REPORT
issued by an Accredited Testing Laboratory

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

Date	Reference	Page
2012-02-28	FX108941-7 Rev 1	1 (2)

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

Class II Permissive Change measurements on GSM Base station Transceiver Unit with FCC ID: B5KBKRC1311004-2

(8 appendices)

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

Test object

Transceiver Unit dTRU-19, product KRC 131 1004/2, revision R1G

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) 1900 MHz
TX frequency band:	1930 – 1990 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	41,7	38,4	37,0	36,6	38,3
Uncombined (UC) mode	45,0	41,7	40,3	39,9	41,6
TCC mode	47,0	43,7	42,3	41,9	43,6

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 in SCPIR 0 dB with results for 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 output power, where GMSK modulation results in the highest RMS output power, and for band-edge performance, where only AQPSK was tested as described in appendix 4. Where several modulations were compared, GMSK modulation shall be considered a worst case set-up.

Tested configuration

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 49, resulting in the highest achievable output power. 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 TX/RX 1 output of the CDU-G19.

Radiated measurements

During radiated emission measurements the TX/RX 1 output of CDU-G19 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.

Frequencies used

Channel	ARFCN	Frequency		Comment
B	512	1930.2	MHz	Lowest usable TX frequency
B+1	513	1930.4	MHz	Low alternate TX frequency, 1 channel inside band
M	661	1960.0	MHz	TX band centre frequency
T-1	809	1989.6	MHz	High alternate TX frequency, 1 channel inside band
T	810	1989.8	MHz	Highest usable TX frequency

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 24, 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 23rd May 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	504 200
High pass filter	2012-08	503 739
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).

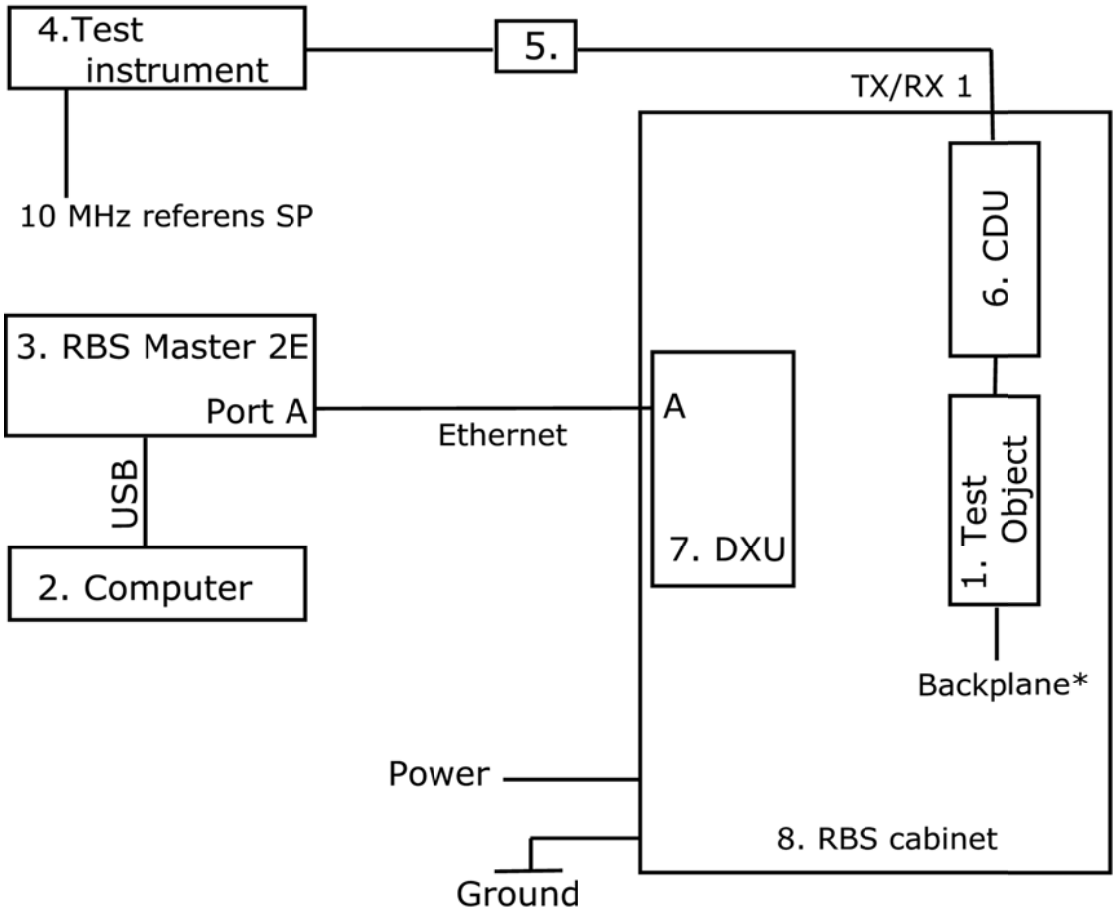
Test engineers

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

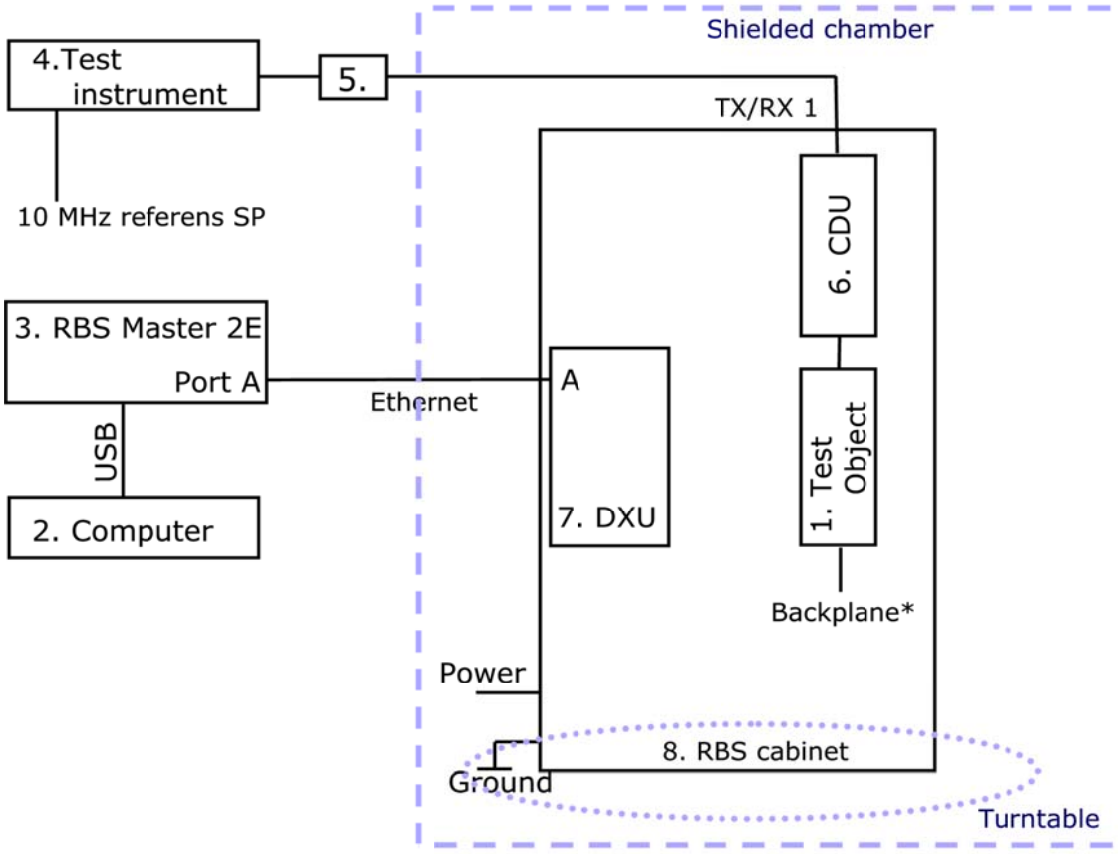
Test object

1. Transceiver Unit dTRU-19, product KRC 131 1004/2, revision R1G, SN AE50094077 with FCC ID: B5KBKRC1311004-2

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 or SP measurement instrument used according respective appendix
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-19, product KRC 131 1004/2, revision R1G, SN AE50094077 with FCC ID: B5KBKRC1311004-2

Functional test equipment

2. HP laptop computer model Compaq NC6400 SN CND72717JP with RBS Master2 control software
3. Ericsson RBS Master 2E hardware, product LBY 107 1007/3, revision R1C, BAMS 1000735211
4. Rohde & Schwarz ESI40 for signal verification or 50 ohm termination
5. Attenuator 40 dB, SP 504 159
6. CDU-G19, product BFL 119 153/1, revision R5F, serial number A40003X4CF

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

Appendix 1

Test object connections

Interface	**Type of port**
Power via RBS backplane	DC power
TX 1 + TX 2 interconnection to CDU in TCC/HC mode	RF interconnect
Interconnection TX 1 to CDU in UC mode	RF interconnect
Interconnection TX 2 to CDU in UC mode	
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
2011-11-30	24 °C ± 3 °C	25 % ± 5 %

Test set-up and procedure

Measurements were made at the CDU 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

The test object was configured for maximum nominal output power, using TCC mode configuration with RBS master 2E setting 49.

Transmitter power (dBm)			
Channel	Modulation	Peak	RMS
M	GMSK	47.4	46.6
M	AQPSK	47.3	43.4

The maximum measured PAR was 3.9 dB.

Limits

According to CFR § 24 there are no conducted limits at the antenna connector.

§ 24.232: The peak-to-average (PAR) ratio shall not exceed 13 dB. Base stations with an emission bandwidth of 1 MHz or less are limited to 1640 watts equivalent isotropically radiated power (EIRP).

Complies?	Yes

Occupied bandwidth measurements according to 47CFR 2.1049

Date	Temperature	Humidity
2011-11-29	23 °C ± 3 °C	27 % ± 5 %
2011-12-01	24 °C ± 3 °C	25 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. Measurements were made at the CDU output connector, which 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

The results are shown in the diagrams below.

Configuration:

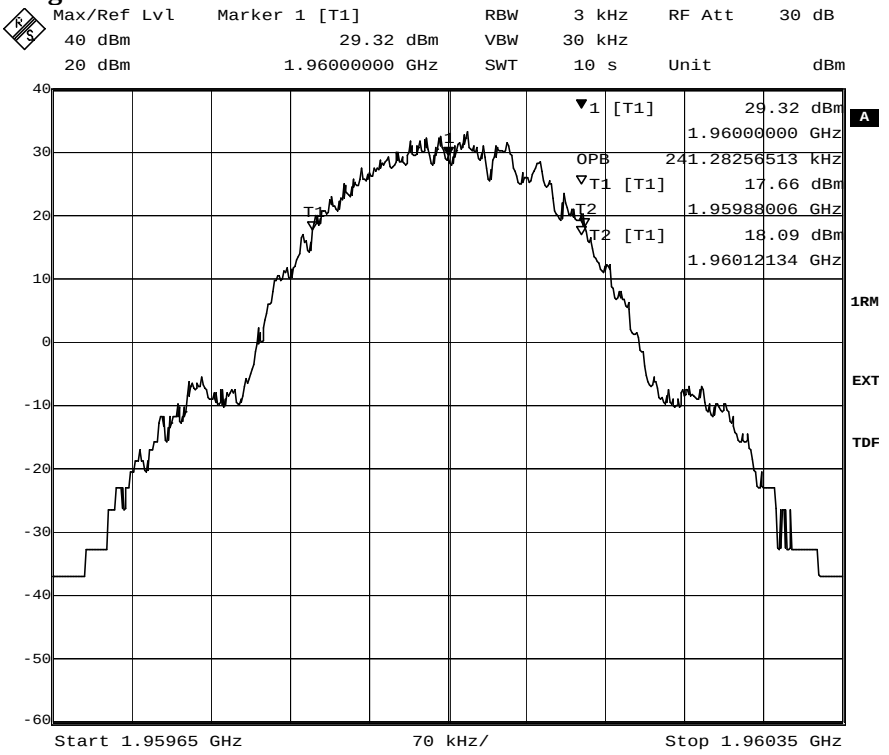
TCC mode with RBS master 2E setting 49, maximum nominal output power.

Diagram	Channel	Modulation	OBW
1	M	GMSK	241 kHz
2	M	AQPSK	237 kHz

Complies?	Yes

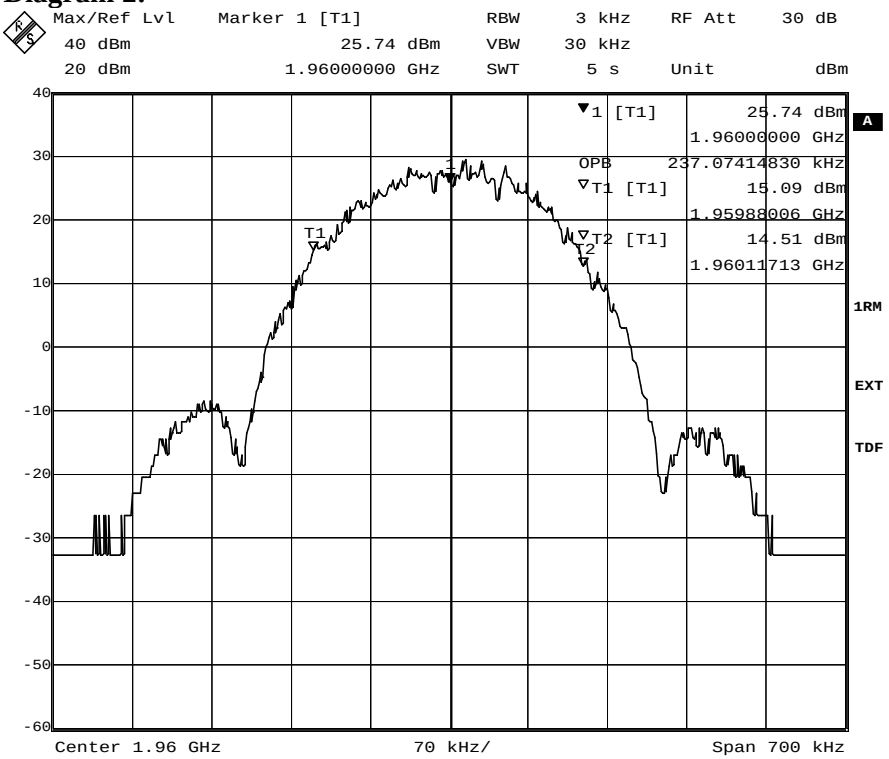
Appendix 3

Diagram 1:



Date: 1.DEC.2011 14:13:13

Diagram 2:



Date: 29.NOV.2011 10:56:45

Band edge measurements according to 47CFR 2.1051

Date	Temperature	Humidity
2011-11-30	22 °C ± 3 °C	59 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238, with the CDU output 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.

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 1 MHz for measurements of emissions with band edge offsets exceeding 1 MHz. Measurement bandwidths of 3 kHz, 30 kHz and 1MHz were used and the respective limit was adapted by [10 * log(RBWused/RBWrequired)] dB.

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

Configuration: AQPSK modulation with SCPIR 0 dB.

Diagram	Channel	Configuration	RBS master 2E setting	Measured RMS power / [dBm]
1 a, b, c	B	HC mode	43	36.9
2 a, b, c	T	UC mode	45	40.3
3 a, b, c	B+1	TCC mode	49	42.8
4 a, b, c	T-1	TCC mode	49	42.7

The diagrams are shown on the following pages.

Remark

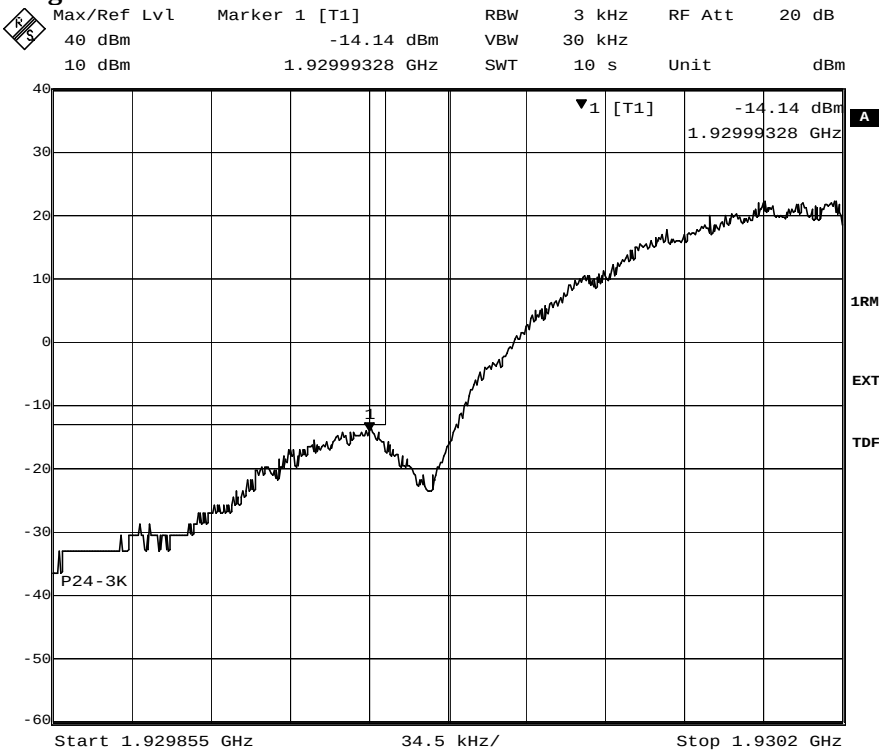
For channels B and T the above documented RMS output powers were found to represent maximum usable settings for AQPSK modulation using SCPIR 0 dB.

Limit

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.

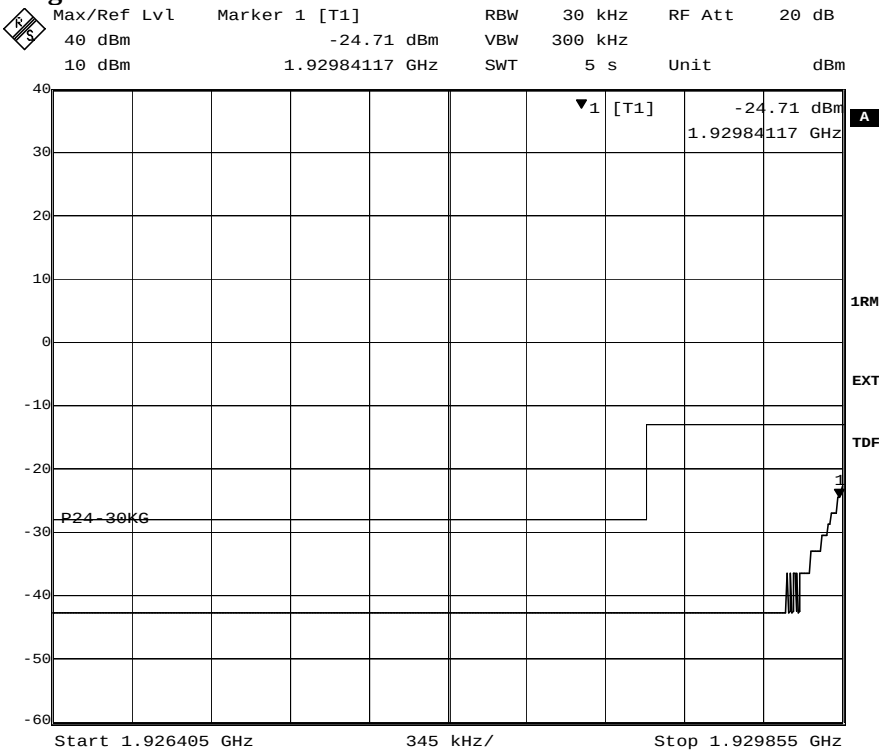
Complies?	Yes

Diagram 1 a:



Date: 30.NOV.2011 11:28:36

Diagram 1 b:



Date: 30.NOV.2011 12:14:55

Diagram 1 c:

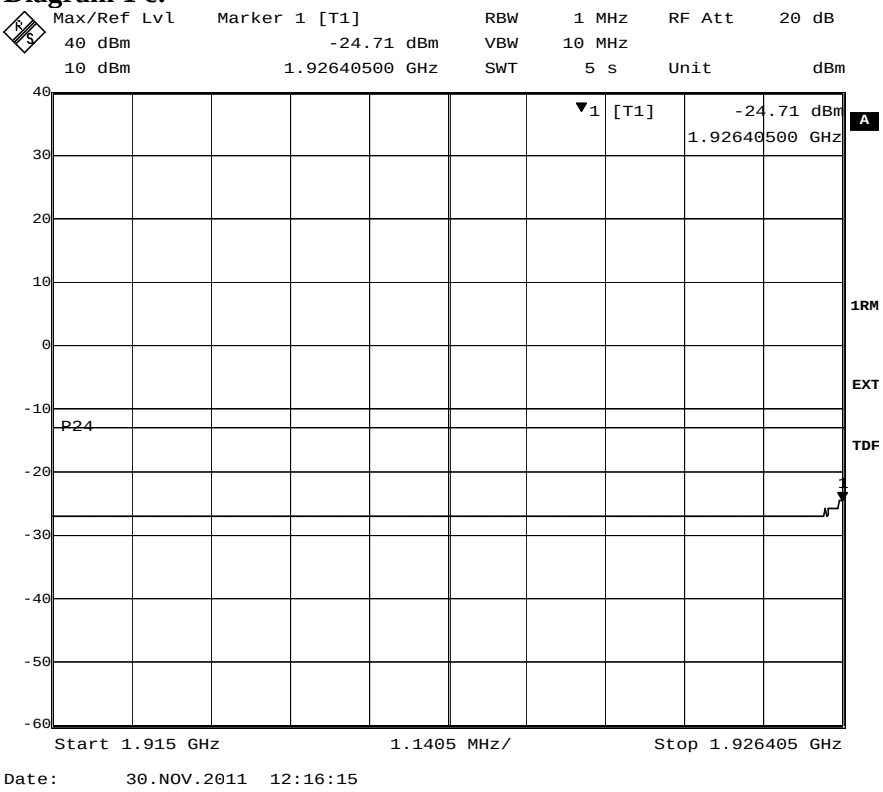
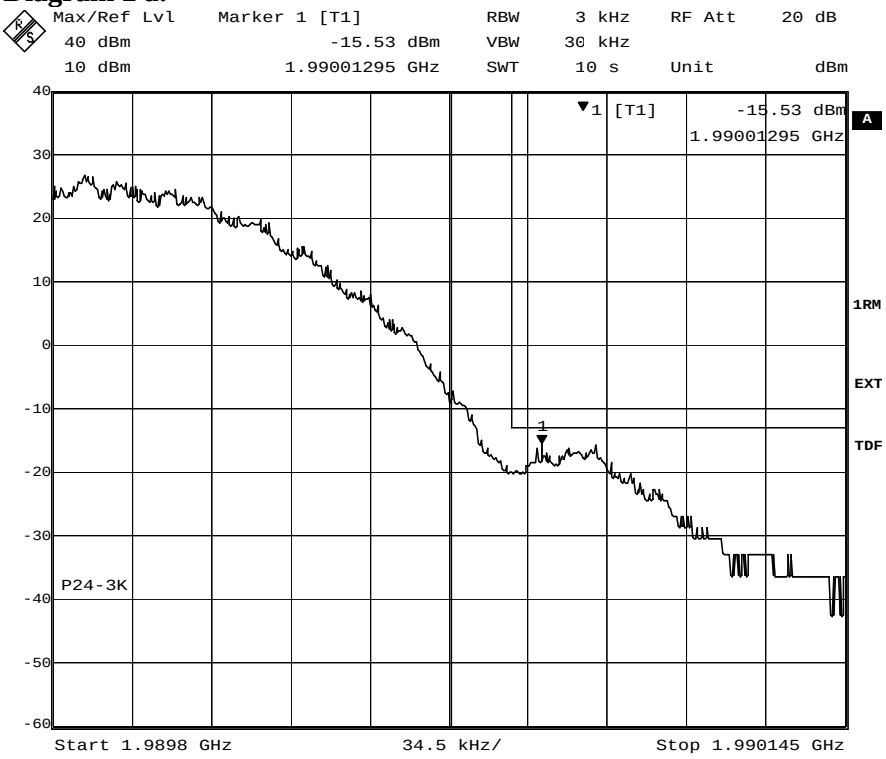
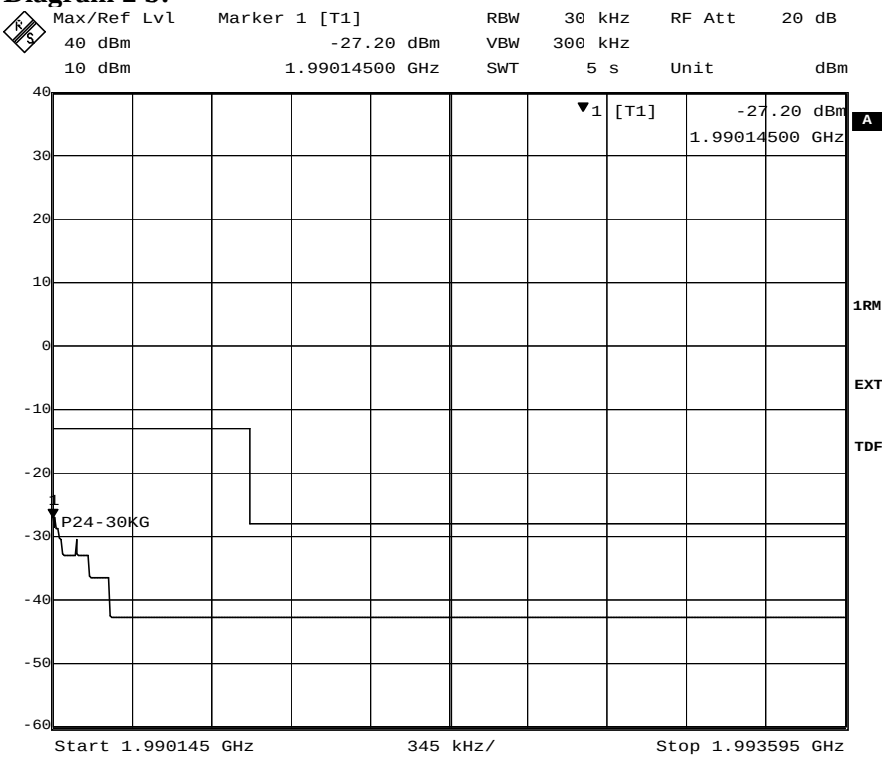

Max/Ref Lvl
40 dBm
10 dBm
Marker 1 [T1]
-24.71 dBm
1.92640500 GHz
RBW 1 MHz
VBW 10 MHz
SWT 5 s
RF Att 20 dB
Unit dBm
1 [T1]
-24.71 dBm
1.92640500 GHz
A
1RM
EXT
TDF
P24
40
30
20
10
0
-10
-20
-30
-40
-50
-60
Start 1.915 GHz
1.1405 MHz/
Stop 1.926405 GHz
Date: 30.NOV.2011 12:16:15

Diagram 2 a:



Date: 30.NOV.2011 13:37:20

Diagram 2 b:



Date: 30.NOV.2011 13:39:16

Diagram 2 c:

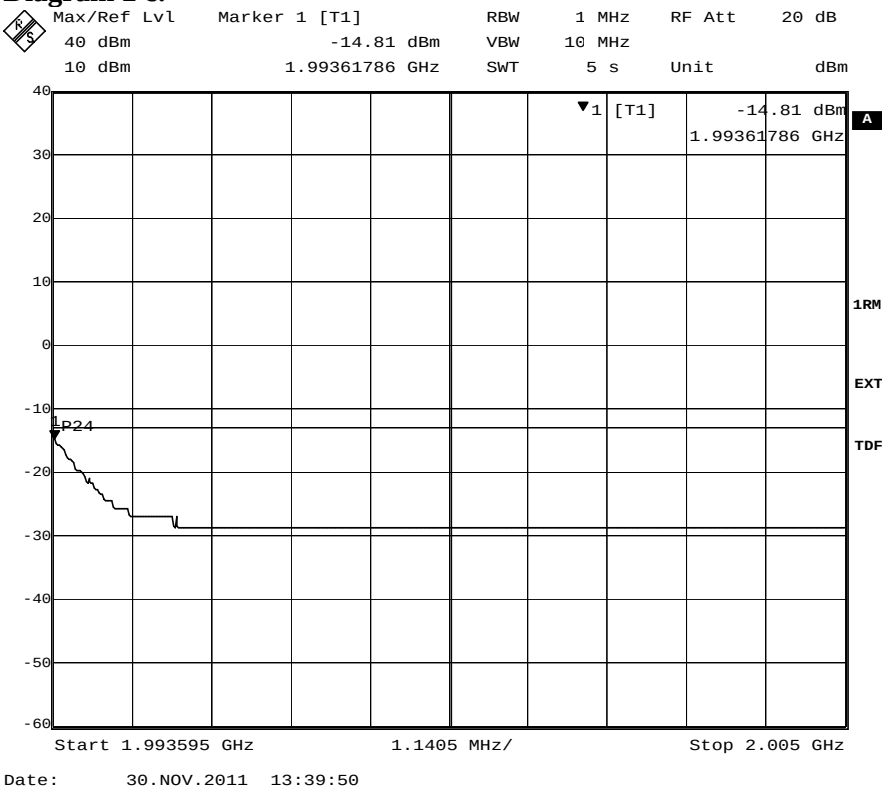
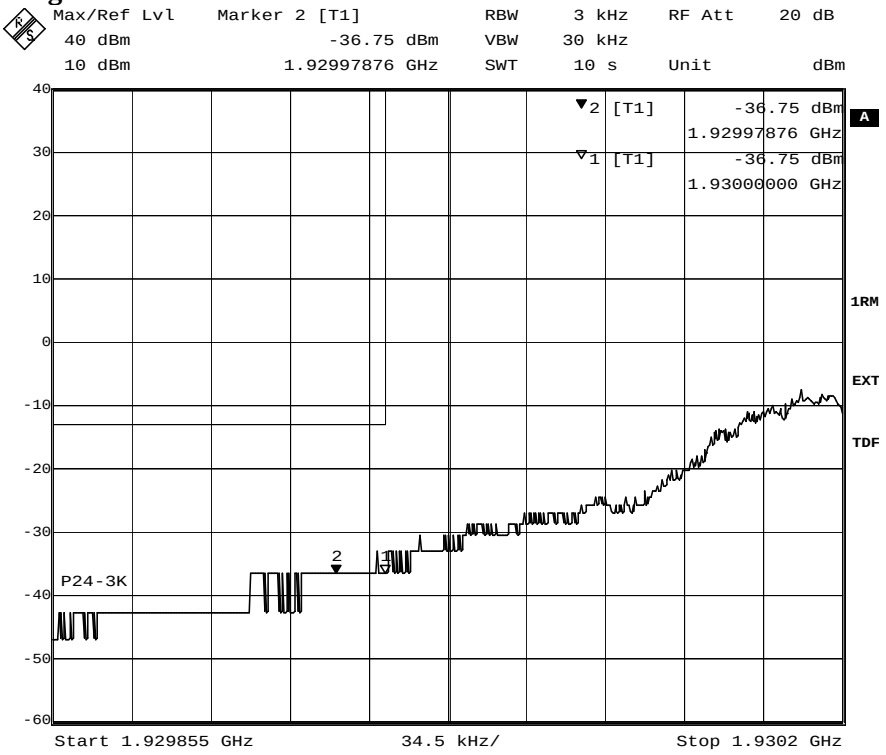
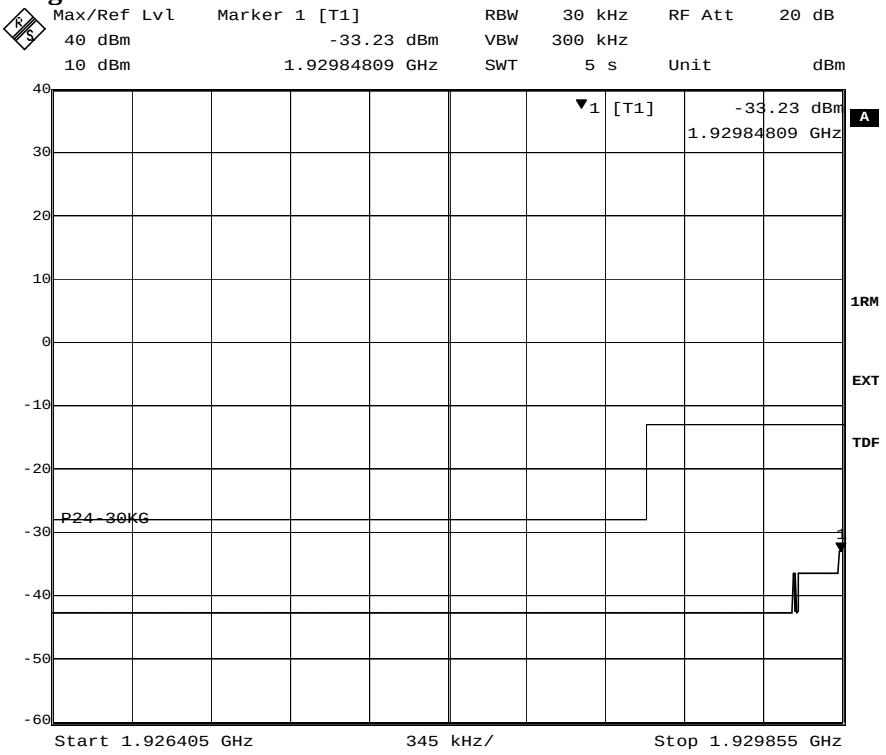

Max/Ref Lvl
40 dBm
10 dBm
Marker 1 [T1]
-14.81 dBm
1.99361786 GHz
RBW 1 MHz
VBW 10 MHz
SWT 5 s
RF Att 20 dB
Unit dBm
1 [T1]
-14.81 dBm
1.99361786 GHz
A
1RM
EXT
TDF
1P24
40
30
20
10
0
-10
-20
-30
-40
-50
-60
Start 1.993595 GHz
1.1405 MHz/
Stop 2.005 GHz
Date: 30.NOV.2011 13:39:50

Diagram 3 a:



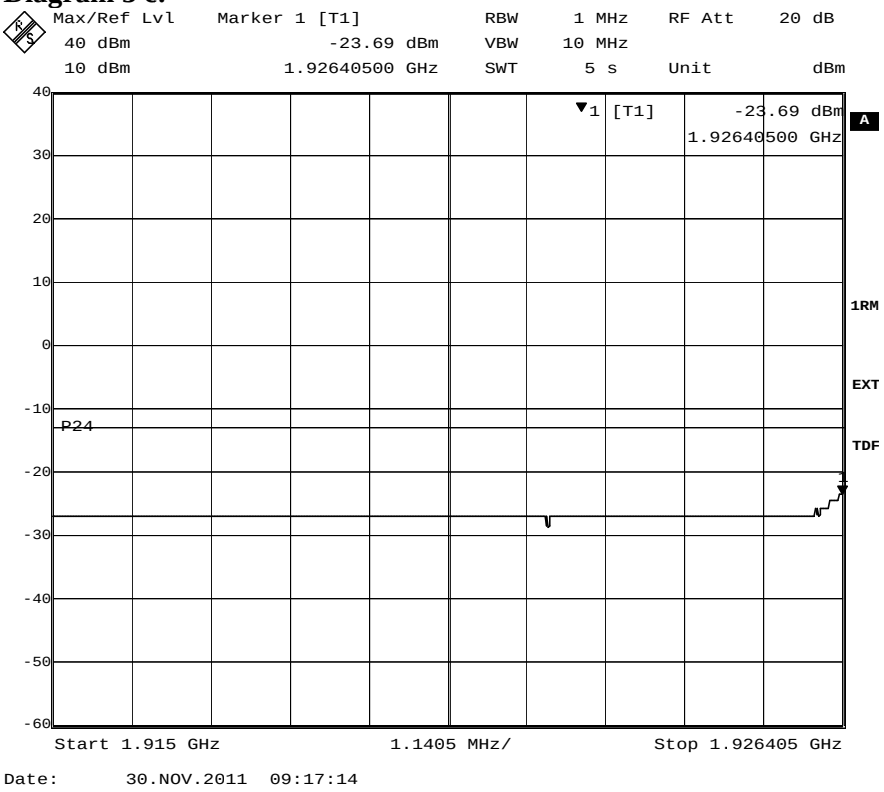
Date: 30.NOV.2011 09:15:54

Diagram 3 b:



Date: 30.NOV.2011 09:14:54

Diagram 3 c:


Max/Ref Lvl
40 dBm
10 dBm
Marker 1 [T1]
-23.69 dBm
1.92640500 GHz
RBW 1 MHz
VBW 10 MHz
SWT 5 s
RF Att 20 dB
Unit dBm
1 [T1]
-23.69 dBm
1.92640500 GHz
A
1RM
EXT
TDF
P24
40
30
20
10
0
-10
-20
-30
-40
-50
-60
Start 1.915 GHz
1.1405 MHz/
Stop 1.926405 GHz
Date: 30.NOV.2011 09:17:14

Appendix 4

Diagram 4 a:

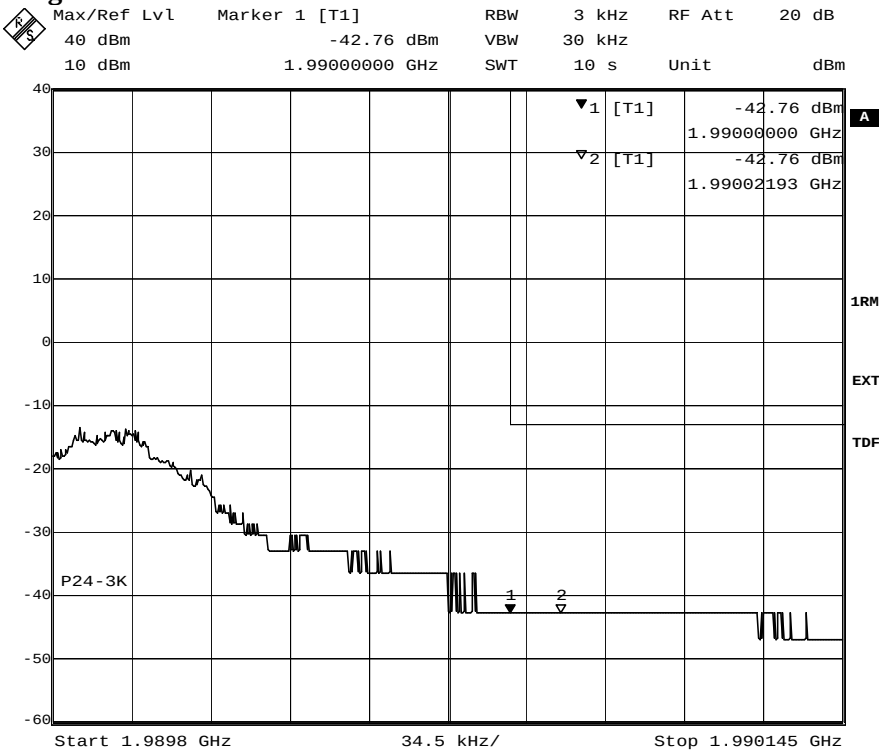


Diagram 4 b:

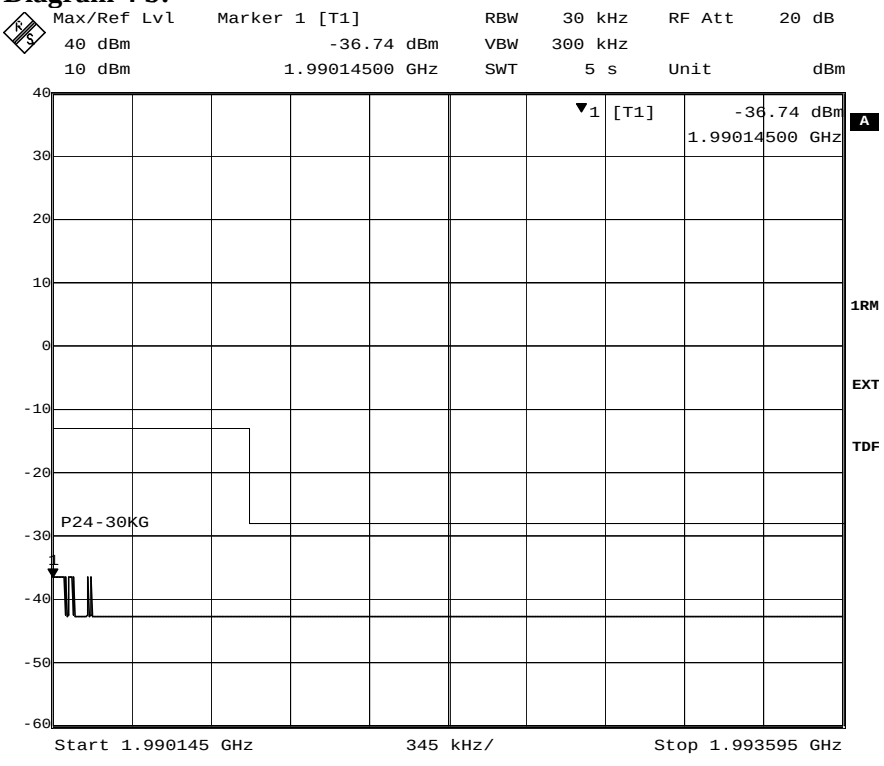
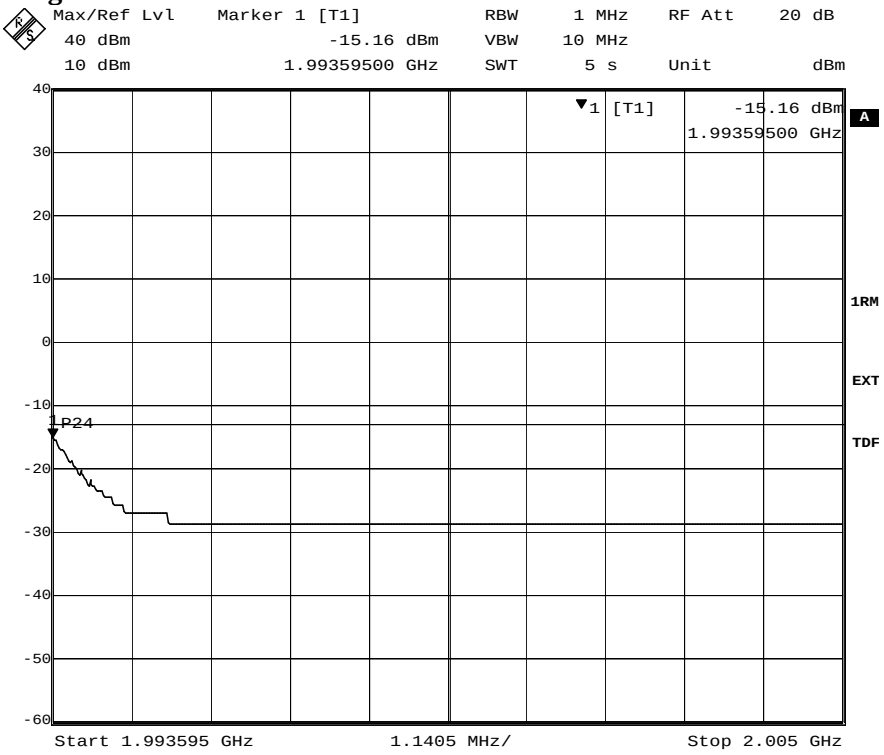


Diagram 4 c:


Max/Ref Lvl
40 dBm
10 dBm
Marker 1 [T1]
-15.16 dBm
1.99359500 GHz
RBW 1 MHz
VBW 10 MHz
SWT 5 s
RF Att 20 dB
Unit dBm
1 [T1]
-15.16 dBm
1.99359500 GHz
A
1RM
EXT
TDF
1P24
40
30
20
10
0
-10
-20
-30
-40
-50
-60
Start 1.993595 GHz
1.1405 MHz/
Stop 2.005 GHz
Date: 30.NOV.2011 10:22:36

Conducted spurious emission measurements according to 47CFR 2.1051

Date	Temperature	Humidity
2011-11-29	23 °C ± 3 °C	27 % ± 5 %
2011-12-01	24 °C ± 3 °C	25 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. Measurements were made with the CDU output connected to a spectrum analyser. A pre-measurement was performed with the PEAK detector activated. Emission close to 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	504 200
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

The results are shown in the diagrams below.

Configuration: TCC mode with RBS master 2E setting 49 for maximum nominal output power. The measurement was performed using ARFCN 661 (1960.0 MHz)

Diagram	Modulation	Frequency range
1 a:	GMSK	9 KHz – 3 GHz
1 b:	GMSK	3 GHz – 20 GHz
2 a:	AQPSK	9 KHz – 3 GHz
2 b:	AQPSK	3 GHz – 20 GHz

The diagrams are shown on the following pages.

Remark

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

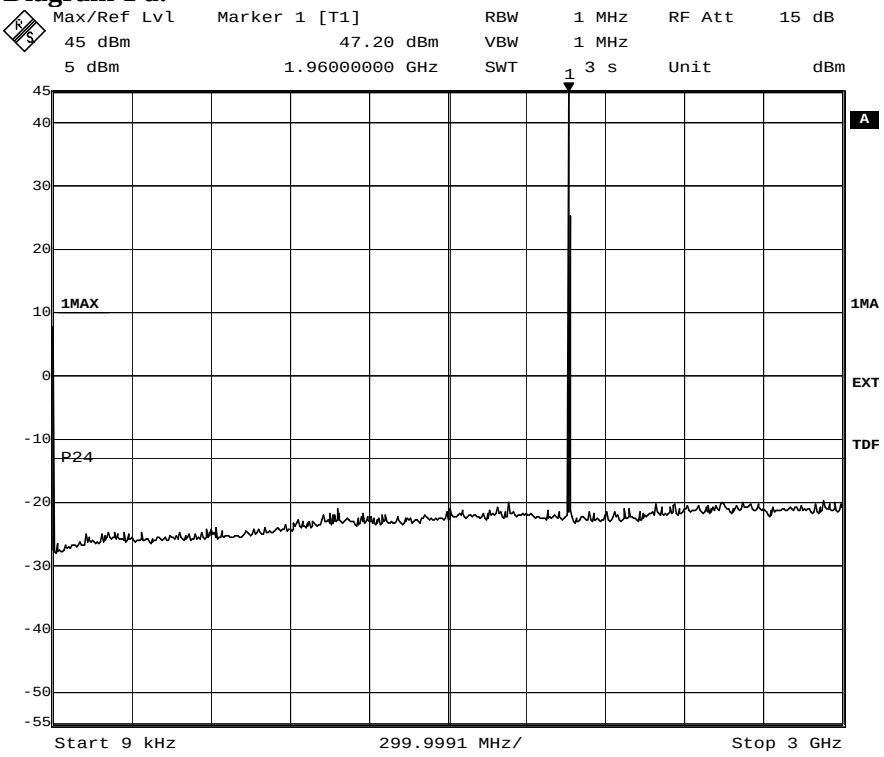
Limits

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

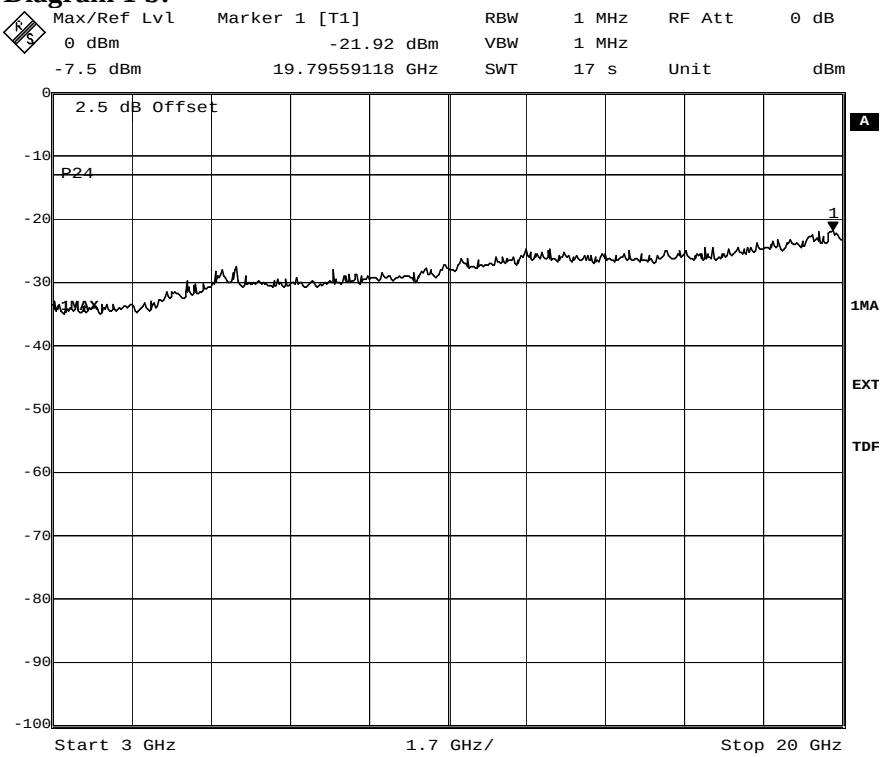
Appendix 5

Diagram 1 a:



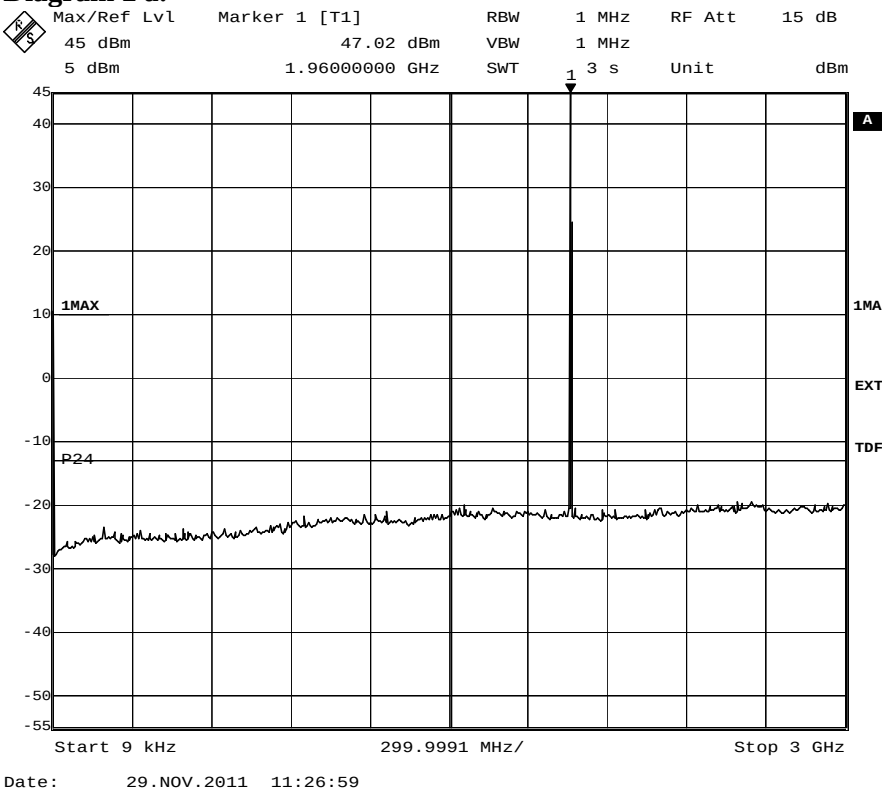
Date: 1.DEC.2011 14:17:02

Diagram 1 b:



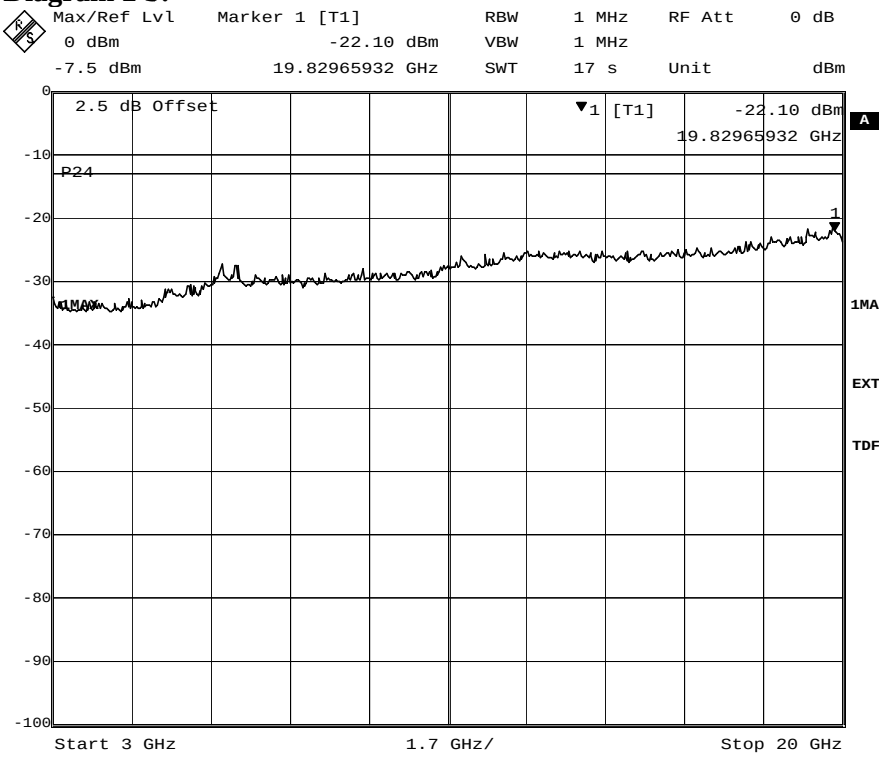
Date: 1.DEC.2011 14:18:22

Diagram 2 a:



Date: 29.NOV.2011 11:26:59

Diagram 2 b:



Date: 29.NOV.2011 11:32:44

Field strength of spurious radiation measurements according to 47CFR 2.1053

Date	Temperature	Humidity
2011-06-23	22 °C ± 3 °C	52 % ± 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 – 18 GHz and 1m in the frequency range 18-20 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.

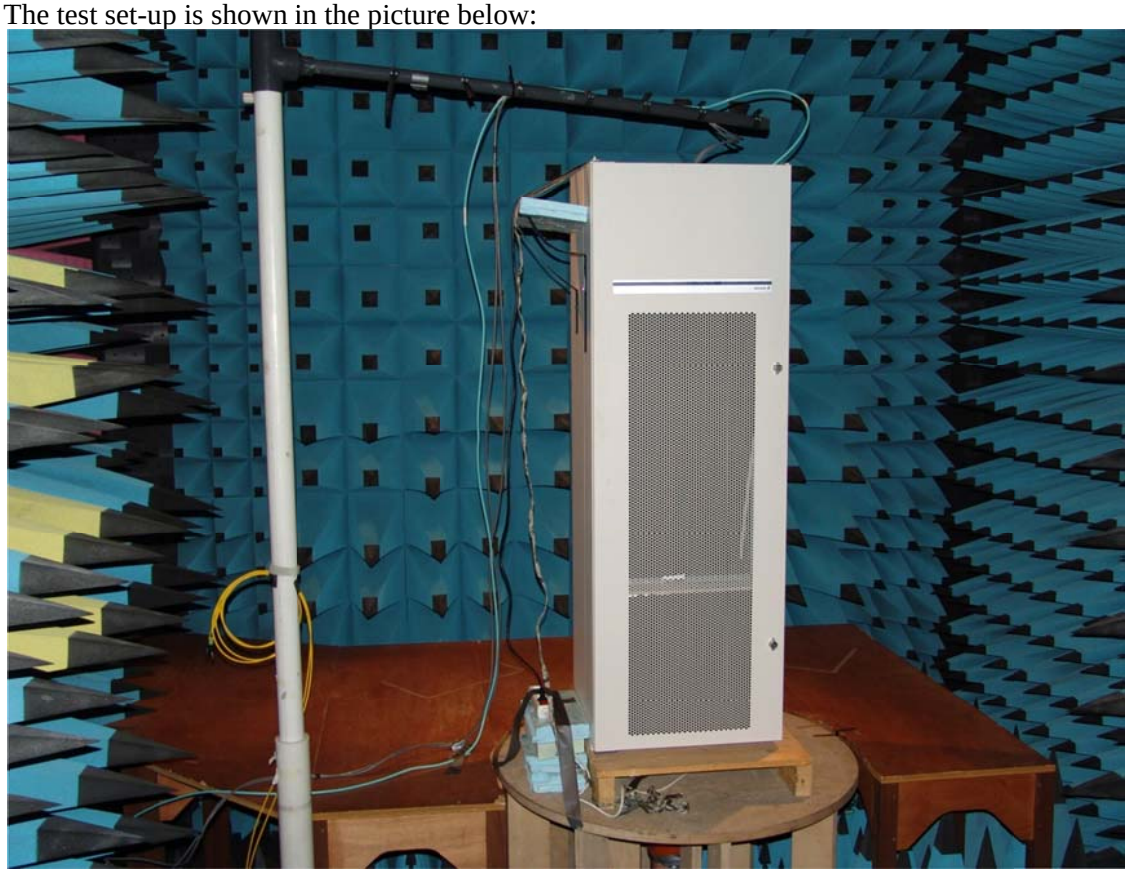
The measurement procedure was as the following:

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.

The test object was configured in TCC mode with RBS master 2E setting 49.
TX ARFCN 661 (1960.0 MHz) was used.

Measurement equipment	SP number
Anechoic chamber, Hertz	15:116
Rohde & Schwarz FSIQ40 Signal Analyser	503 738
Rohde & Schwarz 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
Flann Std gain horn 20240-20	503 674
MITEQ Low Noise Amplifier	503 277
Rohde & Schwarz Vector Network Analyser	503 687
Attenuator	504 159
Highpass filter	503 739
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
30-20 000	All emission > 20 dB below limit	All emission > 20 dB below limit

Modulation AQPSK

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-20 000	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, conducted & radiated measurements

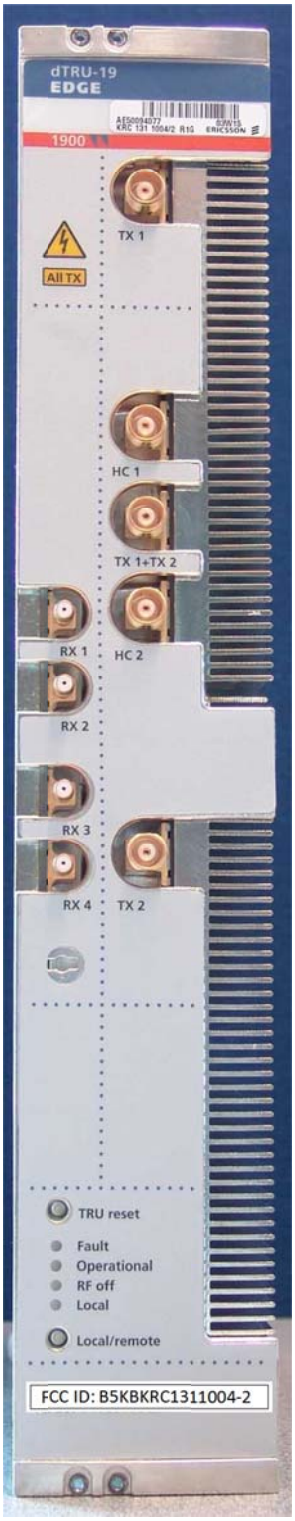
Unit	Product Number	Revision	Serial Number
Cabinet RBS 2206 V2	SEB 112 1154/1	R3A	AB20131926
Door	SXK 109 7157/1	R1B	-
ACCU-11	BMG 980 07/09	R1C	(S)BH41071675
Subrack	BFL 119 424/1	R2C	-
CDU-G19	BFL 119 153/1	R5F	A40003KLA1
CDU-G19	BFL 119 153/1	R5F	TR40177576
CDU-G19	BFL 119 153/1	R5F	A40003TYJ8
Dummy	SXK 107 5031/2	R1B	-
CXU-10	KRY 101 1856/1	R3D	TR43605527
Dummy	SXK 107 5031/1	R1B	-
TRU shelf	BFL 119 425/1	R1C	-
Backplane	BFX 101 107/3	R1B	-
Empty	-	-	-
Empty	-	-	-
dTRU-19	KRC 131 1004/2	R1G	AE50094077
Empty	-	-	-
Empty	-	-	-
Empty	-	-	-
IDM-11	BMG 980 327/2	R1B	X181175710
PSU-shelf	BFL 119 453/1	R1A	(S)BK41073473
Backplane	BFX 101 107/3	R1A	-
PSU-AC-32	BML 353 206/2	R1C	(S)BR80299542
PSU-AC-32	BML 353 206/2	R1C	(S)BR80397732
PSU-AC-32	BML 353 206/2	R1C	(S)BR80348807
Dummy	SXK 107 9314/1	R1C	-
Cover plate	-	-	-
(Empty gap)	-	-	-
DXU-23	BOE 602 21/1	R1C/A	TU8D176697

Test object software during conducted and radiated measurements

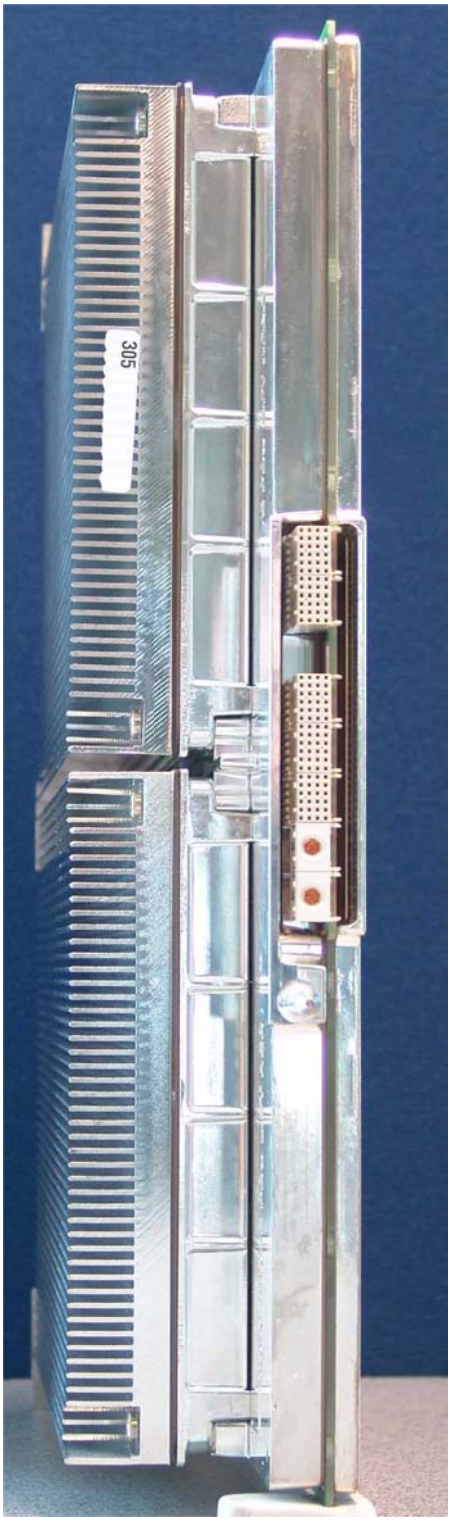
Software	Revision
CXP 104 0007/05	R31E

Photos of the test object

Front side

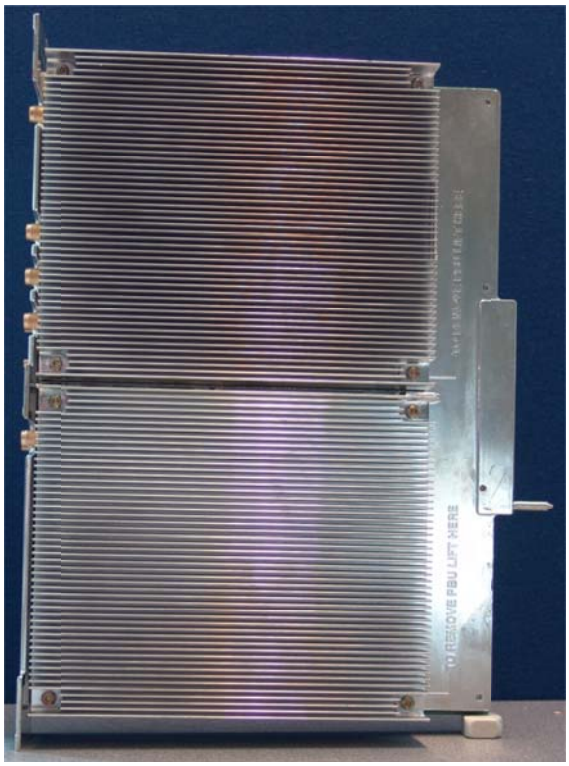


Rear side



Appendix 8

Left side



Right side