

Handled by, department

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## Equipment authorization measurements on WCDMA Base Station 850 MHz Radio Unit with FCC ID: TA8AKRC11822-2 (8 appendices)

### Test object

Radio Unit KRC 118 22/2 rev R1B

### Summary

Standard	Compliant	Appendix	Remarks
<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	-

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FCC ID: TA8AKRC11822-2

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**Description – Test object**

Equipment: WCDMA Transceiver unit 850 MHz, single and multi carrier

Tx Frequency range: 871.4 – 891.6 MHz

Modulations: QPSK and 16QAM

Maximum output power: Single carrier: 1x47.8 dBm (1x60W)  
Multi carrier: 2x44.8 dBm (2x30W)

Nominal power voltage: -48 VDC

**Tested channels**

UARFCN	Frequency
4357	871.4 MHz
4382	876.4 MHz
4407	881.4 MHz
4408	881.6 MHz
4432	886.4 MHz
4458	891.6 MHz

**Operation mode during measurements****Test models**

All measurements were performed with the test object configured with the test models 1 and 5 as defined in 3GPP TS 25.141. Test model 1 uses the QPSK modulation only, and test model 5 includes the 16QAM modulation.

**Conducted measurements**

All RF conducted measurements were performed with the test object installed in a RBS 3206 cabinet powered with -48 VDC. All measurements were done at the output connector (Ant A) of the Filter Unit (FU) KRC 118 21/1. The measurements were performed at maximum output power with both modulations.

The settings below were found to be representative for all traffic scenarios when several settings were tested to find the setting for worst case.

**Single carrier**

Test model 1: 64 DPCHs at 30 ksps (SF=128)

Test model 5: 30 DHCPs at 30 ksps (SF=128) and 8 HS-PDSCHs at 240 ksps (SF=16)

**Multi carrier**

Test model 1: 32 DPCHs at 30 ksps (SF=128)

Test model 5: 30 DHCPs at 30 ksps (SF=128) and 8 HS-PDSCHs at 240 ksps (SF=16)

### Radiated measurements

All radiated measurements were performed with the test object installed in a wooden rack without EMC shielding. This configuration represents worst case for radiated spurious emission measurements. The test object was powered with 48 VDC.

The RU unit were activated as Single Carrier 1x1 (1x47.8 dBm) and Multi Carrier 2x1 (2x44.8 dBm). The RF output power port were terminated with 50 ohm loads.

The RU unit were allocated to the following UARFCN:

Downlink	4357 (871,4 MHz)	4357 (871,4 MHz)	4458 (891.6 MHz)	4458 (891.6 MHz)
Uplink	4132 (826,4 MHz)	4132 (826,4 MHz)	4233 (846.6 MHz)	4233 (846.6 MHz)
Test model	1	5	1	5

Test model 1: 64 DPCHs at 30 ksps (SF=128)

Test model 5: 30 DHCPs at 30 ksps (SF=128) and 8 HS-PDSCHs at 240 ksps (SF=16)

### Multi Carrier:

Cell	1	2
Downlink	4382 (876,4 MHz)	4432 (886,4 MHz)
Uplink	4157 (831,4 MHz)	4207 (841,4 MHz)
Test model	1	5

Test model 1: 32 DPCHs at 30 ksps (SF=128)

Test model 5: 30 DHCPs at 30 ksps (SF=128) and 8 HS-PDSCHs at 240 ksps (SF=16)

### Purpose of test

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

### References

Measurements were done according to relevant parts of the following standards:  
ANSI/TIA/EIA-603-B-2002  
3GPP TS 25.141

### 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: 2007-05-28



## **REPORT**

Date  
2007-06-15

Reference  
F709913-F22

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Appendix 1

### **Manufacturer's representative**

Larry Lindström, Ericsson AB

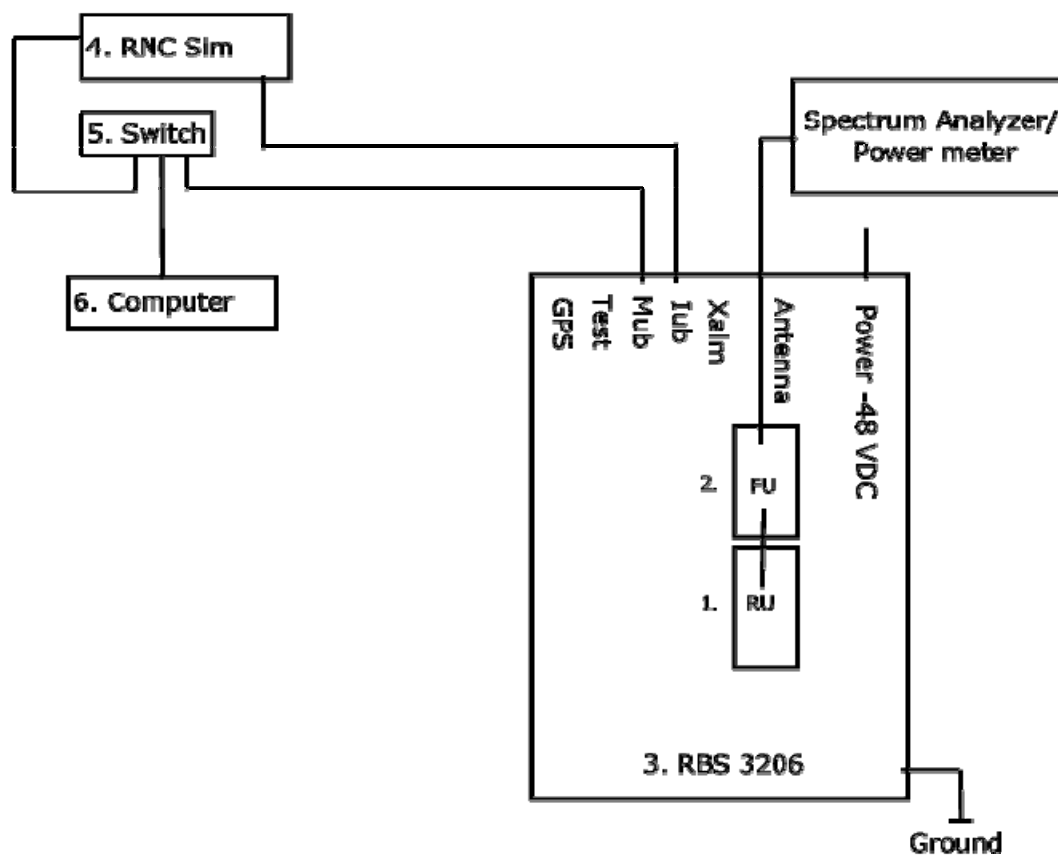
### **Test engineers**

.  
Jonas Bremholt and Jörgen Wassholm

### **Test witnesses**

Larry Lindström, Mats Iregren and Thomas Odén, Ericsson AB

### Test set-up, conducted measurements



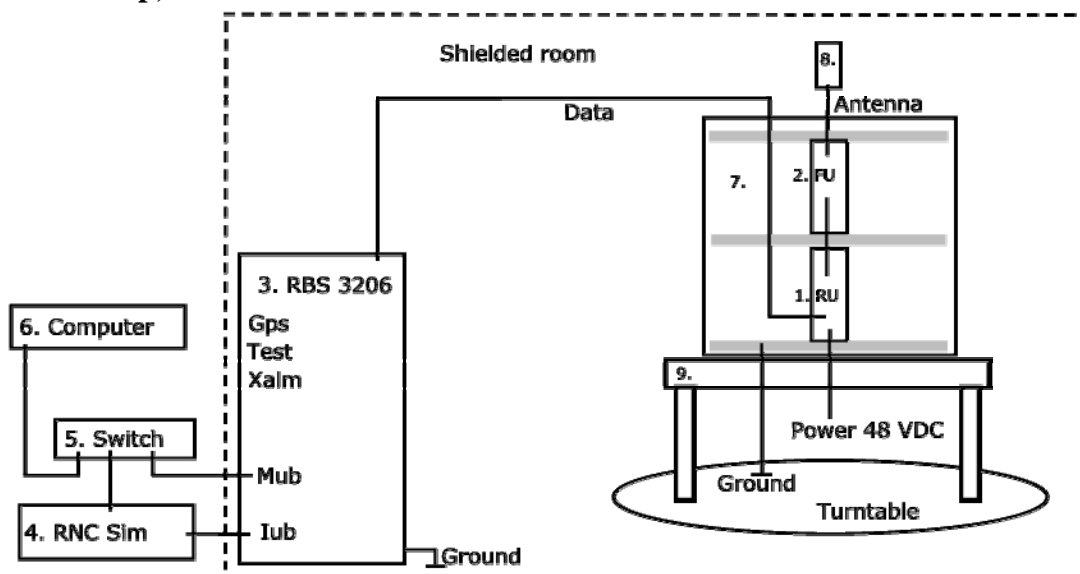
### Test object

1. RU KRC 118 22/2 Rev. R1B, Serial No: AE54294152 (FCC ID: TA8AKRC11822-2)
2. FU KRC 118 21/1 Rev. R1E, Serial No: TU8F135213

### Functional test equipment

3. RBS 3206 Product number: 2/BFE 401 1012 R1K, Serial No: AB20197204 with software CXP 901 1610/1 rev. P11AD02
4. RNC Sim CES 4780BA Mini-sim #31
5. Switch, Netgear Ethernet switch DS108
6. Computer, SunBlade

### Test set-up, radiated measurements



### Test object

1. RU KRC 118 22/2 Rev. R1B, Serial No: AE54294152 (FCC ID: TA8AKRC11822-2)
2. FU KRC 118 21/1 Rev. R1E, Serial No: TU8F135213

### Functional test equipment

3. RBS 3206 Product number: 2/BFE 401 1012 R1K, Serial No: AB20197204 with software CXP 901 1610/1 rev. P11AD02
4. RNC Sim CES 4780BA Mini-sim #33
5. Switch, Netgear Ethernet switch DS108
6. Computer, SunBlade
7. Wooden rack
8. Terminator (50 ohm)
9. Non conductive table

## RF power output measurements according to 47 CFR 2.1046

Date	Temperature	Humidity
2007-06-04	23 °C ± 3 °C	38 % ± 5 %
2007-06-11	23 °C ± 3 °C	40 % ± 5 %

### Test set-up and procedure

The output was connected to a Peak power analyzer. The transmitter was set up according to Test model 1 and Test model 5 during the measurements.

Measurement equipment	Calibration Due	SP number
Boonton RF Peak power meter/analyzer	2007-08	503 144
Boonton Power sensor 56518-S/4	2008-02	503 145
Multimeter Fluke 87	2008-04	502 190
Testo 610, Temperature and humidity meter	2008-04	502 658

**Measurement uncertainty:** 0.5 dB

### Results

#### Single carrier

Maximum rated output power level after FU unit: 1x47.8 dBm

Test conditions $T_{nom}$ 22 °C/ $V_{nom}$ -48 V DC	Transmitter power (dBm) RMS		
	Frequency 871.4	Frequency 881.4	Frequency 891.6
QPSK	48.0	48.0	47.9
16QAM	48.1	48.2	48.0

#### Multi carrier

Maximum rated output power level after FU unit: 2x44.8 dBm

Test conditions $T_{nom}$ 23 °C/ $V_{nom}$ -48 V DC	Transmitter combined power (dBm) RMS	
	Frequencies 871.4 + 881.4 MHz	Frequencies 881.6 + 891.6MHz
QPSK	48.0	47.8
16QAM	48.0	47.8

### Limit

According to CFR § 22 there are no conducted limits at the antenna connector.

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

Complies?	Yes
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### Occupied bandwidth measurements according to 47 CFR 2.1049

Date	Temperature	Humidity
2007-06-05	23 °C ± 3 °C	38 % ± 5 %
2007-06-07	23 °C ± 3 °C	34 % ± 5 %

### Test set-up and procedure

The measurements were made per definition in §2.1049. The output was connected to a spectrum analyzer. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements. The transmitter was set up according to Test model 1 and Test model 5 during the measurements.

Measurement equipment	Calibration Due	SP number
R&S FSIQ	2007-08	503 738
Testo 610, Temperature and humidity meter	2008-04	502 658

**Measurement uncertainty:** 3.7 dB

### Results

The results are shown in appendix 3.1

#### QPSK

	Frequency	OBW
Diagram 1:	871.4 MHz	4.2 MHz
Diagram 2:	881.4 MHz	4.2 MHz
Diagram 3:	891.6 MHz	4.2 MHz

#### 16QAM

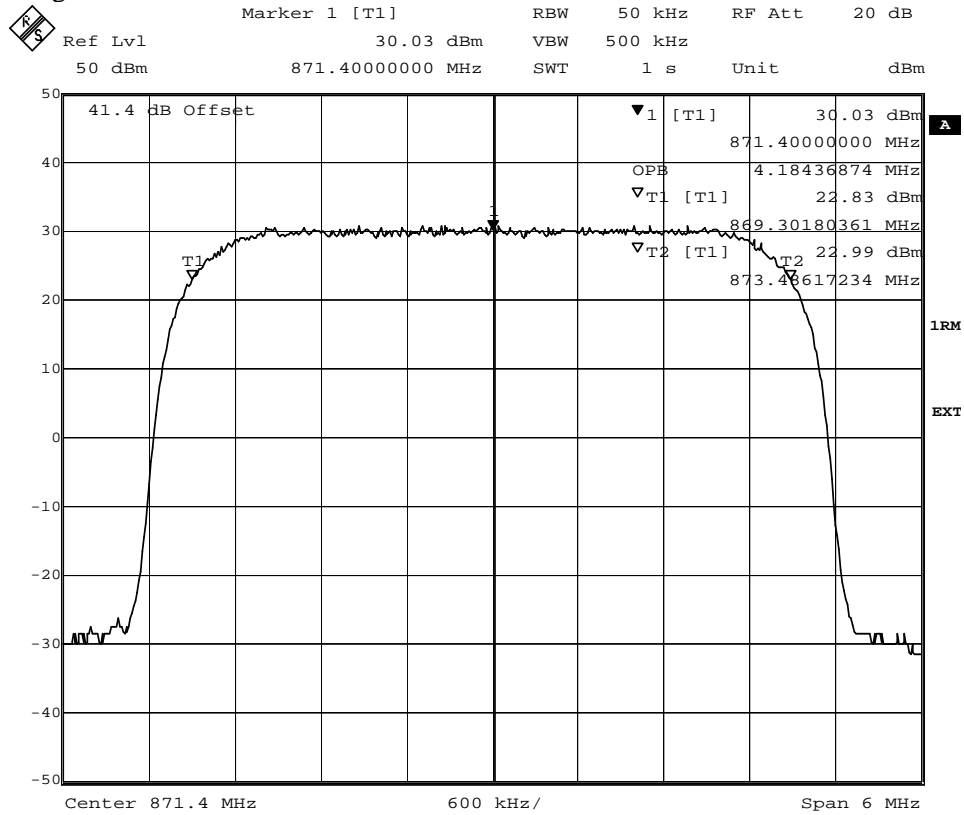
	Frequency	OBW
Diagram 4:	871.4 MHz	4.2 MHz
Diagram 5:	881.4 MHz	4.2 MHz
Diagram 6:	891.6 MHz	4.2 MHz



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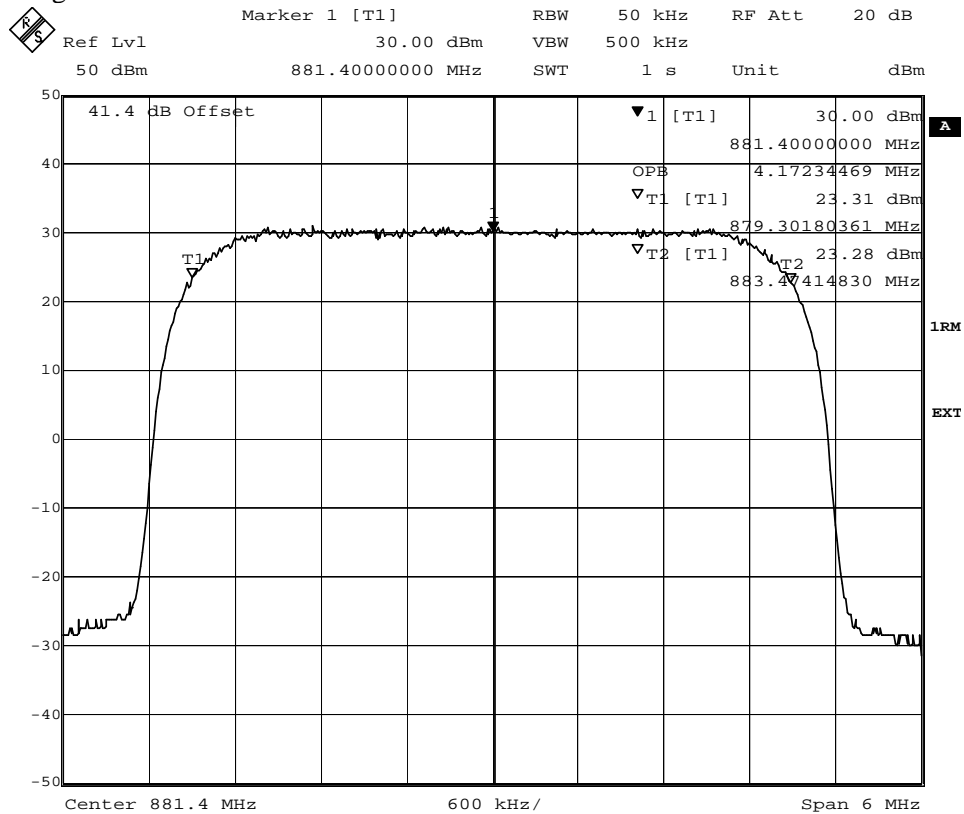
Appendix 3.1

Diagram 1



Date: 7.JUN.2007 11:29:13

Diagram 2



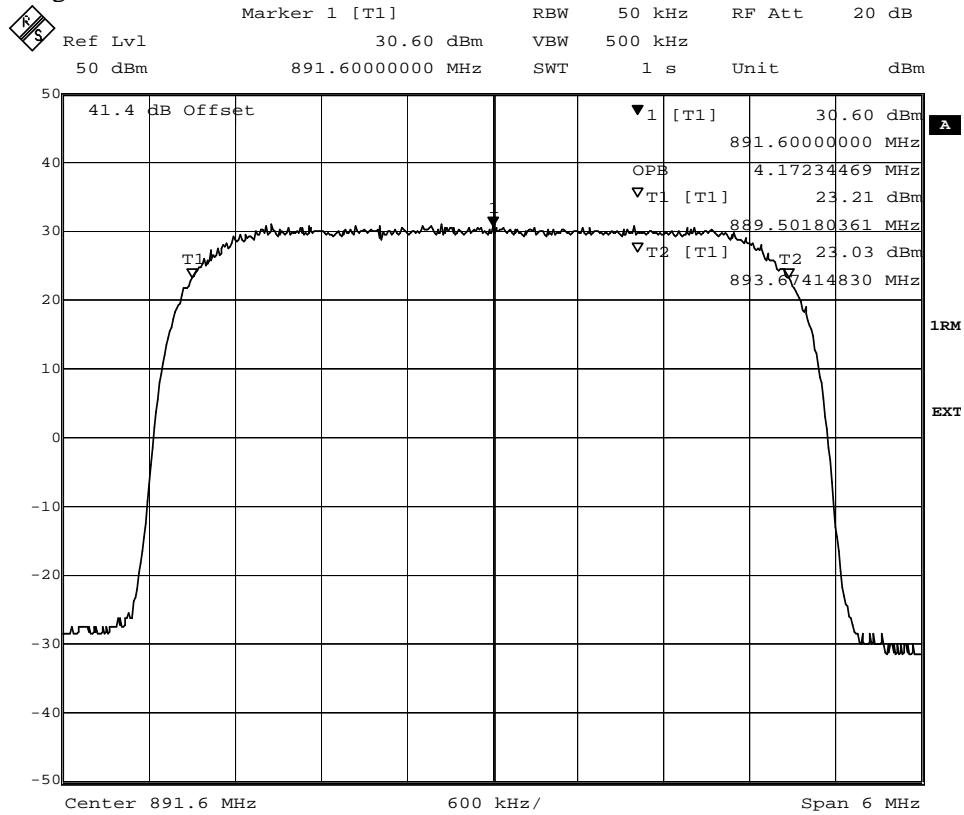
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FCC ID: TA8AKRC11822-2

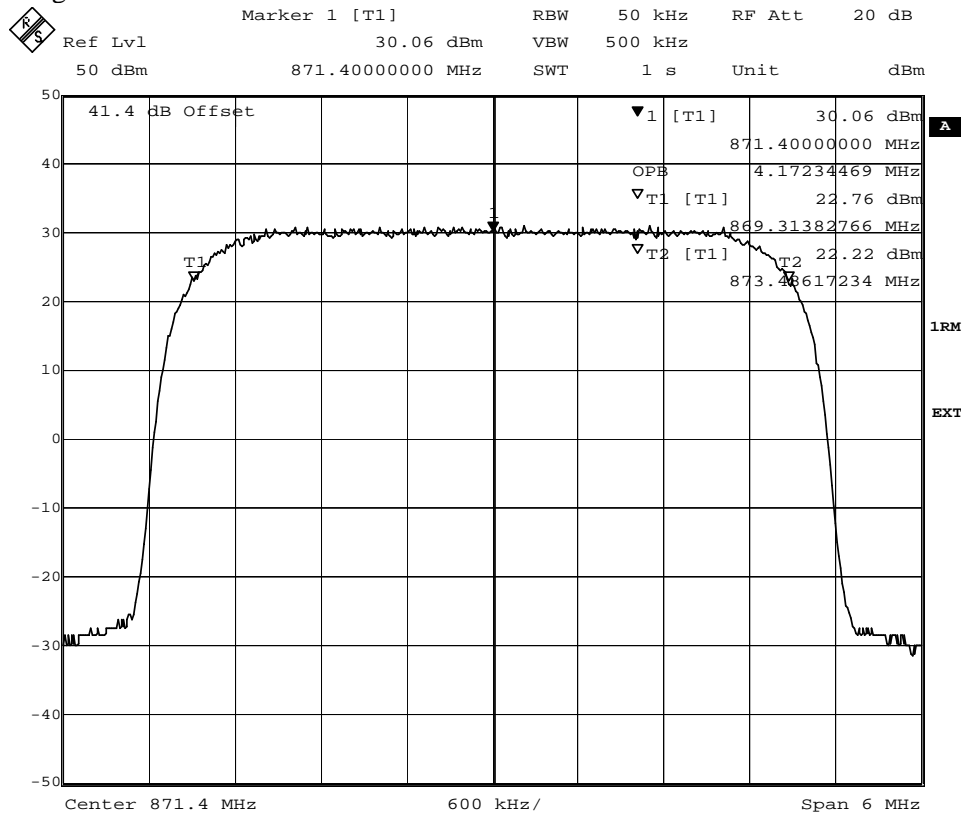
Appendix 3.1

Diagram 3



Date: 5.JUN.2007 13:51:08

Diagram 4



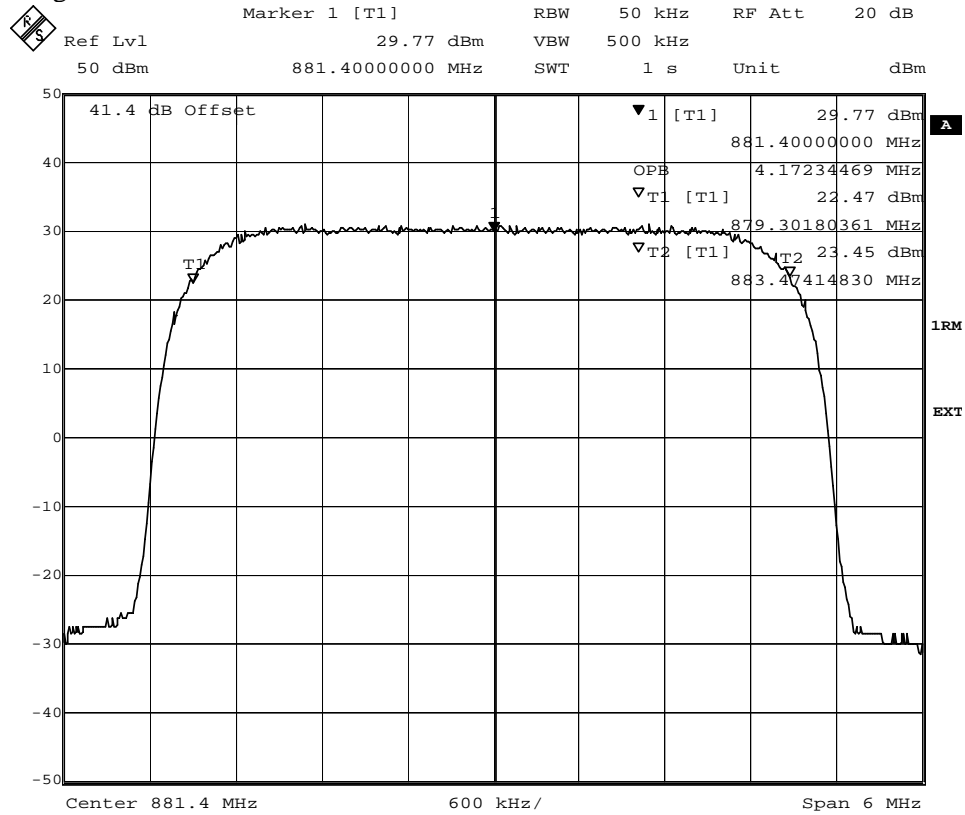
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FCC ID: TA8AKRC11822-2

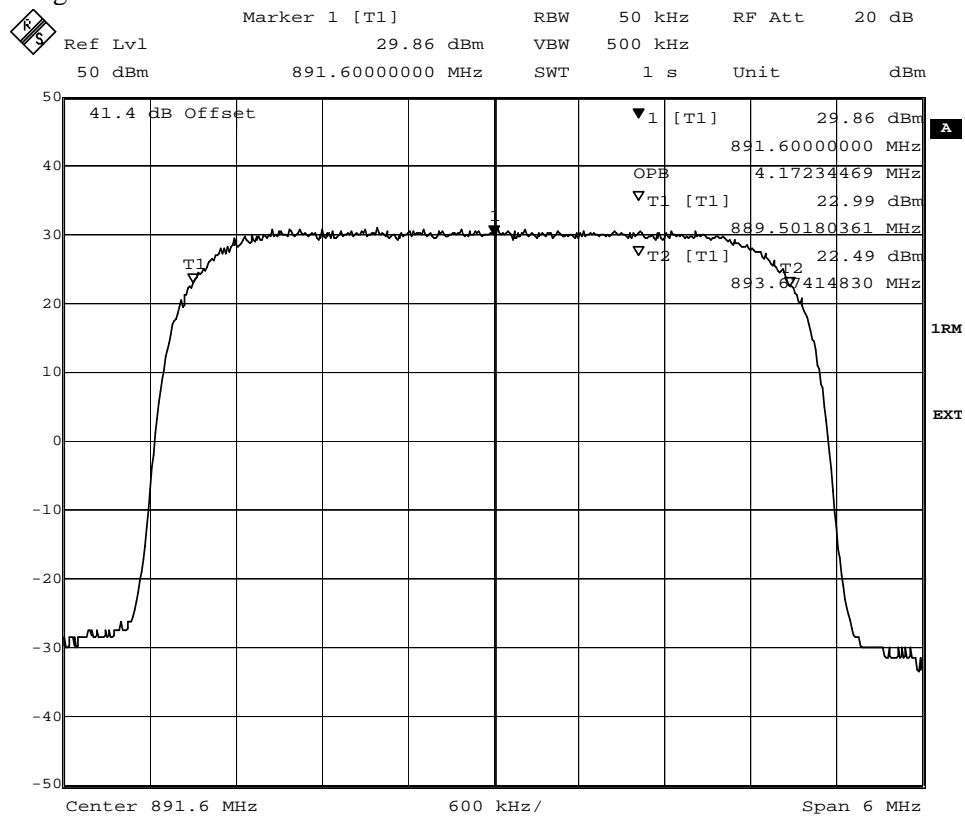
Appendix 3.1

Diagram 5



Date: 5.JUN.2007 16:53:53

Diagram 6



Date: 5.JUN.2007 14:13:01

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

Date	Temperature	Humidity
2007-06-08	23 °C ± 3 °C	38 % ± 5 %
2007-06-11	23 °C ± 3 °C	40 % ± 5 %

**Test set-up and procedure**

The measurements were made per definition in §22.917. 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 3.25 MHz away from the band edges. 30 kHz is <1% of the Emission BW(4.25 MHz between the 26 dB points). To compensate for the reduced measurement band width, the limit was adjusted with 1.5 dB to -14.5 dBm up to 1 MHz away from the band edges and with 13 dB to -28.2 dBm between 1 MHz to 3.25 MHz away from the band edges. The transmitter was set up according to Test model 1 and Test model 5 during the measurements.

Measurement equipment	Calibration Due	SP number
R&S FSIQ	2007-08	503 738
Testo 610, Temperature and humidity meter	2008-04	502 658

**Measurement uncertainty:** 3.7 dB**Results**

The results are shown in appendix 4.1

**Single carrier****QPSK**

Diagram 1: 871.4 MHz  
Diagram 2: 891.6 MHz

**16QAM**

Diagram 3: 871.4 MHz  
Diagram 4: 891.6 MHz

**Multi carrier****QPSK**

Diagram 5: 871.4+881.4 MHz  
Diagram 6: 881.6+891.6 MHz

**16QAM**

Diagram 7: 871.4+881.4 MHz  
Diagram 8: 881.6+891.6 MHz

**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.

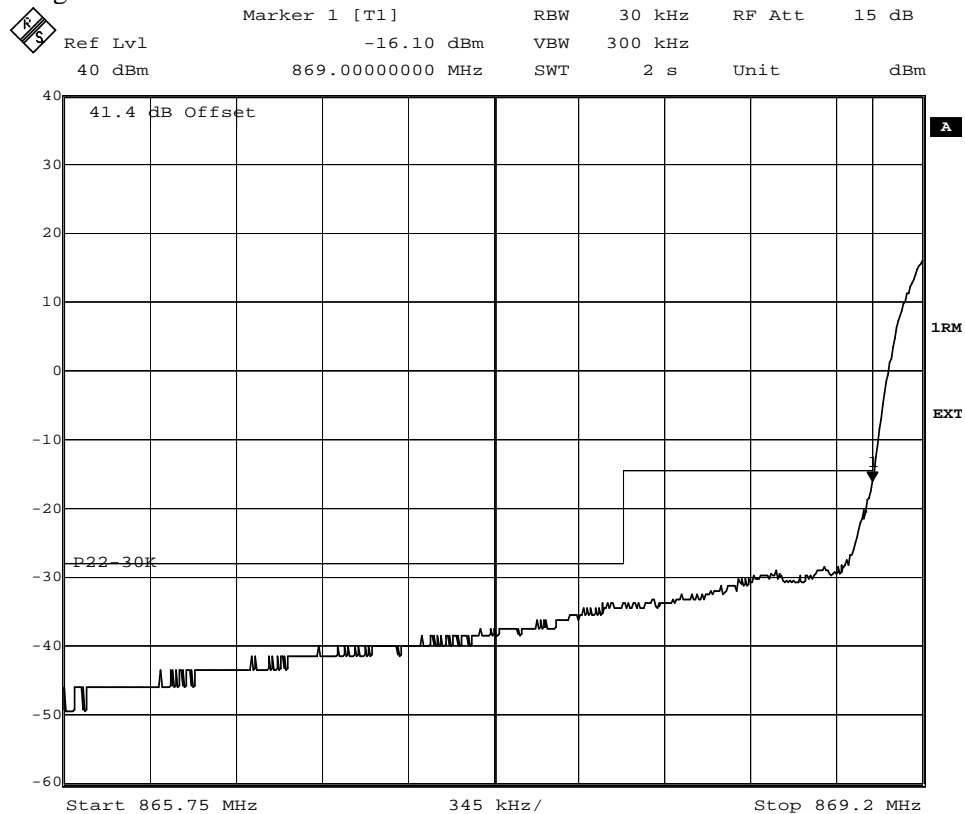
Complies?	Yes
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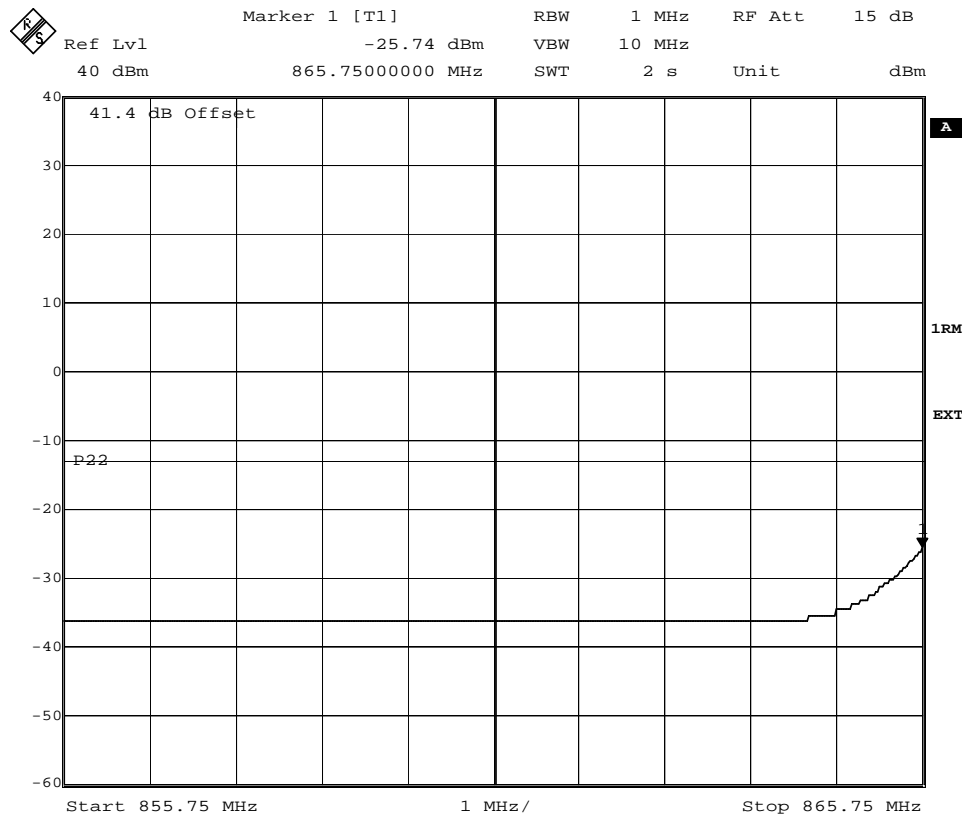
FCC ID: TA8AKRC11822-2

Appendix 4.1

Diagram 1



Date: 8.JUN.2007 13:09:18



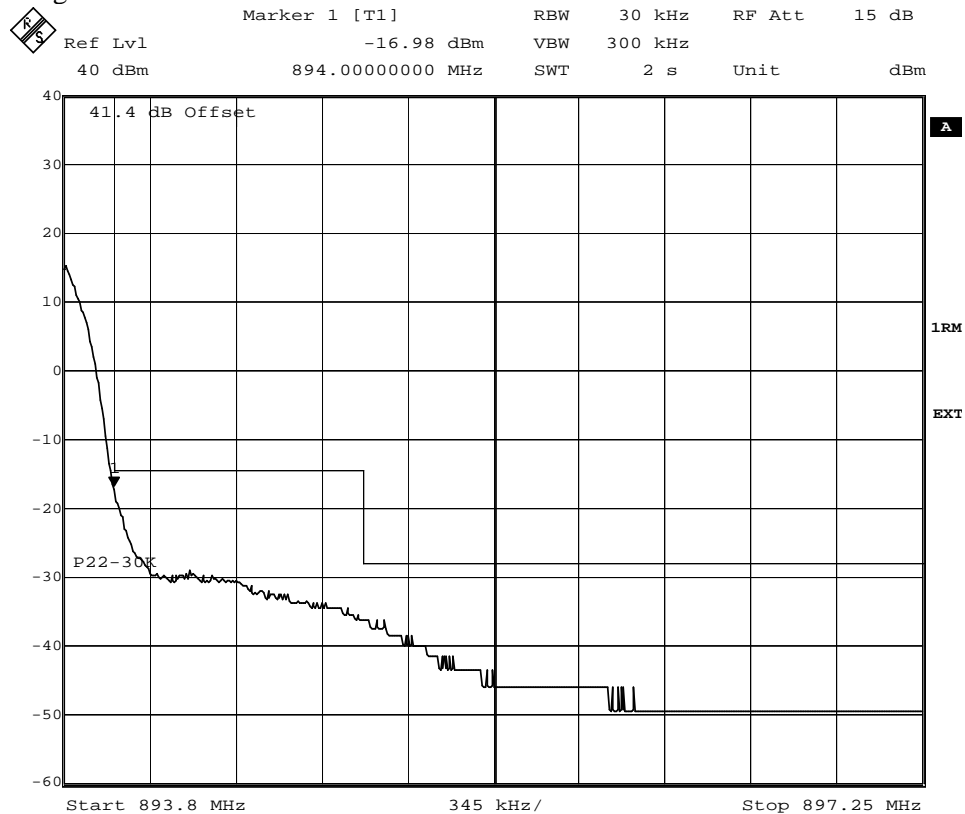
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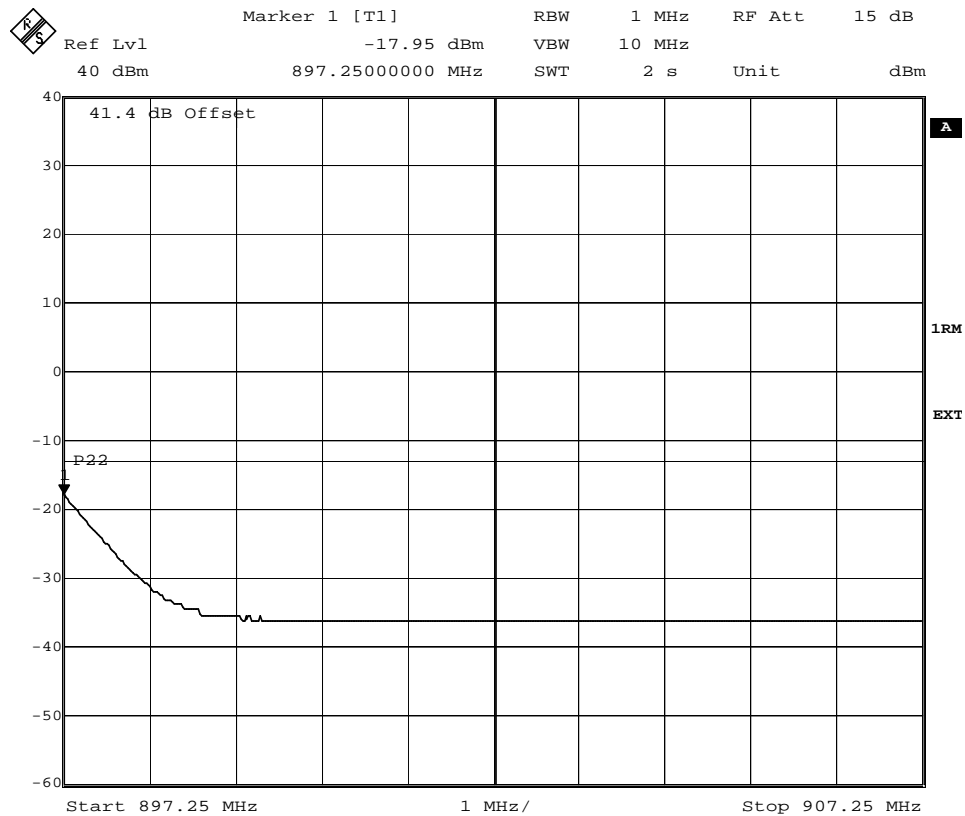
FCC ID: TA8AKRC11822-2

Appendix 4.1

Diagram 2



Date: 8.JUN.2007 13:48:17



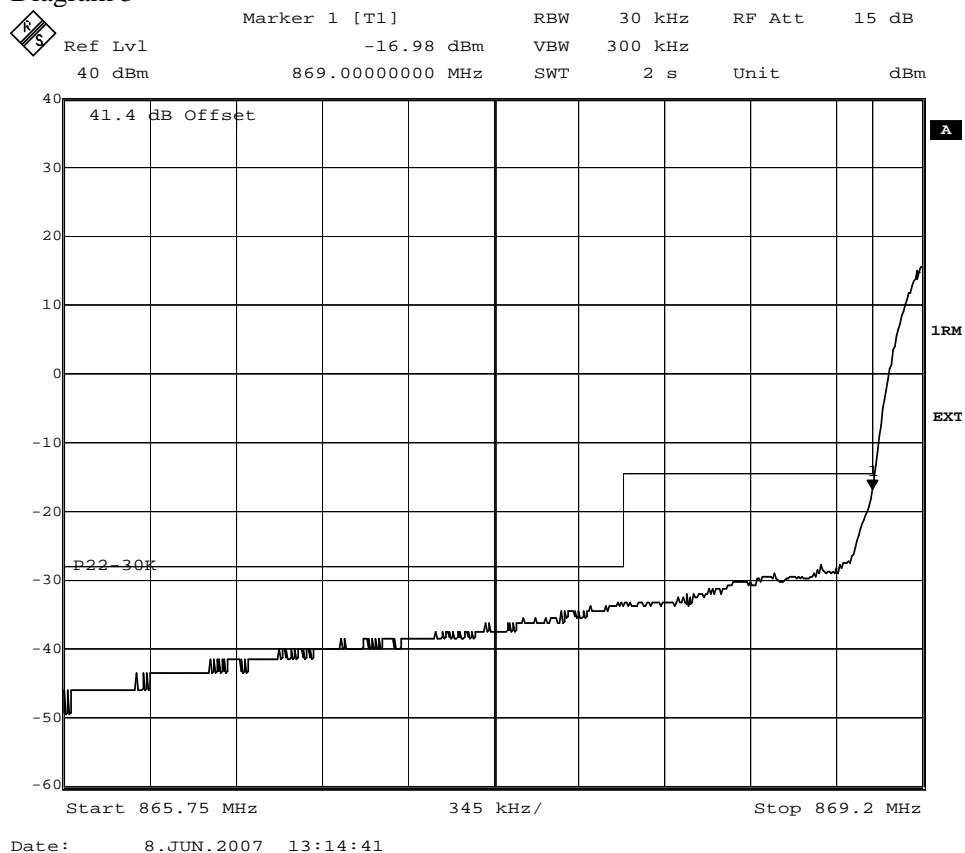
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FCC ID: TA8AKRC11822-2

Appendix 4.1

Diagram 3



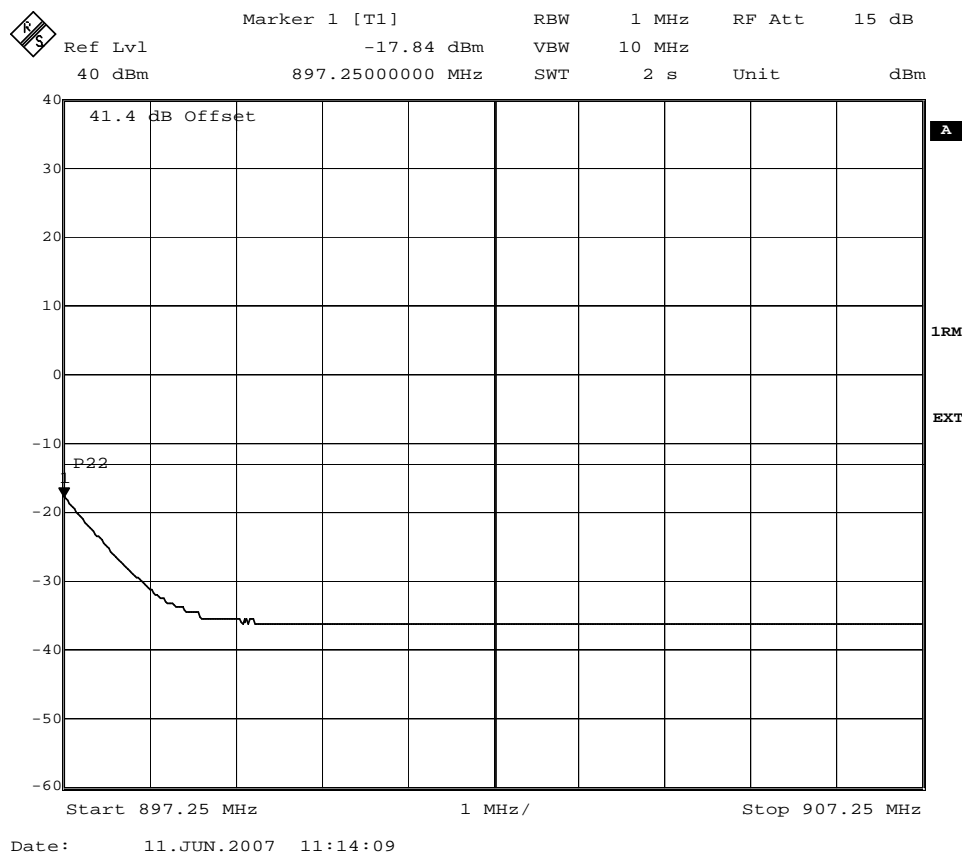
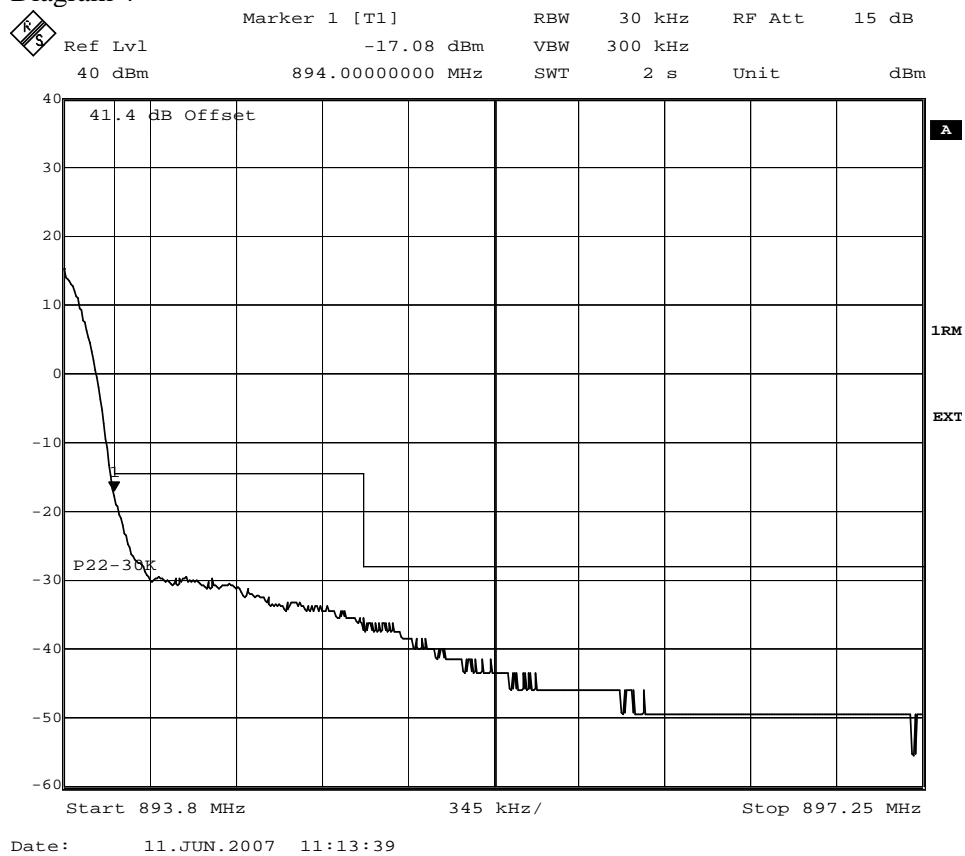




FCC ID: TA8AKRC11822-2

Appendix 4.1

Diagram 4

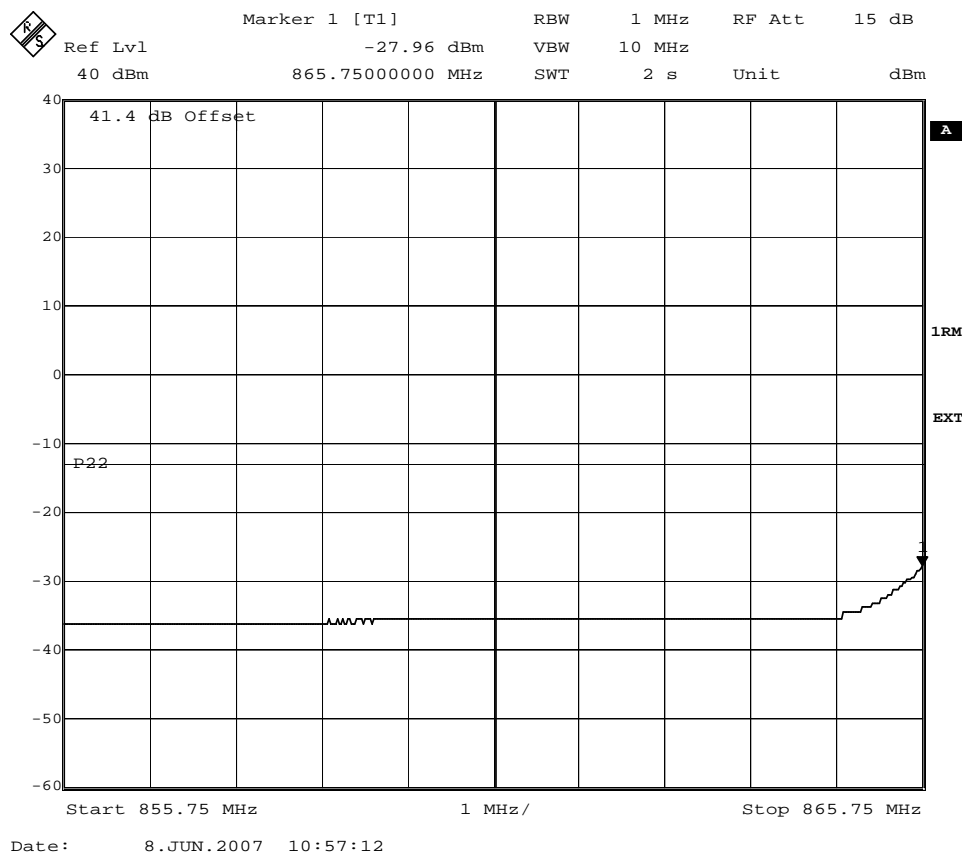
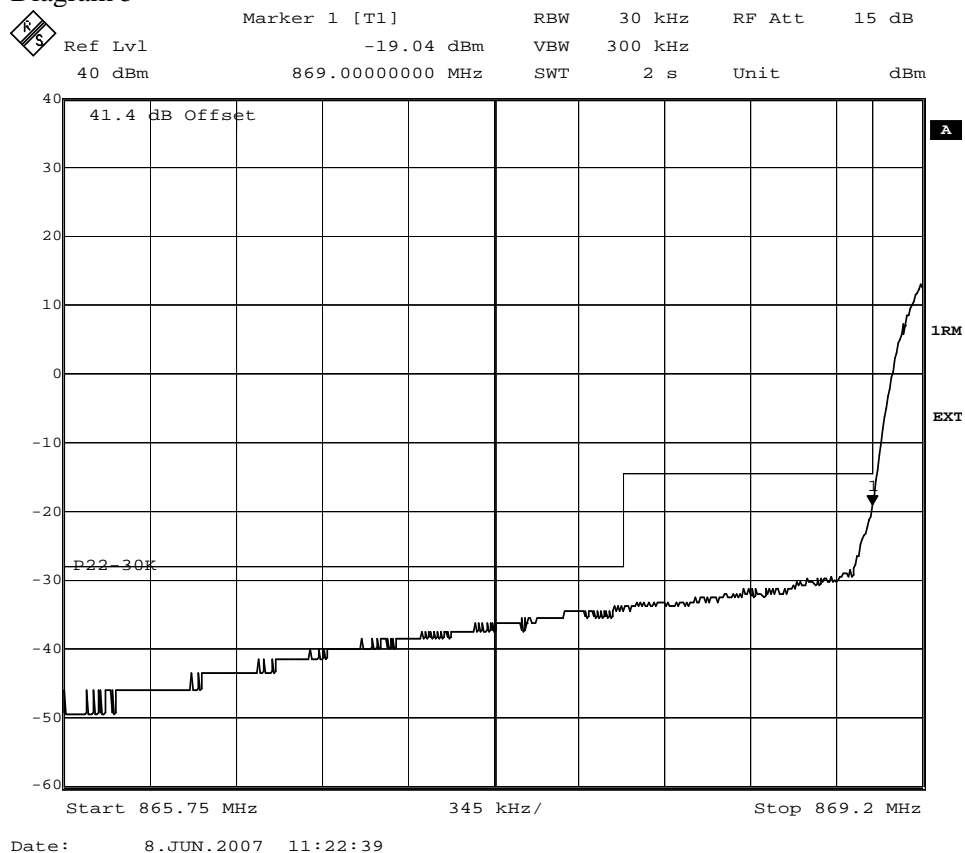




FCC ID: TA8AKRC11822-2

Appendix 4.1

Diagram 5

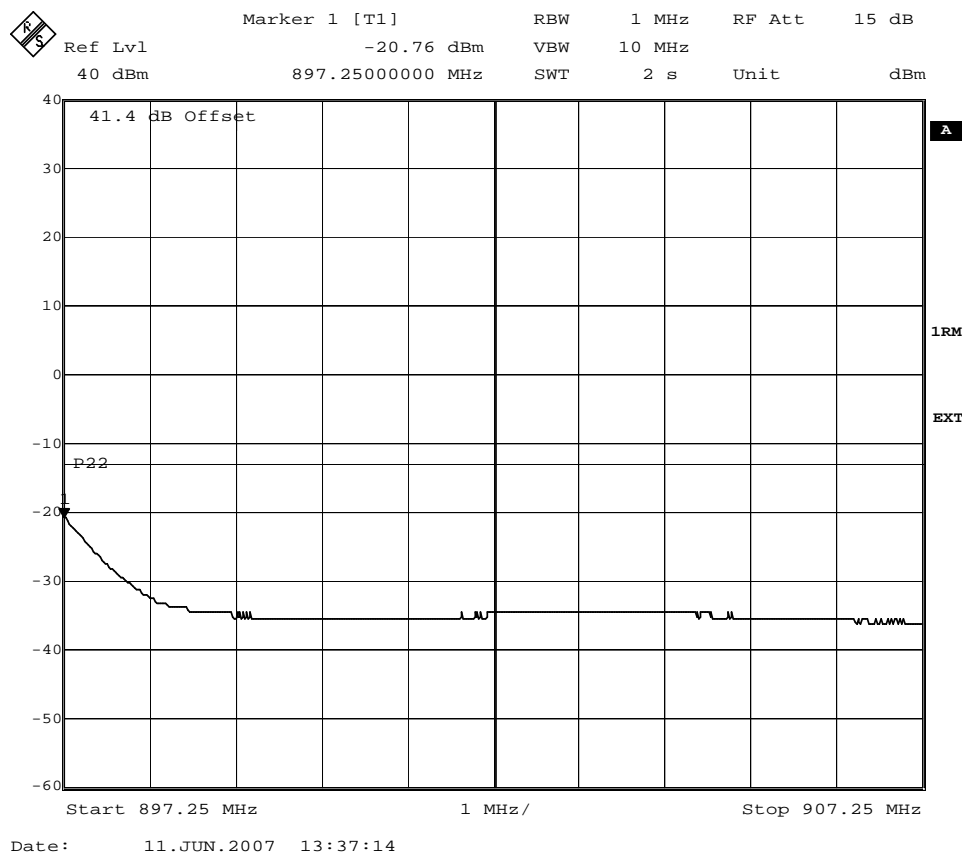
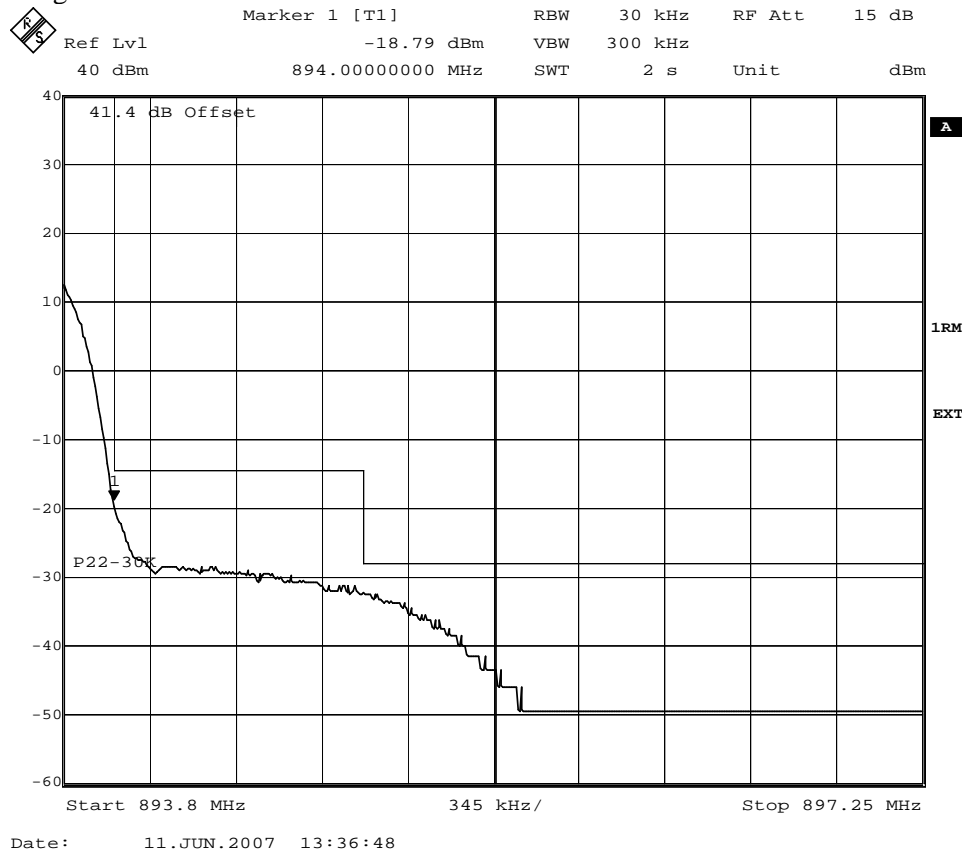




FCC ID: TA8AKRC11822-2

Appendix 4.1

Diagram 6

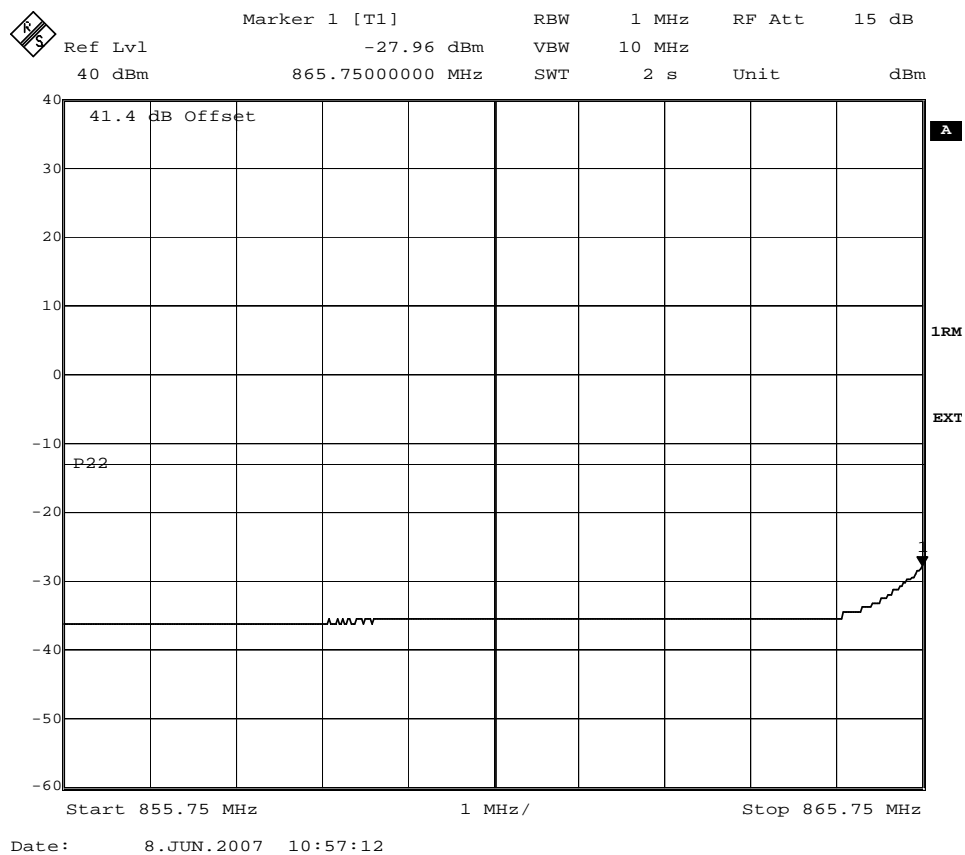
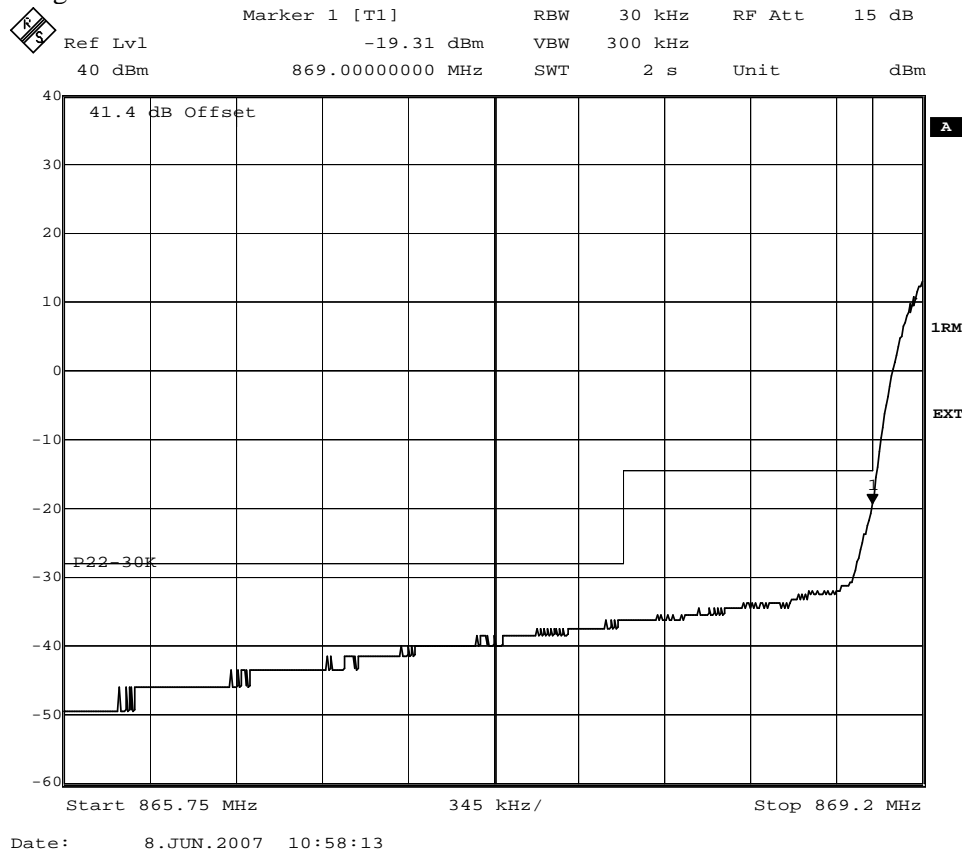




FCC ID: TA8AKRC11822-2

Appendix 4.1

Diagram 7

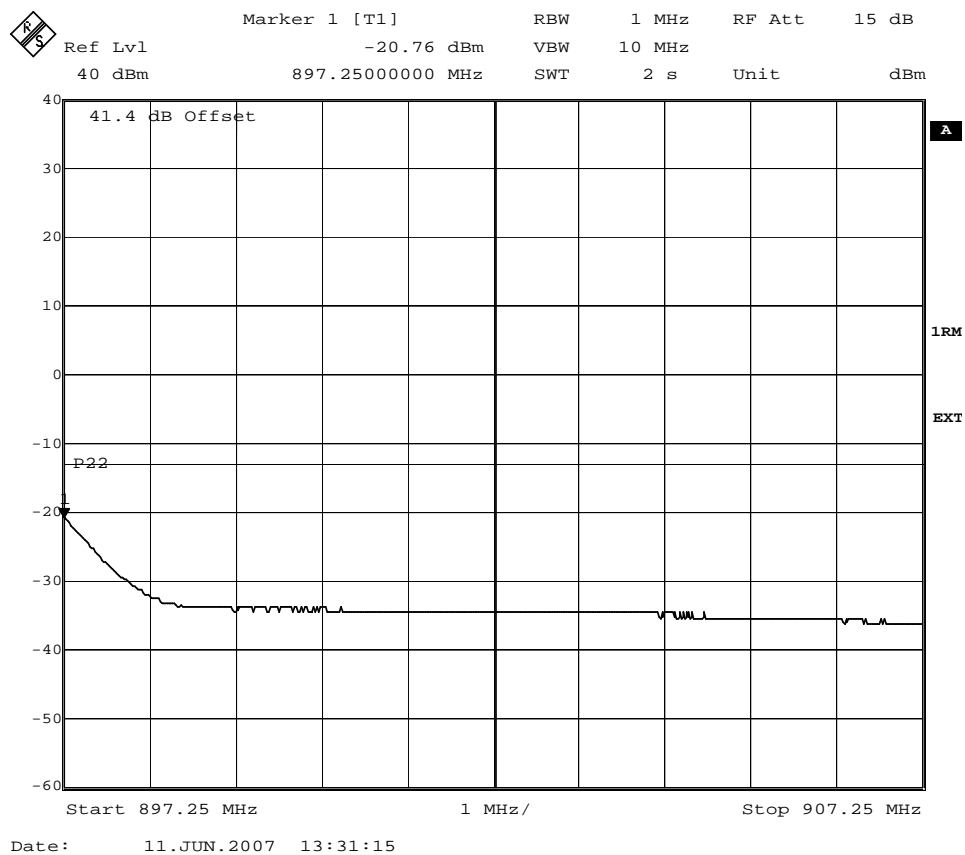
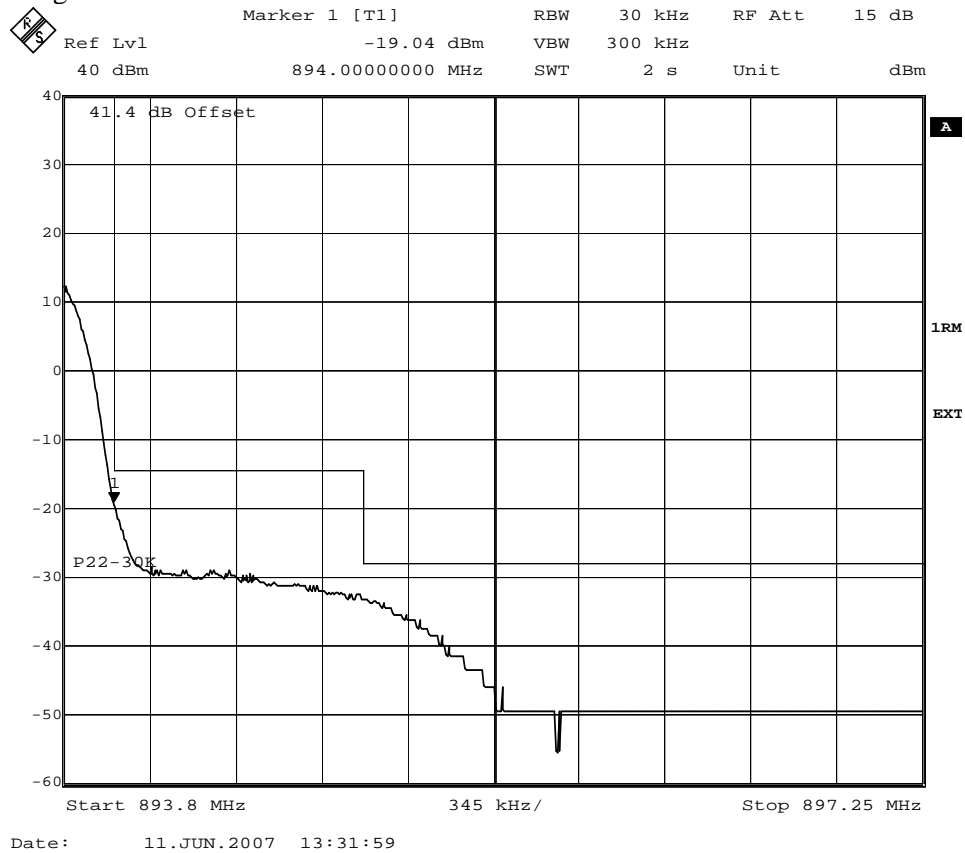




FCC ID: TA8AKRC11822-2

Appendix 4.1

Diagram 8



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

Date	Temperature	Humidity
2007-06-05	23 °C ± 3 °C	38 % ± 5 %
2007-06-07	23 °C ± 3 °C	34 % ± 5 %
2007-06-08	24 °C ± 3 °C	38 % ± 5 %
2007-06-11	23 °C ± 3 °C	40 % ± 5 %

**Test set-up and procedure**

The measurements were made per definition in §22.917, with a RBW of 1 MHz. The output was connected to a spectrum analyzer. A pre-measurement was performed with the PEAK detector activated. Emission above the limit with the PEAK detector is measured with the RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements. The transmitter was set up according to Test model 1 and Test model 5 during the measurements.

Measurement equipment	Calibration Due	SP number
R&S FSIQ	2007-08	503 738
Testo 610, Temperature and humidity meter	2008-04	502 658

**Measurement uncertainty:** 3.7 dB**Results**

The results are shown in appendix 5.1

**Single carrier****QPSK**

Diagram 1: 871.4 MHz  
Diagram 2: 881.4 MHz  
Diagram 3: 891.6 MHz

**16QAM**

Diagram 4: 871.4 MHz  
Diagram 5: 881.4 MHz  
Diagram 6: 891.6 MHz

**Multi carier****QPSK**

Diagram 7: 871.4+881.4 MHz  
Diagram 8: 881.6+891.6 MHz

**16QAM**

Diagram 9: 871.4+881.4 MHz  
Diagram 10: 881.6+891.6 MHz

**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.

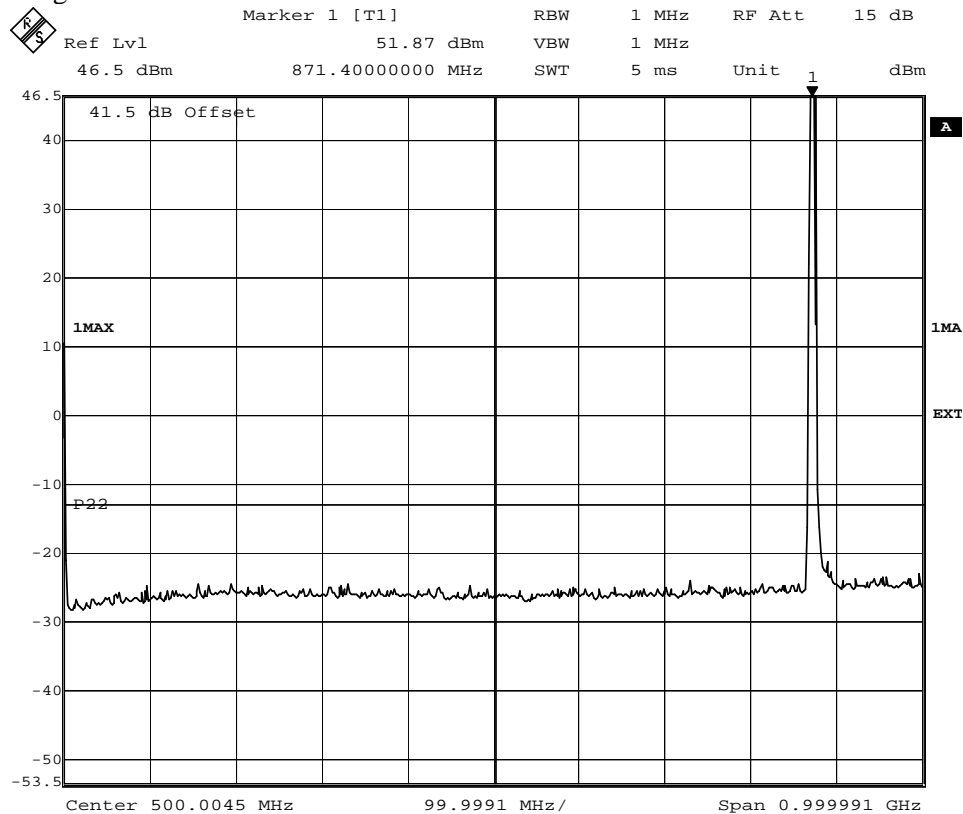
Complies?	Yes
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FCC ID: TA8AKRC11822-2

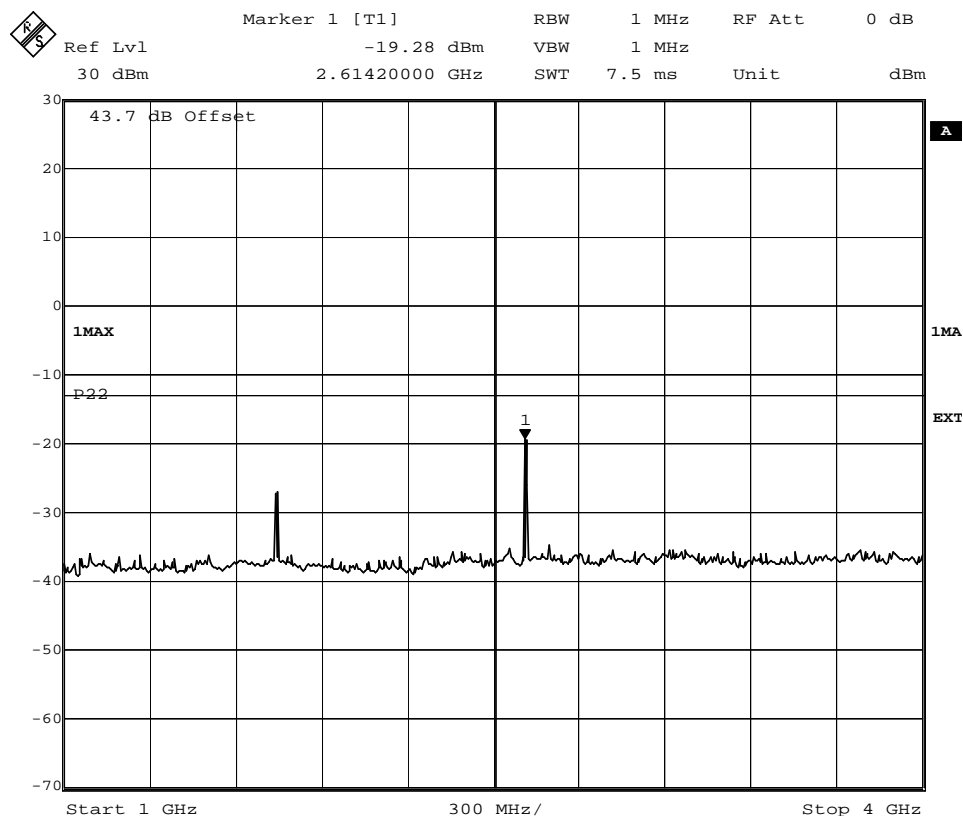
Appendix 5.1

Diagram 1-1



Date: 7.JUN.2007 11:26:52

Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



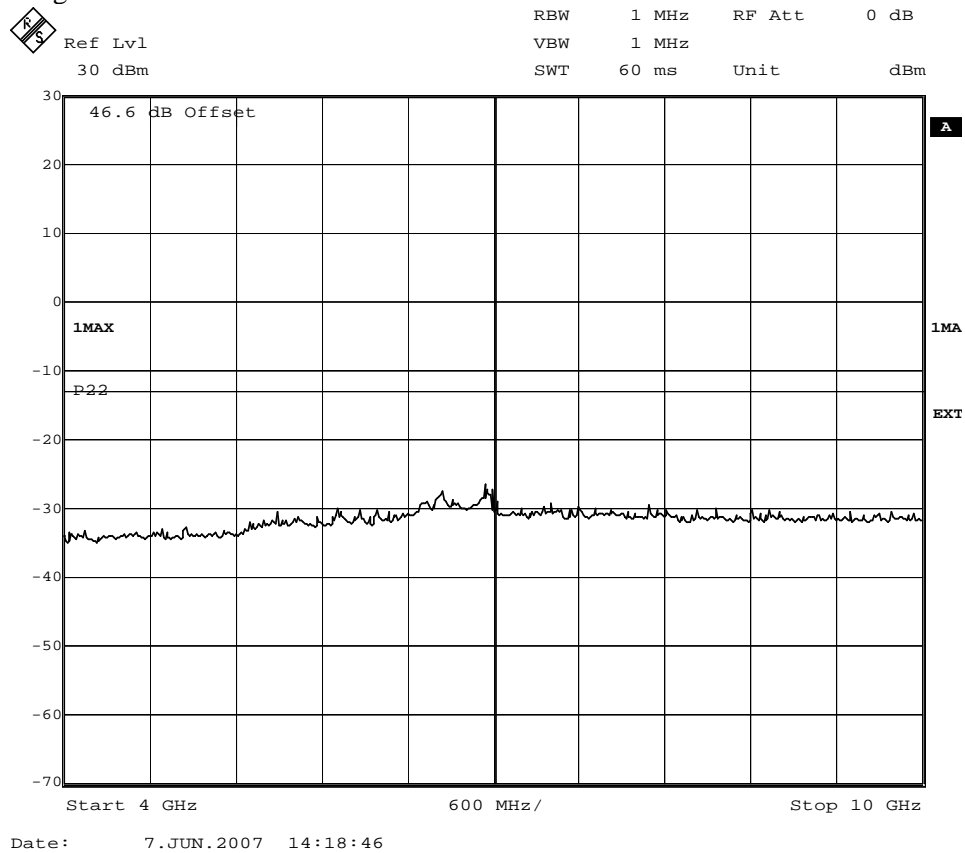
Date: 7.JUN.2007 13:17:55



FCC ID: TA8AKRC11822-2

Appendix 5.1

Diagram 1-2



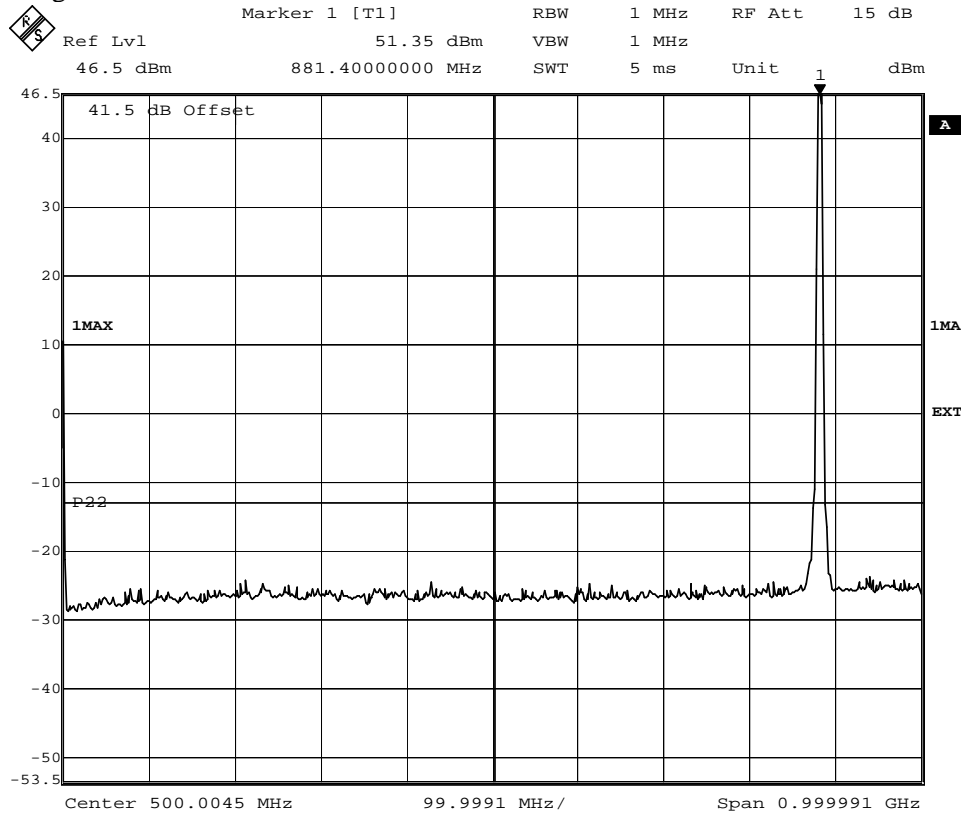




FCC ID: TA8AKRC11822-2

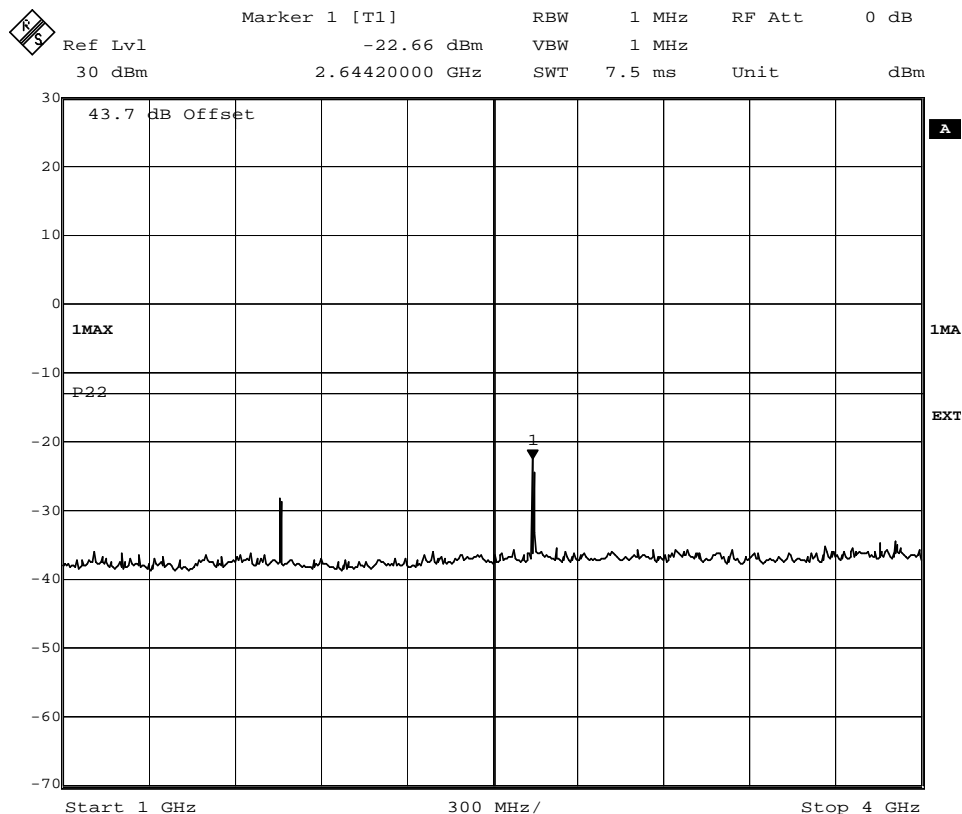
Appendix 5.1

Diagram 2-1



Date: 5.JUN.2007 16:59:40

Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



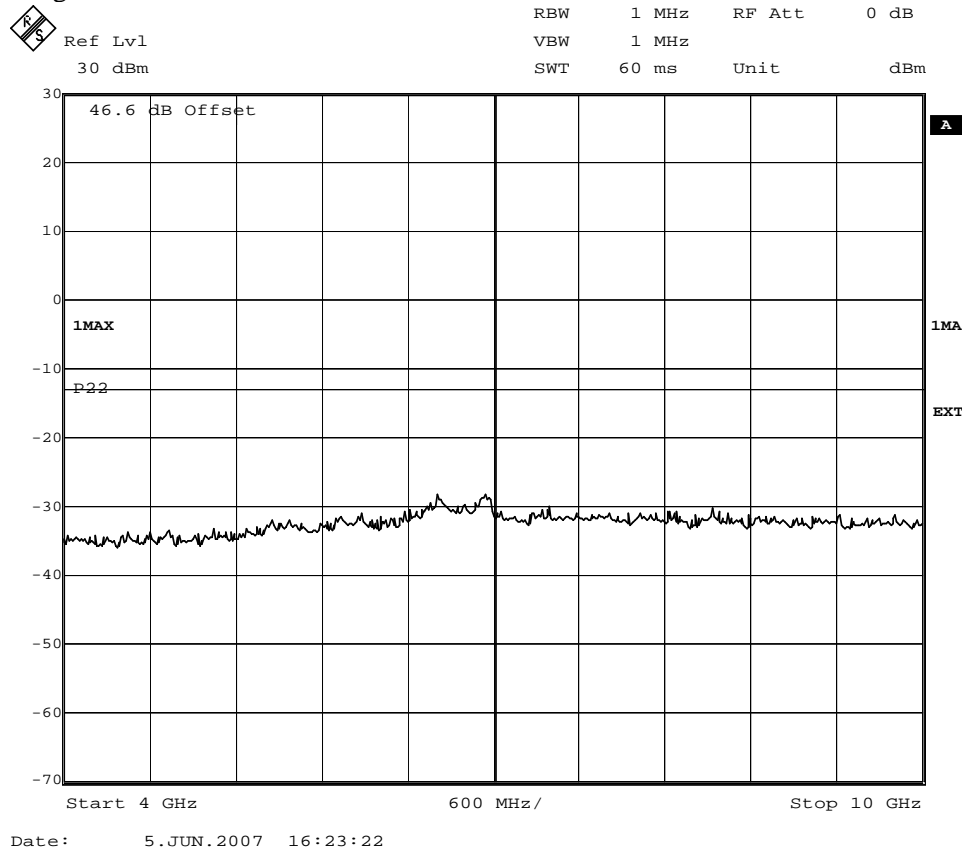
Date: 5.JUN.2007 16:29:12



FCC ID: TA8AKRC11822-2

Appendix 5.1

Diagram 2-2

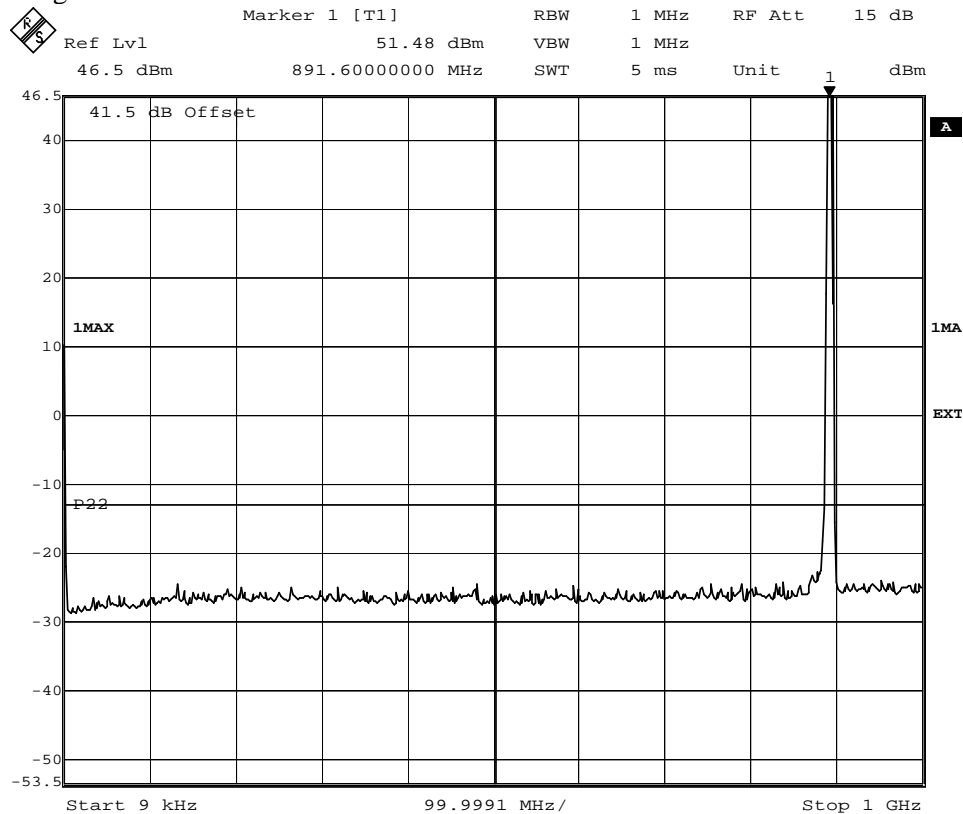




FCC ID: TA8AKRC11822-2

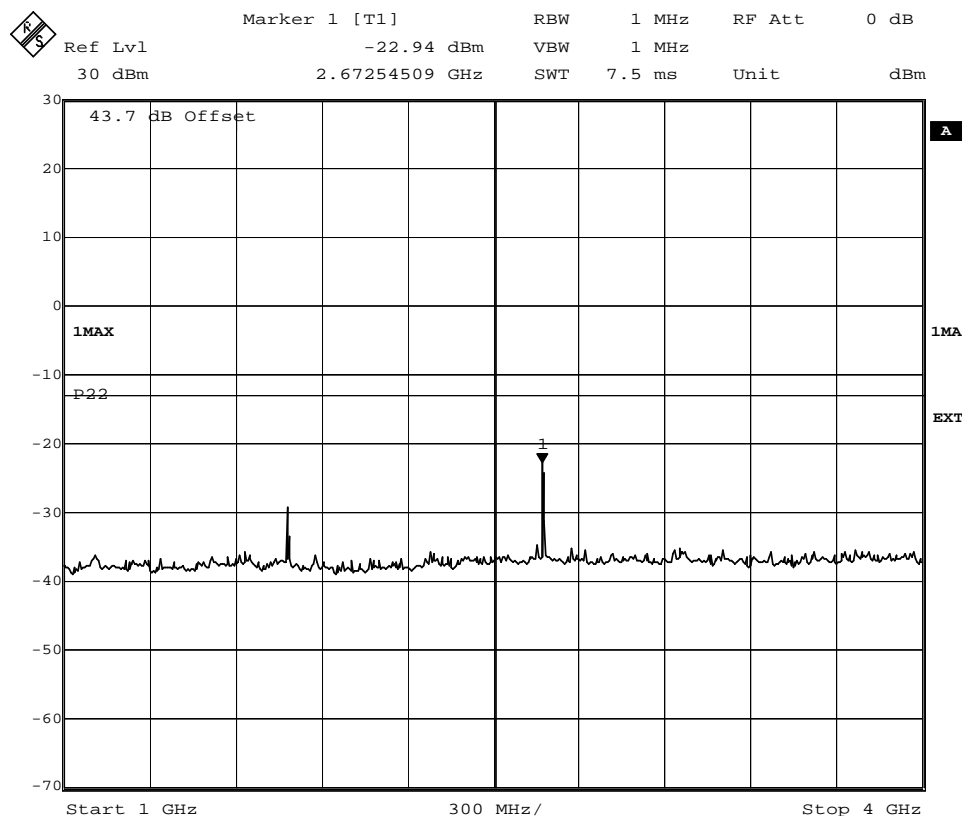
Appendix 5.1

Diagram 3-1



Date: 5.JUN.2007 15:32:01

Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



Date: 5.JUN.2007 15:54:49



FCC ID: TA8AKRC11822-2

Appendix 5.1

Diagram 3-2

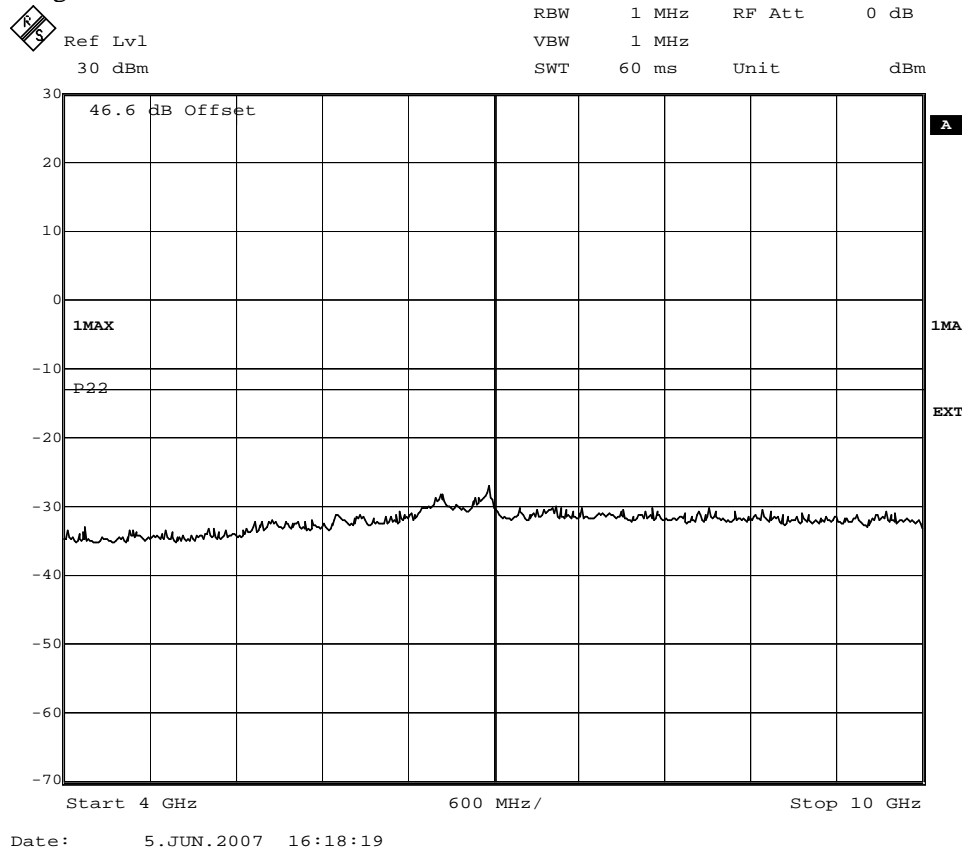
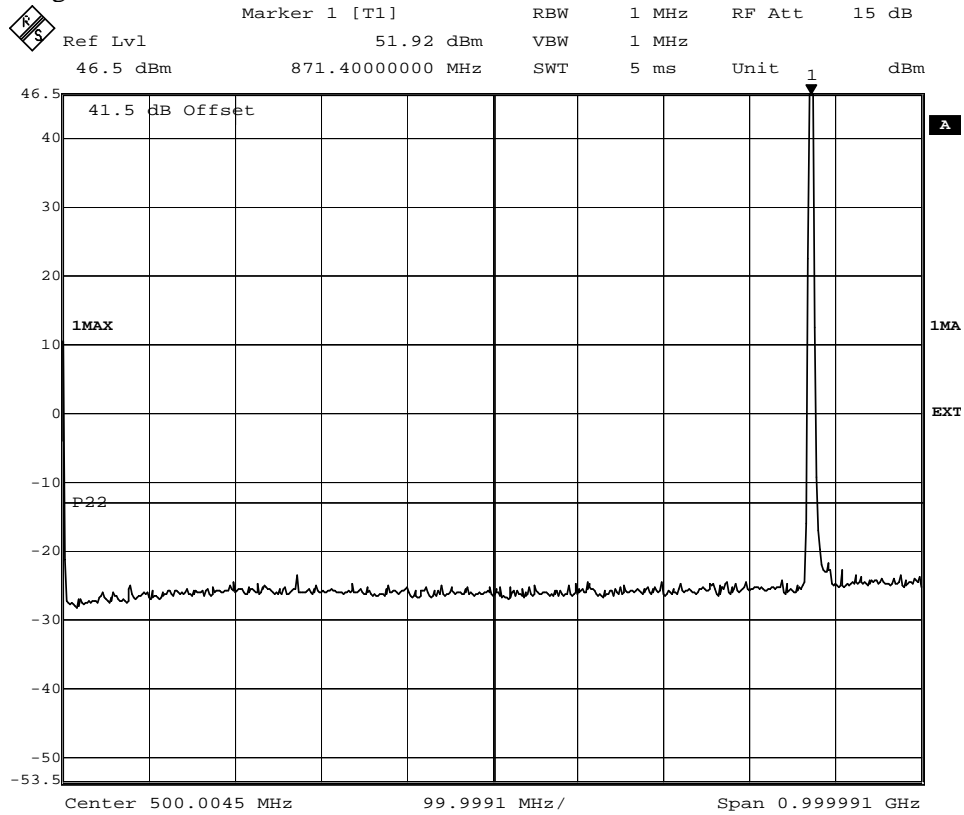


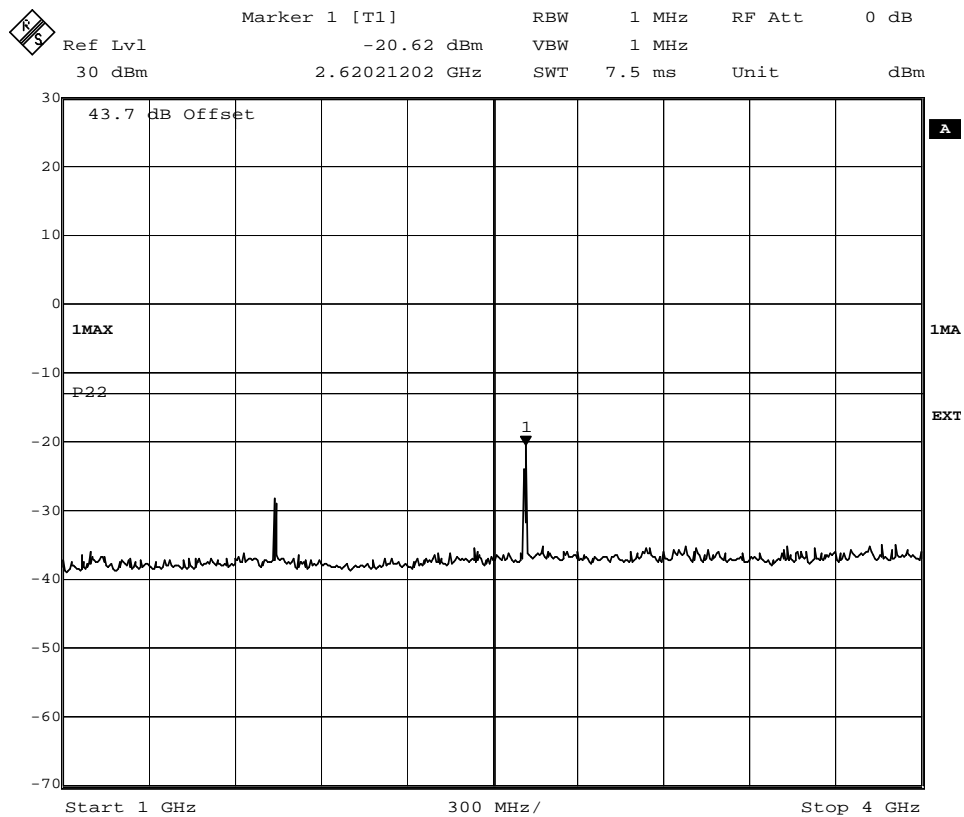


Diagram 4-1



Date: 7.JUN.2007 11:19:12

Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



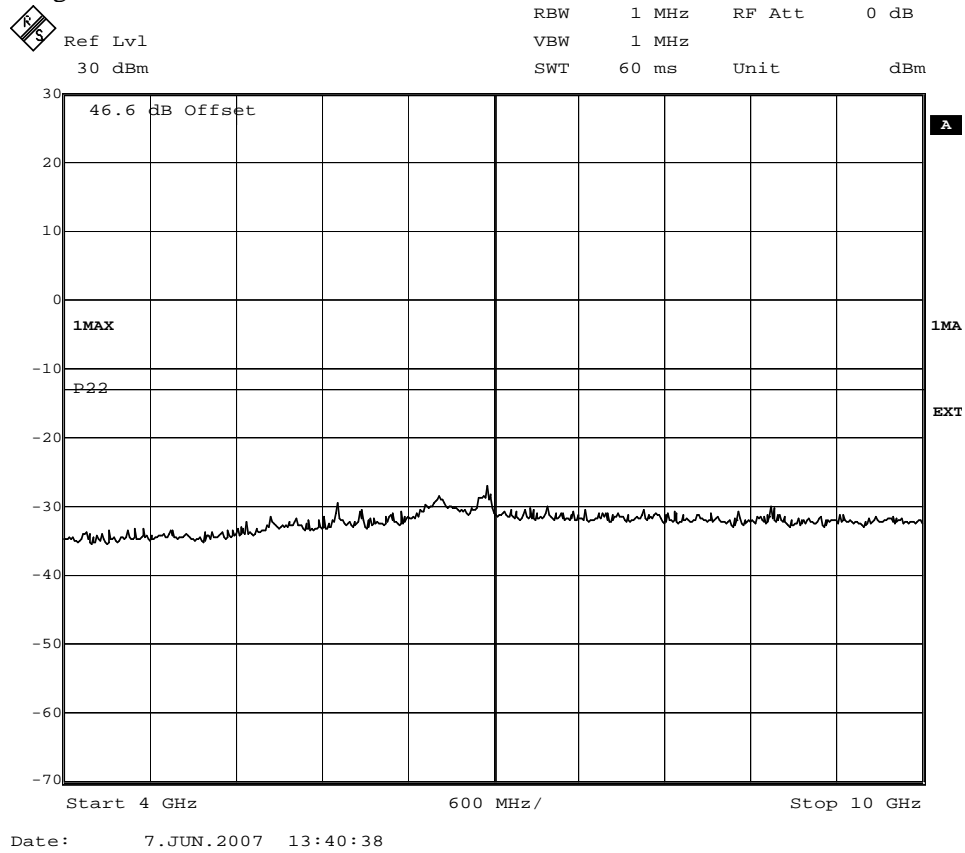
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FCC ID: TA8AKRC11822-2

Appendix 5.1

Diagram 4-2

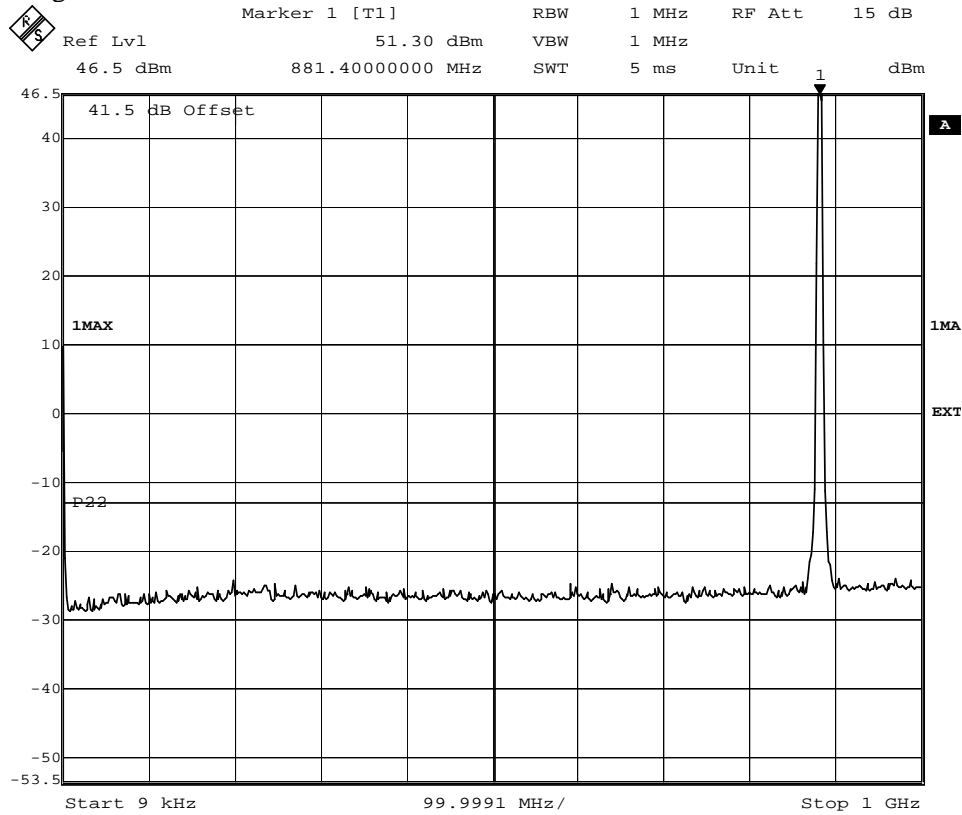




FCC ID: TA8AKRC11822-2

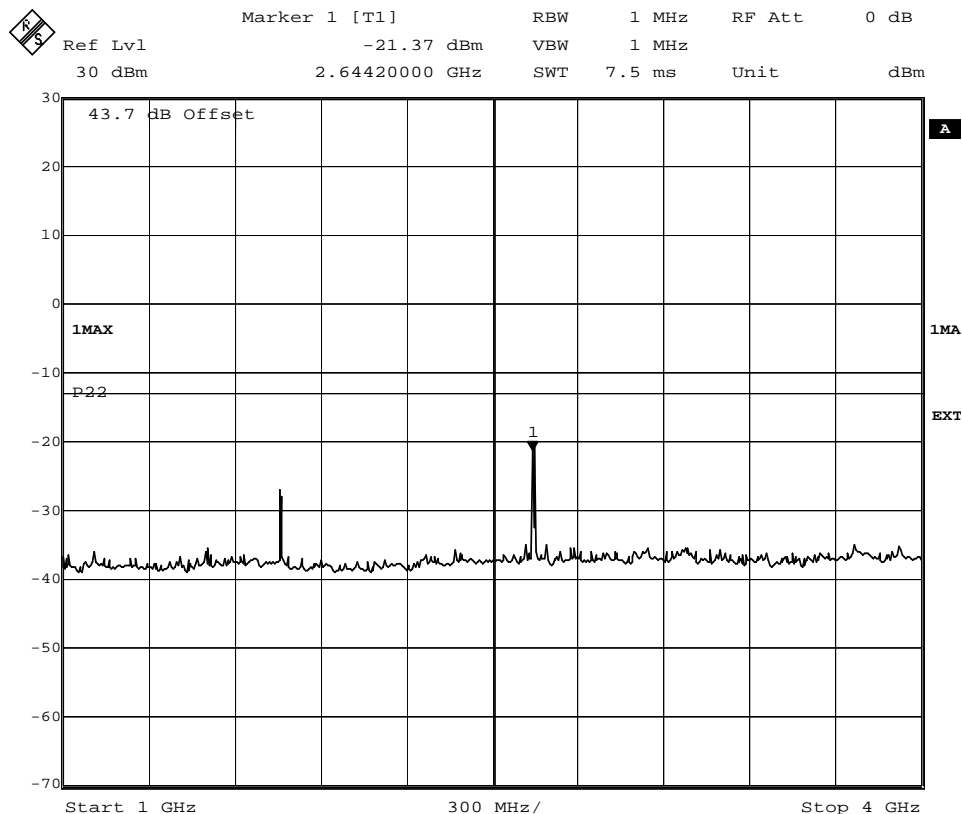
Appendix 5.1

Diagram 5-1



Date: 5.JUN.2007 16:52:23

Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



Date: 5.JUN.2007 16:44:41



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Appendix 5.1

Diagram 5-2

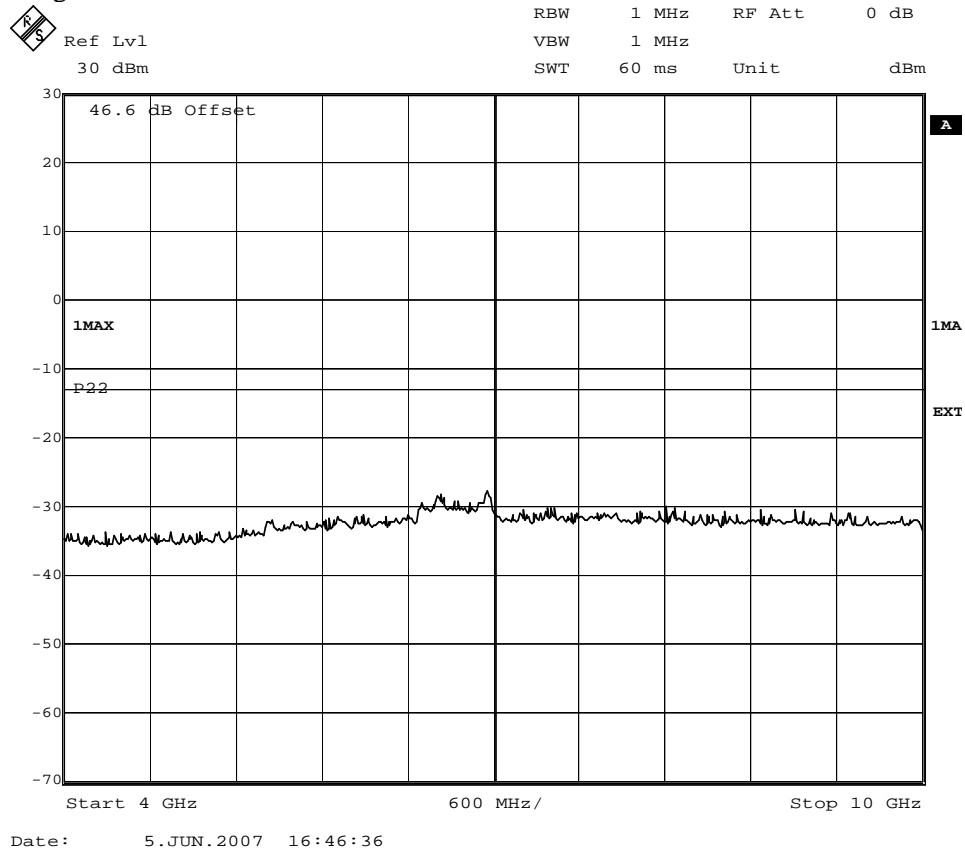
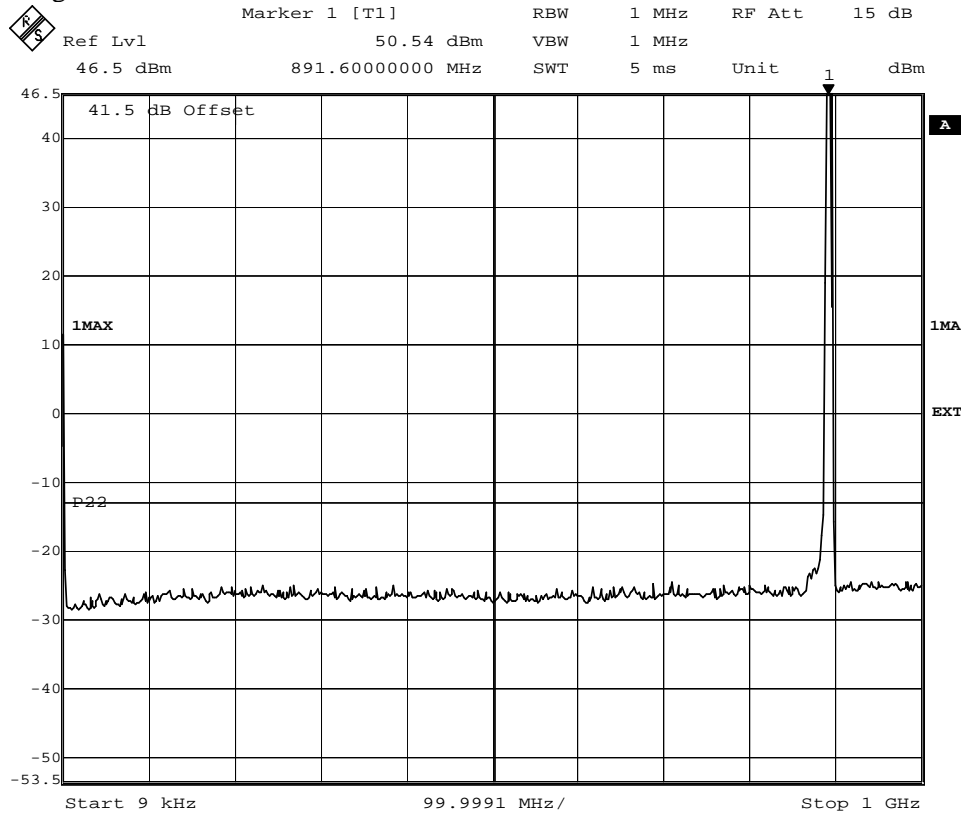


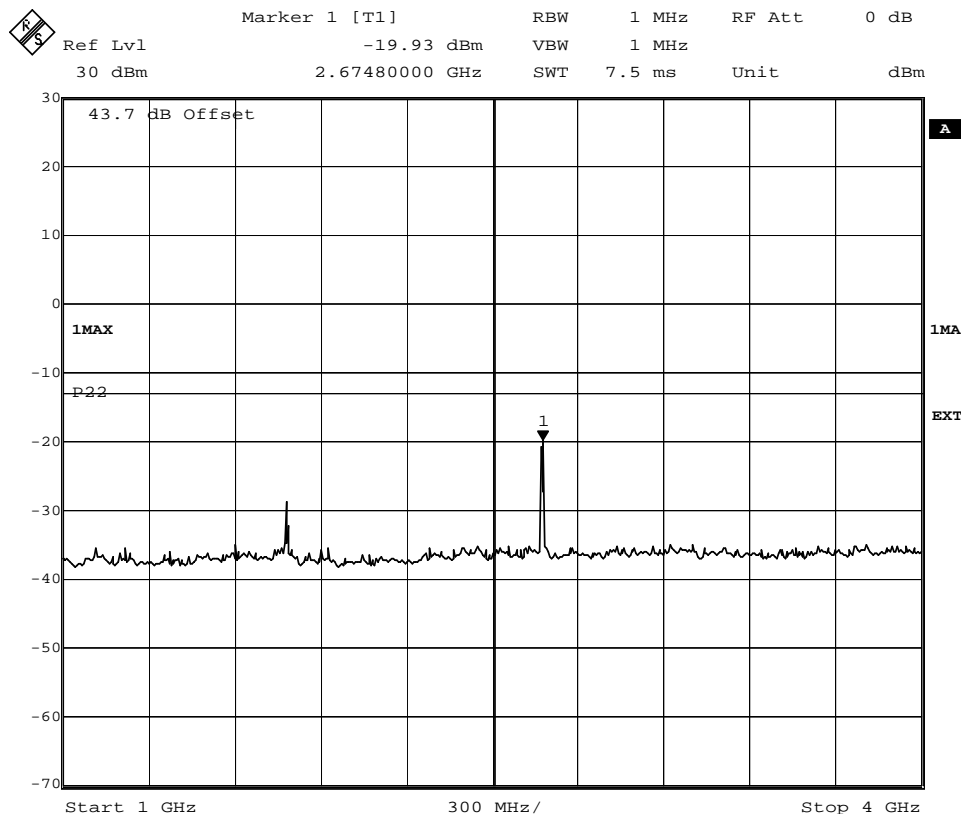


Diagram 6-1



Date: 5.JUN.2007 14:21:25

Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



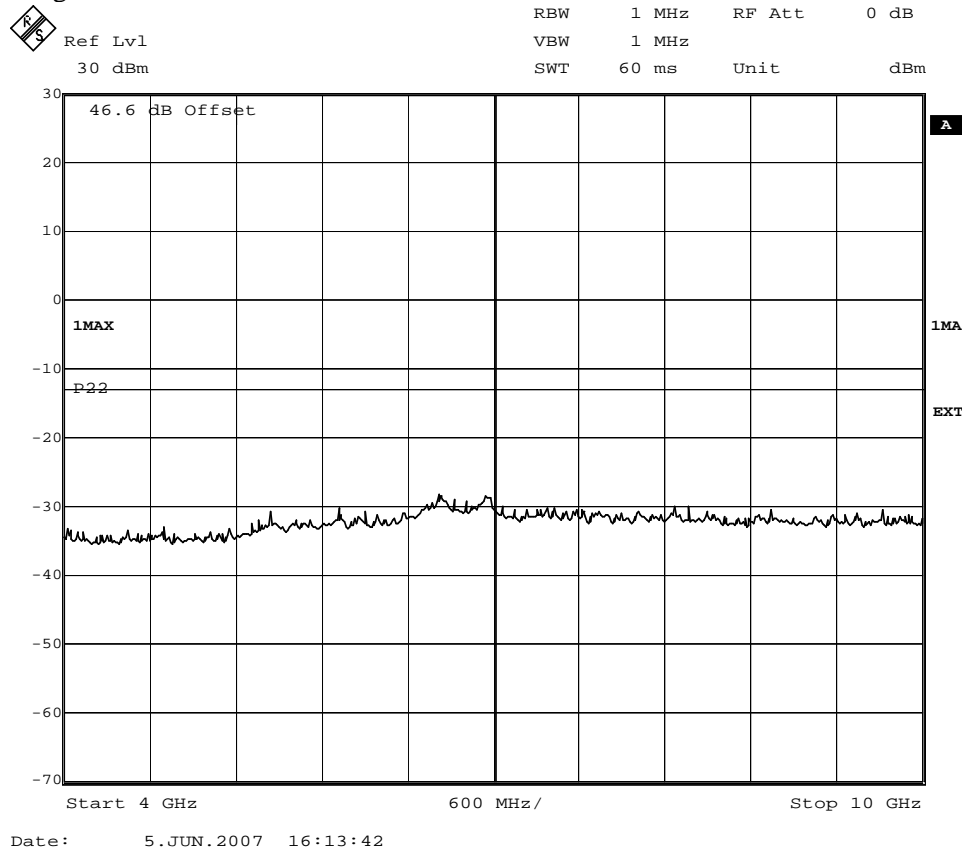
Date: 5.JUN.2007 16:02:38



FCC ID: TA8AKRC11822-2

Appendix 5.1

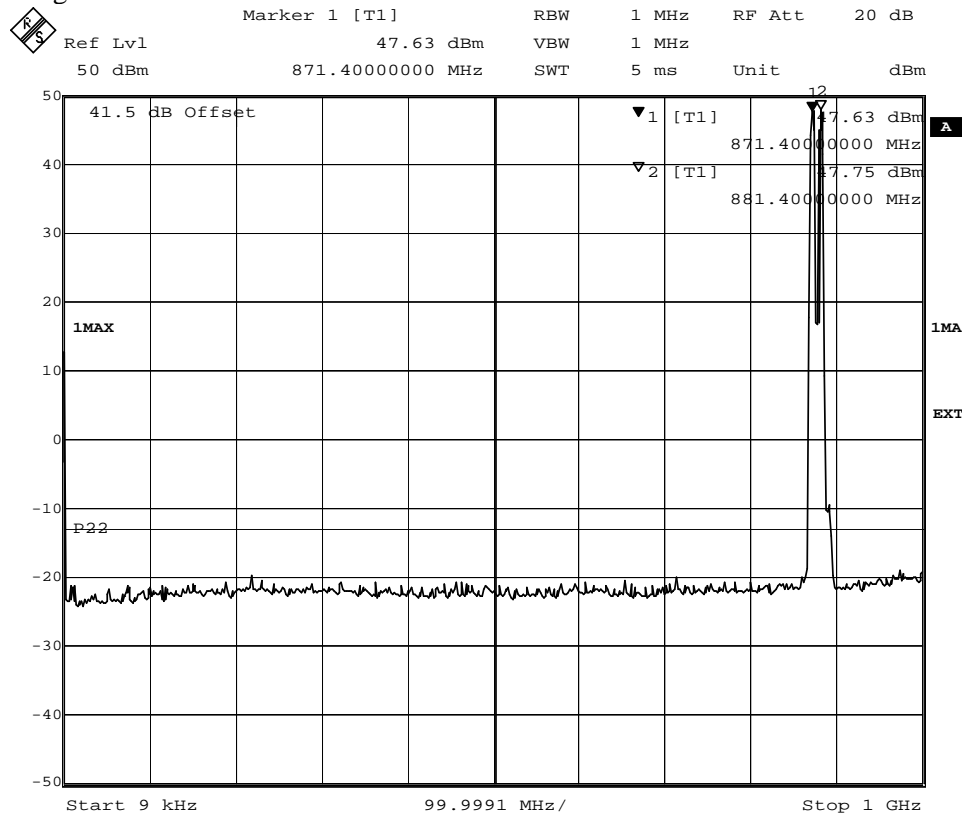
Diagram 6-2



FCC ID: TA8AKRC11822-2

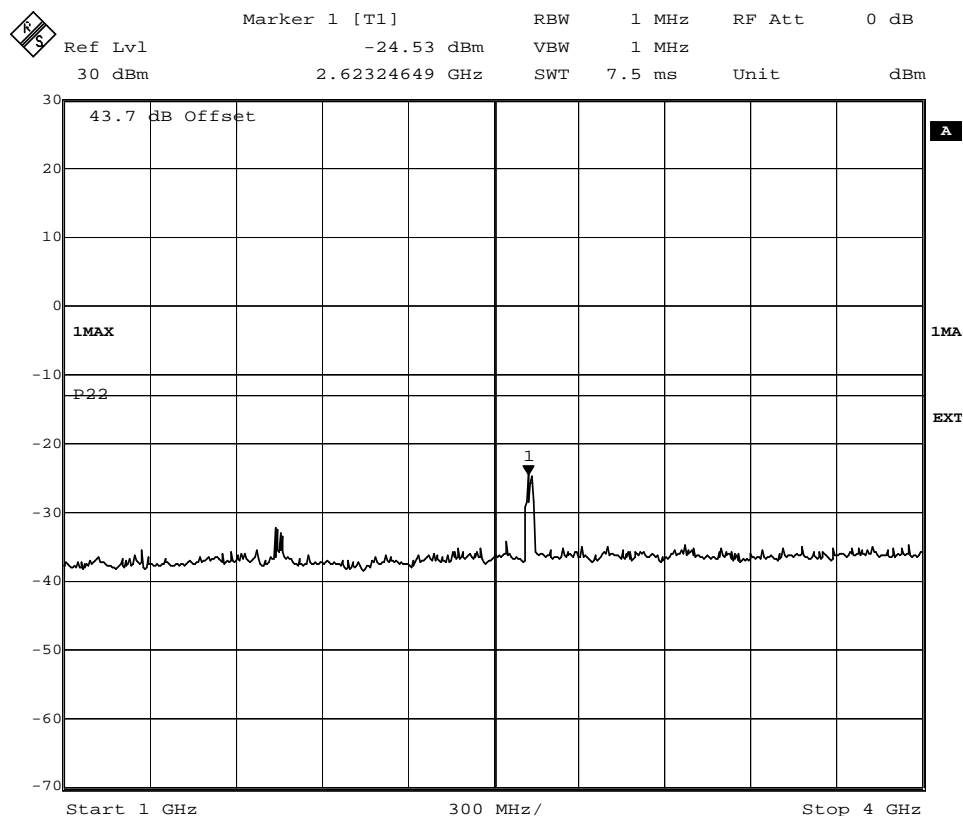
Appendix 5.1

Diagram 7



Date: 7.JUN.2007 16:16:01

Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



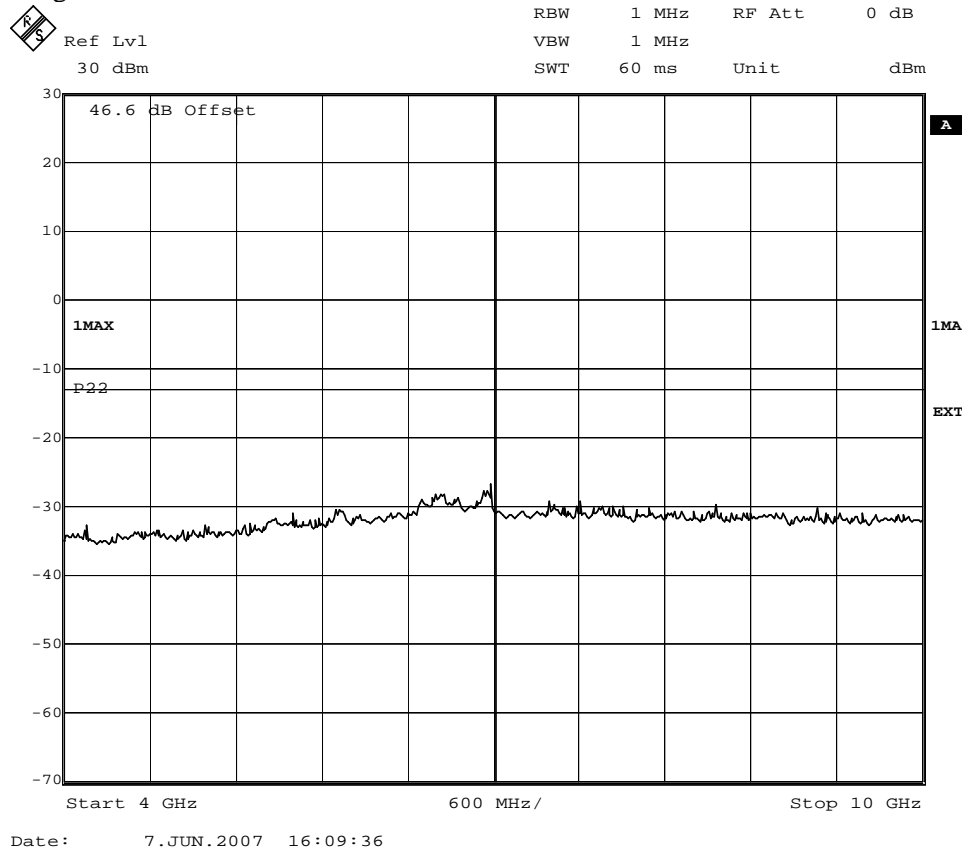
Date: 7.JUN.2007 16:13:05



FCC ID: TA8AKRC11822-2

Appendix 5.1

Diagram 7-2

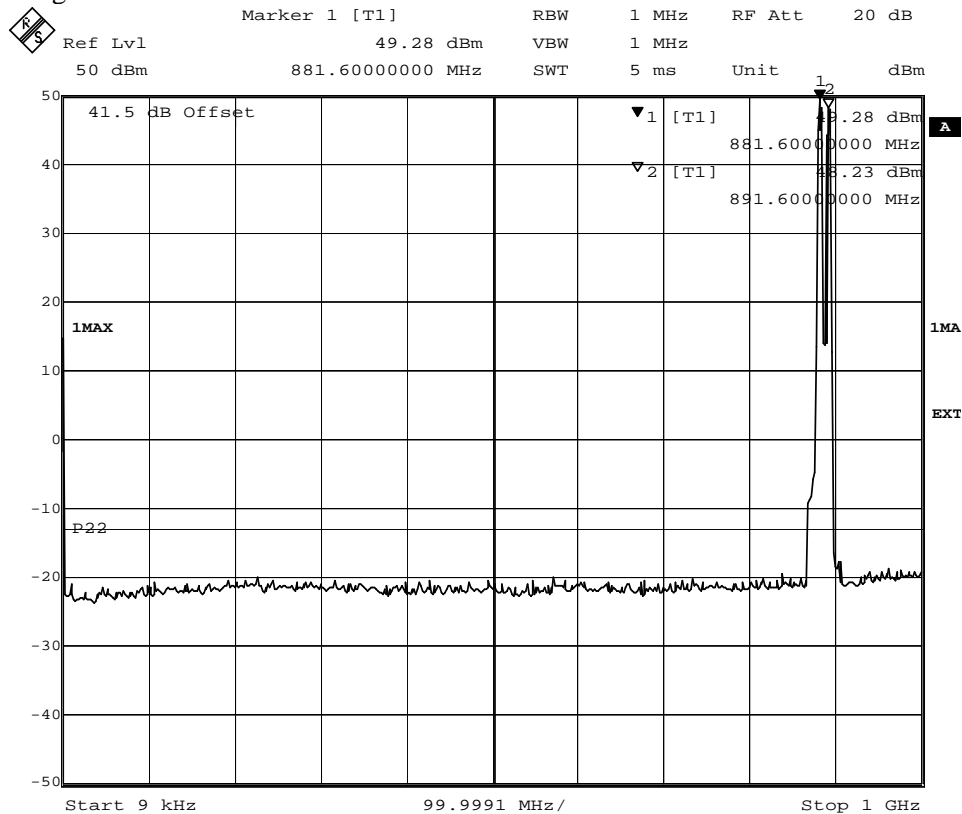




FCC ID: TA8AKRC11822-2

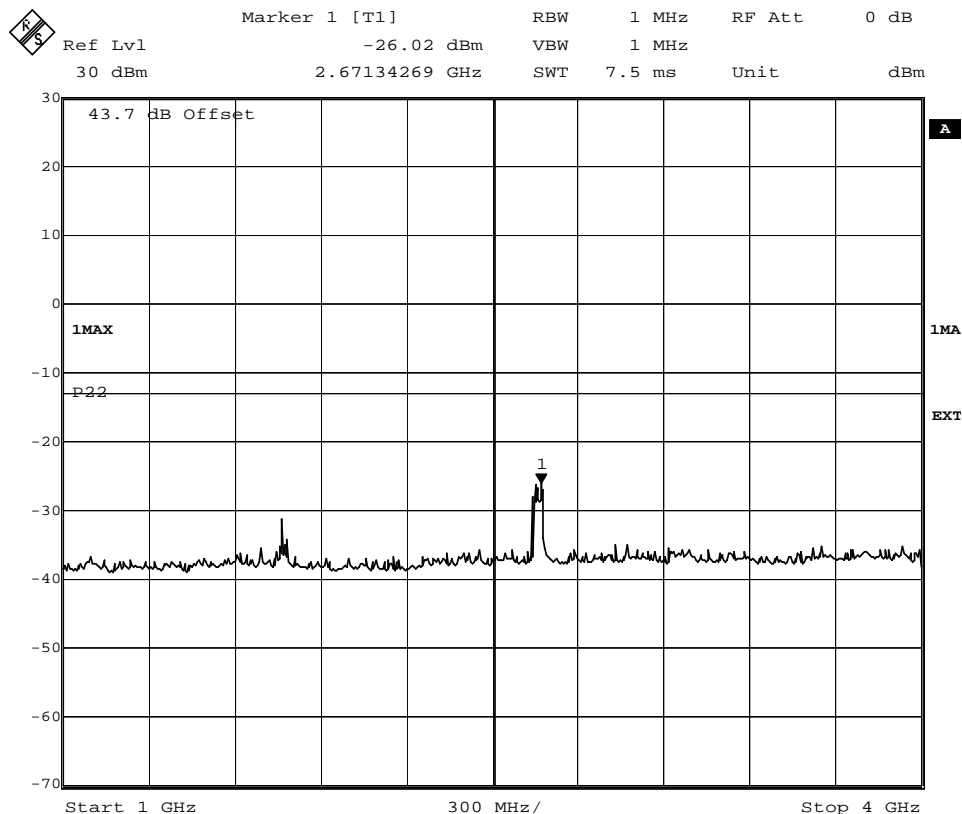
Appendix 5.1

Diagram 8-1



Date: 11.JUN.2007 13:59:49

Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



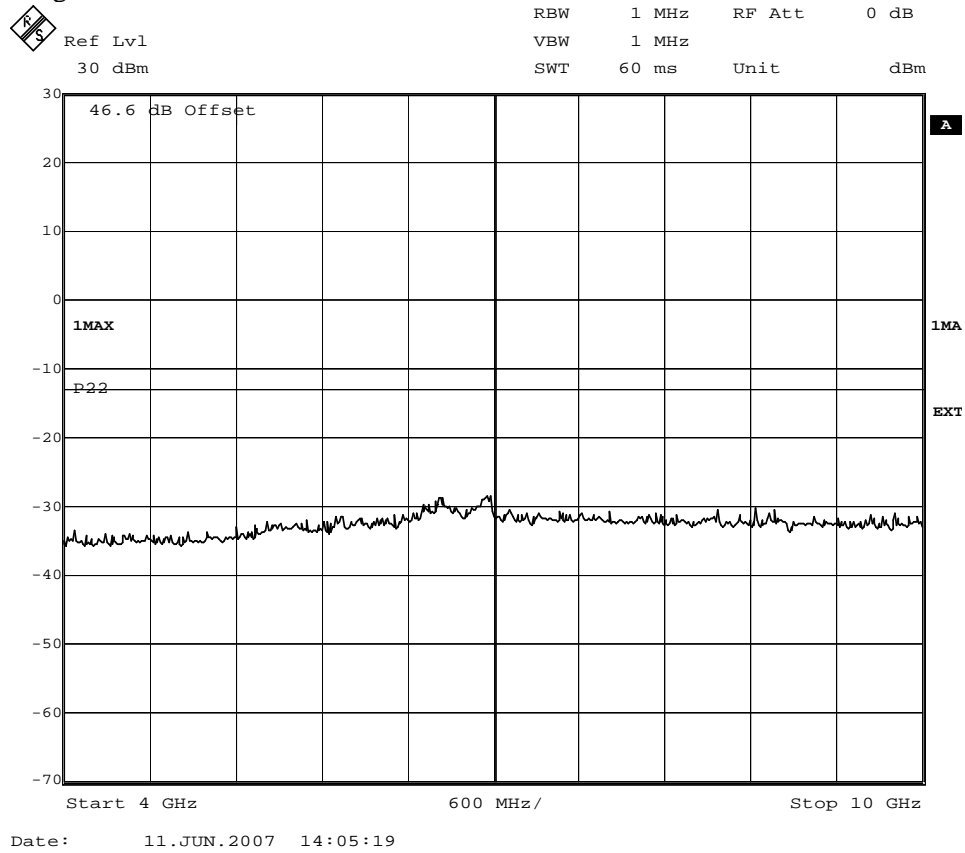
Date: 11.JUN.2007 14:03:17



FCC ID: TA8AKRC11822-2

Appendix 5.1

Diagram 8-2

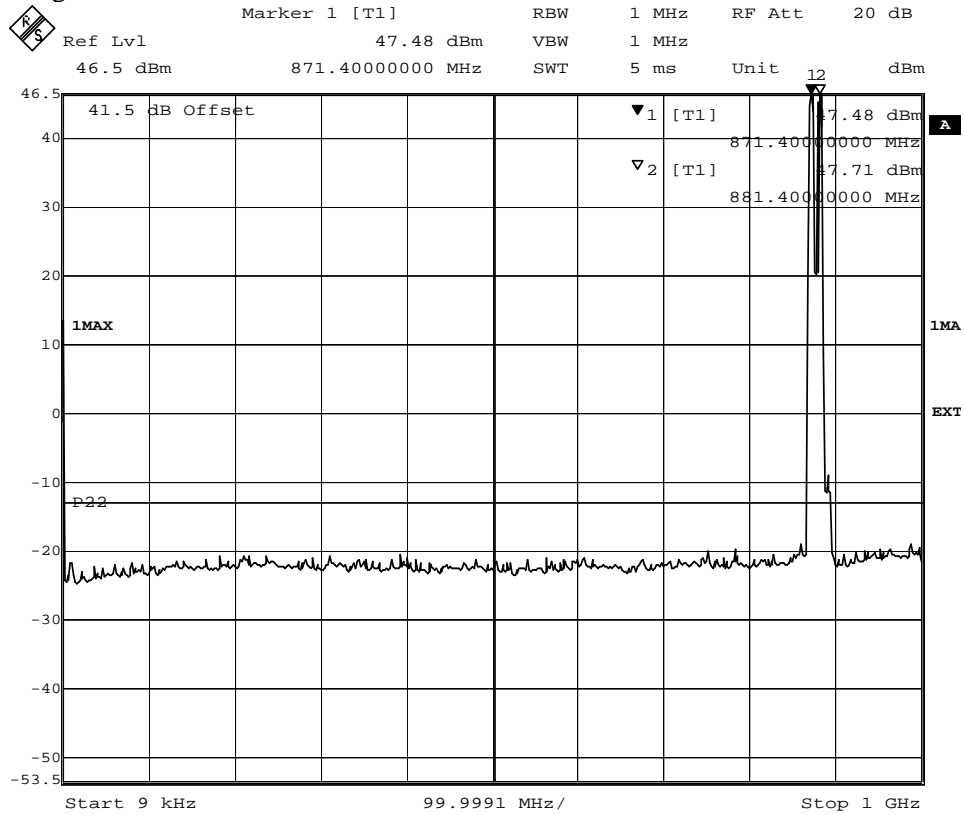




FCC ID: TA8AKRC11822-2

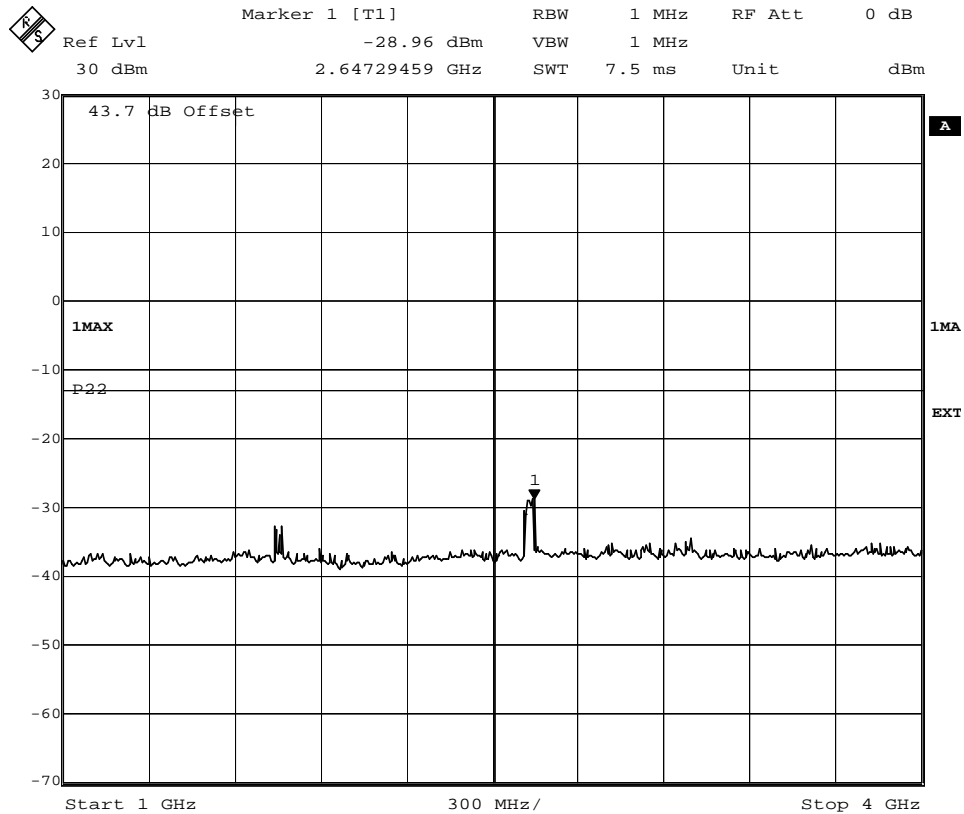
Appendix 5.1

Diagram 9



Date: 8.JUN.2007 11:31:31

Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



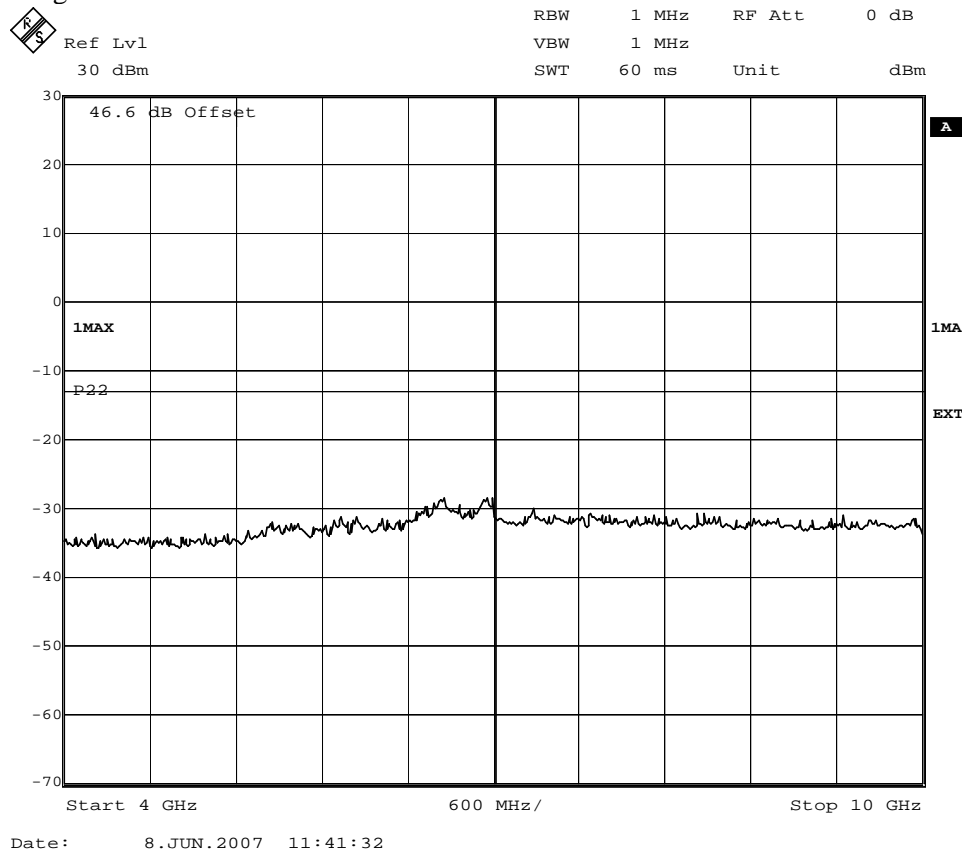
Date: 8.JUN.2007 11:37:57



FCC ID: TA8AKRC11822-2

Appendix 5.1

Diagram 9-2



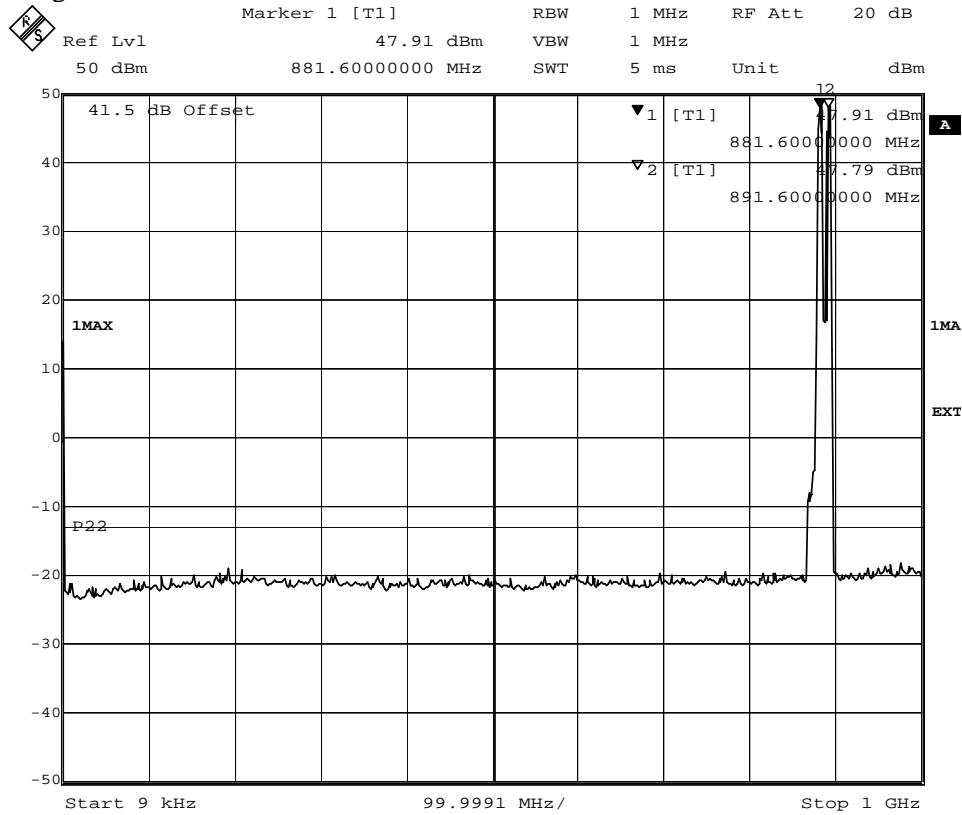




FCC ID: TA8AKRC11822-2

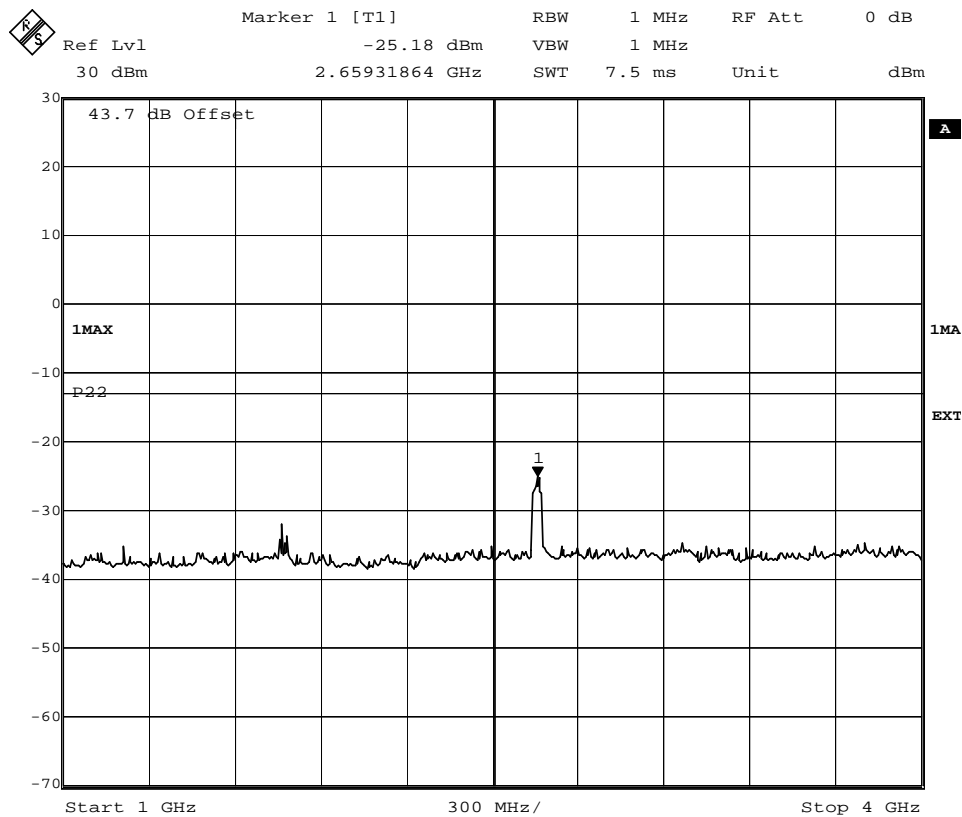
Appendix 5.1

Diagram 10



Date: 11.JUN.2007 13:53:28

Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



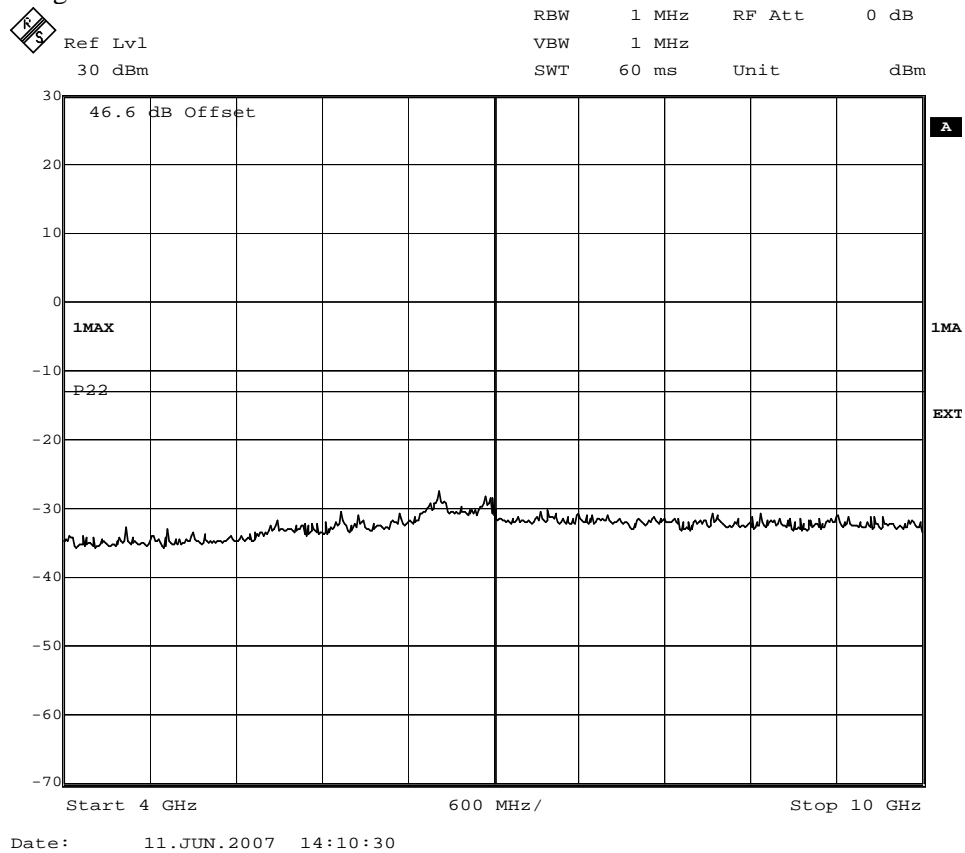
Date: 11.JUN.2007 14:13:58



FCC ID: TA8AKRC11822-2

Appendix 5.1

Diagram 10-2



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

Date 2007-06-07 to 2007-06-12	Temperature 23 °C ± 3 °C	Humidity 35-55 % ± 5 %
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### Test set-up and procedure

The test site is listed at FCC, Columbia with registration number: 93866. The test site also complies with RSS 212, Issue 1, Industry Canada file no.:IC 3482.

The transmitter was set up according to Test model 1 and Test model 5 during the measurements. The antenna ports were terminated with 50 ohm loads.

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

A pre-measurement was first performed:

In the frequency range 30 MHz-10 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,

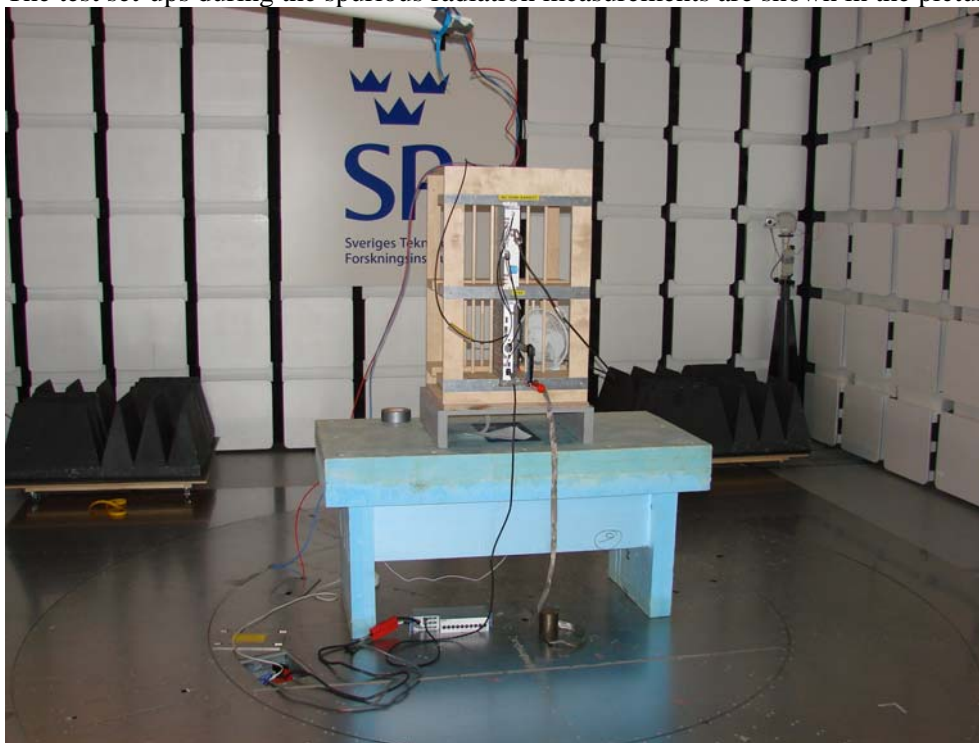
$$\gamma = 20 \log \left( \frac{4\pi D}{\lambda} \right), \gamma \text{ is the propagation loss and } D \text{ is the antenna distance.}$$

The measurement procedure was as the following:

1. The pre-measurement was first performed with peak detector. The EUT was measured in eight directions and with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m.
2. Spurious radiation on frequencies closer than 20 dB to the limit is scanned 0-360 degrees and the antenna is scanned 1-4 m for maximum response. The emission is then measured with the average detector and the average value is reported, frequencies closer than 10 dB to the limit measured with the average detector was measured with the substitution method according to the standard.

Measurement equipment	Calibration Due	SP number
Test site	2008-11	503 881
R&S ESI 26	2007-09	503 292
Control computer	-	503 479
Software: R&S ES-K1, ver. 1.60	-	-
Chase Bilog antenna CBL 6111A	2008-11	503 182
EMCO Horn Antenna 3115	2007-11	502 175
MITEQ Low Noise Amplifier	2007-08	503 285
Testo 615, Temperature and humidity meter	2007-09	503 505

The test set-ups during the spurious radiation measurements are shown in the picture below.



## Results

### Single carrier

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-22 000	All emission > 20 dB below limit	All emission > 20 dB below limit
Measurement uncertainty		4.7 dB

### Multi carrier

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-22 000	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
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### Frequency stability measurements according to 47 CFR 2.1055

Date 2007-06-11 to 2007-06-14	Temperature (test equipment) 23 °C ± 3 °C	Humidity (test equipment) 40 % ± 5 %
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#### Test set-up and procedure

The measurement was made per 3GPP TS 25.141. The output was connected to a spectrum analyzer. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements. The transmitter was set up according to Test model 1 and Test model 5 during the measurements.

Measurement equipment	Calibration Due	SP number
Climate chamber	2009-05	503 546
R&S FSIQ	2007-08	503 738
Multimeter Fluke 87	2008-04	502 190
Testo 610, Temperature and humidity meter	2008-04	502 658

#### Results

Nominal Voltage -48 V DC  
47.8 dBm output power at 881.4 MHz

Test conditions		Frequency error (Hz)	
Supply voltage DC (V)	T (°C)	QPSK	16QAM
-48.0	+20	+7	+6
-55.2	+20	-5	+4
-40.8	+20	+6	+9
-48.0	+30	+5	+6
-48.0	+40	+8	+8
-48.0	+50	-8	+12
-48.0	+10	+6	+6
-48.0	0	+6	+5
Maximum freq. error (Hz)		+12	
Measurement uncertainty		< ± 1 x 10 <sup>-7</sup>	

Note: At -10°C it was not possible to enable the transmitter, the cell was not available.

#### Limits (according to 3GPP TS 25.141)

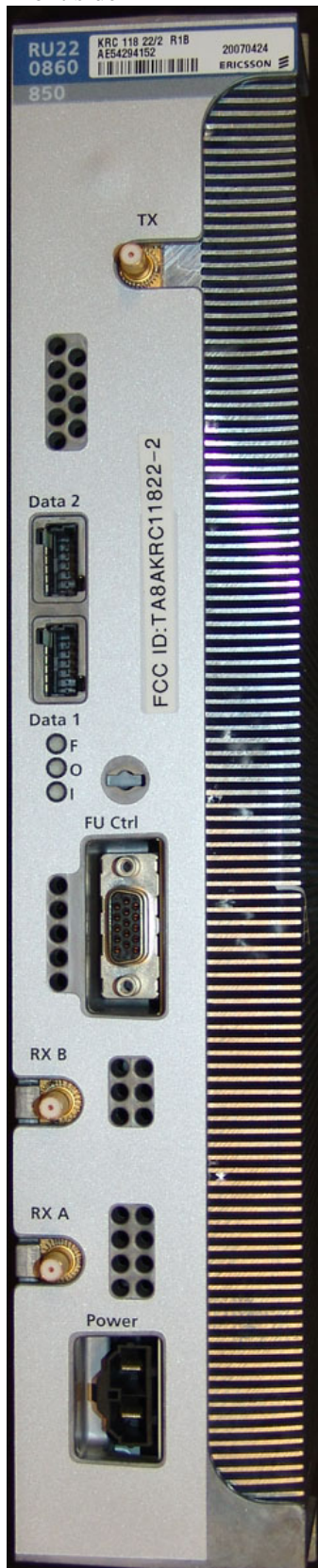
The frequency Error shall be within ± 0.05 PPM (44.07 Hz).

Complies?	Yes
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**Photos**

**Radio Unit KRC 118 22/2**

Front side

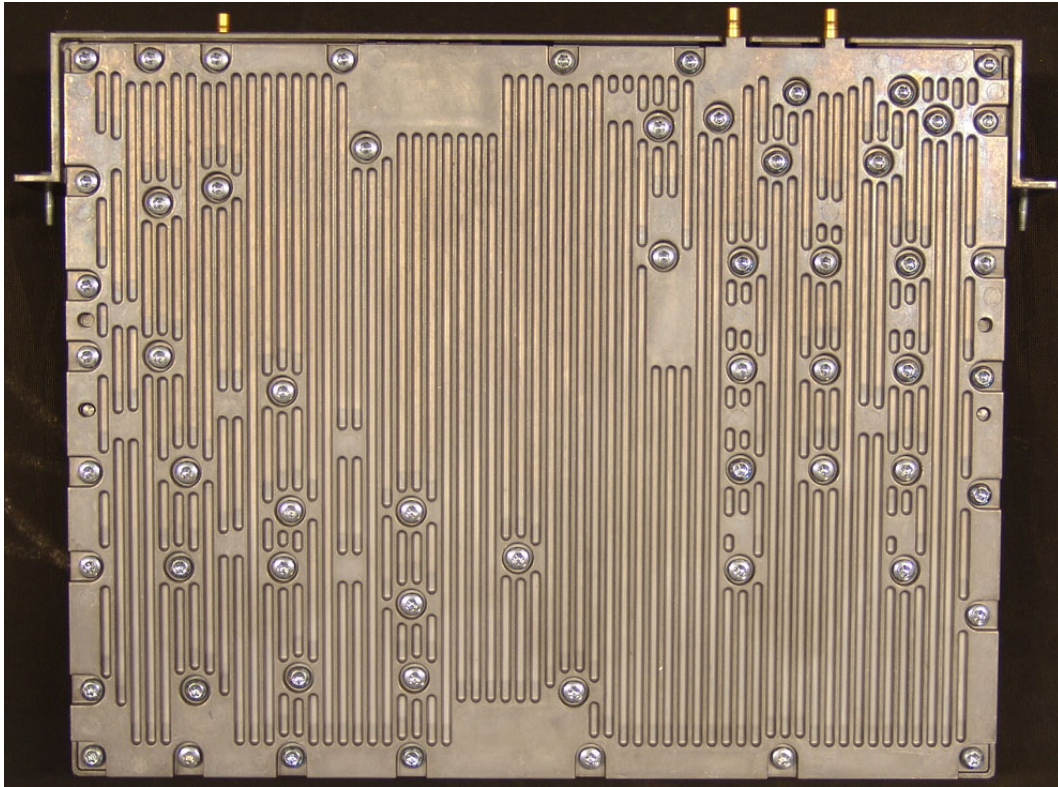


Rear side





Left side



Right side

