



# REPORT

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

Date  
2010-03-29

Reference  
FX000131-F27

Page  
1 (2)



Handled by, department  
**Reinhold Reul**  
Electronics  
+46 (0)10 516 5584, reinhold.reul@sp.se

Ericsson AB  
Anders Johansson  
PDU Radio Base Stations  
164 80 Stockholm

## Radio measurements on RUL 01 B13 700 MHz radio equipment with FCC ID: TA8AKRC11856-1

(9 appendices)

### Test object

RUL 01 B13, KRC 118 56/1 Rev. R1B/A, S/N C823055227

Appendix 1 provides information about the test object and the test set-up.

Appendix 9 provides external photos of the test object.

### Summary

Standard	Compliant	Appendix
<b>FCC CFR 47</b>		
2.1046 RF power output	Yes	2
2.1049 Occupied bandwidth	Yes	3
2.1051 Band edge	Yes	4
2.1051 Spurious emission at antenna terminals	Yes	5
2.1053 Field strength of spurious radiation	Yes	6
2.1055 Frequency stability	Yes	7
15.111 Receiver spurious emissions	Yes	8

### SP Technical Research Institute of Sweden Electronics - EMC

Christer Karlsson  
Technical Manager

Reinhold Reul  
Technical Officer

### 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

+46 105 16 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: TA8AKRC11856-1

**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
Frequency stability	Appendix 7
Receiver spurious emissions	Appendix 8
External photos	Appendix 9



FCC ID: TA8AKRC11856-1

Appendix 1

**Description of test object**

Equipment:	LTE radio equipment (RUL) 700 MHz single carrier	
Frequency band	TX: 746 – 756 MHz RX: 777 – 787 MHz	
Supported channel bandwidth configuration	10 MHz (50 RB) according 3GPP 36.141 section 5.6	
Modulation and access scheme	OFDMA in FDD	
OFDM subcarrier modulation	System information and pilots use BPSK and QPSK. For payload data QPSK, 16QAM and 64QAM can be used.	
Maximum rated output power:	Single carrier 1x 47.8 dBm (1x60 W)	
Number of antenna ports:	TX/RX: 1	RX: 1
Nominal power voltage:	-48 VDC	

**Tested frequencies and EARFCNs**

Downlink	751.0 MHz, E-UTRA channel number 5230
Uplink	782.0 MHz, E-UTRA channel number 23230

**Operation mode during measurements**

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 payload modulation.

The settings, single carrier E-TM1.1, channel bandwidth configuration 10 MHz, was found to be representative for all traffic scenarios when several settings with the different modulations were tested to find the worst case setting. This setting was used for all measurements unless noted otherwise.

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

**Conducted measurements**

The test object was powered with -48 VDC. TX measurements were done at connector RF A. RX measurements were done at connector RF B.

**Radiated measurements**

The test object was powered with -48 VDC. During the measurements output port RF A was via a RF attenuator connected to functional test equipment for supervision of the transmitted signal.

**Purpose of test**

The purpose of the tests is to verify compliance to the performance characteristics specified in applicable items of FCC CFR 47.

**References**

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

ANSI 63.4-2003  
ANSI/TIA/EIA-603-B-2002  
3GPP TS 36.141

**Measurement equipment**

Measurement equipment	Calibration Due	SP number
Test site Tesla	2010-10	503 881
R&S FSIQ 40	2010-07	503 738
R&S FSQ 40	2010-07	504 143
R&S ESI 26	2010-07	503 292
High pass filter	2010-06	502 758
High pass filter	2011-03	504 199
RF attenuator	2010-06	504 159
RF attenuator	2010-08	900 299
RF attenuator	2010-06	900 115
RF step attenuator	2010-06	503 096
Boonton RF Peak power meter/analyzer	2010-09	503 144
Boonton Power sensor 56518-S/4	2012-02	503 146
Chase Bilog antenna CBL 6111A	2011-11	502 181
EMCO Horn Antenna 3115	2011-01	502 175
MITEQ Low Noise Amplifier	2010-08	503 285
Climate chamber 3	2012-05	503 546
Multimeter Fluke 87	2010-01	502 190
Testo 635 temperature and humidity meter	2011-03	504 203
Testo 625 temperature and humidity meter	2010-05	504 188
Rotronic temperature and humidity meter	2010-04	502 946

**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 2010-02-01.

**Manufacturer's representative**

Anders Johansson, Ericsson AB

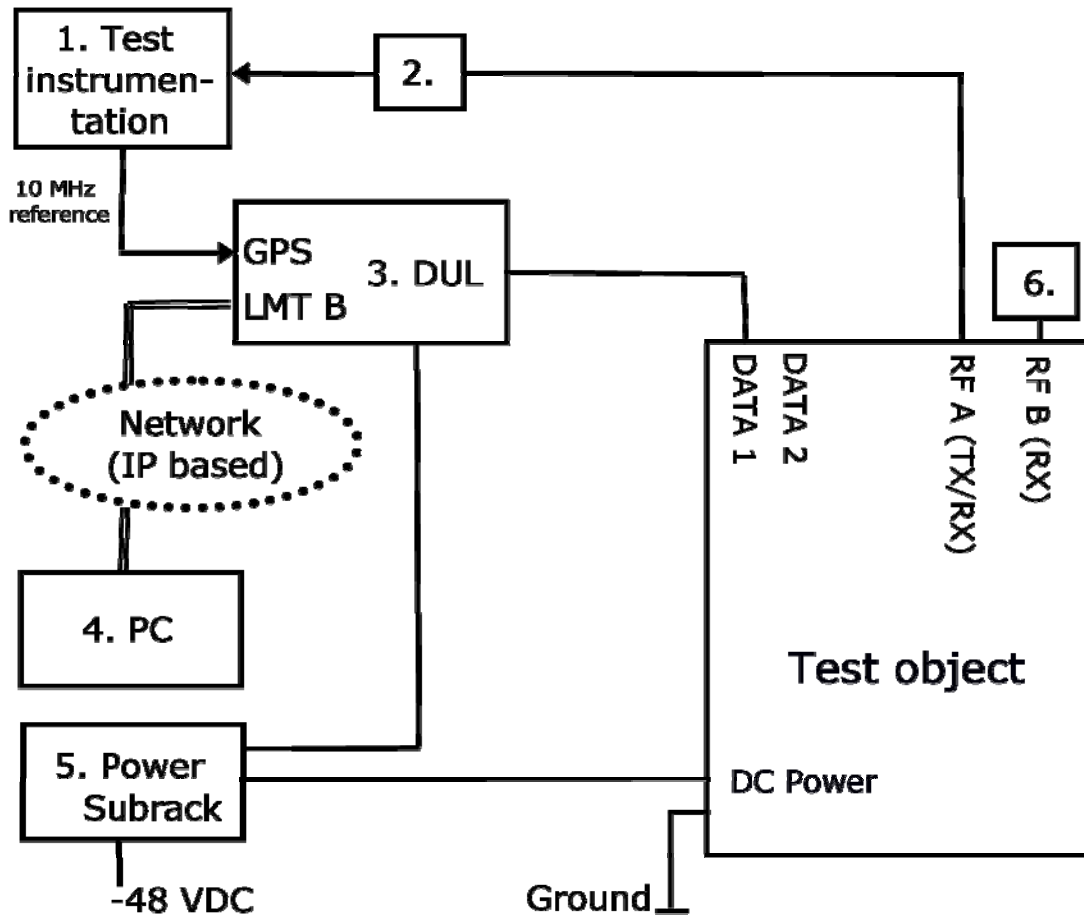
**Test engineers**

Jörgen Wassholm, Tomas Lennhager, Jonas Bremholt and Reinhold Reul

**Test participants**

Samir Catic, Christer Gustavsson and Johnny Berg, Ericsson AB

**Test set-up conducted TX measurements at port RF A**



**Test object**

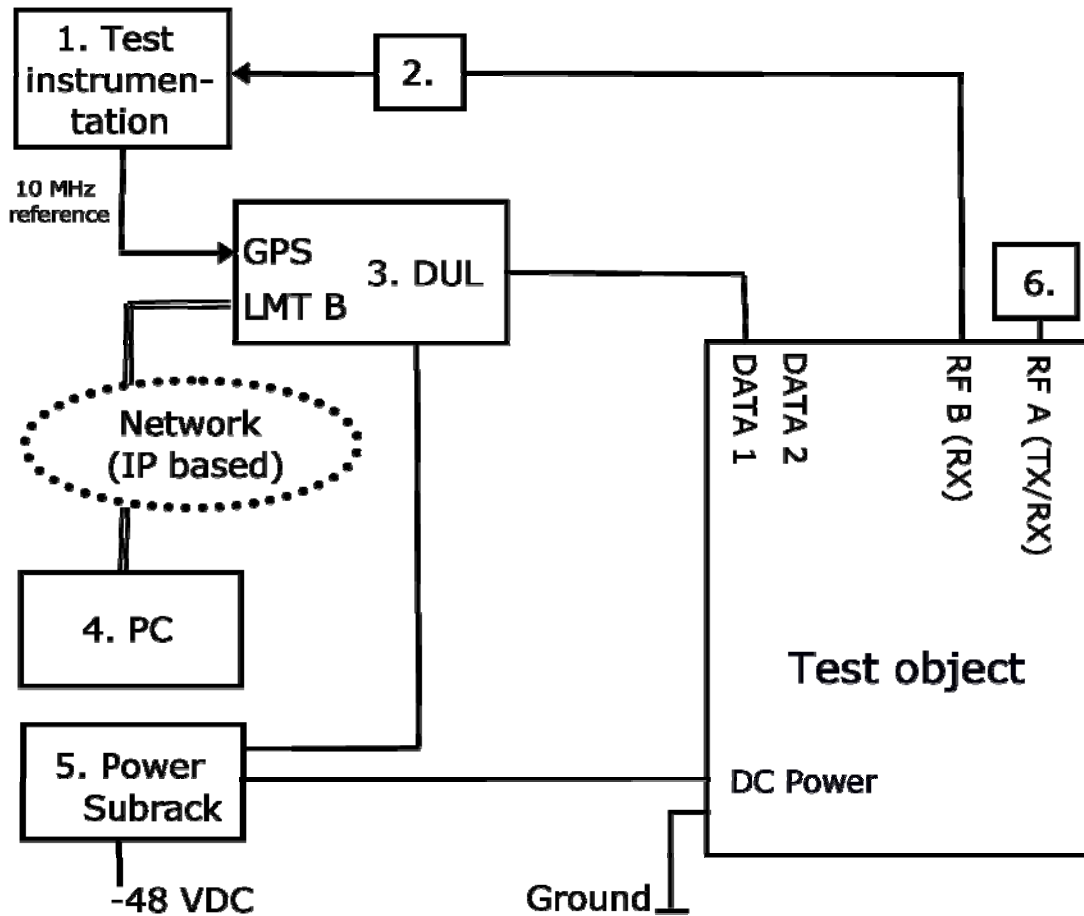
RUL 01 B13, KRC 118 56/1 Rev. R1B/A, S/N C823055227,  
 FCC ID: TA8AKRC11856-1  
 with software CXP 102 051/1 Rev R19M

**Functional test equipment**

1. SP test instrument according equipment list
2. Attenuator SP504159
3. DUL KDU 137 533/3 Rev R2B, SN (s)C823228904
4. Computer, SunFire x2200
5. Power Subrack, SXX 109 8115/1, Rev. R2A  
 individual components see section ‘Components of Power Subrack’ below
6. Termination 50 ohm



**Test set-up conducted RX measurements at port RF B**



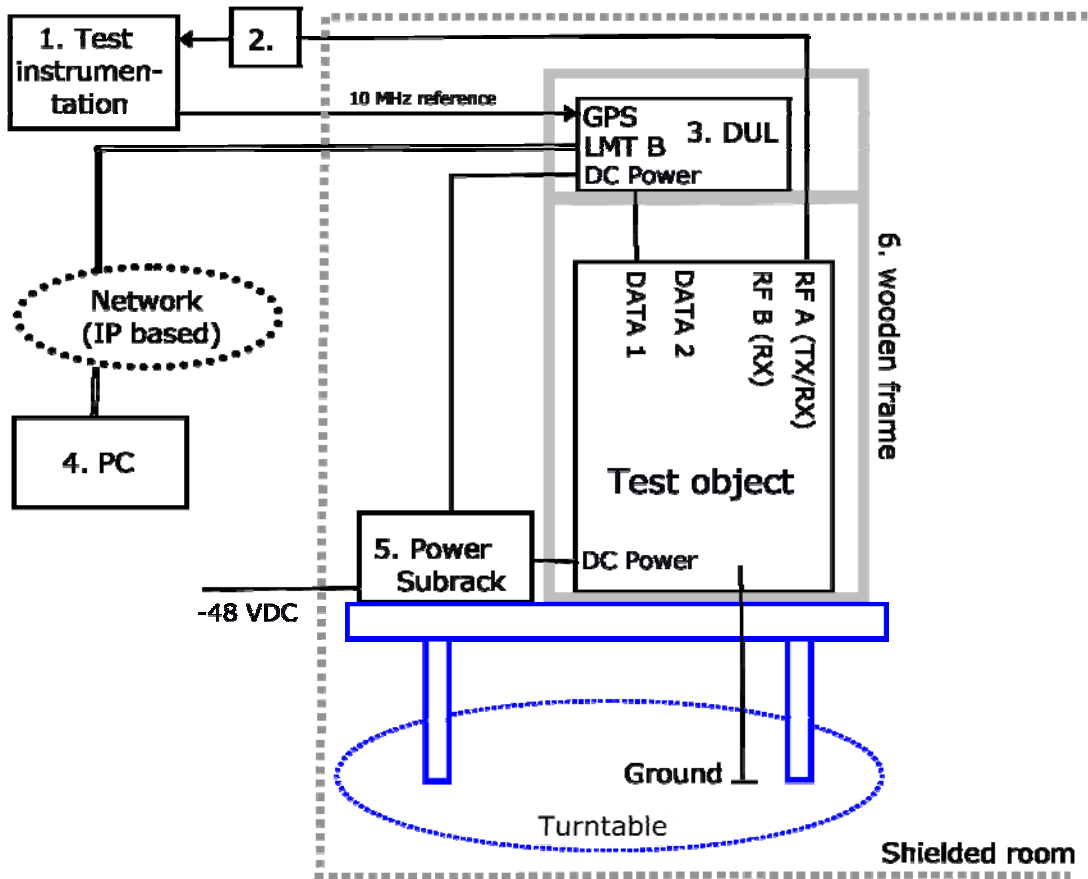
**Test object**

RUL 01 B13, KRC 118 56/1 Rev. R1B/A, S/N C823055227,  
 FCC ID: TA8AKRC11856-1  
 with software CXP 102 051/1 Rev R19M

**Functional test equipment**

1. SP test instrument according equipment list
2. Attenuator SP503096 (below 1 GHz), DC-block (1 GHz and higher)
3. DUL KDU 137 533/3 Rev R2B, SN (s)C823228904
4. Computer, SunFire x2200
5. Power Subrack, SXX 109 8115/1, Rev. R2A  
 individual components see section 'Components of Power Subrack' below
6. Attenuator & termination 50 ohm

**Test set-up radiated measurements**



**Test object**

RUL 01 B13, KRC 118 56/1 Rev. R1B/A, S/N C823055227,  
 FCC ID: TA8AKRC11856-1  
 with software CXP 102 051/1 Rev R19M

**Functional test equipment**

1. Anritsu MS2691A, Signal Analyzer 50Hz-13.5 GHz, BAMS 1000710578 for supervision of the transmitted signal
2. Attenuator
3. DUL KDU 137 533/3 Rev R2B, SN (s)C823228904
4. Computer, SunFire x2200
5. Power Subrack, SXX 109 8115/1, Rev. R2A  
 individual components see section ‘Components of Power Subrack’ below
6. Wooden frame



**Test object ports**

<b>Interface:</b>	<b>Type of port:</b>
Ground connection	Ground
Supply power -48 VDC	DC Power
Antenna port 1 "RF A", 7/16 connector, female, combined TX/RX	Antenna
Antenna port 2 "RF B", 7/16 connector, female, RX only	Antenna
"DATA 1", data connection to AE for O&M	Signal
"DATA 2", unconnected	Signal
RXA I/O: RXA cross connector output 17 dB / external input. Connector QMA. Not used	Signal
RXB I/O: RXB cross connector input / co-site output 18 dB. Connector QMA. Not used	Signal
RXA OUT: RXA co-site output 18dB. Connector QMA. Not used	Signal

**Components of Power Subrack**

<b>Position</b>	<b>Product name</b>	<b>Product number</b>	<b>R-state</b>	<b>Serial number</b>	<b>Comment</b>
	<b>Power Subrack</b>	<b>SXK 109 8115/1</b>	<b>R2A</b>	-	
1	PDU 01 01	BMG 980 336/2	R4F	(s)BJ31532384	
2	PDU 01 01	BMG 980 336/2	R4F	(s)BJ31532382	
3	SHU 01 01	BMG 980 336/2	R3C	(s)BJ31446269	
4	DUMMY	SXK 109 8257/1	R1F	-	
5	DUMMY	SXK 109 8257/1	R1F	-	
6	DUMMY	SXK 109 8257/1	R1F	-	
7	DUMMY	SXK 109 8257/1	R1F	-	
8	DUMMY	SXK 109 8257/1	R1F	-	
9	PCF 02 01	KFE 101 1157/1	R1C	(s)BW95301450	



**RF power output measurements according to 47 CFR 2.1046**

Date 2010-03-25	Temperature 23 °C ± 3 °C	Humidity 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	503 146
Multimeter Fluke 87	502 190
Testo 625 temperature and humidity meter	504 188

**Measurement uncertainty:** 0.5 dB

**Results**

Nominal transmitter frequency was 751 MHz in channel bandwidth configuration 10 MHz.  
Rated output power level at RF A connector (maximum): 47.8 dBm (60 W).

Transmitter power (dBm / dB) RMS / PAR
47.6 / 6.5

**Limit**

From CFR 47 § 27.50 (b) (4): Fixed and base stations transmitting in the 746–757 MHz band with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz.

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



**Occupied bandwidth measurements according to 47 CFR 2.1049**

Date 2010-03-25	Temperature 23 °C ± 3 °C	Humidity 23 % ± 5 %
--------------------	-----------------------------	------------------------

**Test set-up and procedure**

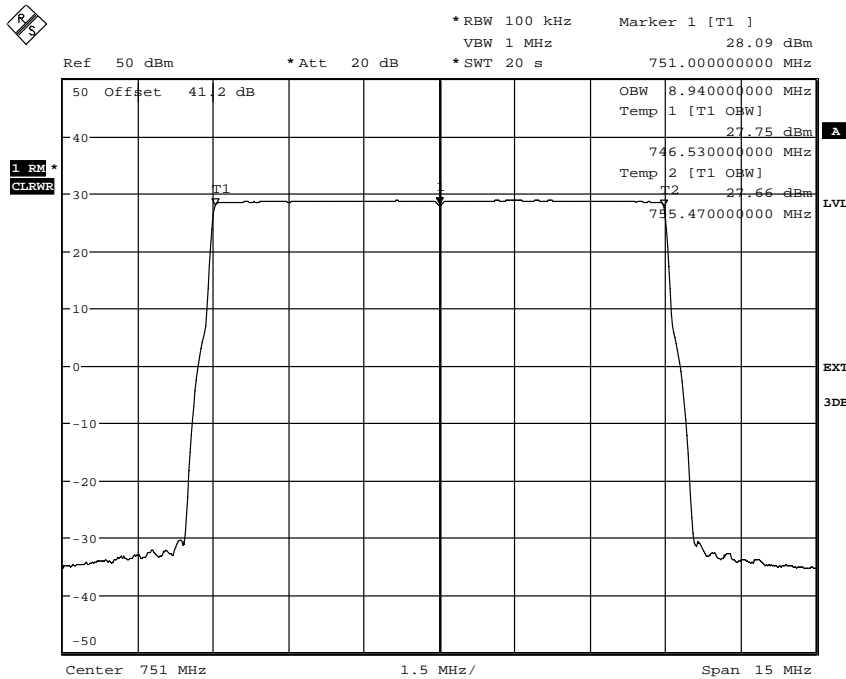
The measurements were made as defined in §2.1049. The output was connected to a spectrum analyzer. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

Measurement instrument	SP number
R&S FSQ	504 143
Testo 625 temperature and humidity meter	504 188

Measurement uncertainty: 3.7 dB

**Results**

OBW  
Diagram 1 8.94 MHz





**Band edge measurements according to 47 CFR 2.1051**

Date 2010-03-25	Temperature 23 °C ± 3 °C	Humidity 23 % ± 5 %
--------------------	-----------------------------	------------------------

**Test set-up and procedure**

The measurements were made as defined in §27.53 (c) (5). The test object 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 3.25 MHz away from the band edges. 30 kHz is less than 1% of the Emission BW. After the 100 kHz immediately outside the band edges the limit was adjusted with  $-5.2 \text{ dB} (10 \log (30/100))$  to  $-18.2 \text{ dBm}$  in order to compensate for the reduced measurement bandwidth.

Measurement instrument	SP number
R&S FSQ	504 143
Testo 625 temperature and humidity meter	504 188

Measurement uncertainty: 3.7 dB

**Results**

The results are shown in appendix 4.1

Nominal transmitter frequency was 751 MHz in channel bandwidth configuration 10 MHz. Rated output power level at RF A connector (maximum): 47.8 dBm (60 W).

- Diagram 1: Low side
- Diagram 2: High side

**Limits**

From CFR 47 § 27.53 (c) (1): On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P) \text{ dB}$ , resulting in a limit of  $-13 \text{ dBm}$ .

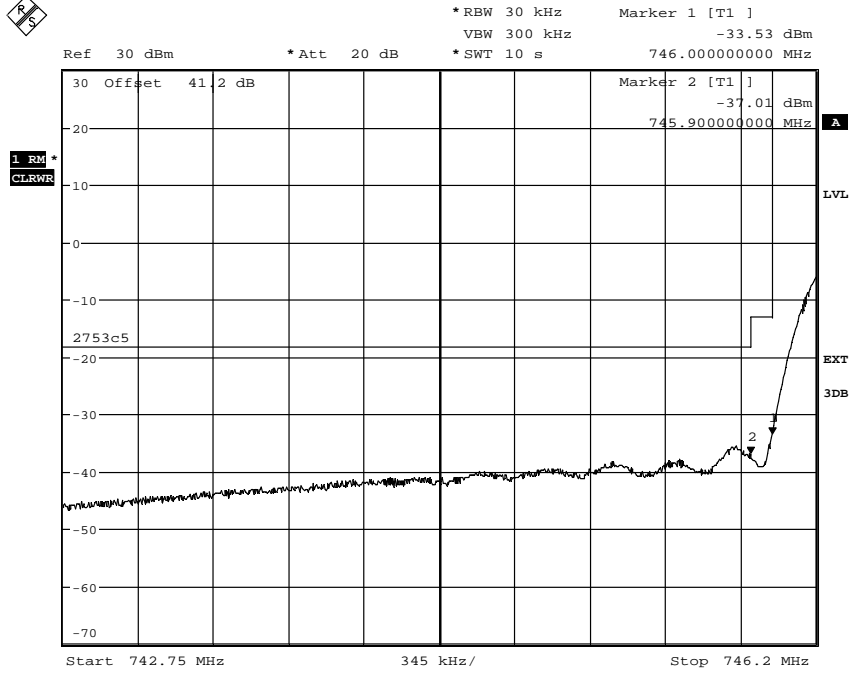
Complies?	Yes
-----------	-----



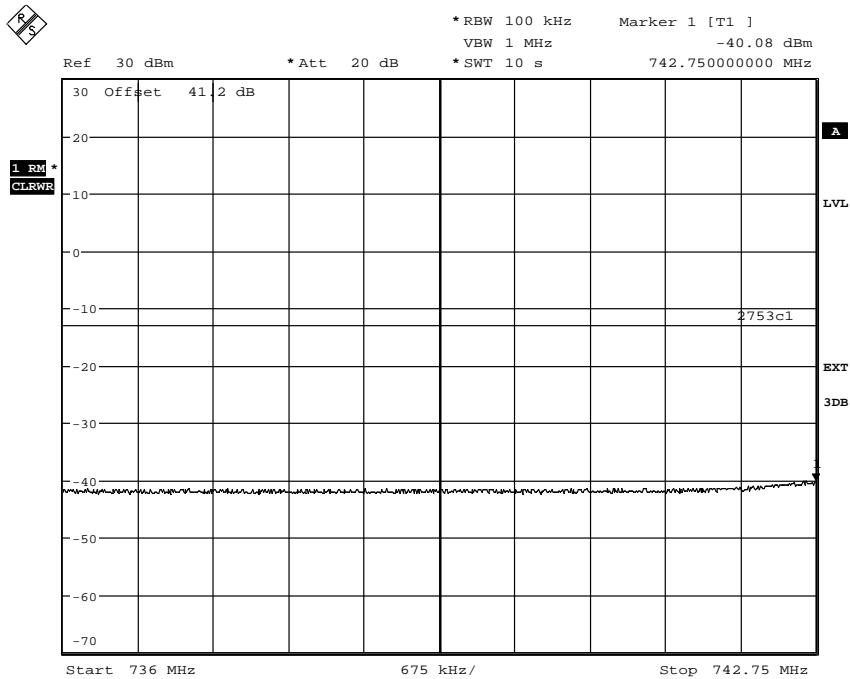
FCC ID: TA8AKRC11856-1

Appendix 4.1

Diagram 1



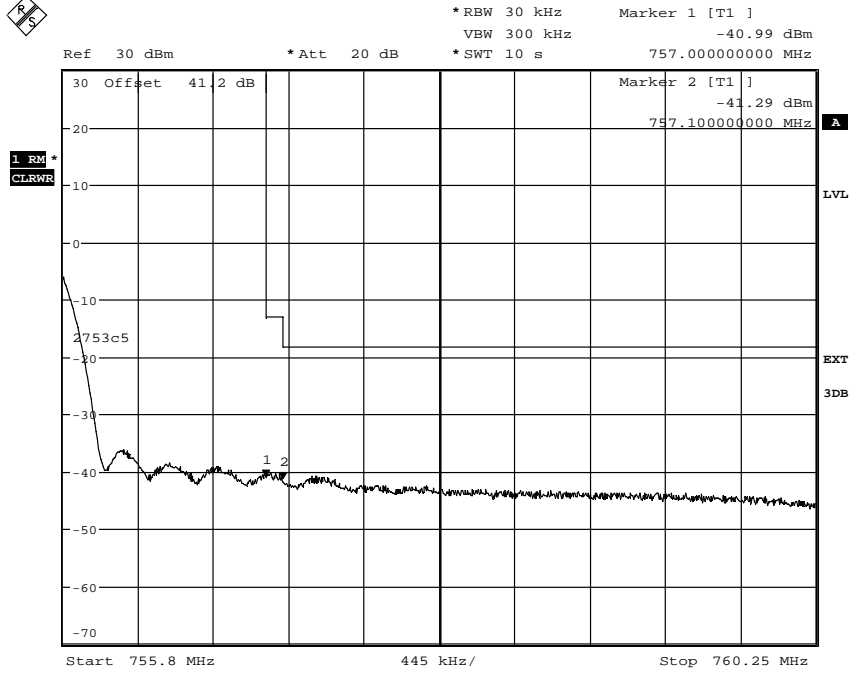
Date: 25.MAR.2010 08:04:00



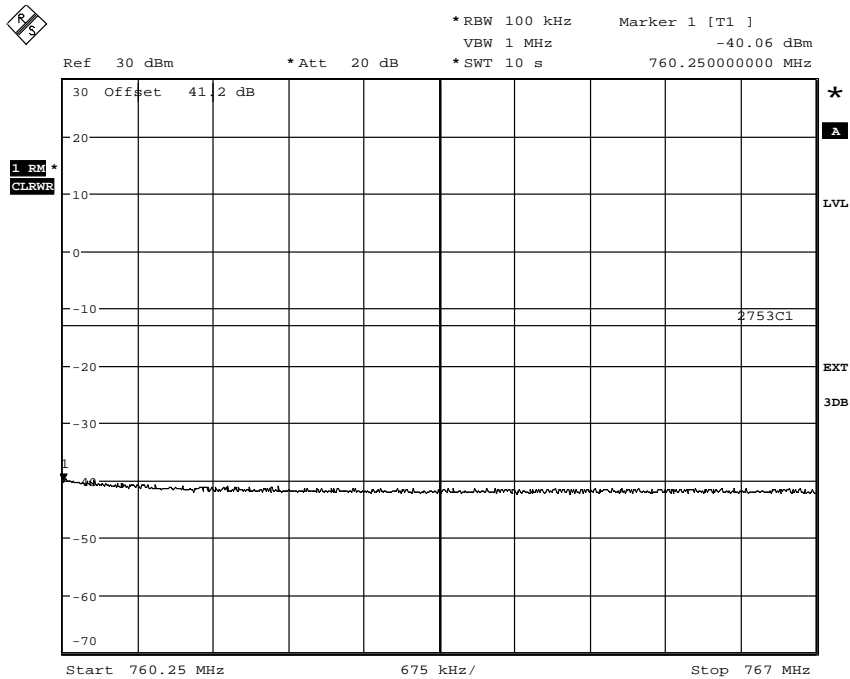
Date: 25.MAR.2010 08:06:29



Diagram 2



Date: 25.MAR.2010 08:08:55



Date: 25.MAR.2010 08:09:41



**Conducted spurious emission measurements according to 47 CFR 2.1051**

Date 2010-03-25	Temperature 23 °C ± 3 °C	Humidity 23 % ± 5 %
--------------------	-----------------------------	------------------------

**Test set-up and procedure**

The output was connected to a spectrum analyzer. First a pre-measurement with activated peak detector was performed. Emissions 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
R&S FSQ	504 143
High pass filter	502 758
Testo 625 temperature and humidity meter	504 188

Measurement uncertainty: 3.7 dB

**Results**

The results are shown in appendix 5.1

Diagram 1 a-d

**Remark**

The emission at 9 kHz on the plot 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 1.47456 GHz, thus the choice of the upper frequency boundary to 10x1.5 GHz = 15 GHz for TX emission measurements.

**Limits**

CFR 47 § 27.53

(c) (1): On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm (per 100 kHz measurement bandwidth).

(c) (3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations, resulting in a limit of -46 dBm (per 6.25 kHz measurement bandwidth).

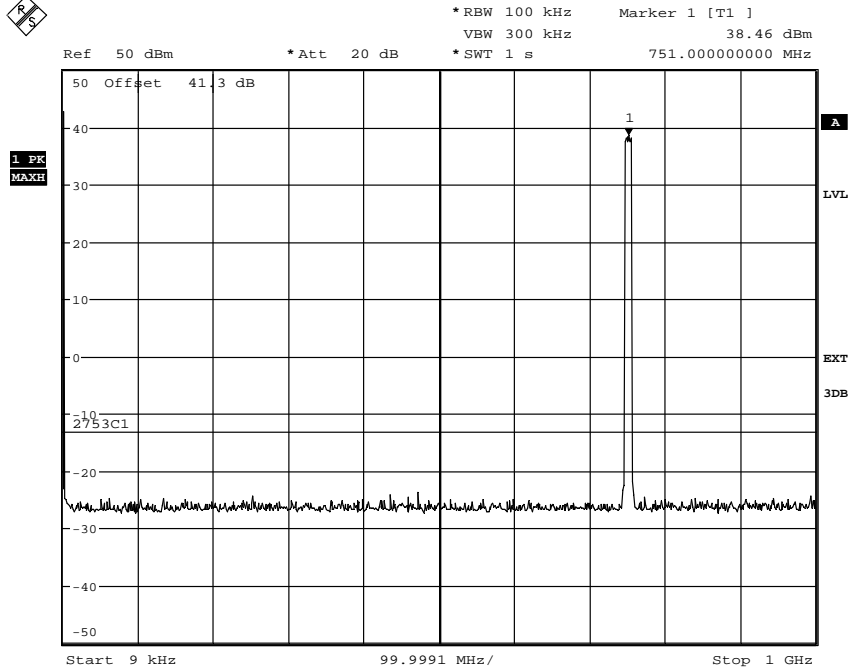
(f) For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

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



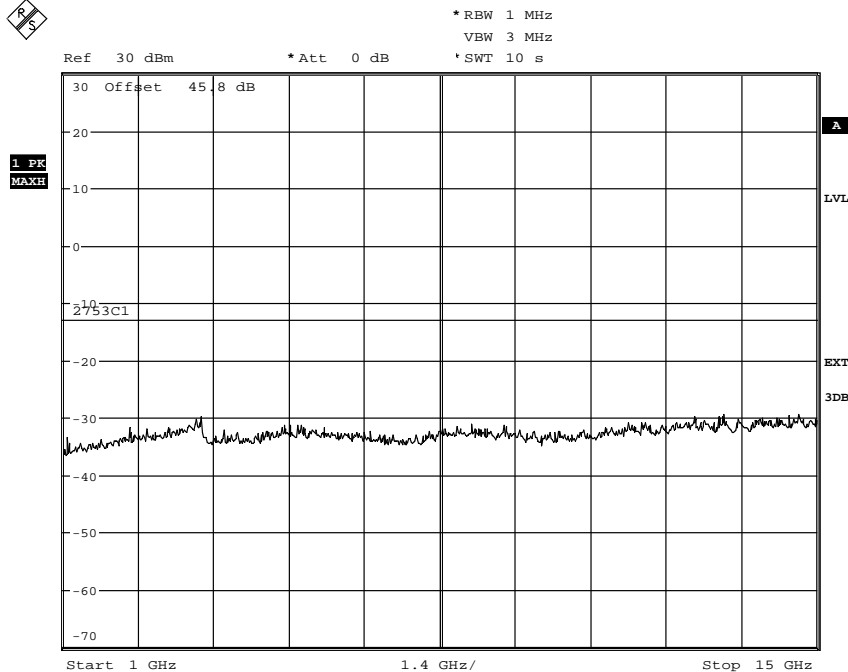


Diagram 1a: 27.53 (c)(1)



Date: 25.MAR.2010 08:15:55

Diagram 1b: 27.53 (c)(1)

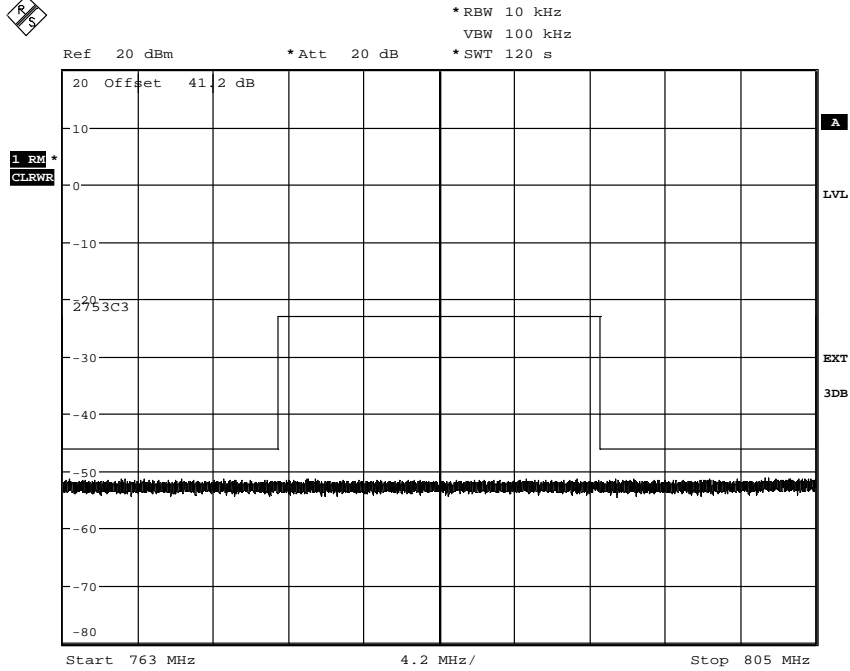


Date: 25.MAR.2010 13:01:59

Note: 1 MHz RBW was intentionally used for the measurement, while the limit is defined per 100 KHz RBW. The presented measurement is a conservative approach. The intent was to use the available margin to the limit to be prepared for expected future rule adaptations for wideband signals.

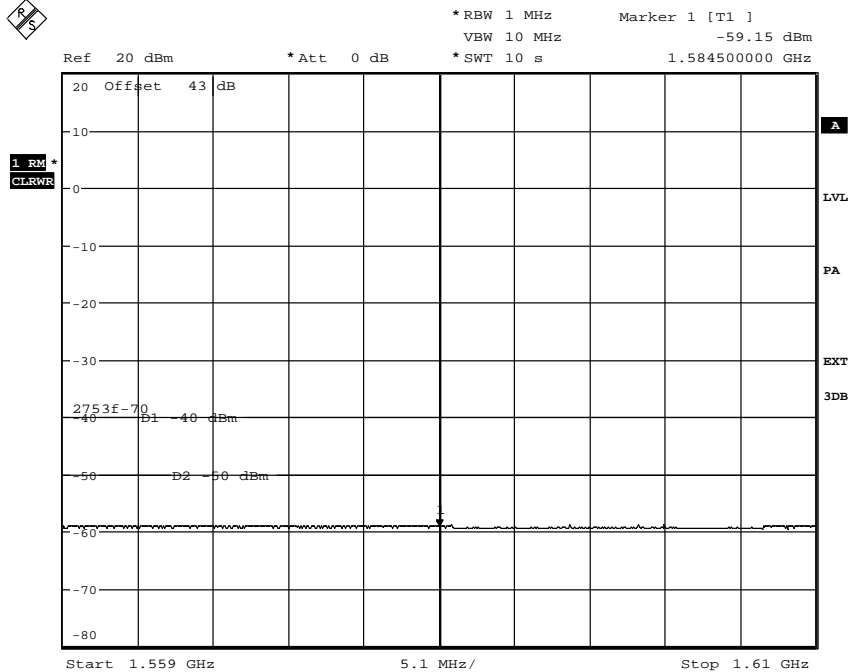


Diagram 1c: 27 53(c)(3)



Date: 25.MAR.2010 08:25:33

Diagram 1d: 27 53(f)



Date: 25.MAR.2010 08:28:03



**Field strength of spurious radiation measurements according to 47 CFR 2.1053**

Date	Temperature	Humidity
2010-03-11	22 °C ± 3 °C	18 % ± 5 %
2010-03-12	22 °C ± 3 °C	18 % ± 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 file no.:IC 3482.

The measurements were performed with both horizontal and vertical polarization of the antenna. The antenna distance was 3 m.

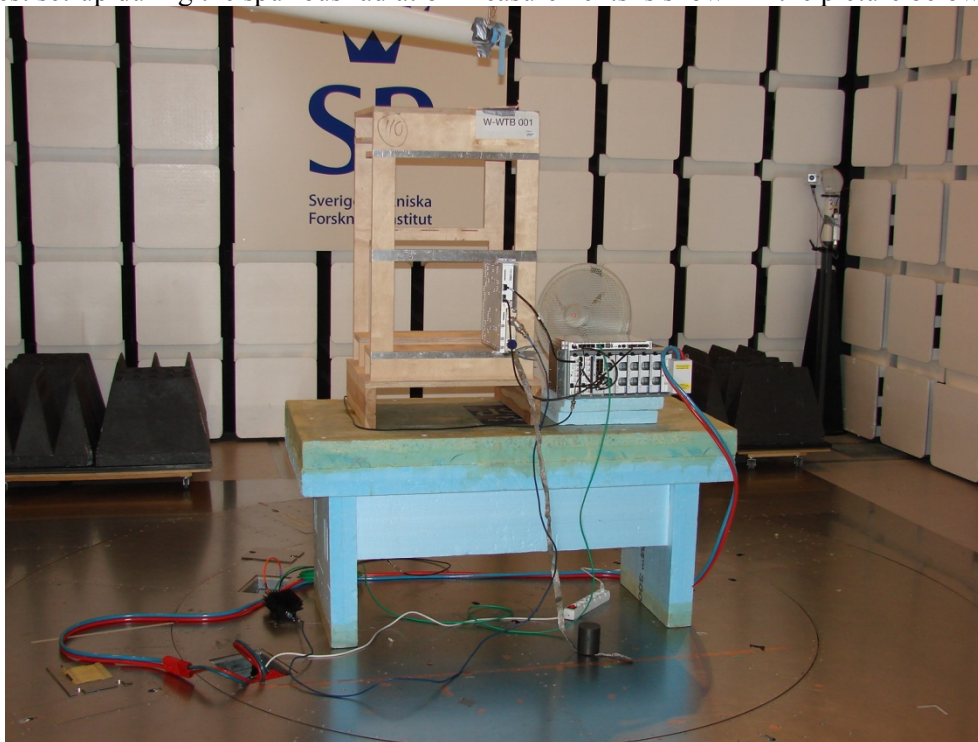
1. A pre-measurement was first performed:
2. In the frequency range 30 MHz-15 GHz the measurement was performed in power with a RBW of 1 MHz. The frequency range 763-775 MHz and 793-805 MHz was additionally measured with RBW 10 kHz. A propagation loss in free space was calculated. The used formula was,

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

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
Test site Tesla	503 881
R&S ESI 26	503 292
Control computer	503 479
Software: R&S EMC32, ver. 8.20.1	-
Chase Bilog antenna CBL 6111A	502 182
EMCO Horn Antenna 3115	502 175
MITEQ Low Noise Amplifier	503 285
Testo 625 temperature and humidity meter	504 188
High pass filter	504 199

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 - 15000	All emission > 20 dB below limit	All emission > 20 dB below limit
Measurement uncertainty 4.7 dB		

**Limits**

CFR 47 § 27.53 (c)

(1): On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB, resulting in a limit of -13 dBm (per 100 kHz measurement bandwidth).

(3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than  $76 + 10 \log (P)$  dB in a 6.25 kHz band segment, for base and fixed stations, resulting in a limit of -46 dBm (per 6.25 kHz measurement bandwidth).

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



**Frequency stability according to 47 CFR 2.1055**

Date 2010-02-01 – 2010-02-04	Temperature (test equipment) 22 -24°C ± 3 °C	Humidity (test equipment) 21 to 24 % ± 5 %
---------------------------------	---	---

**Test set-up and procedure**

The measurement was made per 3GPP TS 36.141. Port RF A was connected to a spectrum analyzer. The spectrum analyzer was connected to an external 10 MHz reference standard.

Measurement equipment	SP number
R&S FSQ 40	504 143
Rotronic temperature and humidity meter	502 946
Climate chamber 3	503 546

**Results**

Nominal supply voltage: -48.0 V DC.

Test conditions		Frequency error (Hz)
Supply voltage DC (V)	T (°C)	
-48.0	+20	+1
-55.2	+20	+2
-40.8	+20	+2
-48.0	+30	+2
-48.0	+40	+3
-48.0	+50	+2
-48.0	+10	-1
-48.0	0	+2
-48.0	-10	TX inoperable (Note 1)
-48.0	-20	Not tested
-48.0	-30	Not tested
Maximum freq. error (Hz)		+3
Measurement uncertainty		< ± 1 x 10 <sup>-7</sup>

Note 1: The test object firmware successfully disabled TX transmission outside the temperature range specified by the manufacturer.

Limit (according to 3GPP TS 36.141)

The frequency error shall be within ± 0.05 PPM ± 12 Hz (±49.6 Hz).

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



**Receiver spurious emissions measurements according to 47 CFR 15.111**

Date 2010-03-25	Temperature 23 °C ± 3 °C	Humidity 23 % ± 5 %
--------------------	-----------------------------	------------------------

**Test set-up and procedure**

The measurements were performed according to ANSI C63.4.

Measurements were performed on the receiver antenna port 2 “RF B”. The measurement is first performed with peak detector. Emission on frequencies close to or above the limit is re-measured with quasi-peak detector (average detector above 1000 MHz).

During the measurement at the receiver port “RF B” the combined TX/RX port “RF A” was terminated into 50 ohm The TX was active at maximum power at center frequency 751 MHz in channel bandwidth configuration 10 MHz using E-TM1.1.

Measurement equipment	SP number
R&S FSQ	504 143
High pass filter	504 199
Testo 625 temperature and humidity meter	504 188

**Result**

The results are shown in appendix 8.1:

The nominal RX frequency was 782.0 MHz.

	Tested port, frequency range
Diagram 1a	RX B, 9 KHz – 1 GHz
Diagram 1b	RX B, 1 GHz – 7.5 GHz
Diagram 1c	RX B, 9KHz – 30 MHz sweep to close-in on spurious emission

**Remark**

The highest internal frequency as declared by the client was 1.47456 GHz, thus the choice of the upper frequency boundary to 5x1.5 GHz = 7.5 GHz for RX emission measurements.

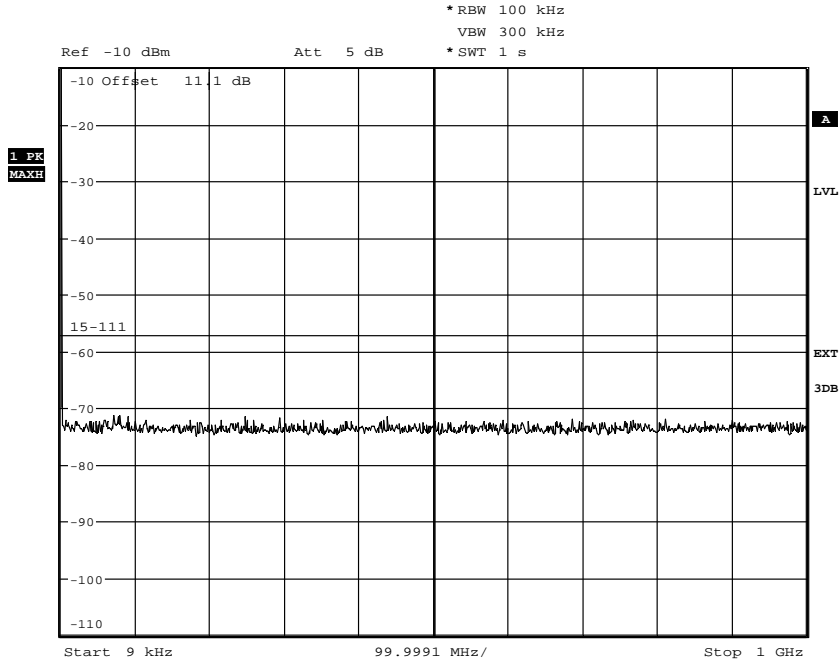
**Limit**

The power of any spurious output signals appearing at the antenna terminals must not exceed -57 dBm (2 nanowatt).

Emission below limit?	Yes
-----------------------	-----



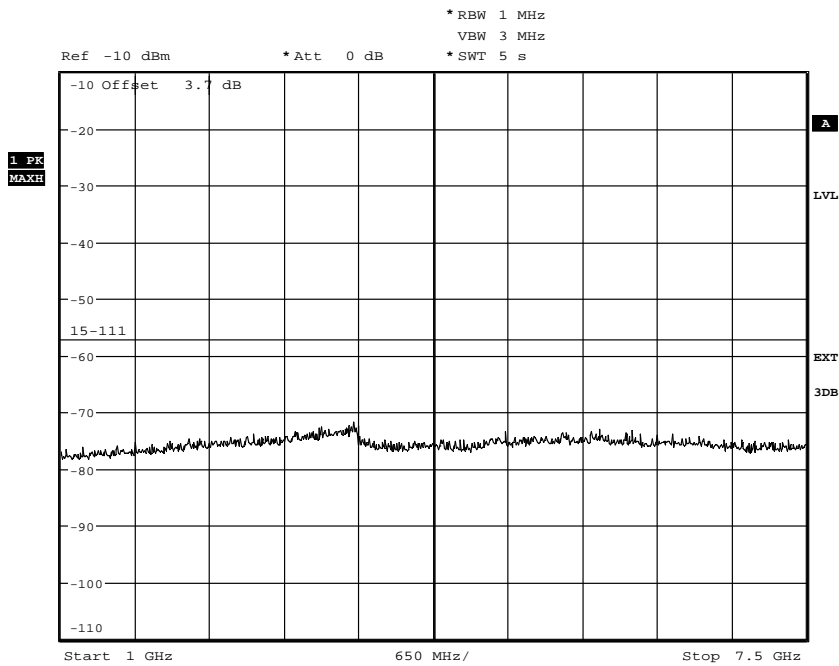
Diagram 1a:



Date: 25.MAR.2010 10:14:17

The low frequency emission in above diagram is presented with higher resolution diagram 1c below.

Diagram 1b:

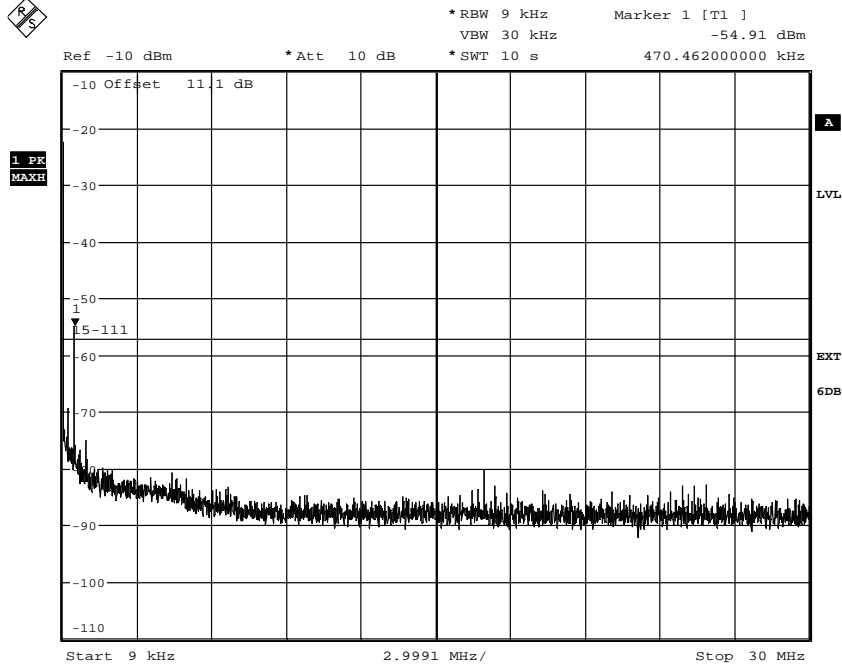


Date: 25.MAR.2010 10:16:59





Diagram 1c:



Date: 25.MAR.2010 15:23:02

Above marked spurious emission at 470.462 KHz was measured with the QP-detector and RBW 9 kHz , resulting in a level of -57.0 dBm.

The emission at 9 kHz was related to LO feed-through and shall be ignored.

FCC ID: TA8AKRC11856-1

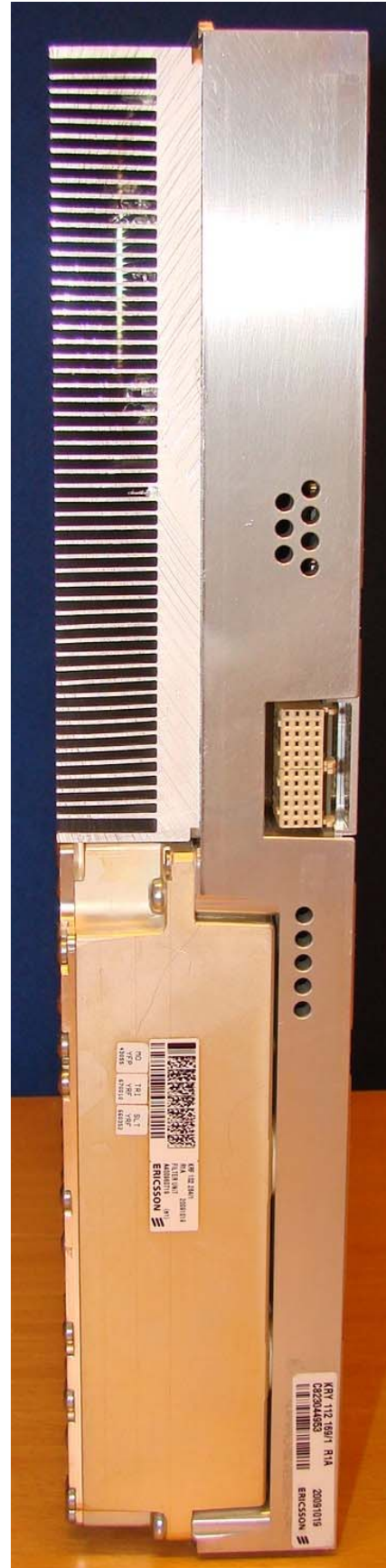
Appendix 9

**External photos of EUT**

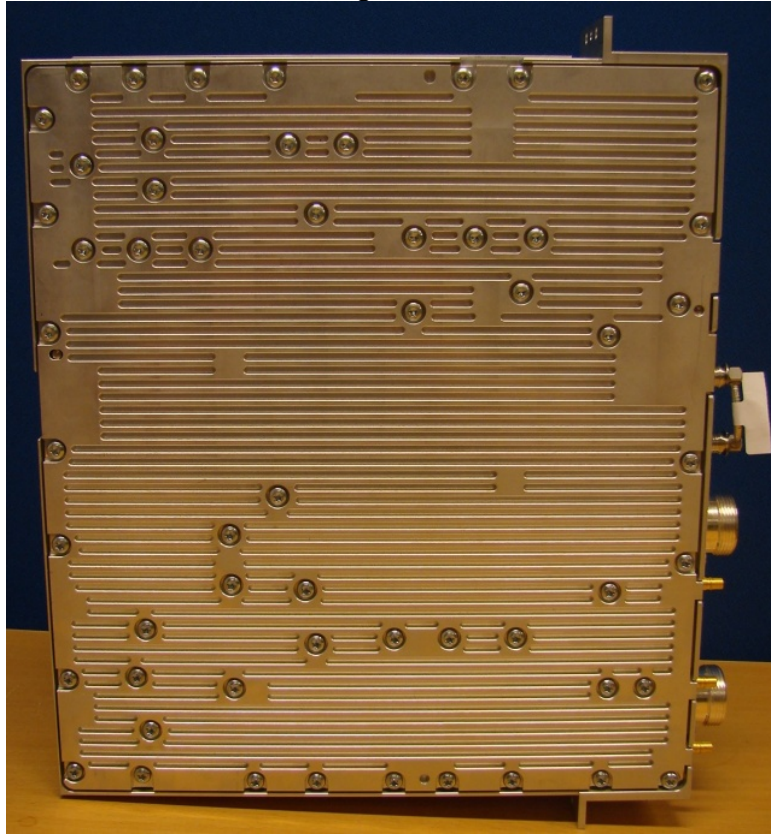
Front side



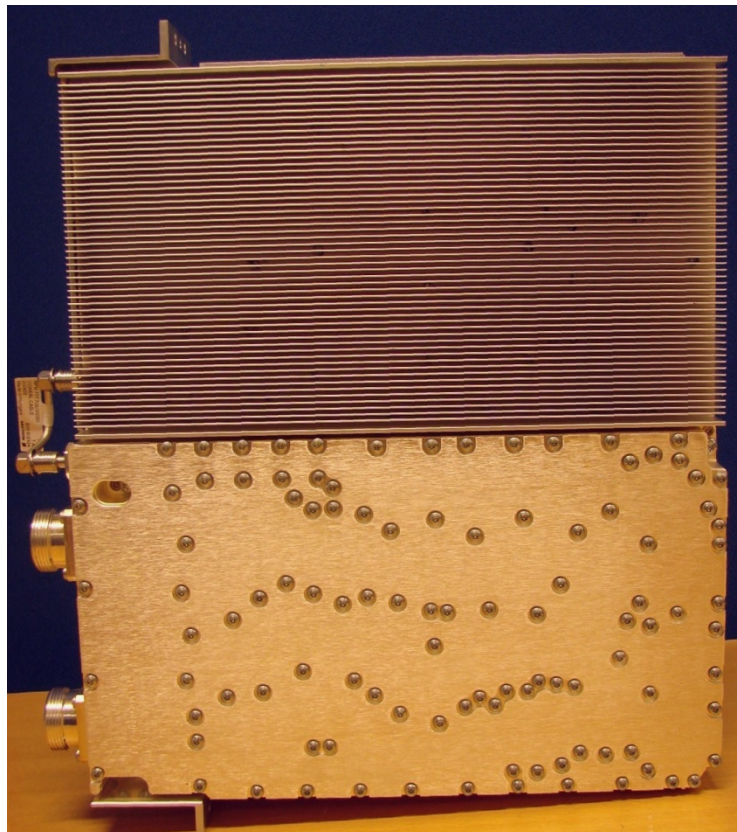
Rear side



Right side



Left side





FCC ID: TA8AKRC11856-1

Appendix 9

Bottom side



Top side

