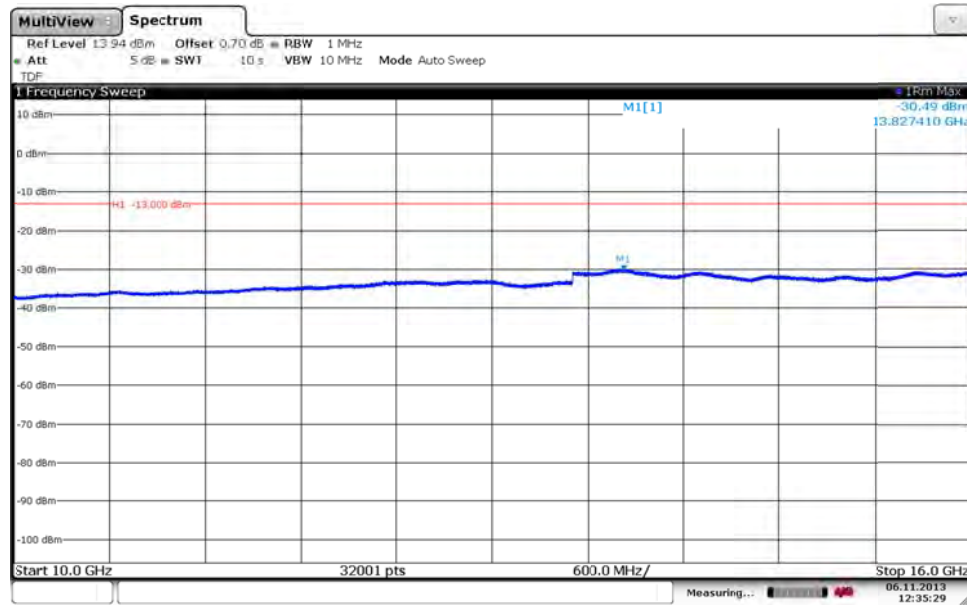
Diagram 4 b:



Date: 6 NOV. 2013 12:40:58

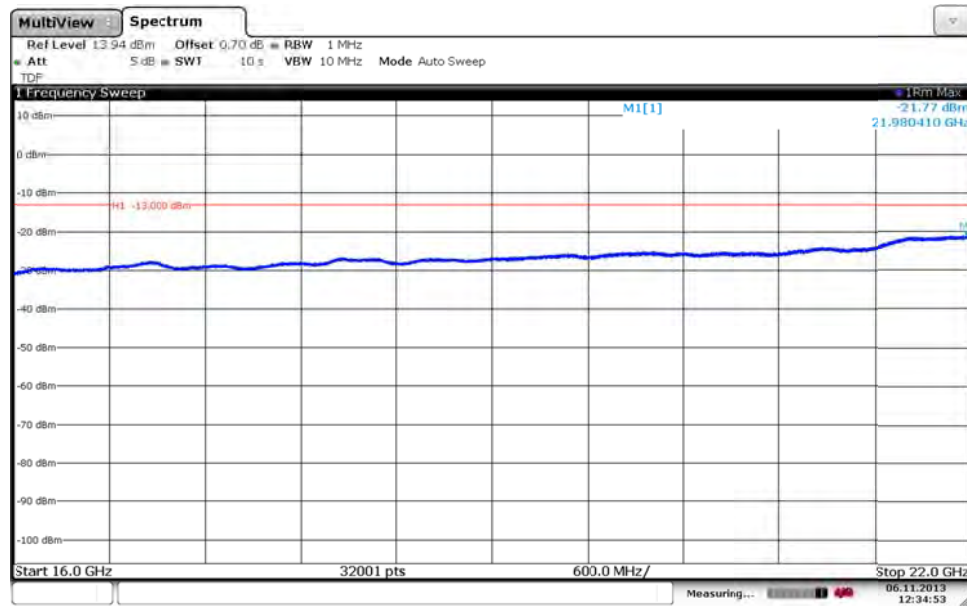
Appendix 5

Diagram 4 c:



Date: 6 NOV. 2013 12:35:29

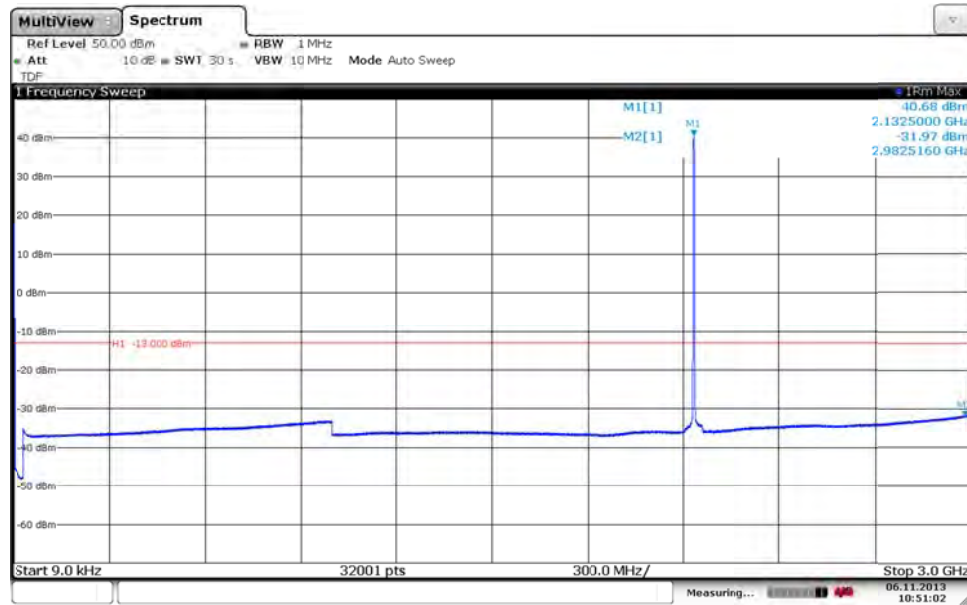
Diagram 4 d:



Date: 6 NOV. 2013 12:34:53

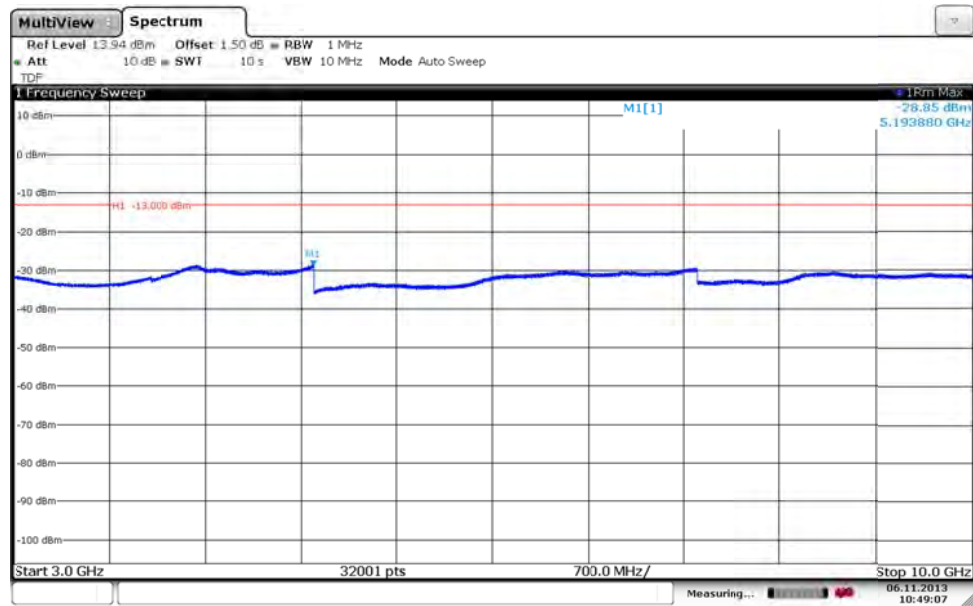
Appendix 5

Diagram 5 a:



Date: 6 NOV. 2013 10:51:02

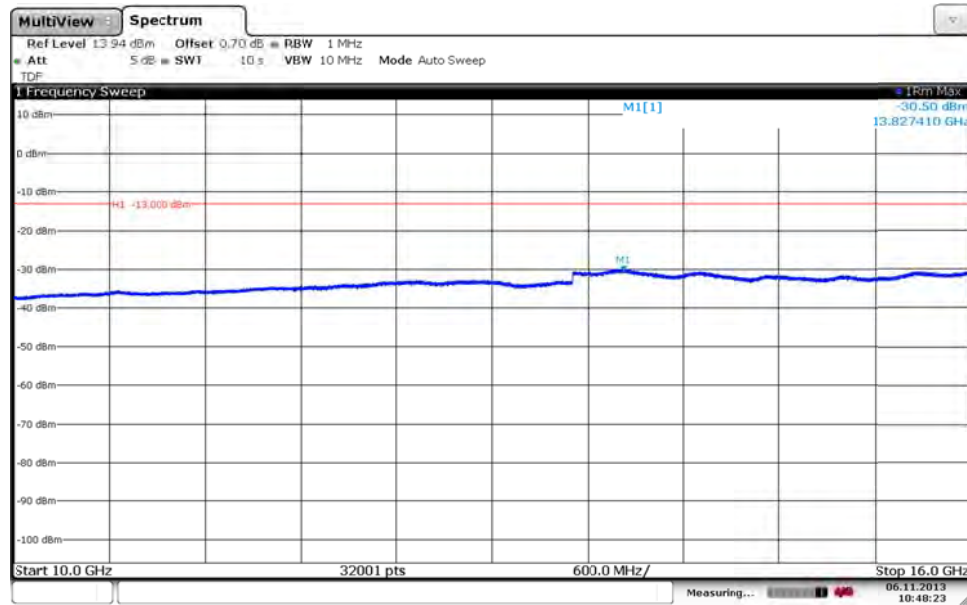
Diagram 5 b:



Date: 6 NOV. 2013 10:49:07

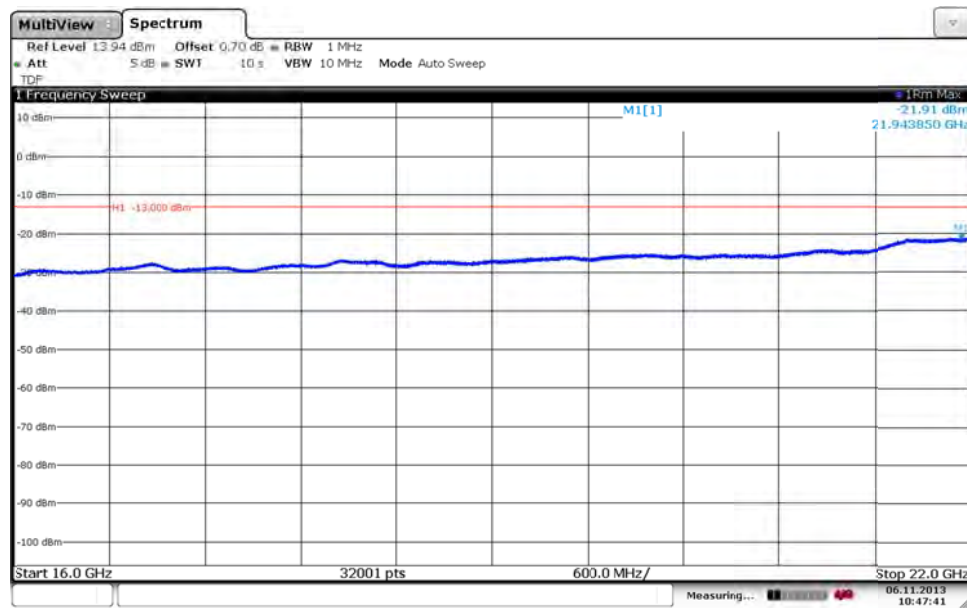
Appendix 5

Diagram 5 c:



Date: 6 NOV. 2013 10:48:22

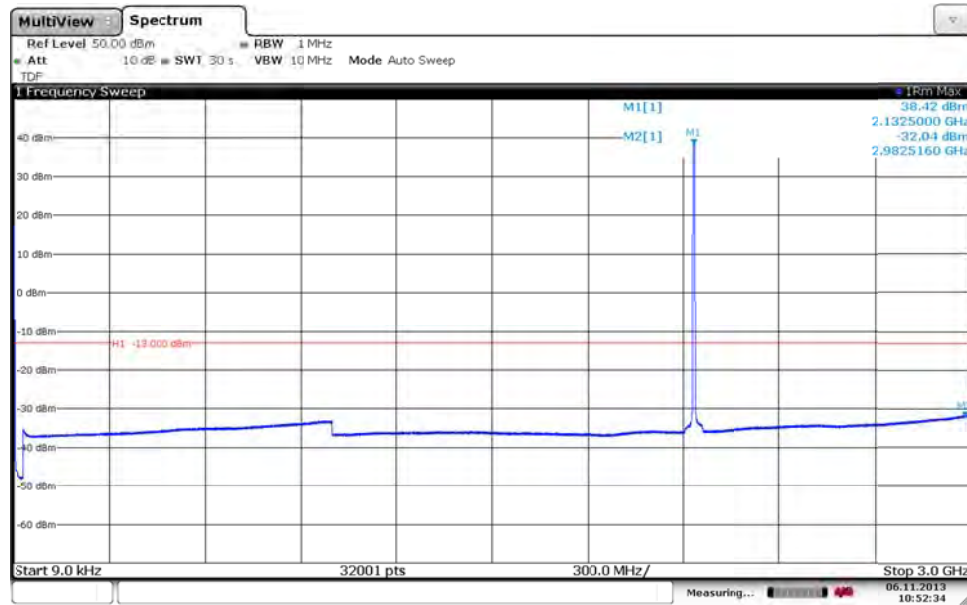
Diagram 5 d:



Date: 6 NOV. 2013 10:47:41

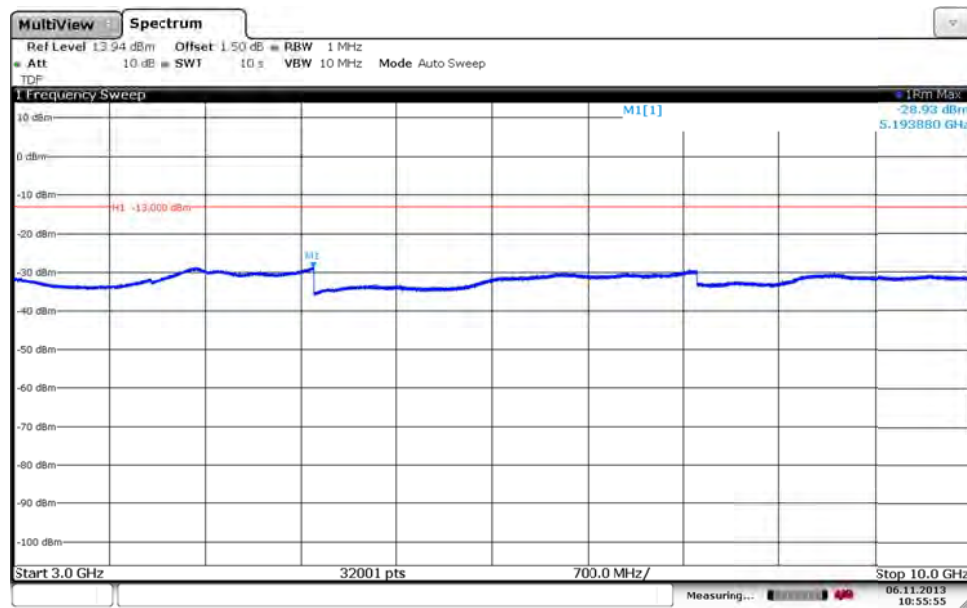
Appendix 5

Diagram 6 a:



Date: 6 NOV. 2013 10:52:34

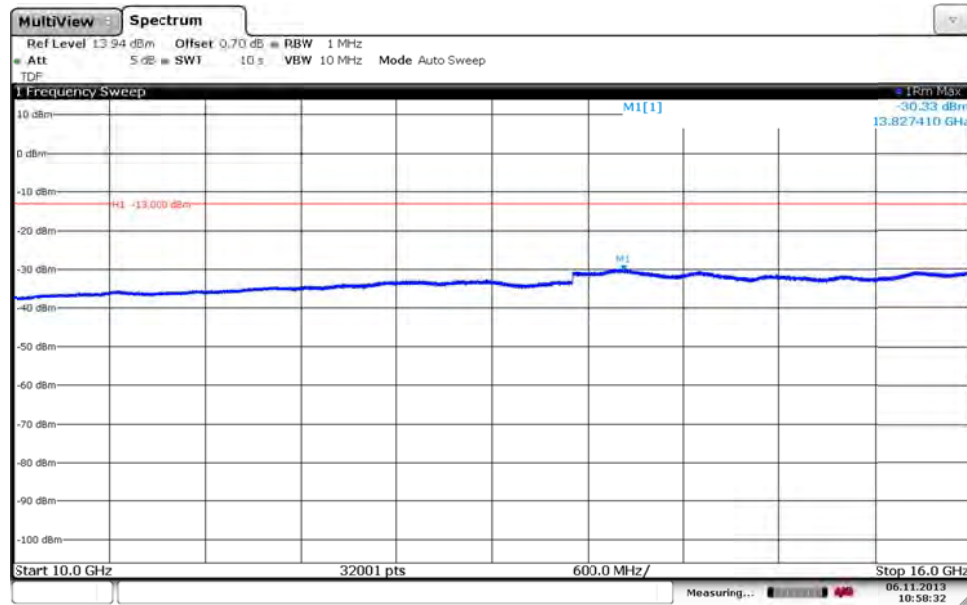
Diagram 6 b:



Date: 6 NOV. 2013 10:55:55

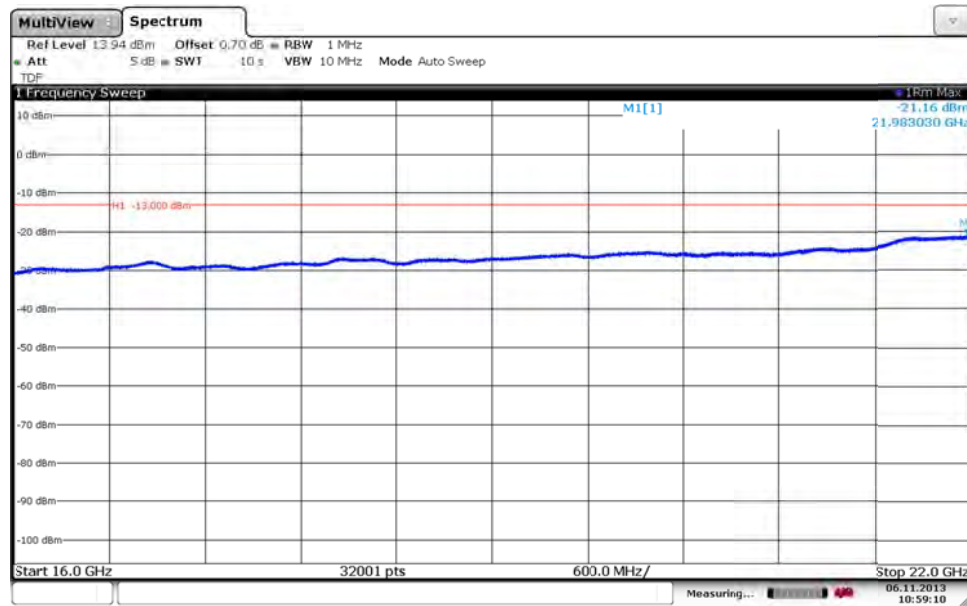
Appendix 5

Diagram 6 c:



Date: 6 NOV. 2013 10:58:32

Diagram 6 d:



Date: 6 NOV. 2013 10:59:10

Appendix 5

Diagram 7 a:

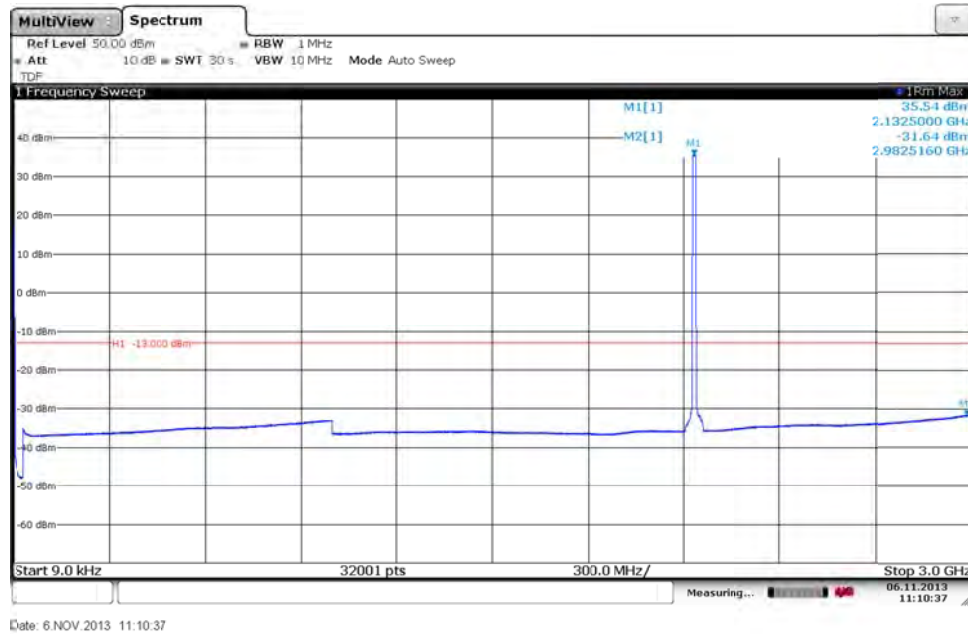
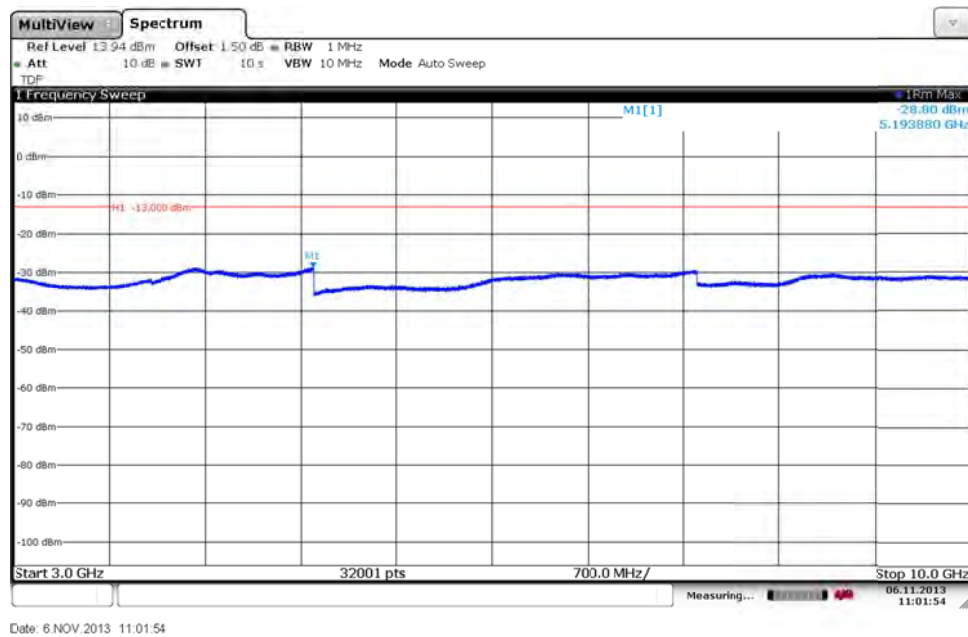
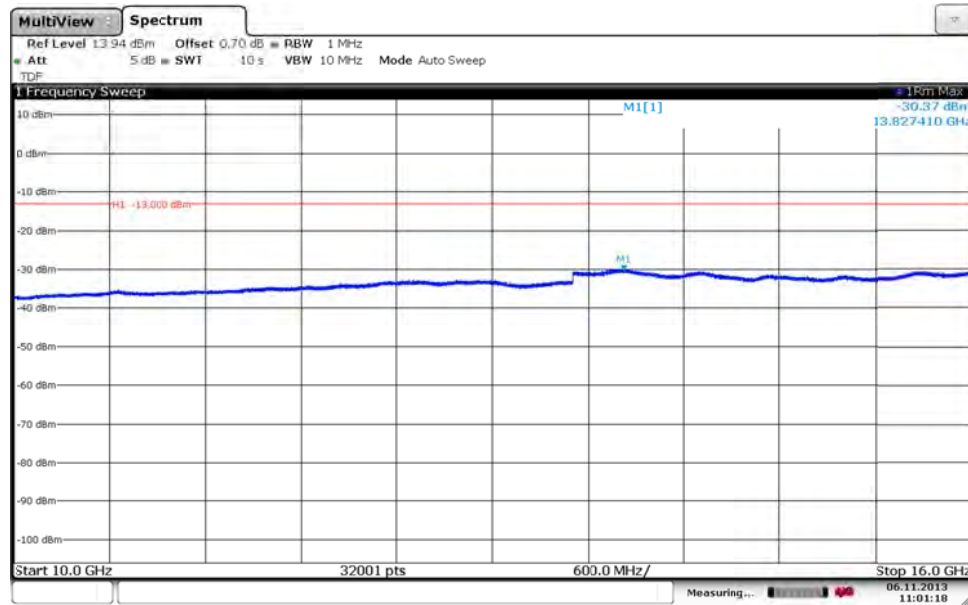


Diagram 7 b:



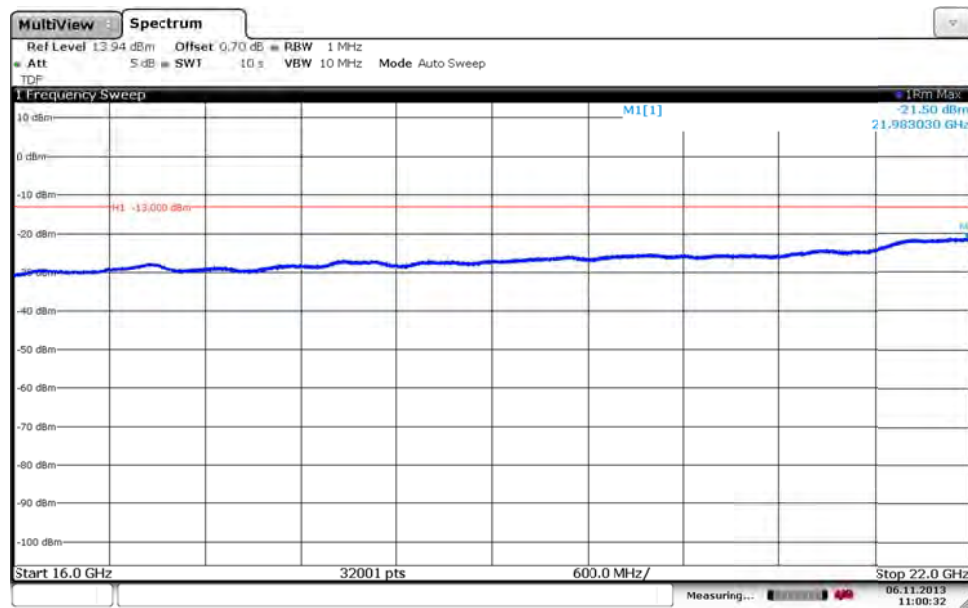
Appendix 5

Diagram 7 c:



Date: 6 NOV. 2013 11:01:13

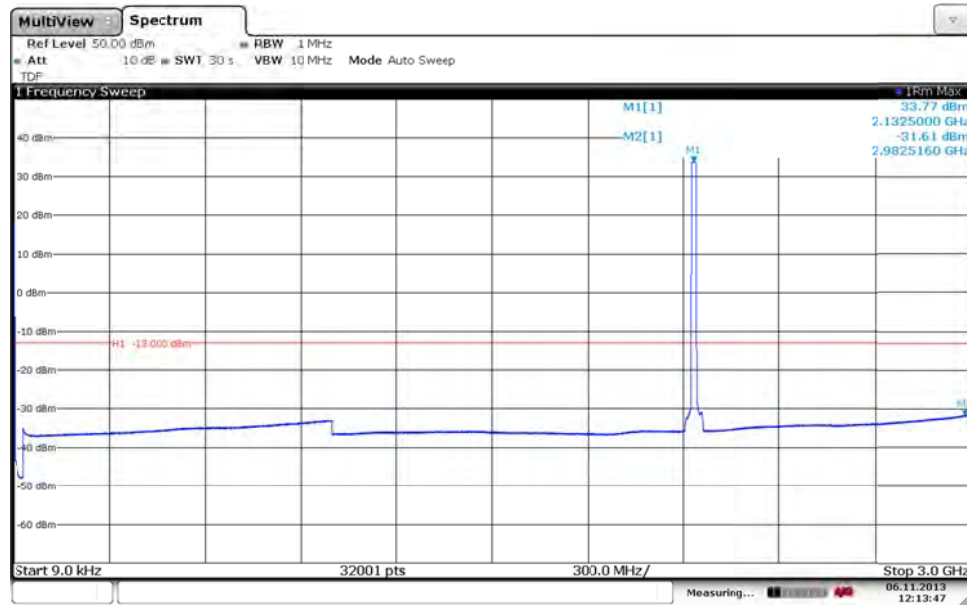
Diagram 7 d:



Date: 6 NOV. 2013 11:00:32

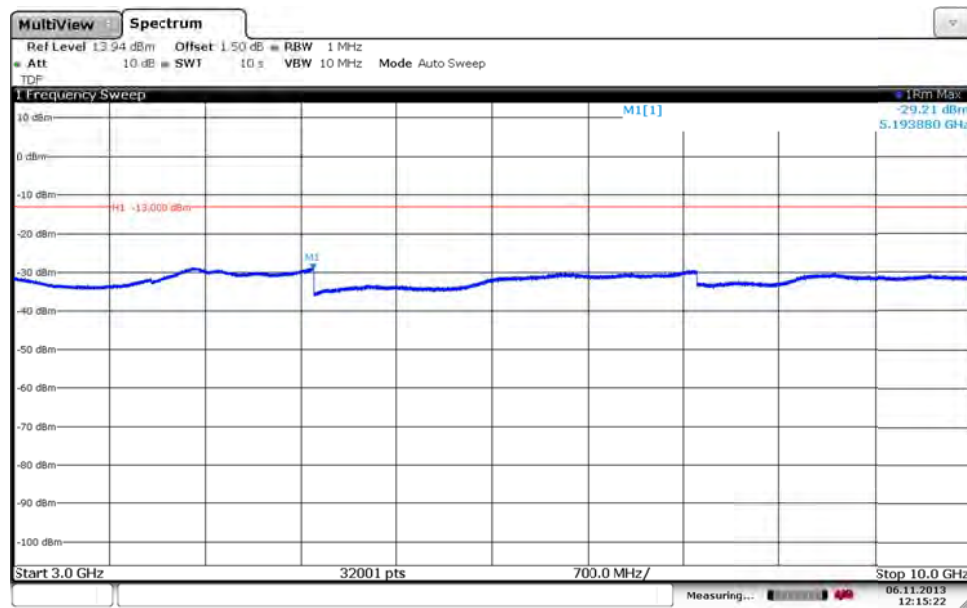
Appendix 5

Diagram 8 a:



Date: 6 NOV 2013 12:13:45

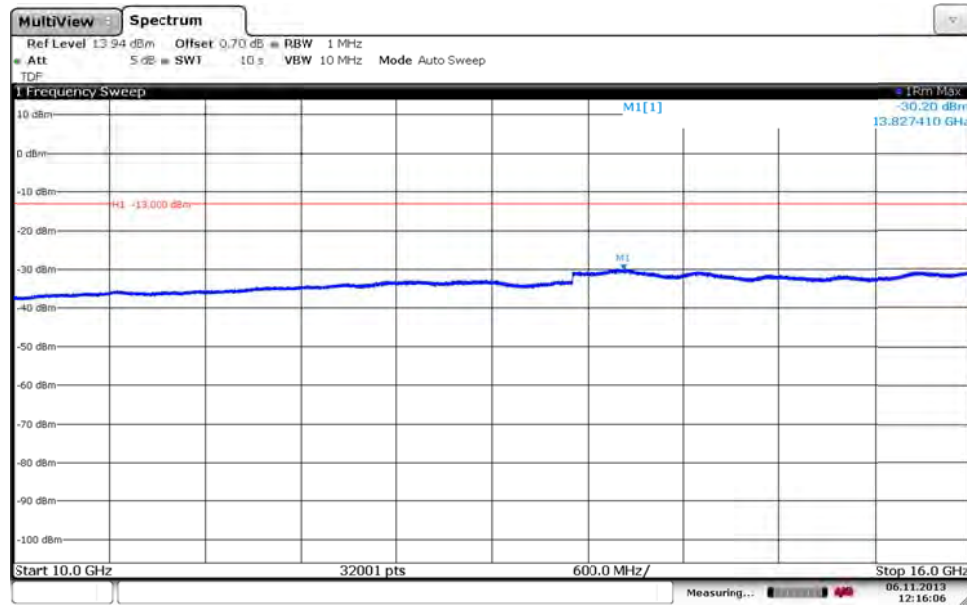
Diagram 8 b:



Date: 6 NOV 2013 12:15:22

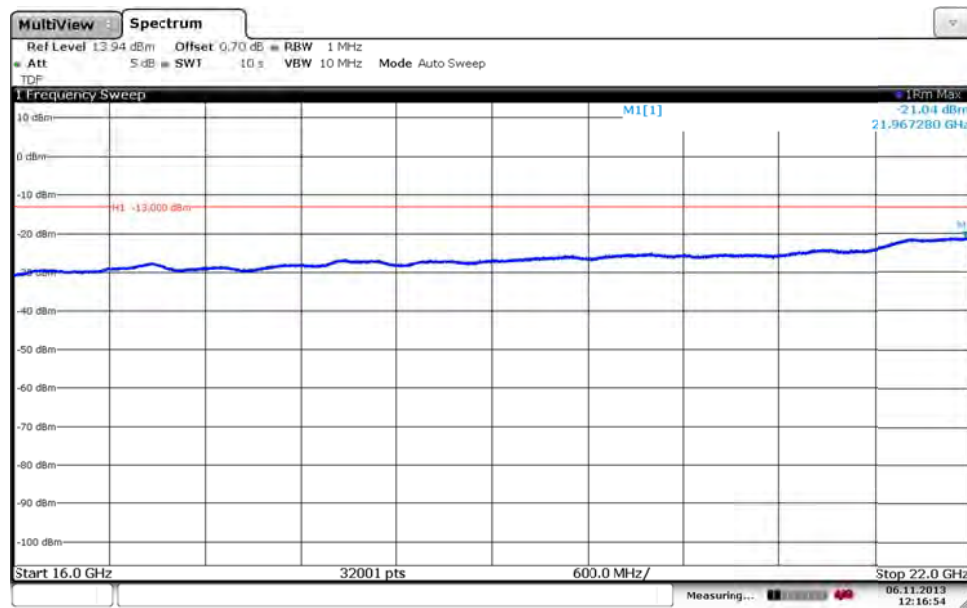
Appendix 5

Diagram 8 c:



Date: 6 NOV. 2013 12:16:05

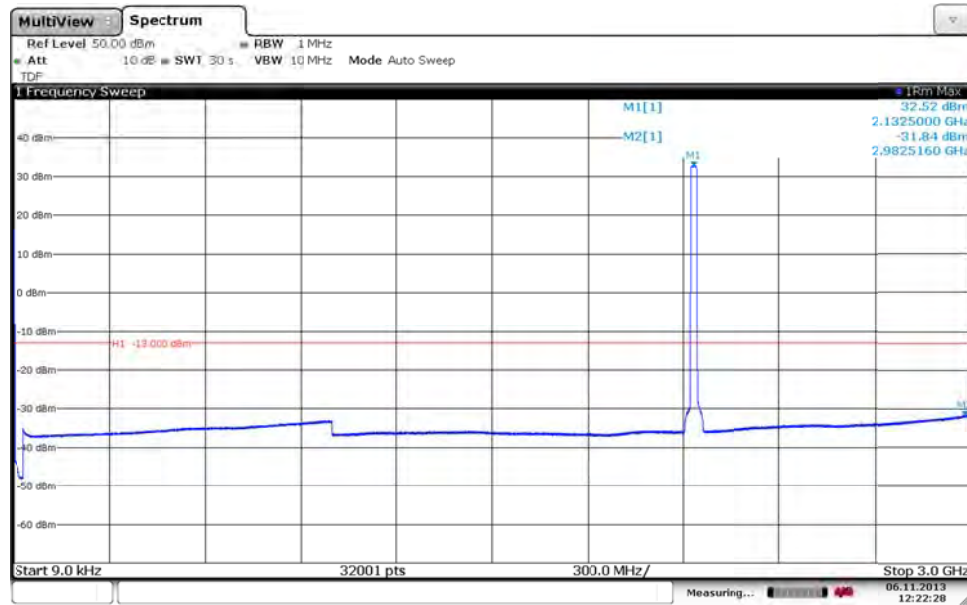
Diagram 8 d:



Date: 6 NOV. 2013 12:16:55

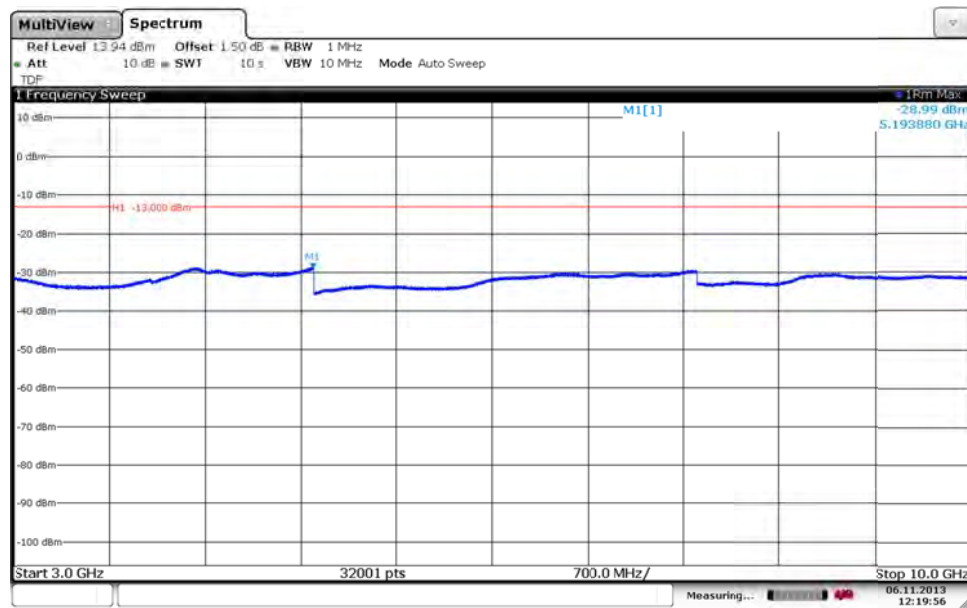
Appendix 5

Diagram 9 a:



Date: 6 NOV. 2013 12:22:28

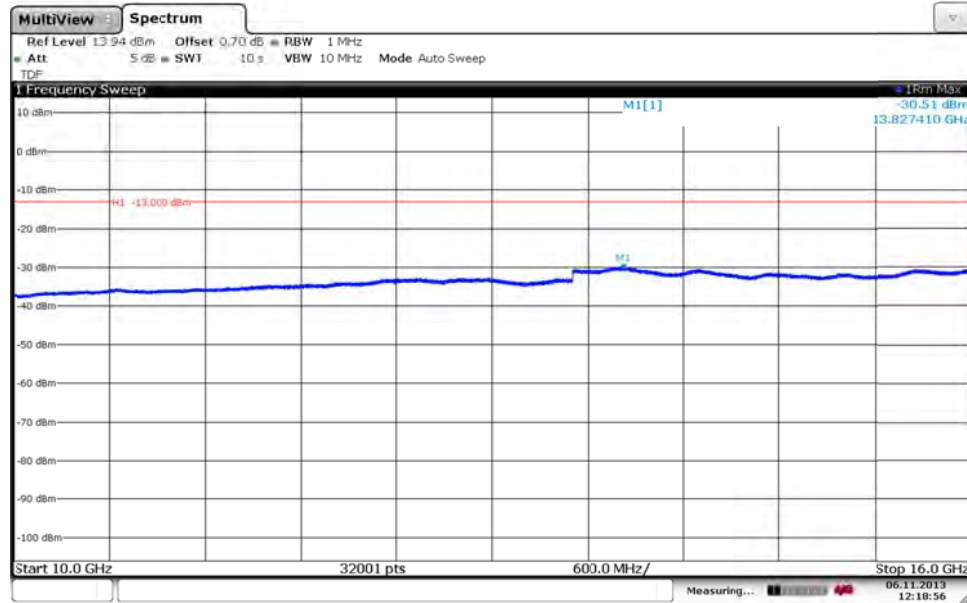
Diagram 9 b:



Date: 6 NOV. 2013 12:19:56

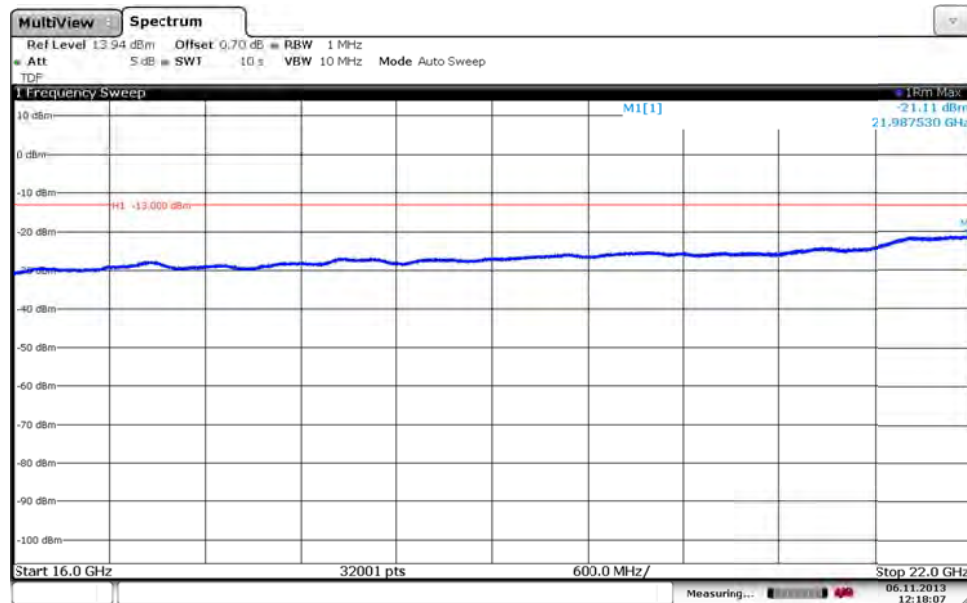
Appendix 5

Diagram 9 c:



Date: 6 NOV. 2013 12:18:53

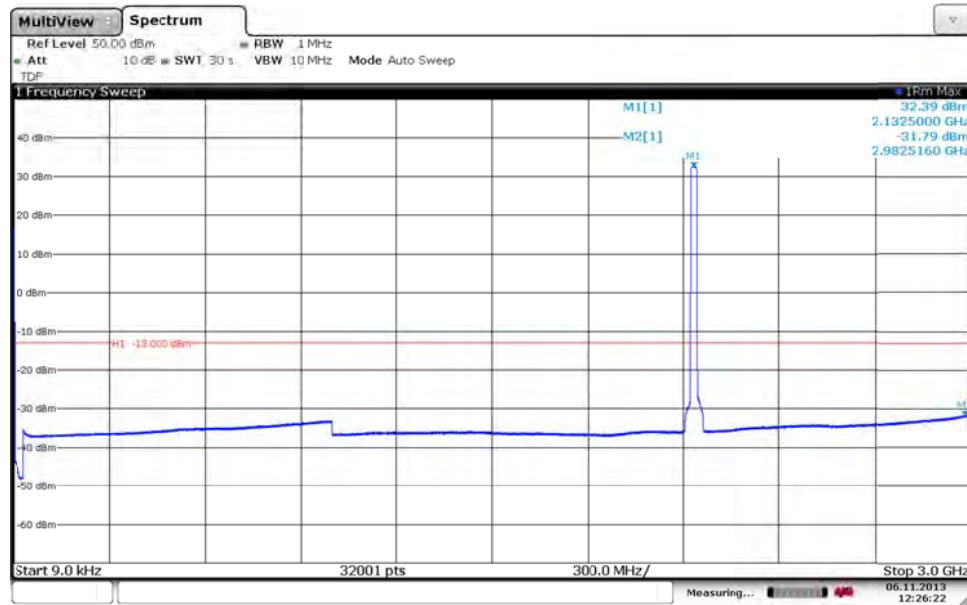
Diagram 9 d:



Date: 6 NOV. 2013 12:18:07

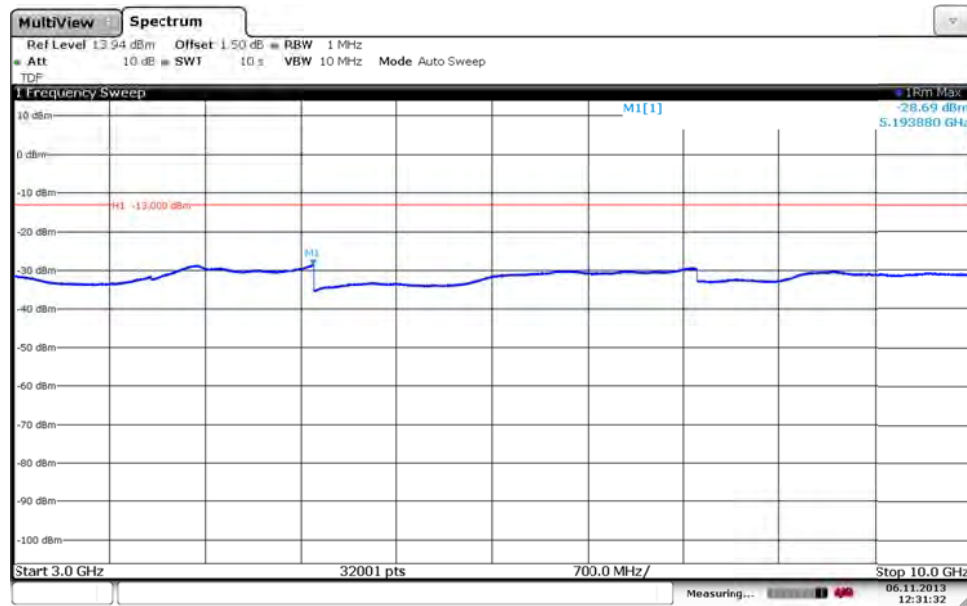
Appendix 5

Diagram 10 a:



Date: 6 NOV. 2013 12:26:22

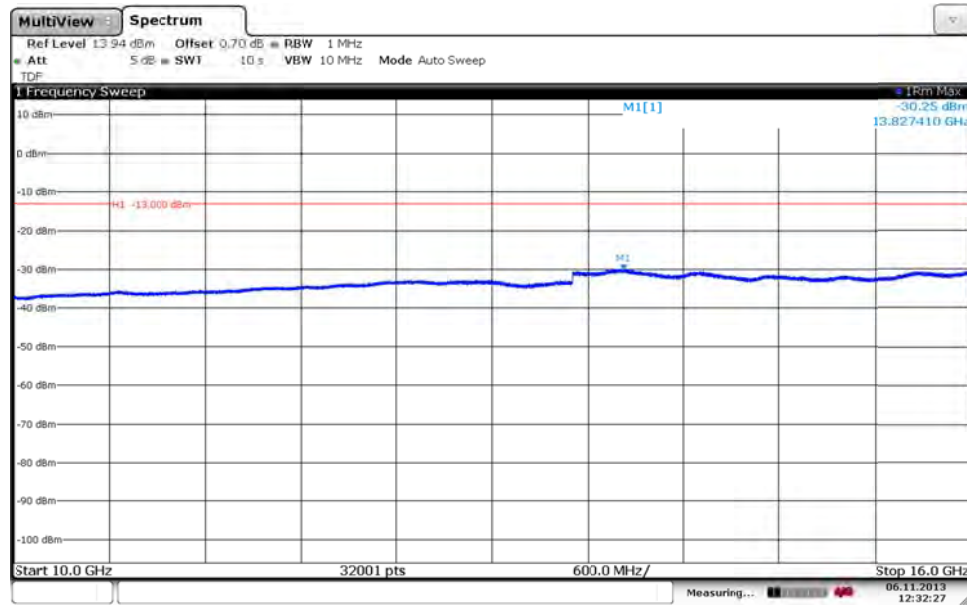
Diagram 10 b:



Date: 6 NOV. 2013 12:31:33

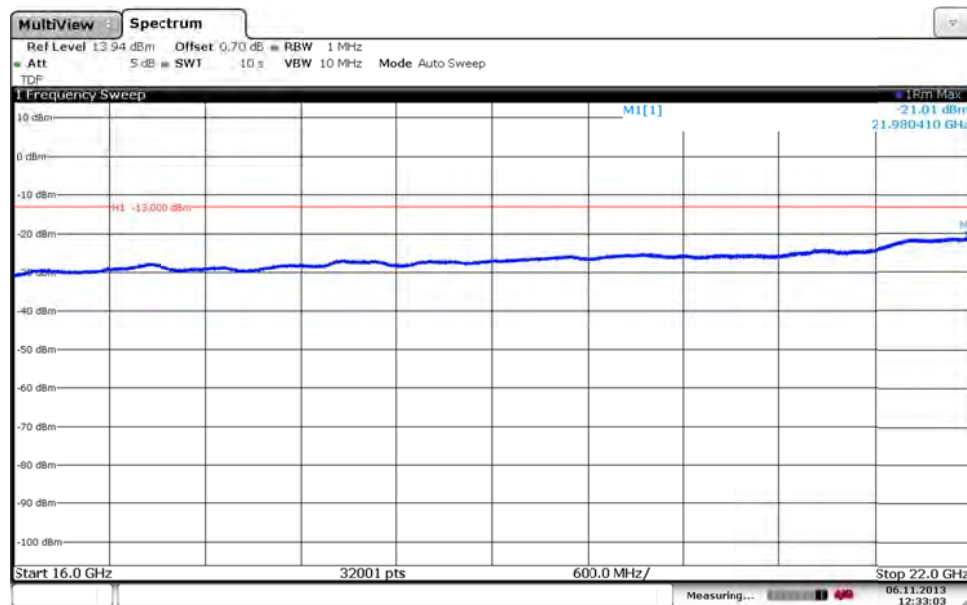
Appendix 5

Diagram 10 c:



Date: 6 NOV. 2013 12:32:27

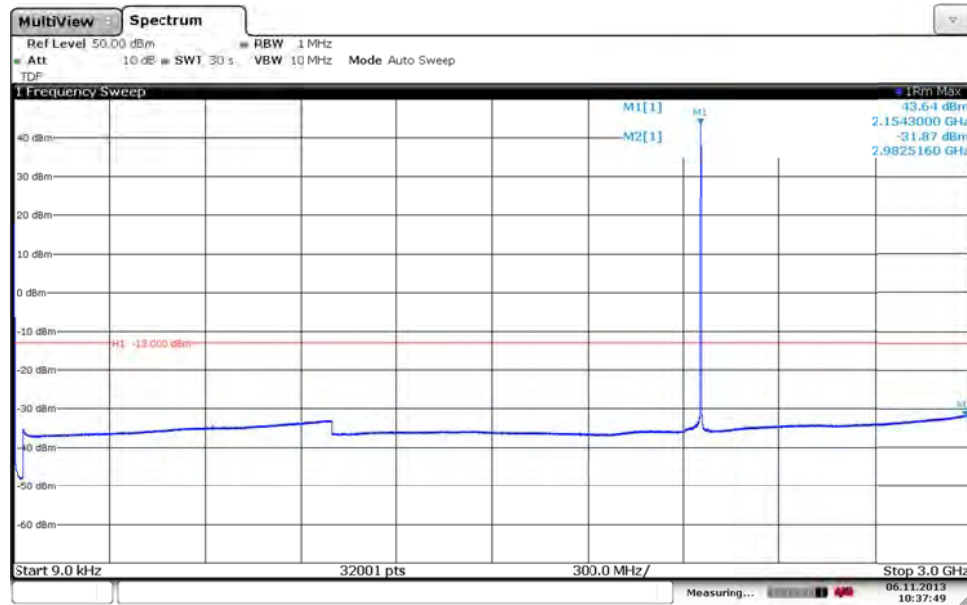
Diagram 10 d:



Date: 6 NOV. 2013 12:33:02

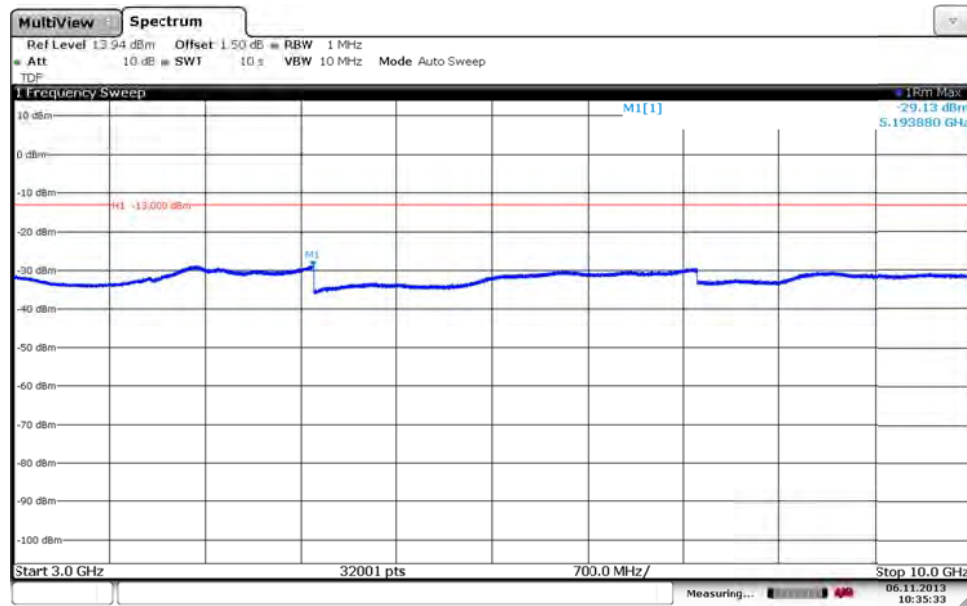
Appendix 5

Diagram 11 a:



Date: 6 NOV. 2013 10:37:50

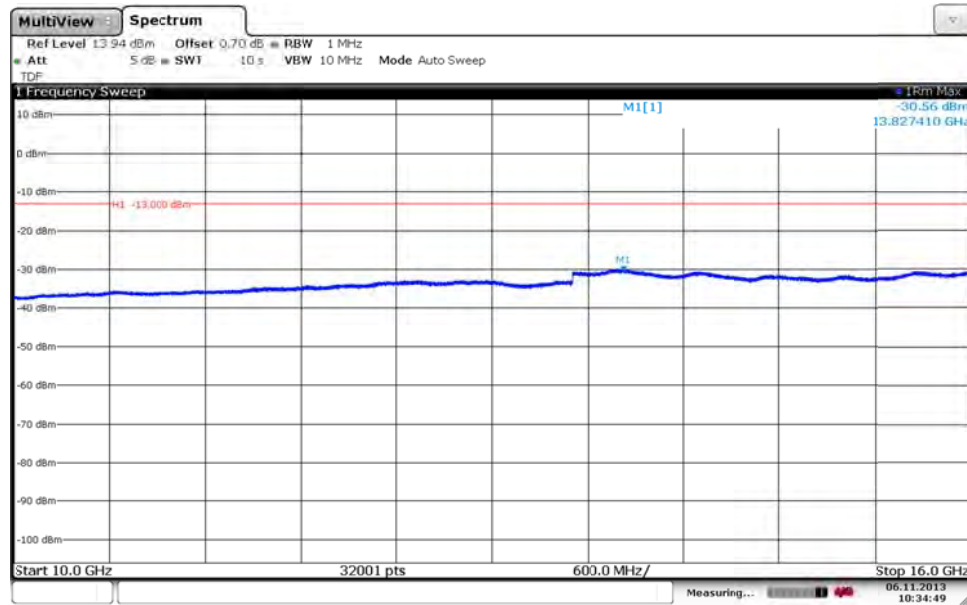
Diagram 11 b:



Date: 6 NOV. 2013 10:35:33

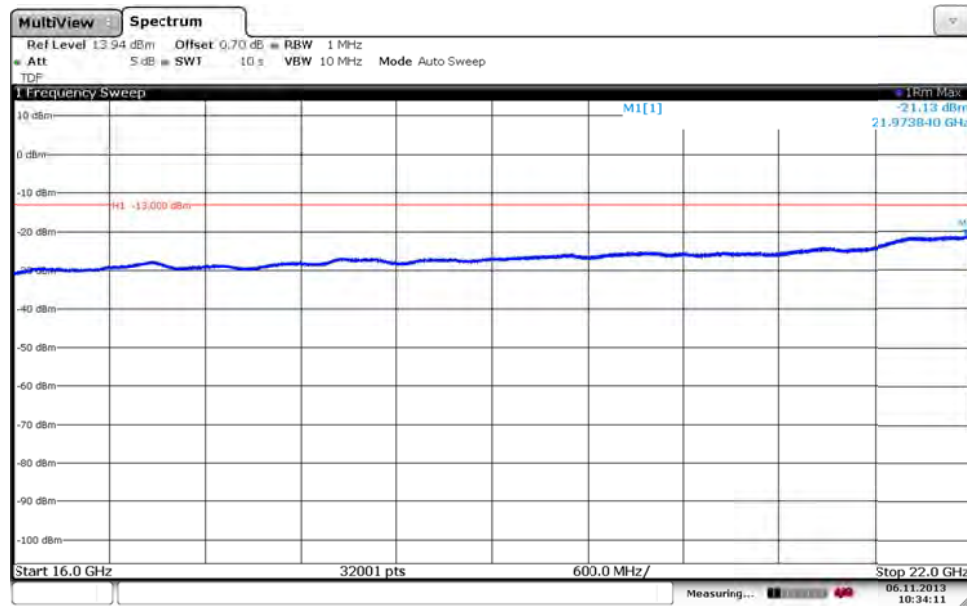
Appendix 5

Diagram 11 c:



Date: 6 NOV. 2013 10:34:49

Diagram 11 d:



Date: 6 NOV. 2013 10:34:11

Appendix 5

Diagram 12 a:

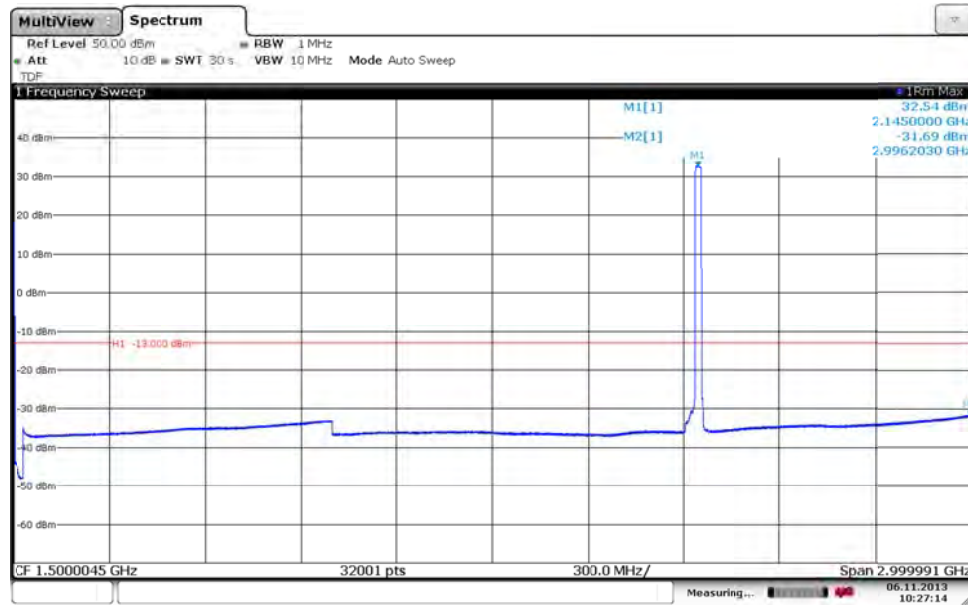
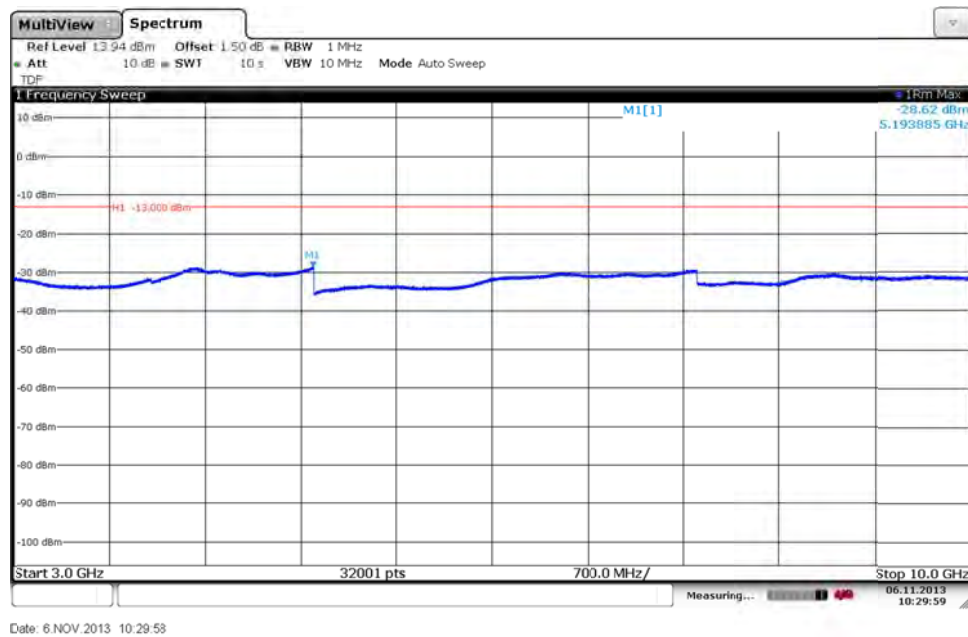
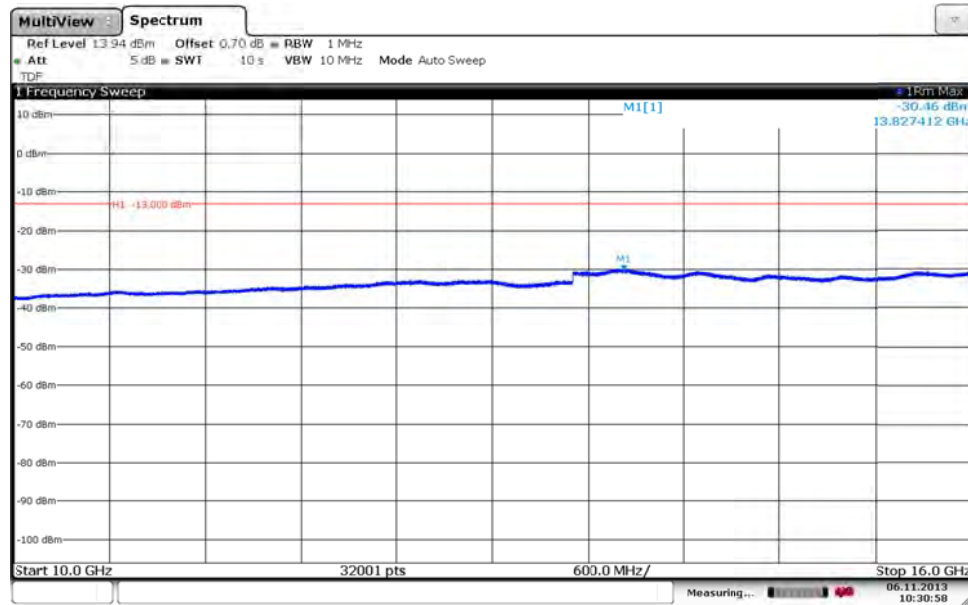


Diagram 12 b:



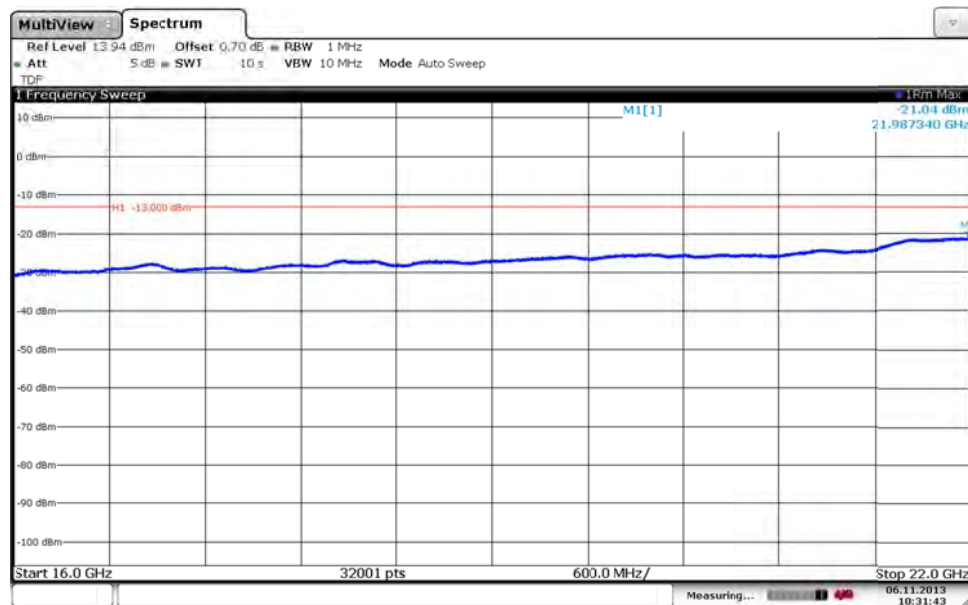
Appendix 5

Diagram 12 c:



Date: 6 NOV. 2013 10:30:53

Diagram 12 d:



Date: 6 NOV. 2013 10:31:43

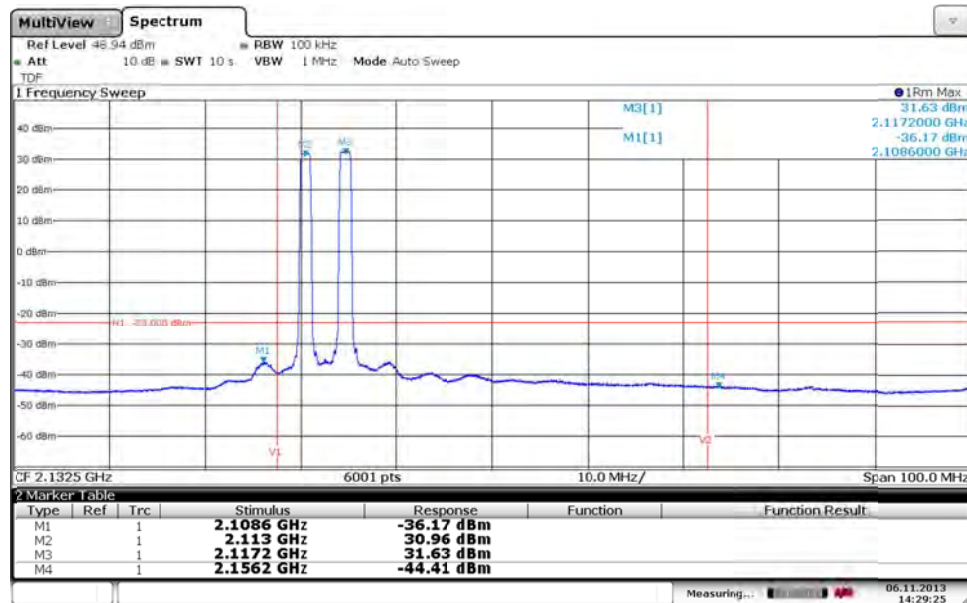
Appendix 5

Diagram 13 a:



Date: 6 NOV 2013 14:26:27

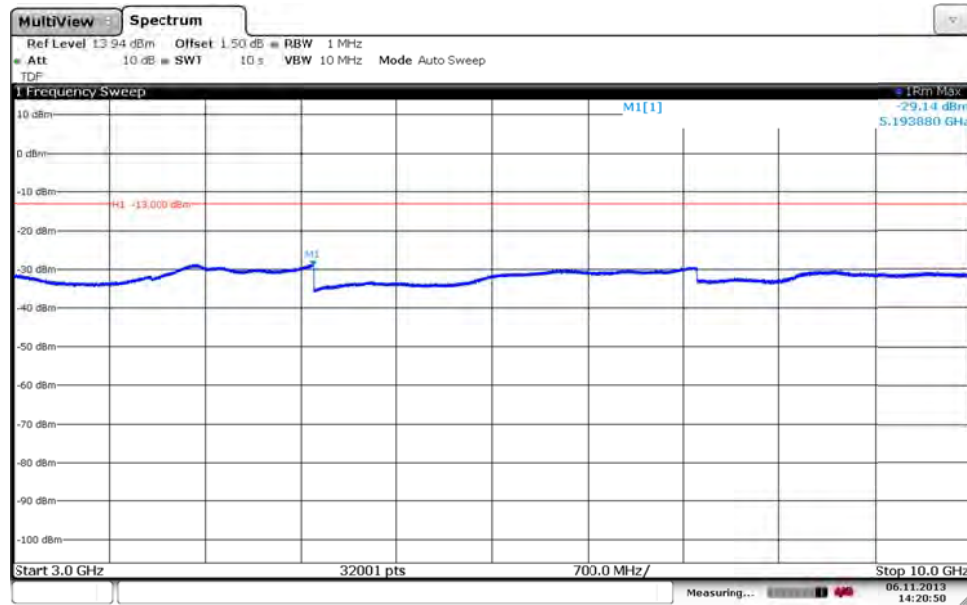
Diagram 13 b:



Date: 6 NOV 2013 14:29:25

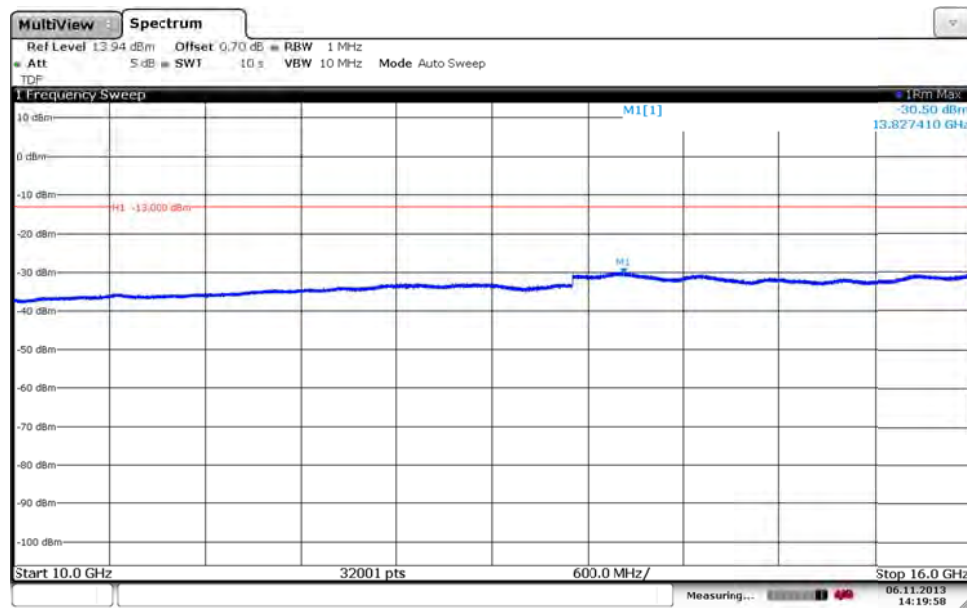
Appendix 5

Diagram 13 c:



Date: 6 NOV. 2013 14:20:50

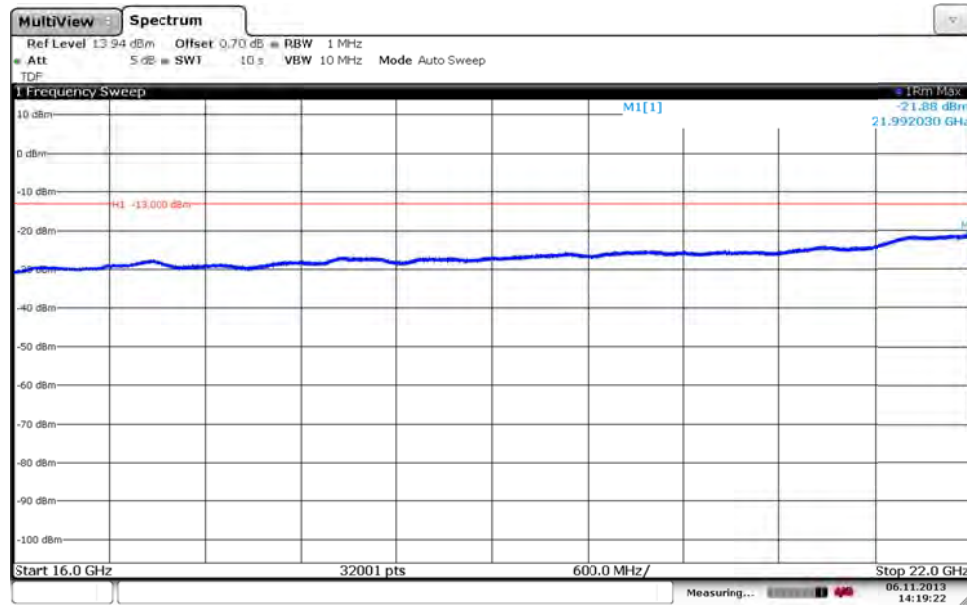
Diagram 13 d:



Date: 6 NOV. 2013 14:19:58

Appendix 5

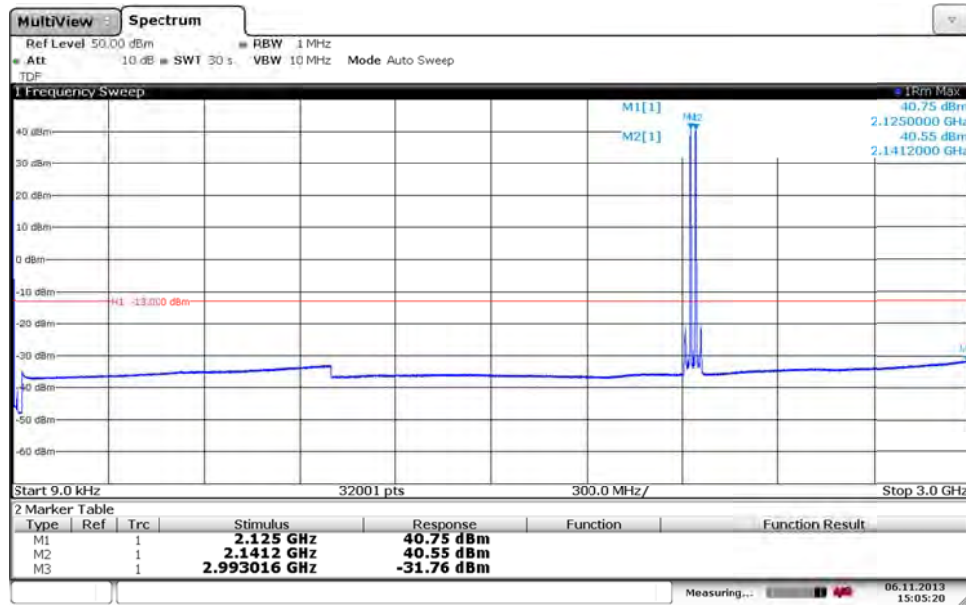
Diagram 13 e:



Date: 6 NOV. 2013 14:19:22

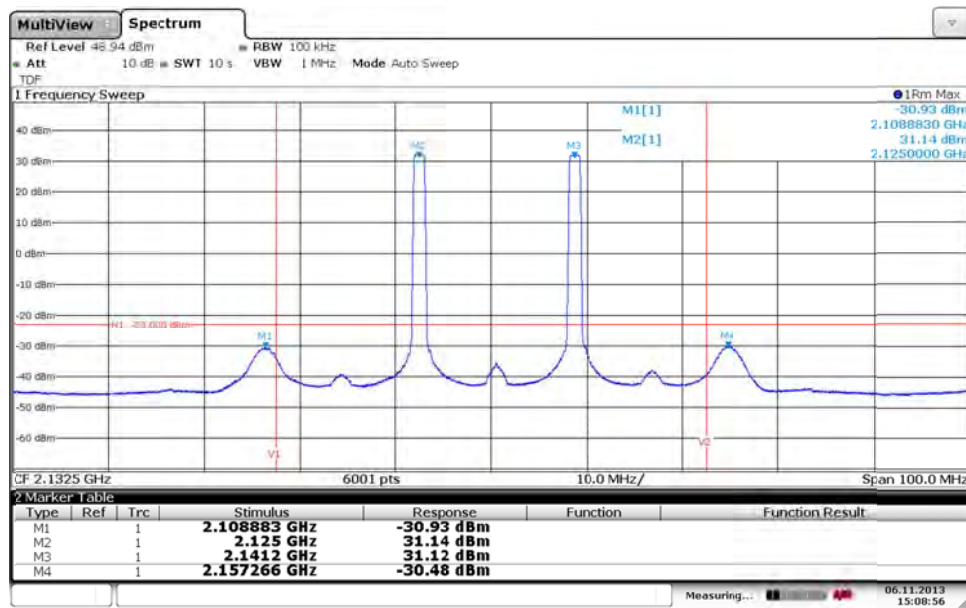
Appendix 5

Diagram 14 a:



Date: 6 NOV 2013 15:05:19

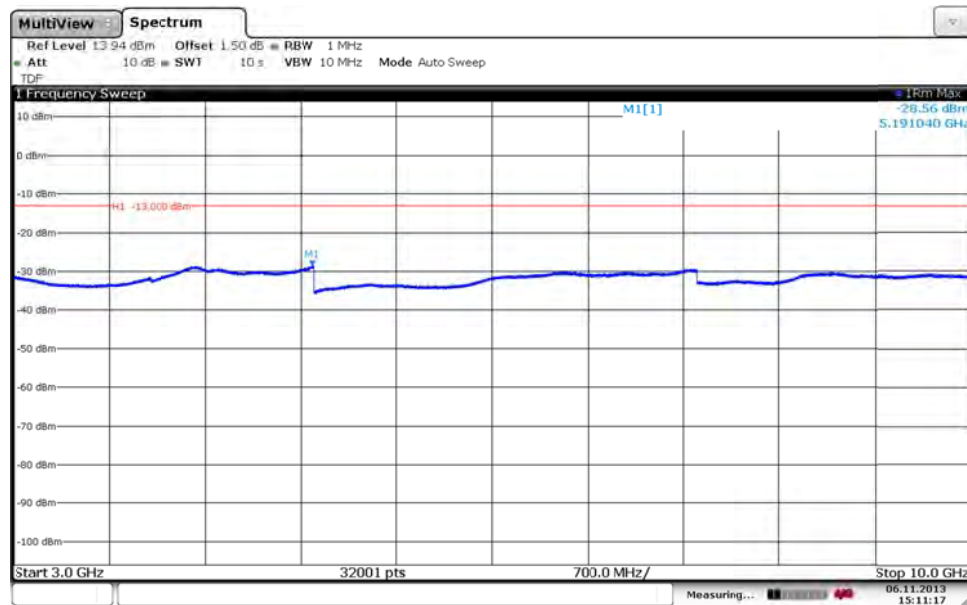
Diagram 14 b:



Date: 6 NOV 2013 15:08:56

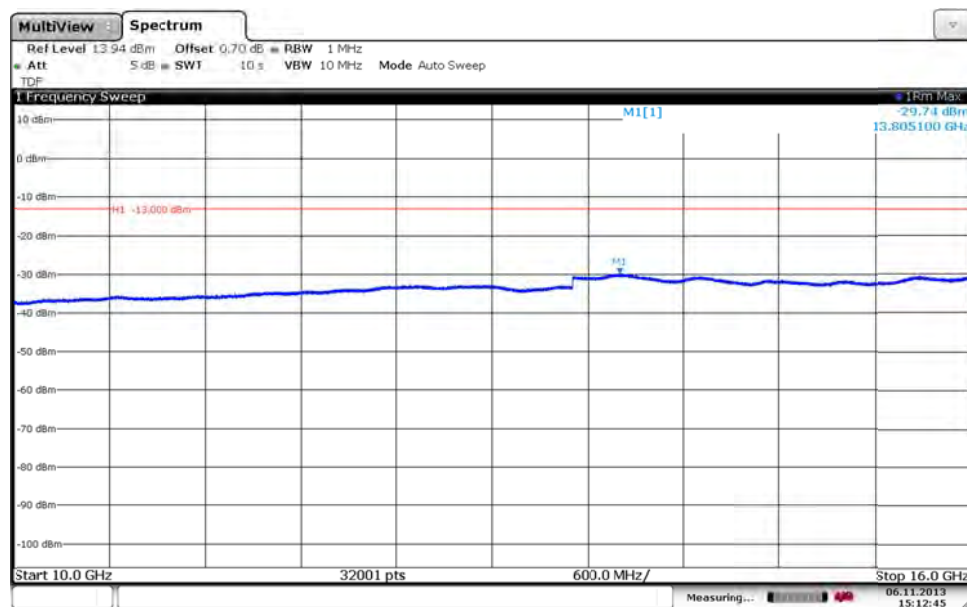
Appendix 5

Diagram 14 c:



Date: 6 NOV. 2013 15:11:15

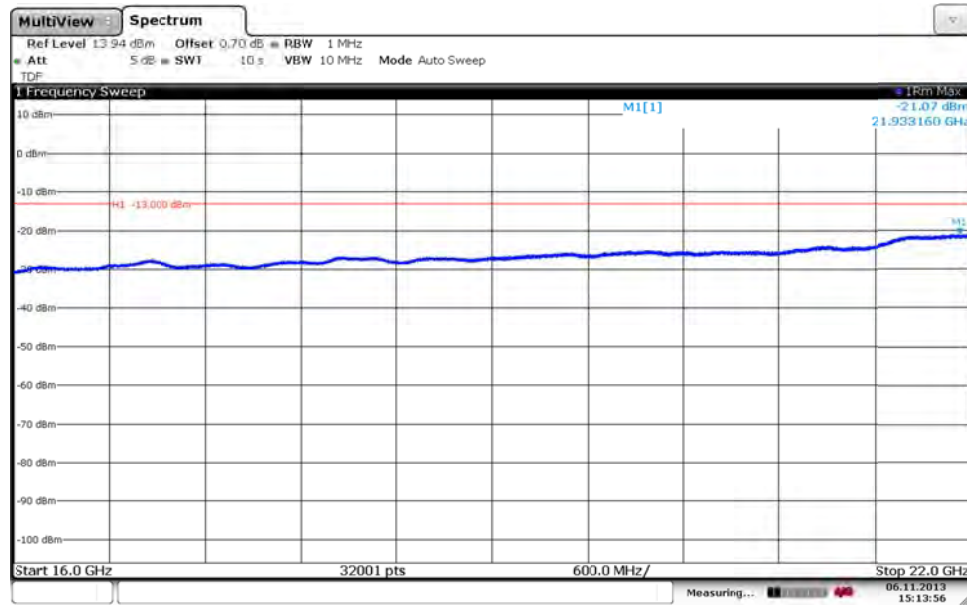
Diagram 14 d:



Date: 6 NOV. 2013 15:12:45

Appendix 5

Diagram 14 e:



Date: 6 NOV. 2013 15:13:55

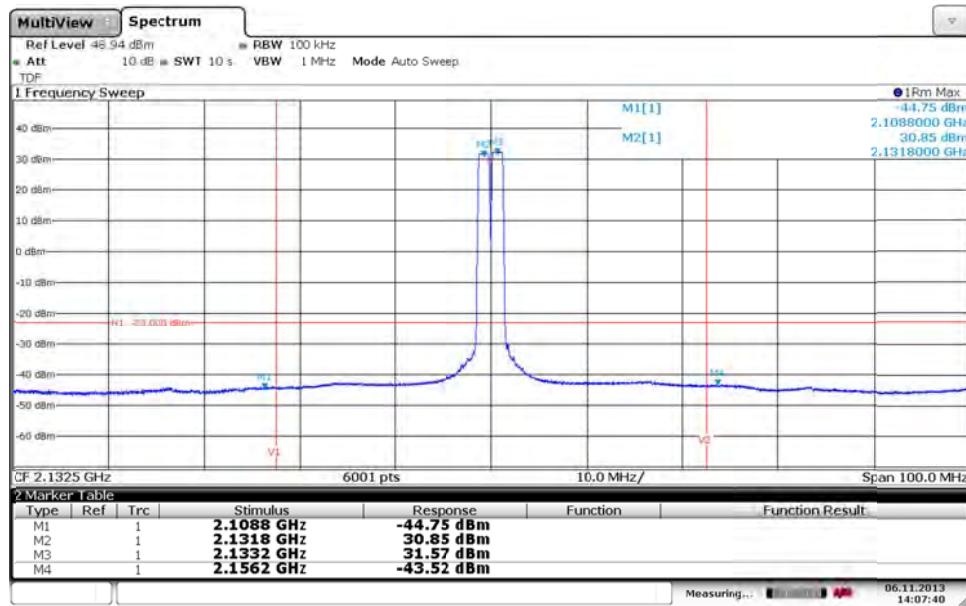
Appendix 5

Diagram 15 a:



Date: 6 NOV 2013 14:33:41

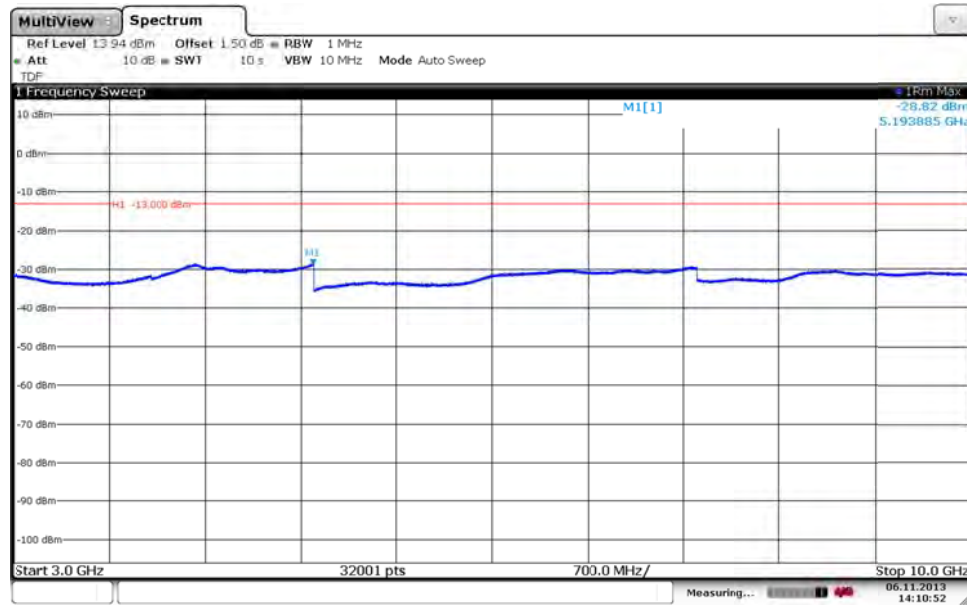
Diagram 15 b:



Date: 6 NOV 2013 14:07:40

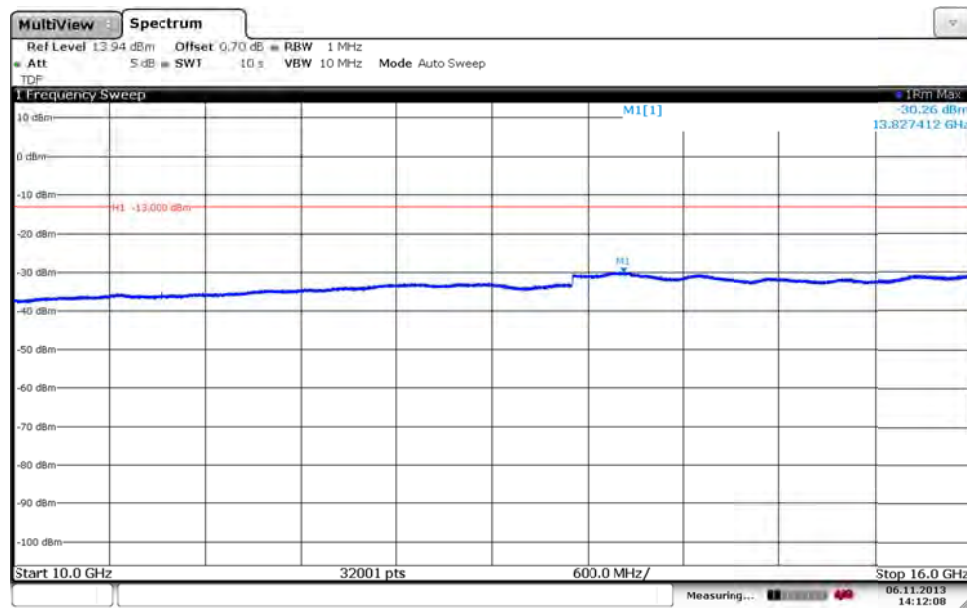
Appendix 5

Diagram 15 c:



Date: 6 NOV. 2013 14:10:52

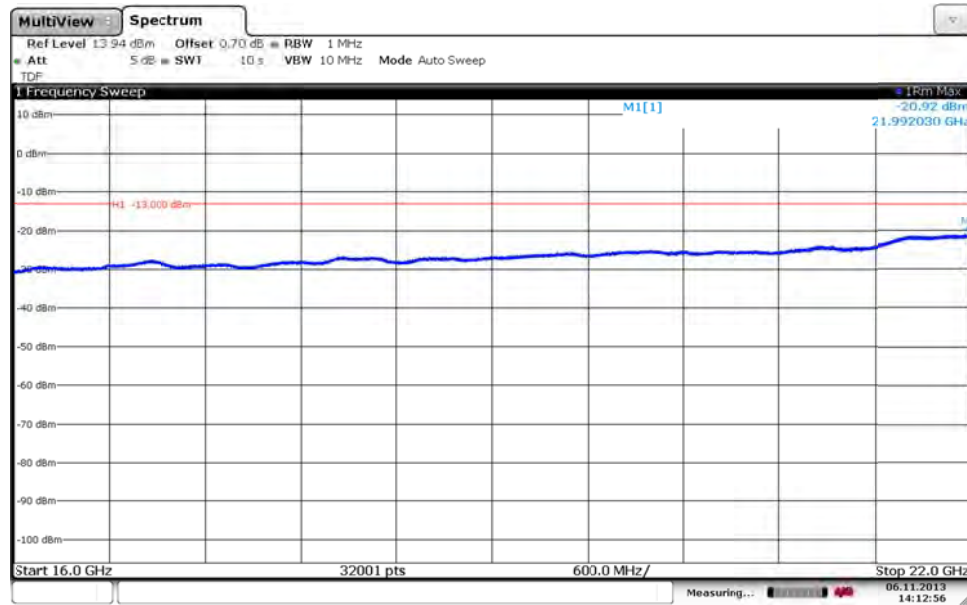
Diagram 15 d:



Date: 6 NOV. 2013 14:12:08

Appendix 5

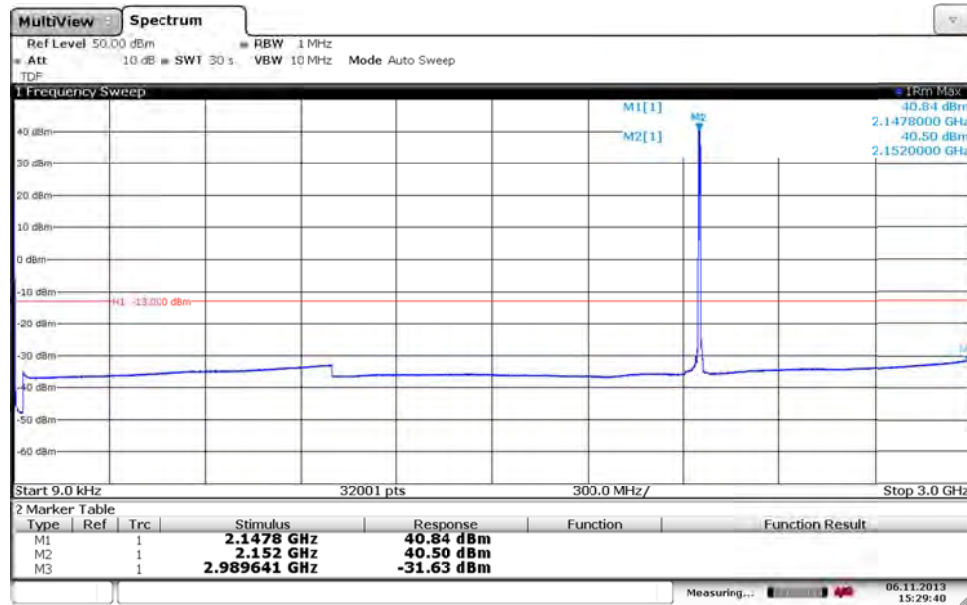
Diagram 15 e:



Date: 6 NOV. 2013 14:12:53

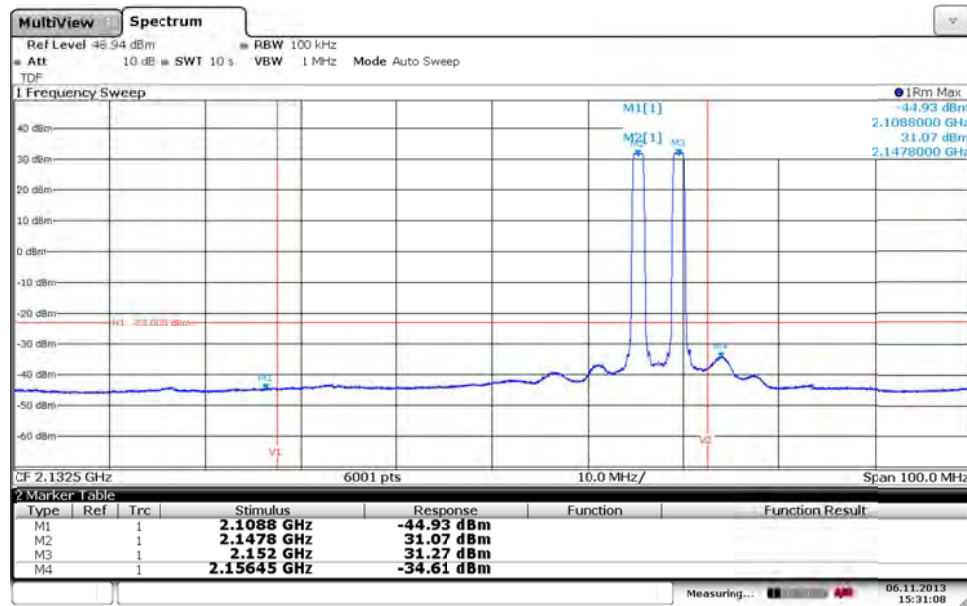
Appendix 5

Diagram 16 a:



Date: 6 NOV 2013 15:29:40

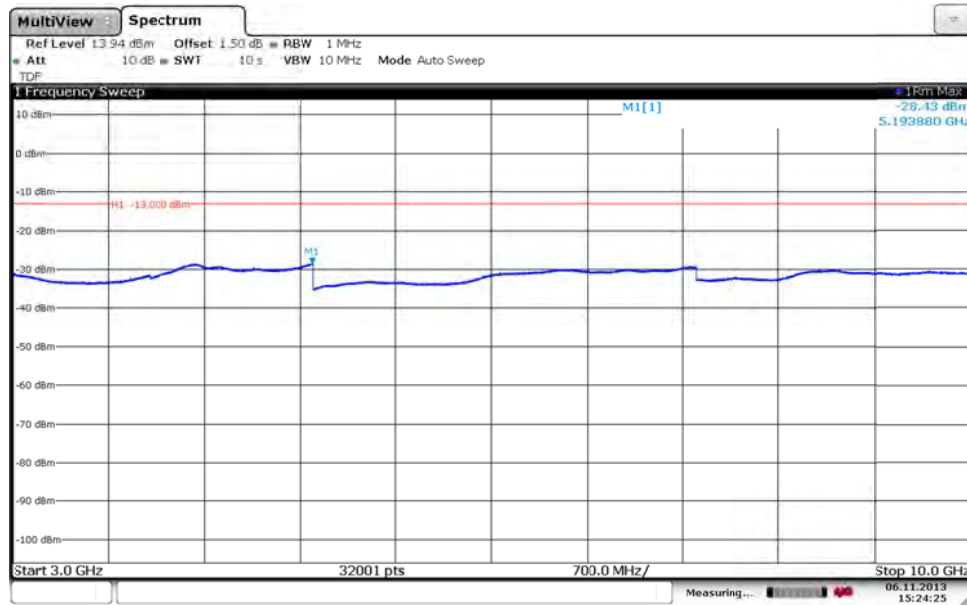
Diagram 16 b:



Date: 6 NOV 2013 15:31:08

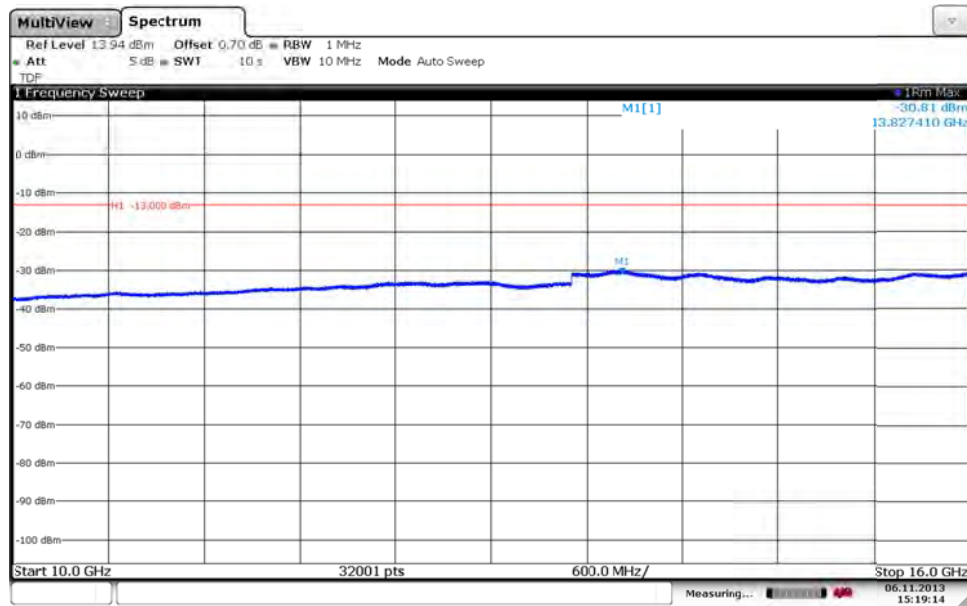
Appendix 5

Diagram 16 c:



Date: 6 NOV. 2013 15:24:24

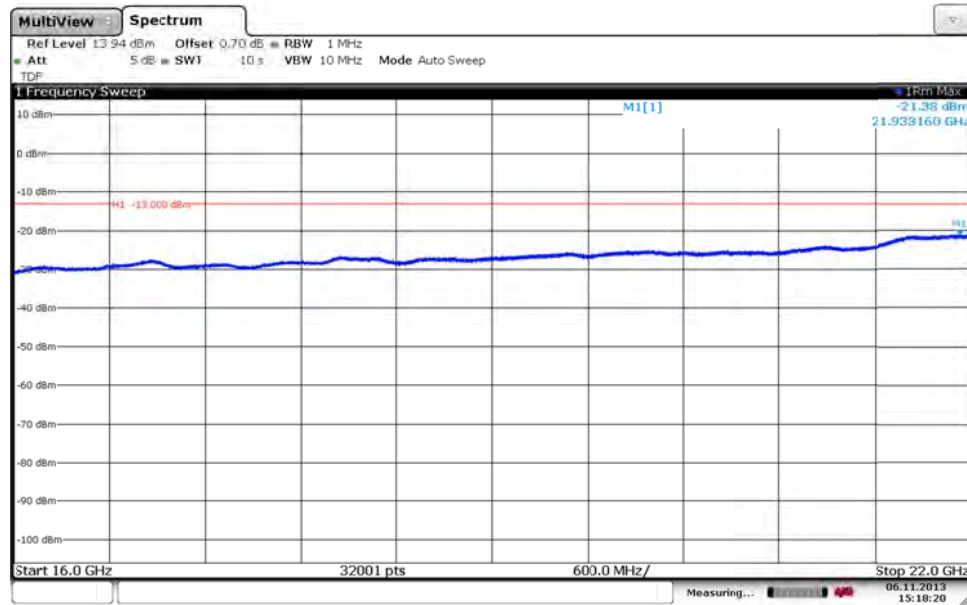
Diagram 16 d:



Date: 6 NOV. 2013 15:19:14

Appendix 5

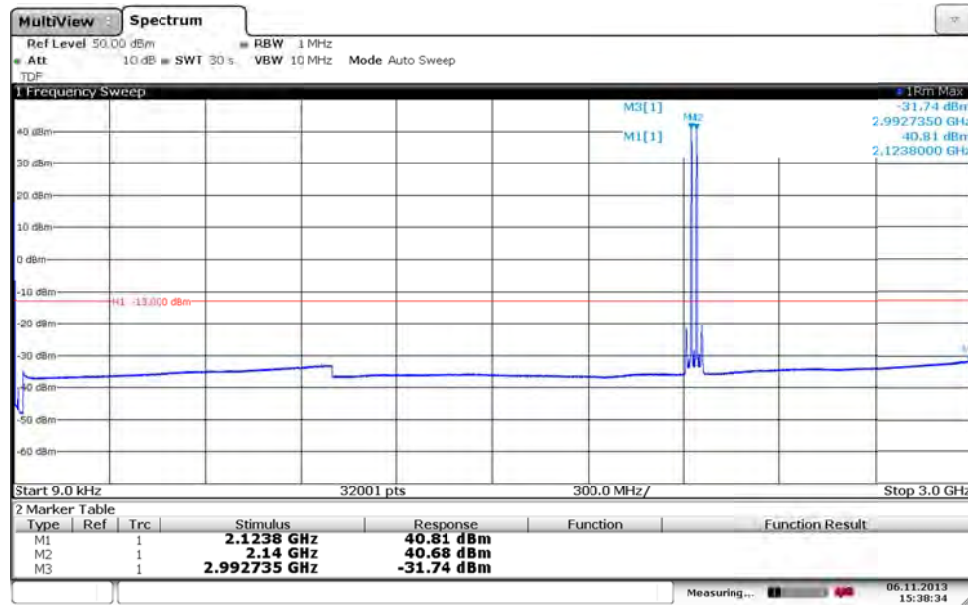
Diagram 16 e:



Date: 6 NOV. 2013 15:18:20

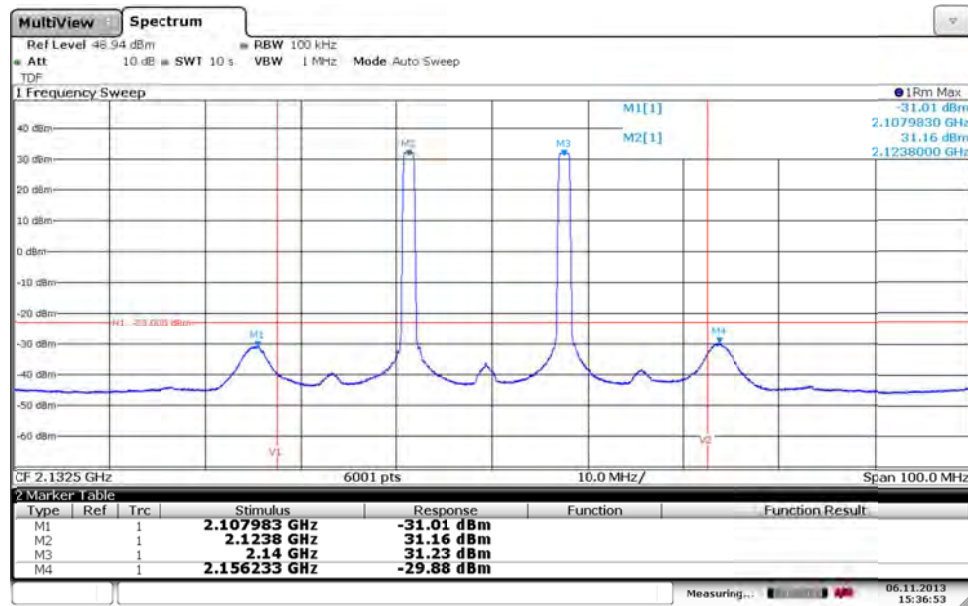
Appendix 5

Diagram 17 a:



Date: 6 NOV 2013 15:38:35

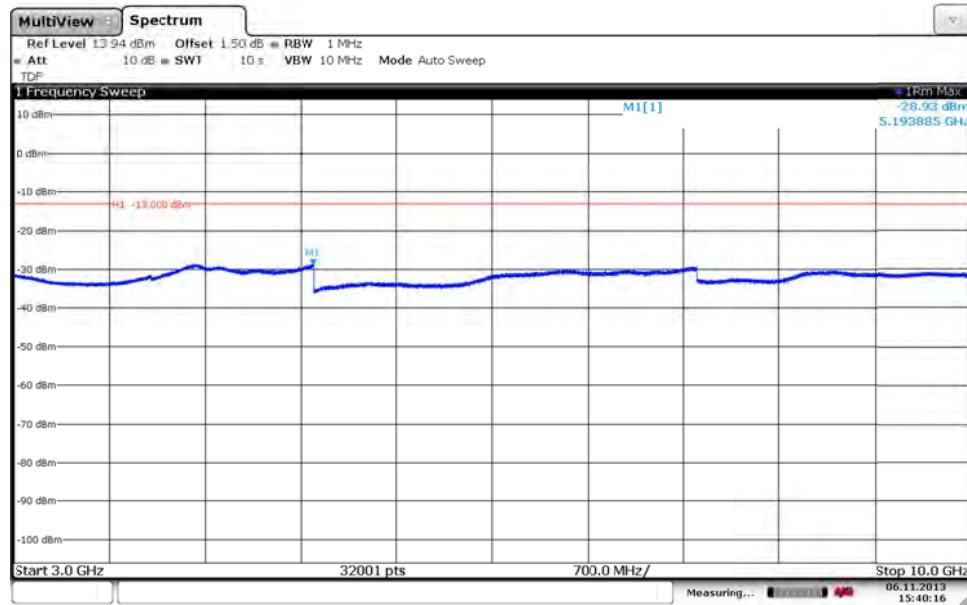
Diagram 17 b:



Date: 6 NOV 2013 15:36:53

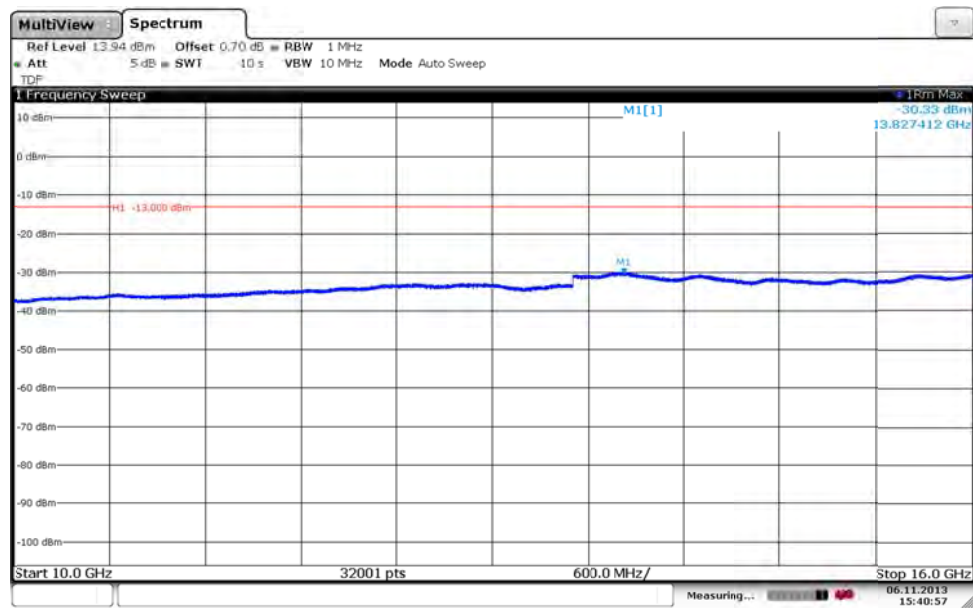
Appendix 5

Diagram 17 c:



Date: 6 NOV. 2013 15:40:15

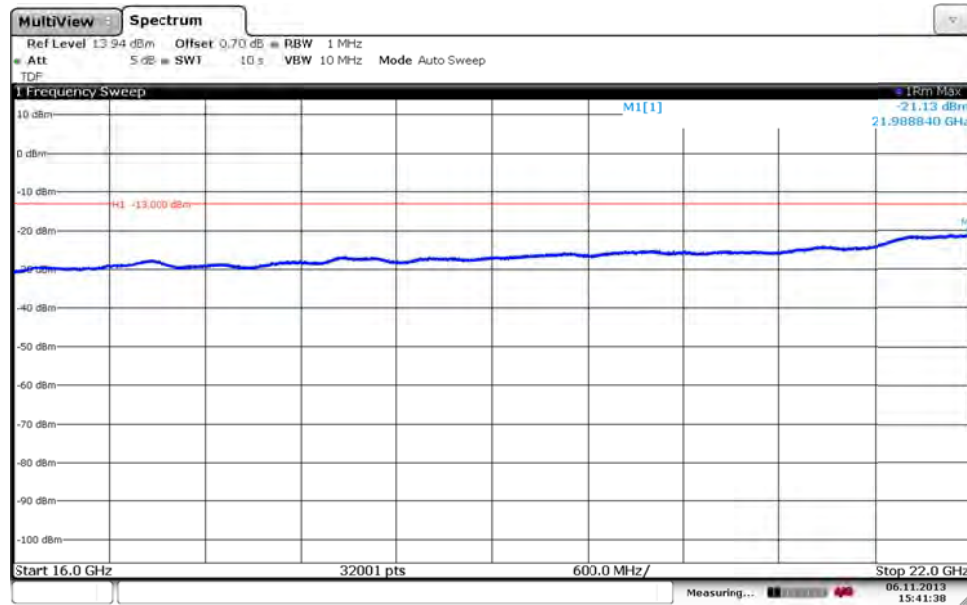
Diagram 17 d:



Date: 6 NOV. 2013 15:40:57

Appendix 5

Diagram 17 e:



Date: 6 NOV. 2013 15:41:38

Appendix 6

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

Date	Temperature	Humidity
2013-10-30	23°C ± 3°C	37 % ± 5 %
2013-10-31	23°C ± 3°C	38 % ± 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

$$\gamma = 20 \log \left(\frac{4\pi D}{\lambda} \right), \gamma \text{ is the propagation loss and } D \text{ is the antenna distance.}$$

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.

Appendix 6

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 ESU 26	901 553
EMC 32 ver. 8.52.0	503 899
Chase Bilog Antenna CBL 6111A	502 182
EMCO Horn Antenna 3115	502 175
Flann STD Gain Horn Antenna 20240-20	503 674
High pass filter, RLC Electronics	503 739
Miteq, Low Noise Amplifier	503 285
Schwarzbeck preamplifier BBV 9742	504 085
µComp Nordic, Low Noise Amplifier	901 545
Temperature and humidity meter, Testo 625	504 188

Appendix 6

Tested configurations

Symbolic name
B
M
T
T2

Results, representing worst case

T, 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
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Appendix 6

Diagram 1 a:

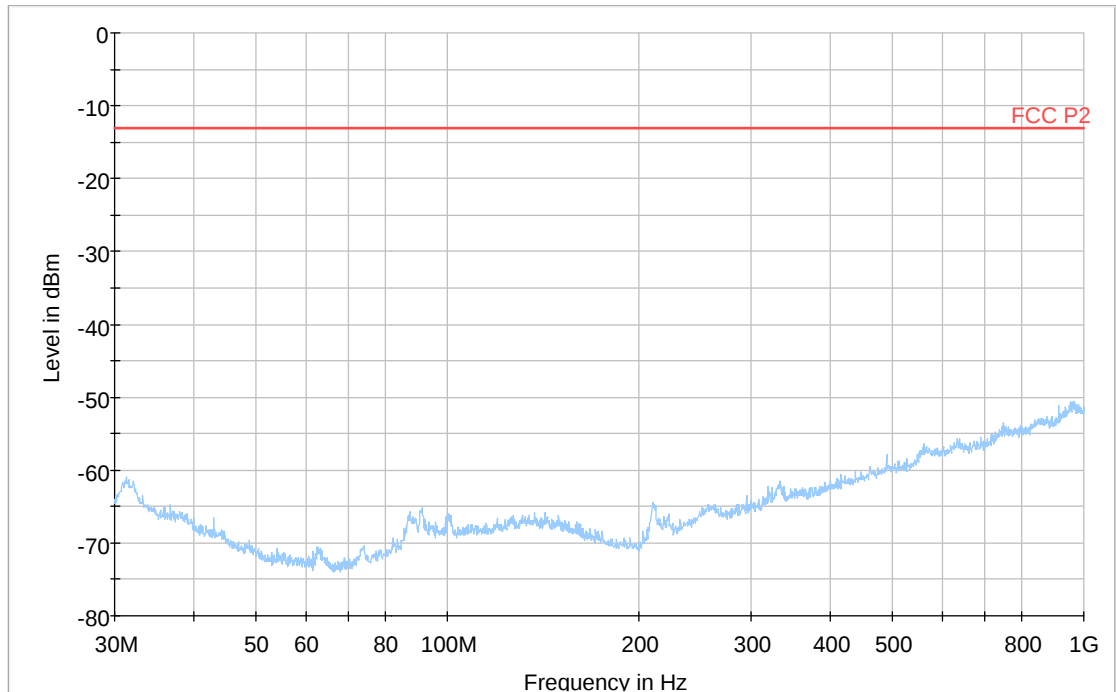
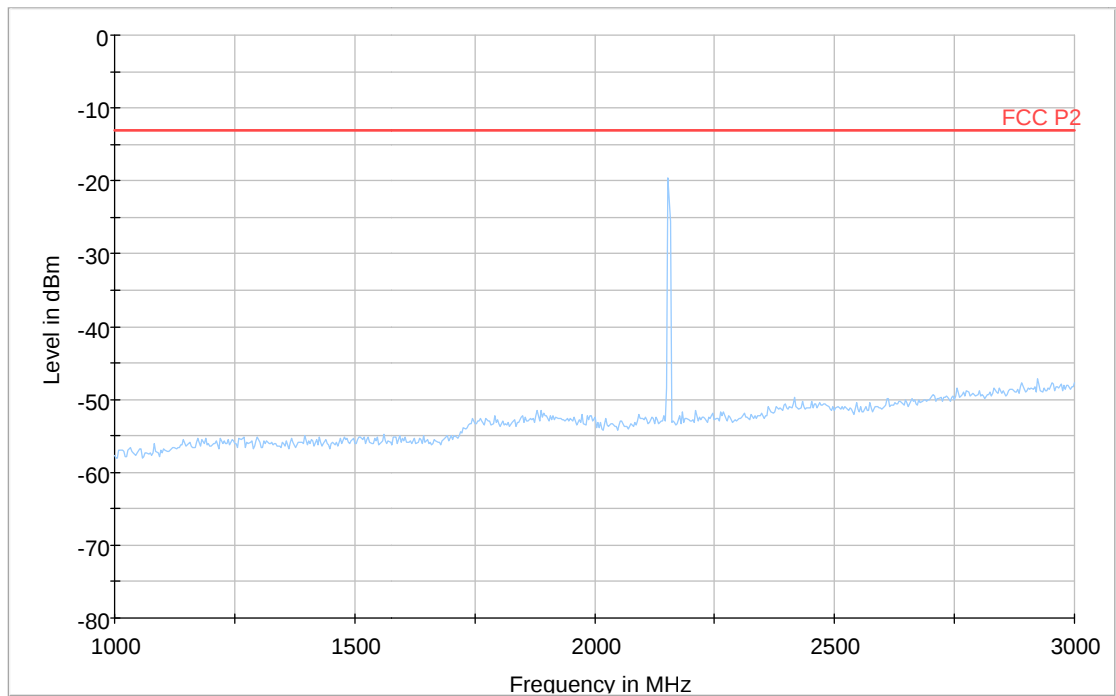


Diagram 1 b:



Note: The emission at 2154.3 MHz is the carrier frequency and shall be ignored in the context.

Appendix 6

Diagram 1 c:

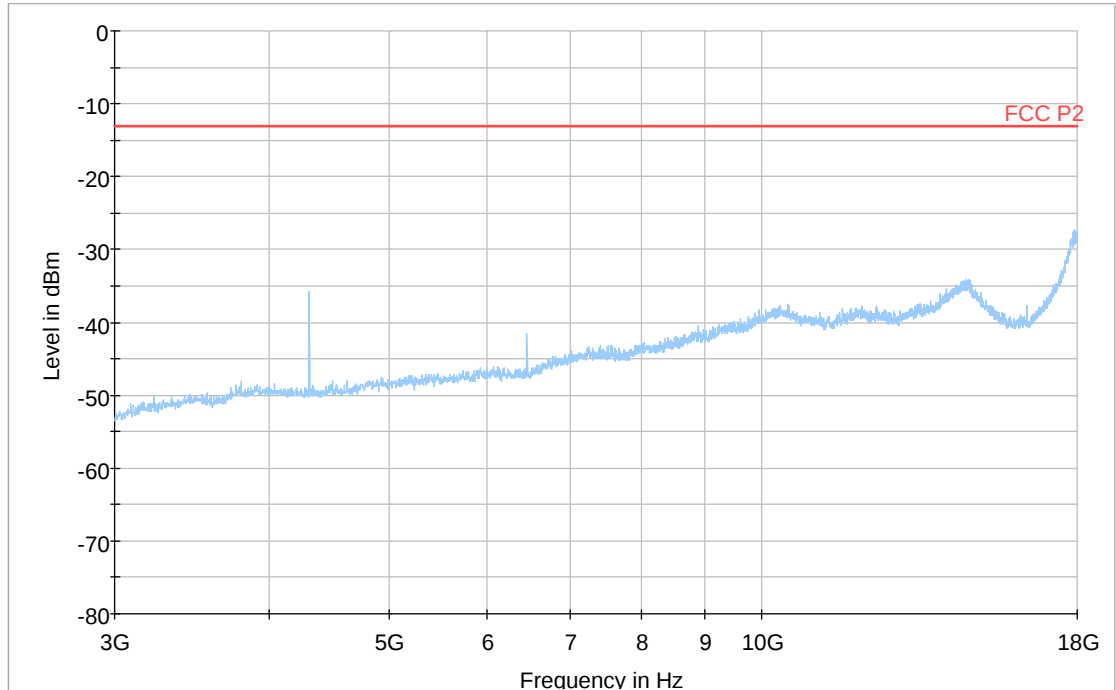
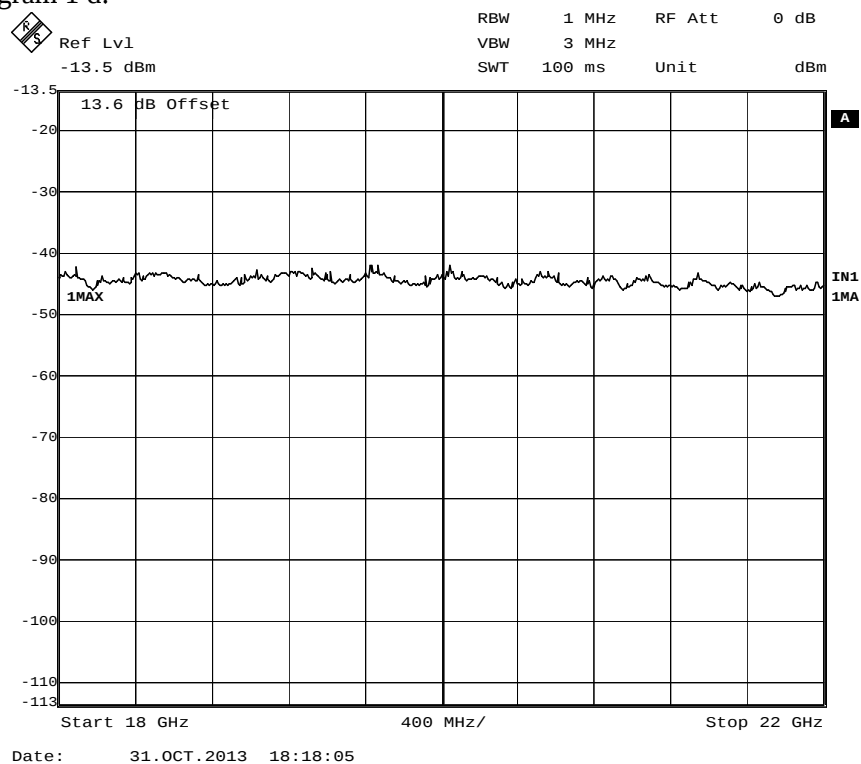


Diagram 1 d:



Appendix 7

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

Date 2013-10-24 to 2013-10-27	Temperature (test equipment) 22-23 °C ± 3 °C	Humidity (test equipment) 35-41 % ± 5 %
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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
Rohde & Schwarz signal analyzer FSQ40	504 143
RF attenuator	503 870
Testo 635, Temperature and humidity meter	504 203
Temperature cabinet	503 360

Results

Nominal transmitter frequency was 2132.5 MHz (M) with a bandwidth of 5 MHz. Rated output power level at connector RF A (maximum): 44.8 dBm (30 W).

Test conditions		Frequency error (Hz)
Supply voltage DC (V)	Temp. (°C)	
-48.0	+20	-6
-55.2	+20	-7
-40.8	+20	-6
-48.0	+30	-5
-48.0	+40	+4
-48.0	+50	-4
-48.0	+10	+5
-48.0	0	+4
-48.0	-10	+2
-48.0	-20	+4
-48.0	-30	+4
Maximum freq. error (Hz)		7
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Appendix 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 (± 118.625 Hz).

§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
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Appendix 8

External photos

Front side



Rear side



Appendix 8

Left side



Right side



Appendix 8

Top side



Bottom side

