

Produkte
Products

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<i>Test Report No.:</i>			
Auftraggeber: <i>Client:</i>		Panasonic Corporation 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>		Serien-Nr.: <i>Serial No.:</i>	
DKB-DP13		56, 5A	
Wareneingangs-Nr.: <i>Receipt No.:</i>		Eingangsdatum: <i>Date of Receipt:</i>	
PT0214033628		2013-02-21	
Zustand des Prüfgegenstandes bei Anlieferung: Good <i>Condition of Test Item at Delivery:</i>			
Prüfort: <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 C63.4-2009 KDB Publication No. 558074 D01: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (v02) RSS-210 (Issue 8): 2010 RSS-Gen (Issue 3): 2010 ANSI C63.4-2009			
Prüfergebnis: <i>Test Result:</i>			
Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). The test item passed the test specification(s).			
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:	
 2013-03-11 Y. Mashima / Inspector		 2013-03-11 T. Cheung / 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:			
This test report, 12029422 001, only covers the testing of the intentional radiators of IEEE 802.15.4 (ZigBee) aspect of the product. For the other aspect, please refer to the other test reports 12029422 002 to 003.			
Abkürzungen:		Abbreviations:	
P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet		P(ass) = passed F(ail) = failed N/A = not applicable N/T = not tested	
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. 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.			

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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: PASS

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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	2014-01
DC Power Supply	Agilent	E3646A	MY503500 07	RF-0412	N/A
DC Power Supply	KIKUSUI	PWR400L	QL002003	Y3-1221	2014-01
For AC Power Line Conducted Emission					
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2014-01
LISN	Rohde & Schwarz	ENV216	100276	RF-0016	2013-06
LISN	Rohde & Schwarz	ENV216	101371	RF-0459	2013-12
For Radiated Emission					
Receiver	Rohde & Schwarz	ESU 8	100025	RF-0020	2014-02
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	2014-02
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
Microwave Pre-Amplifier, 1-8GHz	Toyo Corporation	TPA0108-40	0634	RF-0052	2013-05
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
Constant Voltage Constant Frequency Stabilizers and Power Accessories					
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
True RMS Multimeter	Fluke	87V	16110176	RF-0414	2013-05

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
AC Power Line Conducted Emission	9kHz- 150kHz	±3.0dB
	150kHz - 30MHz	±3.0dB
Antenna Port Conducted Emission	20Hz - 40GHz	±1.5dB
Radiated Emission	9kHz – 150kHz	±4.0dB
	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 Electronic Pen which communicates by IEEE 802.15.4(ZigBee) with Electronic Pen Adapter attached to a PC or display to transmit drawing, writing or deleting data. And also EUT has the feature of wireless charging from the Pen Charger.

3.2 System Details

Radio standard:	IEEE 802.15.4
Specified output power:	-4.0dBm (conducted)
Antenna gain:	Max.: 0.8dBi
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 3.7V via battery and/or DC 5V via USB.
Protection class:	III
Test voltage:	DC 3.7V via Battery and/or DC 5V via USB.

3.3 Clock Frequencies

The highest frequency generated or used by the EUT are 16MHz for the RF MCU, and 12MHz for the digital interface.

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 C63.4-2009 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.

These operation modes shall be coupled with the following configurations:

- 1. EUT is charging via USB cable.
- 2. EUT is operating in stand-alone configuration.

4.3 Physical Configuration for Testing

The EUT was tested on a stand-alone basis and 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 C63.4-2009.

Figure 1: Block Diagram 1

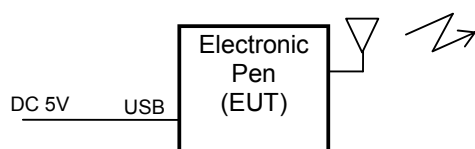


Figure 2: Block Diagram 2

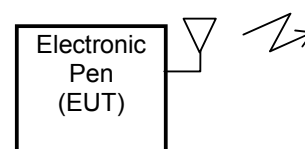


Table 3: Interfaces present on the EUT

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	USB	2m, shielded	DC input port

Notes:

Two test samples were available. Sample No. 56 was used for antenna conducted measurements and sample No. 5A was used for AC power line conducted measurement and for radiated measurements.

For antenna conducted measurements, the antenna was replaced by a 50Ω antenna connector. For more details, refer to section: Photographs of the Test Set-Up.

4.4 Test Software

The EUT was provided by the manufacturer with suitable software to allow operation in all the required modes.

4.5 Special Accessories and Auxiliary Equipment

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

- Product: AC Adapter for EUT
Manufacturer: Nikon
Model: EH-69P
Rated Voltage: 100-240V
Input Current: 0.068-0.042A
Frequency: 50/60Hz
Protection Class: II
Serial Number: 11PK50

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. And there is a DC/DC voltage regulator. 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: 2013-02-21

Ambient temperature: 20°C

Relative humidity: 35%

Atmospheric pressure: 1017hPa

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 C63.4-2009, 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 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 3.7V via battery and DC 5V via USB) 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 3.7V. Therefore, all the other measurements for the evaluation of the radio properties of the EUT have been performed using this input voltage.

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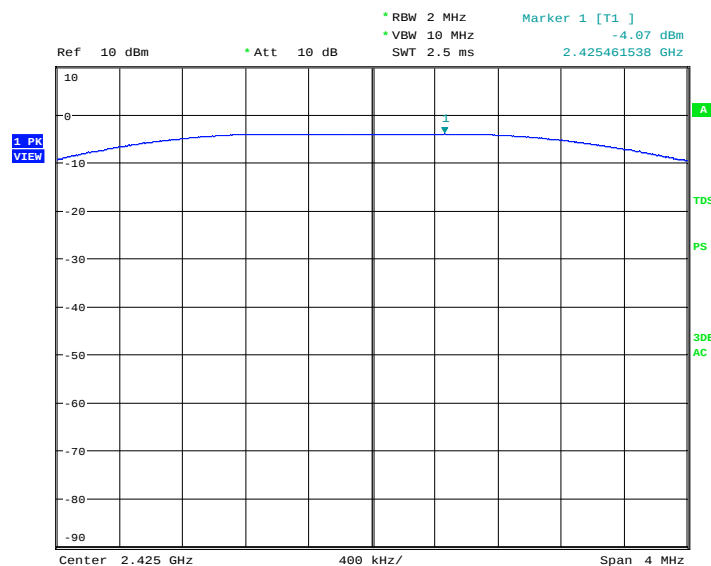
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Table 4: Conducted Output Power, Mode A (2425MHz), DC 3.7V and DC 5V Input Voltages

Input Voltage	Output Power [dBm]	Limit [dBm]	Margin [dB]
DC 3.7V	-4.07	30.00	34.07
DC 5.0V	-4.09	30.00	34.09

Figure 3: Conducted Output Power, Mode A (2425MHz), Worst Case Input Voltage (DC 3.7V)



Maximum peak conducted output power, mode A
Date: 21.FEB.2013 09:37:41

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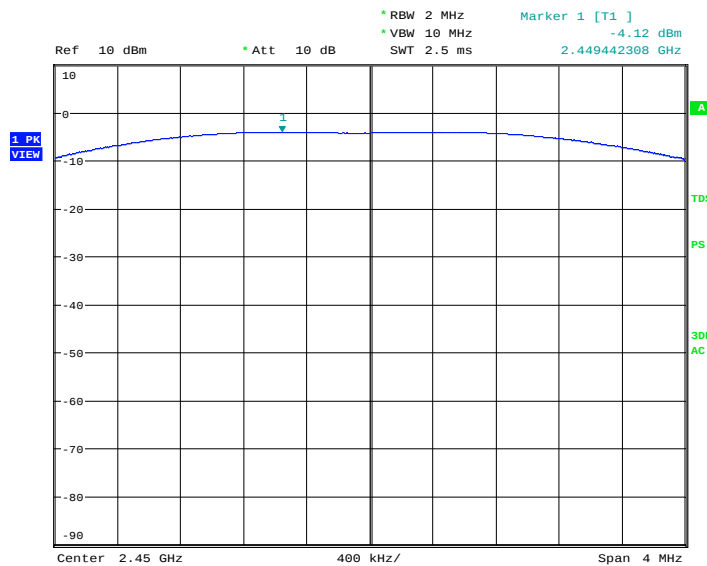
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Table 5: Conducted Output Power, Mode B (2450MHz), DC 3.7V and DC 5V Input Voltages

Data Rate [Mbps]	Output Power [dBm]	Limit [dBm]	Margin [dB]
DC 3.7V	-4.12	30.00	34.12
DC 5.0V	-4.15	30.00	34.15

Figure 4: Conducted Output Power, Mode B (2450MHz), Worst Case Input Voltage (DC 3.7V)



Maximum peak conducted output power, mode B

Date: 21.FEB.2013 09:38:46

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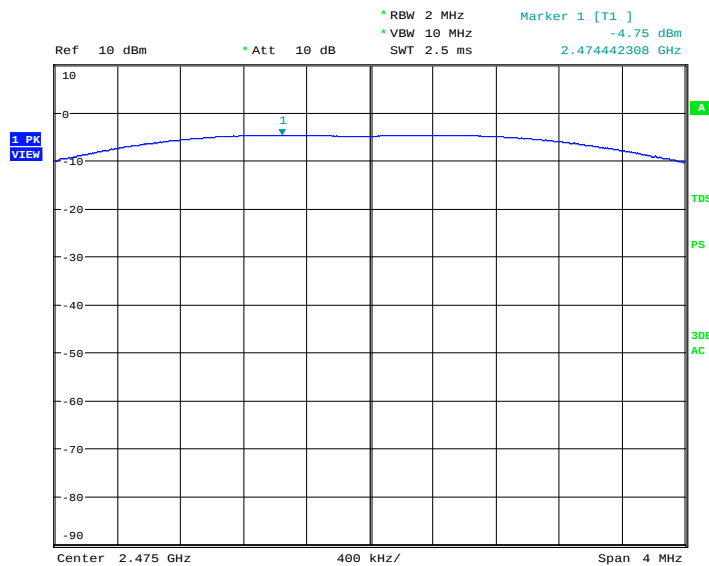
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Table 6: Conducted Output Power, Mode C (2475MHz), DC 3.7V and DC 5V Input Voltages

Data Rate [Mbps]	Output Power [dBm]	Limit [dBm]	Margin [dB]
DC 3.7V	-4.75	30.00	34.75
DC 5.0V	-4.76	30.00	34.76

Figure 5: Conducted Output Power, Mode C (2475MHz), Worst Case Input Voltage (DC 3.7V)



Maximum peak conducted output power, mode C

Date: 21.FEB.2013 09:39:42

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5.2.2 6dB Bandwidth

RESULT:

PASS

Date of testing: 2013-02-21

Ambient temperature: 20°C

Relative humidity: 35%

Atmospheric pressure: 1017hPa

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:

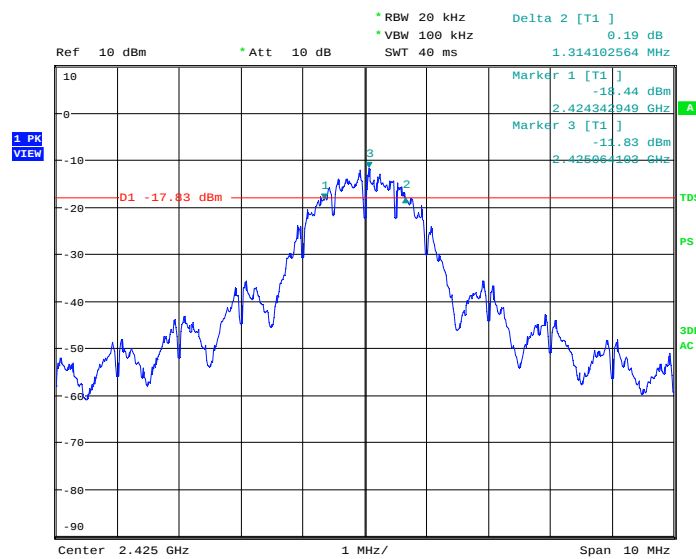
ANSI C63.4-2009, RSS-Gen 4.6.2 and KDB Publication No. 558074 D01.

The 6dB bandwidth was measured at the antenna port with a spectrum analyzer using a peak detector. The resolution bandwidth was set to 20kHz and the video bandwidth to 100kHz. 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	1.314	0.5
2450	1.282	0.5
2475	1.298	0.5

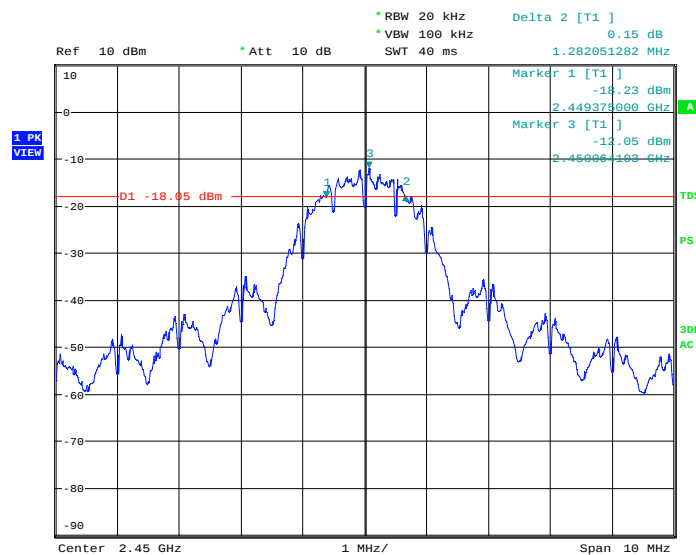
Figure 6: 6dB Bandwidth, Mode A (2425MHz)



6dB bandwidth, mode A

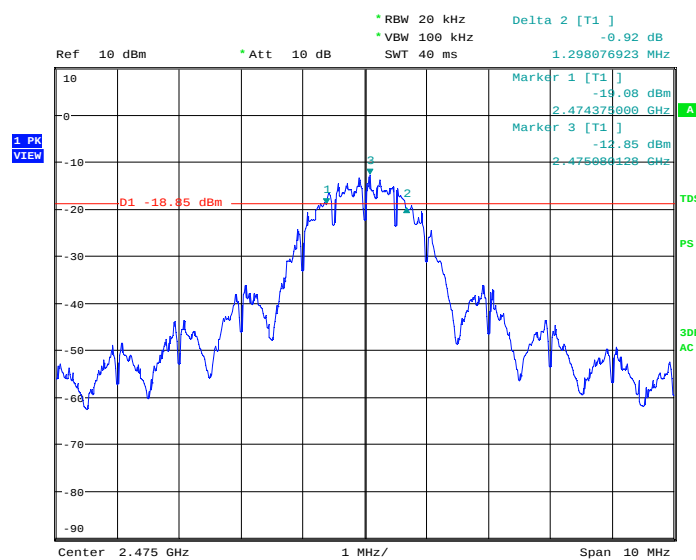
Date: 21.FEB.2013 09:09:45

Figure 7: 6dB Bandwidth, Mode B (2450MHz)



6dB bandwidth, mode B
Date: 21.FEB.2013 09:00:17

Figure 8: 6dB Bandwidth, Mode C (2475MHz)



6dB bandwidth, mode C
Date: 21.FEB.2013 09:05:21

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5.2.3 99% Bandwidth

Date of testing: 2013-02-21

Ambient temperature: 20°C

Relative humidity: 35%

Atmospheric pressure: 1017hPa

Requirements:

RSS-Gen 4.6.1

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

Test procedure:

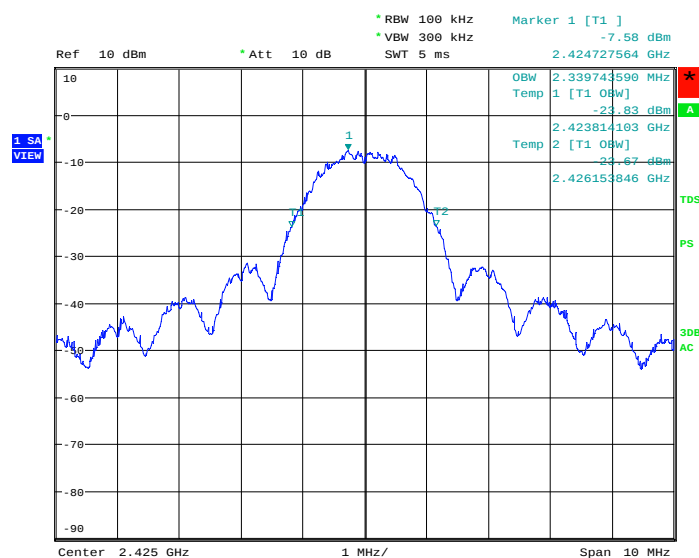
RSS-Gen 4.6.1.

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.

Table 8: 99% Bandwidth

Operating Frequency [MHz]	99% Bandwidth [MHz]
2425	2.34
2450	2.36
2475	2.37

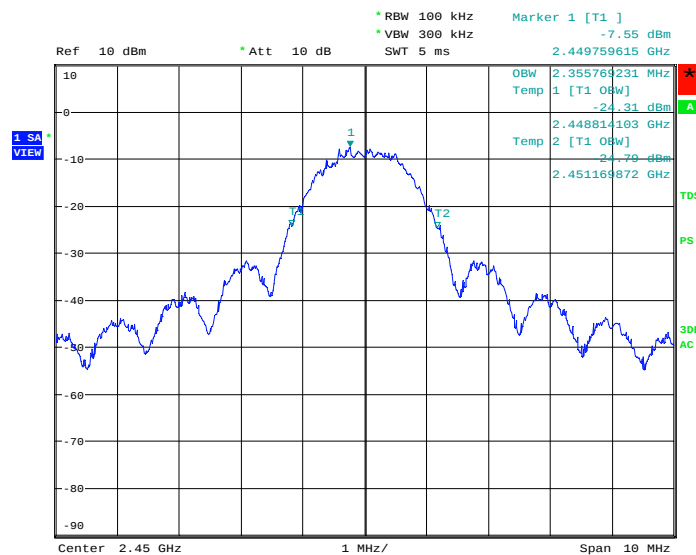
Figure 9: 99% Bandwidth, Mode A (2425MHz)



99% bandwidth, mode A

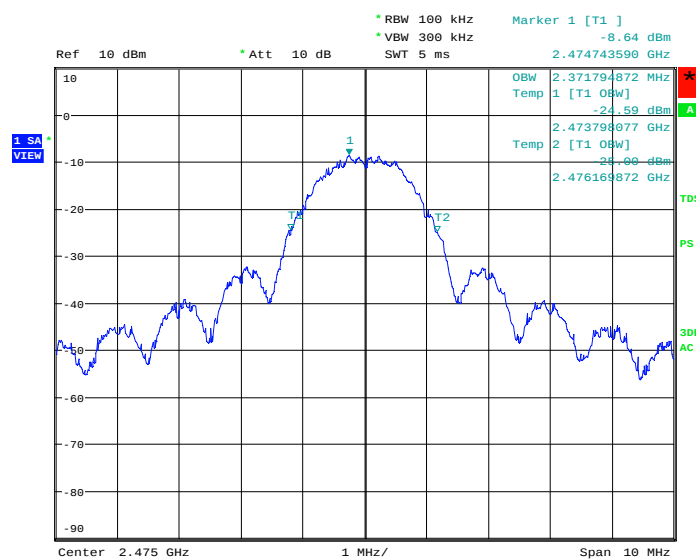
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Figure 10: 99% Bandwidth, Mode B (2450MHz)



99% bandwidth, mode B
Date: 21.FEB.2013 12:44:25

Figure 11: 99% Bandwidth, Mode C (2475MHz)



99% bandwidth, mode C
Date: 21.FEB.2013 12:45:05

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5.2.4 Conducted Spurious Emissions

RESULT:

PASS

Date of testing: 2013-02-21

Ambient temperature: 20°C

Relative humidity: 35%

Atmospheric pressure: 1017hPa

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.

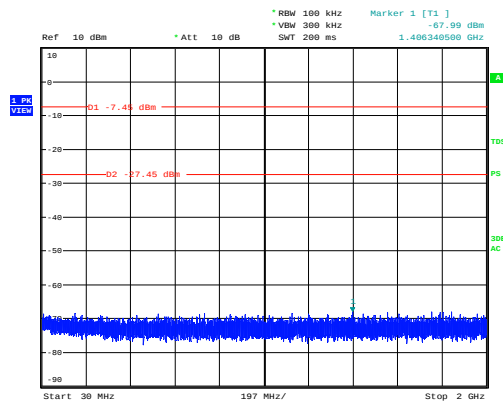
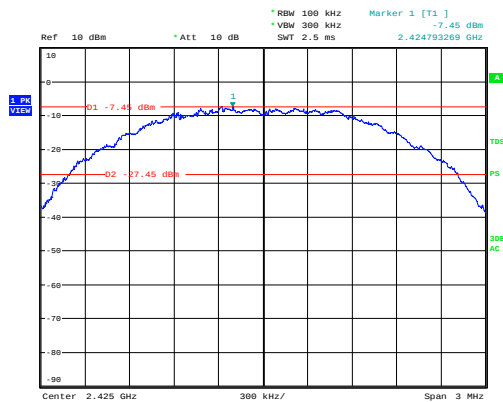
Test procedure:

ANSI C63.4-2009, 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).

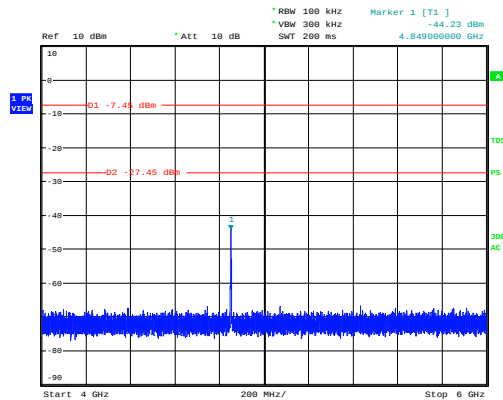
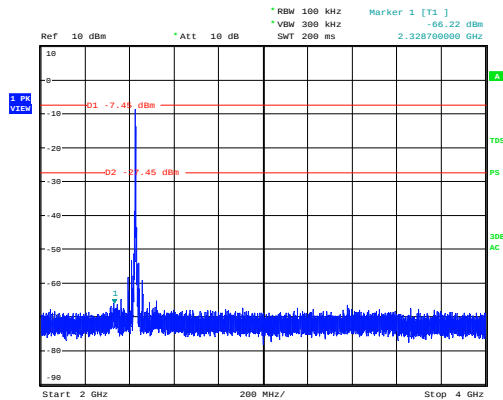
The readings of the measurements take into account the loss generated by all the involved cables.

Figure 12: Conducted Spurious Emissions, 30MHz - 10GHz, Mode A (2425MHz)



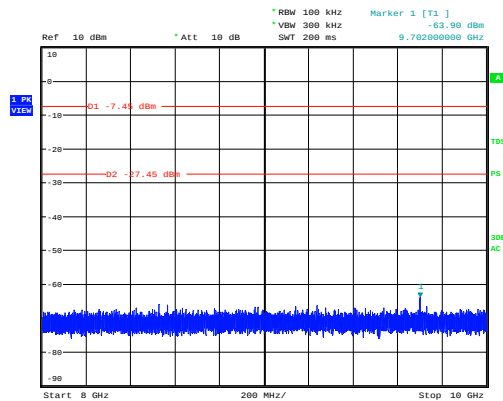
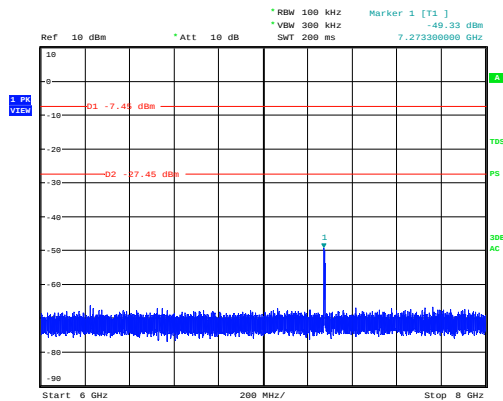
Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:53:52

Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:54:38



Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:56:55

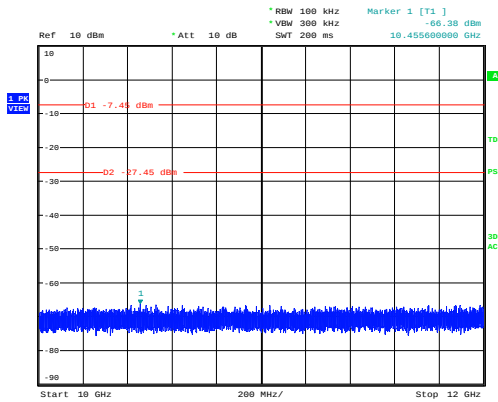
Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:57:17



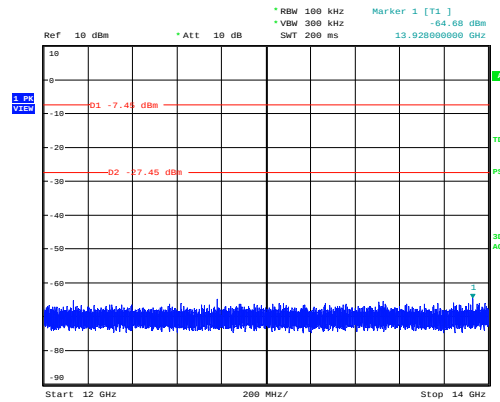
Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:57:33

Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:57:49

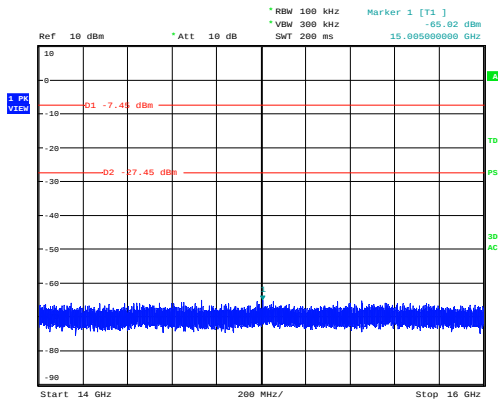
Figure 13: Conducted Spurious Emissions, 10 - 22GHz, Mode A (2425MHz)



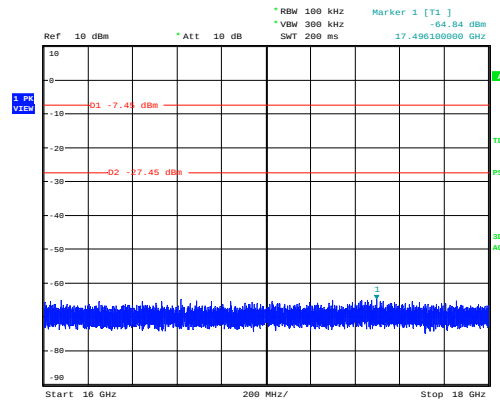
Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:58:04



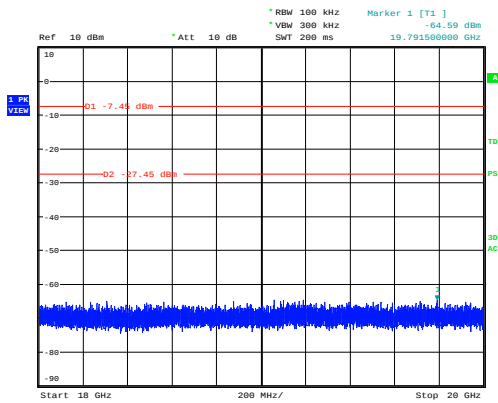
Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:58:20



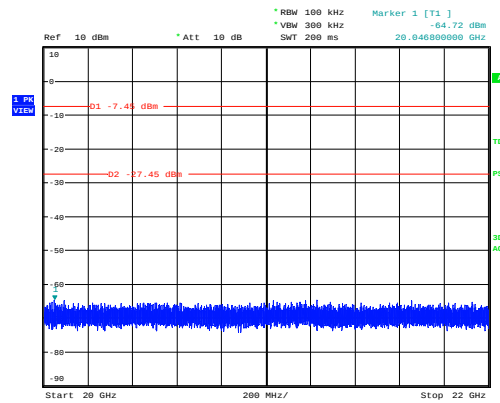
Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:58:36



Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:58:52



Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:59:07



Conducted spurious emissions, mode A
Date: 21.FEB.2013 09:59:23

Produkte
Products

Figure 14: Conducted Spurious Emissions, 22 - 25GHz, Mode A (2425MHz)

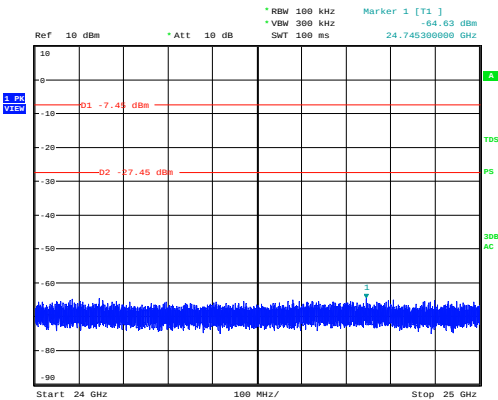
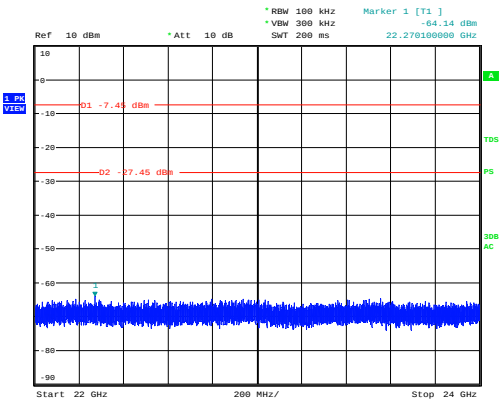
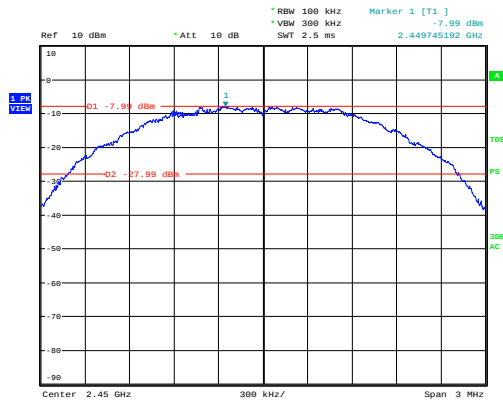
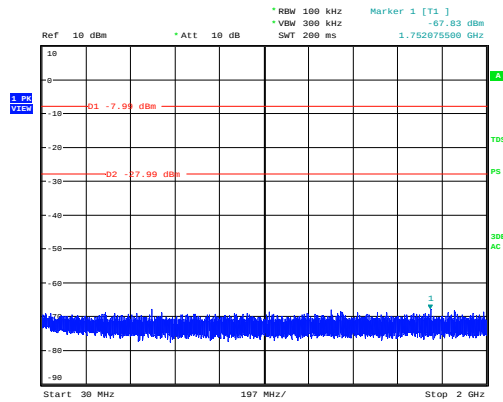


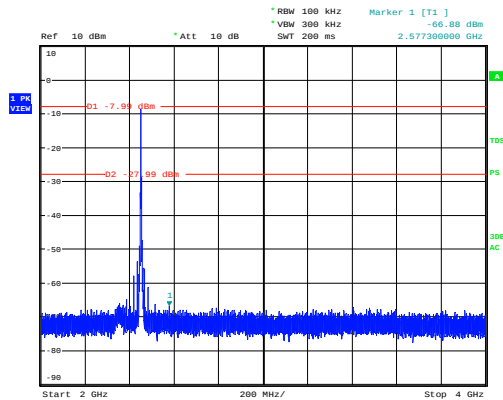
Figure 15: Conducted Spurious Emissions, 30MHz - 10GHz, Mode B (2450MHz)



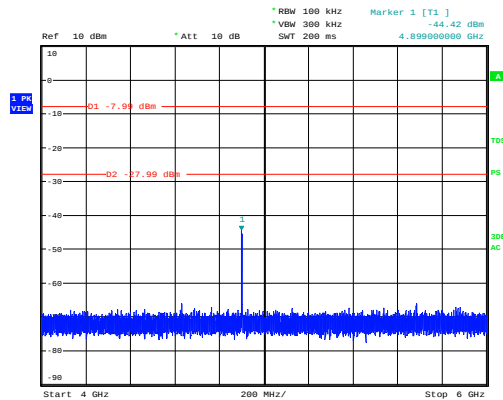
Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:03:01



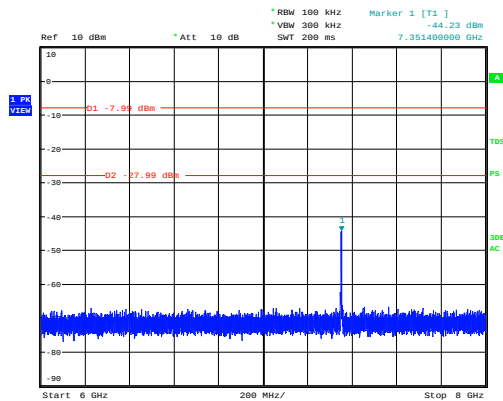
Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:03:17



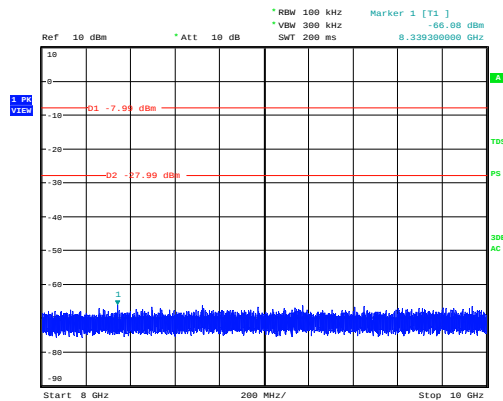
Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:04:26



Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:04:44



Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:05:00

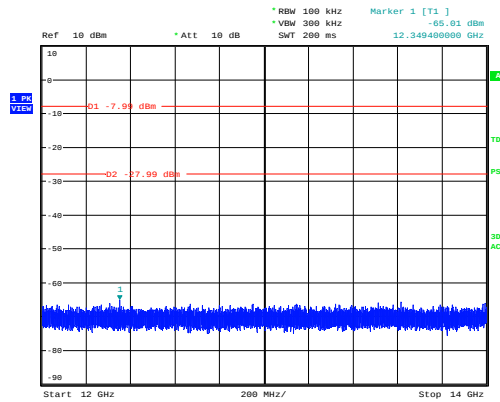
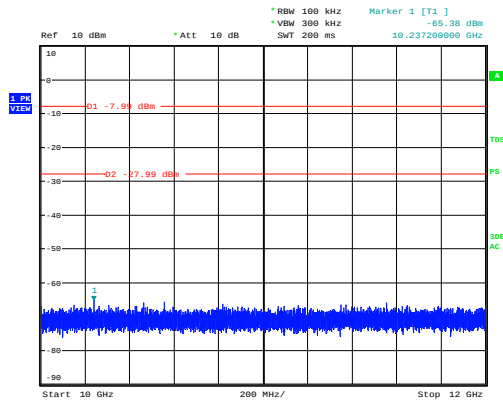


Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:05:16

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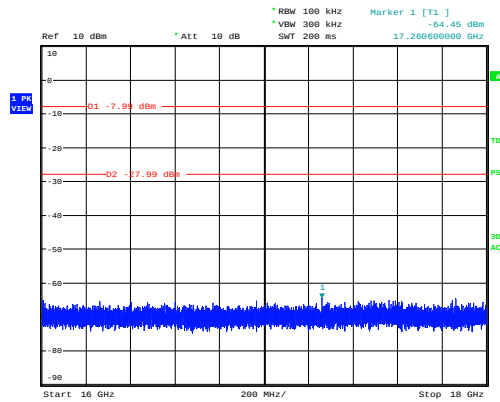
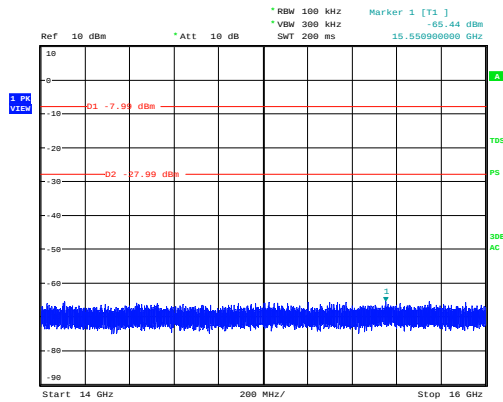
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Figure 16: Conducted Spurious Emissions, 10 - 22GHz, Mode B (2450MHz)



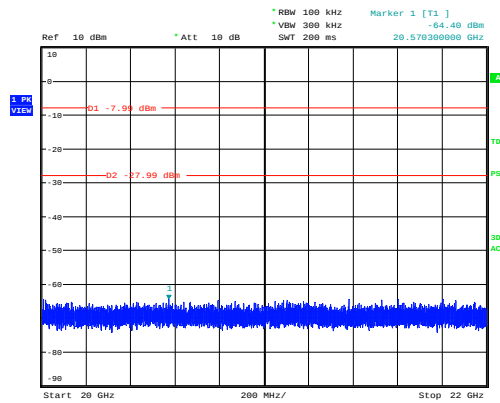
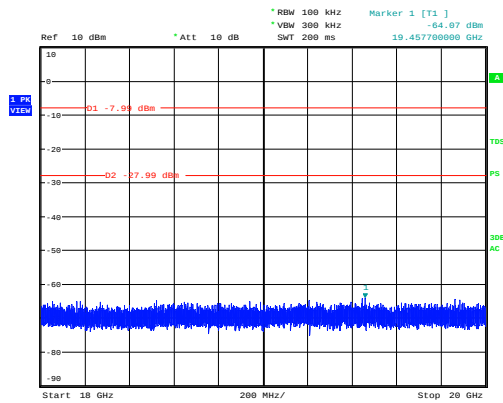
Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:05:32

Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:05:48



Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:06:05

Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:06:20



Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:06:36

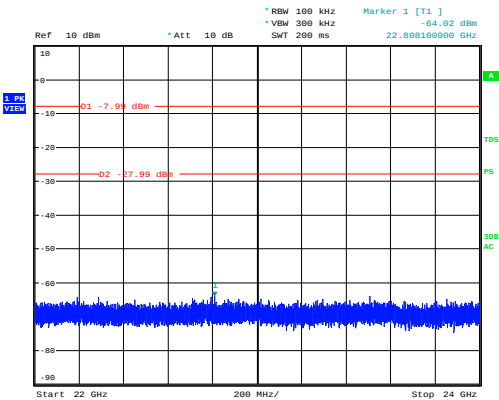
Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:06:52

Produkte
Products

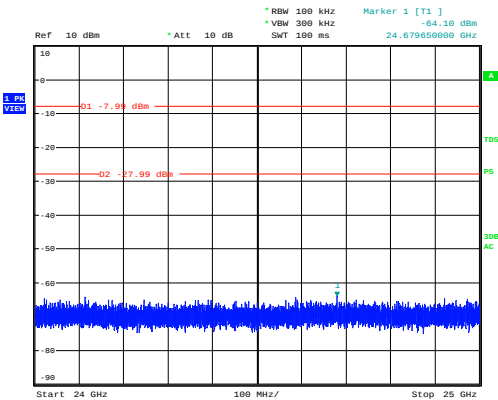
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Figure 17: Conducted Spurious Emissions, 22 - 25GHz, Mode B (2450MHz)

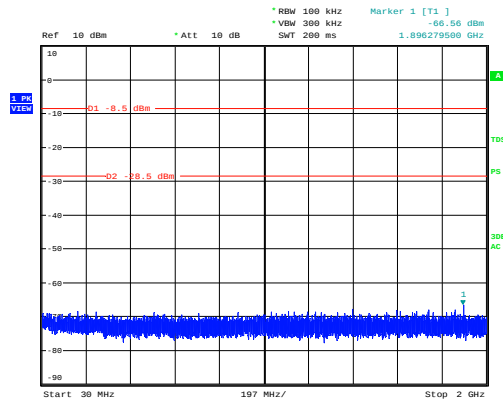
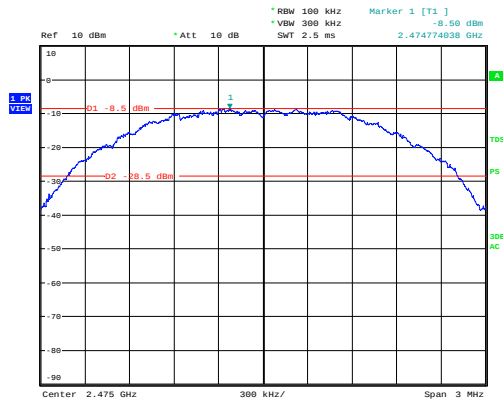


Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:07:08



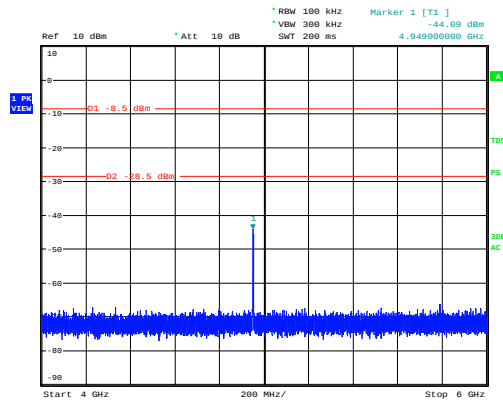
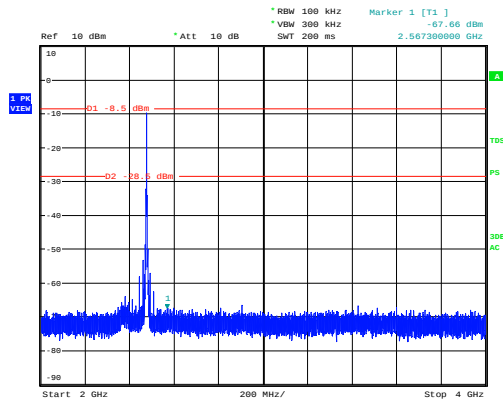
Conducted spurious emissions, mode B
Date: 21.FEB.2013 10:07:26

Figure 18: Conducted Spurious Emissions, 30MHz - 10GHz, Mode C (2475MHz)



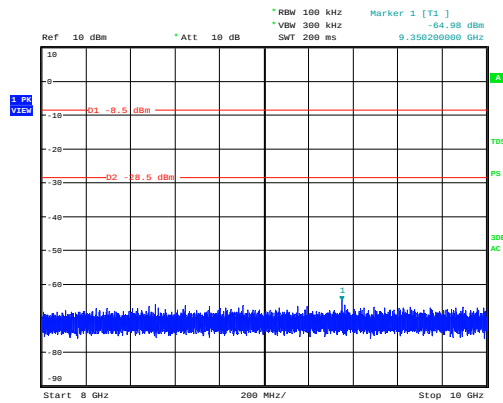
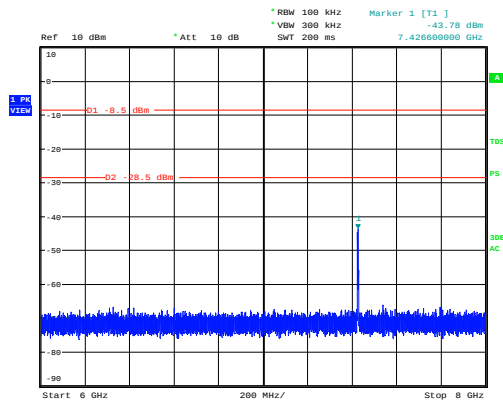
Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:09:05

Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:09:22



Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:10:51

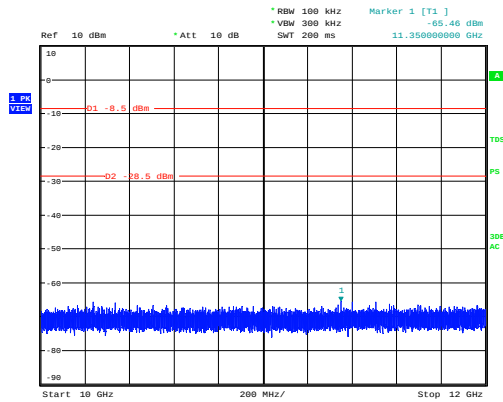
Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:11:09



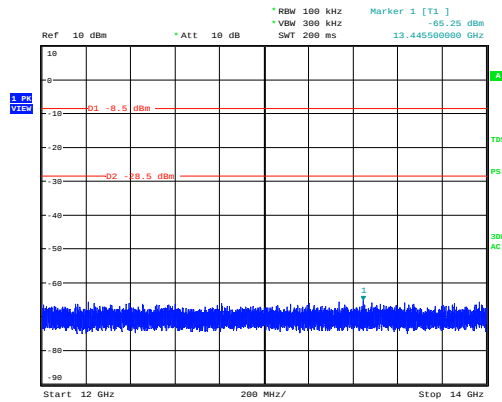
Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:11:25

Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:11:41

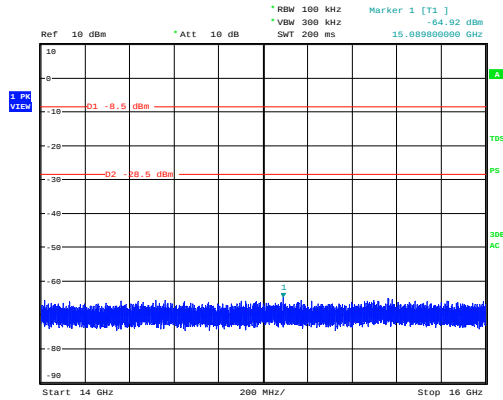
Figure 19: Conducted Spurious Emissions, 10 - 22GHz, Mode C (2475MHz)



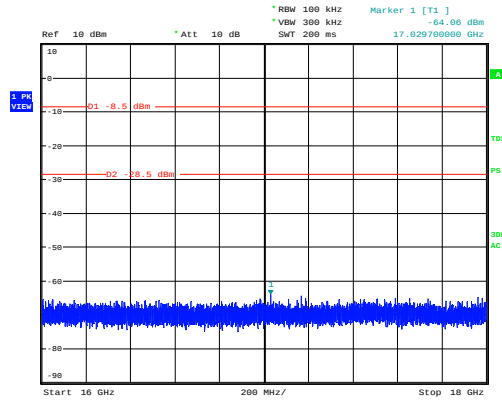
Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:11:58



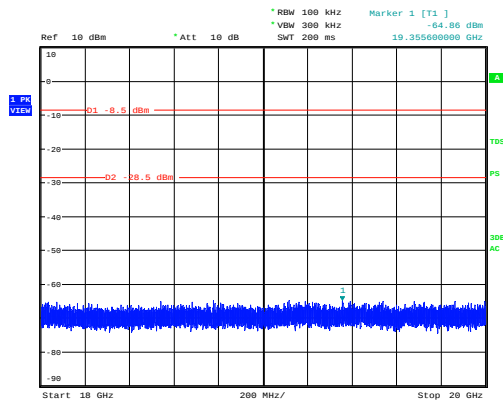
Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:12:15



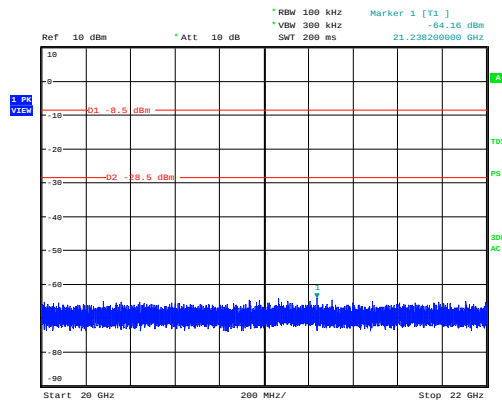
Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:12:30



Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:12:48



Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:13:04



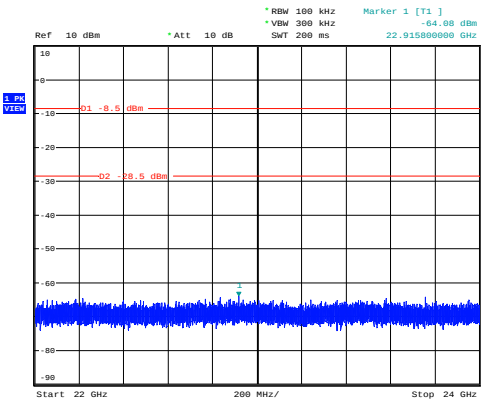
Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:13:20

Produkte
Products

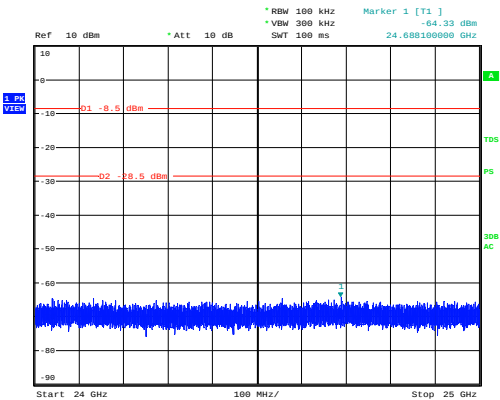
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Figure 20: Conducted Spurious Emissions, 22 - 25GHz, Mode C (2475MHz)



Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:13:37



Conducted spurious emissions, mode C
Date: 21.FEB.2013 10:13:53

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5.2.5 Peak Power Spectral Density

RESULT:

PASS

Date of testing: 2013-02-21

Ambient temperature: 20°C

Relative humidity: 35%

Atmospheric pressure: 1017hPa

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 C63.4-2009 and KDB Publication No. 558074 D01.

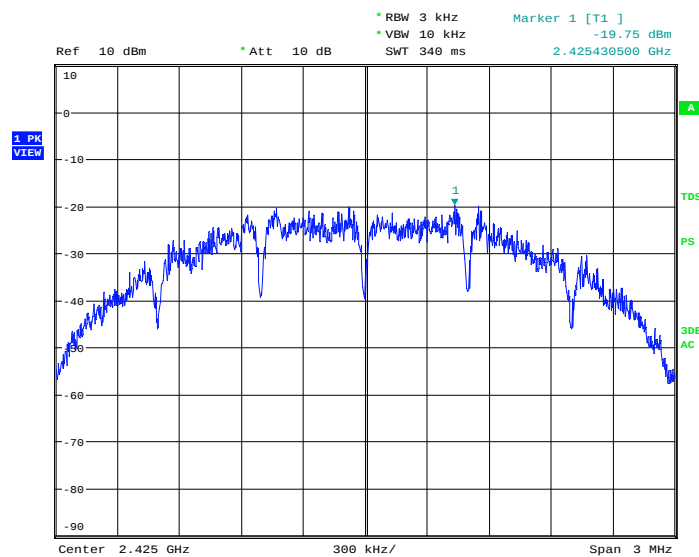
The peak power spectral density was measured at the antenna port with a spectrum analyzer using a peak detector with a resolution bandwidth of 3kHz and a video bandwidth of 10kHz.

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

Table 9: Peak Power Spectral Density

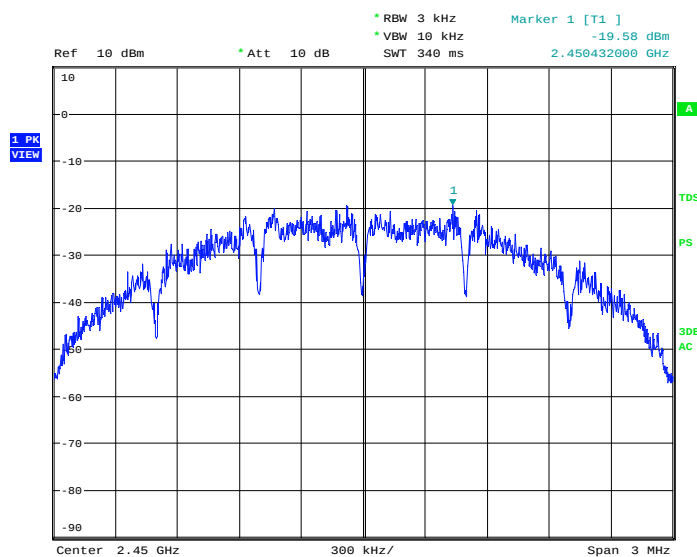
Operating Frequency [MHz]	Max PSD Frequency [MHz]	Max PSD [dBm]	Limit [dBm]	Margin [dB]
2425	2425.4	-19.8	8.00	27.75
2450	2450.4	-19.6	8.00	27.58
2475	2475.4	-20.3	8.00	28.29

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



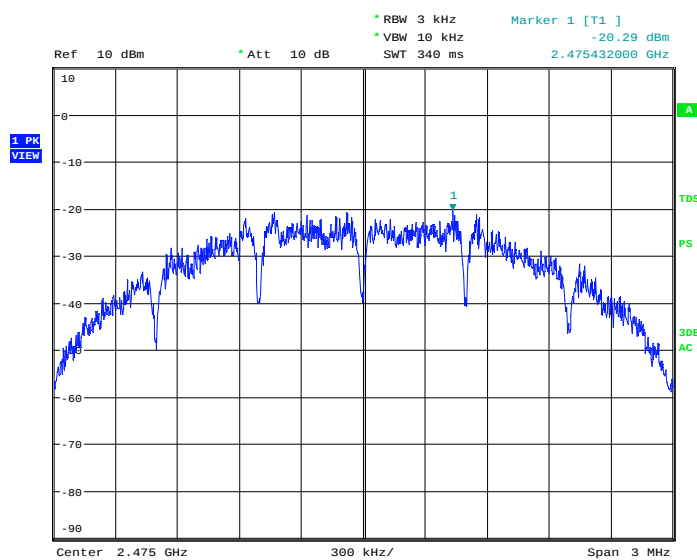
Peak power spectral density, mode A
Date: 21.FEB.2013 09:52:58

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



Peak power spectral density, mode B
Date: 21.FEB.2013 09:47:53

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



Peak power spectral density, mode C
Date: 21.FEB.2013 09:49:34

5.3 Radiated Measurements

5.3.1 Radiated Spurious Emissions of Transmitter

RESULT:

PASS

Date of testing: 2013-03-01 till 2013-03-06

Ambient temperature: 21 to 23°C

Relative humidity: 37 to 51%

Atmospheric pressure: 1011 to 1017hPa

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 C63.4-2009, 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.

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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 = 1MHz & VBW = 3MHz; for average field strength: RBW = 1MHz & VBW = 10Hz.

Absorbers have been placed on the floor between the EUT and the measuring antenna for testing above 1GHz.

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, C and configuration 1 and 2 from 9kHz to 25GHz. Final measurements were taken for the worst case operation modes only. The worst case operation modes were mode A, configuration 2 in the frequency range 30-1000MHz and mode C configuration 1 in the frequency range 1-25GHz. 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 A (2425MHz), Configuration 2

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 [°]
32.073	Z / H	34.3	-17.0	17.3	40.0	22.7	100	5
44.974	Z / V	30.4	-15.9	14.5	40.0	25.5	269	114
151.469	Z / V	30.3	-15.3	15.0	43.5	28.5	400	275
504.836	Z / V	40.6	-8.4	32.2	46.0	13.8	103	125
530.708	Z / V	39.9	-7.7	32.2	46.0	13.8	103	101
658.111	Z / V	33.6	-5.4	28.2	46.0	17.8	166	128

Note: Level QP = Reading QP + Factor

Table 11: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, Mode C (2475MHz), Configuration 1

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 [°]
1299.800	Z / V	40.7	-16.2	24.5	54.0	29.5	199	178
7423.538	Z / H	43.2	0.7	43.9	54.0	10.1	122	286

Note: Level AV = Reading AV + Factor

Table 12: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, Mode C (2475MHz), Configuration 1

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 [°]
1299.800	Z / V	54.8	-16.2	38.6	74.0	35.4	199	178
7423.538	Z / H	55.3	0.7	56.0	74.0	18.0	122	286

Note: Level PK = Reading PK + Factor

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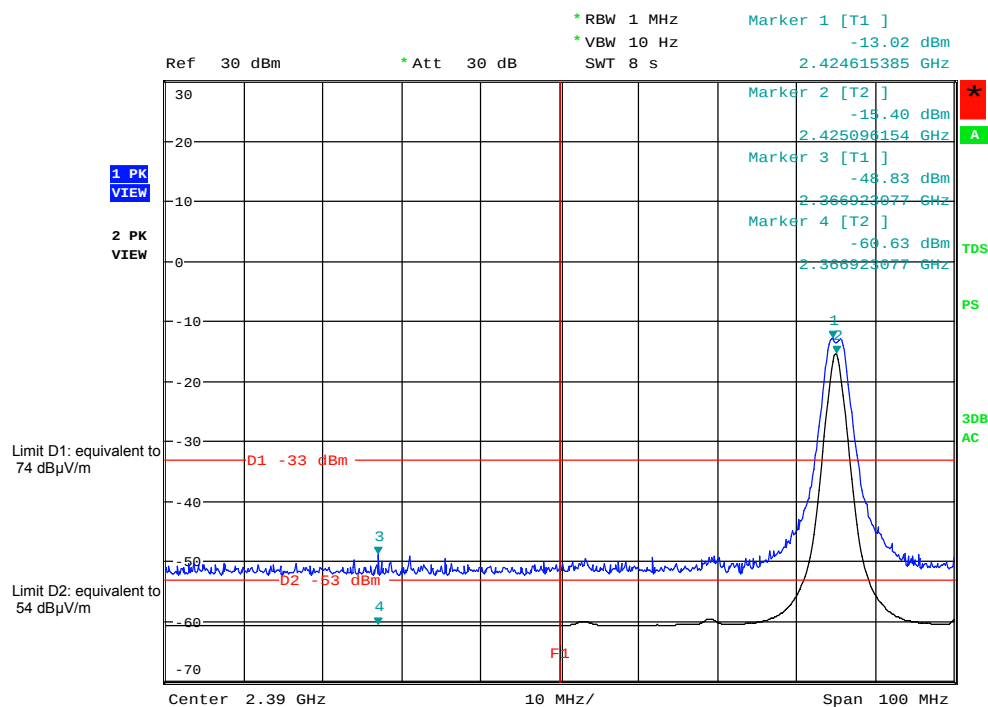
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Table 13: Radiated Emissions at Band Edge, Average and Peak Data, Horizontal and Vertical Antenna Orientations, Modes A (2425MHz), Configuration 1 and C (2475MHz), Configuration 1

Operating Frequency [MHz]	EUT / Antenna Orientation	Level AV [dBuV/m]	Level PK [dBuV/m]	Limit AV [dBuV/m]	Limit PK [dBuV/m]	Margin AV [dB]	Margin PK [dB]
2425	Z / V	46.37	58.17	54.00	74.00	7.63	15.83
2475	Z / V	47.82	58.33	54.00	74.00	6.18	15.67

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(500µV/m).
Peak limit in dBuV/m is calculated as follows: Peak limit = Average limit + 20dB.

Figure 24: Radiated Emissions at Band Edge, Spectral Diagram, Mode A (2425MHz)

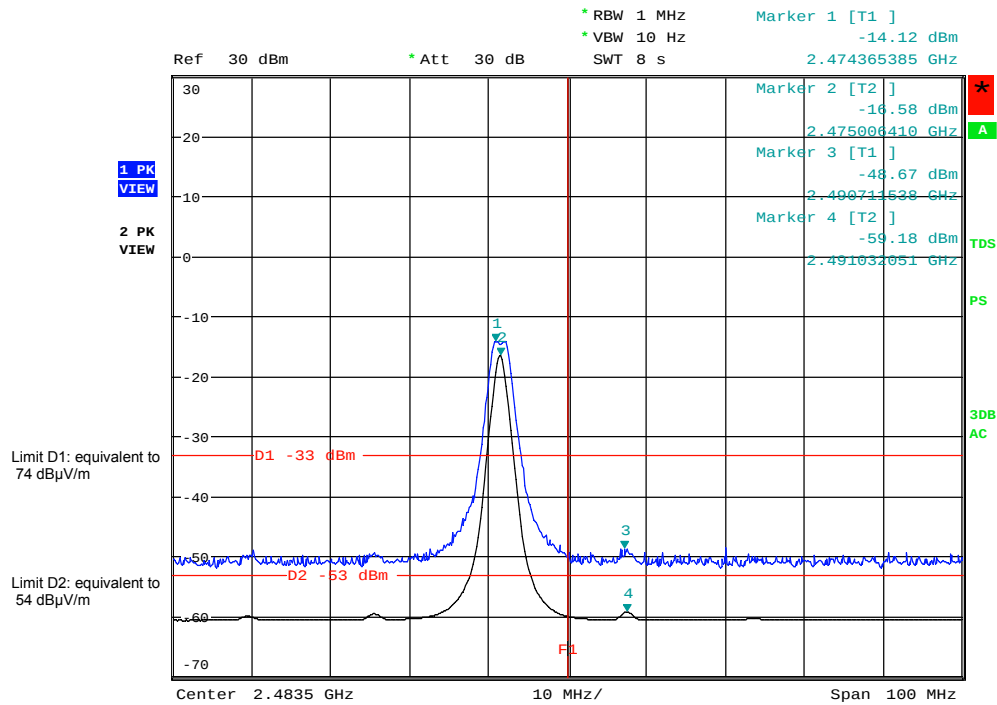


Band Edge, Vert, Mode A, Pos. Z

Date: 5.MAR.2013 15:49:56

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 dBuV/m.

Figure 25: Radiated Emissions at Band Edge, Spectral Diagram, Mode C (2475MHz)



Band Edge, Vert, Mode C, Pos. Z

Date: 5.MAR.2013 15:51:38

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: 2013-03-04

Ambient temperature: 23°C

Relative humidity: 19%

Atmospheric pressure: 1014hPa

Frequency range: 0.15 - 30MHz

Kind of test site: Shielded Room

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 C63.4-2009 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 AC adapter of 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.

Disturbances other than those mentioned are small or not detectable.

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Table 14: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase N (N) and L1 (L), Mode A (2425MHz)

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]
0.17692	N	30.4	12.4	9.7	40.1	22.1	64.6	54.6	24.5	32.5
0.18079	L1	30.9	12.1	9.8	40.7	21.9	64.4	54.4	23.7	32.5
0.26960	L1	23.5	10.8	9.8	33.3	20.6	61.1	51.1	27.8	30.5
0.39388	N	23.8	14.0	9.8	33.6	23.8	58.0	48.0	24.4	24.2
0.39582	L1	22.3	11.7	9.8	32.1	21.5	57.9	47.9	25.8	26.4
0.69340	L1	19.0	7.2	9.9	28.9	17.1	56.0	46.0	27.1	28.9
0.93036	L1	16.8	5.9	9.9	26.7	15.8	56.0	46.0	29.3	30.2
1.15794	N	20.4	8.5	9.9	30.3	18.4	56.0	46.0	25.7	27.6
1.79623	L1	18.8	6.5	10.1	28.9	16.6	56.0	46.0	27.1	29.4
2.72835	L1	19.6	7.3	10.3	29.9	17.6	56.0	46.0	26.1	28.4
3.09524	N	18.9	5.9	10.2	29.1	16.1	56.0	46.0	26.9	29.9
3.61770	L1	17.7	5.8	10.4	28.1	16.2	56.0	46.0	27.9	29.8

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

Table 15: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase N (N) and L1 (L), Mode B (2450MHz)

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]
0.17536	L1	30.9	11.8	9.8	40.7	21.6	64.7	54.7	24.0	33.1
0.17649	N	30.4	12.5	9.7	40.1	22.2	64.6	54.6	24.5	32.4
0.27313	L1	23.8	11.2	9.8	33.6	21.0	61.0	51.0	27.4	30.0
0.39085	L1	23.2	12.8	9.8	33.0	22.6	58.0	48.0	25.0	25.4
0.39120	N	24.2	14.6	9.8	34.0	24.4	58.0	48.0	24.0	23.6
0.59508	L1	19.2	7.2	9.9	29.1	17.1	56.0	46.0	26.9	28.9
0.79226	N	19.3	7.8	9.8	29.1	17.6	56.0	46.0	26.9	28.4
1.87003	L1	19.8	7.8	10.1	29.9	17.9	56.0	46.0	26.1	28.1
2.37394	N	20.5	7.9	10.1	30.6	18.0	56.0	46.0	25.4	28.0

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

Table 16: AC Power Line Conducted Emission, Quasi Peak and Average Data, 0.15 - 30MHz, Phase N (N) and L1 (L), Mode C (2475MHz)

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]
0.17536	N	30.2	12.3	9.7	39.9	22.0	64.7	54.7	24.8	32.7
0.17697	L1	30.9	11.8	9.8	40.7	21.6	64.6	54.6	23.9	33.0
0.26526	L1	22.6	10.2	9.8	32.4	20.0	61.3	51.3	28.9	31.3
0.39391	N	23.7	14.0	9.8	33.5	23.8	58.0	48.0	24.5	24.2
0.59245	L1	18.9	7.3	9.9	28.8	17.2	56.0	46.0	27.2	28.8
2.78255	N	20.4	7.8	10.1	30.5	17.9	56.0	46.0	25.5	28.1
3.15440	L1	18.8	7.0	10.3	29.1	17.3	56.0	46.0	26.9	28.7

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

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