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<i>Test Report No.:</i>		<i>Page 1 of 49</i>
<b>Auftraggeber:</b> <i>Client:</i>	<b>Panasonic Corporation</b> 1-15 Matuso-cho, Kadoma City, Osaka 571-8504, Japan	
<b>Gegenstand der Prüfung:</b> <i>Test item:</i>	<b>2.4 GHz RF Module</b>	
<b>Bezeichnung:</b> <i>Identification:</i>	<b>TNPA4870</b>	<b>Serien-Nr.:</b> <i>Serial No.:</i> <b>FCCIC001</b>
<b>Wareneingangs-Nr.:</b> <i>Receipt No.:</i>	<b>0213085616-1</b>	<b>Eingangsdatum:</b> <i>Date of receipt:</i> <b>2008-12-22</b>
<b>Prüfart:</b> <i>Testing location:</i>	4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan	
<b>Prüfgrundlage:</b> <i>Test specification:</i>	47 CFR Part 15.247 (Subpart: C), October 1, 2007 ANSI C63.4-2003 Measurement of Digital Transmission Systems Operating under Section 15.247  RSS-210 (Issue 7): 2007 RSS-Gen (Issue 2): 2007	
<b>Prüfresultat:</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. - Regional Office West Japan</b> Higashi-Tenma 2-9-1, Kita-ku, Osaka 530-0044, Japan	
<b>geprüft/ tested by:</b>	<b>kontrolliert/ reviewed by:</b>	
2009-02-20 T. Cheung / Inspector	2009-02-20 R. Sehb / Reviewer	
<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>		
Details refer to Section 1: "General Remarks"		
<b>Abkürzungen:</b>	<i>P(ass) = entspricht Prüfgrundlage</i>	<b>Abbreviations:</b> <i>P(ass) = passed</i>
	<i>F(ail) = entspricht nicht Prüfgrundlage</i>	<i>F(ail) = failed</i>
	<i>N/A = nicht anwendbar</i>	<i>N/A = not applicable</i>
	<i>N/T = nicht getestet</i>	<i>N/T = not tested</i>
<p><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></p>		

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## TEST SUMMARY

**3.2.1 VOLTAGE REQUIREMENTS, FCC 15.31(E)**

RESULT: PASS

**3.2.2 ANTENNA REQUIREMENTS, FCC 15.203, FCC 15.204 AND RSS-GEN 7.1.4**

RESULT: PASS

**5.1.1 CONDUCTED OUTPUT POWER AT ANTENNA TERMINALS, FCC 15.247(B)(3) AND RSS-210 A8.4(4)**

RESULT: PASS

**5.1.2 6dB BANDWIDTH, FCC 15.247(A)(2) AND RSS-210 A8.2(A)**

RESULT: PASS

**5.1.3 CONDUCTED SPURIOUS EMISSION, FCC 15.247(D) AND RSS-210 A8.5**

RESULT: PASS

**5.1.4 PEAK POWER SPECTRAL DENSITY, FCC 15.247(E) AND RSS-210 A8.2(B)**

RESULT: PASS

**6.1.1 MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE OF TRANSMITTER, FCC 15.207 AND RSS-GEN §7.2.2**

RESULT: PASS

**7.1.1 BAND EDGE RADIATED EMISSION, FCC 15.247(D) AND RSS- 210 §2.2**

RESULT: Pass

**7.1.2 RADIATED EMISSION, OUT-OF-BAND AND SPURIOUS EMISSION, FCC 15.247(D), FCC 15.205, FCC 15.209, RSS-210 §2.2, RSS-210 A8.5 AND RSS-GEN §7.2.1**

RESULT: PASS

**7.2.1 RADIATED EMISSION OF RECEIVER, FCC 15.109, RSS-210 §2.2, RSS-210 §2.6, RSS-210 A8.5, RSS-GEN §7.2.3.2**

RESULT: PASS

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## 1. General Remarks

### 1.1 Complementary Materials

All attachments are integral parts of 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 Communication Commission has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities 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 facility, and has found these test facilities to be in compliance. The description of the test facility is listed under O.A.T.S filing number 3466B.

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.

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## 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 Conducted Emission</b>					
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2009-02
Peak Power Meter	Agilent	N1911A	MY451013 39	-	2008-12
Wideband Power Sensor (50MHz-18GHz)	Agilent	N1921A	MY452410 19	-	2008-12
<b>For AC Mains Conducted Emission (CE)</b>					
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2009-02
Two-Line V-Network (LISN)	Rohde & Schwarz	ENV216	100276	RF-0016	2009-05
<b>For Radiated Emission (RE)</b>					
Receiver	Rohde & Schwarz	ESU 8	100025	RF-0020	2009-02
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2009-02
RF Selector (10m)	Toyo Corporation	NS4900	0703-182	RF-0029	2009-05
Low Noise Pre-Amplifier	TSJ	MLA-10K01-B01-35	1370750	RF-0253	2009-05
3dB Attenuator 50Ohm	Tamagawa Electronics Co., Ltd.	CFA-01	-	RF-0265	2009-05
Band Reject Filter	Nitsuki	NF-49BT	027	RF-0131	2008-12
Microwave Preamplifier, 1-8GHz	Toyo Corporation	TPA0108-40	0634	RF-0052	2008-12
Trilog Antenna	Schwarzbeck	VULB9168	0245	RF-0019	2009-05
Biconical Antenna	EMCO	3110B	9603-2379	RF-0207	2009-03
Broad Band Horn Antenna (1-10GHz)	Schwarzbeck	BBHA9120B	419	RF-0050	2009-05
Double Ridged Broadband Horn Antenna (2-18GHz)	Toyo Corporation	HAP06-18W	00000025	RF-0065	2009-05
Broad Band Horn Antenna (18-26.5GHz)	Toyo Corporation	HAP18-26N	00000010	RF-0070	2009-05
<b>Constant Voltage Constant Frequency Stabilizers</b>					
CVCF (3m chamber)	NF Corporation	ESU2000S	9067195	RF-0208	N/A
CVCF Booster (3m chamber)	NF Corporation	ESU2000B	9072132	RF-0209	N/A
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

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Kind of Equipment	Manufacturer	Model Name	Serial Number	Equipment ID	Calibrated until
CVCF Booster (10m chamber)	NF Corporation	ESU2000B	9074408	RF-0213	N/A
CVCF (Pulse Test lab)	NF Corporation	ESU2000U	9067195	RF-0122	N/A
CVCF Booster (Pulse Test lab)	NF Corporation	ESU2000B	9072108	RF-0121	N/A

## 2.3 Measurement Uncertainty

**Table 2: Emission Measurement Uncertainty**

Measurement Type	Frequency	Uncertainty
Conducted Emission	150kHz - 30MHz	±2.0dB
Antenna Port Conducted Emissions	< 1GHz	±0.39dB
	> 1GHz	±0.68dB
Radiated Emission	30-1000MHz	±3.9dB

### 3. General Product Information

#### 3.1 Product Function and Intended Use

The **EUT (Equipment Under Test)** is a module built in TV tuner box. It communicates operating information within 2425-2475MHz with the RF remote controller.

#### 3.2 System Details

Radio standard:	IEEE 802.15.4
Specified power output:	0dBm
Antenna gain:	-0.14dBi
Antenna type:	Printed Inverted-F antenna
Mounting type:	Internal
Frequency range:	2425 – 2475 MHz
Number of channel:	3
Channel spacing:	25 MHz
Modulation type:	Offset-QPSK
FCC Classification:	DTS
Classification:	G1D
System Input Voltage:	DC 5V
Protection Class:	II

##### 3.2.1 Voltage Requirements, FCC 15.31(e)

**RESULT:** **PASS**

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

##### 3.2.2 Antenna Requirements, FCC 15.203, FCC 15.204 and RSS-Gen 7.1.4

**RESULT:** **PASS**

The EUT has an Printed Inverted-F antenna.

### 3.3 Clock Frequencies

The EUT generates internally the following clock frequencies:

Frequency	Source
16MHz	Crystal unit

### 3.4 Independent Operation Modes

The system was configured for testing 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. Testing was performed at the lowest operating frequency (2425 MHz), the operating frequency in the middle of the specified frequency band (2450 MHz) and the highest operating frequency (2475 MHz).

- A. EUT transmits at lowest Channel (2425 MHz)
- B. EUT transmits at middle Channel (2450 MHz)
- C. EUT transmits at highest Channel (2475 MHz)
- D. EUT receives packets with 802.15.4 radio

### 3.5 Noise Suppressing Parts

Refer to the schematic

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

### **4.1 Test Methodology**

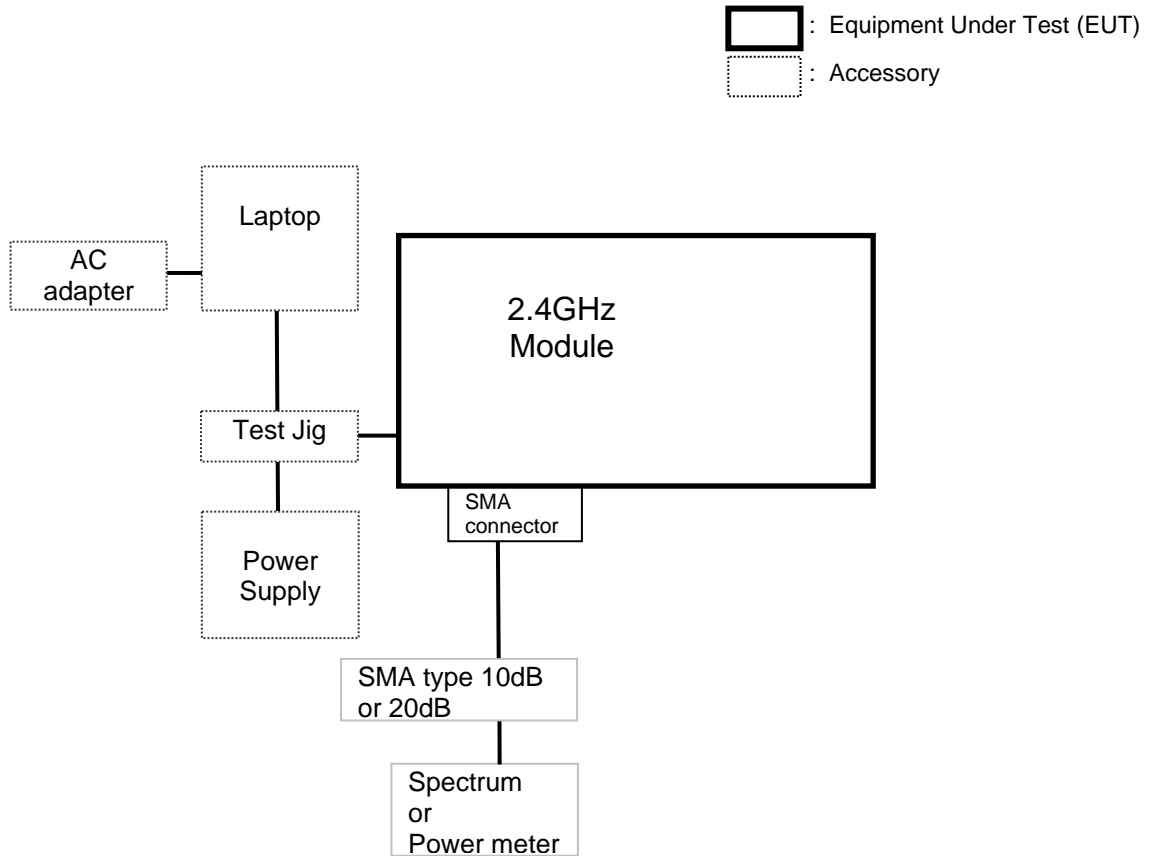
The test methodology used is based on the requirements of 47 CFR Part 15, sections 15.31, 15.33, 15.35, 15.205, 15.209 and Measurement of Digital Transmission Systems Operating under Section 15.247.

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

For details, see under each test item.

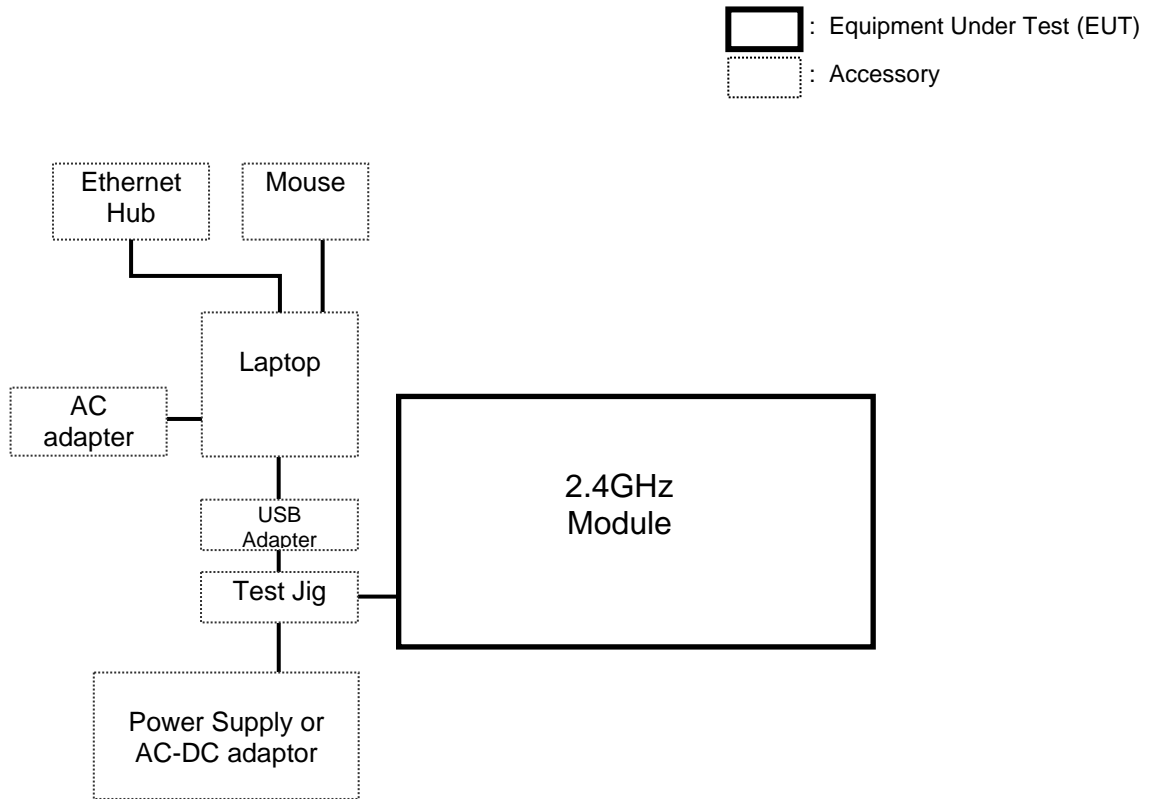
## 4.2 Physical Configuration for Testing

**Figure 1: Test setup of Conducted testing**



*Remark: The laptop and the AC adapter are used for setting operation mode, which would be taken out during the testing.*

**Figure 2: Test setup of Conducted and Radiated emission testing**



*Remark: AC input power ports of Ethernet Hub is not shown.*

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

### 4.3 Test Operation and Test Software

Following software were used for testing provided by Panasonic Corporation.

Tera Term Professional, Version 4.58

Above software as running on the external PC performing continuous radio communication of the EUT with the WLAN Access Point, and data process (Digital Interface) was disable. It was used to enable on the EUT the test operation mode specified in section 3.4 as appropriate.

## 4.4 Special Accessories and Auxiliary Equipment

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

1. Product: Personal Computer  
Manufacturer: IBM  
Model: 2684-KAU  
Rated voltage: AC120V/60Hz  
Input current: 1.5A  
Frequency: -  
Serial number: 99-DAY98
  
2. Product: AC Adapter  
Manufacturer: IBM  
Model: 08K5204  
Rated voltage: AC120V  
Frequency: 60Hz  
Serial number: 11S08K824Z1Z6LV45B51U
  
3. Product: HUB Buffalo  
Manufacturer: Buffalo  
Model: LSW3-GT-5NS  
Rated voltage: AC120V  
Input power: 5W  
Frequency: 60Hz  
Serial number: 16485784211186
  
4. Product: Mouse  
Manufacturer: Dell  
Model: MOC5UO  
Rated voltage: USB  
Input current: -  
Frequency: -  
Serial number: H0A01H36
  
5. Product: DC Power Supply  
Manufacturer: HP  
Model: E3631A  
Rated voltage: AC 100V  
Input current: 210VA  
Frequency: 50Hz  
Serial number: KR92920296

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6. Product: Test Jig  
Manufacturer: -  
Model: -  
Rated voltage: -  
Input current: -  
Frequency: -  
Serial number: -
7. Product: iPod USB Power Adapter  
Manufacturer: Foxlink Technology Ltd.  
Model: A1205 W005B050  
Rated voltage: AC 100-240V  
Input current: 0.15A  
Frequency: 50/60Hz  
Protection class:II  
Serial number: 2B6428SEFVURA

#### **4.5 Countermeasures to achieve EMC Compliance**

No additional measures were employed to achieve compliance.

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## 5. Test Results Conducted Testing at Antenna Port

For conducted tests, the antenna was replaced by a 50Ω antenna connector.

### 5.1.1 Conducted Output Power at Antenna Terminals, FCC 15.247(b)(3) and RSS-210 A8.4(4)

**RESULT: PASS**

Date of testing: 2008-12-22

Ambient temperature: 22 °C  
 Relative humidity: 43 %  
 Atmospheric pressure: 1004hPa

**Requirements:**

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

**Test procedure:**

ANSI C63.4-2003, RSS-Gen 4.8 and Measurement of Digital Transmission Systems Operating under Section 15.247.

The maximum peak output power (conducted) was measured directly at the antenna connector with the power meter. The final measurement takes into account the loss generated by the short cable provided by the EUT manufacturer to support the antenna connector.

The highest emission amplitudes relative to the appropriate limit were recorded in this report.

**Table 3: Conducted Output Power**

Power (dBm), DSSS, Peak					
	Reading	Cable Loss	Output	Limit	Margin
Lo (2425MHz)	-3.62	0.50	-3.12	30.00	33.12
Mid (2450MHz)	-3.78	0.50	-3.28	30.00	33.28
Hi (2475MHz)	-3.52	0.50	-3.02	30.00	33.02

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### 5.1.2 6dB Bandwidth, FCC 15.247(a)(2) and RSS-210 A8.2(a)

**RESULT:**

**PASS**

Date of testing: 2008-12-22

Ambient temperature: 22 °C

Relative humidity: 43 %

Atmospheric pressure: 1004hPa

Requirements:

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

Test procedure:

ANSI C63.4-2003, RSS-Gen 4.6.2

The antenna connector was connected to a spectrum analyzer. The spectrum analyzer resolution bandwidth was set to 1% of the SPAN (10MHz). The 6dB Bandwidth was measured by using the DELTA MARKER function of the analyzer.

**Table 4: 6dB Bandwidth**

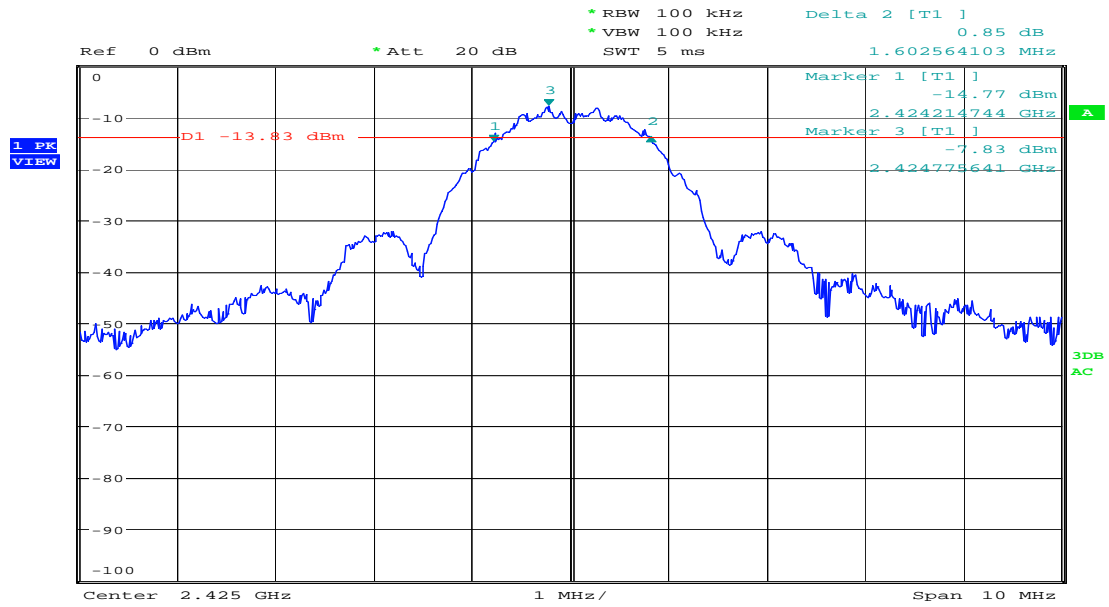
Frequency [MHz]	6dB Bandwidth [MHz]	Minimum Limit [kHz]
2425	1.60	500
2450	1.60	500
2475	1.67	500

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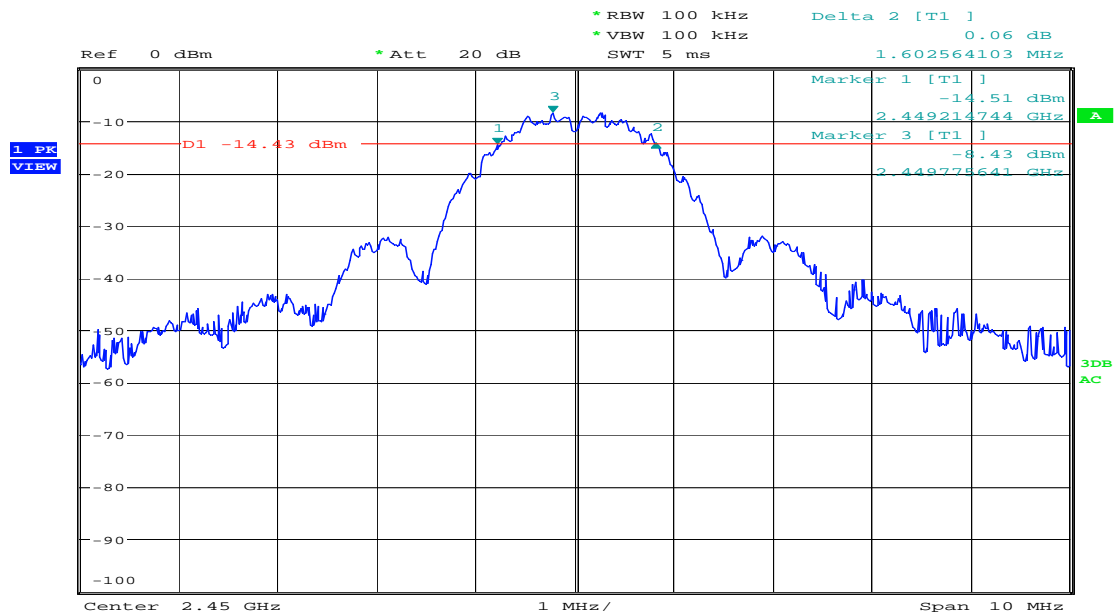
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**Figure 3: 6dB Bandwidth, Mode A (2425MHz)**



6dB bandwidth, lower channel  
 Date: 22.DEC.2008 11:45:33

**Figure 4: 6dB Bandwidth, Mode B (2450MHz)**



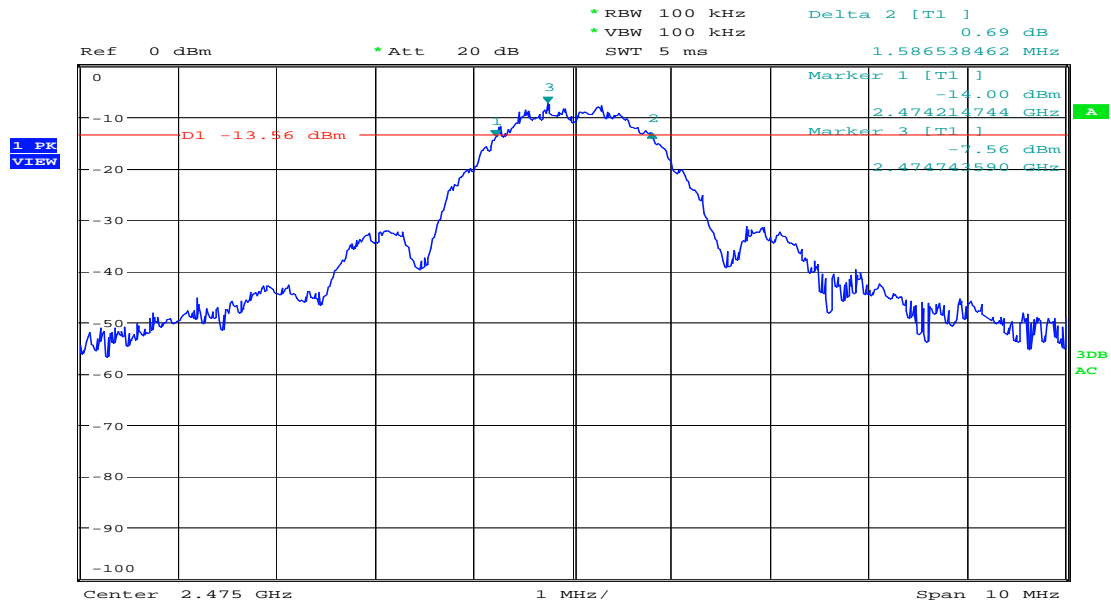
6dB bandwidth, middle channel  
 Date: 22.DEC.2008 13:18:11

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Figure 5: 6dB Bandwidth, Mode C (2475MHz)



6dB bandwidth highest channel  
Date: 20.JAN.2009 10:17:51

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**5.1.3 Conducted Spurious Emission, FCC 15.247(d) and RSS-210 A8.5**

**RESULT: PASS**

Date of testing: 2008-12-22

Ambient temperature: 22 °C  
 Relative humidity: 43 %  
 Atmospheric pressure: 1004hPa

Requirements:

In any 100 kHz bandwidth outside the frequency band, the RF power shall be at least 20 dBc below that of the maximum in-band 100 kHz emission.

Test procedure:

ANSI C63.4-2003, RSS-Gen 4.9 and Measurement of Digital Transmission Systems Operating under Section 15.247.

A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 100 kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 30 MHz to 25 GHz (10<sup>th</sup> harmonics).

The final measurement takes into account the loss generated by all the involved cables.

**Table 5: Conducted Spurious Emission, Mode A (2425MHz)**

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
74.23	-63.53	0.22	-63.31	-28.44	34.86
2425.20	-9.38	0.94	-8.44	N/A	N/A
1931.20	-50.02	0.87	-49.15	-28.44	20.70
2418.00	-52.28	0.94	-51.34	-28.44	22.90
4851.60	-43.23	1.20	-42.03	-28.44	13.59
7276.50	-57.17	1.42	-55.75	-28.44	27.30
9702.00	-61.67	1.76	-59.91	-28.44	31.46
18827.00	-65.62	2.21	-63.41	-28.44	34.97
22608.50	-65.07	2.26	-62.81	-28.44	34.37

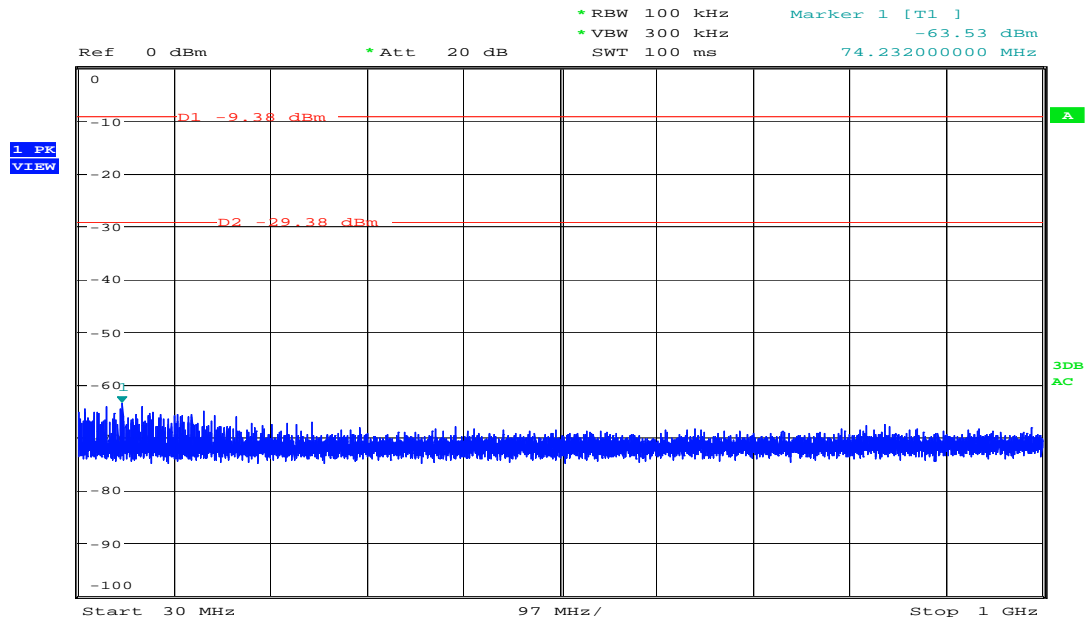
Notes: Limit = Reading of fundamental + Correction factor – 20dB  
 Emission level = Reading + Correction factor  
 Correction factor = Total cable loss

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 Products

Prüfbericht - Nr.: **12307581 001**  
 Test Report No.:

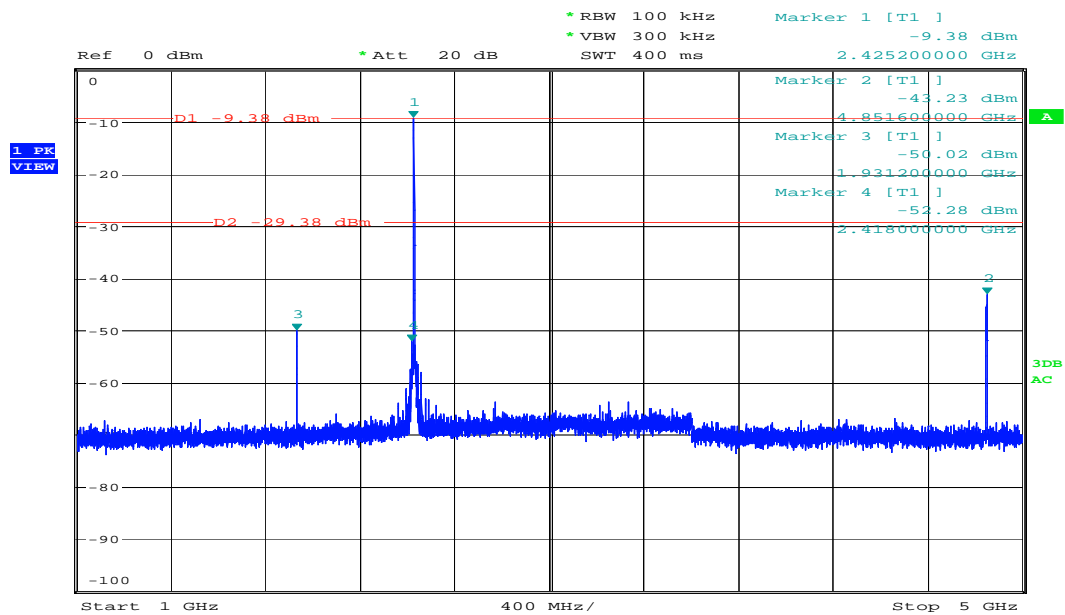
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Figure 6: Spurious Emission from 30MHz to 1GHz, Mode A (2425MHz)



Spurious, lowest channel  
 Date: 22.DEC.2008 13:49:27

Figure 7: Spurious Emission from 1 to 5GHz, Mode A (2425MHz)



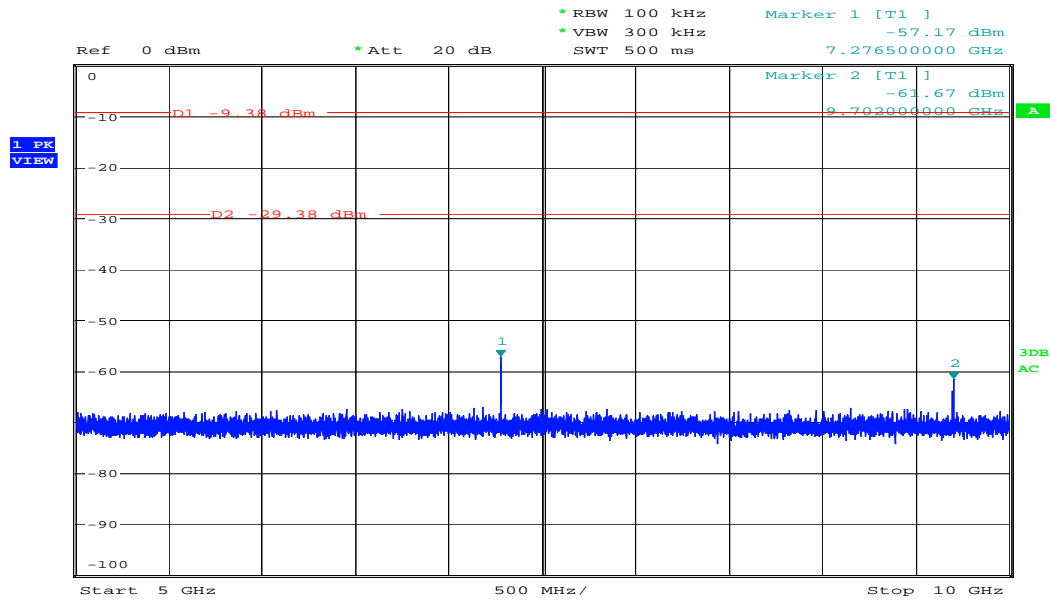
Spurious, lowest channel  
 Date: 22.DEC.2008 13:47:52

Produkte  
Products

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Test Report No.:

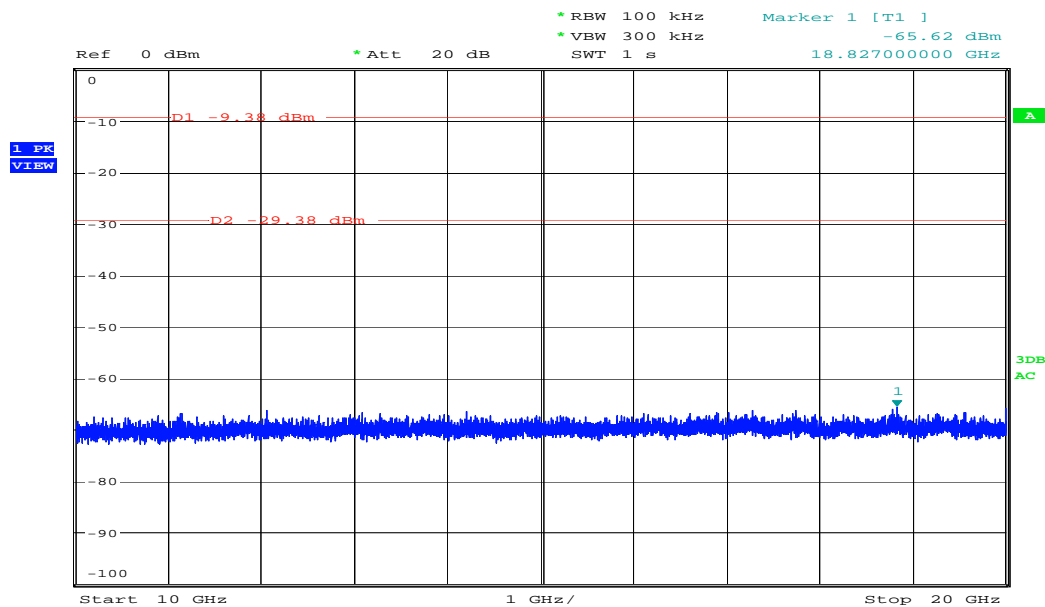
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Figure 8: Spurious Emission from 5 to 10GHz, Mode A (2425MHz)



Spurious, lowest channel  
Date: 22.DEC.2008 13:51:44

Figure 9: Spurious Emission from 10 to 20GHz, Mode A (2425MHz)



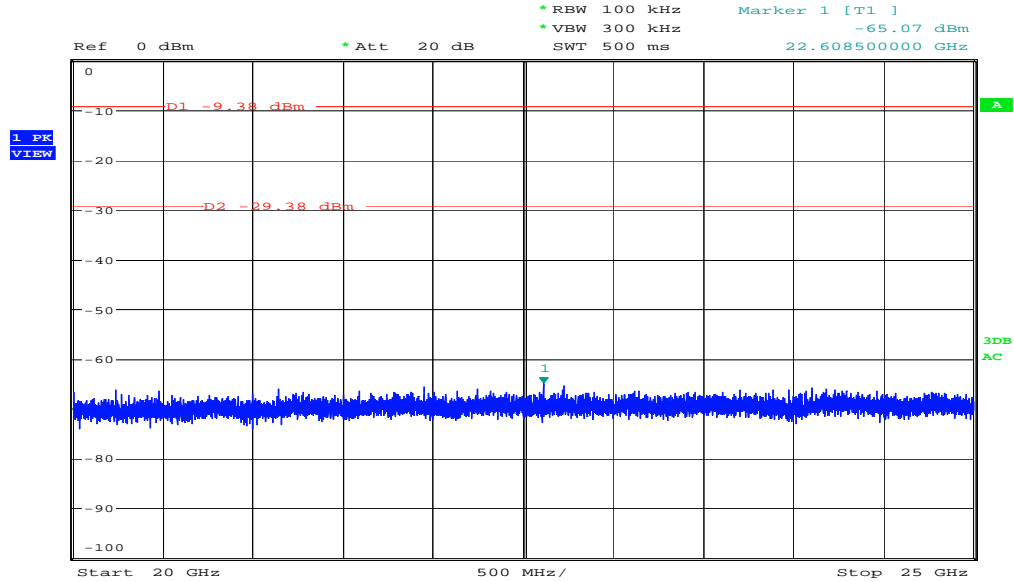
Spurious, lowest channel  
Date: 22.DEC.2008 13:53:45

Produkte  
Products

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Figure 10: Spurious Emission from 20 to 25GHz, Mode A (2425MHz)



Spurious, lowest channel  
Date: 22.DEC.2008 13:54:54

Produkte  
 Products

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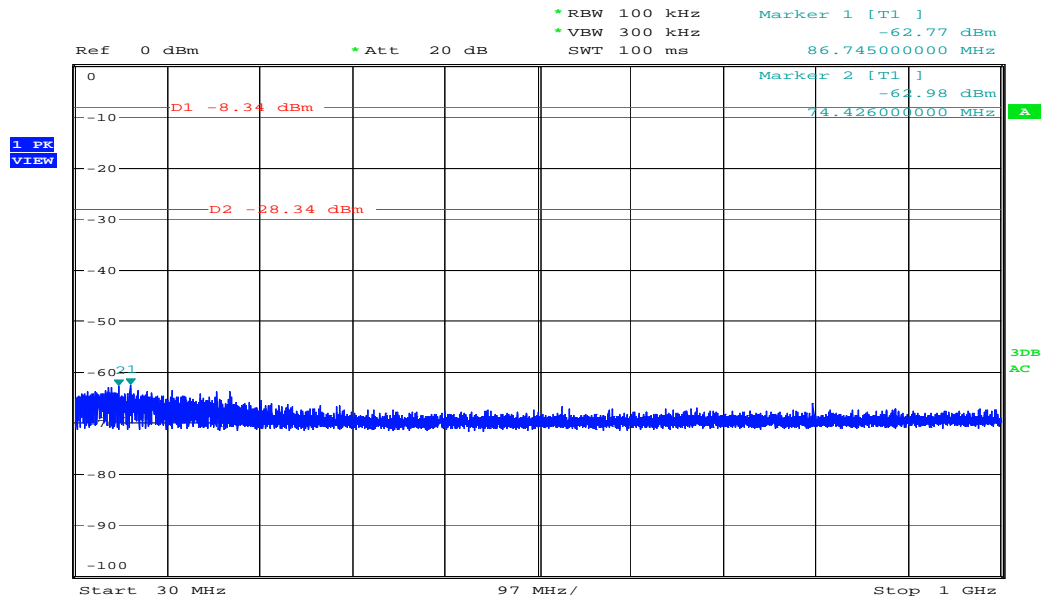
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**Table 6: Conducted Spurious Emissions, Mode B (2450MHz)**

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
86.75	-62.77	0.23	-62.54	-27.40	35.14
74.43	-62.98	0.22	-62.76	-27.40	35.36
2449.60	-8.34	0.94	-7.40	N/A	N/A
1931.60	-57.94	0.87	-57.07	-27.40	29.67
2482.40	-57.66	0.95	-56.71	-27.40	29.31
4899.20	-42.76	1.24	-41.52	-27.40	14.12
7352.00	-57.06	1.45	-55.61	-27.40	28.21
9798.50	-63.69	1.78	-61.91	-27.40	34.51
17307.00	-65.28	2.02	-63.26	-27.40	35.86
24237.00	-65.02	2.51	-62.51	-27.40	35.11

Notes: Limit = Reading of fundamental + Correction factor – 20dB  
 Emission level = Reading + Correction factor  
 Correction factor = Total cable loss

**Figure 11: Spurious Emission from 30MHz to 1GHz, Mode B (2450MHz)**



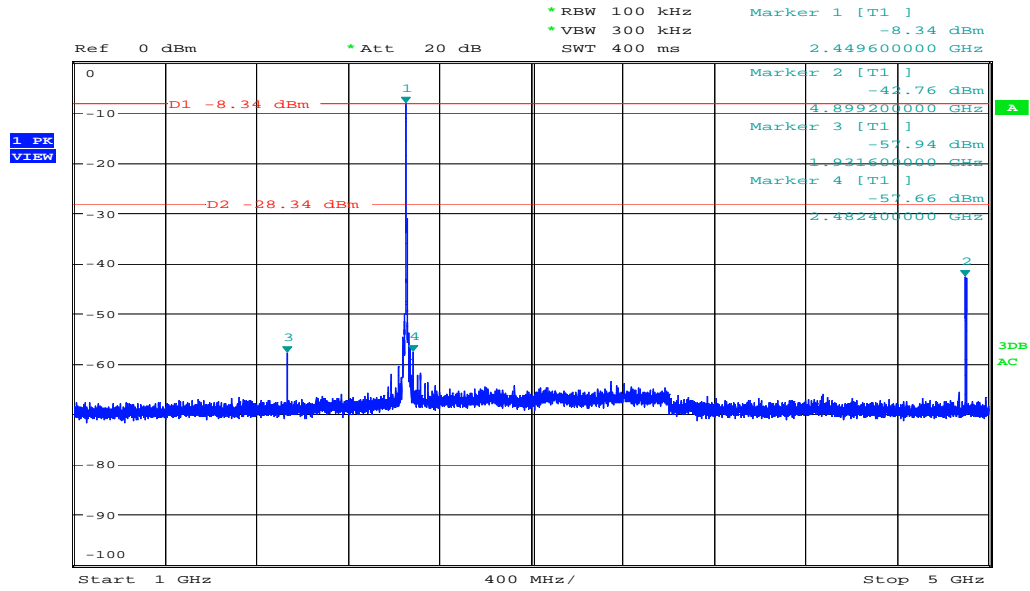
Spurious, middle channel  
 Date: 22.DEC.2008 13:34:38

Produkte  
 Products

**Prüfbericht - Nr.: 12307581 001**  
 Test Report No.:

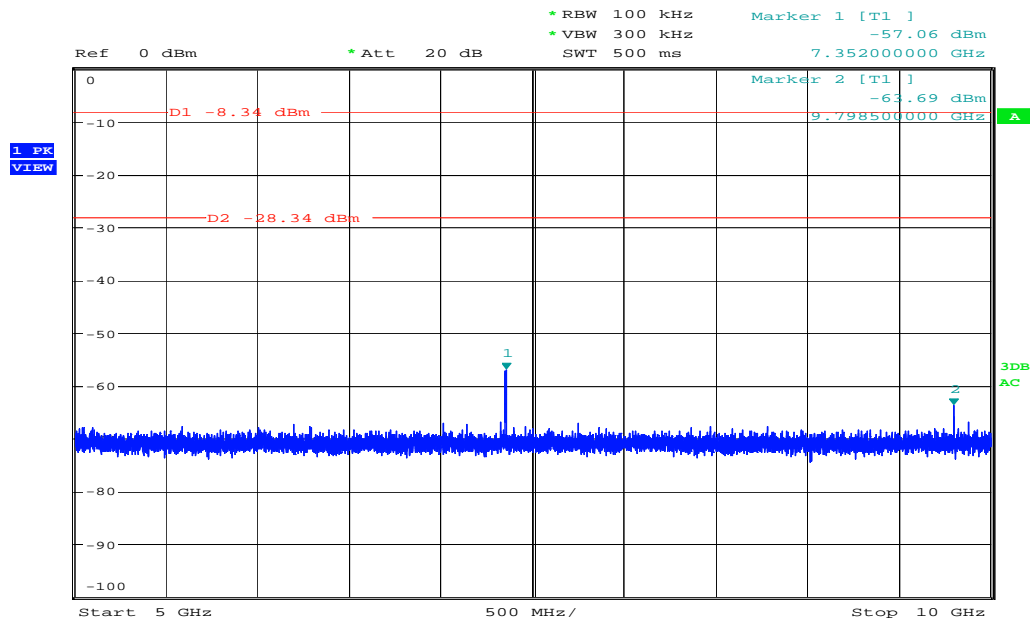
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**Figure 12: Spurious Emission from 1 to 5GHz, Mode B (2450MHz)**



Spurious, middle channel  
 Date: 22.DEC.2008 13:28:47

**Figure 13: Spurious Emission from 5 to 10GHz, Mode B (2450MHz)**



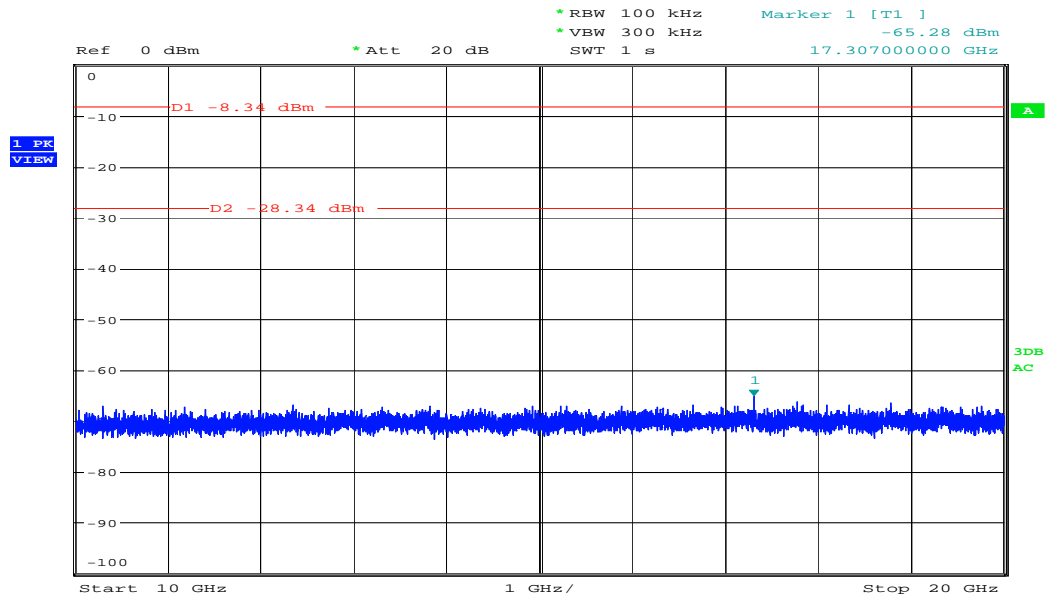
Spurious, middle channel  
 Date: 22.DEC.2008 13:36:54

Produkte  
Products

Prüfbericht - Nr.: 12307581 001  
Test Report No.:

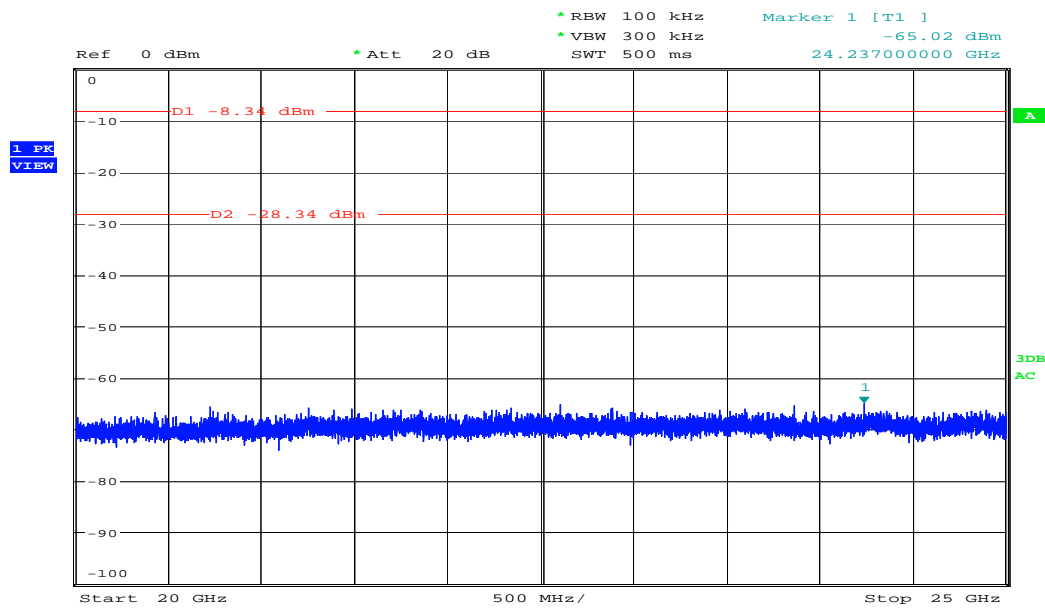
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Figure 14: Spurious Emission from 10 to 20GHz, Mode B (2450MHz)



Spurious, middle channel  
Date: 22.DEC.2008 13:39:01

Figure 15: Spurious Emission from 20 to 25GHz, Mode B (2450MHz)



Spurious, middle channel  
Date: 22.DEC.2008 13:40:40

Produkte  
 Products

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 Test Report No.:

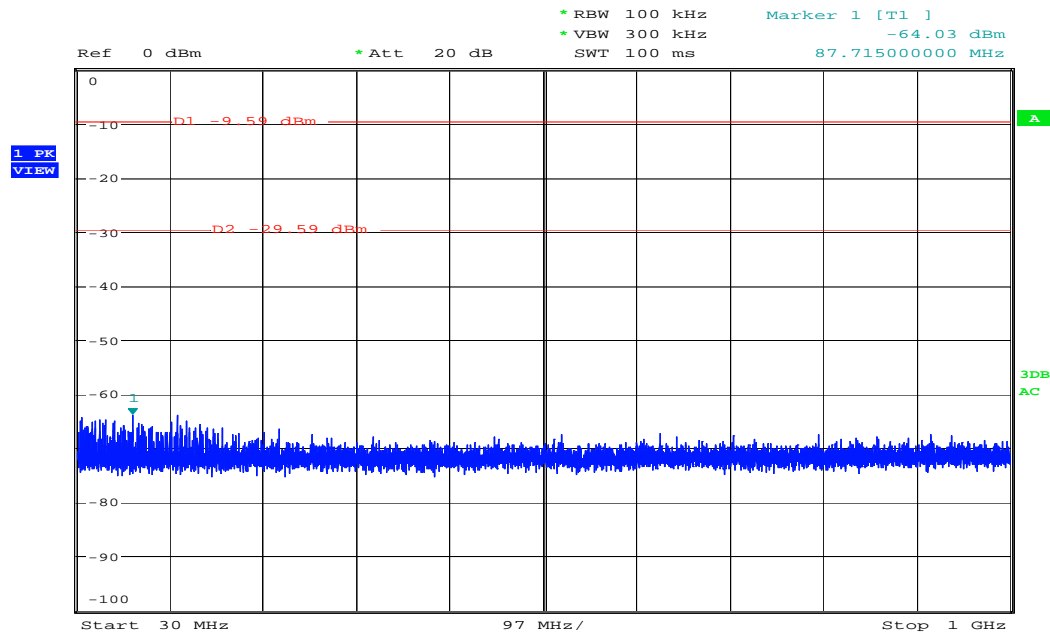
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**Table 7: Conducted Spurious Emissions, Mode C (2475MHz)**

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
87.72	-64.03	0.23	-63.80	-28.64	35.17
2475.00	-9.59	0.95	-8.64	N/A	N/A
4951.60	-42.43	1.41	-41.02	-28.64	12.39
7426.50	-55.52	1.44	-54.08	-28.64	25.45
9898.50	-64.21	1.78	-62.43	-28.64	33.79
18781.00	-66.46	2.28	-64.18	-28.64	35.55
22681.00	-65.46	2.14	-63.32	-28.64	34.69

Notes: Limit = Reading of fundamental + Correction factor – 20dB  
 Emission level = Reading + Correction factor  
 Correction factor = Total cable loss

**Figure 16: Spurious Emission from 30MHz to 1GHz, Mode C (2475MHz)**



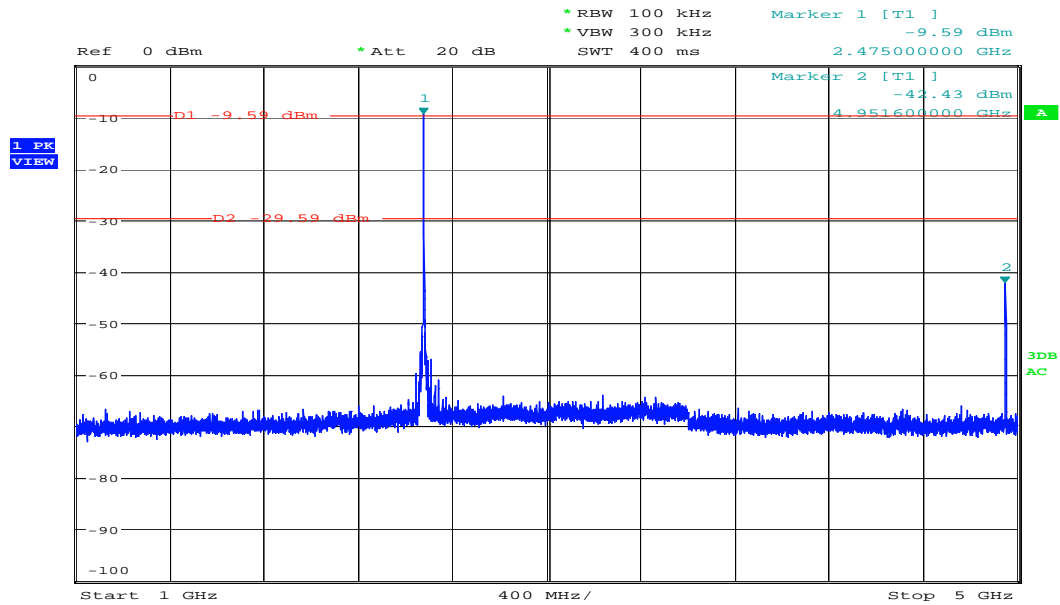
Spurious, highest channel  
 Date: 22.DEC.2008 14:06:33

Produkte  
Products

Prüfbericht - Nr.: 12307581 001  
Test Report No.:

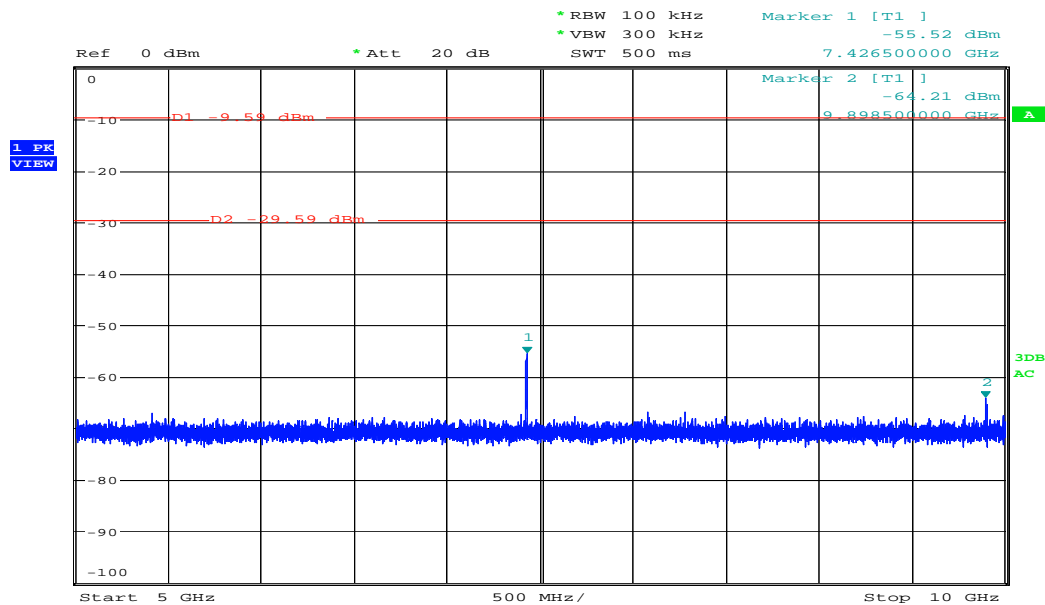
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Figure 17: Spurious Emission from 1 to 5GHz, Mode C (2475MHz)



Spurious, highest channel  
Date: 22.DEC.2008 14:04:52

Figure 18: Spurious Emission from 5 to 10GHz, Mode C (2475MHz)



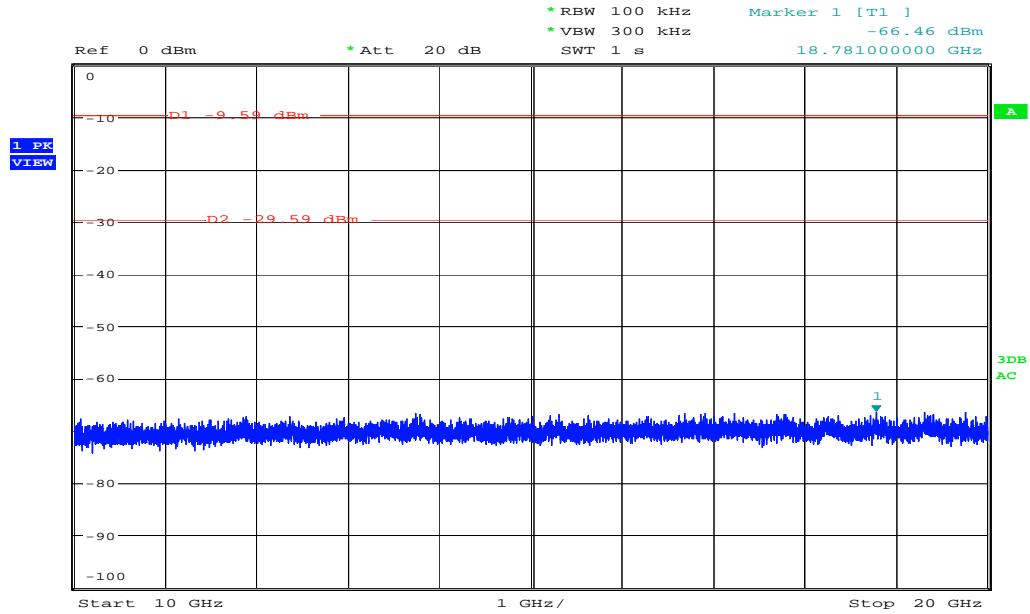
Spurious, highest channel  
Date: 22.DEC.2008 14:07:46

Produkte  
Products

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Test Report No.:

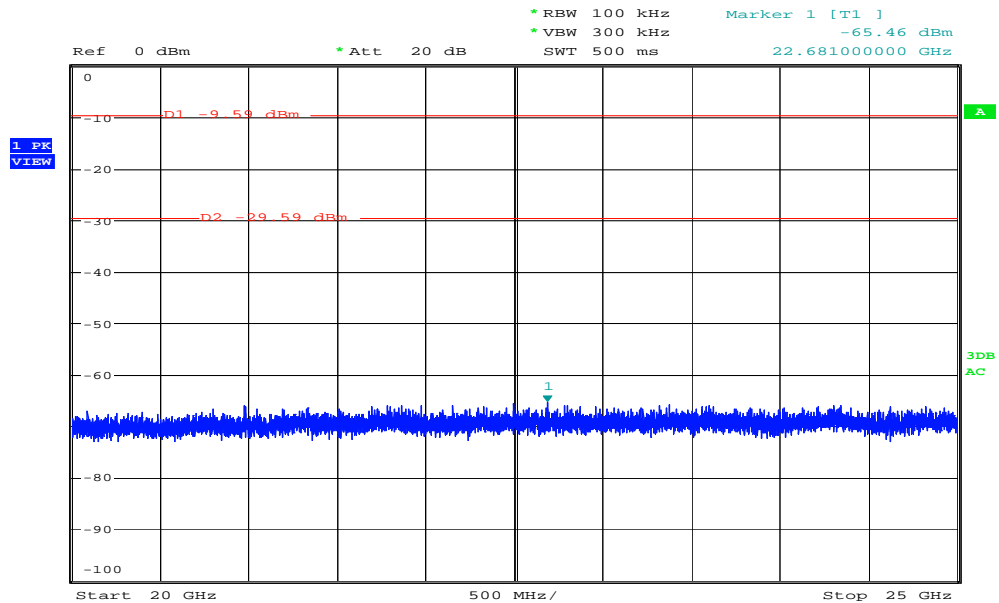
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Figure 19: Spurious Emission from 10 to 20GHz, Mode C (2475MHz)



Spurious, highest channel  
Date: 22.DEC.2008 14:09:13

Figure 20: Spurious Emission from 20 to 25GHz, Mode C (2475MHz)



Spurious, highest channel  
Date: 22.DEC.2008 14:12:16

Produkte  
Products

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### 5.1.4 Peak Power Spectral Density, FCC 15.247(e) and RSS-210 A8.2(b)

**RESULT:**

**PASS**

Date of testing: 2008-12-22

Ambient temperature: 22 °C  
Relative humidity: 43 %  
Atmospheric pressure: 1004hPa

**Requirements:**

For digitally modulated systems, the power spectral density 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 Measurement of Digital Transmission Systems Operating under Section 15.247.

A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 3kHz. The Video Bandwidth was set to 10kHz, and the sweep time was set to 500sec.

The final measurement takes into account the loss generated by all the involved cables.

**Table 8: Peak Power Spectral Density**

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Power Density [dBm]	Limit [dBm]	Margin [dB]
2425.23	-17.23	0.94	-16.29	8.00	24.29
2450.23	-17.12	0.94	-16.18	8.00	24.18
2475.23	-16.97	0.95	-16.02	8.00	24.02

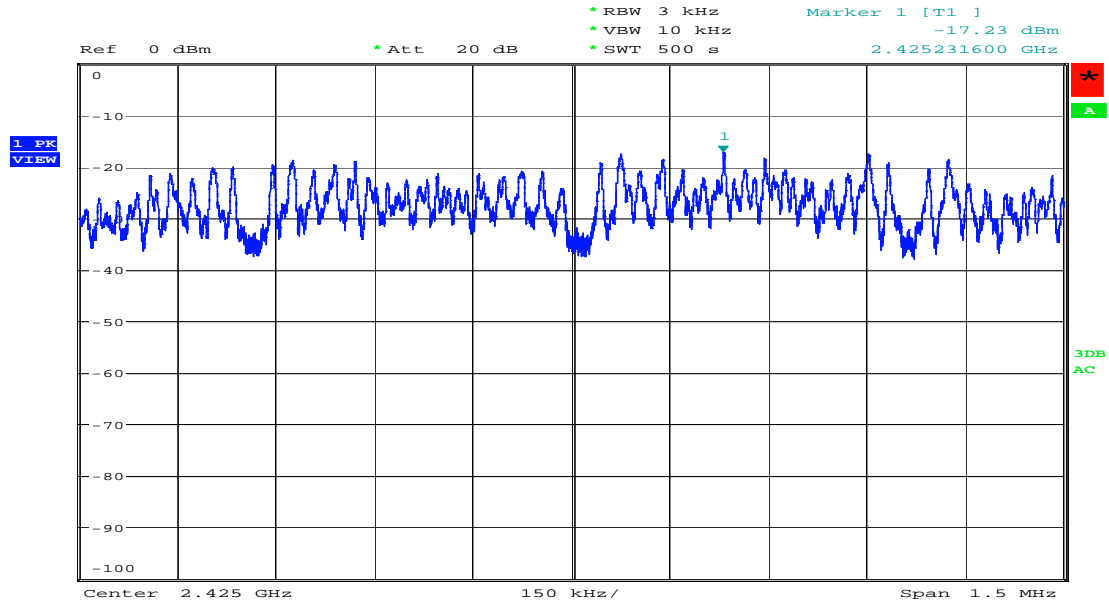
Notes: Power density = Reading + Correction factor  
Correction factor = Total cable loss

Produkte  
Products

Prüfbericht - Nr.: 12307581 001  
Test Report No.:

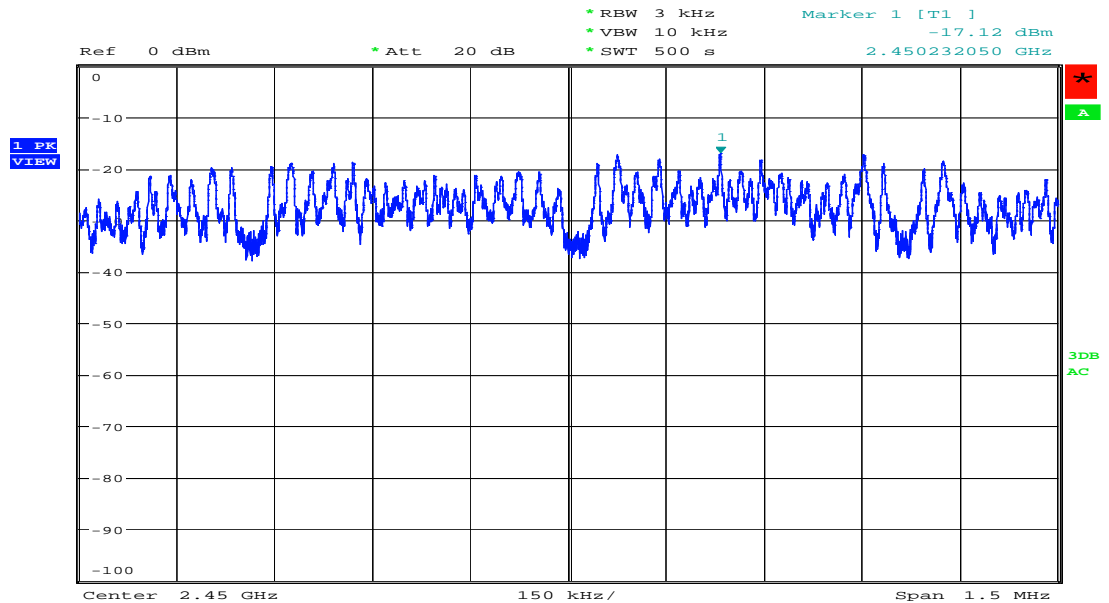
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Figure 21: Power Spectral Density, Mode A (2425MHz)



Peak Power Spectral Density, highest channel  
Date: 22.DEC.2008 14:46:02

Figure 22: Power Spectral Density, Mode B (2450MHz)



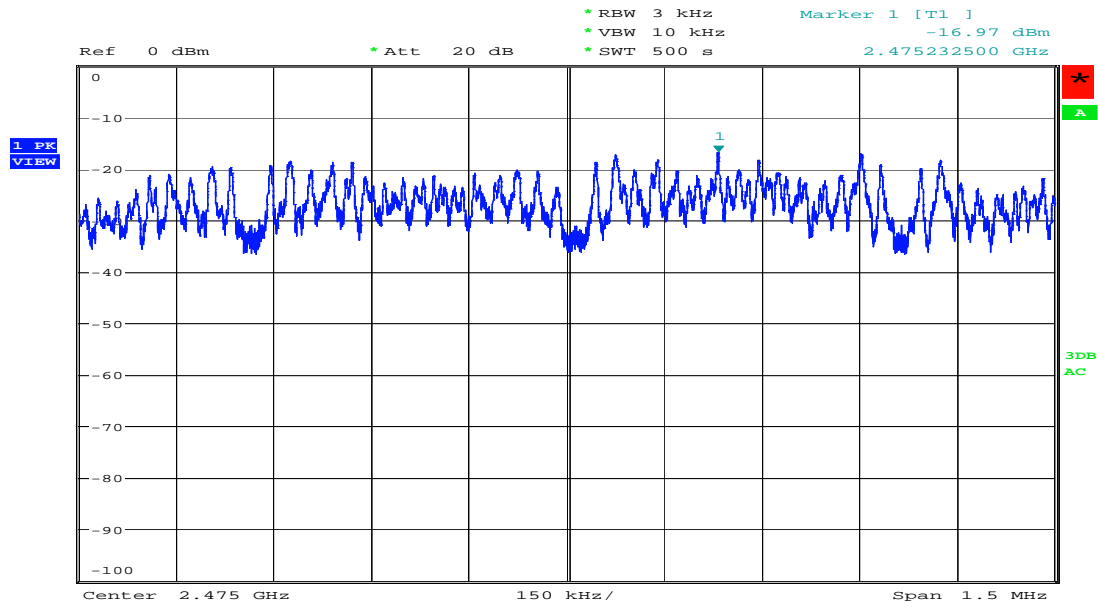
Peak Power Spectral Density, Middle channel  
Date: 22.DEC.2008 14:57:13

Produkte  
Products

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Figure 23: Power Spectral Density, Mode C (2475MHz)



Peak Power Spectral Density, highest channel  
Date: 22.DEC.2008 14:33:43

## 6. Test Results AC Mains Conducted Emission

### 6.1 AC Mains Conducted Emission of Transmitter

#### 6.1.1 Mains Terminal Continuous Disturbance Voltage of Transmitter, FCC 15.207 and RSS-Gen §7.2.2

**RESULT:** **PASS**

Date of testing:	2008-02-20
Ambient temperature:	25°C
Relative humidity:	22%
Atmospheric pressure:	989hPa
Frequency range:	0.15 – 30MHz
Kind of test site:	Shielded Room

**Requirements:**

The AC power line on any frequency within the band 150 kHz to 30MHz shall not exceed the limits specified in FCC 15.207 and RSS-Gen 7.2.2.

**Test procedure:**

ANSI C63.4-2003 and RSS-Gen 7.2.2

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

The EUT was powered by the AC-DC adaptor connected to a Line Impedance Stabilization Network (LISN) / Artificial Mains Network (AMN).

The measurements were performed using a CISPR quasi-peak detector and average detector.

Disturbances other than those mentioned are small or not detectable.

Produkte  
 Products

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**Table 9: Conducted Emission, 150kHz – 30MHz, Quasi Peak and Average Data, Phase N (N) and L1 (L), Mode A**

Freq. [MHz]	Phase	Reading QP [dB(µV)]	Reading AV [dB(µV)]	Factor [dB]	Level QP [dB(µV)]	Level AV [dB(µV)]	Limit QP [dB(µV)]	Limit AV [dB(µV)]	Margin QP [dB]	Margin AV [dB]
0.15	L1	29.0	16.8	9.6	38.6	26.4	66.0	56.0	27.4	29.6
0.46	N	29.9	21.7	9.7	39.6	31.4	56.6	46.6	17.0	15.2
0.47	L1	30.9	23.6	9.7	40.6	33.3	56.6	46.6	16.0	13.3
2.42	N	20.9	11.2	9.8	30.7	21.0	56.0	46.0	25.3	25.0
2.47	N	21.4	12.5	9.8	31.2	22.3	56.0	46.0	24.8	23.7
2.50	L1	21.0	13.7	9.8	30.8	23.5	56.0	46.0	25.2	22.5
8.28	L1	26.0	15.0	10.0	36.0	25.0	60.0	50.0	24.0	25.0
8.30	N	24.3	14.1	10.0	34.3	24.1	60.0	50.0	25.7	25.9

Notes: Level QP = Reading QP + Factor  
 Level AV = Reading AV + Factor

**Table 10: Conducted Emission, 150kHz – 30MHz, Quasi Peak and Average Data, Phase N (N) and L1 (L), Mode C**

Freq. [MHz]	Phase	Reading QP [dB(µV)]	Reading AV [dB(µV)]	Factor [dB]	Level QP [dB(µV)]	Level AV [dB(µV)]	Limit QP [dB(µV)]	Limit AV [dB(µV)]	Margin QP [dB]	Margin AV [dB]
0.16	N	28.5	17.0	9.6	38.1	26.6	65.5	55.5	27.4	28.9
0.19	L1	26.0	15.3	9.6	35.6	24.9	63.8	53.8	28.2	28.9
0.19	N	25.9	15.1	9.6	35.5	24.7	63.8	53.8	28.3	29.1
0.24	L1	24.8	13.8	9.6	34.4	23.4	62.2	52.2	27.8	28.8
0.46	L1	31.1	23.8	9.7	40.8	33.5	56.6	46.6	15.8	13.1
0.47	N	33.1	23.6	9.7	42.8	33.3	56.5	46.5	13.7	13.2
2.42	N	23.0	12.5	9.8	32.8	22.3	56.0	46.0	23.2	23.7
2.47	L1	21.8	13.6	9.8	31.6	23.4	56.0	46.0	24.4	22.6
8.33	N	30.8	19.2	10.0	40.8	29.2	60.0	50.0	19.2	20.8
8.39	L1	24.2	13.5	10.0	34.2	23.5	60.0	50.0	25.8	26.5

Notes: Level QP = Reading QP + Factor  
 Level AV = Reading AV + Factor

**Table 11: Conducted Emission, 150kHz – 30MHz, Quasi Peak and Average Data, Phase N (N) and L1 (L), Mode D**

Freq. [MHz]	Phase	Reading QP [dB(µV)]	Reading AV [dB(µV)]	Factor [dB]	Level QP [dB(µV)]	Level AV [dB(µV)]	Limit QP [dB(µV)]	Limit AV [dB(µV)]	Margin QP [dB]	Margin AV [dB]
0.16	N	35.4	23.7	9.6	45.0	33.3	65.7	55.7	20.7	22.4
0.16	L1	35.6	23.7	9.6	45.2	33.3	65.6	55.6	20.4	22.3
0.20	L1	33.3	23.1	9.6	42.9	32.7	63.7	53.7	20.8	21.0
0.23	L1	33.2	23.8	9.6	42.8	33.4	62.3	52.3	19.5	18.9
0.24	N	33.4	23.7	9.6	43.0	33.3	62.2	52.2	19.2	18.9
0.46	N	32.6	23.7	9.7	42.3	33.4	56.6	46.6	14.3	13.2
0.47	L1	33.1	23.9	9.7	42.8	33.6	56.5	46.5	13.7	12.9
2.44	N	23.3	13.2	9.8	33.1	23.0	56.0	46.0	22.9	23.0
8.41	N	30.7	19.0	10.0	40.7	29.0	60.0	50.0	19.3	21.0
8.42	L1	28.3	16.6	10.0	38.3	26.6	60.0	50.0	21.7	23.4

Notes: Level QP = Reading QP + Factor  
 Level AV = Reading AV + Factor

## 7. Test Results Radiated Emission

### 7.1 Radiated Emission of Transmitter

#### 7.1.1 Band Edge Radiated Emission, FCC 15.247(d) and RSS- 210 §2.2

**RESULT:** **Pass**

Date of testing:	2009-02-04	2009-02-19
Ambient temperature:	23°C	21°C
Relative humidity:	24%	27%
Atmospheric pressure:	1008hPa	1016hPa
Measurement distance:	3m	
Kind of test site:	Semi Anechoic Chamber	

**Requirements:**

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-210 §2.7 (Table 1), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-210 §2.7 (Table 2 and 3).

**Test procedure:**

ANSI C63.4-2003, RSS-Gen §4.9, §4.10 and Measurement of Digital Transmission Systems Operating under Section 15.247

Measurements were made in a Semi Anechoic Chamber at a measurement distance of 3m. The EUT was placed on a nonconductive turntable 0.8m above the ground plane. The EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level.

Measurements were taken using both horizontal and vertical antenna polarizations for 3 orientations (X, Y and Z) of the EUT.

Peak (1 MHz RBW/VBW) and average (1 MHz RBW/10 Hz VBW) radiated measurements were taken with a suitable span to encompass the peak of the fundamental.

The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Produkte  
 Products

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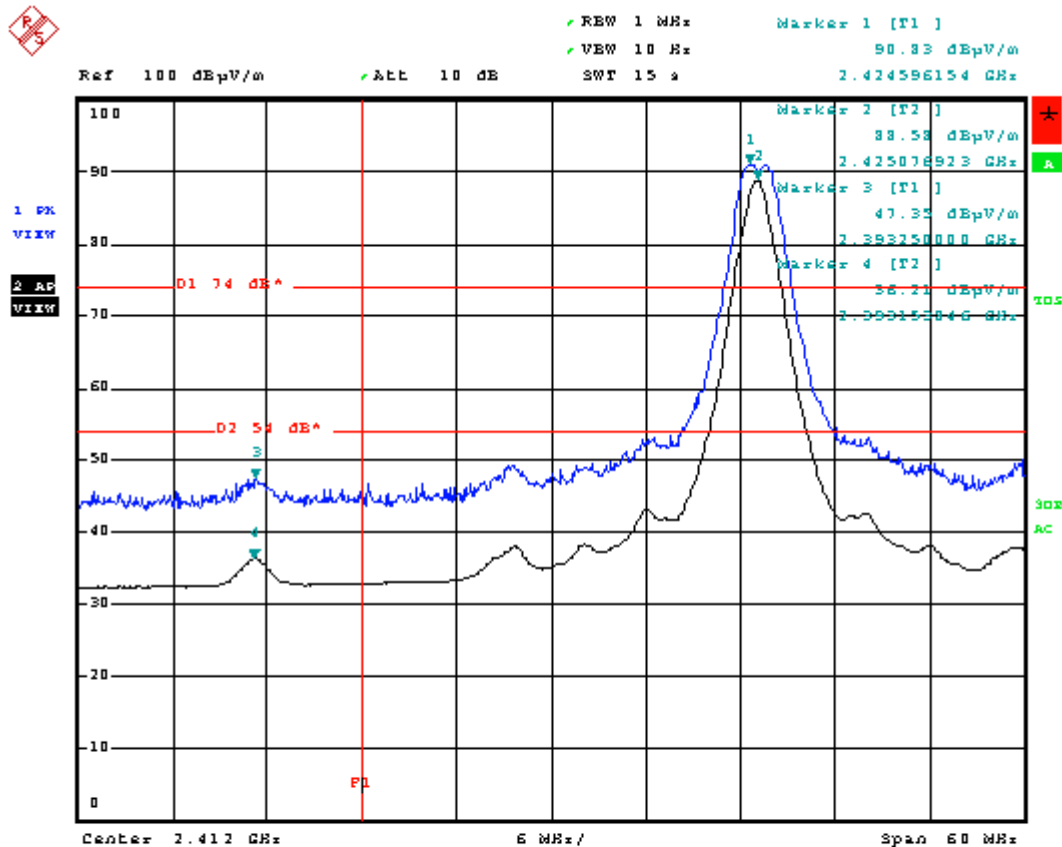
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**Table 12: Band Edge Radiated Emission, 802.11.b**

Operating Frequency [MHz]	EUT / Antenna Orient.	Peak Value [dBuV/m]	Average Value [dBuV/m]	Peak Limit [dBuV/m]	Average Limit [dBuV/m]	Peak Margin [dB]	Average Margin [dB]
2425.00	Y / H	47.35	36.21	74.00	54.00	26.65	17.79
2475.00	Z / H	52.82	40.91	74.00	54.00	21.18	13.09

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

**Figure 24: Band Edge Radiated Emission, Mode A (2425MHz), Peak and Average**



Spurious Emissions 1-8GHz, Hor, Mode: A, Pos.: Y  
 Date: 4.FEB.2009 15:35:33

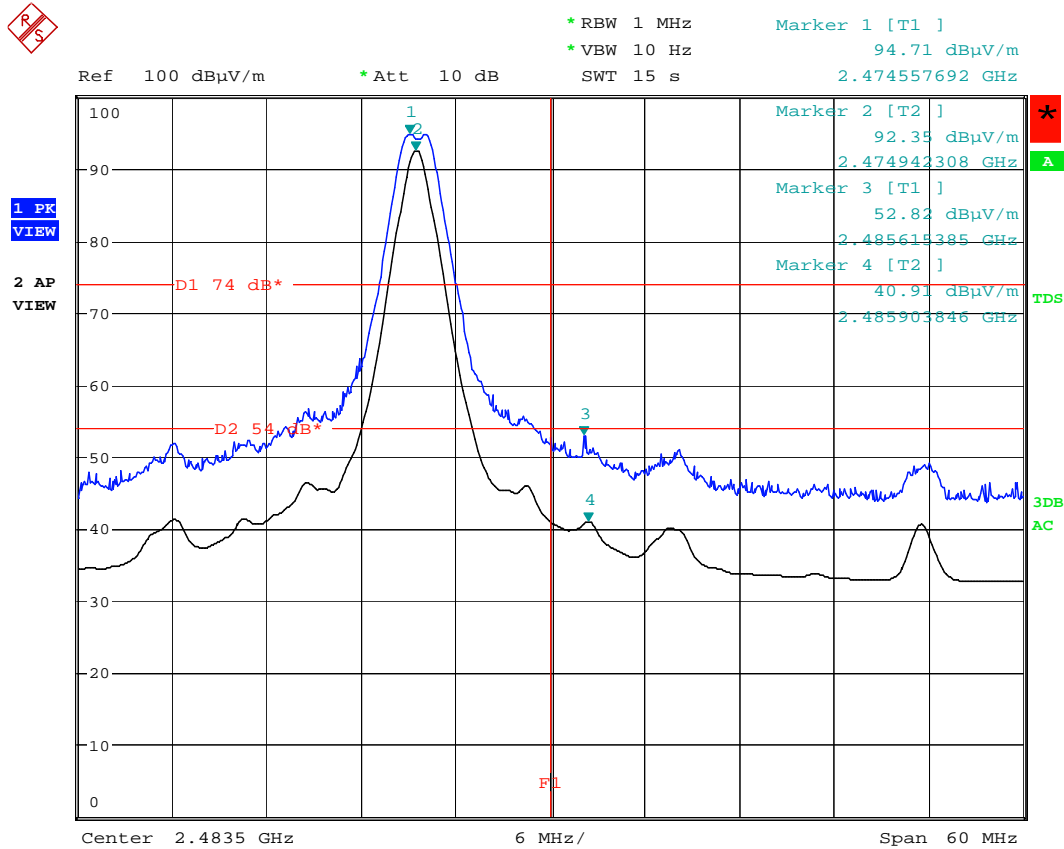
Note: The upper trace shows the peak value and the lower trace shows the average value.

Produkte  
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**Figure 25: Band Edge Radiated Emission, Mode C (2475MHz), Peak and Average**



Band Edge (Hi), Hor, Mode C, Position Z  
 Direct/Fundamental  
 Date: 19.FEB.2009 15:24:35

Note: The upper trace shows the peak value and the lower trace shows the average value.

Produkte  
Products

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**7.1.2 Radiated Emission, Out-of-Band and Spurious Emission, FCC 15.247(d), FCC 15.205, FCC 15.209, RSS-210 §2.2, RSS-210 A8.5 and RSS-Gen §7.2.1**

**RESULT: PASS**

Date of testing:	2008-12-29	2008-12-30
Ambient temperature:	23°C	23°C
Relative humidity:	22%	28%
Atmospheric pressure:	1010hPa	1008hPa
Frequency range:	9kHz – 25GHz	
Measurement distance:	3m	
Kind of test site:	Semi Anechoic Chamber	

**Requirements:**

The emissions from the intentional radiator shall not exceed the field strength specified in FCC 15.209(a) and RSS-210 2.7.

**Test procedure:**

ANSI C63.4-2003, RSS-Gen §4.9, §4.10 and Measurement of Digital Transmission Systems Operating under Section 15.247

Before final measurements of radiated emissions were made in Semi Anechoic Chamber, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the orientation (X, Y, Z) of the EUT were varied in order to ensure that maximum emission amplitudes were attained.

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Final radiated emission measurements were made at 3m. The spectrum was examined from 30 MHz to the 10th harmonic of the highest fundamental transmitter frequency (25 GHz).

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

For frequencies between 30MHz and 1GHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1GHz, emissions were measured using following settings: Peak: RBW=1MHz, VBW=1MHz, Average: RBW=1MHz, VBW=10Hz.

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

Produkte  
 Products

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**Table 13: Radiated Emission 30MHz – 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode A**

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dB(µV)]	Factor [dB(1/m)]	Level QP [dB(µV/m)]	Limit [dB(µV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
47.96	Z / V	53.2	-23.2	30.0	40.0	10.0	100	175
59.81	Z / V	56.6	-23.8	32.8	40.0	7.2	103	86
71.76	Z / V	49.8	-25.5	24.3	40.0	15.7	101	166
115.93	Z / V	53.8	-25.3	28.5	43.5	15.0	102	128
168.00	Z / H	54.3	-22.7	31.6	43.5	11.9	181	271
199.98	Z / H	52.3	-25.6	26.7	43.5	16.8	186	271
209.11	Z / V	56.1	-24.4	31.7	43.5	11.8	103	355
666.09	Z / V	40.3	-12.9	27.4	46.0	18.6	107	309
930.81	Z / H	38.6	-9.9	28.7	46.0	17.3	101	147

Note: Level QP = Reading QP + Factor

**Table 14: Radiated Emission 30MHz – 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode B**

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dB(µV)]	Factor [dB(1/m)]	Level QP [dB(µV/m)]	Limit [dB(µV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
48.00	Z / V	53.7	-23.2	30.5	40.0	9.5	102	148
59.82	Z / V	56.6	-23.8	32.8	40.0	7.2	101	81
115.30	Z / V	52.8	-25.4	27.4	43.5	16.1	103	107
167.99	Z / H	54.3	-22.7	31.6	43.5	11.9	203	273
209.12	Z / V	56.0	-24.4	31.6	43.5	11.9	114	351
209.11	Z / H	58.9	-25.4	33.5	43.5	10.0	171	75
799.79	Z / V	41.6	-11.5	30.1	46.0	15.9	100	72

Note: Level QP = Reading QP + Factor

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**Table 15: Radiated Emission 30MHz – 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode C**

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dB(µV)]	Factor [dB(1/m)]	Level QP [dB(µV/m)]	Limit [dB(µV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
48.02	Z / V	52.0	-23.2	28.8	40.0	11.2	100	136
59.83	Z / V	56.6	-23.8	32.8	40.0	7.2	102	80
71.73	Z / V	51.8	-25.5	26.3	40.0	13.7	101	166
114.81	Z / V	52.8	-25.4	27.4	43.5	16.1	101	90
209.11	Z / H	57.0	-25.4	31.6	43.5	11.9	182	75
666.15	Z / H	39.1	-12.9	26.2	46.0	19.8	241	280
951.76	Z / H	32.6	-9.2	23.4	46.0	22.6	106	242

Note: Level QP = Reading QP + Factor

**Table 16: Radiated Emission 1GHz – 25GHz, Horizontal & Vertical Antenna Orientations, Peak and Average Data, Mode A**

Freq. [MHz]	EUT / Antenna P	Reading AV [dB(µV)]	Reading PK [dB(µV)]	Factor [dB(1/m)]	Level AV [dB(µV/m)]	Level PK [dB(µV/m)]	Limit AV / PK [dB(µV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
4850.00	Z / V	44.6	67.3	-9.3	35.3	58.0	54.0 / 74.0	18.7	16.0	116	215
4850.97	Z / H	41.4	59.5	-9.3	32.1	50.2	54.0 / 74.0	21.9	23.8	103	71
9576.15	Z / H	36.8	51.7	-10.0	26.8	41.7	54.0 / 74.0	27.2	32.3	199	316
9702.02	X / V	37.5	52.1	-9.7	27.8	42.4	54.0 / 74.0	26.2	31.6	177	20

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.

**Table 17: Radiated Emission 1GHz – 25GHz, Horizontal & Vertical Antenna Orientations, Peak and Average Data, Mode B**

Freq. [MHz]	EUT / Antenna P	Reading AV [dB(µV)]	Reading PK [dB(µV)]	Factor [dB(1/m)]	Level AV [dB(µV/m)]	Level PK [dB(µV/m)]	Limit AV / PK [dB(µV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
4900.11	Z / V	45.6	69.5	-9.2	36.4	60.3	54.0 / 74.0	17.6	13.7	114	23
4901.02	Z / H	40.9	57.3	-9.2	31.7	48.1	54.0 / 74.0	22.3	25.9	131	187
9889.90	Z / H	36.0	50.1	-9.2	26.8	40.9	54.0 / 74.0	27.2	33.1	101	147
9802.11	Z / V	36.6	50.5	-9.4	27.2	41.0	54.0 / 74.0	26.8	33.0	132	356

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.

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**Table 18: Radiated Emission 1GHz – 25GHz, Horizontal & Vertical Antenna Orientations, Peak and Average Data, Mode C**

Freq. [MHz]	EUT / Antenna P	Reading AV [dB(µV)]	Reading PK [dB(µV)]	Factor [dB(1/m)]	Level AV [dB(µV/m)]	Level PK [dB(µV/m)]	Limit AV / PK [dB(µV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
4950.18	Z / H	43.3	64.0	-9.2	34.1	54.8	54.0 / 74.0	19.9	19.2	107	187
4950.22	Z / V	43.8	65.2	-9.2	34.6	56.0	54.0 / 74.0	19.4	18.0	174	280
9902.11	Z / V	37.2	51.9	-9.2	28.0	42.7	54.0 / 74.0	26.0	31.3	147	7
9939.07	Z / H	36.2	50.9	-9.1	27.1	41.8	54.0 / 74.0	26.9	32.2	177	18

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.

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## 7.2 Radiated Emission of Receiver

### 7.2.1 Radiated Emission of Receiver, FCC 15.109, RSS-210 §2.2, RSS-210 §2.6, RSS-210 A8.5, RSS-Gen §7.2.3.2

**RESULT:**

**PASS**

Date of testing:	2008-12-29	2008-12-30
Ambient temperature:	23°C	23°C
Relative humidity:	22%	28%
Atmospheric pressure:	1010hPa	1008hPa
Frequency range:	30MHz – 25GHz	
Equipment classification:	Class B	
Measurement distance:	3m	
Kind of test site:	Semi Anechoic Chamber	

Requirements:

The emissions from the unintentional radiator shall not exceed the field strength specified in 15.109(a) and RSS-210 Table 2 (and RSS-Gen Table 1).

Test procedure:

ANSI C63.4-2003, RSS-Gen §4.9, §4.10

Before final measurements of radiated emissions were made in Semi Anechoic Chamber, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the orientation (X, Y, Z) of the EUT were varied in order to ensure that maximum emission amplitudes were attained.

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Final radiated emission measurements were made at 3m. The spectrum was examined from 30 MHz to the 10th harmonic of the highest fundamental transmitter frequency (25 GHz).

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

For frequencies between 30MHz and 1GHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1GHz, emissions were measured using following settings: Peak: RBW=1MHz, VBW=1MHz, Average: RBW=1MHz, VBW=10Hz.

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

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**Table 19: Radiated Emission 30MHz – 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode D**

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dB(µV)]	Factor [dB(1/m)]	Level QP [dB(µV/m)]	Limit [dB(µV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
32.00	Z / V	54.4	-24.5	29.9	40.0	10.1	102	213
47.84	Z / V	51.4	-23.2	28.2	40.0	11.8	110	214
59.82	Z / V	56.4	-23.8	32.6	40.0	7.4	100	91
71.72	Z / V	53.9	-25.5	28.4	40.0	11.6	102	169
173.25	Z / H	54.3	-23.2	31.1	43.5	12.4	230	272
209.12	Z / H	58.8	-25.4	33.4	43.5	10.1	171	73
233.01	Z / V	59.2	-23.7	35.5	46.0	10.5	101	181
711.59	Z / V	33.9	-12.6	21.3	46.0	24.7	106	80

Note: Level QP = Reading QP + Factor

**Table 20: Radiated Emission 1GHz – 25GHz, Horizontal & Vertical Antenna Orientations, Peak and Average Data, Mode D**

Freq. [MHz]	EUT / Antenna P	Reading AV [dB(µV)]	Reading PK [dB(µV)]	Factor [dB(1/m)]	Level AV [dB(µV/m)]	Level PK [dB(µV/m)]	Limit AV / PK [dB(µV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
1460.62	Z / V	48.3	68.1	-15.1	33.2	53.0	54.0 / 74.0	20.8	21.0	100	61
1863.02	Z / V	45.7	61.6	-14.0	31.7	47.6	54.0 / 74.0	22.3	26.4	135	284
7790.91	Z / H	37.2	51.0	-4.3	32.9	46.7	54.0 / 74.0	21.1	27.3	103	111

Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.

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