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Test Report: 85902-1TRFWL


Applicant: Honeywell Analytics
4005-G, Matte Blvd
Brossard Quebec
J4Y 2P4 Canada

Apparatus: 301R8W, 301R8WF

FCC ID: U5C301R8W1

In Accordance With: FCC Part 15 Subpart C, 15.247
FHSS System and Digitally Modulated Radiators
902-928MHz, 2400 - 2483.5 MHz, 5725-5850MHz

Tested By: Nemko Canada Inc.
303 River Road
Ottawa, Ontario
K1V 1H2

Authorized By: 
Xu Jin, Wireless Specialist

Date: March 25, 2008

Total Number of Pages: 24

Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed:	301R8W, 301R8WF
Specification:	FCC Part 15 Subpart C, 15.247
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release

Author: Heng Lin EMC / Wireless Specialist

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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Section 1 : Equipment Under Test

1.1 Product Identification

The Equipment Under Test was identified as follows:

Wireless 8 Relays Module 301R8W

1.2 Samples Submitted for Assessment

The following samples of the apparatus have been submitted for type assessment:

Sample No.	Description	Serial No.
4	Wireless 8 Relays Module	None
10	Wireless 8 Relays Module	None
	AC Adaptor (Manufacturer: Honeywell, Model No.: HTP2450)	None

The first samples were received on: April 30, 2007

1.3 Technical Specifications of the EUT

Operating Frequency: 2405 MHz – 2480 MHz

Peak Output Power: 22.15 dBm

Emission Designator F1D

Modulation: QPSK

Antenna Data: 0 dBi

Antenna Connector: Monopole, internal PCB printed

Power: 24VAC or 24VDC

Section 2 : Test Conditions

2.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247

FHSS System and Digitally Modulated Radiators

902-928MHz, 2400 - 2483.5 MHz, 5725-5850MHz

2.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

2.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	15 – 30 °C
Humidity range	:	20 - 75 %
Pressure range	:	86 - 106 kPa
Power supply range	:	+/- 5% of rated voltages

2.4 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next Cal.
Spectrum Analyzer	Rohde & Schwarz	FSU	FA001877	Jan. 16/08
Receiver	Rohde & Schwarz	ESVS-30	FA001445	July 14/07
Biconical (2) Antenna	EMCO	3109	FA000904	Sept. 12/07
Log Periodic Antenna #2	EMCO	3148	FA001355	May 16/07
Horn Antenna #1	EMCO	3115	FA000649	Feb. 26/08
Horn Antenna #2	EMCO	3115	FA000825	Jan. 30/08
Horn 18 – 26.5 GHz	Electro-Metrics	SH-50/60-1	FA000479	COU
1.0 – 2.0 GHz Amplifier	JCA	12-400	FA001498	Aug. 02/07
2.0 – 4.0 GHz Amplifier	JCA	24-600	FA001496	Aug. 02/07
4.0 – 8.0 GHz Amplifier	JCA	48-600	FA001497	Aug. 02/07
5.0 – 18.0 GHz Amplifier	NARDA	DWT-186N23U40	FA001409	COU
18.0 – 26.0 GHz Amplifier	NARDA	BBS-1826N612	FA001550	COU

COU – Calibrate on Use

NCR – No Calibration Required

Section 3 : Observations

3.1 Modifications Performed During Assessment

No modifications were performed during assessment.

3.2 Record Of Technical Judgements

As declared by the manufacturer, both models have exactly same hardware. The only difference is that the model 301R8WF comes with a Firmware with all relays “FAIL_SAFE_ACTIVATED” by default. Therefore, only the model 301R8W was tested for compliance assessment.

3.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

3.4 Test Deleted

No Tests were deleted from this assessment.

3.5 Additional Observations

There were no additional observations made during this assessment.

Section 4 : Results Summary

This section contains the following:

FCC Part 15 Subpart C : Test Results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- N No : not applicable / not relevant.
- Y Yes : Mandatory i.e. the apparatus shall conform to these tests.
- N/T Not Tested, mandatory but not assessed. (See section 3.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

4.1 FCC Part 15 Subpart C : Test Results

Part 15	Test Description	Required	Result
15.31(e)	Variation of power supply	Y	PASS
15.207(a)	Powerline Conducted Emissions	Y	PASS
15.209(a)	Radiated Emissions within Restricted Bands	Y	PASS
15.247(a)(1)	Frequency hopping systems	N	
15.247(a)(1)(i)	Frequency hopping systems operating in the 902-928 MHz band	N	
15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725-5850 MHz band	N	
15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400-2483.5 MHz band	N	
15.247(a)(2)	Systems using digital modulation techniques	Y	PASS
15.247(b)(1)	Maximum peak output power of Frequency hopping systems operating in the 2400-2483.5 MHz band and 5725-5850 MHz band	N	
15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902-928 MHz band	N	
15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands	Y	PASS
15.247(b)(4)	Maximum peak output power	Y	PASS
15.247(c)(1)	Fixed point-to-point Operation with directional antenna gains greater than 6 dBi	N	
15.247(c)(2)	Transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams	N	
15.247(d)	Radiated Emissions Not in Restricted Bands	Y	PASS
15.247(e)	Power Spectral Density for Digitally Modulated Devices	Y	PASS
15.247(f)	Time of Occupancy for Hybrid Systems	N	

Notes:

Appendix A : Test Results

Clause 15.207(a) Powerline Conducted Emissions

Frequency of Conducted limit (dB μ V)		
Emission (MHz)	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

Test Conditions:

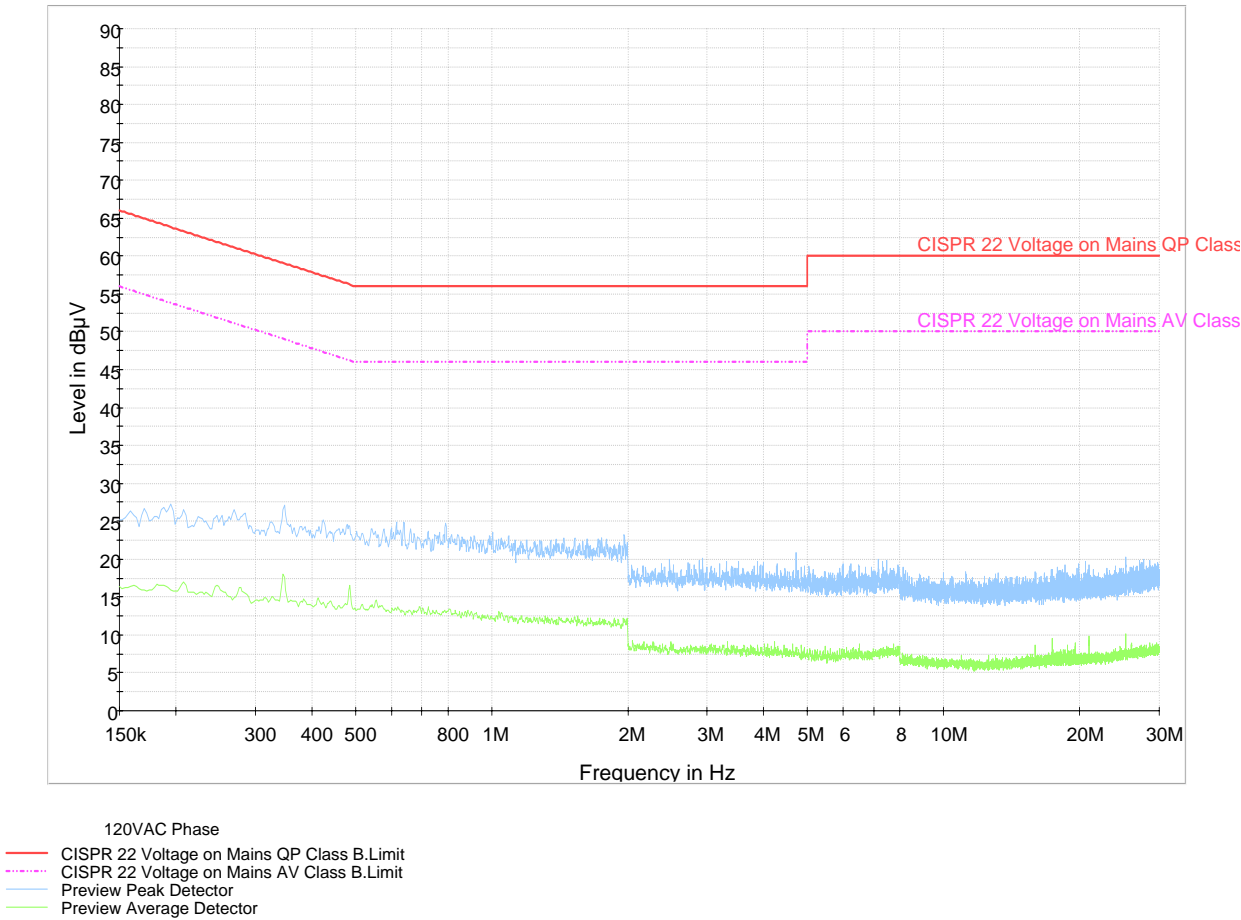
Sample Number:	10	Temperature (°C):	23
Date:	March 7, 2008	Humidity (%) :	33
Modification State:	0	Tester:	Heng Lin
		Laboratory:	3m Chamber

Test Results: See Attached Plots.

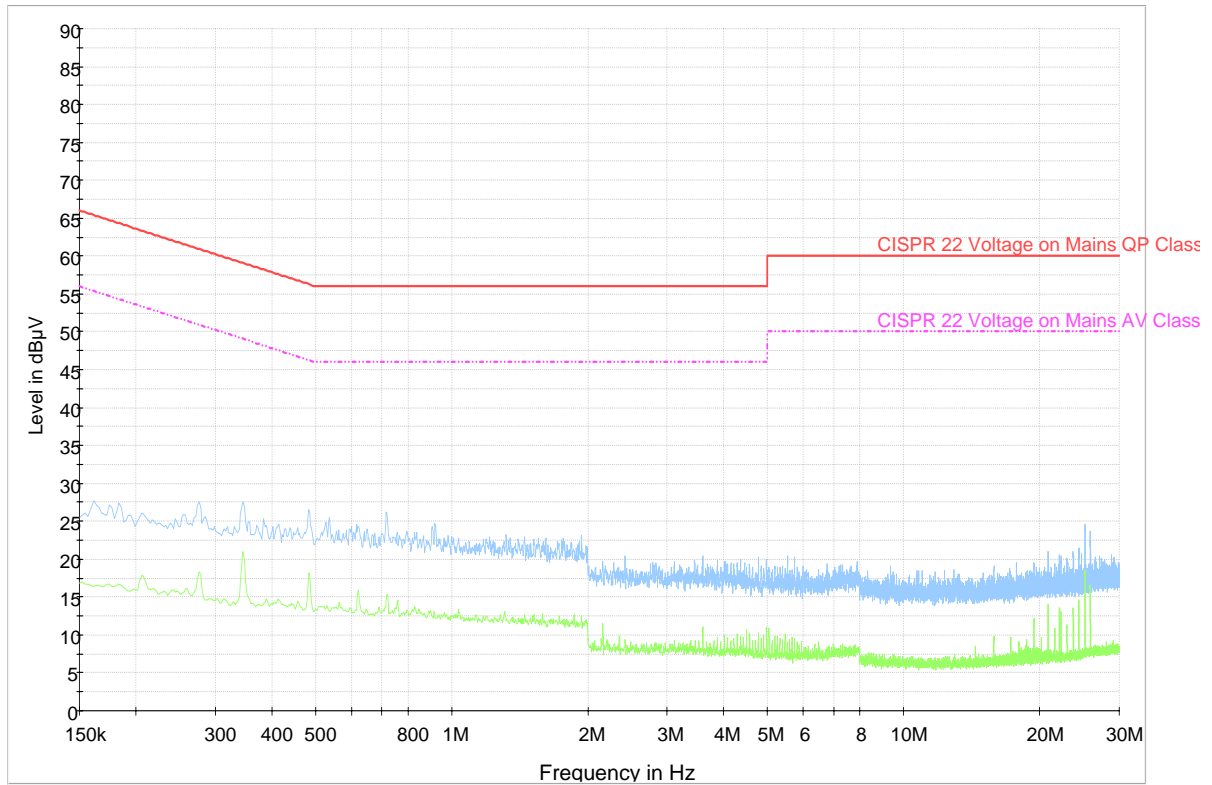
Additional Observations:

Plots were obtained using a scanning receiver with IF bandwidth set to 9kHz Peak Detector and Average detector. Cable and LISN losses were included to show compliance. The Correction factor includes both cable loss and LISN loss.

Phase Conductor



Neutral Conductor



120VAC Neutral
 — CISPR 22 Voltage on Mains QP Class B.Limit
 - - - CISPR 22 Voltage on Mains AV Class B.Limit
 — Preview Peak Detector
 — Preview Average Detector

Clause 15.209(a) Radiated Emissions within Restricted Bands

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Conditions:

Sample Number:	4	Temperature (°C):	20
Date:	March 17, 2008	Humidity (%):	40
Modification State:	0	Tester:	Heng Lin
		Laboratory:	Ottawa

Test Results:

See Attached Table for Results

Additional Observations:

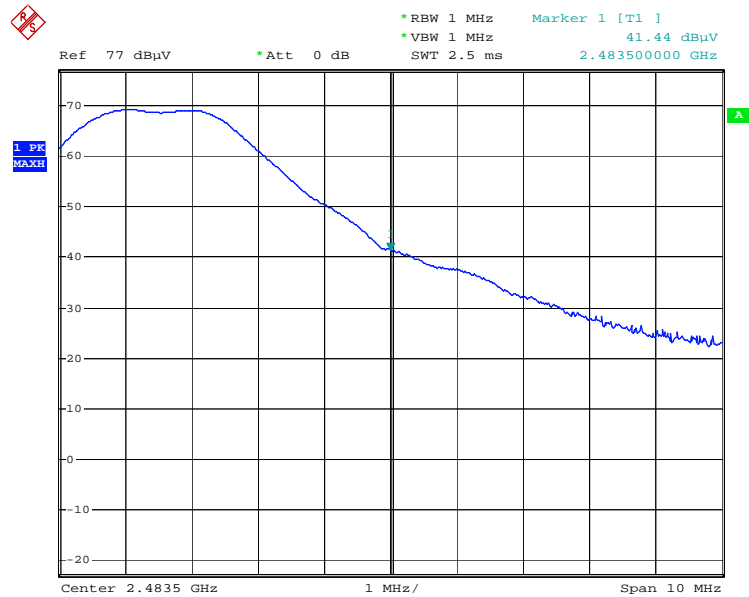
The Spectrum was searched from 30MHz to the 10th Harmonic.

These results apply to emissions found in the Restricted Bands defined in FCC Part 15 Subpart C, 15.205.

All measurements for radiated emissions within the restricted bands were performed using a Peak detector with 100kHz RBW / VBW below 1GHz and a Peak and Average Detector with 1MHz RBW / VBW above 1GHz.

Radiated Emission at 2.4835MHz Band Edge

Frequency (MHz)	Band Edge Level (PK) (dBμV)	Af (dB/m)	Cable Loss(dB)	Emission Level (dBμV/m)	Margin (dB)	Limit (dBμV/m)
2483.5	41.44	28.8	2	71.91	2.1	74

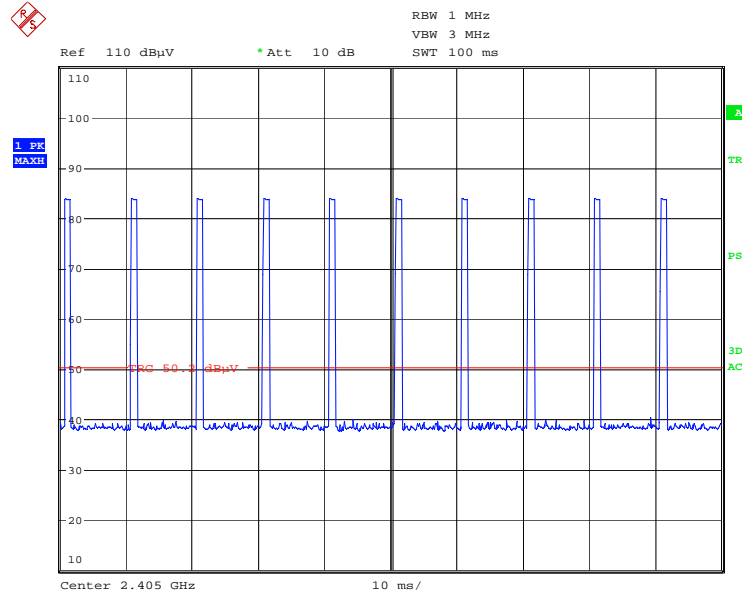


Date: 17.MAR.2008 09:09:43

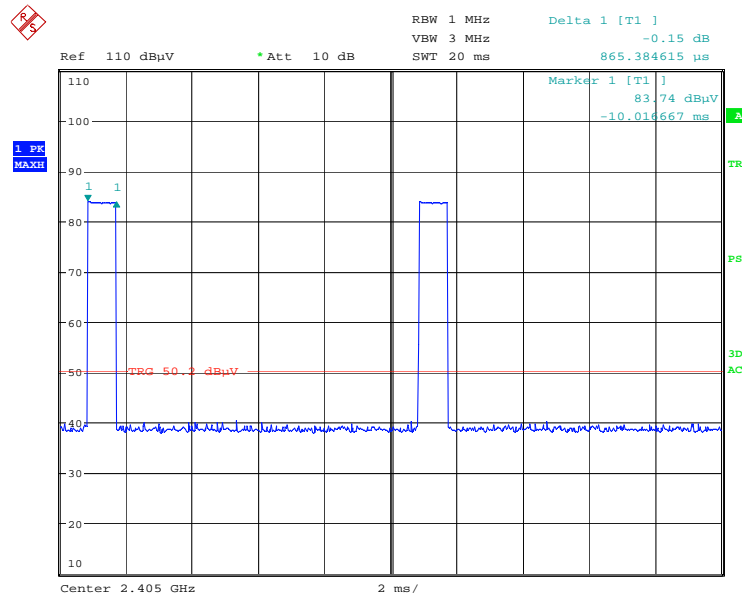
Average Field Strength = 71.91 dBμV/m – 21.3dB(Duty Cycle) = 50.6 dBμV/m

Limit = 54 dBμV/m

Duty Cycle Correction Factor:



Date: 7.MAR.2008 22:06:28



Date: 7.MAR.2008 22:05:45

Duty Cycle Correction factor: $20\text{Log}[(10 \times 0.865\text{ms})/100\text{ms}] = -21.3\text{dB}$

Clause 15.247(a)(2) Systems using digital modulation techniques

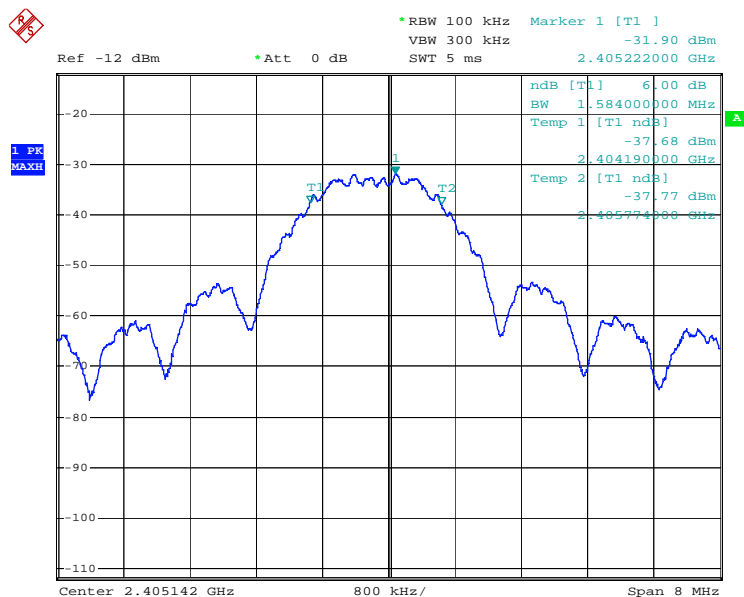
Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Conditions:

Sample Number:	4	Temperature (°C):	20
Date:	May 11, 2007	Humidity (%):	45
Modification State:	0	Tester:	Heng Lin
		Laboratory:	Ottawa

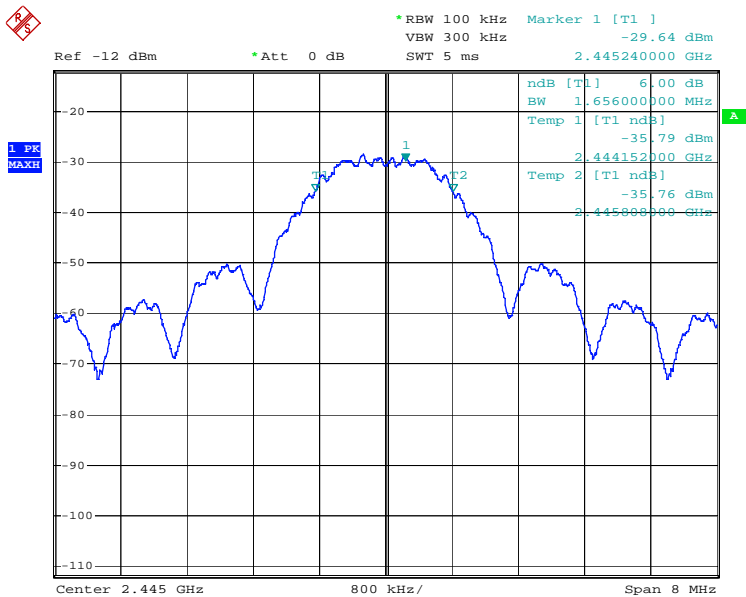
Test Results:**6dB Bandwidth:**

Channel (MHz)	Low 2405	Mid 2445	High 2480
Bandwidth (MHz)	1.58	1.66	1.59

Low Channel

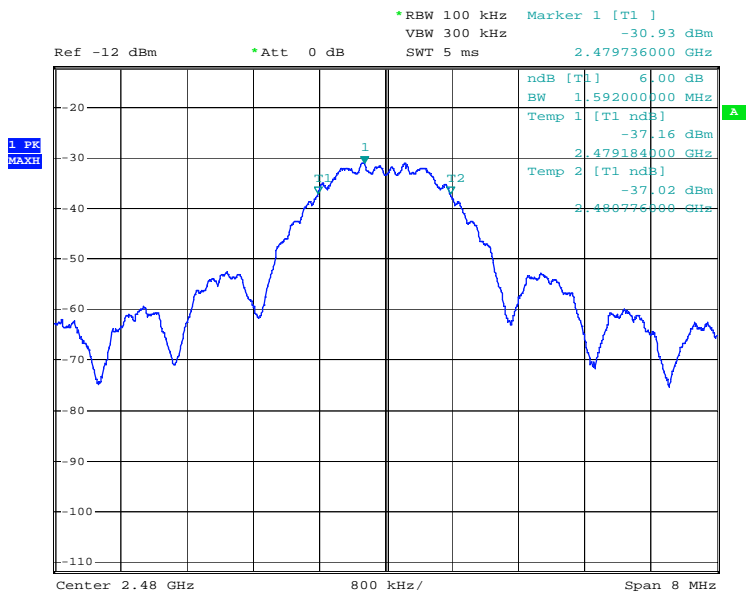
Date: 11.MAY.2007 11:59:40

Mid Channel



Date: 11.MAY.2007 12:00:56

High Channel



Date: 11.MAY.2007 12:02:28

Clause 15.247(b)(3) Maximum peak output power of systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Conditions:

Sample Number:	4	Temperature (°C):	20
Date:	March 4, 2008	Humidity (%):	45
Modification State:	0	Tester:	Heng Lin
		Laboratory:	Ottawa

Test Results:

See Attached Table and Plots.

Radiated Output Power:

Ch.	Freq.	Pol V/H	ANT.	Rx dBuV	Cable loss dB	Ant Factor dB/m	F.S. dBuV/m
low	2405	H	Horn2	83.16	4.5	28.5	116.16
	2405	V	Horn2	76.18	4.5	28.3	108.98
mid	2445	H	Horn2	84.38	4.5	28.5	117.38
	2445	V	Horn2	78.13	4.5	28.3	110.93
hi	2480	H	Horn2	84.07	4.6	28.5	117.17
	2480	V	Horn2	77.04	4.6	28.3	109.94

$$\text{Measured value (V/m)} = 10^{(FS/20)} / 1000000 = 0.7396 \text{ V/m}$$

$$\text{Antenna Gain (numeric)} = 10^{(Ag/10)} = 1$$

$$\text{Output Power (W)} = \frac{E^2 R^2}{30G} = 0.164 \text{ W (22.15 dBm)}$$

E = Measured Value (V/m)

R = Measurement distance

G = Antenna Gain (numeric)

Maximum EIRP

Measured output power = 22.15dBm

Maximum output power = 22.15dBm + 0dBi = 22.15dBm EIRP

Additional Observations:

All Measurements were performed at 3m using a Peak Detector with 3MHz RBW/10MHz VBW.

The EUT uses 0dBi PCB printed antenna. The conducted output power is equivalent to the Radiated output power EIRP.

The output power was measured at +/-15% of the supply voltage and found that there was no change.

Clause 15.247(d) Radiated Emissions Not in Restricted Bands

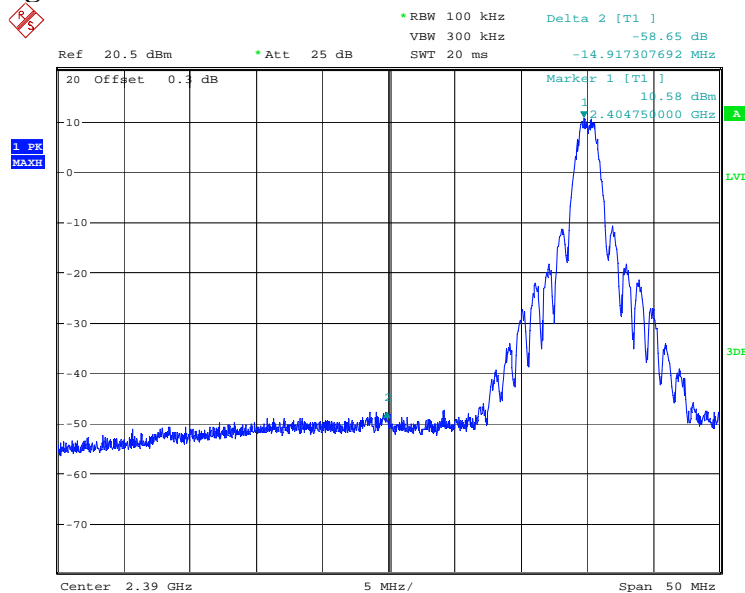
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Conditions:

Sample Number:	4	Temperature (°C):	22
Date:	March 4, 2008	Humidity (%):	45
Modification State:	0	Tester:	Heng Lin
		Laboratory:	Ottawa

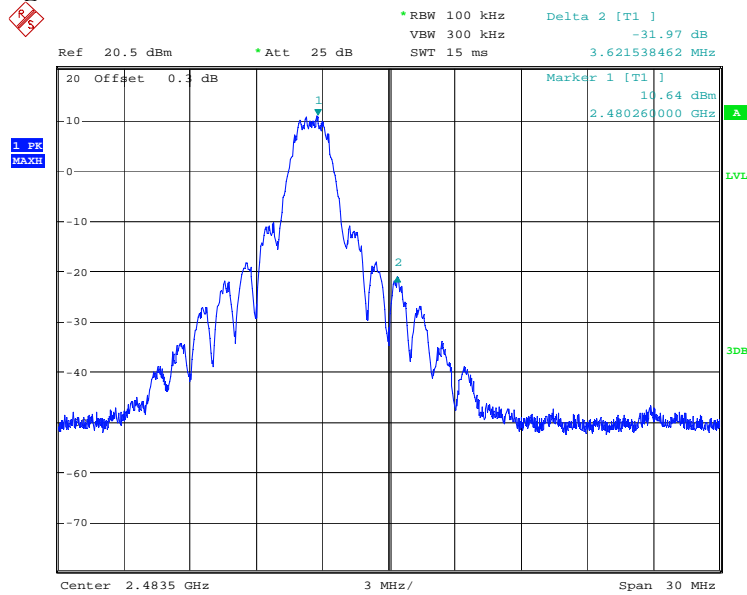
Test Results:

See Attached Plots.

Lower Band Edge:

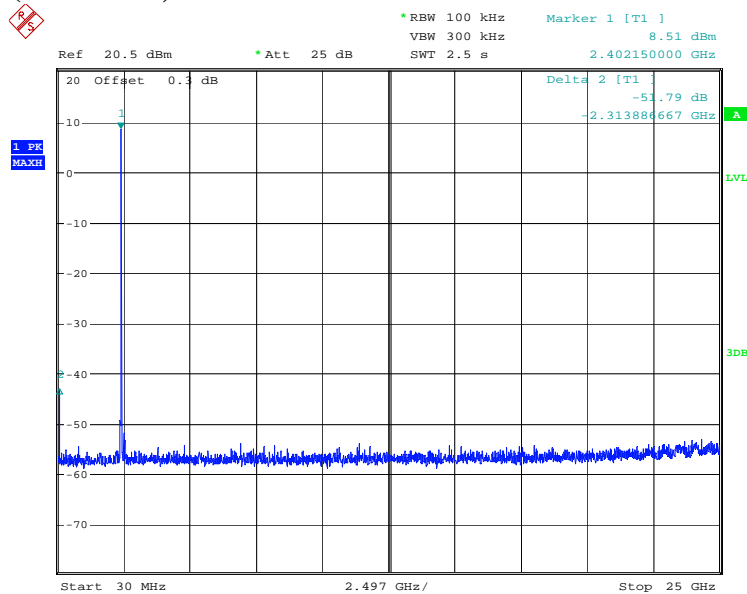
Date: 4.MAR.2008 16:53:06

Upper Band Edge:



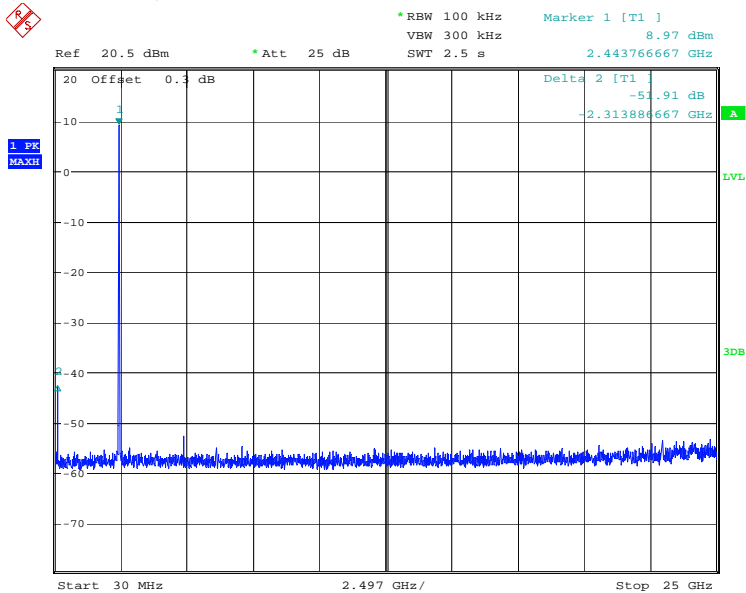
Date: 4.MAR.2008 16:55:21

Conducted Emissions Low Channel: (2405 MHz)



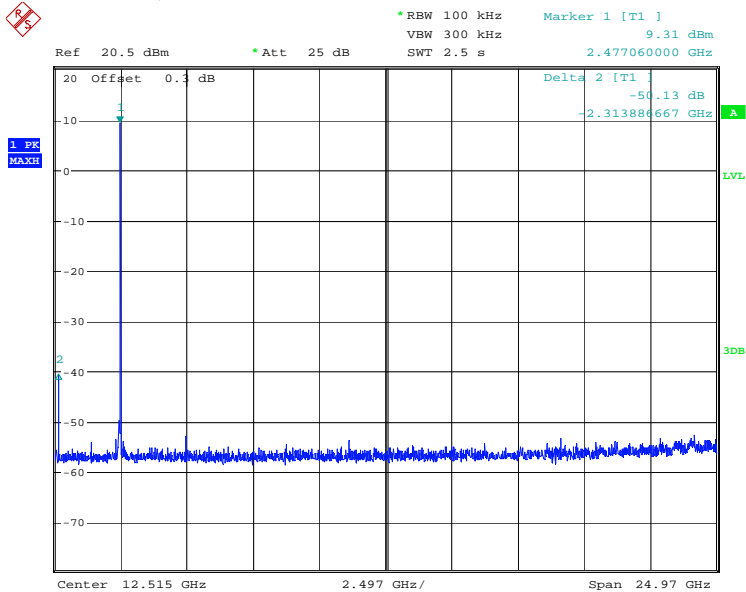
Date: 4.MAR.2008 17:14:29

Mid Channel: (2445 MHz)



Date: 4.MAR.2008 17:15:00

High Channel: (2480MHz)



Date: 4.MAR.2008 17:16:24

Clause 15.247(e) Power Spectral Density for Digitally Modulated Devices

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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Conditions:

Sample Number:	4	Temperature (°C):	22
Date:	March 7, 2008	Humidity (%):	45
Modification State:	0	Tester:	Heng Lin
		Laboratory:	Ottawa

Test Results:

See Attached Plots.

Radiated Power Spectral Density Power:

Ch.	Freq.	Pol V/H	Rx dBuV	Cable loss dB	Ant Factor dB/m	F.S. dBuV/m	PSD Conducted dBm
low	2405MHz	H	60.94	4.5	28.5	93.94	-1.30
	2405MHz	V	58.74	4.5	28.3	91.54	-3.70
mid	2455MHz	H	62.15	4.5	28.5	95.15	-0.08
	2455MHz	V	58.45	4.5	28.3	91.25	-3.99
hi	2480MHz	H	61.93	4.6	28.5	95.03	-0.20
	2480MHz	V	57.86	4.6	28.3	90.76	-4.47

Example Calculation:

FS=95.15dBuV/m

Measured value (V/m) = $10^{(FS/20)} / 1000000 = 0.05721\text{V/m}$

Antenna Gain (numeric) = $10^{(Ag/10)} = 1$

$$\text{Output Power (W)} = \frac{E^2 R^2}{30G} = 0.000981\text{W} = -0.08\text{dBm}$$

E = Measured Value (V/m)

R = Measurement distance

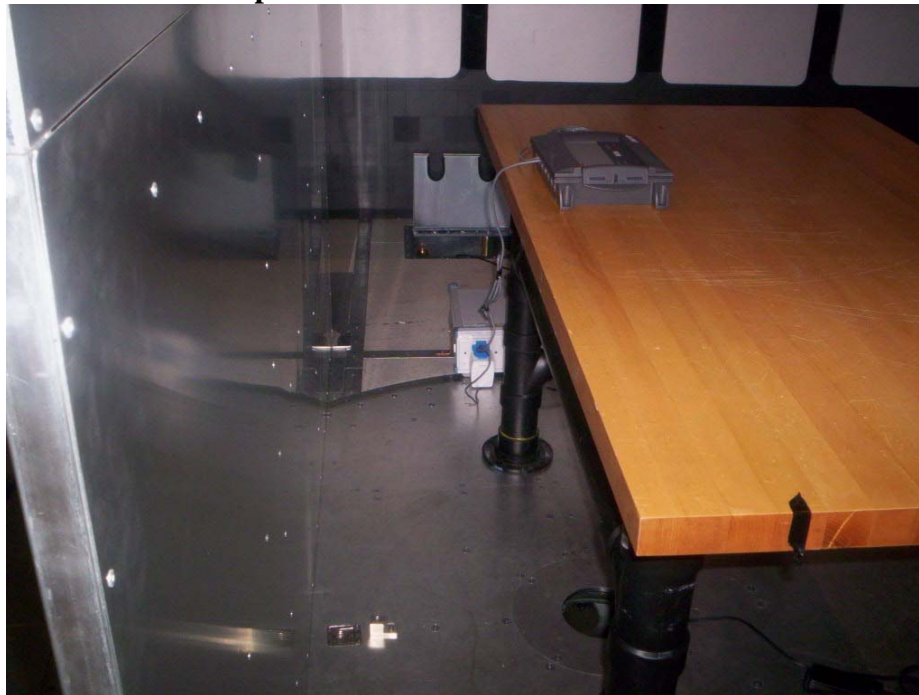
G = Antenna Gain (numeric)

Additional Observations:

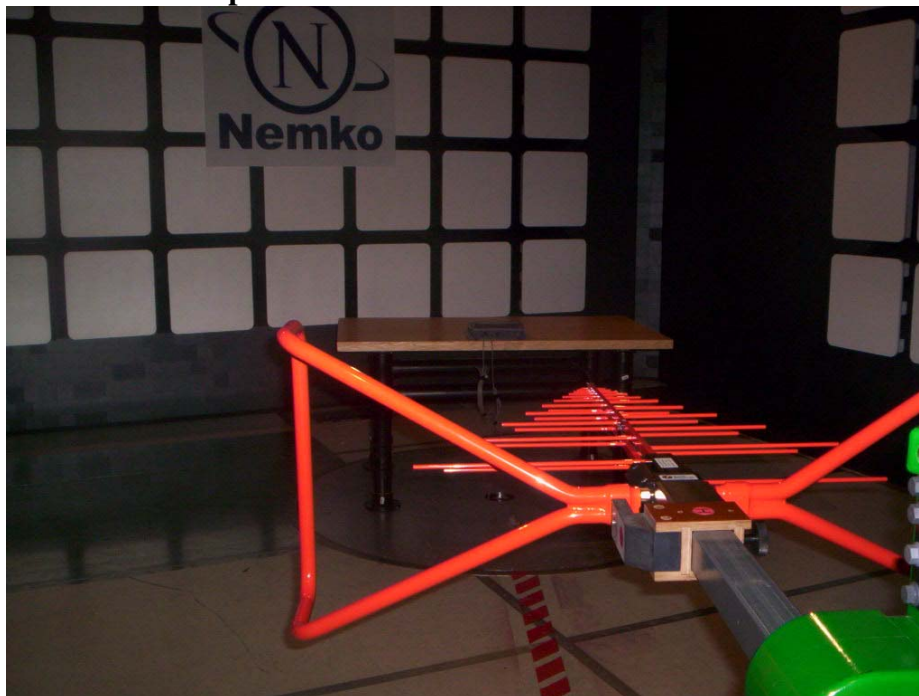
All Measurements were performed at 3m using a Peak Detector with 3kHzRBW/10kHz VBW, the span was set to 1.5MHz and the sweep time was set to 500 seconds.

Appendix B : Setup Photographs

Conducted Emissions Setup:

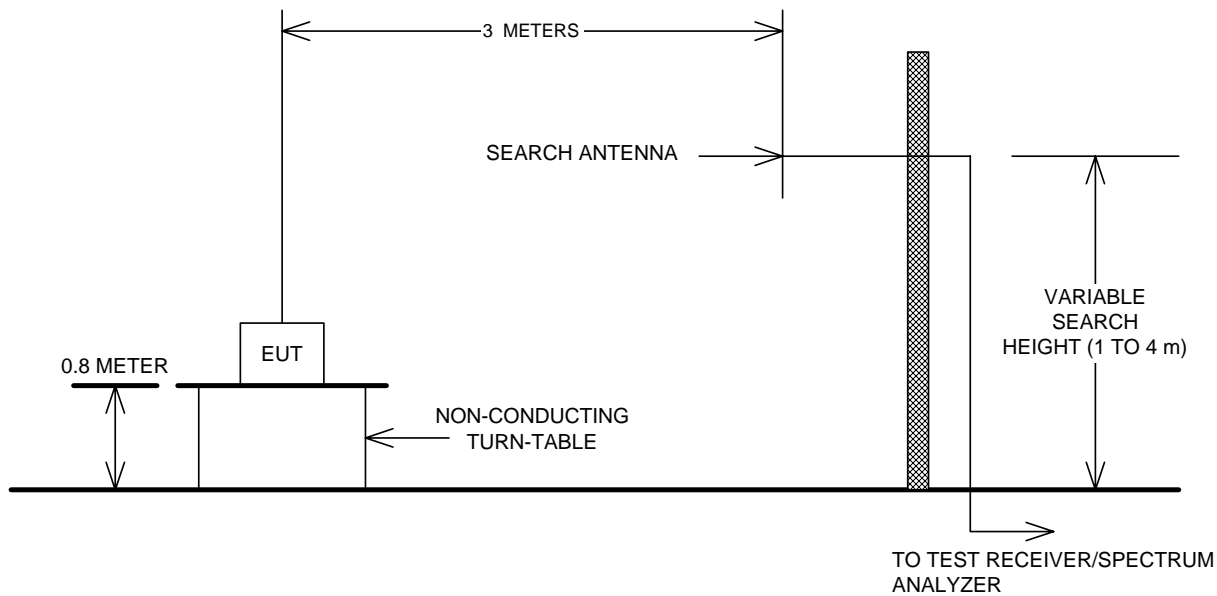


Spurious Emissions Setup:



Appendix C : Block Diagram of Test Setups

Test Site For Radiated Emissions



Conducted Emissions

