REPORT

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Date	Reference	Page
2012-02-09	FX108941-2	1 (2)

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P. R. China

Class II Permissive Change measurements on GSM Base Station Transceiver Unit with FCC ID: B5KAKRC131139-01 and IC ID: 287V-AGS13901

(8 appendices)

Rev. 1: In appendix 1 the client information for the declared nominal output power was updated.

Test object

Transceiver Unit sTRU19, product KRC 131 139/01, revision R1C

Summary

Standard		Compliant	Appendix
FCC CFR 47 / IC RSS-133			
2.1046 / RSS-133 6.4	RF power output	Yes	2
2.1049 / RSS-Gen 4.6.1	Occupied bandwidth	Yes	3
2.1051 / RSS-133 6.5	Band edge	Yes	4
2.1051 / RSS-133 6.5	Spurious emission at antenna terminals	Yes	5
2.1053 / RSS-133 6.5	Field strength of spurious radiation	Yes	6

Note: Above RSS-133 items are given as cross-reference only. Measurements were performed according to ANSI procedures referenced by FCC and covered by SP's accreditation.

SP Technical Research Institute of Sweden
Electronics - EMC

Performed by

Reinhold Reul

Examined by

Christer Karlsson

Table of contents

Description of the test object

Equipment:	GSM Base station transceiver unit (sTRU) 1900 MHz			
TX frequency band:	1930 - 1990 MHz			
Modulations:	GMSK	8PSK	16QAM	32QAM
Declared maximum output power, RMS value in [dBm]	39.7	36.4	35.0	34.6
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 16QAM and 32QAM modulation. This report verifies maintained performance characteristics of affected items by re-testing the updated equipment.

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. For band-edge performance the test scope was to verify compliance for the new implemented modulations. When 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 2202 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 with RBS master 2E setting 45, resulting in the highest achievable output power. The activated TX transmitted random data in all time slots, with the various tested modulations being activated one at a time.

Conducted measurements

Reference point for conducted measurements was the RF port on the RBS 2202 cabinet top side. RBS internally this port is attached to the output of CDU-C+ with serial number T04B238144.

Radiated measurements

During radiated emission measurements the RF port on the RBS 2202 cabinet top side connected to the CDU-C+ with serial T04B238144 was via a 50 ohm attenuator attached to test equipment outside the shielded chamber to monitor the transmitted signal. For the scope of this test it was deemed sufficient to measure and compare radiated spurious emission at the TX band center frequency for GMSK, 16QAM and 32QAM modulation.

Frequencies used

Channel	ARFCN	Frequency	Comment
B	512	1930.2 MHz	TX lowest usable frequency
M	661	1960.0 MHz	TX band center frequency
T	810	1989.8 MHz	TX highest usable frequency

Manufacturer's representative

Hua Yang, Ericsson (China) Communications Company Ltd

References

Measurements were done according to relevant parts of the following standards:
ANSI 63.4-2009
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
RSS-Gen Issue 3
RSS-133 Issue 5

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: 2011-06-23.

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	2012-10	503 145
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
Attenuator 30 dB	2012-08	900 229
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

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).

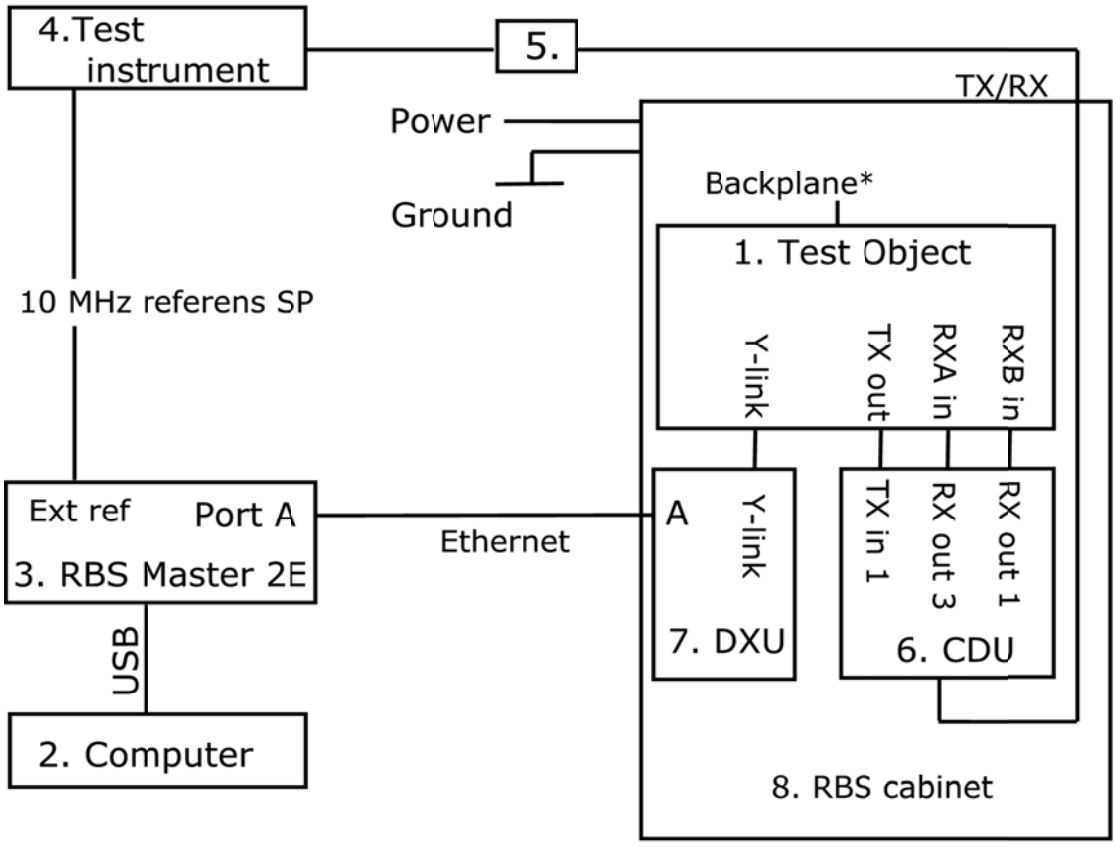
Test engineers

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

Test witness

-

Test set-up, conducted measurements



*) Power via backplane

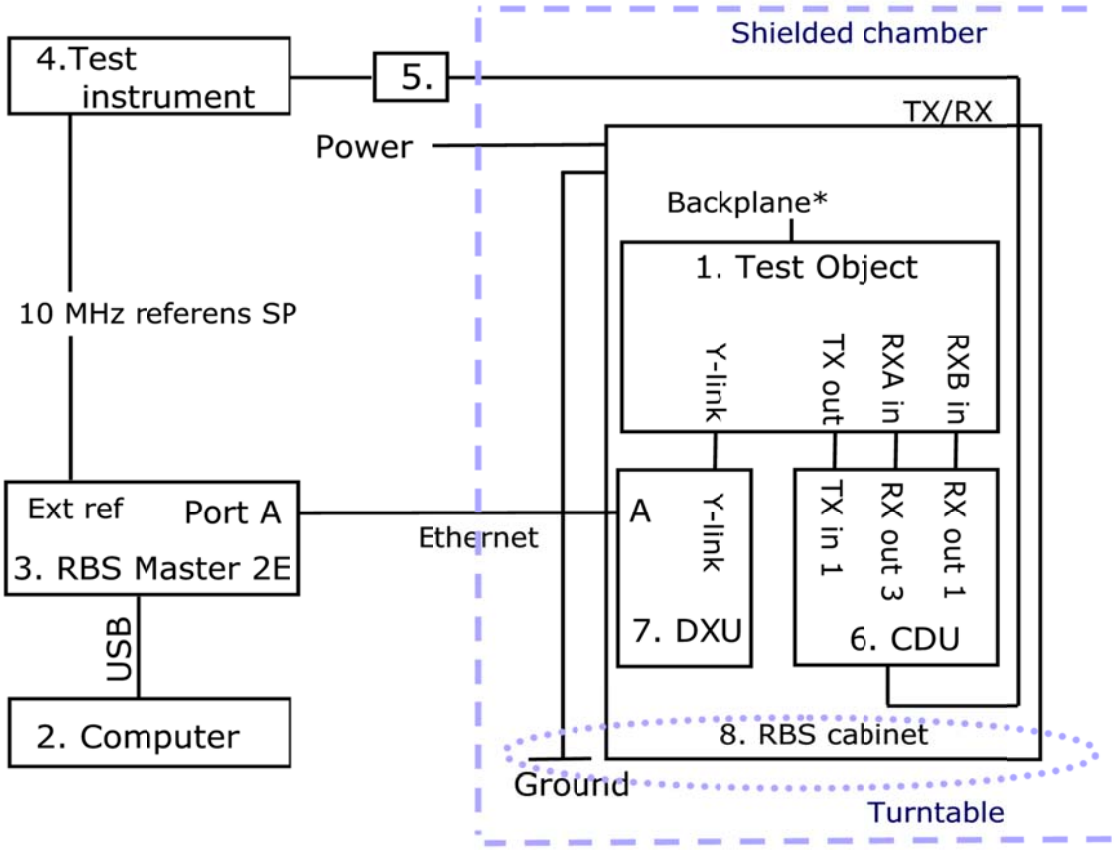
Test object

1. Transceiver Unit sTRU-19, product KRC 131 139/01, revision R1C ,
   SN AE5000PMLW, with FCC ID: B5KAKRC131139-01 and
   IC ID: 287V-AGS13901

Functional test equipment

2. HP laptop computer Compaq nc6000, product PM307ES#AB2, SN CNU51206GT, with 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 and SP test equipment according respective appendix
5. Attenuator / filter listed as test equipment in respective appendix
6. CDU-C+, product BFL 119 128/1, revision R1B, SN T04B238144
7./8. DXU and remaining RBS cabinet according hardware list in appendix 7

Test set-up, radiated emission



*) Power via backplane

Test object

1. Transceiver Unit sTRU-19, product KRC 131 139/01, revision R1C , SN AE5000PMLW, with FCC ID: B5KAKRC131139-01 and IC ID: 287V-AGS13901

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 intermediate signal monitoring or 50 ohm termination
5. Attenuator 40 dB, SP 504 159
6. CDU-C+, product BFL 119 128/1, revision R1B, SN T04B238144

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

Test object connections

Interface	Type of port
Power via RBS backplane	DC power
TX out to CDU-C+ TX in 1	RF interconnect
RXA in to CDU-C+ RX out 3	RF interconnect
RXB in to CDU-C+ RX out 1	RF interconnect
Y-link to DXU-21A port Y-link Y1-6	Signal

RBS cabinet external connections

Interface	Type of port:
External supply 24 V DC	DC power
Cabinet 7/16 top RF port connector of active CDU-C+ used for measurement and monitoring	RF/Antenna
Remaining cabinet top 7/16 RF ports unconnected	RF/Antenna
DXU 21A port A via adapter TH160 and Ethernet shielded multi-wire with RJ-45 connected to RBS master 2E, port A, mode E1	Telecom
DXU-21A ports B, C and D not connected	Telecom
DXU-21A port ESB not connected	Signal
DXU-21A port GPS not connected	Signal
DXU-21A port OMT interface for configuration not connected	O/M

RF Power output measurements according to CFR 47 2.1046 / RSS-133 6.4

Date	Temperature	Humidity
2011-06-28	22 °C ± 3 °C	60 % ± 5 %

Test set-up and procedure

Reference point for conducted measurements was the RF port on the RBS 2202 cabinet top side. The reference point was connected to a peak power analyser via a 50 ohm attenuator.

Measurement equipment	SP number
Boonton 4500A RF Peak power meter/analyser	503 144
Boonton Power sensor 56518-S/4	503 145
Attenuator	900 229
Multimeter Fluke 87	502 190
Testo 615 temperature and humidity meter	503 498

Measurement uncertainty: 0.7 dB

Results

Tested with RBS master 2E setting 45 for maximum nominal output power.

Transmitter power (dBm)			
Channel	Modulation	Peak	RMS
M	GMSK	41.3	40.4
M	16QAM	41.3	35.6
M	32QAM	41.2	35.4

The maximum PAR measured above was 5.8 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).

RSS-133: Base station transmitters operating within the frequency range 1930 – 1995 MHz shall not exceed 100 W output power. The peak-to-average (PAR) ratio shall not exceed 13 dB. 1640 W EIRP shall not be exceeded (according SRSP-510).

Complies?	Yes

Occupied bandwidth measurements according to 47CFR 2.1049 / RSS-Gen 4.6.1

Date	Temperature	Humidity
2011-06-28	22 °C ± 3 °C	60 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. The reference point for conducted measurements on the RBS 2202 cabinet top side was via an attenuator connected to a spectrum analyser with activated RMS detector. An external 10 MHz reference standard was used by the spectrum analyser during the measurements.

Measurement equipment	SP number
R&S FSIQ	503 738
Attenuator	900 229
Multimeter Fluke 87	502 190
Testo 615 temperature and humidity meter	503 498

Measurement uncertainty: 3.7 dB, 1.33 kHz

Results

Tested with RBS master 2E setting 45 for maximum nominal output power.
The measurement was performed on ARFCN 661 (1960.0 MHz).

		Modulation	OBW
Diagram	1:	GMSK	241 kHz
Diagram	2:	16QAM	237 kHz
Diagram	3:	32QAM	240 kHz

The diagrams are shown on the following pages.

Diagram 1:

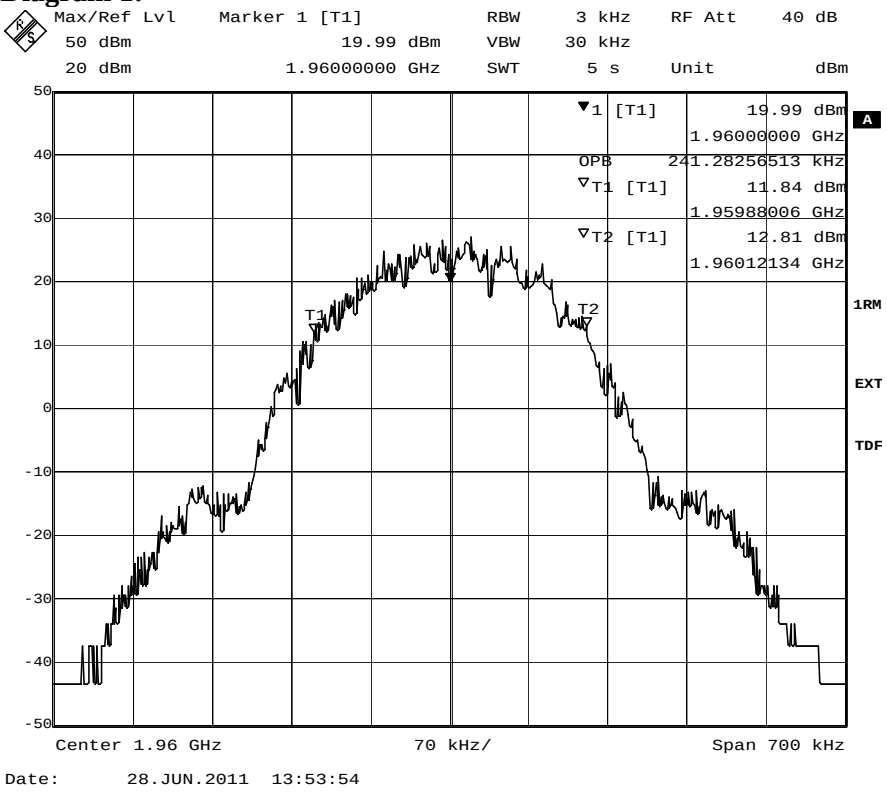


Diagram 2:

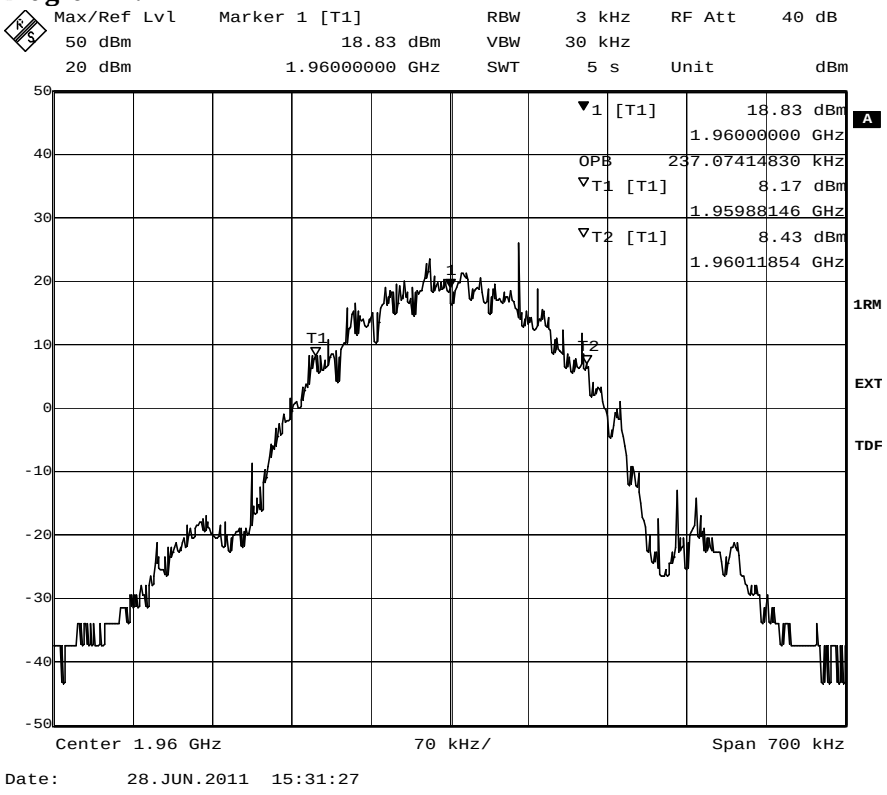
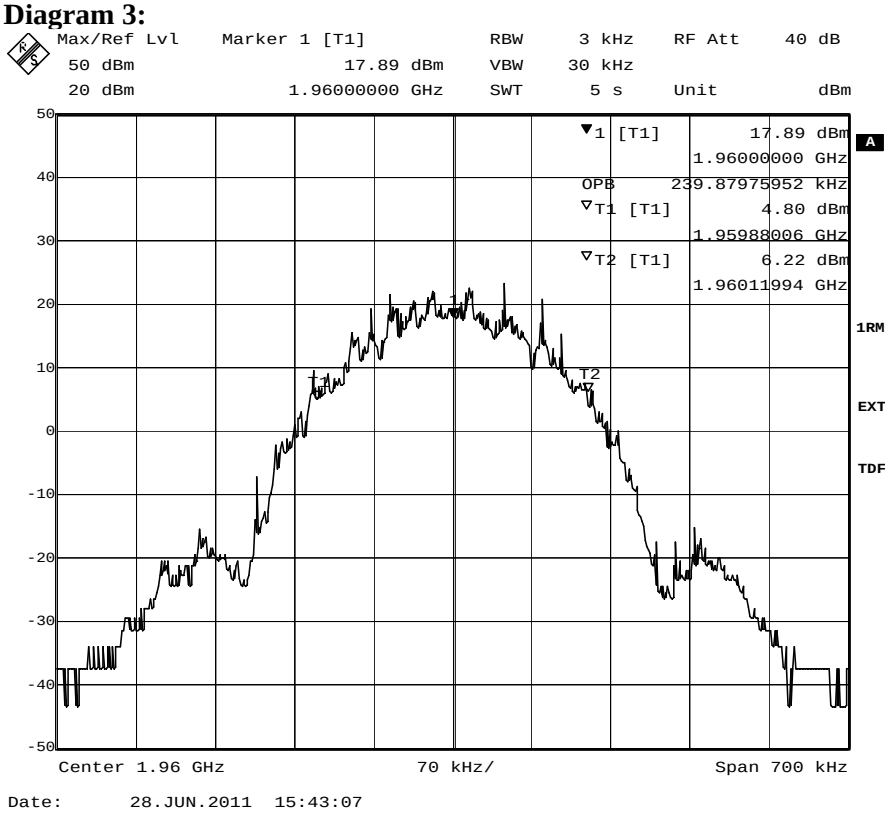


Diagram 3:


Max/Ref Lvl
50 dBm
20 dBm
Marker 1 [T1]
17.89 dBm
1.96000000 GHz
RBW 3 kHz
VBW 30 kHz
SWT 5 s
RF Att 40 dB
Unit dBm
1 [T1] 17.89 dBm
1.96000000 GHz
OPB 239.87975952 kHz
T1 [T1] 4.80 dBm
1.95988006 GHz
T2 [T1] 6.22 dBm
1.96011994 GHz
A
1RM
EXT
TDF
50
40
30
20
10
0
-10
-20
-30
-40
-50
T1
T2
Center 1.96 GHz
70 kHz/
Span 700 kHz
Date: 28.JUN.2011 15:43:07

Band edge measurements according to 47CFR 2.1051 / RSS-133 6.5

Date	Temperature	Humidity
2011-06-28	22 °C ± 3 °C	60 % ± 5 %
2011-06-29	22 °C ± 3 °C	45 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. The reference point for conducted measurements on the RBS 2202 cabinet top side was via an attenuator connected to a spectrum analyser with the RMS detector activated and an external 10 MHz reference standard being used 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	900 229
Multimeter Fluke 87	502 190
Testo 615 temperature and humidity meter	503 498

Measurement uncertainty: 3.7 dB

Results

Tested with RBS master 2E setting 45 for maximum nominal output power.

Diagram	Modulation	ARFCN (Frequency)
1 a, b, c	16QAM	512 (1930.2 MHz)
2 a, b, c	16QAM	810 (1989.8 MHz)
3 a, b, c	32QAM	512 (1930.2 MHz)
4 a, b, c	32QAM	810 (1989.8 MHz)

The results 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:

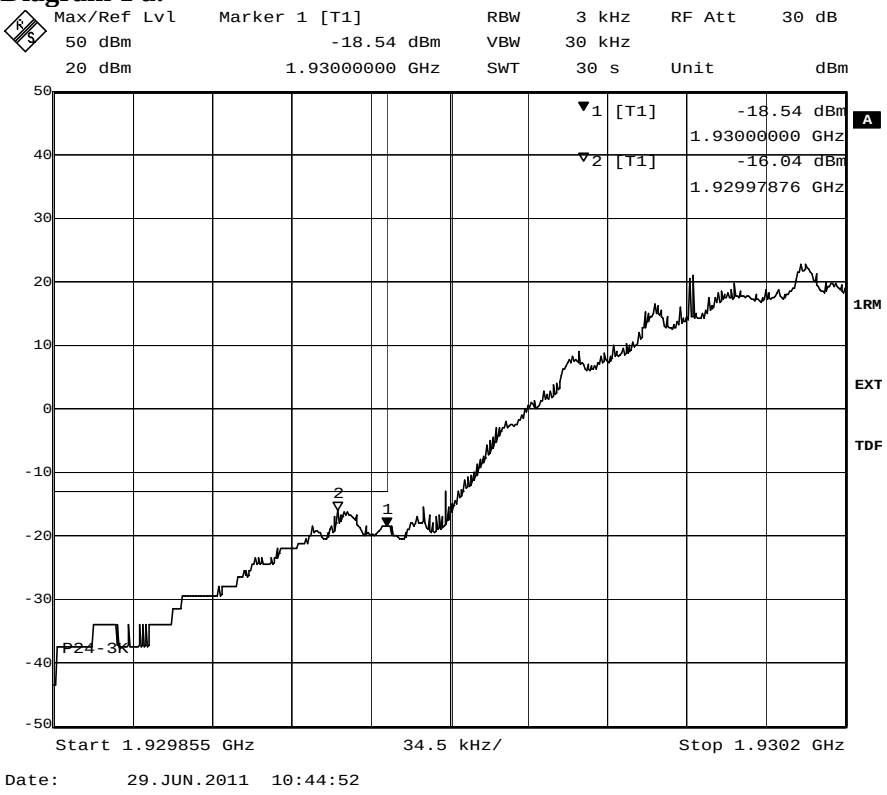


Diagram 1 b:

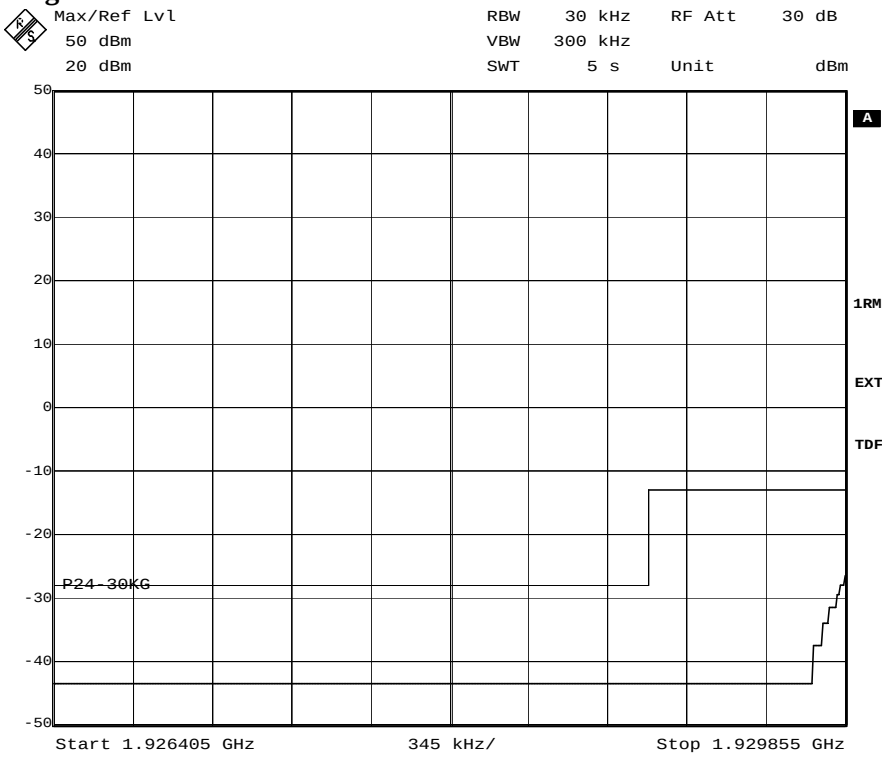


Diagram 1 c:

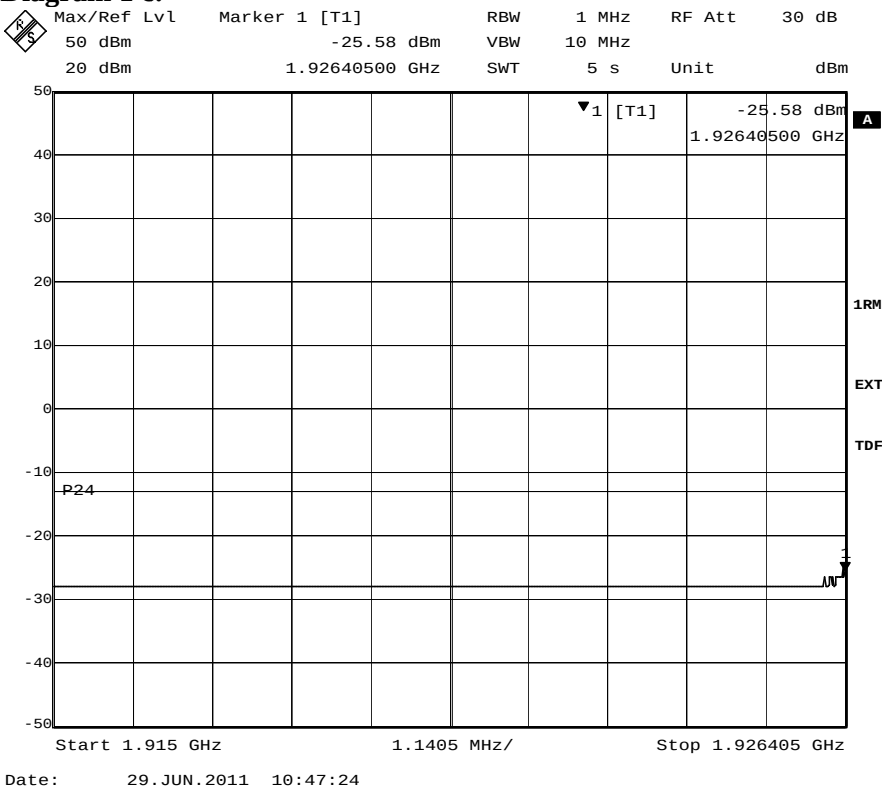

Max/Ref Lvl
50 dBm
20 dBm
Marker 1 [T1]
-25.58 dBm
1.92640500 GHz
RBW 1 MHz
VBW 10 MHz
SWT 5 s
RF Att 30 dB
Unit dBm
1 [T1]
-25.58 dBm
1.92640500 GHz
A
1RM
EXT
TDF
P24
Start 1.915 GHz
1.1405 MHz/
Stop 1.926405 GHz
Date: 29.JUN.2011 10:47:24

Diagram 2 a:

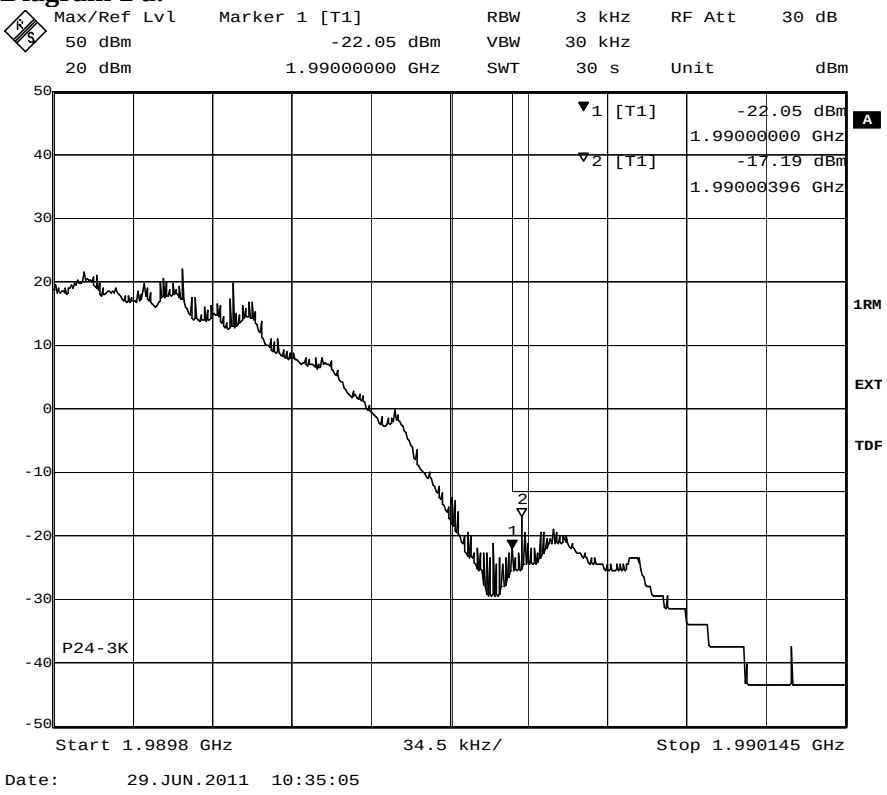


Diagram 2 b:

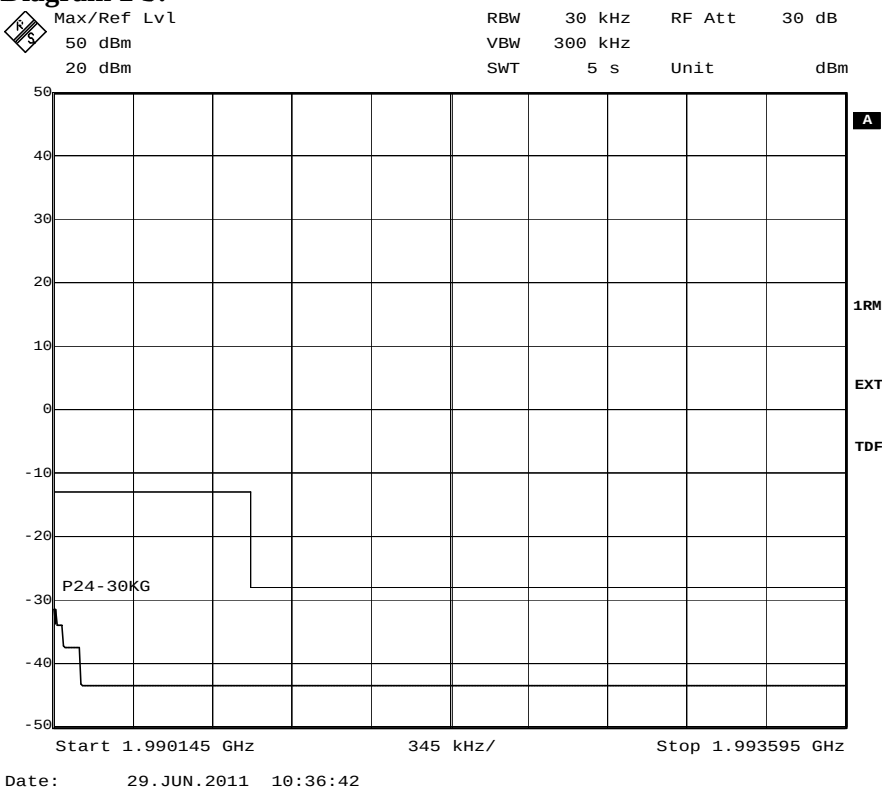


Diagram 2 c:

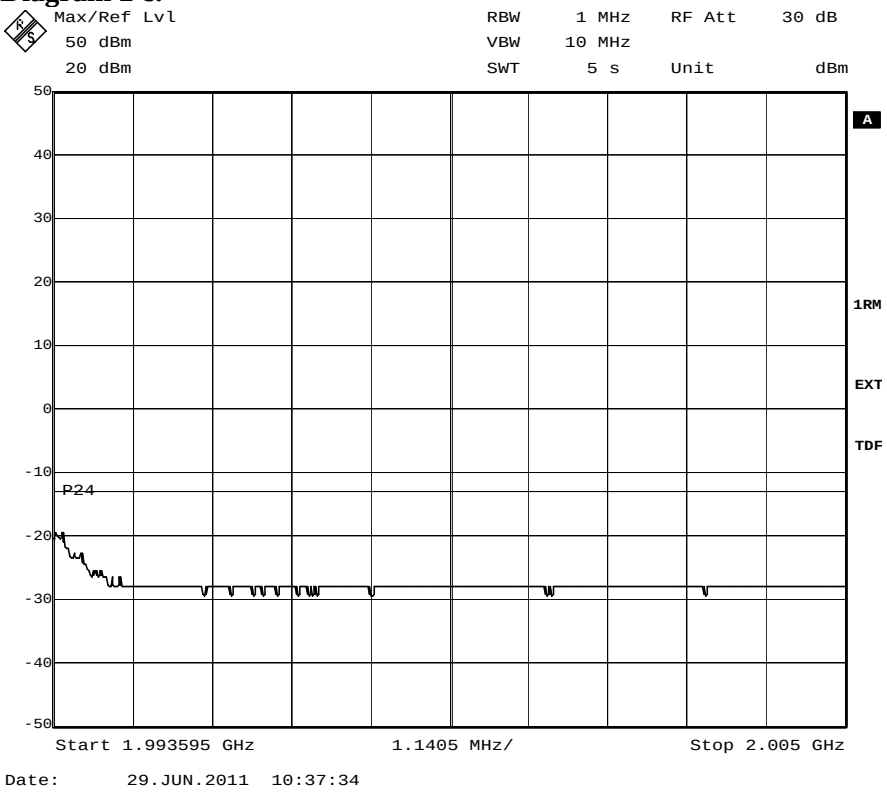

Max/Ref Lvl
50 dBm
20 dBm
RBW 1 MHz
VBW 10 MHz
SWT 5 s
RF Att 30 dB
Unit dBm
A
1RM
EXT
TDF
P24
Start 1.993595 GHz
1.1405 MHz/
Stop 2.005 GHz
Date: 29.JUN.2011 10:37:34

Diagram 3 a:

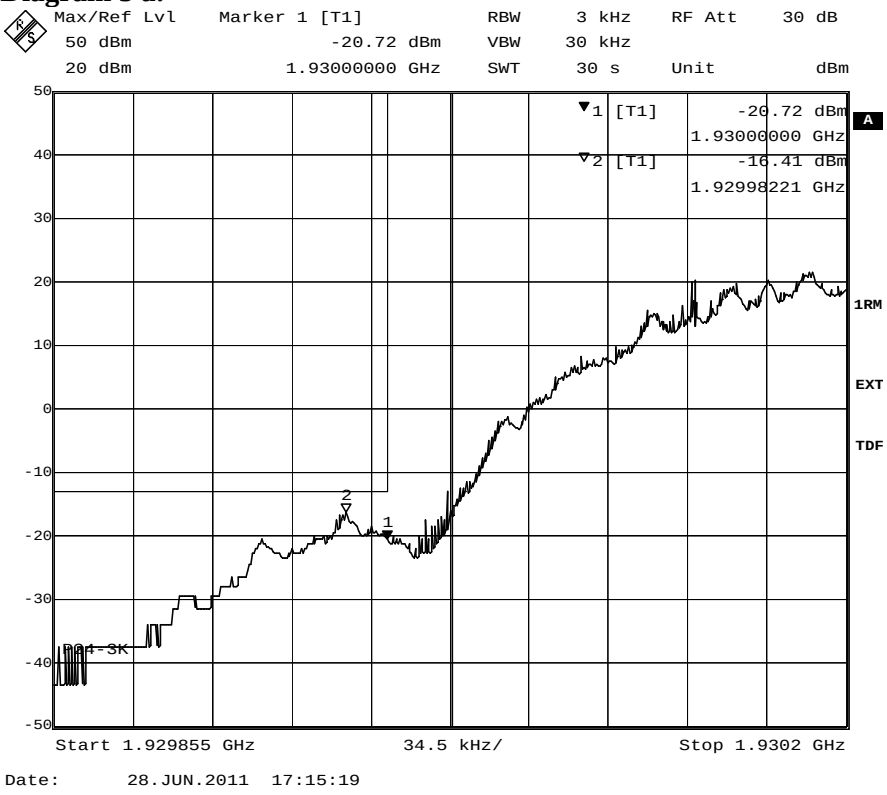


Diagram 3 b:

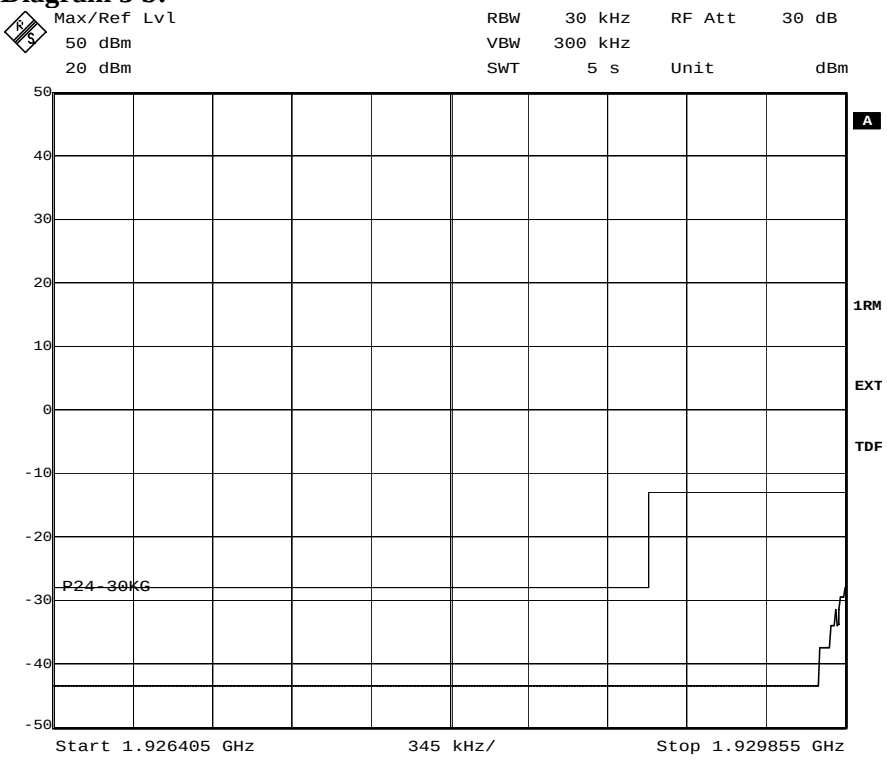


Diagram 3 c:

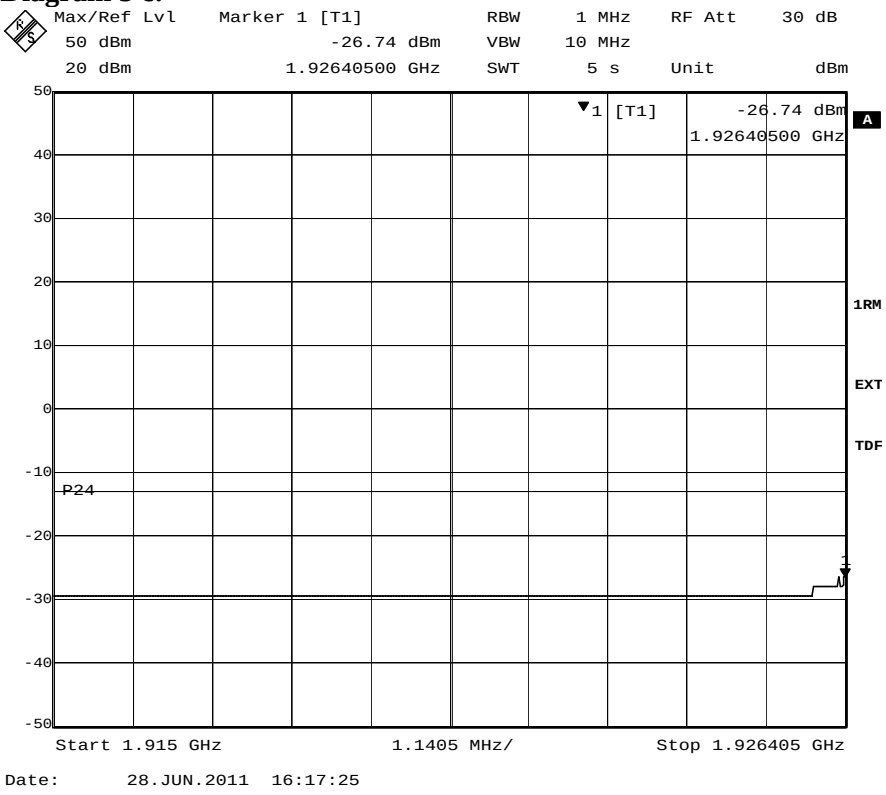

Max/Ref Lvl
50 dBm
20 dBm
Marker 1 [T1]
-26.74 dBm
1.92640500 GHz
RBW 1 MHz
VBW 10 MHz
SWT 5 s
RF Att 30 dB
Unit dBm
1 [T1]
-26.74 dBm
1.92640500 GHz
A
1RM
EXT
TDF
P24
Start 1.915 GHz
1.1405 MHz/
Stop 1.926405 GHz
Date: 28.JUN.2011 16:17:25

Diagram 4 a:

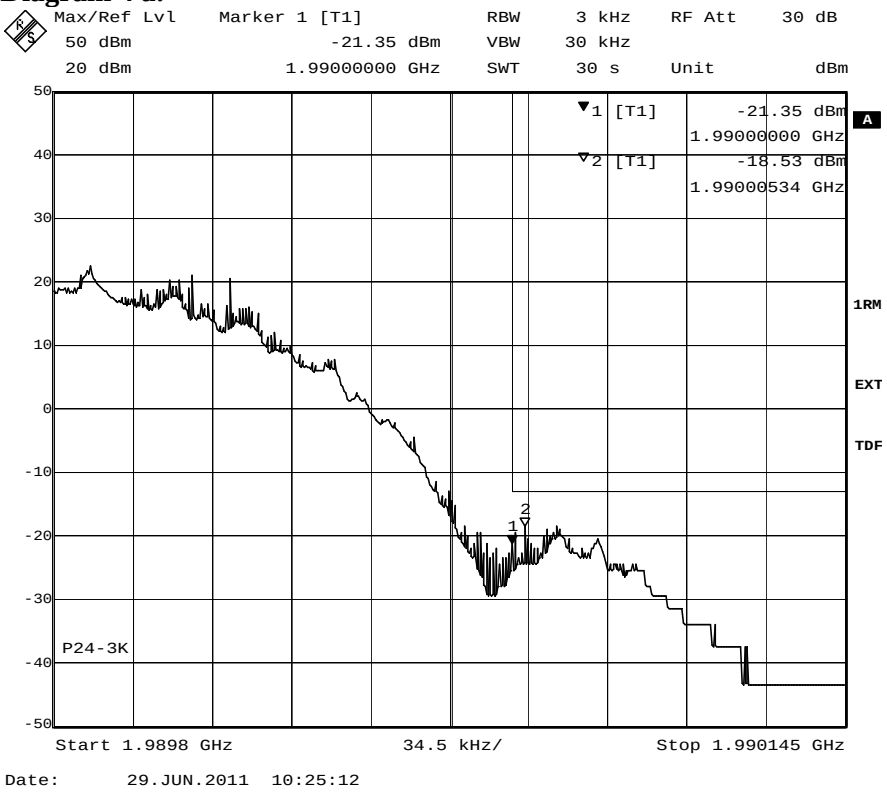


Diagram 4 b:

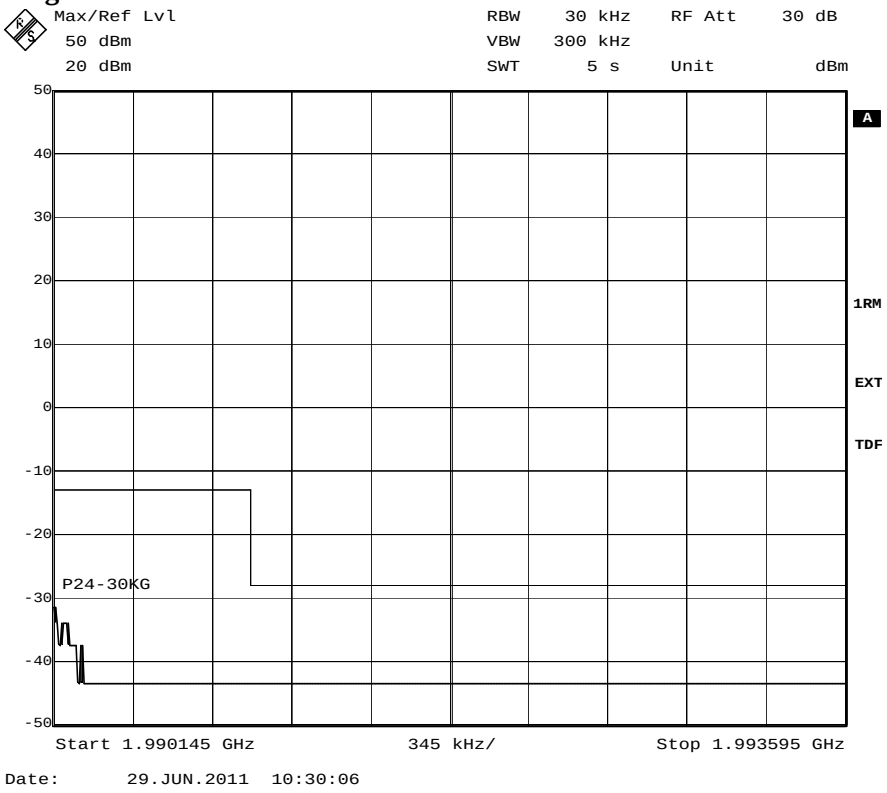
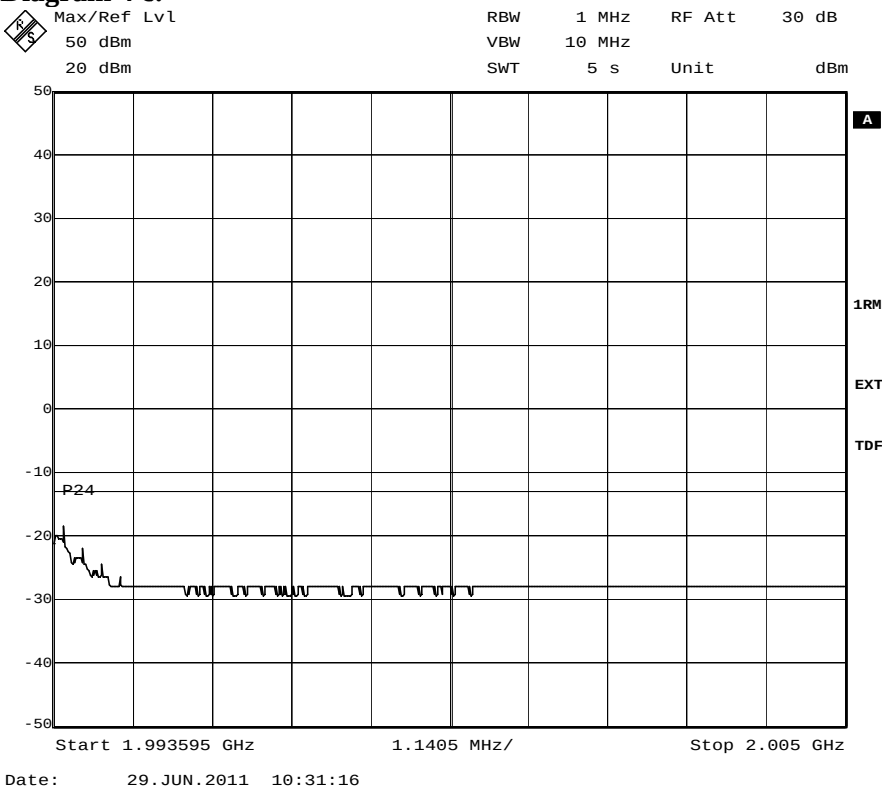


Diagram 4 c:


Max/Ref Lvl
50 dBm
20 dBm
RBW 1 MHz
VBW 10 MHz
SWT 5 s
RF Att 30 dB
Unit dBm
A
1RM
EXT
TDF
P24
50
40
30
20
10
0
-10
-20
-30
-40
-50
Start 1.993595 GHz
1.1405 MHz/
Stop 2.005 GHz
Date: 29.JUN.2011 10:31:16

Conducted spurious emission measurements according to 47CFR 2.1051 / RSS-133 6.5

Date	Temperature	Humidity
2011-06-28	22 °C ± 3 °C	60 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. The reference point for conducted measurements on the RBS 2202 cabinet top side was via an attenuator 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	900 229
Highpass filter	504 200
Multimeter Fluke 87	502 190
Testo 615 temperature and humidity meter	503 498

Measurement uncertainty: 3.7 dB

Results

Tested with RBS master 2E setting 45 for maximum nominal output power and TX 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:	16QAM	9 KHz – 3 GHz
2 b:	16QAM	3 GHz – 20 GHz
3 a:	32QAM	9 KHz – 3 GHz
3 b:	32QAM	3 GHz – 20 GHz

The results 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

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm per 1 MHz RBW.

Complies?	Yes

Diagram 1 a:

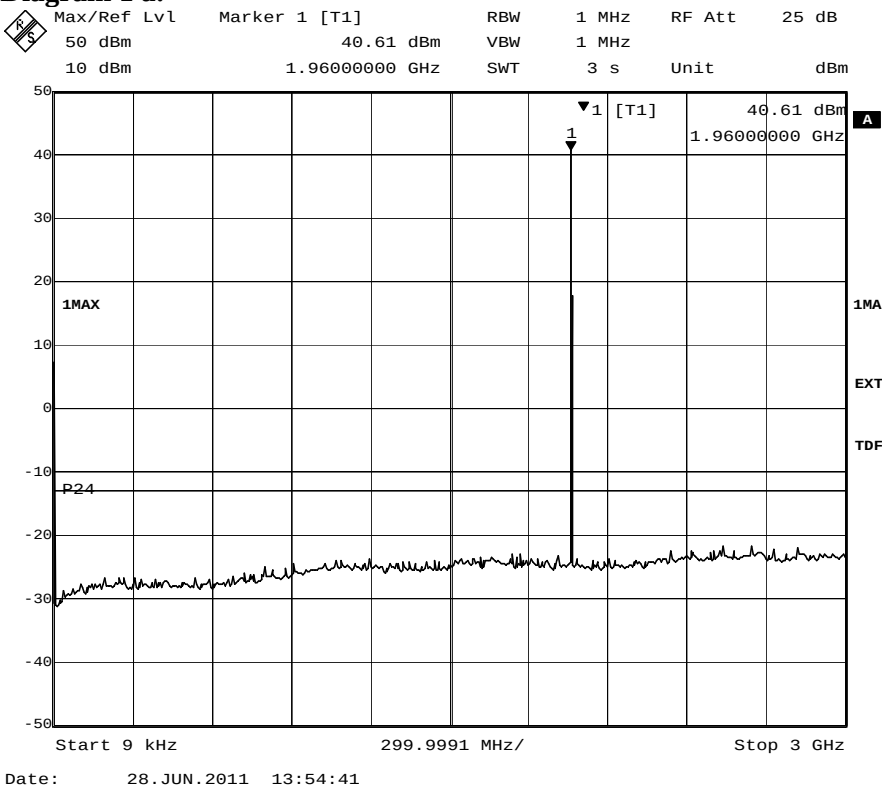


Diagram 1 b:

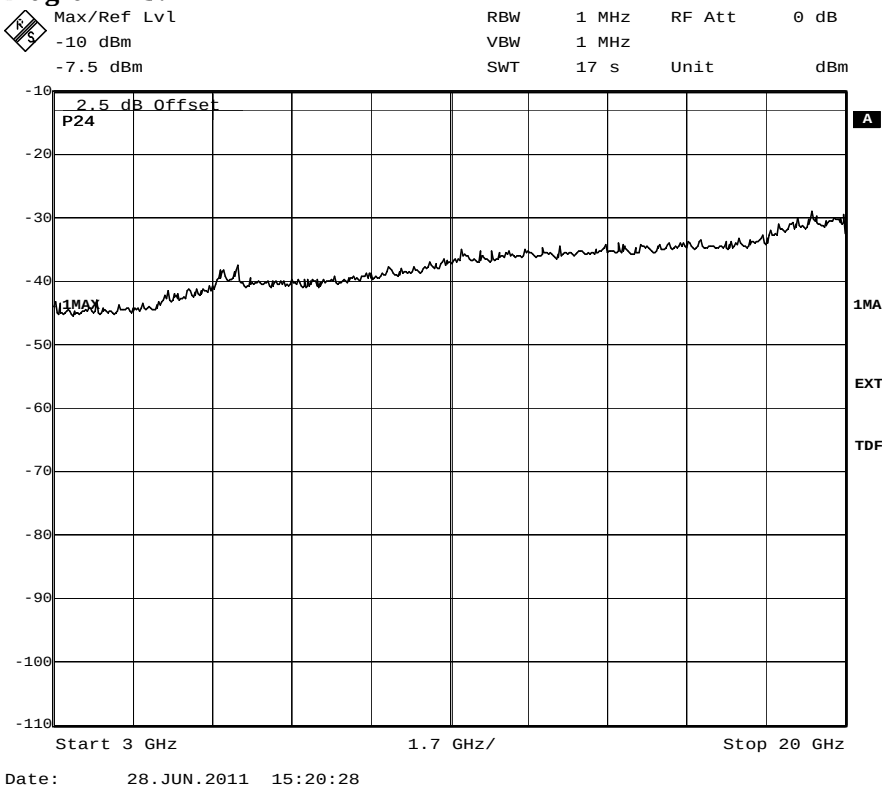


Diagram 2 a:

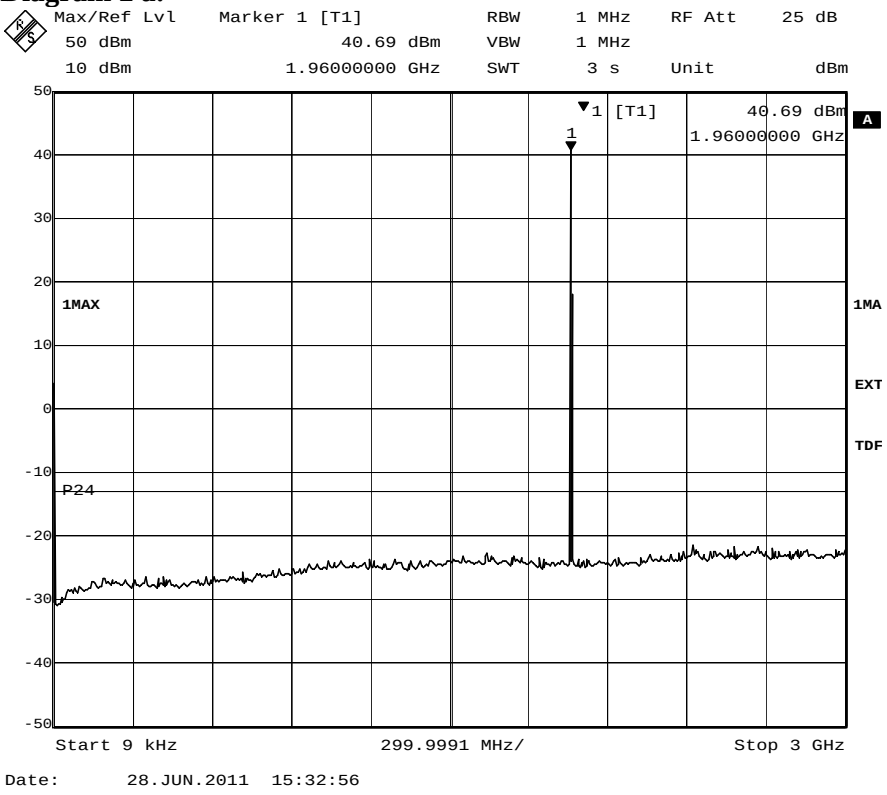


Diagram 2 b:

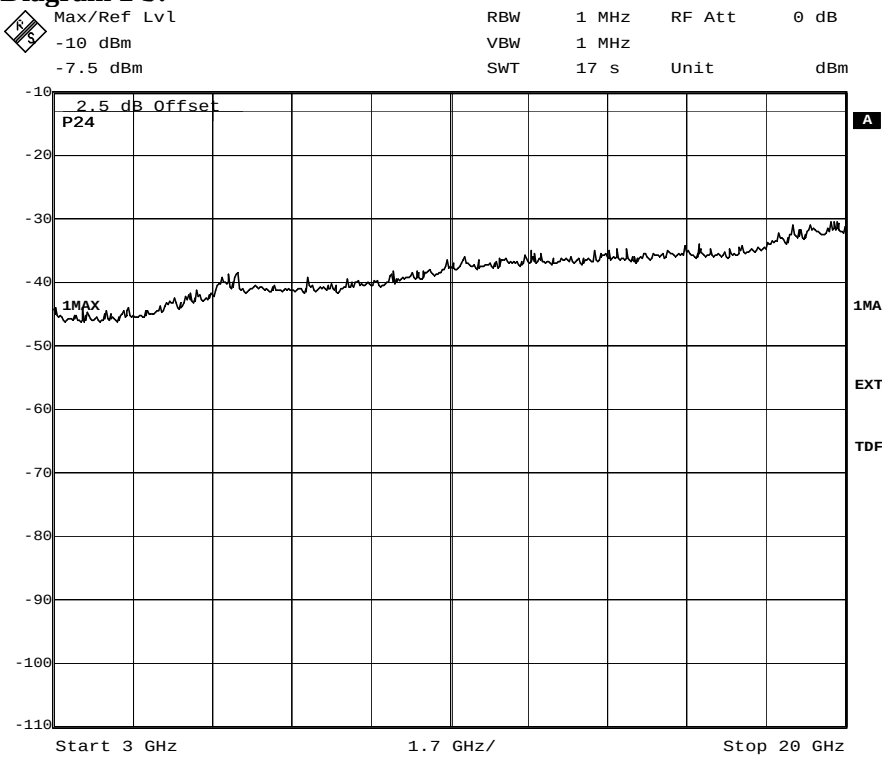


Diagram 3 a:

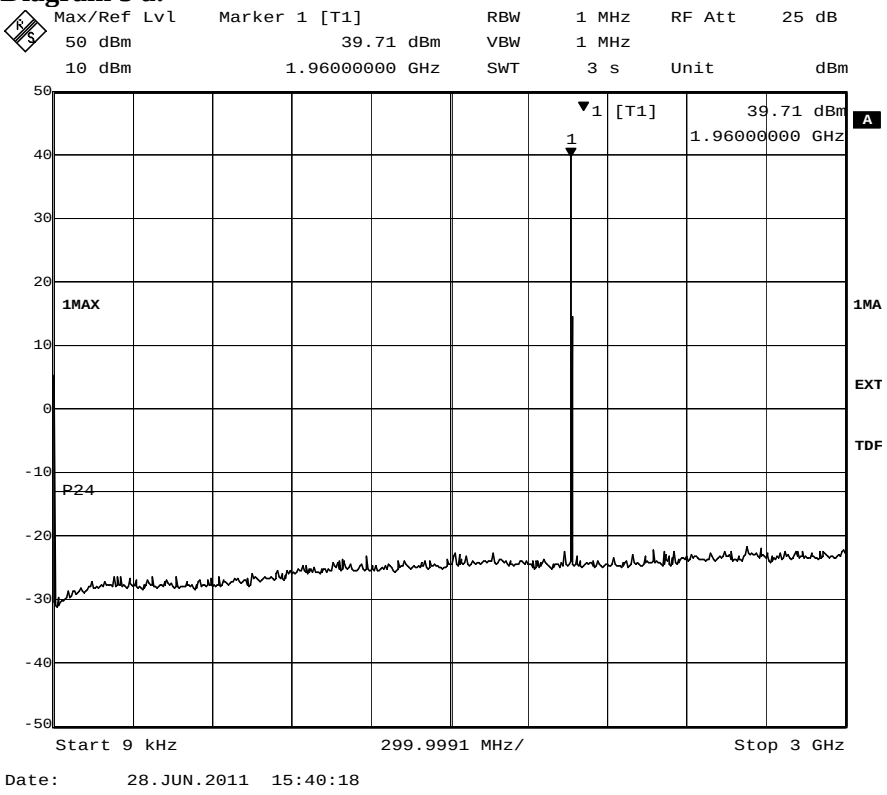
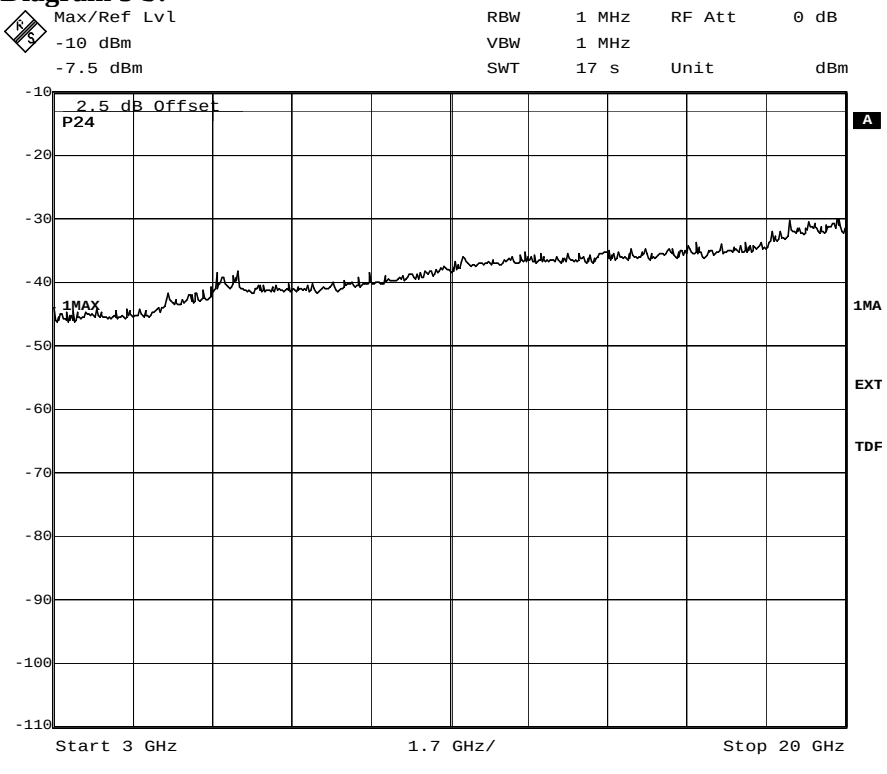


Diagram 3 b:



Field strength of spurious radiation measurements according to 47CFR 2.1053 / RSS-133 6.5

Date	Temperature	Humidity
2011-06-27	22 °C ± 3 °C	46 % ± 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.

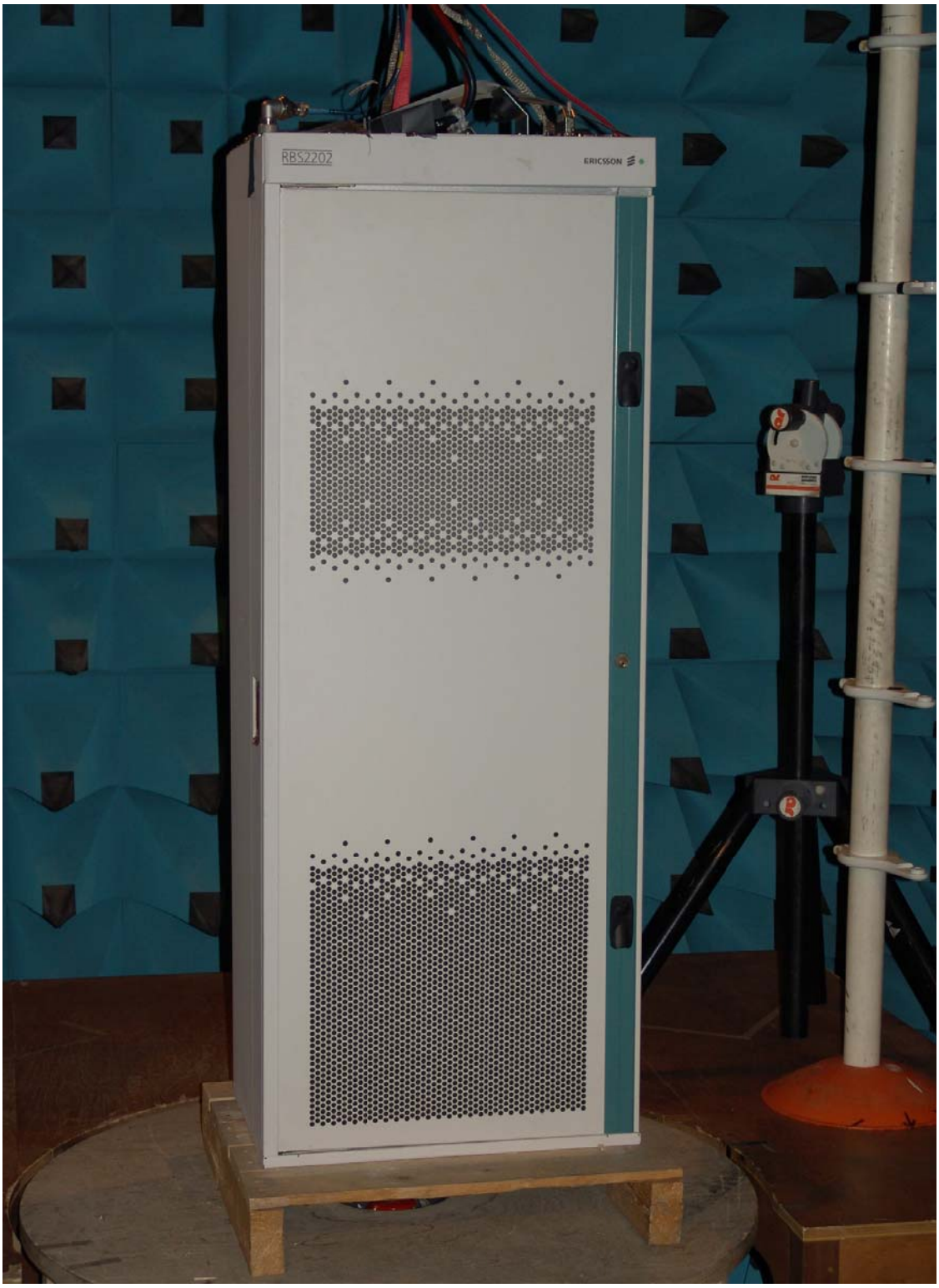
The measurement procedure was as the following:

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.

Tested with RBS master 2E setting 45 for maximum nominal output power.
TX ARFCN 661 (1960.0 MHz).

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
RLC Electronics HP-filter F-16149	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 16QAM

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

Modulation 32QAM

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

§24.238 and RSS-133 6.5

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm per 1 MHz RBW.

Complies?	Yes

Hardware list RBS 2202, conducted and radiated measurements

Pos.	Unit	Product Number	Revision	Serial Number
	RBS 2202 cabinet	SEB 112 1024/01	R3B	A5304BSJXF
	IDM	BMG 980 316/1	R1C	S762013601
	sTRU sub rack	BFL 119 80/3	R3A	-
1	sTRU-19	KRC 131 139/01	R1C	AE5000PMLW
2	sTRU-19	KRC 131 139/01	R1C	AE5000PZUP
3	Empty	-	-	-
4	Empty	-	-	-
5	Empty	-	-	-
6	Empty	-	-	-
	CDU Subrack	BFL 119 319/1	R1A	-
1	CDU-C+	BFL 119 128/1	R1B	T04B238144
2	CDU-C+	BFL 119 128/1	R1B	A40003JACO
3	CDU-C+	BFL 119 128/1	R1B	T04B238519
	PSU/DXU subrack	BFL 119 310/1	R1G	-
1	PSU 230	BML 231 201/1	R5D	A0800CC9JS
2	PSU 230	BML 231 201/1	R5D	A0800CC9KA
3	PSU 230	BML 231 201/1	R5D	A0800C6F1Z
4	PSU 230	BML 231 201/1	R5D	A0800CC9JV
5	ECU	BMT 903 021/1	R6H	A0800DLXGZ
6	DXU-21A	BOE 602 14/1	R14A	TU84973325
	Cover plate			

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

Left side

Right side