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Test Report No.:			
Auftraggeber: Mitutoyo Corporation Client: 20-1, Sakado 1-Chome, Takatsu-ku, Kawasaki-shi, Kanagawa 213-8533, Japan			
Gegenstand der Prüfung: Wireless Communication System Test item:			
Bezeichnung: 02AZD880D (U-WAVE-T) Identification:		Serien-Nr.: 0999999285, Serial No.: 0999999287-1	
Wareneingangs-Nr.: 213082671 Receipt No.:		Eingangsdatum: 2008-08-20 Date of receipt:	
Prüfart: 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan Testing location:			
Prüfgrundlage: 47 CFR Part 15.247 (Subpart: C), October 1, 2007 Test specification: ANSI C63.4-2003 Measurement of Digital Transmission Systems Operating under Section 15.247 RSS-210 (Issue 7): 2007 RSS-Gen (Issue 2): 2007			
Prüfgegenstand: Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). Test Result: The test item passed the test specification(s).			
Prüflaboratorium: TÜV Rheinland Japan Ltd. - Global Technology Assessment Center Testing Laboratory: 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan			
geprüft/ tested by: T. Sauter / Inspector 2008-10-06		kontrolliert/ reviewed by: M. Zietz / Reviewer 2008-10-06	
Datum Date	Name/Stellung Name/Position	Unterschrift Signature	Datum Date
Sonstiges / Other Aspects: This test report deals with the intentional radiator portion of the tested product. Unintentional radiator aspects are covered by test reports 12605166 002 and 003.			
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. 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.			

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 AT ANTENNA TERMINALS, FCC 15.247(B)(3) AND RSS-210 A8.4(4)

RESULT: PASS

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

RESULT: PASS

5.1.3 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 MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE OF TRANSMITTER, FCC 15.207 AND RSS-GEN 7.2.2

RESULT: N/A

6.2.1 MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE 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 RADIATED EMISSION, OUT-OF-BAND AND SPURIOUS EMISSION, FCC 15.247(D), FCC 15.205, FCC 15.209, RSS-210 2.2, RSS-210 A8.5 AND RSS-GEN 7.2.1

RESULT: PASS

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

RESULT: PASS

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1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report.

2. Test Sites

2.1 Test Facilities

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

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

The Federal Communication Commission has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance with the requirements of section 2.948 of the FCC rules.

The description of the test facility is listed under FCC registration number 299054.

The Industry Canada has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance. The description of the test facility is listed under O.A.T.S filing number 3466B.

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 Conducted Emission					
Spectrum Analyzer	Rohde & Schwarz	FSP30	10006/030	BT-8017	2009-08
High Frequency Power Supply	Takasago	AA500F	3030395066	Y3-0473	N/A
Peak Power Meter	Agilent	N19118	MY45101408	-	2009-01
Wideband Power Sensor (50MHz-18GHz)	Agilent	N1921A	MY45241752	-	2009-01
Digital Multimeter	Yokogawa	755501 -1-M/C1	12WC42892 M	TL-9070	2009-07
For Radiated Emission					
Receiver	Rohde & Schwarz	ESU 8	100025	RF-0020	2009-02
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	2009-02
RF Selector (10m)	Toyo Corporation	NS4900	0703-182	RF-0029	2009-05
Low Noise Pre-Amplifier	TSJ	MLA-10K01-B01-35	1370750	RF-0253	2009-05
3dB Attenuator 50Ohm	Tamagawa Electronics Co., Ltd.	CFA-01	-	RF-0265	2009-05
Band Reject Filter	Nitsuki	NF-49BT	027	RF-0131	2008-12
Microwave Preamplifier, 1-8GHz	Toyo Corporation	TPA0108-40	0634	RF-0052	2008-12
Trilog Antenna	Schwarzbeck	VULB9168	0245	RF-0019	2009-05
Broad Band Horn Antenna (1-10GHz)	Schwarzbeck	BBHA9120B	419	RF-0050	2009-05
Double Ridged Broadband Horn Antenna (2-18GHz)	Toyo Corporation	HAP06-18W	00000025	RF-0065	2009-05
Broad Band Horn Antenna (18-26.5GHz)	Toyo Corporation	HAP18-26N	00000010	RF-0070	2009-05

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 (Horizontal Orientation)	30MHz - 1GHz	±4.8dB
	> 1GHz	±5.2dB
Radiated Emission (Vertical Orientation)	30MHz - 1GHz	±4.2dB
	> 1GHz	±5.2dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is a IEEE802.15.4 radio unit, which is to be connected via a serial data interface to measurement tools, e.g. caliper. Data from the measurement tool are transmitted via the EUT to a remote DTS U-WAVE-R unit attached to a PC. The measurement tool is not part of the EUT. The EUT has a proprietary connector and can be connected only to measurement tools, not to any other digital devices or PCs.

3.2 System Details

Radio standard:	IEEE 802.15.4
Specified power output:	0dBm (max. peak power: 1mW)
Antenna gain:	+2 dBi
Antenna type:	Chip antenna
Mounting type:	Internal
Frequency range:	2405 – 2475 MHz
Number of channel:	15
Channel spacing:	5 MHz
Modulation type:	DSSS, OQPSK
FCC Classification:	DTS
Classification:	G1D
System Input Voltage:	DC 3.0V (CR2032 Lithium Battery)
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 EUT generates internally the following clock frequencies:

4 MHz
16 MHz

3.4 Independent Operation Modes

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

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.4:2003. Testing was performed at the lowest operating frequency (2405 MHz), the operating frequency in the middle of the specified frequency band (2440 MHz) and the highest operating frequency (2475 MHz).

The basic operation modes are:

- A. EUT transmits (TX mode), with full power, at lowest Channel (2405 MHz), modulation ON, continuous data streaming with 100% duty cycle.
- B. EUT transmits (TX mode), with full power, at middle Channel (2440 MHz), modulation ON, continuous data streaming with 100% duty cycle.
- C. EUT transmits (TX mode), with full power, at highest Channel (2475 MHz), modulation ON, continuous data streaming with 100% duty cycle.
- D. EUT receives (RX mode), on middle Channel (2440 MHz), continuously.

3.5 Noise Suppressing Parts

None mentioned explicitly.

4. Test Set-up and Operation Modes

4.1 Test Methodology

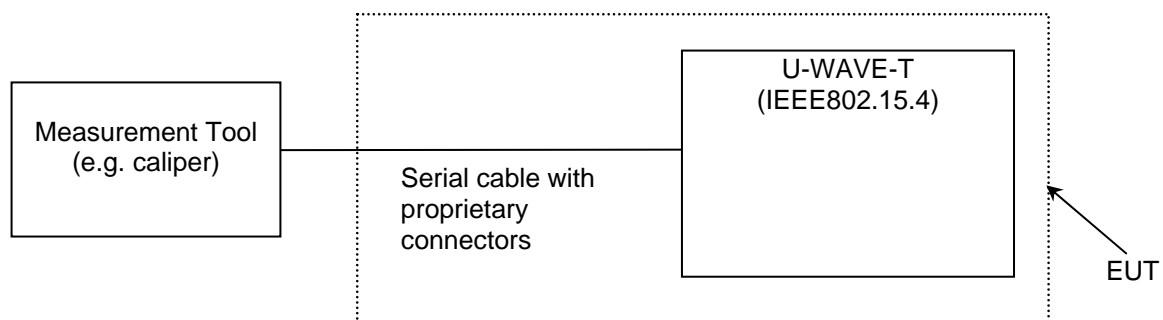
The test methodology used is based on the requirements of 47 CFR Part 15, sections 15.31, 15.33, 15.35, 15.205, 15.209 and Measurement of Digital Transmission Systems Operating under Section 15.247.

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

For details, see under each test item.

4.2 Physical Configuration for Testing

Figure 1: Test setup



In the sample for conducted tests, the antenna was replaced by a 50Ω antenna connector. In addition, a test jig (switch) used to enable the test operation modes was attached to the EUT instead of the measurement tool.

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

4.3 Test Operation and Test Software

No software was used for testing. The EUT has built-in test modes. They were used to enable on the EUT the operation modes listed in section 3.4 as appropriate.

4.4 Special Accessories and Auxiliary Equipment

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

- | | |
|----------------|--|
| 1. Product: | Measurement Tool (Battery powered Gauge) |
| Manufacturer: | Mitutoyo Corporation |
| Model: | ID-C1012EB |
| Serial Number: | 39162 |

4.5 Countermeasures to achieve EMC Compliance

No additional measures were employed to achieve compliance.

5. Test Results Conducted Testing at Antenna Port

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

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

RESULT:

PASS

Date of testing: 2008-09-17

Ambient temperature: 25 °C

Relative humidity: 42 %

Atmospheric pressure: 1009hPa

Requirements:

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

Test procedure:

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

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

The EUT was connected to a DC power supply with a voltage of 3.0V simulating a full battery.

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

Table 3: Conducted Output Power at Normal Voltage DC 3.0V

Frequency [MHz]	Reading [dBm]	Cable Loss [dB]	Output [dBm]	Output [mW]	Limit [mW]	Limit [dBm]	Margin [dB]
2405	-3.37	0.43	-2.94	0.51	1000	30	32.94
2440	-3.09	0.44	-2.65	0.54	1000	30	32.65
2475	-2.62	0.44	-2.18	0.61	1000	30	32.18

Notes: Output = Reading + Cable loss
 $\text{mW} = 10^{\frac{\text{dBm}}{10}}$
 $\text{dBm} = 10 \times \log(\text{mW})$

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

RESULT:

PASS

Date of testing: 2008-09-25

Ambient temperature: 25°C

Relative humidity: 41%

Atmospheric pressure: 1006hPa

Requirements:

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

Test procedure:

ANSI C63.4-2003, RSS-Gen 4.6.2

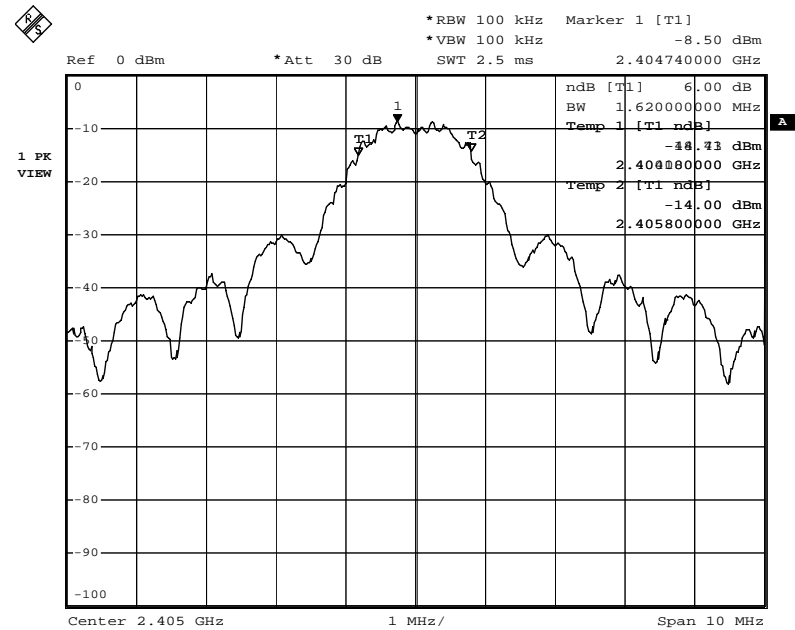
The antenna connector was connected to a spectrum analyzer. The spectrum analyzer resolution bandwidth was set to 1% of the SPAN (10MHz). The 6dB Bandwidth was measured by using the DELTA MARKER function of the analyzer.

The EUT was connected to a DC power supply with a voltage of 3.0V simulating a full battery.

Table 4: 6dB Bandwidth

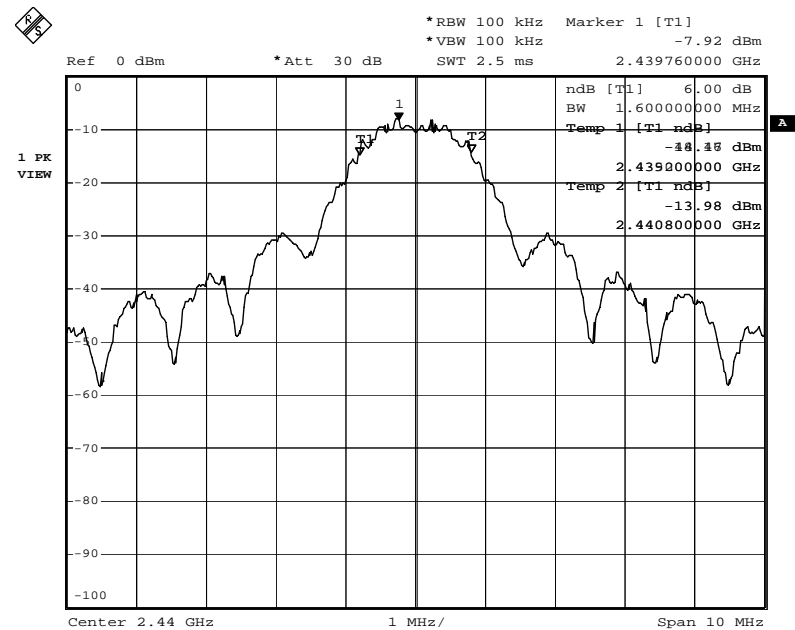
Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2405	1.62	500
2440	1.60	500
2475	1.60	500

Figure 2: 6dB Bandwidth, Mode A (2405MHz)



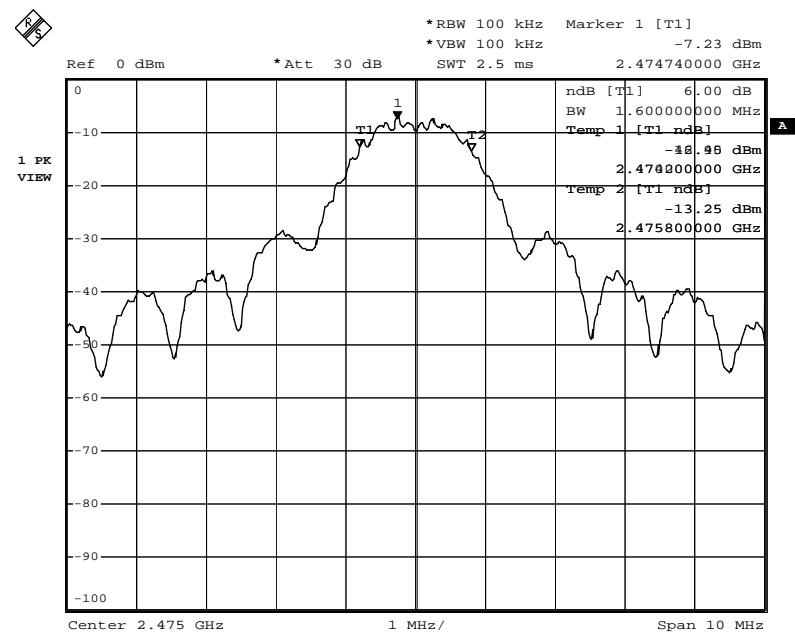
Comment A: FCC 6dB Bandwidth
Date: 25.SEP.2008 10:29:05

Figure 3: 6dB Bandwidth, Mode B (2440MHz)



Comment A: FCC 6dB Bandwidth
Date: 25.SEP.2008 10:31:23

Figure 4: 6dB Bandwidth, Mode C (2475MHz)



Comment A: FCC 6dB Bandwidth
Date: 25.SEP.2008 10:25:43

5.1.3 99% Bandwidth, RSS-Gen 4.6.1

RESULT:

N/A

Date of testing: 2008-09-25

Ambient temperature: 25°C

Relative humidity: 41%

Atmospheric pressure: 1006hPa

Requirements:

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

Test procedure:

RSS-Gen 4.6.1

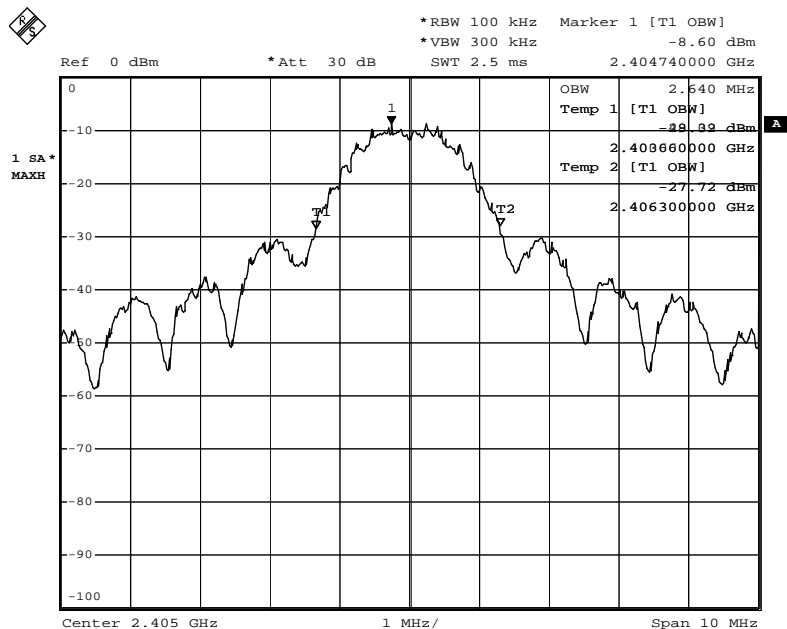
The antenna connector was connected to a spectrum analyzer. The spectrum analyzer resolution bandwidth was set to 1% of the SPAN (10MHz). The 99% Bandwidth was measured by using the OBW function of the analyzer with a 99% coverage setting.

The EUT was connected to a DC power supply with a voltage of 3.0V simulating a full battery.

Table 5: 99% Bandwidth

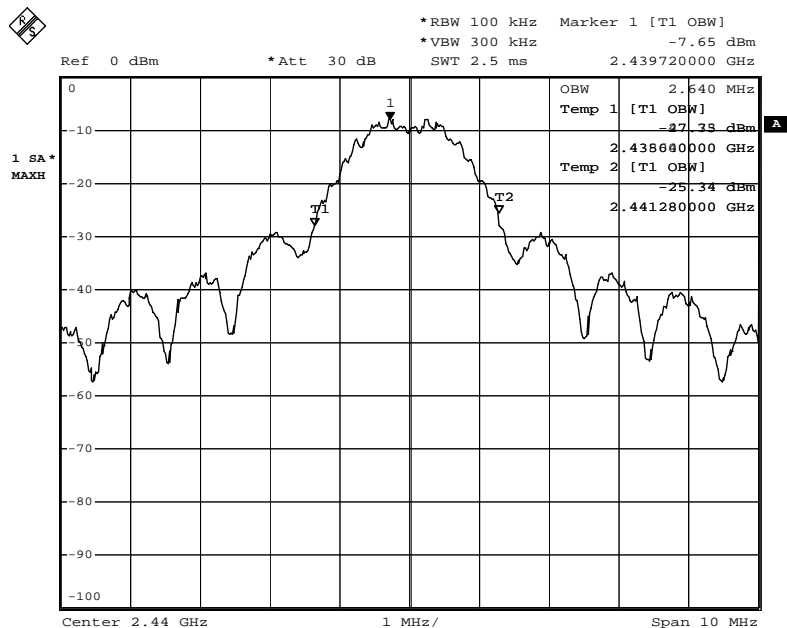
Frequency (MHz)	99% Bandwidth (MHz)
2405	2.64
2440	2.64
2475	2.64

Figure 5: 99% Bandwidth, Mode A (2405MHz)



Comment A: 99% Bandwidth
Date: 25.SEP.2008 10:38:28

Figure 6: 99% Bandwidth, Mode B (2440MHz)



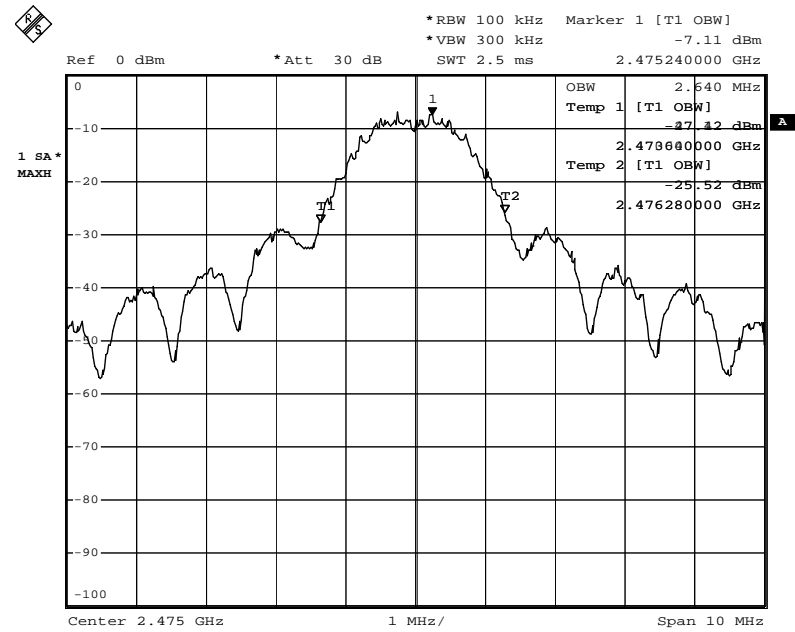
Comment A: 99% Bandwidth
Date: 25.SEP.2008 10:35:03

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Figure 7: 99% Bandwidth, Mode C (2475MHz)



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

RESULT:

PASS

Date of testing: 2008-09-25

Ambient temperature: 25°C

Relative humidity: 41%

Atmospheric pressure: 1006hPa

Requirements:

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

Test procedure:

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

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

The EUT was connected to a DC power supply with a voltage of 3.0V simulating a full battery.

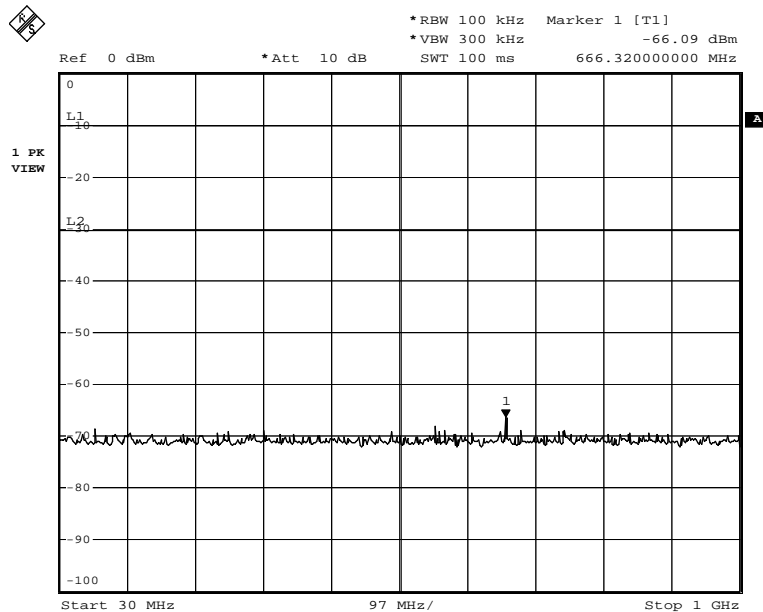
The final measurement takes into account the loss generated by all the involved cables, including the short cable provided by the EUT manufacturer to support the antenna connector.

Table 6: Conducted Spurious Emission, Mode A (2405MHz)

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
666.32	-66.09	0.82	-65.27	-28.60	36.66
1384	-67.55	1.20	-66.35	-28.60	37.74
2405	-10.20	1.60	-8.60	N/A	N/A
2552	-62.36	1.65	-60.71	-28.60	32.11
4816	-49.55	2.20	-47.35	-28.60	18.75
9620	-65.43	2.93	-62.50	-28.60	33.89
18000	-61.96	3.55	-58.41	-28.60	29.81
24740	-60.69	5.52	-55.17	-28.60	26.56

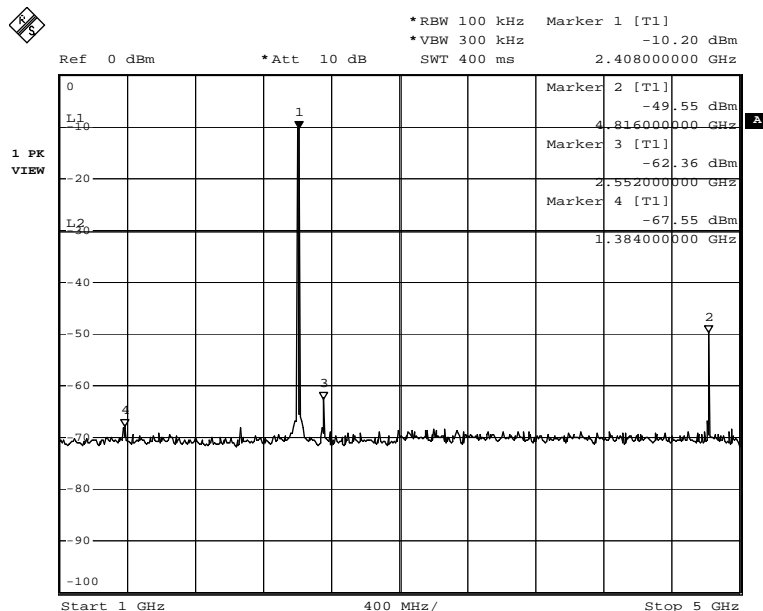
Notes: Limit = Reading of fundamental + Correction factor – 20dB
Emission level = Reading + Correction factor
Correction factor = Total cable loss

Figure 8: Spurious Emission from 30MHz to 1GHz, Mode A (2405MHz)



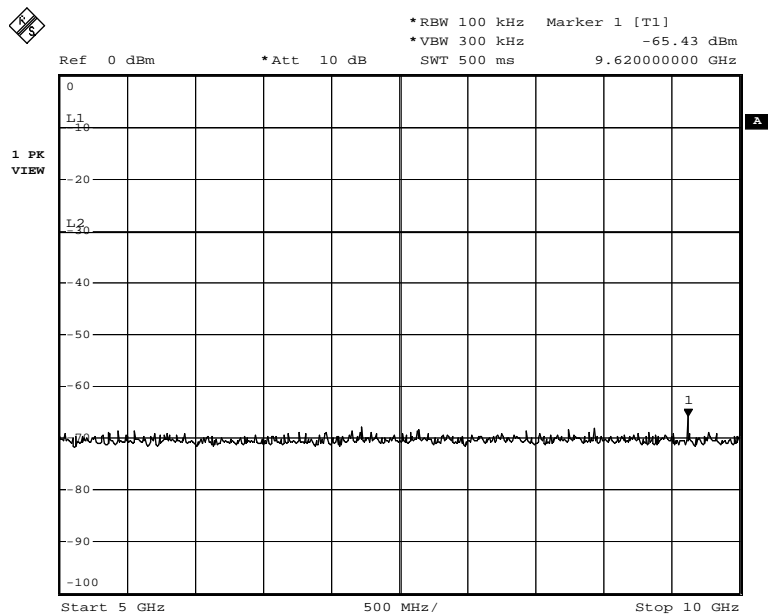
Comment A: FCC Conducted Spurious
L1=-10.20dBm, L2=-30.20dBm
Date: 25.SEP.2008 11:58:02

Figure 9: Spurious Emission from 1 to 5GHz, Mode A (2405MHz)



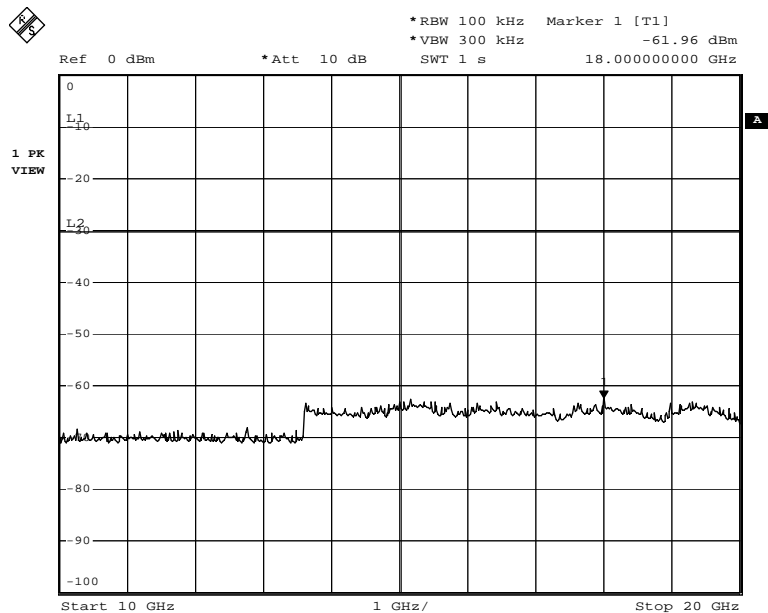
Comment A: FCC Conducted Spurious
L1=-10.20dBm, L2=-30.20dBm
Date: 25.SEP.2008 11:52:51

Figure 10: Spurious Emission from 5 to 10GHz, Mode A (2405MHz)



Comment A: FCC Conducted Spurious
L1=-10.20dBm, L2=-30.20dBm
Date: 25.SEP.2008 11:53:59

Figure 11: Spurious Emission from 10 to 20GHz, Mode A (2405MHz)



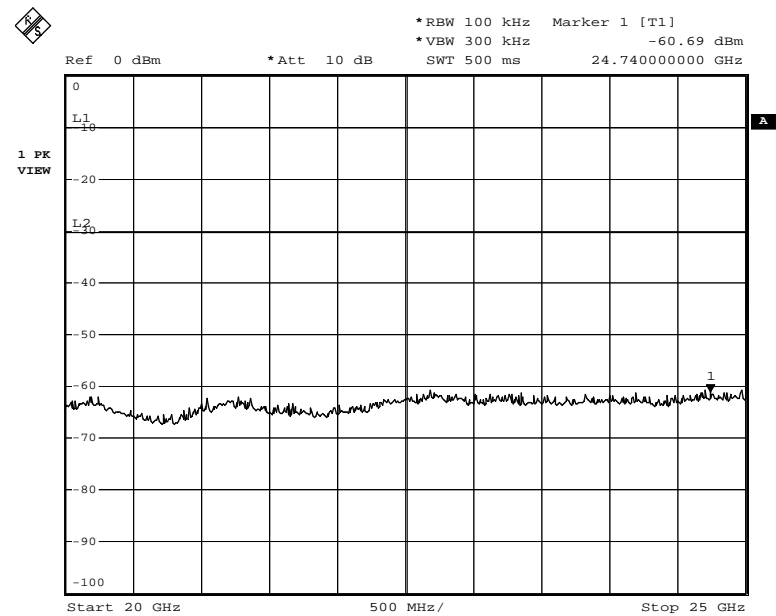
Comment A: FCC Conducted Spurious
L1=-10.20dBm, L2=-30.20dBm
Date: 25.SEP.2008 11:55:59

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Figure 12: Spurious Emission from 20 to 25GHz, Mode A (2405MHz)



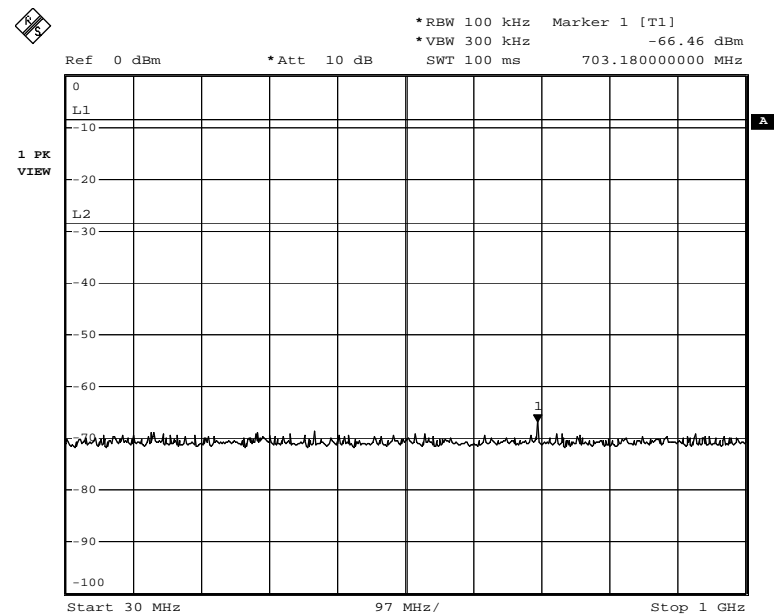
Comment A: FCC Conducted Spurious
L1=-10.20dBm, L2=-30.20dBm
Date: 25.SEP.2008 11:57:18

Table 7: Conducted Spurious Emissions, Mode B (2440MHz)

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
703.18	-66.46	0.85	-65.61	-26.93	38.68
2440	-8.54	1.61	-6.93	N/A	N/A
4888	-49.00	2.20	-46.80	-26.93	19.87
9760	-66.30	2.99	-63.31	-26.93	36.38
14860	-62.45	3.33	-59.12	-26.93	32.19
24900	-60.27	4.28	-55.99	-26.93	29.06

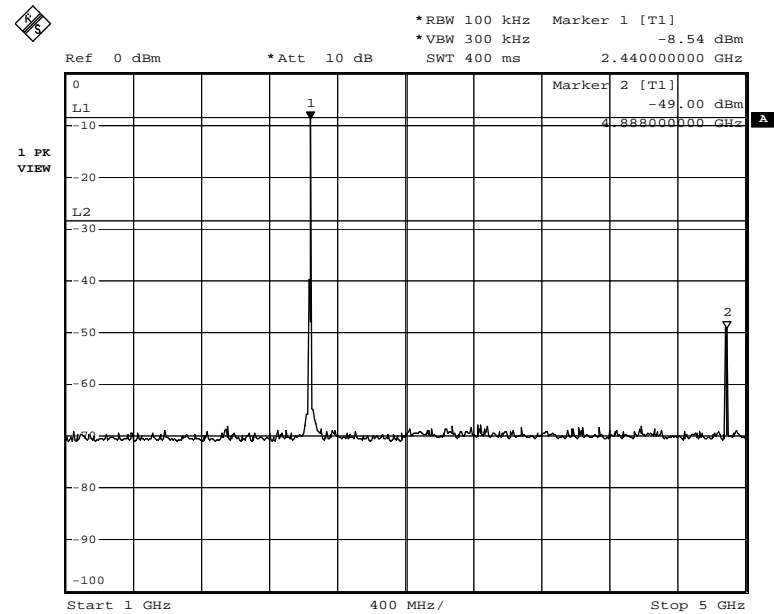
Notes: Limit = Reading of fundamental + Correction factor – 20dB
Emission level = Reading + Correction factor
Correction factor = Total cable loss

Figure 13: Spurious Emission from 30MHz to 1GHz, Mode B (2440MHz)



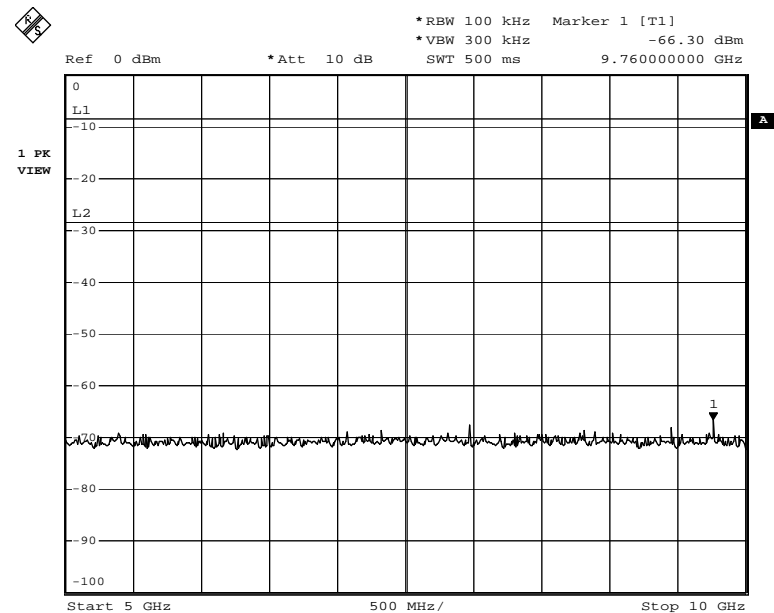
Comment A: FCC Conducted Spurious
L1=-8.54dBm, L2=-28.54dBm
Date: 25.SEP.2008 11:40:39

Figure 14: Spurious Emission from 1 to 5GHz, Mode B (2440MHz)



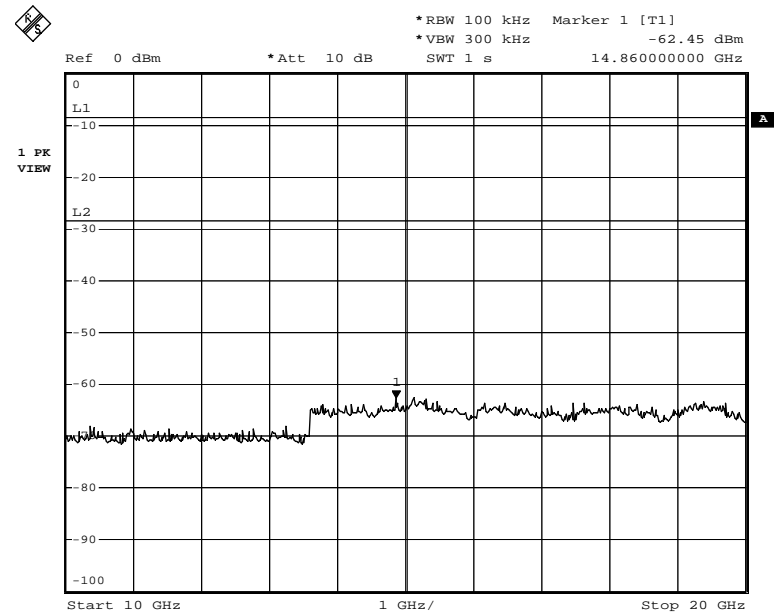
Comment A: FCC Conducted Spurious
L1=-8.54dBm, L2=-28.54dBm
Date: 25.SEP.2008 11:36:51

Figure 15: Spurious Emission from 5 to 10GHz, Mode B (2440MHz)



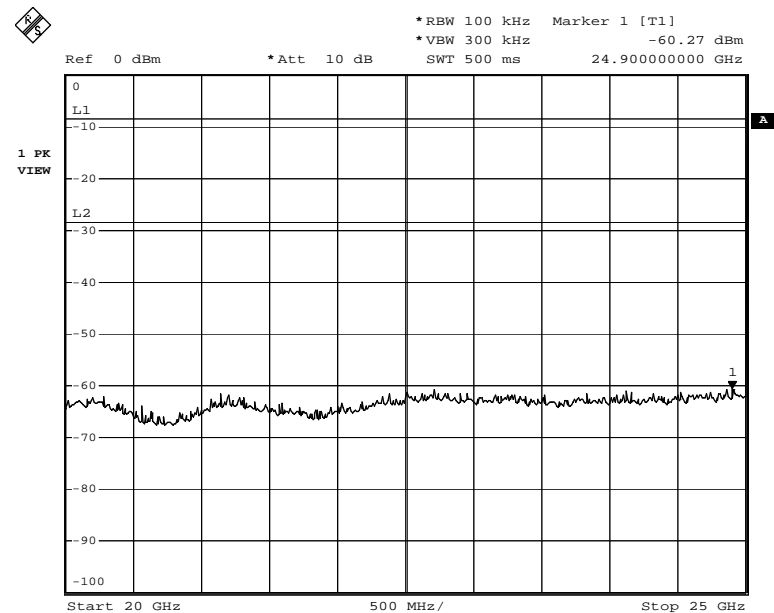
Comment A: FCC Conducted Spurious
L1=-8.54dBm, L2=-28.54dBm
Date: 25.SEP.2008 11:38:02

Figure 16: Spurious Emission from 10 to 20GHz, Mode B (2440MHz)



Comment A: FCC Conducted Spurious
L1=-8.54dBm, L2=-28.54dBm
Date: 25.SEP.2008 11:38:43

Figure 17: Spurious Emission from 20 to 25GHz, Mode B (2440MHz)



Comment A: FCC Conducted Spurious
L1=-8.54dBm, L2=-28.54dBm
Date: 25.SEP.2008 11:39:39

Table 8: Conducted Spurious Emissions, Mode C (2475MHz)

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Emission Level [dBm]	Limit [dBm]	Margin [dB]
738.1	-66.15	0.87	-65.28	-26.78	38.50
2475	-8.40	1.62	-6.78	N/A	N/A
4952	-48.40	2.22	-46.18	-26.78	19.40
2624	-62.25	1.67	-60.58	-26.78	33.80
1424	-66.15	1.23	-64.92	-26.78	38.14
9370	-66.97	2.96	-64.01	-26.78	37.23
19400	-62.16	3.66	-58.50	-26.78	31.72
24620	-60.17	4.41	-55.76	-26.78	28.98

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

Figure 18: Spurious Emission from 30MHz to 1GHz, Mode C (2475MHz)

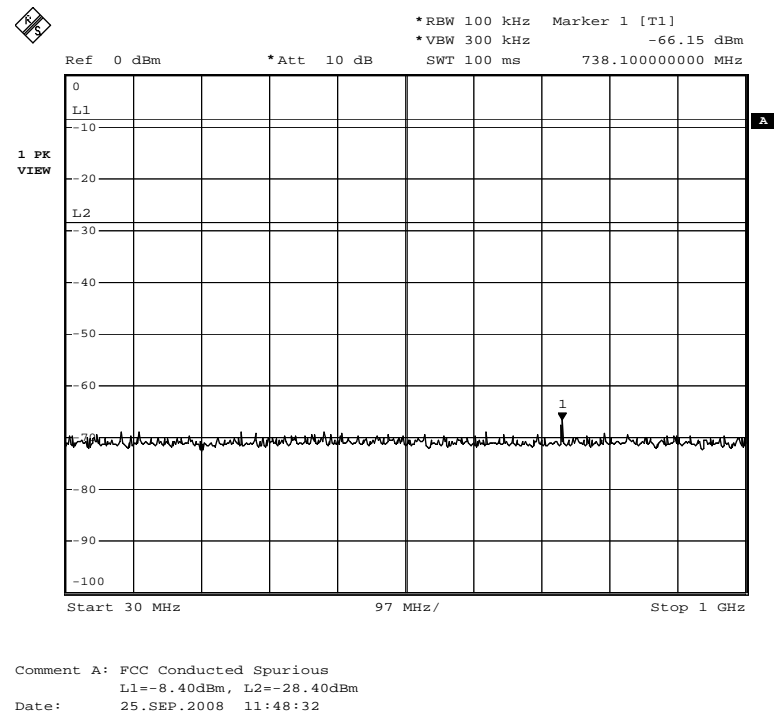
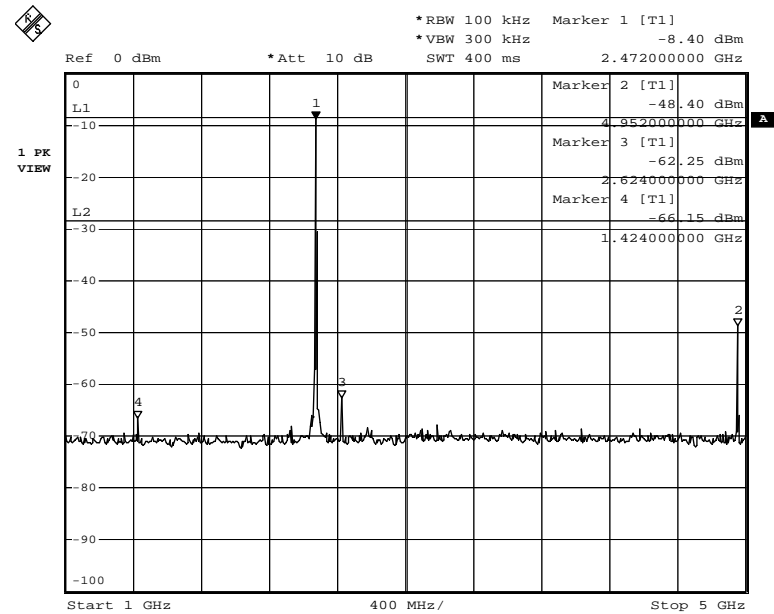
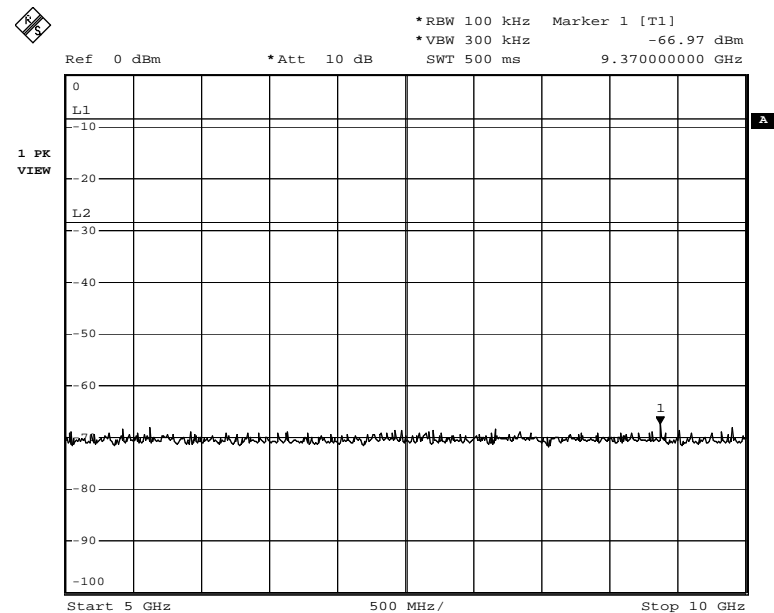


Figure 19: Spurious Emission from 1 to 5GHz, Mode C (2475MHz)



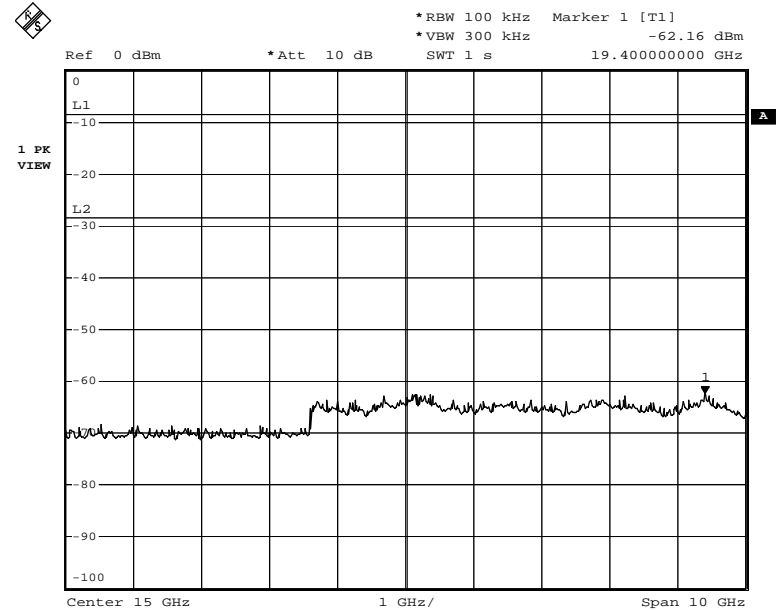
Comment A: FCC Conducted Spurious
L1=-8.40dBm, L2=-28.40dBm
Date: 25.SEP.2008 11:44:29

Figure 20: Spurious Emission from 5 to 10GHz, Mode C (2475MHz)



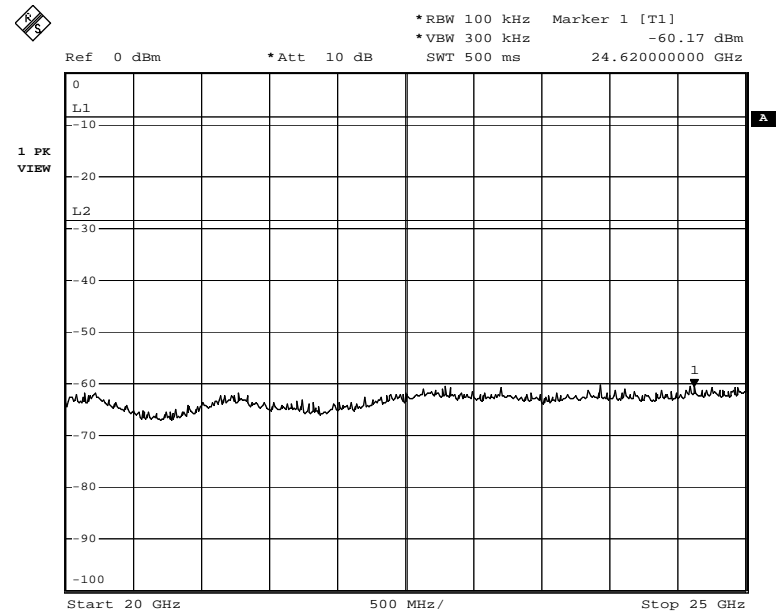
Comment A: FCC Conducted Spurious
L1=-8.40dBm, L2=-28.40dBm
Date: 25.SEP.2008 11:45:28

Figure 21: Spurious Emission from 10 to 20GHz, Mode C (2475MHz)



Comment A: FCC Conducted Spurious
L1=-8.40dBm, L2=-28.40dBm
Date: 25.SEP.2008 11:46:37

Figure 22: Spurious Emission from 20 to 25GHz, Mode C (2475MHz)



Comment A: FCC Conducted Spurious
L1=-8.40dBm, L2=-28.40dBm
Date: 25.SEP.2008 11:47:32

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

RESULT:

PASS

Date of testing: 2008-09-18

Ambient temperature: 25°C

Relative humidity: 41%

Atmospheric pressure: 1006hPa

Requirements:

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

Test procedure:

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

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

The EUT was connected to a DC power supply with a voltage of 3.0V simulating a full battery.

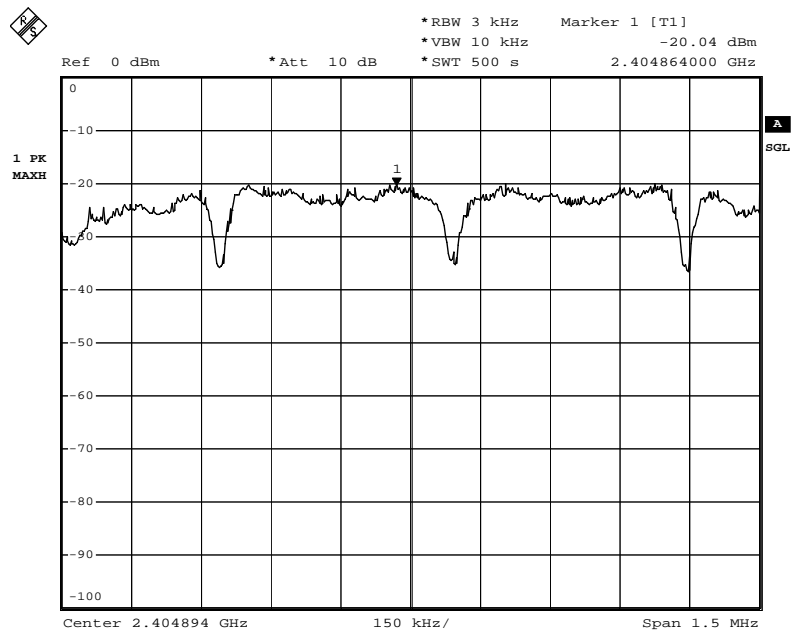
The final measurement takes into account the loss generated by all the involved cables, including the short cable provided by the EUT manufacturer to support the antenna connector.

Table 9: Peak Power Spectral Density

Frequency [MHz]	Reading [dBm]	Correction Factor [dB]	Power Density [dBm]	Limit [dBm]	Margin [dB]
2404.864	-20.04	1.60	-18.44	8	26.44
2440.422	-18.94	1.61	-17.33	8	25.33
2474.546	-18.49	1.62	-16.87	8	24.87

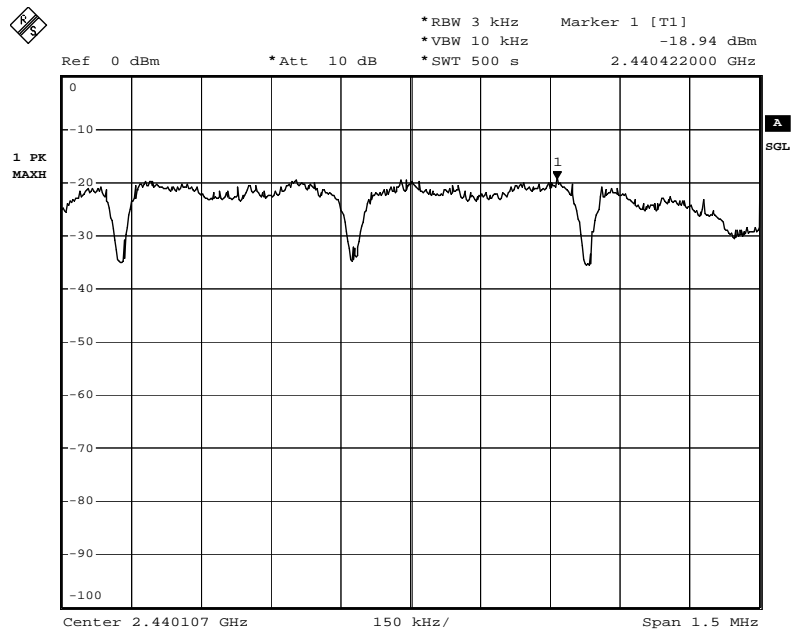
Notes: Power density = Reading + Correction factor
Correction factor = Total cable loss

Figure 23: Power Spectral Density, Mode A (2405MHz)



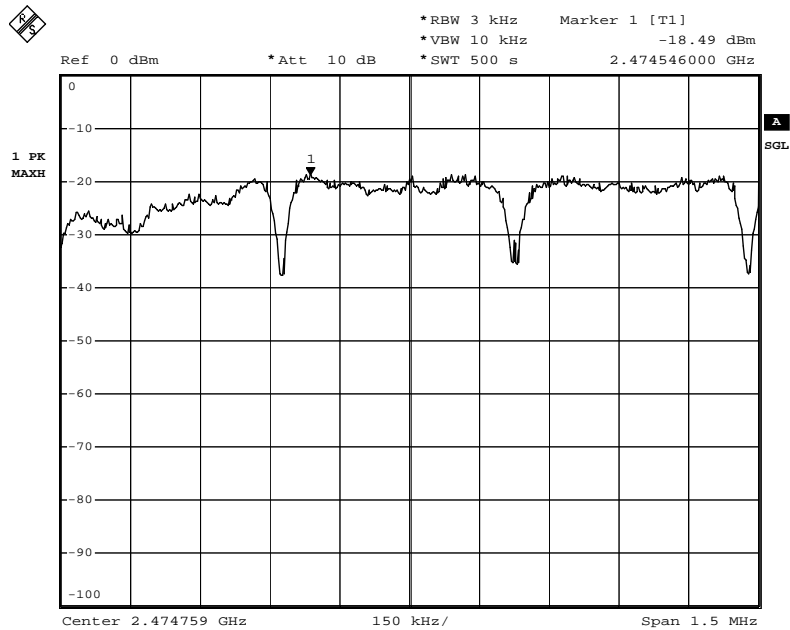
Comment A: FCC Power Spectral Density
Date: 25.SEP.2008 12:14:50

Figure 24: Power Spectral Density, Mode B (2440MHz)



Comment A: FCC Power Spectral Density
Date: 25.SEP.2008 12:27:31

Figure 25: Power Spectral Density, Mode C (2475MHz)



Comment A: FCC Power Spectral Density
Date: 25.SEP.2008 12:40:33

6. Test Results AC Mains Conducted Emission

6.1 AC Mains Conducted Emission of Transmitter

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

RESULT: N/A

Not applicable. The EUT is battery powered only. No charger or AC adapter is provided.

6.2 AC Mains Conducted Emission of Receiver

6.2.1 Mains Terminal Continuous Disturbance Voltage of Receiver, FCC 15.107 and RSS-Gen 7.2.2

RESULT: N/A

Not applicable. The EUT is battery powered only. No charger or AC adapter is provided.

7. Test Results Radiated Emission

7.1 Radiated Emission of Transmitter

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

RESULT: **Pass**

Date of testing: 2008-09-18

Ambient temperature: 24°C

Relative humidity: 71%

Atmospheric pressure: 1013hPa

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

Requirements:

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

Test procedure:

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

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

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

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

The test was performed using a new battery.

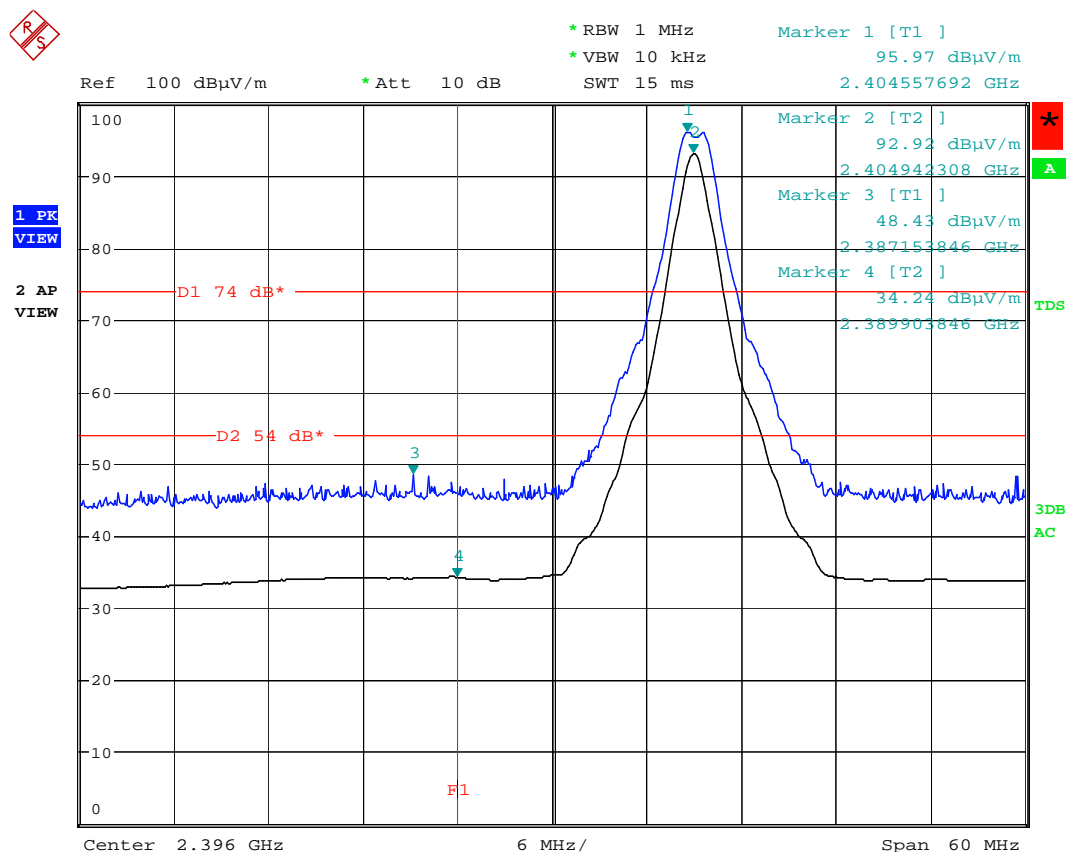
The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 10: Band Edge Radiated Emission

Operating Frequency [MHz]	EUT / Antenna Orient.	Peak Value [dBuV/m]	Average Value [dBuV/m]	Peak Limit [dBuV/m]	Average Limit [dBuV/m]	Peak Margin [dB]	Average Margin [dB]
2405	Z / V	48.43	34.24	74	54	25.57	19.76
2475	Z / V	46.31	33.19	74	54	27.69	20.81

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.

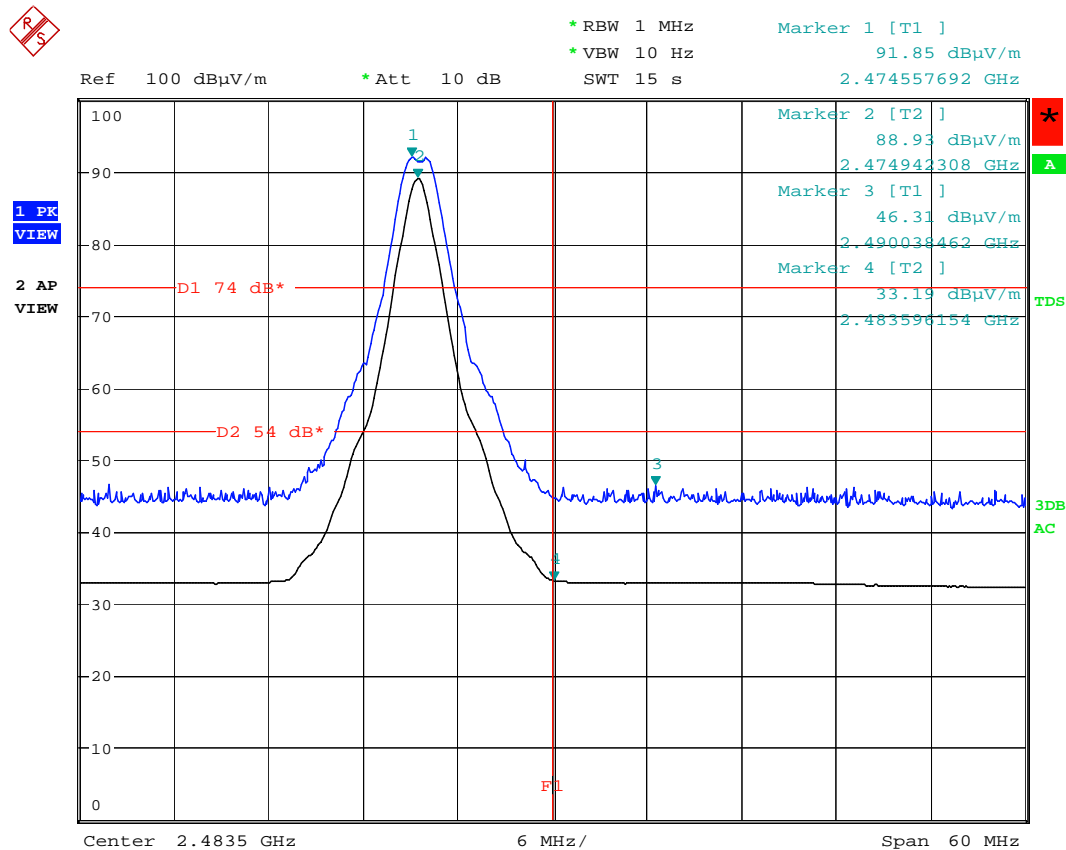
Figure 26: Band Edge Radiated Emission, Mode A (2405MHz), Peak and Average



Band Edge (Lo), Vert, Mode A, Position Z
Direct/Fundamental
Date: 18.SEP.2008 14:40:25

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

Figure 27: Band Edge Radiated Emission, Mode C (2475MHz), Peak and Average



Band Edge (Hi), Vert, Mode C, Position Z
Direct/Fundamental
Date: 18.SEP.2008 14:20:36

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

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

RESULT:

PASS

Date of testing: 2008-09-18, 2008-09-19

Ambient temperature: 24, 23°C

Relative humidity: 71, 74%

Atmospheric pressure: 1013, 1010hPa

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

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

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

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

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

The 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 11: Radiated Emission 30MHz – 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode A

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dB(μV)]	Factor [dB(1/m)]	Level QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
32.042	Z / H	41.4	-24.4	17	40	23	180	2
33.700	Z / V	40.6	-24.3	16.3	40	23.7	222	331
44.334	Z / V	36.1	-23.2	12.9	40	27.1	121	209
44.905	Z / V	36.3	-23.2	13.1	40	26.9	114	104
53.569	Z / H	32.8	-23	9.8	40	30.2	259	10
66.708	Z / H	36.8	-24.2	12.6	40	27.4	225	343
120.000	Z / H	43.8	-24.8	19	43.5	24.5	101	28
359.995	Z / V	35.7	-19.3	16.4	46	29.6	102	341

Note: Level QP = Reading QP + Factor

Table 12: Radiated Emission 30MHz – 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode B

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dB(μV)]	Factor [dB(1/m)]	Level QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
32.037	Z / H	40.9	-24.4	16.5	40	23.5	160	10
32.046	Z / V	42.5	-24.5	18	40	22	219	0
44.075	Z / H	41	-23.1	17.9	40	22.1	100	308
66.531	Z / H	39.7	-24.2	15.5	40	24.5	251	261
79.966	Z / H	33.5	-27.4	6.1	40	33.9	228	14
120.007	Z / H	38.5	-24.8	13.7	43.5	29.8	268	313
159.997	Z / H	34.4	-22.4	12	43.5	31.5	106	316

Note: Level QP = Reading QP + Factor

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

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dB(μV)]	Factor [dB(1/m)]	Level QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
33.863	Z / V	40.9	-24.3	16.6	40	23.4	152	38
39.988	Z / H	44.6	-23.5	21.1	40	18.9	104	30
66.543	Z / H	38.6	-24.2	14.4	40	25.6	258	141
79.997	Z / H	37	-27.4	9.6	40	30.4	237	153
116.642	Z / H	30.3	-25.1	5.2	43.5	38.3	167	344
129.955	Z / H	32.6	-23.9	8.7	43.5	34.8	173	17
920.462	Z / H	31.1	-10	21.1	46	24.9	284	95

Note: Level QP = Reading QP + Factor

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

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]
2382.896	Z / V	25.5	39.6	54	74	28.5	34.4
2552.963	Z / V	28.5	39.9	54	74	25.5	34.1
4809.962	Z / V	47.2	50.5	54	74	6.8	23.5

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

Table 15: Radiated Emission 1GHz – 25GHz, Horizontal & Vertical Antenna Orientations, Peak and Average Data, Mode B

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]
2876.849	Y / V	25.5	39.6	54	74	28.5	34.4
4879.951	Y / V	42.3	49	54	74	11.7	25

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

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

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]
2622.982	X / V	27.4	39.5	54	74	26.6	34.5
4949.971	X / V	38.4	45.8	54	74	15.6	28.2

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

7.2 Radiated Emission of Receiver

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

RESULT:

PASS

Date of testing: 2008-09-17, 2008-09-18

Ambient temperature: 24, 24°C

Relative humidity: 62, 71%

Atmospheric pressure: 1009, 1013hPa

Frequency range: 30MHz – 25GHz

Equipment classification: Class B

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

Requirements:

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

Test procedure:

ANSI C63.4-2003, RSS-Gen 4.9, 4.10

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

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

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

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

The test was performed using a new battery.

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

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dB(μV)]	Factor [dB(1/m)]	Level QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
32.068	Z / V	42	-24.5	17.5	40	22.5	208	0
45.975	Z / V	38.4	-23.2	15.2	40	24.8	115	350
66.542	Z / H	39.6	-24.2	15.4	40	24.6	103	180
79.981	Z / V	39.5	-26.9	12.6	40	27.4	102	267
124.677	Z / H	30.7	-24.3	6.4	43.5	37.1	264	122
160	Z / H	38.9	-22.4	16.5	43.5	27	191	153
755.744	Z / H	30.6	-12	18.6	46	27.4	367	217
113.18	Z / V	30.2	-25.6	4.6	43.5	38.9	116	66

Note: Level QP = Reading QP + Factor

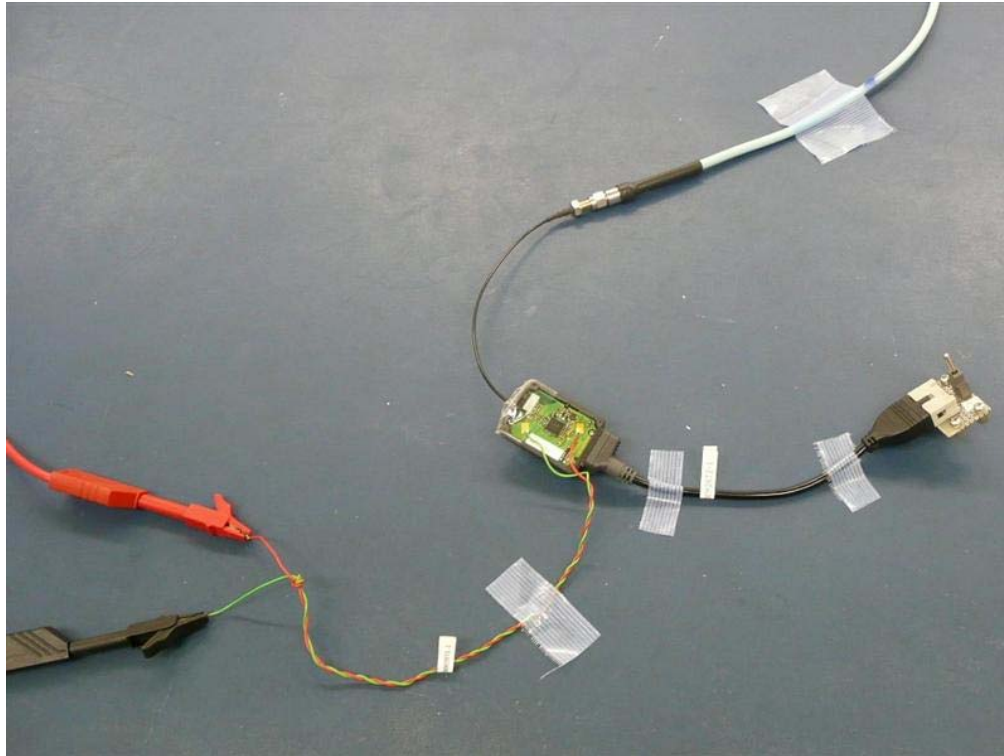
Table 18: Radiated Emission 1GHz – 25GHz, Horizontal & Vertical Antenna Orientations, Peak and Average Data, Mode D

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]
4875.943	X / H	39.3	46.2	54	74	14.7	27.8

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

8. Photographs of test setup

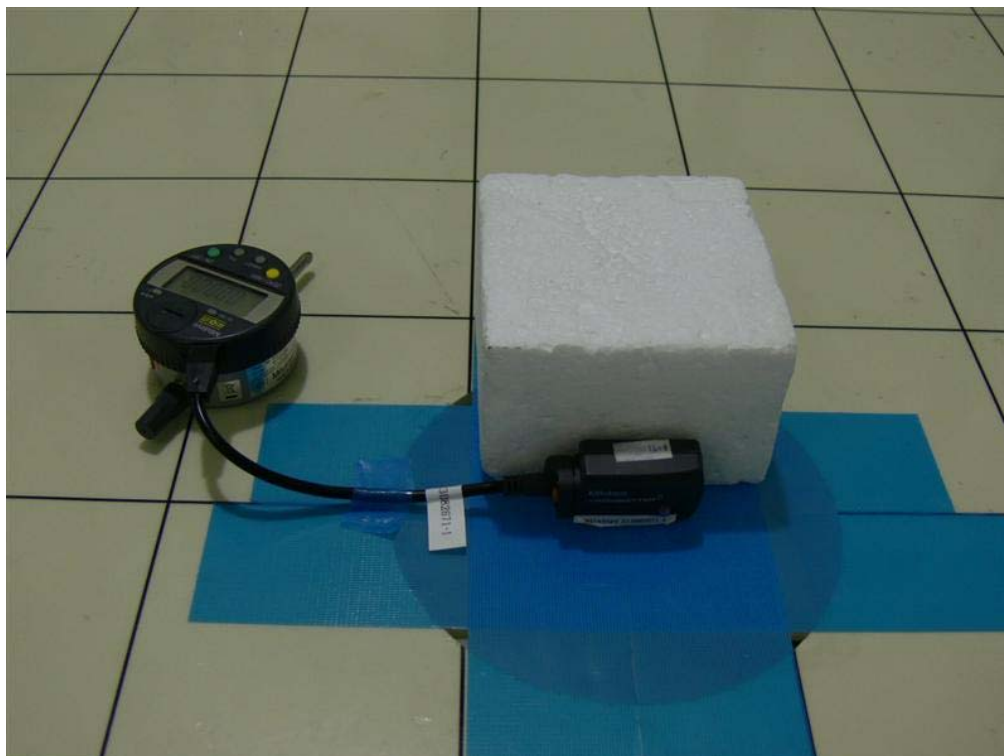
Photograph 1: Set-up for Conducted Emissions at Antenna Port



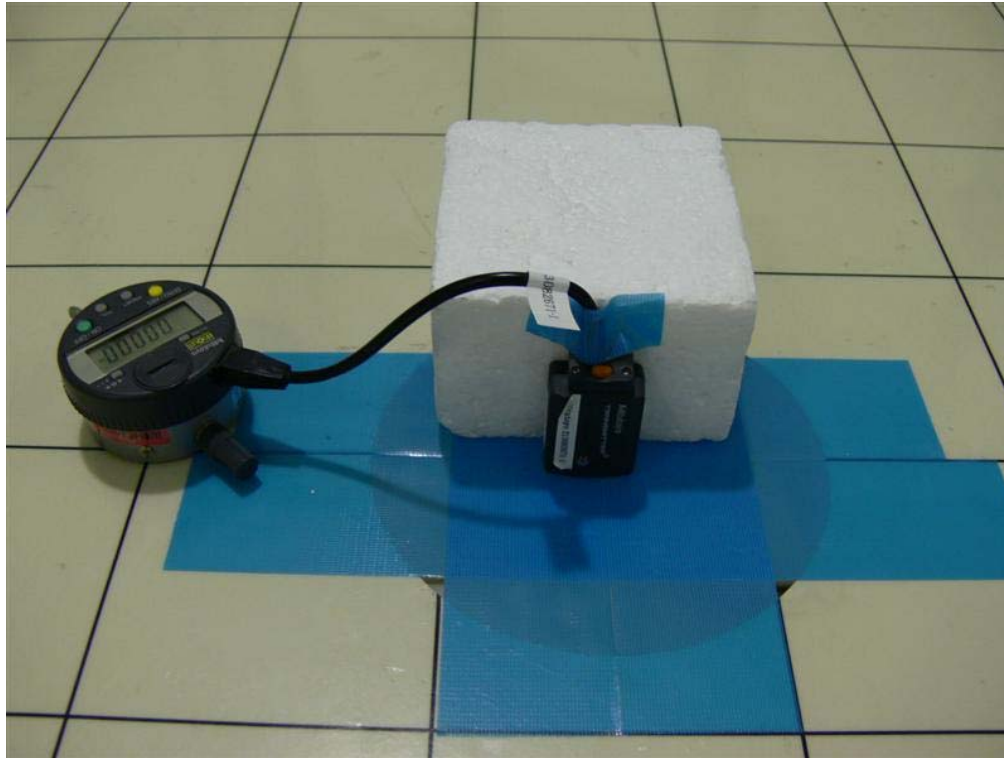
Photograph 2: Set-up for Radiated Emission, EUT Configuration X-Axis



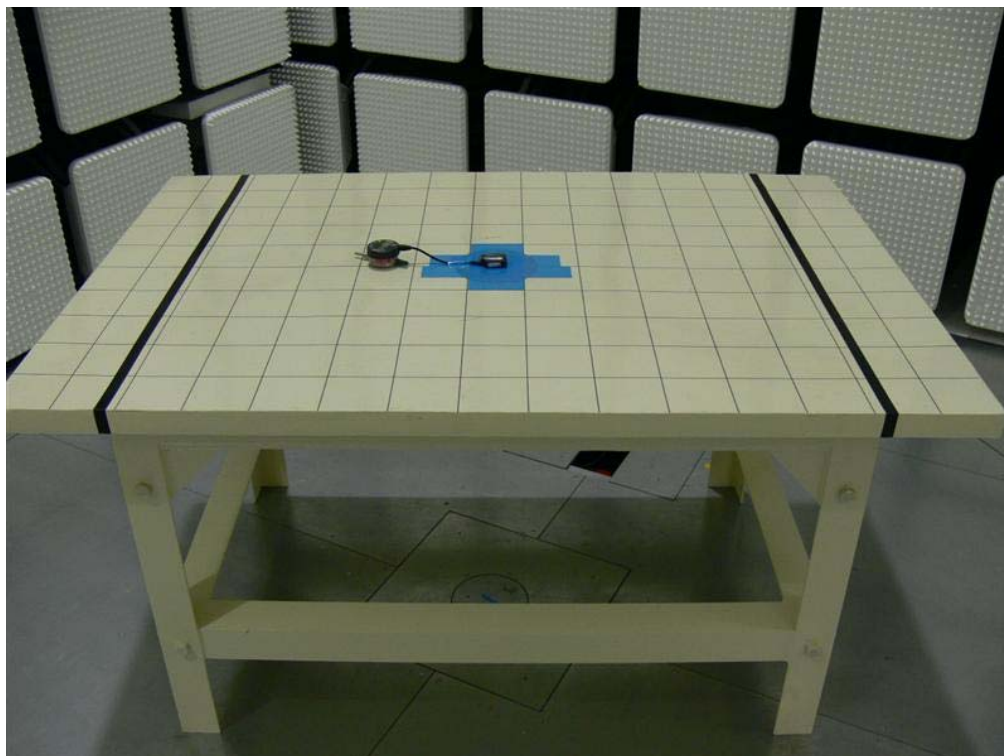
Photograph 3: Set-up for Radiated Emission, EUT Configuration Y-Axis



Photograph 4: Set-up for Radiated Emission, EUT Configuration Z-Axis



Photograph 5: Set-up for Radiated Emission of Transmitter



Photograph 6: Set-up for Radiated Emission of Receiver



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