REPORT

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The test site complies with RSS-Gen, IC file no. 3482A-1

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Date	Reference	Page
2013-10-17	3P05720-04-F22	1 (2)

1002
ISO/IEC 17025

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164 80 Stockholm

Radio measurements on RUS 02 B5 850 MHz radio equipment with FCC ID TA8AKRC161320-1 and IC 287AB-AS1613201

(5 appendices)

Test object

Product name: RUS 02 B5
Product number: KRC 161 320/1, R1C

Summary

See appendix 1 for details.

Standard		Compliant	Appendix
FCC CFR 47 / IC RSS-132 ISSUE 3			
2.1046 / RSS-132 5.4	RF power output	Yes	2
2.1051 / RSS-132 5.5	Spurious emission at antenna terminals	Yes	3
2.1053 / RSS-132 5.5	Field strength of spurious radiation	Yes	4

Note: Above RSS-132 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

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Prepared by

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Examined by

Anders Nordlöf

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Appendix 1

Description of the test object

Equipment:	Product name: RUS 02 B5 supporting mixed mode WCDMA + LTE Product number KRC 161 320/1 FCC ID TA8AKRC161320-1 IC: 287AB-AS1613201 IC MODEL NO: AS1613201
Frequency range:	TX: 869 - 894 MHz RX: 824 - 849 MHz
Antenna ports:	1 TX/RX port 1 RX Port
RF configurations:	Single carrier, multi carrier, TX diversity and MIMO 2x2 (TX diversity only LTE)
Nomina output power per antenna port:	1-2 LTE + 1-3 WCDMA (Total power 50 dBm, 100W)
Antenna:	No dedicated antenna, handled during licensing
LTE	
Modulations:	QPSK, 16QAM and 64QAM
Channel bandwidth:	1.4 MHz, 3 MHz, 5 MHz, 10 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

Appendix 1

Operation modes during measurements

MSR, WCDMA + LTE

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

LTE measurements were performed with the test object transmitting test models as defined in 3GPP TS 36.141. Test model E-TM1.1 was used to represent QPSK, test model E-TM3.2 to represent 16QAM and test model E-TM3.1 to represent 64QAM modulation.

The settings below were deemed representative for all traffic scenarios when settings with different modulations, channel bandwidths, number of carriers and RF configurations has been tested to find the worst case setting.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 1.4MHz.

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

Purpose of test

The purpose of the tests is to verify compliance to the performance characteristics specified in applicable items of FCC CFR 47 and Industry Canada RSS-132 and RSS-Gen.

Appendix 1

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 22, 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-132 Issue 3

Measurement equipment

	Calibration Due	SP number
Test site Tesla	2014-01	503 881
R&S ESU 26	2014-05	901 553
Control computer with R&S software EMC32 version 8.52.0	-	503 899
R&S FSQ 40	2014-03	504 143
Rohde & Schwarz signal analyzer FSW43	2014-03	902 073
High pass filter	2014-07	901 501
NRVS Power meter	2013-09	503 684
High pass filter	2014-07	901 502
High pass filter	2014-07	504 199
High pass filter	2014-09	901 373
High pass filter	2014-09	503 739
High pass filter	2014-07	503 740
RF attenuator	2014-07	504 159
RF attenuator	2014-07	900 233
RF attenuator	2014-07	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
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 2013-08-19.

Manufacturer’s representative

Christer Gustavsson, Ericsson AB.

Test engineers

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

Test participant

None.

Appendix 1

Test frequencies used for conducted and radiated measurements

MSR, WCDMA + LTE TX test frequencies

Configuration 1:

WCDMA 1x50W			LTE 1x50W		
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]
4385	877.0	5	2572	886.2	1.4

Configuration 2:

WCDMA 1x50W			LTE 1x50W		
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]
4385	877.0	5	2572	886.2	3

Configuration 3:

WCDMA 1x50W			LTE 1x50W		
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]
4385	877.0	5	2572	886.2	5

Configuration 4:

WCDMA 1x50W			LTE 1x50W		
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]
4385	877.0	5	2572	886.2	10

Configuration 5:

WCDMA 1x50W			LTE 1x50W		
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]
4357	871.4	5	2590	888.0	1.4

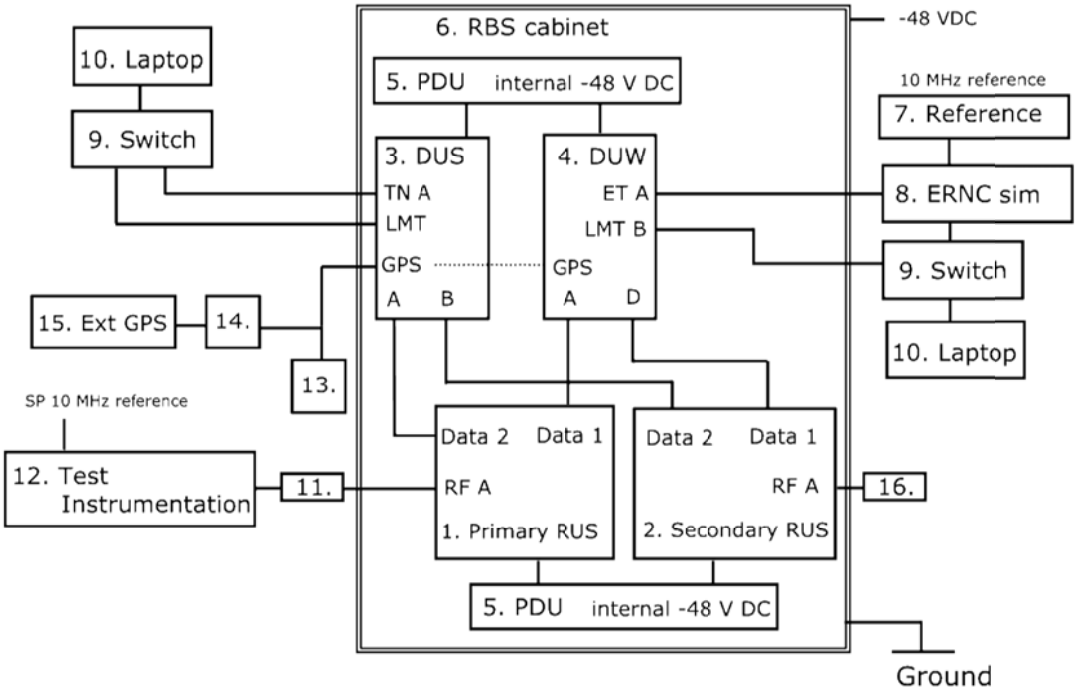
Configuration 6:

WCDMA 1x50W			LTE 1x50W		
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]
4383	876.6	5	2643	893.3	1.4

All RX frequencies were configured 45 MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

Appendix 1

Test set-up conducted measurements WCDMA and LTE MIMO



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

Test object:

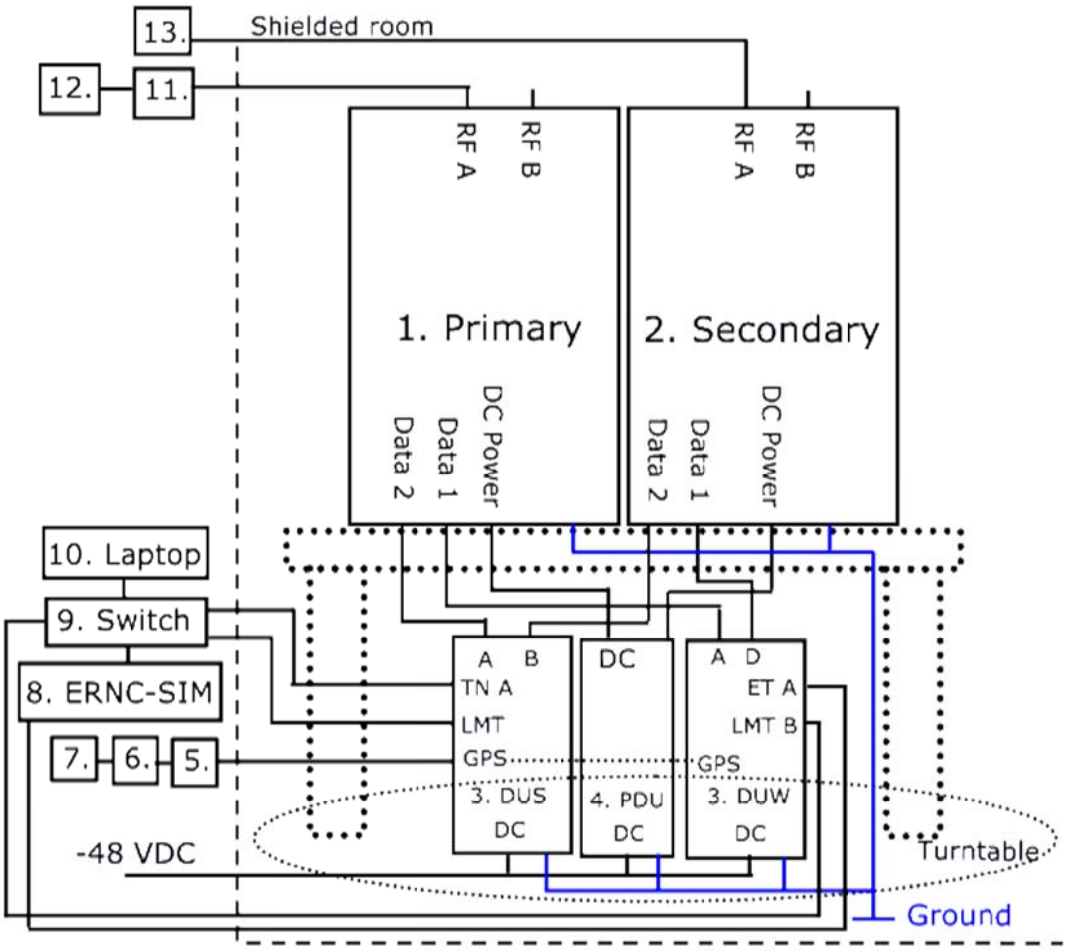
1.	RUS 02 B5, KRC 161 320/1, rev. R1C, s/n: C827123129, primary/ secondary
2.	RUS 02 B5, KRC 161 320/1, rev. R1C, s/n: C827123115, Dummy: secondary/ primaty working software CXP 901 7316/2, rev. R51MTDU with FCC ID TA8AKRC161320-1 and IC: 287AB-AS1613201

Functional test equipment:

3.	DUS 41 01, KDU 137 624/1, rev:R5A, s/n: D165724695
4.	DUW 30 01, KDU 127 161/3, rev:R4F, s/n: TU8XB20706
5.	PDU 02 01, BMG 980 336/4, rev: R2A, s/n: BJ31528316
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.	Controlling laptop HP EliteBook 8560 w, BAMS – 1001236858
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 set-up radiated measurements WCDMA and LTE MIMO



Test object:

1.	RUS 02 B5, KRC 161 320/1, rev. R1C, s/n: C827123103 primary
2.	RUS 02 B5, KRC 161 320/1, rev. R1C, s/n: C827159515 secondary
	working software: CXP 901 7316/2, rev. R51MT with
	FCC ID TA8AKRC161320-1 and IC: 287AB-AS1613201

Appendix 1

Functional test equipment:

3.	Main Unit SUP 6601, 1/BFL 901 009/4, rev. R1E, s/n: BR88258668 DUS 41 01, KDU 137 624/1, rev:R5A, s/n: D165724695 SUP 6601, 1/BFL 901 009/4, rev. R1E, s/n: BR88237597 DUW 30 01, KDU 127 161/3, rev:R4F, s/n: TU8XB20706
4.	Power Subrack: PDU 01 01, BMG 980 336/2, R4F, BJ31532384 PDU 01 01, BMG 980 336/2, R4F, BJ31532382 SHU 01 01, BGK 901 18/1, R3C, BJ31446269 PFU 01 01, KFE 101 1162/1, R1B, BR80910495 PCF 02 01, KFE 101 1157/1, R1C, BW95301450 DUMMY x3, SXK 109 8257/1, R1D DUMMY x1, SXK 109 8257/1, R1F
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.	ESI 26, SP number: 503 292, for supervision purpose only
13.	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**
WCDMA	CXP 902 1719	R1DC14
LTE	CXP 102 051/18	R32AV

Appendix 2

RF power output measurements according to CFR 47 2.1046 / IC RSS-132 5.4

Date	Temperature	Humidity
2013-09-09	22 °C ± 3 °C	47% ± 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 RBW 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 50 dB.

Tested configuration	Primary mode [RMS dBm/ dB PAR]	Secondary mode [RMS dBm/ dB PAR]	Total power[1)] [RMS dBm]
1	49.62/ 6.90	Not tested[2)]	52.62
2	49.61/ 7.09	Not tested[2)]	52.61
3	49.40/ 6.73	Not tested[2)]	52.40
4	49.38/ 6.78	Not tested[2)]	52.38
5	49.28/ 7.04	Not tested[2)]	52.28
6	49.26/ 7.12	Not tested[2)]	52.26

[1)]: Since secondary mode isn't measured 3dB has been added to the result on primary mode.
[2)]: Measurements were limited to primary mode due to the measurements result in LTE- and WCDMA single RAT MIMO mode that shows that the primary and secondary modes are identical.

Note: The highest PAR measured was 7.12 dB (0.1%). For multi-carrier constellations the measured "PAR" is informative only as to the definition of Peak to Average Ratio per carrier.

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

CFR47 § 22.913: The effective radiated power ERP shall not exceed 1000 W.

RSS-132 5.4: The average equivalent isotropically radiated power (e.i.r.p.) limits in SRSP-503 apply, resulting in a maximum EIRP of 1640 W.
The PAR (0.1%) shall not exceed 13 dB.

Complies?	Yes

Appendix 3

Conducted spurious emission measurements according to CFR 47 2.1051 / IC RSS-132 5.5

Date	Temperature	Humidity
2013-09-09	22 °C ± 3 °C	47% ± 5 %
2013-09-16	22 °C ± 3 °C	44% ± 5 %

Test set-up and procedure

The measurements were made per definition in § 22.917, but with a conservative 1 MHz RBW. The output 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.

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 v02

Measurement equipment	SP number
Rohde & Schwarz signal analyzer FSQ40	504 143
RF attenuator	901 508
High pass filter	901 501
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

Diagram	Tested configuration	Tested Port RFA
1 a+b+c	Config 1	Primary mode
2 a+b+c	Config 2	Primary mode
3 a+b+c	Config 3	Primary mode
4 a+b+c	Config 4	Primary mode
5 a+b+c	Config 5	Primary mode
6 a+b+c	Config 6	Primary mode

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 covers 10x the highest TX fundamental frequency.
The highest fundamental frequency is 894MHz. The measurements were made up to 9 GHz (10x894 MHz = 8.94 GHz).

Limits

CFR 47 § 22.917: 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 100 kHz RBW.

IC RSS-132 5.5.1.2: 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 per any 100 kHz RBW.

Complies?	Yes

Appendix 3

Diagram 1 a:

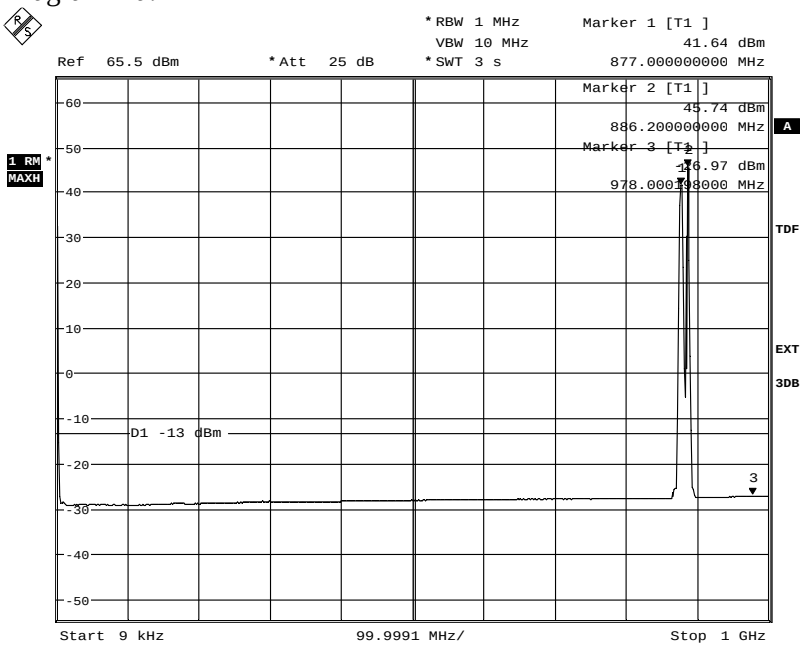


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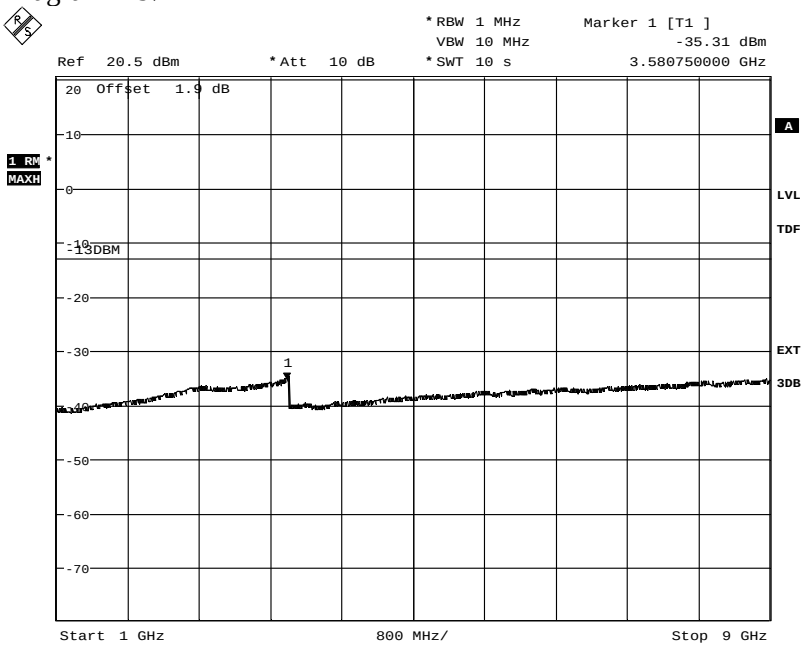
Diagram 1 b:



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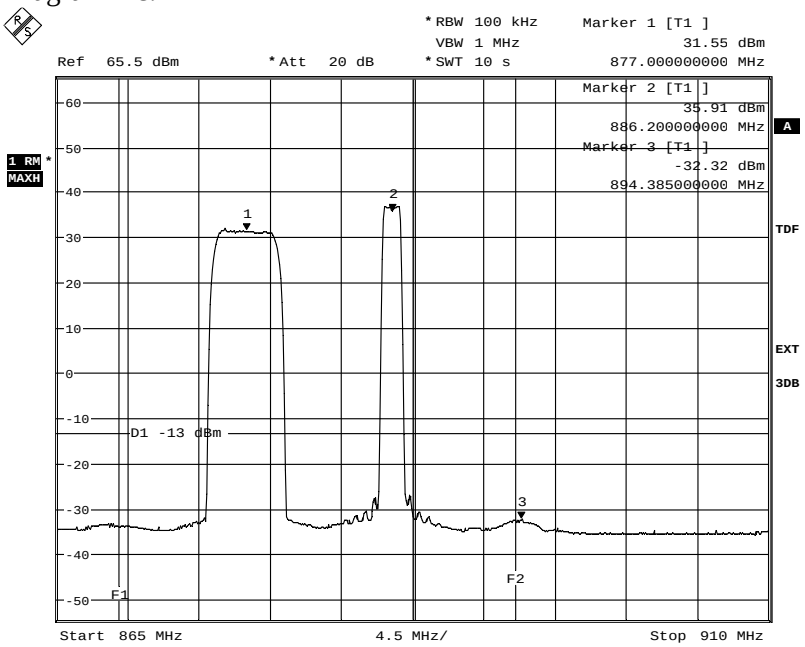
Appendix 3

Diagram 1 c:



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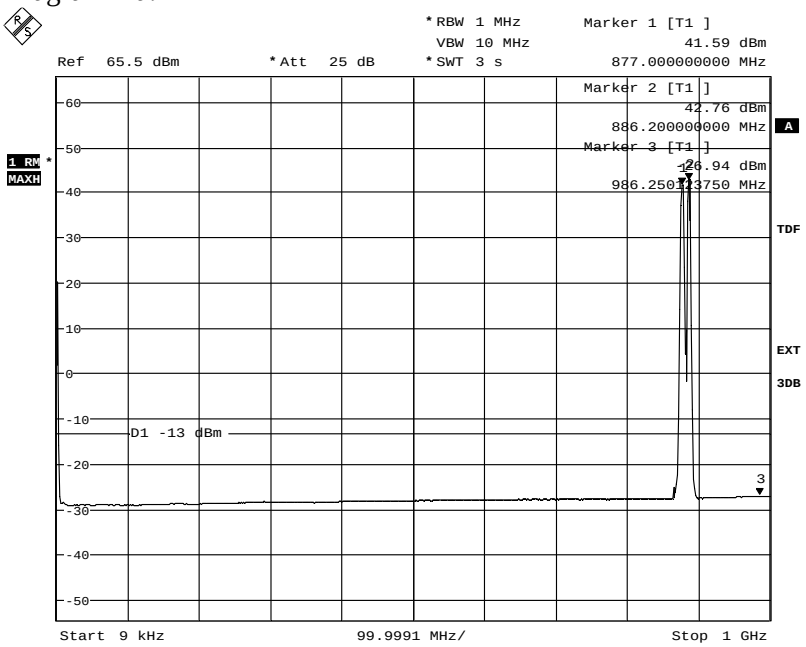
Appendix 3

Diagram 2 a:



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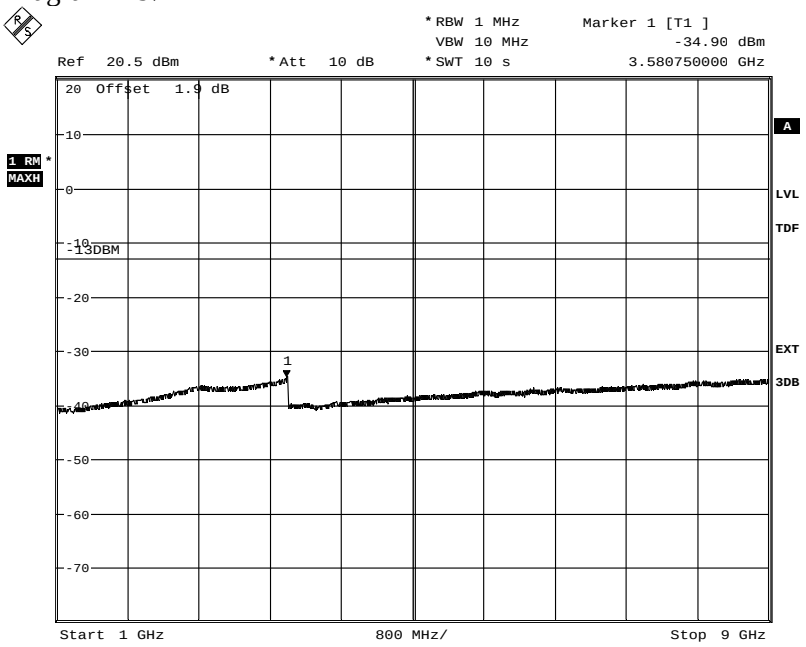

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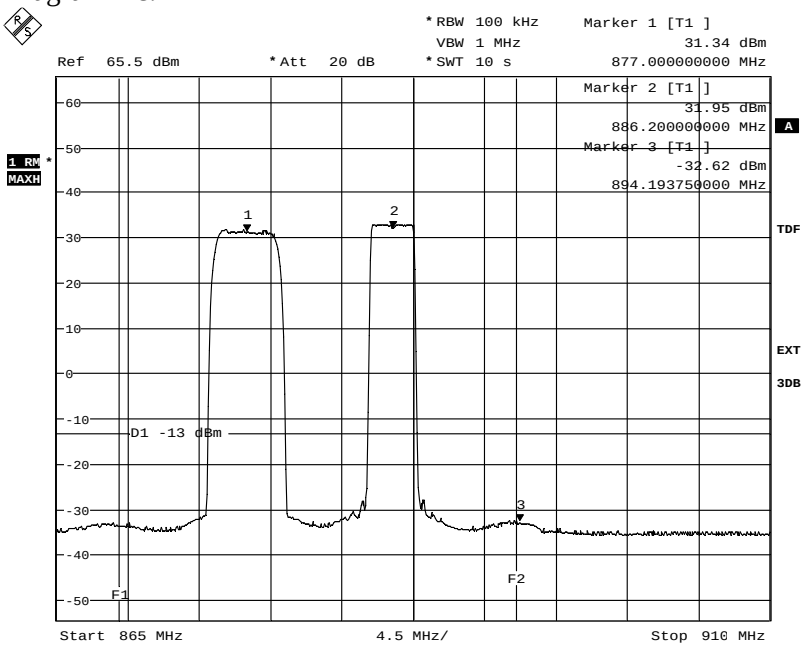
Diagram 2 c:



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Appendix 3

Diagram 3 a:

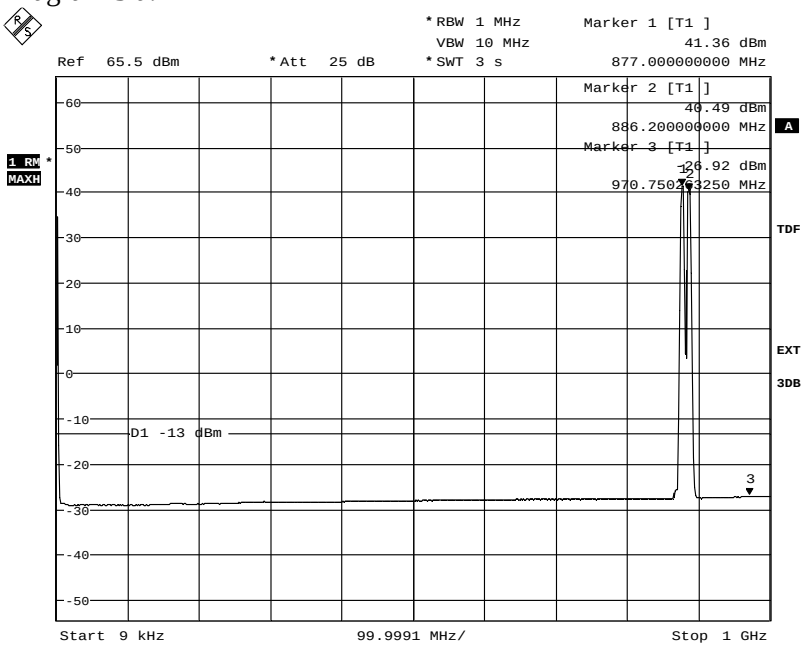

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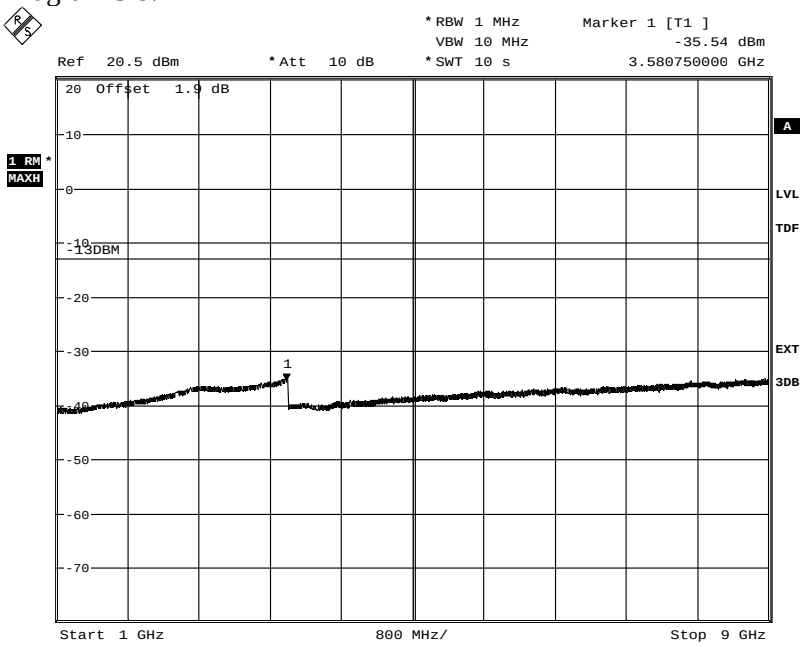
Diagram 3 b:



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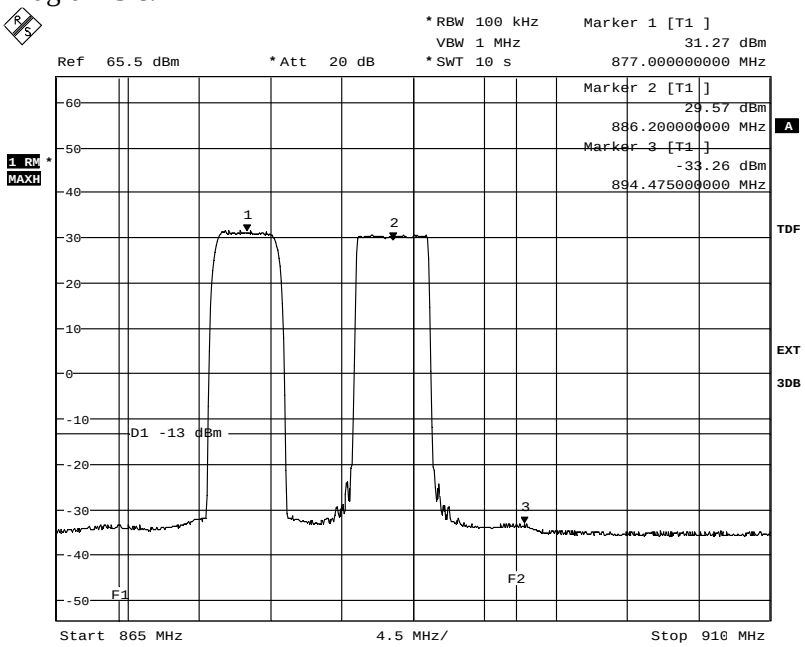
Appendix 3

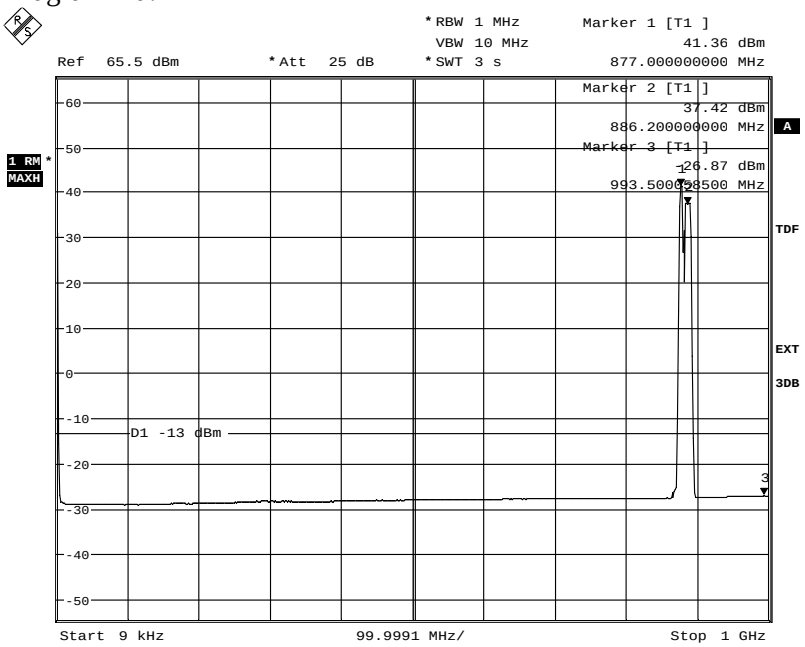
Diagram 3 c:



Date: 9.SEP.2013 15:22:09

Appendix 3

Diagram 4 a:



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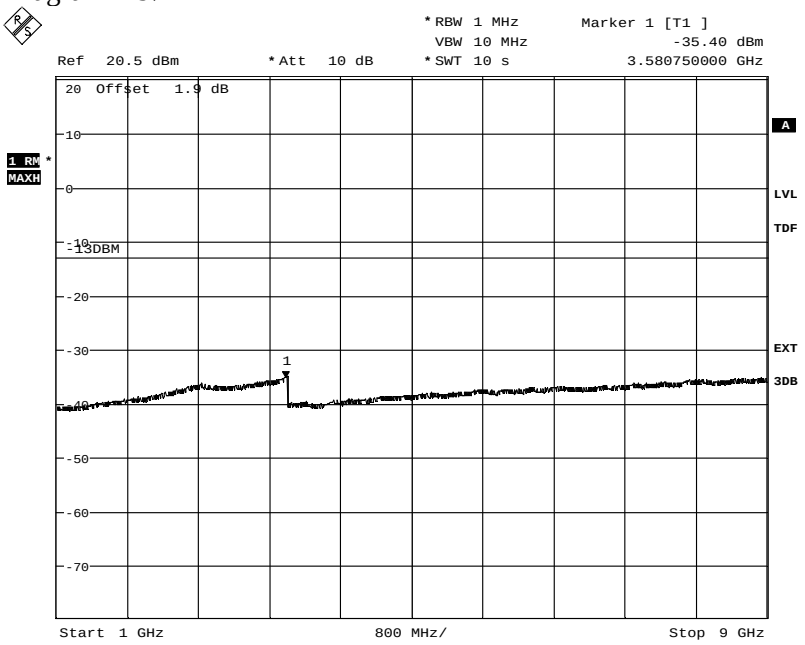

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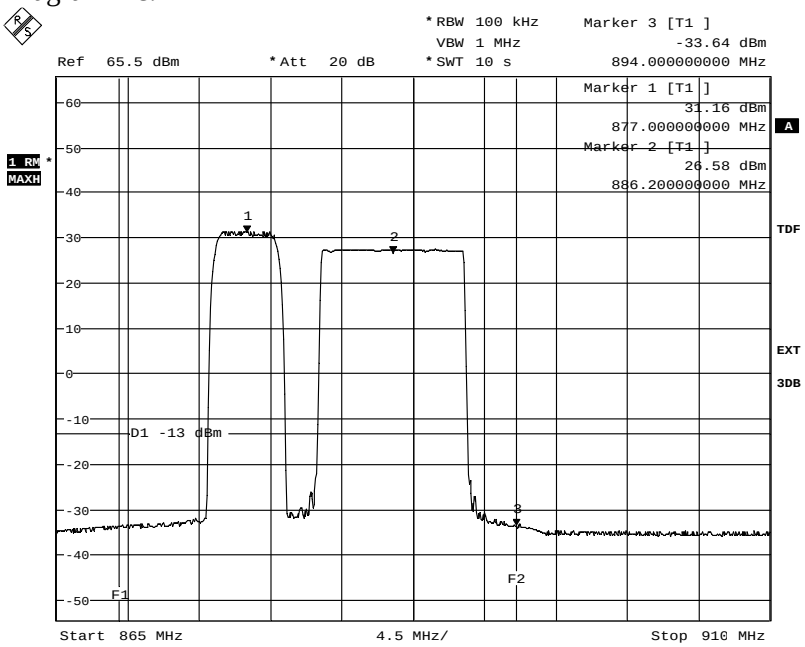
Appendix 3

Diagram 4 c:



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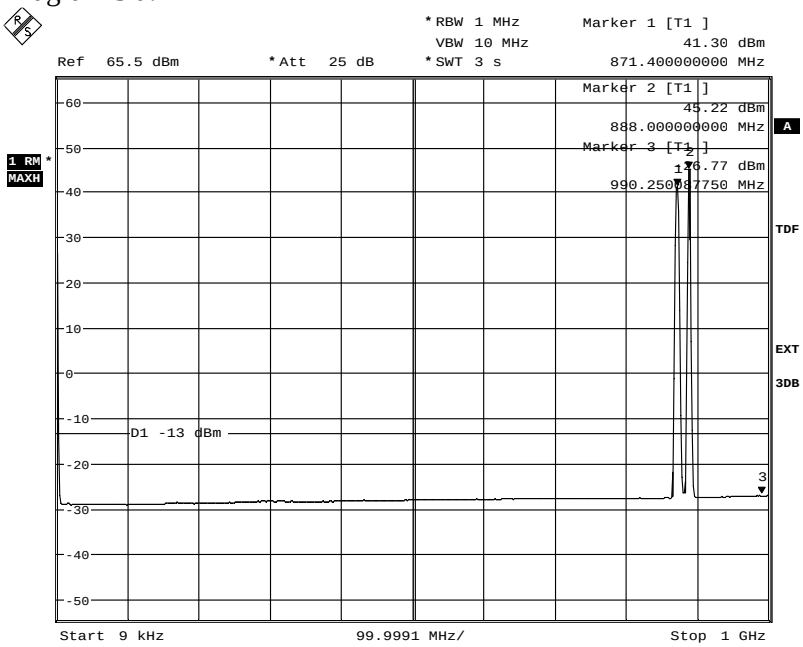
Appendix 3

Diagram 5 a:



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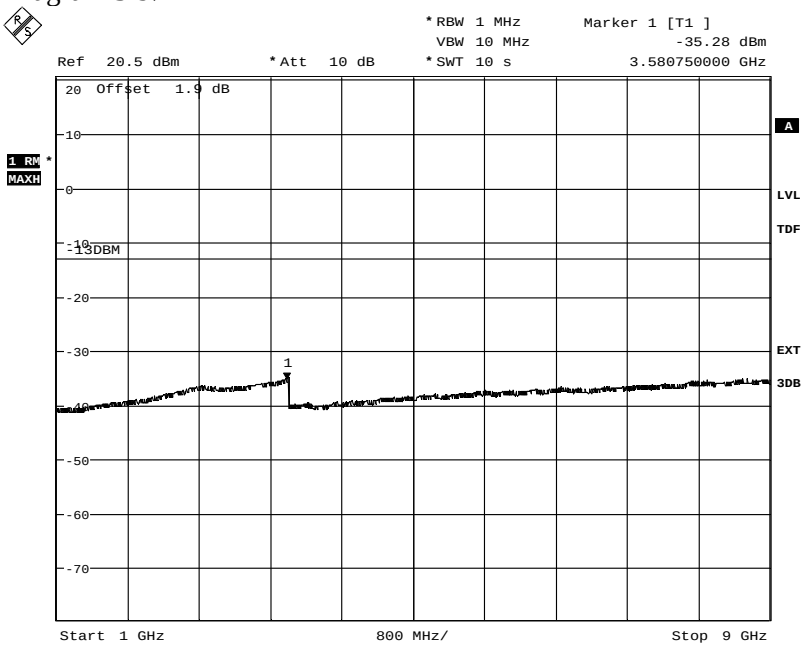

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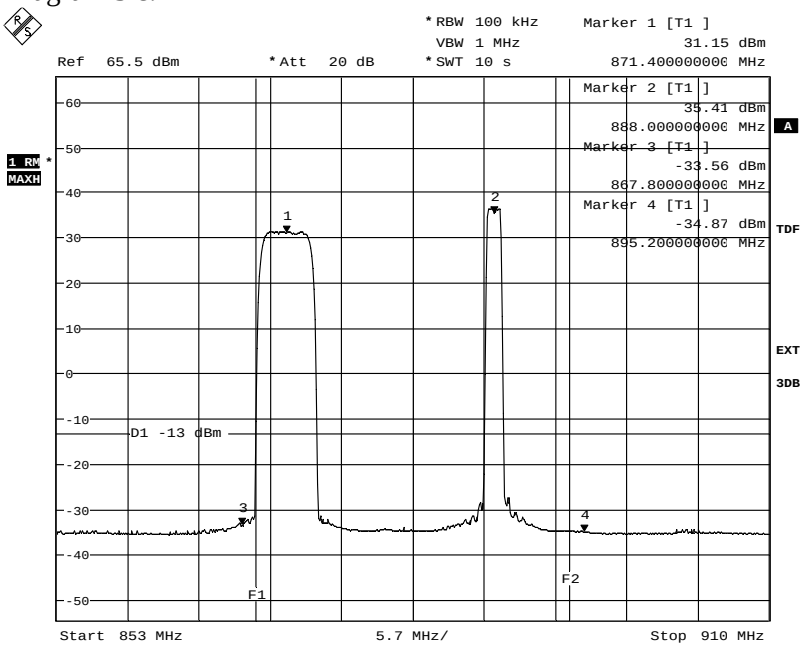
Appendix 3

Diagram 5 c:



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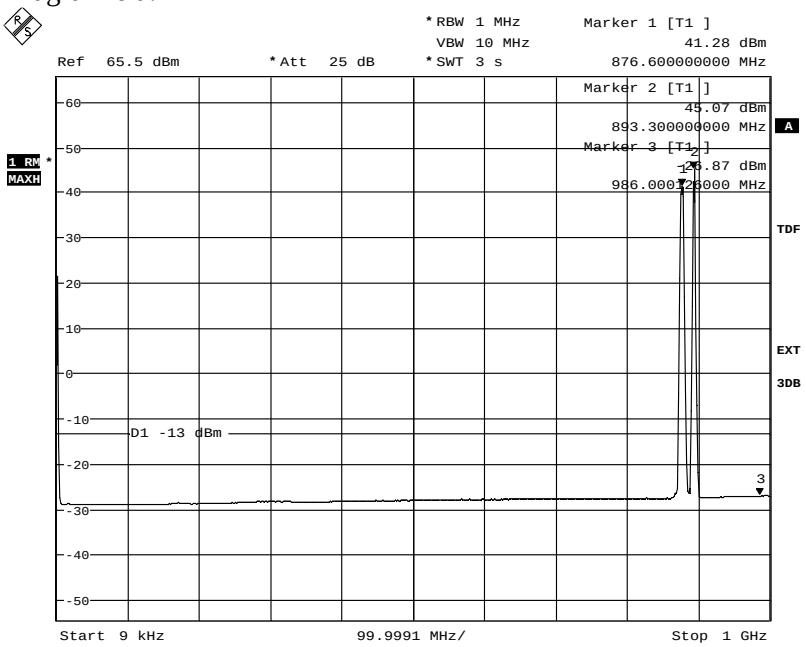
Appendix 3

Diagram 6 a:



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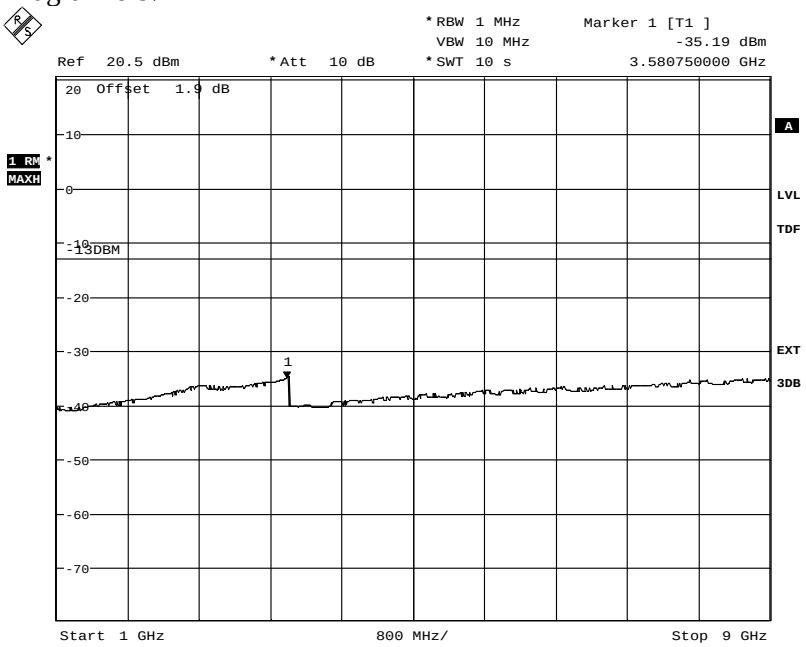

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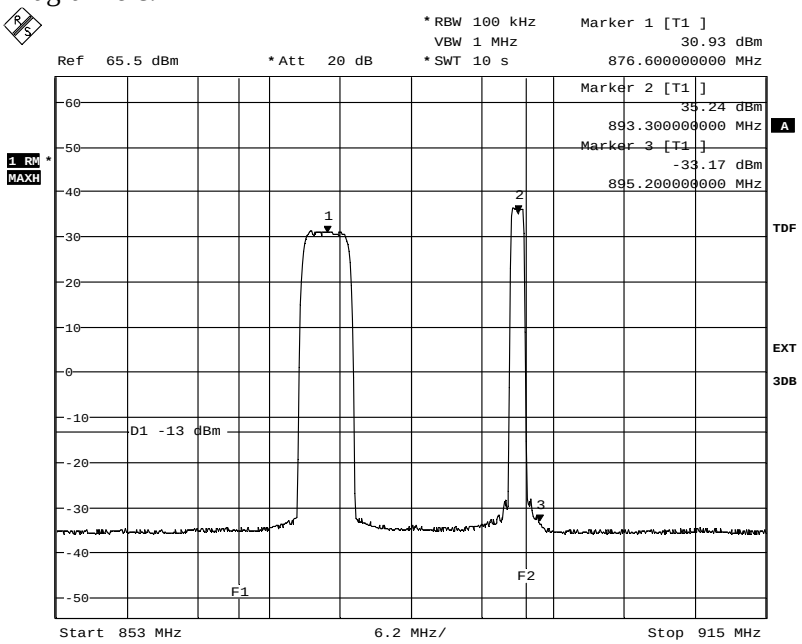
Appendix 3

Diagram 6 c:



Date: 16.SEP.2013 15:04:21

Appendix 4

Field strength of spurious radiation measurements according to 47 CFR 2.1053 / IC RSS-132 5.5

Date	Temperature	Humidity
2013-09-02	22 °C ± 3 °C	53 % ± 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 – 9 GHz. The upper frequency boundary was chosen to comprise 10x the highest fundamental TX frequency.

In the frequency range 30 MHz - 9 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.

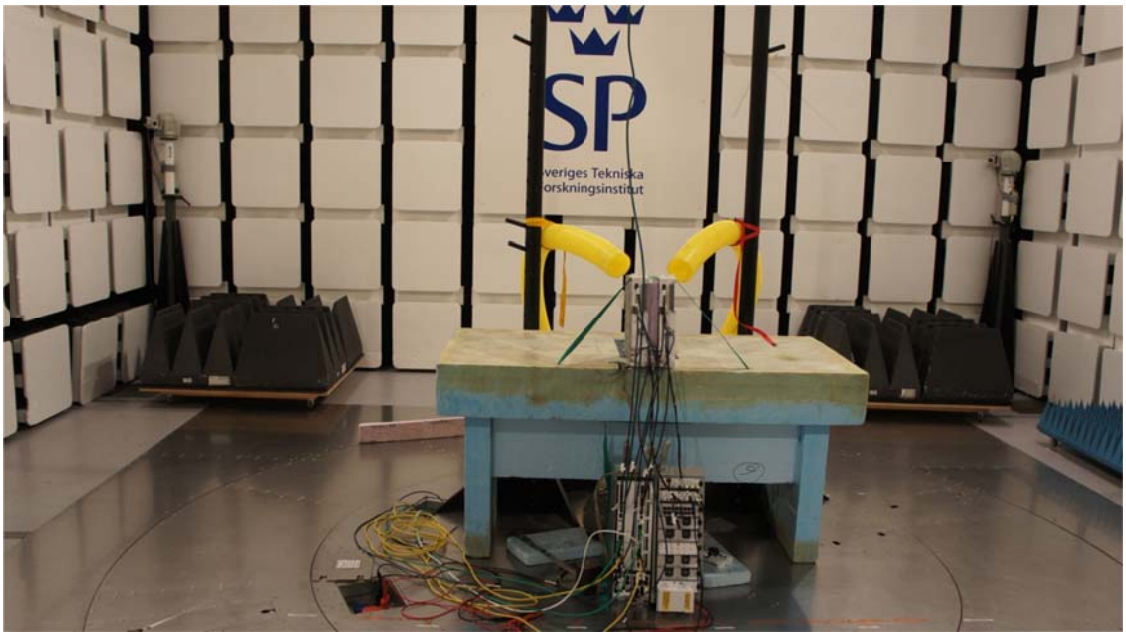
The measurement procedure was as the following:

1. A pre-measurement was first performed with peak detector. The Test object 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 with the substitution method according to the standard.

Appendix 4

Representative 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
µComp Nordic, Low Noise Amplifier	901 545
High pass filter	901 373
Temperature and humidity meter, Testo 625	504 188

Tested configurations

Configuration 1
Configuration 2
Configuration 3
Configuration 4

Appendix 4

Results, representing worst case

Diagram	Configuration
1 a+b	Config 1

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30 - 9 000	All emissions > 20 dB below limit	All emissions > 20 dB below limit

Measurement uncertainty: 3.2 dB

Remarks

The upper frequency bound for verification was chosen as 9 GHz in order to cover 10 x the maximum fundamental TX frequency.

Limits

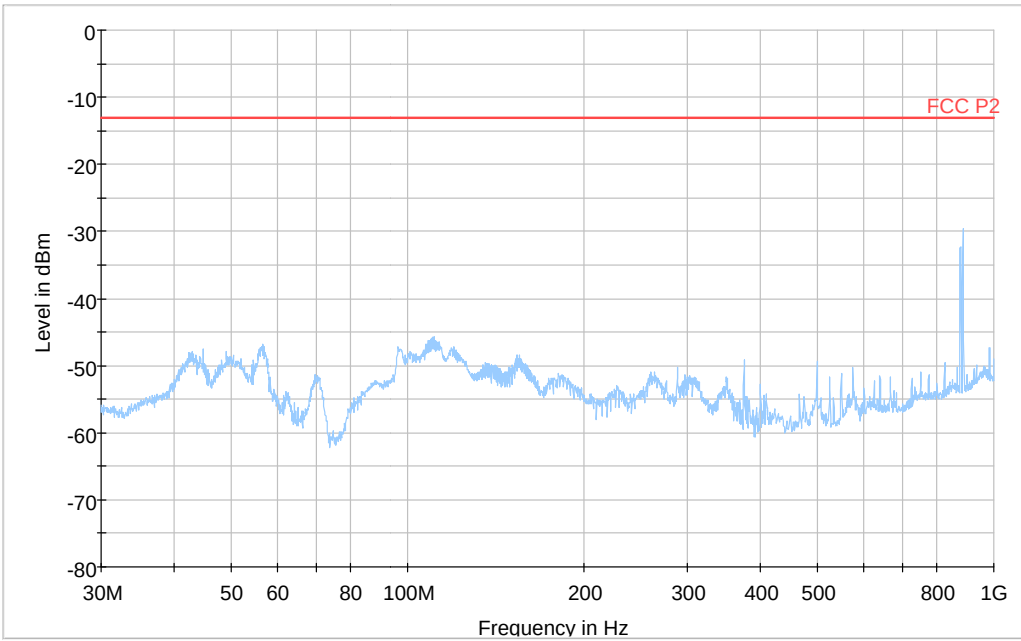
CFR 47 § 22.917 and IC RSS-132 5.5

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 any 100 kHz bandwidth.

Complies?	Yes

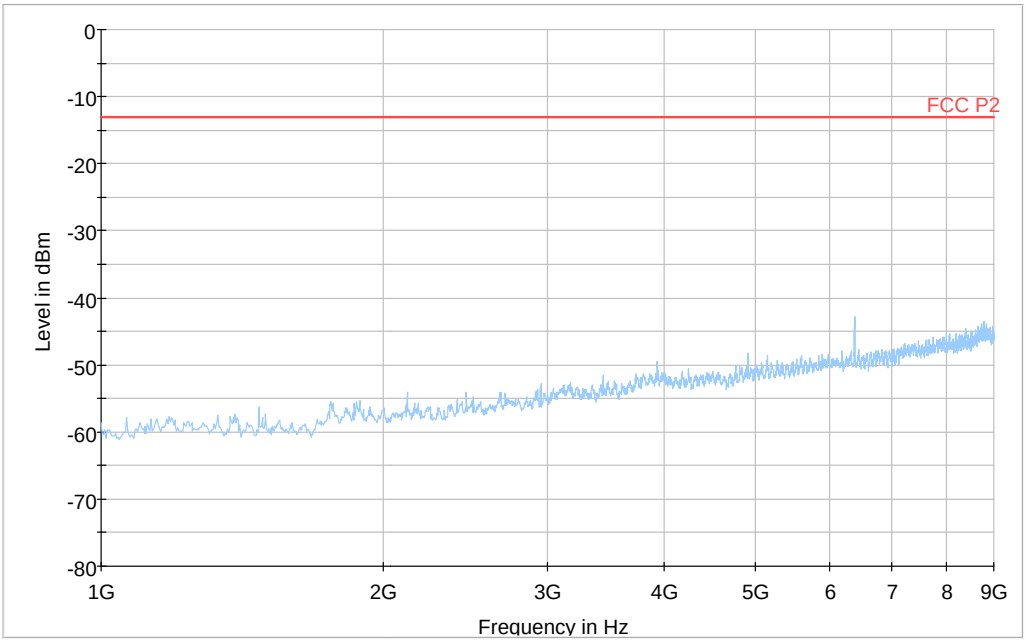
Appendix 4

Diagram 1 a:



Note: The emission between 869 MHz and 894 MHz is the carrier frequency and shall be ignored in this context.

Diagram 1 b:



Appendix 5

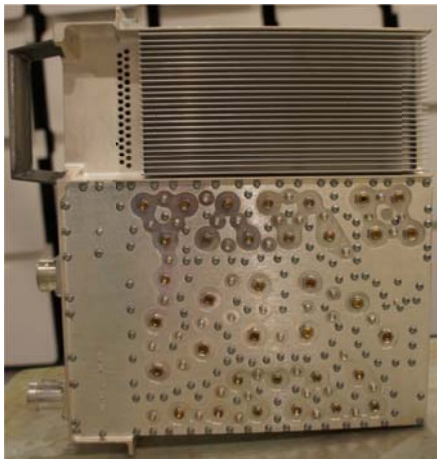
External photos

Front side:

Back side:

Product Label:

Left side:



Right side:

Appendix 5

Top side:

Bottom side: