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Permissive change measurements on WCDMA 1700/2100 MHz Radio unit with FCC ID: TA8AKRC11829-2 (7 appendices)

Test object

Radio unit KRC 118 29/2 rev R1B

Appendix 1 provides information about the test object and the test set-up.
Appendix 7 provides external photos of the test object.

Summary

| Standard | Compliant | Appendix |
|---|-----------|----------|
| 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: TA8AKRC11829-2

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| Occupied bandwidth | Appendix 3 |
| Band edge | Appendix 4 |
| Spurious emission at antenna terminals | Appendix 5 |
| Field strength of spurious radiation | Appendix 6 |
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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, 16QAM and 64QAM

Maximum output power: Single carrier: 1x 43 dBm (40W)
Multi carrier: 2x 40 dBm (20W)

Nominal power voltage: -48 VDC

Tested channels

UARFCN Frequency
1537 2112.4 MHz

Operation mode during measurements

All measurements were performed with the test object configured with the Test models 1 and 6 as defined in 3GPP TS 25.141. Test model 1 uses the QPSK modulation only, and Test model 6 includes the 64QAM modulation as follows:

Test model 1 (TM1): 64 DPCHs with at 30 ksps (SF=128) with QPSK modulation
Test model 6 (TM6): 30 DPCHs at 30 ksps (SF=128) with QPSK modulation and
8 HS-PDSCHs at 240 ksps (SF=16) with 64QAM modulation

Conducted measurements

All RF conducted measurements were performed with the test object configured for single carrier, installed in a wooden frame and powered with -48 VDC. All measurements were done at the output connector (Ant A) of the Filter Unit (FU) KRC 118 28/1. The measurements were performed at maximum output power with both Test models.

Radiated measurements

All radiated measurements were performed with the test object configured for single carrier, installed in a wooden frame and powered with -48 VDC. This configuration represents worst case for radiated spurious emission measurements.

The measurements were performed at maximum output power with both Test models. The RF output power port was via a RF attenuator connected to functional test equipment for supervision.

The RU unit were allocated to the following UARFCN:

| | | |
|----------|----------------------|----------------------|
| Downlink | 1537 (2112.4 MHz) | 1537 (2112.4 MHz) |
| Uplink | 1312 (1712.4 MHz) | 1312 (1712.4 MHz) |
| | TM1 with only QPSK | TM6 incl. 64QAM |

Purpose of test

The purpose of this test is to justify a Class II permissive change of the test object to include the use of 64QAM modulation. This report verifies maintained performance characteristics of affected items according FCC CFR47 by re-testing the updated equipment with QPSK, using Test model 1, and with a combination of QPSK and 64QAM, using Test model 6.

Summary of results

Measurement results for both set-ups are near identical and Test model 1 can be considered a worst case set-up.

References

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

ANSI 63.4-2003
ANSI/TIA/EIA-603-B-2002
3GPP TS 25.141

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Appendix 1

Measurement equipment

| Measurement equipment | Calibration Due | SP number |
|---|-----------------|-----------|
| Test site Tesla | 2010-10 | 503 881 |
| R&S FSIQ | 2009-08 | 503 738 |
| R&S ESI 26 | 2009-07 | 503 292 |
| High pass filter | 2010-06 | 503 739 |
| Boonton RF Peak power meter/analyzer | 2009-09 | 503 144 |
| Boonton Power sensor 56518-S/4 | 2009-09 | 503 145 |
| Chase Bilog antenna CBL 6111A | 2011-11 | 502 181 |
| EMCO Horn Antenna 3115 | 2011-01 | 502 175 |
| Flann Standard gain horn 20240-20 | - | 503 674 |
| MITEQ Low Noise Amplifier | 2009-06 | 503 285 |
| Multimeter Fluke 87 | 2009-04 | 502 190 |
| Testo 610, Temperature and humidity meter | 2009-04 | 502 658 |

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: 2008-12-11

Manufacturer's representative

Mats Falk, Ericsson AB.

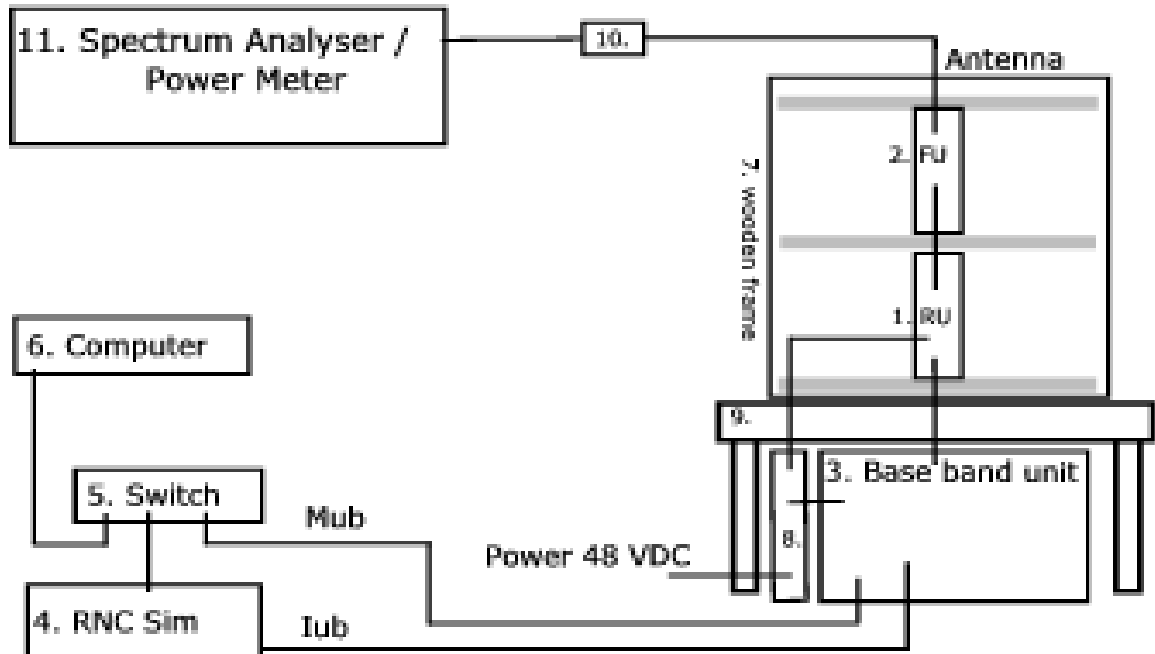
Test engineers

Andreas Johnson, Jonas Bremholt and Jörgen Wassholm

Test witnesses

Christer Hjort and Ove Nilsson, Ericsson AB.

Test set-up, conducted measurements



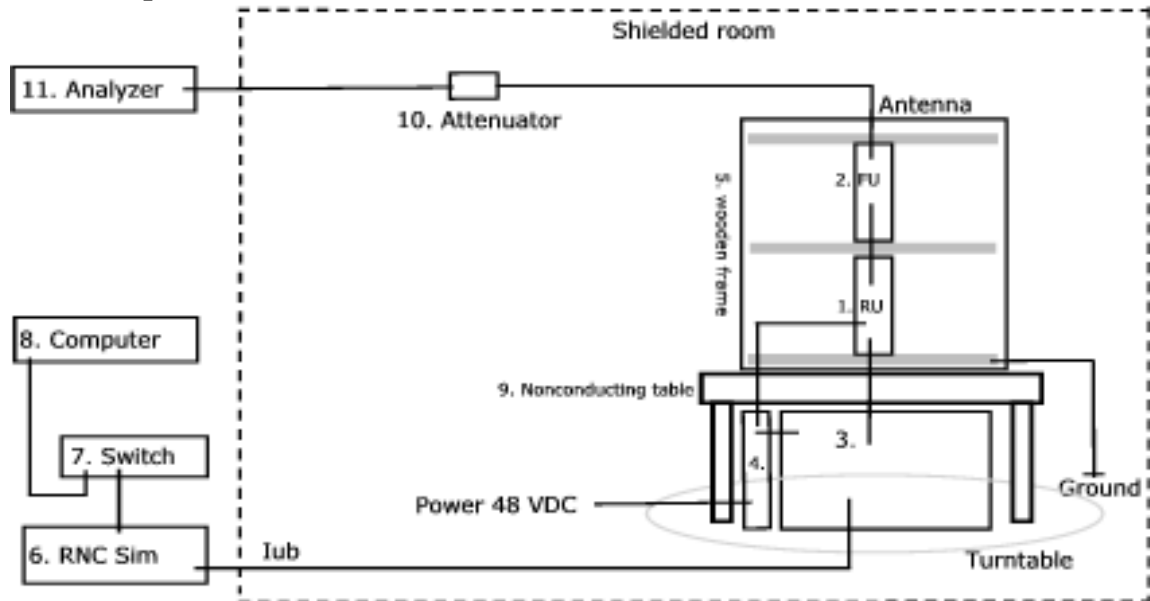
Test object

1. RU KRC 118 29/2, Rev. R1B, S/N AE56676619 (FCC ID: TA8AKRC11829-2)

Functional test equipment

2. FU KRC 118 28/1, Rev. R1B, S/N: A400436981
3. Base band sub rack:
S/N AB20199733 with software version:
Basic package: CXP9012418/2, rev R2B08
Upgrade package: CXP 901 2959, rev. R6T/9
4. RNC Sim 4780 DA, mini-SIM#55, BAMS 1000134364
5. Netgear switch FS108
6. Computer Sunblade 2500 BAMS 0000015232
7. Wooden frame
8. PDU 02, product BMG 980 33/02, Rev. R1A, S/N (s)T671498775
9. Non conductive table
10. RF attenuator
11. Measurement equipment

Test set-up, radiated measurements



Test object

1. RU KRC 118 29/2, Rev. R1B, S/N AE56676619 (FCC ID: TA8AKRC11829-2)

Functional test equipment

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5. Wooden frame
6. RNC Sim 4780 DA, mini-SIM#55, BAMS 1000134364
7. Netgear switch FS108
8. Computer Sunblade 2500 BAMS 0000015232
9. Non conductive table
10. Attenuator, Weinschel model 49-40-33
11. Anritsu Signal Analyzer, MS2691A, SN 6200750255



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Appendix 2

RF power output measurements according to 47 CFR 2.1046

| | | |
|--------------------|-----------------------------|------------------------|
| Date 2008-12-15 | Temperature 23 °C ± 3 °C | Humidity 22 % ± 5 % |
|--------------------|-----------------------------|------------------------|

Test set-up and procedure

The output was connected to a peak power analyzer with the CDF mode activated.

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

Measurement uncertainty: 0.5 dB**Results**

Rated output power level at Ant 1 connector (maximum): 1x 46 dBm

| Test conditions V _{nom} -48 V DC | Transmitter power (dBm/ dB) RMS/ PAR |
|--|---|
| | Frequency 2112.4 MHz |
| TM1 with only QPSK | 46.0/ 7.0 |
| TM6 incl. 64QAM | 45.8/ 7.0 |

Limit

§27.50 **Federal Register** / Vol. 73, No. 86
The maximum output power may not exceed 1640 W (EIRP)
The Peak to Average Ratio (PAR) may not exceed 13 dB.

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

Occupied bandwidth measurements according to 47 CFR 2.1049

| | | |
|------------|--------------|------------|
| Date | Temperature | Humidity |
| 2008-12-15 | 23 °C ± 3 °C | 22 % ± 5 % |

Test set-up and procedure

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

| Measurement equipment | SP number |
|---|-----------|
| R&S FSIQ | 503 738 |
| Testo 610, Temperature and humidity meter | 502 658 |

Measurement uncertainty: 3.7 dB**Results**

The results are shown in appendix 3.1

| | | |
|-----------|--------------------|---------|
| | TM1 only with QPSK | |
| | Frequency | OBW |
| Diagram 1 | 2112.4 MHz | 4.2 MHz |

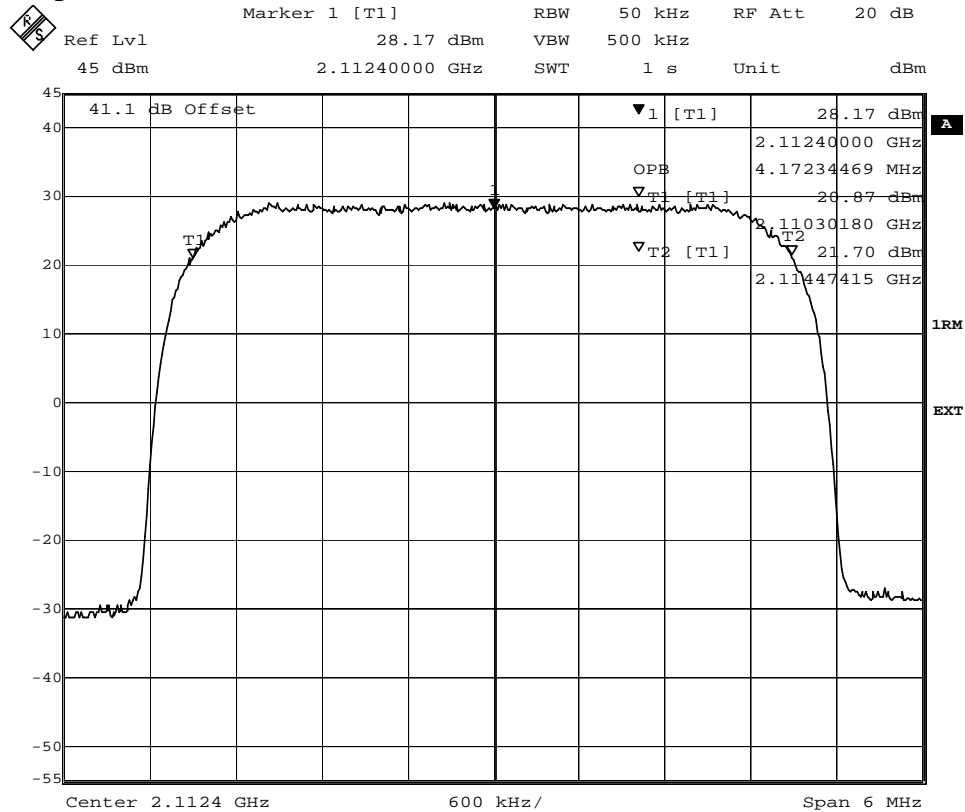
| | | |
|-----------|-----------------|---------|
| | TM6 incl. 64QAM | |
| | Frequency | OBW |
| Diagram 2 | 2112.4 MHz | 4.2 MHz |



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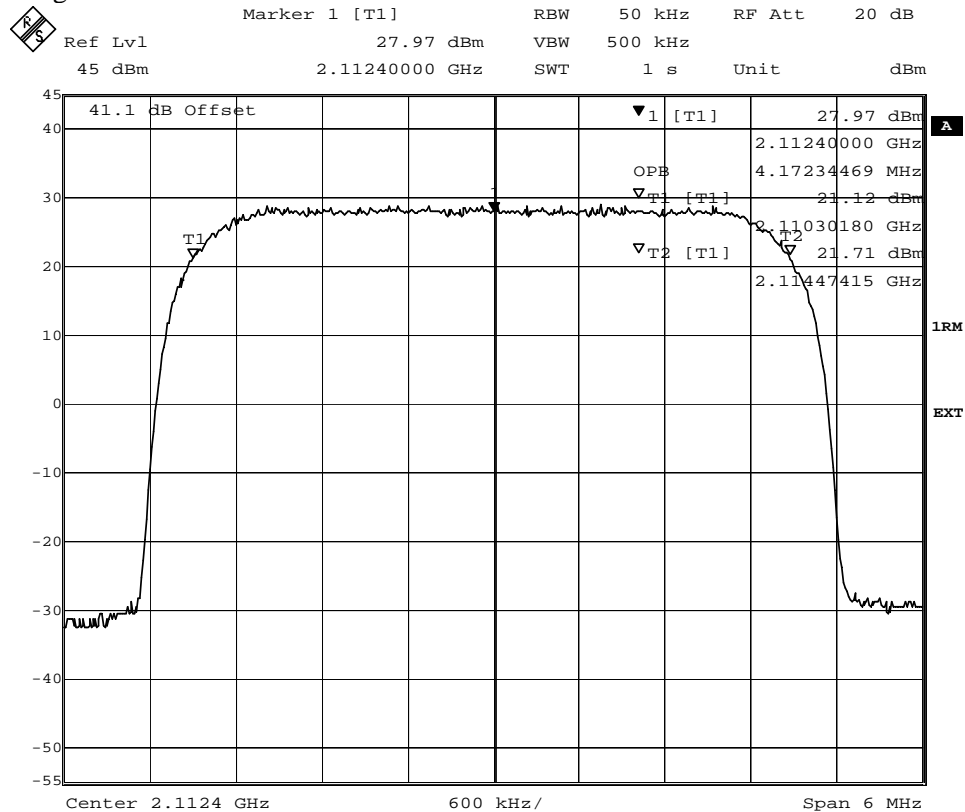
Appendix 3.1

Diagram 1



Date: 15.DEC.2008 13:28:52

Diagram 2



Date: 15.DEC.2008 13:08:45

Band edge measurements according to 47 CFR 2.1051

| | | |
|------------|--------------|------------|
| Date | Temperature | Humidity |
| 2008-12-15 | 23 °C ± 3 °C | 22 % ± 5 % |

Test set-up and procedure

The measurements were made as defined 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 3.25 MHz away from the band edges. 30 kHz is <1% of the Emission BW(4.25 MHz between the 26 dB points). To compensate for the reduced measurement band width, the limit was adjusted with 1.5 dB to -14.5 dBm up to 1 MHz away from the band edges and with 15.2 dB to -28.2 dBm between 1 MHz to 3.25 MHz away from the band edges.

| Measurement equipment | SP number |
|---|-----------|
| R&S FSIQ | 503 738 |
| Testo 610, Temperature and humidity meter | 502 658 |

Measurement uncertainty: 3.7 dB

Results

The results are shown in appendix 4.1

Diagram 1 TM1 only with QPSK
2112.4 MHz

Diagram 2 TM6 incl. 64QAM
2112.4 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.

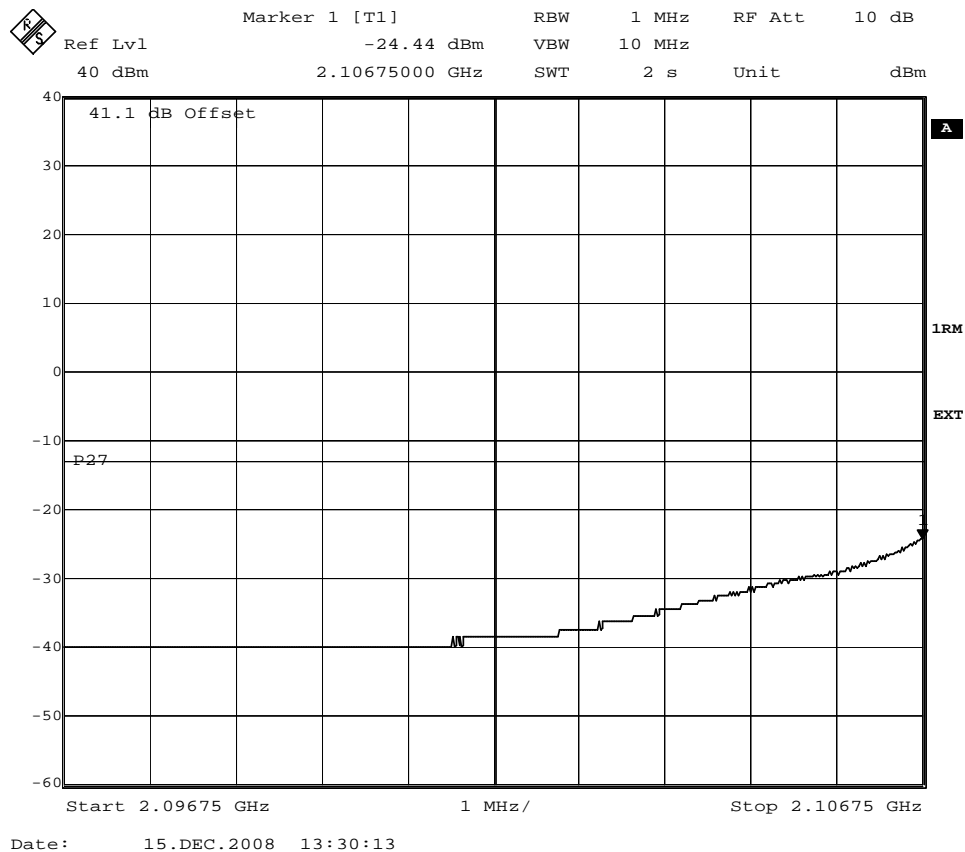
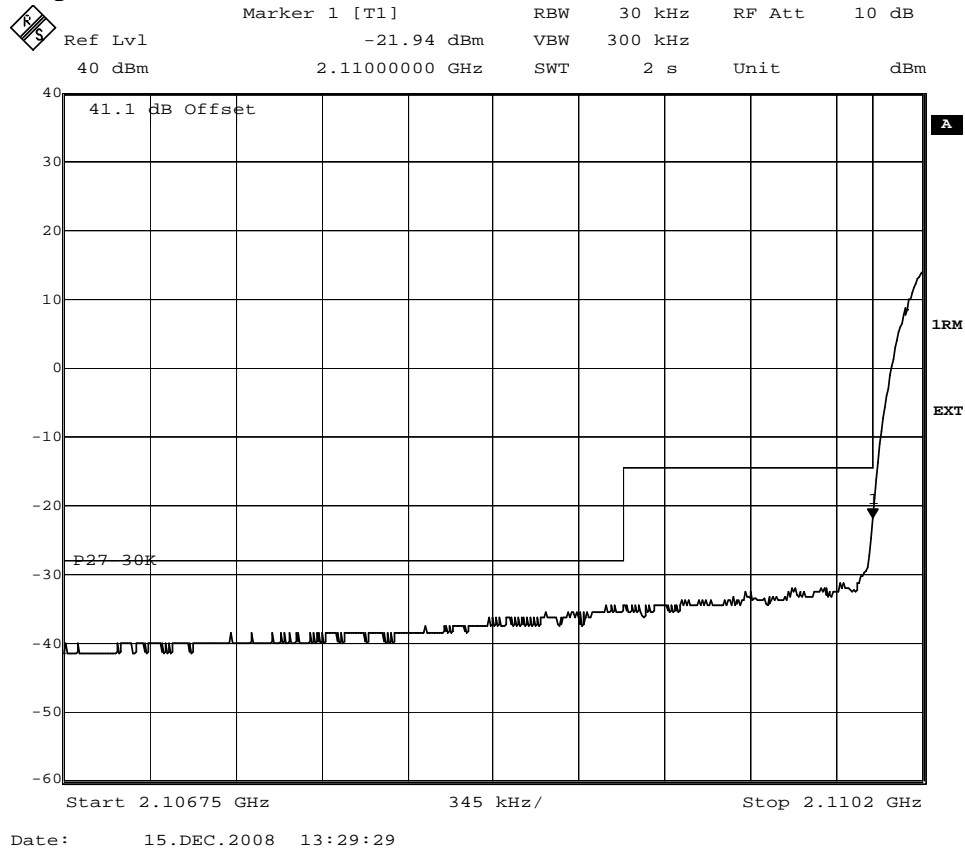
| | |
|-----------|-----|
| Complies? | Yes |
|-----------|-----|



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Appendix 4.1

Diagram 1

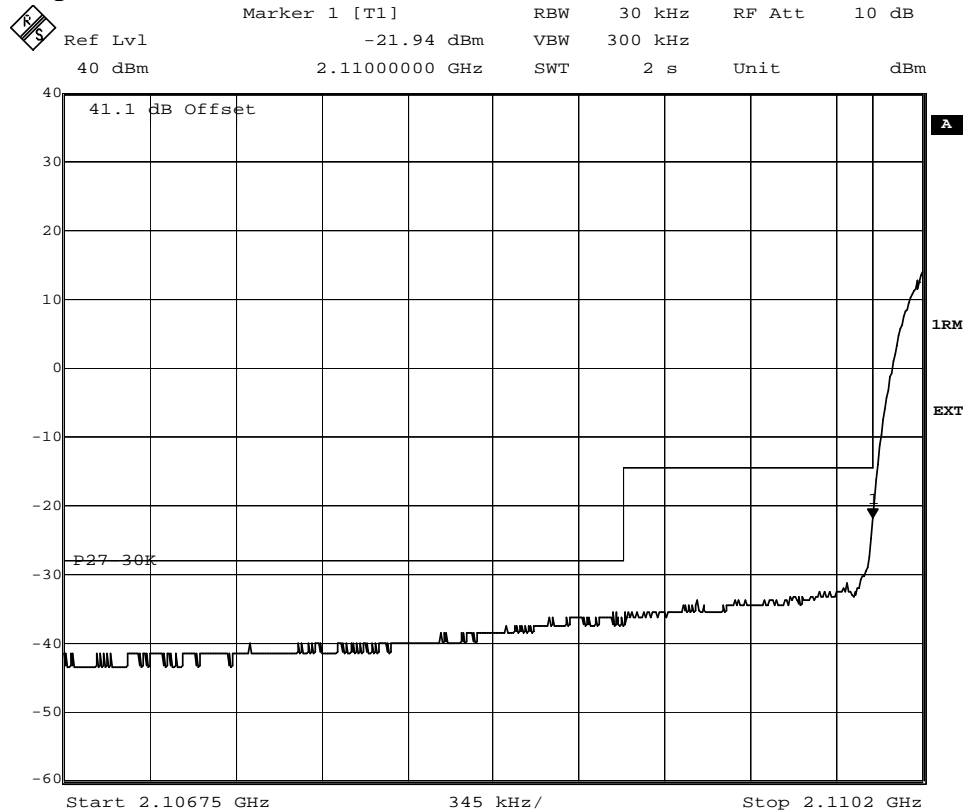




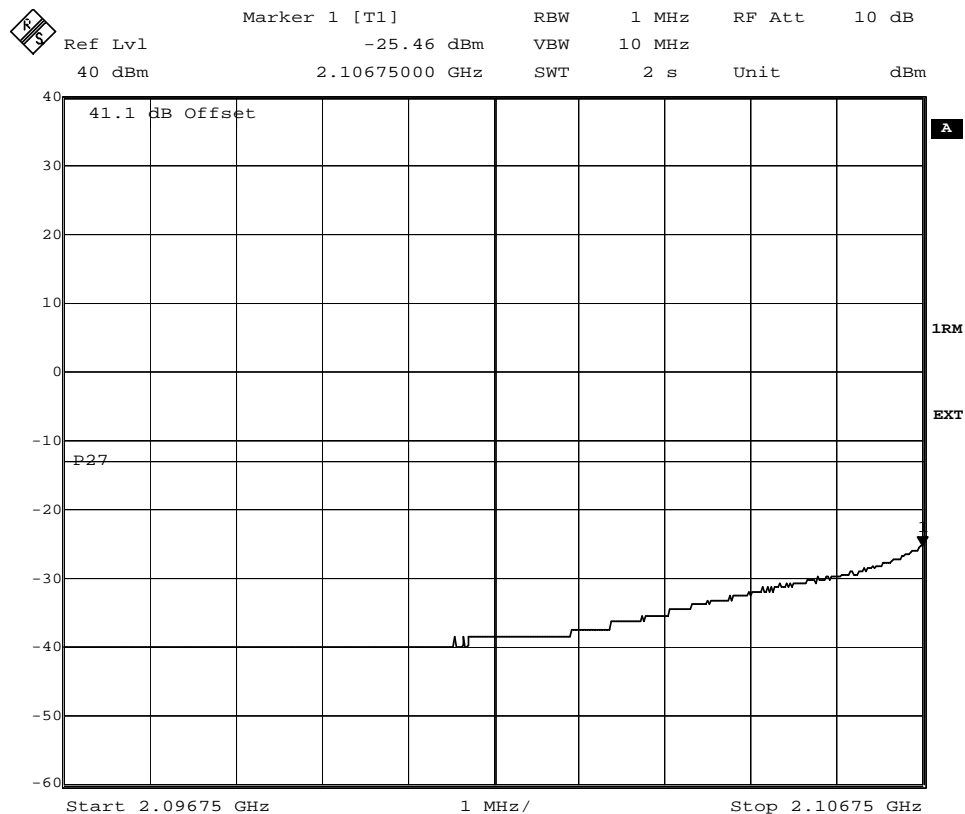
FCC ID: TA8AKRC11829-2

Appendix 4.1

Diagram 2



Date: 15.DEC.2008 13:07:26



Date: 15.DEC.2008 13:08:00

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

| | | |
|------------|--------------|------------|
| Date | Temperature | Humidity |
| 2008-12-15 | 23 °C ± 3 °C | 22 % ± 5 % |

Test set-up and procedure

The measurements were made as defined in §27.53. The output was connected to a spectrum analyzer. First a pre-measurement with activated peak detector was performed. Emissions close to or above the limit is measured with activated RMS detector and the RMS measurement result is noted. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

| Measurement equipment | SP number |
|---|-----------|
| R&S FSIQ | 503 738 |
| High pass filter | 503 739 |
| Testo 610, Temperature and humidity meter | 502 658 |

Measurement uncertainty: 3.7 dB**Results**

The results are shown in appendix 5.1

Diagram 1 TM1 only with QPSK
 2112.4 MHz

Diagram 2 TM6 incl. 64QAM
 2112.4 MHz

Remark

The emission at 9 kHz on the plots was not generated by the test object. A complementary measurement with a smaller RBW showed that it was related to the LO feedthrough.

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.

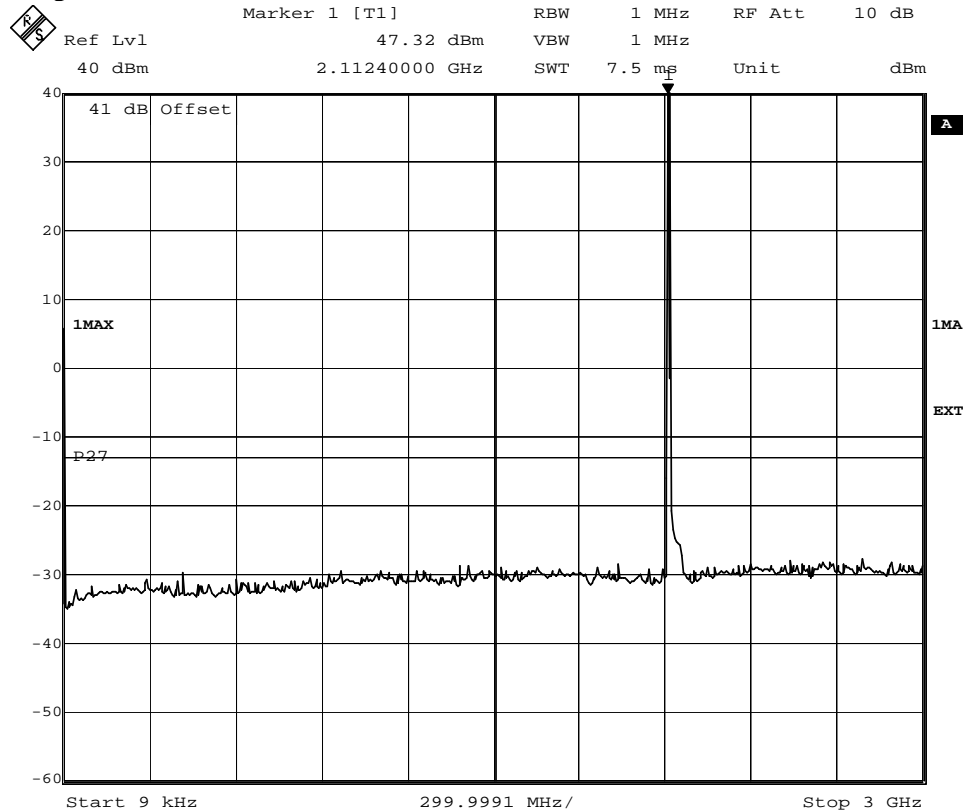
| | |
|-----------|-----|
| Complies? | Yes |
|-----------|-----|



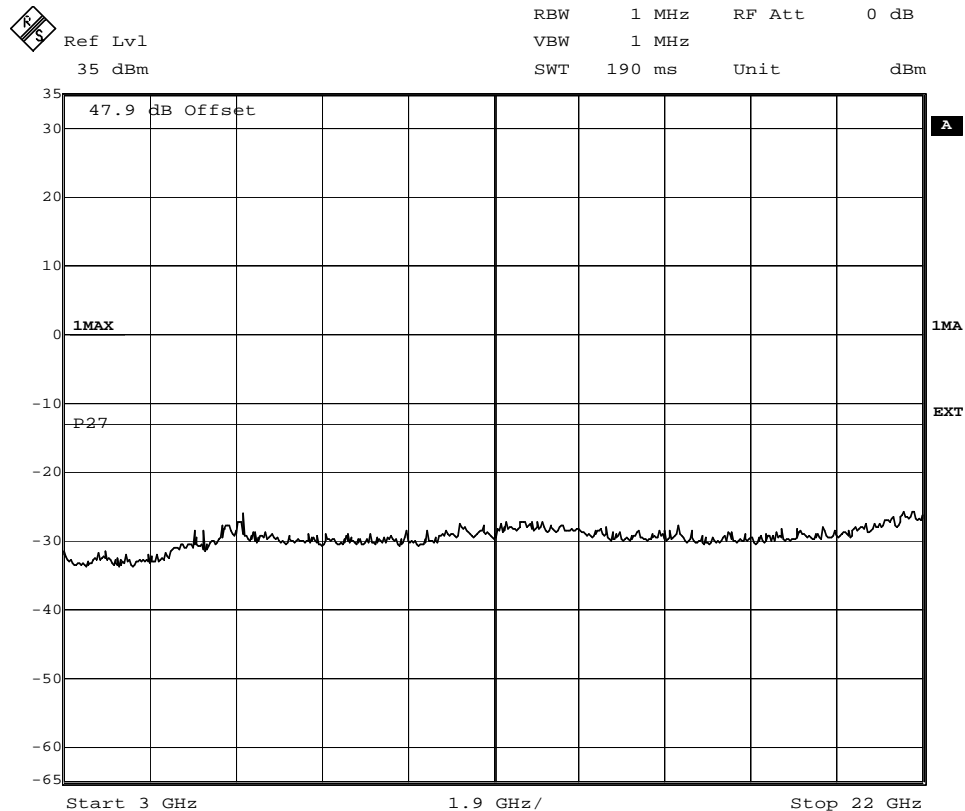
FCC ID: TA8AKRC11829-2

Appendix 5.1

Diagram 1



Date: 15.DEC.2008 13:31:30



Date: 15.DEC.2008 13:33:26



REPORT

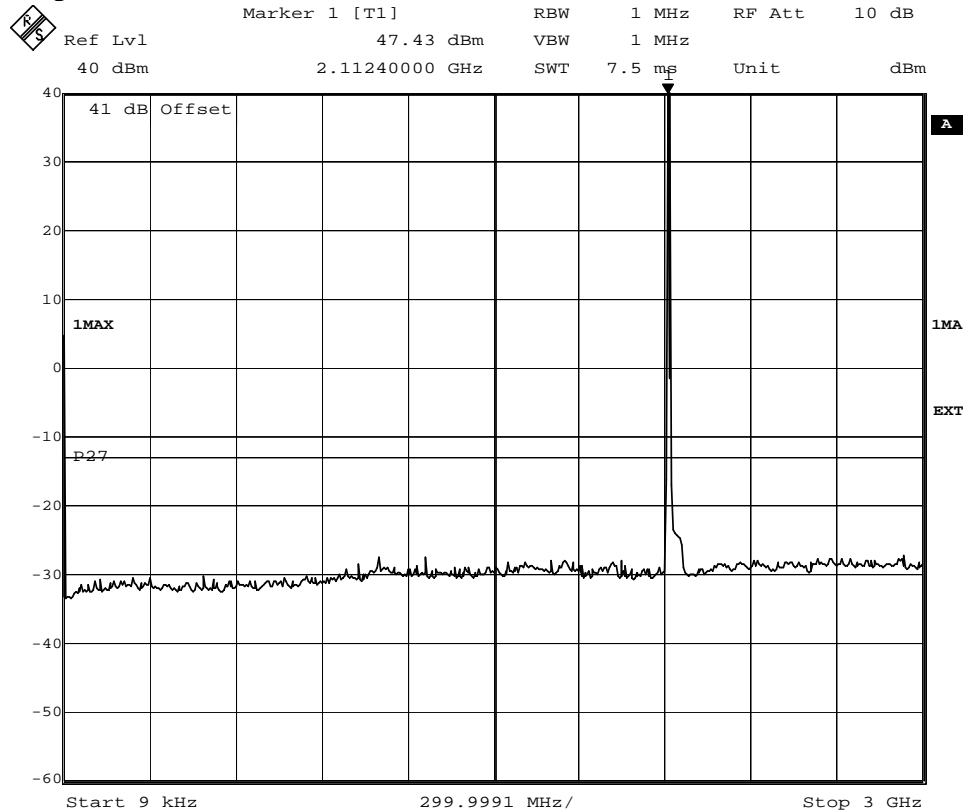
Date 2008-12-15 Reference F823455-F27

Page 2 (2)

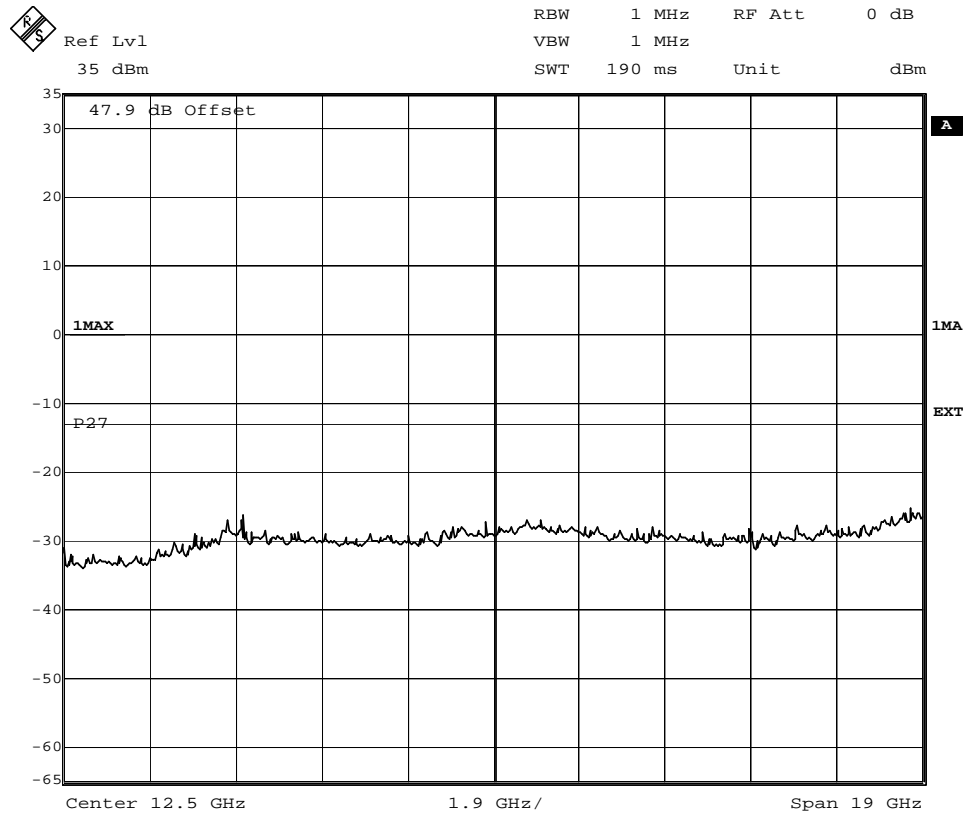
FCC ID: TA8AKRC11829-2

Appendix 5.1

Diagram 2



Date: 15.DEC.2008 13:05:05



Date: 15.DEC.2008 13:02:07

Field strength of spurious radiation measurements according to 47 CFR 2.1053

| Date | Temperature | Humidity |
|------------|--------------|------------|
| 2008-12-11 | 23 °C ± 3 °C | 26 % ± 5 % |
| 2008-12-12 | 22 °C ± 3 °C | 24 % ± 5 % |

Test set-up and procedure

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

The 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 – 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,

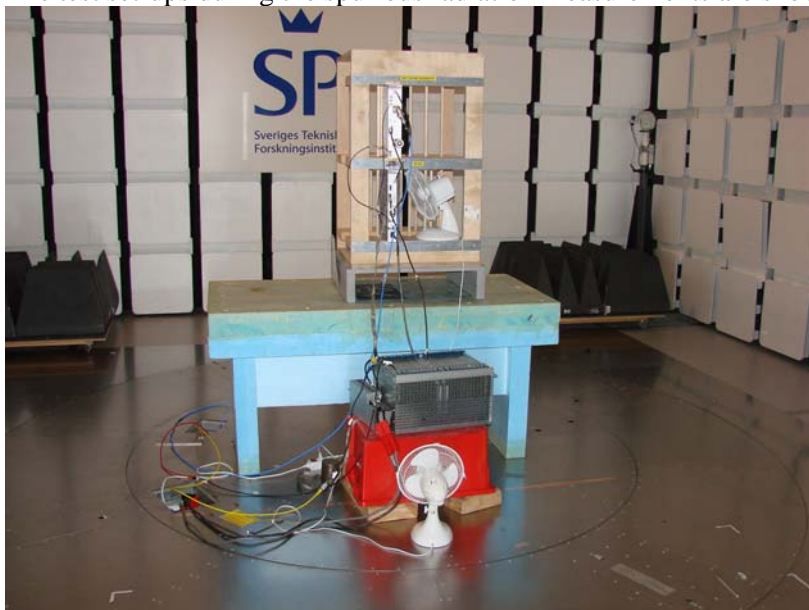
$$\gamma = 20 \log \left(\frac{4\pi D}{\lambda} \right), \gamma \text{ is the propagation loss and } D \text{ is the antenna distance.}$$

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 RMS detector and the RMS value is reported, frequencies closer than 10 dB to the limit measured with the RMS detector were measured with the substitution method according to the standard.

| Measurement equipment | SP number |
|---|-----------|
| Test site Tesla | 503 881 |
| R&S ESI 26 | 503 292 |
| R&S FSIQ | 503 738 |
| Control computer | 503 479 |
| Software: R&S EMC32, ver. 6.30.10 | - |
| Chase Bilog antenna CBL 6111A | 502 181 |
| EMCO Horn Antenna 3115 | 502 175 |
| Flann Standard gain horn 20240-20 | 503 674 |
| MITEQ Low Noise Amplifier | 503 285 |
| High pass filter | 503 739 |
| Testo 610, Temperature and humidity meter | 502 658 |

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



Results

TM1 with only QPSK

| 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 | | |

TM6 incl. 64QAM

| 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 |
|-----------|-----|

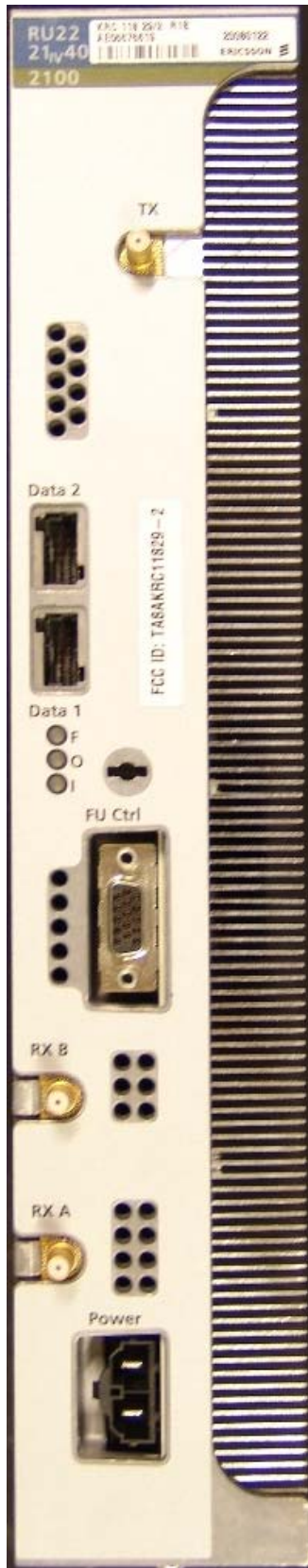
FCC ID: TA8AKRC11829-2

Appendix 7

Photos

Radio Unit KRC 118 29/2 R1B

Front side



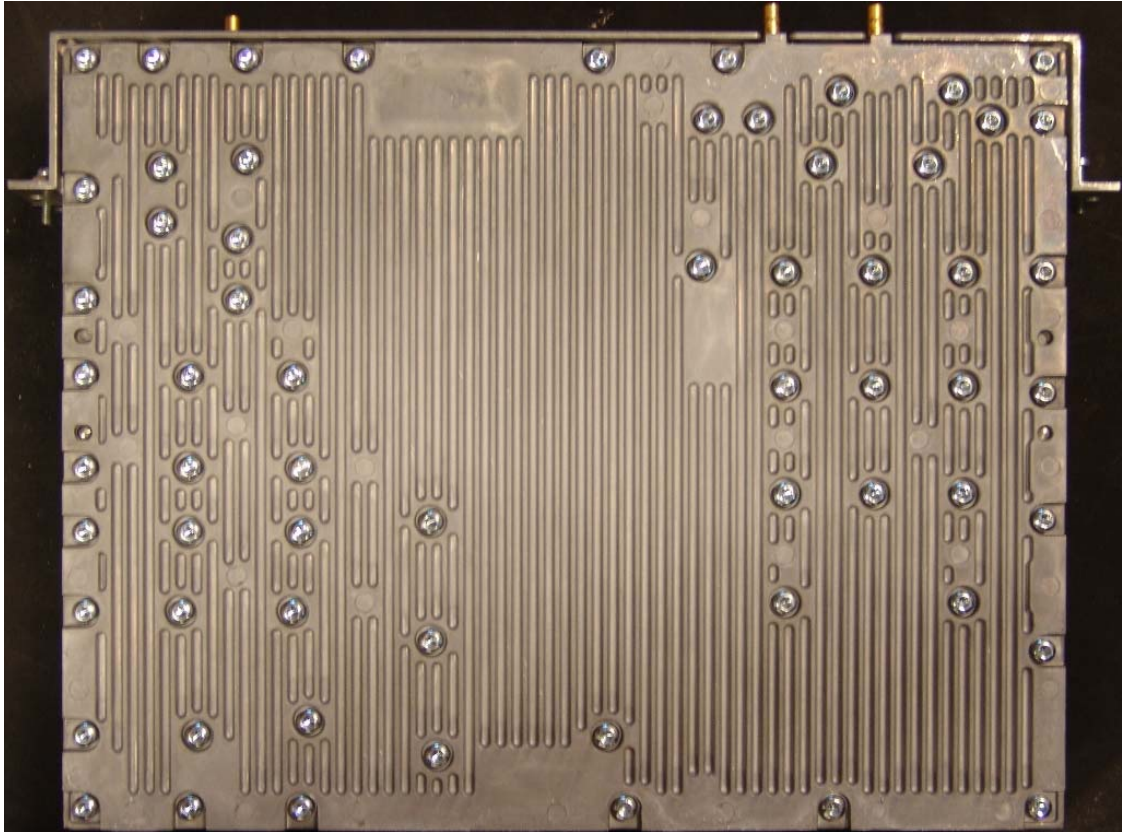
Rear side



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Appendix 7

Left side



Right side

