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Equipment authorization measurements on WCDMA Base Station 850 MHz Power Amplifier Unit with FCC ID: TA8AKRB90118-1 (7 appendices)

Test object

PA unit KRB 901 18/1

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	-

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FCC ID: TA8AKRB90118-1

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Description – Test object

Equipment: WCDMA Power Amplifier Unit (PAU) 850 MHz, single carrier

Tx Frequency range: 869 - 894 MHz

Modulations: QPSK and 16QAM

Maximum output power: 42.4 dBm (17.4 W)

Nominal power voltage: -48 VDC

Tested channels

ARFCN	Frequency
4357	871.4 MHz
4407	881.4 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 use the QPSK modulation only, and Test model 5 includes the 16QAM modulation.

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

Test model 5: 30 DPCH:s at 30 ksps (SF=128) and 8 HS-PDSCH:s at 240 ksps (SF=16)

Conducted measurements

All RF conducted measurements were performed with the test object installed in a RBS 3303 cabinet powered with -48 VDC. The sTRX ROJ 119 2288/1 WCDMA transceiver unit were used to generate the carrier channels. The measurements were done at the output connector (Ant A) of the single Antenna Interface Unit (sAIU) KRY 112 124/1. All measurements were performed at maximum output power with both modulations. A directional coupler were used the measure the input signal.

Radiated measurements

All radiated measurements were performed with the test object installed in a RBS 3303 cabinet powered with -48 VDC. The sTRX ROJ 119 2288/1 WCDMA transceiver unit were used to generate the carrier channels.

The sTRX was activated for maximum transmit power. The sTRX was sequentially allocated to UARFCN 4357 (871.4 MHz), 4407 (881.4 MHz) and 4458 (891.6 MHz) for downlink and to UARFCN 4132 (826.4 MHz), 4182 (836.4 MHz) and 4233 (846.6 MHz) for uplink.

Purpose of test

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



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Appendix 1

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: 2005-10-17.

Manufacturer's representative

Jan-Olof Karlsson, Ericsson AB

Test engineers

Fredrik Isaksson and Reinhold Reul

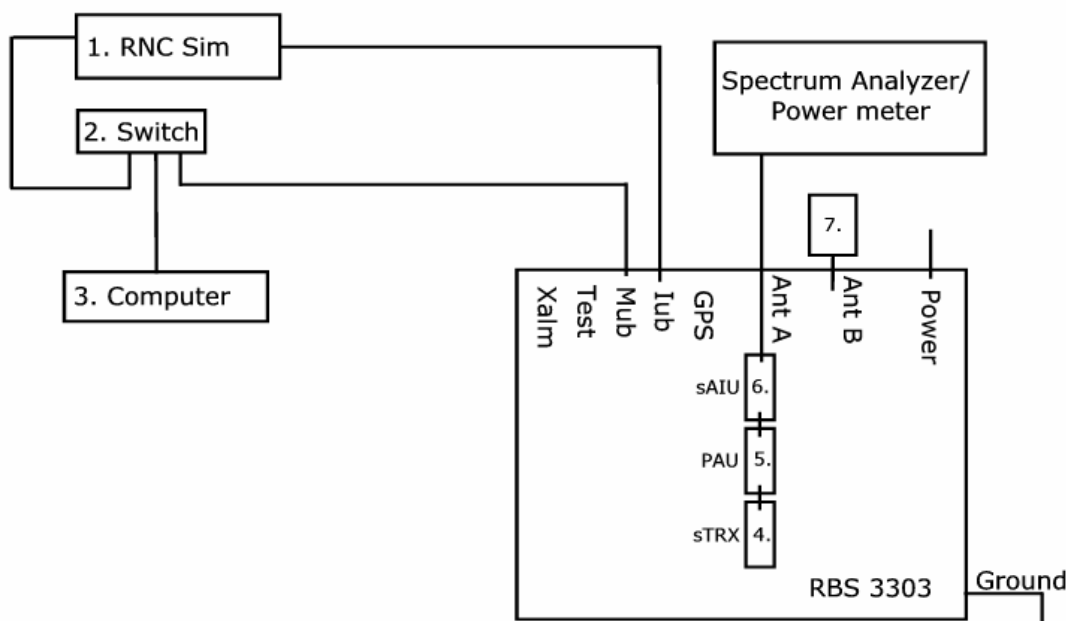
Test witness

Ronny Hansson, Ericsson AB

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Appendix 1

Test set-up, conducted measurements



RBS 3303: FAR 102 125/6 with software CXP 901 0809/1 rev. R12B
Enclosure: BDE 202 85/2, R-state: R1C, Serial No: SS781315039

1. RNC Sim CES 4780BA Mini-sim #23, Serial no.: 0219 Rev. CCA
2. Switch, Netgear Ethernet switch DS108
3. Computer, Naturetech, ETE ASSET ID: 207505
4. ROJ 119 2288/1 Rev. R1C, Serial No: SAE52088733 (FCC ID: TA8AR0J1192288-1)
5. KRB 901 18/1 Rev. R1D, Serial no: SBQ63900738 (FCC ID: TA8AKRB90118-1)
6. KRY 112 124/1, Rev. R1B, Serial no: SA400298164
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, no cable attached.
GPS, no cable attached.

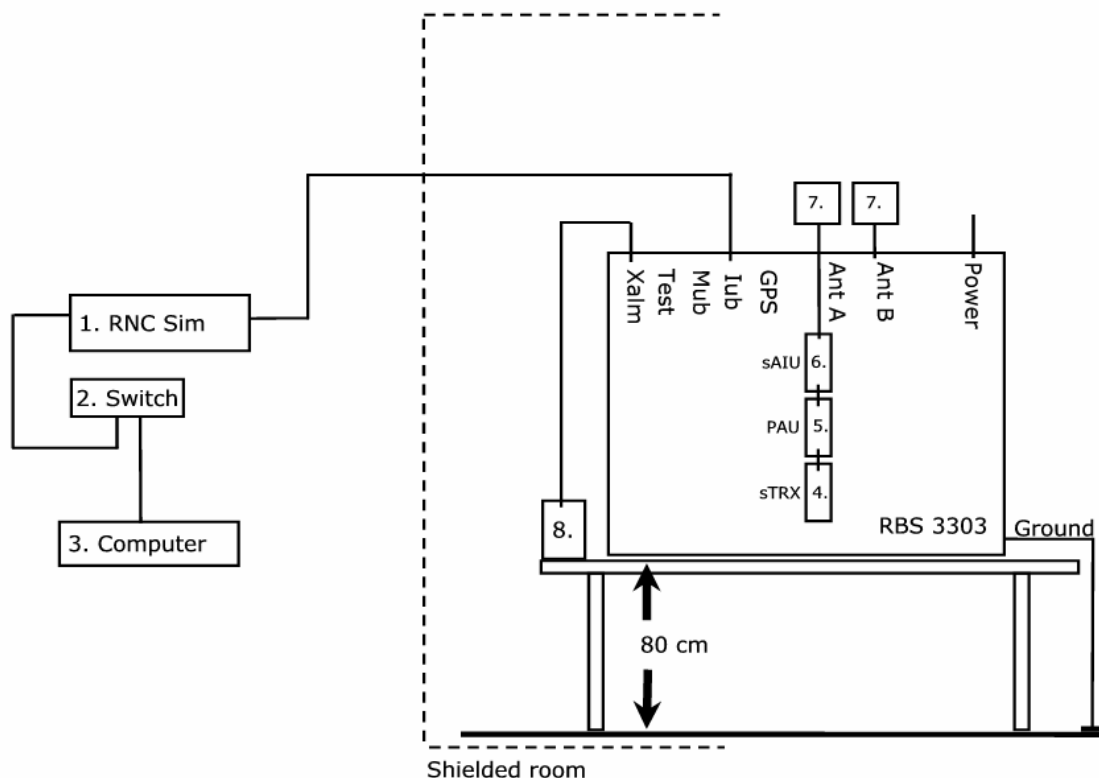
Type of port:

DC power
Telecom
Test purpose
Test purpose
Signal
Signal

FCC ID: TA8AKRB90118-1

Appendix 1

Test set-up, radiated measurements



RBS 3303: FAR 102 125/6 with software CXP 901 0809/1 rev. R12B
Enclosure: BDE 202 85/2, R-state: R1C, Serial No: SS781315039

1. RNC Sim CES 4780BA Mini-sim #23, Serial no.: 0219 Rev. CCA
2. Switch, Netgear Ethernet switch DS108
3. Computer, Naturetech, ETE ASSET ID: 207505
4. ROJ 119 2288/1 Rev. R1C, Serial No: SAE52088733 (FCC ID: TA8AR0J1192288-1)
5. KRB 901 18/1 Rev. R1D, Serial no: SBQ63900738 (FCC ID: TA8AKRB90118-1)
6. KRY 112 124/1, Rev. R1B, Serial no: SA400298164
7. 50 ohm terminator

Interfaces:

Power, -48 VDC
Iub, configured as T1 by CBU, shielded multi-wire with RJ-45 connector
Mub, no cable attached
Test, no cable attached
Xalm, Multi-wire TEL 431 01/013
GPS, no cable attached

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
2005-10-20	22 °C ± 3 °C	34 % ± 5 %
2005-10-31	23 °C ± 3 °C	47 % ± 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	2005-11	503 144
Boonton Power sensor 56518-S/4	2005-11	503 145
Multimeter Fluke 87	2005-11	502 190
Testo 610, Temperature and humidity meter	2006-12	502 658

Measurement uncertainty: 0.5 dB

Results

Rated output power level after sAIU (maximum): 42.4 dBm

Test conditions T_{nom} 22 °C/ V_{nom} -48 V DC	Transmitter output power (dBm) Average		
	Frequency 871.4 MHz	Frequency 881.4 MHz	Frequency 891.6 MHz
QPSK	42.8	43.0	42.8
16QAM	42.8	43.0	42.7

Test conditions T_{nom} 23 °C/ V_{nom} -48 V DC	Input power level at PAU input (dBm) Average		
	Frequency 871.4 MHz	Frequency 881.4 MHz	Frequency 891.6 MHz
QPSK	1.7	1.3	1.5
16QAM	1.7	1.4	1.6

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
2005-10-20	22 °C ± 3 °C	34 % ± 5 %
2005-10-21	23 °C ± 3 °C	41 % ± 5 %
2005-10-31	23 °C ± 3 °C	47 % ± 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

Input vs. Output measurements.

The results are shown in appendix 3.1

QPSK

	Frequency	OBW
Diagram 1:	871.4 MHz input signal	4.2 MHz
Diagram 2:	871.4 MHz output signal	4.2 MHz
Diagram 3:	881.4 MHz input signal	4.2 MHz
Diagram 4:	881.4 MHz output signal	4.2 MHz
Diagram 5:	891.6 MHz input signal	4.2 MHz
Diagram 6:	891.6 MHz output signal	4.2 MHz

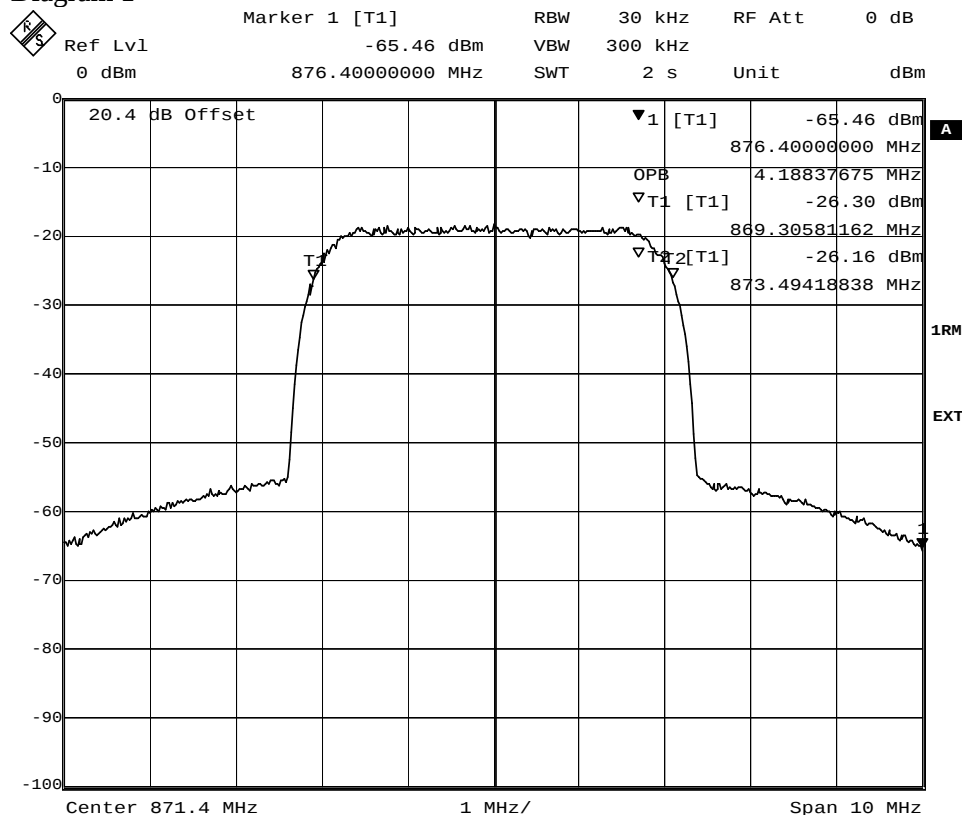
16QAM

	Frequency	OBW
Diagram 7:	871.4 MHz input signal	4.2 MHz
Diagram 8:	871.4 MHz output signal	4.2 MHz
Diagram 9:	881.4 MHz input signal	4.2 MHz
Diagram 10:	881.4 MHz output signal	4.2 MHz
Diagram 11:	891.6 MHz input signal	4.2 MHz
Diagram 12:	891.6 MHz output signal	4.2 MHz

FCC ID: TA8AKRB90118-1

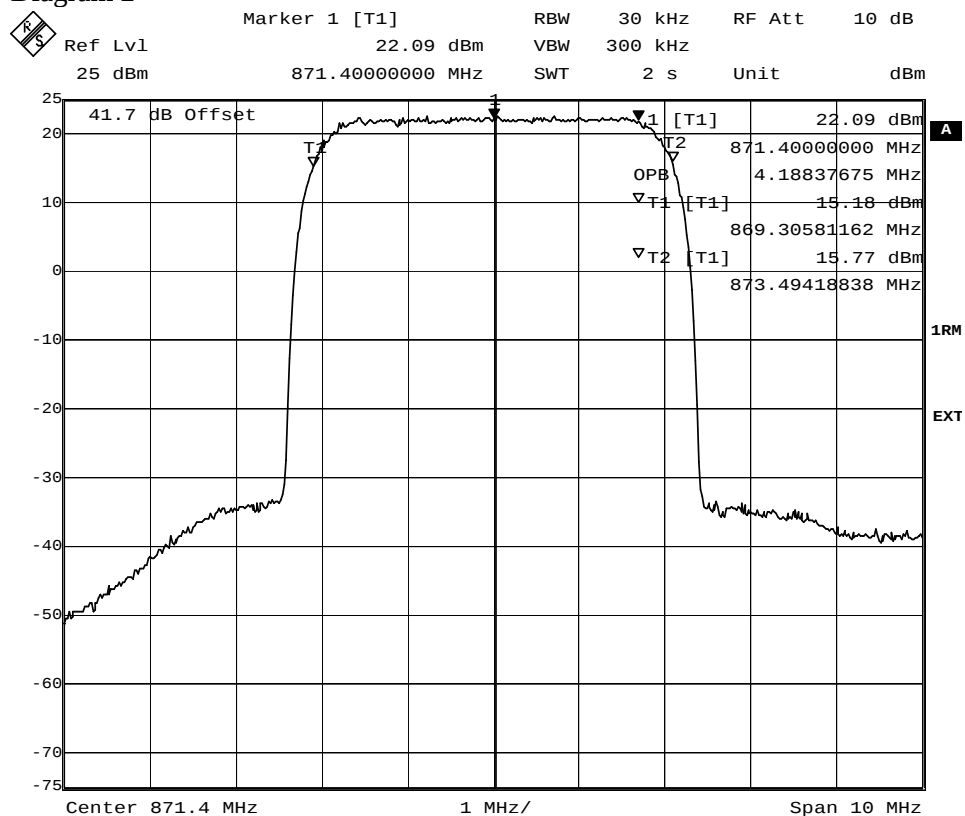
Appendix 3.1

Diagram 1



Date: 31.OCT.2005 17:01:36

Diagram 2

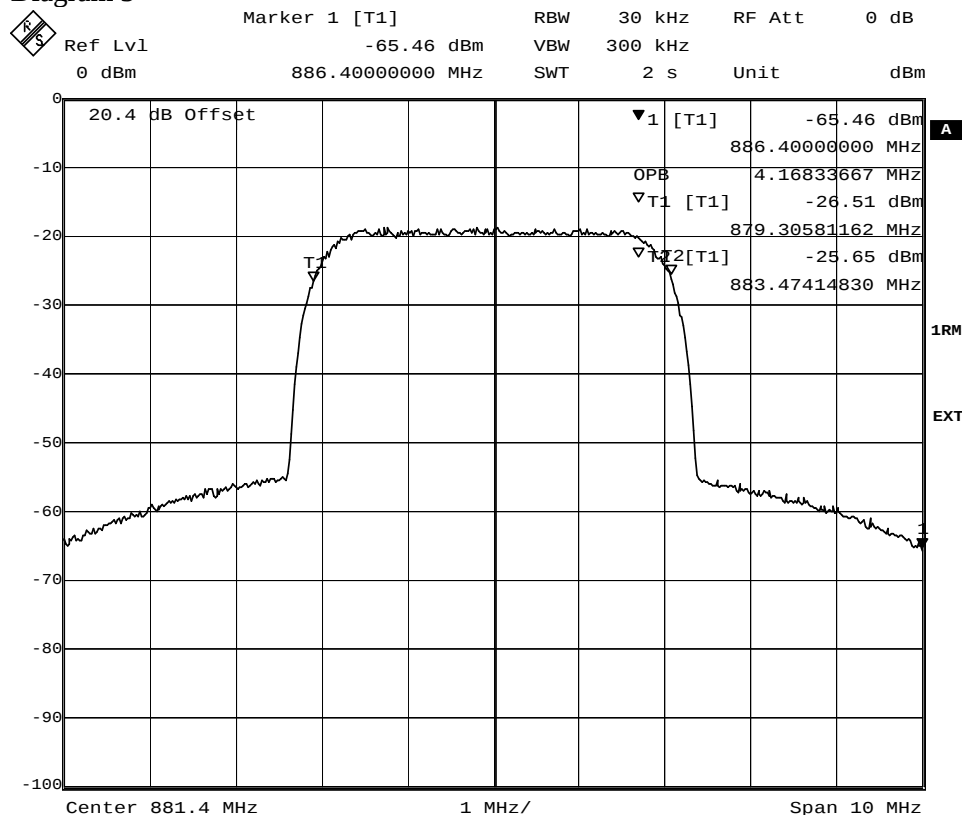


Date: 21.OCT.2005 09:14:55

FCC ID: TA8AKRB90118-1

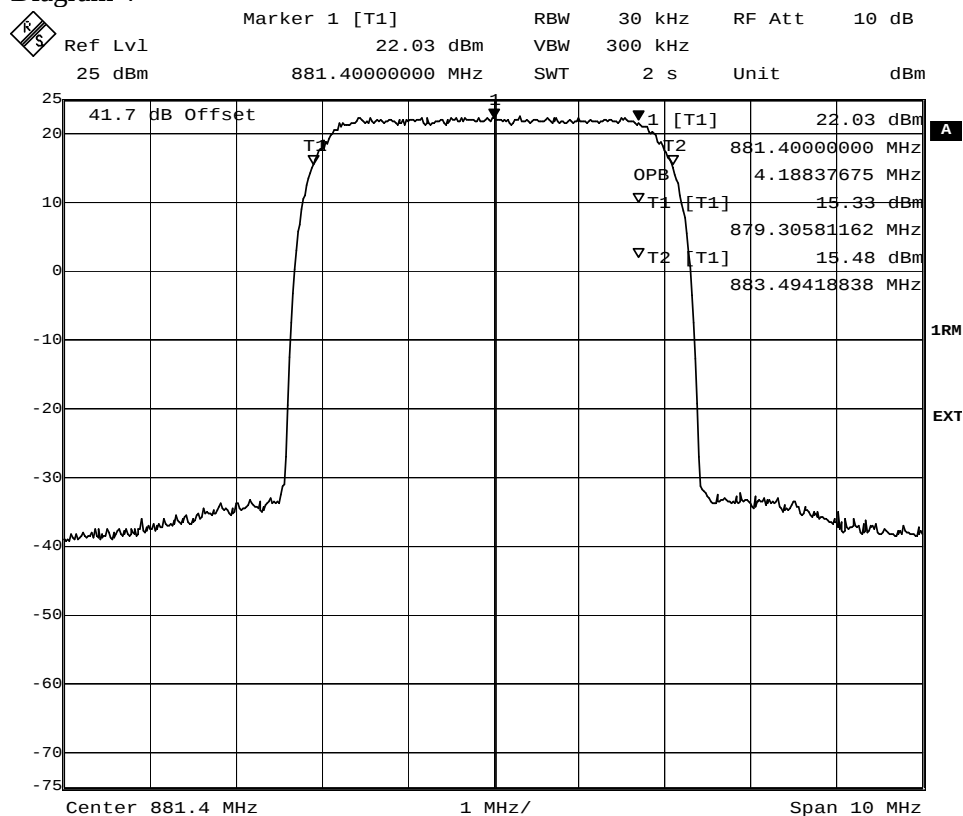
Appendix 3.1

Diagram 3



Date: 31.OCT.2005 16:42:58

Diagram 4

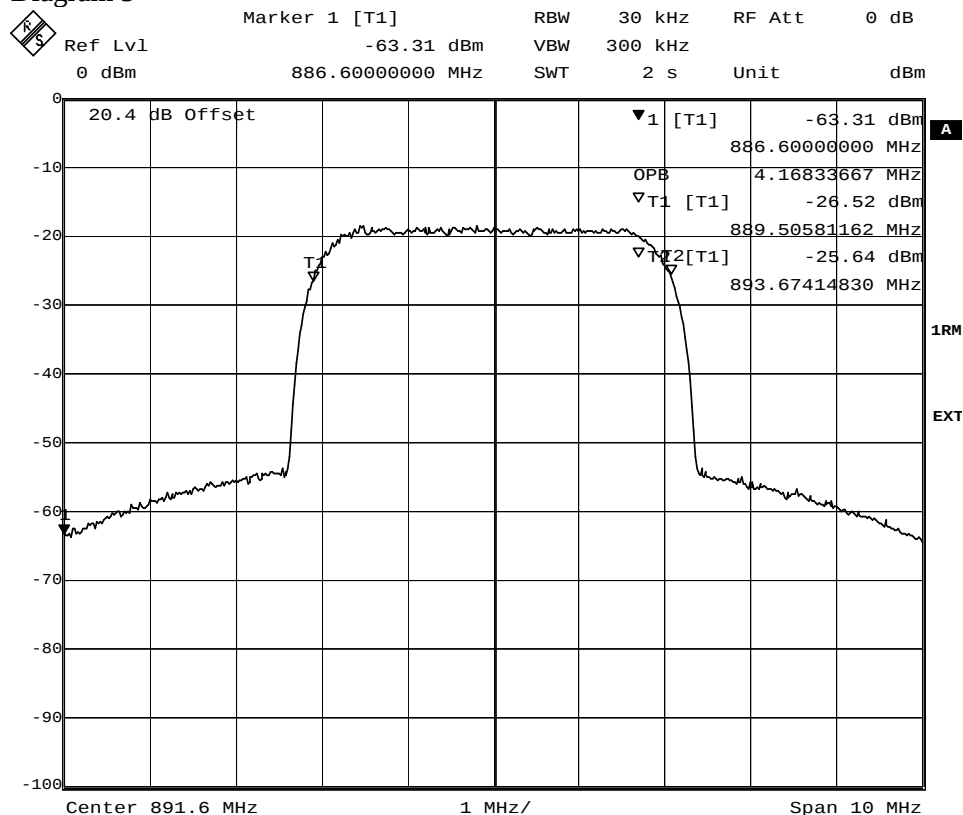


Date: 20.OCT.2005 11:18:01

FCC ID: TA8AKRB90118-1

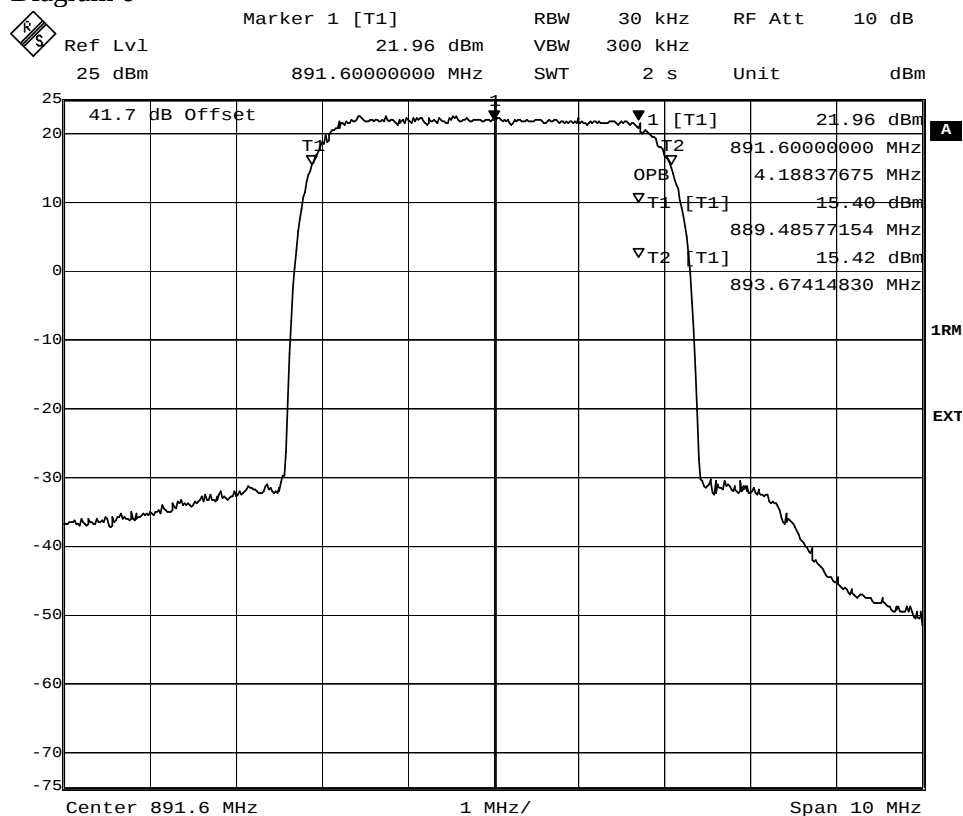
Appendix 3.1

Diagram 5



Date: 31.OCT.2005 16:35:01

Diagram 6

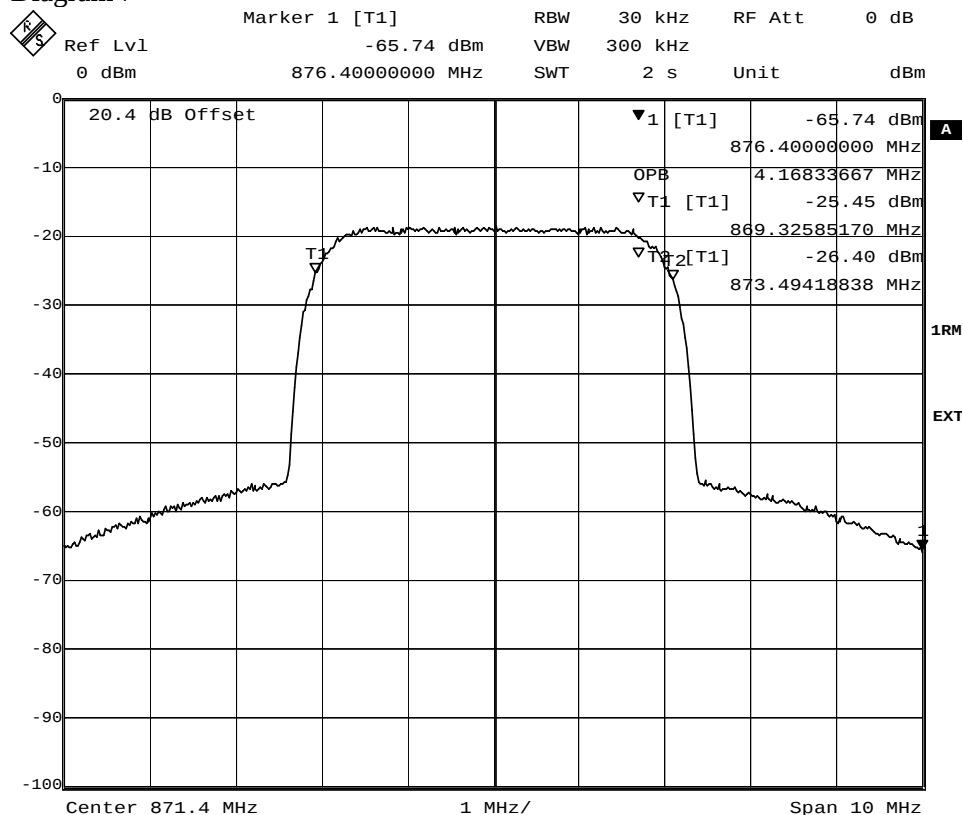


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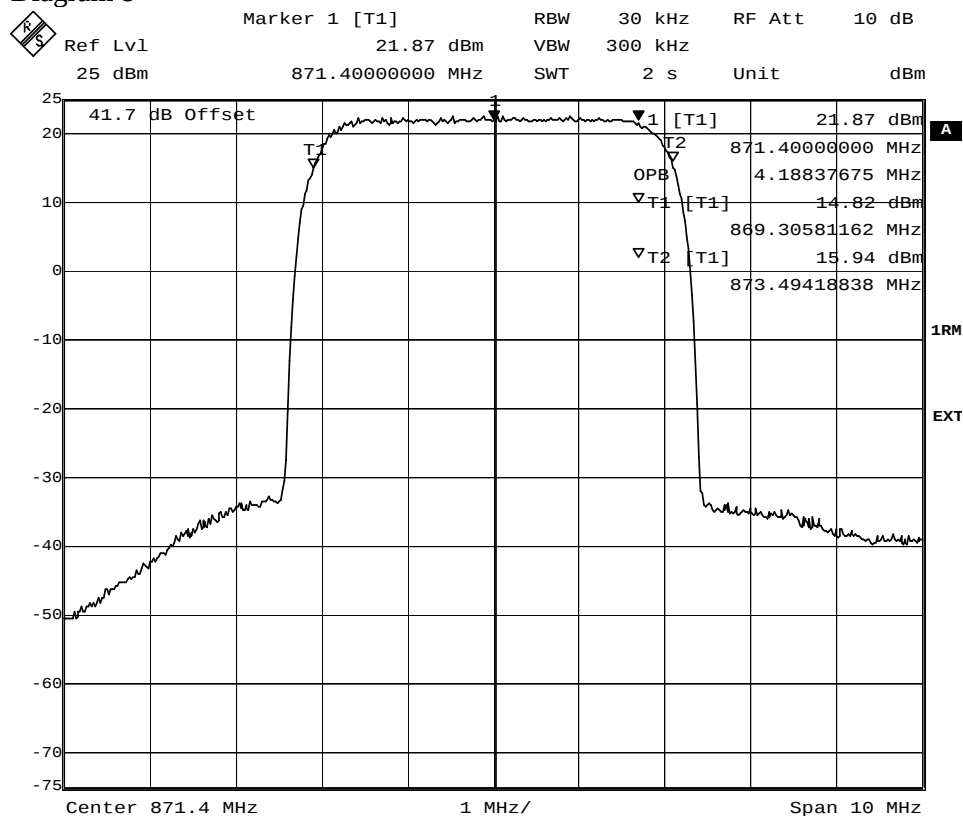
Appendix 3.1

Diagram 7



Date: 31.OCT.2005 16:56:13

Diagram 8

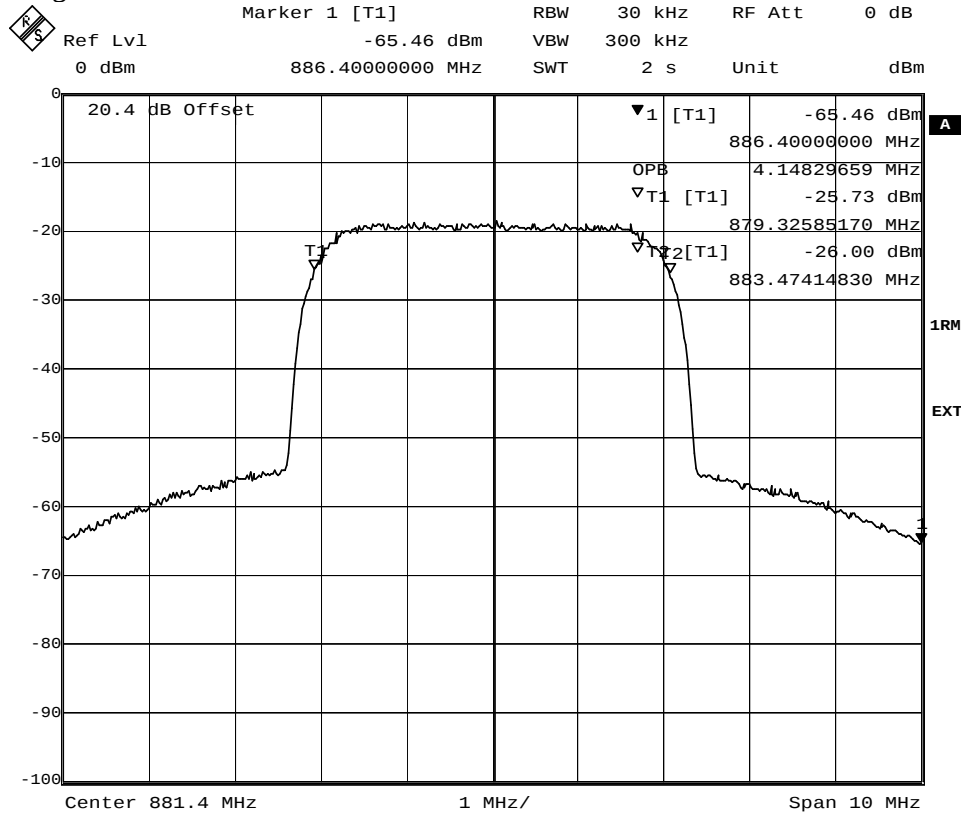


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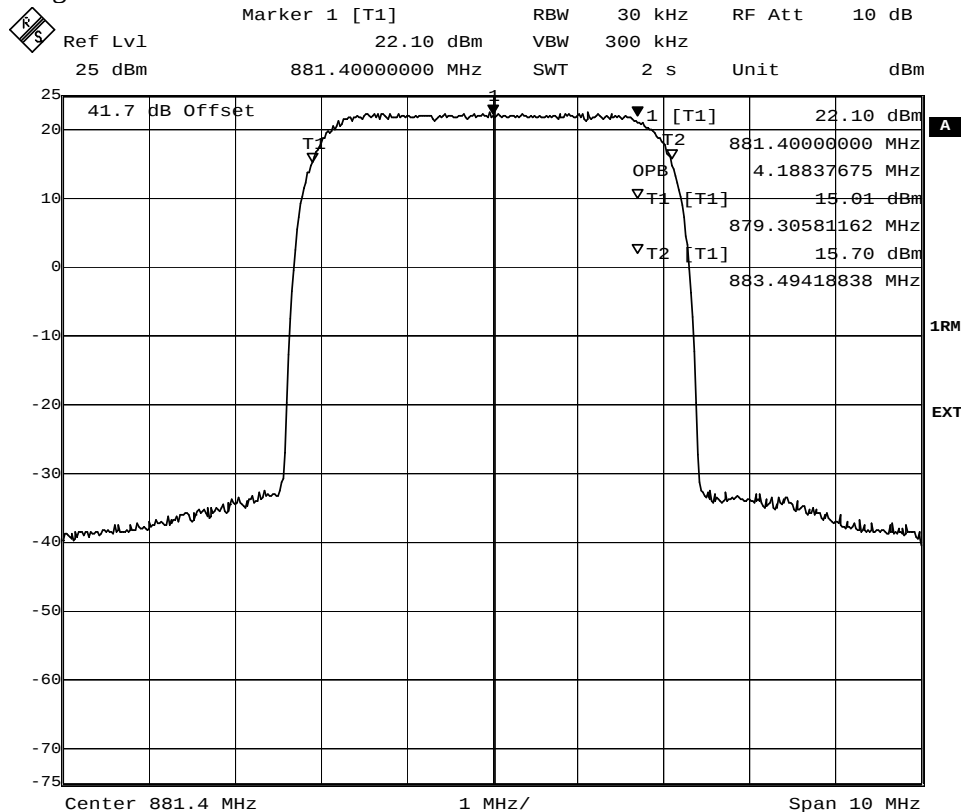
Appendix 3.1

Diagram 9



Date: 31.OCT.2005 16:50:23

Diagram 10

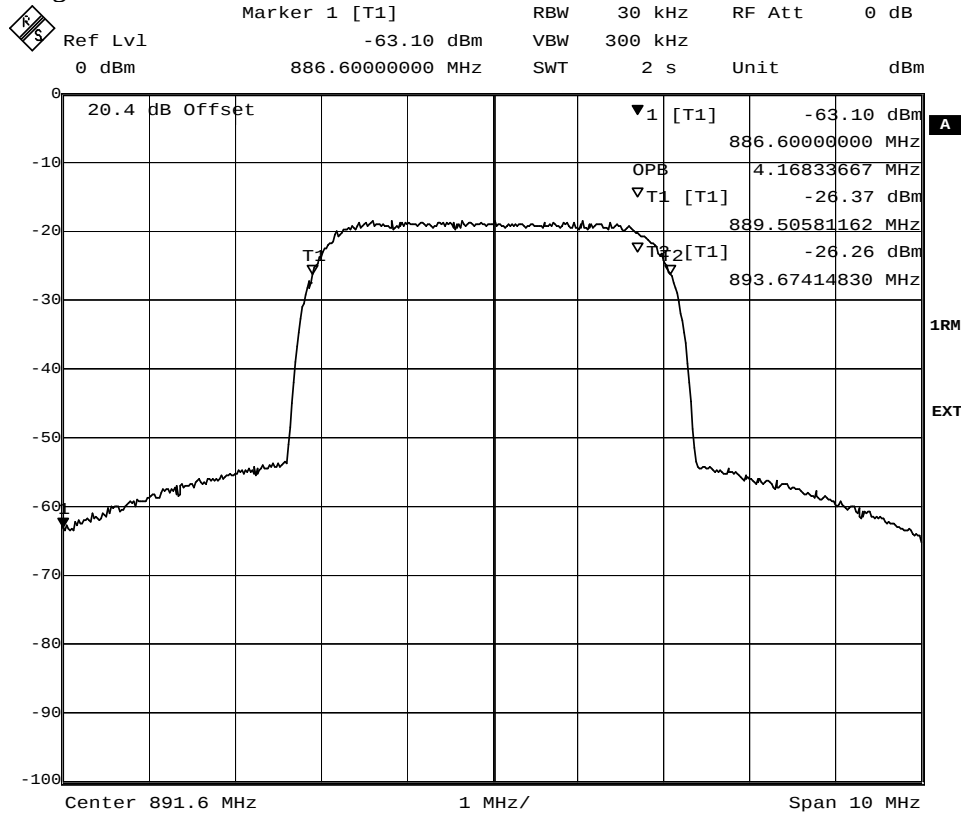


Date: 20.OCT.2005 11:25:38

FCC ID: TA8AKRB90118-1

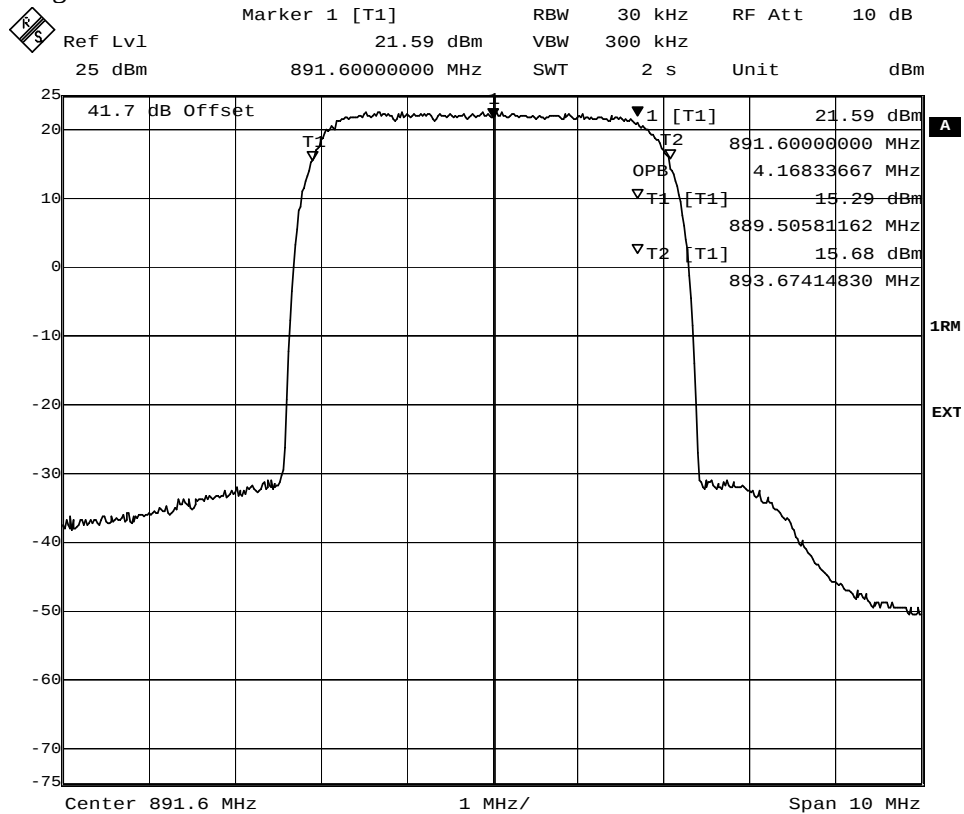
Appendix 3.1

Diagram 11



Date: 31.OCT.2005 16:26:29

Diagram 12



Date: 21.OCT.2005 09:04:58

Band edge measurements according to 47 CFR 2.1051

Date 2005-10-21	Temperature 23 °C ± 3 °C	Humidity 41 % ± 5 %
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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 50 kHz (1% of Emission BW) was used up 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

QPSK

- Diagram 1 871.4 MHz Band edge/Block edge Low
- Diagram 2 877.5 MHz Block edge High
- Diagram 3 882.5 MHz Block edge Low
- Diagram 4 887.5 MHz Band edge High
- Diagram 5 891.6 MHz Band edge High

16QAM

- Diagram 6 871.4 MHz Band edge/Block edge Low
- Diagram 7 877.5 MHz Block edge High
- Diagram 8 882.5 MHz Block edge Low
- Diagram 9 887.5 MHz Band edge High
- Diagram 10 891.6 MHz Band edge High

Limits

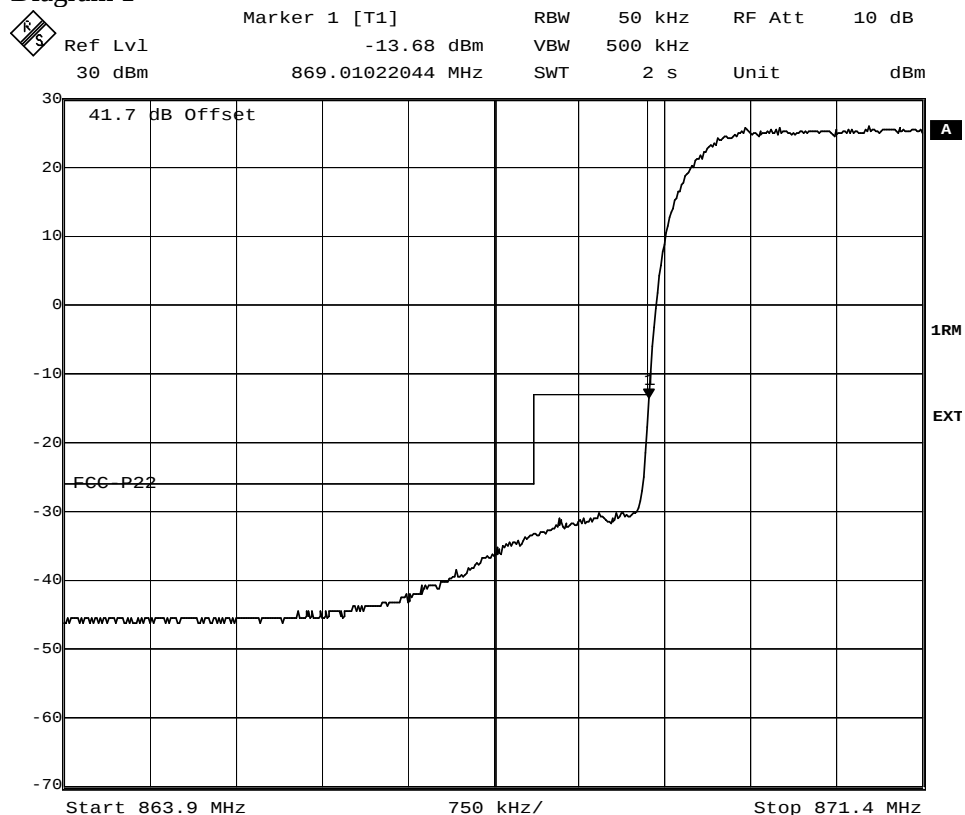
The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least $43 + 10 \log P$ dB.

Complies?	Yes
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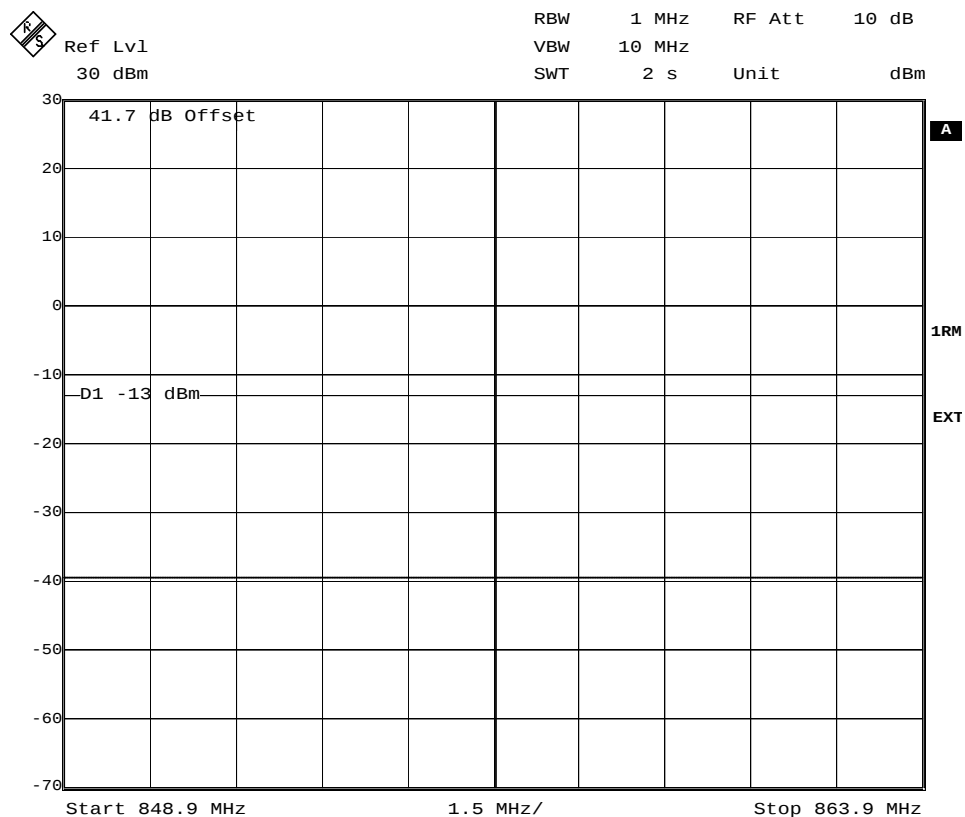
FCC ID: TA8AKRB90118-1

Appendix 4.1

Diagram 1



Date: 21.OCT.2005 11:20:47

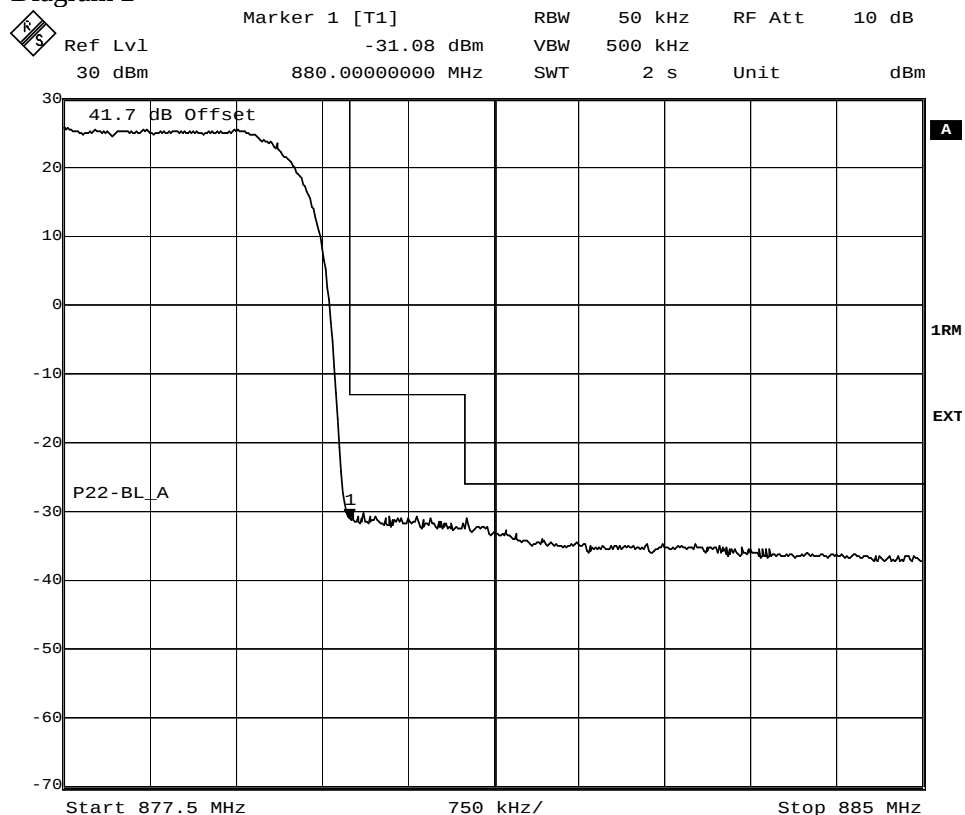


Date: 21.OCT.2005 11:19:12

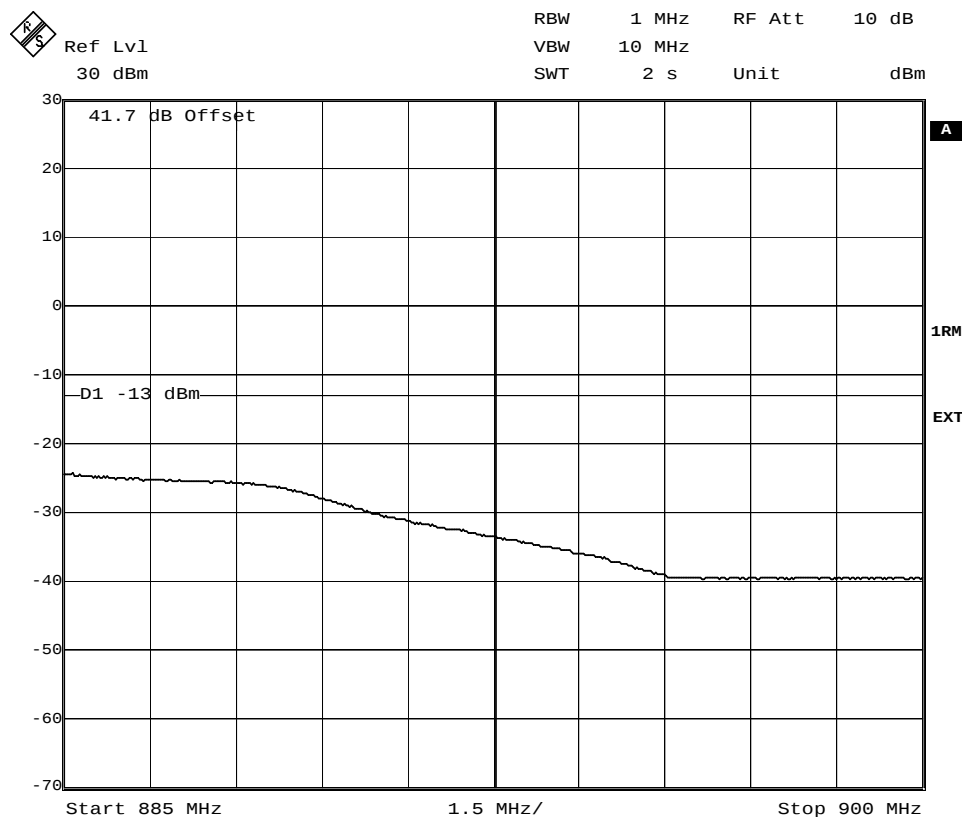
FCC ID: TA8AKRB90118-1

Appendix 4.1

Diagram 2



Date: 21.OCT.2005 13:36:01

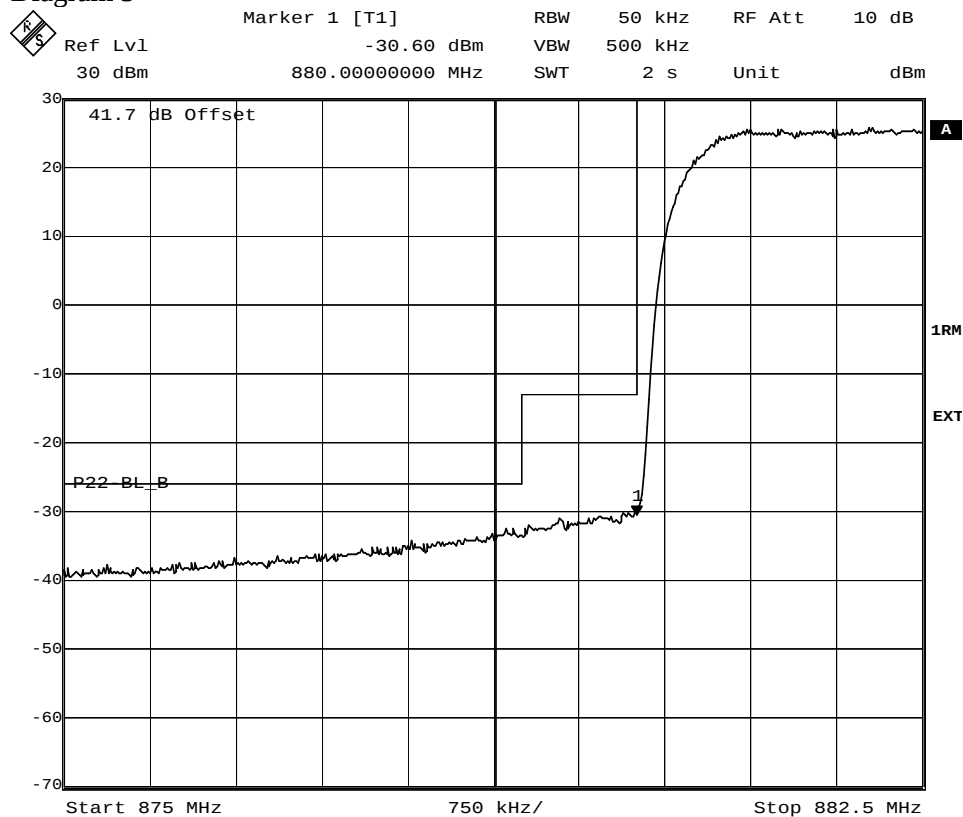


Date: 21.OCT.2005 13:37:06

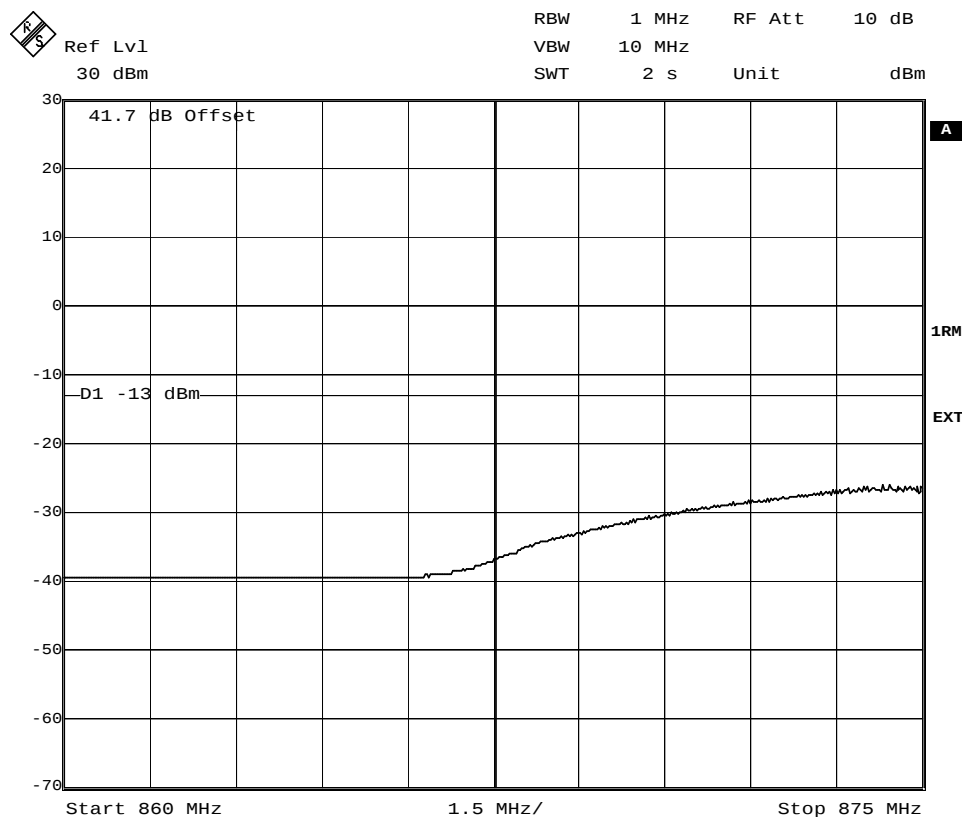
FCC ID: TA8AKRB90118-1

Appendix 4.1

Diagram 3



Date: 21.OCT.2005 13:01:29

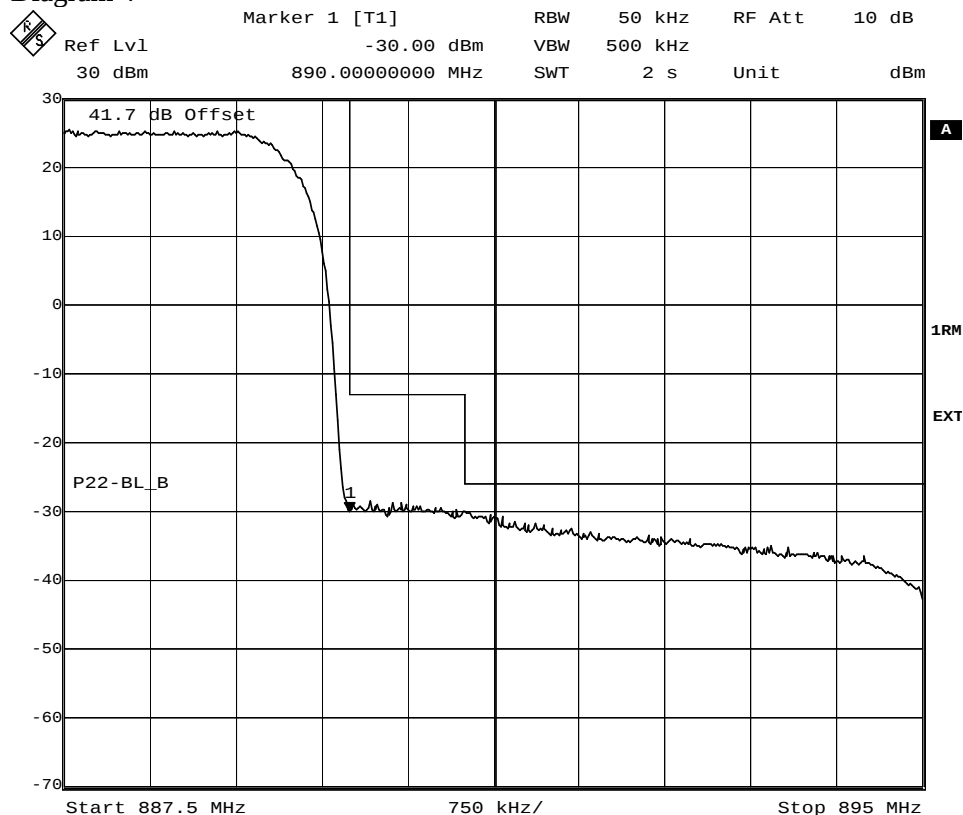


Date: 21.OCT.2005 12:59:56

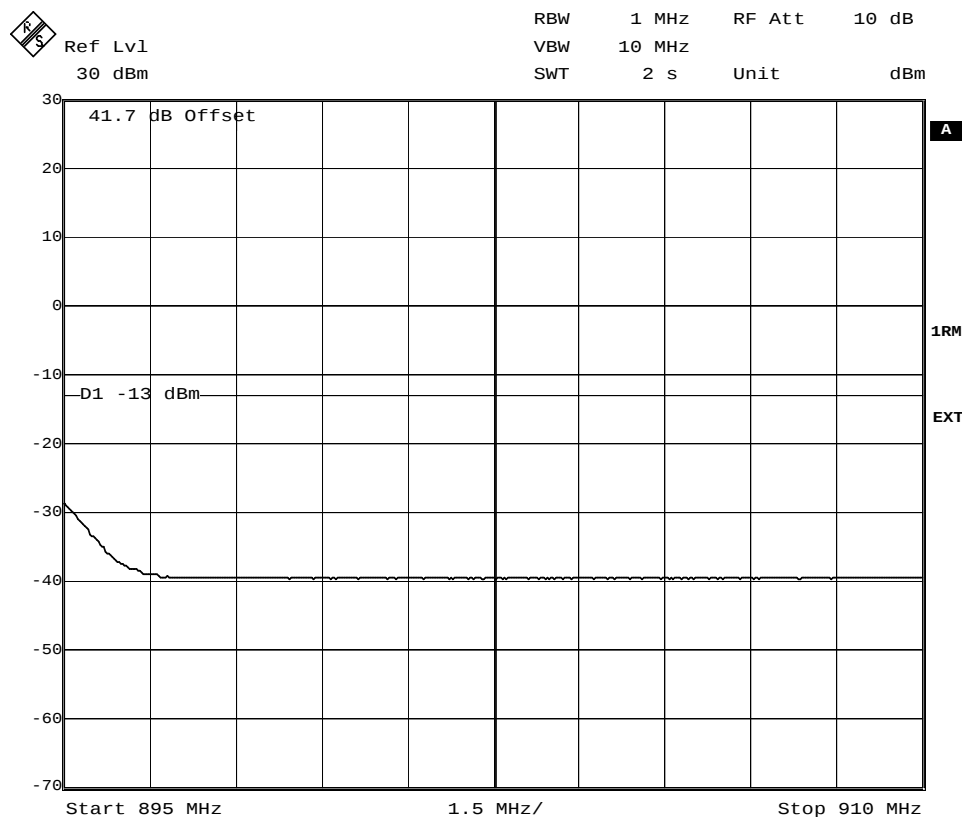
FCC ID: TA8AKRB90118-1

Appendix 4.1

Diagram 4



Date: 21.OCT.2005 13:23:56

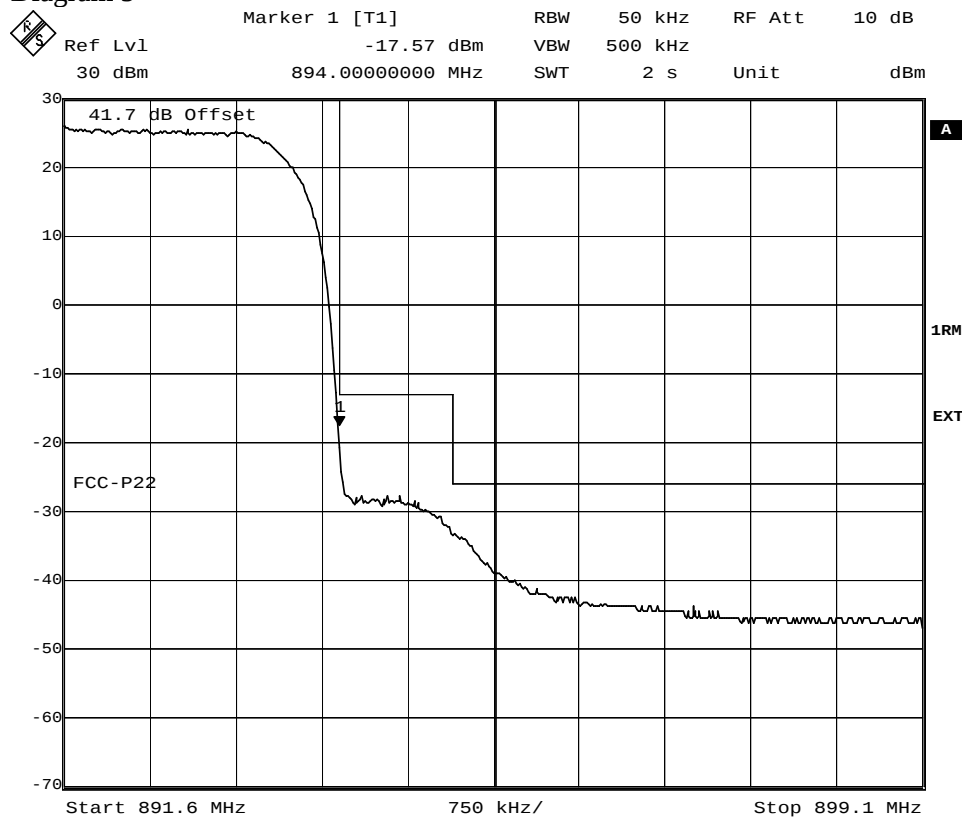


Date: 21.OCT.2005 13:24:56

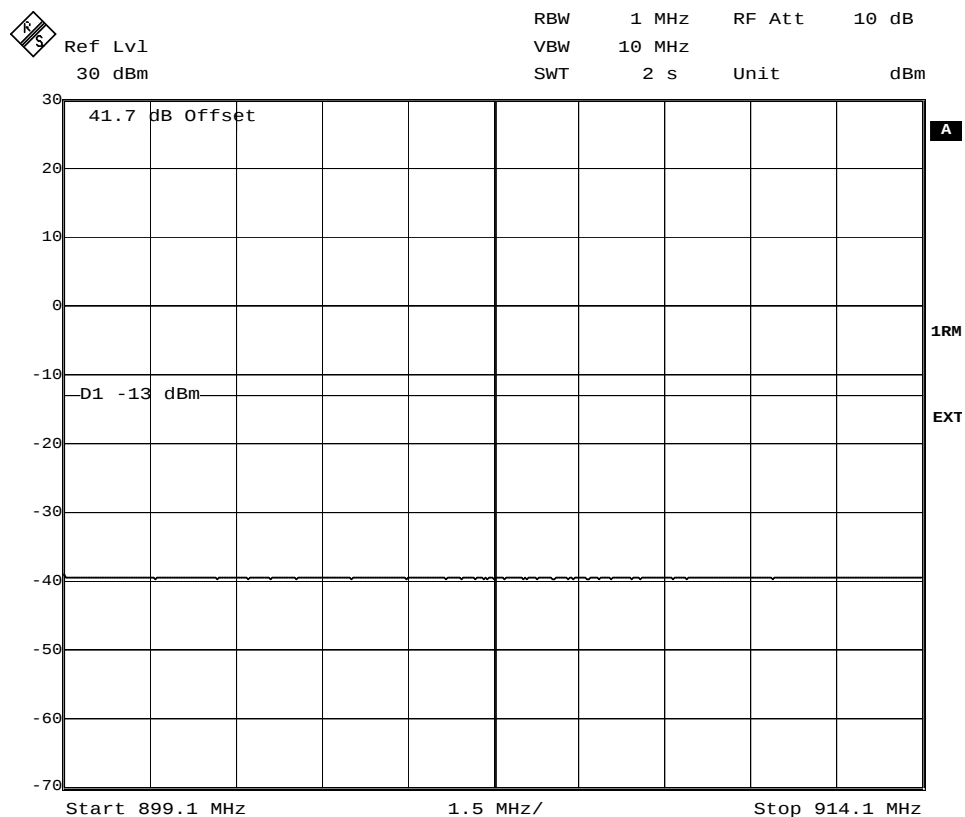
FCC ID: TA8AKRB90118-1

Appendix 4.1

Diagram 5



Date: 21.OCT.2005 12:17:53

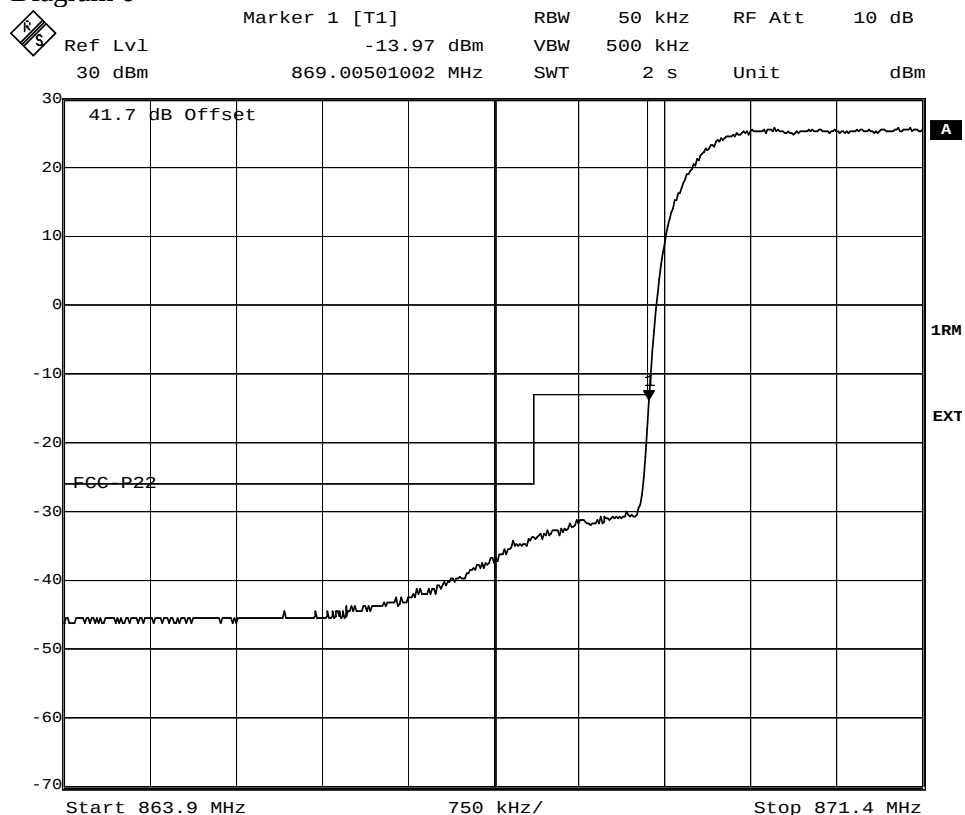


Date: 21.OCT.2005 12:19:22

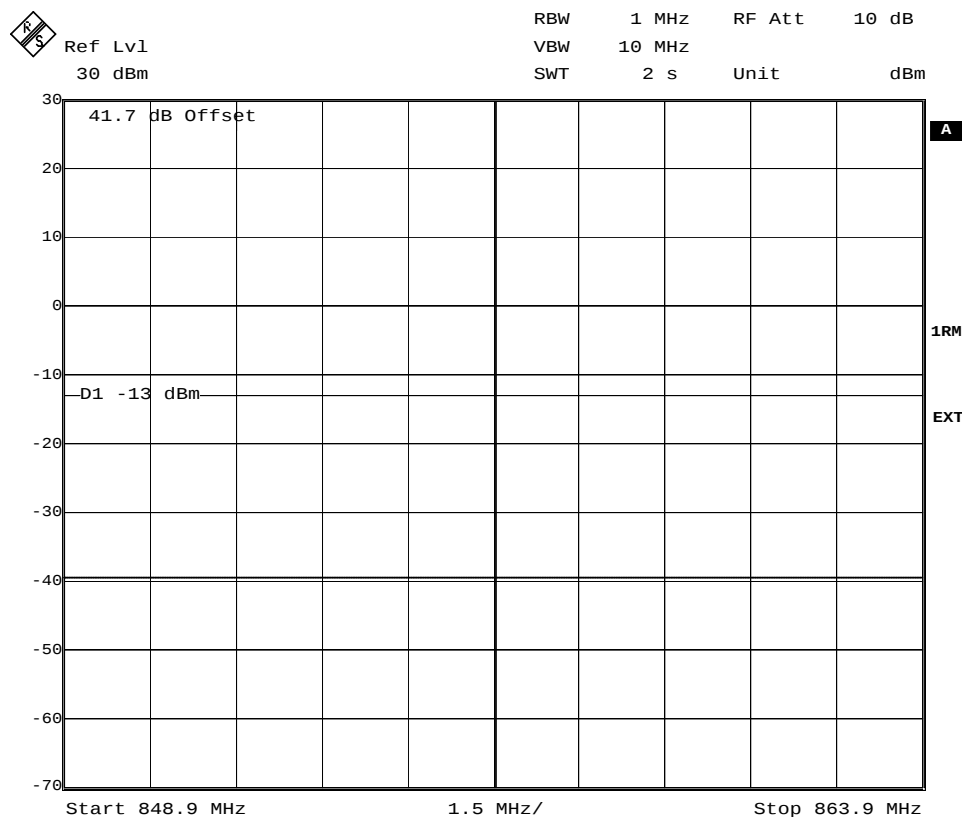
FCC ID: TA8AKRB90118-1

Appendix 4.1

Diagram 6



Date: 21.OCT.2005 11:10:24

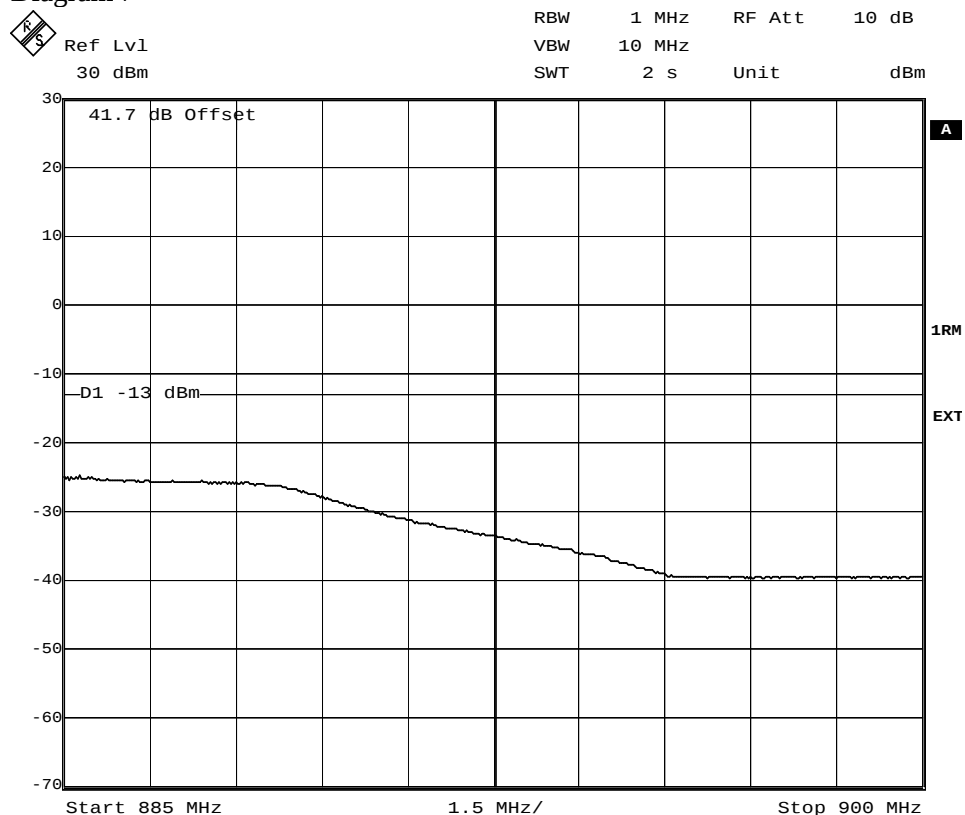


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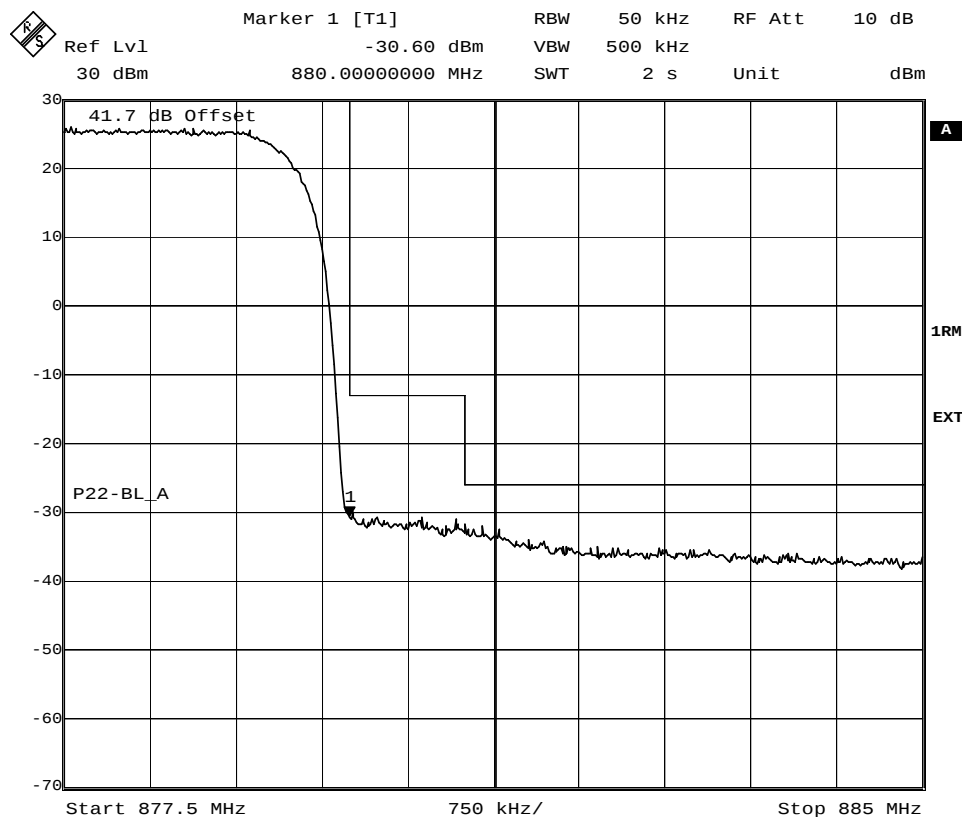
FCC ID: TA8AKRB90118-1

Appendix 4.1

Diagram 7



Date: 21.OCT.2005 13:41:41

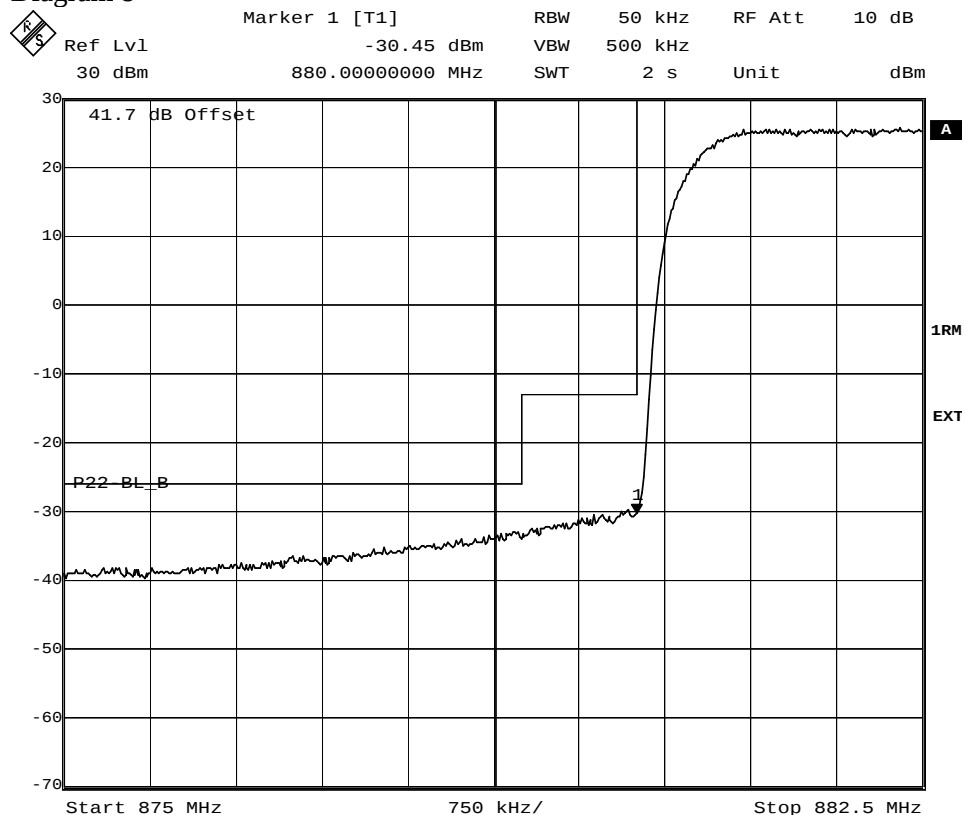


Date: 21.OCT.2005 13:42:36

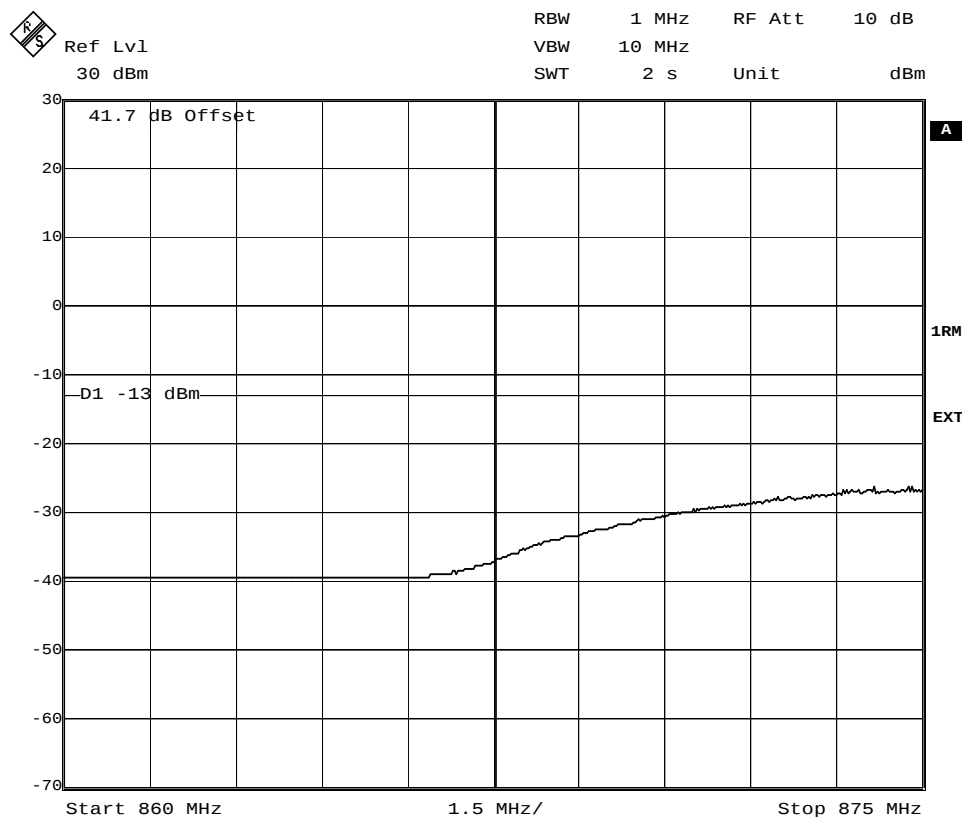
FCC ID: TA8AKRB90118-1

Appendix 4.1

Diagram 8



Date: 21.OCT.2005 13:06:37

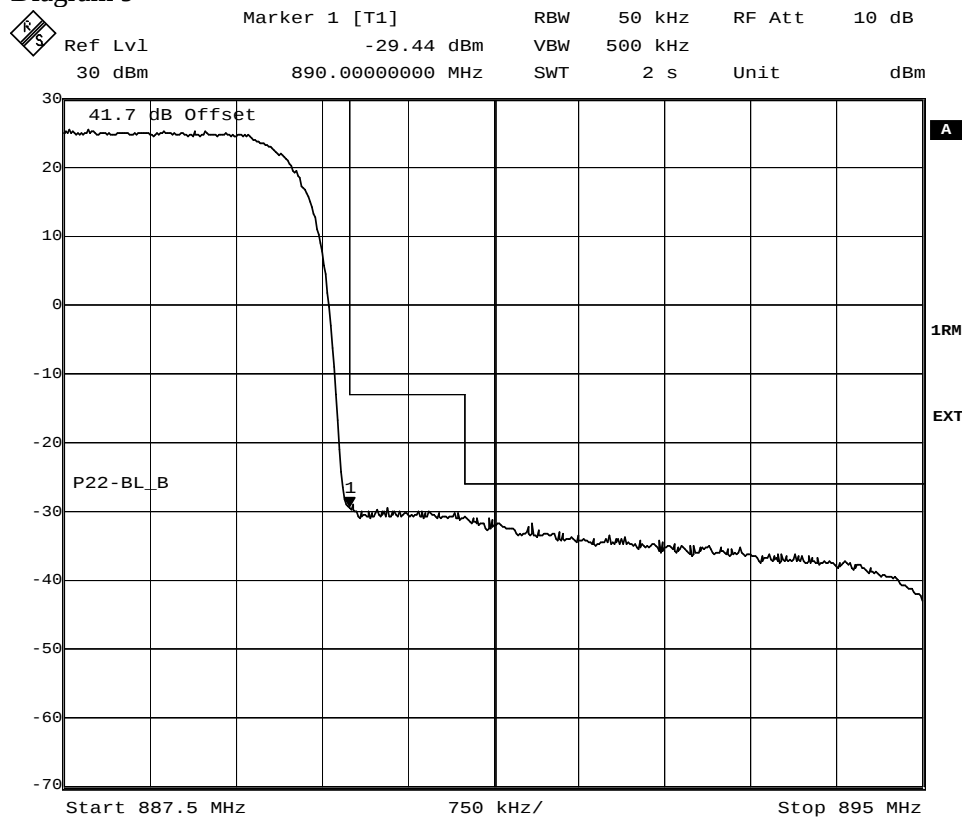


Date: 21.OCT.2005 13:07:20

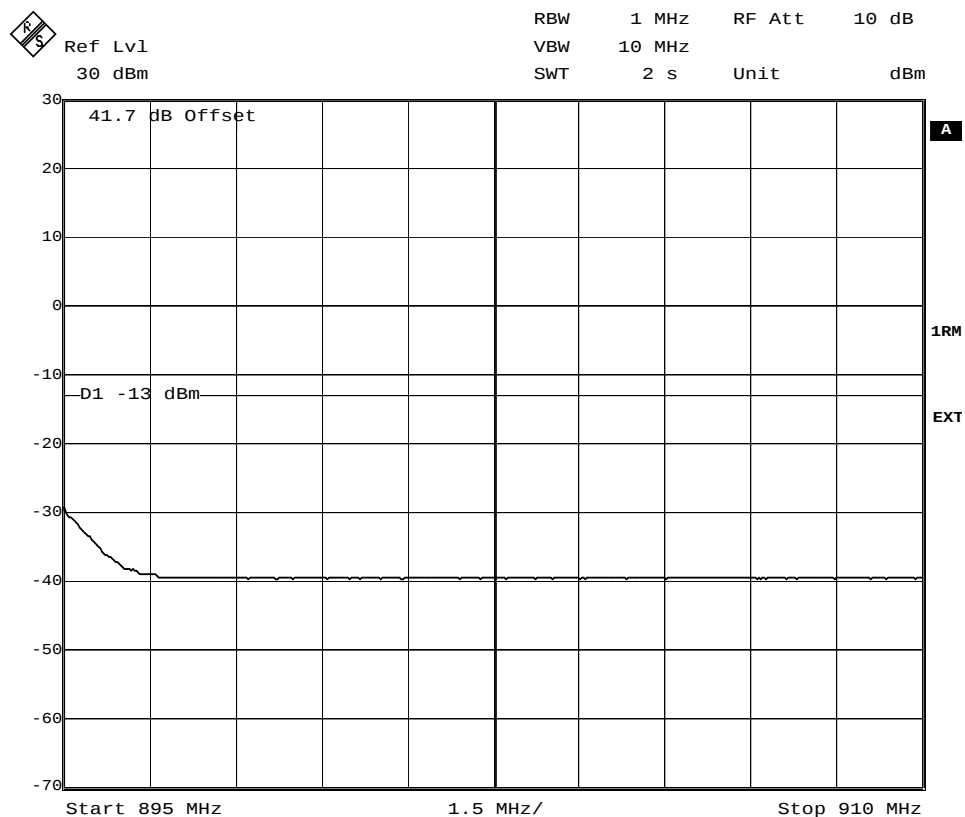
FCC ID: TA8AKRB90118-1

Appendix 4.1

Diagram 9



Date: 21.OCT.2005 13:14:12

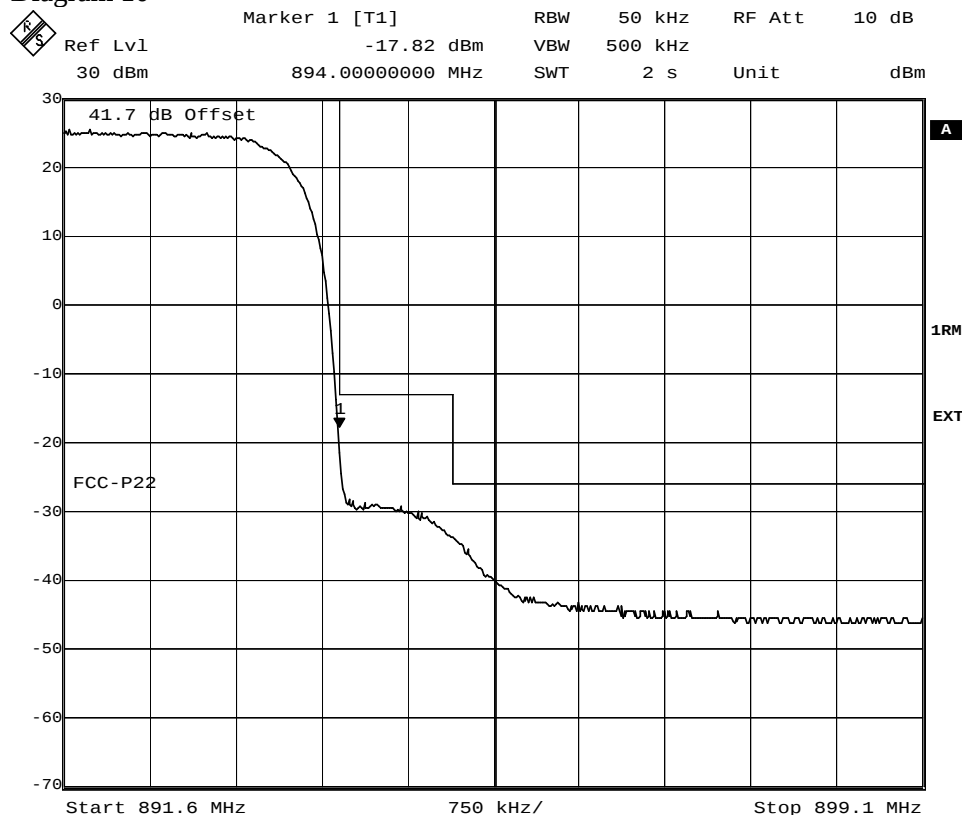


Date: 21.OCT.2005 13:13:15

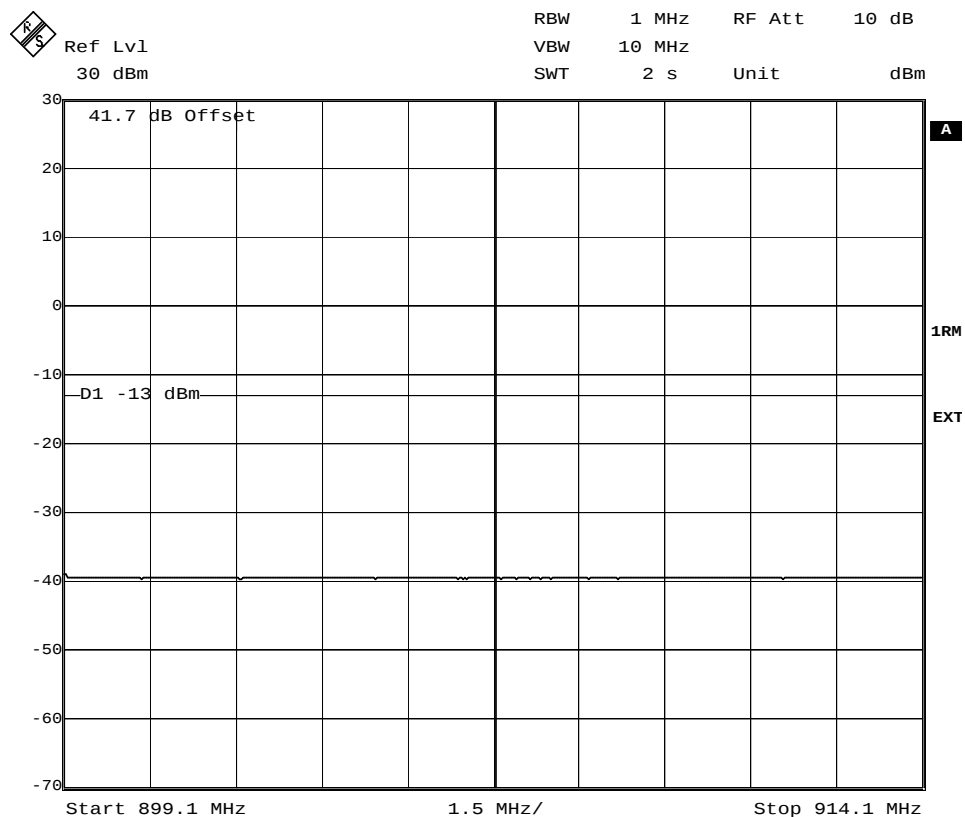
FCC ID: TA8AKRB90118-1

Appendix 4.1

Diagram 10



Date: 21.OCT.2005 12:26:20



Date: 21.OCT.2005 12:24:25

Conducted spurious emission measurements according to 47 CFR 2.1051

Date	Temperature	Humidity
2005-10-20	22 °C ± 3 °C	34 % ± 5 %
2005-10-21	23 °C ± 3 °C	41 % ± 5 %
2005-10-27	21 °C ± 3 °C	30 % ± 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	2006-04	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

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

Limits

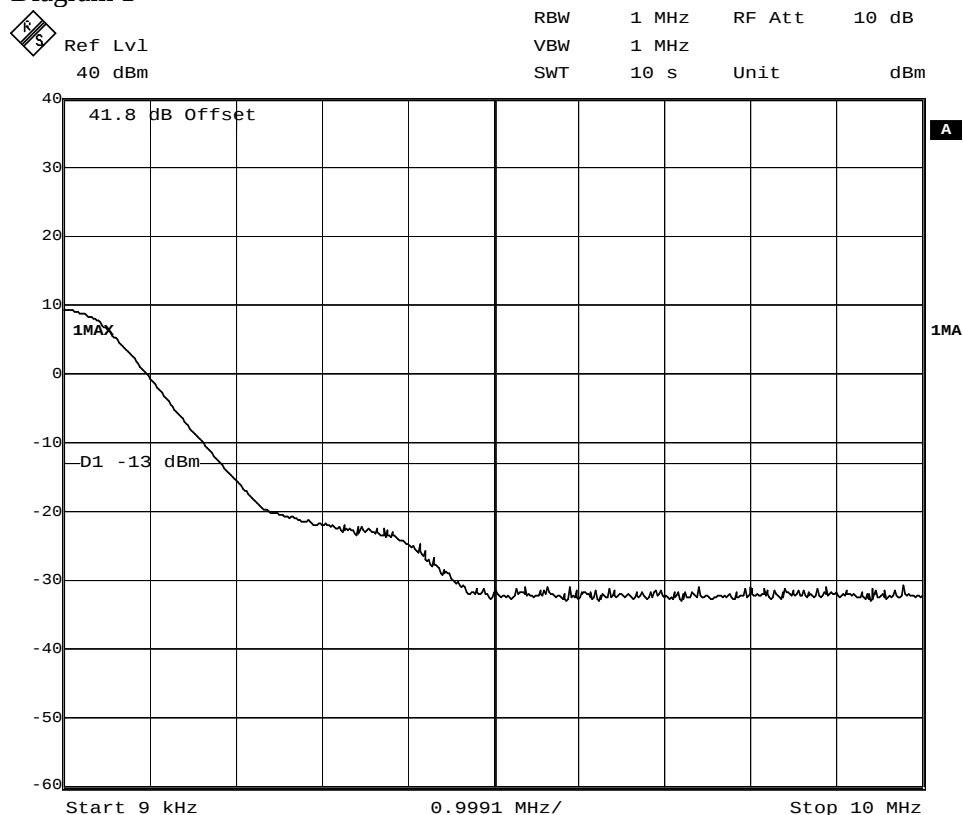
The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least $43 + 10 \log P$ dB.

Complies?	Yes
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FCC ID: TA8AKRB90118-1

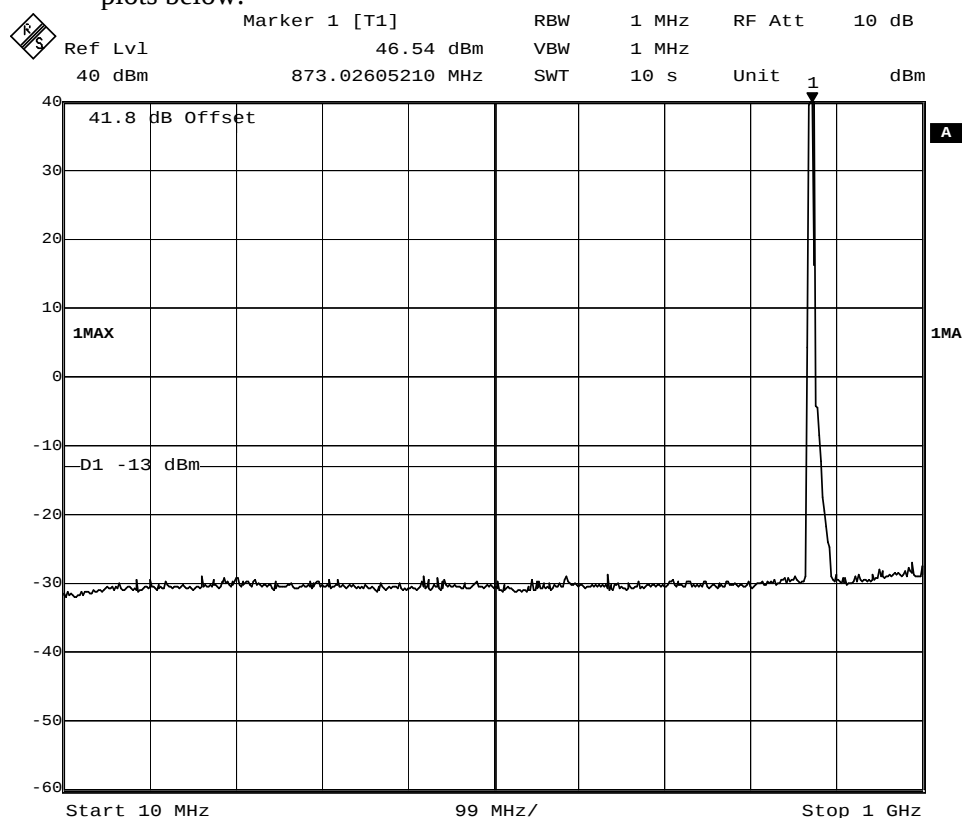
Appendix 5.1

Diagram 1



Date: 27.OCT.2005 10:49:53

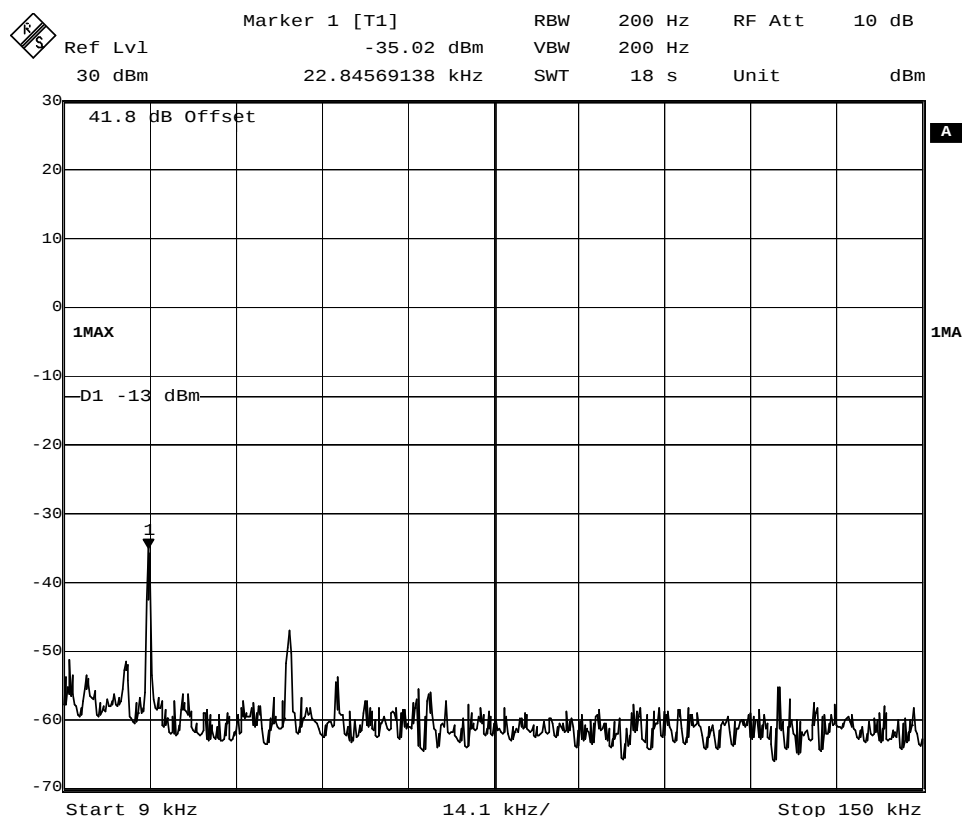
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz, see plots below.



Date: 27.OCT.2005 10:50:58

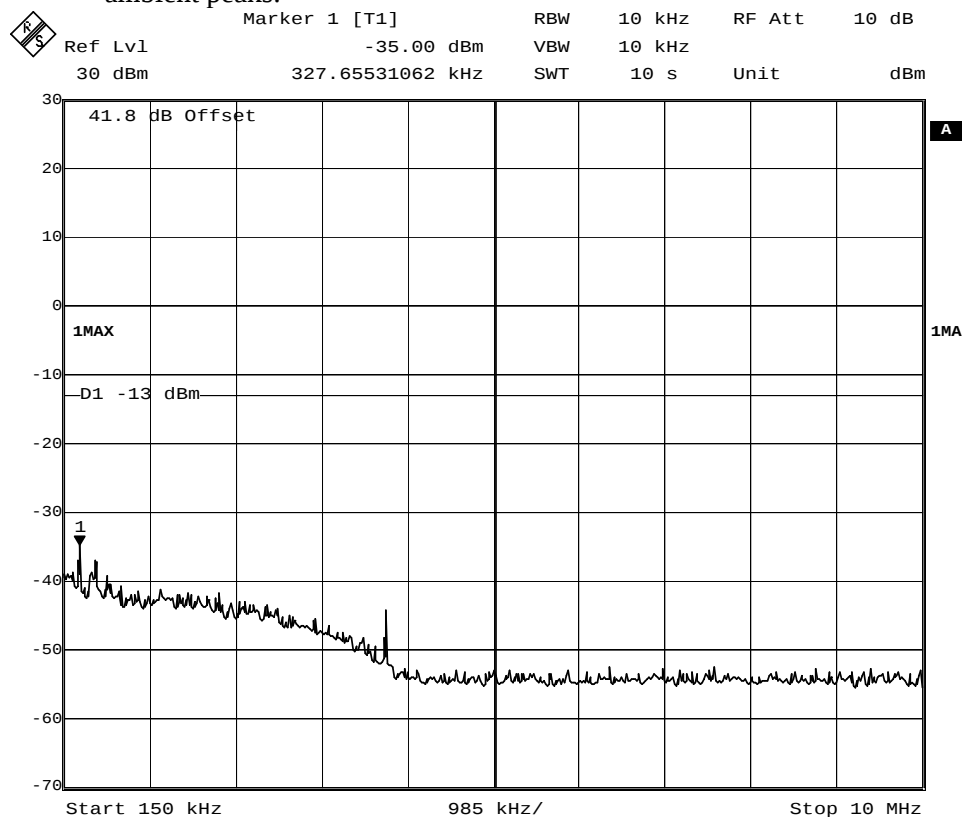
FCC ID: TA8AKRB90118-1

Appendix 5.1



Date: 27.OCT.2005 10:52:13

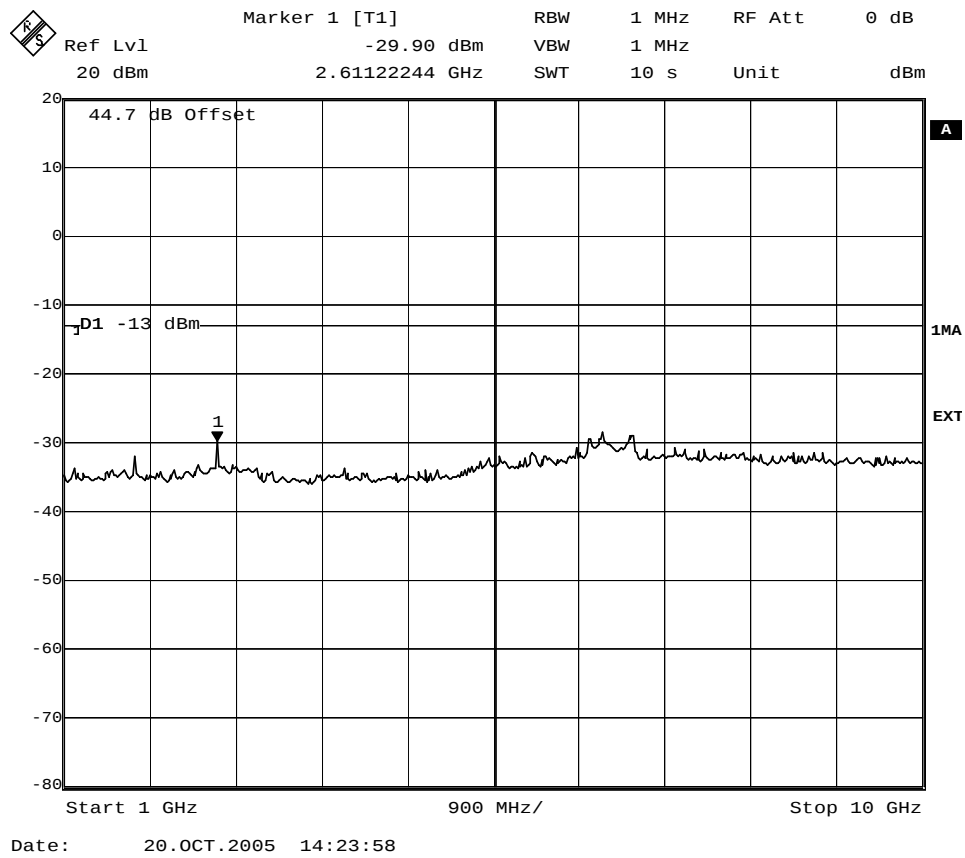
Note: The emission at 22 kHz and 44 kHz were not related to the EUT. It were ambient peaks.



Date: 27.OCT.2005 10:53:32

FCC ID: TA8AKRB90118-1

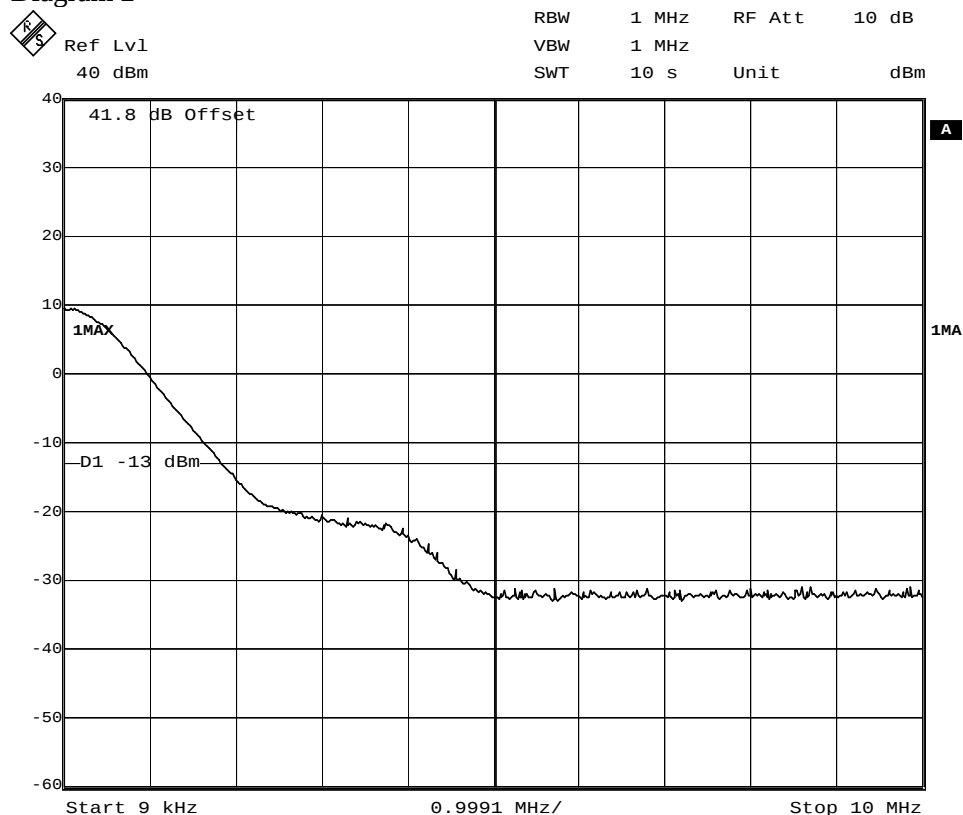
Appendix 5.1



FCC ID: TA8AKRB90118-1

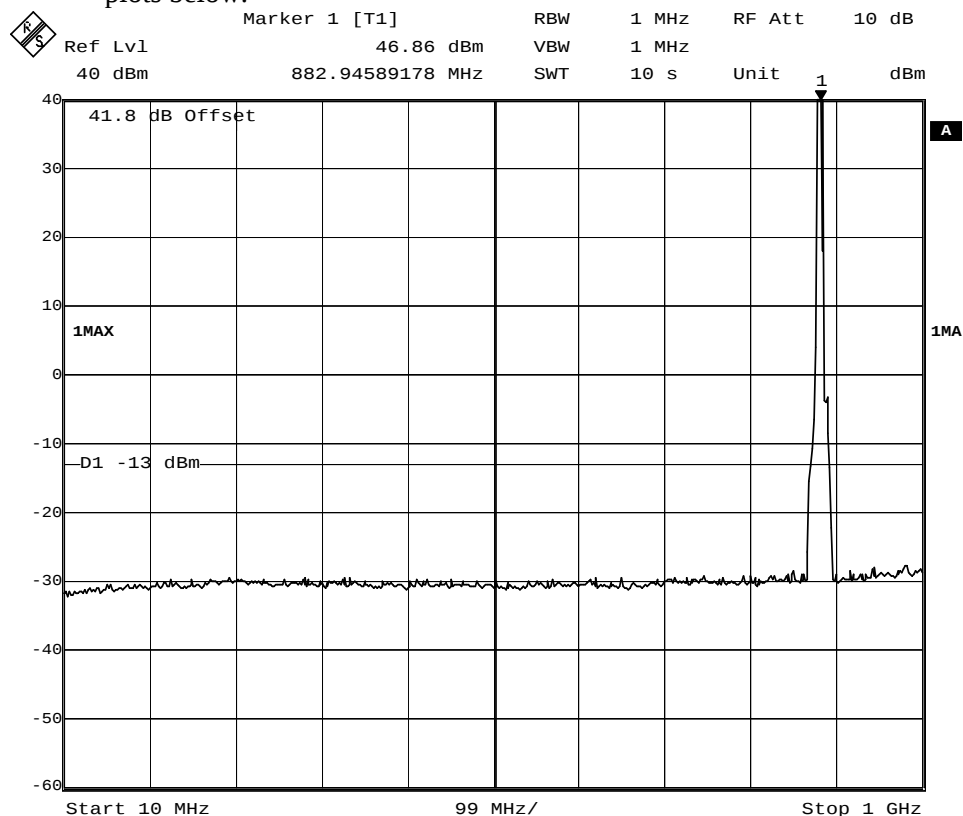
Appendix 5.1

Diagram 2



Date: 27.OCT.2005 10:59:39

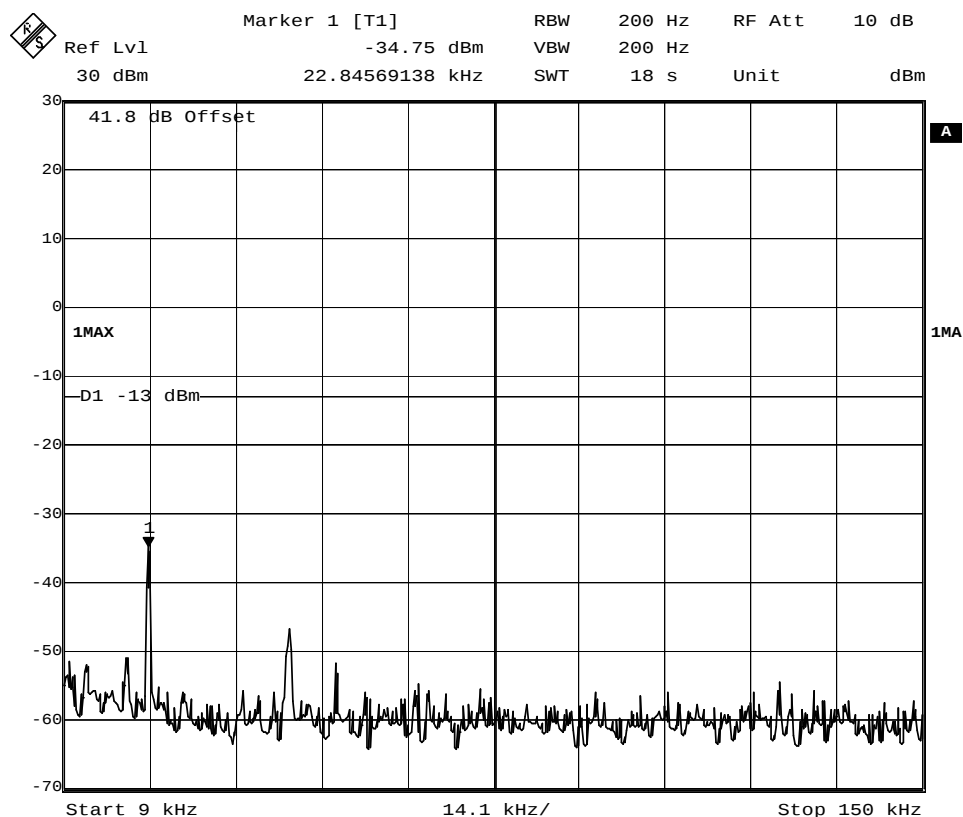
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz, see plots below.



Date: 27.OCT.2005 11:00:49

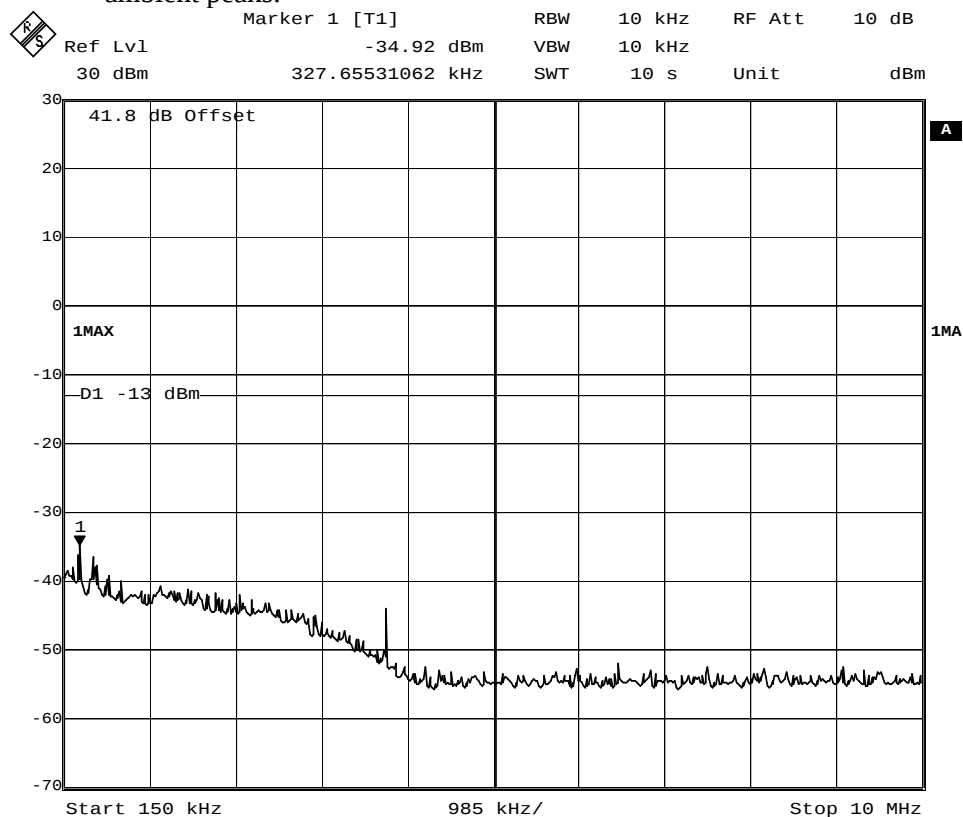
FCC ID: TA8AKRB90118-1

Appendix 5.1



Date: 27.OCT.2005 11:02:20

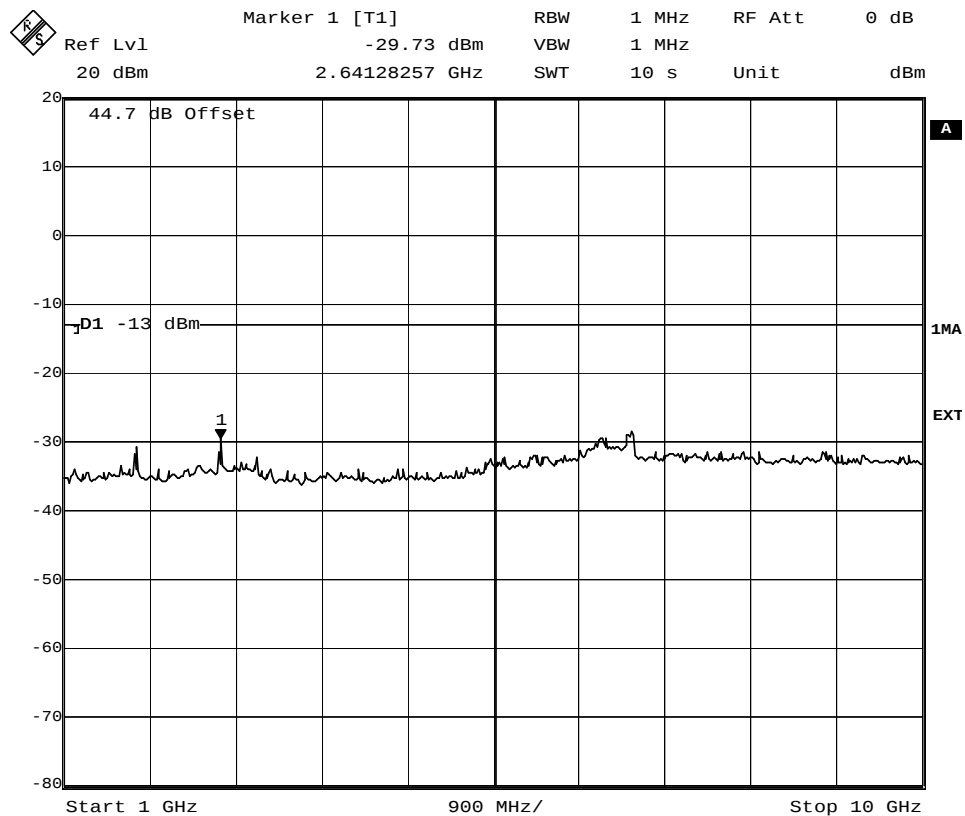
Note: The emission at 22 kHz and 44 kHz were not related to the EUT. It were ambient peaks.



Date: 27.OCT.2005 11:03:16

FCC ID: TA8AKRB90118-1

Appendix 5.1

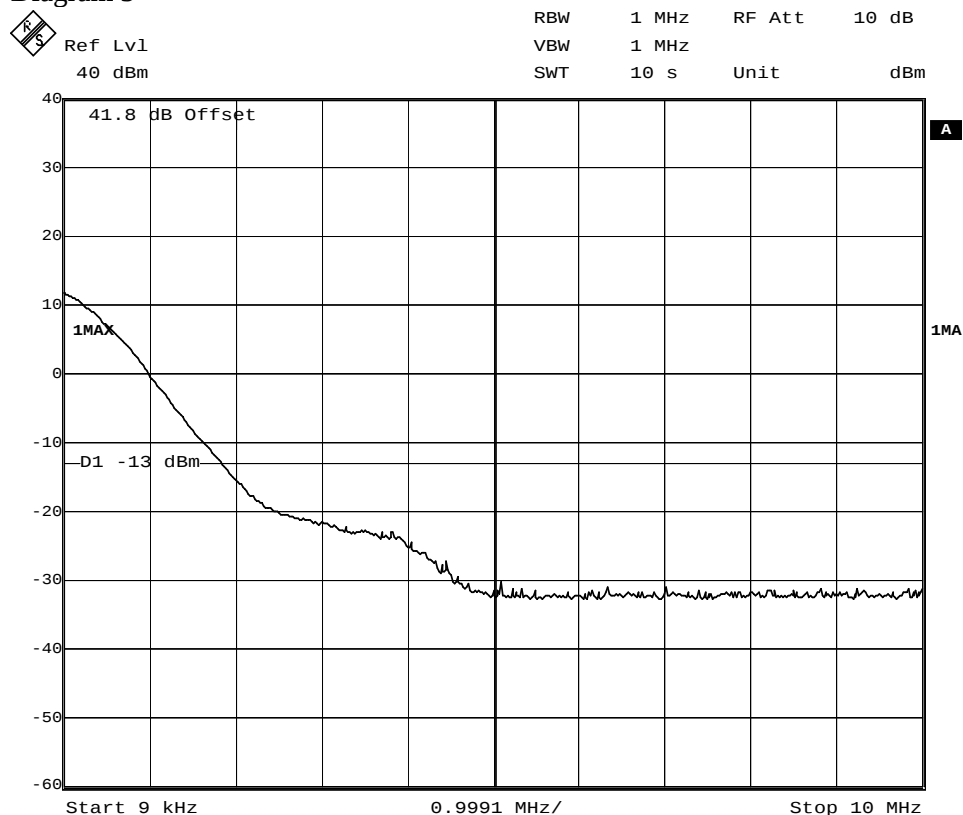


Date: 21.OCT.2005 08:20:17

FCC ID: TA8AKRB90118-1

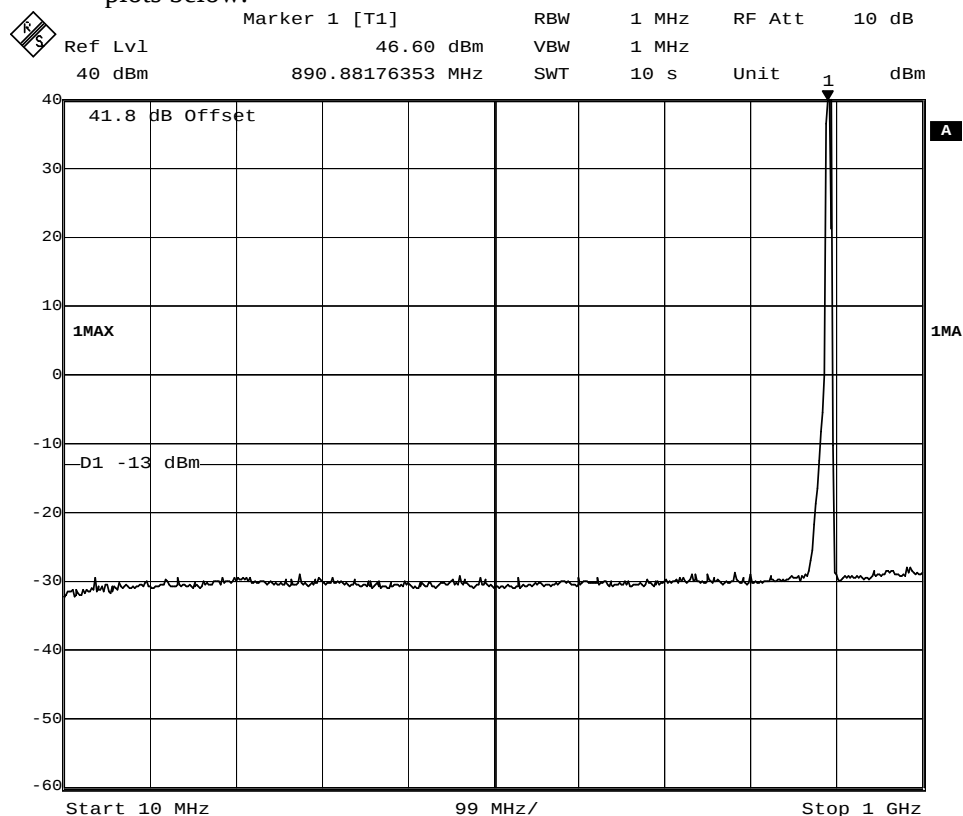
Appendix 5.1

Diagram 3



Date: 27.OCT.2005 10:37:35

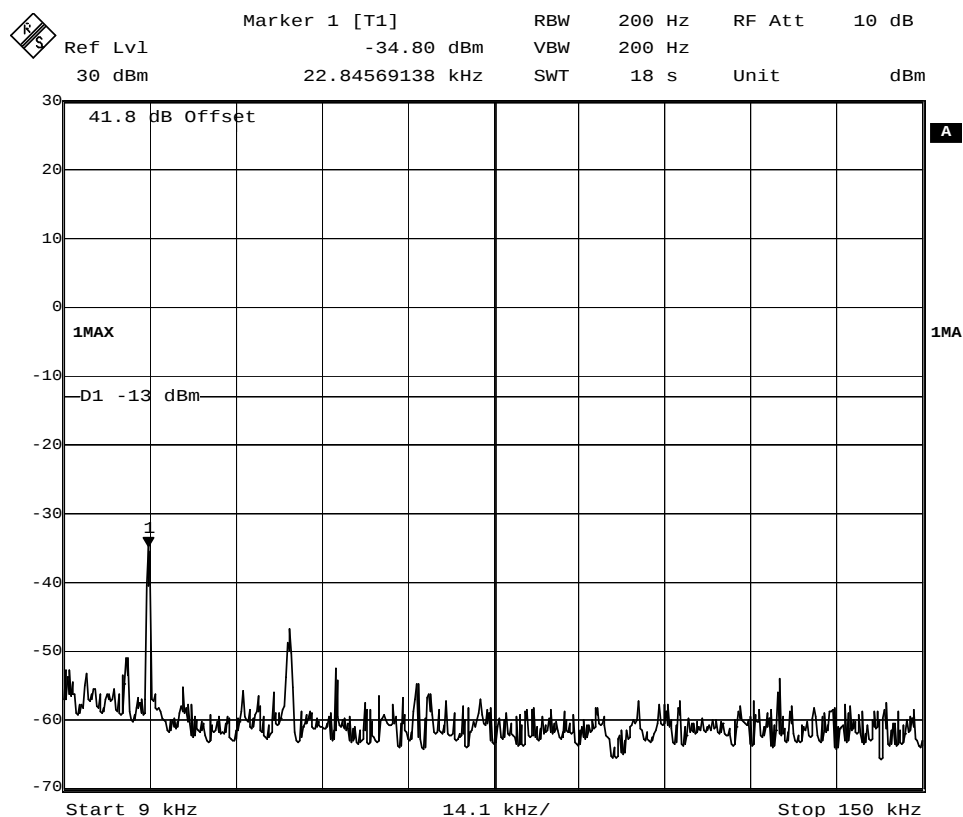
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz, see plots below.



Date: 27.OCT.2005 10:38:53

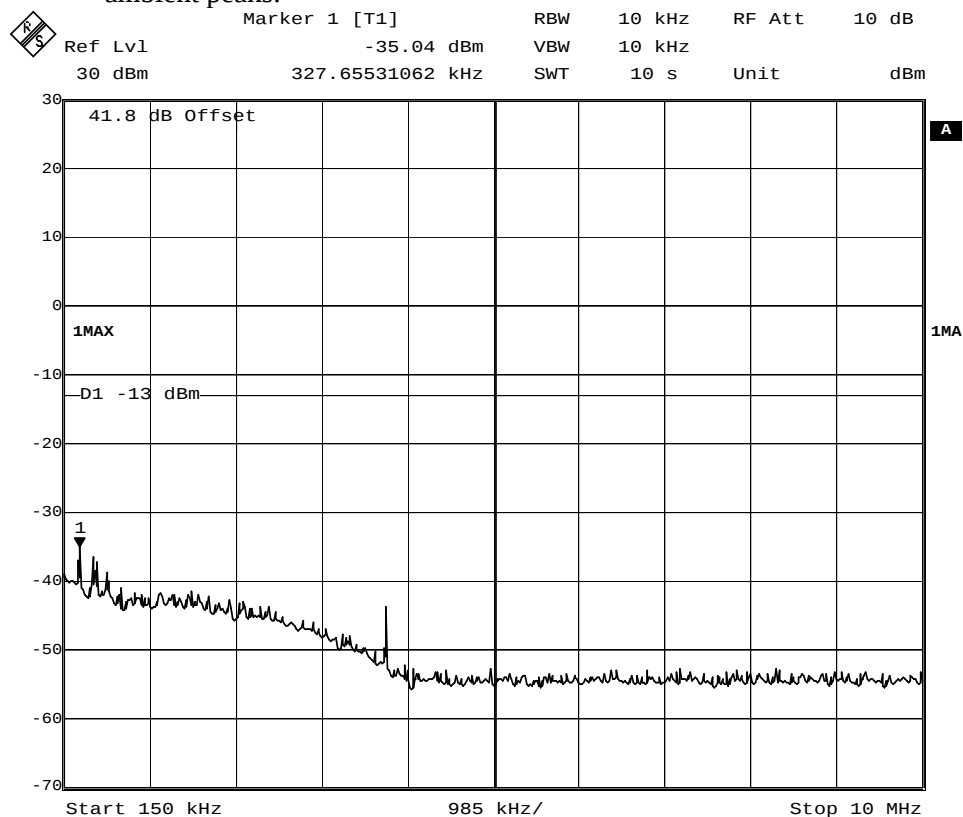
FCC ID: TA8AKRB90118-1

Appendix 5.1



Date: 27.OCT.2005 10:40:29

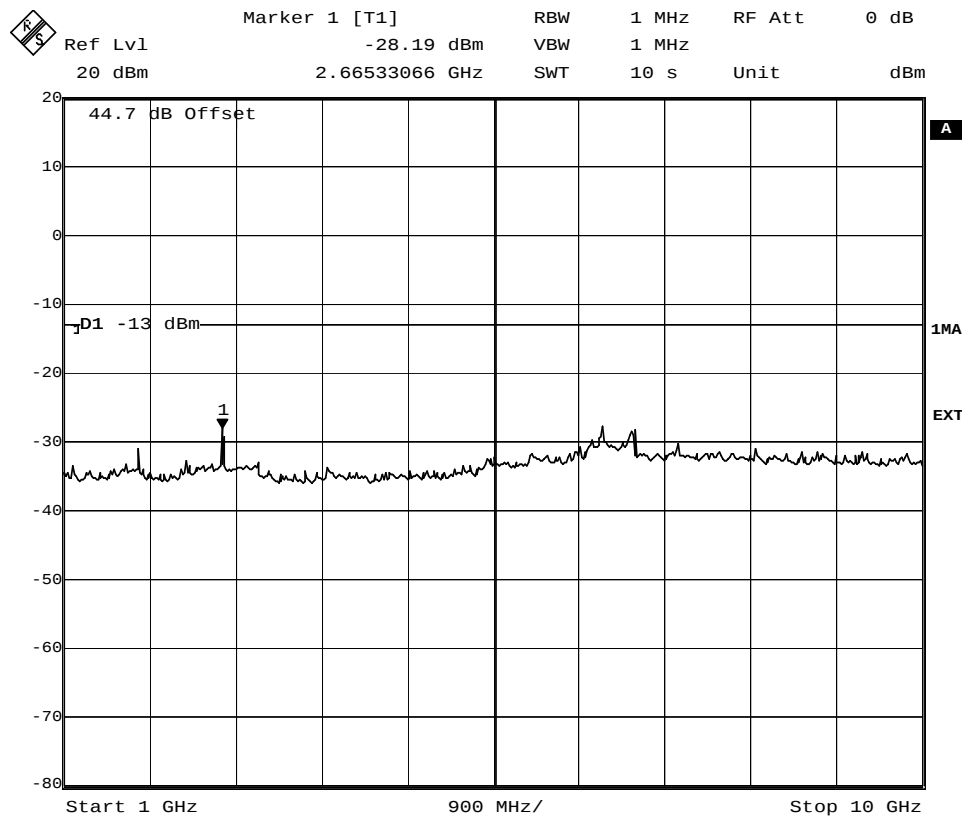
Note: The emission at 22 kHz and 44 kHz were not related to the EUT. It were ambient peaks.



Date: 27.OCT.2005 10:41:41

FCC ID: TA8AKRB90118-1

Appendix 5.1

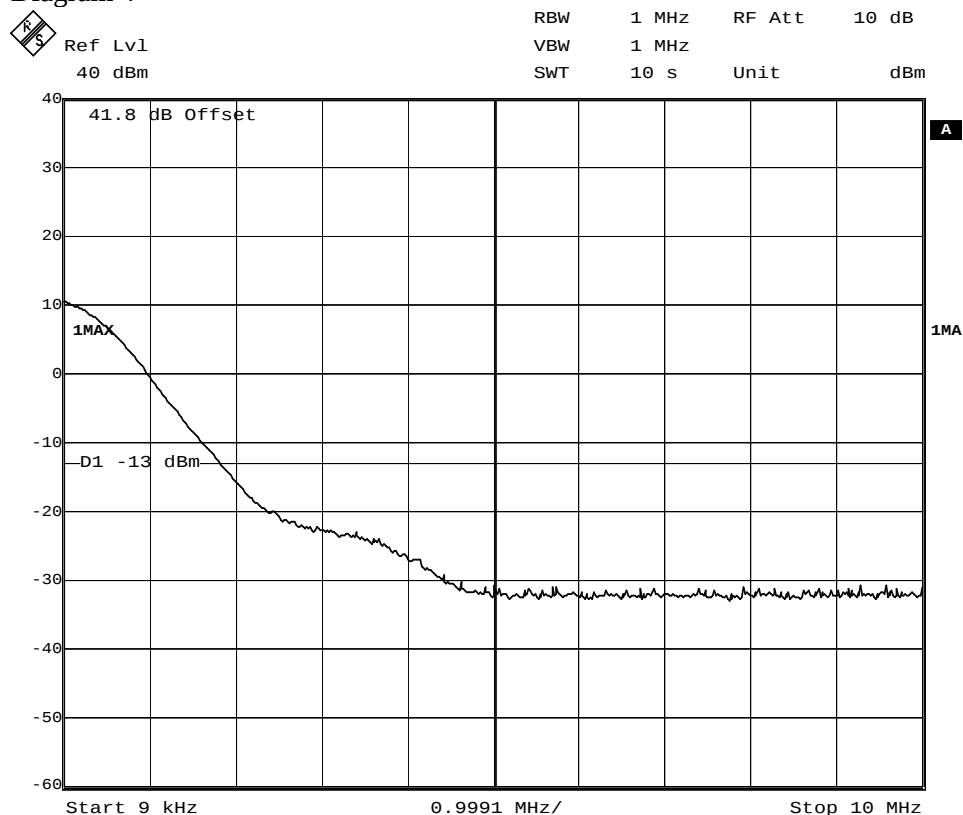


Date: 20.OCT.2005 15:01:40

FCC ID: TA8AKRB90118-1

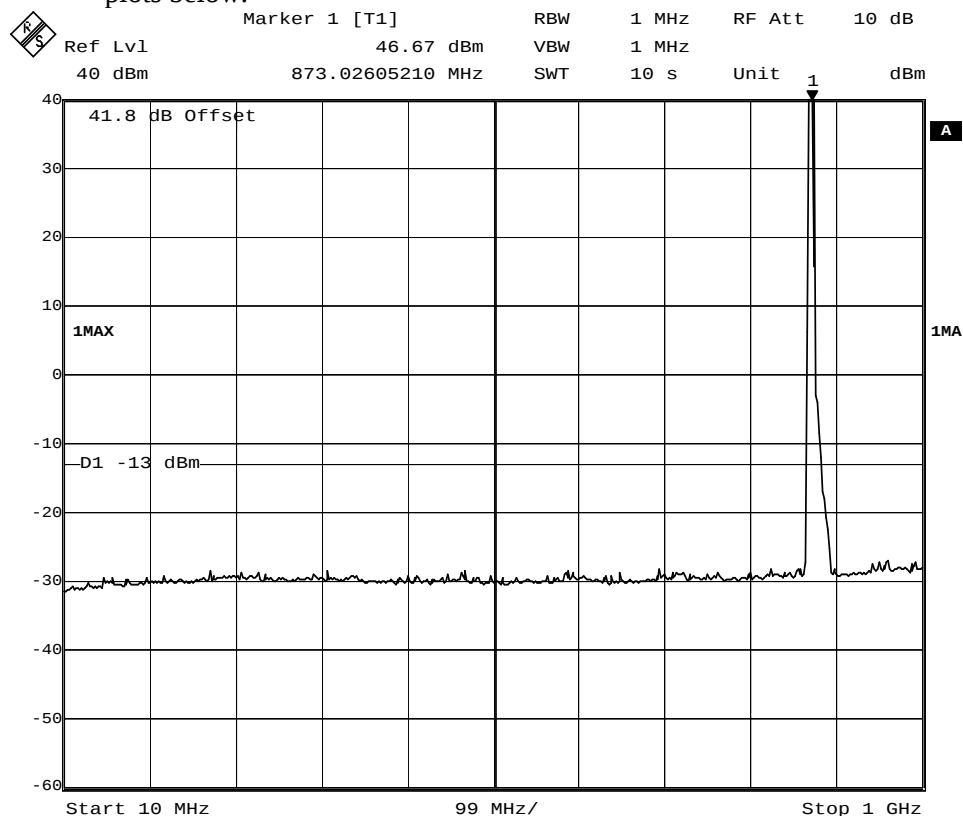
Appendix 5.1

Diagram 4



Date: 27.OCT.2005 10:06:57

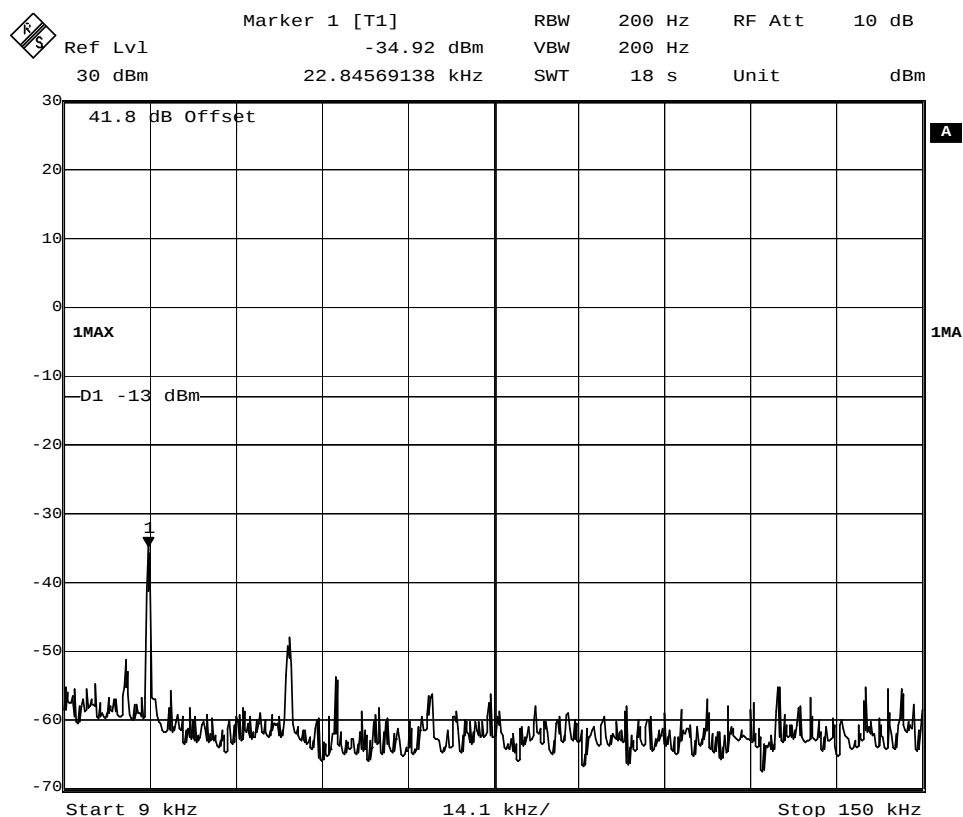
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz, see plots below.



Date: 27.OCT.2005 10:14:50

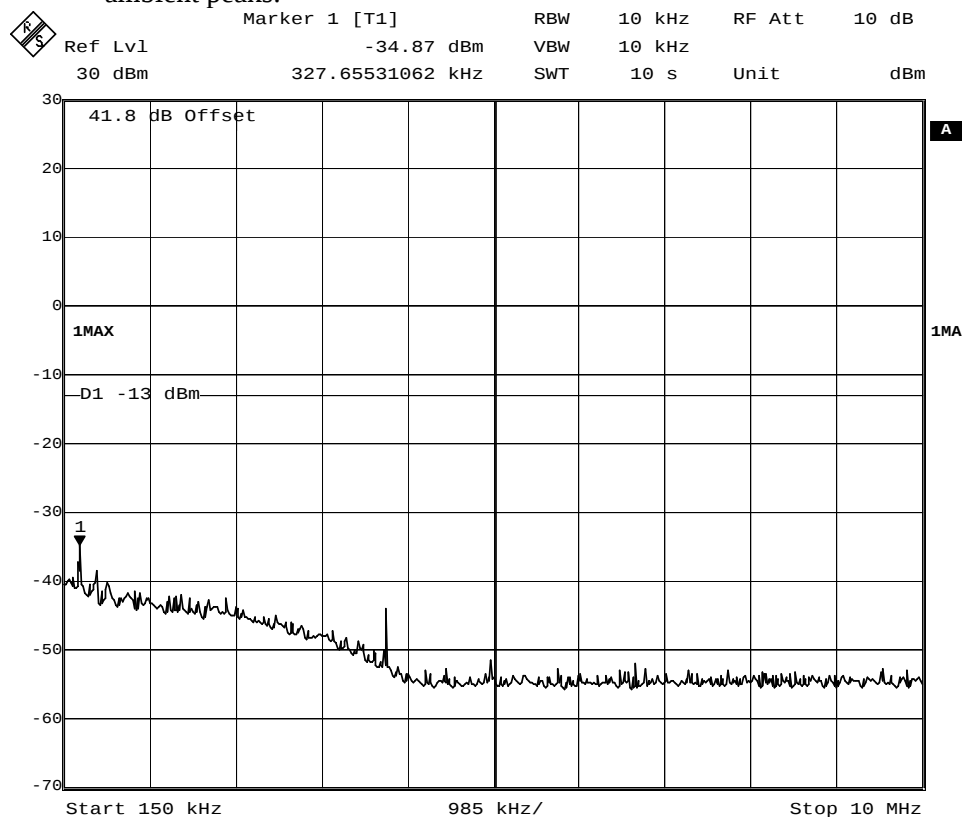
FCC ID: TA8AKRB90118-1

Appendix 5.1



Date: 27.OCT.2005 10:16:38

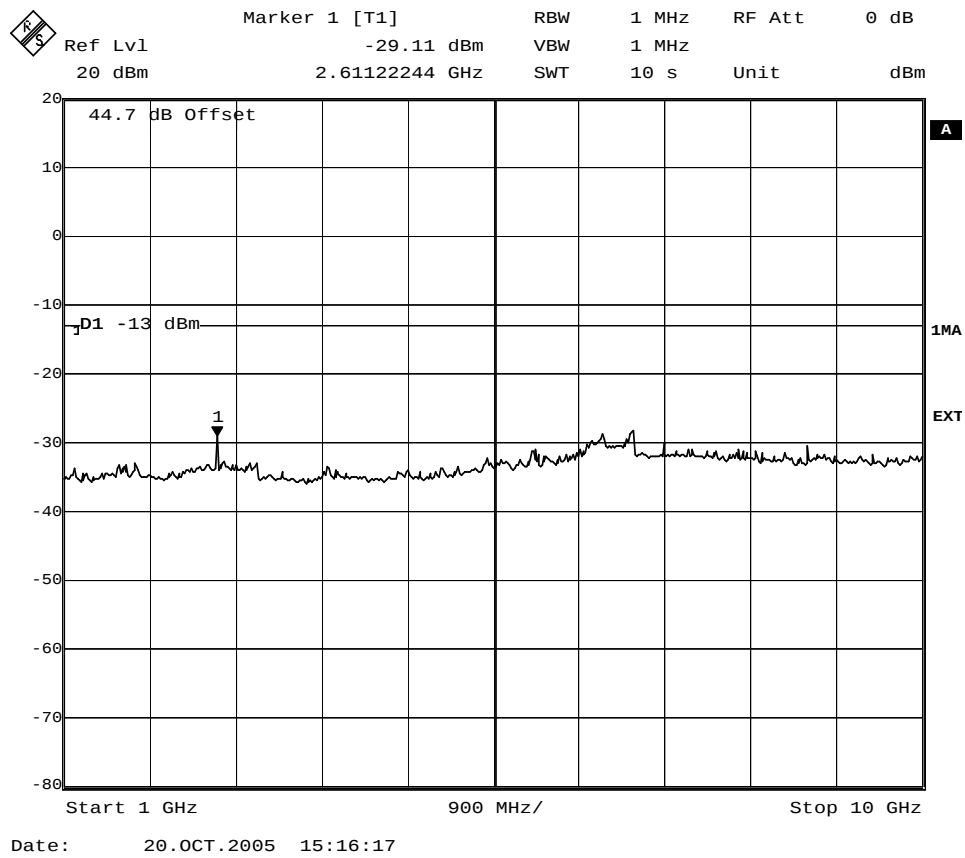
Note: The emission at 22 kHz and 44 kHz were not related to the EUT. It were ambient peaks.



Date: 27.OCT.2005 10:17:57

FCC ID: TA8AKRB90118-1

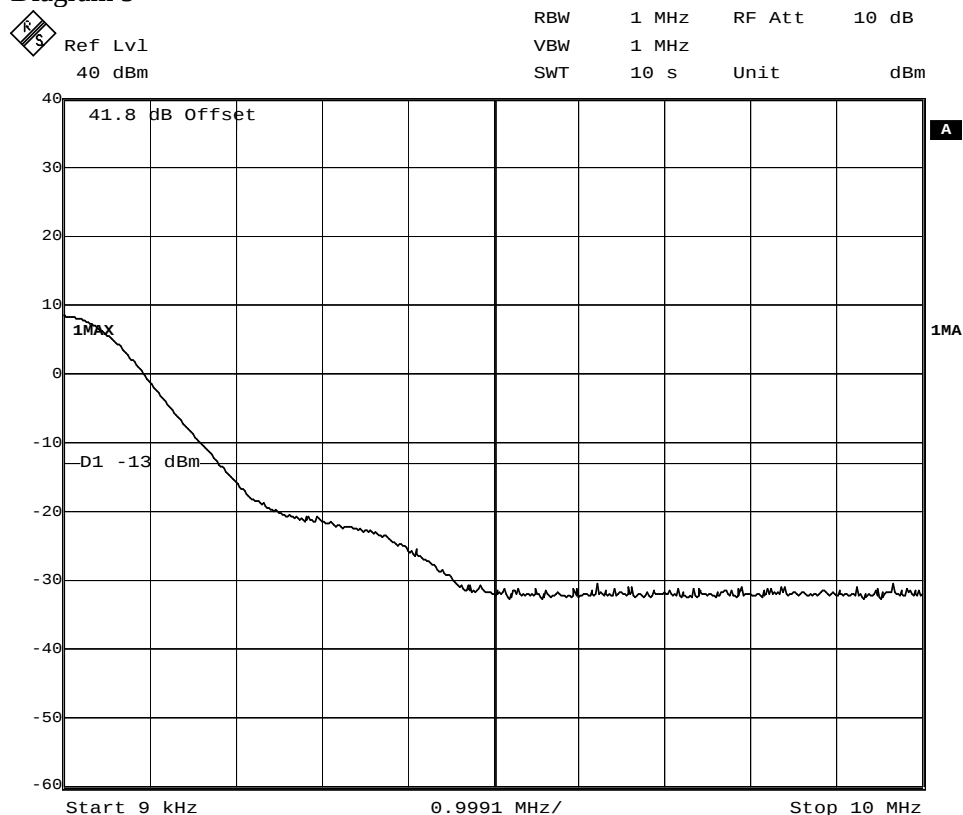
Appendix 5.1



FCC ID: TA8AKRB90118-1

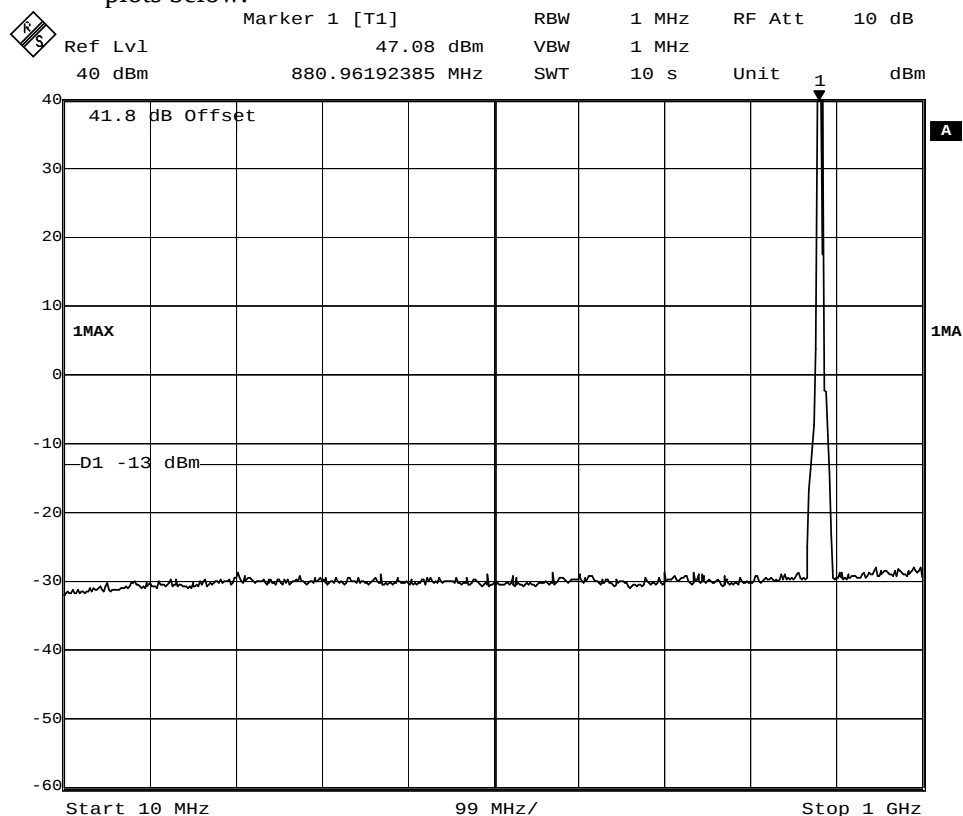
Appendix 5.1

Diagram 5



Date: 27.OCT.2005 09:08:50

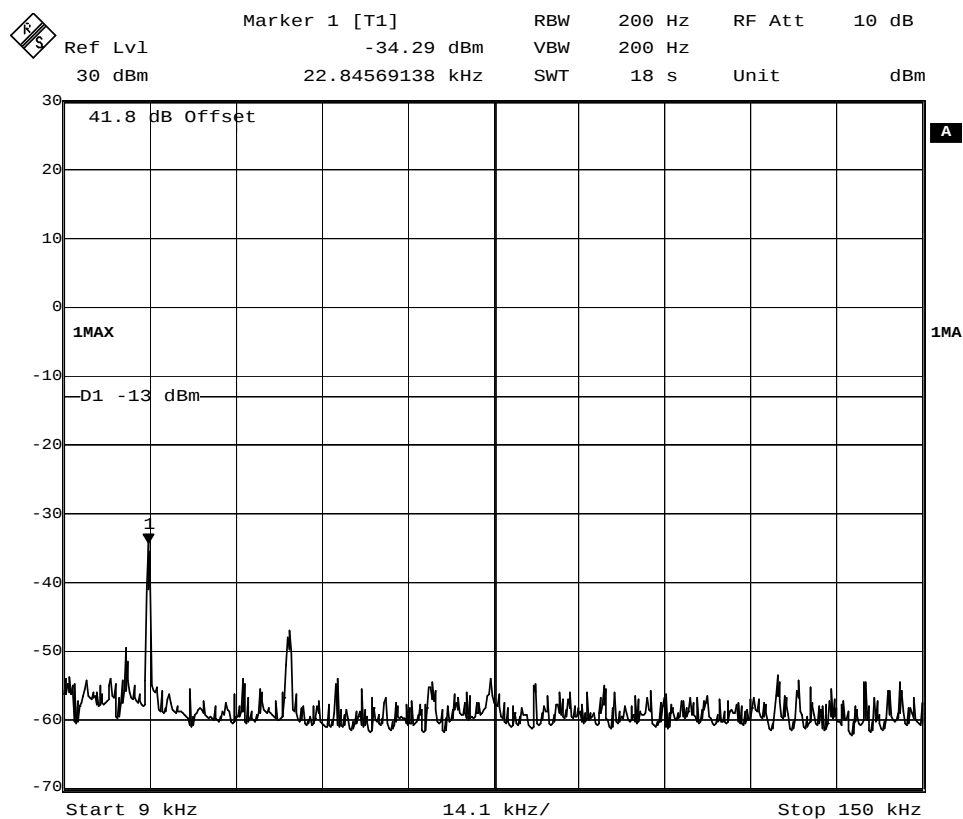
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz, see plots below.



Date: 27.OCT.2005 09:10:29

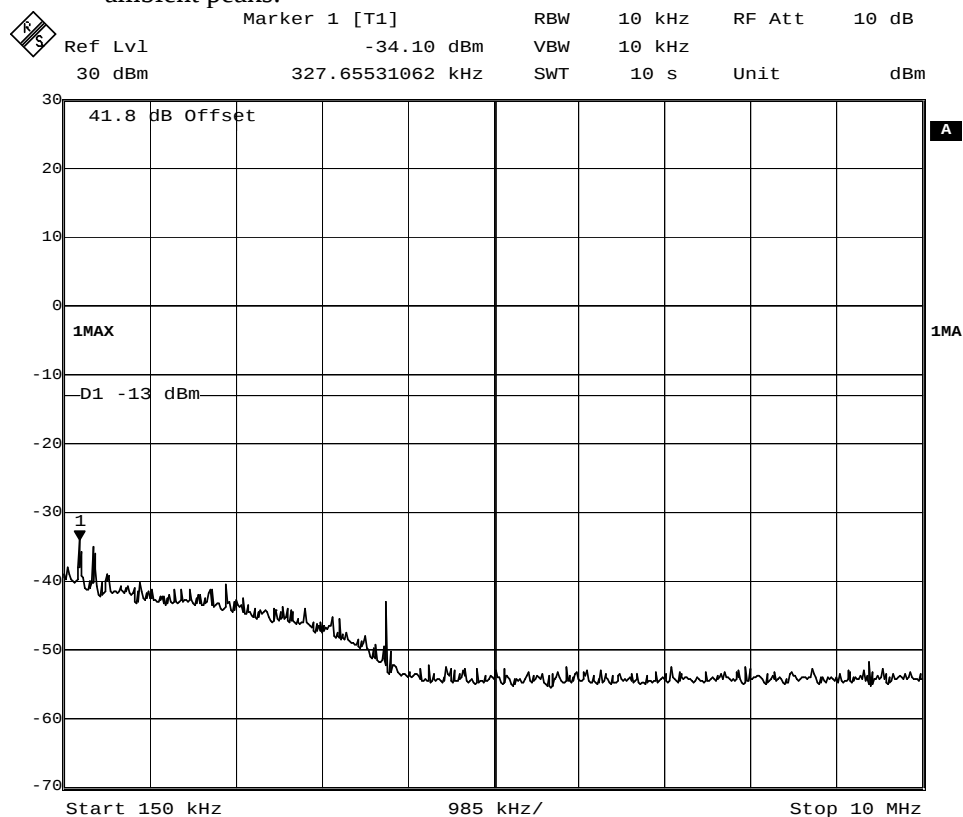
FCC ID: TA8AKRB90118-1

Appendix 5.1



Date: 27.OCT.2005 09:13:08

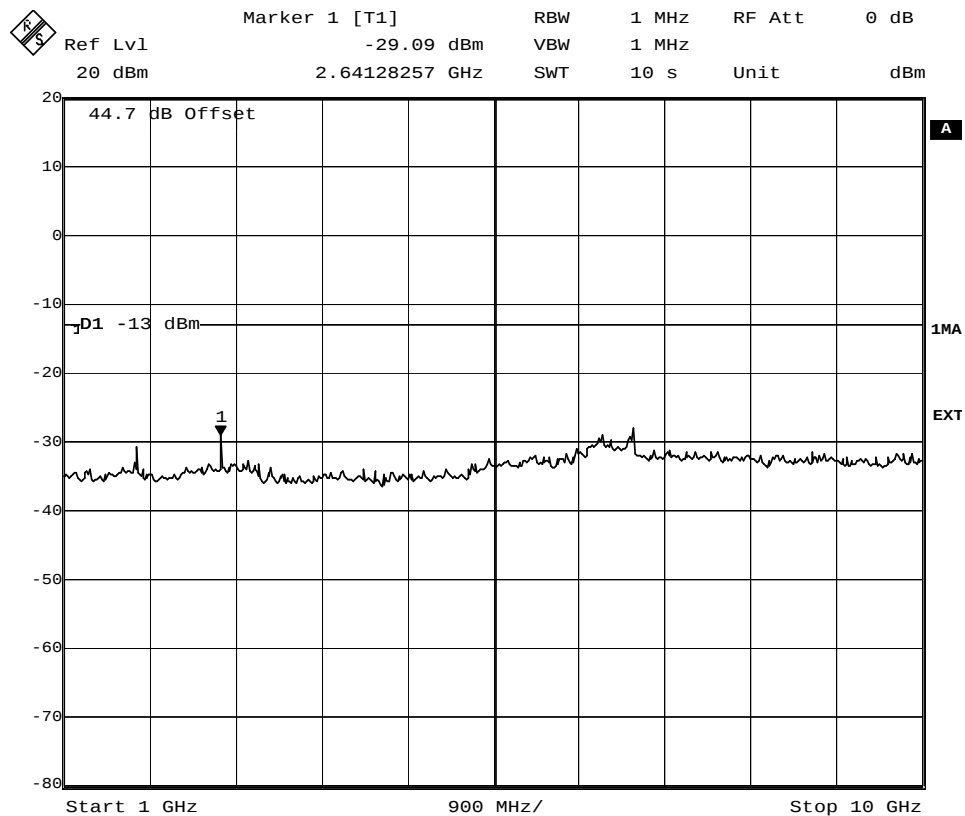
Note: The emission at 22 kHz and 44 kHz were not related to the EUT. It were ambient peaks.



Date: 27.OCT.2005 09:14:44

FCC ID: TA8AKRB90118-1

Appendix 5.1

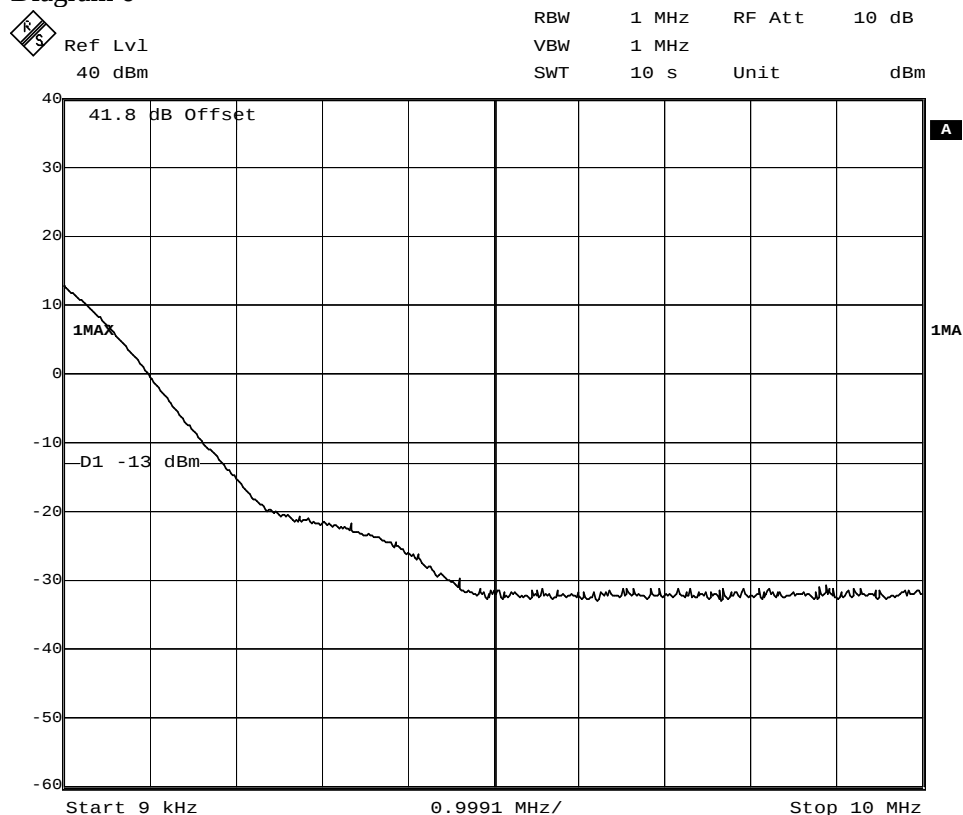


Date: 21.OCT.2005 08:15:34

FCC ID: TA8AKRB90118-1

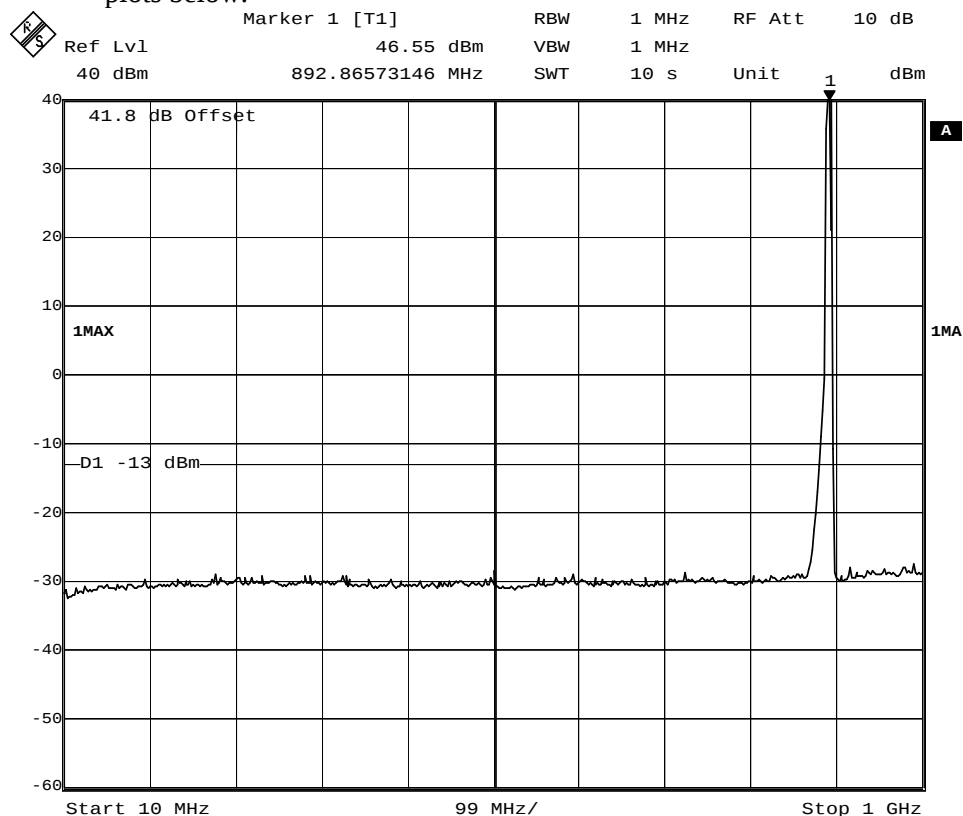
Appendix 5.1

Diagram 6



Date: 27.OCT.2005 10:26:01

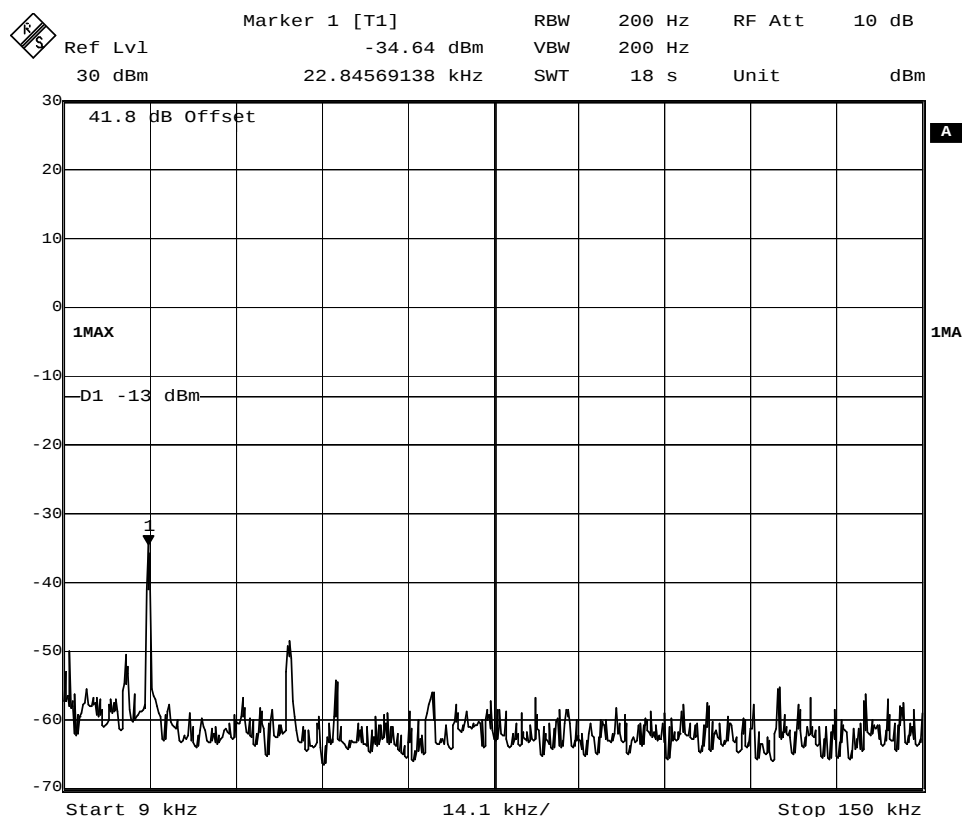
Note: The emission at 9 kHz was related to the LO feedthrough. A complementary measurement was performed with a smaller RBW to verify that there were no emission in the frequency range 9k-10MHz, see plots below.



Date: 27.OCT.2005 10:27:24

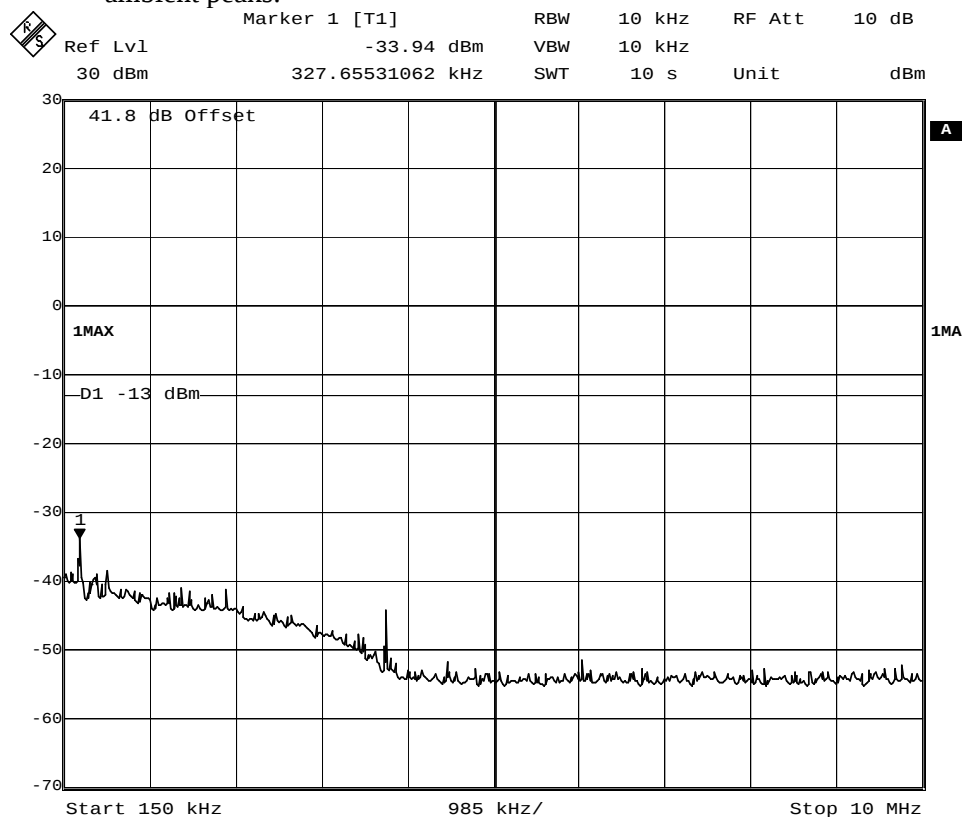
FCC ID: TA8AKRB90118-1

Appendix 5.1



Date: 27.OCT.2005 10:28:54

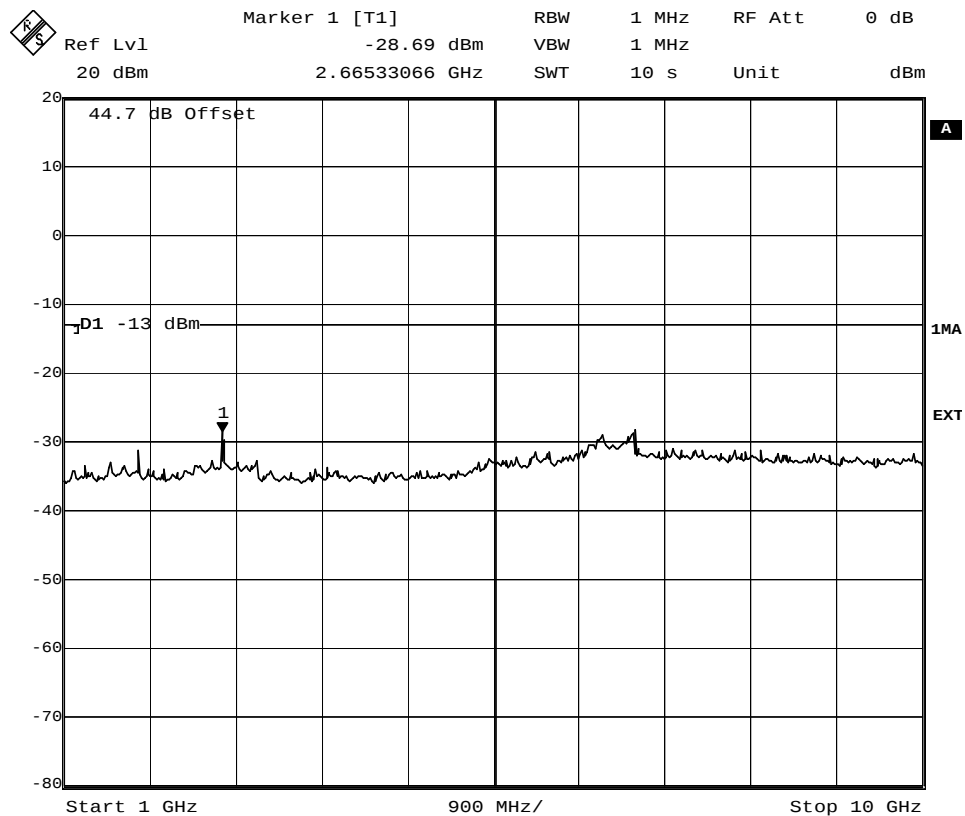
Note: The emission at 22 kHz and 44 kHz were not related to the EUT. It were ambient peaks.



Date: 27.OCT.2005 10:30:16

FCC ID: TA8AKRB90118-1

Appendix 5.1



Date: 20.OCT.2005 15:11:05

Field strength of spurious radiation measurements according to 47 CFR 2.1053

Date	Temperature	Humidity
2005-10-25	21 °C ± 3 °C	26 % ± 5 %
2005-10-26	22 °C ± 3 °C	38 % ± 5 %

Test set-up and procedure

The chamber 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,

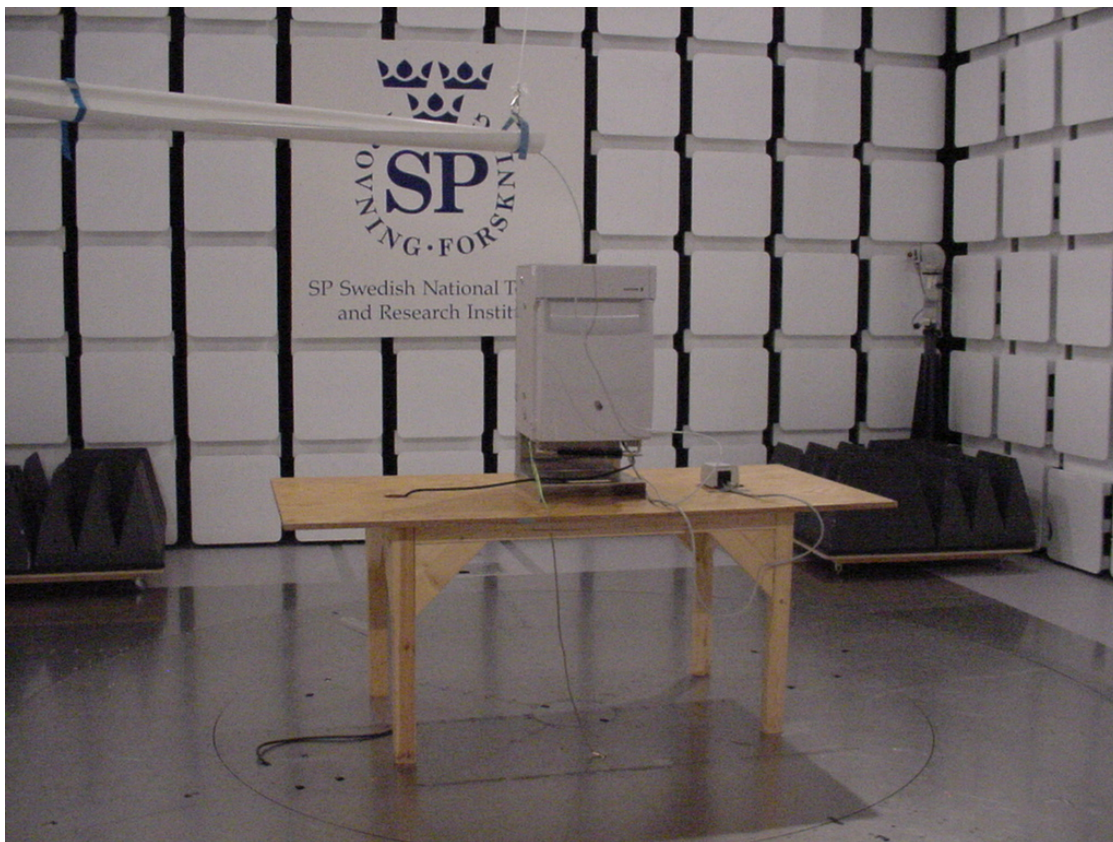
$$\gamma = 20 \log \left(\frac{4\pi D}{\lambda} \right), \gamma \text{ is the propagation loss and } D \text{ is the antenna distance.}$$

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
Anechoic chamber	-	15:115
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	2006-08	503 182
EMCO Horn Antenna 3115	2006-11	502 548
MITEQ Low Noise Amplifier	2006-04	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

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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FCC ID: TA8AKRB90118-1

Appendix 7

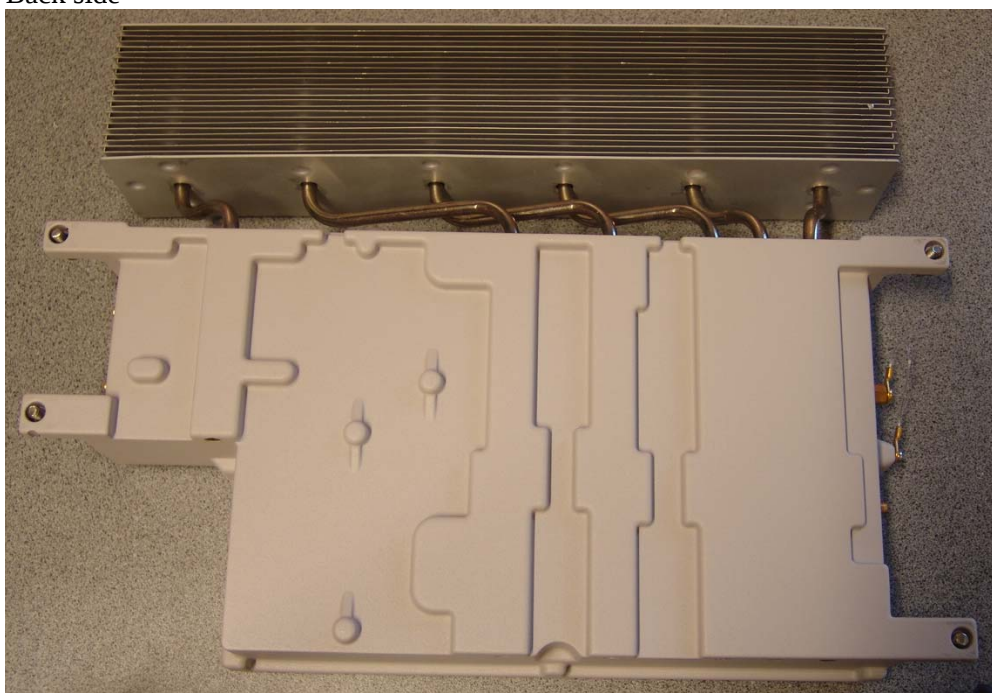
Photos

PAU KRB 901 18/1 Rev. R1D

Front side



Back side



Rear side

FCC ID: TA8AKRB90118-1

Appendix 7

Left side



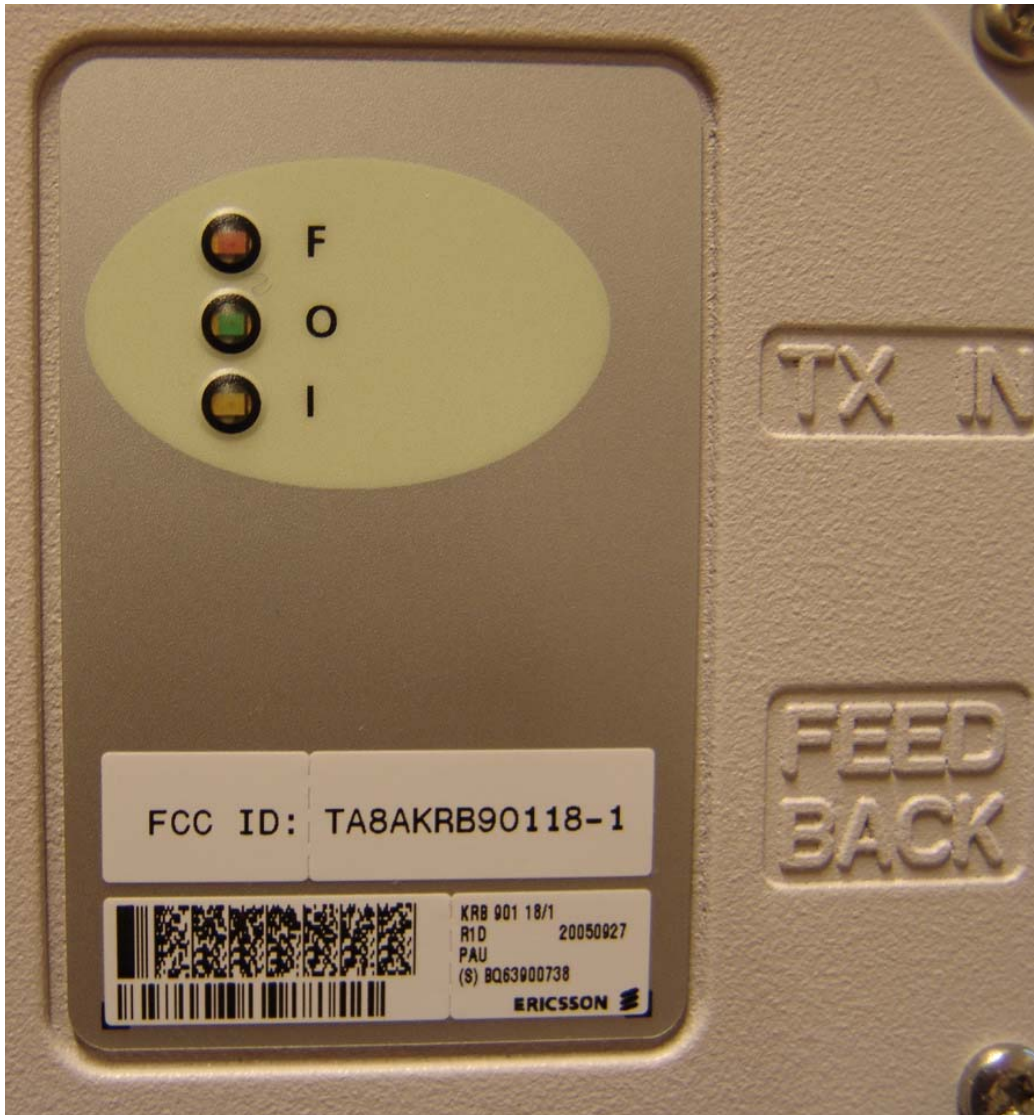
Right side



FCC ID: TA8AKRB90118-1

Appendix 7

FCC ID



FCC ID: TA8AKRB90118-1

Appendix 7

RBS 3303

Front side



FCC ID: TA8AKRB90118-1

Appendix 7

Left side



FCC ID: TA8AKRB90118-1

Appendix 7

Right side

