# REPORT

issued by an Accredited Testing Laboratory

Contact person
Reinhold Reul
Electronics
+46 10 516 55 84
Reinhold.Reul@sp.se

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1002
ISO/IEC 17025

Ericsson (China) Communications Company Ltd
Att. Hua Yang
Ericsson Tower
No. 5 Lize East Street
Chaoyang District, Beijing 100102
P. R. China

**(8 appendices)**

## Class II Permissive Change measurements on GSM Base station Transceiver Unit with FCC ID: B5KBKRC1311005-2

(8 appendices)

Revision 2 corrects client information in appendix 1 regarding the declared nominal output power.

### Test object

Transceiver Unit dTRU8, product KRC 131 1005/2, revision R2C

### 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 port | Yes | 5 | - |
| 2.1053 Field strength of spurious radiation | Yes | 6 | - |

**SP Technical Research Institute of Sweden**
**Electronics - EMC**

Performed by

Reinhold Reul

Examined by

Christer Karlsson

Laboratory is FCC listed with Reg. no. 93866 and IC recognized pursuant IC file no. 3482A.

## Table of contents

## Description - Equipment Under Test (EUT)

| | |
|---|---|
| Equipment: | GSM Base station transceiver unit (dTRU) 850 MHz |
| TX frequency band: | 869 – 894 MHz |
| Modulations: | GMSK, 8PSK, 16QAM, 32QAM, AQPSK |

| Declared maximum output power, RMS value in [dBm] | Modulations | | | | |
|---|---|---|---|---|---|
| | GMSK | 8PSK | 16QAM | 32QAM | AQPSK |
| Hybrid combined (HC) mode | 42,7 | 39,4 | 38,0 | 37,6 | 39,3 |
| Uncombined (UC) mode | 46,0 | 42,7 | 41,3 | 40,9 | 42,6 |
| TCC mode | 49,0 | 45,7 | 44,3 | 43,9 | 45,6 |

Supply voltage 24 V DC

## 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 AQPSK modulation with SCPIR 0 dB. This report verifies maintained performance characteristics of affected items according FCC CFR47 by re-testing the updated equipment and comparing results for AQPSK modulation with SCPIR 0 dB and GMSK reference modulation. For band-edge performance the acceptable settings for the new implemented AQPSK modulation were determined.

## Summary of results

Measurement results are similar for all tested modulations, apart from RF output power, where GMSK modulation results in the highest RMS output power, and for band-edge performance, where specific restrictions apply as described in appendix 4. Where several modulations were compared, GMSK modulation shall be considered a worst case set-up.

## Tested configurations

All measurements were performed with the test object installed in a RBS 2206 V2 cabinet. The hardware list for radiated and conducted measurements is shown in appendix 7. Unless noted otherwise the test object was activated at maximum power, configured for TCC mode with RBS master 2E setting 51, resulting in the highest achievable RF output power. For band-edge performance verification UC and TCC configurations were used as described in appendix 4. In all used configurations random data was transmitted in all time slots with the various tested modulations being activated one at a time.

**Conducted measurements**

Conducted measurements were done at the output TX/RX 1 of the CDU-G8.

**Radiated measurements**

During radiated emission measurements the TX/RX 1 output of CDU-G8 was via a 50 ohm attenuator connected to a spectrum analyser to monitor the transmitted signal level. For the scope of this test it was deemed sufficient to measure radiated spurious emission at the TX band centre frequency for GMSK modulation as worst case reference modulation with the highest RMS power and compare it with results for the AQPSK modulation with SCPIR 0 dB.

**Test frequencies used**

| Channel | ARFCN | Frequency | Comment |
|---|---|---|---|
| B | 128 | 869.2 MHz | TX frequency adjacent to lower frequency band edge |
| B+1 | 129 | 869.4 MHz | TX low alternate frequency, 1 channel inside band |
| M | 190 | 881.6 MHz | TX band centre frequency |
| T-1 | 250 | 893.6 MHz | TX high alternate frequency, 1 channel inside band |
| T | 251 | 893.8 MHz | TX frequency adjacent to higher frequency band edge |

## Manufacturer's representative

Hua Yang, Ericsson (China) Communications Company Ltd

## References

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

ANSI C63.4-2009
ANSI/TIA/EIA-603-C-2004
ANSI/TIA/EIA 136-280-D-2002
CFR 47 part 2, October 1st, 2010
CFR 47 part 22, October 1st, 2010

## Reservation

The test results in this report apply only to the particular Equipment Under Test (EUT) as declared in the report.

## Delivery of test object

The test object was delivered on May 23rd 2011.

## Test equipment

| Measurement equipment | Calibration Due | SP number |
|---|---|---|
| Anechoic chamber, Hertz | 2013-10 | 15:116 |
| Boonton 4500A RF Peak power meter/analyser | 2012-11 | 503 144 |
| Boonton Power sensor 56518-S/4 | 2012-11 | 503 146 |
| Rohde & Schwarz FSIQ40 | 2012-07 | 503 738 |
| Rohde & Schwarz ESI40 | 2012-07 | 503 125 |
| Rohde & Schwarz Vector Network Analyser | 2012-07 | 503 687 |
| Chase bilog antenna CBL 6121A | 2014-10 | 502 460 |
| Schaffner Reference Dipole BSRD6500 | 2012-03 | 502 181 |
| EMCO Horn Antenna 3115 | 2014-01 | 502 175 |
| EMCO Horn Antenna 3115 | 2014-01 | 501 548 |
| MITEQ Low Noise Amplifier | 2012-08 | 503 277 |
| Flann Std gain horn 20240-20 | 2014-03 | 503 674 |
| Attenuator 40 dB | 2012-08 | 504 159 |
| High pass filter | 2012-08 | 504 199 |
| High pass filter | 2012-08 | 502 758 |
| Multimeter Fluke 87 | 2012-05 | 502 190 |
| Testo 615 temperature and humidity meter | 2012-03 | 503 498 |
| Testo 635 temperature and humidity meter | 2013-05 | 504 203 |

## Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”SP-QD 10885”. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence).

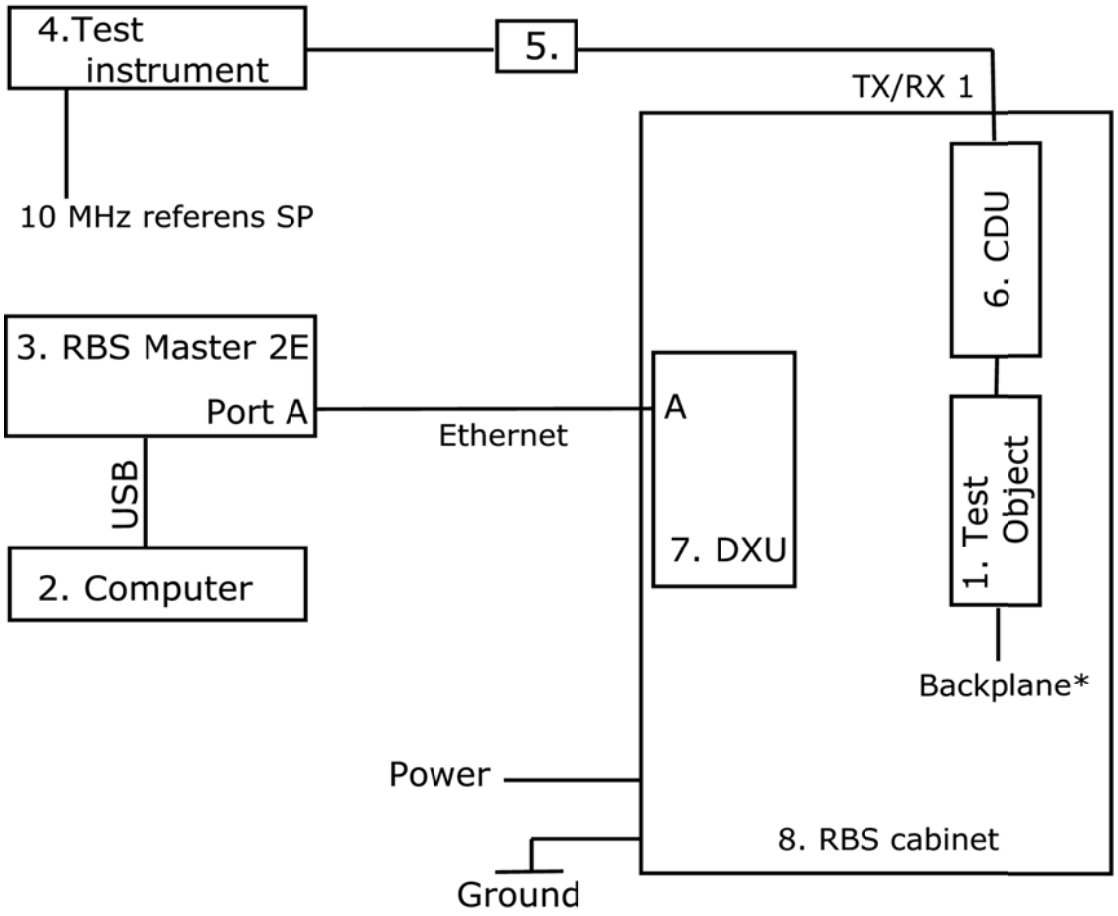
## Test engineers

Jörgen Wassholm, Fredrik Isaksson, Martin Nilsson, Martin Forsberg and Reinhold Reul, SP

## Test witness

-

**Test set-up, conducted measurements**




*) Power and data communication via backplane

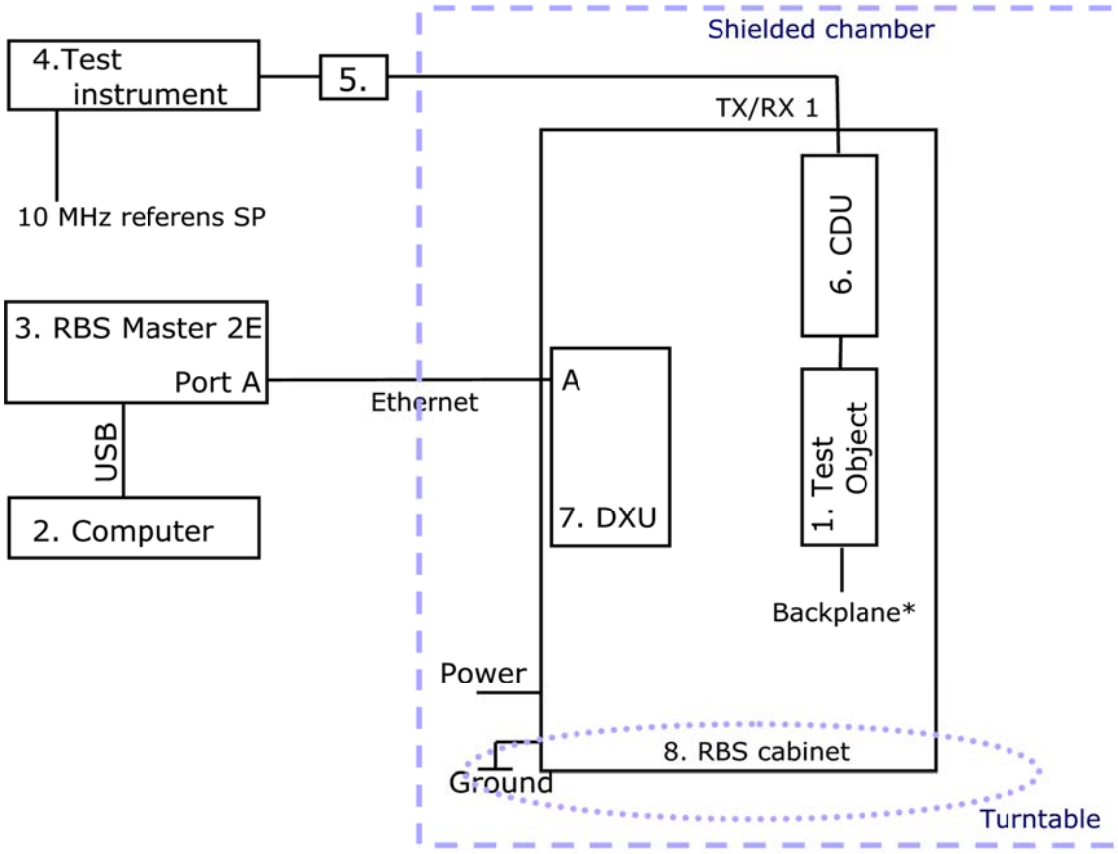
**Test object**

1. Transceiver Unit dTRU-8, product KRC 131 1005/2, revision R2C, SN AE50308770 with FCC ID: B5KBKRC1311005-2

**Functional test equipment**

2. HP laptop computer Compaq nc6000, product PM307ES#AB2, SN CNU51206GT With software RBS Master2 control software
3. Ericsson RBS Master 2E hardware, product LBY 107 1007/3, revision R1C BAMS 1000878365
4. Agilent MXA Signal Analyser model N9020A 20 Hz – 3.6 GHz, BAMS 1000785533, used to verify the modulation schemes
5. Attenuator / filter listed as test equipment in respective appendix
6. CDU-G8, product BFL 119 155/1, revision R3A, serial number A40004WCLV
7./8. DXU and remaining RBS cabinet according hardware list in appendix 7

## Test set-up, radiated emission




*) Power and data communication via backplane

## Test object

1. Transceiver Unit dTRU-8, product KRC 131 1005/2, revision R2C, SN AE50308770 with FCC ID: B5KBKRC1311005-2

## Functional test equipment

2. HP laptop computer model Compaq NC6400 SN CND72717JP
   With software RBS Master2 control software
3. Ericsson RBS Master 2E hardware, product number LBY 107 1007/3, revision R1C, BAMS 1000735211
4. Rohde & Schwarz FSIQ40 for signal monitoring, SP 503738
5. Attenuator 40 dB, SP 504 159
6. CDU-G8, product BFL 119 155/1, revision R3A, serial number A40004WCLV

7./8. DXU and remaining RBS cabinet according hardware list in appendix 7

**Test object connections**

| Interface | Type of port |
|---|---|
| Power via RBS backplane | DC power |
| TCC/HC mode: TX 1+TX 2 interconnection to CDU | RF interconnect |
| Interconnection TX 1 + HC 1 and Interconnection TX 2 + HC 2 | |
| UC mode: TX 1 to CDU and TX 2 to CDU | RF interconnect |
| RX 1 to CXU10 | RF interconnect |
| RX 2 to CXU10 | RF interconnect |
| RX 3 not connected | RF interconnect |
| RX 4 not connected | RF interconnect |

**RBS cabinet external connections**

| Interface | Type of port: |
|---|---|
| External supply 24 V DC | DC power |
| Active CDU TX/RX 1, used for measurement and monitoring | RF/Antenna |
| Active CDU TX/RX 2 and inactive CDU's outputs unconnected | RF/Antenna |
| Ethernet shielded multi-wire with RJ-45connector to RBS master 2E, port A, mode E1 | Telecom |
| External alarm not connected | Signal |
| ESB not connected | Signal |
| GPS not connected | Signal |
| OMT interface for configuration not connected | O/M |

## RF Power output measurements according to CFR 47 2.1046

| Date | Temperature | Humidity |
|---|---|---|
| 2011-12-06 | 23 °C ± 3 °C | 27 % ± 5 % |

### Test set-up and procedure

Measurements were made at the CDU-G8 output connector. The output was connected to a Peak power analyser via a 50 ohm attenuator.

| Measurement equipment | SP number |
|---|---|
| Boonton 4500A RF Peak power meter/analyzer | 503 144 |
| Boonton Power sensor 56518-S/4 | 503 146 |
| Attenuator | 504 159 |
| Multimeter Fluke 87 | 502 190 |
| Testo 635 temperature and humidity meter | 504 203 |

**Measurement uncertainty**: 0.7 dB

### Results

Configuration: TCC mode, RBS master 2E setting 51

| Transmitter power (dBm) | | | |
|---|---|---|---|
| Channel | Modulation | Peak | RMS |
| M | GMSK | 49.4 | 48.6 |
| M | AQPSK | 49.2 | 45.2 |

The maximum measured PAR was 4.0 dB.

### Limit

CFR 47 § 22.913: 500 W ERP shall not be exceeded.

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

## Occupied bandwidth measurements according to 47CFR 2.1049

| Date | Temperature | Humidity |
|---|---|---|
| 2011-12-06 | 23 °C ± 3 °C | 27 % ± 5 % |

### Test set-up and procedure

Measurements were made at CDU-G8 output connector. The output was connected to a spectrum analyser with the RMS detector activated. The spectrum analyser was connected to an external 10 MHz reference standard during the measurements.

| Measurement equipment | SP number |
|---|---|
| R&S FSIQ | 503 738 |
| Attenuator | 504 159 |
| Multimeter Fluke 87 | 502 190 |
| Testo 635 temperature and humidity meter | 504 203 |

**Measurement uncertainty:** 3.7 dB, 1.33 kHz

### Results

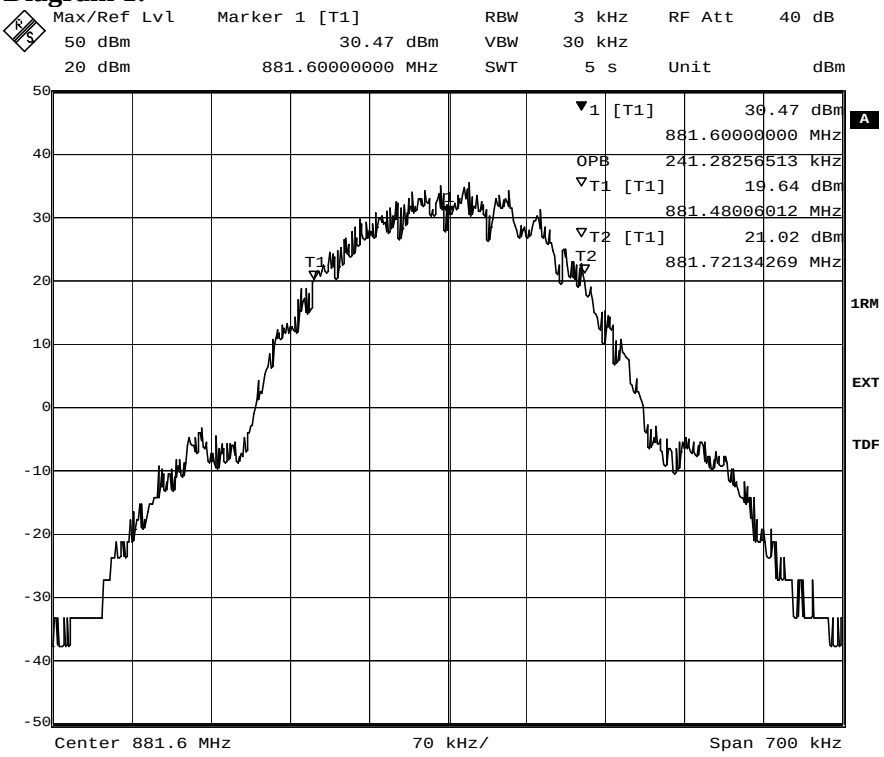
Configuration: TCC mode, RBS master 2E setting 51

| Diagram | Channel | Modulation | OBW |
|---|---|---|---|
| 1 | M | GMSK | 241 kHz |
| 2 | M | AQPSK | 240 kHz |

The diagrams are shown on the following page.

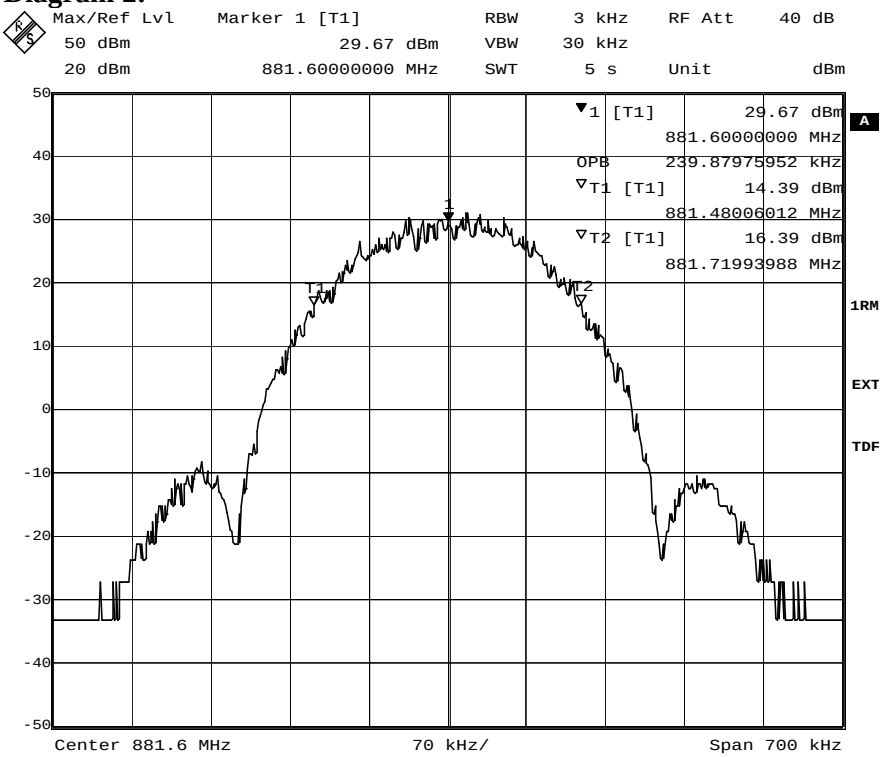
Appendix 3

**Diagram 1:**




Date: 6.DEC.2011 07:07:01

**Diagram 2:**




Date: 6.DEC.2011 07:08:48

## Band edge measurements according to 47CFR 2.1051

| Date | Temperature | Humidity |
|---|---|---|
| 2011-12-06 | 23 °C ± 3 °C | 27 % ± 5 % |

### Test set-up and procedure

The measurements were made per definition in §22.917, with the CDU output connected to a spectrum analyser with the RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

FCC rules allow a resolution bandwidth of one per cent of the emission bandwidth of the fundamental emission within the first 1 MHz off the band edge. FCC rules require a resolution bandwidth of 100 kHz for measurements of emissions for offsets from the band edges exceeding 1 MHz.

| Measurement equipment | SP number |
|---|---|
| R&S FSIQ | 503 738 |
| Attenuator | 504 159 |
| Multimeter Fluke 87 | 502 190 |
| Testo 635 temperature and humidity meter | 504 203 |

**Measurement uncertainty:** 3.7 dB

### Results

| Diagram | Channel | Combiner configuration | RBS master 2E setting | Measured RMS power / [dBm] |
|---|---|---|---|---|
| 1 a, b, c | B | UC mode | 41 | 39.5 |
| 2 a, b, c | T | UC mode | 43 | 41.6 |
| 3 a, b, c | B+1 | TCC mode | 51 | 44.9 |
| 4 a, b, c | T-1 | TCC mode | 51 | 45.0 |

The diagrams are shown on the following pages.

### Remark

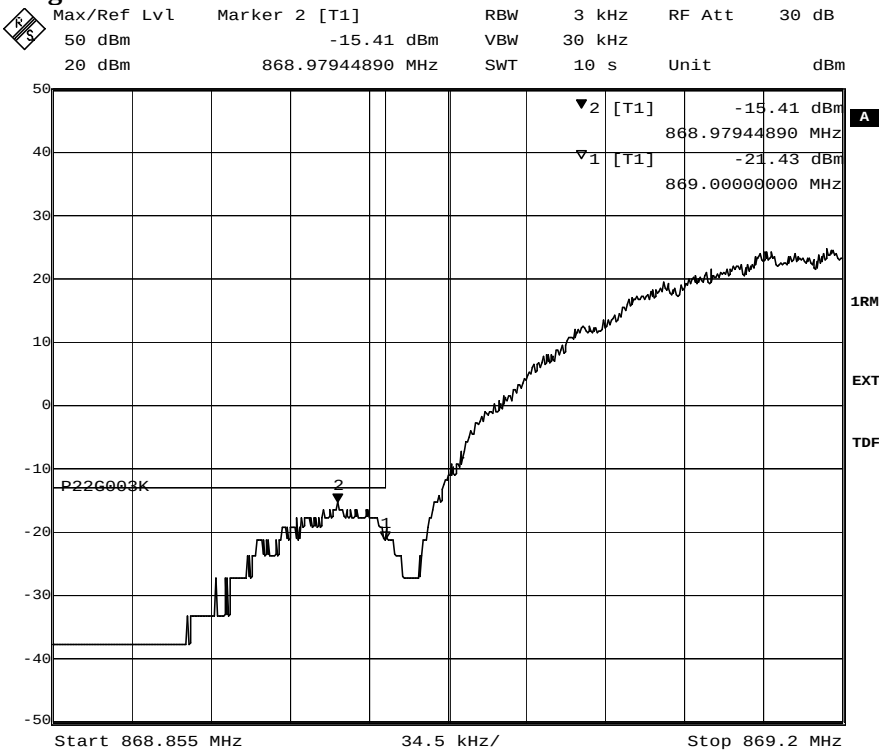
For channels B and T the above documented RMS powers were found to represent the maximum acceptable RF output power with AQPSK modulation using SCPIR 0 dB to meet band-edge requirements.

### 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.

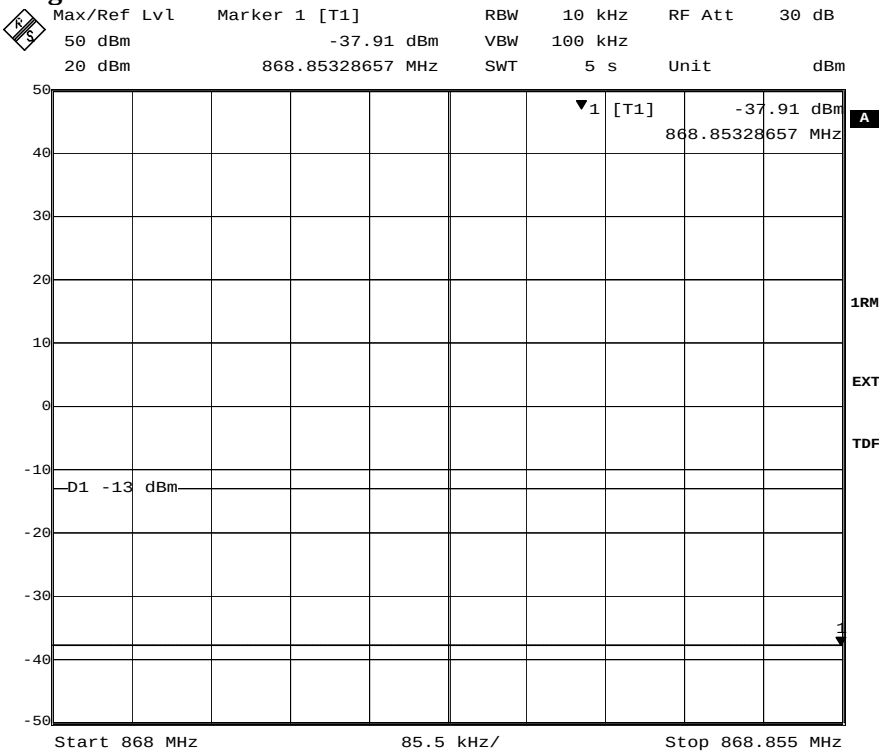
| Complies? | Yes |
|---|---|

## Diagram 1 a:



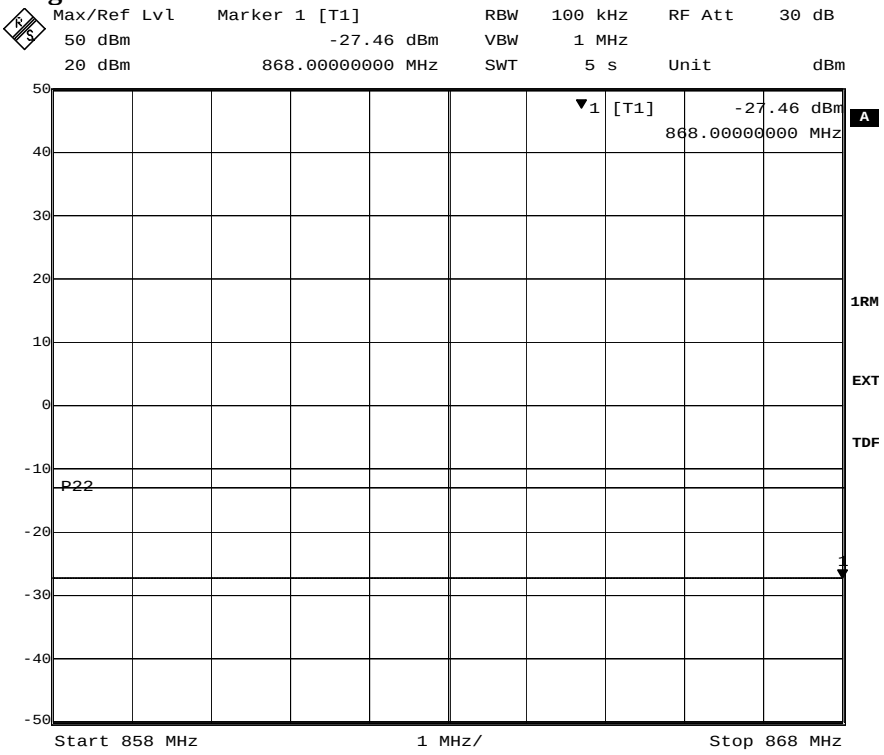

Date: 6.DEC.2011 08:29:29

## Diagram 1 b:



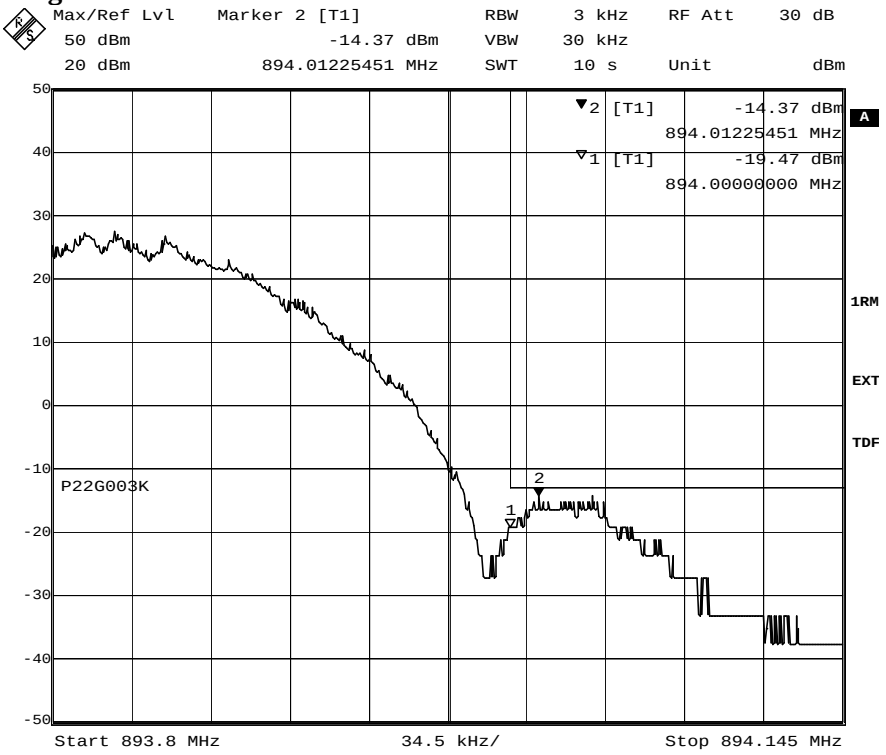

Date: 6.DEC.2011 08:31:16

**Diagram 1 c:**


Max/Ref Lvl
50 dBm
20 dBm
Marker 1 [T1]
-27.46 dBm
868.00000000 MHz
RBW 100 kHz
VBW 1 MHz
SWT 5 s
RF Att 30 dB
Unit dBm
1 [T1] -27.46 dBm
868.00000000 MHz
A
1RM
EXT
TDF
P22
Start 858 MHz
1 MHz/
Stop 868 MHz
Date: 6.DEC.2011 08:32:30

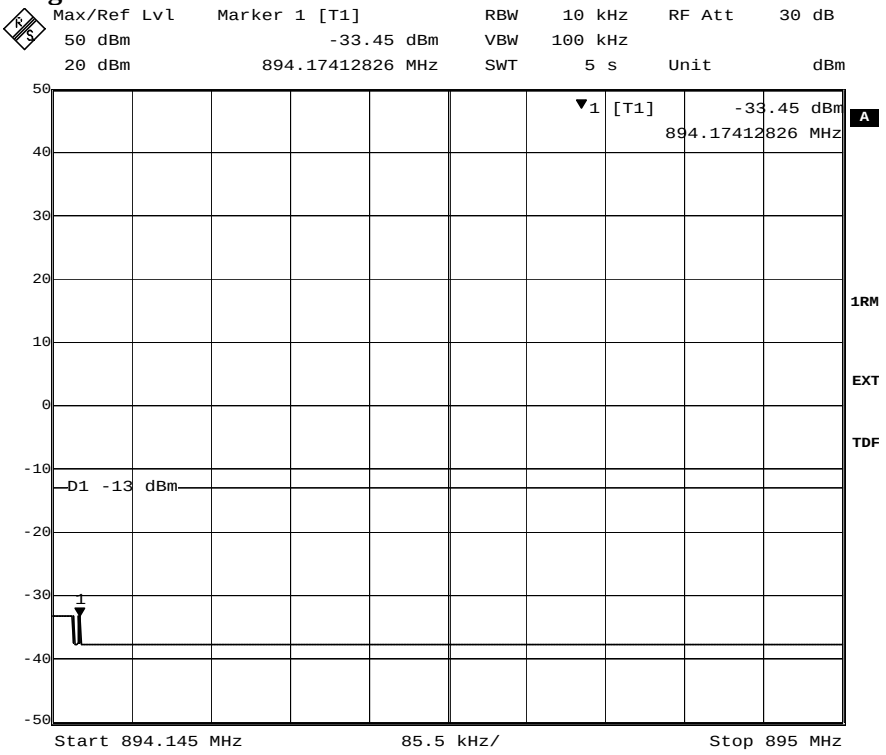
Appendix 4

**Diagram 2 a:**




Date: 6.DEC.2011 08:52:47

**Diagram 2 b:**




Date: 6.DEC.2011 08:54:07

**Diagram 2 c:**

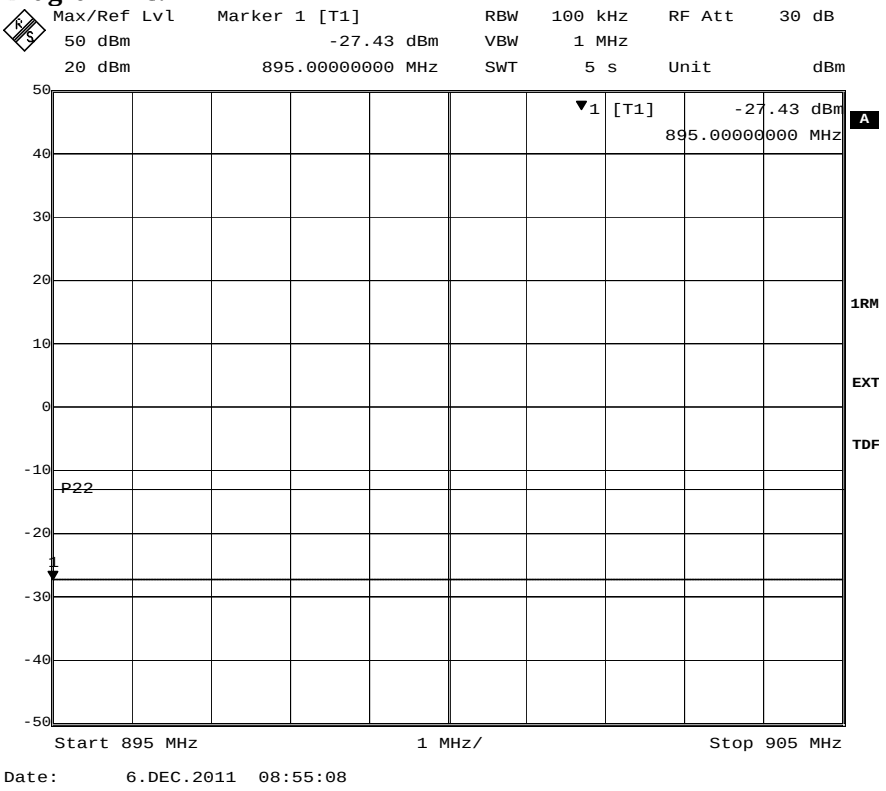
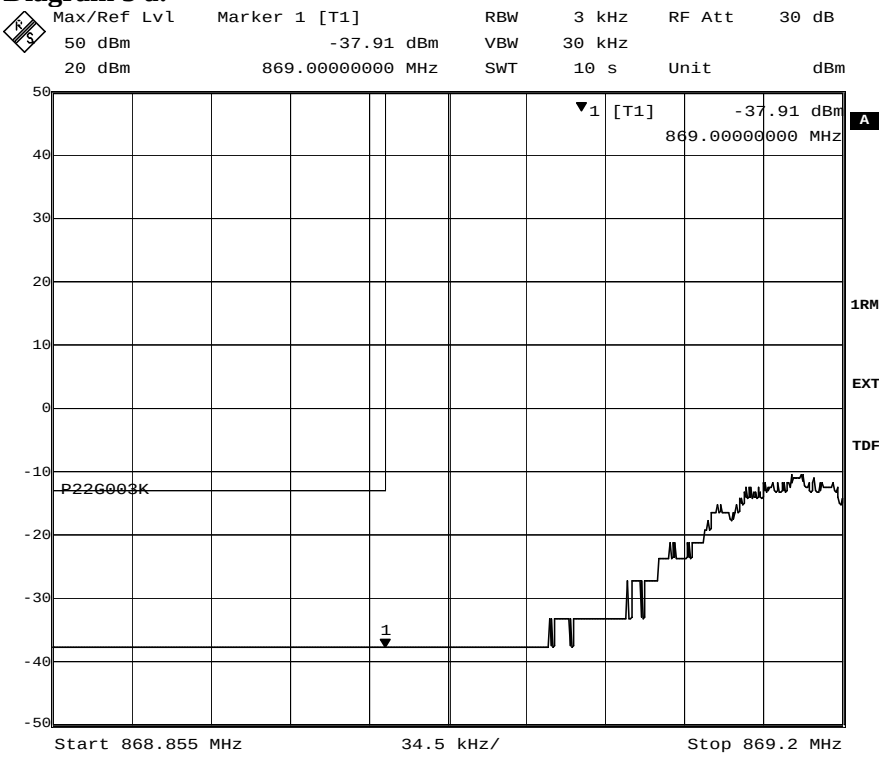
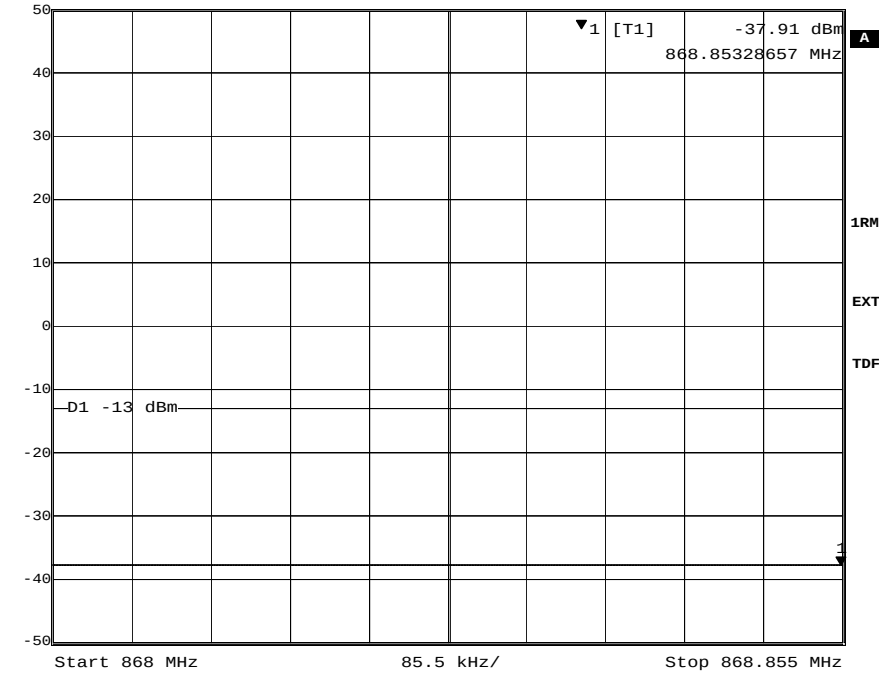

Max/Ref Lvl
50 dBm
20 dBm
Marker 1 [T1]
-27.43 dBm
895.00000000 MHz
RBW 100 kHz
VBW 1 MHz
SWT 5 s
RF Att 30 dB
Unit dBm
▼1 [T1]
-27.43 dBm
895.00000000 MHz
A
1RM
EXT
TDF
P22
Start 895 MHz
1 MHz/
Stop 905 MHz
Date: 6.DEC.2011 08:55:08

**Diagram 3 a:**



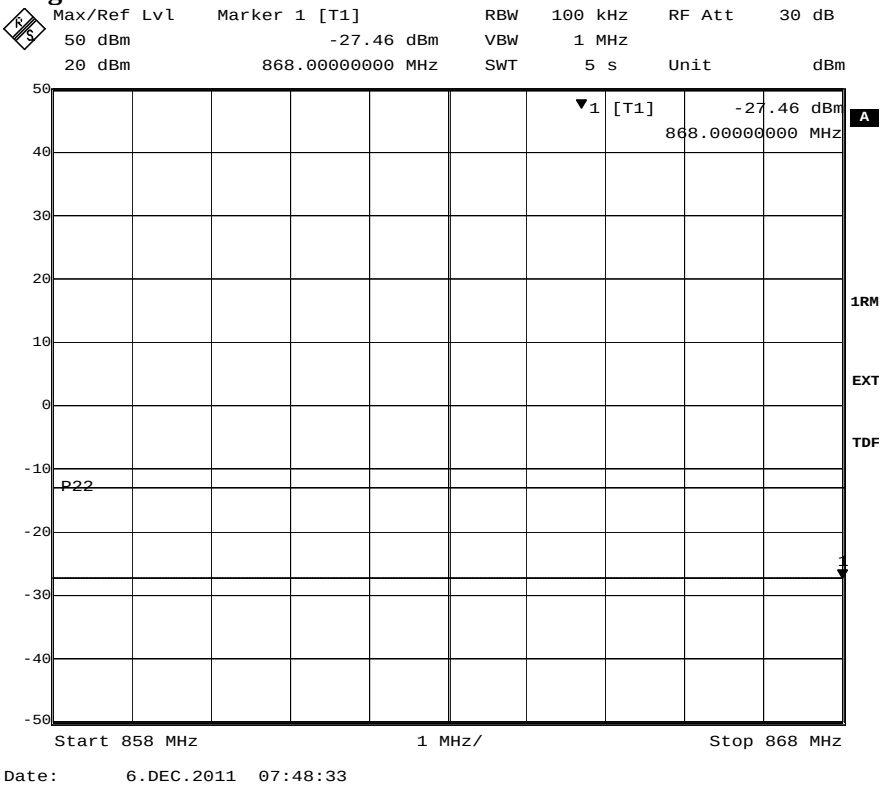

Date: 6.DEC.2011 07:46:01

**Diagram 3 b:**



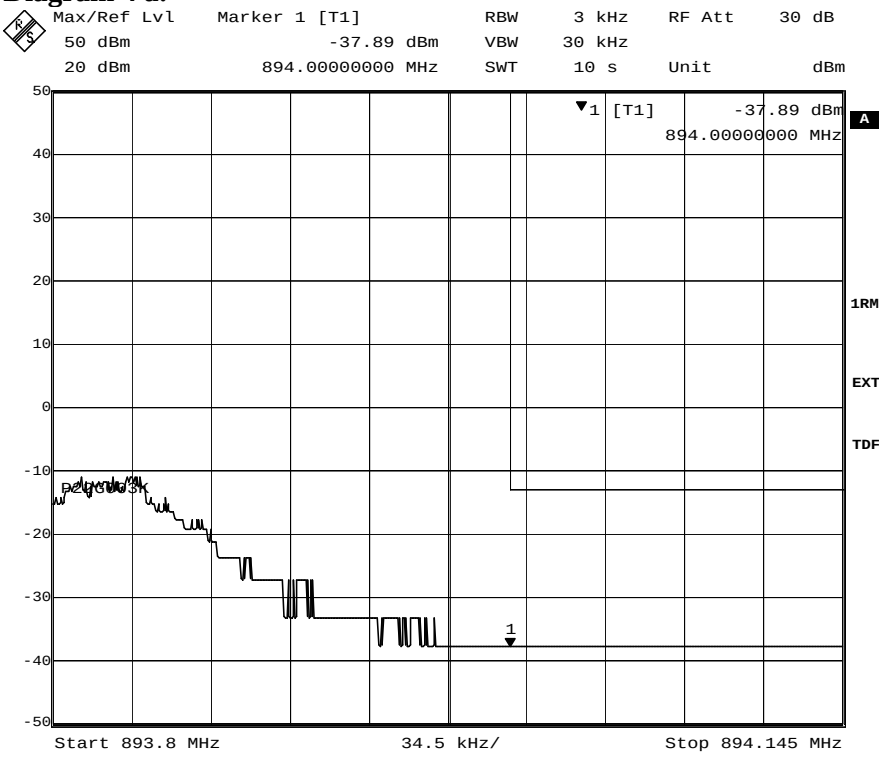

Date: 6.DEC.2011 07:47:26

**Diagram 3 c:**


Max/Ref Lvl
50 dBm
20 dBm
Marker 1 [T1]
-27.46 dBm
868.00000000 MHz
RBW 100 kHz
VBW 1 MHz
SWT 5 s
RF Att 30 dB
Unit dBm
1 [T1] -27.46 dBm
868.00000000 MHz
A
1RM
EXT
TDF
P22
Start 858 MHz
1 MHz/
Stop 868 MHz
Date: 6.DEC.2011 07:48:33

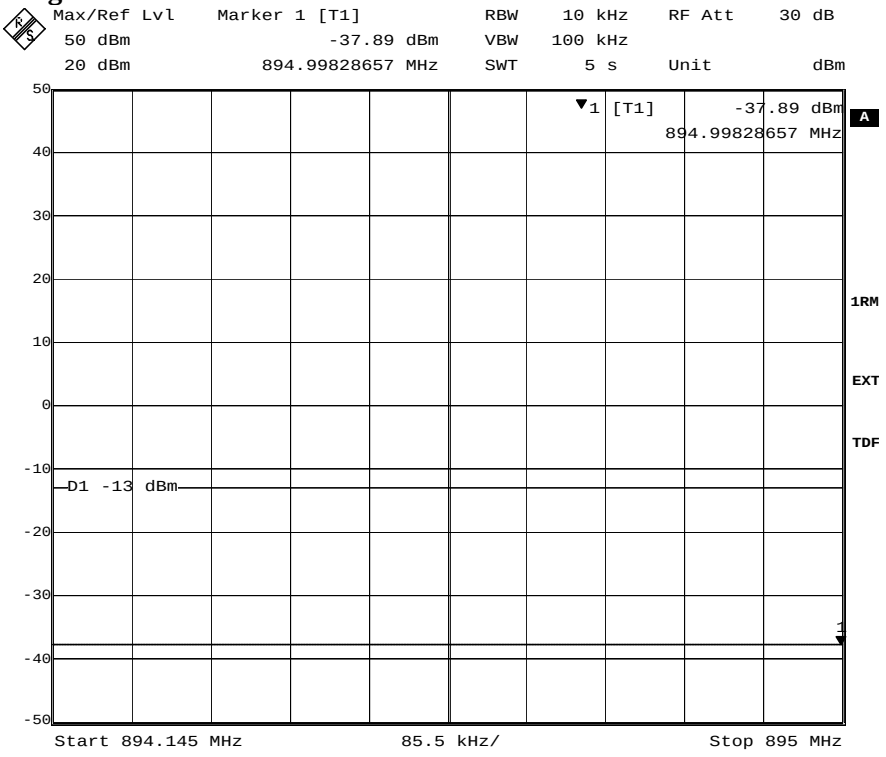
Appendix 4

**Diagram 4 a:**



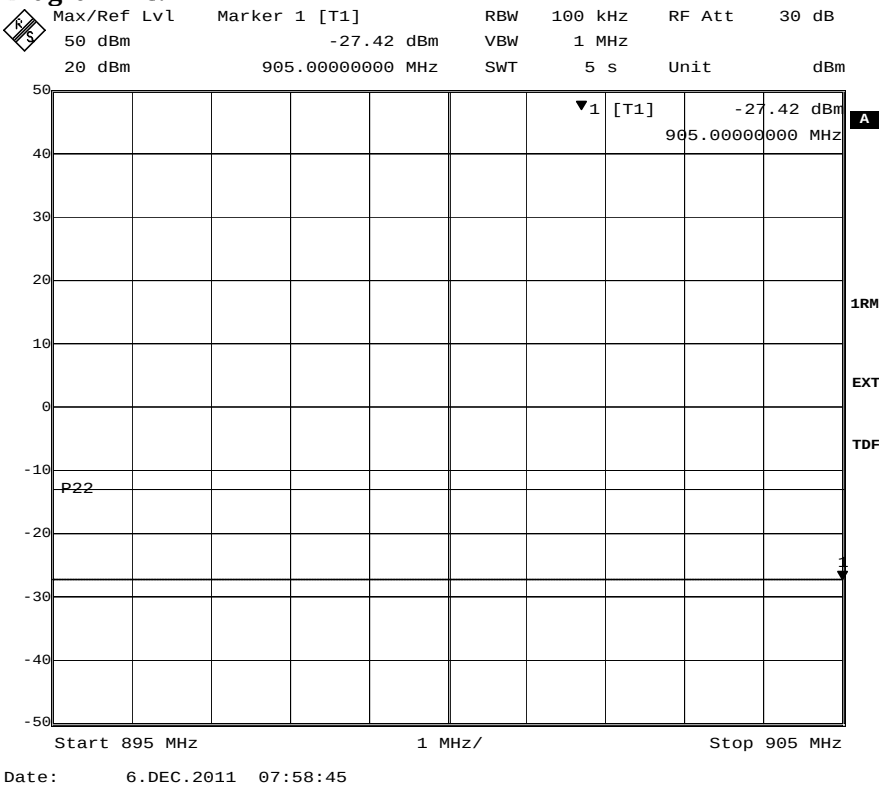

Date: 6.DEC.2011 07:56:46

**Diagram 4 b:**




Date: 6.DEC.2011 07:58:08

**Diagram 4 c:**


Max/Ref Lvl
50 dBm
20 dBm
Marker 1 [T1]
-27.42 dBm
905.00000000 MHz
RBW 100 kHz
VBW 1 MHz
SWT 5 s
RF Att 30 dB
Unit dBm
1 [T1] -27.42 dBm
905.00000000 MHz
A
1RM
EXT
TDF
P22
50
40
30
20
10
0
-10
-20
-30
-40
-50
Start 895 MHz
1 MHz/
Stop 905 MHz
Date: 6.DEC.2011 07:58:45

## Conducted spurious emission measurements according to 47CFR 2.1051

| Date | Temperature | Humidity |
|---|---|---|
| 2011-12-06 | 23 °C ± 3 °C | 27 % ± 5 % |

**Test set-up and procedure**

The measurements were made with the CDU output connected to a spectrum analyser. A pre-measurement was performed with the PEAK detector activated. Emission close or above the limit with the PEAK detector is measured with the RMS detector activated. The spectrum analyser was connected to an external 10 MHz reference standard during the measurements.

| Measurement equipment | SP number |
|---|---|
| R&S FSIQ | 503 738 |
| Attenuator | 504 159 |
| High pass filter | 502 758 |
| Testo 635 temperature and humidity meter | 504 203 |

**Measurement uncertainty:** 3.7 dB

**Results**

Configuration: TCC mode, RBS master 2E setting 51, TX ARFCN 190 (881.6 MHz)

Diagram 1 a: GMSK, 9 KHz – 1 GHz
Diagram 1 b: GMSK, 1 GHz – 10 GHz

Diagram 2 a: AQPSK, 9 KHz – 1 GHz
Diagram 2 b: AQPSK, 1 GHz – 10 GHz

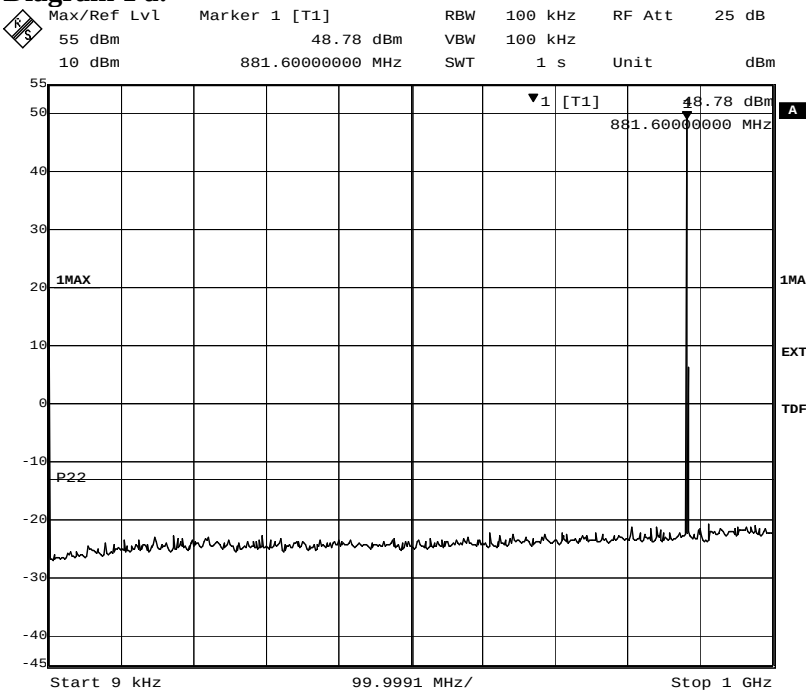
The diagrams are shown on the following pages.

**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.

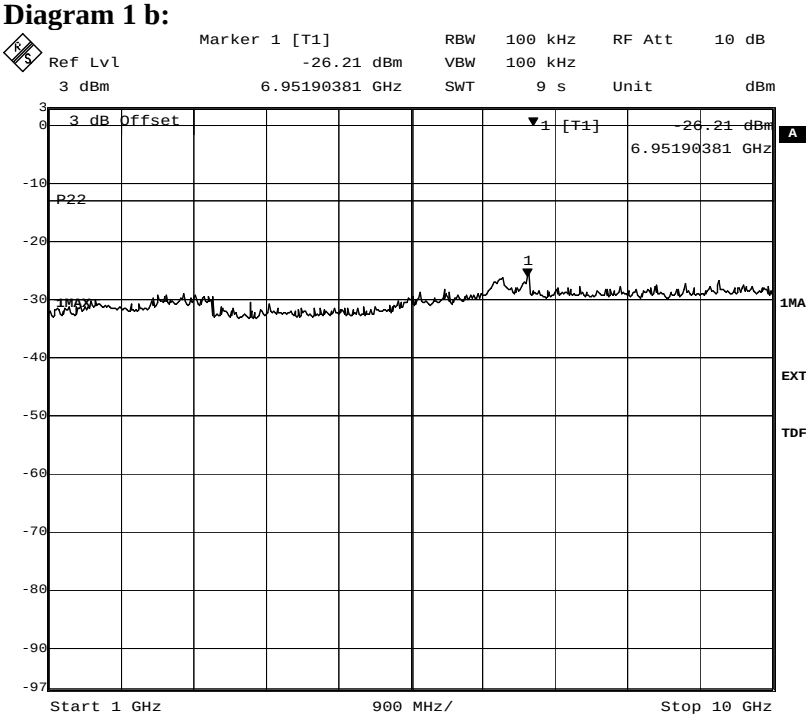
| Complies? | Yes |
|---|---|

**Diagram 1 a:**



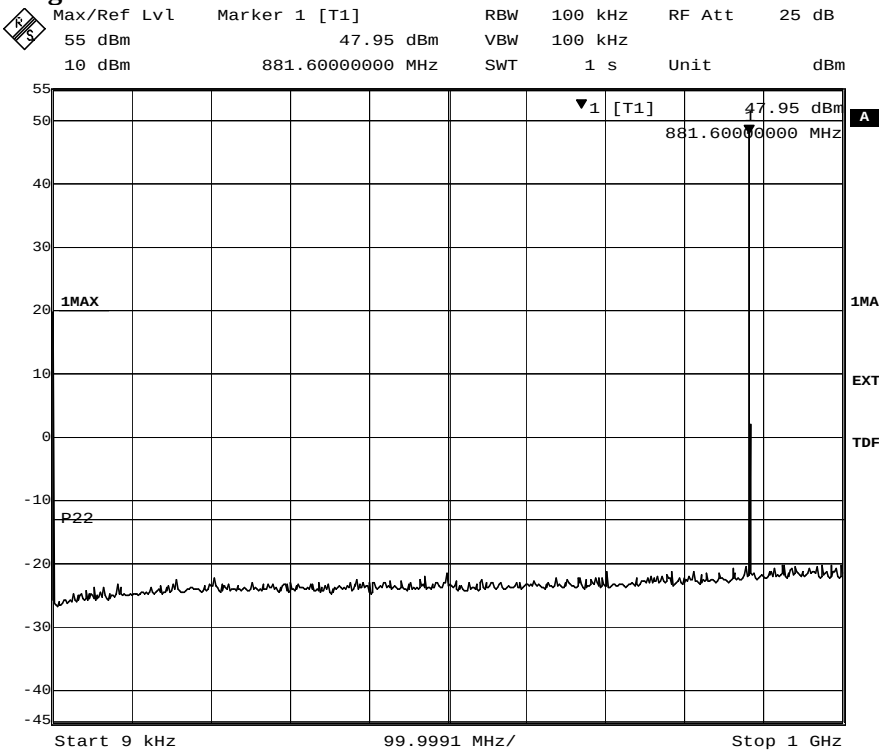

Date: 6.DEC.2011 07:12:46

**Diagram 1 b:**



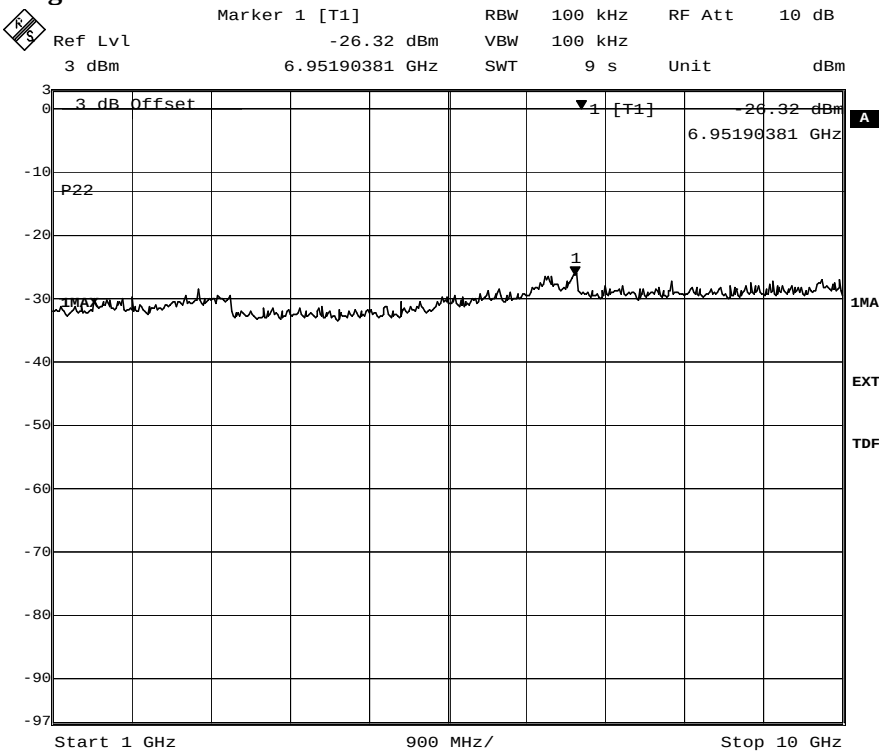

Date: 6.DEC.2011 07:14:51

**Diagram 2 a:**




Date: 6.DEC.2011 07:10:49

**Diagram 2 b:**




Date: 6.DEC.2011 07:16:45

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

| Date | Temperature | Humidity |
|---|---|---|
| 2011-06-22 | 22 °C ± 3 °C | 28 % ± 5 % |

### Test set-up and procedure

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.
The measurements were performed in Effective Radiated Power (ERP). A fully anechoic chamber was used during the measurements. The chamber is regularly calibrated with the substitution method and from that calibration an ERP correction factor is derived. The correction factor was used as a transducer to get the readings in ERP.

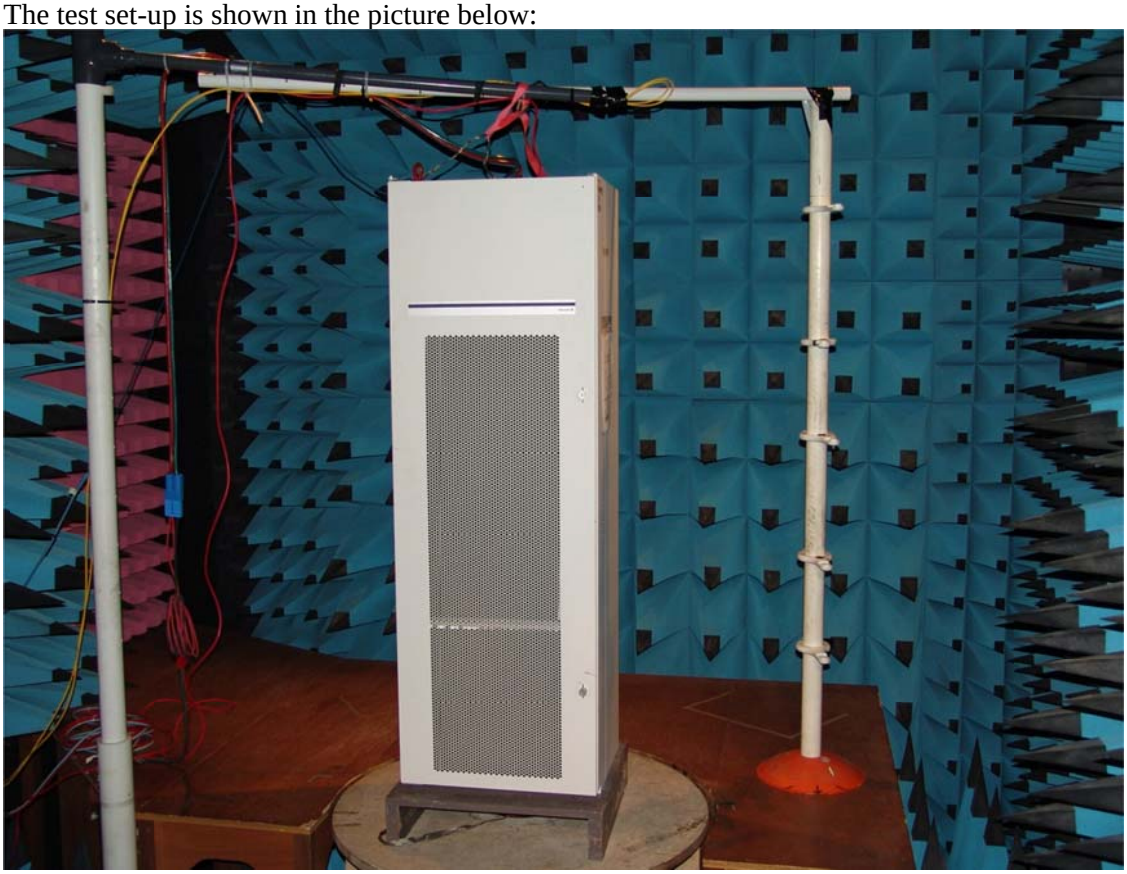
The measurement procedure was as the following:

1. A pre-measurement was first performed with peak detector. The EUT was continuously measured in 360 degrees.
2. Spurious radiation on frequencies closer than 6 dB to the limit was re-measured with RMS detector and with the substitution method according to the standard.

EUT configuration: TCC mode, RBS master 2E setting 51, TX ARFCN 190 (881.6 MHz)

| Measurement equipment | SP number |
|---|---|
| Anechoic chamber, Hertz | 15:116 |
| R&S FSIQ40 Signal Analyser for signal monitoring | 503 738 |
| R&S EMI Test Receiver ESI40 | 503 125 |
| Chase bilog antenna CBL 6121A | 502 460 |
| Schaffner Reference Dipole BSRD6500 | 503 649 |
| EMCO Horn Antenna 3115 | 502 175 |
| EMCO Horn Antenna 3115 | 501 548 |
| MITEQ Low Noise Amplifier | 503 277 |
| R&S Vector Network Analyser | 503 687 |
| High pass filter | 502 758 |
| Attenuator | 504 159 |
| Testo 615 temperature and humidity meter | 503 498 |

The test set-up is shown in the picture below:



**Results**

Modulation GMSK

| Frequency (MHz) | Spurious emission level (dBm) | |
|---|---|---|
| | Vertical | Horizontal |
| 30-10 000 | All emission > 20 dB below limit | All emission > 20 dB below limit |

Modulation AQPSK

| 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:** 3.1 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 |

## Hardware list RBS 2206 V2 used for conducted and radiated measurements

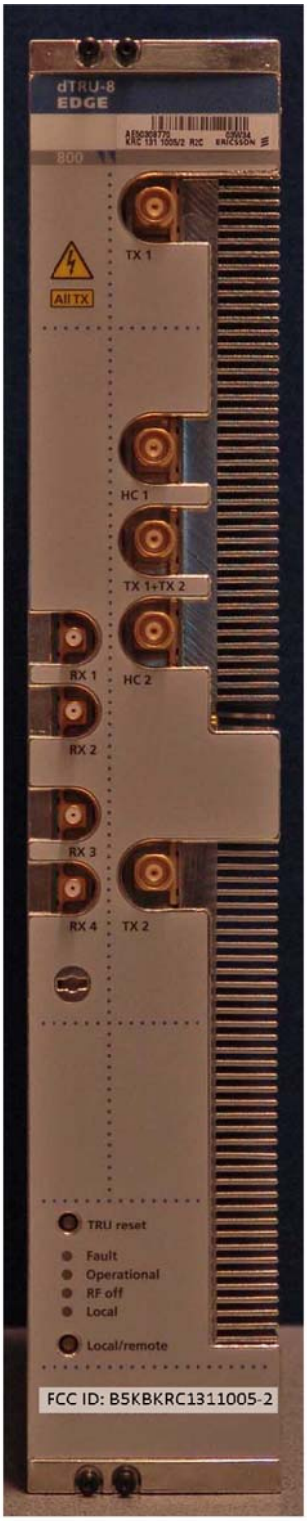
| Pos. | Unit | Product Number | Revision | Serial Number |
|---|---|---|---|---|
| | Cabinet RBS 2206 V2 | SEB 112 1154/1 | R2A | AB20110385 |
| | Door | SXK 109 7157/1 | R1A | - |
| | DCCU-13 | BMG 980 07/11 | R1D | BH41057606 |
| | ACCU-11 | BMG 980 07/09 | R1A | BH41037398 |
| | | | | |
| | Subrack | BFL 119 424/1 | R2A | - |
| 1 | CDU-G8 | BFL 119 155/1 | R3A | A40004WCLA |
| 2 | CDU-G8 | BFL 119 155/1 | R3A | A40004WCLV |
| 3 | CDU-G8 | BFL 119 155/1 | R3A | A40004WCL8 |
| | | | | |
| | Dummy | SXK 107 5031/2 | R1B | - |
| | CXU-10 | KRY 101 1856/1 | R3D | TR44252258 |
| | CXU-10 | KRY 101 1856/1 | R3D | TR45062312 |
| | | | | |
| | TRU subrack | BFL 119 425/1 | R1C | - |
| | Backplane | BFX 101 107/3 | R1A | - |
| 1 | dTRU-8 | KRC 131 1005/2 | R4A | AE53038582 |
| 2 | dTRU-8 | KRC 131 1005/2 | R5A | AE55540317 |
| 3 | dTRU-8 | KRC 131 1005/2 | R2C | AE50308770 |
| 4 | dTRU-8 | KRC 131 1005/2 | R5A | AE55540324 |
| 5 | dTRU-8 | KRC 131 1005/2 | R4A | AE53038668 |
| 6 | dTRU-8 | KRC 131 1005/2 | R3A | AE51304512 |
| | | | | |
| | IDM-11 | BMG 980 327/2 | R1A | X181175714 |
| | | | | |
| | PSU/DXU subrack | BFL 119 453/1 | R1A | BK41067514 |
| | Backplane | BFX 101 109/1 | R1A | - |
| 1 | PSU-AC-32 | BML 353 206/2 | R1C | BR80397724 |
| 2 | PSU-AC-32 | BML 353 206/2 | R1C | BR80299548 |
| 3 | PSU-AC-32 | BML 353 206/2 | R1C | BR80303083 |
| 4 | Dummy | SXK 107 9314/1 | R1D | - |
| 5 | Metal cover plate 1 slot | - | - | - |
| 6a | TMA-CM-02 | SDK 107 881/1 | R3A | BG800000QP |
| 6b | Metal cover plate ½ slot | - | - | - |
| 7 | DXU-23 | BOE 602 21/1 | R1D | TU8D552374 |

## Test object software during both radiated and conducted measurements

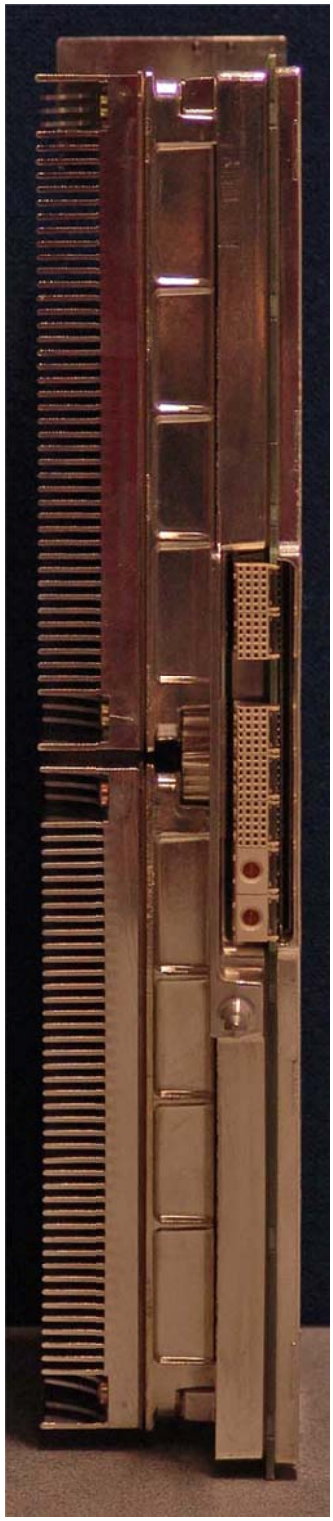
| Software | Revision |
|---|---|
| CXP 104 0007/05 | R31E |

## Photos of the test object

Front side

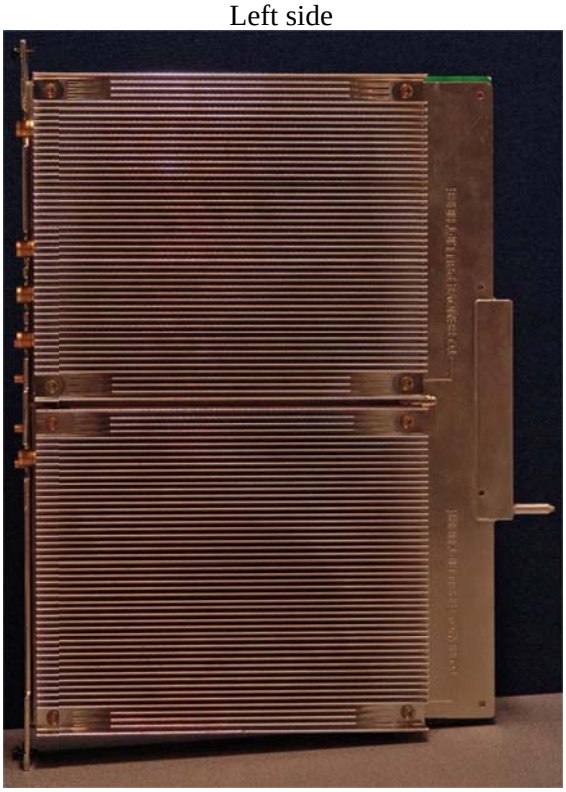



Rear side



Appendix 8

Left side



Right side