
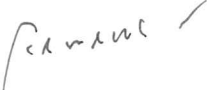


Produkte  
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<b>Prüfbericht - Nr.:</b> <b>12029438 001</b>		<b>Seite 1 von 69</b>			
<i>Test Report No.:</i>		<i>Page 1 of 69</i>			
<b>Auftraggeber:</b> <i>Client:</i>	<b>Fujitsu Limited</b> Shiodome City Center, 1-5-2 Higashi-Shimbashi, Minato-ku, Tokyo 105-7123, Japan				
<b>Gegenstand der Prüfung:</b> <i>Test Item:</i>	<b>Communication Module</b>				
<b>Bezeichnung:</b> <i>Identification:</i>	<b>WR-2012-00a-MM</b>	<b>Serien-Nr.:</b> <i>Serial No.:</i>	<b>473</b>		
<b>Wareneingangs-Nr.:</b> <i>Receipt No.:</i>	<b>PT0214033685</b>	<b>Eingangsdatum:</b> <i>Date of Receipt:</i>	<b>2013-02-13</b>		
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <b>Good</b> <i>Condition of Test Item at Delivery:</i>					
<b>Prüfört:</b> <i>Testing Location:</i>	<b>TÜV Rheinland Japan Ltd. – Global Technology Assessment Center</b> 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan				
<b>Prüfgrundlage:</b> <i>Test Specification:</i>	<b>FCC 47 CFR Part 15, Subpart C, Section 15.247 (October 1, 2012)</b> ANSI C63.4-2003 KDB Publication No. 558074 D01: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (v02)  <b>RSS-210 (Issue 8): 2010</b> <b>RSS-Gen (Issue 3): 2010</b> ANSI C63.4-2003				
<b>Prüfergebnis:</b> <i>Test Result:</i>	<b>Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).</b> <i>The test item passed the test specification(s).</i>				
<b>Prüflaboratorium:</b> <i>Testing Laboratory:</i>	<b>TÜV Rheinland Japan Ltd. – Global Technology Assessment Center</b> 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan				
<b>geprüft/ tested by:</b>		<b>kontrolliert/ reviewed by:</b>			
 2013-03-07 T. Sauter / Inspector		 2013-03-07 T. Cheung / Reviewer			
<b>Datum</b> <i>Date</i>	<b>Name/Stellung</b> <i>Name/Position</i>	<b>Unterschrift</b> <i>Signature</i>	<b>Datum</b> <i>Date</i>	<b>Name/Stellung</b> <i>Name/Position</i>	<b>Unterschrift</b> <i>Signature</i>
<b>Sonstiges / Other Aspects:</b>					
This test report covers the testing of the intentional radiator aspects of the Communication Module WR-2012-00a-MM used in conjunction with the following hosts: FM1S, FM2S, FM12S and FM25S. The tests were performed with the models FM1S, FM2S and FM25S. Model FM25S was used as representative sample for the model FM12S. Refer to section 3.2 of this report for more details.					
<b>Abkürzungen:</b> P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet			<b>Abbreviations:</b> P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested		
<b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b> <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>					

**Prüfbericht - Nr.: 12029438 001**  
*Test Report No.:*

**Seite 2 von 69**  
*Page 2 of 69*

## TEST SUMMARY

### **5.1.1 SUPPLY VOLTAGE REQUIREMENTS**

*RESULT: PASS*

### **5.1.2 ANTENNA REQUIREMENTS**

*RESULT: PASS*

### **5.1.3 RESTRICTED BANDS OF OPERATION**

*RESULT: PASS*

### **5.2.1 CONDUCTED OUTPUT POWER**

*RESULT: PASS*

### **5.2.2 6dB BANDWIDTH**

*RESULT: PASS*

### **5.2.3 99% BANDWIDTH**

### **5.2.4 CONDUCTED SPURIOUS EMISSIONS**

*RESULT: PASS*

### **5.2.5 PEAK POWER SPECTRAL DENSITY**

*RESULT: PASS*

### **5.3.1 RADIATED SPURIOUS EMISSIONS OF TRANSMITTER**

*RESULT: PASS*

### **5.4.1 AC POWER LINE CONDUCTED EMISSION OF TRANSMITTER**

*RESULT: PASS*

## Contents

<b>1.</b>	<b>GENERAL REMARKS .....</b>	<b>5</b>
<b>1.1</b>	<b>COMPLEMENTARY MATERIALS .....</b>	<b>5</b>
<b>2.</b>	<b>TEST SITES .....</b>	<b>5</b>
<b>2.1</b>	<b>TEST FACILITIES .....</b>	<b>5</b>
<b>2.2</b>	<b>LIST OF TEST AND MEASUREMENT INSTRUMENTS .....</b>	<b>6</b>
<b>2.3</b>	<b>MEASUREMENT UNCERTAINTY .....</b>	<b>7</b>
<b>3.</b>	<b>GENERAL PRODUCT INFORMATION .....</b>	<b>8</b>
<b>3.1</b>	<b>PRODUCT FUNCTION AND INTENDED USE .....</b>	<b>8</b>
<b>3.2</b>	<b>SYSTEM DETAILS .....</b>	<b>8</b>
<b>3.3</b>	<b>CLOCK FREQUENCIES .....</b>	<b>9</b>
<b>3.4</b>	<b>NOISE SUPPRESSING PARTS .....</b>	<b>9</b>
<b>4.</b>	<b>TEST SET-UP AND OPERATION MODES .....</b>	<b>10</b>
<b>4.1</b>	<b>TEST METHODOLOGY .....</b>	<b>10</b>
<b>4.2</b>	<b>OPERATION MODES .....</b>	<b>10</b>
<b>4.3</b>	<b>PHYSICAL CONFIGURATION FOR TESTING .....</b>	<b>10</b>
<b>4.4</b>	<b>TEST SOFTWARE .....</b>	<b>12</b>
<b>4.5</b>	<b>SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT .....</b>	<b>12</b>
<b>4.6</b>	<b>COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE .....</b>	<b>13</b>
<b>5.</b>	<b>TEST RESULTS RADIO .....</b>	<b>14</b>
<b>5.1</b>	<b>TECHNICAL REQUIREMENTS .....</b>	<b>14</b>
5.1.1	<i>Supply Voltage Requirements .....</i>	<i>14</i>
5.1.2	<i>Antenna Requirements .....</i>	<i>14</i>
5.1.3	<i>Restricted Bands of Operation .....</i>	<i>15</i>
<b>5.2</b>	<b>CONDUCTED MEASUREMENTS AT ANTENNA PORT .....</b>	<b>16</b>
5.2.1	<i>Conducted Output Power .....</i>	<i>16</i>
5.2.2	<i>6dB Bandwidth .....</i>	<i>21</i>
5.2.3	<i>99% Bandwidth .....</i>	<i>26</i>
5.2.4	<i>Conducted Spurious Emissions .....</i>	<i>29</i>
5.2.5	<i>Peak Power Spectral Density .....</i>	<i>48</i>
<b>5.3</b>	<b>RADIATED MEASUREMENTS .....</b>	<b>51</b>
5.3.1	<i>Radiated Spurious Emissions of Transmitter .....</i>	<i>51</i>
<b>5.4</b>	<b>AC POWER LINE CONDUCTED MEASUREMENTS .....</b>	<b>61</b>
5.4.1	<i>AC Power Line Conducted Emission of Transmitter .....</i>	<i>61</i>
<b>6.</b>	<b>PHOTOGRAPHS OF THE TEST SETUP .....</b>	<b>63</b>

Produkte  
Products

**Prüfbericht - Nr.: 12029438 001**  
*Test Report No.:*

**Seite 4 von 69**  
*Page 4 of 69*

<b>7.</b>	<b>LIST OF TABLES.....</b>	<b>67</b>
<b>8.</b>	<b>LIST OF FIGURES .....</b>	<b>68</b>
<b>9.</b>	<b>LIST OF PHOTOGRAPHS .....</b>	<b>69</b>

## 1. General Remarks

### 1.1 Complementary Materials

There is no attachment to this test report.

## 2. Test Sites

### 2.1 Test Facilities

TÜV Rheinland Japan Ltd. – Global Technology Assessment Center  
4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan

The used test equipment is in accordance with CISPR 16 for measurement of radio interference.

The Federal Communications Commission has reviewed the technical characteristics of the radiated and conducted emission facilities and has found these test sites to be in compliance with the requirements of section 2.948 of the FCC rules. The description of the test facility is listed under FCC registration number 299054.

The Industry Canada has reviewed the technical characteristics of the radiated and conducted emission facilities and has found these test sites to be in compliance with Canadian requirements. The description of the test facility is listed under OATS filing number 3466B-1.

The test facility is accredited by VLAC (member of ILAC) under number VLAC-017 according to ISO/IEC 17025:2005.



TÜV Rheinland Japan Ltd. is accredited by the Federal Communications Commission as a Conformity Assessment Body under Designation Number JP0017 and Test Firm Registration Number 386498.

Produkte  
 Products

**Prüfbericht - Nr.: 12029438 001**

Seite 6 von 69

Test Report No.:

Page 6 of 69

## 2.2 List of Test and Measurement Instruments

**Table 1: List of Test and Measurement Equipment**

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equipment ID	Calibrated until
<b>For Antenna Port Conducted Emission</b>					
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2014-01
<b>For AC Power Line Conducted Emission</b>					
Receiver	Rohde & Schwarz	ESU 26	100070	-	2014-01
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2014-01
LISN	Rohde & Schwarz	ENV216	100276	RF-0016	2013-06
<b>For Radiated Emission</b>					
Receiver	Rohde & Schwarz	ESU 26	100070	-	2014-01
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2014-01
RF Selector (10m Chamber)	Toyo Corporation	NS4900	0703-182	RF-0029	2013-05
Loop Antenna with Amplifier, 9kHz-30MHz	Rohde & Schwarz	HFH2-Z2	100139	RF-0048	2013-02
Trilog Antenna No. 2, 30-1000MHz	Schwarzbeck	VULB9168	9168-475	RF-0462	2014-01
10dB Attenuator	Hewlett Packard	8491A 10dB	58354	RF-0314	2013-05
Low Noise Pre-Amplifier, 9kHz-1GHz	TSJ	MLA-10K01-B01-35	1370750	RF-0253	2013-05
Low Pass Filter, DC-1GHz	R&K	LP1000CH3	12104001	RF-0515	2013-10
Horn Antenna, 1-8GHz	Schwarzbeck	BBHA9120B	419	RF-0050	2013-05
Horn Antenna, 1-8GHz	Schwarzbeck	BBHA9120D	1059	RF-0553	2013-11
Microwave Pre-Amplifier, 1-8GHz	Toyo Corporation	TPA0108-40	0634	RF-0052	2014-02
Band Reject Filter, 1-8GHz	Nitsuki	NF-49BT	027	RF-0131	2013-05
Horn Antenna with Pre-Amplifier, 8-18GHz	Toyo Corporation	HAP06-18W	00000025	RF-0065	2013-05
High Pass Filter, 8-18GHz	Micro-Tronics	HPM50107	006	RF-0334	2013-05
Horn Antenna with Pre-Amplifier, 18-26.5GHz	Toyo Corporation	HAP18-26N	00000010	RF-0070	2013-05
<b>Constant Voltage Constant Frequency Stabilizers</b>					
CVCF (Shielded Room)	NF Corporation	ESU2000S	9075612	RF-0210	N/A
CVCF Booster (Shielded Room)	NF Corporation	ESU2000B	9074403	RF-0211	N/A
CVCF (10m Chamber)	NF Corporation	ESU2000S	9067307	RF-0212	N/A
CVCF Booster (10m Chamber)	NF Corporation	ESU2000B	9074408	RF-0213	N/A

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing.

## 2.3 Measurement Uncertainty

**Table 2: Emission Measurement Uncertainty**

Measurement Type	Frequency	Uncertainty
AC Power Line Conducted Emission	150kHz - 30MHz	±3.0dB
Antenna Port Conducted Emission	20Hz - 40GHz	±1.5dB
Radiated Emission	150kHz - 30MHz	±4.7dB
	30MHz - 1GHz	±4.7dB
	> 1GHz	±4.7dB

### 3. General Product Information

#### 3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is a wireless communication module to be installed into a wattmeter for home use. It is used to transmit power consumption information via IEEE 802.11b signals to a remote access point.

#### 3.2 System Details

Radio standard: IEEE 802.11b  
Specified output power: 20dBm  
Antenna gain: Antenna 1: max. -1dBi, Antenna 2: max. +2.9dBi  
Antenna type: Printed-circuit antenna  
Antenna mounting type: Internal  
Frequency range: 2412 - 2462MHz  
Number of channels: 11  
Channel spacing: 5MHz  
Data rate: 1Mbps  
Modulation type: DSSS coupled with BPSK  
FCC classification: DTS  
IC classification: Spread Spectrum/Digital Device (2400-2483.5 MHz)  
Emission designator: G1D

Rated voltage: AC 120/240V  
Rated frequency: 50/60Hz  
Rated power: Max. 8.49W  
Protection class: II

Test voltage: Refer to each test item.  
Test frequency: 60Hz

The EUT is intended to be used with the following hosts:

Host Model Name	Rated Input Voltage	Serial Number of Host used for Testing
FM1S	AC 120V	52415519
FM2S	AC 240V	40924582
FM12S with 120V setting	AC 120V	Not tested (See Note)
FM12S with 240V setting	AC 240V	Not tested (See Note)
FM25S with 120V setting	AC 120V	52415491
FM25S with 240V setting	AC 240V	52415491



Note:

The models FM12S and FM25S are identical, except for the location of the N (neutral) terminal. This difference is deemed not to affect the EMC and radio properties of the equipment and therefore the model FM25S was used as representative sample for the model FM12S.

The two antennas do not transmit simultaneously.

### **3.3 Clock Frequencies**

Refer to schematics.

### **3.4 Noise Suppressing Parts**

Refer to schematics.

## **4. Test Set-up and Operation Modes**

### **4.1 Test Methodology**

The test methodology used is based on the requirements of 47 CFR Part 15, Sections 15.31, 15.33, 15.35, 15.205, 15.207, 15.209 and KDB Publication No. 558074 D01.

The test methods, which have been used, are based on ANSI C63.4-2003 and RSS-Gen (Issue 3).

For details, see under each test item.

### **4.2 Operation Modes**

Testing was performed at the lowest operating frequency (2412MHz), at the operating frequency in the middle of the specified frequency band (2437MHz) and at the highest operating frequency (2462MHz).

The basic operation modes used for testing are:

- A. EUT transmits (TX mode), with full power, at lowest channel (2412MHz), a continuous modulated signal streaming with 100% duty cycle.
- B. EUT transmits (TX mode), with full power, at middle channel (2437MHz), a continuous modulated signal streaming with 100% duty cycle.
- C. EUT transmits (TX mode), with full power, at highest channel (2462MHz), a continuous modulated signal streaming with 100% duty cycle.

Note:

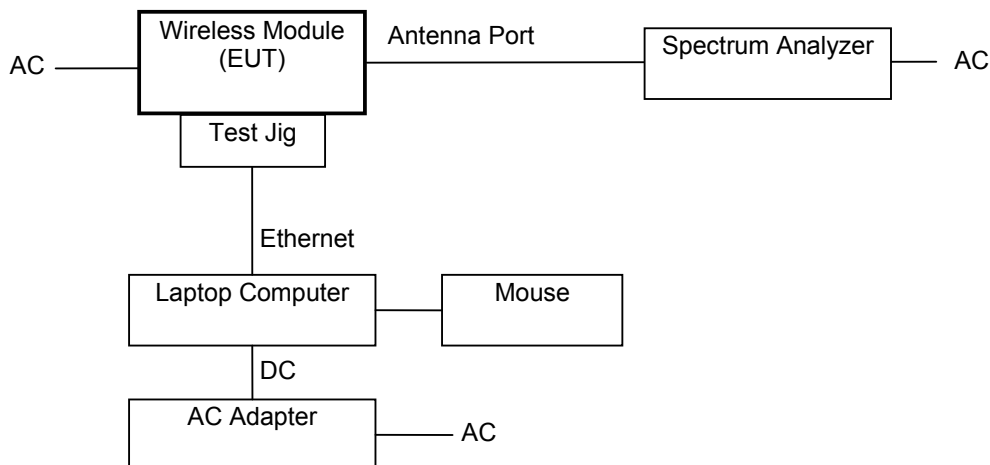
The duty cycle was 100% for testing purpose. The maximum duty cycle per 100ms period in normal operation conditions (transfer of data) is 5.47%.

### **4.3 Physical Configuration for Testing**

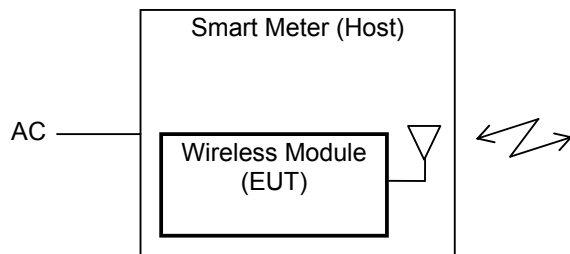
The EUT was tested in a standalone configuration (only connected to test jig) for conducted measurements at antenna port and it was installed inside a host for radiated and AC power line conducted emission measurements. The test system was configured in a typical fashion (as a customer would normally use it).

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.4:2003.

**Figure 1: Block Diagram for Conducted Measurements at Antenna Port**



**Figure 2: Block Diagram for Radiated Spurious Emissions and AC Power Line Conducted Emissions**



**Table 3: Interfaces present on the EUT**

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	AC Input (on Host)	2.1m, un-shielded	AC input power port
2.	Ethernet, via test jig (See Note)	1m, un-shielded	Signal Line

Note:

The Ethernet cable is for maintenance purpose only and is not accessible to the final user. For testing purpose, it was used to set the operation mode only; it was disconnected and the test jig was removed during radiated and AC power line conducted tests.

For more details, refer to section: Photographs of the Test Set-Up.

## 4.4 Test Software

Software used for testing: TeraTerm version 4.76 by TeraTerm Project and WinSCP version 5.13.

These softwares were running on the laptop computer. They were used to enable on the EUT the test operation modes listed in section 4.2 as appropriate.

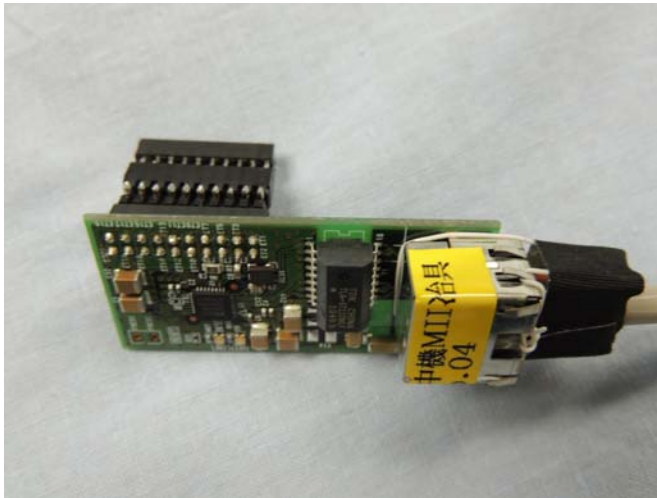
Operation modes were set by connecting the laptop computer directly to the EUT via a test jig and an Ethernet cable.

## 4.5 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

1. Product: Laptop Computer  
Manufacturer: Fujitsu  
Model: Lifebook A531/DX (FMVXN4KN2Z)  
Rated Voltage: DC 19V  
Input Current: 3.42A  
Protection Class: III  
Serial Number: 564496-01R2500062
2. Product: AC Adapter for Laptop Computer  
Manufacturer: Fujitsu  
Model: ADP-65YH A  
Rated Voltage: 100-240V  
Input Current: 1.5A  
Frequency: 50-60Hz  
Protection Class: II  
Serial Number: 12414196A
3. Product: Mouse  
Manufacturer: Elecom  
Model: Laser Mouse  
Rated Voltage: DC 5V  
Protection Class: III  
Serial Number: 5091402399A
4. Product: Test Jig (see photograph here below)  
Model: TEST-LAN-S01

**Photograph 1: Test Jig**



**4.6 Countermeasures to achieve EMC Compliance**

No additional measures were employed to achieve compliance.

## 5. Test Results RADIO

### 5.1 Technical Requirements

#### 5.1.1 Supply Voltage Requirements

**RESULT:** **PASS**

Requirements:

FCC 15.31(e)

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Verdict:

The EUT has an internal voltage regulator to supply the RF circuit. Hence it complies with the supply voltage requirements.

#### 5.1.2 Antenna Requirements

**RESULT:** **PASS**

Requirements:

FCC 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.

Verdict:

The EUT has internal printed-circuit antennas which are not user accessible. Hence it complies with the antenna requirements.

**Prüfbericht - Nr.:** 12029438 001  
*Test Report No.:*

Seite 15 von 69  
Page 15 of 69

### 5.1.3 Restricted Bands of Operation

**RESULT:**

**PASS**

Requirements:

FCC 15.205 and RSS-Gen 7.2.2

Only spurious emissions are permitted in any of the restricted frequency bands, unless otherwise specified.

Verdict:

The EUT operation frequency range is 2412-2462MHz. Therefore only spurious emissions may be found in the restricted bands of operation and the EUT complies with the restricted frequency band requirement.

## 5.2 Conducted Measurements at Antenna Port

### 5.2.1 Conducted Output Power

**RESULT:**

**PASS**

Date of testing: 2013-02-13

Ambient temperature: 25°C

Relative humidity: 17%

Atmospheric pressure: 1010hPa

Requirements:

FCC 15.247(b)(3) and RSS-210 A8.4(4)

For systems using digital modulation in the 2400-2483.5MHz band, the maximum peak output power is 1W (30dBm).

If transmitting antennas of directional gain greater than 6dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Test procedure:

ANSI C63.4-2003, RSS-Gen 4.8 and KDB Publication No. 558074 D01.

The maximum peak output power was measured at the antenna port with a spectrum analyzer using a peak detector. The resolution bandwidth and the video bandwidth were set to 10MHz. The measured power levels were integrated over the 6dB bandwidth of the carrier.

The readings of the measurements take into account the loss generated by all the involved cables.

The measurement was performed at both AC 120V and AC 240V input voltages in order to identify the input voltage producing the highest output power. The results given here below show that the worst case output power is found for AC 240V input voltage.

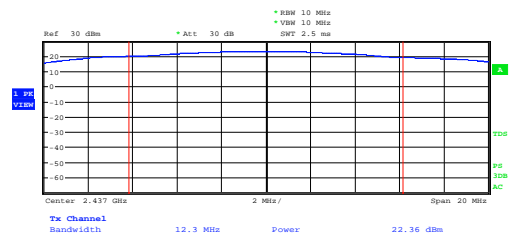
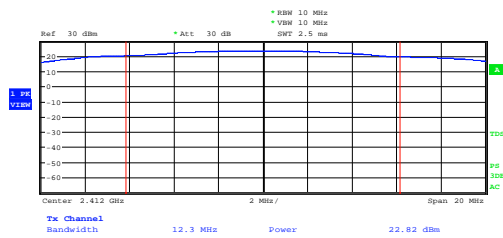
Therefore, all the other antenna port conducted measurements for the evaluation of the radio properties of the EUT have been performed with AC 240V input voltage.



**Table 4: Conducted Output Power, AC 120V Input Voltage, Antenna 1**

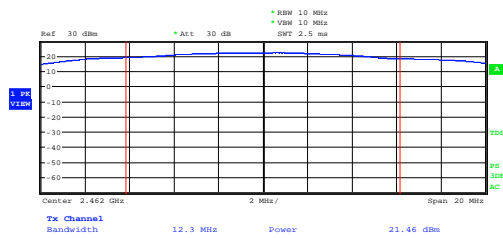
Operating Freq. [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
2412	22.82	30.00	7.18
2437	22.36	30.00	7.64
2462	21.46	30.00	8.54

**Figure 3: Conducted Output Power, AC 120V Input Voltage, Antenna 1**



Maximum peak conducted output power, mode A, 120V  
 Date: 13.FEB.2013 14:05:27

Maximum peak conducted output power, mode B, 120V  
 Date: 13.FEB.2013 14:04:51

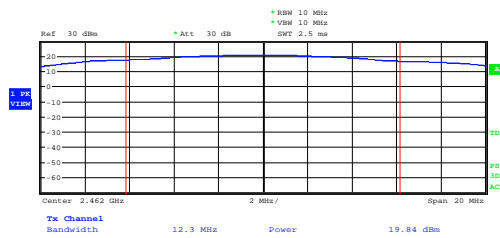
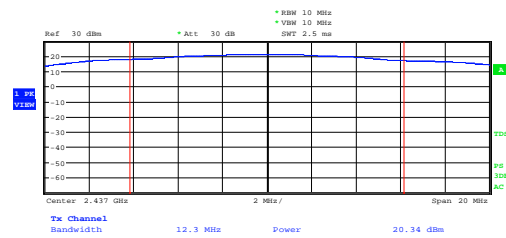
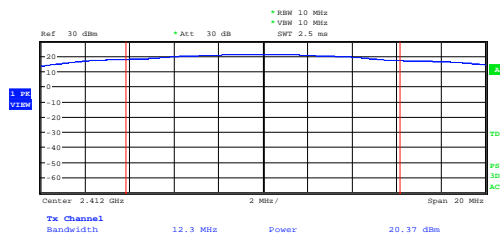


Maximum peak conducted output power, mode C, 120V  
 Date: 13.FEB.2013 14:04:07

**Table 5: Conducted Output Power, AC 120V Input Voltage, Antenna 2**

Operating Freq. [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
2412	20.37	30.00	9.63
2437	20.34	30.00	9.66
2462	19.84	30.00	10.16

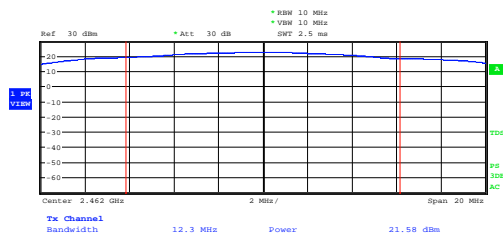
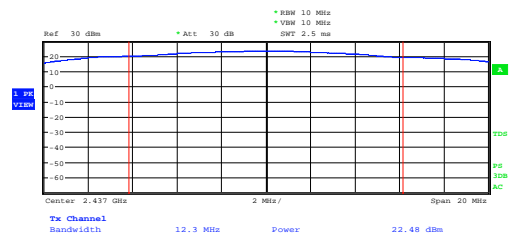
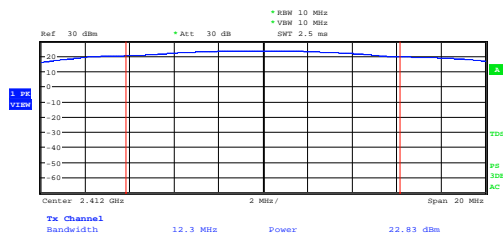
**Figure 4: Conducted Output Power, AC 120V Input Voltage, Antenna 2**



**Table 6: Conducted Output Power, AC 240V Input Voltage, Antenna 1**

Operating Freq. [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
2412	22.83	30.00	7.17
2437	22.48	30.00	7.52
2462	21.58	30.00	8.42

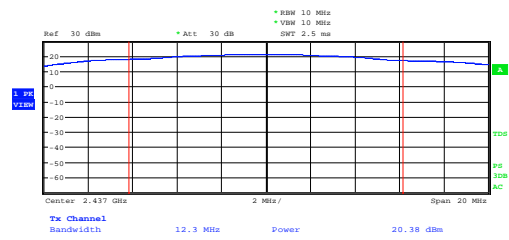
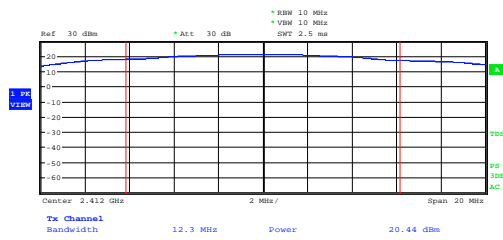
**Figure 5: Conducted Output Power, AC 240V Input Voltage, Antenna 1**



**Table 7: Conducted Output Power, AC 240V Input Voltage, Antenna 2**

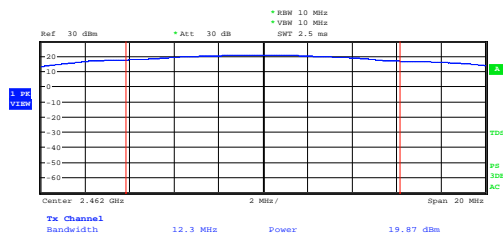
Operating Freq. [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
2412	20.44	30.00	9.56
2437	20.38	30.00	9.62
2462	19.87	30.00	10.13

**Figure 6: Conducted Output Power, AC 240V Input Voltage, Antenna 2**



Maximum peak conducted output power, mode A, 240V  
 Date: 13.FEB.2013 15:35:23

Maximum peak conducted output power, mode B, 240V  
 Date: 13.FEB.2013 15:36:38



Maximum peak conducted output power, mode C, 240V  
 Date: 13.FEB.2013 15:37:46

**Prüfbericht - Nr.:** 12029438 001

Seite 21 von 69

Test Report No.:

Page 21 of 69

## 5.2.2 6dB Bandwidth

**RESULT:**

**PASS**

Date of testing: 2013-02-13

Ambient temperature: 25°C

Relative humidity: 17%

Atmospheric pressure: 1010hPa

Requirements:

FCC 15.247(a)(2) and RSS-210 A8.2(a)

For systems using digital modulation in the 2400-2483.5MHz band, the 6dB bandwidth shall be at least 500kHz.

Test procedure:

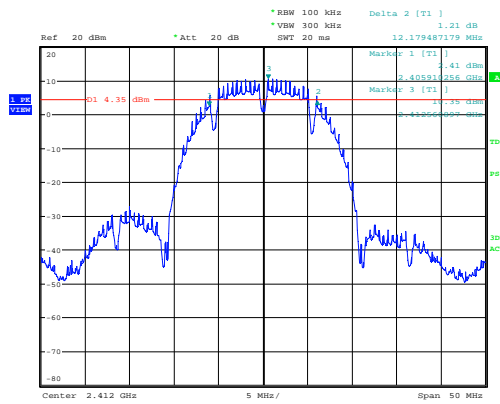
ANSI C63.4-2003, RSS-Gen 4.6.2 and KDB Publication No. 558074 D01.

The 6dB bandwidth was measured at the antenna port with a spectrum analyzer using a peak detector. The resolution bandwidth was set to 100kHz and the video bandwidth to 300kHz. Markers placed at the lowest and highest intersections of the trace with a 6dBc line were used to calculate the emission bandwidth.

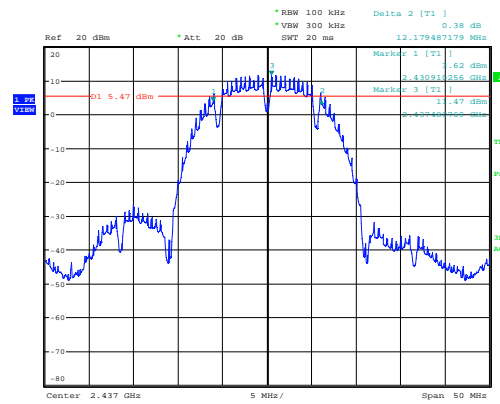
**Table 8: 6dB Bandwidth, AC 120V Input Voltage, Antenna 1**

Operating Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
2412	12.179	0.500
2437	12.179	0.500
2462	12.260	0.500

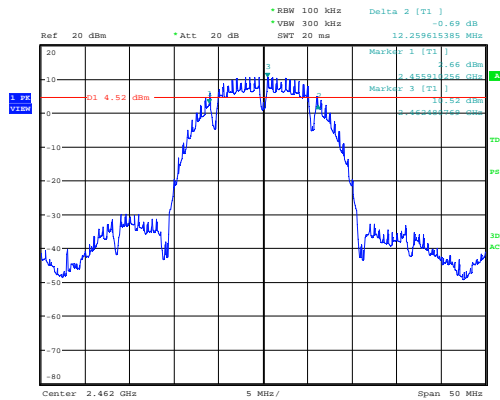
**Figure 7: 6dB Bandwidth, AC 120V Input Voltage, Antenna 1**



6dB bandwidth, mode A, 120V  
 Date: 13.FEB.2013 13:55:07



6dB bandwidth, mode B, 120V  
 Date: 13.FEB.2013 13:57:32

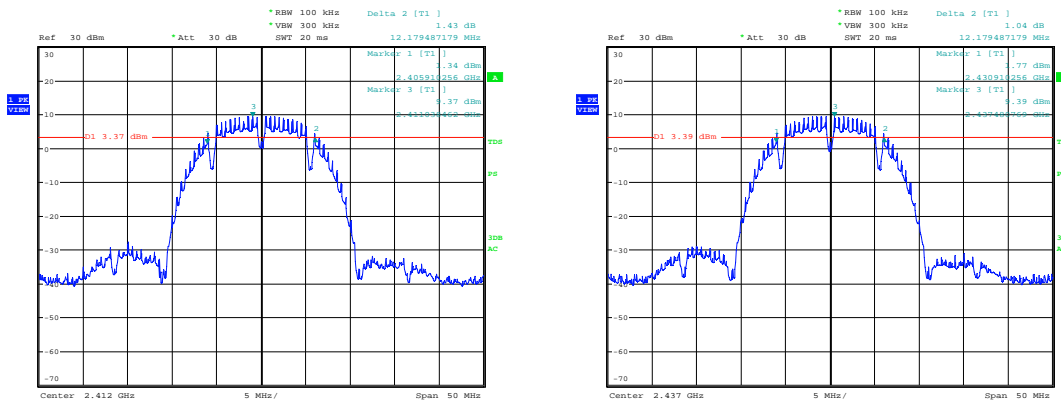


6dB bandwidth, mode C, 120V  
 Date: 13.FEB.2013 13:58:49

**Table 9: 6dB Bandwidth, AC 120V Input Voltage, Antenna 2**

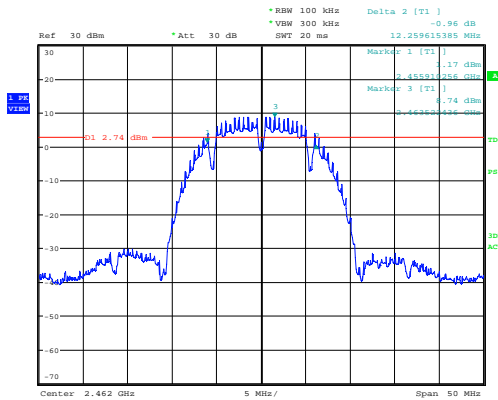
Operating Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
2412	12.179	0.500
2437	12.179	0.500
2462	12.260	0.500

**Figure 8: 6dB Bandwidth, AC 120V Input Voltage, Antenna 2**



6dB bandwidth, mode A, 120V  
 Date: 13.FEB.2013 15:28:38

6dB bandwidth, mode B, 120V  
 Date: 13.FEB.2013 15:30:06

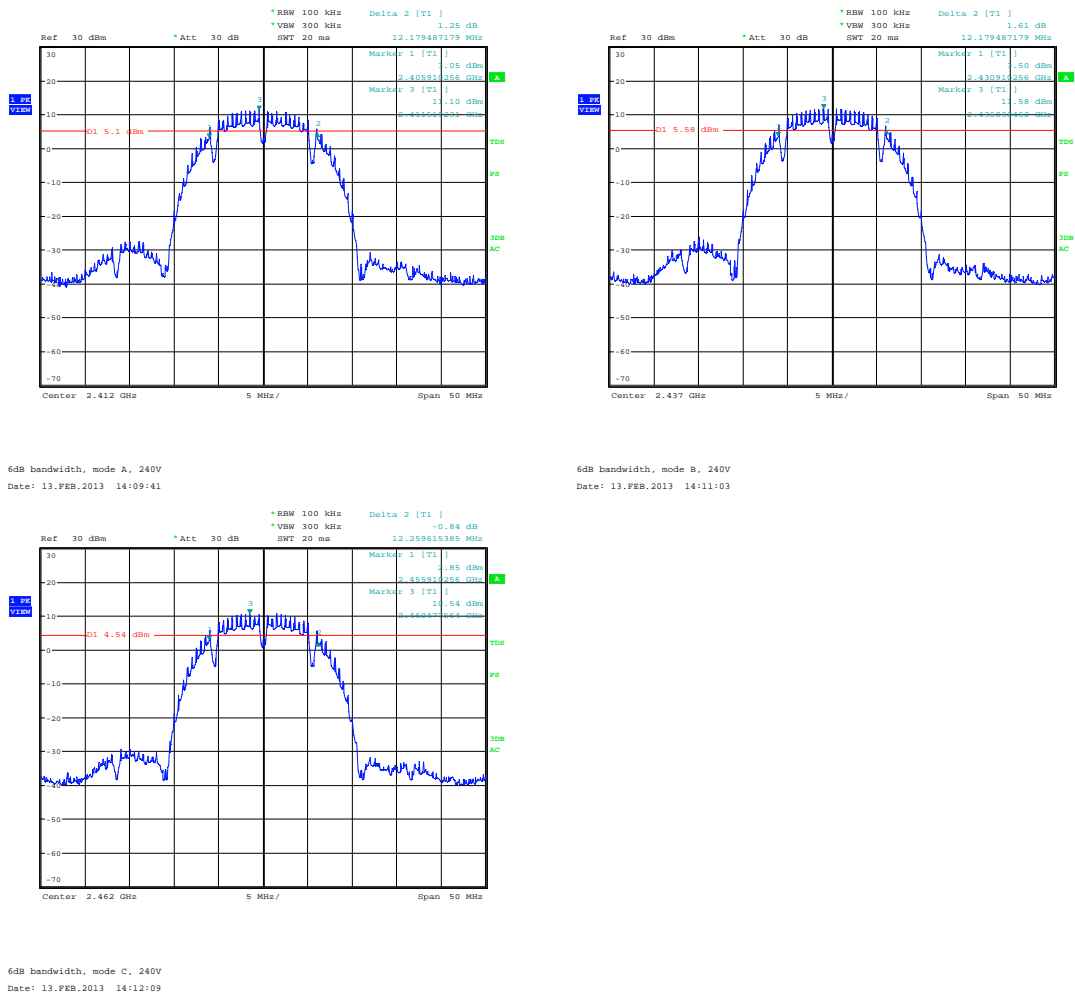


6dB bandwidth, mode C, 120V  
 Date: 13.FEB.2013 15:31:13

**Table 10: 6dB Bandwidth, AC 240V Input Voltage, Antenna 1**

Operating Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
2412	12.179	0.500
2437	12.179	0.500
2462	12.260	0.500

**Figure 9: 6dB Bandwidth, AC 240V Input Voltage, Antenna 1**

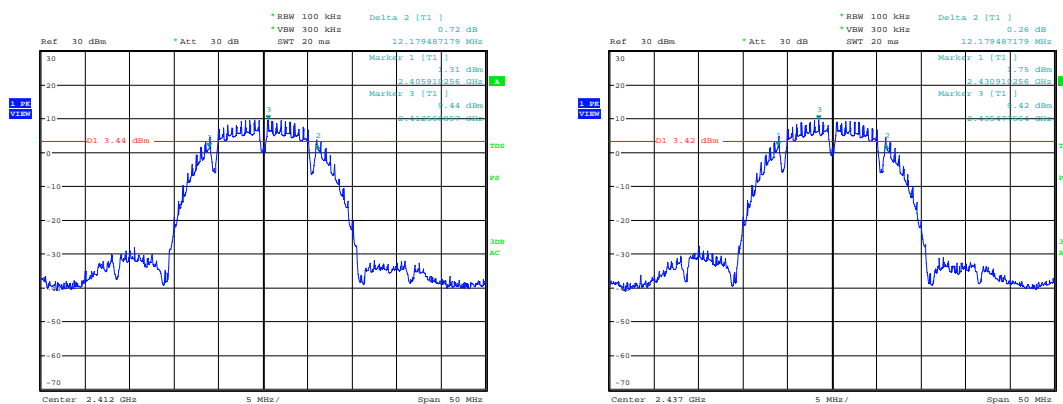




**Table 11: 6dB Bandwidth, AC 240V Input Voltage, Antenna 2**

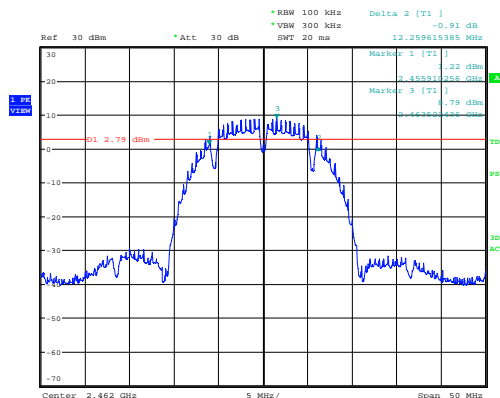
Operating Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
2412	12.179	0.500
2437	12.179	0.500
2462	12.260	0.500

**Figure 10: 6dB Bandwidth, AC 240V Input Voltage, Antenna 2**



6dB bandwidth, mode A, 240V  
 Date: 13.FEB.2013 15:34:56

6dB bandwidth, mode B, 240V  
 Date: 13.FEB.2013 15:36:14



6dB bandwidth, mode C, 240V  
 Date: 13.FEB.2013 15:37:21

### 5.2.3 99% Bandwidth

Date of testing: 2013-02-13

Ambient temperature: 25°C

Relative humidity: 17%

Atmospheric pressure: 1010hPa

Requirements:

RSS-Gen 4.6.1

The 99% bandwidth shall be reported according to RSS-Gen 4.6.1.

Test procedure:

RSS-Gen 4.6.1.

The 99% bandwidth was measured at the antenna port with a spectrum analyzer using a sample detector. The resolution bandwidth was set to 1MHz (1% of the span) and the video bandwidth to 3MHz. The 99% bandwidth was measured by using the OBW function of the analyzer with a 99% coverage setting.

Produkte  
 Products

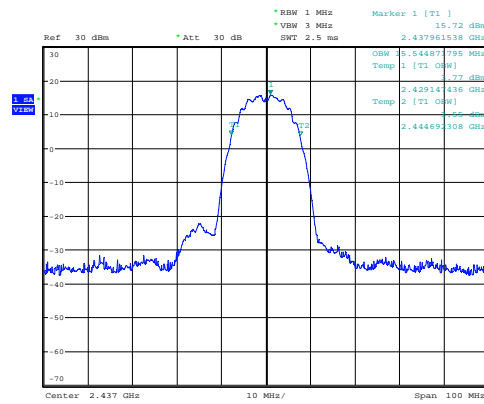
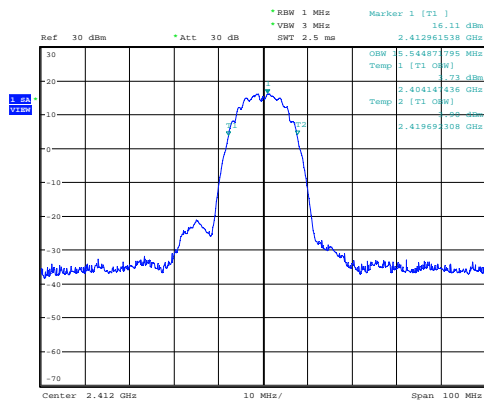
Prüfbericht - Nr.: **12029438 001**  
 Test Report No.:

Seite 27 von 69  
 Page 27 of 69

**Table 12: 99% Bandwidth, AC 240V Input Voltage, Antenna 1**

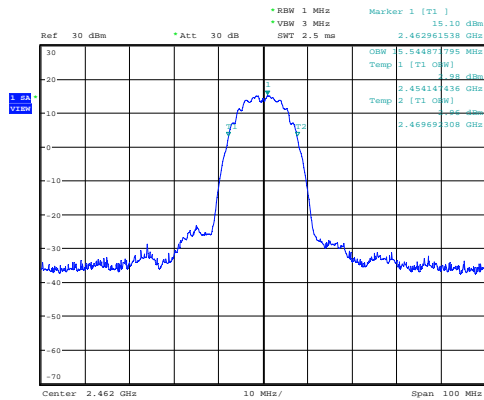
Operating Frequency [MHz]	99% Bandwidth [MHz]
2412	15.545
2437	15.545
2462	15.545

**Figure 11: 99% Bandwidth, AC 240V Input Voltage, Antenna 1**



99% bandwidth, mode A, 240V  
 Date: 13.FEB.2013 14:15:43

99% bandwidth, mode B, 240V  
 Date: 13.FEB.2013 14:38:04

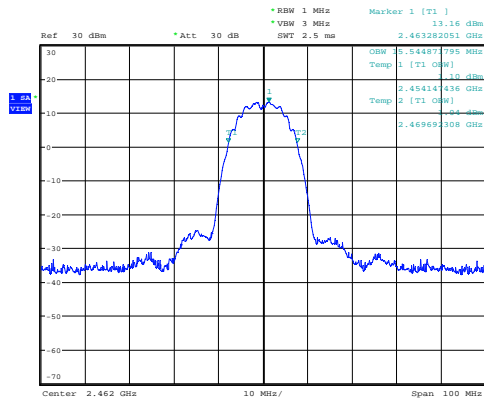
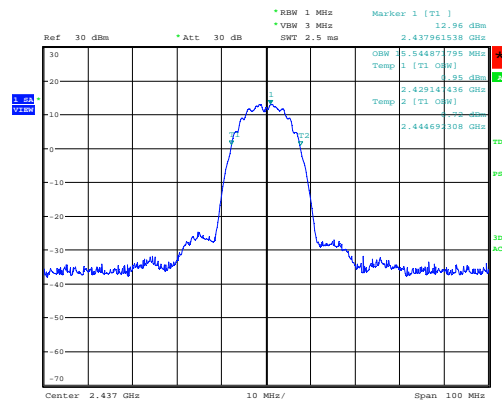
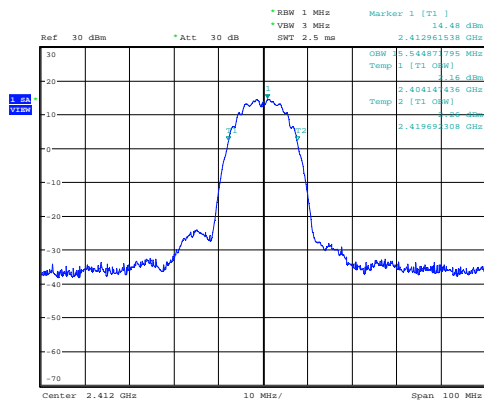


99% bandwidth, mode C, 240V  
 Date: 13.FEB.2013 15:08:25

**Table 13: 99% Bandwidth, AC 240V Input Voltage, Antenna 2**

Operating Frequency [MHz]	99% Bandwidth [MHz]
2412	15.545
2437	15.545
2462	15.545

**Figure 12: 99% Bandwidth, AC 240V Input Voltage, Antenna 2**



**Prüfbericht - Nr.: 12029438 001**

Seite 29 von 69

Test Report No.:

Page 29 of 69

## 5.2.4 Conducted Spurious Emissions

**RESULT:**

**PASS**

Date of testing: 2013-02-13

Ambient temperature: 25°C

Relative humidity: 17%

Atmospheric pressure: 1010hPa

Requirements:

FCC 15.247(d) and RSS-210 A8.5

In any 100kHz bandwidth outside the frequency band in which the intentional radiator is operating, the RF power shall be at least 20dB below that of the maximum in-band 100kHz emission.

Test procedure:

ANSI C63.4-2003, RSS-Gen 4.9 and KDB Publication No. 558074 D01.

The conducted spurious emissions were measured at the antenna port with a spectrum analyzer using a peak detector. The resolution bandwidth was set to 100kHz and the video bandwidth to 300kHz. Measurements were performed from 30MHz to 25GHz (10<sup>th</sup> harmonics).

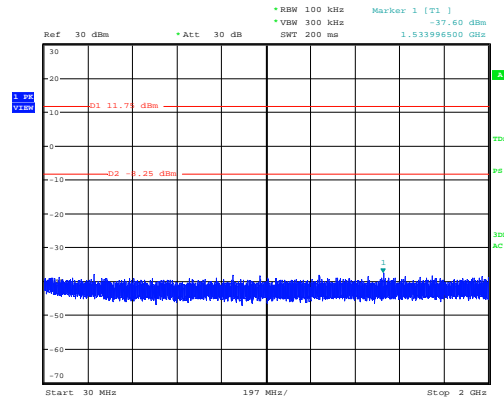
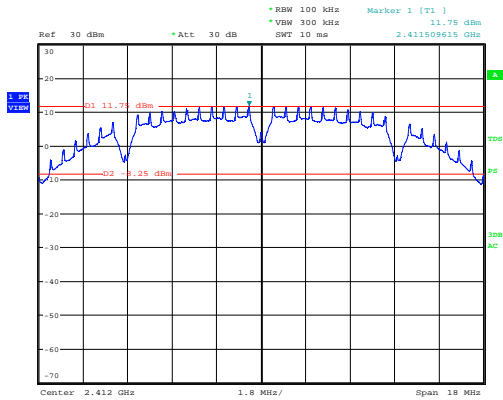
The readings of the measurements take into account the loss generated by all the involved cables.

Produkte  
 Products

**Prüfbericht - Nr.: 12029438 001**  
 Test Report No.:

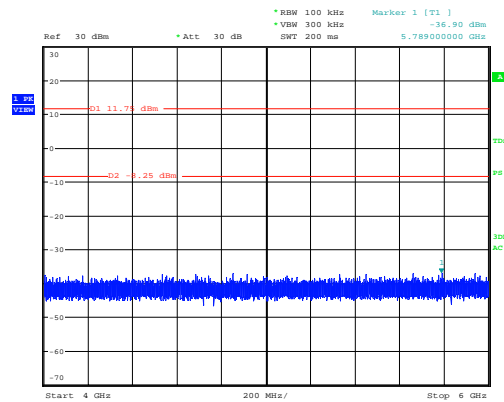
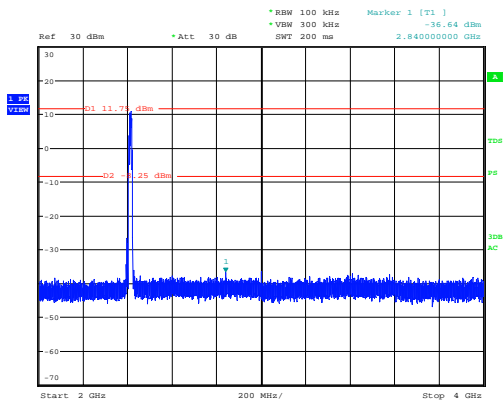
Seite 30 von 69  
 Page 30 of 69

**Figure 13: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 1, Mode A (2412MHz)**



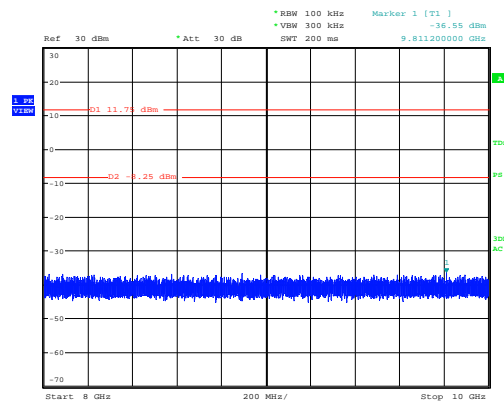
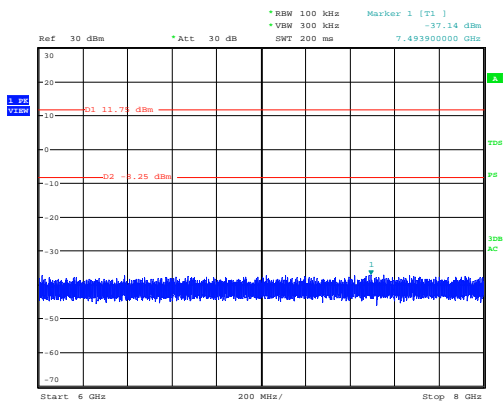
Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:17:11

Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:17:33



Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:18:18

Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:18:41



Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:18:03

Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:19:26

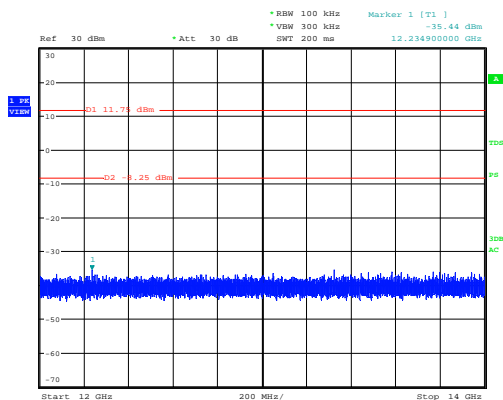
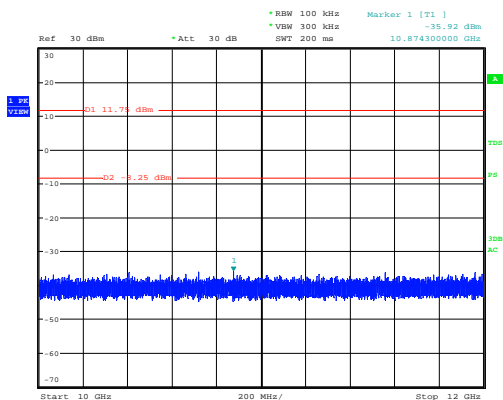
Produkte  
 Products

**Prüfbericht - Nr.: 12029438 001**

Seite 31 von 69  
 Page 31 of 69

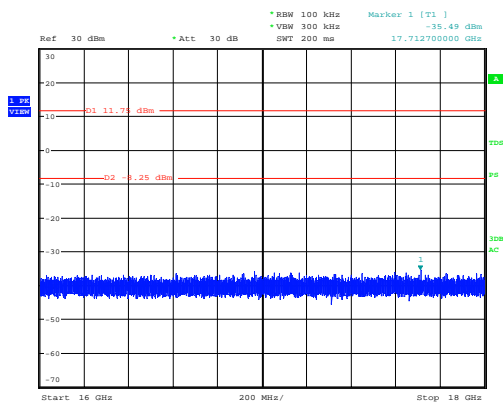
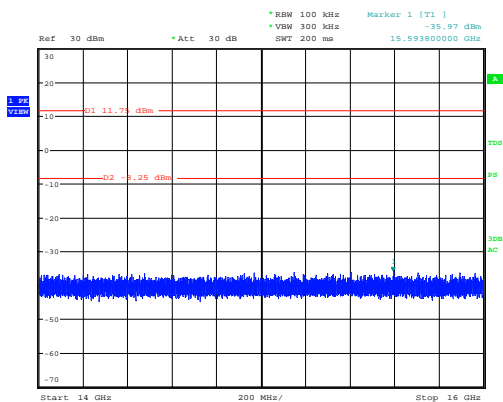
Test Report No.:

**Figure 14: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 1, Mode A (2412MHz)**



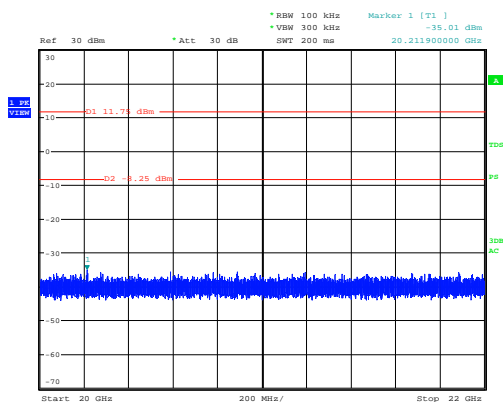
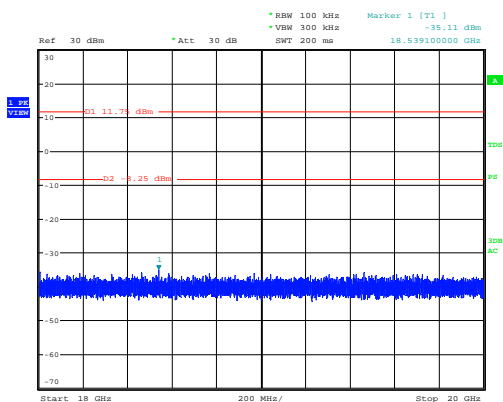
Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:19:51

Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:20:15



Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:20:39

Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:21:03



Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:21:26

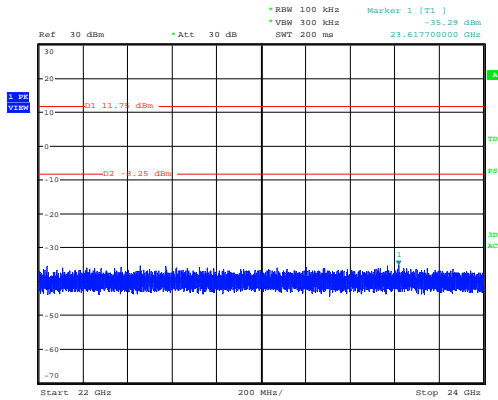
Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 14:21:48

Produkte  
Products

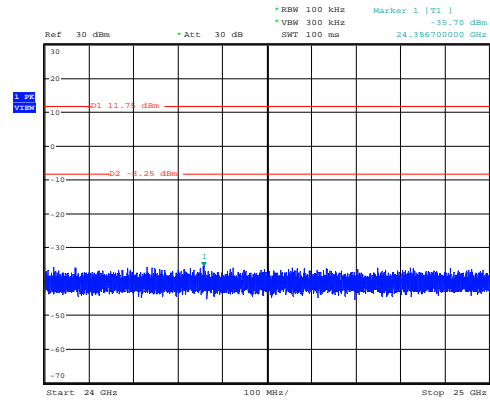
Prüfbericht - Nr.: 12029438 001  
Test Report No.:

Seite 32 von 69  
Page 32 of 69

Figure 15: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 1, Mode A (2412MHz)



Conducted spurious emissions, mode A, 240V  
Date: 13.FEB.2013 14:22:09



Conducted spurious emissions, mode A, 240V  
Date: 13.FEB.2013 14:22:31

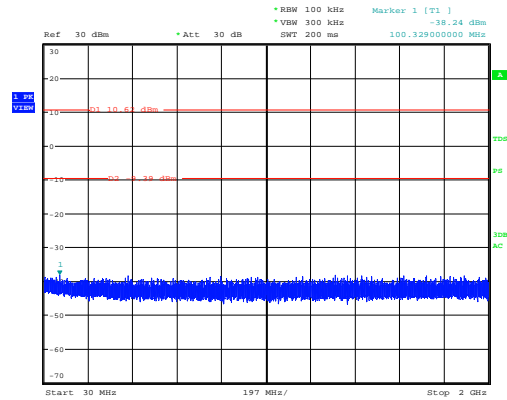
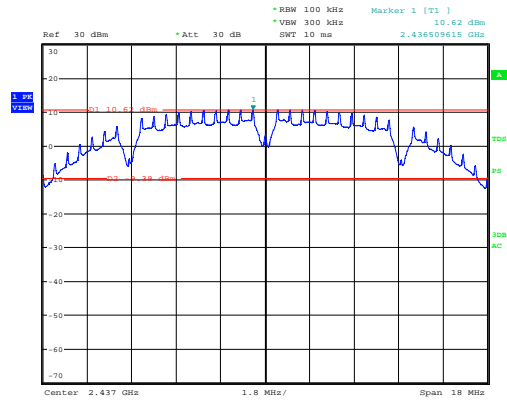


Produkte  
 Products

**Prüfbericht - Nr.: 12029438 001**  
 Test Report No.:

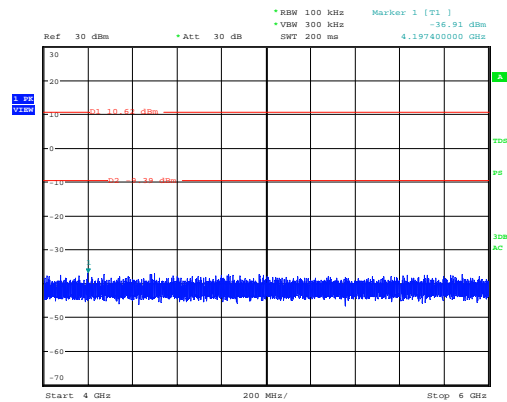
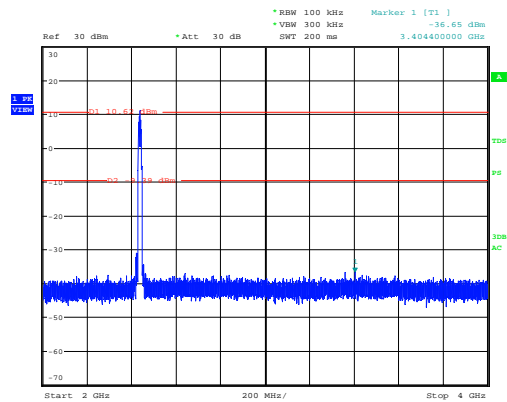
Seite 33 von 69  
 Page 33 of 69

**Figure 16: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 1, Mode B (2437MHz)**



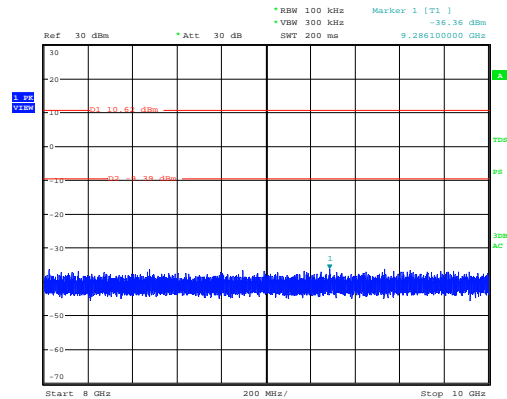
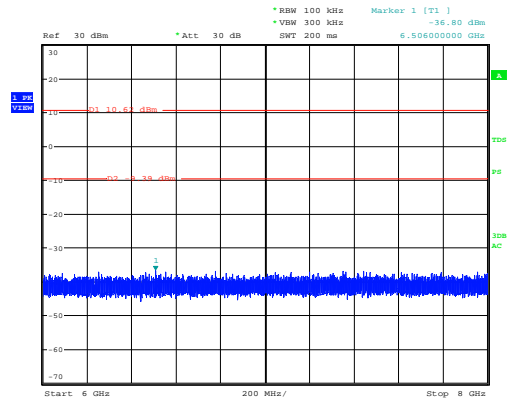
Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:00:11

Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:00:35



Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:01:51

Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:02:14



Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:02:41

Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:03:12

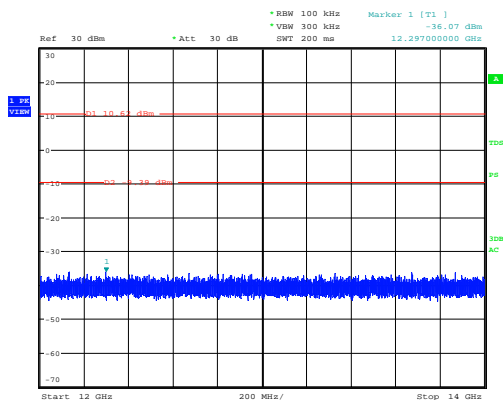
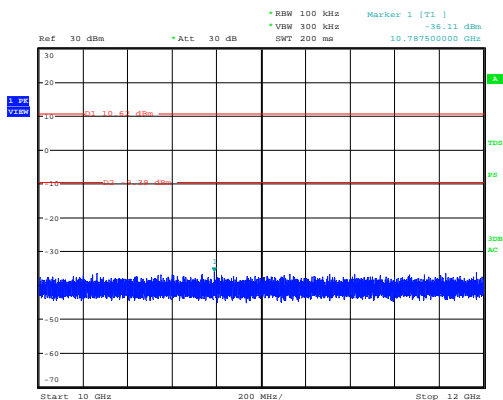
Produkte  
 Products

Prüfbericht - Nr.: 12029438 001

Seite 34 von 69  
 Page 34 of 69

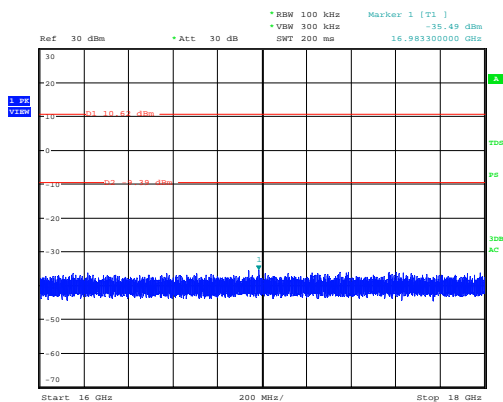
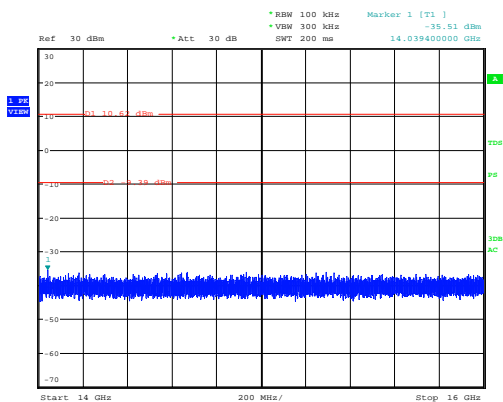
Test Report No.:

**Figure 17: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 1, Mode B (2437MHz)**



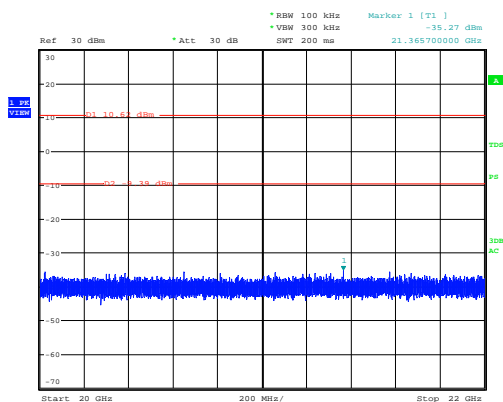
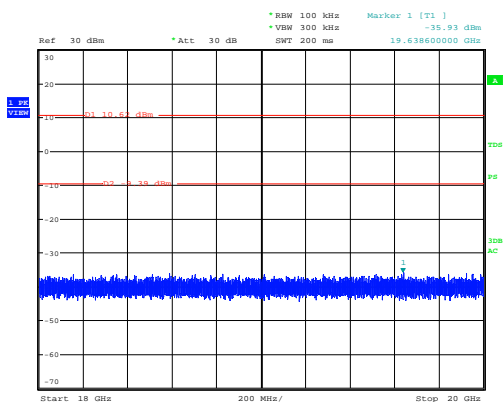
Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:03:43

Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:04:15



Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:04:47

Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:05:11



Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:05:40

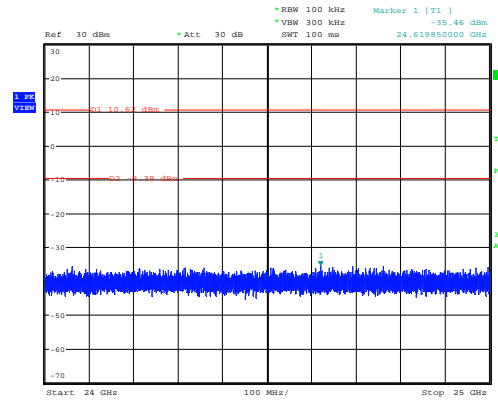
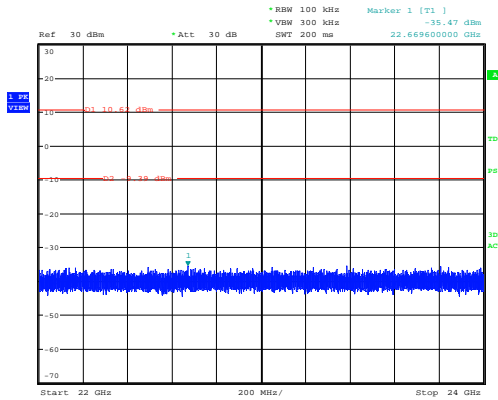
Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 15:06:10

Produkte  
Products

Prüfbericht - Nr.: 12029438 001  
Test Report No.:

Seite 35 von 69  
Page 35 of 69

Figure 18: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 1, Mode B (2437MHz)



Conducted spurious emissions, mode B, 240V  
Date: 13.FEB.2013 15:06:35

Conducted spurious emissions, mode B, 240V  
Date: 13.FEB.2013 15:06:57

Produkte  
 Products

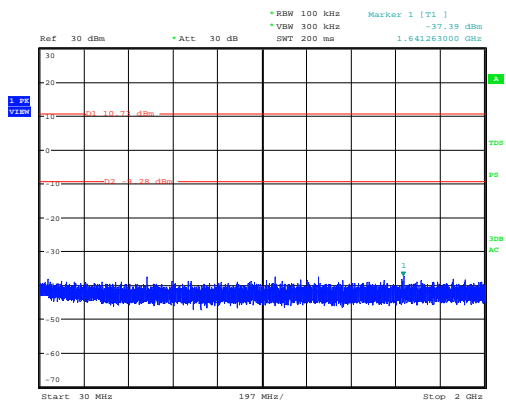
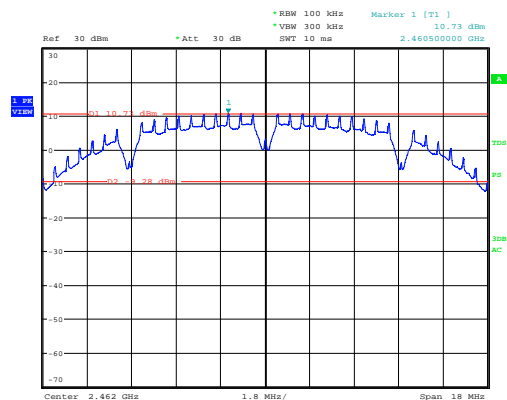
**Prüfbericht - Nr.: 12029438 001**

Test Report No.:

Seite 36 von 69

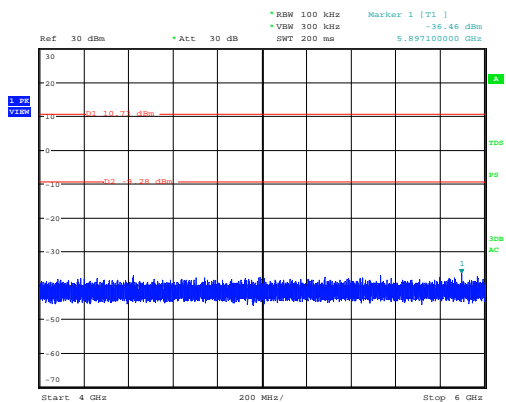
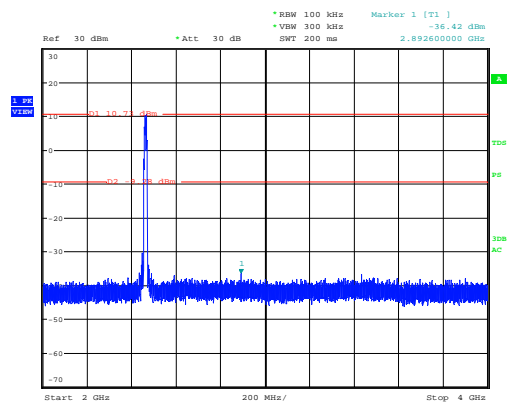
Page 36 of 69

**Figure 19: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 1, Mode C (2462MHz)**



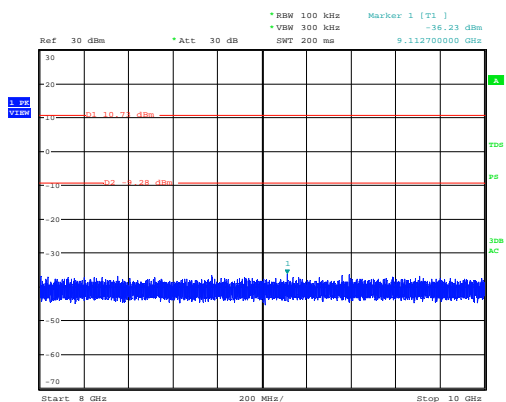
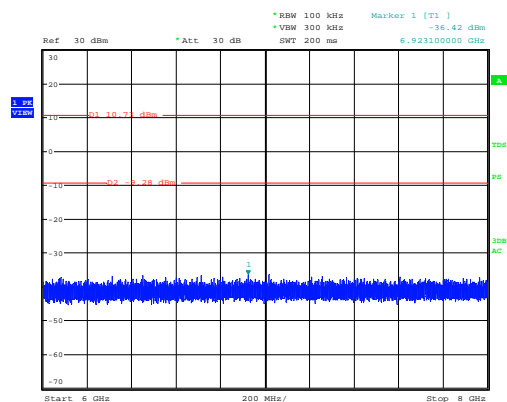
Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:08:54

Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:09:23



Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:10:18

Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:10:47



Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:11:10

Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:11:34

Produkte  
 Products

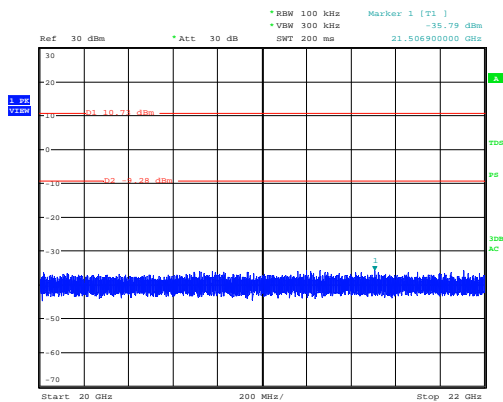
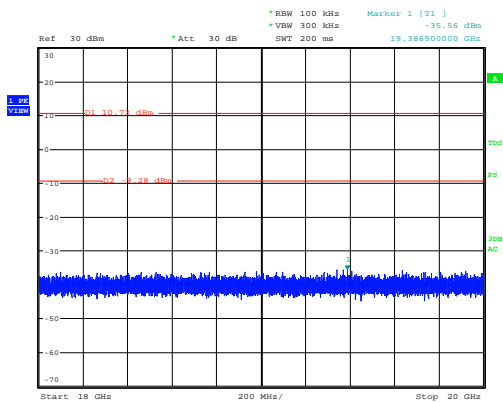
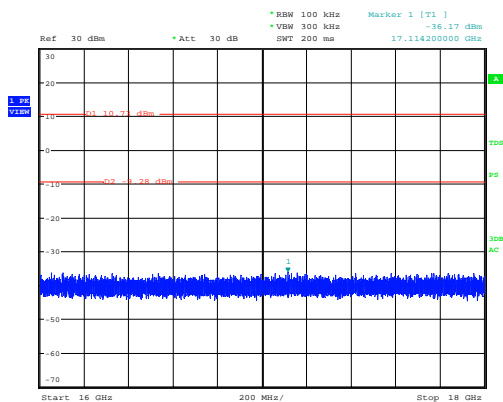
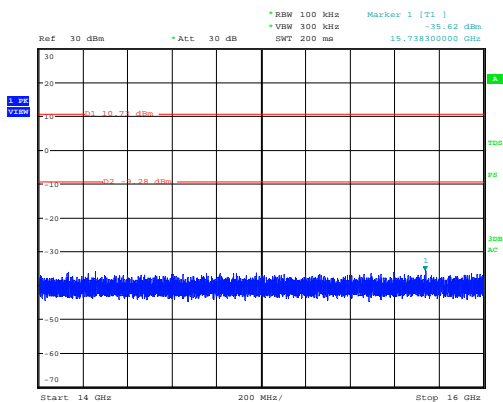
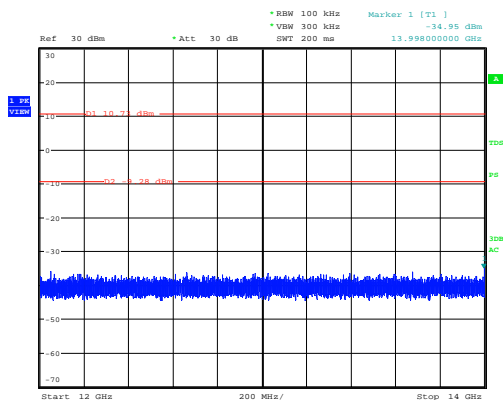
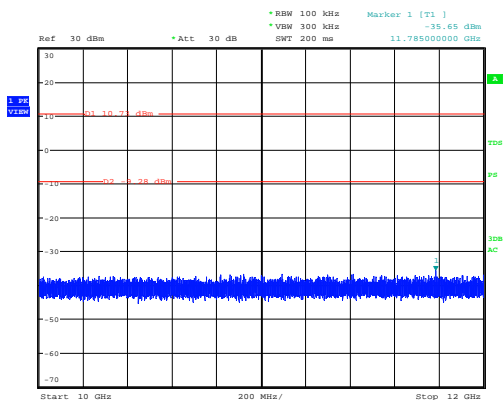
**Prüfbericht - Nr.: 12029438 001**

Seite 37 von 69

Test Report No.:

Page 37 of 69

**Figure 20: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 1, Mode C (2462MHz)**

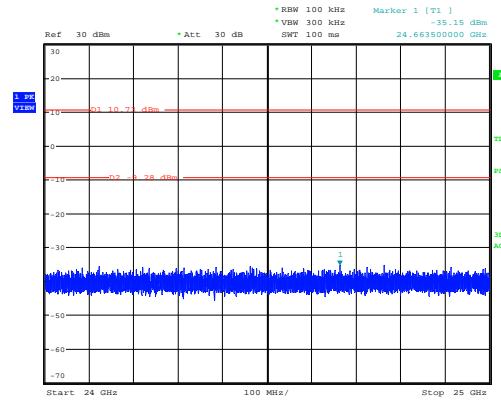
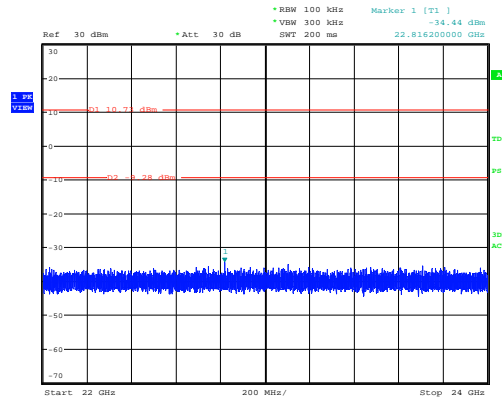


Produkte  
Products

Prüfbericht - Nr.: 12029438 001  
Test Report No.:

Seite 38 von 69  
Page 38 of 69

Figure 21: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 1, Mode C (2462MHz)



Conducted spurious emissions, mode C, 240V  
Date: 13.FEB.2013 15:14:38

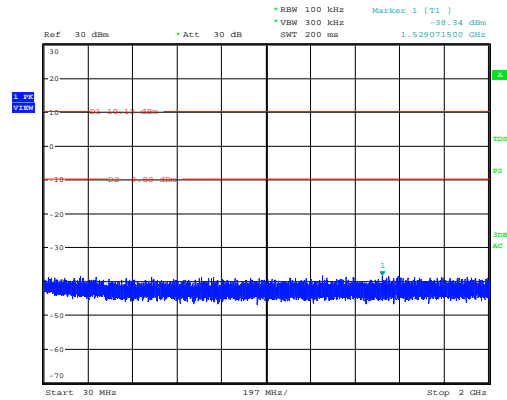
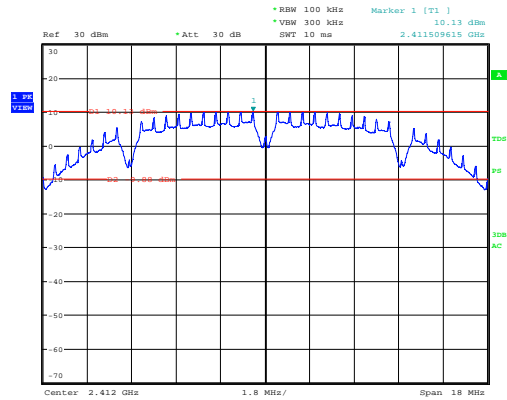
Conducted spurious emissions, mode C, 240V  
Date: 13.FEB.2013 15:15:10

Produkte  
 Products

**Prüfbericht - Nr.: 12029438 001**  
 Test Report No.:

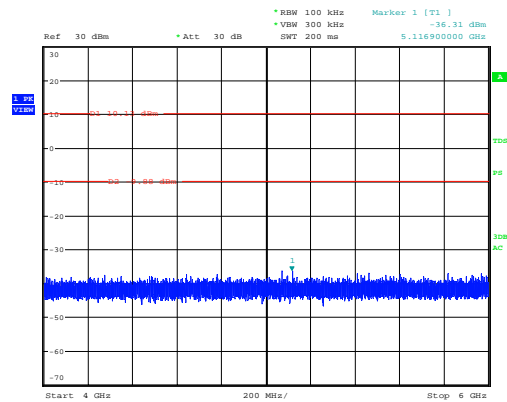
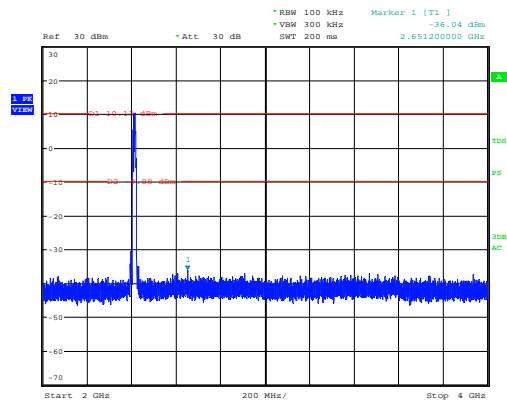
Seite 39 von 69  
 Page 39 of 69

**Figure 22: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 2, Mode A (2412MHz)**



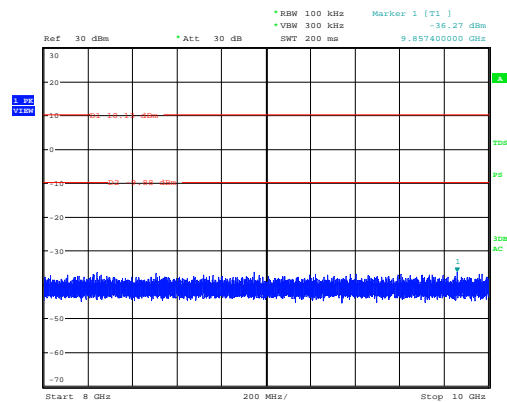
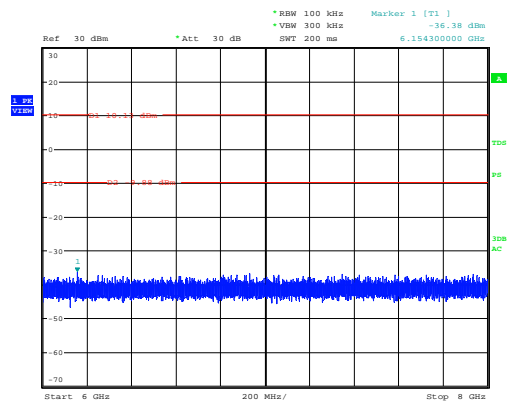
Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:29:00

Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:29:28



Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:30:05

Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:30:36



Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:31:00

Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:31:26

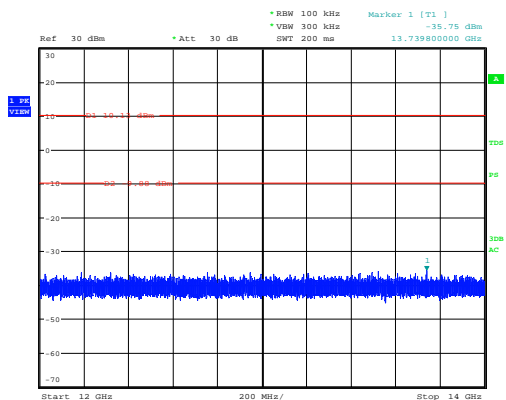
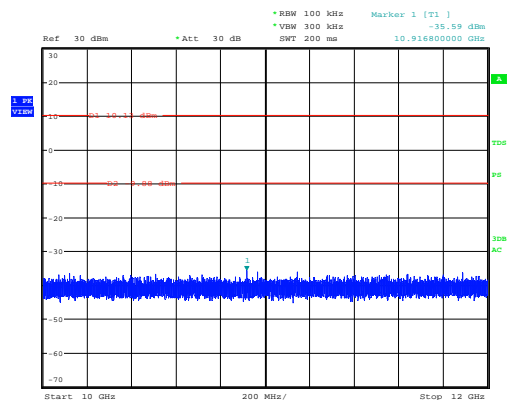
Produkte  
 Products

**Prüfbericht - Nr.: 12029438 001**

Seite 40 von 69  
 Page 40 of 69

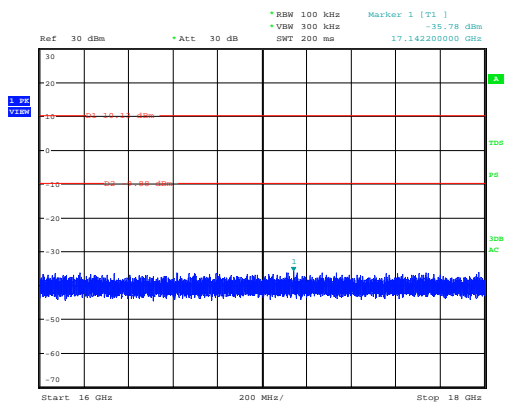
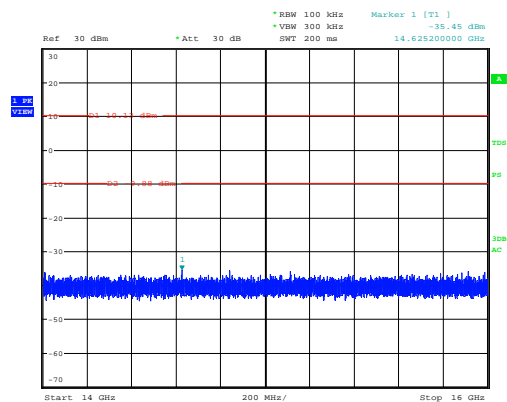
Test Report No.:

**Figure 23: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 2, Mode A (2412MHz)**



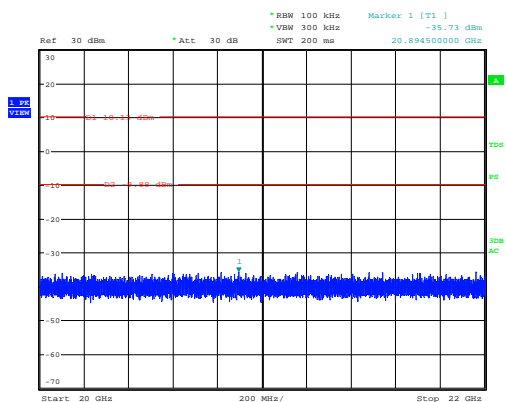
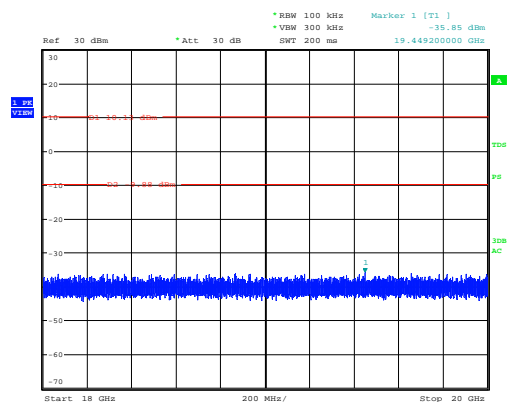
Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:31:53

Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:32:16



Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:32:37

Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:33:06



Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:33:32

Conducted spurious emissions, mode A, 240V  
 Date: 13.FEB.2013 16:33:56

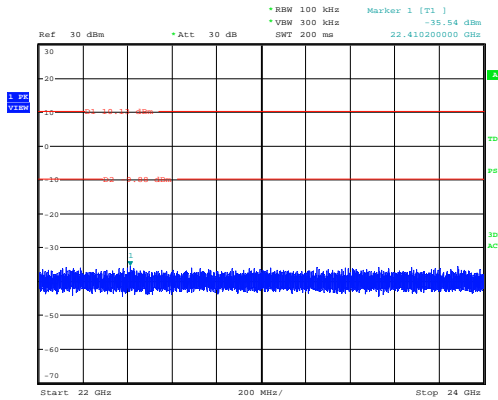


Produkte  
Products

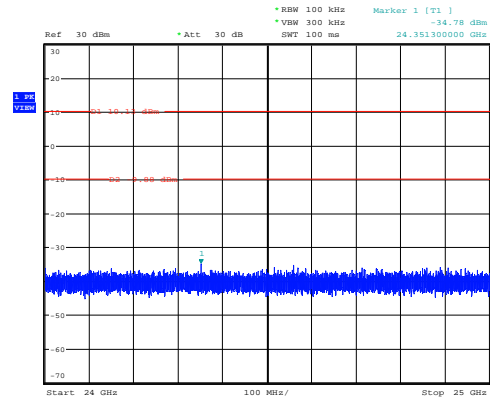
Prüfbericht - Nr.: 12029438 001  
Test Report No.:

Seite 41 von 69  
Page 41 of 69

Figure 24: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 2, Mode A (2412MHz)



Conducted spurious emissions, mode A, 240V  
Date: 13.FEB.2013 16:34:20



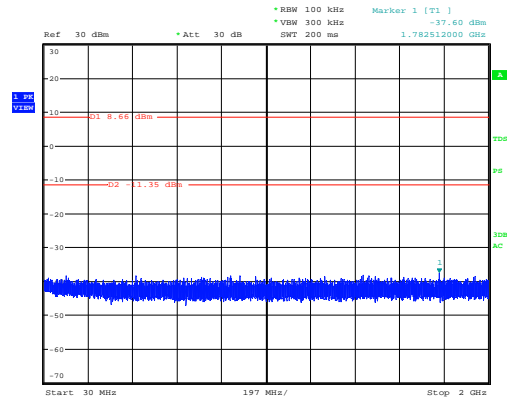
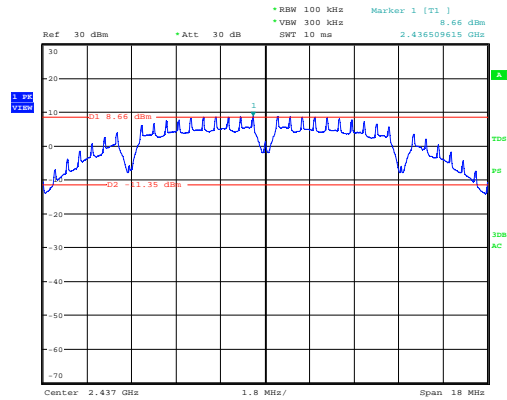
Conducted spurious emissions, mode A, 240V  
Date: 13.FEB.2013 16:34:43

Produkte  
 Products

**Prüfbericht - Nr.: 12029438 001**  
 Test Report No.:

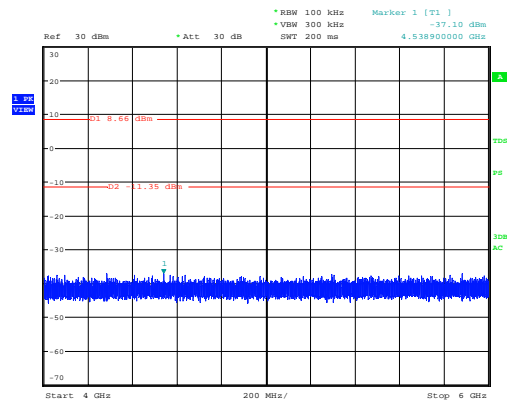
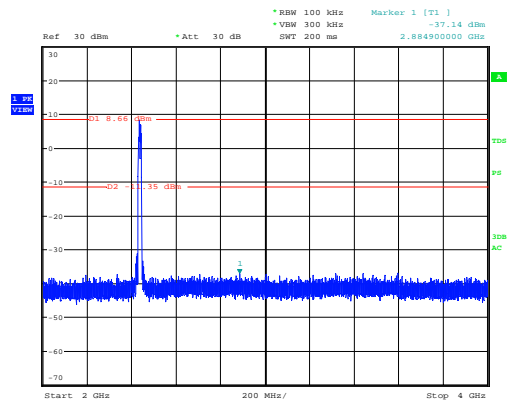
Seite 42 von 69  
 Page 42 of 69

**Figure 25: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 2, Mode B (2437MHz)**



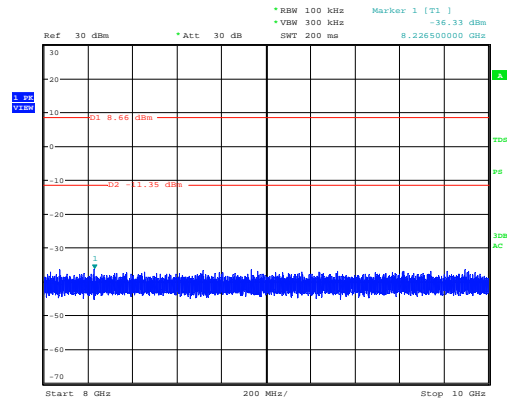
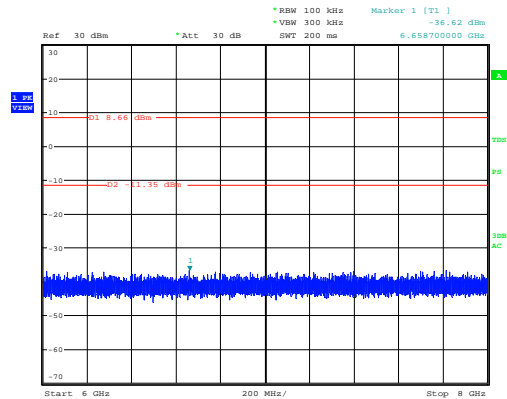
Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:19:57

Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:20:19



Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:27:16

Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:21:03



Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:21:24

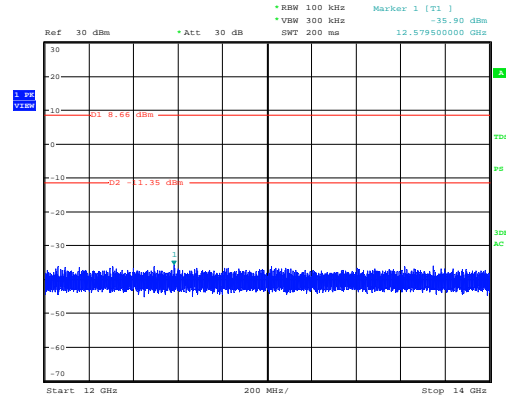
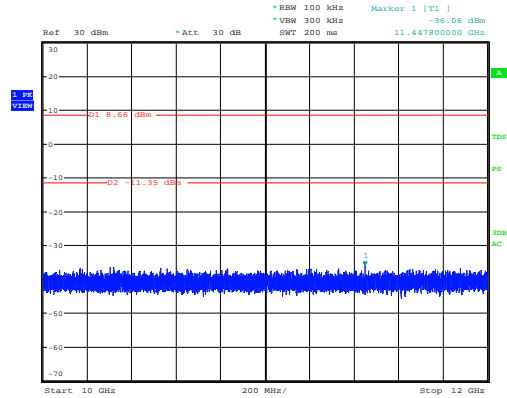
Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:21:47

Produkte  
 Products

Prüfbericht - Nr.: **12029438 001**  
 Test Report No.:

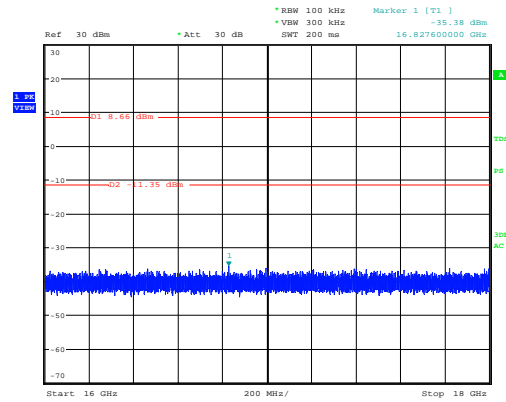
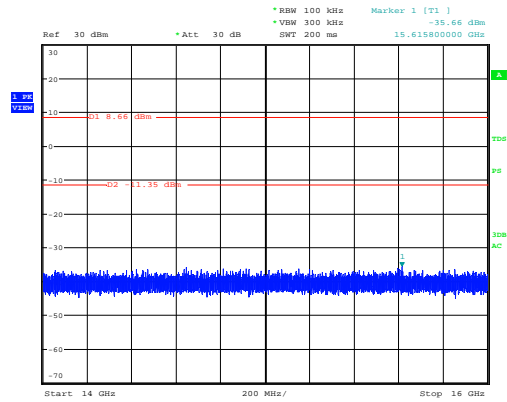
Seite 43 von 69  
 Page 43 of 69

**Figure 26: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 2, Mode B (2437MHz)**



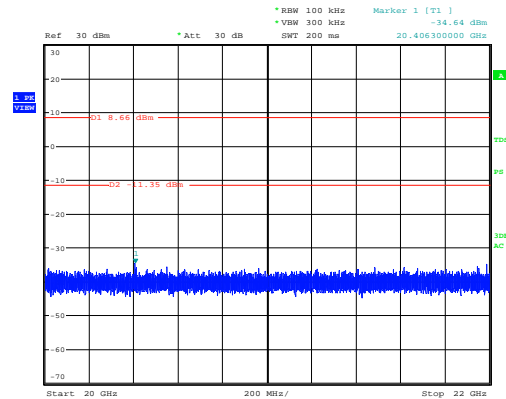
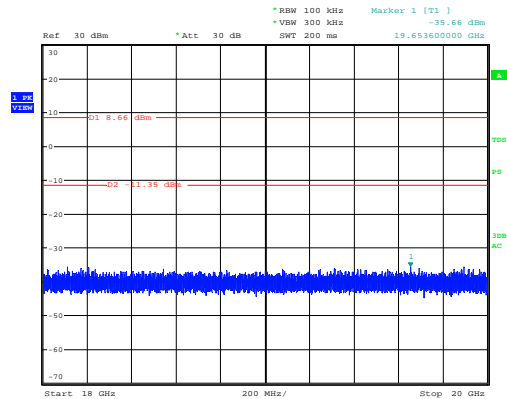
Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:22:10

Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:22:32



Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:22:55

Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:23:16



Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:23:57

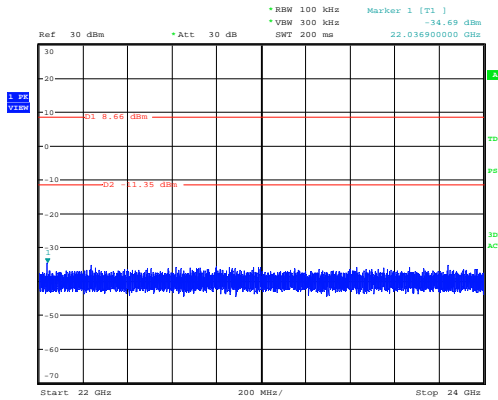
Conducted spurious emissions, mode B, 240V  
 Date: 13.FEB.2013 16:24:26

Produkte  
Products

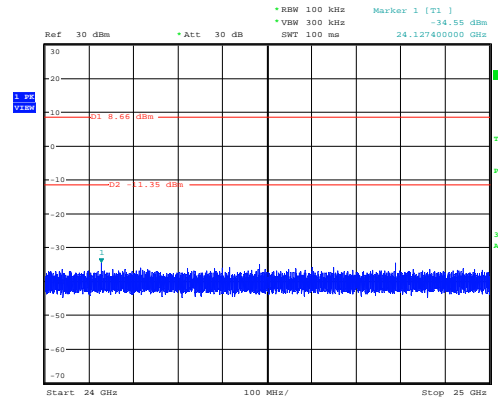
Prüfbericht - Nr.: 12029438 001  
Test Report No.:

Seite 44 von 69  
Page 44 of 69

Figure 27: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 2, Mode B (2437MHz)



Conducted spurious emissions, mode B, 240V  
Date: 13.FEB.2013 16:25:00



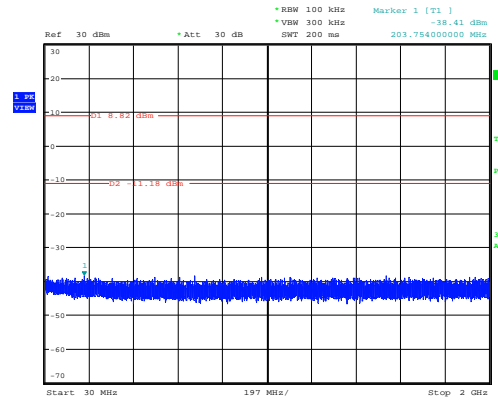
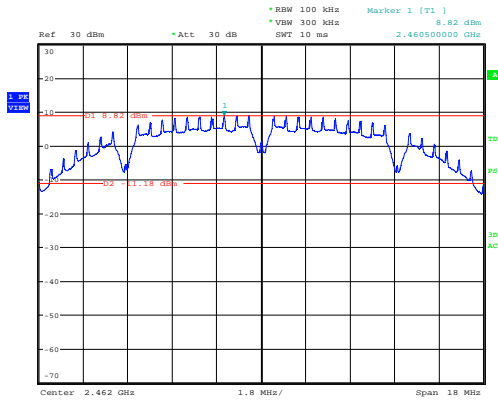
Conducted spurious emissions, mode B, 240V  
Date: 13.FEB.2013 16:25:30

Produkte  
 Products

Prüfbericht - Nr.: **12029438 001**  
 Test Report No.:

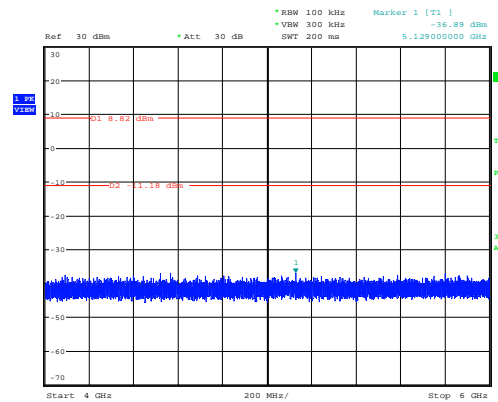
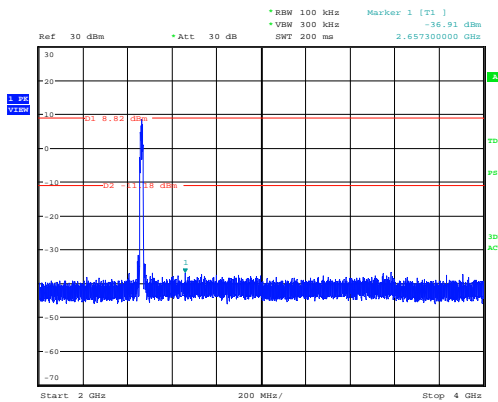
Seite 45 von 69  
 Page 45 of 69

**Figure 28: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 2, Mode C (2462MHz)**



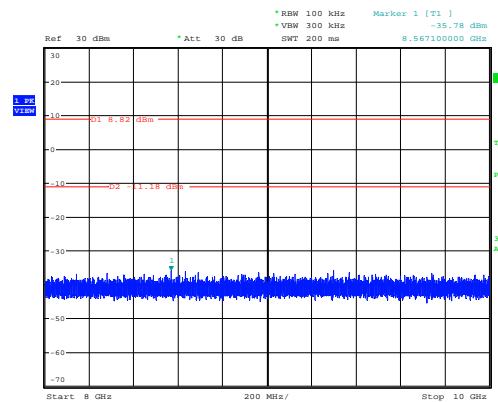
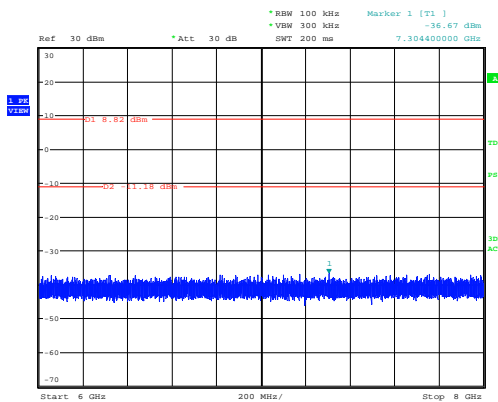
Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:39:31

Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:39:58



Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:40:48

Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:41:14



Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:41:38

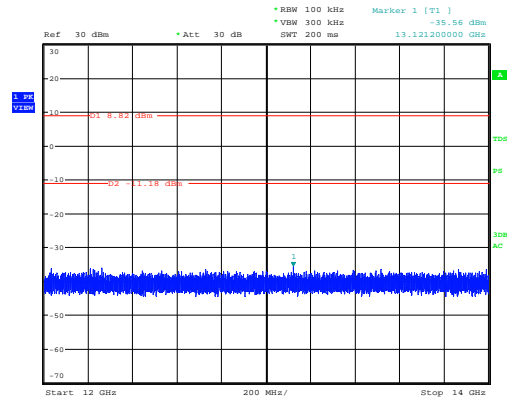
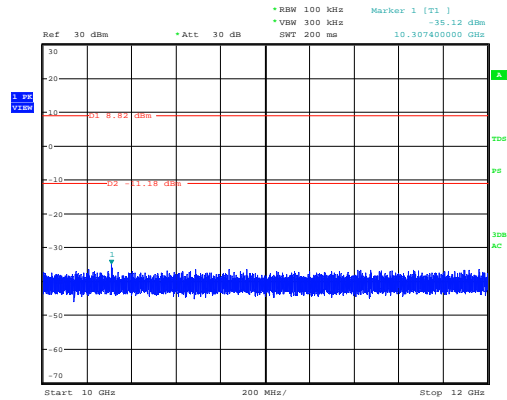
Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:42:13

Produkte  
 Products

**Prüfbericht - Nr.: 12029438 001**  
 Test Report No.:

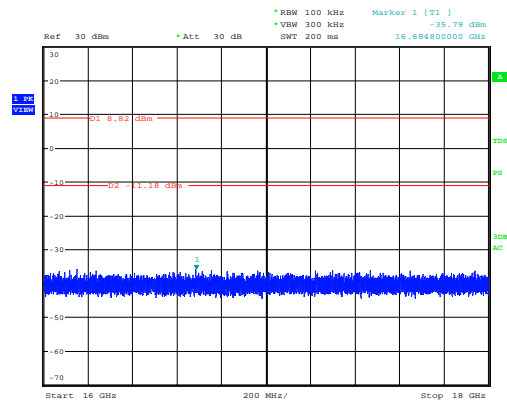
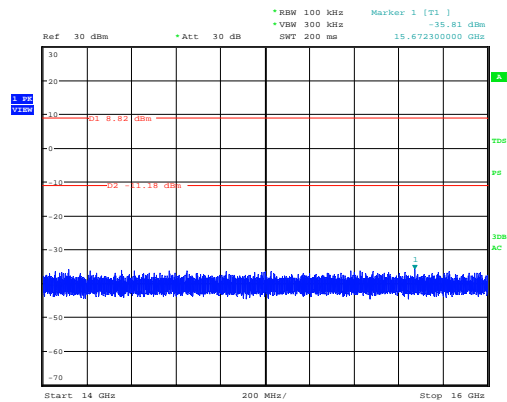
Seite 46 von 69  
 Page 46 of 69

**Figure 29: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 2, Mode C (2462MHz)**



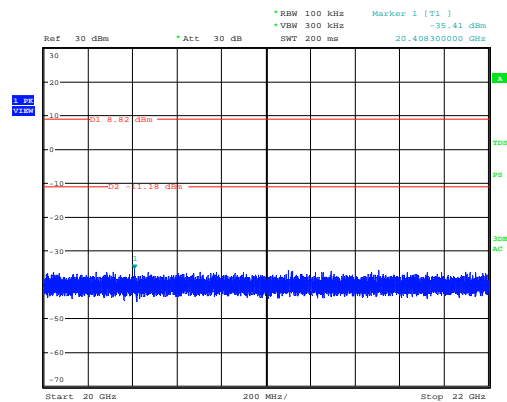
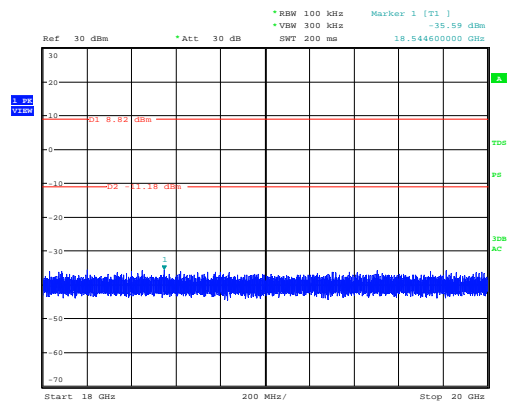
Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:42:45

Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:43:13



Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:43:34

Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:44:04



Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:44:37

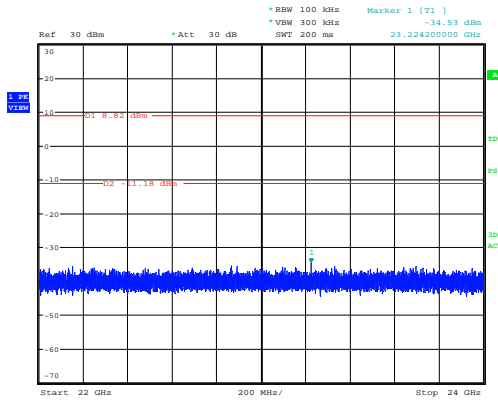
Conducted spurious emissions, mode C, 240V  
 Date: 13.FEB.2013 15:45:02

Produkte  
Products

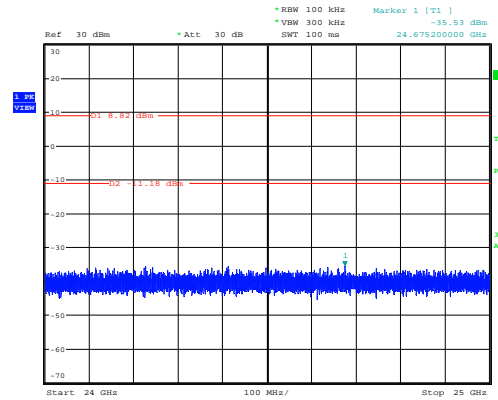
Prüfbericht - Nr.: 12029438 001  
Test Report No.:

Seite 47 von 69  
Page 47 of 69

Figure 30: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 2, Mode C (2462MHz)



Conducted spurious emissions, mode C, 240V  
Date: 13.FEB.2013 15:45:27



Conducted spurious emissions, mode C, 240V  
Date: 13.FEB.2013 15:46:04

**Prüfbericht - Nr.: 12029438 001**

Seite 48 von 69

Test Report No.:

Page 48 of 69

### 5.2.5 Peak Power Spectral Density

**RESULT:**

**PASS**

Date of testing: 2013-02-13

Ambient temperature: 25°C

Relative humidity: 17%

Atmospheric pressure: 1010hPa

Requirements:

FCC 15.247(e) and RSS-210 A8.2(b)

For digitally modulated systems, the power spectral density (PSD) conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

Test procedure:

ANSI C63.4-2003 and KDB Publication No. 558074 D01.

The peak power spectral density was measured at the antenna port with a spectrum analyzer using a peak detector with a resolution bandwidth of 3kHz and a video bandwidth of 10kHz.

The readings of the measurements take into account the loss generated by all the involved cables.



Produkte  
 Products

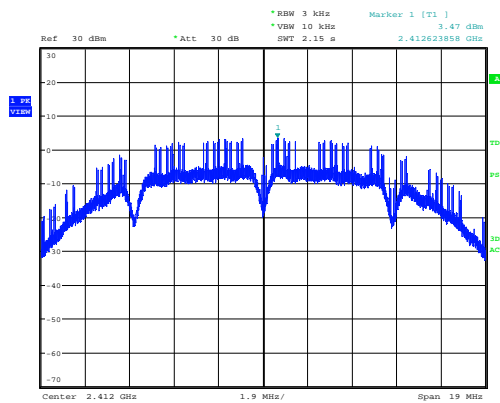
Prüfbericht - Nr.: **12029438 001**  
 Test Report No.:

Seite 49 von 69  
 Page 49 of 69

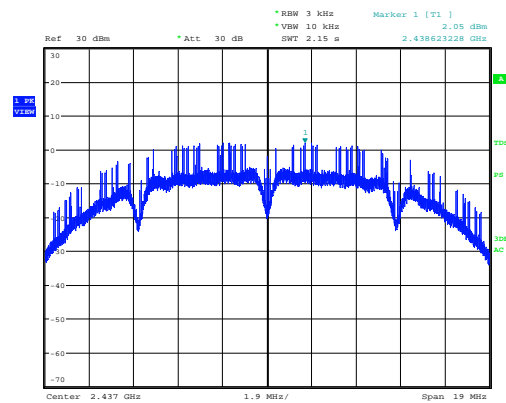
**Table 14: Peak Power Spectral Density, AC 240V Input Voltage, Antenna 1**

Operating Frequency [MHz]	Max PSD Frequency [MHz]	Max PSD [dBm]	Limit [dBm]	Margin [dB]
2412	2412.62	3.47	8.00	4.53
2437	2438.62	2.05	8.00	5.95
2462	2461.37	2.38	8.00	5.62

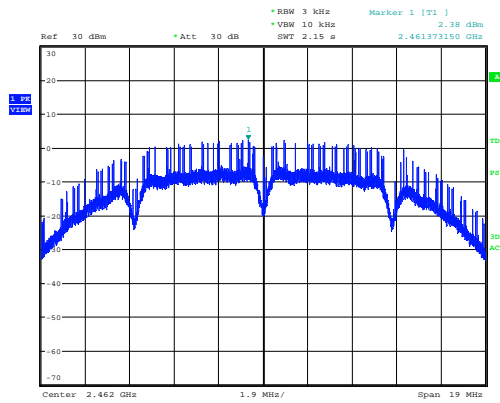
**Figure 31: Power Spectral Density, AC 240V Input Voltage, Antenna 1**



Peak power spectral density, mode A, 240V  
 Date: 13.FEB.2013 14:35:52



Peak power spectral density, mode B, 240V  
 Date: 13.FEB.2013 14:57:04



Peak power spectral density, mode C, 240V  
 Date: 13.FEB.2013 15:21:55

Produkte  
 Products

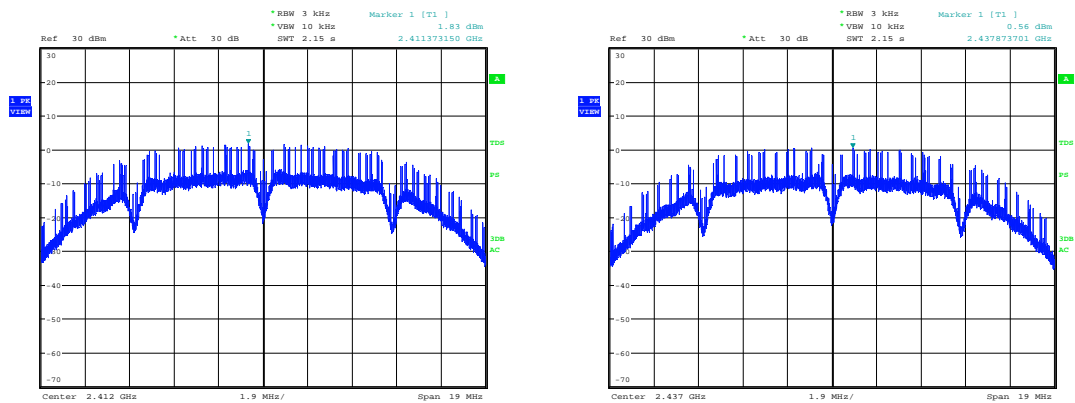
Prüfbericht - Nr.: **12029438 001**  
 Test Report No.:

Seite 50 von 69  
 Page 50 of 69

**Table 15: Peak Power Spectral Density, AC 240V Input Voltage, Antenna 2**

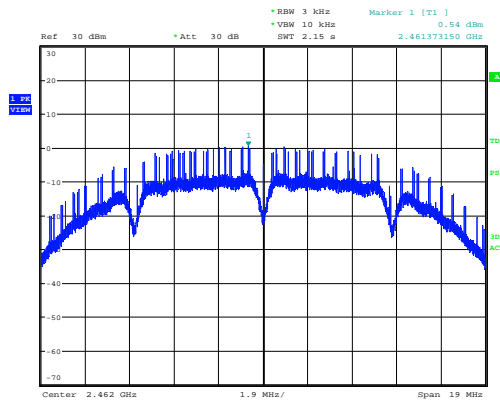
Operating Frequency [MHz]	Max PSD Frequency [MHz]	Max PSD [dBm]	Limit [dBm]	Margin [dB]
2412	2411.37	1.83	8.00	6.17
2437	2437.87	0.56	8.00	7.44
2462	2461.37	0.54	8.00	7.46

**Figure 32: Power Spectral Density, AC 240V Input Voltage, Antenna 2**



Peak power spectral density, mode A, 240V  
 Date: 13.FEB.2013 16:40:37

Peak power spectral density, mode B, 240V  
 Date: 13.FEB.2013 16:18:40



Peak power spectral density, mode C, 240V  
 Date: 13.FEB.2013 15:51:54

## 5.3 Radiated Measurements

### 5.3.1 Radiated Spurious Emissions of Transmitter

**RESULT:**

**PASS**

Date of testing:	2013-02-14 till 2013-02-26
Ambient temperature:	20 to 22°C
Relative humidity:	25 to 56%
Atmospheric pressure:	1005 to 1021hPa
Frequency range:	9kHz - 25GHz
Measurement distance:	3m
Kind of test site:	Semi Anechoic Chamber
Tested host:	FM1S (AC 120V input voltage) FM2S (AC 240V input voltage) FM25S (AC 120V and 240V input voltages)

Requirements:

FCC 15.205, FCC 15.209, FCC 15.247(d), RSS-Gen 7.2.2 and 7.2.5 and RSS-210 2.1, 2.2, 2.5 and A8.5

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-Gen 7.2.2 (table 3), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen 7.2.5 (tables 5 and 6).

Radiated emissions which fall outside the operation frequency band and outside restricted bands shall either meet the limit specified in FCC 15.209(a) and RSS-Gen 7.2.5 or be attenuated at least 20dB below the power level in the 100kHz bandwidth within the band that contains the highest level of the desired power (the less severe limit applies).

Test procedure:

ANSI C63.4-2003, RSS-Gen 4.9 and 7.2 and KDB Publication No. 558074 D01.

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 9kHz to the 10th harmonic of the highest fundamental transmitter frequency (25GHz). Final radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

For emissions between 30MHz and 1GHz, measurements were performed with a test receiver operating in the CISPR quasi-peak detection mode. The receiver's 6dB bandwidth was set to 120kHz. For emissions above 1GHz, measurements were performed with a spectrum analyzer using the following settings: for peak field strength: RBW = 1MHz & VBW ≥ 1MHz; for average field strength: RBW = 1MHz & VBW = 10Hz.

Prechecks were performed for all the hosts and input voltages mentioned here above. It was found that the worst case results are obtained with the following hosts:

- FM2S (AC 240V input voltage) for the frequency range 30-1000MHz
- FM25S (AC 120V input voltage) for the frequency range 1-8GHz (except band edge)
- FM2S (AC 240V input voltage) for the frequency range 8-25GHz
- FM1S (AC 120V input voltage) for band edge measurement

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Emissions other than those mentioned are small or not detectable.

No spurious emission was found in the range 9kHz - 30MHz.

Note:

Some spurious emissions above 1GHz were measured with an average level exceeding the average limit. For these cases, a duty cycle correction factor was applied to reduce the average level, as permitted by FCC 15.35(c).

The duty cycle correction factor (in dB) is given by the following formula:

$$F = 20 \times \log(\text{maximum duty cycle per 100ms in normal use})$$

For this product, the duty cycle correction factor is:

$$F = 20 \times \log(5.47\%) = -25.2\text{dB}$$

When used, the duty cycle correction factor was applied to the corresponding peak level to calculate an average result.

Unless otherwise specified in the test result tables given here below, no duty cycle correction factor was applied.

Produkte  
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**Prüfbericht - Nr.: 12029438 001**

Seite 53 von 69

Test Report No.:

Page 53 of 69

**Table 16: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode A (2412MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
32.825	Y / V	37.7	-17.3	20.4	40.0	19.6	101	134
51.578	Y / V	49.0	-15.9	33.1	40.0	6.9	101	1
56.275	Y / V	47.1	-16.4	30.7	40.0	9.3	103	62
65.661	Y / V	43.6	-17.5	26.1	40.0	13.9	100	1
114.903	Y / H	49.4	-18.2	31.2	43.5	12.3	158	87
133.678	Y / H	49.8	-16.3	33.5	43.5	10.0	243	248
173.540	Y / V	42.8	-15.9	26.9	43.5	16.6	100	267
275.999	Y / V	43.5	-14.6	28.9	46.0	17.1	198	352
276.001	Y / H	45.5	-14.8	30.7	46.0	15.3	101	125
368.000	Y / H	42.9	-12.0	30.9	46.0	15.1	100	302
459.998	Y / V	42.9	-9.4	33.5	46.0	12.5	196	22
459.999	Y / H	45.7	-9.5	36.2	46.0	9.8	194	308
534.050	Y / V	32.0	-7.6	24.4	46.0	21.6	168	173

Note: Level QP = Reading QP + Factor

**Table 17: Radiated Emissions, Average Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode A (2412MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
1607.950	Y / V	50.5	-16.0	34.5	54.0	19.5	154	118
1607.958	Y / H	56.2	-16.0	40.2	54.0	13.8	130	77
1607.972	Y / H	50.1	-16.0	34.1	54.0	19.9	173	174
2179.198	Y / V	40.1	-16.1	24.0	54.0	30.0	197	106
2210.721	Y / H	42.1	-16.1	26.0	54.0	28.0	160	4
2393.805	Y / H	51.2	-16.5	34.7	54.0	19.3	107	315
2575.977	Y / H	54.4	-16.5	37.9	54.0	16.1	153	321
2575.987	Y / V	52.5	-16.5	36.0	54.0	18.0	111	272
2613.328	Y / H	50.3	-16.4	33.9	54.0	20.1	134	306
2639.990	Y / V	44.2	-16.4	27.8	54.0	26.2	195	139
4823.977	Y / V	70.5	-10.2	60.3 / 36.2 (**)	54.0	-6.3 / 17.8 (**)	105	113
4823.984	Y / H	72.0	-10.2	61.8 / 37.8 (**)	54.0	-7.8 / 16.2 (**)	144	217
4849.451	Y / H	39.0	-10.2	28.8	54.0	25.2	195	175
4854.944	Y / H	38.9	-10.2	28.7	54.0	25.3	144	171
7221.649	Y / H	39.6	-6.5	33.1	54.0	20.9	108	214

Note: Level AV = Reading AV + Factor

(\*\*) Result without/with duty cycle correction factor. Result with duty cycle correction factor is relevant.

**Table 18: Radiated Emissions, Peak Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode A (2412MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
1607.950	Y / V	56.7	-16.0	40.7	74.0	33.3	154	118
1607.958	Y / H	60.2	-16.0	44.2	74.0	29.8	130	77
1607.972	Y / H	57.1	-16.0	41.1	74.0	32.9	173	174
2179.198	Y / V	54.3	-16.1	38.2	74.0	35.8	197	106
2210.721	Y / H	58.0	-16.1	41.9	74.0	32.1	160	4
2393.805	Y / H	61.2	-16.5	44.7	74.0	29.3	107	315
2575.977	Y / H	61.8	-16.5	45.3	74.0	28.7	153	321
2575.987	Y / V	60.8	-16.5	44.3	74.0	29.7	111	272
2613.328	Y / H	61.5	-16.4	45.1	74.0	28.9	134	306
2639.990	Y / V	56.3	-16.4	39.9	74.0	34.1	195	139
4823.977	Y / V	71.6	-10.2	61.4	74.0	12.6	105	113
4823.984	Y / H	73.2	-10.2	63.0	74.0	11.0	144	217
4849.451	Y / H	52.9	-10.2	42.7	74.0	31.3	195	175
4854.944	Y / H	52.8	-10.2	42.6	74.0	31.4	144	171
7221.649	Y / H	53.5	-6.5	47.0	74.0	27.0	108	214

Note: Level PK = Reading PK + Factor

**Table 19: Radiated Emissions, Average Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode A (2412MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
9647.970	Z / V	64.6	-8.1	56.5 / 33.1 (**)	54.0	-2.5 / 20.9 (**)	100	283
9647.989	Z / H	65.1	-8.1	57.0 / 33.3 (**)	54.0	-3.0 / 20.7 (**)	100	224
11984.535	Z / H	36.4	-5.2	31.2	54.0	22.8	141	174
12040.754	Z / V	36.3	-4.8	31.5	54.0	22.5	128	337

Note: Level AV = Reading AV + Factor

(\*\*) Result without/with duty cycle correction factor. Result with duty cycle correction factor is relevant.

**Table 20: Radiated Emissions, Peak Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode A (2412MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
9647.970	Z / V	66.4	-8.1	58.3	74.0	15.7	100	283
9647.989	Z / H	66.6	-8.1	58.5	74.0	15.5	100	224
11984.535	Z / H	51.0	-5.2	45.8	74.0	28.2	141	174
12040.754	Z / V	50.4	-4.8	45.6	74.0	28.4	128	337

Note: Level PK = Reading PK + Factor

**Table 21: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode B (2437MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
46.909	X / V	41.8	-15.9	25.9	40.0	14.1	102	132
49.269	X / V	43.2	-15.9	27.3	40.0	12.7	102	63
51.604	X / V	49.2	-15.9	33.3	40.0	6.7	101	137
51.604	X / H	40.5	-15.6	24.9	40.0	15.1	254	93
56.307	X / V	44.5	-16.4	28.1	40.0	11.9	115	182
124.314	X / V	47.5	-17.6	29.9	43.5	13.6	101	139
128.944	X / H	38.9	-16.8	22.1	43.5	21.4	245	73
129.008	X / V	48.9	-17.1	31.8	43.5	11.7	103	142
133.684	X / H	41.8	-16.3	25.5	43.5	18.0	238	244
140.710	X / H	36.2	-15.9	20.3	43.5	23.2	237	262
187.668	X / V	39.6	-17.1	22.5	43.5	21.0	100	284
276.003	X / V	44.3	-14.6	29.7	46.0	16.3	186	78
407.334	X / V	40.8	-10.7	30.1	46.0	15.9	152	268
460.001	X / V	43.8	-9.4	34.4	46.0	11.6	100	173
460.002	X / H	43.0	-9.5	33.5	46.0	12.5	175	53
555.317	X / H	31.8	-6.9	24.9	46.0	21.1	151	121

Note: Level QP = Reading QP + Factor

**Table 22: Radiated Emissions, Average Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode B (2437MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
1499.975	X / V	42.7	-16.3	26.4	54.0	27.6	121	292
1624.643	X / V	49.6	-15.9	33.7	54.0	20.3	133	115
2299.960	X / V	51.4	-16.3	35.1	54.0	18.9	120	106
2639.948	X / H	50.2	-16.4	33.8	54.0	20.2	112	26
4841.242	X / V	39.0	-10.2	28.8	54.0	25.2	195	85
4873.944	X / H	44.4	-10.2	34.2	54.0	19.8	124	147
4873.953	X / V	49.1	-10.2	38.9	54.0	15.1	132	95
4873.964	X / V	47.7	-10.2	37.5	54.0	16.5	123	84

Note: Level AV = Reading AV + Factor

**Table 23: Radiated Emissions, Peak Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode B (2437MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
1499.975	X / V	59.2	-16.3	42.9	74.0	31.1	121	292
1624.643	X / V	56.4	-15.9	40.5	74.0	33.5	133	115
2299.960	X / V	61.4	-16.3	45.1	74.0	28.9	120	106
2639.948	X / H	59.5	-16.4	43.1	74.0	30.9	112	26
4841.242	X / V	53.5	-10.2	43.3	74.0	30.7	195	85
4873.944	X / H	54.0	-10.2	43.8	74.0	30.2	124	147
4873.953	X / V	55.9	-10.2	45.7	74.0	28.3	132	95
4873.964	X / V	55.3	-10.2	45.1	74.0	28.9	123	84

Note: Level PK = Reading PK + Factor

**Table 24: Radiated Emissions, Average Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode B (2437MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
9747.960	Z / V	63.9	-7.4	56.5 / 32.8 (**)	54.0	-2.5 / 21.2 (**)	108	208
9747.970	Z / H	64.2	-7.4	56.8 / 32.9 (**)	54.0	-2.8 / 21.1 (**)	108	197
12184.889	Z / H	41.2	-5.1	36.1	54.0	17.9	182	19
12184.940	Z / V	51.6	-5.1	46.5	54.0	7.5	100	268

Note: Level AV = Reading AV + Factor

(\*\*) Result without/with duty cycle correction factor. Result with duty cycle correction factor is relevant.

**Table 25: Radiated Emissions, Peak Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode B (2437MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
9747.960	Z / V	65.4	-7.4	58.0	74.0	16.0	108	208
9747.970	Z / H	65.5	-7.4	58.1	74.0	15.9	108	197
12184.889	Z / H	52.8	-5.1	47.7	74.0	26.3	182	19
12184.940	Z / V	58.1	-5.1	53.0	74.0	21.0	100	268

Note: Level PK = Reading PK + Factor



**Table 26: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode C (2462MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
31.881	X / V	37.9	-17.5	20.4	40.0	19.6	100	146
49.125	X / V	41.5	-15.9	25.6	40.0	14.4	100	122
51.588	X / V	43.3	-15.9	27.4	40.0	12.6	100	99
129.559	X / H	36.5	-16.8	19.7	43.5	23.8	238	95
133.649	X / H	39.7	-16.3	23.4	43.5	20.1	237	249
187.589	X / V	36.3	-17.1	19.2	43.5	24.3	100	335
275.999	X / H	45.6	-14.8	30.8	46.0	15.2	103	323
276.002	X / V	41.3	-14.6	26.7	46.0	19.3	173	164
368.001	X / V	44.0	-11.7	32.3	46.0	13.7	154	353
368.003	X / H	42.7	-12.0	30.7	46.0	15.3	100	68
398.300	X / H	40.2	-11.2	29.0	46.0	17.0	101	99
408.130	X / V	39.0	-10.7	28.3	46.0	17.7	141	306
460.001	X / V	46.0	-9.4	36.6	46.0	9.4	118	271
460.002	X / H	46.3	-9.5	36.8	46.0	9.2	205	128
526.822	X / V	39.0	-7.8	31.2	46.0	14.8	104	359

Note: Level QP = Reading QP + Factor

**Table 27: Radiated Emissions, Average Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode C (2462MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
1641.280	Y / V	49.7	-15.9	33.8	54.0	20.2	117	112
2299.978	Y / V	52.1	-16.3	35.8	54.0	18.2	104	264
2575.997	Y / H	50.3	-16.5	33.8	54.0	20.2	113	263
3548.869	Y / V	40.0	-12.1	27.9	54.0	26.1	154	24
3561.756	Y / H	40.2	-12.0	28.2	54.0	25.8	113	167
3843.560	Y / V	39.4	-11.4	28.0	54.0	26.0	171	301
5036.326	Y / H	39.5	-10.3	29.2	54.0	24.8	100	63
5703.007	Y / V	40.7	-10.6	30.1	54.0	23.9	100	267
6910.118	Y / H	39.9	-7.6	32.3	54.0	21.7	182	78
7613.557	Y / H	39.0	-5.7	33.3	54.0	20.7	199	284
7680.261	Y / H	39.4	-5.7	33.7	54.0	20.3	188	41

Note: Level AV = Reading AV + Factor

Produkte  
 Products

**Prüfbericht - Nr.: 12029438 001**

Seite 58 von 69

Test Report No.:

Page 58 of 69

**Table 28: Radiated Emissions, Peak Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode C (2462MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
1641.280	Y / V	56.1	-15.9	40.2	74.0	33.8	117	112
2299.978	Y / V	63.3	-16.3	47.0	74.0	27.0	104	264
2575.997	Y / H	59.3	-16.5	42.8	74.0	31.2	113	263
3548.869	Y / V	54.3	-12.1	42.2	74.0	31.8	154	24
3561.756	Y / H	54.5	-12.0	42.5	74.0	31.5	113	167
3843.560	Y / V	53.0	-11.4	41.6	74.0	32.4	171	301
5036.326	Y / H	53.4	-10.3	43.1	74.0	30.9	100	63
5703.007	Y / V	54.5	-10.6	43.9	74.0	30.1	100	267
6910.118	Y / H	53.9	-7.6	46.3	74.0	27.7	182	78
7613.557	Y / H	53.2	-5.7	47.5	74.0	26.5	199	284
7680.261	Y / H	53.0	-5.7	47.3	74.0	26.7	188	41

Note: Level PK = Reading PK + Factor

**Table 29: Radiated Emissions, Average Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode C (2462MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
9847.961	Z / V	61.7	-7.3	54.4 / 31.2 (**)	54.0	-0.4 / 22.8 (**)	111	281
9847.971	Z / H	64.6	-7.3	57.3 / 33.6 (**)	54.0	-3.3 / 20.4 (**)	124	232

Note: Level AV = Reading AV + Factor

(\*\*) Result without/with duty cycle correction factor. Result with duty cycle correction factor is relevant.

**Table 30: Radiated Emissions, Peak Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode C (2462MHz)**

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
9847.961	Z / V	63.7	-7.3	56.4	74.0	17.6	111	281
9847.971	Z / H	66.1	-7.3	58.8	74.0	15.2	124	232

Note: Level PK = Reading PK + Factor

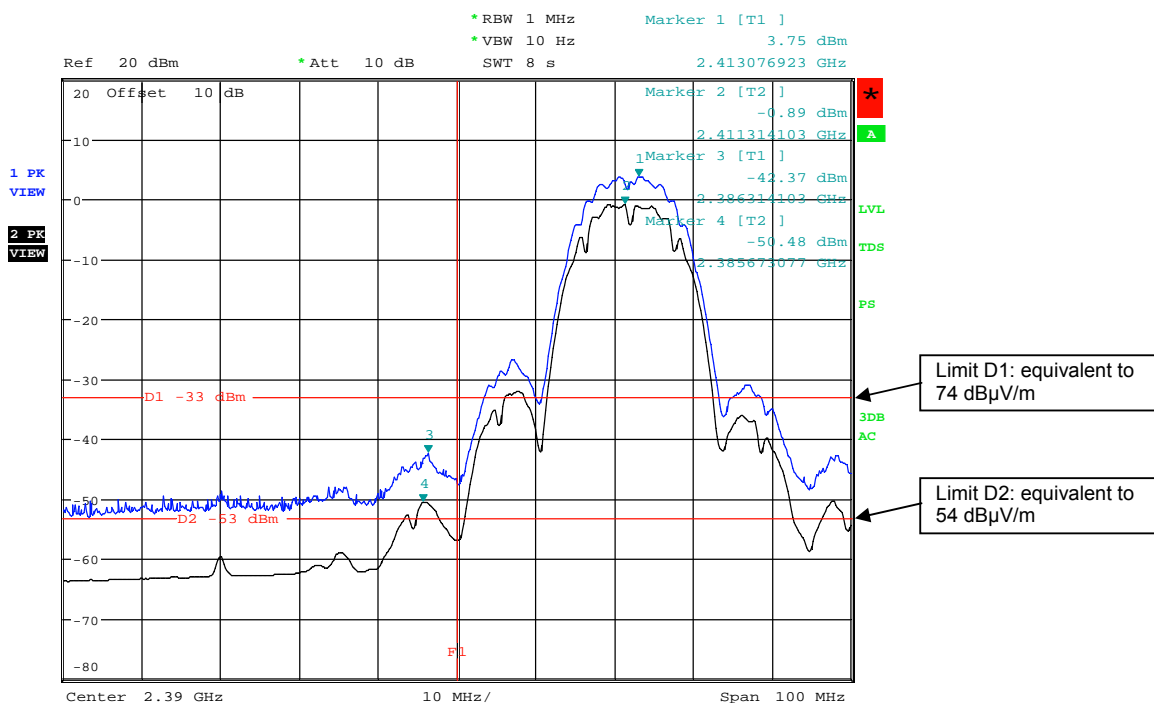
**Table 31: Radiated Emissions at Band Edge, Average and Peak Data, Horizontal and Vertical Antenna Orientations, Host FM1S, AC 120V Input Voltage, Modes A (2412MHz) and C (2462MHz)**

Operating Frequency [MHz]	EUT / Antenna Orientation	Level AV [dBµV/m]	Level PK [dBµV/m]	Limit AV [dBµV/m]	Limit PK [dBµV/m]	Margin AV [dB]	Margin PK [dB]
2412	X / V	56.5 / 39.4 (**)	64.6	54.0	74.0	-2.5 / 14.6 (**)	9.4
2462	Z / H	55.1 / 38.4 (**)	63.6	54.0	74.0	-1.1 / 15.6 (**)	10.4

Notes: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.  
 Average limit in dBµV/m is calculated as follows: Average limit = 20 x log(500µV/m).  
 Peak limit in dBµV/m is calculated as follows: Peak limit = Average limit + 20dB.

(\*\*) Result without/with duty cycle correction factor. Result with duty cycle correction factor is relevant.

**Figure 33: Radiated Emissions at Band Edge, Spectral Diagram, Host FM1S, AC 120V Input Voltage, Mode A (2412MHz)**



Band Edge, Ver, Mode A, Pos.X  
 Date: 15.FEB.2013 17:27:57

Note: The upper trace shows the peak value and the lower trace shows the average value.  
 Add 107dB to convert values in this spectrum from dBm to dBµV/m.

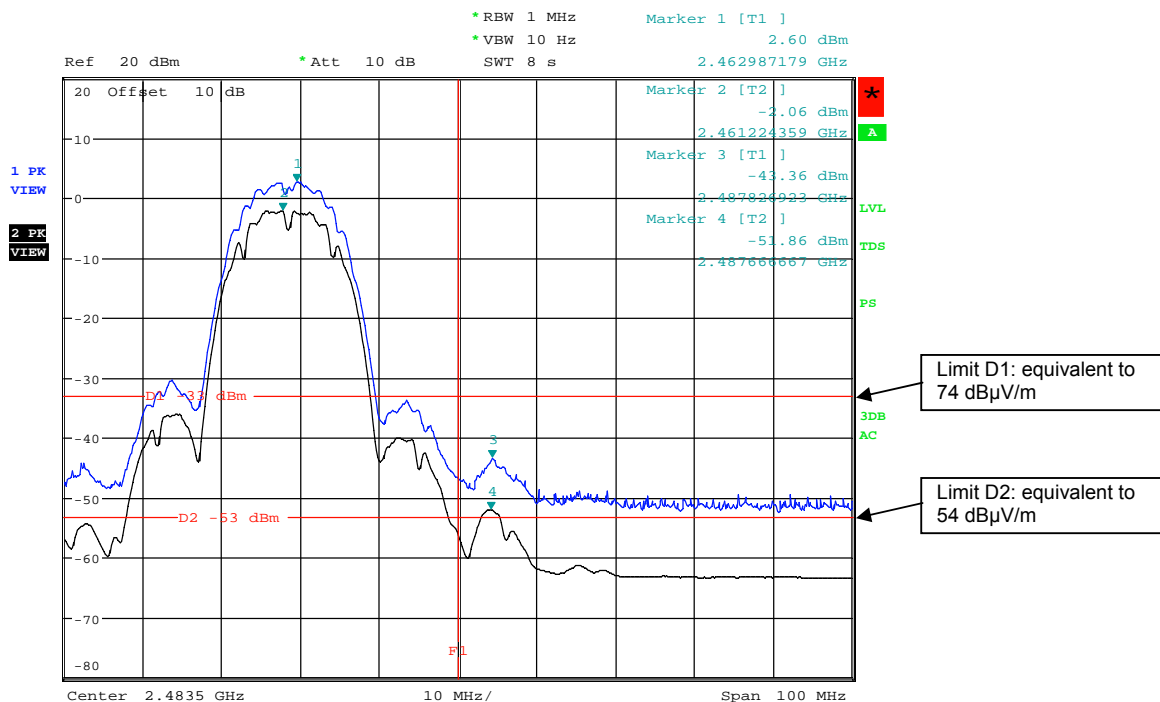
Produkte  
 Products

Prüfbericht - Nr.: 12029438 001

Seite 60 von 69  
 Page 60 of 69

Test Report No.:

**Figure 34: Radiated Emissions at Band Edge, Spectral Diagram, Host FM1S, AC 120V Input Voltage, Mode C (2462MHz)**



Band Edge, Hor, Mode C, Pos. Z  
 Date: 15.FEB.2013 16:15:29

Note: The upper trace shows the peak value and the lower trace shows the average value.  
 Add 107dB to convert values in this spectrum from dBm to dBµV/m.

## 5.4 AC Power Line Conducted Measurements

### 5.4.1 AC Power Line Conducted Emission of Transmitter

**RESULT:** **PASS**

Date of testing: 2013-02-16

Ambient temperature: 20°C

Relative humidity: 40%

Atmospheric pressure: 1011hPa

Frequency range: 0.15 - 30MHz

Kind of test site: Shielded Room

Tested host: FM1S (AC 120V input voltage)  
FM2S (AC 240V input voltage)  
FM25S (AC 120V and 240V input voltages)

Requirements:

FCC 15.207 and RSS-Gen 7.2.4

The AC power line conducted emission on any frequency within the band 150kHz to 30MHz shall not exceed the limits specified in FCC 15.207 and RSS-Gen 7.2.4 (table 4).

Test procedure:

ANSI C63.4-2003 and RSS-Gen 7.2

The EUT was placed on a wooden table raised 80cm above the reference ground plane. A vertical conducting plane of the screened room was located 40cm to the rear of the EUT. The EUT was connected to a Line Impedance Stabilization Network (LISN).

The physical arrangement of the test system and associated cabling was varied to determine the effect on the EUT's emissions in amplitude and frequency in order to ensure that maximum emission amplitudes were attained.

The measurements were performed with a test receiver operating in the CISPR quasi-peak and average detection modes. The receiver's 6dB bandwidth was set to 9kHz.

Prechecks were performed in modes A, B, C for all the hosts and input voltages mentioned here above. It was found that the worst case results are obtained for the host FM25S (AC 240V input voltage) in mode B and final measurements were performed for this configuration only.

Disturbances other than those mentioned are small or not detectable.

Produkte  
 Products

**Prüfbericht - Nr.: 12029438 001**

Seite 62 von 69

Test Report No.:

Page 62 of 69

**Table 32: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase N (N) and L1 (L), Host FM25S, AC 240V Input Voltage, Mode B (2437MHz)**

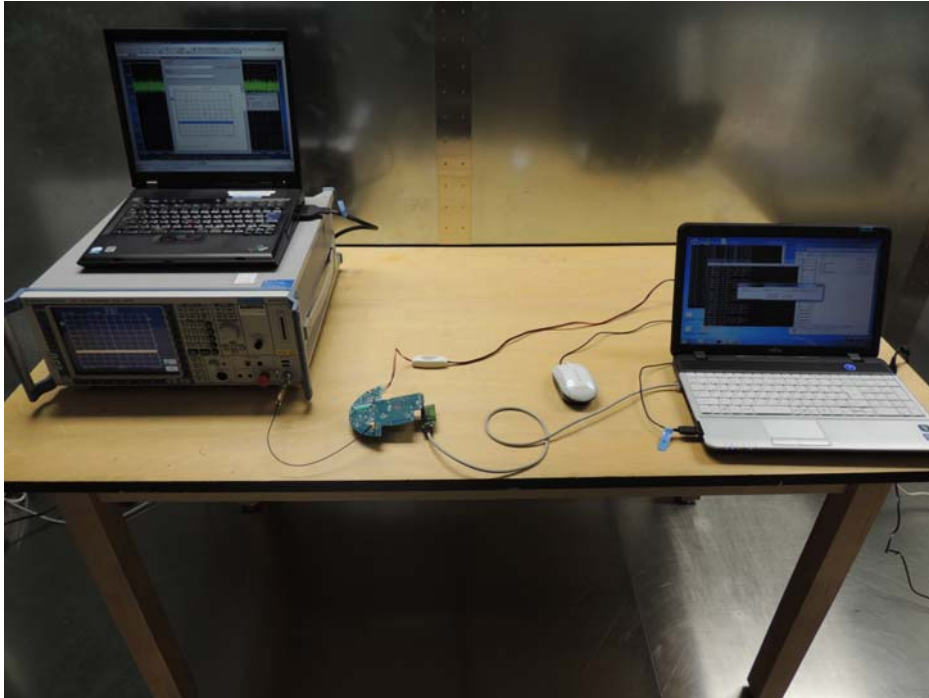
Freq. [MHz]	Phase	Reading QP [dBµV]	Reading AV [dBµV]	Factor [dB]	Level QP [dBµV]	Level AV [dBµV]	Limit QP [dBµV]	Limit AV [dBµV]	Margin QP [dB]	Margin AV [dB]
0.18786	N	41.0	28.2	9.6	50.6	37.8	64.1	54.1	13.5	16.3
0.19250	N	40.6	29.3	9.6	50.2	38.9	63.9	53.9	13.7	15.0
0.19257	L1	41.2	29.7	9.6	50.8	39.3	63.9	53.9	13.1	14.6
0.38568	L1	31.2	18.5	9.6	40.8	28.1	58.2	48.2	17.4	20.1
0.45420	L1	33.7	22.1	9.6	43.3	31.7	56.8	46.8	13.5	15.1
0.50219	L1	39.3	23.3	9.6	48.9	32.9	56.0	46.0	7.1	13.1
0.57480	L1	39.2	24.8	9.7	48.9	34.5	56.0	46.0	7.1	11.5
0.64134	L1	36.0	22.5	9.7	45.7	32.2	56.0	46.0	10.3	13.8
0.75784	L1	45.4	27.5	9.7	55.1	37.2	56.0	46.0	0.9 (*)	8.8
0.77570	N	40.9	24.0	9.7	50.6	33.7	56.0	46.0	5.4	12.3
1.28787	N	19.0	7.7	9.7	28.7	17.4	56.0	46.0	27.3	28.6
1.41130	L1	30.1	15.5	9.7	39.8	25.2	56.0	46.0	16.2	20.8
1.46245	N	28.2	13.8	9.7	37.9	23.5	56.0	46.0	18.1	22.5
2.10115	L1	34.0	19.4	9.8	43.8	29.2	56.0	46.0	12.2	16.8
2.14598	N	31.4	17.6	9.8	41.2	27.4	56.0	46.0	14.8	18.6
2.40130	L1	28.6	14.7	9.8	38.4	24.5	56.0	46.0	17.6	21.5
2.50208	N	25.9	16.2	9.8	35.7	26.0	56.0	46.0	20.3	20.0
2.77428	N	32.9	17.4	9.8	42.7	27.2	56.0	46.0	13.3	18.8
2.90861	L1	33.5	18.6	9.8	43.3	28.4	56.0	46.0	12.7	17.6
3.08228	N	30.6	16.0	9.8	40.4	25.8	56.0	46.0	15.6	20.2
3.75279	N	24.5	10.3	9.9	34.4	20.2	56.0	46.0	21.6	25.8
3.99716	L1	28.4	13.6	9.8	38.2	23.4	56.0	46.0	17.8	22.6
4.07824	N	28.6	13.9	9.9	38.5	23.8	56.0	46.0	17.5	22.2
4.65865	L1	19.4	8.2	9.9	29.3	18.1	56.0	46.0	26.7	27.9
4.72604	N	21.3	9.5	9.9	31.2	19.4	56.0	46.0	24.8	26.6
5.41872	L1	33.4	19.9	9.9	43.3	29.8	60.0	50.0	16.7	20.2
5.47574	N	34.4	21.1	9.9	44.3	31.0	60.0	50.0	15.7	19.0
5.68199	N	32.4	19.0	9.9	42.3	28.9	60.0	50.0	17.7	21.1
5.85152	L1	26.9	14.3	9.9	36.8	24.2	60.0	50.0	23.2	25.8
6.43583	N	28.1	14.6	9.9	38.0	24.5	60.0	50.0	22.0	25.5
6.64311	N	27.4	13.4	9.9	37.3	23.3	60.0	50.0	22.7	26.7
10.09375	N	27.2	17.0	10.1	37.3	27.1	60.0	50.0	22.7	22.9
15.45897	N	15.2	3.3	10.2	25.4	13.5	60.0	50.0	34.6	36.5

Note: Level QP = Reading QP + Factor, Level AV = Reading AV + Factor

(\*) The measured result is below the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to determine compliance at a level of confidence of 95%. However, the measured result indicates a high probability that the tested product complies with the specification limit.

## 6. Photographs of the Test Setup

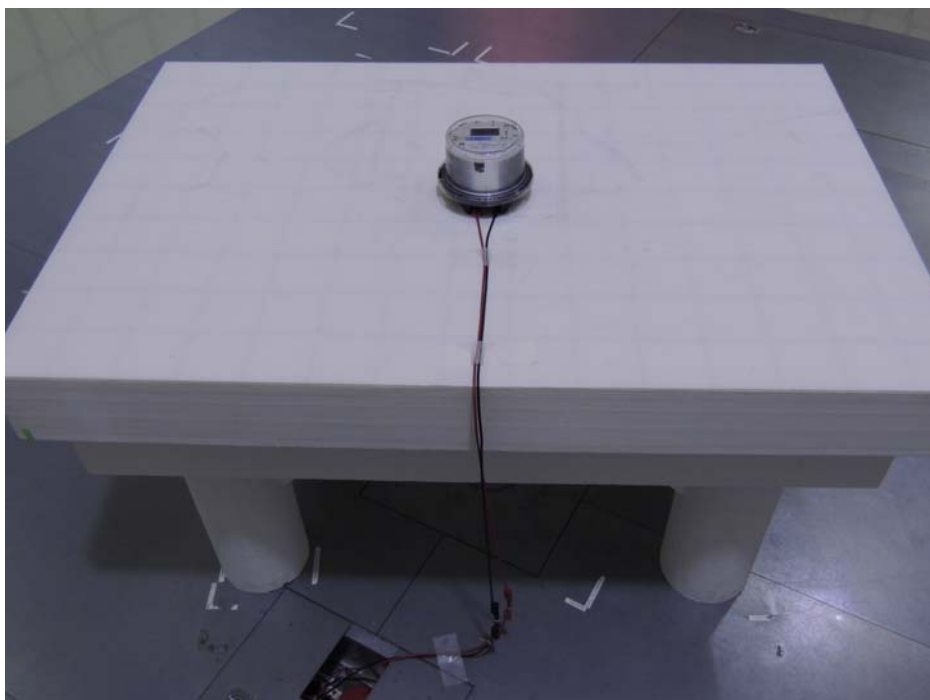
### Photograph 2: Set-up for Conducted Emissions at Antenna Port



**Photograph 3: Set-up for Radiated Emission of Transmitter, Front View**



**Photograph 4: Set-up for Radiated Emission of Transmitter, Rear View**





Produkte  
Products

**Prüfbericht - Nr.:** 12029438 001  
*Test Report No.:*

Seite 65 von 69  
*Page 65 of 69*

**Photograph 5: Set-up for Radiated Emission, EUT Configuration X-Axis**



**Photograph 6: Set-up for Radiated Emission, EUT Configuration Y-Axis**



**Prüfbericht - Nr.:** 12029438 001  
*Test Report No.:*

Seite 66 von 69  
*Page 66 of 69*

**Photograph 7: Set-up for Radiated Emission, EUT Configuration Z-Axis**



**Photograph 8: Set-up for AC Power Line Conducted Emission of Transmitter**



## 7. List of Tables

Table 1: List of Test and Measurement Equipment.....	6
Table 2: Emission Measurement Uncertainty.....	7
Table 3: Interfaces present on the EUT .....	11
Table 4: Conducted Output Power, AC 120V Input Voltage, Antenna 1.....	17
Table 5: Conducted Output Power, AC 120V Input Voltage, Antenna 2.....	18
Table 6: Conducted Output Power, AC 240V Input Voltage, Antenna 1.....	19
Table 7: Conducted Output Power, AC 240V Input Voltage, Antenna 2.....	20
Table 8: 6dB Bandwidth, AC 120V Input Voltage, Antenna 1.....	22
Table 9: 6dB Bandwidth, AC 120V Input Voltage, Antenna 2.....	23
Table 10: 6dB Bandwidth, AC 240V Input Voltage, Antenna 1.....	24
Table 11: 6dB Bandwidth, AC 240V Input Voltage, Antenna 2.....	25
Table 12: 99% Bandwidth, AC 240V Input Voltage, Antenna 1.....	27
Table 13: 99% Bandwidth, AC 240V Input Voltage, Antenna 2.....	28
Table 14: Peak Power Spectral Density, AC 240V Input Voltage, Antenna 1 .....	49
Table 15: Peak Power Spectral Density, AC 240V Input Voltage, Antenna 2 .....	50
Table 16: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode A (2412MHz).....	53
Table 17: Radiated Emissions, Average Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode A (2412MHz).....	53
Table 18: Radiated Emissions, Peak Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode A (2412MHz).....	54
Table 19: Radiated Emissions, Average Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode A (2412MHz).....	54
Table 20: Radiated Emissions, Peak Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode A (2412MHz).....	54
Table 21: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode B (2437MHz).....	55
Table 22: Radiated Emissions, Average Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode B (2437MHz).....	55
Table 23: Radiated Emissions, Peak Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode B (2437MHz).....	56
Table 24: Radiated Emissions, Average Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode B (2437MHz).....	56
Table 25: Radiated Emissions, Peak Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode B (2437MHz).....	56
Table 26: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode C (2462MHz).....	57
Table 27: Radiated Emissions, Average Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode C (2462MHz).....	57
Table 28: Radiated Emissions, Peak Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Host FM25S, AC 120V Input Voltage, Mode C (2462MHz).....	58
Table 29: Radiated Emissions, Average Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode C (2462MHz).....	58
Table 30: Radiated Emissions, Peak Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Host FM2S, AC 240V Input Voltage, Mode C (2462MHz).....	58
Table 31: Radiated Emissions at Band Edge, Average and Peak Data, Horizontal and Vertical Antenna Orientations, Host FM1S, AC 120V Input Voltage, Modes A (2412MHz) and C (2462MHz).....	59
Table 32: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase N (N) and L1 (L), Host FM25S, AC 240V Input Voltage, Mode B (2437MHz) .....	62

## 8. List of Figures

Figure 1: Block Diagram for Conducted Measurements at Antenna Port.....	11
Figure 2: Block Diagram for Radiated Spurious Emissions and AC Power Line Conducted Emissions ....	11
Figure 3: Conducted Output Power, AC 120V Input Voltage, Antenna 1 .....	17
Figure 4: Conducted Output Power, AC 120V Input Voltage, Antenna 2 .....	18
Figure 5: Conducted Output Power, AC 240V Input Voltage, Antenna 1 .....	19
Figure 6: Conducted Output Power, AC 240V Input Voltage, Antenna 2 .....	20
Figure 7: 6dB Bandwidth, AC 120V Input Voltage, Antenna 1 .....	22
Figure 8: 6dB Bandwidth, AC 120V Input Voltage, Antenna 2 .....	23
Figure 9: 6dB Bandwidth, AC 240V Input Voltage, Antenna 1 .....	24
Figure 10: 6dB Bandwidth, AC 240V Input Voltage, Antenna 2 .....	25
Figure 11: 99% Bandwidth, AC 240V Input Voltage, Antenna 1.....	27
Figure 12: 99% Bandwidth, AC 240V Input Voltage, Antenna 2.....	28
Figure 13: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 1, Mode A (2412MHz) .....	30
Figure 14: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 1, Mode A (2412MHz).....	31
Figure 15: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 1, Mode A (2412MHz).....	32
Figure 16: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 1, Mode B (2437MHz) .....	33
Figure 17: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 1, Mode B (2437MHz).....	34
Figure 18: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 1, Mode B (2437MHz).....	35
Figure 19: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 1, Mode C (2462MHz) .....	36
Figure 20: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 1, Mode C (2462MHz).....	37
Figure 21: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 1, Mode C (2462MHz).....	38
Figure 22: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 2, Mode A (2412MHz) .....	39
Figure 23: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 2, Mode A (2412MHz).....	40
Figure 24: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 2, Mode A (2412MHz).....	41
Figure 25: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 2, Mode B (2437MHz) .....	42
Figure 26: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 2, Mode B (2437MHz).....	43
Figure 27: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 2, Mode B (2437MHz).....	44
Figure 28: Conducted Spurious Emissions, 30MHz - 10GHz, AC 240V Input Voltage, Antenna 2, Mode C (2462MHz) .....	45
Figure 29: Conducted Spurious Emissions, 10 - 22GHz, AC 240V Input Voltage, Antenna 2, Mode C (2462MHz).....	46
Figure 30: Conducted Spurious Emissions, 22 - 25GHz, AC 240V Input Voltage, Antenna 2, Mode C (2462MHz).....	47
Figure 31: Power Spectral Density, AC 240V Input Voltage, Antenna 1 .....	49
Figure 32: Power Spectral Density, AC 240V Input Voltage, Antenna 2 .....	50
Figure 33: Radiated Emissions at Band Edge, Spectral Diagram, Host FM1S, AC 120V Input Voltage, Mode A (2412MHz).....	59
Figure 34: Radiated Emissions at Band Edge, Spectral Diagram, Host FM1S, AC 120V Input Voltage, Mode C (2462MHz) .....	60

Produkte  
Products

**Prüfbericht - Nr.:** 12029438 001  
*Test Report No.:*

**Seite 69 von 69**  
*Page 69 of 69*

## 9. List of Photographs

Photograph 1: Test Jig.....	13
Photograph 2: Set-up for Conducted Emissions at Antenna Port.....	63
Photograph 3: Set-up for Radiated Emission of Transmitter, Front View .....	64
Photograph 4: Set-up for Radiated Emission of Transmitter, Rear View .....	64
Photograph 5: Set-up for Radiated Emission, EUT Configuration X-Axis.....	65
Photograph 6: Set-up for Radiated Emission, EUT Configuration Y-Axis.....	65
Photograph 7: Set-up for Radiated Emission, EUT Configuration Z-Axis.....	66
Photograph 8: Set-up for AC Power Line Conducted Emission of Transmitter.....	66