



FCC ID: NXIWRS

Registration No. DAT-P-207/05

## EMI -- TEST REPORT

- FCC Part 15.247 -

<b>Test Report No. :</b>	<b>T33196-00-03HS</b>	12 February 2009 Date of issue
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Type / Model Name : WRS RF Module

Product Description : RF Module for transmitting Data at 2.4 GHz

**Applicant** : Marposs S.p.A.

Address : Via Saliceto 13  
40010 BENTIVOGLIO BO, ITALIEN

**Manufacturer** : Marposs S.p.A.

Address : Via Saliceto 13  
40010 BENTIVOGLIO BO, ITALIEN

**Licence holder** : Marposs S.p.A.

Address : Via Saliceto 13  
40010 BENTIVOGLIO BO, ITALIEN

<b>Test Result</b> according to the standards listed in clause 1 test standards:	<b>POSITIVE</b>
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DAT-P-207/05-00

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test results without the written permission of the test laboratory.

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# 1 TEST STANDARDS

The tests were performed according to following standards:

## **FCC Rules and Regulations Part 15, Subpart A - General (October 15, 2008)**

Part 15, Subpart A, Section 15.31	Measurement standards
Part 15, Subpart A, Section 15.33	Frequency range of radiated measurements
Part 15, Subpart A, Section 15.35	Measurement detector functions and bandwidths

## **FCC Rules and Regulations Part 15, Subpart B - Unintentional Radiators (October 15, 2008)**

Part 15, Subpart B, Section 15.109	Radiated emissions, general requirements
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## **FCC Rules and Regulations Part 15, Subpart C - Intentional Radiators (October 15, 2008)**

Part 15, Subpart C, Section 15.203	Antenna requirement
Part 15, Subpart C, Section 15.204	External radio frequency power amplifiers and antenna modifications
Part 15, Subpart C, Section 15.205	Restricted bands of operation
Part 15, Subpart C, Section 15.209	Radiated emission limits, general requirements
Part 15, Subpart C, Section 15.247	Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

## **FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969**

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: portable device

## **OET Bulletin 65, 65A, 65B, 65C Edition 97-01, August 1997 – Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.**

ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
ANSI C95.1:1992	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
CISPR 16-4-2: 2003	Uncertainty in EMC measurement
CISPR 22: 2005 EN 55022: 2006	Information technology equipment

## 2 SUMMARY

### GENERAL REMARKS:

The EUT is a RF-Module based on a wireless USB chip set with the focus to save the battery power. The EUT has an integrated chip antenna and have for test issues an antenna connector where conducted measurements can be performed. The protocol stack is proprietary and supports no hopping.

#### Available Features:

Working in the frequency band of 2.4 GHz to 2.4835 GHz and supplies 81 channels from 2.402 GHz to 2.482 GHz with a bandwidth of 1 MHz.

DSSS with GFSK Modulation, Data transmission 1 Mbit/s, baseband spreading system applies 64 chips, using 8DR mode, eight bits are encoded in each derived code symbol transmitted.

The EUT was set with test modulation to transmit data during the tests with a duty cycle (X) of about X=1.

### FINAL ASSESSMENT:

The equipment under test **fulfills** the EMI requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 16 January 2009

Testing concluded on : 12 February 2009

Checked by:

Tested by:

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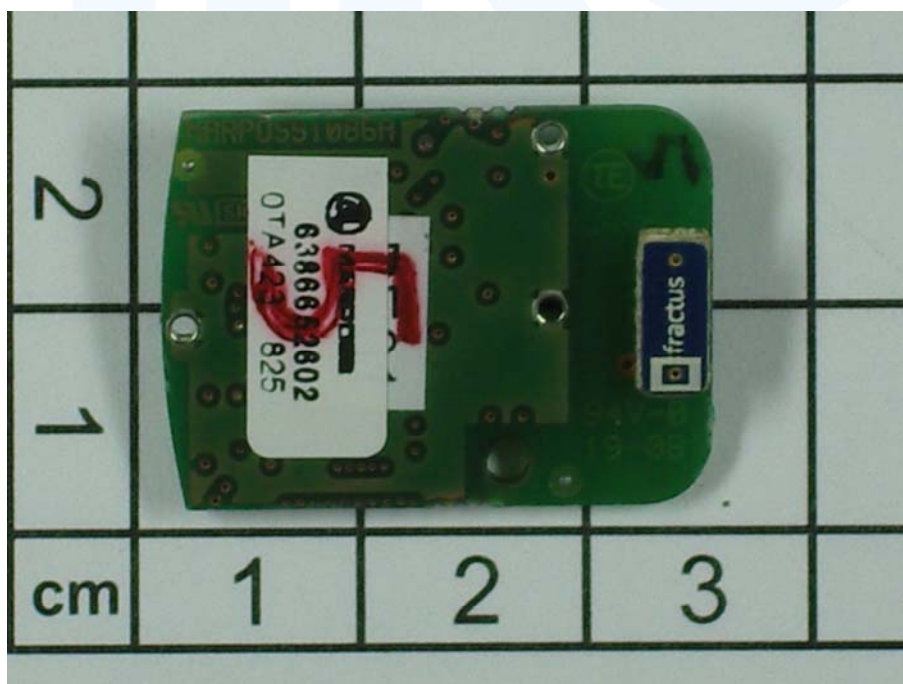
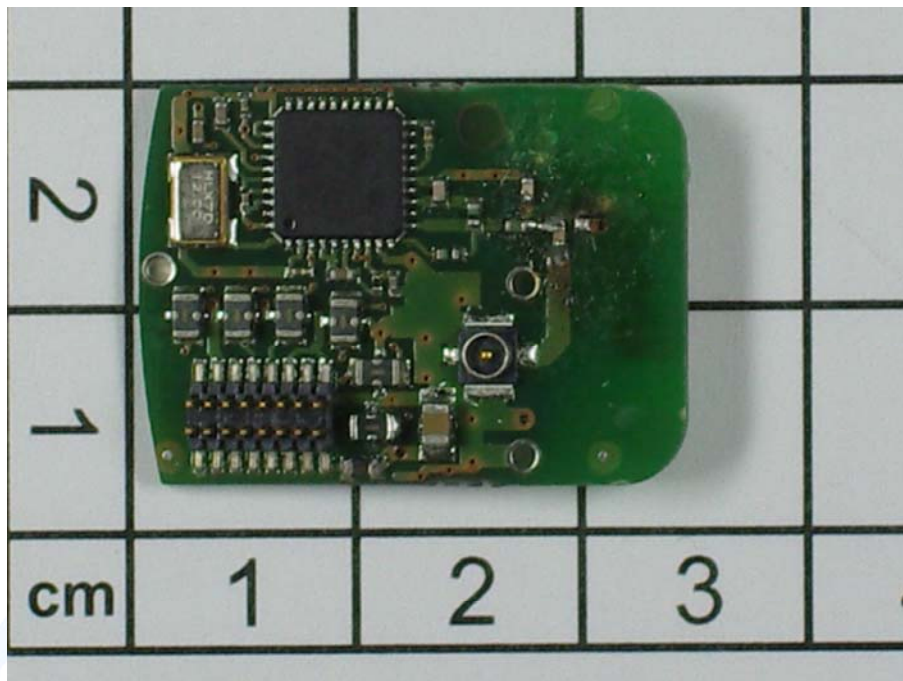
Klaus Gegenfurtner  
Dipl.-Ing.(FH)  
Manager: Radio Group

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Hermann Smetana  
Dipl.-Ing.(FH)  
Radio Expert

### 3 EQUIPMENT UNDER TEST

#### 3.1 Photo documentation of the EUT



**FCC ID: NXIWRS**

### 3.2 Power supply system utilised

Power supply voltage : 24 VDC (test pcb)

### 3.3 Short description of the Equipment under Test (EUT)

The EUT is a RF-Module based on a wireless USB chip set with the focus to save the battery power for the wireless applications in the metering industry and a comfortable data rate. The EUT has an integrated chip antenna. The protocol stack is proprietary and supports no hopping.

Number of tested samples: 2 for radiated measurements and 1 for conducted measurements  
Serial number: 3, 5, 4

#### EUT operation mode:

The equipment under test was operated during the measurement under the following conditions:

- TX continuous

- RX

#### EUT configuration:

(The CDF filled by the applicant can be viewed at the test laboratory.)

**The following peripheral devices and interface cables were connected during the measurements:**

- _____	Model : _____
- _____	Model : _____
- _____	Model : _____
- _____	Model : _____
- _____	Model : _____
- _____	Model : _____

## **4 TEST ENVIRONMENT**

### **4.1 Address of the test laboratory**

**mikes-testingpartners gmbh**  
**Ohmstrasse 2-4**  
**94342 STRASSKIRCHEN**  
**GERMANY**

### **4.2 Environmental conditions**

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

### **4.3 Statement of the measurement uncertainty**

The data and results referenced in this document are true and accurate. The reader may notice that tolerances within the calibration of the equipment and facilities may cause additional uncertainty. The measurement uncertainty is calculated for all measurements listed in this test report acc. to CISPR 16-4-2 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurement“ and documented in the mikes-testingpartners gmbh quality system acc. to DIN EN ISO/IEC 17025. For all measurements shown in this report, the measurement uncertainty of the test laboratory, mikes-testingpartners gmbh, is below the measurement uncertainty as defined by CISPR. Therefore, no special measures must be taken into consideration with regard to the limits according to CISPR. Furthermore, component diversity and modifications in production process of devices may result in additional deviation. If necessary, refer to the test lab for the actual measurement uncertainty for the specific test. The manufacturer has the sole responsibility of continued compliance of the EUT.

## **4.4 Measurement Protocol for FCC, VCCI and AUSTEL**

### **4.4.1 GENERAL INFORMATION**

#### **4.4.1.1 Test Methodology**

Conducted and radiated disturbance testing is performed according to the procedures set out by the International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

The test methods used comply with CISPR Publication 22, EN 55022 - "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement" and with ANSI C63.4 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

In compliance with 47 CFR Part 15 Subpart A, Section 15.38 testing for FCC compliance may be achieved by following the procedures set out in ANSI C63.4 and applying the CISPR 22 limits.

#### **4.4.1.2 Justification**

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral using the appropriate impedance characteristic or left unterminated. Where appropriate, cables are manually manipulated with respect to each other thus obtaining maximum disturbances from the unit.

## **4.5 Discovery of worst case measurement conditions**

Measurements have been made in all three orthogonal axes and the settings of the EUT were changed to locate at which position and at what setting of the EUT produce the maximum of the emissions. For the further measurement the EUT is set in X position with the following output power settings: channel 1 to 80 to power 7 (4 dBm) channel 81 to power 6 (0 dBm).



## 5 TEST CONDITIONS AND RESULTS

### 5.1 Conducted emissions

For test instruments and accessories used see section 6 Part A 4.

#### 5.1.1 Description of the test location

Test location:                      Shielded Room S2

#### 5.1.2 Photo documentation of the test set-up



#### 5.1.3 Applicable standard

According to FCC Part 15, Section 15.207(a):

Except as shown in paragraphs (b) and (c) of this Section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency

#### 5.1.4 Description of Measurement

The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a line impedance stabilization network (LISN) with 50Ω/50 μH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 cm above the floor and is positioned 40 cm from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emissions are remeasured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

To convert between dBμV and μV, the following conversions apply:

$$\text{dB}\mu\text{V} = 20 \log \mu\text{V}$$

$$\mu\text{V} = 10^{(\text{dB}\mu\text{V}/20)}$$

#### 5.1.5 Test result

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin 5.6 dB at 0.42 MHz

The requirements are **FULFILLED**.

**Remarks:** For detailed test result please refer to following test protocols

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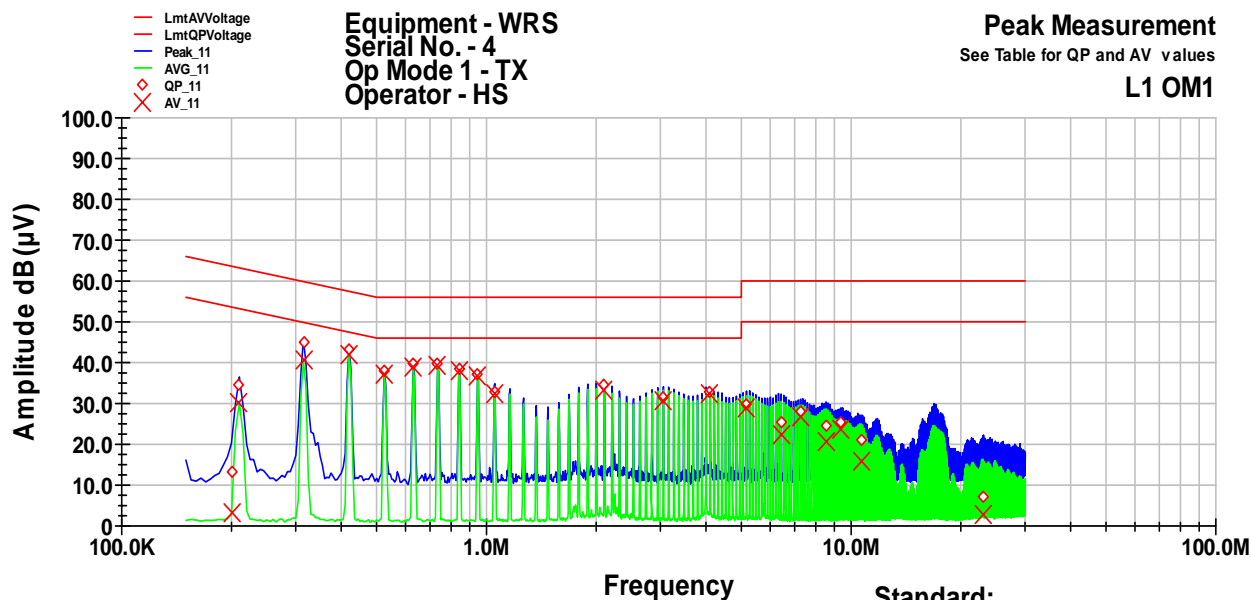
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### 5.1.6 Test protocol

Test point L1  
Operation mode: TX continuous  
Remarks:

Result: passed



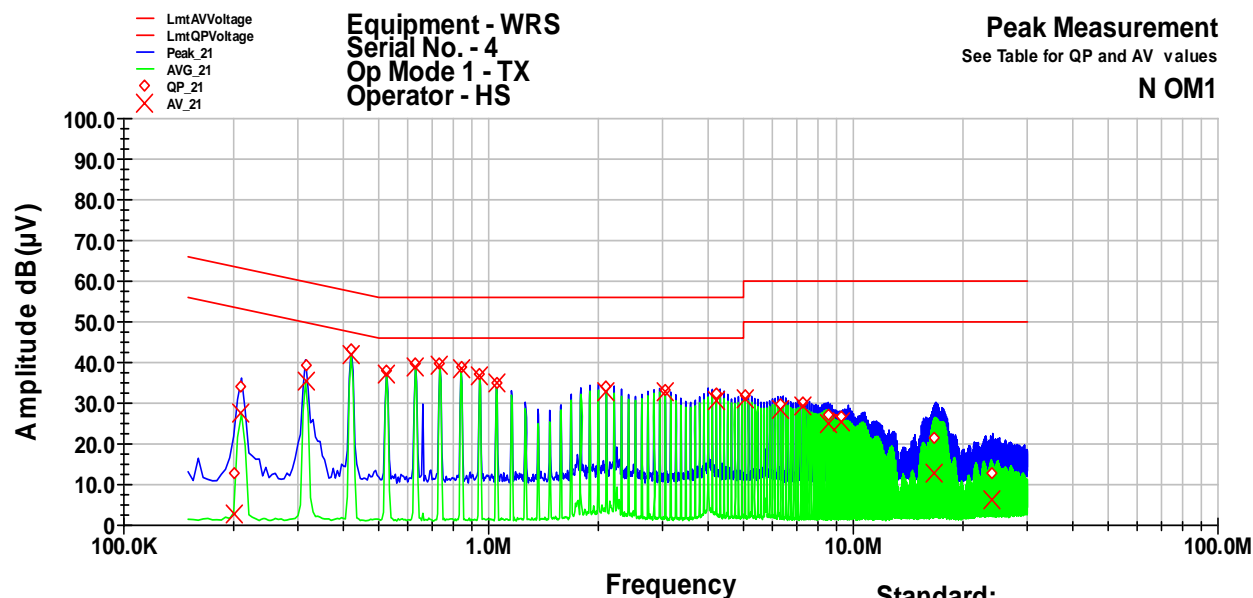
Standard:  
File Number:

Frequency MHz	QP Level dB(μV)	QP Delta dB	QP Limit dB	AV Level dB(μV)	AV Delta dB	AV Limit dB
0.2	13.3	-50.3	63.6	3.3	-50.4	53.6
0.21	34.5	-28.7	63.2	30.1	-23.1	53.2
0.315	44.8	-15.0	59.8	40.5	-9.3	49.8
0.42	43.1	-14.3	57.4	41.8	-5.7	47.4
0.525	37.9	-18.1	56.0	37.0	-9.0	46.0
0.63	39.7	-16.3	56.0	38.9	-7.1	46.0
0.735	39.7	-16.3	56.0	39.1	-6.9	46.0
0.84	38.6	-17.4	56.0	38.2	-7.8	46.0
0.945	37.0	-19.0	56.0	36.7	-9.3	46.0
1.055	33.0	-23.0	56.0	32.5	-13.5	46.0
2.105	34.4	-21.6	56.0	33.2	-12.8	46.0
3.055	31.3	-24.7	56.0	30.5	-15.5	46.0
4.105	33.0	-23.0	56.0	32.4	-13.6	46.0
5.16	29.8	-30.3	60.0	28.9	-21.1	50.0
6.425	25.4	-34.6	60.0	22.5	-27.5	50.0
7.265	28.0	-32.0	60.0	26.7	-23.3	50.0
8.53	24.5	-35.5	60.0	20.5	-29.5	50.0
9.37	25.4	-34.6	60.0	23.8	-26.3	50.0
10.635	21.0	-39.0	60.0	15.9	-34.0	50.0
22.96	7.0	-53.0	60.0	2.8	-47.2	50.0

FCC ID: NXIWRS

Test point N  
Operation mode: TX continuous  
Remarks:

Result: passed



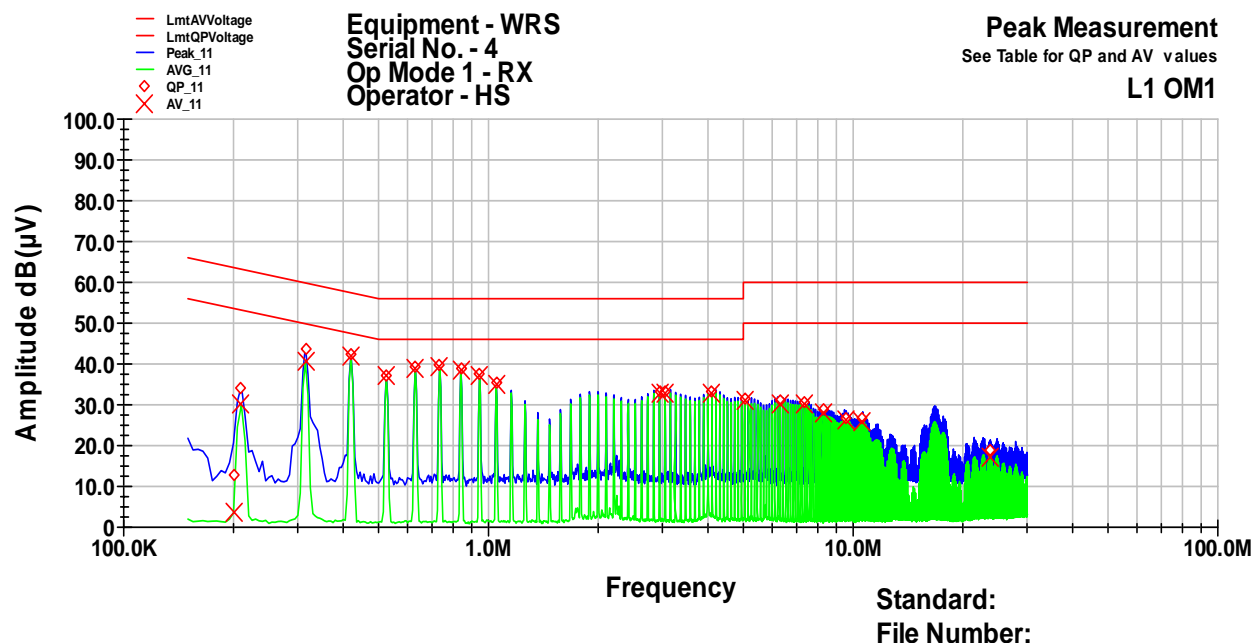
Standard:  
File Number:

Frequency MHz	QP Level dB(μV)	QP Delta dB	QP Limit dB	AV Level dB(μV)	AV Delta dB	AV Limit dB
0.2	13.0	-50.6	63.6	3.0	-50.7	53.6
0.21	34.1	-29.1	63.2	27.5	-25.7	53.2
0.315	39.1	-20.7	59.8	35.2	-14.6	49.8
0.42	43.2	-14.3	57.4	41.7	-5.7	47.4
0.525	37.9	-18.1	56.0	37.0	-9.0	46.0
0.63	39.7	-16.3	56.0	38.9	-7.1	46.0
0.735	39.8	-16.2	56.0	39.2	-6.8	46.0
0.84	38.7	-17.3	56.0	38.3	-7.7	46.0
0.945	37.2	-18.8	56.0	36.9	-9.1	46.0
1.05	35.2	-20.8	56.0	34.8	-11.2	46.0
2.105	33.9	-22.1	56.0	32.8	-13.2	46.0
3.05	33.2	-22.8	56.0	32.8	-13.2	46.0
4.21	32.2	-23.8	56.0	30.8	-15.2	46.0
5.05	31.7	-28.3	60.0	31.1	-18.9	50.0
6.315	29.7	-30.3	60.0	28.4	-21.6	50.0
7.26	30.0	-30.0	60.0	29.5	-20.5	50.0
8.525	27.1	-32.9	60.0	24.8	-25.2	50.0
9.26	26.7	-33.3	60.0	25.4	-24.6	50.0
16.735	21.4	-38.6	60.0	12.6	-37.4	50.0
23.89	12.9	-47.1	60.0	6.3	-43.7	50.0

FCC ID: NXIWRS

Test point L1  
Operation mode: RX  
Remarks:

Result: passed

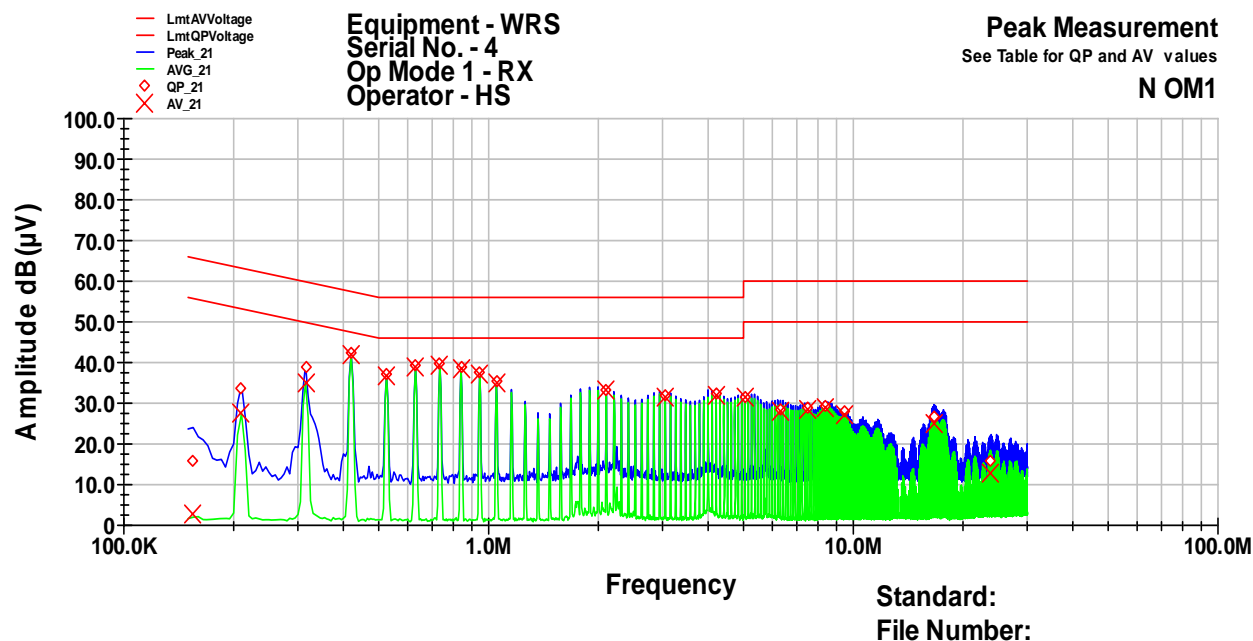


Frequency MHz	QP Level dB(μV)	QP Delta dB	QP Limit dB	AV Level dB(μV)	AV Delta dB	AV Limit dB
0.2	12.9	-50.7	63.6	3.6	-50.0	53.6
0.21	33.9	-29.3	63.2	30.0	-23.2	53.2
0.315	43.9	-16.0	59.8	40.4	-9.4	49.8
0.42	42.2	-15.2	57.4	41.8	-5.6	47.4
0.525	37.3	-18.7	56.0	37.0	-9.0	46.0
0.63	39.3	-16.7	56.0	39.0	-7.0	46.0
0.735	39.7	-16.3	56.0	39.4	-6.6	46.0
0.84	38.8	-17.2	56.0	38.6	-7.4	46.0
0.945	37.5	-18.5	56.0	37.2	-8.8	46.0
1.05	35.5	-20.5	56.0	35.1	-10.9	46.0
2.945	33.2	-22.8	56.0	32.9	-13.1	46.0
3.05	33.3	-22.7	56.0	32.9	-13.1	46.0
4.1	33.3	-22.7	56.0	33.0	-13.0	46.0
5.045	31.5	-28.5	60.0	31.1	-18.9	50.0
6.31	30.9	-29.1	60.0	30.3	-19.7	50.0
7.36	30.8	-29.2	60.0	30.4	-19.6	50.0
8.305	28.8	-31.2	60.0	28.2	-21.8	50.0
9.57	26.9	-33.1	60.0	26.2	-23.8	50.0
10.62	26.7	-33.3	60.0	25.8	-24.2	50.0
23.66	18.9	-41.1	60.0	17.1	-32.9	50.0

FCC ID: NXIWRS

Test point N  
Operation mode: RX  
Remarks:

Result: passed



Frequency MHz	QP Level dB(μV)	QP Delta dB	QP Limit dB	AV Level dB(μV)	AV Delta dB	AV Limit dB
0.155	15.6	-50.1	65.7	2.8	-52.9	55.7
0.21	33.5	-29.7	63.2	27.5	-25.7	53.2
0.315	38.7	-21.1	59.8	35.2	-14.6	49.8
0.42	42.2	-15.2	57.4	41.8	-5.7	47.4
0.525	37.3	-18.7	56.0	36.9	-9.1	46.0
0.63	39.3	-16.7	56.0	39.0	-7.0	46.0
0.735	39.7	-16.3	56.0	39.4	-6.6	46.0
0.84	38.8	-17.2	56.0	38.5	-7.5	46.0
0.945	37.4	-18.6	56.0	37.1	-8.9	46.0
1.05	35.3	-20.7	56.0	35.0	-11.0	46.0
2.1	33.4	-22.6	56.0	33.1	-12.9	46.0
3.05	32.1	-23.9	56.0	31.6	-14.4	46.0
4.205	32.3	-23.7	56.0	31.9	-14.1	46.0
5.045	31.7	-28.3	60.0	31.3	-18.7	50.0
6.31	28.4	-31.6	60.0	27.8	-22.2	50.0
7.465	29.0	-31.0	60.0	28.4	-21.6	50.0
8.41	29.3	-30.7	60.0	28.9	-21.1	50.0
9.46	27.9	-32.1	60.0	27.3	-22.7	50.0
16.61	26.9	-33.1	60.0	24.9	-25.1	50.0
23.76	15.8	-44.2	60.0	12.6	-37.4	50.0

## 5.2 Emission bandwidth

For test instruments and accessories used see section 6 Part MB.

### 5.2.1 Description of the test location

Test location:                   Shielded Room S4

### 5.2.2 Photo documentation of the test set-up



### 5.2.3 Applicable standard

According to FCC Part 15, Section 15.247(a)(2):

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### 5.2.4 Description of Measurement

The bandwidth was measured at an amplitude level reduced from the reference level of a modulated channel by a ratio of -6 dB. The reference level is the level of the highest signal amplitude observed at the transmitter at either the fundamental frequency or the first order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. An alternative is to use the bandwidth measurement of the analyzer.

Spectrum analyzer settings:

RBW	100 kHz
VBW	300 kHz
Detector	Peak
Sweep time	5 s

The table below shows the settings according to ANSI C63.4:

Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1kHz
30 to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

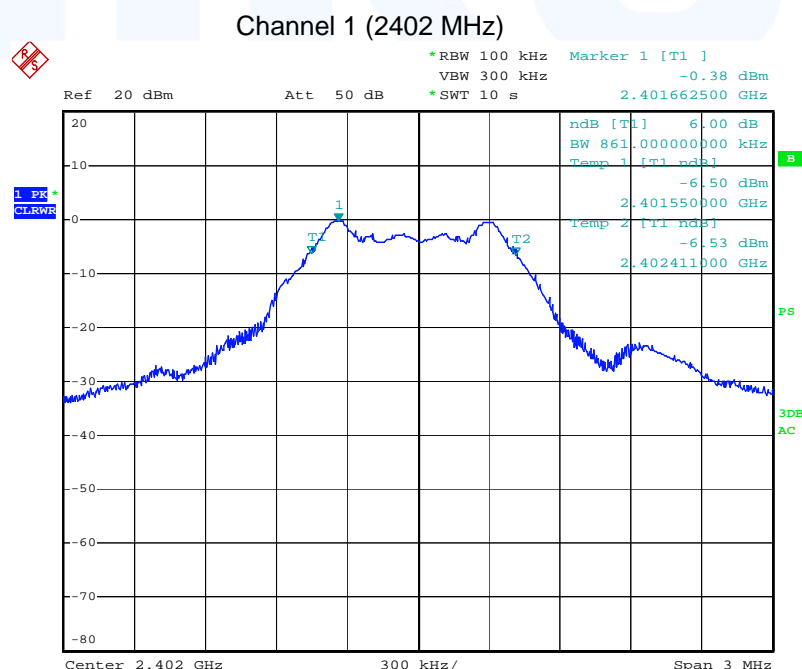
## 5.2.5 Test result

Channel number	Fundamental frequency (MHz)	6 dB Bandwidth (MHz)	Minimum limit (MHz)
1	2402	0.86	0.5
41	2442	0.86	0.5
81	2482	0.86	0.5

The requirements are **FULFILLED**.

**Remarks:** For detailed test results please refer to following test protocols.

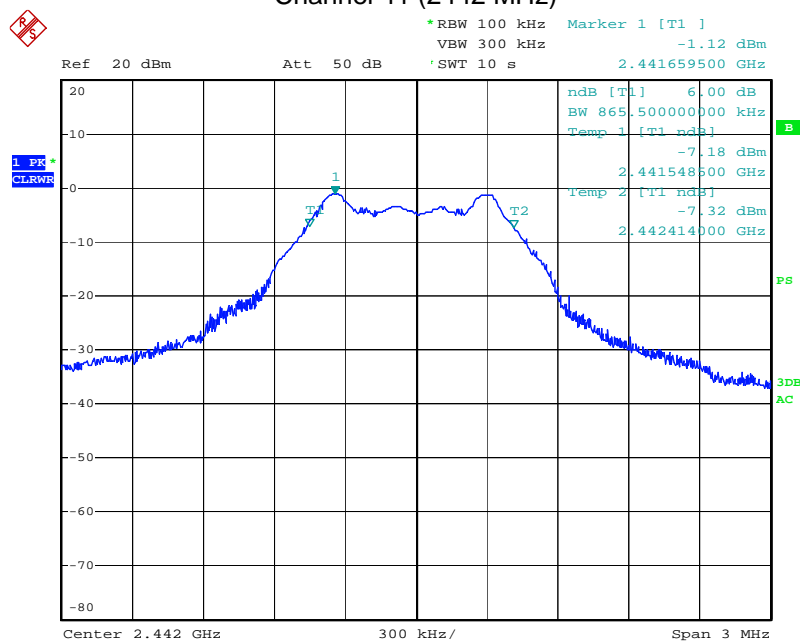
## 5.2.6 Test protocols



CH1, TX, NC,  
Date: 19.JAN.2009 10:16:11



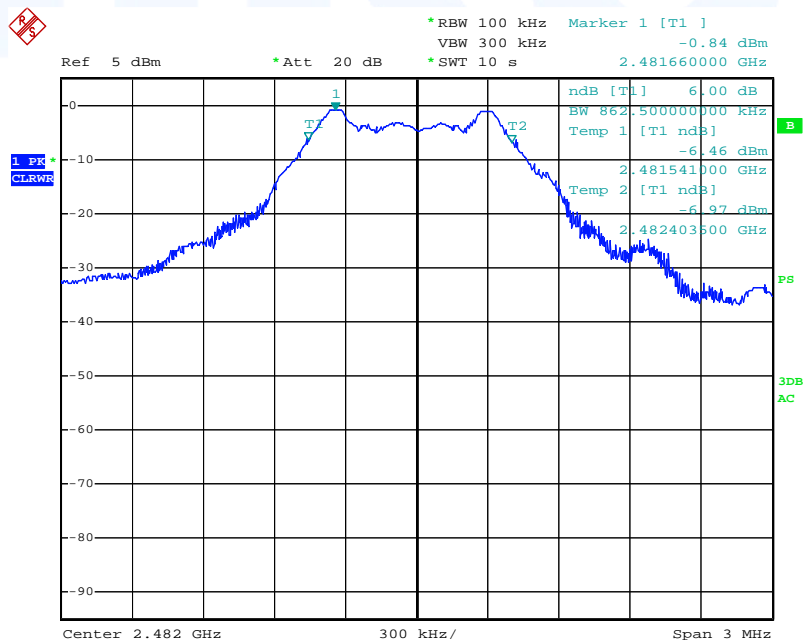
FCC ID: NXIWRS



CH40, TX, NC,

Date: 19.JAN.2009 10:15:15

Channel 81 (2482 MHz)



CH81, TX, NC,

Date: 19.JAN.2009 10:09:40

### 5.3 Maximum peak conducted output power

For test instruments and accessories used see section 6 Part CPC 3.

#### 5.3.1 Description of the test location

Test location:                   Shielded Room S4

#### 5.3.2 Photo documentation of the test set-up



#### 5.3.3 Applicable standard

According to FCC Part 15, Section 15.247(b)(3):

For systems using digital modulation in the 2400-2483.5 MHz and 5725 – 5850 MHz bands, the maximum peak output power of the transmitter shall not exceed 1 Watt. The limit is based on transmitting antennas of directional gain that do not exceed 6 dBi.

#### 5.3.4 Description of Measurement

The transmitter output was connected to the spectrum analyzer through an attenuator. The center frequency of the spectrum analyzer is set to the fundamental frequency. The span of the spectrum analyzer should be larger than the emission bandwidth (EBW). To get the total power of the occupied bandwidth the function "Channel Power Measurement" of the analyzer has been used. The channel bandwidth has been set to EBW. With peak detector and power mode "Max Hold" the result is the summed maximum output power of the EBW. To determine the max. output power the worst case power setting is used dependent of the antenna gain. The cable loss or other external attenuation was taken into account and expressed in a correction factor. The absolute maximum peak output power is calculated by adding the reading of the analyzer plus correction and compared with the limit.

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Spectrum analyzer settings:

RBW 1 MHz  
VBW 300 kHz  
Detector Peak

Sweep time 1 s  
Power Mode Max. hold  
Channel bandwidth 2 MHz

### 5.3.5 Test result

Channel	Frequency (MHz)	Software Power set(dBm)	Measured power (dBm)	Cable loss correction (dB)	Corr. peak power (dBm)	Peak power limit (dBm)	Delta (dB)
1	2402	7	-0.2	2.4	2.2	30	-27.8
41	2442	7	-0.8	2.4	1.6	30	-28.4
81	2482	7	-0.8	2.4	1.6	30	-28.4

Remark: The cable loss correction take account of the overall loss of the measurement cable: 16 cm U-FL-Cable + Adapter UFL/SMA + 1.5 m Measure cable = 2.4 dB at 2.45 GHz

Peak Power Limit according to FCC Part 15, Section 15.247(b)(3):

Frequency (MHz)	Peak Power Limit	
	(dBm)	(Watt)
902-928	30	1.0
<b>2400-2483.5</b>	<b>30</b>	<b>1.0</b>
5725-5850	30	1.0

The requirements are **FULFILLED**.

**Remarks:** The power set in channel 81 was set to 7 for the max available power.

## **5.4 Spurious emissions**

For test instruments and accessories used see section 6 Part **SER 2**, **SER 3**.

### **5.4.1 Description of the test location**

Test location: OATS1  
Test location: Anechoic Chamber A2

Test distance: 3 metres

### **5.4.2 Photo documentation of the test set-up**

Open area test site



### Anechoic chamber



#### 5.4.3 Applicable standard

According to FCC Part 15, Section 15.247(d):

In any 100 kHz bandwidth outside the frequency bands 2400 – 2483.50 MHz and 5725 – 5850 MHz, the digitally modulated radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or an radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limit specified in Section 15.209(a) (see Section 15.205(c)).

#### 5.4.4 Description of Measurement

Radiated spurious emissions from the EUT are measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linear polarized antennas. The measurements are made with 120 kHz bandwidth and quasi-peak detection. The EUT is placed on a 1.0 X 1.5 m non-conducting table 80 cm above the ground plane. The set up of the equipment under test will be in accordance to ANSI C63.4. To locate maximum emissions from the EUT the antenna is shifted in height from 1 to 4 m, after the EUT is rotated 360 degrees. The measurement scan is made in horizontal and vertical polarization of the antenna.

For the radiated measurement up from 1 GHz to maximum frequency as specified in Section 15.33, a spectrum analyzer and appropriate linear polarized antennas are used. The EUT is placed on a 1.0 X 1.5 m non-conducting table 80 cm above the ground plane. The set up of the EUT will be in accordance to ANSI C63.4. To locate maximum emissions the EUT was rotated vertically 360 degrees in the fully anechoic chamber. The measurement scan is made in horizontal and vertical polarization of the antenna. For testing above 1 GHz, if the emission level of the EUT in peak mode complies with the average limit is 20 dB lower, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.

**FCC ID: NXIWRS**

Average values were measured with spectrum analyzer settings:

RBW: 1 MHz VBW: 3 MHz  
Detector: Max. peak Trace: Max. hold  
Sweep: Auto

#### 5.4.5 Test result

##### 5.4.5.1 RF conducted test

Spectrum analyzer settings:

RBW 100 kHz VBW 300 kHz  
Detector Max. peak Trace: Max. hold  
Sweep time auto

Channel 1 (2402 MHz) max. level -0.2 dBm			Channel 41 (2442 MHz) max. level -0.8 dBm			Channel 81 (2482 MHz) max. level -0.8 dBm		
f (MHz)	Peak Power (dBm)	Limit (-20 dB) (dBm)	f (MHz)	Peak Power (dBm)	Limit (-20 dB) (dBm)	f (MHz)	Peak Power (dBm)	Limit (-20 dB) (dBm)
800	-48.8	-20.2	814	-48.2	-20.8	825	-48.3	-20.8
1594	-39.4	-20.2	1580	-37.9	-20.8	1650	-39.7	-20.8
3200	-47.2	-20.2	3204	-43.5	-20.8	3300	-46.8	-20.8
7204	-43.4	-20.2	7322	-44.4	-20.8	7300	-44.1	-20.8

##### 5.4.5.2 Radiated emission test

Antenna		Power Setting (dBm)	Frequency (MHz)	Peak		Average	
Type	Gain (dBi)			Value dB(μV/m)	Limit dB(μV/m)	Value dB(μV/m)	Limit dB(μV/m)
Integrated	1.5	7	1024	44.6			54
Integrated	1.5	7	1222	46.3			54
Integrated	1.5	7	1702	45.9			54
Integrated	1.5	7	4000	38.9			54
Integrated	1.5	7	4805	46.6			54
Integrated	1.5	7	5627	52.5			54
Integrated	1.5	7	7202	52.9			54

##### 5.4.5.3 Band edge requirement

Channel 1 (2402 MHz), nearest restricted band: 2310 - 2390 MHz

Antenna		Power Setting	Frequency (MHz)	Peak		Average	
Type	Gain (dBi)			Value dB(μV/m)	Limit dB(μV/m)	Value dB(μV/m)	Limit dB(μV/m)
Integrated	1.5	7	2400		84.9	73.8	82.1
Integrated	1.5	7	2390			44.2	54



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Channel 81 (2482 MHz), nearest restricted band: 2483.5 - 2500 MHz

Antenna		Power Setting	Frequency (MHz)	Peak		Average	
Type	Gain (dBi)			Value dB(μV/m)	Limit dB(μV/m)	Value dB(μV/m)	Limit dB(μV/m)
Integrated	1.5	6	2.4835			50.0	54

The power level 6 is the highest level in the real application.

Radiated limits according to FCC Part 15 Section 15.209(a) for spurious emissions which fall in restricted bands:

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (metres)
	(μV/m)	dB(μV/m)	
0.009-0.490	2400/F (kHz)		300
0.490-1.705	24000/F (kHz)		30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

### Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6

The requirements are **FULFILLED**.

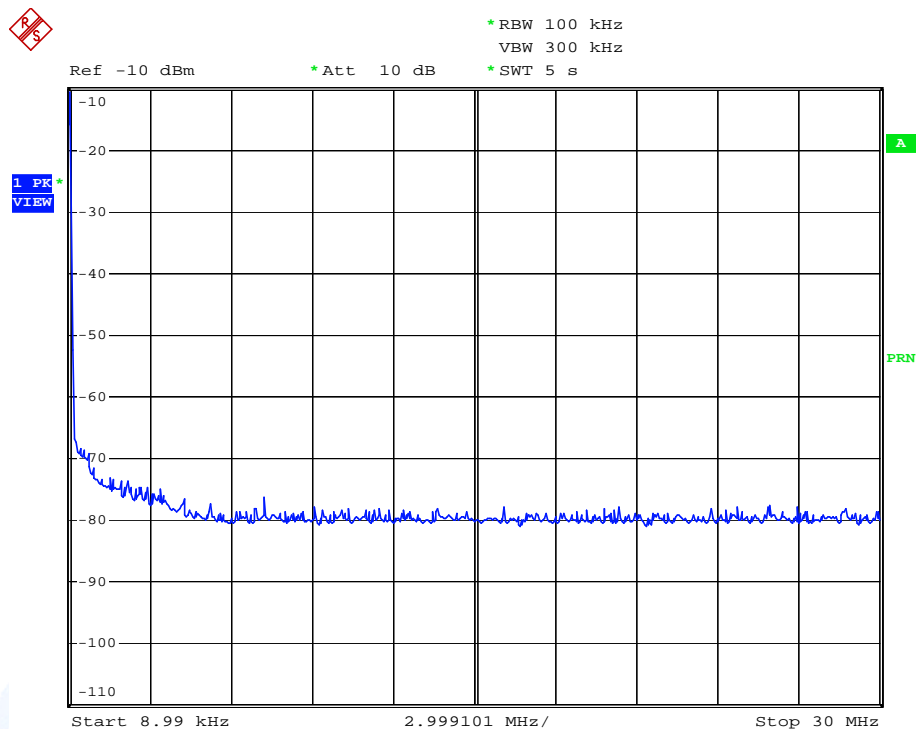
**Remarks:** Only spurious emissions falling not in restricted bands have been measured conducted.

The measurement was performed up to the 10<sup>th</sup> harmonic. All emissions not reported in this test report are more than 20 dB below the specified limit.

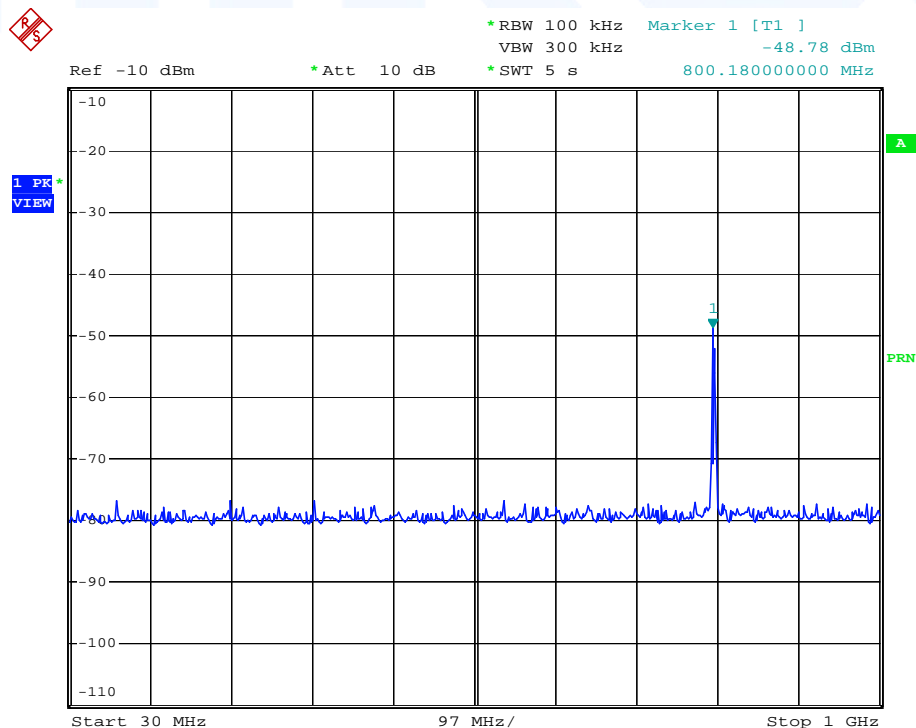
For detailed test results please refer to following test protocols.

## 5.4.6 Test protocols

Plots of spurious emissions conducted out of operating frequency bands (-20 dBc)



Comment: WRS, TX, SEC1  
Date: 19.JAN.2009 10:15:50

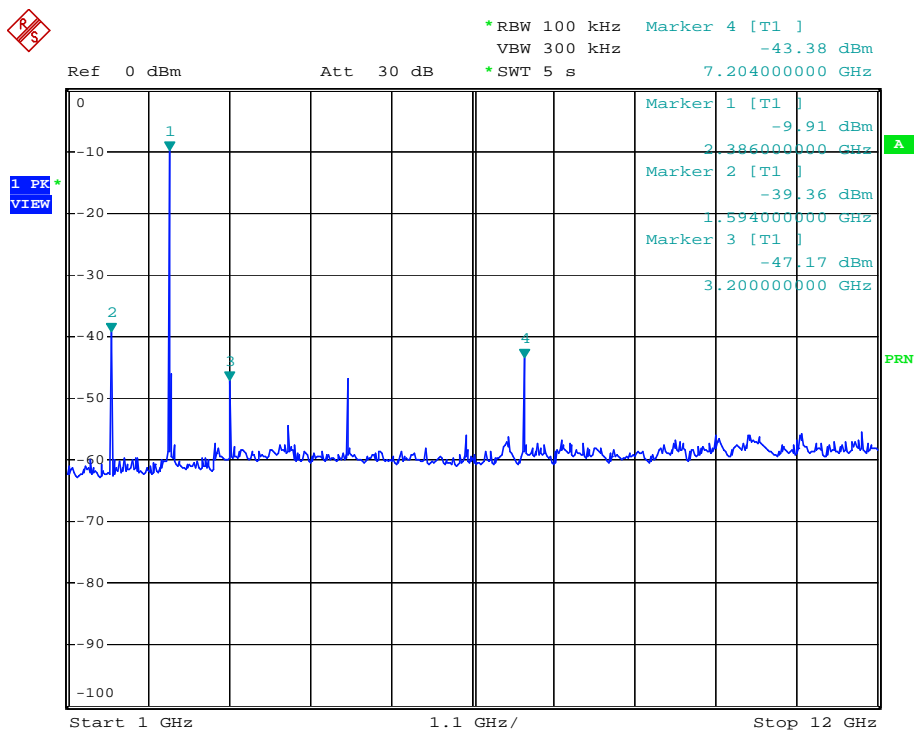


Comment: WRS, TX, SEC2, LP, CH1  
Date: 19.JAN.2009 10:26:55



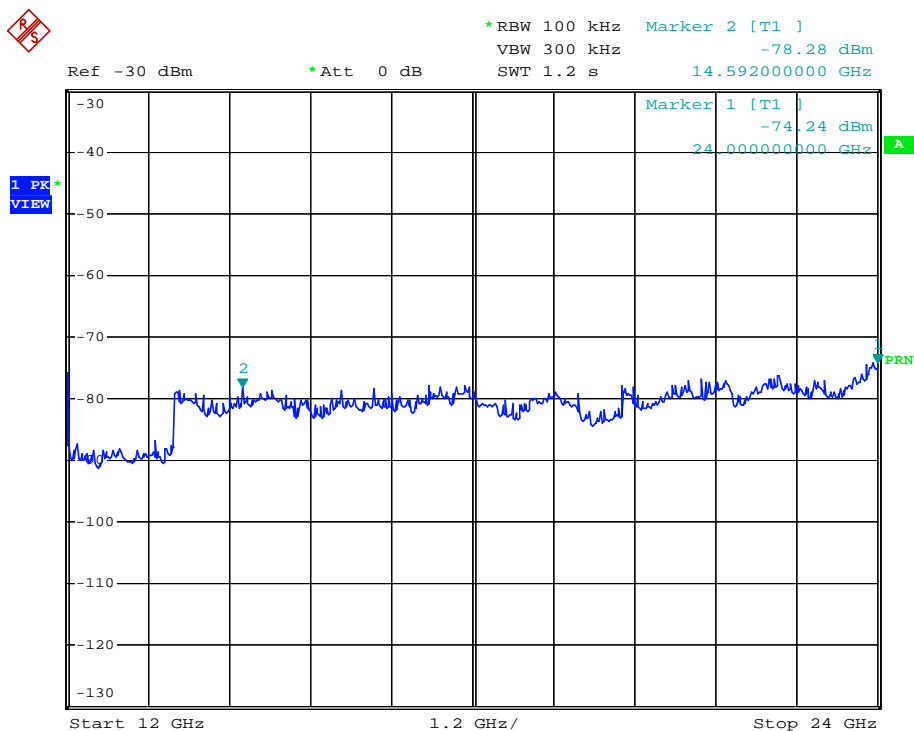
FCC ID: NXIWRS

Spurious emissions conducted from 1 GHz to 12 GHz (worst case)



Comment: WRS, TX, SEC3, CH1  
Date: 19.JAN.2009 10:29:58

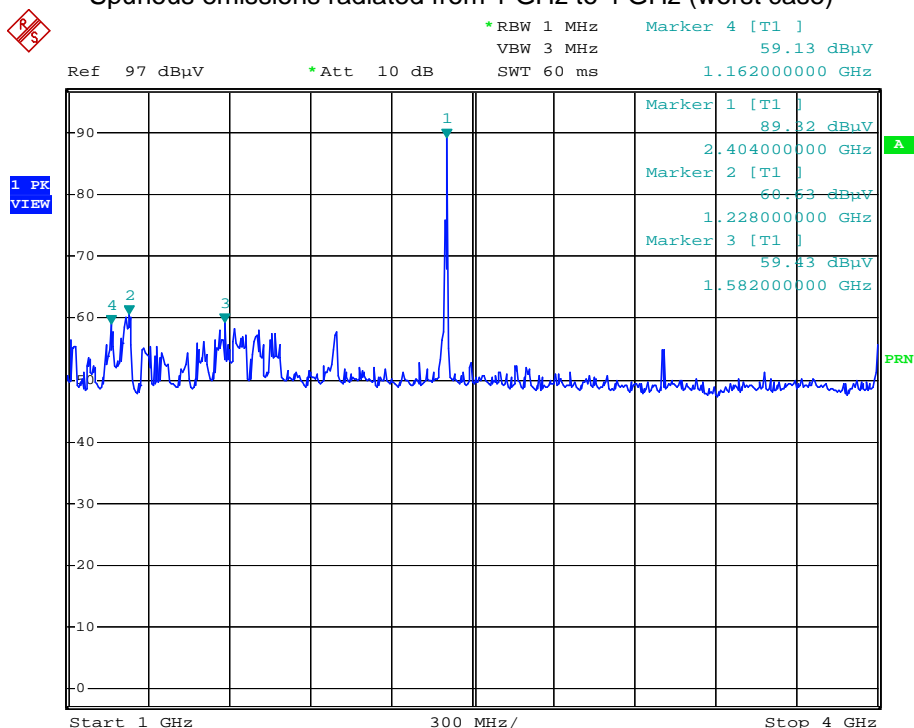
Spurious emissions conducted from 12 GHz to 24 GHz (worst case)



Date: 29.JAN.2009 15:14:02

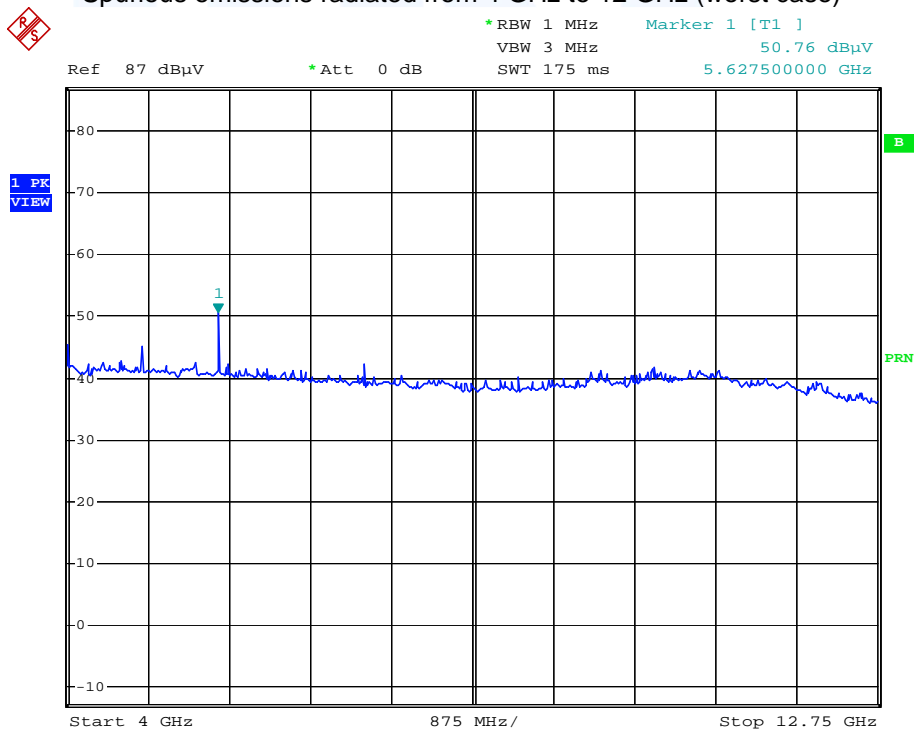
FCC ID: NXIWRS

Spurious emissions radiated from 1 GHz to 4 GHz (worst case)



Comment: WRS, TX, SER3 1-4 GHz, CH1, 50Ohm, vert  
Date: 19.JAN.2009 14:15:38

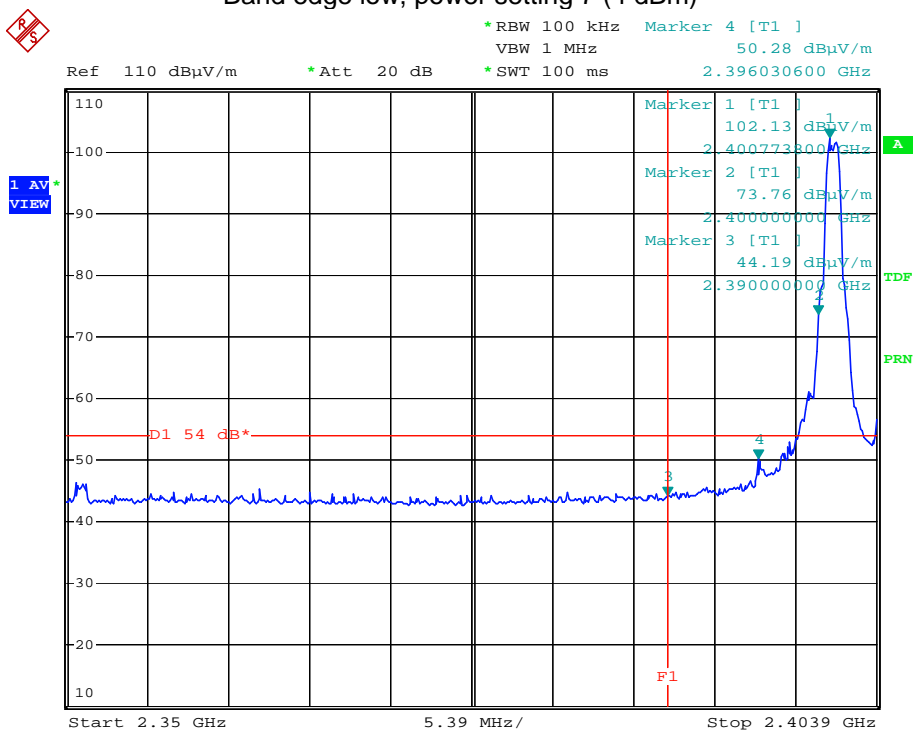
Spurious emissions radiated from 4 GHz to 12 GHz (worst case)



Comment: WRS, TX, SER3 4-12 GHz, CH1, 50Ohm, hor  
Date: 19.JAN.2009 14:06:39

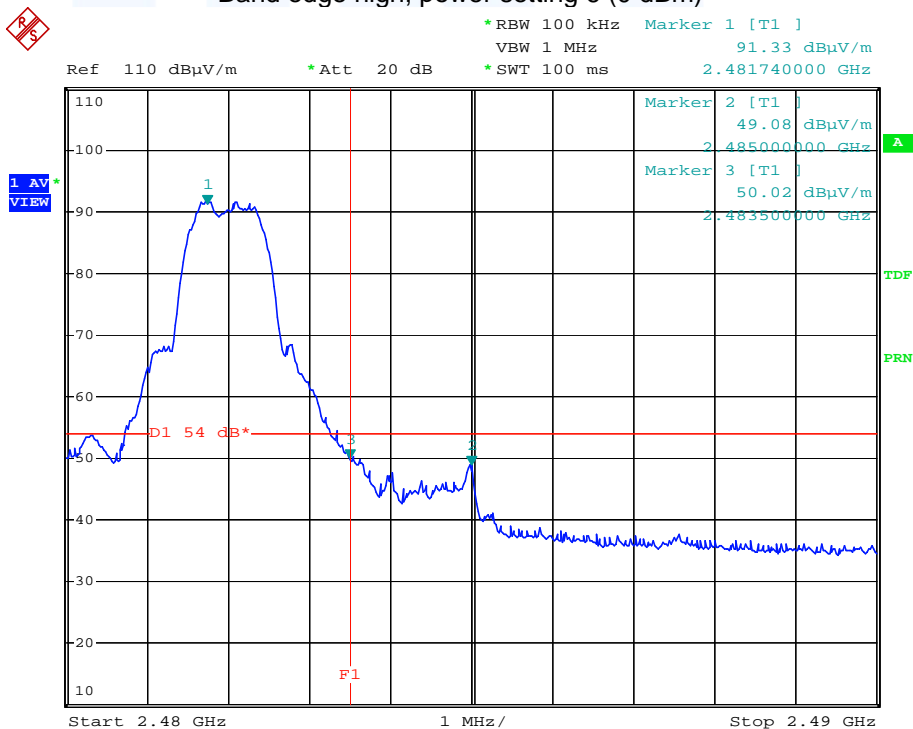
FCC ID: NXIWRS

Band edge low, power setting 7 (4 dBm)



Comment: WRS4, rad. Edge  
Date: 30.JAN.2009 09:04:05

Band edge high, power setting 6 (0 dBm)



Comment: WRS4, rad. Edge  
Date: 30.JAN.2009 08:56:00

**Remark:** All peak emissions were below the limits of part 15.209.

## **5.5 Power spectral density**

For test instruments and accessories used see section 6 Part CPC 3.

### **5.5.1 Description of the test location**

Test location:                   Shielded Room S4

### **5.5.2 Photo documentation of the test set-up**



### **5.5.3 Applicable standard**

According to FCC Part 15, Section 15.247(e):

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### **5.5.4 Description of Measurement**

The EUT was connected to the spectrum analyzer with a suitable attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer, set sweep time equal to span/3 kHz. The power spectral density was measured using the analyzer function "Channel Power" in dBm/Hz. The result is calculated by adding 35 dB (10 log 3000 Hz/Hz) as bandwidth correction factor to the analyzer reading.

Spectrum analyzer settings:

RBW	3 kHz
VBW	30 kHz
Detector	Max. peak (refer to point 5.2)
Sweep time	10s
Channel bandwidth	1.4 MHz

**FCC ID: NXIWRS**

**5.5.5 Test result**

Channel	Frequency (MHz)	Reading (dBm/Hz)	Correction to 3 kHz (dB)	PSD (dBm)	Limit (dBm)
1	2402	-56.2	35	-21.2	8.0
41	2442	-57.2	35	-22.2	8.0
81	2482	-57.1	35	-22.1	8.0

The requirements are **FULFILLED**.

**Remarks:** For detailed test results please refer to following test protocols.

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\_\_\_\_\_

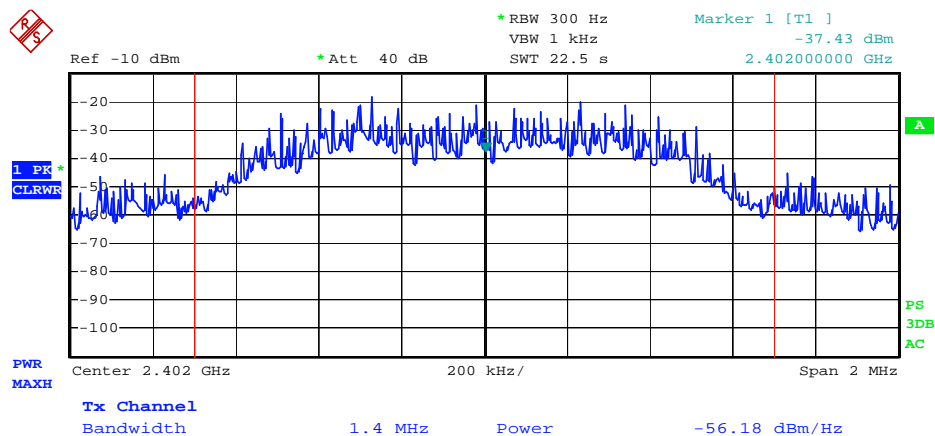
\_\_\_\_\_

\_\_\_\_\_

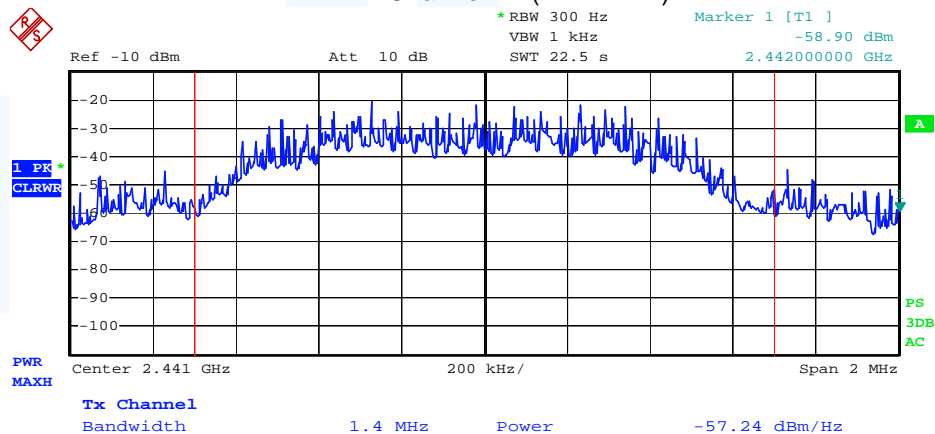
mikes

# Power spectral density plots

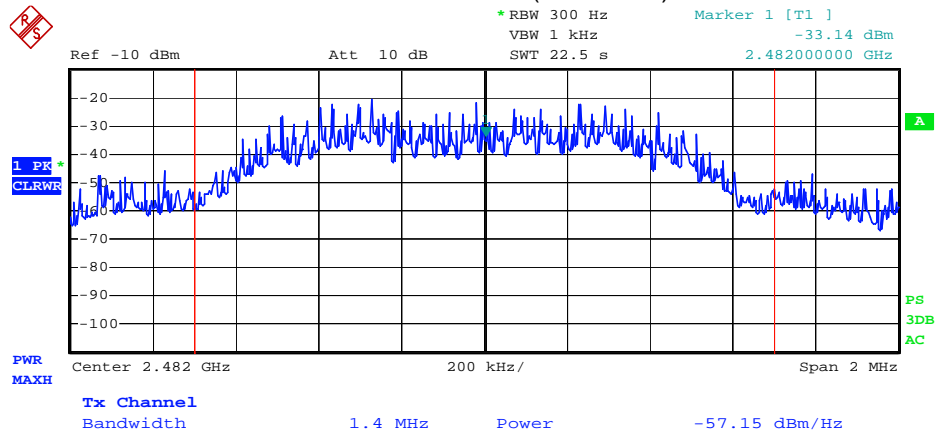
## Channel 1 (2402 MHz)



## Channel 41 (2442 MHz)



## Channel 81 (2482 MHz)



## 5.6 Maximum permissible exposure (MPE)

For test instruments and accessories used see section 6 Part **CPC 3**.

### 5.6.1 Description of the test location

Test location:                      Shielded Room S4

### 5.6.2 Applicable standard

According to FCC Part 15, Section 15.247(i):

Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

The test methods used comply with ANSI/IEEE C95.1, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".

This test report shows the compliance with the limits for Maximum Permissible Exposure (MPE) specified in FCC Part 1, Section 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in FCC Part 1, Section 1.1307(b).

### 5.6.3 Description of Measurement

The maximum total power input to the antenna has been measured conducted as described in clause 5.3 of this document. Through the Friis transmission formula, the known maximum gain of the antenna and the maximum power, can be calculated the MPE in a defined distance away from the product.

Friis transmission formula:  $P_d = \frac{P_{out} * G}{4 * \pi * r^2}$

where

$P_d$  = power density (mW/cm<sup>2</sup>)

$P_{out}$  = output power to antenna (mW)

$G$  = gain of antenna (linear scale)

$r$  = distance between antenna and observation point (cm)

According to FCC Rules 47CFR 2.1093(b) the EUT is not a portable device. The EUT is designed to be used that radiating structures are 20 cm outside of the body of the user. ( $r = 20$  cm)

#### 5.6.4 Test result

**Worst case:** Integrated Antenna with power setting: max.

Channel No.	Frequency	Max power output to antenna		Antenna gain	Power density	Limit of power density
	(MHz)	(dBm)	(mW)	(dBi)	(mW/cm <sup>2</sup> )	(mW/cm <sup>2</sup> )
1	2402	2.2	1.66	1.5	0.00047	1.0
41	2442	1.6	1.44	1.5	0.00042	1.0
81	2482	1.6	1.44	1.5	0.00042	1.0

Limits for maximum permissible exposure (MPE):

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(B) Limits for General Population / Uncontrolled Exposure</b>				
0.3 – 3.0	614	1.63	100	30
3.0 – 30	824/f	2.19/f	180/f <sup>2</sup>	30
30 - 300	27.5	0.073	0.2	30
300-1500	---	---	f/1500	30
<b>1500-100000</b>	---	---	<b>1.0</b>	<b>30</b>

f = Frequency in MHz

The requirements are **FULFILLED**.

Remarks:

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## **5.7 Antenna application**

### **5.7.1 Applicable standard**

According to FCC Part 15C, Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit that broken antennas can be replaced by the user, but the use of a standard antenna jack is prohibited.

The EUT is designed with integrated antenna.

The supplied antenna meets the requirements of part 15.203 and 15.204.

### **5.7.2 Antenna requirements**

According to FCC Part 15C, Section 15.247(b)(4):

The conducted output power limit specified in paragraph (b) of 15.247 is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from intentional radiator shall be reduced below the stated values in paragraph (b)(1), (b)(2) and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The integrated antenna, Part Nr. FR05-S1-N-0-102, peak gain 1.5 dBi, needs no output power reduction.

FCC ID: NXIWRS

## 6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model / Type	Kind of Equipment	Manufacturer	Equipment No.
CPC 3	ESCI	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-005
MB	ESCI	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-005
SER 2	ESVS 30	EMI Test Receiver	Rohde & Schwarz München	02-02/03-05-006
	VULB 9168	Trilog Broad Band Antenne	Schwarzbeck Mess-Elektron	02-02/24-05-005
	S10162-B	RF Cable 33 m	Huber + Suhner	02-02/50-05-031
	KK-EF393-21N-16	RF Cable 20 m	Huber + Suhner	02-02/50-05-033
	NW-2000-NB	RF Cable	Huber + Suhner	02-02/50-05-113
SER 3	AFS4-01000400-10-10P-4	RF Amplifier 1-4 GHz	PARZICH GMBH	02-02/17-05-003
	AMF-4F-04001200-15-10P	RF Amplifier 4-12 GHz	PARZICH GMBH	02-02/17-05-004
	AFS5-12001800-18-10P-6	RF Amplifier 12-18 GHz	PARZICH GMBH	02-02/17-06-002
	3115	Horn Antenna 1-18 GHz	EMCO Elektronik GmbH	01-02/24-01-011
	Sucoflex N-1600-SMA	RF Cable	novotronik Signalverarbeitung	02-02/50-05-073
	Sucoflex N-2000-SMA	RF Cable	novotronik Signalverarbeitung	02-02/50-05-075

Equipment No.	Next Calibration	Last Calibration	Next Verification	Last Verification
02-02/03-05-005	01/26/2010	01/26/2009		
02-02/03-05-005	01/26/2010	01/26/2009		
02-02/03-05-006	07/30/2009	07/30/2008		
02-02/24-05-005	05.06.2011	05.06.2008	02/28/2009	08/29/2008
02-02/50-05-031				
02-02/50-05-033				
02-02/50-05-113				
02-02/17-05-003				
02-02/17-05-004				
02-02/17-06-002				
01-02/24-01-011	05/08/2009	05/08/2008		
02-02/50-05-073				
02-02/50-05-075				