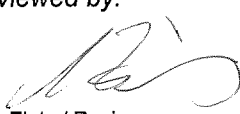


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<i>Test Report No.:</i>					
Auftraggeber: <i>Client:</i>		MINEBEA CO., LTD. 1-1-1 Katase, Fujisawa City, Kanagawa 251-8531			
Gegenstand der Prüfung: <i>Test item:</i>		Wireless Keyboard			
Bezeichnung: <i>Identification:</i>		VGP-WKB10		Serien-Nr.: <i>Serial No.:</i>	
				2000027, 2000042	
Wareneingangs-Nr.: <i>Receipt No.:</i>		213090491		Eingangsdatum: <i>Date of receipt:</i>	
				2009-05-19	
Prüfört: <i>Testing location:</i>		4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan			
Prüfgrundlage: 47 CFR Part 15, Subpart C, Section 15.247 (October 1, 2008) <i>Test specification:</i> ANSI C63.4-2003 Measurement of Digital Transmission Systems Operating under Section 15.247 (March 23, 2005) RSS-210 (Issue 7): 2007 RSS-Gen (Issue 2): 2007					
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:		
 2009-06-10 T. Sauter / Inspector			 2009-06-10 M. Zietz / 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 deals only with the intentional radiator portion of the tested product. Unintentional radiator aspects are covered by another test report. This test report supersedes test report 12605643 001 issued by TÜV Rheinland Japan, Ltd.					
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		
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>					

TEST SUMMARY

3.2.1 ANTENNA REQUIREMENTS, FCC 15.203, FCC 15.204 AND RSS-GEN 7.1.4

RESULT: PASS

5.1.1 CONDUCTED OUTPUT POWER, 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 99% BANDWIDTH, RSS-GEN 4.6.1

RESULT: N/A

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

RESULT: PASS

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

RESULT: PASS

6.1.1 AC POWER LINE CONDUCTED EMISSION OF TRANSMITTER, FCC 15.207 AND RSS-GEN 7.2.2

RESULT: N/A

6.2.1 AC POWER LINE CONDUCTED EMISSION OF RECEIVER, FCC 15.107 AND RSS-GEN 7.2.2

RESULT: N/A

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

RESULT: Pass

7.1.2 OUT-OF-BAND AND SPURIOUS EMISSION OF TRANSMITTER, 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 SPURIOUS 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.

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 8	100025	RF-0020	2010-02
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2010-01
RF Power Meter	Agilent	N1911A	MY451017 37	BT-8226	2009-10
RF Peak Power Sensor	Agilent	N1921A	MY452422 28	BT-8227	2009-10
For Radiated Emission					
Receiver	Rohde & Schwarz	ESU 8	100025	RF-0020	2010-02
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2010-01
RF Selector (10m)	Toyo Corporation	NS4900	0703-182	RF-0029	2010-05
3dB Attenuator 50Ohm	Tamagawa Electronics Co., Ltd.	CFA-01	-	RF-0265	2010-05
Low Noise Pre-Amplifier	TSJ	MLA-10K01-B01-35	1370750	RF-0253	2010-05
Microwave Pre-Amplifier, 1-8GHz	Toyo Corporation	TPA0108-40	0634	RF-0052	2009-12
Band Reject Filter	Nitsuki	NF-49BT	027	RF-0131	2009-12
Trilog Antenna, 30-1000MHz	Schwarzbeck	VULB9168	0245	RF-0019	2010-05
Horn Antenna, 1-10GHz	Schwarzbeck	BBHA9120B	419	RF-0050	2010-05
Horn Antenna with Pre-Amplifier, 2-18GHz	Toyo Corporation	HAP06-18W	00000025	RF-0065	2010-05
Horn Antenna with Pre-Amplifier, 18-26.5GHz	Toyo Corporation	HAP18-26N	00000010	RF-0070	2010-05

2.3 Measurement Uncertainty

Table 2: Emission Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emissions	< 1GHz	±0.39dB
	> 1GHz	±0.68dB
Radiated Emission	30MHz - 1GHz	±3.9dB
	> 1GHz	±5.2dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is a wireless keyboard intended to be produced for the general market. The EUT is to be used together with a receiver module which is to be inserted in a host computer. (The receiver module is out of the scope of this test report.)

3.2 System Details

Radio standard:	IEEE 802.15.4
Output power:	-6.82dBm (0.21mW)
Antenna gain:	+2dBi
Antenna type:	Printed trace wiggle antenna
Antenna mounting type:	Internal
Frequency range:	2402 – 2479MHz
Number of channels:	78
Channel spacing:	1MHz
Modulation type:	GFSK
FCC classification:	DTS
Emission designator:	F1D
System input voltage:	DC 3.0V (through two AA alkaline batteries)
Test voltage:	DC 3.0V (through two AA alkaline batteries)
Protection class:	III

3.2.1 Antenna Requirements, FCC 15.203, FCC 15.204 and RSS-Gen 7.1.4

RESULT:

PASS

The EUT has an internal antenna which is not user accessible. Hence it complies with the requirements.

3.3 Clock Frequencies

The highest clock frequency generated by the EUT is 12 MHz.

3.4 Independent Operation Modes

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

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.4:2003. Testing was performed at the lowest operating frequency (2402MHz), at the operating frequency in the middle of the specified frequency band (2440MHz) and at the highest operating frequency (2479MHz).

The basic operation modes are:

- A. EUT transmits (TX mode), with full power, at lowest channel (2402MHz), a continuous modulated signal streaming with 100% duty cycle.
- B. EUT transmits (TX mode), with full power, at middle channel (2440MHz), a continuous modulated signal streaming with 100% duty cycle.
- C. EUT transmits (TX mode), with full power, at highest channel (2479MHz), a continuous modulated signal streaming with 100% duty cycle.
- D. EUT receives (RX mode), at middle channel (2440MHz), continuously.

3.5 Noise Suppressing Parts

None mentioned explicitly.

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 (Issue 2).

For details, see under each test item.

4.2 Physical Configuration for Testing

Figure 1: Test Setup for Radiated Measurements

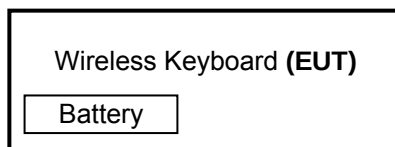


Figure 2: Test Setup for Antenna Conducted Measurements



Notes:

Two test samples were available. Sample 2000027 was used for antenna conducted measurements and sample 2000042 was used 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.

4.3 Test Operation and Test Software

The test samples had built-in test modes.

They were used to enable the test operation modes listed in section 3.4 as appropriate.

4.4 Special Accessories and Auxiliary Equipment

None

4.5 Countermeasures to achieve EMC Compliance

No additional measures were employed to achieve compliance.

5. Test Results of Conducted Measurements at Antenna Port

For conducted tests, the antenna was replaced by a temporary SMA-type connector, directly attached to the transmitter.

The tests were performed using a new battery.

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

RESULT:

PASS

Date of testing: 2009-05-20

Ambient temperature: 22°C

Relative humidity: 45%

Atmospheric pressure: 1006hPa

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 at the antenna connector with a power meter. The final measurement takes into account the loss generated by all the involved cables.

The measurement was performed at all the available data rates in order to identify the one producing the highest output power.

Table 3: Conducted Output Power, Mode A (2402MHz)

Data Rate [kbps]	Reading [dBm]	Correction Factor [dB]	Output Power [dBm]	Output Power [mW]	Limit [dBm]	Limit [mW]	Margin [dB]
250	-7.62	0.53	-7.09	0.20	30.00	1000	37.09
62.5	-7.63	0.53	-7.10	0.19	30.00	1000	37.10
15.625	-7.66	0.53	-7.13	0.19	30.00	1000	37.13

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

Table 4: Conducted Output Power, Mode B (2440MHz)

Data Rate [kbps]	Reading [dBm]	Correction Factor [dB]	Output Power [dBm]	Output Power [mW]	Limit [dBm]	Limit [mW]	Margin [dB]
250	-7.34	0.52	-6.82	0.21	30.00	1000	36.82
62.5	-7.35	0.52	-6.83	0.21	30.00	1000	36.83
15.625	-7.34	0.52	-6.82	0.21	30.00	1000	36.82

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

Table 5: Conducted Output Power, Mode C (2479MHz)

Data Rate [kbps]	Reading [dBm]	Correction Factor [dB]	Output Power [dBm]	Output Power [mW]	Limit [dBm]	Limit [mW]	Margin [dB]
250	-7.41	0.51	-6.90	0.20	30.00	1000	36.90
62.5	-7.43	0.51	-6.92	0.20	30.00	1000	36.92
15.625	-7.42	0.51	-6.91	0.20	30.00	1000	36.91

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

Remark:

The above results show that the worst case output power is found at the data rate of 250kbps. Therefore, all the other measurements for the evaluation of the radio properties of the EUT have been performed using this data rate.

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

RESULT:

PASS

Date of testing: 2009-05-21

Ambient temperature: 25°C

Relative humidity: 50%

Atmospheric pressure: 1014hPa

Requirements:

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

Test procedure:

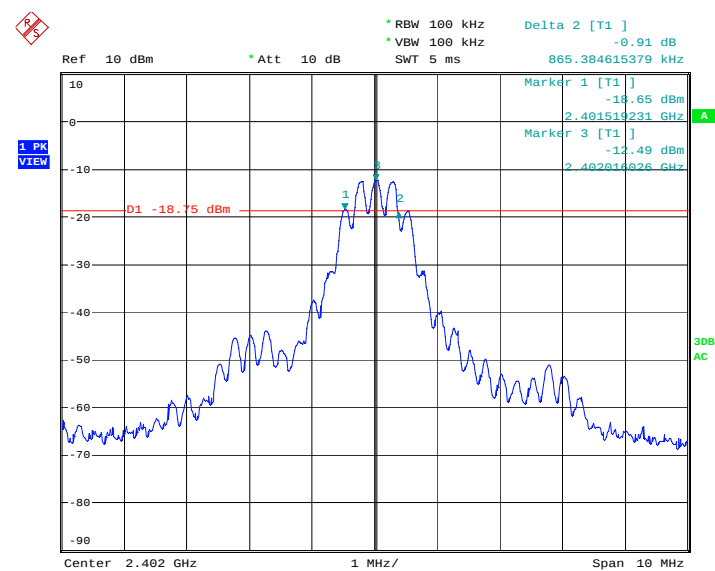
ANSI C63.4-2003, RSS-Gen 4.6.2 and Measurement of Digital Transmission Systems Operating under Section 15.247.

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 100kHz and the span to 10MHz.

Table 6: 6dB Bandwidth

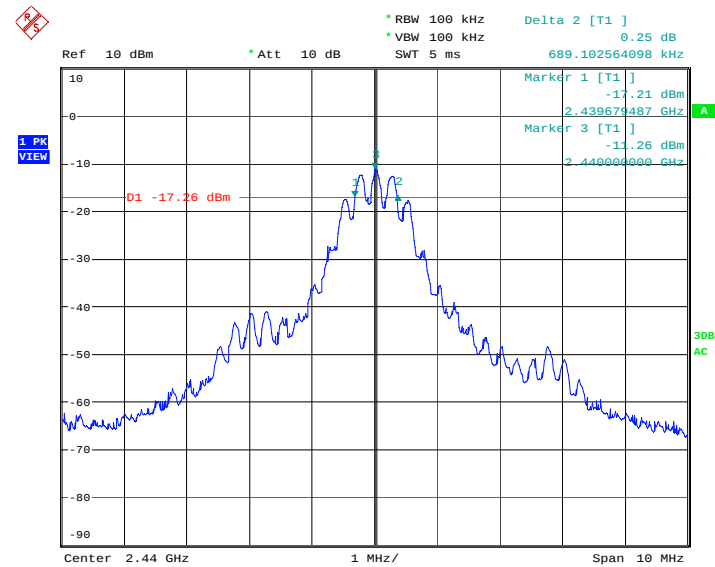
Operating Frequency [MHz]	6dB Bandwidth [kHz]	Limit [kHz]
2402	865.4	500
2440	689.1	500
2479	1025.6	500

Figure 3: 6dB Bandwidth, Mode A (2402MHz)



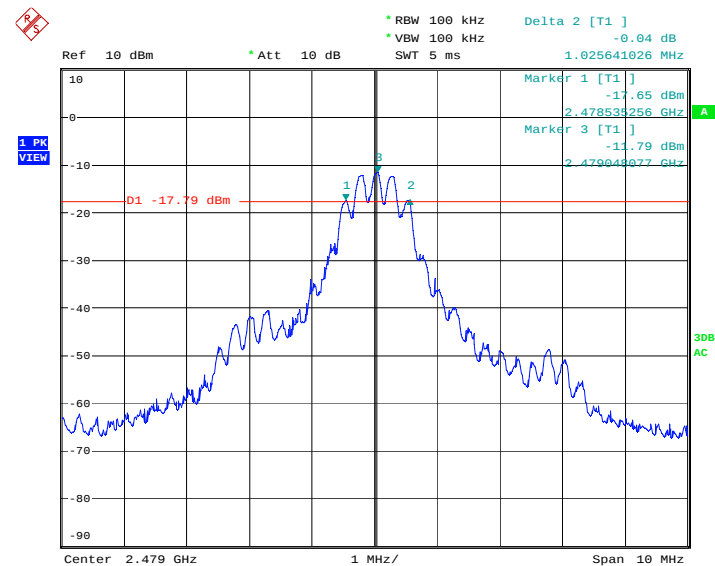
6dB bandwidth, mode A
Date: 21.MAY.2009 12:36:10

Figure 4: 6dB Bandwidth, Mode B (2440MHz)



6dB bandwidth, mode B
Date: 21.MAY.2009 12:45:41

Figure 5: 6dB Bandwidth, Mode C (2479MHz)



6dB bandwidth, mode C
Date: 21.MAY.2009 12:47:37

5.1.3 99% Bandwidth, RSS-Gen 4.6.1

RESULT:

N/A

Date of testing: 2009-05-21

Ambient temperature: 25°C

Relative humidity: 50%

Atmospheric pressure: 1014hPa

Requirements:

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

Test procedure:

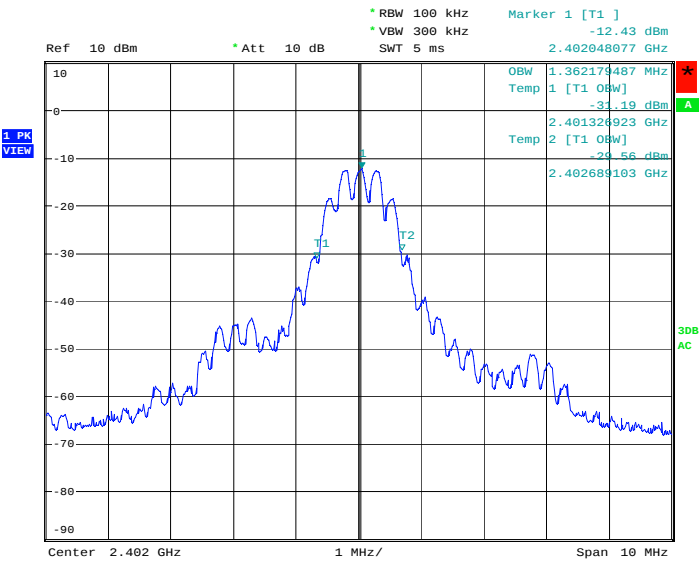
RSS-Gen 4.6.1

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 1% of the span (10MHz). The 99% bandwidth was measured by using the OBW function of the analyzer with a 99% coverage setting.

Table 7: 99% Bandwidth, Radio 802.11b

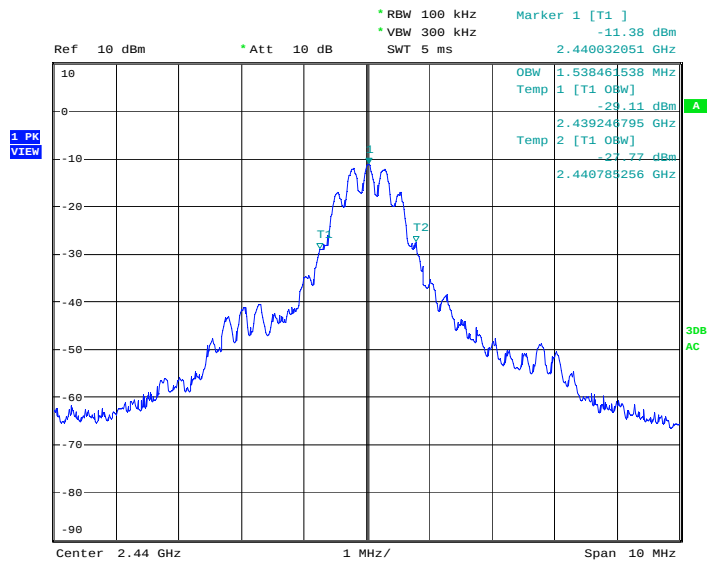
Operating Frequency [MHz]	99% Bandwidth [MHz]
2402	1.36
2440	1.54
2479	1.54

Figure 6: 99% Bandwidth, Mode A (2402MHz)



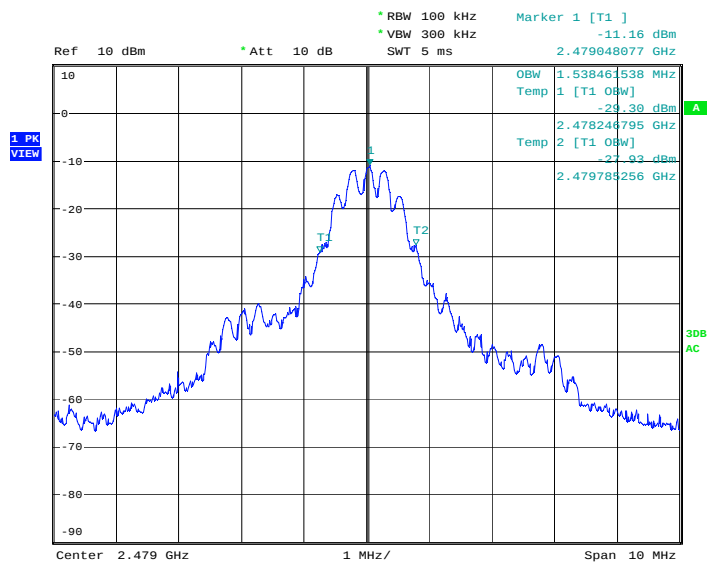
99% bandwidth, mode A
Date: 21.MAY.2009 13:55:19

Figure 7: 99% Bandwidth, Mode B (2440MHz)



99% bandwidth, mode B
Date: 21.MAY.2009 13:56:34

Figure 8: 99% Bandwidth, Mode C (2479MHz)



99% bandwidth, mode C
Date: 21.MAY.2009 13:57:38

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

RESULT:

PASS

Date of testing: 2009-05-21

Ambient temperature: 25°C

Relative humidity: 50%

Atmospheric pressure: 1014hPa

Requirements:

In any 100kHz bandwidth outside the frequency band, 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 Measurement of Digital Transmission Systems Operating under Section 15.247.

A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 100kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 30MHz to 25GHz (10th harmonics).

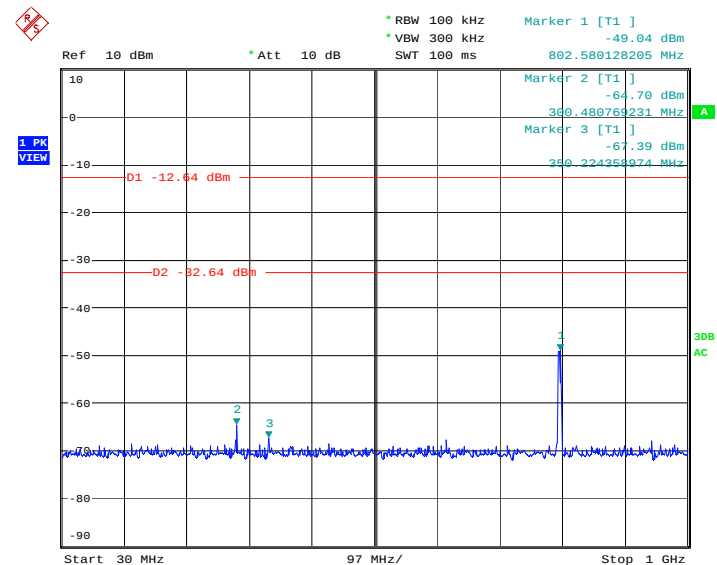
The final measurement takes into account the loss generated by all the involved cables.

Table 8: Conducted Spurious Emission, Mode A (2402MHz)

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
Fundamental	-12.64	0.53	-12.11	N/A	N/A
300.48	-64.70	0.16	-64.54	-32.11	32.43
350.22	-67.39	0.20	-67.19	-32.11	35.08
802.58	-49.04	0.25	-48.79	-32.11	16.67
1596.15	-44.89	0.42	-44.47	-32.11	12.36
2352.56	-62.53	0.49	-62.04	-32.11	29.93
2448.72	-64.56	0.52	-64.04	-32.11	31.93
3205.13	-65.49	0.60	-64.89	-32.11	32.78
4807.69	-61.22	0.77	-60.45	-32.11	28.34
6402.24	-60.39	0.90	-59.49	-32.11	27.38
7203.53	-47.43	0.81	-46.62	-32.11	14.50
8806.09	-62.83	1.12	-61.71	-32.11	29.60
9607.37	-65.57	1.09	-64.48	-32.11	32.37
13493.59	-68.04	1.31	-66.73	-32.11	34.61
24126.60	-68.42	1.61	-66.81	-32.11	34.70

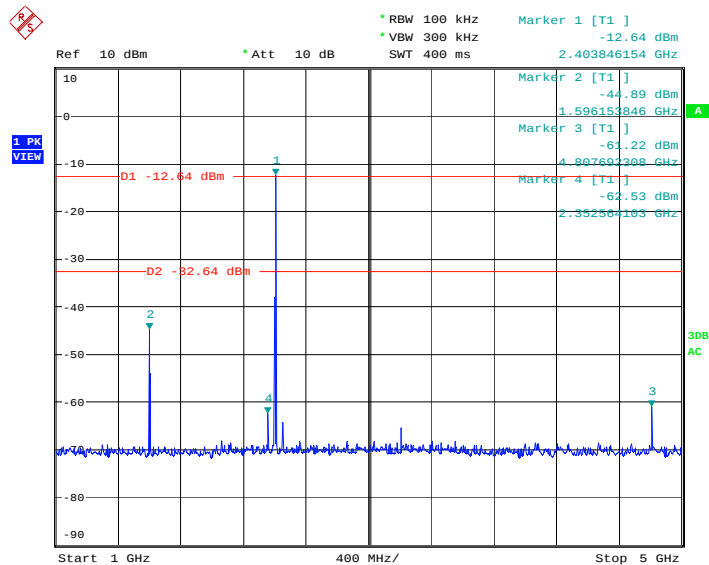
Notes: Limit = Reading of fundamental + Correction factor – 20dB
Emission level = Reading + Correction factor
Correction factor = Total cable loss

Figure 9: Spurious Emission from 30MHz to 1GHz, Mode A (2402MHz)



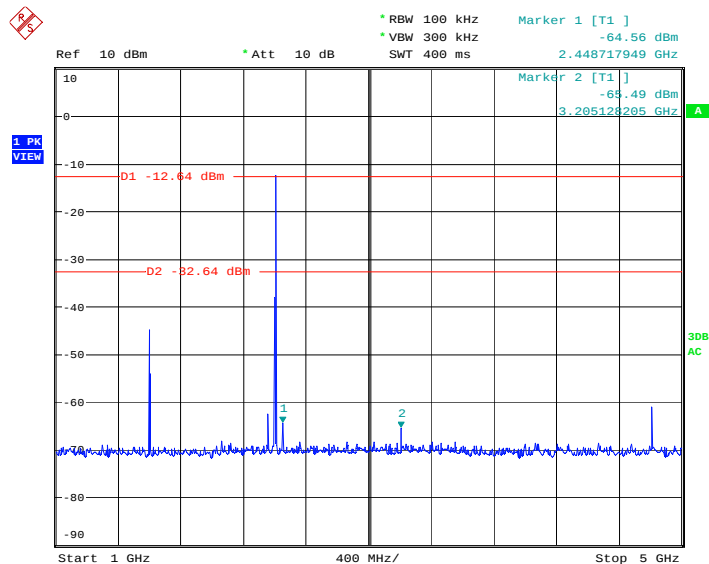
Antenna conducted spurious emissions, mode A
Date: 21.MAY.2009 13:09:47

Figure 10: Spurious Emission from 1 to 5GHz, Mode A (2402MHz)



Antenna conducted spurious emissions, mode A
Date: 21.MAY.2009 13:07:41

Figure 11: Spurious Emission from 1 to 5GHz, Mode A (2402MHz), Additional Points



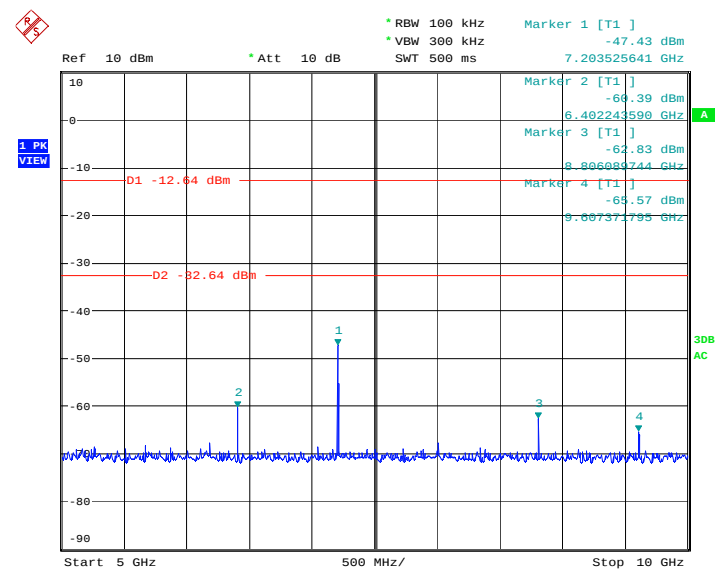
Antenna conducted spurious emissions, mode A
Date: 21.MAY.2009 13:08:35

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Test Report No.:

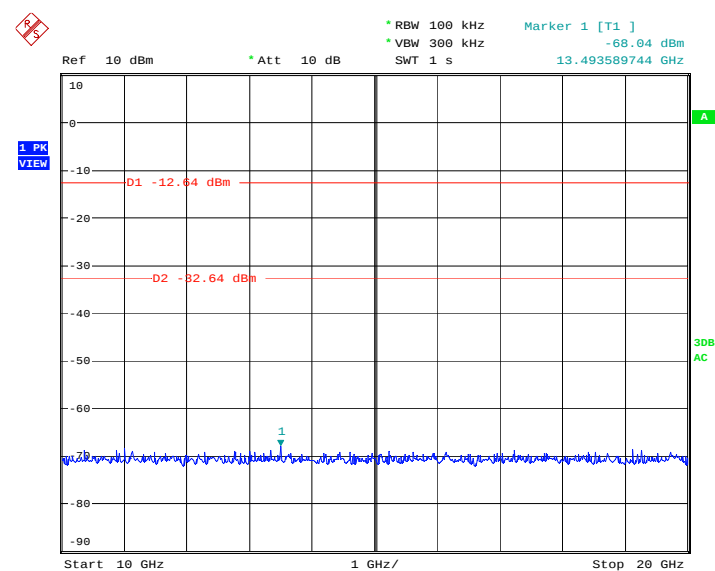
Seite 23 von 49
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Figure 12: Spurious Emission from 5 to 10GHz, Mode A (2402MHz)



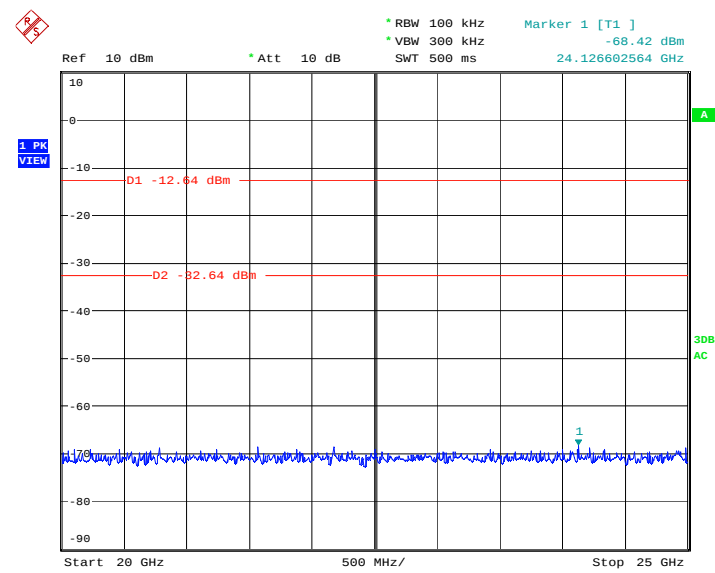
Antenna conducted spurious emissions, mode A
Date: 21.MAY.2009 13:10:58

Figure 13: Spurious Emission from 10 to 20GHz, Mode A (2402MHz)



Antenna conducted spurious emissions, mode A
Date: 21.MAY.2009 13:11:52

Figure 14: Spurious Emission from 20 to 25GHz, Mode A (2402MHz)



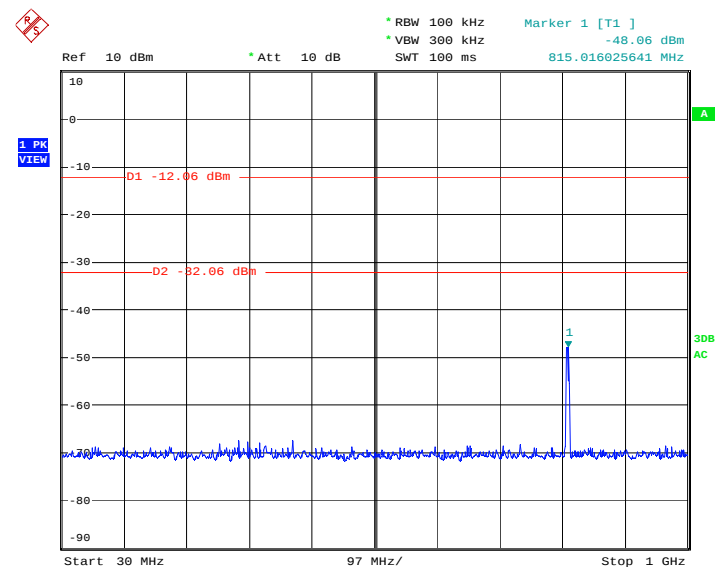
Antenna conducted spurious emissions, mode A
Date: 21.MAY.2009 13:12:24

Table 9: Conducted Spurious Emission, Mode B (2440MHz)

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
Fundamental	-12.06	0.52	-11.54	N/A	N/A
815.02	-48.06	0.27	-47.79	-31.54	16.26
1621.79	-45.01	0.39	-44.62	-31.54	13.09
2391.03	-62.94	0.53	-62.41	-31.54	30.88
2487.18	-64.92	0.53	-64.39	-31.54	32.86
3250.00	-64.06	0.63	-63.43	-31.54	31.89
4884.62	-62.02	0.70	-61.32	-31.54	29.78
6506.41	-58.71	0.88	-57.83	-31.54	26.29
7315.71	-47.49	0.86	-46.63	-31.54	15.10
8942.31	-63.50	1.14	-62.36	-31.54	30.82
9759.62	-66.81	1.12	-65.69	-31.54	34.15
12676.28	-68.60	1.17	-67.43	-31.54	35.90
23461.54	-67.87	1.70	-66.17	-31.54	34.64

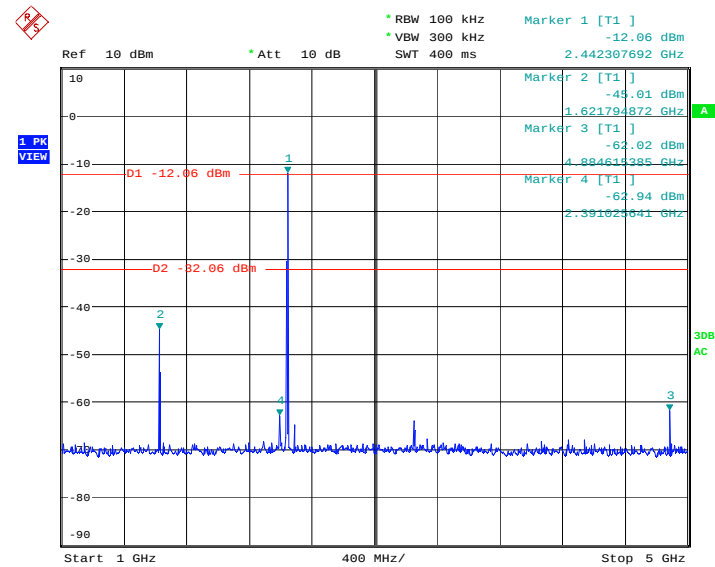
Notes: Limit = Reading of fundamental + Correction factor – 20dB
Emission level = Reading + Correction factor
Correction factor = Total cable loss

Figure 15: Spurious Emission from 30MHz to 1GHz, Mode B (2440MHz)



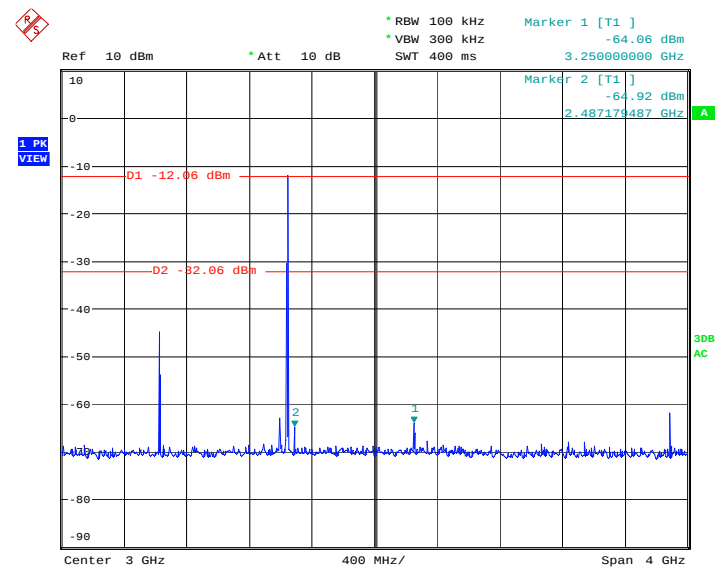
Antenna conducted spurious emissions, mode B
Date: 21.MAY.2009 13:15:55

Figure 16: Spurious Emission from 1 to 5GHz, Mode B (2440MHz)



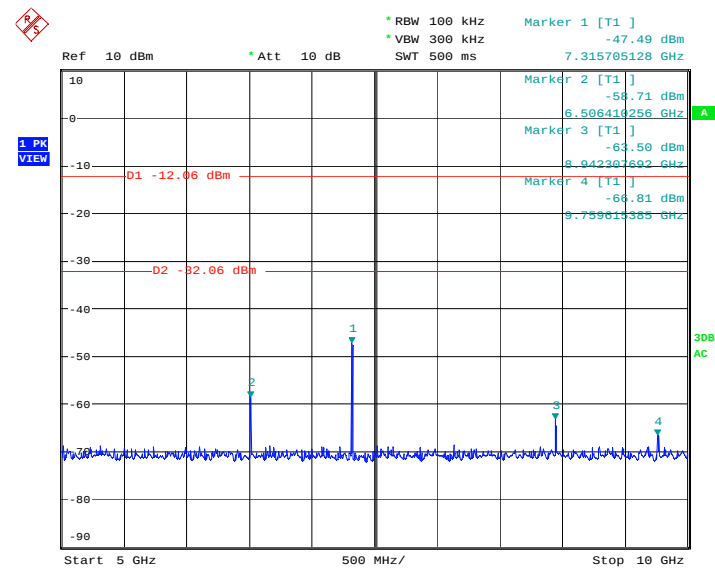
Antenna conducted spurious emissions, mode B
Date: 21.MAY.2009 13:14:43

Figure 17: Spurious Emission from 1 to 5GHz, Mode B (2440MHz), Additional Points



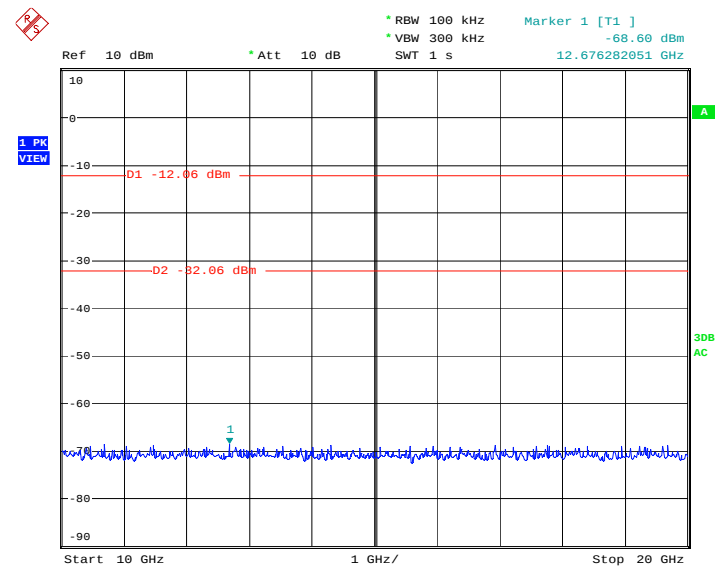
Antenna conducted spurious emissions, mode B
Date: 21.MAY.2009 13:15:15

Figure 18: Spurious Emission from 5 to 10GHz, Mode B (2440MHz)



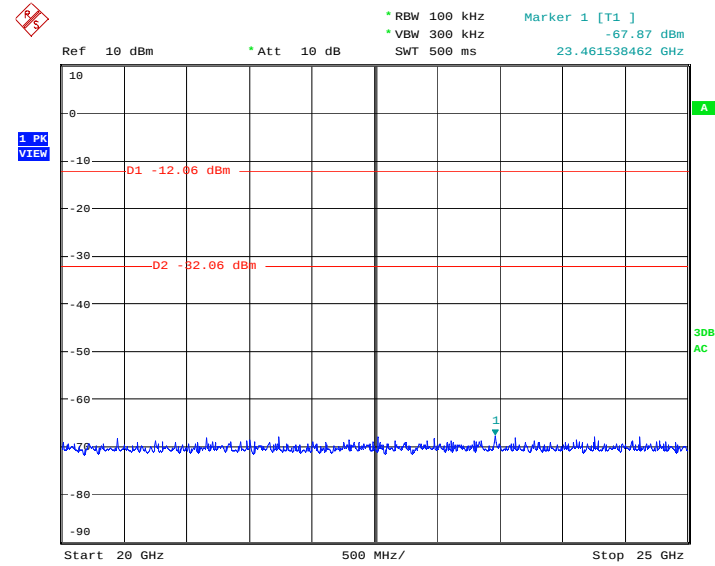
Antenna conducted spurious emissions, mode B
Date: 21.MAY.2009 13:17:06

Figure 19: Spurious Emission from 10 to 20GHz, Mode B (2440MHz)



Antenna conducted spurious emissions, mode B
Date: 21.MAY.2009 13:17:52

Figure 20: Spurious Emission from 20 to 25GHz, Mode B (2440MHz)



Antenna conducted spurious emissions, mode B
Date: 21.MAY.2009 13:18:35

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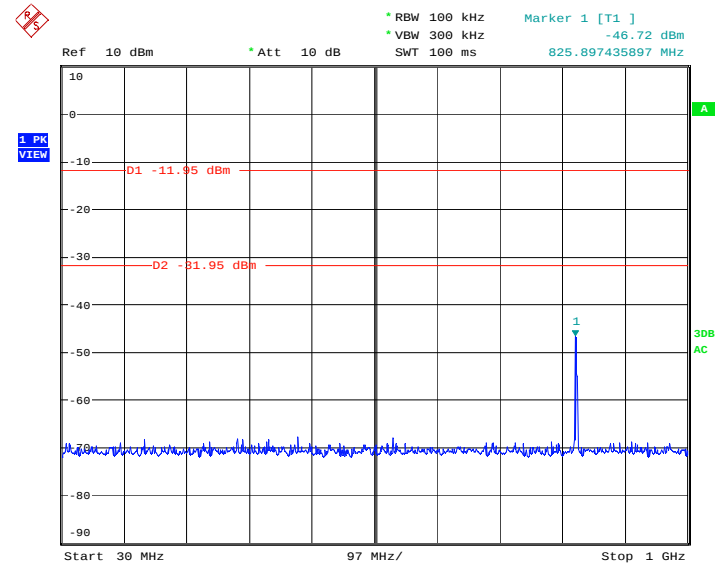
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Table 10: Conducted Spurious Emission, Mode C (2479MHz)

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
Fundamental	-11.95	0.51	-11.44	N/A	N/A
825.90	-46.72	0.28	-46.44	-31.44	14.99
1647.44	-44.94	0.44	-44.50	-31.44	13.06
2429.49	-63.39	0.53	-62.86	-31.44	31.41
2532.05	-66.62	0.55	-66.07	-31.44	34.62
3307.69	-62.88	0.61	-62.27	-31.44	30.82
4961.54	-62.76	0.79	-61.97	-31.44	30.52
6610.58	-56.65	0.87	-55.78	-31.44	24.34
7435.90	-48.73	0.96	-47.77	-31.44	16.33
8261.22	-66.81	1.19	-65.62	-31.44	34.17
9086.54	-65.18	1.12	-64.06	-31.44	32.62
13365.38	-68.42	1.17	-67.25	-31.44	35.81
20673.08	-68.09	1.49	-66.60	-31.44	35.15

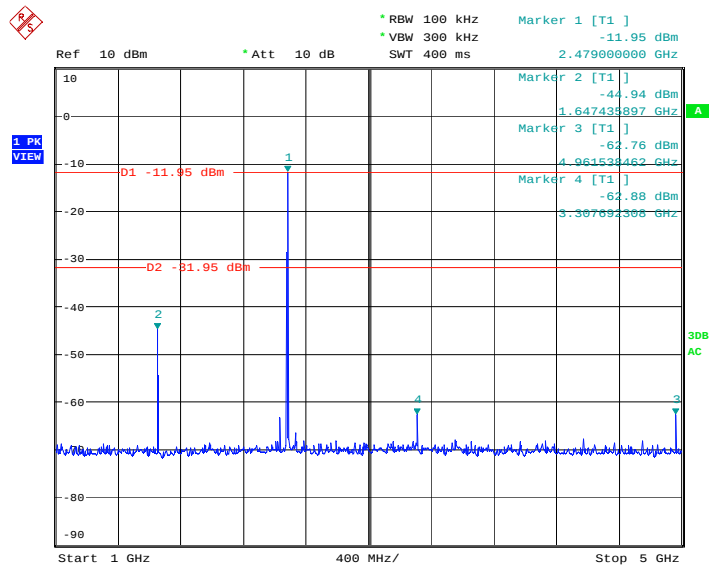
Notes: Limit = Reading of fundamental + Correction factor – 20dB
Emission level = Reading + Correction factor
Correction factor = Total cable loss

Figure 21: Spurious Emission from 30MHz to 1GHz, Mode C (2479MHz)



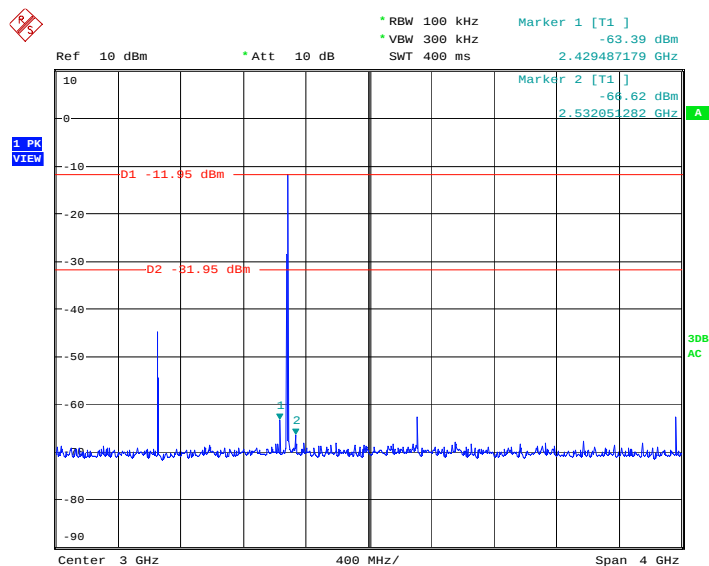
Antenna conducted spurious emissions, mode C
Date: 21.MAY.2009 13:22:10

Figure 22: Spurious Emission from 1 to 5GHz, Mode C (2479MHz)



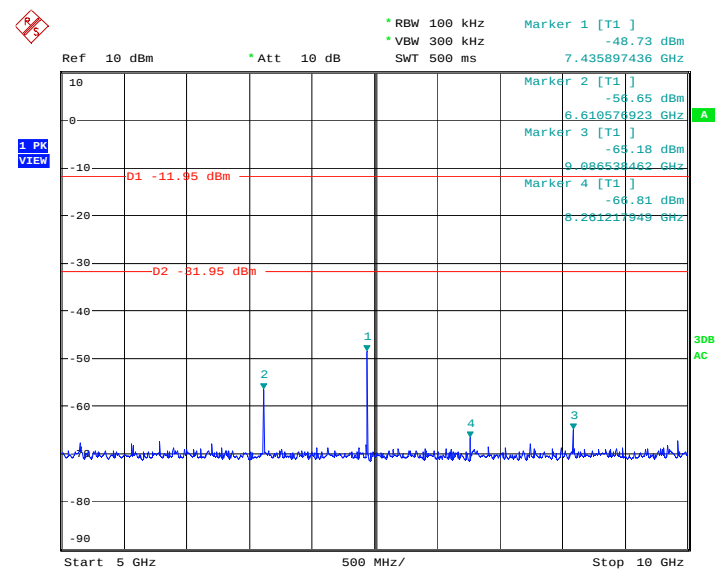
Antenna conducted spurious emissions, mode C
Date: 21.MAY.2009 13:20:29

Figure 23: Spurious Emission from 1 to 5GHz, Mode C (2479MHz), Additional Points



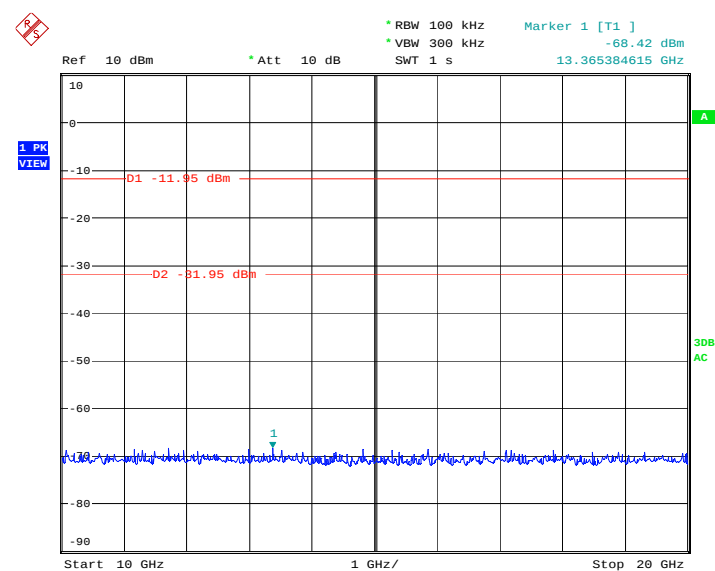
Antenna conducted spurious emissions, mode C
Date: 21.MAY.2009 13:21:05

Figure 24: Spurious Emission from 5 to 10GHz, Mode C (2479MHz)



Antenna conducted spurious emissions, mode C
Date: 21.MAY.2009 13:23:28

Figure 25: Spurious Emission from 10 to 20GHz, Mode C (2479MHz)



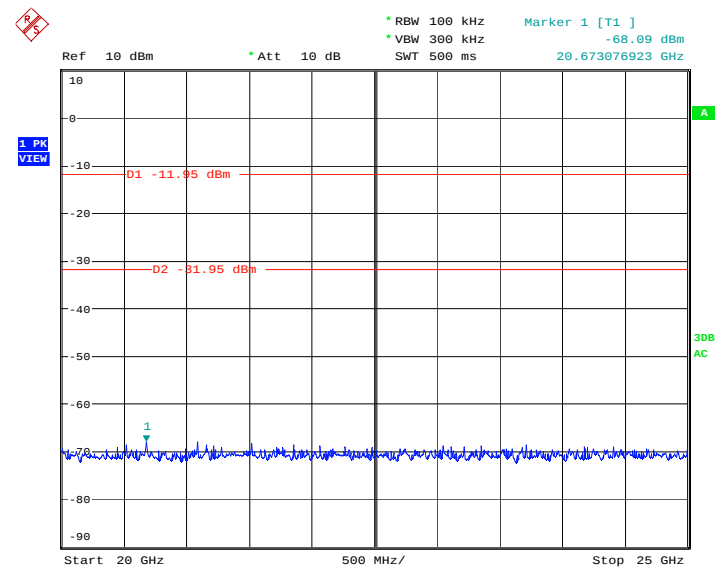
Antenna conducted spurious emissions, mode C
Date: 21.MAY.2009 13:24:06

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Figure 26: Spurious Emission from 20 to 25GHz, Mode C (2479MHz)



Antenna conducted spurious emissions, mode C
Date: 21.MAY.2009 13:24:39

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

RESULT:

PASS

Date of testing: 2009-05-21

Ambient temperature: 25°C

Relative humidity: 50%

Atmospheric pressure: 1014hPa

Requirements:

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 Measurement of Digital Transmission Systems Operating under Section 15.247.

A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 3kHz and the video bandwidth was set to 10kHz. The sweep time was set to 500s.

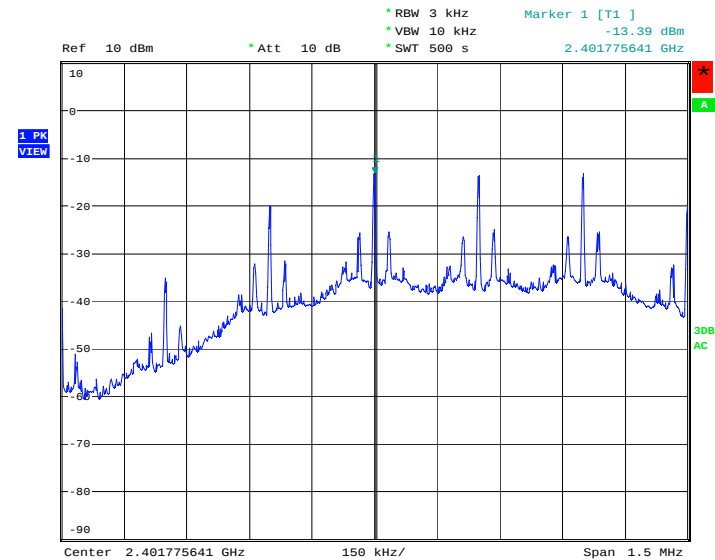
The final measurement takes into account the loss generated by all the involved cables.

Table 11: Peak Power Spectral Density

Operating Frequency [MHz]	Max PSD Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Max PSD [dBm]	Limit [dBm]	Margin [dB]
2402	2401.78	-13.39	0.53	-12.86	8.00	20.86
2440	2439.78	-13.12	0.52	-12.60	8.00	20.60
2479	2478.78	-12.88	0.51	-12.37	8.00	20.37

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

Figure 27: Power Spectral Density, Mode A (2402MHz)



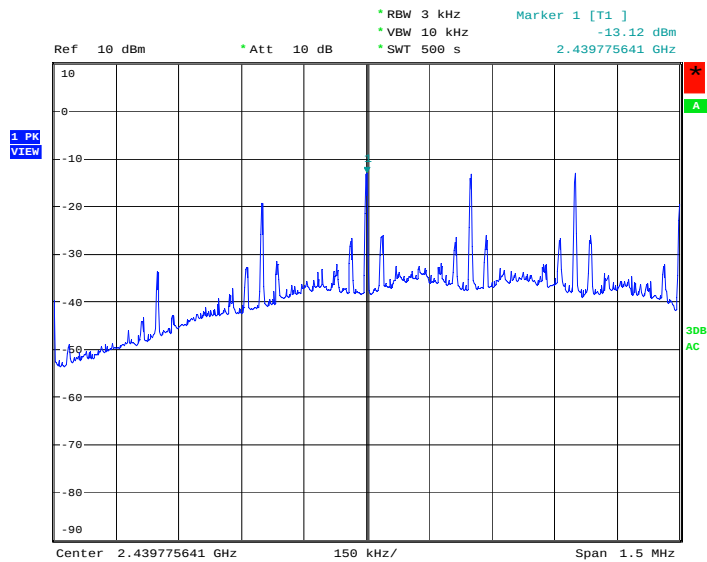
Peak power spectral density, mode A
Date: 21.MAY.2009 14:44:43

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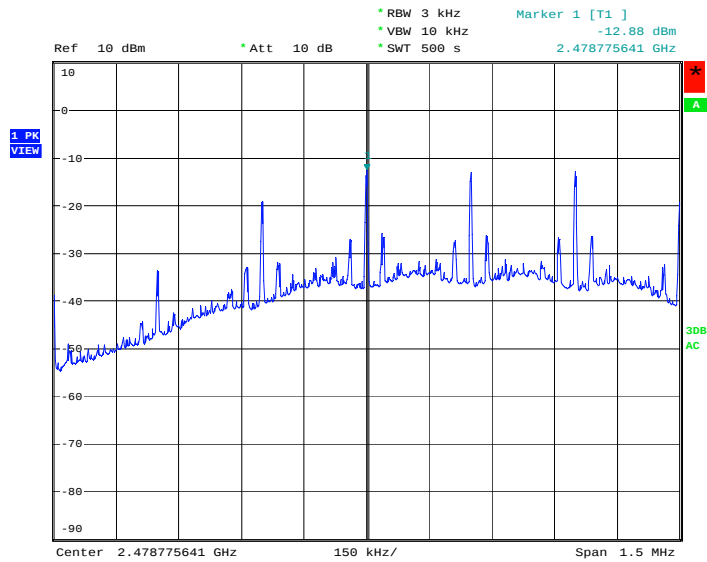
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Figure 28: Power Spectral Density, Mode B (2440MHz)



Peak power spectral density, mode B
Date: 21.MAY.2009 14:55:36

Figure 29: Power Spectral Density, Mode C (2479MHz)



Peak power spectral density, mode C
Date: 21.MAY.2009 15:19:03

6. Test Results of AC Power Line Conducted Measurements

6.1 AC Power Line Conducted Emission of Transmitter

6.1.1 AC Power Line Conducted Emission of Transmitter, FCC 15.207 and RSS-Gen 7.2.2

RESULT: N/A

The EUT is battery powered only and cannot be connected to the AC mains. Therefore this test is not applicable.

6.2 AC Power Line Conducted Emission of Receiver

6.2.1 AC Power Line Conducted Emission of Receiver, FCC 15.107 and RSS-Gen 7.2.2

RESULT: N/A

The EUT is battery powered only and cannot be connected to the AC mains. Therefore this test is not applicable.

7. Test Results of Radiated Measurements

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: 2009-05-21

Ambient temperature: 22°C

Relative humidity: 53%

Atmospheric pressure: 1014hPa

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.

The EUT was placed horizontally on a nonconductive turntable 0.8m above the ground plane. Measurements were made at 3m distance. 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.

Measurements were performed using a spectrum analyzer with a suitable span to encompass the peak of the fundamental and using the following settings: Peak: RBW & VBW = 1MHz, Average: RBW = 1MHz, VBW = 10Hz.

The test was performed using a new battery.

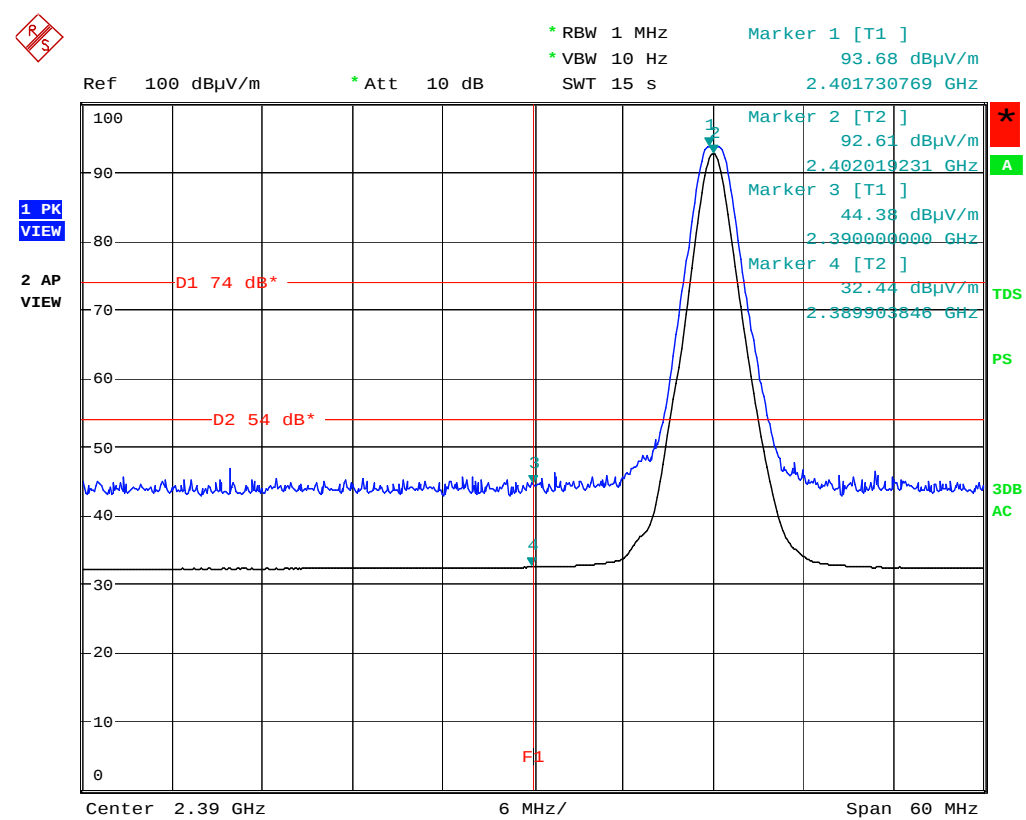
The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 12: Band Edge Radiated Emission

Operating Frequency [MHz]	Antenna Orient.	Peak Value [dBuV/m]	Average Value [dBuV/m]	Peak Limit [dBuV/m]	Average Limit [dBuV/m]	Peak Margin [dB]	Average Margin [dB]
2402	H	44.38	32.44	74.00	54.00	29.62	21.56
2479	H	50.14	38.37	74.00	54.00	23.86	15.63

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.

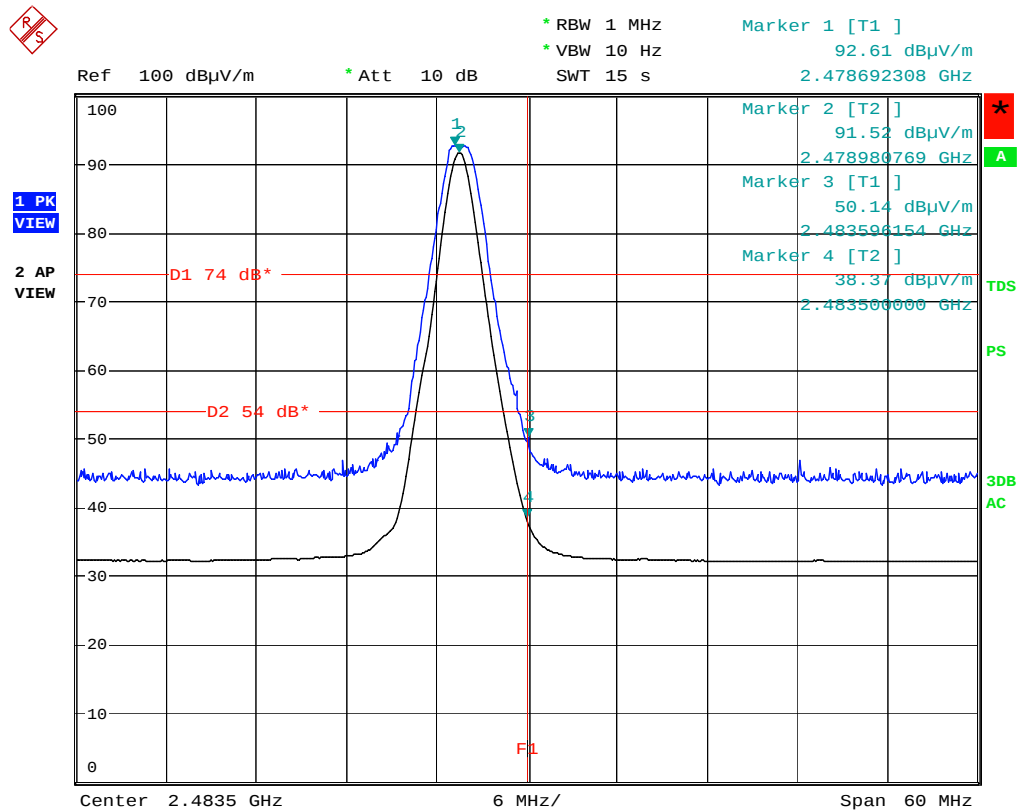
Figure 30: Band Edge Radiated Emission, Mode A (2402MHz), Peak and Average



Band Edge (Lo), Hor, Mode A, Position Z
Direct/Fundamental
Date: 21.MAY.2009 14:16:42

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

Figure 31: Band Edge Radiated Emission, Mode C (2479MHz), Peak and Average



Band Edge (Hi), Hor, Mode A, Position Z
Direct/Fundamental
Date: 21.MAY.2009 14:28:51

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

**7.1.2 Out-of-Band and Spurious Emission of Transmitter, 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: 2009-05-20, 2009-05-21

Ambient temperature: 22, 22°C

Relative humidity: 45, 53%

Atmospheric pressure: 1006, 1014hPa

Frequency range: 30MHz – 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.

The EUT was placed horizontally 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 was varied in order to ensure that maximum emission amplitudes were attained.

Final radiated emission measurements were made at 3m distance. The spectrum was examined from 30MHz to the 10th harmonic of the highest fundamental transmitter frequency (25GHz).

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

For 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, measurements were performed using the following settings: Peak: RBW & VBW = 1MHz, Average: RBW = 1MHz, VBW = 10Hz.

The test was performed using a new battery.

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 13: Radiated Emission 30MHz – 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode A (2402MHz)

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 [°]
30.62	V	38.50	-24.90	13.60	40.00	26.40	142	184
55.92	H	31.90	-23.10	8.80	40.00	31.20	304	229
300.01	H	42.10	-21.20	20.90	46.00	25.10	104	175
801.60	H	47.00	-11.30	35.70	46.00	10.30	103	236

Note: Level QP = Reading QP + Factor

Table 14: Radiated Emission 1GHz – 25GHz, Horizontal and Vertical Antenna Orientations, Peak and Average Data, Mode A (2402MHz)

Freq. [MHz]	EUT / Antenna Orientation	Level AV [dB(μV/m)]	Level PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]
1600.7	H	46.7	49.5	54.0	74.0	7.3	24.5
4000.7	V	43.0	47.7	54.0	74.0	11.0	26.3
4804.1	H	49.6	54.5	54.0	74.0	4.4 (*)	19.5
7206.0	V	45.6	54.7	54.0	74.0	8.4	19.3
8804.8	V	31.7	41.0	54.0	74.0	22.3	33.0
9607.2	H	32.6	44.2	54.0	74.0	21.4	29.8
9607.1	V	30.0	42.3	54.0	74.0	24.0	31.7
16306.2	V	30.3	44.5	54.0	74.0	23.7	29.5
24138.4	H	27.0	40.8	54.0	74.0	27.0	33.2

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

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

Table 15: Radiated Emission 30MHz – 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode B (2440MHz)

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 [°]
30.63	H	37.00	-24.30	12.70	40.00	27.30	111	223
54.10	V	32.90	-23.50	9.40	40.00	30.60	248	81
304.01	H	38.00	-21.10	16.90	46.00	29.10	106	176
814.27	H	48.90	-11.20	37.70	46.00	8.30	100	235

Note: Level QP = Reading QP + Factor

Table 16: Radiated Emission 1GHz – 25GHz, Horizontal and Vertical Antenna Orientations, Peak and Average Data, Mode B (2440MHz)

Freq. [MHz]	EUT / Antenna Orientation	Level AV [dB(μV/m)]	Level PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]
1626.0	H	46.6	49.7	54.0	74.0	7.4	24.3
3252.1	V	42.8	47.2	54.0	74.0	11.2	26.8
4880.1	H	49.1	54.3	54.0	74.0	4.9 (*)	19.7
4880.1	V	48.8	54.2	54.0	74.0	5.2	19.8
7320.1	V	46.3	55.4	54.0	74.0	7.7	18.6
7319.9	H	43.0	53.1	54.0	74.0	11.0	20.9
9759.2	V	31.0	43.6	54.0	74.0	23.0	30.4
24392.0	H	25.1	39.6	54.0	74.0	28.9	34.4

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

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

Table 17: Radiated Emission 30MHz – 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode C (2479MHz)

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 [°]
32.08	H	39.70	-24.20	15.50	40.00	24.50	200	4
66.71	V	32.20	-24.50	7.70	40.00	32.30	127	132
329.90	H	30.10	-20.40	9.70	46.00	36.30	336	112
827.26	H	50.80	-11.10	39.70	46.00	6.30	100	234

Note: Level QP = Reading QP + Factor

Table 18: Radiated Emission 1GHz – 25GHz, Horizontal and Vertical Antenna Orientations, Peak and Average Data, Mode C (2479MHz)

Freq. [MHz]	EUT / Antenna Orientation	Level AV [dB(μV/m)]	Level PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]
1652.0	H	47.1	49.9	54.0	74.0	6.9	24.1
3304.1	V	41.2	45.9	54.0	74.0	12.8	28.1
4958.1	H	50.0	55.0	54.0	74.0	4.0 (*)	19.0
7437.0	V	43.5	53.2	54.0	74.0	10.5	20.8
9915.1	V	31.8	44.0	54.0	74.0	22.2	30.0
24392.0	H	25.1	39.6	54.0	74.0	28.9	34.4

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

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

7.2 Radiated Emission of Receiver

7.2.1 Radiated Spurious 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: 2009-05-20, 2009-05-21

Ambient temperature: 22, 22°C

Relative humidity: 45, 53%

Atmospheric pressure: 1006, 1014hPa

Frequency range: 30MHz – 13GHz

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

The EUT was placed horizontally 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 was varied in order to ensure that maximum emission amplitudes were attained.

Final radiated emission measurements were made at 3m distance. The spectrum was examined from 30MHz to the 5th harmonic of the highest fundamental transmitter frequency (13.5GHz).

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

For 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, measurements were performed using the following settings: Peak: RBW & VBW = 1MHz, Average: RBW = 1MHz, VBW = 10Hz.

The test was performed using a new battery.

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

Table 19: Radiated Emission 30MHz – 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode D (Receive at 2440MHz)

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 [°]
32.11	H	37.50	-24.20	13.30	40.00	26.70	200	340
54.07	V	33.20	-23.50	9.70	40.00	30.30	256	221
207.16	H	35.50	-25.50	10.00	43.50	33.50	169	176
220.11	H	39.40	-25.00	14.40	46.00	31.60	147	187
246.33	H	37.60	-23.40	14.20	46.00	31.80	177	195
299.99	H	40.30	-21.20	19.10	46.00	26.90	107	175

Note: Level QP = Reading QP + Factor

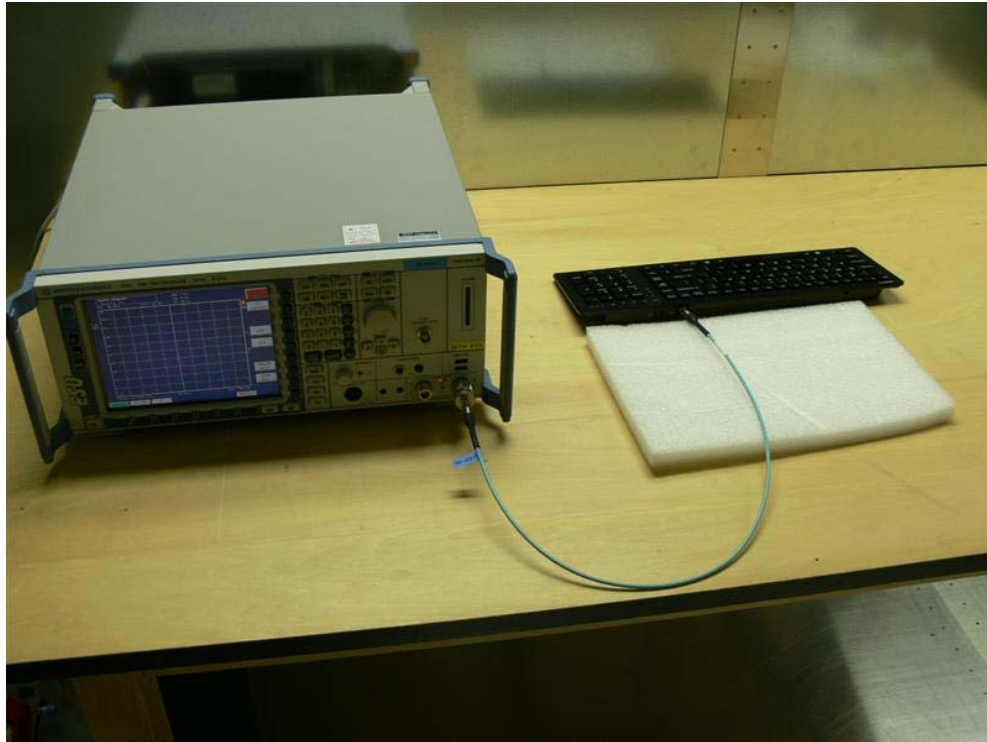
Table 20: Radiated Emission 1GHz – 13.5GHz, Horizontal & Vertical Antenna Orientations, Peak and Average Data, Mode D (Receive at 2440MHz)

Freq. [MHz]	EUT / Antenna Orientation	Level AV [dB(μV/m)]	Level PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]
2784.9	V	26.3	40.8	54.0	74.0	27.7	33.2
3664.4	V	28.6	42.8	54.0	74.0	25.4	31.2
7065.8	H	33.4	47.3	54.0	74.0	20.6	26.7
9553.0	H	26.4	40.5	54.0	74.0	27.6	33.5

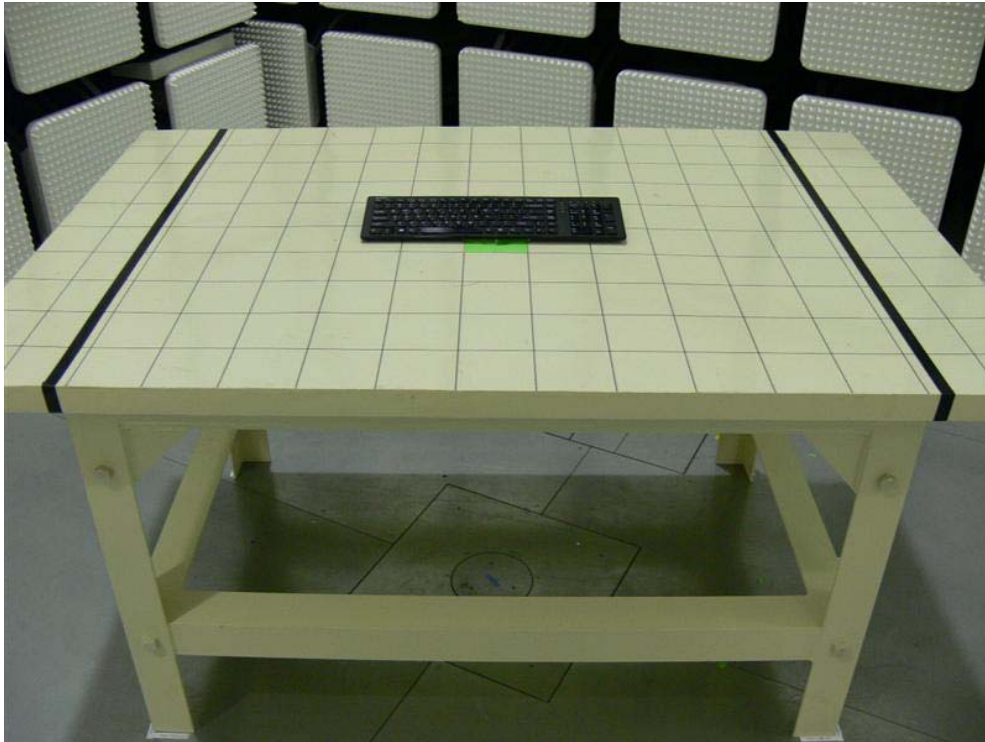
Note: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.

8. Photographs of the Test Setup

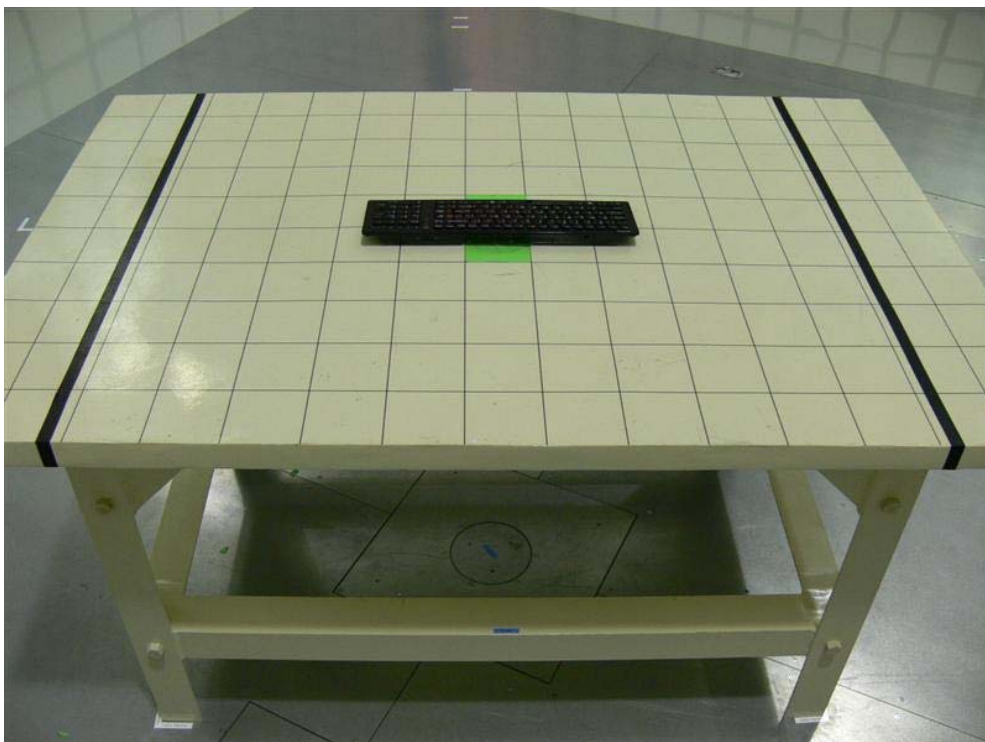
Photograph 1: Set-up for Conducted Emissions at Antenna Port



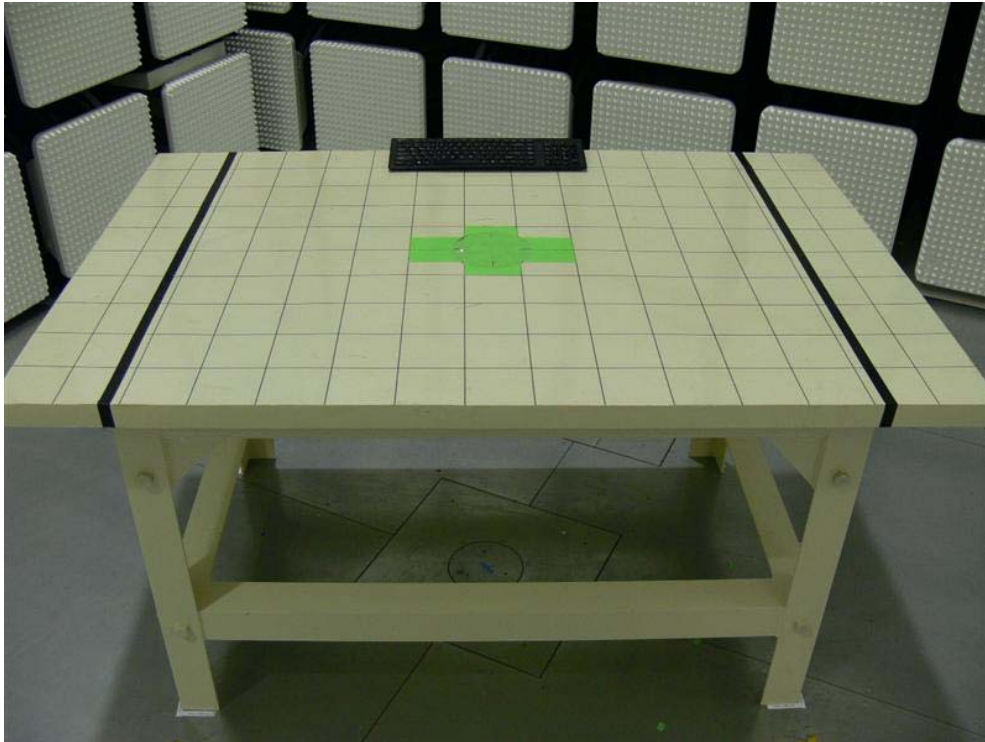
Photograph 2: Set-up for Radiated Emission of Transmitter, Front View



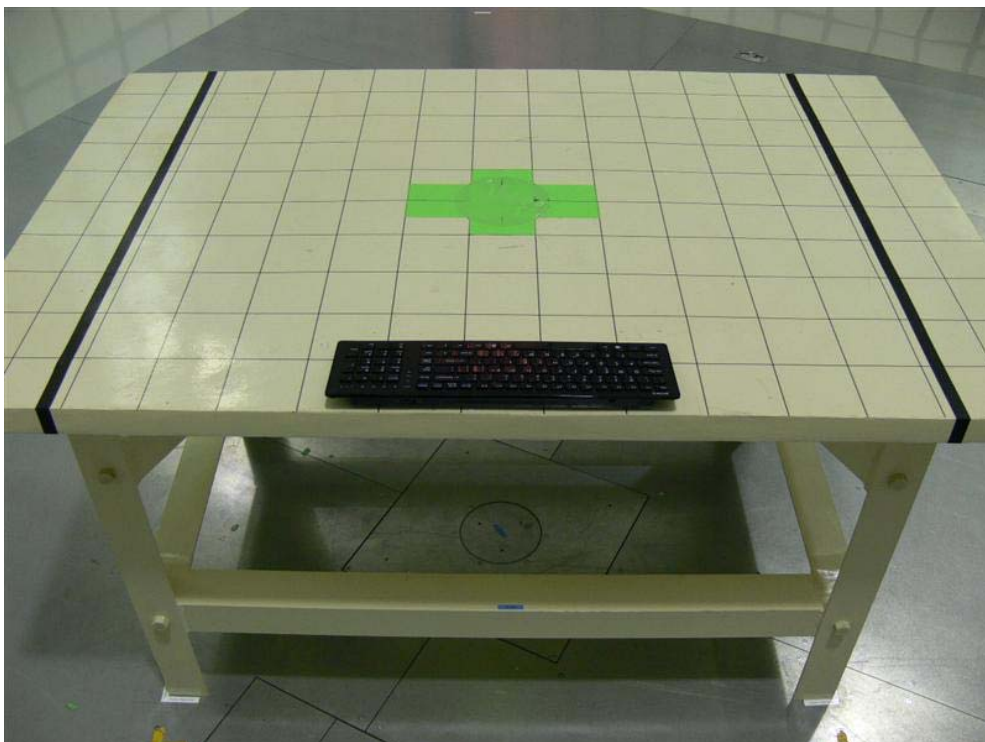
Photograph 3: Set-up for Radiated Emission of Transmitter, Rear View



Photograph 4: Set-up for Radiated Emission of Receiver, Front View



Photograph 5: Set-up for Radiated Emission of Receiver, Rear View



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