REPORT
issued by an FCC listed Laboratory Reg. no. 93866.
The test site complies with RSS-Gen, IC file no. 3482A-1.
issued by an Accredited Testing Laboratory.
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Date 2013-12-12 Reference 3P06723-02-F24

1002 ISO/IEC 17025

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Radio measurements on mRRUS 12 B2 radio equipment with FCC ID: TA8AKRC161328 and IC: 287AB-AS161328

(9 appendices)

Test object

Product name: mRRUS 12 B2
Product number: KRC 161 328/X, see appendix 1 for details.

Summary

Standard		Compliant	Appendix
FCC CFR 47 / IC RSS-133 ISSUE 6			
2.1046 / RSS-133 6.4	RF power output conducted	Yes	2
2.1046 / RSS-133 6.4	RF power output radiated	Yes	3
2.1049 / RSS-Gen 4.6.1	Occupied bandwidth	Yes	4
2.1051 / RSS-133 6.5	Band edge	Yes	5
2.1051 / RSS-133 6.5	Spurious emission at antenna terminals	Yes	6
2.1053 / RSS-133 6.5	Field strength of spurious radiation	Yes	7
2.1055 / RSS-133 6.3	Frequency stability	Yes	8

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

Jörgen Wassholm

Examined by

Anders Nordlöf

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Appendix 1

Description of the test object

Equipment:	Radio equipment mRRUS 12 B2 supporting WCDMA KRC 161 328/1, 110-240 VAC internal antenna KRC 161 328/2, -48 VDC internal antenna KRC 161 328/3, 110-240 VAC no internal antenna KRC 161 328/4, -48 VDC no internal antenna FCC ID: TA8AKRC161328 IC: 287AB-AS161328 IC model numbers: IC MODEL NO: AS1613281 IC MODEL NO: AS1613282 IC MODEL NO: AS1613283 IC MODEL NO: AS1613284	
Antenna ports:	2 TX/RX ports	
RF configurations:	Single carrier, multi carrier and MIMO 2x2	
Frequency bands:	TX: 1930 – 1990 MHz RX: 1850 – 1910 MHz	
Nominal output power per antenna port:	Single carrier: Multi carrier:	1x 37.0 dBm (1 x 5 W) 2 x 34.0 dBm (2 x 2.5 W) 3 x 32.2 dBm (3 x 1.67 W) 4 x 31.0 dBm (4 x 1.25 W)
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, 120 VAC 60 Hz	

Operation mode during measurements

WCDMA, single RAT

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.

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.

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

MIMO mode multi carrier, 2 carriers
TM5: 8 HS-PDSCH at 240 ksps +30 DPCH:s at 30 ksps (SF=128)

Channel bandwidth 5 MHz

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

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.
Frequency stability measurements were also tested using 120VAC.

Radiated measurements

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

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.

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
RSS-Gen Issue 3
RSS-133 Issue 6

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 ESI 26	2014-07	503 292
R&S FSQ 40	2014-03	504 143
R&S ESU 40	2014-07	901 385
R&S SME 06	2014-07	502 755
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	2014-07	503 740
RF attenuator	2014-07	504 159
RF attenuator	2014-07	900 233
RF attenuator	2014-07	900 691
RF attenuator	2013-12	901 508
Chase Bilog Antenna CBL 6111A	2014-10	503 182
EMCO Horn Antenna 3115	2015-09	502 175
ETS Lindgren Horn Antenna 3115	2015-03	902 212
EMCO Horn Antenna 3115	2015-09	501 548
Std.gain horn FLANN model 20240-20	-	503 674
µComp Nordic, Low Noise Amplifier	2014-04	901 545
MITEQ Low Noise Amplifier	2014-09	503 285
Multimeter Fluke 87	2014-08	502 190
Temperature and humidity meter, Testo 635	2014-06	504 203
Temperature and humidity meter, Testo 635	2014-06	504 188
Temperature Chamber	-Note [1)]	503 360

Note [1)]: The temperature and humidity meter testo 635 SP number 504 203 was used to monitor the temperature.

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 2013-10-21.

Manufacturer’s representative

Mihai Simon, Ericsson AB.

Test engineers

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

Test participant

Mihai Simon.

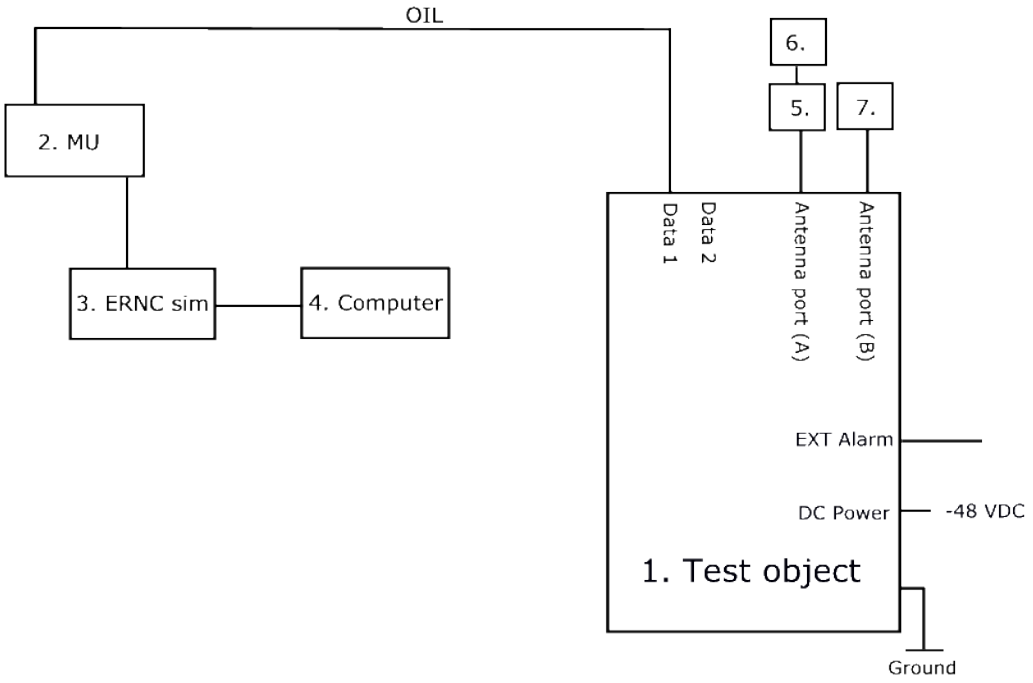
Appendix 1

Test frequencies during measurements

Single RAT TX test frequencies

UARFCN Downlink	Frequency [MHz]	Symbolic name	Comment
9662	1932.4	B	TX band bottom (B) frequency configuration 1 carrier
9662 9712	1932.4 1937.4	B2+5	TX band bottom (B) frequency configuration 2 carriers
9662 9712	1932.4 1942.4	B2+10	TX band bottom (B) frequency configuration 2 carriers
9662 9687 9712 9737	1932.4 1937.4 1942.4 1947.4	B4	TX band bottom (B) frequency configuration 4 carriers
9800	1960.0	M	TX band mid (M) frequency configuration 1 carrier
9800 9825	1960.0 1965.0	M2	TX band mid (M) frequency configuration 2 carriers
9775 9800 9825 9850	1955.0 1960.0 1965.0 1970.0	M4	TX band mid (M) frequency configuration 4 carriers
9938	1987.6	T	TX band top (T) frequency configuration 1 carrier
9913 9938	1982.6 1987.6	T2-5	TX band top (T) frequency configuration 2 carriers
9888 9938	1977.6 1987.6	T2-10	TX band top (T) frequency configuration 2 carriers
9662 9687 9712 9737	1932.4 1937.4 1942.4 1947.4	T4	TX band top (T) frequency configuration 4 carriers

Test set-up conducted measurements



Test object

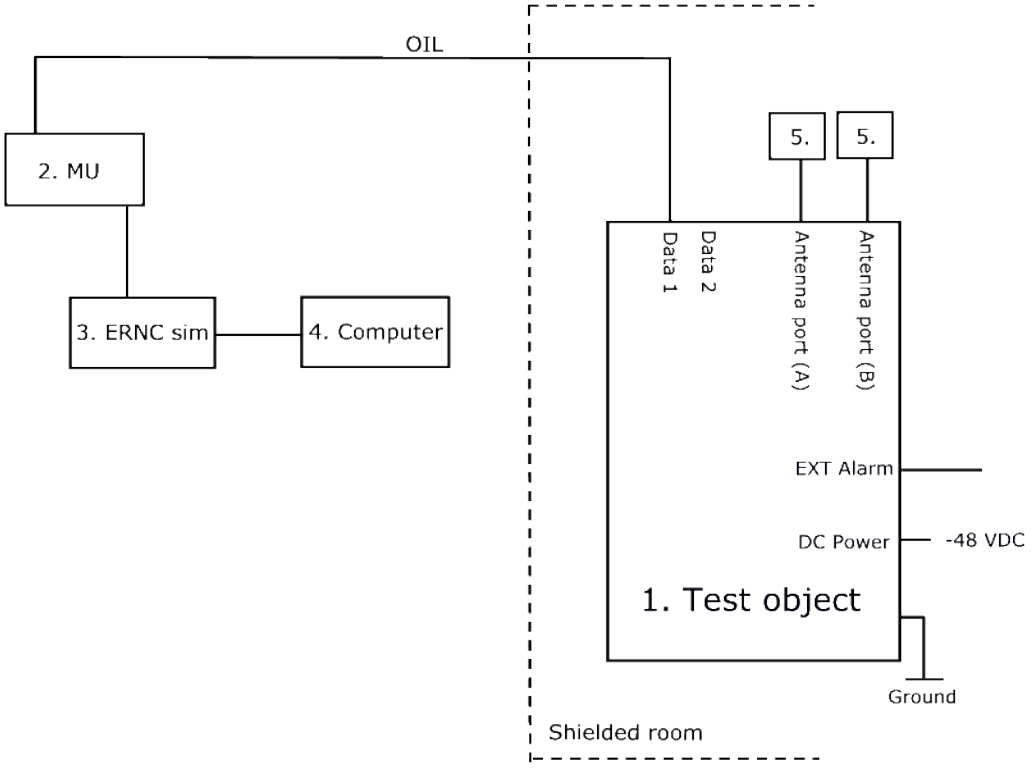
1.	mRRUS 12 B2, KRC 161 328/4, revision R1A, s/n: D16A183078 working software CXP 901 7316/2, rev. R51NK with FCC ID: TA8AKRC161328 and IC: 287AB-AS161328

Functional test equipment

2.	DUW 30 01, KDU 127 161/3, rev. R4E, s/n: TU8X621359, hosted in SUP 6601 1/BFL 901 009/4, rev. R1E, s/n. BR82081105 DUW 30 01, KDU 127 161/3, rev. R4E, s/n: C825945810, hosted in SUP 6601 1/BFL 901 009/4, rev. R1E, s/n. BR88186222
3.	ERNC-SIM 072, BAMS – 1000579045 Netgear Switch GSM7212, BAMS – 1000517289 Symmetricom SyncServer S250, BAMS – 1000690719 Symmetricom 8040 Rubidium Frequency Standard, BAMS – 1001292861
4.	Computer I-ultra27-06 standalone, BAMS – 1000758439
5.	SP test Instrumentation according to measurement equipment list
6.	SP test Instrumentation according to measurement equipment list
7.	Terminator, 50 ohm

Appendix 1

Test set-up radiated measurements



Test object:

1.	mRRUS 12 B2, KRC 161 328/4, revision R1A, s/n: D16A183078 working software CXP 901 7316/2, rev. R51NK with FCC ID: TA8AKRC161328 and IC: 287AB-AS161328

Functional test equipment:

2.	Main Unit SUP 6601 1/BFL 901 009/4, rev. R1E, s/n: BR88258668 DUW 30 01, KDU 127 161/3, rev. R4E, s/n: C825945801 SUP 6601 1/BFL 901 009/4, rev. R1E, s/n: BR88258854 DUW 30 01, KDU 127 161/3, rev. R4E, s/n: TU8X621348
3.	ERNC-SIM 145, BAMS – 1000707989 Netgear Switch GSM7224, BAMS – 1000517289 Symmetricom SyncServer S250, BAMS – 1000699484 Symmetricom 8040 Rubidium Frequency Standard, BAMS – 1001292861
4.	Computer Sun ultra27-01, BAMS – 1000758436
5.	Terminator

Interfaces:	**Type of port:**
Power: -48 VDC	DC Power
Data 1, optical interface	Signal
Data 2, optical interface, not used in this configuration	Signal
Ext Alarm, unshielded multi wire	Signal
Ground wire	Ground

RBS software:

Software	**Revision**
CXP 902 1719	R4G03

Appendix 2

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

Date	Temperature	Humidity
2013-11-01	23 °C ± 3 °C	39 % ± 5 %
2013-11-04	23 °C ± 3 °C	34 % ± 5 %

Test set-up and procedure

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

Measurement equipment	SP number
R&S FSQ	504 143
RF attenuator	901 508
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 1.1 dB

Results

MIMO mode, single carrier

Rated output power level at RF connector 1x 37 dBm.

Tested configuration	Transmitter power RMS [RMS dBm/ dB PAR]		
BW and frequency	Port RF A	Port RF B	Total power[1)]
B	36.82/6.73	36.89/6.75	39.87
M	37.07/6.73	37.07/6.73	40.08
T	36.94/6.73	36.96/6.73	39.96

MIMO mode, 2- carrier

Rated output power level at RF connector 2x 34 dBm.

Tested configuration	Transmitter power RMS [RMS dBm/ dB PAR]		
BW and frequency	Port RF A	Port RF B	Total power[1)]
B2+5	36.03/7.50	36.08/7.50	39.07
M2	36.28/7.43	36.04/7.43	39.17
T2-5	36.21/7.43	36.20/7.43	39.22

MIMO mode, 4- carrier

Rated output power level at RF connector 4x 31 dBm.

Tested configuration	Transmitter power RMS [RMS dBm/ dB PAR]		
BW and frequency	Port RF A	Port RF B	Total power[1)]
B4	36.79/7.21	36.78/7.28	39.54
M4	36.86/6.85	36.91/6.85	39.90
T4	36.84/7.00	36.79/6.97	39.83

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

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

MIMO mode, single carrier

Measured output power per 1 MHz

Tested configuration with symbolic name	RFA [RMS dBm]	RF B [RMS dBm]	Total power[1)] [RMS dBm]
B	31.71	31.69	34.71
M	31.90	31.86	34.90
T	31.72	31.69	34.72

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

Limits

§24.232: The maximum output power may not exceed 3280 W (e.i.r.p)/ 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, resulting in a maximum output power of 3280 W (e.i.r.p)/ MHz for the scope of this report. Moreover, base station transmitters operating in the band 1930-1995 MHz shall not have output power exceeding 100 watts. The peak-to-average ratio of the power shall not exceed 13 dB.

Complies?	Yes

Appendix 3

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

Date	Temperature	Humidity
2013-11-05	23°C ± 3°C	34 % ± 5 %
2013-11-06	23°C ± 3°C	31 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI/TIA/EIA-603-C-2004.

The test of radiated emission was performed in a fully anechoic chamber. The measurements were performed with both horizontal and vertical polarizations of the antenna. The antenna distance was 3.0 m.

The fundamental was scanned with PEAK-detector and the turntable was rotated between 0-360 degrees for maximum response. The carrier power was measured with RMS- detector activated with a RBW of 1 MHz. The (e.i.r.p) output power was verified with the substitution method.

Measurement equipment

Measurement equipment	SP number
Anechoic chamber	15:116
R&S ESU 40	901 385
EMC 32 ver. 8.52.0	503 889
EMCO Horn Antenna 3115	501 548
EMCO Horn Antenna 3115	902 212
R&S SME 06	502 755
Attenuator	504 159
Testo 635 temperature and humidity meter	504 188

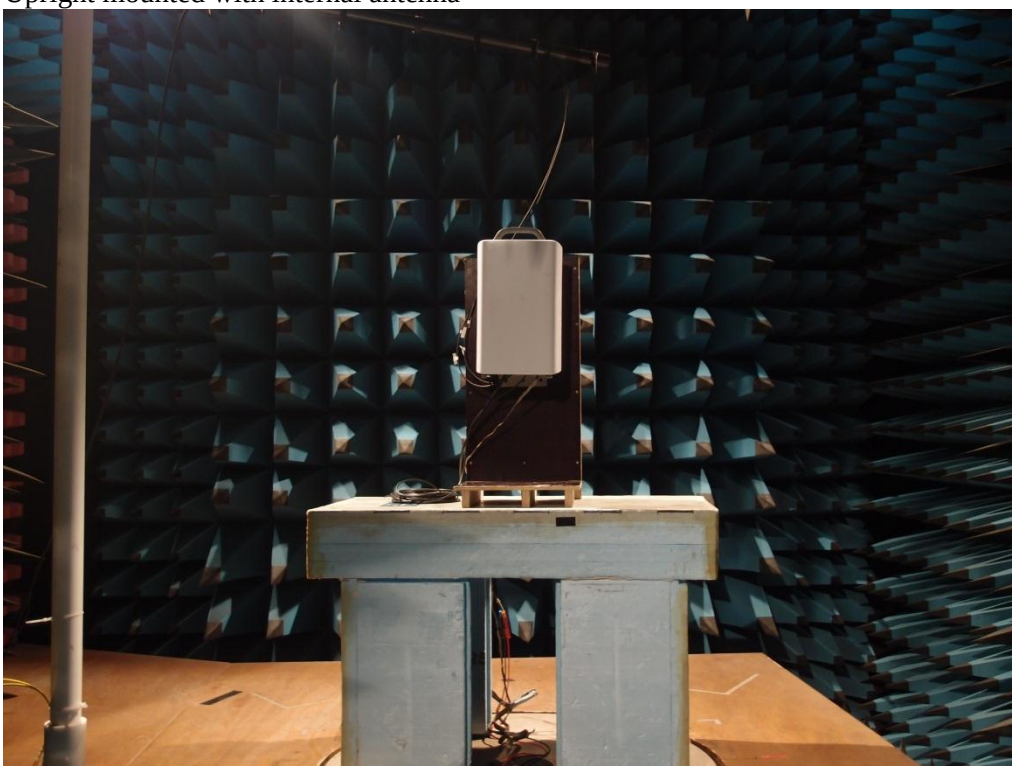
Measurement uncertainty:

3.2 dB

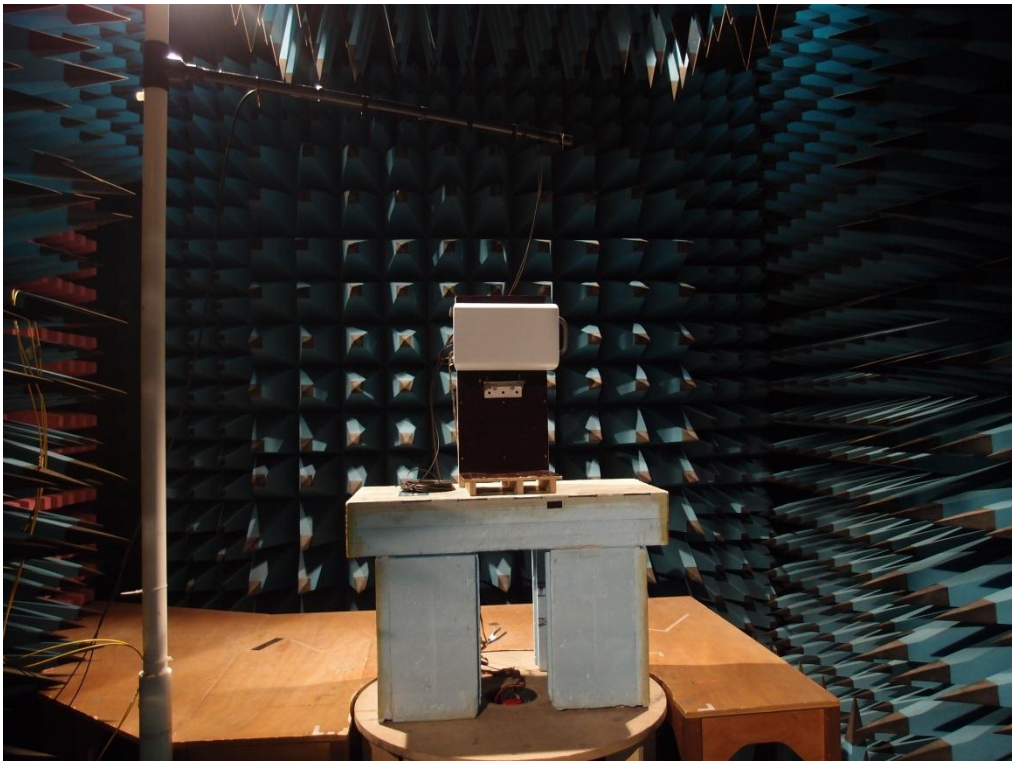
Appendix 3

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

Upright mounted with internal antenna

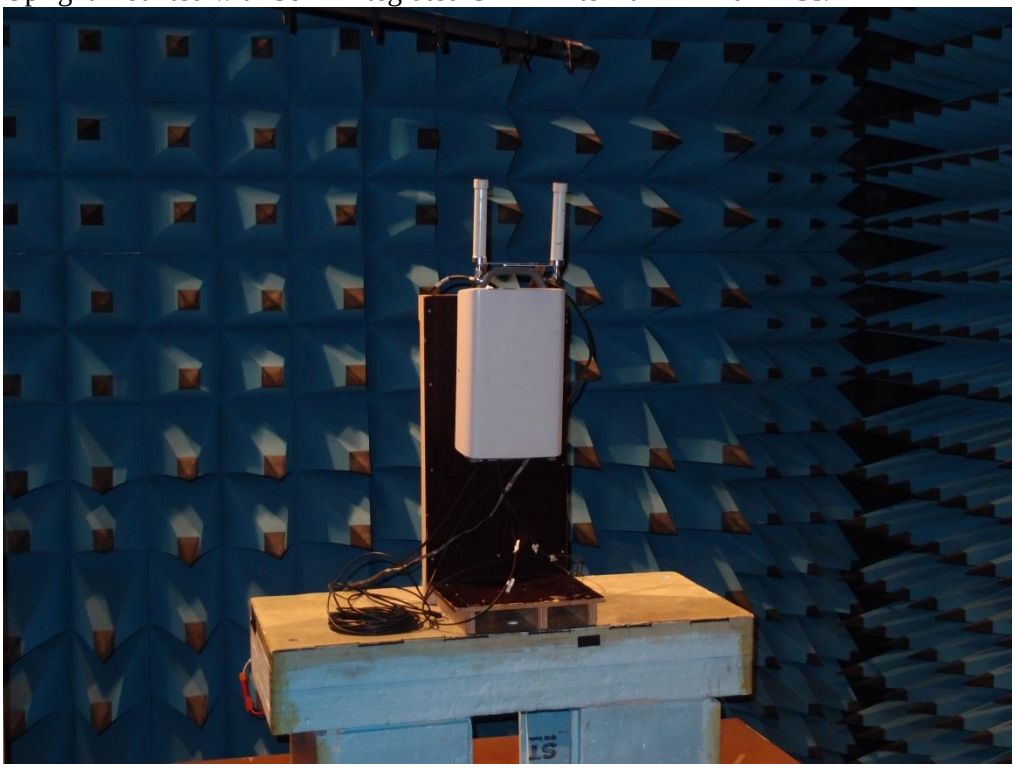


Side mounted with internal antenna

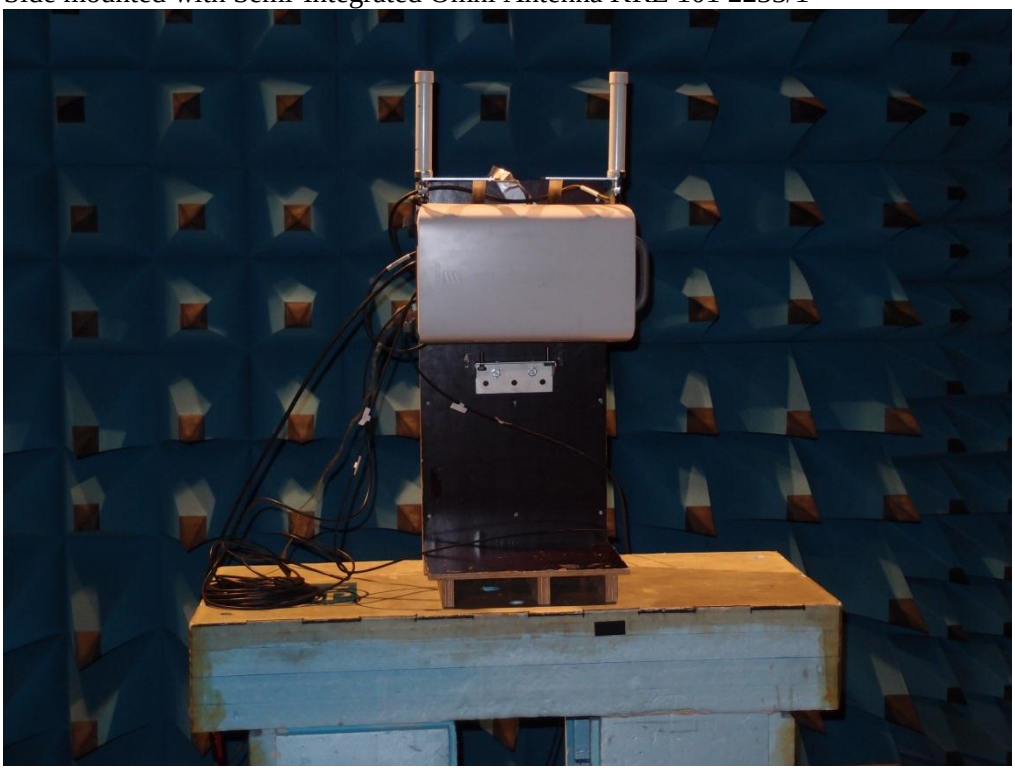


Appendix 3

Upright mounted with Semi-Integrated Omni Antenna KRE 101 2233/1



Side mounted with Semi-Integrated Omni Antenna KRE 101 2233/1



Results

Internal antenna, upright mounted

Tested frequency B		Tested frequency M		Tested frequency T	
Vertical/Horizontal RMS power		Vertical/Horizontal RMS power		Vertical/Horizontal RMS power	
dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz
32.5/ 39.4	1.8/ 8.6	30.4/ 40.9	1.1/ 12.2	28.6/ 41.1	0.7/ 12.7

Internal antenna, side mounted

Tested frequency B		Tested frequency M		Tested frequency T	
Vertical/Horizontal RMS power		Vertical/Horizontal RMS power		Vertical/Horizontal RMS power	
dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz
40.5/ 36.1	11.1/ 4.0	41.4/ 35.4	13.6/ 3.4	41.7/ 34.2	14.6/ 2.6

External antenna, upright mounted (Semi-Integrated Omni Antenna KRE 101 2233/1)

Tested frequency B		Tested frequency M		Tested frequency T	
Vertical/Horizontal RMS power		Vertical/Horizontal RMS power		Vertical/Horizontal RMS power	
dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz
39.9/ 28.6	9.7/ 0.7	40.2/ 28.9	10.4/ 0.8	40.2/ 28.7	10.4/ 0.7

External antenna, side mounted (Semi-Integrated Omni Antenna KRE 101 2233/1)

Tested frequency B		Tested frequency M		Tested frequency T	
Vertical/Horizontal RMS power		Vertical/Horizontal RMS power		Vertical/Horizontal RMS power	
dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz	dBm/ MHz	W/ MHz
38.4/ 26.8	6.8/ 0.5	39.0/ 28.0	7.9/ 0.6	38.6/ 27.2	7.2/ 0.5

Limits

§24.232: The maximum output power may not exceed 3280 W (e.i.r.p)/ 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, resulting in a maximum output power of 3280 W (e.i.r.p)/ MHz for the scope of this report. Moreover, base station transmitters operating in the band 1930-1995 MHz shall not have output power exceeding 100 watts. The peak-to-average ratio of the power shall not exceed 13 dB.

Complies?	Yes

Appendix 4

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

Date	Temperature	Humidity
2013-11-01	23 °C ± 3 °C	39 % ± 5 %
2013-11-04	23 °C ± 3 °C	34 % ± 5 %

Test set-up and procedure

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

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	901 508
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

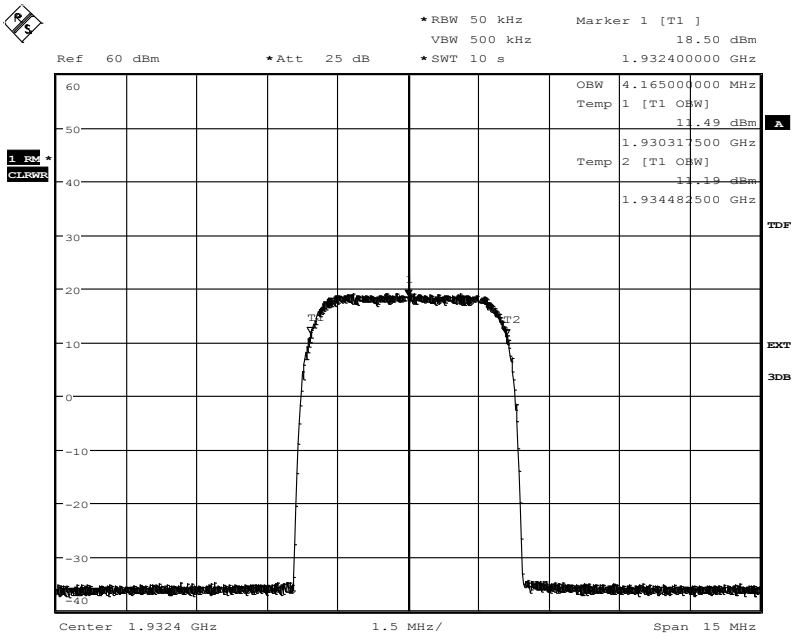
Results

MIMO mode, single carrier

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

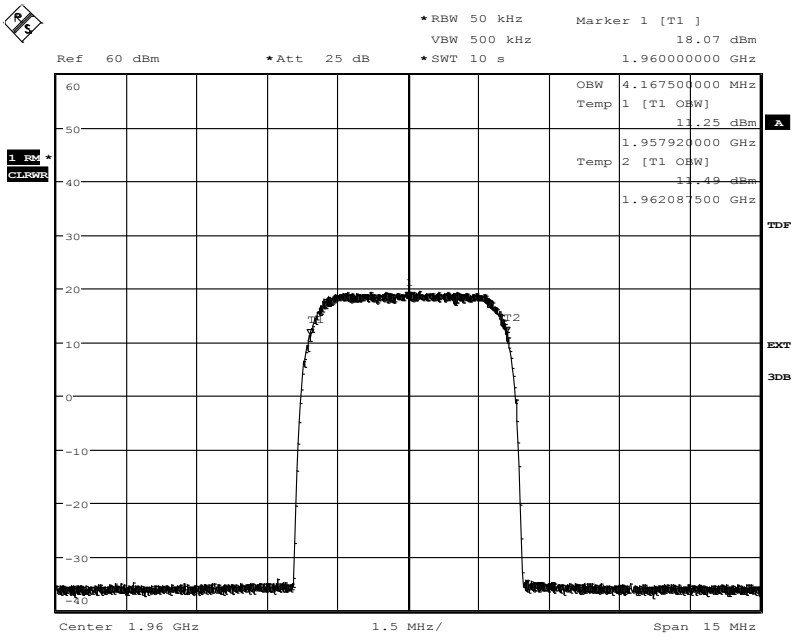
Appendix 4

Diagram 1:



Date: 1.NOV.2013 17:47:56

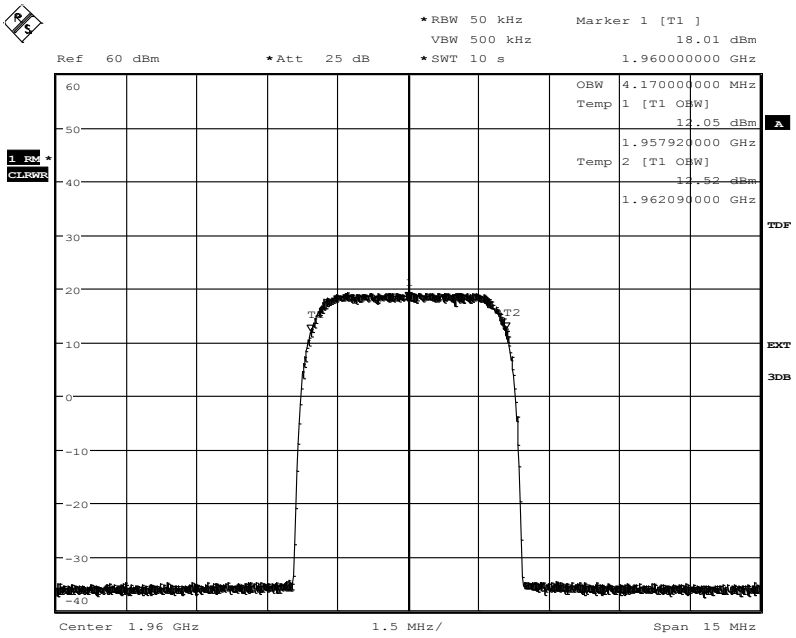
Diagram 2:



Date: 1.NOV.2013 16:33:49

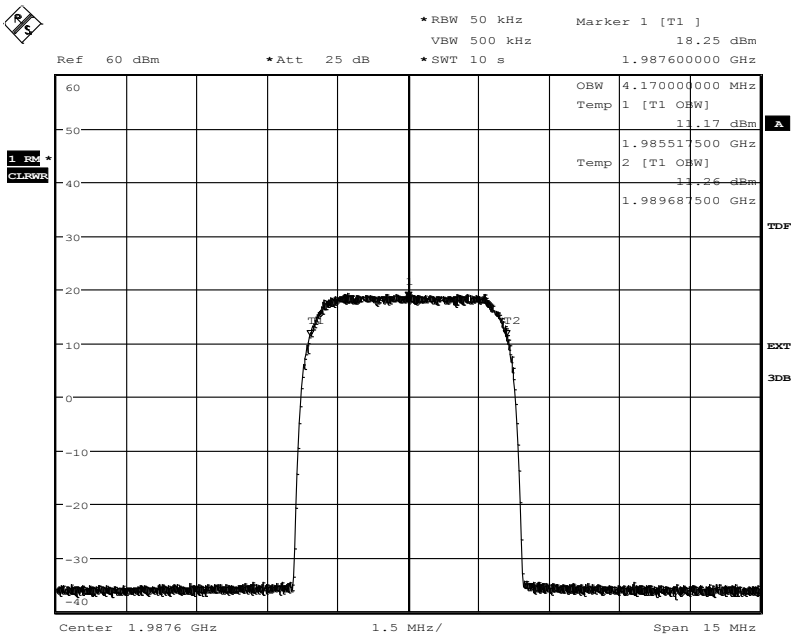
Appendix 4

Diagram 3:



Date: 1.NOV.2013 16:42:55

Diagram 4:



Date: 1.NOV.2013 18:19:03

Appendix 5

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

Date	Temperature	Humidity
2013-11-01	23 °C ± 3 °C	39 % ± 5 %
2013-11-04	23 °C ± 3 °C	34 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. The test object was connected to a spectrum analyser with the RMS detector activated. The spectrum analyser was connected to an external 10 MHz reference standard during the measurements.

A resolution bandwidth of 30 kHz was used up to 1 MHz away from the band edges. 30 kHz is <1% of the Emission BW (4.37 MHz between the 26 dB points for 5 MHz nominal BW setting). To compensate for the reduced resolution bandwidth, the limit was adjusted with 1.63 dB to -14.63 dBm.
A resolution bandwidth of 100 kHz was used 1 MHz to 6 MHz away from the band edges, to compensate for the reduced resolution bandwidth the limit was adjusted by 10 dB to -23 dBm.

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

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	901 508
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

MIMO mode: single carrier

Diagram	BW configuration	Tested frequency	Tested Port
1 a+c	5 MHz	B	RF A
2 a+c	5 MHz	B	RF B
3 a+c	5 MHz	T	RF A
4 a+c	5 MHz	T	RF B

MIMO mode: 2-carriers

Diagram	BW configuration	Tested frequency	Tested Port
5 a+c	5 MHz	B2+5	RF A
6 a+c	5 MHz	T2-5	RF A

Limits

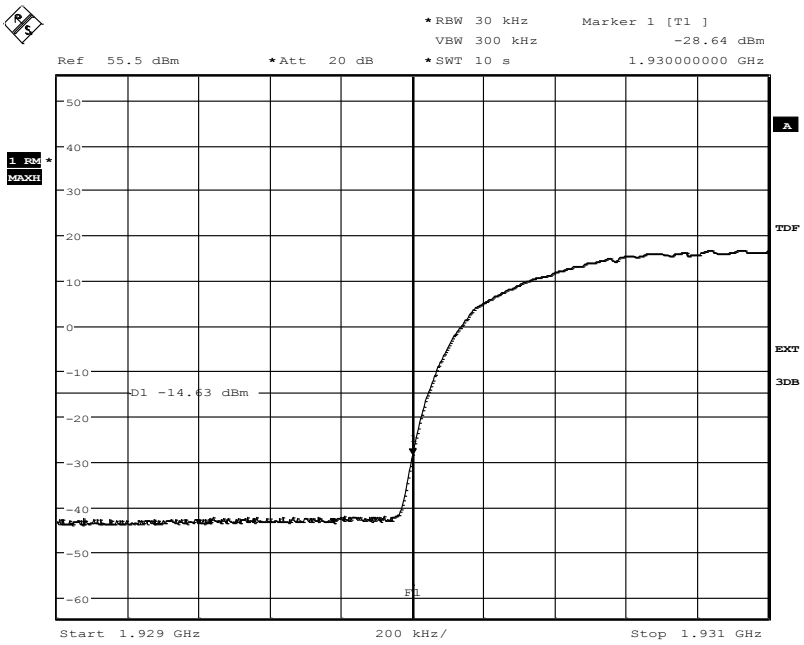
CFR 47 §24.238 and RSS-133 6.5

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

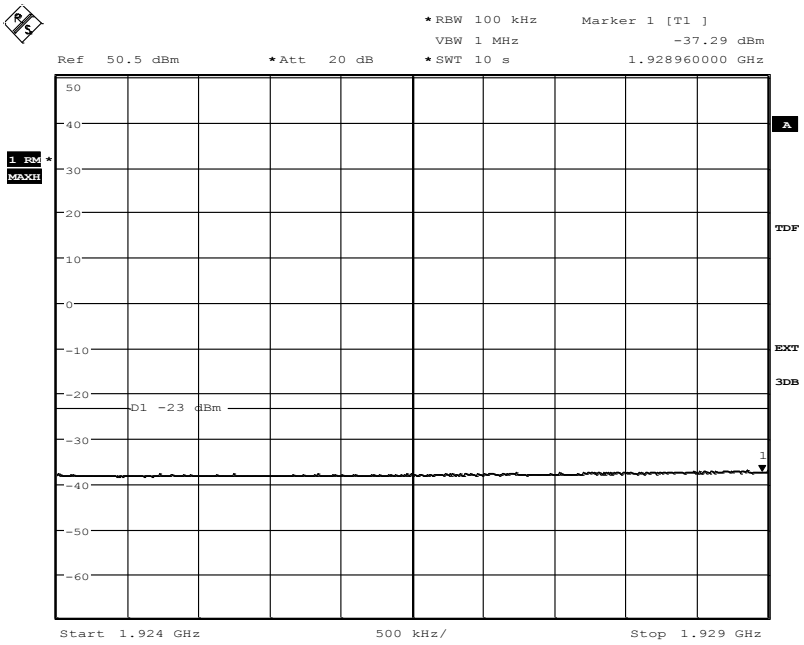
Appendix 5

Diagram 1a:



Date: 1.NOV.2013 17:12:59

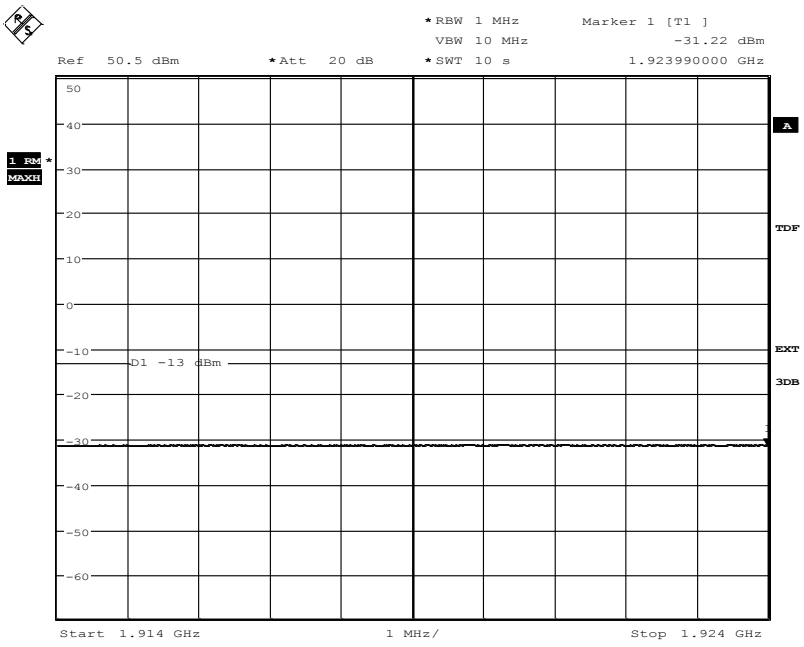
Diagram 1b:



Date: 1.NOV.2013 17:15:04

Appendix 5

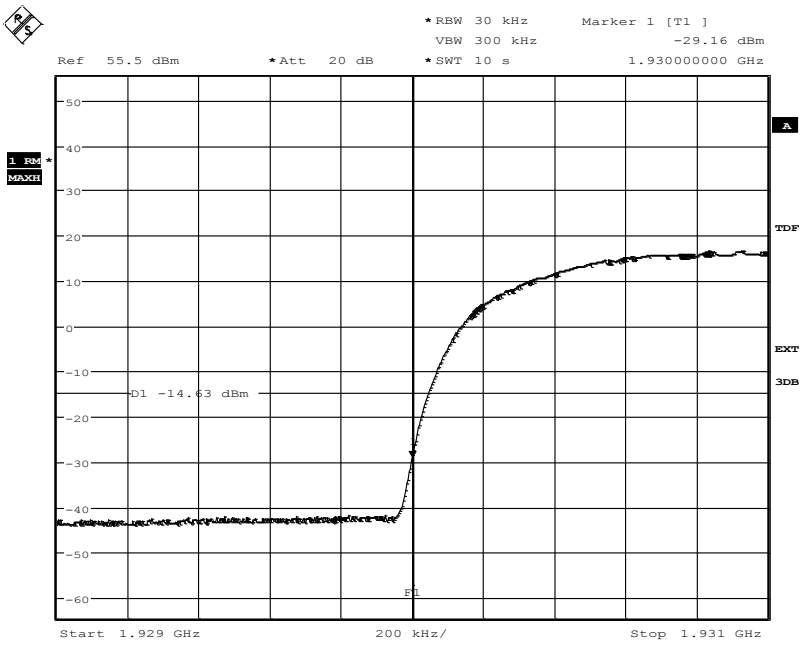
Diagram 1c:



Date: 1.NOV.2013 17:09:01

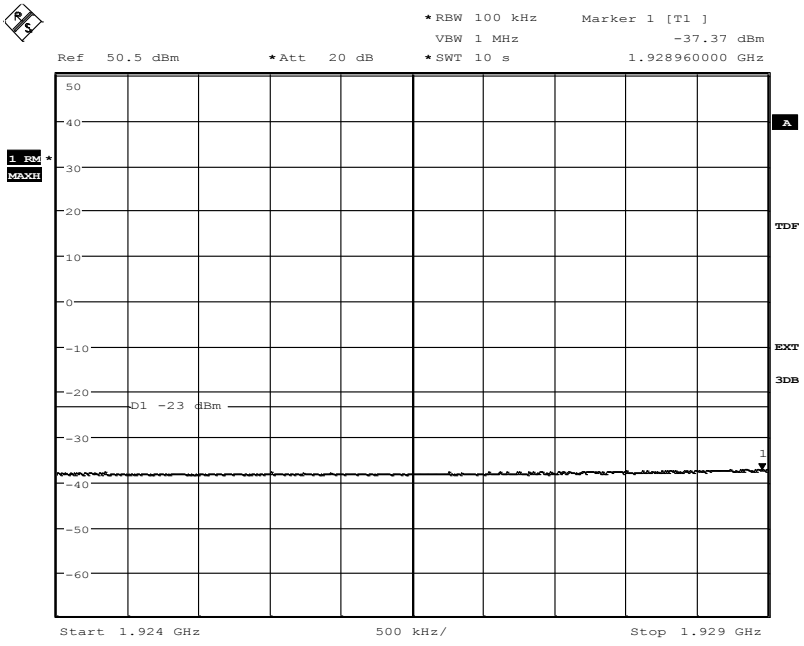
Appendix 5

Diagram 2a:



Date: 1.NOV.2013 16:54:47

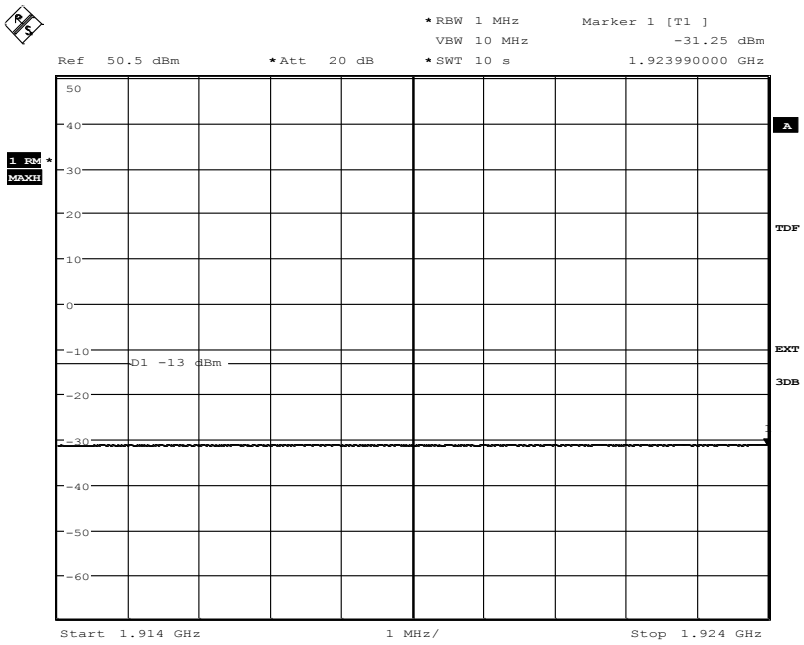
Diagram 2b:



Date: 1.NOV.2013 16:56:00

Appendix 5

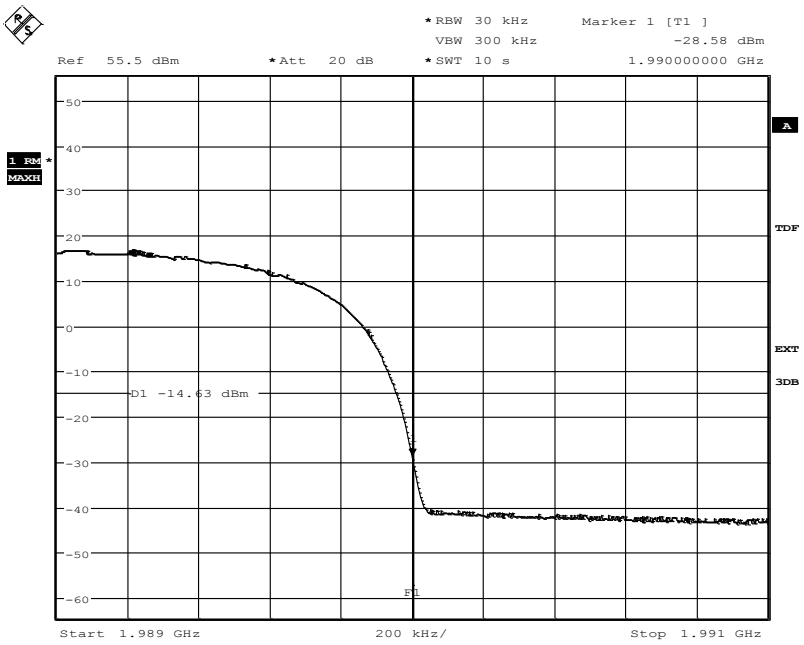
Diagram 2c:



Date: 1.NOV.2013 16:56:42

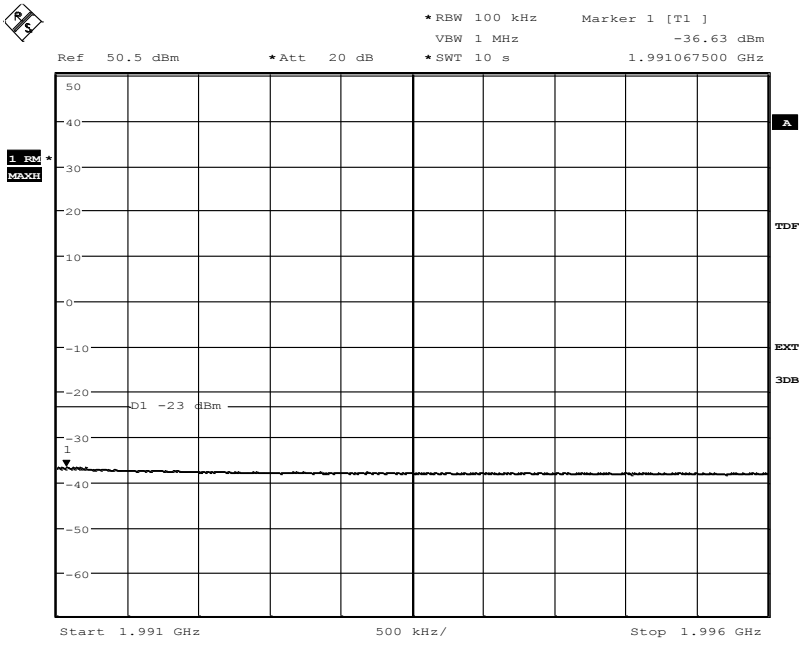
Appendix 5

Diagram 3a:



Date: 1.NOV.2013 18:26:36

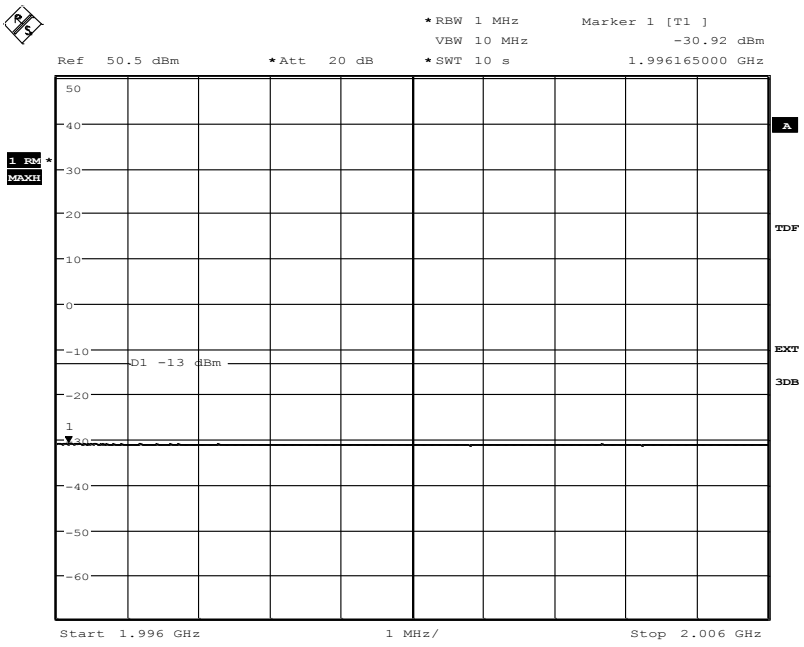
Diagram 3b:



Date: 1.NOV.2013 18:27:56

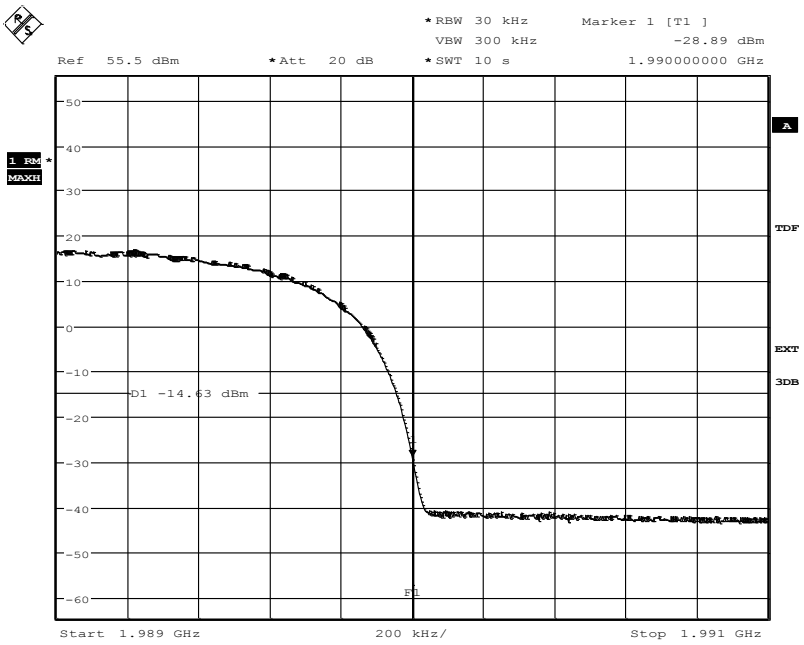
Appendix 5

Diagram 3c:



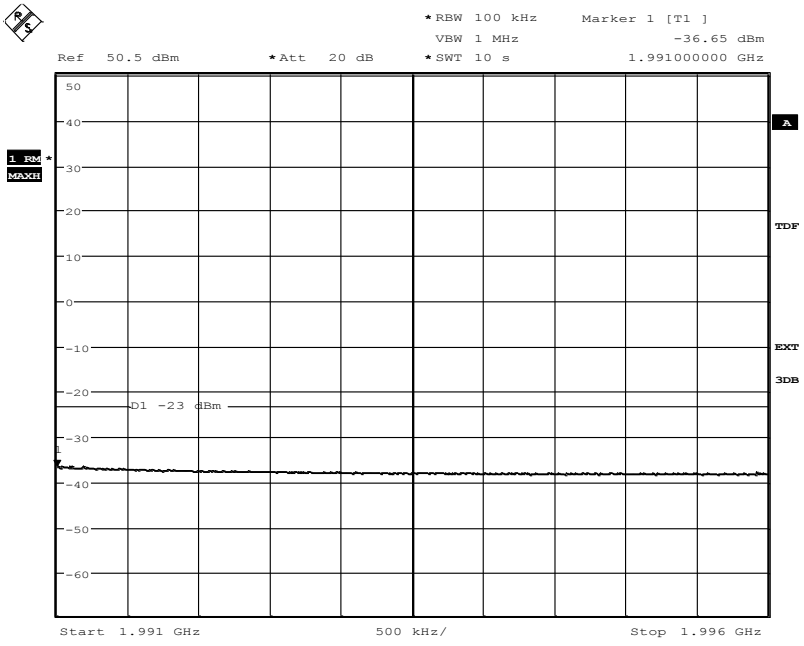
Appendix 5

Diagram 4a:



Date: 1.NOV.2013 18:34:54

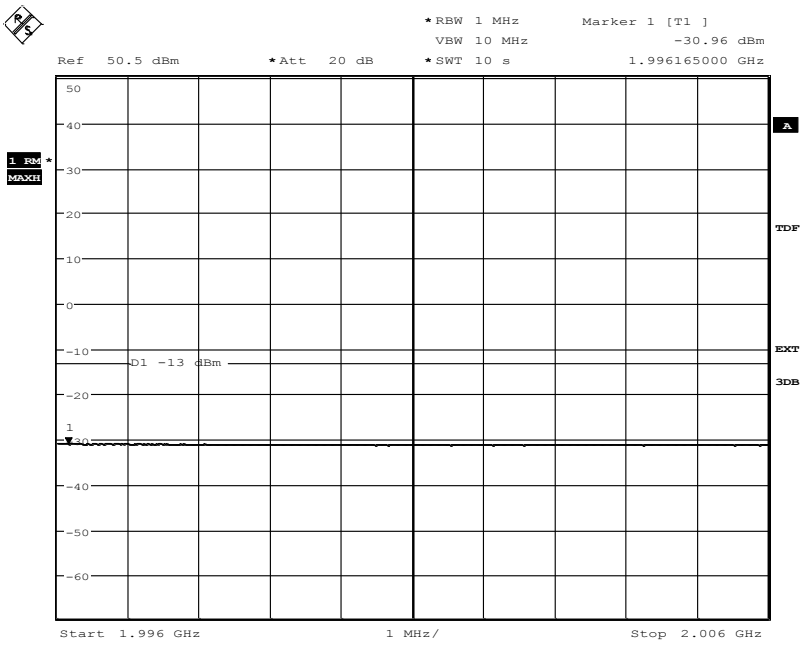
Diagram 4b:



Date: 1.NOV.2013 18:33:52

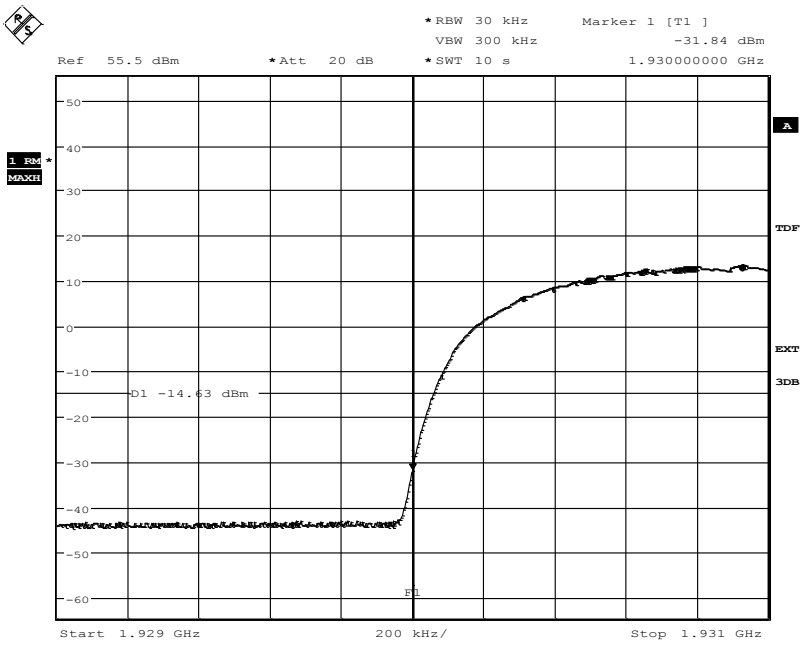
Appendix 5

Diagram 4c:



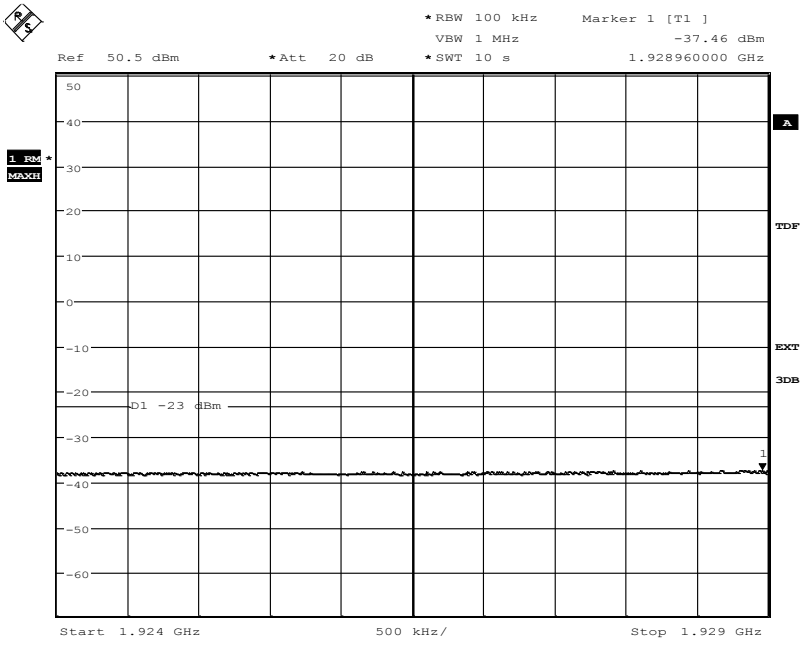
Appendix 5

Diagram 5a:



Date: 4.NOV.2013 12:30:02

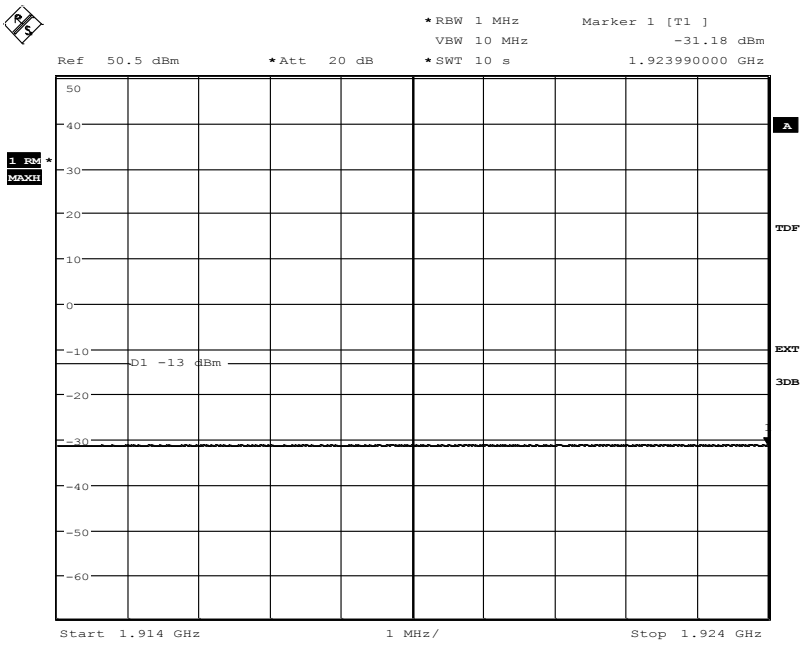
Diagram 5b:



Date: 4.NOV.2013 12:24:23

Appendix 5

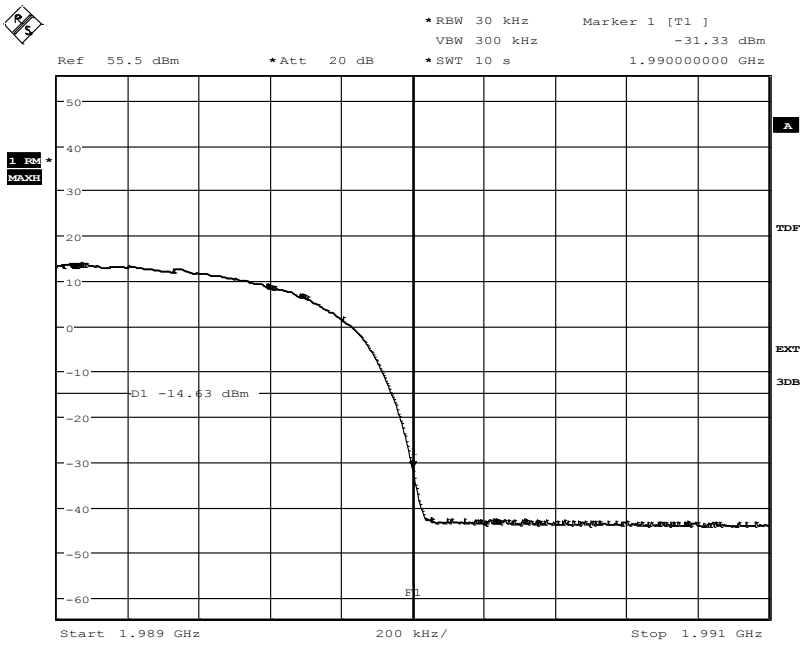
Diagram 5c:



Date: 4.NOV.2013 12:27:49

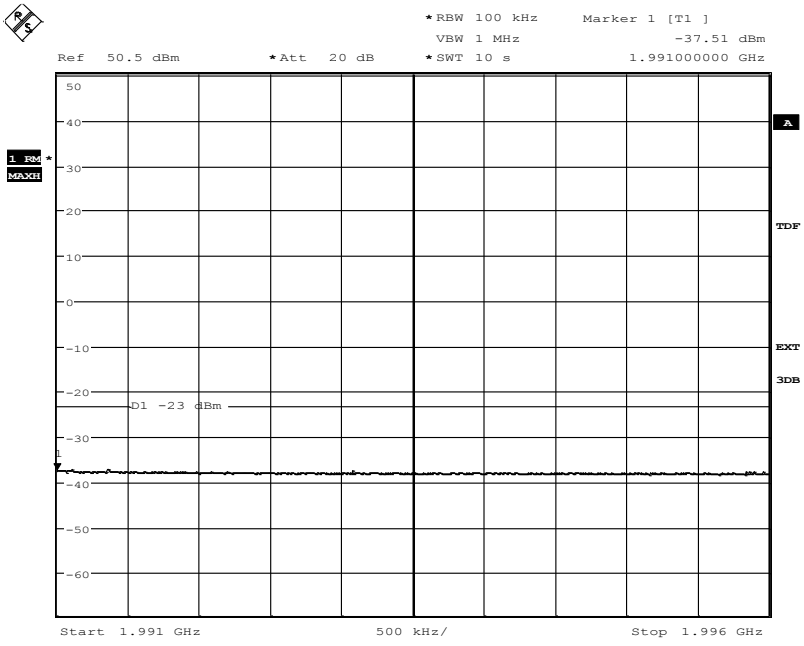
Appendix 5

Diagram 6a:



Date: 4.NOV.2013 14:14:21

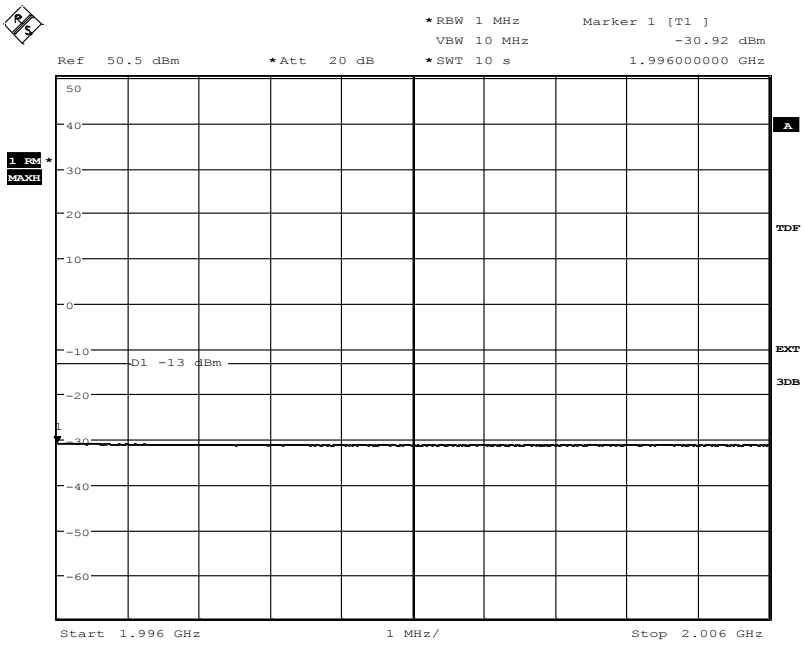
Diagram 6b:



Date: 4.NOV.2013 14:15:36

Appendix 5

Diagram 6c:



Appendix 6

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

Date	Temperature	Humidity
2013-11-01	23 °C ± 3 °C	39 % ± 5 %
2013-11-04	23 °C ± 3 °C	34 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. The output was connected to a spectrum analyser with a RBW setting of 1 MHz and RMS detector activated. The spectrum analyser 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), a), (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	901 508
HP filter	901 502
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

MIMO mode, single carrier

Diagram	BW configuration	Tested frequency	Tested Port
1 a+d	5 MHz	B	RF A
2 a+d	5 MHz	M	RF A
3 a+d	5 MHz	M	RF B
4 a+d	5 MHz	T	RF A

MIMO mode, 2-carriers

Diagram	BW configuration	Testedfrequency	Tested Port
5 a+d	5 MHz	B2+10	RF A
6 a+d	5 MHz	T2-10	RF A

MIMO mode, 4-carriers

Diagram	BW configuration	Testedfrequency	Tested Port
7 a+d	5 MHz	B4	RF A
8 a+d	5 MHz	T4	RF A

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 1.990 GHz. The measurements were made up to 20 GHz (10x1.990 GHz = 19.90 GHz).

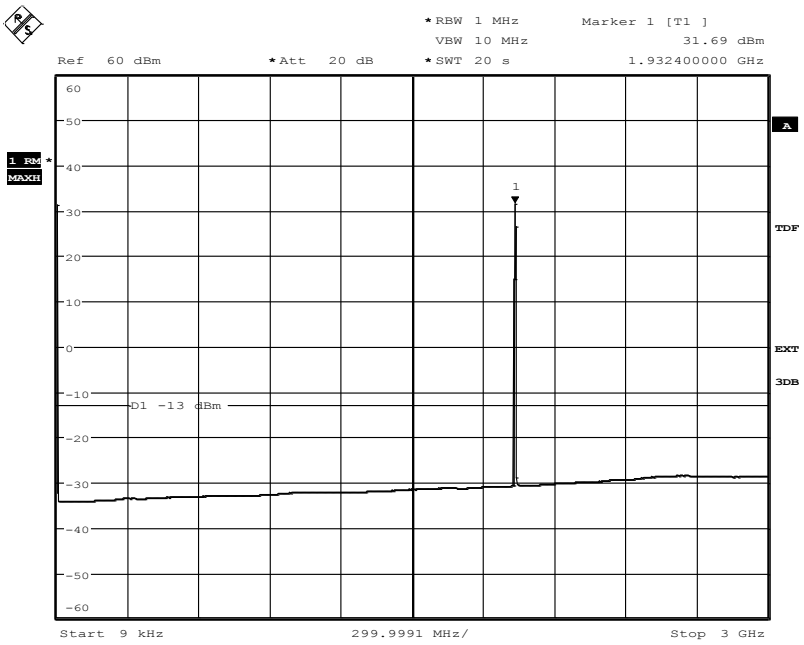
Limits

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

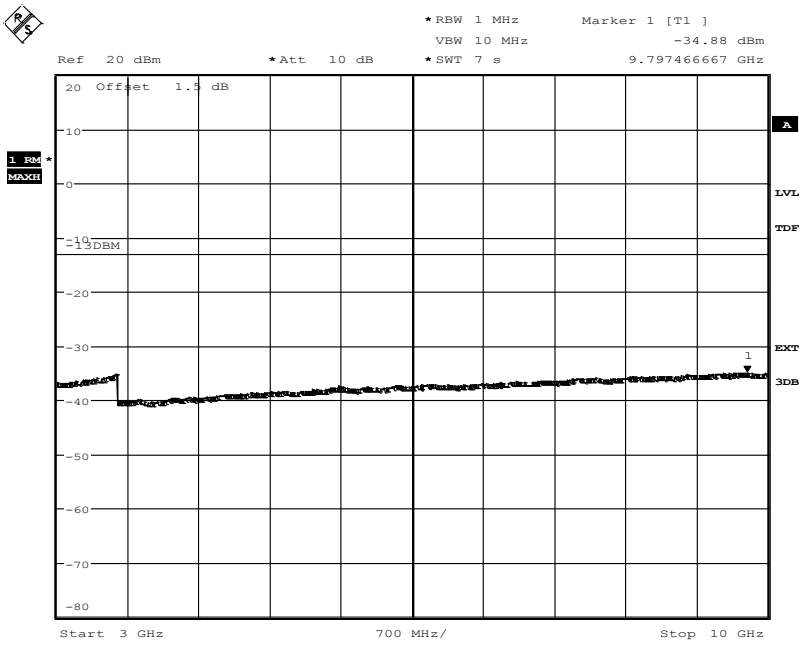
Appendix 6

Diagram 1a:



Date: 1.NOV.2013 17:57:20

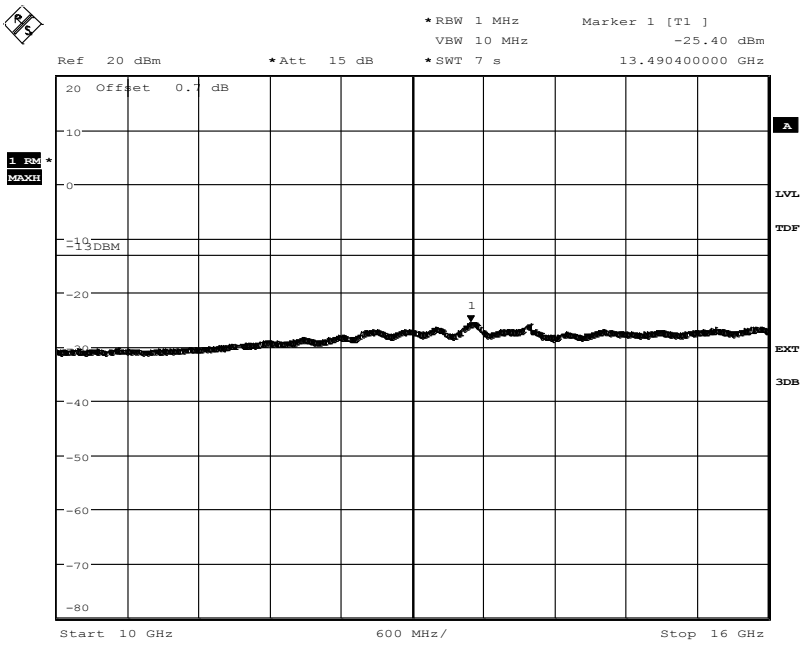
Diagram 1b:



Date: 1.NOV.2013 18:02:45

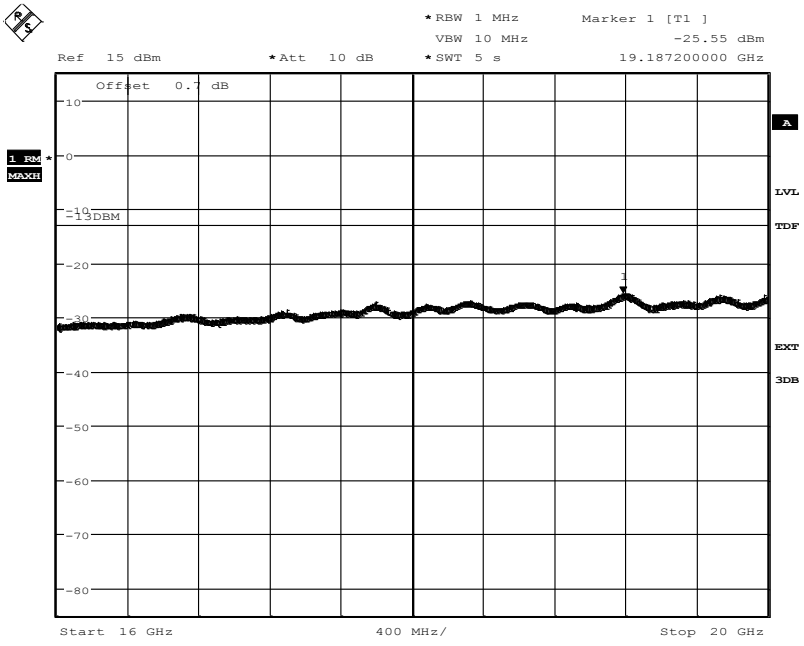
Appendix 6

Diagram 1c:



Date: 1.NOV.2013 18:03:46

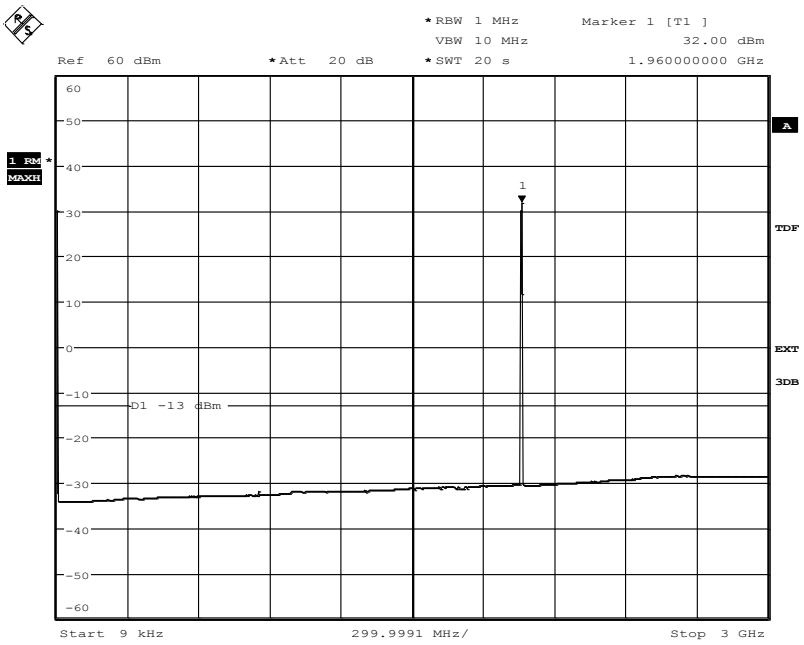
Diagram 1d:



Date: 1.NOV.2013 18:04:42

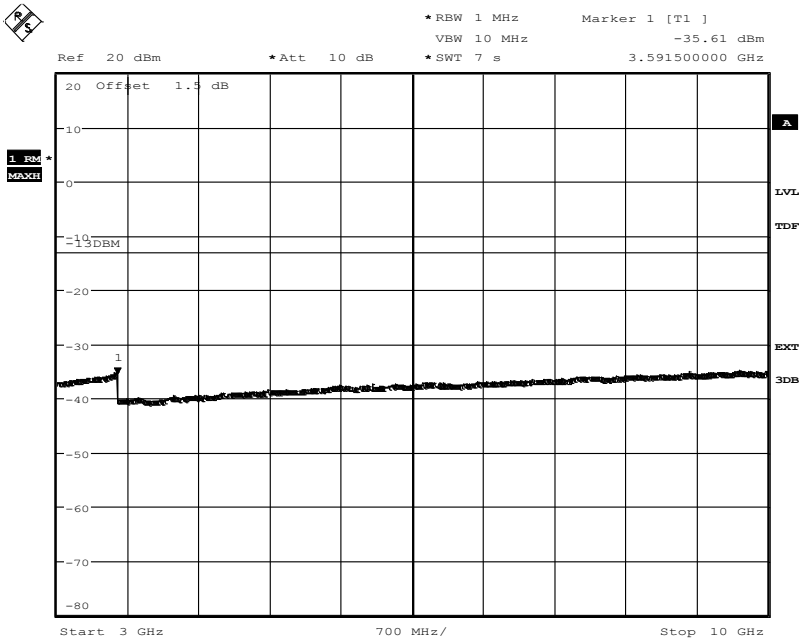
Appendix 6

Diagram 2a:



Date: 1.NOV.2013 18:47:33

Diagram2b:



Date: 1.NOV.2013 16:36:05

Appendix 6

Diagram 2c:

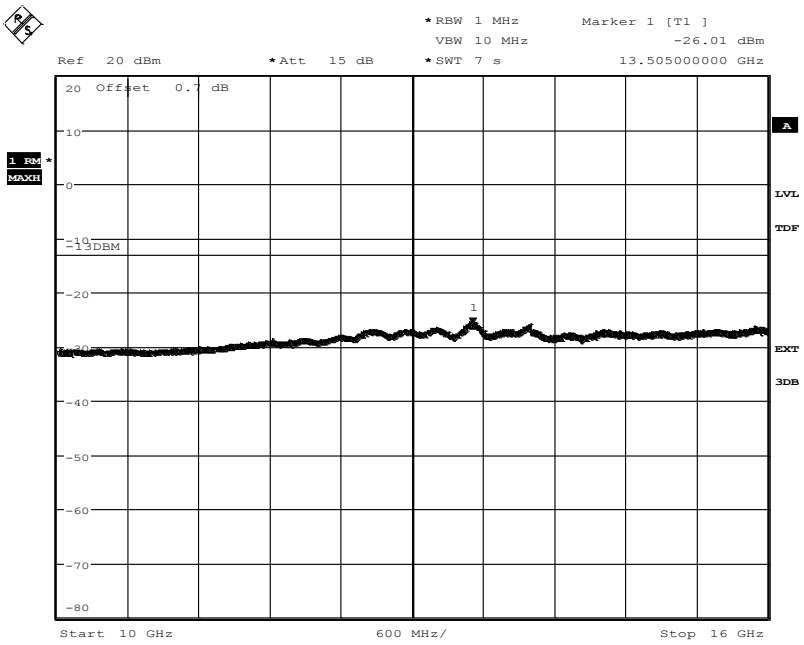


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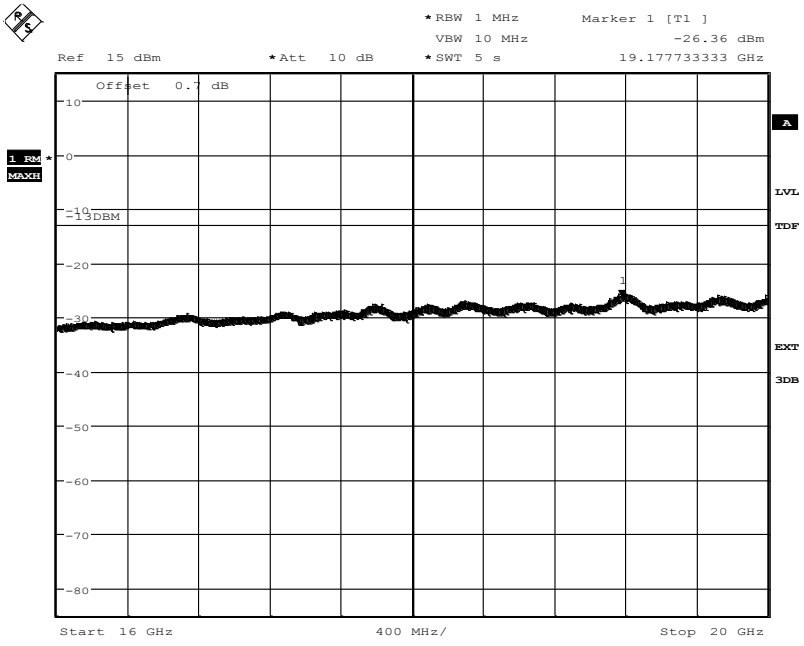
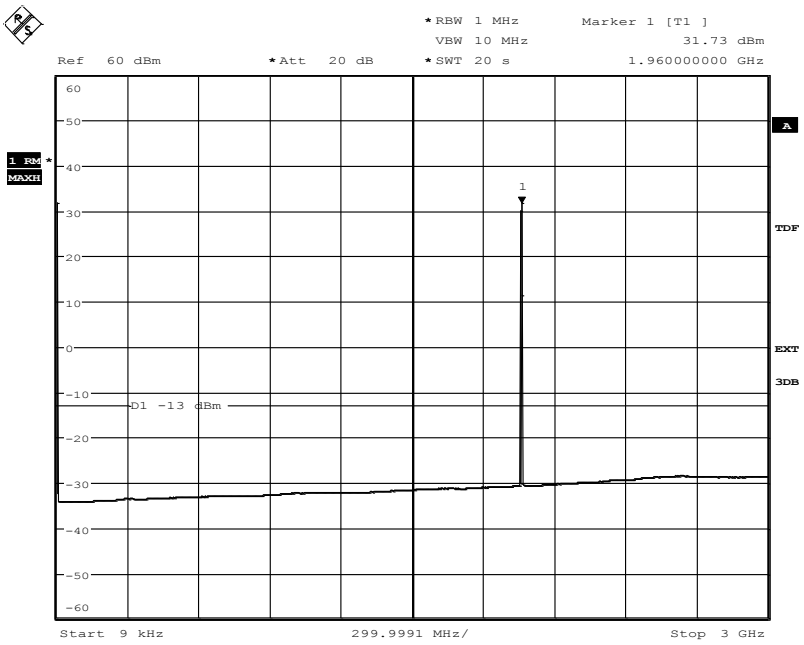
Diagram 2d:



Date: 1.NOV.2013 16:37:13

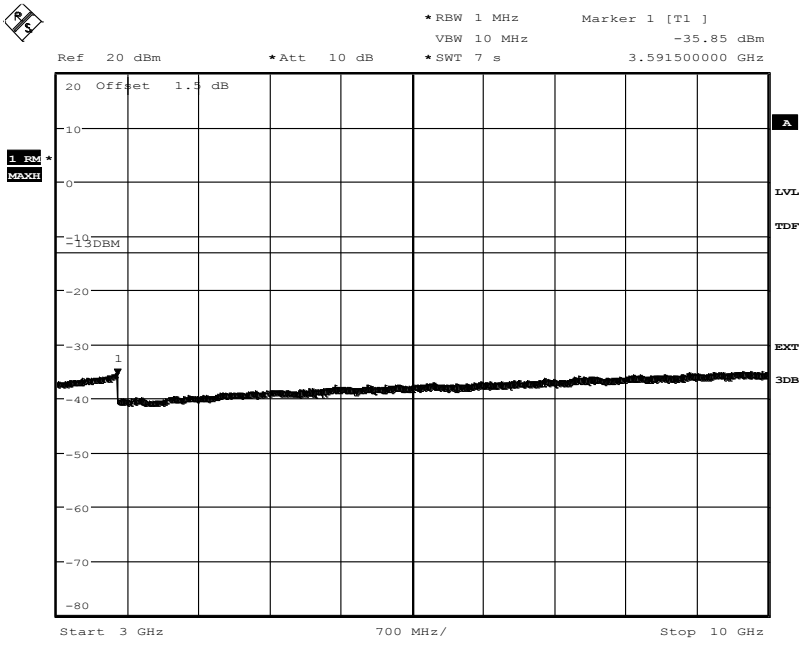
Appendix 6

Diagram 3a:



Date: 1.NOV.2013 16:42:16

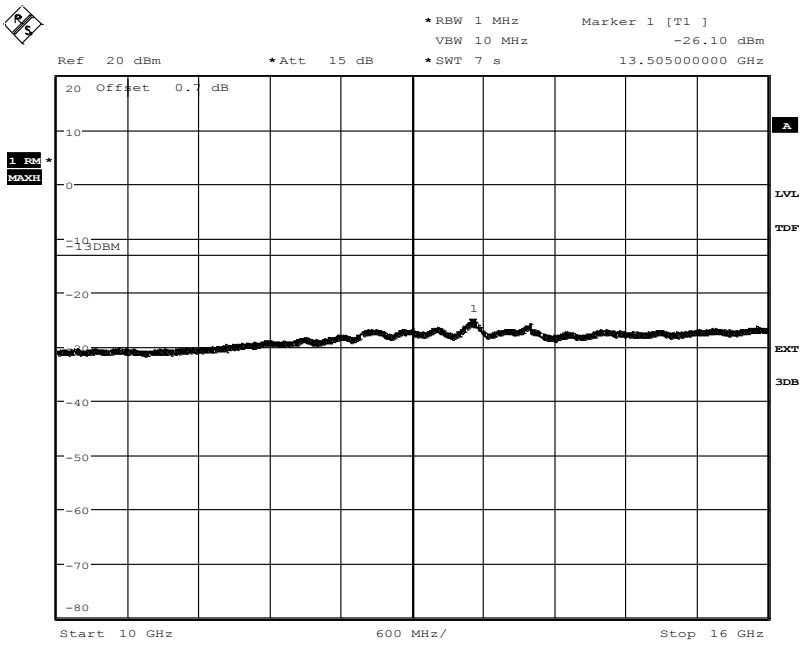
Diagram 3b:



Date: 1.NOV.2013 16:41:03

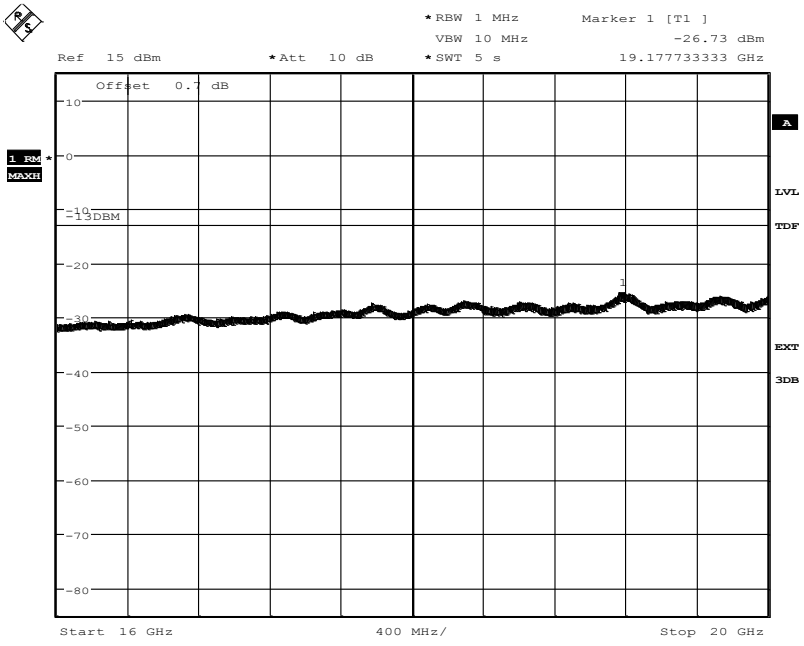
Appendix 6

Diagram 3c:



Date: 1.NOV.2013 16:40:39

Diagram 3d:



Date: 1.NOV.2013 16:40:03

Appendix 6

Diagram 4a:

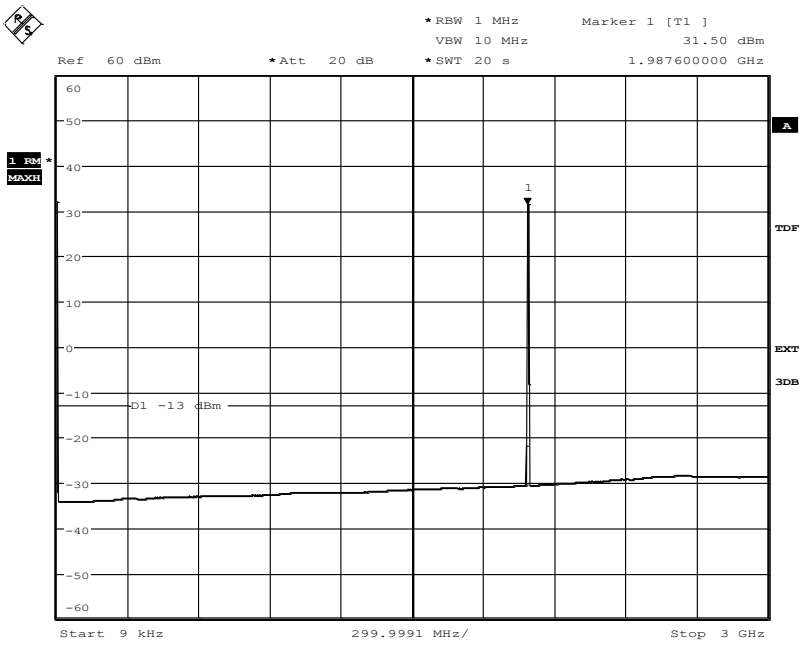


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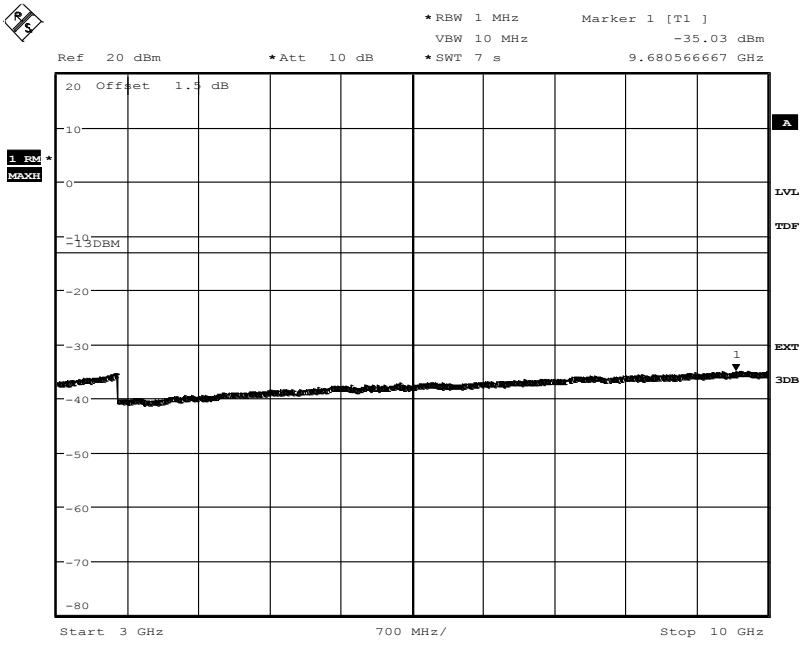
Diagram 4b:



Date: 1.NOV.2013 18:14:25

Appendix 6

Diagram 4c:

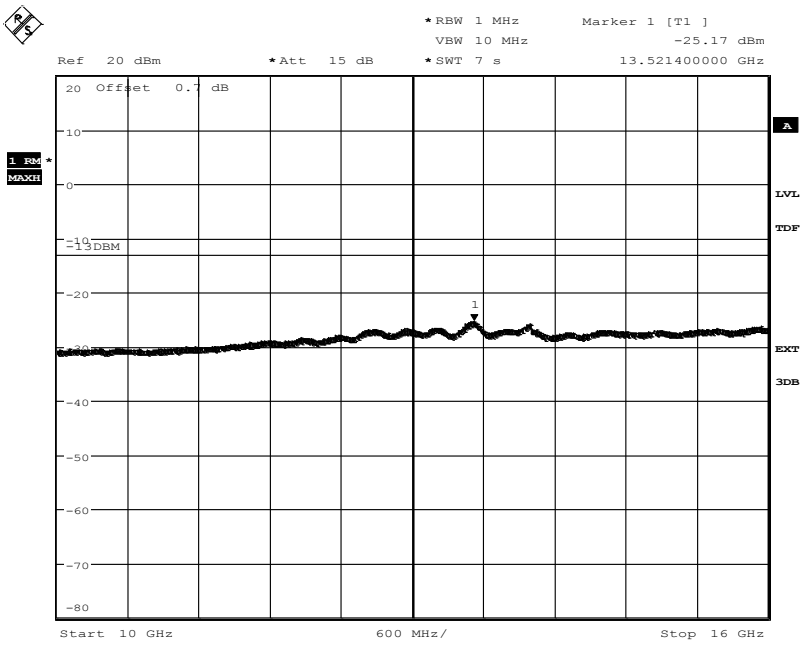


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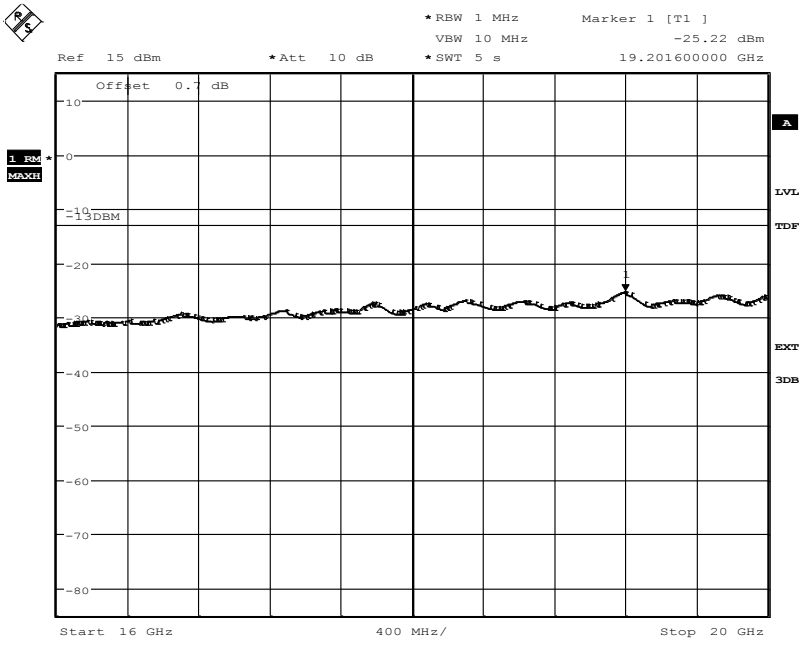
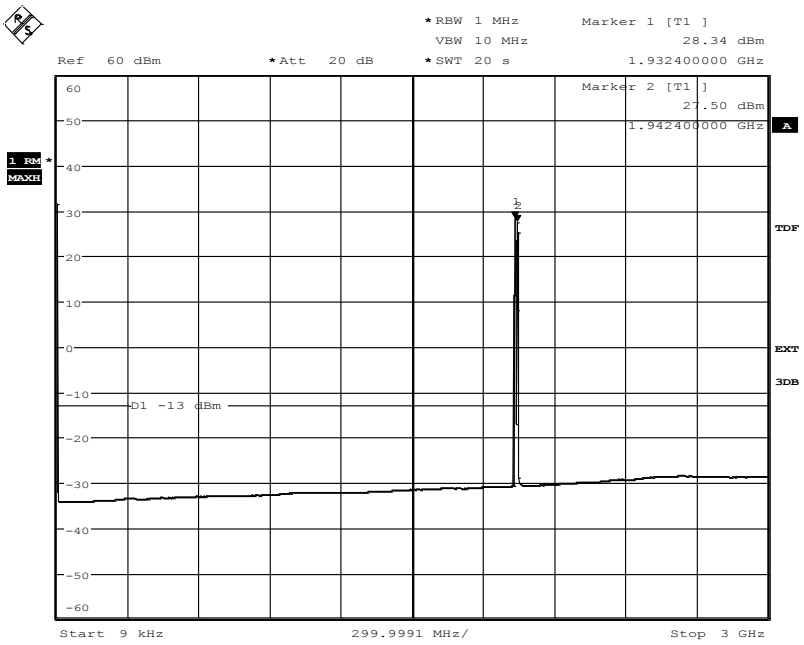
Diagram 4d:



Date: 1.NOV.2013 18:12:27

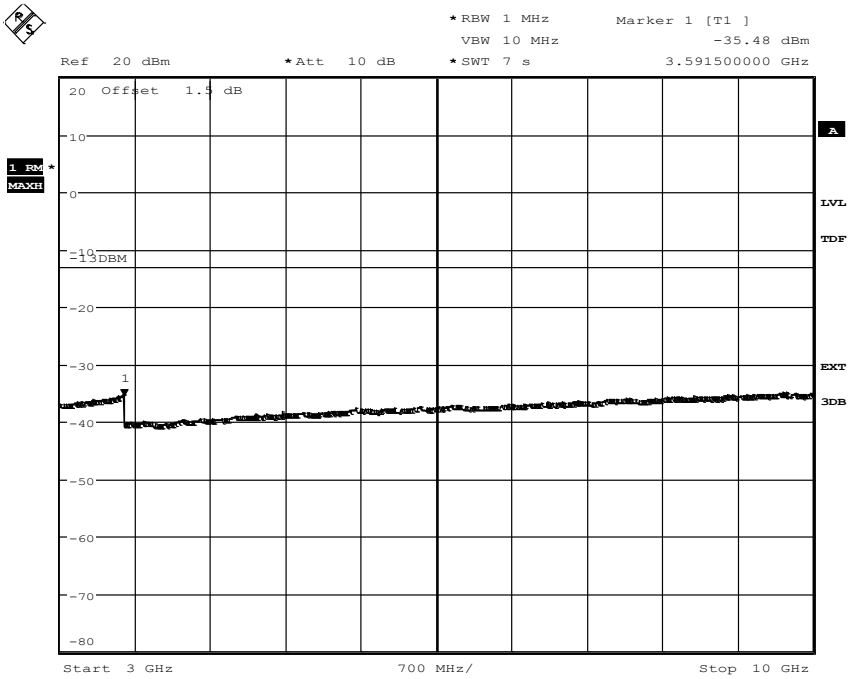
Appendix 6

Diagram 5a:



Date: 4.NOV.2013 12:40:49

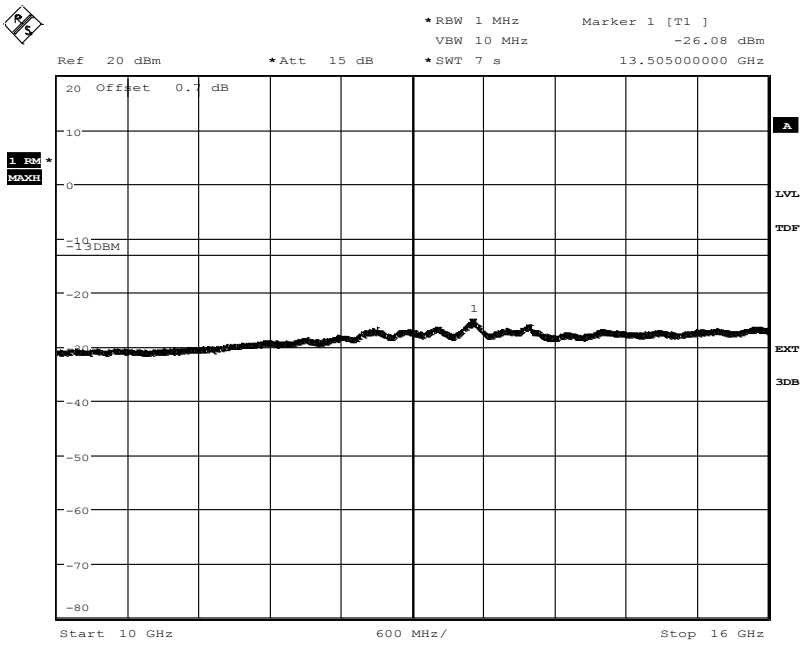
Diagram 5b:



Date: 4.NOV.2013 12:42:56

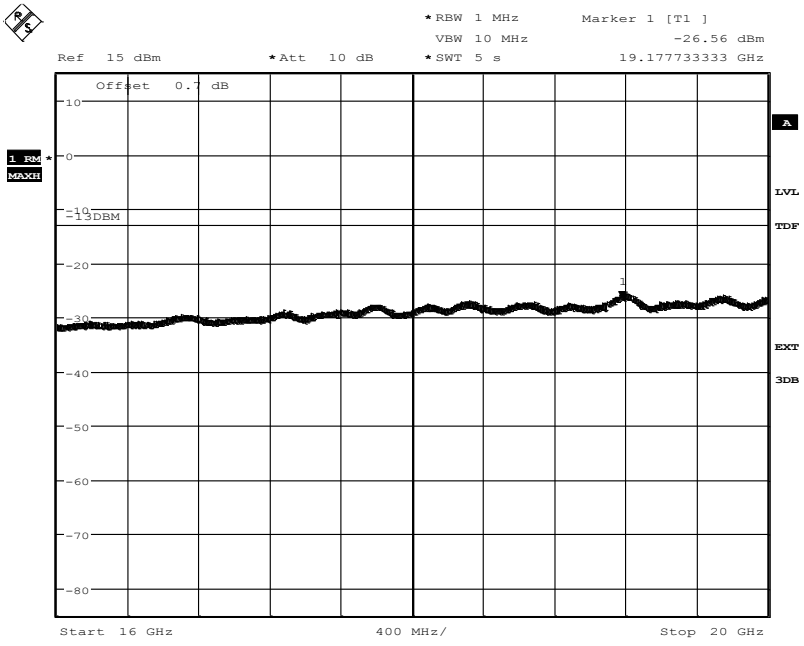
Appendix 6

Diagram 5c:



Date: 4.NOV.2013 12:45:05

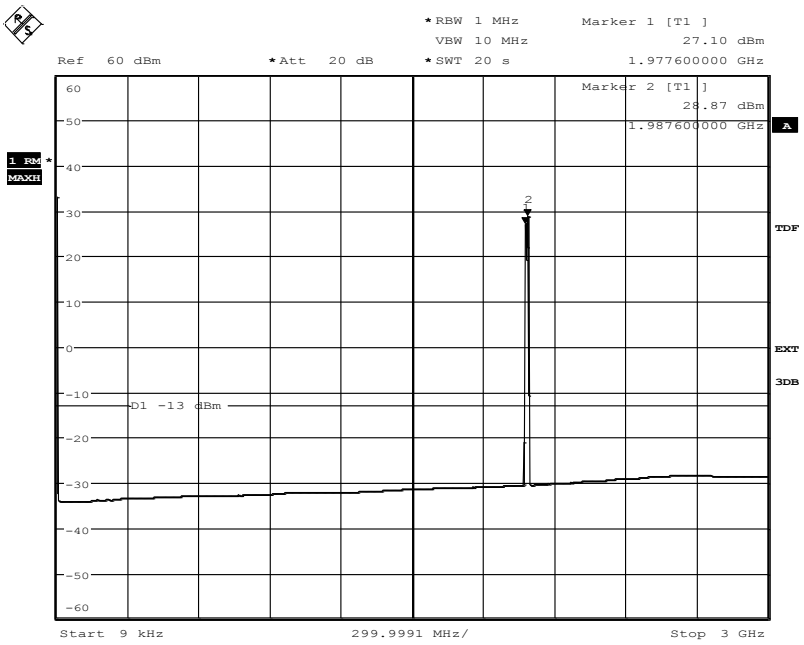
Diagram 5d:



Date: 4.NOV.2013 12:46:02

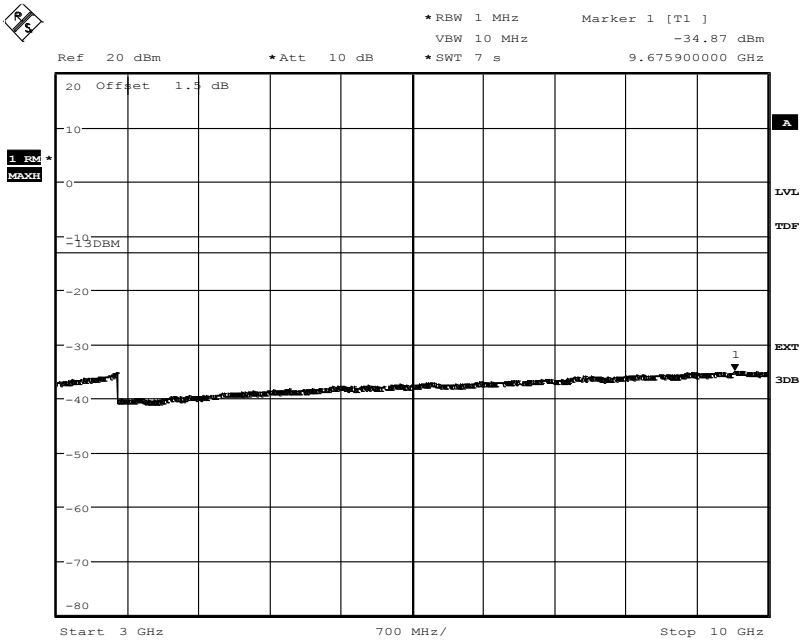
Appendix 6

Diagram 6a:



Date: 4.NOV.2013 14:30:11

Diagram 6b:



Date: 4.NOV.2013 14:40:32

Appendix 6

Diagram 6c:

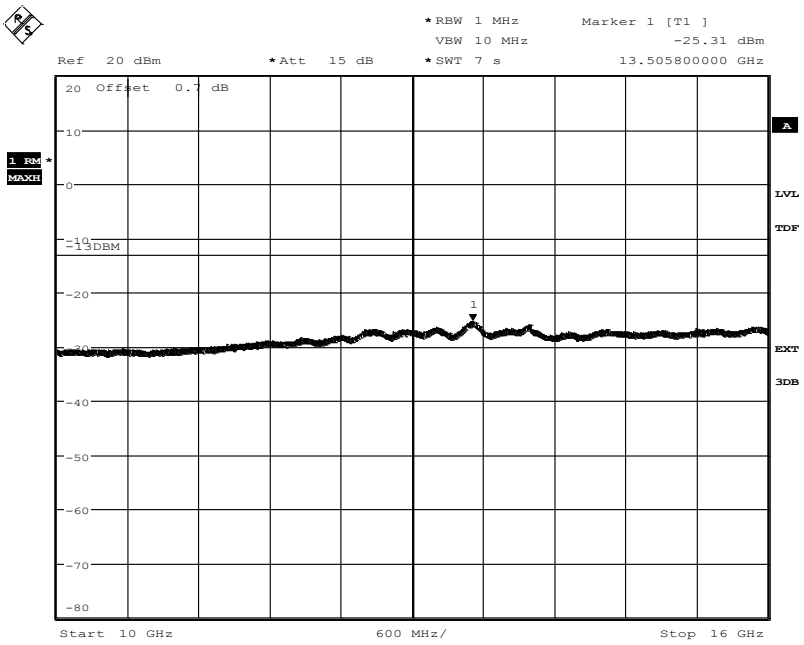


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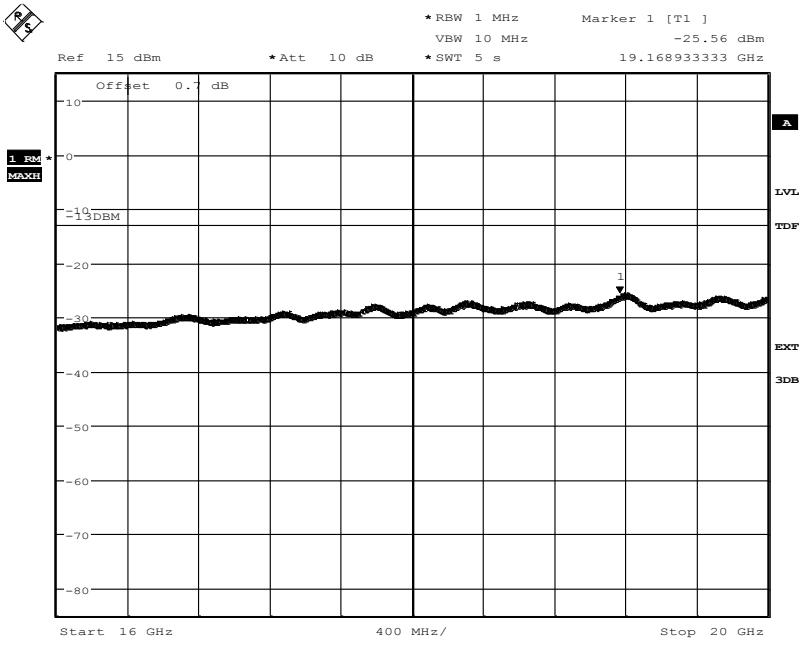
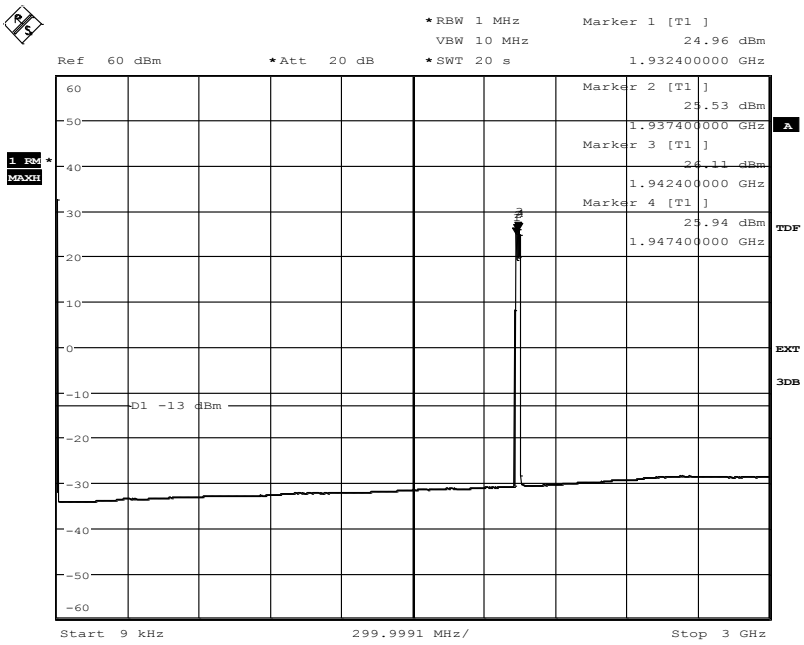
Diagram 6d:



Date: 4.NOV.2013 14:47:49

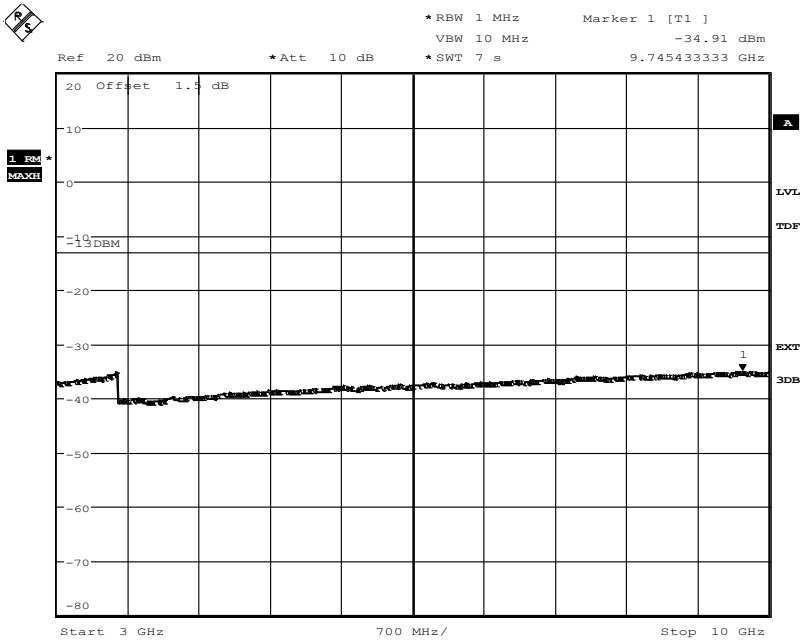
Appendix 6

Diagram 7a:



Date: 4.NOV.2013 15:43:43

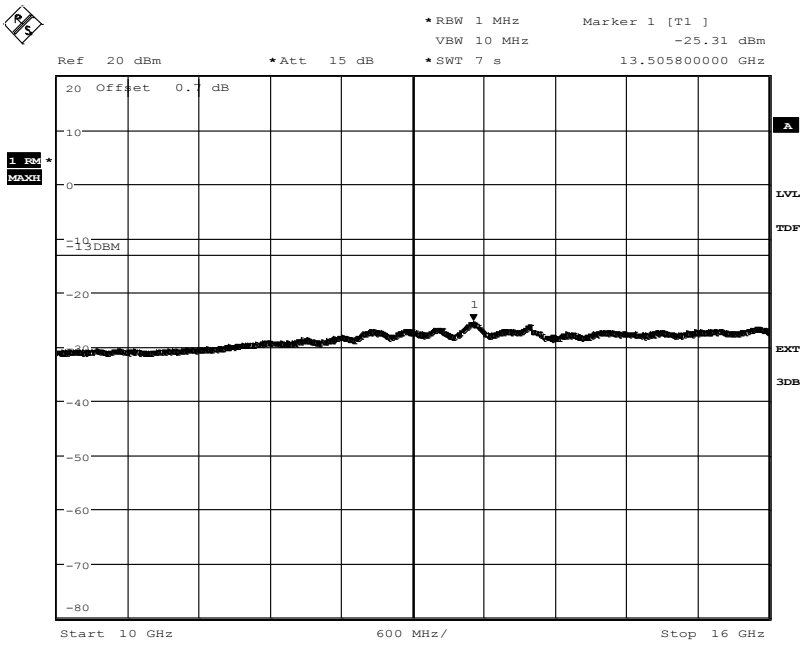
Diagram 7b:



Date: 4.NOV.2013 15:35:18

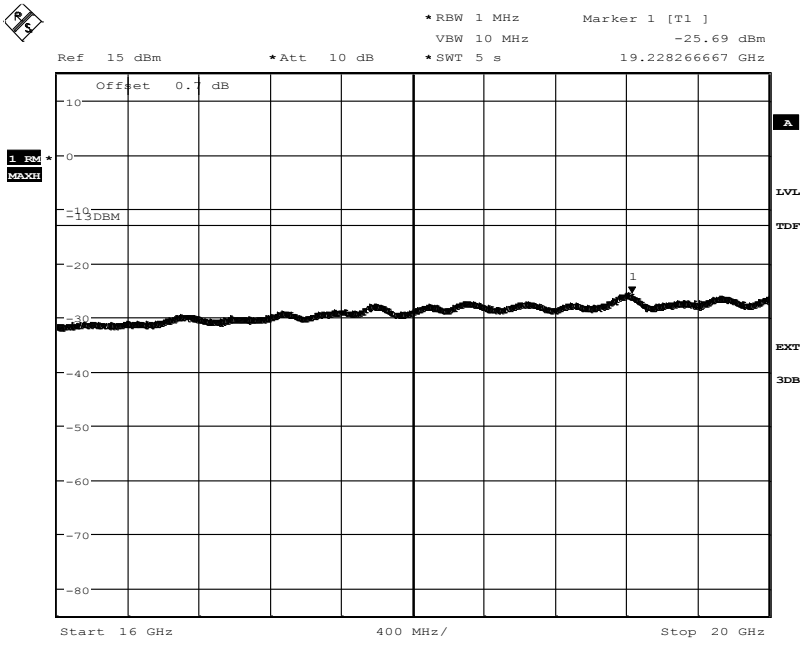
Appendix 6

Diagram 7c:



Date: 4.NOV.2013 15:36:08

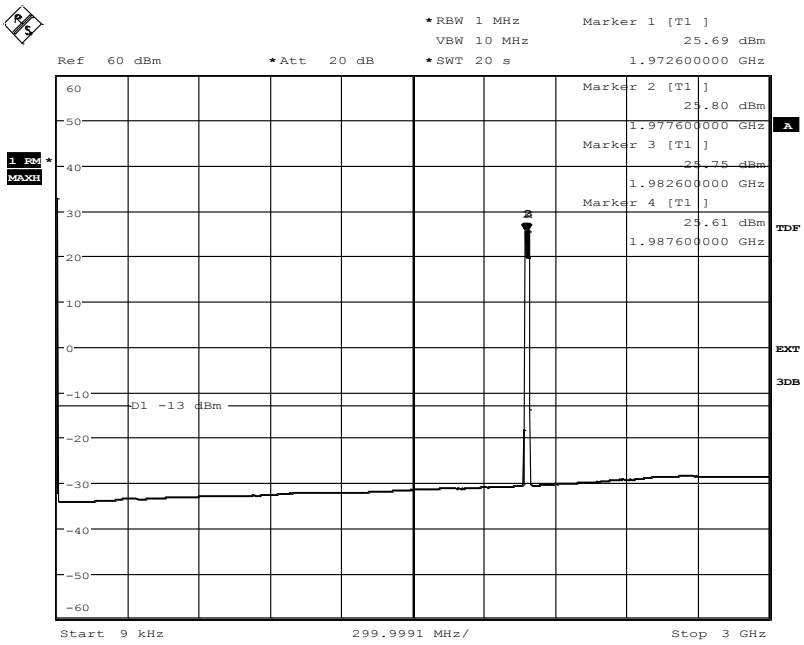
Diagram 7d:



Date: 4.NOV.2013 15:37:16

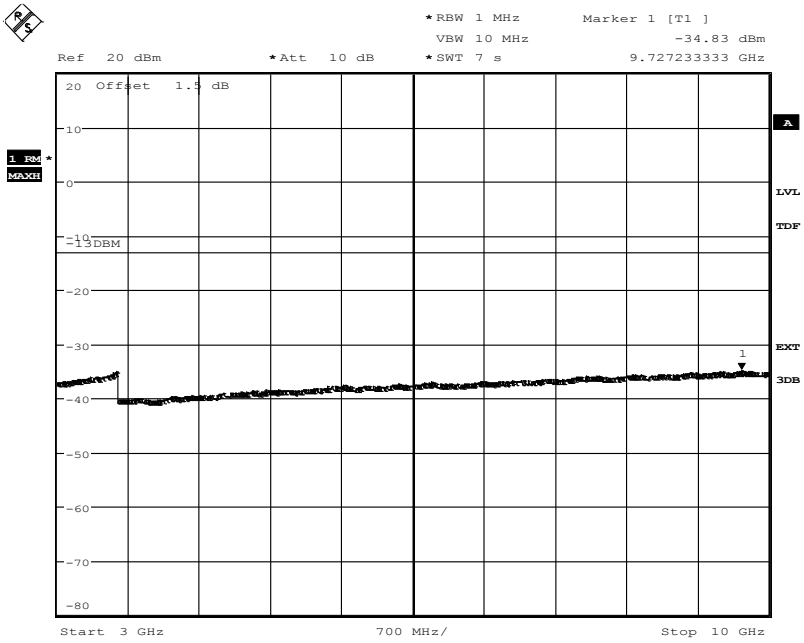
Appendix 6

Diagram 8a:



Date: 4.NOV.2013 15:59:08

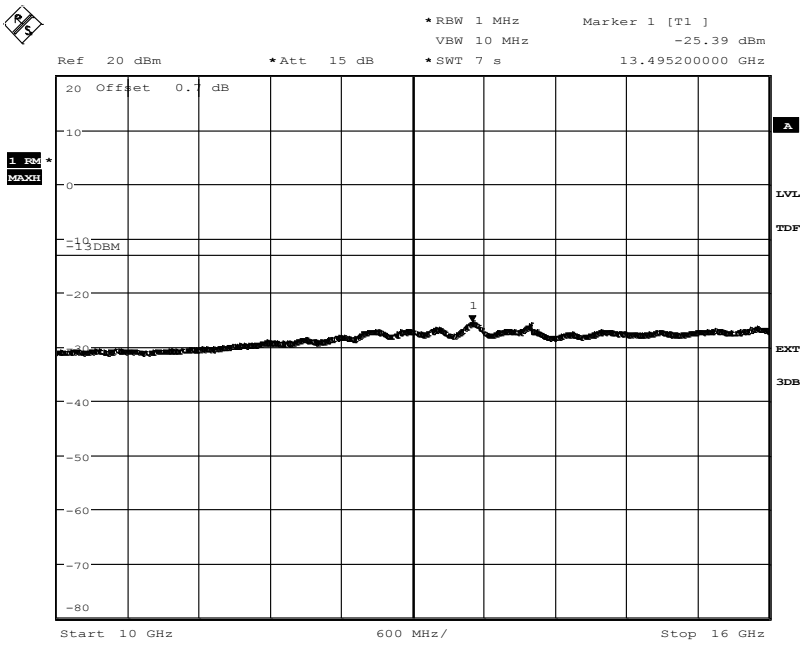
Diagram 8b:



Date: 4.NOV.2013 16:00:44

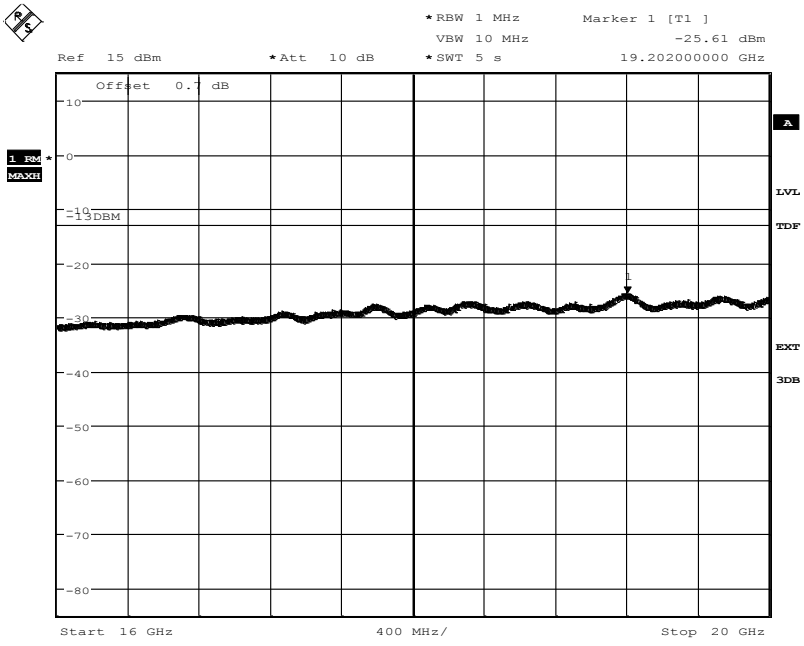
Appendix 6

Diagram 8c:



Date: 4.NOV.2013 16:01:30

Diagram 8d:



Date: 4.NOV.2013 16:02:13

Appendix 7

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

Date	Temperature	Humidity
2013-10-25	24 °C ± 3°C	35 % ± 5 %
2013-10-26	23 °C ± 3°C	40 % ± 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.

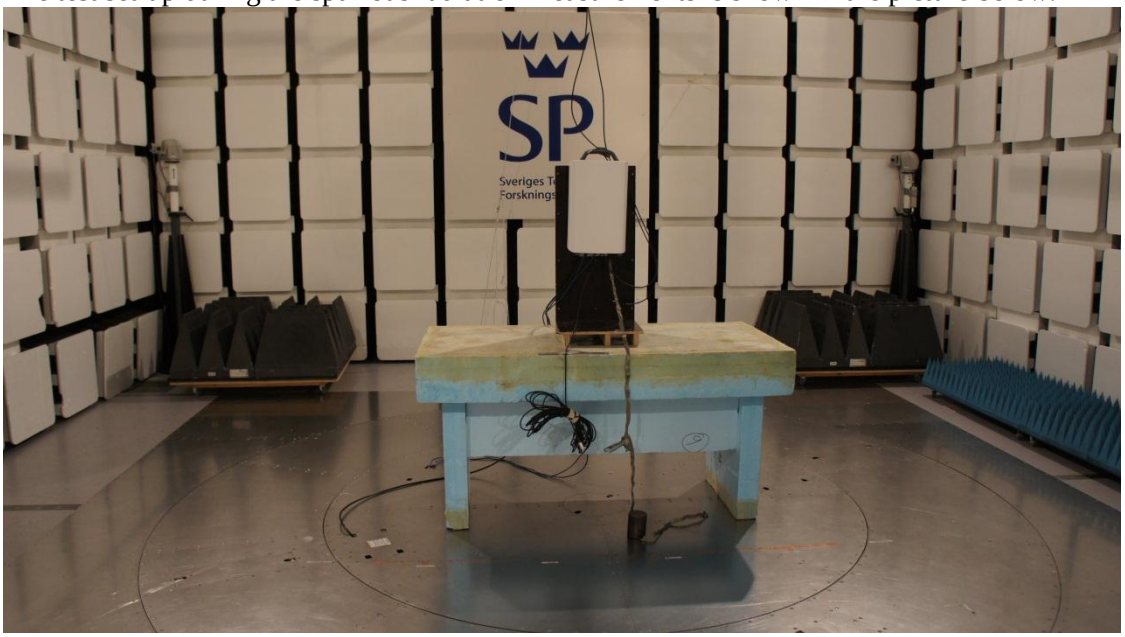
In the frequency range 30 MHz – 20 GHz the measurement was performed in power with a RBW of 1 MHz. A propagation loss in free space was calculated. The used formula was $\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.

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
EMC 32 ver. 8.52.0	503 899
Chase Bilog Antenna CBL 6111A	503 182
EMCO Horn Antenna 3115	502 175
Flann STD Gain Horn Antenna 20240-20	503 674
Miteq, Low Noise Amplifier	503 285
µComp Nordic, Low Noise Amplifier	901 545
Testo 635 temperature and humidity meter	504 188

Tested configurations

B
B2+10
B4
M
T

Results, representing worst case

Diagram	BW configuration[MHz]	Configuration
1 a-c	5 MHz	B

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-20 000	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

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 per 1 MHz RBW.

Complies?	Yes

Diagram 1a:

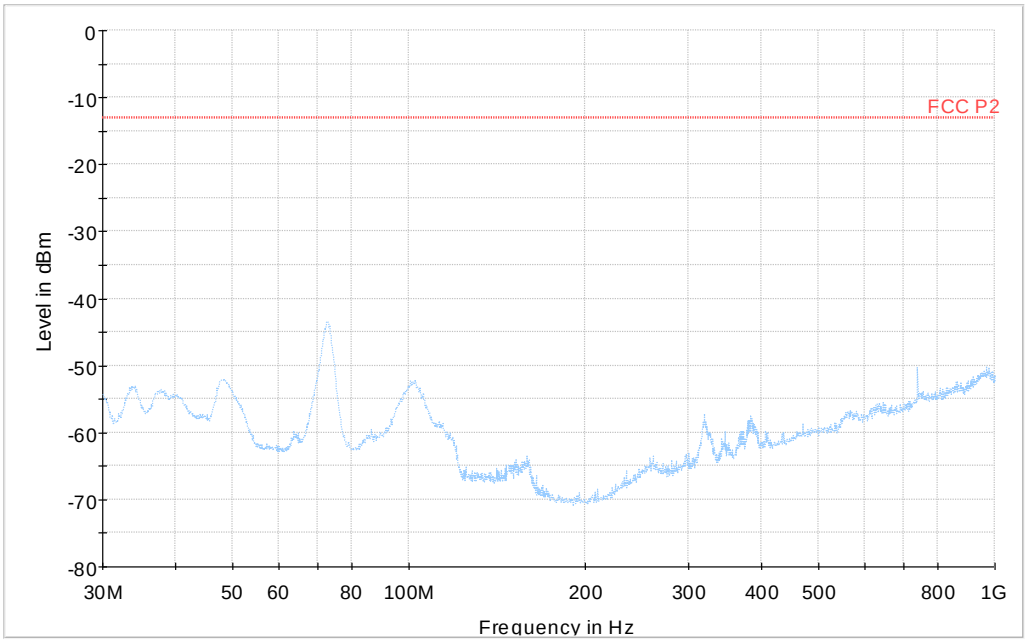
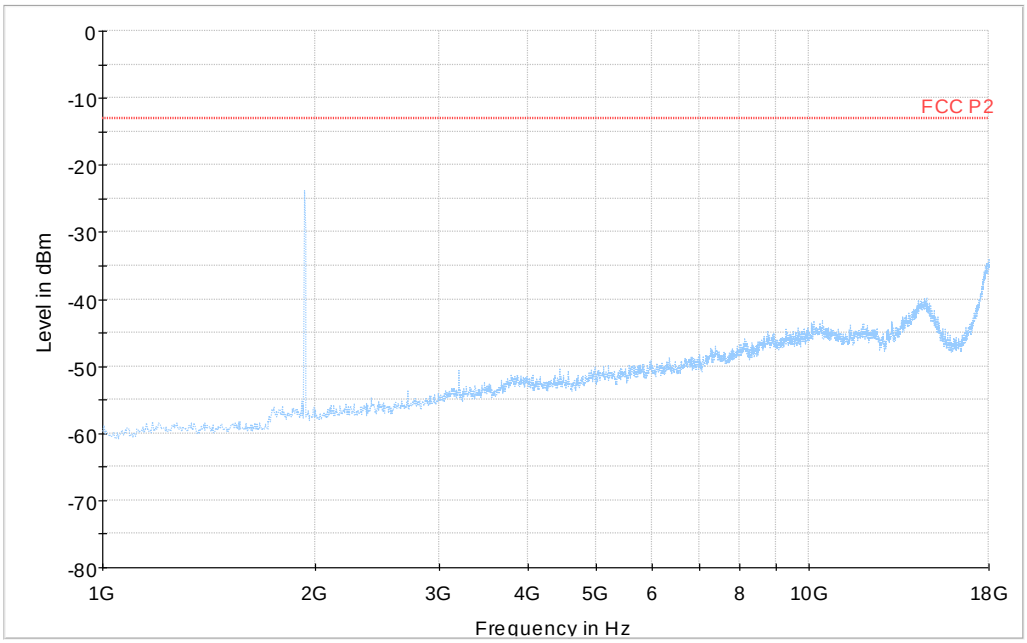


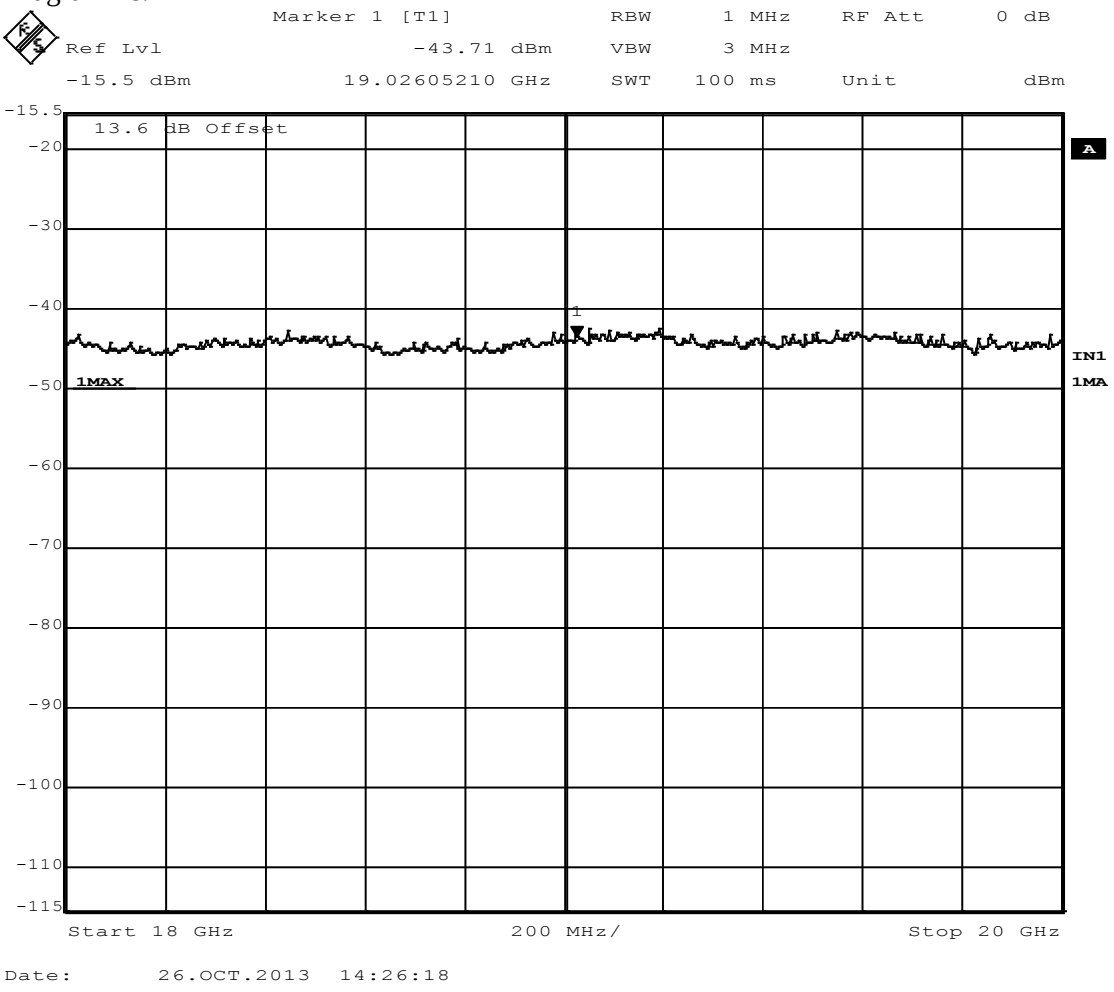
Diagram 1b:



Note: The emission at 1960 MHz is the carrier frequency and shall be ignored in the context.

Appendix 7

Diagram 1c:



Frequency stability measurements according to §2.1055 / IC RSS 133 6.3

Date	Temperature (test equipment)	Humidity (test equipment)
2013-10-15	23 °C ± 3 °C	31% ± 5 %
2013-10-16	22 °C ± 3 °C	31% ± 5 %
2013-10-17	23 °C ± 3 °C	38% ± 5 %
2013-11-01	23 °C ± 3 °C	42% ± 5 %

Test set-up and procedure

The measurement was made per 3GPP TS 25.141. The output was connected to a spectrum analyser. The spectrum analyser was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
R&S FSQ 40	504 143
RF attenuator	900 233
RF Terminator	-
Temperature Chamber	503 360
Testo 635, temperature and humidity meter	504 203
Multimeter Fluke 87	502 190

Results

Nominal Voltage -48 V DC

Maximum output power at mid channel (M)

Test conditions		Frequency error (Hz)
Supply voltage DC (V)	T (°C)	Test model TM5
-48.0	+20	-6
-55.2	+20	+5
-40.8	+20	-5
-48.0	+30	-4
-48.0	+40	-7
-48.0	+50	-5
-48.0	+10	-5
-48.0	0	-6
-48.0	-10	-5
-48.0	-20	-4
-48.0	-30	+5
Maximum freq. error (Hz)		7
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Results

Nominal Voltage 120 V AC, 60 Hz

Maximum output power at mid channel (M)

Test conditions		Frequency error (Hz)
Supply voltage AC (V)	T (°C)	Test model E-TM1.1
102.0	+20	-9
120.0	+20	-7
138.0	+20	-8
Maximum freq. error (Hz)		4
Measurement uncertainty		< ± 1 x 10^{-7}

Remark

Measurements were performed on test objects mRRUS 12 B2, KRC 161 328/4, revision R1A, s/n: D16A183078 and KRC 161 328/3, revision R1A, s/n: D16A076659.

It was deemed sufficient to test one combination of TX frequency, channel bandwidth configuration and test model (modulation), as all combinations share a common internal reference to derive the TX frequency from.

Limits

According to 3GPP TS 25.141, section 6.5.1.5:
The frequency Error shall be within ±(0.05 PPM+12 Hz) (±110 Hz).

§24.235 The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

RSS-133 The carrier frequency shall not depart from the reference frequency, in excess of ±1.0 ppm for base stations.

Complies?	Yes

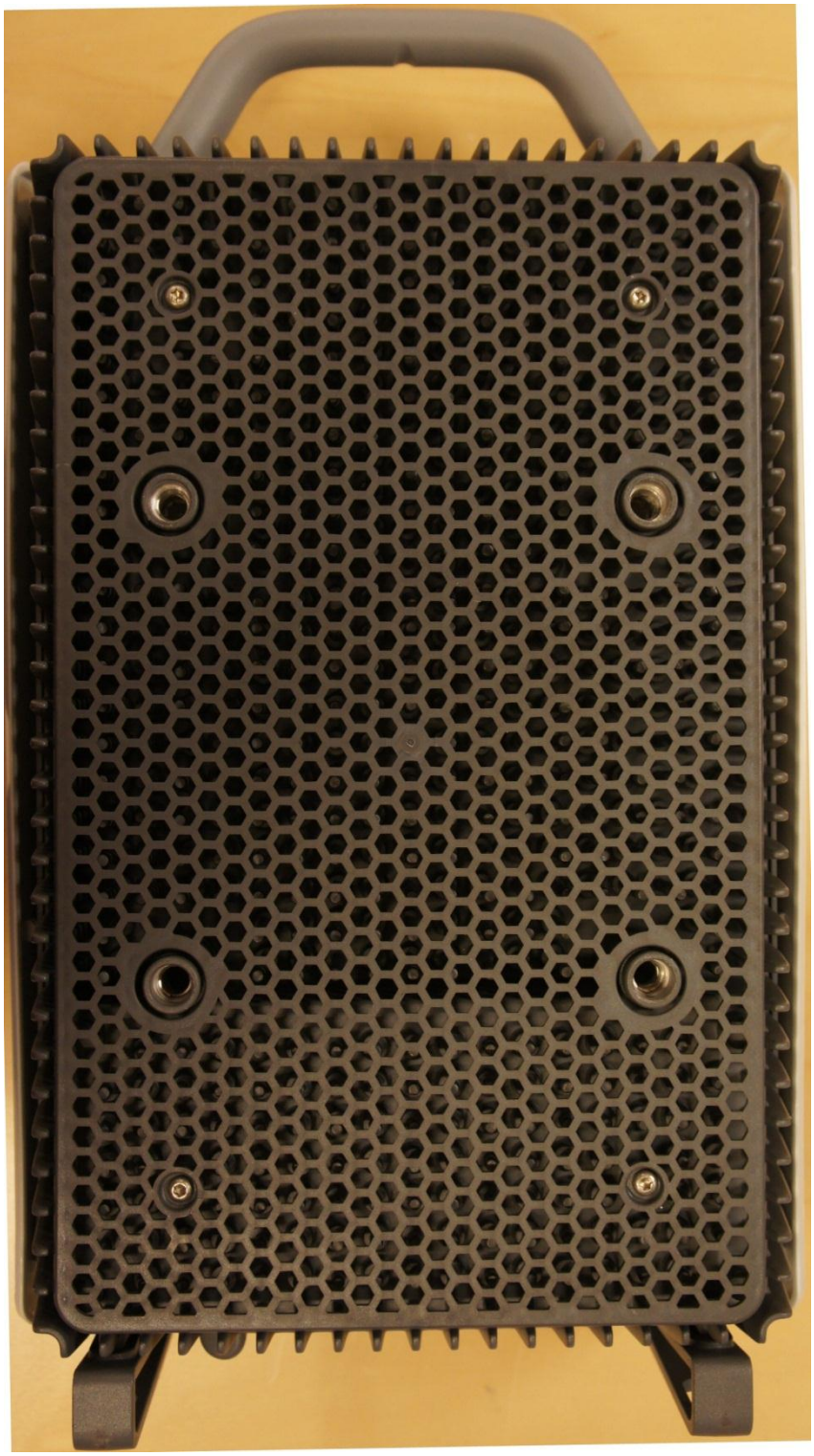
Appendix 9

External photos

Front side

Appendix 9

Rear side



Appendix 9

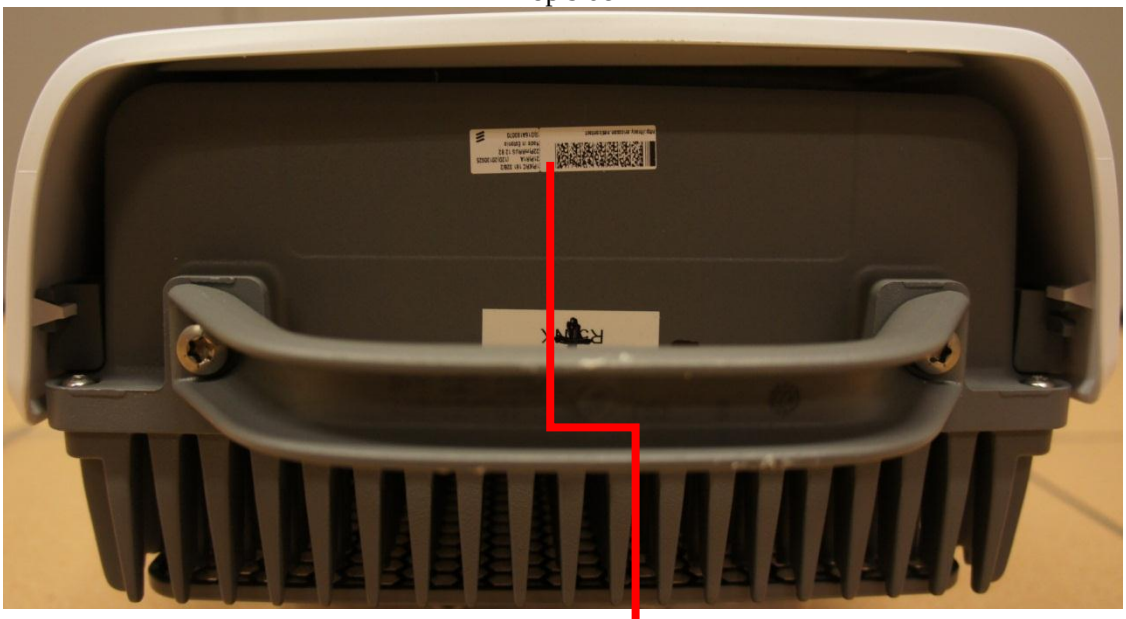
Left side

Right side

Appendix 9

Bottom side

Top side



Product label