REPORT

Issued by an FCC listed Laboratory Reg. no93866
The test site complies with RSS-Gen, IC file no. 3482A-1
Contact person
Tomas Lennhager
Electronics
+46 10 516 54 09
Tomas.Lennhager@sp.se

Date 2014-05-27 Reference 4P02595-05-F24 Page 1 (2)

1002
ISO/IEC 17025

Ericsson AB
Klaes Holm
PDU HW
164 80 Stockholm

Radio measurements on RUS 01 B2 1900 MHz radio equipment with FCC ID: TA8CKRC11866-1 and IC: 287AB-CS118661

(5 appendices)

Test object

Product name: RUS 01 B2
Product number: KRC 118 66/1, R2H

Summary

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

Standard		Compliant	Appendix
FCC CFR 47 / IC RSS-133 ISSUE 6			
2.1046 / RSS-133 6.4	RF power output	Yes	2
2.1051 / RSS-136 6.5	Spurious emission at antenna terminals	Yes	3
2.1053 / RSS-136 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: 2014-05-27 15:13:03 +02:00

Jörgen Wassholm

Examined by

Signed by: Anders Nordlöf
Reason: I have reviewed this document
Date & Time: 2014-05-27 15:04:51 +02:00

Anders Nordlöf

Table of contents

Appendix 1

Description of the test object

Equipment:	Radio equipment RUS 01 B2 (MR) WCDMA + LTE Product number KRC 118 66/1 FCC ID: TA8CKRC11866-1 IC: 287AB-CS118661 IC MODEL NO: CS118661
Operating bands:	TX: 1930 – 1990 MHz RX: 1850 – 1910 MHz
Antenna ports:	1 TX/RX port 1 RX port
RF configurations:	MR WCDMA + LTE, TX diversity and MIMO 2x2 (TX diversity only LTE)
Nominal output power per antenna port:	1-2 LTE + 1-3 WCDMA (Total power 47.8 dBm, 60W) Total number of carriers 4
Antenna:	No dedicated antenna, handled during licensing
LTE Modulations:	QPSK, 16QAM and 64QAM
Channel bandwidth:	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 100/200kHz)
Nominal supply voltage:	-48VDC

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 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 5 MHz

Conducted measurements

The test object was hosted in a RBS 6201 powered with -48 VDC. Additional connections are documented in the set-up drawings below.
All measurements were performed on test object 1(described in the Test setup diagram), running in primary mode.

Radiated measurements

The test object was tested stand-alone. It was powered with -48 VDC. RF A port was terminated into 50 ohm.

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 , 2013
CFR 47 part 24, October 1st, 2013
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-133 Issue 6

Appendix 1

Measurement equipment

	Calibration Due	SP number
Test site Tesla	2014-01	503 881
R&S ESU 26	2014-05	901 553
R&S FSQ 40	2014-03	504 143
R&S FSW 43	2014-03	902 073
R&S FSIQ 40	2014-07	503 738
Control computer with R&S software EMC32 version 8.52.0	-	503 899
High pass filter	2015-01	BX40074
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	2014-08	503 739
High pass filter	2014-07	503 740
RF attenuator	2014-09	503 248
RF attenuator	2014-09	503 249
RF attenuator	2014-07	504 159
RF attenuator	2014-07	900 233
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	2014-01	502 175
µComp Nordic, Low Noise Amplifier	2014-04	901 545
Miteq, Low Noise Amplifier	2014-09	503 285
Schwarzbeck preamplifier BBV 9742	2014-03	504 085
Temperature and humidity meter, Testo 635	2014-06	504 203
Temperature and humidity meter, Testo 625	2014-06	504 188
Temperature Chamber	--	503 360
Multimeter Fluke 87	2014-08	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 2013-10-08

Manufacturer’s representative

Christer Gustavsson, Ericsson AB.

Test engineers

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

Test participant

None.

Test frequencies used for radiated and conducted measurements

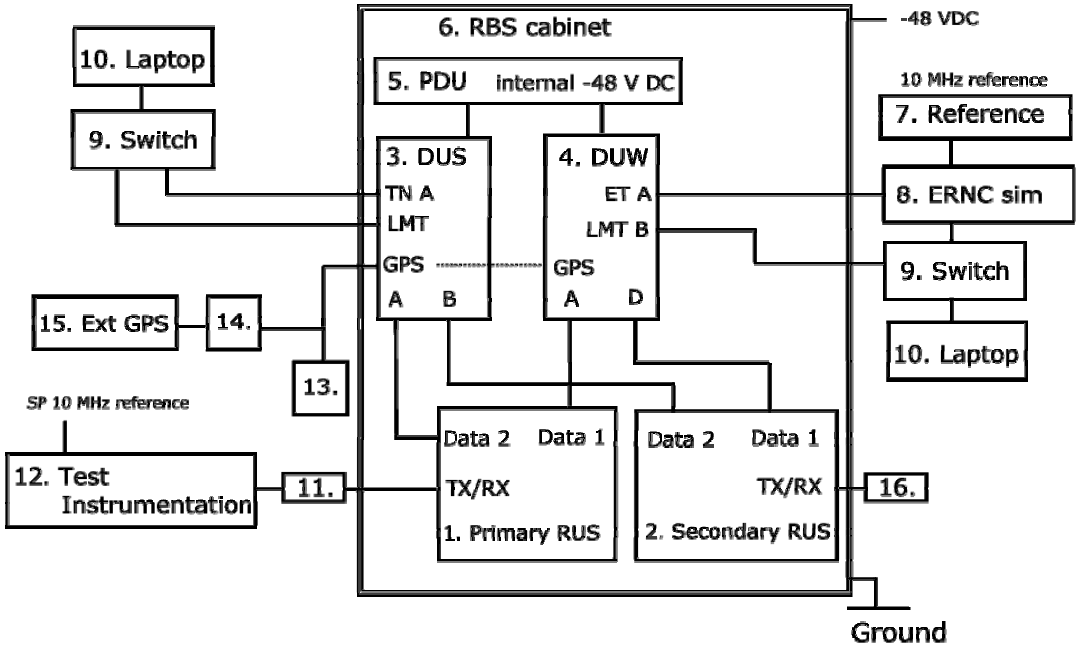
WCDMA & LTE MR TX test frequencies

WCDMA			LTE				
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]	Symbolic name	Comment
9662	1932.4	5	775	1947.5	5	B	TX bottom constellation per LTE BW
9763	1952.6	5	975	1967.5	5	M	TX mid constellation per LTE BW
9763	1952.6	5	950	1965.0	10	M	
9763	1952.6	5	925	1962.5	15	M	
9863	1972.6	5	1175	1987.5	5	T	TX top constellation per LTE BW
9690	1938.0	5	775	1947.5	5	B_{IM}	TX constellation for bottom spurious IM
9862	1972.8	5	1120	1982.0	5	T_{IM}	TX constellation top for spurious IM

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



Note: Unconnected interfaces were omitted in the picture for simplicity, but are listed in the interface table on page 10.

Test object:

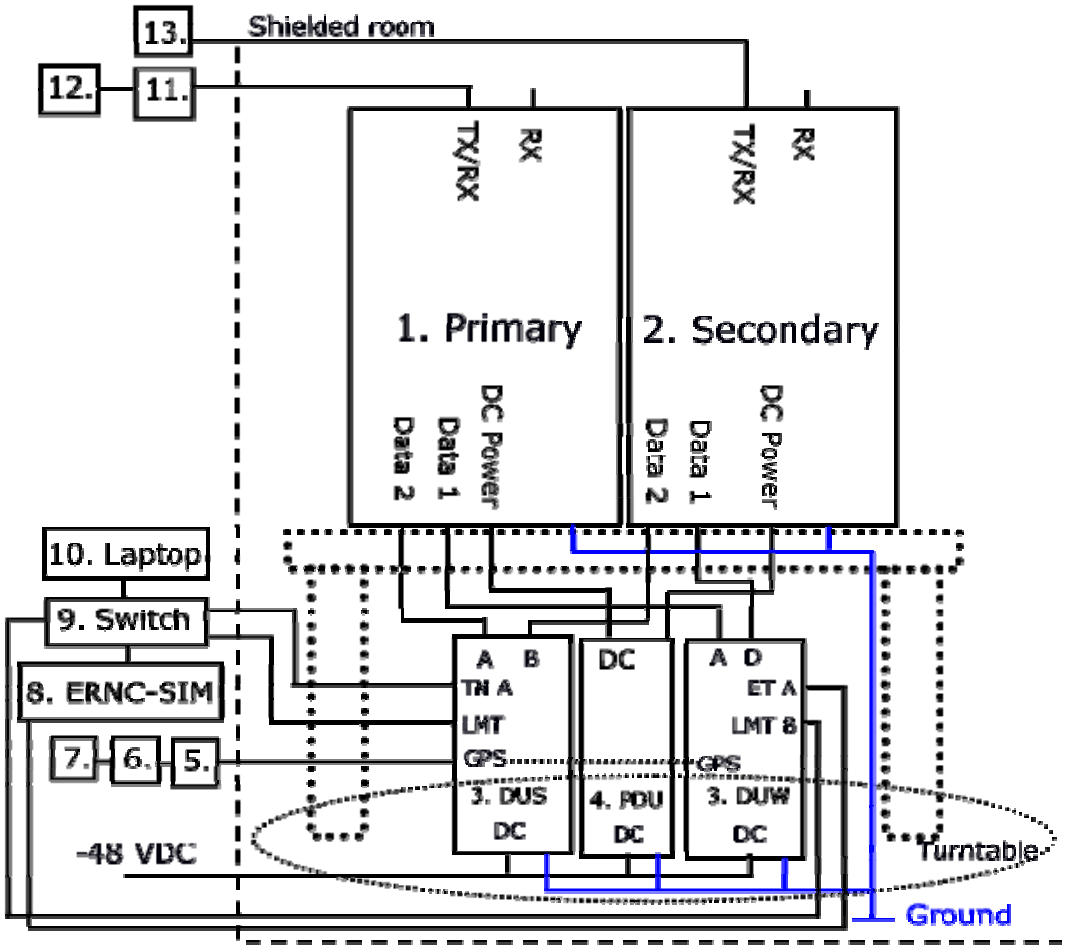
1. 2.	RUS 01 B2, KRC 118 66/1, rev. R2H, s/n: : CB4J994518, Test object: primary/ secondary RUS 01 B2, KRC 118 66/1, rev. R2H, s/n: : CB4J994533, Dummy (secondary/ primary) working software CXP 901 3268/6, rev. R49FH with FCC ID: TA8CKRC11866-1 and IC: 287AB-CS118661

Functional test equipment:

3.	DUS 41 01, KDU 137 624/1, rev:R5A, s/n: D165724695
4.	DUW 41 01, KDU 127 174/4, rev:R2C, s/n: A401998222
5.	PDU 02 02, BMG 980 336/5, rev: R1F, s/n: X051445683
6.	RBS 6201 cabinet, BAMS – 1000778792
7.	Symmetricon 8040 reference, BAMS – 1000714189
8.	ERNC Sim 130, BAMS – 100066091
9.	Fast Ethernet switch, Netgear FS726T
10.	Laptop, EliteBook 8560w, BAMS – 1001236856
11.	Attenuator, filter, according respective appendix
12.	SP test instrument according measurement equipment list
13.	Power supply, Mascot Type 719
14.	GPS 02 01, NCD 901 41/1, rev. R1D, s/n: TU8K474887
15.	GPS Active Antenna, KRE 101 2082/1
16.	Terminator

Appendix 1

Test setup radiated measurements MR LTE+WCDMA



Test object:

1. 2.	RUS 01 B2, KRC 118 66/1, rev. R2H, s/n: CB4J994518 primary RUS 01 B2, KRC 118 66/1, rev. R2H, s/n: CB4J994533 secondary working software CXP 901 3268/6, rev. R49FH with FCC ID: TA8CKRC11866-1 and IC: 287AB-CS118661

Functional test equipment:

3.	DUS 41 01, KDU 137 624/1, rev:R5A, s/n: D165724695 DUW 41 01, KDU 127 174/4, rev:R2C, s/n: A401998222
4.	RBS 6202: PDU 02 02, BMG 980 336/5, rev: R1F, s/n: X051445683
5.	Power supply, Mascot Type 719
6.	GPS 02 01, NCD 901 41/1, rev. R1D, s/n: TU8K356428
7.	GPS Active Antenna, KRE 101 2082/1
8.	ERNC-SIM 131, BAMS – 1000660992
9.	Switch Netgear FS726T
10.	Laptop, EliteBook 8560w, BAMS – 1001236856
11.	Attenuator
12.	FSIQ 40, SP number: 503 738, for supervision purpose only
13.	Terminator

Appendix 1

Interfaces:	**Type of port:**
Power: -48 VDC	DC Power
Antenna port (A), 7/16 connector, combined TX/RX	Antenna
Antenna port (B), 7/16 connector, only RX	Antenna
Data 1, electrical interface	Signal
Data 2, electrical interface	Signal
RX A Out, no cable attached	RF
RX A I/O, cross connector used for MIMO	RF
RX B I/O, cross connector used for MIMO	RF
Ground wire	Ground

RBS software:

RAT	**Software**	**Revision**
WCDMA	CXP 902 1719	R1DG07
LTE	CXP 102 051/18	R32AV

Appendix 2

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

Date	Temperature	Humidity
2013-10-11	23 °C ± 3 °C	29 % ± 5 %
2013-10-14	23 °C ± 3 °C	32 % ± 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 FSQ40	504 143
RF attenuator	901 508
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty: 1.1 dB

Results

Rated output power at RF connector 47.8 dBm.

Tested configuration	Port RFA primary [RMS dBm/ dB PAR[3)]]	Port RFA secondery[2)] [RMS dBm/ dB PAR[3)]]	Total power[1)] [RMS dBm]
B LTE BW 5 MHz	47.69/ 7.12	Not tested[2)]	50.69
M LTE BW 5 MHz	47.71/ 7.00	Not tested[2)]	50.71
M LTE BW 10 MHz	47.71/ 6.97	Not tested[2)]	50.71
M LTE BW 15 MHz	47.65/ 6.92	Not tested[2)]	50.65
T LTE BW 5 MHz	47.78/ 7.02	Not tested[2)]	50.78

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

[2)]: Measurements were limited to port RF A in primary mode due to the measurement result in LTE and WCDMA single carrier MIMO mode that shows that the ports are identical.

[3)]: The PAR value is the 0.1 % Peak to Average Ratio.

Remark

This unit is tested without antenna. ERP/EIRP compliance is addressed at the time of licensing, as required by the responsible FCC/IC Bureau(s). Licensee's are required to take into account maximum allowed antenna gain used in combination with above power settings to prevent the radiated output power to exceed the limits.

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
2013-10-11	23 °C ± 3 °C	29 % ± 5 %
2013-10-14	23 °C ± 3 °C	32 % ± 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
Rohde & Schwarz signal analyzer FSQ40	504 143
RF attenuator	901 508
High pass filter	901 502
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

MR WCDMA + LTE

Diagrams	WCDMA BW/[MHz]	LTE BW/[MHz]	Symbolic frequency	Tested Port
1 a-e	5	5	B	RF A
2 a-e	5	5	M	RF A
3 a-e	5	10	M	RF A
4 a-e	5	15	M	RF A
5 a-e	5	5	T	RF A
6 a-e	5	5	B_{IM}	RF A
7 a-e	5	5	T_{IM}	RF A

The diagrams are shown on the following pages.

Remarks

The emission at 9 kHz on some of 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 upper frequency boundary was chosen to cover 10x the highest TX fundamental frequency.

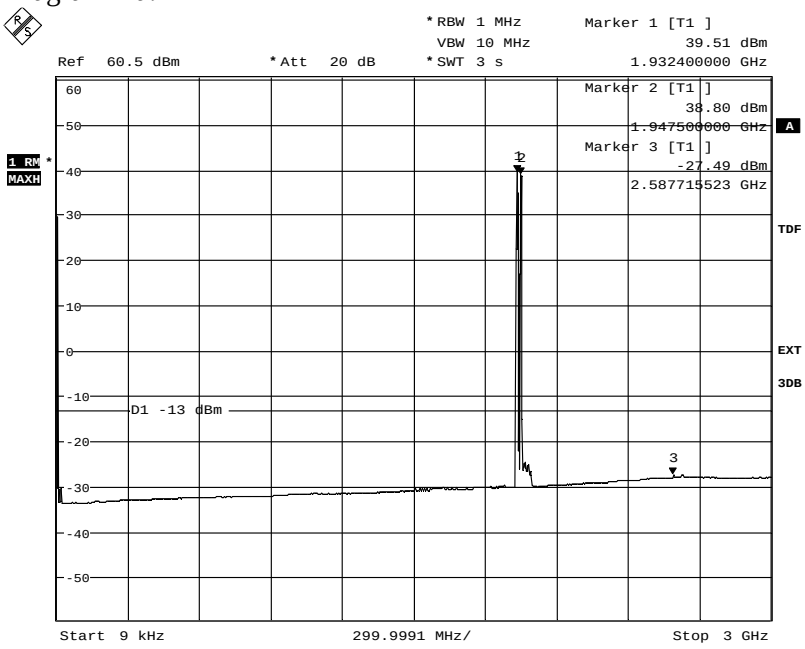
Limits

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

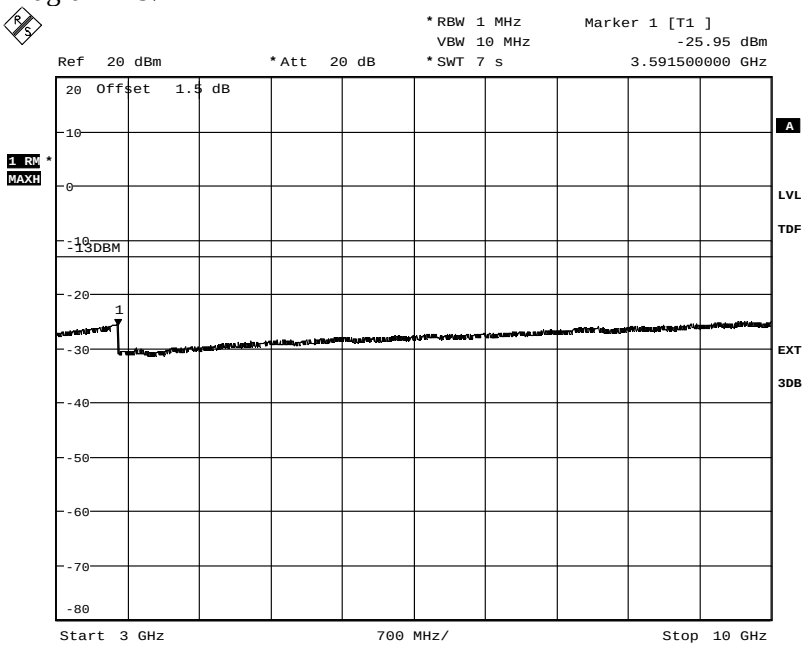
Appendix 3

Diagram 1 a:



Date: 11.OCT.2013 15:38:29

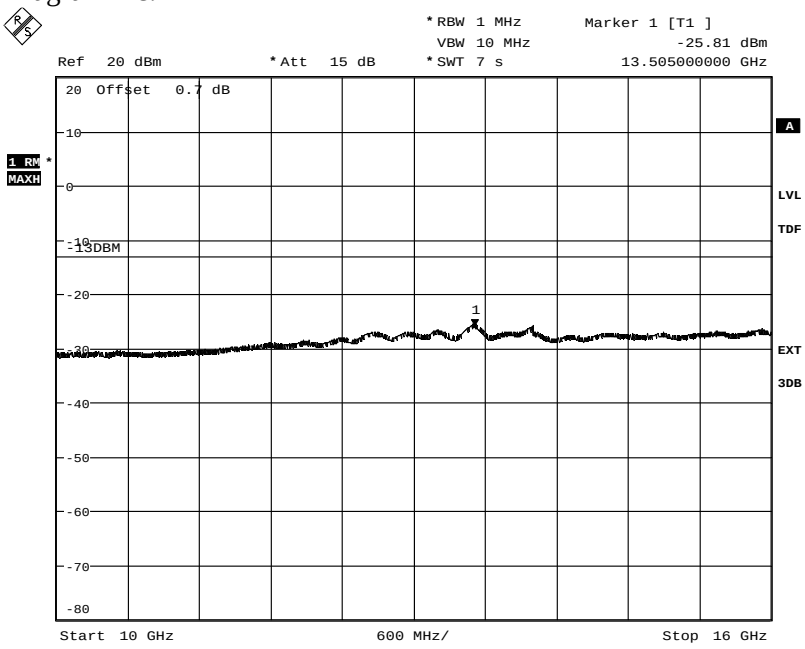
Diagram 1 b:



Date: 11.OCT.2013 15:44:56

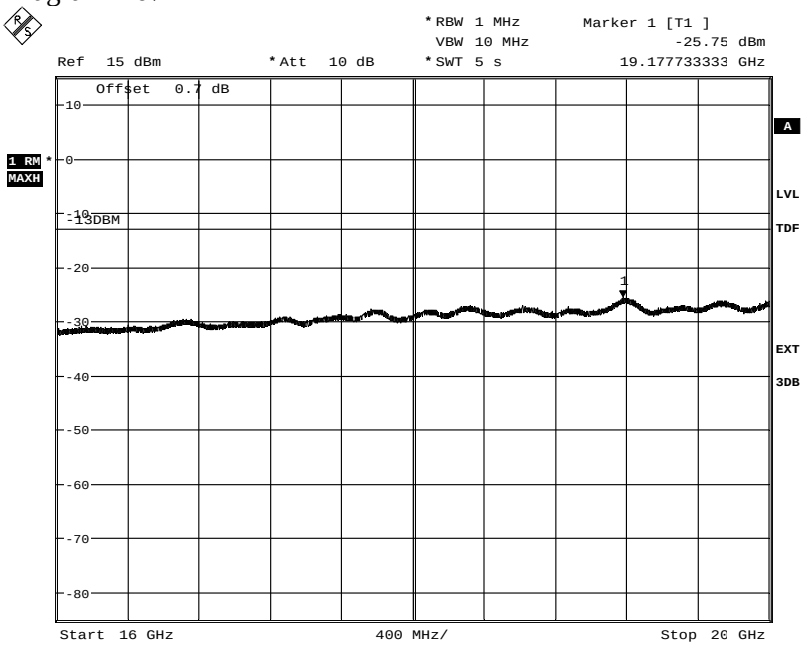
Appendix 3

Diagram 1 c:



Date: 11.OCT.2013 15:46:39

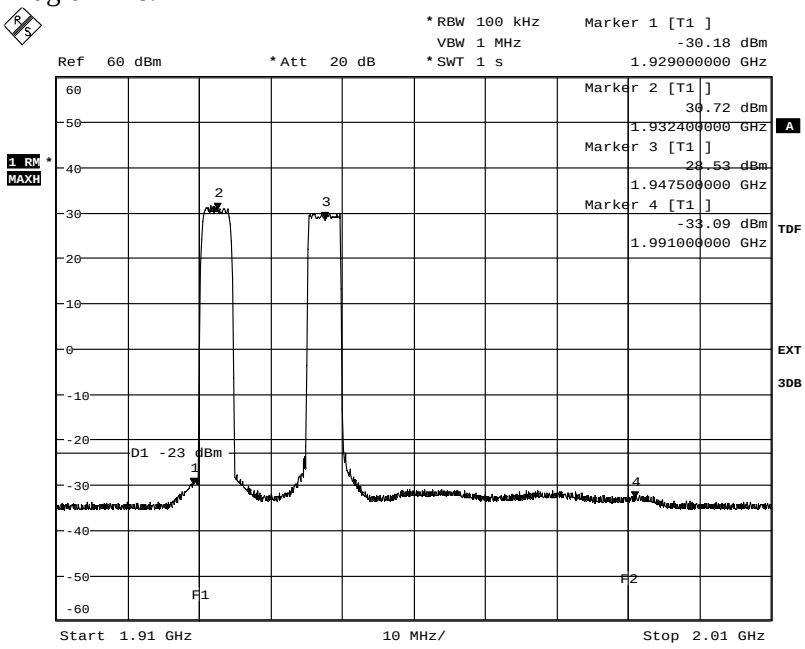
Diagram 1 d:



Date: 11.OCT.2013 15:47:53

Appendix 3

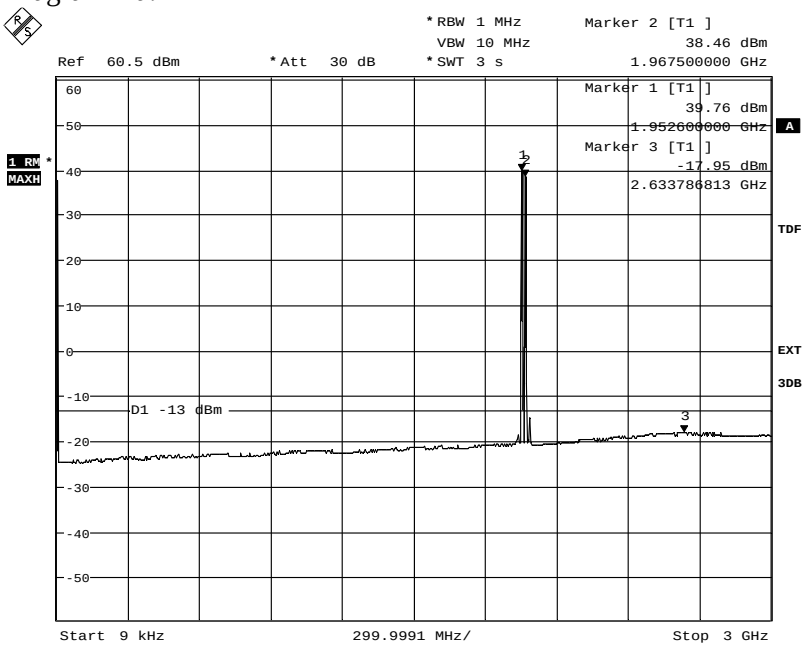
Diagram 1 e:



Date: 11.OCT.2013 15:42:36

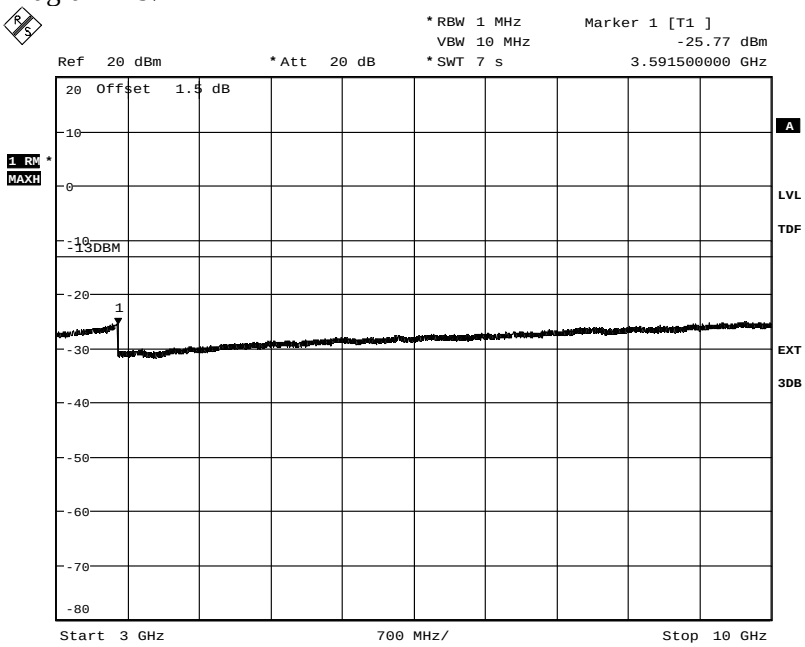
Appendix 3

Diagram 2 a:



Date: 11.OCT.2013 16:02:02

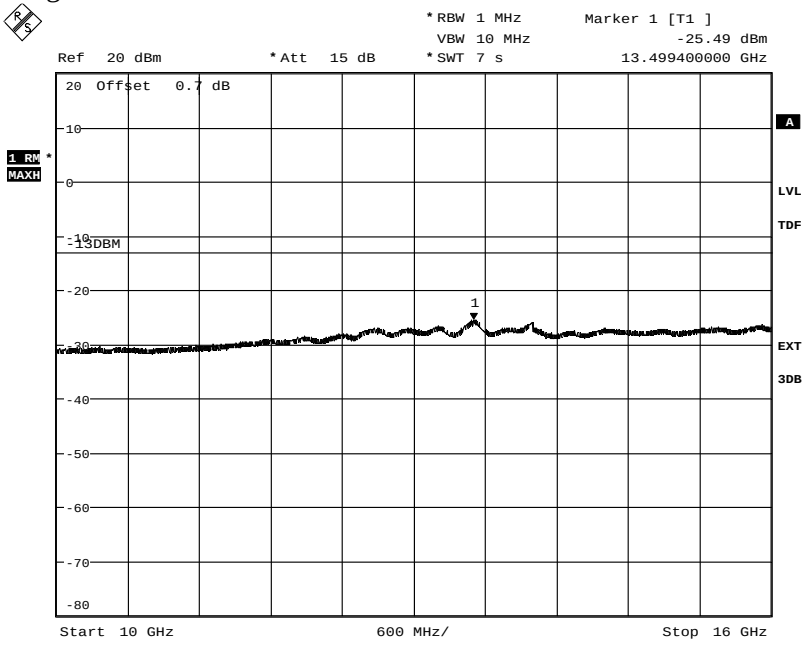
Diagram 2 b:



Date: 11.OCT.2013 15:58:53

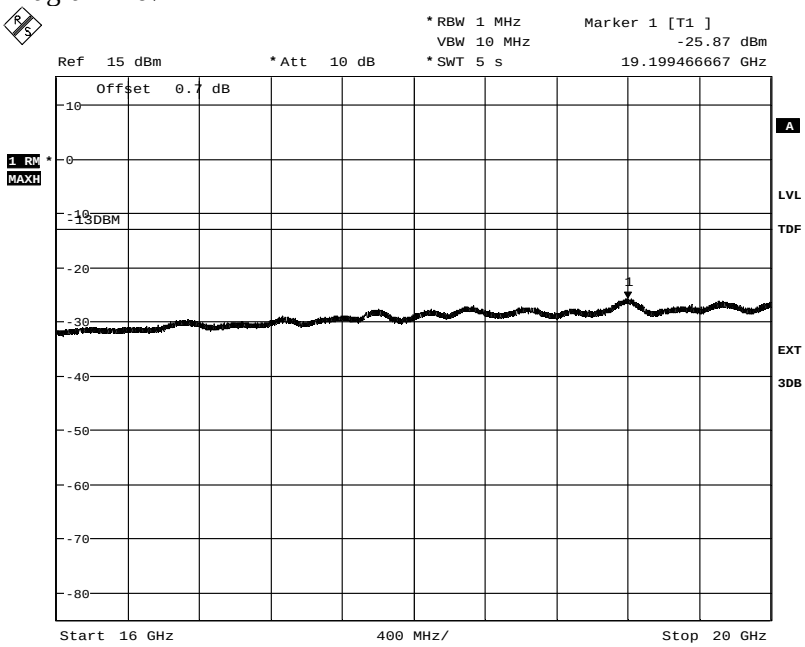
Appendix 3

Diagram 2 c



Date: 11.OCT.2013 15:58:09

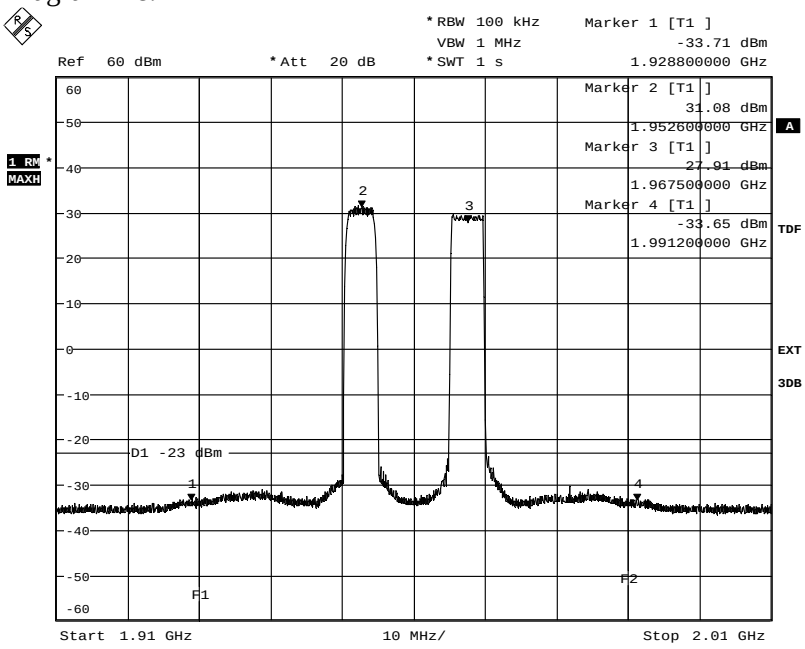
Diagram 2 d:



Date: 14.OCT.2013 10:58:14

Appendix 3

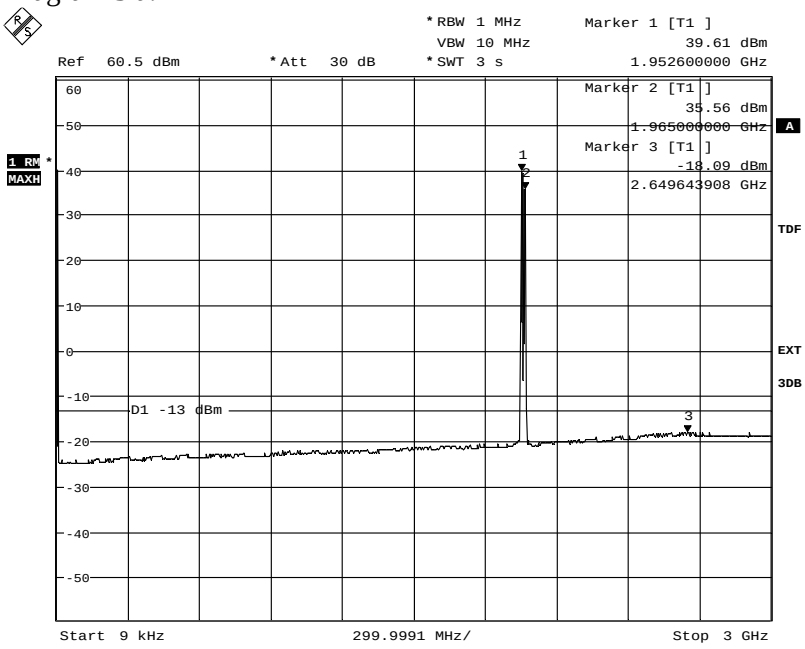
Diagram 2 e:



Date: 11.OCT.2013 16:03:56

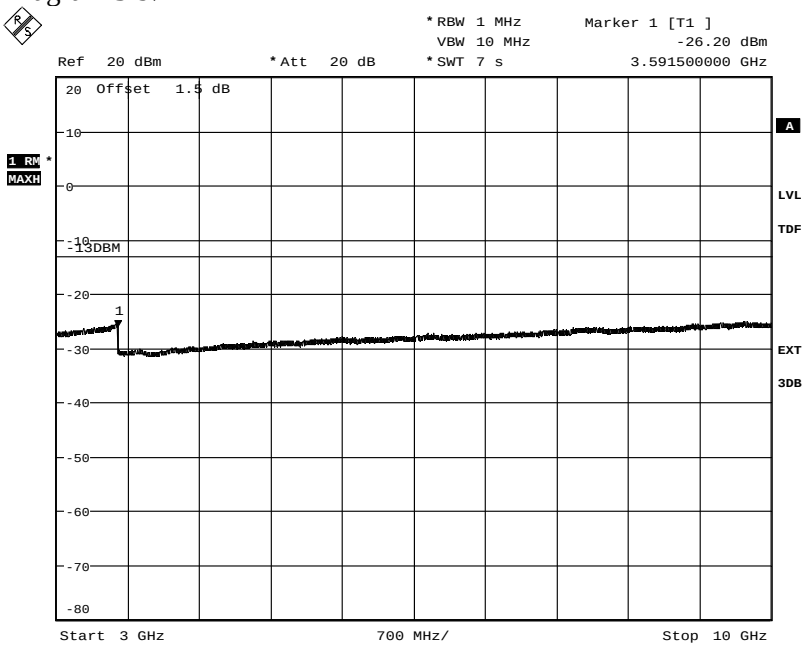
Appendix 3

Diagram 3 a:



Date: 11.OCT.2013 16:11:20

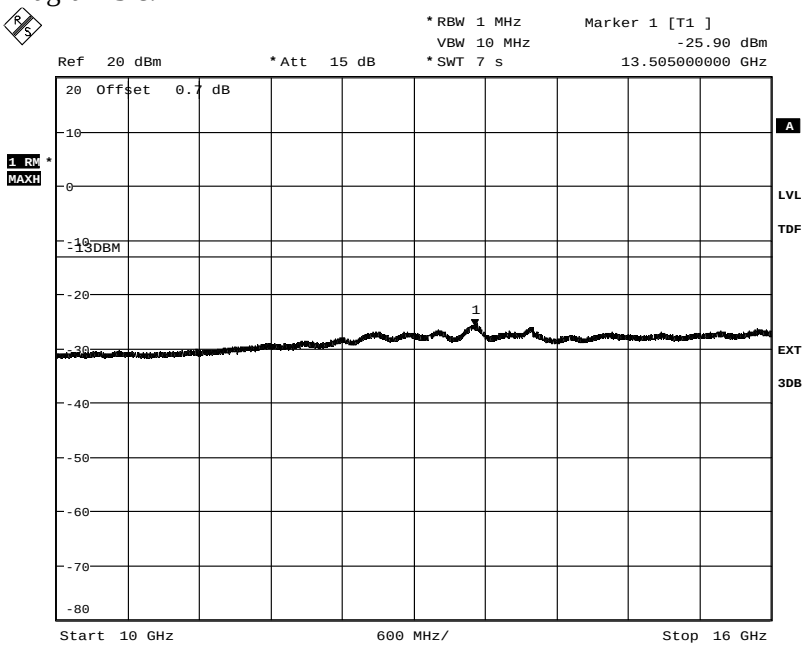
Diagram 3 b:



Date: 11.OCT.2013 16:14:38

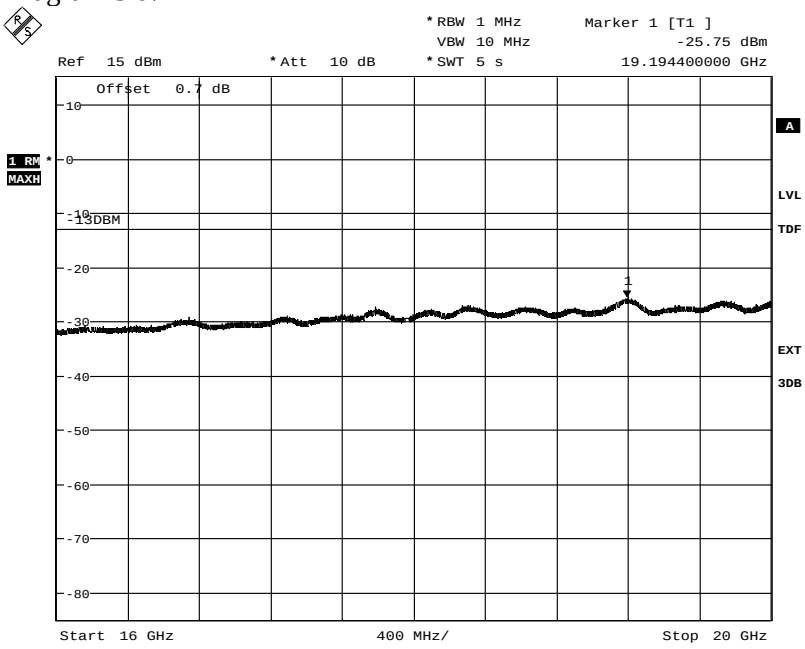
Appendix 3

Diagram 3 c:



Date: 11.OCT.2013 16:15:42

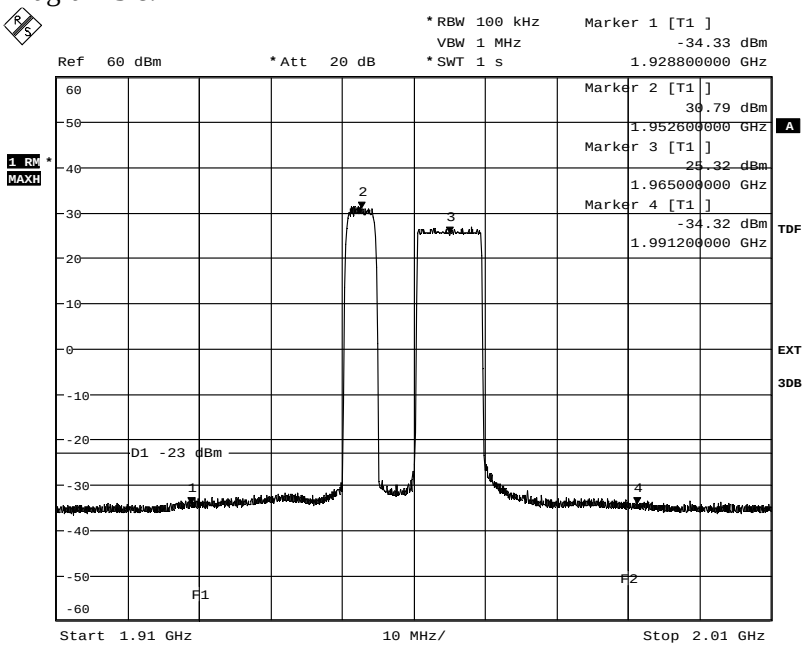
Diagram 3 d:



Date: 11.OCT.2013 16:17:04

Appendix 3

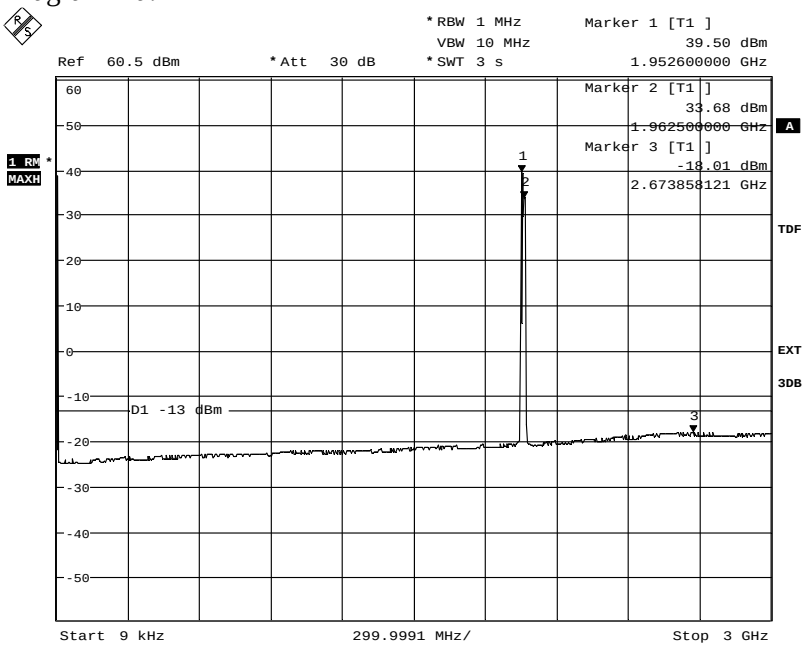
Diagram 3 e:



Date: 11.OCT.2013 16:09:36

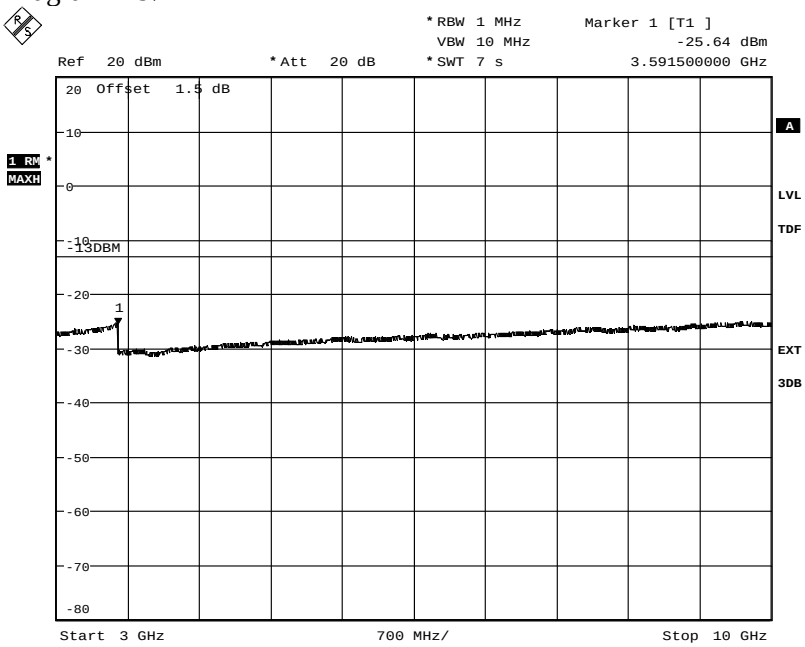
Appendix 3

Diagram 4 a:



Date: 11.OCT.2013 16:22:28

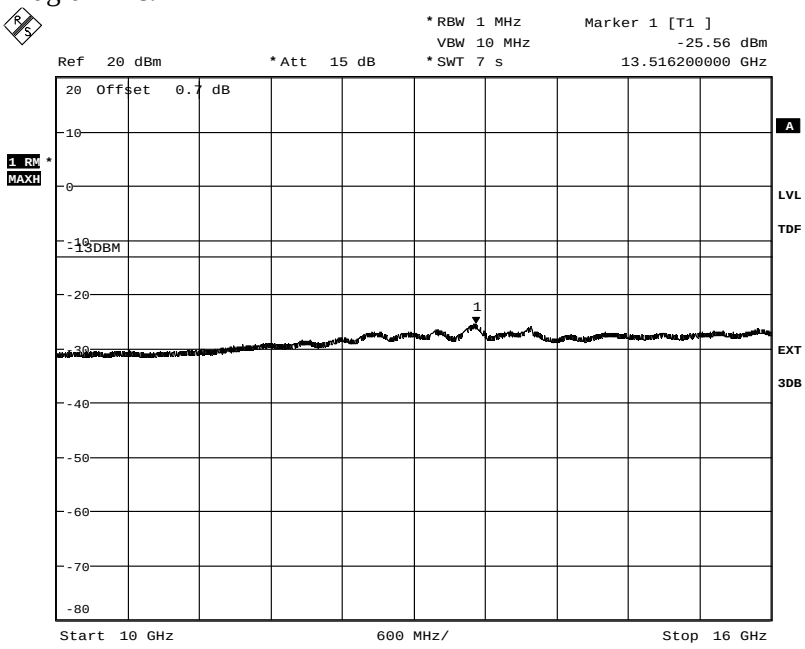
Diagram 4 b:



Date: 11.OCT.2013 16:21:01

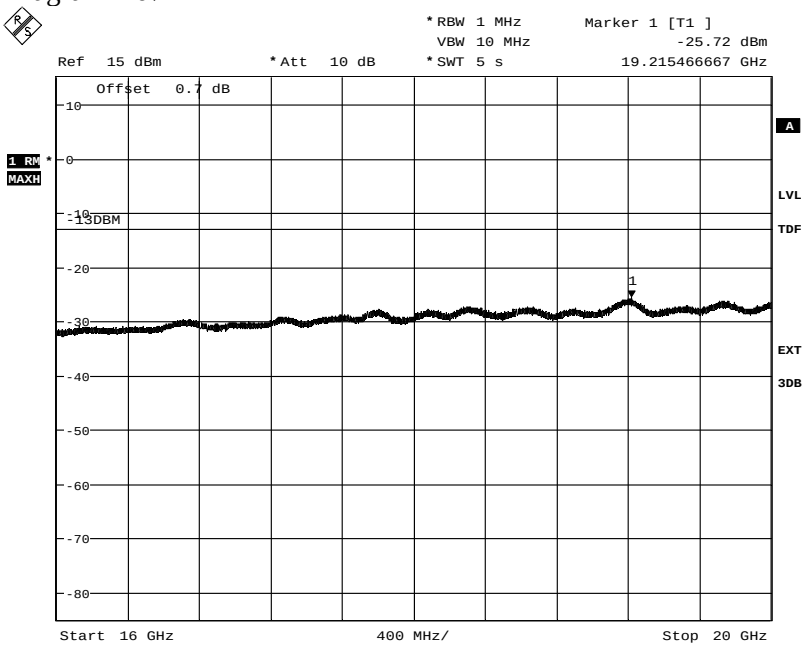
Appendix 3

Diagram 4 c:



Date: 11.OCT.2013 16:19:33

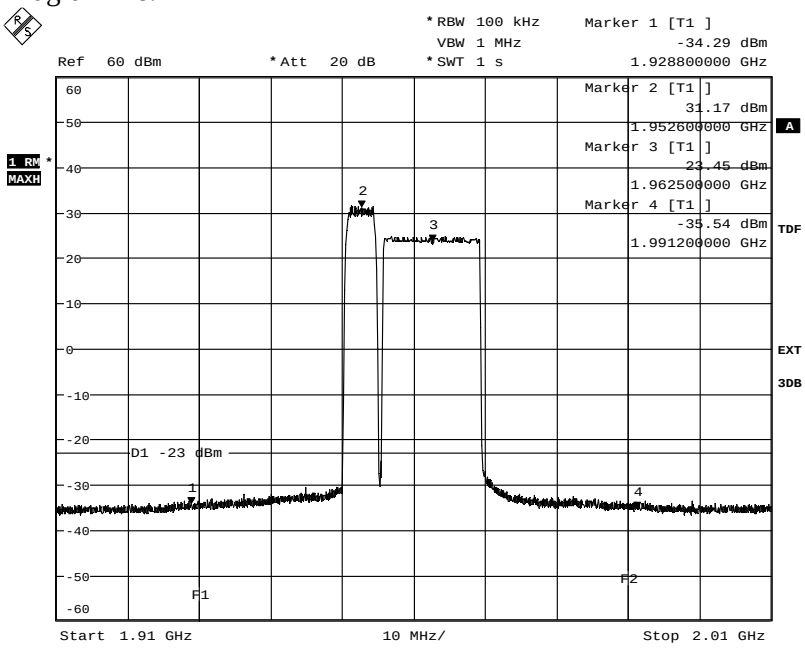
Diagram 4 d:



Date: 11.OCT.2013 16:18:09

Appendix 3

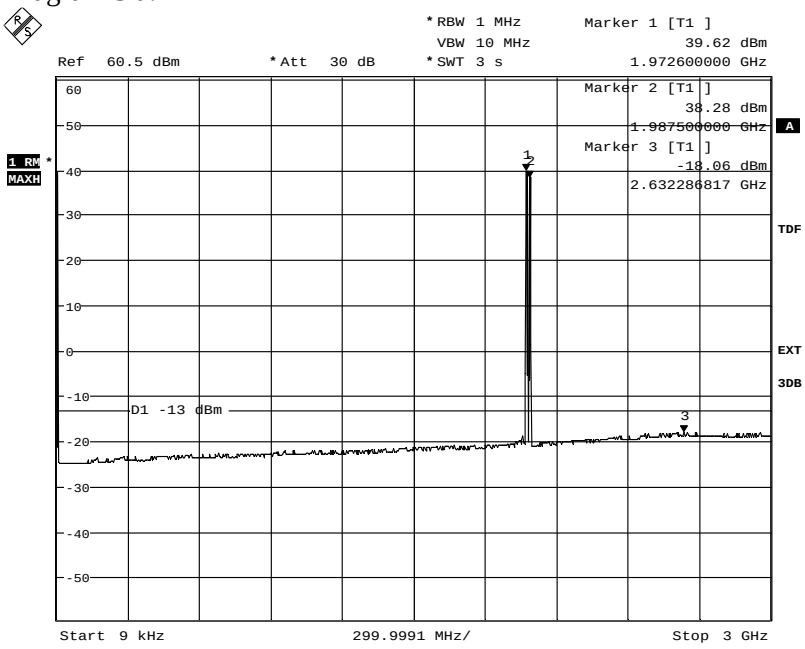
Diagram 4 e:



Date: 11.OCT.2013 16:23:32

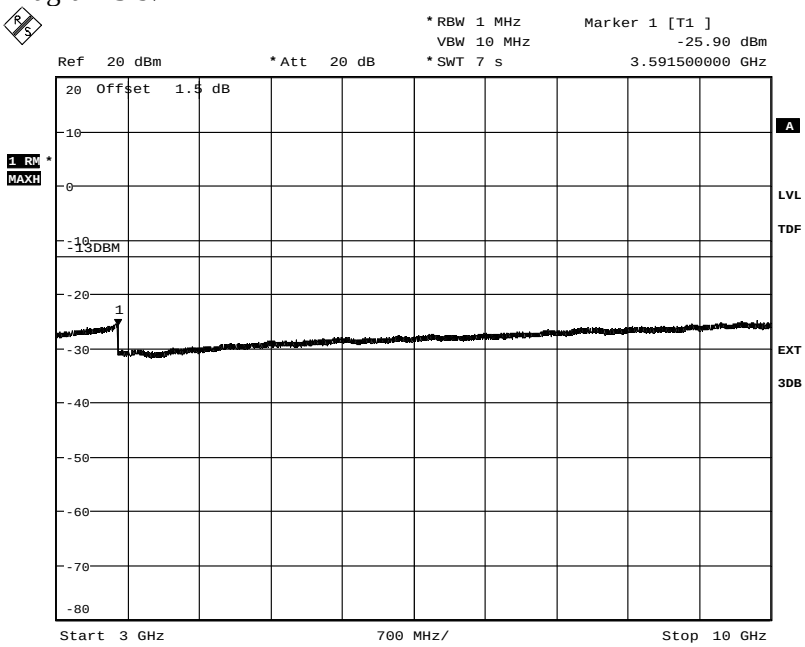
Appendix 3

Diagram 5 a:



Date: 14.OCT.2013 09:58:27

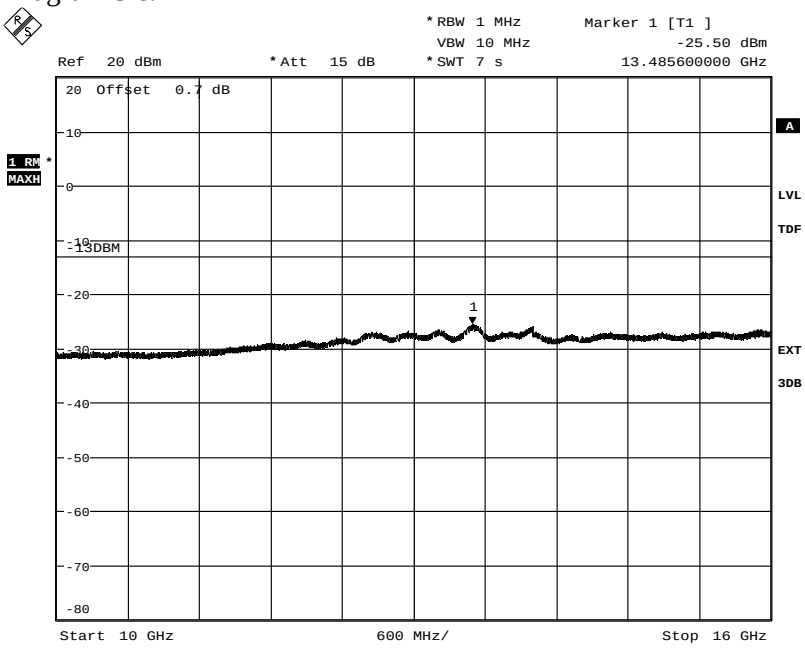
Diagram 5 b:



Date: 14.OCT.2013 09:59:52

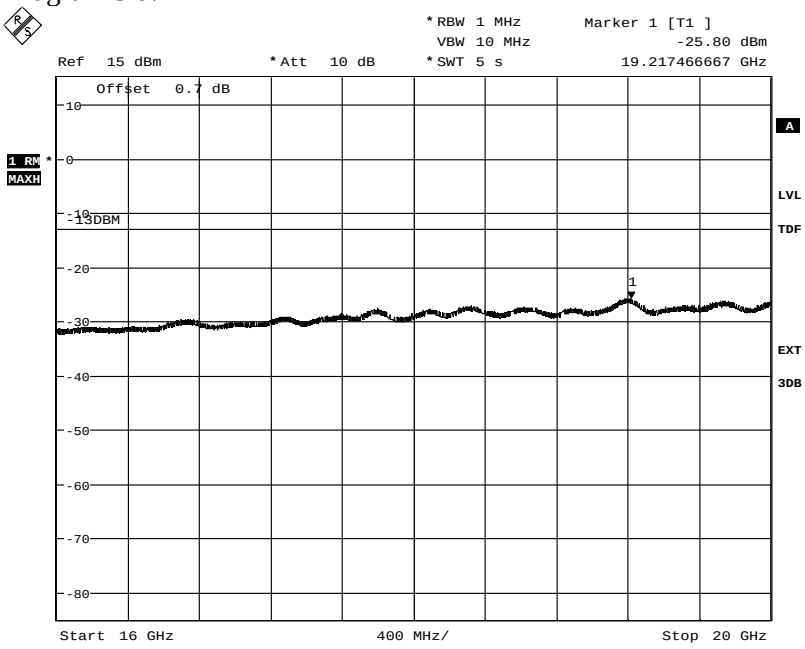
Appendix 3

Diagram 5 c:



Date: 14.OCT.2013 11:03:20

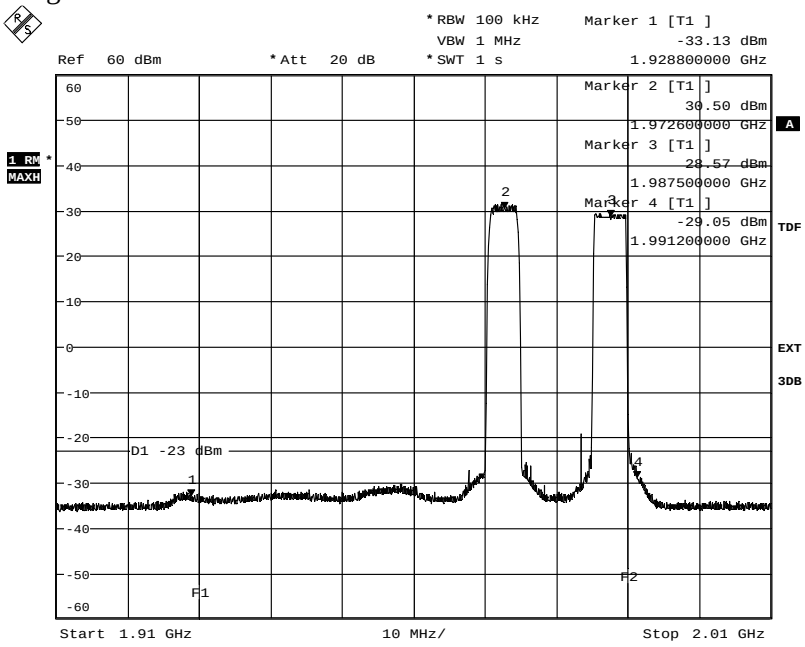
Diagram 5 d:



Date: 14.OCT.2013 10:02:53

Appendix 3

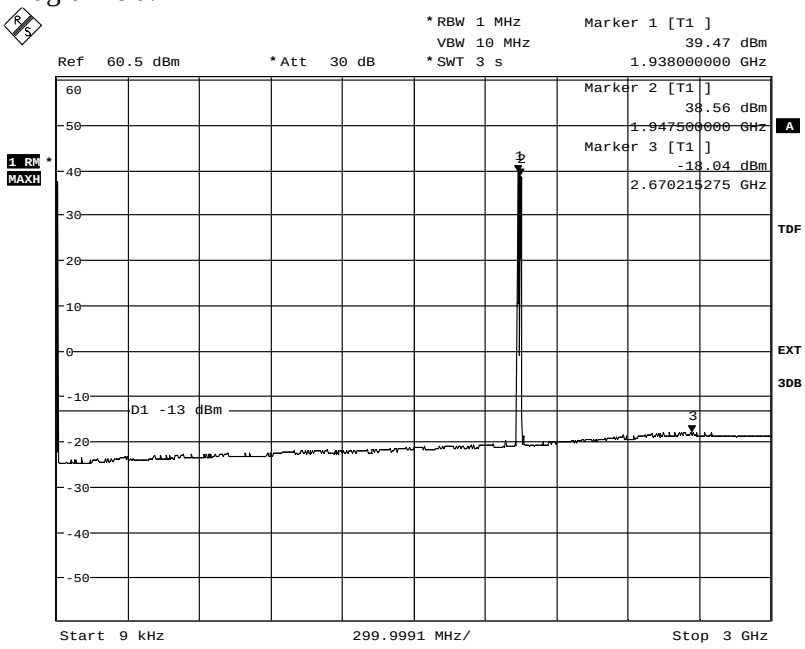
Diagram 5 e:



Date: 14.OCT.2013 09:57:09

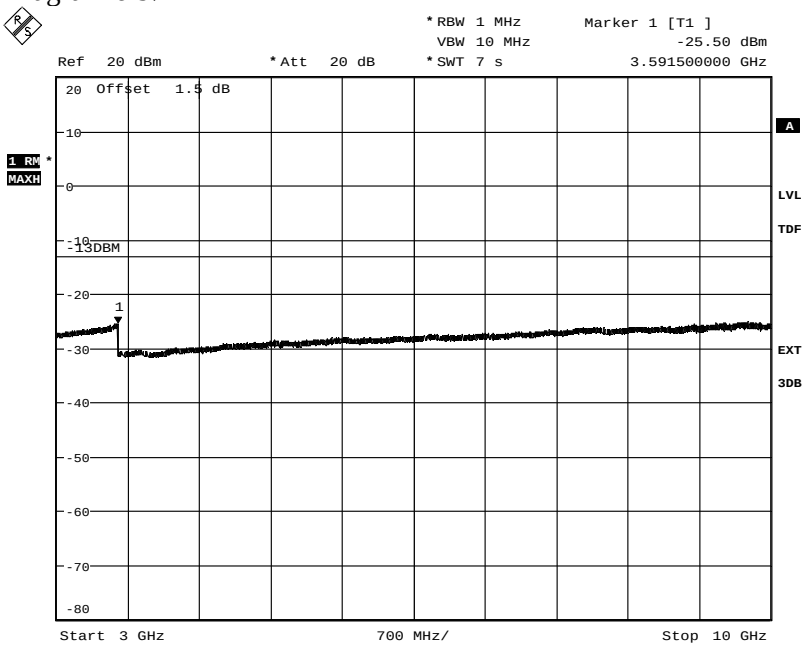
Appendix 3

Diagram 6 a:



Date: 14.OCT.2013 10:30:52

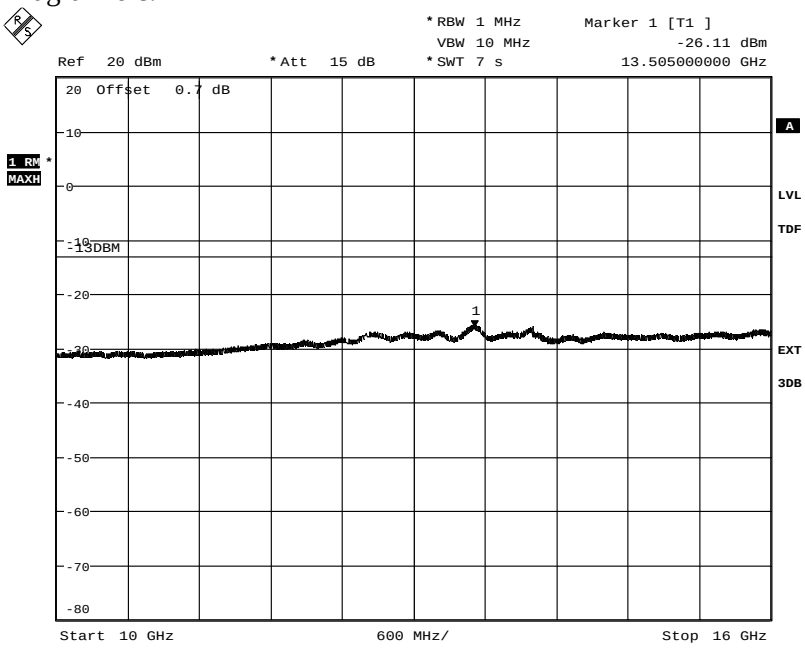
Diagram 6 b:



Date: 14.OCT.2013 10:25:41

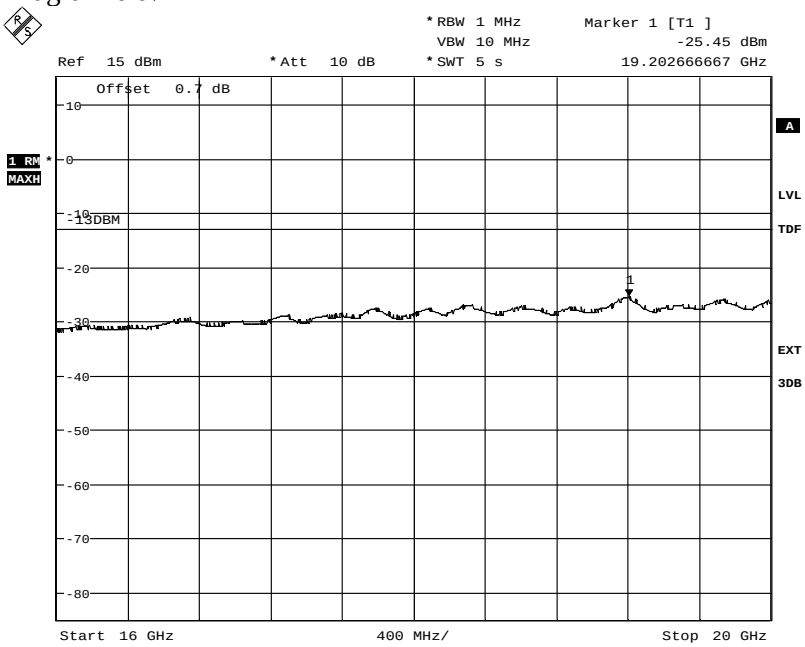
Appendix 3

Diagram 6 c:



Date: 14.OCT.2013 10:24:50

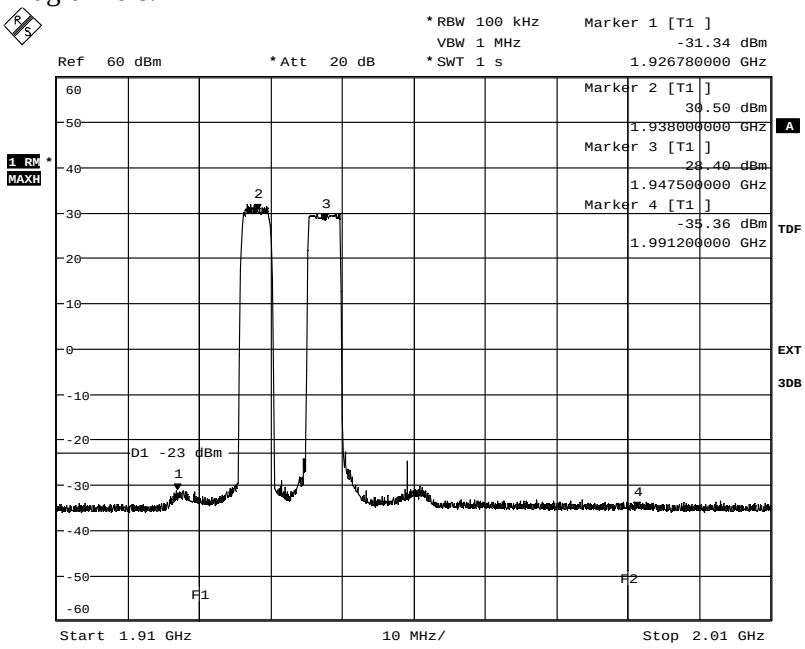
Diagram 6 d:



Date: 14.OCT.2013 10:23:54

Appendix 3

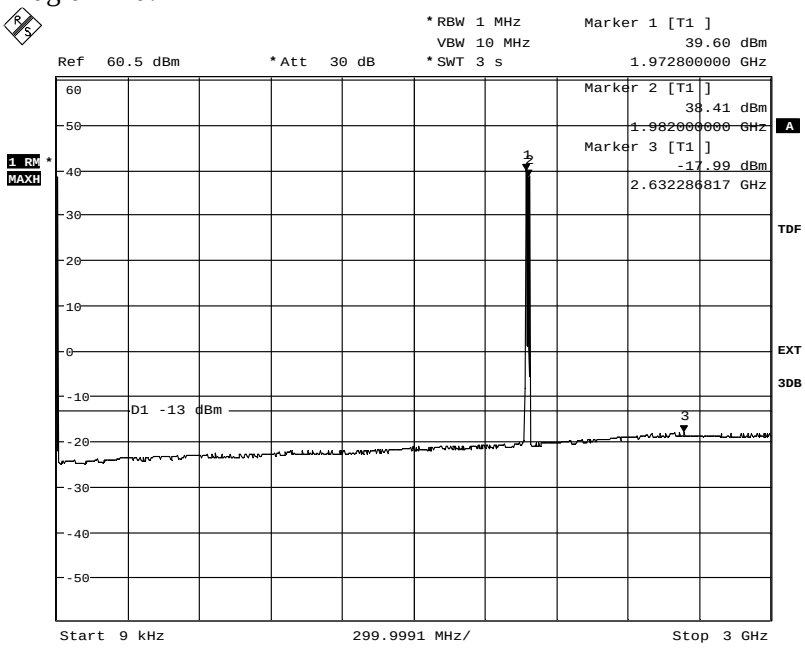
Diagram 6 e:



Date: 14.OCT.2013 10:41:00

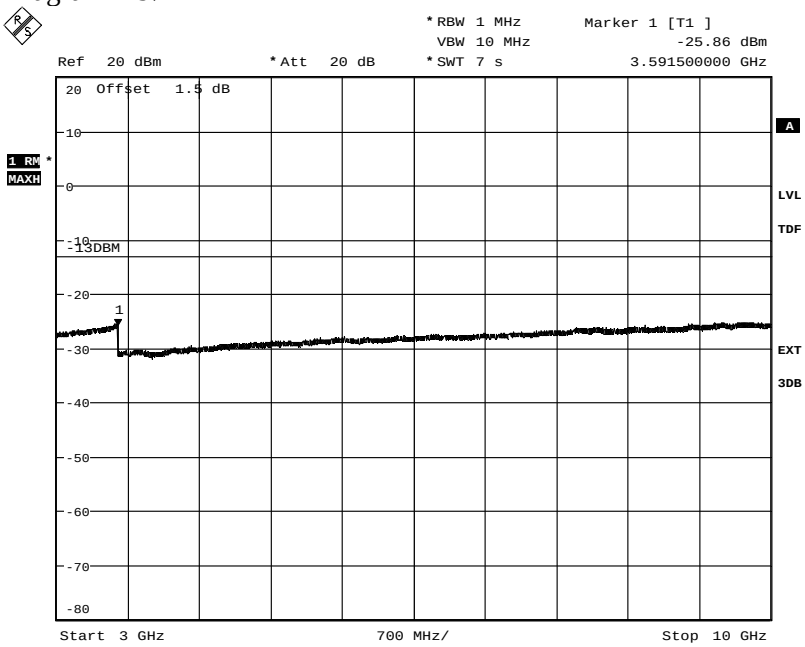
Appendix 3

Diagram 7 a:



Date: 14.OCT.2013 10:47:37

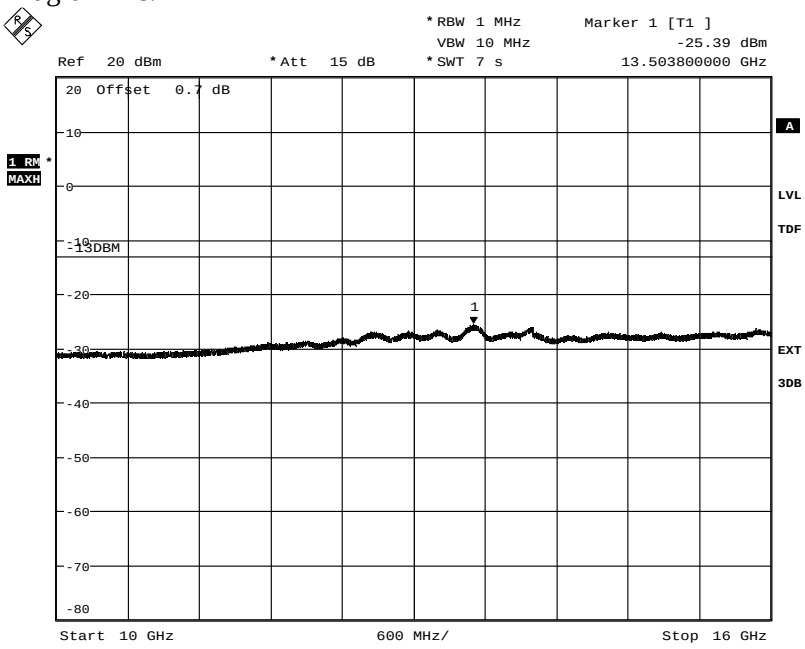
Diagram 7 b:



Date: 14.OCT.2013 10:49:24

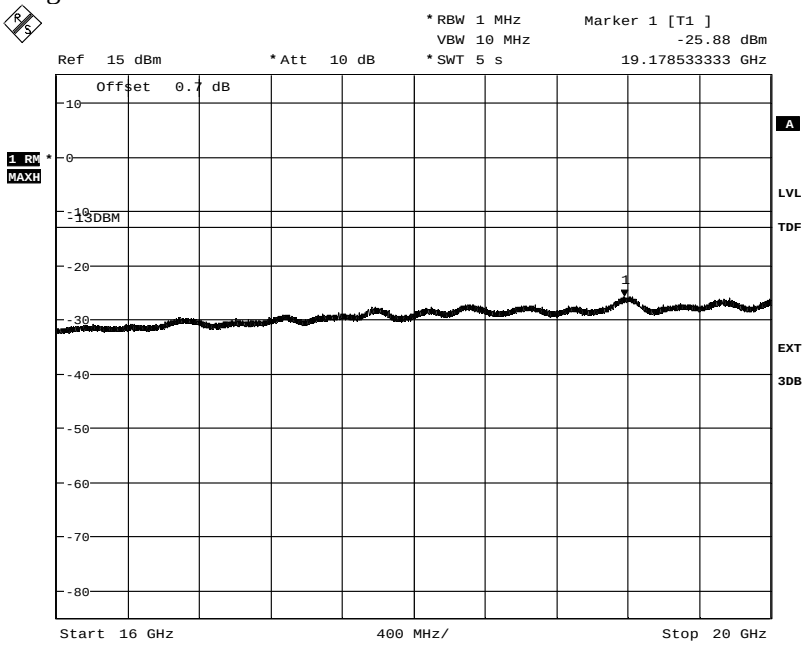
Appendix 3

Diagram 7 c:



Date: 14.OCT.2013 10:50:10

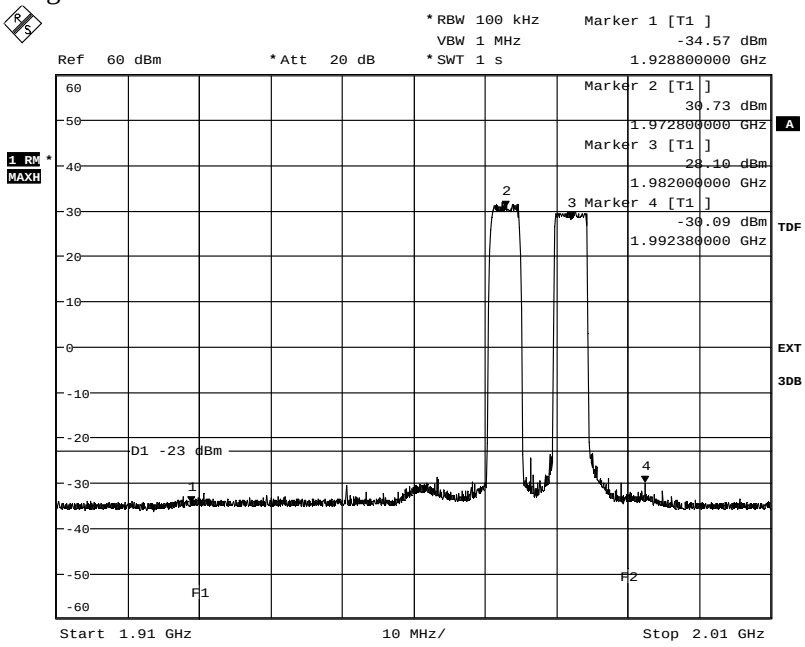
Diagram 7 d:



Date: 14.OCT.2013 10:50:59

Appendix 3

Diagram 7 e:



Date: 14.OCT.2013 10:46:30

Appendix 4

Field strength of spurious radiation measurements according to 47 CFR 2.1053 / IC RSS-139 6.5

Date	Temperature	Humidity
2013-10-09	22 °C ± 3 °C	47 % ± 5 %
2013-10-10	23 °C ± 3 °C	45 % ± 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.

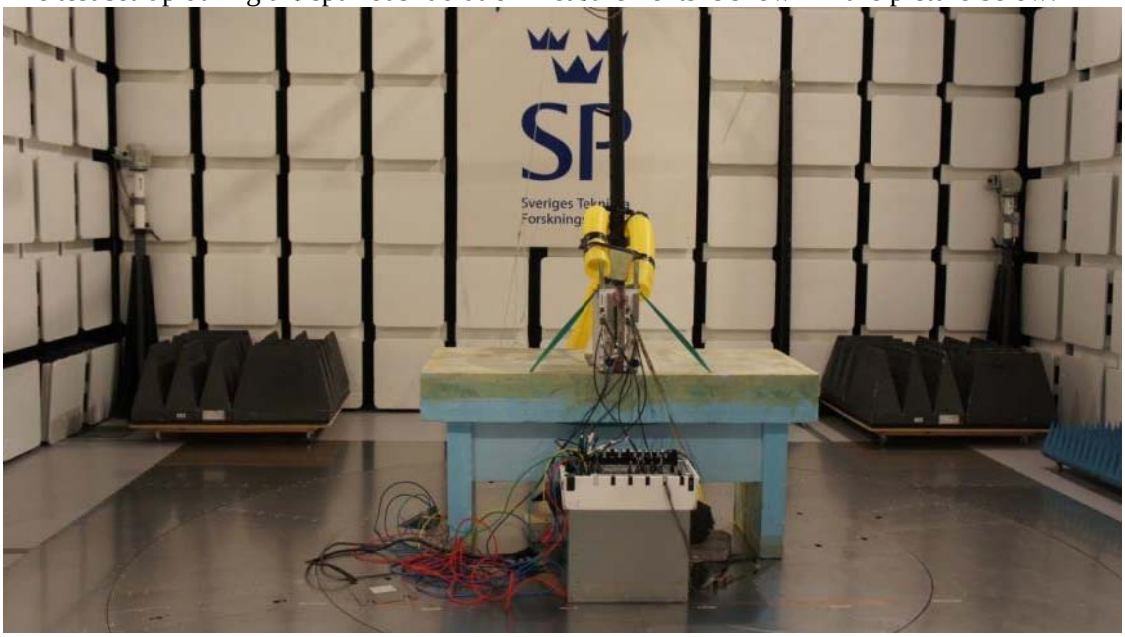
In the frequency range 30 MHz - 20 GHz the measurement was performed in power with a RBW of 1 MHz. A propagation loss in free space was calculated. The used formula was $\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.

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 to the standard.

The test set-up during the spurious radiation measurements is shown in the picture below:



Measurement equipment

Measurement equipment	SP number
Semi anechoic chamber	503 881
R&S ESU 26	901 553
R&S FSIQ 40	503 738
EMC 32 ver. 8.52.0	503 899
Chase Bilog Antenna CBL 6111A	503 182
EMCO Horn Antenna 3115	502 175
High pass filter, RLC Electronics	901 373
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

Tested configurations

LTE BW [MHz]	Symbolic name
5	B
5	M
10	M
15	M
5	T

Results for worst emissions found

Diagram	LTE BW [MHz]	Symbolic name
1 a-d	5	M

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, 3.6 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:

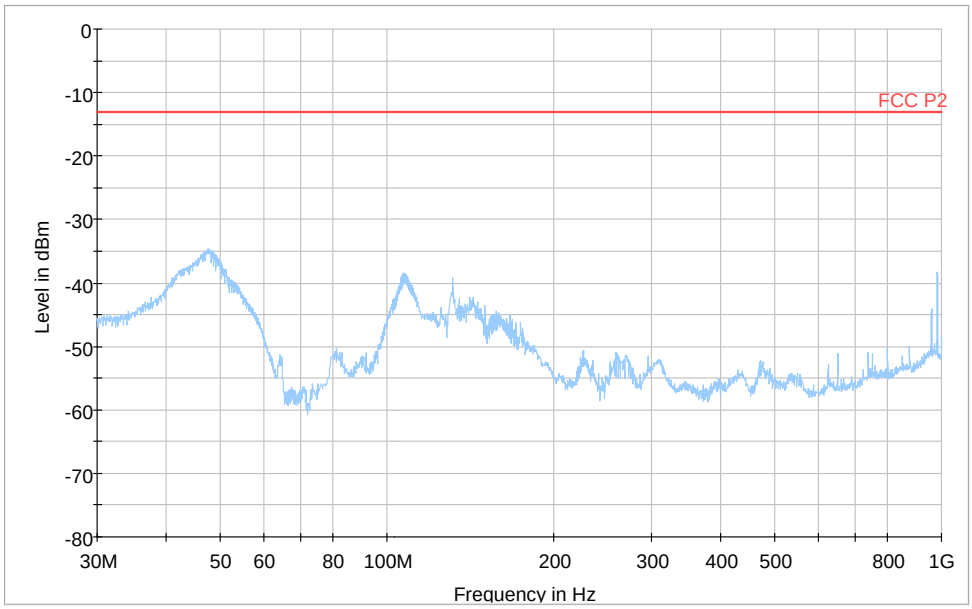
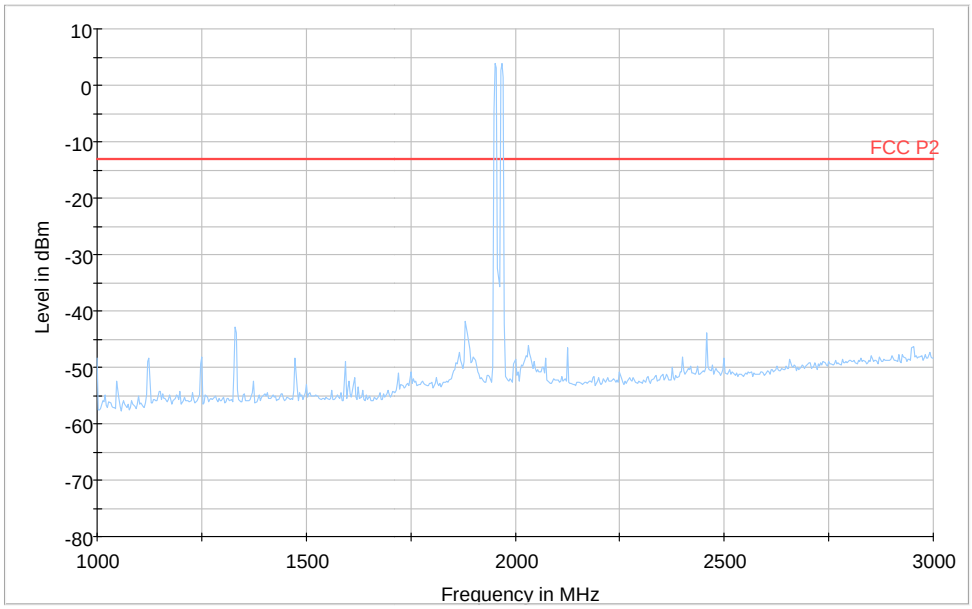


Diagram 1 b:



Note: The emission between 1952.6 MHz and 1967.5 MHz are the carrier frequencies and shall be ignored in the context.

Appendix 4

Diagram 1 c:

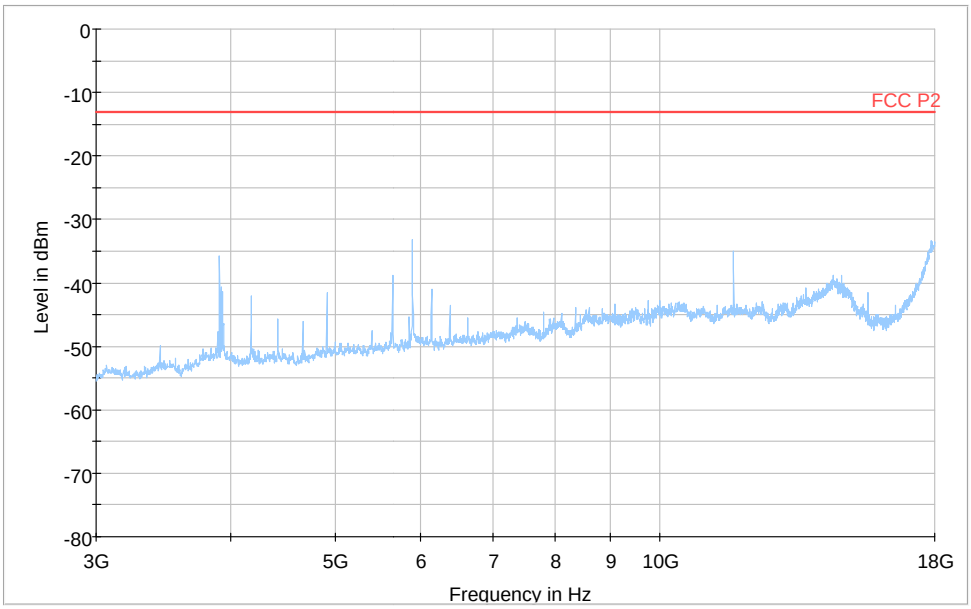
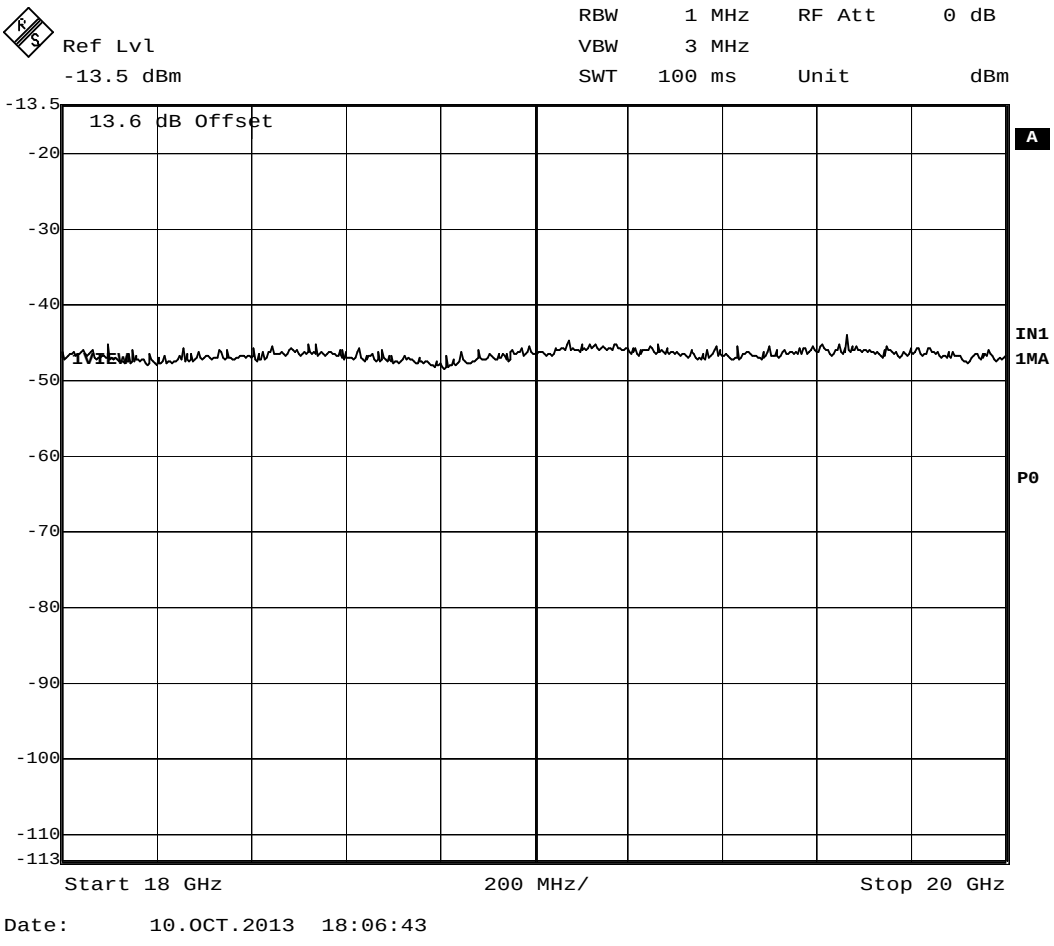


Diagram 1 d:



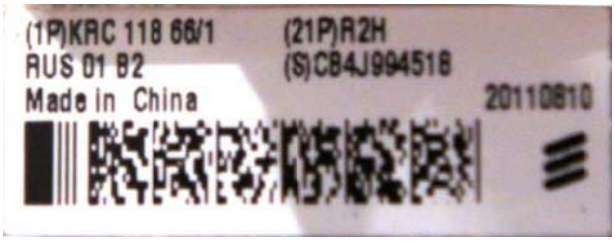
Appendix 5

External photos

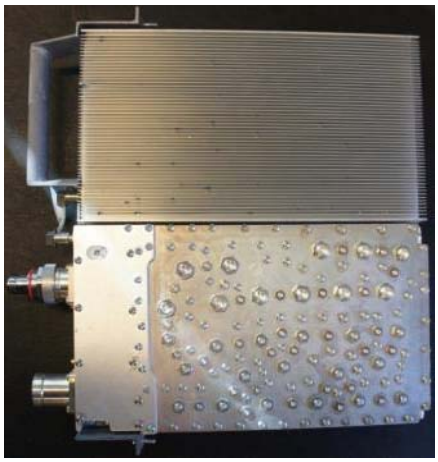
Front side:

Back side:

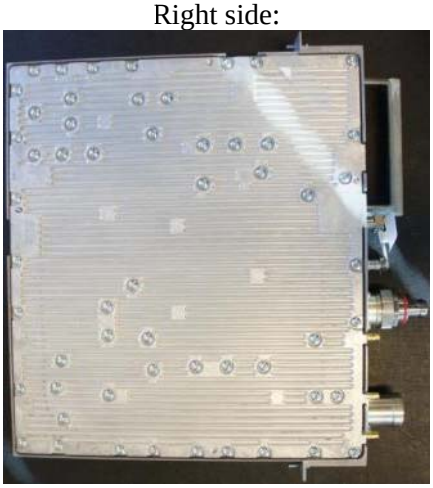
Product Label:



Left side:



Right side:



Appendix 5

Top side:

Bottom side: