REPORT

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

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Date	Reference	Page
2013-09-04	3P04068-04-F22	1 (2)

1002
ISO/IEC 17025

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Radio measurements on RRUS 12 B5 850 MHz radio equipment with FCC ID TA8AKRC161321-2 and IC 287AB-AS1613212

(5 appendices)

Test object

Product name: RRUS 12 B5
Product number: KRC 161 321/2, R1B

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

Electronics – EMC

Prepared by

Jörgen Wassholm

Examined by

Bengt Andersson

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Appendix 1

Description of the test object

Equipment:	Product name: RRUS 12 B5 supporting mixed mode WCDMA + LTE Product number KRC 161 321/2 FCC ID TA8AKRC161321-2 IC: 287AB-AS1613212 IC MODEL NO: AS1613212
Frequency range:	TX: 869 - 894 MHz RX: 824 - 849 MHz
Antenna ports:	2 TX/RX ports
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 47.8dBm, 60W) Total number of carriers 4
Antenna:	No dedicated antenna, handled during licensing
LTE Modulations:	QPSK, 16QAM and 64QAM
Channel bandwidth:	1.4 MHz, 3 MHz, 5 MHz and 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

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

Radiated measurements

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 and Industry Canada RSS-132 and RSS-Gen.

References

Measurements were done according to relevant parts of the following standards:
ANSI 63.4-2009
ANSI/TIA/EIA-603-C-2004
CFR 47 part 2, October 1st , 2012
CFR 47 part 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 FSIQ 40	2013-07	503 738
R&S FSQ 40	2014-03	504 143
R&S ESI 26	2013-07	503 292
Control computer with R&S software EMC32 version 8.52.0	-	503 479
High pass filter	2013-07	901 501
High pass filter	2013-07	901 502
High pass filter	2013-07	504 199
High pass filter	2013-08	901 373
High pass filter	2014-08	503 739
High pass filter	2013-07	503 740
RF attenuator	2013-07	504 159
RF attenuator	2013-09	900 233
RF attenuator	2013-08	900 691
RF attenuator	2013-12	901 508
Chase Bilog Antenna CBL 6111A	2014-10	503 182
EMCO Horn Antenna 3115	2014-01	502 175
Std.gain horn FLANN model 20240-20	2014-03	503 674
Schwarzbeck preamplifier BBV 9742	2014-03	504 085
µComp Nordic, Low Noise Amplifier	2014-04	901 545
MITEQ Low Noise Amplifier	2013-08	503 285
Testo 635 Temperature and humidity meter	2014-06	504 203
Temperature and humidity meter, Testo 625	2014-06	504 188

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 2013-05-22.

Manufacturer’s representative

Christer Gustavsson

Test engineers

Andreas Johnson, Tomas Lennhager, Kexin Chen, Tomas Isbring, Jörgen Wassholm and Martin Theorin, SP

Test participant

Adam Skoglund, Ericsson AB (partially)

Appendix 1

Test frequencies used for conducted and radiated measurements

MSR, WCDMA + LTE TX test frequencies

Configuration 1:

WCDMA 1x30W			LTE 2x15W				
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]
4408	881.6	5	2482	877.2	2572	886.2	1.4

Configuration 2:

WCDMA 1x30W			LTE 1x30W		
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]
4385	877.0	5	2572	886.2-	1.4

Configuration 3:

WCDMA 1x30W			LTE 1x30W		
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]
4385	877.0	5	2572	886.2-	3

Configuration 4:

WCDMA 1x30W			LTE 1x30W		
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]
4385	877.0	5	2572	886.2-	5

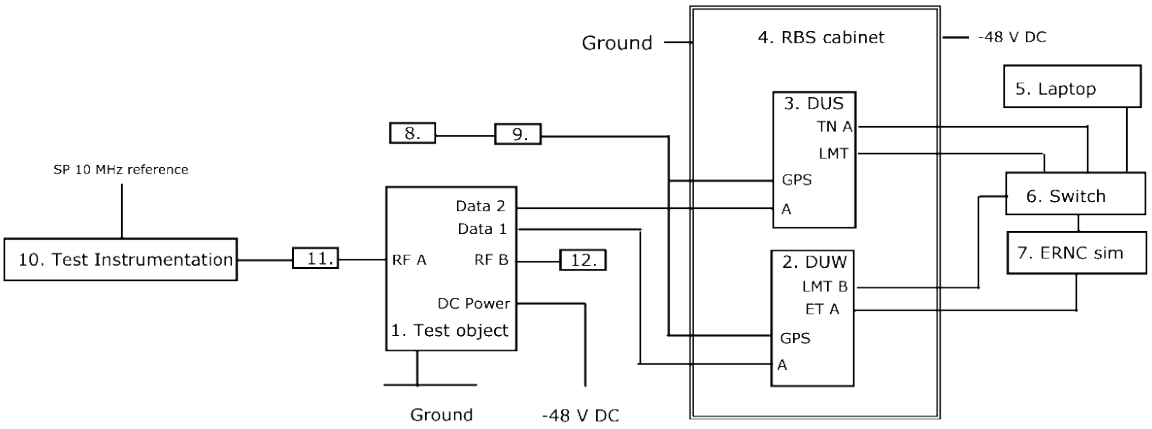
Configuration 5:

WCDMA 1x30W			LTE 1x30W		
UARFCN Downlink	Frequency [MHz]	BW [MHz]	EARFCN Downlink	Frequency [MHz]	BW [MHz]
4385	877.0	5	2572	886.2-	10

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



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

Test object:

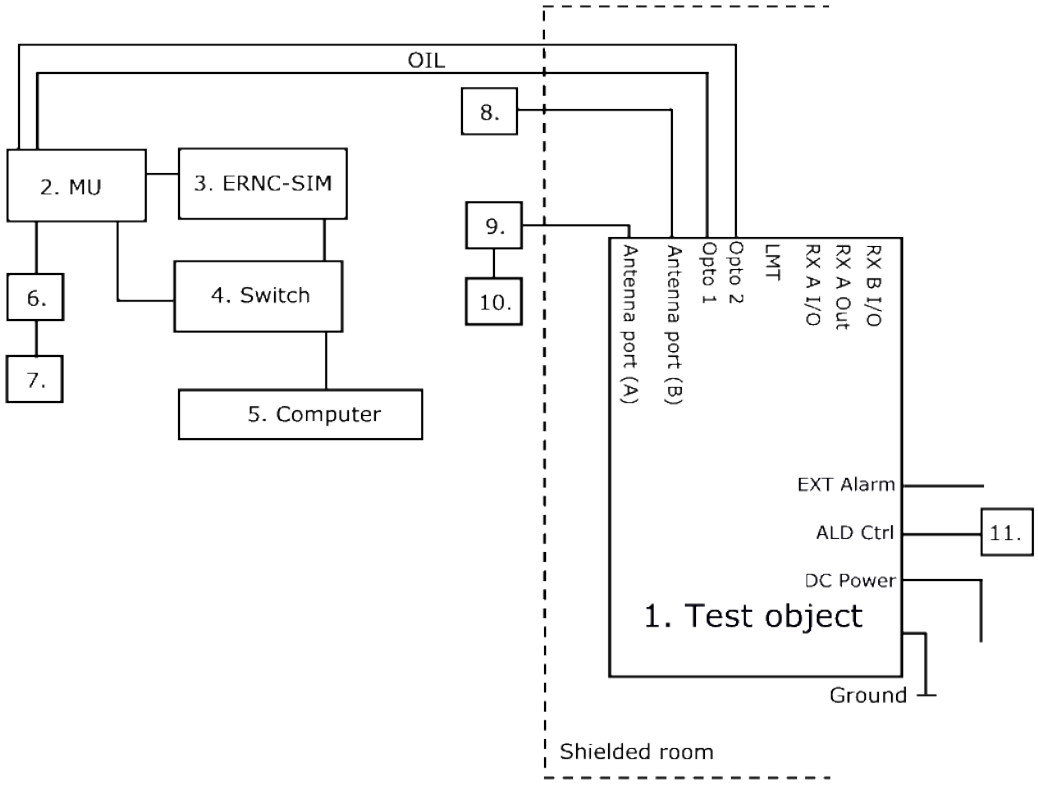
1.	RRUS 12 B5, KRC 161321/2, rev. R1B, s/n: C827002288 working software CXP 901 7316/2, rev. R49DU with FCC ID TA8AKRC161321-2 and IC: 287AB-AS1613212

Functional test equipment:

2.	DUW 30 01, KDU 127 161/3, rev:R4E, s/n: C826303721
3.	DUS 40 01, KDU 137 624/1, rev:R3C, s/n: C826152153
4.	RBS 6202 BAMS 1000961945
5.	Controlling computer HP EliteBook 8560 w, BAMS 1001236850
6.	Fast Ethernet switch, Netgear FS726T
7.	ERNC Sim 130, BAMS – 100066091 Fast Ethernet switch, Netgear FS726T Fast Ethernet switch, Netgear GSM7212 NTP Symmetricom sync server S250, BAMS – 1000532027 10 MHz reference, Symmetricom model 8040, BAMS – 1000714189
8.	GPS Active Antenna, KRE 101 2082/1
9.	GPS 02 01, NCD 901 41/1, rev. R1D, s/n: TU8K474887
10.	SP Test Instrumentation according to measurement equipment list
11.	Attenuator
12.	Terminator, 50 ohm

Appendix 1

Test set-up radiated measurements



Test object:

1.	RRUS 12 B5, KRC 161 321/2, rev. R1B, s/n: C827002289 working software: CXP 901 7316/2, rev. R49DU with FCC ID TA8AKRC161321-2 and IC: 287AB-AS1613212

Functional test equipment:

2.	Main Unit SUP 6601, 1/BFL 901 009/4, rev. R1E, s/n: BR82081105 DUS 41 01, KDU 137 624/1, rev. R3C, s/n: C826152153 SUP 6601, 1/BFL 901 009/4, rev. R1E, s/n: BR82691785 DUW 3001: KDU 127 161/3, R4F, TU8XB20908
3.	ERNC-SIM 130, BAMS – 1000660991 Symmetricom SyncServer, BAMS – 1000532027 Switch Netgear FS726T Switch Netgear GSM 7212 10 MHz reference Symmetricom 8040, BAMS – 1000714189
4.	Switch Netgear FS726T
5.	Computer, EliteBook 8560w, BAMS – 1001236854
6.	GPS 02 01, NCD 901 41/1, rev. R1D, s/n: TU8K356490
7.	GPS Active Antenna, KRE 101 2082/1
8.	Terminator
9.	Attenuator
10.	Signal Analyzer FSIQ 40 for supervision purpose only
11.	RET – Remote Electrical Tilt unit, KRY 121 67/2, rev. R1N

Interfaces:	Type of port:
Power: -48 VDC	DC Power
Antenna port (A), 7/16 connector, terminated	Antenna
Antenna port (B), 7/16 connector, terminated	Antenna
Opto 1, Optical Interface Link, single mode opto fibre	Telecom
Opto 2, Optical Interface Link, single mode opto fibre, not in use	Telecom
LMT, for maintenance use only, no cable attached	Telecom
RX A Out, no cable attached	Antenna
RX A I/O, no cable attached	Antenna
RX B I/O, no cable attached	Antenna
EXT Alarm, shielded multi-wire	Signal
ALD Ctrl, shielded multi-wire	Signal
Ground wire	Ground

RBS Softwares

RAT	Software	Revision
WCDMA	CXP 902 1719	R1CB18
LTE	CXP 102 051/18	R27X

Appendix 2

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

Date	Temperature	Humidity
2013-06-11	23 °C ± 3 °C	33% ± 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 47.8 dBm. Total nominal RF power 50.8 dBm.

Tested configuration	Port RFA [RMS dBm/ dB PAR]	Port RFB [RMS dBm/ dB PAR]	Total power[1)] [RMS dBm]
Configuration1	47.28/ 6.68	Not tested[2)]	50.28
Configuration 3	47.67/ 7.07	Not tested[2)]	50.67

[1)]: Since port B isn't measured 3dB has been added to the result on port RFA.
[2)]: Note:Measurements were limited to port RF A due to the measurement result in LTE and WCDMA single carrier MIMO mode that shows that the ports are electrical identical as declared by the client.

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
2013-06-11	23 °C ± 3 °C	33% ± 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 c "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
1 a+b+c	Configuration 1	RFA
2 a+b+c	Configuration 3	RFA

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

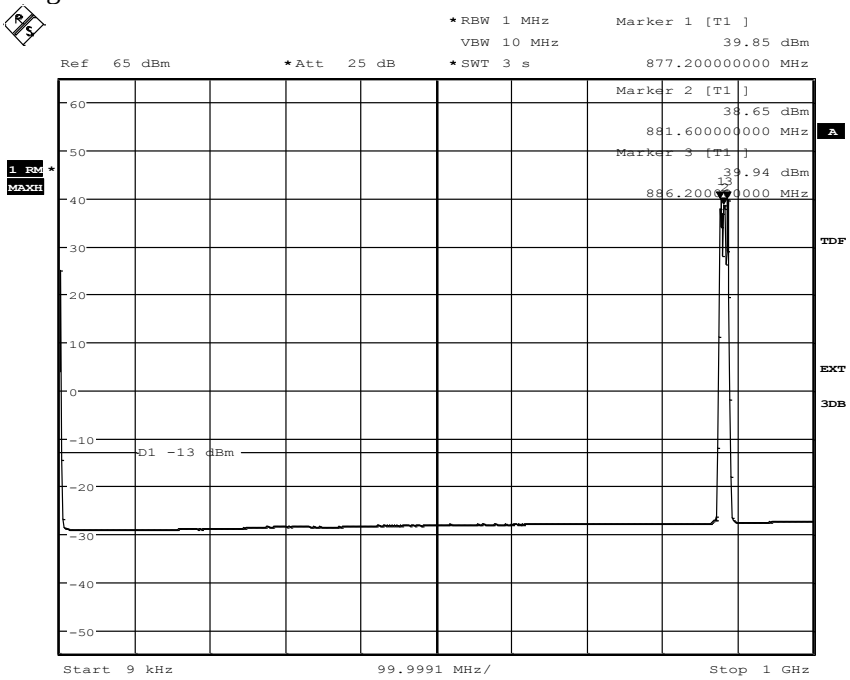
CFR 47 § 22.917: Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm per 100 kHz RBW.

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

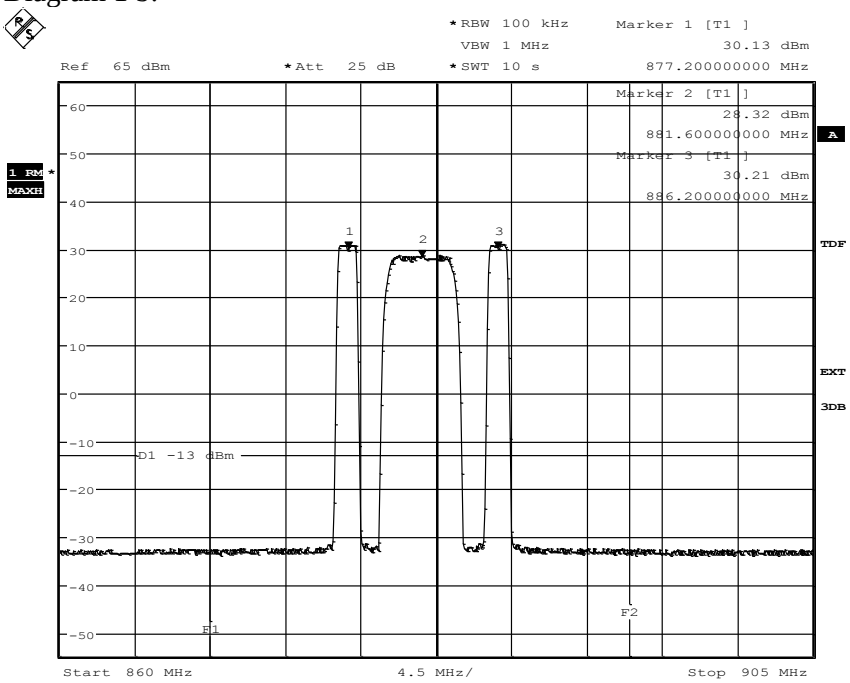
Appendix 3

Diagram 1 a:



Date: 11.JUN.2013 10:22:00

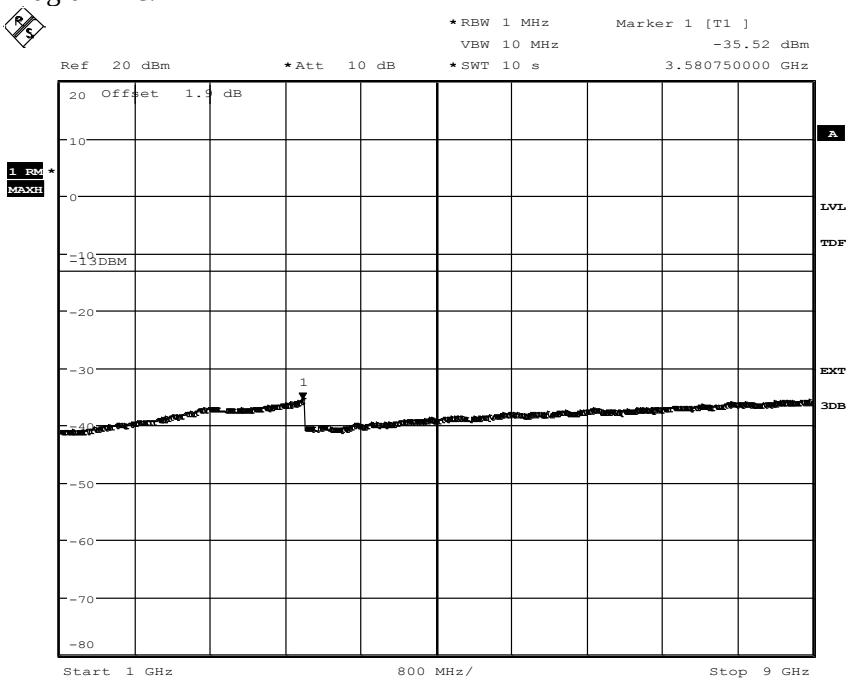
Diagram 1 b:



Date: 11.JUN.2013 10:19:40

Appendix 3

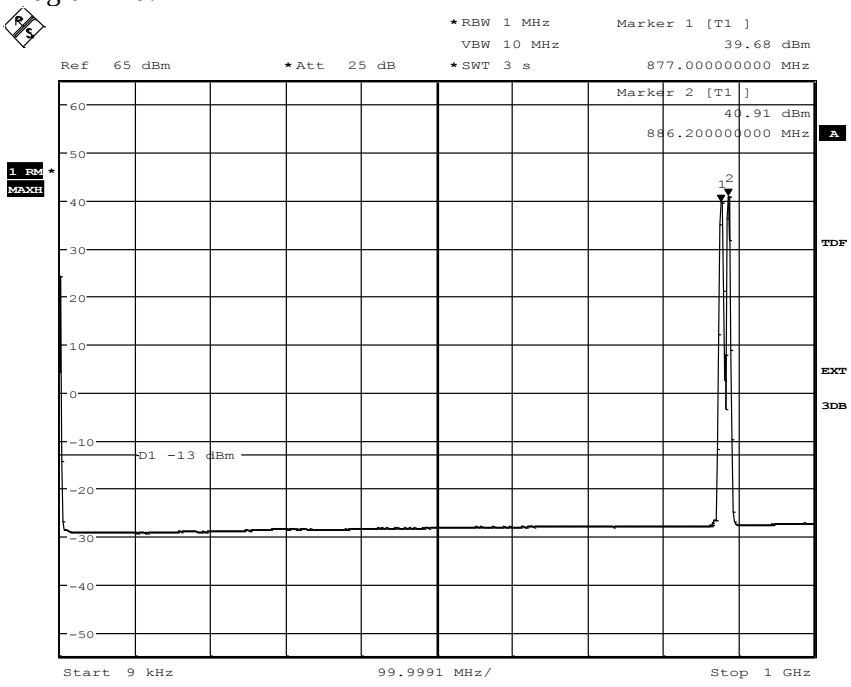
Diagram 1 c:



Date: 11.JUN.2013 10:24:13

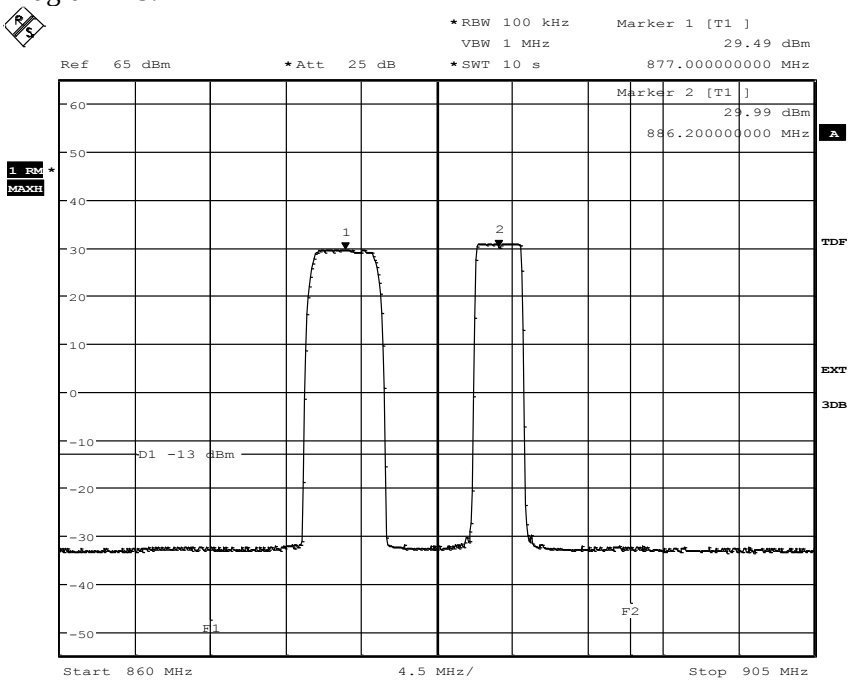
Appendix 3

Diagram 2 a:



Date: 11.JUN.2013 09:47:59

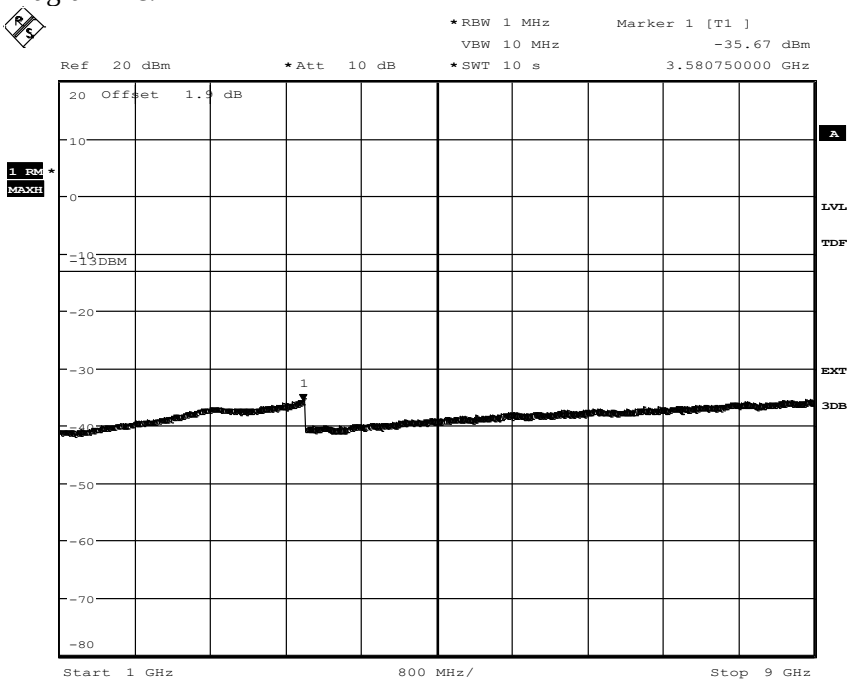
Diagram 2 b:



Date: 11.JUN.2013 09:49:15

Appendix 3

Diagram 2 c:



Date: 11.JUN.2013 09:45:38

Appendix 4

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

Date	Temperature	Humidity
2013-06-03	23°C ± 3°C	44 % ± 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.

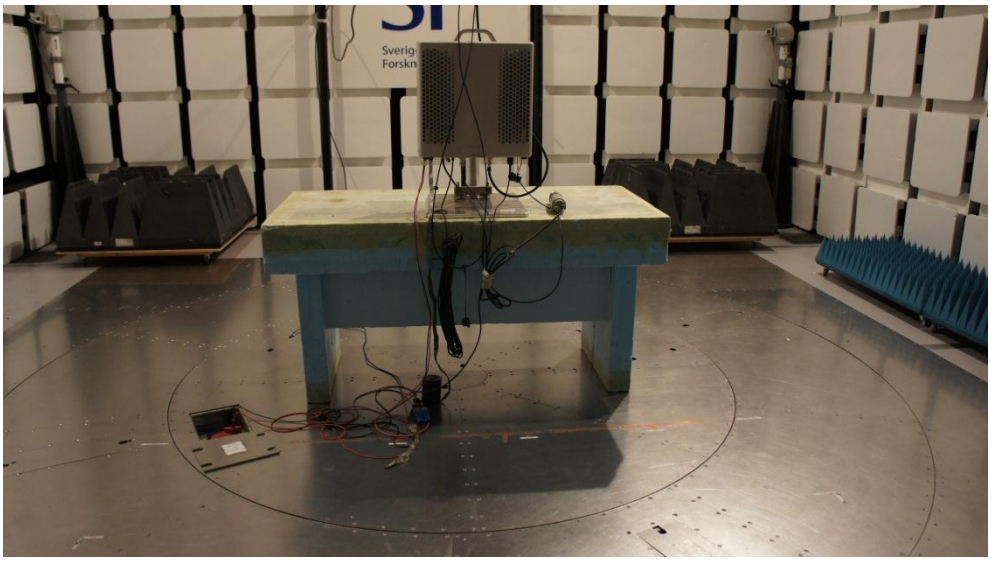
In the frequency range 30 MHz - 9 GHz the measurement was performed in power with a RBW of 1 MHz. A propagation loss in free space was calculated. The used formula was $\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.

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.

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	503 745
Chase Bilog Antenna CBL 6111A	502 182
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

Results, representing worst case

Diagram	Configuration
1 a+b	Configuration 4

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

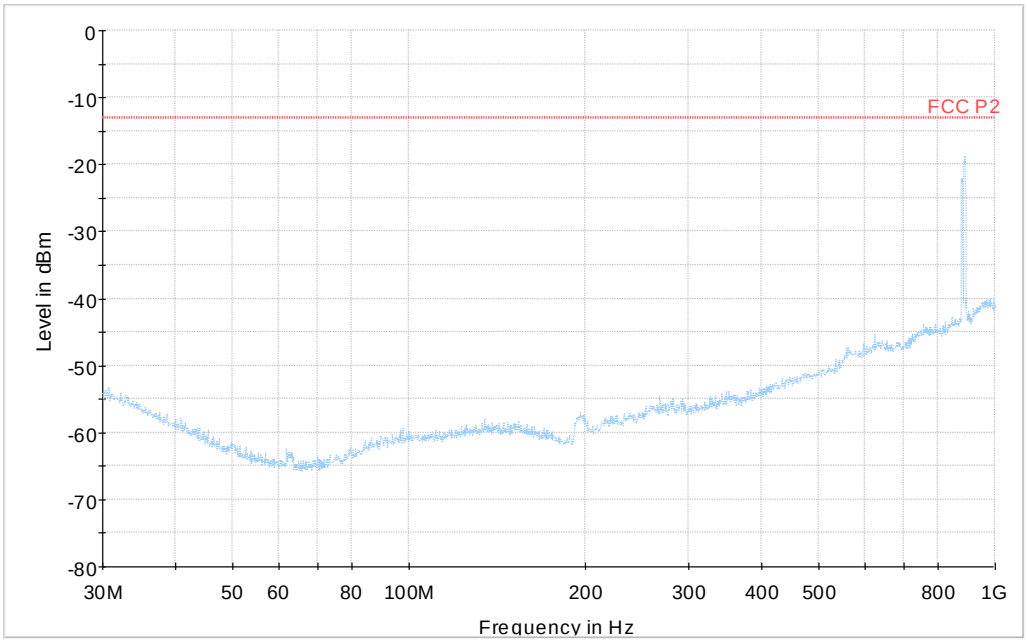
CFR 47 § 22.917 and IC RSS-132 5.5

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

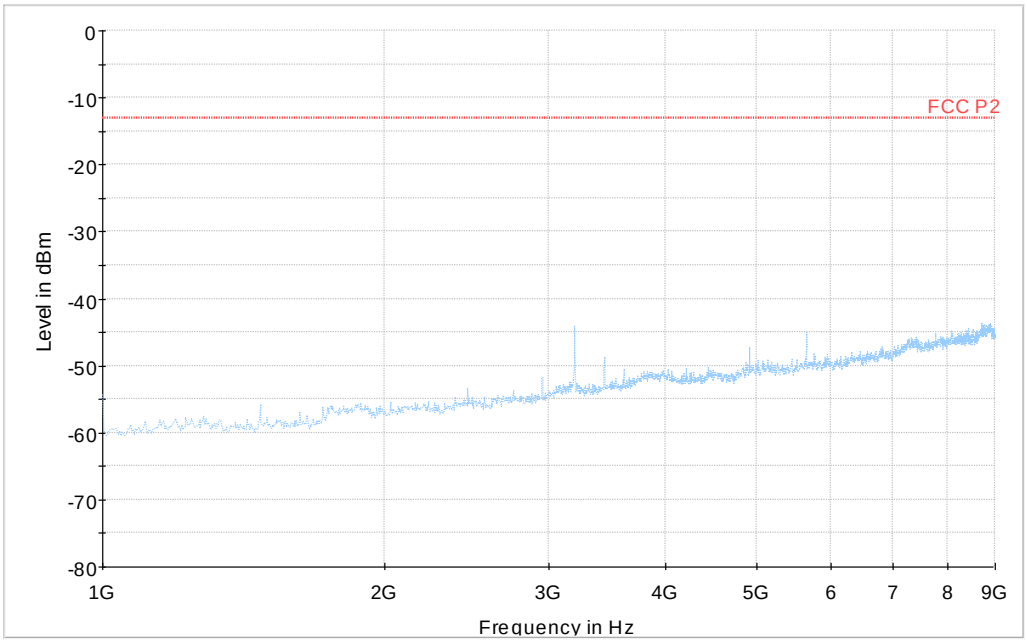
Appendix 4

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

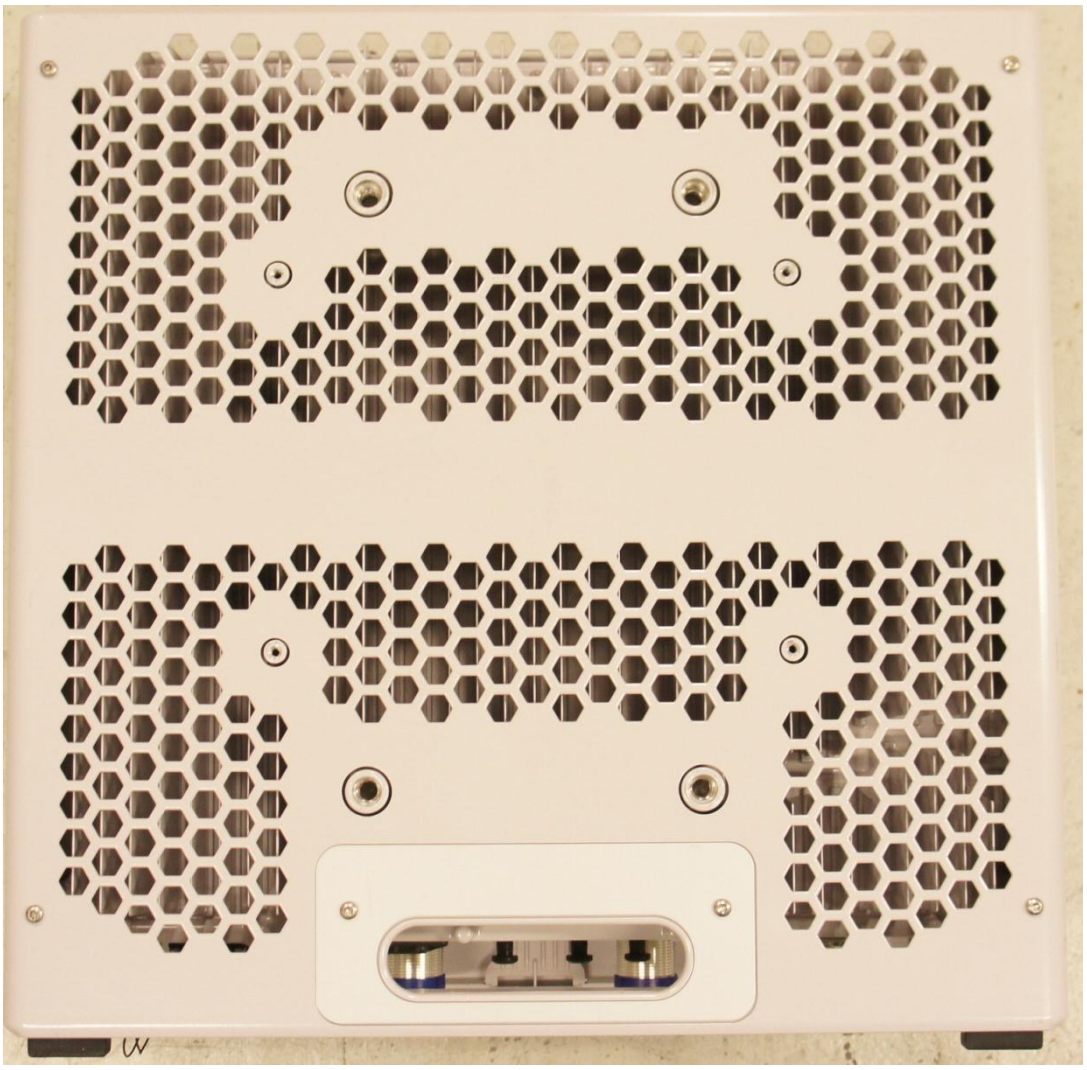
External photos

Front side:

Product label

Appendix 5

Rear side



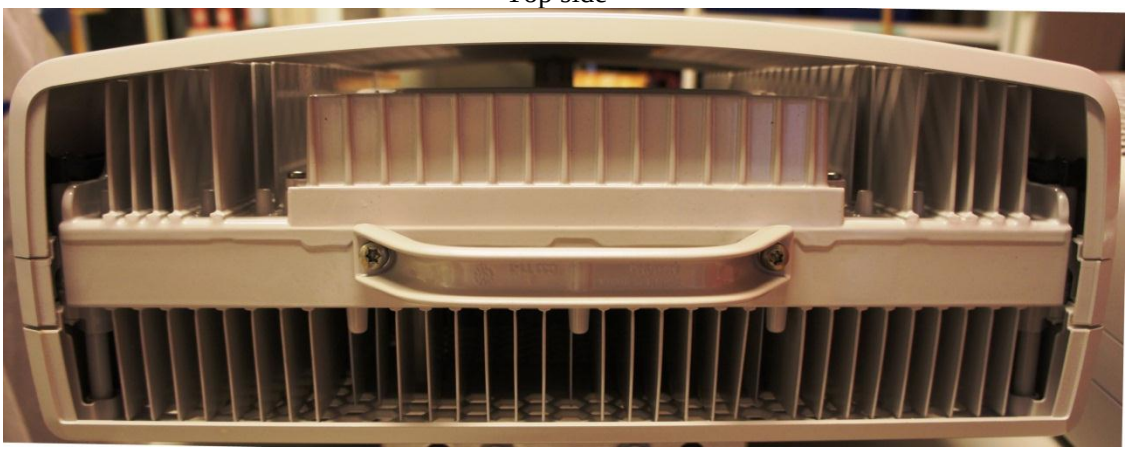
Appendix 5

Left side

Right side

Appendix 5

Top side



Bottom side