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Radio measurements on RD 2242 B2 with FCC ID: TA8AKRY901328-1 and IC: 287AB-AS9013281

(5 appendices)

Test object

Product name: RD 2242 B2
Product number: KRC 901 328/1

Summary

See appendix 1 for general information and appendix 5 for external photos.

Standard		Compliant	Appendix
FCC CFR 47 part 2 and 24 / IC RSS-133 Issue 6			
2.1046 / RSS-133 6.4	RF power output	Yes	2
2.1051 / RSS-133 6.5	Spurious emission at antenna terminals	Yes	3
2.1053 / RSS-133 6.5	Field strength of spurious radiation	Yes	4

Note: Above RSS-133 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

Signed by: Jörgen Wassholm
Reason: I am the author of this document
Date & Time: 2015-02-13 12:10:00 +01:00

Jörgen Wassholm

Examined by

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Reason: I have reviewed this document
Date & Time: 2015-02-13 12:38:57 +01:00

Anders Nordlöf

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Appendix 1

Description of the test object

Radio equipment:	RD 2242 B2 Product number: KRY 901 328/1 FCC ID TA8AKRY901328-1 IC 287AB-AS9013281 IC MODEL NO: AS9013281
Hardware revision state:	R2B
Tested configuration:	MR WCDMA + LTE
Operating bands:	TX: 1930 – 1990 MHz RX: 1850 – 1910 MHz MR WCDMA + LTE
Antenna ports:	2 TX/RX ports, (internally connected to integrated Omni directional antenna elements)
RF configuration:	LTE: TX diversity and MIMO 2x2 WCDMA: Single Antenna (Multiple port) and MIMO 2x2
RF power tolerance	+2.7/ -4.3dB
Nominal output power per antenna port:	1-2 LTE + 1-4 WCDMA (Total power 17 dBm, 50mW) Total number of carriers 6
Antenna type:	Omni directional antenna
Antenna gain:	+3 dBi
LTE Modulations:	QPSK, 16QAM and 64QAM
Channel bandwidth:	5 MHz, 10 MHz, 15 MHz and 20 MHz
WCDMA Modulations:	QPSK, 16QAM and 64QAM
Channel bandwidth:	5 MHz
Channel spacing:	5 MHz
Nominal supply voltage:	-48VDC (associated equipment)

Purpose of test

The purpose of the tests is to verify compliance to the performance characteristics specified in applicable items of FCC CFR 47, IC RSS-133 and IC RSS-Gen.

Operation modes during measurements

MR WCDMA + LTE

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

LTE 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.

WCDMA Single Antenna (Multiple port)
TM1: 64 DPCH:s at 30 ksps (SF=128)
LTE MIMO mode
E-TM1.1
Channel bandwidth 5 MHz

Cable configurations between RD and IRU

The cables, used during tests, correspond to minimum and maximum length, according to clause 2.9 in Exhibit 12 – Technical Circuit Description. The following cable configurations has been used:

RDI Cable 20 m: total cable length 20 m patch cables included.

RDI Cable 92 m: total cable length 92 m patch cables included.

RDI Cable 200 m: total cable length 200 m patch cables included.

Patch cable	Cat 6a Schneider Electric Actassi CL-MNC6A
RDI cable	Cat 6a Schneider Electric Actassi CL-MXC6A

Appendix 1

Conducted measurements

The conducted measurements were performed on RD 2242 B2 with product number KRY 901 328/1.

The test object was mounted in a fixture and powered by the RBS Main Unit via the RDI LAN cable.
All TX parameters were measured at port RF B with port RF A terminated into 50 ohm.
Complete measurements were made on RF B, limited measurements on RF A.

Radiated measurements

The test object was mounted in a fixture and powered by the RBS Main Unit via the 200 m RDI LAN cable representing worst case. In field strength of spurios radiation both RF ports were terminated into 50 ohm. For RF power output measurement the internal antenna was used.

References

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

ANSI 63.4 2009
ANSI/TIA -603-C 2004
CFR 47 part 2, October 1st , 2013
CFR 47 part 24, October 1st, 2013
3GPP TS 36.141, version 11.4.0
RSS-Gen Issue 4
RSS-133 Issue 6

Measurement equipment

	Calibration Due	SP number
Semi anechoic chamber, Tesla	2015-12	503 881
R&S ESU 26	2015-08	901 553
R&S FSQ 40	2015-07	504 143
R&S FSW 43	2015-07	902 073
Control computer with R&S software EMC32 ver. 9.15.0	-	- 503 889
High pass filter	2015-12	BX40074
High pass filter	2015-07	901 501
High pass filter	2015-07	901 502
High pass filter	2015-07	504 199
High pass filter	2015-07	901 373
High pass filter	2016-07	503 739
High pass filter	2015-07	503 740
High pass filter	2015-07	504 200
RF attenuator	2016-07	503 248
RF attenuator	2016-06	503 249
RF attenuator	2015-08	504 159
RF attenuator	2015-07	900 233
RF attenuator	2015-11	900 691
RF attenuator	2015-06	901 384
Chase Bilog Antenna CBL 6111A	2017-10	503 182
EMCO Horn Antenna 3115	2016-09	502 175
µComp Nordic, Low Noise Amplifier	2016-01	901 545
Flann STD Gain Horn Antenna 16-240	-	503 939
Flann STD Gain Horn Antenna 18-240	-	503 900
Flann STD Gain Horn Antenna 20240-20	-	503 674
Schwarzbeck preamplifier BBV 9742	2015-12	504 085
Temperature and humidity meter, Testo 635	2015-03	504 203
Temperature and humidity meter, Testo 625	2015-06	504 188
Temperature Chamber	-	503 360
Multimeter Fluke 87	2015-08	502 190

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 2015-01-19.

Manufacturer’s representative

Lars Wallin, Ericsson AB.

Test engineers

Andreas Johnson, Maulo Rivera, Tomas Isbring, Patric Augustsson and Jörgen Wassholm, SP.

Test participant

None.

Test configurations used for radiated and conducted measurements

MR WCDMA+ LTE TX test configurations

Configuration 1:

	WCDMA	**WCDMA**	**WCDMA**	**WCDMA**	**LTE**	**LTE**
	(4.25W)	(4.25W)	(4.25W)	(4.25W)	(8.5W)	(8.5W)
Downlink UARFCN/ EARFCN (MHz)	9863 (1972.6)	9888 (1977.6)	9913 (1982.6)	9938 (1987.6)	850 (1955.0)	950 (1965.0)
Test model	TM1	TM1	TM1	TM1	E-TM1.1	E-TM1.1
Bandwidth	5 MHz	5 MHz	5 MHz	5 MHz	10 MHz	10 MHz

Configuration 2:

	WCDMA	**WCDMA**	**WCDMA**	**LTE**	**LTE**
	(5.67W)	(5.67W)	(5.67W)	(8.5W)	(8.5W)
Downlink UARFCN/ EARFCN (MHz)	9837 (1967.4)	9888 (1972.4)	9887 (1977.4)	1125 (1982.5)	1175 (1987.5)
Test model	TM1	TM1	TM1	E-TM1.1	E-TM1.1
Bandwidth	5 MHz	5 MHz	5 MHz	5 MHz	5 MHz

Configuration 3:

	WCDMA	**WCDMA**	**LTE**	**LTE**
	(8.5W)	(8.5W)	(8.5W)	(8.5W)
Downlink UARFCN/ EARFCN (MHz)	9888 (1972.4)	9887 (1977.4)	1125 (1982.5)	1175 (1987.5)
Test model	TM1	TM1	E-TM1.1	E-TM1.1
Bandwidth	5 MHz	5 MHz	5 MHz	5 MHz

Configuration 4:

	WCDMA	**WCDMA**	**LTE**
	(8.5W)	(8.5W)	(17W)
Downlink UARFCN/ EARFCN (MHz)	9888 (1972.4)	9887 (1977.4)	1175 (1987.5)
Test model	TM1	TM1	E-TM1.1
Bandwidth	5 MHz	5 MHz	5 MHz

Configuration 5:

	WCDMA	**WCDMA**	**LTE**
	(8.5W)	(8.5W)	(17W)
Downlink UARFCN/ EARFCN (MHz)	9888 (1962.4)	9887 (1967.4)	1100 (1980.0)
Test model	TM1	TM1	E-TM1.1
Bandwidth	5 MHz	5 MHz	20 MHz

Configuration 6:

	WCDMA	**LTE**
	(17W)	(17W)
Downlink UARFCN/ EARFCN (MHz)	9748 (1949.6)	1004 (1970.4)
Test model	TM1	E-TM1.1
Bandwidth	5 MHz	5 MHz

Configuration 7:

	WCDMA	**LTE**
	(17W)	(17W)
Downlink UARFCN/ EARFCN (MHz)	9687 (1937.4)	762 (1946.2)
Test model	TM1	E-TM1.1
Bandwidth	5 MHz	5 MHz

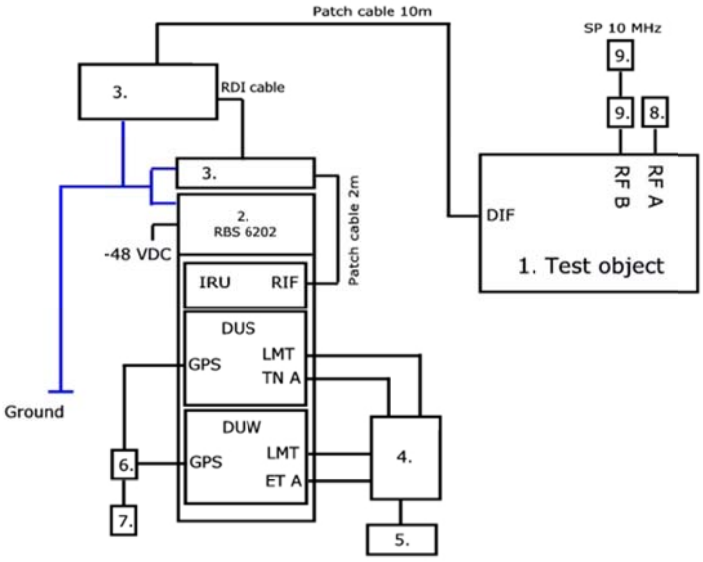
Configuration 8:

	WCDMA	**LTE**
	(17W)	(17W)
Downlink UARFCN/ EARFCN (MHz)	9687 (1973.6)	1125 (1982.5)
Test model	TM1	E-TM1.1
Bandwidth	5 MHz	5 MHz

All RX frequencies were configured 80 MHz below the corresponding TX frequency according the appclicable duplex offset for the operating band.

Appendix 1

Test set-up conducted measurements MR LTE+WCDMA



Test object

1.	RD 2242 B4, KRY 901 328/1, revision R2B, s/n: C828953704 (FCC ID: TA8AKRY901328-1 and IC: 287AB-AS9013281) with software: CXP 901 3268/14, revision R59FC

Associated equipment:

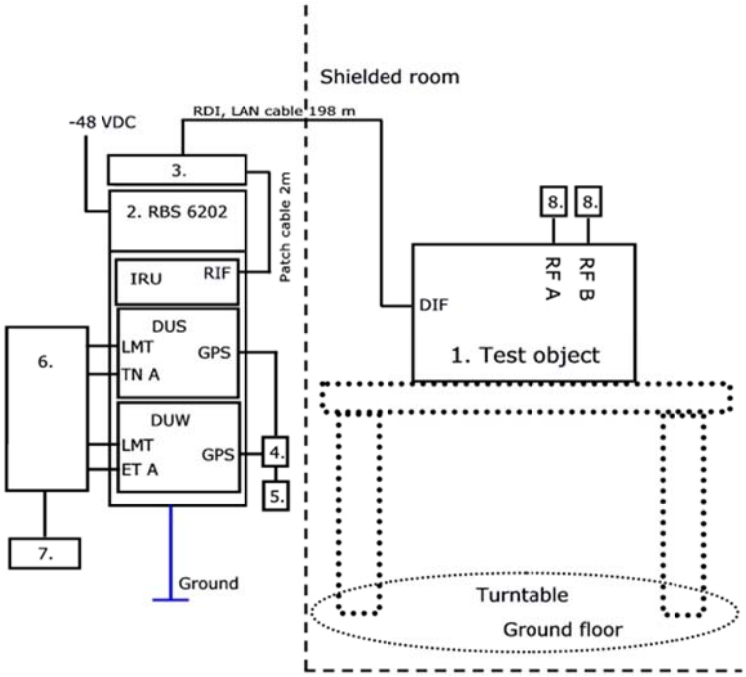
2.	RBS 6202: BYB 911 40/1, revision R3B, s/n: TU8J525857 DUW 41 01, KDU 127 174/4, revision R2D, s/n: A402039680 DUS 41 01, KDU 137 624/1, revision R5A/A, s/n: D16H559114 IRU 2242, KRC 161 444/1, revision R1C, s/n: C828558497
3.	Patch panel, BGK 901 55/1, revision R1A, s/n: -
6.	GPS 02 01, NCD 901 41/1, revision R1D, s/n: TU8K474887
7.	GPS Active Antenna, KRE 101 2082/1

Functional test equipment:

4.	ERNC-SIM 127, BAMS – 1000660988: Netgear switch FS726T Netgear switch GSM 7212 Symmetricom NTP-server Symmetricom 8040
5.	Laptop EliteBook 8540w
8.	Attenuator/ Terminator 50 ohm
9.	SP test instrument according measurement equipment list

Appendix 1

Test setup radiated measurements MR LTE+WCDMA



Test object

1.	RD 2242 B4, KRY 901 328/1, revision R2B, s/n: C828953704 (FCC ID: TA8AKRY901328-1 and IC: 287AB-AS9013281) with software: CXP 901 3268/14, revision R59FC

Associated equipment:

2.	RBS 6202: BYB 911 40/1, revision R3B, s/n: TU8J525857 DUS 41 01, KDU 137 624/1, revision R5A/A, s/n: D16H559114 DUW 41 01, KDU 127 174/4, revision R2D, s/n: A402039680 IRU 2242, KRC 161 444/1, revision R1C, s/n: C828558497
3.	Patch panel, BGK 901 55/1, revision R1A, s/n: -
4.	GPS 02 01, NCD 901 41/1, revision R1D, s/n: TU8KH76616
5.	GPS Active Antenna, KRE 101 2082/1

Functional test equipment:

6.	ERNC-SIM 127, BAMS – 1000660988: Netgear switch FS726T Netgear switch GSM 7212 Symmetricom NTP-server Symmetricom 8040
7.	Laptop EliteBook 8540w
8.	Attenuator/ Terminator 50 ohm

Appendix 1

Interfaces:	**Type of port:**
Antenna port (A), hirose connector	Antenna
Antenna port (B), hirose connector	Antenna
DIF, Patch cable Cat 6a Schneider Electric Actassi CL-MNC6A	Signal

RBS software:

RAT	**Software**	**Revision**
WCDMA	CXP 902 3291/3	R2CA13
LTE	CXP 102 051/22	R46AL

Appendix 2

RF power output measurements according to CFR 47 §2.1046 / IC RSS-133 6.4

Date	Temperature	Humidity
2015-01-28	22 °C ± 3 °C	18 % ± 5 %
2015-01-29	22 °C ± 3 °C	19 % ± 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
Rohde & Schwarz signal analyzer FSW43	902 073
RF attenuator	901 508
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty: 1.1 dB

Results

Configuration: RDI Cable 200 m

Rated output power level at RF connector 1x 17 dBm.

Tested configuration	[RMS dBm/ PAR dB]		
	Port RF A	Port RF B	Total power[1)]
1	16.44/ 8.08	17.36/ 8.20	19.93
2	17.01/ 7.92	18.73/ 7.72	20.96
3	16.93/ 7.88	18.42/ 7.92	20.75
4	17.12/ 7.82	17.95/ 7.92	20.56
5	16.36/ 7.94	17.43/ 8.06	19.94
6	17.23/ 7.60	17.52/ 7.68	20.39
7	15.99/ 7.64	16.28/ 7.64	19.15
8	16.90/ 7.68	18.38/ 7.74	20.71

[1)]: summed output power according to FCC KDB662911 D01 Multiple transmitter output v02r01

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

Appendix 2

Limits

§24.232 The maximum output power may not exceed 3280 W/MHz (EIRP).
The Peak to Average Ratio (PAR) may not exceed 13 dB.

RSS-133 Base station transmitters operating in the band 1930-1995 MHz shall not have output power exceeding 100 watts. When the transmitter power is measured in terms of average value, the peak-to-average ratio(PAR) of the power shall not exceed 13 dB

There is no EIRP limit specified for base station equipment in the RSS-133.

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 EIRP limits specified in SRSP-510

Complies?	Yes

Appendix 3

Conducted spurious emission measurements according to CFR 47 §2.1051 / IC RSS-133 6.5

Date	Temperature	Humidity
2015-01-28	22 °C ± 3 °C	18 % ± 5 %
2015-01-29	22 °C ± 3 °C	19 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. 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 v02r01.

Measurement equipment	SP number
902 073	504 143
RF attenuator	900 691
HP filter	BX40074
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

Configuration: RDI Cable 200 m

MR WCDMA + LTE

Diagrams	WCDMA BW/[MHz]	LTE BW/[MHz]	Tested Port
1 a-e	5+5+5+5	10+10	RF B
2 a-e	5+5+5	5+5	RF B
3 a-e	5+5	5+5	RF B
4 a-e	5+5	5	RF B
5 a-e	5+5	20	RF B
6 a-e	5	5	RF B
7 a-e	5	5	RF B
8 a-e	5	5	RF B

The diagrams are shown on the following pages.

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 1.99 GHz. The measurements were made up to 20 GHz (10x1.99 GHz = 19.90 GHz).

Limits

CFR 47 §24.238 and IC RSS-133 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 3

Diagram 1 a:

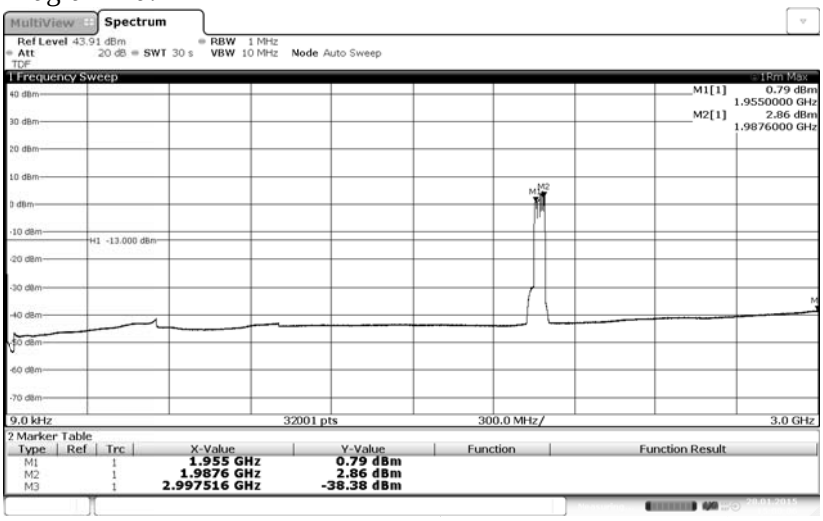


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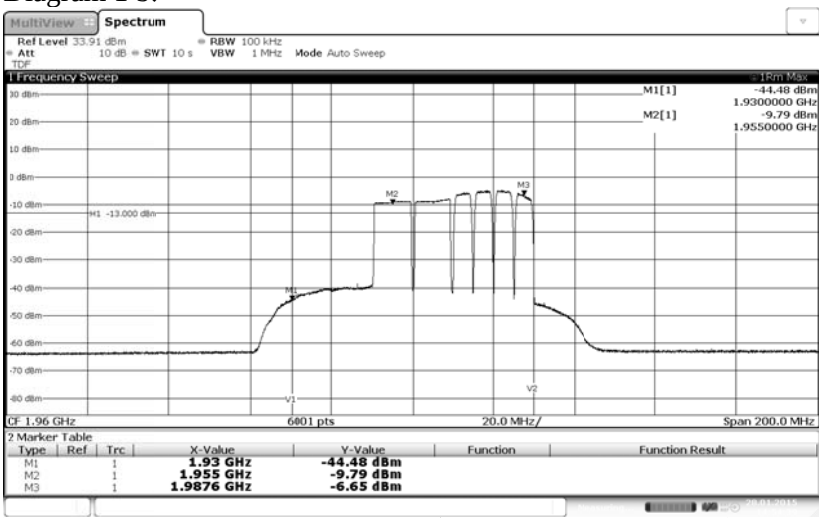
Diagram 1 b:



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Appendix 3

Diagram 1 c:

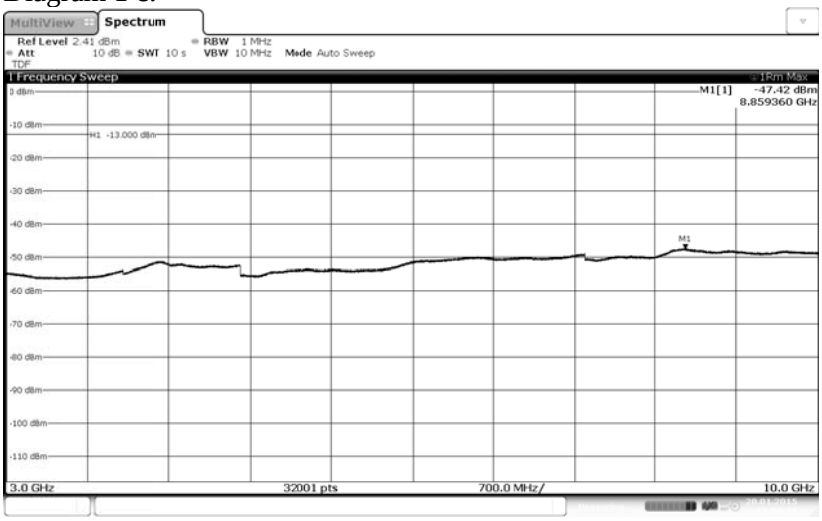
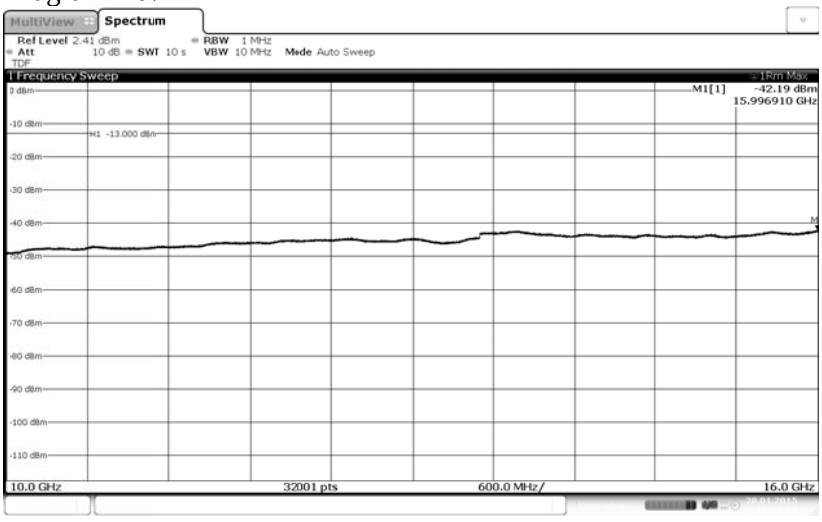
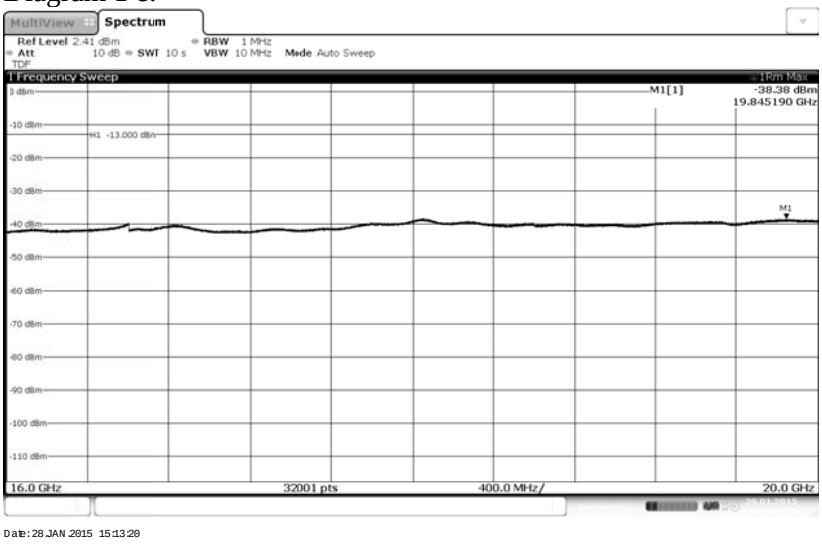


Diagram 1 d:



Appendix 3

Diagram 1 e:



Appendix 3

Diagram 2 a:

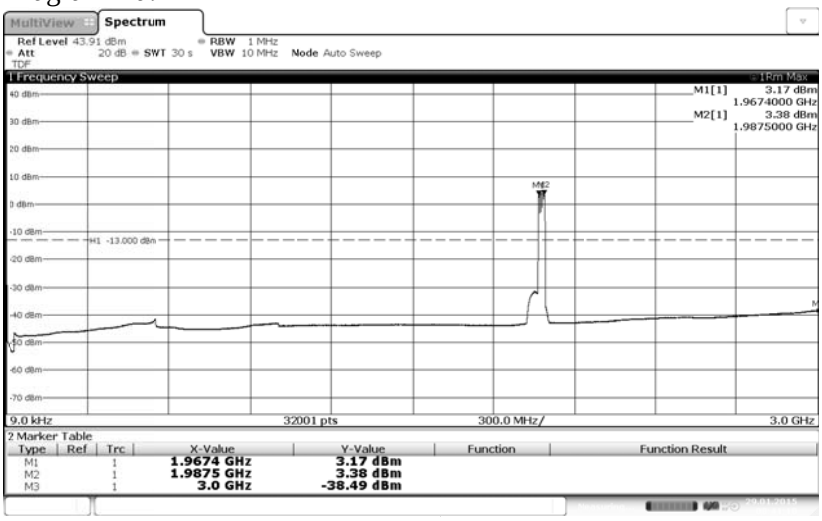


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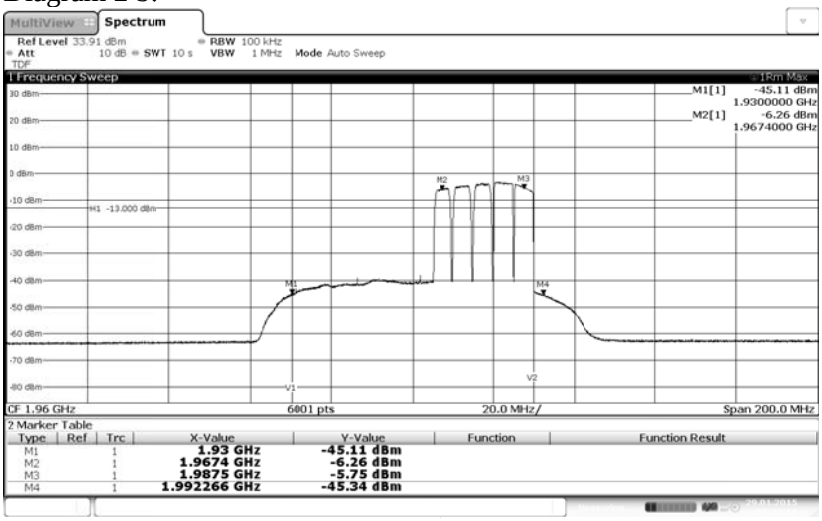
Diagram 2 b:



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Appendix 3

Diagram 2 c

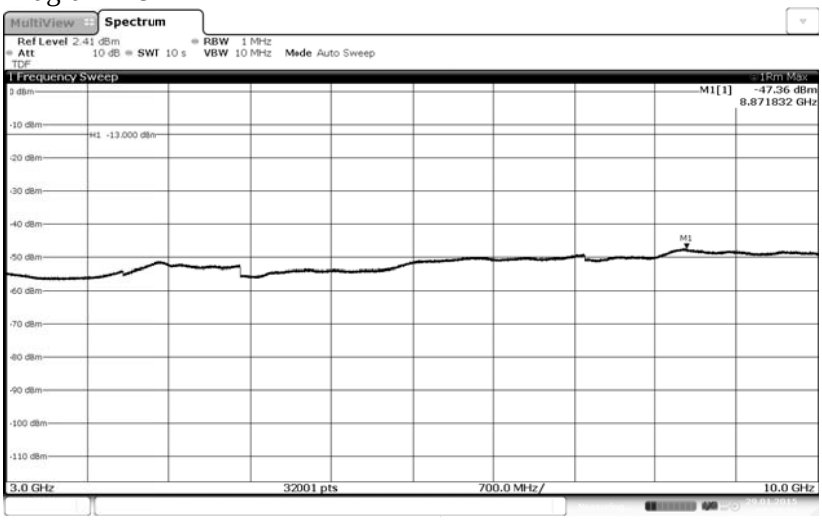
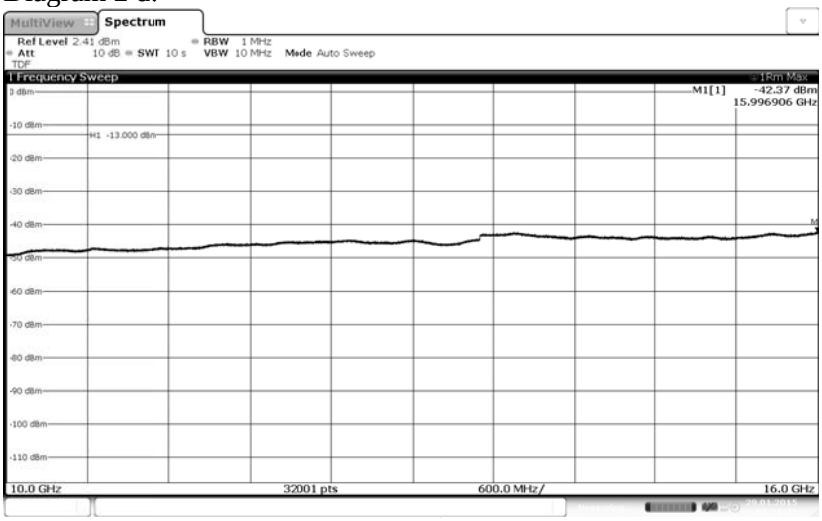
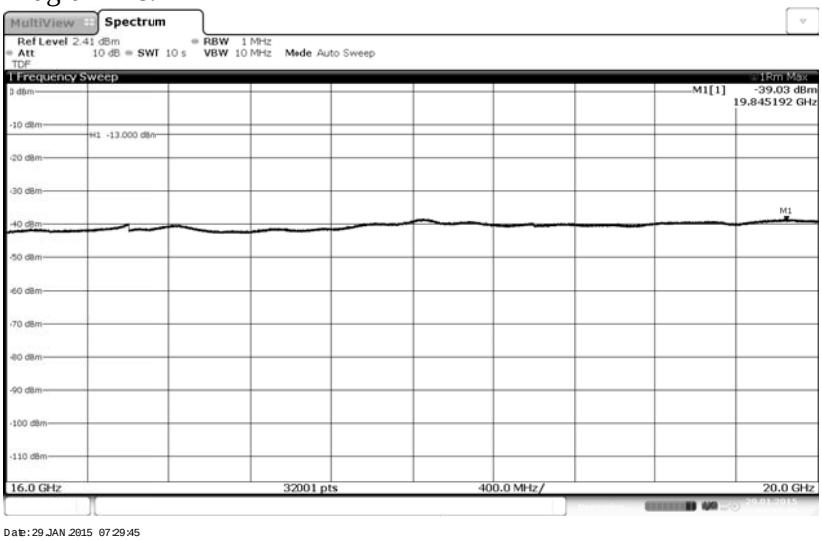


Diagram 2 d:



Appendix 3

Diagram 2 e:



Appendix 3

Diagram 3 a:

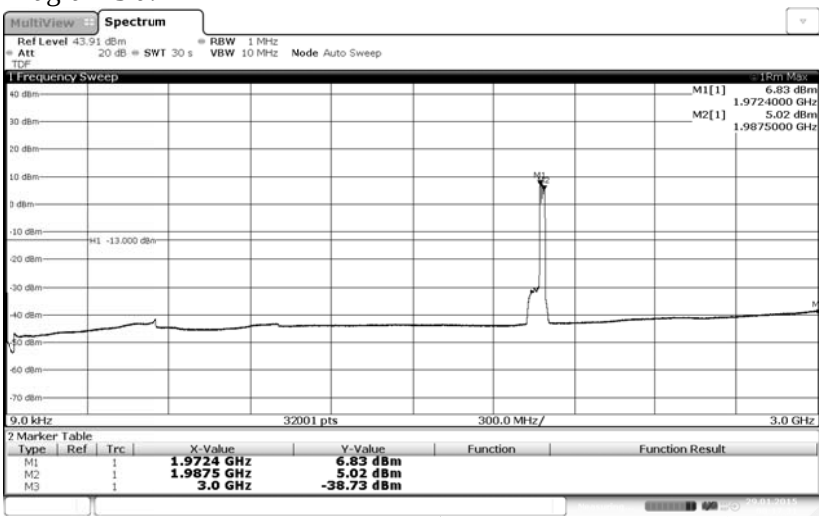


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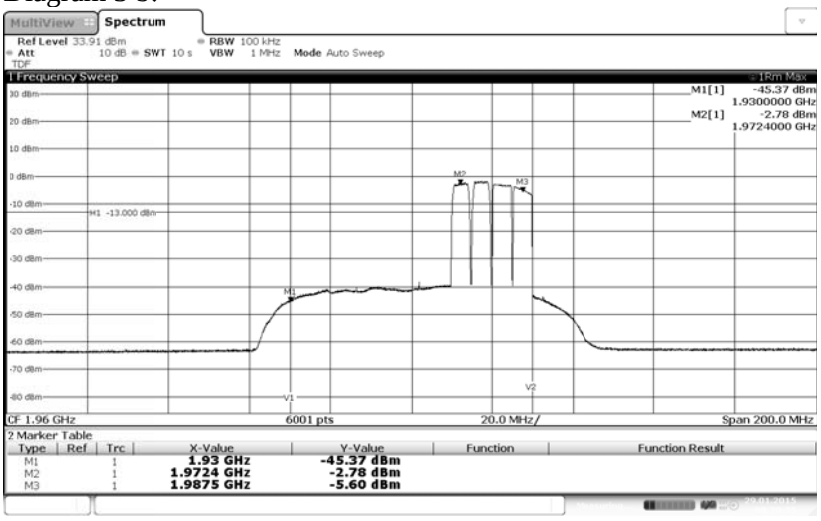
Diagram 3 b:



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Appendix 3

Diagram 3 c:

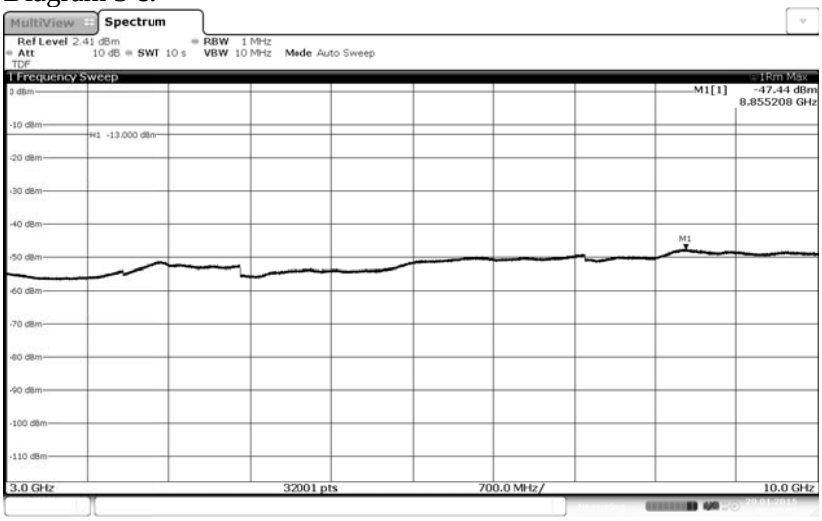
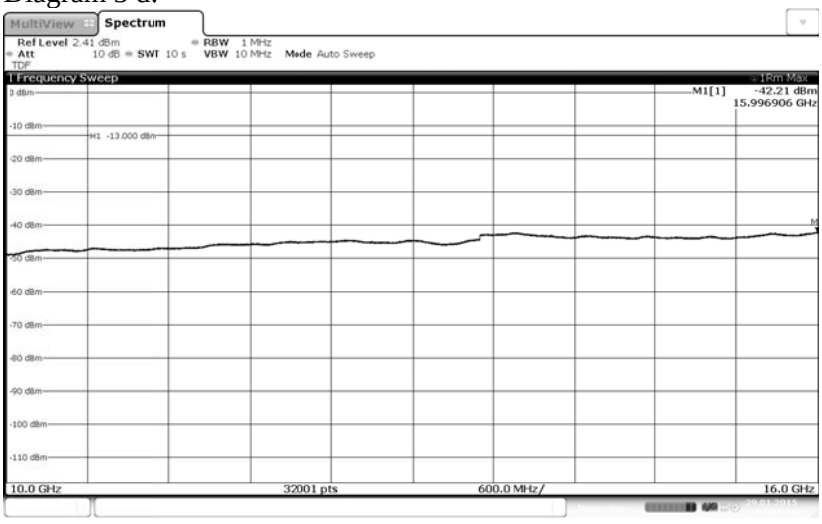
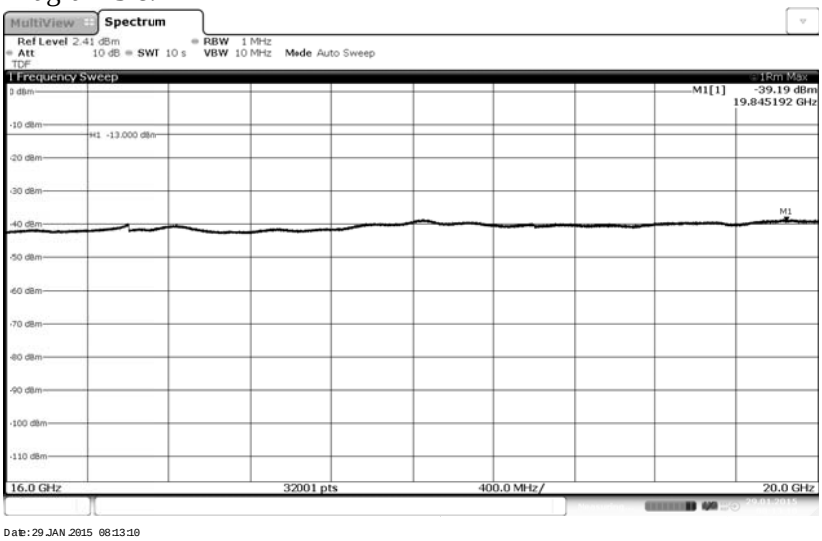


Diagram 3 d:



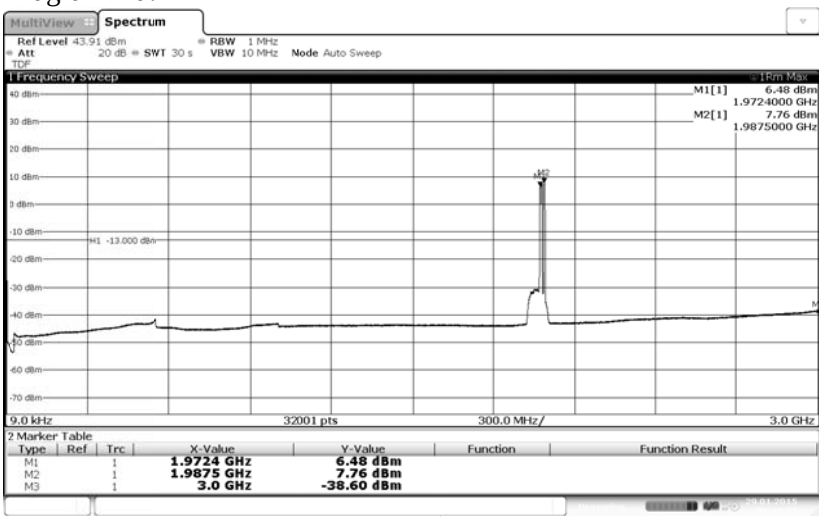
Appendix 3

Diagram 3 e:



Appendix 3

Diagram 4 a:



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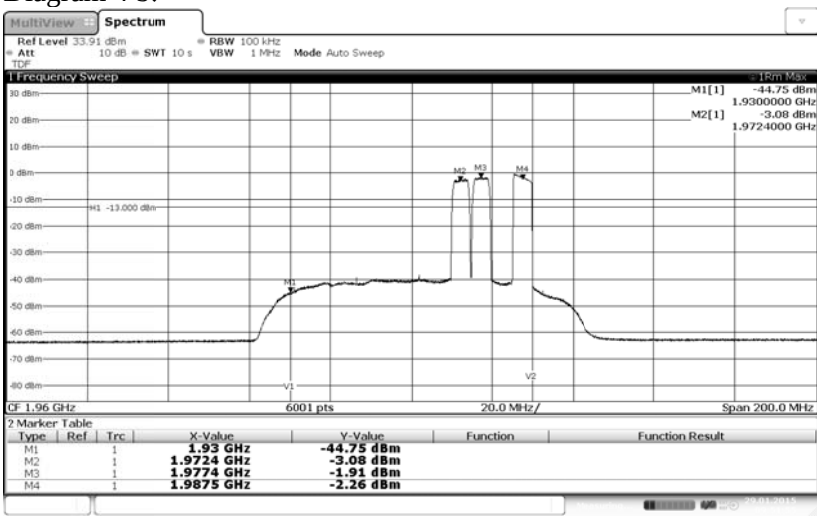

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Appendix 3

Diagram 4 c:

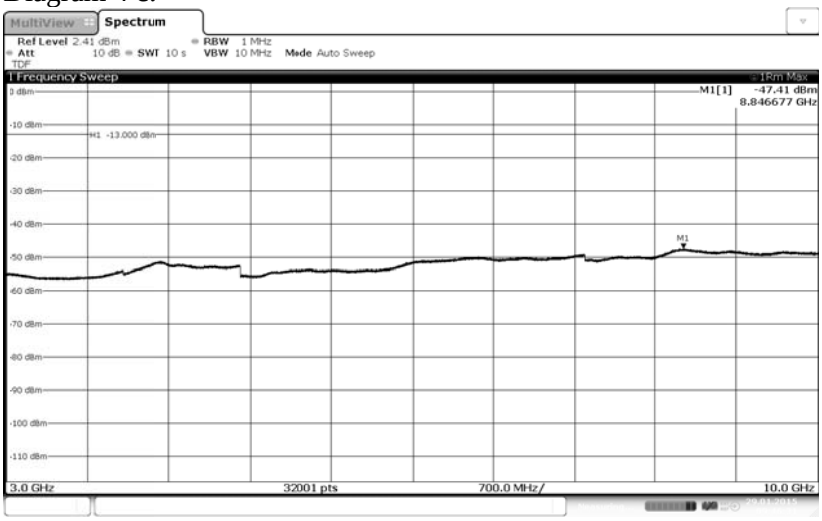
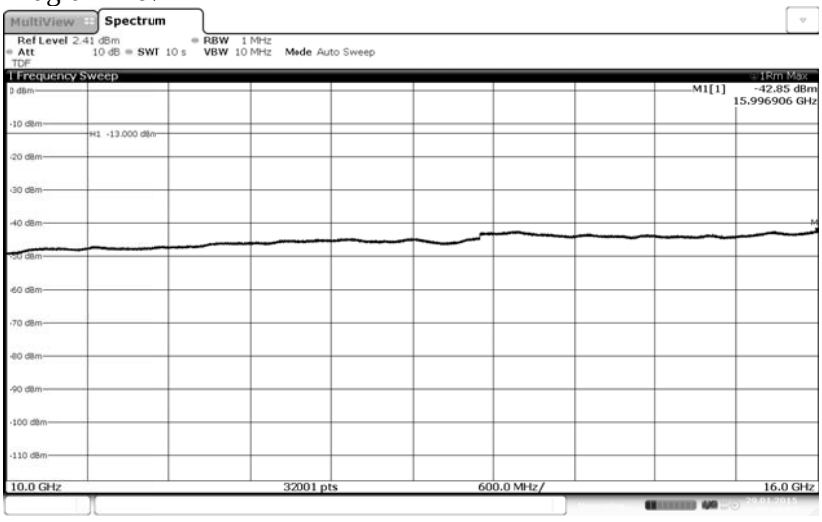
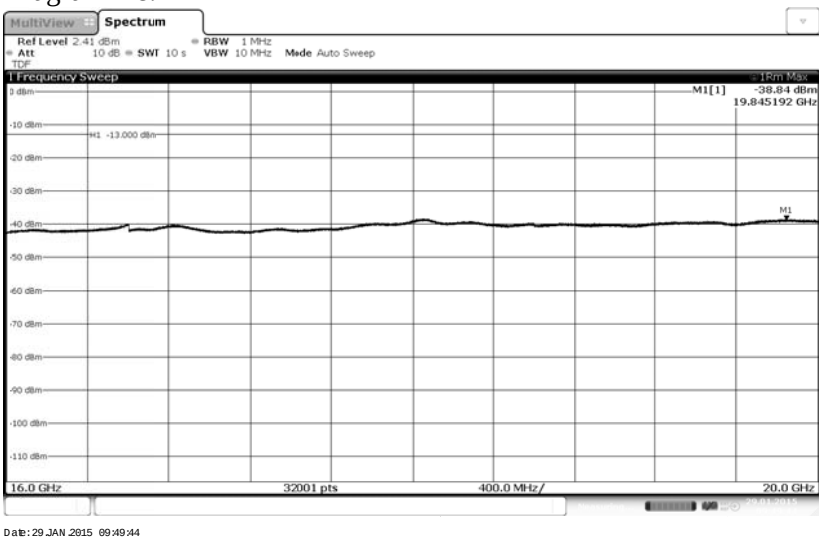


Diagram 4 d:



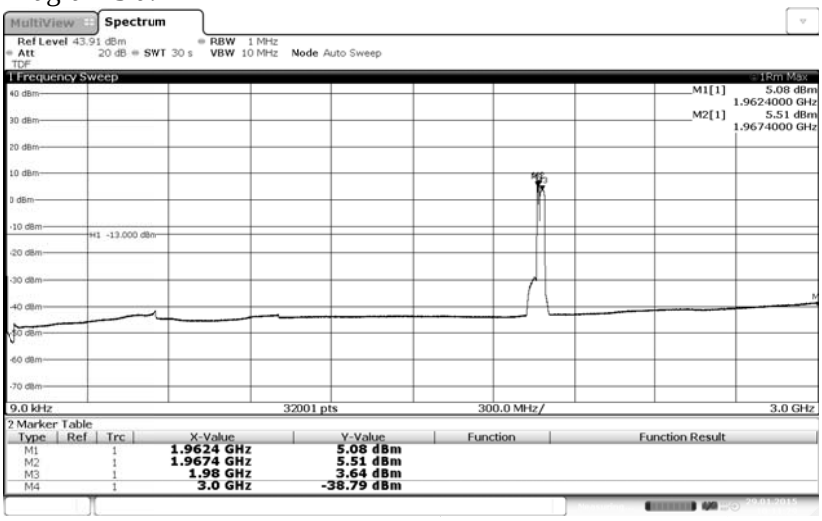
Appendix 3

Diagram 4 e:



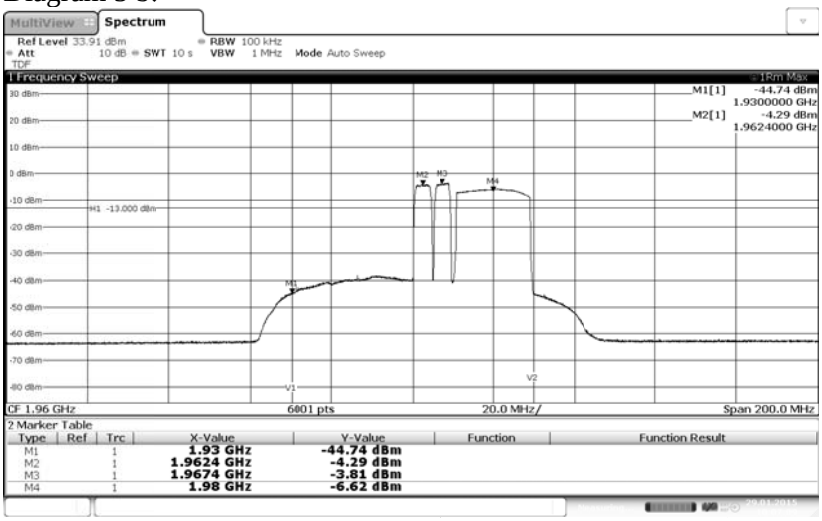
Appendix 3

Diagram 5 a:



Date: 29.JAN.2015 10:11:29

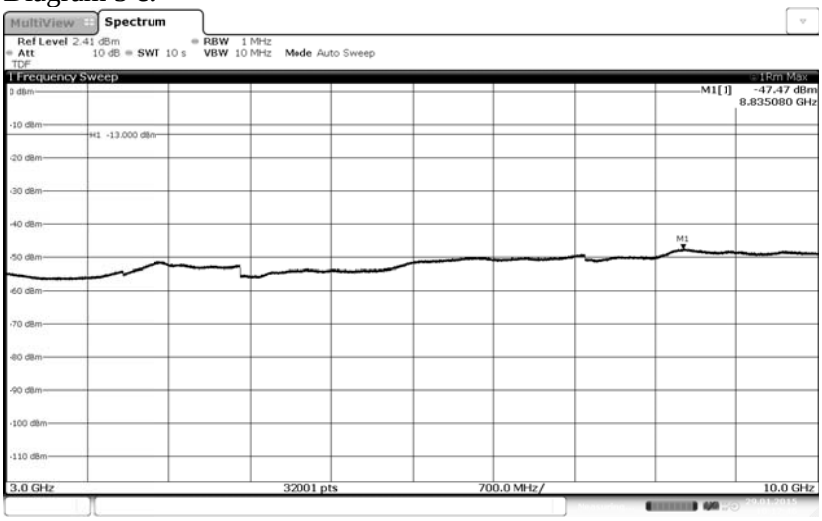
Diagram 5 b:



Date: 29.JAN.2015 10:07:09

Appendix 3

Diagram 5 c:



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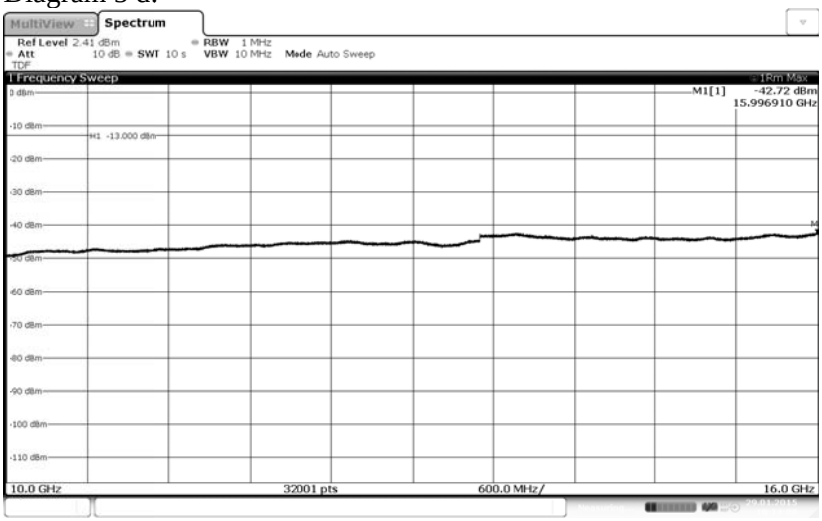
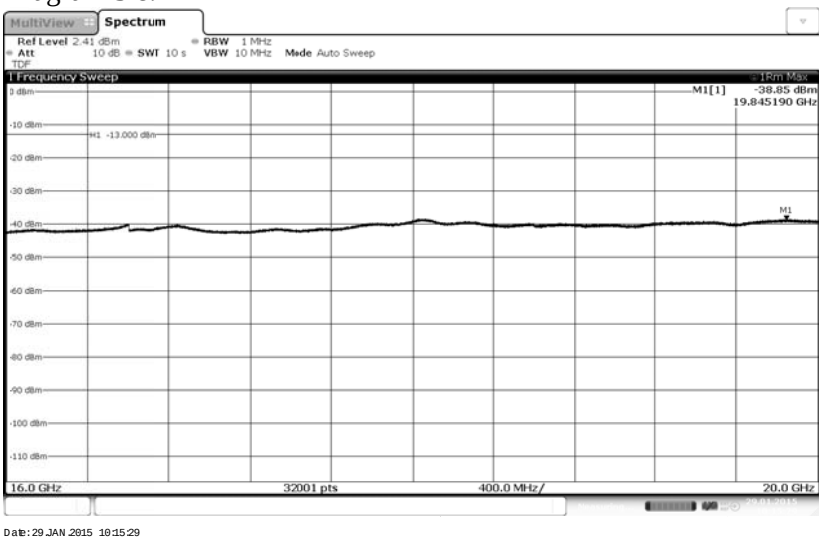


Appendix 3

Diagram 5 e:



Appendix 3

Diagram 6 a:

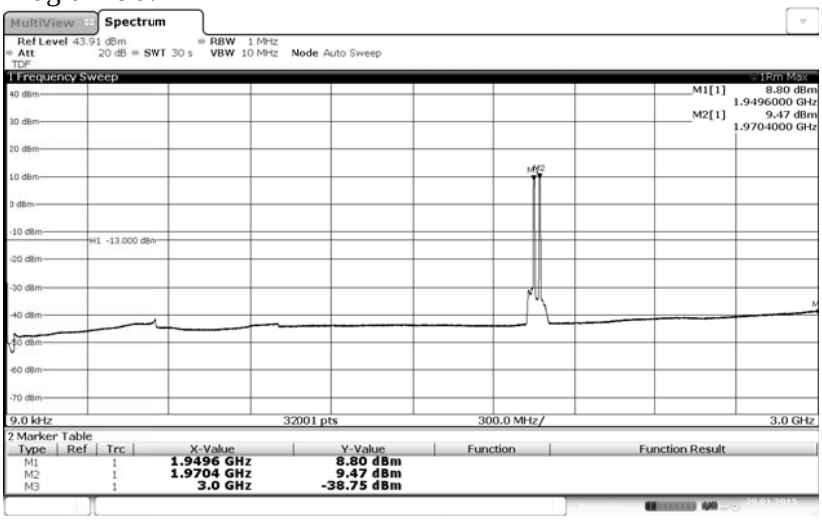


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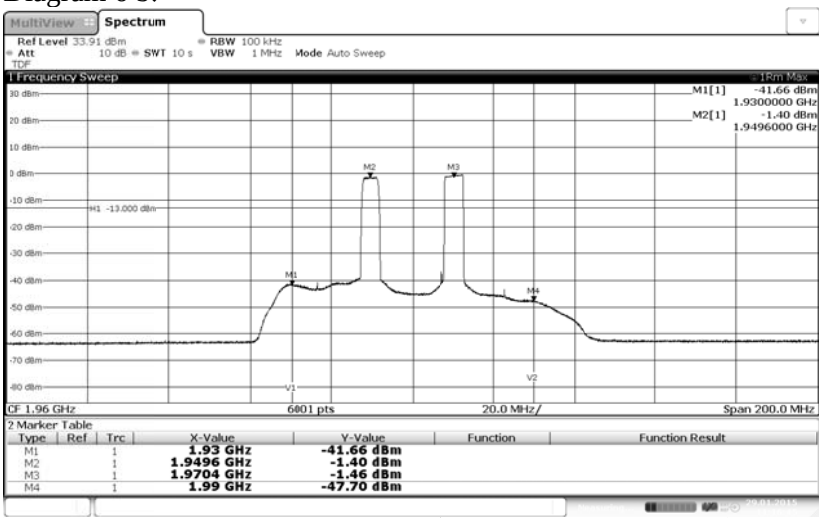
Diagram 6 b:



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Appendix 3

Diagram 6 c:

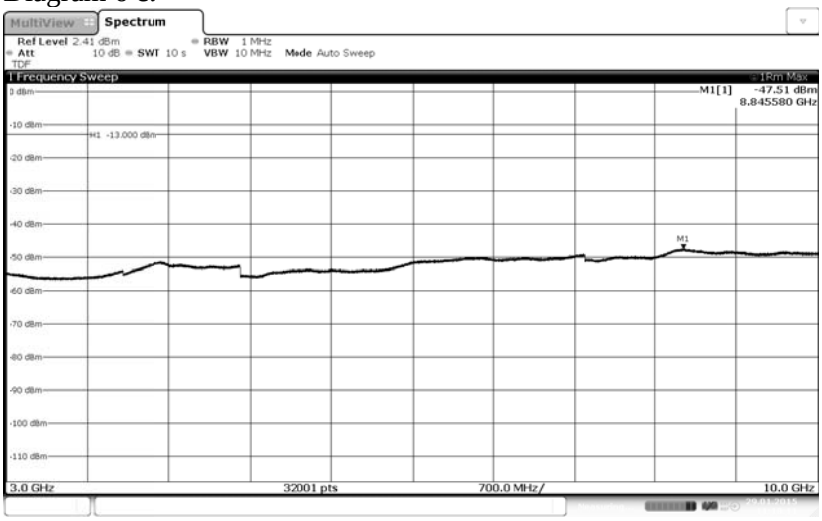
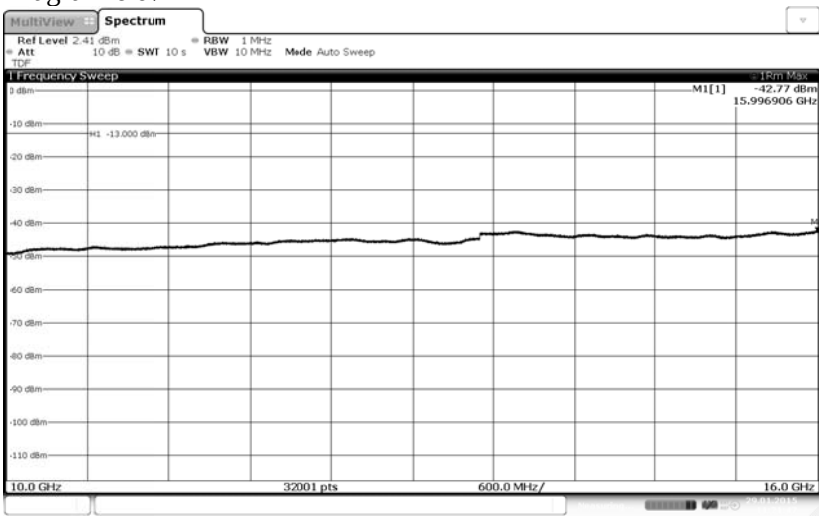
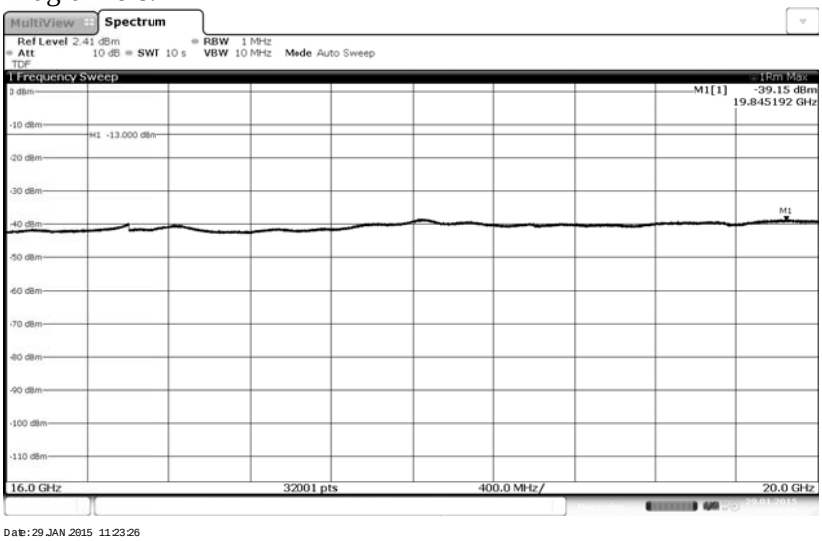


Diagram 6 d:



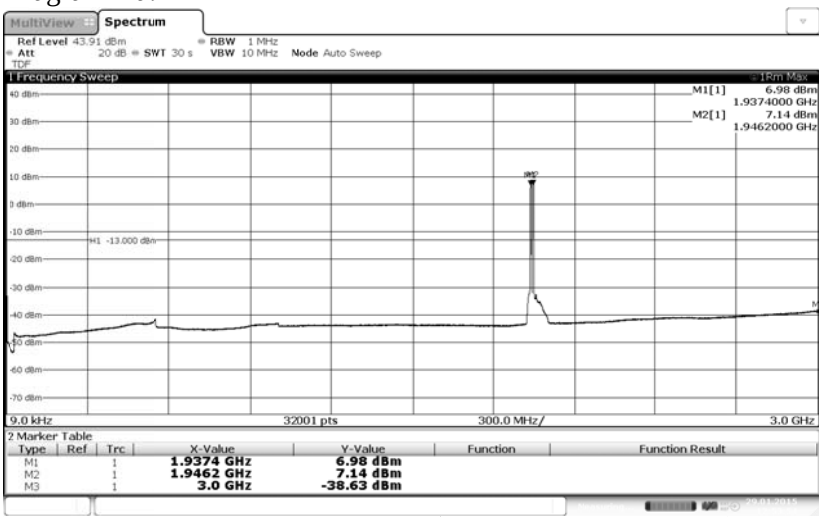
Appendix 3

Diagram 6 e:



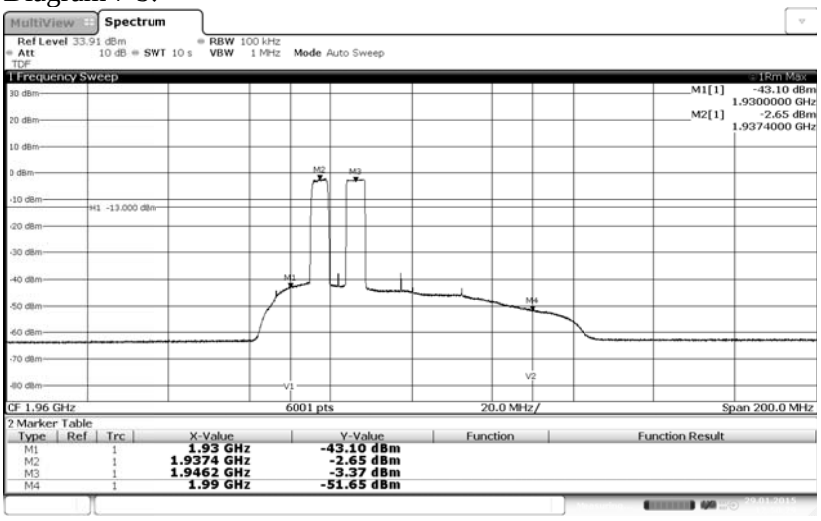
Appendix 3

Diagram 7 a:



Date: 29.JAN.2015 12:53:54

Diagram 7 b:



Date: 29.JAN.2015 12:58:28

Appendix 3

Diagram 7 c:

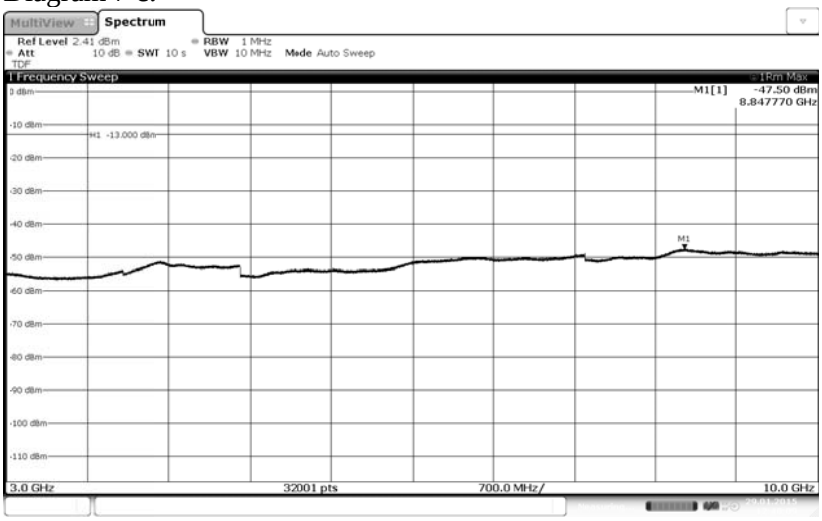
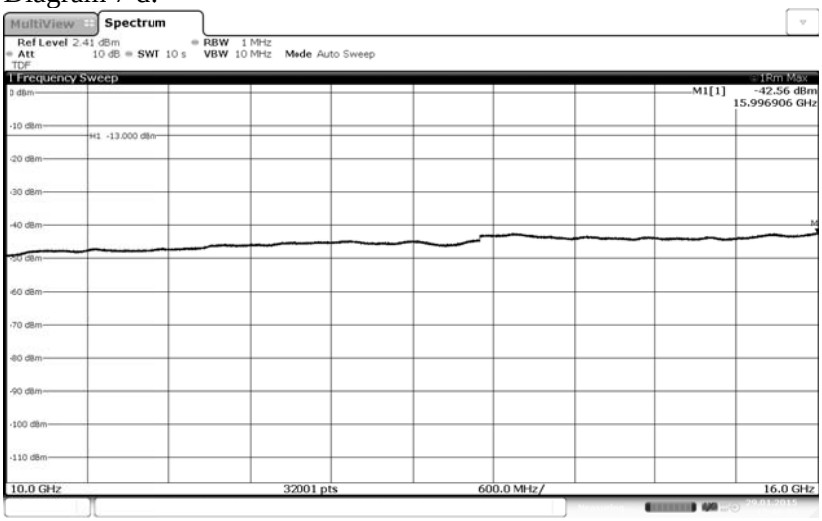
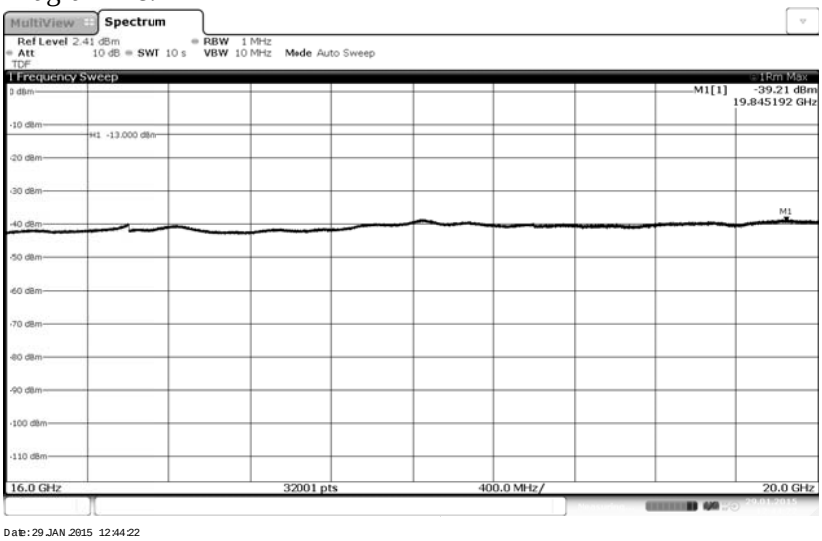


Diagram 7 d:



Appendix 3

Diagram 7 e:



Appendix 3

Diagram 8 a:

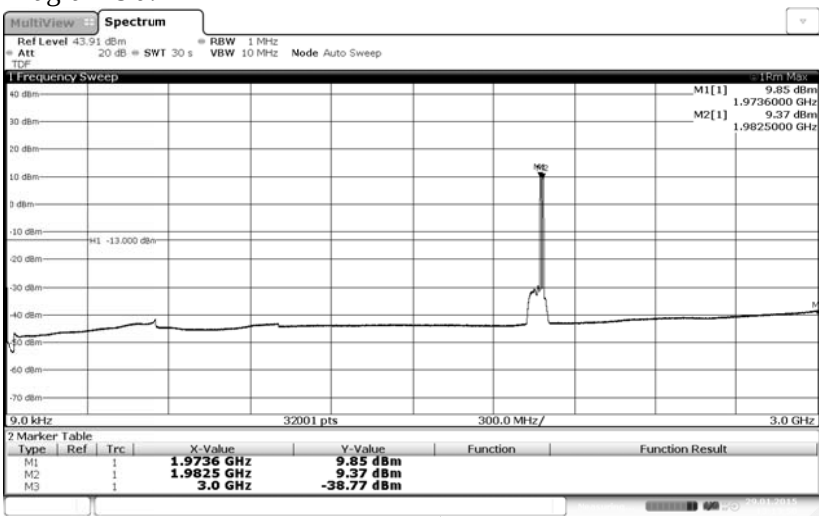


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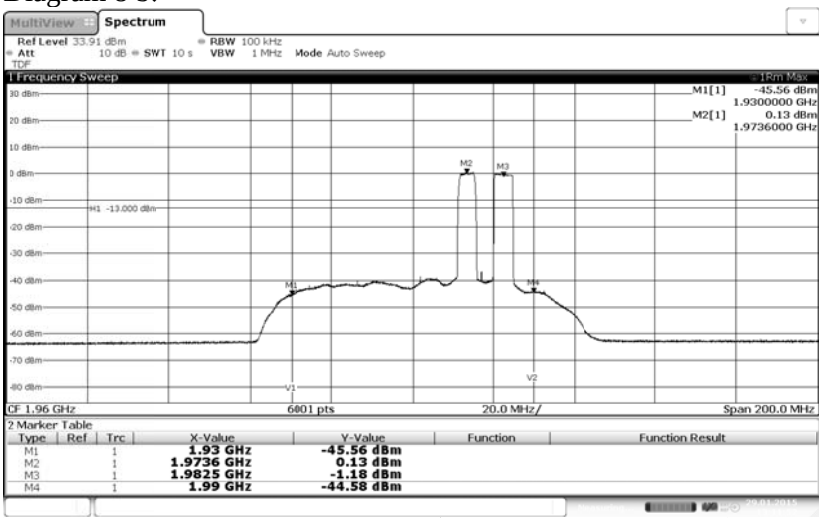
Diagram 8 b:



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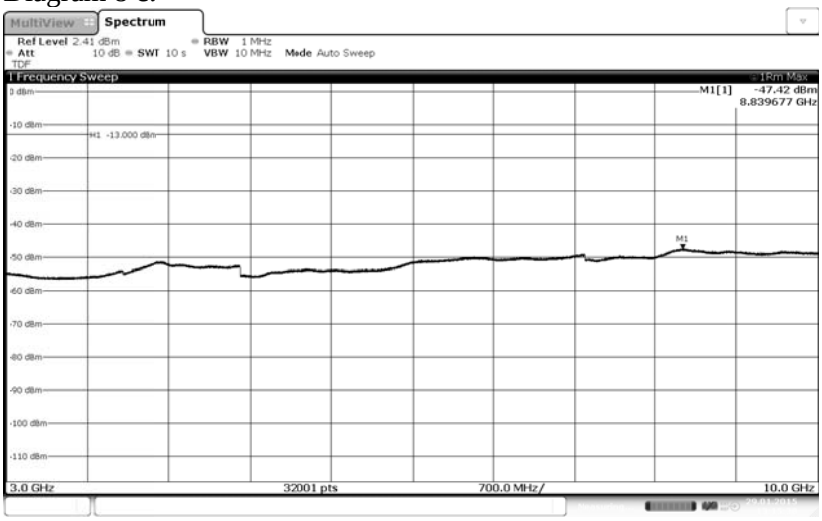
Appendix 3

Diagram 8 c:



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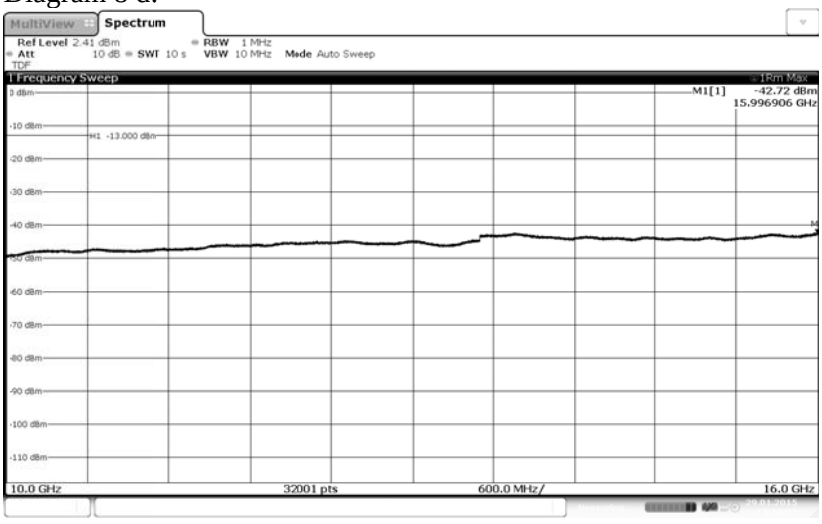
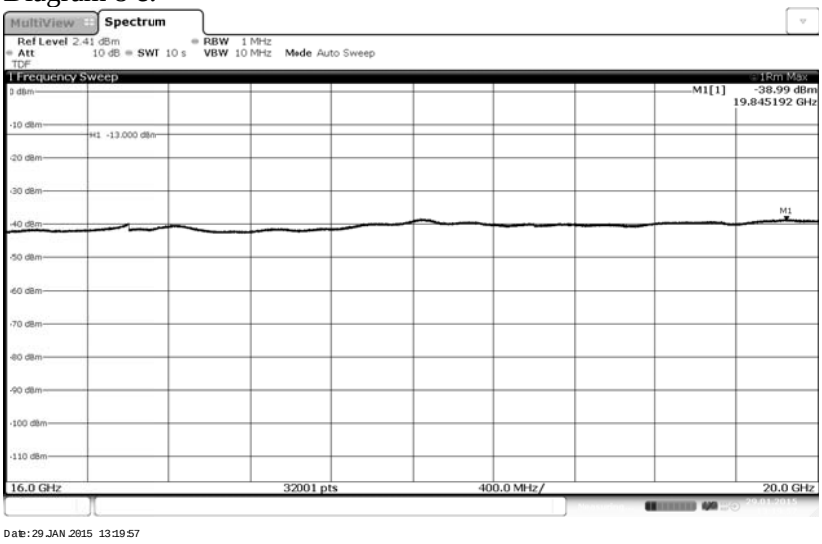


Appendix 3

Diagram 8 e:



Appendix 4

Field strength of spurious radiation measurements according to 47 CFR 2.1053 / IC RSS-133 6.5

Date	Temperature	Humidity
2015-02-02	23 °C ± 3 °C	18 % ± 5 %
2015-02-03	22 °C ± 3 °C	18 % ± 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 - 20 GHz.

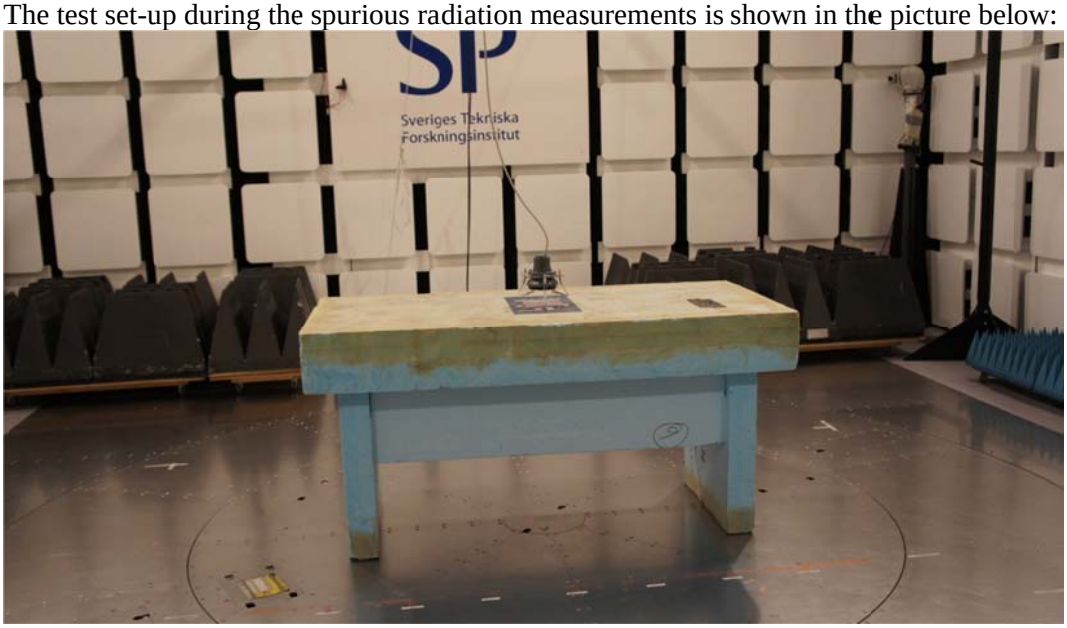
In the frequency range 30 MHz - 20 GHz the measurement was performed in power with a RBW of 1 MHz. A propagation loss in free space was calculated. The used formula was $\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.

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 ANSI/TIA-603-C.

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
EMC32 ver. 9.15.0	503 899
Chase Bilog Antenna CBL 6111A	503 182
EMCO Horn Antenna 3115	502 175
Flann STD Gain Horn Antenna 16-240	503 939
Flann STD Gain Horn Antenna 18-240	503 900
Flann STD Gain Horn Antenna 20240-20	503 674
µComp Nordic, Low Noise Amplifier	901 545
Schwarzbeck BBV9742, Low Noise Amplifier	504 085
HP Filter 3-18 GHz	504 200
Temperature and humidity meter, Testo 625	504 188

Configuration: RDI Cable 200 m

Tested configurations

Configuration
1
3
5
8

Results for worst emissions found

Diagram	Configuration 1
1 a-d	1

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-20000	All emission > 20 dB below limit	All emission > 20 dB below limit

Measurement uncertainty:

3.2 dB up to 18 GHz, 3.1 dB above 18 GHz

Limits

CFR 47 §24.238 and IC RSS-133 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:

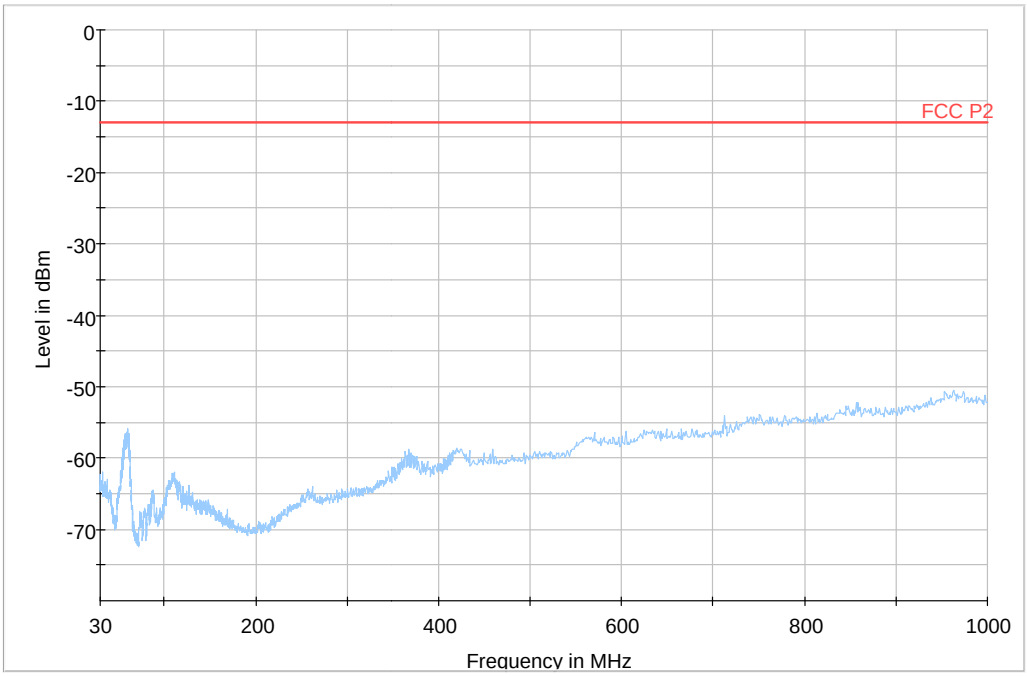
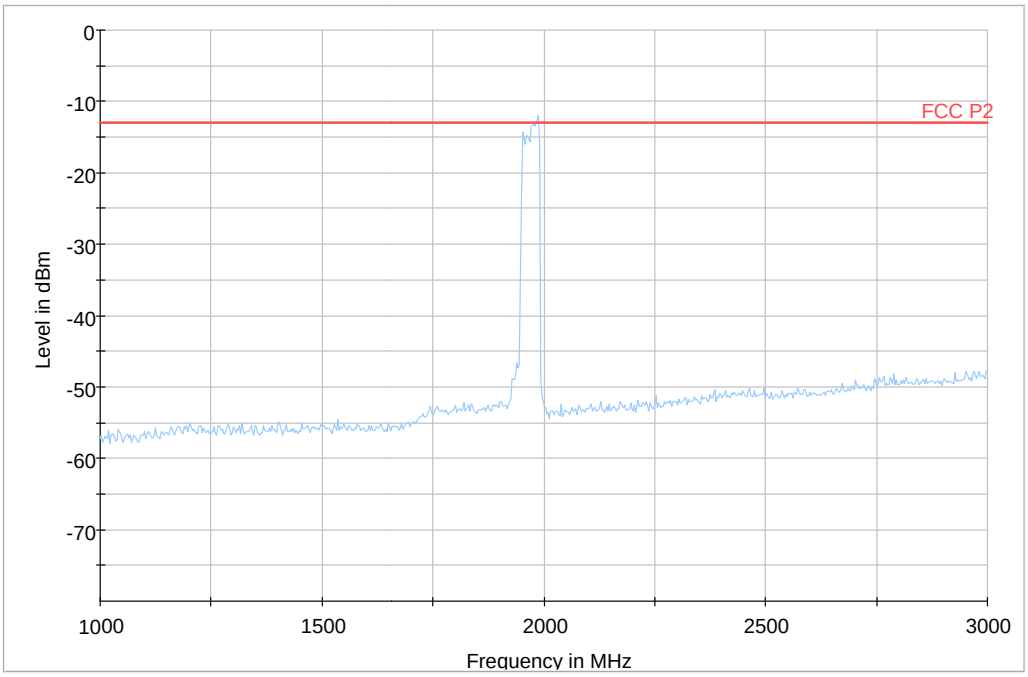


Diagram 1 b:



Note: The emission between 1950.0 MHz and 1990.0 MHz are the carrier frequencies and shall be ignored in the context.

Appendix 4

Diagram 1 c:

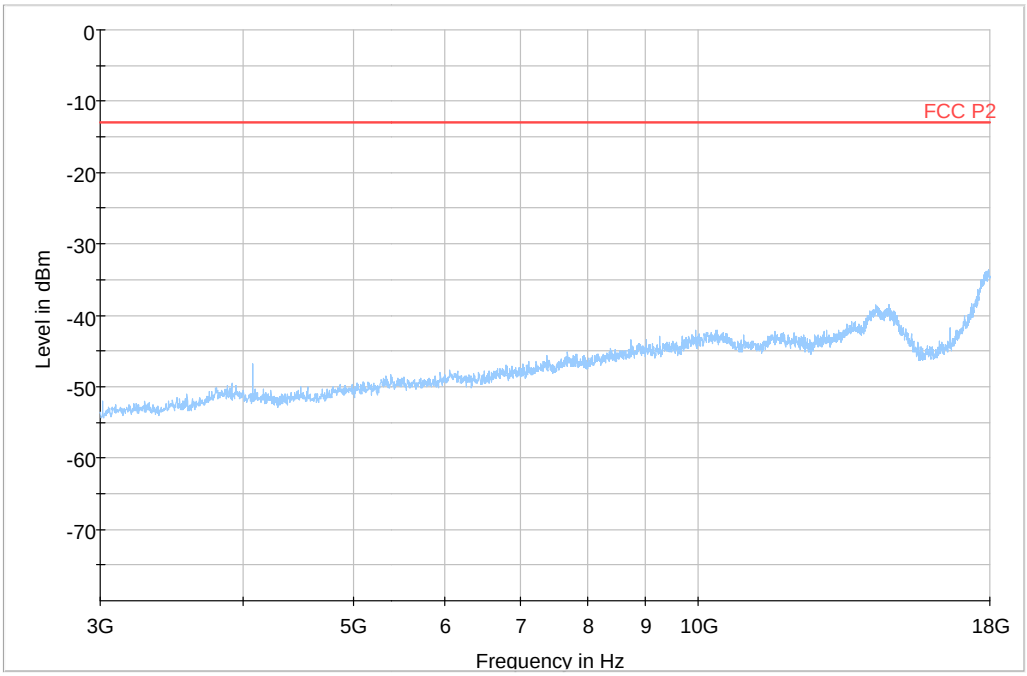
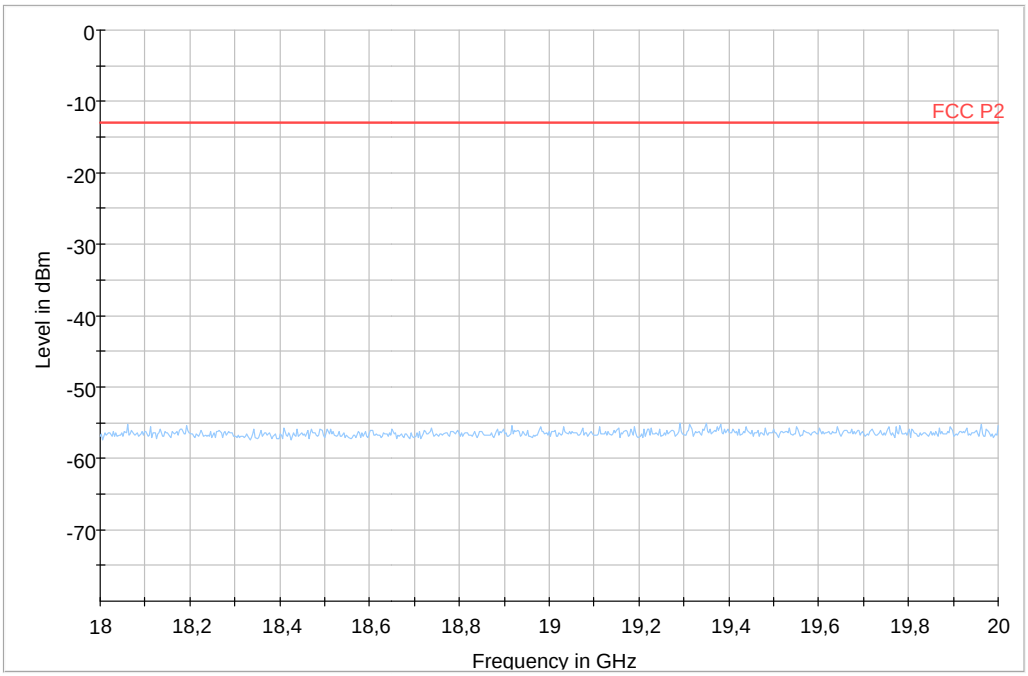


Diagram 1 d:

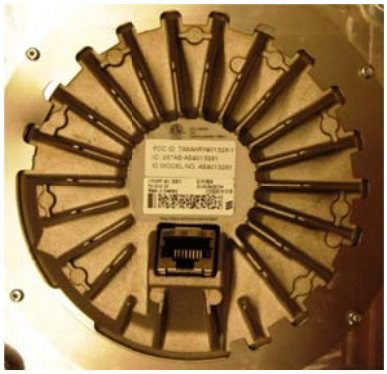


Appendix 5

External photos

Top side

Bottom side



Side

Label