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Class II permissive change on RUS 01 B2 1900 MHz radio equipment with FCC ID: TA8AKRC11866-2 and IC: 287AB-AS118662 (6 appendices)

Test object

Product name: RUS 01 B2
Product number: KRC 118 66/2, R1G

Summary

See appendix 1 for general information and appendix 6 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-133 6.5 Band edge	Yes	3
2.1051 / RSS-136 6.5 Spurious emission at antenna terminals	Yes	4
2.1053 / RSS-136 6.5 Field strength of spurious radiation	Yes	5

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.

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Appendix 1

Description of the test object

Equipment:	Radio equipment RUS 01 B2 Product number KRC 118 66/2 FCC ID: TA8AKRC11866-2 IC: 287AB-AS118662 IC MODEL NO: AS118662
Operating bands:	TX: 1930 – 1990 MHz RX: 1850 – 1910 MHz
Antenna ports:	1 TX/RX port 1 RX port
RF configurations:	Single carrier, multi carrier, TX diversity and MIMO 2x2
Nominal output power per antenna port:	Total power: 1x 49 dBm, (80 W), 2x 46 dBm (2x 40 W) Total number of carriers: 2
Antenna:	No dedicated antenna, handled during licensing
LTE Modulations:	QPSK, 16QAM and 64QAM
Channel bandwidth:	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz
Nominal supply voltage:	-48VDC

Purpose of test

The purpose of this test is to justify a Class II Permissive Change of the test object to include the use of multi carrier with LTE access technology, by verifying compliance to the performance characteristics specified in applicable items of FCC CFR 47 and Industry Canada RSS-133 and RSS-Gen.

Appendix 1

Operation modes during measurements

LTE Single RAT, MIMO mode

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. The settings below were used for all measurements if not otherwise noted.

LTE MIMO mode 2- carriers

E-TM1.1

Channel bandwidth 1.4 MHz.

Measurements were performed with the test object configured for the maximum transmit power applicable for the tested configuration.

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 set-up diagram), running in primary mode.

Radiated measurements

The test object was tested stand-alone. It was powered with -48 VDC. All measurements were performed with the test object configured for maximum transmit power.

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 24, 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-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
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	2014-08	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
Schwarzbeck preamplifier BBV972	2014-04	504 085
Temperature and humidity meter, Testo 635	2014-06	504 203
Temperature and humidity meter, Testo 625	2014-06	504 188

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 2013-09-27.

Manufacturer's representative

Christer Gustavsson, Ericsson AB.

Test engineers

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

Test participant

None.

Appendix 1

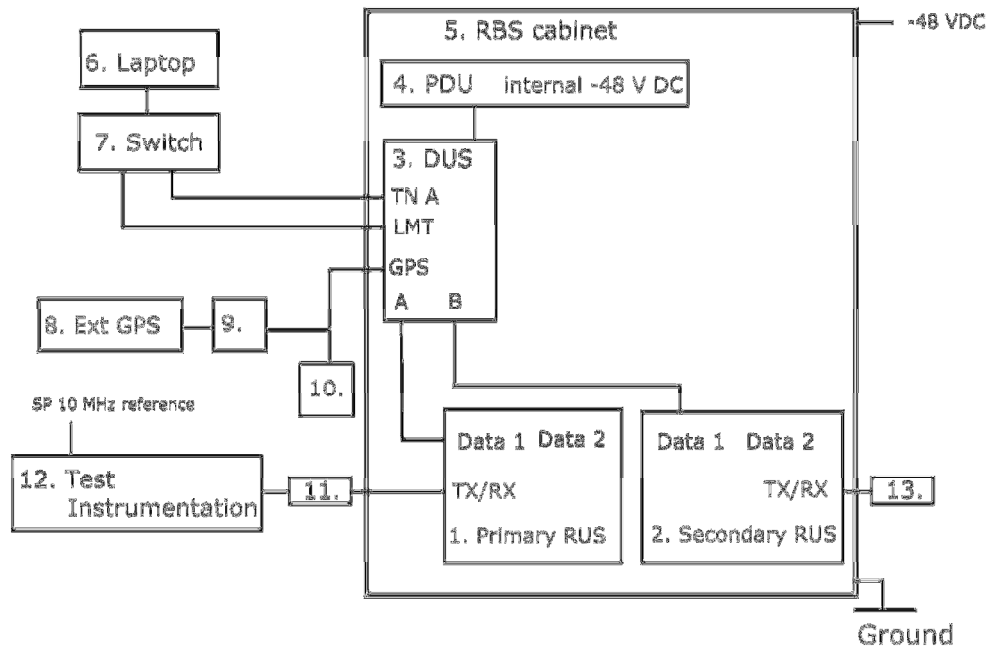
Test frequencies used for conducted and radiated measurements

EARFCN Downlink	Frequency [MHz]	Symbolic name	Comment
607 657	1930.7 1935.7	B2	TX bottom frequency in 1.4 MHz BW configuration 2 carriers.
615 665	1931.5 1936.5	B3	TX bottom frequency in 3 MHz BW configuration 2 carriers.
607 621	1930.7 1932.1	B2im1	TX bottom frequency in 1.4 MHz BW configuration 2 carriers.
700 812	1940.0 1951.2	B2im2	TX bottom frequency in 1.4 MHz BW configuration 2 carriers.
850 950	1955.0 1965.0	M2	TX band mid frequency in 1.4 MHz BW configuration 2 carriers.
875 925	1957.5 1962.5	M3	TX band mid frequency in 1.4 MHz BW configuration 2 carriers.
1193 1143	1989.3 1984.3	T2	TX bottom frequency in 1.4 MHz BW configuration 2 carriers.
1185 1135	1988.5 1983.5	T3	TX bottom frequency in 3 MHz BW configuration 2 carriers.
1193 1179	1989.3 1987.9	T2im1	TX bottom frequency in 1.4 MHz BW configuration 2 carriers.
1100 988	1980.0 1968.8	T2im2	TX bottom frequency in 1.4 MHz BW configuration 2 carriers.

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

Appendix 1

Test set-up conducted measurements



Note: Unconnected interfaces were omitted in the picture for simplicity, but are listed in the interface table on page 7.

Test object:

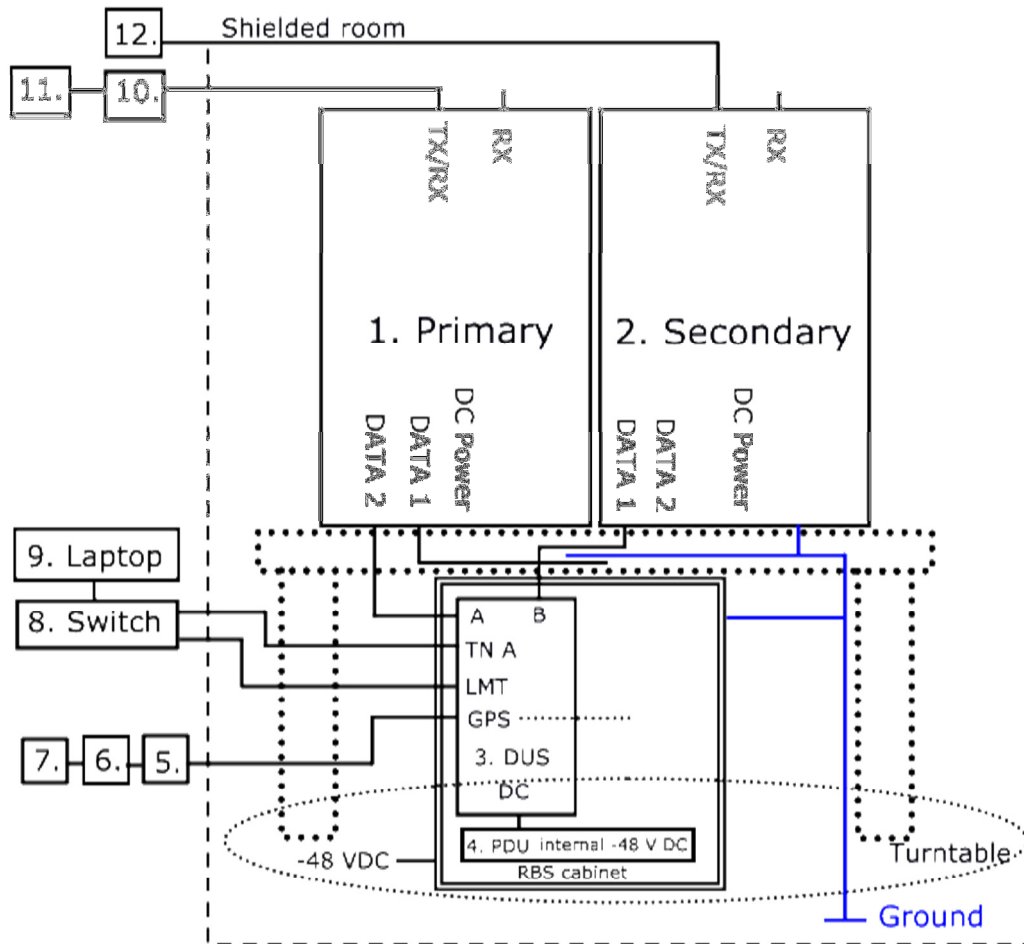
1.	RUS 01 B2, KRC 118 66/2, rev. R1G, s/n: D169299399 ,Test object: primary/ secondary
2.	RUS 01 B2, KRC 118 66/2, rev. R1G, s/n: D169299373, Dummy (secondary/ primary) working software CXP 901 3268/6, rev. R49FH with FCC ID: TA8AKRC11866-2 and IC: 287AB-AS118662

Functional test equipment:

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

Appendix 1

Test setup radiated measurements



Test object:

1. RUS 01 B2, KRC 118 66/2, rev. R1G, s/n: D169299399 primary
2. RUS 01 B2, KRC 118 66/2, rev. R1G, s/n: D169299373 secondary
working software CXP 901 3268/6, rev. R49FH with
FCC ID: TA8AKRC11866-2 and IC: 287AB-AS118662

Appendix 1

Functional test equipment:

3.	DUS 41 01, KDU 137 624/1, rev:R5A, s/n: D165724695
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.	Switch Netgear FS726T
9.	Laptop, EliteBook 8560w, BAMS – 1001236856
10.	Attenuator
11.	ESI 26, SP number: 503 292, for supervision purpose only
12.	Terminator

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, no cable attached	RF
RX B I/O, no cable attached	RF
Ground wire	Ground

RBS software:

RAT	Software	Revision
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
2013-11-07	23 °C ± 3 °C	31 % ± 5 %
2013-11-08	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
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 49 dBm.

Symbolic name	Port RFA primary [RMS dBm/ dB PAR ²⁾]	Port RFA secondary [RMS dBm/ dB PAR ²⁾]	Total power ¹⁾ [RMS dBm]
B2	48.28/ 6.73	48.25/ 6.75	51.28
M3	48.23/ 6.71	48.23/ 6.73	51.24
T2	48.15/ 6.73	48.10/ 6.73	51.14
T3	48.56/ 6.51	48.53/ 6.51	51.56

¹⁾: Measured according to FCC KDB662911 D01 Multiple Transmitter Output v02r01. Method E), 1), Total power is the sum of the conducted power levels measured at the various output ports.

²⁾: The PAR value is the 0.1 % Peak to Average Ratio.

Appendix 2

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 equivalent isotropically radiated power (e.i.r.p.) may not exceed 3280 W (EIRP) / MHz.
The Peak to Average Ratio (PAR) may not exceed 13 dB.

RSS-133 6.4: The average equivalent isotropically radiated power (e.i.r.p.) limits in SRSP-510 apply. Base station transmitters operating in the band 1930 – 1995 MHz shall not have output power exceeding 100 Watts.
The Peak to Average Ratio (PAR) may not exceed 13 dB.

Complies?	Yes
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Appendix 3

Band edge measurements according to CFR 47 §2.1051 / IC RSS-133 6.5

Date	Temperature	Humidity
2013-11-07	22 °C ± 3 °C	31 % ± 5 %
2013-11-08	22 °C ± 3 °C	31 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. 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.

FCC rules specify a RBW of at least 1% of the fundamental emission bandwidth (EBW) for offsets up to 1 MHz from the band edge and a RBW of 1 MHz for measurements of emissions more than 1 MHz away from the band edges.

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
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Appendix 3

Results

2- carrier, MIMO

Diagram	BW configuration	Symbolic name	Test mode
1 a+b+c	1.4 MHz	B2	Primary
2 a+b+c	3 MHz	B3	Primary
3 a+b+c	1.4 MHz	T2	Primary
4 a+b+c	3 MHz	T3	Primary

The diagrams are shown on the following pages.

Remark

Where multiple requirements apply, the most stringent requirement is considered for compliance assessment.

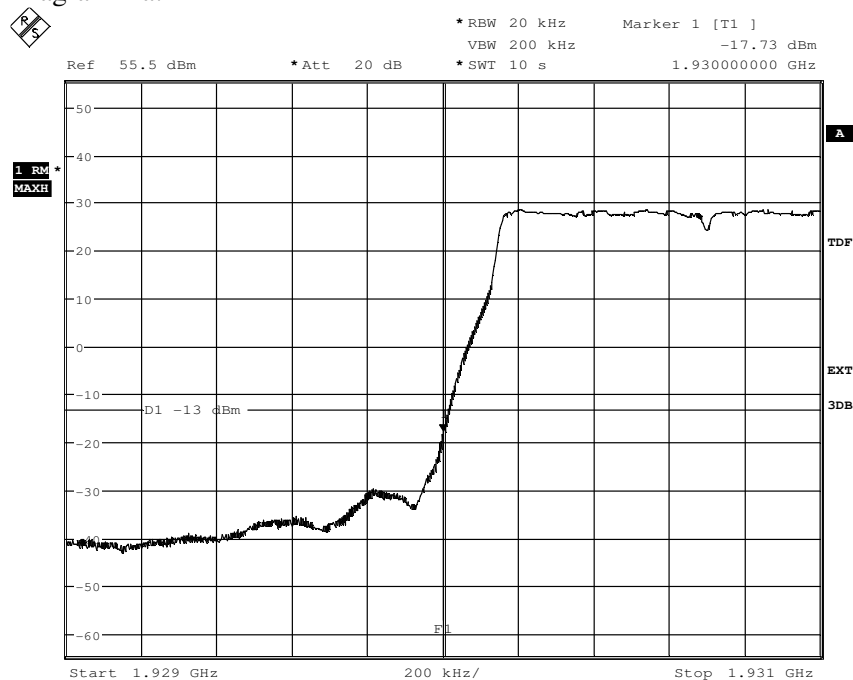
Limits

CFR 47 §24.238 and 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
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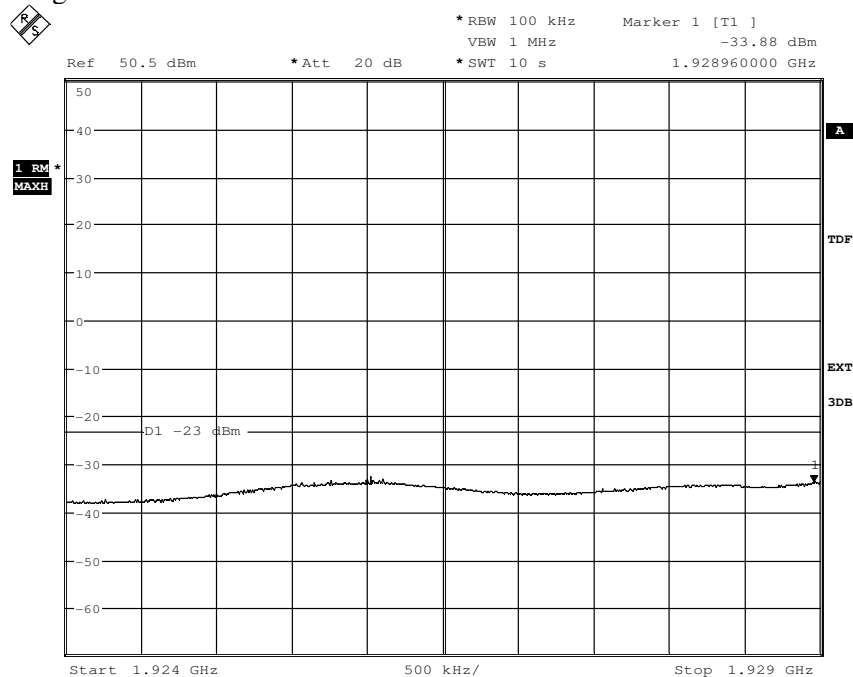
Appendix 3

Diagram 1 a:



Date: 7.NOV.2013 21:34:56

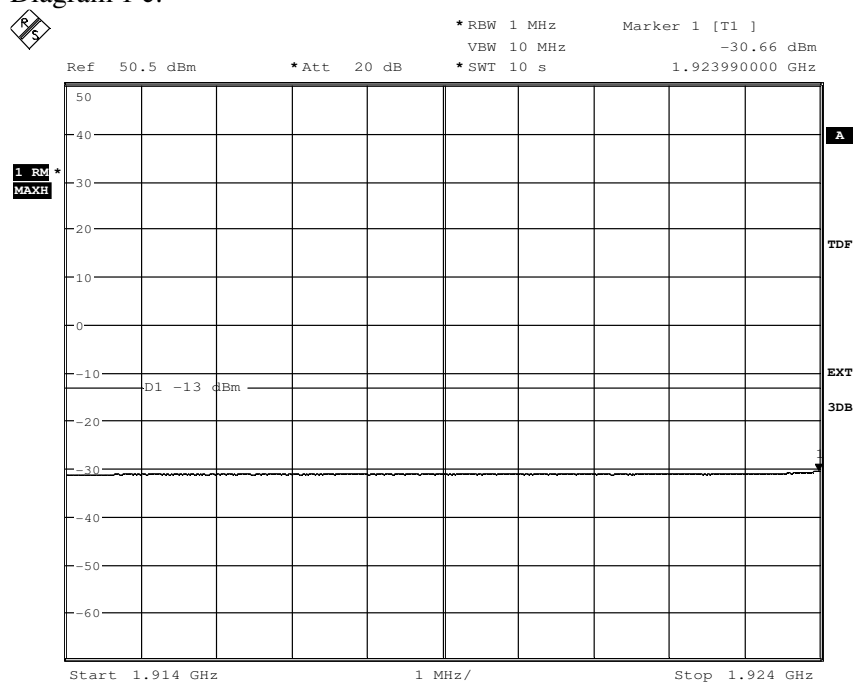
Diagram 1 b:



Date: 7.NOV.2013 21:36:06

Appendix 3

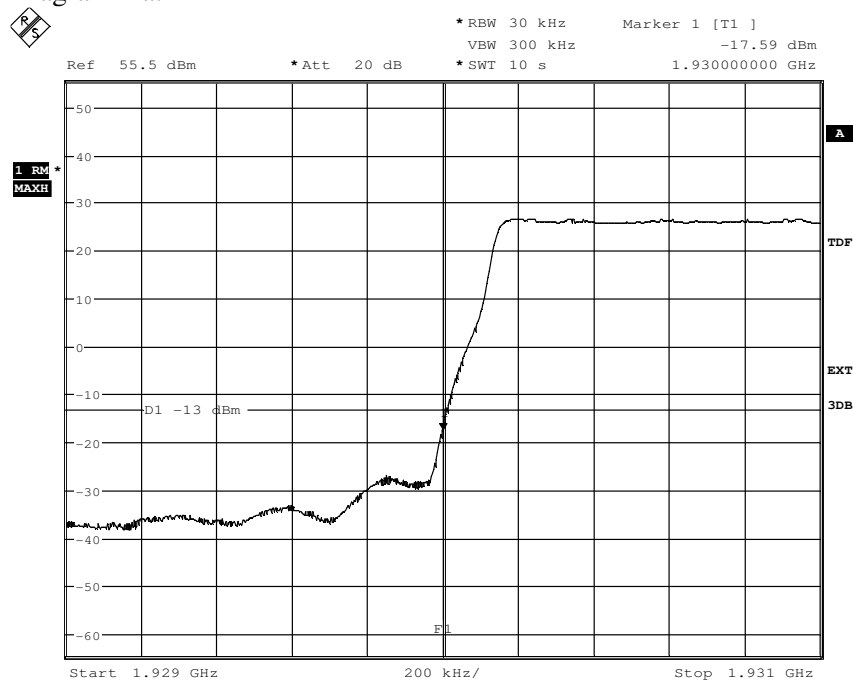
Diagram 1 c:



Date: 8.NOV.2013 13:51:09

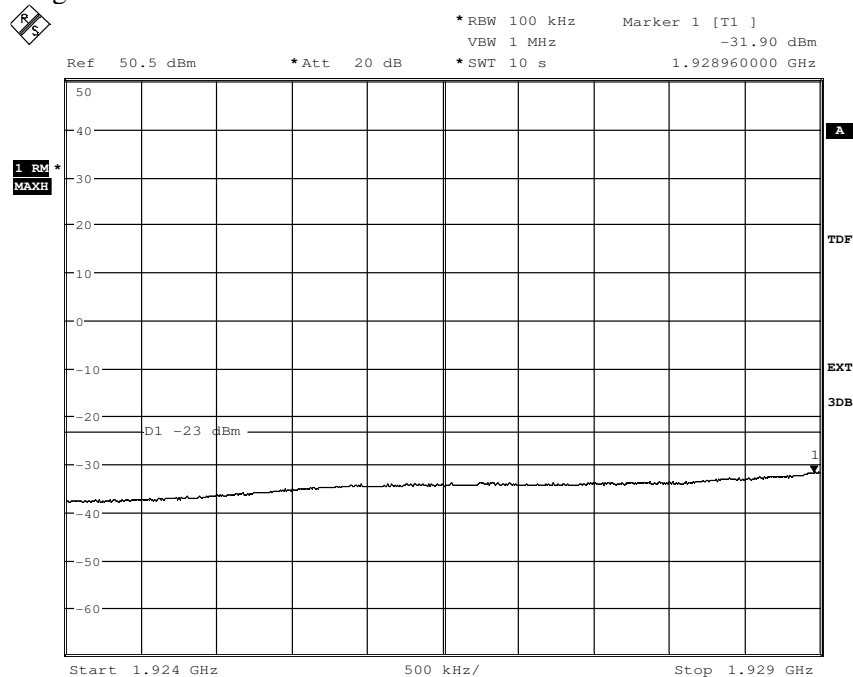
Appendix 3

Diagram 2 a:



Date: 8.NOV.2013 07:43:18

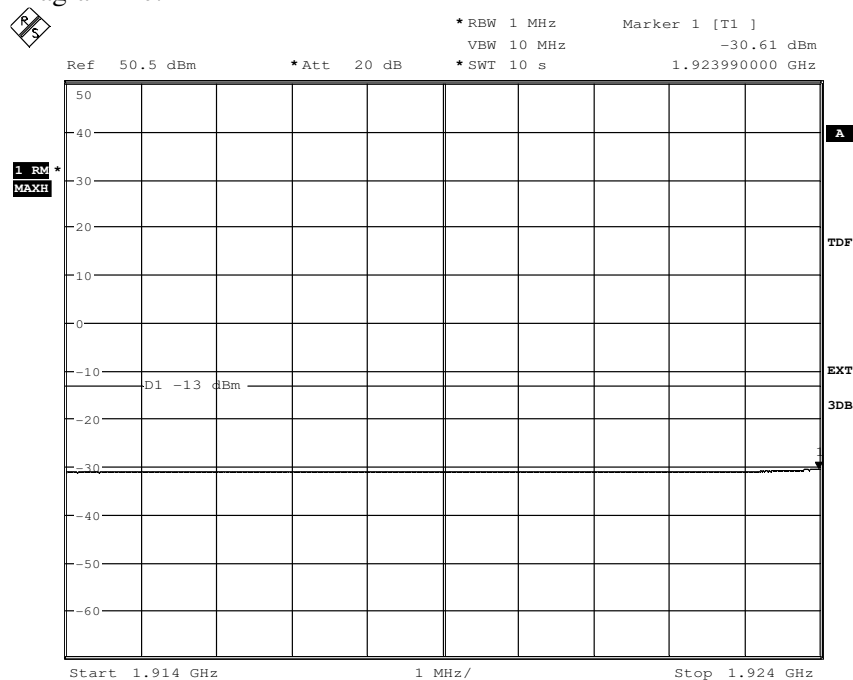
Diagram 2 b:



Date: 8.NOV.2013 07:45:38

Appendix 3

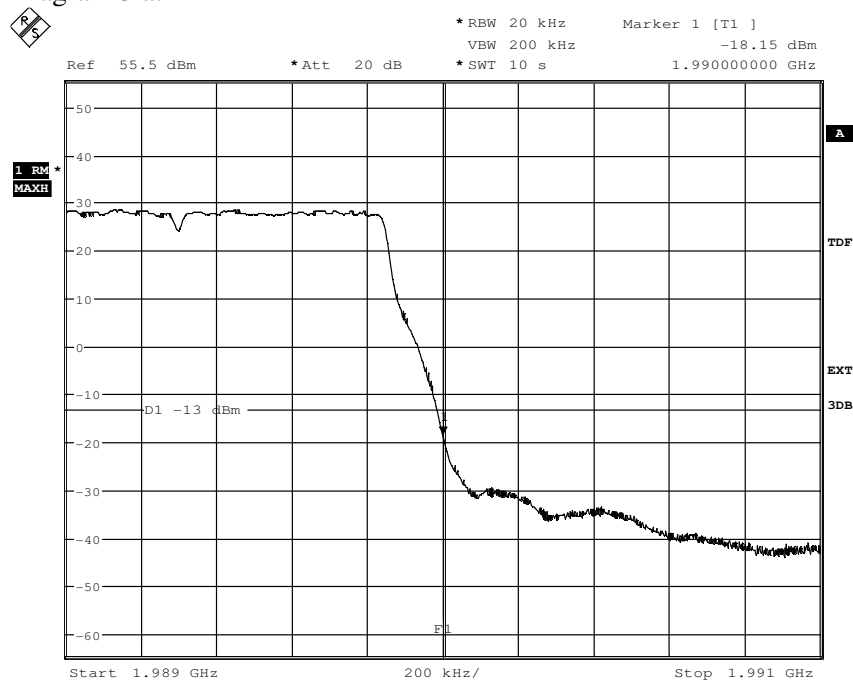
Diagram 2 c:



Date: 8.NOV.2013 07:46:50

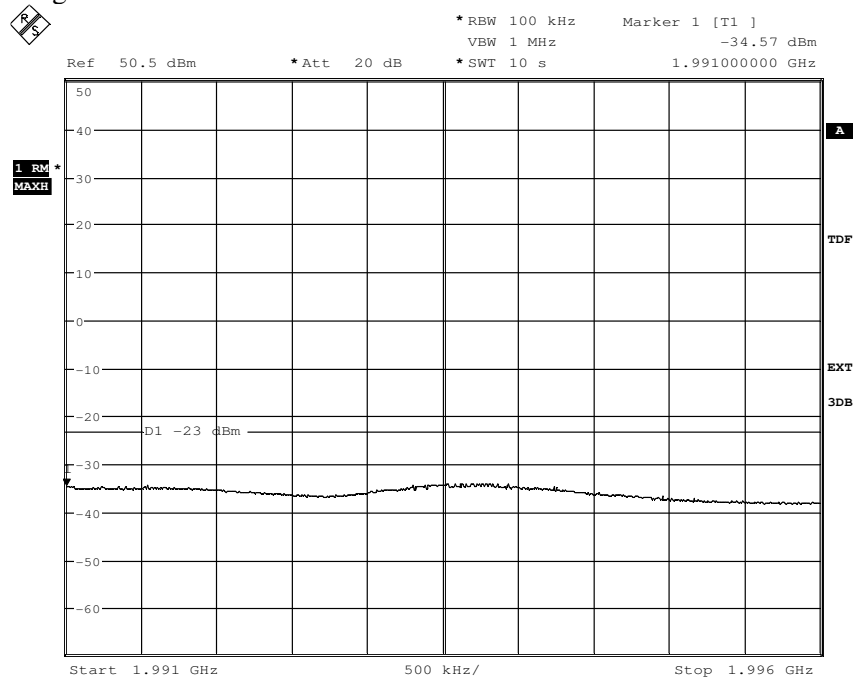
Appendix 3

Diagram 3 a:



Date: 8.NOV.2013 09:00:28

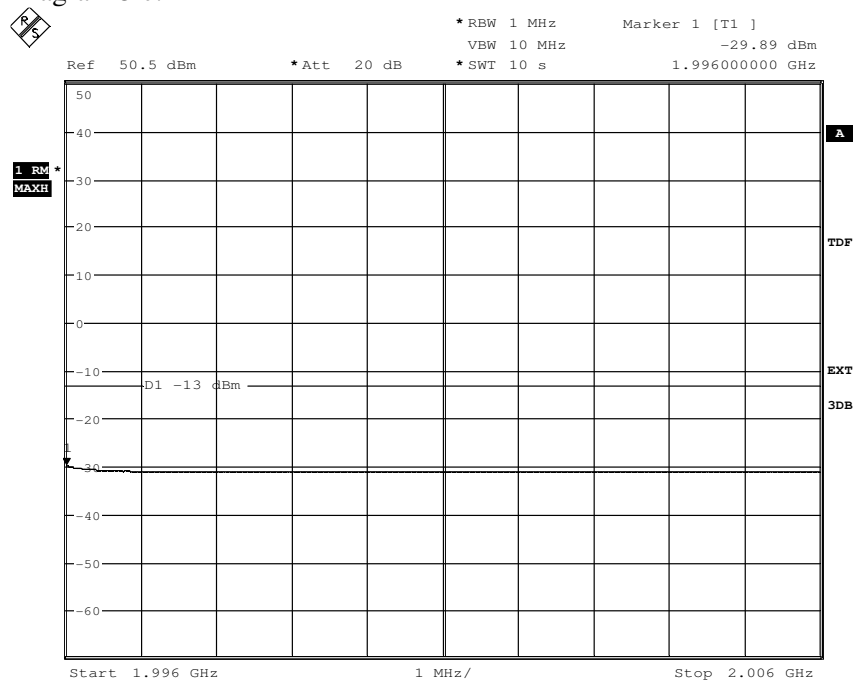
Diagram 3 b:



Date: 8.NOV.2013 09:02:02

Appendix 3

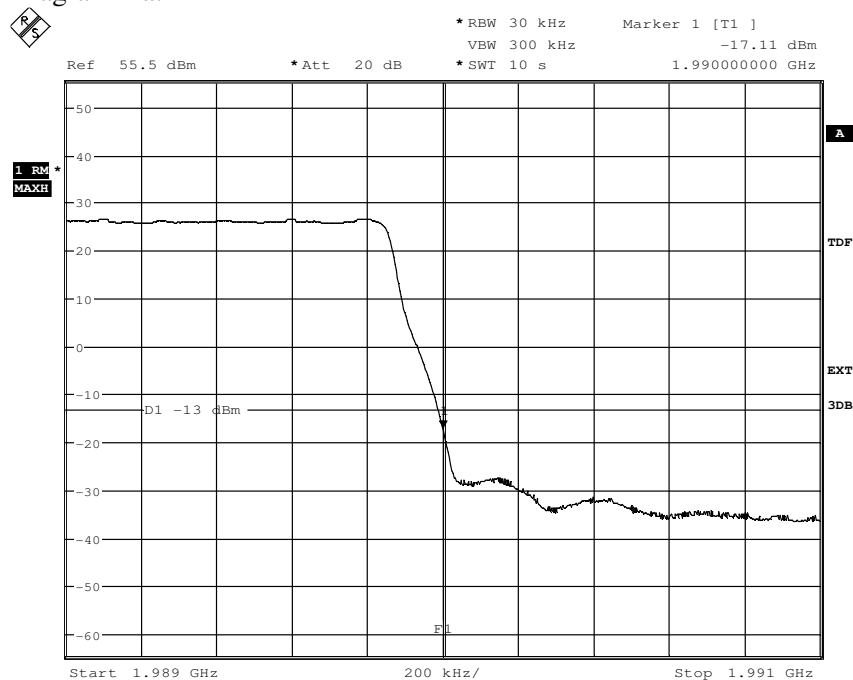
Diagram 3 c:



Date: 8.NOV.2013 09:03:05

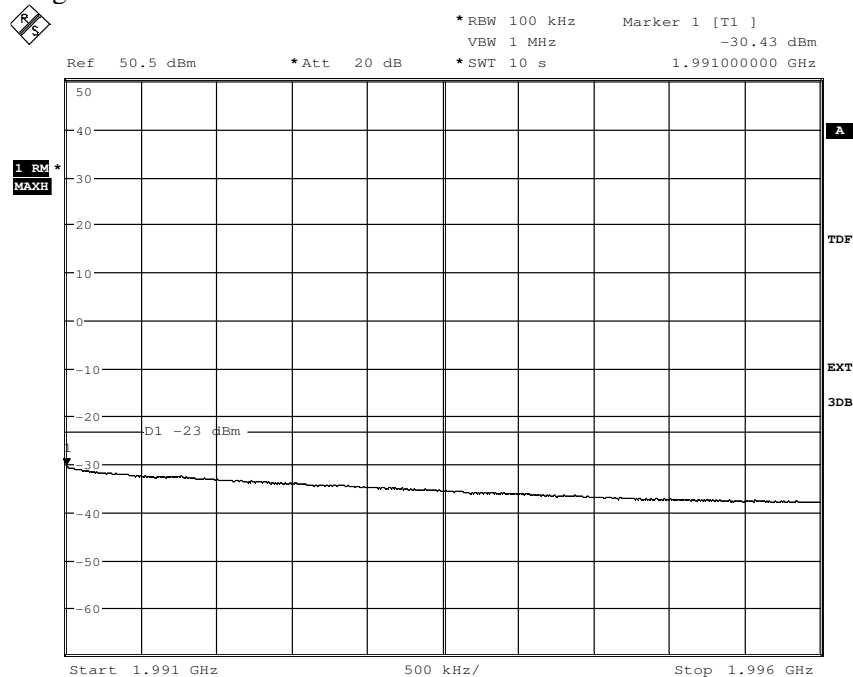
Appendix 3

Diagram 4 a:



Date: 8.NOV.2013 09:18:26

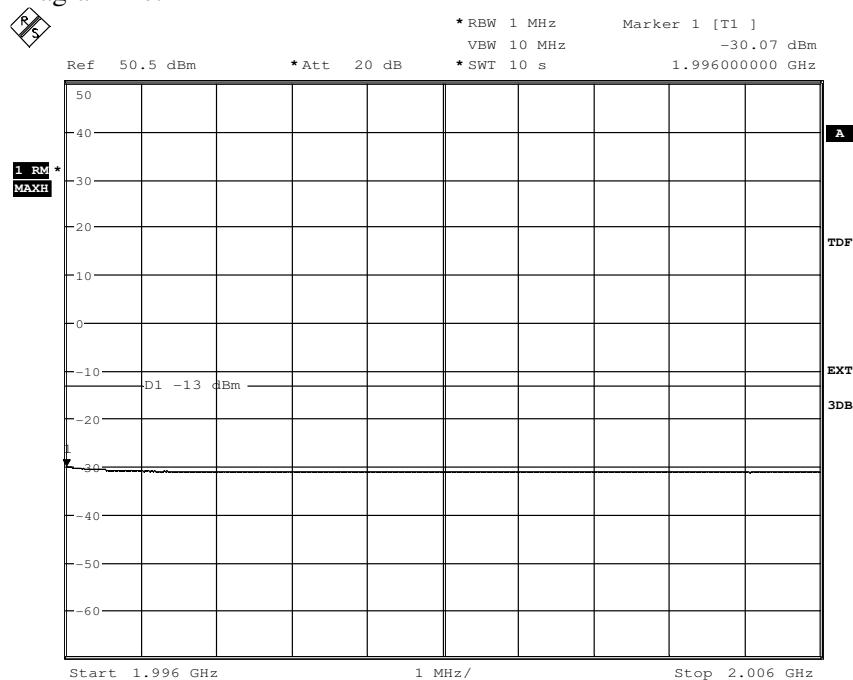
Diagram 4 b:



Date: 8.NOV.2013 09:19:29

Appendix 3

Diagram 4 c:



Date: 8.NOV.2013 09:20:22

Appendix 4

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

Date	Temperature	Humidity
2013-11-07	22 °C ± 3 °C	31 % ± 5 %
2013-11-08	22 °C ± 3 °C	31 % ± 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

2- carrier MIMO

Diagram	BW configuration	Symbolic name	Tested mode
1 a+b+c+d+e	1.4 MHz	Bim1	Primary
2 a+b+c+d+e	1.4 MHz	Bim2	Primary
3 a+b+c+d	1.4 MHz	M2	Primary
4 a+b+c+d+e	1.4 MHz	Tim1	Primary
5 a+b+c+d+e	1.4 MHz	Tim2	Primary

The diagrams are shown on the following pages.

Appendix 4

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

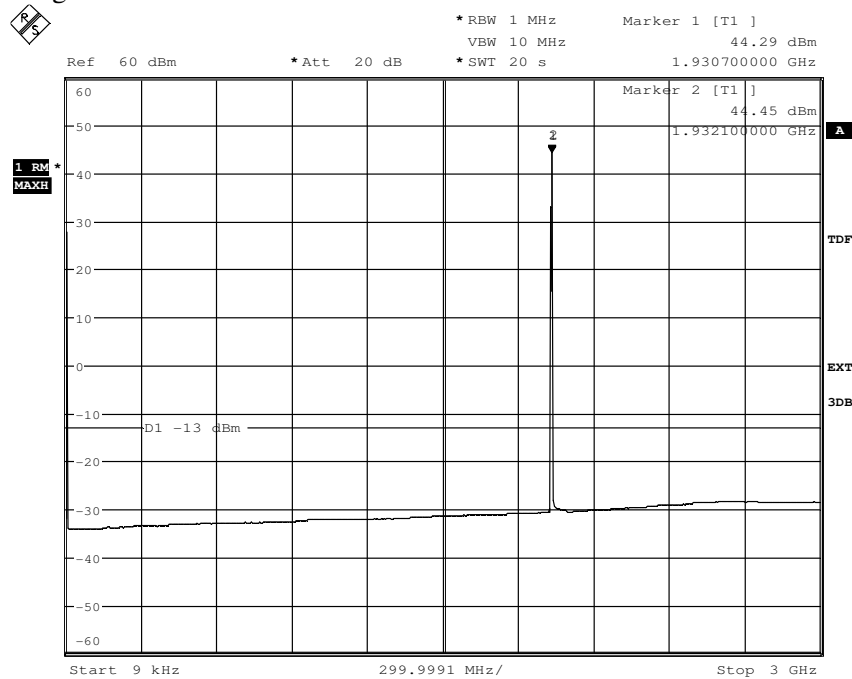
CFR 47 §24.238 and IC RSS-133 6.5

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
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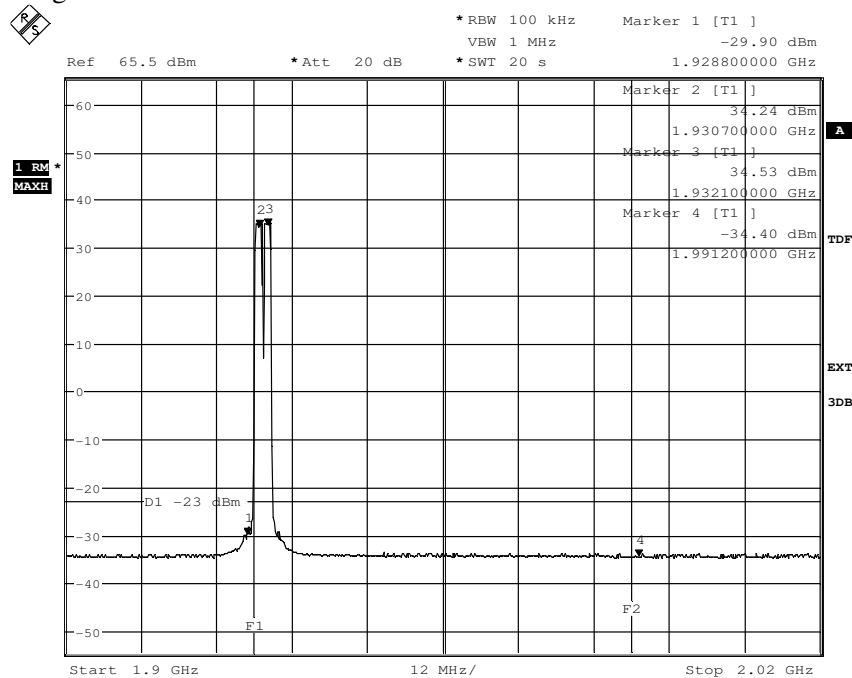
Appendix 4

Diagram 1 a:



Date: 8.NOV.2013 07:53:28

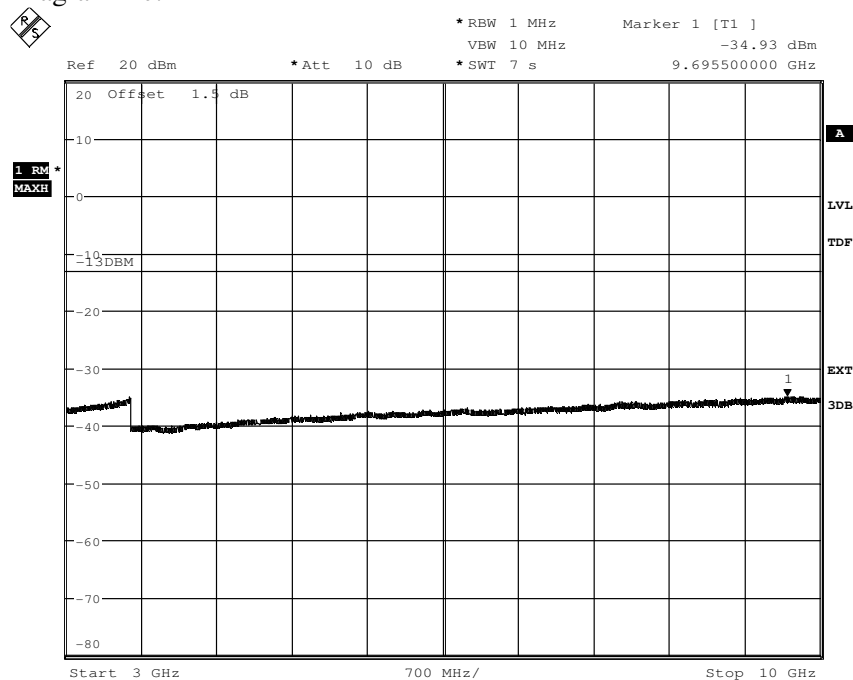
Diagram 1 b:



Date: 8.NOV.2013 07:54:52

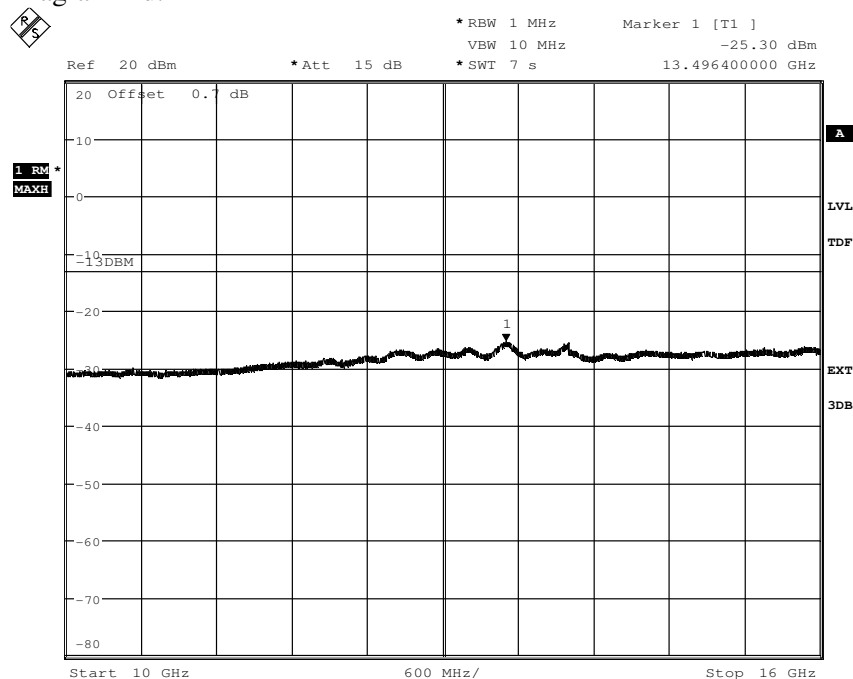
Appendix 4

Diagram 1 c:



Date: 8.NOV.2013 07:56:38

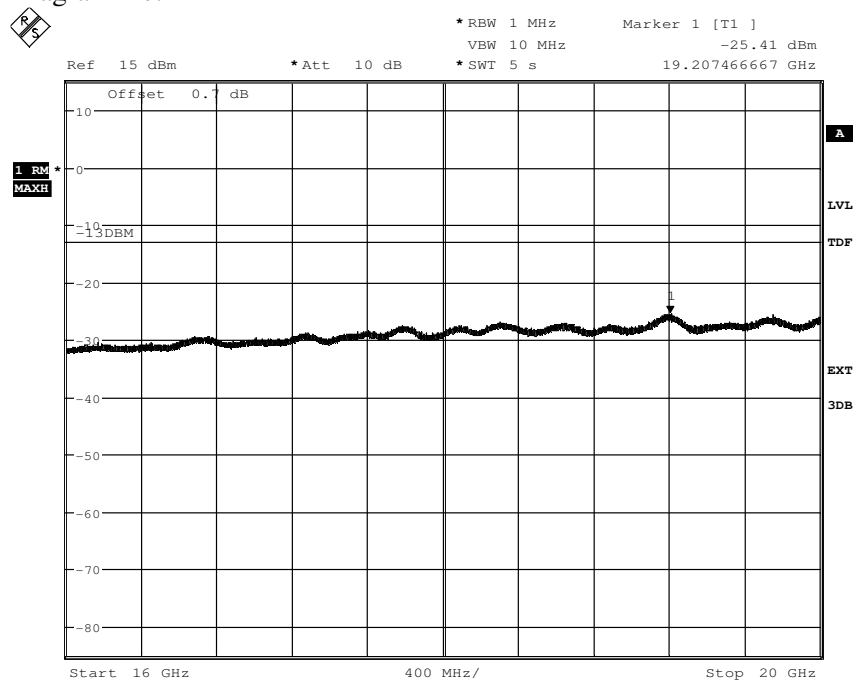
Diagram 1 d:



Date: 8.NOV.2013 07:57:32

Appendix 4

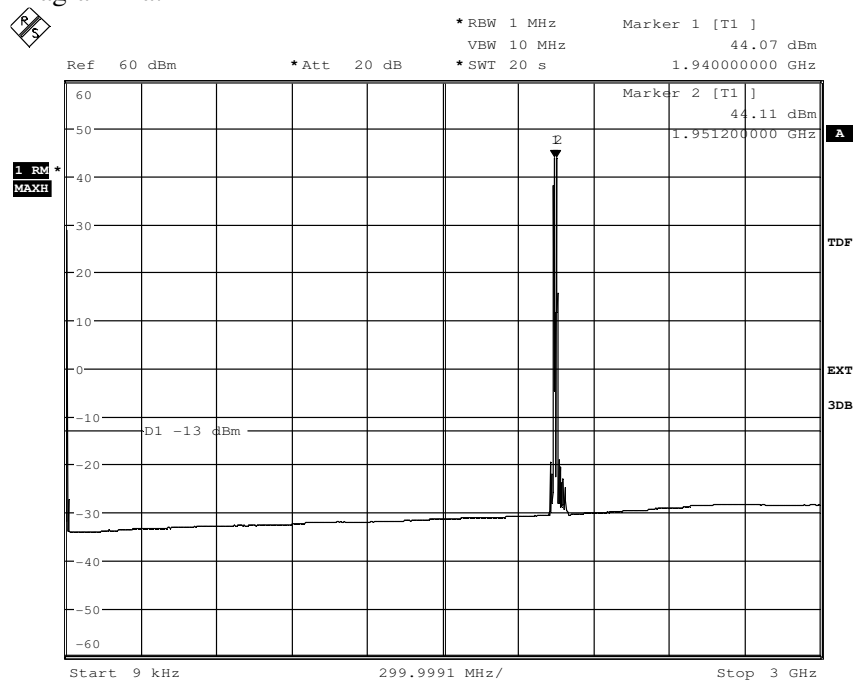
Diagram 1 e:



Date: 8.NOV.2013 07:58:19

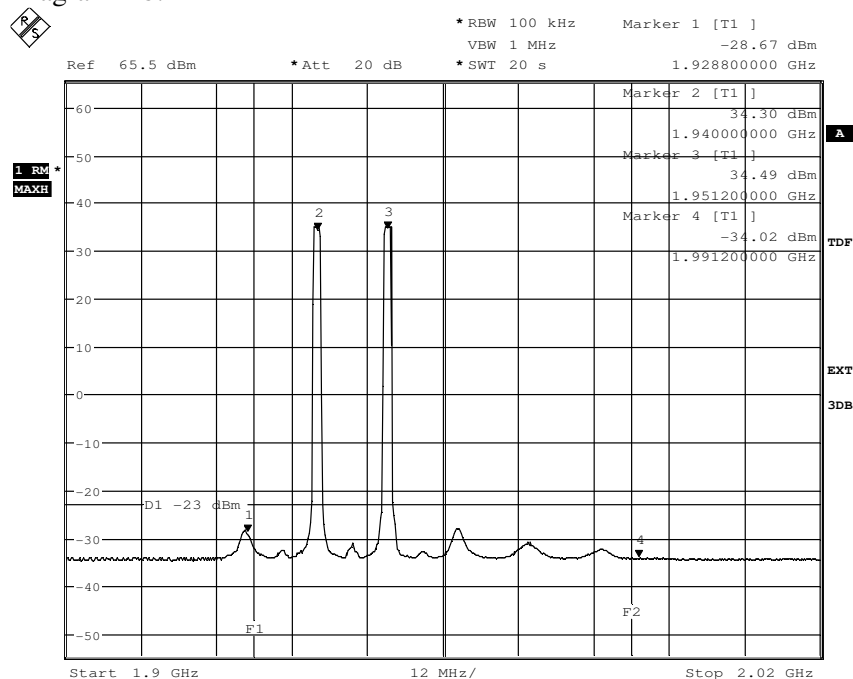
Appendix 4

Diagram 2 a:



Date: 8.NOV.2013 08:04:46

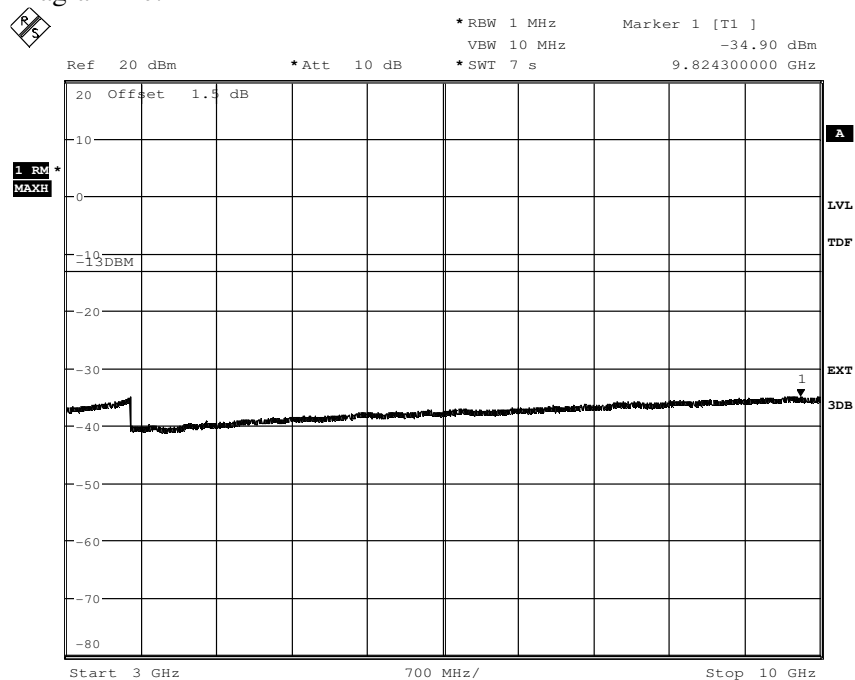
Diagram 2 b:



Date: 8.NOV.2013 08:06:06

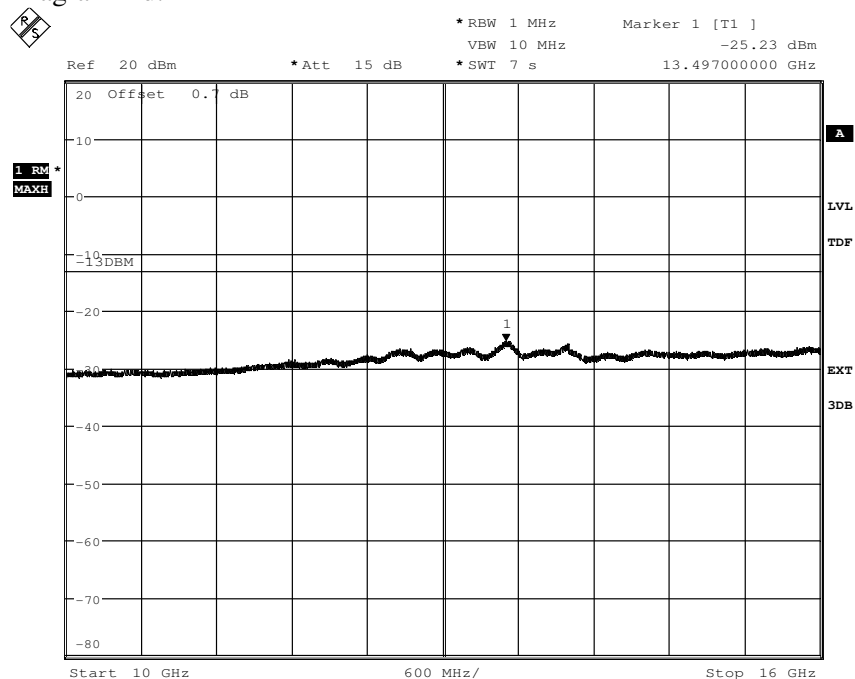
Appendix 4

Diagram 2 c:



Date: 8.NOV.2013 08:02:40

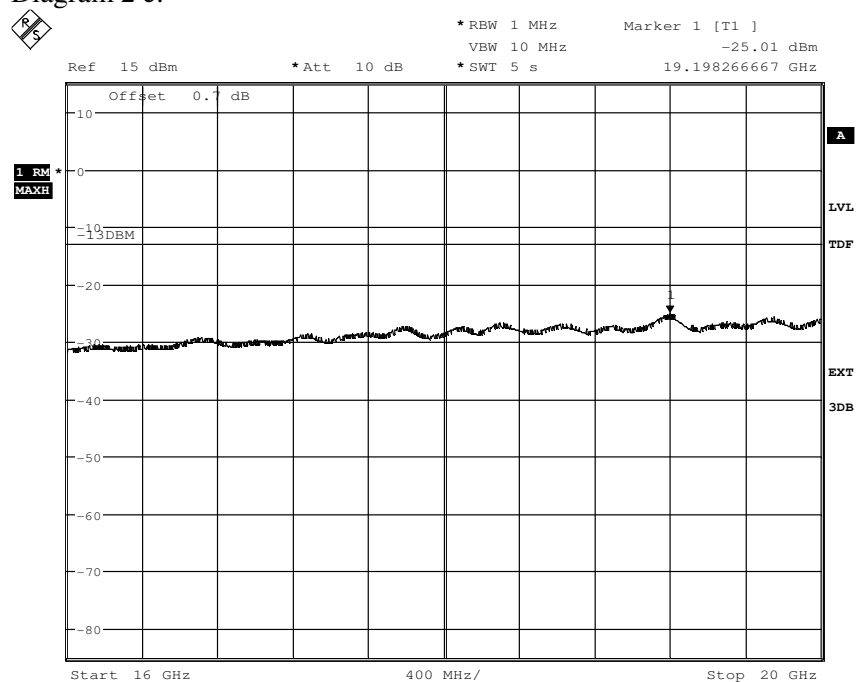
Diagram 2 d:



Date: 8.NOV.2013 08:01:39

Appendix 4

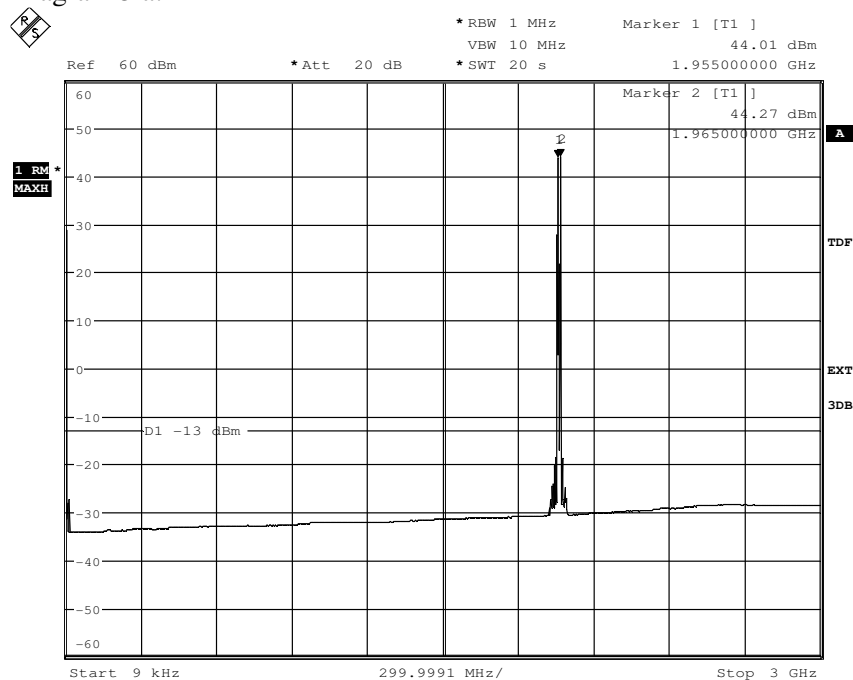
Diagram 2 e:



Date: 8.NOV.2013 08:00:55

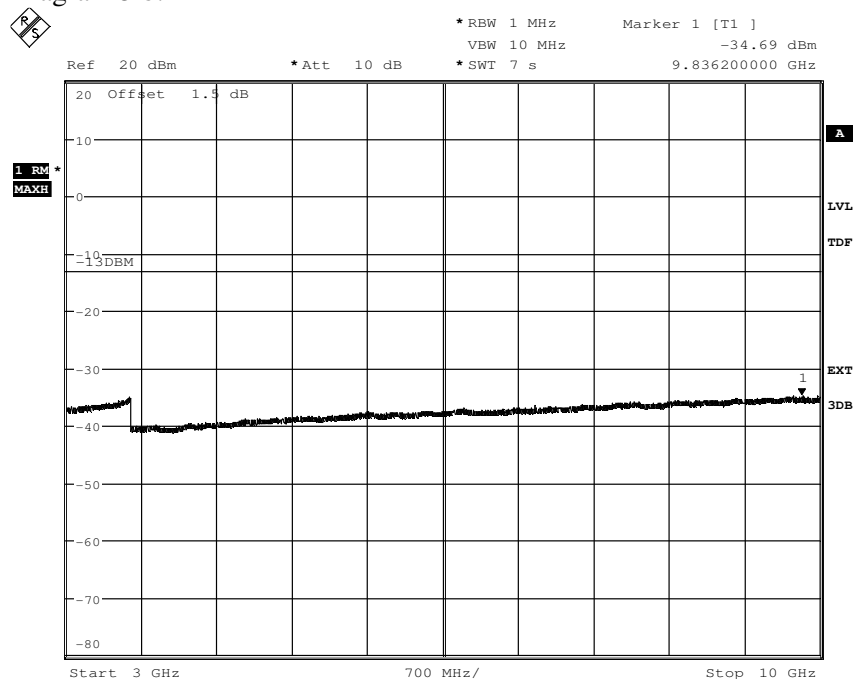
Appendix 4

Diagram 3 a:



Date: 8.NOV.2013 08:10:22

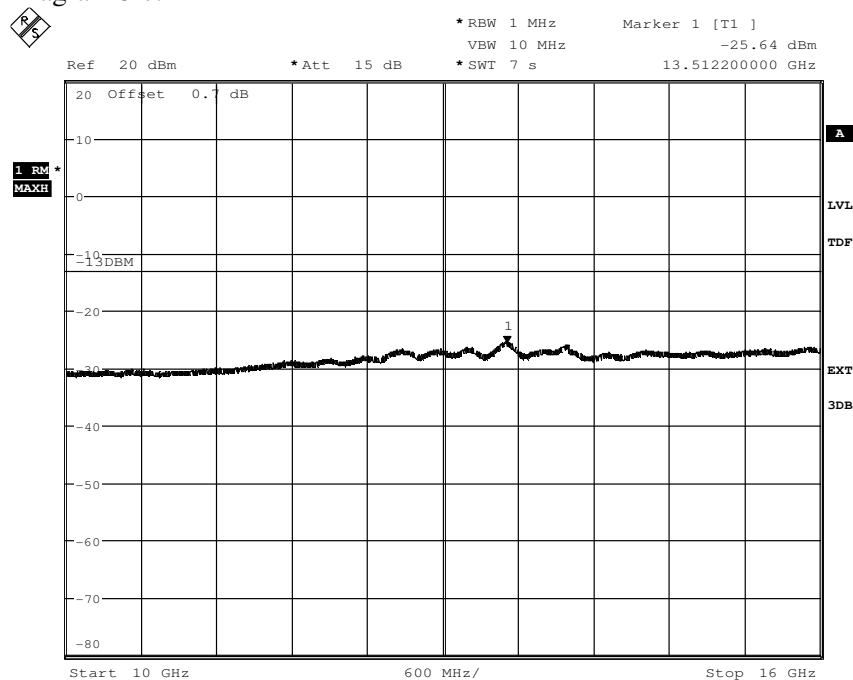
Diagram 3 b:



Date: 8.NOV.2013 08:12:02

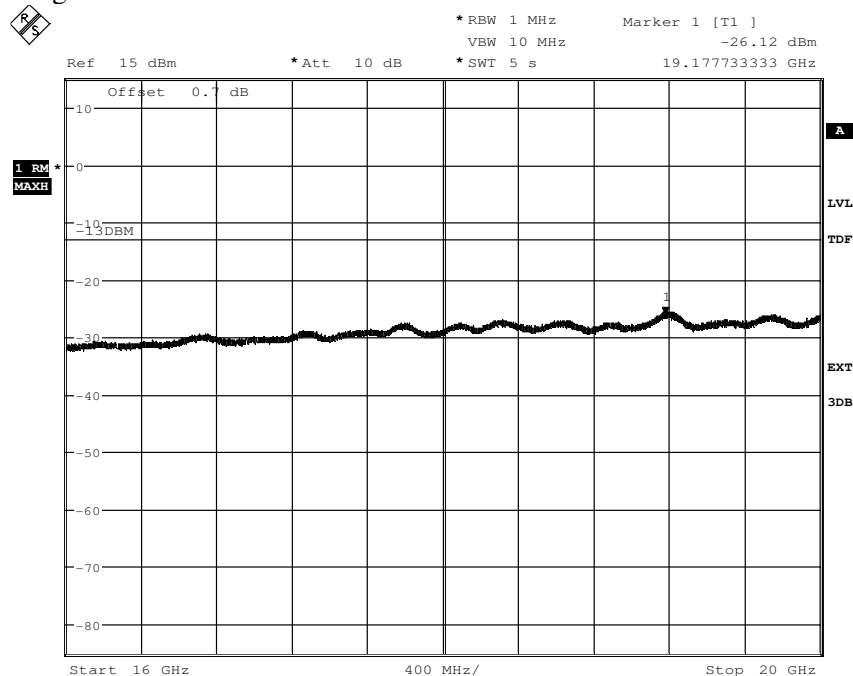
Appendix 4

Diagram 3 c:



Date: 8.NOV.2013 13:46:32

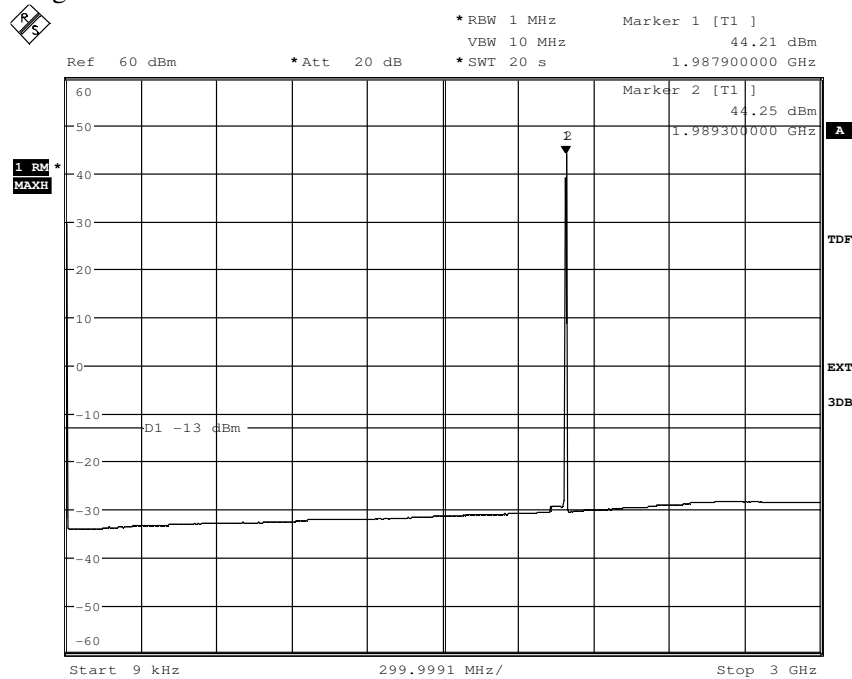
Diagram 3 d:



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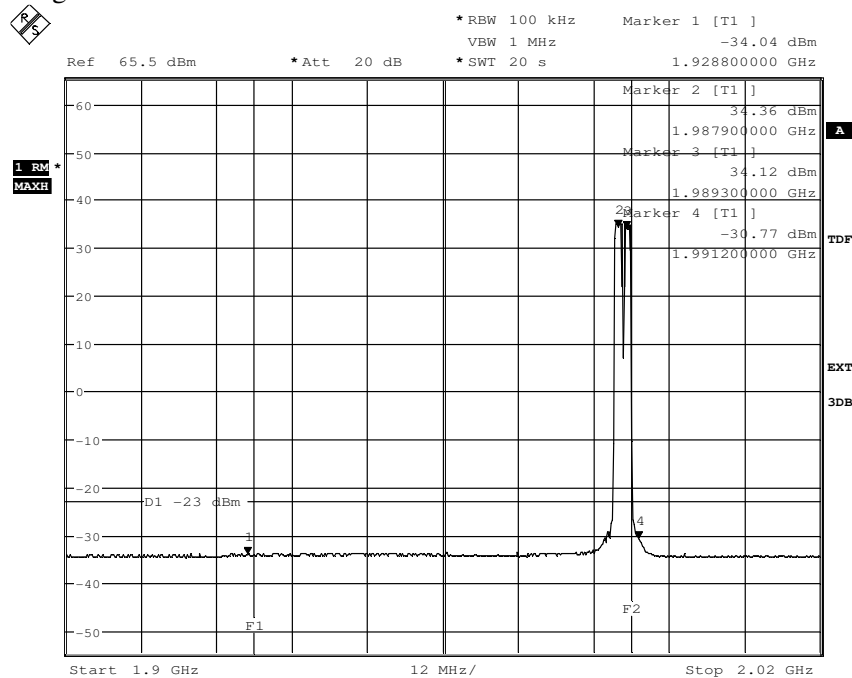
Appendix 4

Diagram 4 a:



Date: 8.NOV.2013 08:19:32

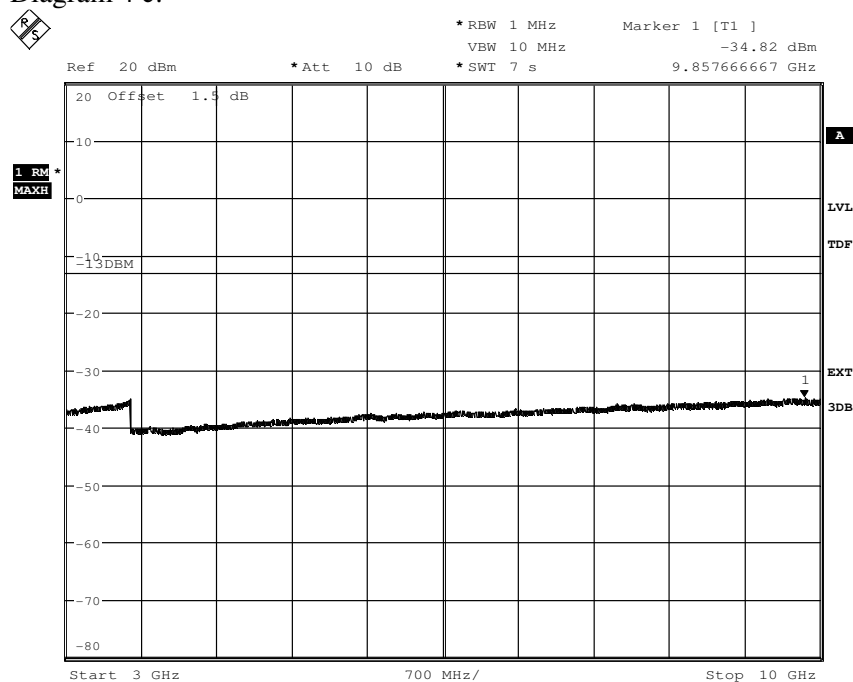
Diagram 4 b:



Date: 8.NOV.2013 08:20:51

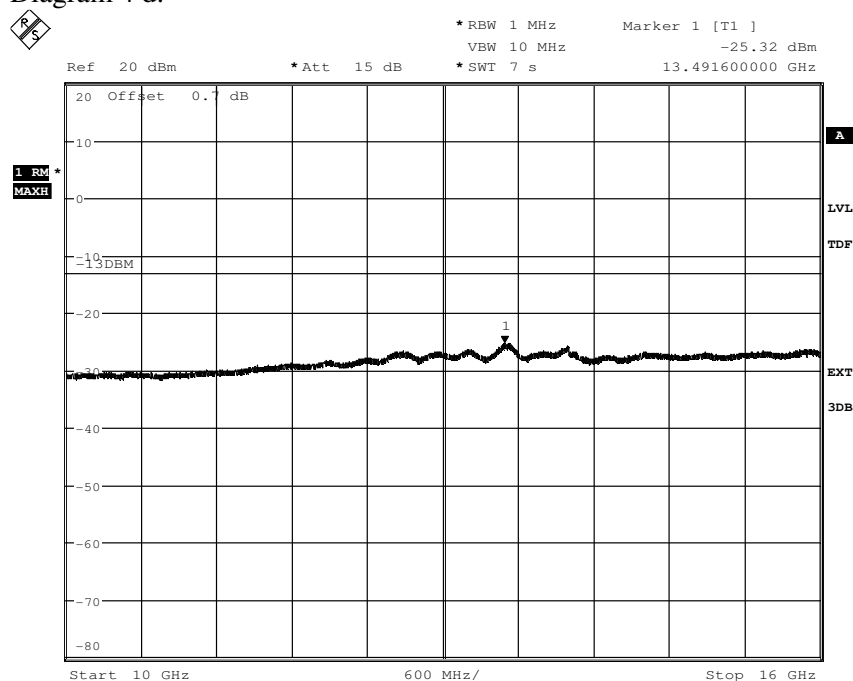
Appendix 4

Diagram 4 c:



Date: 8.NOV.2013 08:17:42

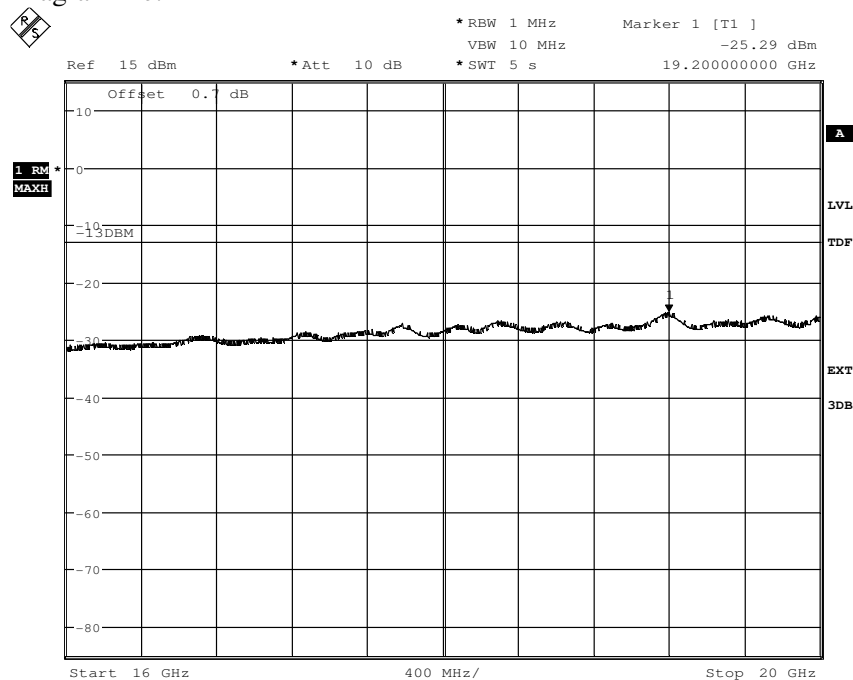
Diagram 4 d:



Date: 8.NOV.2013 08:16:50

Appendix 4

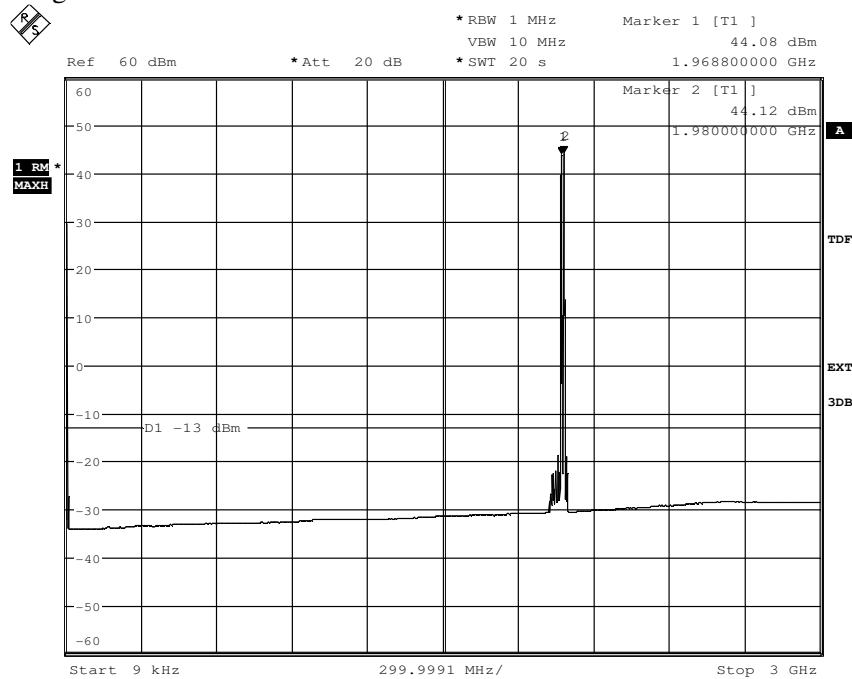
Diagram 4 e:



Date: 8.NOV.2013 08:16:02

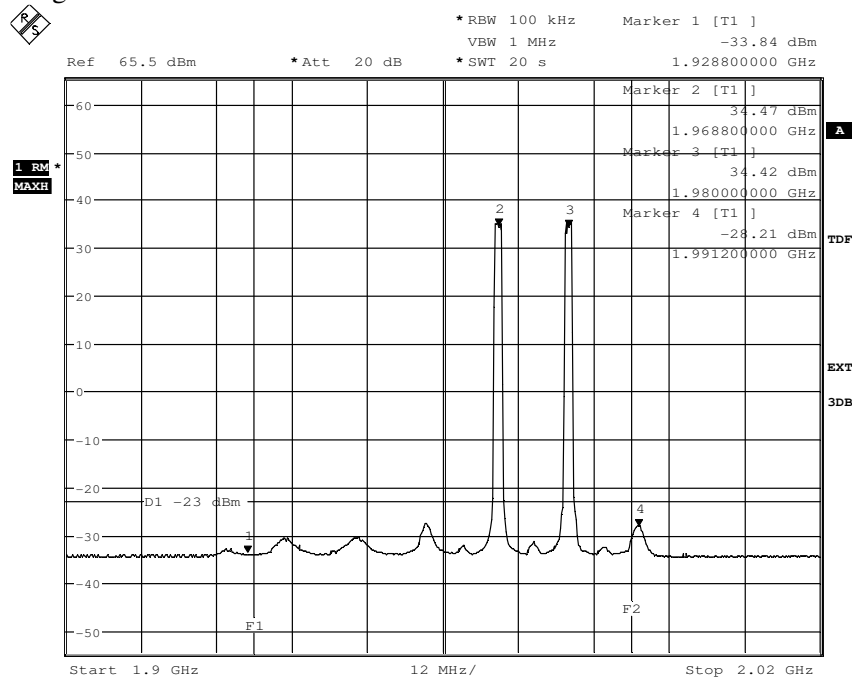
Appendix 4

Diagram 5 a:



Date: 8.NOV.2013 08:25:35

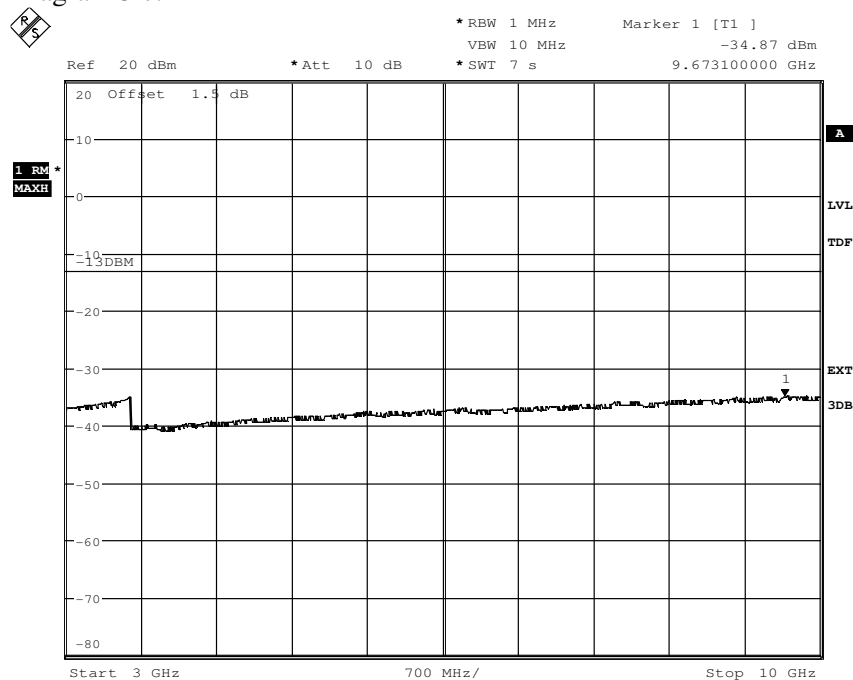
Diagram 5 b:



Date: 8.NOV.2013 08:24:21

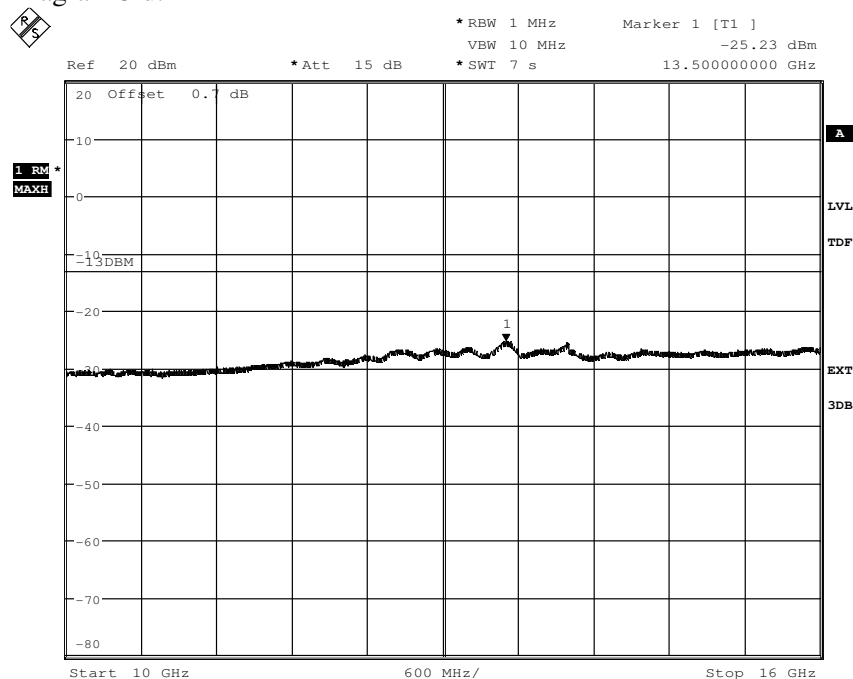
Appendix 4

Diagram 5 c:



Date: 8.NOV.2013 08:29:15

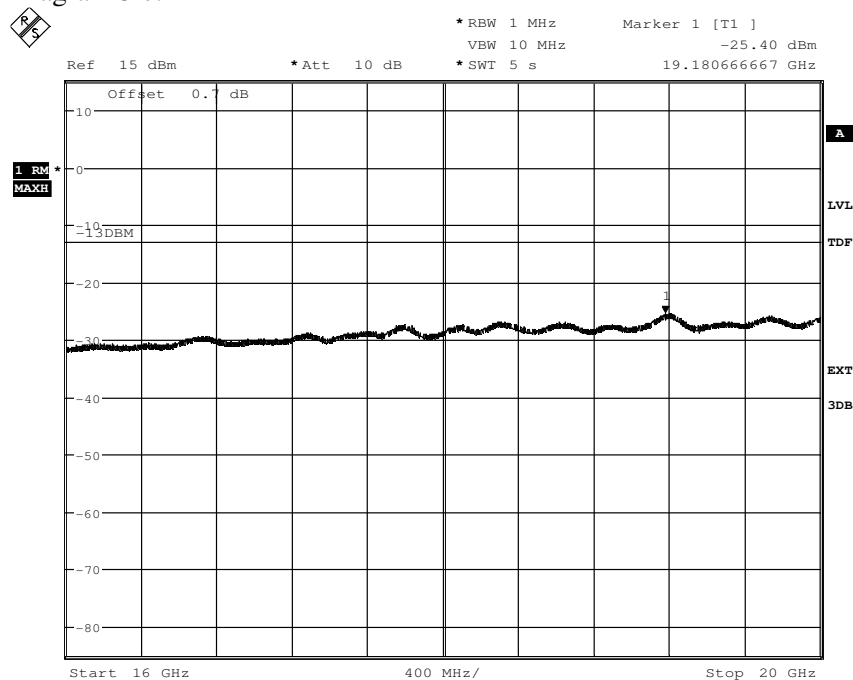
Diagram 5 d:



Date: 8.NOV.2013 08:30:52

Appendix 4

Diagram 5 e:



Date: 8.NOV.2013 08:53:55

Appendix 5

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

Date	Temperature	Humidity
2013-11-07	22 °C ± 3 °C	31 % ± 5 %
2013-11-08	22 °C ± 3 °C	31 % ± 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

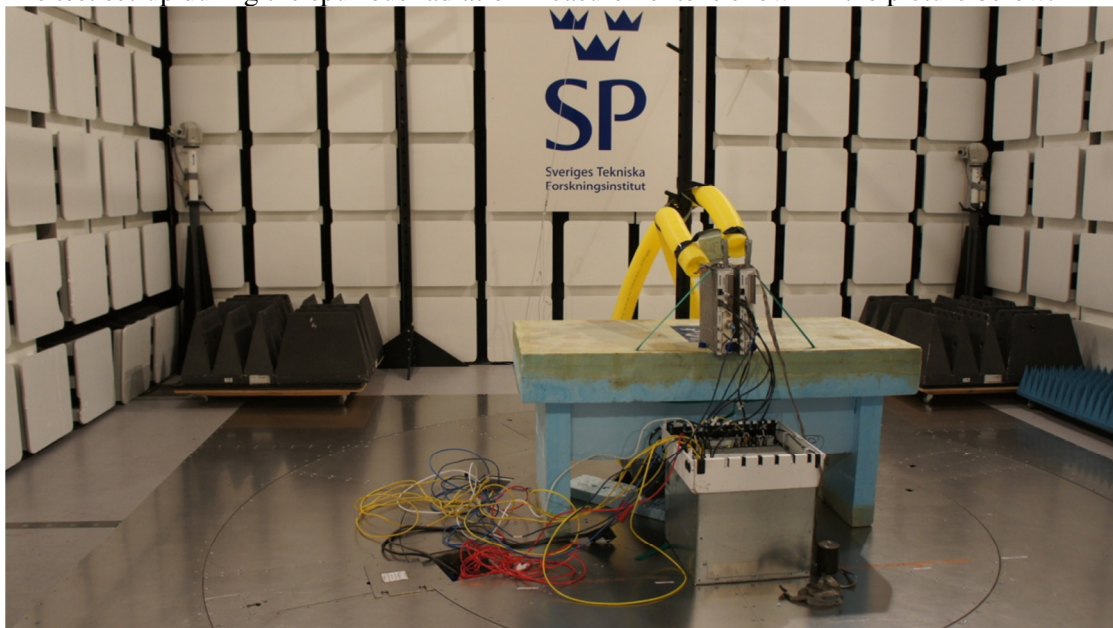
$$\gamma = 20 \log \left(\frac{4\pi D}{\lambda} \right), \gamma \text{ is the propagation loss and } D \text{ is the antenna distance.}$$

The measurement procedure was as the following:

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

Appendix 5

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	503 739
Miteq, Low Noise Amplifier	503 285
Schwarzbeck preamplifier BBV 9742	504 085
µComp Nordic, Low Noise Amplifier	901 545
Temperature and humidity meter, Testo 625	504 188

Tested configurations

Symbolic name
B2
M2
T2

Appendix 5

Results for worst emissions found

Diagram	Symbolic name
1 a-d	B2

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
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Appendix 5

Diagram 1 a:

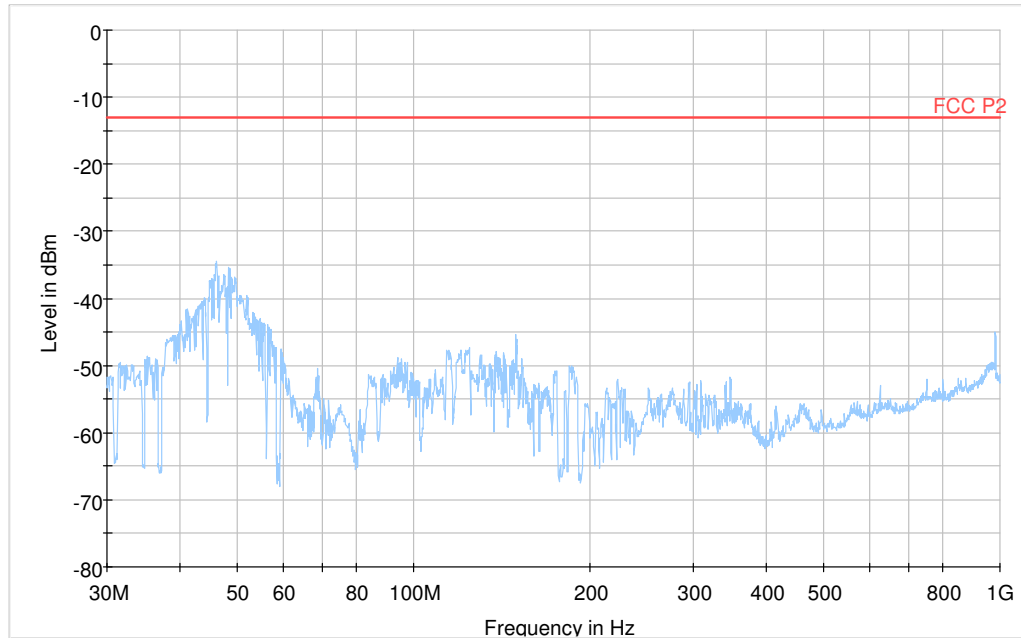
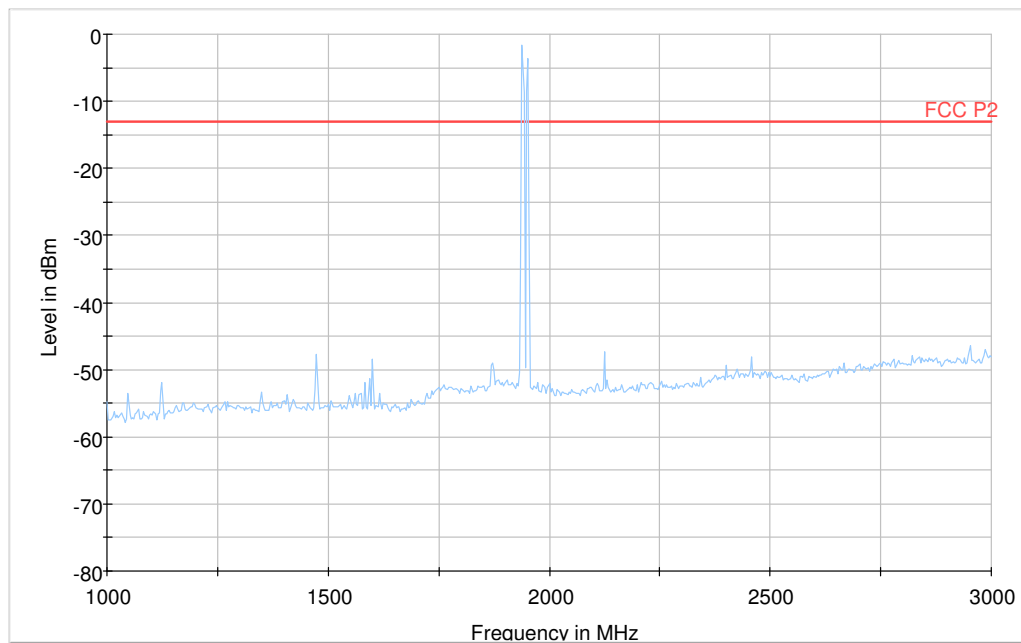


Diagram 1 b:



Note: The emission at 1930.7 MHz and 1935.7 MHz are the carrier frequencies and shall be ignored in the context.

Appendix 5

Diagram 1 c:

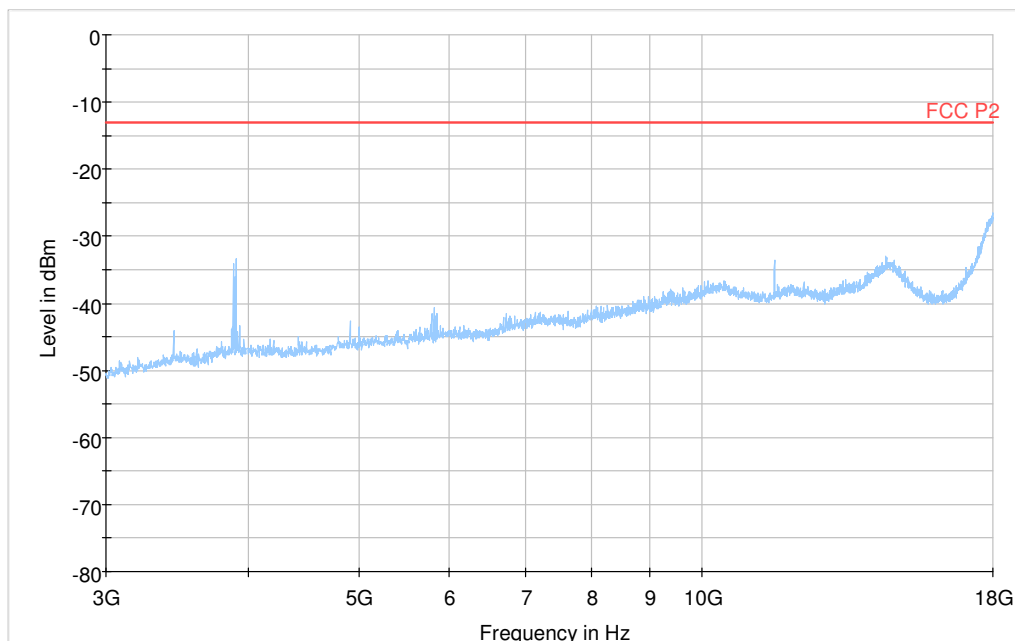
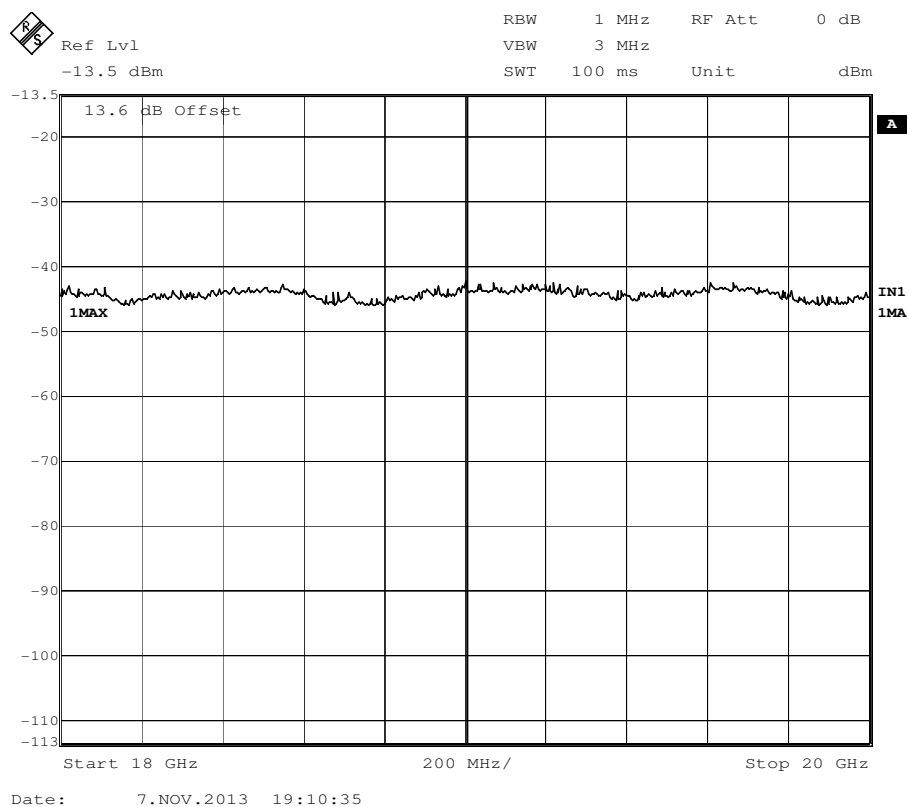


Diagram 1 d:



Appendix 6

External photos

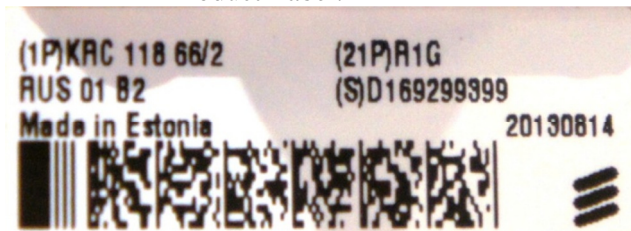
Front side:



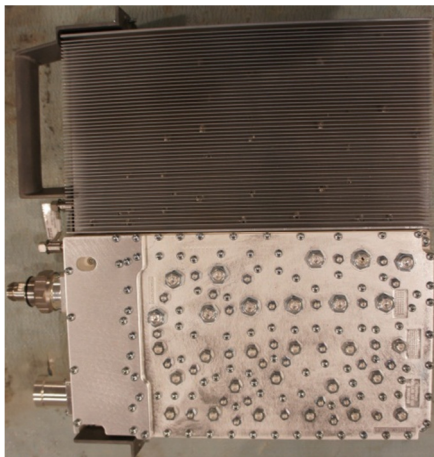
Back side:



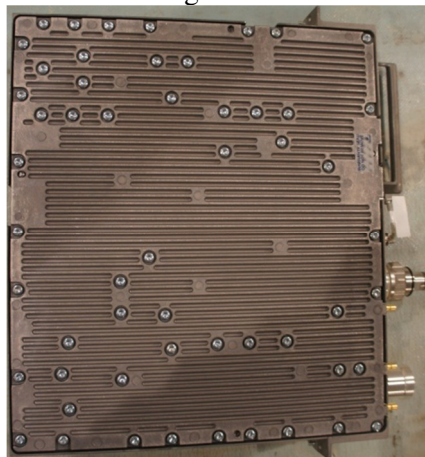
Product Label:



Left side:



Right side:



Appendix 6

Top side:



Bottom side:

