TÜVRheinland®

Produkte
Products

Prüfbericht - Nr.: *Test Report No.:*	**12604408 005**	**Seite 1 von 50** *Page 1 of 50*
Auftraggeber: *Client:*	**Mitutoyo Corporation** 20-1, Sakado 1-Chome, Takatsu-ku, Kawasaki-shi, Kanagawa 213-8533, Japan	
Gegenstand der Prüfung: *Test item:*	**Wireless Communication System**	
Bezeichnung: *Identification:*	**02AZD810C (U-WAVE-R)**	**Serien-Nr.:** *Serial No.:* **1999999967, 1999999977**
Wareneingangs-Nr.: *Receipt No.:*	**213072894**	**Eingangsdatum:** *Date of receipt:* **2008-01-15**
Prüfort: *Testing location:*	4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan	
Prüfgrundlage: *Test specification:*	**47 CFR Part 15.247 (Subpart: B)** **47 CFR Part 15.247 (Subpart: C)** **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: *Test Result:*	**Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).** *The test item passed the test specification(s).*	
Prüflaboratorium: *Testing Laboratory:*	**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:*		
2008-05-20	T. Sauter / Inspector		2008-05-20	M. Zietz / Reviewer	
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges / *Other Aspects:*

This test report deals with the intentional radiator portion of the tested product. Unintentional radiator aspects are covered by another test report.

This test report supersedes test report 12604408 001 issued by TÜV Rheinland Japan, Ltd.

Abkürzungen:				*Abbreviations:*			
	P(ass)	=	*entspricht Prüfgrundlage*		*P(ass)*	=	*passed*
	F(ail)	=	*entspricht nicht Prüfgrundlage*		*F(ail)*	=	*failed*
	N/A	=	*nicht anwendbar*		*N/A*	=	*not applicable*
	N/T	=	*nicht getestet*		*N/T*	=	*not tested*

TEST SUMMARY

3.2.1 VOLTAGE REQUIREMENT FCC 15.31(E)
RESULT: PASS

3.2.2 ANTENNA REQUIREMENTS FCC 15.203, FCC 15.204 AND RSS-210 A8.4
RESULT: PASS

5.1.1 CONDUCTED OUTPUT POWER AT ANTENNA TERMINALS FCC 15.247(B)(3) AND RSS-210 A8.4
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 EMISSIONS 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 BAND EDGE RADIATED EMISSION FCC 15.247(D) AND RSS- 210 A2.2
RESULT: Pass

6.1.2 RADIATED EMISSION (RE) OUT-OF-BAND AND SPURIOUS EMISSION FCC PART 15.247(D)/15.205/15.209 AND RSS-210 2.2/RSS-210 A.8.5 RSS-GEN 7.2.1/7.2.3
RESULT: PASS

7.1.1 RADIATED EMISSION RECEIVER
RESULT: PASS

Contents

1. General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report.

1.2 FCC Cross-Reference Table

The results of emission measurements and product related information contained in this test report and the attached materials relate to the contents of the FCC standard report in the following way:

FCC § / Heading	
1.1 Product Description	See 3.1
1.2 Tested System Details	See 4.2
1.3 Test Methodology	See 4.1
1.4 Test Facility	See 2.1
3.2 EUT Exercise Software	See 4.3
3.3 Special Accessories	See 4.4
3.4 Equipment Modifications	See 4.5
3.5 Configuration of Tested System	See 4.2

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

Test Equipment calibration is traceable to NIST

Table 1: List of Test and Measurement Equipment

kind of equipment	manufacturer	type	S/N	calibrated until
RECEIVER	ROHDE & SCHWARZ	ESU8	100025	2009-02
RECEIVER	ROHDE & SCHWARZ	ESU40	100029	2009-01
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSP30	10006/30	2008-08
ANTENNA	SCHWARZBECK	VULB9168 (30 - 1000M)	0245	2008-04
ANTENNA	SCHWARZBECK	BBHA9120B	419	2008-03
ANTENNA	TOYO	HAP06-18W	00000025	2008-03
ANTENNA	TOYO	HAP18-26N	00000010	2008-03
PRE AMPLIFIER	HEWLETT PACKARD	8447D	2944A08481	2008-01
PRE AMPLIFIER	TOYO	TPA0108-40	0634	2008-03
POWER METER	Agilent	N1911A	MY45101408	2009-01
POWER SENSOR	Agilent	N1921A	MY45241752	2009-01
DC POWER SUPPLY	Agilent	E3646A	MY40004642	N/A
LISN	ROHDE & SCHWARZ	ENV216	100276	2008-04
RF SELECTOR	TOYO CORPORATION	NS4900	N/A	2009-01

2.3 Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emissions	< 1GHz	0.39dB
	> 1GHz	0.68dB
Radiated Emission	9kHz-30MHz	±4.77dB
	30-1000MHz	±5.11dB
	1000-40GHz	±5.19dB

3. General Product Information

3.1 Product Function and Intended Use

The **EUT** (**E**quipment **U**nder **T**est) is a IEEE802.15.4 unit, which is to be used with personal computers (PC, laptop or desktop type). Measurement data from e.g. a calipper are transmitted via a DTS U-WAVE-T unit attached to a measurement tool to the EUT connected to PCs. The measurement tools and PCs are not part of the EUT.

3.2 System Details

Specified power output:	-3dBm (max. peak power: 0.5mW)
Antenna gain:	-5 dBi
Antenna type:	Pattern 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 5.0V (USB bus power system)
Typical Nominal Voltage:	DC 5.0V (USB bus power system)
Protection Class:	III

3.2.1 Voltage Requirement FCC 15.31(e)

RESULT: **PASS**

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

3.2.2 Antenna Requirements FCC 15.203, FCC 15.204 and RSS-210 A8.4

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 following clock frequencies:

6 MHz
8 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

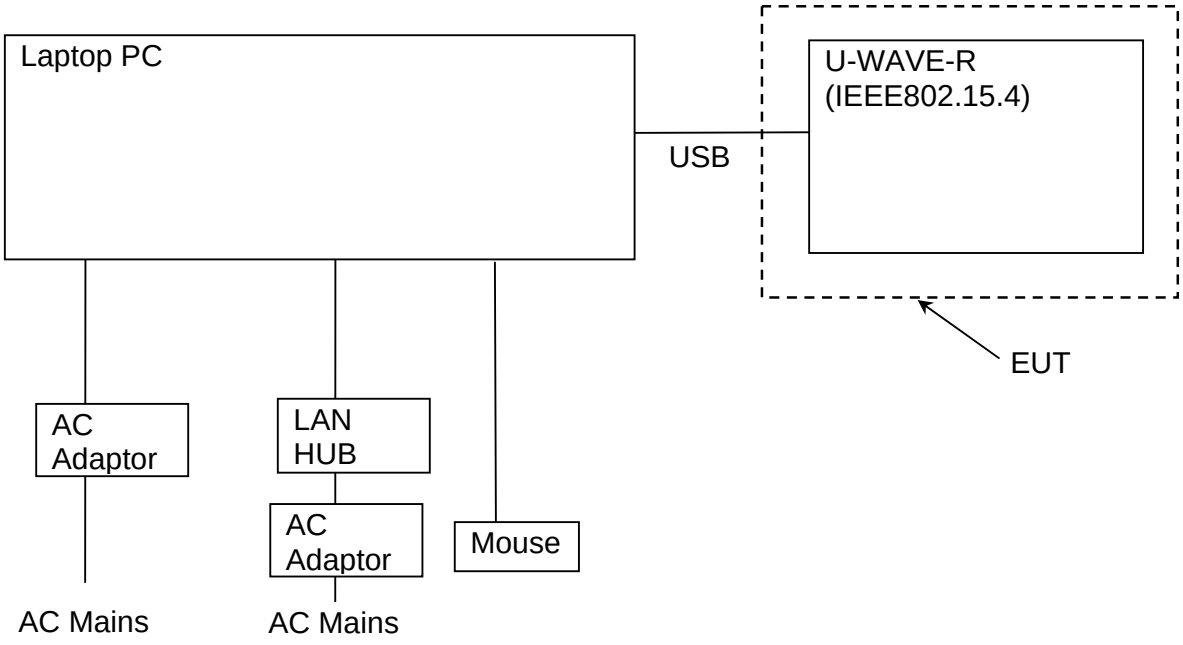
4.1 Test Methodology

The test methodology used is based on the requirements of 47 CFR Part 15 (2007-04-05), 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.
Details see under each test.

4.2 Physical Configuration for Testing

Refer to section: Photographs of the Test Set-Up

Figure 1: Test setup



In the sample for conducted test, the antenna was replaced by a 50Ω antenna connector.

4.3 Test Operation and Test Software

Software used for testing:

U-WAVEPAK

This software was running on the external PC performing continuous data reading and hence permanent radio communication of the EUT with a second radio device.

The EUT was exercised in the operation modes listed under 3.4 as appropriate.

4.4 Special Accessories and Auxiliary Equipment

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

1. Product: Laptop PC
   Manufacturer: IBM
   Model: A22P
   Serial Number: 97-413BZ 05/01

2. Product: AC Adapter for Laptop PC
   Manufacturer: IBM
   Model: 02K6665
   Rated Voltage: AC (110 - 240)V
   Frequency: 50/60Hz
   Serial Number: 11S02K6665Z1Z2U8185T30

3. Product: Mouse
   Manufacturer: Dell
   Model: MO58UC
   Serial Number: G0601Z20

4. Product: Ethernet Hub
   Manufacturer: Buffalo
   Model: Broad Station
   Serial Number: 8647276112009

5. Product: AC Adapter for Hub
   Manufacturer: Buffalo
   Model: 420AS44252
   Rated Voltage: AC 100V
   Serial Number: 0648

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

RESULT: **PASS**

Date of testing: 2008-02-20

Ambient temperature: 24.0 °C
Relative humidity: 24 %
Atmospheric pressure: 1010hPa

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

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 (without additional cable) at the antenna connector with the power meter.

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

Table 2: Conducted output power at normal voltage DC 5.0V

Frequency (MHz)	Limit (dBm)	Limit (mW)	Output (dBm)	Output (mW)	Margin (dB)
2405	30	1000	-5.43	0.29	35.43
2440	30	1000	-4.81	0.33	34.81
2475	30	1000	-4.23	0.38	34.23

The output power is independent from the supply voltage as the following reference measurements show.

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

RESULT: **PASS**

Date of testing: 2008-02-20

Ambient temperature: 24.0 °C
Relative humidity: 24 %
Atmospheric pressure: 1010hPa

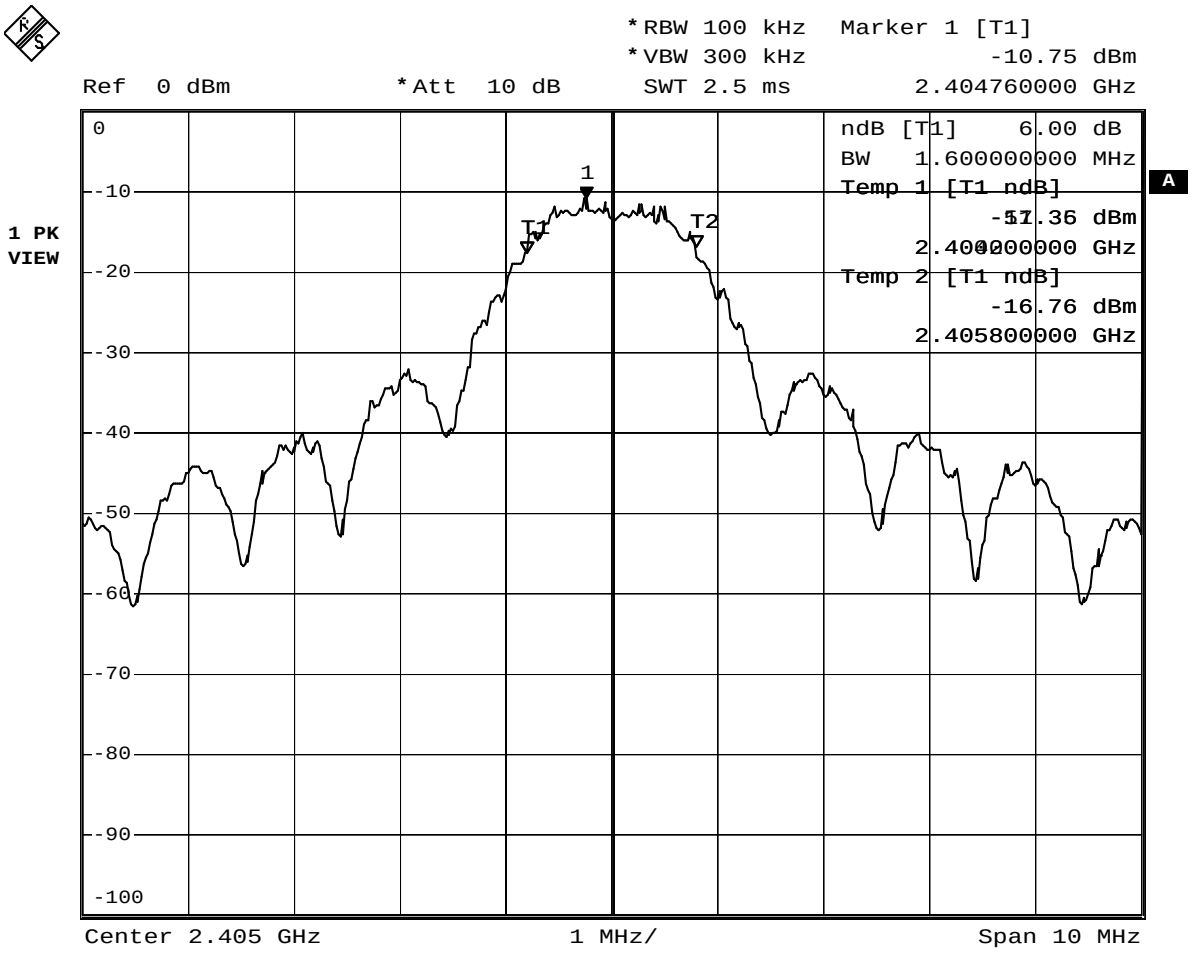
Requirements:
For systems using digital modulation in the 2400-2483.5MHz band the minimum 6dB bandwidth shall be at least 500 kHz.

Test procedure:
ANSI C63.4-2003, RSS-Gen 4.6.2
The output connector is connected to a spectrum analyzer. The spectrum analyzer resolution bandwidth was set to 1% of the SPAN (10MHz). The 6dBc Bandwidth was measured by using the DELTA MARKER function of the analyzer.

Table 3: 6dB Bandwidth

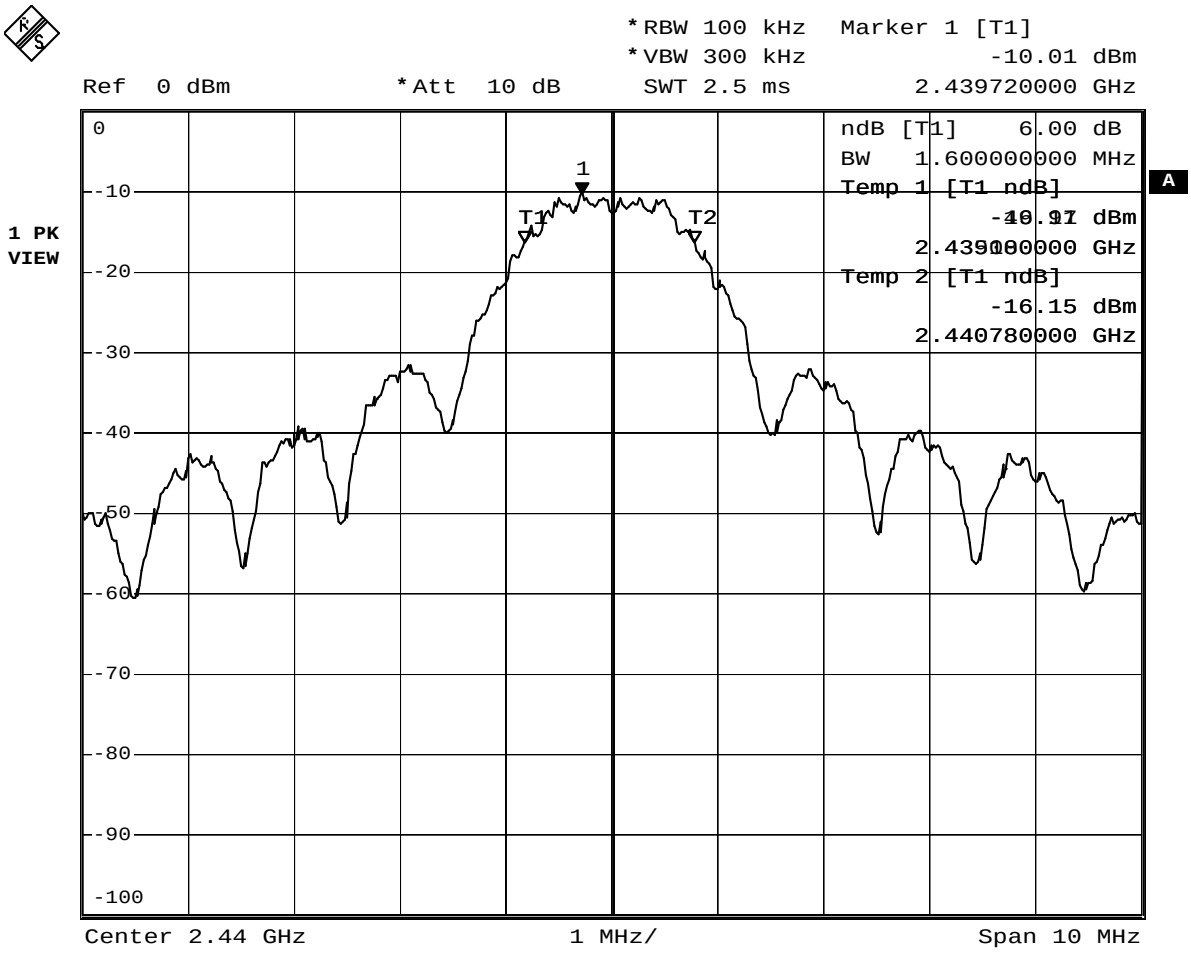
Frequency (MHz)	Limit (kHz)	6dB Bandwidth (kHz)
2405	500	1600
2440	500	1600
2475	500	1620

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



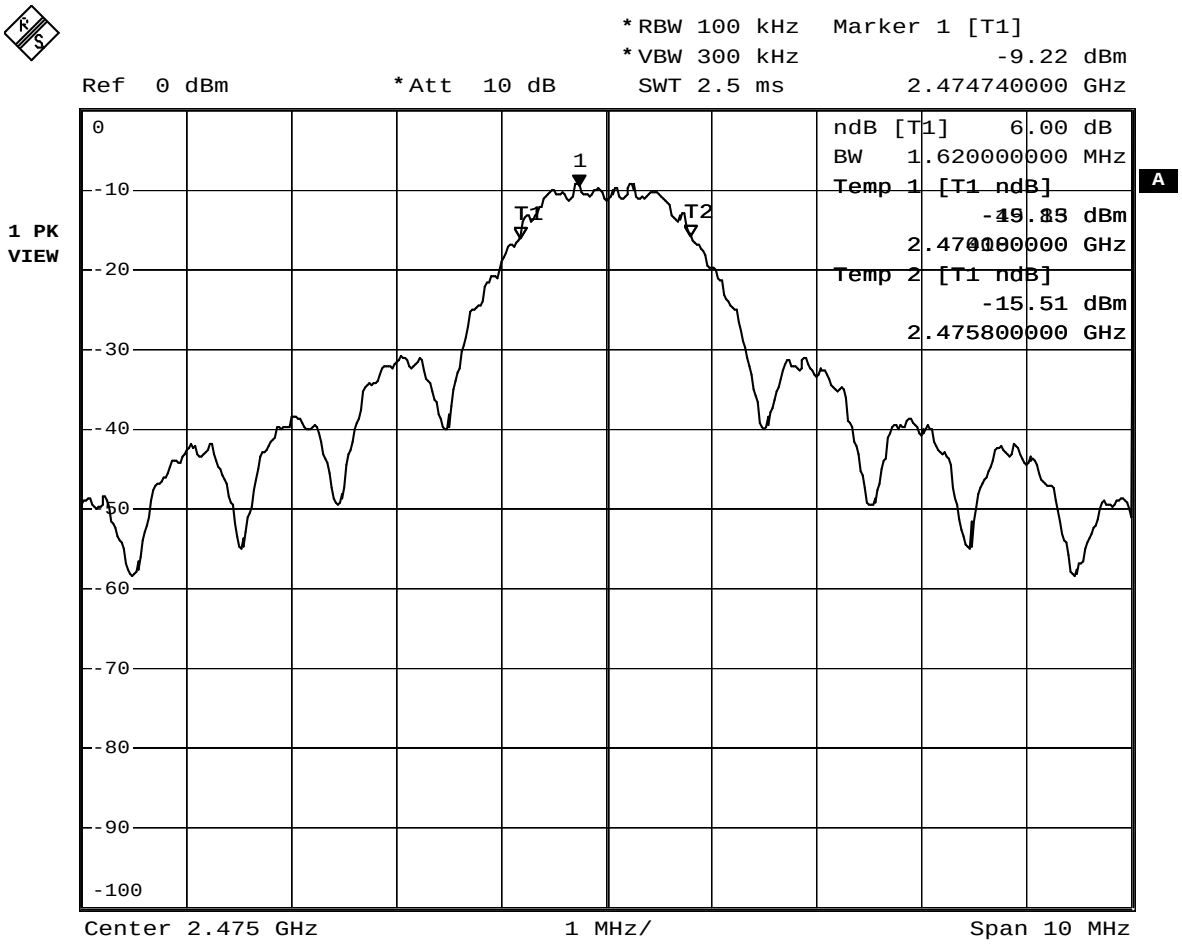
Comment A: FCC 6dB Bandwidth
Date: 20.FEB.2008 10:15:51

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



Comment A: FCC 6dB Bandwidth
Date: 20.FEB.2008 10:19:21

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



Comment A: FCC 6dB Bandwidth
Date: 20.FEB.2008 09:43:54

5.1.3 99% Bandwidth, RSS-Gen 4.6.1

RESULT: **N/A**

Date of testing: 2008-02-21

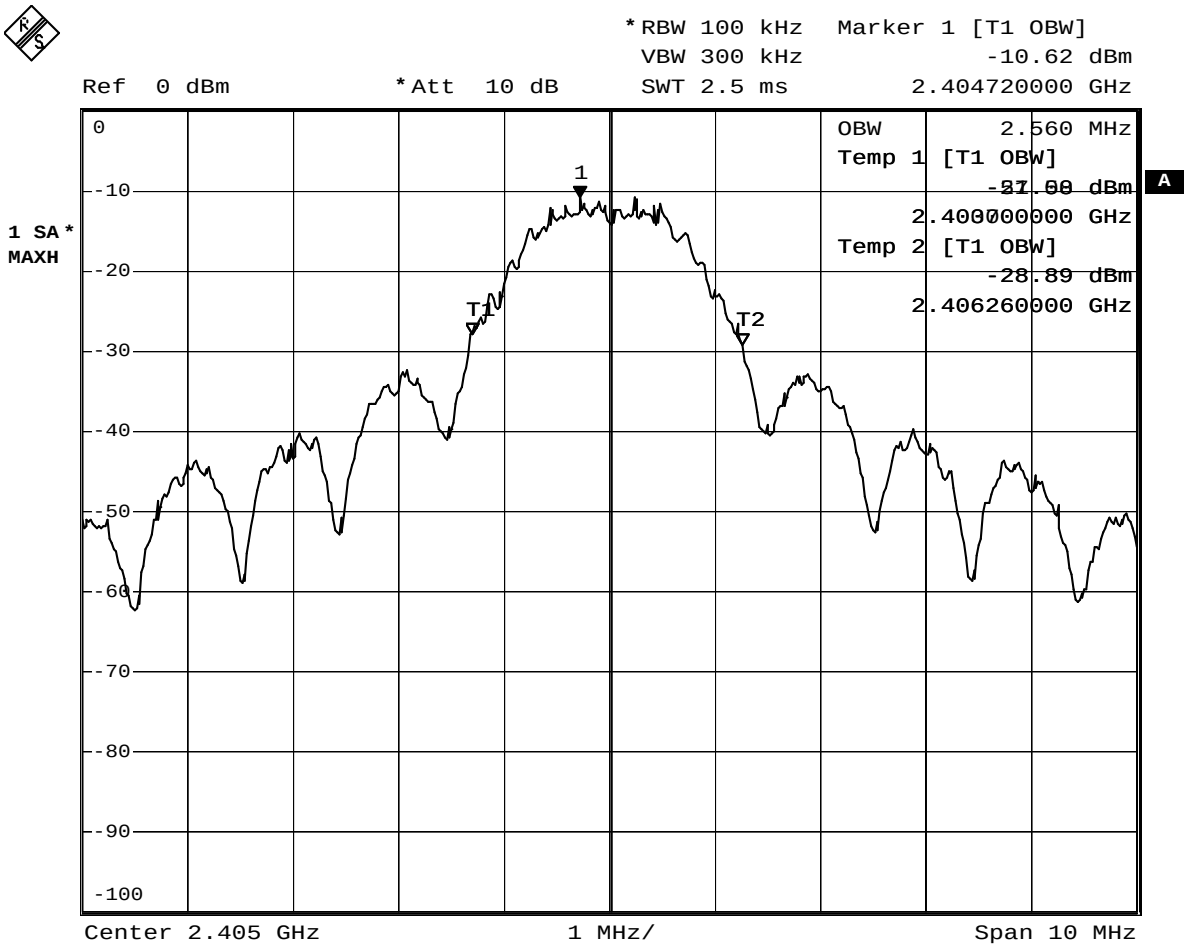
Ambient temperature: 24.0 °C
Relative humidity: 24 %
Atmospheric pressure: 1008hPa

Test procedure:
RSS-Gen 4.6.1
The output connector is 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.

Table 4: 99% Bandwidth

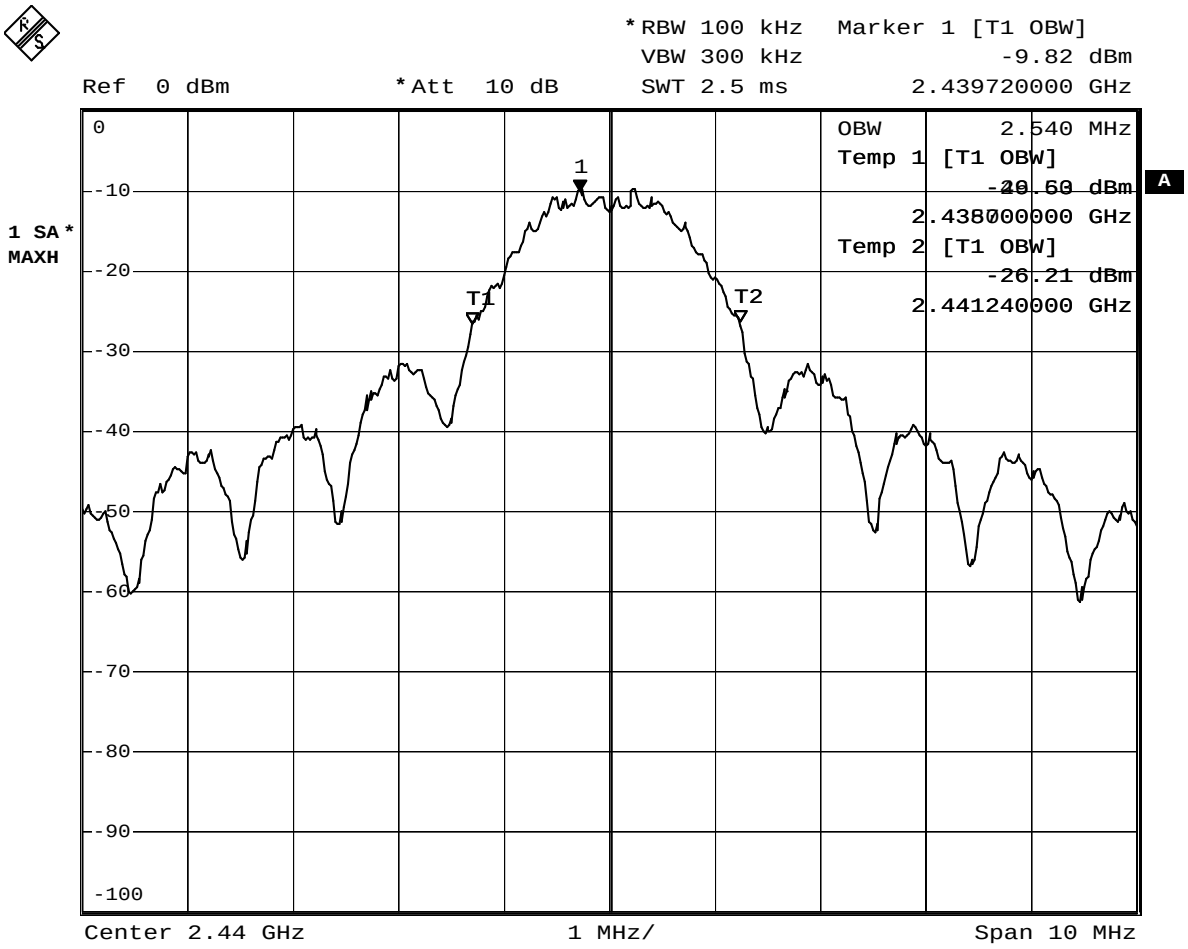
Frequency (MHz)	Limit (MHz)	99% Bandwidth (MHz)
2405	N/A	2.56
2440	N/A	2.54
2475	N/A	2.54

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



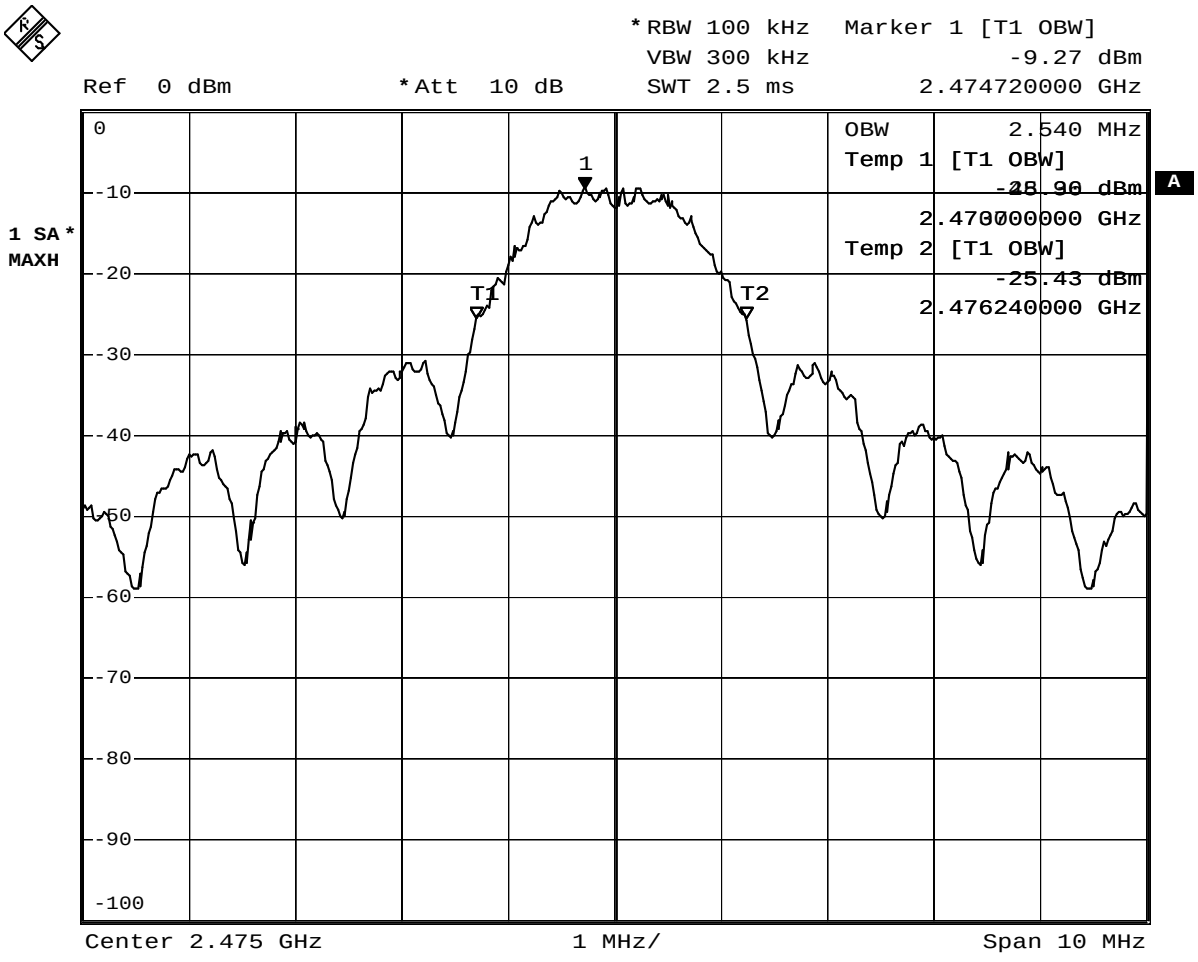
Comment A: 99% Bandwidth
Date: 21.FEB.2008 08:37:35

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



Comment A: 99% Bandwidth
Date: 21.FEB.2008 08:39:02

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



Comment A: 99% Bandwidth
Date: 21.FEB.2008 08:49:21

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

RESULT: **PASS**

Date of testing: 2008-02-21

Ambient temperature: 24.0 °C
Relative humidity: 24 %
Atmospheric pressure: 1010hPa

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.

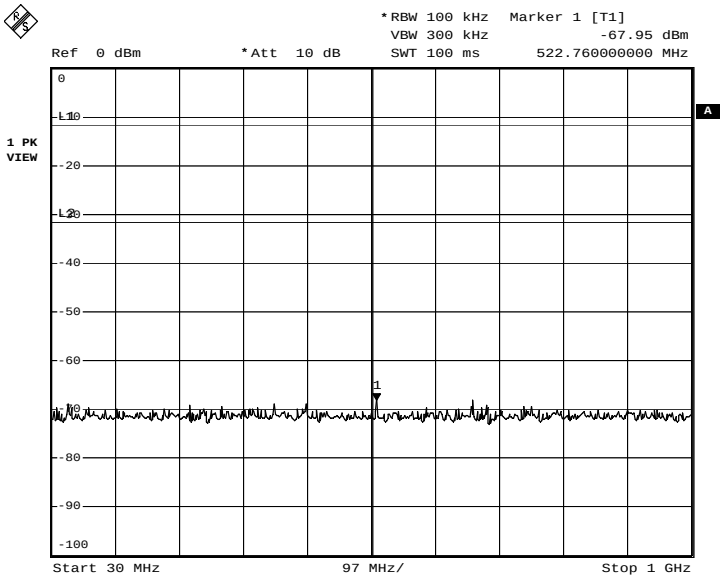
A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 100 kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 30 MHz to 25 GHz (10^{th} harmonics).

Table 5: Conducted Spurious Emissions of 2405MHz (Mode A)

Frequency (MHz)	Limit (dBm)	Reading (dBm)	Correction factor (dB)	Emission level (dBm)	Margin (dB)
2405	N/A	-11.75	1.16	-10.59	N/A
522.76	-30.59	-67.95	0.54	-67.41	36.82
1896.00	-30.59	-57.19	1.04	-56.15	25.56
2552.00	-30.59	-62.70	1.20	-61.50	30.91
4816.00	-30.59	-43.30	1.70	-41.60	11.01
5200.00	-30.59	-67.29	1.77	-65.52	34.93
17860	-30.59	-62.55	3.15	-59.40	28.82
24680	-30.59	-60.21	3.91	-56.30	25.71

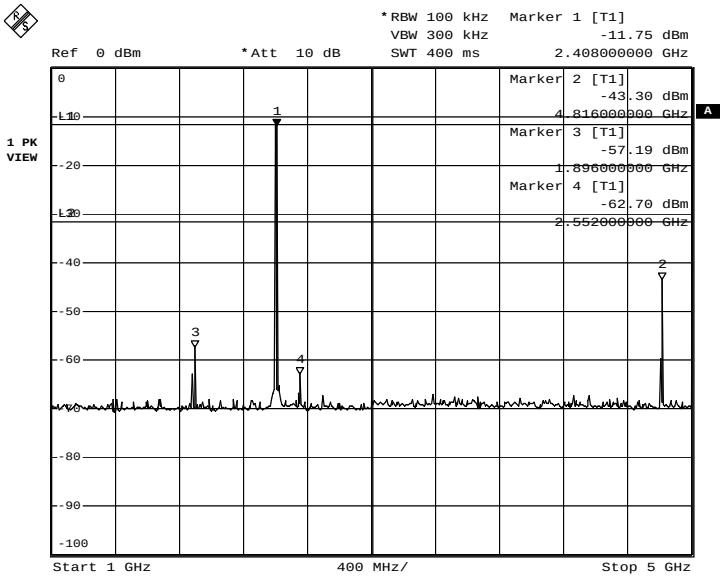
Notes : 1) Limit = (Reading fundamental) + (Correction factor) – 20
2) Emission level = (Reading) + (Correction factor)
3) Correction factor = Cable loss

Figure 8: Operating 2405MHz (Mode A) spurious from 30MHz to 1GHz



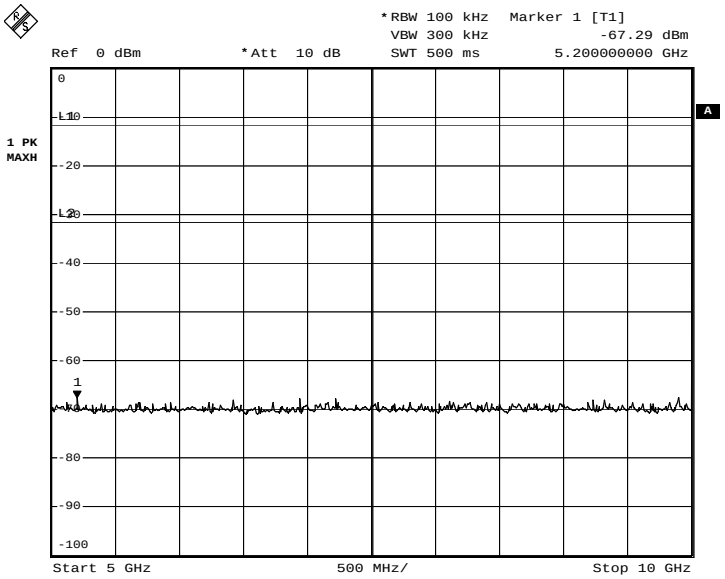
Comment A: 2405 MHz, L1: -11.75dBm, L2: -31.75dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:04:16

Figure 9: Operating 2405MHz (Mode A) spurious from 1GHz to 5GHz



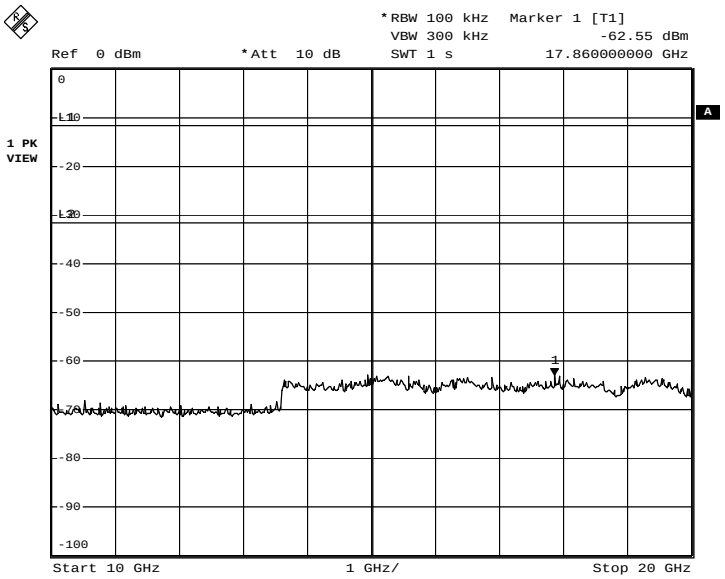
Comment A: 2405 MHz, L1: -11.75dBm, L2: -31.75dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:01:55

Figure 10: Operating 2405MHz (Mode A) spurious from 5GHz to 10GHz



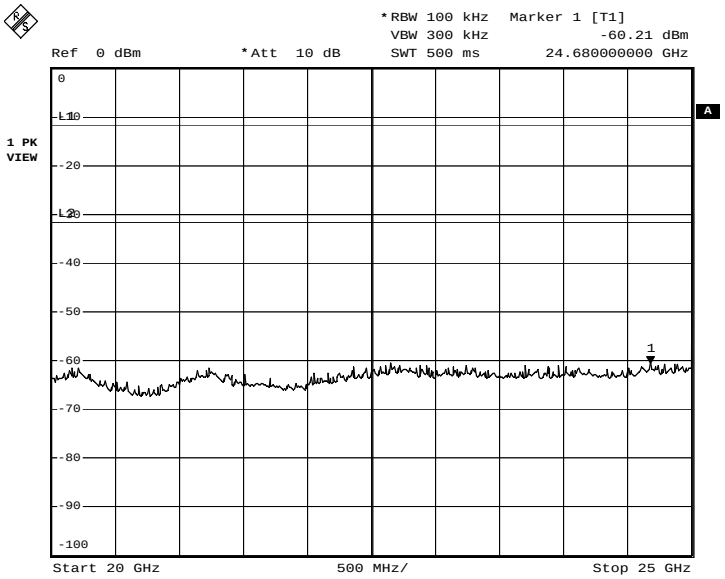
Comment A: 2405 MHz, L1: -11.75dBm, L2: -31.75dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:06:25

Figure 11: Operating 2405MHz (Mode A) spurious from 10GHz to 20GHz



Comment A: 2405 MHz, L1: -11.75dBm, L2: -31.75dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:07:03

Figure 12: Operating 2405MHz (Mode A) spurious from 20GHz to 25GHz



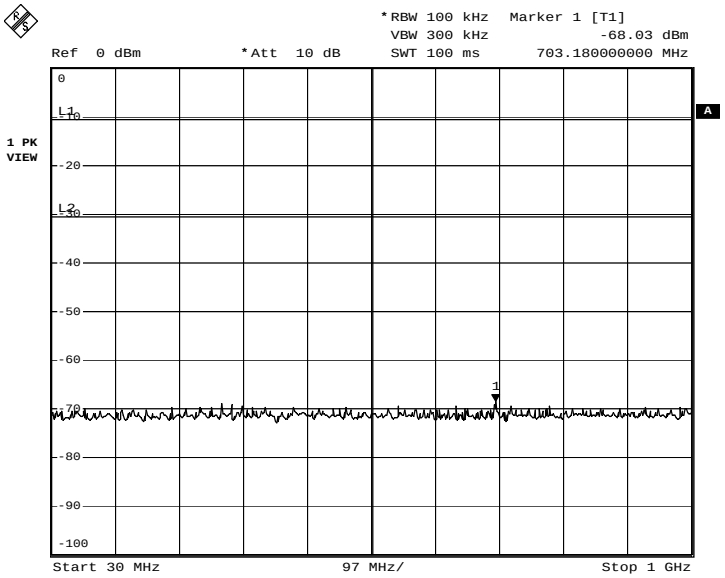
Comment A: 2405 MHz, L1: -11.75dBm, L2: -31.75dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:07:45

Table 6: Conducted Spurious Emissions of 2440MHz (Mode B)

Frequency (MHz)	Limit (dBm)	Reading (dBm)	Correction factor (dB)	Emission level (dBm)	Margin (dB)
2440	N/A	-10.53	1.17	-9.36	N/A
703.18	-29.36	-68.03	0.63	-67.40	38.04
1880.00	-29.36	-54.24	1.02	-53.22	23.86
4880.00	-29.36	-43.09	1.70	-41.39	12.03
9760.00	-29.36	-66.93	2.49	-64.44	35.08
15240	-29.36	-61.74	2.88	-58.86	29.50
24760	-29.36	-61.03	5.03	-56.00	26.65

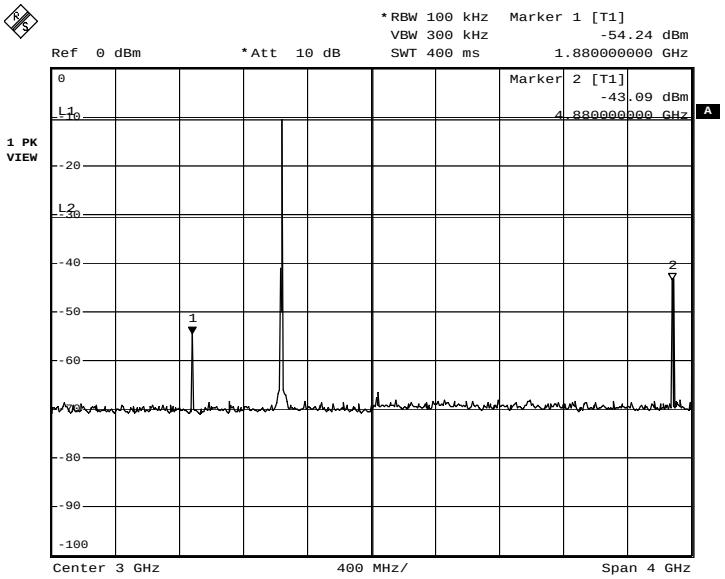
Notes : 1) Limit = (Reading fundamental) + (Correction factor) – 20
2) Emission level = (Reading) + (Correction factor)
3) Correction factor = Cable loss

Figure 13: Operating 2440MHz (Mode B) spurious from 30MHz to 1GHz



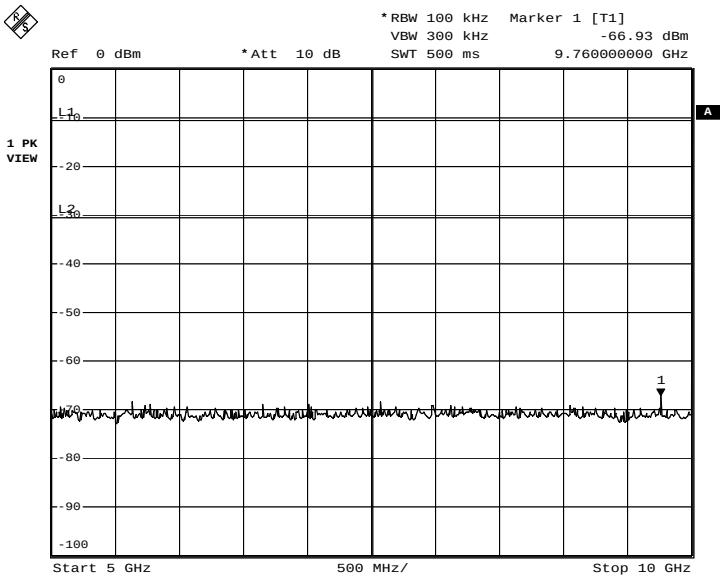
Comment A: 2440 MHz, L1: -10.53dBm, L2: -30.53dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:17:11

Figure 14: Operating 2440MHz (Mode B) spurious from 1GHz to 5GHz



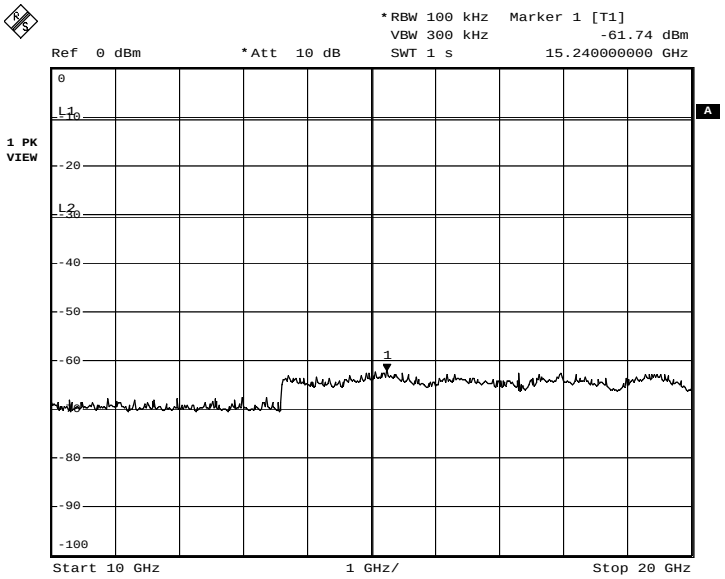
Comment A: 2440 MHz, L1: -10.53dBm, L2: -30.53dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:16:35

Figure 15: Operating 2440MHz (Mode B) spurious from 5GHz to 10GHz



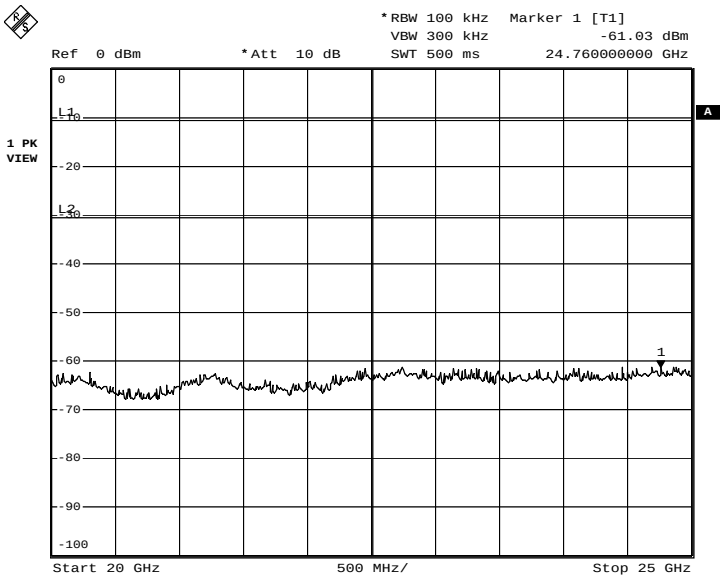
Comment A: 2440 MHz, L1: -10.53dBm, L2: -30.53dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:18:18

Figure 16: Operating 2440MHz (Mode B) spurious from 10GHz to 20GHz



Comment A: 2440 MHz, L1: -10.53dBm, L2: -30.53dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:21:33

Figure 17: Operating 2440MHz (Mode B) spurious from 20GHz to 25GHz



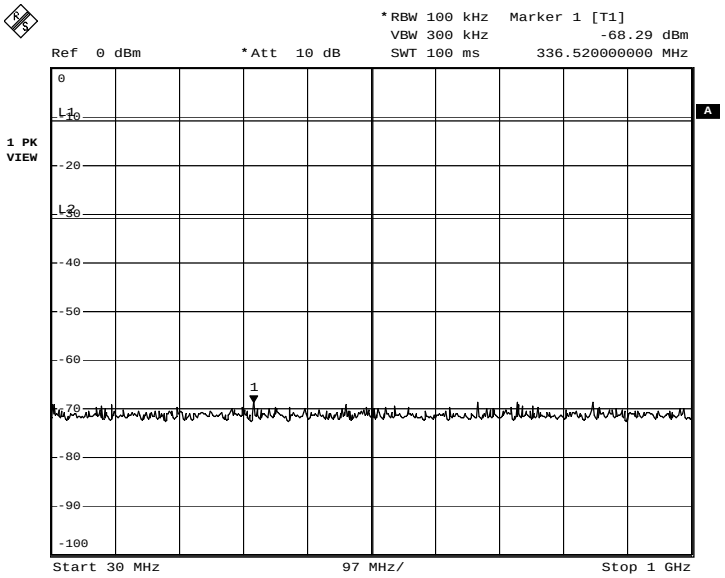
Comment A: 2440 MHz, L1: -10.53dBm, L2: -30.53dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:21:56

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

Frequency (MHz)	Limit (dBm)	Reading (dBm)	Correction factor (dB)	Emission level (dBm)	Margin (dB)
2475	N/A	-10.78	1.18	-9.60	N/A
336.52	-29.60	-68.29	0.44	-67.85	38.25
2624.00	-29.60	-63.38	1.21	-62.17	32.56
4952.00	-29.60	-43.99	1.72	-42.27	12.67
6950.00	-29.60	-67.93	2.14	-65.79	36.18
15120	-29.60	-63.39	2.83	-60.56	30.95
22610	-29.60	-60.38	3.80	-56.58	26.98

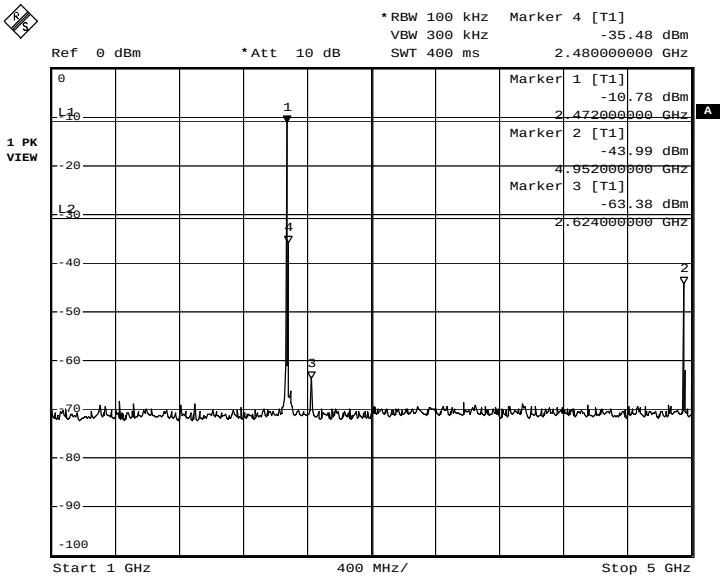
Notes : 1) Limit = (Reading fundamental) + (Correction factor) – 20
2) Emission level = (Reading) + (Correction factor)
3) Correction factor = Cable loss

Figure 18: Operating 2475MHz (Mode C) spurious from 30MHz to 1GHz



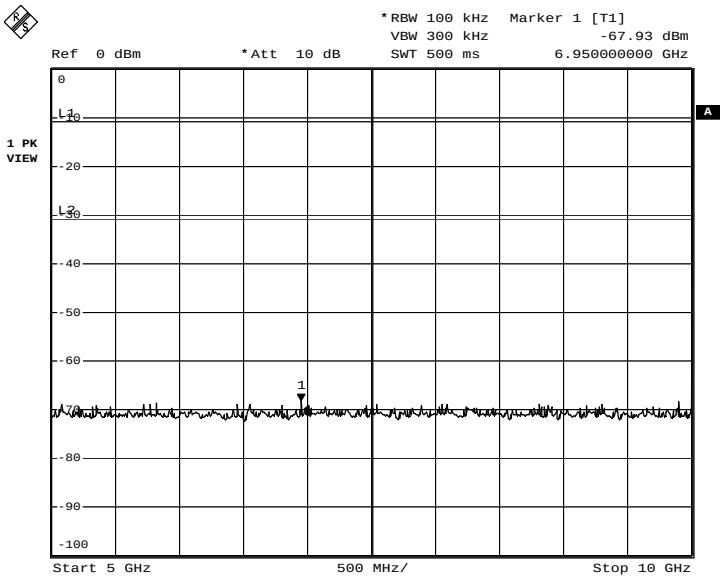
Comment A: 2475 MHz, L1: -10.78dBm, L2: -30.78dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:28:16

Figure 19: Operating 2475MHz (Mode C) spurious from 1GHz to 5GHz



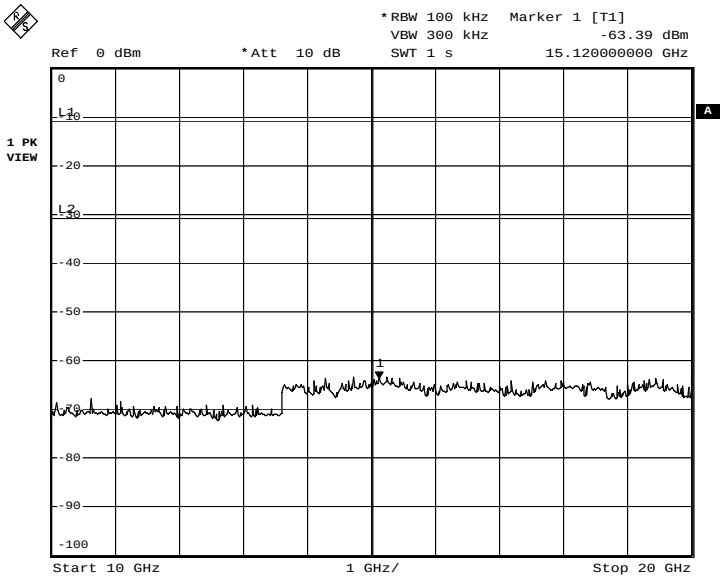
Comment A: 2475 MHz, L1: -10.78dBm, L2: -30.78dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:26:31

Figure 20: Operating 2475MHz (Mode C) spurious from 5GHz to 10GHz



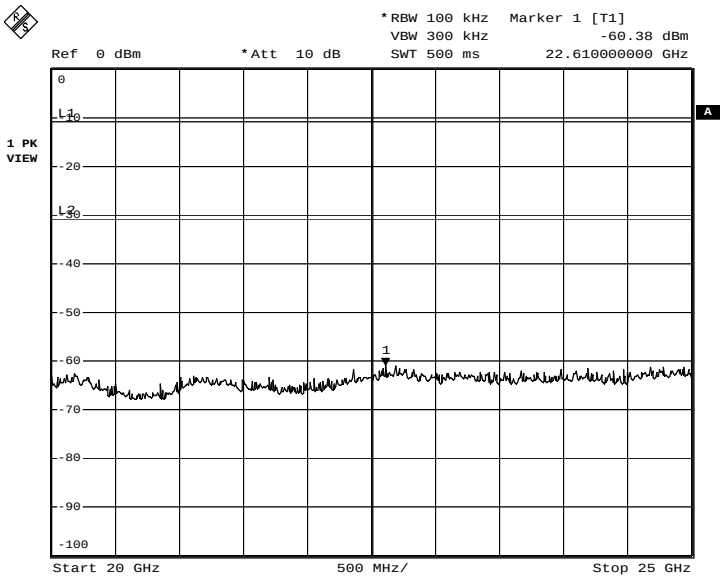
Comment A: 2475 MHz, L1: -10.78dBm, L2: -30.78dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:28:49

Figure 21: Operating 2475MHz (Mode C) spurious from 10GHz to 20GHz



Comment A: 2475 MHz, L1: -10.78dBm, L2: -30.78dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:29:15

Figure 22: Operating 2475MHz (Mode C) spurious from 20GHz to 25GHz



Comment A: 2475 MHz, L1: -10.78dBm, L2: -30.78dBm
FCC Conducted Spurious
Date: 21.FEB.2008 09:29:36

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

RESULT: **PASS**

Date of testing: 2008-02-21

Ambient temperature: 24.0 °C
Relative humidity: 24 %
Atmospheric pressure: 1010hPa

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

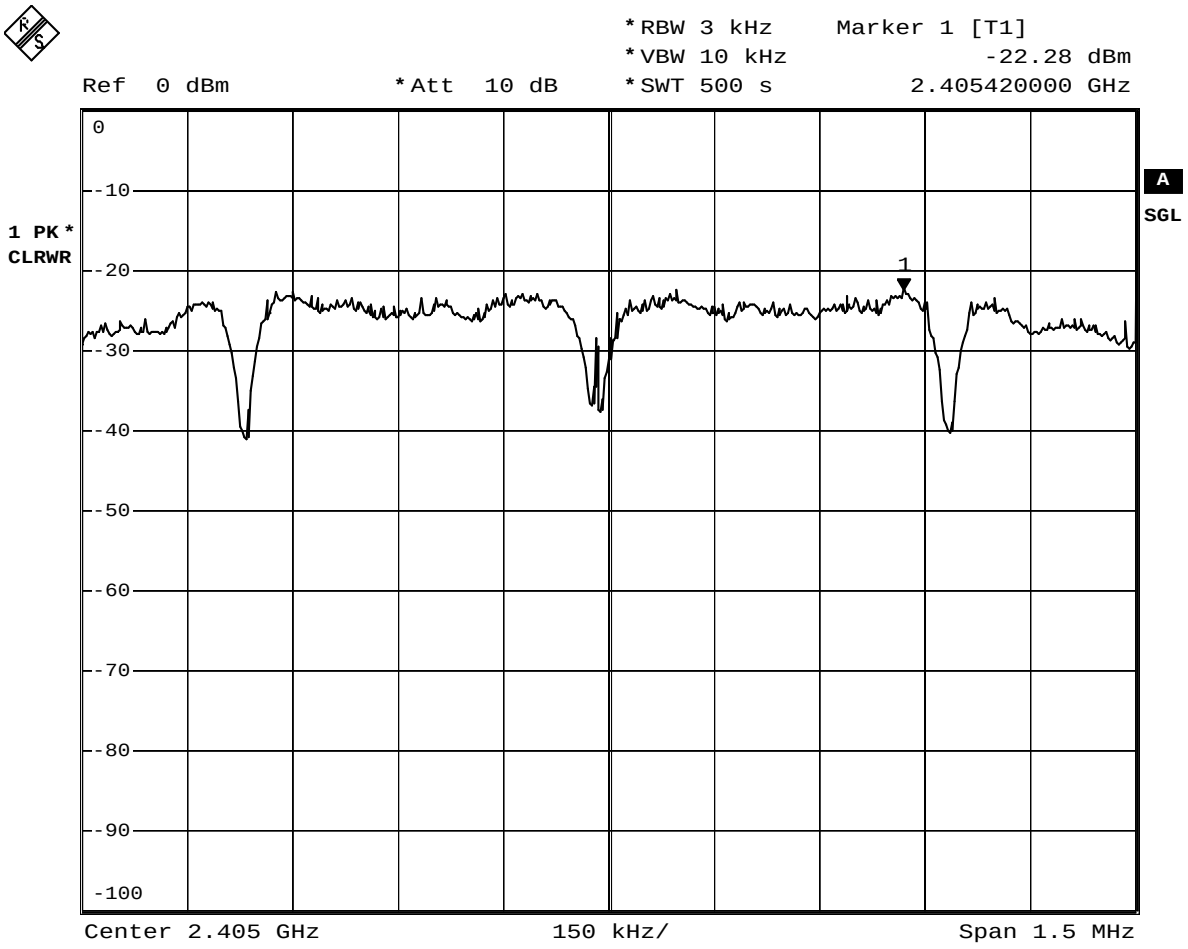
Test procedure:
ANSI C63.4-2003 and Measurement of Digital Transmission Systems Operating under Section 15.247.
A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 3 kHz. The Video Bandwidth was set to 10 kHz, and the sweep time was set to 500sec..

Table 8: Peak Power Spectral Density

Frequency (MHz)	Limit (dBm)	Reading (dBm)	Correction factor (dB)	Power Density (dBm)	Margin (dB)
2405	8	-22.28	1.16	-21.12	29.12
2440		-21.38	1.17	-20.21	28.21
2475		-20.29	1.18	-19.11	27.11

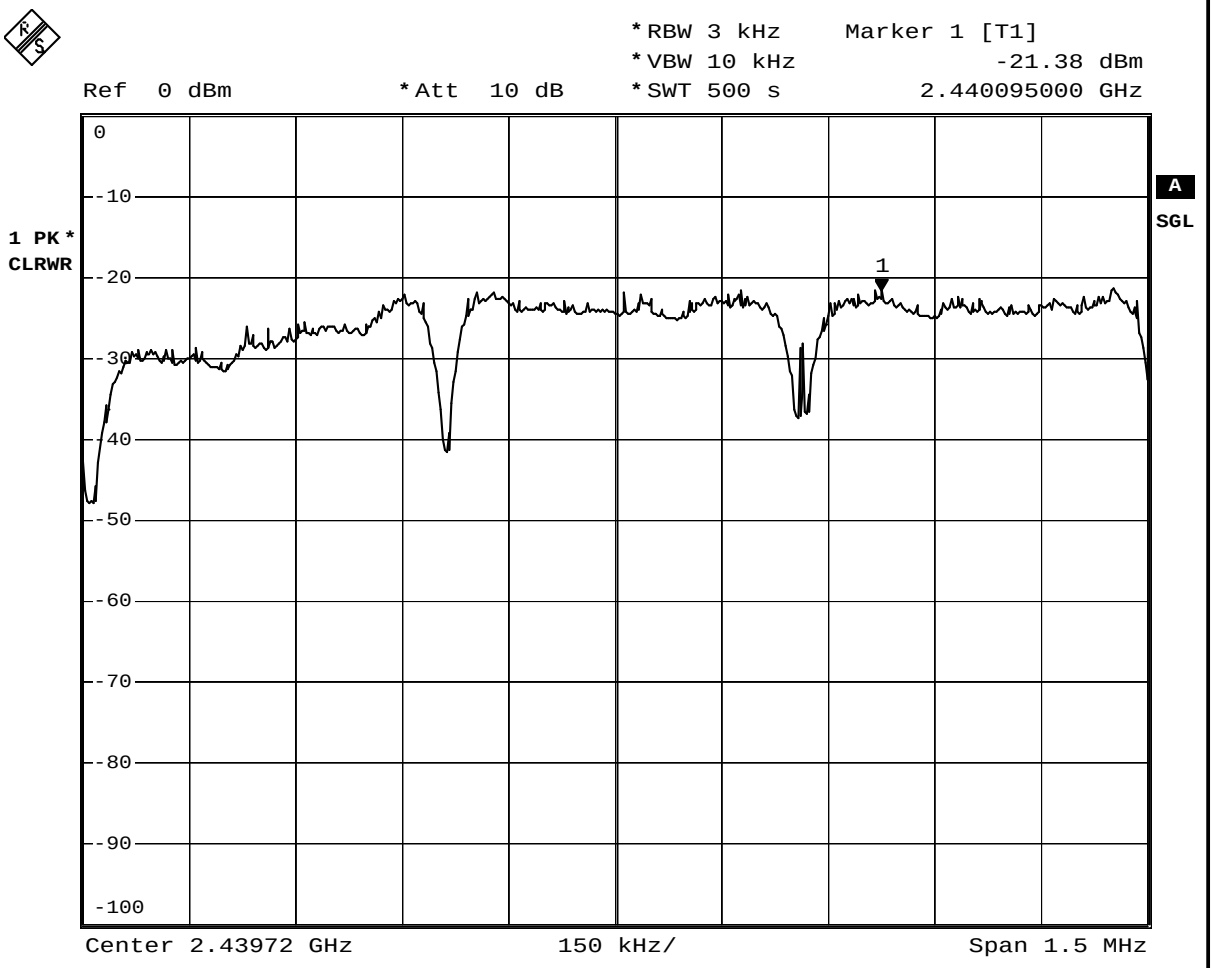
Notes : 1) Power density = (Reading) + (Correction factor)
2) Correction factor = Cable loss

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



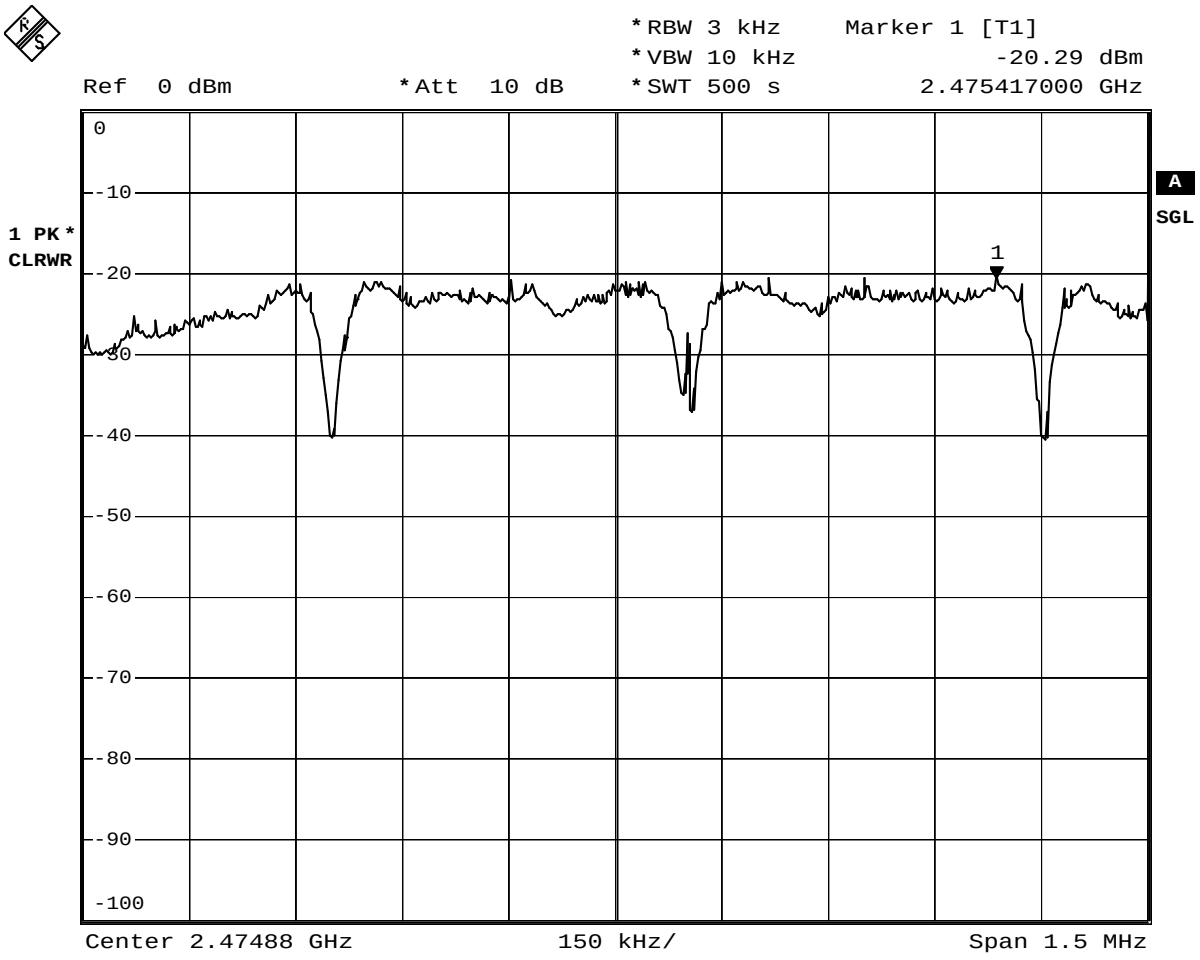
Comment A: FCC Power Spectral Density
Date: 21.FEB.2008 10:30:25

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



Comment A: FCC Power Spectral Density
Date: 21.FEB.2008 10:15:29

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



Comment A: FCC Power Spectral Density
Date: 21.FEB.2008 10:03:28

6. Test Results EMISSIONS

6.1.1 Band edge Radiated Emission FCC 15.247(d) and RSS- 210 A2.2

RESULT: **Pass**

Date of testing:	2008-02-14
Ambient temperature:	22.0°C
Relative humidity:	29%
Atmospheric pressure:	1010hPa

Requirements:
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) and RSS-210 2.7, must also comply with the radiated emission limits specified in Section 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
Measurements were made in a Semi Anechoic Chamber at a measurement distance of 3m.

The EUT was placed on a nonconductive turntable 0.8 meters 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 at 3 EUT positions(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.

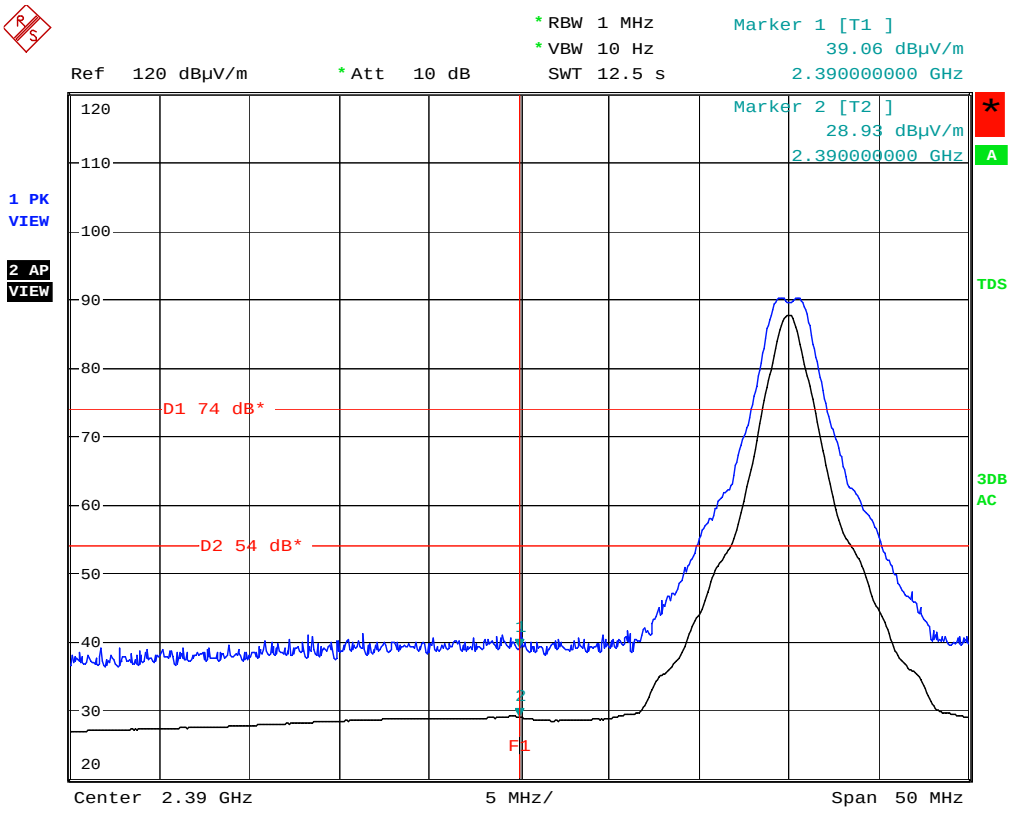
The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 9: Band Edge Radiated Emission

Operating Frequency (MHz)	Peak Value (dBuV/m)	Average Value (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Peak Margin (dB)	Average Margin (dB)
2405	39.06	28.93	74.0	54.0	34.94	25.07
2475	39.51	29.64	74.0	54.0	34.49	24.36

Notes : 1) Duty cycle correction was not applied.
2) All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.

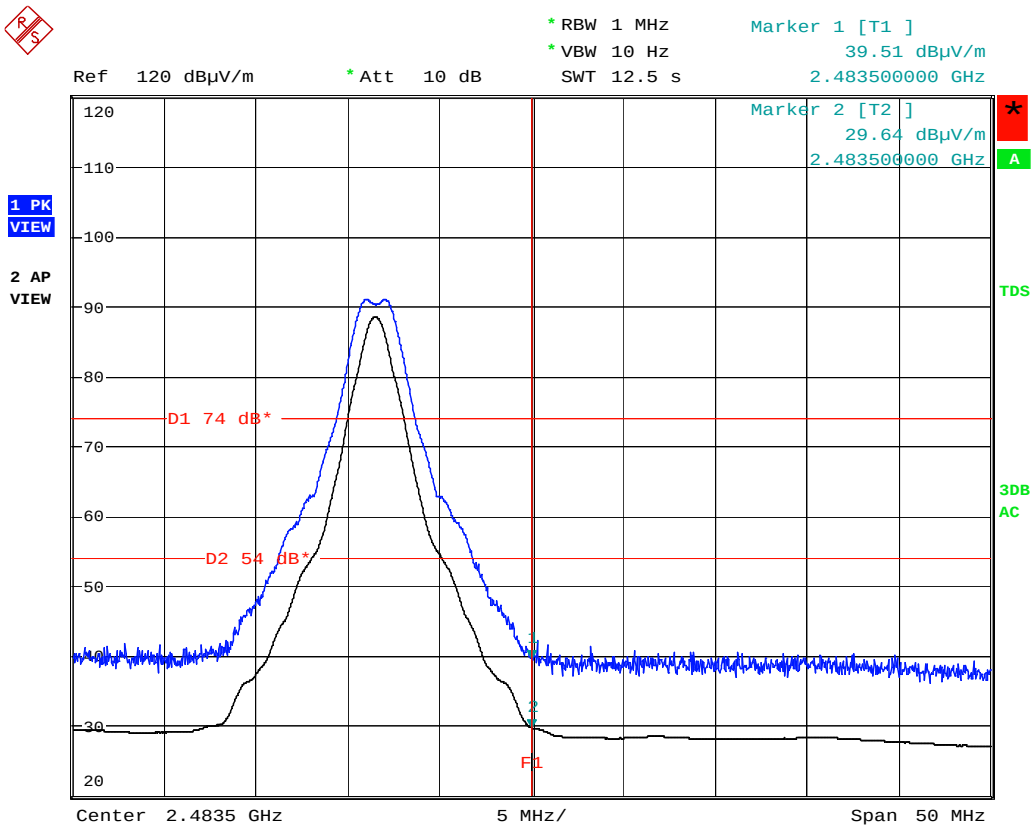
Figure 26: Band edge radiated emission of 2405MHz (Mode A), Peak and average



Band Edge (Lo), Hor, Mode A, Position Z
Direct/Fundamental
Date: 14.FEB.2008 11:33:08

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

Figure 27: Band edge radiated emission of 2475MHz (Mode C), Peak and average



Band Edge (Hi), Hor, Mode C, Position Y
Direct/Fundamental
Date: 14.FEB.2008 12:37:36

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

6.1.2 Radiated Emission (RE) out-of-band and spurious emission FCC part 15.247(d)/15.205/15.209 and RSS-210 2.2/RSS-210 A.8.5 RSS-Gen 7.2.1/7.2.3

RESULT: **PASS**

Date of testing:	2008-02-14
Ambient temperature:	22.0°C
Relative humidity:	29%
Atmospheric pressure:	1010hPa
Frequency range:	30MHz – 25GHz
Measurement distance:	10m for 30MHz to 1GHz 3m for above 1GHz
Kind of test site:	Semi Anechoic Chamber

Requirements:
The emissions from the intentional radiator shall not exceed the field strength specified in 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 before final testing. This was done in order to determine its emissions spectrum profile. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements, at each frequency, in order to ensure that maximum emission amplitudes were attained.
Final radiated emissions measurements were made at 3meters or 10meters. Below 1 GHz the measurement was performed at a distance of 10m. The values were recalculated accordingly using a factor of 20dB/decade.The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. 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 and 3 EUT positions(X,Y, and Z). For frequencies between 30 and 1000 MHz, 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 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz.

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

Table 10: Radiated Emission 30MHz - 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode A

Freq. [MHz]	Antenna Orientation	Result (Measured) QP [dB(µV)]	Factor [dB(1/m)]	Level QP [dB(µV/m)]	Limit [dB(µV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
48.013	V	46.9	-12.5	34.4	40	5.6	100	115
49.636	V	36.7	-12.5	24.2	40	15.8	125	93
71.993	V	33.6	-14.8	38.8	40	1.2	234	10
91.602	V	40.4	-18	22.4	43.5	21.1	203	249
95.999	V	53.1	-17.4	35.7	43.5	7.8	119	259
99.075	V	35.2	-16.9	18.3	43.5	25.2	173	187

Table 11: Radiated Emission 30MHz - 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode B

Freq. [MHz]	Antenna Orientation	Result (Measured) QP [dB(µV)]	Factor [dB(1/m)]	Level QP [dB(µV/m)]	Limit [dB(µV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
48	V	50.6	-12.5	38.1	40	1.9	101	166
71.984	V	44.4	-14.8	29.6	40	10.4	232	355
96.029	V	43.6	-17.4	26.2	43.5	17.3	138	253
192.026	V	45.4	-14.4	31	43.5	12.5	102	233
384	V	45.3	-8.6	36.7	46	9.3	400	175
431.99	V	44.3	-7.5	36.8	46	9.2	100	67

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

Freq. [MHz]	Antenna Orientation	Result (Measured) QP [dB(µV)]	Factor [dB(1/m)]	Level QP [dB(µV/m)]	Limit [dB(µV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
48	V	50.6	-12.5	38.1	40	1.9	101	159
71.993	V	44.5	-14.8	29.7	40	10.3	227	9
120	V	44.4	-14.1	30.3	43.5	13.2	151	298
192.004	V	46.9	-14.4	32.5	43.5	11	100	213
383.989	V	46.2	-8.6	37.6	46	8.4	400	192
456.008	H	43.7	-7	36.7	46	9.3	210	347

Table 13: Radiated Emission 1GHz-25GHz, Horizontal & Vertical Antenna Orientations, Peak and Average Data, Mode A

Freq. [MHz]	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]
4810.1	V	51.32	60.10	54.0	74.0	2.68	13.90

Notes : 1) All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
2) AV: average, PK: peak
3) Above mentioned value was measured at EUT Z-axis.

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

Freq. [MHz]	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]
4880.1	V	52.74	61.26	54.0	74.0	1.26	12.74

Notes : 1) All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
2) AV: average, PK: peak
3) Above mentioned value was measured at EUT Z-axis.

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

Freq. [MHz]	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]
4949.4	V	53.66	61.70	54.0	74.0	0.34	12.30

Notes : 1) All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
2) AV: average, PK: peak
3) Above mentioned value was measured at EUT Z-axis.

7. Test Results Receiver

7.1.1 Radiated Emission Receiver

RESULT: **PASS**

Date of testing:	2008-02-14
Ambient temperature:	22.0°C
Relative humidity:	29%
Atmospheric pressure:	1010hPa
Frequency range:	30MHz – 25GHz
Equipment classification:	class B
Measurement distance:	3m (>1GHz) and 10m (<1GHz)
Kind of test site:	Semi Anechoic Chamber

Requirements:
The emissions from the intentional radiator shall not exceed the field strength specified in 15.109 class B and RSS-210 Table 2 (and RSS-Gen Table 1).

Test procedure:
ANSI C63.4-2003, RSS-Gen 4.9, 4.10
The physical arrangement of the test system and associated cabling was varied in order to ensure that maximum emission amplitudes were attained.
Final radiated emissions measurements were made at 3meters or 10meters. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. 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 and 3 EUT positions (X, Y and Z). For frequencies between 30 and 1000 MHz, 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 1000 MHz, emissions are measured using following settings:
Peak: RBW=1MHz, VBW=1MHz
Average: RBW=1MHz, VBW=10Hz

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

Table 16: Radiated Emission 30MHz - 1GHz, Horizontal & Vertical Antenna Orientations, Quasi Peak Data, Mode D

Freq. [MHz]	Antenna Orientation	Result (Measured) QP [dB(µV)]	Factor [dB(1/m)]	Level QP [dB(µV/m)]	Limit [dB(µV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
47.978	V	49.8	-12.5	37.3	30	2.7	106	127
95.99	V	53.5	-17.4	36.1	33.5	7.4	122	256
119.97	V	43.3	-14.1	29.2	33.5	14.3	146	305
192.017	V	47.5	-14.4	33.1	33.5	10.4	103	238
215.984	V	42.6	-14.2	28.4	33.5	15.1	110	239
479.981	H	44.7	-6.6	38.1	36	7.9	205	136

Measurement was performed at a distance of 10m. The values were recalculated accordingly using a factor of 20dB/decade.

Table 17: Radiated Emission 1GHz-25GHz, Horizontal & Vertical Antenna Orientations, Peak and Average Data, Mode D

Freq. [MHz]	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]
1297.5	V	N/A	41.91	54.0	74.0	12.09	32.09

Notes : 1) All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
2) AV: average, PK: peak
3) Above mentioned value was measured at EUT Z-axis.
4) The peak measured value complies with the average limit hence measurement of the AV value can be omitted.

8. Photographs of test setup

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

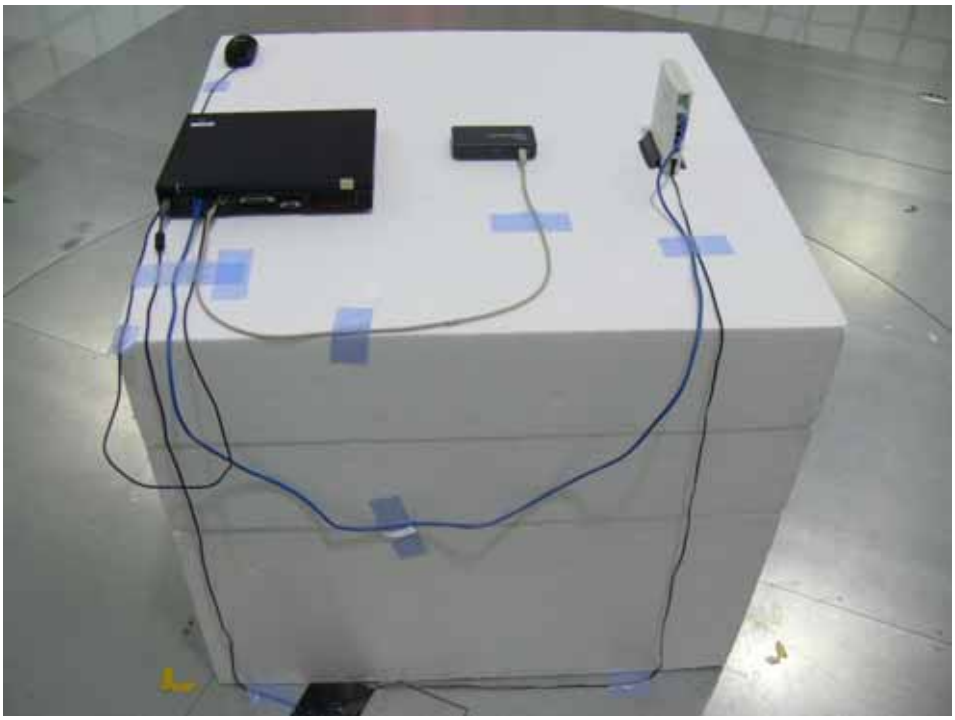
Photograph 2: Set-up for Radiated Emission, EUT Configuration X-axis

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 (Front)

Photograph 6: Set-up for Radiated Emission (Rear)



9. List of Tables

10. List of Figures

11. List of Photographs