Global EMC Inc. Labs

EMC & RF Test Report

As per

RSS 210 Issue 7:2007

&

FCC Part 15 Subpart C:2006

Unlicensed Intentional Radiators

on the

RW80G – WiFi Module

Scott Drysdale, Nartc Certified Technician
EMC Lab Manager
Global EMC Inc.
180 Brodie Dr, Unit 2
Richmond Hill, ON L4B 3K8
Canada
Ph: (905) 883-3919

Testing produced for

RUGGEDCOM
INDUSTRIAL STRENGTH NETWORKS™

See Appendix A for full customer & EUT details.

Industry Canada
LAB REGISTRATION #6844A-1

FCC REGISTRATION
#612361

ACCREDITED
TESTING LABORATORY
CERTIFICATE #2565.01

Table of Contents

Report Scope

This report addresses the EMC verification testing and test results of the <EUT>, herein referred to as EUT (Equipment Under Test) performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:

RSS 210 Issue 7:2007 / FCC Part 15 Subpart C 15:2006

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

The results contained in this report relate only to the item(s) tested.

This report does not imply product endorsement by A2LA or any other accreditation agency, any government, or Global EMC Inc.

Opinions/interpretations expressed in this report, if any, are outside the scope of Global EMC Inc accreditation. Any opinions expressed do not necessarily reflect the opinions of Global EMC Inc, unless otherwise stated.

Client	**RuggedCom**
Product	RW80G – WiFi Module
Standard(s)	RSS 210 Issue 7:2007/ FCC Part 15 Subpart C 15:2006

Summary

The results contained in this report relate only to the item(s) tested.

EUT FCC Certification #, FCC ID:	VG5-RW80G
EUT Industry Canada Certification #, IC:	4997A-VG5RW80G
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Scott Drysdale

Client	**RuggedCom**
Product	RW80G – WiFi Module
Standard(s)	RSS 210 Issue 7:2007/ FCC Part 15 Subpart C 15:2006

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS 210 (Table 1)	Restricted Bands for intentional operation	None within chart	Pass See description
FCC 15.207	Power line conducted emissions	QuasiPeak Average	Pass See Justification
FCC 15.209 RSS-210 (Table 2)	Spurious Radiated emissions	QuasiPeak Average	Pass
FCC 15.247(a)2 RSS-210 A8.2(a)	6 dB Bandwidth	> 500 kHz	Pass
FCC 15.247(b)2 RSS-210 A8.4(4)	Max output power	< 1 Watt	Pass
FCC 15.247(b)(4) RSS-210 A8.4(5)	Antenna Gain	< 6 dBi	Pass See Justification
FCC 15.247(d) RSS-210 A8.5	Antenna conducted spurious	< 20 dBc	Pass
FCC 15.247(e) RSS-210 A8.2(b)	Spectral Density	< 8 dBm (3 kHz BW)	Pass
FCC 15.247(i) IC Safety code 6	Maximum Permissible Exposure	> 20 cm separation.	Pass See justification and calculations
Overall Result			**PASS**

All tests were performed by Scott Drysdale.

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a 'PASS' grade. If not 'FAIL' grade will be issued. Note that 'PASS' / 'FAIL' grade is independent of any measurement uncertainties. A 'PASS' / 'FAIL' grade within measurement uncertainty is marked with a '*'.

Justifications, Descriptions, or Deviations

The following justifications for tests not performed or deviations from the above listed specifications apply:

For the Antenna requirement specified in FCC 15.203, this device employs a reverse polarity SMA connector.

For the Restricted Bands of operation, the EUT is designed to only operate between 2400 to 2483.5

For the power line conducted emissions requirements, the EUT is DC powered, and this test does not apply.

For the Antenna gain, the antenna gain is 3 dBi, which is less then 6 dBi.

For maximum permissible exposure, this device operates at less then 1 Watt at 2400-2483.5 MHz and is designed to operate greater then 20 cm from personnel during normal operation. No testing is required, however worst case calculated exposure compliance follows later in this report.

Applicable Standards, Specifications and Methods

ANSI C63.4:2003	- Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CFR 47 FCC 15	- Code of Federal Regulations – Radio Frequency Devices
CISPR 22:2006	- Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
ICES-003:2004	- Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
ISO 17025:2005	- General Requirements for the competence of testing and calibration laboratories
RSS 210:2007	- Issue 7: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power Licence-Exempt Radiocommunication Devices

Sample calculation(s)

Margin = limit – (received signal + antenna factor + cable loss – pre-amp gain)
Margin = 50.5dBuV/m – (50dBuV + 10dB + 2.5dB – 20dB)
Margin = 8.5 dB

Document Revision Status

Revision 1 - First release.

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

AE – Auxiallary Equipment.

BW – Bandwidth. Unless otherwise stated, this is refers to the 6 dB bandwidth.

EMC – Electro-Magnetic Compatibility

EMI – Electro-Magnetic Immunity

EUT – Equipment Under Test

ITE – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

LISN – Line impedance stabilization network

NCR – No Calibration Required

RF – Radio Frequency

Testing Facility

Testing for EMC on the EUT was carried out at Global EMC labs in Toronto, Ontario, Canada. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT with a maximum width or length of up to 2m and height up to 3m. The chamber is equipped with a turn table that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120 Vac and 240Vac single phase, or 208 Vac 3 phase input. DC capability is also available. The chamber is equipped with an antenna mast that controls polarization and height from the control room adjoining the shielded chamber. Radiated emissions measurements are performed using a Bilog, and Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN.

Calibrations and Accreditations

The measurement site used is registered with Federal Communications Commission (FCC) and Industry Canada (IC). This site is calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The semi-anechoic chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. Global EMC Inc is accredited to ISO 17025 by A2LA with Testing Certificate #2555.01. The laboratories current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

Testing Environmental Conditions and Dates

Following were the environmental conditions in the facility during time of testing –

Date	Test	Init.	Temperature (ºC)	Humidity (%)	Pressure (kPa)
August 20 – 31, 2007	All	SD	20-25ºC	50-55%	100 -103kPa

Detailed Test Results Section

Spurious Radiated Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limit(s) and Method

The method is as defined in ANSI C63.4:2003.

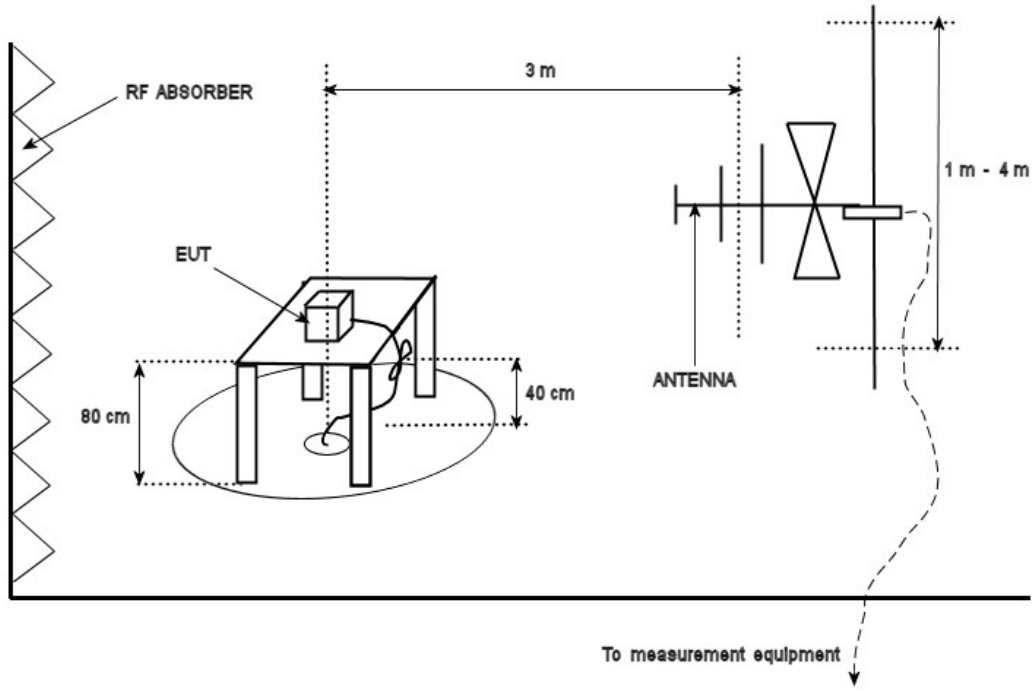
The limits, as defined in 15.247(d) for unintentional radiated emissions apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

All unintentional emissions must also meet the 'Spurious Conducted Emissions' requirements of -20 dBc or greater. See also 'Spurious Conducted Emissions' for further details.

30 MHZ – 88 MHz, 100 uV/m (40.0 dBuV/m[1]) at 3 m
88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m[1]) at 3 m
216 MHz – 960 MHz, 200 uV/m (46.4 dBuV/m[1]) at 3 m
Above 960 MHz, 500 uV/m (54.0 dBuV/m[1]) at 3 m
Above 1000 MHz, 500 uV/m (54.0 dBuV/m[2]) at 3m

[1]Limit is with 120 kHz measurement bandwidth and a using a Quasi Peak detector.
[2]Limit is with 1 MHz measurement bandwidth and using an Average detector, scanned in accordance with 15.33 to above the 10th harmonic (25 GHz).

Typical Radiated Emissions Setup



Measurement Uncertainty

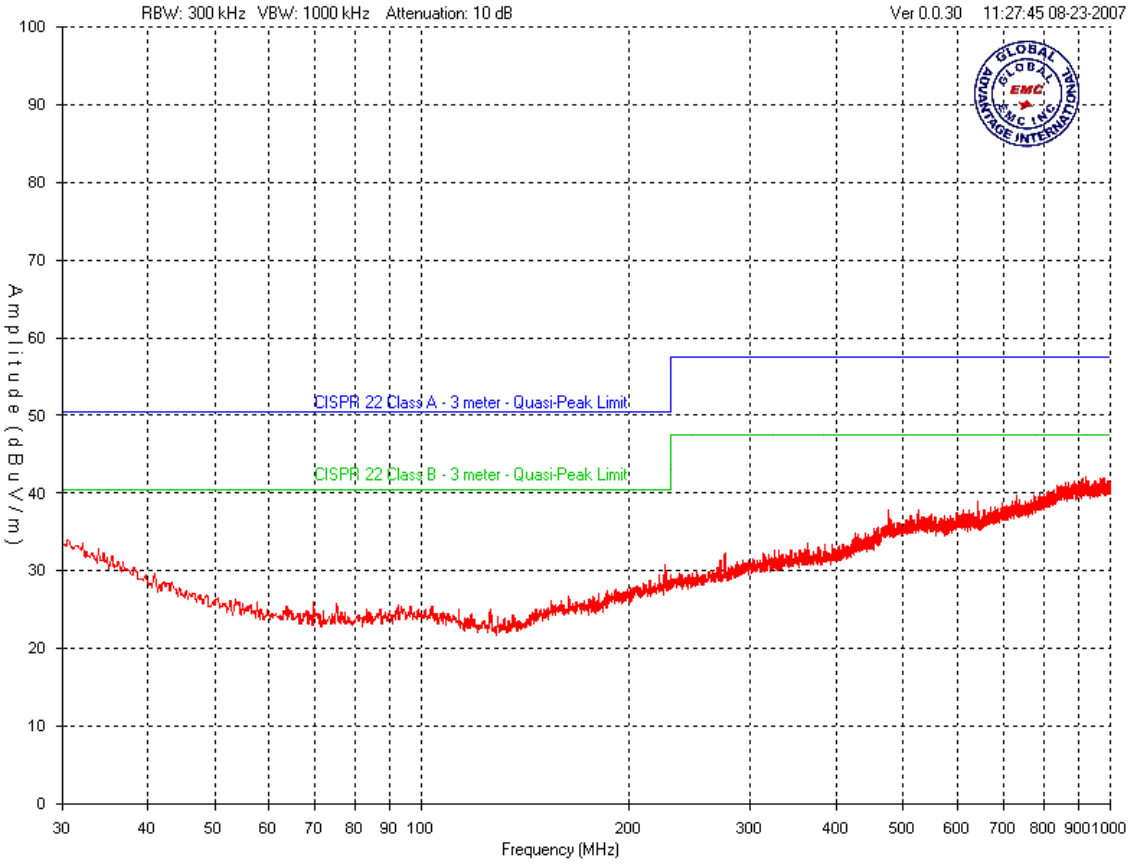
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-4.4 dB with a 'k=2' coverage factor and a %95 confidence level.

Preliminary Graphs

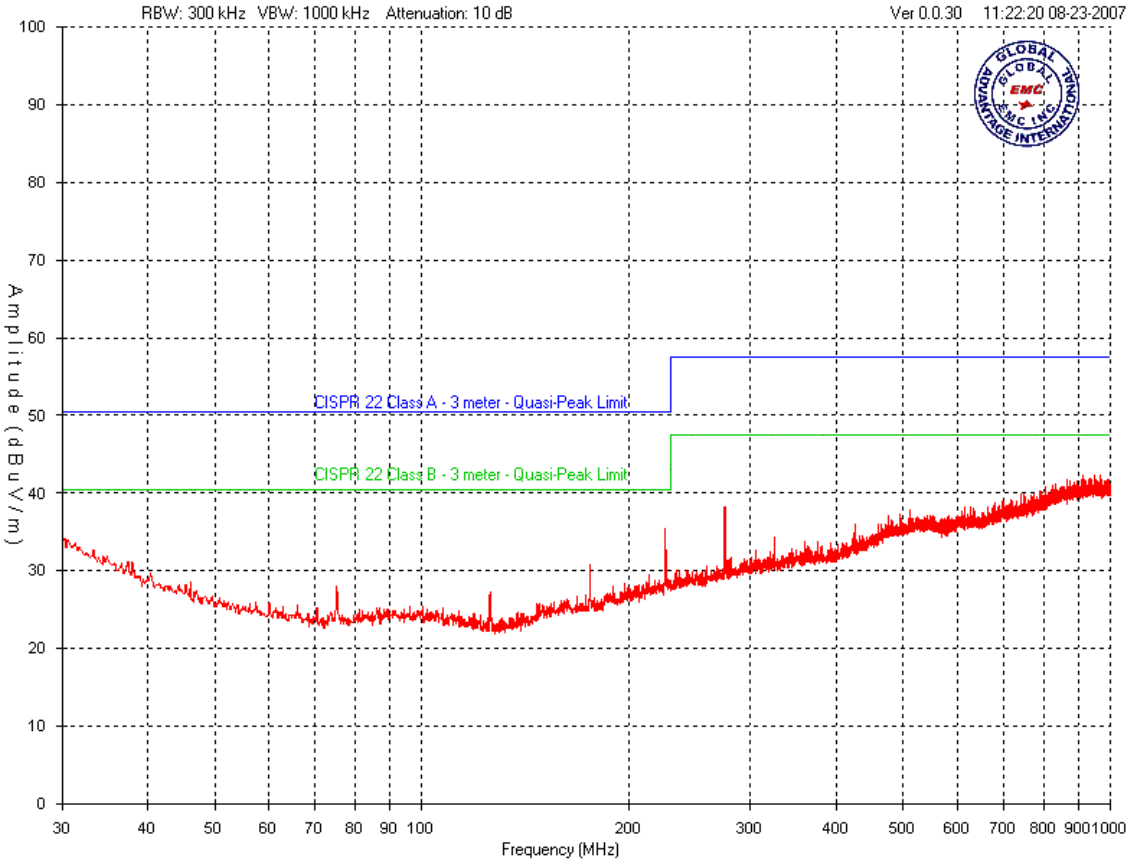
Note the graphs shown below are for graphical illustration. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater then the final required detector and over a full 0-360 rotation. This peaking process is done as a worst case measurement. This process enables the detection of frequencies of concern for final measurement, and provides considerable time savings.

In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to a minimum of a 25 GHz.

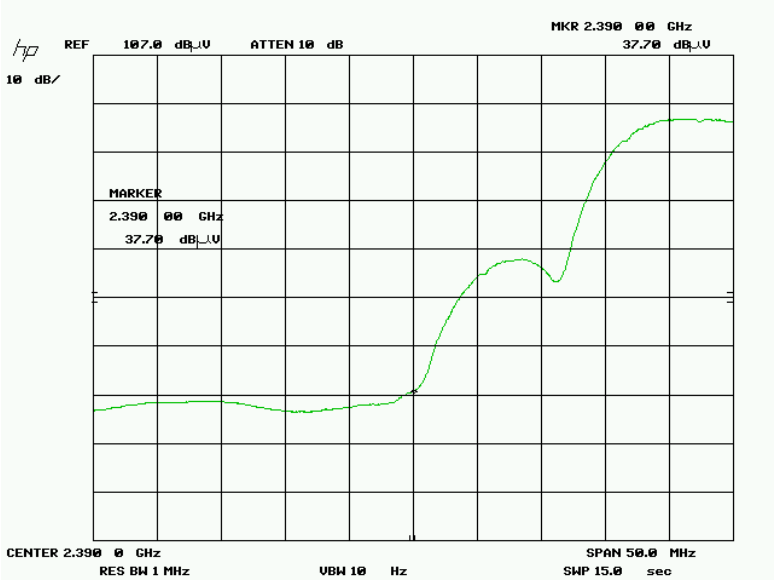
Vertical – Worst case emissions below 1 GHz (802.11b mode, high channel)



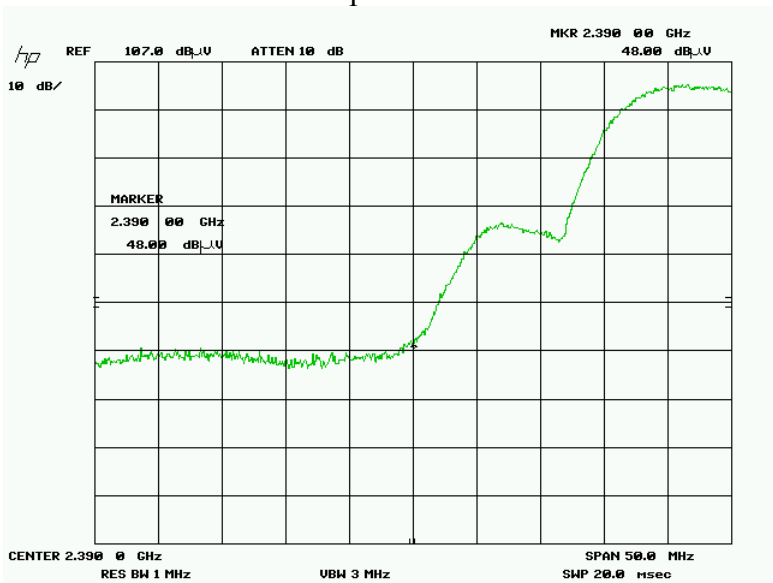
Horizontal – Worst case emissions below 1 GHz (802.11b, high channel)



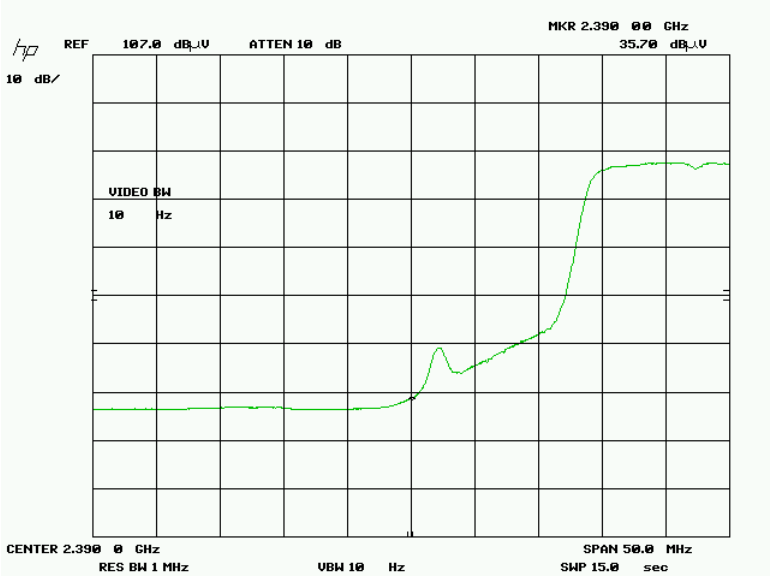
Vertical – Peak Emissions Graph – Low Channel – 802.11b - Average



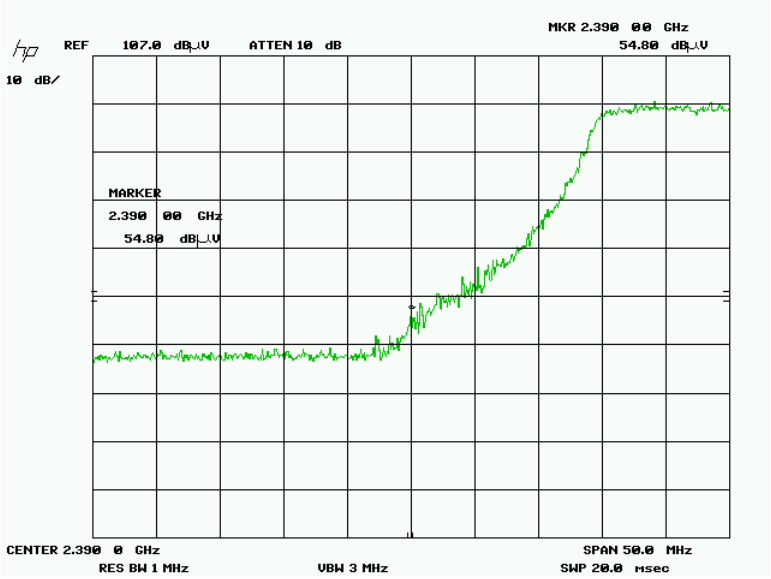
Vertical – Peak Emissions Graph – Low Channel – 802.11b – Peak



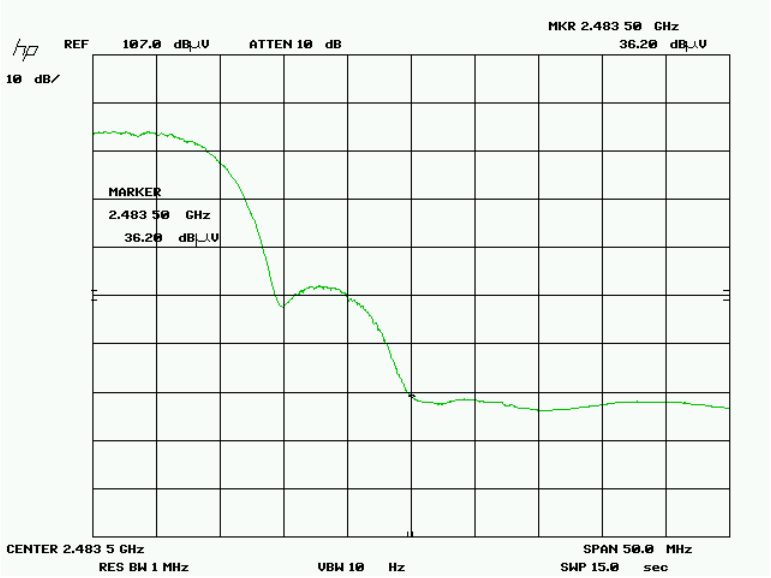
Vertical – Peak Emissions Graph – Low Channel – 802.11g - Average



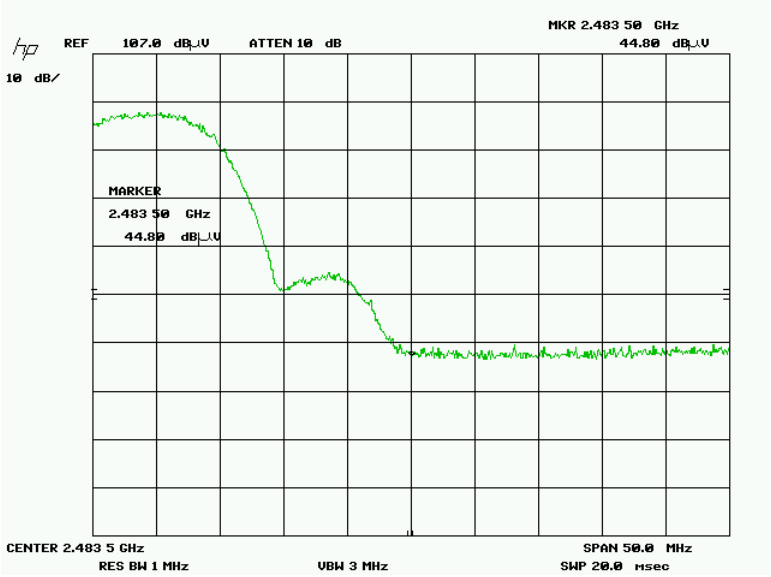
Vertical – Peak Emissions Graph – Low Channel – 802.11g – Peak



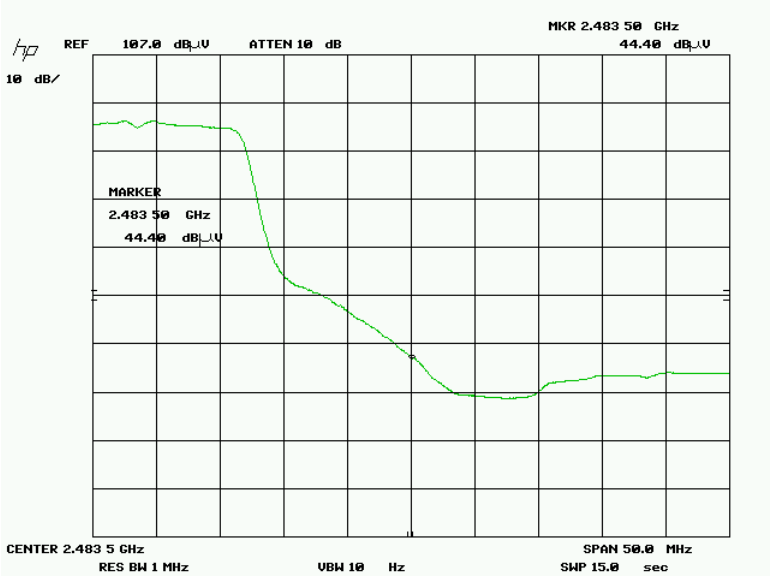
Vertical – Peak Emissions Graph – High Channel – 802.11b – Average



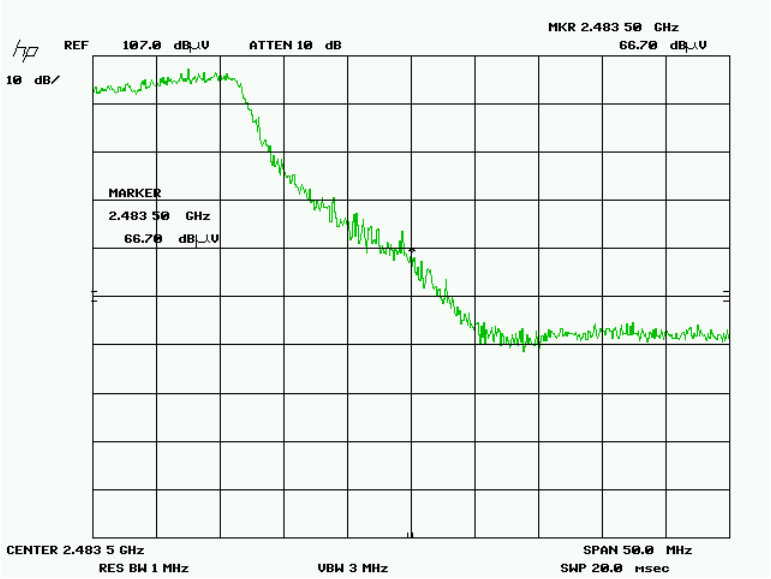
Vertical – Peak Emissions Graph – High Channel – 802.11b – Peak



Vertical – Peak Emissions Graph – High Channel – 802.11g - Average



Vertical – Peak Emissions Graph – High Channel – 802.11g - Peak



Final Measurements

Note: In accordance with 15.247(d), only radiated emissions exceeding the 15.209 limit that occur within the bands listed in 15.205, need to be verified with a quasi-peak detector or an average detector.

See below table for radiated emission band edge measurements and radiated emissions harmonics measurements. Harmonic measurements were performed up to 25 GHz.

The worst case unintentional emissions graph for below 1 GHz is shown, (802.11b mode, high channel) however all modes were verified in both vertical and horizontal polarity.

The requirement of -20dBc is verified by the conducted method; please see 'Spurious Antenna Conducted Emissions' section of this report.

For information purposes, the fundamental was measured to be 108.6 dBuV/m at 3 meters, and none of the unintentional radiated emissions that fall outside of the restricted bands exceeded the -20dBc (or 88.6 dBuV/m) requirement.

The following measurements were made at the fundamental and harmonics.

Radiated Emissions Measurements

802.11b mode

Test Frequency (MHz)	Tuned Frequency	Detector	Raw signal dB(µV)	Antenna factor dB	Cable loss dB	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB	Result
2390	2412	Peak	48.0	30.3	2.4	6.0	35.9	50.8	74.0	23.2	PASS
2390	2412	AVG	37.7	30.3	2.4	6.0	35.9	40.5	54.0	13.5	PASS
2412	2412	Peak	104.8	30.5	2.4	6.0	35.9	107.8			
2412	2412	AVG	96.5	30.5	2.4	6.0	35.9	99.5			
4824	2412	Peak	57.8	33.1	3.0	6.0	35.8	64.1	74.0	9.9	PASS
4824	2412	AVG	37.5	33.1	3.0	6.0	35.8	43.8	54.0	10.2	PASS
7236	2412	Peak	48.9	36.1	4.0	6.0	35.2	59.8	74.0	14.2	PASS
7236	2412	AVG	34.9	36.1	4.0	6.0	35.2	45.8	54.0	8.2	PASS
2437	2437	Peak	105.5	30.6	2.4	6.0	35.9	108.6			
2437	2437	AVG	98.4	30.6	2.4	6.0	35.9	101.5			
4874	2437	Peak	59.8	33.2	3.0	6.0	35.8	66.2	74.0	7.8	PASS
4874	2437	AVG	44.5	33.2	3.0	6.0	35.8	50.9	54.0	3.1	PASS
7311	2437	Peak	54.8	36.2	4.0	6.0	35.2	65.8	74.0	8.2	PASS
7311	2437	AVG	42.3	36.2	4.0	6.0	35.2	53.3	54.0	0.7	PASS
2462	2462	Peak	104.5	30.6	2.4	6.0	35.9	107.6			
2462	2462	AVG	95.6	30.6	2.4	6.0	35.9	98.7			
2483.5	2462	Peak	44.8	33.2	3.0	6.0	35.8	51.2	74.0	22.8	PASS
2483.5	2462	AVG	36.2	33.2	3.0	6.0	35.8	42.6	54.0	11.4	PASS
4924	2462	Peak	57.1	33.2	3.0	6.0	35.8	63.5	74.0	10.5	PASS
4924	2462	AVG	41.3	33.2	3.0	6.0	35.8	47.7	54.0	6.3	PASS
7386	2462	Peak	50.1	36.2	4.0	6.0	35.2	61.1	74.0	12.9	PASS
7386	2462	AVG	37.6	36.2	4.0	6.0	35.2	48.6	54.0	5.4	PASS

Note: No emissions above the 3rd harmonic were detected at 1 meter, scanned to the 10th harmonic at 1m.

802.11g mode

Test Frequency (MHz)	Tuned Frequency	Detector	Raw signal dB(µV)	Antenna factor dB	Cable loss dB	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
2390	2412	Peak	54.8	30.3	2.4	6.0	35.9	57.6	74.0	16.4	PASS
2390	2412	AVG	35.7	30.3	2.4	6.0	35.9	38.5	54.0	15.5	PASS
2412	2412	Peak	99.5	30.5	2.4	6.0	35.9	102.5			
2412	2412	AVG	89.5	30.5	2.4	6.0	35.9	92.5			
4824	2412	Peak	47.8	33.1	3.0	6.0	35.8	54.1	74.0	19.9	PASS
4824	2412	AVG	35.2	33.1	3.0	6.0	35.8	41.5	54.0	12.5	PASS
7236	2412	Peak	49.5	36.1	4.0	6.0	35.2	60.4	74.0	13.6	PASS
7236	2412	AVG	34.3	36.1	4.0	6.0	35.2	45.2	54.0	8.8	PASS
2437	2437	Peak	103.2	30.6	2.4	6.0	35.9	106.3			
2437	2437	AVG	91.5	30.6	2.4	6.0	35.9	94.6			
4874	2437	Peak	53.4	33.2	3.0	6.0	35.8	59.8	74.0	14.2	PASS
4874	2437	AVG	40.9	33.2	3.0	6.0	35.8	47.3	54.0	6.7	PASS
7311	2437	Peak	52.0	36.2	4.0	6.0	35.2	63.0	74.0	11.0	PASS
7311	2437	AVG	34.8	36.2	4.0	6.0	35.2	45.8	54.0	8.2	PASS
2462	2462	Peak	103.3	30.6	2.4	6.0	35.9	106.4			
2462	2462	AVG	93.2	30.6	2.4	6.0	35.9	96.3			
2483.5	2462	Peak	66.7	33.2	3.0	6.0	35.8	73.1	74.0	0.9	PASS
2483.5	2462	AVG	44.4	33.2	3.0	6.0	35.8	50.8	54.0	3.2	PASS
4924	2462	Peak	53.7	33.2	3.0	6.0	35.8	60.1	74.0	13.9	PASS
4924	2462	AVG	41.8	33.2	3.0	6.0	35.8	48.2	54.0	5.8	PASS
7386	2462	Peak	50.0	36.2	4.0	6.0	35.2	61.0	74.0	13.0	PASS
7386	2462	AVG	35.6	36.2	4.0	6.0	35.2	46.6	54.0	7.4	PASS

Note: No emissions above the 3rd harmonic were detected at 1 meter, scanned to the 10th harmonic at 1m.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
BiLog Antenna	3142-C	ETS	2006-08-06	2008-08-06	GEMC 8
Horn Antenna	6878/24	Q-Par	On file	2008-08-01	GEMC 65
1-26G pre-amp	HP 8449B	HP	On file	2008-08-01	GEMC 68
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Pre-Amplifier	PA-2.5-26	Vican	2006-09-12	2008-09-12	GEMC 9
IFR Spectrum Analyzer	AN940	IFR	May 4/2006	May 4/2008	GEMC 6350
Horn Antenna	SAS-572	AH	NCR	NCR	GEMC 6371
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev2.doc"

6 dB Bandwidth of Digitally Modulated Systems

Purpose

The purpose of this test is to ensure that the bandwidth occupied exceeds a stated minimum. This helps ensure the utilization of the frequency allocation is sufficiently wide. This also helps prevent corruption of data by ensuring adequate data separation to distinguish the reception of the intended information.

Limits

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. This should be measured with a 100 kHz RBW and a 300 kHz VBW.

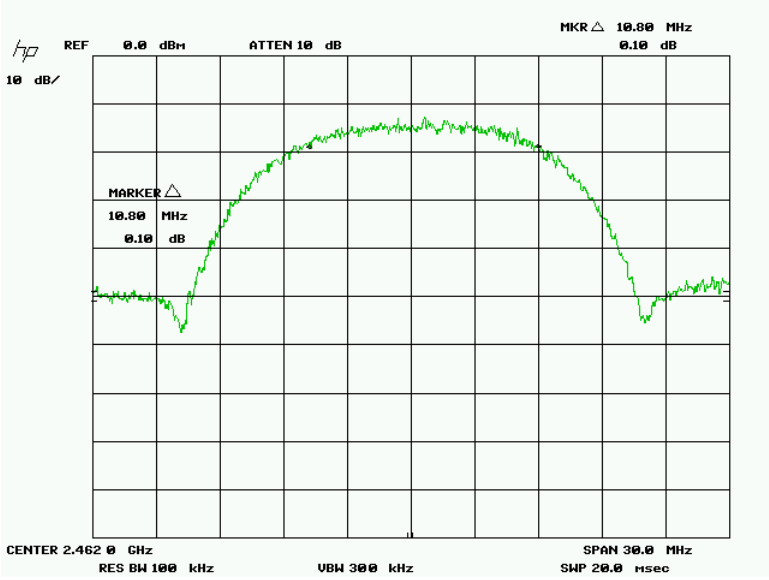
Results

The EUT passed. Measurements were obtained in low, medium, and high bands at each channel. Worst case graphs are presented. The minimum 6 dB bandwidth measured was 10.8 MHz which exceeds the minimum requirement of at least 500 kHz.

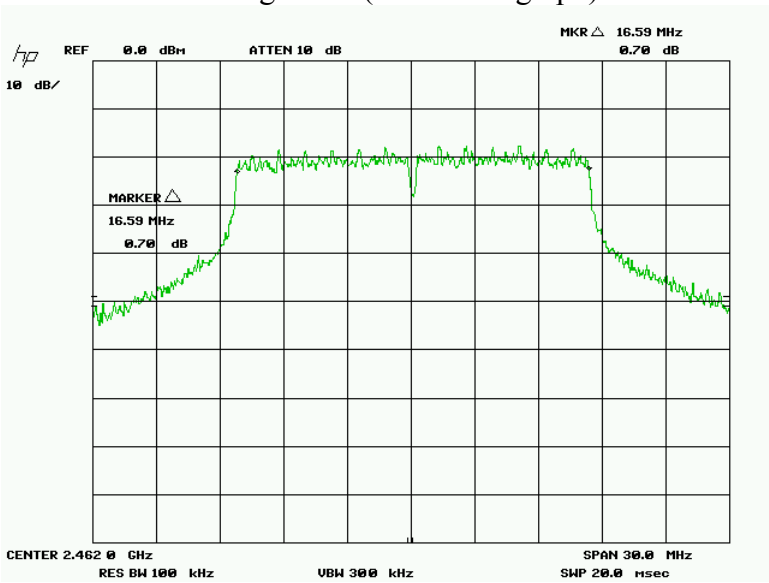
Graph(s)

The graphs shown below shows the channel spacing during the operation of the device. This measurement is a peak measurement. Max hold is performed for a duration of not less then 1 minute.

802.11b mode (worst case graph)



802.11g mode (worst case graph)



Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
Spectrum Analyzer	8566B	HP	2006-08-09	2007-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2007-08-07	GEMC 7
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Maximum Peak Envelope Conducted Power

Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element does not exceed the limits specified. This ensures that if the end-user replaces the antenna, that the maximum power does not exceed an amount which may create an an excessive power level.

Limits

The limits are defined in 15.247(b).

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands, the peak limit is 1 watt.

Results

The EUT passed. The peak power measured was 17.1 dBm (51.3 mW), in 802.11b mode. 802.11g mode produced a worst case of 15.4 dBm.

Table(s)

The tables shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 20 dB of external attenuation taken during this measurement.

802.11g mode

Band	Channel	Frequency (GHz)	Reading (dBm)	Factor (dB)	Output Power (dBm)
Low	1	2.412	-7.9	20	12.1
Medium	6	2.437	-5.5	20	14.5
High	11	2.462	-4.6	20	15.4

802.11b mode

Band	Channel	Frequency (GHz)	Reading (dBm)	Factor (dB)	Output Power (dBm)
Low	1	2.412	-3.4	20	16.6
Medium	6	2.437	-3.8	20	16.2
High	11	2.462	-2.9	20	17.1

The calculated value is:
-2.9 dBm + 20 dB (attenuator)
= 17.1

Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Power Head	PH 2000	AR	2006-10-13	2008-10-13	GEMC 15
Power meter	PM 2002	AR	2006-10-13	2008-10-13	GEMC 16
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Spurious Conducted Emissions

Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element at frequencies outside of the authorized spectrum does not exceed the limits specified. This ensures that the only the intended signal is delivered to the radiating element.

Limits

The limits are defined in 15.247(d). In any 100 kHz band, the peak spurious harmonics emissions must be at least 20 dB below the fundamental. Spurious Conducted emissions are to be evaluated up to the 10^{th} harmonic. This -20 dBc requirement also applies at the 'band edge' or 2.4 GHz and 2.4835 GHz.

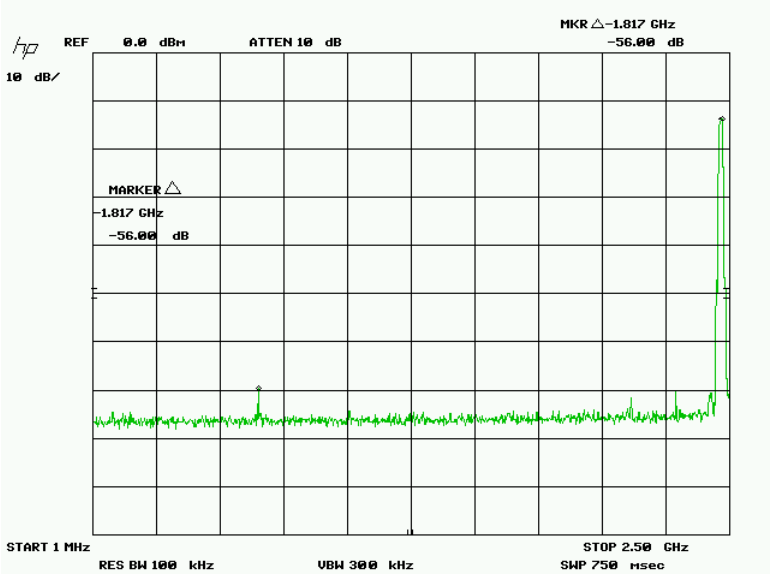
Results

The EUT pass. Low, middle and high band was measured for each 802.11b and 802.11g mode. The worst case for each mode is presented as a graph for the spectrum. The -20 dBc requirement is shown for the lower band edge at 2.4 GHz in the low band for both modes. The -20 dBc requirement is also shown for the higher band edge at 2.4835 GHz in the high band for both modes. There were no emissions detected between 22 GHz and 25 GHz.

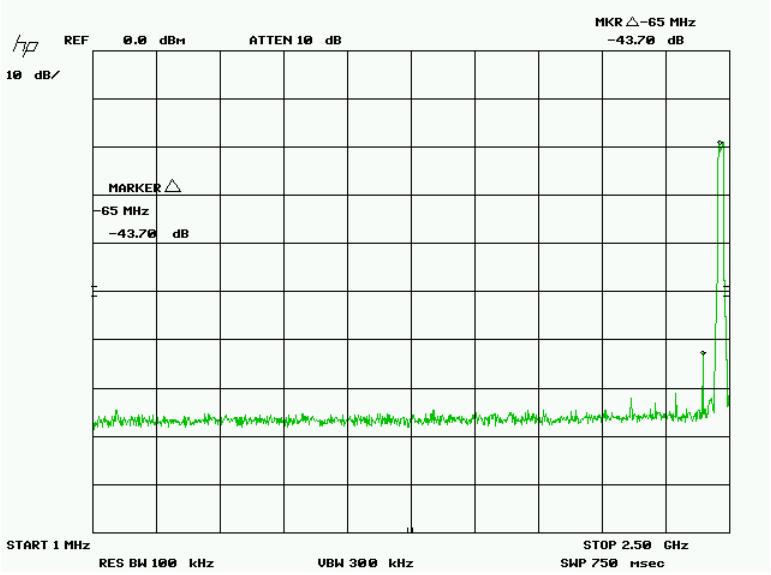
Graph(s)

The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 20 dB of external attenuation taken during this measurement.

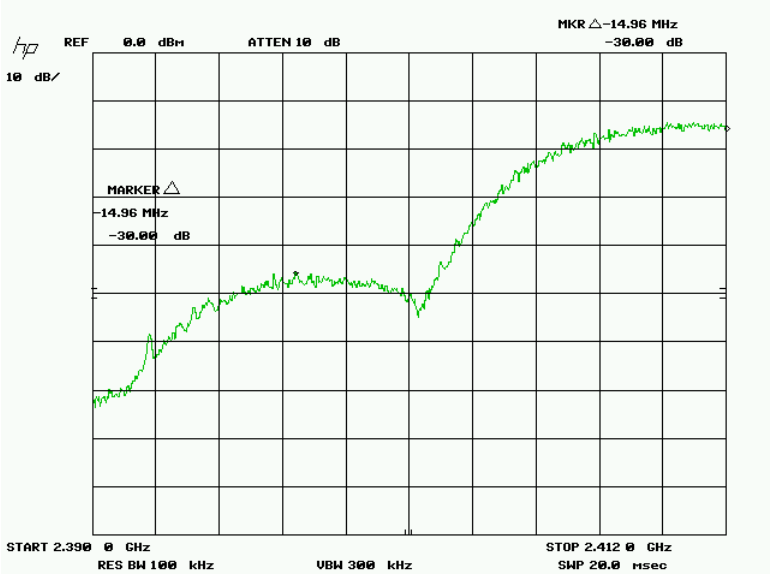
Frequencies below fundamental - 802.11b mode (worst case shown)



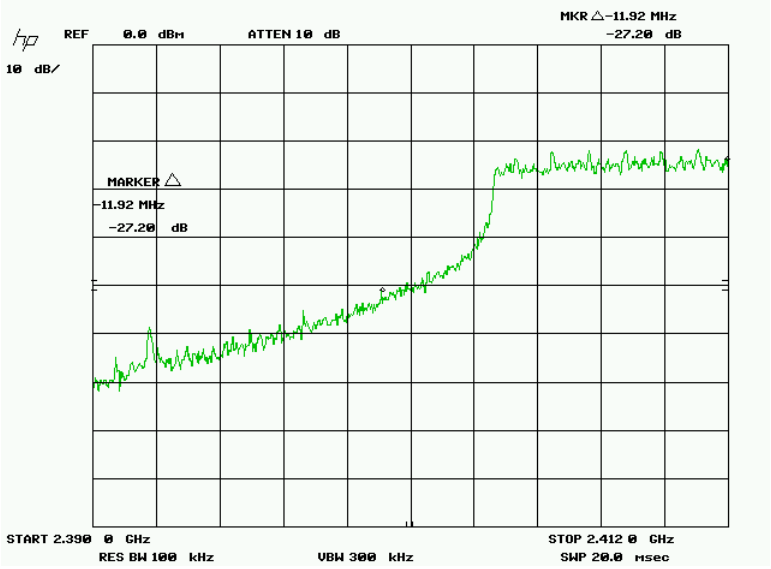
Frequencies below fundamental - 802.11g mode (worst case shown)



Low Channel, Lower Band Edge - 802.11b mode (worst case shown)

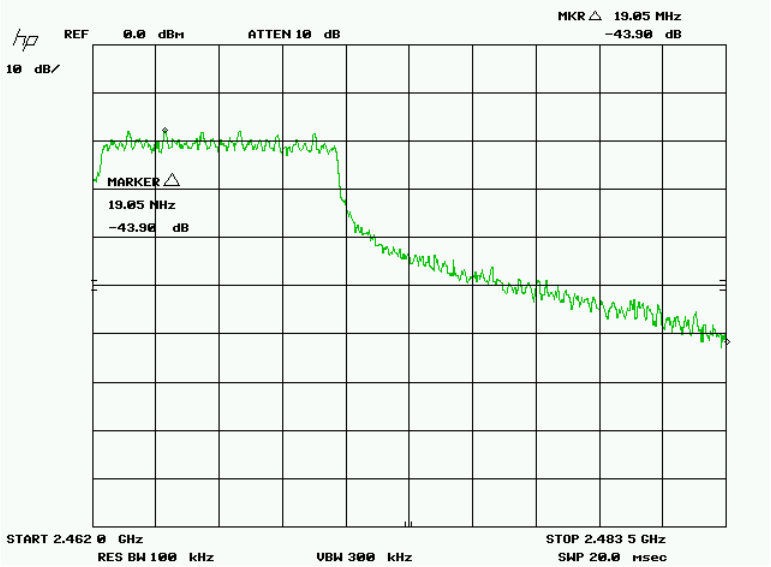


Low Channel, Lower Band Edge - 802.11g mode (worst case shown)

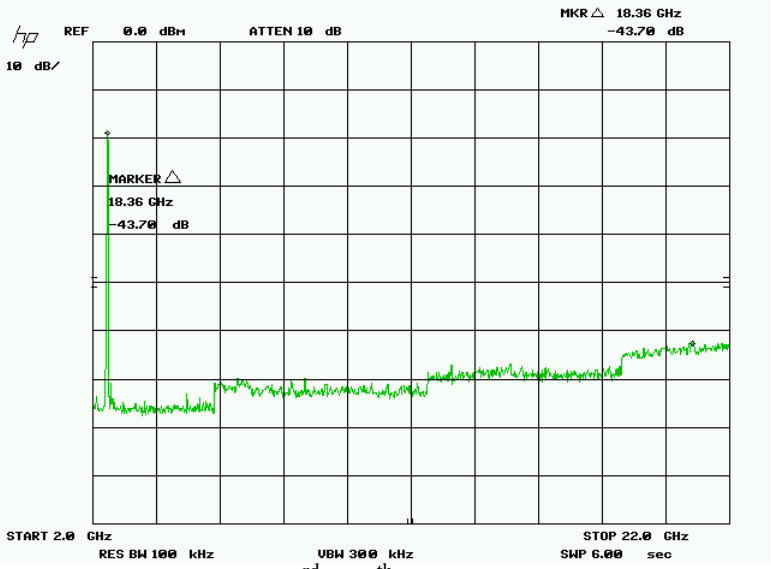


High Channel, Upper Band Edge - 802.11b mode (worst case shown)

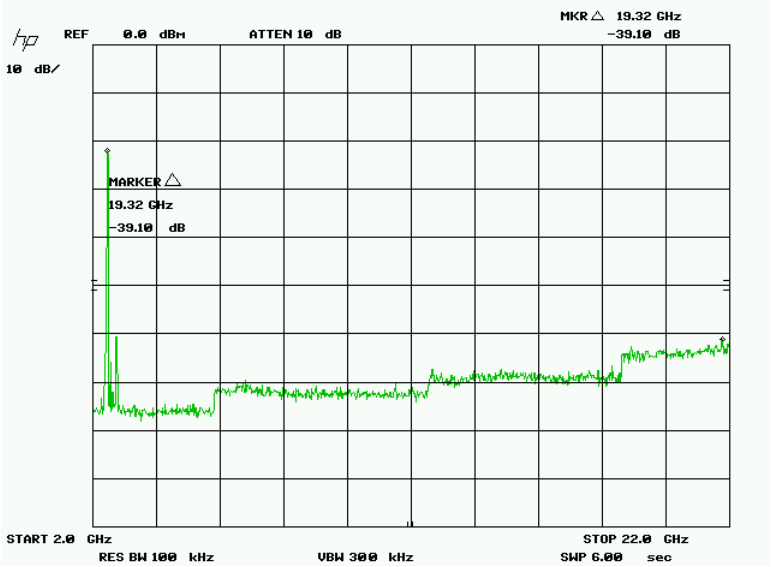
High Channel, Upper Band Edge - 802.11g mode (worst case shown)



Frequencies above Fundamental (2rd to 9th Harmonics) - 802.11b mode (worst case)



Frequencies above Fundamental (2rd to 9th Harmonics)- 802.11g mode (worst case)



The frequency range of 22 – 25 GHz, the 10th harmonic (and 9th harmonic where applicable) was additionally scanned using an alternate spectrum analyzer, in low, middle and high band for each mode. No emissions were detected at the 9th and 10th harmonic.

Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 1 dB	FP-50-1	Trilithic	NCR	NCR	GEMC 38
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Attenuator 6 dB	FP-50-6	Trilithic	NCR	NCR	GEMC 41
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
IFR Spectrum Analyzer	AN940	IFR	May 4/2006	May 4/2008	GEMC 6350
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Power Spectral Density

Purpose

The purpose of this test is to ensure that the maximum power spectral density to the radiating element does not exceed the limits specified. This ensures that the modulation is significantly wide enough, or low enough in power that it will allow for co-operation of other wireless devices operating within this frequency allocation.

Limits

The limits are defined in 15.247(e).

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.

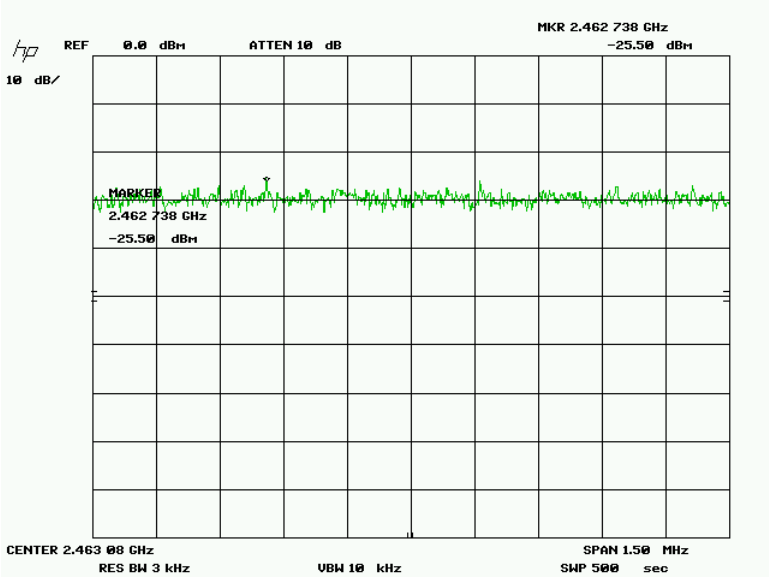
Results

The EUT passed. Each mode was tested at low, medium, and high band. The graph for the worst case for each mode is presented below. The worst case value is -5.5 dBm in 802.11b mode.

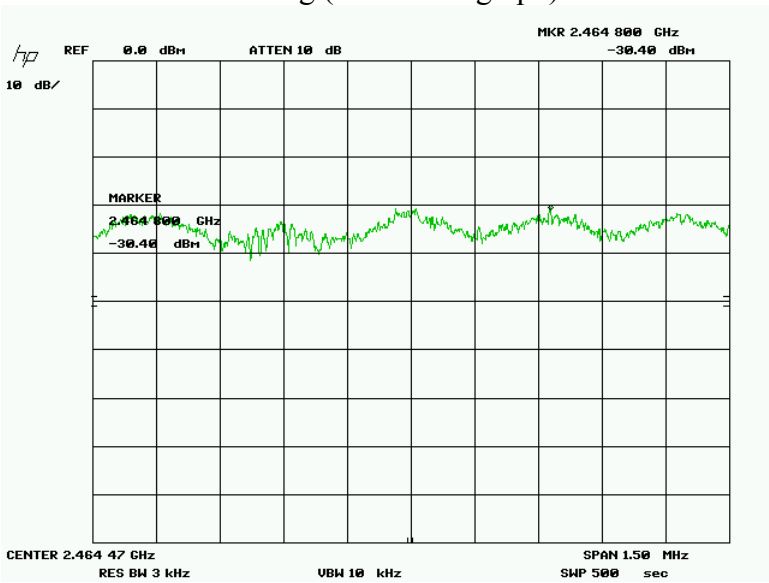
Graph(s)

The graphs shown below shows the power spectral density of the device during the conducted measurement during transmit operation of the EUT. Low, middle, and high channel was investigated in each mode. The worst case graphs are shown for each mode.

802.11b (worst case graph)



802.11g (worst case graph)



Note there was 20 dB of external attenuation taken during this measurement.

Note: See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Maximum Permissible Exposure

Purpose

The purpose of this test is to ensure that the RF energy intentionally transmitted, in terms of power density emitted from the EUT at a stated operating distance does not exceed the limits listed below as defined in the applicable test standard, as calculated based upon readings obtained during testing. This helps protect human exposure to excessive RF fields.

Limit(s) and Method

The limits, as defined in FCC 15.247(i), and FCC 1.1310 Table 1 (B) limits for general public exposure was applied. The limit for the frequency range of 1.5 GHz to 100 GHz was applied. This is a limit of 1.0 mW/ cm^2 The distance used for calculations was 20cm, as this is the minimum distance an operator will be from the EUT during normal operation, as stated by the manufacturer.

Results

The EUT passed the requirements. The worst case calculated power density was 0.02 mW/cm^2, this is significantly under the 1.0 mW/cm^2 requirement.

Calculations

Method 1 (conducted power)

$P_d = (P_t * G) / (4 * pi * R^2)$
Where Pt = 17.1 or 51.3mW as per Peak power conducted output
Where G = 3 dBi, or numerically 2
Where R = 20 cm

$P_d = (51.3\ mW * 2) / (4 * pi * 20cm^2)$
$P_d = 102.6\ mW / 5026\ cm^2$
$P_d = 0.02\ mW/cm^2$

Appendix A – EUT Summary

For further details for filing purposes, refer to filing package.

General EUT Description

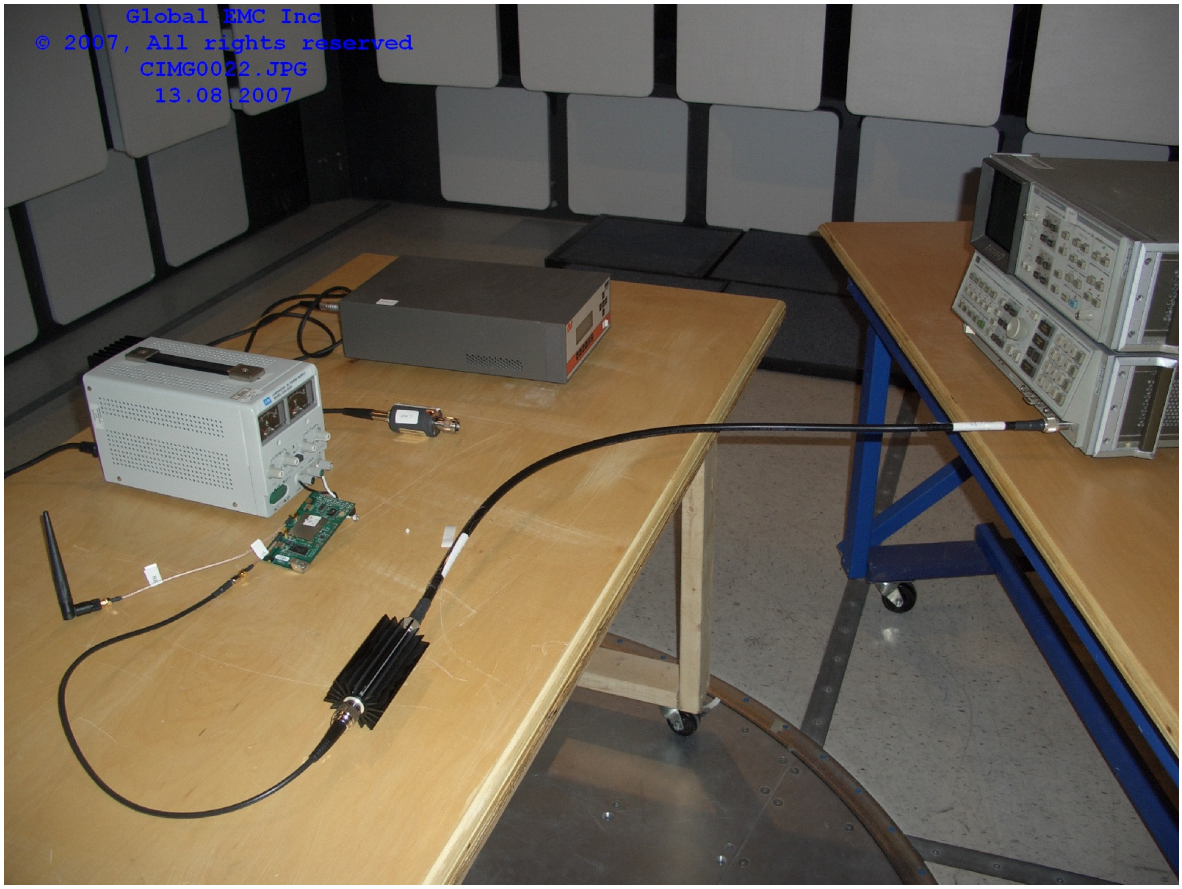
Manufacturer	RuggedCom
	30 Whitmore Rd Woodbridge, ON
EUT Name	RW80G
FCCID	VGR-RW80G
IC #	4997A-VG5RW80G
Approximate Size (LxWxH)	10x6x2 cm
Equipment Category (Commercial / Residential / Medical)	Commercial
Input Voltage and Frequency	DC 3.3V
Intentional RF (If yes describe)	Yes – low power WiFi
Table Top / Wall mount / Floor standing (choose table top if unsure)	Table top
I/O Connectors available on EUT	None
Peripherals required for test	None
Minimum Separation distance from operator	20 cm
Types and lengths of all I/O cables	None

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT & Test Setup Photographs'.

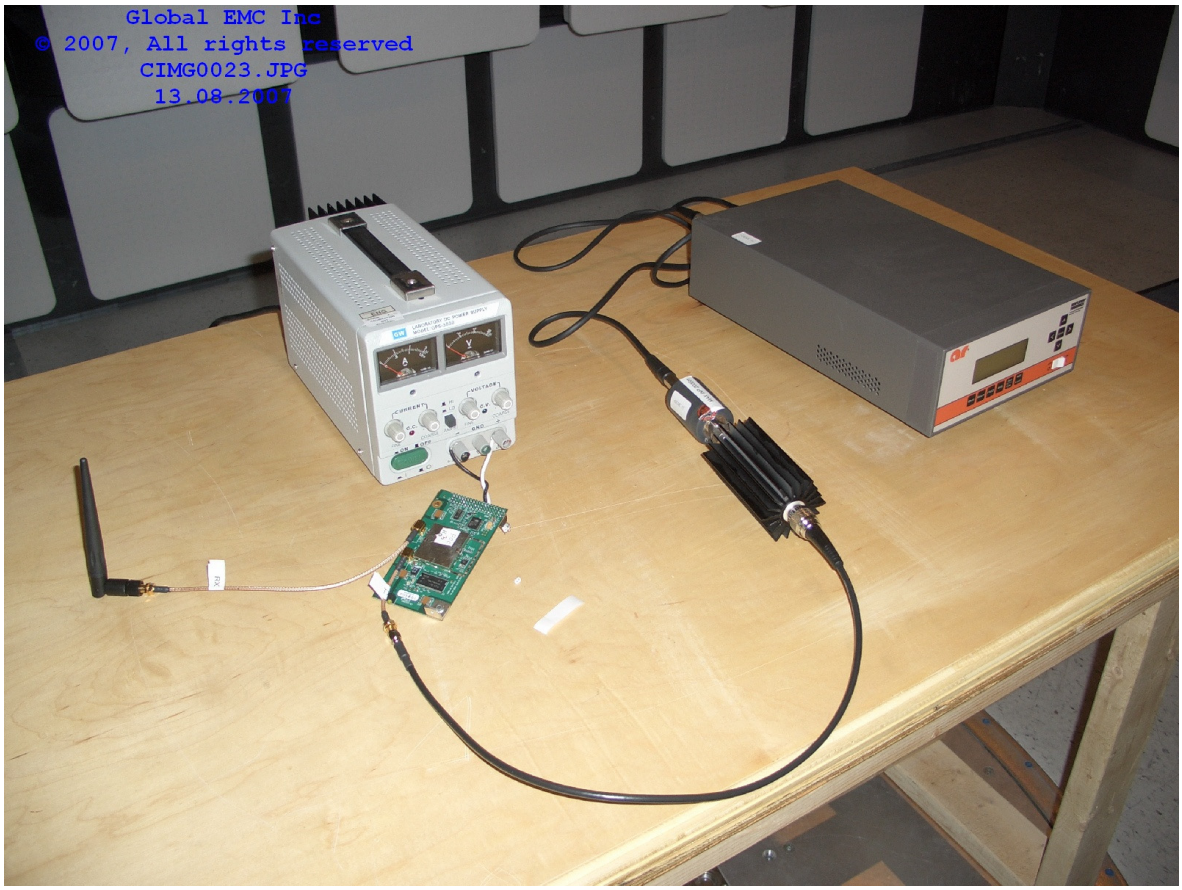
Appendix B – EUT and Test Setup Photographs

Note: These photos are for information purposes only. Also refer to PDF files that are separate from this test report.

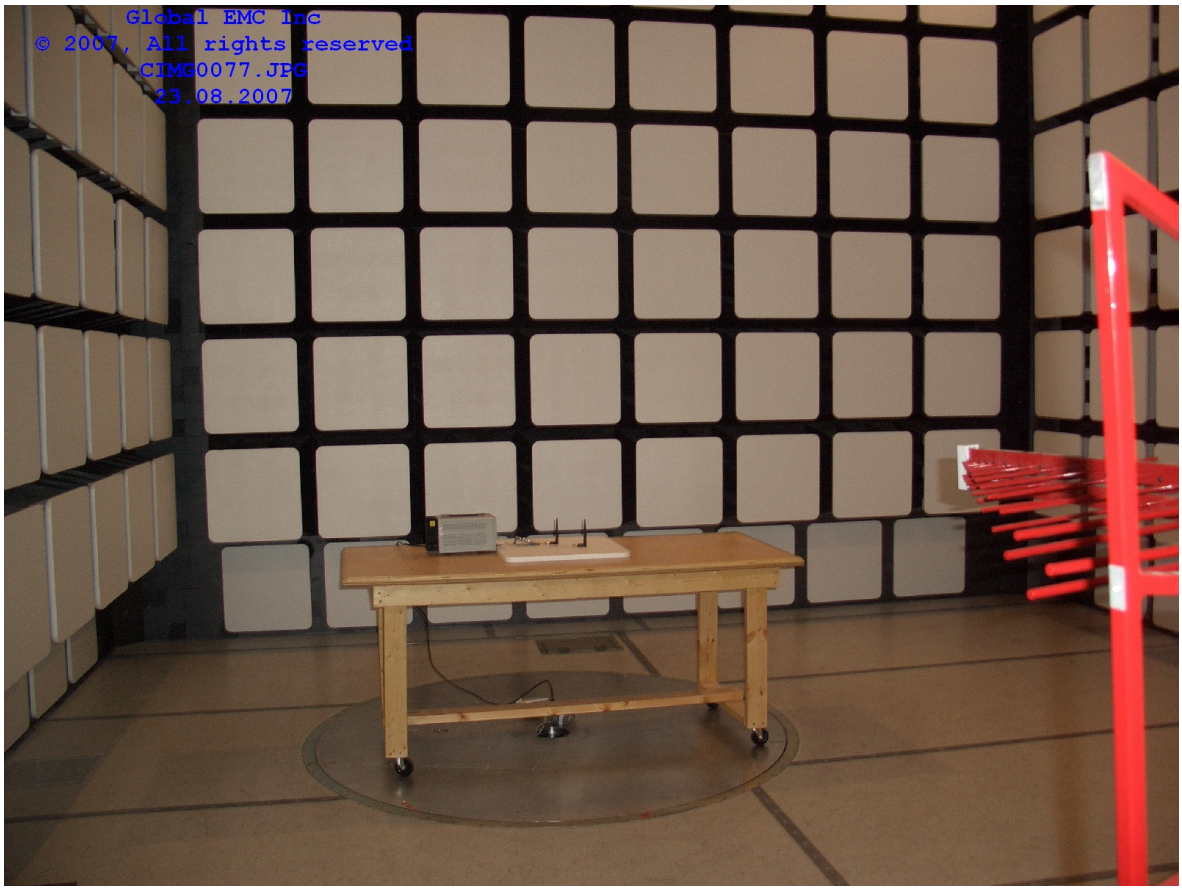
Conducted Measurements Photo



Power Conducted Measurement Photo



Radiated Emissions Photo 1



Radiated Emissions Photo 2

Radiated Emissions Photo 3