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Equipment authorization measurements on WCDMA Base Station 850 MHz Radio Unit with FCC ID: TA8AKRC11822-1 (8 appendices)

Test object

Transceiver unit KRC 118 22/1

Summary

Standard	Compliant	Appendix	Remarks
FCC CFR 47			
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: TA8AKRC11822-1

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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: 1x46 dBm (40W)
Multi carrier: 2x43 dBm (2x20W)

Nominal power voltage: -48 VDC

Tested channels

UARFCN	Frequency
4357	871.4 MHz
4407	881.4 MHz
4408	881.6 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 DPCCHs at 30 ksps (SF=128)

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

Multi carrier

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

Test model 5: 30 DCHPs 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 RBS 3206 cabinet powered with -48 VDC. The RBS model was selected to represent worst case.

The RU units were activated as Single Carrier 3x1 (1x46 dBm) and Multi Carrier 3x2 (2x43 dBm). The RF output power ports were terminated with 50 ohm loads.

The RU units were allocated to the following UARFCN:

Single Carrier:

RU	1	2	3
Cell	1	2	3
Downlink	4357 (871.4 MHz)	4407 (881.4 MHz)	4458 (891.6 MHz)
Uplink	4132 (826.4 MHz)	4182 (836.4 MHz)	4233 (846.6 MHz)
Test model	1	5	1

Multi Carrier:

RU	1		2		3	
Cell	1	2	3	4	5	6
Downlink	4357 (871.4 MHz)	4407 (881.4 MHz)	4408 (881.6 MHz)	4458 (891.6 MHz)	4408 (881.6 MHz)	4458 (891.6 MHz)
Uplink	4132 (826.4 MHz)	4182 (836.4 MHz)	4183 (836.6 MHz)	4233 (846.6 MHz)	4183 (836.6 MHz)	4233 (846.6 MHz)
Test model	5	1	5	1	1	5

Test model 1: 16 DPCHs at 30 kbps (SF=128)

Test model 5: 6 DHCPs at 30 kbps (SF=128) and 2 HS-PDSCHs at 240 kbps (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: 2006-06-05

**Manufacturer's representative**

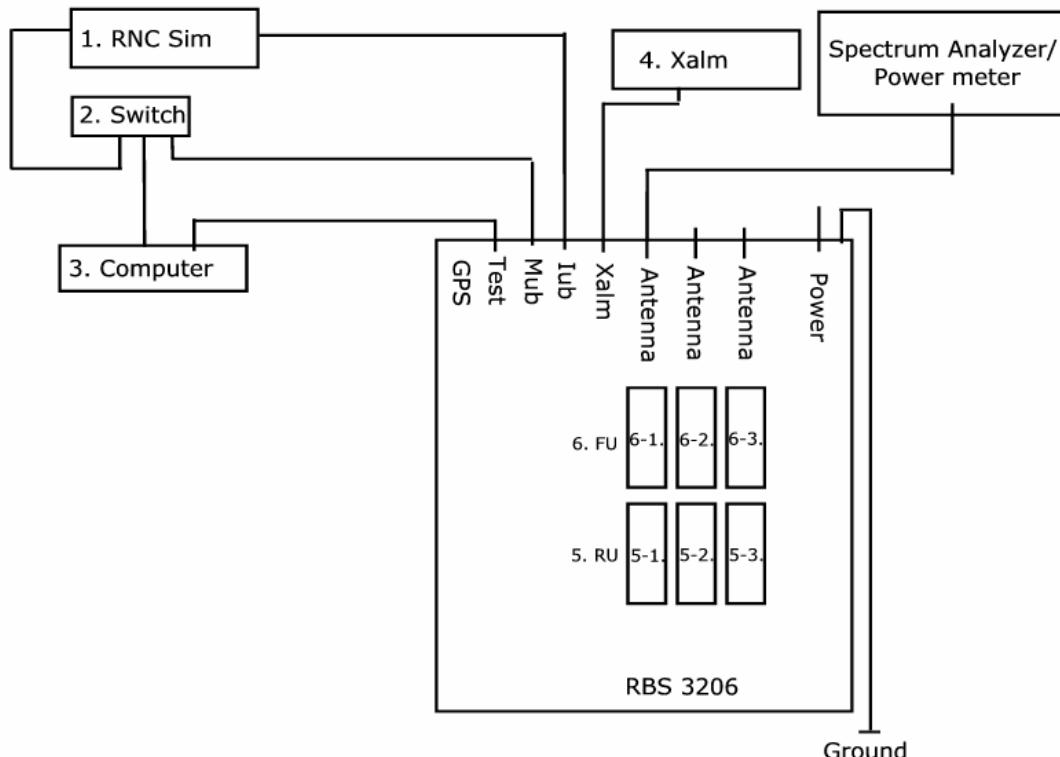
Larry Lindström, Ericsson AB

Test engineers

Stefan Larsson, Jonas Bremholt and Jörgen Wassholm

Test witnesses

Larry Lindström, Christer Gustavsson and Thomas Odén, Ericsson AB

Test set-up, conducted measurements

RBS 3206: Product number: 3/BFE 401 1012 R1A, Serial No: A534716880 with software CXP 901 0809/1 rev. P30AG. More information about the RBS hardware units are shown in SP document F610687-H.

1. RNC Sim CES 4780BA Mini-sim #53, Asset ID: ETE 212119
2. Switch, Netgear Ethernet switch DS108
3. Computer, SunBlade, Asset ID: ETE-203521
4. Xalm unit ZHA 901 01/3, Serial No: TE72314306
- 5-1. KRC 118 22/1 Rev. R1F, Serial No: AE52710603 (FCC ID: TA8AKRC11822-1)
- 6-1. KRC 118 21/1 Rev. R1D/A, Serial No: A400318914

Interfaces:

Power, -48 VDC

Iub, configured as T1 by CBU, shielded multi-wire with RJ-45 connector

Mub, shielded multi-wire with RJ-45 connector

Test, shielded multi-wire with RJ-45 connector

Xalm, shielded multi-wire with RJ-45 connector

GPS, not supported

Type of port:

DC power

Telecom

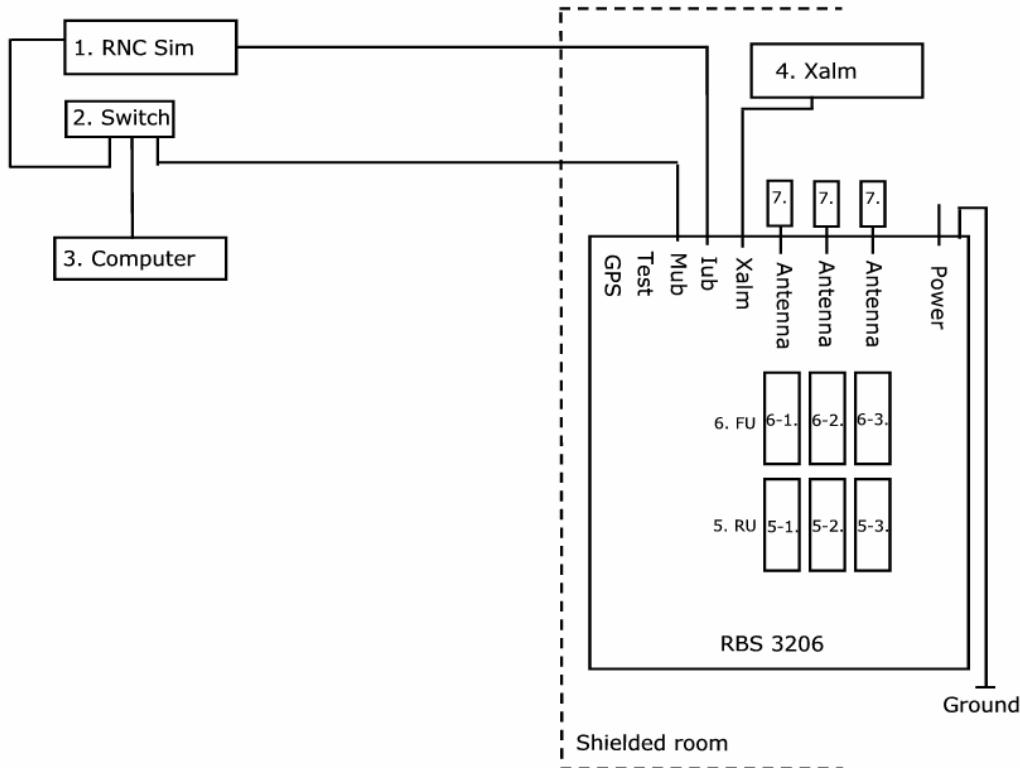
Test purpose

Test purpose

Signal

Signal

Test set-up, radiated measurements



RBS 3206: Product number: 3/BFE 401 1012 R1A, Serial No: A534716880 with software CXP 901 0809/1 P30AG. More information about the RBS hardware units are shown in SP document F610687-H.

1. RNC Sim 4780 DA, mini-SIM#33, Asset ID ETE-203565
2. Switch, Netgear Ethernet switch DS108
3. Computer, SunBlade, Asset ID: ETE-203521
4. Xalm unit ZHA 901 01/3, Serial No: TE72314306
5. KRC 118 22/1 (FCC ID: TA8AKRC11822-1)
 - 5-1 Rev. R1F, Serial No: AE52710603
 - 5-2 Rev. R1D/A, Serial No: AE52372656
 - 5-3 Rev. R1D/A, Serial No: AE52362800
6. KRC 118 21/1
 - 6-1 Rev. R1D/A, Serial No: A400318914
 - 6-2 Rev. R1D/A, Serial No: A400318917
 - 6-3 Rev. R1B, Serial No: A400271788
7. 50 ohm terminator

Interfaces:

Power, -48 VDC

Iub, configured as T1 by CBU, shielded multi-wire with RJ-45 connector

Mub, shielded multi-wire with RJ-45 connector

Test, no cable attached

Xalm, shielded multi-wire with RJ-45 connector

GPS, not supported

Type of port:

DC power

Telecom

Test purpose

Test purpose

Signal

Signal

RF power output measurements according to 47 CFR 2.1046

Date	Temperature	Humidity
2006-06-19	22 °C ± 3 °C	52 % ± 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/analyizer	2007-03	503 144
Boonton Power sensor 56518-S/4	2007-03	503 145
Multimeter Fluke 87	2006-11	502 190
Testo 610, Temperature and humidity meter	2006-12	502 658

Measurement uncertainty: 0.5 dB

Results

Single carrier

Rated output power level after FU unit (maximum): 1x46 dBm

Test conditions	Transmitter power (dBm)		
	Average		
T _{nom} 23 °C/ V _{nom} -48 V DC	Frequency 871.4	Frequency 881.4	Frequency 891.6
QPSK	46.1	46.3	46.1
16QAM	46.1	46.3	46.1

Multi carrier

Rated output power level after FU unit (maximum): 2x43 dBm

Test conditions	Transmitter combined power (dBm)	
	Average	
T _{nom} 23 °C/ V _{nom} -48 V DC	Frequencies 871.4 + 881.4 MHz	Frequencies 881.6 + 891.6MHz
QPSK	46.0	46.0
16QAM	45.9	46.0

Limits

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
2006-06-16	23 °C ± 3 °C	32 % ± 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	2006-07	503 738
Testo 610, Temperature and humidity meter	2006-12	502 658

Measurement uncertainty: 3.7 dB**Results**

The results are shown in appendix 3.1

QPSK

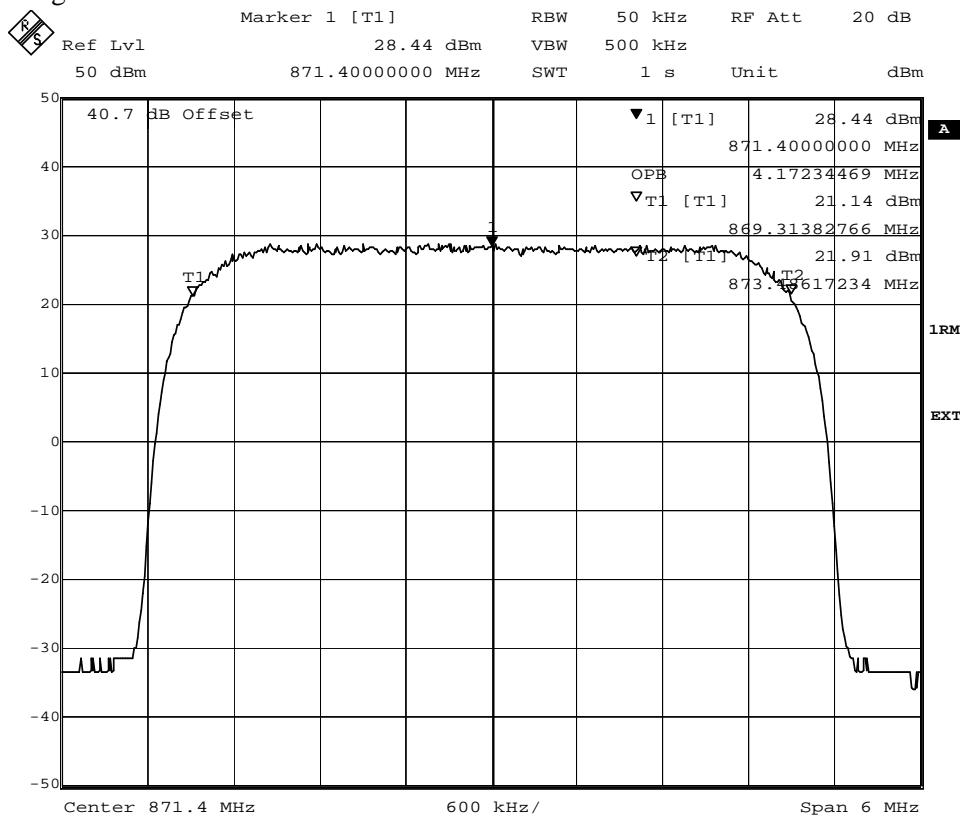
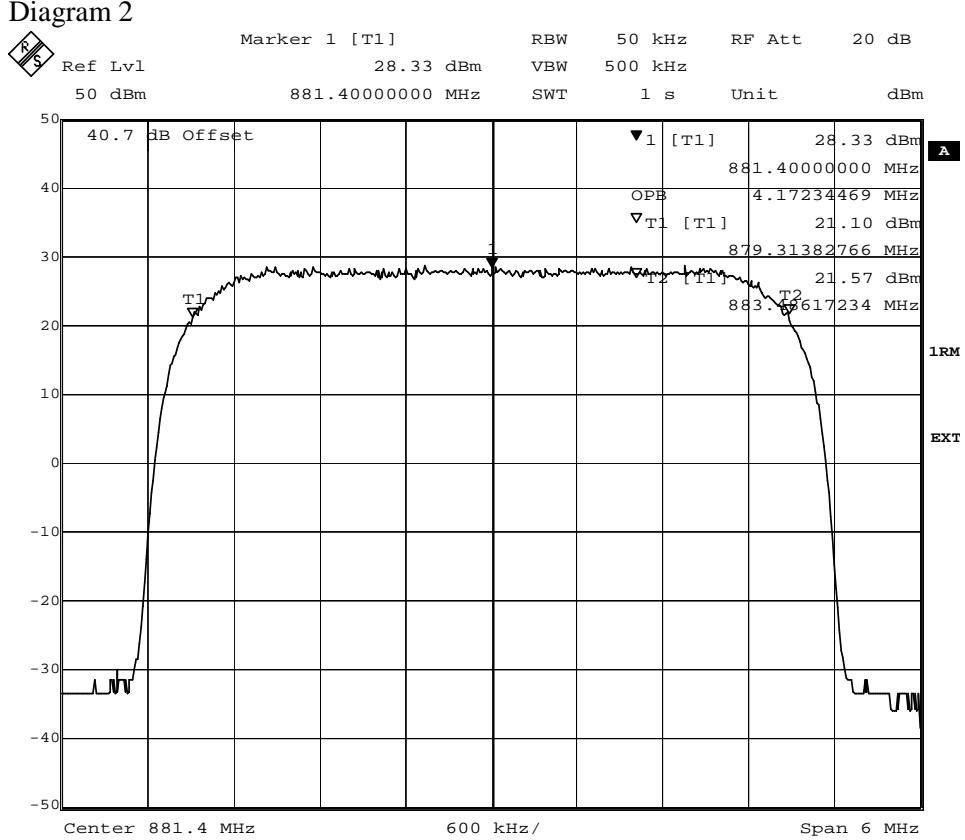
	Frequency	OBW
Diagram 1:	871.4 MHz	4.2 MHz
Diagram 2:	881.4 MHz	4.2 MHz
Diagram 3:	891.6 MHz	4.2 MHz

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

FCC ID: TA8AKRC11822-1

Appendix 3.1

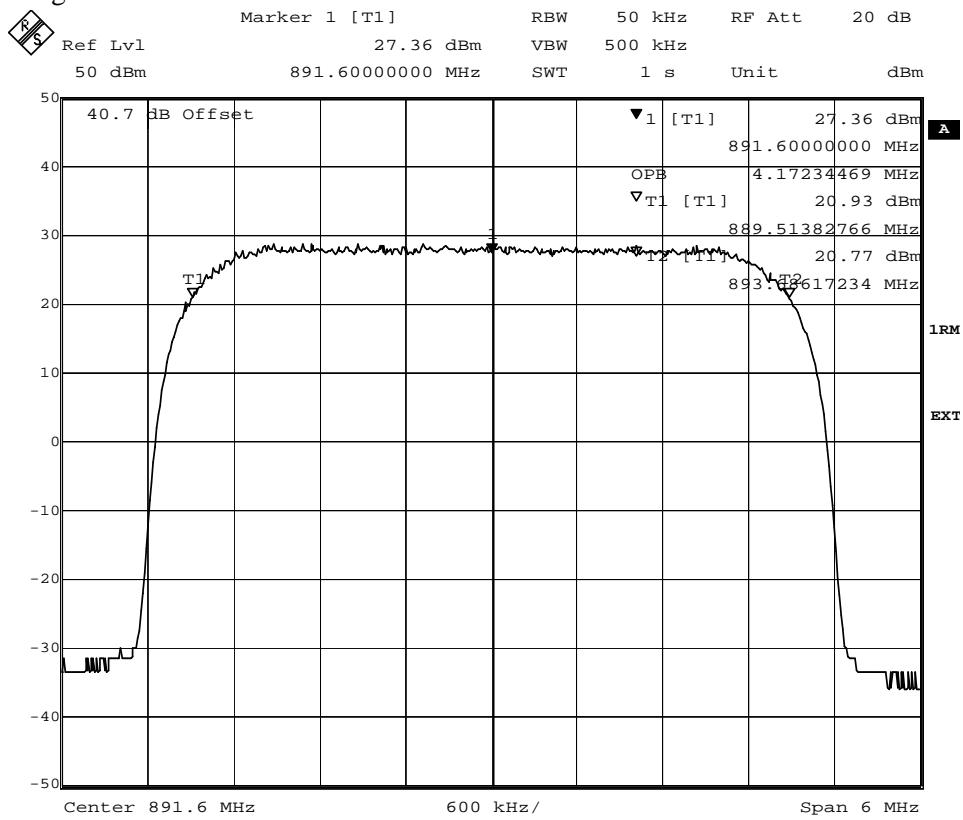
Diagram 1**Diagram 2**

FCC ID: TA8AKRC11822-1

Appendix 3.1

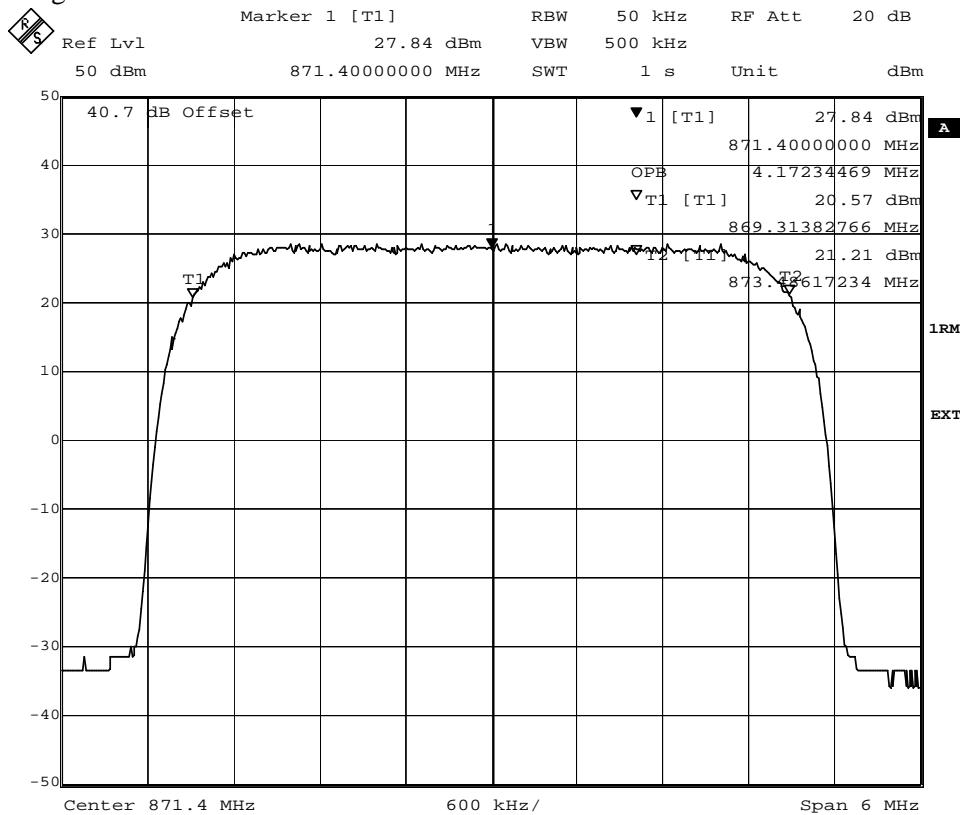


Diagram 3



Date: 16.JUN.2006 14:10:30

Diagram 4



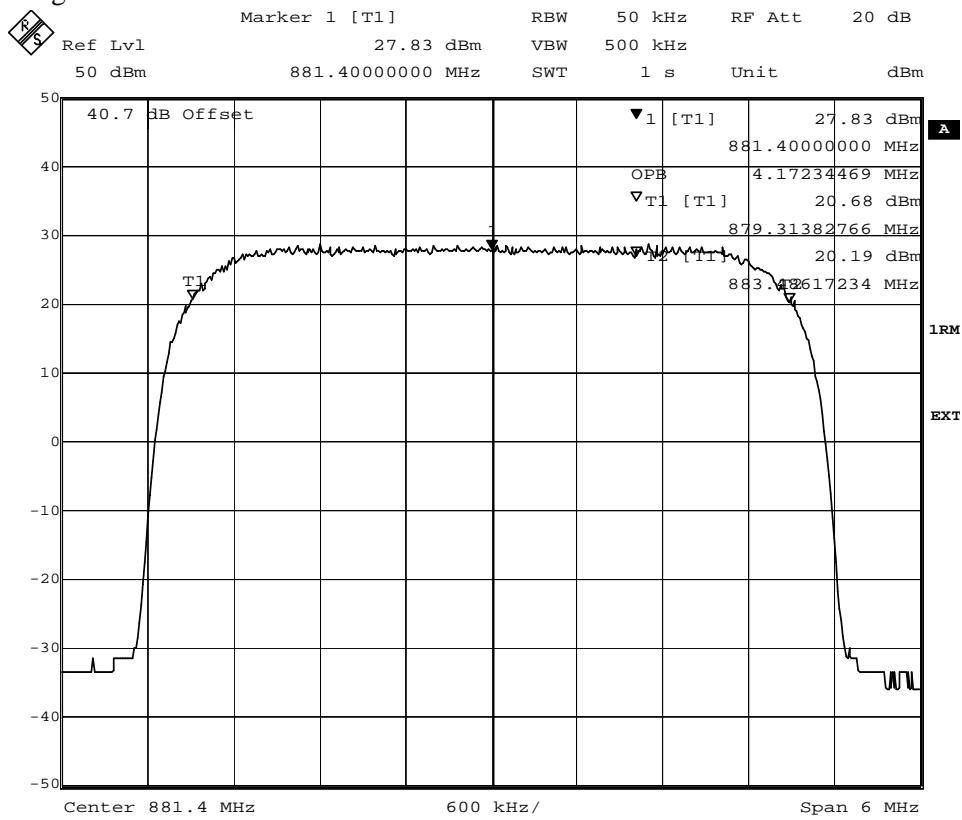
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FCC ID: TA8AKRC11822-1

Appendix 3.1

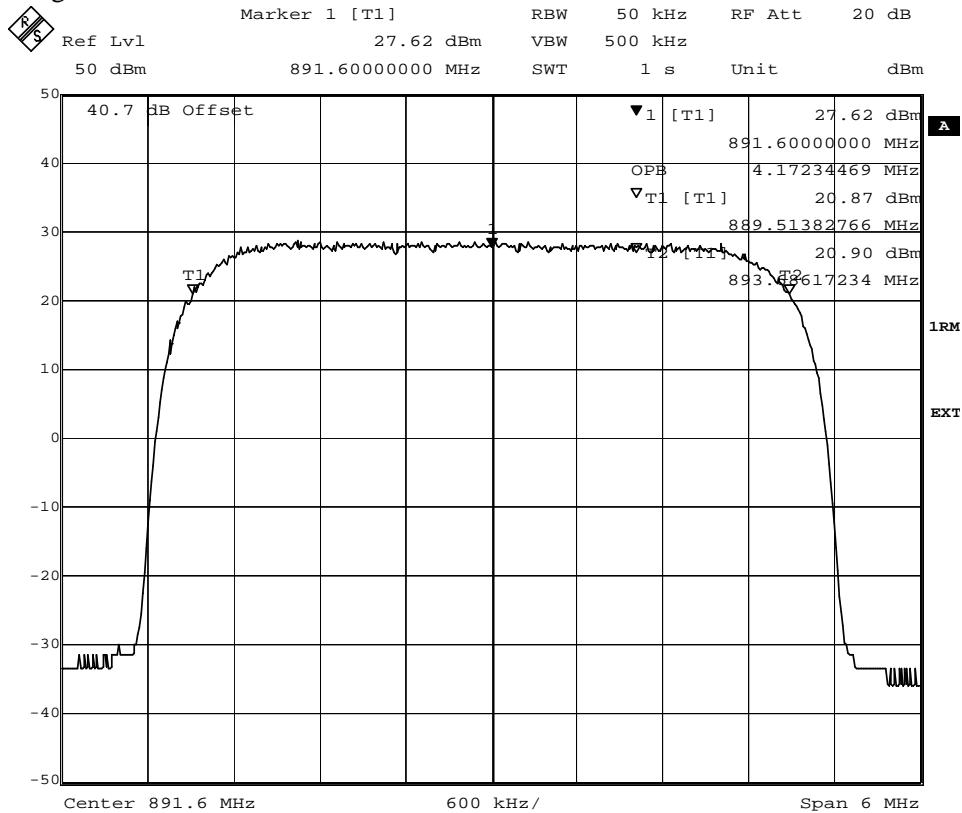


Diagram 5



Date: 15.JUN.2006 19:48:22

Diagram 6



Date: 16.JUN.2006 14:07:49

Band edge measurements according to 47 CFR 2.1051

Date	Temperature	Humidity
2006-06-19	22 °C ± 3 °C	52 % ± 5 %
2006-06-20	23 °C ± 3 °C	54 % ± 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 average 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 1 MHz away from the band edges. 30 kHz is <1% of the Emission BW(4.25 MHz between the 26 dB points). The limit was adjusted with 1.5 dB to -14.5 dBm to compensate for the reduced bandwidth. A RBW of 50 kHz was used between 1 to 5 MHz away from the band edges. As the FCC rules specify a RBW of 1 MHz for measurements of emissions >1 MHz away from the band edges, the limit was adjusted with 13 dB to -26 dBm to compensate for the reduced measurement bandwidth. 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	2006-07	503 738
Testo 610, Temperature and humidity meter	2006-12	502 658

Measurement uncertainty: 3.7 dB**Results**

The results are shown in appendix 4.1

Single carrier

QPSK	16QAM
Diagram 1: 871.4 MHz	Diagram 3: 871.4 MHz
Diagram 2: 891.6 MHz	Diagram 4: 891.6 MHz

Multi carrier

QPSK	16QAM
Diagram 5: 871.4+881.4 MHz	Diagram 7: 871.4+881.4 MHz
Diagram 6: 881.6+891.6 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.

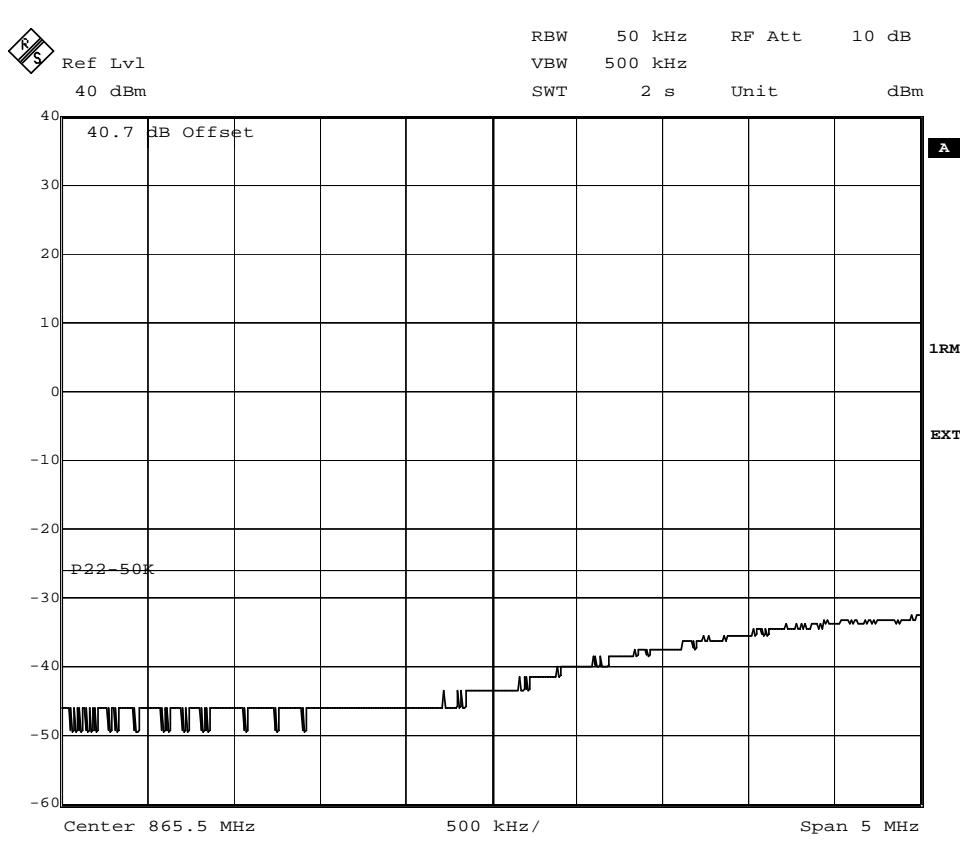
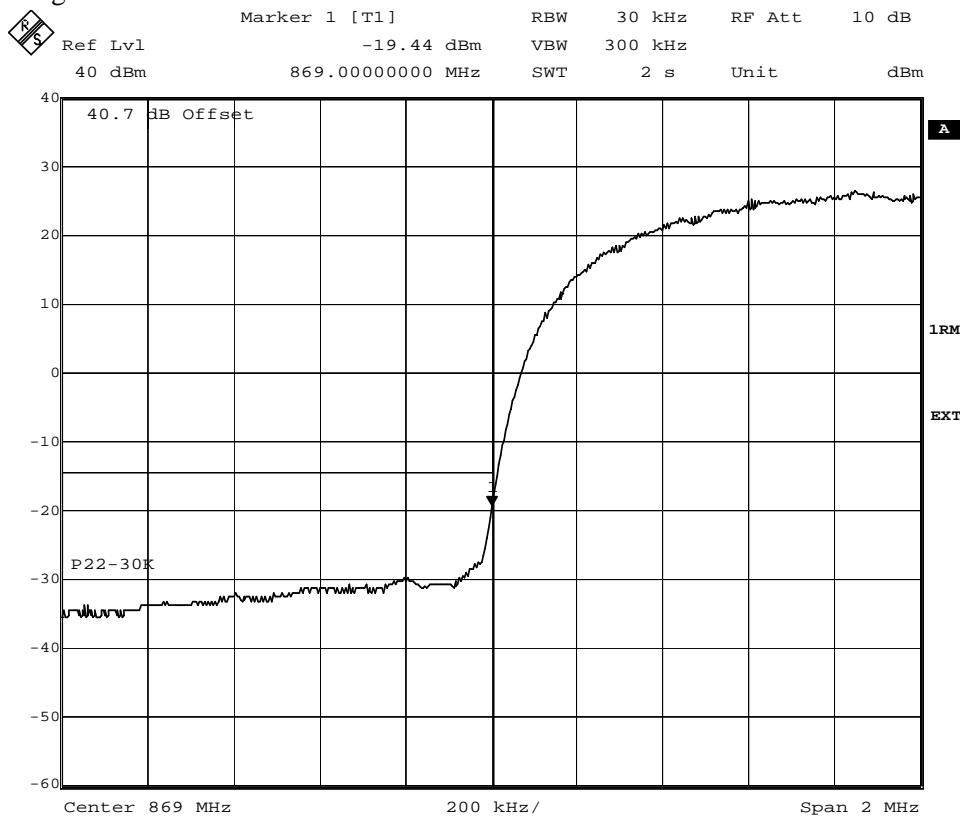
Complies?	Yes
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FCC ID: TA8AKRC11822-1

Appendix 4.1

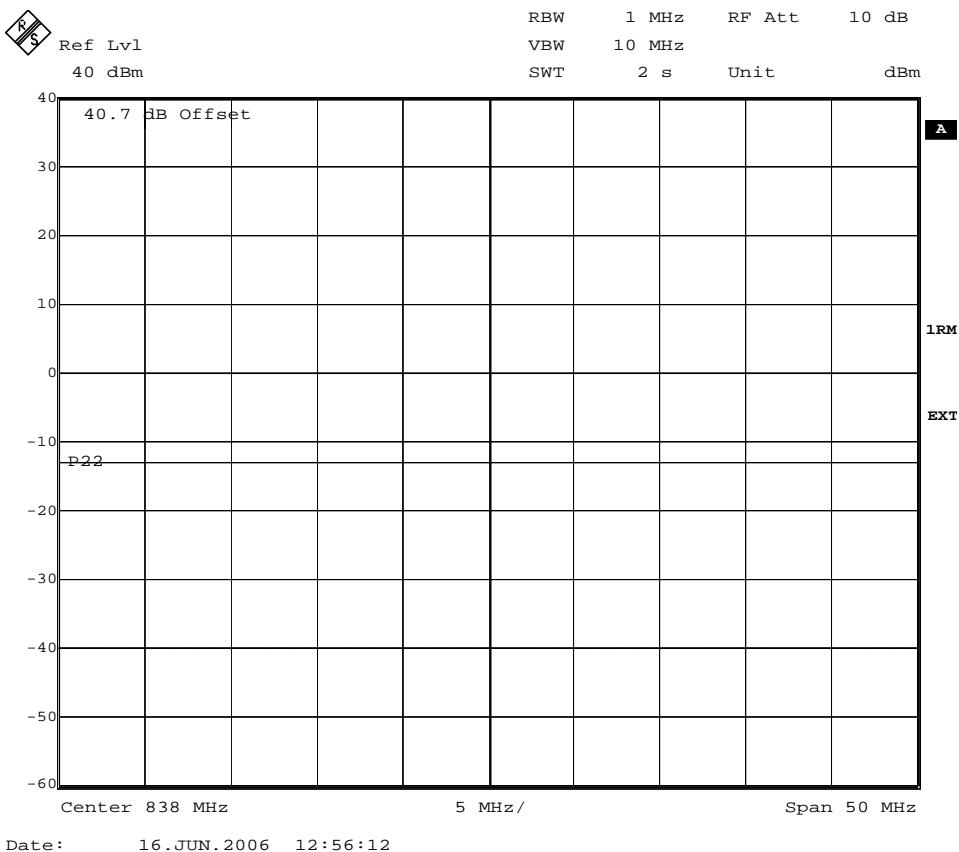


Diagram 1



FCC ID: TA8AKRC11822-1

Appendix 4.1



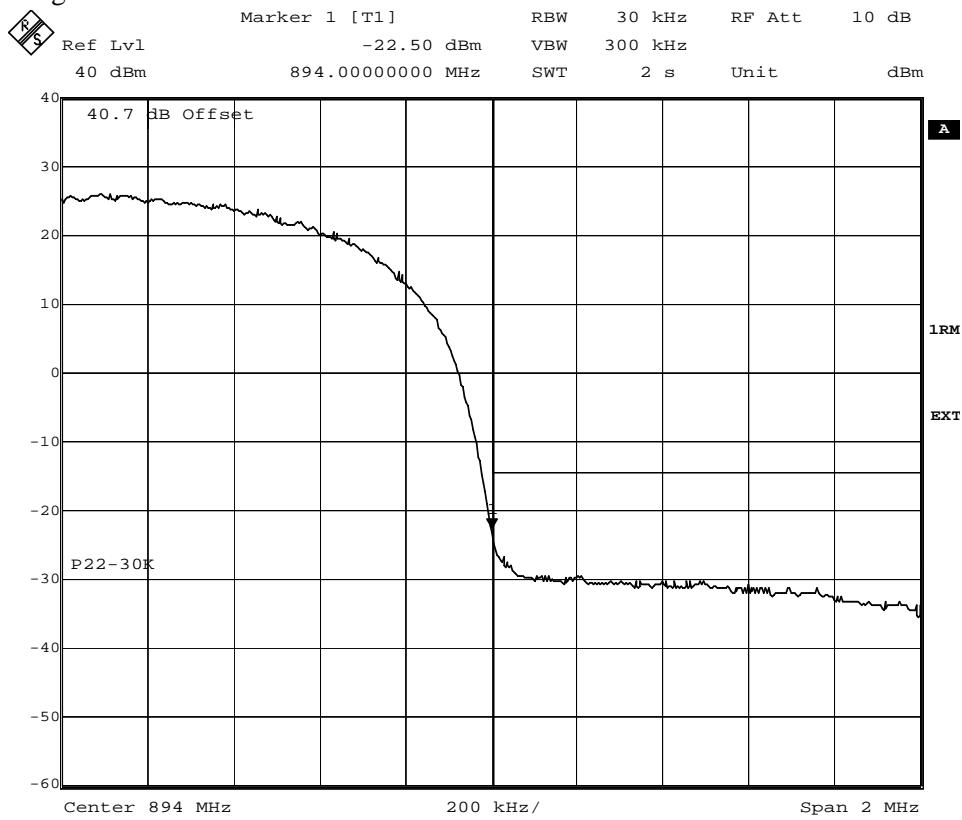
Date: 16.JUN.2006 12:56:12

The trace are on the grid at -40 dBm.

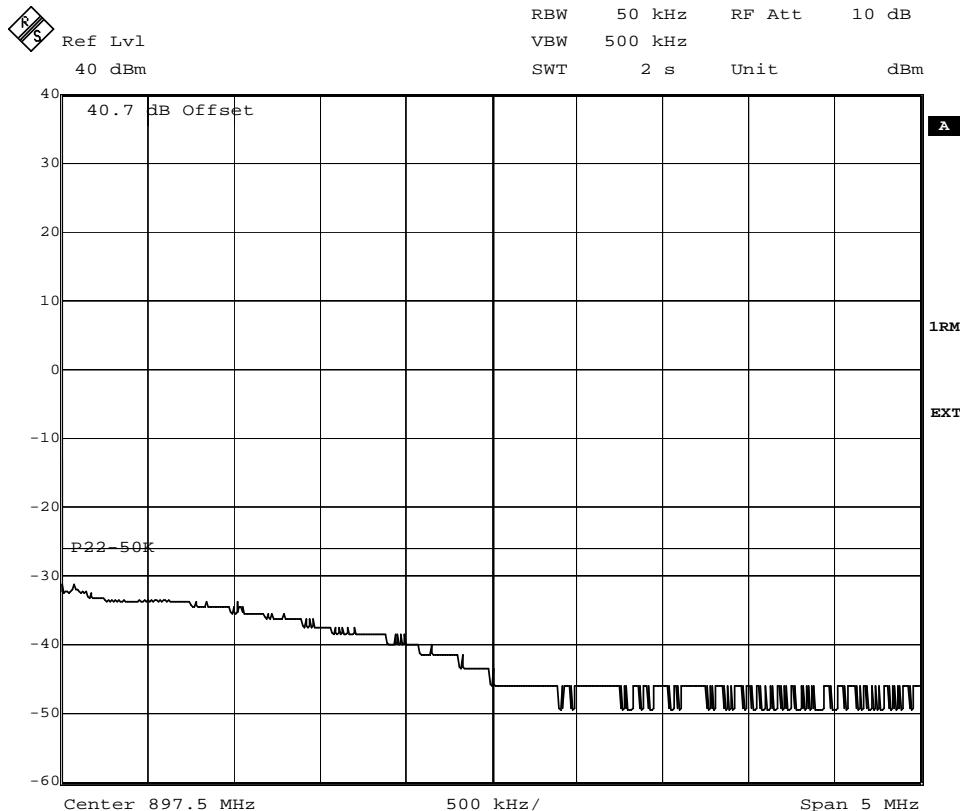
FCC ID: TA8AKRC11822-1

Appendix 4.1

Diagram 2



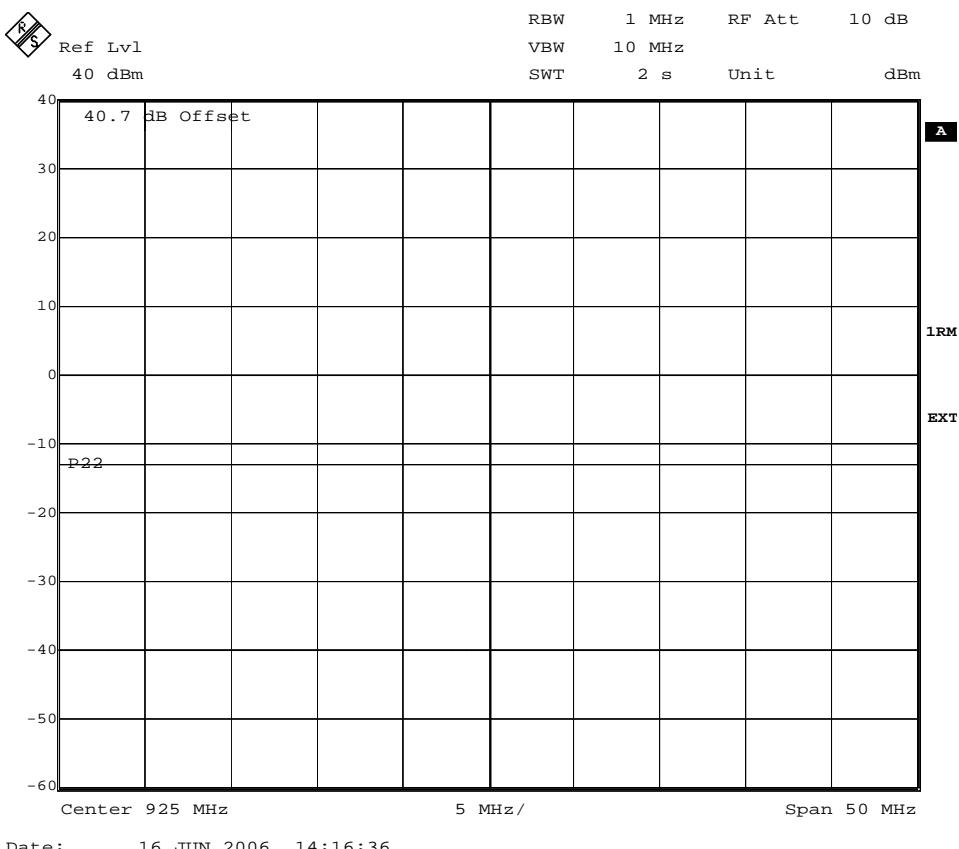
Date: 16.JUN.2006 14:15:40



Date: 16.JUN.2006 14:16:18

FCC ID: TA8AKRC11822-1

Appendix 4.1

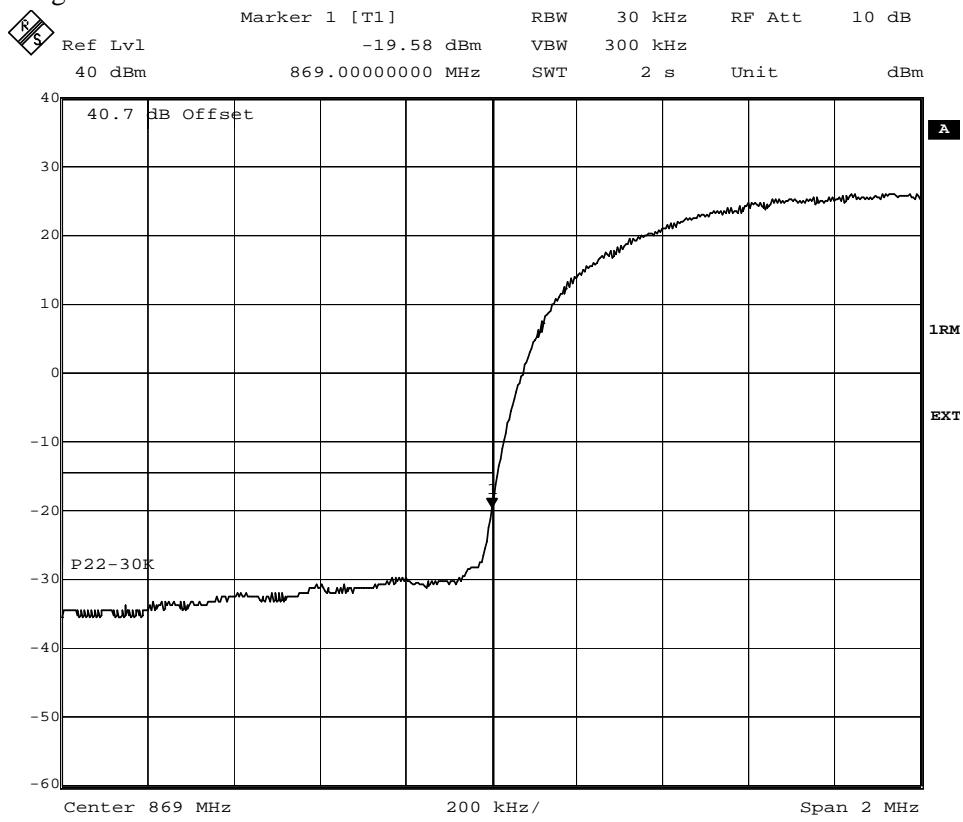


Date: 16.JUN.2006 14:16:36

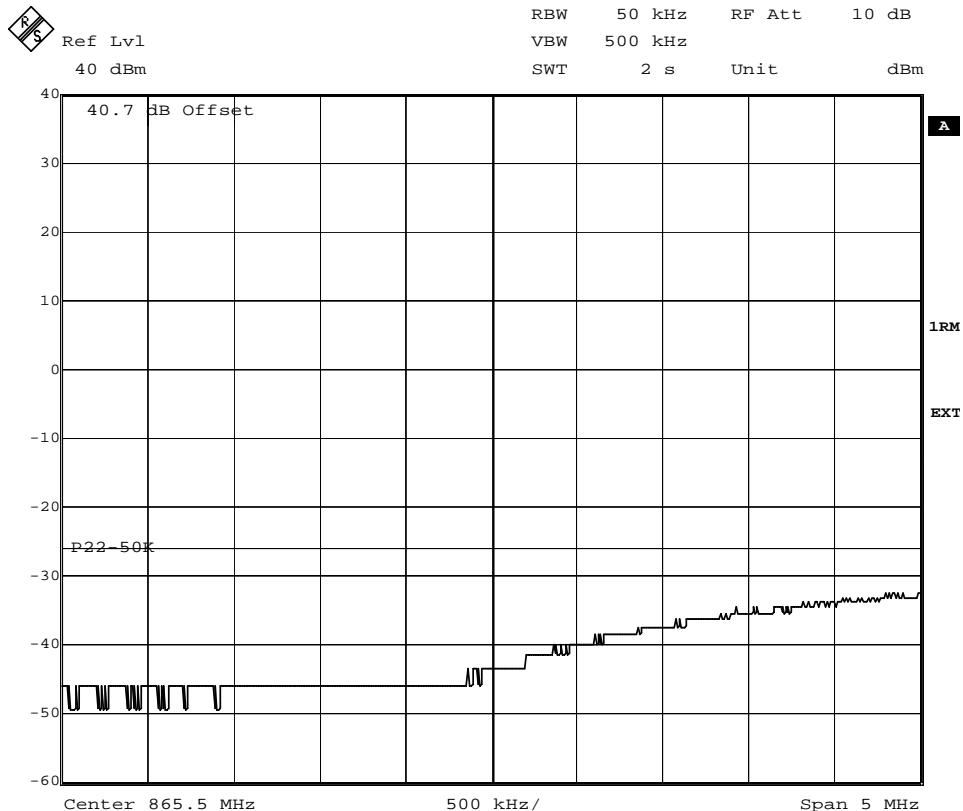
The trace are on the grid at -40 dBm.

FCC ID: TA8AKRC11822-1

Appendix 4.1

**Diagram 3**

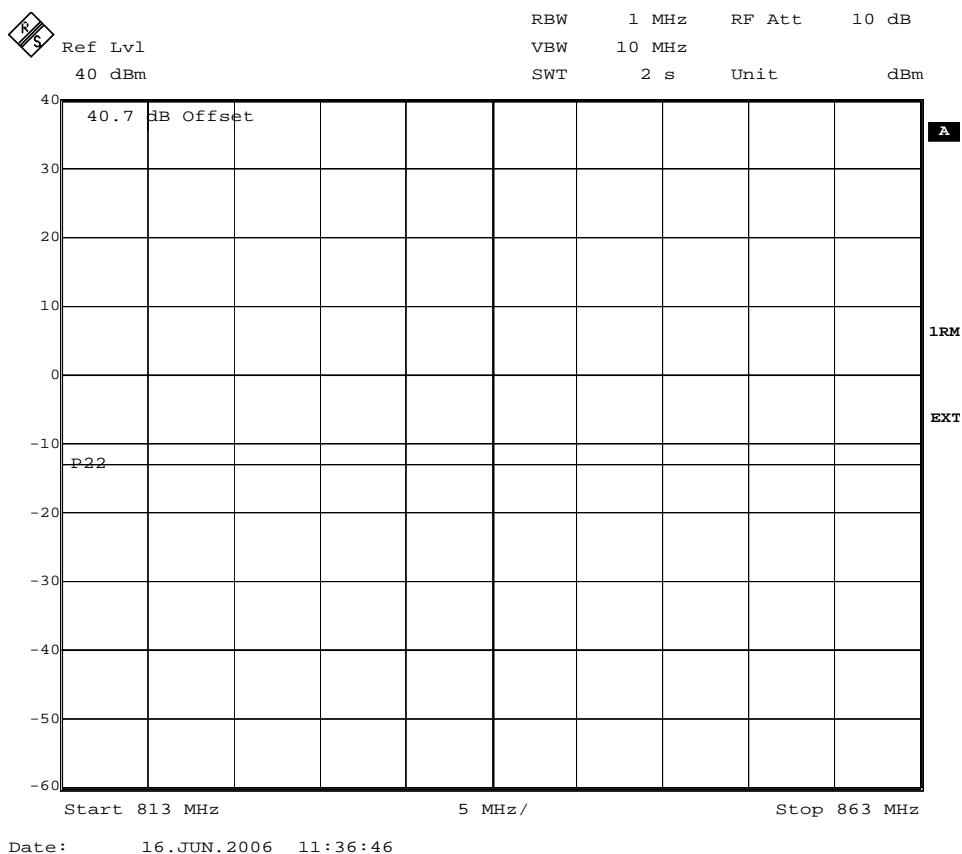
Date: 16.JUN.2006 11:34:31



Date: 16.JUN.2006 11:35:04

FCC ID: TA8AKRC11822-1

Appendix 4.1



Date: 16.JUN.2006 11:36:46

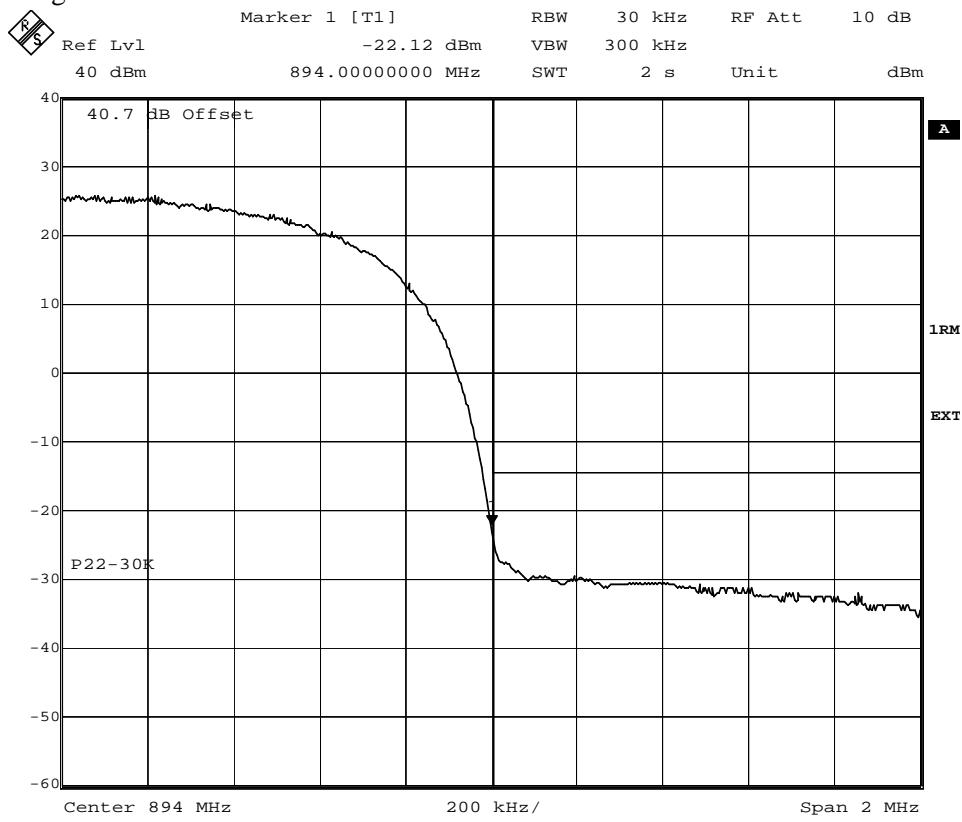
The trace are on the grid at -40 dBm.

FCC ID: TA8AKRC11822-1

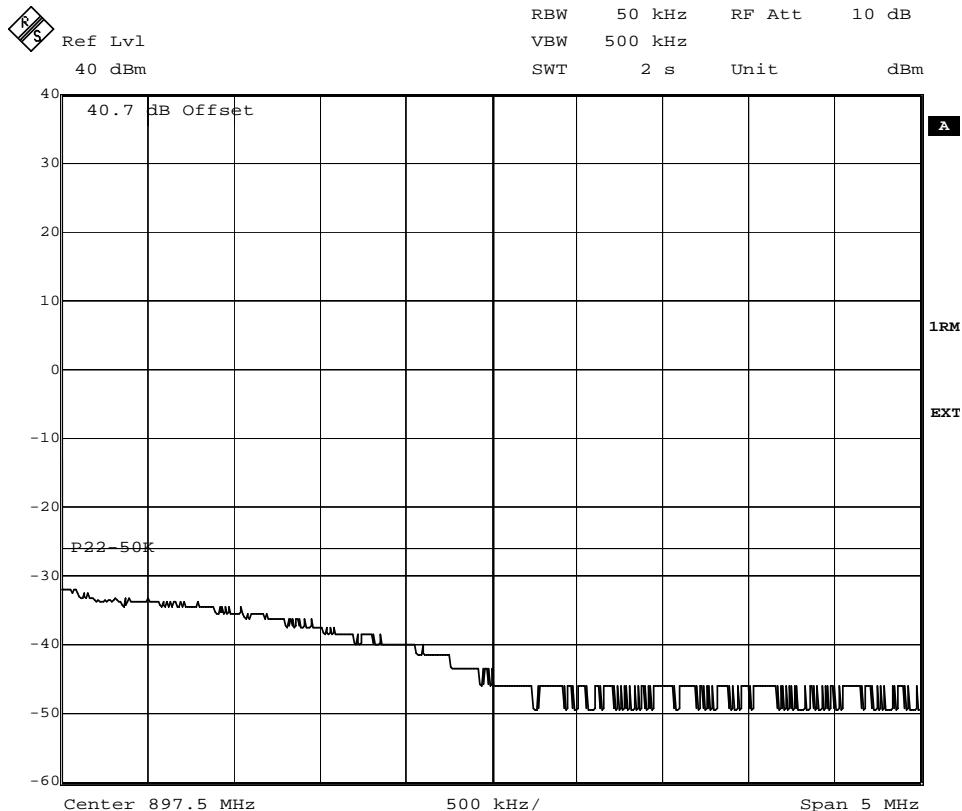
Appendix 4.1



Diagram 4



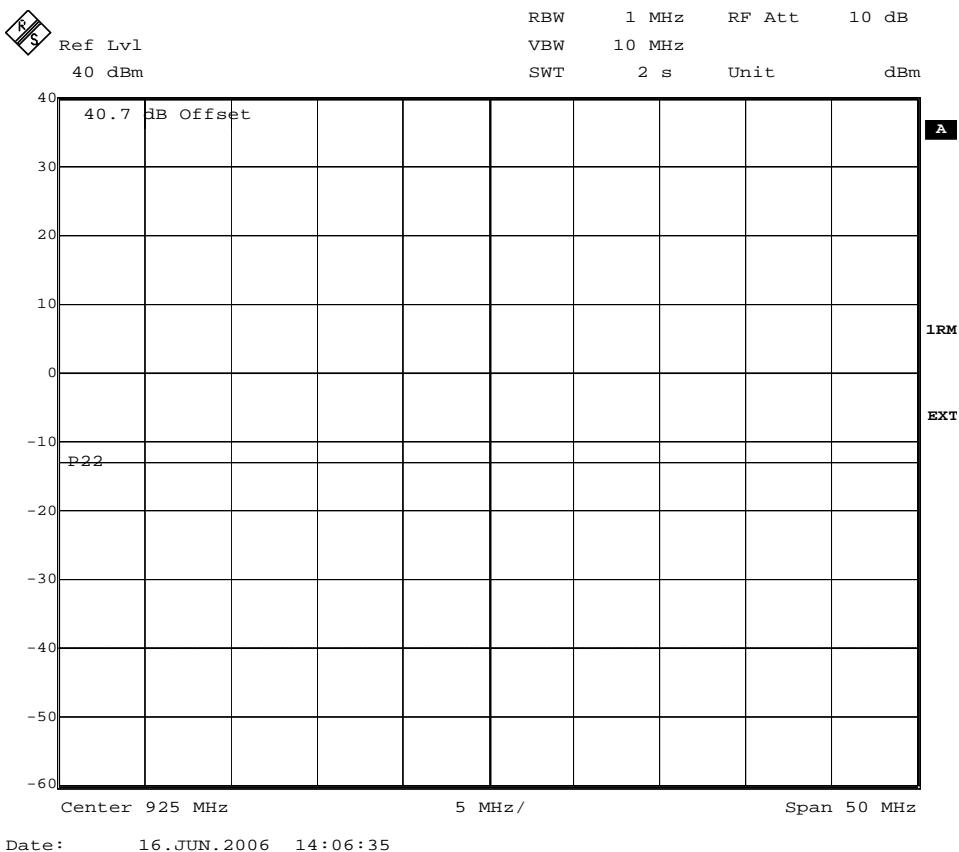
Date: 16.JUN.2006 14:05:44



Date: 16.JUN.2006 14:06:05

FCC ID: TA8AKRC11822-1

Appendix 4.1



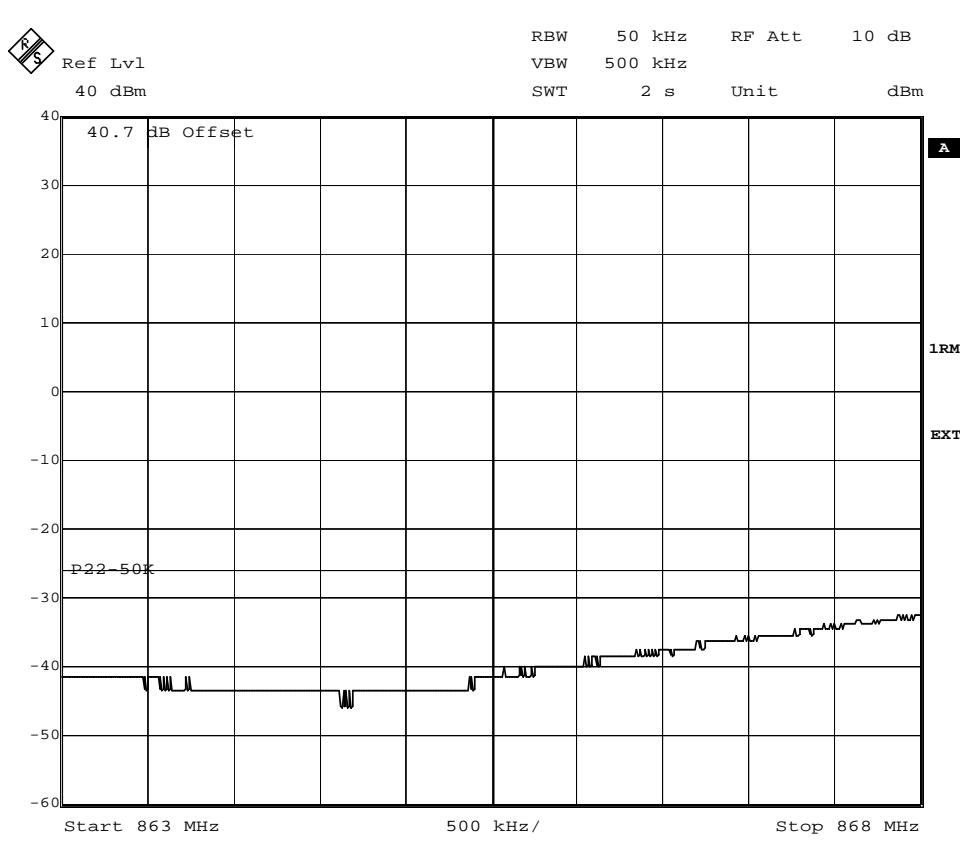
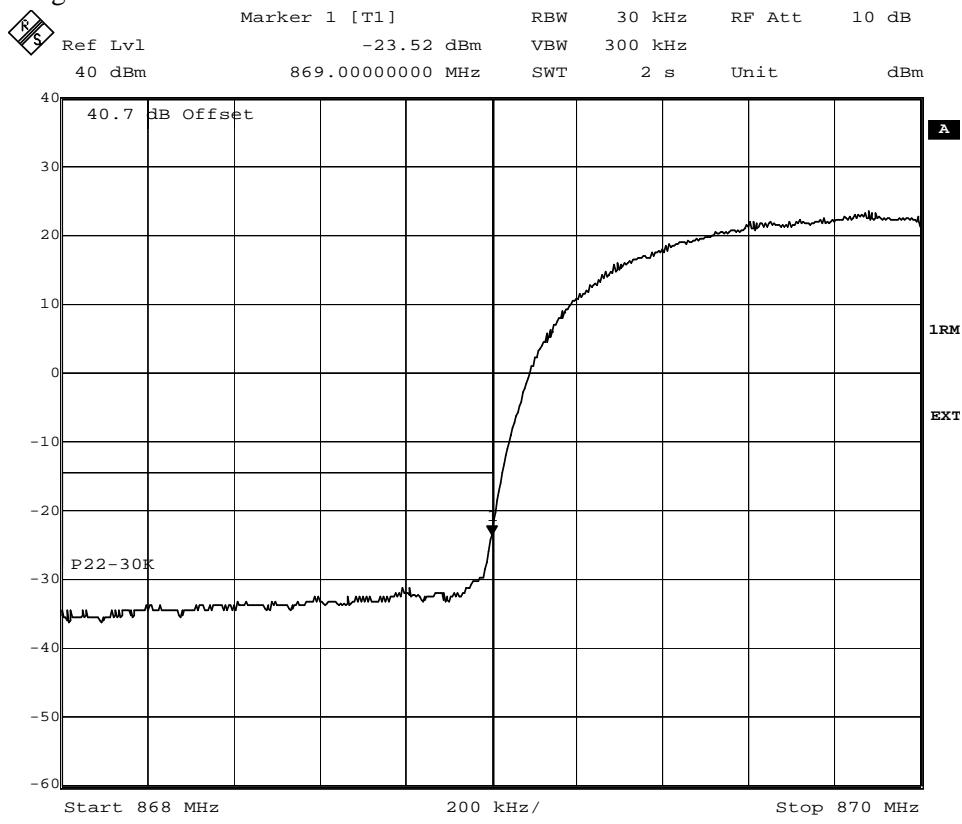
The trace are on the grid at -40 dBm.

FCC ID: TA8AKRC11822-1

Appendix 4.1

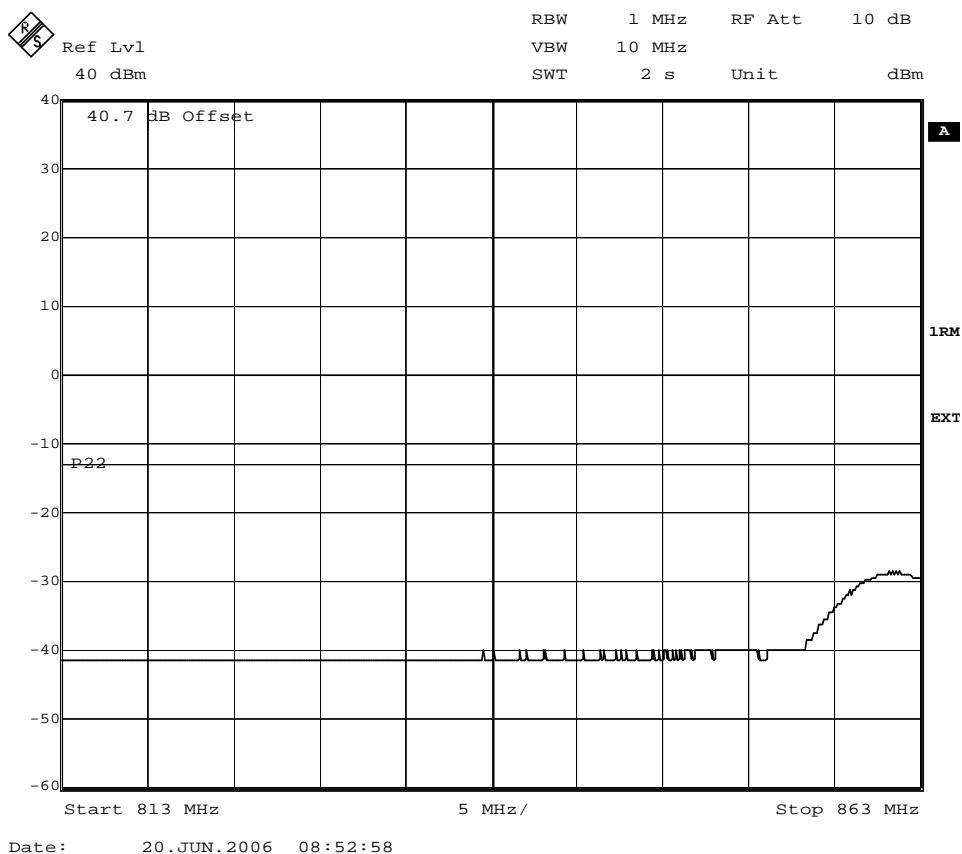


Diagram 5



FCC ID: TA8AKRC11822-1

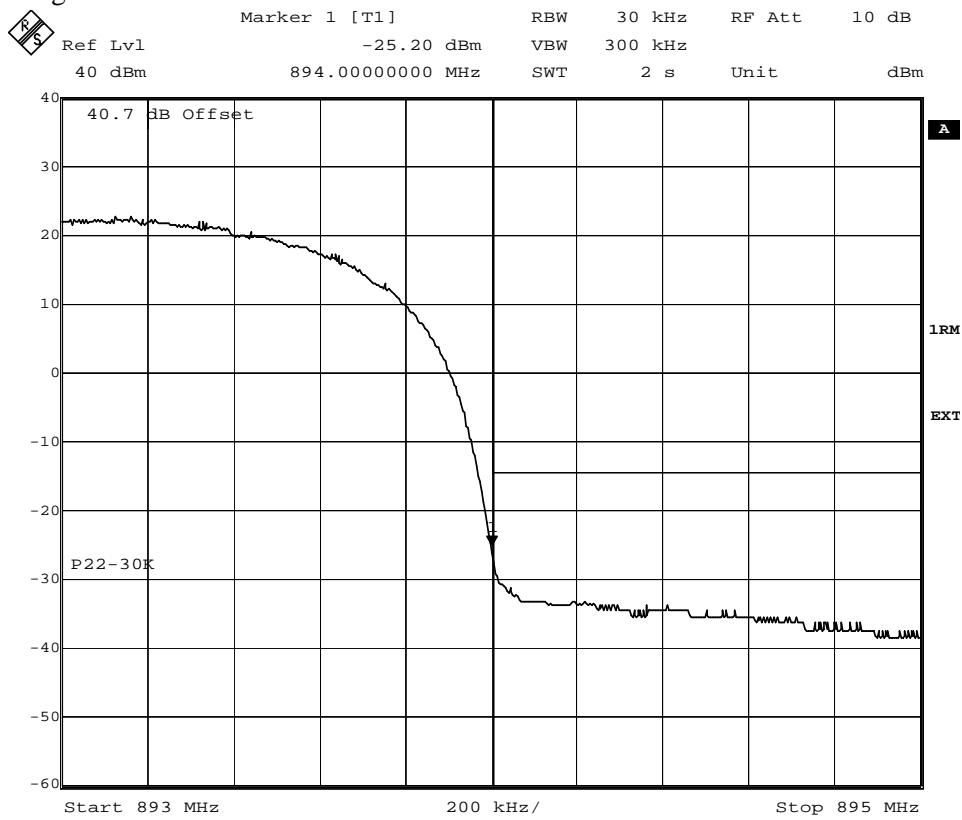
Appendix 4.1



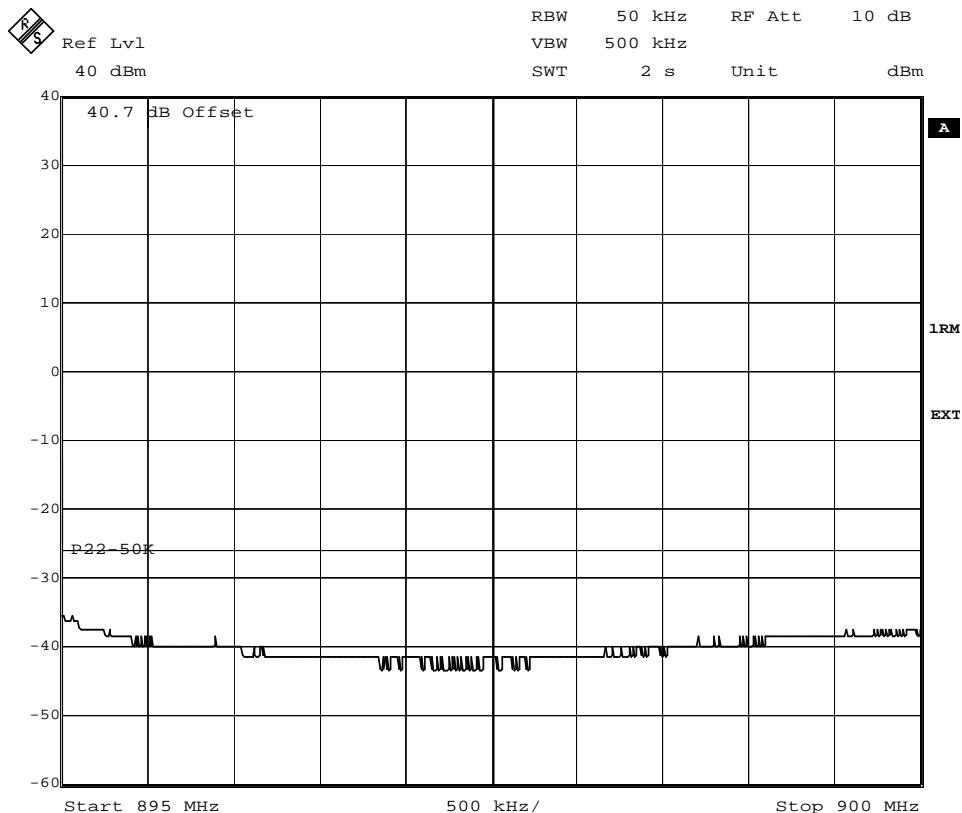
FCC ID: TA8AKRC11822-1

Appendix 4.1

Diagram 6



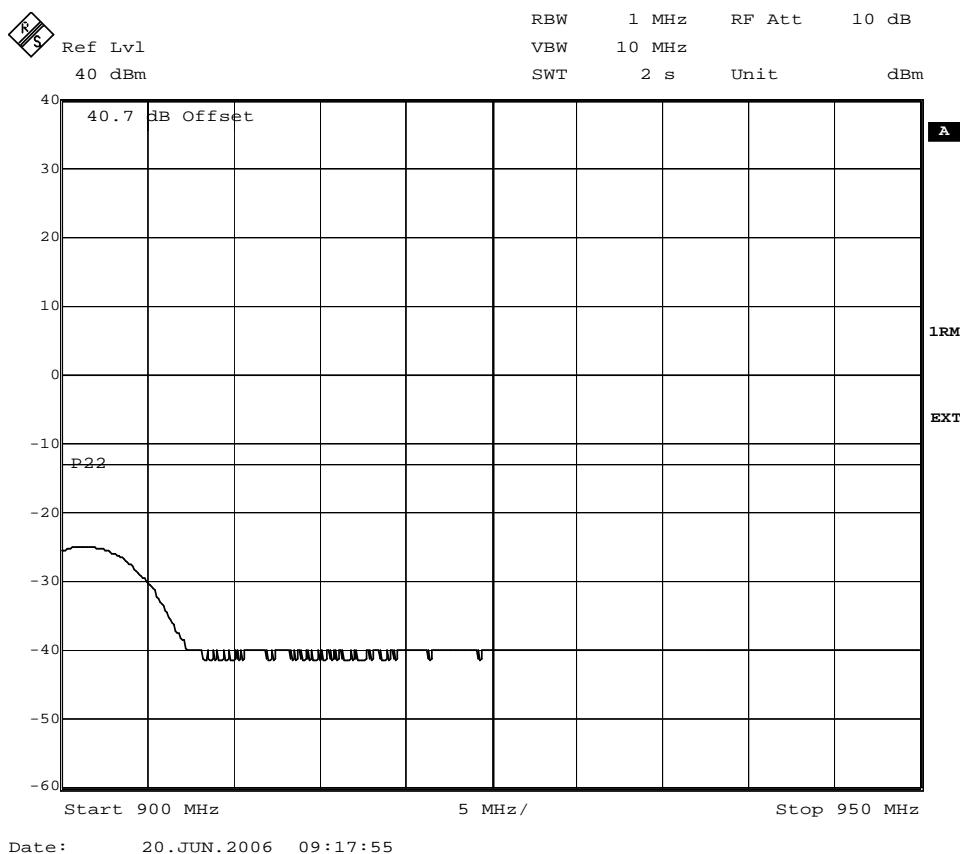
Date: 20.JUN.2006 09:16:56



Date: 20.JUN.2006 09:17:27

FCC ID: TA8AKRC11822-1

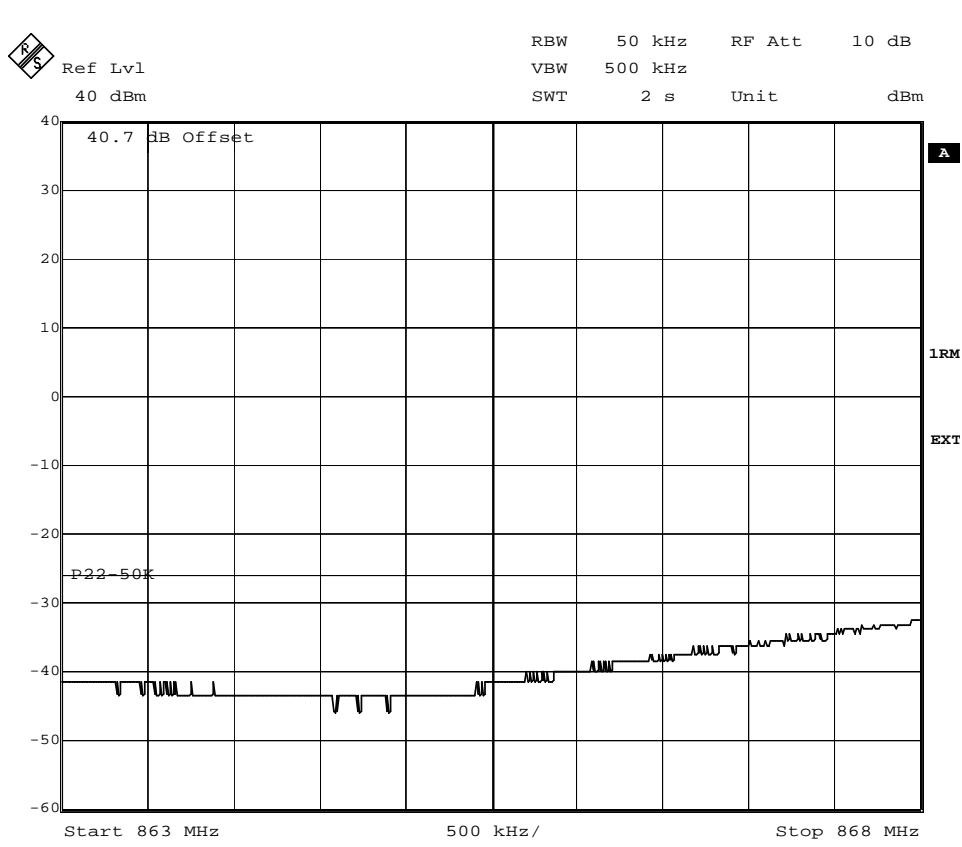
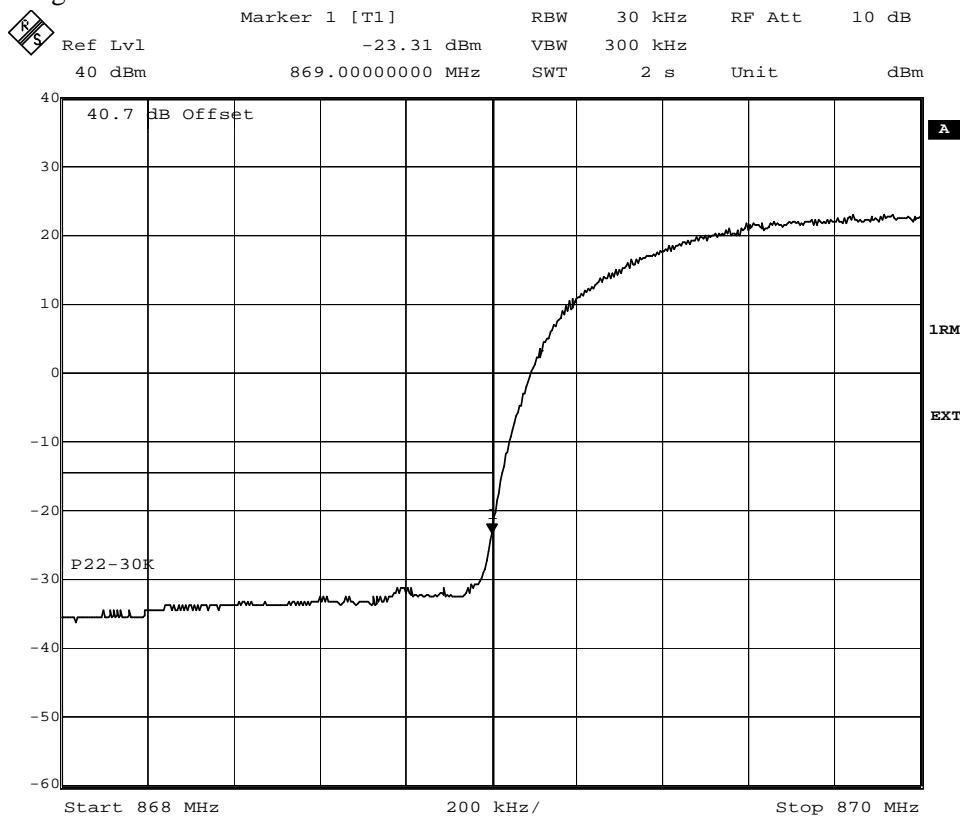
Appendix 4.1



FCC ID: TA8AKRC11822-1

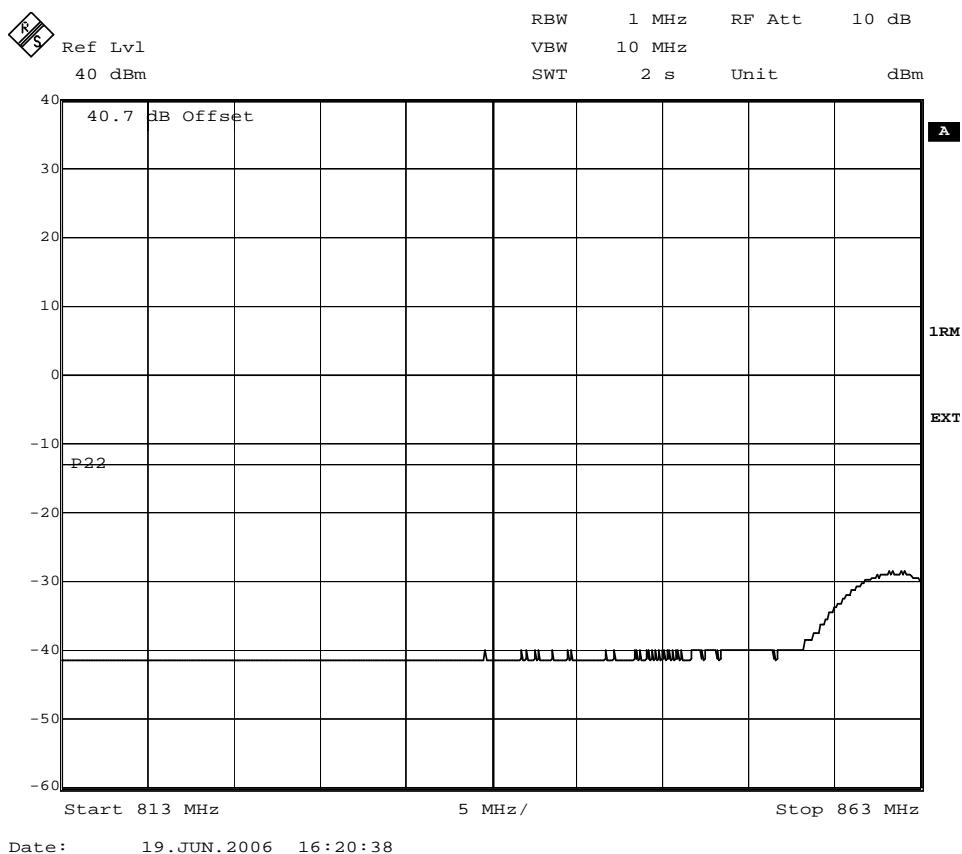
Appendix 4.1

Diagram 7



FCC ID: TA8AKRC11822-1

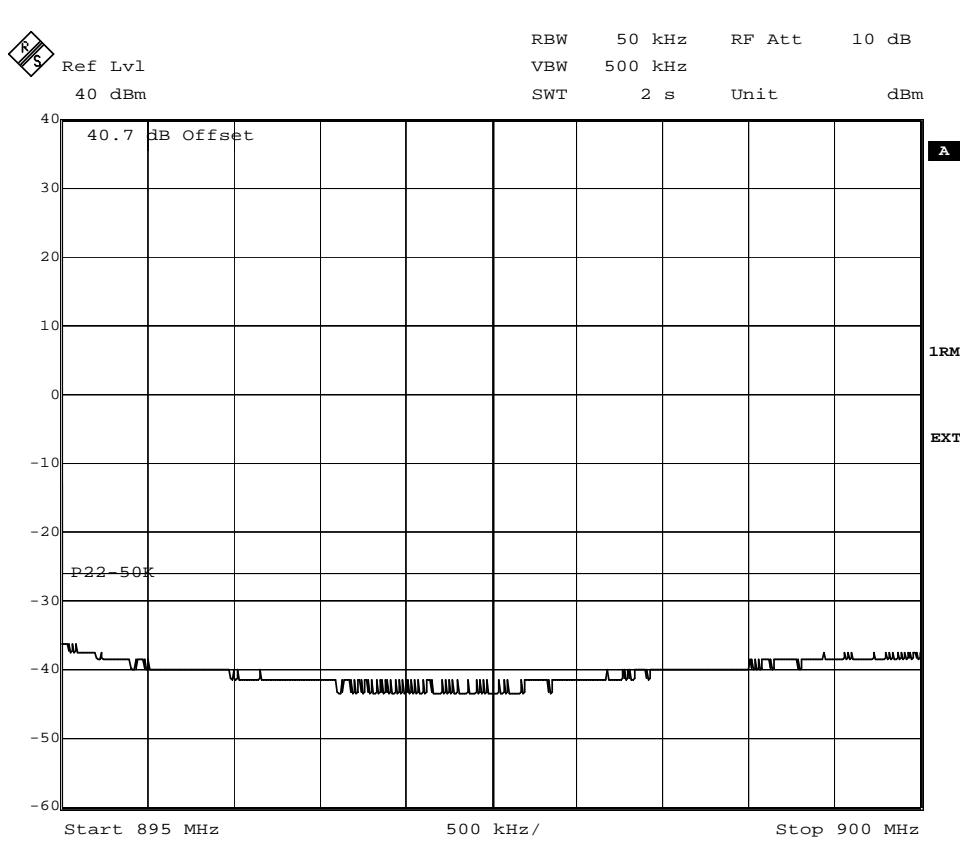
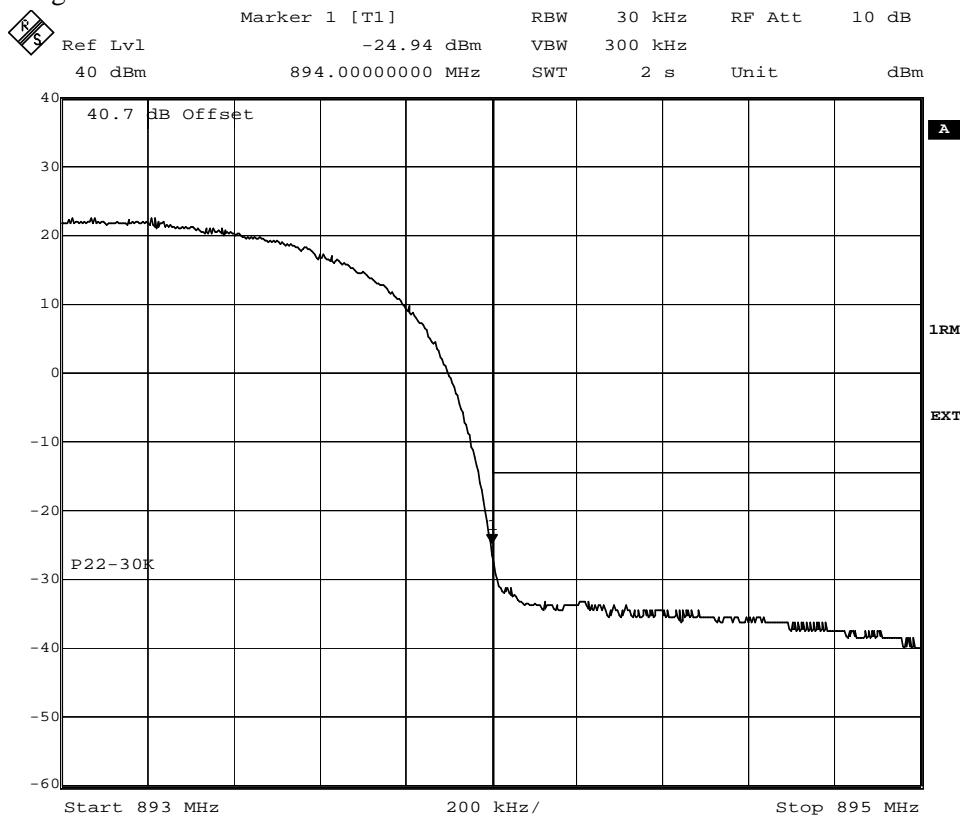
Appendix 4.1



FCC ID: TA8AKRC11822-1

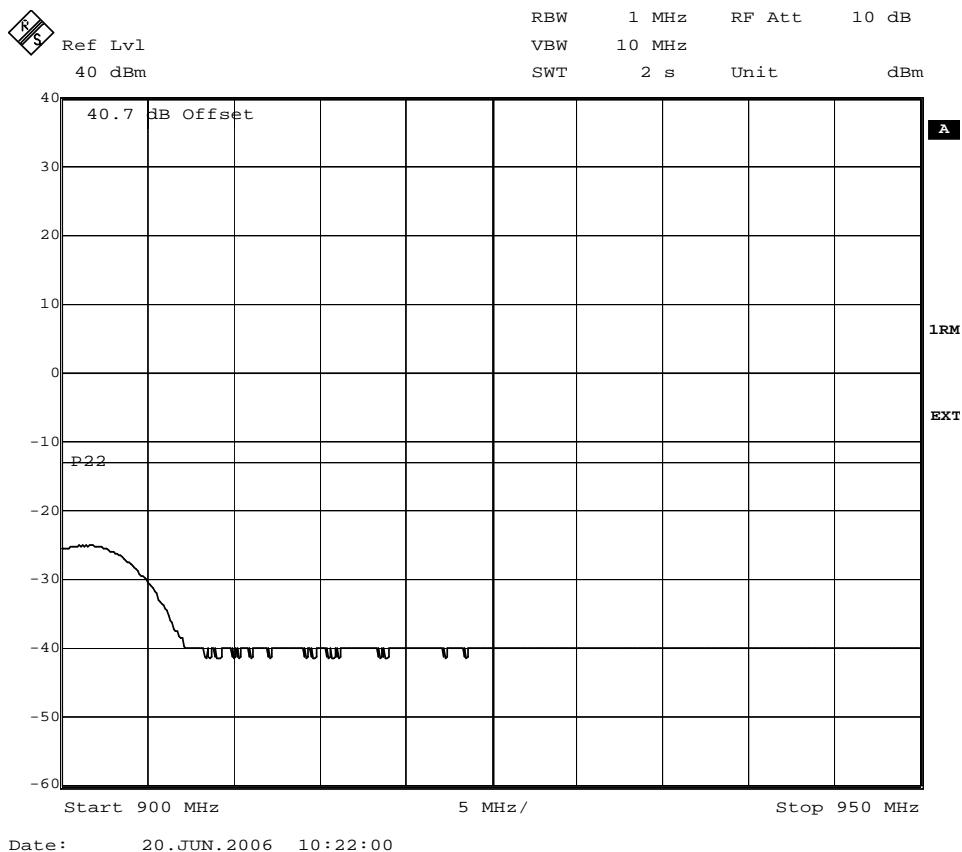
Appendix 4.1

Diagram 8



FCC ID: TA8AKRC11822-1

Appendix 4.1



Conducted spurious emission measurements according to 47 CFR 2.1051

Date	Temperature	Humidity
2006-06-19	22 °C ± 3 °C	52 % ± 5 %
2006-06-20	23 °C ± 3 °C	54 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §22.917, with a RBW of 1 MHz. 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. A pre-measurement is first performed with peak detector, spurious emissions closer than 10 dB to the limit is measured with the RMS detector.

Measurement equipment	Calibration Due	SP number
R&S FSIQ	2006-07	503 738
HP filter	2006-07	502 739
Testo 610, Temperature and humidity meter	2006-12	502 658

Measurement uncertainty: 3.7 dB**Results**

The results are shown in appendix 5.1

Single carrier

QPSK	16QAM
Diagram 1: 871.4 MHz	Diagram 4: 871.4 MHz
Diagram 2: 881.4 MHz	Diagram 5: 881.4 MHz
Diagram 3: 891.6 MHz	Diagram 6: 891.6 MHz

Multi carier

QPSK	16QAM
Diagram 7: 871.4+881.4 MHz	Diagram 9: 871.4+881.4 MHz
Diagram 8: 881.6+891.6 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.

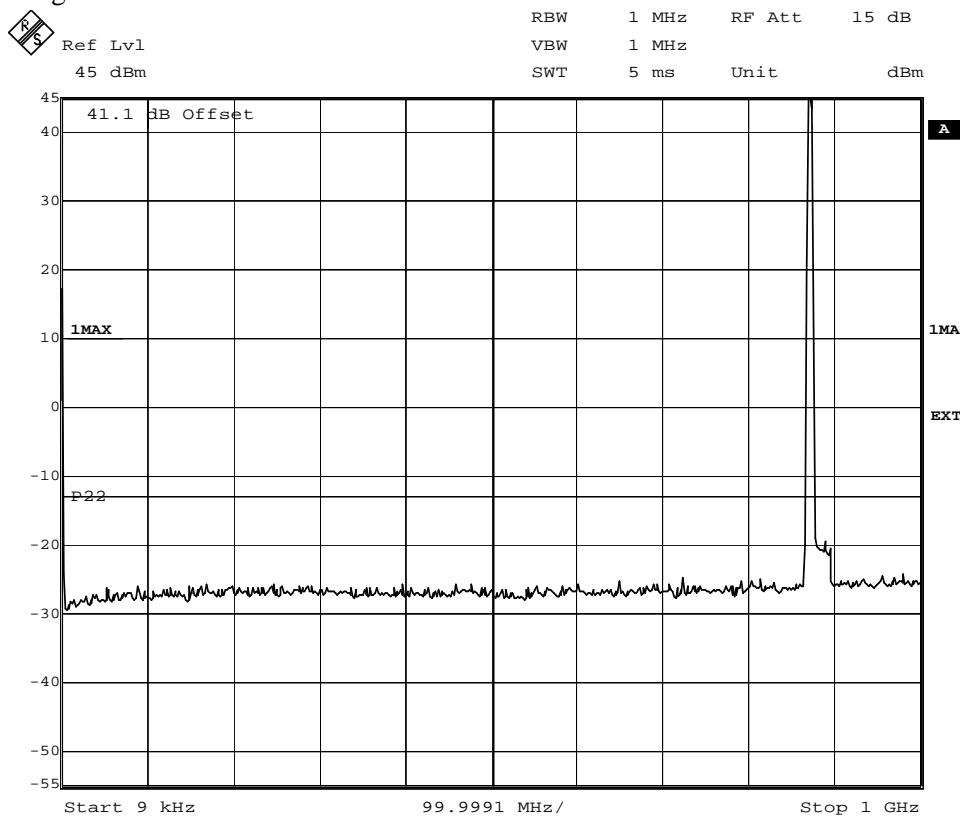
Complies?	Yes
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FCC ID: TA8AKRC11822-1

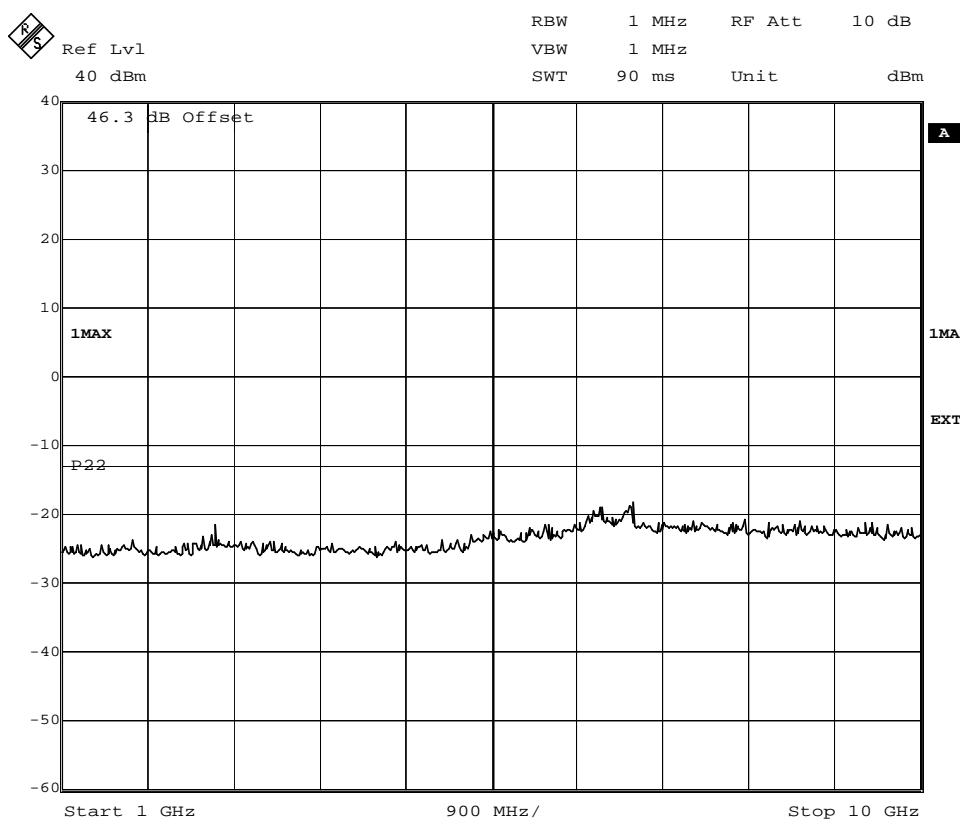
Appendix 5.1



Diagram 1



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.

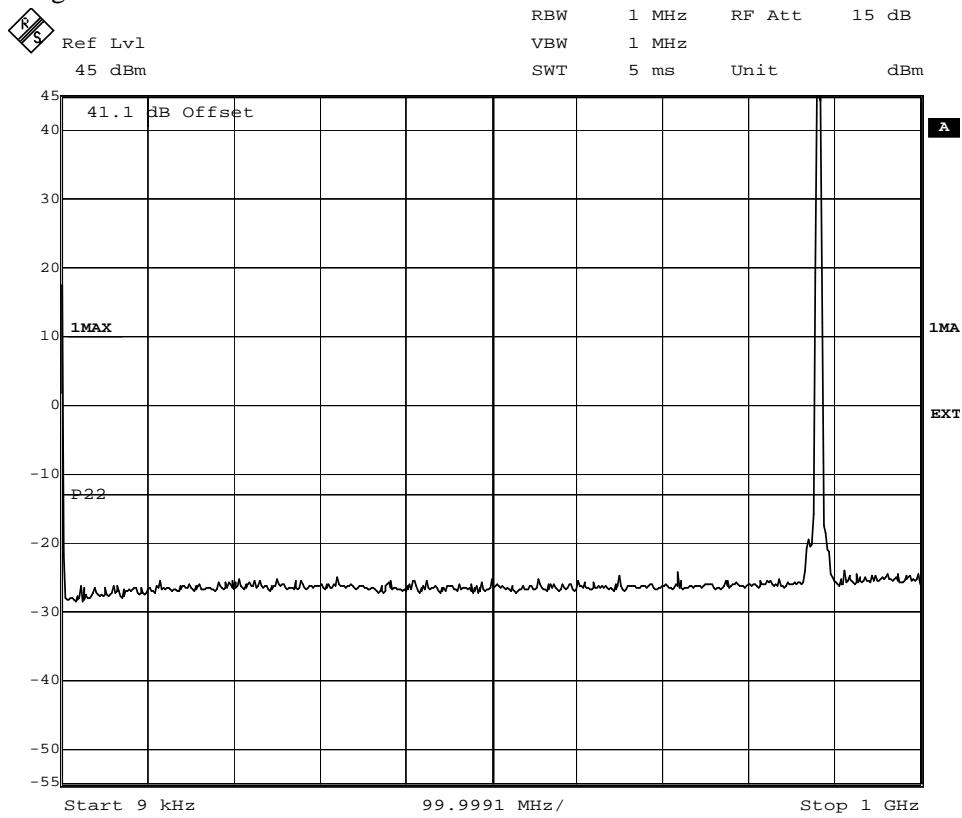


FCC ID: TA8AKRC11822-1

Appendix 5.1

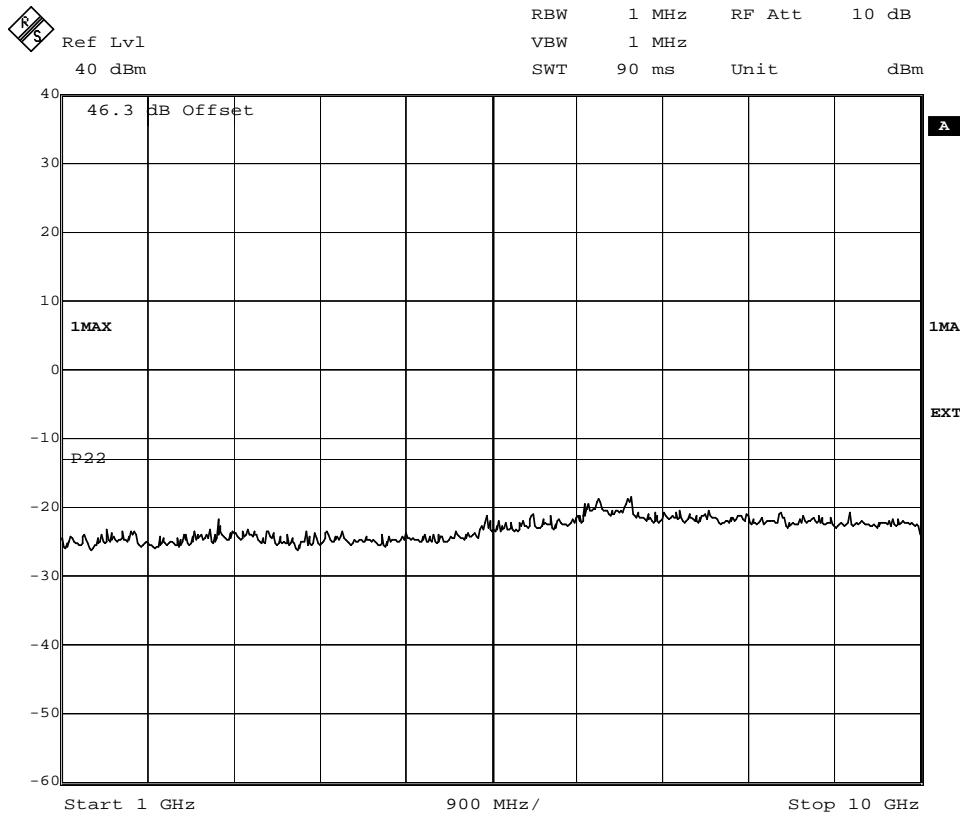


Diagram 2



Date: 19.JUN.2006 10:50:19

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.

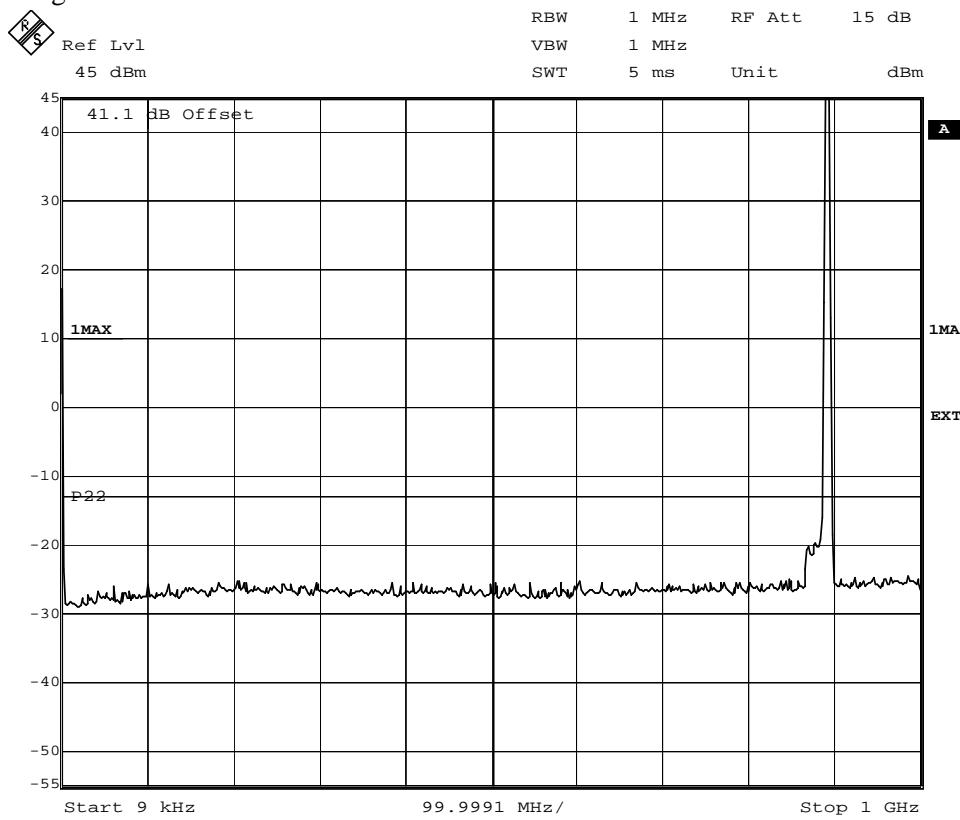


Date: 19.JUN.2006 10:51:49

FCC ID: TA8AKRC11822-1

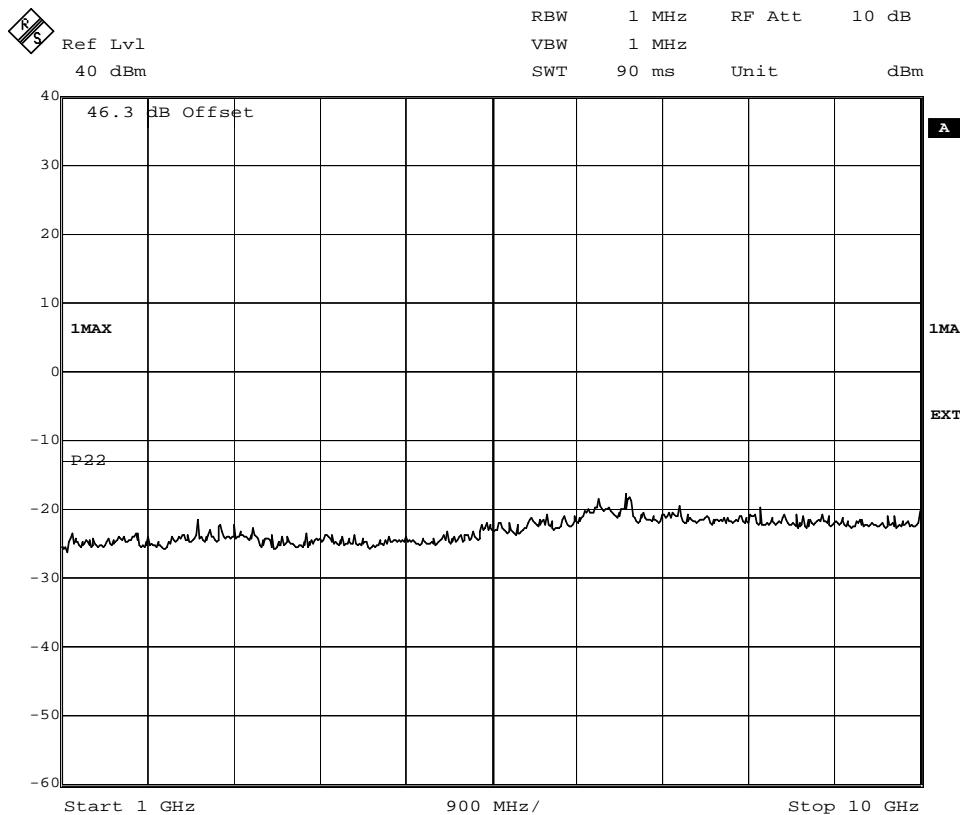
Appendix 5.1

Diagram 3



Date: 19.JUN.2006 10:24:25

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.



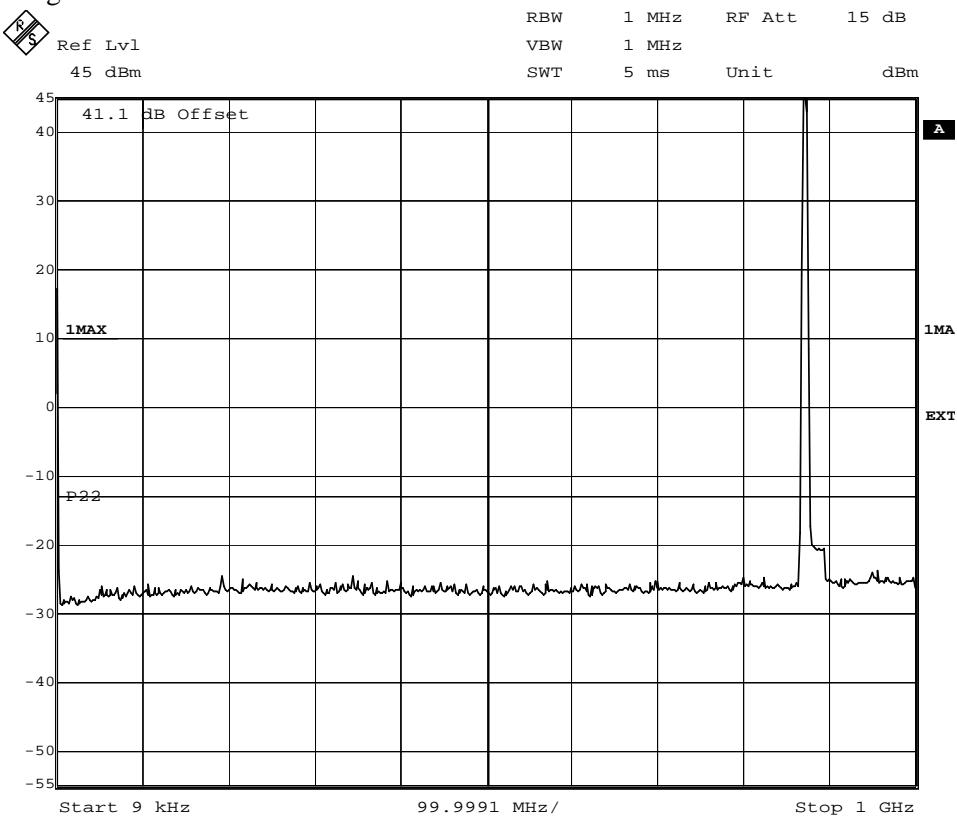
Date: 16.JUN.2006 15:15:23

FCC ID: TA8AKRC11822-1

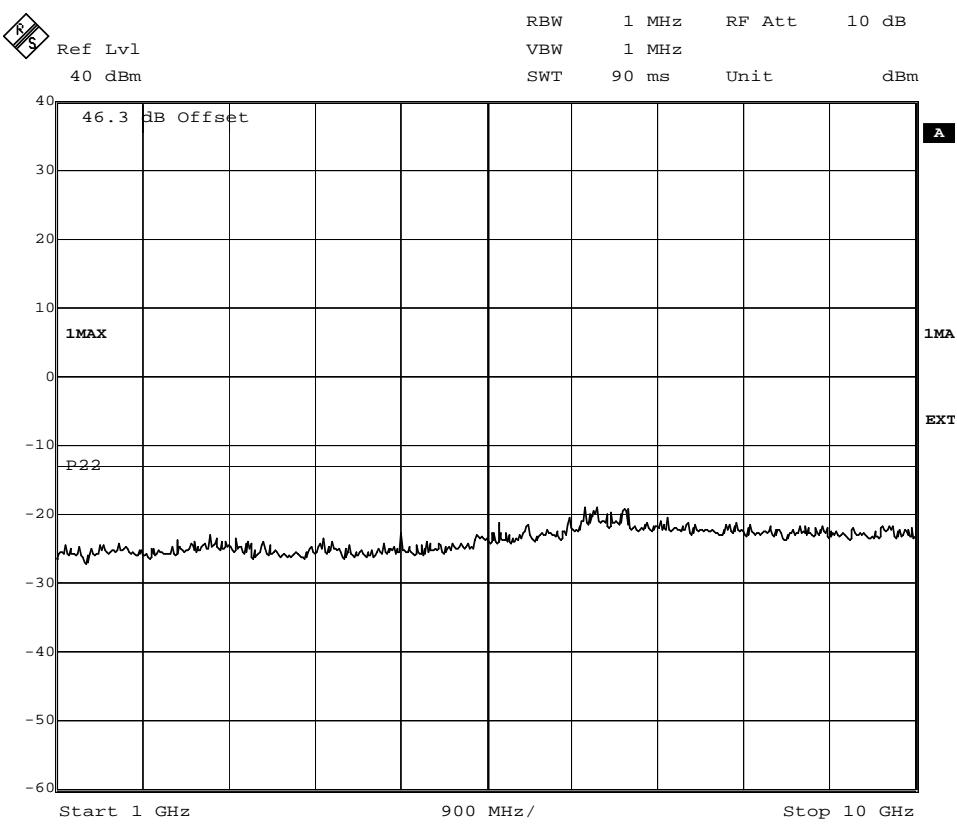
Appendix 5.1



Diagram 4



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.

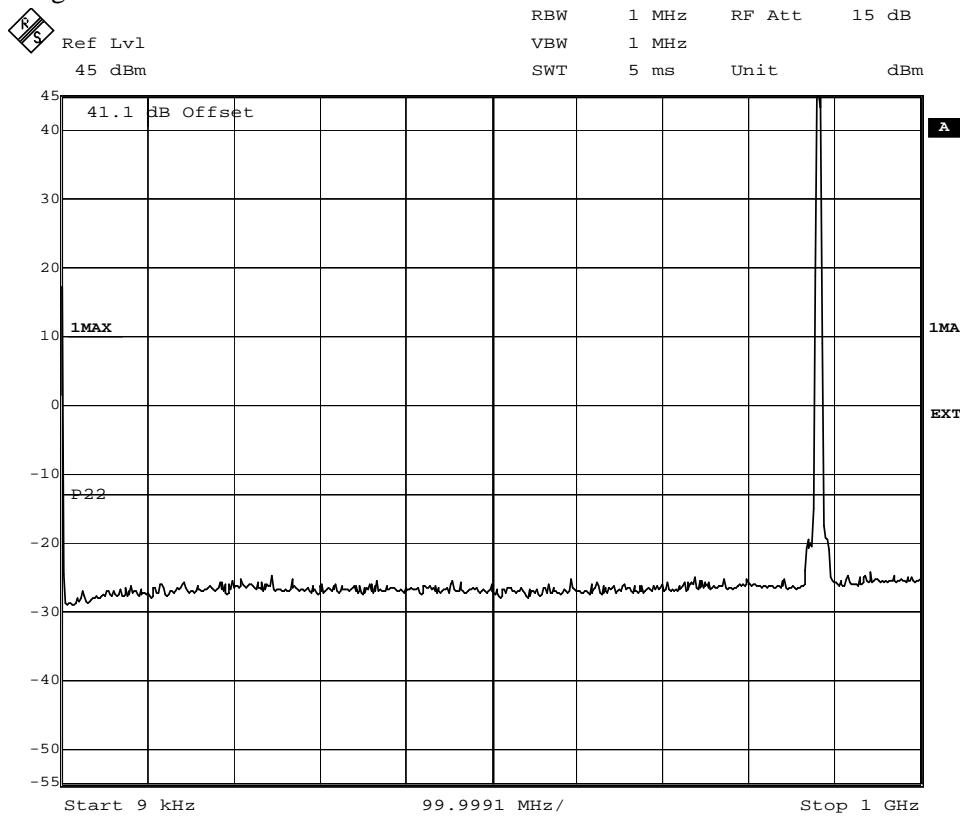


FCC ID: TA8AKRC11822-1

Appendix 5.1

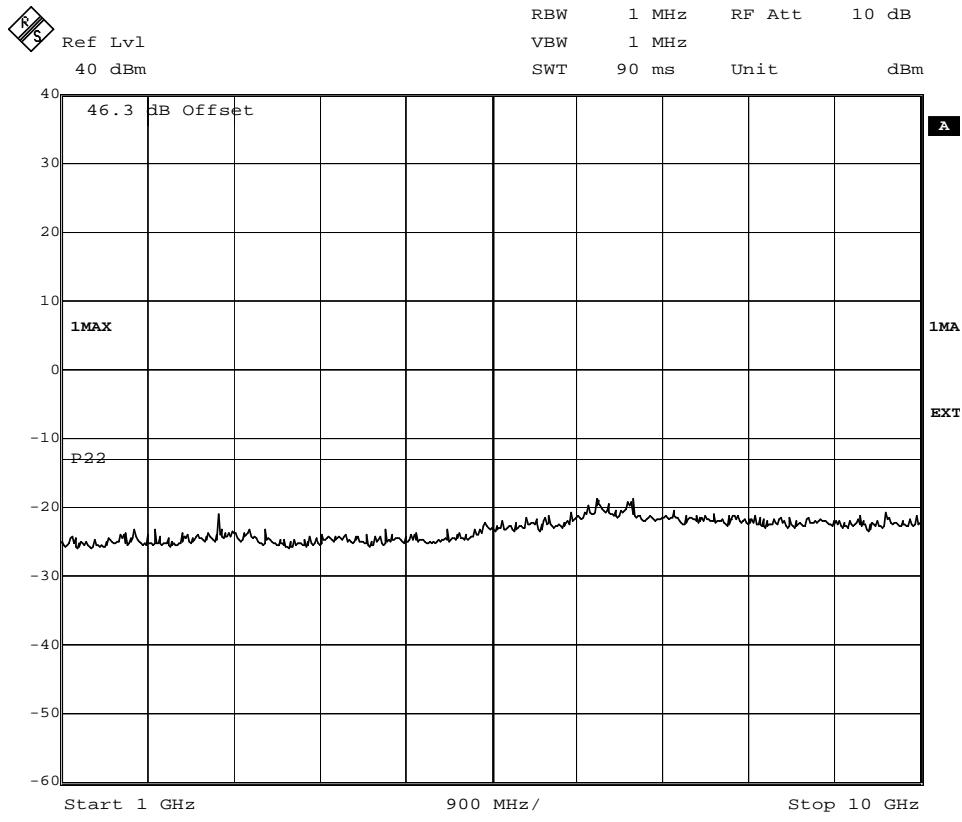


Diagram 5



Date: 19.JUN.2006 10:59:15

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.



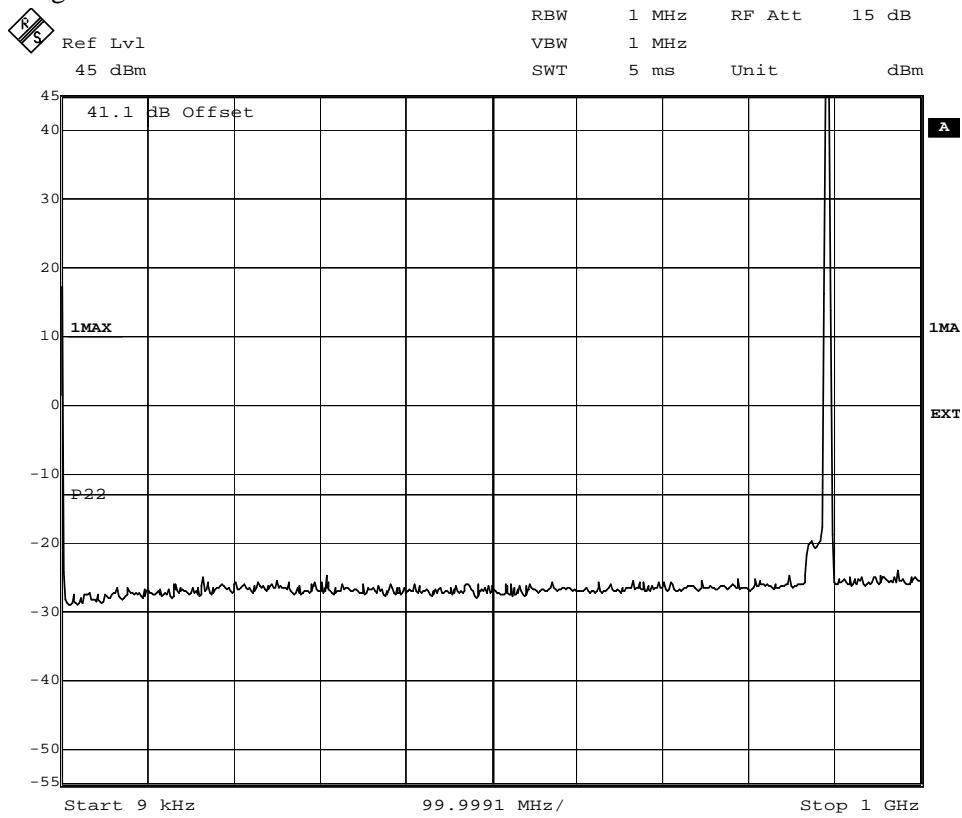
Date: 19.JUN.2006 10:58:06

FCC ID: TA8AKRC11822-1

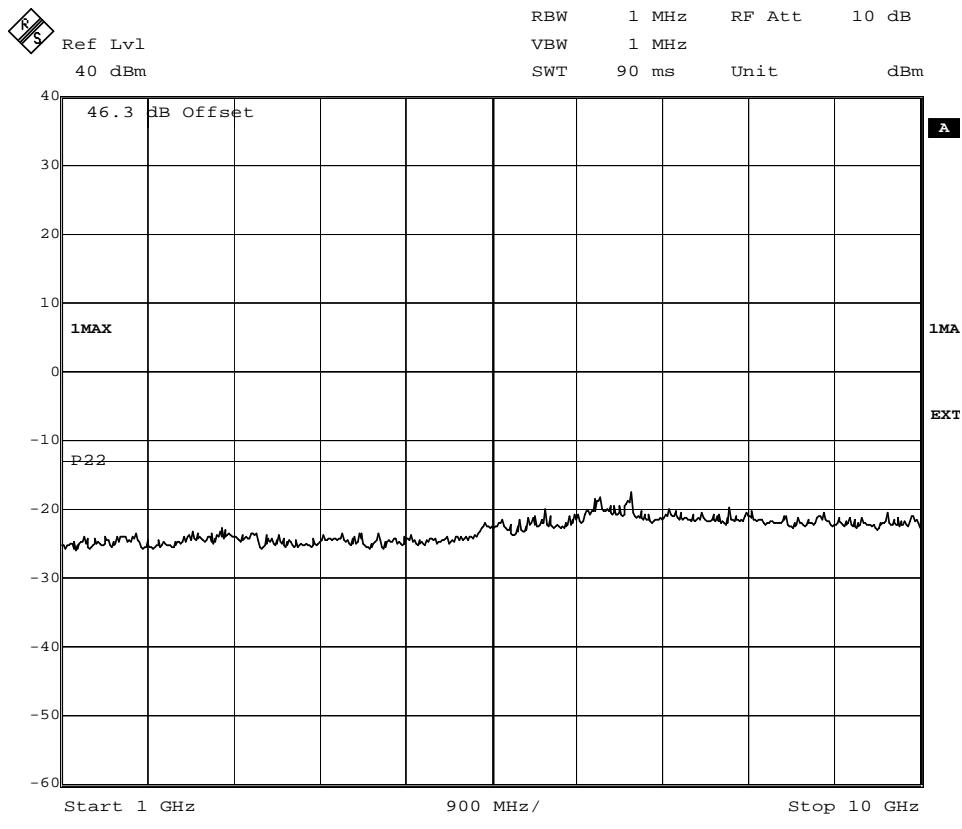
Appendix 5.1



Diagram 6



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.

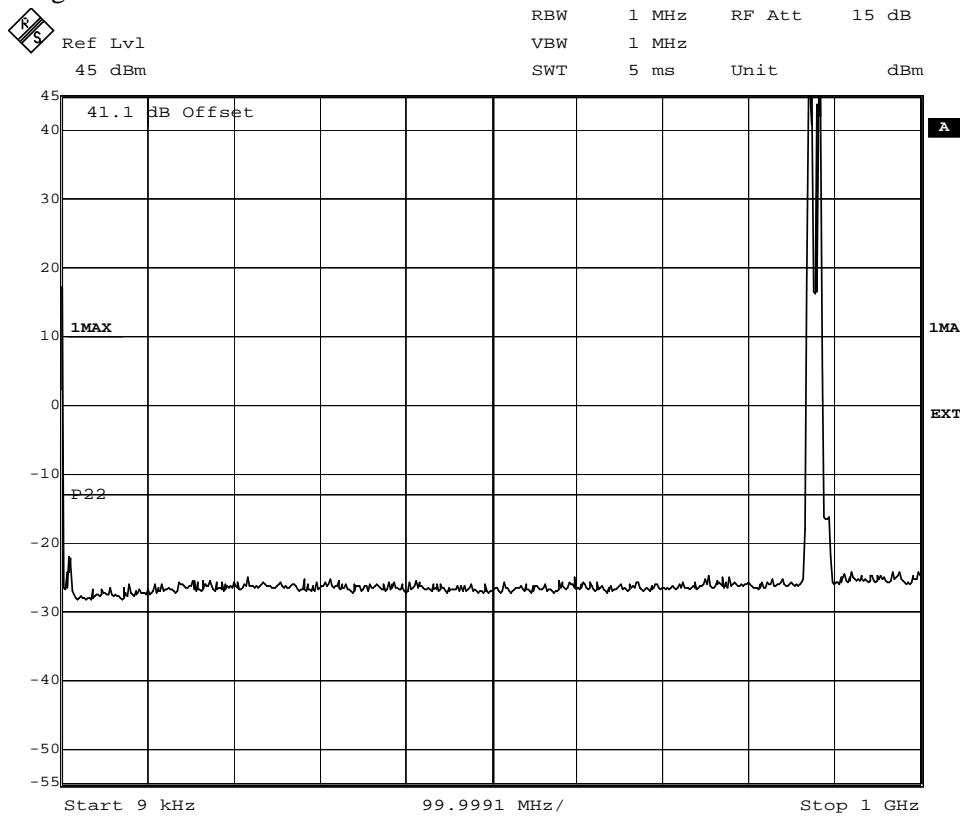


FCC ID: TA8AKRC11822-1

Appendix 5.1

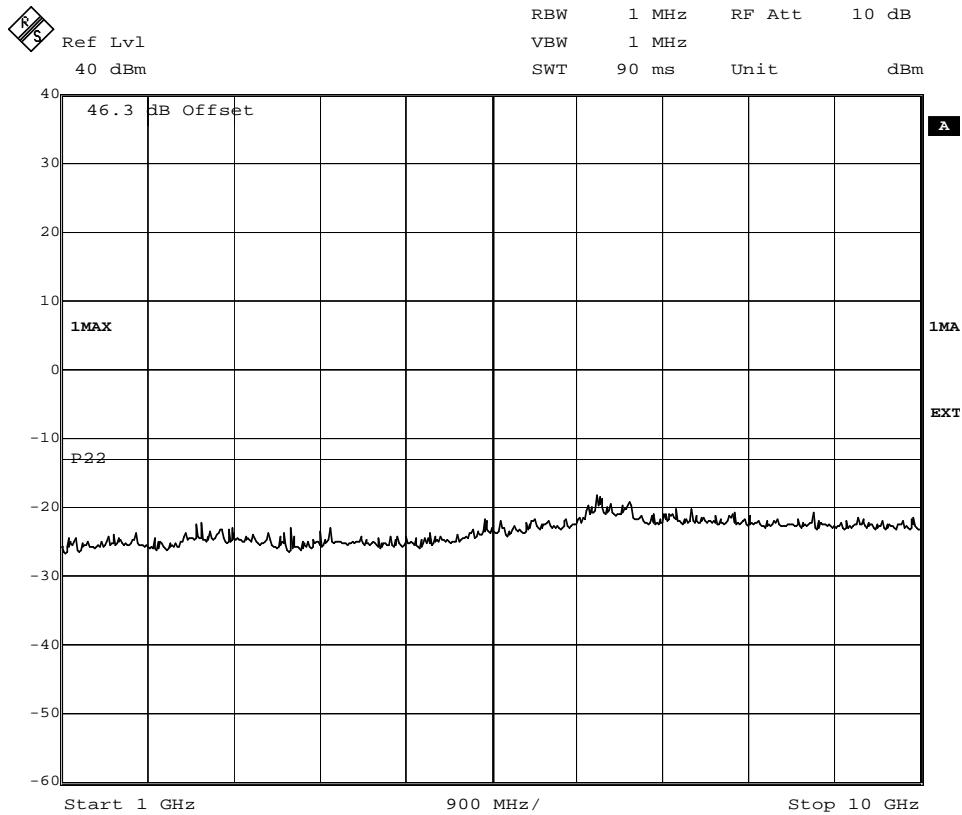


Diagram 7



Date: 19.JUN.2006 15:44:45

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.



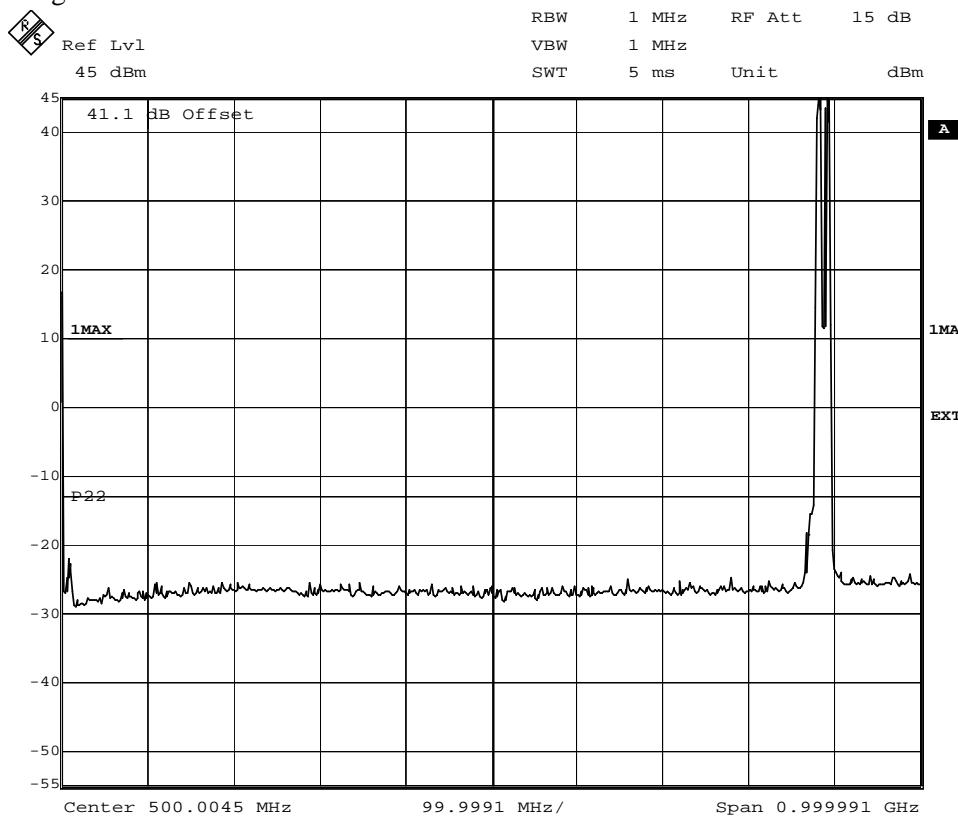
Date: 19.JUN.2006 15:48:18

FCC ID: TA8AKRC11822-1

Appendix 5.1

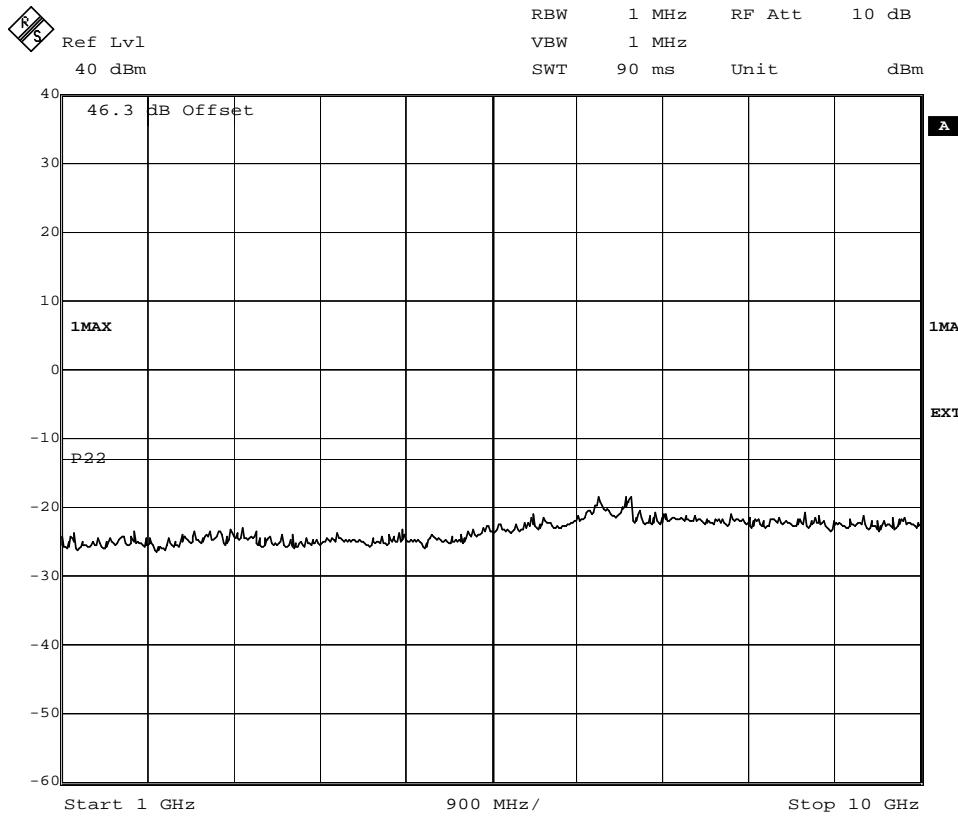


Diagram 8



Date: 20.JUN.2006 10:06:55

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.



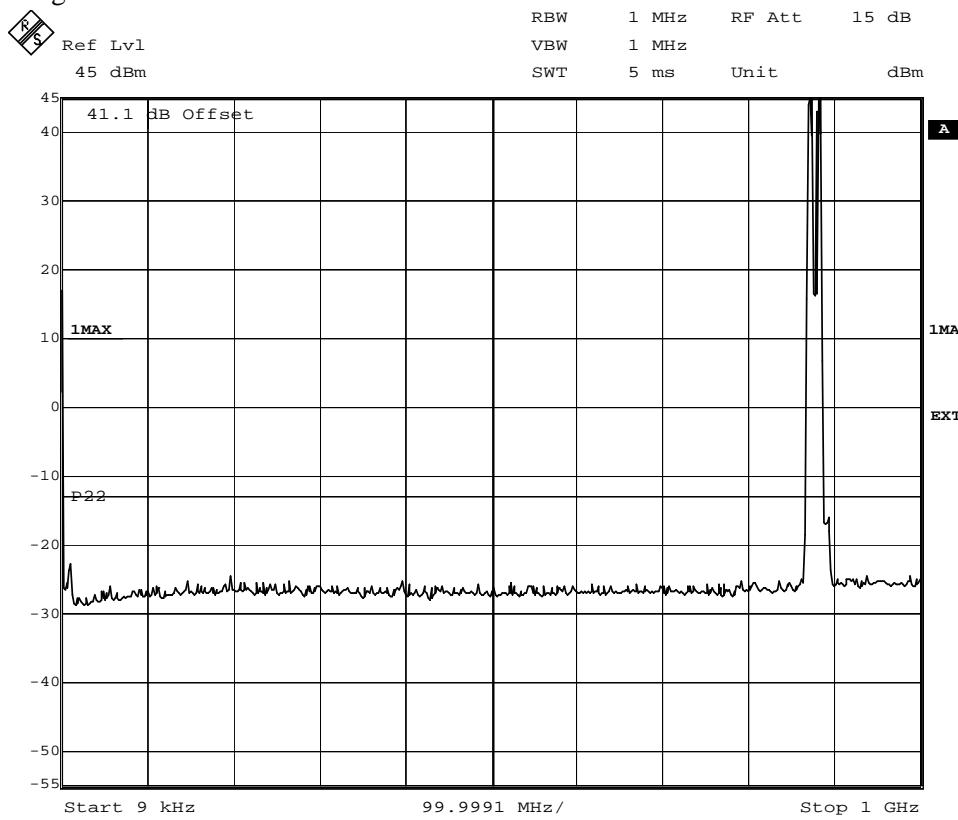
Date: 20.JUN.2006 10:08:01

FCC ID: TA8AKRC11822-1

Appendix 5.1

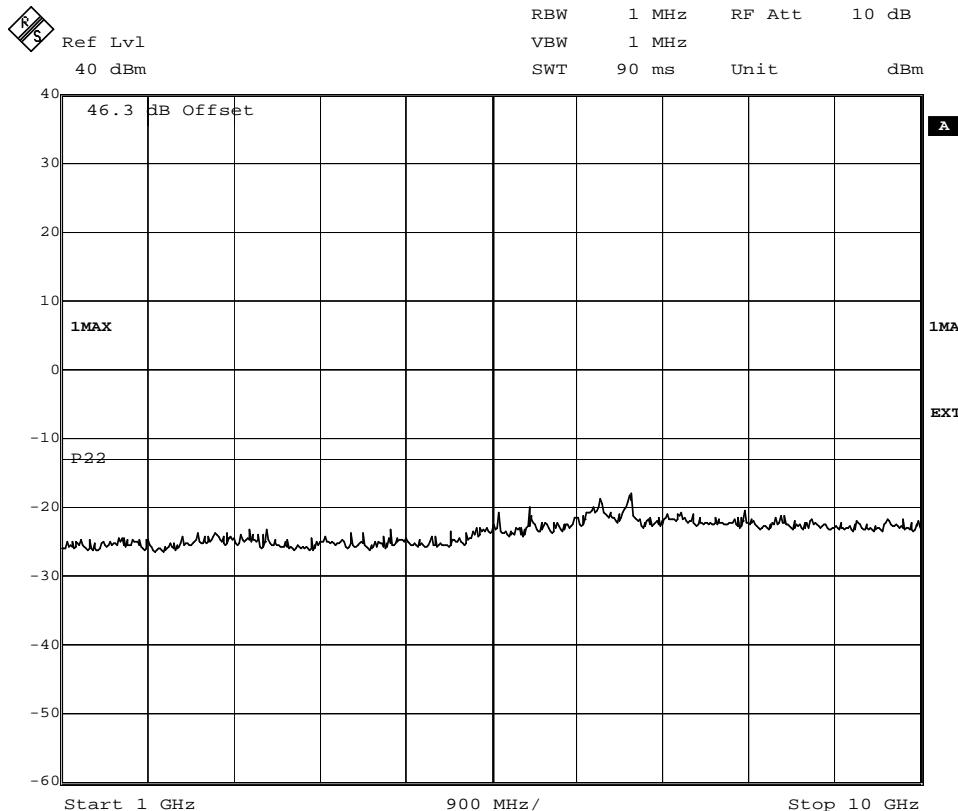


Diagram 9



Date: 19.JUN.2006 16:11:18

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.



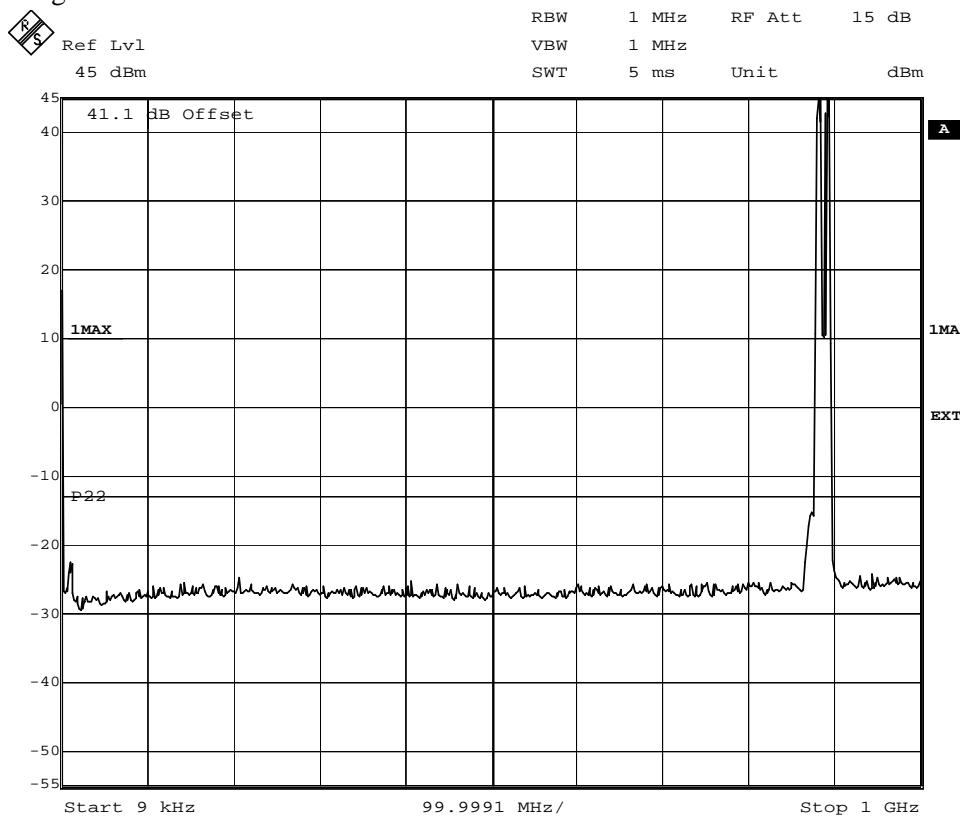
Date: 19.JUN.2006 16:09:52

FCC ID: TA8AKRC11822-1

Appendix 5.1

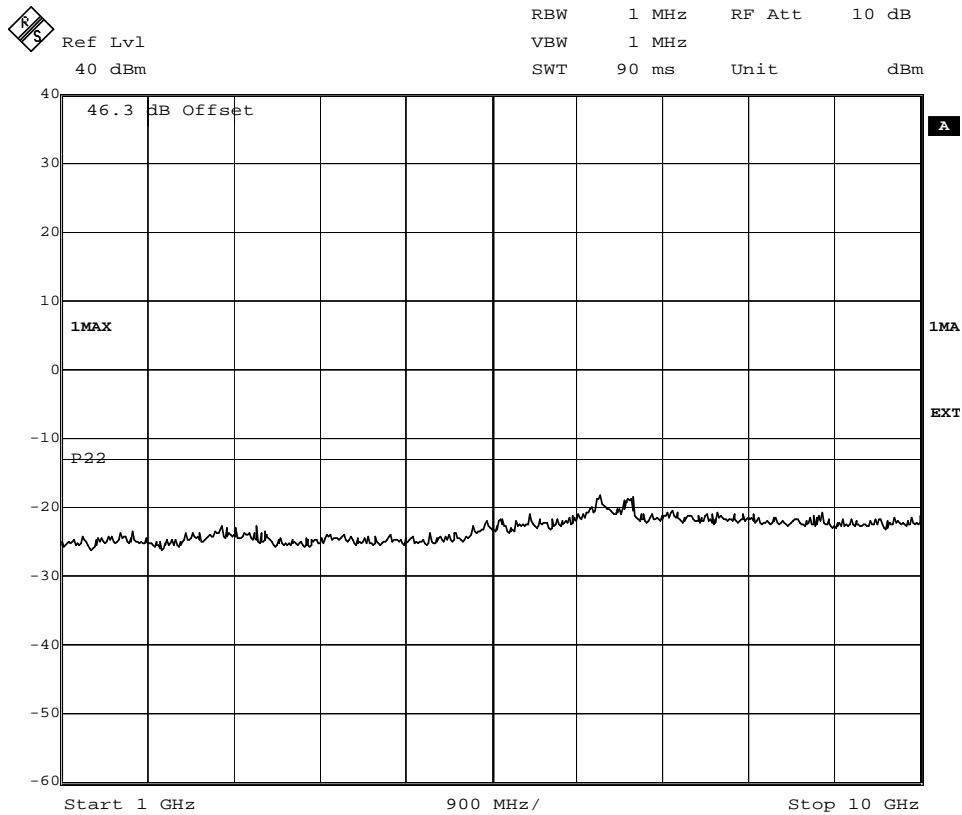


Diagram 10



Date: 20.JUN.2006 10:15:26

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: 20.JUN.2006 10:14:32

Field strength of spurious radiation measurements according to 47 CFR 2.1053

Date	Temperature	Humidity
2006-06-07	22 °C ± 3 °C	39 % ± 5 %
2006-06-08	22 °C ± 3 °C	41 % ± 5 %

Test set-up and procedure

The test site is listed at FCC, Columbia with registration number: 93866.

The transmitter was modulated with pseudorandom data during the measurements. The antenna ports were terminated with 50 ohm loads.

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 – 10 GHz.

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,

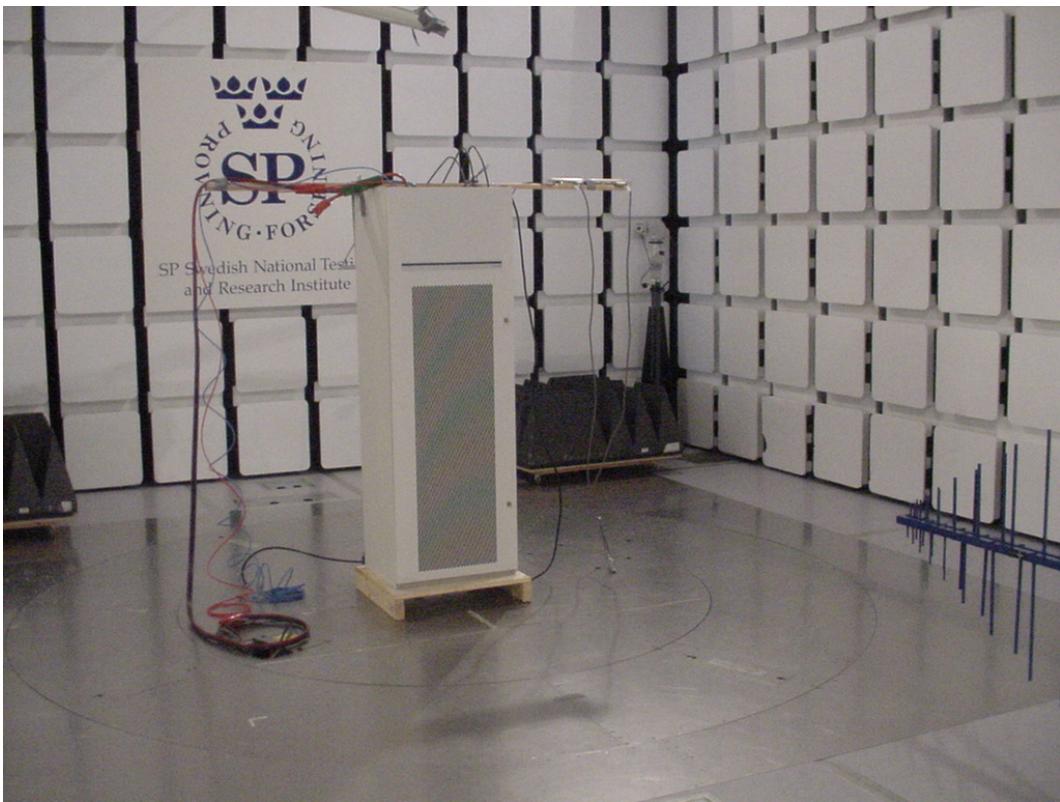
$$\gamma = 20 \log \left(\frac{4\pi D}{\lambda} \right), \quad \gamma \text{ is the propagation loss and } D \text{ is the antenna distance.}$$

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	2006-07	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	2006-07	503 285
Testo 615, Temperature and humidity meter	2007-09	503 505

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



Results

Single carrier and multi carrier

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-10 000	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	Temperature (test equipment)	Humidity (test equipment)
2006-06-12 - 2006-06-15	22 °C ± 3 °C	48 % ± 5 %

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	2007-03	501 031
R&S FSIQ	2006-07	503 738
Multimeter Fluke 87	2006-11	502 190
Testo 610, Temperature and humidity meter	2006-12	502 658

Results

Nominal Voltage -48 V DC

Nominal 46 dBm output power at 881.4 MHz

Test conditions		Frequency error (Hz)	
Supply voltage DC (V)	T (°C)	QPSK	16QAM
-48.0	+20	+14	-12
-55.2	+20	-10	-11
-40.8	+20	+15	+9
-48.0	+30	-20	-20
-48.0	+40	+12	-14
-48.0	+50	+14	+18
-48.0	+10	-14	-15
-48.0	0	-13	-12
Maximum freq. error (Hz)		-20	
Measurement uncertainty		$< \pm 1 \times 10^{-7}$	

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

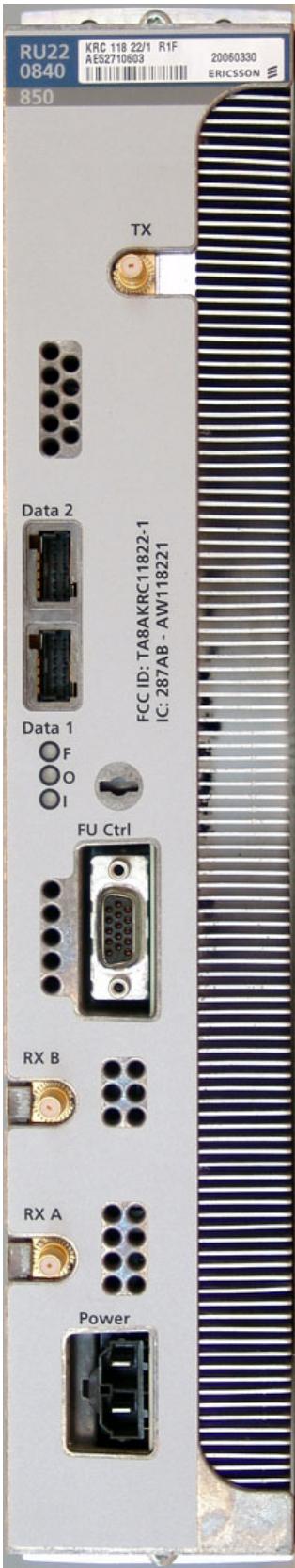
Limits (according to 3GPP TS 25.141)

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

Complies?	Yes
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Photos
KRC 118 22/1

Front side



Rear side

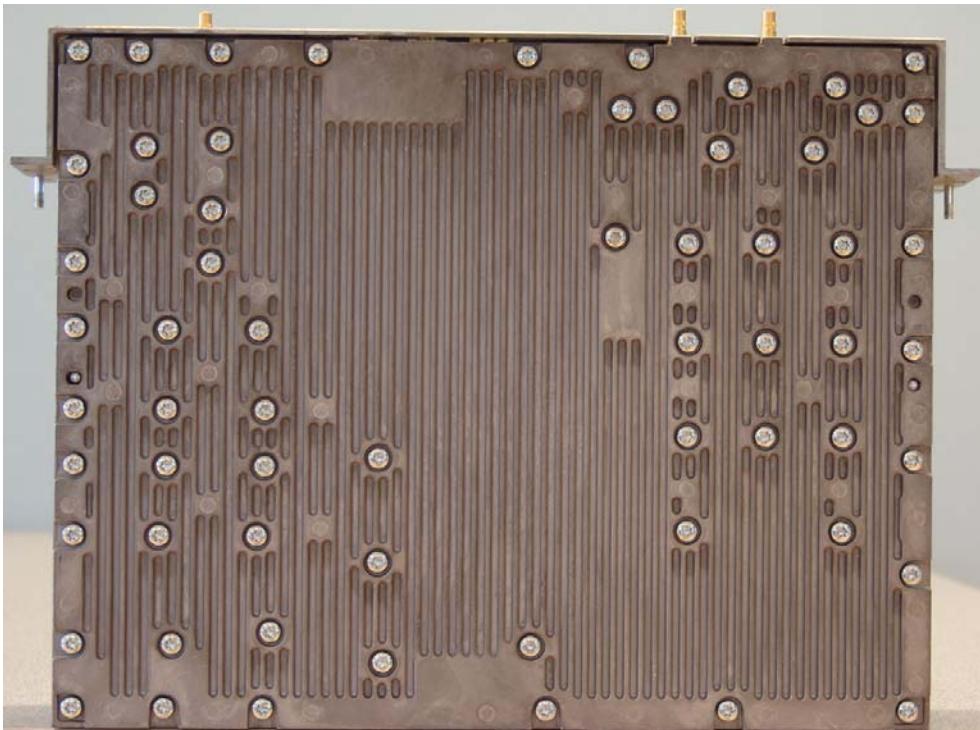


FCC ID: TA8AKRC11822-1

Appendix 8



Left side



Right side



RBS 3206

Front side

