



FCC ID: U9A277IWLAN-V211

Registration No. DAT-P-207/05

# EMI -- TEST REPORT

- FCC Part 15.407 -

<b>Test Report No. :</b> <b>T34493-00-02AA</b>	08. November 2010
	Date of issue

Type / Model Name                   : MobilePanel277FIWLAN RF

Product Description                 : Mobile Human Machine Interface

**Applicant**                             : Siemens AG, I IA AS RD ST TT

Address                                 : Werner-von-Siemens-Str. 50  
92224 AMBERG, GERMANY

**Manufacturer**                     : Siemens AG, I IA AS

Address                                 : Gleiwitzer Str. 555  
90475 NUERNBERG, GERMANY

**Licence holder**                   : Siemens AG, I IA AS RD ST TT

Address                                 : Werner-von-Siemens-Str. 50  
92224 AMBERG, GERMANY

<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 C - Intentional Radiators (October, 2009)**

Part 15, Subpart C, Section 15.35(c)	Correction for Pulse Operation (Duty Cycle)
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 15.207(a)	AC Line conducted emissions
Part 15, Subpart C, Section 15.209(a)	Radiated emissions, general requirements
Part 15, Subpart C, Section 15.407	Operation within the bands 5.15-5.25 GHz, 5.25-5.35 GHz, 5.47-5.725 GHz and 5.725-5.825 GHz

### **FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (October, 2009)**

Part 15, Subpart B, Section 15.107(a)	AC Line conducted emissions
Part 15, Subpart B, Section 15.109(a)	Radiated emissions, general requirements

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

## 2 SUMMARY

### GENERAL REMARKS:

The EuT is configured as client.

The EuT consists of one WLAN Module working in 2.4 and 5 GHz frequency band and one RFID Module working at 13.56 MHz. The EuT has an input voltage stabilisation and a voltage stabilisation directly in the RF module. Therefore no influence will be expected by voltage variations. For this reason the tests have been performed with nominal voltage only.

The EuT is equipped with 2 internal WLAN antennas (gain=3 dBi at 2.4 GHz, 5 dBi at 5 GHz) and 1 RFID antenna.

This test report describes only the assessment of the WLAN Module in the 5 GHz frequency band.

For the RFID Module please refer to test report T34493-00-00AA by mikes-testingpartners gmbh.

### Available Features:

The WLAN client module is compatible with 802.11a/h, 802.11b, 802.11g technology. It is able to operate in the 2.4 GHz and 5 GHz frequency band.

- 802.11a Mode            5.15 GHz – 5.25 GHz and 5.725 GHz – 5.850 GHz
- 802.11b/g Mode        2400 – 2483.5 MHz
- 802.11h Mode           5.25 GHz – 5.35 GHz and 5.47 GHz – 5.725 GHz

The module uses DSSS or OFDM modulation and is capable to provide following data rates:

- 802.11b Mode           11, 5.5, 2, 1 Mbps, auto-fallback
- 802.11g Mode           54, 48, 36, 24, 18, 12, 9, 6 Mbps, auto-fallback
- 802.11a/h               54, 48, 36, 24, 18, 12, 9, 6 Mbps, auto-fallback

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**Note: The US version will be firmware limited to operate only in the 5150-5250 MHz band.**

The tests have been carried out in the frequency band from 5150 to 5250 MHz.

Conducted measurements have been performed using an Access point (LAP). The EuT (WLAN module) was mounted in the AP and controlled via LAN by a Laptop.

Radiated measurements have been performed with normal configuration of the MP (WLAN Module inside).

Pre-scan has been performed to determine the worst-case mode from all possible combinations between available modulations and data rates. The maximum output power depends on used data rate.

**As worst case the following data rate was used:**

- **802.11a: 6 Mbits**

The EuT has been adjusted to transmit data during the tests with a duty cycle (X) of about X=1.

**4 channels are provided to this EuT in 802.11a mode:**

Channel	Frequency
36	5180
40	5200
44	5220
48	5240

Following channels were selected for the final test as listed below:

Technology	Available Channel	Tested Channel	Modulation	Modulation Type	Data Rate (Mbps)
802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6

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**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 : 20 July 2010

Testing concluded on : 10 September 2010

Checked by:

Tested by:

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Thomas Weise  
Dipl.-Ing.(FH)  
Laboratory Manager

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Anton Altmann  
Dipl.-Ing.(FH)

### **3 EQUIPMENT UNDER TEST**

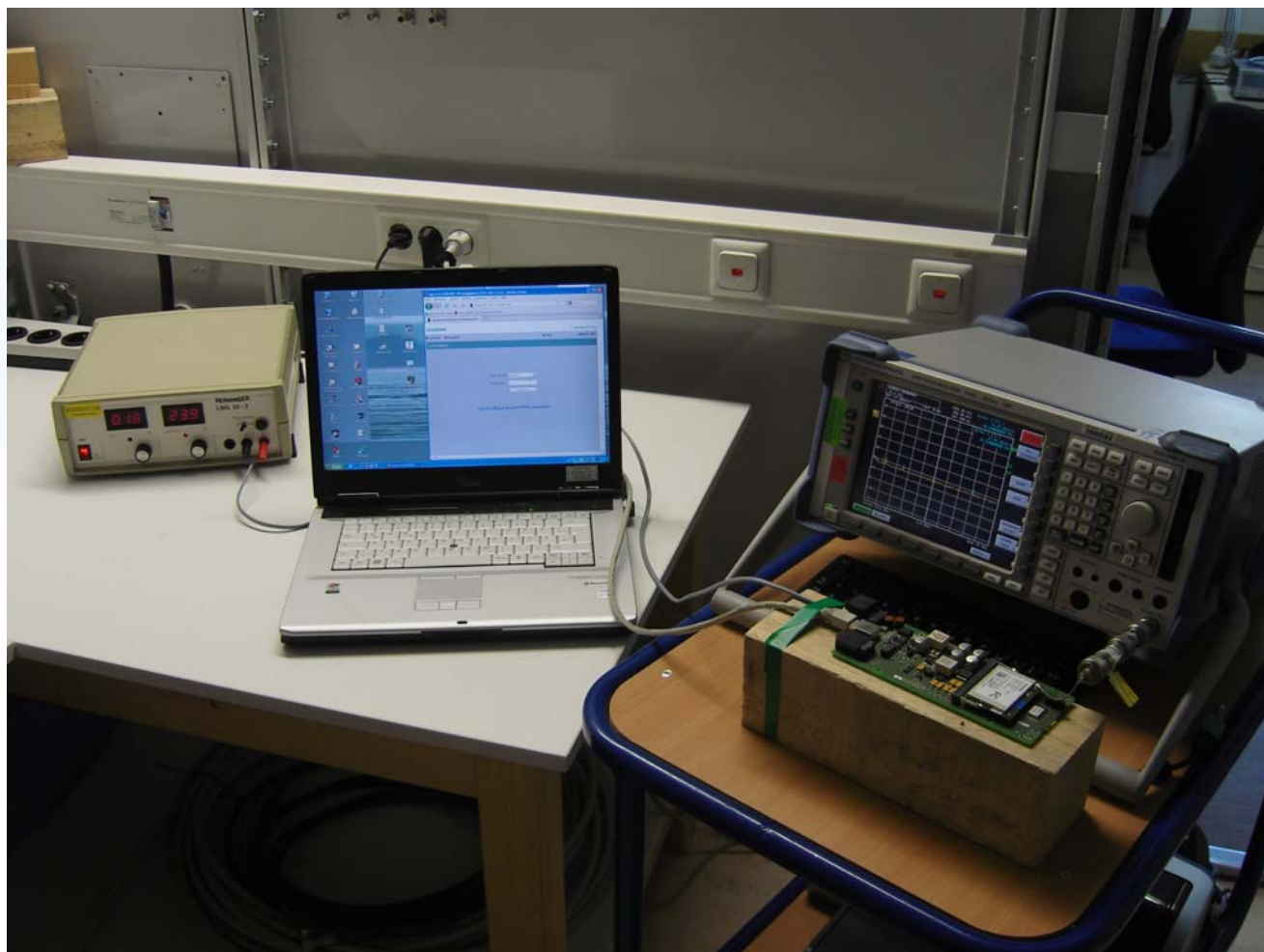
#### **3.1 Photo documentation of the EuT – Detailed photos see Attachment A**

#### **3.2 Power supply system utilised**

Power supply voltage : 7.2 V DC Battery  
Power supply voltage (alternative) : Input: 110-240 V / 47-63 Hz / 1 $\phi$  Power supply  
Output: +12 V DC

#### **3.3 Test setup**

Conducted measurements



### 3.4 Short description of the Equipment under Test (EuT)

The WLAN Module is a part of the Mobile Panel (MP). It consists of an additional RFID Module. The MP permits mobile operation at any point in the system. The HMI device communicates with the PLC via WLAN. The HMI device is equipped with a zone recognition function (RFID). The operator can operate the system wireless at almost any location on the machine or system.

Number of tested samples: 1  
Serial number: Prototype

#### EuT operation mode:

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

- Data transmission (Client mode) \_\_\_\_\_
- Continuous transmit mode (conducted test mode only) \_\_\_\_\_

#### EuT configuration:

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

- AC/DC power supply \_\_\_\_\_ Model : MEAN WELL GS60A12 \_\_\_\_\_
- \_\_\_\_\_ 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 is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16-4-2 /11.2003 „Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements“ and is documented in the quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

## 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 in International Special Committee on Radio Interference (CISPR) Publication 22, European Standard EN 55022 as shown under section 1 of this report.

In compliance with 47 CFR Part 15 Subpart A Section 15.38 testing for FCC compliance may be done following the ANSI C63.4-2003 procedures and using the CISPR 22 Limits.

#### 4.4.1.2 Measurement Error

The data and results referenced in this document are true and accurate. The reader is cautioned that there is some measurement variability due to the tolerances of the test equipment that can contribute to a nominal product measurement uncertainty. The measurement uncertainty was calculated for all measurements listed in this test report according to NIS 81/5.1994 "The treatment of uncertainty in EMC measurements" and is documented in the mikes-testingpartners gmbh quality system according to DIN EN ISO/IEC 17025. Furthermore, component differences and manufacturing process variability of production units similar to that tested may result in additional product uncertainty. If necessary, refer to the test lab for the actual measurement uncertainty for specific tests. The manufacturer has the sole responsibility of continued compliance of the device.

#### 4.4.1.3 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.

### 4.4.2 DETAILS OF TEST PROCEDURES

#### 4.4.2.1 General Standard Information

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 C63.4-2003 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

## **5 TEST CONDITIONS AND RESULTS**

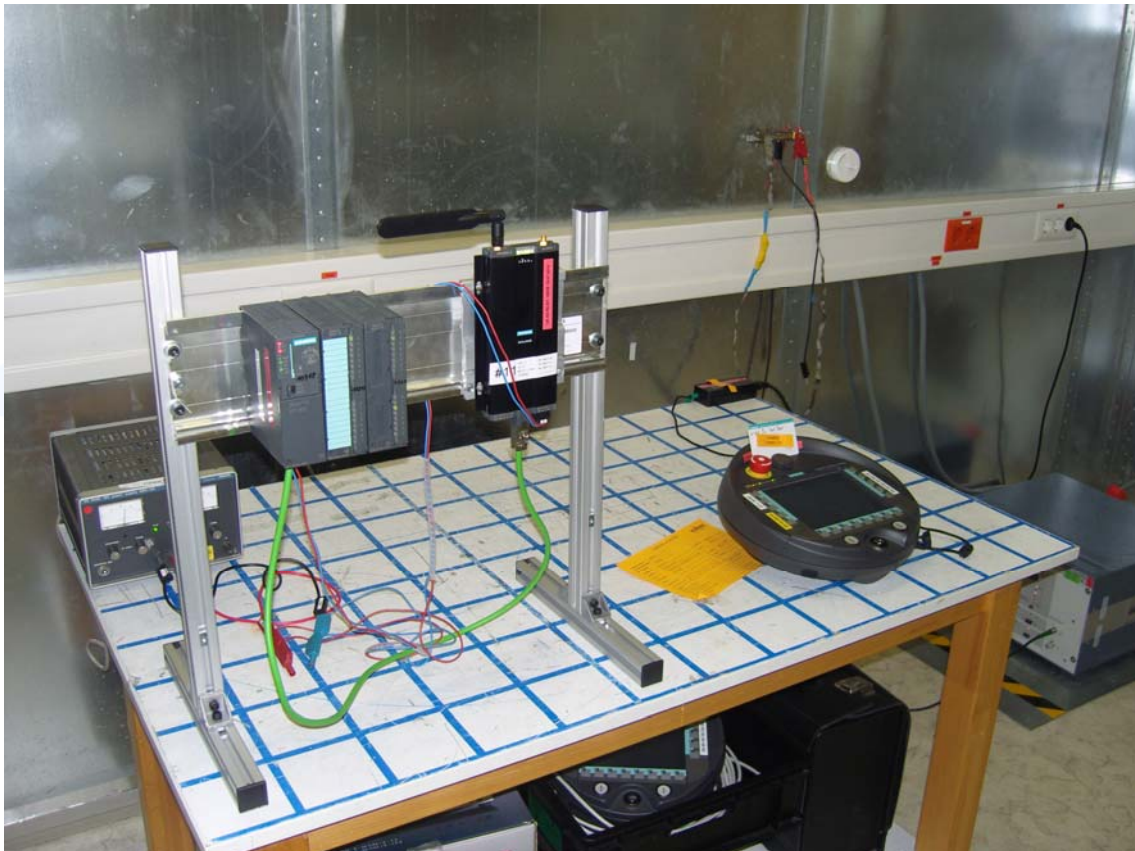
### **5.1 Conducted emissions**

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 Subpart 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.

**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 centimeters above the floor and is positioned 40 centimeters 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.

**5.1.5 Test result**

Frequency range: 0.15 MHz - 30 MHz

Min. limit margin -9.0 dB at 1.18 MHz

The final level, expressed in dBμV, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC Limit or to the CISPR limit.

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

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

$$\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$$

Limit according to FCC Part 15 Subpart 15.207 (a)

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

The requirements are **FULFILLED**.

**Remarks:** The tests have been performed with RFID Module in standby mode (no RF radiation).

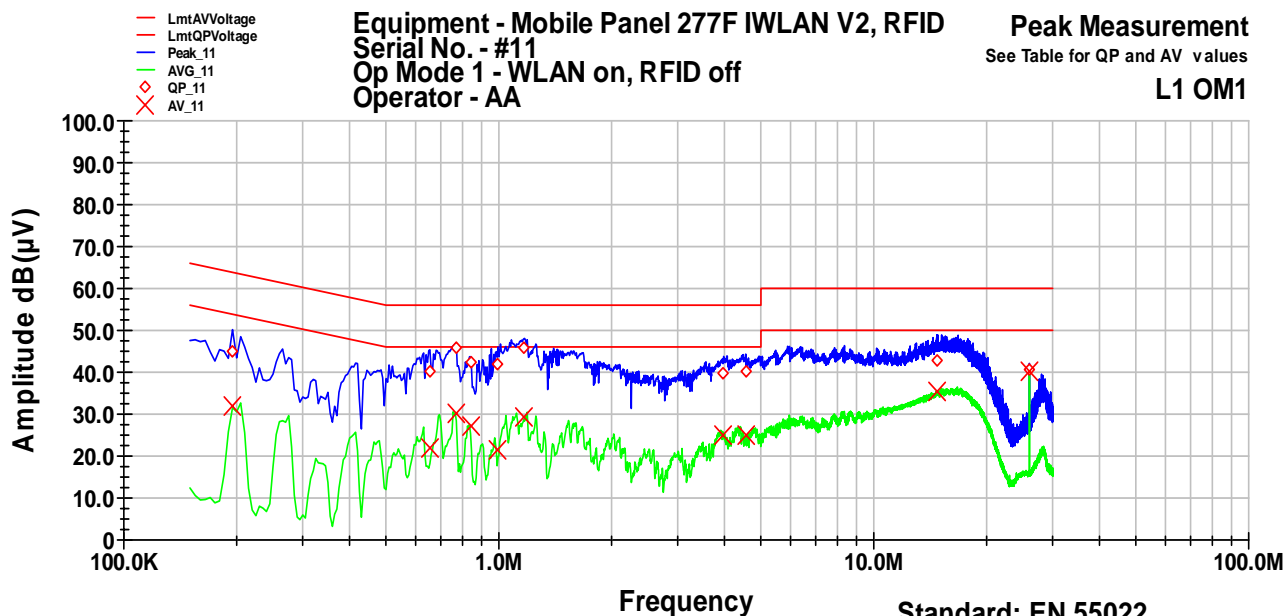
For detailed results please refer to the following plots.

\_\_\_\_\_

\_\_\_\_\_

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**Conducted emissions at power line L1**  
WLAN mode: 5 GHz Range

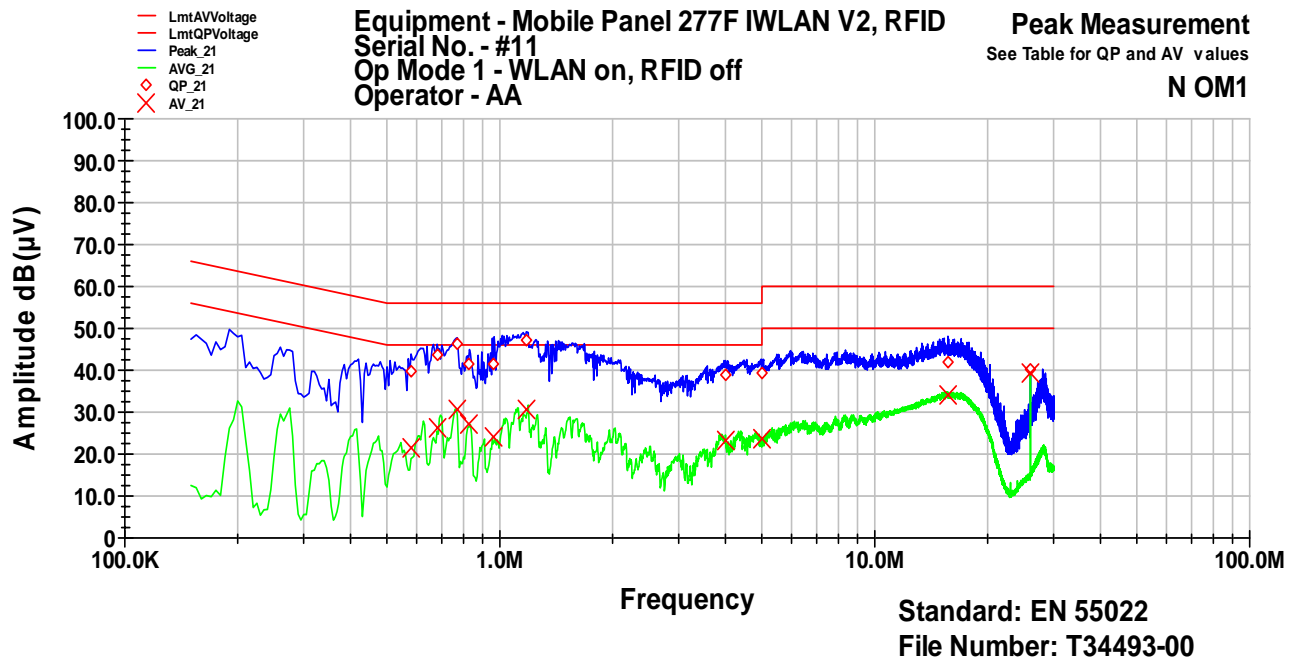


Standard: EN 55022  
File Number: T34493-00

Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.195	45.1	-18.7	63.8	31.7	-22.1	53.8
0.655	40.3	-15.7	56.0	21.8	-24.2	46.0
0.77	45.7	-10.3	56.0	30.2	-15.8	46.0
0.84	42.5	-13.5	56.0	27.0	-19.0	46.0
0.995	42.0	-14.0	56.0	21.7	-24.3	46.0
1.17	45.7	-10.3	56.0	29.2	-16.8	46.0
3.98	39.8	-16.2	56.0	24.8	-21.2	46.0
4.555	40.3	-15.7	56.0	25.1	-20.9	46.0
14.735	42.9	-17.1	60.0	35.5	-14.5	50.0
26	40.8	-19.2	60.0	40.2	-9.8	50.0

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**Conducted emissions at power line N**  
WLAN mode: 5 GHz Range



Frequency MHz	QP Level dB(µV)	QP Margin dB	QP Limit dB	AV Level dB(µV)	AV Margin dB	AV Limit dB
0.58	39.6	-16.4	56.0	21.5	-24.5	46.0
0.68	43.5	-12.5	56.0	26.3	-19.8	46.0
0.77	46.3	-9.7	56.0	30.6	-15.4	46.0
0.83	41.5	-14.5	56.0	27.2	-18.8	46.0
0.965	41.7	-14.3	56.0	24.2	-21.8	46.0
1.18	47.0	-9.0	56.0	30.5	-15.5	46.0
3.995	38.9	-17.1	56.0	23.2	-22.8	46.0
4.985	39.4	-16.6	56.0	23.9	-22.1	46.0
15.655	41.8	-18.2	60.0	34.1	-15.9	50.0
26	40.1	-19.9	60.0	39.4	-10.6	50.0

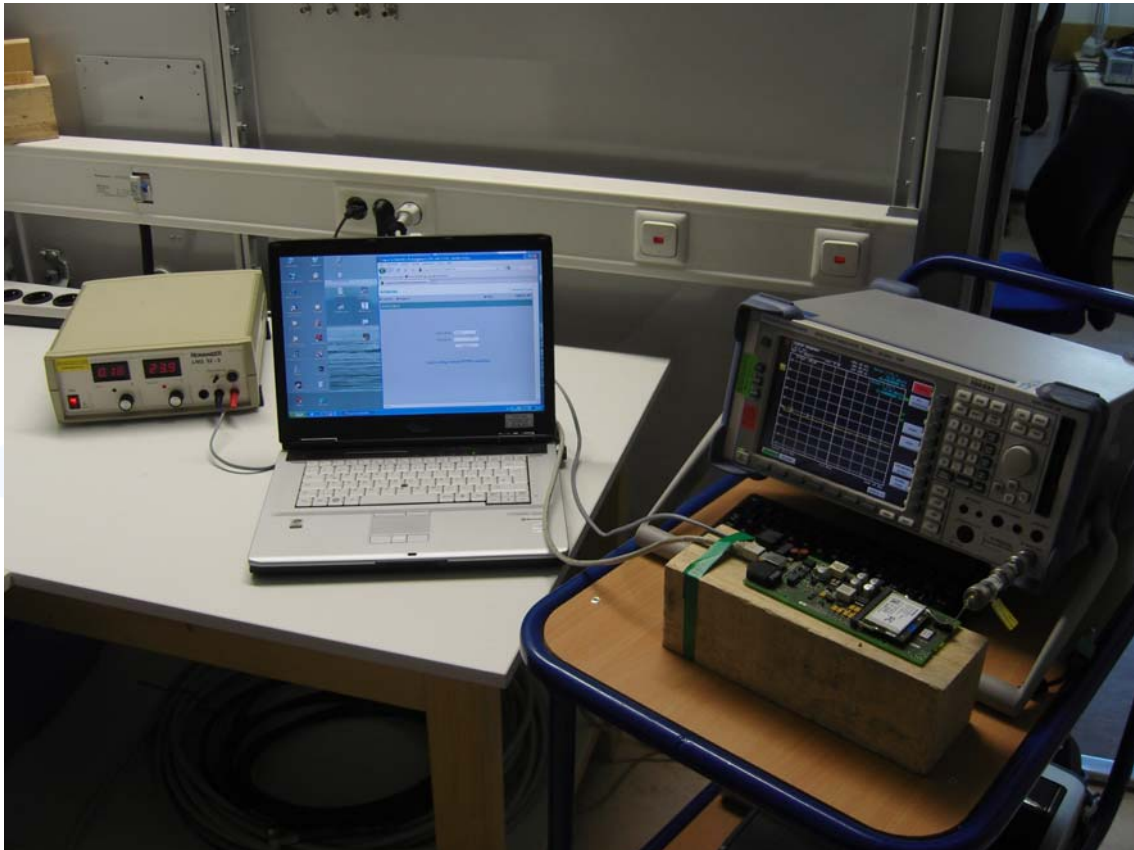
## 5.2 26 dB Emission Bandwidth

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

### 5.2.1 Description of the test location

Test location: AREA4

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



**5.2.3 Applicable standard**

According to FCC Part 15 Subpart 15.401 (i): The emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum of the modulated carrier.

**5.2.4 Description of Measurement**

The bandwidth was measured at an amplitude level reduced from the reference level by a specified ratio of -26 dB. The reference level is the level of the highest amplitude signal observed from the transmitter fundamental frequency. The measurement has been carried out using a spectrum analyzer with the following settings:

RBW=300 kHz

VBW=1 MHz

PEAK Detector

The table below shows the settings according to ANSI C63.4-2003.

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)	26 dB BANDWIDTH (MHz)
36	5180	37.3
40	5200	35.4
48	5240	31.3

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



5.2.6 Test protocol

26dB Bandwidth Measurement plots

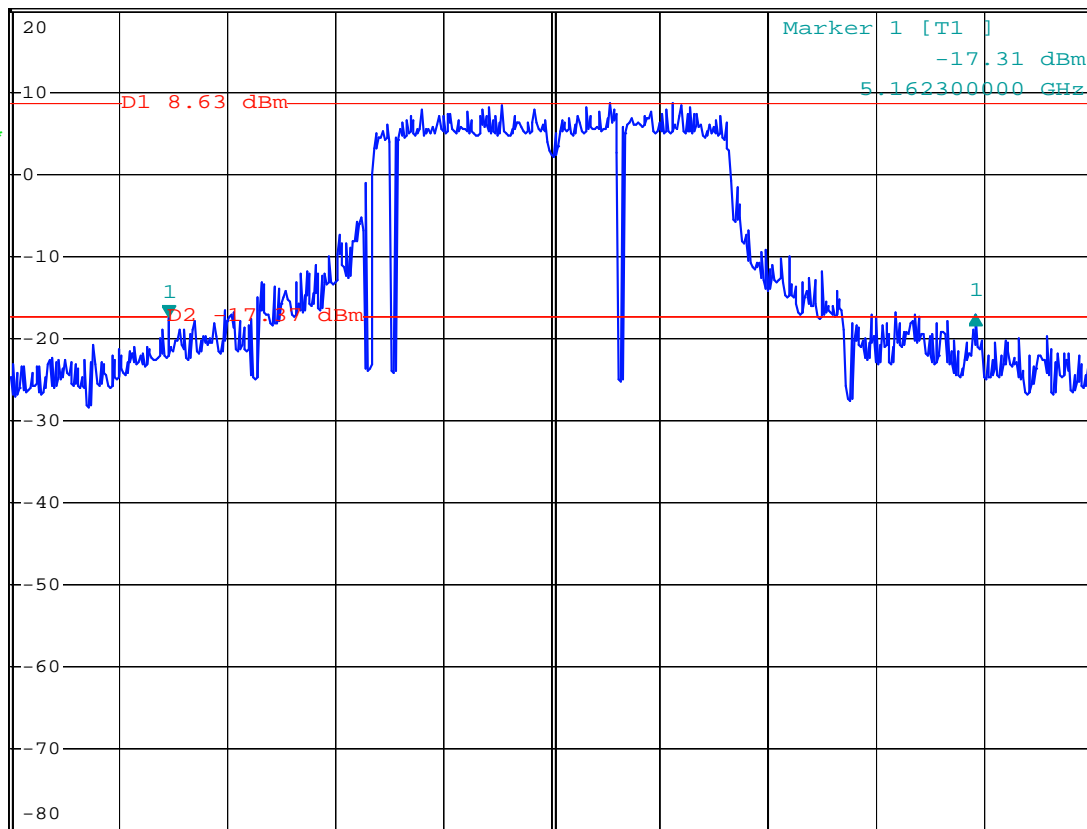
Channel 36 (5180 MHz)



**DELTA MARKER 1**  
37.3 MHz  
Ref 20 dBm Att 50 dB

\*RBW 300 kHz Delta 1 [T1 ]  
\*VBW 1 MHz 0.17 dB  
SWT 20 ms 37.30000000 MHz

1 PK \*  
VIEW



Center 5.18 GHz 5 MHz / Span 50 MHz

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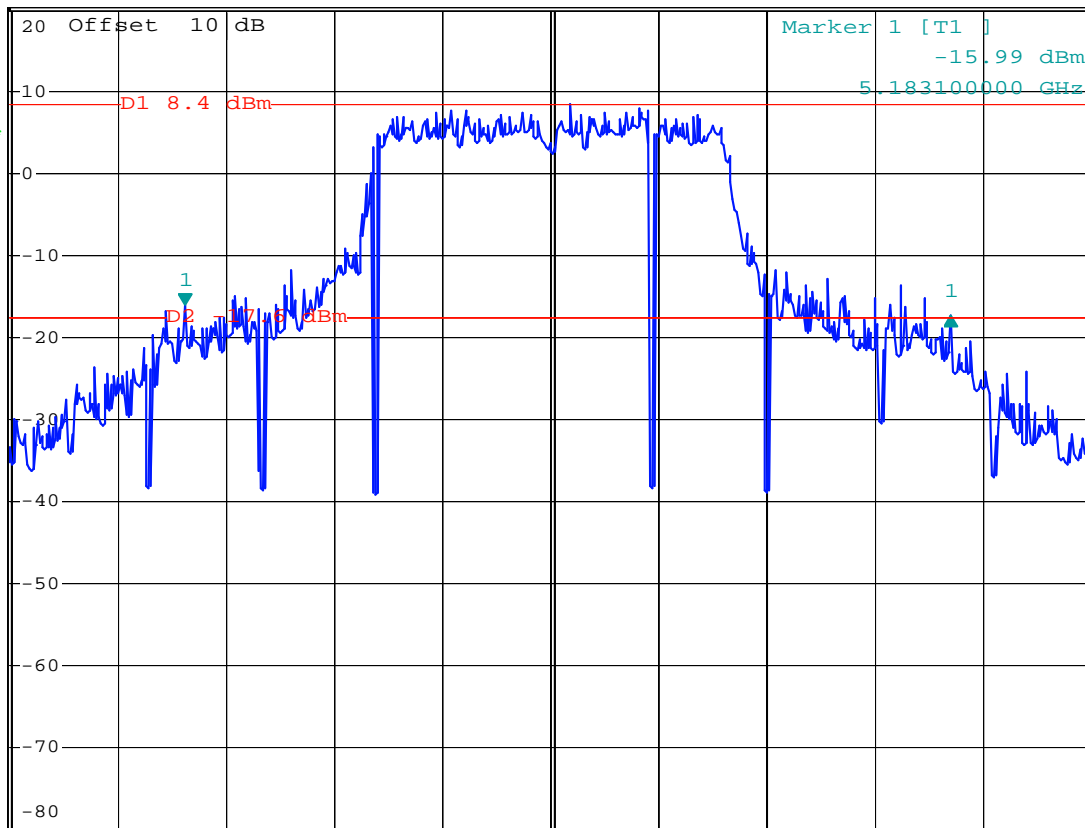
Channel 40 (5200 MHz)



**DELTA MARKER 1**  
35.4 MHz  
Ref 20 dBm Att 40 dB

\*RBW 300 kHz Delta 1 [T1 ]  
\*VBW 1 MHz -1.53 dB  
SWT 20 ms 35.40000000 MHz

1 PK\*  
VIEW



Center 5.2 GHz 5 MHz/ Span 50 MHz

FCC ID: U9A277IWLAN-V211

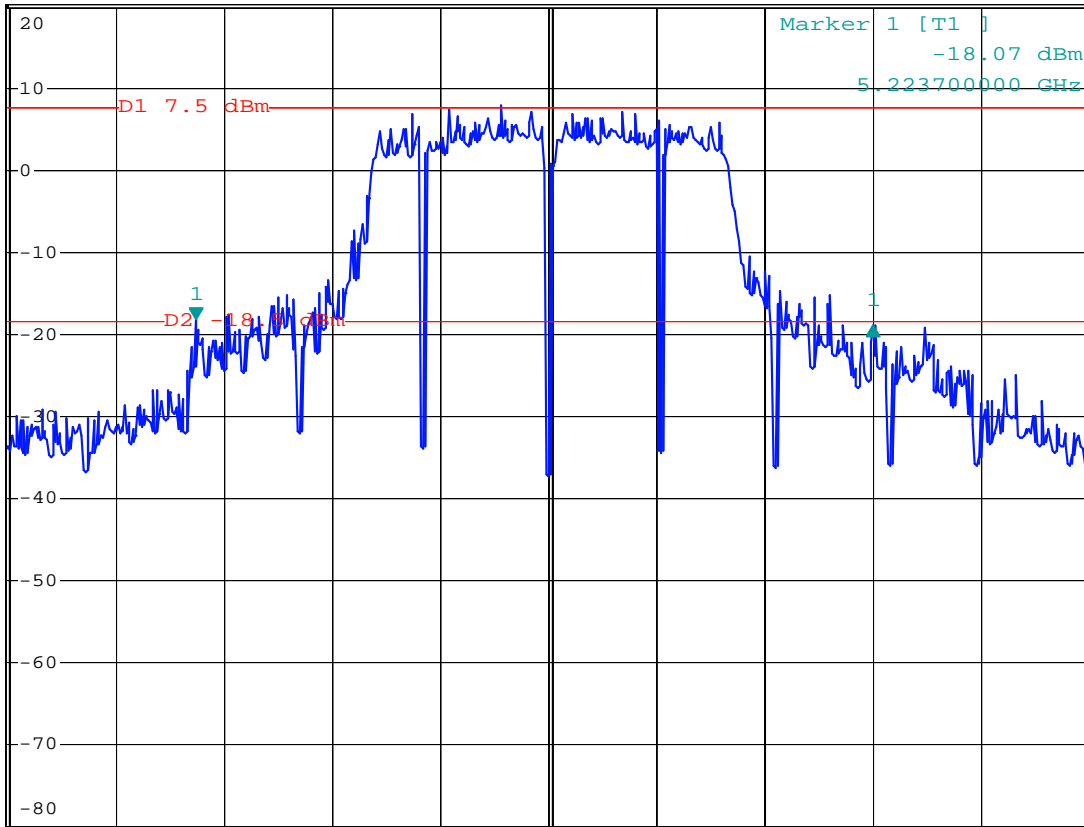
Channel 48 (5240 MHz)



**CENTER FREQUENCY**  
5.24 GHz  
Ref 20 dBm Att 50 dB

\*RBW 300 kHz Delta 1 [T1 ]  
VBW 1 MHz -0.98 dB  
SWT 20 ms 31.30000000 MHz

1 PK\*  
VIEW



Center 5.24 GHz 5 MHz/ Span 50 MHz

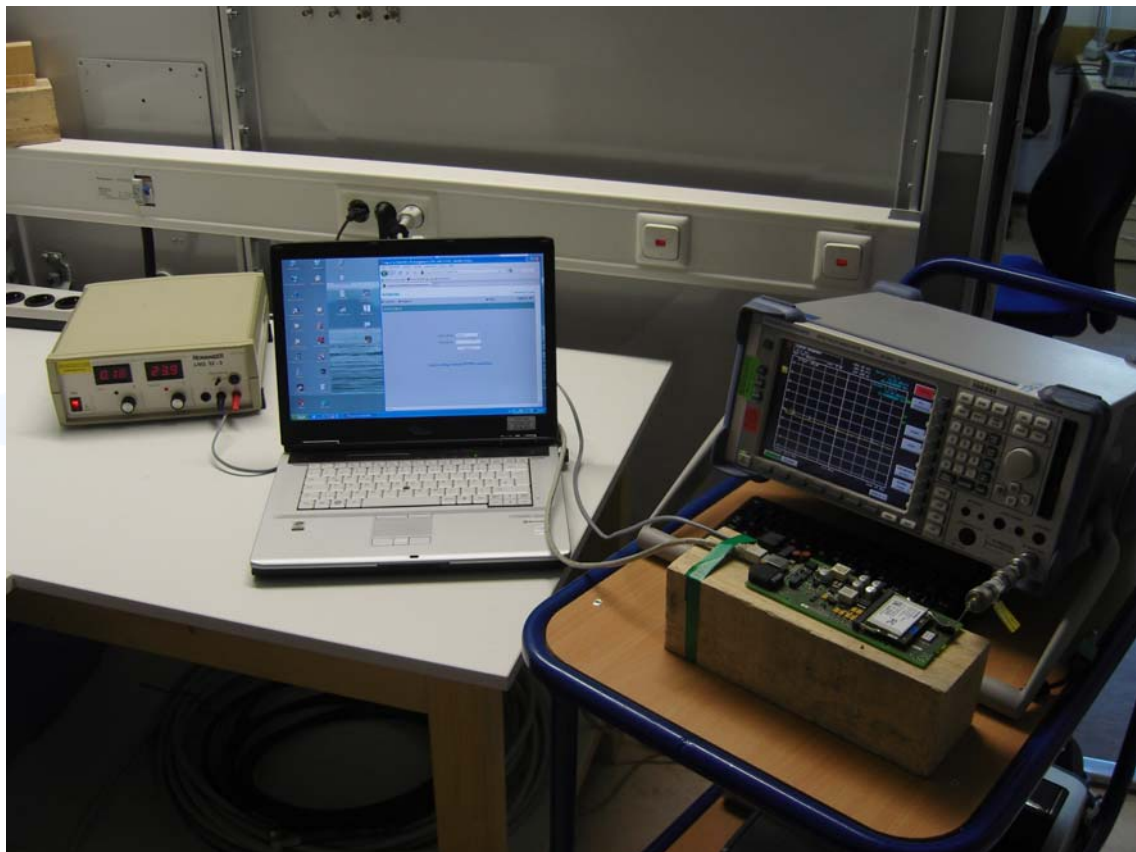
### 5.3 Maximum Conducted Output Power

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

#### 5.3.1 Description of the test location

Test location: AREA4

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



**5.3.3 Applicable standard**

According to FCC Part 15 Subpart 15.401 (n): The total transmits power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level.

The applicable power limits are defined in Part 15.407 (a).

If transmitting antennas of directional gain are greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 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 using 1 MHz RBW and 300 kHz VBW. The span of the spectrum analyzer should be larger than the Emission Band Width (EBW). To get the total power of the occupied band width the function "Channel Power Measurement" of the analyzer has been used. The channel band width has been set to EBW. With Peak detector and Power Mode Max Hold the result is the summed maximum output power of the EBW.

According to Public Notice DA 02-2138, method 3, the VBW has been calculated.

**5.3.5 Test result**

Ch	Frequ. (MHz)	WEB Settings (dB)	Measured Power (dBm)	Correct. (dB)	Power Conducted (dBm)	Antenna Gain (dBi)	EIRP Power (dBm)	EIRP Limit (dBm)	Delta (dB)
36	5180	-3	15.7	0.2	15.9	5.0	20.9	23.0	-2.1
40	5200	-3	15.9	0.2	16.1	5.0	21.1	23.0	-1.9
48	5240	-3	15.6	0.2	15.8	5.0	20.8	23.0	-2.2

Remarks: Where Correction means cable loss of 0.2 dB.

Peak Power Limit according to FCC Subpart 15.407(a)

Frequency (GHz)	Conducted Power Limit		EIRP Limit
	(dBm)	(mW)	(dBm)
5.15-5.25	17	50	23

The requirements are **FULFILLED**.

**Remarks:** This test has been performed conducted at antenna jack on WLAN module.  
\_\_\_\_\_  
\_\_\_\_\_

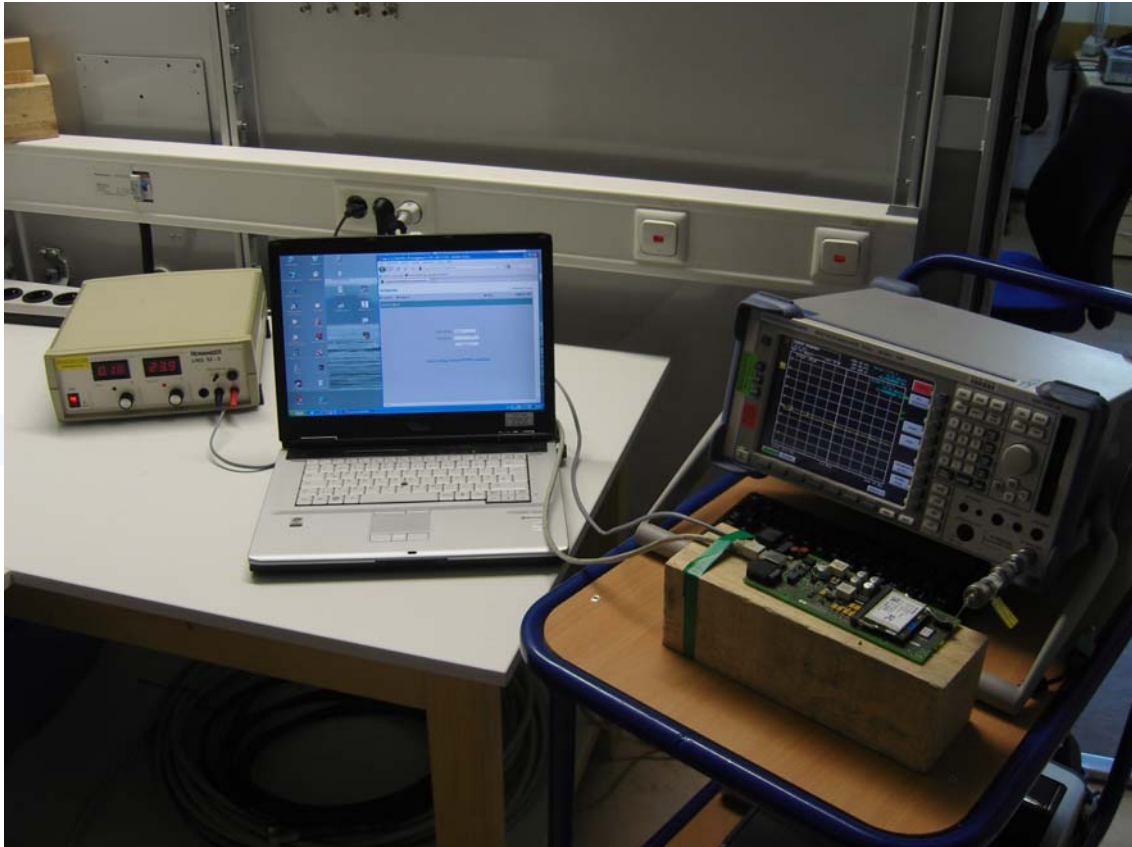
## 5.4 Maximum Permissible Exposure (MPE)

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

### 5.4.1 Description of the test location

Test location: AREA4

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



### 5.4.3 Applicable standard

According to FCC Part 15 Subpart 15.407 (f): U-NII devices are subject to the radio frequency radiation exposure requirements specified in §§ 1.1307 (b), 2.1091 and 2.1093 of this chapter, as appropriate.

The test methods used comply with ANSI/IEEE C95.1-1992, "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 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in FCC 1.1307(b).

#### 5.4.4 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, which is a far field assumption and the known maximum gain of the antenna, the maximum MPE at a defined distance away from the product, can be calculated.

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

where

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

$P_{out}$  = output power to antenna in mW

G = gain of antenna (linear scale)

r = distance between antenna and observation point (cm)

#### 5.4.5 Test result

Channel No.	Frequency (MHz)	Max Power Output to Antenna		Antenna gain (dBi)	Power Density (mW/cm <sup>2</sup> )	Limit of Power Density (mW/cm <sup>2</sup> )
		(dBm)	(mW)			
36	5180	15.9	37.3	5.0	0.024	1.0
40	5200	16.1	35.4	5.0	0.026	1.0
48	5240	15.8	31.3	5.0	0.024	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>(A) Limits for Occupational / Controlled Exposure</b>				
0.3 – 3.0	614	1.63	100	6
3.0 – 30	1842/f	4.89/f	900/f <sup>2</sup>	6
30 - 300	61.4	0.163	1.0	6
300-1500	---	---	f/300	6
1500-100000	---	---	5.0	6
<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
1500-100000	---	---	1.0	30

f = Frequency in MHz

**5.4.6 Compliance regarding Co-location and Co-transmission**

**Applicable standard:** ANSI/IEEE C95.1-1999, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz", Clause 4.1.1. e):

For mixed or broadband fields at a number of frequencies for which there are different values of the MPE, the fraction of the MPE (in terms of E, H, or power density (S)) occurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity (1.0, or 100 % in terms of percentage).

1. MPE of WLAN-Module:  $P_d = 0.026 \text{ mW/cm}^2$   
Limit:  $1 \text{ mW/cm}^2$   
Fraction of MPE: 2.6 %
2. MPE of RFID Module: The fieldstrength radiated by the RFID Module is too small to be considered.

The requirements are **FULFILLED**.

**Remarks:** The MPE limit is reached at 1.72 cm or further to the transmitting antenna. Because the antenna is inside the MP and its diameter is 30 cm, no RF exposure warnings will be used with the EuT.  
For the test result of RFID Module please refer to Test report T34493-00-00AA  
(mikes-testingpartners gmbh)



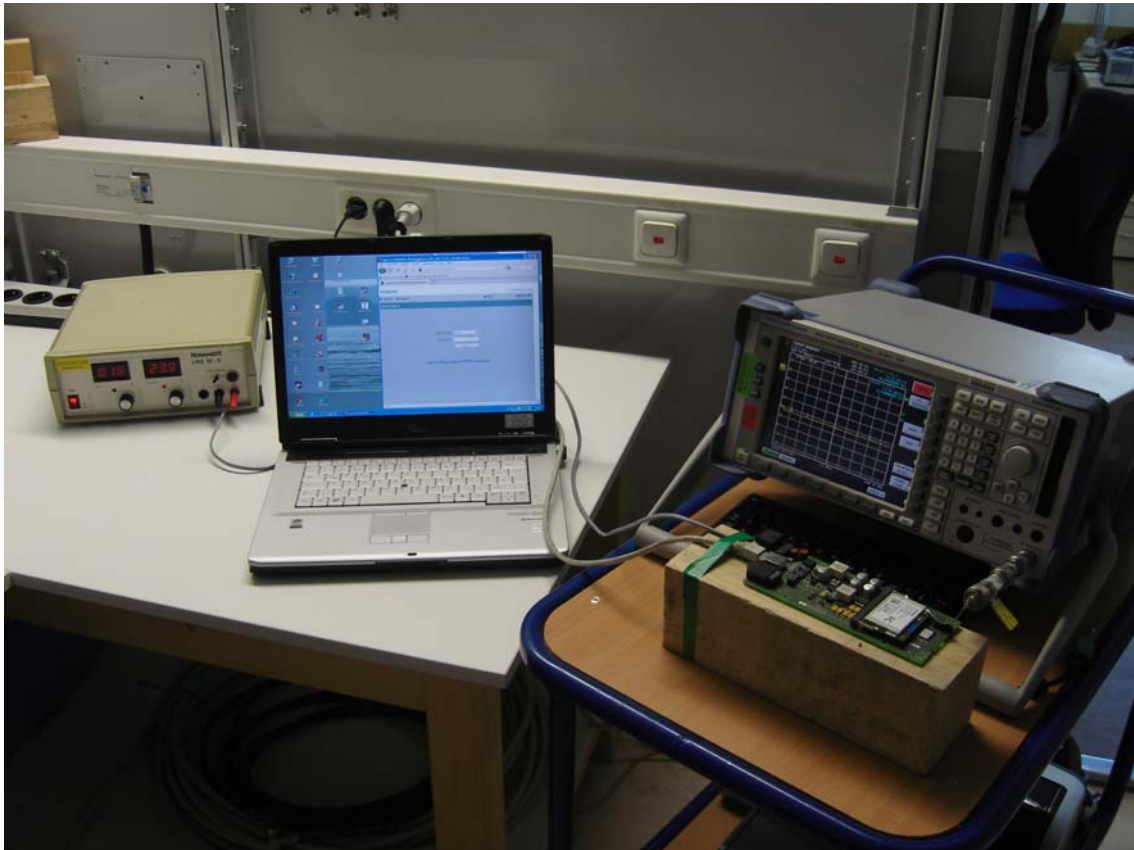
## 5.5 Peak Power Spectral Density

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

### 5.5.1 Description of the test location

Test location: Area 4

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



**5.5.3 Applicable standard**

According to FCC Part 15 Subpart 15.407 (a): For the band 5.15-5.25 GHz the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 4 dBm in any 1-MHz band during any time interval of continuous transmission.

**5.5.4 Description of Measurement**

The EuT was connected to the spectrum analyzer with a suitable attenuator. The peak power spectral density was measured using the analyzer function of measuring the band power/Hz and the same settings like the power measuring. The result is calculated by addition of 60 dB (10 log 1 MHz/Hz) to the readings.

Settings on the spectrum analyzer:

RBW: 1 MHz  
 VBW: 3 MHz  
 Sweep: auto  
 Detector function: AV

**5.5.5 Test result**

Channel	Fundamental Frequency (MHz)	Reading (dBm/Hz)	Correction to 1 MHz (dB)	PPSD Result (dBm)	Limit (dBm)
36	5180	-56.8	60	3.2	4
40	5200	-57.0	60	3.0	4
48	5240	-56.3	60	3.7	4

The requirements are **FULFILLED**.

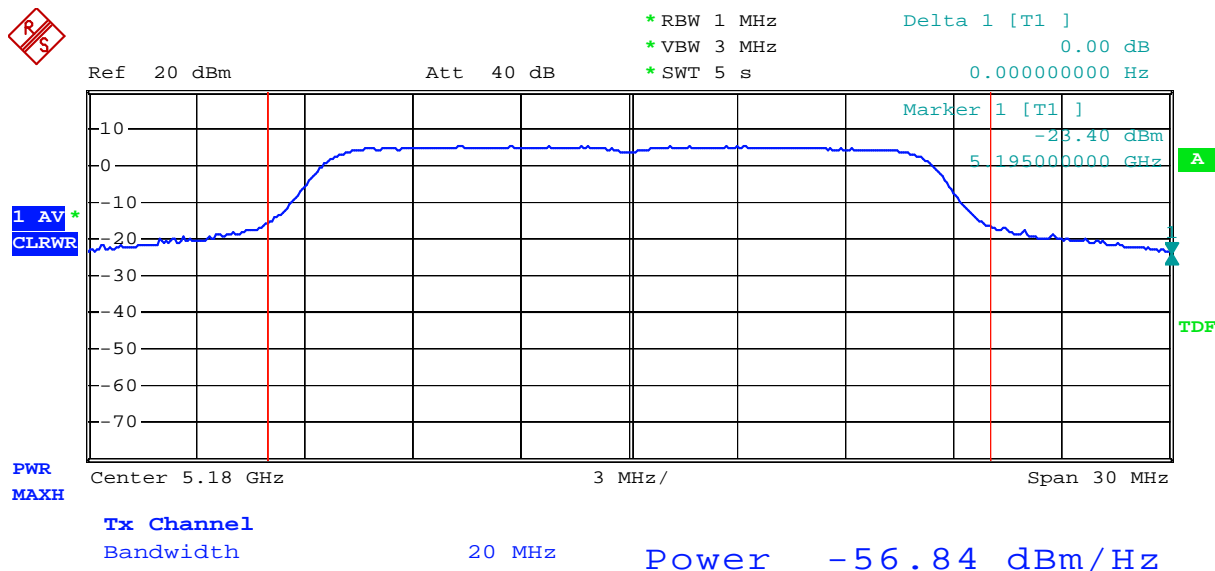
**Remarks:** For detailed test results please refer to following test protocols.

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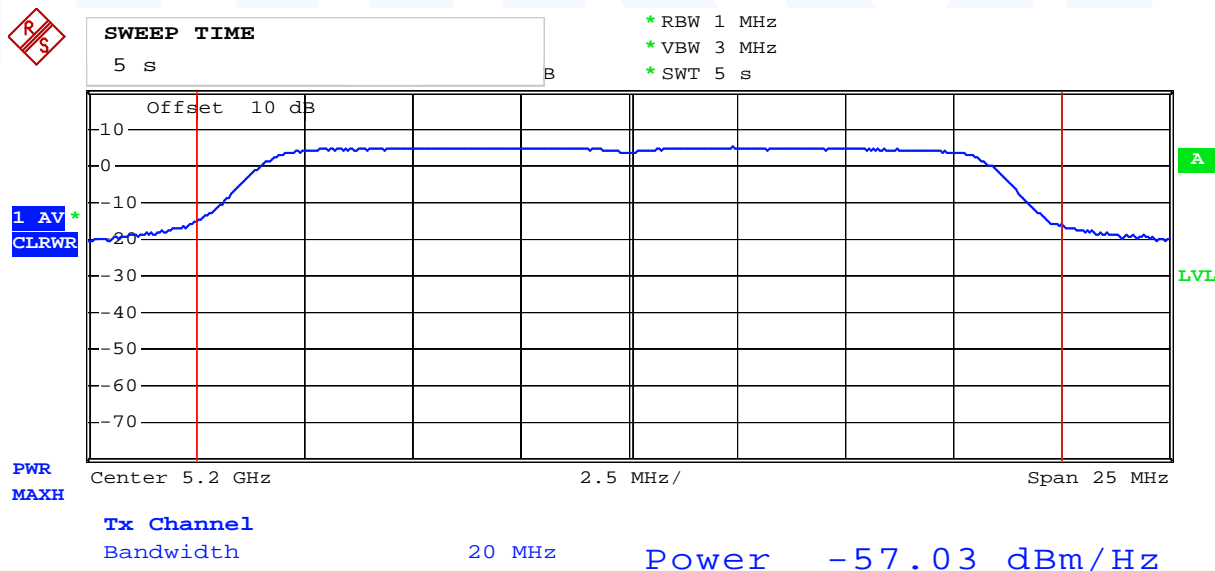
FCC ID: U9A277IWLAN-V211

Peak Power spectral density plots

Channel 36 (5180 MHz)



Channel 40 (5200 MHz)



FCC ID: U9A277IWLAN-V211

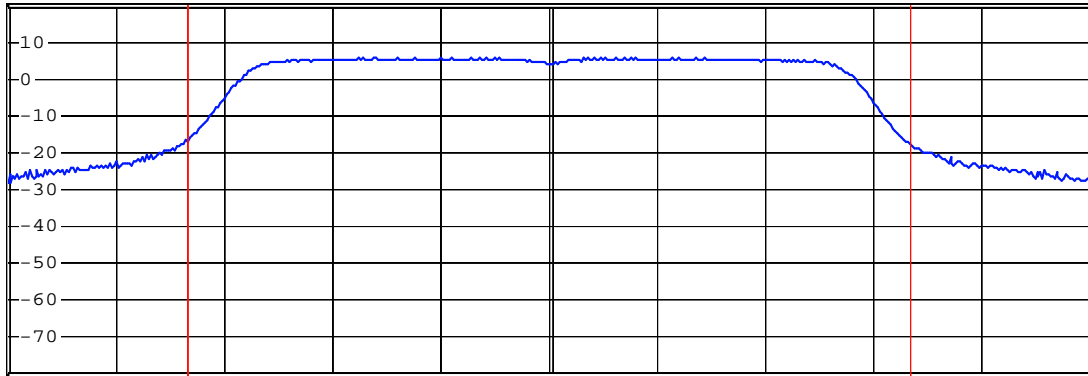
Channel 48 (5240 MHz)



SELECT TRACE  
1 B

RBW 1 MHz  
\* VBW 3 MHz  
\* SWT 5 s

1 AV\*  
CLRWR



PWR  
MAXH

Center 5.24 GHz

3 MHz/

Span 30 MHz

Tx Channel

Bandwidth

20 MHz

Power

-56.28 dBm/Hz

mikes

## 5.6 Undesirable emissions

For test instruments and accessories used see section 6 Part **SEC 1-3, SER 1, SER 2 and SER 3.**

### 5.6.1 Description of the test location

Test location: OATS1  
Anechoic Chamber A2

Test distance: 3 metres

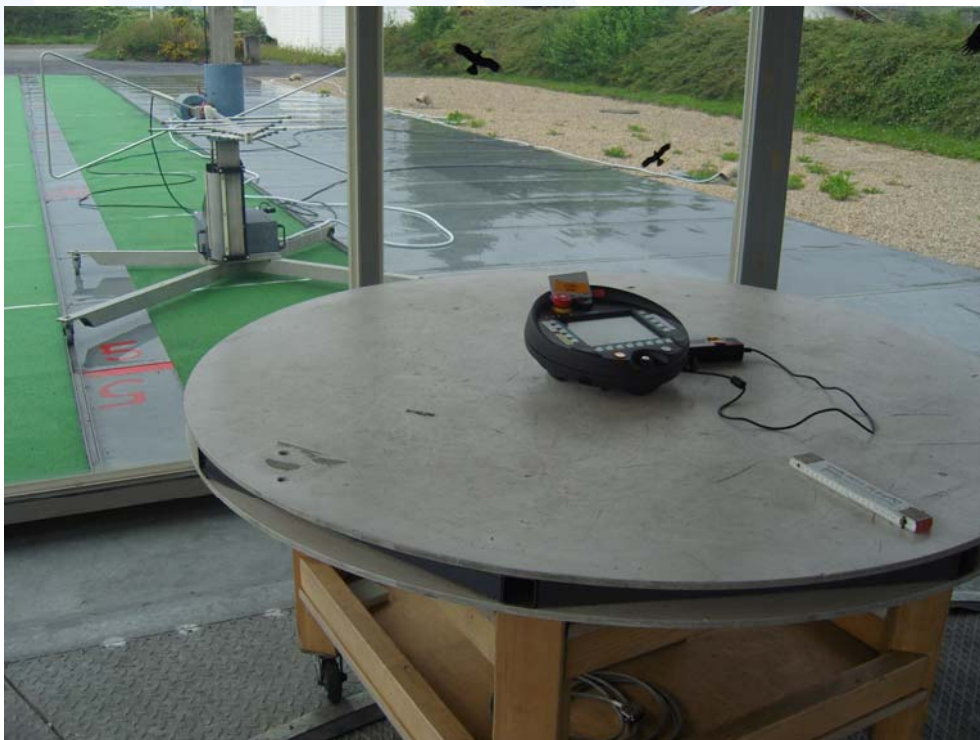
### 5.6.2 Photo documentation of the test set-up

Anechoic chamber



FCC ID: U9A277IWLAN-V211

Open Area Test Site



### 5.6.3 Applicable standard

According to FCC Part 15 Subpart 15.407 (b):

- (1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.
- (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limit specified in §15.209(a) (see §15.205(c)).

### 5.6.4 Description of Measurement

Spurious emissions from the EuT are measured in the frequency range from 9 kHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. The measurements are made with 120 kHz/6 dB bandwidth and quasi-peak detection. The EuT is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003. The antenna was positioned 3 meters horizontally from the EuT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarization`s and the EuT are rotated 360 degrees.

The final level, expressed in dB $\mu$ V/m, is arrived by taking the reading from the EMI receiver (Level dB $\mu$ V) and adding the correction factors and cable loss factor (Factor dB) to it. This is done automatically in the EMI receiver, where the correction factors are stored.

The radiated emissions from the EuT are measured in the frequency range of 1 GHz to maximum frequency as specified in section 15.33, using a Spectrum Analyzer and appropriate linearly polarized antennas. The EuT is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. The set up of the EuT will be in accordance to ANSI C63.4-2003. The antenna was positioned 3 m horizontally from the EuT.

Measurement are made in both the horizontal and vertical planes of polarization in a fully anechoic room using a spectrum analyzer with the detector function set to peak, RBW 1 MHz and VBW set to 3 MHz for any spurious emission or modulation product that falls in **Restricted bands** as defined in Section 15.205.

All tests are performed at a test-distance of 3 meters. During the tests the EuT measurement scans are made with both horizontal and vertical antenna polarization`s and the EuT are rotated 360 degrees.

According to Part 15.407 (b) (5): The emission measurements have been performed using a minimum RBW of 1 MHz. At some measurements it was necessary to use a RBW of 100 kHz near the band edge. The results than have been calculated to show the total power over 1 MHz.

Average values were measured with spectrum analyzer by taking the following Settings

RBW: 1 MHz

VBW: 10 Hz

Sweep: Auto

5.6.5 Test result

Occupied Frequency band: 5.15 GHz to 5.25 GHz

5.6.5.1 Conducted spurious emissions

Channel 36 (5180 MHz)			
Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Delta (dB)
9 kHz-30	<-50	-27	>20
30-1000	<-60	-27	>20
10329	-32.3	-27	-5.3
Channel 40 (5200 MHz)			
Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Delta (dB)
9 kHz-30	<-50	-27	>20
30-1000	<-60	-27	>20
10379	-35.2	-27	-8.2
Channel 48 (5240 MHz)			
Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Delta (dB)
9 kHz-30	<-50	-27	>20
30-1000	<-60	-27	>20
10477	-36.6	-27	-9.6

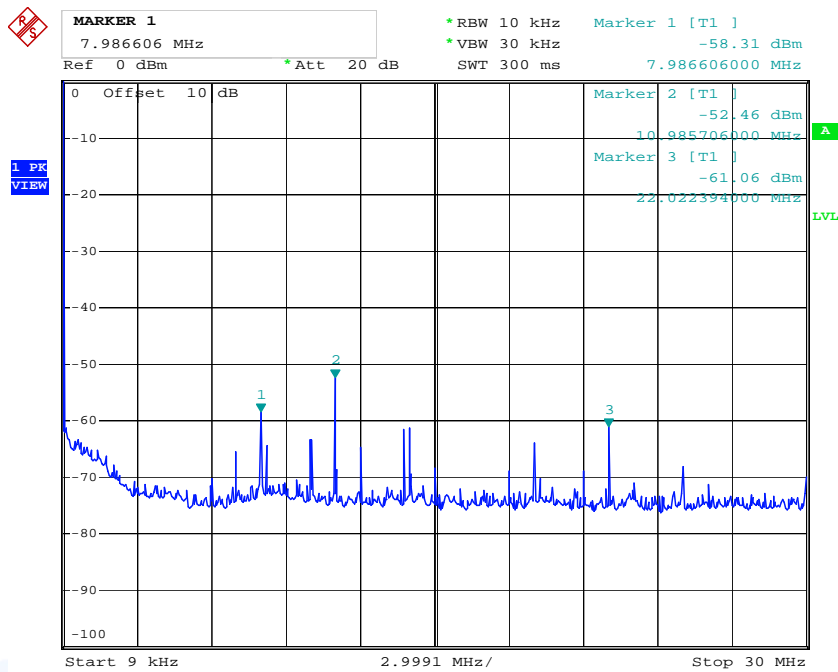
Remarks: All spurious emissions falling in restricted bands have been measured radiated.

For detailed test results please refer to test plots below.



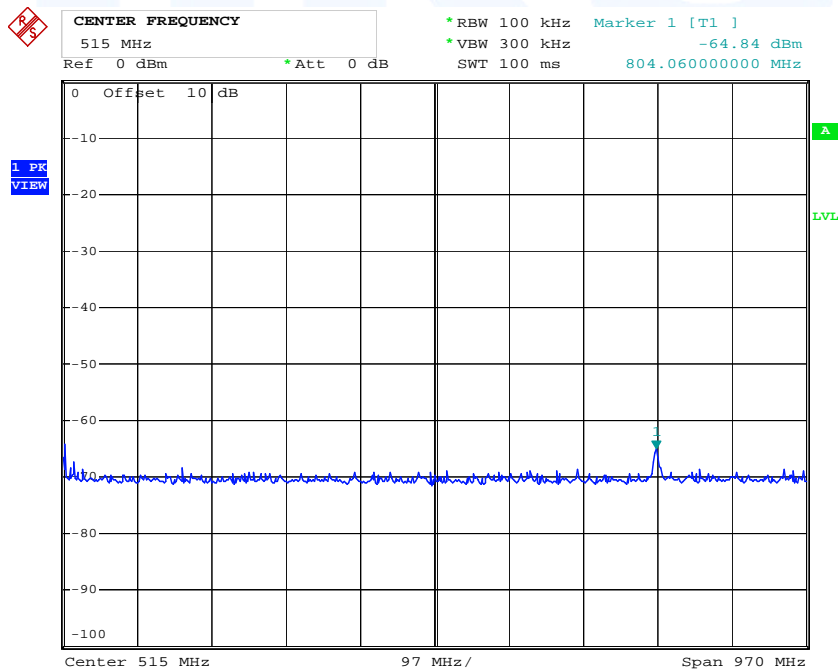
FCC ID: U9A277IWLAN-V211

Worst case measurement from 9 kHz to 30 MHz



Date: 2.AUG.2010 15:05:19

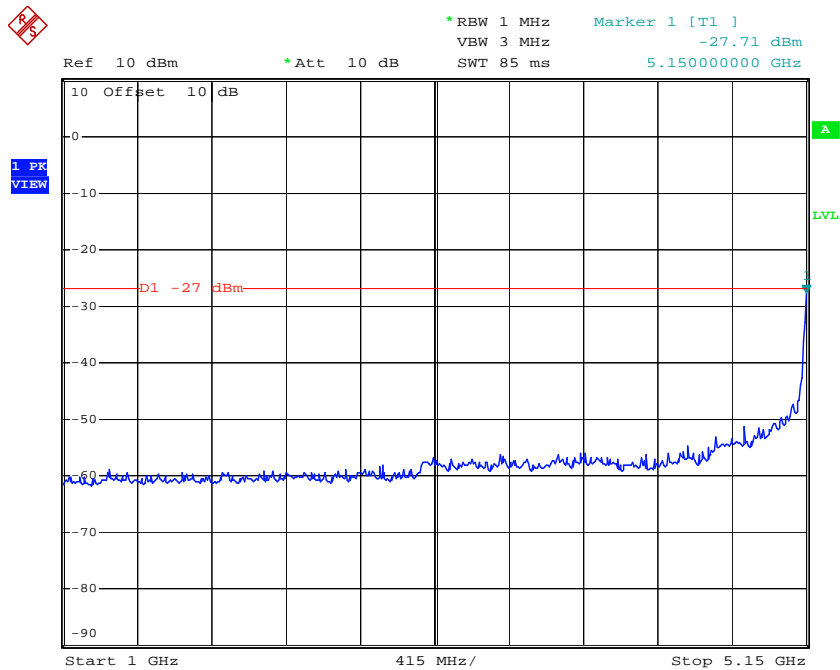
Worst case measurement from 30 to 1000 MHz



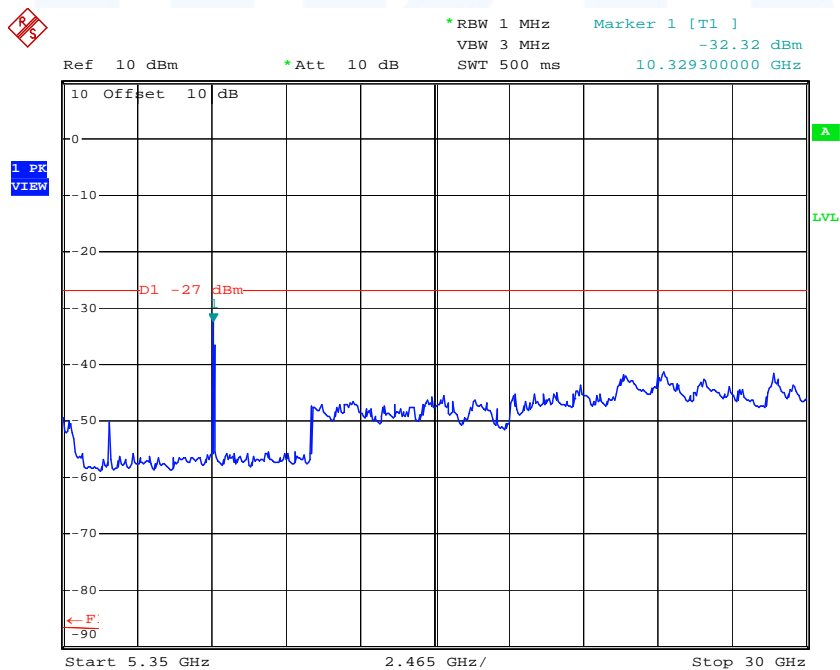
Date: 2.AUG.2010 14:50:05

FCC ID: U9A277IWLAN-V211

Channel 36 (5180 MHz)



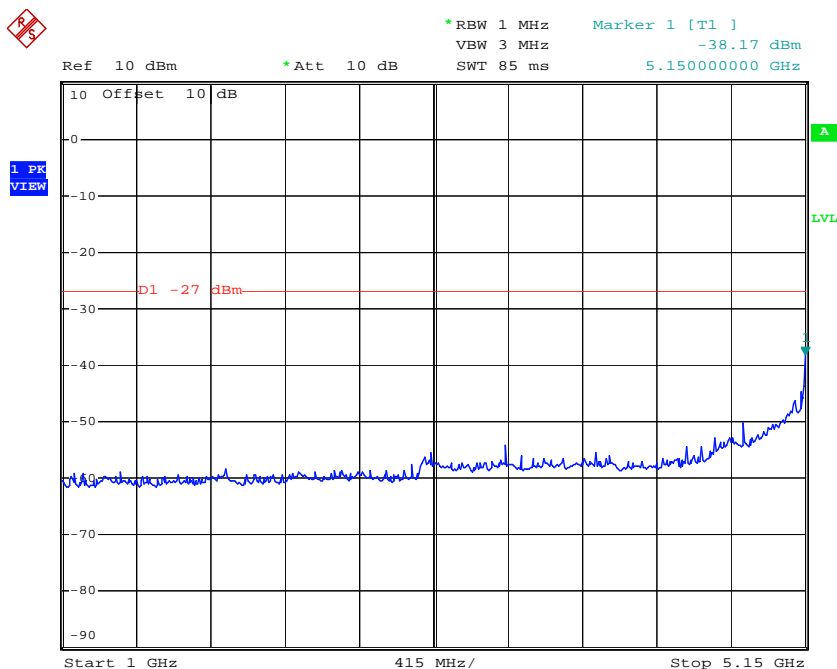
Date: 3.AUG.2010 09:29:02



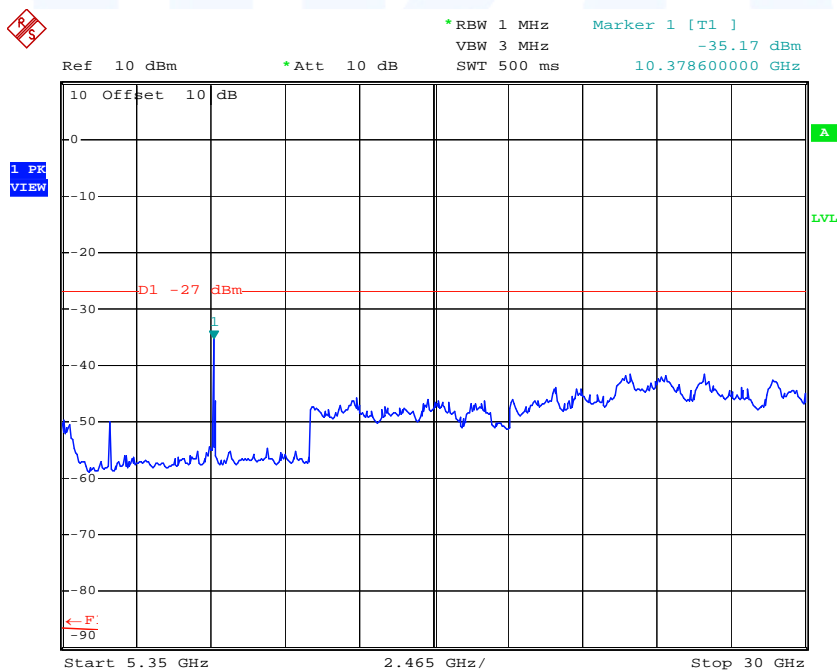
Date: 3.AUG.2010 09:55:47

FCC ID: U9A277IWLAN-V211

Channel 40 (5200 MHz)



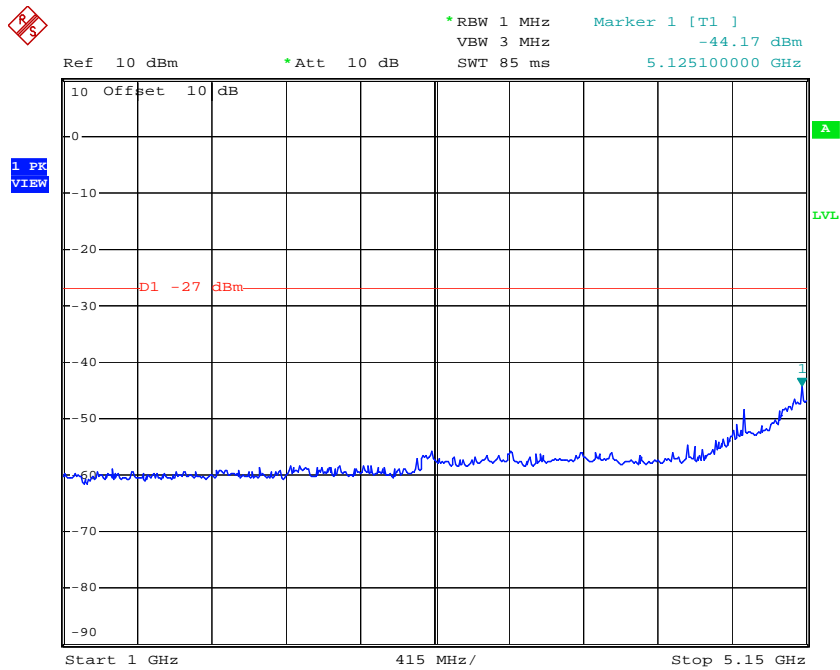
Date: 3.AUG.2010 09:34:17



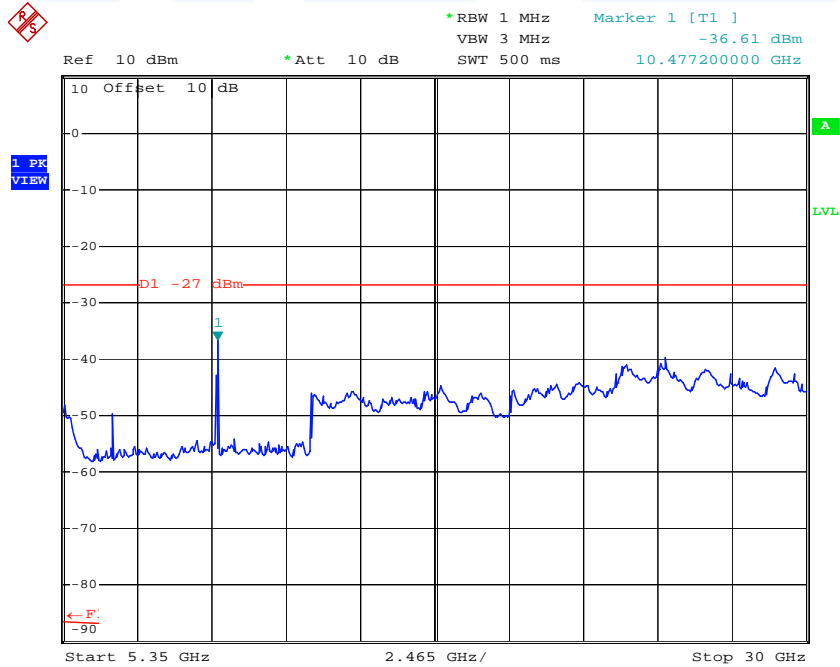
Date: 3.AUG.2010 10:05:53

FCC ID: U9A277IWLAN-V211

Channel 48 (5240 MHz)



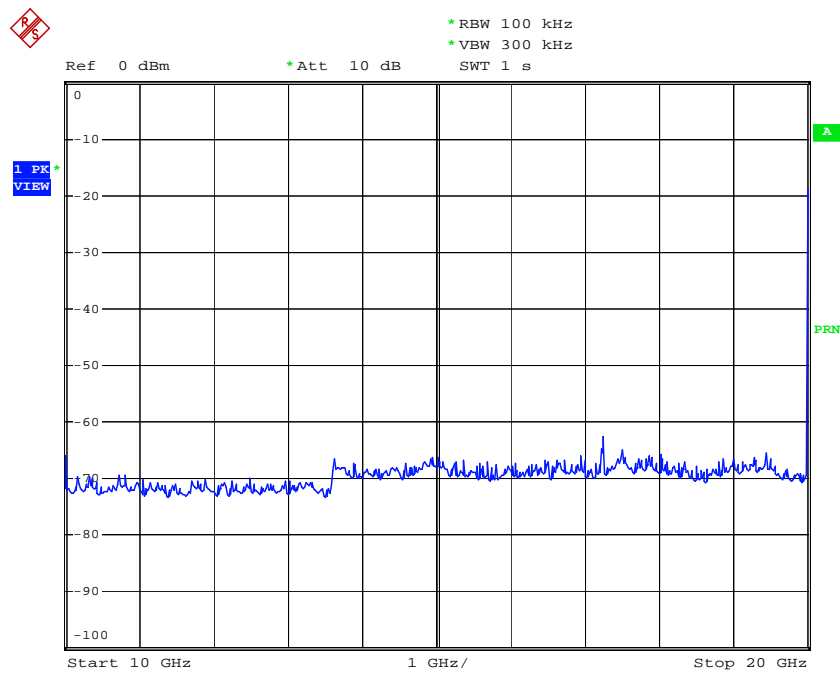
Date: 3.AUG.2010 09:36:04



Date: 3.AUG.2010 09:51:12

FCC ID: U9A277IWLAN-V211

Worst case measurement from 30 to 40 GHz



**Notes:** The measurement range from 30 – 40 GHz has been transposed by a mixer of 20 GHz to the analyzer range from 10 – 20 GHz.

FCC ID: U9A277IWLAN-V211

5.6.5.2 Radiated emissions and Harmonics in restricted bands

Spurious emissions in the frequency range from 9 kHz to 1 GHz

Frequency (MHz)	Reading Level QP (dBµV)	Reading Level AV (dBµV)	Bandwidth (kHz)	Correction Factor (dB/m)	Corrected Level QP (dBµV/m)	Corrected Level AV (dBµV/m)	Limit (dBµV/m)	Delta (dB)
0.009-0.150	---	---	0.200	---	---	---	---	---
0.150-30	---	---	9	---	---	---	---	---
169	18.5	---	120	15.4	33.9	---	43.5	-9.6
250	19.2	---	120	14.9	34.1	---	46.0	-11.9
260	20.8	---	120	15.3	36.1	---	46.0	-9.9

**Remark:** According to Section 15.31 (f) (2): The measurement below 30 MHz has been performed at a distance of 3 m. The results have been extrapolated to the specified distance by using the square of an inverse linear distance extrapolation factor of 40 dB/decade.

Channel 36 (5180 MHz)

Nearest restricted band: 4500 to 5150 MHz

Frequency (MHz)	Detector	Measurement (dBµV)		Correction (dB 1/m)	Result (dBµV/m)		Limit (dBµV/m)	Delta (dB)
		hor	vert		hor	vert		
5125	Pk	55.9	<45	4.5	60.4	---	74	-13.6
	AV	28.0	---	4.5	32.5	---	54	-21.5
5140	Pk	62.0	<45	4.4	68.4	---	74	-5.6
	AV	28.4	---	4.4	32.8	---	54	-21.2
5149	Pk	66.1	<45	4.4	70.5	---	74	-3.5
	AV	29.2	---	4.4	33.6	---	54	-20.4

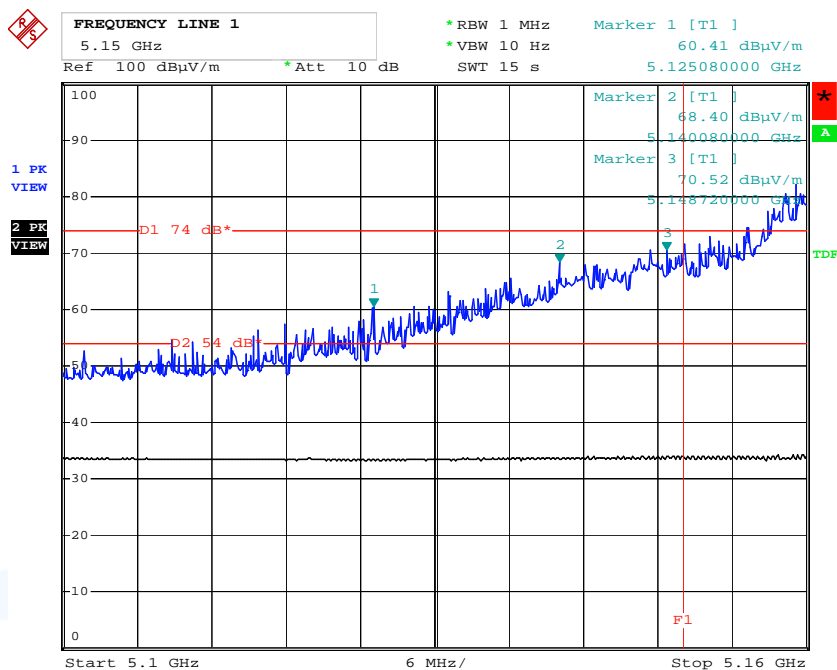
Channel 48 (5240 MHz)

Nearest restricted band: 4500 to 5150 MHz and 5350 to 5460 MHz

Frequency (MHz)	Detector	Measurement (dBµV)		Correction (dB 1/m)	Result (dBµV/m)		Limit (dBµV/m)	Delta (dB)
		hor	vert		hor	vert		
5120	Pk	46.9	<45	4.6	51.5	---	74	-22.5
	AV	---	---	---	---	---	54	---
5440	Pk	45.8	<45	5.2	51.0	---	74	-23.0
	AV	---	---	---	---	---	54	---

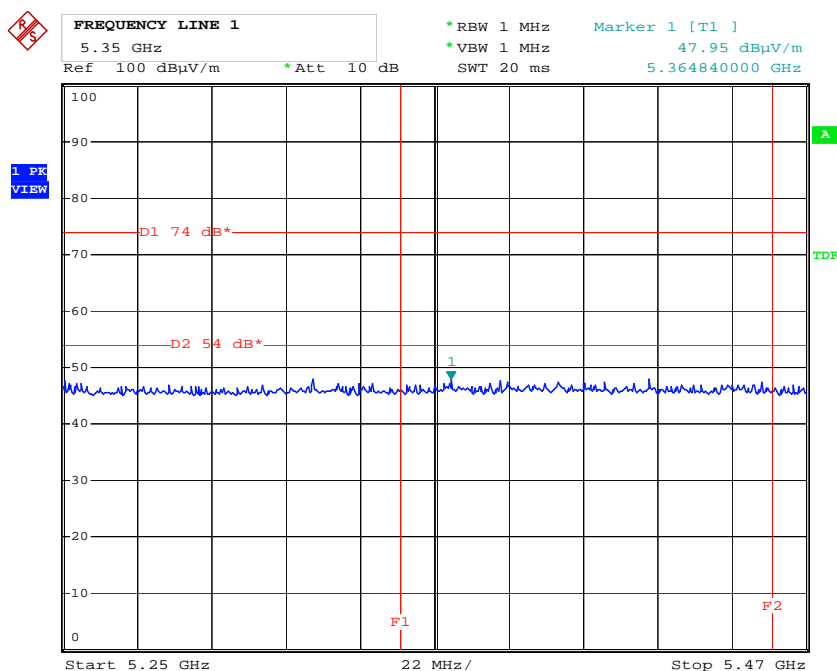
**Carrier frequency at channel 36 (5180 MHz)**

Peak and AV plot has been taken to show the restricted band emission levels near the authorized bandedges.  
(Restricted band at lower bandedge from 4500 to 5150 MHz)



Date: 2.AUG.2010 11:46:03

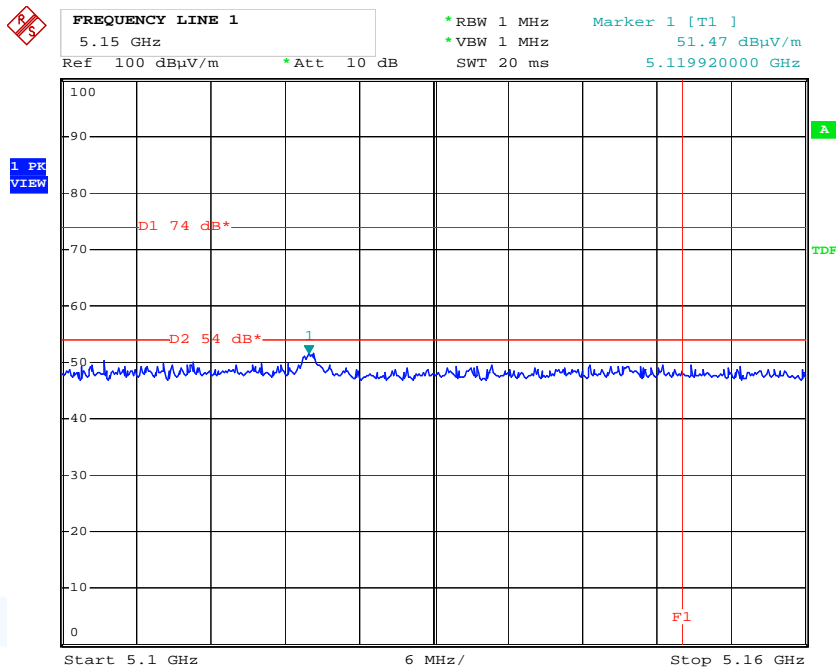
**(Restricted band at upper bandedge from 5350 to 5460 MHz)**



Date: 2.AUG.2010 11:52:43

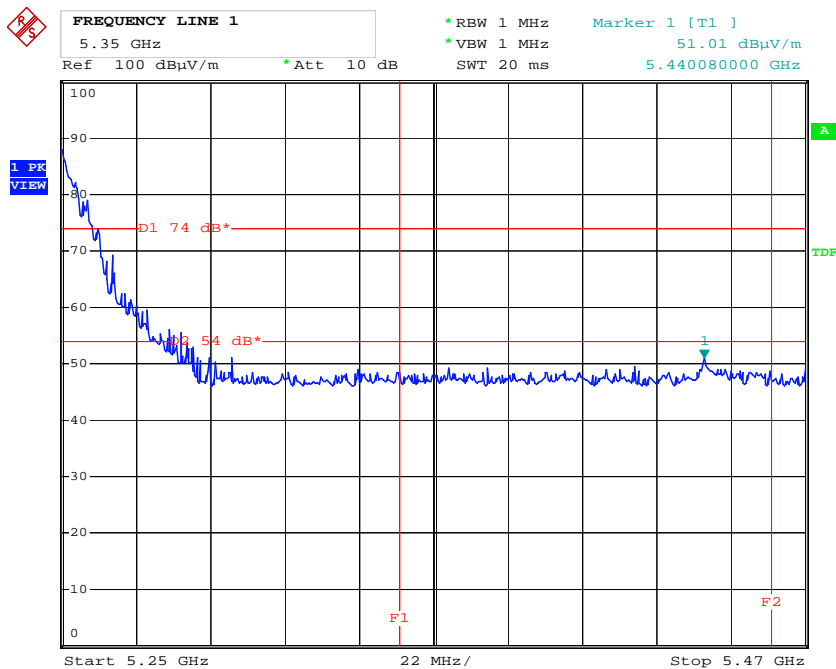
**Carrier frequency at channel 48 (5240 MHz)**

Peak plot has been taken to show the restricted band emission levels near the authorized bandedges.  
(Restricted band at lower bandedge from 4500 to 5150 MHz)



Date: 2.AUG.2010 12:04:39

**(Restricted band at upper bandedge from 5350 to 5460 MHz)**

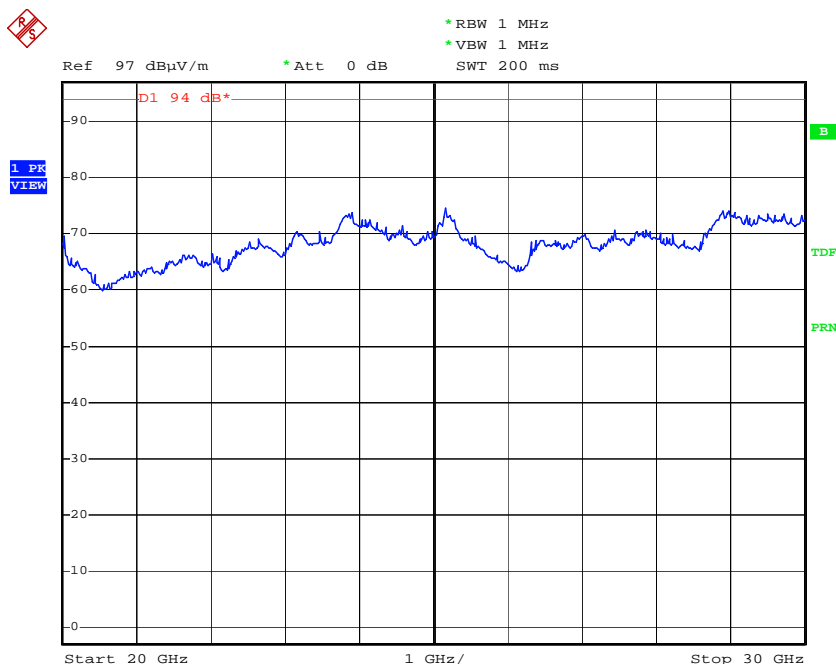


Date: 2.AUG.2010 12:00:06



FCC ID: U9A277IWLAN-V211

**Worst case radiated spurious emissions from 20 GHz to 40 GHz**



**Notes:** All peak emissions were below the limits of part 15.209.  
Measurement distance: 0.3 m  
Limit is extrapolated by 20 dB/decade



**Notes:** Limit is extrapolated by 20 dB/decade  
The measurement range from 30 – 40 GHz has been transposed by a mixer of 20 GHz to the analyzer range from 10 – 20 GHz.

**FCC ID: U9A277IWLAN-V211**

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

Frequency (MHz)	Field strength of spurious emissions		Measurement distance (meters)
	( $\mu\text{V/m}$ )	dB ( $\mu\text{V/m}$ )	
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 §15.209

(MHz)	(MHz)	(GHz)
25.5 – 25.67	960 – 1240	4.5 – 5.15
37.5 – 38.25	1300 – 1427	5.35 – 5.46
73 – 74.6	1435 – 1626.5	7.25 – 7.75
74.8 – 75.2	1645.5 – 1646.5	8.025 – 8.5
108 – 121.94	1660 – 1710	9.0 – 9.2
123 – 138	1718.8 – 1722.2	9.3 – 9.5
149.9 – 150.05	2200 – 2300	10.6 – 12.7
156.52475 – 156.52525	2310 – 2390	13.25 – 13.4
156.7 – 156.9	2483.5 – 2500	14.47 – 14.5
162.0125 – 167.17	2655 – 2900	15.35 – 16.2
167.72 – 173.2	3260 – 3267	17.7 – 21.4
240 – 285	3332 – 3339	22.01 – 23.12
322 – 335.4	3345.8 – 3358	23.6 – 24.0
399.9 – 410	3600 – 4400	31.2 – 31.8
608 – 614		36.43 – 36.5

The requirements are **FULFILLED**.

**Remarks:** The measurement was performed up to the 10<sup>th</sup> harmonic.

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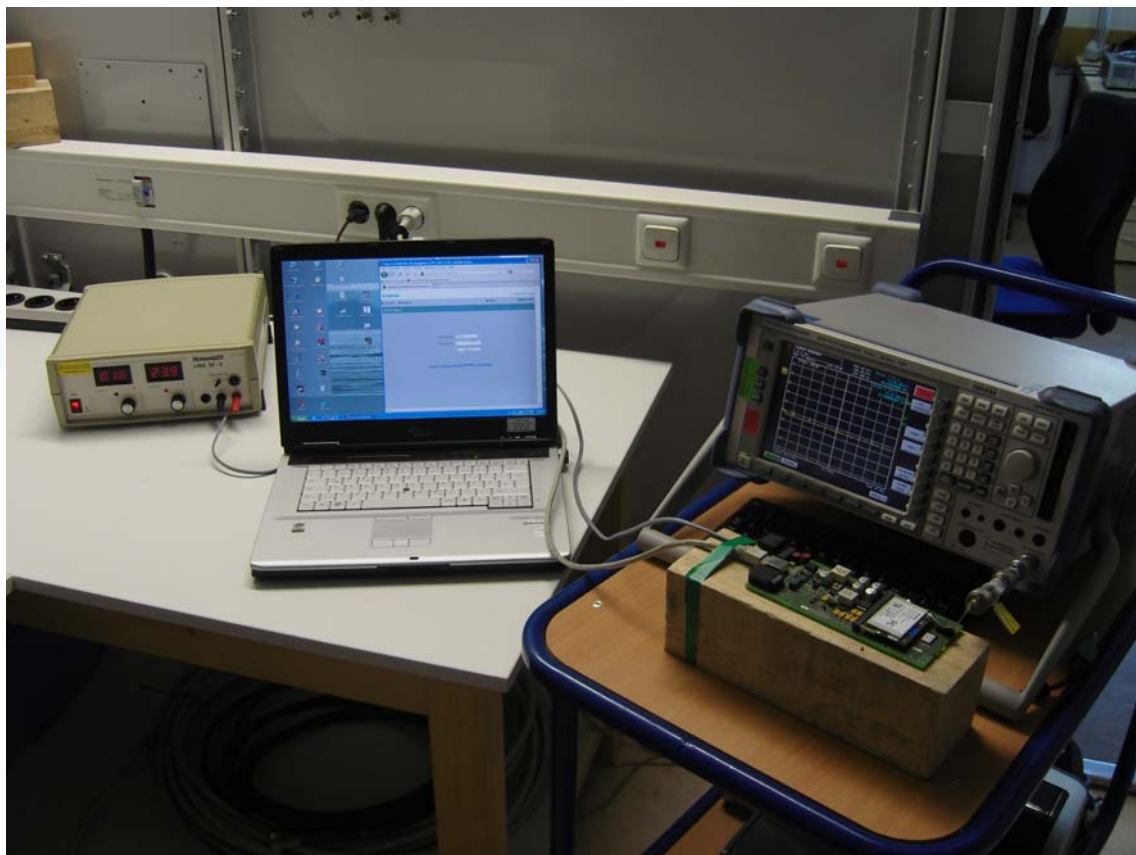
## 5.7 Peak Excursion

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

### 5.7.1 Description of the test location

Test location: AREA4

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



**5.7.3 Applicable standard**

According to FCC Part 15 Subpart 15.407 (a) (6): The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**5.7.4 Description of Measurement**

The transmitter output was connected to the spectrum analyzer. Using Peak detector and MAX HOLD-function for Trace 1 with 1 MHz RBW and 3 MHz VBW and Trace 2 with 1 MHz RBW and 300 kHz VBW both traces were recorded. The largest difference between Trace 1 and Trace 2 in any 1 MHz band was noted as maximum Peak Excursion value.

**5.7.5 Test result**

Channel	Frequency (MHz)	Peak Power Excursion (dBm)	Peak to Average Excursion Limit (dBm)	Delta (dB)
36	5180	8.2	13	-4.8
40	5200	7.9	13	-5.1
48	5240	9.3	13	-3.7

The requirements are **FULFILLED**.

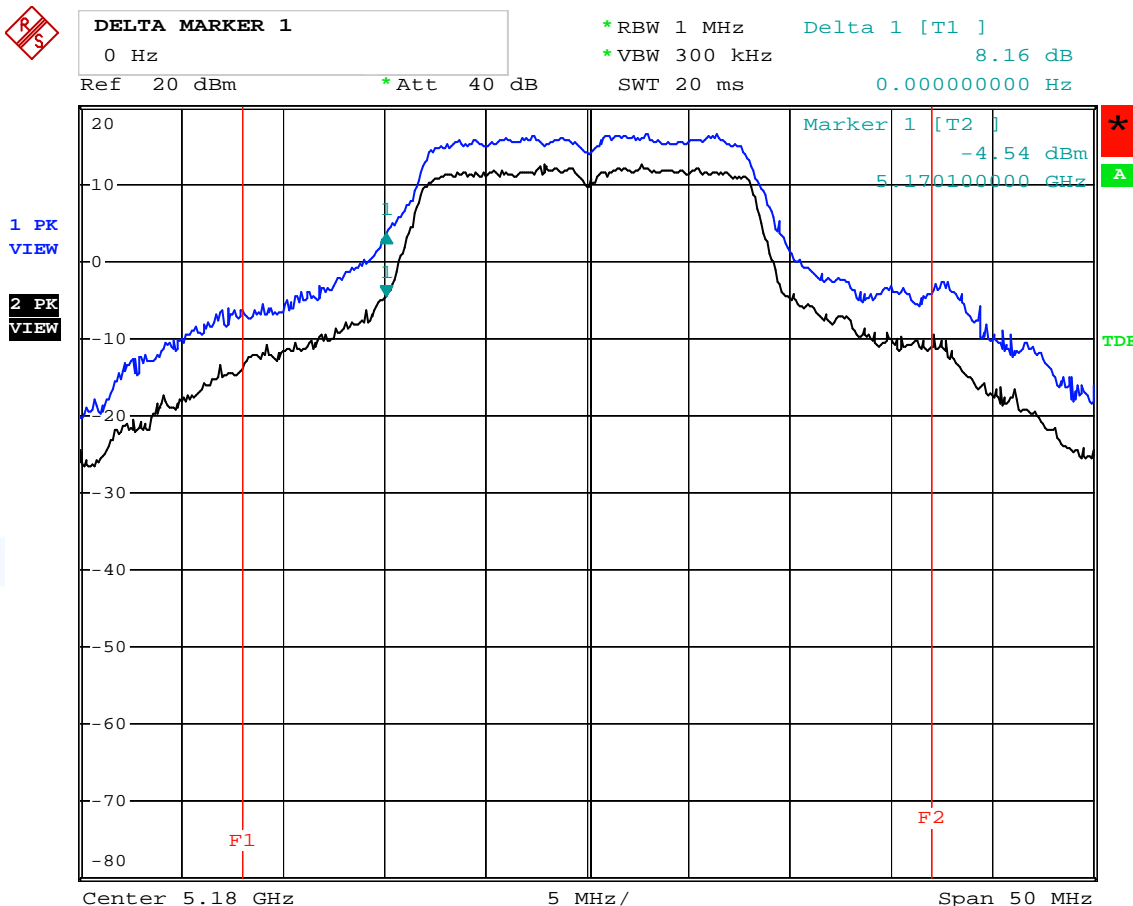
**Remarks:** For detailed test results please refer to following test protocols.

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FCC ID: U9A277IWLAN-V211

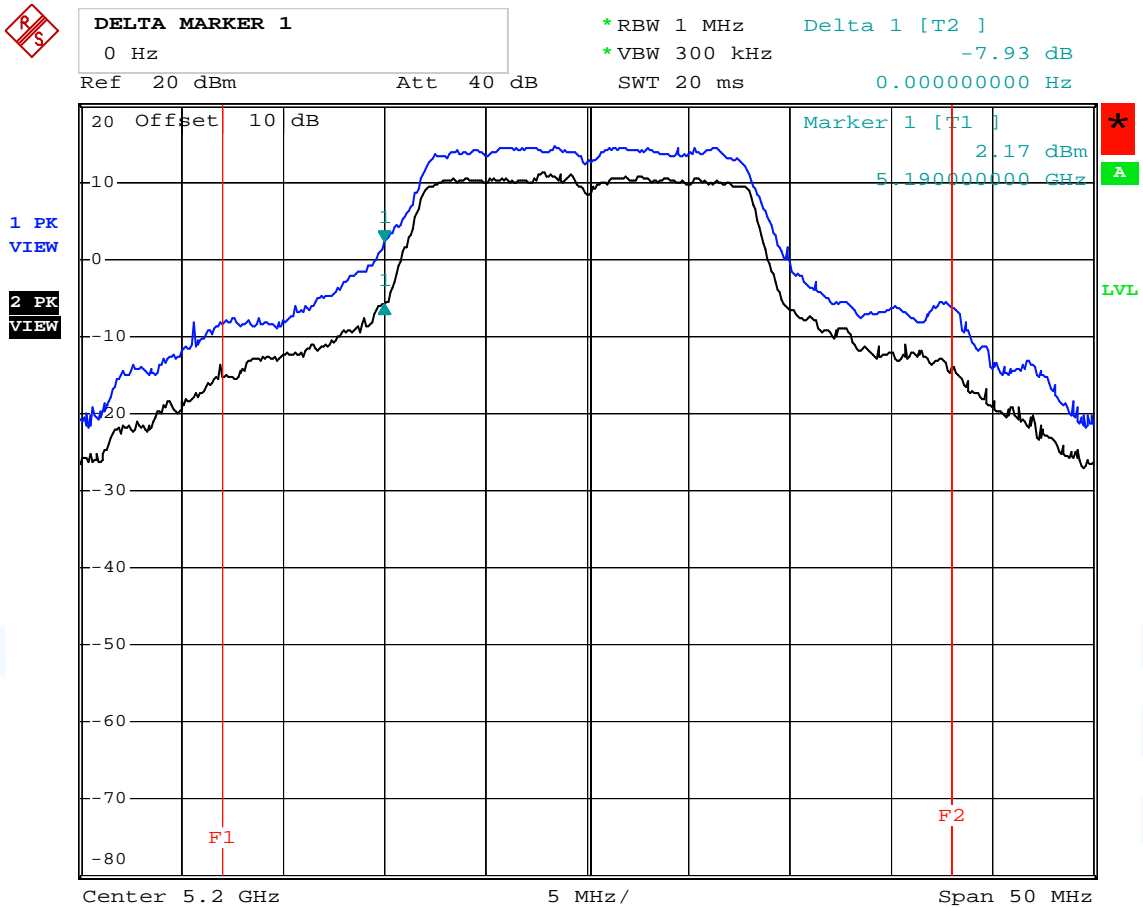
Peak Excursion Plots

Channel 36 (5180 MHz)



FCC ID: U9A277IWLAN-V211

Channel 40 (5200 MHz)



FCC ID: U9A277IWLAN-V211

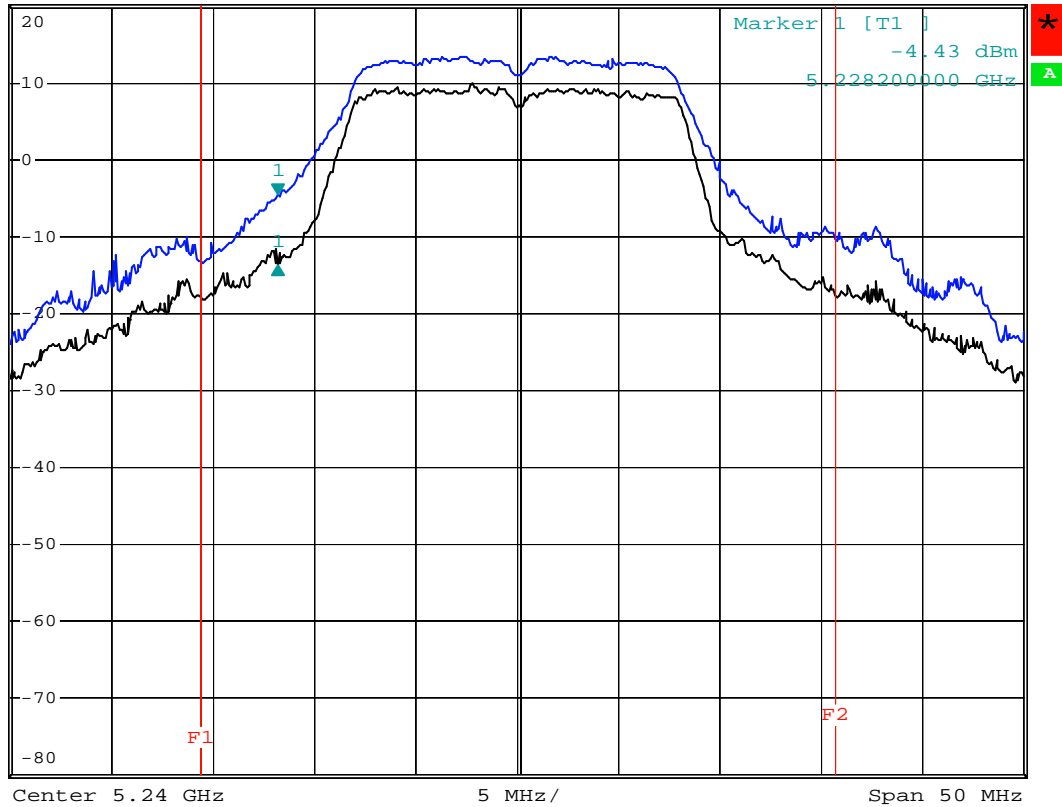
Channel 48 (5240 MHz)



\*RBW 1 MHz      Delta 1 [T2 ]  
\*VBW 300 kHz      -9.32 dB  
Ref 20 dBm      Att 50 dB      SWT 20 ms      0.00000000 Hz

1 PK  
VIEW

2 PK  
VIEW



## 5.8 Frequency stability Measurement

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

### 5.8.1 Description of the test location

Test location: AREA4

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



### 5.8.3 Applicable standard

According to FCC Part 15 Subpart 15.407 (g): Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

### 5.8.4 Description of Measurement

This test has been performed over variations in temperature and voltage. The lowest and the highest channel in the frequency band from 5150 to 5250 MHz have been measured at the 20 dB bandwidth under following conditions:

1. Supply voltage from 85 to 115 % of nominal voltage at normal temperature
2. Extreme temperature from 0 °C to 40 °C at nominal voltage.

### 5.8.5 Test result

The carrier frequencies (5180 MHz, 5240 MHz) maintain inside the operating frequency band from 5150 to 5250 MHz.

The requirements are **FULFILLED**.

**Remarks:** This test has been performed conducted at antenna jack on WLAN module.



## 5.9 Antenna application

### 5.9.1 Applicable standard

According to FCC Part 15 Subpart 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 EuT's antenna meets the requirement of FCC Part 15C, Section 15.203 and 15.204

### 5.9.2 Result

The requirements are **FULFILLED**.

**Remarks:** The EuT is equipped with two internal antennas (gain=5.0 dBi).

The EuT don't have any external antenna connectors.

mikes

## 5.10 Receiver Spurious Emissions

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

### 5.10.1 Description of the test location

Test location: OATS1  
Anechoic Chamber A2

Test distance: 3 metres

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

Anechoic chamber



FCC ID: U9A277IWLAN-V211

Open area test site



### 5.10.3 Applicable standard

According to FCC Part 15 Subpart 15.109: Field strength of radiated emissions from unintentional radiators at 3 m.

### 5.10.4 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 linearly polarized antennas. The measurements are made with 120 kHz/6 dB bandwidth and quasi-peak detection. The EuT is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003.

The antenna was positioned 3 meters horizontally from the EuT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarization`s and the EuT are rotated 360 degrees.

The final level, expressed in dB $\mu$ V/m, is arrived by taking the reading from the EMI receiver (Level dB $\mu$ V) and adding the correction factors and cable loss factor (Factor dB) to it. This is done automatically in the EMI receiver, where the correction factors are stored.

The radiated emissions from the EuT are measured in the frequency range of 1 GHz to maximum frequency as specified in section 15.33, using a Spectrum Analyzer and appropriate linearly polarized antennas. The EuT is placed on a 1.0 X 1.5 meter non-conducting table 80 centimetres above the ground plane. The set up of the EuT will be in accordance to ANSI C63.4-2003. The antenna was positioned 3 m horizontally from the EuT.

Measurement are made in both the horizontal and vertical planes of polarization in a fully anechoic room using a spectrum analyzer with the detector function set to peak, RBW 1 MHz and VBW set to 3 MHz for any spurious emission or modulation product that falls in Restricted bands as defined in Section 15.205.

All tests are performed at a test-distance of 3 meters. During the tests the EuT measurement scans are made with both horizontal and vertical antenna polarization`s and the EuT are rotated 360 degrees.

Average values were measured with spectrum analyzer by taking the following Settings

RBW: 1 MHz

VBW: 10 Hz

Sweep: Auto

5.10.5 Test result

Frequency (MHz)	Detector	Measurement		Correction (dB 1/m)	Result		Limit (dBµV/m)	Delta (dB)
		hor (dBµV)	vert (dBµV)		hor (dBµV/m)	vert (dBµV/m)		
30-1000	QPk	<30	<30		---	---	---	---
1000-30000	Pk	<45	<45		---	---	74	---
	AV	---	---		---	---	54	---

**Note:** No unwanted emissions could be detected within 20 dB to the defined limit.

Limit according to FCC Subpart 15.109(a)

Frequency of emission (MHz)	Field strength Limits (µV/m)	Field strength Limits (dBµV/m)
0,009-0,490	2400/F(kHz)	
0,490-1,705	24000/F(kHz)	
1,705-30	30	
30-88	100	40
88-216	150	44
216-960	200	46
Above 960	500	54

The requirements are **FULFILLED**.

**Remarks:** The measurement was performed up to the 5<sup>th</sup> harmonic.

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## 6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used, in addition to the test accessories, are calibrated and verified regularly.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
A 4	ESHS 30	02-02/03-05-002	18/06/2011	18/06/2010		
	NNLK 8129	02-02/20-05-001			17/12/2010	17/06/2010
	ESH 2 - Z 5	02-02/20-05-004	13/03/2011	13/03/2008	11/12/2010	11/06/2010
	N-4000-BNC	02-02/50-05-138				
	N-1500-N	02-02/50-05-140				
	ESH 3 - Z 2 LNG32-3	02-02/50-05-155 02-02/50-07-034			07/10/2010	07/04/2010
CPC 3	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	THS730A	02-02/13-05-001	18/09/2010	18/09/2009		
	LNG32-3	02-02/50-07-034				
MB	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	THS730A	02-02/13-05-001	18/09/2010	18/09/2009		
	WK-340/40	02-02/45-05-001	17/06/2014	17/06/2009	28/12/2010	28/06/2010
	LNG32-3	02-02/50-07-034				
SEC 1-3	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	WLJS 3500-3EF	02-02/50-05-042				
	WHKX 7.5/18G-8SS	02-02/50-07-010				
	LNG32-3	02-02/50-07-034				
SER 1	FMZB 1516	01-02/24-01-018			15/02/2011	15/02/2010
	ESCI	02-02/03-05-004	09/02/2011	09/02/2010		
	LNG32-3	02-02/50-07-034				
SER 2	ESVS 30	02-02/03-05-006	11/06/2011	11/06/2010		
	VULB 9168	02-02/24-05-005	06/05/2011	06/05/2008	16/03/2011	16/09/2010
	S10162-B	02-02/50-05-031				
	KK-EF393-21N-16	02-02/50-05-033				
	NW-2000-NB	02-02/50-05-113				
	LNG32-3	02-02/50-07-034				
SER 3	FSP 30	02-02/11-05-001	04/05/2011	04/05/2010		
	AFS4-01000400-10-10P-4	02-02/17-05-003				
	AMF-4F-04001200-15-10P	02-02/17-05-004				
	AFS5-12001800-18-10P-6	02-02/17-06-002				
	3117	02-02/24-05-009	10/02/2011	10/02/2010		
	R2	02-02/30-09-001			22/02/2011	22/02/2010
	R1	02-02/30-09-002			17/02/2011	17/02/2010
	Sucoflex N-1000-SMA	02-02/50-05-072				
	Sucoflex N-1600-SMA	02-02/50-05-073				
	Sucoflex N-2000-SMA	02-02/50-05-075				
	C12-K1K1-157	02-02/50-06-001				
	LNG32-3	02-02/50-07-034				
	H26G40G1	02-02/50-10-011				