REPORT

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The test site complies with RSS Gen, file no: IC 3482A

Date	Reference	Page
2010-08-25	FX009340-13	1 (2)

1002
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P. R. China

Permissible change measurements on GSM Remote Radio Unit with FCC ID: WODFKRC161170-5 and IC: 287AH-FG1611705

(8 appendices)

Test object

RRUN19-22, product number KRC 161 170/5, revision R1B, SN (S)CB4A320705

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	Note 1
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 1: The highest usable output power for 16QAM and 32QAM modulation on the lower band edge channel 512 is with RBS master 2E software set to "35", resulting in a measured RMS output power of 34.9 dBm for 16QAM and 34.4 dBm for 32QAM.
The highest usable setting for 16QAM and 32QAM on the higher band edge channel 810 is with RBS master 2E software set to "37", resulting in a measured RMS output power of 36.8 dBm with 16QAM and 36.4 dBm with 32QAM modulation.
Remaining channels comply with RBS master 2E setting for maximum nominal output power.

Note 2: 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
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Technical Manager

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Technical Officer

FCC ID: WODFKRC161170-5
IC: 287AH-FG1611705

Table of contents

Description - Equipment Under Test (EUT)

Equipment:	GSM Base station Remote Radio Unit
TX frequency range:	1930.2 - 1989.8 MHz
Modulations:	GMSK, 8PSK, 16QAM and 32QAM

	Modulation			
	GMSK	8PSK	16QAM	32QAM
Nominal maximum output power, RMS value in [dBm]	43.0	39.7	38.3	37.9

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 hardware lists for radiated and conducted measurements are shown in appendix 7. The test object was activated at maximum power, unless noted otherwise. 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.

An additional band edge measurement was done on channels 512 and 810 adjacent to the band edge with the test object output power reduced as far as necessary to meet band edge requirements. Pseudorandom data was transmitted in all time slots with various modulations being tested, one at a time.

Conducted measurements

Conducted measurements were done at antenna connector “ANT 1”.

Radiated measurements

During radiated emission measurements the antenna connector “ANT 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 with the highest RMS output power was chosen as worst case reference modulation to compare the new 16QAM and 32QAM modulations with.

Frequencies used

ARFCN	Frequency		Comment
512	1930.2	MHz	Low TX frequency, reduced output power
513	1930.4	MHz	Low TX frequency, maximum output power
661	1960.0	MHz	TX band center frequency, maximum output power
809	1989.6	MHz	High TX frequency, maximum output power
810	1989.8	MHz	High TX frequency, reduced output power

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: 2010-05-07

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
Flann Std gain horn 20240-20	-	503 674
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	504 200
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).

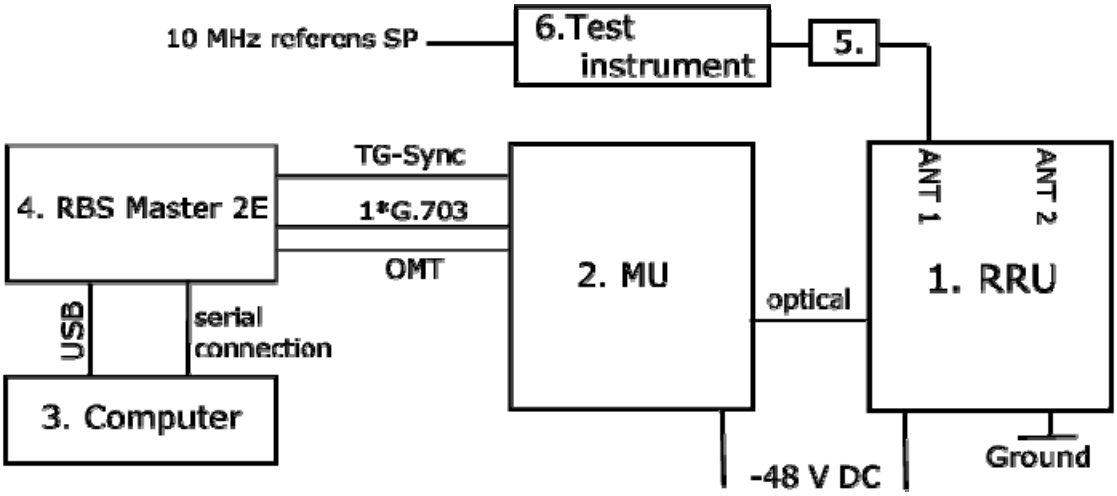
Test engineers

Fredrik Isaksson and Reinhold Reul

Test witnesses

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

Test set-up conducted measurements



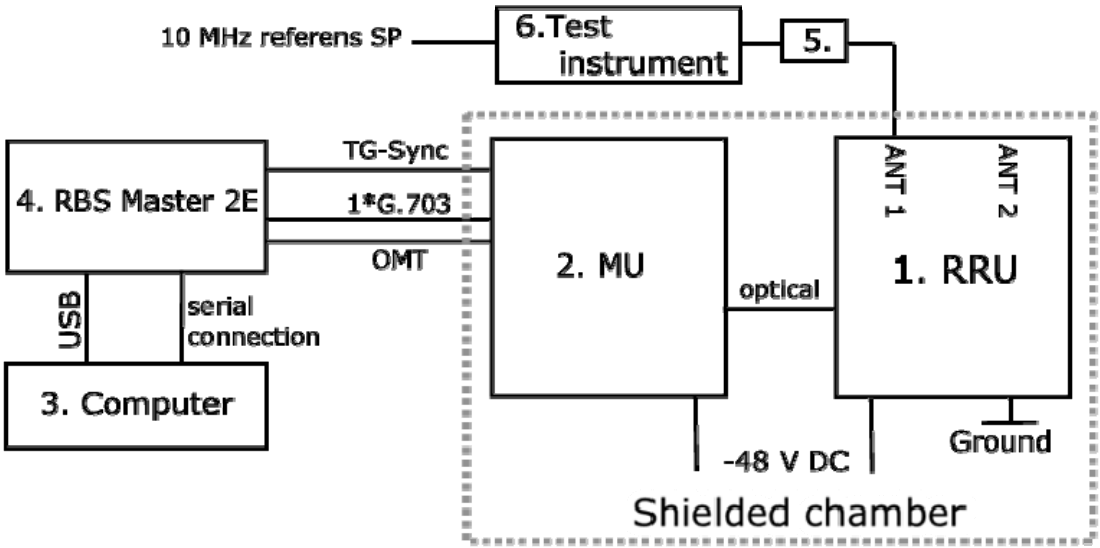
Test object

1. RRUN19-22, product KRC 161 170/5, revision R1B, SN (S)CB4A320705
   with FCC ID: WODFKRC161170-5 and IC: 287AH-FG1611705

Functional test equipment conducted measurements

2. MU according hardware list in 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 set-up radiated measurements



Test object

1. RRUN19-22, product KRC 161 170/5, revision R1B, SN (S)CB4A320705
   with FCC ID: WODFKRC161170-5 and IC: 287AH-FG1611705

Functional test equipment radiated measurements

2. MU according hardware list in 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
5. Attenuator 30 dB, SP 900229
6. Rohde & Schwarz FSIQ40 for signal monitoring, SP 503738

Test object connections

Interface	Type of port
-48 V DC	DC power
GND	Ground
Optical connection to MU	Optical interface
ANT 1, connected to test equipment	RF/Antenna
ANT 2, unconnected	RF/Antenna

Other connections

Interface	Type of port:
PC – RBS Master 2E USB connection	Signal
PC – RBS Master 2E serial communication	Signal
TG-sync connection between RBS Master 2E & MU	Signal
MU supply -48 V DC	DC power
G.703, shielded multi-wire with RJ-45connector, mode E1	Telecom
OMT interface (only configuration, not connected in normal use)	O/M

FCC ID: WODFKRC161170-5
IC: 287AH-FG1611705

Appendix 2

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

Date	Temperature	Humidity
2010-06-01	22 °C ± 3 °C	32 % ± 5 %
2010-06-02	22 °C ± 3 °C	34 % ± 5 %

Test set-up and procedure

Measurements were made at antenna connector ANT 1. The output was connected to a peak power analyser via a 50 ohm attenuator. Pseudorandom data was transmitted in all time slots at maximum nominal output power .

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: TX ARFCN 661, 1960.0 MHz, maximum nominal output power,
RBS master 2E software setting “43”

Test conditions		Transmitter power (dBm) Peak / RMS		
Modulation		GMSK	16QAM	32QAM
T_{nom} 22 °C	V_{nom} -48.0 V DC	43.3 / 42.6	43.6 / 38.5	43.2 / 37.7

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

FCC ID: WODFKRC161170-5
IC: 287AH-FG1611705

Appendix 3

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

Date	Temperature	Humidity
2010-06-02	22 °C ± 3 °C	34 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. Measurements were made at antenna connector ANT 1. The test object 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

The measurement was performed at TX ARFCN 661 (1960.0 MHz)

		Modulation	**OBW**	
Diagram	1:	GMSK	240.7	kHz
Diagram	2:	16QAM	239.3	kHz
Diagram	3:	32QAM	240.0	kHz

Complies?	Yes

FCC ID: WODFKRC161170-5 Appendix 3.1
IC: 287AH-FG1611705

Diagram 1

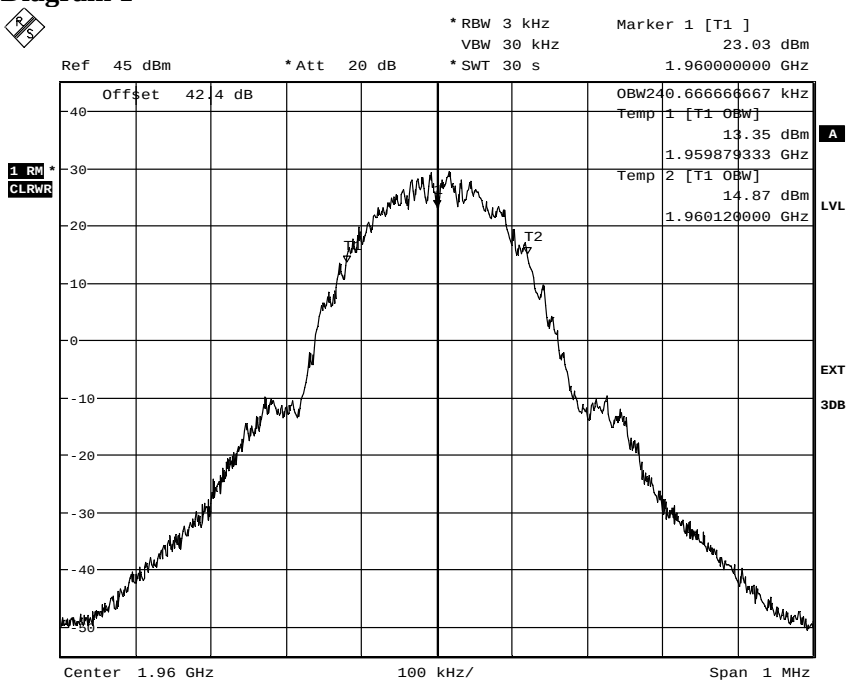


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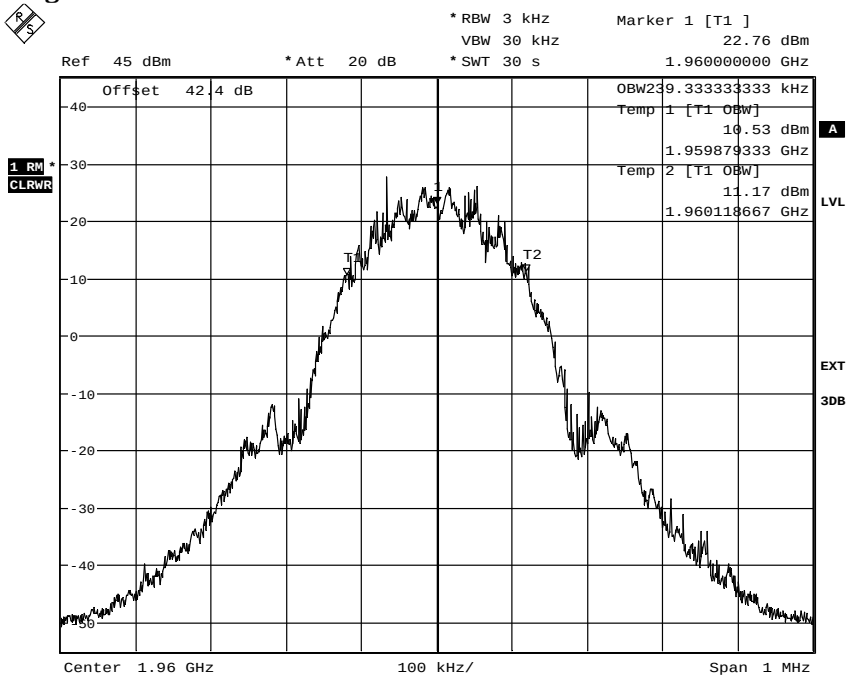
Diagram 2



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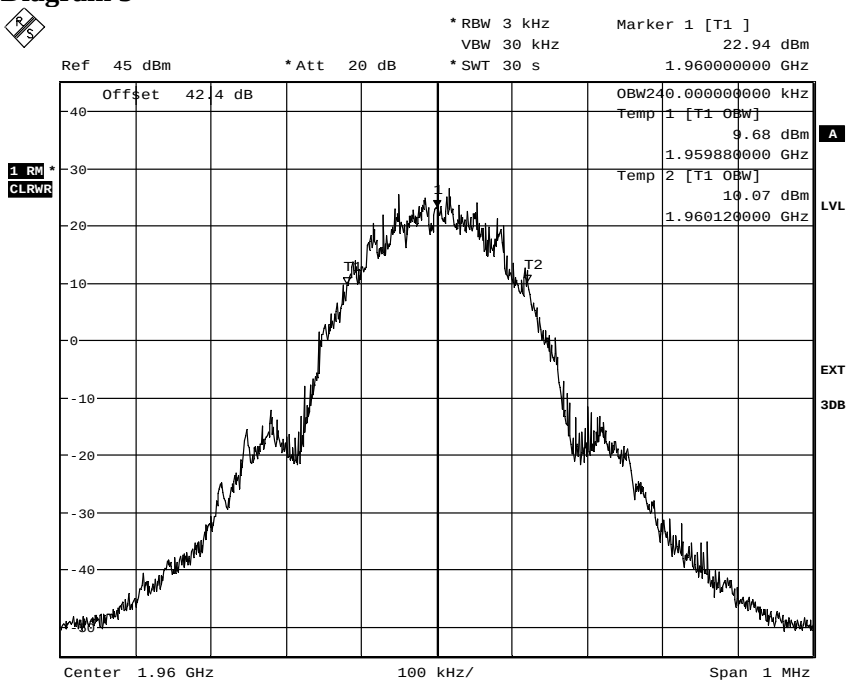
FCC ID: WODFKRC161170-5 Appendix 3.1
IC: 287AH-FG1611705

Diagram 3



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

Date	Temperature	Humidity
2010-06-01	22 °C ± 3 °C	32 % ± 5 %
2010-06-02	22 °C ± 3 °C	34 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. The measurements were made at antenna connector Ant 1. 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. FCC rules specify a RBW of 1 MHz 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 -25.2 dB (10*log(3/1000) to -38.2 dBm for frequencies >1 MHz away from the band edges. For the 10 MHz wide measurement beyond the first MHz off the band edges a RBW of 50 kHz was used and the limit was adapted by -13 dB (10*log(50/1000)) to -26 dBm.

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

Reduced output power on the outermost channels:
Diagram 1 16QAM, Ch 512 (1930.2 MHz) Lower band edge, power setting 35
Diagram 2 16QAM, Ch 810 (1989.8 MHz) Upper band edge, power setting 37
Diagram 3 32QAM, Ch 512 (1930.2 MHz) Lower band edge, power setting 35
Diagram 4 32QAM, Ch 810 (1989.8 MHz) Upper band edge, power setting 37

Maximum nominal output power (setting 43):
Diagram 5 16QAM, Ch 513 (1930.4 MHz) Lower band edge + 1 channel,
Diagram 6 16QAM, Ch 809 (1989.6 MHz) Upper band edge - 1 channel
Diagram 7 32QAM, Ch 513 (1930.4 MHz) Lower band edge + 1 channel
Diagram 8 32QAM, Ch 809 (1989.6 MHz) Upper band edge - 1 channel

Remark

The highest usable output power setting for 16QAM and 32QAM modulation on the lower band edge channel 512 is with RBS master 2E software set to “35”, resulting in a measured RMS output power of 34.9 dBm for 16QAM and 34.4 dBm for 32QAM. The highest usable setting for 16QAM and 32QAM modulation on the higher band edge channel 810 is with RBS master 2E software set to “37”, resulting in a measured RMS output power of 36.8 dBm with 16QAM and 36.4 dBm with 32QAM.

Limits

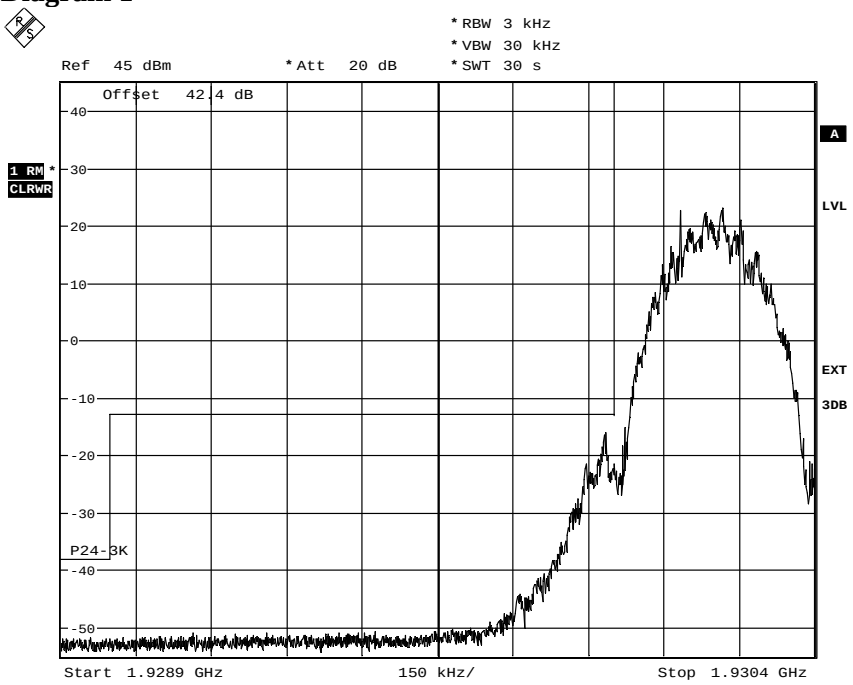
The power of any emission outside the frequency band shall be attenuated below the transmitter power (P) by at least 43 + 10 log P dB.

Complies?	Yes

FCC ID: WODFKRC161170-5
IC: 287AH-FG1611705

Appendix 4.1

Diagram 1



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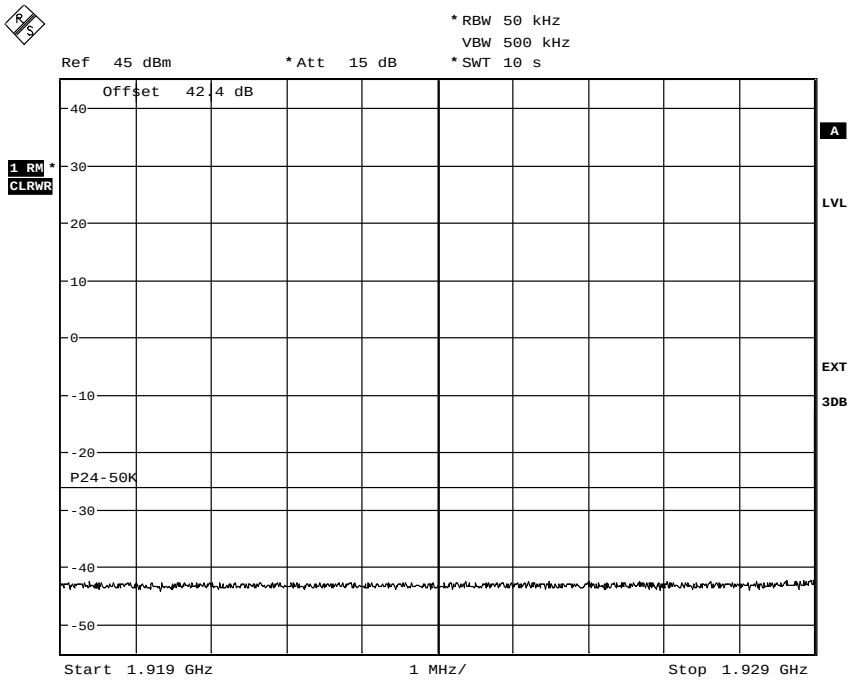

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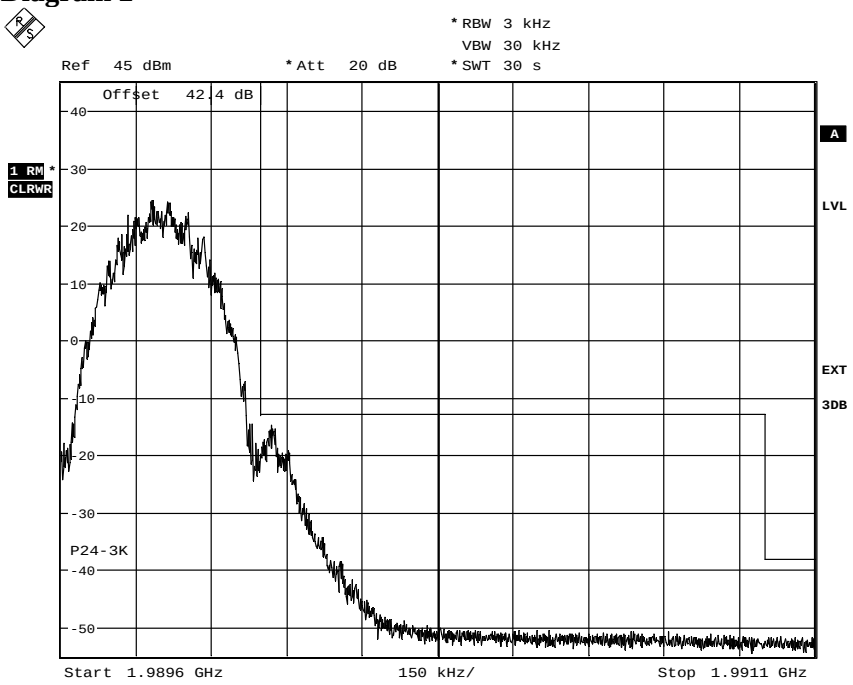
Diagram 2



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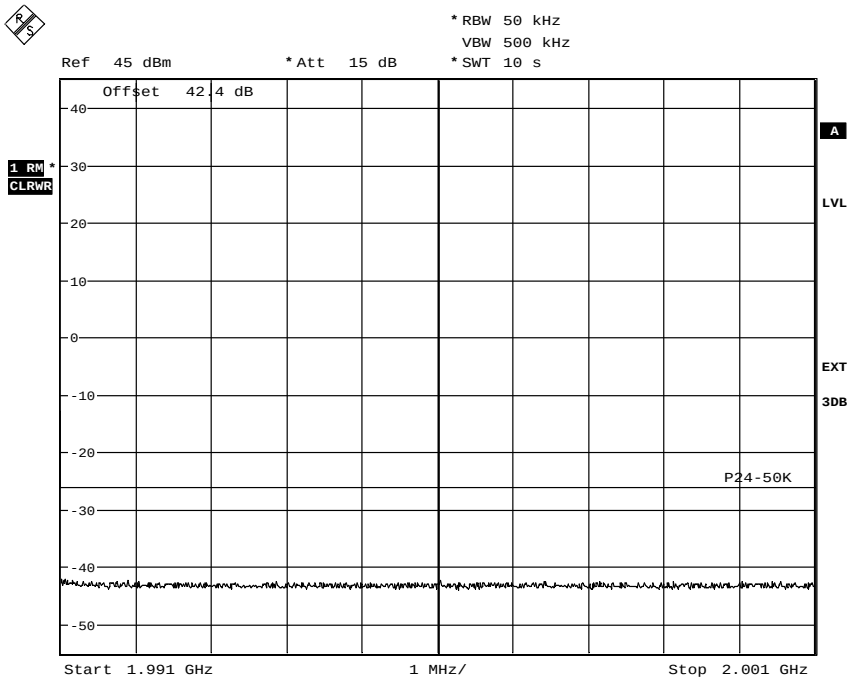

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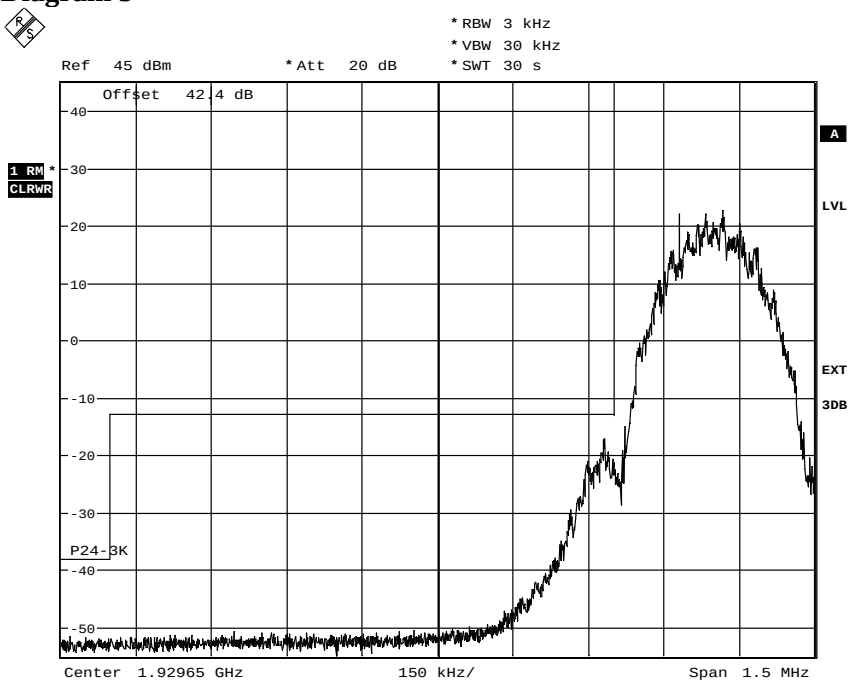
Diagram 3



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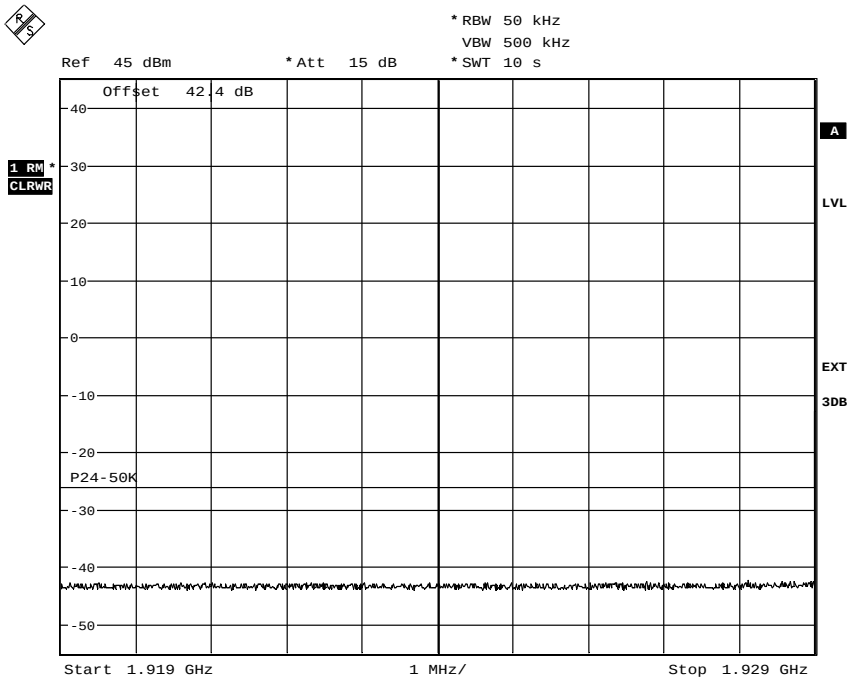

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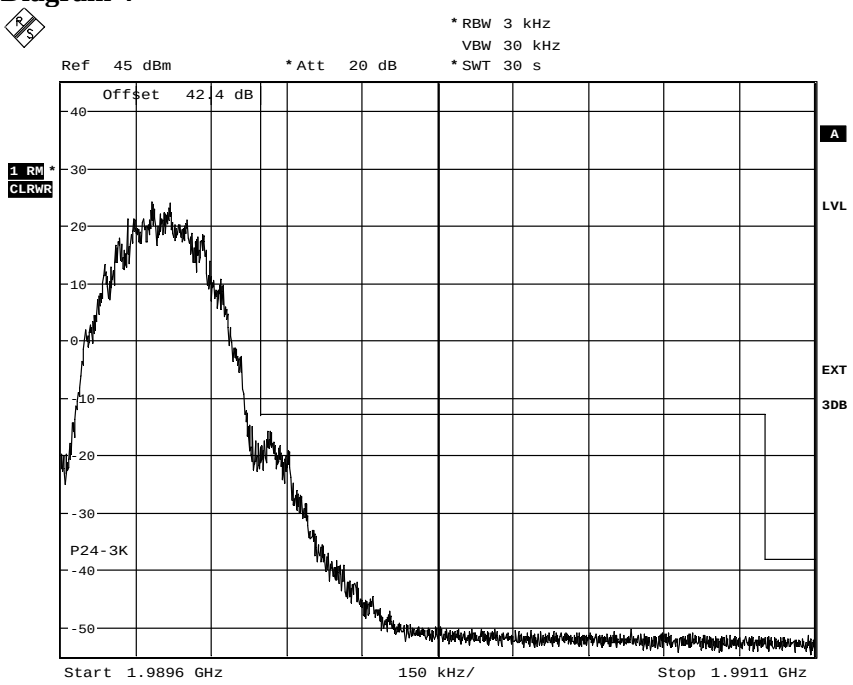
Diagram 4



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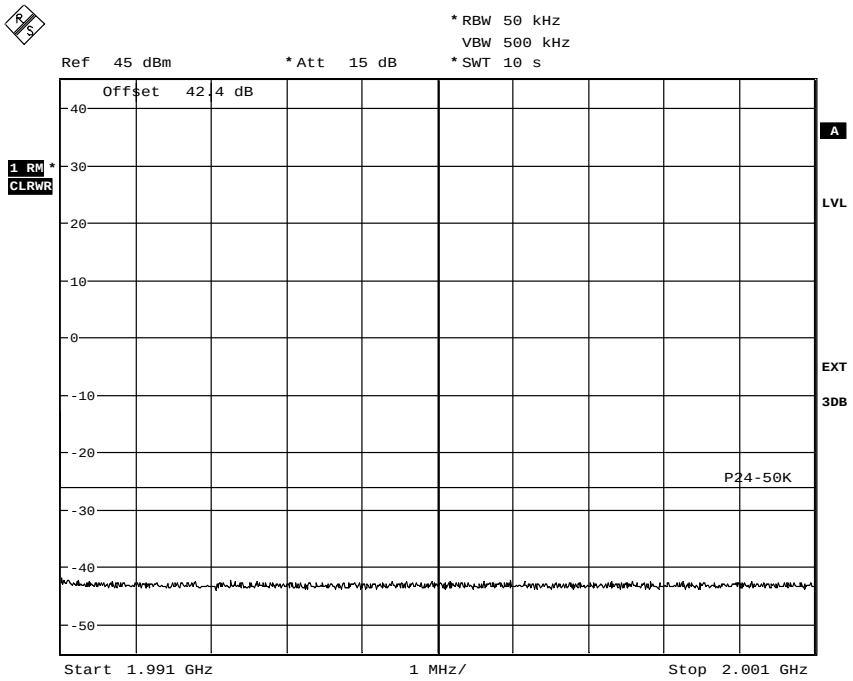

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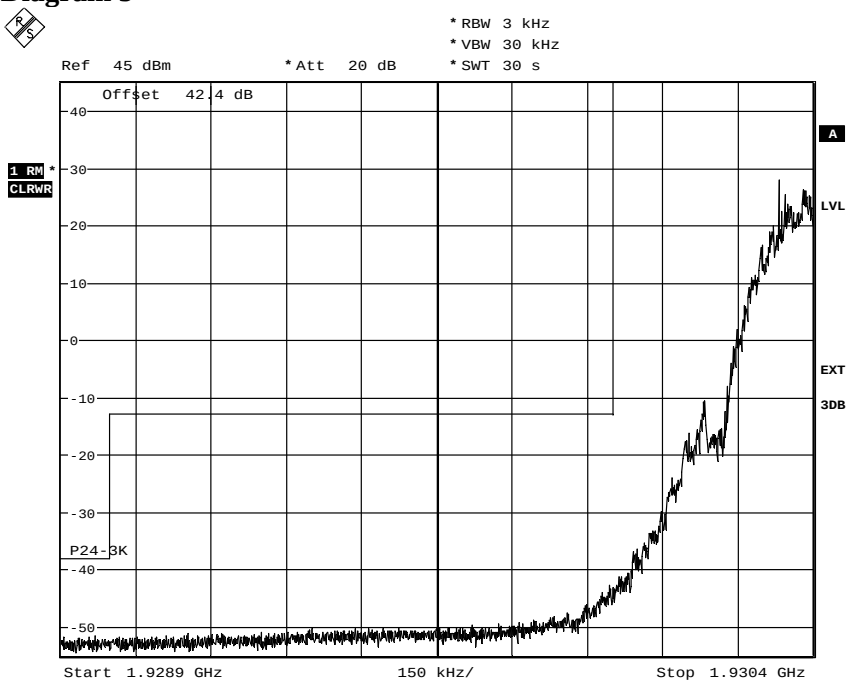

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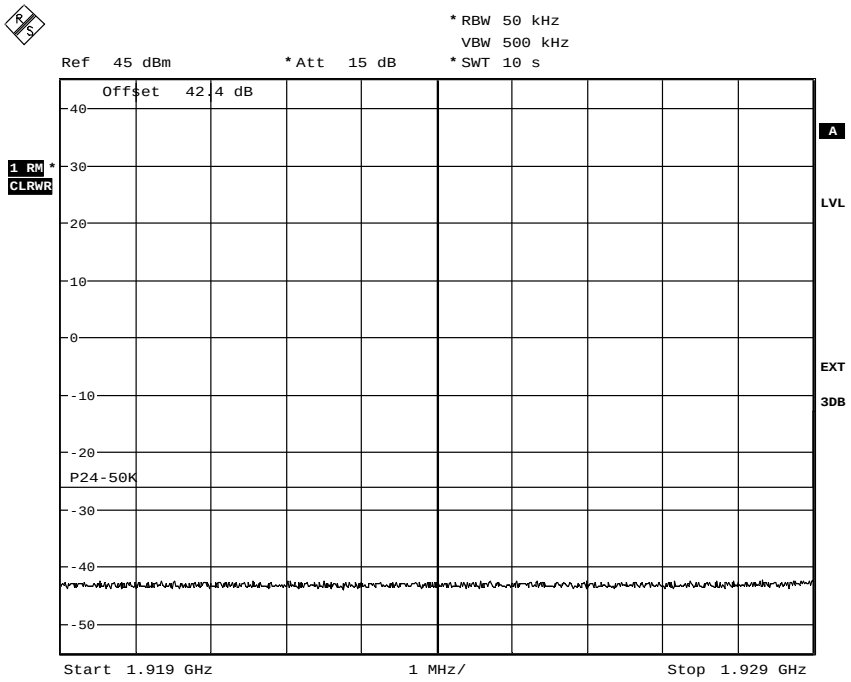

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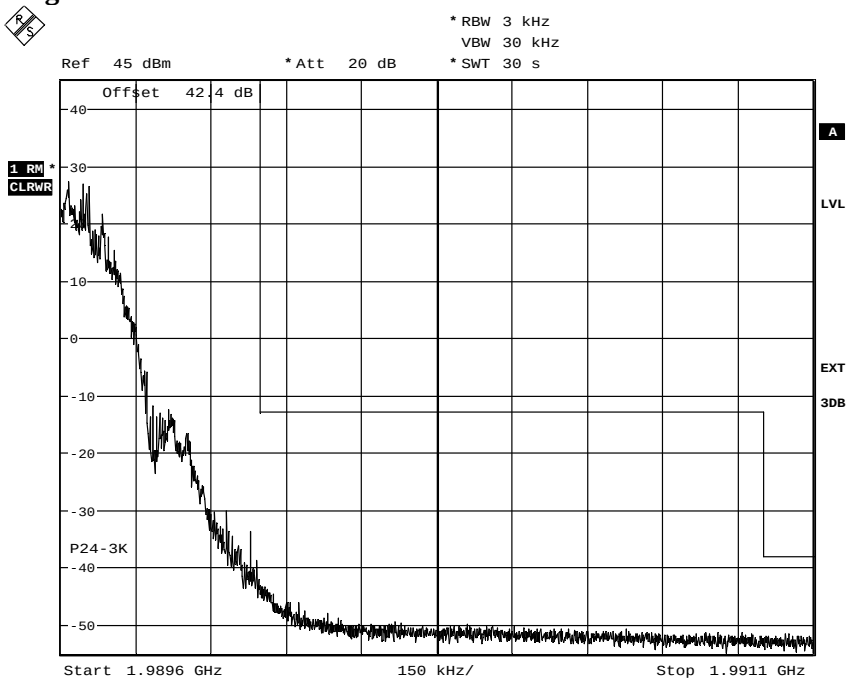
Diagram 6



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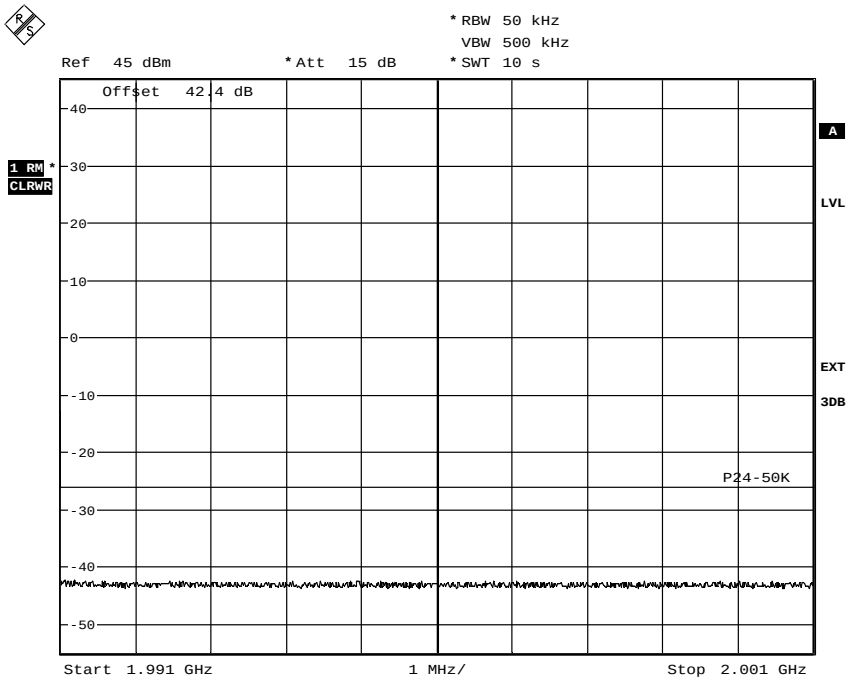

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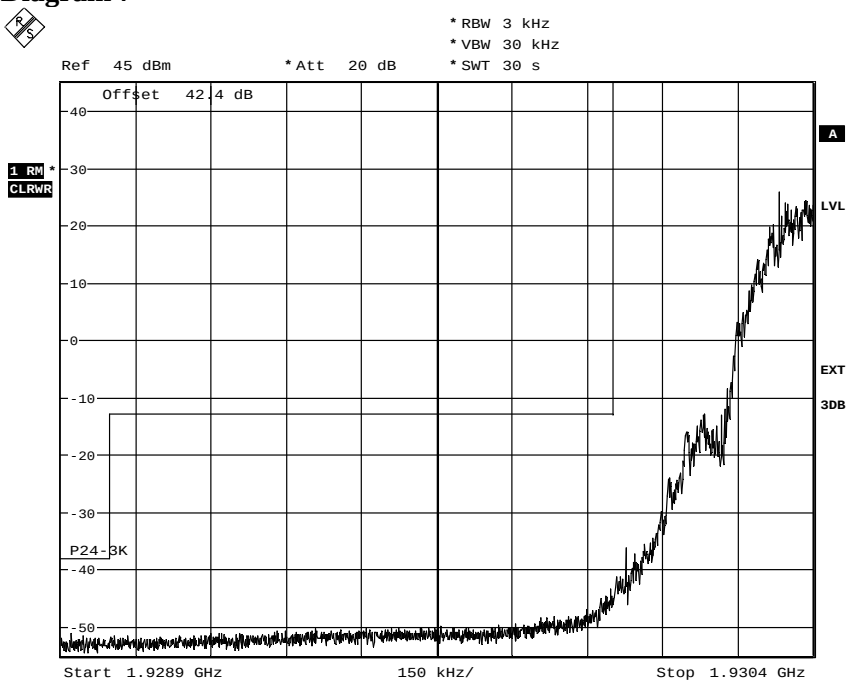
Diagram 7



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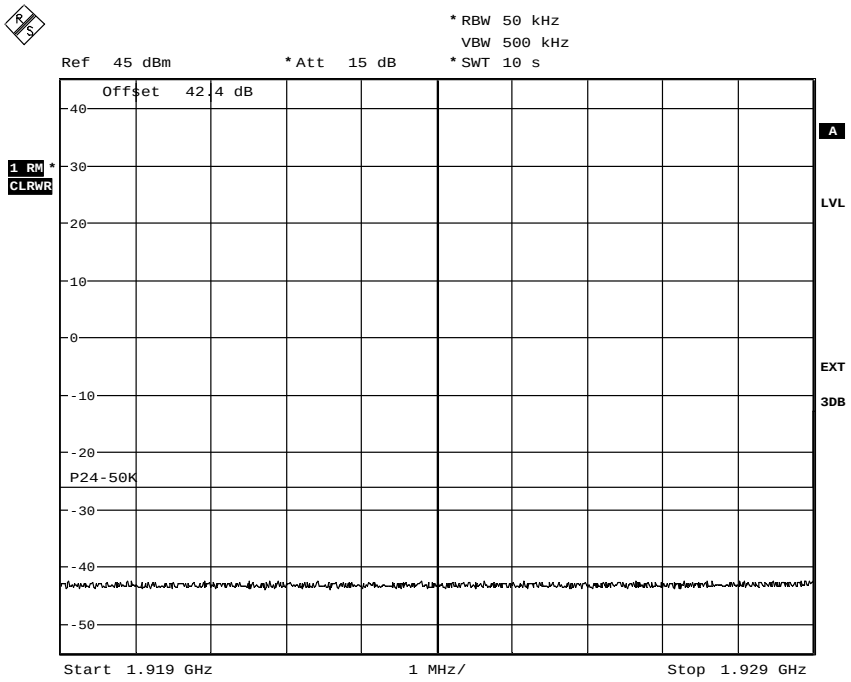

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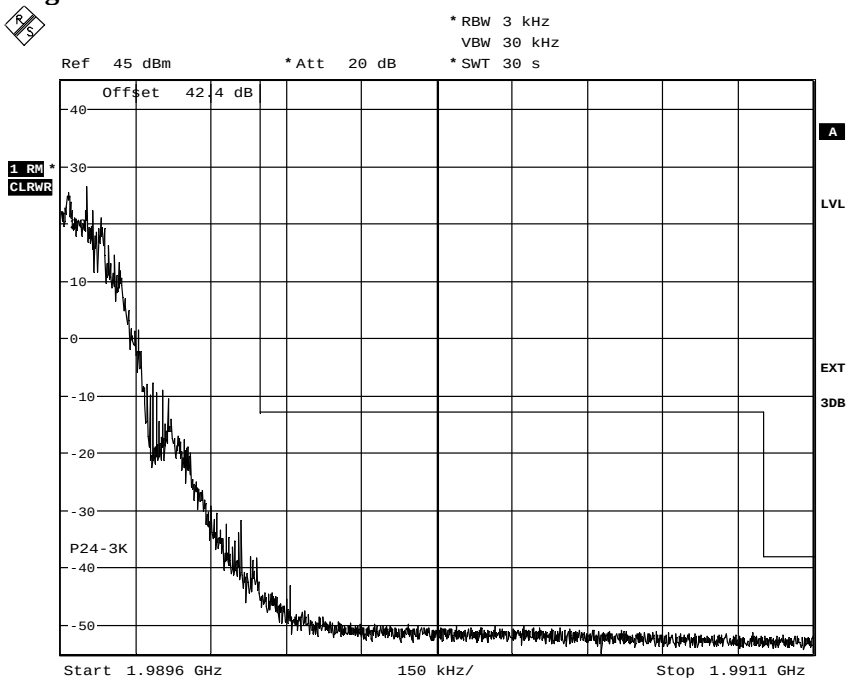
Diagram 8



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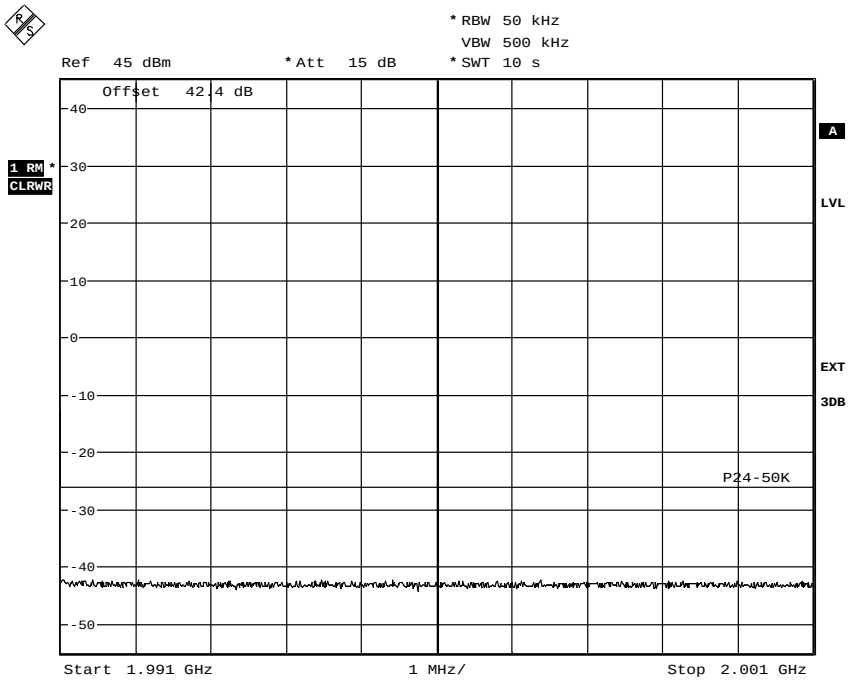

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FCC ID: WODFKRC161170-5
IC: 287AH-FG1611705

Appendix 5

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

Date	Temperature	Humidity
2010-06-02	22 °C ± 3 °C	34 % ± 5 %

Test set-up and procedure

The measurements were made per definition in §24.238. Measurements were made at antenna connector ANT 1. The test object 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	504 200
Testo 615 temperature and humidity meter	503 498

Measurement uncertainty: 3.7 dB

Results

The results are shown in appendix 5.1

Configuration: TX ARFCN 661, 1960.0 MHz, RBS master 2E software setting “43” for maximum output power.

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

Diagram 3: 16QAM, 9 KHz – 3 GHz
Diagram 4: 16QAM, 3 GHz – 20 GHz

Diagram 5: 32QAM, 9 KHz – 3 GHz
Diagram 6: 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 feedthrough.

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

FCC ID: WODFKRC161170-5
IC: 287AH-FG1611705

Appendix 5.1

Diagram 1

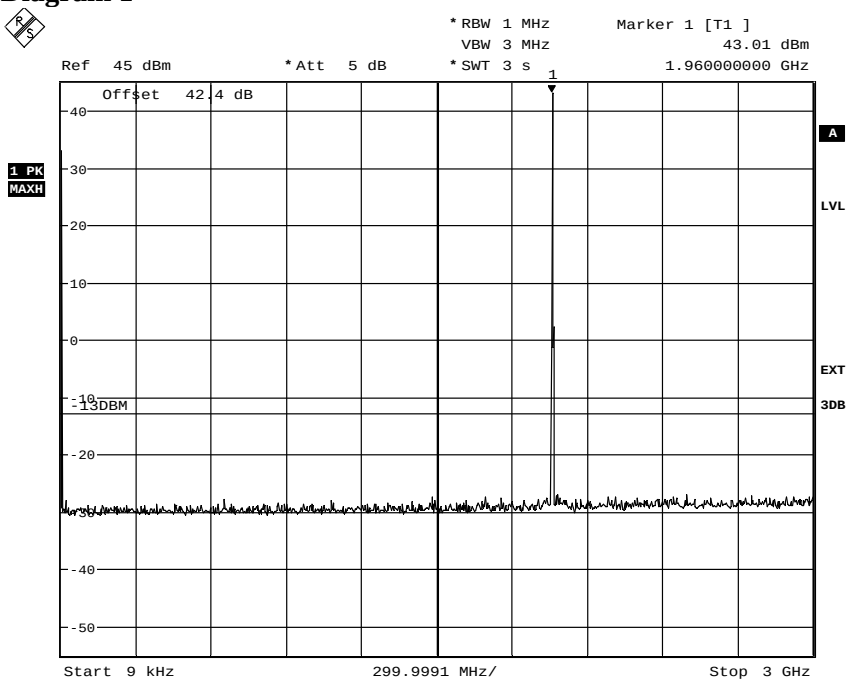

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Diagram 2

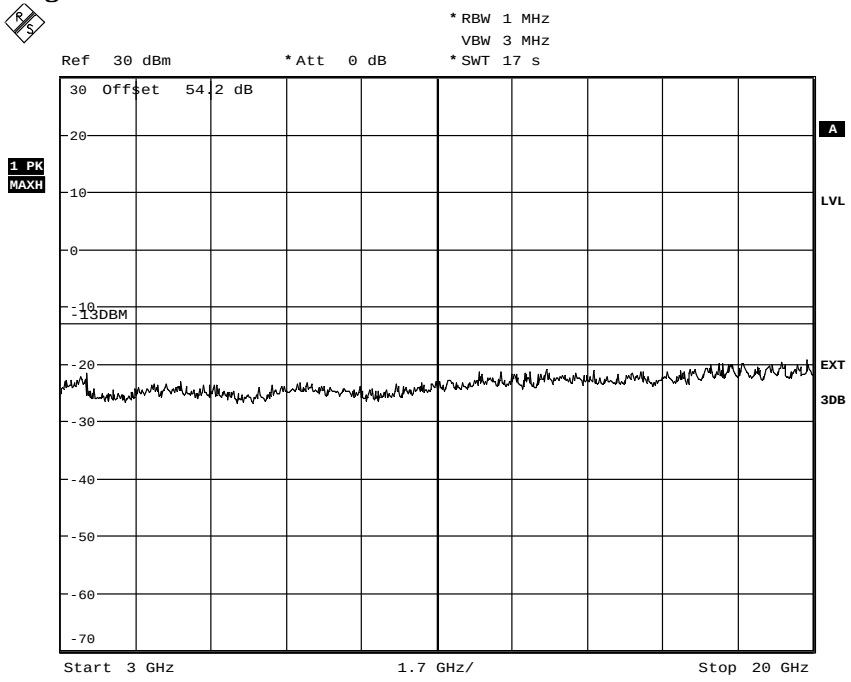

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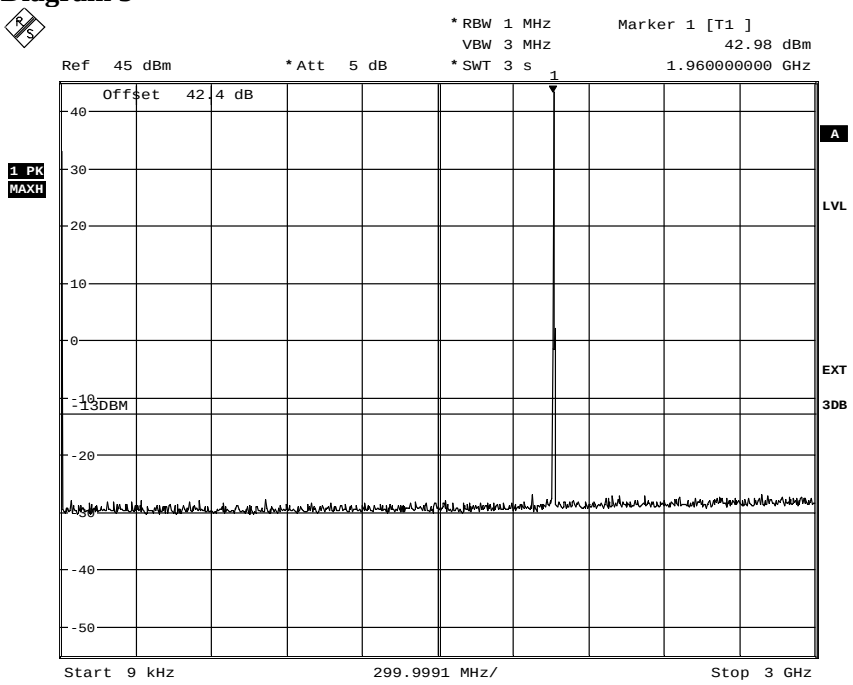
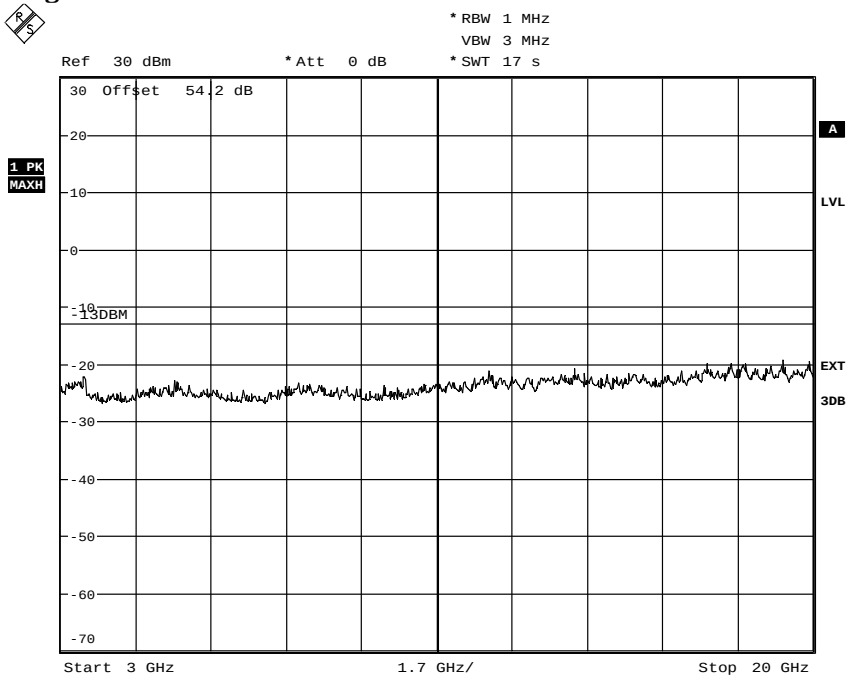
Diagram 3



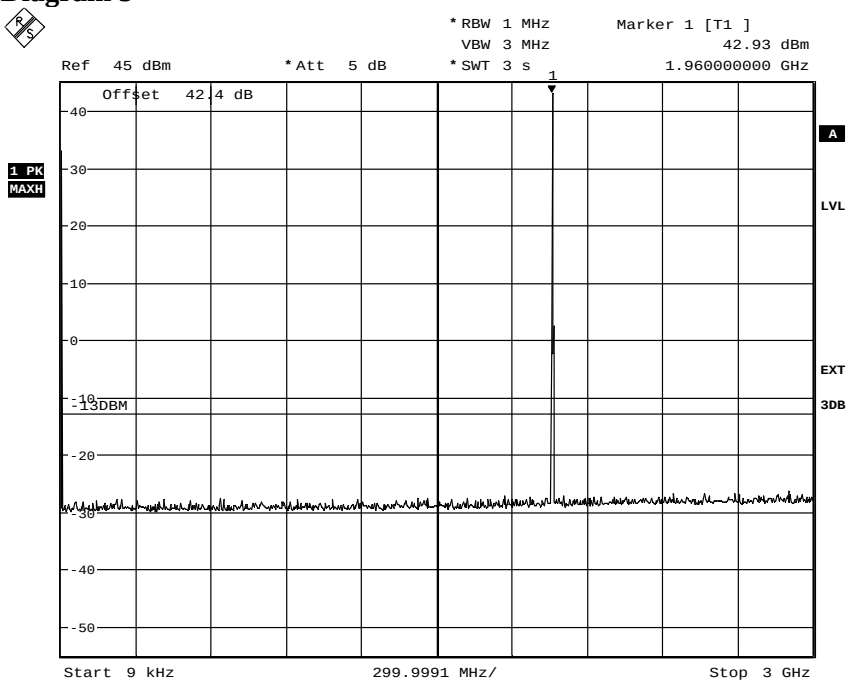
Date: 2.JUN.2010 09:41:55

Diagram 4



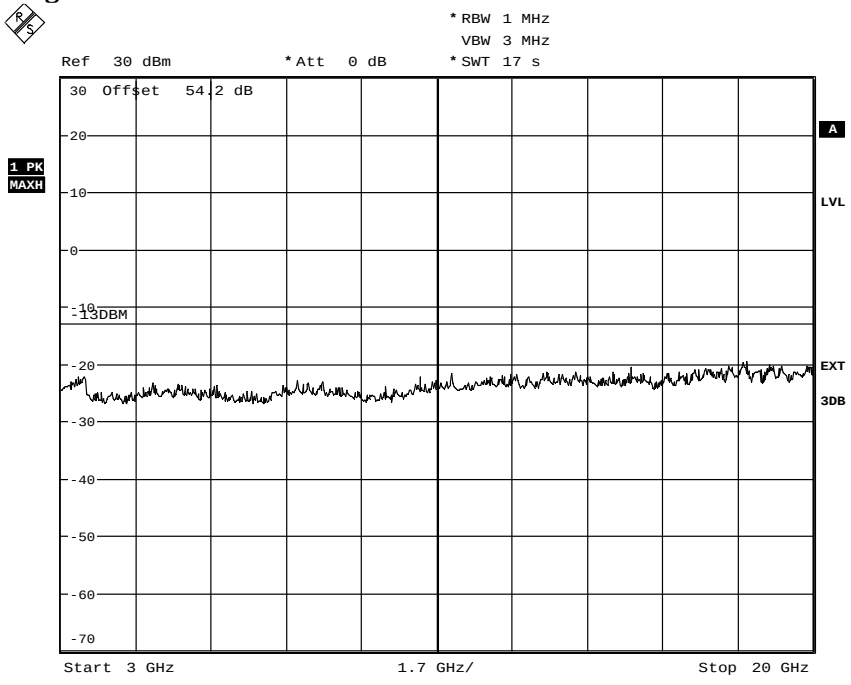
Date: 2.JUN.2010 09:44:28

Diagram 5



Date: 2.JUN.2010 10:03:21

Diagram 6



Date: 2.JUN.2010 10:06:15

FCC ID: WODFKRC161170-5
IC: 287AH-FG1611705

Appendix 6

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

Date	Temperature	Humidity
2010-06-07	22 °C ± 3 °C	50 % ± 5 %

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 – 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.

During all radiated measurements 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
RLC Electronics HP-filter F-16149	503 739
Testo 615 temperature and humidity meter	503 498

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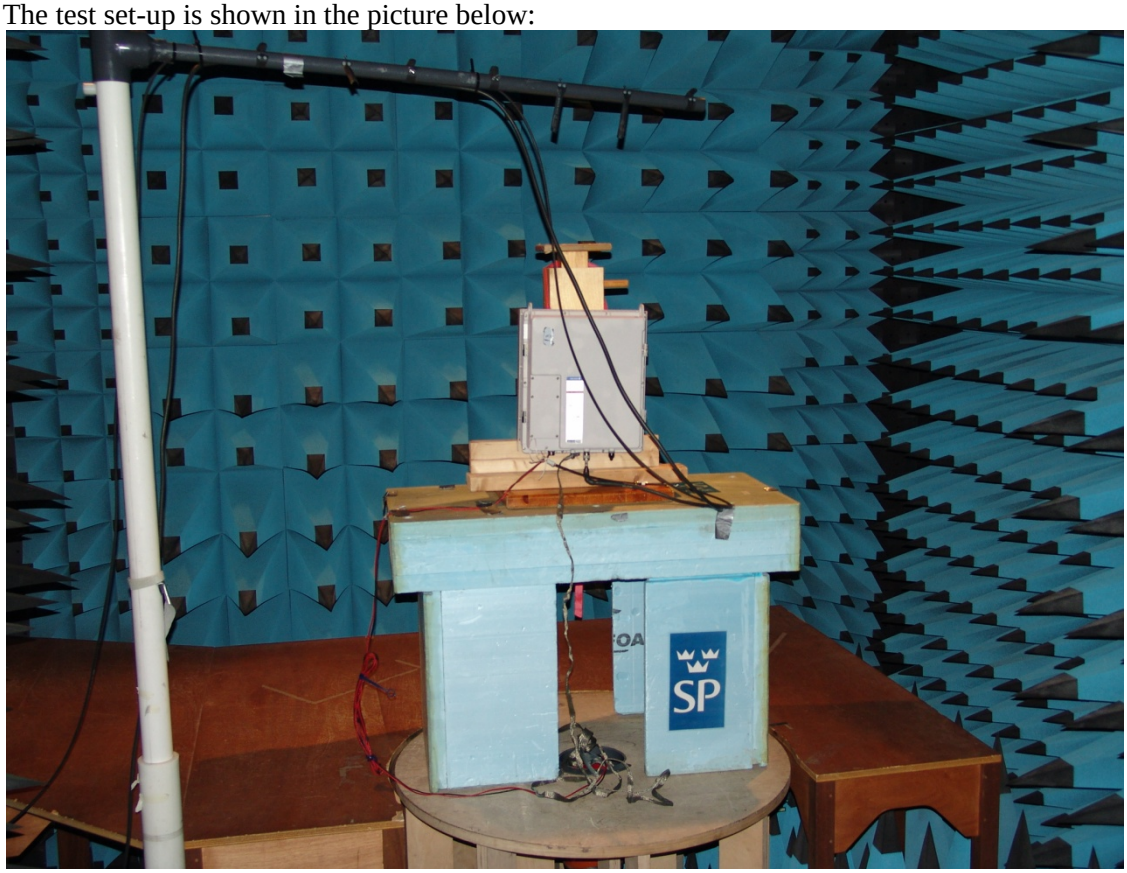
Appendix 6

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: 3.2 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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Appendix 7

Hardware & software list

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

Unit	Product Number	Revision	Serial Number
MU-12	BFE 899 101/2	R2A	(S)CB4B944307
RRUN19-22	KRC 161 170/5	R1B	(S)CB4A320705

Test object software during both radiated and conducted measurements

Software	Revision
CXP 104 0007/05	G11B

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Appendix 8

Photos oft the test object

Front side

Rear side

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IC: 287AH-FG1611705

Appendix 8

Left side

Right side

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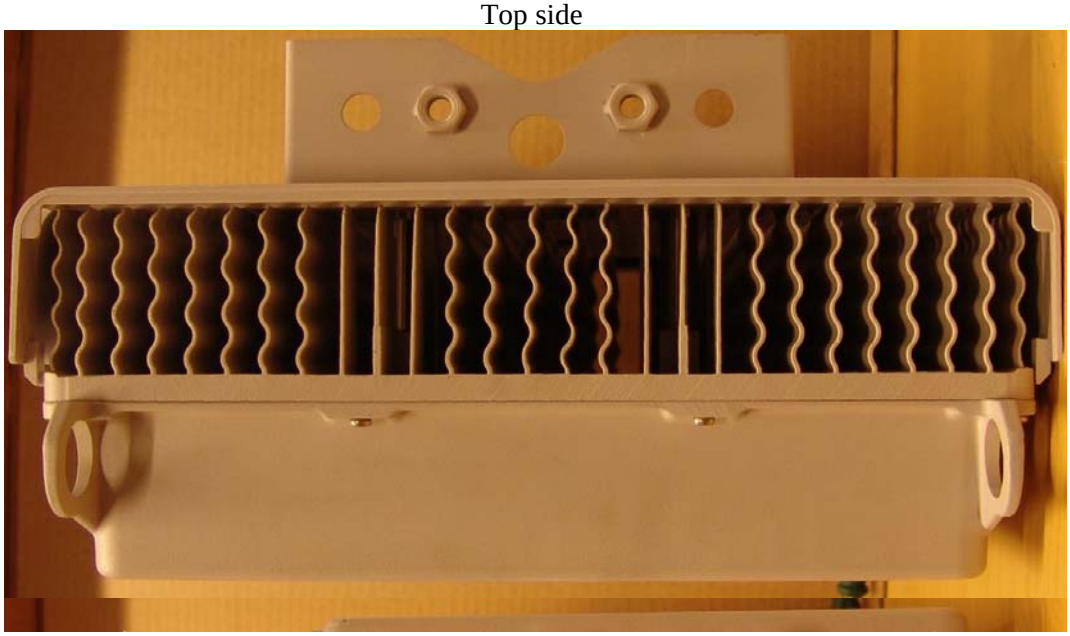
IC: 287AH-FG1611705

Appendix 8

Top side



Bottom side