

Handled by, department

Jonas Bremholt

Electronics

+46 (0)10 516 5438, jonas.bremholt@sp.se

Ericsson AB
Anders Johansson
PDU Radio Base Station

164 80 Stockholm

Class II permissive change measurements on RUS 01 B5 radio equipment with FCC ID: TA8AKRC11864-2 and IC: 287AB-AS118642 (7 appendices)

Test object

RUS 01 B5, KRC 118 64/2 Rev. R2A

Summary

Appendix 1 describes the test object and set-ups during test.
Appendix 7 presents photos of the test object.

Standard	Compliant	Appendix
FCC CFR 47 / IC RSS-132		
2.1046 / RSS-132 4.4 RF power output	Yes	2
2.1049 / RSS-Gen 4.6.1 Occupied bandwidth	Yes	3
2.1051 / RSS-132 4.5 Band edge	Yes	4
2.1051 / RSS-132 4.5 Spurious emission at antenna terminals	Yes	5
2.1053 / RSS-132 4.5 Field strength of spurious radiation	Yes	6

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



Jonas Bremholt
Technical Officer



Christer Karlsson
Technical Manager

SP Technical Research Institute of Sweden

Postal address
SP
Box 857
SE-501 15 Borås
SWEDEN

Office location
Västeråsen
Brinellgatan 4
Borås

Phone / Fax / E-mail
+46 10 516 50 00
+46 33 13 55 02
info@sp.se

Laboratories are accredited by the Swedish Board for Accreditation and Conformity Assessment (SWEDAC) under the terms of Swedish legislation. This report may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Table of contents

Description of the test object	Appendix 1
Operation mode during measurements	Appendix 1
Test setups	Appendix 1
Purpose of test	Appendix 1
RF power output	Appendix 2
Occupied bandwidth	Appendix 3
Band edge	Appendix 4
Spurious emission at antenna terminals	Appendix 5
Field strength of spurious radiation	Appendix 6
External photos	Appendix 7

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 1

Description – Test object

Equipment:	Radio equipment RUS 01 B5 running in WCDMA mode supporting single and multi carrier.
Antenna ports:	1 TX/RX port and 1 RX port
Frequency range:	TX: 869 – 894 MHz RX: 824 – 849 MHz
Modulations:	QPSK, 16QAM and 64QAM
Nominal output power: (Maximum)	Single carrier: 1x 47.8 dBm (1x 60W) Multi carrier: 2x 44.8 dBm (2x 30W) 4x 41.8 dBm (4x 15W)
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:	-48 VDC

Tested channels

Channel	Downlink		Uplink	
	Frequency*	UARFCN	Frequency*	UARFCN
B	871.4	4357	826.4	4132
B+5	876.4	4382	831.4	4157
B+10	881.4	4407	836.4	4182
M	881.6	4408	836.6	4183
T-10	881.6	4408	836.6	4183
T-5	886.6	4433	841.6	4208
T	891.6	4458	846.6	4233

* Frequency in MHz

Operation mode during measurements

The settings below with test model TM1 (defined in 3GPP TS 25.141) with 5 MHz channel bandwidth was found to be representative for worst case setting for all traffic scenarios. This setting was used for all measurements unless noted otherwise.

Single carrier

64 DPCCH:s at 30 ksps (SF=128)

Multi carrier

32 DPCCH:s at 30 ksps (SF=128) in each carrier (Two carriers activated)

The test object was powered with -48 VDC during all measurements if not otherwise noted.

Conducted measurements

The test object was mounted into an RBS 6201 cabinet and powered by the cabinets internal -48 VDC. All RF conducted measurements were performed with the test object configured for maximum transmit power. All TX measurements were done at the RF A connector, with antenna port RF B unterminated..



REPORT

Date 2011-02-14 Reference FX100778-F22W Page 2 (6)

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 1

Radiated measurements

The test object was tested stand-alone and supplied with -48 VDC from functional test equipment. The active port RF A was monitored with signal analyzer outside the test chamber. Port RF B was unterminated.

The RUS unit was allocated to the following UARFCN:

Single Carrier: (One carrier configuration)

Cell	1
Channel	M

Multi Carrier: (Two carrier configuration)

Cell	1	2
Channel	B	B+10

Purpose of test

The purpose of the tests is a class II permissive change verification of maintained compliance to the performance characteristics specified in applicable parts of FCC CFR 47 and IC RSS-132. The changes comprise a product revision update to version R2A due to minor HW changes as described in the client documentation. Limited verification measurements in WCDMA mode were performed and showed maintained compliance.

References

Measurements were done according to relevant parts of the following standards:

ANSI 63.4-2003

ANSI/TIA/EIA-603-C-2004

CFR 47 part 2, October 1st, 2010

CFR 47 part 22, October 1st, 2010

3GPP TS 25.141, version 8.9.0

RSS-Gen Issue 3

RSS-132 Issue 2

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 1

Measurement equipment

Measurement equipment	Calibration Due	SP number
Semi anechoic chamber, Tesla	2012-10	503 881
Rohde & Schwarz FSIQ 40	2011-07	503 738
Rohde & Schwarz FSQ 40	2011-07	504 143
Rohde & Schwarz ESI 26	2011-08	503 292
EMI measurement computer	-	-
Software: R&S EMC32, ver. 8.20.1	-	503 745
High pass filter	2011-07	502 758
High pass filter	2011-07	503 739
High pass filter	2011-07	503 740
High pass filter	2011-07	504 199
High pass filter	2011-07	504 200
RF attenuator	2011-07	504 159
RF attenuator	2011-08	900 233
Boonton RF Peak power meter/analyzer	2011-10	503 144
Boonton Power sensor 56518-S/4	2012-10	503 145
Chase Bilog antenna CBL 6111A	2011-10	503 182
Horn antenna EMCO 3115	2014-01	502 175
Standard Gain model 20240-20	-	503 674
Low Noise Amplifier, Miteq	2011-07	503 285
μComp Nordic, Low Noise Amplifier	2011-07	504 160
Multimeter Fluke 87	2011-03	502 190
Testo 625 temperature and humidity meter	2011-04	504 117
Testo 635 temperature and humidity meter	2011-03	504 203

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation "SP-QD 10885". The measurement uncertainties can be found in the table below. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence).

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 2011-01-31.

Manufacturer's representative

Samir Catic, Ericsson AB

Test engineers

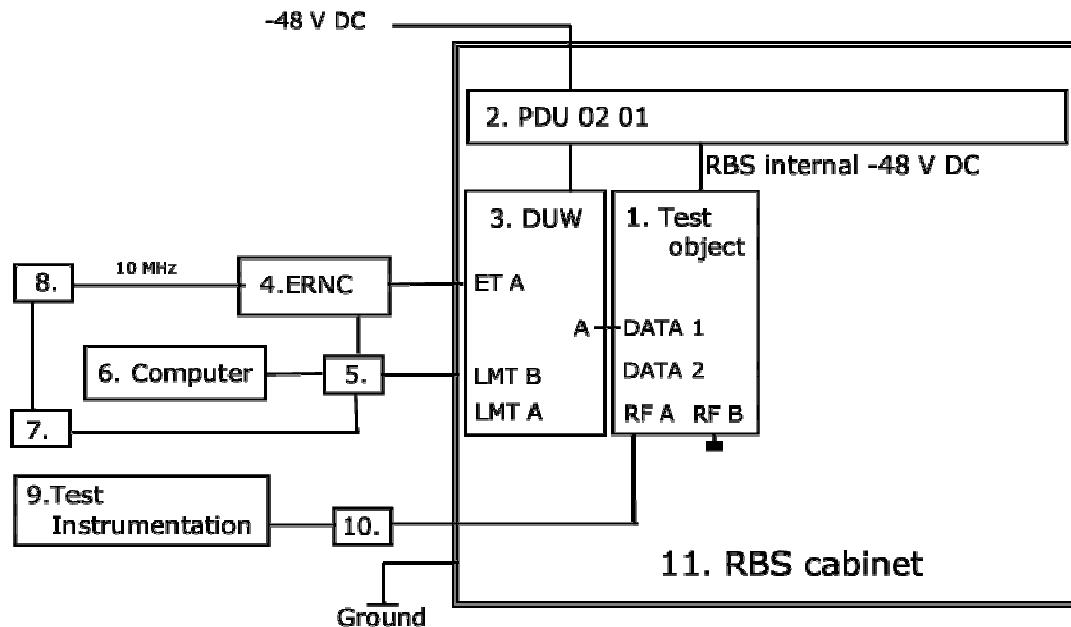
Andreas Johnson, Jörgen Wassholm, and Jonas Bremholt

Test participants

Samir Catic, Ericsson AB (partially present)

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 1

Test set-up conducted measurements TX**Test object**

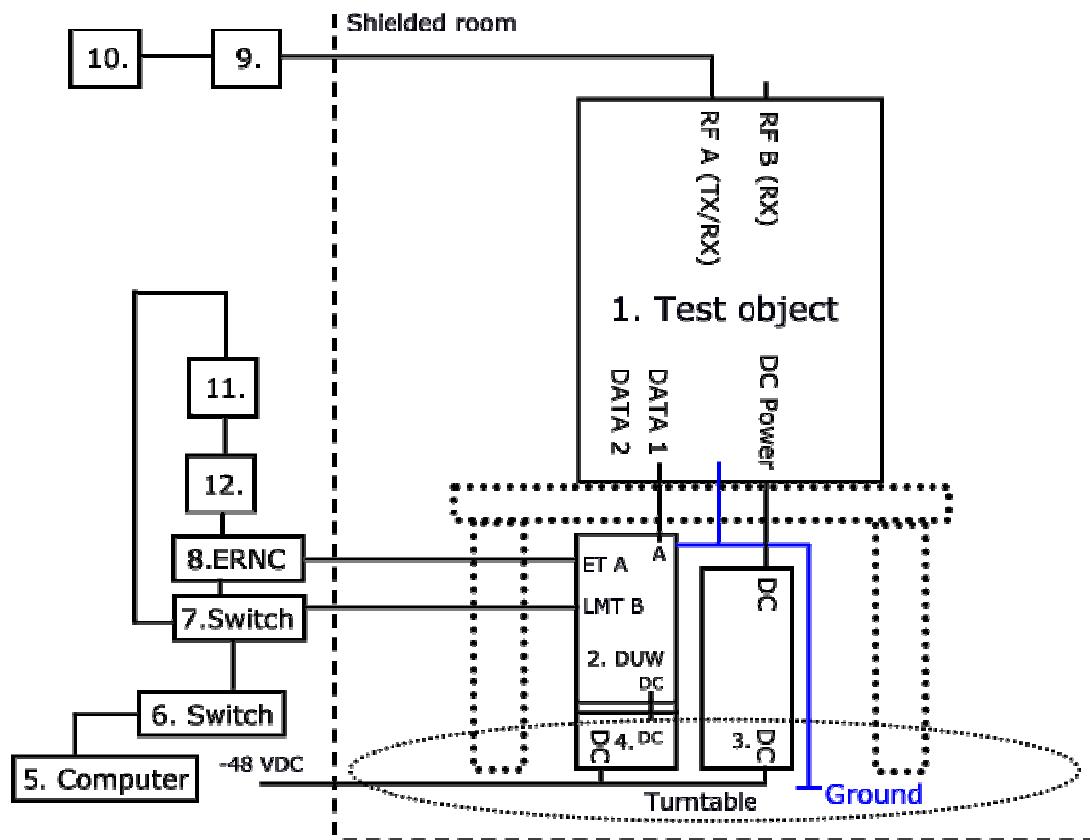
1. RUS 01 B5, KRC 118 64/2, revision R2A, S/N: C823990634.
FCC ID: TA8AKRC11864-2 and IC: 287AB-AS118642

Functional test equipment

2. PDU 02 01, BMG 980336/4, R2A, (S)BJ31528316
3. DUW 30 01 KDU 127 161/3 Rev R2B S/N C823486753
4. ERNC SIM 127, BAMS – 1000660988
5. Fast Ethernet switch, Netgear FS726T
6. Computer, Sunblade 2500, BAMS – 0000015233
7. NTP server, Symmetricom SyncServer, BAMS – 1000714181
8. 10 MHz reference, Symmetricom model 8040, BAMS – 1000714186
9. SP test instrument according measurement equipment list
10. Attenuator
11. RBS 6201 cabinet, BAMS 1000778792

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 1

Test set-up radiated measurements**Test object**

1. RUS 01 B5, KRC 118 64/2, revision R2A, S/N: C823990634.
FCC ID: TA8AKRC11864-2 and IC: 287AB-AS118642

Functional test equipment

2. DUW 30 01 KDU 127 161/3, revision R2B S/N: C823486753
3. Power subrack, for details see table below
4. SUP 6601 1/BFL 901 009/1 Rev R1B, S/N: BR80867188
5. Computer, Sunblade 2500, BAMS – 0000015233
6. Switch, D-Link DES-3526
7. Fast Ethernet switch, Netgear FS726T
8. ERNC SIM 127, BAMS – 1000660988
9. Attenuator
10. Spectrum analyzer, Rohde & Schwarz FSIQ 40, SP 503 738, for supervision purposes
11. NTP server, Symmetricom SyncServer, BAMS – 1000714181
12. 10 MHz reference, Symmetricom model 8040, BAMS – 1000714186



REPORT

Date 2011-02-14 Reference FX100778-F22W Page 6 (6)

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 1

Test object interfaces	Type of port:
Power configuration: -48 VDC	DC Power
Ground via RBS frame during conducted measurements, Ground via ground strap during radiated stand-alone measurements	Ground
Antenna port RF A, combined TX/RX, female 7/16 connector	Antenna
Antenna port RF B, RX only, female 7/16 connector	Antenna
Cross connect RX A, not supported, omitted in set-up drawings above	-
Cross connect RX B, not supported, omitted in set-up drawings above	-
RXA CO-site, not supported, omitted in set-up drawings above	-
Data 1, connected to DUW port RI A	Signal
Data 2, not supported	-

Test object software

Software	Revision
Basic CXP 901 6867/3	R1J02
Upgrade package: CXP 901 6868/1	R3AF12

Hardware of power subrack used during stand-alone radiated tests

Position	Product name	Product number	R-state	Serial number
	Power subrack	SXK 109 8115/1	R2A	
1	PDU 01 01	BMG 980 336/2	R4F	BJ31532384
2	PDU 01 01	BMG 980 336/2	R4F	BJ31532382
3	SHU 01 01	BGK 901 18/1	R3C	BJ31446269
4	DUMMY	SXK 109 8257/1	R1D	-
5	DUMMY	SXK 109 8257/1	R1D	-
6	PFU 01 01	KFE 101 1162/1	R1B	BR80910495
7	DUMMY	SXK 109 8257/1	R1D	-
8	DUMMY	SXK 109 8257/1	R1D	-
9	PCF 02 01	KFE 101 1157/1	R1C	BW95301450

Note: The power subrack is functional test equipment in the context of this test report.



REPORT

Date 2011-02-14 Reference FX100778-F22W Page 1 (1)

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 2

RF power output measurements according to 47 CFR 2.1046, 22.913 / RSS-132 4.4

Date	Temperature	Humidity
2011-02-03	23 °C ± 3 °C	23 % ± 5 %

Test set-up and procedure

The output was connected to a peak power analyzer with the CDF mode activated.

Measurement equipment	SP number
Boonton RF Peak power meter/analyzer	503 144
Boonton Power sensor 56518-S/4	503 145
RF attenuator	504 159
Multimeter Fluke 87	502 190
Testo 635, Temperature and humidity meter	504 203

Measurement uncertainty: 0.7 dB

Results

Single carrier: Rated output power level at RF A connector (maximum): 1x 47.8 dBm

Transmitter power (dBm / dB) RMS / PAR		
B	M	T
-	47.6/ 6.7	-

Limit

According to CFR 47/ RSS there are no conducted limits at the antenna connector.

CFR § 22.913/ SRSP-503 5.1: The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts (57 dBm).

RSS-132: The transmitter output power shall not exceed the limits given in SRSP-503

Complies?	Yes
-----------	-----



REPORT

Date 2011-02-14 Reference FX100778-F22W Page 1 (1)

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 3

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

Date	Temperature	Humidity
2011-02-03	23 °C ± 3 °C	23 % ± 5 %

Test set-up and procedure

The measurements were made as defined in §2.1049. The output was connected to a spectrum analyzer. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
Rohde & Schwarz FSQ 40	504 143
RF attenuator	504 159
Testo 635, Temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

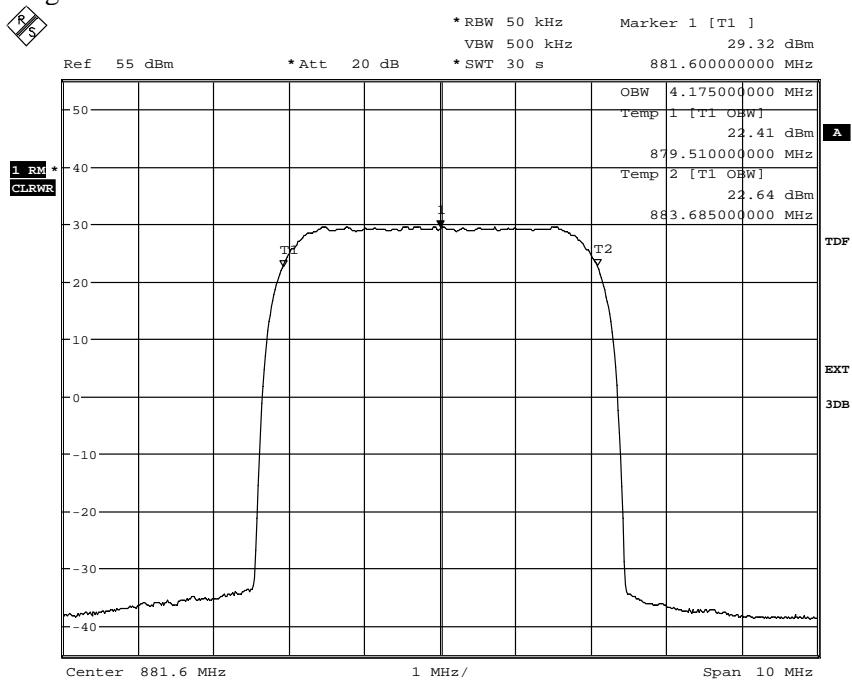
The results are shown in appendix 3.1

Diagram 1 Channel M OBW 4.175 MHz

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 3.1

Diagram 1



Date: 3.FEB.2011 09:08:48



REPORT

Date 2011-02-14 Reference FX100778-F22W Page 1 (1)

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 4

Band edge measurements according to 47 CFR 2.1051, 22.917 / RSS-132 4.5

Date	Temperature	Humidity
2011-02-03	23 °C ± 3 °C	23 % ± 5 %

Test set-up and procedure

The measurements were made as defined in §22.917 except that the limit is adjusted for a reference RBW of 1 MHz instead of 100 kHz for spurious emission >1 MHz away from the band edges as RSS 132 specify 1 MHz RBW for equipment having an emission bandwidth >4 MHz.

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. A resolution bandwidth of 30 kHz was used up to 5 MHz away from the band edges. 30 kHz is <1% of the Emission BW (4.25 MHz between the 26 dB points for 5 MHz nominal BW setting). To compensate for the reduced measurement bandwidth, the limit was adjusted with 1.5 dB to -14.5 dBm up to 1 MHz away from the band edges and with 15.2 dB to -28.2 dBm from 1 MHz to 5 MHz away from the band edges.

Measurement equipment	SP number
Rohde & Schwarz FSQ 40	504 143
RF attenuator	504 159
Testo 635, Temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

The results are shown in appendix 4.1

Single carrier:

Diagram 1: B

Diagram 2: T

Multi carrier:

Diagram 3: B+(B+5)

Diagram 4: T+(T-5)

Limits

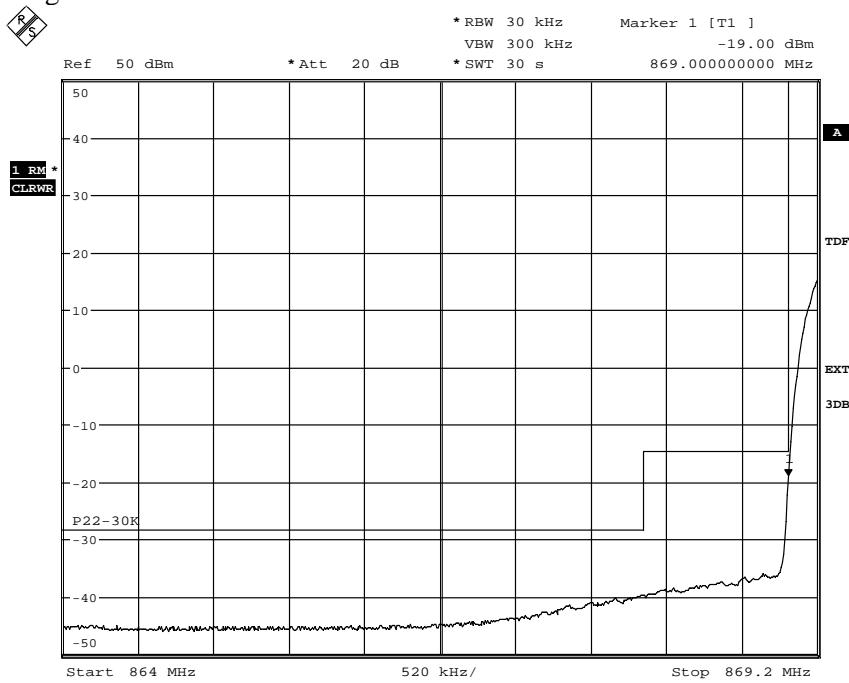
The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least $43 + 10 \log P$ dB.

Complies?	Yes
-----------	-----

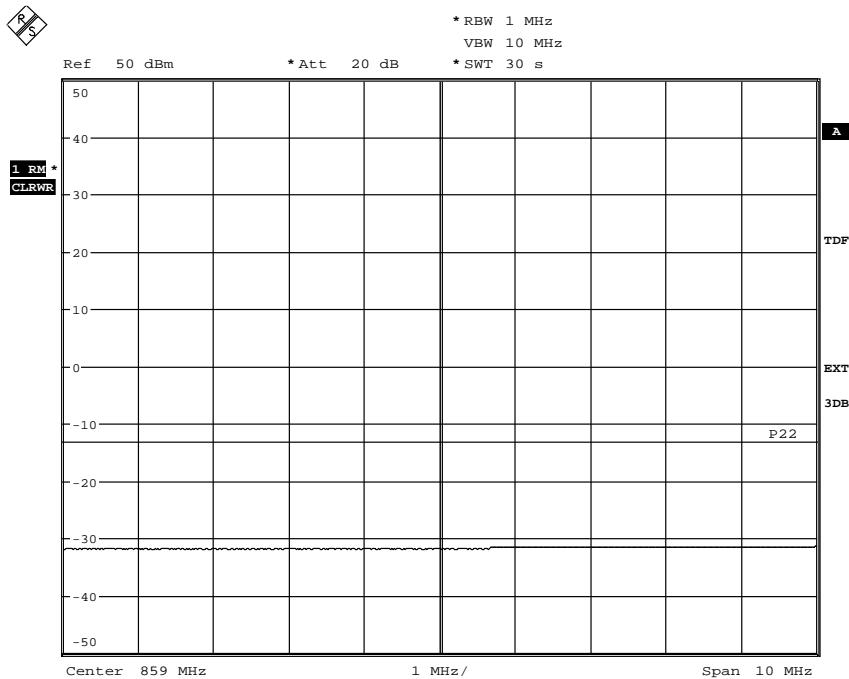
FCC ID: TA8AKRC11864-2
 IC: 287AB-AS118642

Appendix 4.1

Diagram 1



Date: 3.FEB.2011 10:27:54

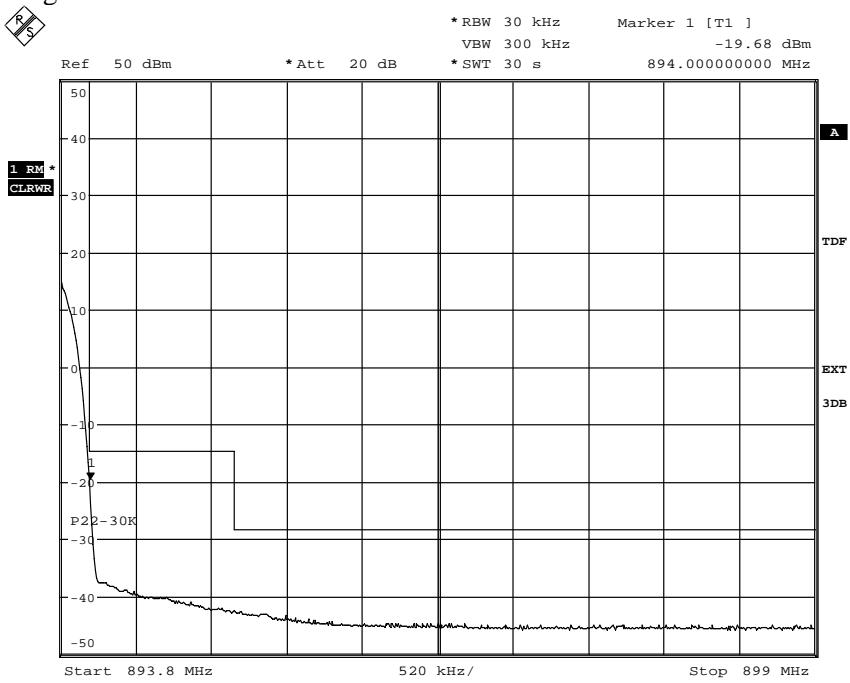


Date: 3.FEB.2011 10:33:43

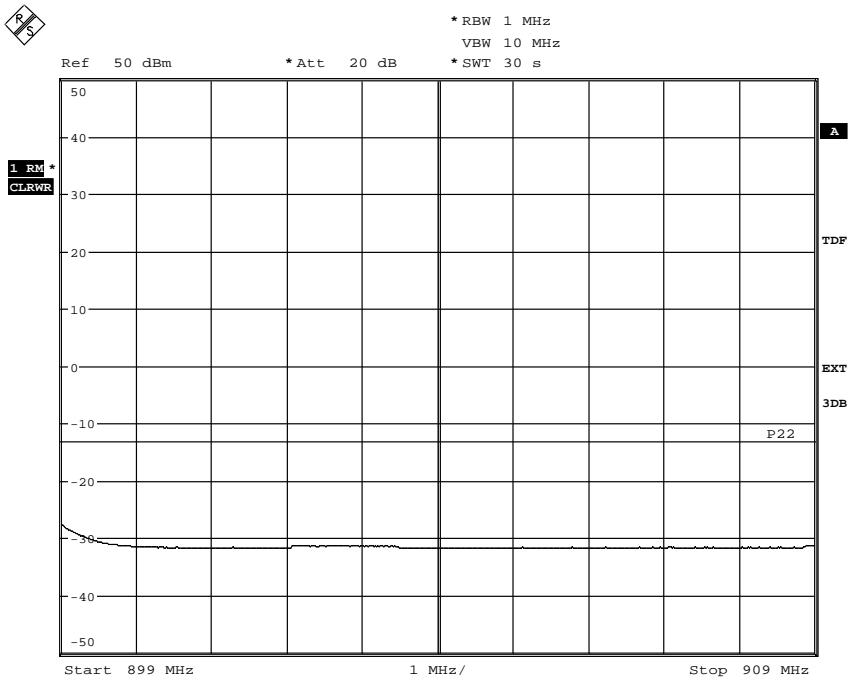
FCC ID: TA8AKRC11864-2
 IC: 287AB-AS118642

Appendix 4.1

Diagram 2

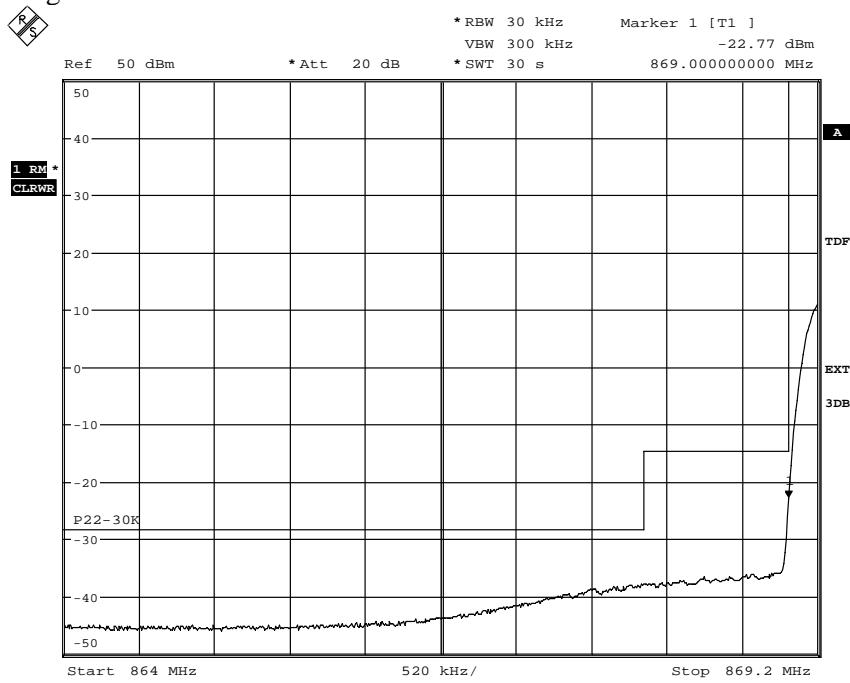


Date: 3.FEB.2011 11:08:01

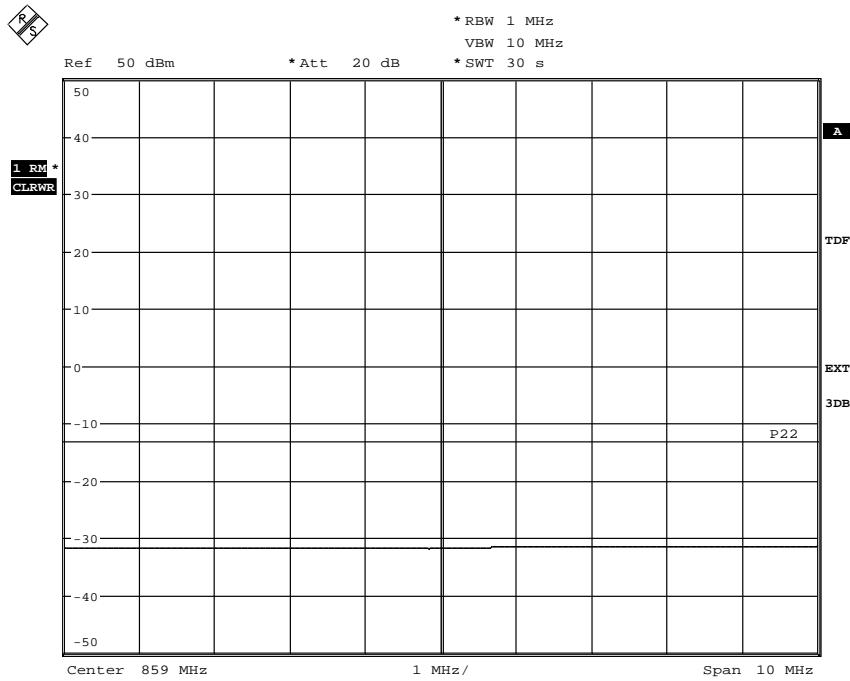


Date: 3.FEB.2011 11:10:00

FCC ID: TA8AKRC11864-2
 IC: 287AB-AS118642

Appendix 4.1
Diagram 3


Date: 3.FEB.2011 13:25:14

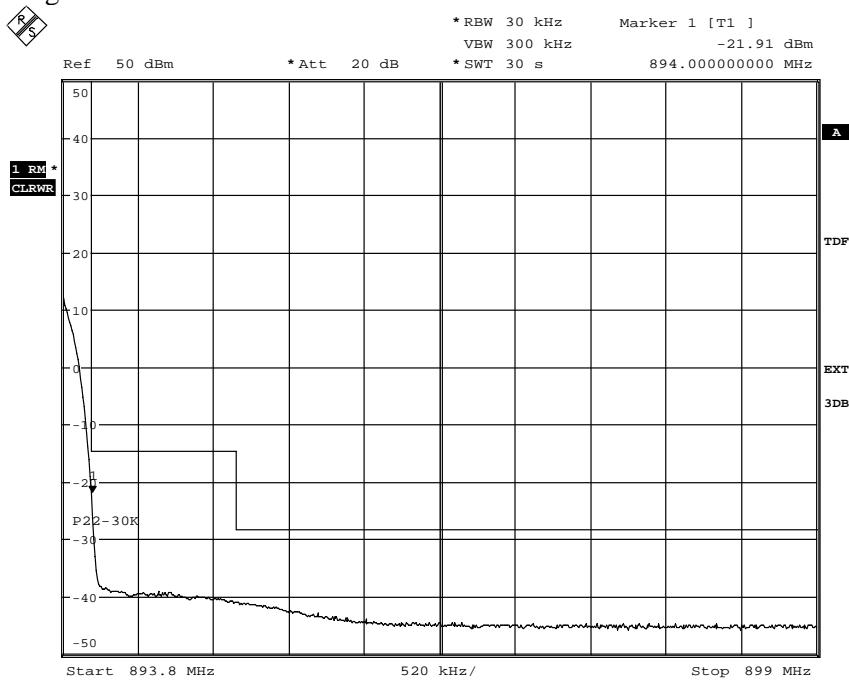


Date: 3.FEB.2011 14:33:39

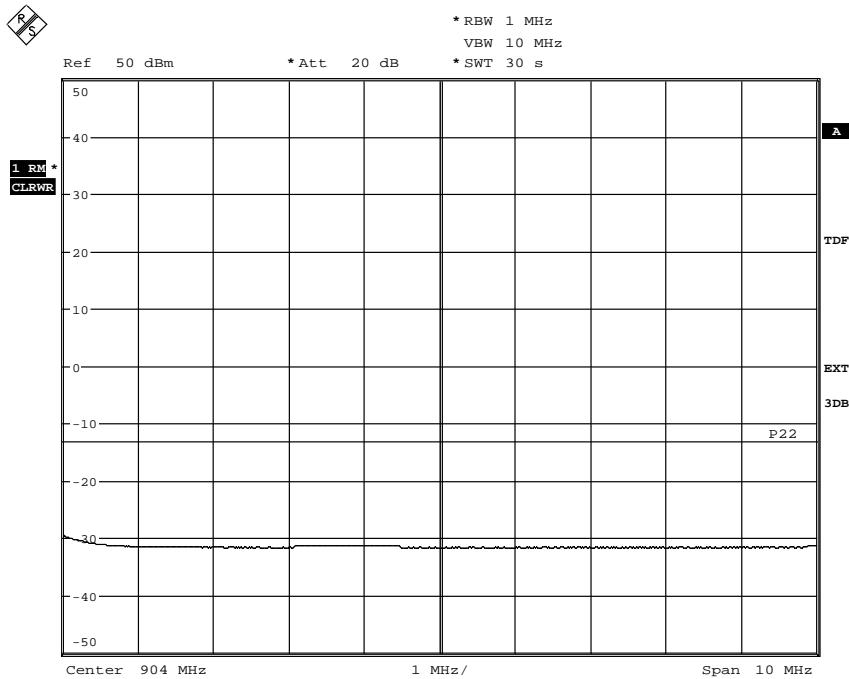
FCC ID: TA8AKRC11864-2
 IC: 287AB-AS118642

Appendix 4.1

Diagram 4



Date: 3.FEB.2011 13:46:51



Date: 3.FEB.2011 14:04:53

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 5

Conducted spurious emission measurements according to 47 CFR 2.1051, 22.917 / RSS-132 4.5

Date	Temperature	Humidity
2011-02-03	23 °C ± 3 °C	23 % ± 5 %

Test set-up and procedure

The measurements were made with a resolution bandwidth of 1 MHz instead of 100 kHz as RSS-132 specifies 1 MHz for equipment with an emission bandwidth of ≥ 4 MHz. The output was connected to a spectrum analyzer. First a pre-measurement with activated peak detector was performed. An emission close to or above the limit is measured with activated RMS detector and the RMS measurement result is noted. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
Rohde & Schwarz FSQ 40	504 143
RF attenuator	504 159
RF attenuator	900 233
High pass filter	504 199
High pass filter	503 739
High pass filter	503 740
Testo 635, Temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

The results are shown in appendix 5.1

Single carrier:

Diagram 1: M

Multi carrier:

Diagram 2: B+(B+10)

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 internal frequency as declared by the client was 2.4576 GHz, thus the choice of the upper frequency boundary was set to 10×2.5 GHz = 25 GHz for emission measurements.

The 2.4576 GHz frequency was identified as not used in the RF chain and is not affected by the power setting of the carrier frequency, the transmitter was activated for 40 W output power during the measurements in the frequency range 15 to 25 GHz. In the frequency range 9 kHz to 15 GHz the transmitter was activated for maximum output power.

Limits

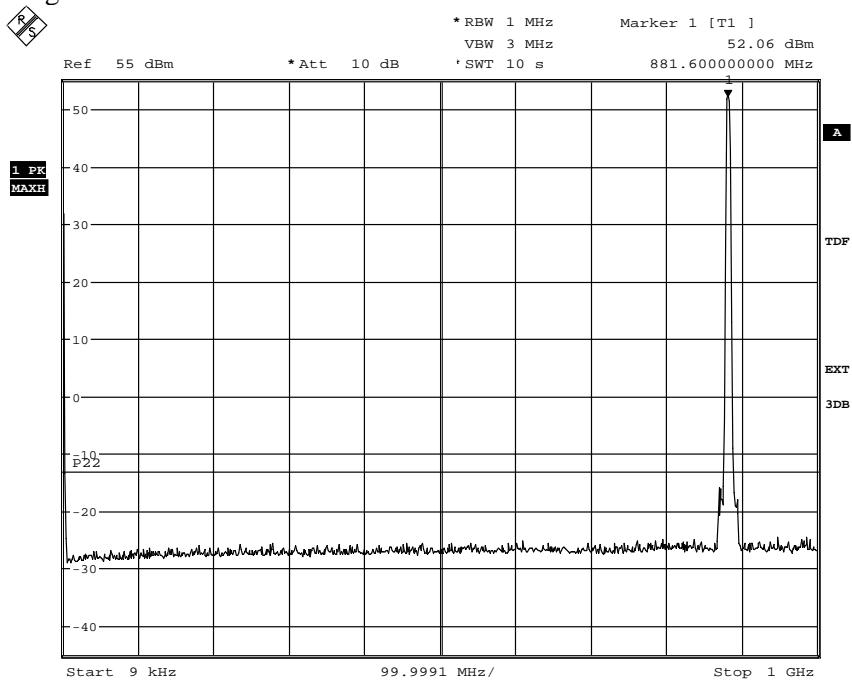
The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least $43 + 10 \log P$ dB.

Complies?	Yes
-----------	-----

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 5.1

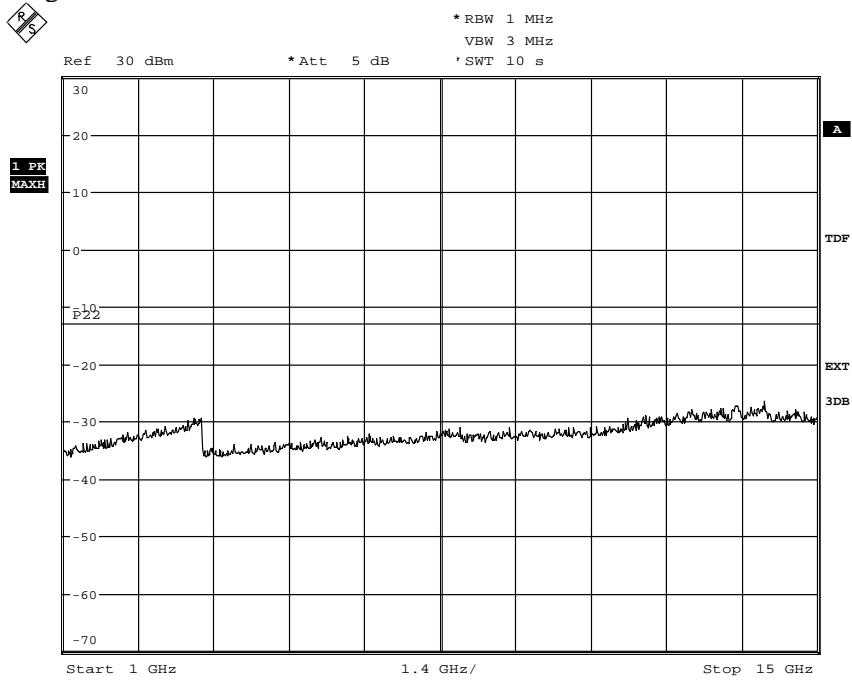
Diagram 1a



Date: 3.FEB.2011 09:14:36

The emissions around the carrier are within the operating frequency band

Diagram 1b

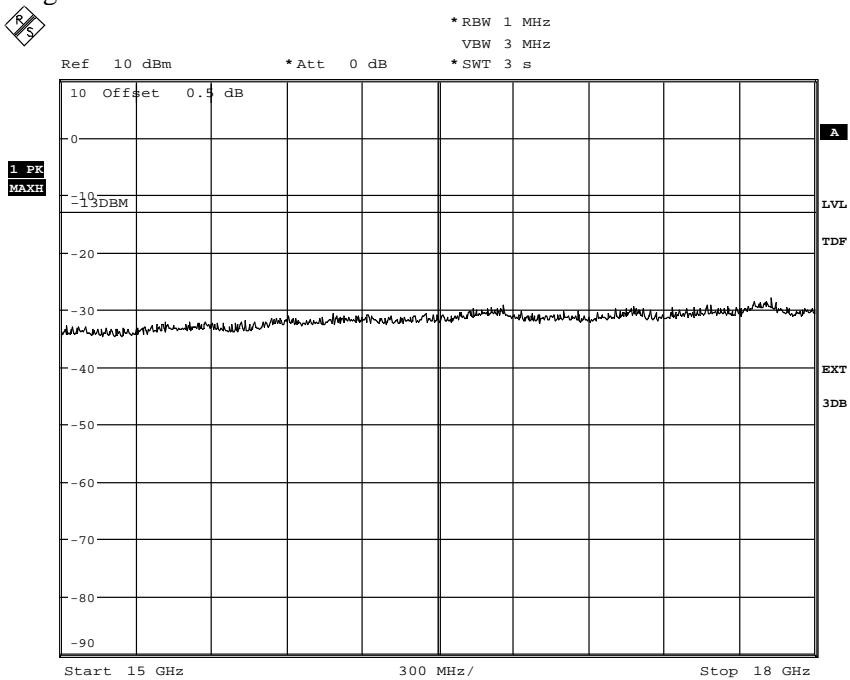


Date: 3.FEB.2011 09:33:58

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

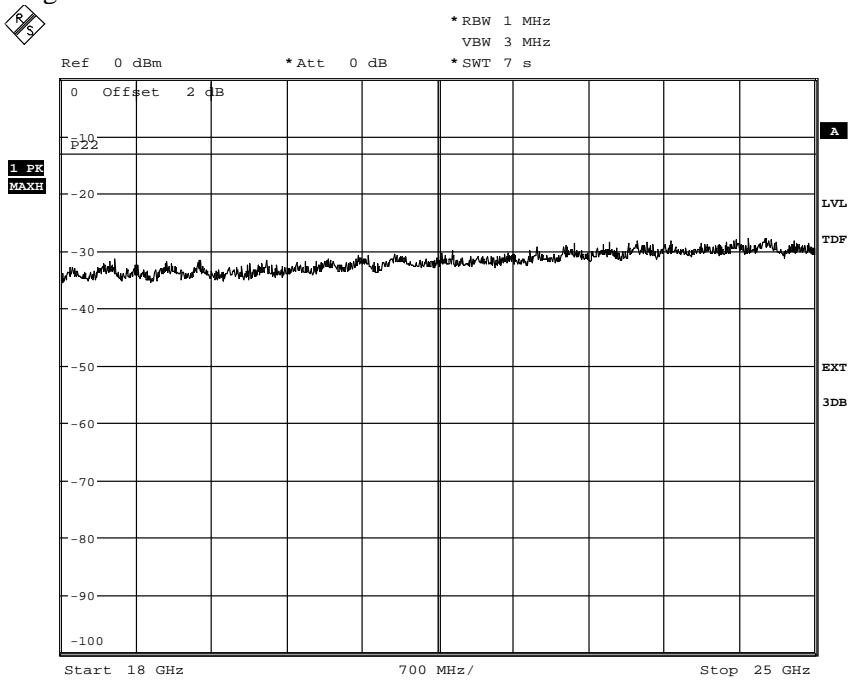
Appendix 5.1

Diagram 1c



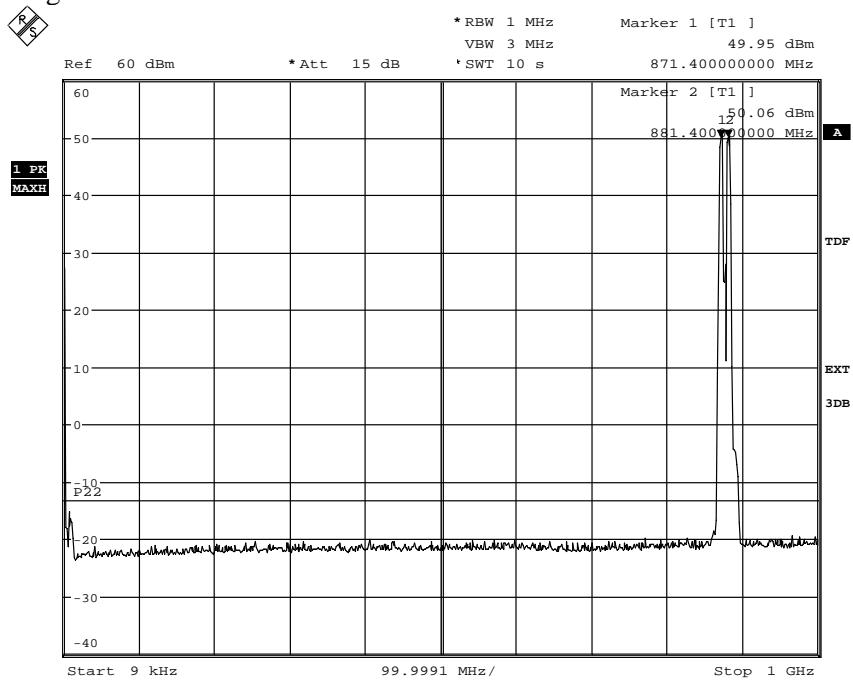
Date: 3.FEB.2011 15:42:54

Diagram 1d



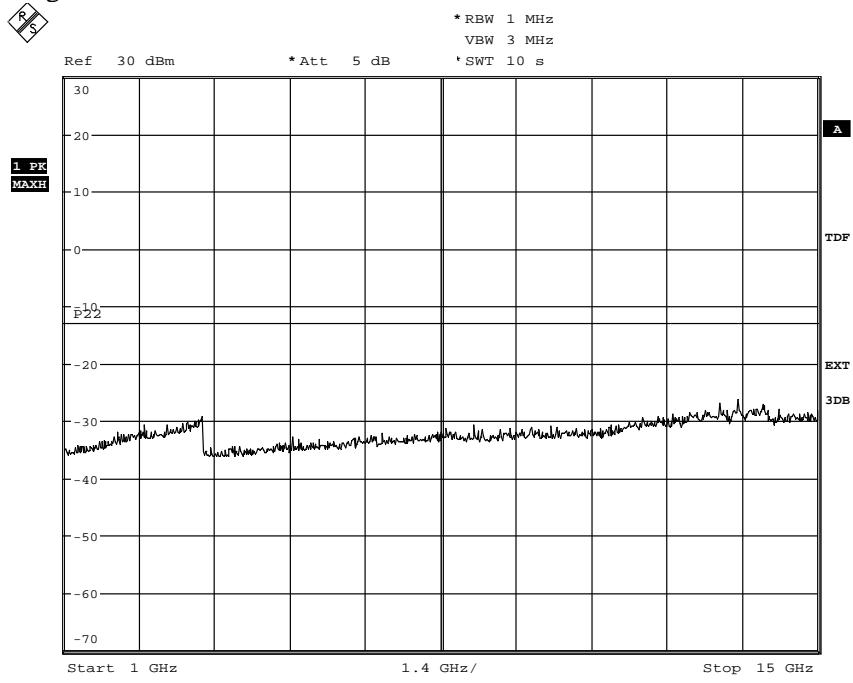
Date: 3.FEB.2011 15:48:29

FCC ID: TA8AKRC11864-2
 IC: 287AB-AS118642

Appendix 5.1
Diagram 2a


Date: 3.FEB.2011 12:38:52

The emissions around the carrier are within the operating frequency band

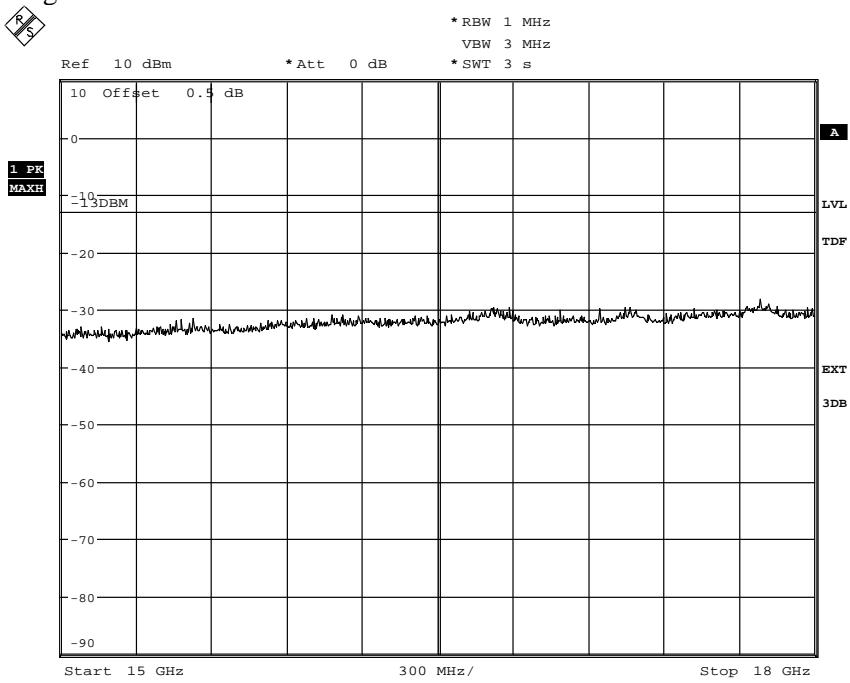
Diagram 2b


Date: 3.FEB.2011 14:37:56

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

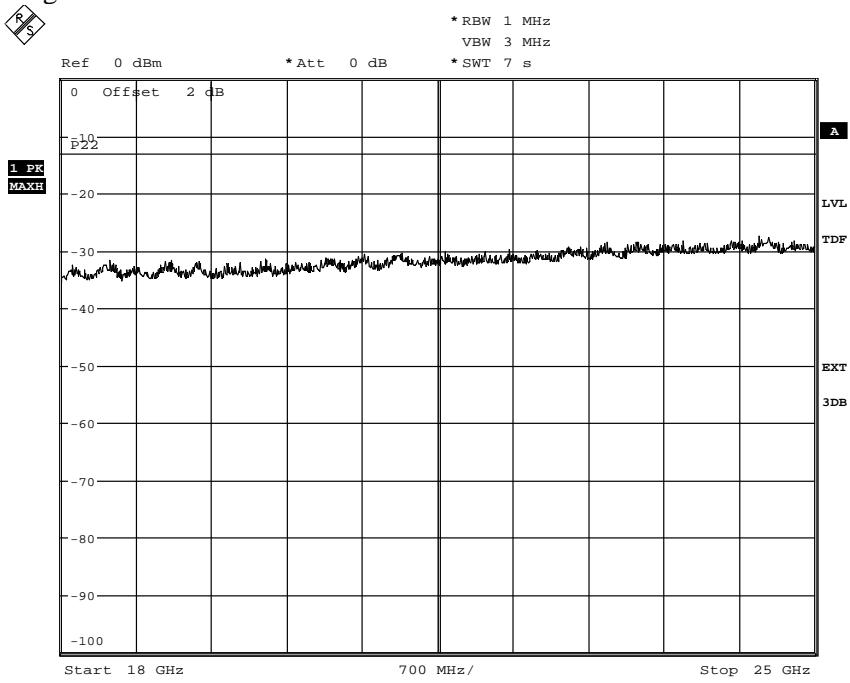
Appendix 5.1

Diagram 2c



Date: 3.FEB.2011 15:28:39

Diagram 2d



Date: 3.FEB.2011 15:25:54

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 6

**Field strength of spurious radiation measurements according to 47 CFR 2.1053/
RSS-132 4.5**

Date	Temperature	Humidity
2011-02-03	22 °C ± 3 °C	29 ± 5 %

Test set-up and procedure

The test site is listed at FCC, Columbia with registration number: 93866. The test site also complies with RSS-Gen, Industry Canada IC file no.: 3482A-1.

The antenna port “RF A” was connected to functional test equipment outside the test chamber for signal monitoring. Antenna port “RF B” was unterminated.

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 to 15 GHz and 1 m in the frequency range 15 GHz to 25 GHz.

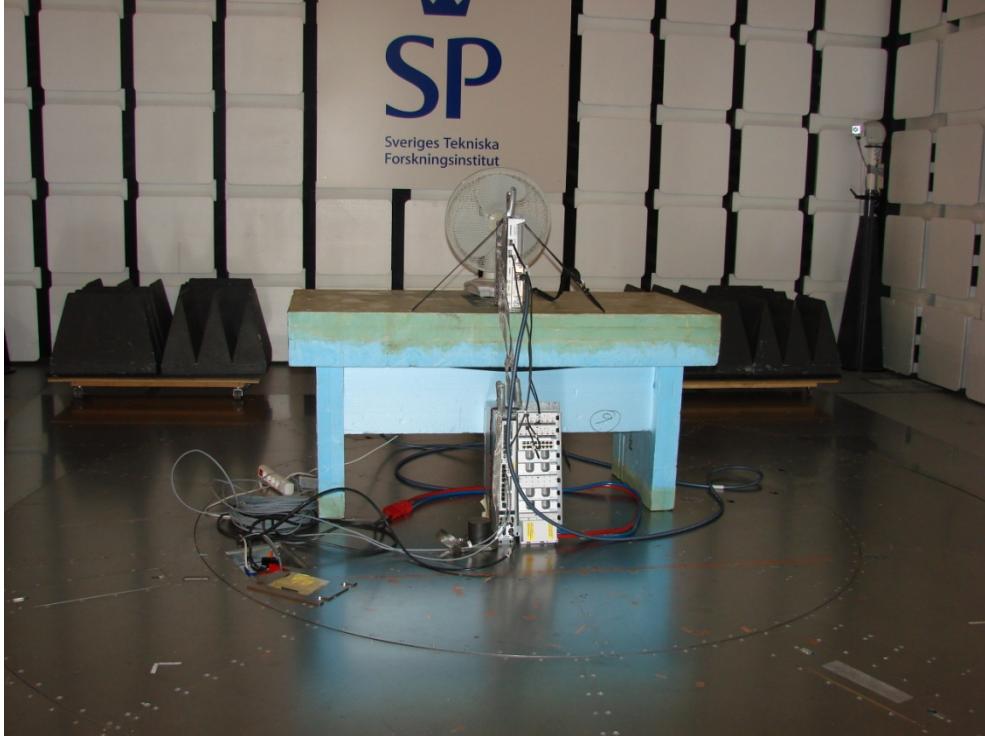
1. A pre-measurement was first performed:
2. In the frequency range 30 MHz-25 GHz the measurement was performed in power with a RBW of 1 MHz. A propagation loss in free space was calculated. The used formula was,
$$\gamma = 20 \log\left(\frac{4\pi D}{\lambda}\right)$$
, γ is the propagation loss and D is the antenna distance.
3. The measurement procedure was as the following:
4. 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.
5. Spurious radiation on frequencies closer than 20 dB to the limit 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 measured with the RMS detector were measured with the substitution method according to the standard.

Measurement equipment	SP number
Semi anechoic chamber Tesla	503 881
Rohde & Schwarz ESI 26	503 292
Rohde & Schwarz FSIQ 40	503 738
EMC 32 ver. 8.20.1	503 745
Chase Bilog antenna CBL 6111A	503 182
EMCO Horn Antenna 3115	502 175
Standard Gain model 20240-20	503 674
Highpass filter 1-15 GHz	504 199
Highpass filter 3-18 GHz	504 200
MITEQ Low Noise Amplifier	503 285
uComp Nordic Low Noise Amplifier	504 160
Testo 625 temperature and humidity meter	504 188

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 6

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



Results

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-25 000	All emission > 20 dB below limit	All emission > 20 dB below limit
Measurement uncertainty 4.7 dB		

Limits

The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least $43 + 10 \log P$ dB.

Complies?	Yes
-----------	-----

FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 7

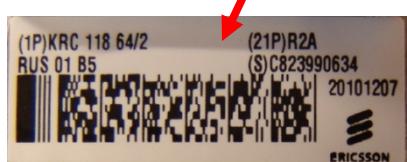
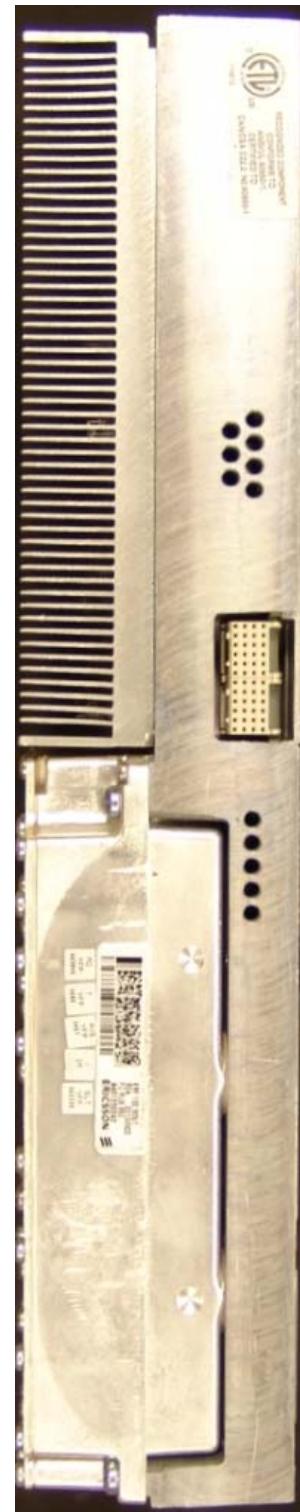
External photos of the test object

Note: The pictures show the sample used for radiated tests.

Front side



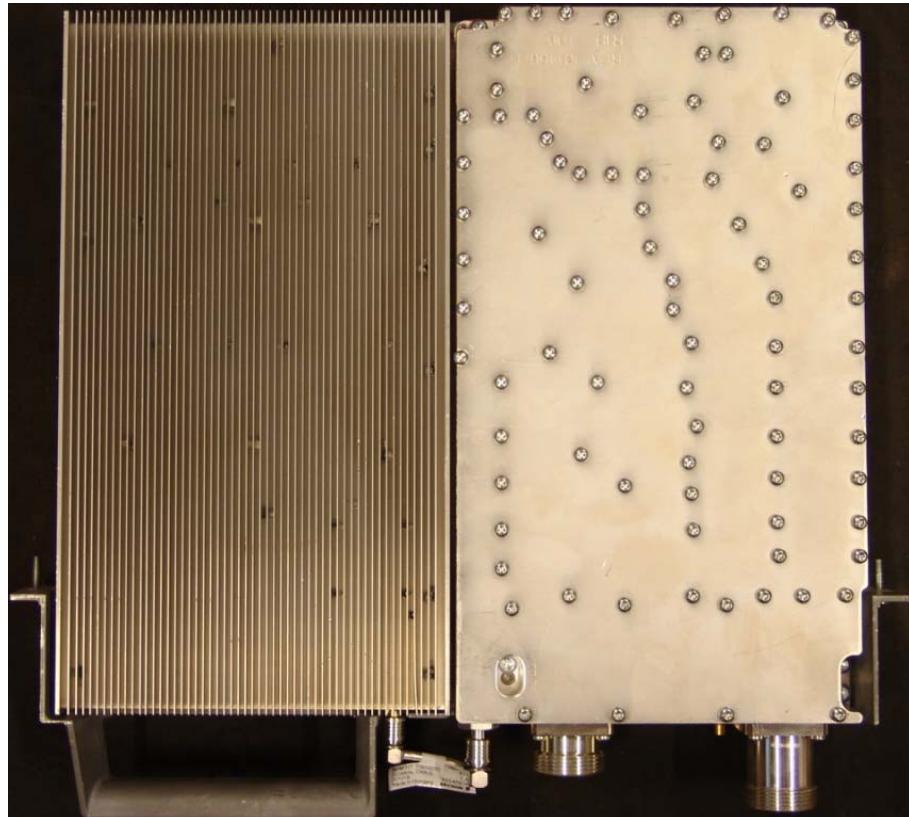
Rear side



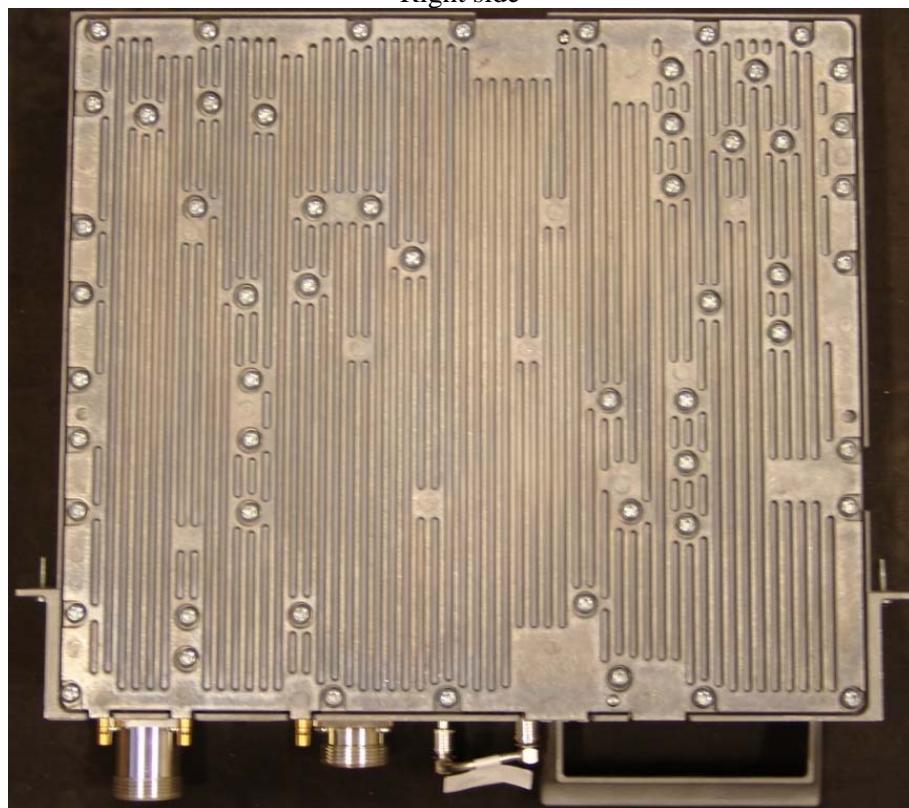
FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 7

Left side



Right side



FCC ID: TA8AKRC11864-2
IC: 287AB-AS118642

Appendix 7

Bottom side



Top side

