Global EMC Inc. Labs

EMC & RF Test Report

As per

RSS 210 Issue 7:2007

&

FCC Part 15 Subpart C:2010

Unlicensed Intentional Radiators

on the

Wireless Audio Transceiver Module – WTX1010

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Testing produced for

See Appendix A for full customer & EUT details.

LAB REGISTRATION #6844A-1

FCC REGISTRATION #612361

Testing Laboratory Certificate #2555.01

Table of Contents

Report Scope

This report addresses the EMC verification testing and test results of the Wireless Audio Transceiver Module – WTX1010, 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 15:2010

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.

Summary

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

EUT FCC Certification #, FCC ID:	WUO-WTX1010
EUT Industry Canada Certification #, IC:	7985A-WTX1010
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Scott Drysdale

Client	**Sonavox Audio Solution**
Product	Wireless Audio Transceiver Module – WTX1010
Standard(s)	RSS 210 Issue 7:2007 / FCC Part 15 Subpart C 15:2010

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	QuasiPeak Average	Pass
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	Pass See Justifications
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	< 2.4 mW	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),

For the Restricted Bands of operation, the EUT is designed to only operate between 2.405 GHz and 2.477 GHz

For the power line conducted emissions requirements, the EUT is DC powered, and this test does not apply, however representative power line conducted emissions using a test bed host are

For the Antenna gain, this antenna has (significantly) less than 6 dBi.

The unit can be configured as a transmitter or RX transceiver, which the client refers to as a receiver but also send acknowledgement packets. This configuration is accomplished by changing a D-A or A-D converter on the board. The RX Transceiver uses the same modulation, power output, bandwidth and as the transmitter, but uses a smaller duty cycle or packet size. As the duty cycle is not taken into account in this report, all tests are considered equal. Peak power output and spurious emissions were verified on both the transmitter and the RX transceiver. All other tests were performed on the transmitter as worst case measurements.

For maximum permissible exposure, this device operates at less than 2.4mW and is allowable for portable & mobile configurations. 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
ANSI C63.10:2009	- American national standard for testing unlicensed wireless devices
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 - Sept 27, 2010

Revision 2 - Oct 1, 2010 – minor changes as per TCB request to include receive mode only data and report noise floor at 2390 MHz.

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)
Sept 2010	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

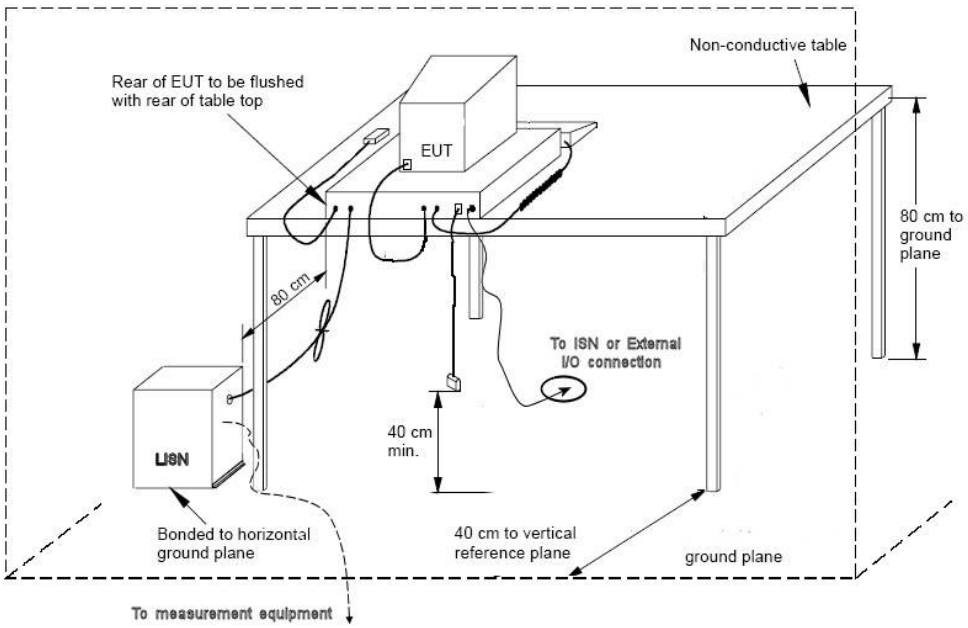
Average Limits		QuasiPeak Limits	
150 kHz – 500 kHz	56 to 46 dBuV	150 kHz – 500 kHz	66 to 56 dBuV
500 kHz – 5 MHz	46 dBuV	500 kHz – 5 MHz	56 dBuV
5 MHz – 30 MHz	50 dBuV	500 kHz – 30 MHz	60 dBuV

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

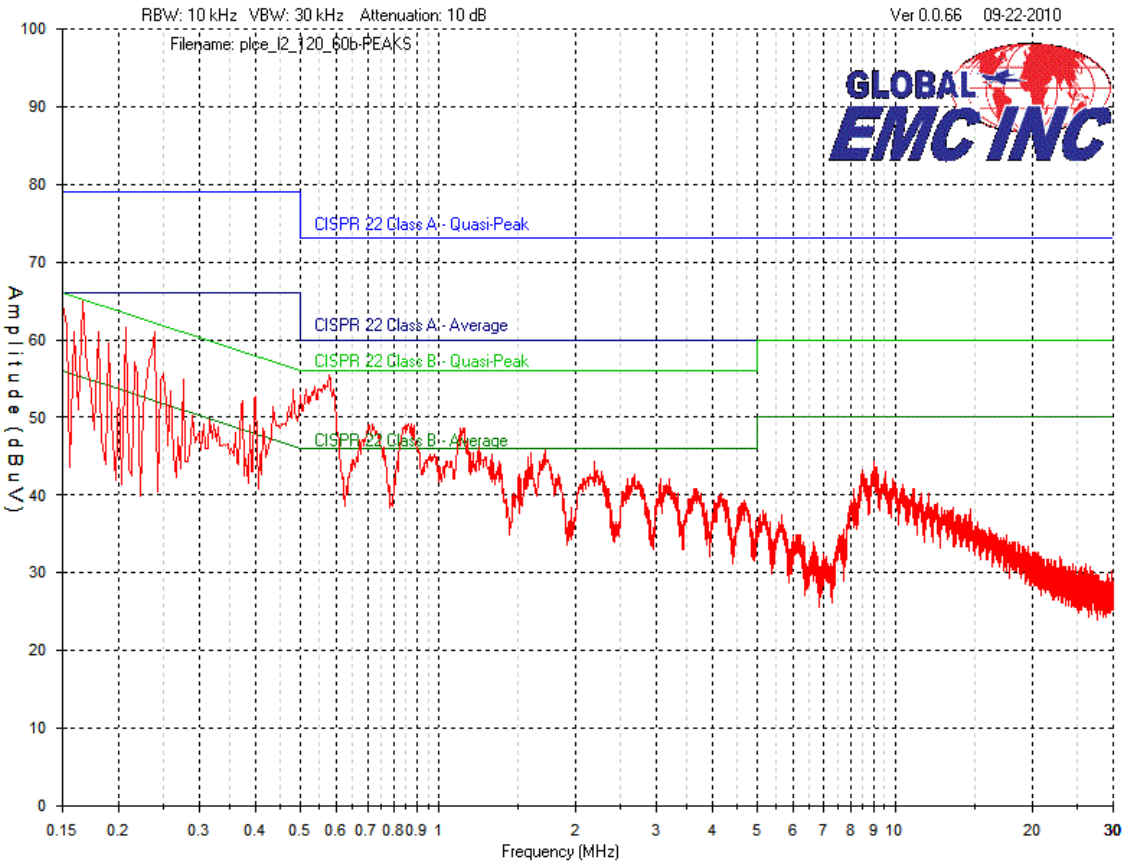
Measurement Uncertainty

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.

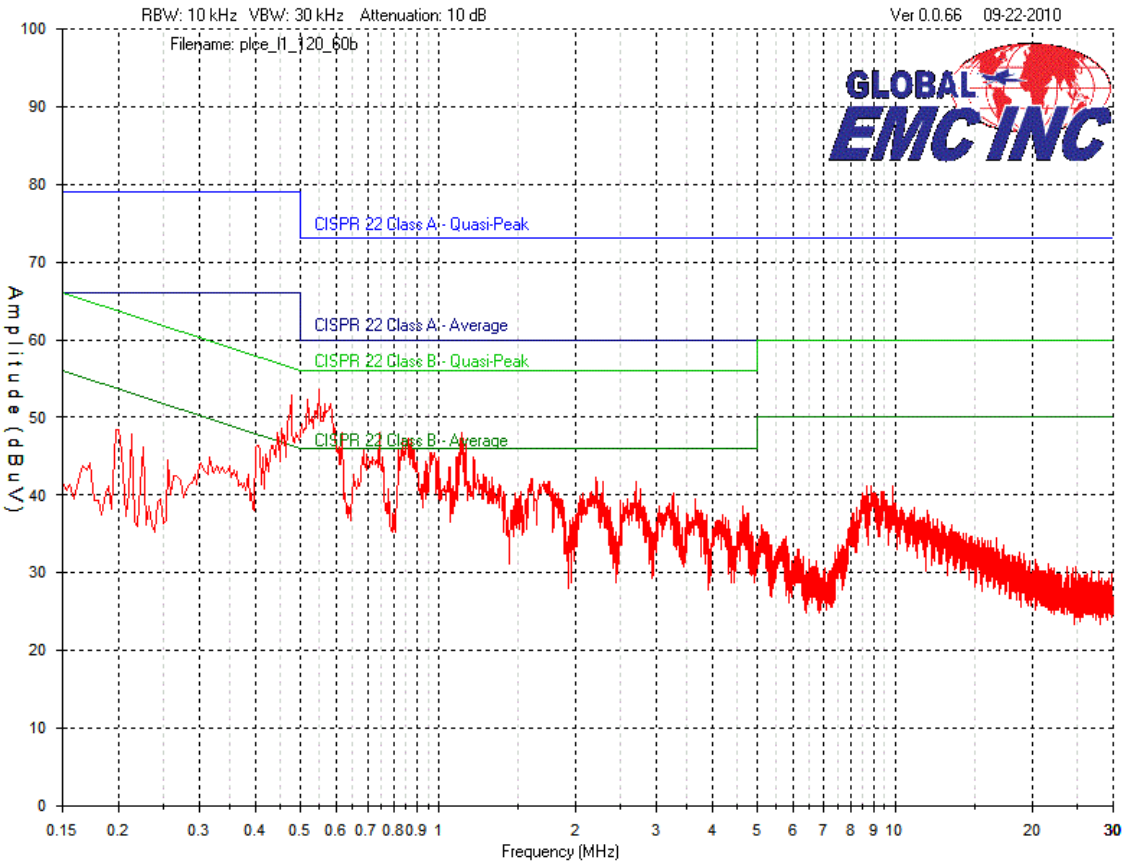
Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector where applicable, please refer to the table. The graph shown below is a peak measurement graph, measured with a resolution bandwidth greater then or equal to the final required detector. These graphs are performed as a worst case measurement to enable the detection of frequencies of concern and for considerable time savings.

Phase (Black/Brown)



Neutral (White/Blue)



Final Measurements

Average Measurements:

Line 1 – Phase (Black/Brown)

Frequency (MHz)	Raw (dBuV)	Atten Factor (dB)	LISN Factor (dB)	Level (dBuV)	Limit (dB)	Margin (dB)	Pass/Fail
0.15652	43.4	10	1.3	54.7	55.6	0.9	Pass
0.58462	34.6	10	0.2	44.8	46	1.2	Pass
0.17742	42.1	10	1.2	53.3	54.6	1.3	Pass
0.15584	42.5	10	1.5	54	55.7	1.7	Pass
0.2012	33.6	10	1	44.6	53.6	9	Pass
0.23219	31.3	10	0.8	42.1	52.4	10.3	Pass

Line 2 – Neutral (White/Blue)

Frequency (MHz)	Raw (dBuV)	Atten Factor (dB)	LISN Factor (dB)	Level (dBuV)	Limit (dB)	Margin (dB)	Pass/Fail
0.55	34.4	10	0.2	44.6	46	1.4	Pass
0.476	32.8	10	0.2	43	46.4	3.4	Pass
0.743	27.8	10	0.2	38	46	8	Pass
1.126	27.8	10	0.2	38	46	8	Pass
0.859	27.2	10	0.2	37.4	46	8.6	Pass
0.982	25.3	10	0.2	35.5	46	10.5	Pass

Quasi-peak readings

Line 1 – Phase (Black/Brown)

Frequency (MHz)	Raw (dBuV)	Atten Factor (dB)	LISN Factor (dB)	Level (dBuV)	Limit (dB)	Margin (dB)	Pass/Fail
0.15652	53	10	1.3	64.3	65.6	1.3	Pass
0.58462	43.5	10	0.2	53.7	56	2.3	Pass
0.23219	49.5	10	0.8	60.3	62.4	2.1	Pass
0.2012	48.8	10	1	59.8	63.6	3.8	Pass
0.17742	46.5	10	1.2	57.7	64.6	6.9	Pass
0.15584	49.8	10	1.5	61.3	65.7	4.4	Pass

Line 2 – Neutral (White/Blue)

Frequency (MHz)	Raw (dBuV)	Atten Factor (dB)	LISN Factor (dB)	Level (dBuV)	Limit (dB)	Margin (dB)	Pass/Fail
0.55	43.4	10	0.2	53.6	56	2.4	Pass
0.476	42.8	10	0.2	53	56.4	3.4	Pass
0.743	37.8	10	0.2	48	56	8	Pass
1.126	37.8	10	0.2	48	56	8	Pass
0.859	37.2	10	0.2	47.4	56	8.6	Pass
0.982	35.3	10	0.2	45.5	56	10.5	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 #
IFR Spectrum Analyzer	AN940	IFR	12/29/2009	12/29/2011	GEMC 6350
BiLog Antenna	3142-C	ETS	2009-02-12	2011-02-12	GEMC 8
LISN	FCC-LISN-50/250-16-2-01	FCC	2009-02-11	2011-02-11	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"

Radiated Emissions

Purpose

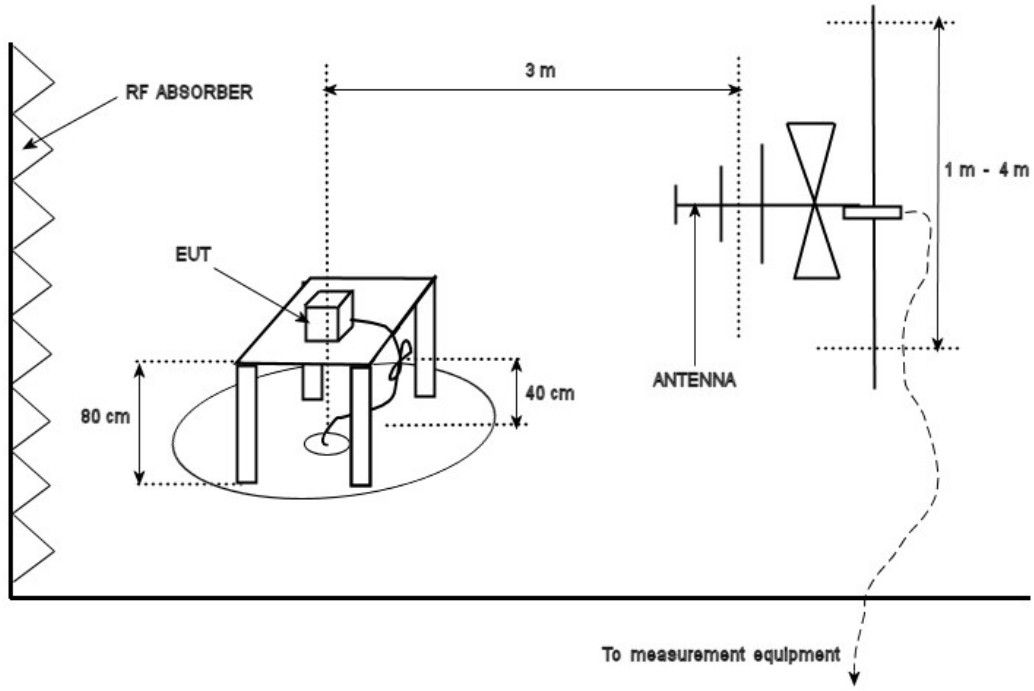
The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular 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 are as defined in FCC Part 15, Section 15.209:
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[2], 500 uV/m (54 dBuV/m) 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

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.

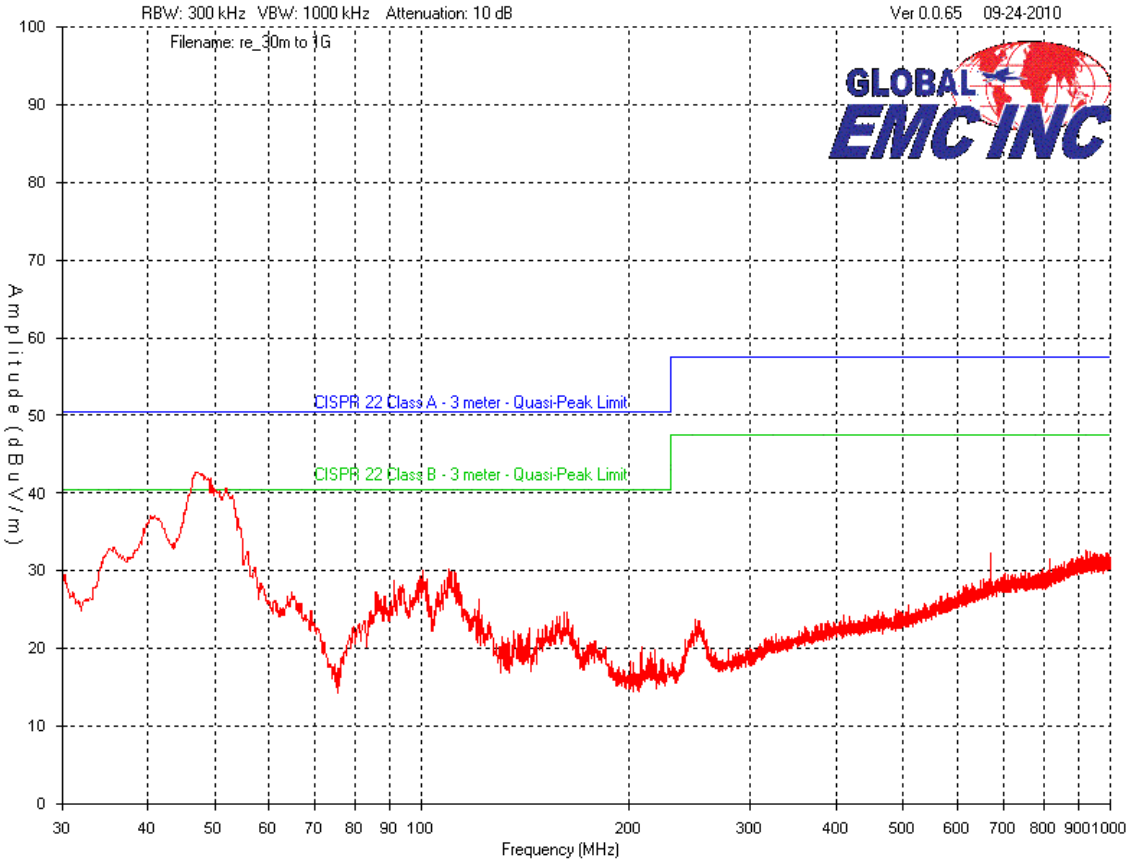
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10^{th} harmonic (a minimum of a 25 GHz).

The graphs shown represent mid channel as representative, however low, middle, and high channel were scanned.

Devices scanned above 10 GHz were scanned at 1 meter test distance, and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m / 3m) is applied.

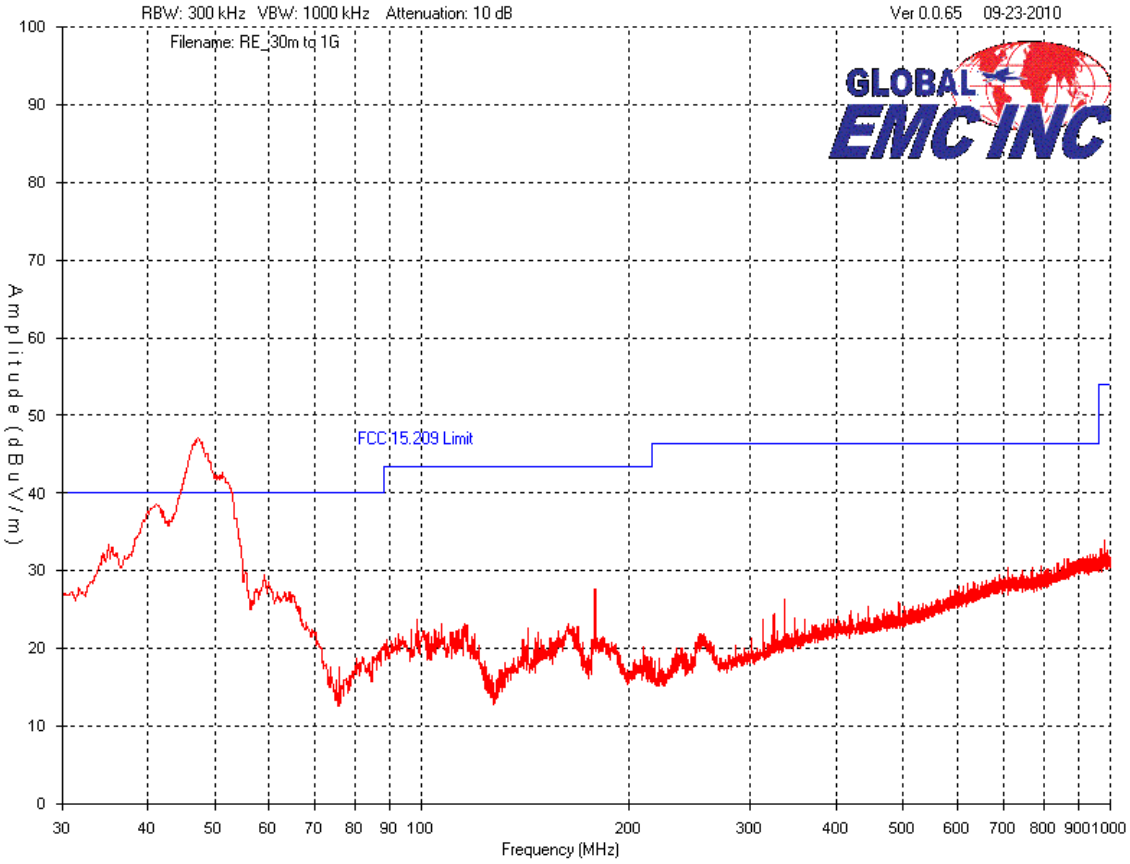
Vertical – Peak Emissions Graph

Transmitter (30M to 1 GHz)



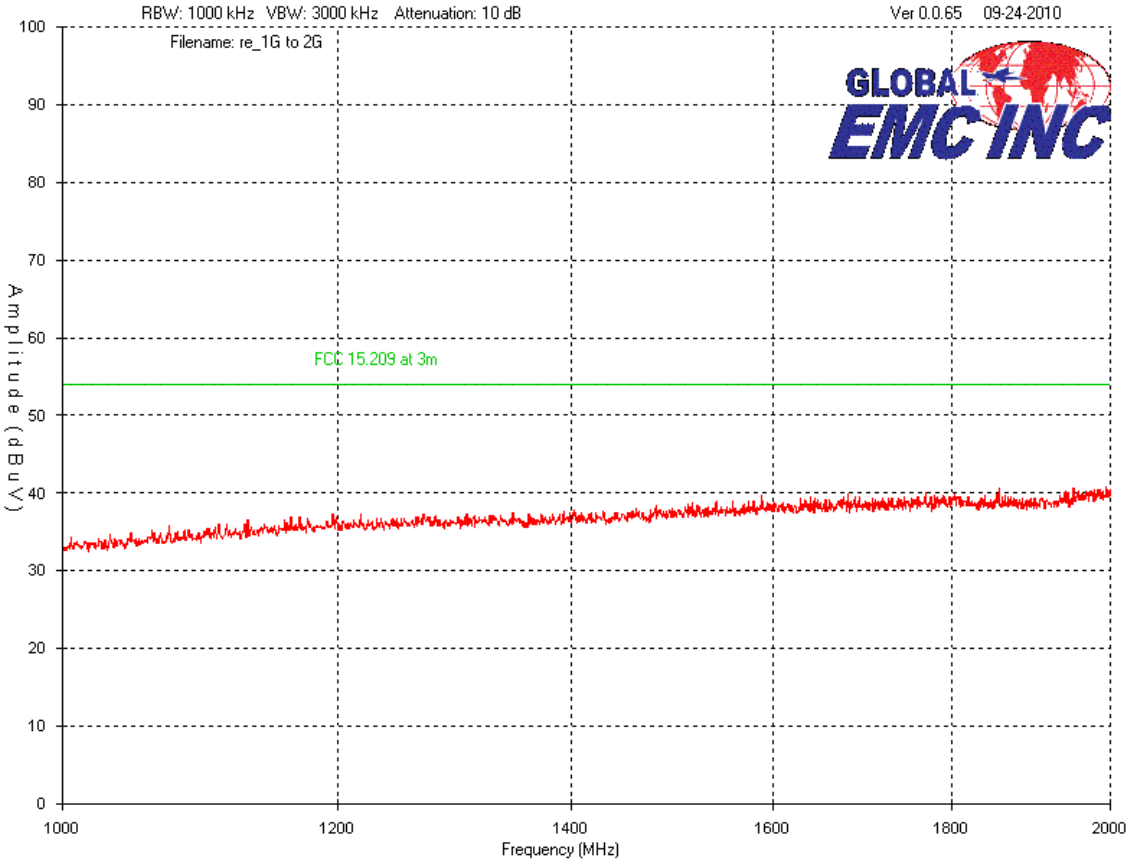
Vertical – Peak Emissions Graph

RX Transceiver (30M to 1 GHz)



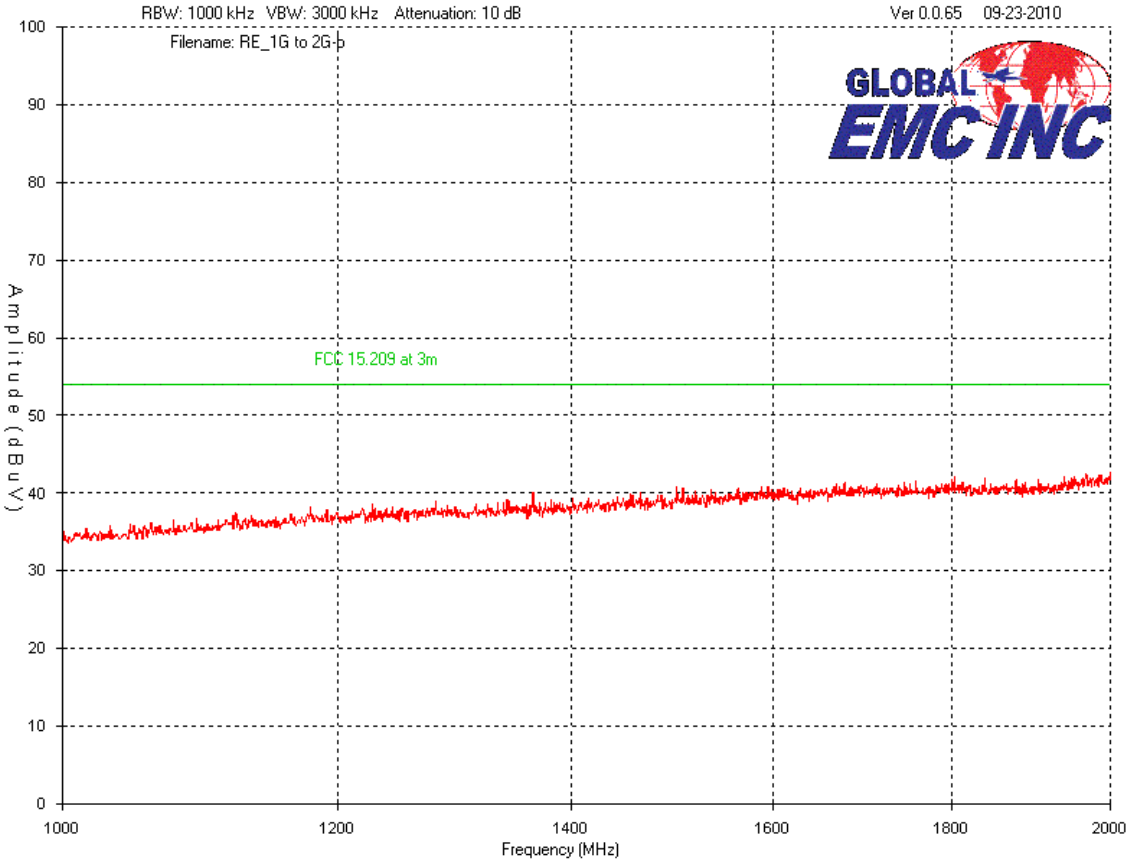
Vertical – Peak Emissions Graph

Transmitter (1GHz to 2 GHz)



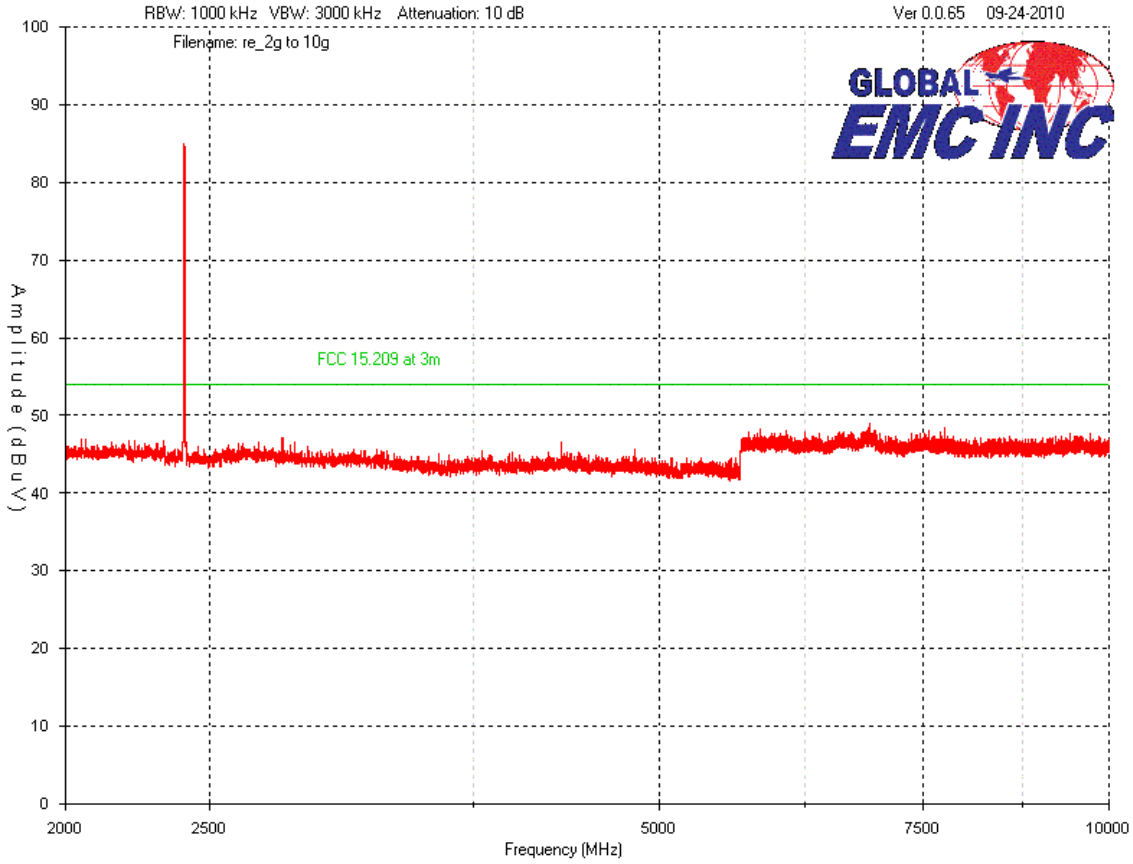
Vertical – Peak Emissions Graph

RX Transceiver (1GHz to 2 GHz)



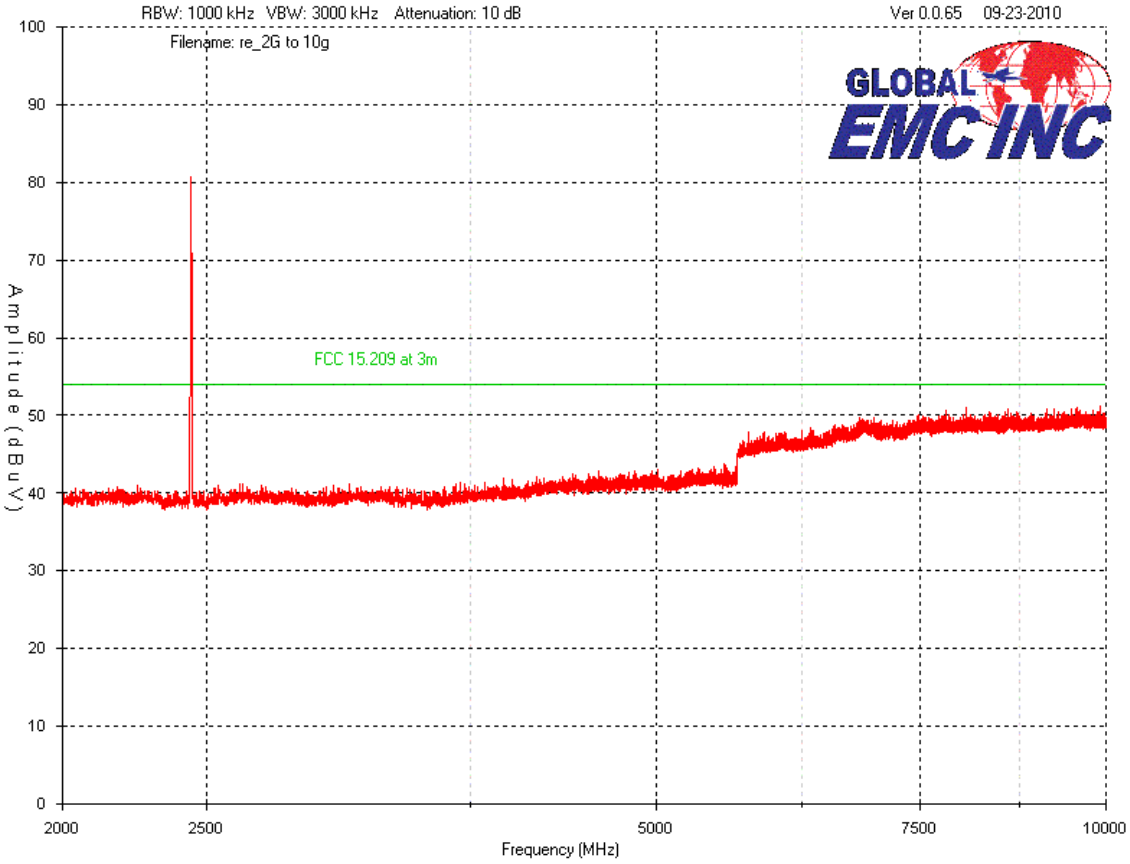
Vertical – Peak Emissions Graph

Transmitter (2 GHz to 10 GHz)



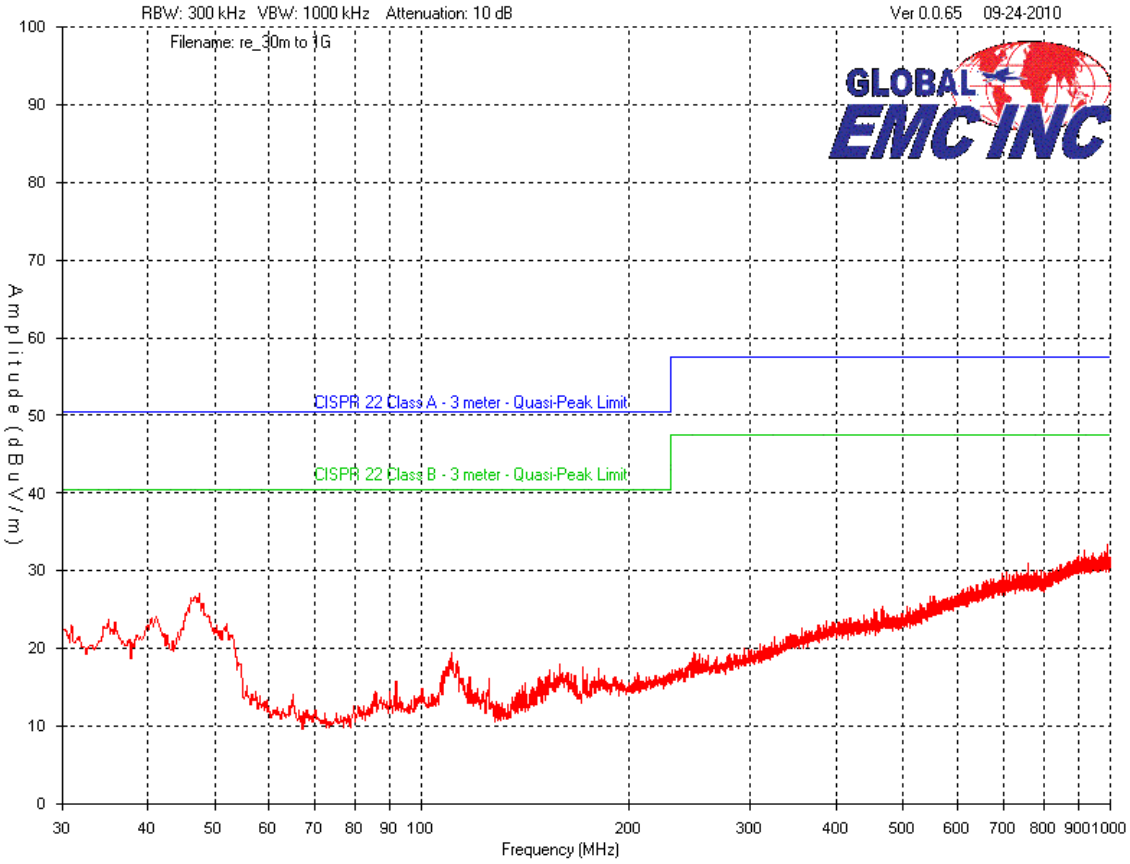
Vertical – Peak Emissions Graph

RX Transceiver (2 GHz to 10 GHz)



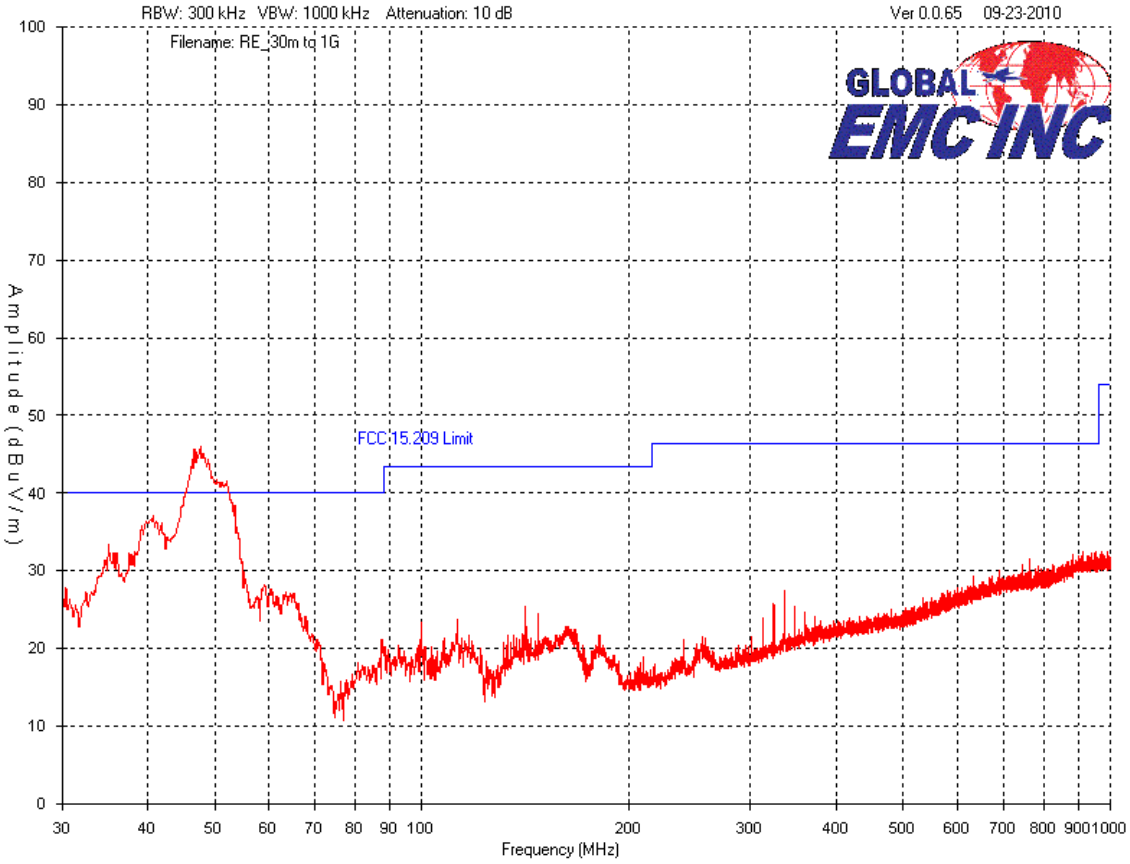
Horizontal – Peak Emissions Graph

Transmitter (30M to 1 GHz)



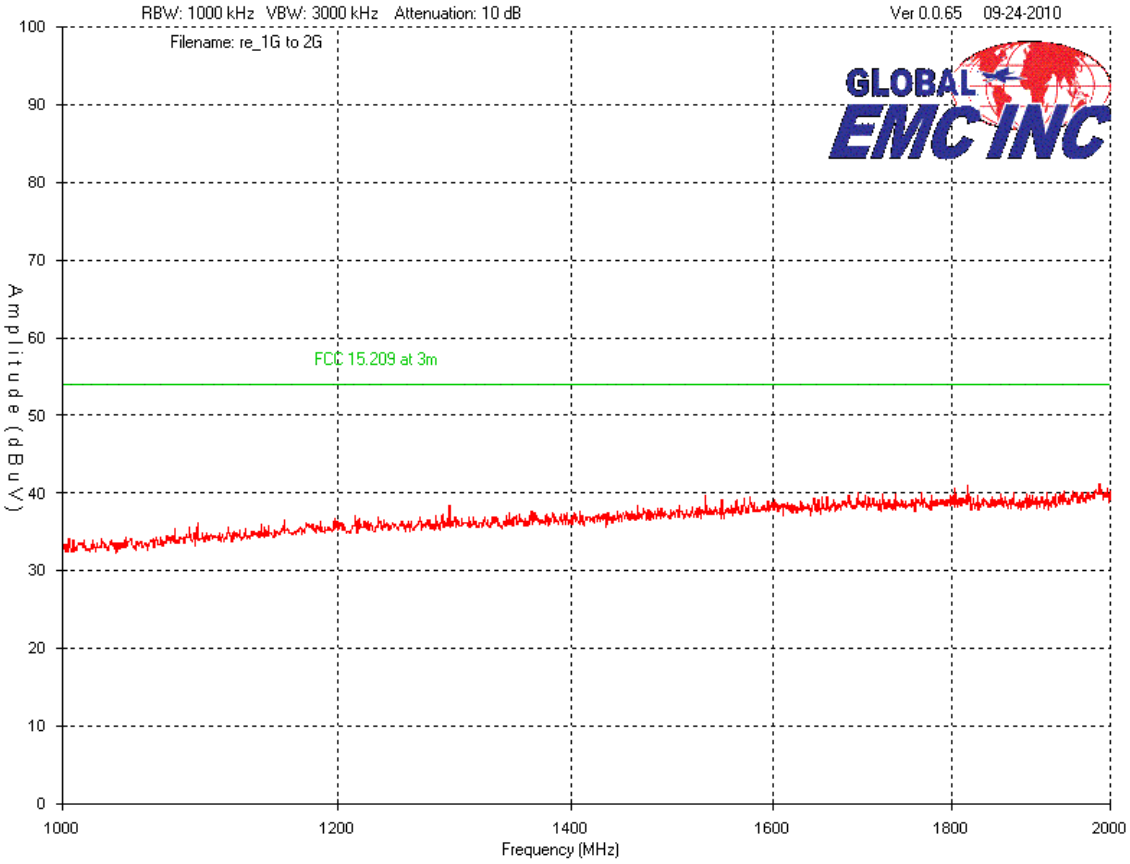
Horizontal – Peak Emissions Graph

RX Transceiver (30M to 1 GHz)



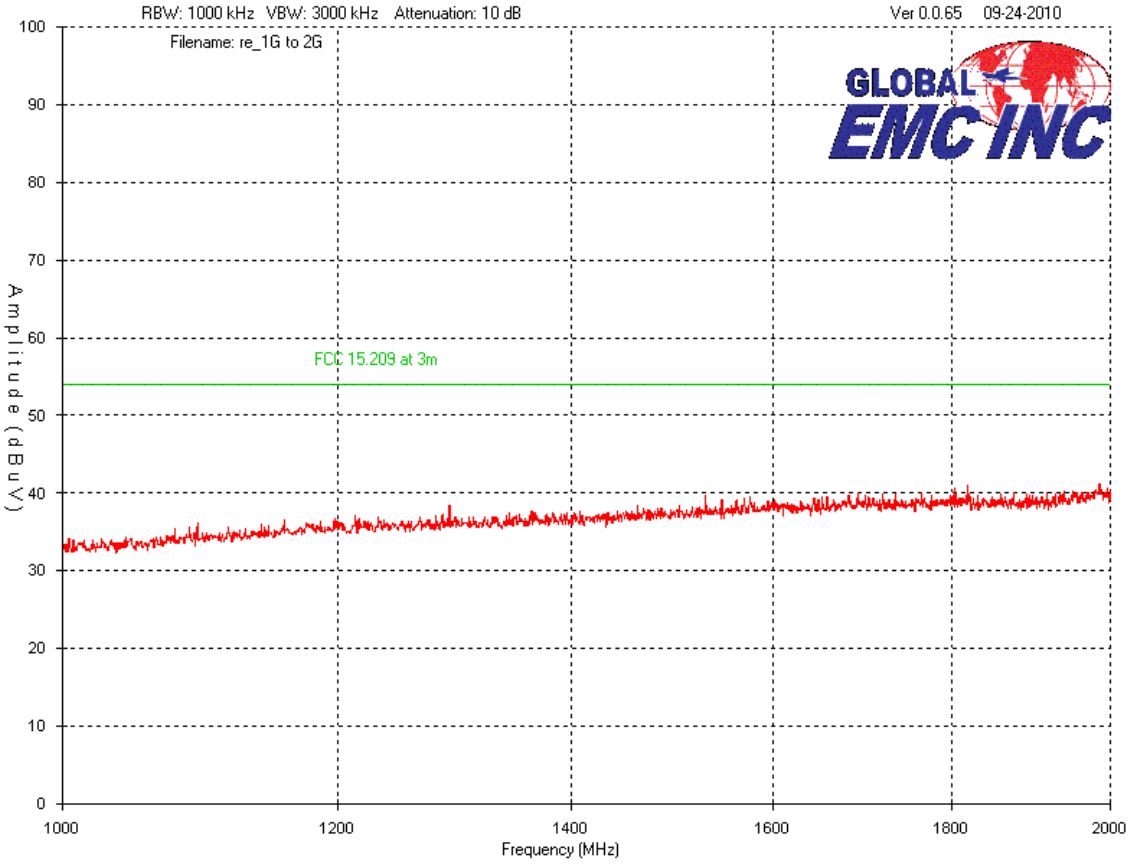
Horizontal – Peak Emissions Graph

Transmitter (1GHz to 2 GHz)



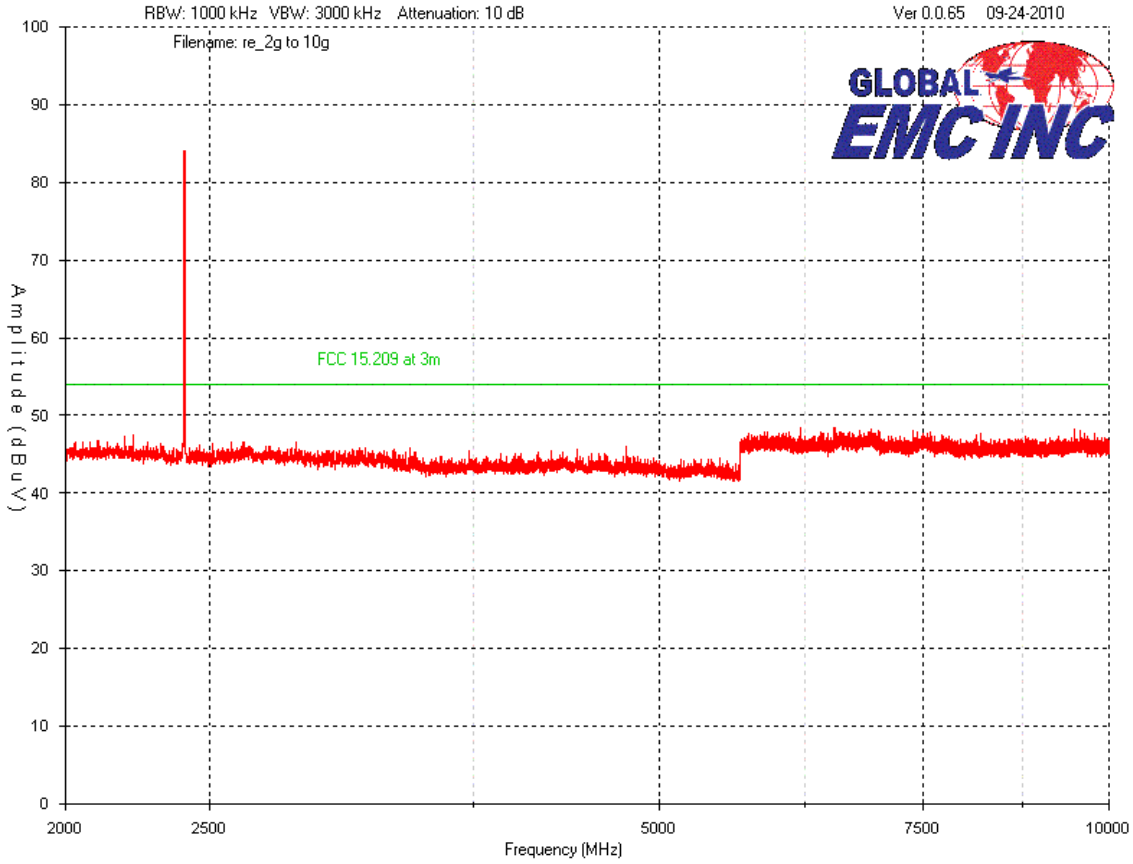
Horizontal – Peak Emissions Graph

RX Transceiver (1GHz to 2 GHz)



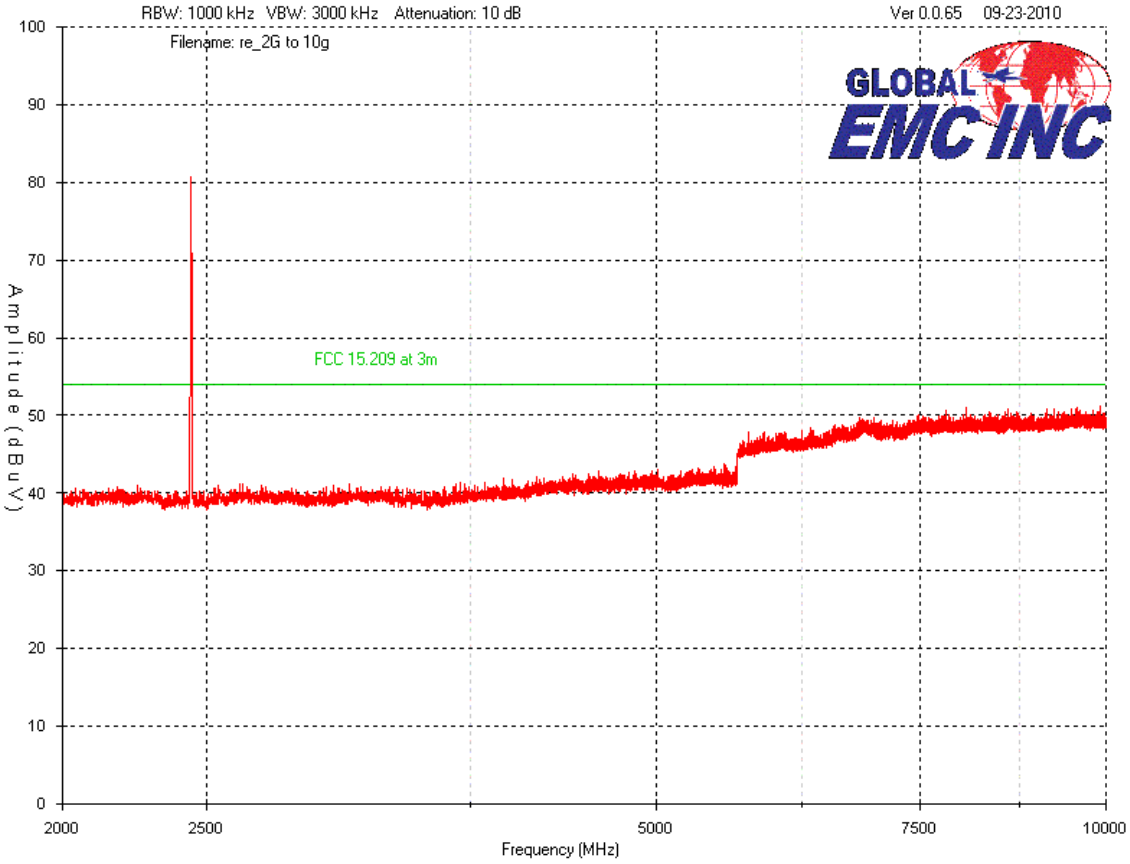
Horizontal – Peak Emissions Graph

Transmitter (2 GHz to 10 GHz)

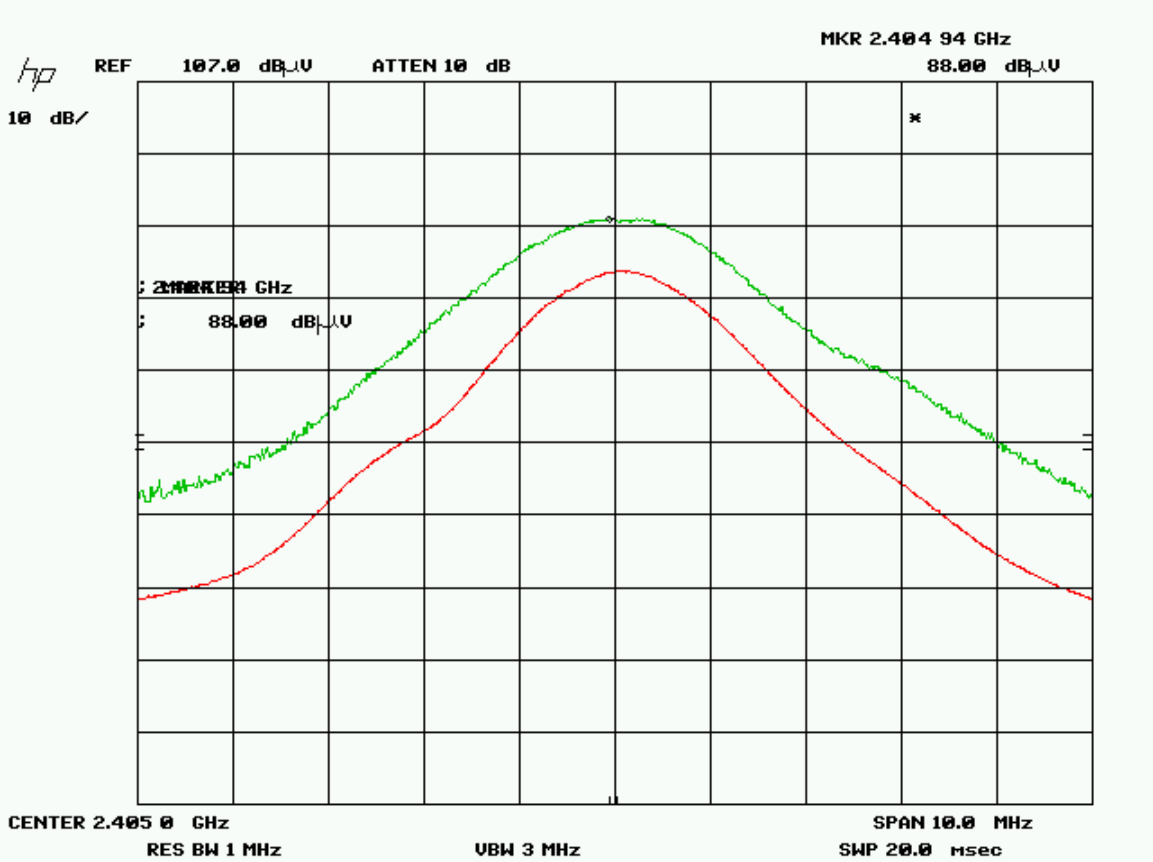


Horizontal – Peak Emissions Graph

RX Transceiver (2 GHz to 10 GHz)



2405 MHz (raw)



Final Measurements

For information purposes, the worst case fundamental was measured to be 84.6 dBuV/m at 3 meters.

Transmitter data is presented below as worst case.

Quasi-Peak Emissions 30MHz to 1GHz.

Quasi Peak Emissions Table - Vertical

Frequency (MHz)	Raw (dBuV)	Ant. (dB/m)	Cable (dB)	Amp (dB)	Level (dBuV/m)	Limit (dB)	Margin (dB)	Pass/Fail
47.266	58.5	10.2	0.3	-32	37	40	3	Pass
178.507	49.2	9.7	0.5	-31.8	27.6	43.5	15.9	Pass
98.579	46.6	8.7	0.5	-32	23.8	43.5	19.7	Pass
981.279	38.7	23.9	1.5	-30	34.1	54	19.9	Pass
335.938	41.9	15.2	0.6	-31.4	26.3	46.4	20.1	Pass
162.89	45.4	9.1	0.5	-31.8	23.2	43.5	20.3	Pass

Quasi Peak Emissions Table - Horizontal

Frequency (MHz)	Raw (dBuV)	Ant. (dB/m)	Cable (dB)	Amp (dB)	Level (dBuV/m)	Limit (dB)	Margin (dB)	Pass/Fail
47.654	57.5	10.1	0.4	-32	36	40	4	Pass
141.065	48.9	8	0.5	-31.9	25.5	43.5	18	Pass
335.938	43.1	15.2	0.6	-31.4	27.5	46.4	18.9	Pass
147.661	47.3	8.6	0.5	-31.9	24.5	43.5	19	Pass
112.45	46.9	8.4	0.5	-32	23.8	43.5	19.7	Pass
99.743	46.2	8.8	0.5	-32	23.5	43.5	20	Pass

Note the emissions shown in the table above were determined to be emanating from the host power supply and the host board.

Emissions above 1 GHz

Test Freq (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											
2405	Peak	Horz	88.0	30.6	2.2	0.0	36.2	84.6			PASS
2405	Avg	Horz	80.9	30.6	2.2	0.0	36.2	77.5			PASS
2405	Peak	Vert	86.5	30.6	2.2	0.0	36.2	83.1			PASS
2405	Avg	Vert	80.3	30.6	2.2	0.0	36.2	76.9			PASS
2400	Peak	Horz	48.6	30.6	2.2	0.0	36.2	45.2	74.0	28.8	PASS
2400	Avg	Horz	35.4	30.6	2.2	0.0	36.2	32.0	54.0	22.0	PASS
2400	Peak	Vert	47.5	30.6	2.2	0.0	36.2	44.1	74.0	29.9	PASS
2400	Avg	Vert	34.2	30.6	2.2	0.0	36.2	30.8	54.0	23.2	PASS
2390(1)	Peak	Horz	45.0	30.6	2.2	0.0	36.2	41.6	74.0	32.4	PASS
2390(1)	Avg	Horz	35.0	30.6	2.2	0.0	36.2	31.6	54.0	22.4	PASS
2390(1)	Peak	Vert	45.0	30.6	2.2	0.0	36.2	41.6	74.0	32.4	PASS
2390(1)	Avg	Vert	35.0	30.6	2.2	0.0	36.2	31.6	54.0	22.4	PASS
4810	Peak	Horz	45.0	33.7	2.9	0.0	35.7	45.9	74.0	28.1	PASS
4810	Avg	Horz	35.0	33.7	2.9	0.0	35.7	35.9	54.0	18.1	PASS
4810	Peak	Vert	45.0	33.7	2.9	0.0	35.7	45.9	74.0	28.1	PASS
4810	Avg	Vert	35.0	33.7	2.9	0.0	35.7	35.9	54.0	18.1	PASS
7215	Peak	Vert	42.2	37.9	4.3	0.0	35.9	48.5	74.0	25.5	PASS
7215	Avg	Vert	29.5	37.9	4.3	0.0	35.9	35.8	54.0	18.2	PASS
7215	Peak	Horz	43.1	37.9	4.3	0.0	35.9	49.4	74.0	24.6	PASS
7215	Avg	Horz	30.4	37.9	4.3	0.0	35.9	36.7	54.0	17.3	PASS

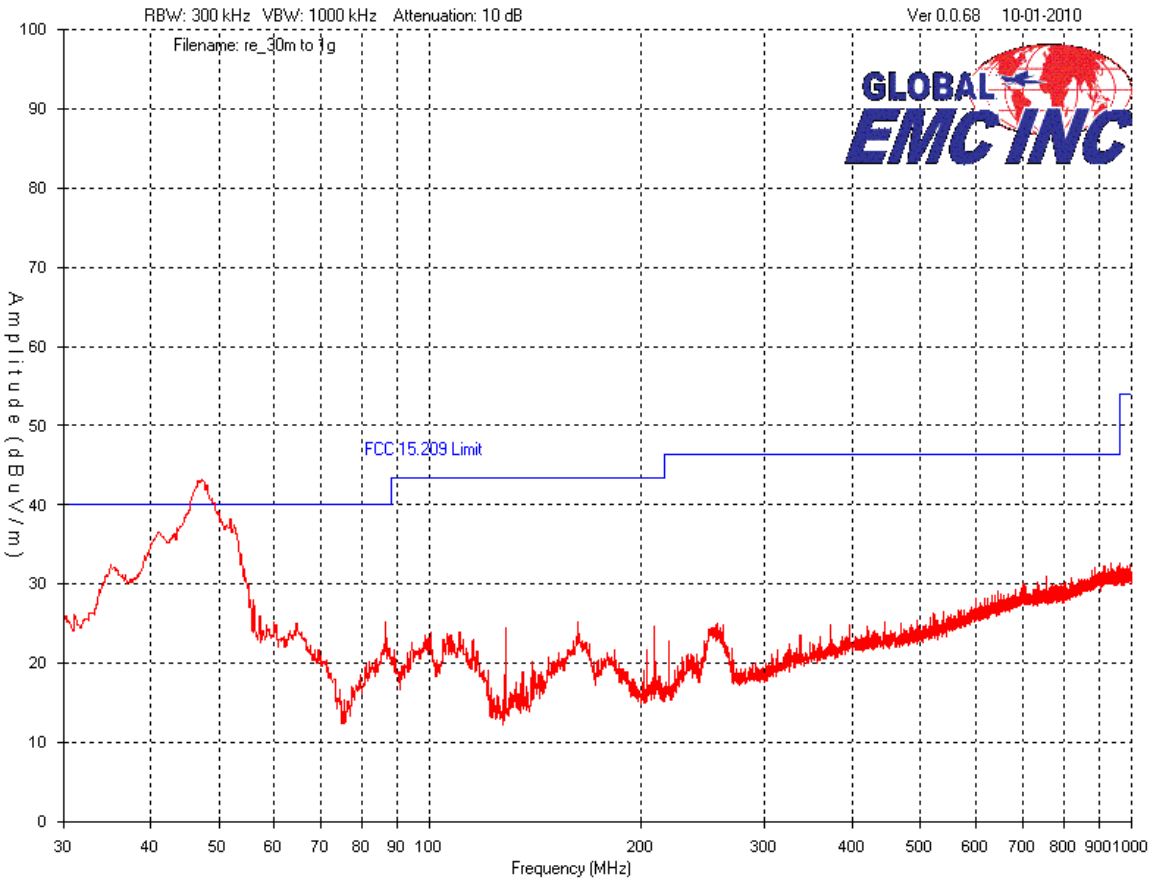
Note 1: Worst case between 2310 and 2390 MHz

Test Freq (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
Mid Channel											
2441	Peak	Horz	85.7	30.6	2.2	0.0	36.2	82.3			PASS
2441	Avg	Horz	82.4	30.6	2.2	0.0	36.2	79.0			PASS
2441	Peak	Vert	86.7	30.6	2.2	0.0	36.2	83.3			PASS
2441	Avg	Vert	83.0	30.6	2.2	0.0	36.2	79.6			PASS
4882	Peak	Horz	40.3	33.7	2.9	0.0	35.7	41.2	74.0	32.8	PASS
4882	Avg	Horz	29.6	33.7	2.9	0.0	35.7	30.5	54.0	23.5	PASS
4882	Peak	Vert	N/A	33.7	2.9	0.0	35.7		74.0		PASS
4882	Avg	Vert	N/A	33.7	2.9	0.0	35.7		54.0		PASS
7323	Peak	Vert	N/A	37.9	4.3	0.0	35.9		74.0		PASS
7323	Avg	Vert	N/A	37.9	4.3	0.0	35.9		54.0		PASS
7323	Peak	Horz	47.0	37.9	4.3	0.0	35.9	53.3	74.0	20.7	PASS
7323	Avg	Horz	41.7	37.9	4.3	0.0	35.9	48.0	54.0	6.0	PASS
High Channel											
2477	Peak	Horz	85.1	30.6	2.2	0.0	36.2	81.7			PASS
2477	Avg	Horz	82.4	30.6	2.2	0.0	36.2	79.0			PASS
2477	Peak	Vert	85.0	30.6	2.2	0.0	36.2	81.6			PASS
2477	Avg	Vert	81.0	30.6	2.2	0.0	36.2	77.6			PASS
2483.5	Peak	Horz	50.7	30.6	2.2	0.0	36.2	47.3	74.0	26.7	PASS
2483.5	Avg	Horz	39.1	30.6	2.2	0.0	36.2	35.7	54.0	18.3	PASS
2483.5	Peak	Vert	49.8	30.6	2.2	0.0	36.2	46.4	74.0	27.6	PASS
2483.5	Avg	Vert	37.5	30.6	2.2	0.0	36.2	34.1	54.0	19.9	PASS
4954	Peak	Horz	40.5	33.7	2.9	0.0	35.7	41.4	74.0	32.6	PASS
4954	Avg	Horz	26.0	33.7	2.9	0.0	35.7	26.9	54.0	27.1	PASS
4954	Peak	Vert	39.2	33.7	2.9	0.0	35.7	40.1	74.0	33.9	PASS
4954	Avg	Vert	26.0	33.7	2.9	0.0	35.7	26.9	54.0	27.1	PASS
7431	Peak	Vert		37.9	4.3	0.0	35.9	6.3	74.0	67.7	PASS
7431	Avg	Vert		37.9	4.3	0.0	35.9	6.3	54.0	47.7	PASS
7431	Peak	Horz		37.9	4.3	0.0	35.9	6.3	74.0	67.7	PASS
7431	Avg	Horz		37.9	4.3	0.0	35.9	6.3	54.0	47.7	PASS

No emissions were detected above 10 GHz.

Receiver Spurious Emissions

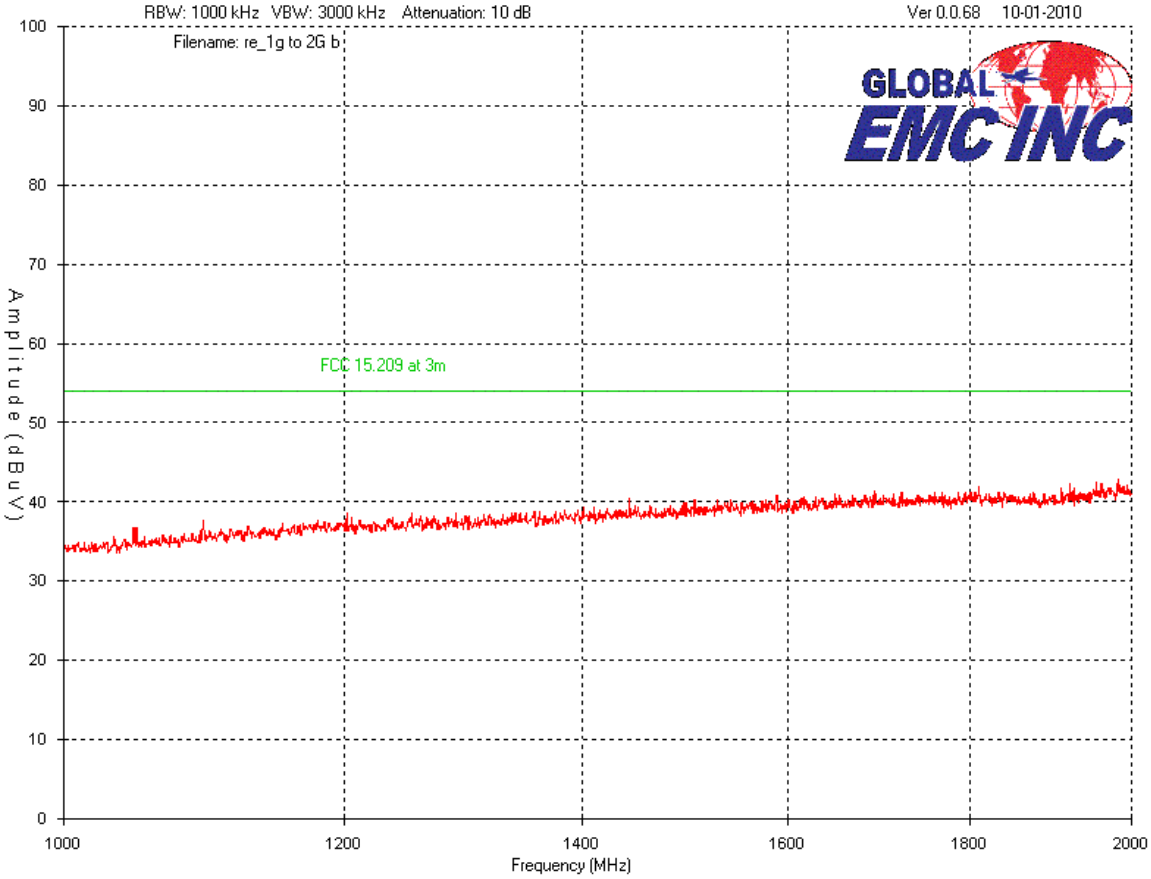
Vertical

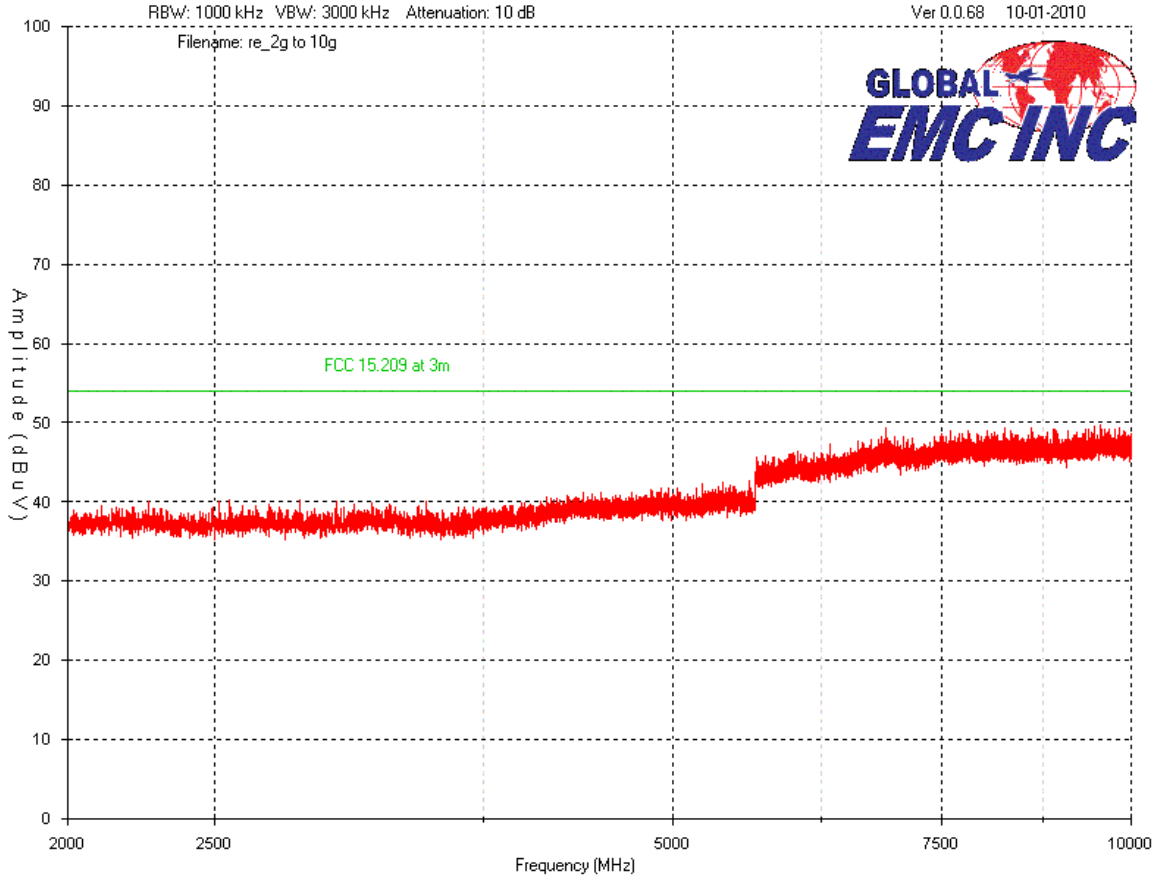


Quasi-Peak Emissions 30MHz to 1GHz.

Quasi Peak Emissions Table - Vertical

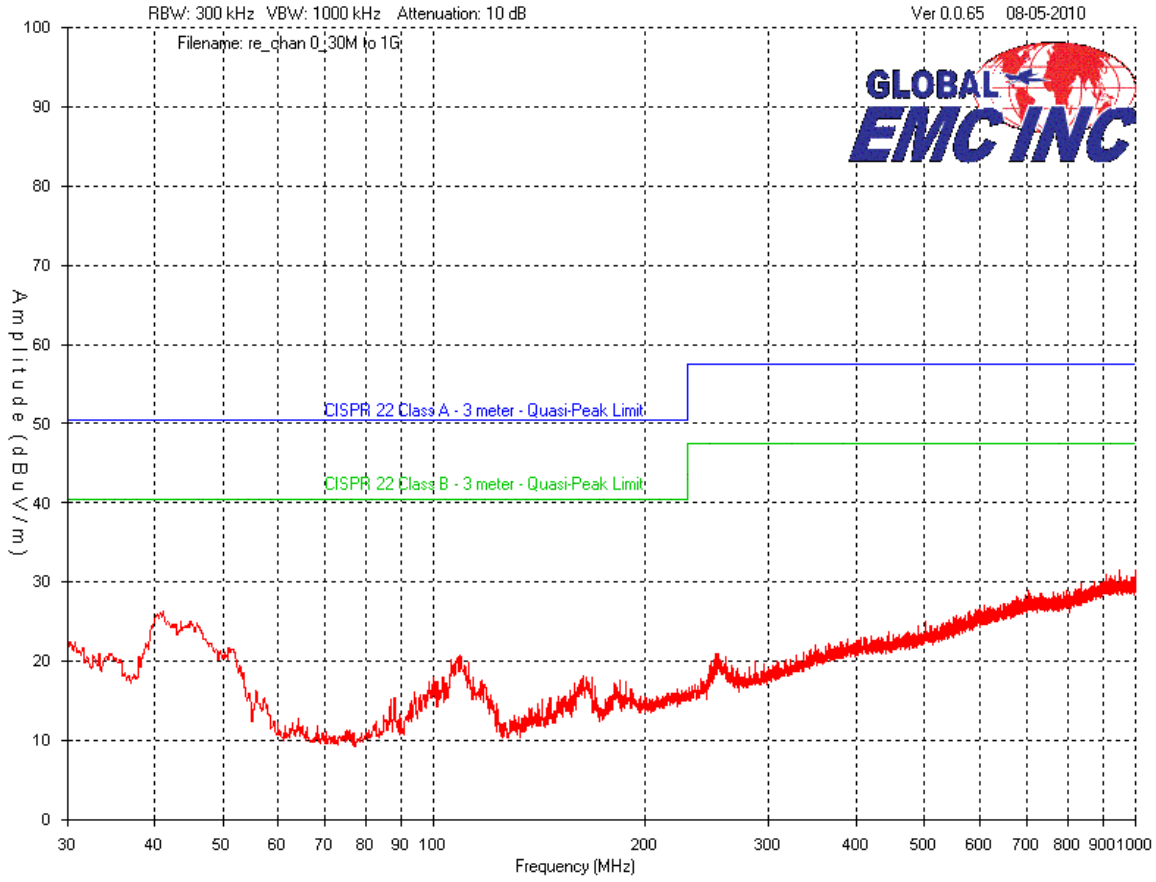
Frequency (MHz)	Raw (dBuV)	Ant. (dB/m)	Cable (dB)	Amp (dB)	Level (dBuV/m)	Limit (dB)	Margin (dB)	Pass/Fail
47.266	58.5	10.2	0.3	-32	37	40	3	Pass

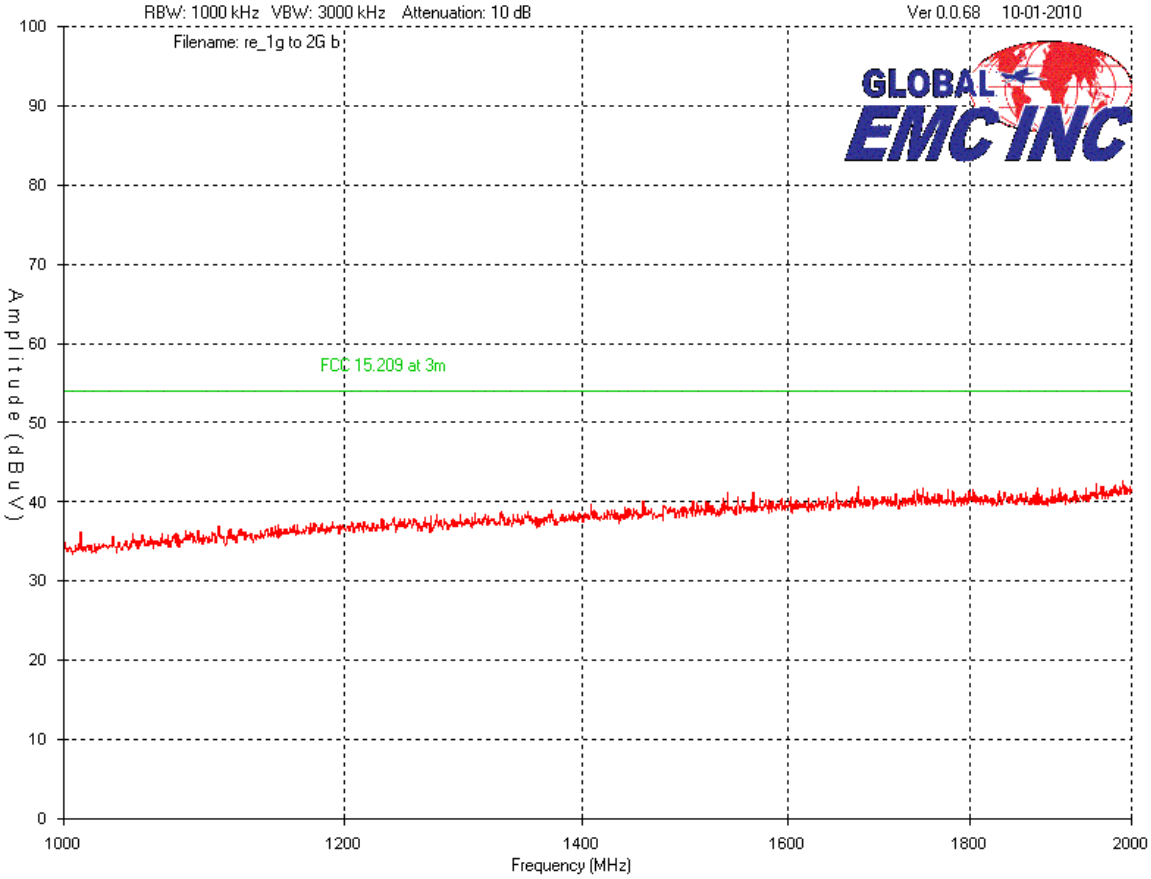


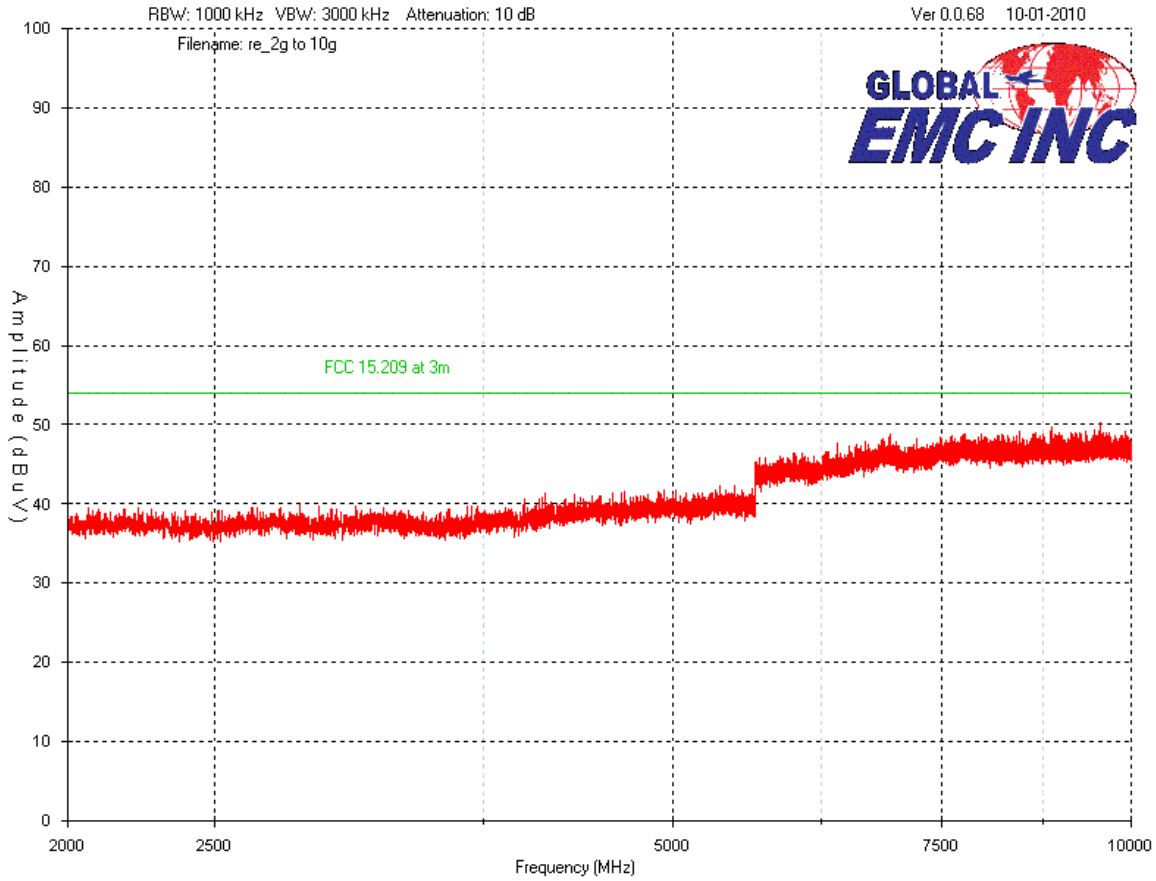


No emissions were detected from 10 GHz to 26 GHz.

Horizontal







No emissions were detected from 10 GHz to 26 GHz.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
IFR Spectrum Analyzer	AN940	IFR	12/29/2009	12/29/2011	GEMC 6350
BiLog Antenna	3142-C	ETS	2009-02-12	2011-02-12	GEMC 8
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	8/25/2010	8/25/2012	GEMC 6403
Q-Par 1.5-18 GHz Horn	6878/24	Q-par	8/25/2010	8/25/2012	GEMC 65
1-26G pre-amp	HP 8449B	HP	8/25/2010	8/25/2012	GEMC 68
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_Rev1.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.

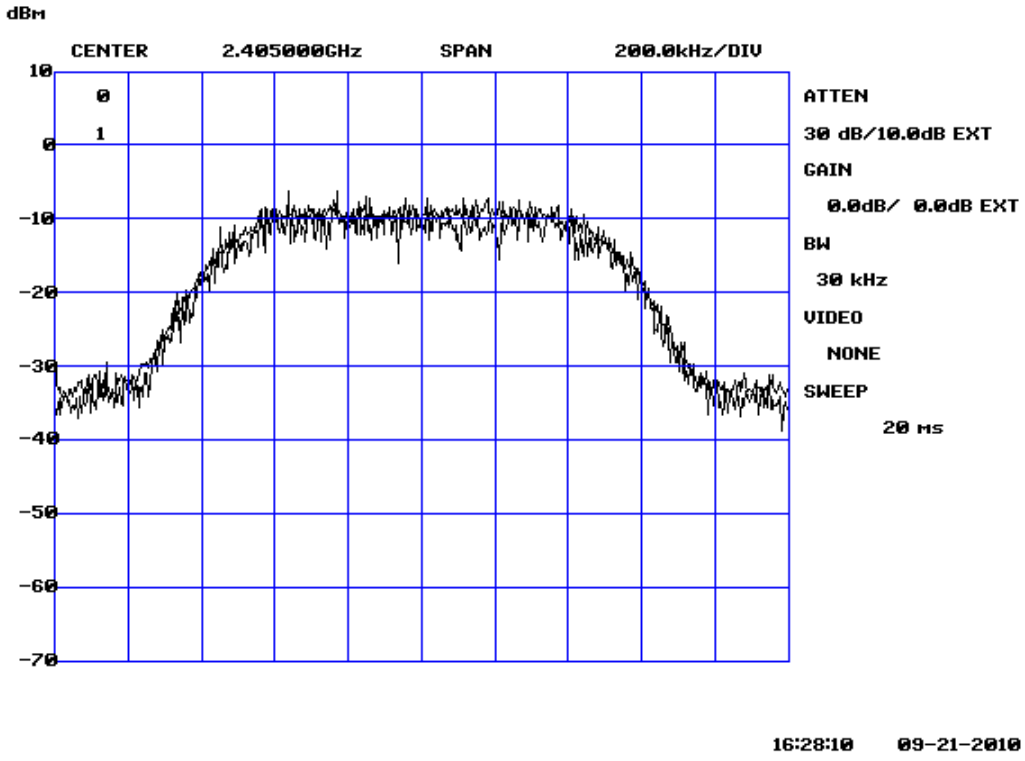
Results

The EUT passed. The 6 dB BW measured was 1.02 MHz well more than the 500 kHz requirement.

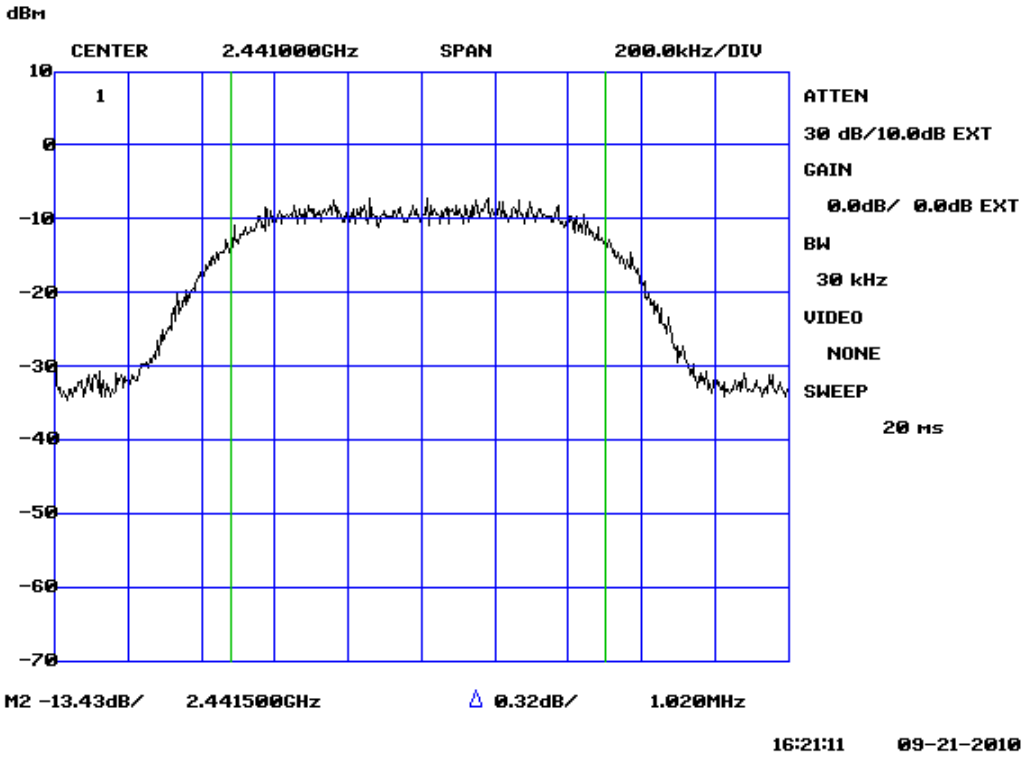
Graph(s)

The graphs shown below shows the channel spacing 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.

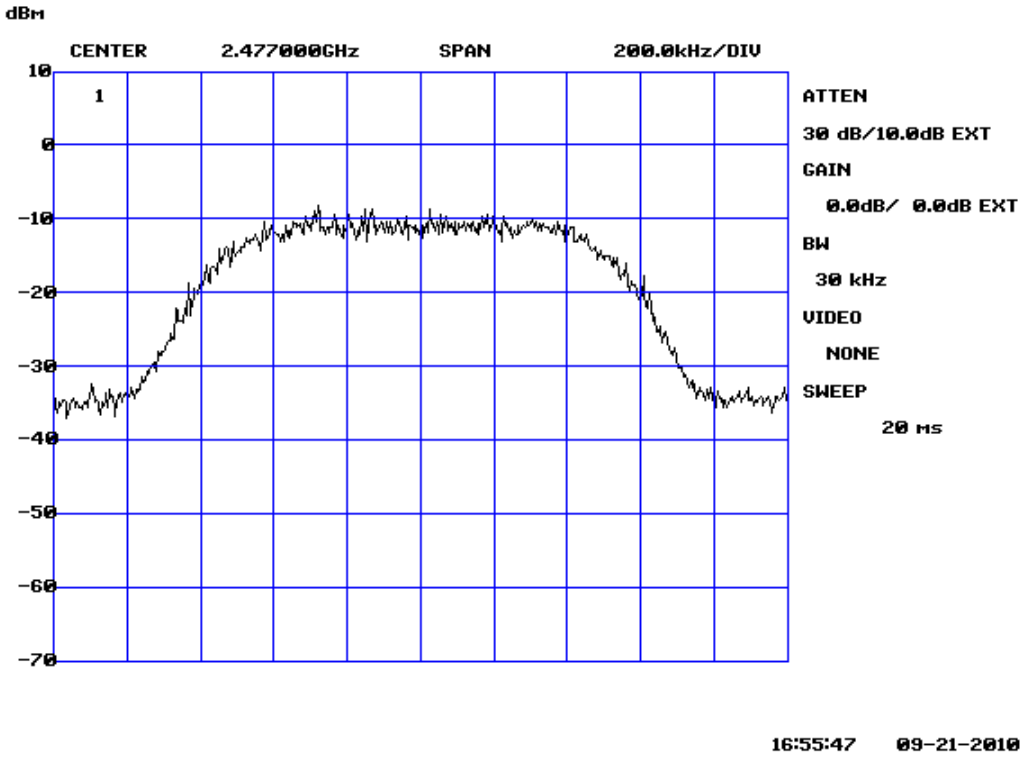
Low Channel

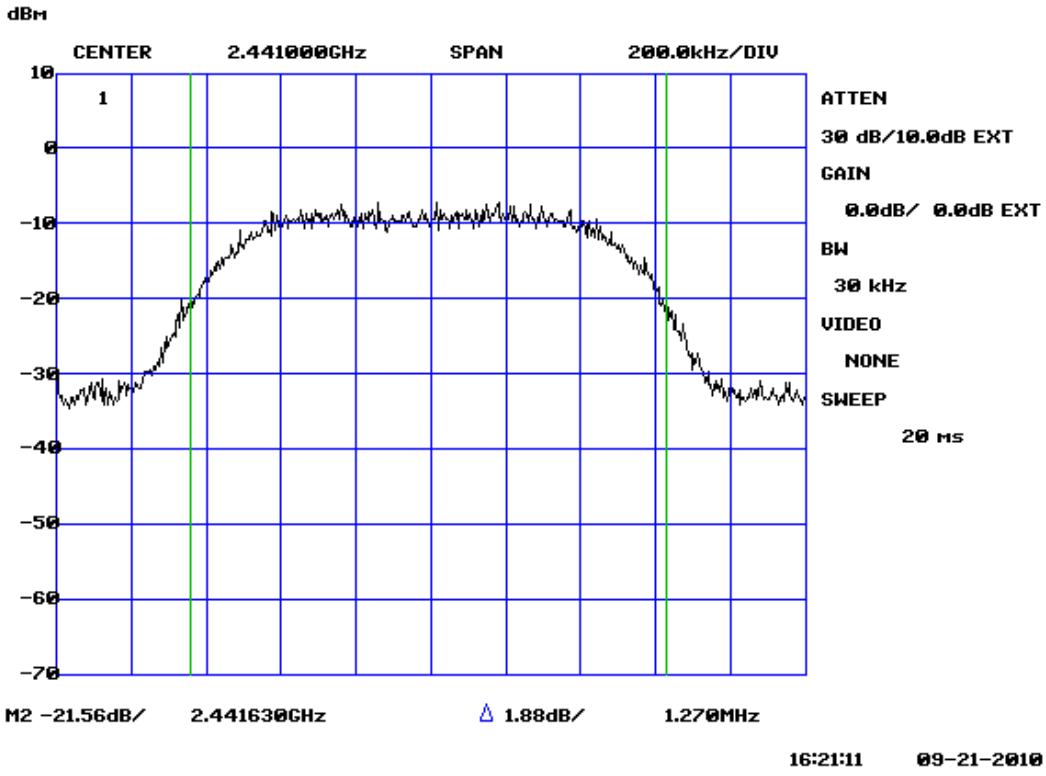


Mid Channel



High Channel





Note 1: 20 dB bandwidth shown above.

Note 2: 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 #
IFR Spectrum Analyzer	AN940	IFR	12/29/2009	12/29/2011	GEMC 6350
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
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 measured was 0 dBm (1mW),

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 10 dB of external attenuation taken during this measurement.

Transmitter

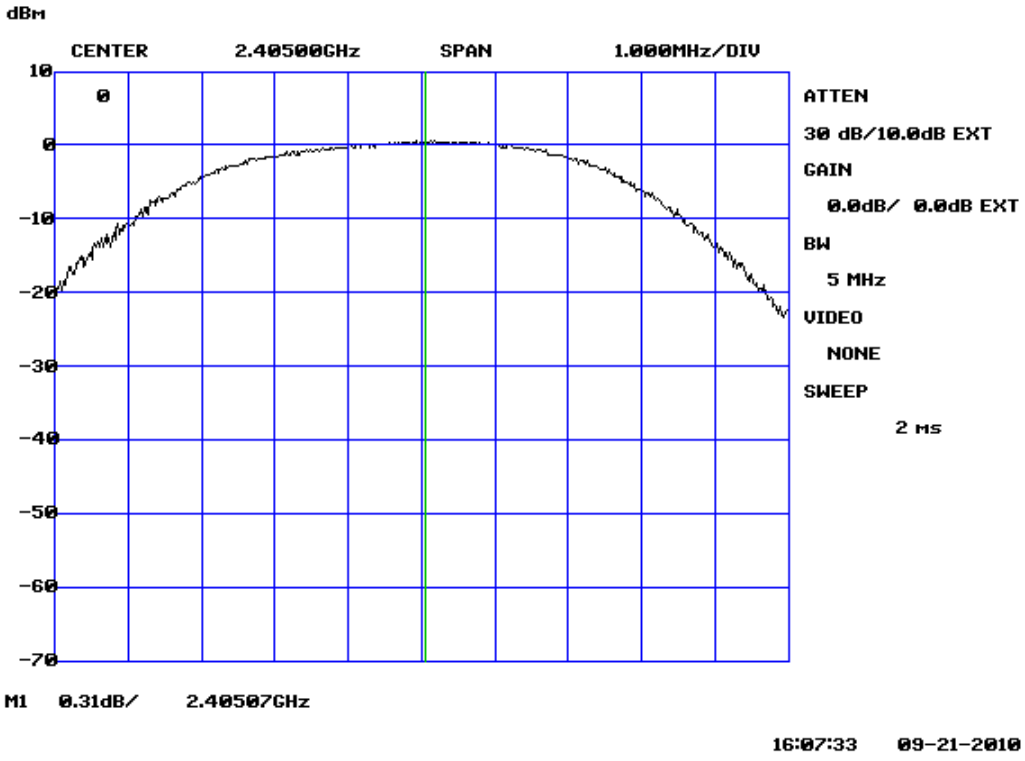
Channel	Frequency (GHz)	Received (dBm)	Ext Atten (dB)	Output Power (dBm)
2	2405	-9.7	10	0.3
20	2441	-11.2	10	-1.2
38	2477	-12.2	10	-2.2

"Rx" transceiver

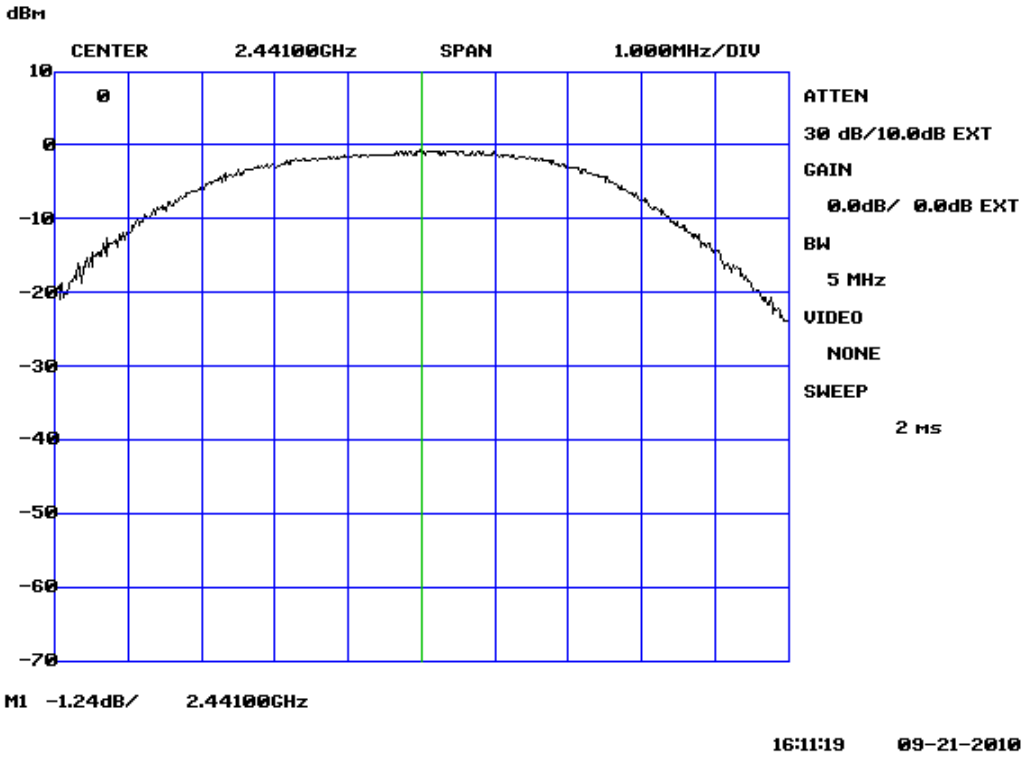
Channel	Frequency (GHz)	Received (dBm)	Factor (dB)	Output Power (dBm)
2	2405	-9.7	10	0.3
20	2441	-11.3	10	-1.3
38	2477	-12.3	10	-2.3

The calculated value is:
-10 dBm + 10 dB (attenuator)
= 0 dBm = 1.07 mW

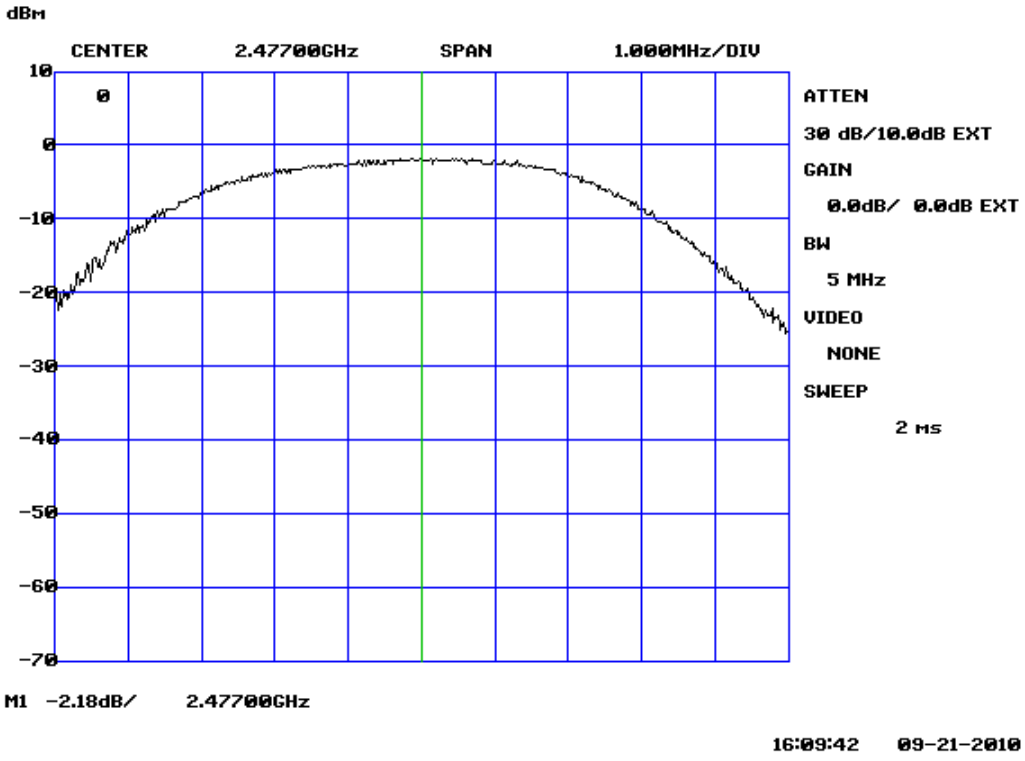
Transceiver (low channel)



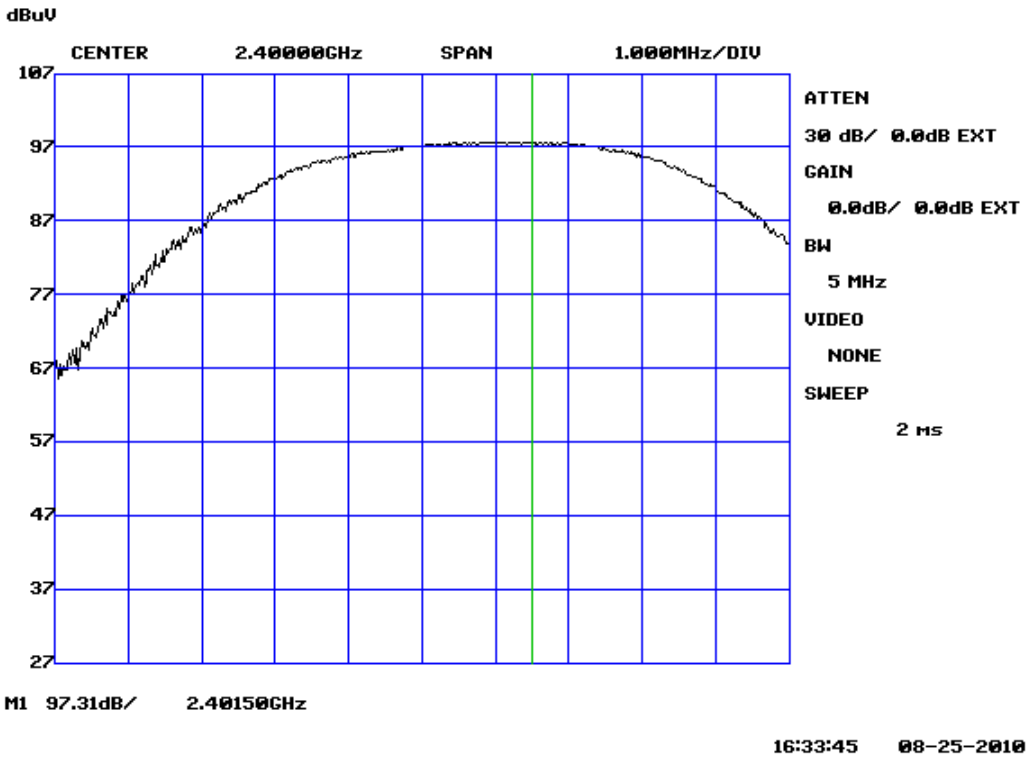
Transmitter (Mid channel)



Transmitter (High Channel)



Rx “transceiver” (low channel)



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 #
IFR Spectrum Analyzer	AN940	IFR	12/29/2009	12/29/2011	GEMC 6350
BiLog Antenna	3142-C	ETS	2009-02-12	2011-02-12	GEMC 8
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.

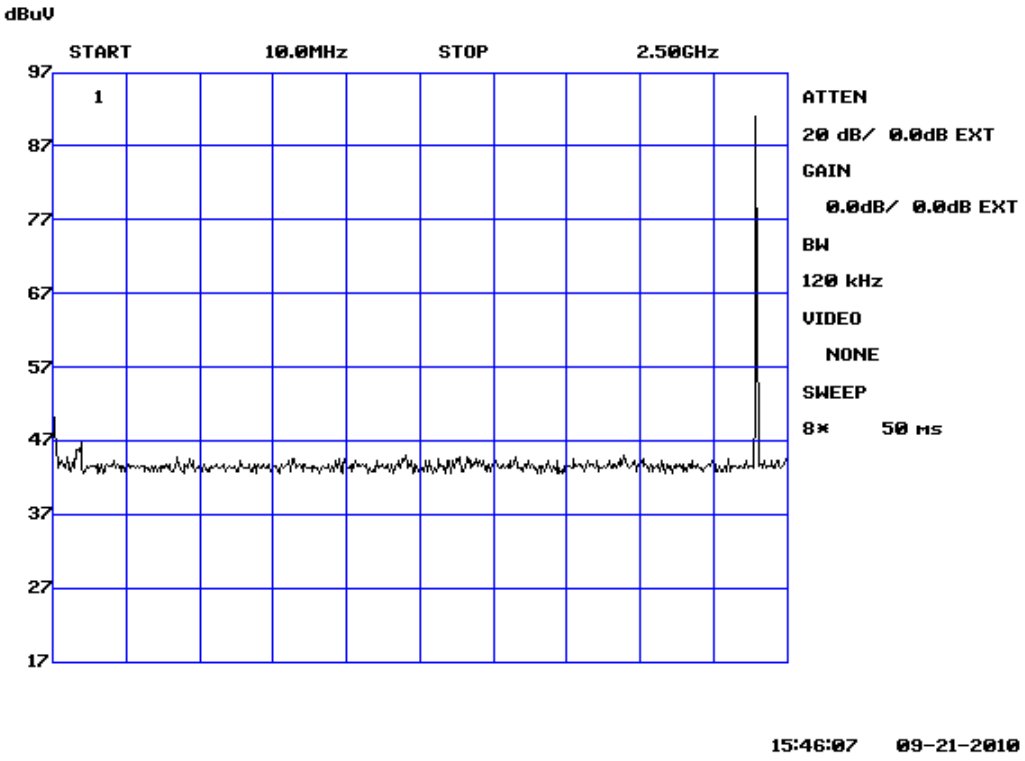
Results

The EUT pass. Low, middle and high band was measured for each transmitter and 'RX/transceiver' 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 transmitter as representative. The -20 dBc requirement is also shown for the higher band edge at 2.4835 GHz in the high band for transmitter as representative.

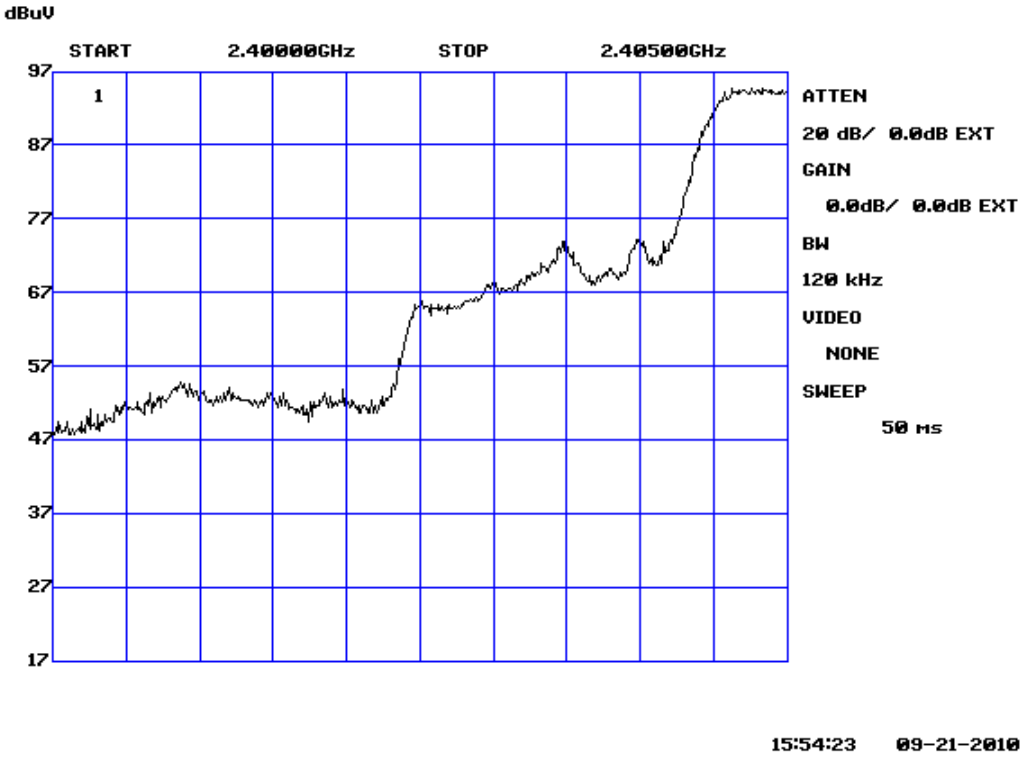
Graph(s)

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.

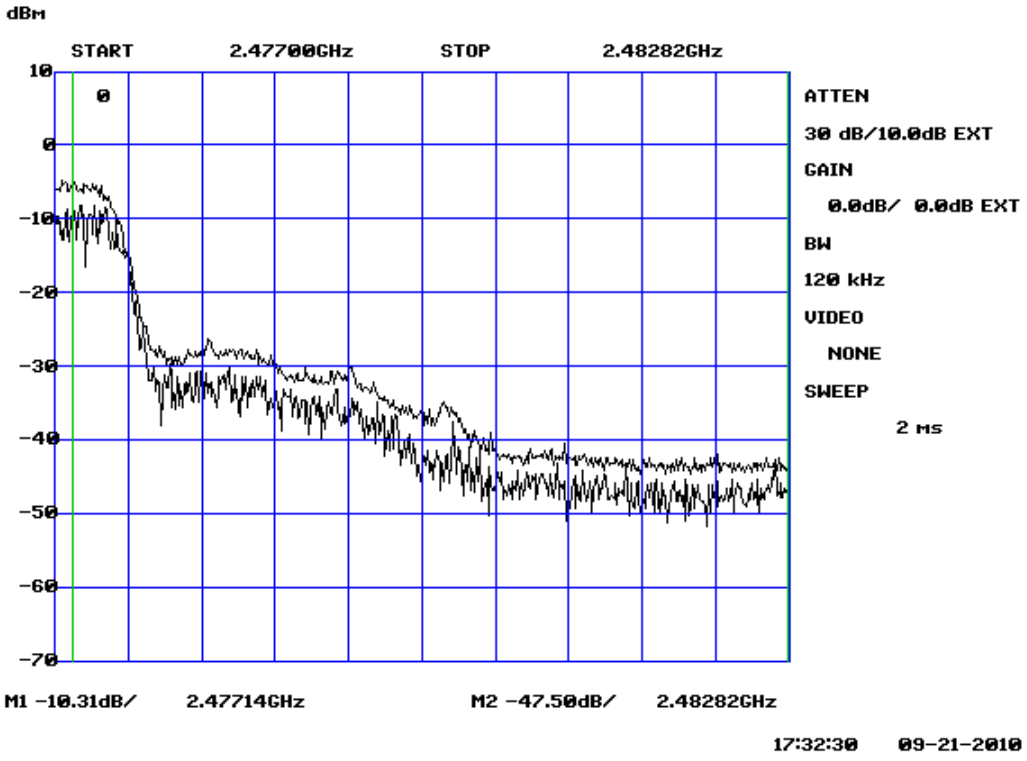
Frequencies below fundamental



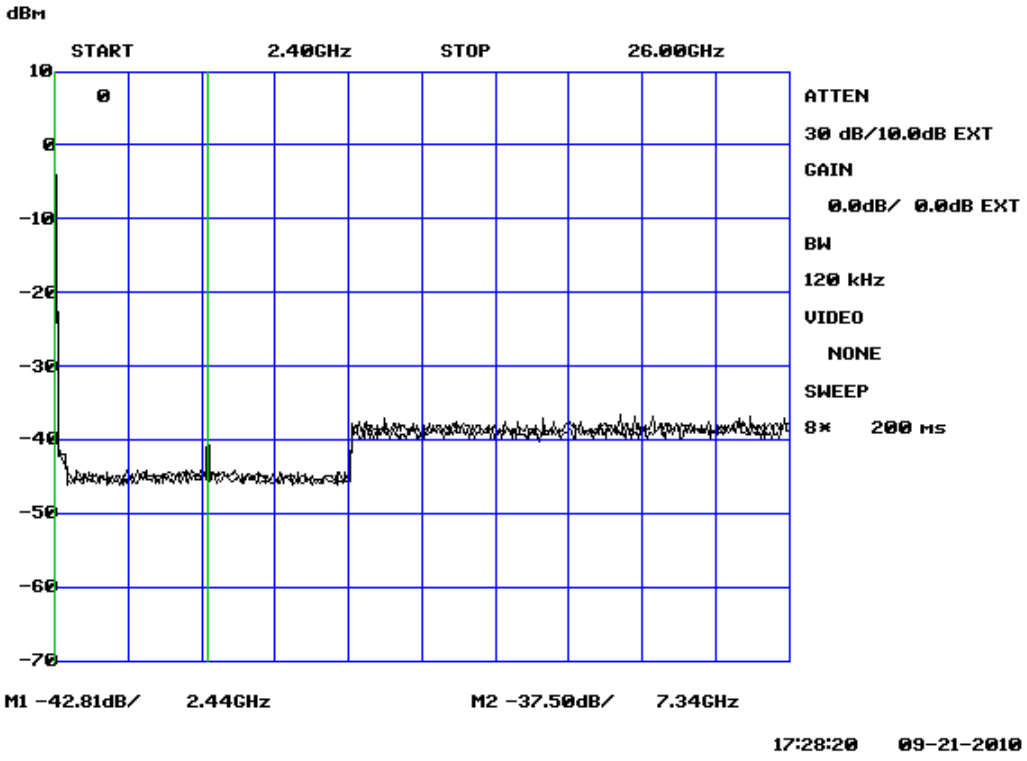
Low Channel, Lower Band Edge



High Channel, Upper Band Edge



Frequencies above Fundamental (2rd to 10th Harmonics)



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
IFR Spectrum Analyzer	AN940	IFR	12/29/2009	12/29/2011	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.

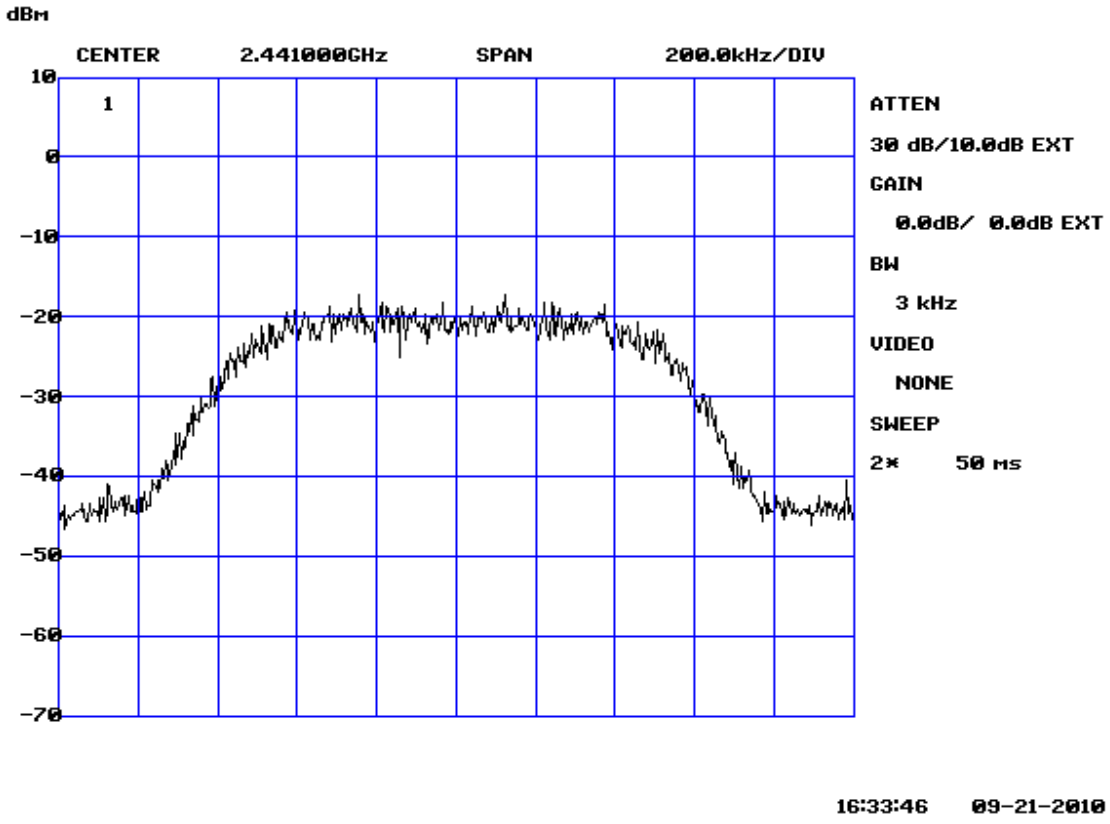
Results

The EUT passed. Note that the worst case peak power output is 0.3 dBm, therefore this meets this requirement with significant margin when measured with a significantly wider bandwidth.

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. Middle is shown as representative. Peak readings shown were taken with a 3 kHz Resolution using the radiated method and are raw readings as shown.

Mid channel



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 #
IFR Spectrum Analyzer	AN940	IFR	12/29/2009	12/29/2011	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"

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 1cm, as this is the minimum distance an operator will be from the EUT during normal operation, however limitations apply as this is less than 2.4 mW.

Note: This device does not exceed the 60 / f (GHz) in mW limit as per FCC KDB 447498 2(a)(i), so it is allowable to be used in portable exposure conditions with no restrictions on host platforms

Results

The EUT passed the requirements. The worst case calculated power density was 0.08 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 = 1 mW as per Peak power conducted output
Where G = 0 dBi, or numerically 1
Where R = 1 cm

$P_d = (1\ mW * 1) / (4 * pi * 1\ cm^2)$
$P_d = 1\ mW / 12.5\ cm^2$
$P_d = 0.08\ mW/cm^2$

Appendix A – EUT Summary

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

General EUT Description

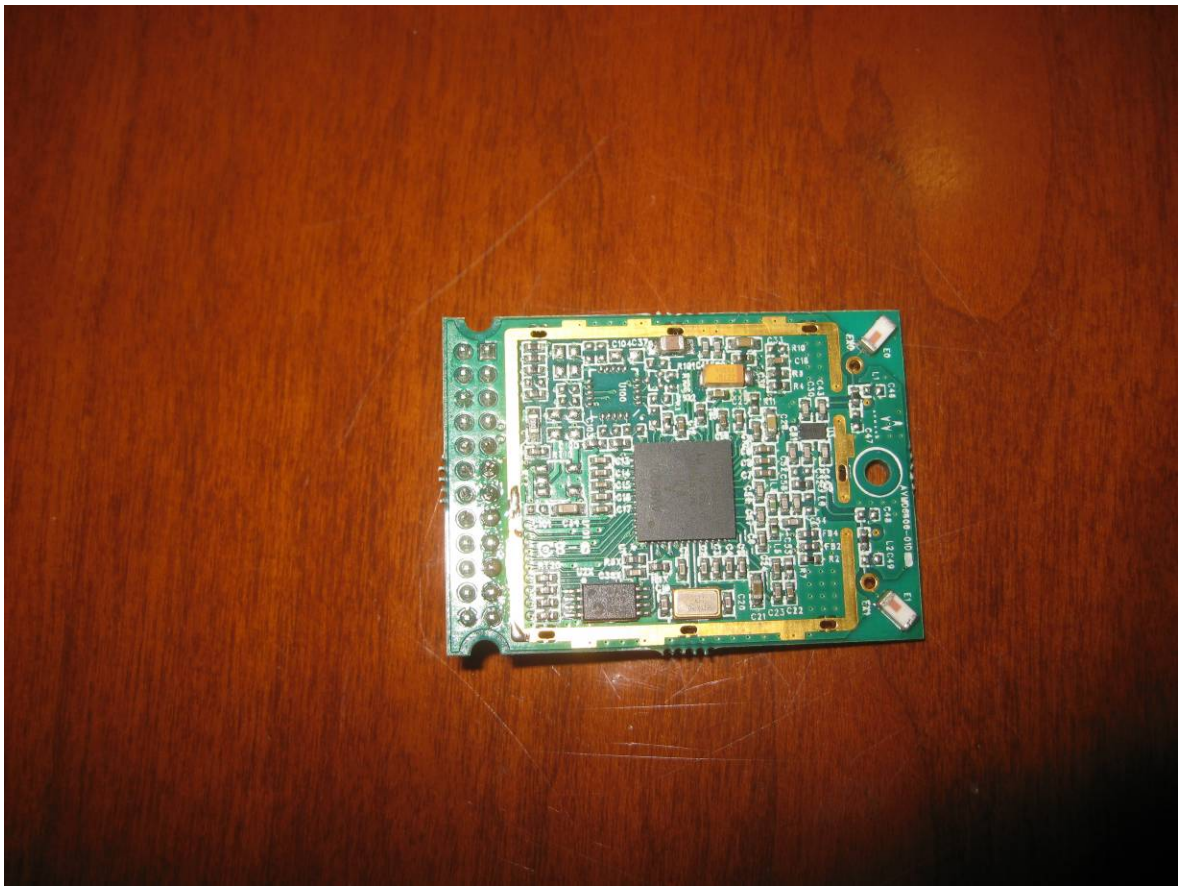
Manufacturer	Sonavox Audio Solution
EUT Name	Wireless Audio Transceiver Module – WTX1010
FCCID	WUO-WTX1010
IC #	7985A-WTX1010
Approximate Size (LxWxH)	5cm x 5cm x 2 cm
Equipment Category (Commercial / Residential / Medical)	Portable / mobile
Minimum Separation distance from operator	Possibly body worn
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'.

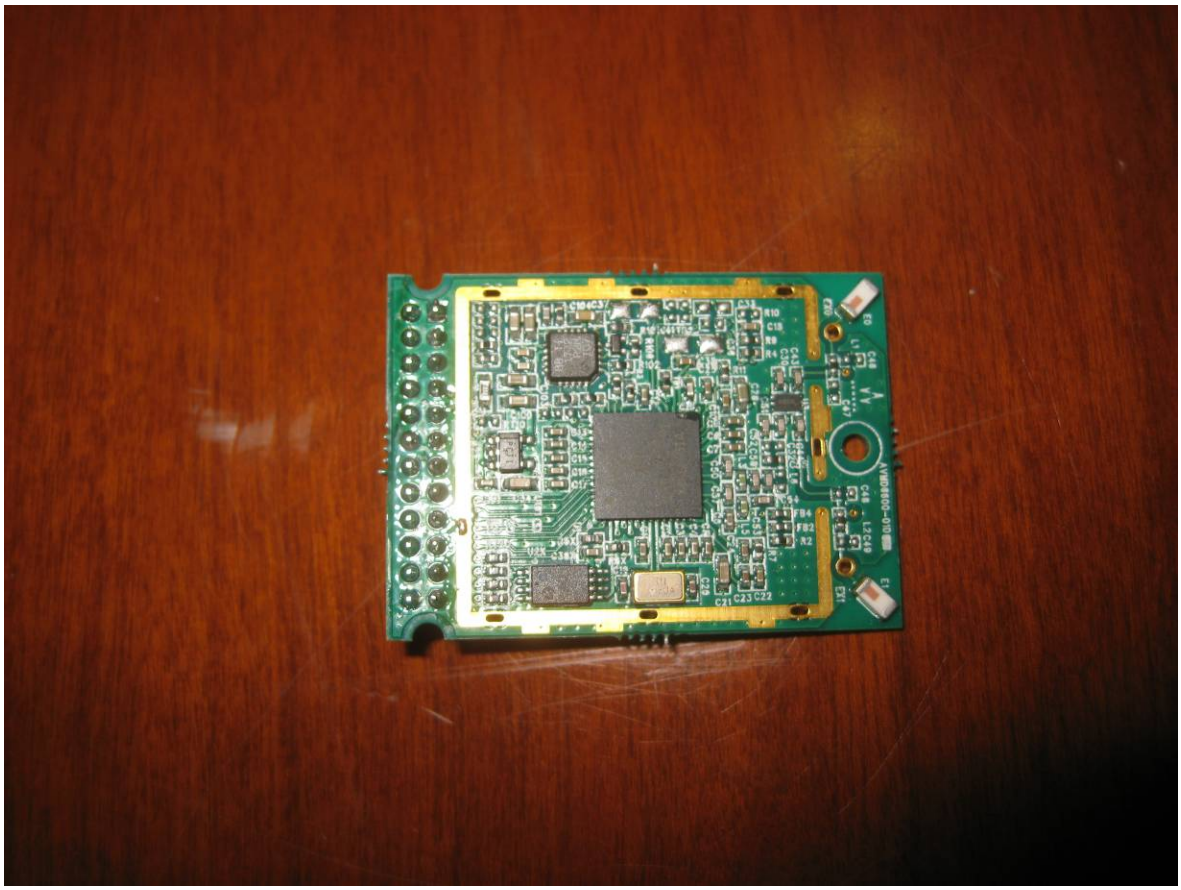
Appendix B – EUT and Test Setup Photographs

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

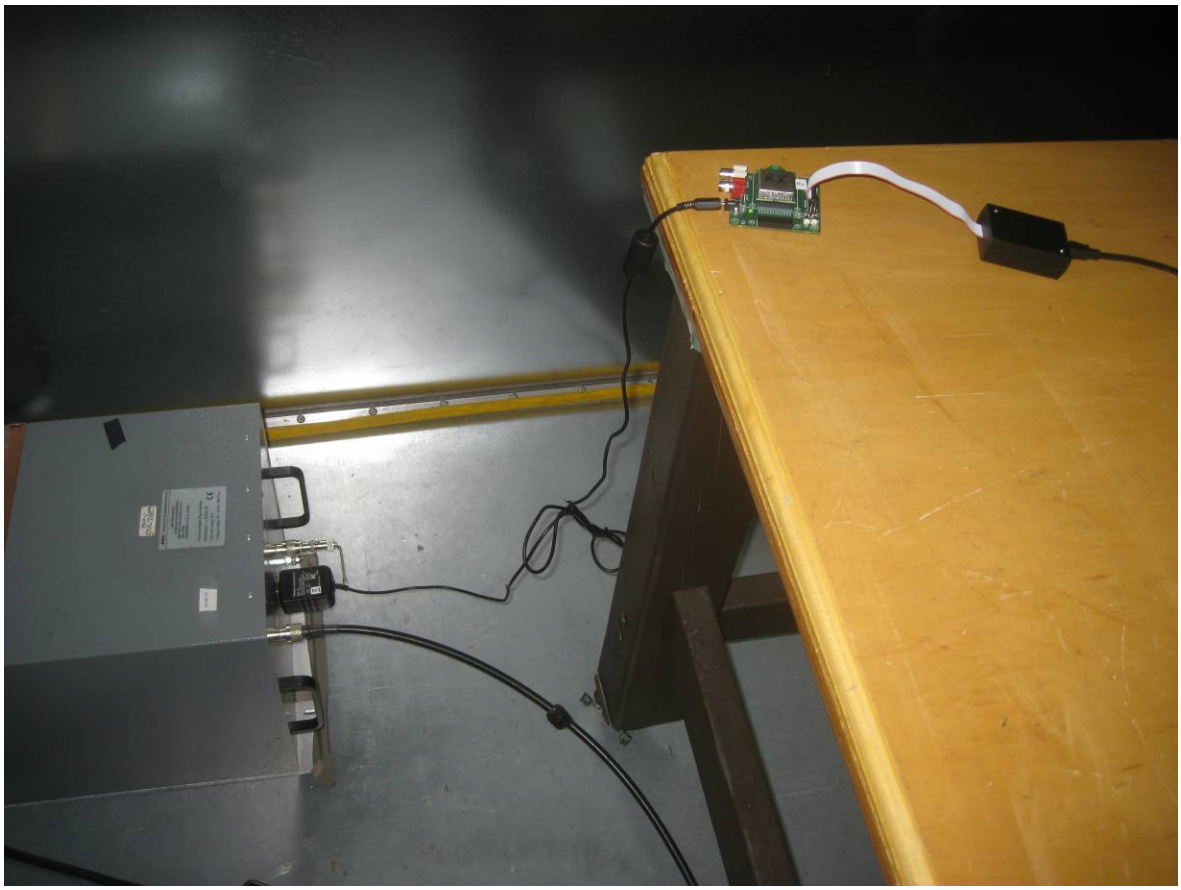
EUT – Transmitter



EUT – RX Transceiver



Power Line Conducted Emissions



Radiated Emissions

Radiated Emissions 2

Antenna Conducted Measurements