



REPORT

issued by an FCC listed Laboratory Reg. no. 93866.
The test site complies with RSS Gen, file no: IC 3482A

Date
2010-08-25

Reference
FX009340-14

Page
1 (2)



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Permissible change measurements on GSM Pico base station with FCC ID: WODFKRC161175-3 and IC: 287AH-FG1611753 (8 appendices)

Test object

BSU GSM 1900 EDGE, product KRC 161 175/3, revision R1A, SN (S)CB47635658

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

Summary

Standard	Compliant	Appendix	Remarks
FCC CFR 47 / IC RSS-133 Issue 5			
2.1046 / RSS-133 6.4 RF Power output	Yes	2	-
2.1049 / RSS-133 6.5 Occupied bandwidth	Yes	3	-
2.1051 / RSS-133 6.5 Band Edge	Yes	4	-
2.1051 / RSS-133 6.5 Spurious emission at antenna port	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.

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REPORT

Date
2010-08-25

Reference
FX009340-14

Page
2 (2)

FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Table of contents

Description of the test object	Appendix 1
Operation mode during measurements	Appendix 1
Purpose of test	Appendix 1
Test setups	Appendix 1
RF power output	Appendix 2
Occupied bandwidth	Appendix 3
Band edge	Appendix 4
Spurious emission at antenna terminals	Appendix 5
Field strength of spurious radiation	Appendix 6
Hardware list and software	Appendix 7
Photos of the test object	Appendix 8

FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 1

Description - Equipment Under Test (EUT)

Equipment:	GSM Pico base station BSU GSM 1900 EDGE (short form reference BSU19, radio part of RBS 2409)			
TX frequency range:	1930.2 - 1989.8 MHz			
Modulations:	GMSK, 8PSK, 16QAM and 32QAM Modulation			
Nominal maximum output power, RMS value in [dBm]	GMSK	8PSK	16QAM	32QAM
	23.0	23.0	21.6	21.2
Supply voltage	12 V DC supplied to from the external power supply PSU-AC-41 listed in appendix 7. The external supply is rated 100 – 240 VAC, 50/60 Hz in to 12 V DC 5 A out. For the tests 120 V AC / 60 Hz mains were used.			

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, 8PSK, 16QAM and 32QAM modulation.

Summary of results

Measurement results are near identical for all modulations, apart from output power. Both GMSK and 8PSK modulations were used as reference modulation, as both modulations resulted in identical measured RMS output power on the sample provided for test.

Tested configuration

The hardware lists are shown in appendix 7. The test object was activated at maximum power with the RBS Master 2E software configured with a value of 23. Pseudorandom 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 the internal QMA contact normally connected to the test object's integrated antenna.

Radiated measurements

During radiated emission measurements the test objects' integrated antenna was connected to the internal QMA connector. For the scope of this test it was deemed sufficient to measure and compare radiated spurious emission for the supported modulations, GMSK, 8PSK, 16QAM and 32QAM at the TX band center frequency.

FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 1

Frequencies used

ARFCN	Frequency		Comment
512	1930.2	MHz	Bottom channel
661	1960.0	MHz	Mid channel
810	1989.8	MHz	Top channel

Manufacturer's representative

Hua Yang, Ericsson (China) Communications Company Ltd

References

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

ANSI ANSI/TIA/EIA-603-C-2004

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

RSS-133, Issue 5 (February 2009)

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: 2010-06-10.

FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 1

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
Flann Std gain horn 20240-20	-	503 674
MITEQ Low Noise Amplifier	2010-06	503 277
Attenuator 10 dB	2010-06	900 116
Wainright high pass filter	2011-03	504 200
RLC Electronics HP-filter F-16149	2010-06	503 739
Multimeter Fluke 87	2011-01	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 and Reinhold Reul

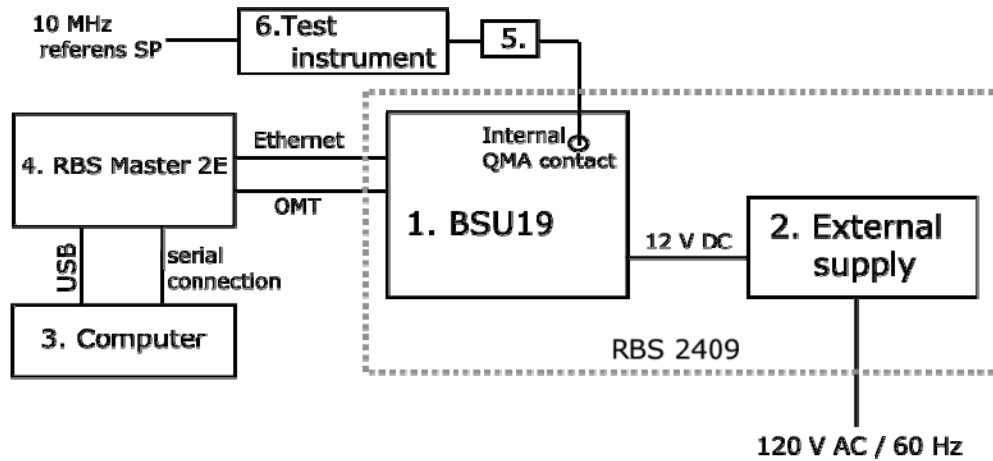
Test witness

Kevin Sun, Ericsson (China) Communications Company Ltd.

FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 1

Test set-up conducted measurements



Test object

1. BSU GSM 1900 EDGE, product KRC 161 175/3, revision R1A, SN (S)CB47635658 with FCC ID: WODFKRC161175-3 and IC: 287AH-FG1611753

Functional test equipment

2. External AC/DC power supply according appendix 7
3. HP laptop computer model Compaq NC6400,SN CND70310FD With software RBS Master2 control software, revision R7D02
4. Ericsson RBS Master 2E hardware, product number LBY 107 1007/3, revision R1C BAMS 1000735209
5. Attenuator / filter listed under test equipment in respective appendix
6. 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 object connections

Interface	Type of port
Ethernet connection between RBS Master 2E and BSU Ethernet port, shielded Ethernet cable required	Signal
OMT interface (only configuration, not connected in normal use)	O/M
DC supply from external power supply to BSU	DC power
AC supply to PSU	AC power
Antenna reference point (ARP) at internal QMA connector normally connected to integrated antenna.	RF/antenna

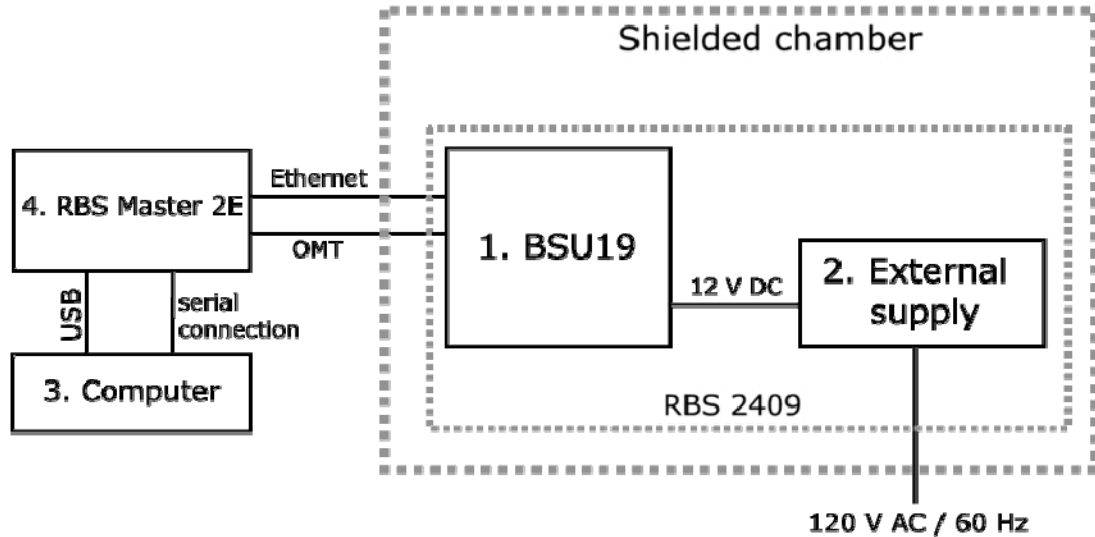
Other connections

Interface	Type of port:
PC – RBS Master 2E USB connection	Signal
PC – RBS Master 2E serial communication	Signal

FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 1

Test set-up radiated measurements



Test object

1. BSU GSM 1900 EDGE, product KRC 161 175/3, revision R1A, SN (S)CB47635658 with FCC ID: WODFKRC161175-3 and IC: 287AH-FG1611753

Functional test equipment radiated measurements

2. External AC/DC power supply according appendix 7
3. HP laptop computer model Compaq NC6400 SN CND72717JP
With software RBS Master2 control software, revision R7D02
4. Ericsson RBS Master 2E hardware, product number LBY 107 1007/3, revision R1C, BAMS 1000735211

Test object connections

Interface

Ethernet connection between RBS Master 2E and BSU Ethernet port, shielded Ethernet cable required
OMT interface (only configuration, not connected in normal use)
DC supply from external power supply to BSU
AC supply to PSU

Type of port

Signal
O/M
DC power
AC power

Other connections

Interface

PC – RBS Master 2E USB connection
PC – RBS Master 2E serial communication

Type of port:

Signal
Signal



FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 2

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

Date 2010-06-16-	Temperature 22 °C ± 3 °C	Humidity 36 % ± 5 %
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Test set-up and procedure

Measurements were made at the internal QMA RF contact normally connected to the integrated antenna. This reference point was connected to a peak power analyser via a 50 ohm attenuator. The transmitter activated at maximum power and 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	900 116
Multimeter Fluke 87	502 190
Testo 615 temperature and humidity meter	503 498

Measurement uncertainty: 0.7 dB

Results

RBS master 2E software used maximum nominal output power setting “23”.
The TX was configured for ARFCN 661 (1960.0 MHz).

Test conditions Modulation		Transmitter power (dBm) Peak / RMS			
		GMSK	8PSK	16QAM	32QAM
T _{nom} 22 °C	V _{nom} 120 V AC	23.4 / 22.6	26.8 / 22.6	27.0 / 21.6	26.4 / 21.2

Limit

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
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FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 3

Occupied bandwidth measurements according to 47CFR 2.1049 / IC RSS 133 6.5

Date 2010-06-16-	Temperature 22 °C ± 3 °C	Humidity 36 % ± 5 %
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Test set-up and procedure

The measurements were made per definition in §24.238 at the internal QMA connector normally connected to the integrated antenna. This 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	900 116
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

RBS master 2E software used maximum nominal output power setting “23”.
The TX was configured for ARFCN 661 (1960.0 MHz).

	Modulation	OBW	
Diagram 1:	GMSK	240.0	kHz
Diagram 2:	8PSK	236.0	kHz
Diagram 3:	16QAM	240.7	kHz
Diagram 4:	32QAM	239.3	kHz

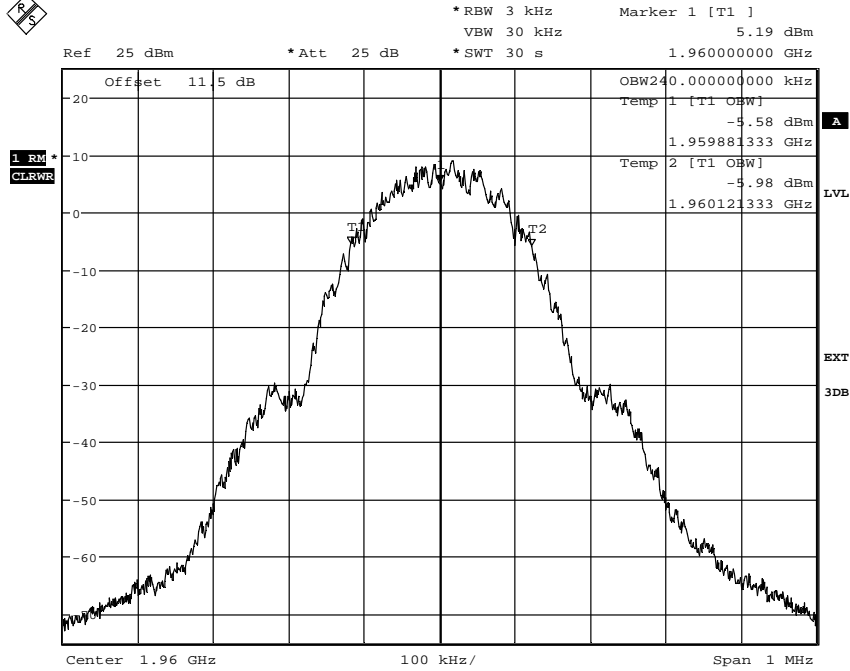
Complies?	Yes
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FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

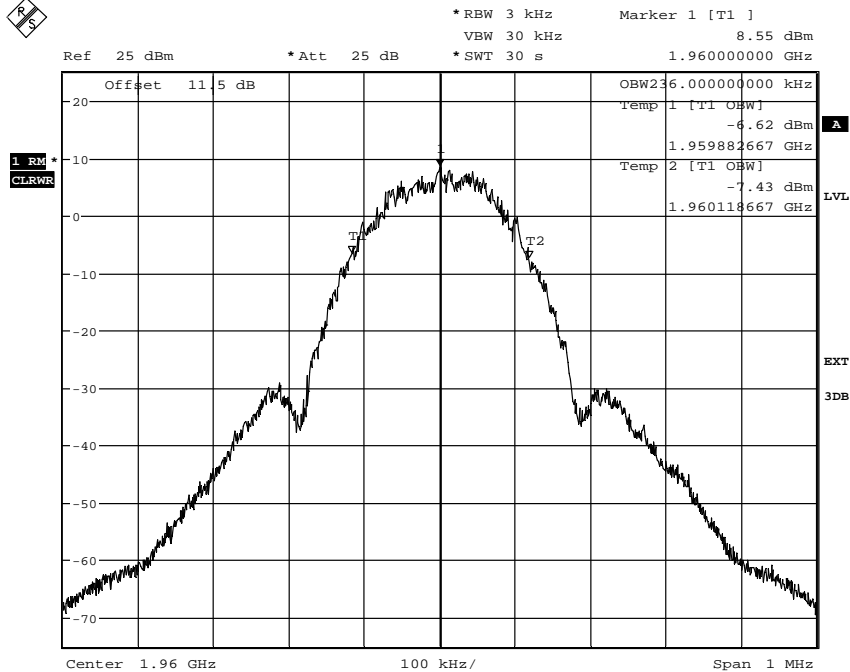
Appendix 3.1

Diagram 1



Date: 16.JUN.2010 14:10:01

Diagram 2



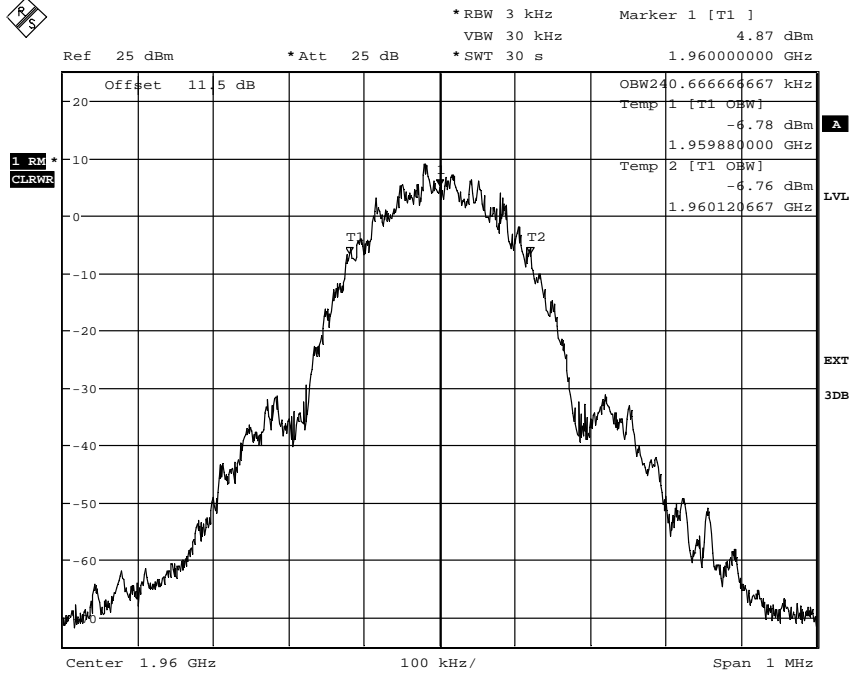
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FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

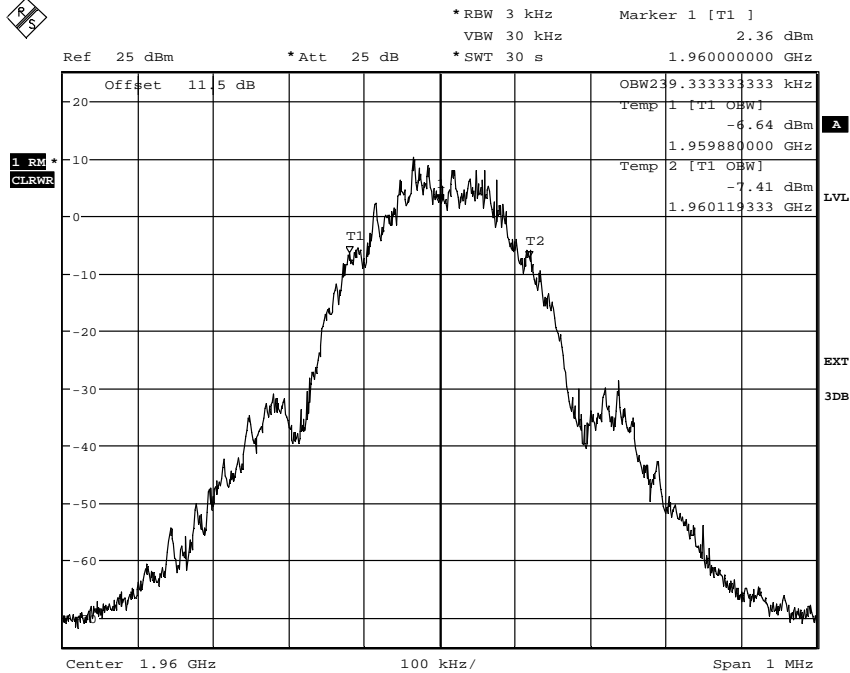
Appendix 3.1

Diagram 3



Date: 16.JUN.2010 14:33:38

Diagram 4



Date: 16.JUN.2010 14:41:05



FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 4

Band edge measurements according to 47CFR 2.1049 / IC RSS 133 6.5

Date 2010-06-16-	Temperature 22 °C ± 3 °C	Humidity 36 % ± 5 %
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Test set-up and procedure

The measurements were made per definition in §24.238. Measurements were made at the internal QMA connector normally connected to the integrated antenna. The output was connected to a spectrum analyzer with the RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements. The transmitter was modulated with pseudorandom data during the measurements.

For the measurement close to the band edges a resolution bandwidth of 3 kHz was used. FCC rules specify a RBW of 1 MHz for measurements of emissions >1 MHz away from the band edges. For measurement beyond the first MHz off the band edges a RBW of 50 kHz was used and the limit was adapted to the reduced RBW by -13 dB (10*log(50/1000)) to -26 dBm.

Measurement equipment	SP number
Rohde & Schwarz FSQ40	504 143
Attenuator	900 116
Testo 615 temperature and humidity meter	503 498

Measurement uncertainty: 3.7 dB

Results

The results are shown in appendix 4.1

RBS master 2E software used maximum nominal output power setting “23”.

- Diagram 1 Ch 512 (1930.2 MHz) Lower band edge, reduced output power, 16QAM
- Diagram 2 Ch 810 (1989.8 MHz) Upper band edge, reduced output power, 16QAM
- Diagram 3 Ch 512 (1930.2 MHz) Lower band edge, reduced output power, 32QAM
- Diagram 4 Ch 810 (1989.8 MHz) Upper band edge, reduced output power, 32QAM

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.

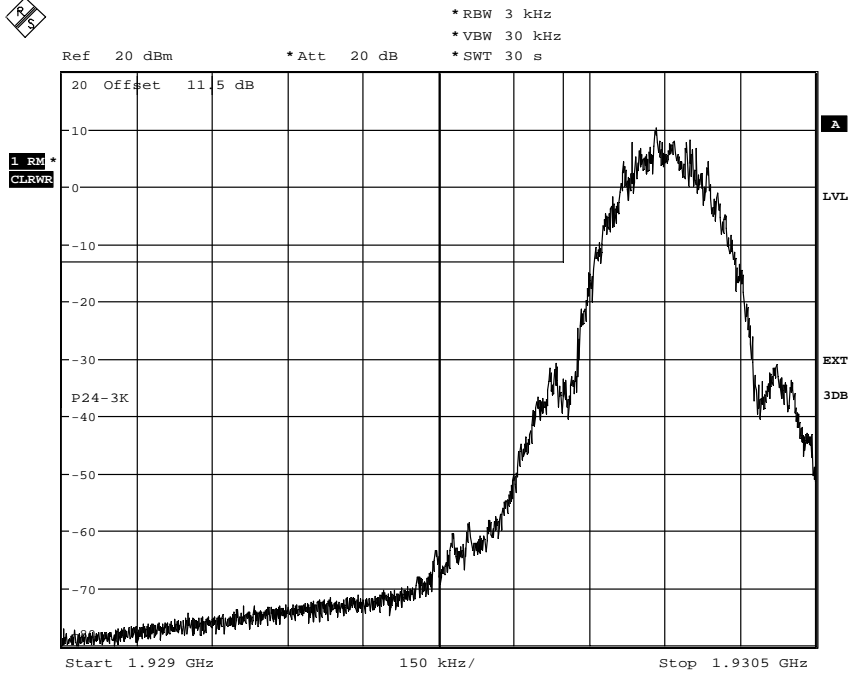
Complies?	Yes
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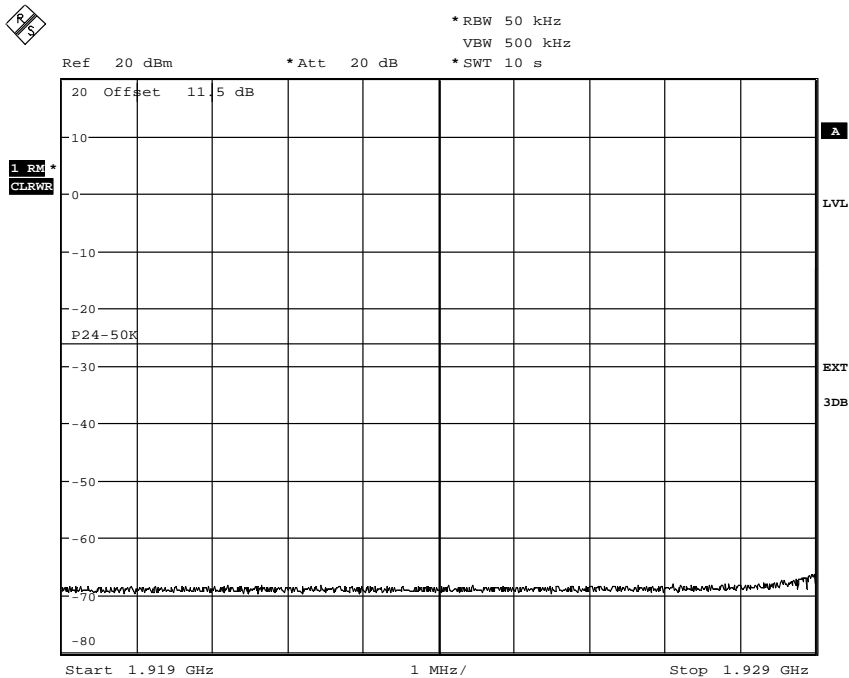
FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 4.1

Diagram 1



Date: 16.JUN.2010 13:01:11



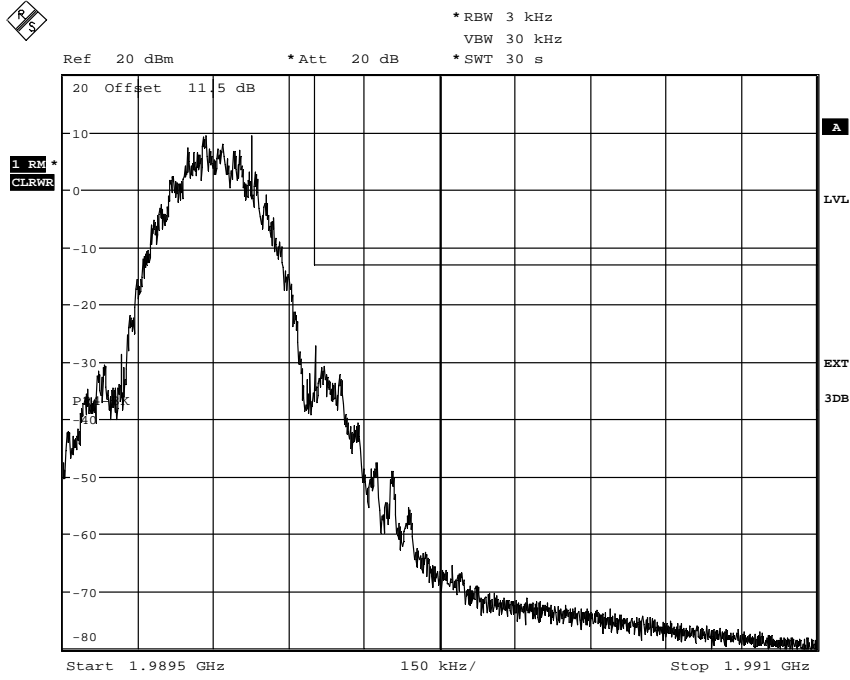
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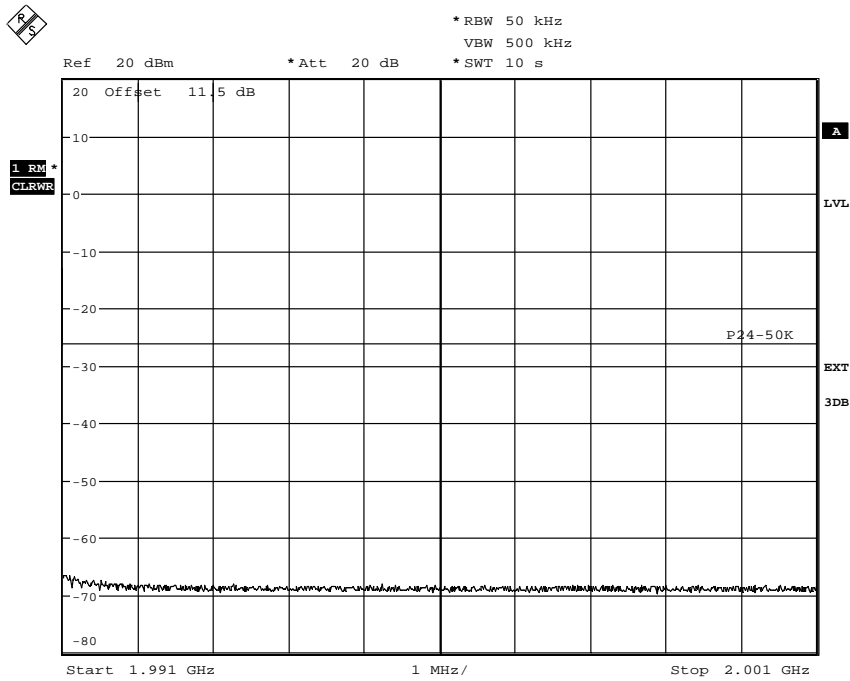
FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 4.1

Diagram 2



Date: 16.JUN.2010 13:42:23



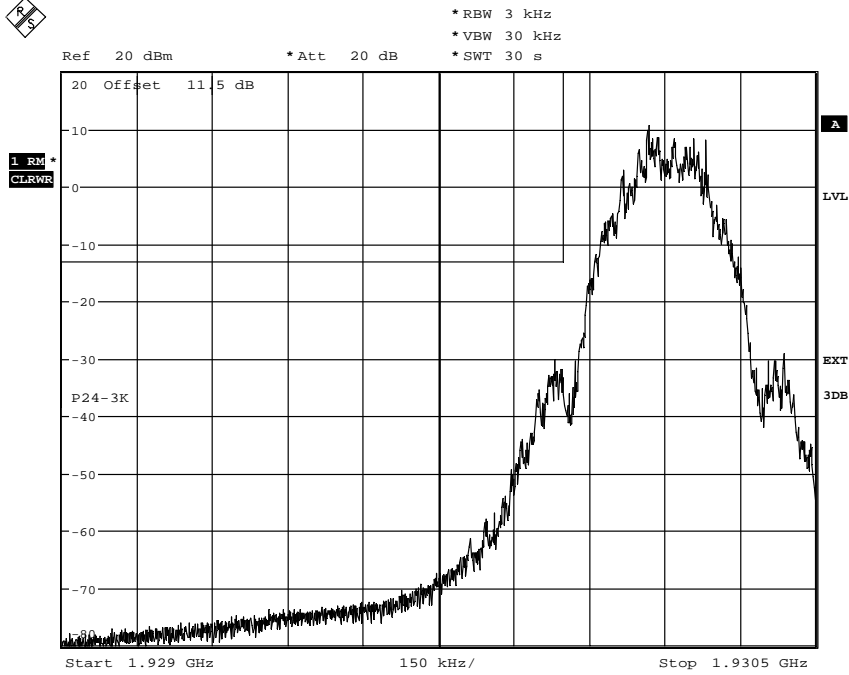
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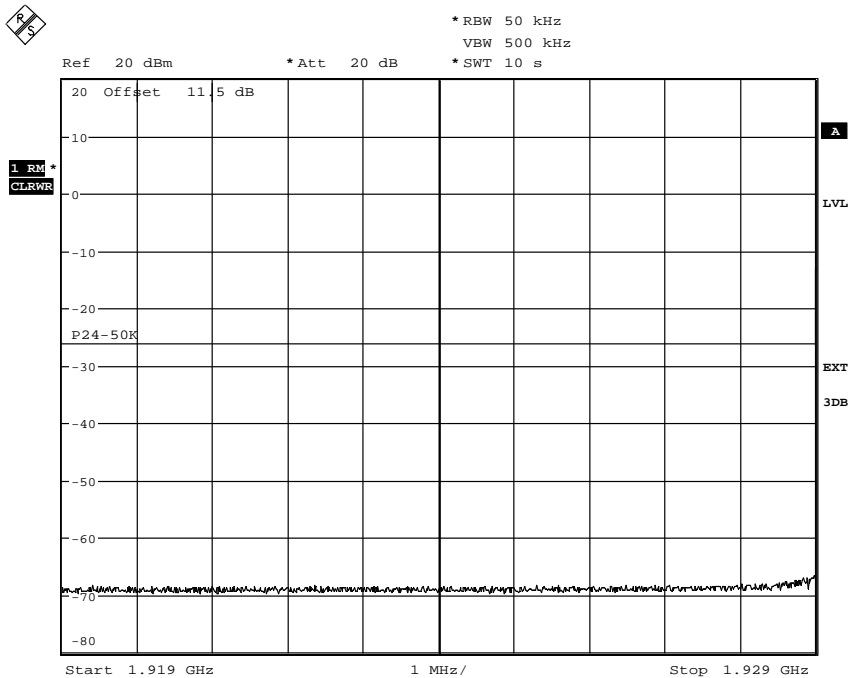
FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 4.1

Diagram 3



Date: 16.JUN.2010 13:11:39

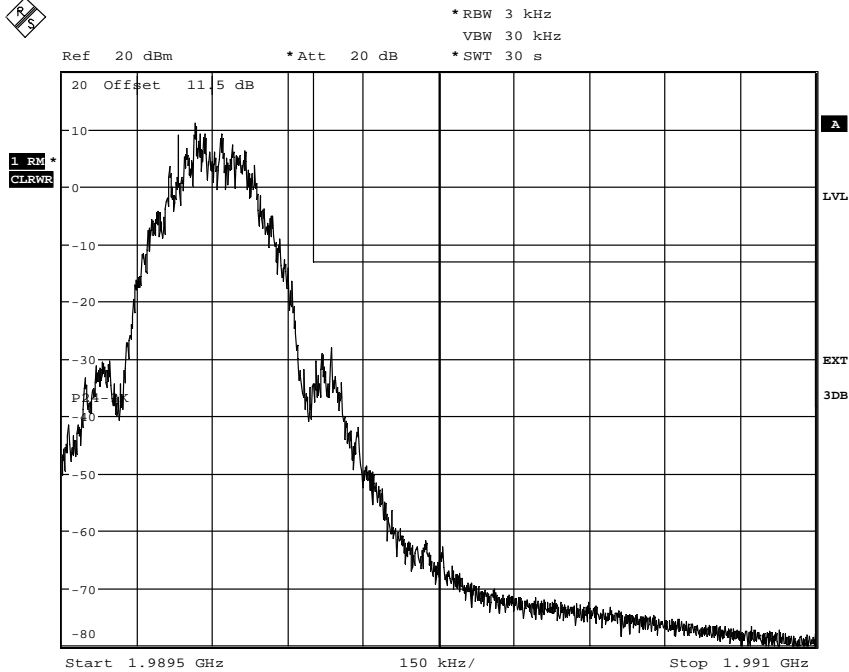


Date: 16.JUN.2010 13:12:45

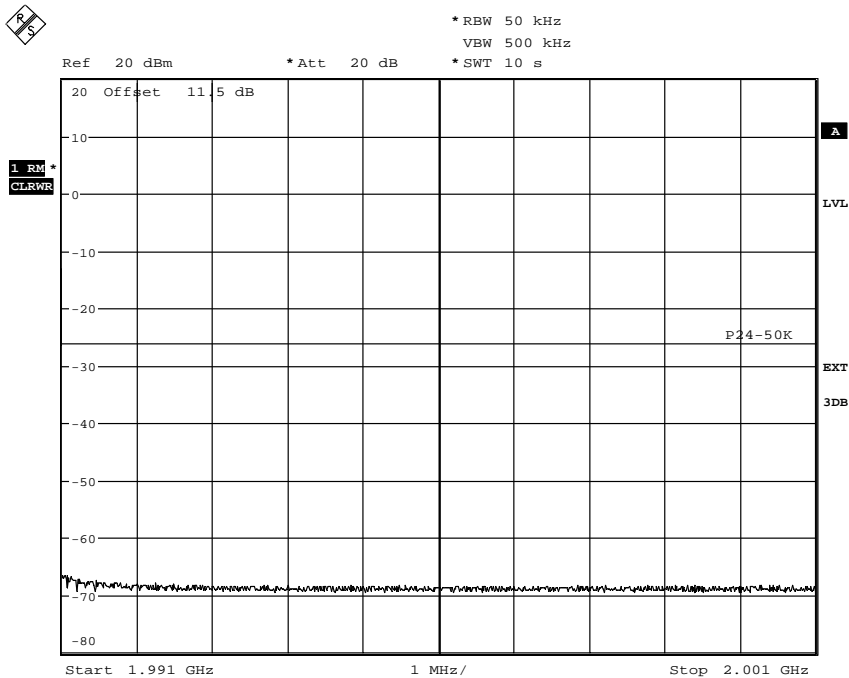
FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 4.1

Diagram 4



Date: 16.JUN.2010 14:00:39



Date: 16.JUN.2010 14:02:31



FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 5

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

Date 2010-06-16-	Temperature 22 °C ± 3 °C	Humidity 36 % ± 5 %
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Test set-up and procedure

The measurements were made per definition in §24.238. Measurements were made at the internal QMA connector normally connected to the integrated antenna. This reference point 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	900 116
High pass filter	504 200
Testo 615 temperature and humidity meter	503 498

Measurement uncertainty: 3.7 dB

Results

The results are shown in appendix 5.1

RBS master 2E software used maximum nominal output power setting “23”.
The TX was configured for ARFCN 661 (1960.0 MHz).

- Diagram 1: GMSK, 9 KHz – 3 GHz
- Diagram 2: GMSK, 3 GHz – 20 GHz

- Diagram 3: 8PSK, 9 KHz – 3 GHz
- Diagram 4: 8PSK, 3 GHz – 20 GHz

- Diagram 5: 16QAM, 9 KHz – 3 GHz
- Diagram 6: 16QAM, 3 GHz – 20 GHz

- Diagram 7 32QAM, 9 KHz – 3 GHz
- Diagram 8 32QAM, 3 GHz – 20 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.

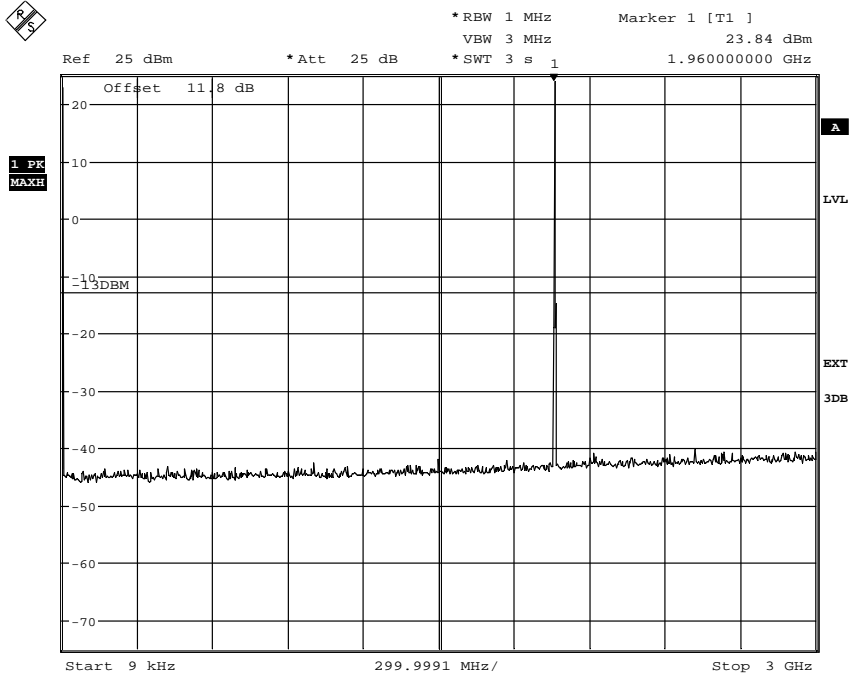
Complies?	Yes
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FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

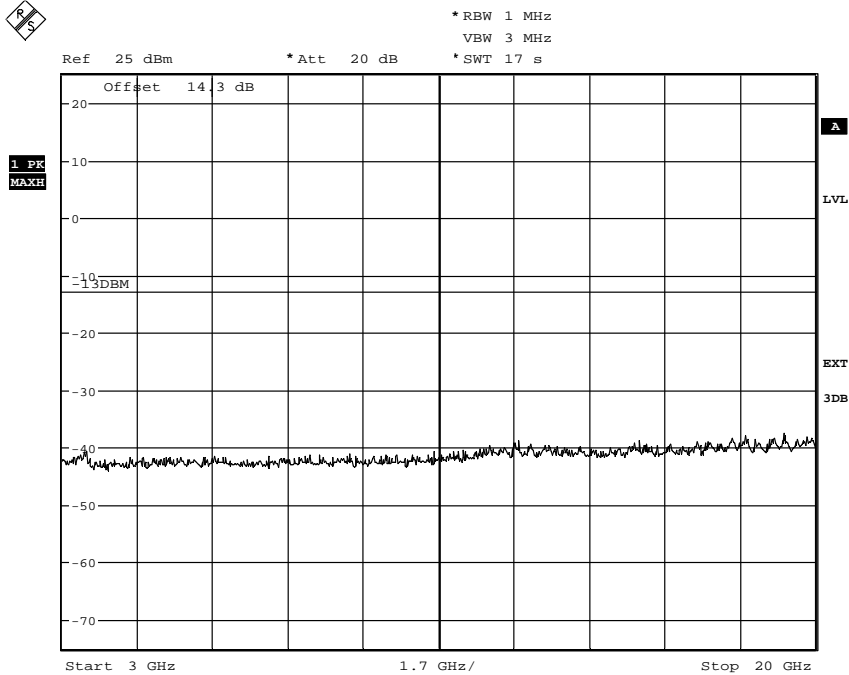
Appendix 5.1

Diagram 1



Date: 16.JUN.2010 14:13:55

Diagram 2



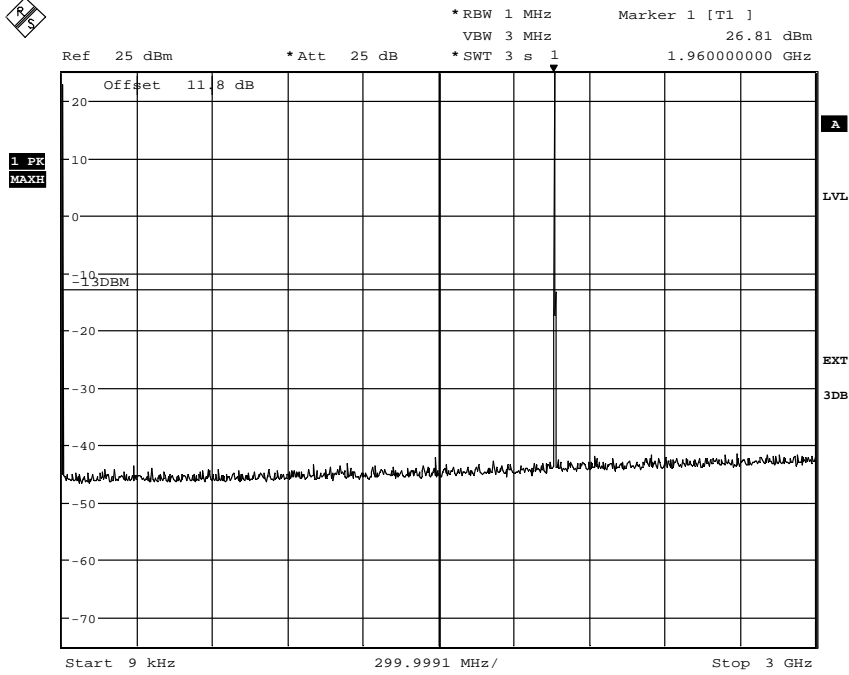
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FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

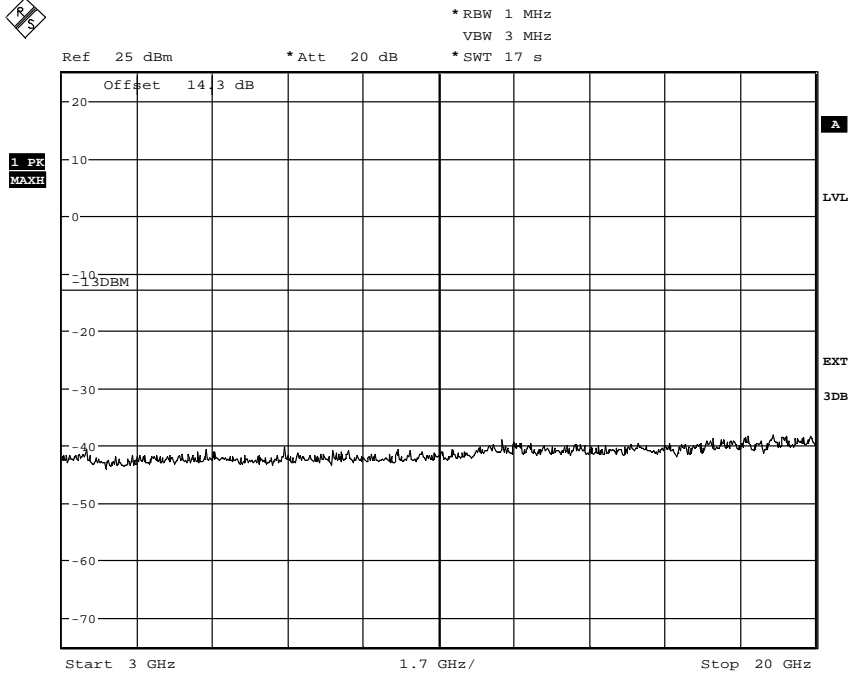
Appendix 5.1

Diagram 3



Date: 16.JUN.2010 14:25:52

Diagram 4



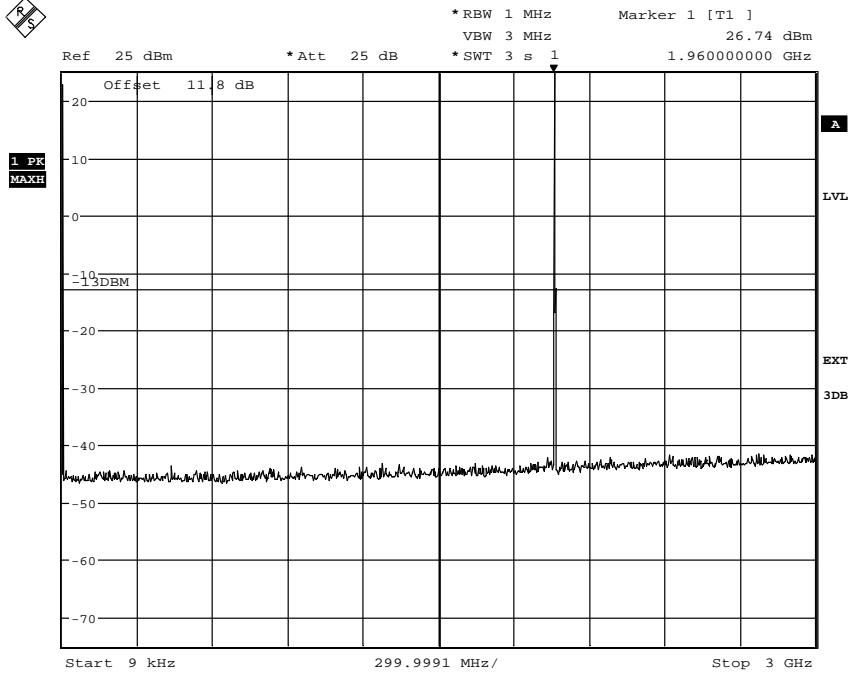
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FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

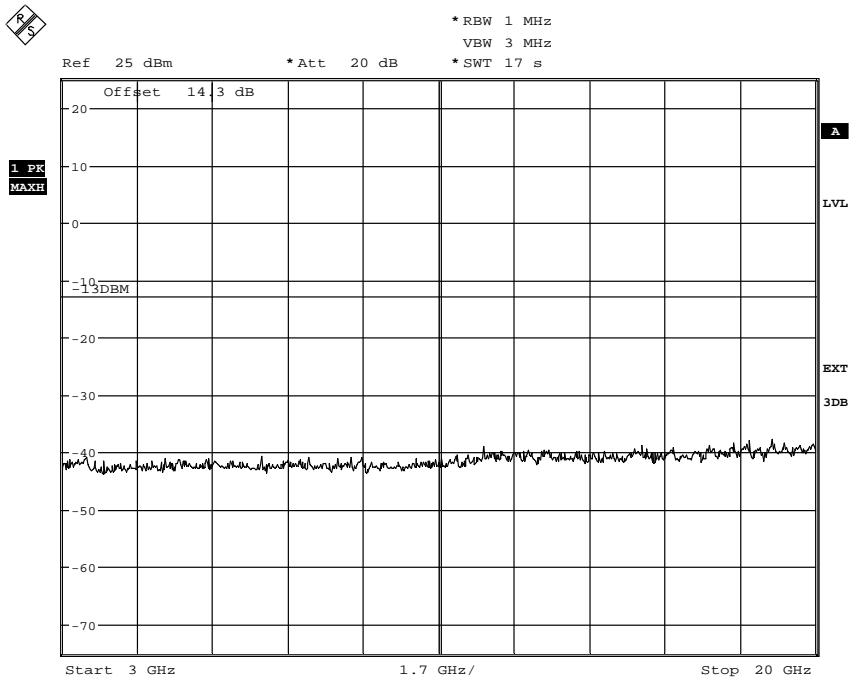
Appendix 5.1

Diagram 5



Date: 16.JUN.2010 14:34:59

Diagram 6



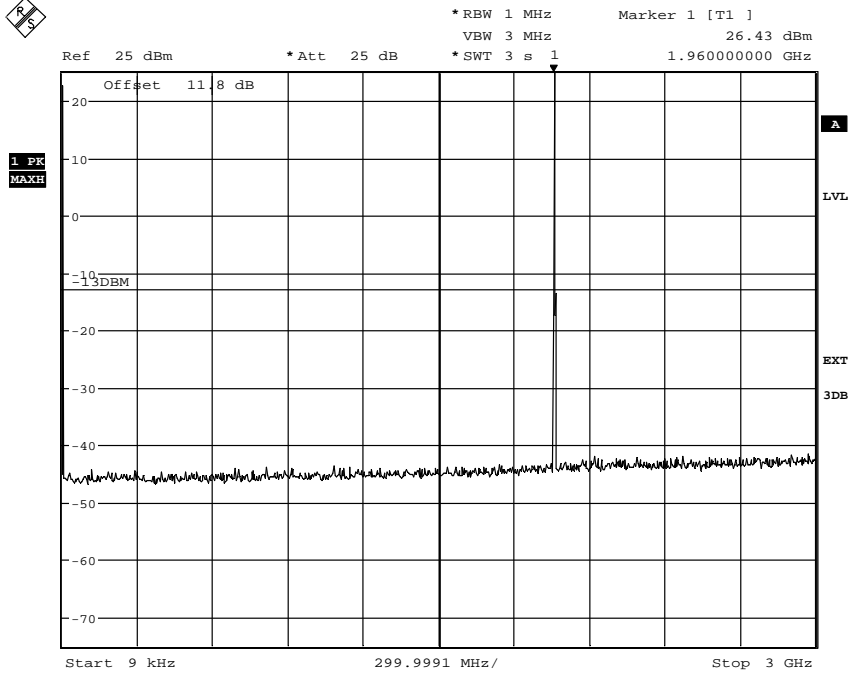
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FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

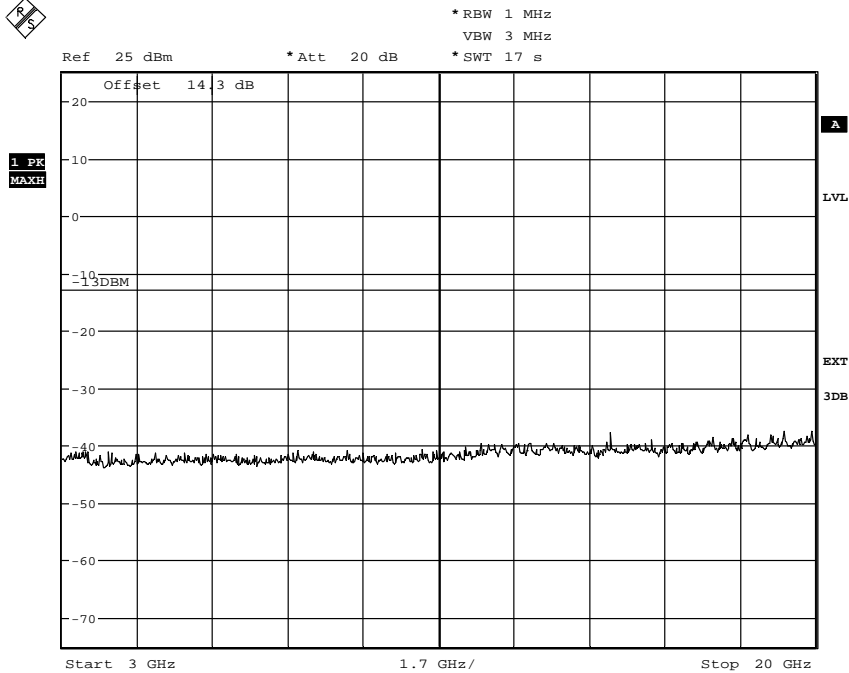
Appendix 5.1

Diagram 7



Date: 16.JUN.2010 14:42:48

Diagram 8



Date: 16.JUN.2010 14:44:09

FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 6

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

Date 2010-06-17	Temperature 23 °C ± 3 °C	Humidity 37 % ± 5 %
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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.

RBS master 2E software used maximum nominal output power setting “23”.
The TX was configured for 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
RLC Electronics HP-filter F-16149	503 739
Testo 615 temperature and humidity meter	503 498

FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 6

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





FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 6

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 8PSK

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: 3.2 dB up to 18 GHz, 3.6 dB above 18 GHz

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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REPORT

Date
2010-08-25

Reference
FX009340-14

Page
1 (1)

FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 7

Hardware & software list

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

Unit	Product Number	Rev.	Serial Number
BSU GSM 1900 EDGE	KRC 161 175/3	R1A	(S)CB47635658
PSU-AC-41	BML 151 124/1	R1A	C121000006

Software	Revision
CXP 104 0007/05	G11B

FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

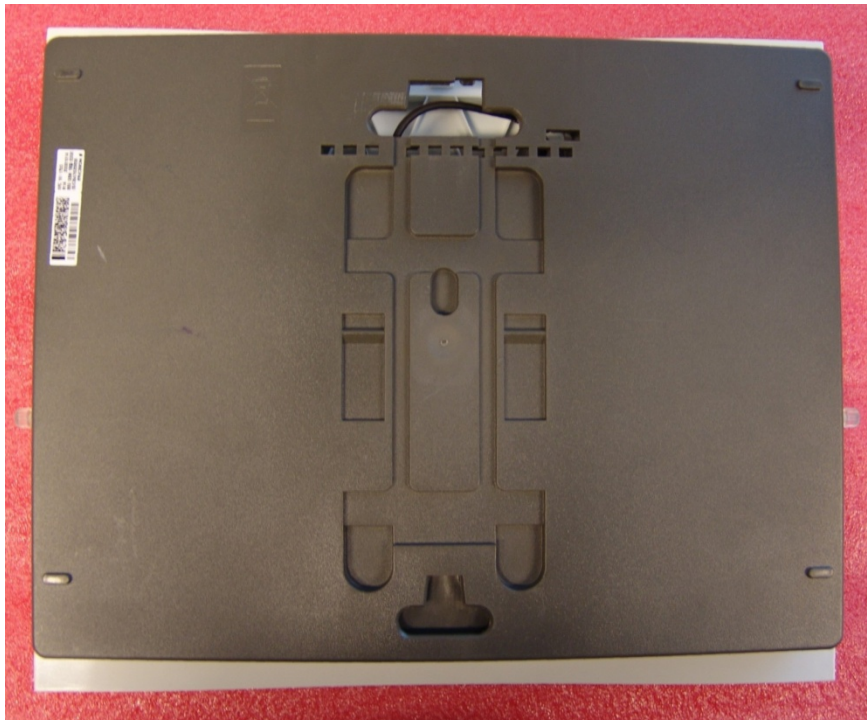
Appendix 8

Photos of the test object

Front side



Rear side



FCC ID: WODFKRC161175-3
IC: 287AH-FG1611753

Appendix 8

Left side



Right side



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IC: 287AH-FG1611753

Appendix 8

Top side



Opened test object to uncover the connection area on the top side. For conducted measurements the cable for the integrated antenna was replaced by a connection to test equipment. The internal QMA antenna contact was used as reference point.

