

Contact person
Tomas Lennhager
Electronics
+46 10 516 54 09
Tomas.Lennhager@sp.se

Date
2013-12-02

Reference
3P07326-02-F27

Page
1 (2)

Ericsson AB
Klaes Holm
PDU HW
164 80 Stockholm

Class II permissive change on AIR 21 B4A B12P B5 1700/2100 MHz radio equipment with FCC ID: TA8AKRC118048-1 and IC: 287AB- AS1180481 (6 appendices)

Test object

Product name: AIR 21 B4A B12P B5P
Product number: KRC 118 048/1, R2A

Summary

See appendix 1 for general information and appendix 6 for external photos.

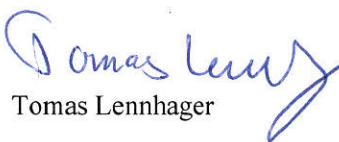
Standard	Compliant	Appendix
FCC CFR 47 / IC RSS-139 Issue 2		
2.1046 / RSS-139 6.4 RF power output conducted	Yes	2
2.1049 / RSS-Gen 4.6.1 Occupied bandwidth	Yes	3
2.1051 / RSS-139 6.5 Band edge	Yes	4
2.1051 / RSS-139 6.5 Spurious emission at antenna terminals	Yes	5

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

Examined by


Tomas Lennhager


Bengt Andersson

SP Technical Research Institute of Sweden

Postal address
SP
Box 857
SE-501 15 BORÅS
Sweden

Office location
Västerås
Brinellgatan 4
SE-504 62 BORÅS

Phone / Fax / E-mail
+46 10 516 50 00
+46 33 13 55 02
info@sp.se

Laboratories are accredited by the Swedish Board for Accreditation and Conformity Assessment (SWEDAC) under the terms of Swedish legislation. This report may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Table of contents

Description of the test object	Appendix 1
Operation mode during measurements	Appendix 1
Test setups	Appendix 1
Purpose of test	Appendix 1
RF power output conducted	Appendix 2
Occupied bandwidth	Appendix 3
Band edge	Appendix 4
Spurious emission at antenna terminals	Appendix 5
External photos	Appendix 6

Appendix 1

Description of the test object

Equipment:	Product name: AIR 21 B4A B12P B5P Product number: KRC 118 048/1, R2A FCC ID TA8AKRC118048-1 IC 287AB-AS1180481 IC MODEL NO: AS1180481
Tested configuration:	WCDMA single RAT
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 configurations:	Single carrier, multi carrier and MIMO 2x2
Nominal RF output power per antenna port:	Single carrier: 1x 44.8 dBm (1x 30W) Multi carrier: 2x 41.8 dBm (2x 15W) 4x 38.8 dBm (4x 7.5W)
Antenna type:	Cross- polarized antenna
Antenna gain:	18 dBi
Modulations:	QPSK, 16QAM and 64QAM
Channel bandwidths:	4.2 to 5 MHz (configurable in steps of 100/200 kHz)
Channel spacing:	4.4 to 5 MHz (configurable in steps of 100/200 kHz)
Nominal supply voltage:	-48VDC

Appendix 1

Operation mode during measurements

Measurements were performed with the test object transmitting the Test model 1 which are defined in 3GPP TS 25.141. Test model 1 (TM1) represent QPSK modulation. Test model 5 (TM5) includes the 16QAM modulation and Test model 6 (TM6) includes the 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

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

MIMO mode, multi carrier (2 carriers)

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

Channel bandwidth 5 MHz

Conducted measurements

The conducted measurements were performed on AIR 21 B4A B12P B8P with product number KRC 118 056/1 including the radio unit ARUS B4 1/KRC 118 046 which is identical for AIR 21 B4 B12P B5P and is representative for conducted TX performance 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.

Purpose of test

The purpose of test is to justify a Class II Permissive Change of the test object with hardware update and to include the use of MIMO mode, by verifying compliance to the performance characteristics specified in applicable parts of FCC CFR 47, 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 25.141, 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 2013-10-18.

Manufacturer's representative

Christer Gustavsson, Ericsson AB.

Test engineers

Andreas Johnson, Tomas Isbring, Hyder Khalaf, Kexin Chen, Tomas Lennhager 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	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	2014-09	503 285
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 during measurements

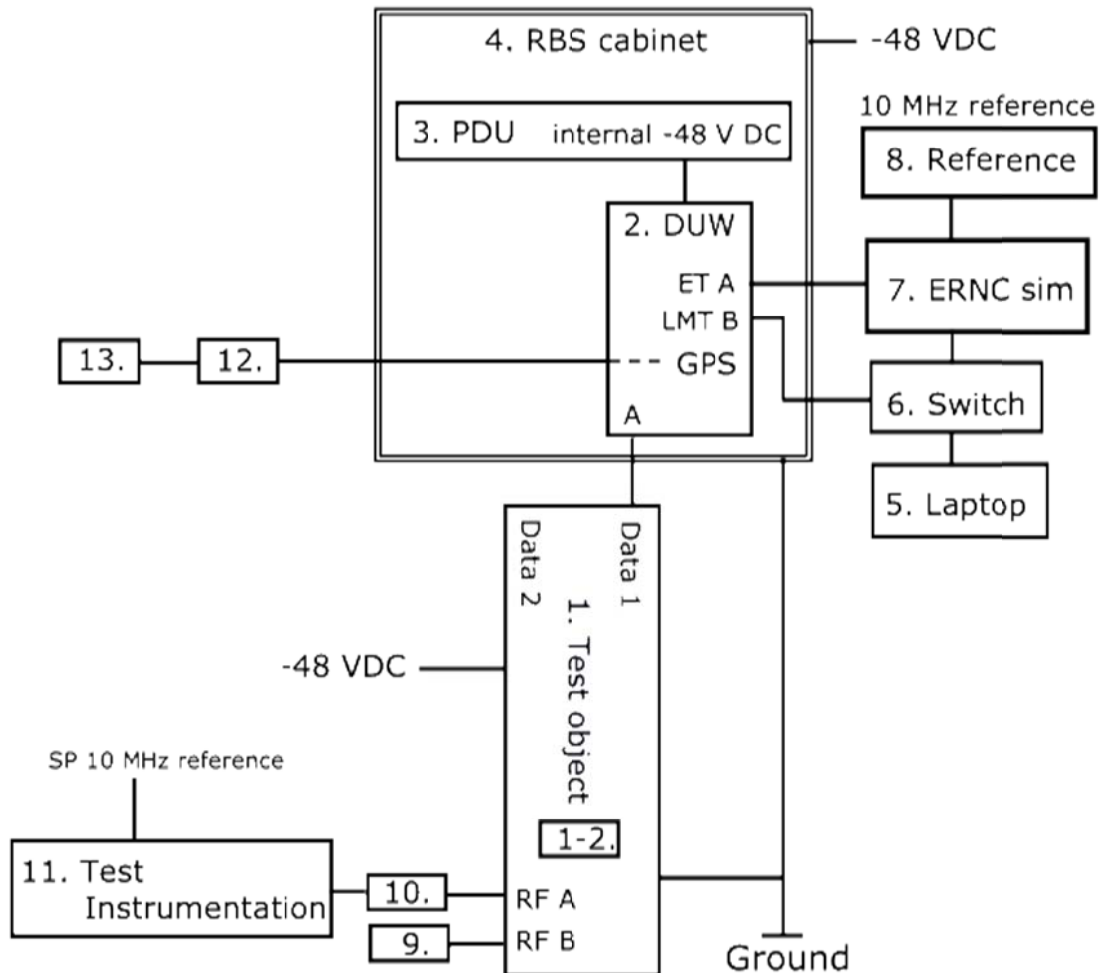
TX test frequencies

UARFCN Downlink	Frequency [MHz]	Symbolic name	Comment
1537	2112.4	B	Single carrier TX bottom frequency
1537 1562	2112.4 2117.4	B2	2 carrier TX band bottom constellation
1537 1587	2112.4 2122.4	B3	2 carrier TX band bottom constellation
1537 1562 1587 1612	2112.4 2117.4 2122.4 2127.4	B4	4 carrier TX band bottom constellation
1638	2132.6	M	Single carrier TX band mid frequency
1625 1650	2130.0 2135.0	M2	2 carrier TX band mid constellation
1600 1625 1650 1675	2125.0 2130.0 2135.0 2140.0	M4	4 carrier TX band midconstellation
1738	2152.6	T	Single carrier TX top frequency
1713 1738	2147.6 2152.6	T2	2 carrier TX band top constellation
1688 1738	2142.6 2152.6	T3	2 carrier TX band top constellation
1663 1688 1713 1738	2137.6 2142.6 2147.6 2152.6	T4	4 carrier TX band top constellation

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

Appendix 1

Test setup conducted measurements



Test object:

1.	AIR 21 B4A B12 P B8P, KRC 118 056/1, revision R1A, S/N: CQ30112763 with software: CXP 901 3268/6, Rev. R51NE 1-2. Transceiver, ARUS B4 1/KRC 118 046, revision R1C
----	--

Functional test equipment

2.	DUW 30 01, KDU 127 161/3, revision R4F, s/n: TU8XB20713
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.	ERNC Sim 130, BAMS – 100066091
8.	Symmetricon 8040 reference, BAMS – 1000714189
9.	Terminator, 50 ohm
10.	Attenuator, according respective appendix
11.	SP Test Instrumentation according to measurement equipment list
12.	GPS 02 01, NCD 901 41/1, revision R1D, s/n: TU8K474887
13.	GPS Active Antenna, KRE 101 2082/1

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	Signal
Ground wire	Ground

RBS software:

Software	Revision
CXP 902 1719	R4F/5

Appendix 2

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

Date	Temperature	Humidity
2013-11-08	23°C ± 3°C	31 % ± 5 %
2013-11-10	23°C ± 3°C	31 % ± 5 %

Test set-up and procedure

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

Measurement equipment	SP number
R&S FSQ 40	504 143
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 1 x 44.8 dBm per RF port.

Symbolic name	Transmitter power [RMS (dBm)/ PAR dB]		
	Port RF A	Port RF B	Total power ¹⁾
B	44.88/ 7.24	44.72/ 7.24	47.81
M	44.86/ 7.24	44.76/ 7.24	47.82
T	44.86/ 7.24	44.71/ 7.24	47.80

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, 2-Carrier

Rated output power 2 x 41.8 dBm per RF port.

Symbolic name	Transmitter power [RMS (dBm)/ PAR dB]		
	Port RF A	Port RF B	Total power ¹⁾
B2	44.72/ 7.24	44.70/ 7.26	47.72
M2	44.81/ 7.24	44.71/ 7.21	47.77
T2	44.79/ 7.24	44.78/ 7.19	47.80

MIMO mode, 4-Carrier

Rated output power 4 x 38.8 dBm per RF port.

Symbolic name	Transmitter power [RMS (dBm)/ PAR dB]		
	Port RF A	Port RF B	Total power ¹⁾
B4	44.93/ 7.31	44.93/ 7.31	47.94
M4	45.01/ 7.19	44.84/ 7.19	47.94
T4	44.90/ 7.38	44.93/ 7.38	47.93

¹⁾: 2 outputs summed 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, single carrier

Measured output power per 1 MHz.

Symbolic name	[RMS dBm]		Total power ¹⁾ [RMS dBm]
	Port RF A	Port RF B	
B	38.99	39.61	42.61
M	39.94	39.67	42.94
T	40.00	39.59	43.00

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

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:

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

Complies?	Yes
-----------	-----

Appendix 3

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

Date	Temperature	Humidity
2013-11-07	23 °C ± 3 °C	31 % ± 5 %
2013-11-08	23 °C ± 3 °C	31 % ± 5 %

Test set-up and procedure

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

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

Measurement uncertainty: 3.7 dB

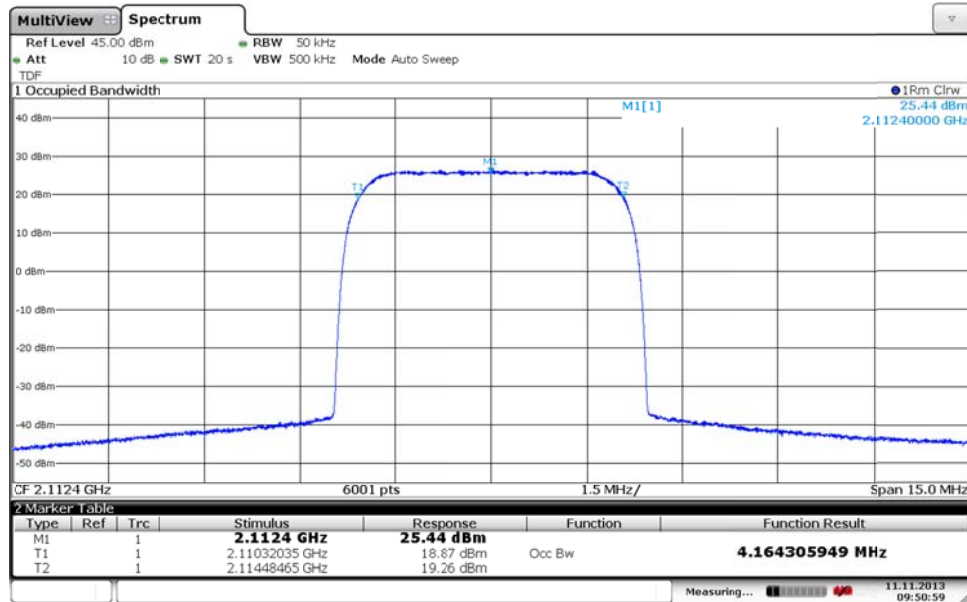
Results

MIMO mode, single carrier

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

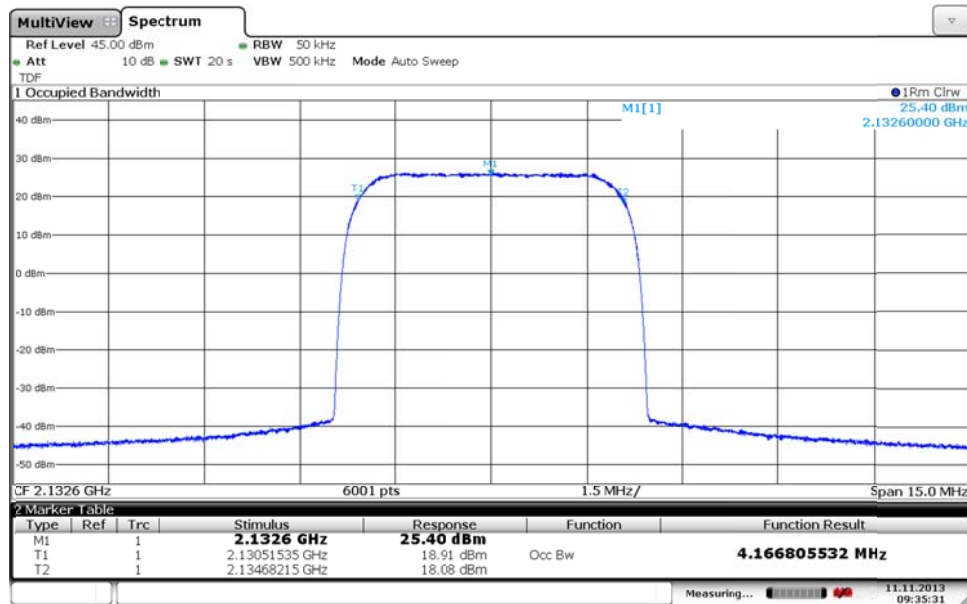
Appendix 3

Diagram 1:



Date: 11.NOV.2013 09:50:58

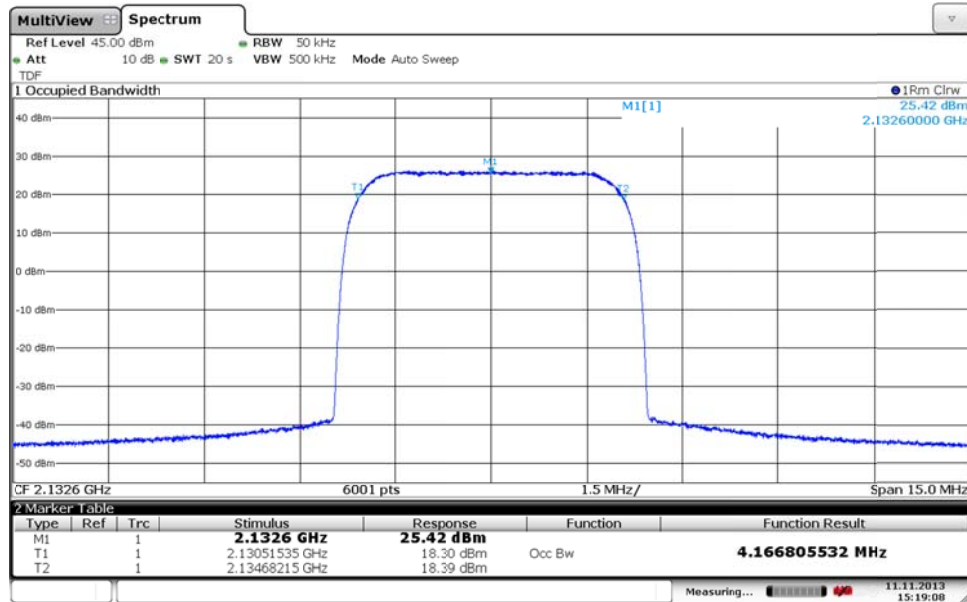
Diagram 2:



Date: 11.NOV.2013 09:35:31

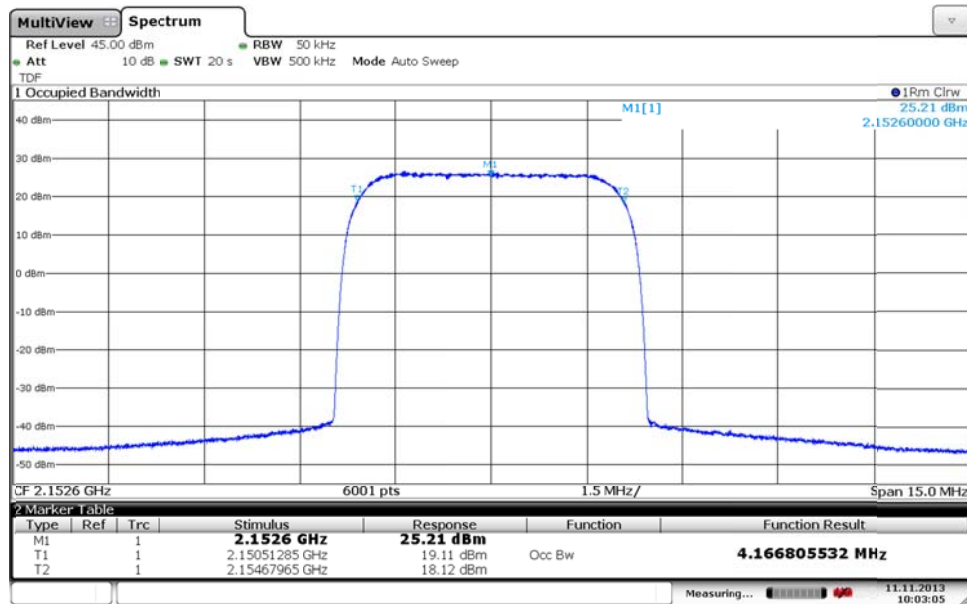
Appendix 3

Diagram 3:



Date: 11.NOV.2013 15:19:08

Diagram 4:



Date: 11.NOV.2013 10:03:05

Appendix 4

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

Date	Temperature	Humidity
2013-11-07	23 °C ± 3 °C	31 % ± 5 %
2013-11-08	23 °C ± 3 °C	31 % ± 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.

A resolution bandwidth of 20 kHz was used up to 1 MHz away from the band edges. 20 kHz is <1% of the Emission BW (4.37 MHz between the 26 dB points for 5 MHz nominal BW setting). To compensate for the reduced resolution bandwidth, the limit was adjusted with 3.4 dB to -16.4 dBm.

A resolution bandwidth of 200 kHz was used 1 MHz to 6 MHz away from the band edges, to compensate for the reduced resolution bandwidth the limit was adjusted by 7 dB to -20 dBm.

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

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	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	Symbolic name	Tested Port
1 a-c	5 MHz	B	RF A
2 a-c	5 MHz	B	RF B
3 a-c	5 MHz	T	RF A
4 a-c	5 MHz	T	RF B

MIMO mode, 2-carriers

Diagram	BW configuration	Symbolic name	Tested Port
5 a-c	5 MHz	B2	RF A
6 a-c	5 MHz	T2	RF A

Limits

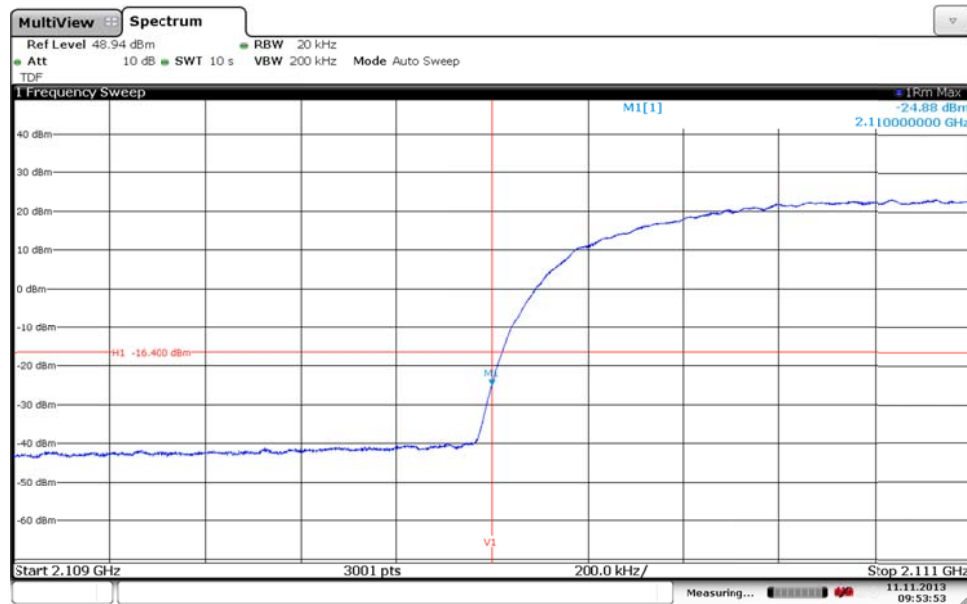
CFR 47 §27.53(h) and RSS-139 6.5

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 1 a:



Date: 11.NOV.2013 09:53:53

Diagram 1 b:



Date: 11.NOV.2013 09:54:53

Appendix 4

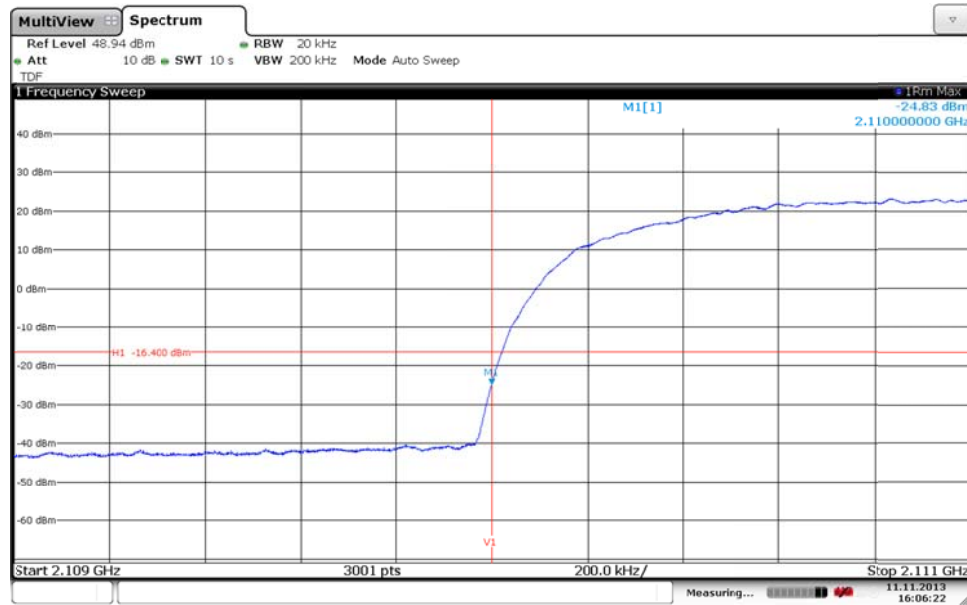
Diagram 1 c



Date: 11.NOV.2013 09:55:31

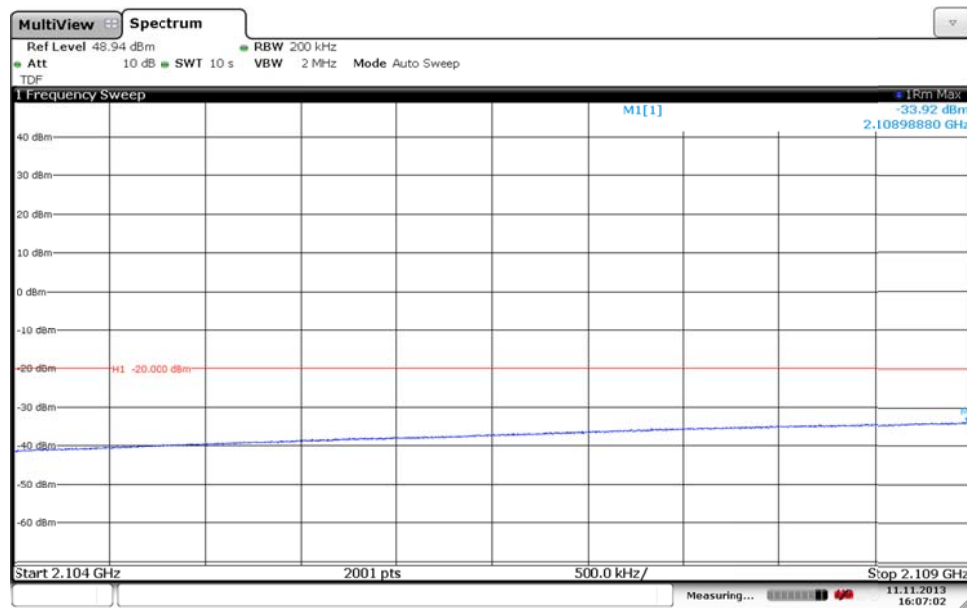
Appendix 4

Diagram 2 a:



Date: 11.NOV.2013 16:06:22

Diagram 2 b:



Date: 11.NOV.2013 16:07:02

Appendix 4

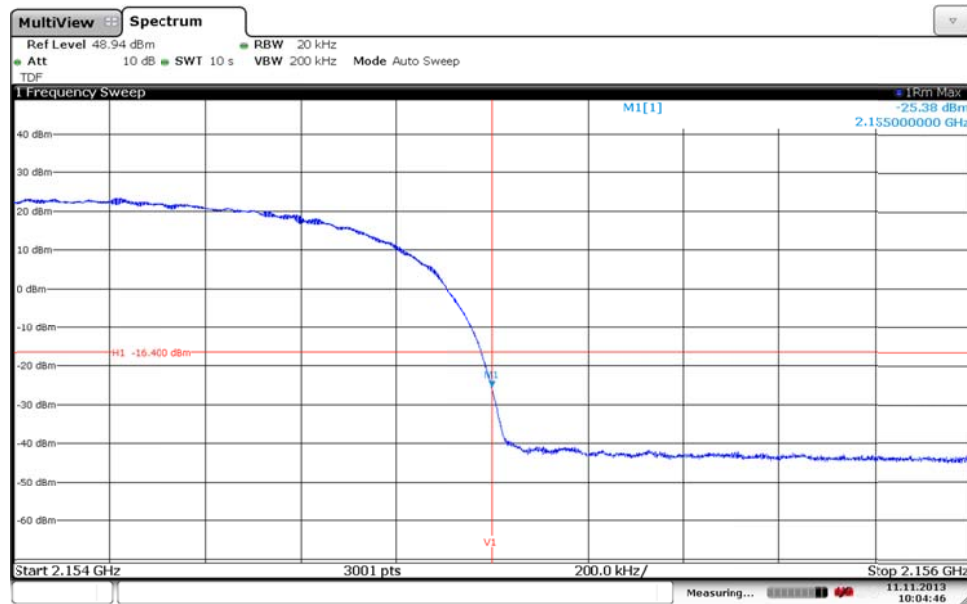
Diagram 2 c:



Date: 11.NOV.2013 16:07:29

Appendix 4

Diagram 3 a:



Date: 11.NOV.2013 10:04:46

Diagram 3 b:



Date: 11.NOV.2013 10:05:19

Appendix 4

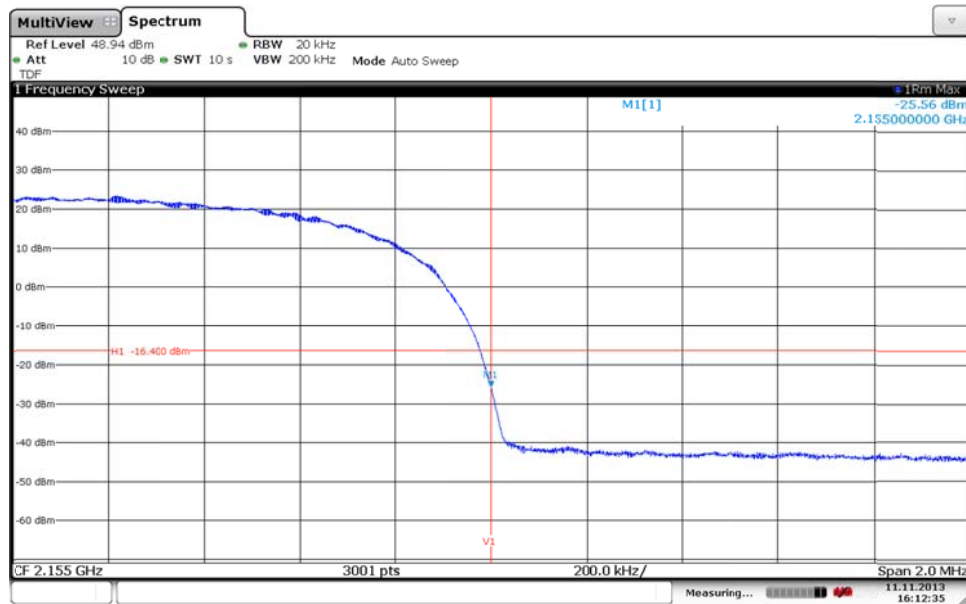
Diagram 3 c:



Date: 11.NOV.2013 10:05:46

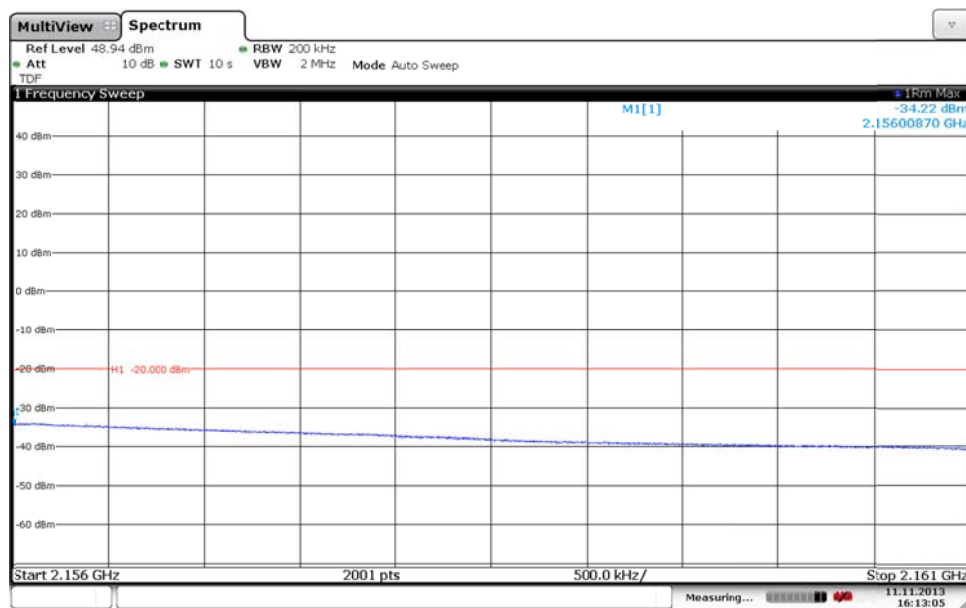
Appendix 4

Diagram 4 a:



Date: 11.NOV.2013 16:12:35

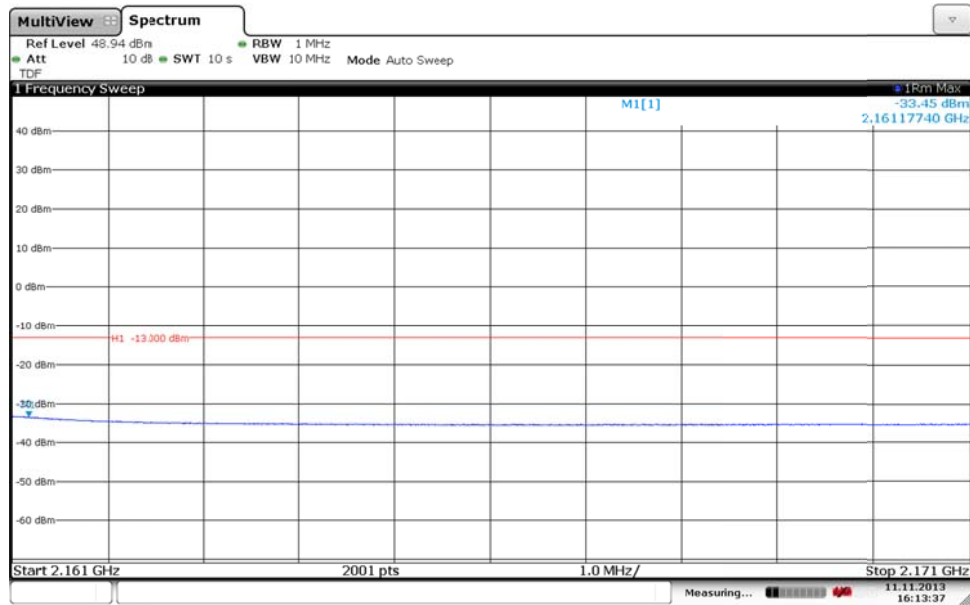
Diagram 4 b:



Date: 11.NOV.2013 16:13:05

Appendix 4

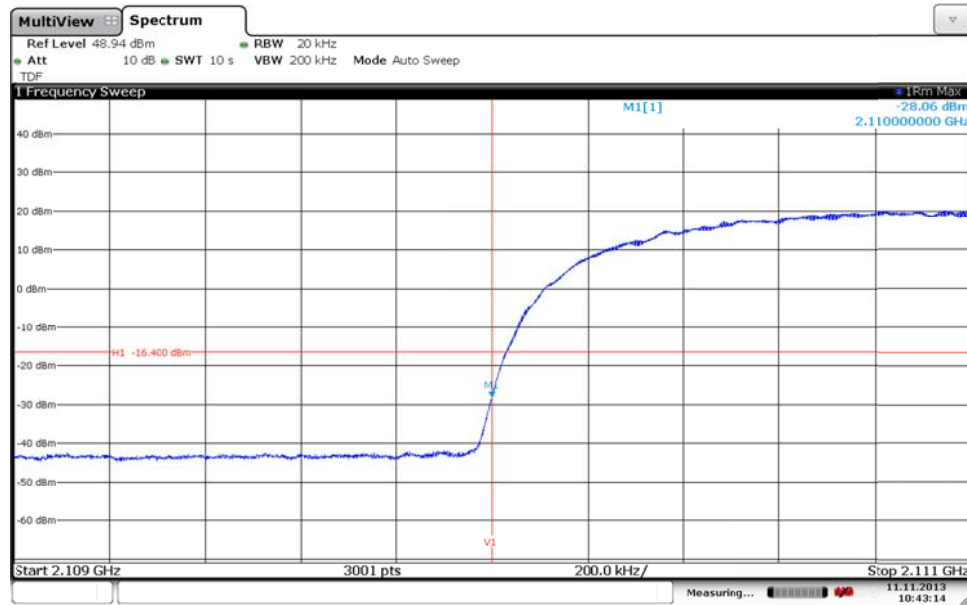
Diagram 4 c:



Date: 11.NOV.2013 16:13:37

Appendix 4

Diagram 5 a:



Date: 11.NOV.2013 10:43:14

Diagram 5 b:



Date: 11.NOV.2013 10:44:46

Appendix 4

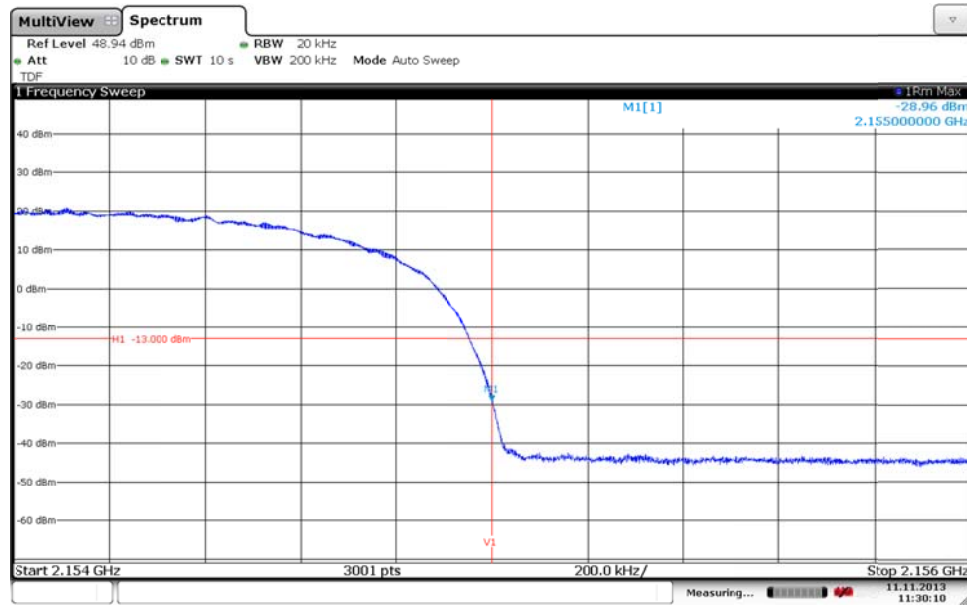
Diagram 5 c:



Date: 11.NOV.2013 10:45:14

Appendix 4

Diagram 6 a:



Date: 11.NOV.2013 11:30:10

Diagram 6 b:



Date: 11.NOV.2013 11:31:56

Appendix 4

Diagram 6 c:



Date: 11.NOV.2013 11:33:09

Appendix 5

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

Date	Temperature	Humidity
2013-11-07	23 °C ± 3 °C	31 % ± 5 %
2013-11-08	23 °C ± 3 °C	31 % ± 5 %

Test set-up and procedure

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

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

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

Measurement uncertainty: 3.7 dB

Results

MIMO mode, single carrier

Diagram	Symbolic name	Tested Port
1 a+b+c+d	B	RF A
2 a+b+c+d	M	RF A
3 a+b+c+d	M	RF B
4 a+b+c+d	T	RF A

MIMO mode, 2-carriers

Diagram	Symbolic name	Tested Port
5 a+b+c+d	B3	RF A
6 a+b+c+d	T3	RF A

MIMO mode, 4-carriers

Diagram	Symbolic name	Tested Port
7 a+b+c+d	M4	RF A

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

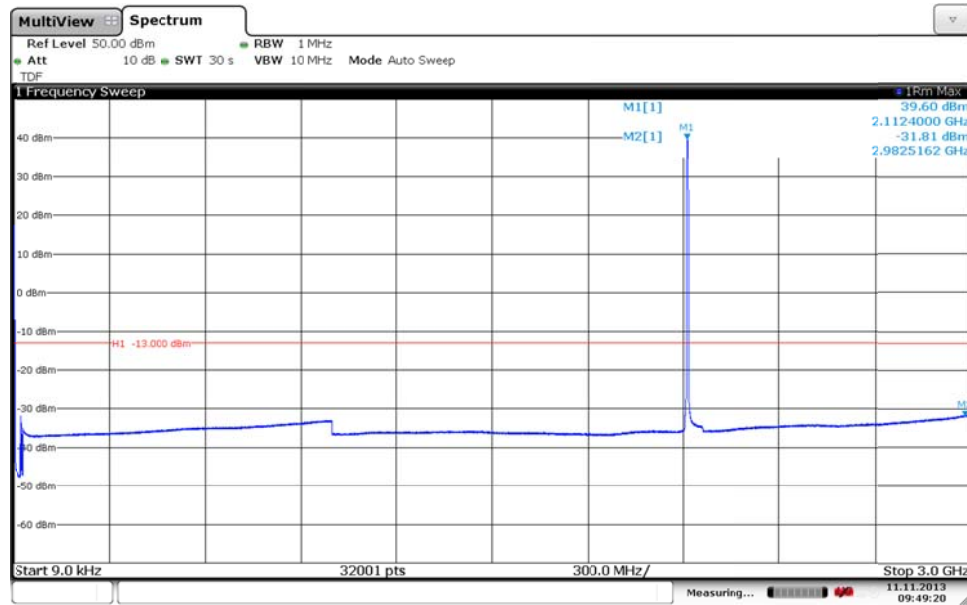
§27.53(h) and RSS-139 6.5

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

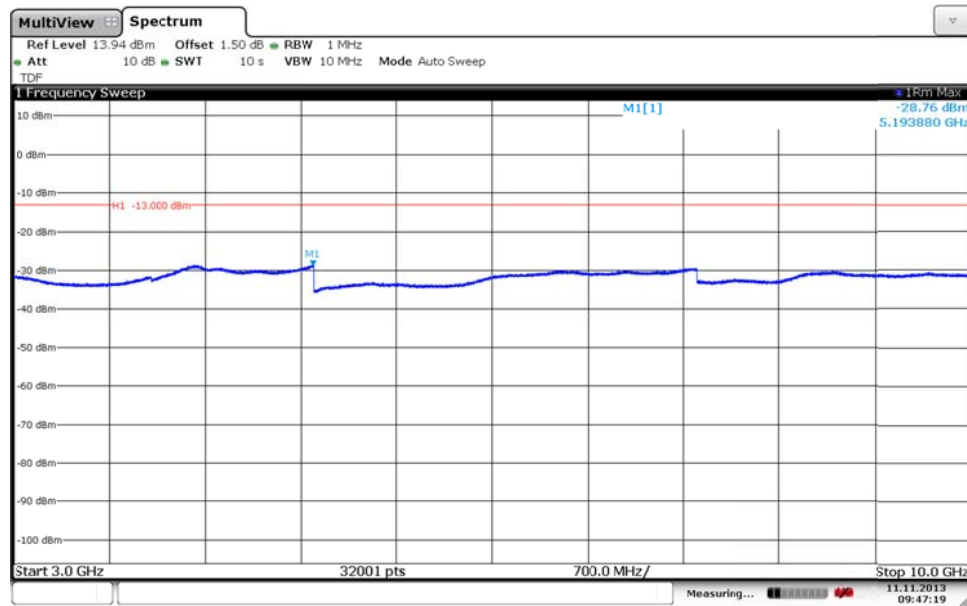
Appendix 5

Diagram 1 a:



Date: 11.NOV.2013 09:49:20

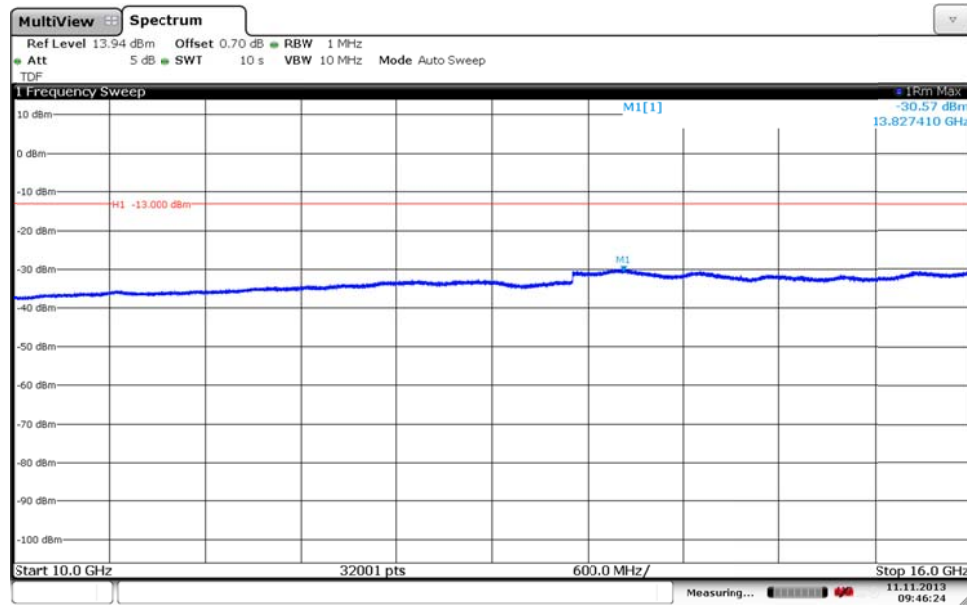
Diagram 1 b:



Date: 11.NOV.2013 09:47:19

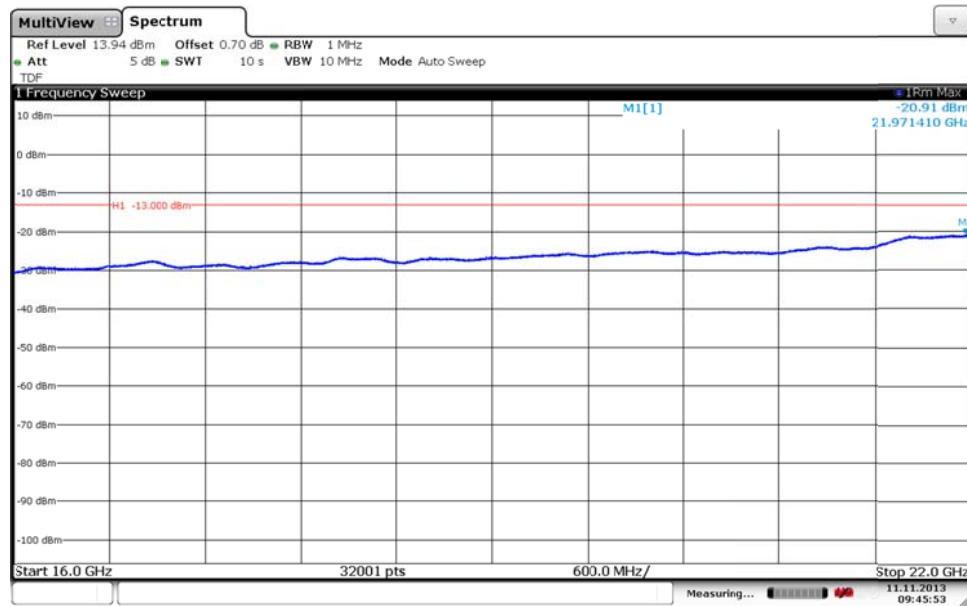
Appendix 5

Diagram 1 c:



Date: 11.NOV.2013 09:46:24

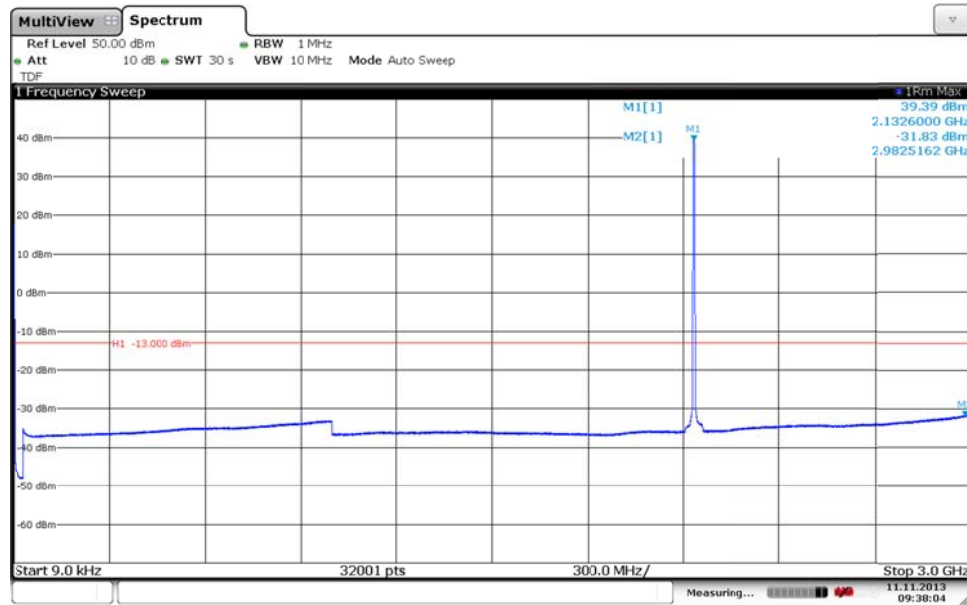
Diagram 1 d:



Date: 11.NOV.2013 09:45:53

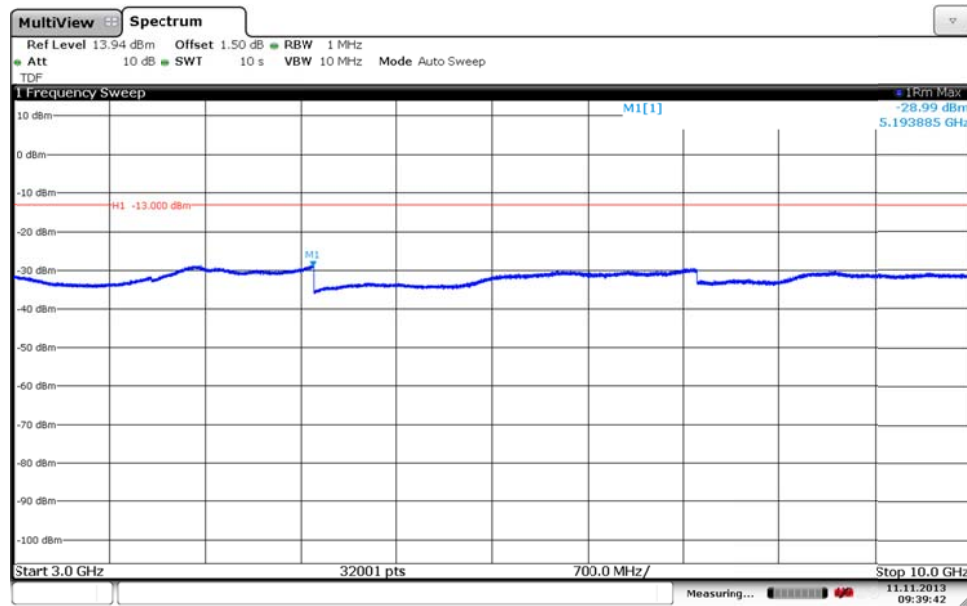
Appendix 5

Diagram 2 a:



Date: 11.NOV.2013 09:38:04

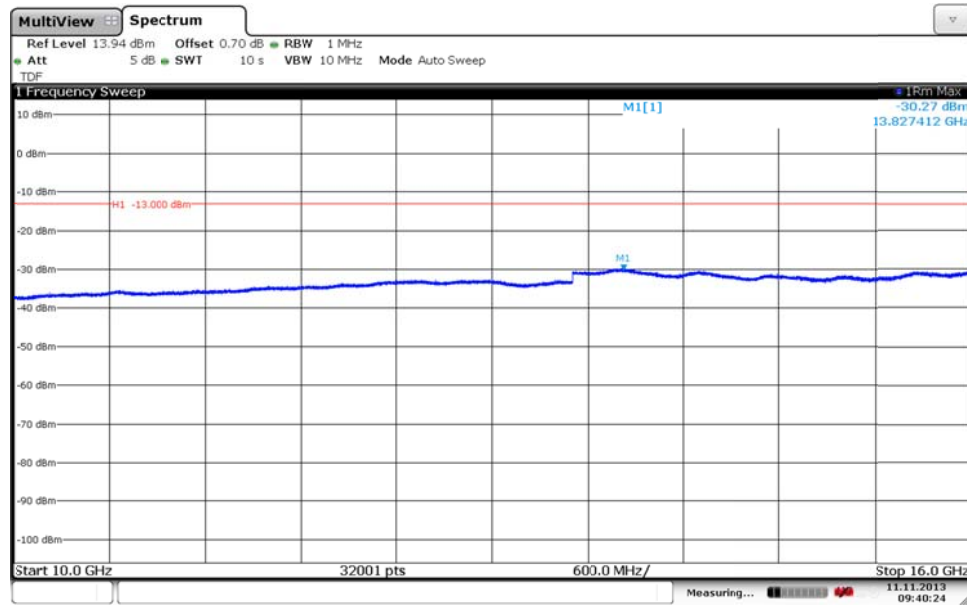
Diagram 2 b:



Date: 11.NOV.2013 09:39:42

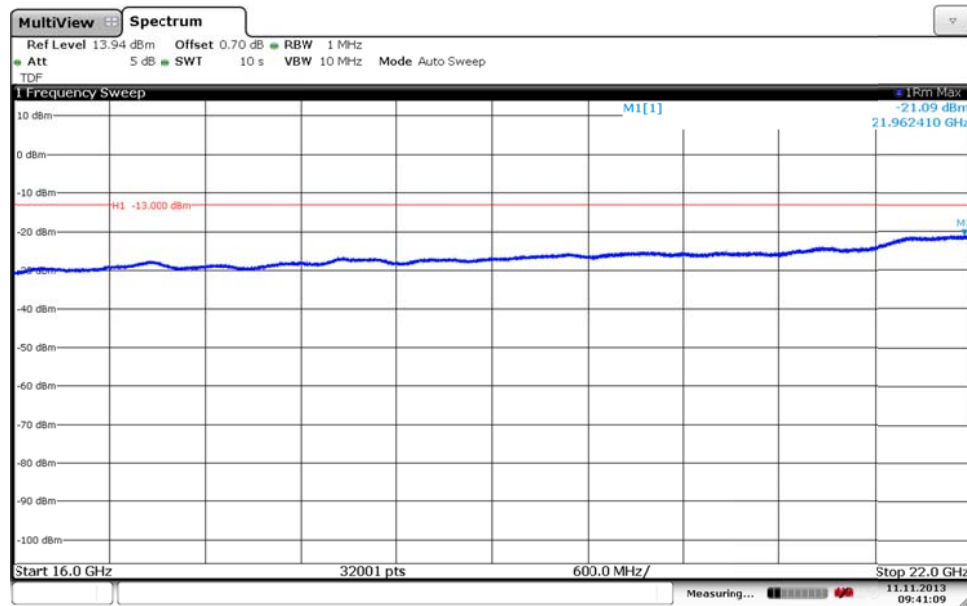
Appendix 5

Diagram 2 c:



Date: 11.NOV.2013 09:40:24

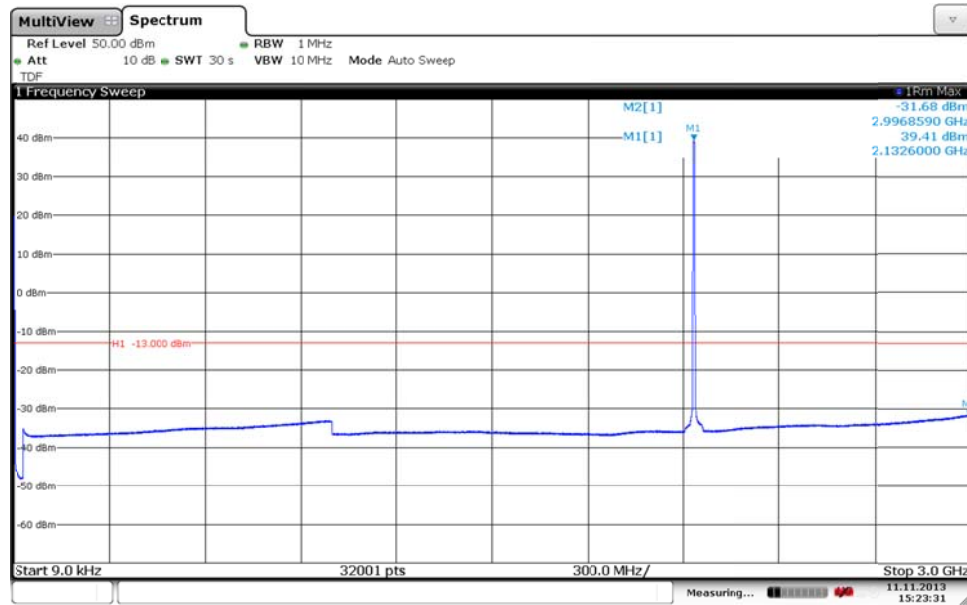
Diagram 2 d:



Date: 11.NOV.2013 09:41:09

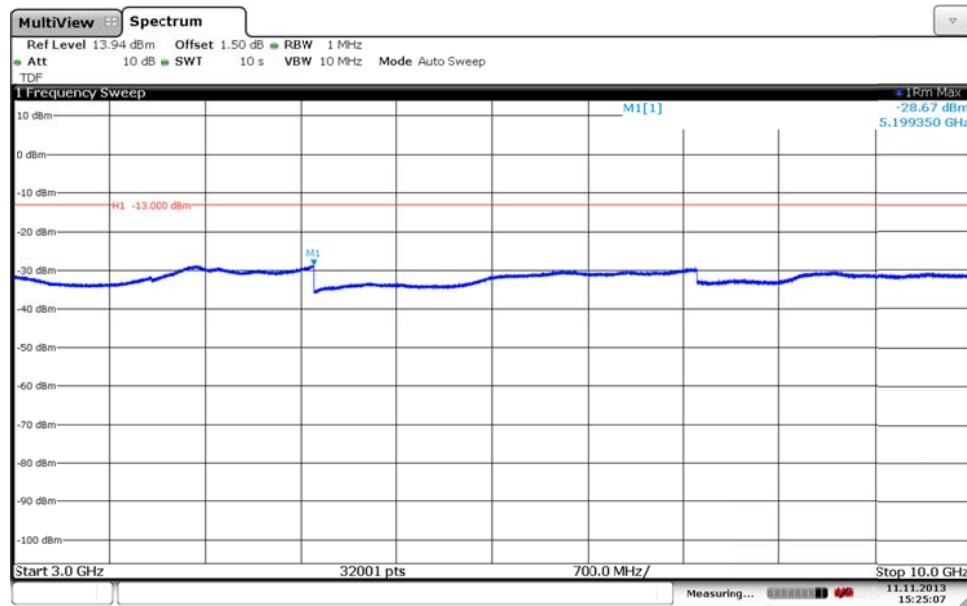
Appendix 5

Diagram 3 a:



Date: 11.NOV.2013 15:23:31

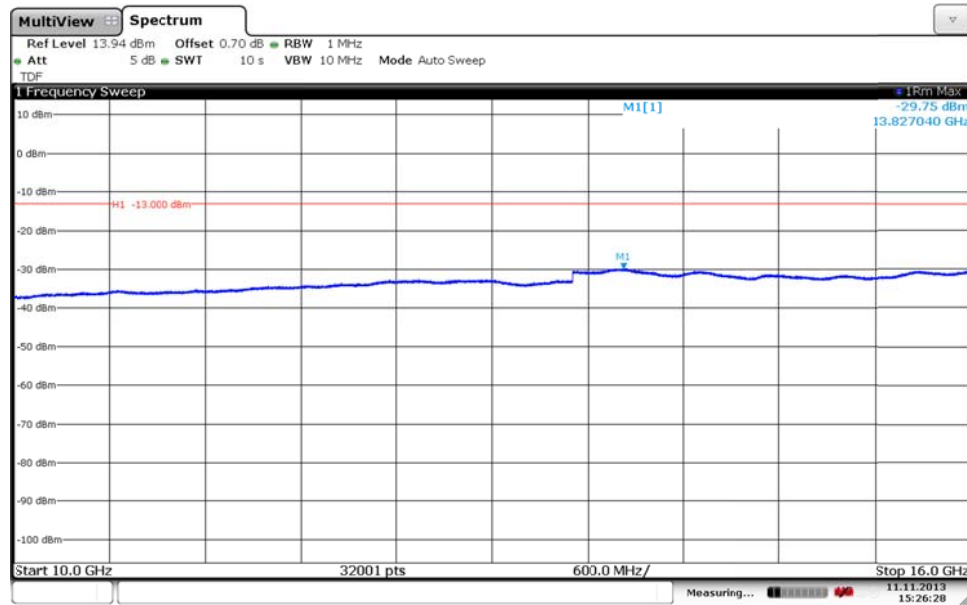
Diagram 3 b:



Date: 11.NOV.2013 15:25:07

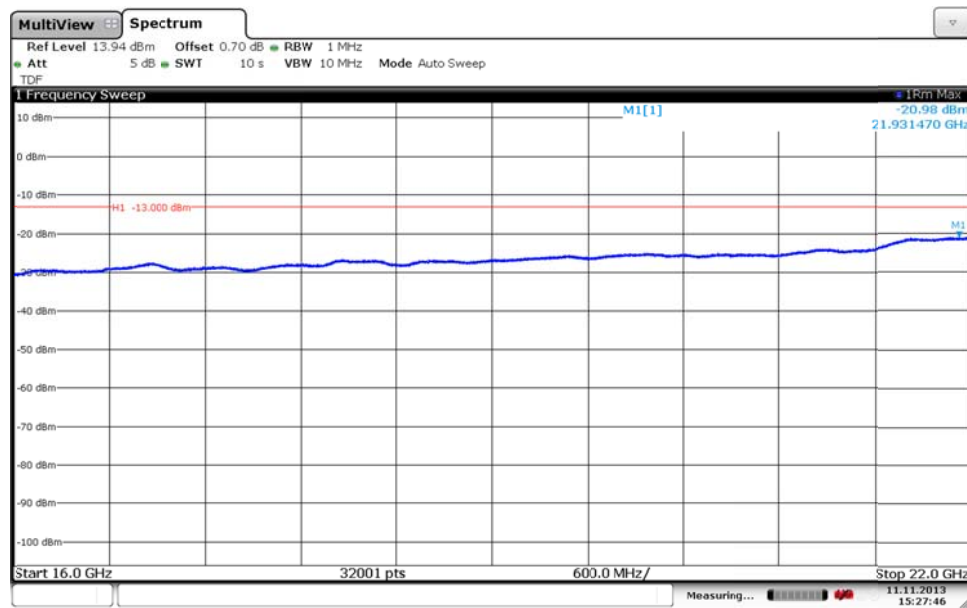
Appendix 5

Diagram 3 c:



Date: 11.NOV.2013 15:26:28

Diagram 3 d:



Date: 11.NOV.2013 15:27:45

Appendix 5

Diagram 4 a:

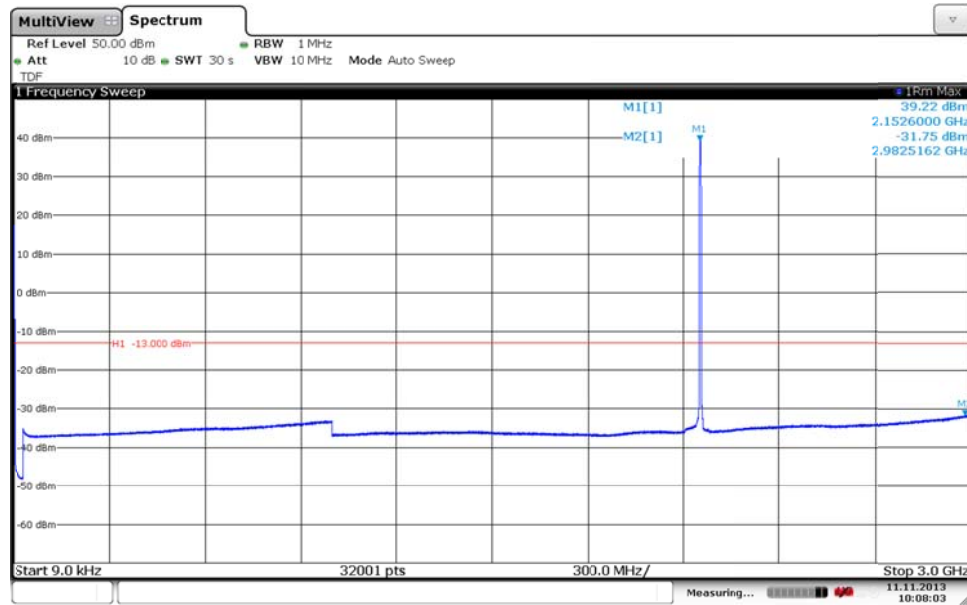
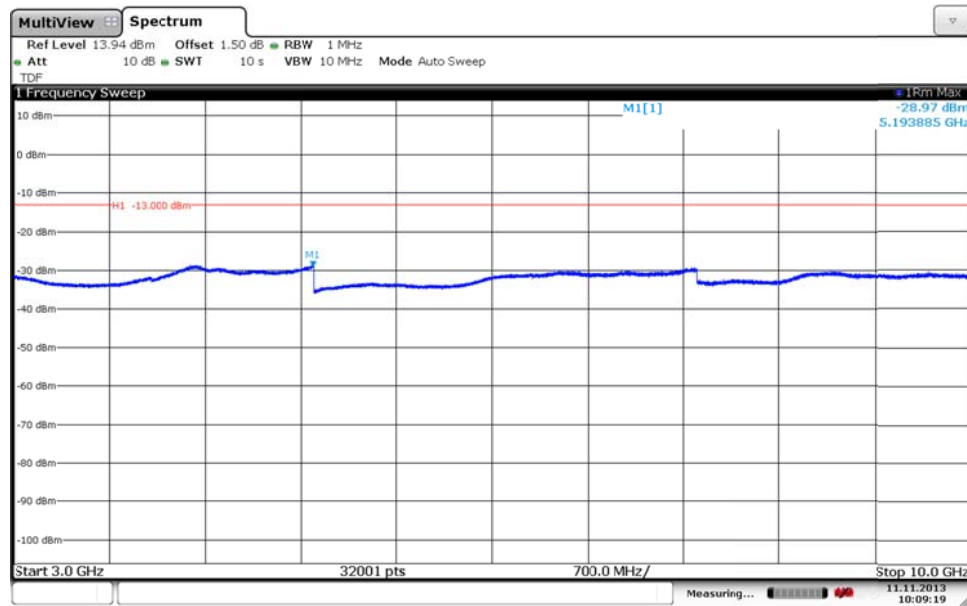
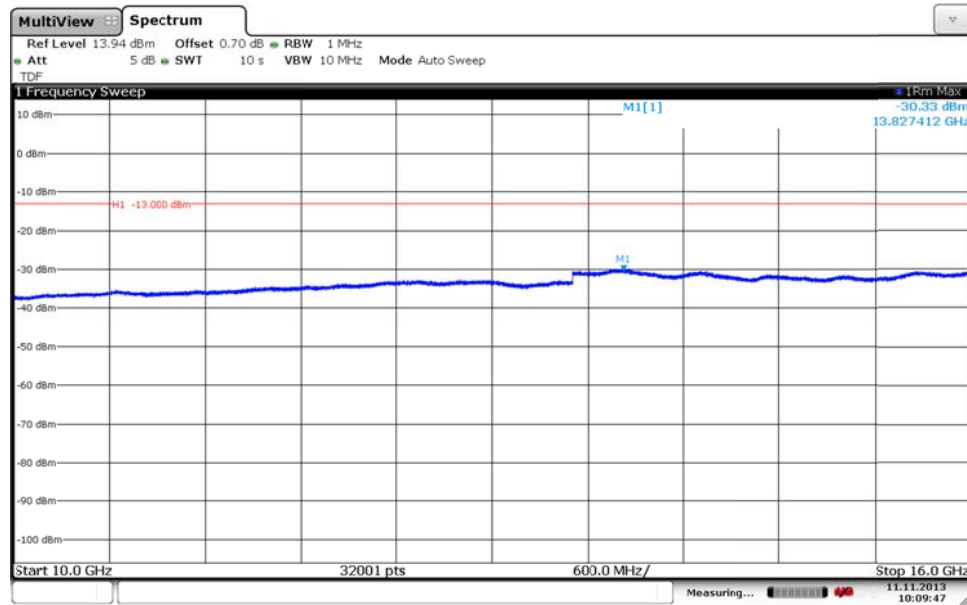


Diagram 4 b:



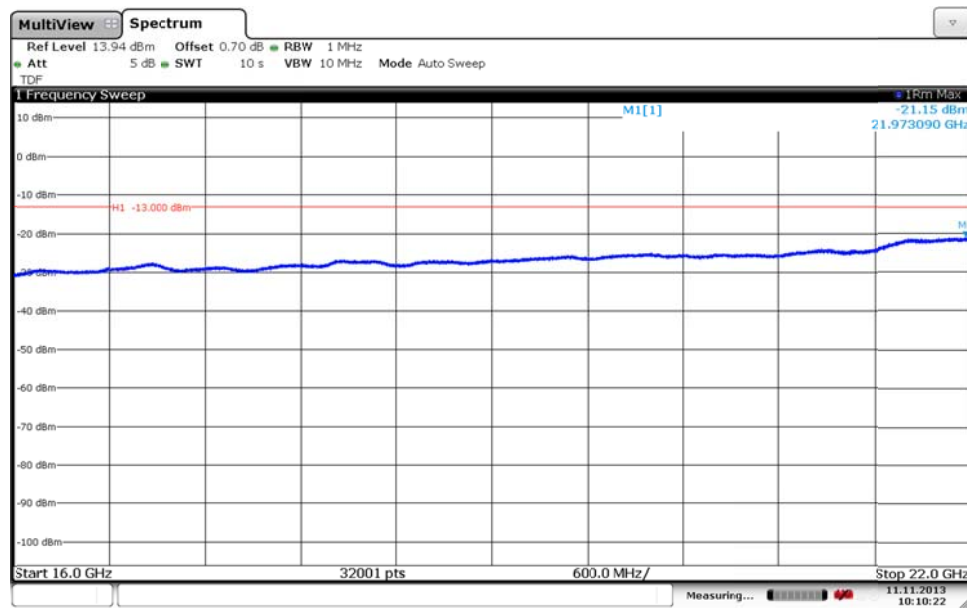
Appendix 5

Diagram 4 c:



Date: 11.NOV.2013 10:09:47

Diagram 4 d:



Date: 11.NOV.2013 10:10:22

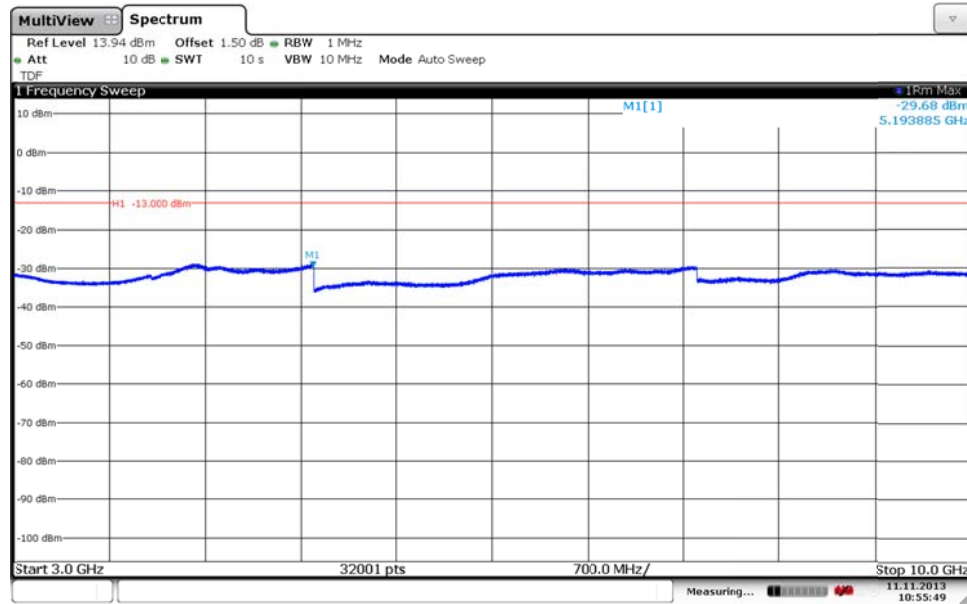
Appendix 5

Diagram 5 a:



Date: 11.NOV.2013 10:54:20

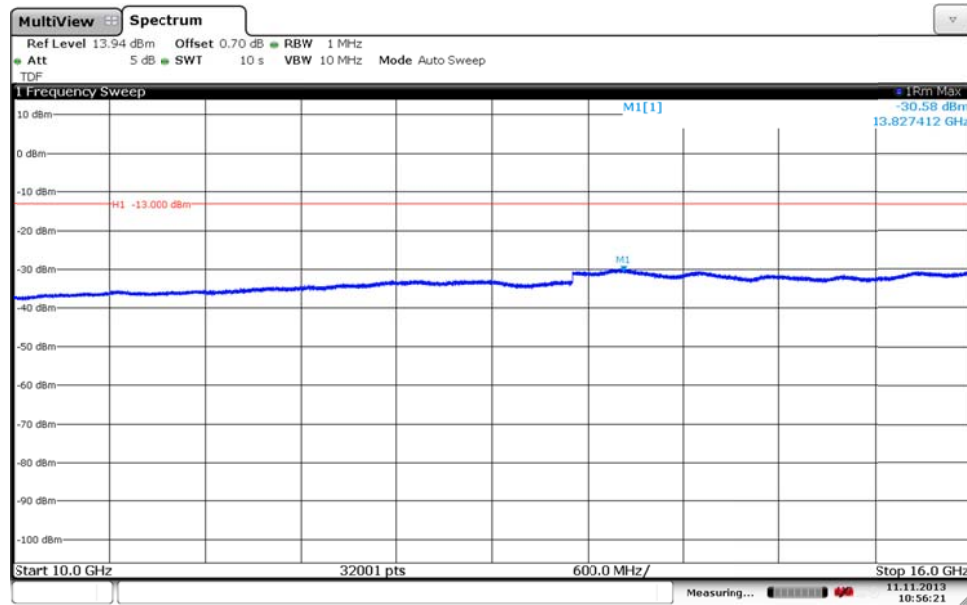
Diagram 5 b:



Date: 11.NOV.2013 10:55:49

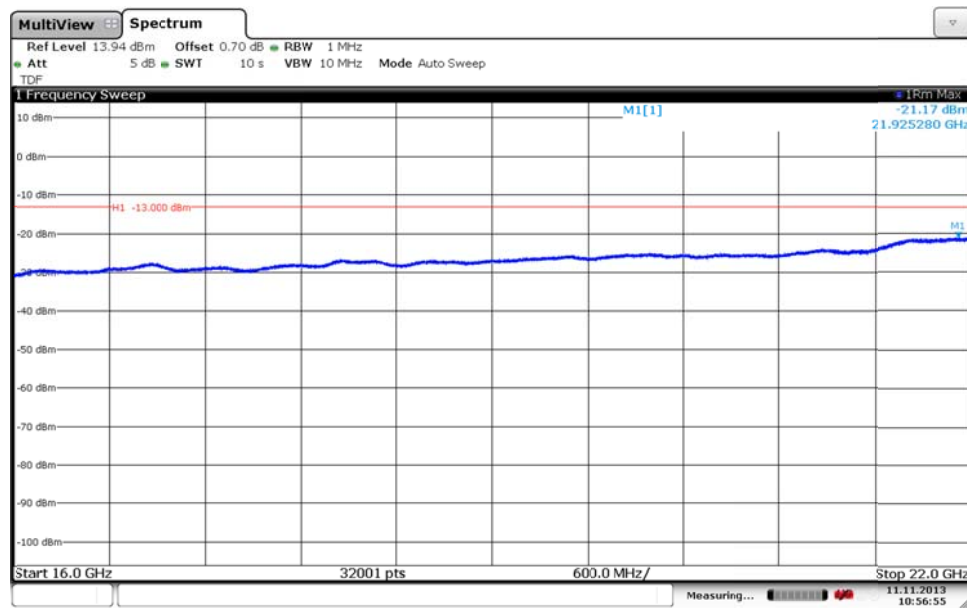
Appendix 5

Diagram 5 c:



Date: 11.NOV.2013 10:56:21

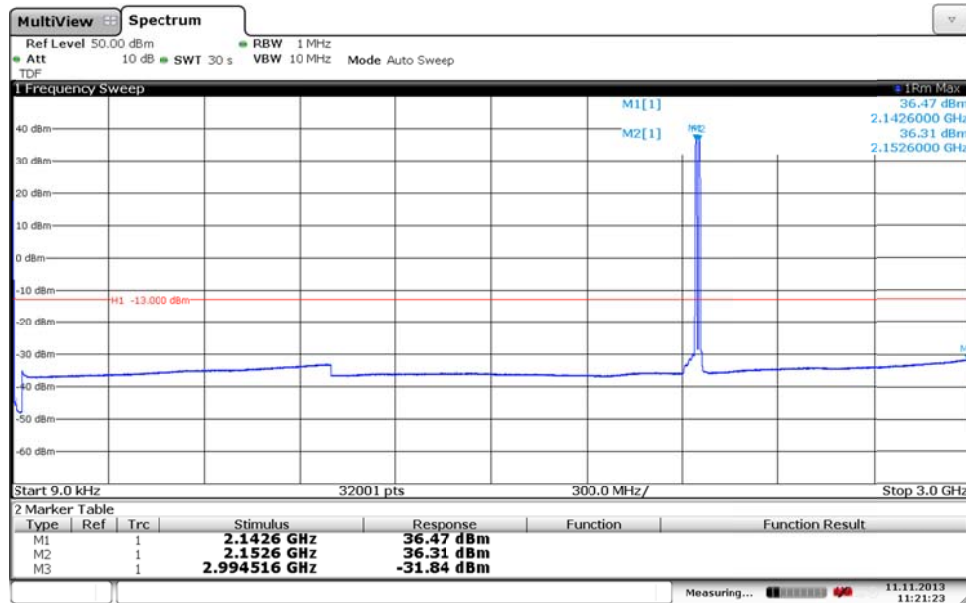
Diagram 5 d:



Date: 11.NOV.2013 10:56:55

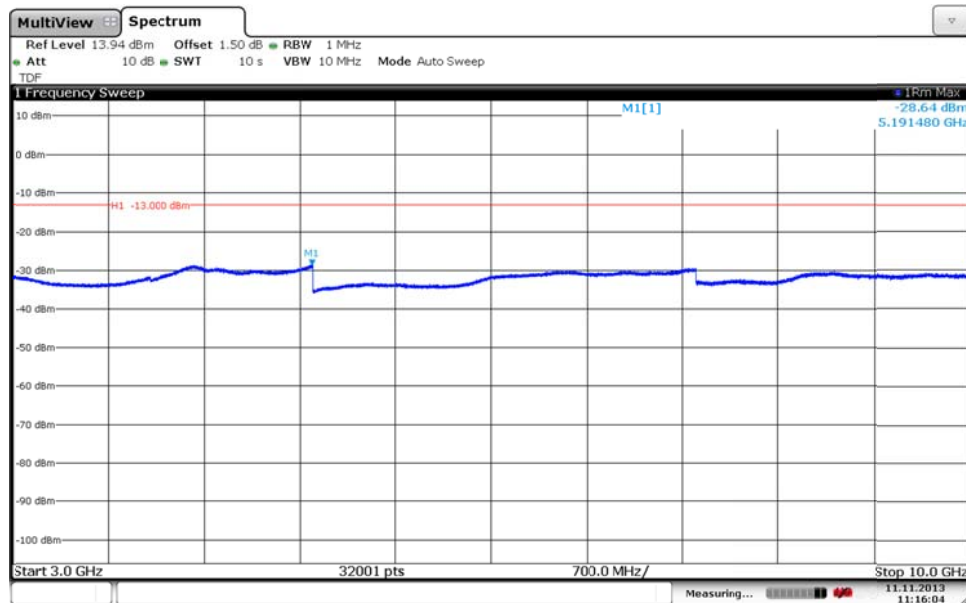
Appendix 5

Diagram 6 a:



Date: 11.NOV.2013 11:21:23

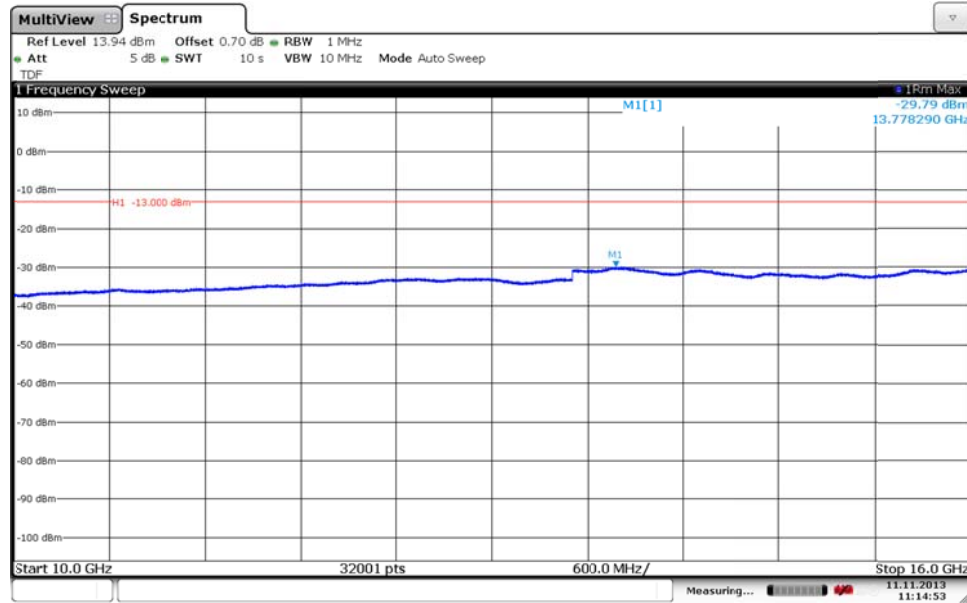
Diagram 6 b:



Date: 11.NOV.2013 11:16:04

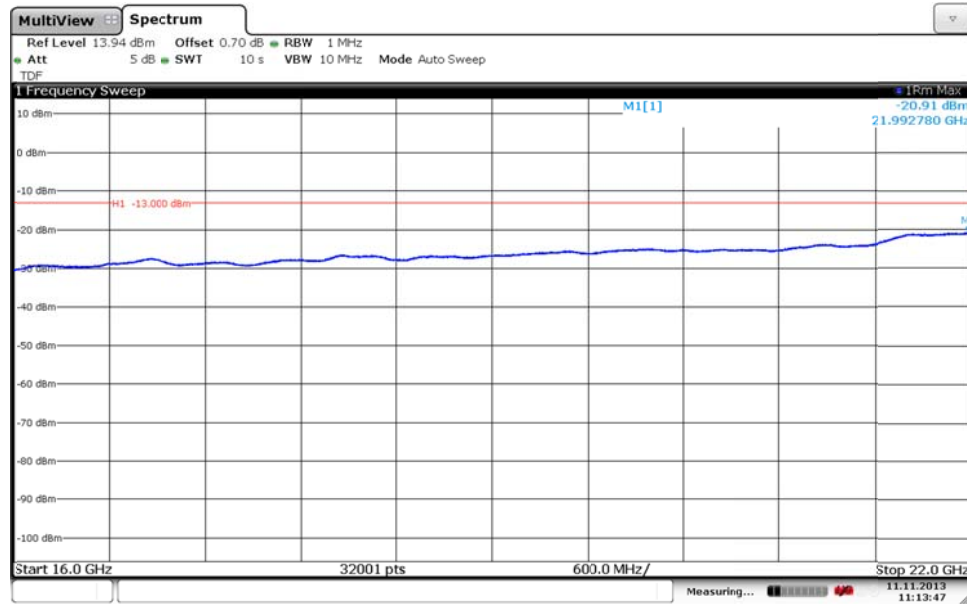
Appendix 5

Diagram 6 c:



Date: 11.NOV.2013 11:14:53

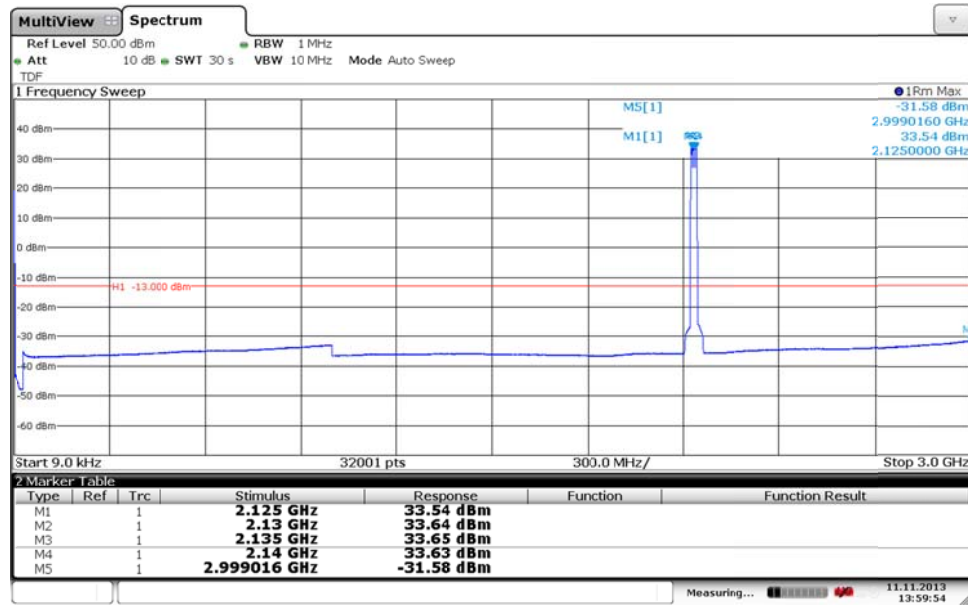
Diagram 6 d:



Date: 11.NOV.2013 11:13:48

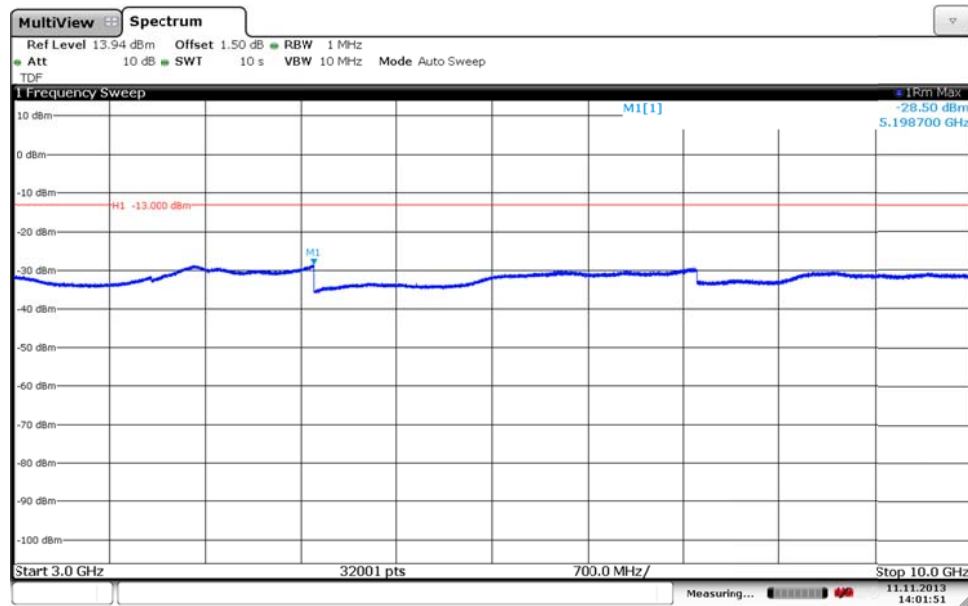
Appendix 5

Diagram 7 a:



Date: 11.NOV.2013 13:59:54

Diagram 7 b:



Date: 11.NOV.2013 14:01:52

Appendix 5

Diagram 7 c:

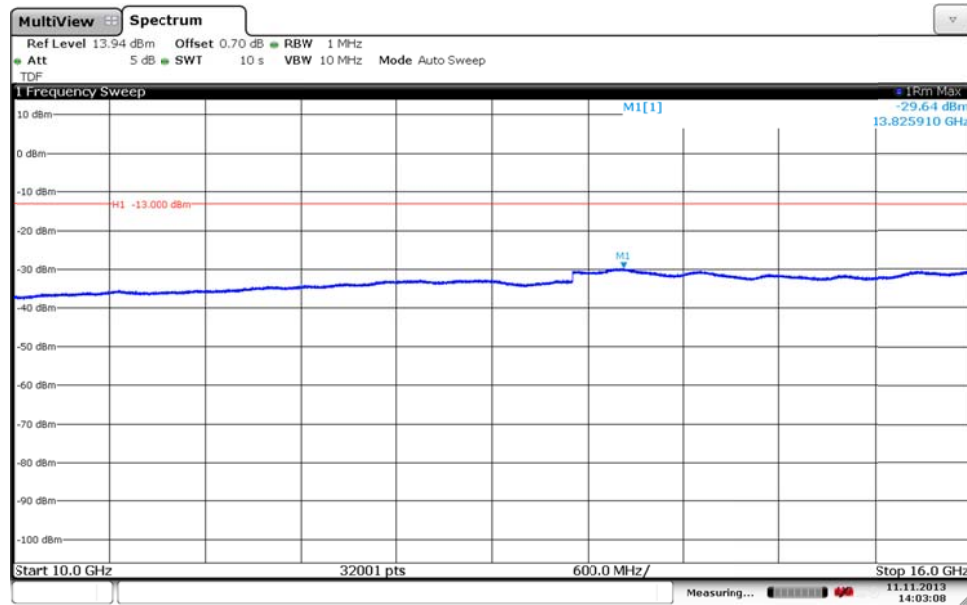
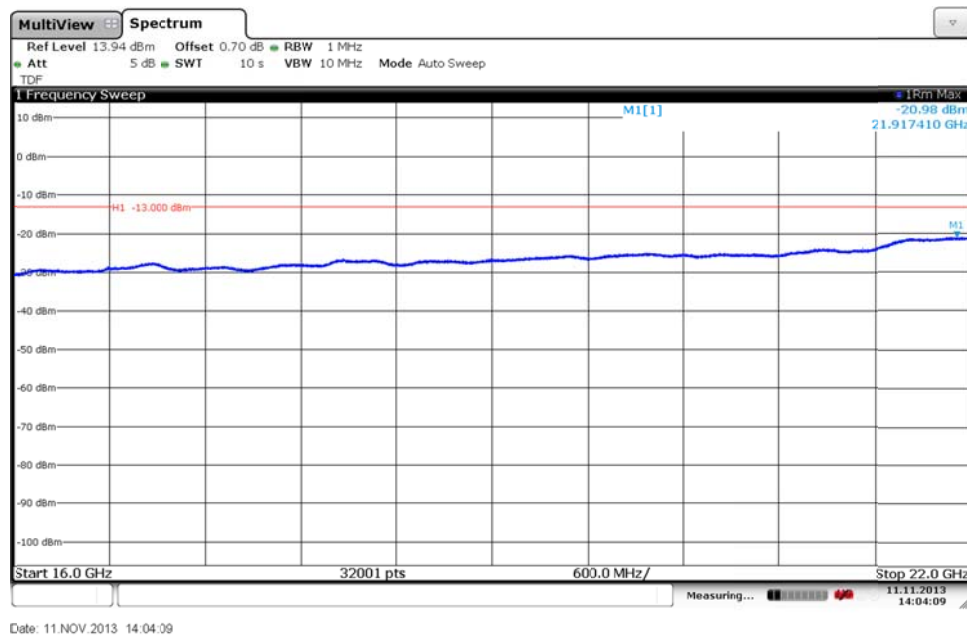


Diagram 7 d:



Appendix 6

External photos

Front side



Rear side



Appendix 6

Left side



Right side



Appendix 6

Top side



Bottom side

