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## Equipment authorization measurements on WCDMA Base Station 1700/2100 MHz Radio Unit with FCC ID: TA8AKRC11829-4 (8 appendices)

### Test object

Radio Unit KRC 118 29/4

### 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: TA8AKRC11829-4

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**Description – Test object**

Equipment: WCDMA Radio Unit (RU) 1700/2100 MHz, single and multi carrier  
Tx Frequency range: 2112.4-2152.6 MHz  
Modulations: QPSK and 16QAM  
Maximum rated output power: Single carrier: 1x43 dBm (20 W)  
Multi carrier: 2x40 dBm (2x10 W)  
Nominal power voltage: 48 VDC

**Tested channels**

UARFCN	Frequency
1537	2112.4 MHz
1587	2122.4 MHz
1612	2127.4 MHz
1637	2132.4 MHz
1662	2137.4 MHz
1688	2142.6 MHz
1738	2152.6 MHz

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

All measurements were performed with the test object transmitting the Test models 1 and 5 defined in 3GPP TS 25.141. Test model 1 use 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 3308 cabinet powered with 48 VDC. All measurements were done at the output connector (Ant A) of the Filter Unit (FU) KRC 118 28/1. All 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 RBS 3308 cabinet powered with 48 VDC.

The RU unit was activated for maximum transmit power. The RU unit was activated as Single Carrier (1x43dBm) and Multi Carrier (2x40 dBm). The RF output power port was terminated with 50 ohm loads.

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

The RU unit was allocated to the following UARFCN:

**Single Carrier:**

Downlink	1537 (2112.4 MHz)	1537 (2112.4 MHz)	1738 (2152,6 MHz)	1738 (2152,6 MHz)
Uplink	1312 (1712.4 MHz)	1312 (1712.4 MHz)	1513 (1752,6 MHz)	1513 (1752,6 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	1612 (2127,4 MHz)	1662 (2137,4 MHz)
Uplink	1387 (1727,4 MHz)	1437 (1737,4 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)



## **REPORT**

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Appendix 1

### **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.



## **REPORT**

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Appendix 1

### **Delivery of test object**

The test object was delivered: 2007-04-27

### **Manufacturer's representative**

Jan-Olof Karlsson, Ericsson AB

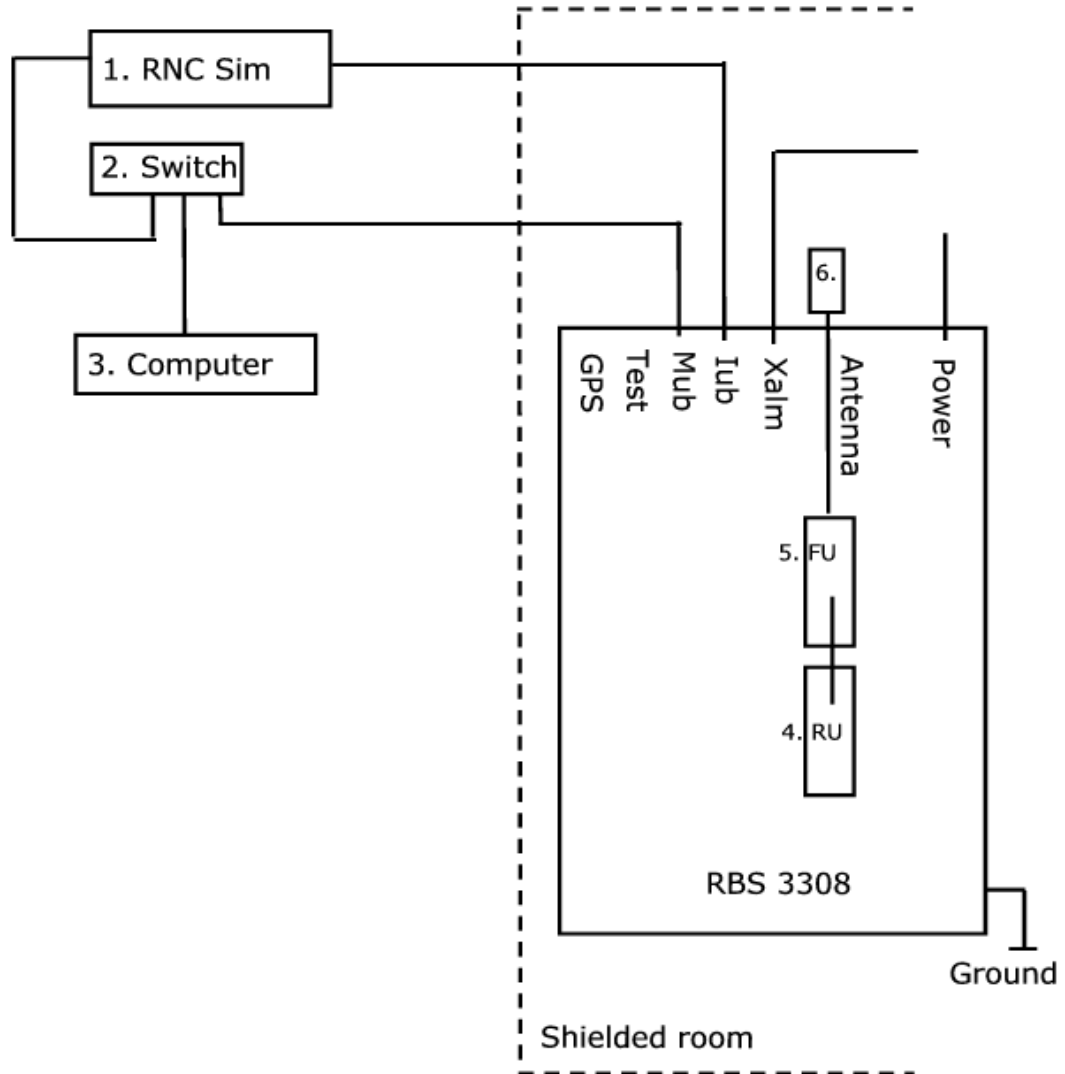
### **Test engineers**

Jörgen Wassholm, Fredrik G Isaksson and Jonas Bremholt.

### **Test witnesses**

Christer Hjort and Nicklas Forsmark, Ericsson AB

**Test set-up, radiated measurements**



RBS 3308: SEB 104 083/1 with software CXP 901 1610/1 rev. R3AL. More information about the RBS hardware units are shown in SP document F702759-H

1. RNC Sim CES 4780DA Mini-sim#10, Ericsson no.: ETE-201157
2. Switch, Centrecom FH716SW
3. Computer, SUN Microsystems, Ericsson no.: ED 121978
4. RU KRC 118 29/4 Rev. R1B, (FCC id: TA8AKRC11829-4)
5. FU KRC 118 28/1 Rev. R1C
6. 50 ohm terminator

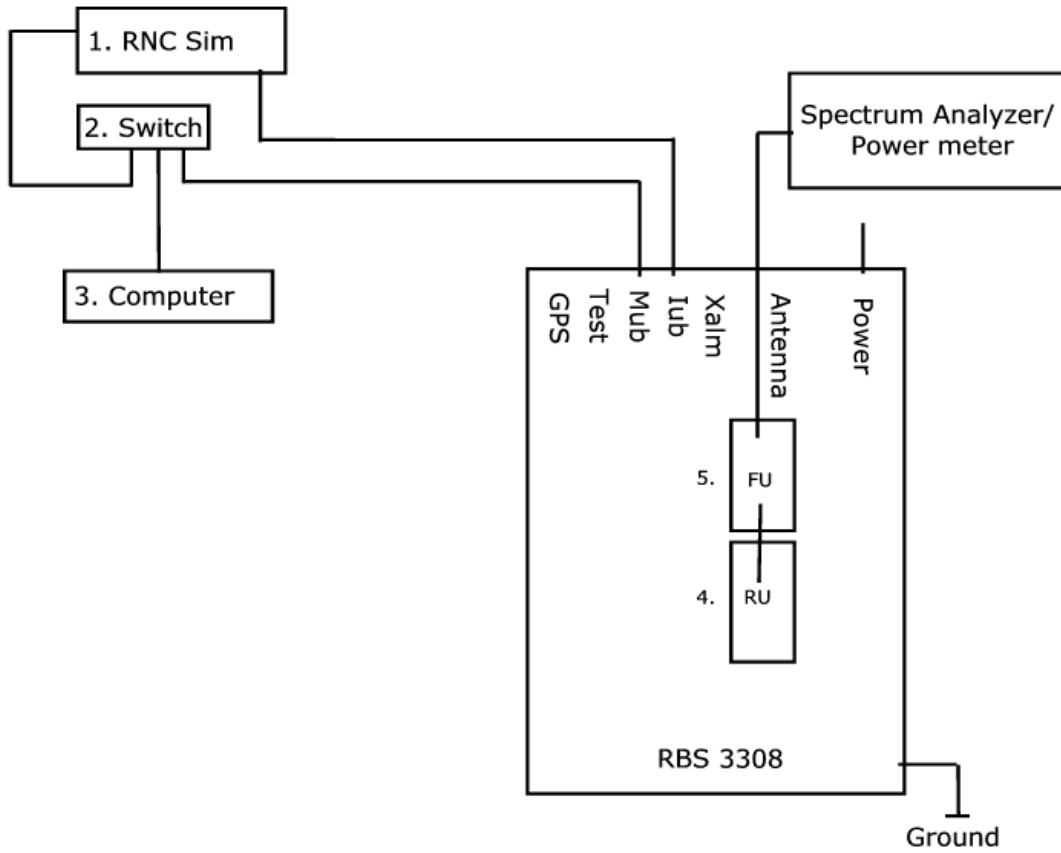
**Interfaces:**

Power, -48 VDC  
 Coaxial cable with N connector and adaptor to 7/16”  
 Iub, configured as T1 by CBU, shielded multi-wire with RJ-45 connector  
 Mub, shielded multi-wire with RJ-45 connector  
 Test, serial interface, no cable attached  
 Xalm, shielded multi-wire with RJ-45 connector  
 GPS, not supported

**Type of port:**

DC power  
 Antenna  
 Telecom  
 Test purpose  
 Test purpose  
 Signal  
 Signal

**Test set-up, conducted measurements**



RBS 3308: SEB 104 083/1 with software CXP 901 1610/1 rev. R3AL. More information about the RBS hardware units are shown in SP document F702759-H

1. RNC Sim CES 4780DA Mini-sim#10, Ericsson no.: ETE-201157
2. Switch, Centrecom FH716SW
3. Computer, SUN Microsystems, Ericsson no.: ED 121978
4. RU KRC 118 29/4 Rev. R1B (FCC id: TA8AKRC11829-4)
5. FU KRC 118 28/1 Rev. R1C





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

Date 2007-05-09	Temperature 22 °C ± 3 °C	Humidity 35 % ± 5 %
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**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**

Rated output power level after FU unit (maximum): 1x43 dBm

Test conditions $T_{nom}$ 22 °C/ $V_{nom}$ -48 V DC	Transmitter power (dBm) RMS		
	Frequency 2112.4	Frequency 2132.4	Frequency 2152.6
QPSK	43.1	43.2	43.0
16QAM	43.4	43.4	43.3

**Multi carrier**

Rated output power level after FU unit (maximum): 2x40 dBm

Test conditions $T_{nom}$ 22 °C/ $V_{nom}$ -48 V DC	Transmitter combined power (dBm) RMS		
	Frequencies 2112.4 2122.4	Frequencies 2127.4 2137.4	Frequencies 2142.6 2152.6
QPSK	43.3	43.5	43.4
16QAM	43.4	43.5	43.4

**Limit**

§27.50: Maximum output power shall not exceed 100W (50dBm).

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

Date 2007-05-09	Temperature 23 °C ± 3 °C	Humidity 32 % ± 5 %
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**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 FS1Q	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**

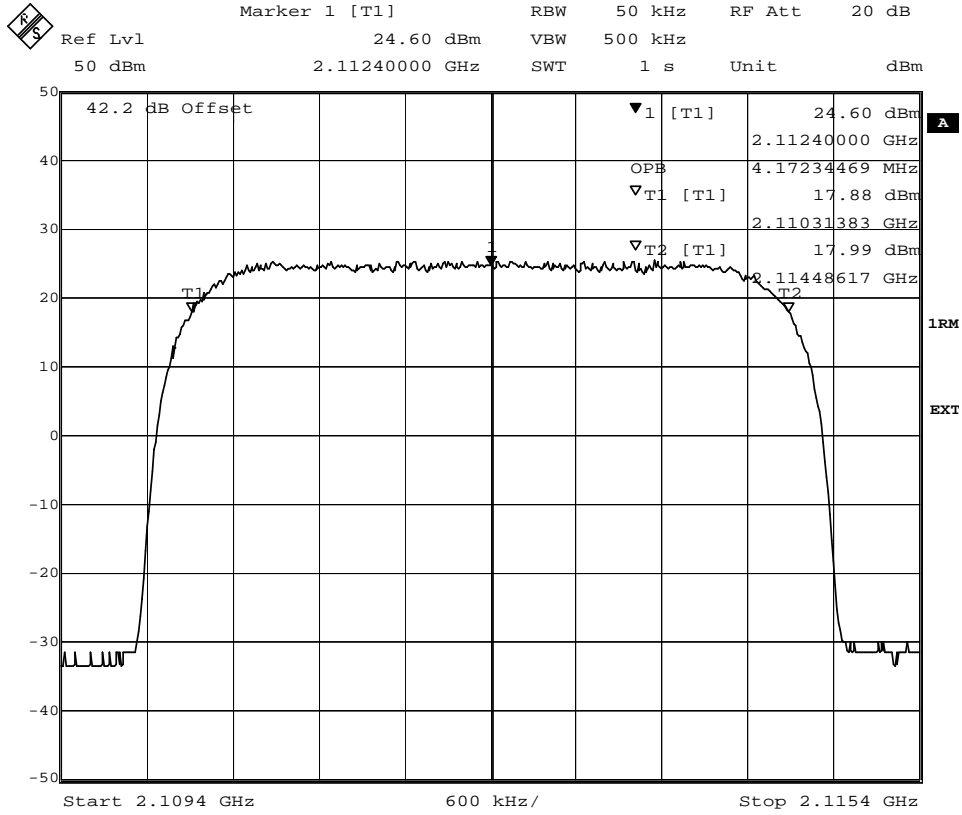
	Frequency	OBW
Diagram 1	2112.4 MHz	4.2 MHz
Diagram 2	2132.4 MHz	4.2 MHz
Diagram 3	2152.6 MHz	4.2 MHz

**16QAM**

	Frequency	OBW
Diagram 4	2112.4 MHz	4.2 MHz
Diagram 5	2132.4 MHz	4.2 MHz
Diagram 6	2152.6 MHz	4.2 MHz

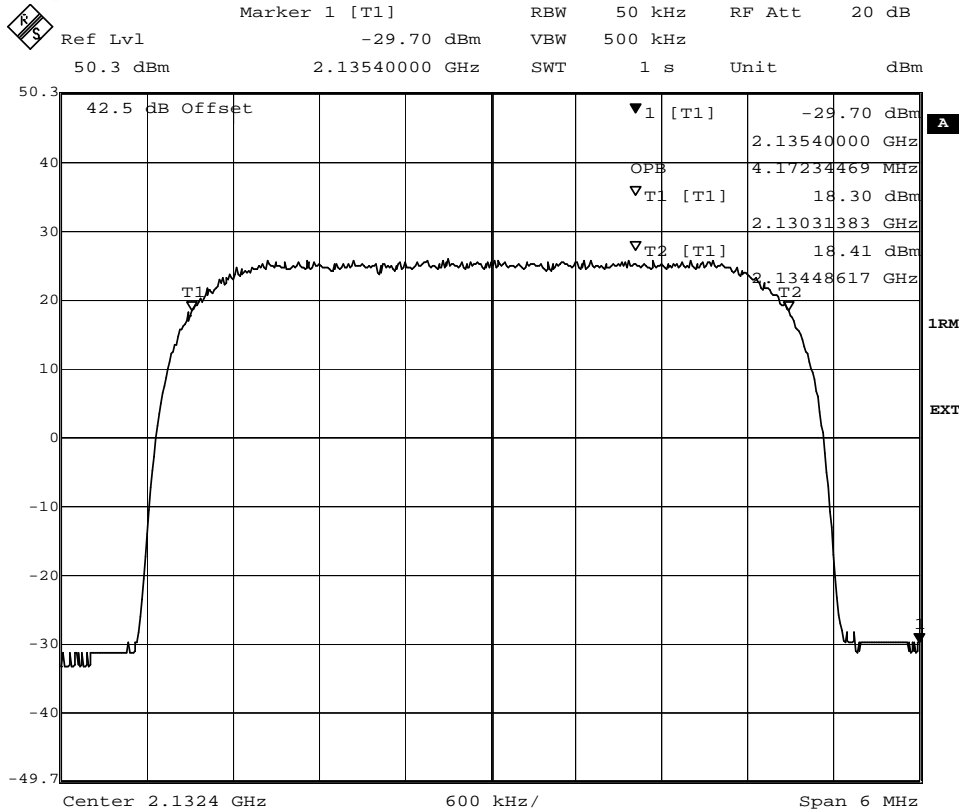


Diagram 1



Date: 9.MAY.2007 08:47:07

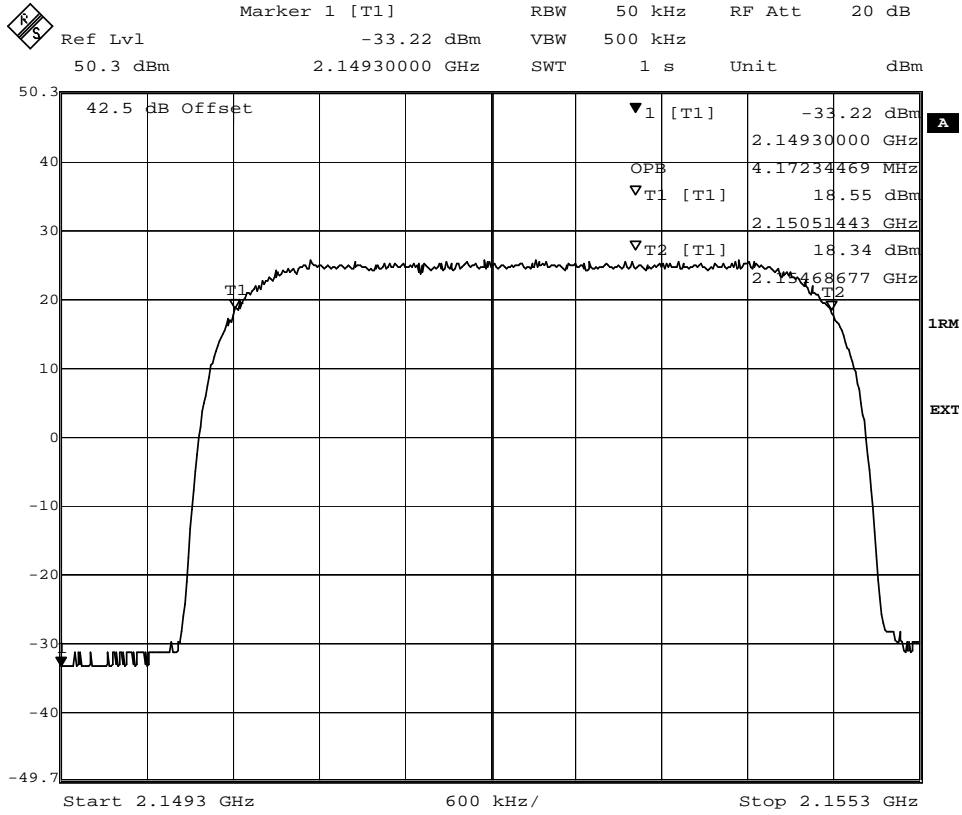
Diagram 2



Date: 9.MAY.2007 12:24:23

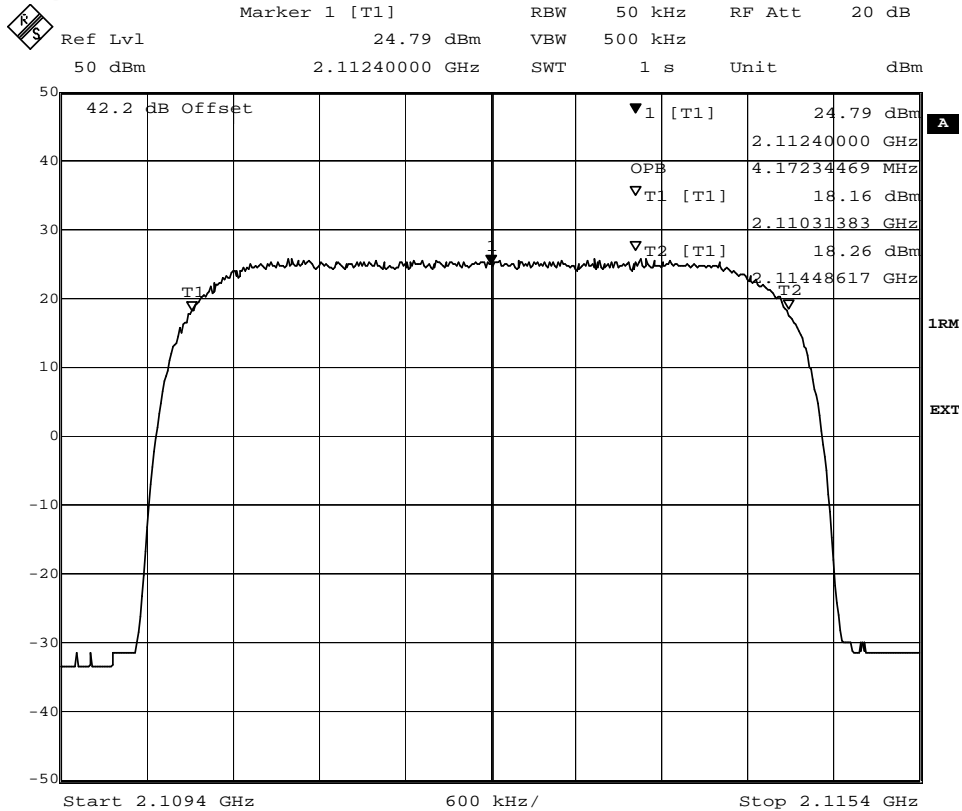


Diagram 3



Date: 9.MAY.2007 10:45:39

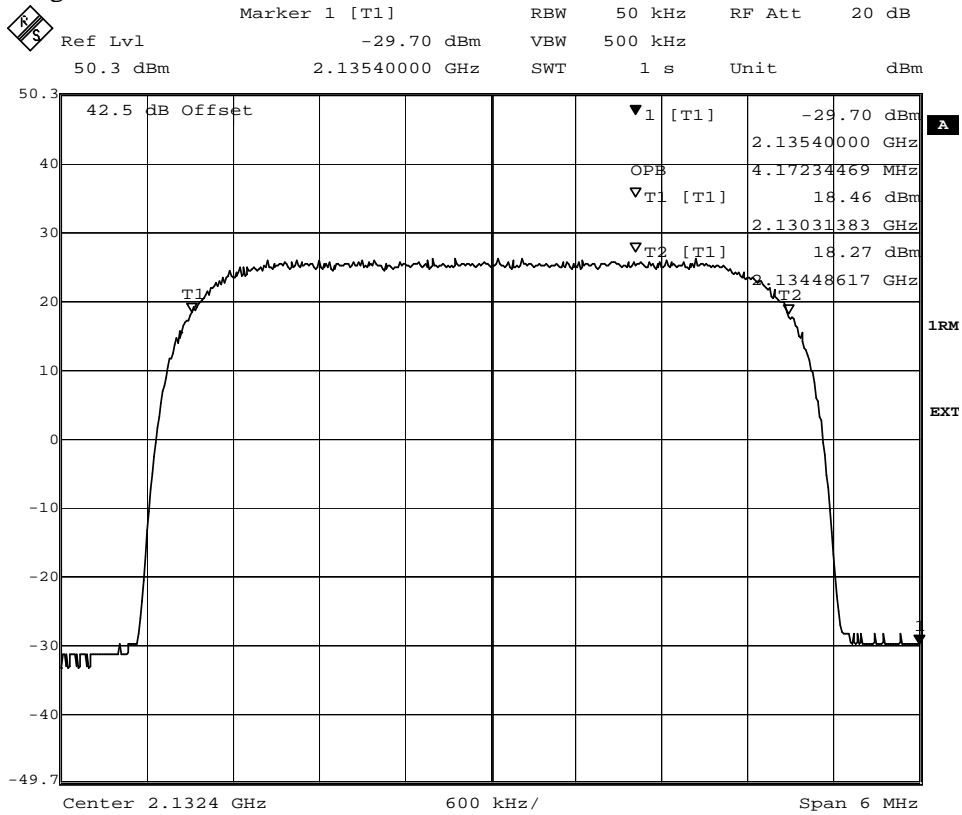
Diagram 4



Date: 9.MAY.2007 08:41:14

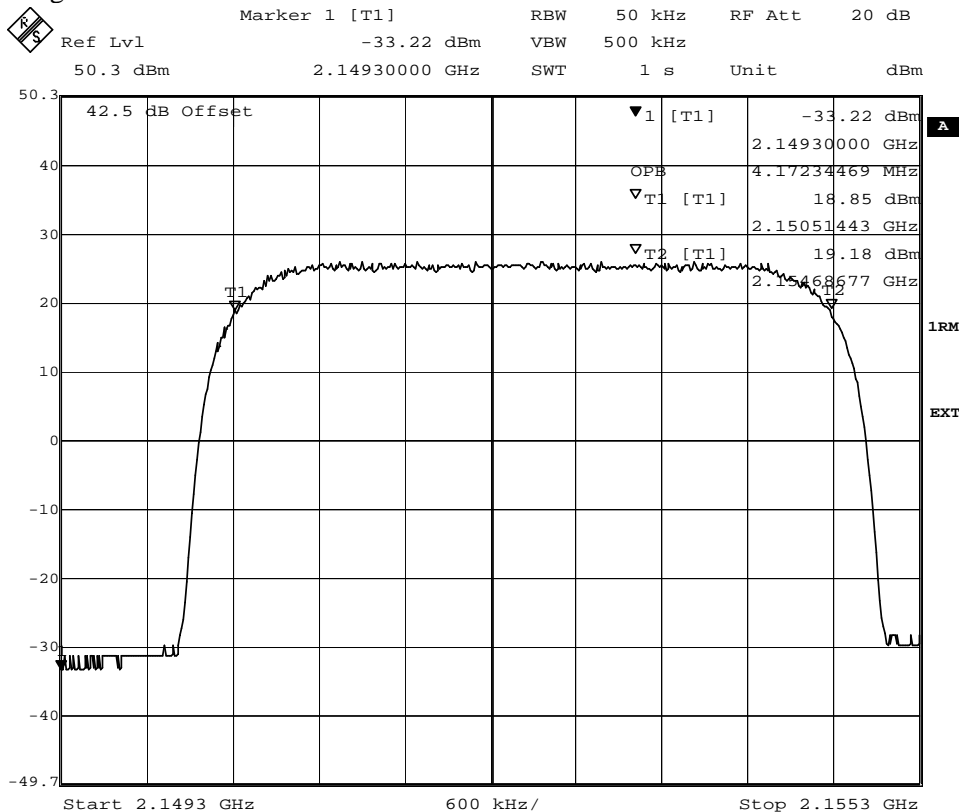


Diagram 5



Date: 9.MAY.2007 12:43:32

Diagram 6



Date: 9.MAY.2007 11:26:00



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

Date 2007-05-09	Temperature 23 °C ± 3 °C	Humidity 37 % ± 5 %
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**Test set-up and procedure**

The measurements were made per definition in §27.53. 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 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 6 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	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: 2112.4 MHz  
 Diagram 2: 2152.6 MHz

**16QAM**  
 Diagram 3: 2112.4 MHz  
 Diagram 4: 2152.6 MHz

**Multi carrier**

**QPSK**  
 Diagram 5: 2112.4+2122.4 MHz  
 Diagram 6: 2142.6+2152.6 MHz

**16QAM**  
 Diagram 7: 2112.4+2122.4 MHz  
 Diagram 8: 2142.6+2152.6 MHz

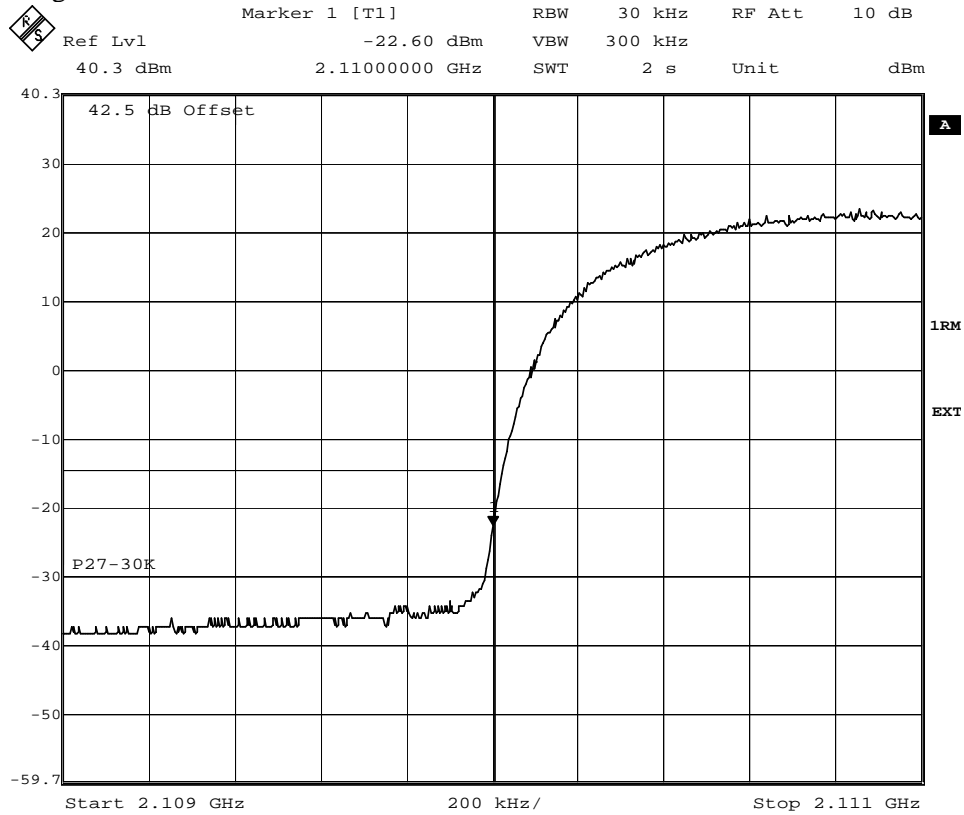
**Limits**

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.

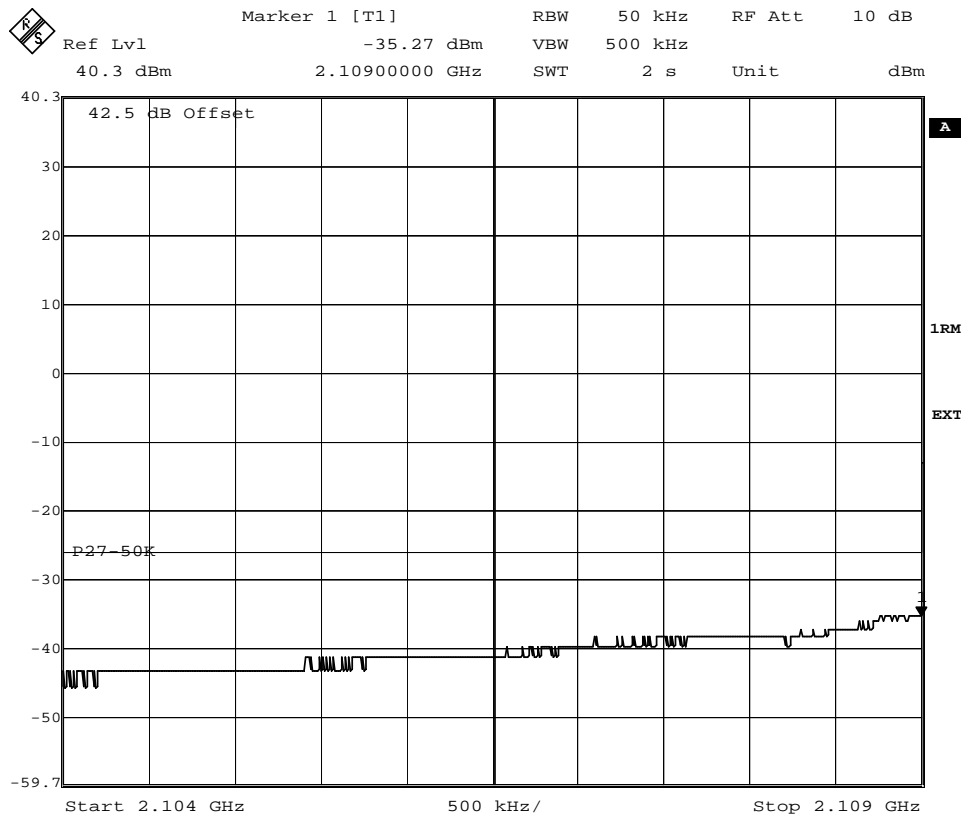
Complies?	Yes
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Diagram 1-1



Date: 9.MAY.2007 08:52:54



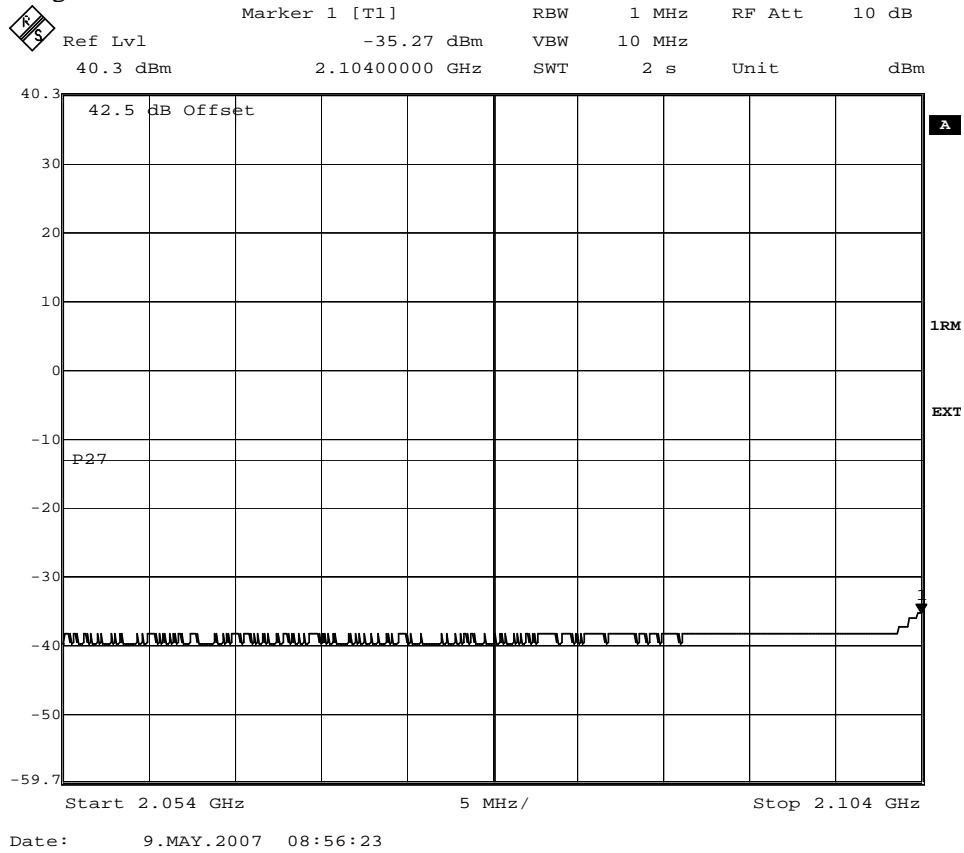
Date: 9.MAY.2007 08:55:34



FCC ID: TA8AKRC11829-4

Appendix 4.1

Diagram 1-2



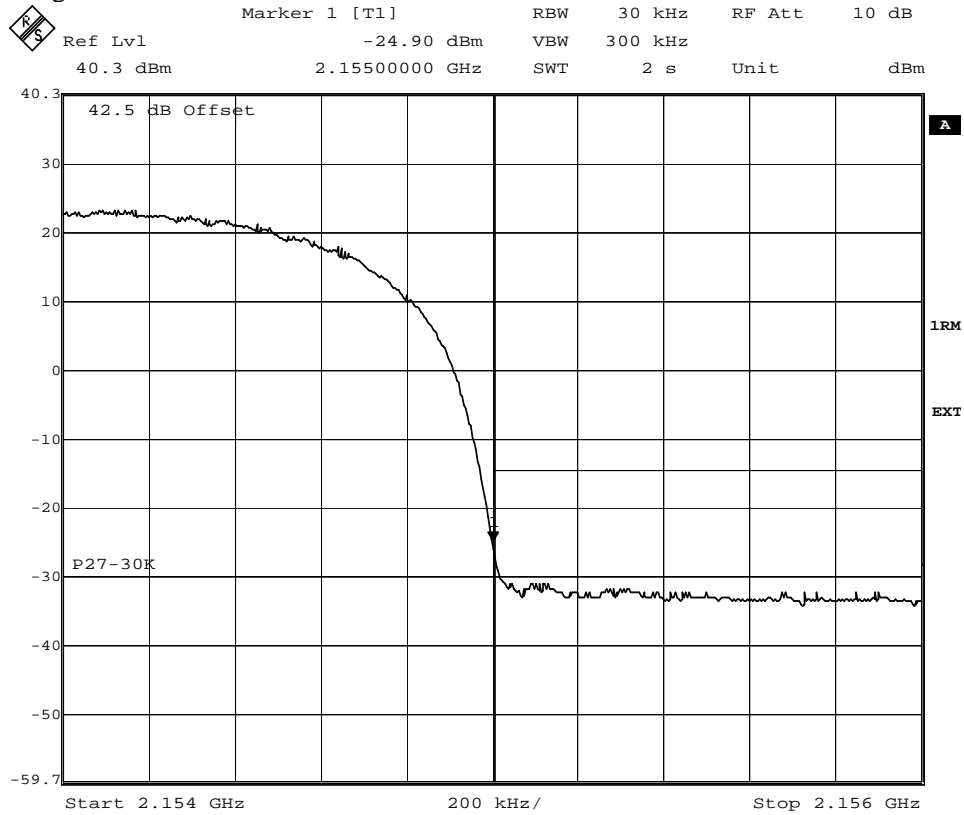




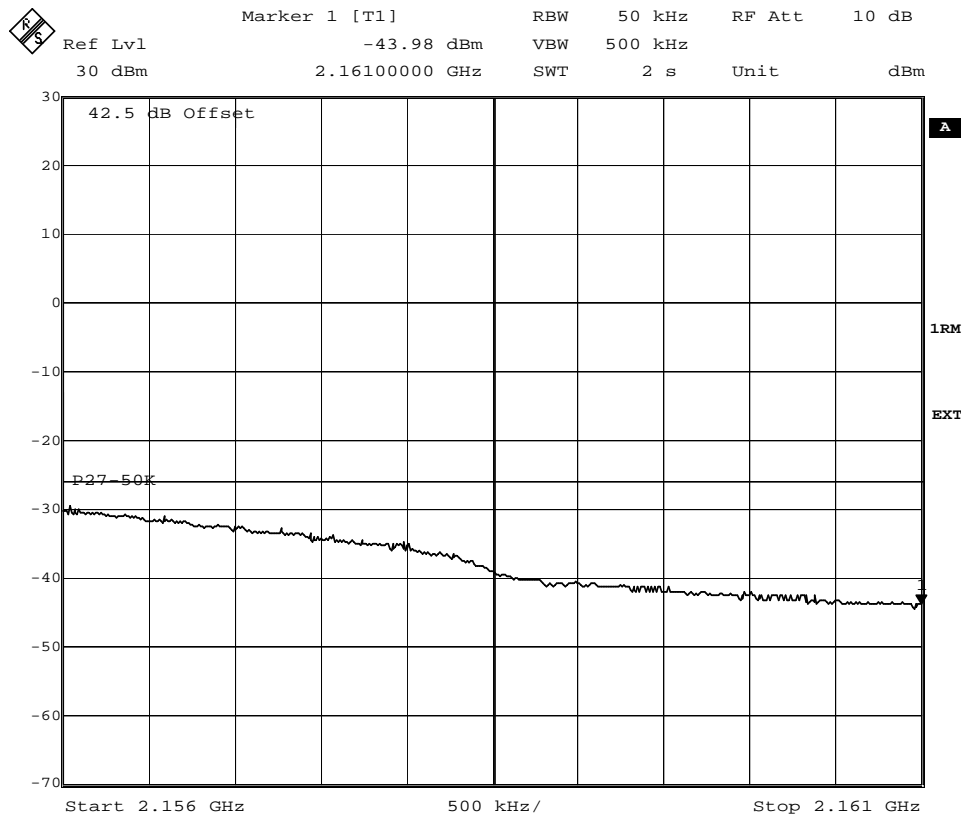
FCC ID: TA8AKRC11829-4

Appendix 4.1

Diagram 2-1



Date: 9.MAY.2007 10:47:44



Date: 9.MAY.2007 10:59:37



FCC ID: TA8AKRC11829-4

Appendix 4.1

Diagram 2-2

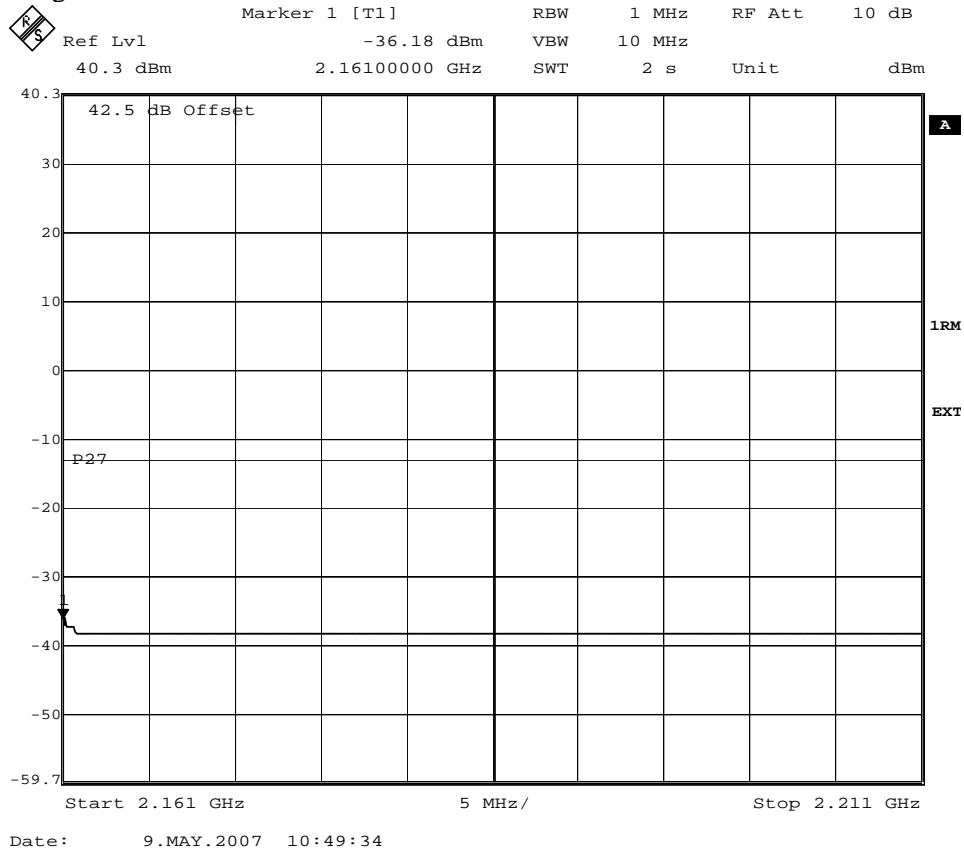
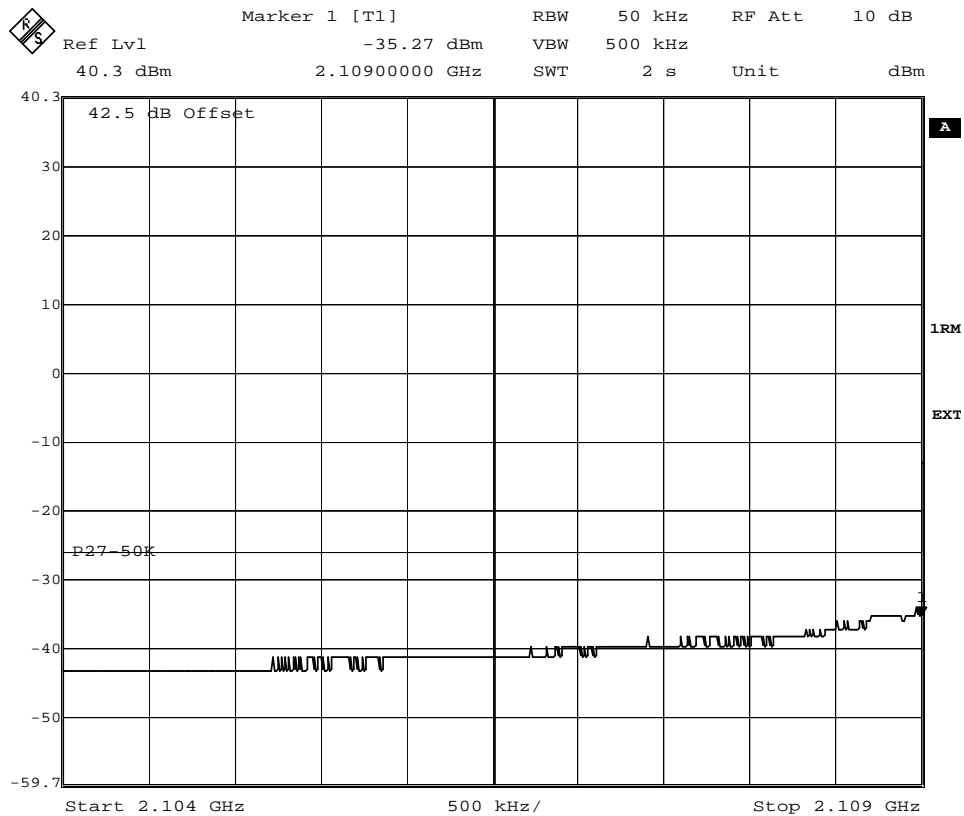
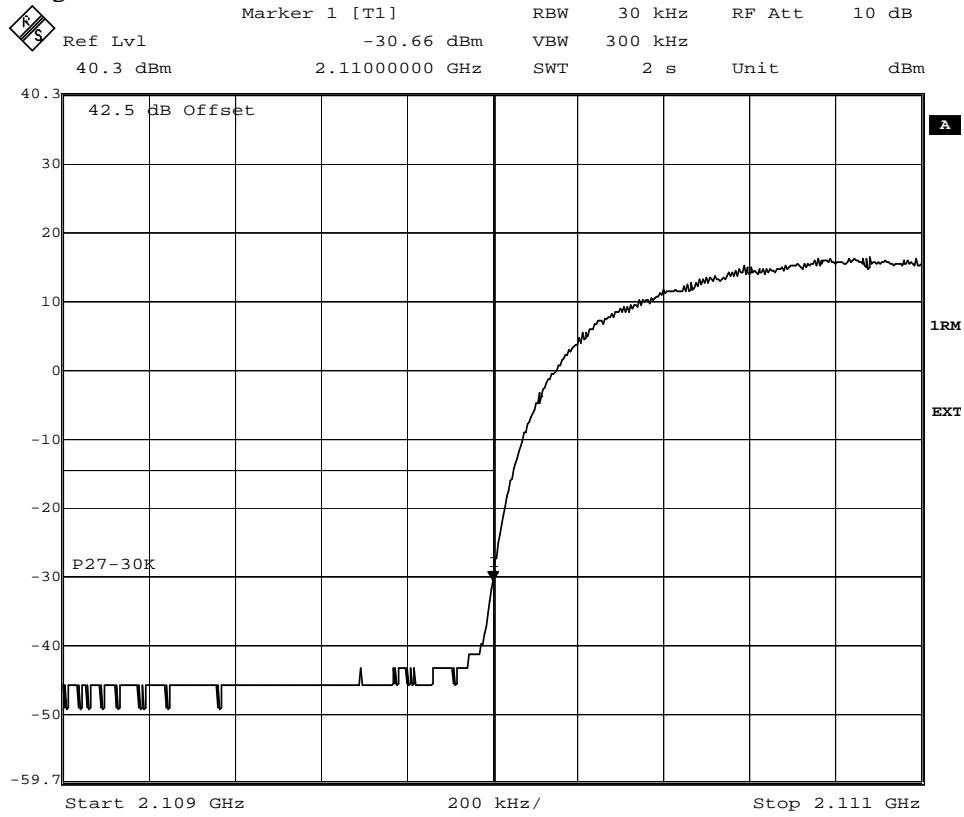




Diagram 3-1





FCC ID: TA8AKRC11829-4

Appendix 4.1

Diagram 3-2

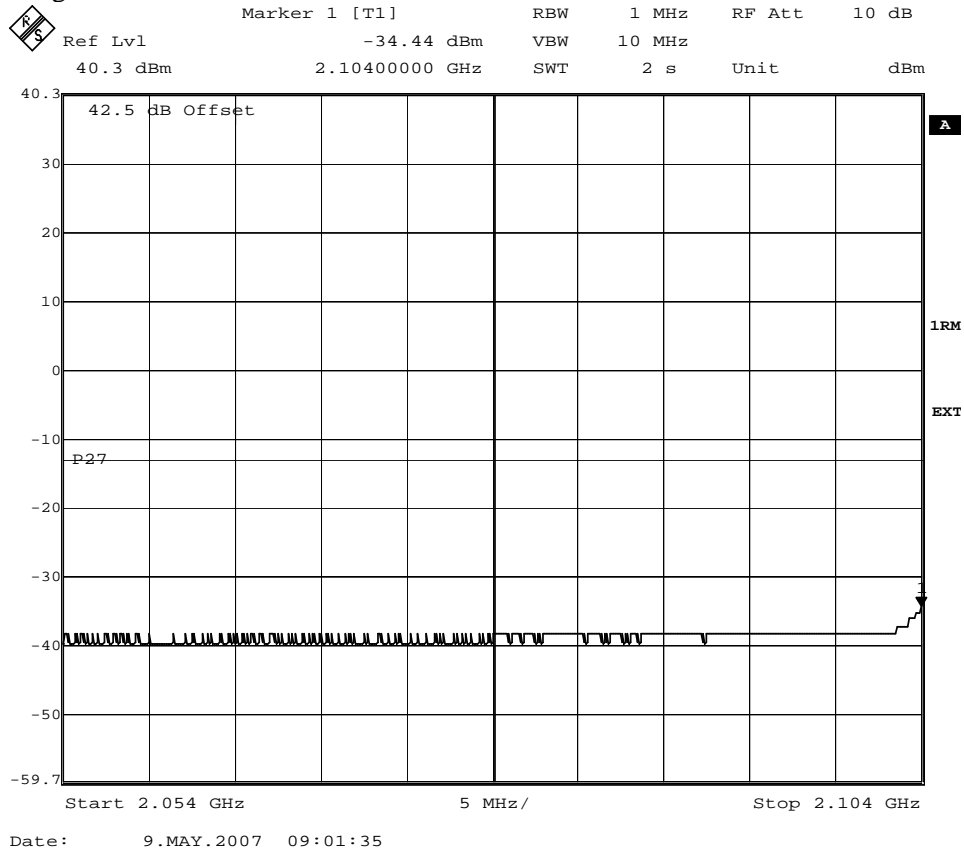
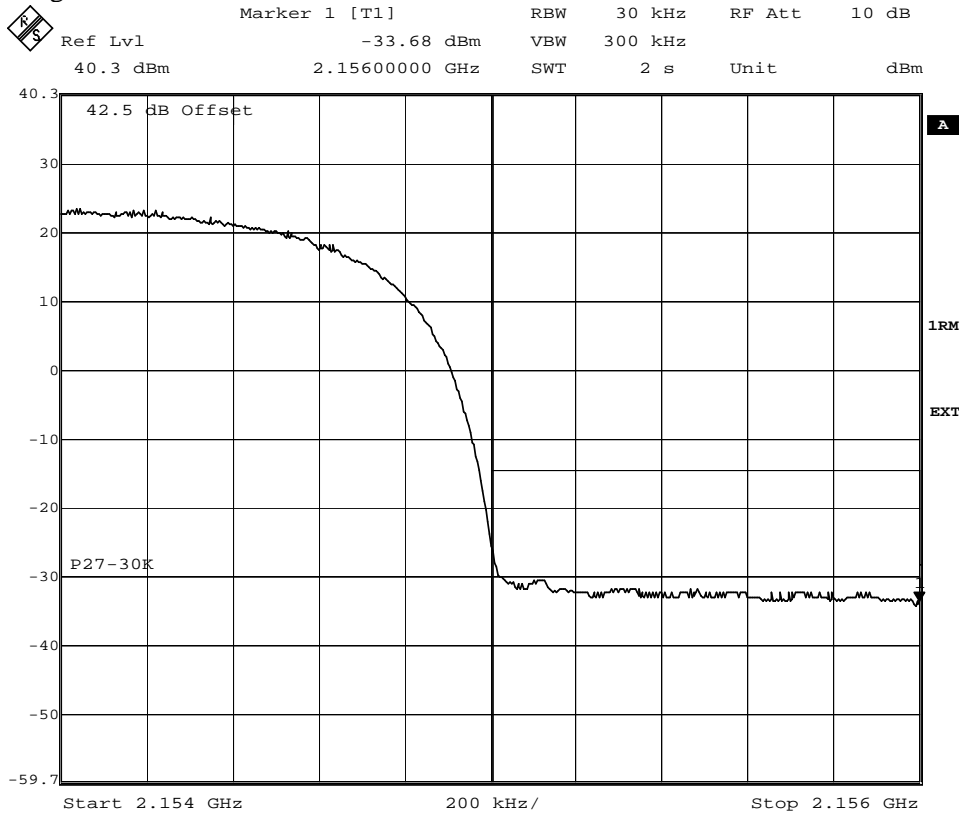
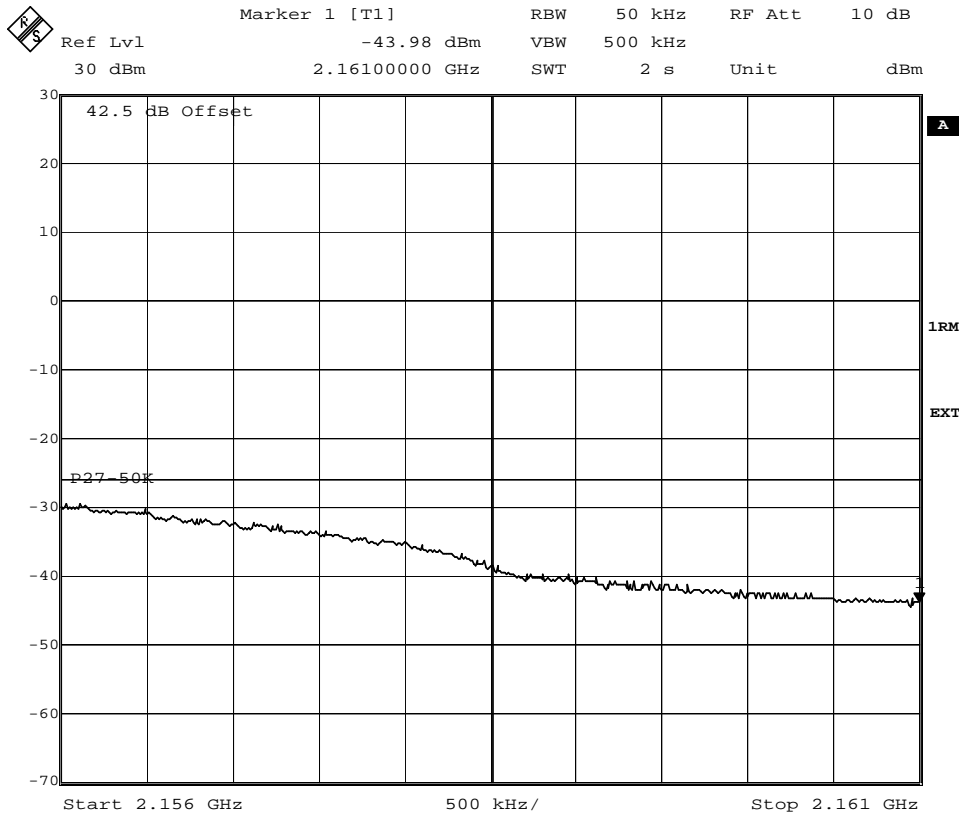




Diagram 4-1



Date: 9.MAY.2007 11:23:19



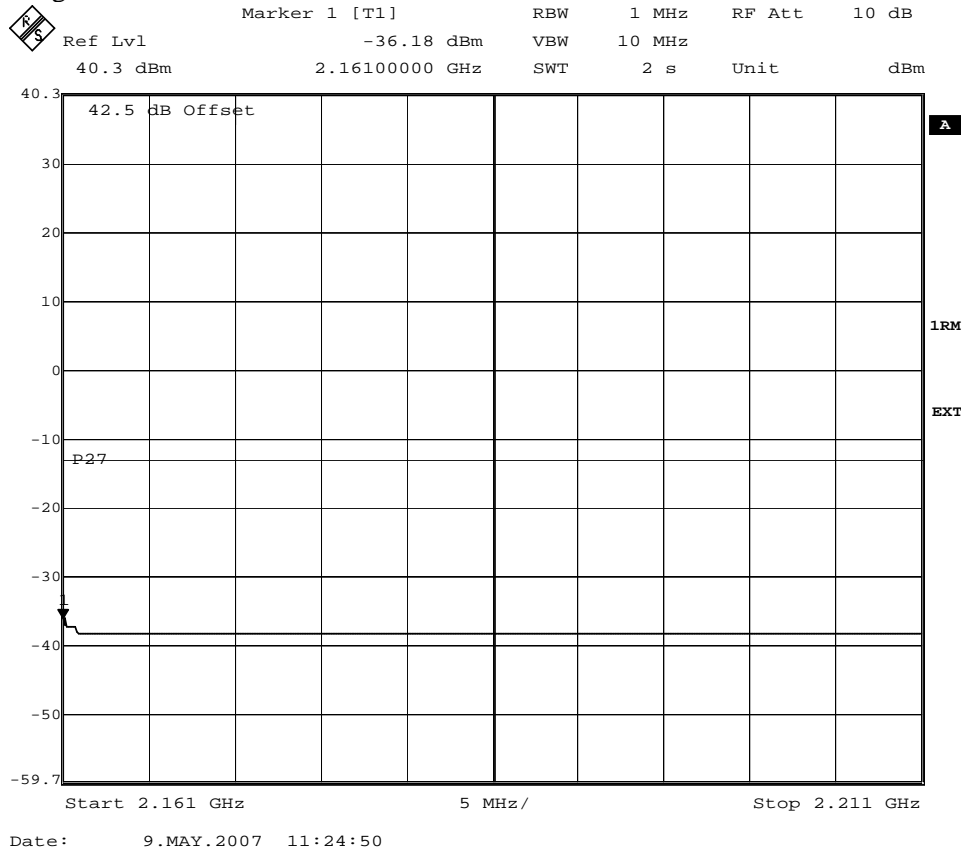
Date: 9.MAY.2007 11:24:14



FCC ID: TA8AKRC11829-4

Appendix 4.1

Diagram 4-2

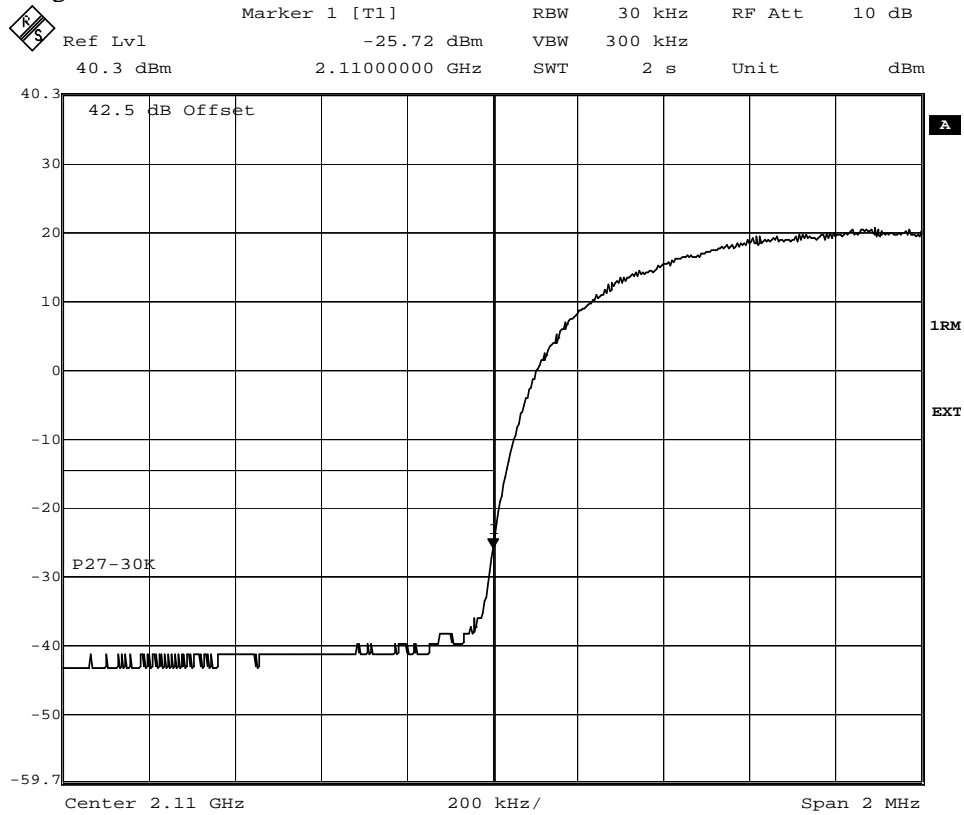




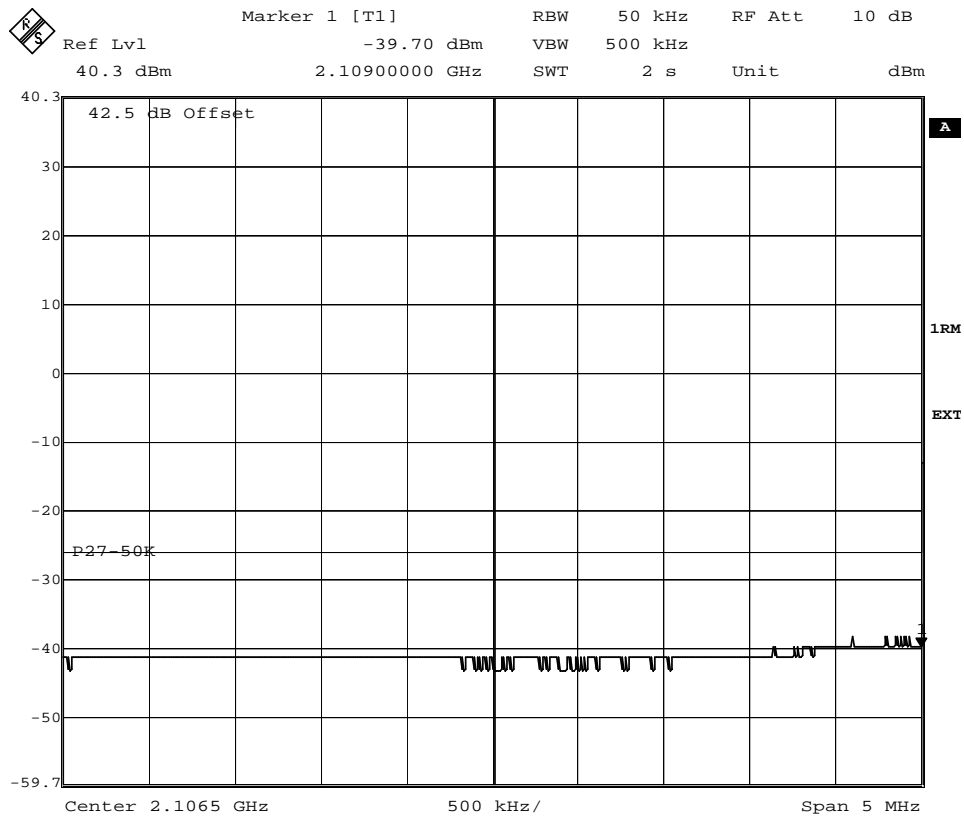
FCC ID: TA8AKRC11829-4

Appendix 4.1

Diagram 5-1



Date: 9.MAY.2007 13:12:02



Date: 9.MAY.2007 13:12:59



FCC ID: TA8AKRC11829-4

Appendix 4.1

Diagram 5-2

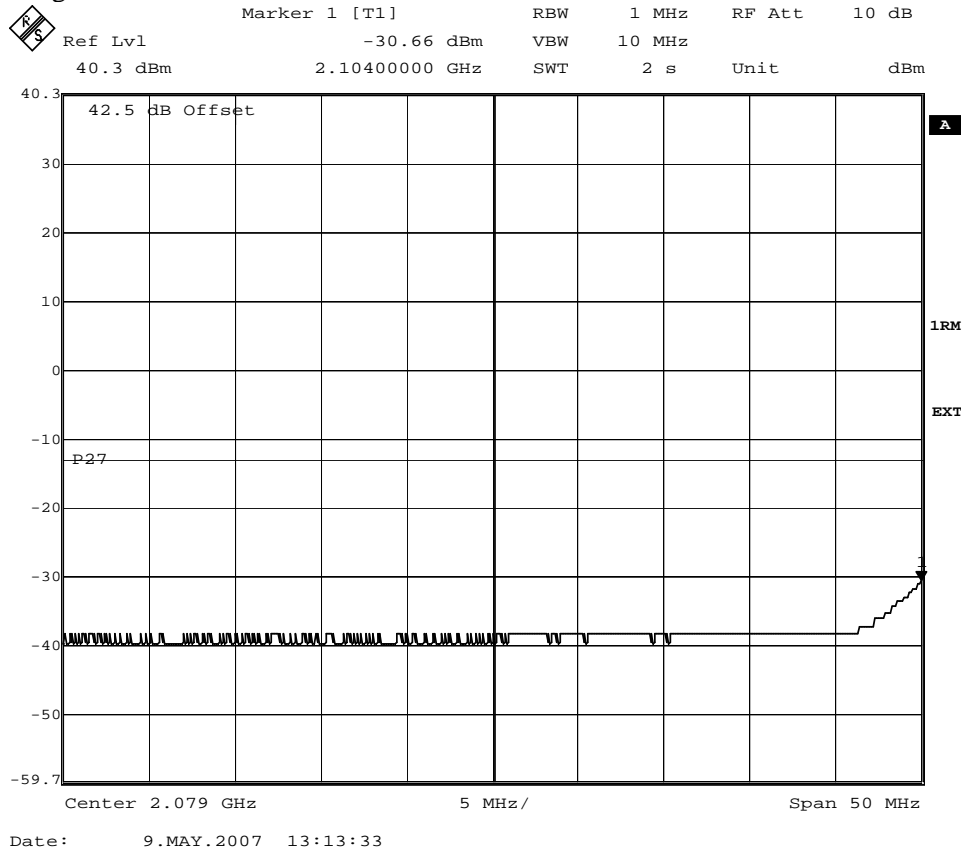
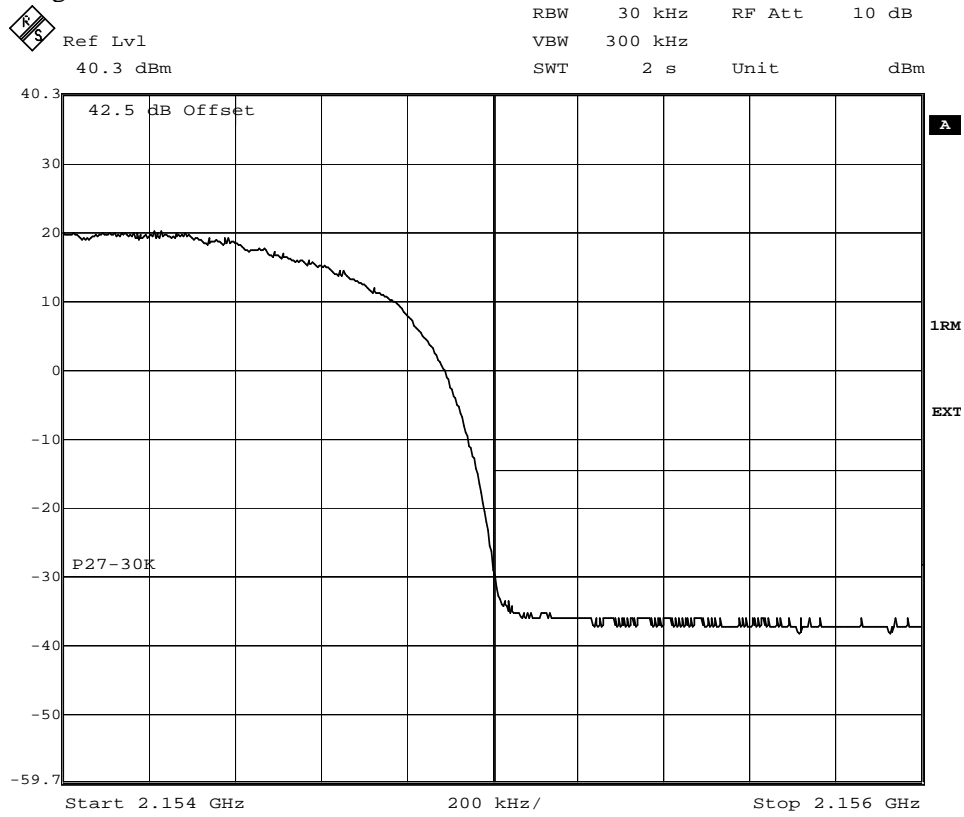


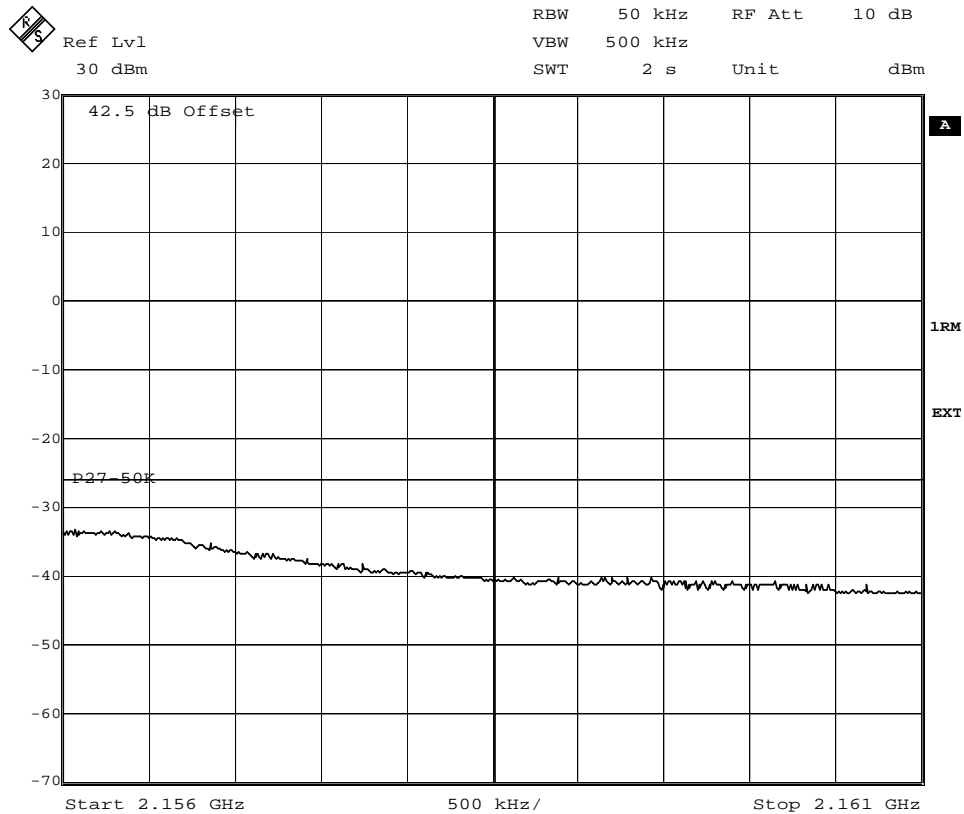




Diagram 6-1



Date: 9.MAY.2007 16:28:02



Date: 9.MAY.2007 16:30:09



FCC ID: TA8AKRC11829-4

Appendix 4.1

Diagram 6-2

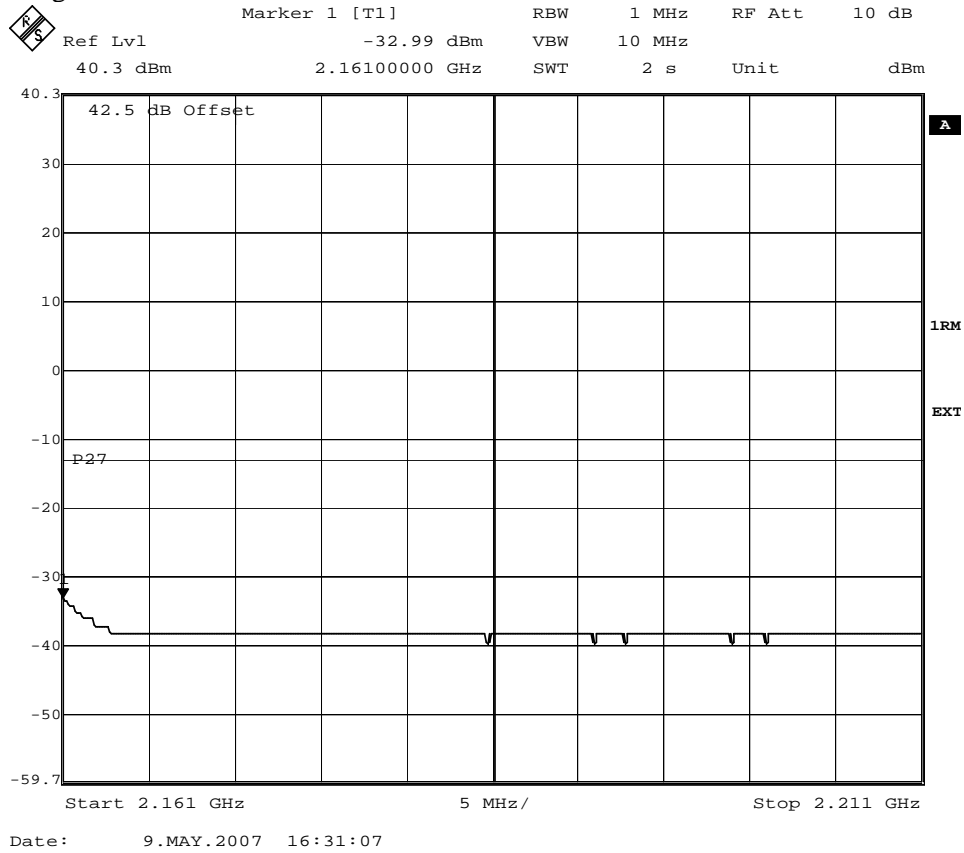
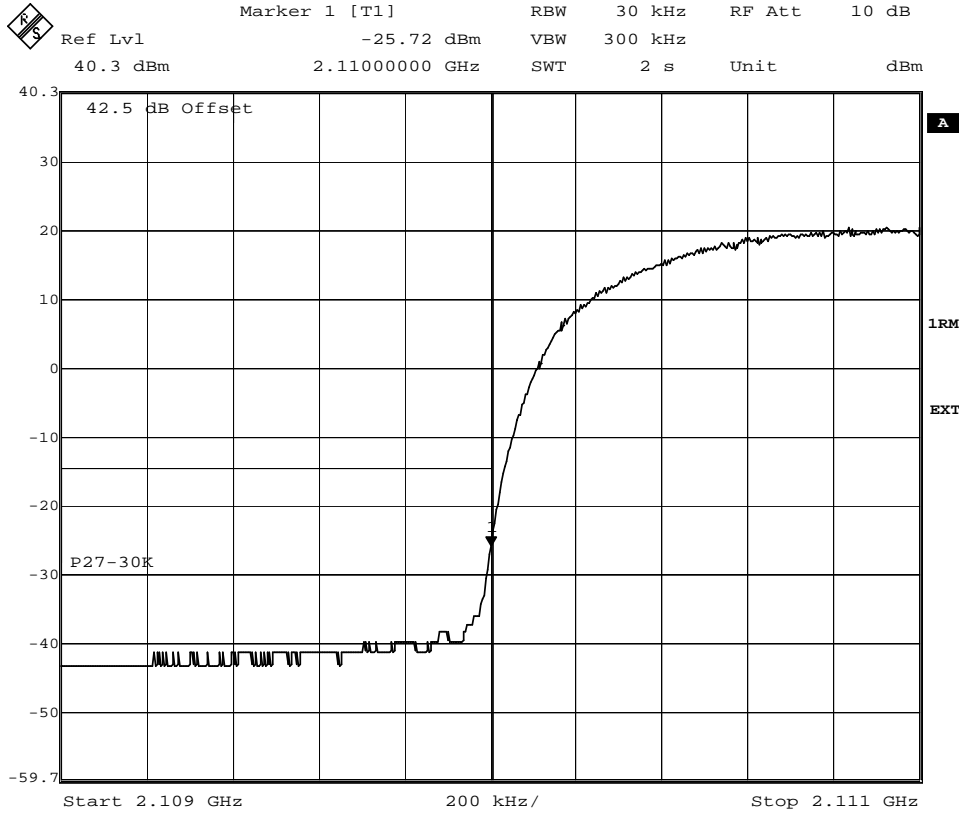
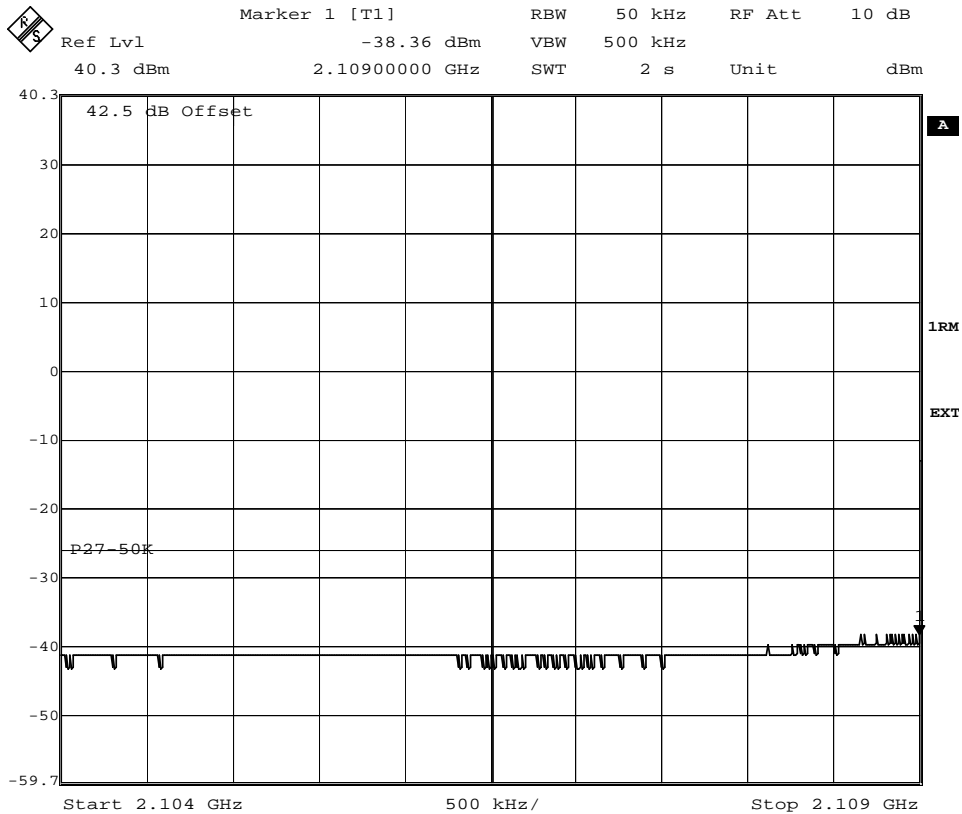




Diagram 7-1



Date: 9.MAY.2007 13:38:25



Date: 9.MAY.2007 13:39:03



FCC ID: TA8AKRC11829-4

Appendix 4.1

Diagram 7-2

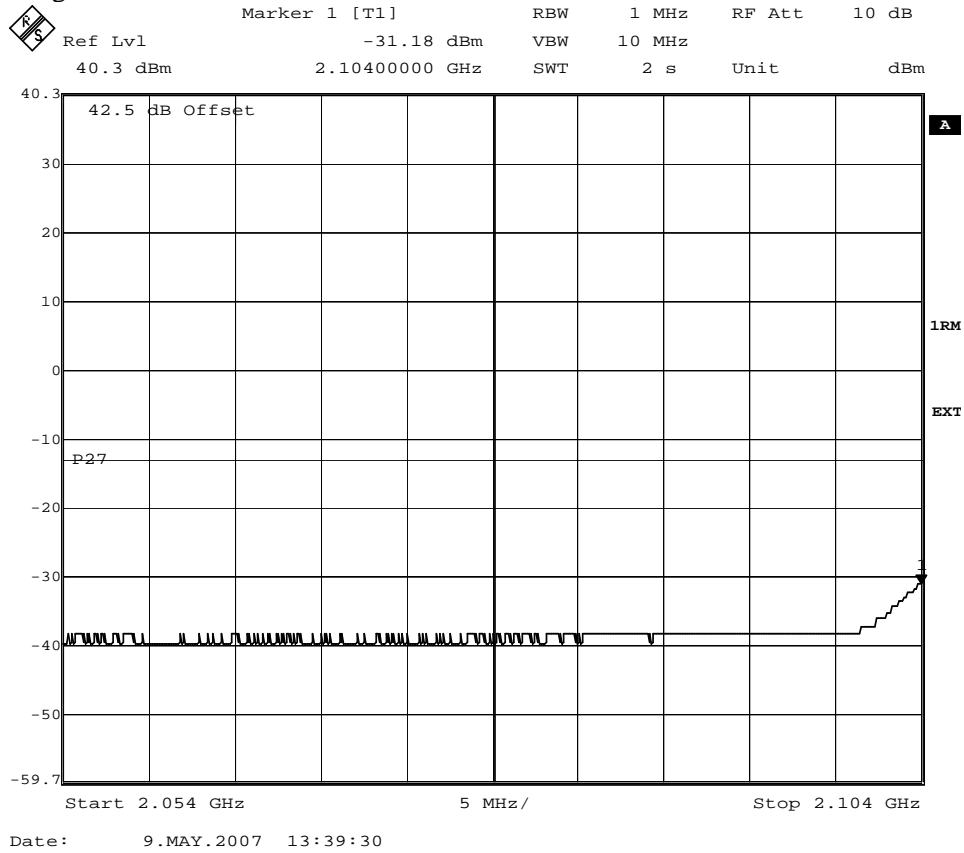
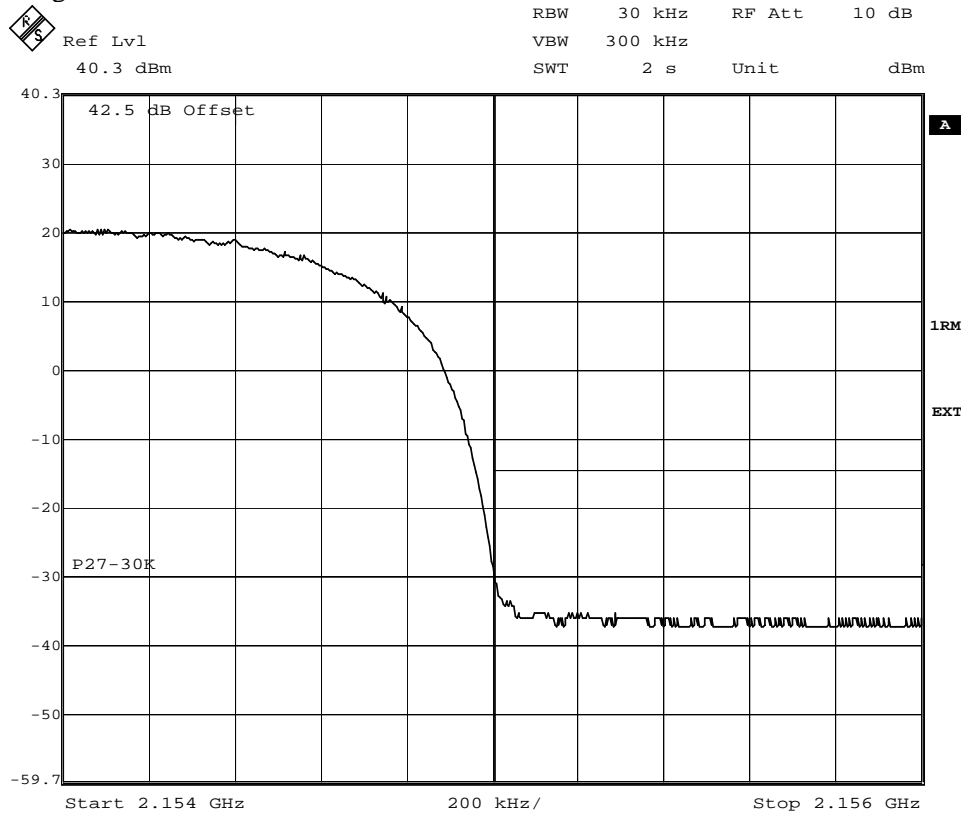
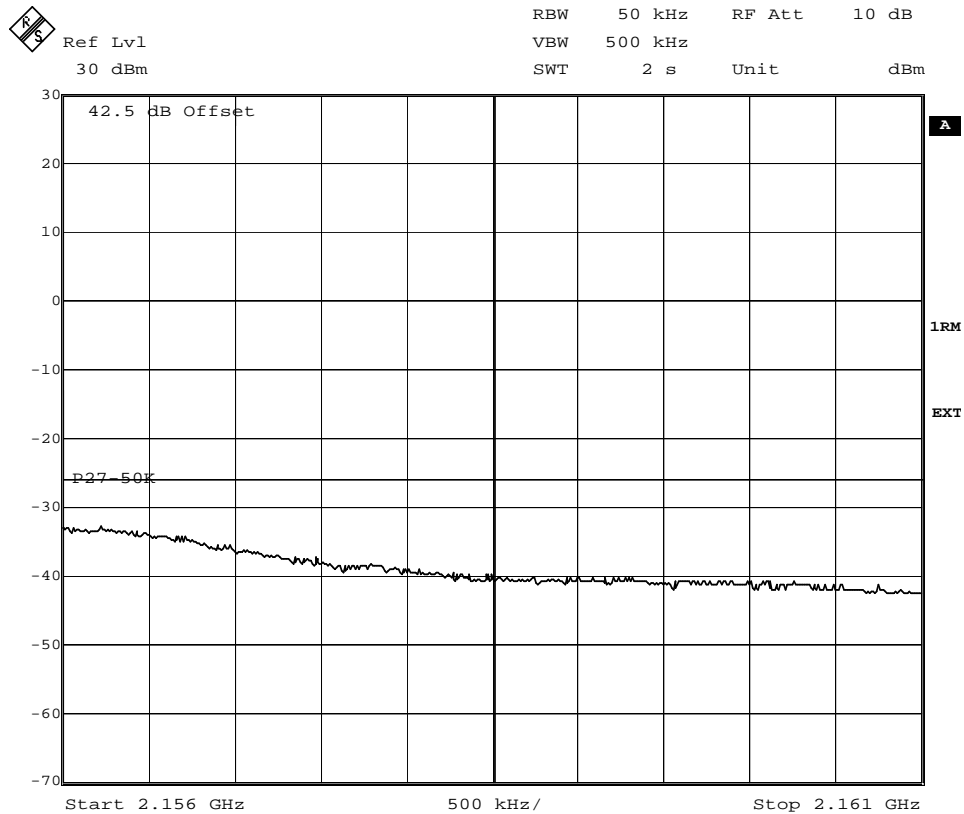




Diagram 8-1



Date: 10.MAY.2007 08:27:41



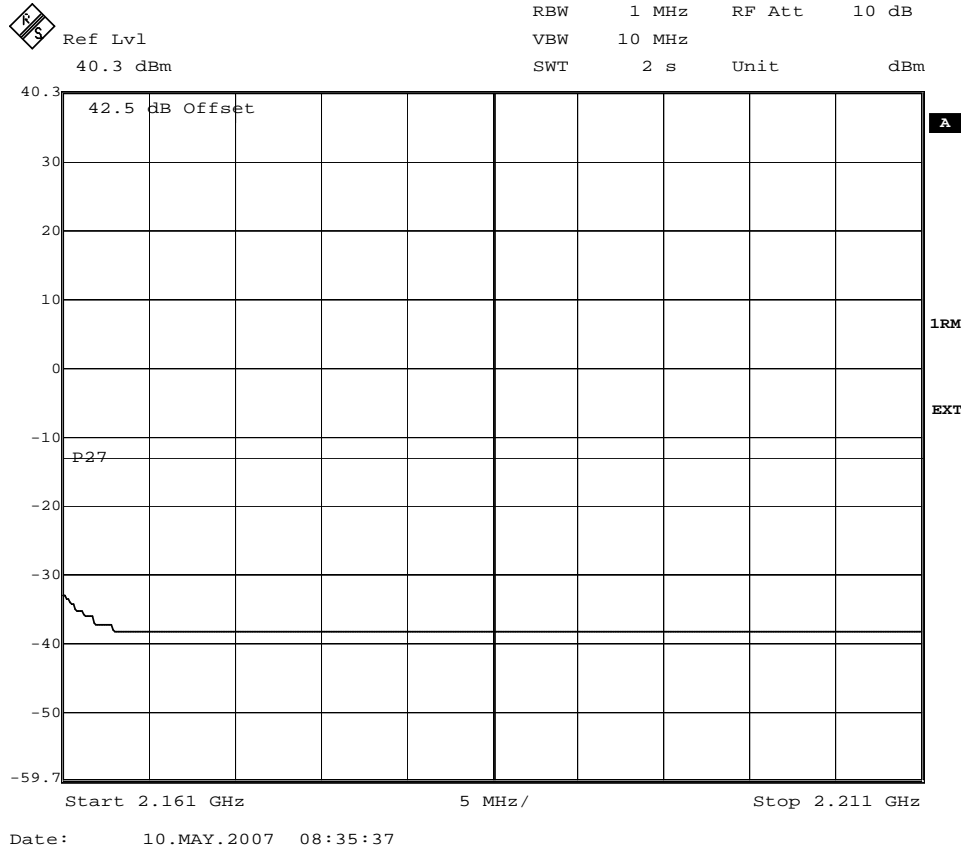
Date: 10.MAY.2007 08:34:45



FCC ID: TA8AKRC11829-4

Appendix 4.1

Diagram 8-2





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

Date	Temperature	Humidity
2007-05-09	23 °C ± 3 °C	37 % ± 5 %
2007-05-10	23 °C ± 3 °C	24 % ± 5 %

**Test set-up and procedure**

The measurements were made per definition in §27.53. 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**

<b>QPSK</b>		<b>16QAM</b>	
Diagram 1:	2112.4 MHz	Diagram 4:	2112.4 MHz
Diagram 2:	2132.4 MHz	Diagram 5:	2132.4 MHz
Diagram 3:	2152.6 MHz	Diagram 6:	2152.6 MHz

**Multi carrier**

<b>QPSK</b>		<b>16QAM</b>	
Diagram 7:	2112.4+2122.4 MHz	Diagram 10:	2112.4+2122.4 MHz
Diagram 8:	2127.4+2137.4 MHz	Diagram 11:	2127.4+2137.4 MHz
Diagram 9:	2142.6+2152.6 MHz	Diagram 12:	2142.6+2152.6 MHz

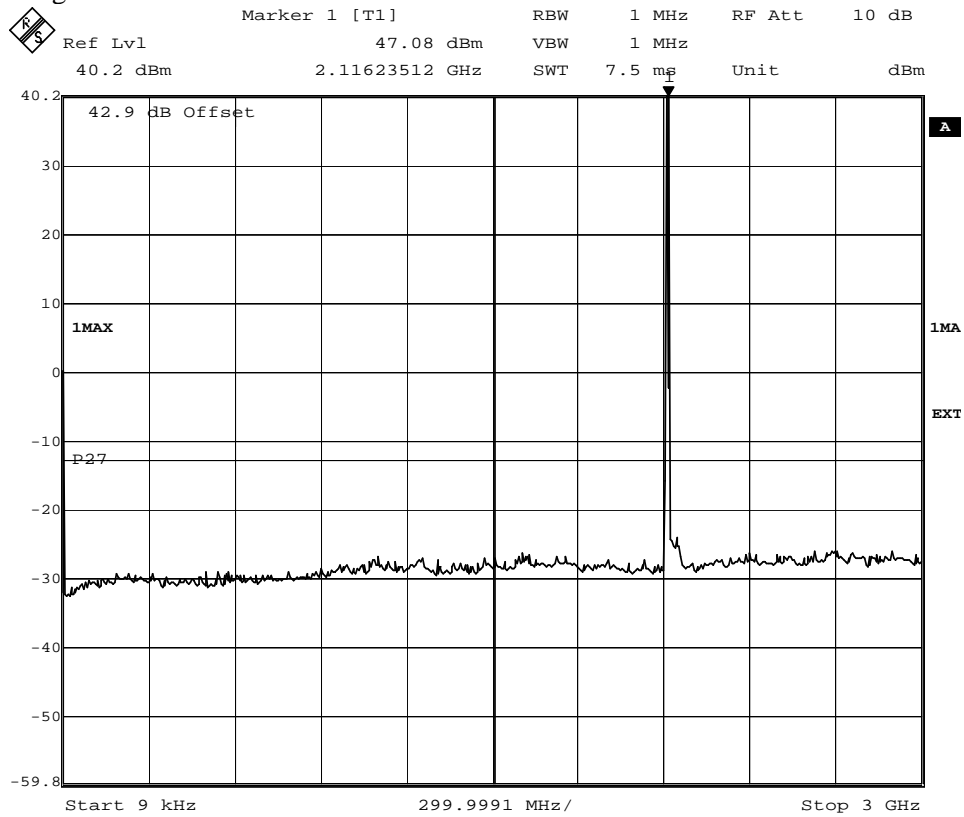
**Limits**

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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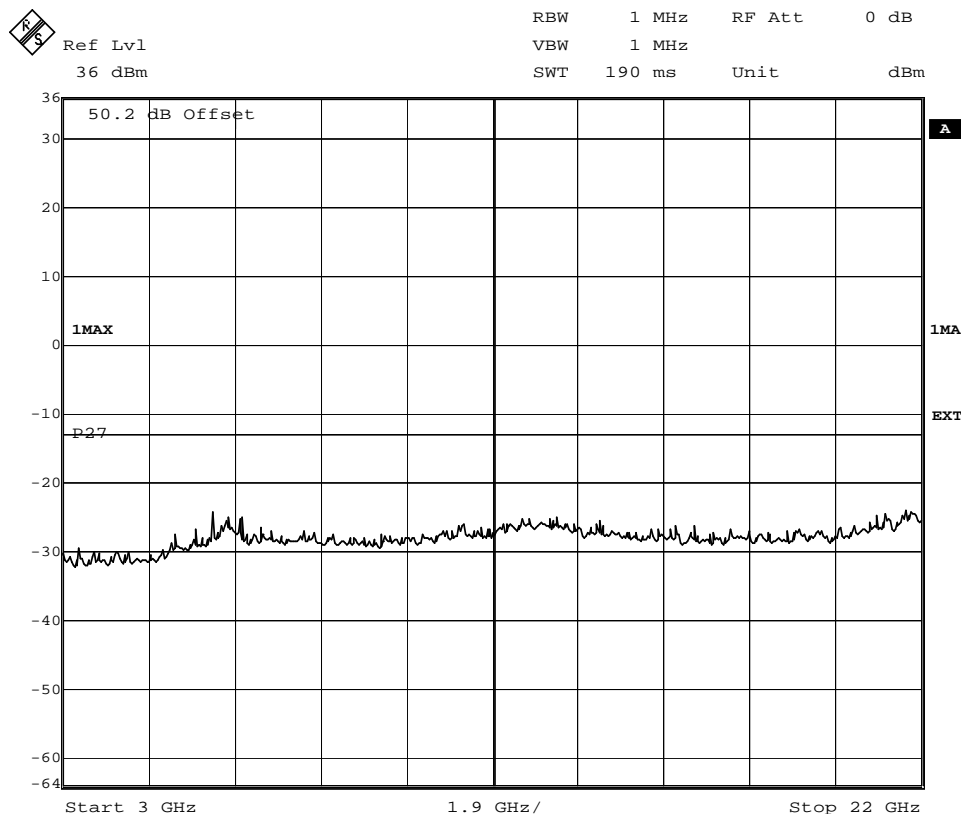


Diagram 1



Date: 9.MAY.2007 10:25:03

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.

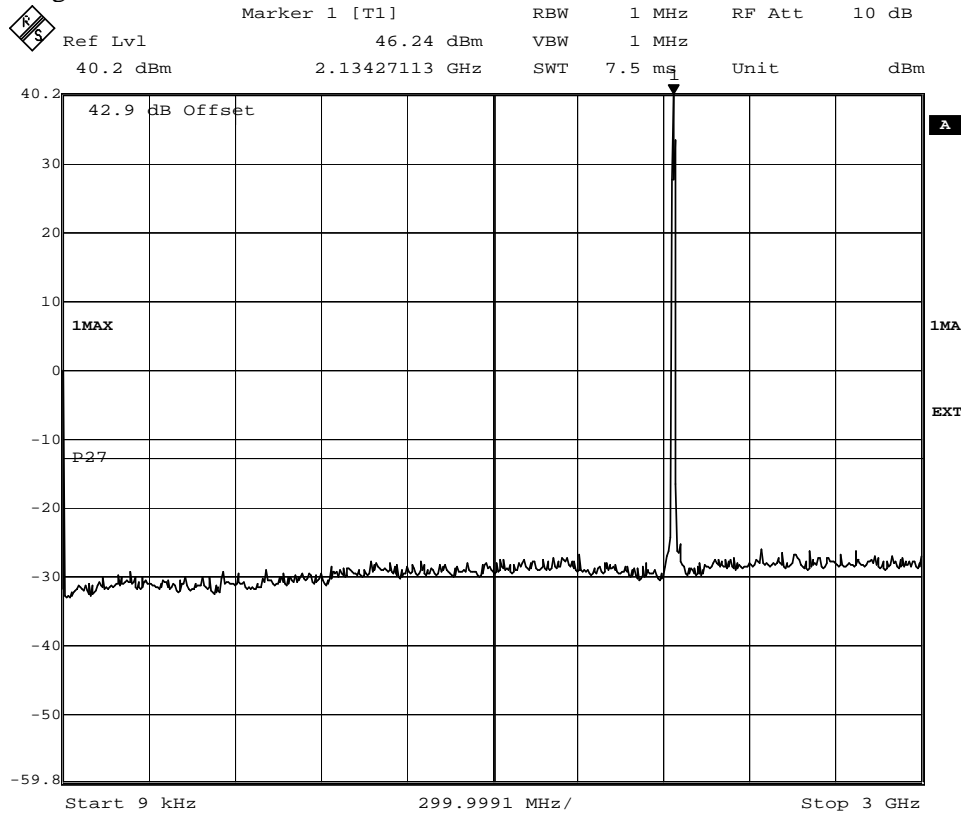


Date: 9.MAY.2007 10:23:08



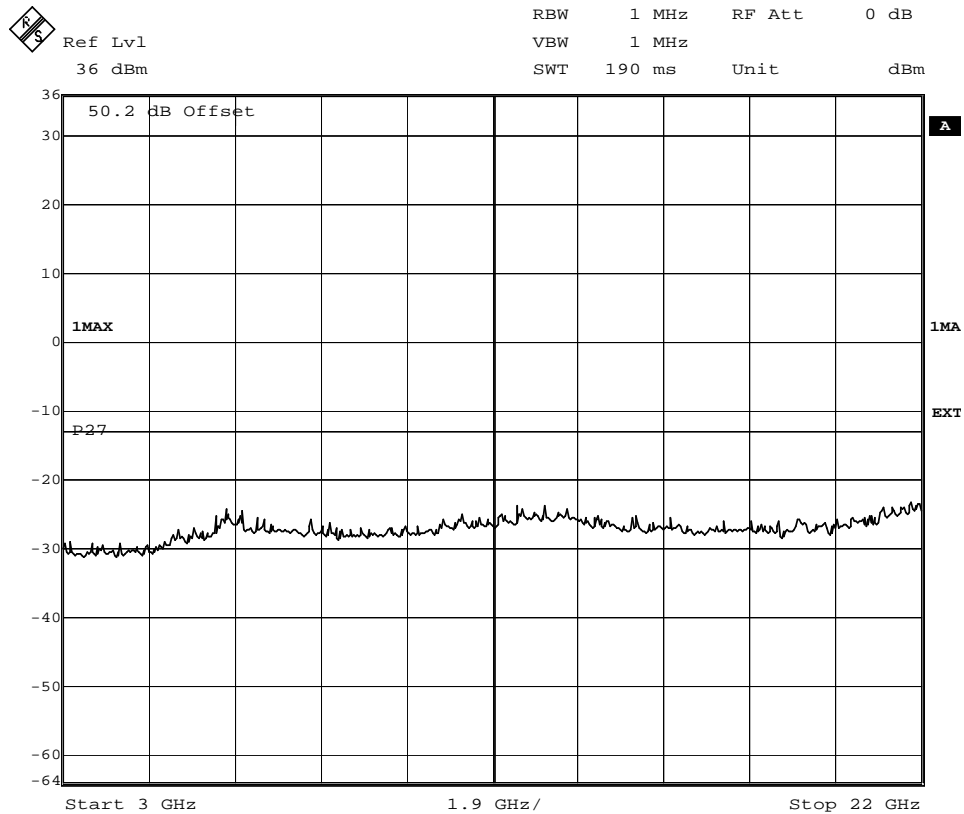


Diagram 2



Date: 9.MAY.2007 12:28:45

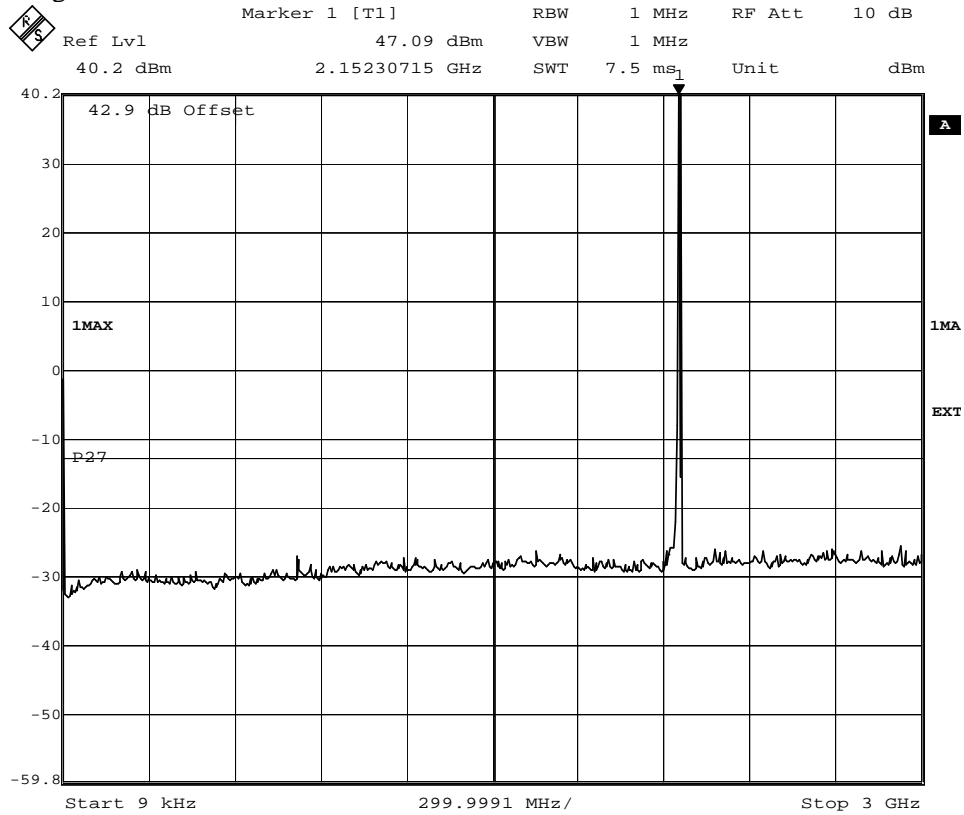
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



Date: 9.MAY.2007 12:27:28

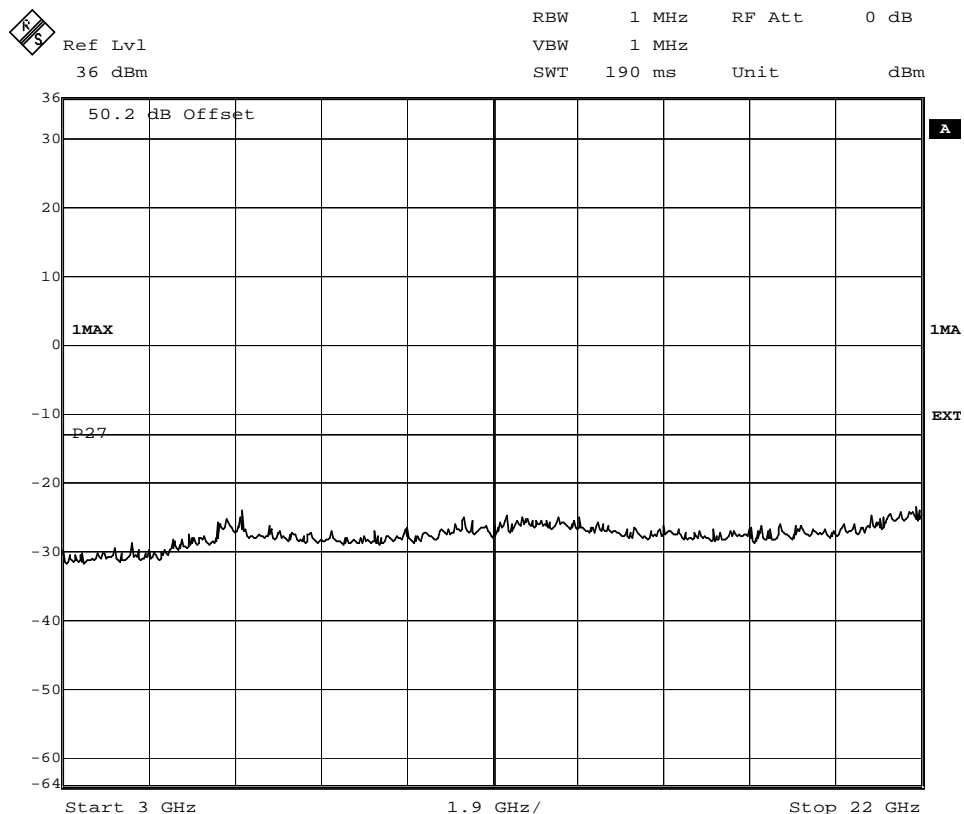


Diagram 3



Date: 9.MAY.2007 11:04:29

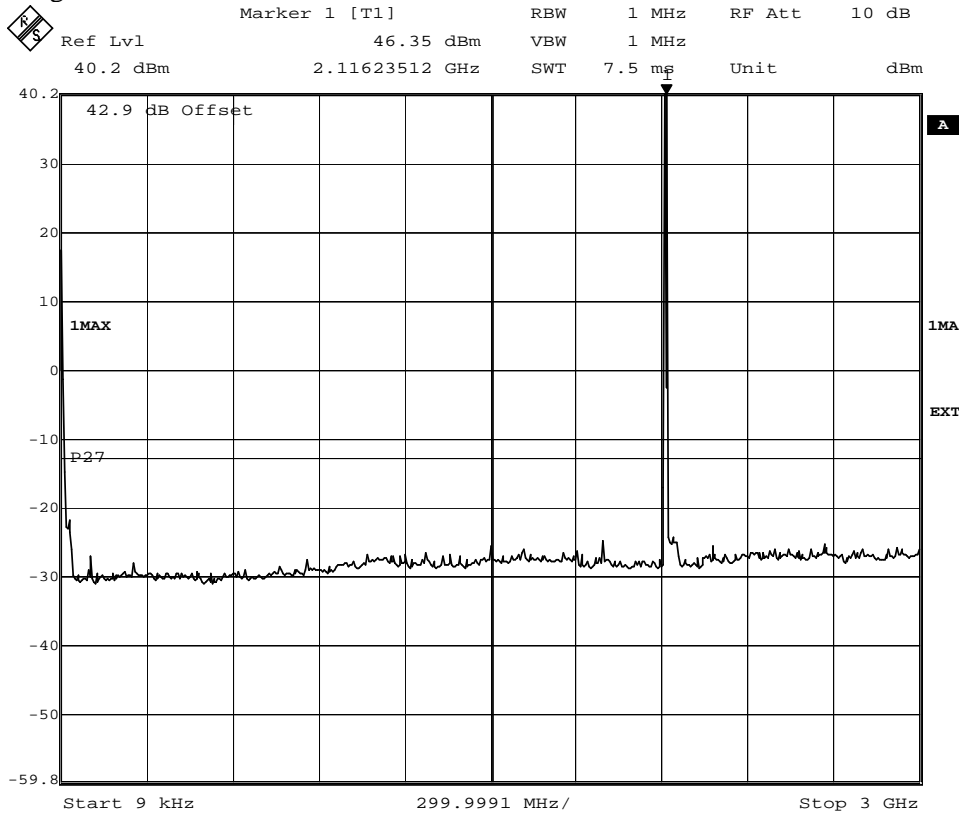
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



Date: 9.MAY.2007 11:02:46

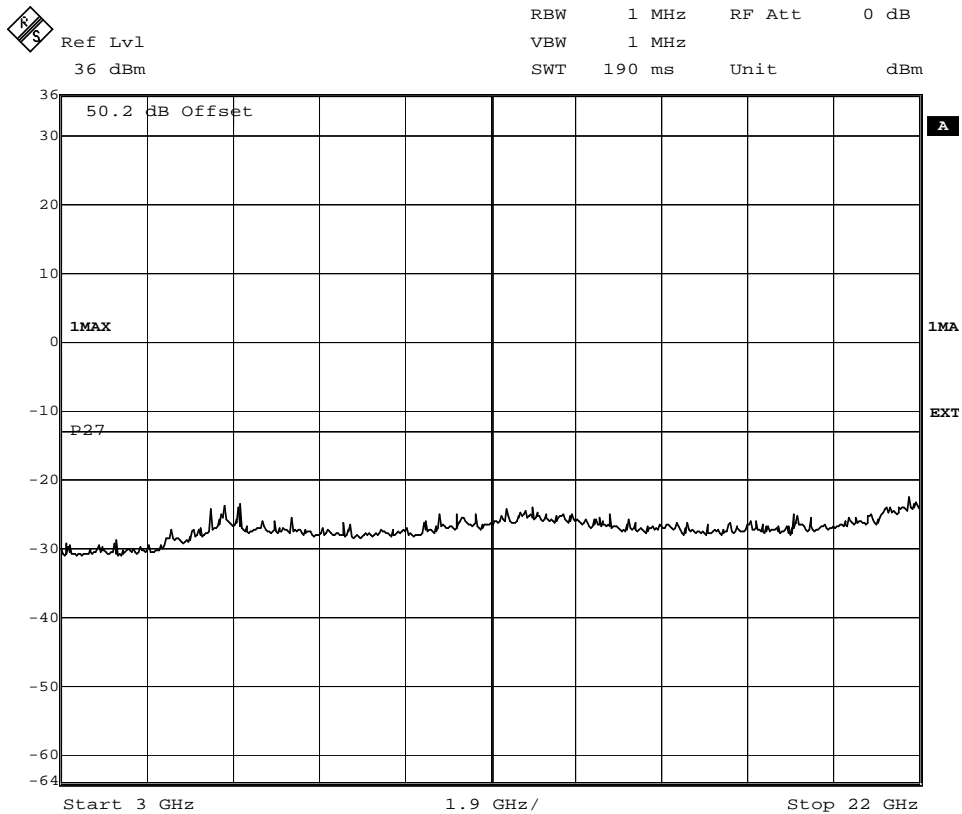


Diagram 4



Date: 9.MAY.2007 09:16:54

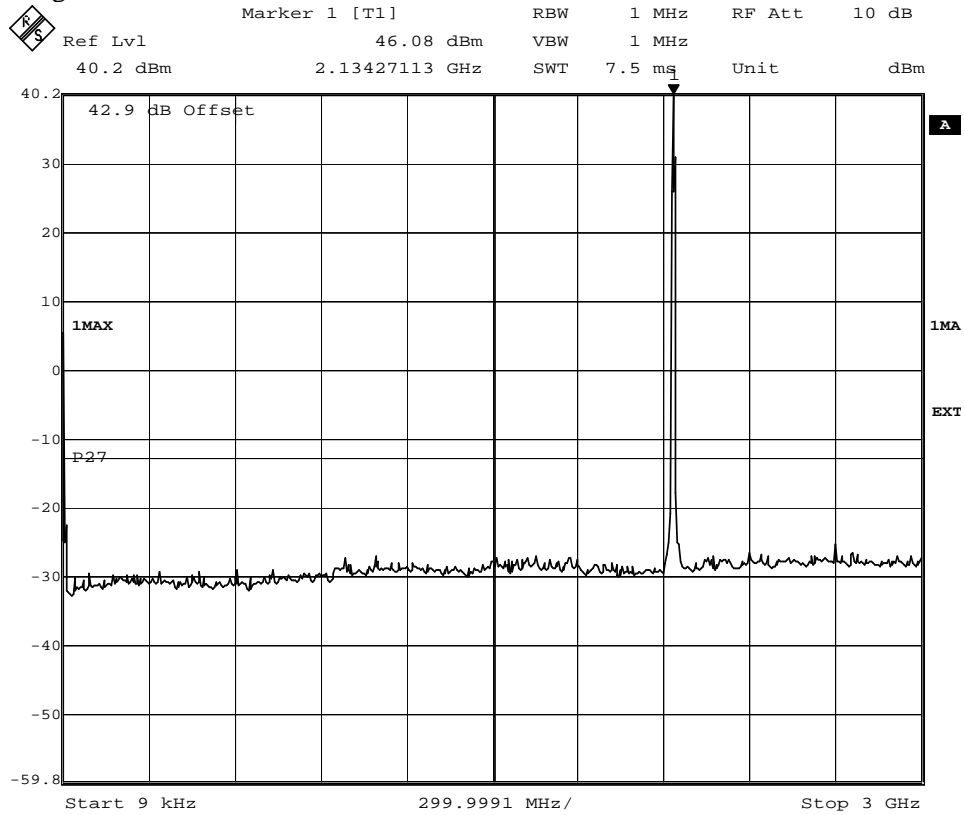
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



Date: 9.MAY.2007 09:14:04

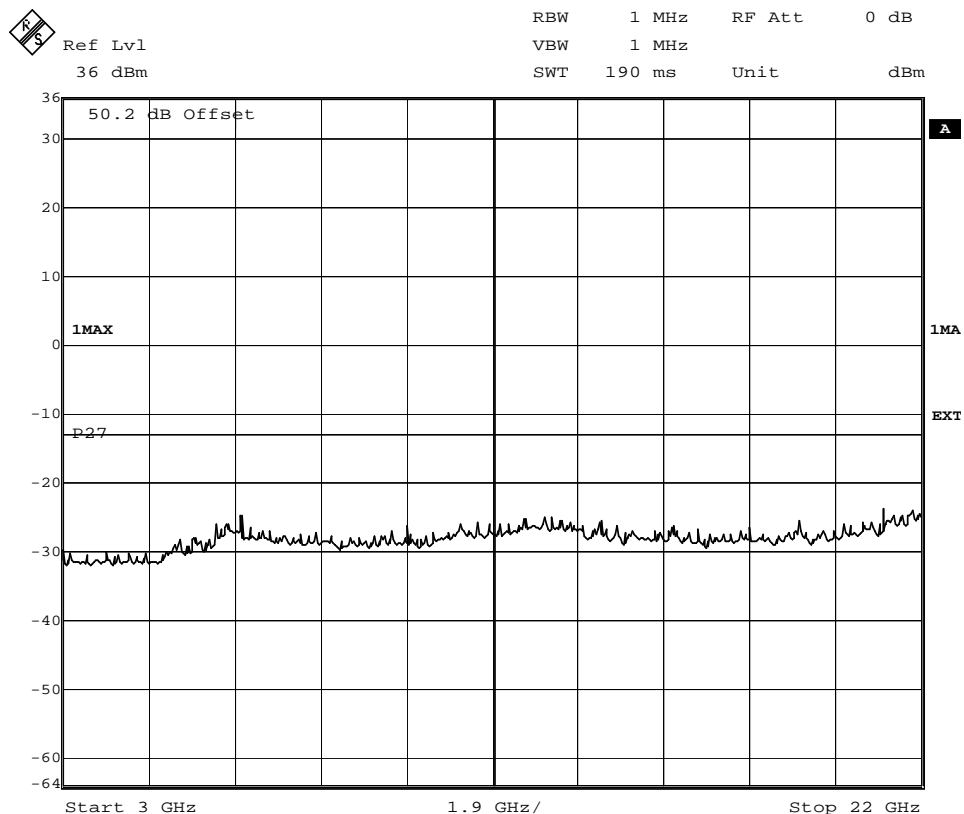


Diagram 5



Date: 9.MAY.2007 12:41:01

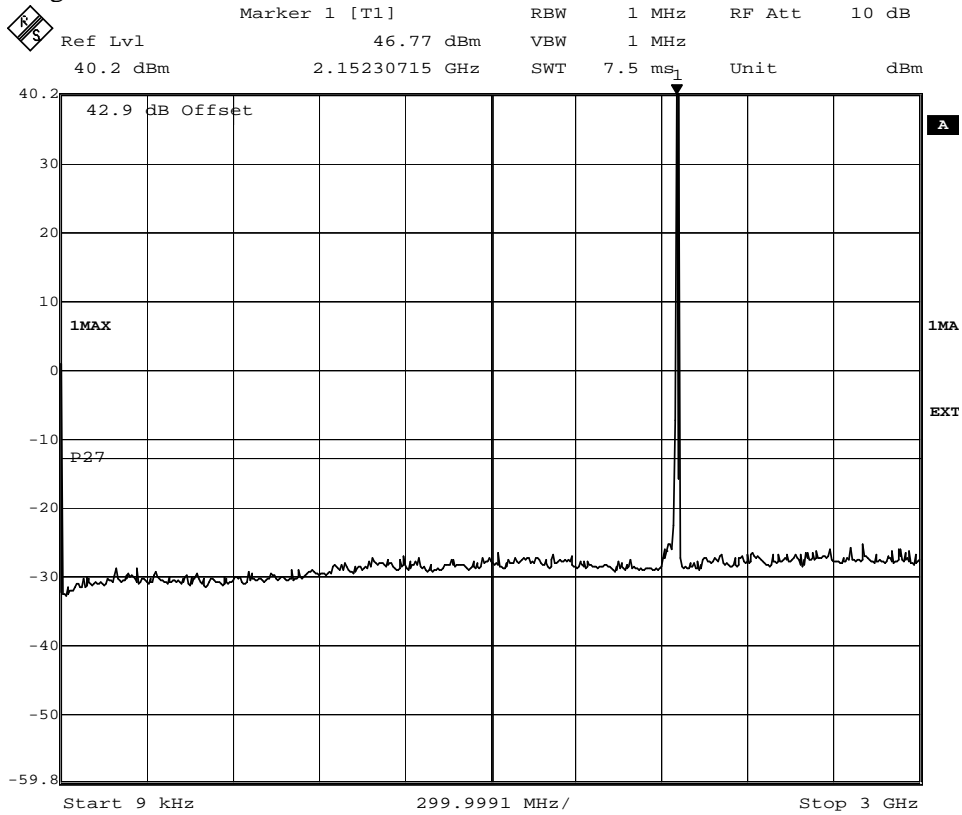
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



Date: 9.MAY.2007 12:39:52

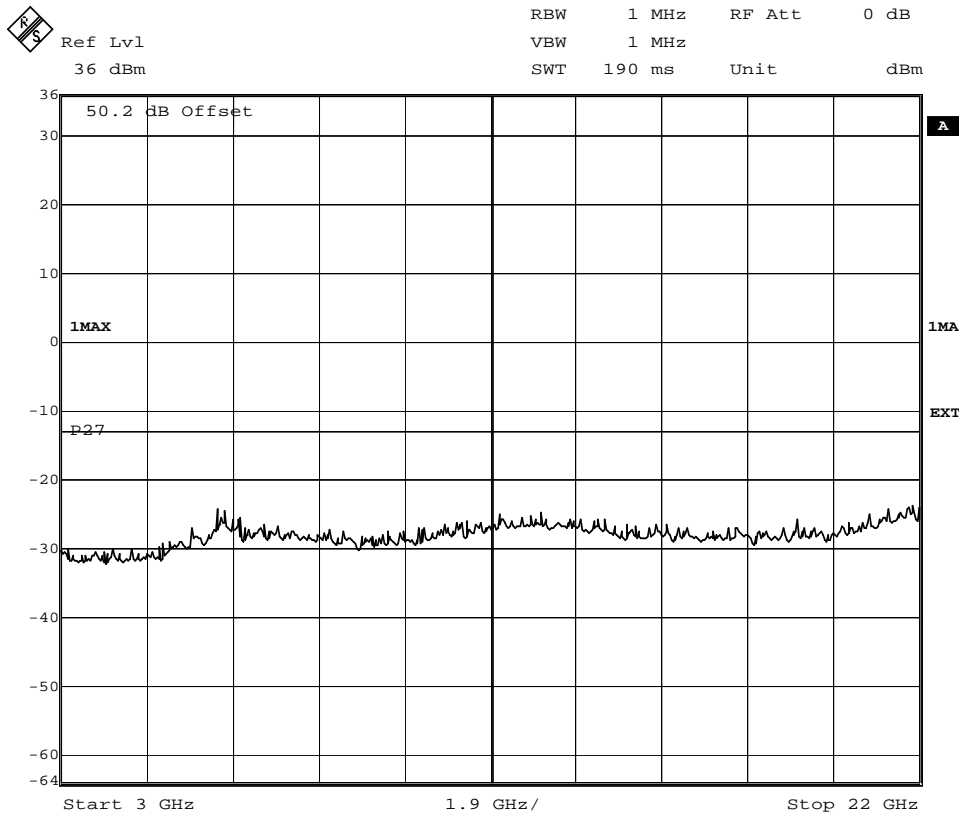


Diagram 6



Date: 9.MAY.2007 11:18:24

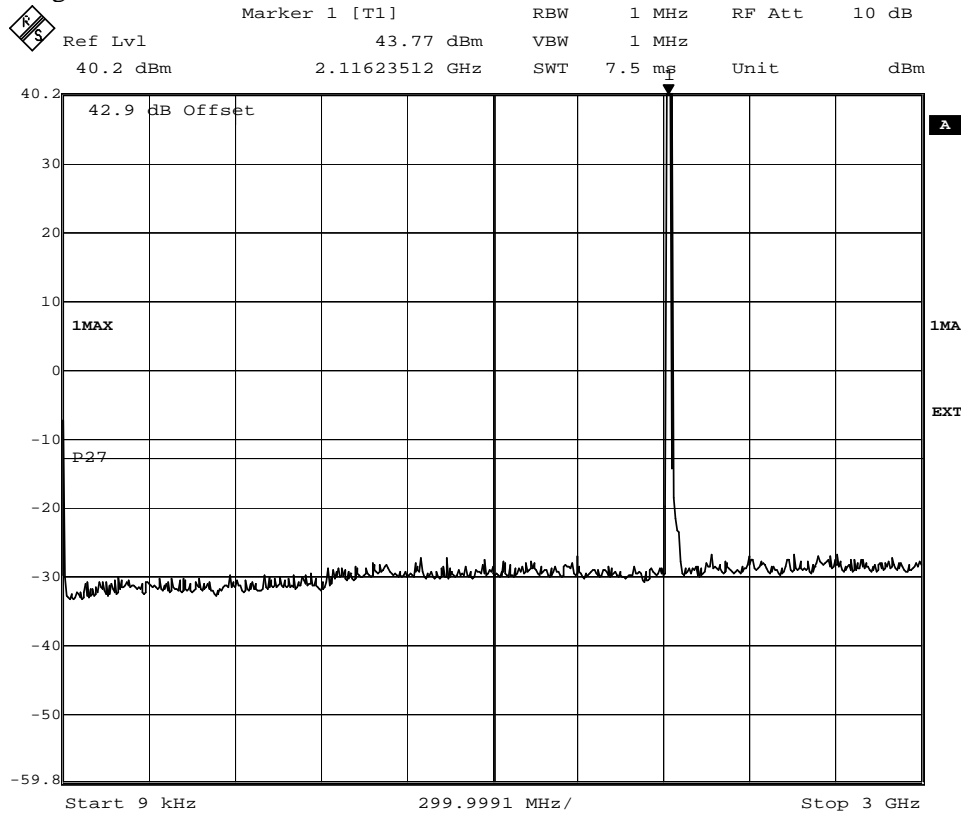
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



Date: 9.MAY.2007 11:16:08

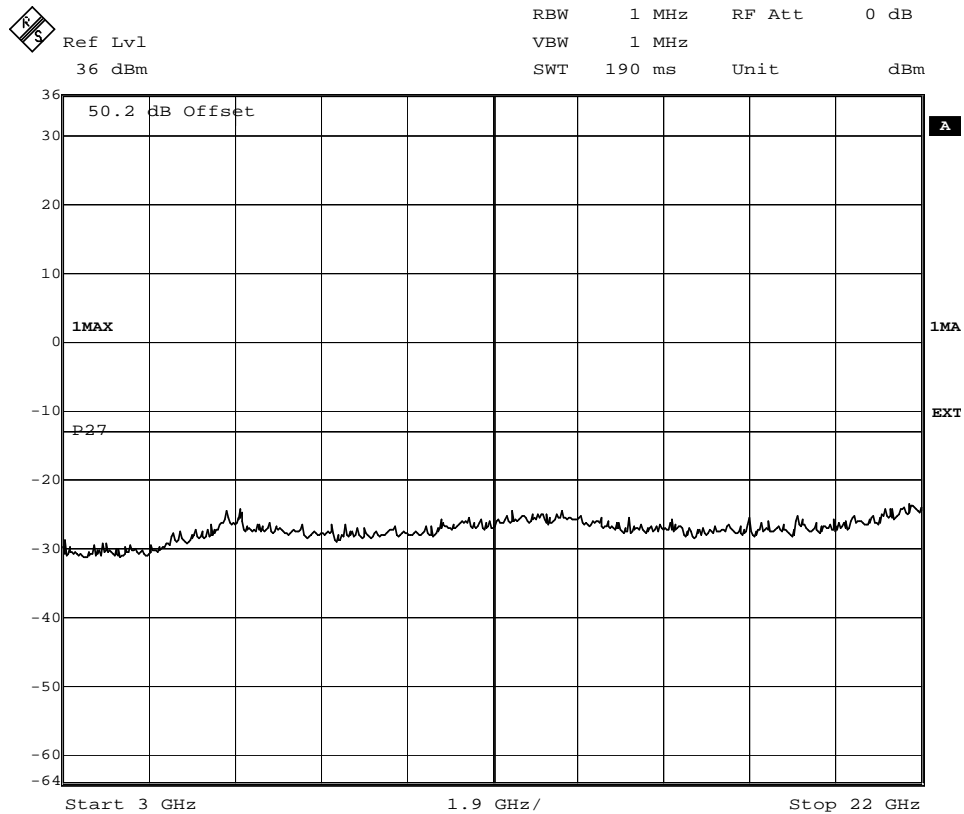


Diagram 7



Date: 9.MAY.2007 13:17:25

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.

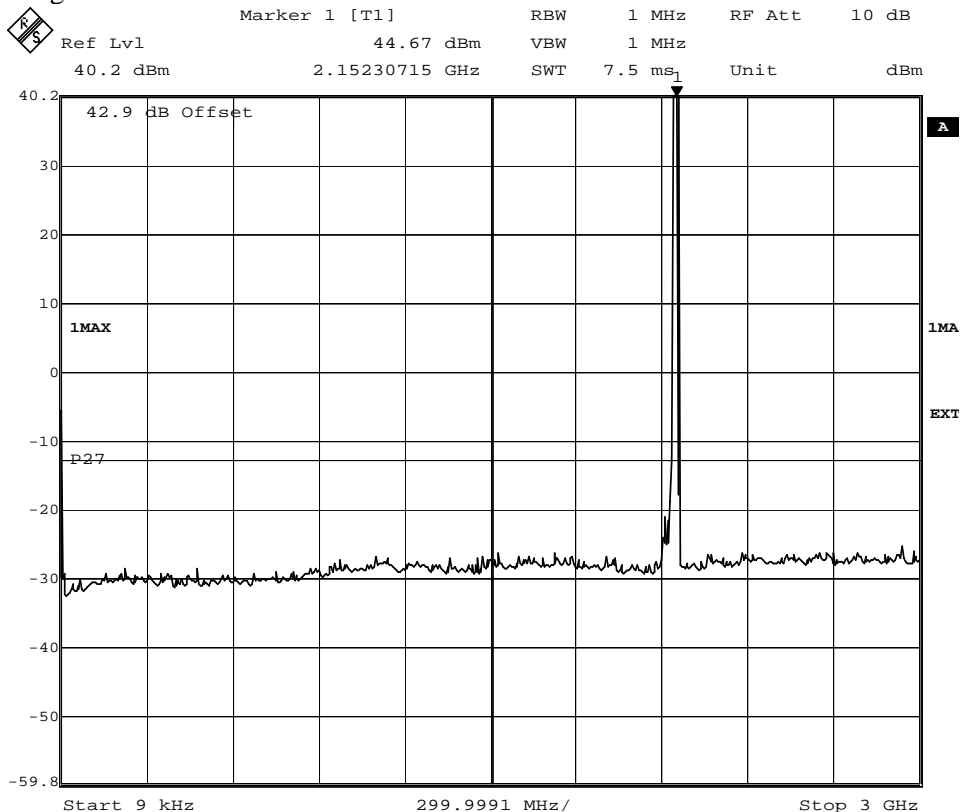


Date: 9.MAY.2007 13:16:02



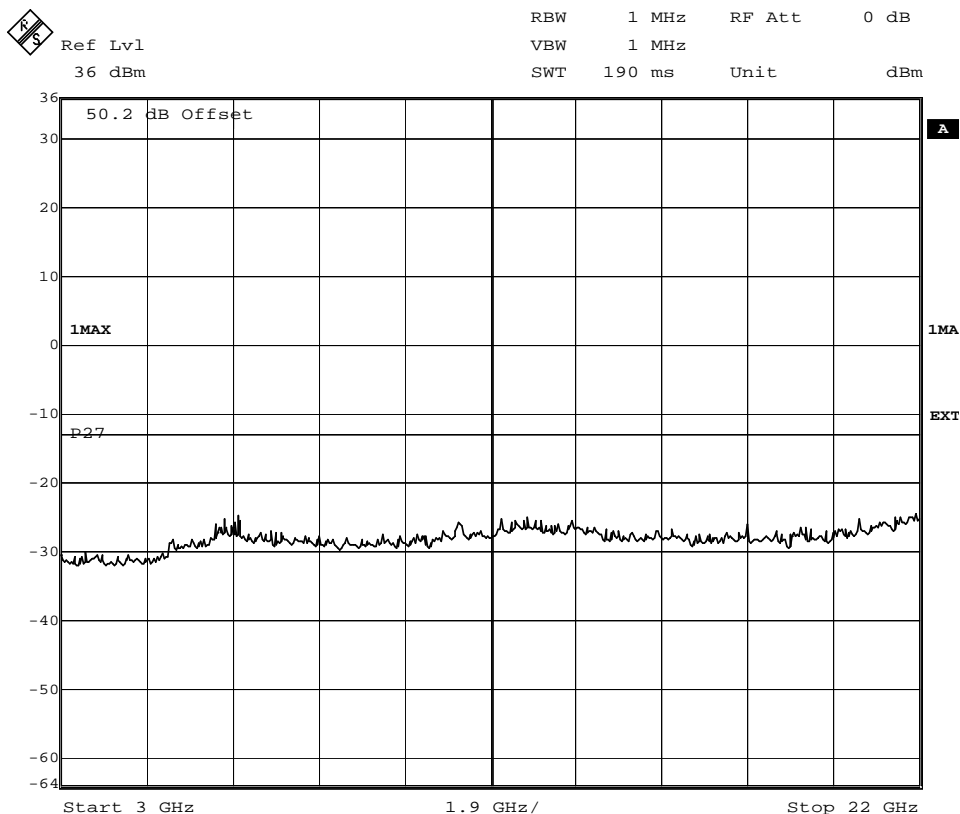


Diagram 9



Date: 10.MAY.2007 10:49:59

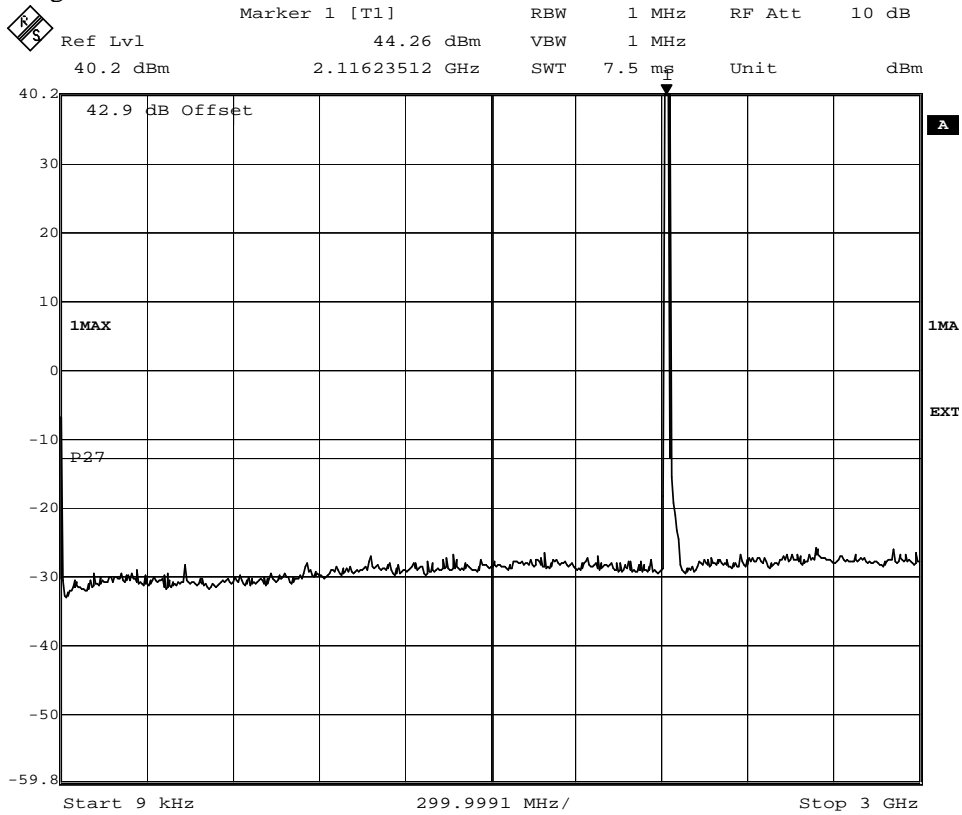
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



Date: 10.MAY.2007 10:52:01

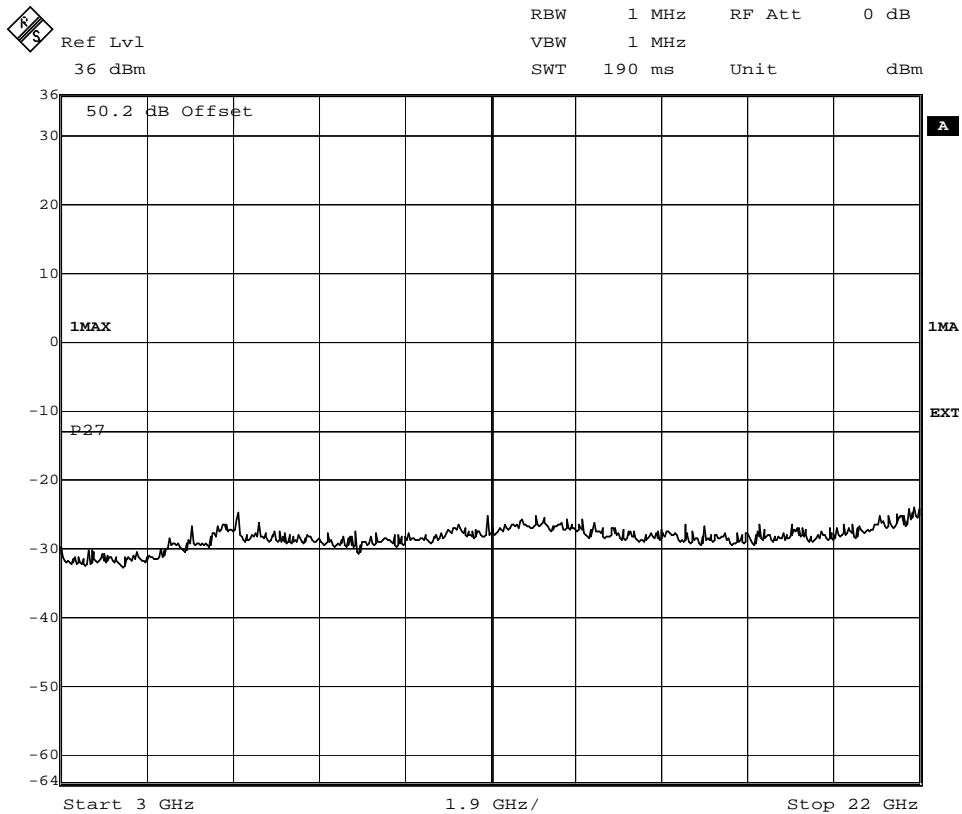


Diagram 10



Date: 9.MAY.2007 13:36:50

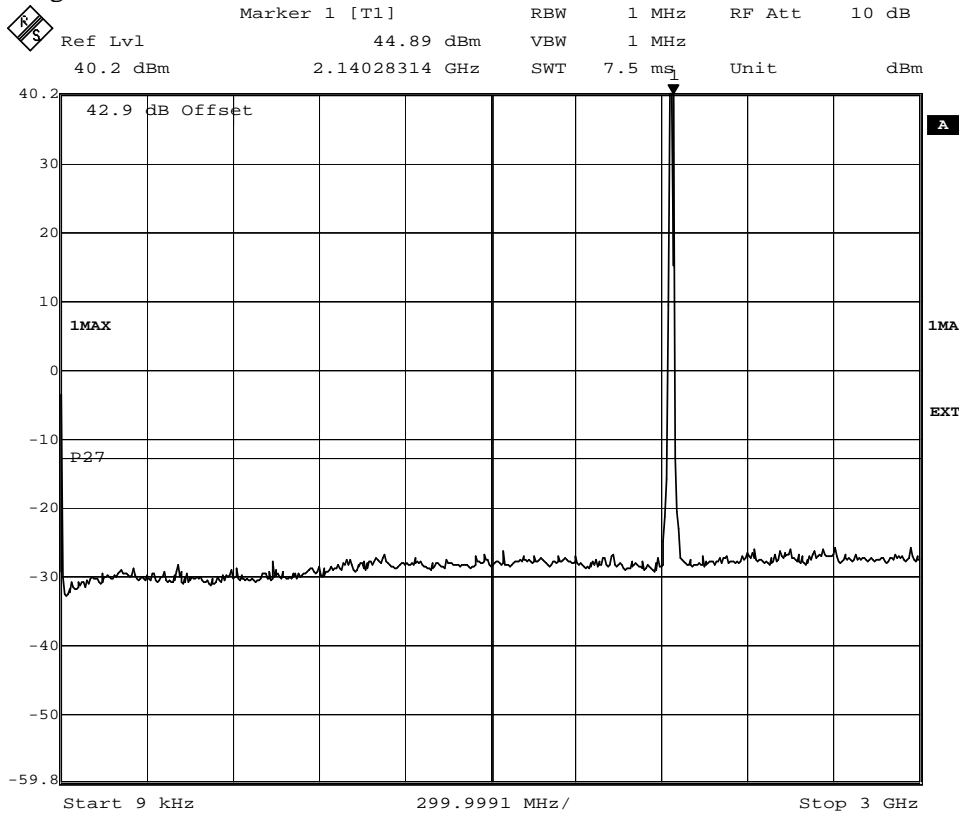
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz.



Date: 9.MAY.2007 13:34:19

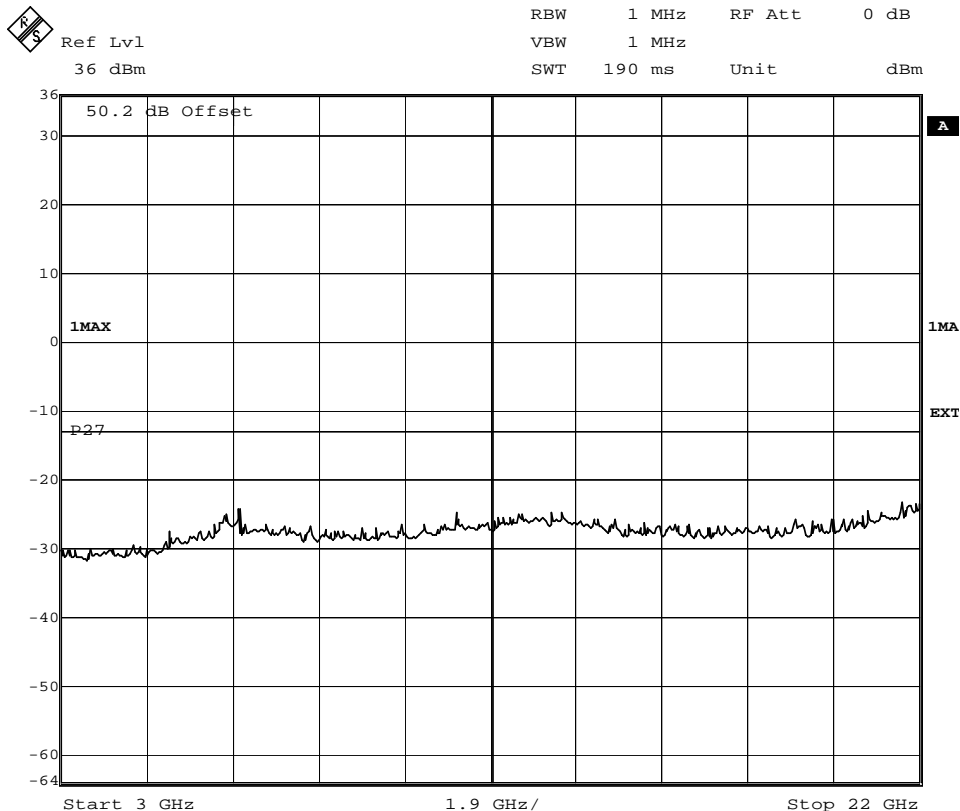


Diagram 11



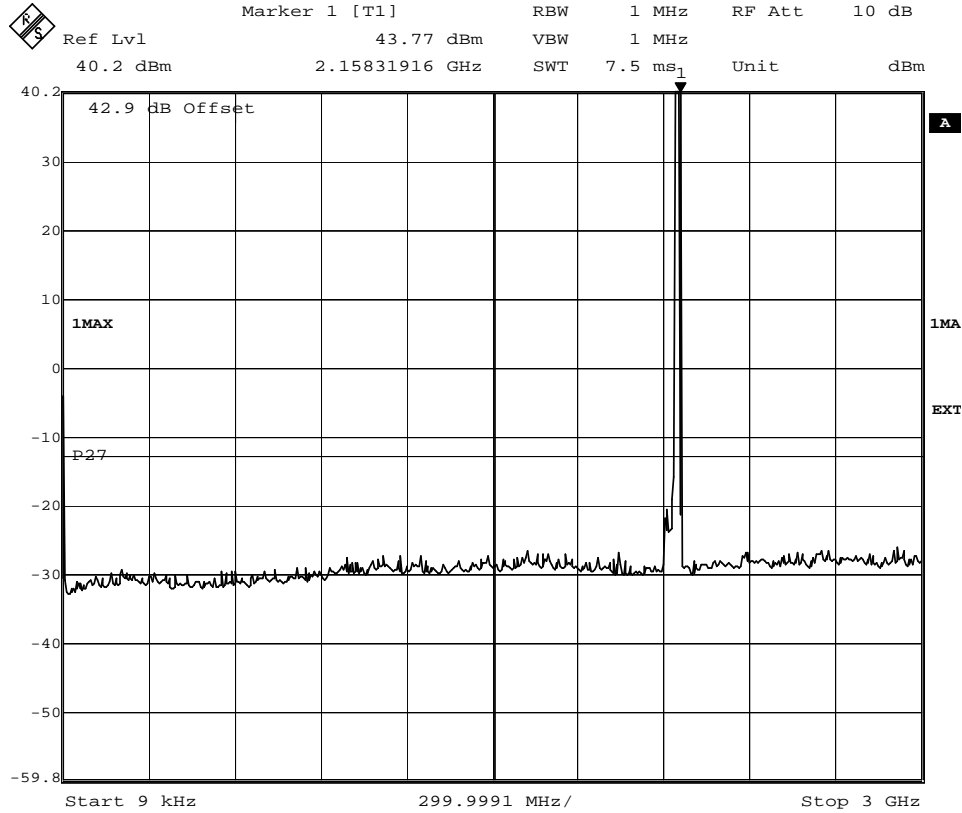
Date: 9.MAY.2007 14:30:15

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.



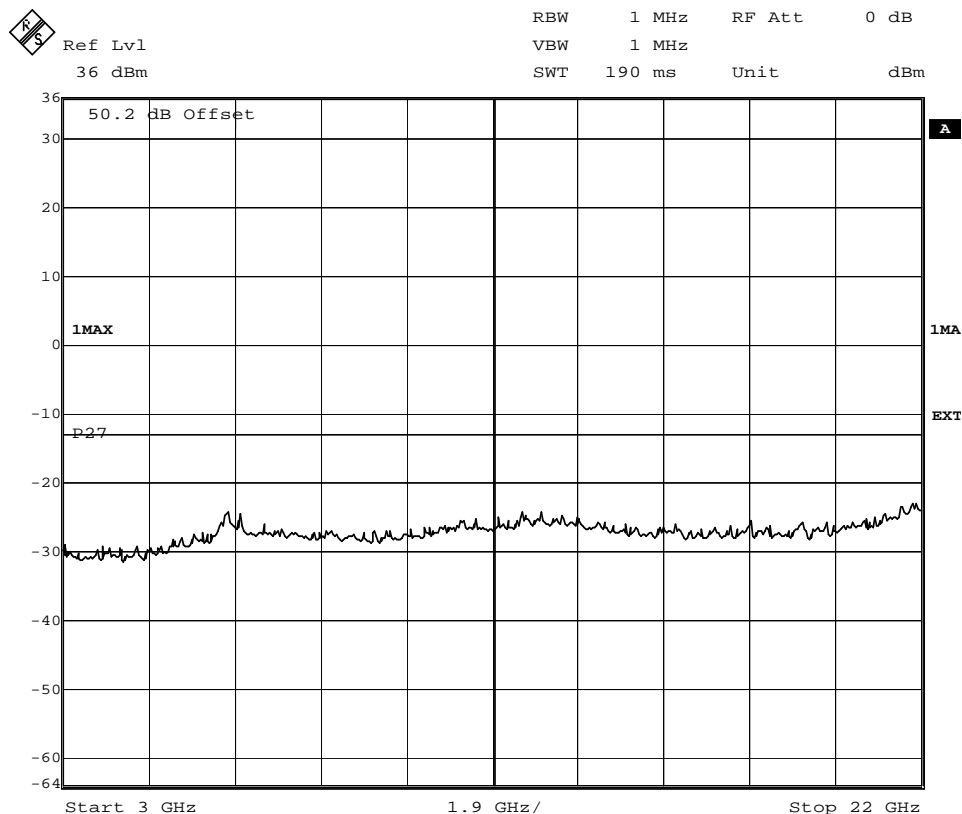
Date: 9.MAY.2007 15:36:28

Diagram 12



Date: 10.MAY.2007 08:40:40

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: 10.MAY.2007 08:16:35

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

Date 2007-05-02 to 2007-05-08	Temperature 21-23 °C ± 3 °C	Humidity 26-33 % ± 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 in the frequency range 30 MHz – 18 GHz and 1m in the frequency range 18-22 GHz.

A pre-measurement was first performed:

In the frequency range 30 MHz-22 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,

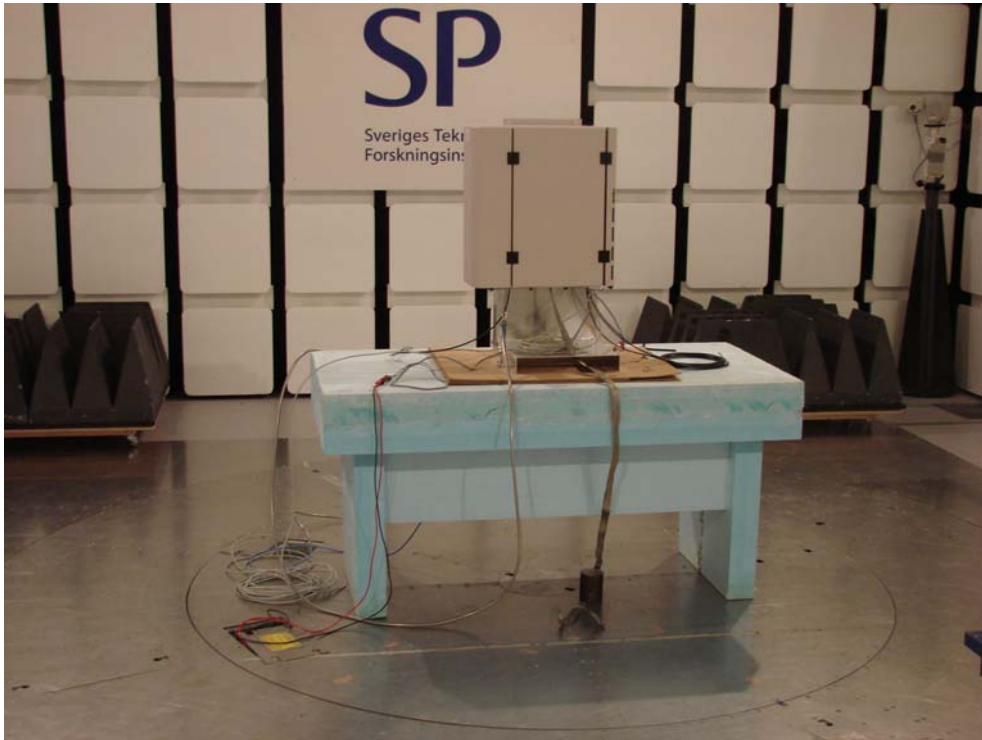
$$\gamma = 20 \log \left( \frac{4\pi D}{\lambda} \right), \gamma \text{ is the propagation loss and } D \text{ is the antenna distance.}$$

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
Std. gain: 16240-25	-	503 939
Std. gain: 18240-25	-	503 900
ETS Lindgren 3116	2007-06	503 878
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 pictures 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 2007-05-10 to 2007-05-14-	Temperature (test equipment) 22 °C ± 3 °C	Humidity (test equipment) 48 % ± 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  
43 dBm output power at (2132.4 MHz)

Test conditions		Frequency error (Hz)	
Supply voltage DC (V)	T (°C)	QPSK	16QAM
-48.0	+20	+24	+18
-55.2	+20	+19	+16
-40.8	+20	-17	+15
-48.0	+30	-21	-25
-48.0	+40	+18	+18
-48.0	+50	+19	-25
-48.0	+10	+17	+15
-48.0	0	+23	+17
Maximum freq. error (Hz)		25	
Measurement uncertainty		$< \pm 1 \times 10^{-7}$	

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

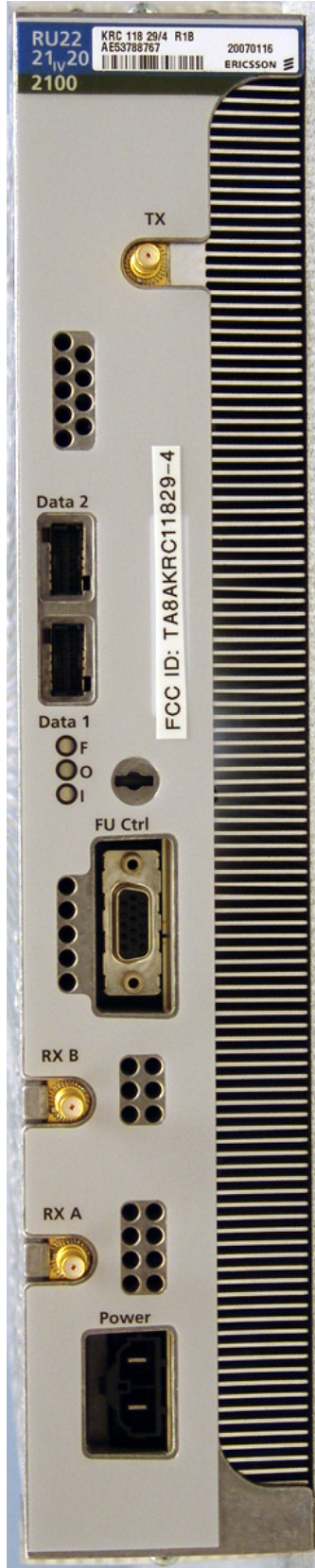
**Limits (according to 3GPP TS 25.141)**

The frequency Error shall be within ± 0.05 PPM (106.62 Hz).

Complies?	Yes
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**Photos**  
**Radio Unit KRC 118 29/4**

Front side

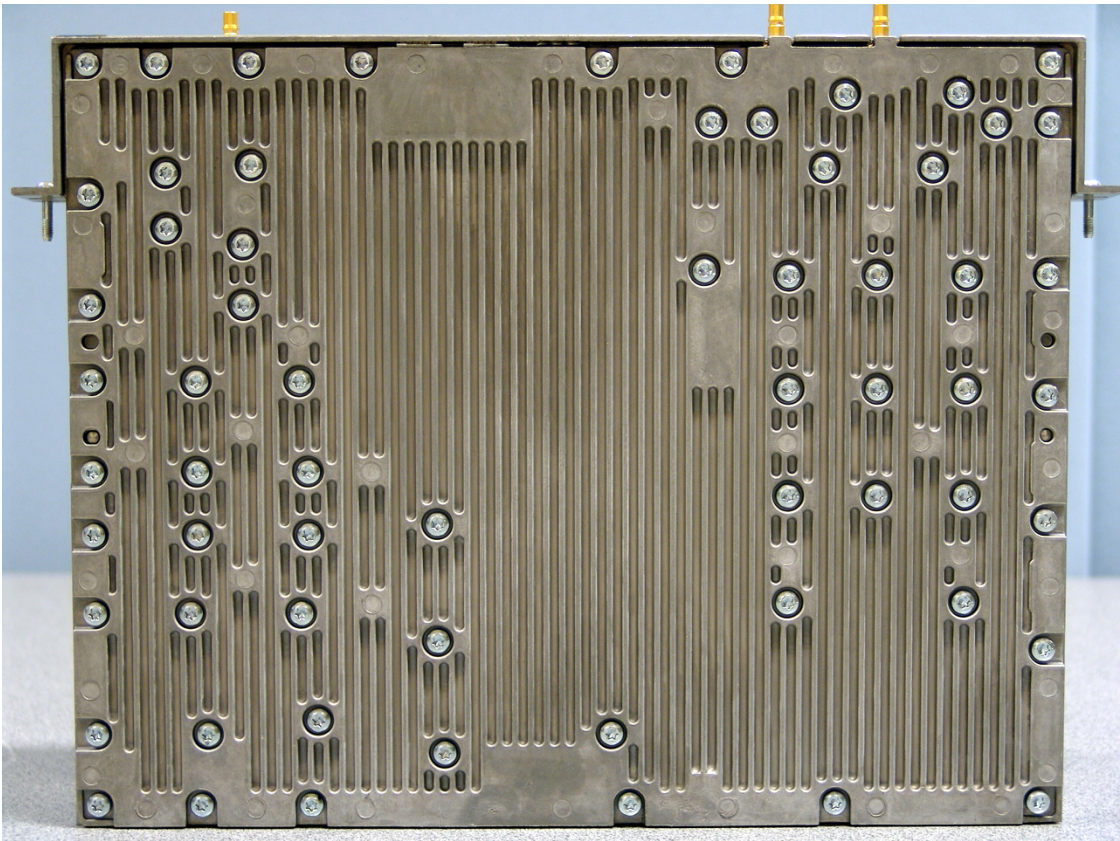


Rear side





Left side



Right side

