Global EMC Inc. Labs

EMC & RF Test Report

As per

RSS 210 Issue 7:2007

&

FCC Part 15 Subpart C:2008

Unlicensed Intentional Radiators

on the

AIRESURF NETWORKS

SPK-1000 System

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Testing produced for

AIRESURF NETWORKS INC.

See Appendix A for full customer & EUT details.

Industry Canada

LAB REGISTRATION #6844A-1

FCC REGISTRATION #612361

ACCREDITED TESTING LABORATORY CERTIFICATE #2555.01

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Report Scope

This report addresses the EMC verification testing and test results of the AIRESURF NETWORKS SPK-1000 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 15:2008

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	AIRESURF NETWORKS
Product	SPK-1000 System
Standard(s)	RSS 210 Issue 7:2007 / FCC Part 15 Subpart C 15:2008

Summary

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

EUT FCC Certification #, FCC ID:	WE6-A7005111
EUT Industry Canada Certification #, IC:	XXXXXXXXX
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Scott Drysdale

Client	AIRESURF NETWORKS
Product	SPK-1000 System
Standard(s)	RSS 210 Issue 7:2007 / FCC Part 15 Subpart C 15:2008

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique / Professional	Pass - See Justification
FCC 15.205 RSS 210 (Table 1)	Restricted Bands for intentional operation	None	Pass - See Justification
FCC 15.207	Power line conducted emissions	QuasiPeak Average	Pass
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 or other	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 (RSS 210 section 5.5), this device is to be professionally installed, see the users' manual for further details.

Note that in accordance with FCC 15.204(b) this system incorporates a transmission system consisting of an intentional radiator, an external radio frequency power amplifier, and an antenna. This system is to be authorized as a system, and it must always be marketed as a complete system and must always be used in the configuration in which it was authorized.

The intentional radiator portion, consisting of a D-Link DWL-2200AP, was set to a full driving power output of 2 dBm, which corresponds to the maximum drive setting to which the end-user may operate this system.

For the Restricted Bands of operation, the EUT is designed to only operate between 2427 and 2452 MHz.

This unit, although designed to operate between 2427 and 2452, was measured from 2412 to 2462 for information purposes in B-mode. The 2412 results are presented in this report as worst case measurements in place of the 2427 channel. The 2462 results are presented in this report as worst case measurements in place of the 2452 channel.

For the Antenna gain, this system was tested with a transmit Antenna gain of 8 dBi. All applicable measurements were corrected by adding 2 dB.

For maximum permissible exposure, this device operates at less then 1 Watt at 2427 to 2452 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 22:1997	- 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 - July 28, 2008 – First revision
Revision 2 - July 30, 2008 – Modifications to clarify results
- Incorporate 'Intentional Radiator' readings
Revision 3 - Aug 5, 2008 - Incorporate Maximum Permissible Exposure.

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. 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)
July 19-25th, 2008	All	SD	20-25ºC	30-45%	100 -103kPa

Detailed Test Results Section

Power Line Conducted Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line does not exceed the limits listed below as defined in the applicable test standard, as measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio operators, maritime radio, CB radio, and so on, from unwanted interference.

Limits & Method

The limits are as defined in 47 CFR FCC Part 15 Section 15.207
Method is as defined in ANSI C64:2003

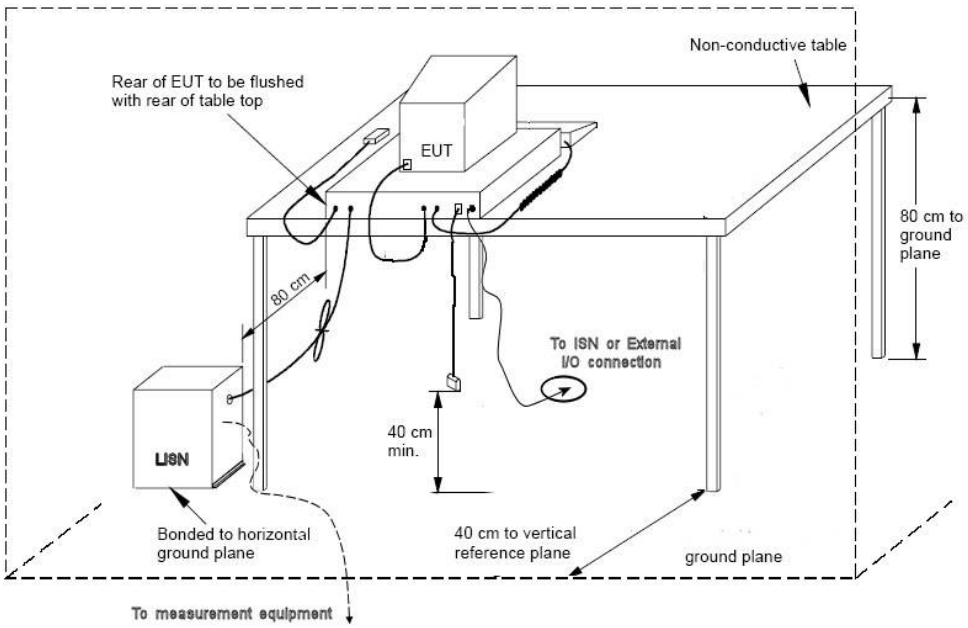
Average Limits		QuasiPeak Limits	
150 kHz – 500 kHz	56 to 46 dBuV	150 kHz – 500 kHz	66 to 56 dBuV
500 kHz – 5 MHz	46 dBuV	500 kHz – 5 MHz	56 dBuV
5 MHz – 30 MHz	50 dBuV	500 kHz – 30 MHz	60 dBuV

The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

Note: If the Peak or Quasi Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Both limits are applicable, and each is specified as being measured with a 9 kHz measurement bandwidth .

Typical Setup Diagram



Note: The vertical reference plane is optional as per ANSI C63.4 section 5.2.2

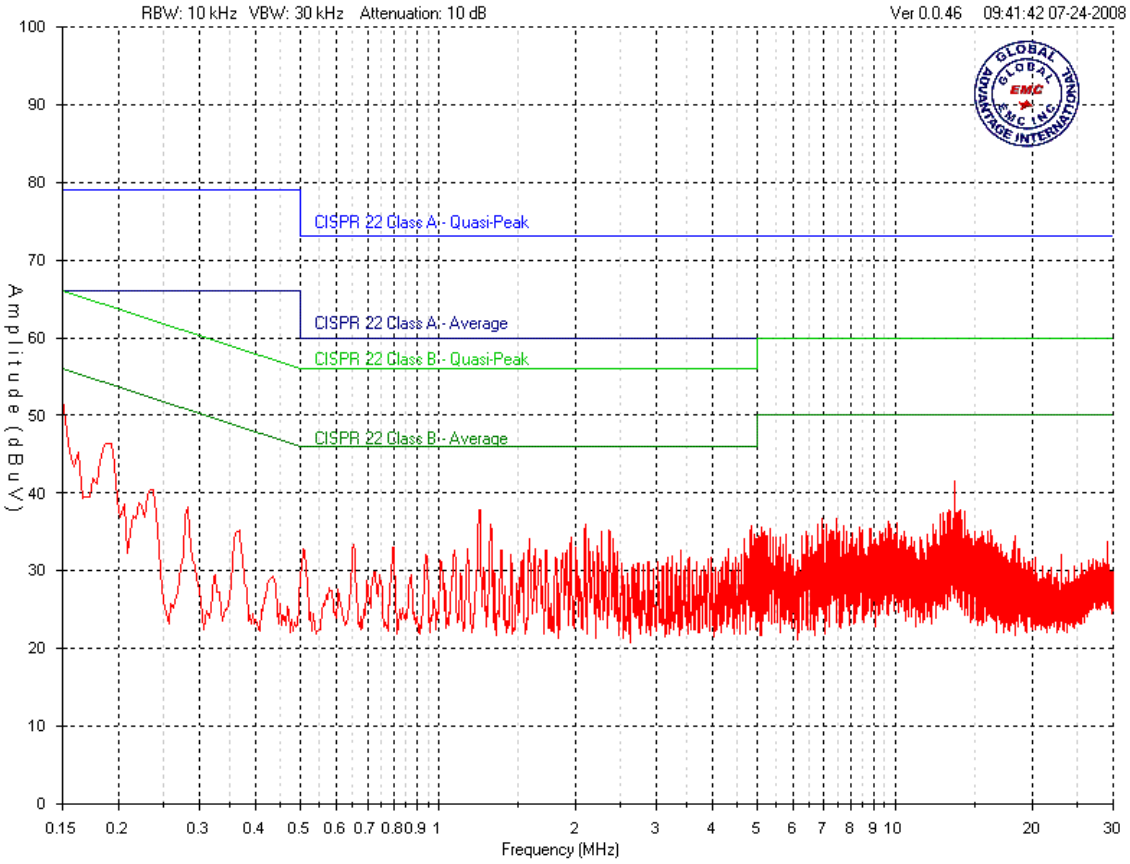
Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-3.6 dB with a 'k=2' coverage factor and a %95 confidence level.

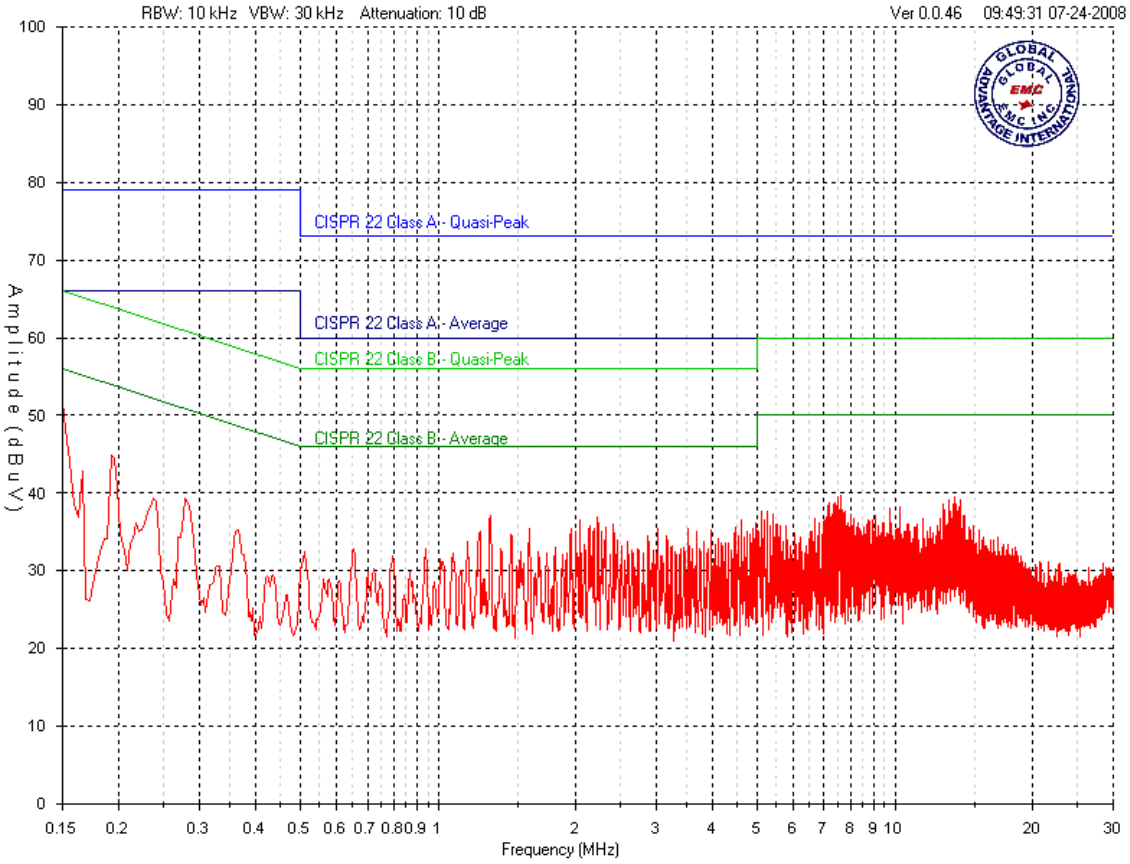
Preliminary Graphs

Note the worst case graphs shown below are for graphical illustration only. High, middle and low channel operation was investigated each mode (G mode and B mode) and no observable difference was detected. For final measurements with the appropriate detector where applicable, please refer to the table. The graph shown below is a peak measurement graph obtained in G mode at middle channel measured with a resolution bandwidth greater then or equal to the final required detector. This graphs are performed as a worst case measurement to enable the detection of frequencies of concern and for considerable time savings.

Phase (Black/Brown – Worst Case)



Neutral (White/Blue)



Final Measurements

High, middle and low channel operation was investigated each mode (G mode and B mode) and no observable difference was detected. The readings below represent peak readings compared against the average limit

Line 1

Test Frequency (MHz)	Received signal (dBµV)	Attenuator (dB)	Cable + LISN (dB)	Emission Level (dBuV)	Emission limit (dBµV)	Margin (dB)	Result
0.153	37.9	10	1.5	49.4	55.8	6.4	PASS
0.192	35.3	10	1.1	46.4	53.9	7.5	PASS
1.234	27.7	10	0.2	37.9	46	8.1	PASS
13.475	31.2	10	0.3	41.5	50	8.5	PASS
2.097	25.9	10	0.2	36.1	46	9.9	PASS
1.305	25.8	10	0.2	36	46	10	PASS

Line 2

Test Frequency (MHz)	Received signal (dBµV)	Attenuator (dB)	Cable + LISN (dB)	Emission Level (dBuV)	Emission limit (dBµV)	Margin (dB)	Result
0.153	36.8	10	1.5	48.3	55.8	7.5	PASS
0.192	33.9	10	1.1	45	53.9	8.9	PASS
1.302	26.9	10	0.2	37.1	46	8.9	PASS
2.236	26.8	10	0.2	37	46	9	PASS
4.611	26.4	10	0.2	36.6	46	9.4	PASS
2.048	26.3	10	0.2	36.5	46	9.5	PASS

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

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2008-02-28	2010-02-28	GEMC 6
Quasi Peak Adapter	85650A	HP	2008-02-28	2010-02-28	GEMC 7
LISN	FCC-LISN-50/250-16-2-01	FCC	2007-05-02	2009-05-02	GEMC 65
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
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42

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

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.

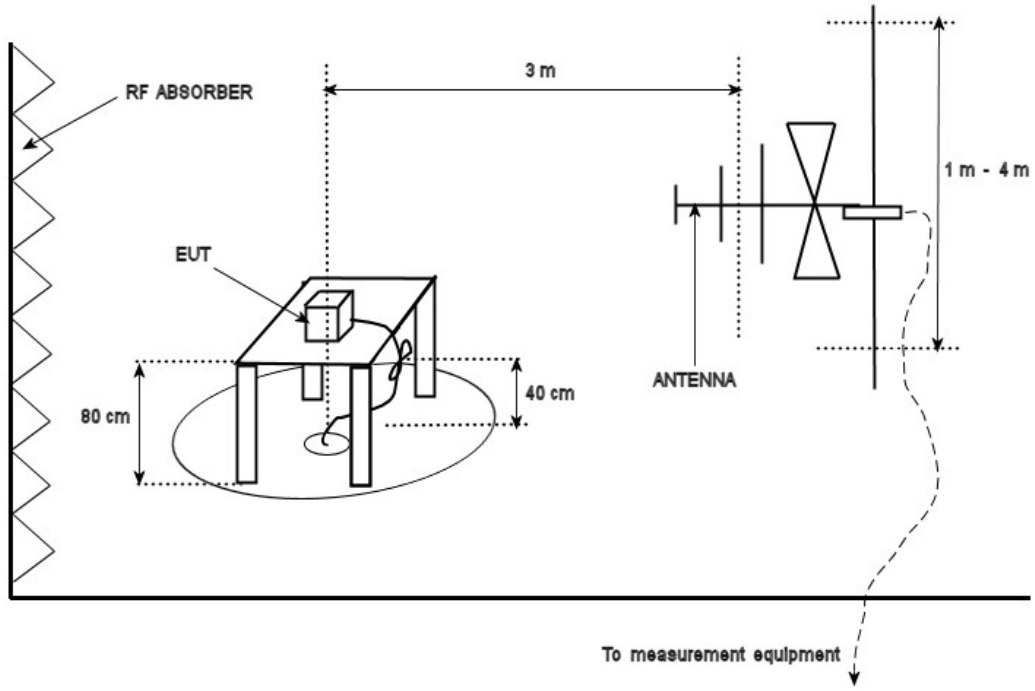
The limits, as defined in 15.247(d) for unintentional radiated emissions apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

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.

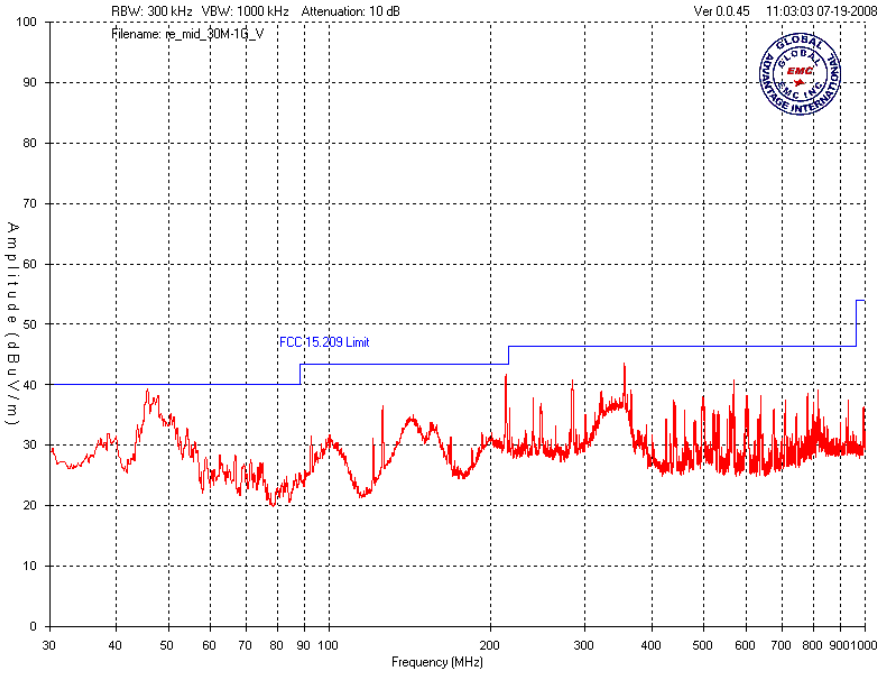
Preliminary Graphs

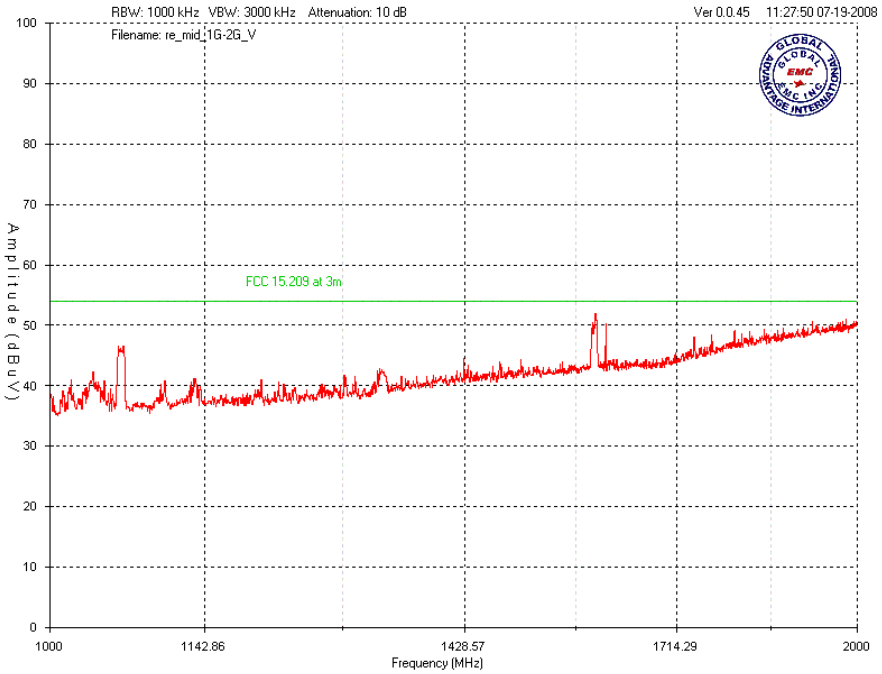
Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater then the final 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.

For the frequency range of 30 MHz to 2 GHz, High, middle and low channel operation was investigated each mode (G mode and B mode) and no observable difference was detected based on channel. The worst case, middle channel, graphs are presented for the frequency range of 30 MHz to 2 GHz for each mode.

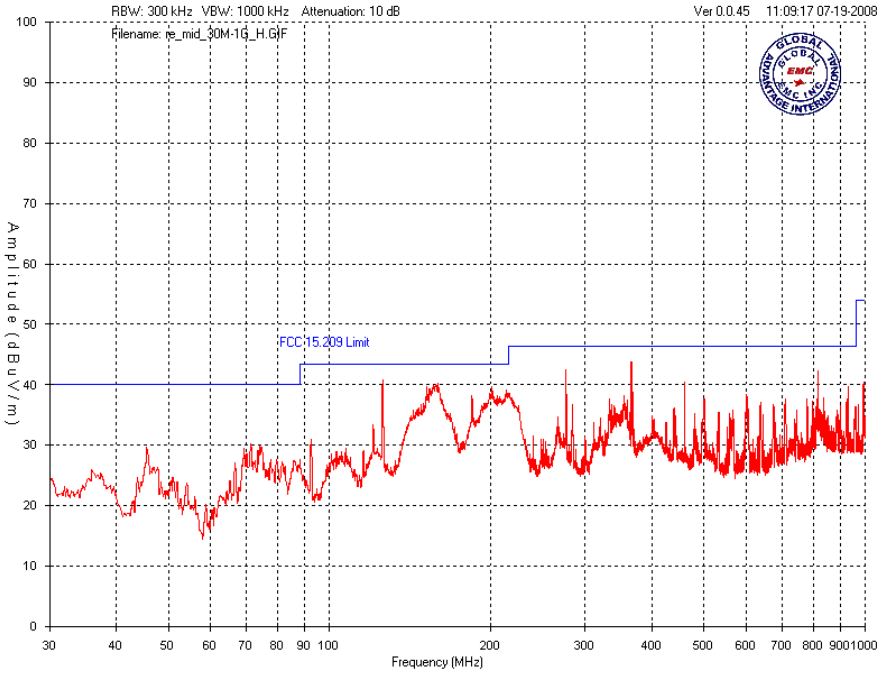
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to a minimum of a 25 GHz.

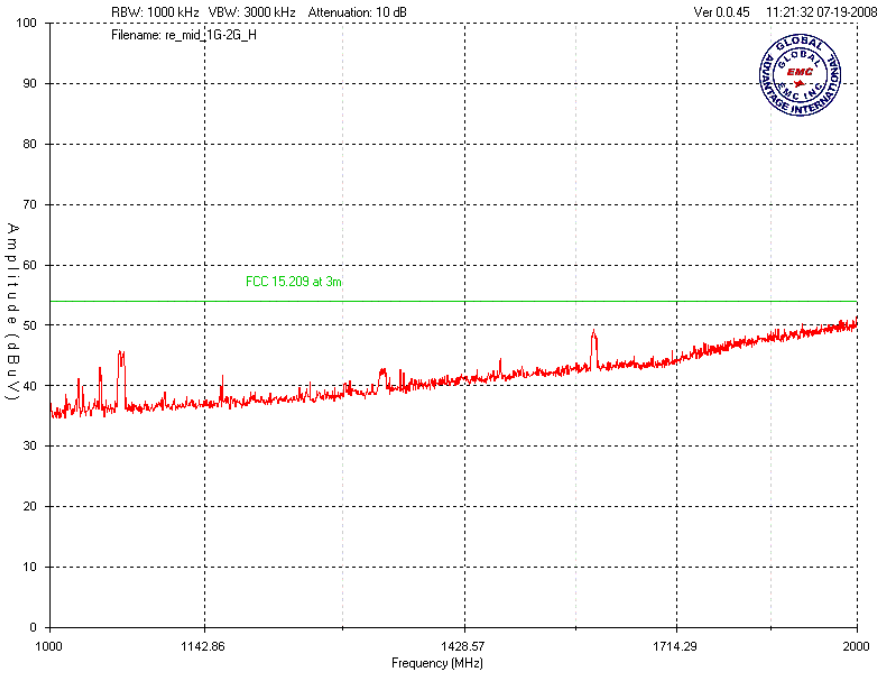
Vertical – Peak Emissions Graphs (Worst Case – B mode middle channel)



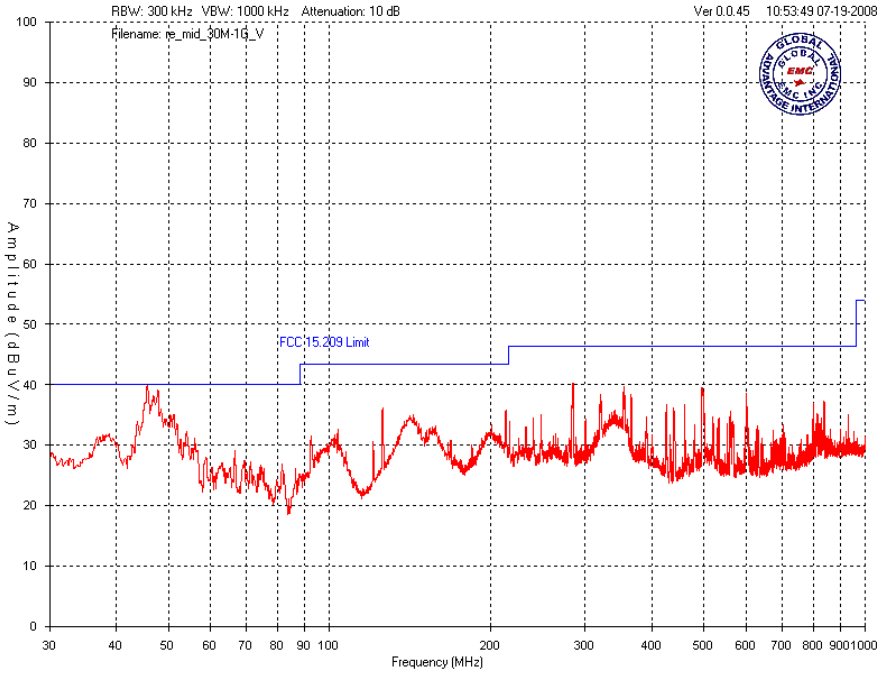


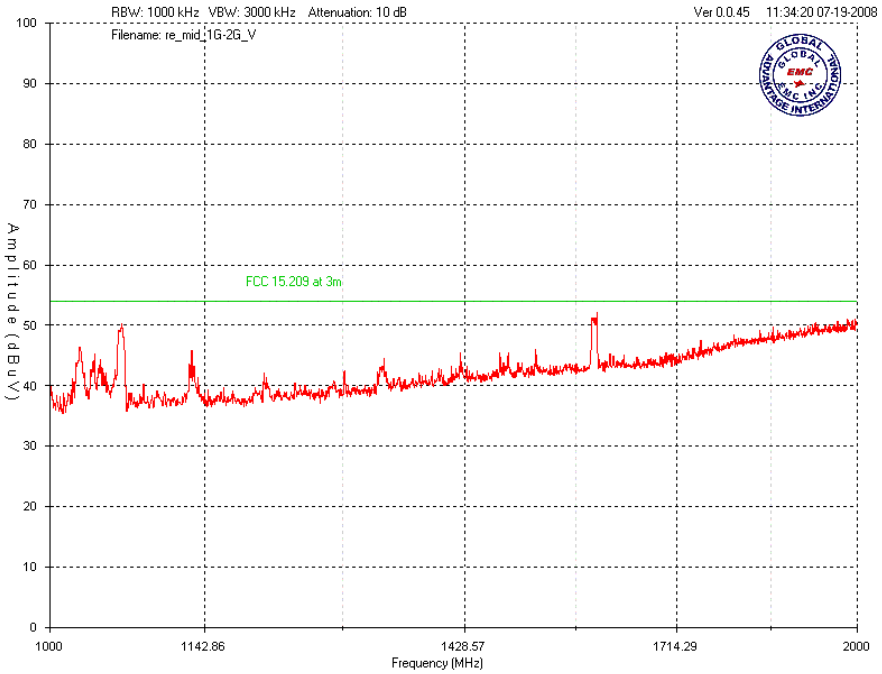
Horizontal – Peak Emissions Graphs (Worst Case – B mode middle channel)



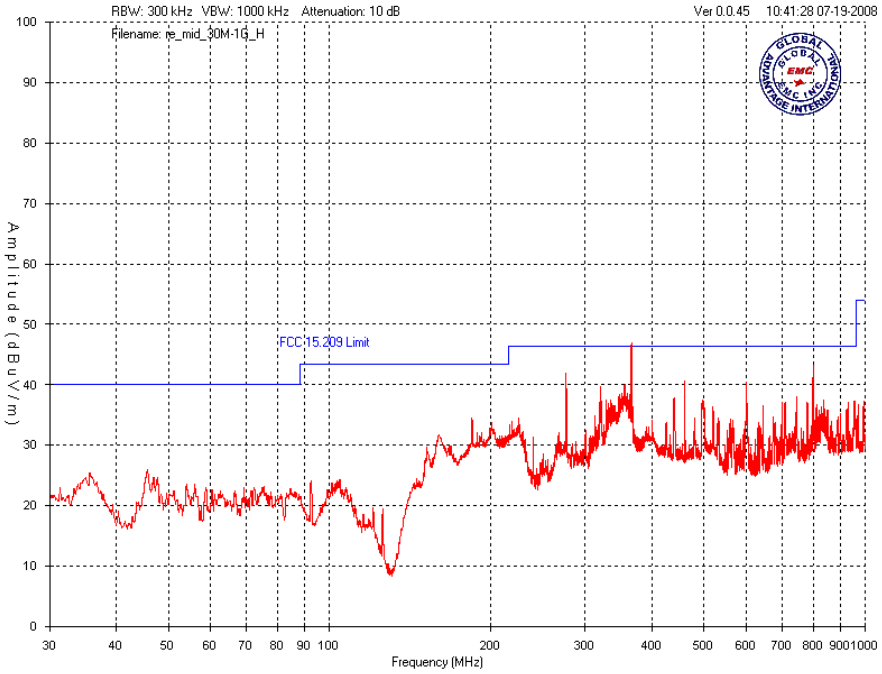


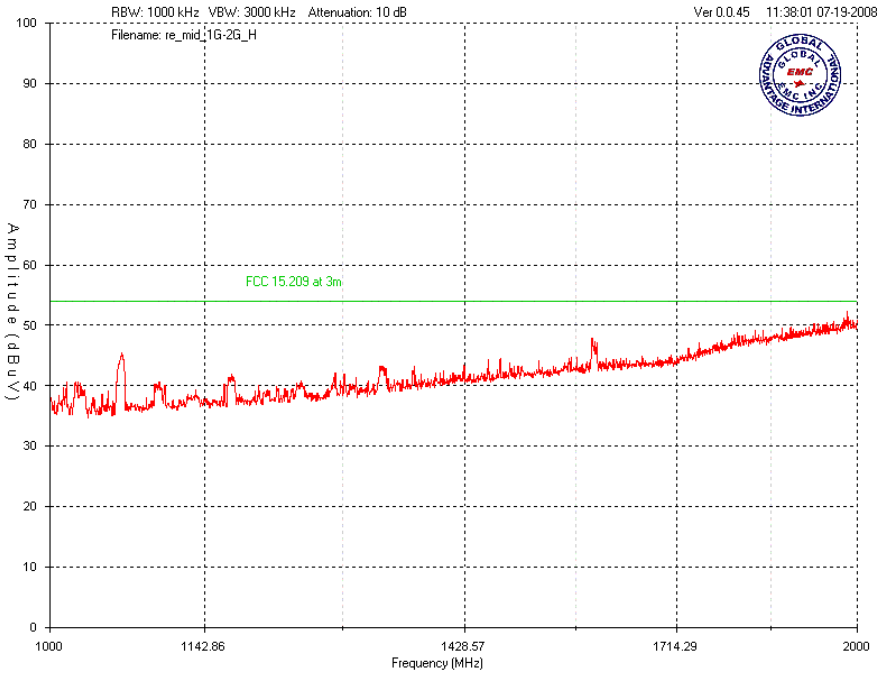
Vertical – Peak Emissions Graphs (Worst Case – G mode middle channel)



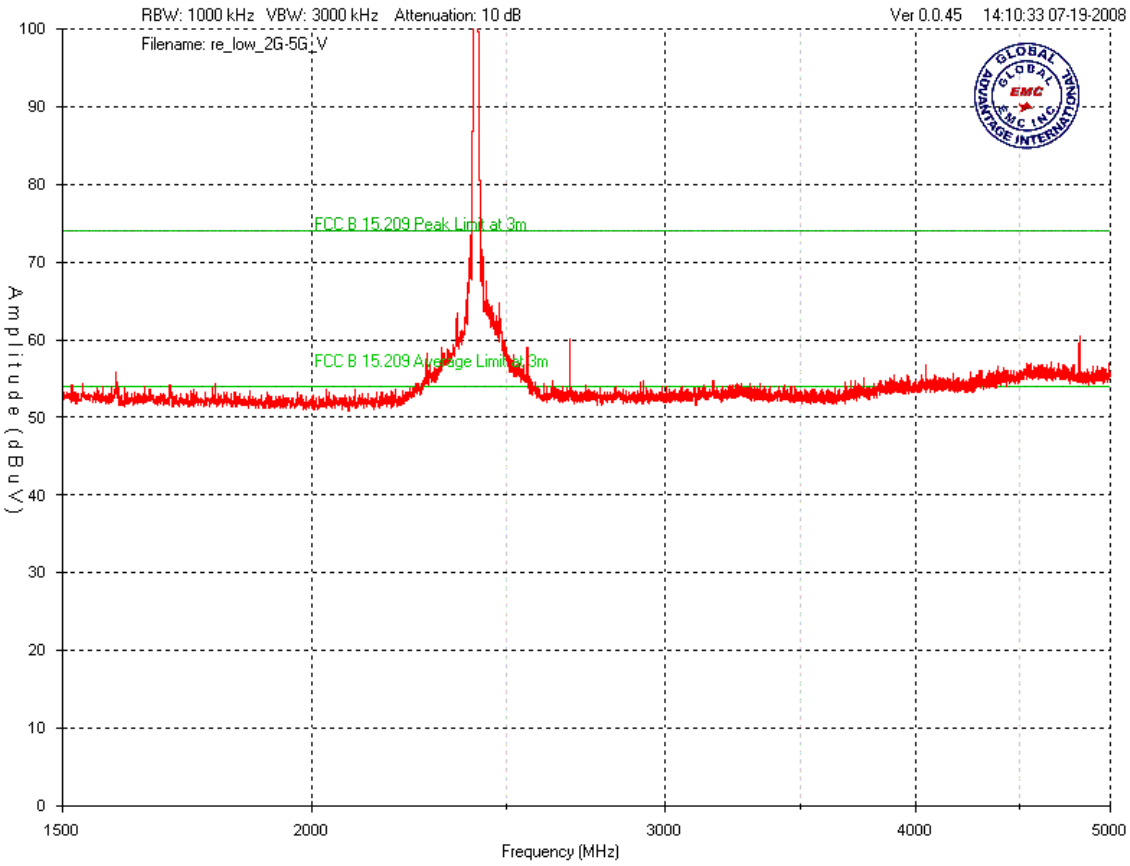


Horizontal – Peak Emissions Graphs (Worst Case – G mode middle channel)

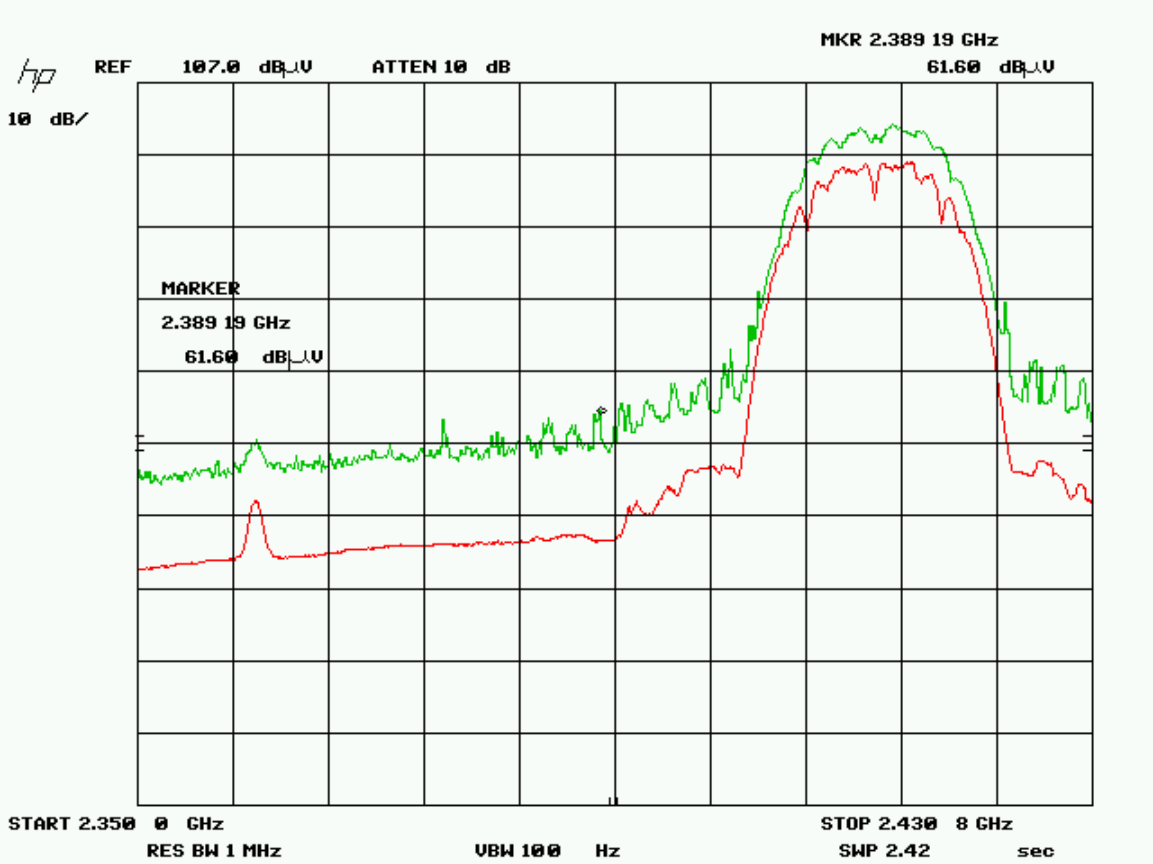




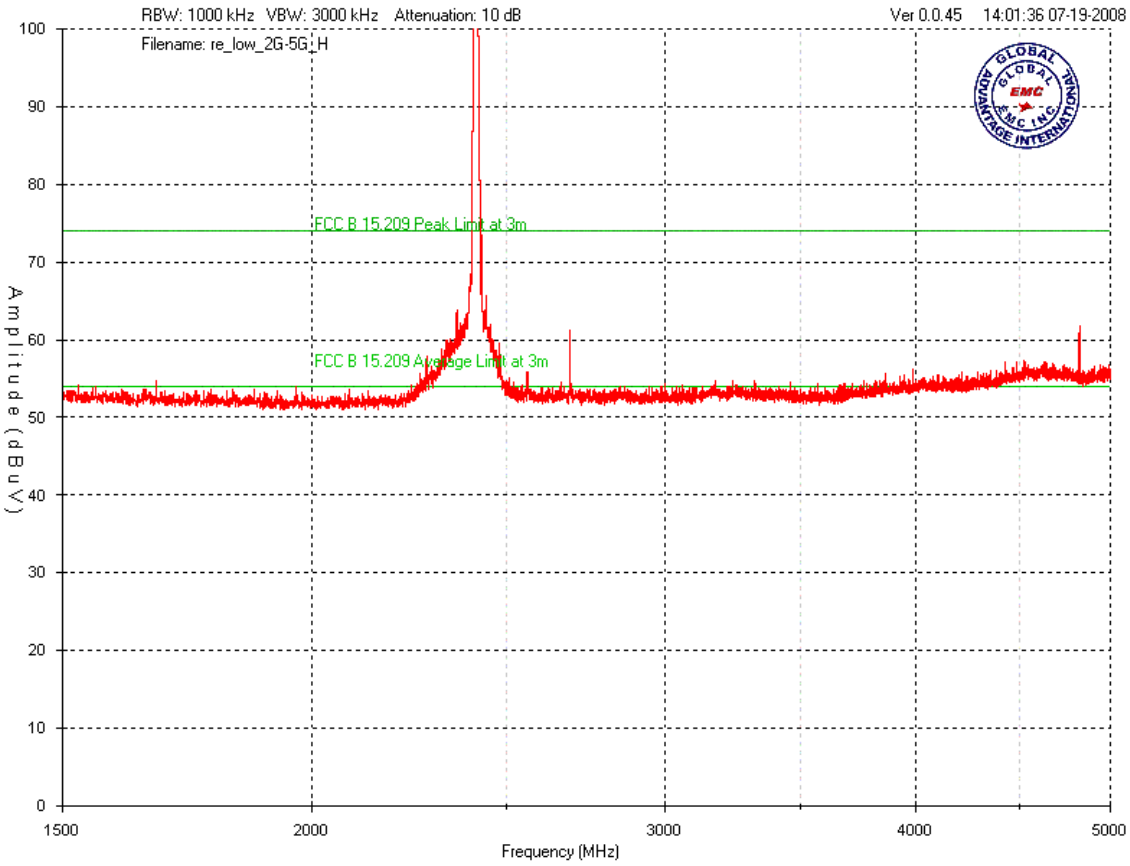
Vertical – Peak Emissions Graphs – Low Channel B mode



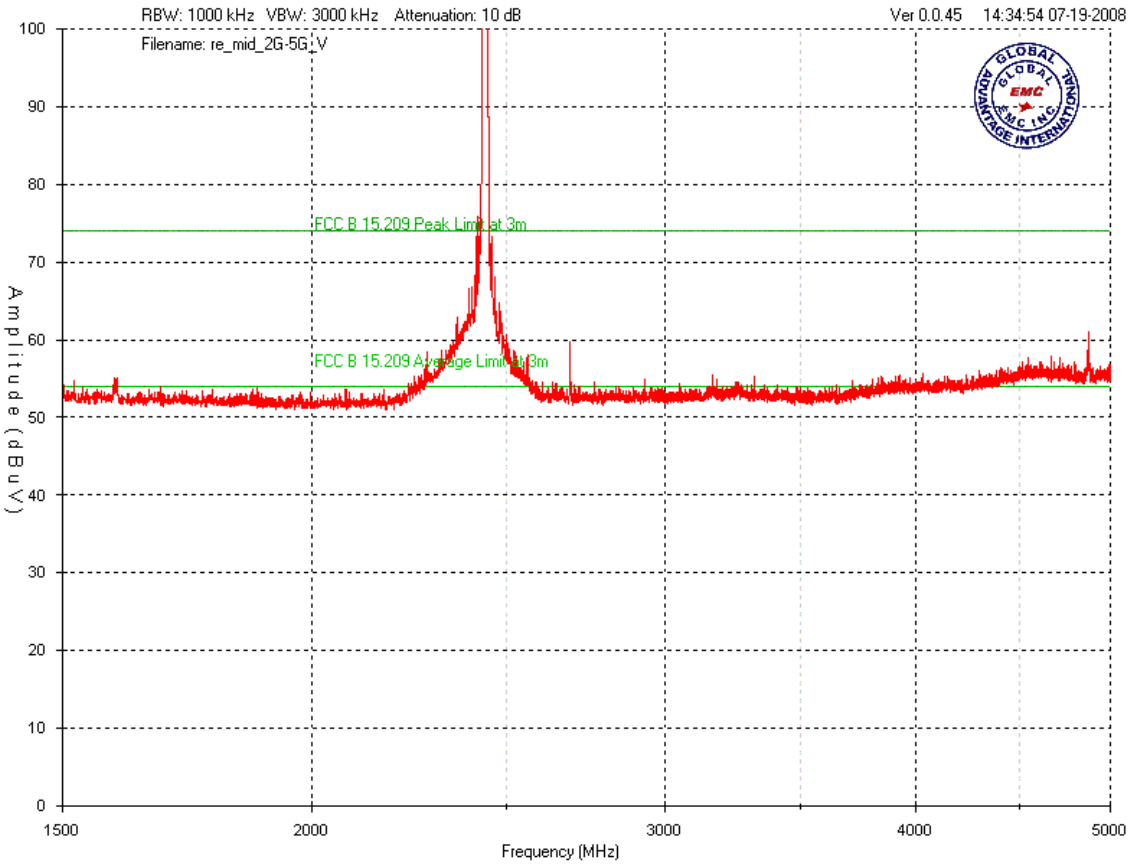
Vertical – Raw Peak Emissions Graph – Low channel B mode
(worst case low frequency radiated emissions band edge)



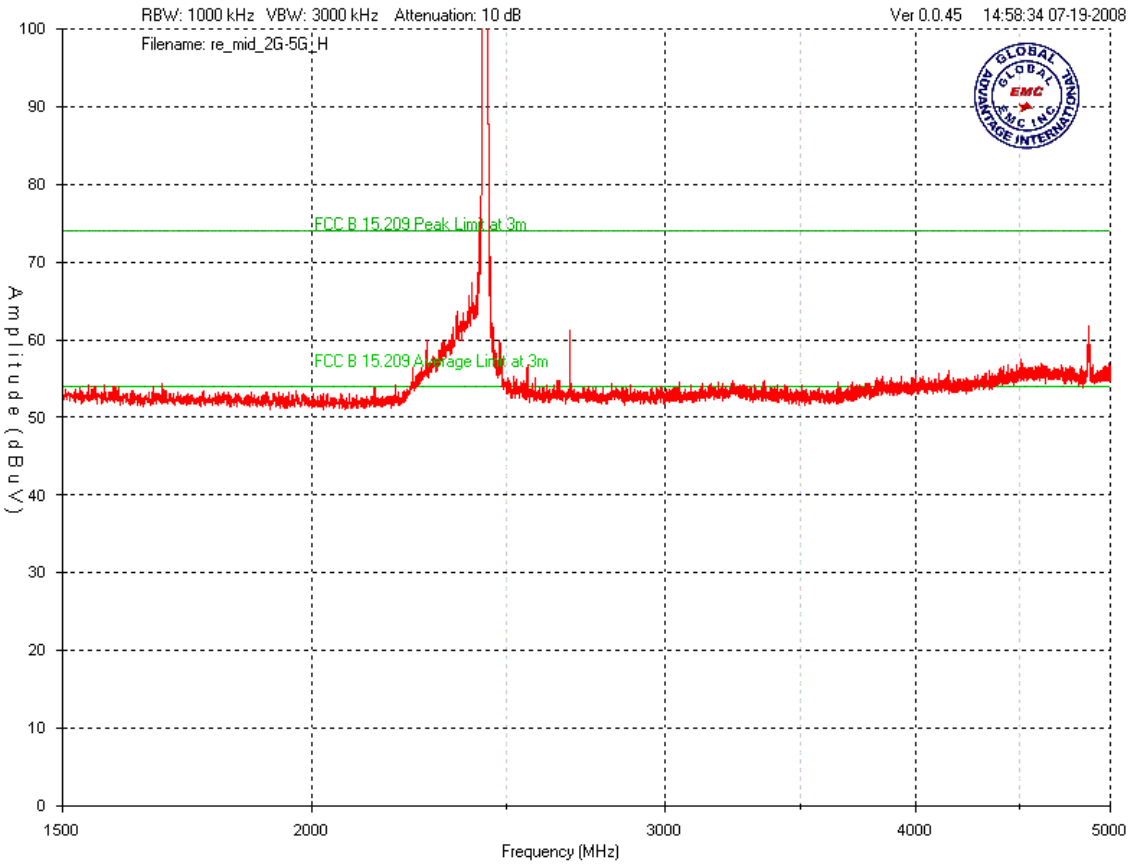
Horizontal – Peak Emissions Graph – Low Channel B mode



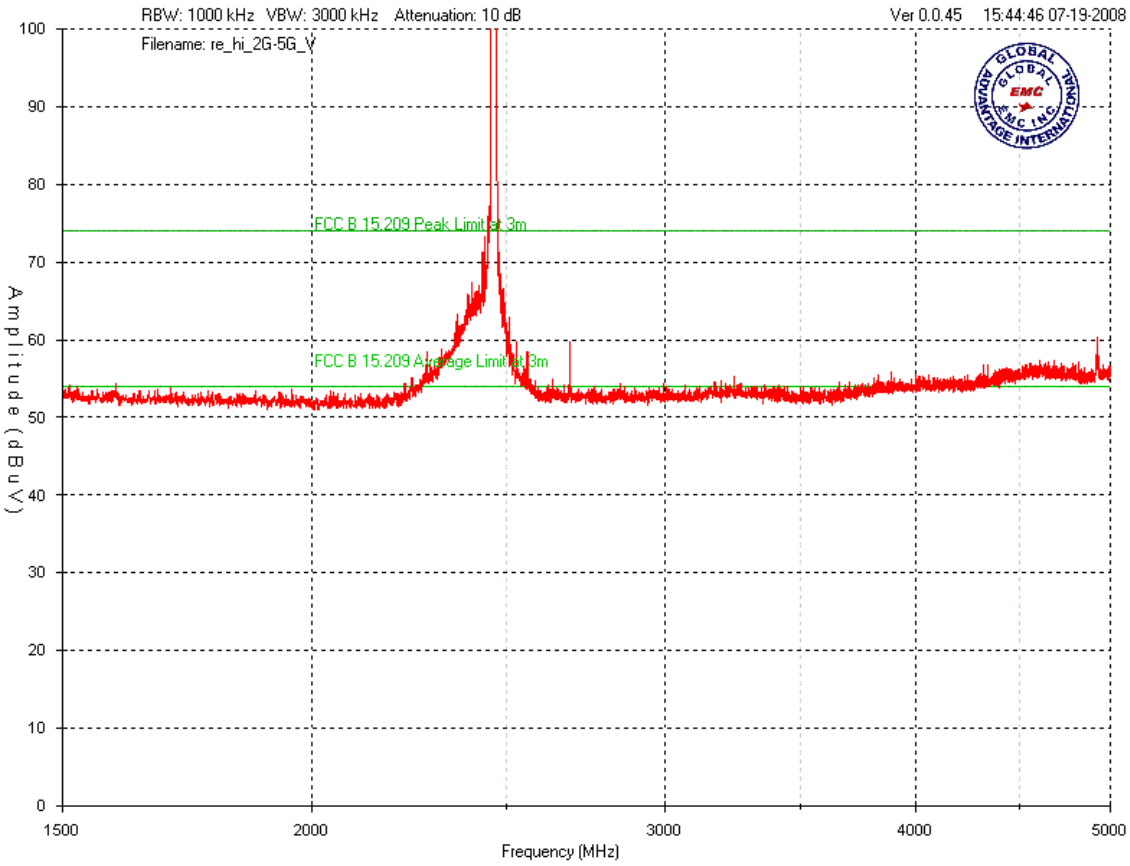
Vertical – Peak Emissions Graph – Mid Channel B mode



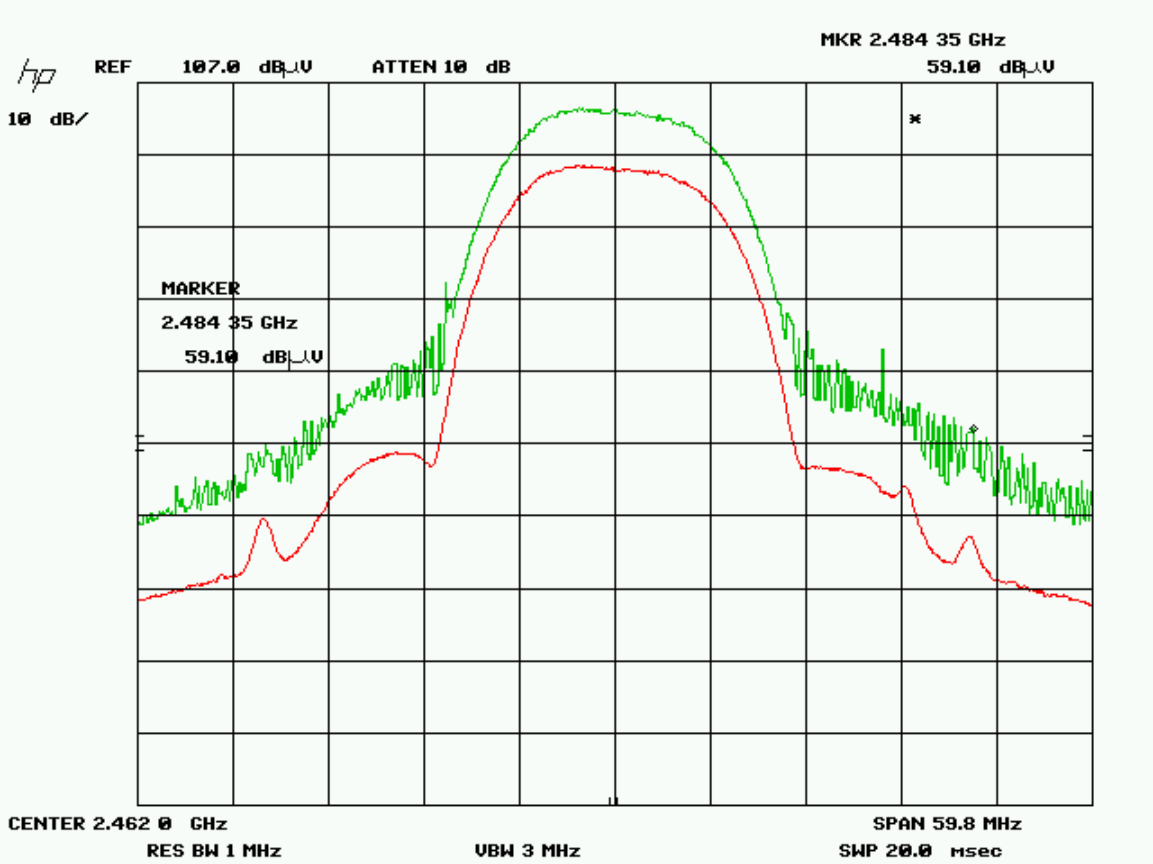
Horizontal – Peak Emissions Graph – Mid Channel B mode



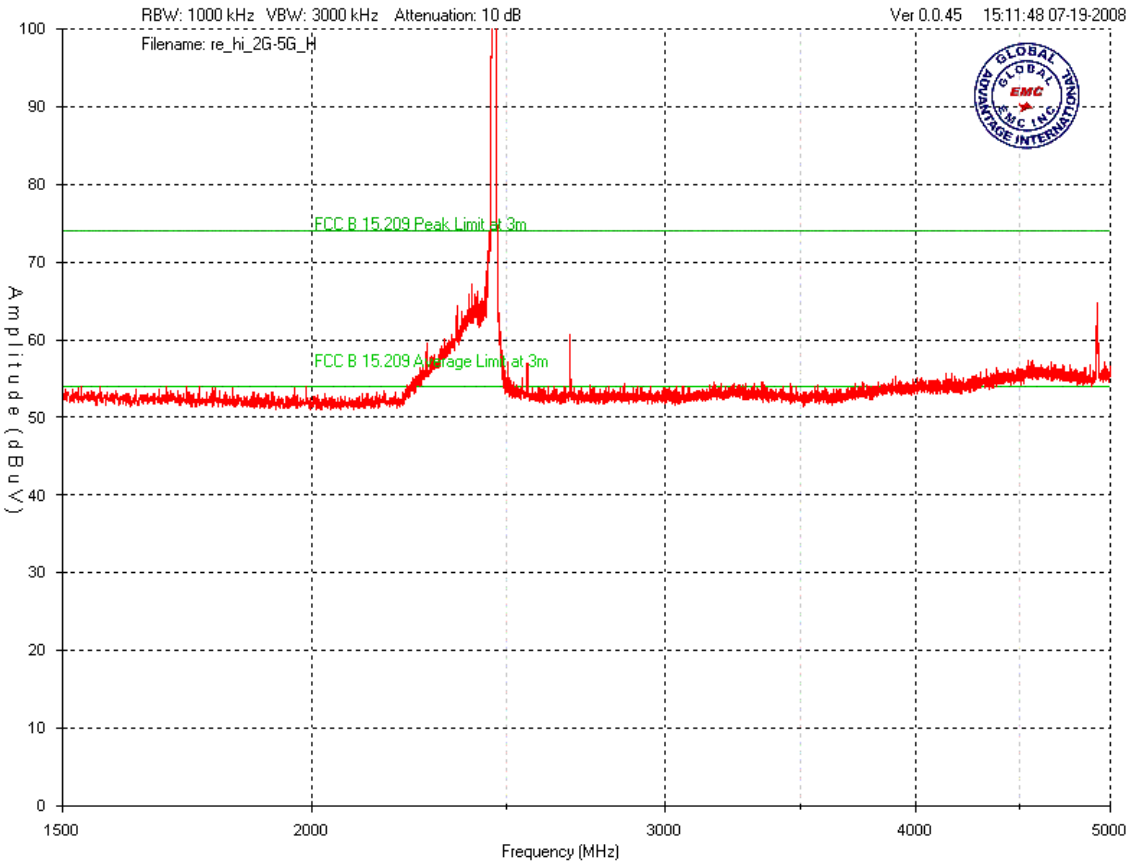
Vertical – Peak Emissions – High Channel B mode



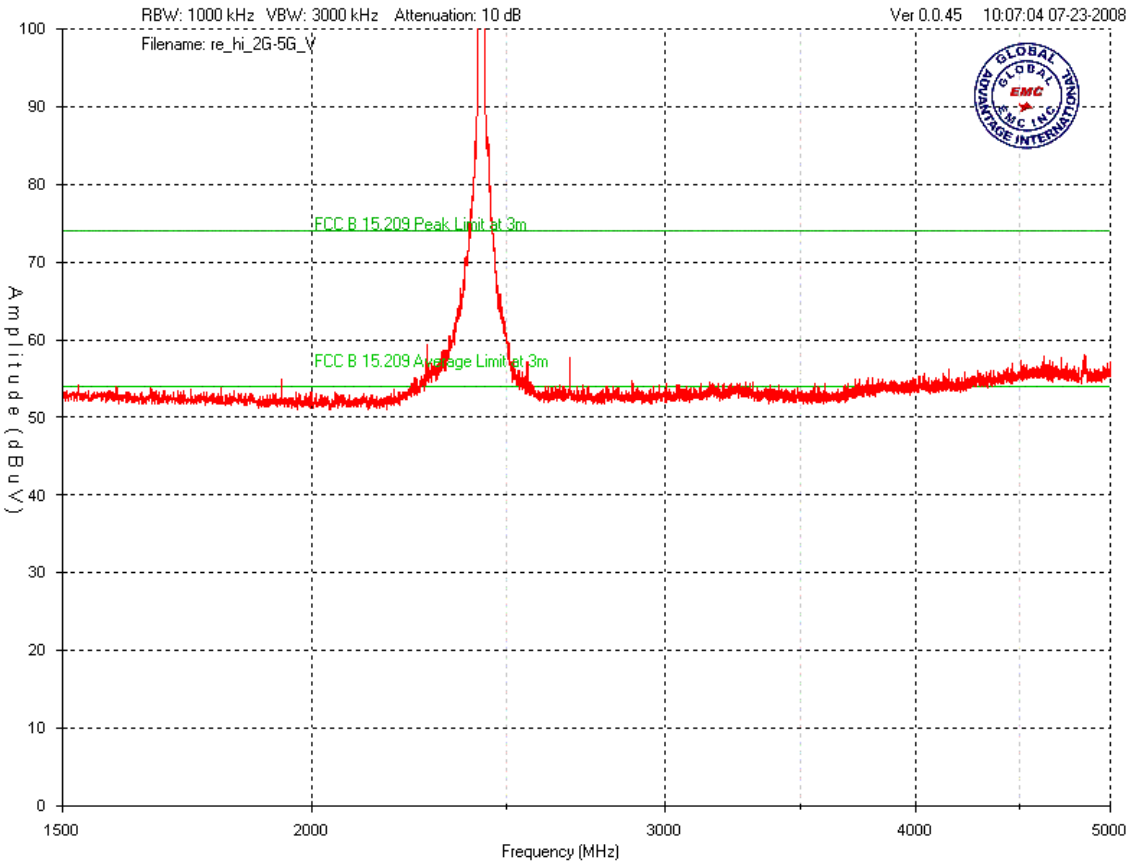
Vertical – Raw Peak Emissions Graph – High channel B mode
(worst case high frequency radiated emissions band edge)



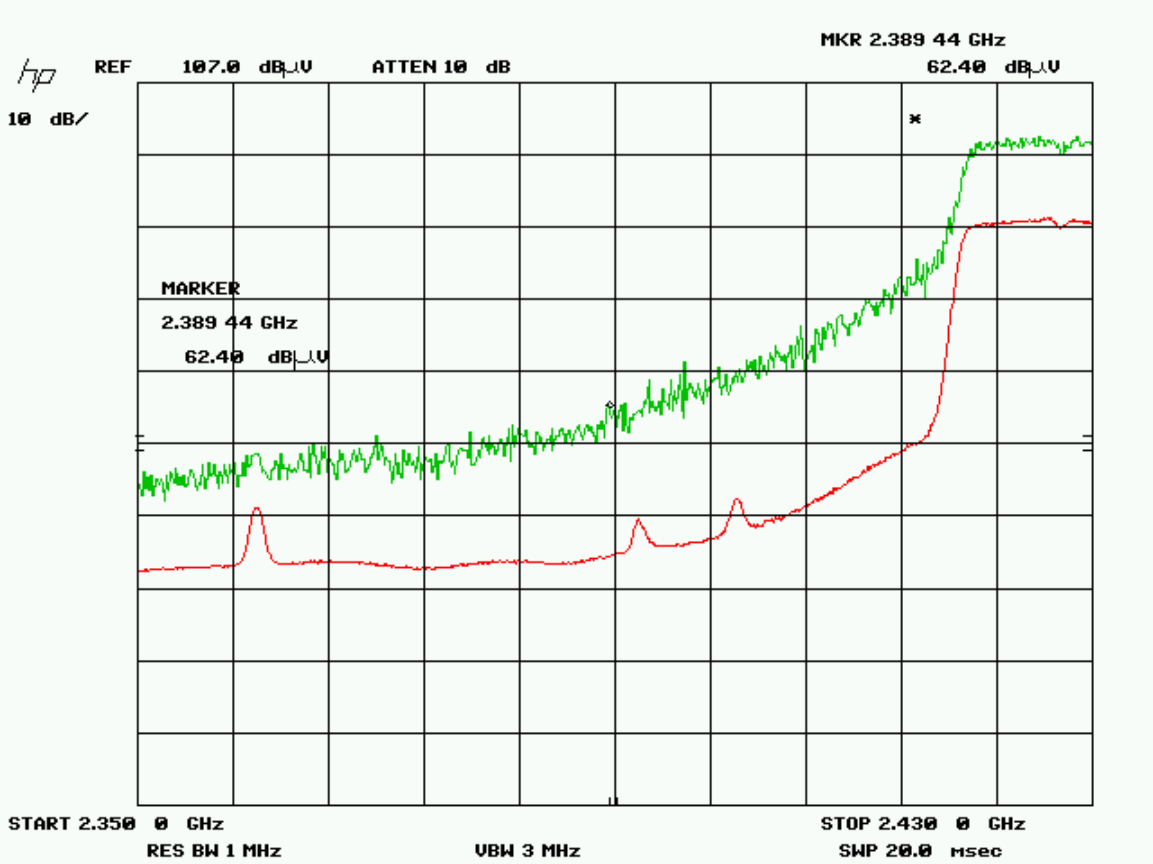
Horizontal – Peak Emissions Graph – High Channel B mode



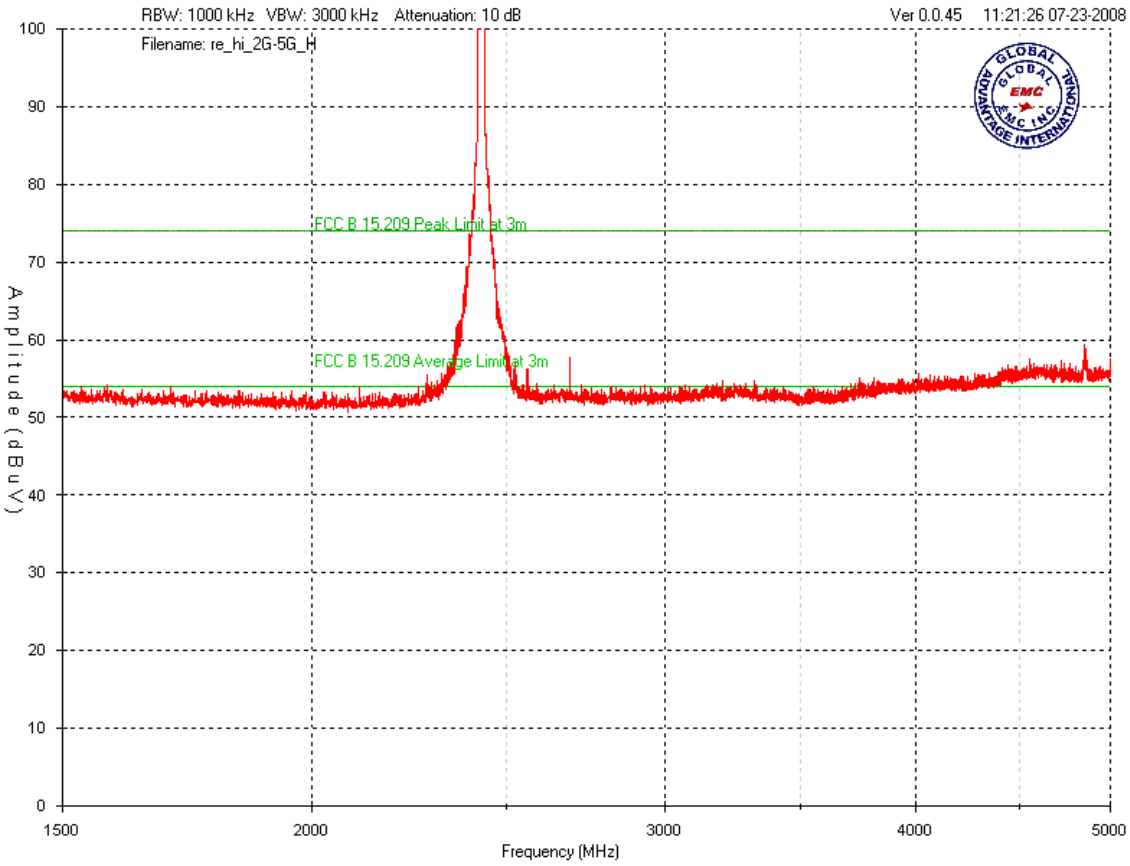
Vertical – Peak Emissions Graphs – Low Channel G mode



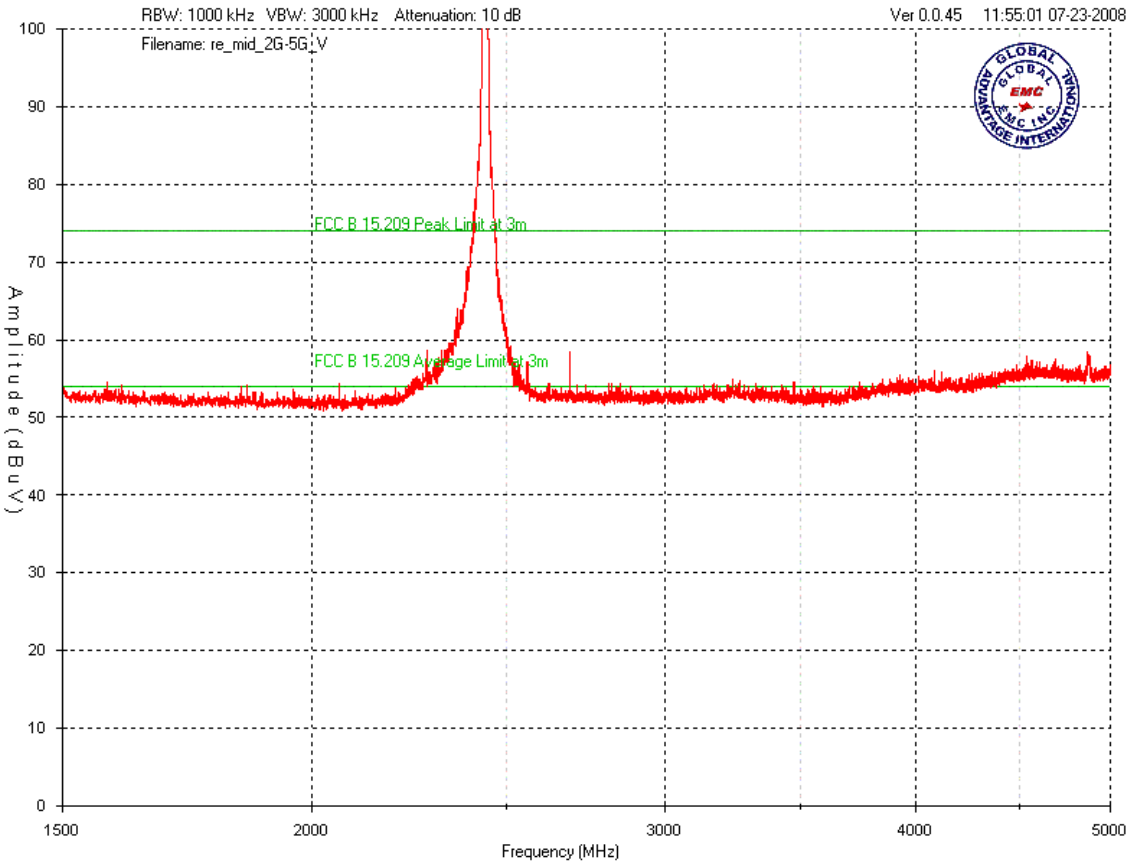
Vertical – Raw Peak Emissions Graph – Low channel G mode
(worst case low frequency radiated emissions band edge)



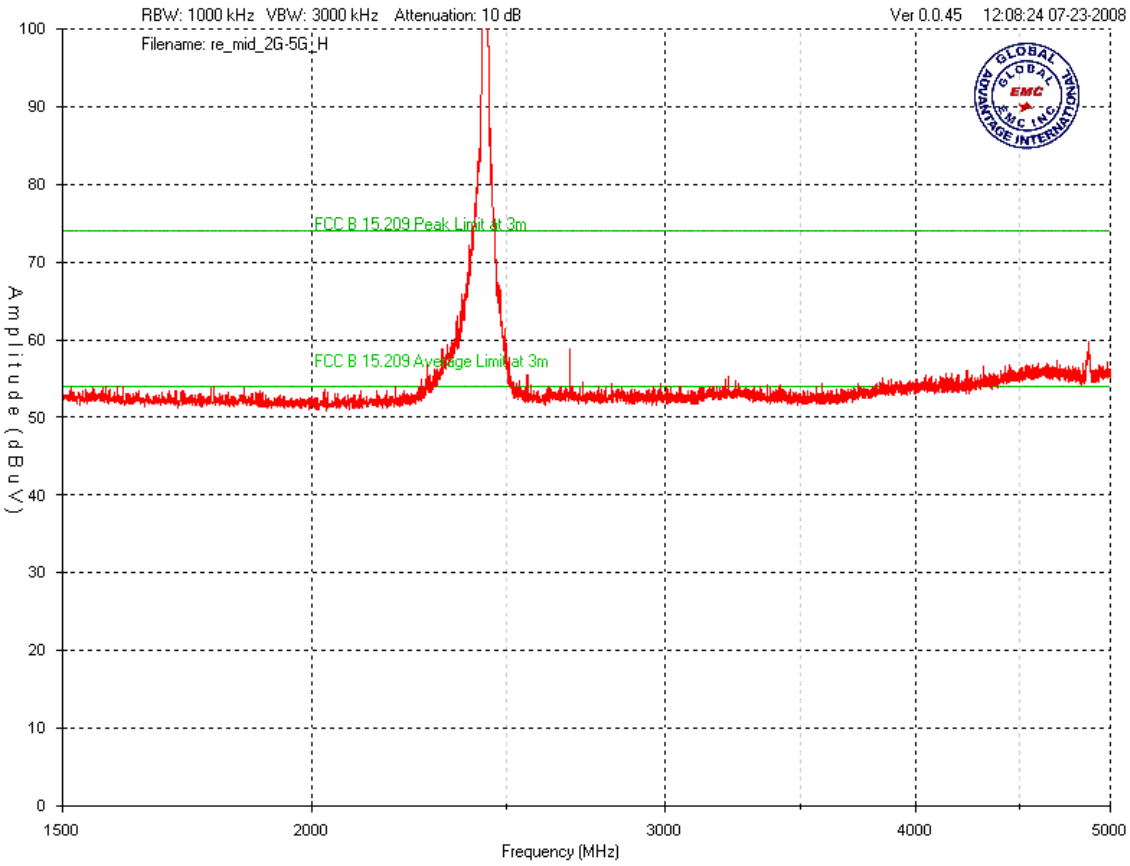
Horizontal – Peak Emissions Graph – Low Channel G mode



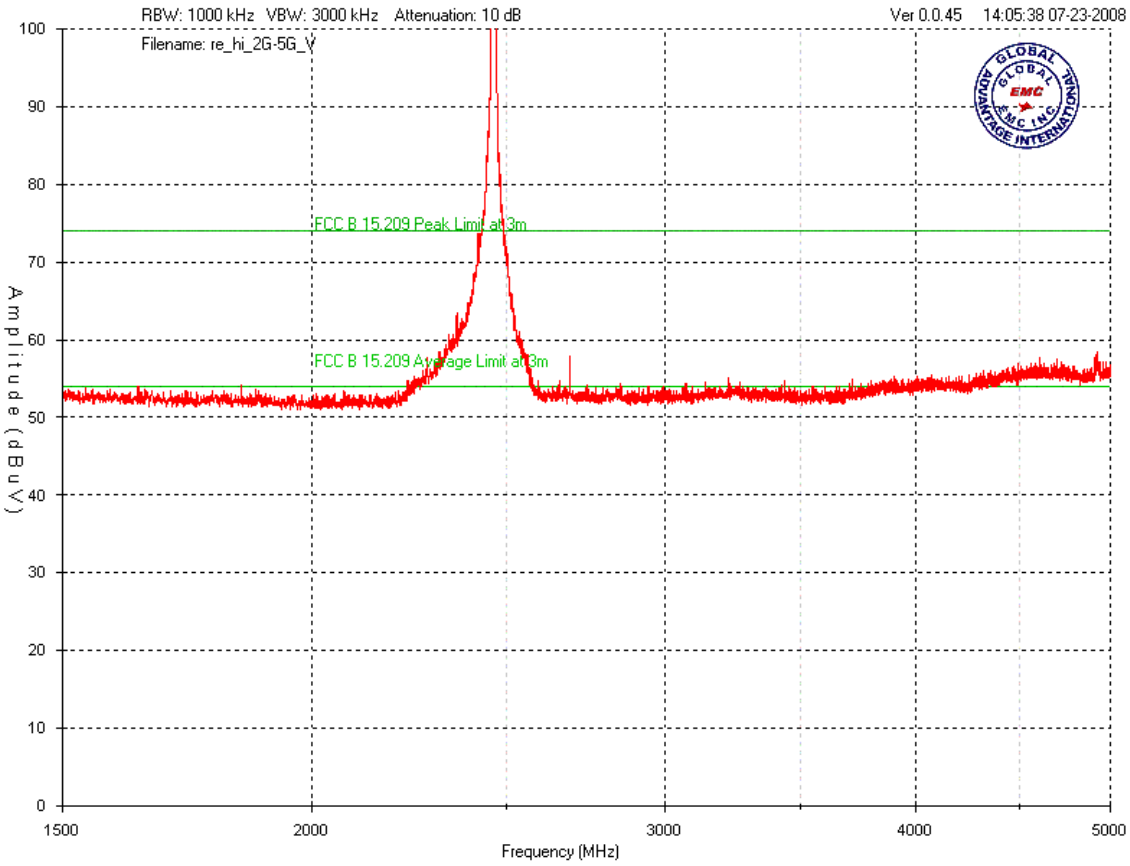
Vertical – Peak Emissions Graph – Mid Channel G mode



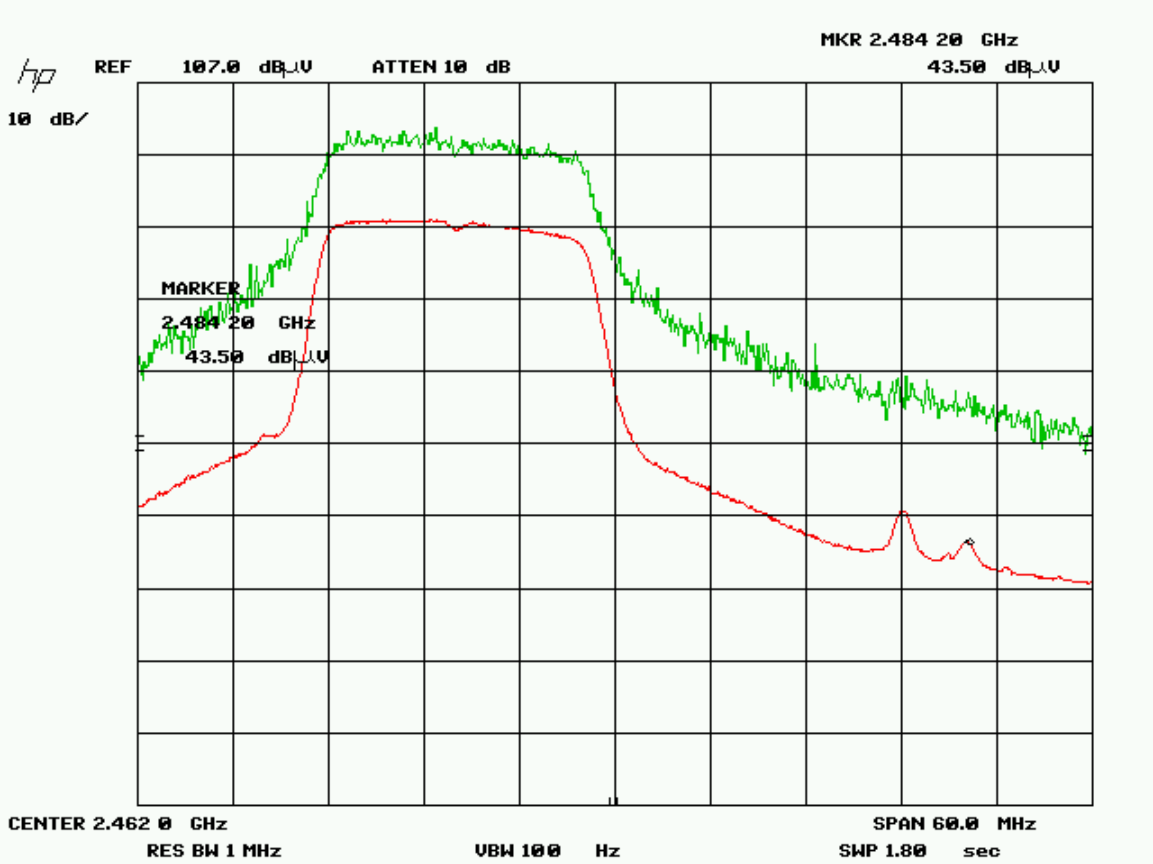
Horizontal – Peak Emissions Graph – Mid Channel G mode



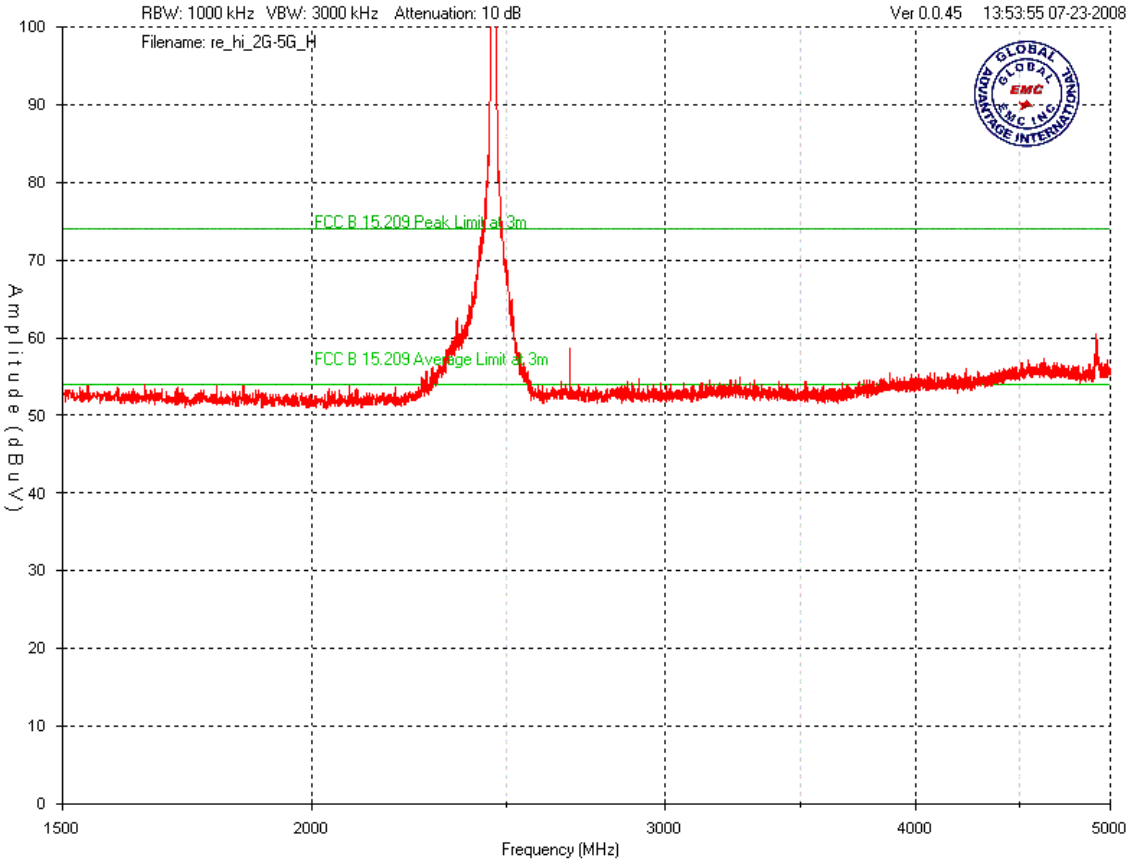
Vertical – Peak Emissions – High Channel G mode



Vertical – Raw Peak Emissions Graph – High channel G mode
(worst case high frequency radiated emissions band edge)



Horizontal – Peak Emissions Graph – High Channel G mode



Final Measurements

See below tables for the applicable Quasi-Peak and Average 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.

All spurious radiated emissions measurements were performed at the full driving power as stated by the manufacturer of the SPK-1000 system.

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 113.1 dBuV/m at 3 meters, and none of the unintentional radiated emissions that fall outside of the restricted bands exceeded the -20dBc (or 93 dBuV/m) requirement.

See 'Spurious Antenna Conducted Emissions' measurements for -20 dBc requirements.

Radiated Emissions Measurements

30 MHz to 2 GHz – B mode

Frequency (MHz)	Pol.	Reading (dBuV)	Ant Factor (dB/m)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
45.714	V	55.4	11	-32	34.4	40	5.6	PASS
213.621	V	58.4	11.1	-31.7	37.8	43.5	5.7	PASS
355.047	V	55	14.9	-31.4	38.5	46.4	7.9	PASS
284.431	V	59	13.4	-31.5	40.9	46.4	5.5	PASS
567.38	V	52.9	18.8	-30.9	40.8	46.4	5.6	PASS
125.642	V	62	6.5	-31.9	36.6	43.5	6.9	PASS
125.642	H	61.3	6.5	-31.9	35.9	43.5	7.6	PASS
366.299	H	55.1	15	-31.3	38.8	46.4	7.6	PASS
159.301	H	58.3	8.8	-31.9	35.2	43.5	8.3	PASS
200.817	H	56.1	10.4	-31.7	34.8	43.5	8.7	PASS
276.38	H	55.9	13.1	-31.6	37.4	46.4	9	PASS
815.991	H	46.6	22	-30.4	38.2	46.4	8.2	PASS

30 MHz to 2 GHz – G mode

Frequency (MHz)	Pol.	Reading (dBuV)	Ant Factor (dB/m)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
45.714	V	57.2	11	-32	36.2	40	3.8	PASS
284.819	V	53.4	13.5	-31.5	35.4	46.4	11	PASS
354.659	V	54.1	14.9	-31.4	37.6	46.4	8.8	PASS
495.309	V	47.9	18.7	-31	35.6	46.4	10.8	PASS
125.545	V	58.6	6.5	-31.9	33.2	43.5	10.3	PASS
599.293	V	45.1	19.4	-30.8	33.7	46.4	12.7	PASS
366.105	H	58.3	15	-31.3	42	46.4	4.4	PASS
799.695	H	48.1	21.6	-30.4	39.3	46.4	7.1	PASS
276.38	H	56.3	13.1	-31.6	37.8	46.4	8.6	PASS
460.292	H	50.1	17.6	-31.1	36.6	46.4	9.8	PASS
599.099	H	47.9	19.4	-30.8	36.5	46.4	9.9	PASS
355.823	H	52.5	14.9	-31.4	36	46.4	10.4	PASS

Radiated Emissions above 2 GHz – B mode

Test Frequency (MHz)	Detection mode (Q-Peak)	Antenna polarity (Horz/Vert)	Raw signal dB(µV)	Antenna factor dB	Cable loss dB + Preselecor	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB	Result
Low Channel 1											
2412	Peak	Horz	97.5	31.6	4.0	10.0	36.0	107.1			PASS
2412	Avg	Horz	92.6	31.6	4.0	10.0	36.0	102.2			PASS
2412	Peak	Vert	101.3	31.6	4.0	10.0	36.0	110.9			PASS
2412	Avg	Vert	96.0	31.6	4.0	10.0	36.0	105.6			PASS
2390	Peak	Horz	57.2	31.6	4.0	10.0	36.0	66.8	74.0	7.2	PASS
2390	Avg	Horz	39.5	31.6	4.0	10.0	36.0	49.1	54.0	4.9	PASS
2390	Peak	Vert	61.6	31.6	4.0	10.0	36.0	71.2	74.0	2.8	PASS
2390	Avg	Vert	43.6	31.6	4.0	10.0	36.0	53.2	54.0	0.8	PASS
4824	Peak	Horz	47.2	30.0	5.0	10.0	36.0	56.2	74.0	17.8	PASS
4824	Avg	Horz	36.4	30.0	5.0	10.0	36.0	45.4	54.0	8.6	PASS
4824	Peak	Vert	50.7	30.0	5.0	10.0	36.0	59.7	74.0	14.3	PASS
4824	Avg	Vert	39.2	30.0	5.0	10.0	36.0	48.2	54.0	5.8	PASS
7236	Peak	Horz	40.5	36.0	6.1	10.1	35.8	56.9	74.0	17.1	PASS
7236	Avg	Horz	29.8	36.0	6.1	10.1	35.8	46.2	54.0	7.8	PASS
7236	Peak	Vert	43.9	36.0	6.1	10.1	35.8	60.3	74.0	13.7	PASS
7236	Avg	Vert	32.1	36.0	6.1	10.1	35.8	48.5	54.0	5.5	PASS
Mid channel 6											
2437	Peak	Horz	102.3	31.6	4.0	10.0	36.0	111.9			PASS
2437	Avg	Horz	95.6	31.6	4.0	10.0	36.0	105.2			PASS
2437	Peak	Vert	102.9	31.6	4.0	10.0	36.0	112.5			PASS
2437	Avg	Vert	96.2	31.6	4.0	10.0	36.0	105.8			PASS
4874	Peak	Horz	47.2	30.0	5.0	10.0	36.0	56.2	74.0	17.8	PASS
4874	Avg	Horz	35.6	30.0	5.0	10.0	36.0	44.6	54.0	9.4	PASS
4874	Peak	Vert	48.6	30.0	5.0	10.0	36.0	57.6	74.0	16.4	PASS
4874	Avg	Vert	36.3	30.0	5.0	10.0	36.0	45.3	54.0	8.7	PASS
7311	Peak	Horz	44.1	36.0	6.1	10.1	35.8	60.5	74.0	13.5	PASS
7311	Avg	Horz	24.3	36.0	6.1	10.1	35.8	40.7	54.0	13.3	PASS
7311	Peak	Vert	43.1	36.0	6.1	10.1	35.8	59.5	74.0	14.5	PASS
7311	Avg	Vert	23.8	36.0	6.1	10.1	35.8	40.2	54.0	13.8	PASS
High channel											
2462	Peak	Horz	98.4	31.6	4.0	10.0	36.0	108.0			PASS
2462	Avg	Horz	90.5	31.6	4.0	10.0	36.0	100.1			PASS
2462	Peak	Vert	103.6	31.5	4.0	10.0	36.0	113.1			PASS
2462	Avg	Vert	95.2	31.6	4.0	10.0	36.0	104.8			PASS
2483.5	Peak	Horz	53.1	31.6	4.0	10.0	36.0	62.7	74.0	11.3	PASS
2483.5	Avg	Horz	39.1	31.6	4.0	10.0	36.0	48.7	54.0	5.3	PASS

2483.5	Peak	Vert	59.1	31.6	4.0	10.0	36.0	68.7	74.0	5.3	PASS
2483.5	Avg	Vert	43.9	31.6	4.0	10.0	36.0	53.5	54.0	0.5	PASS
4924	Peak	Horz	51.2	30.0	5.0	10.0	36.0	60.2	74.0	13.8	PASS
4924	Avg	Horz	35.2	30.0	5.0	10.0	36.0	44.2	54.0	9.8	PASS
4924	Peak	Vert	50.3	30.0	5.0	10.0	36.0	59.3	74.0	14.7	PASS
4924	Avg	Vert	34.6	30.0	5.0	10.0	36.0	43.6	54.0	10.4	PASS
7386	Peak	Horz	48.9	36.0	6.1	10.1	35.8	65.3	74.0	8.7	PASS
7386	Avg	Horz	32.1	36.0	6.1	10.1	35.8	48.5	54.0	5.5	PASS
7386	Peak	Vert	44.9	36.0	6.1	10.1	35.8	61.3	74.0	12.7	PASS
7386	Avg	Vert	30.2	36.0	6.1	10.1	35.8	46.6	54.0	7.4	PASS
2688	Peak	Horz	50.1	31.6	4.0	10.0	36.0	59.7	74.0	14.3	PASS
2688	Avg	Horz	38.1	31.6	4.0	10.0	36.0	47.7	54.0	6.3	PASS
2688	Peak	Vert	50.3	31.6	4.0	10.0	36.0	59.9	74.0	14.1	PASS
2688	Avg	Vert	44.1	31.6	4.0	10.0	36.0	53.7	54.0	0.3	PASS

Radiated Emissions above 2 GHz – G mode

Low Channel 4 2427											
2427	Peak	Horz	99.6	31.6	4.0	10.0	36.0	109.2			PASS
2427	Avg	Horz	86.3	31.6	4.0	10.0	36.0	95.9			PASS
2427	Peak	Vert	99.7	31.6	4.0	10.0	36.0	109.3			PASS
2427	Avg	Vert	86.5	31.6	4.0	10.0	36.0	96.1			PASS
2390	Peak	Horz	62.2	31.6	4.0	10.0	36.0	71.8	74.0	2.2	PASS
2390	Avg	Horz	41.3	31.6	4.0	10.0	36.0	50.9	54.0	3.1	PASS
2390	Peak	Vert	62.4	31.6	4.0	10.0	36.0	72.0	74.0	2.0	PASS
2390	Avg	Vert	41.8	31.6	4.0	10.0	36.0	51.4	54.0	2.6	PASS
4854	Peak	Horz	45.9	30.0	5.0	10.0	36.0	54.9	74.0	19.1	PASS
4854	Avg	Horz	30.6	30.0	5.0	10.0	36.0	39.6	54.0	14.4	PASS
4854	Peak	Vert	46.4	30.0	5.0	10.0	36.0	55.4	74.0	18.6	PASS
4854	Avg	Vert	31.1	30.0	5.0	10.0	36.0	40.1	54.0	13.9	PASS
7281	Peak	Horz	46.2	36.0	6.1	10.1	35.8	62.6	74.0	11.4	PASS
7281	Avg	Horz	32.1	36.0	6.1	10.1	35.8	48.5	54.0	5.5	PASS
7281	Peak	Vert	48.1	36.0	6.1	10.1	35.8	64.5	74.0	9.5	PASS
7281	Avg	Vert	34.2	36.0	6.1	10.1	35.8	50.6	54.0	3.4	PASS
2360	Peak	Horz	51.4	31.6	4.0	10.0	36.0	61.0	74.0	13.0	PASS
2360	Avg	Horz	41.5	31.6	4.0	10.0	36.0	51.1	54.0	2.9	PASS
2360	Peak	Vert	51.8	31.6	4.0	10.0	36.0	61.4	74.0	12.6	PASS
2360	Avg	Vert	42.7	31.6	4.0	10.0	36.0	52.3	54.0	1.7	PASS
Mid channel 6											
2437	Peak	Horz	100.9	31.6	4.0	10.0	36.0	110.5			PASS
2437	Avg	Horz	90.3	31.6	4.0	10.0	36.0	99.9			PASS
2437	Peak	Vert	102.5	31.6	4.0	10.0	36.0	112.1			PASS
2437	Avg	Vert	91.2	31.6	4.0	10.0	36.0	100.8			PASS
4874	Peak	Horz	47.3	30.0	5.0	10.0	36.0	56.3	74.0	17.7	PASS

4874	Avg	Horz	34.0	30.0	5.0	10.0	36.0	43.0	54.0	11.0	PASS
4874	Peak	Vert	48.4	30.0	5.0	10.0	36.0	57.4	74.0	16.6	PASS
4874	Avg	Vert	35.2	30.0	5.0	10.0	36.0	44.2	54.0	9.8	PASS
7311	Peak	Horz	46.3	36.0	6.1	10.1	35.8	62.7	74.0	11.3	PASS
7311	Avg	Horz	34.1	36.0	6.1	10.1	35.8	50.5	54.0	3.5	PASS
7311	Peak	Vert	47.1	36.0	6.1	10.1	35.8	63.5	74.0	10.5	PASS
7311	Avg	Vert	35.8	36.0	6.1	10.1	35.8	52.2	54.0	1.8	PASS
High channel 9 2452											
2452	Peak	Horz	100.7	31.6	4.0	10.0	36.0	110.3			PASS
2452	Avg	Horz	88.9	31.6	4.0	10.0	36.0	98.5			PASS
2452	Peak	Vert	101.3	31.5	4.0	10.0	36.0	110.8			PASS
2452	Avg	Vert	89.8	31.6	4.0	10.0	36.0	99.4			PASS
2483.5	Peak	Horz	63.1	31.6	4.0	10.0	36.0	72.7	74.0	1.3	PASS
2483.5	Avg	Horz	42.6	31.6	4.0	10.0	36.0	52.2	54.0	1.8	PASS
2483.5	Peak	Vert	64.0	31.6	4.0	10.0	36.0	73.6	74.0	0.4	PASS
2483.5	Avg	Vert	43.5	31.6	4.0	10.0	36.0	53.1	54.0	0.9	PASS
4904	Peak	Horz	46.9	30.0	5.0	10.0	36.0	55.9	74.0	18.1	PASS
4904	Avg	Horz	32.6	30.0	5.0	10.0	36.0	41.6	54.0	12.4	PASS
4904	Peak	Vert	47.0	30.0	5.0	10.0	36.0	56.0	74.0	18.0	PASS
4904	Avg	Vert	33.5	30.0	5.0	10.0	36.0	42.5	54.0	11.5	PASS
7356	Peak	Horz	45.6	36.0	6.1	10.1	35.8	62.0	74.0	12.0	PASS
7356	Avg	Horz	33.2	36.0	6.1	10.1	35.8	49.6	54.0	4.4	PASS
7356	Peak	Vert	46.5	36.0	6.1	10.1	35.8	62.9	74.0	11.1	PASS
7356	Avg	Vert	34.0	36.0	6.1	10.1	35.8	50.4	54.0	3.6	PASS
2688	Peak	Horz	50.9	31.6	4.0	10.0	36.0	60.5	74.0	13.5	PASS
2688	Avg	Horz	43.2	31.6	4.0	10.0	36.0	52.8	54.0	1.2	PASS
2688	Peak	Vert	51.5	31.6	4.0	10.0	36.0	61.1	74.0	12.9	PASS
2688	Avg	Vert	44.2	31.6	4.0	10.0	36.0	53.8	54.0	0.2	PASS

Note: Radiated emissions measurements above 5 GHz were performed at a 1 meter test distance, and in accordance with FCC 15.31(f)(1) an extrapolation factor of 9.5 dB was applied. No emissions above the 3rd harmonic were detected at 1 meter. The system noise floor at the 10th harmonic was approximately 12 dB at 1m.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2008-02-28	2010-02-28	GEMC 6
Quasi Peak Adapter	85650A	HP	2008-02-28	2010-02-28	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”

6dB 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

The Limit is as specified in FCC Part 15 and RSS 210.

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.

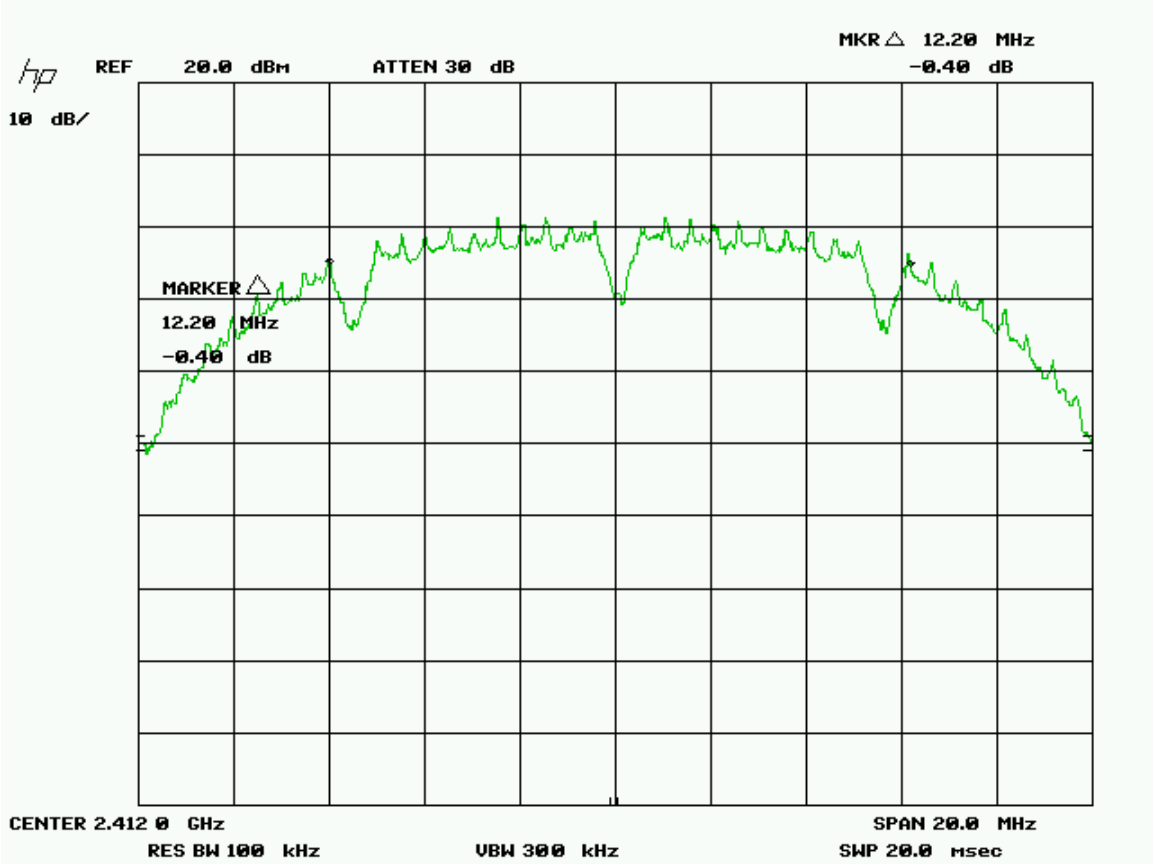
Results

The EUT passed. The 6 dB BW measured was

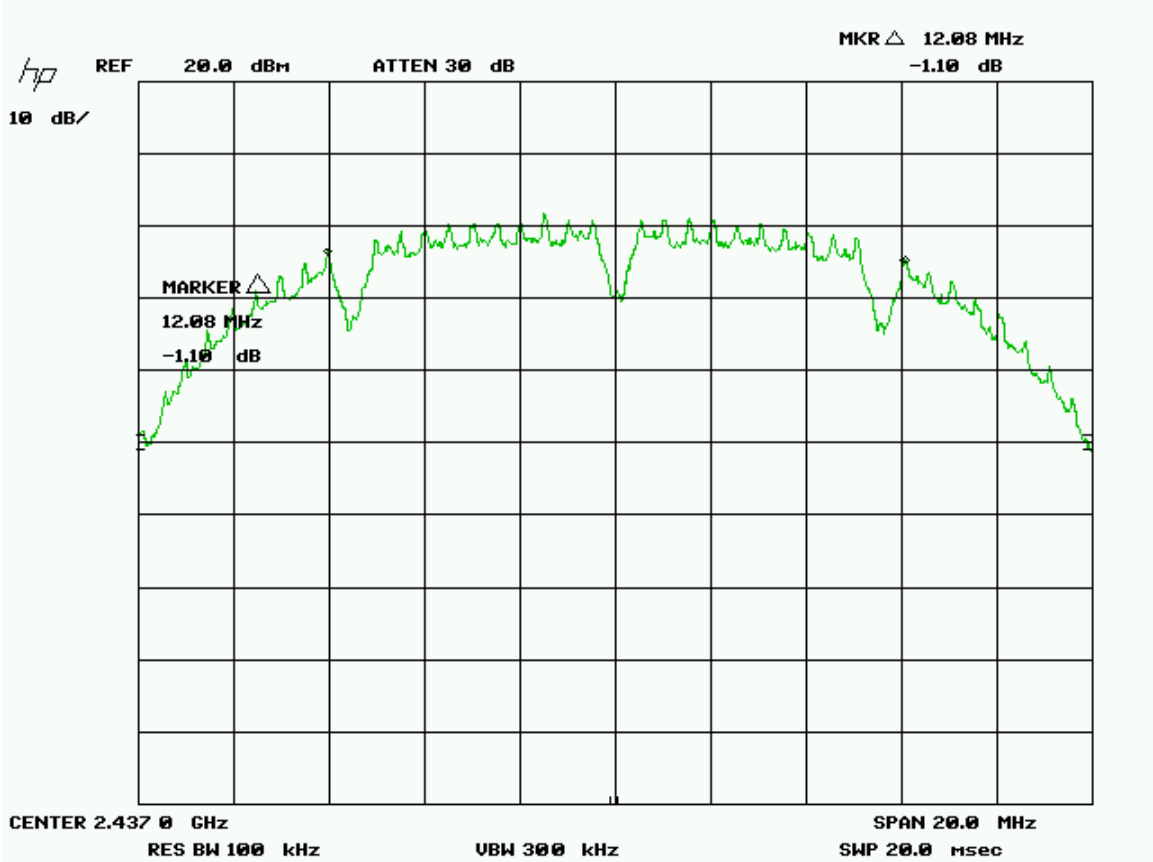
Graph(s)

The graphs shown below shows the 6 dB bandwidth during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 6 dB bandwidth of a channel during operation of the EUT. This measurement is a peak measurement. Max hold is performed for a duration of not less then 1 minute.

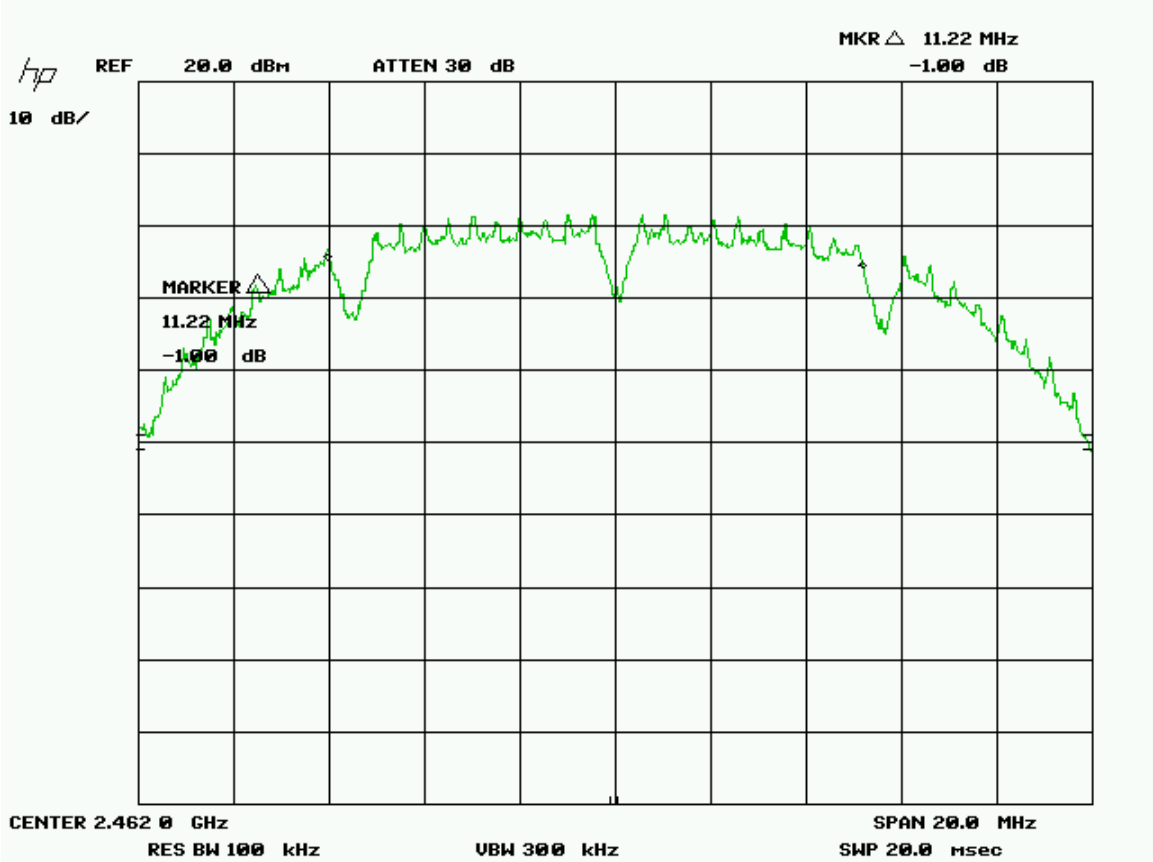
Low Channel – B mode



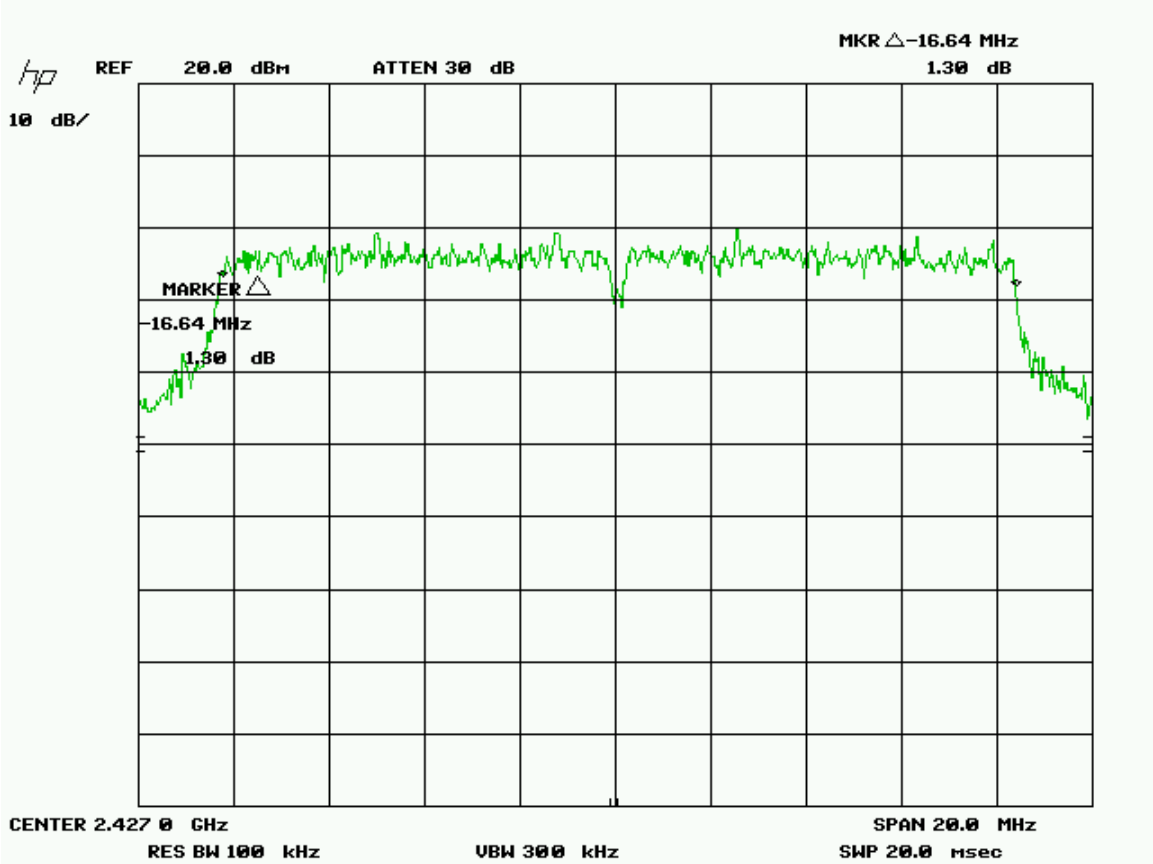
Mid Channel – B mode



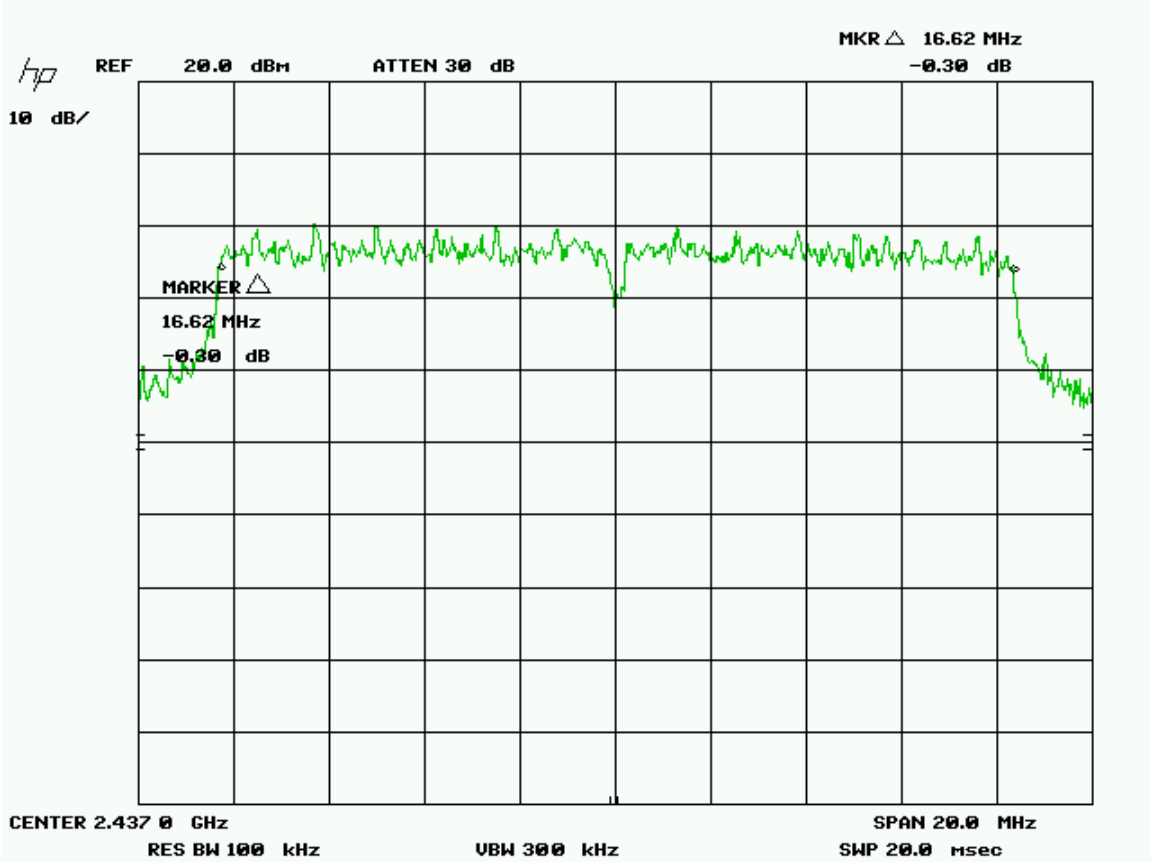
High Channel – B mode



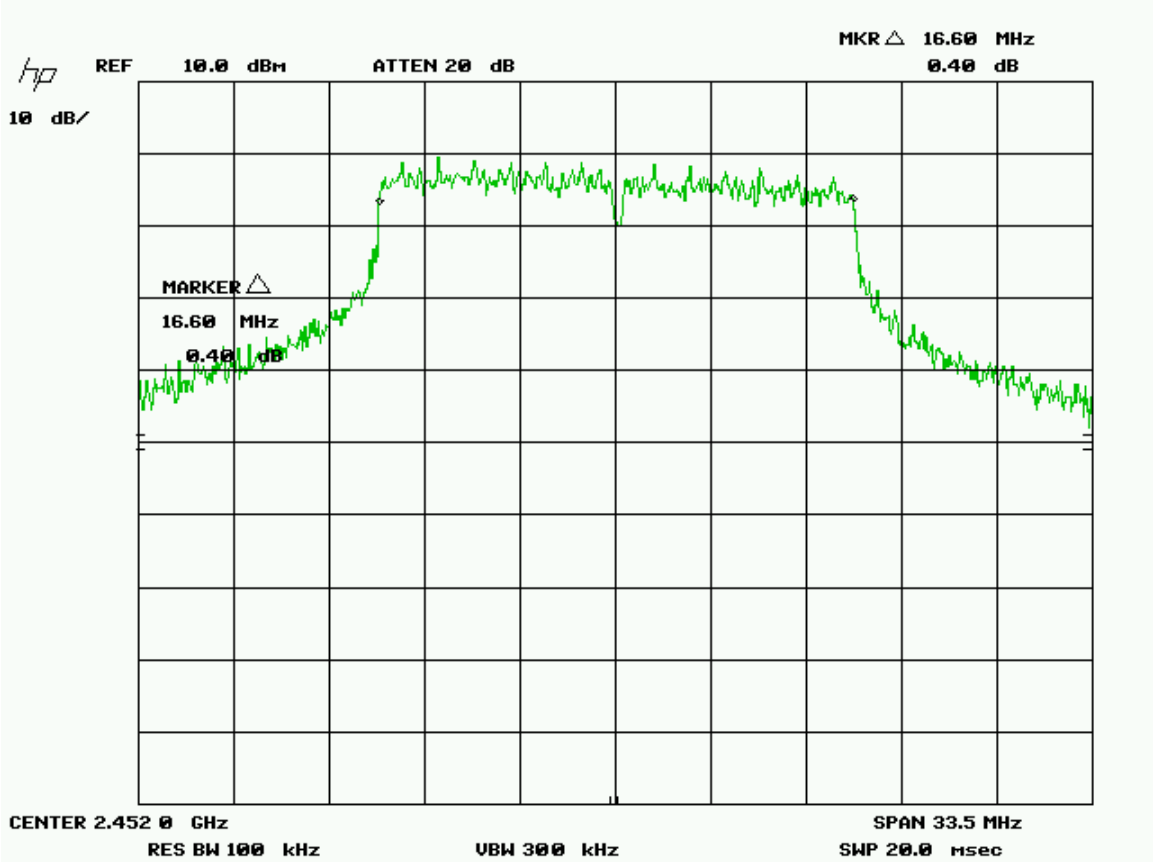
Low Channel – G mode



Mid Channel – G mode



High Channel – G mode



Test Results

Pass. Worst case, or minimum 6 dB bandwidth was 11.22 MHz. The maximum 6 dB bandwidth was 16.64 MHz. 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	2008-02-28	2010-02-28	GEMC 6
Quasi Peak Adapter	85650A	HP	2008-02-28	2010-02-28	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 FCC Part 15.247(b) and RSS 210.
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 output of the BSTR-1000 amplifier measured was 17.1 dBm (51.3 mW), in G mode, with the full driving power allowed as stated by the manufacturer of the SPK-1000 system

Note the peak power output of the DWL-2200AP intentional radiator measured was 2.3 dBm under a setting of 0dBm in G mode. This is the full driving power as stated by the manufacturer of the SPK-1000 system.

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.

BSTR-1000 'External Amplifier' Output

G mode							
Channel	Frequency (GHz)	Reading (dBm)	Factor (dB)	Ant factor above 6 dBi	Output Power (dBm)	Limit dBm	Pass/Fail
Low	2.427	-6.6	20	2	13.4	28	Pass
Medium	2.437	-6.2	20	2	13.8	28	Pass
High	2.452	-6.9	20	2	13.1	28	Pass
B mode							
Channel	Frequency (GHz)	Reading (dBm)	Factor (dB)		Output Power (dBm)		
Low	2.412	-7.7	20	2	12.3	28	Pass
Medium	2.437	-7.9	20	2	12.1	28	Pass
High	2.462	-7.2	20	2	12.8	28	Pass

Note the worst case Effective isotropic radiated power (EiRP) of this product is:

-6.2 + 20 (atten) + 8 (dBi)
= 21.8 dBm
= 151.3 mW

DWL-2200AP 'Intentional Radiator' Output

G mode					
Channel	Frequency (GHz)	Reading (dBm)	Factor (dB)	Output Power (dBm)	mW
Low	2.427	-18.1	20	1.9	1.548817
Medium	2.437	-17.7	20	2.3	1.698244
High	2.452	-18.4	20	1.6	1.44544
B mode					
Channel	Frequency (GHz)	Reading (dBm)	Factor (dB)	Output Power (dBm)	
Low	2.412	-18.4	20	1.6	1.44544
Medium	2.437	-18.3	20	1.7	1.479108
High	2.462	-18.6	20	1.4	1.380384

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.

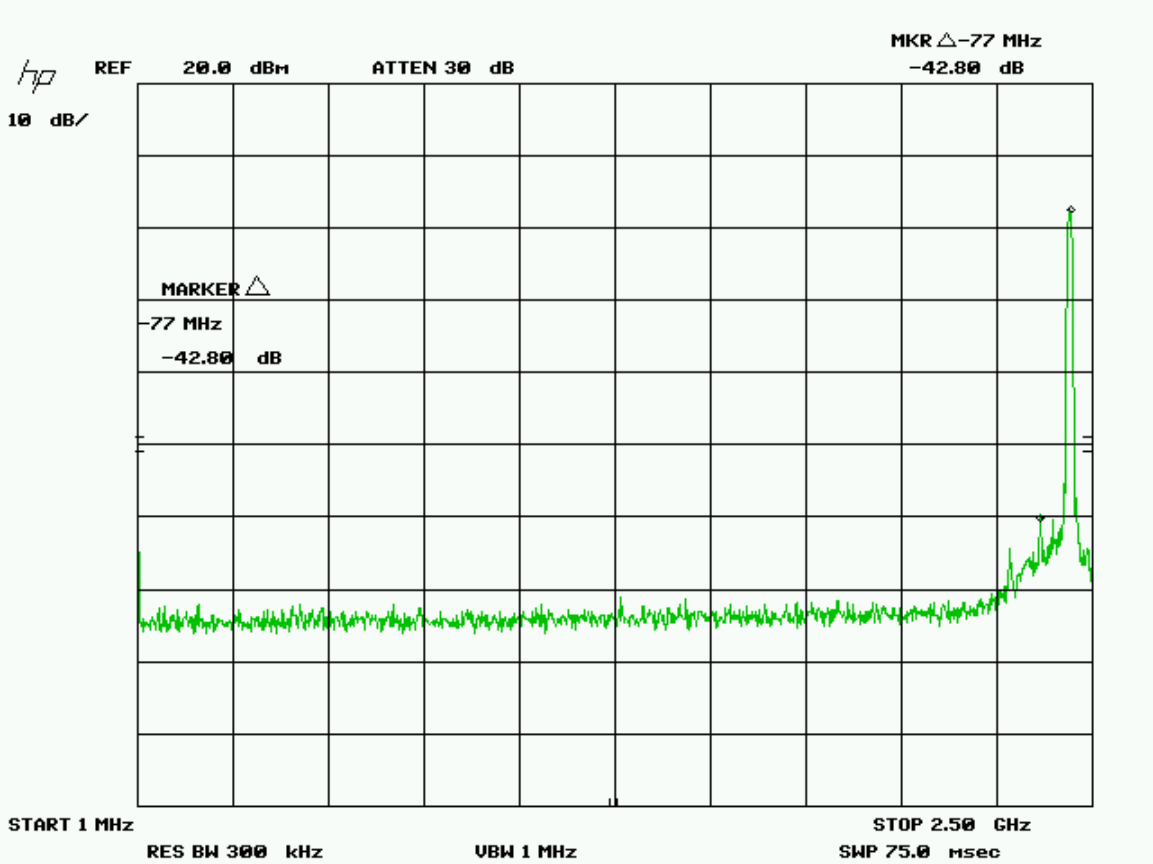
Results

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.

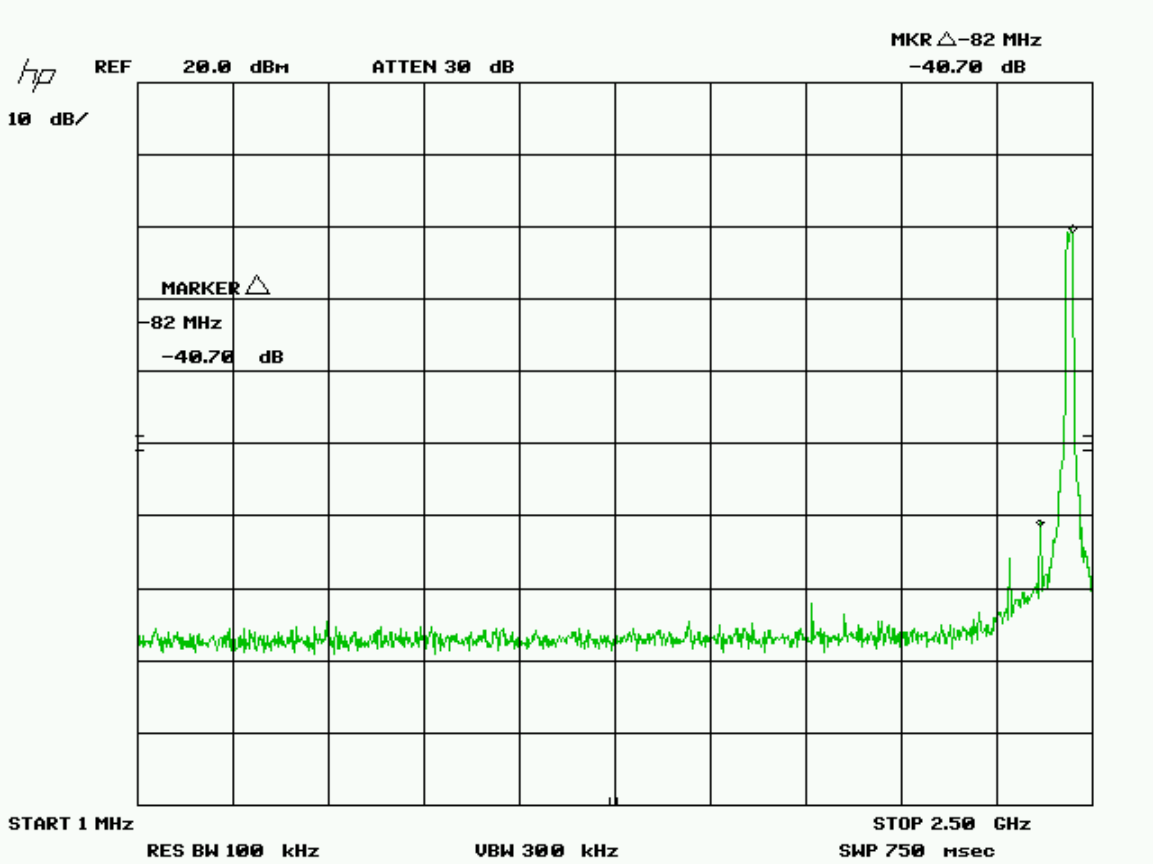
Graph(s)

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.

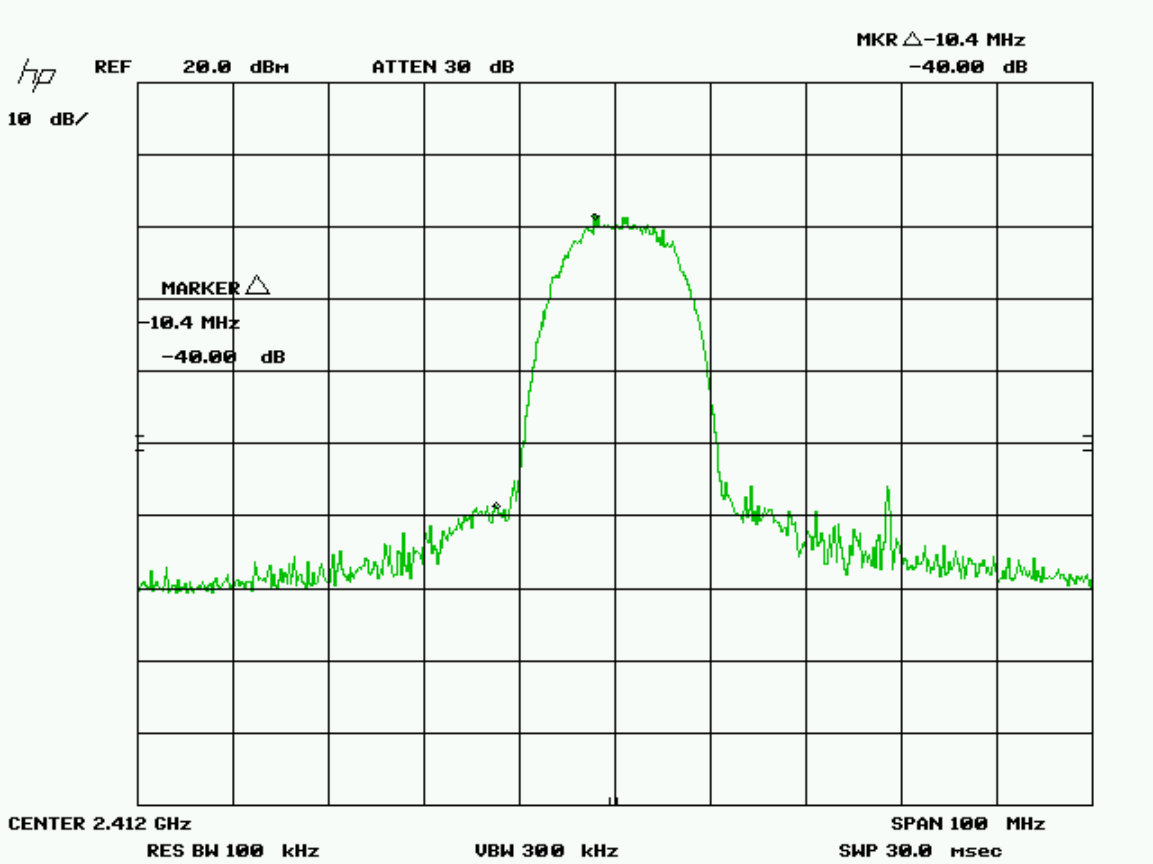
Frequencies below fundamental
B mode (worst case shown)



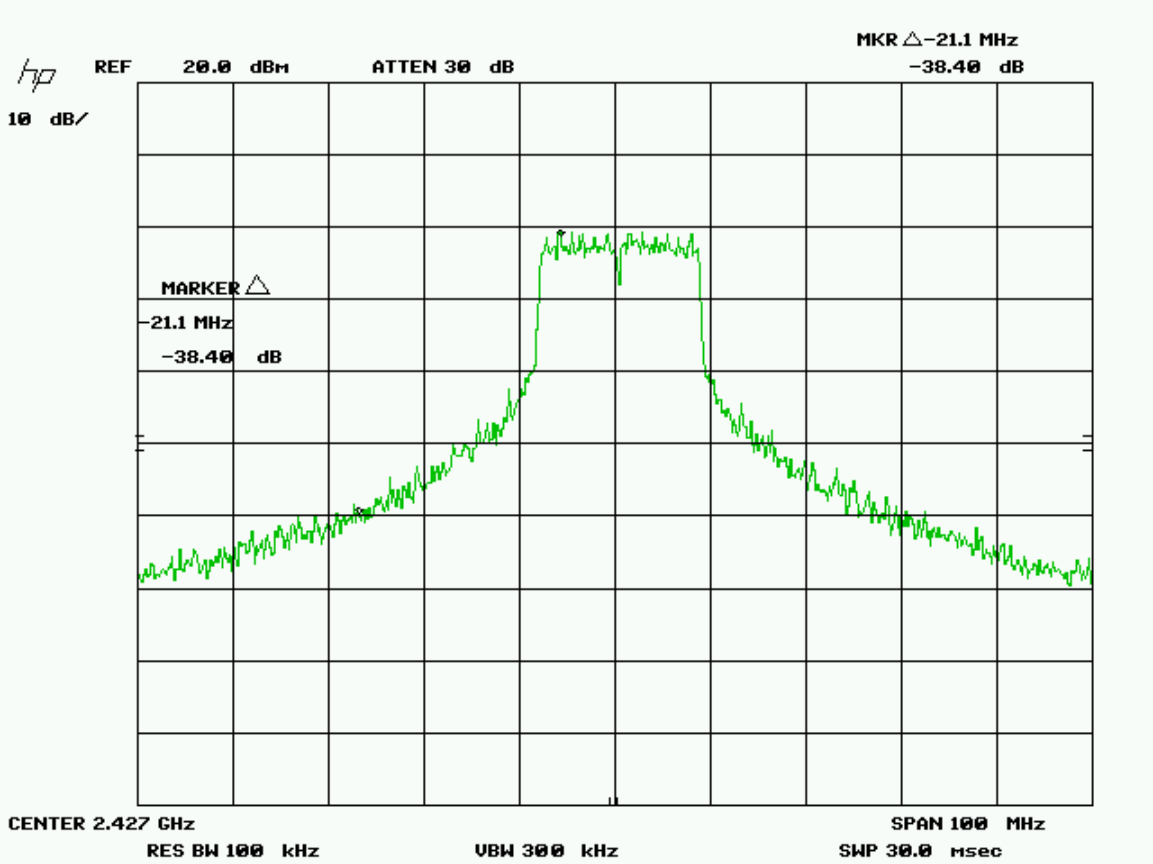
Frequencies below fundamental
G mode (worst case shown)



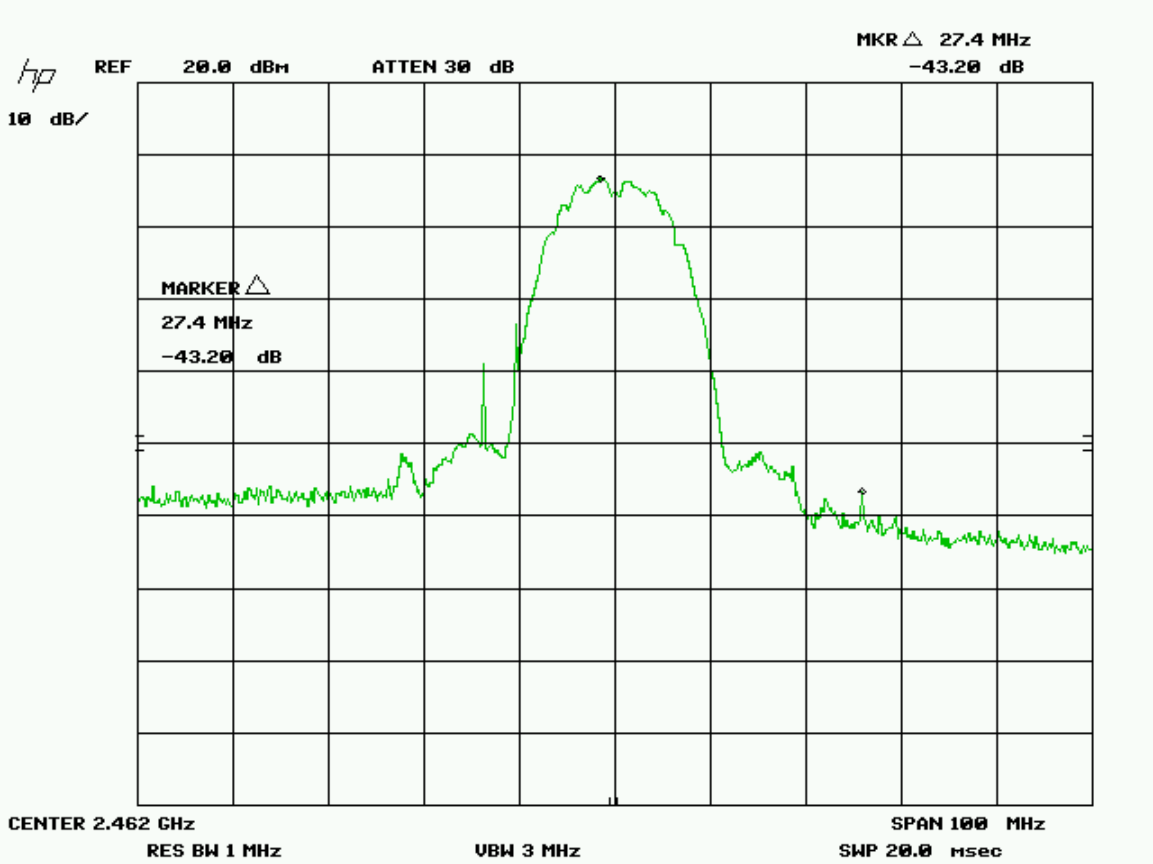
Low Channel, Lower Band Edge
B mode (worst case shown)



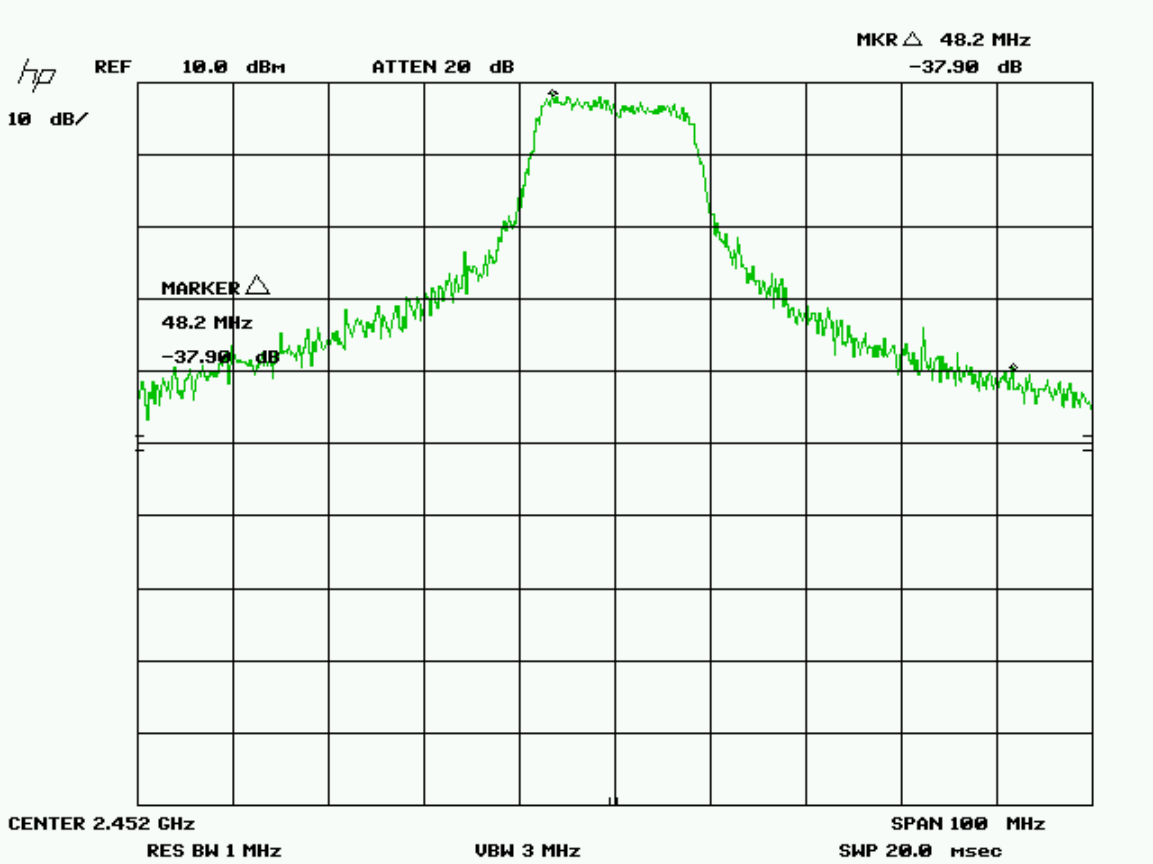
Low Channel, Lower Band Edge
G mode (worst case shown)



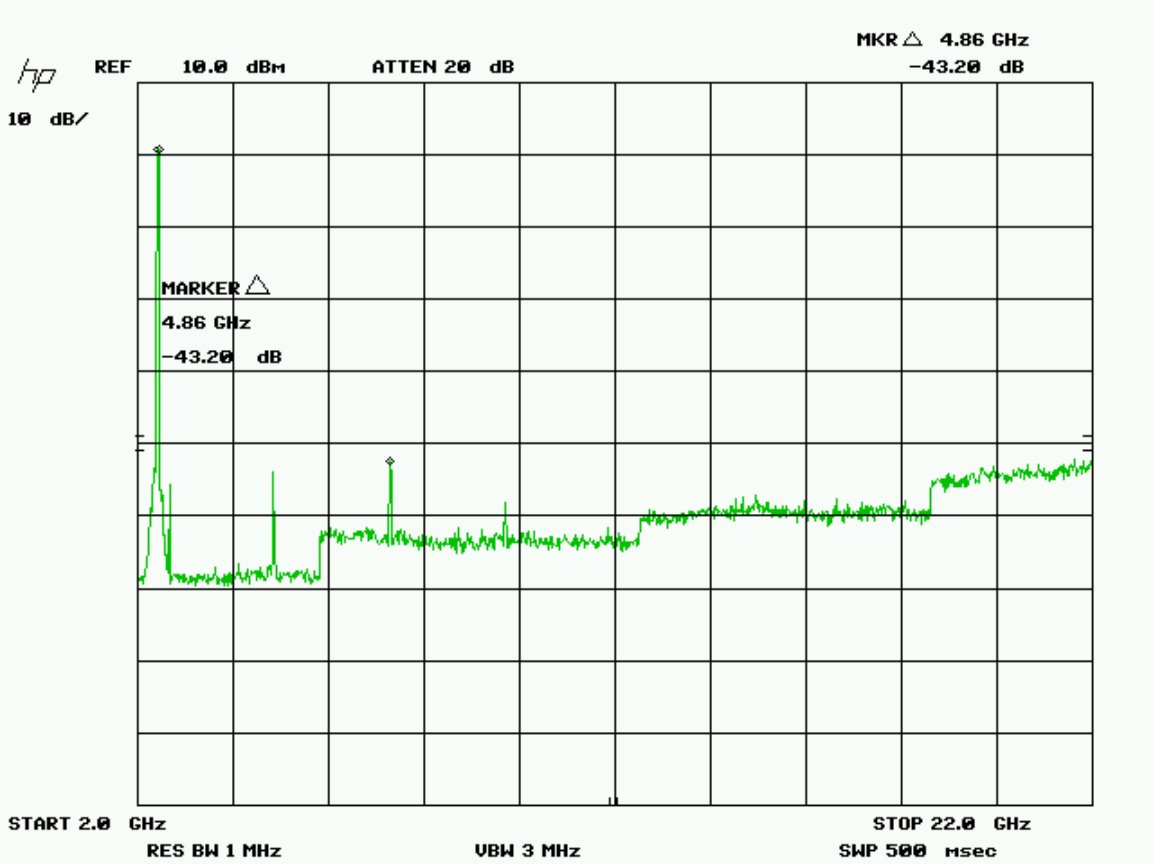
High Channel, Upper Band Edge
B mode (worst case shown)



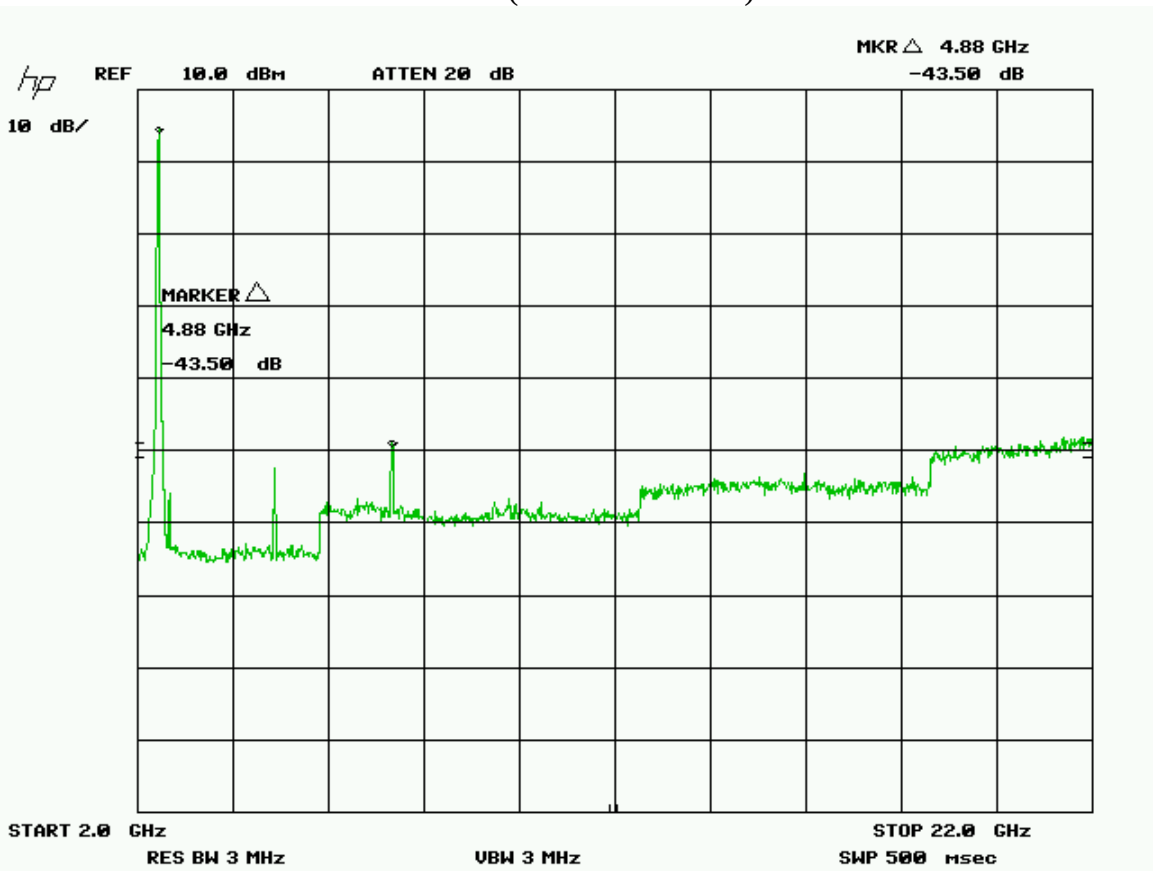
High Channel, Upper Band Edge
G mode (worst case shown)



Frequencies above Fundamental (2rd to 9th Harmonics)
B mode (worst case shown)



Frequencies above Fundamental (2rd to 9th Harmonics)
G mode (worst case shown)



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	2008-02-28	2010-02-28	GEMC 6
Quasi Peak Adapter	85650A	HP	2008-02-28	2010-02-28	GEMC 7
IFR Spectrum Analyzer	AN940	IFR	May 4/2006	Oct 1/2008	GEMC 6350
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"

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.

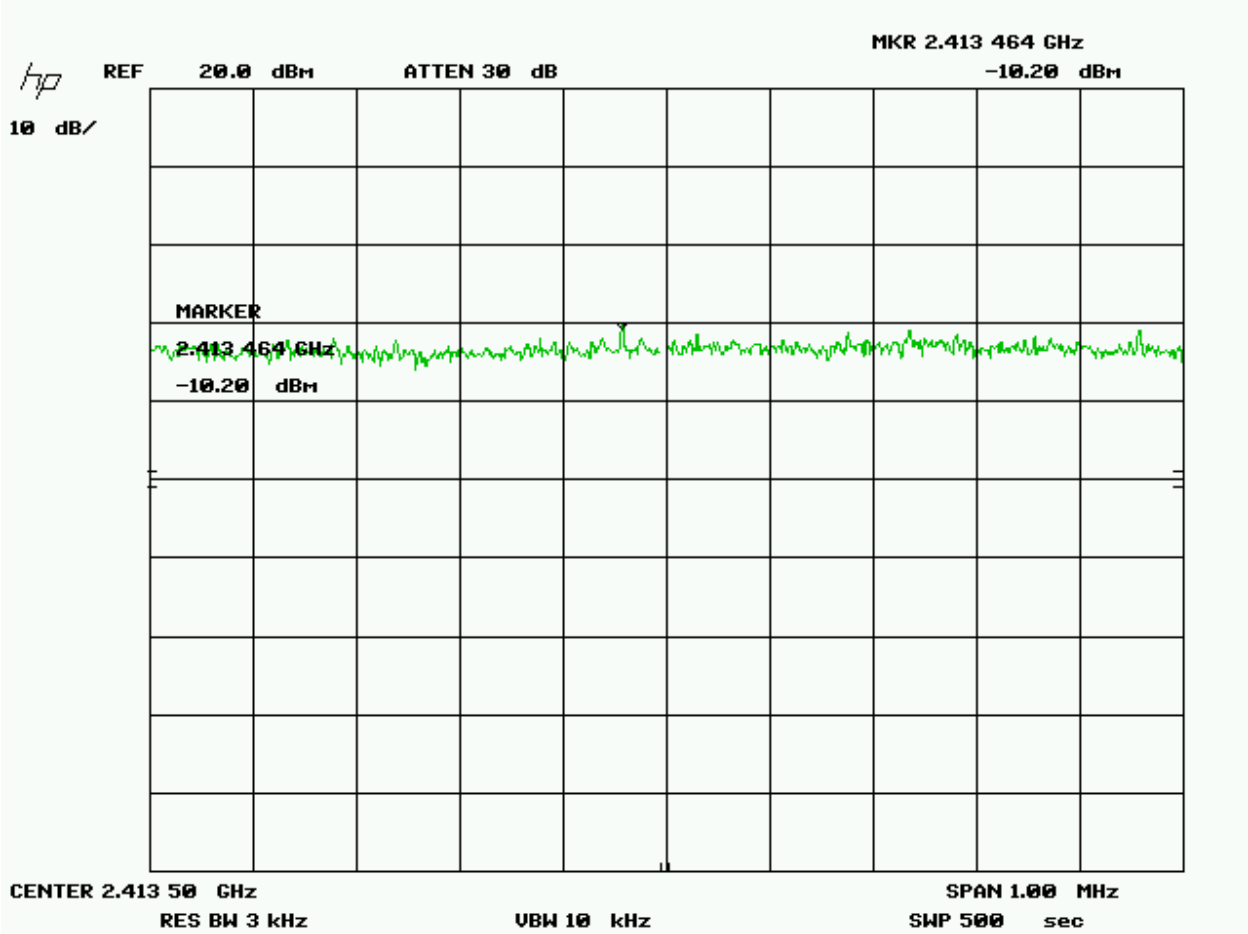
Results

The EUT passed. Each mode was tested at low, medium, and high band. The worst case value is -10.2 dbm

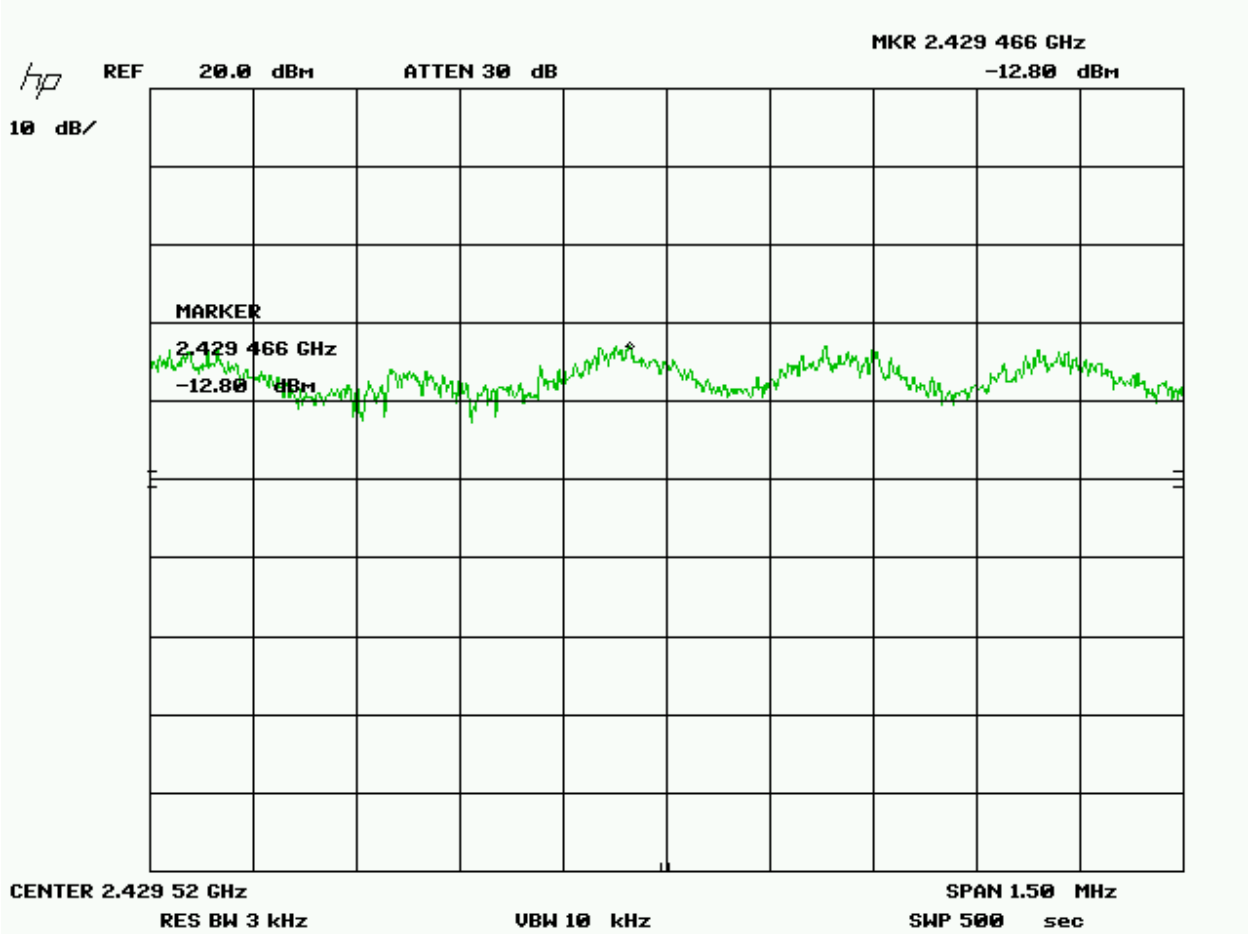
Graph(s)

The graphs shown below show the power spectral density of the device during the conducted measurement operation of the EUT. Low, middle, and high channel was investigated in each mode.

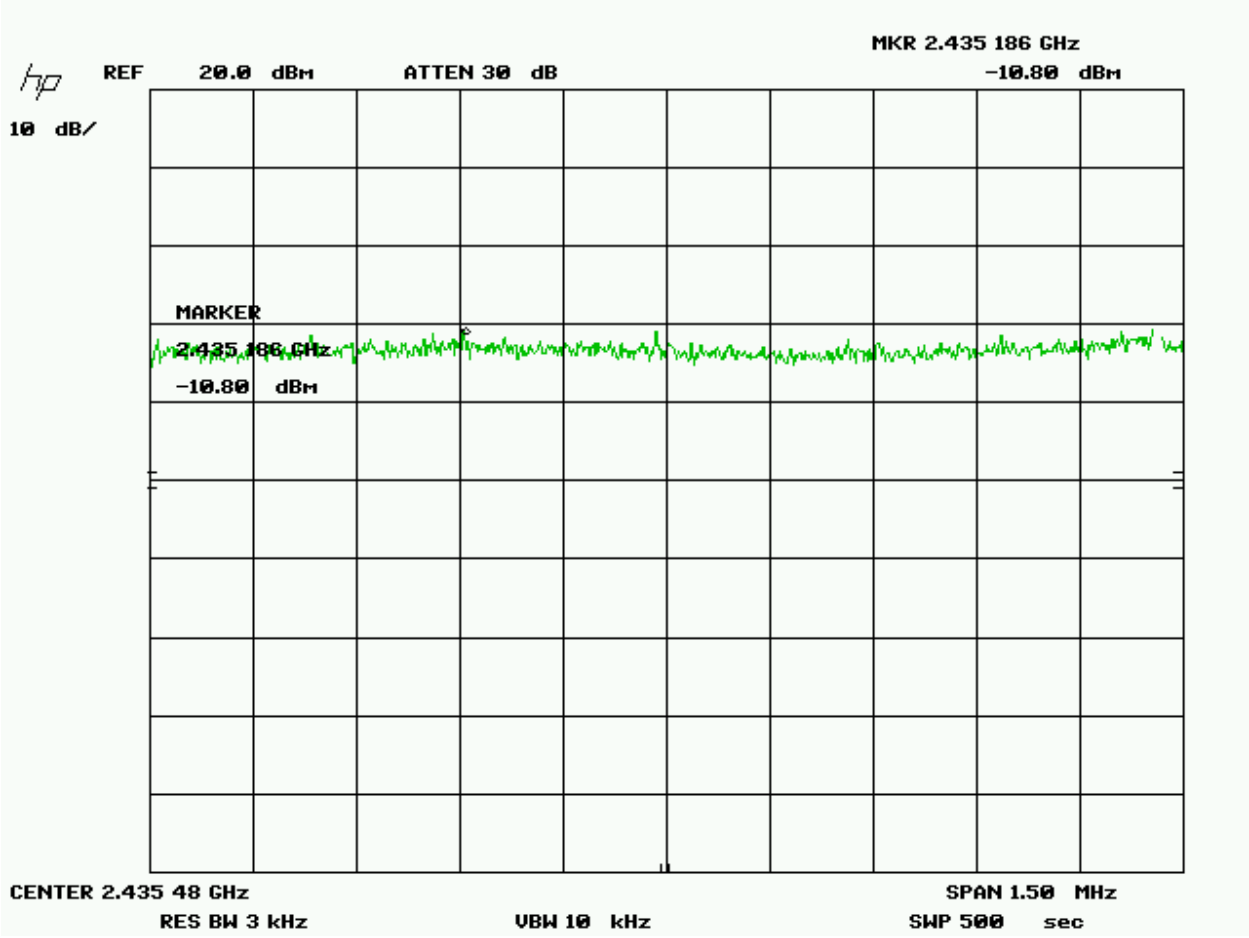
Low channel B mode



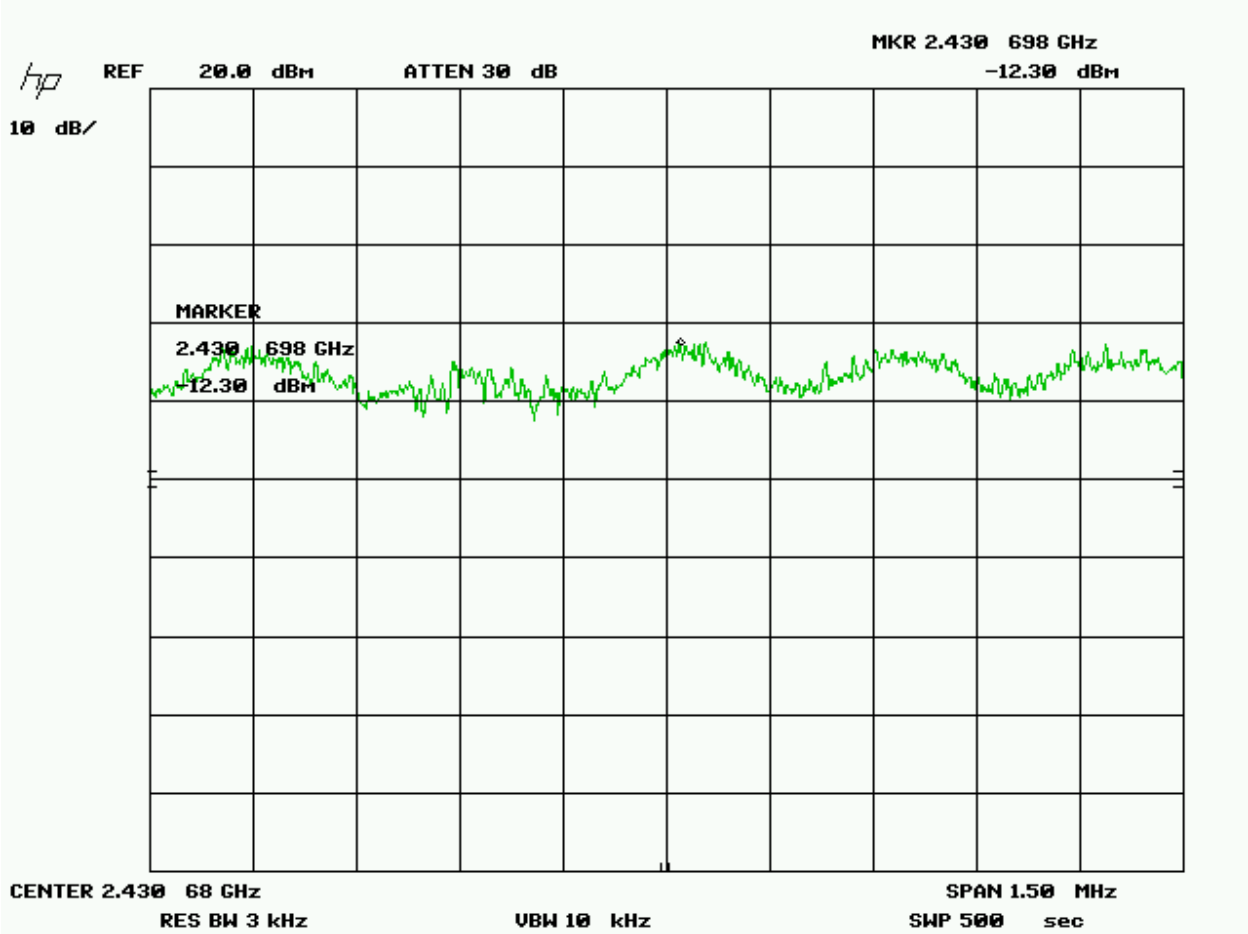
Low channel G mode



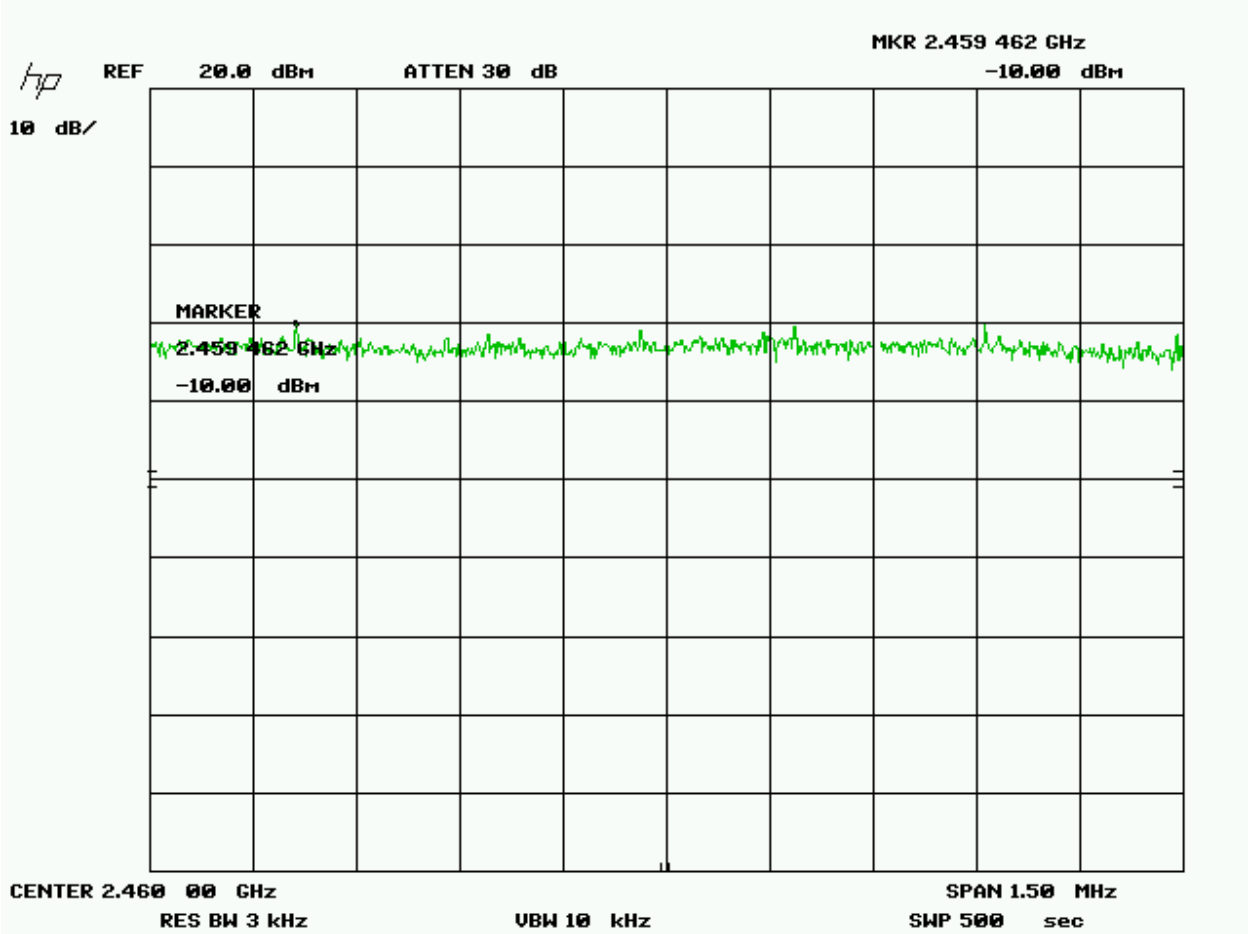
Mid channel B mode



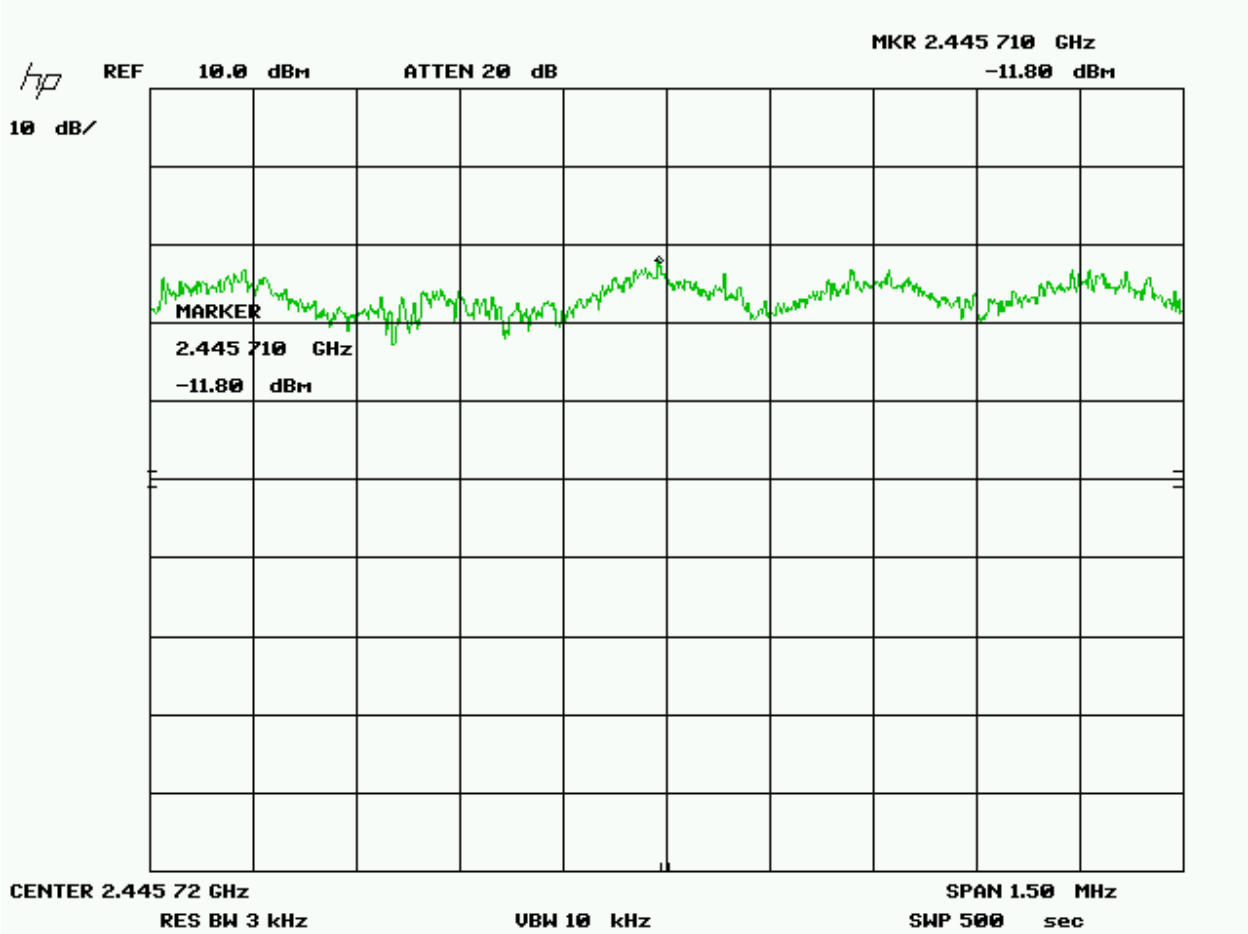
Mid channel G mode



High channel B mode



High Channel – G mode



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	2008-02-28	2010-02-28	GEMC 6
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"

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 = 8 dBi, or numerically 6.3
Where R = 20 cm

$P_d = (51.3\ mW * 6.3) / (4 * pi * 20cm^2)$
$P_d = 323.2\ mW / 5026\ cm^2$
$P_d = 0.064\ mW/cm^2$

Appendix A – EUT Summary

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

General EUT Description

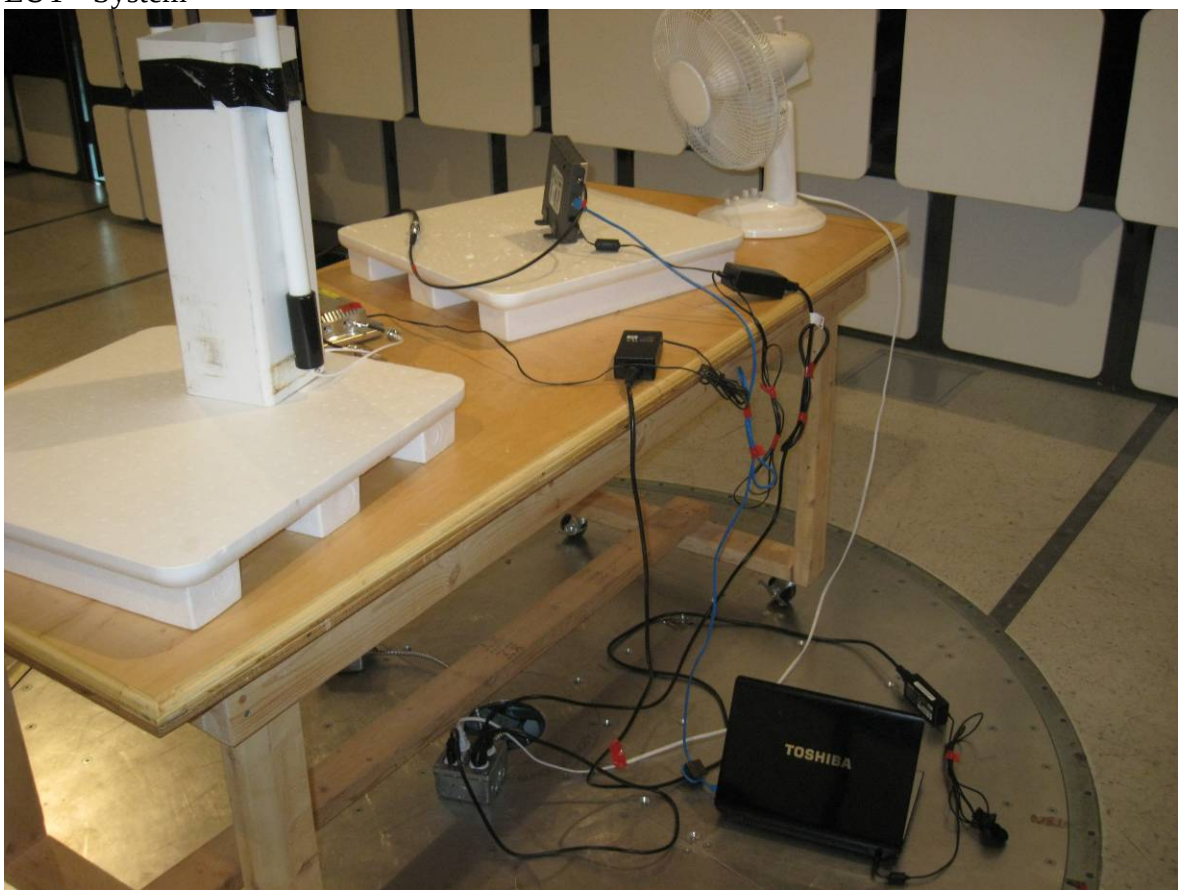
Manufacturer	**Airesurf Networks Inc.** 7030 Woodbine Avenue Suite 500 Markham, Ontario L3R 6G2
	Phone : 905 943-4043
EUT Name	SPK-1000 System
FCCID	WE6-A7005111
IC #	
Approximate Size (LxWxH)	20cm x 16cm x 6cm
Equipment Category (Commercial / Residential / Medical)	Commercial
Input Voltage and Frequency	100-240 Vac, 50-60 Hz
Rated Input Current	0.6 A
Intentional RF (If yes describe)	Yes. 15.247 device.
Table Top / Wall mount / Floor standing (choose table top if unsure)	Table top
I/O Connectors available on EUT	3 sma connectors
Peripherals required for test	Complete system including DWL-2200AP
Minimum Separation distance from operator	1 meter as per documentation
Types and lengths of all I/O cables	Not specified

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.

EUT - System



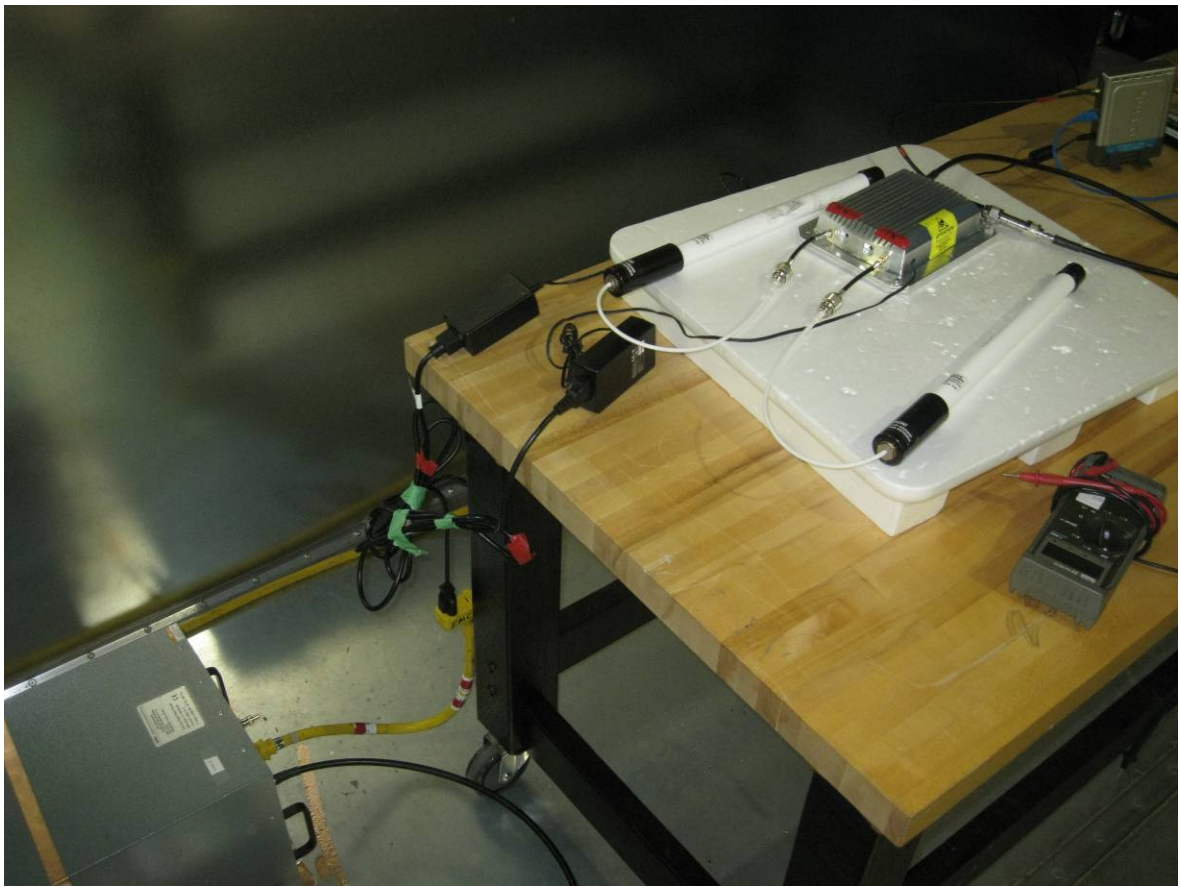
Note: The fan shown is not part of the system, but was used to ensure adequate cooling during continuous transmit operation required for testing.

EUT – DWL-2200AP - intentional radiator as per 15.204(b)

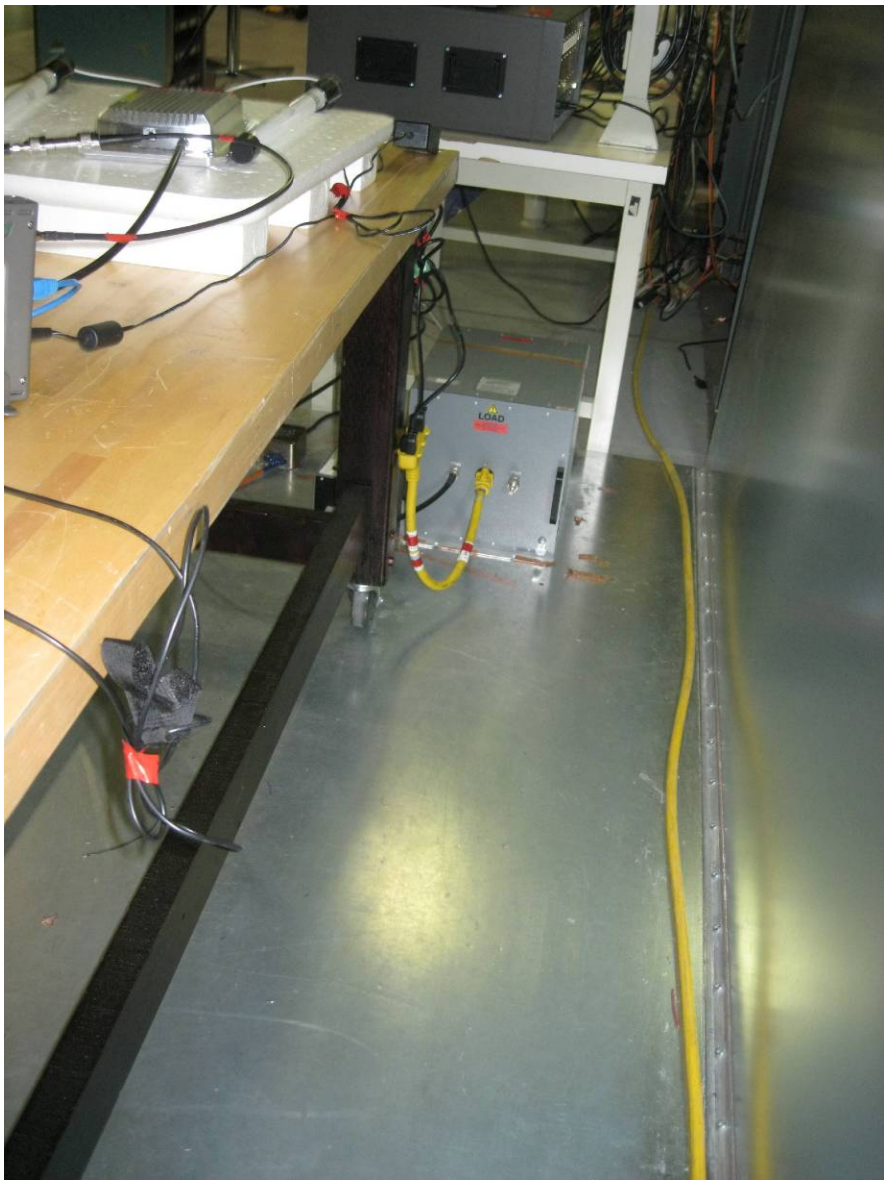
EUT – BSTR-1000 – External Amplifier as per 15.204(b)

EUT – Antenna as as per 15.204(b)

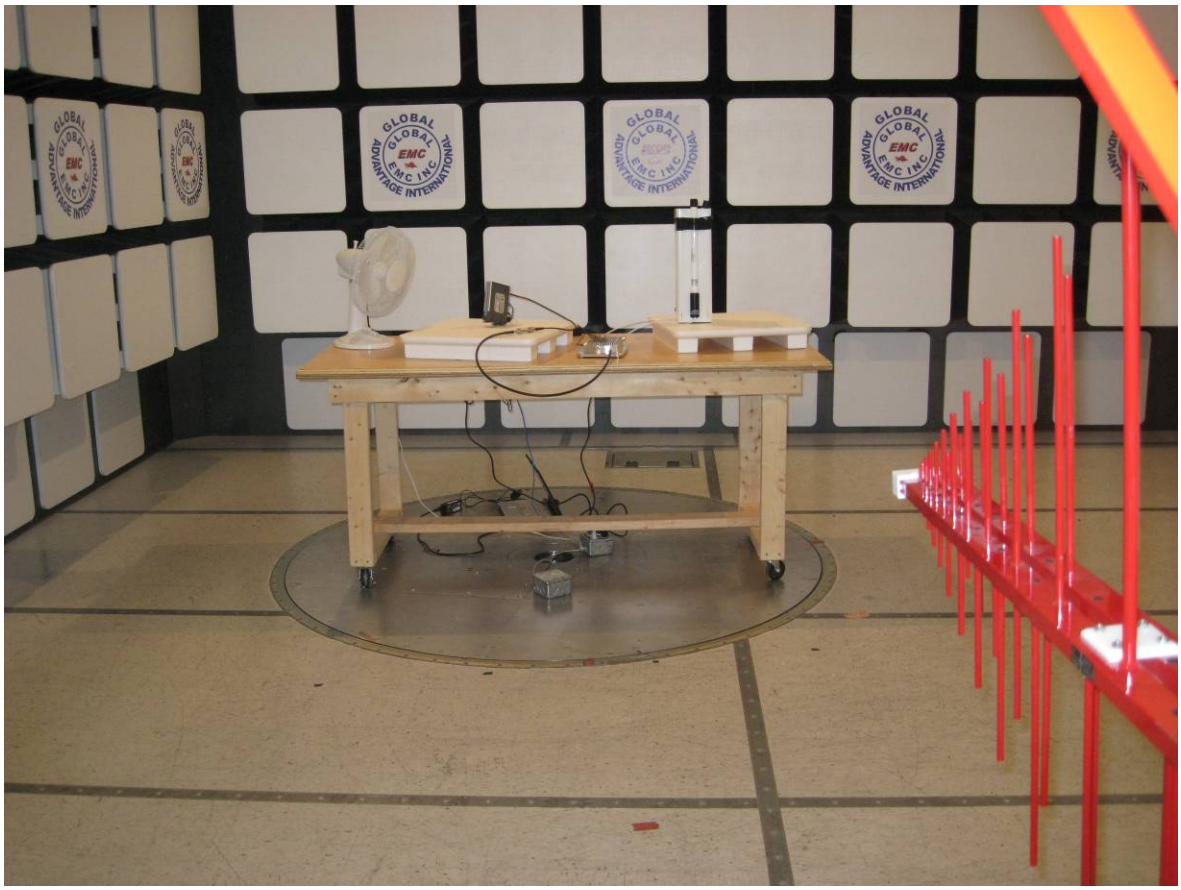
Power Line Conducted Emissions Photo 1



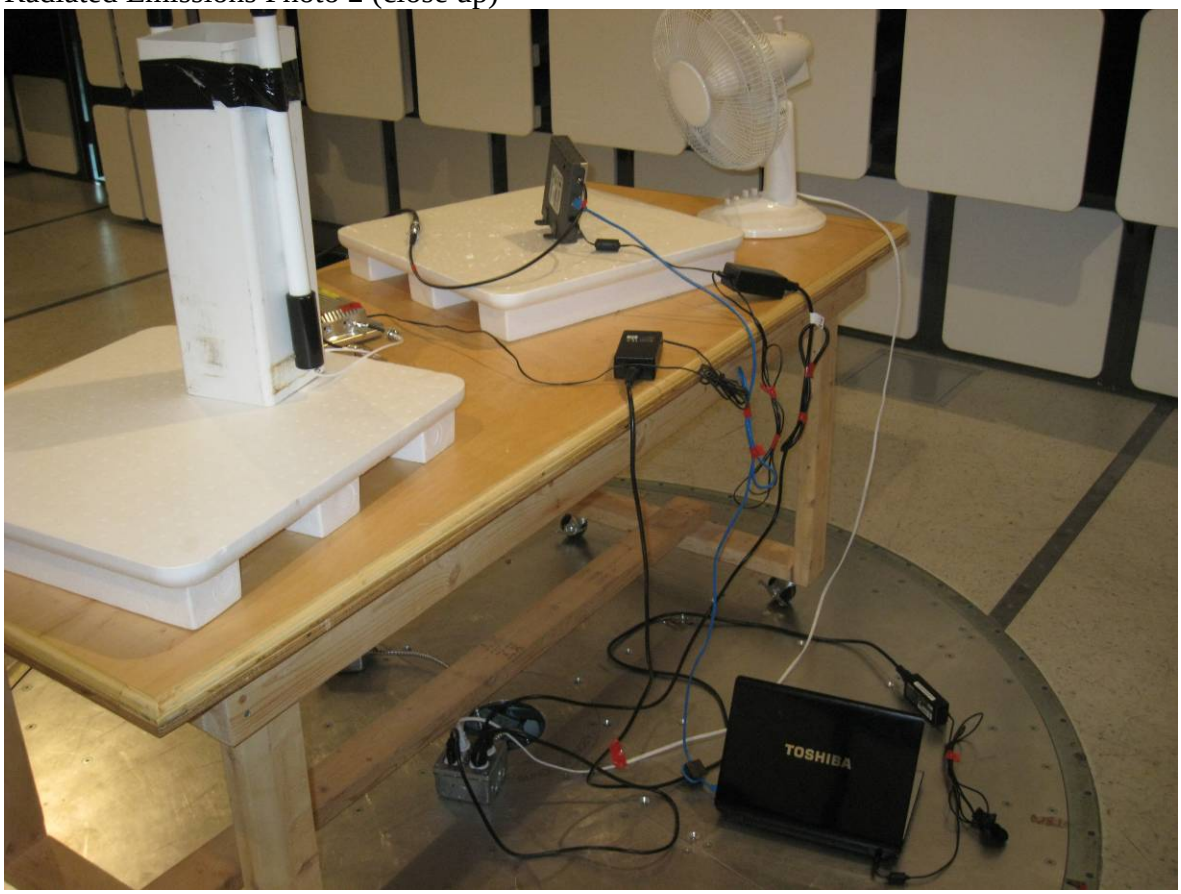
Power Line Conducted Emissions Photo 2



Radiated Emissions Photo 1



Radiated Emissions Photo 2 (close up)



Radiated Emissions Photo 3

Antenna Conducted Measurements Photo

Power Measurements Photo