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Auftraggeber: <i>Client:</i>	Panasonic Plasma Display Co., Ltd. 1-1 Matsushita-cho, Ibaraki-shi, Osaka 567-0026, Japan		
Gegenstand der Prüfung: <i>Test Item:</i>	Electronic Pen for Interactive Plasma Display		
Bezeichnung: <i>Identification:</i>	DKB-DP12	Serien-Nr.: <i>Serial No.:</i>	1, 1205070001
Wareneingangs-Nr.: <i>Receipt No.:</i>	PT0214024094-2-13, -14	Eingangsdatum: <i>Date of Receipt:</i>	2012-05-07
Zustand des Prüfgegenstandes bei Anlieferung: Good <i>Condition of Test Item at Delivery:</i>			
Prüfart: <i>Testing Location:</i>	TÜV Rheinland Japan Ltd. – Global Technology Assessment Center 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan		
Prüfgrundlage: <i>Test Specification:</i>	FCC 47 CFR Part 15, Subpart C, Section 15.247 (October 1, 2011) ANSI C63.4-2003 KDB Publication No. 558074 D01: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (v01) RSS-210 (Issue 8): 2010 RSS-Gen (Issue 3): 2010 ANSI C63.4-2003		
Prüfergebnis: <i>Test Result:</i>	Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). <i>The test item passed the test specification(s).</i>		
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland Japan Ltd. – Global Technology Assessment Center 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan		
geprüft/ tested by:		kontrolliert/ reviewed by:	
			
2012-05-24	Y. Mashima / Inspector	2012-05-24	T. Sauter / Reviewer
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
			Name/Stellung <i>Name/Position</i>
			Unterschrift <i>Signature</i>
Sonstiges / Other Aspects:			
Abkürzungen: P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet		Abbreviations: P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested	
<p>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. <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

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: N/A

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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.

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
For Antenna Port Conducted Emission					
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2013-01
DC Power Supply	Agilent	E3646A	MY503500 07	RF-0412	N/A
For Radiated Emission					
Receiver	Rohde & Schwarz	ESU 8	100025	RF-0020	2013-02
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2013-01
RF Selector (10m Chamber)	Toyo Corporation	NS4900	0703-182	RF-0029	2012-05
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	2013-01
Biconical Antenna, 30-300MHz	EMCO	3110B	9603-2379	RF-0207	2013-02
3dB Attenuator	Tamagawa Electronics	CFA-01	-	RF-0265	2012-05
10dB Attenuator	Hewlett Packard	8491A 10dB	58354	RF-0314	2012-05
Low Noise Pre-Amplifier, 9kHz-1GHz	TSJ	MLA-10K01-B01-35	1370750	RF-0253	2012-05
Horn Antenna, 1-8GHz	Schwarzbeck	BBHA9120B	419	RF-0050	2012-05
Microwave Pre-Amplifier, 1-8GHz	Toyo Corporation	TPA0108-40	0634	RF-0052	2012-05
Band Reject Filter, 1-8GHz	Nitsuki	NF-49BT	027	RF-0131	2012-05
Horn Antenna with Pre-Amplifier, 8-18GHz	Toyo Corporation	HAP06-18W	00000025	RF-0065	2012-05
High Pass Filter, 8-18GHz	Micro-Tronics	HPM50107	006	RF-0334	2012-05
Horn Antenna with Pre-Amplifier, 18-26.5GHz	Toyo Corporation	HAP18-26N	00000010	RF-0070	2012-05

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
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 touch pen device which communicates by ZigBee with USB Dongle attached to a PC to transmit drawing or writing data.

3.2 System Details

Radio standard:	IEEE 802.15.4 (ZigBee)
Specified output power:	1.0mW (peak)
Antenna gain:	0.9dBi
Antenna type:	Loop antenna (printed on PCB)
Frequency range:	2425 - 2475MHz
Number of channels:	3
Channel spacing:	25MHz
Modulation type:	DSSS coupled with OQPSK
FCC classification:	DTS
IC classification:	Spread Spectrum/Digital Device (2400-2483.5 MHz)
Emission designator:	G1D
Rated voltage:	DC 5V via USB for battery charging mode or DC 1.2/1.5V via battery (DC 1.2V chargeable battery or DC 1.5V alkaline battery) for normal operation
Protection class:	III
Test voltage:	DC 1.2/1.5V via battery

3.3 Clock Frequencies

The highest clock frequency generated by the EUT is 16 MHz.

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, 15.209 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 (2425MHz), at the operating frequency in the middle of the specified frequency band (2450MHz) and at the highest operating frequency (2475MHz).

The basic operation modes used for testing are:

- A. EUT transmits (TX mode), with full power, at lowest channel (2425MHz), a continuous modulated signal streaming with 100% duty cycle.
- B. EUT transmits (TX mode), with full power, at middle channel (2450MHz), a continuous modulated signal streaming with 100% duty cycle.
- C. EUT transmits (TX mode), with full power, at highest channel (2475MHz), a continuous modulated signal streaming with 100% duty cycle.

4.3 Physical Configuration for Testing

The test system was configured in a typical fashion (as a customer would normally use it).

The justification and manipulation of 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

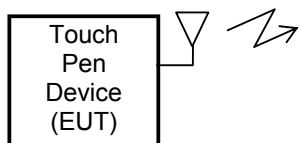


Table 3: Interfaces present on the EUT

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	USB	None (see Note)	DC input power port

Notes:

The USB port is only used for battery charging mode. Transmission of wireless signals is not possible when the EUT is connected to an accessory via USB cable. The USB port is left open in normal operation (wireless transmission of data).

Two test samples were available. Sample No. 1 was used for antenna conducted measurements and sample No. 1205070001 was used for radiated measurements.

For antenna conducted measurements, the measurement equipment was connected directly at the antenna port of the EUT with an RF cable.

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

4.4 Test Software

The EUT had built-in test modes to enable the operation specified in section 4.2.

4.5 Special Accessories and Auxiliary Equipment

No special accessory was used to operate the EUT.

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 is battery operated and it was tested with a new battery. 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 an internal antenna which is not user accessible. Hence it complies with the antenna requirements.

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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 2425-2475MHz. 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: 2012-05-07

Ambient temperature: 27°C

Relative humidity: 38%

Atmospheric pressure: 1004hPa

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).

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 was set to 1MHz and the video bandwidth to 3MHz. 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.

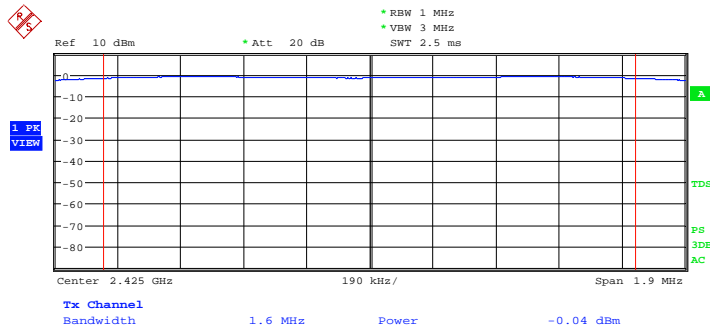
The measurement was performed at both rated input voltages (DC 1.2V and DC 1.5V) in order to identify the one producing the highest output power. The results given here below show that the worst case output power is found at the input voltage of DC 1.5V. Therefore, all the other measurements for the evaluation of the radio properties of the EUT have been performed using this input voltage.

Table 4: Conducted Output Power, Mode A (2425MHz), DC 1.2V and DC 1.5V Input Voltages

Input Voltage	Output Power [dBm]	Output Power [mW]	Limit [dBm]	Limit [mW]	Margin [dB]
DC 1.2V	-0.06	0.99	30.00	1000	30.06
DC 1.5V	-0.04	0.99	30.00	1000	30.04

Notes: Output power = Reading + Correction factor
 $mW = 10^{(dBm/10)}$
 $dBm = 10 \times \log(mW)$

Figure 2: Conducted Output Power, Mode A (2425MHz), Worst Case Input Voltage (DC 1.5V)



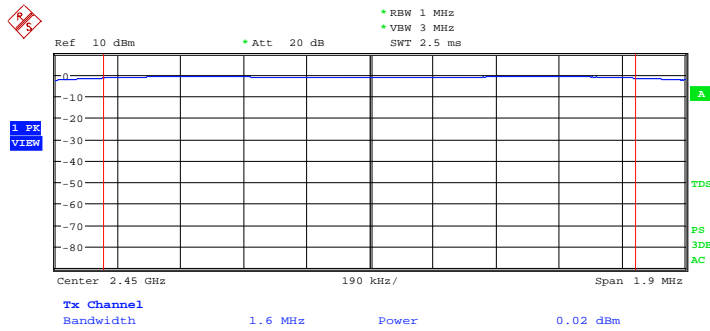
Maximum peak conducted output power, mode A
 Date: 7.MAY.2012 14:57:54

Table 5: Conducted Output Power, Mode B (2450MHz), DC 1.2V and DC 1.5V Input Voltages

Input Voltage	Output Power [dBm]	Output Power [mW]	Limit [dBm]	Limit [mW]	Margin [dB]
DC 1.2V	0.01	1.00	30.00	1000	29.99
DC 1.5V	0.02	1.00	30.00	1000	29.98

Notes: Output power = Reading + Correction factor
 $mW = 10^{(dBm/10)}$
 $dBm = 10 \times \log(mW)$

Figure 3: Conducted Output Power, Mode B (2450MHz), Worst Case Input Voltage (DC 1.5V)



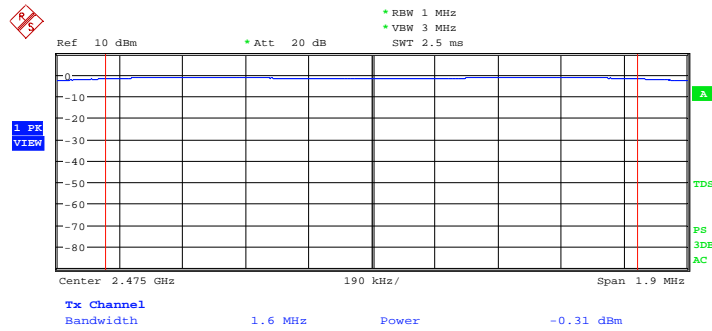
Maximum peak conducted output power, mode B
 Date: 7.MAY.2012 14:56:01

Table 6: Conducted Output Power, Mode C (2475MHz), DC 1.2V and DC 1.5V Input Voltages

Input Voltage	Output Power [dBm]	Output Power [mW]	Limit [dBm]	Limit [mW]	Margin [dB]
DC 1.2V	-0.32	0.93	30.00	1000	30.32
DC 1.5V	-0.31	0.93	30.00	1000	30.31

Notes: Output power = Reading + Correction factor
 $mW = 10^{(dBm/10)}$
 $dBm = 10 \times \log(mW)$

Figure 4: Conducted Output Power, Mode C (2475MHz), Worst Case Input Voltage (DC 1.5V)



Maximum peak conducted output power, mode C
 Date: 7.MAY.2012 14:57:00

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5.2.2 6dB Bandwidth

RESULT:

PASS

Date of testing: 2012-05-07

Ambient temperature: 27°C

Relative humidity: 38%

Atmospheric pressure: 1004hPa

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:

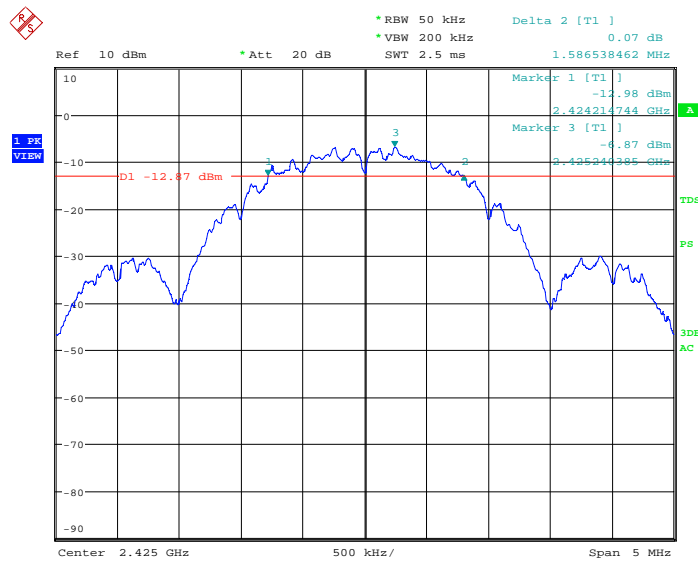
ANSI C63.4-2003, RSS-Gen 4.6.2 and KDB Publication No. 558074 D01.

The 6dB bandwidth was measured at the antenna port with a spectrum analyzer using a peak detector. The resolution bandwidth was set to 50kHz and the video bandwidth to 200kHz. Markers placed at the lowest and highest intersections of the trace with a 6dBc line were used to calculate the emission bandwidth.

Table 7: 6dB Bandwidth

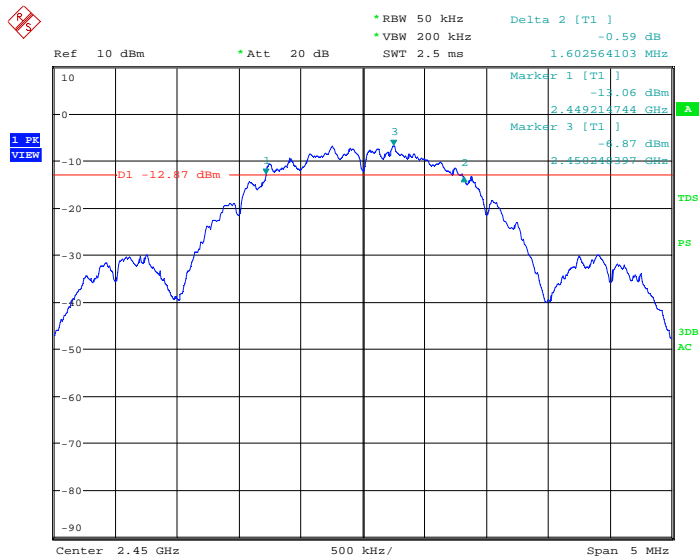
Operating Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
2425	1.587	0.50
2450	1.603	0.50
2475	1.603	0.50

Figure 5: 6dB Bandwidth, Mode A (2425MHz)



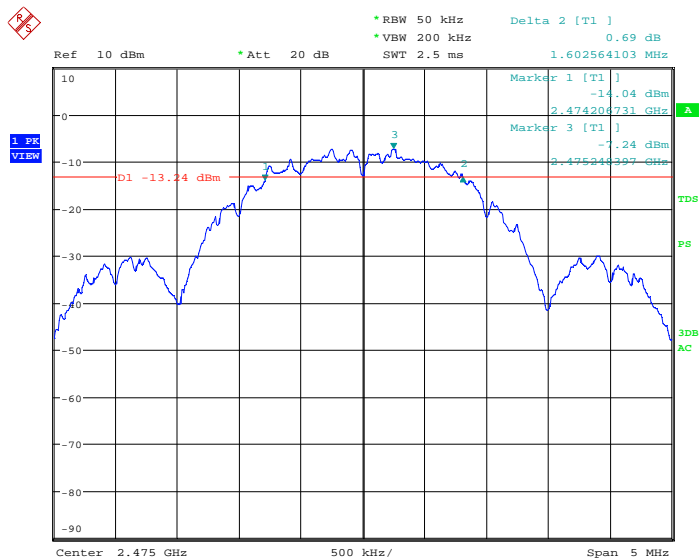
6dB bandwidth, mode A
 Date: 7.MAY.2012 14:53:48

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



6dB bandwidth, mode B
 Date: 7.MAY.2012 14:54:57

Figure 7: 6dB Bandwidth, Mode C (2475MHz)



6dB bandwidth, mode C
 Date: 7.MAY.2012 14:52:45

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5.2.3 99% Bandwidth

Date of testing: 2012-05-07

Ambient temperature: 27°C

Relative humidity: 38%

Atmospheric pressure: 1004hPa

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 100kHz (1% of the span) and the video bandwidth to 300kHz. The 99% bandwidth was measured by using the OBW function of the analyzer with a 99% coverage setting.

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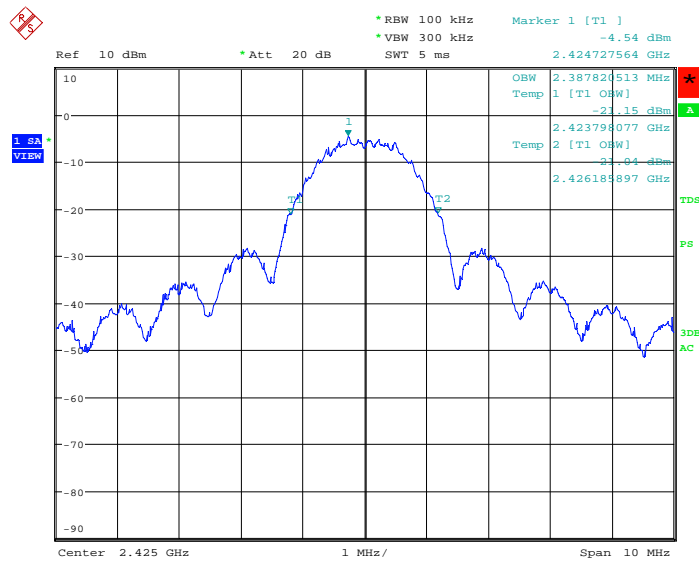
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Table 8: 99% Bandwidth

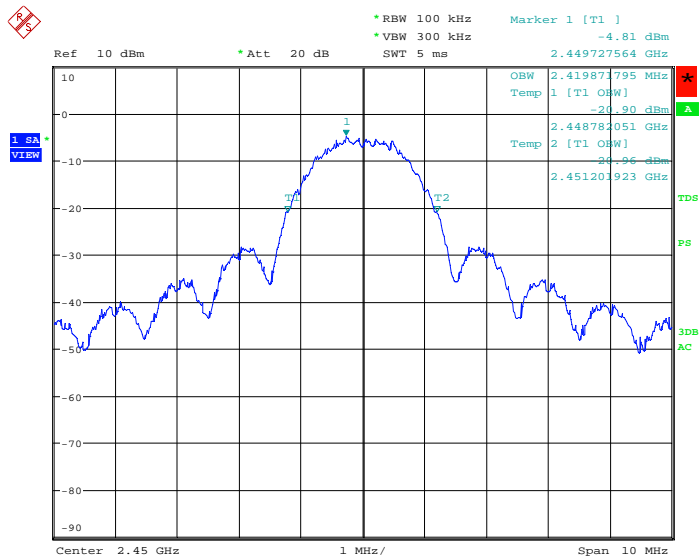
Operating Frequency [MHz]	99% Bandwidth [MHz]
2425	2.388
2450	2.420
2475	2.420

Figure 8: 99% Bandwidth, Mode A (2425MHz)



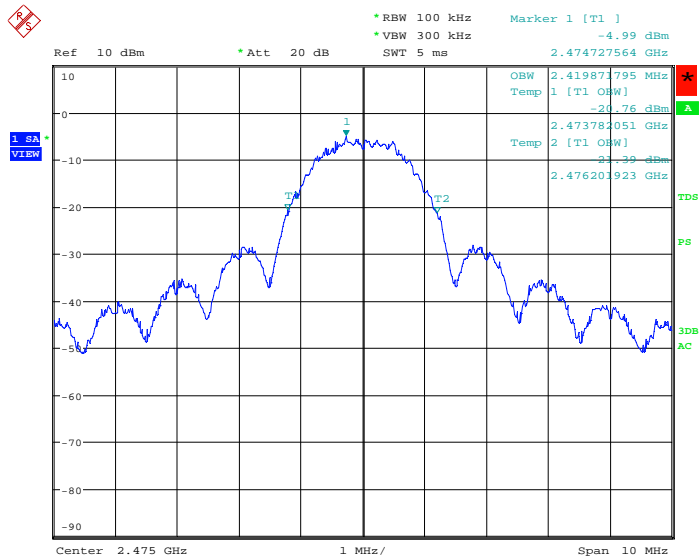
99% bandwidth, mode A
 Date: 7.MAY.2012 15:02:45

Figure 9: 99% Bandwidth, Mode B (2450MHz)



99% bandwidth, mode B
 Date: 7.MAY.2012 15:34:18

Figure 10: 99% Bandwidth, Mode C (2475MHz)



99% bandwidth, mode C
 Date: 7.MAY.2012 16:03:36

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5.2.4 Conducted Spurious Emissions

RESULT:

PASS

Date of testing: 2012-05-07

Ambient temperature: 27°C

Relative humidity: 38%

Atmospheric pressure: 1004hPa

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 (10th harmonics).

The maximum in-band 100kHz emission was determined with the Peak Power Spectral Density test.

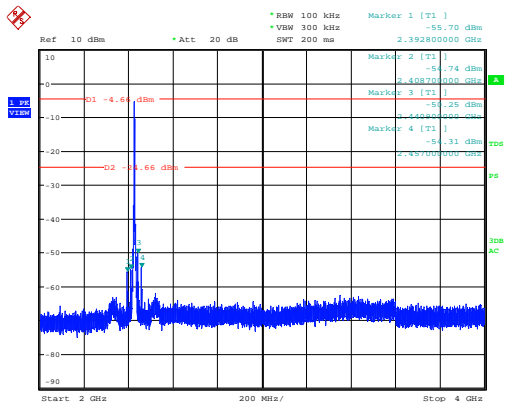
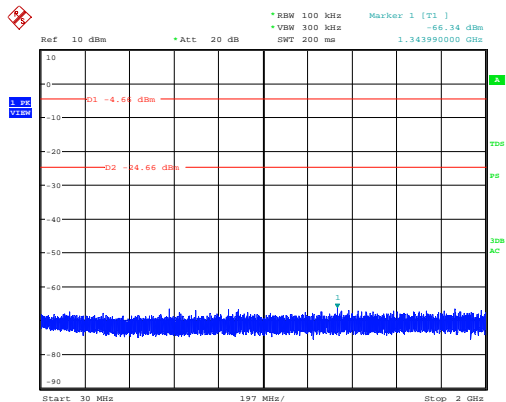
The readings of the measurements take into account the loss generated by all the involved cables.

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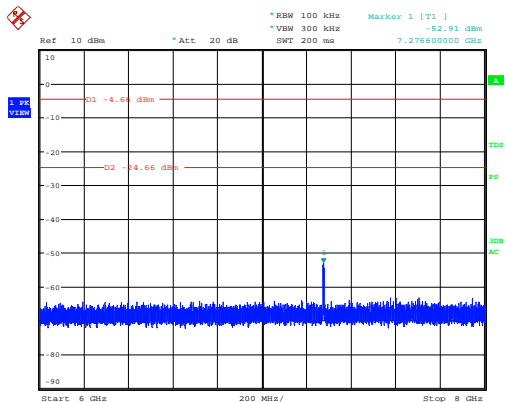
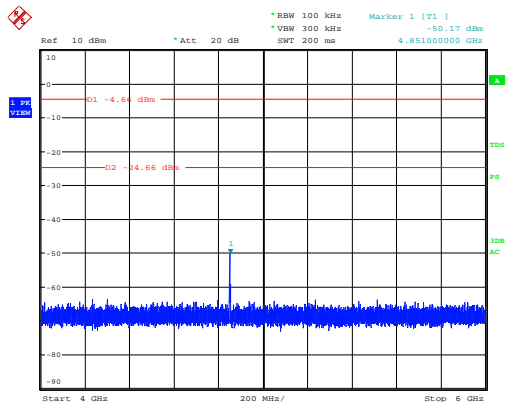
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Figure 11: Conducted Spurious Emissions, 30MHz - 12GHz, Mode A (2425MHz)



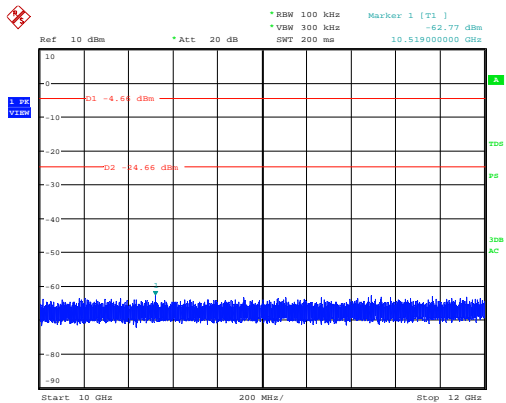
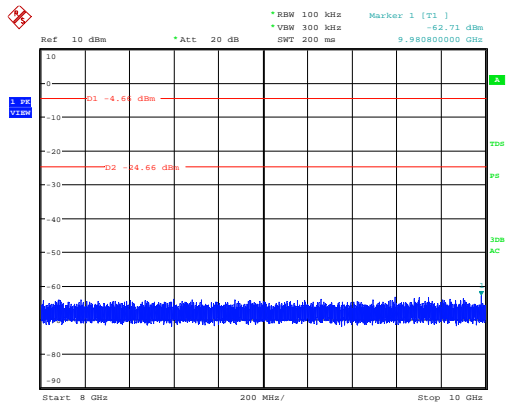
Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:24:42

Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:28:02



Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:28:29

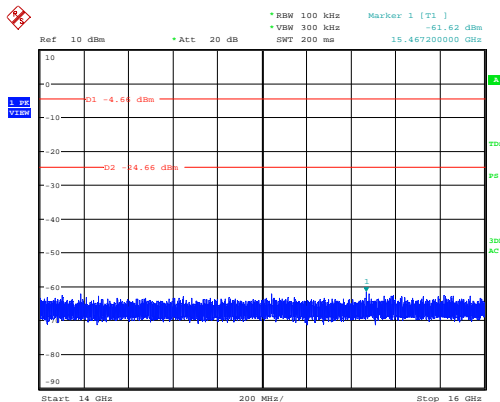
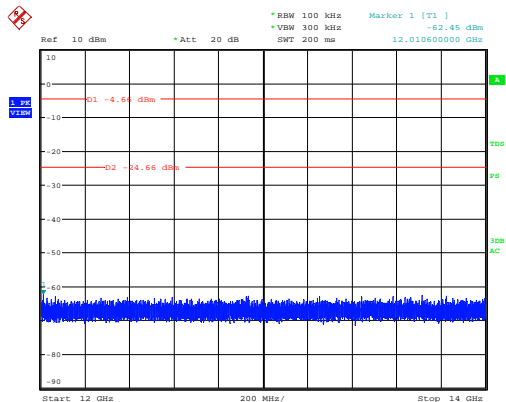
Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:28:55



Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:29:42

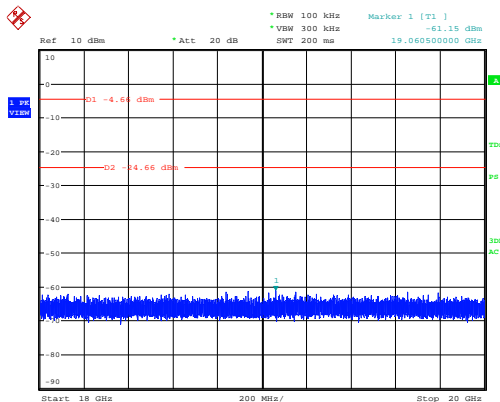
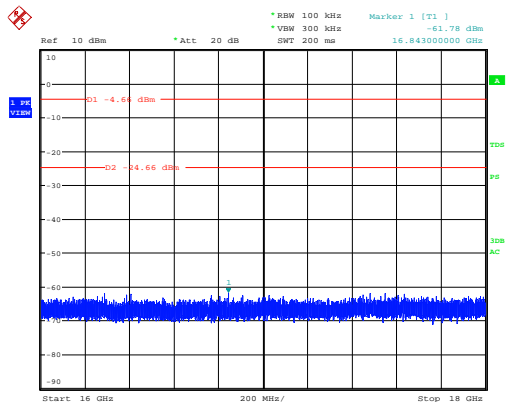
Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:30:07

Figure 12: Conducted Spurious Emissions, 12 - 24GHz, Mode A (2425MHz)



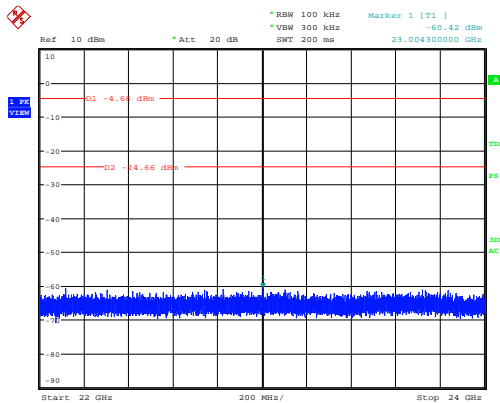
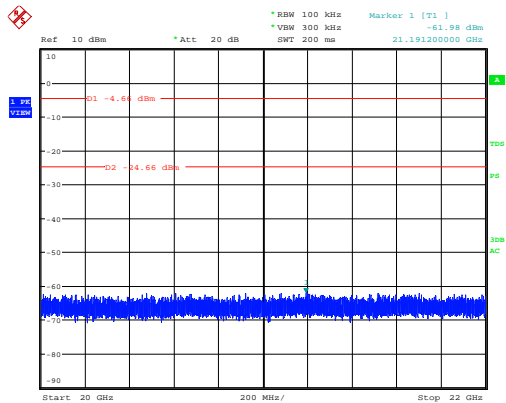
Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:30:31

Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:31:43



Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:32:07

Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:32:33



Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:32:56

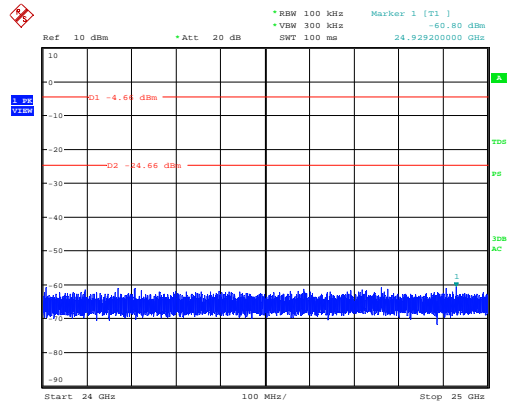
Conducted spurious emissions, mode A
 Date: 7.MAY.2012 16:33:18

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Figure 13: Conducted Spurious Emissions, 24 - 25GHz, Mode A (2425MHz)



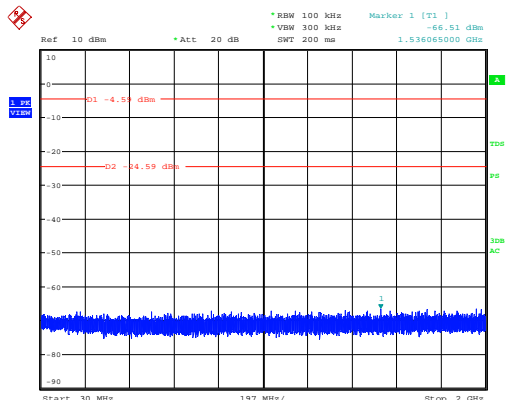
Conducted spurious emissions, mode A
Date: 7.MAY.2012 16:33:44

Produkte
 Products

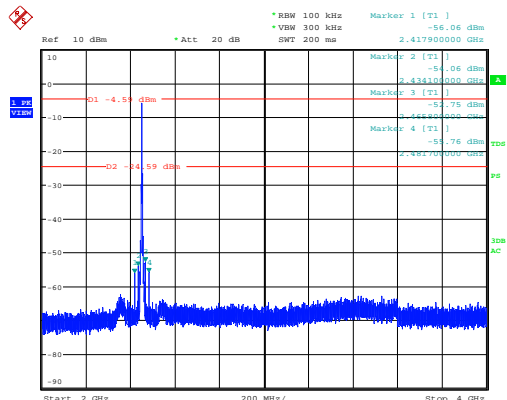
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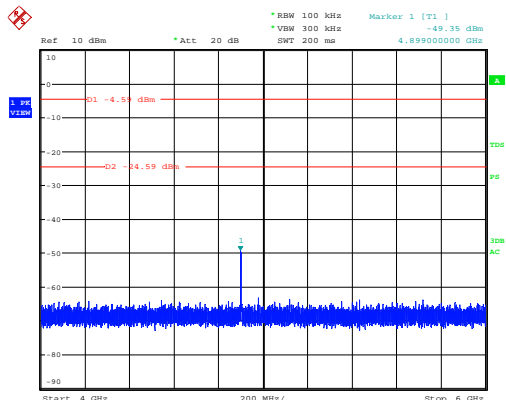
Figure 14: Conducted Spurious Emissions, 30MHz - 12GHz, Mode B (2450MHz)



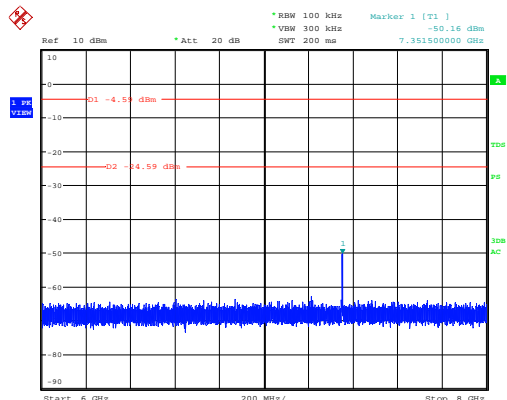
Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:35:27



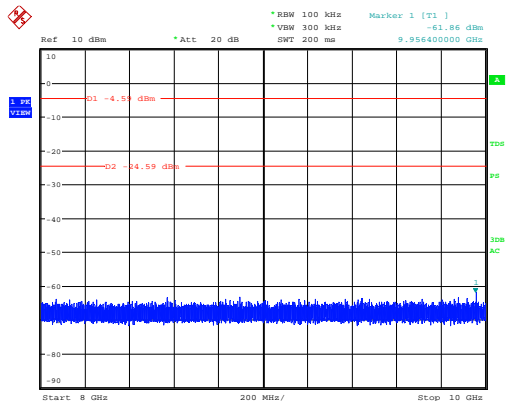
Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:36:48



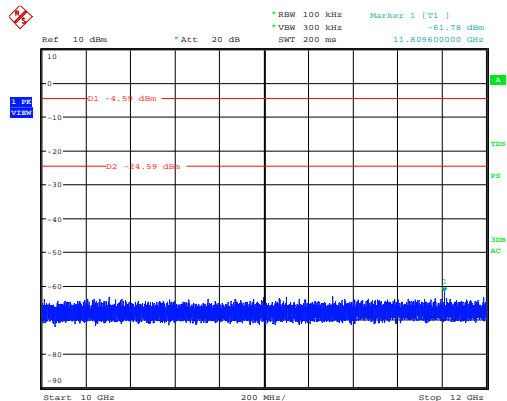
Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:37:15



Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:37:38



Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:38:01



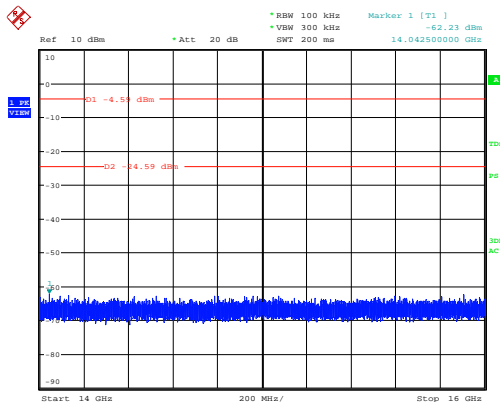
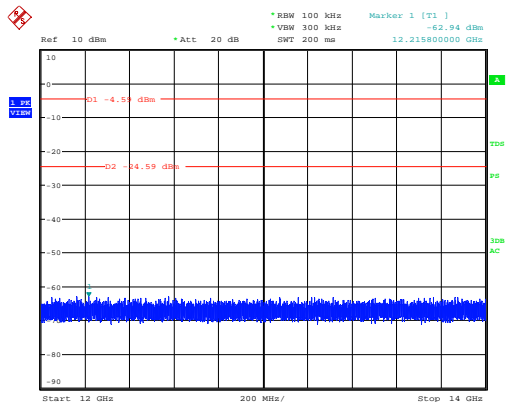
Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:38:30

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 Products

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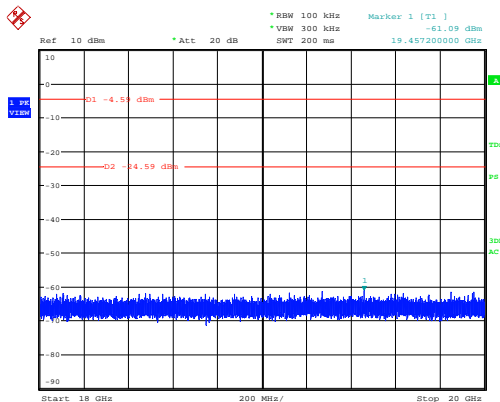
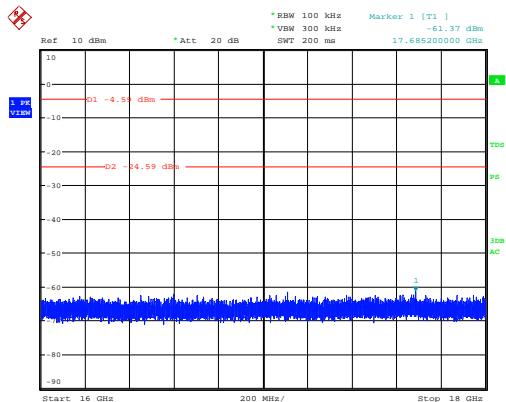
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Figure 15: Conducted Spurious Emissions, 12 - 24GHz, Mode B (2450MHz)



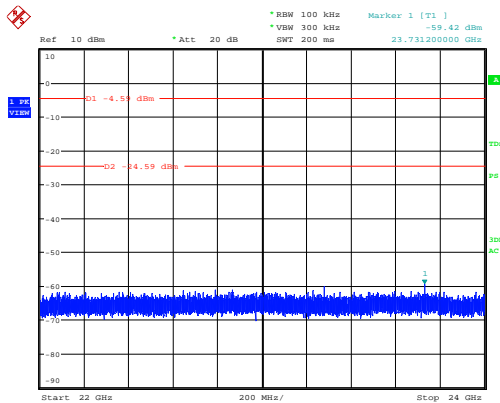
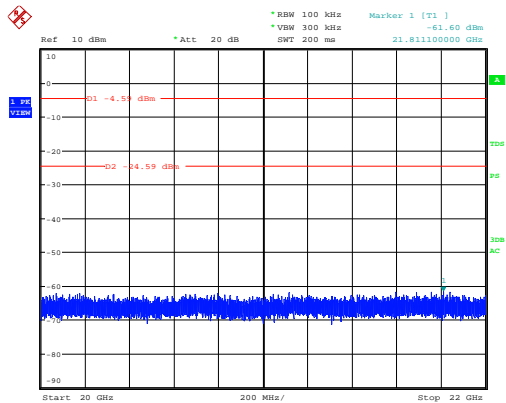
Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:38:54

Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:39:25



Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:39:52

Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:40:17



Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:40:43

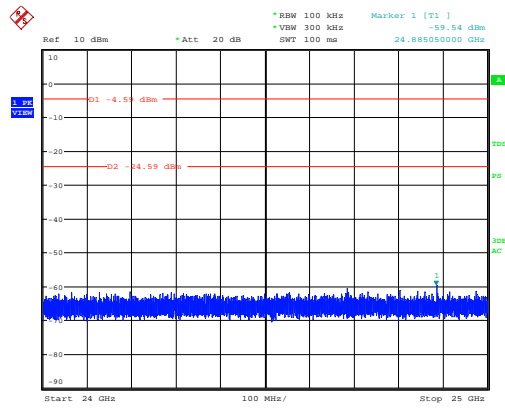
Conducted spurious emissions, mode B
 Date: 7.MAY.2012 15:41:06

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Figure 16: Conducted Spurious Emissions, 24 - 25GHz, Mode B (2450MHz)



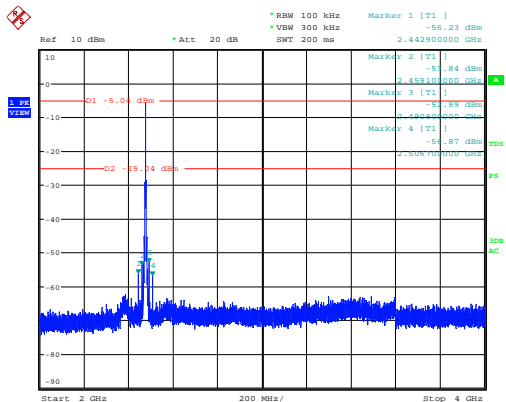
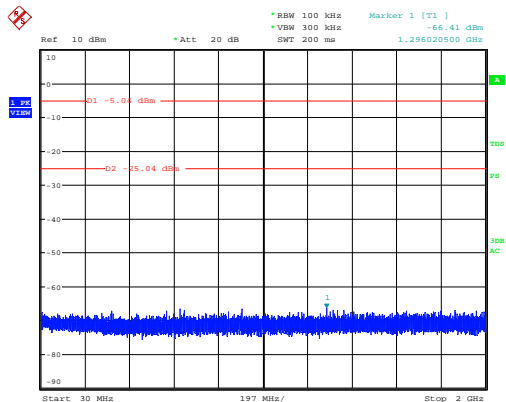
Conducted spurious emissions, mode B
Date: 7.MAY.2012 15:41:31

Produkte
 Products

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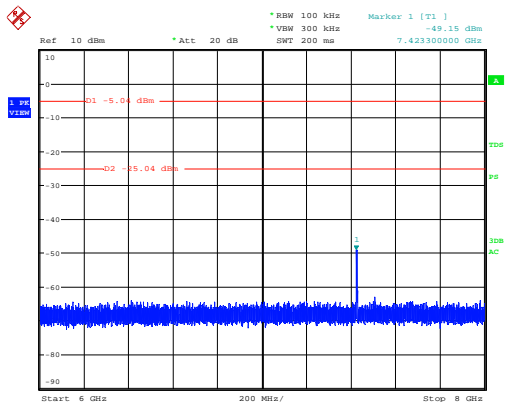
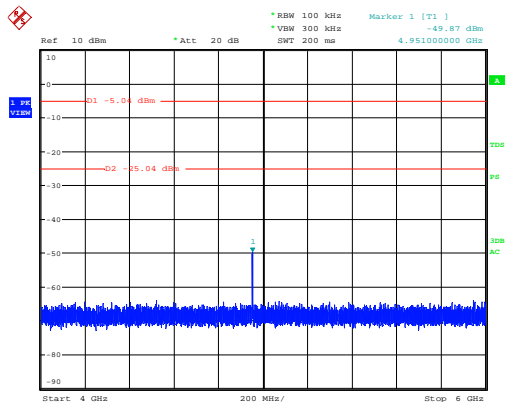
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Figure 17: Conducted Spurious Emissions, 30MHz - 12GHz, Mode C (2475MHz)



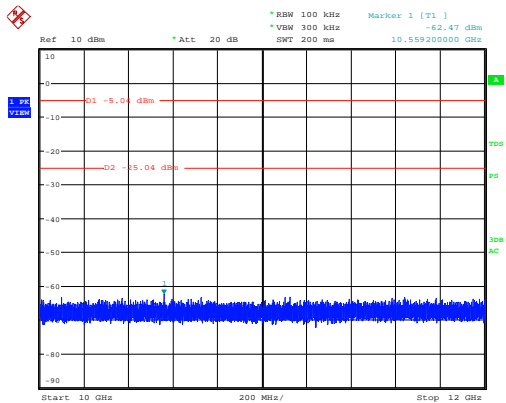
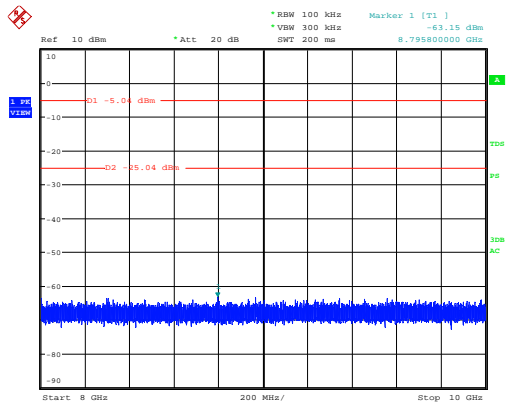
Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:05:28

Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:07:04



Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:07:32

Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:07:57



Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:08:24

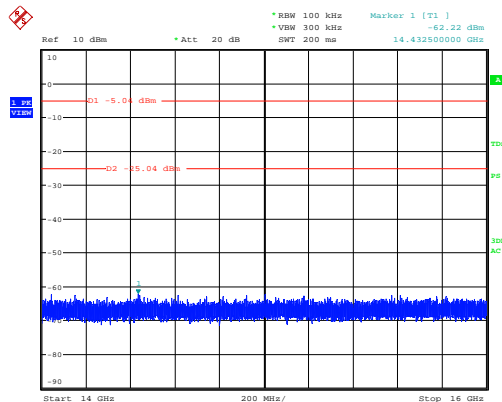
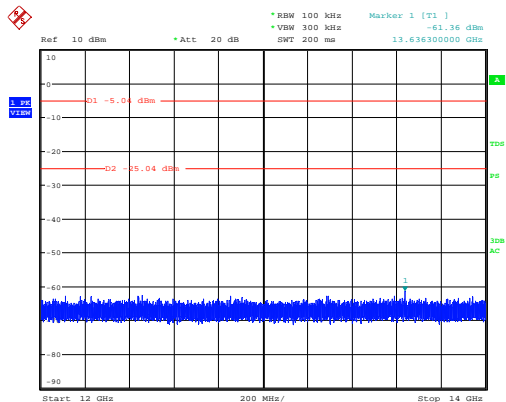
Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:08:48

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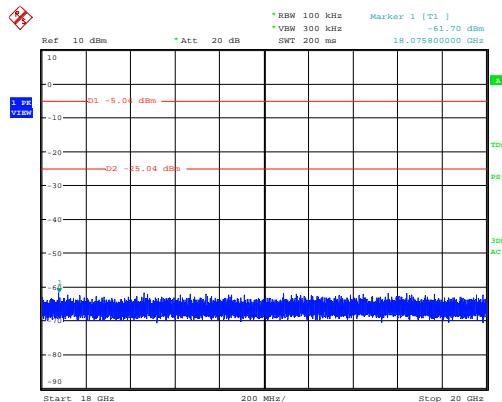
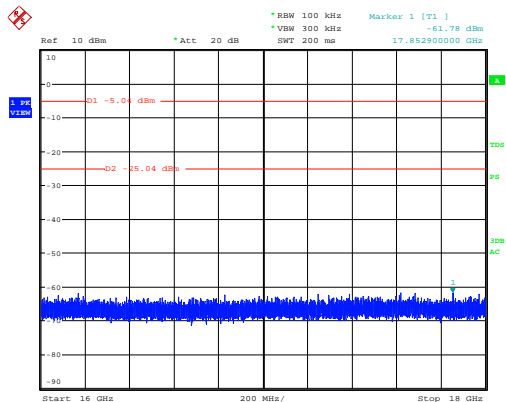
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Figure 18: Conducted Spurious Emissions, 12 - 24GHz, Mode C (2475MHz)



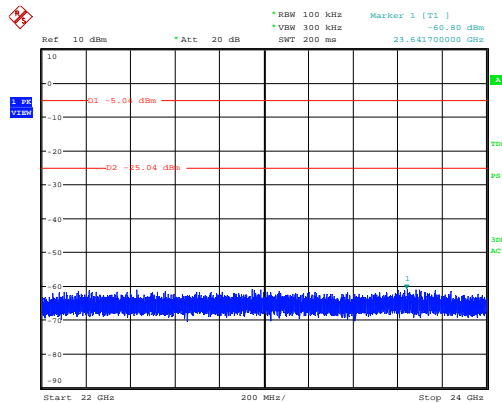
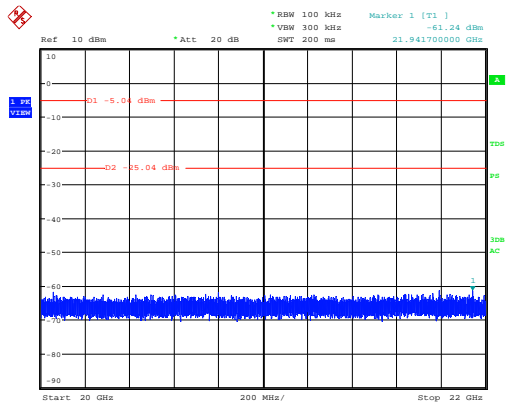
Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:09:11

Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:09:34



Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:09:57

Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:10:21



Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:10:45

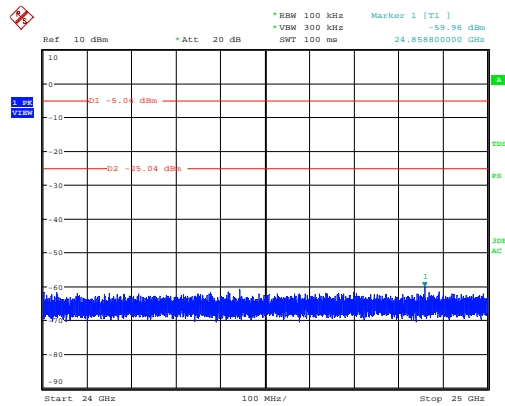
Conducted spurious emissions, mode C
 Date: 7.MAY.2012 16:11:08

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Figure 19: Conducted Spurious Emissions, 24 - 25GHz, Mode C (2475MHz)



Conducted spurious emissions, mode C
Date: 7.MAY.2012 16:11:41

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5.2.5 Peak Power Spectral Density

RESULT:

PASS

Date of testing: 2012-05-07

Ambient temperature: 27°C

Relative humidity: 38%

Atmospheric pressure: 1004hPa

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 100kHz and a video bandwidth of 300kHz. The observed highest power level in a 100kHz band was scaled to an equivalent value in a 3kHz band by adjusting the measured power by a bandwidth correction factor.

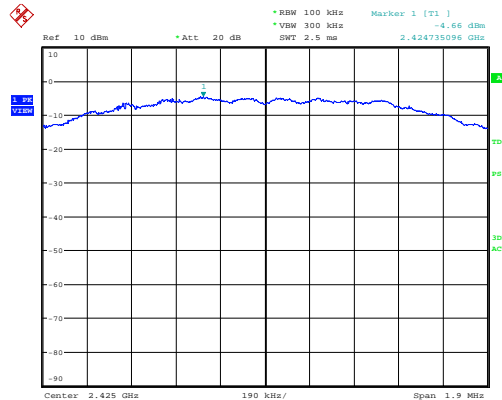
The readings of the measurements take into account the loss generated by all the involved cables.

Table 9: Peak Power Spectral Density

Operating Frequency [MHz]	Max PSD Frequency [MHz]	Max PSD in 100kHz Band [dBm]	Bandwidth Correction Factor [dB]	Max PSD in 3kHz Band [dBm]	Limit [dBm]	Margin [dB]
2425	2424.7	-4.7	-15.2	-19.9	8.0	27.9
2450	2449.8	-4.6	-15.2	-19.8	8.0	27.8
2475	2474.7	-5.0	-15.2	-20.2	8.0	28.2

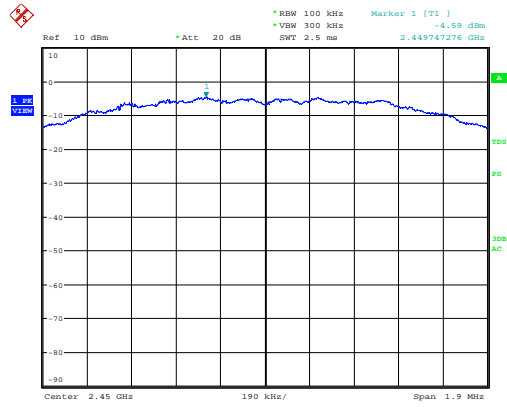
Notes: Max PSD in 3kHz band = Max PSD in 100kHz band + Bandwidth correction factor
 Correction factor = 100kHz to 3kHz bandwidth conversion factor = $10 \times \log(3\text{kHz} / 100\text{kHz})$

Figure 20: Power Spectral Density, Mode A (2425MHz)



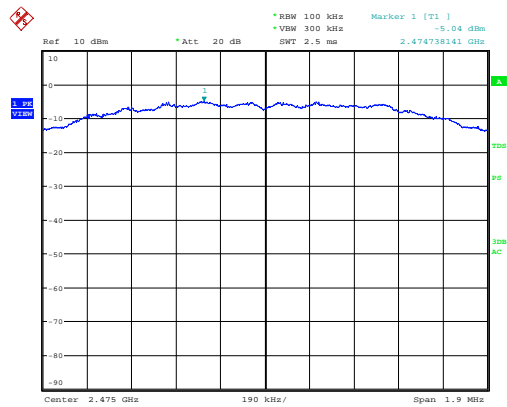
Peak power spectral density, mode A
 Date: 7.MAY.2012 16:23:58

Figure 21: Power Spectral Density, Mode B (2450MHz)



Peak power spectral density, mode B
Date: 7.MAY.2012 15:34:45

Figure 22: Power Spectral Density, Mode C (2475MHz)



Peak power spectral density, mode C
Date: 7.MAY.2012 16:04:23

5.3 Radiated Measurements

5.3.1 Radiated Spurious Emissions of Transmitter

RESULT: **PASS**

Date of testing: 2012-05-15 till 2012-05-18

Ambient temperature: 19 to 24°C

Relative humidity: 45 to 68%

Atmospheric pressure: 997 to 1006hPa

Frequency range: 9kHz - 25GHz

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

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 (EUT orientation: X, Y, Z) was 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.

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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 & VBW = 1MHz; for average field strength: 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.

Prechecks were performed in modes A, B and C from 9kHz to 25GHz. Final measurements were taken for the worst case operation modes only. The worst case operation modes were mode B in the frequency range 30-1000MHz, mode A in the frequency range 1-8GHz and mode B in the frequency range 8-25GHz. No spurious emission was found in the range 9kHz-30MHz.

Table 10: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode B (2450MHz)

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 [°]
32.051	X / H	38.4	-16.8	21.6	40.0	18.4	100	1
32.059	X / V	38.4	-17.5	20.9	40.0	19.1	100	1
53.574	X / H	38.7	-15.6	23.1	40.0	16.9	174	190
53.580	X / V	39.1	-16.1	23.0	40.0	17.0	281	21
66.665	X / H	38.1	-16.8	21.3	40.0	18.7	399	359
66.744	X / V	40.0	-16.9	23.1	40.0	16.9	307	101
940.080	X / H	31.0	-2.0	29.0	46.0	17.0	223	40

Note: Level QP = Reading QP + Factor

Table 11: Radiated Emissions, Average Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Mode A (2425MHz)

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 [°]
4850.866	X / V	43.2	-9.1	34.1	54.0	19.9	127	295
7773.525	X / H	37.7	-3.2	34.5	54.0	19.5	106	198
7859.232	X / V	37.6	-3.0	34.6	54.0	19.4	118	304

Note: Level AV = Reading AV + Factor

Table 12: Radiated Emissions, Peak Data, 1 - 8GHz, Horizontal and Vertical Antenna Orientations, Mode A (2425MHz)

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 [°]
4850.866	X / V	55.0	-9.1	45.9	74.0	28.1	127	295
7773.525	X / H	52.6	-3.2	49.5	74.0	24.5	106	198
7859.232	X / V	52.1	-3.0	49.1	74.0	24.9	118	304

Note: Level PK = Reading PK + Factor

Table 13: Radiated Emissions, Average Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Mode B (2450MHz)

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 [°]
17644.322	X / V	38.4	-5.0	33.4	54.0	20.6	172	124

Note: Level AV = Reading AV + Factor

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Table 14: Radiated Emissions, Peak Data, 8 - 25GHz, Horizontal and Vertical Antenna Orientations, Mode B (2450MHz)

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 [°]
17644.322	X / V	53.4	-5.0	48.3	74.0	25.7	172	124

Note: Level PK = Reading PK + Factor

Table 15: Radiated Emissions at Band Edge, Average and Peak Data, Horizontal and Vertical Antenna Orientations, Modes A (2425MHz) and C (2475MHz)

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]
2425	Z / V	35.20	46.91	54	74	18.80	27.09
2475	Z / V	47.85	53.50	54	74	26.15	20.50

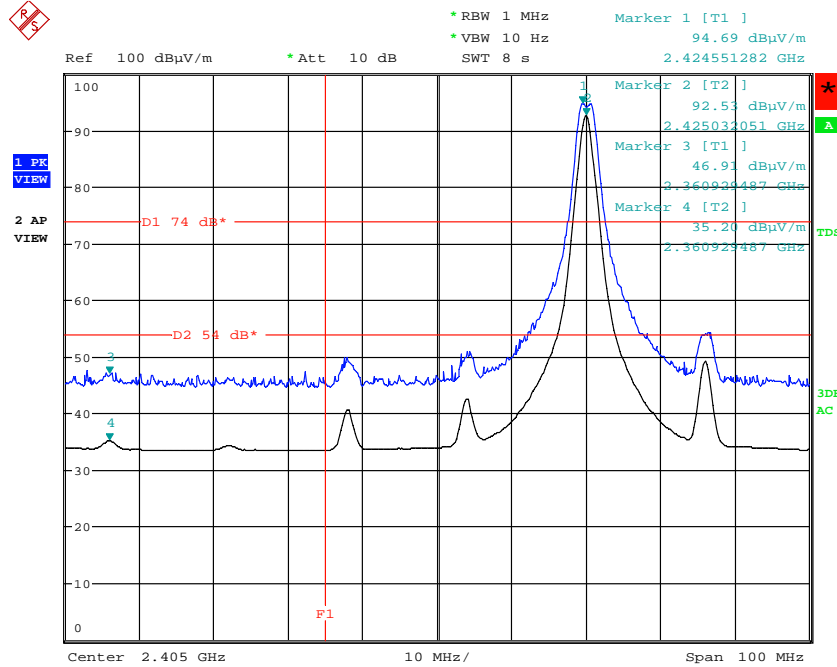
Notes: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
 Average limit in dBμV/m is calculated as follows: Average limit = 20 x log(500μV/m).
 Peak limit in dBμV/m is calculated as follows: Peak limit = Average limit + 20dB.

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Figure 23: Radiated Emissions at Band Edge, Spectral Diagram, Mode A (2425MHz)



Band Edge (Lo), Vert, Mode A, Position Z
Direct/Fundamental
Date: 17.MAY.2012 15:49:02

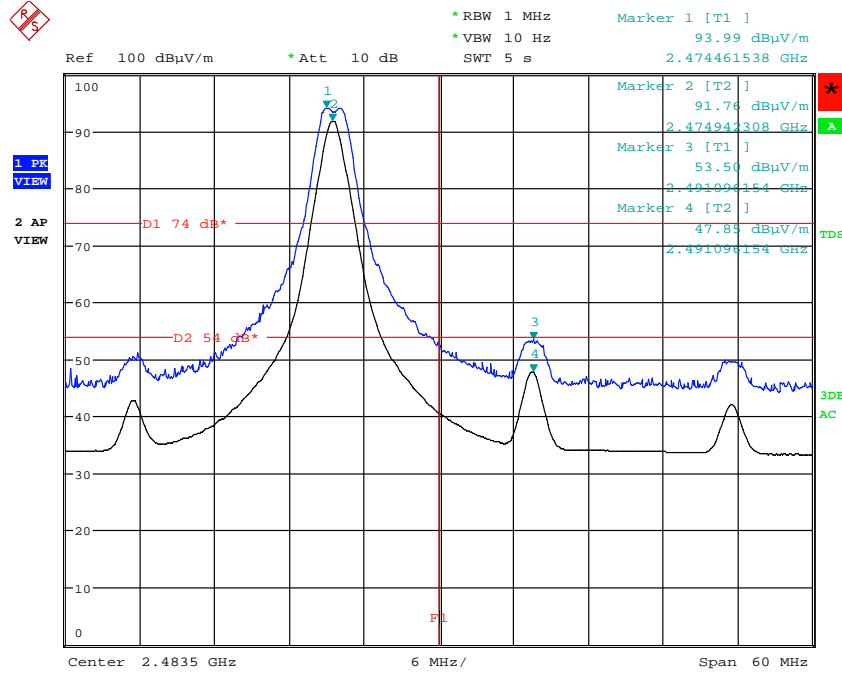
Note: The upper trace shows the peak value and the lower trace shows the average value.

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Figure 24: Radiated Emissions at Band Edge, Spectral Diagram, Mode C (2475MHz)



Band Edge (Hi), Vert, Mode C, Position Z
 Direct/Fundamental
 Date: 17.MAY.2012 15:33:51

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

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5.4 AC Power Line Conducted Measurements

5.4.1 AC Power Line Conducted Emission of Transmitter

RESULT: N/A

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).

Note:

This test is not applicable, since the EUT cannot transmit wireless signals while it is connected to the AC mains network via the USB interface.

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