REPORT

issued by an FCC listed Laboratory Reg. no. 93866.
The test site complies with RSS-Gen, IC file no. 3482A-1

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Date 2013-12-16 | Reference 3P08326-03-F27 | Page 1 (2)

ISO/IEC 17025

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Radio measurements on RRUS 12 B4 1700/2100 MHz radio equipment with FCC ID: TA8BKRC161349-2 and IC: 287AB-BS1613492

(5 appendices)

Test object

Product name: RRUS 12 B4
Product number: KRC 161 349/2, R1C

Summary

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

Standard		Compliant	Appendix
FCC CFR 47 / IC RSS-139 ISSUE 2			
2.1046 / RSS-139 6.4	RF power output	Yes	2
2.1051 / RSS-139 6.5	Spurious emission at antenna terminals	Yes	3
2.1053 / RSS-139 6.5	Field strength of spurious radiation	Yes	4

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
Tomas Lennhager

Examined by
Anders Nordlöf

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Appendix 1

Description of the test object

Equipment:	Product name: RRUS 12 B4 Product number: KRC 161 349/2,R1C FCC ID TA8BKRC161349-2 IC 287AB-BS1613492 IC MODEL NO: BS1613492
Tested configuration:	Multi RAT (MR) WCDMA + LTE
Frequency bands:	TX: 2110 – 2155 MHz RX: 1710 – 1755 MHz
Antenna ports: RF configurations Multi RAT:	2 TX/RX ports WCDMA + LTE, MIMO 2x2
Nominal output power per antenna port:	1-2 LTE + 1-3 WCDMA (Total power 47.8dBm, 60W) Total number of carriers 4
Antenna:	No dedicated antenna, handled during licensing
LTE Modulations: Channel bandwidth:	 QPSK, 16QAM and 64QAM 3 MHz, 5 MHz, 10 MHz, and 15 MHz
WCDMA Modulations:	 QPSK, 16QAM and 64QAM
Channel bandwidth:	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 power voltage:	-48VDC

Appendix 1

Operation mode 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) was used to represent QPSK. Test model 5 (TM5) to represent 16QAM modulation and Test model 6 (TM6) to 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 was used to represent QPSK, test model E-TM3.2 to represent 16QAM and test model E-TM3.1 to represent 64QAM modulation.

The settings below were deemed representative for all traffic scenarios when settings with different modulations, channel bandwidths, number of carriers and RF configurations has been tested to find the worst case setting. 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 MIMO mode
TM5:8 HS-PDSCH at 240ksps + 30 DPCH:s at 30 ksps (SF=128)
Channel bandwidth 5 MHz

LTE MIMO mode
E-TM1.1
Channel bandwidth 3 MHz.

Conducted measurements

The test object was supplied with -48 VDC by an external power supply. Additional connections are documented in the set-up drawings below.
All measurements were made on RF A and additional measurements on RF B to verify that the ports were electrical identical, as declared by the client.

Radiated measurements

Test object was powered with -48 VDC. Additional connections are documented in the setup drawings below.

Purpose of test

The purpose of the tests is to verify compliance to the performance characteristics specified in applicable items of FCC CFR 47 and Industry Canada RSS-139 and RSS-Gen.

References

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

ANSI 63.4-2009
ANSI/TIA/EIA-603-C-2004
CFR 47 part 2, October 1st , 2012
CFR 47 part 27, October 1st, 2012
3GPP TS 25.141, version 11.4.0
3GPP TS 36.141, version 11.4.0
3GPP TS 37.141, version 11.3.0
RSS-Gen Issue 3
RSS-139 Issue 2

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”SP-QD 10885”. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence).
Compliance evaluation is based on a shared risk principle with respect to the measurement uncertainty.

Reservation

The test results in this report apply only to the particular test object as declared in the report.

Delivery of test object

The test object was delivered 2013-11-13.

Manufacturer’s representative

Mihai Simon, Ericsson AB.

Test engineers

Tomas Isbring, Kexin Chen, Jörgen Wassholm, Tomas Lennhager and Rolf Kühn, SP.

Test participant

Mihai Simon, Ericsson AB.

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	2014-07	902 282
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
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
Multimeter Fluke 87	2014-08	502 190

Test frequencies during radiated and conducted measurements

MR WCDMA+ LTE MR TX test frequencies

Configuration 1:

	WCDMA	**LTE**
	(30W)	(30W)
Downlink	1537 (2112.4 MHz)	2235 (2138.5 MHz)
Uplink	1312 (1712.4 MHz)	20235 (1738.5 MHz)
Test model	TM5	E-TM1.1
Bandwidth	5 MHz	3 MHz

Configuration 2:

	WCDMA	**LTE**
	(30W)	(30W)
Downlink	1537 (2112.4 MHz)	2225 (2137.5 MHz)
Uplink	1312 (1712.4 MHz)	20225 (1737.5 MHz)
Test model	TM5	E-TM1.1
Bandwidth	5 MHz	5 MHz

Configuration 3:

	WCDMA	**LTE**
	(30W)	(30W)
Downlink	1537 (2112.4 MHz)	2200 (2135.0 MHz)
Uplink	1312 (1712.4 MHz)	20200 (1735.0 MHz)
Test model	TM5	E-TM1.1
Bandwidth	5 MHz	10 MHz

Configuration 4:

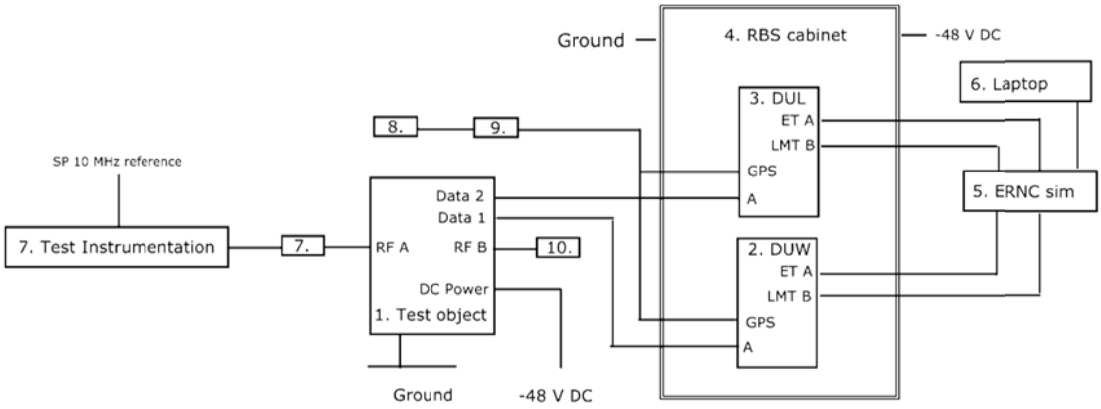
	WCDMA	**LTE**
	(30W)	(30W)
Downlink	1537 (2112.4 MHz)	2175 (2132.5 MHz)
Uplink	1312 (1712.4 MHz)	20175 (1732.5 MHz)
Test model	TM5	E-TM1.1
Bandwidth	5 MHz	15 MHz

Configuration 5:

	WCDMA	**LTE**
	(30W)	(30W)
Downlink	1712 (2147.4 MHz)	2385 (2153.5 MHz)
Uplink	1487 (1747.4 MHz)	20385 (1753.5 MHz)
Test model	TM5	E-TM1.1
Bandwidth	5 MHz	3 MHz

Appendix 1

Test setup conducted measurements MR WCDMA + LTE



Test object:

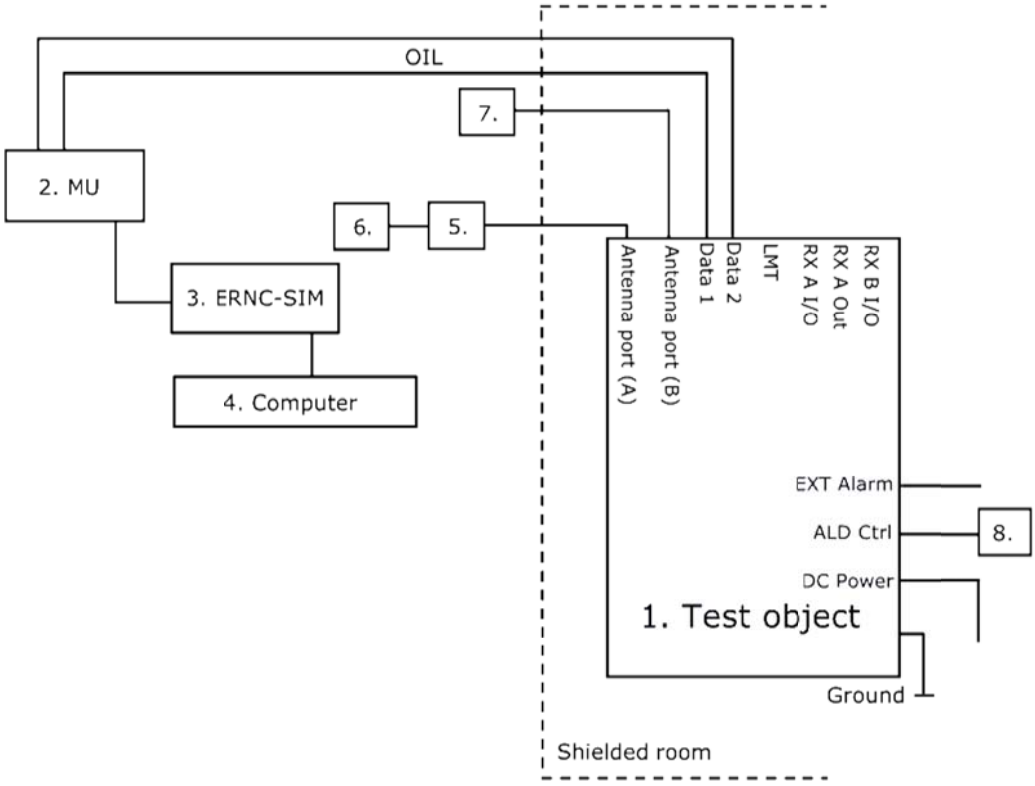
1.	RRUS 12 B4, KRC 161 349/2, revision R1C, s/n: C827491665 Software CXP 901 7316/2, Rev. R51NS FCC ID TA8BKRC161349-2 and IC 287AB-BS1613492

Functional test equipment

2.	DUL 20 01, KDU 137 533/4, revision R1C, s/n: C824279715
3.	RBS 6201 cabinet, BAMS 1000778792. PDU 02 01, BMG 980 336/4, revision R2A, s/n: BJ31528316
4	ERNC Sim 145, BAMS – 1000707989 Fast Ethernet switch, Netgear GSM7224, BAMS – 1000517289
5.	Controlling computer SUN ULTRA 27, BAMS 1000758436
6.	SP Test Instrumentation according to measurement equipment list
7.	GPS Active Antenna, KRE 101 2082/1
8.	GPS 02 01, NCD 901 41/1, revision R1D, s/n: TU8K475230
9.	Terminator, 50 ohm

Appendix 1

Test setup radiated measurements MR WCDMA + LTE



Test object:

1.	RRUS 12 B4, KRC 161 349/2, rev. R1C, s/n: C827491666 Software CXP 901 7316/2, revision R51NS FCC ID TA8BKRC161349-2 and IC 287AB-BS1613492

Functional test equipment:

2.	Main Unit SUP 6601, 1/BFL 901 009/4, revision R1E, s/n: BR82081105 DUL 20 01, KDU 137 533/4, revision R1C, s/n: C824321475 SUP 6601, 1/BFL 901 009/4, revision R1E, s/n: BR82081105 DUW 30 01, KDU 127 161/3, revision R4E, s/n: TU8X621372
3.	ERNC-SIM 072, BAMS – 1000579045 Symmetricom SyncServer S250, BAMS – 1000690719 Switch Netgear GSM 7224, BAMS – 1001252309 10 MHz reference Symmetricom 8040, BAMS – 1000645316
4.	Computer Computer, I-ultra27-6 standalone, BAMS – 1000758439 Switch Netgear GSM 7212, BAMS – 1000517298
5.	GPS 02 01, NCD 901 41/1, revision R1D, s/n: TU8K367383
6.	GPS Active Antenna, KRE 101 2082/1
7.	Attenuator
8.	R&S ESI 26, for supervision purposes only
9.	Terminator
10.	RET – Remote Electrical Tilt unit, KRY 121 67/2, revision R1N

Appendix 1

Interfaces:

Power: -48 VDC	DC Power
Antenna port (A), 7/16 connector	Antenna
Antenna port (B), 7/16 connector	Antenna
Data 1, Optical Interface Link, single mode opto fibre, used for SR WCDMA and MR W+L	Telecom
Data 2, Optical Interface Link, single mode opto fibre, used for SR LTE and MR W+L	Telecom
LMT, for maintenance use only	Telecom
RX A Out, no cable attached	RF
RX A I/O, no cable attached	RF
RX B I/O, no cable attached	RF
EXT Alarm, shielded multi-wire	Signal
ALD Ctrl, shielded multi-wire	Signal
Ground wire	Ground

RBS software:

Software	**Revision**
LTE, CXP 102051/19	R31U
WCDMA, CXP 902 1719	R4G03

Appendix 2

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

Date	Temperature	Humidity
2013-11-29	21 °C ± 3 °C	20 % ± 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	902 282
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 1.1 dB

Results

Measured total output power.
Nominal output power at RF A: 47.8 dBm.
Nominal output power at RF B: 47.8 dBm.

Tested configuration	[RMS dBm/ PAR dB]		Total power[1)] [RMS dBm]
	Port RF A	Port RF A	
1	47.78/ 7.21	47.59/ 7.21	50.70
2	47.58/ 6.90	47.38/ 6.92	50.49
3	47.44/ 6.97	47.32/ 6.97	50.39
4	47.51/ 6.95	47.34/ 6.97	50.44
5	47.64/ 7.04	47.58/ 7.04	50.62

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

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

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 3280 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

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

Date	Temperature	Humidity
2013-11-29	21 °C ± 3 °C	20 % ± 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 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

Results

Diagram	Tested configuration	Tested Port
1 a-e	1	RF A
2 a-e	2	RF A
3 a-e	3	RF A
4 a-e	4	RF A
5 a-e	5	RF A

Appendix 3

Diagram 1 a:

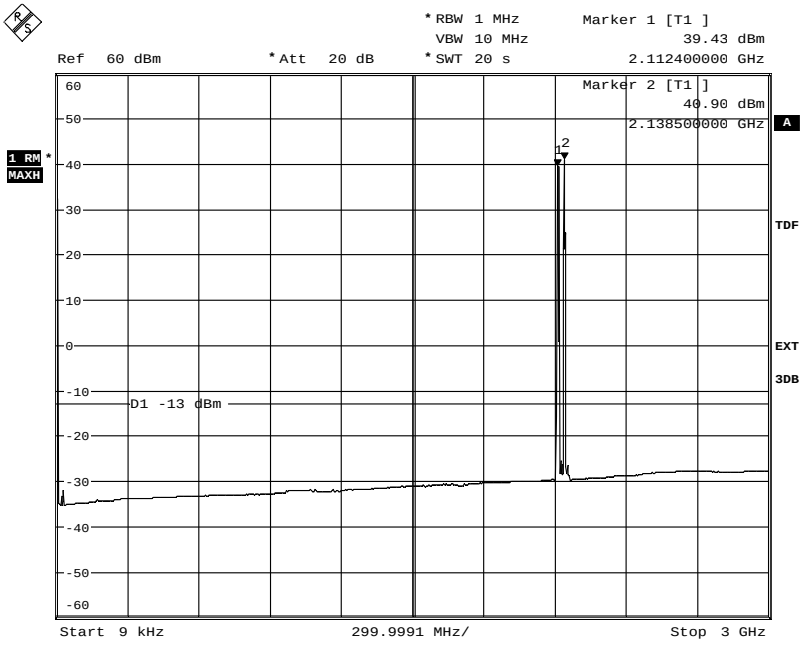


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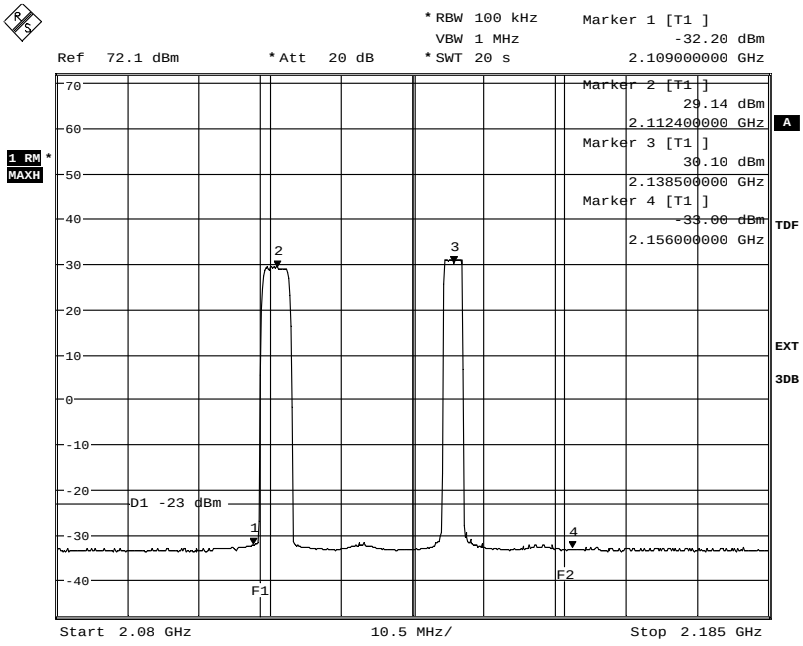
Diagram 1 b:



Date: 29.NOV.2013 17:48:05

Appendix 3

Diagram 1 c:

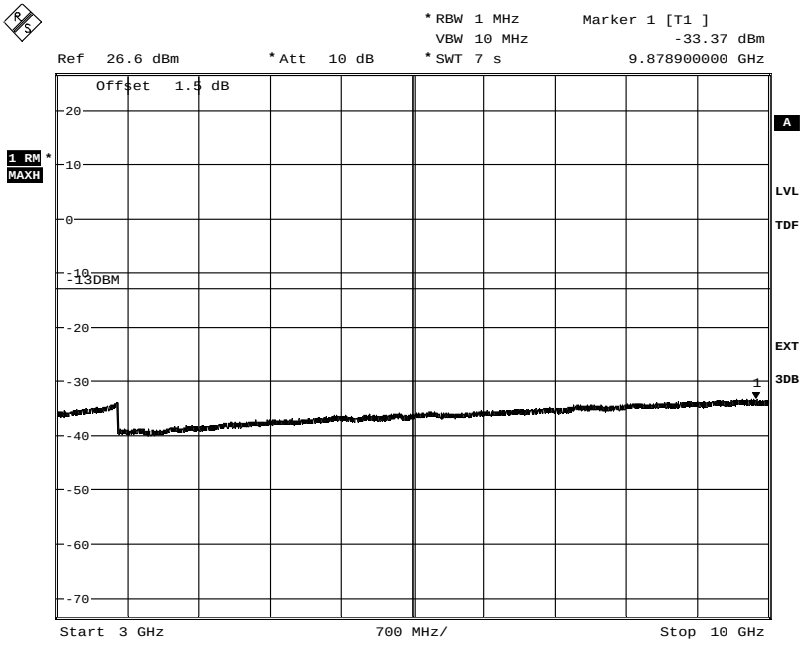


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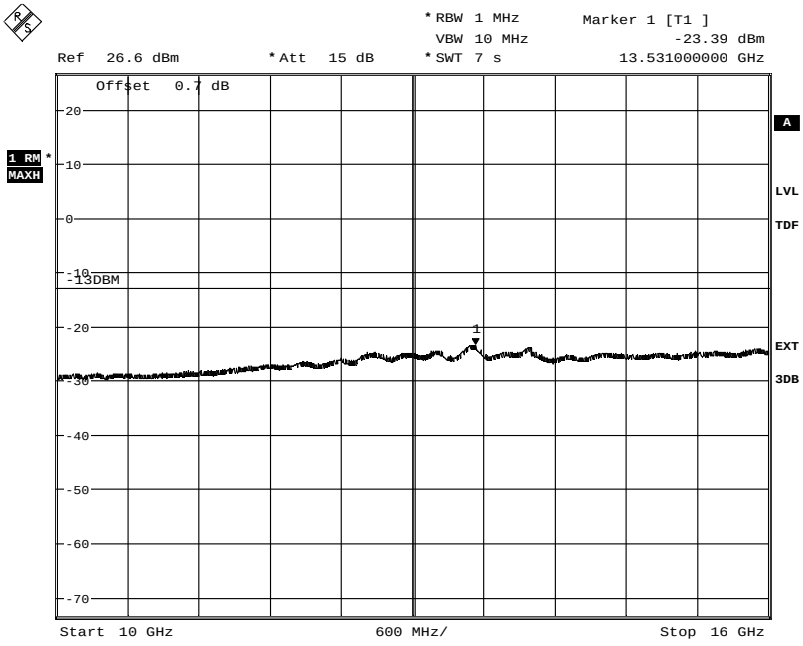
Diagram 1 d:



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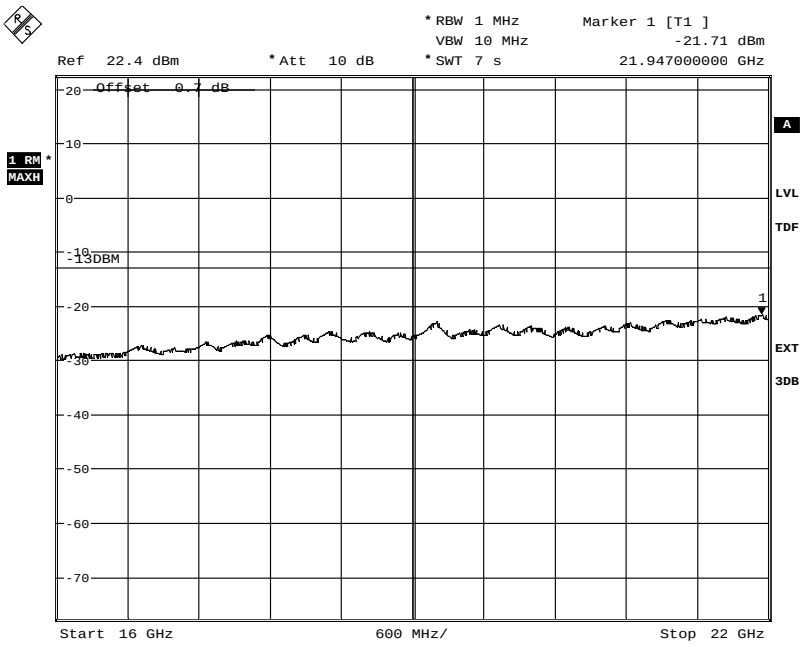
Appendix 3

Diagram 1 e:



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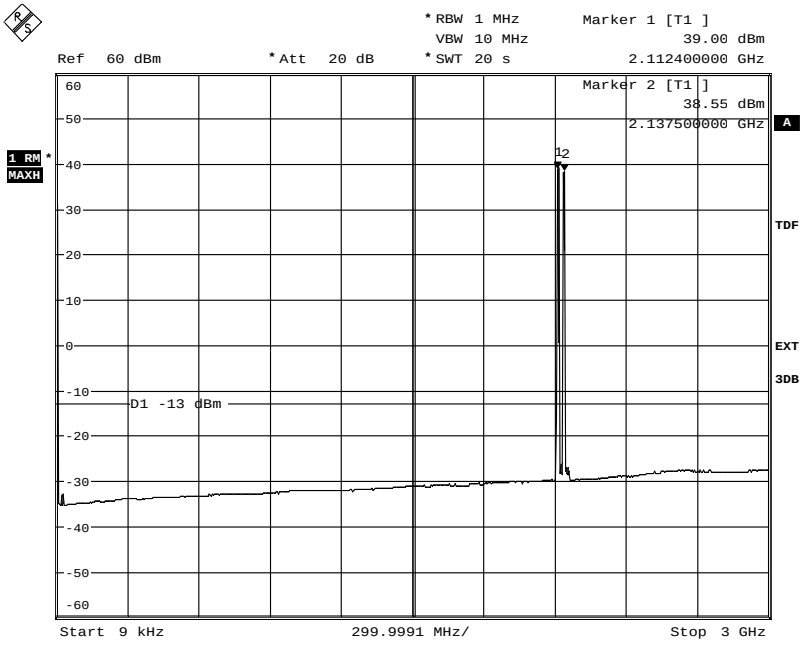
Appendix 3

Diagram 2 a:



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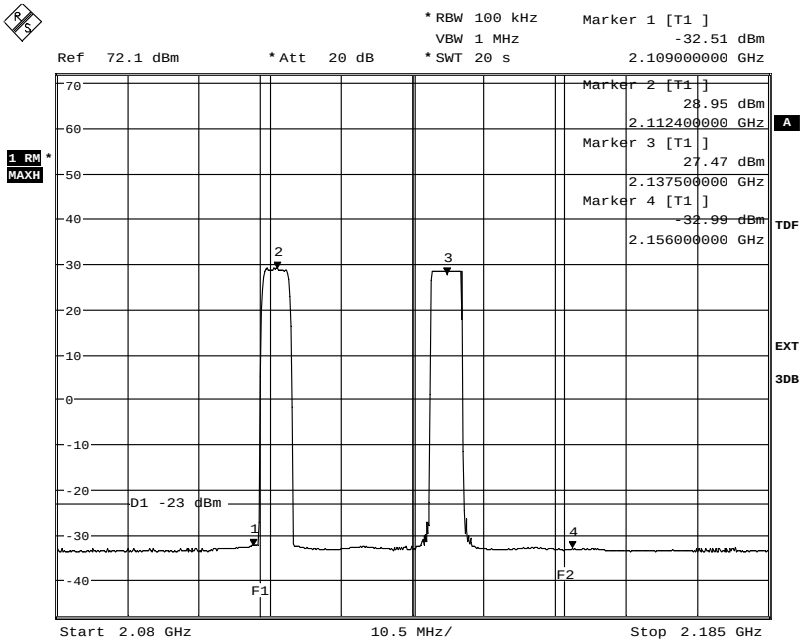

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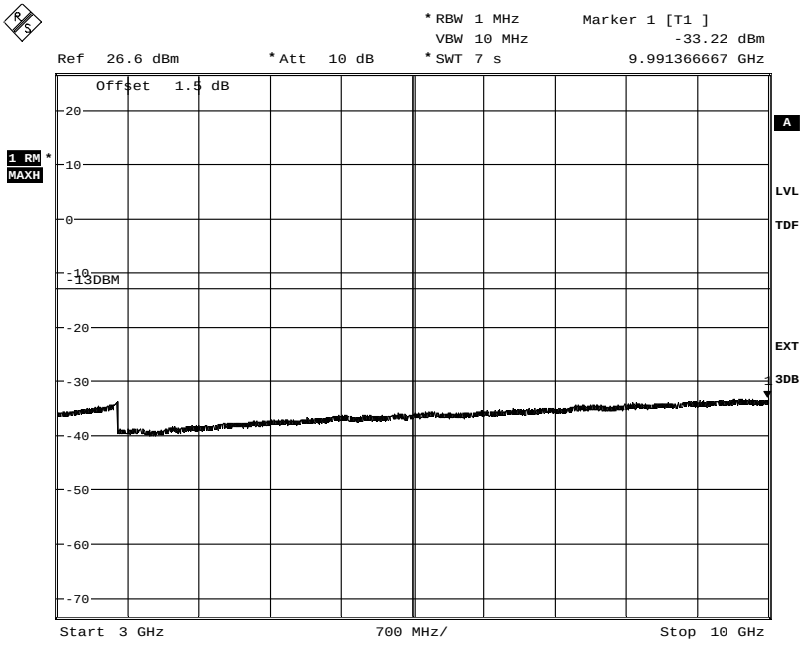
Appendix 3

Diagram 2 c:



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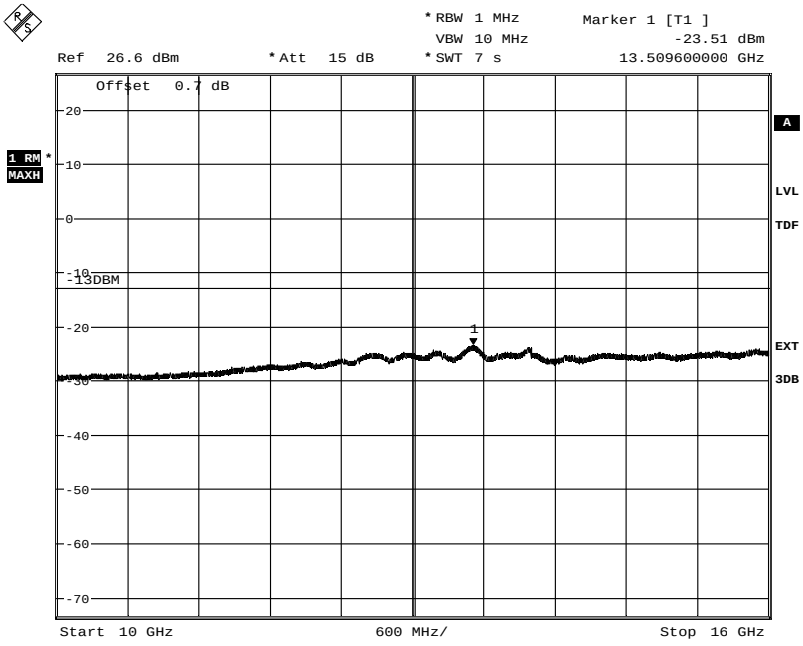

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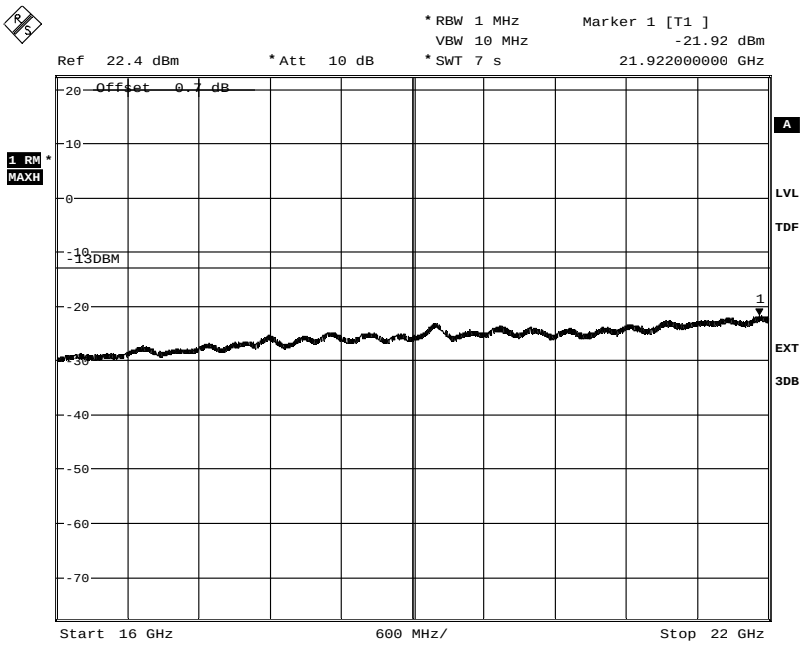
Appendix 3

Diagram 2 e:



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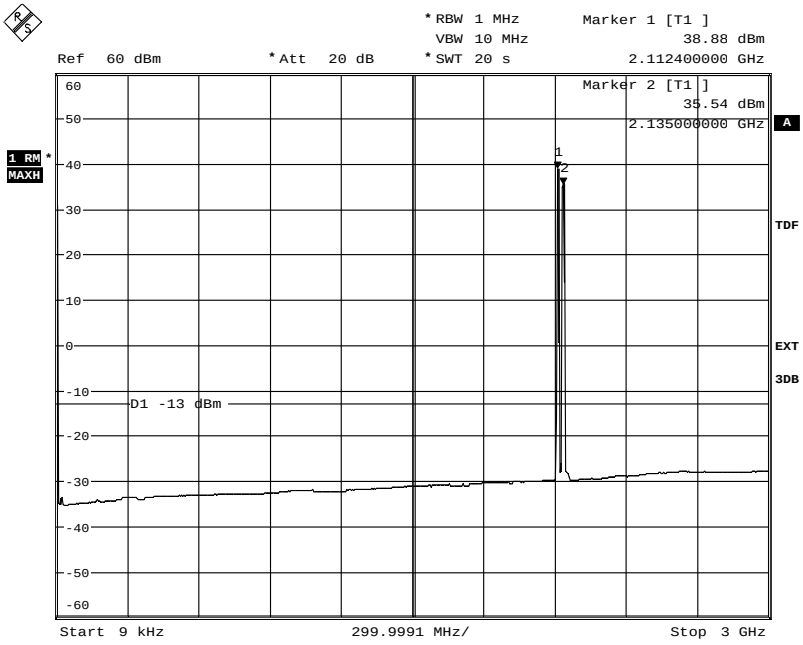
Appendix 3

Diagram 3 a:



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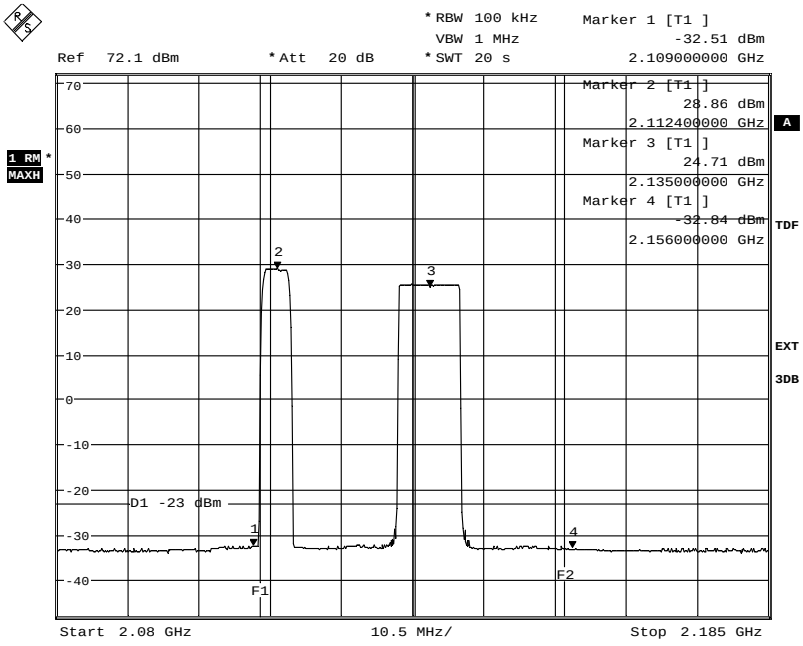

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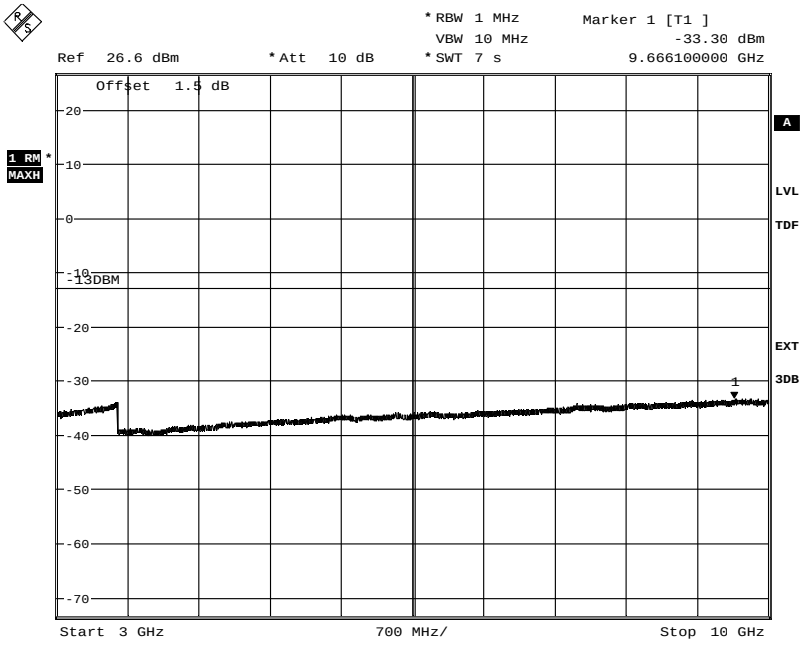
Appendix 3

Diagram 3 c:



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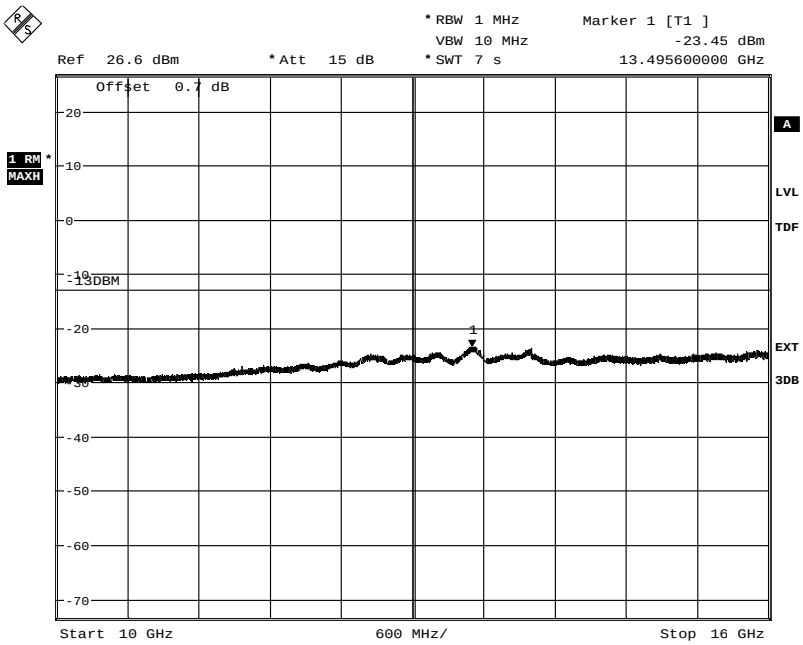

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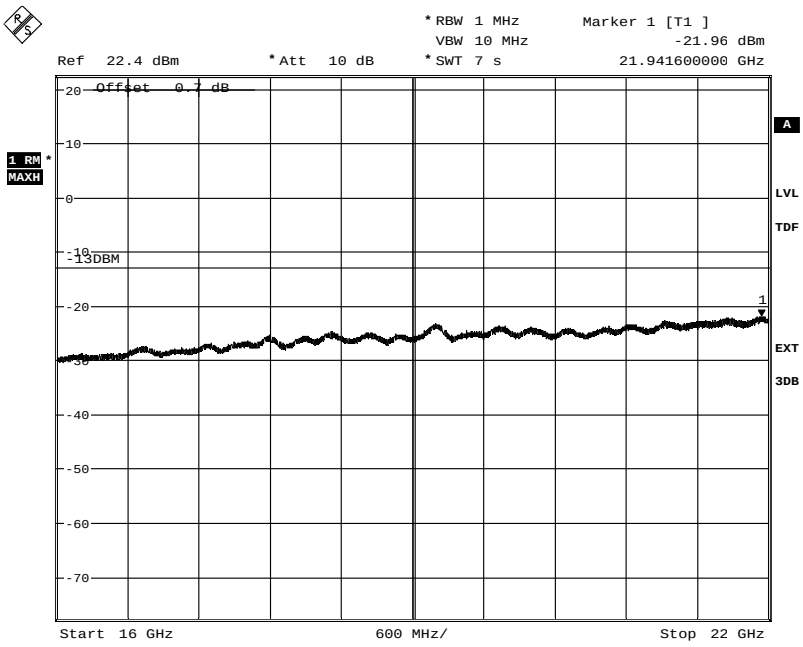
Appendix 3

Diagram 3 e:



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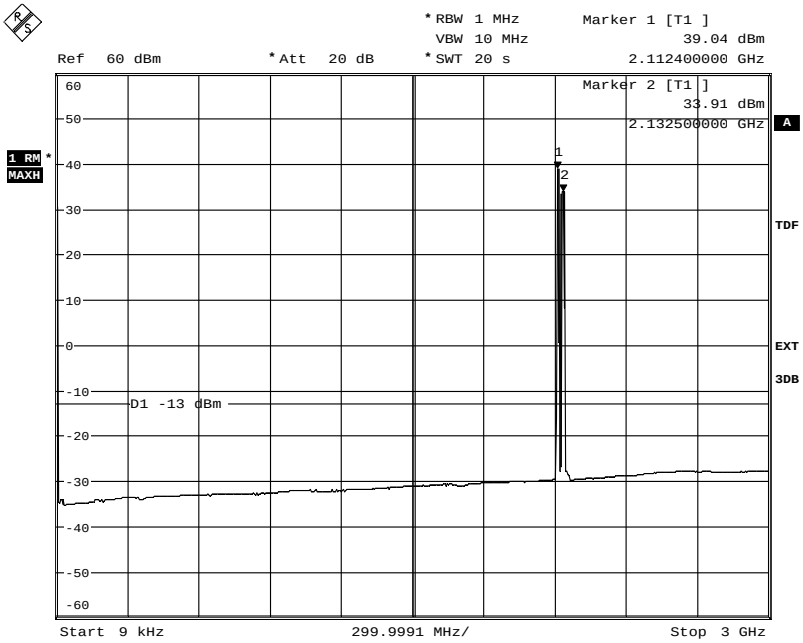

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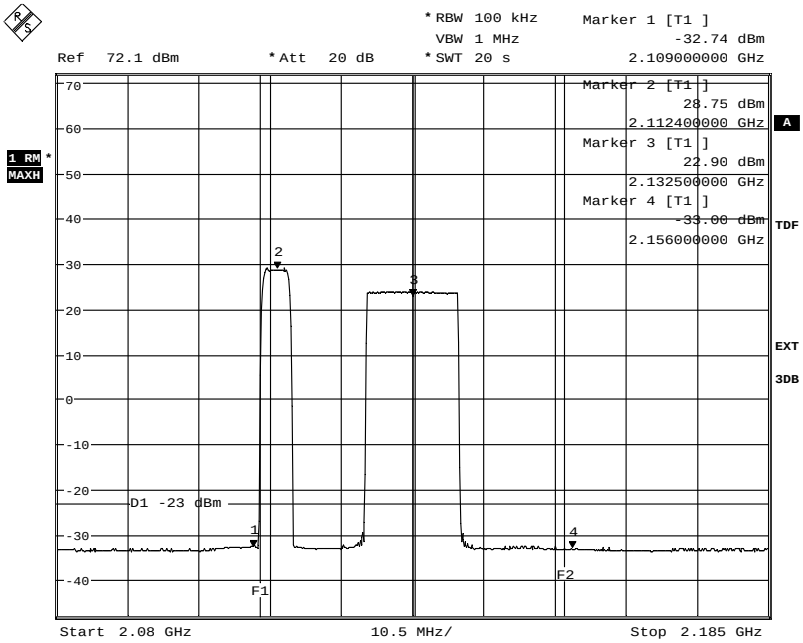

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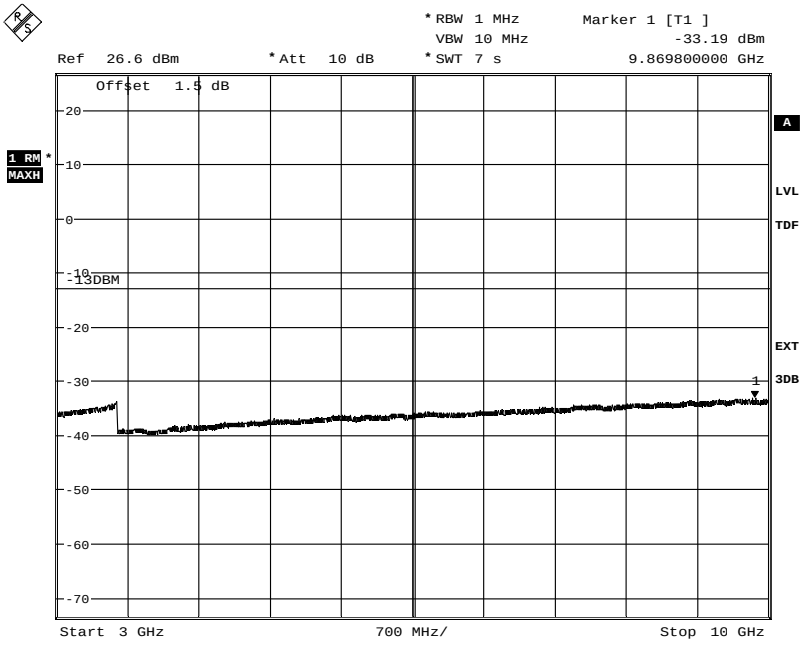
Appendix 3

Diagram 4 c:



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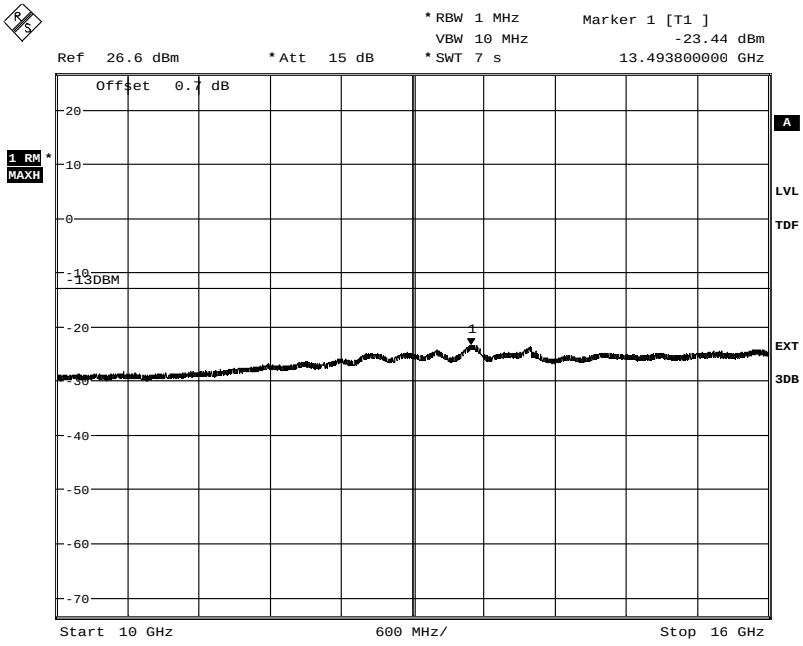

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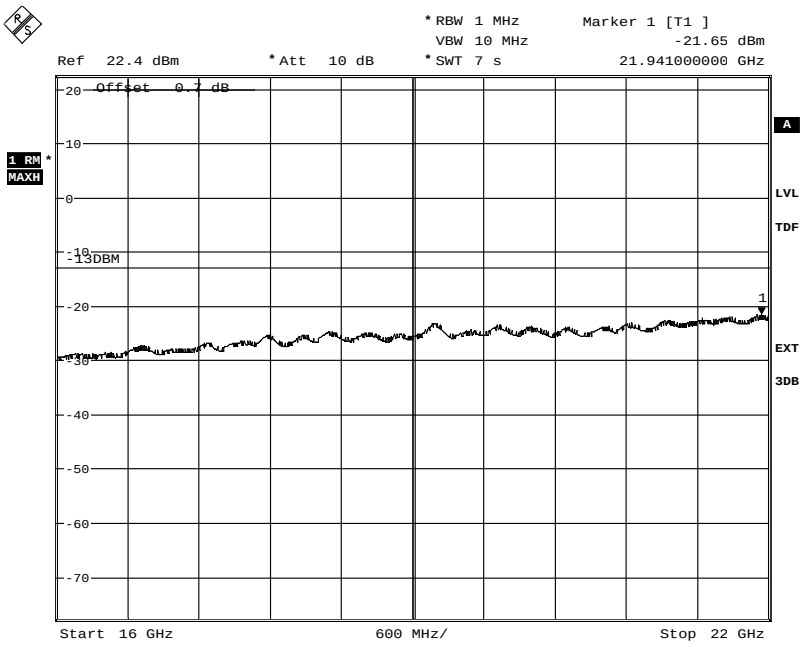
Appendix 3

Diagram 4 e:



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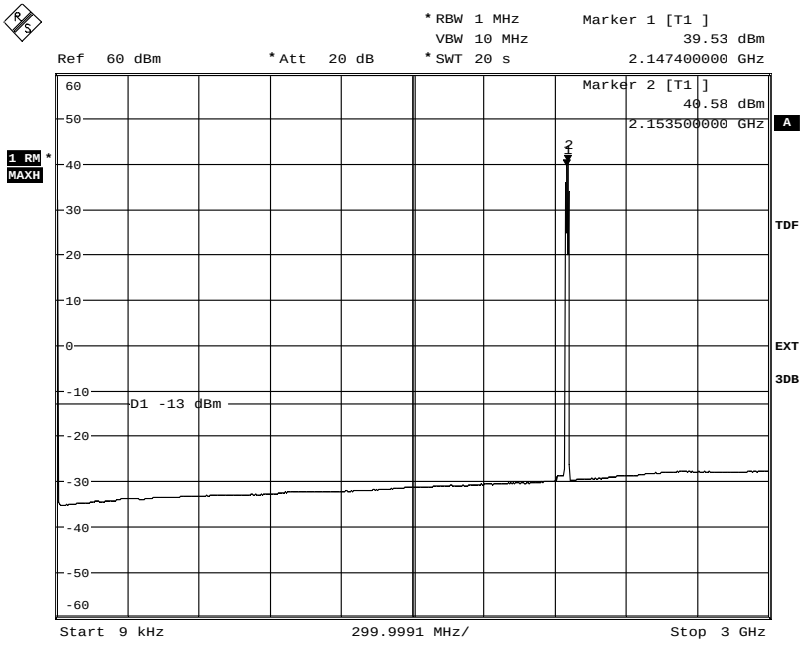
Appendix 3

Diagram 5 a:



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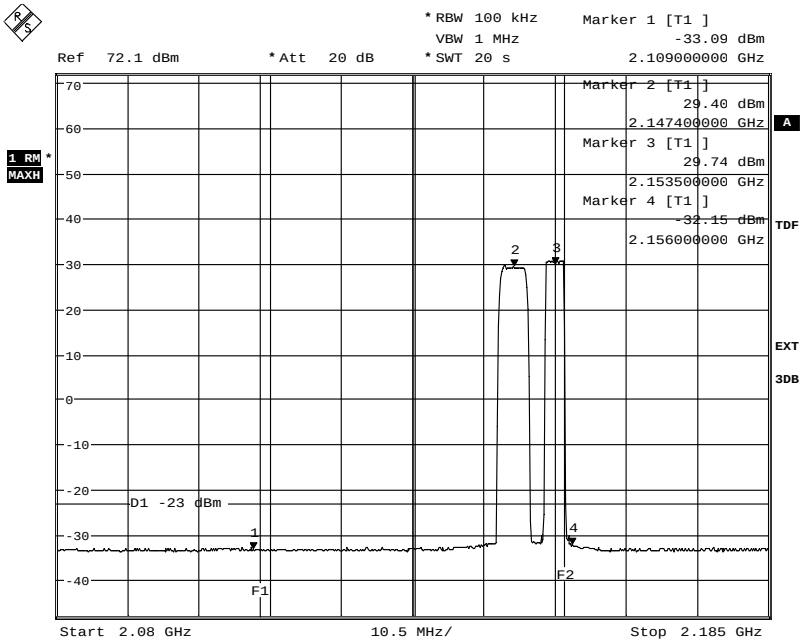

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Appendix 3

Diagram 5 c:

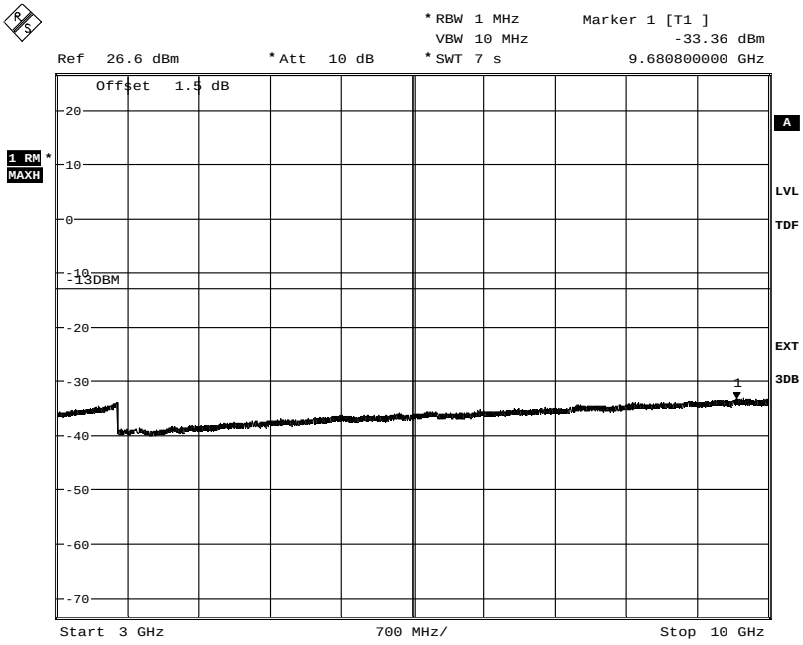

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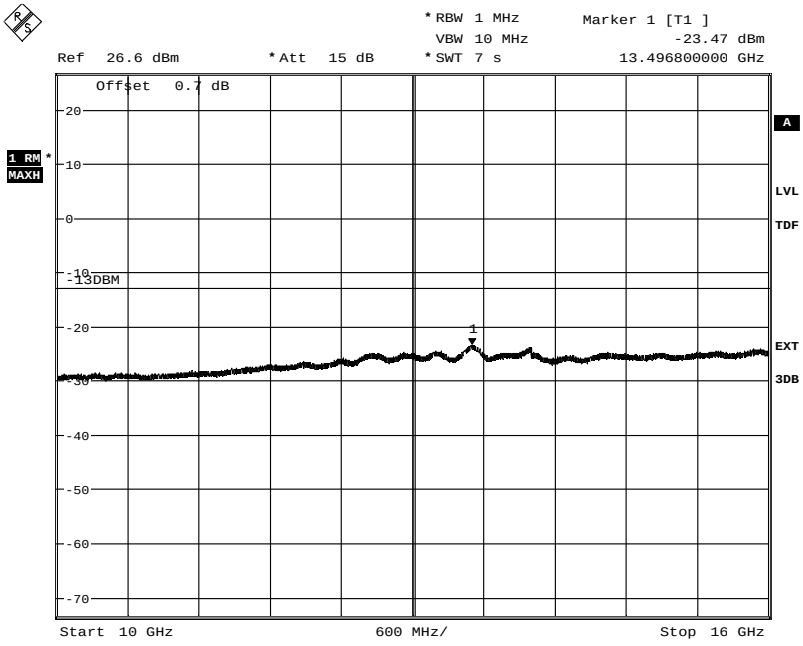
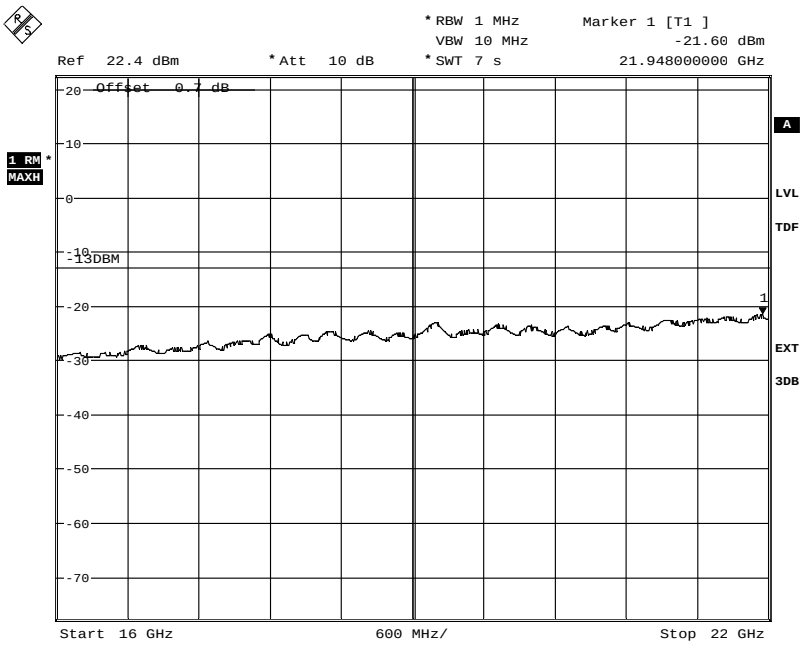
Diagram 5 d:



Date: 29.NOV.2013 18:17:58

Appendix 3

Diagram 5 e:



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Remark

The emission at 9 kHz on the plots was not generated by the test object. A complementary measurement with a smaller RBW showed that it was related to the LO feed-through.

The highest fundamental frequency is 2.155 GHz. The measurements were made up to 22 GHz (10x2.155 GHz = 21.55 GHz).

Limits

§27.53(h) and RSS-139 6.5

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

Complies?	Yes

Appendix 4

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

Date	Temperature	Humidity
2013-11-03	23°C ± 3°C	42 % ± 5 %
2013-11-04	23°C ± 3°C	35 % ± 5 %

Test set-up and procedure

The test sites are listed at FCC, Columbia with registration number: 93866. The test site complies with RSS-Gen, Industry Canada file no. 3482A-1.

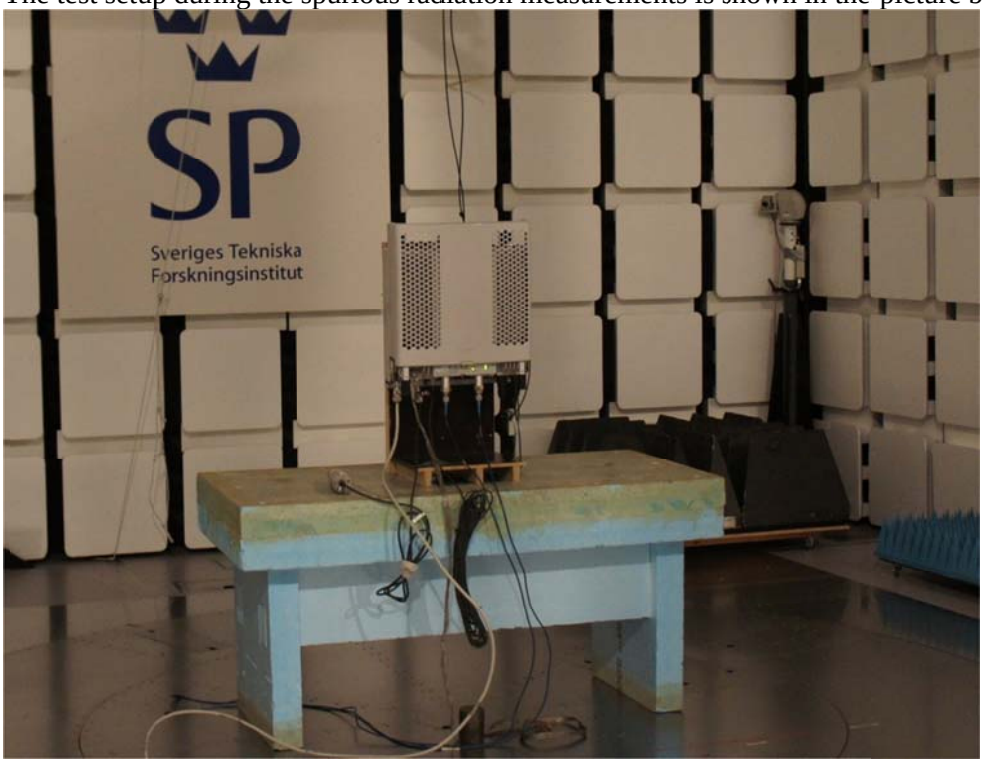
The measurements were performed with both horizontal and vertical polarization of the antenna. The antenna distance was 3 m in the frequency range 30 MHz – 18 GHz and 1m in the frequency range 18 - 22 GHz.

In the frequency range 30 MHz – 22 GHz the measurement was performed in power with a RBW of 1 MHz. A propagation loss in free space was calculated. The used formula was $\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.

The measurement procedure was as the following:

1. The pre-measurement was first performed with peak detector. The EUT was measured in eight directions and with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m.
2. Spurious radiation on frequencies closer than 20 dB to the limit in the pre-measurement is scanned 0-360 degrees and the antenna is scanned 1- 4 m for maximum response. The emission is then measured with the RMS detector and the RMS value is reported. Frequencies closer than 10 dB to the limit when measured with the RMS detector were measured with the substitution method according to the standard.

The test setup 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, 3-18 GHz	503 739
Miteq, Low Noise Amplifier	503 285
Schwartzbeck preamplifier BBV 9742	504 085
µComp Nordic, Low Noise Amplifier	901 545
Temperature and humidity meter, Testo 625	504 188

Tested configurations

BW [MHz]	Configuration
3	1
5	2
10	3
15	4
3	5

Results, representing worst case

Diagram	BW [MHz]	Configuration
1 a-d	5 MHz	2

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-22 000	All emission > 20 dB below limit	All emission > 20 dB below limit

Measurement uncertainty:

3.2 dB up to 18 GHz, 3.6 dB above 18 GHz

Limits

§27.53(h) and RSS-139 6.5

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

Complies?	Yes

Appendix 4

Diagram 1 a:

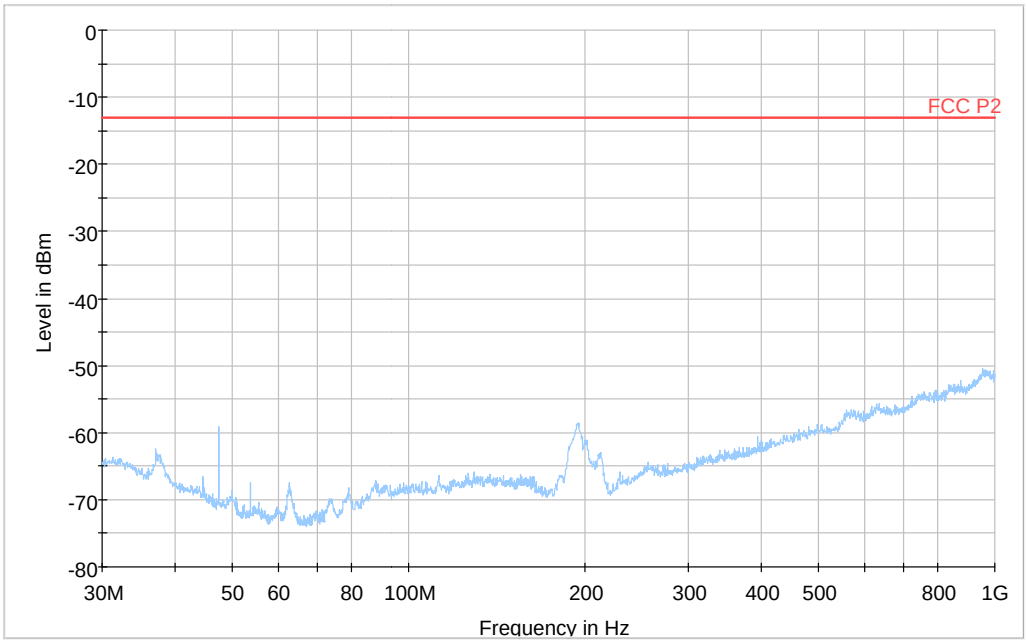
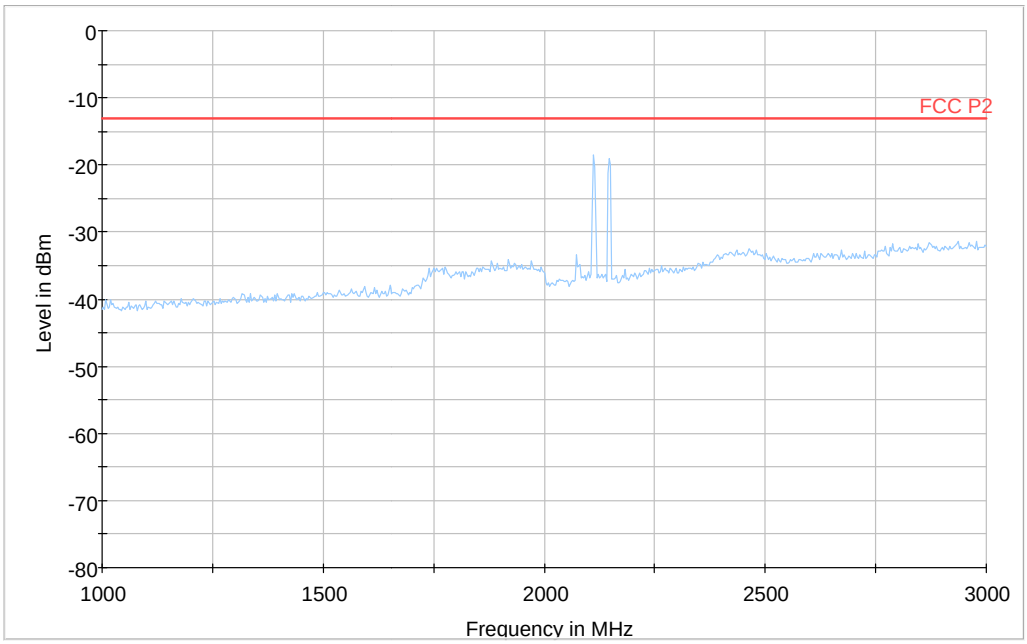


Diagram 1 b:



Note: The emission between 2112.4 and 2137.5 MHz are the carrier frequencies and shall be ignored in the context.

Appendix 4

Diagram 1 c:

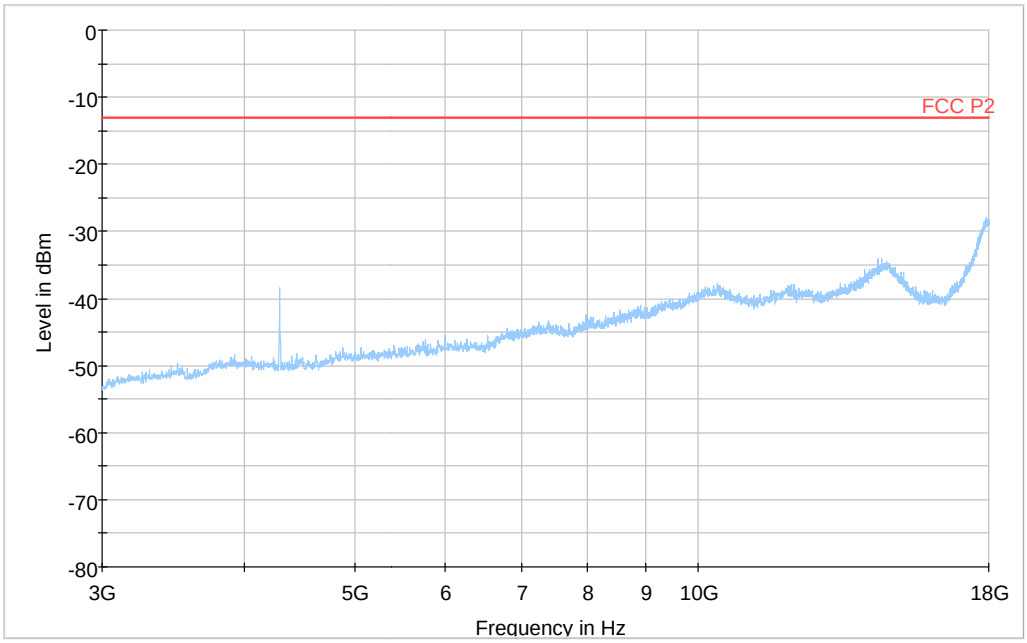
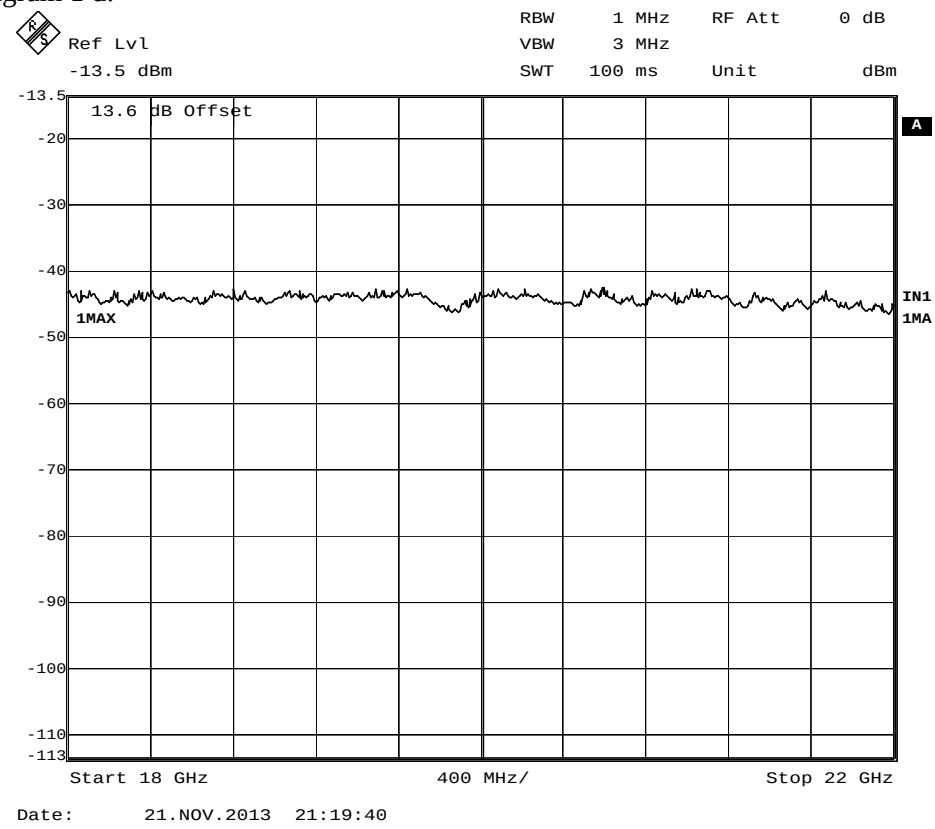


Diagram 1 d:



Appendix 5

External photos

Front side

Rear side

Appendix 5

Top side

Bottom side