

Global EMC Inc. Labs

EMC & RF Test Report

As per

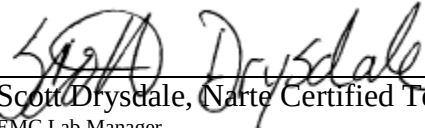
RSS 220 Issue 1:2009

&

FCC Part 15:2011 Subpart F
Ultra Wide Band Transmitters
Ground Penetrating Radar

on the

Noggin (NG1000)


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Testing produced for



Sensors & Software Inc.
Ground Penetrating Radar (GPR) Technology

See Appendix A for full customer & EUT details.



**Industry
Canada**

LAB REGISTRATION #6844A-2



FCC REGISTRATION #612361

Client	Sensors & Software	
Product	Noggin (NG1000)	
Standard(s)	RSS 220 Issue 1:2009 / FCC Part 15:2011 Subpart F	

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Report Scope

This report addresses the EMC verification testing and test results of the Noggin (NG1000), herein referred to as EUT (Equipment Under Test) performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:

RSS 220 Issue 1:2009 / FCC Part 15 Subpart F 15:2011

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 government agency, 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.

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Summary

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

EUT FCC Certification #, FCC ID:	QJQ-NG1000
EUT Industry Canada Certification #, IC:	8393A-NG1000
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Scott Drysdale

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Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.207	Power line conducted emissions	QuasiPeak Average	Not applicable See justification
FCC 15.503(d)	Fractional BW	> 0.20 or > 500 MHz	Pass
FCC 15.509(a)	UWB Bandwidth	< 10.6 GHz	Pass
FCC 15.509(b)(1)	Operating Parties	Eligible for licensing	Pass See Justification
FCC 15.509(b)(2)	Coordination	Required	Pass See Justification
FCC 15.509(c)	Handheld / Wall	Tx < 10 Seconds	Not applicable See Justification
FCC 15.509(d)	Radiated emissions	Under limit	Pass
FCC 15.509(e)	Narrowband Radiated emissions	Under limit	Pass
FCC 15.509(f)	Peak power EIRP	< 0 dBm	Not Applicable See Justification
FCC 15.521(a)	Operation requirements	Not toys, aircraft, ship or satellite	Pass See justification
Overall Result			PASS

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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 220), the device has an internal antenna which is not accessible.

For the 'power line conducted emissions' requirements as specified in FCC 15.207 (RSS 220) , the EUT is DC powered (battery operated), and this test does not apply.

For the 'eligible parties' requirement as per FCC 15.509 (b)(1), (RSS-220) refer to the user's manual which includes the applicable guidance.

For the 'coordination' requirement as per FCC 15.509(b)(2), (RSS-220) refer to the user's manual which includes the applicable guidance.

For the 'handheld' requirement as per FCC 15.509(c) (RSS-220) of 10 seconds of maximum Tx after release, this does not apply as this device is not hand held or wall imaging.

For the 'peak power' requirement as per FCC 15.509(f), (RSS-220) this does not apply as the frequency at which the highest radiated emission occurs is below 960 MHz.

For the 'operation' requirements as per FCC 15.521(a), (RSS-220) this device is not marketed as a toy or for general use. Operation is not intended, or designed for, use on an aircraft, ship or satellite.

As per guidance in ANSI C63.10 section 7.3.10, for frequencies above 960 MHz, the device was tested with absorber placed above the reference ground plane as depicted in the test setup photo's to ensure a free space propagation path measurement was performed. As per guidance in ANSI C63.10 section 7.10.2.2, Anechoic material was used as an alternative to a bed of sand. The bed of sand was investigated during engineering prescan

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measurements to have similar attenuation with respect to the directly-radiated UWB emissions. In accordance with guidance provided in RSS 220 the preferred alternative method for testing GPR devices was performed. This method is to place the DUT at a height of 80 cm on a non-conducting support with the emitter directed downwards. If the DUT emissions are expected to have components below 500 MHz, a layer of ferrite tile is be placed directly on the floor below the DUT. Pyramidal or wedge-shaped RF absorbers not less than 60 cm in height should be placed directly below the DUT. Some sections of absorber may be inverted and placed over other absorbers to form a solid block. The placement of the absorber shall not be disturbed when the device is rotated. This arrangement prevents energy directed directly downwards from consideration in the measurement.

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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:Issue 5	- 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
RSS 220:2009	- Issue 1: Spectrum Management and Telecommunications Policy. Radio Standards Specification Devices Using Ultra-Wideband (UWB) Technology

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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 – Released April 4, 2013

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Definitions and Acronyms

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

AE – Auxillary Equipment.

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

EMC – Electro-Magnetic Compatibility

EMI – Electro-Magnetic Immunity

EUT – Equipment Under Test

GPR – Ground Penetrating Radar

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

RBW – Resolution Bandwidth

RF – Radio Frequency

UWB – Ultra Wide Band

VBW – Video Bandwidth

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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) #612361 and Industry Canada (IC) 6844A-2. 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. Global EMC maintains an ISO 17025 accreditation with A2LA (certificate #2555.01).

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Testing Environmental Conditions and Dates

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

Date	Test	Init.	Temperature (°C)	Humidity (%)	Pressure (kPa)
Feb 12, 2013 and March 1, 2013	RE	SD	20-25°C	30-45%	100 -103kPa

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Detailed Test Results Section

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Bandwidth of Ultra Wide Band Transmitters

Purpose

The purpose of this test is to ensure that the device is capable of being classified as an Ultra Wide Band (UWB) transmitter.

Limits

The Limit is as specified in FCC Part 15 and RSS 220.

In accordance with 15.503(a), “the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L . The frequency at which the highest radiated emission occurs is designated f_M .

In accordance with 15.503(c), Fractional bandwidth. The fractional bandwidth equals $2(f_H - f_L) / (f_H + f_L)$.

For the product to be defined as a UWB is that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

In accordance with FCC 15.509(a), the UWB Bandwidth must be below 10.6 GHz.

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Results

The EUT passed.

f_L was 223.5 MHz and f_H was 2092.5 MHz. The 10 dB BW was measured to be MHz.

The fractional bandwidth is

$$\begin{aligned}
 & 2 \times (2092.5 - 223.5) / (2092.5 + 223.5) \\
 &= 2 \times 1869 / 2316 \\
 &= 2 \times 0.807 \\
 &= 1.61
 \end{aligned}$$

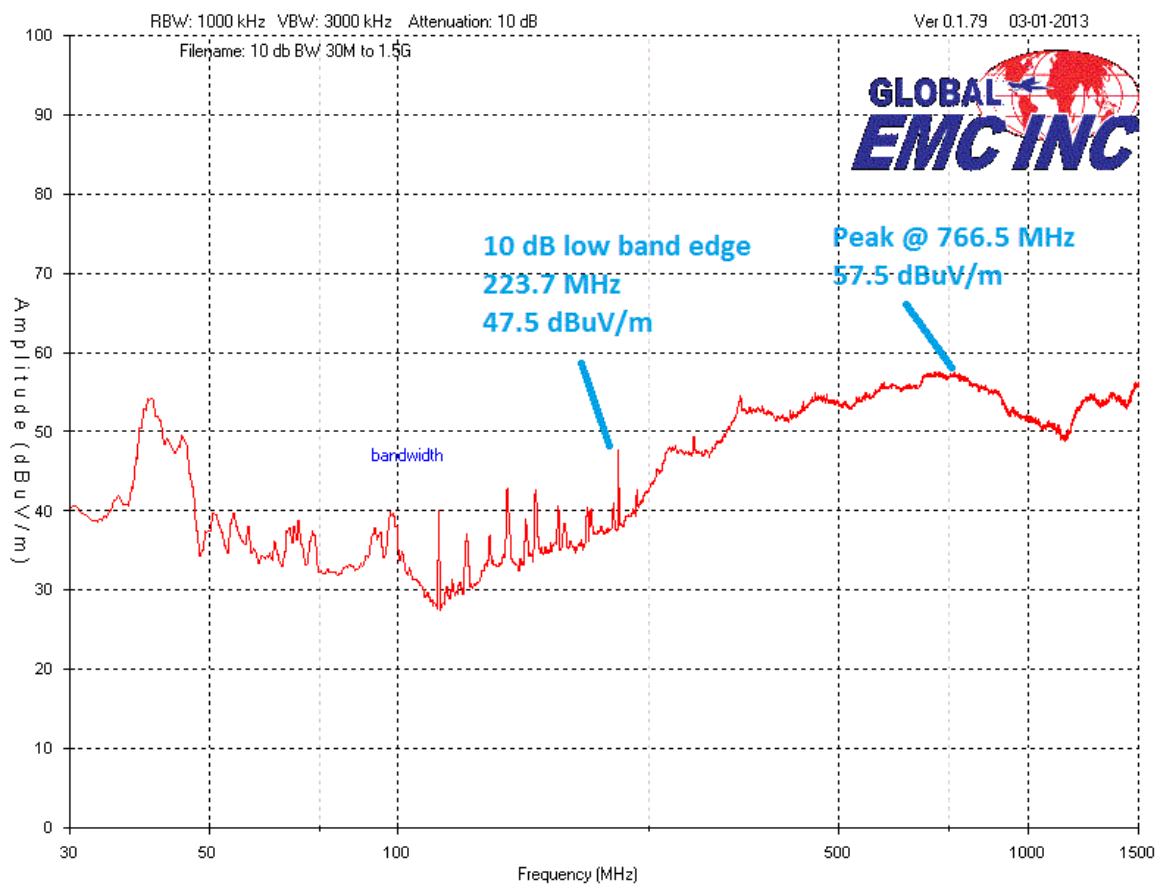
The fractional bandwidth meets the fractional bandwidth requirement.

$$\text{Center Frequency } (f_C) = (2092.5 + 223.5) / 2 = 1158 \text{ MHz}$$

$$\text{Peak Frequency } (f_M) = 766.5 \text{ MHz.}$$

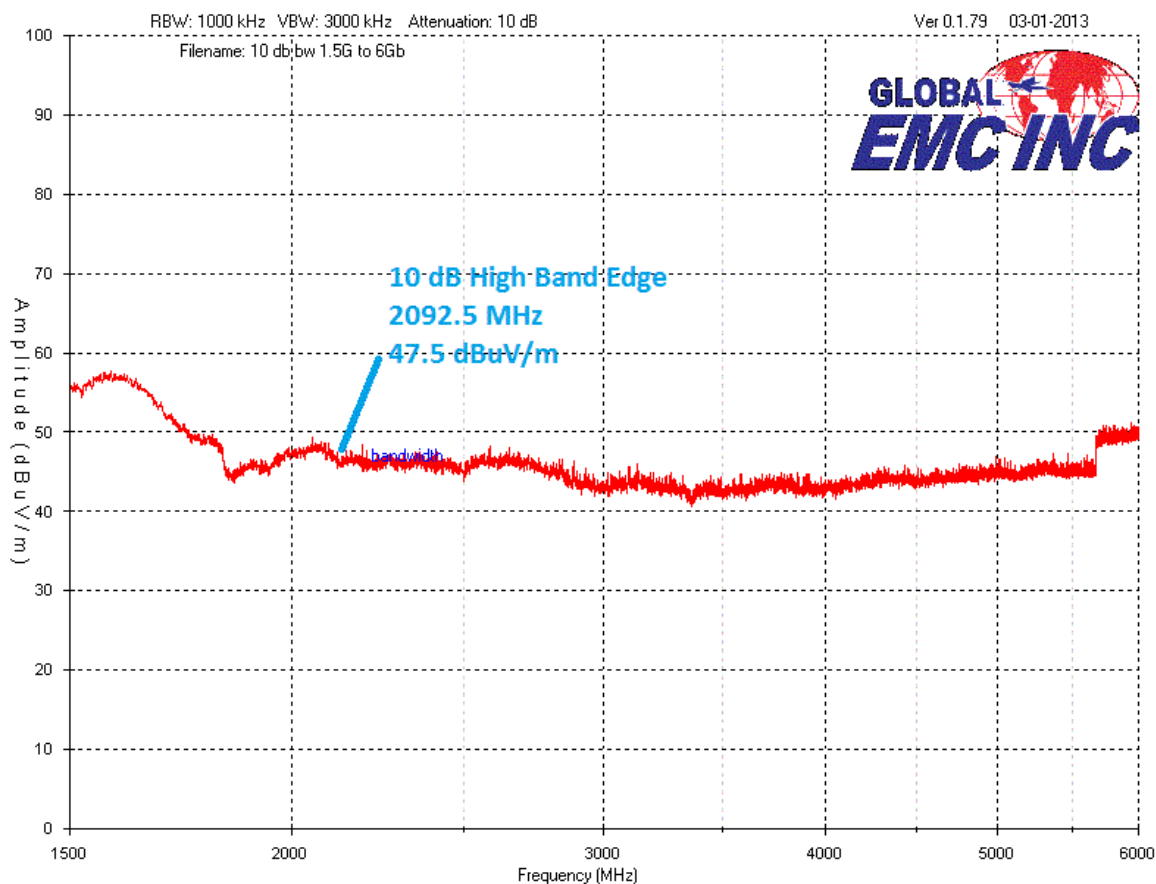
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Graph(s)



Peak emissions measured with 1 MHz bandwidth shown above, measured at 1 meter.

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Peak emissions measured with 1 MHz bandwidth shown above, measured at 1 meter.

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

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Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	12/21/ 2011	12/21/2013	GEMC 141
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Oct-06, 2011	Oct-06, 2013	GEMC 160
Quasi Peak Adapter	85650A	HP	12/21/ 2011	12/21/2013	GEMC 7
Loop Antenna	EM 6871	Electro-Metrics	Feb 5, 2013	Feb 5, 2015	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 5, 2013	Feb 5, 2015	GEMC 71
BiLog Antenna	3142-C	ETS	Feb 4, 2013	Feb 4, 2015	GEMC 137
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	8/29/2012	8/29/2014	GEMC 6403
Q-Par 1.5-18 GHz Horn	6878/24	Q-par	8/23/2012	8/23/2014	GEMC 6365
1-26G pre-amp	HP 8449B	HP	8/22/2012	8/22/2014	GEMC 6351
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 – Power Line Conducted Emissions Class B_Rev1"

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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, GPS, and so on, from unwanted interference.

Limit(s) and Method

The method is as defined in ANSI C63.4 and ANSI C63.10

The limits are as defined in FCC Part 15, Section 15.509(d)

30 MHz – 88 MHz, 100 uV/m (40.0 dBuV/m¹) at 3 m

88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m¹) at 3 m

216 MHz – 960 MHz, 200 uV/m (46.4 dBuV/m¹) at 3 m

¹Limit is specified as with 120 kHz measurement bandwidth and a using a Quasi Peak detector.

Above 960 MHz ²

Frequency (MHz)	EIRP (dBm)	dBuV/m @ 3m
960-1610	-65.3	29.9
1610-1990	-53.3	41.9
1990-3100	-51.3	43.9
3100-10600	-41.3	53.9
Above 10600	-51.3	43.9

²Limit is specified with 1 MHz measurement bandwidth and using an **RMS** detector

Above 960 MHz ³

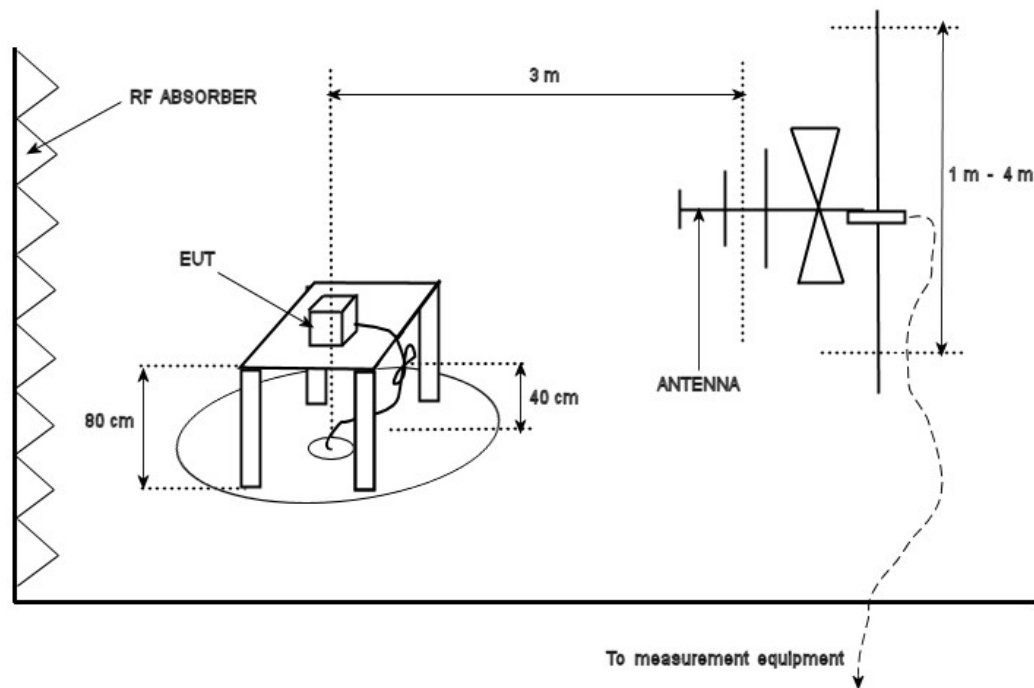
Frequency (MHz)	EIRP (dBm)	dBuV/m @ 3m
1164-1240	-75.3	19.9
1559-1610	-75.3	19.9

³Limit is specified with 1 kHz measurement bandwidth and using an **RMS** detector

In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to 12 GHz, which exceeds the 10th harmonic of f_C.

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Typical Radiated Emissions Setup



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Measurement Uncertainty

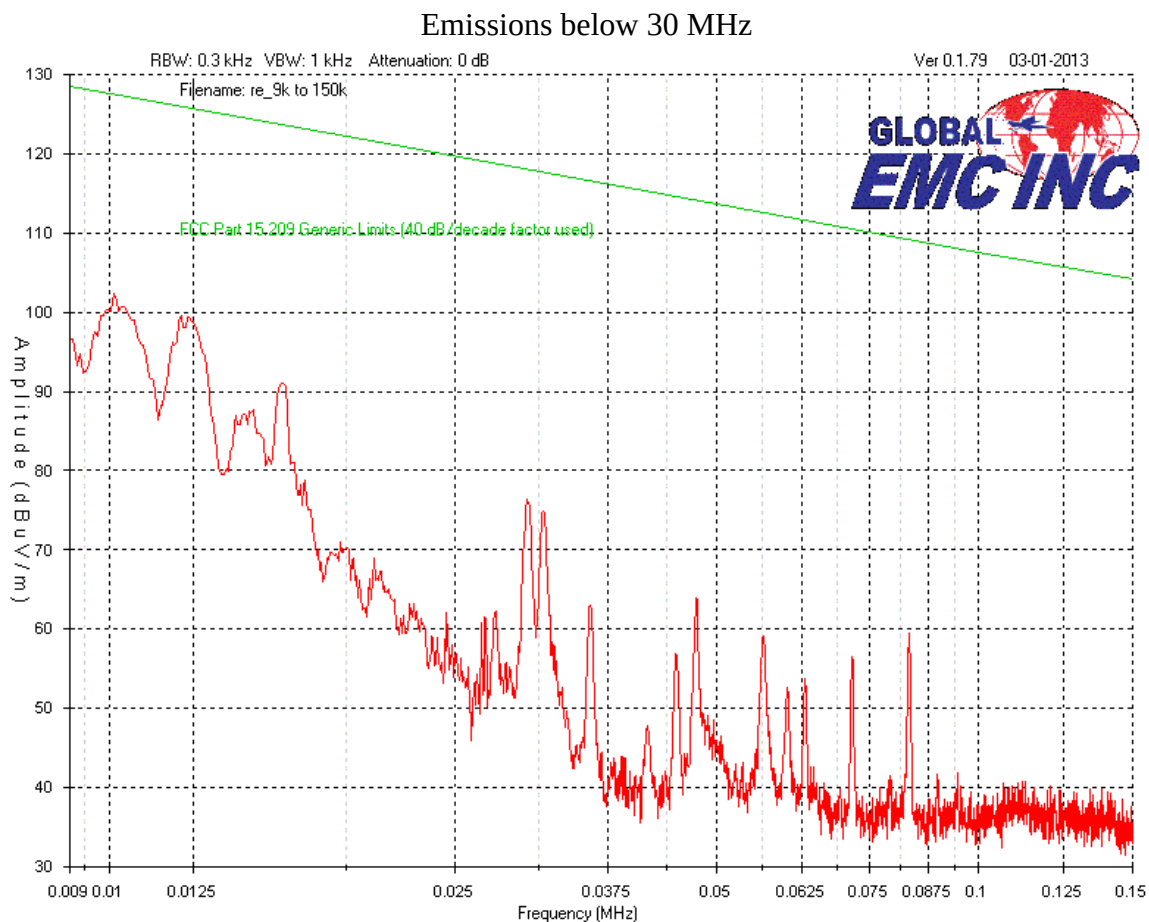
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is +/-4.4 dB with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

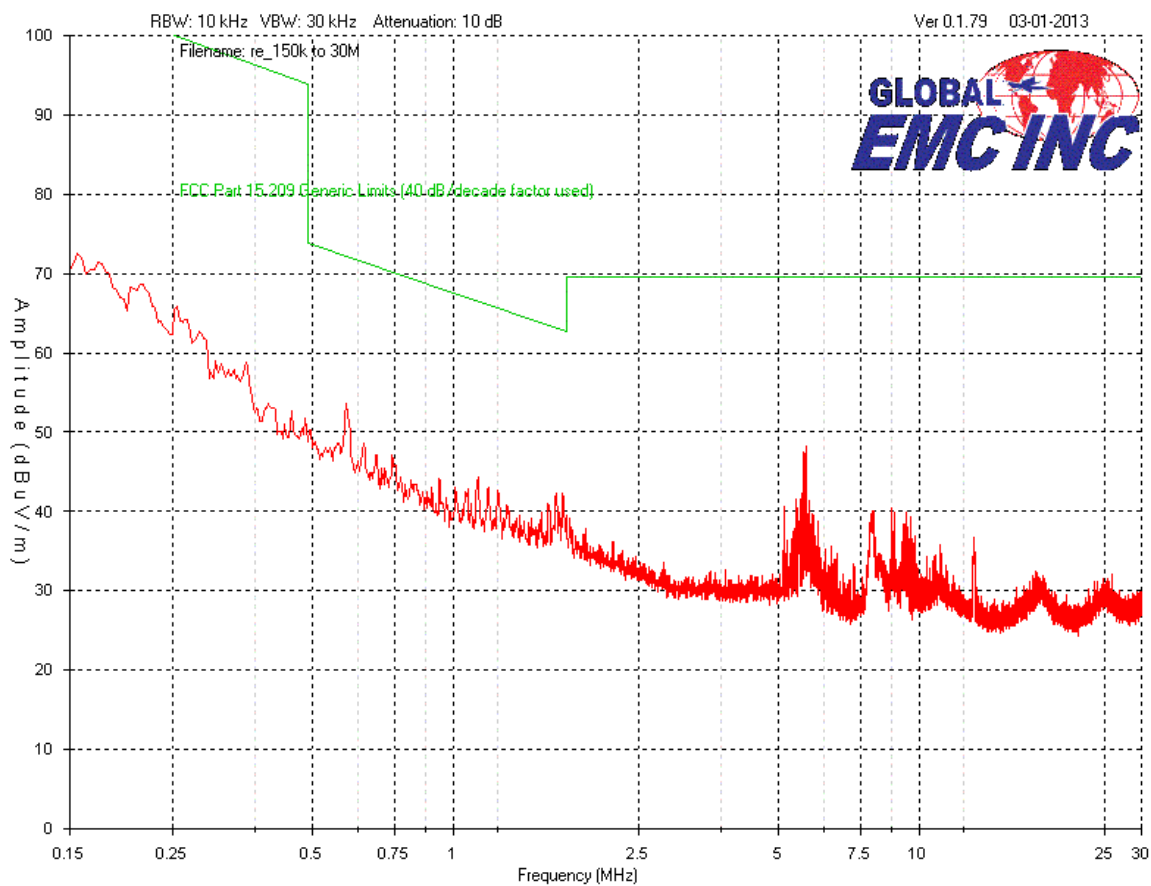
Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graphs shown below are a maximized peak measurement graph, measured with a resolution bandwidth approximately the same as 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 minimum of the 10th harmonic.

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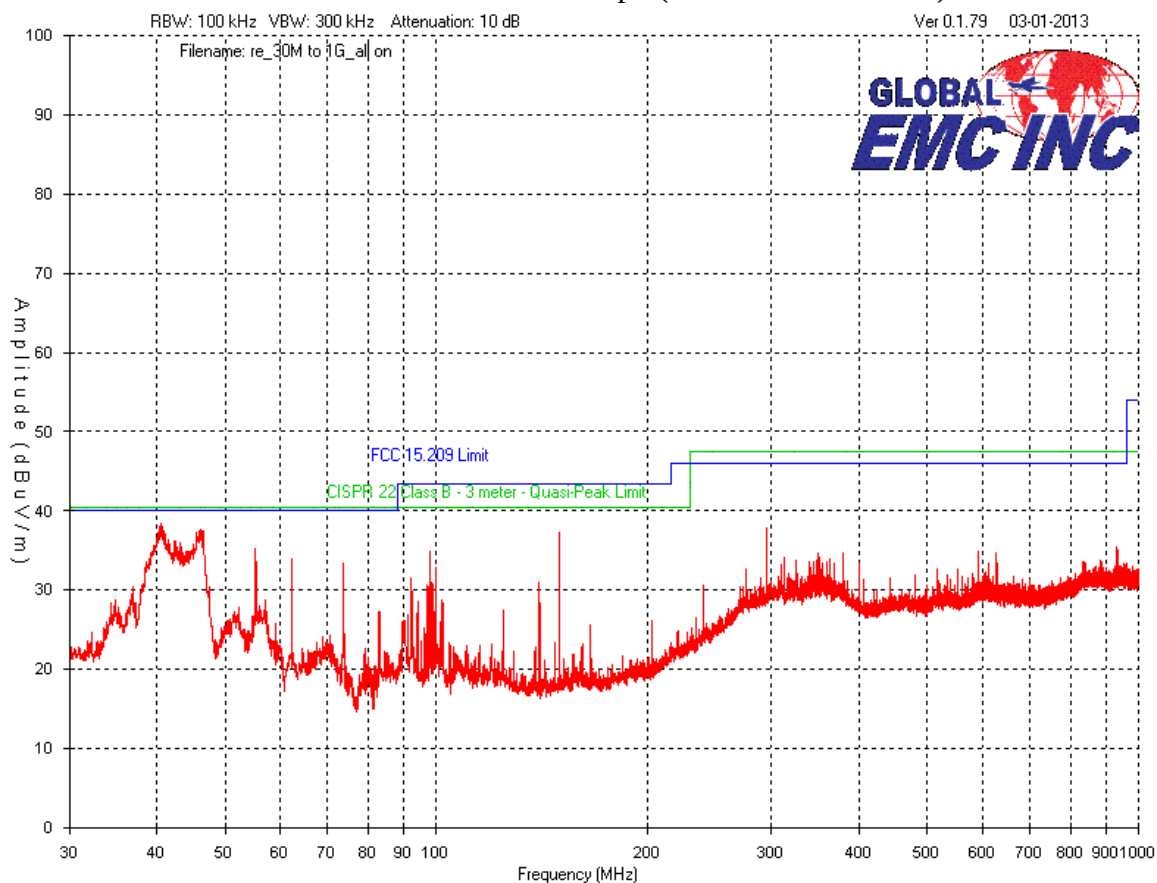


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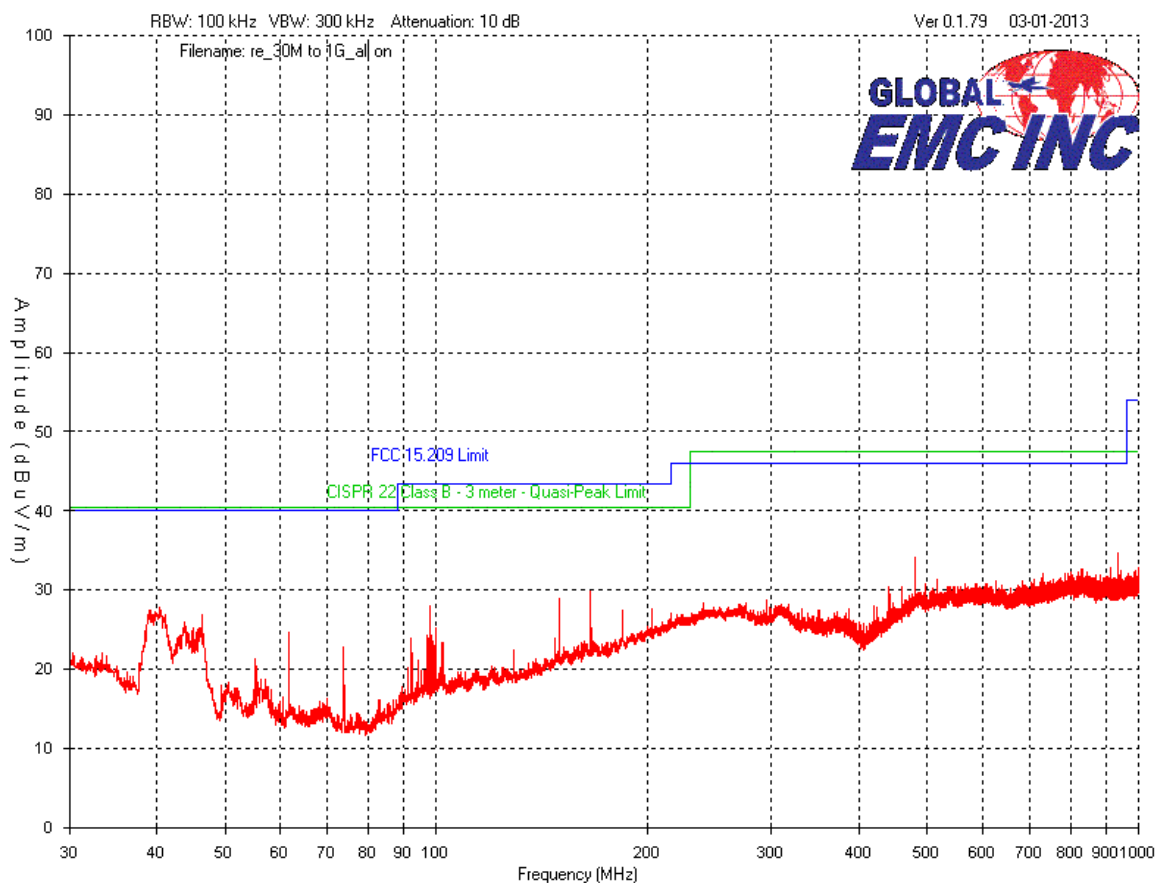
Vertical – Peak Emissions Graph (30 MHz to 960 MHz)



Operating

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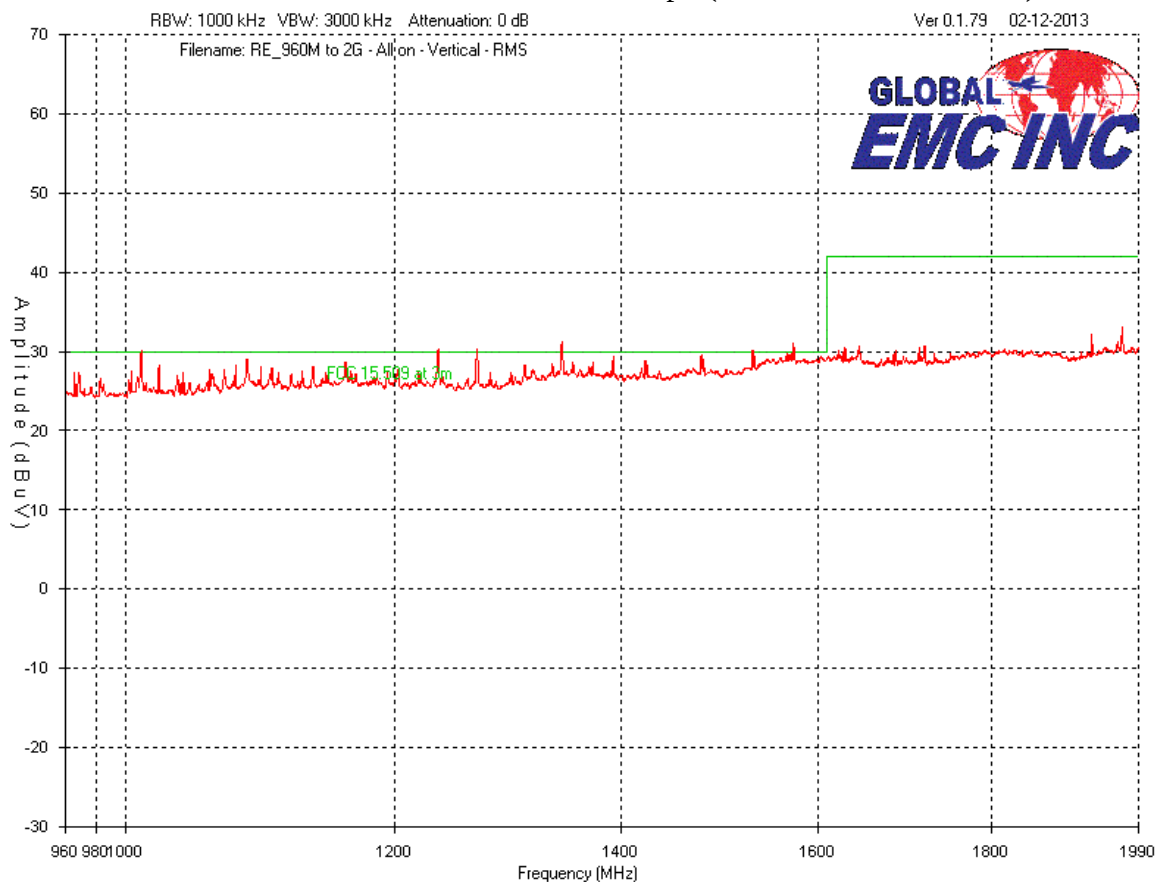
Horizontal – Peak Emissions Graph (30 MHz to 960 MHz)



Operating

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Vertical – Max hold RMS Emissions Graph (960 MHz to 1990 MHz)

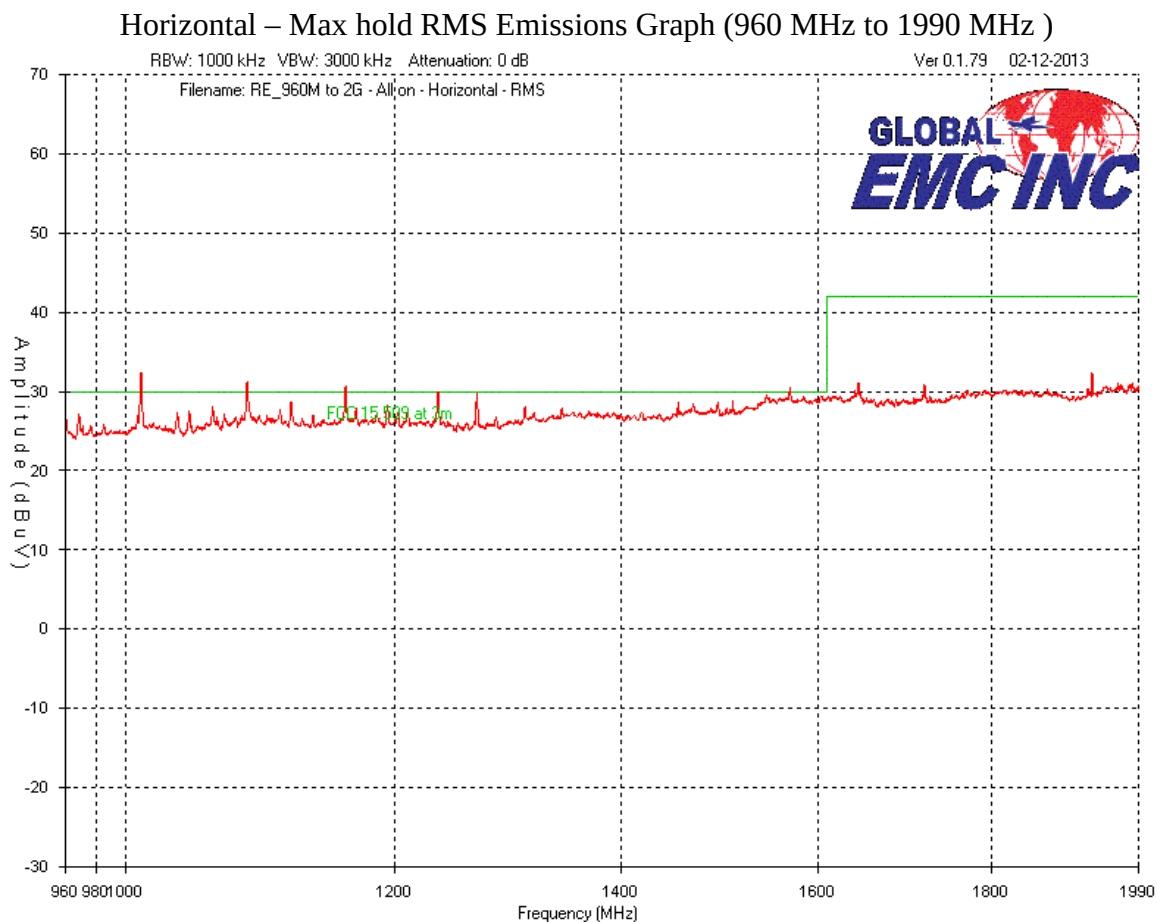


Operating

Note: The above graph represents an RMS. Spikes shown above the limit were determined to be ambient emissions, or unintentional products of the digital peripherals subject to the requirements of 15.109.

For final measurements, refer to table.

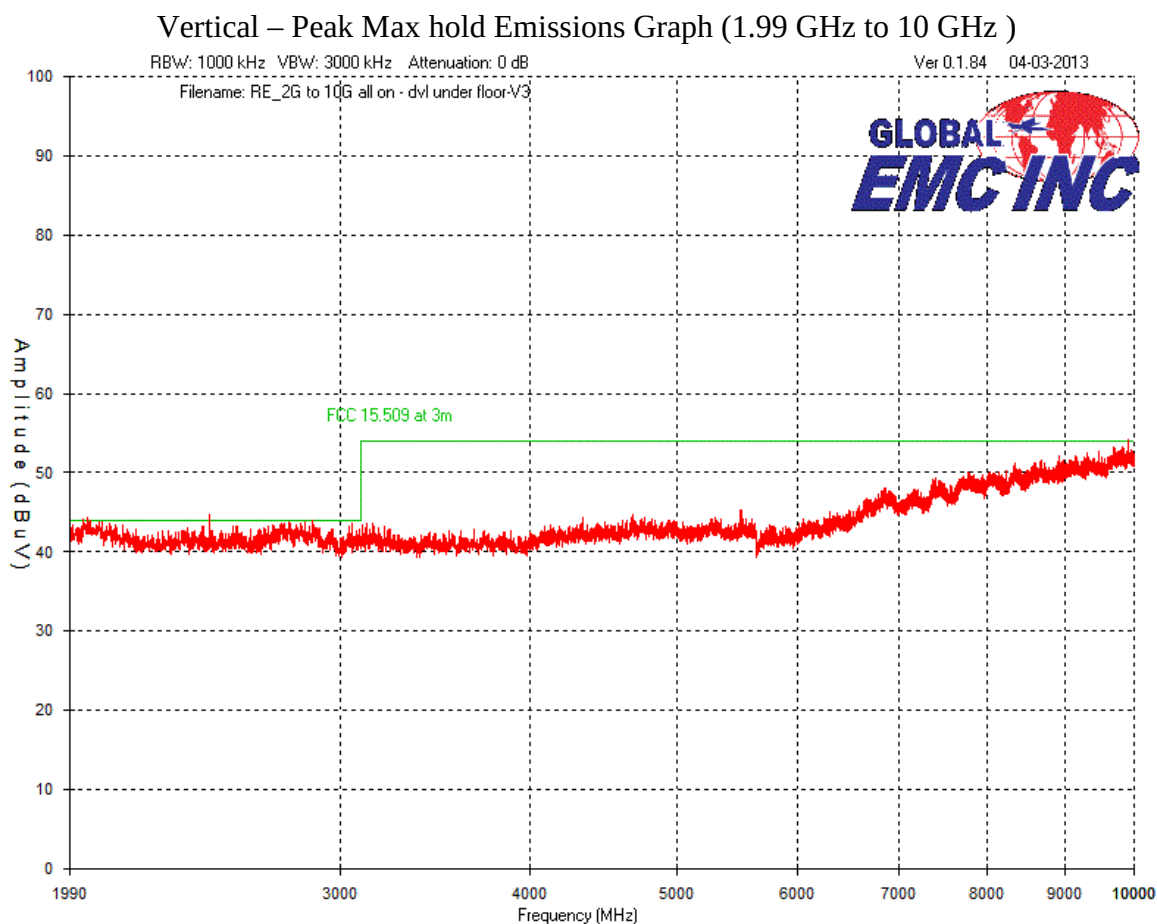
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Note: The above graph represents an RMS. Spikes shown above the limit were determined to be ambient emissions, or unintentional products of the digital peripherals subject to the requirements of 15.109.

For final measurements, refer to table.

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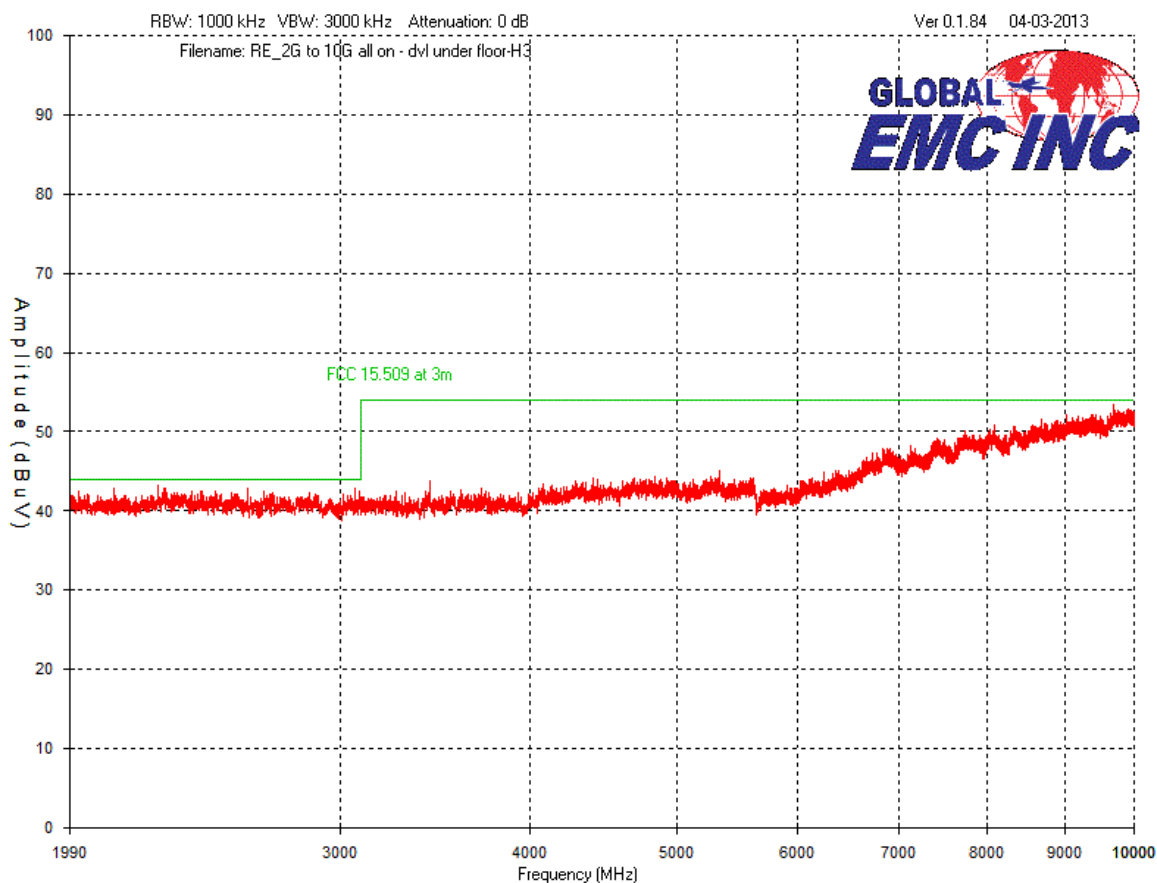


Operating

Note: No emissions were detected in this frequency band when measured with the RMS detector. The EUT was scanned to 12 GHz at a closer distance, and no emissions were detected above 10 GHz.

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Horizontal – Peak Max hold Emissions Graph (1.99 GHz to 10 GHz)

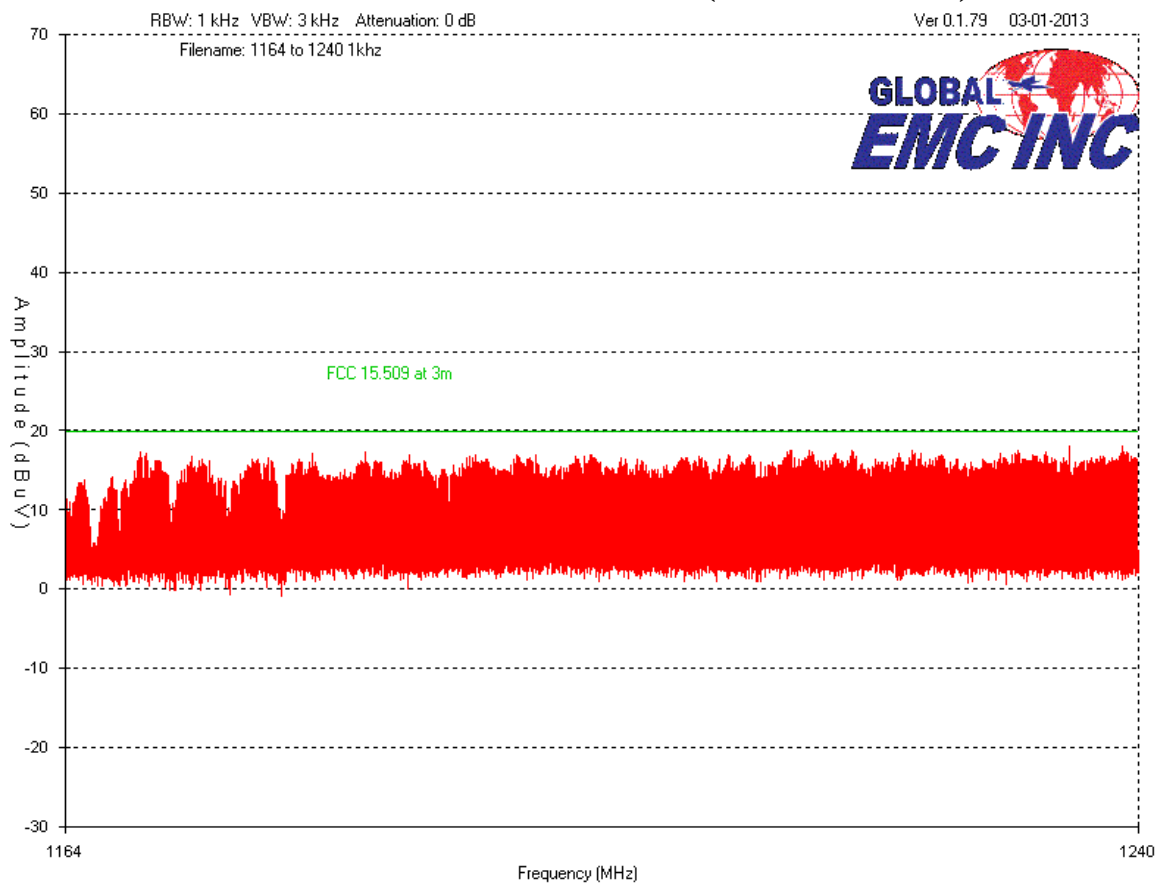


Note: No emissions were detected in this frequency band when measured with the RMS detector. The EUT was scanned to 12 GHz at a closer distance, and no emissions were detected above 10 GHz.

Operating

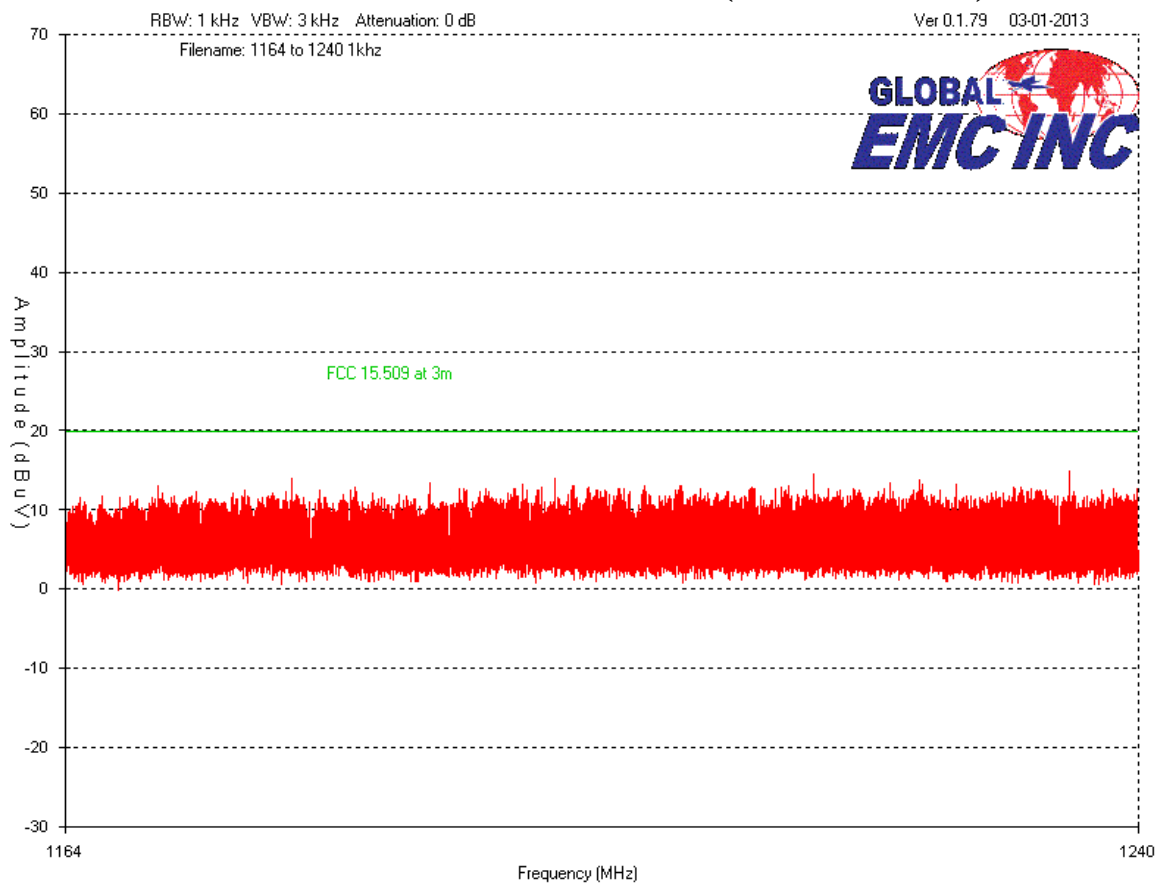
Client	Sensors & Software	
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Narrowband RMS Emissions Vertical (1164 to 1240 MHz)

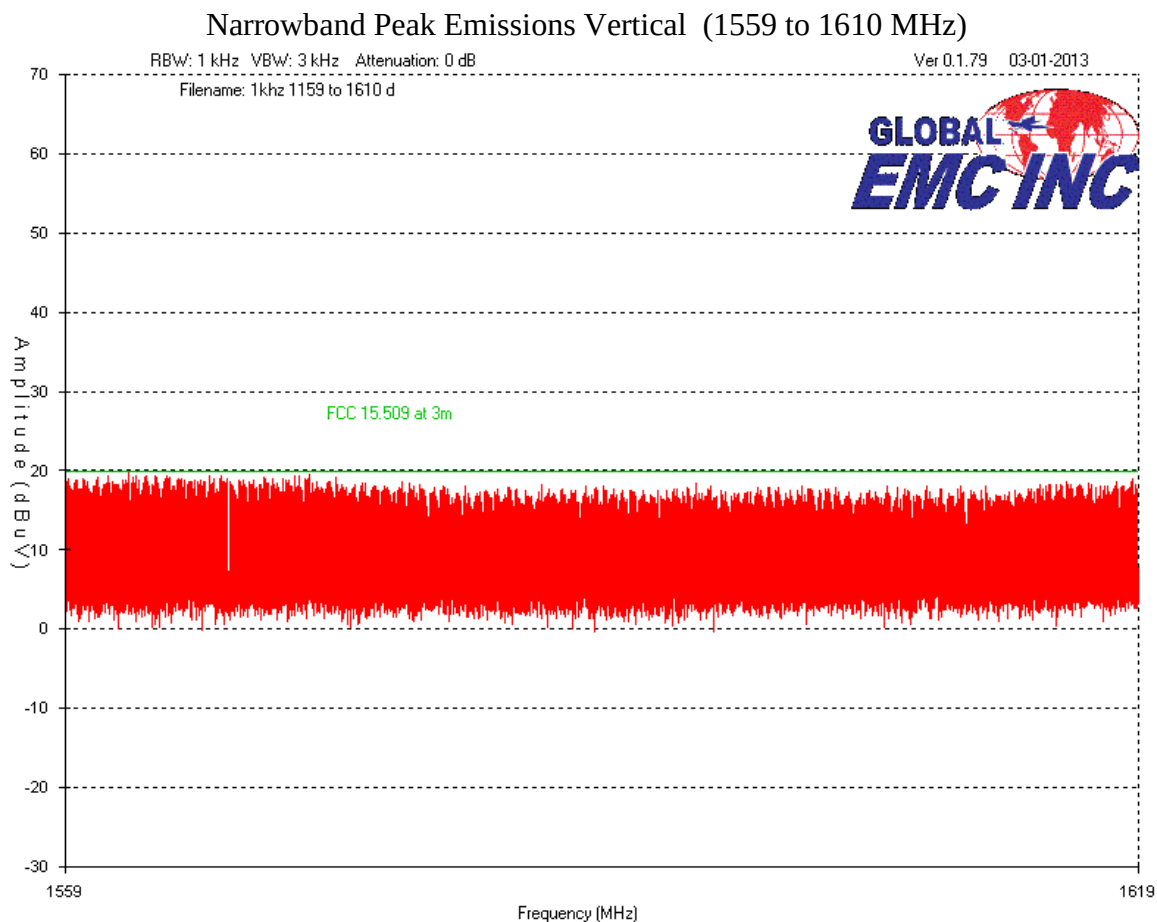


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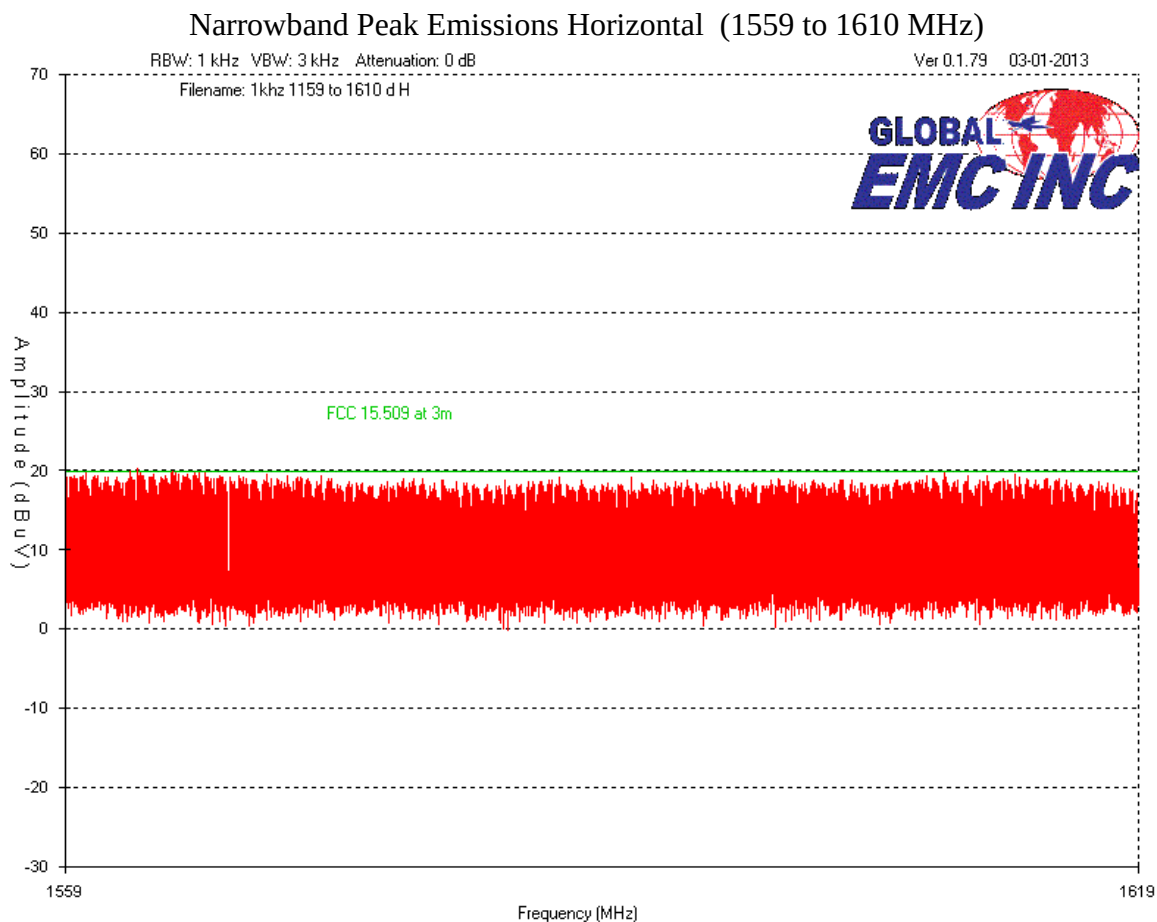
Narrowband RMS Emissions Horizontal (1164 to 1240 MHz)



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For RMS detector readings, refer to table.

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Final Measurements

Quasi Peak Emissions Table - Vertical

Frequency (MHz)	Raw (dBuV)	Ant. (dB/m)	Cable (dB)	Amp (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
40.5407	57.4	10.7	0.3	-30.1	38.3	40	1.7	Pass
55.2847	57.4	7.7	0.4	-30.1	35.4	40	4.6	Pass
62.1393	56.5	7.3	0.4	-30.1	34.1	40	5.9	Pass
149.73	57.8	9.2	0.5	-30.3	37.2	43.5	6.3	Pass
73.6823	57.1	6	0.4	-30.2	33.3	40	6.7	Pass
294.842	54.7	13.1	0.6	-30.5	37.9	46	8.1	Pass

Quasi Peak Emissions Table - Horizontal

Frequency (MHz)	Raw (dBuV)	Ant. (dB/m)	Cable (dB)	Amp (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
40.347	46.9	10.8	0.3	-30.1	27.9	40	12.1	Pass
46.361	47.8	8.9	0.3	-30.1	26.9	40	13.1	Pass
55.285	43.4	7.7	0.4	-30.1	21.4	40	18.6	Pass
61.557	47	7.4	0.4	-30.1	24.7	40	15.3	Pass
73.682	46.6	6	0.4	-30.2	22.8	40	17.2	Pass
92.112	45	8.6	0.5	-30.2	23.9	43.5	19.6	Pass

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RMS Emissions Table – Vertical

Frequency (MHz)	Raw (dBuV)	Ant. (dB/m)	Amp (dB)	Cable (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
960	36.1	23.1	1.4	-35.8	24.8	29.9	5.1	Pass
1610	34.9	28.9	1.8	-36.6	29	29.9	0.9	Pass
1967.59	37.1	30.2	2	-36.2	33.1	42	8.9	Pass

The worst case emission appeared at 1600 MHz at a vertical antenna height of 1 m and at turn table azimuth of 185 degrees as depicted in Appendix B of this test report, however based on the emission; it is possible this was system noise floor during this measurement.

RMS Emissions Table - Horizontal

Frequency (MHz)	Raw (dBuV)	Ant. (dB/m)	Amp (dB)	Cable (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
1010.42	40.2	24	1.5	-37.3	28.4	29.9	1.5	Pass
1086.21	39.1	24.8	1.5	-37.2	28.2	29.9	1.7	Pass
1927.78	37	29.7	2	-36.3	32.4	42	9.6	Pass

Narrowband RMS Emissions Table - Vertical

Frequency (MHz)	Raw (dBuV)	Ant. (dB/m)	Cable (dB)	Amp (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
1562.5	26.7	26.9	1.8	-36.7	18.7	19.9	1.2	Pass
1571.64	26.2	27	1.8	-36.7	18.3	19.9	1.6	Pass
1563.96	26.3	26.9	1.8	-36.7	18.3	19.9	1.6	Pass
1562.91	26.3	26.9	1.8	-36.7	18.3	19.9	1.6	Pass
1560.81	26.3	26.8	1.8	-36.7	18.2	19.9	1.7	Pass
1563.39	26.2	26.9	1.8	-36.7	18.2	19.9	1.7	Pass

Narrowband RMS Emissions Table - Horizontal

Frequency (MHz)	Raw (dBuV)	Ant. (dB/m)	Cable (dB)	Amp (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
1562.99	27.3	26.9	1.8	-36.7	19.3	19.9	0.6	Pass
1564.93	26.9	26.9	1.8	-36.7	18.9	19.9	1	Pass
1566.71	26.7	26.9	1.8	-36.7	18.7	19.9	1.2	Pass
1566.14	26.7	26.9	1.8	-36.7	18.7	19.9	1.2	Pass
1566.39	26.6	26.9	1.8	-36.7	18.6	19.9	1.3	Pass
1570.11	26.5	27	1.8	-36.7	18.6	19.9	1.3	Pass

Client	Sensors & Software	
Product	Noggin (NG1000)	
Standard(s)	RSS 220 Issue 1:2009 / FCC Part 15:2011 Subpart F	

Method of determining RMS value

The Rhode & Schwarz ESL 6 EMI receiver (SN: ESL6100135) incorporating an RMS detector was utilized to take the the RMS measurements below 6 GHz. RMS measurements were not required above 6 GHz, and above 6 GHz peak measurements were used to determine compliance. .

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	12/21/ 2011	12/21/2013	GEMC 141
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Oct-06, 2011	Oct-06, 2013	GEMC 160
Quasi Peak Adapter	85650A	HP	12/21/ 2011	12/21/2013	GEMC 7
Loop Antenna	EM 6871	Electro-Metrics	Feb 5, 2013	Feb 5, 2015	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 5, 2013	Feb 5, 2015	GEMC 71
BiLog Antenna	3142-C	ETS	Feb 4, 2013	Feb 4, 2015	GEMC 137
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Chase Preamplifier 9kHz - 2 GHz	CPA9231A	Chase	8/29/2012	8/29/2014	GEMC 6403
Q-Par 1.5-18 GHz Horn	6878/24	Q-par	8/23/2012	8/23/2014	GEMC 6365
Horn Antenna 18 GHz - 26.5 GHz	SAS-572	A.H. Systems	8/27/2012	8/27/2014	GEMC 6371
18.0-26.5 GHz Harmonic Mixer	11970K	HP	21-Dec-11	21-Dec-13	GEMC 158
1-26G pre-amp	HP 8449B	HP	8/22/2012	8/22/2014	GEMC 6351
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

Client	Sensors & Software	
Product	Noggin (NG1000)	
Standard(s)	RSS 220 Issue 1:2009 / FCC Part 15:2011 Subpart F	

Appendix A – EUT Summary

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

General EUT Description

Manufacturer	Sensors & Software Inc. 1040 Stacey Court, Mississauga ON. L4W 2X8 Toll Free: 1-800-267-6013 T: 905-624-8909
EUT Name	Noggin (NG1000)
FCCID	QJQ-NG1000
IC #	8393A-NG1000
Approximate Size (LxWxH)	As per photos
Equipment Category (Commercial / Residential / Medical)	Commercial
Input Voltage and Frequency	N/A – Battery operated
Rated Input Current	N/A
Table Top / Wall mount / Floor standing (choose table top if unsure)	Floor standing
Minimum Separation distance from operator	> 20 cm from transmit antenna

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’.

Client	Sensors & Software	
Product	Noggin (NG1000)	
Standard(s)	RSS 220 Issue 1:2009 / FCC Part 15:2011 Subpart F	

Appendix B – EUT and Test Setup Photographs

Client	Sensors & Software	
Product	Noggin (NG1000)	
Standard(s)	RSS 220 Issue 1:2009 / FCC Part 15:2011 Subpart F	

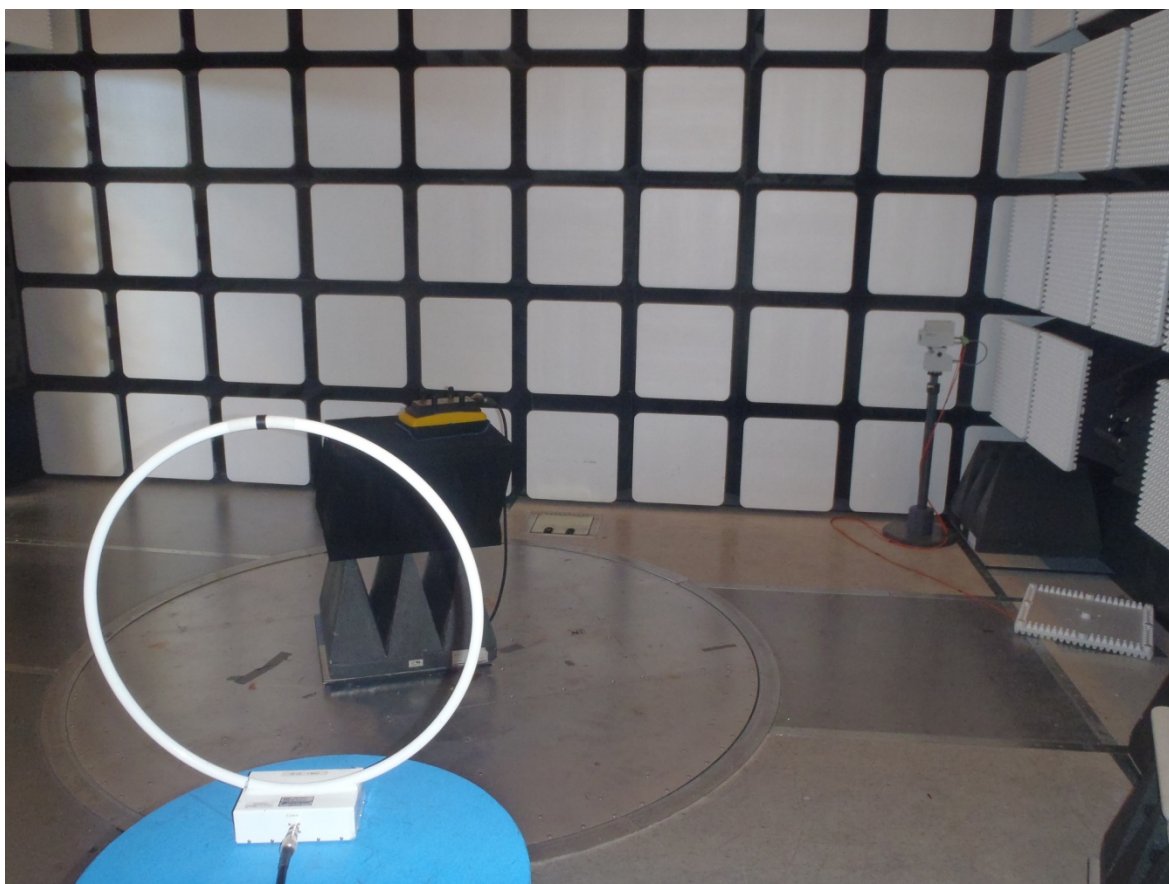
Note: These photos are for information purposes only. Also refer to PDF files that are separate from this test report.

EUT



Client	Sensors & Software	
Product	Noggin (NG1000)	
Standard(s)	RSS 220 Issue 1:2009 / FCC Part 15:2011 Subpart F	

Radiated Emissions (Below 30 MHz) – Test Setup



Client	Sensors & Software	
Product	Noggin (NG1000)	
Standard(s)	RSS 220 Issue 1:2009 / FCC Part 15:2011 Subpart F	

Radiated Emissions – 30 MHz to 960 MHz



As per guidance in ANSI C63.10 section 7.10.2.2, Anechoic material was used as an alternative to a bed of sand. The bed of sand was investigated during engineering prescan measurements to have similar attenuation with respect to the directly-radiated UWB emissions. In accordance with guidance provided in RSS 220 the preferred alternative method for testing GPR devices was performed. This method is to place the DUT at a height of 80 cm on a non-conducting support with the emitter directed downwards. If the DUT emissions are expected to have components below 500 MHz, a layer of ferrite tile is be placed directly on the floor below the DUT. Pyramidal or wedge-shaped RF absorbers not less than 60 cm in height should be placed directly below the DUT. Some sections of absorber may be inverted and placed over other absorbers to form a solid block. The placement of the absorber shall not be disturbed when the device is rotated. This arrangement prevents energy directed directly downwards from consideration in the measurement.

Client	Sensors & Software	
Product	Noggin (NG1000)	
Standard(s)	RSS 220 Issue 1:2009 / FCC Part 15:2011 Subpart F	

Radiated Emissions Above 960 MHz



As per guidance in ANSI C63.10 section 7.3.10, for frequencies above 960 MHz, the device was additionally tested with absorber placed above the reference ground plane, however this absorber is not shown in the photograph above.