



# REPORT

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## Permissible change measurements on Remote Radio Unit with FCC ID: B5KCKRC16184-7

(8 appendices)

### Test object

RRU-M8, product KRC 161 84/7, revision R7E, SN C821096393

See appendix 1 for general information. Appendix 7 lists hardware and software.  
Appendix 8 shows photos of the tested equipment.

### Summary


Standard	Compliant	Appendix	Remarks
<b>FCC CFR 47 / IC RSS-132 Issue 2</b>			
2.1046 / RSS-132 4.4 RF Power output	Yes	2	-
2.1049 / RSS-132 4.5 Occupied bandwidth	Yes	3	-
2.1051 / RSS-132 4.5 Band Edge	Yes	4	-
2.1051 / RSS-132 4.5 Spurious emission at antenna port	Yes	5	-
2.1053 / RSS-132 4.5 Field strength of spurious radiation	Yes	6	-

Note: Above RSS-132 items are given as cross-reference only. Measurements were performed according to ANSI procedures referenced by FCC and covered by SP's accreditation.

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**Description - Equipment Under Test (EUT)**

Equipment:	GSM Base station Remote Radio Unit			
TX frequency range:	869.2 – 893.8 MHz			
Modulations:	GMSK, 8PSK, 16QAM and 32QAM			
	Modulation			
Nominal maximum output power, RMS value in [dBm]:	GMSK	8PSK	16QAM	32QAM
	34.0	30.7	29.3	28.9
Supply voltage:	-48 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 according FCC CFR47 by re-testing the updated equipment with GMSK, 16QAM and 32QAM modulation.

**Summary of results**

Measurement results are near identical for all modulations, apart from RMS output power, where GMSK modulation results in the highest RMS output power. GMSK modulation can be considered a worst case set-up.

**Tested configuration**

The test object was mounted into a RBS 2308 base station during the test. Refer to appendix 7 for the hardware and software list. The test object was activated at maximum power, unless noted otherwise. Random data was transmitted in all time slots with the various modulations being tested, one at a time. This set-up was considered a worst-case configuration.

**Conducted measurements**

Conducted measurements were done at antenna connector “TX(/RX) 1”.

**Radiated measurements**

During radiated emission measurements the antenna connector “TX(/RX) 1” was via a 50 ohm attenuator connected to a spectrum analyser 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. GMSK modulation was chosen as worst case reference modulation to compare the new 16QAM and 32QAM modulations with.

**Frequencies used**

ARFCN	Frequency	Comment
128	869.2 MHz	Bottom TX frequency
190	881.6 MHz	Mid TX frequency
251	893.8 MHz	Top TX frequency



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Appendix 1

**Manufacturer's representative**

Hua Yang, Ericsson (China) Communications Company Ltd

**References**

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

ANSI/TIA/EIA-603-C-2004

ANSI/TIA/EIA 136-280-D-2002

RSS-132, Issue 2 (September 2005)

RSS-Gen, Issue 2 (June 2007)

**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: 2010-05-07.

**Test equipment**

Measurement equipment	Calibration Due	SP number
Anechoic chamber, Hertz	2010-10	15:116
Boonton RF Peak power meter/analyzer	2010-09	503 144
Boonton Power sensor 56518-S/4	2012-02	503 146
Rohde & Schwarz FSQ40	2010-07	504 143
Rohde & Schwarz FSIQ40	2010-10	503 738
Rohde & Schwarz ESI40	2010-07	503 125
Rohde & Schwarz Vector Network Analyser	2010-07	503 687
Chase bilog antenna CBL 6121A	2011-10	502 460
Schaffner Reference Dipole BSRD6500	2012-03	502 181
EMCO Horn Antenna 3115	2011-01	502 175
EMCO Horn Antenna 3115	2011-02	501 548
MITEQ Low Noise Amplifier	2010-06	503 277
Attenuator 40 dB	2010-06	504 159
Attenuator 30 dB	2010-08	900 229
Wainright high pass filter	2011-03	504 199
RLC Electronics high pass filter F-16149	2010-06	503 739
Multimeter Fluke 87	2011-01	502 190
Testo 615 temperature and humidity meter	2012-03	503 498
Testo 635 temperature and humidity meter	2012-03	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).



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Appendix 1

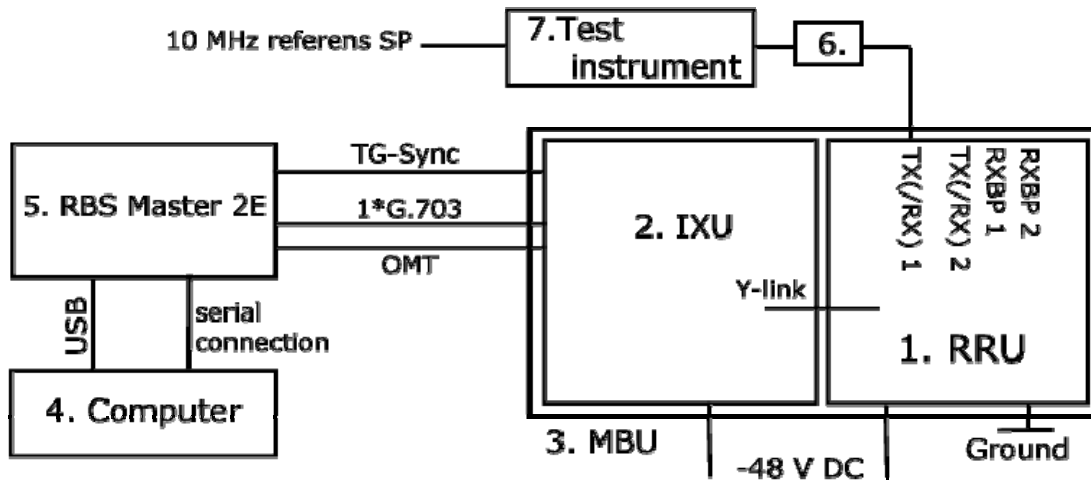
**Test engineers**

Reinhold Reul and Fredrik Isaksson

**Test witnesses**

Bo Zhao and Kevin Sun, Ericsson (China) Communications Company Ltd.

**Test set-up conducted measurements**



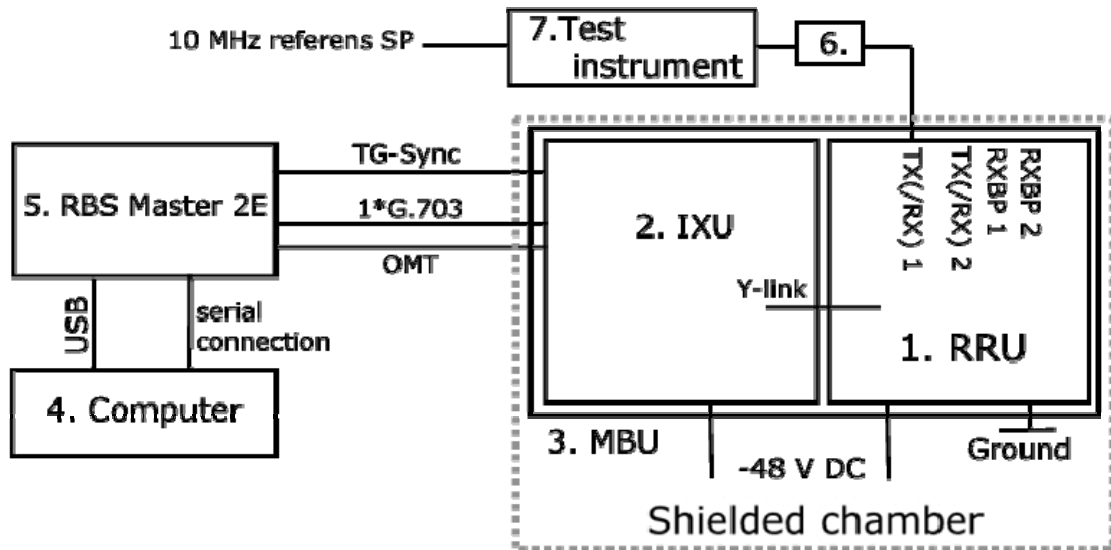
**Test object**

1. RRU-M8, product KRC 161 84/7, revision R7E, SN C821096393 with FCC ID: B5KCKRC16184-7

**Functional test equipment**

2. IXU according hardware list in appendix 7
3. MBU frame according hardware list in appendix 7
4. HP laptop computer model Compaq NC6400,SN CND70310FD With software RBS Master2 control software, revision R7D02
5. Ericsson RBS Master 2E hardware, product number LBY 107 1007/3, revision R1C BAMS 1000735209
6. Attenuator / filter listed under test equipment in respective appendix
7. Measurement equipment specified in respective appendix  
The modulation type was verified using client-supplied Agilent MXA Signal Analyser model N9020A 20 Hz – 26.5 GHz, BAMS 1000737857

**Test set-up radiated measurements**



**Test object**

1. RRU-M8, product KRC 161 84/7, revision R7E, SN C821096393 with FCC ID: B5KCKRC16184-7

**Functional test equipment**

2. IXU according hardware list in appendix 7
3. MBU frame according hardware list in appendix 7
4. HP laptop computer model Compaq NC6400 SN CND72717JP With software RBS Master2 control software, revision R7D02
5. Ericsson RBS Master 2E hardware, product number LBY 107 1007/3, revision R1C, BAMS 1000735211
6. Attenuator 30 dB, SP 900229
7. Rohde & Schwarz FSIQ40 for signal monitoring, SP 503738



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Appendix 1

**Test object connections**

**Interface**

-48 V DC  
GND  
Y-link to IXU, IEEE-1394 interface  
TX(/RX) 1, connected to test equipment  
TX(/RX) 2, RXBP 1, RXBP 2 unconnected

**Type of port**

DC power  
Ground  
Signal  
RF/Antenna  
RF/Antenna

**Other connections**

**Interface**

PC – RBS Master 2E USB connection  
PC – RBS Master 2E serial communication  
TG-sync connection between RBS Master 2E & MU  
IXU supply -48 V DC  
G.703, shielded multi-wire with RJ-45connector, mode E1  
OMT interface (only configuration, not connected in normal use)

**Type of port:**

Signal  
Signal  
Signal  
DC power  
Telecom  
O/M





**RF Power output measurements according to CFR 47 2.1046 / IC RSS-132 4.4**

Date 2010-06-01	Temperature 22 °C ± 3 °C	Humidity 32 % ± 5 %
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**Test set-up and procedure**

Measurements were made at output connector TX(/RX) 1. The output was connected to a peak power analyser via a 50 ohm attenuator. The transmitter was modulated with pseudorandom data in all the time slots during the measurements.

Measurement equipment	SP number
Boonton RF Peak power meter/analyzer	503 144
Boonton Power sensor 56518-S/4	503 146
Attenuator	504 159
Multimeter Fluke 87	502 190
Testo 615 temperature and humidity meter	503 498

**Measurement uncertainty: 0.7 dB**

**Results**

Configuration: RBS master 2E setting 33, maximum nominal output power.  
The measurement was performed at ARFCN 190 (881.6 MHz).

Test conditions Modulation		Transmitter power (dBm) Peak / RMS		
		GMSK	16QAM	32QAM
T <sub>nom</sub> 22 °C	V <sub>nom</sub> -48.0 V DC	34.2 / 33.6	34.2 / 29.6	34.2 / 28.8

**Limit**

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

RSS-132 / SRSP-503:

1640 W EIRP shall not be exceeded with an antenna height above average terrain (HAAT) up to 150 m, except in urban areas where they are limited to a maximum EIRP of 820 watts.

Complies?	Yes
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**Occupied bandwidth measurements according to 47CFR 2.1049 / IC RSS-132 4.5**

Date 2010-06-01	Temperature 22 °C ± 3 °C	Humidity 32 % ± 5 %
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**Test set-up and procedure**

Measurements were made at RF connector TX(/RX) 1. 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. The transmitter was activated at maximum output power and modulated with pseudorandom data during the measurements.

Measurement equipment	SP number
Rohde & Schwarz FSQ40	504 143
Attenuator	504 159
Testo 615 temperature and humidity meter	503 498

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

**Results**

The results are shown in appendix 3.1

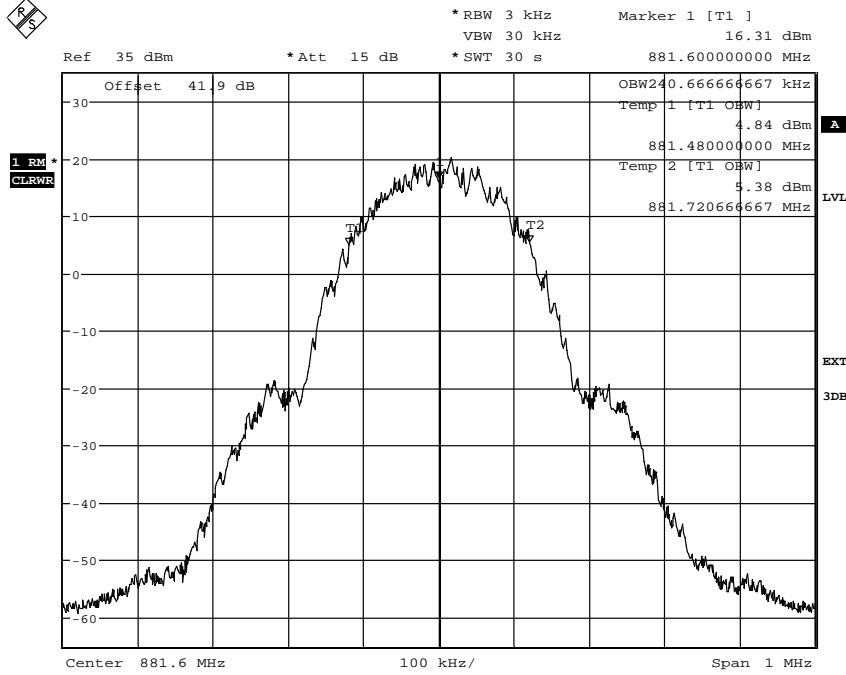
Configuration: RBS master 2E setting 33, maximum nominal output power.  
The measurement was performed at ARFCN 190 (881.6 MHz).

	<b>Modulation</b>	<b>OBW</b>	
Diagram 1:	GMSK	240.7	kHz
Diagram 2:	16QAM	240.7	kHz
Diagram 3:	32QAM	240.7	kHz

Complies?	Yes
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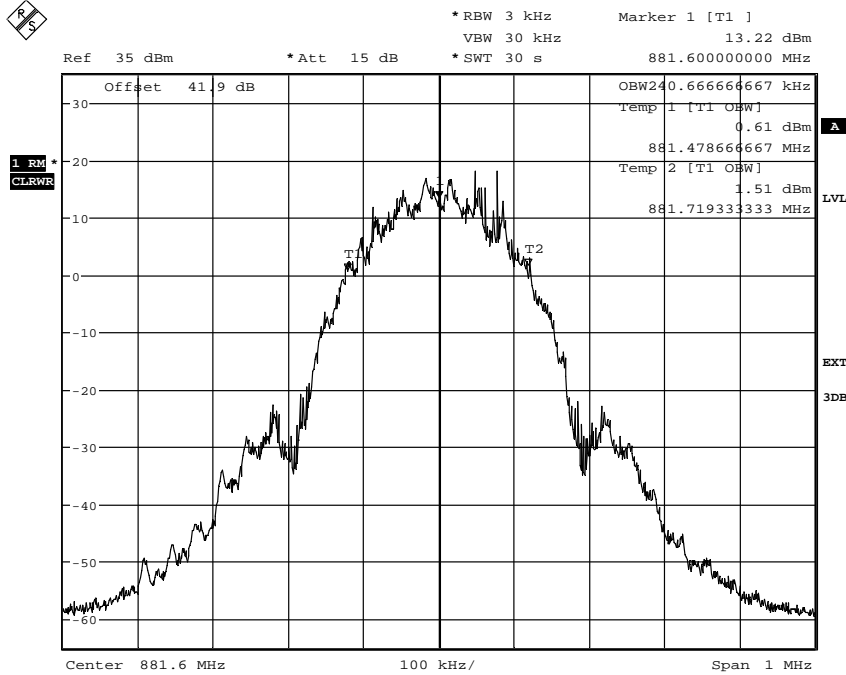


Diagram 1



Date: 1.JUN.2010 14:20:37

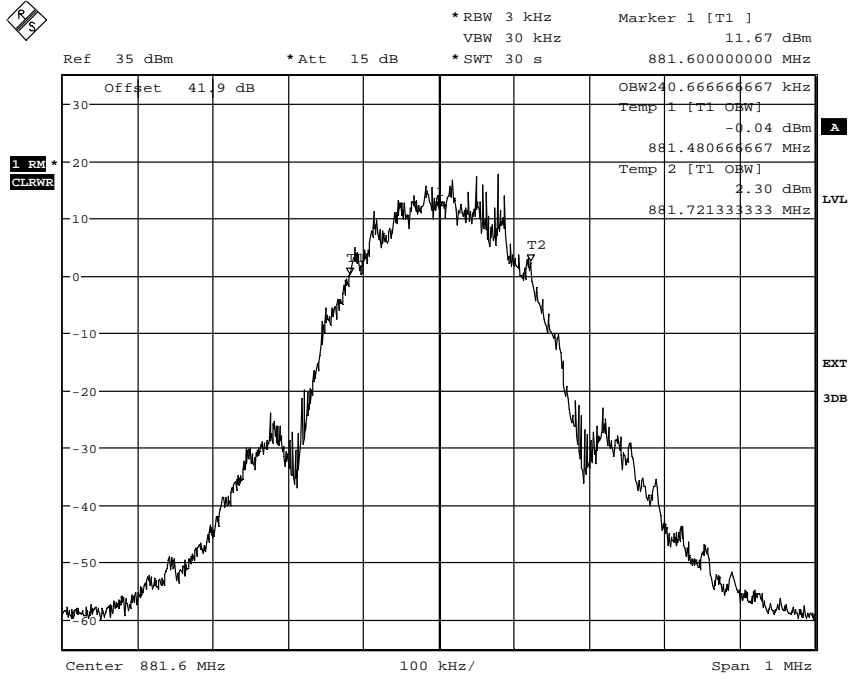
Diagram 2



Date: 1.JUN.2010 14:30:06



Diagram 3



Date: 1.JUN.2010 14:37:39



**Band edge measurements according to 47CFR 2.1049 / IC RSS-132 4.5**

Date 2010-06-01	Temperature 22 °C ± 3 °C	Humidity 32 % ± 5 %
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**Test set-up and procedure**

The measurements were made per definition in §22.917, with the test object output TX(/RX) 1 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.

FCC rules specify a RBW of 100 KHz for measurements of emissions >1 MHz away from the band edges. For the measurement close to the band edges a resolution bandwidth of 3 kHz was used. The limit line was adapted to the reduced RBW by -15.2 dB ( $10 \cdot \log(3/100)$ ) to -28.2 dBm for frequencies >1 MHz away from the band edges.

Measurement equipment	SP number
Rohde & Schwarz FSQ40	504 143
Attenuator	504 159
Testo 615 temperature and humidity meter	503 498

**Measurement uncertainty:** 3.7 dB

**Results**

The results are shown in appendix 4.1

Configuration: RBS master 2E setting 33, maximum nominal output power.

- Diagram 1 16QAM, Ch 128 (869.2 MHz) Lower band edge
- Diagram 2 16QAM, Ch 251 (893.8 MHz) Upper band edge
- Diagram 3 32QAM, Ch 128 (869.2 MHz) Lower band edge
- Diagram 4 32QAM, Ch 251 (893.8 MHz) Upper band edge

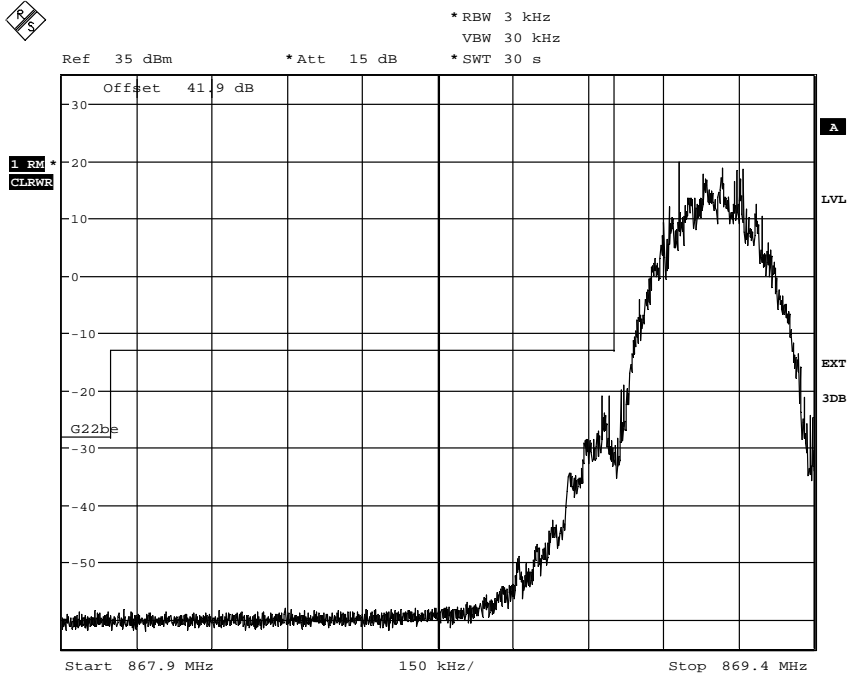
**Limits**

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.

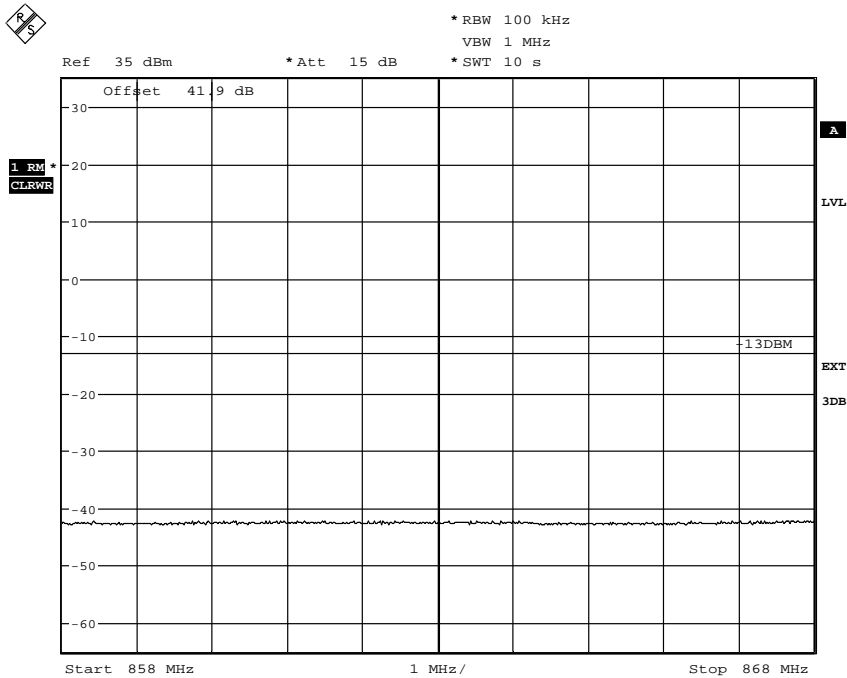
Tested configurations comply?	Yes
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Diagram 1



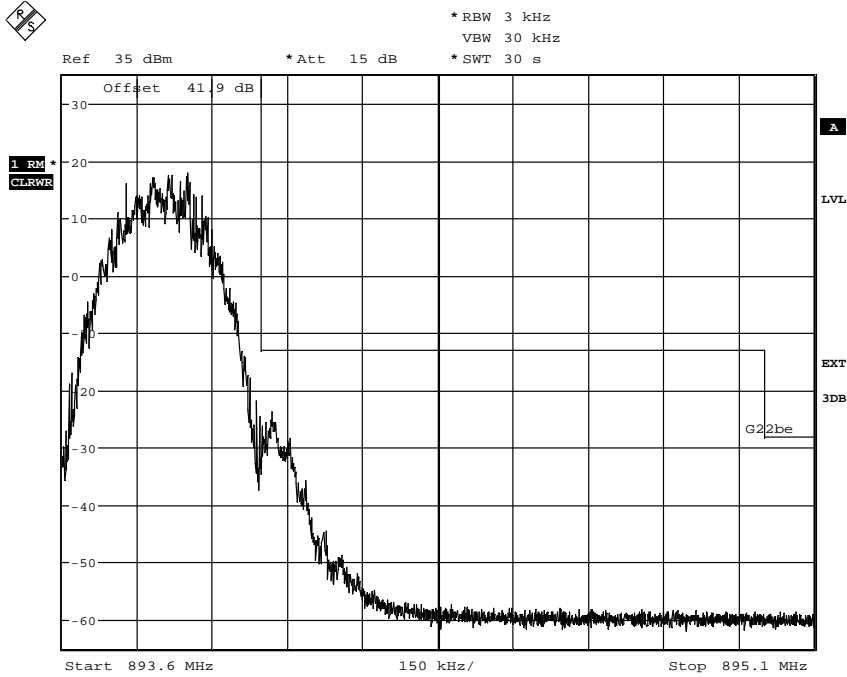
Date: 1.JUN.2010 13:58:00



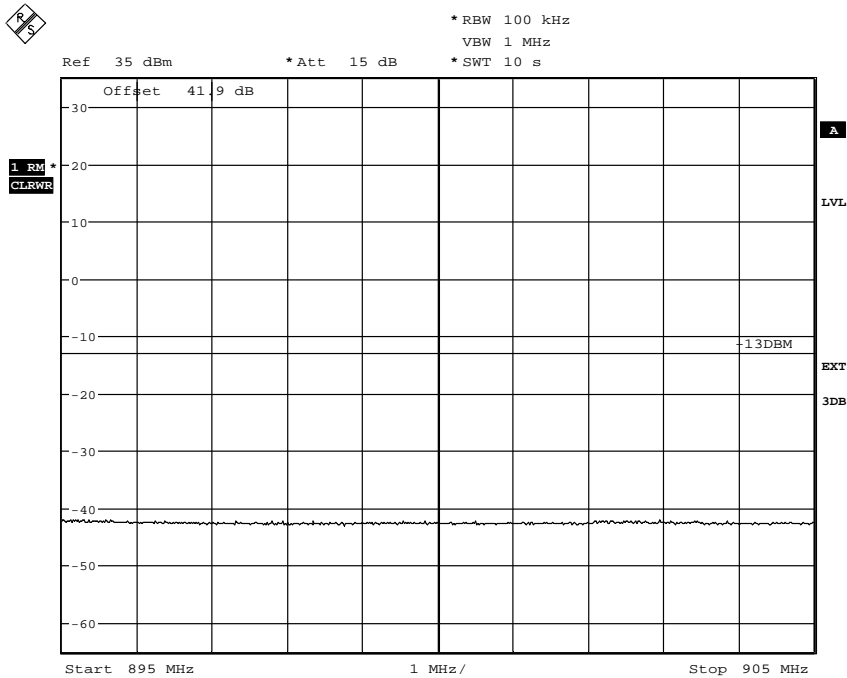
Date: 1.JUN.2010 13:58:56



Diagram 2



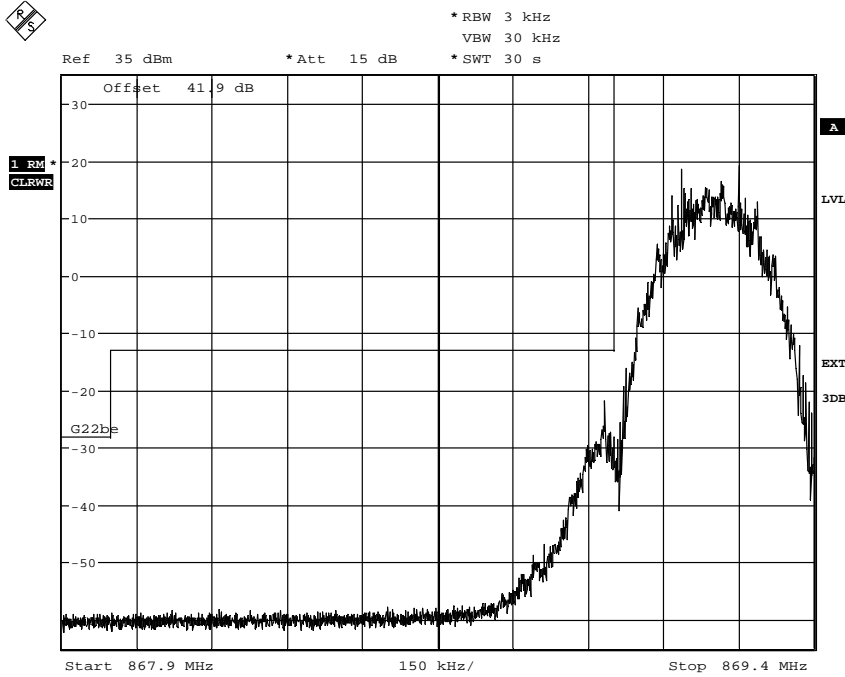
Date: 1.JUN.2010 14:11:34



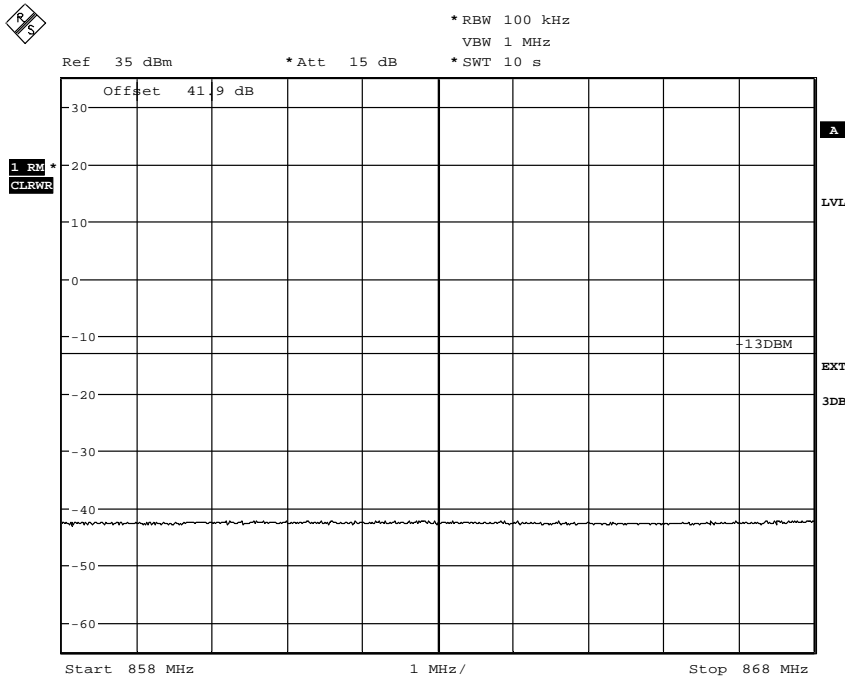
Date: 1.JUN.2010 14:12:25



Diagram 3



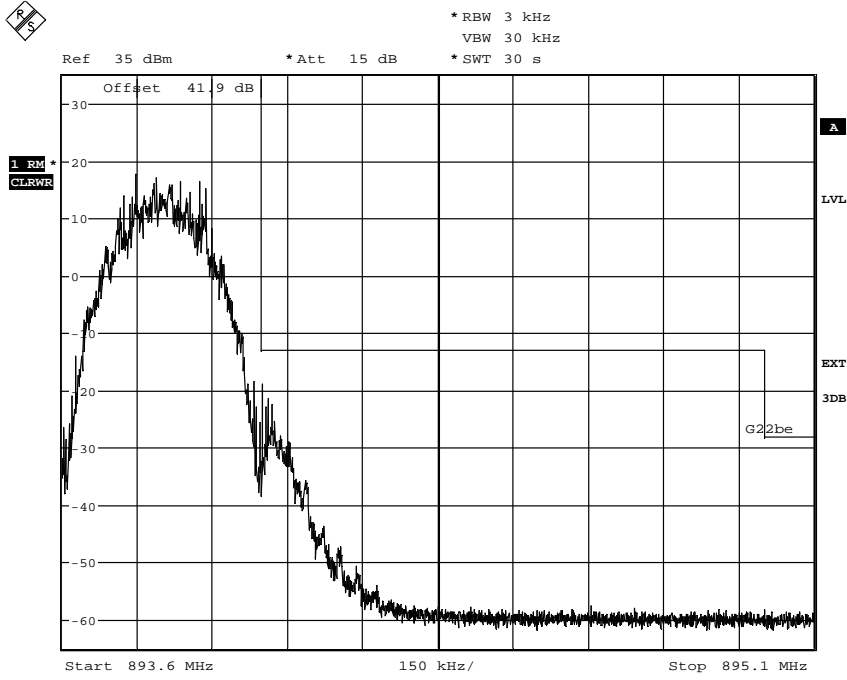
Date: 1.JUN.2010 14:00:57



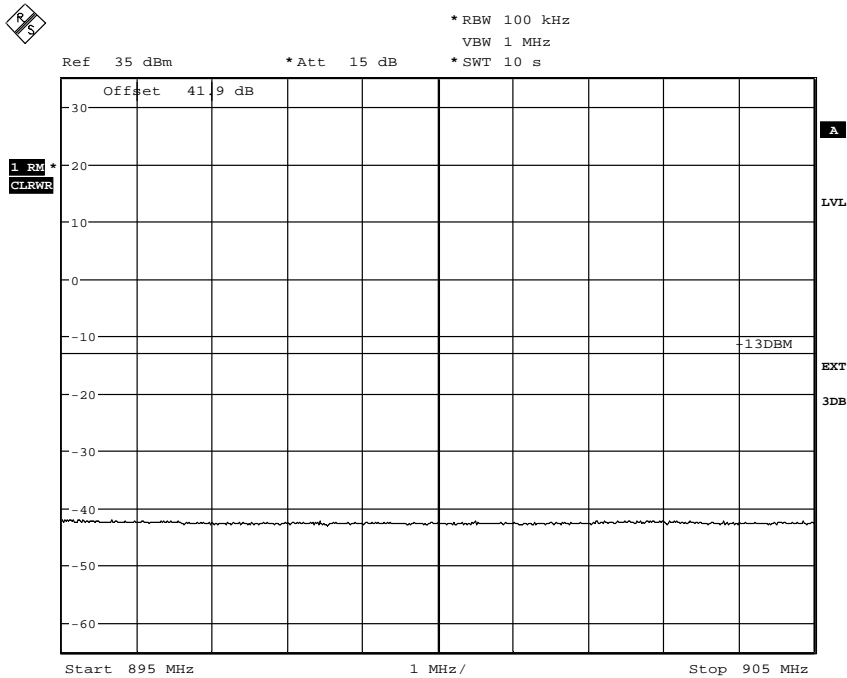
Date: 1.JUN.2010 14:05:27



**Diagram 4**



Date: 1.JUN.2010 14:14:28



Date: 1.JUN.2010 14:15:18



**Conducted spurious emission measurements according to 47CFR 2.1051 / IC RSS-132 4.5**

Date 2010-06-01	Temperature 22 °C ± 3 °C	Humidity 32 % ± 5 %
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**Test set-up and procedure**

The measurements were made at the RF connector TX(/RX) 1. The output was connected to a spectrum analyser. A pre-measurement was performed with the PEAK detector activated. Emission 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. The transmitter was activated at maximum output power and modulated with pseudorandom data during the measurements.

Measurement equipment	SP number
R&S FSQ	504 143
Attenuator	504 159
High pass filter	504 199
Testo 615 temperature and humidity meter	503 498

**Measurement uncertainty:** 3.7 dB

**Results**

The results are shown in appendix 5.1

TX ARFCN 190 (881.6 MHz), configured for nominal maximum output power 43 dBm.

Diagram 1: GMSK, 9 KHz – 1 GHz

Diagram 2: GMSK, 1 GHz – 10 GHz

Diagram 3: 16QAM, 9 KHz – 1 GHz

Diagram 4: 16QAM, 1 GHz – 10 GHz

Diagram 5: 32QAM, 9 KHz – 1 GHz

Diagram 6: 32QAM, 1 GHz – 10 GHz

**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.

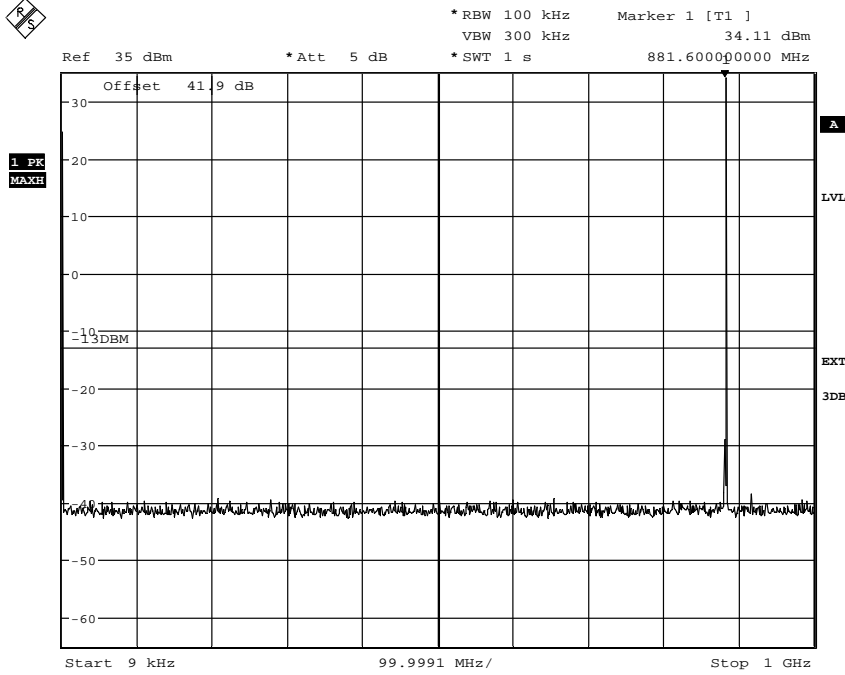
**Limits**

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
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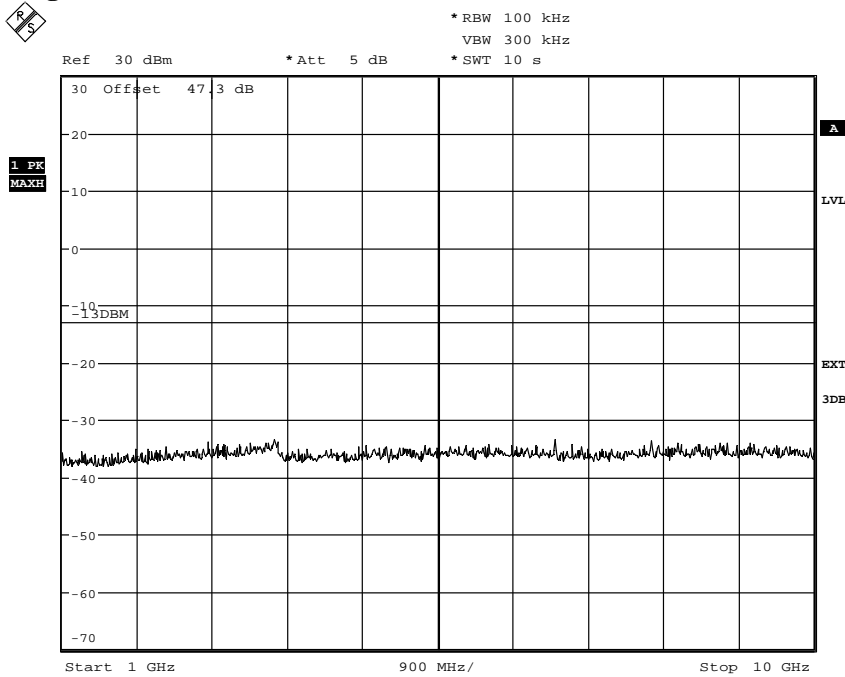


Diagram 1



Date: 1.JUN.2010 14:22:42

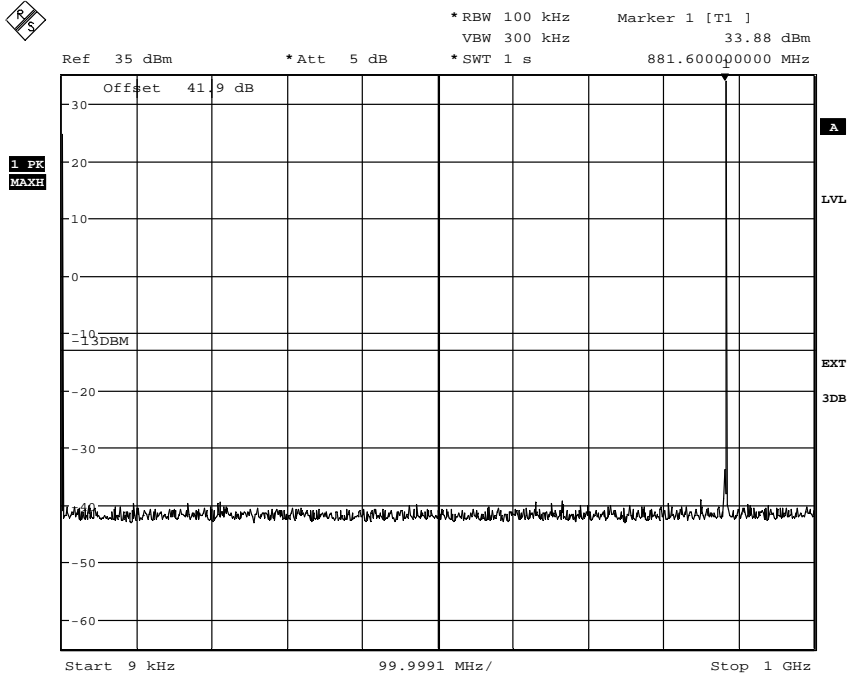
Diagram 2



Date: 1.JUN.2010 14:24:58

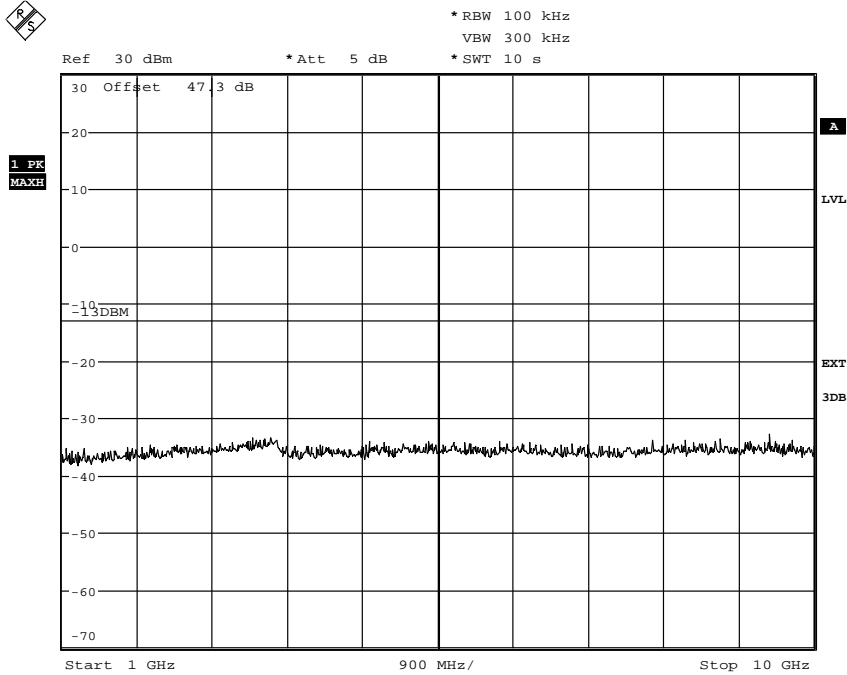


Diagram 3



Date: 1.JUN.2010 14:32:01

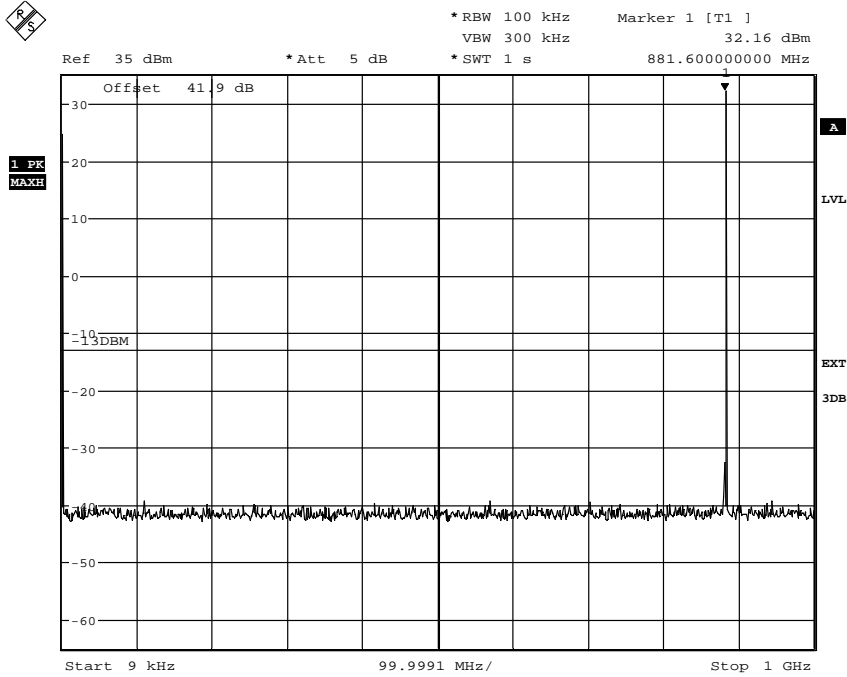
Diagram 4



Date: 1.JUN.2010 14:34:08

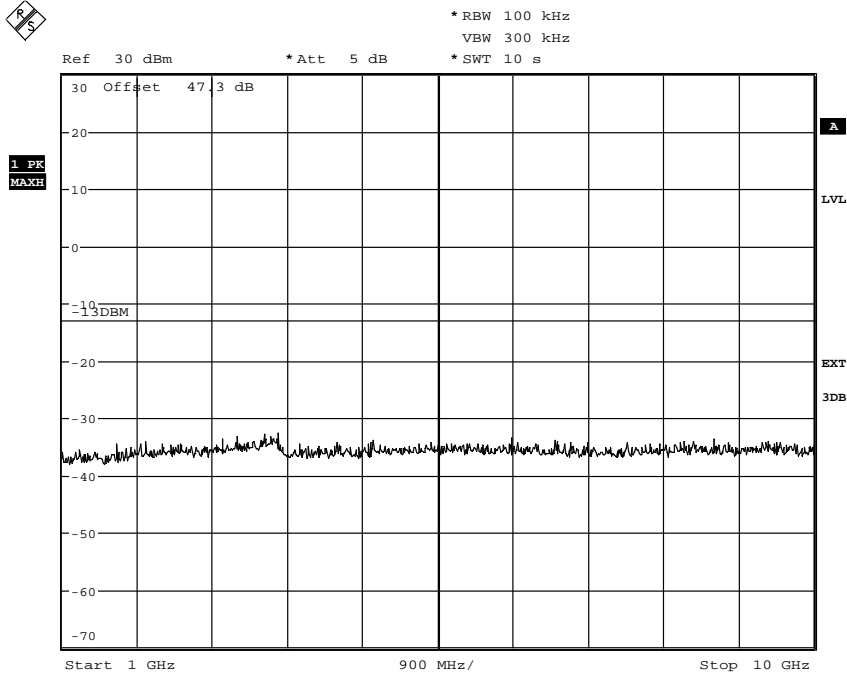


Diagram 5



Date: 1.JUN.2010 14:39:38

Diagram 6



Date: 1.JUN.2010 14:42:01

**Field strength of spurious radiation measurements according to 47CFR 2.1053 / IC RSS-132 4.5**

Date 2010-05-28	Temperature 22 °C ± 3 °C	Humidity 30 % ± 5 %
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**Test set-up and procedure**

The measurements were performed with both horizontal and vertical polarisation 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.

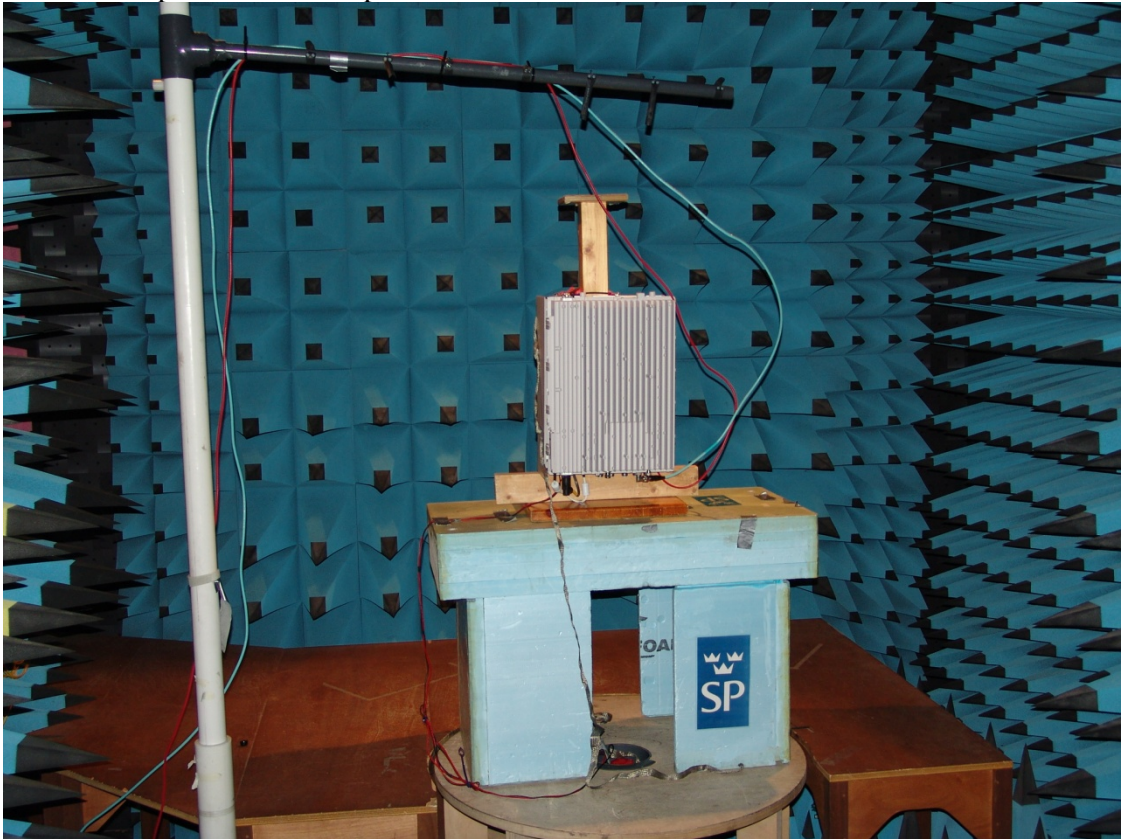
The measurement procedure was as the following:

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.

Configuration: RBS master 2E setting 33 for maximum nominal output power and TX ARFCN 190 (881.6 MHz)

Measurement equipment	SP number
Anechoic chamber, Hertz	15:116
R&S FSIQ40 Signal Analyser	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
Wainwright HP-filter WHKY1.0/15G-12SS	504 199
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 16QAM**

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

**Modulation 32QAM**

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:** 3.2 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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Appendix 7

**Hardware & software list**

The same test sample was used for or both radiated & conducted measurements.

<b>Unit designator</b>	<b>Product Number</b>	<b>Revision</b>	<b>Serial Number</b>
MBU-01	SEB 112 1133/3	R2A	B340340133445
IXU-21	BOE 602 15/2	R4C	AE52553825
RRU-M8	KRC 161 84/7	R7E	C821096393

<b>Software</b>	<b>Revision</b>
CXP 104 0007/05	G11B

**Photos of the test object**

Note: Below pictures show the test object assembled into a complete RBS 2308. Parts are listed in appendix 7.

Front side



Back side



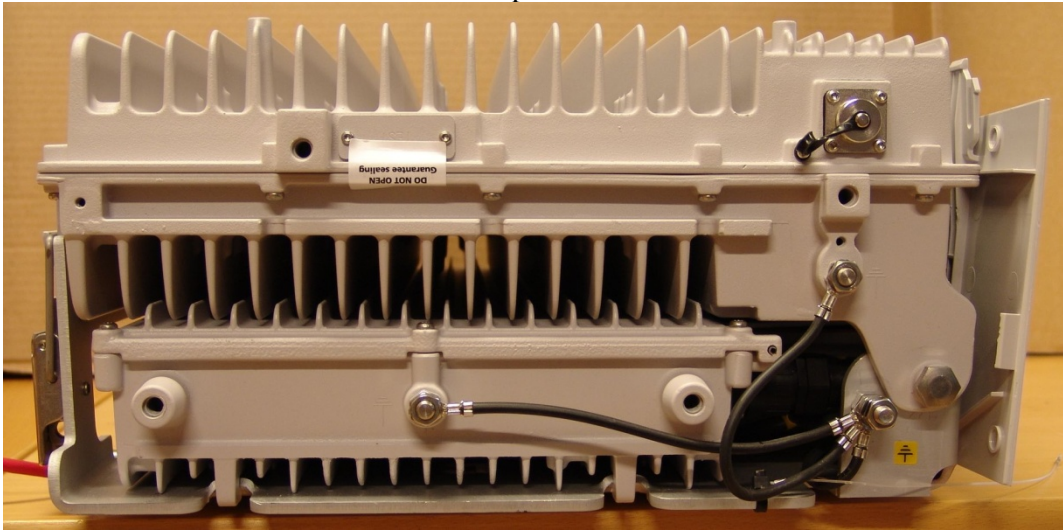
Left side



Right side



Top side



Bottom side

