

# Global EMC Inc. Labs EMC & RF Test Report

As per

**RSS 210 Issue 8:2010**

**&**

**FCC Part 15 Subpart C:2011**

**Unlicensed Intentional Radiators**

on the

**4iii Innovations  
V100 – Viiiiva 100**



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Testing produced for




See **Appendix A** for full customer & EUT details.



Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

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Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

## Report Scope

This report addresses the EMC verification testing and test results of the 4iiii Innovations V100 – Viiiiva 100, 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 8:2010 / FCC Part 15 Subpart C 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 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	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

## Summary


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

EUT FCC Certification #, FCC ID:	ZZNV100
EUT Industry Canada Certification #, IC:	9896A-V100
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Raymond Lee Au

Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

## 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 RSS 210	Power Line Conducted Emissions	QuasiPeak Average	N/A See Justifications
FCC 15.209 RSS-210 (Table 2)	Spurious Radiated emissions	QuasiPeak Average	Pass
FCC 15.249(a) RSS-210 A2.9(a)	Fundamental/Harmonic limits	Peak Average	Pass
<b>Overall Result</b>			<b>PASS</b>

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All tests were performed by Raymond Lee Au.

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 uses a PCB trace antenna which is inside the enclosure, and has no provisions for end-user replacement.

For the Restricted Bands of operation, the EUT is designed to only operate between 2.4 to 2.4835 GHz band.

For the power line conducted emissions requirements, the EUT is powered by a 3V CR2032 coin cell battery. This test does not apply as part of the wireless certification.


The EUT was tested in the three orthogonal axes. The worst case results (which occurred with the EUT horizontal, battery compartment facing downward), are presented in this report.

For maximum permissible exposure, this device does not exceed the 10mW limit as per FCC KDB 447498 ver. 5, Appendix A, so it is allowable to be used in portable exposure conditions with no restrictions on host platforms.

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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 22:2008 - 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
- FCC KDB 558074 - FCC KDB 558074 Digital Transmission Systems, measurements and procedures (Revision 2)
- RSS 210:2010 - Issue 8: Spectrum Management and Telecommunications Radio Standards Specification Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

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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 dB

### ***Document Revision Status***

Revision 1 - February 6, 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 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


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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) 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.

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## ***Testing Environmental Conditions and Dates***

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

<b>Date</b>	<b>Test</b>	<b>Init.</b>	<b>Temperature (°C)</b>	<b>Humidity (%)</b>	<b>Pressure (kPa)</b>
Jan. 8, 2013	Fund. & Harmonics	RA	20-25°C	30-45%	100 -103kPa
Jan. 8, 2013	Occupied Bandwidth	RA	20-25°C	30-45%	100 -103kPa
Jan. 9, 2013	Bandedges	RA	20-25°C	30-45%	100 -103kPa
Jan. 9, 2013	Averaging Value	RA	20-25°C	30-45%	100 -103kPa
Jan. 9-11, 14, 2013	Spurious Emiss. 30MHz – 26GHz,	RA	20-25°C	30-45%	100 -103kPa
Jan. 15, 2013	Spurious Emiss. 9kHz – 30MHz	RA	20-25°C	30-45%	100 -103kPa

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## Detailed Test Results Section

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## ***Radiated Emissions***

### **Purpose**

The purpose of these tests is to ensure that the RF energy 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. RF energy unintentionally emitted from the EUT, and the intentionally emitted fundamental and its harmonics, have limits as shown below.

### **Limit(s) and Method**

The method is as defined in ANSI C63.4:2003 and as per applicable standards.

For the fundamental and harmonics, the limits are as defined in FCC Part 15, Section 15.249 (at 3 m):

Fundamental frequency	Field strength limit of fundamental <sup>2</sup>	Field strength limit of harmonics <sup>2</sup>
2400-2483.5 MHz	50 mV/m (93.97 dBuV/m)	500 uV/m (53.87 dBuV/m)


For other spurious emissions, the limits are as defined in FCC Part 15, Section 15.209:

30 MHz – 88 MHz, 100 uV/m (40.0 dBuV/m<sup>1</sup>) at 3 m  
88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m<sup>1</sup>) at 3 m  
216 MHz – 960 MHz, 200 uV/m (46.4 dBuV/m<sup>1</sup>) at 3 m  
Above 960 MHz, 500 uV/m (54.0 dBuV/m<sup>1</sup>) at 3 m  
Above 1000 MHz, 500 uV/m (54 dBuV/m<sup>2</sup>) at 3m

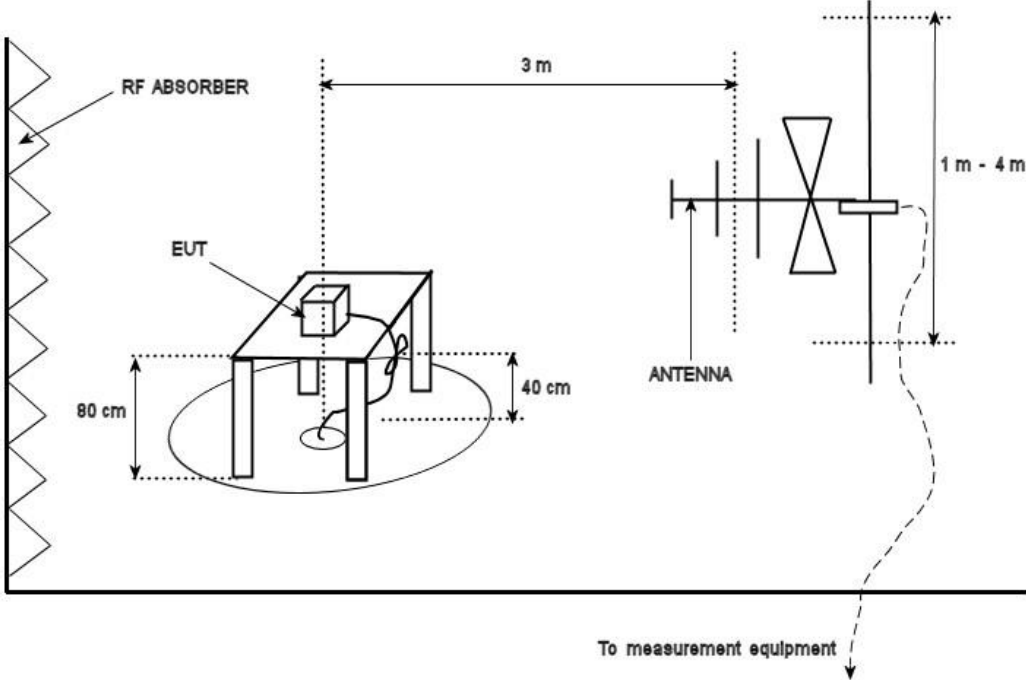
Peak field strengths are limited to be at most 20 dB above the average limits as defined above at the corresponding frequencies.


<sup>1</sup>Limit is with 120 kHz measurement bandwidth and a using a Quasi Peak detector.

<sup>2</sup>Limit is with 1 MHz measurement bandwidth and using an Average detector. Where an average detector is stated, a peak limit of 20 dB higher additionally applies.

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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


The graphs shown below are peak scans 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 than 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<sup>th</sup> harmonic (a minimum of 26 GHz).

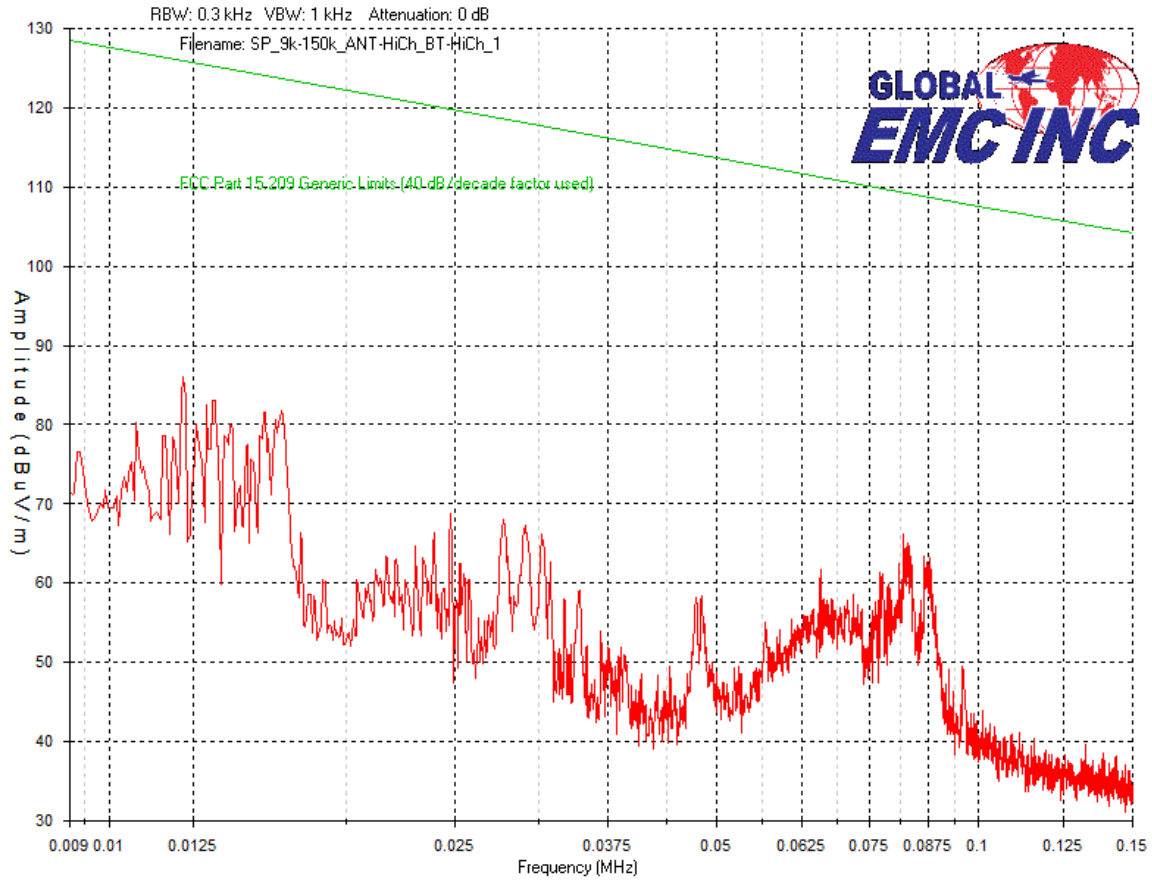
Low, middle, and high modes of both transmitters were investigated. The worst case graphs are presented.

Emissions are also verified at the band edges, with both transmitters operating, and shown in the *Final Measurements* table.


All combinations of the co-located wireless modules at low, middle, and high transmit frequencies are scanned. Where scans are similar, the worst cases are presented below.

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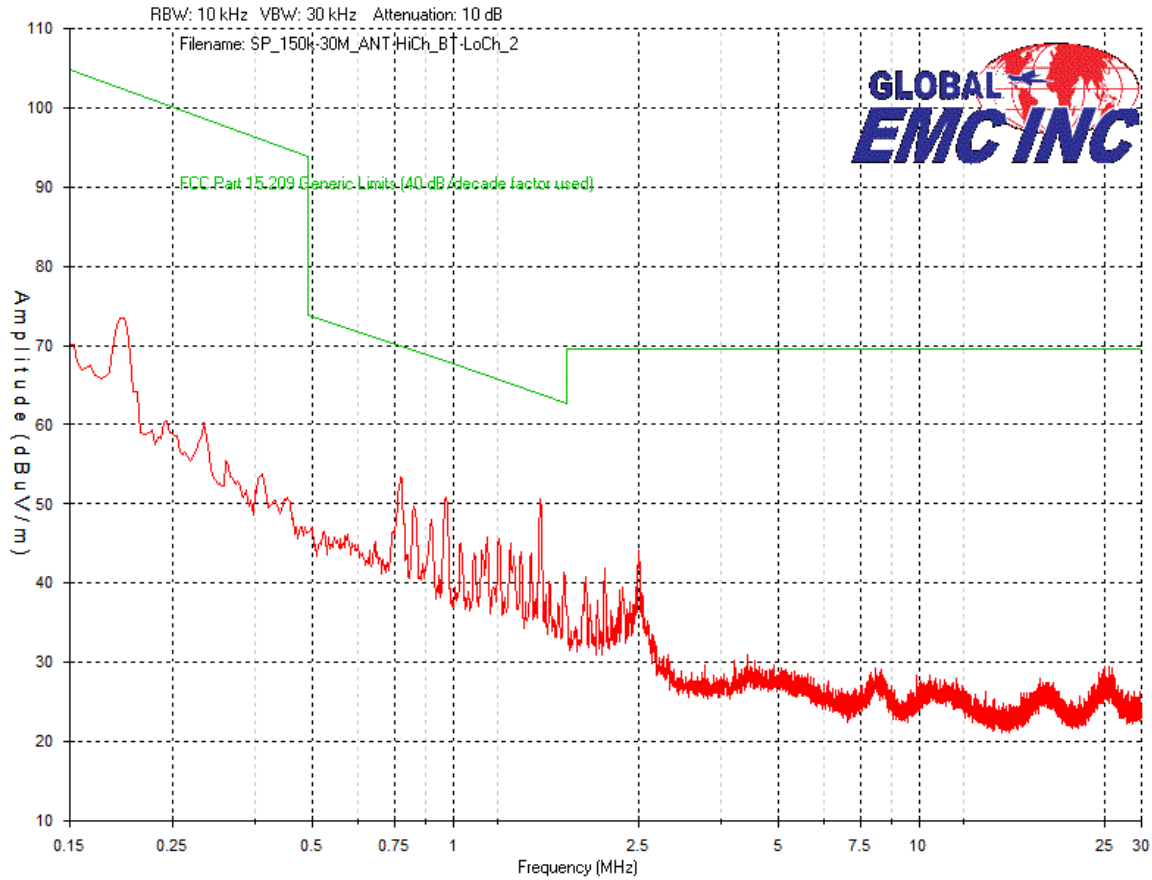
**Peak Emissions Graph**  
**ANT - High Channel, BT – Low Channel**  
**9 kHz – 150 kHz**






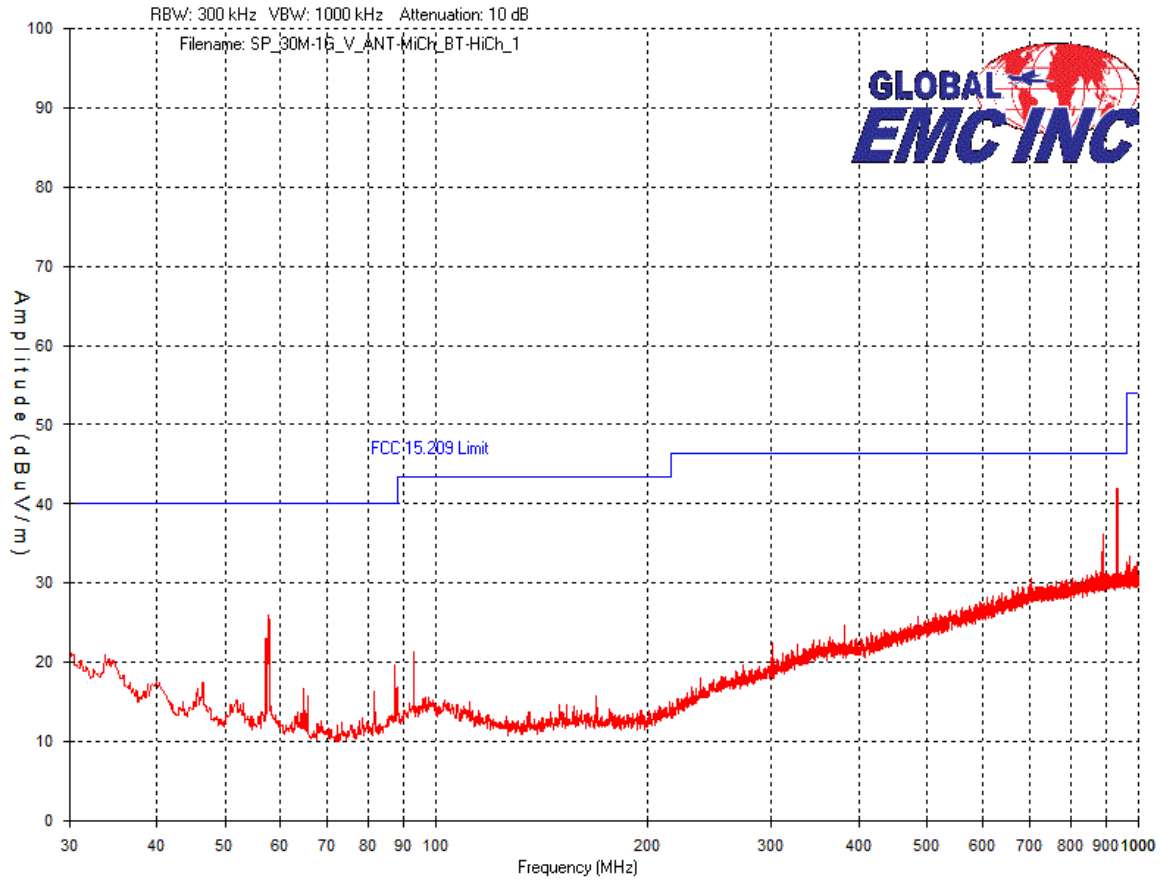
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**Peak Emissions Graph**  
**ANT - High Channel, BT – Low Channel**  
**150 kHz – 30 MHz**



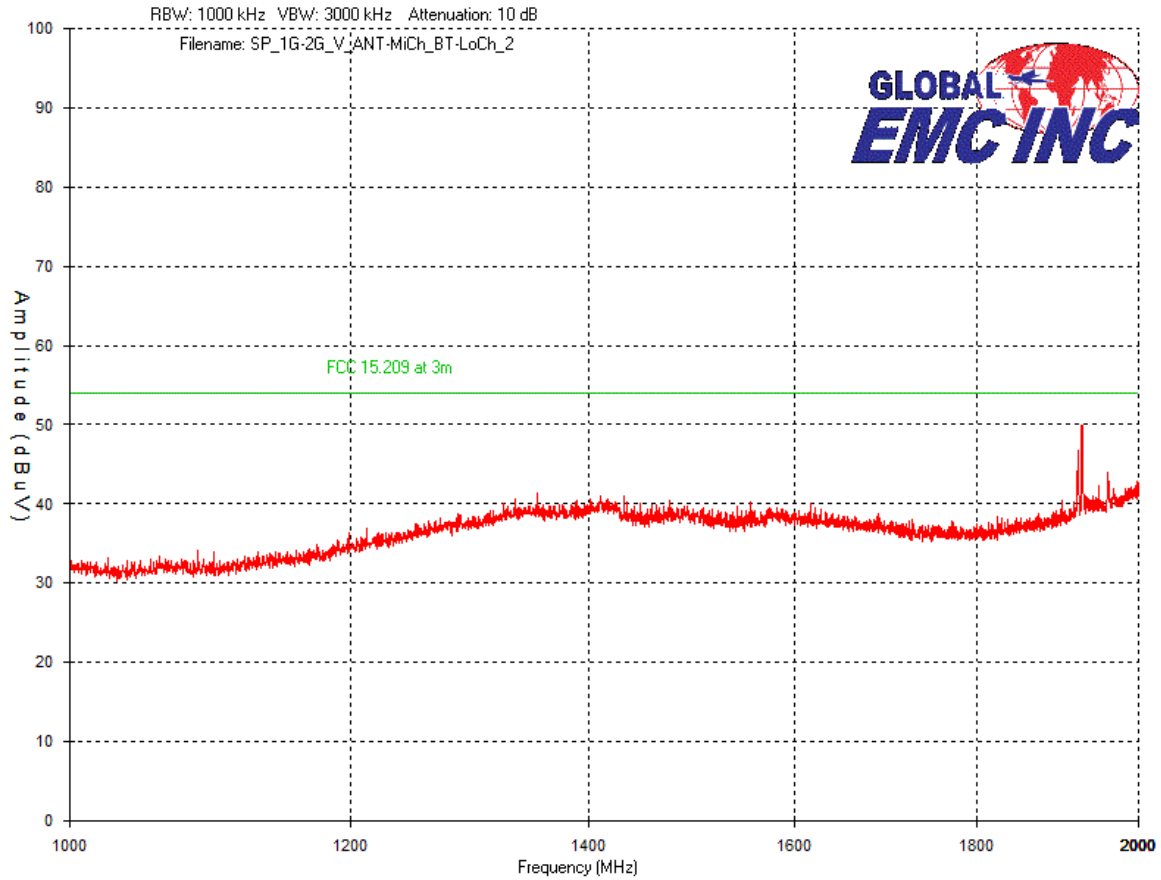
Client	4iiii Innovations Inc.	
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Vertical – Peak Emissions Graph  
 ANT - Middle Channel, BT – High Channel  
 30MHz – 1GHz



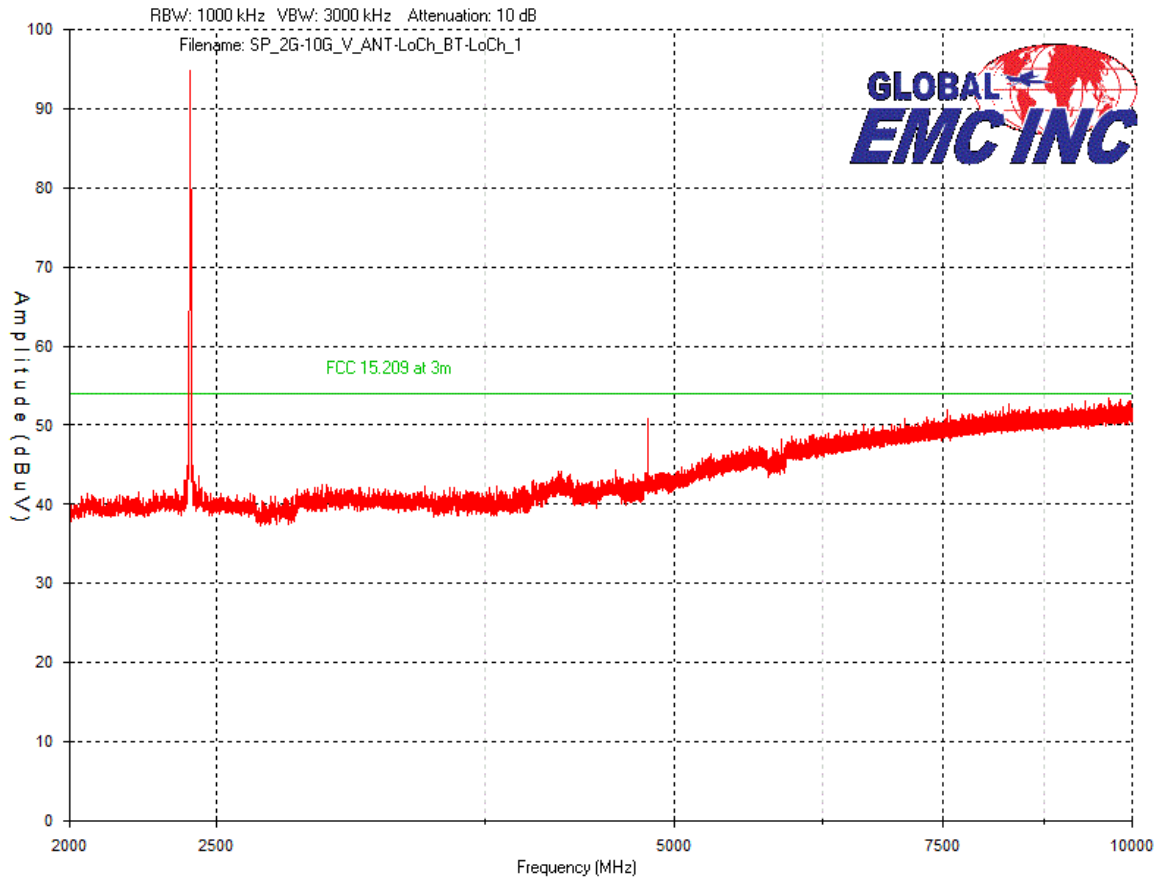
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Vertical – Peak Emissions Graph  
 ANT - Middle Channel, BT – Low Channel  
 1GHz – 2GHz



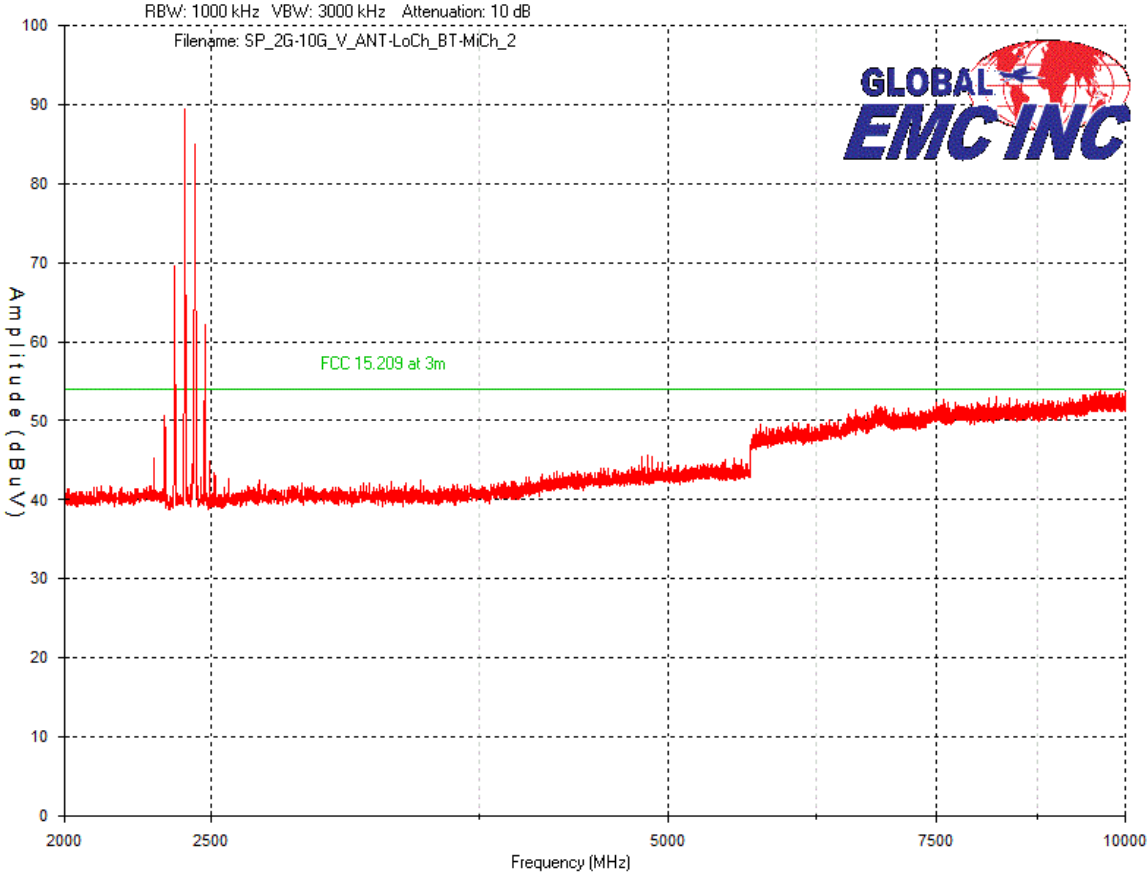
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Vertical – Peak Emissions Graph  
 ANT - Low Channel, BT – Low Channel  
 2 GHz – 10 GHz



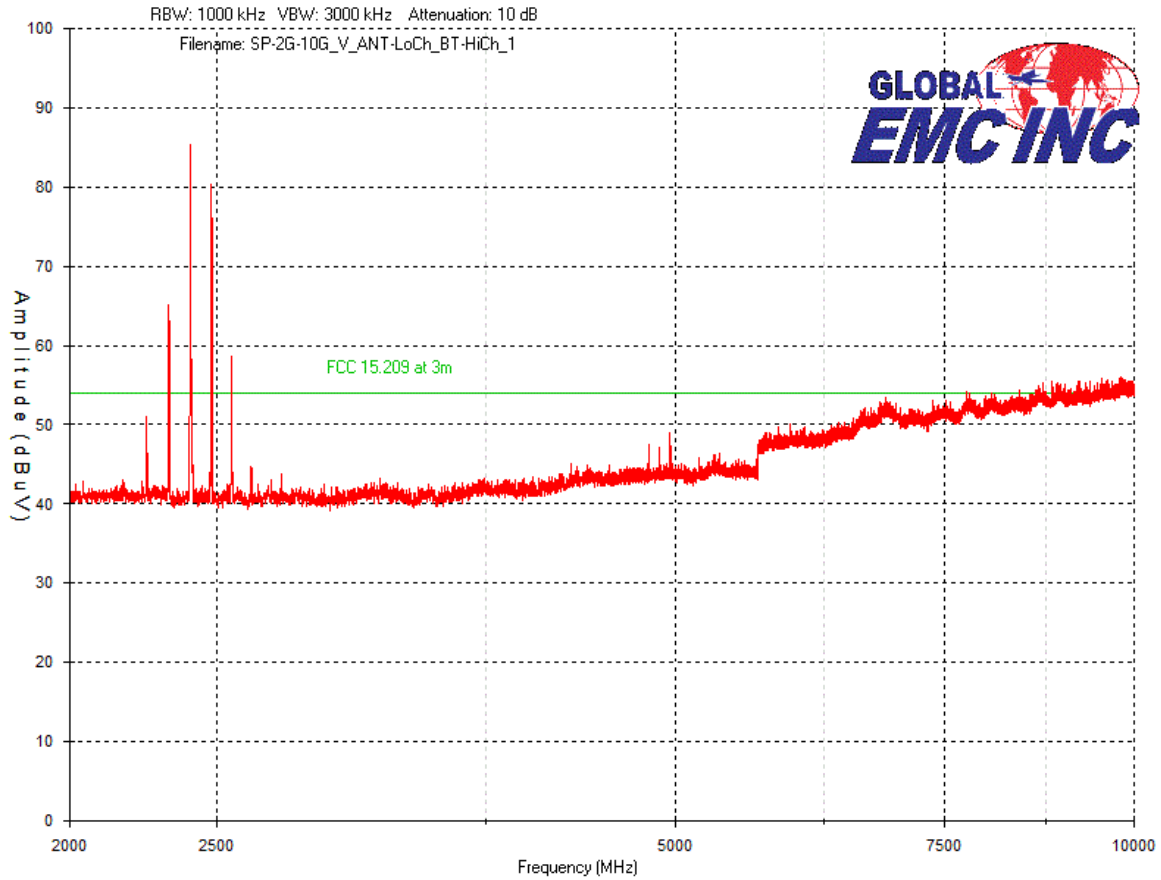
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Vertical – Peak Emissions Graph  
 ANT - Low Channel, BT – Middle Channel  
 2 GHz – 10 GHz



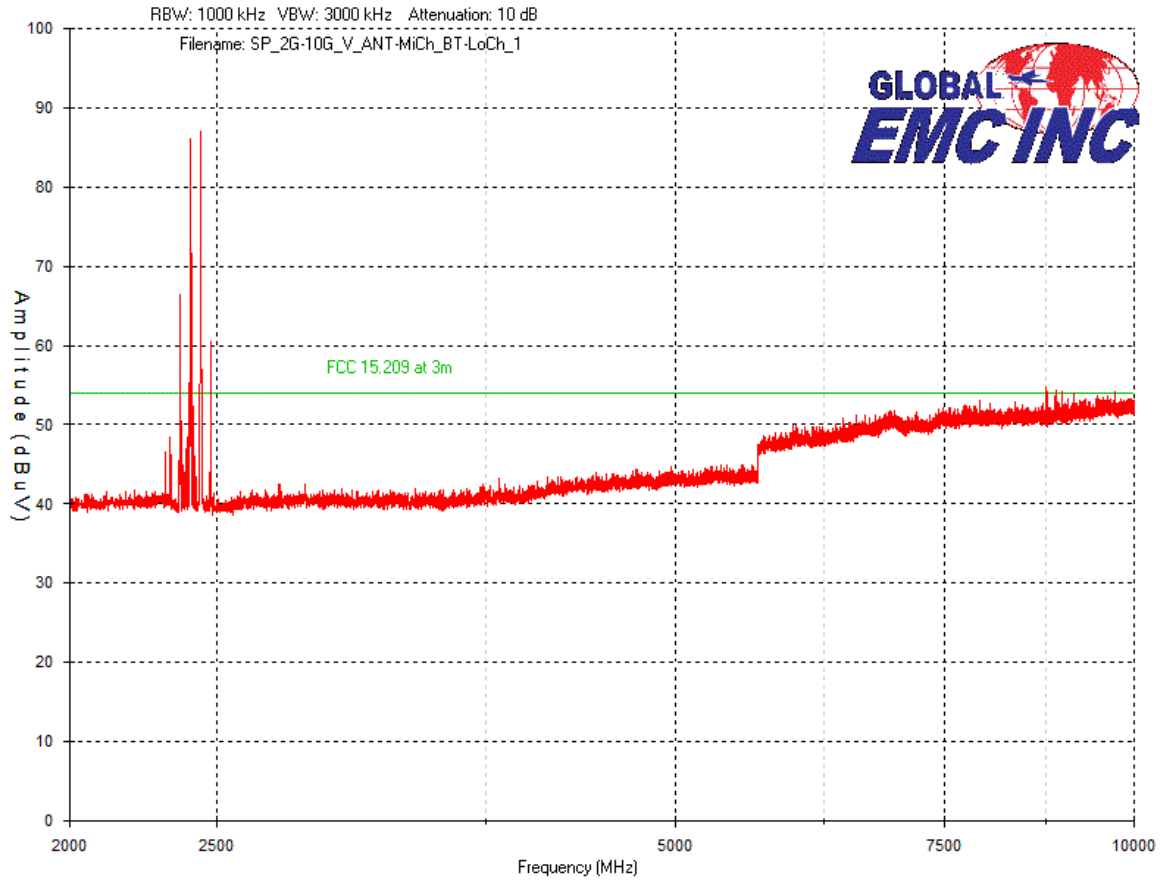
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Vertical – Peak Emissions Graph  
 ANT - Low Channel, BT – High Channel  
 2 GHz – 10 GHz



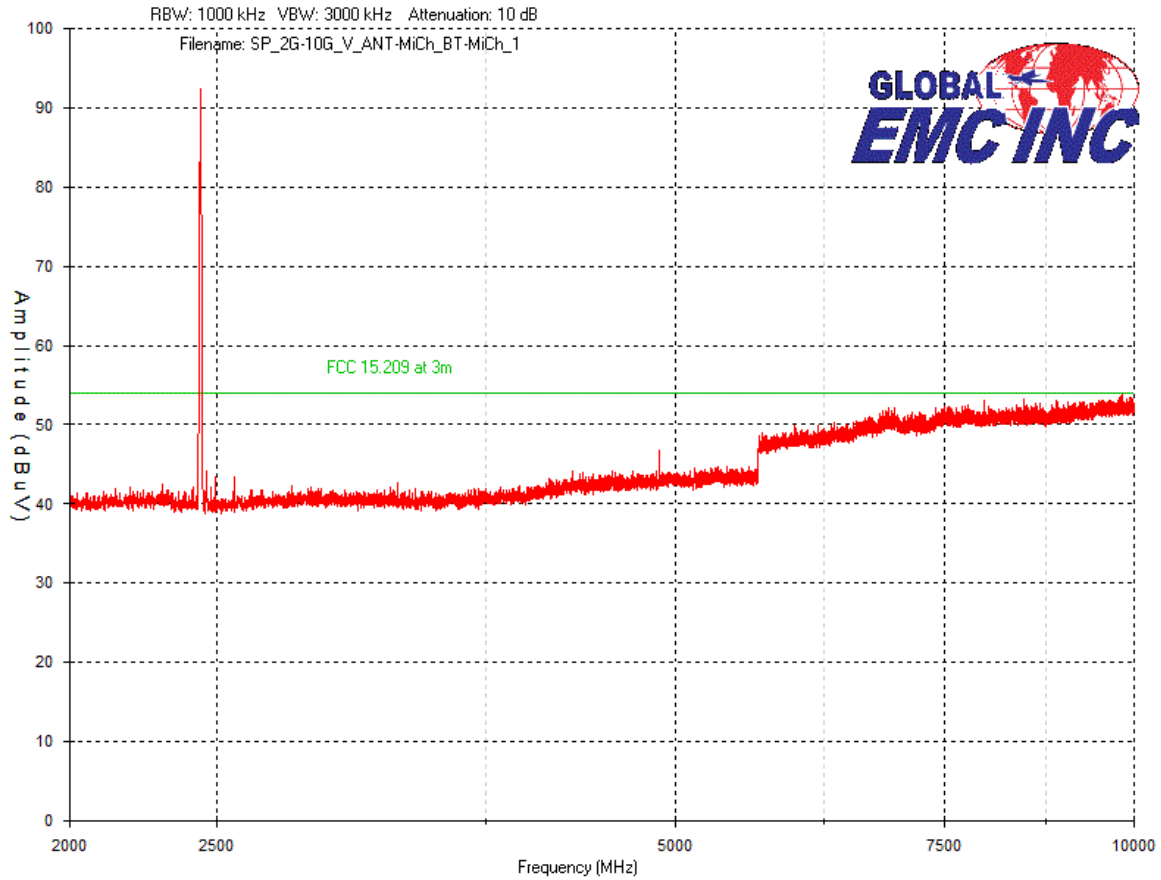
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Vertical – Peak Emissions Graph  
 ANT - Middle Channel, BT – Low Channel  
 2 GHz – 10 GHz




Client	4iiii Innovations Inc.	
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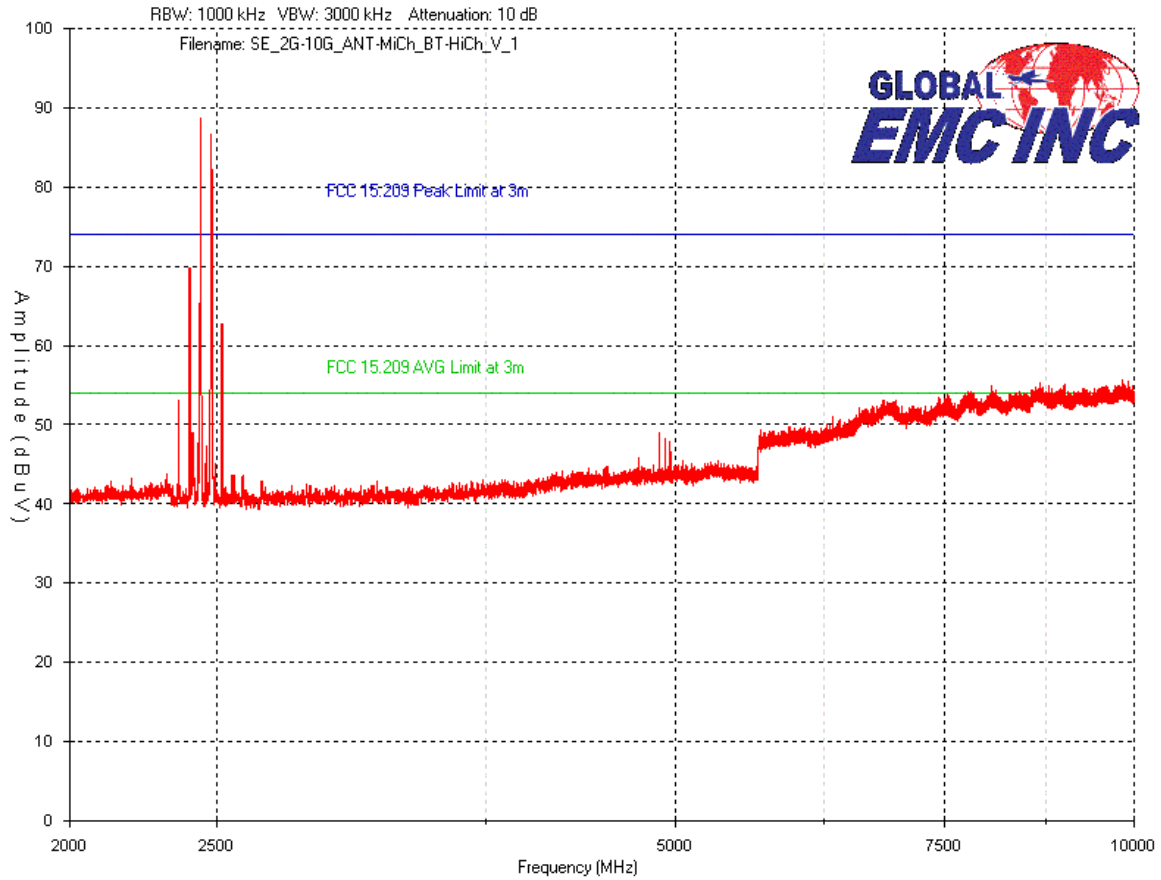
Vertical – Peak Emissions Graph  
 ANT - Middle Channel, BT – Middle Channel  
 2 GHz – 10 GHz






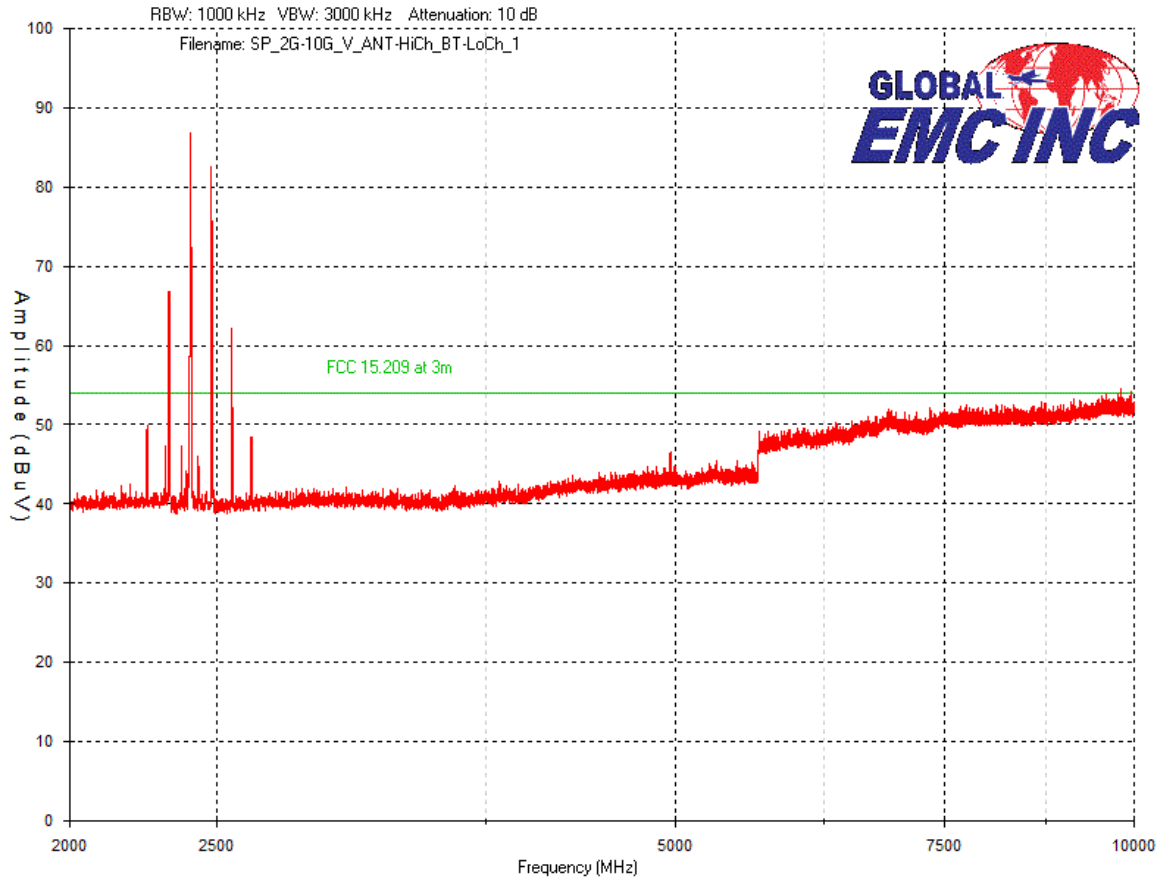
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Vertical – Peak Emissions Graph  
 ANT - Middle Channel, BT – High Channel  
 2 GHz – 10 GHz



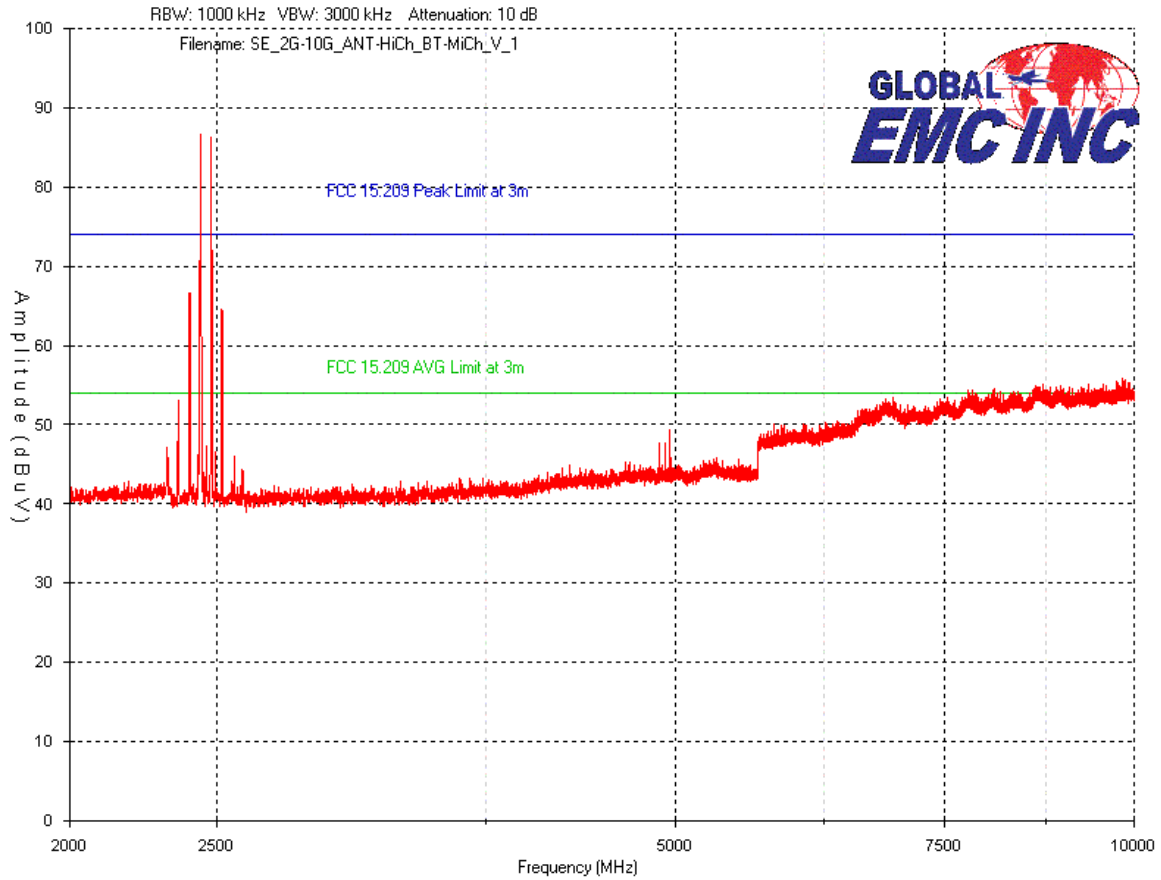
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Vertical – Peak Emissions Graph  
 ANT - High Channel, BT – Low Channel  
 2 GHz – 10 GHz



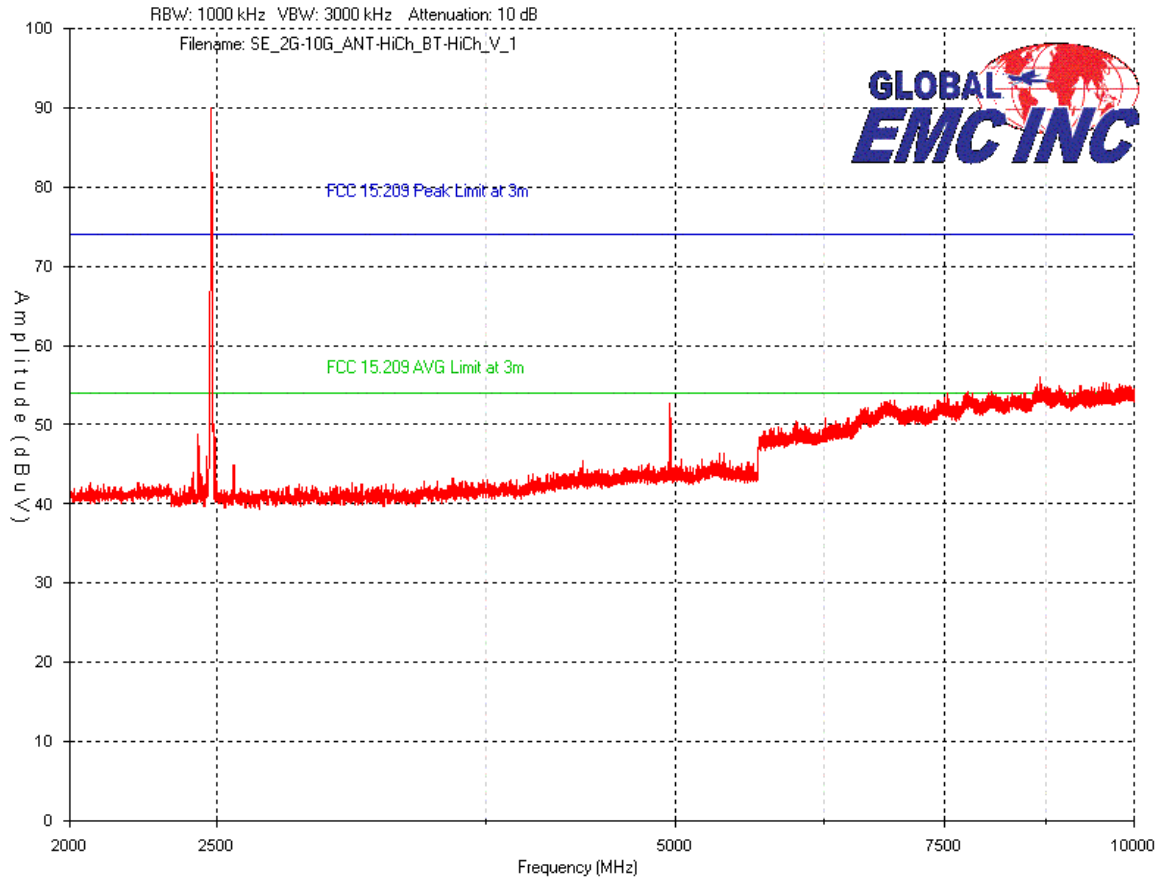
Client	4iiii Innovations Inc.	
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Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	


Vertical – Peak Emissions Graph  
 ANT - High Channel, BT – Middle Channel  
 2 GHz – 10 GHz



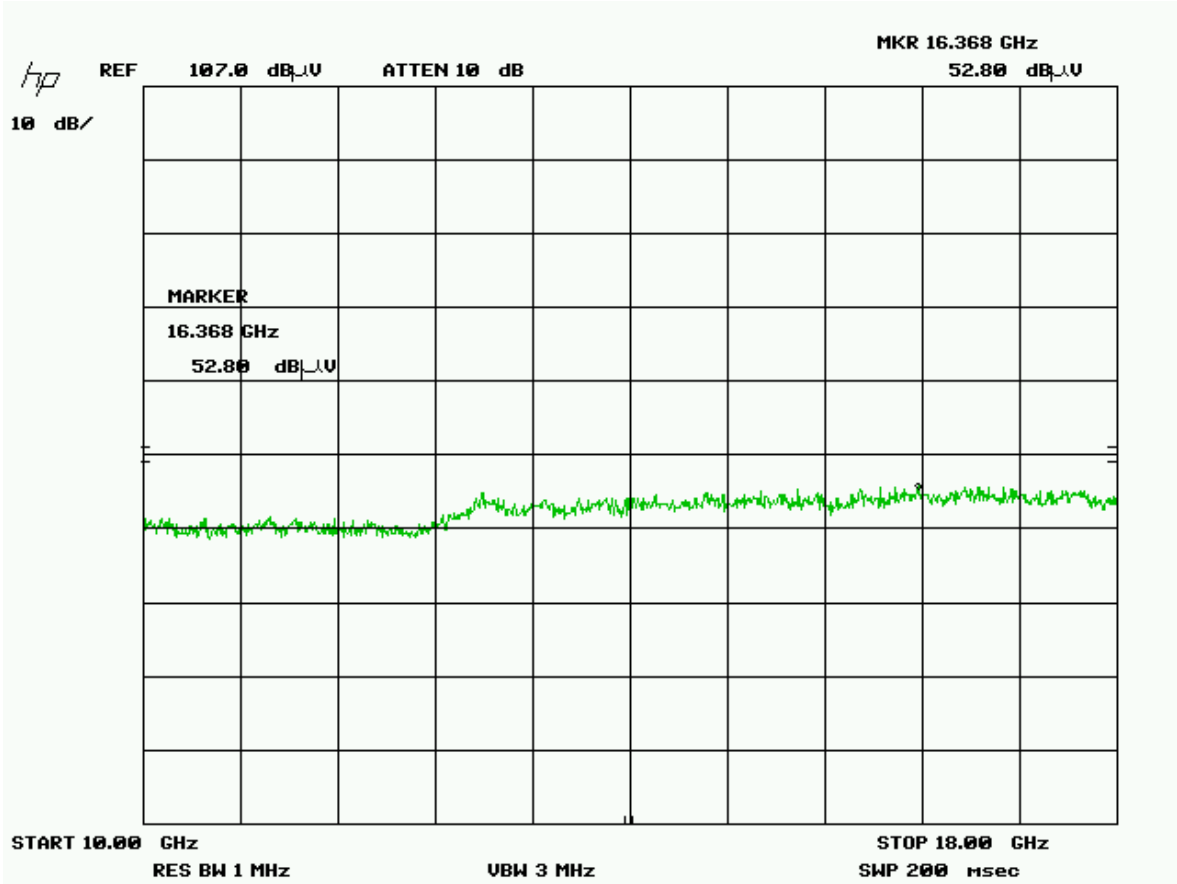
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Vertical – Peak Emissions Graph  
 ANT - High Channel, BT – High Channel  
 2 GHz – 10 GHz



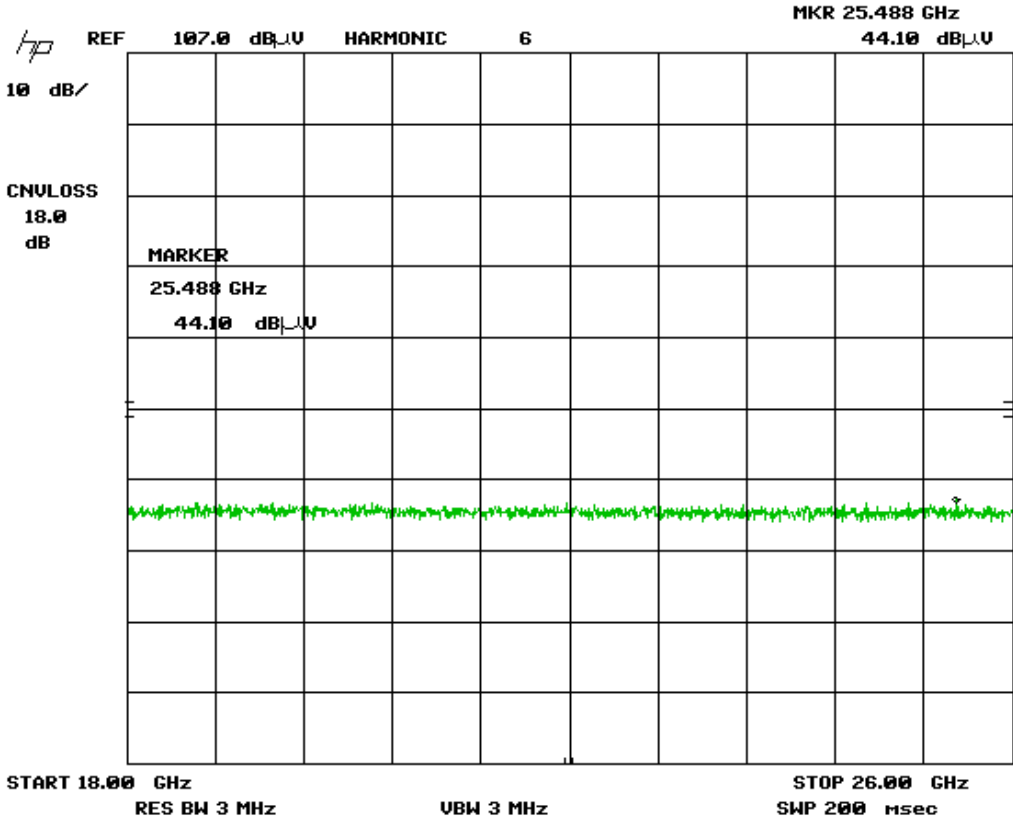
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Vertical – Peak Emissions Graph  
 ANT - Middle Channel, BT – Low Channel  
 10 GHz – 18 GHz



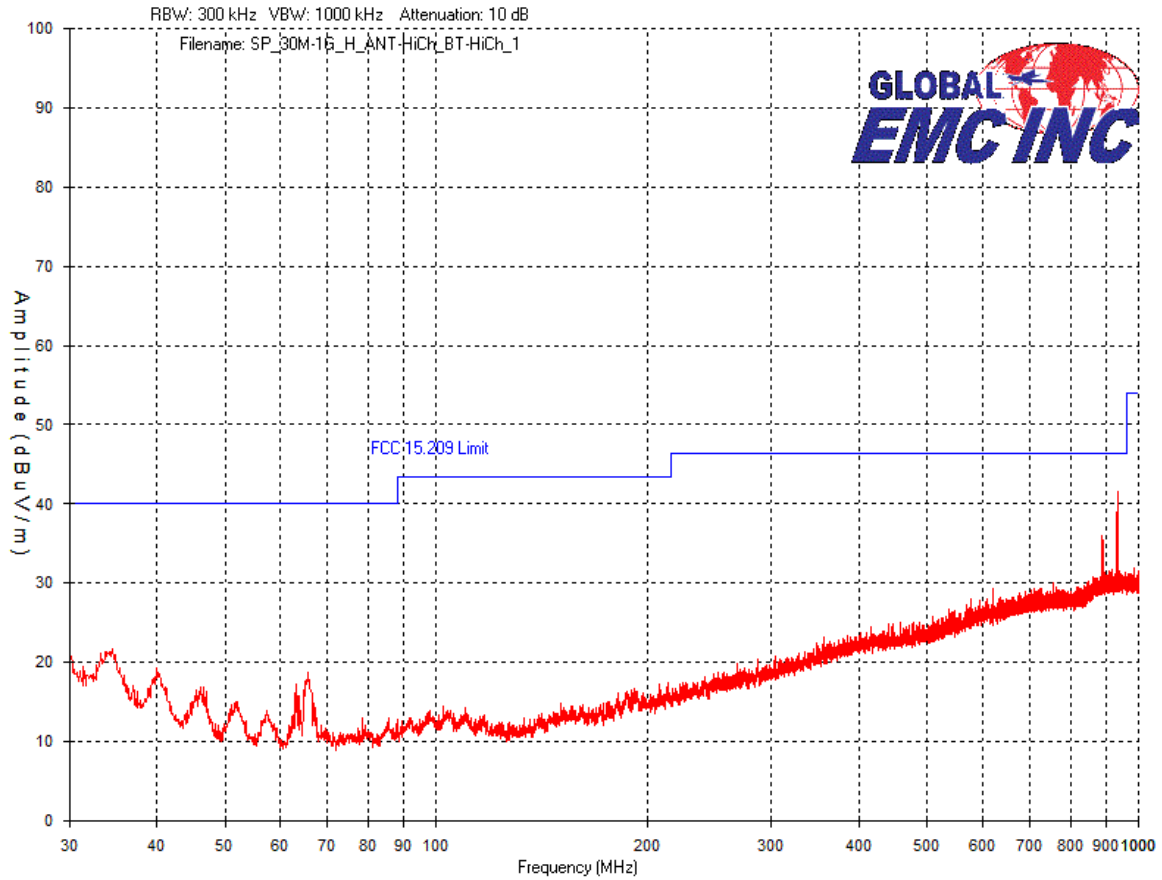
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Vertical – Peak Emissions Graph  
 ANT - Low Channel, BT – High Channel  
 18 GHz –26 GHz



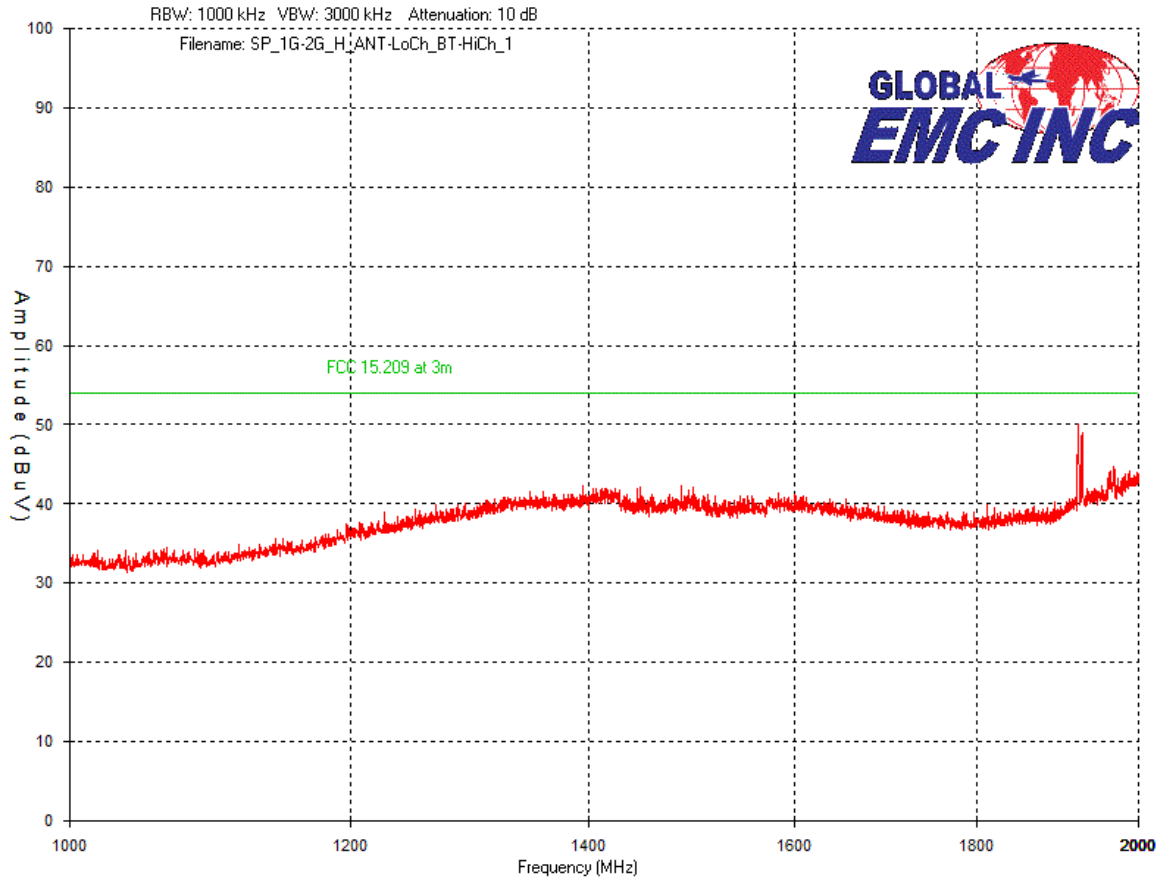
Client	4iiii Innovations Inc.	
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Horizontal – Peak Emissions Graph  
 ANT - High Channel, BT – High Channel  
 30 MHz – 1 GHz




Client	4iiii Innovations Inc.	
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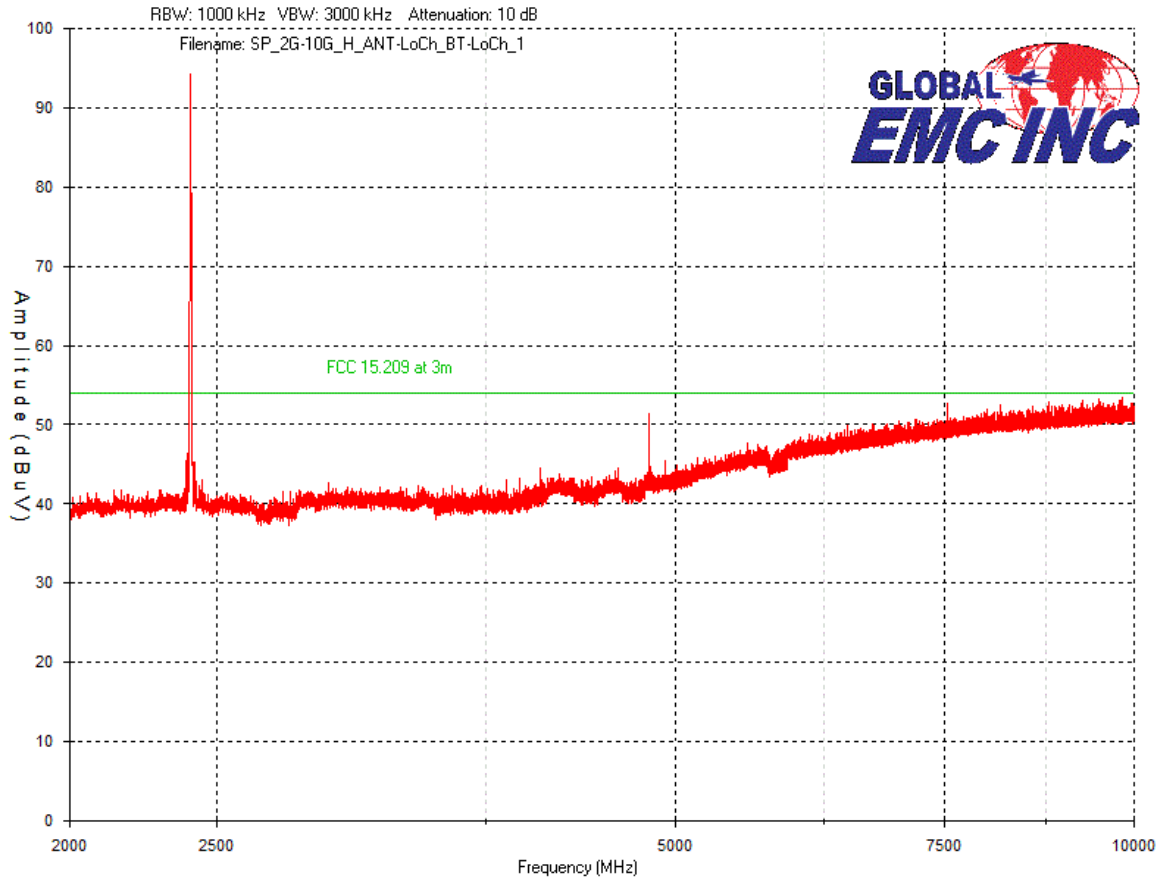
Horizontal – Peak Emissions Graph  
 ANT - Low Channel, BT – High Channel  
 1 GHz – 2 GHz






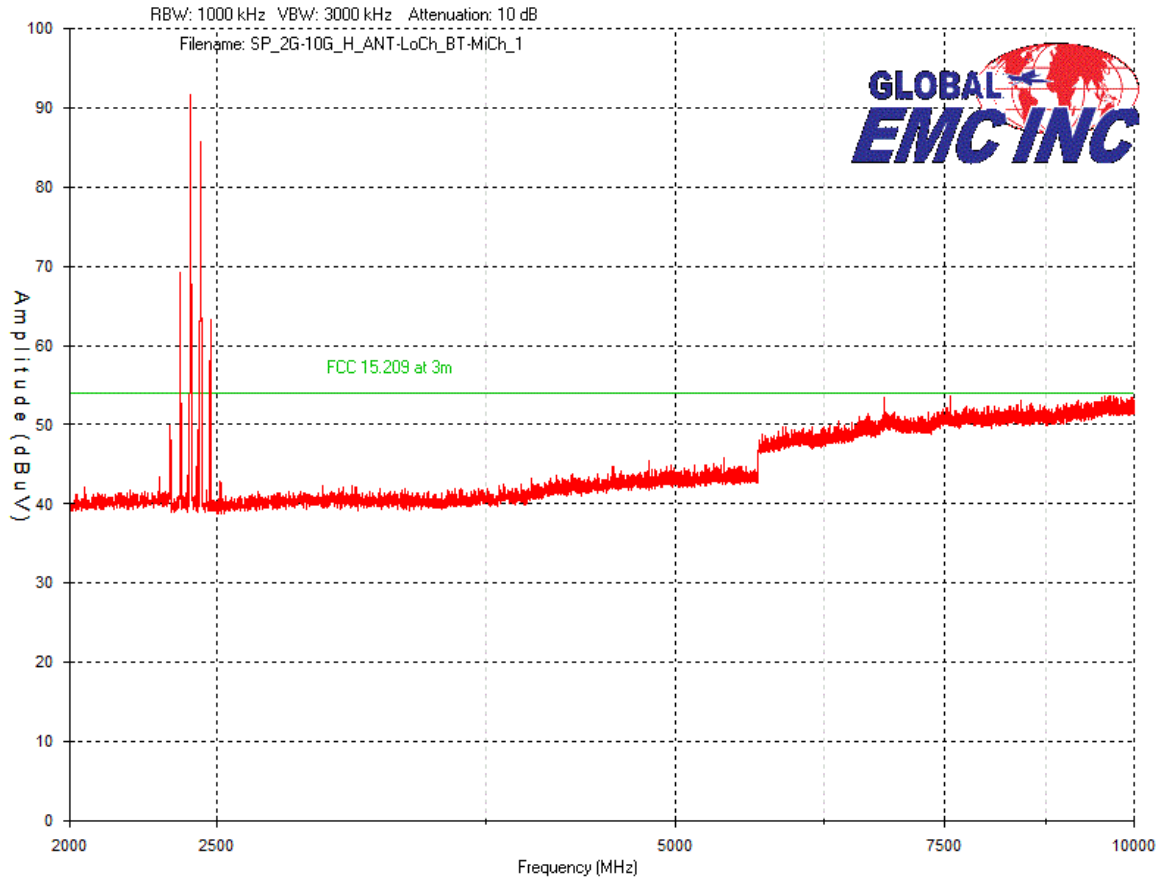
Client	4iiii Innovations Inc.	
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Horizontal – Peak Emissions Graph  
 ANT - Low Channel, BT – Low Channel  
 2 GHz – 10 GHz



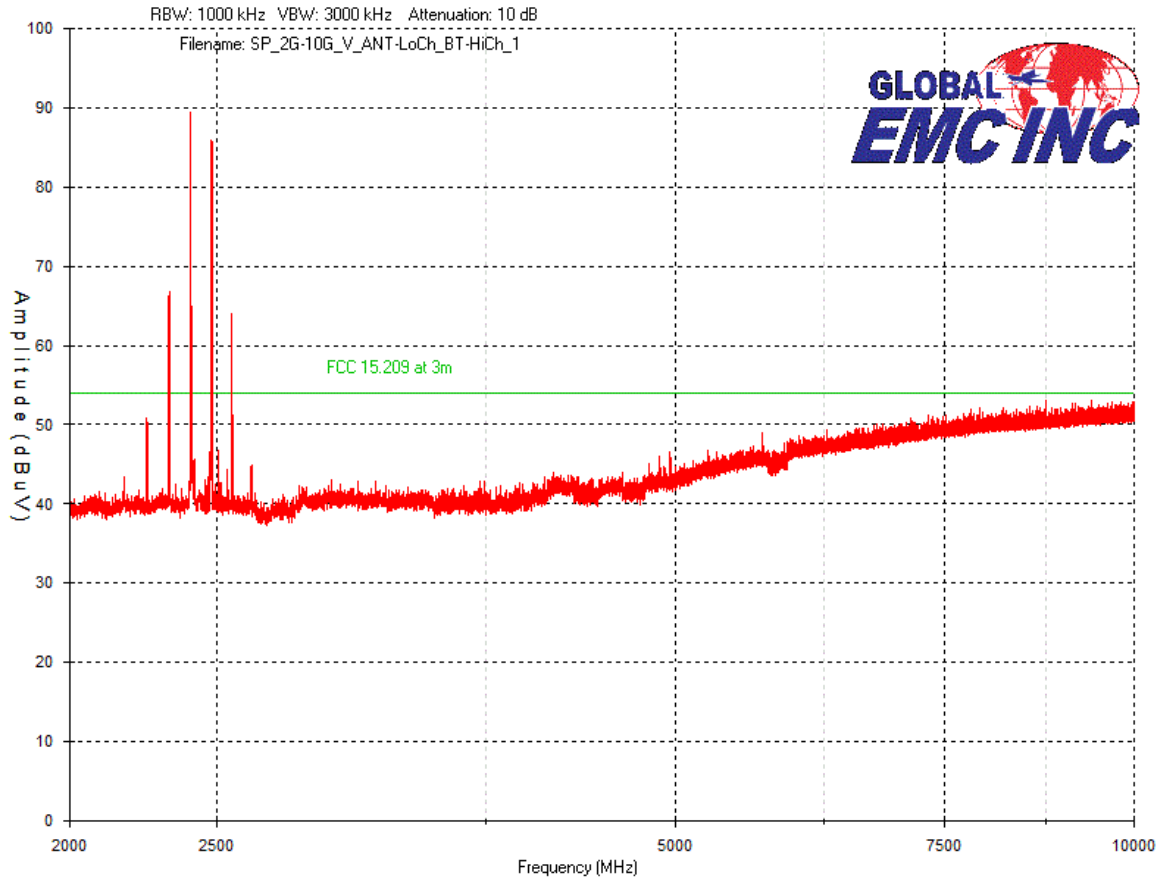
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Horizontal – Peak Emissions Graph  
 ANT - Low Channel, BT – Middle Channel  
 2 GHz – 10 GHz



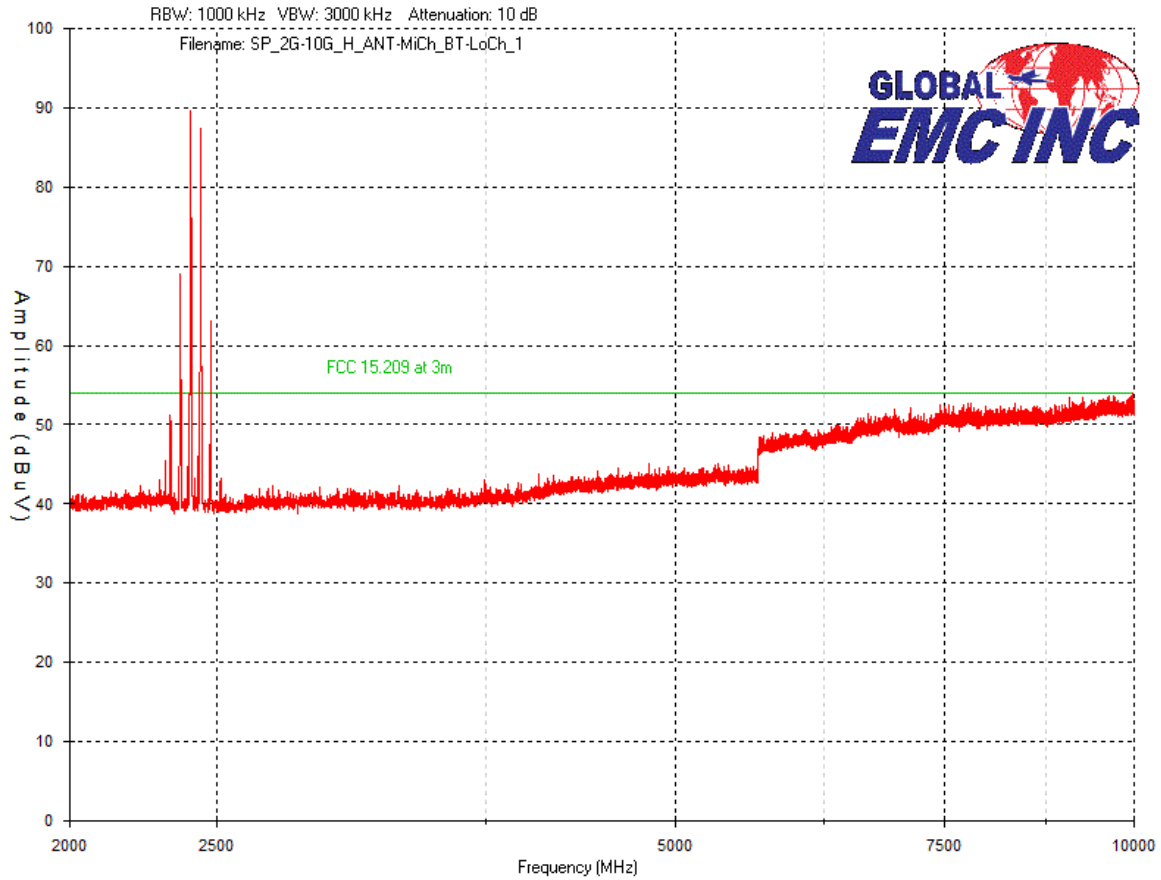
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Horizontal – Peak Emissions Graph  
 ANT - Low Channel, BT – High Channel  
 2 GHz – 10 GHz



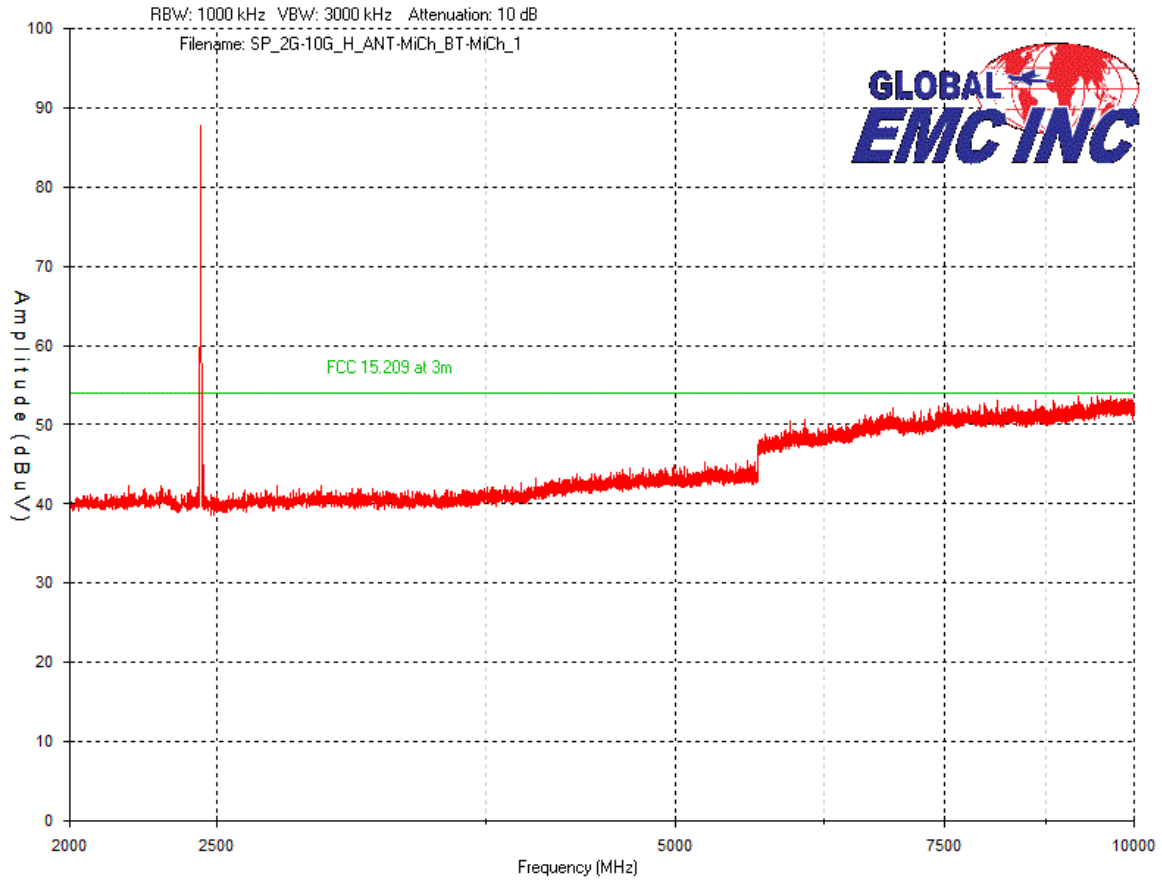
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Horizontal – Peak Emissions Graph  
 ANT – Middle Channel, BT – Low Channel  
 2 GHz – 10 GHz



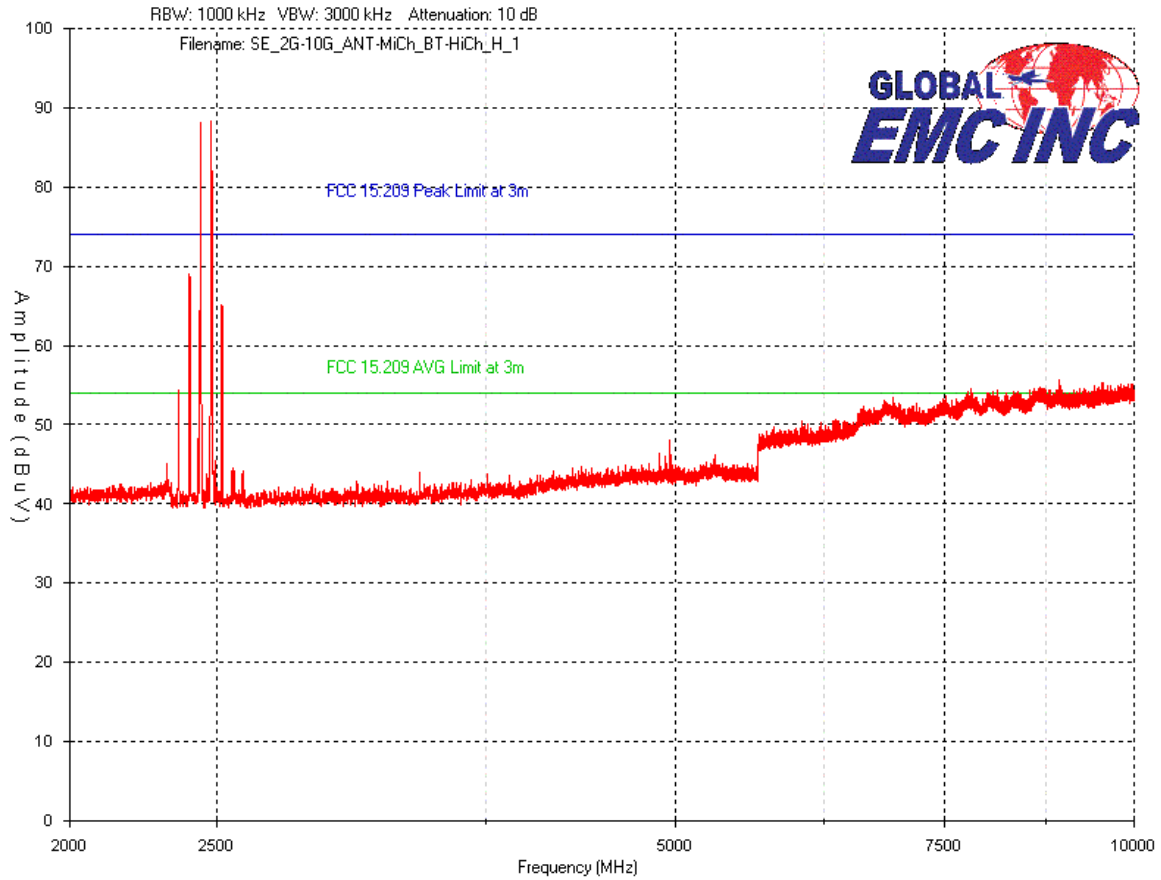
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Horizontal – Peak Emissions Graph  
 ANT – Middle Channel, BT – Middle Channel  
 2 GHz – 10 GHz



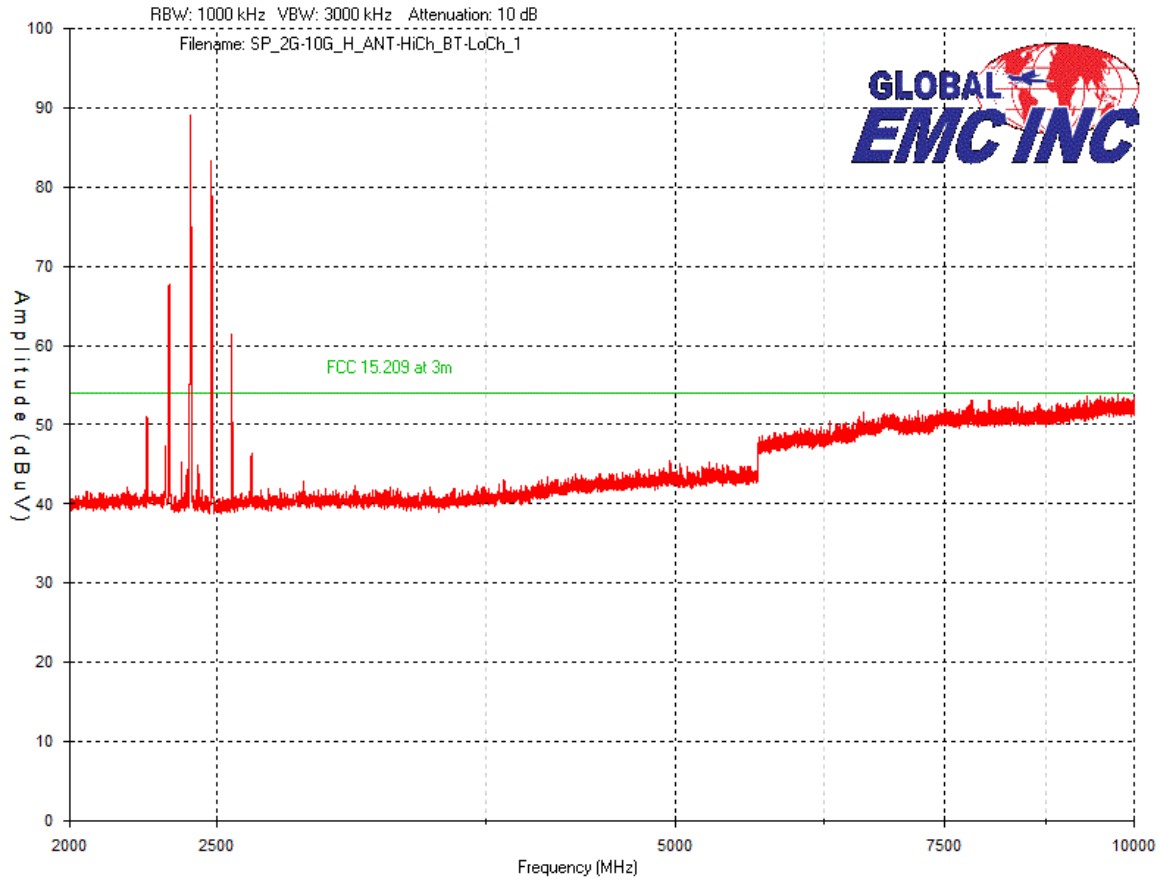
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Horizontal – Peak Emissions Graph  
 ANT – Middle Channel, BT – High Channel  
 2 GHz – 10 GHz



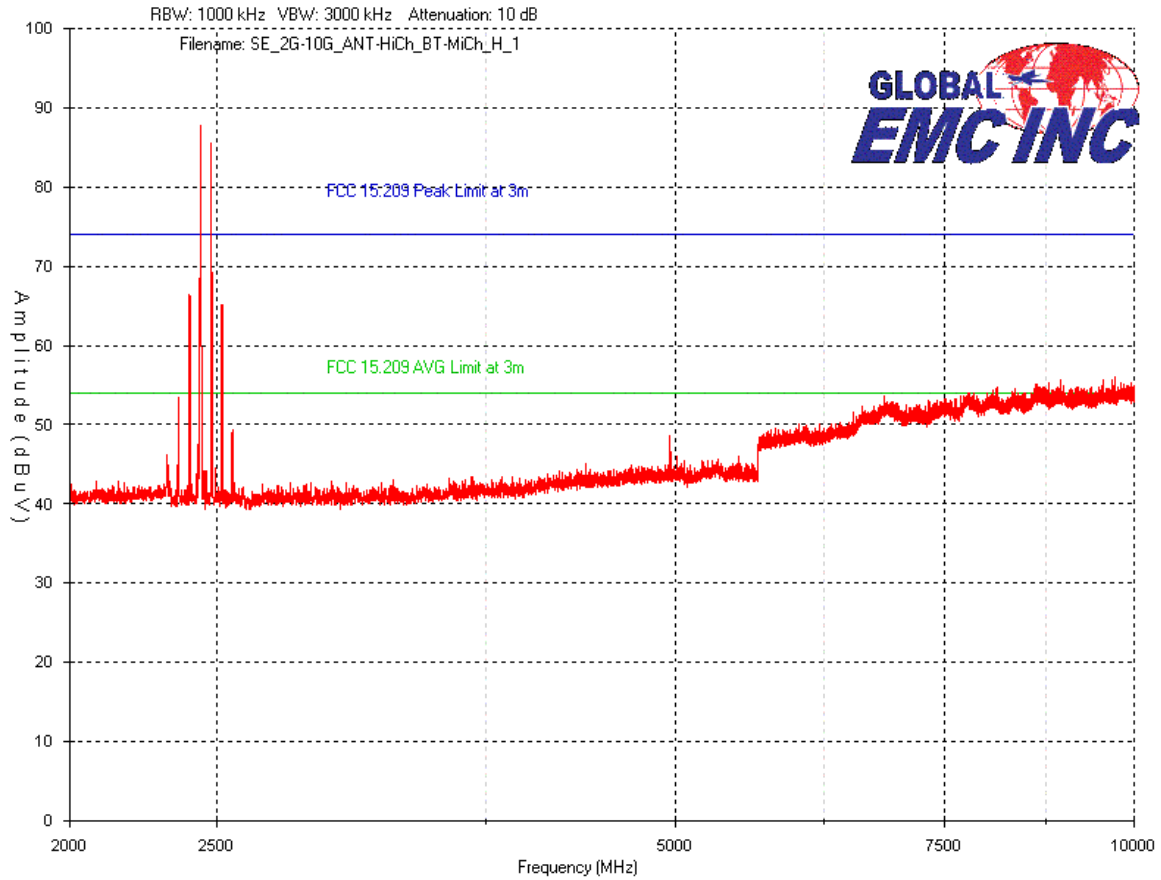
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Horizontal – Peak Emissions Graph  
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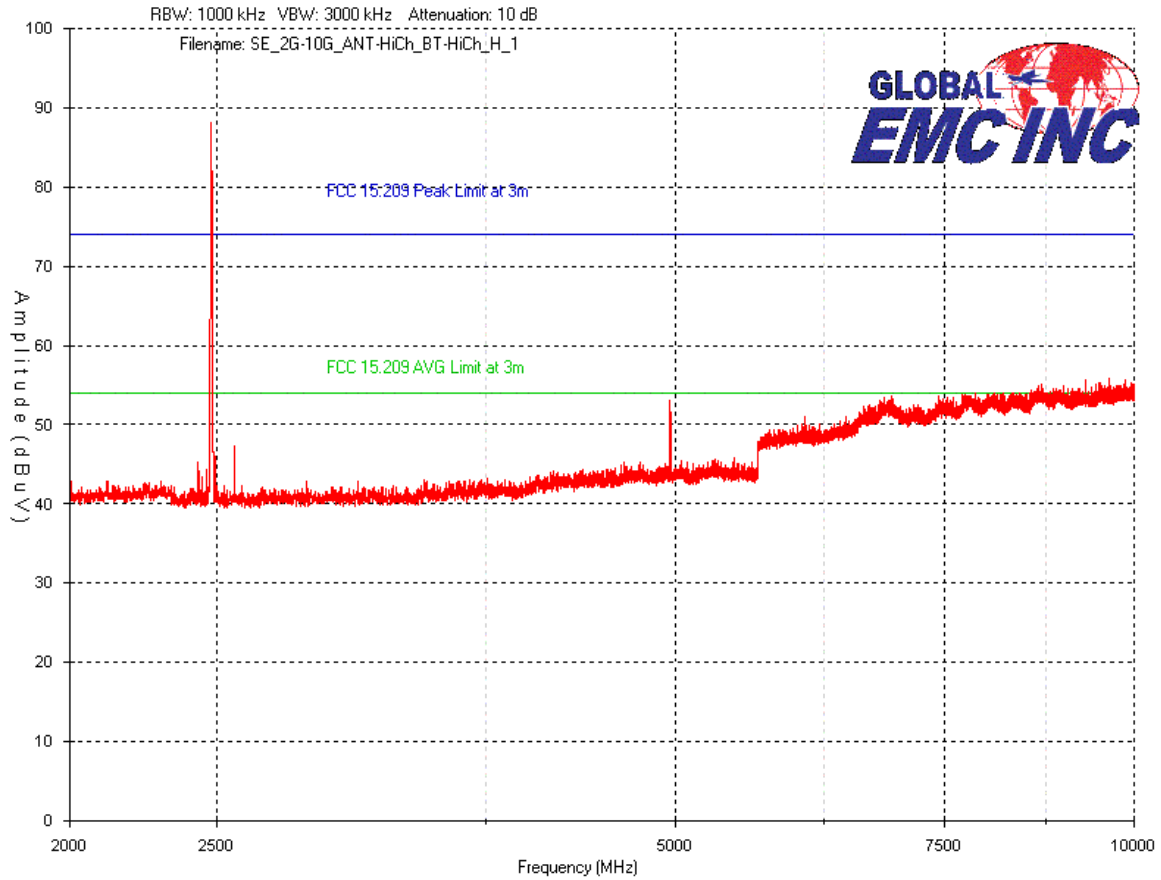
Horizontal – Peak Emissions Graph  
 ANT –High Channel, BT – Middle Channel  
 2 GHz – 10 GHz






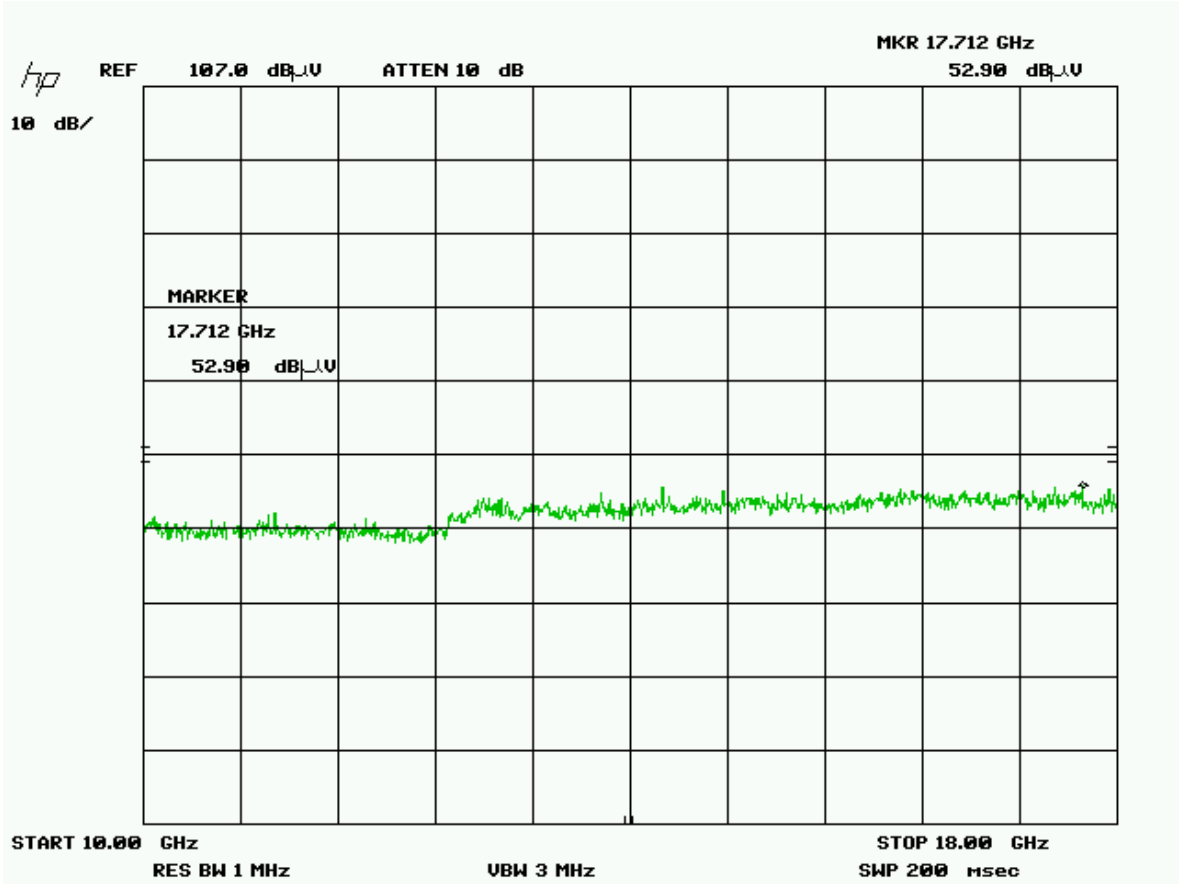
Client	4iiii Innovations Inc.	
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Horizontal – Peak Emissions Graph  
 ANT –High Channel, BT – High Channel  
 2 GHz – 10 GHz



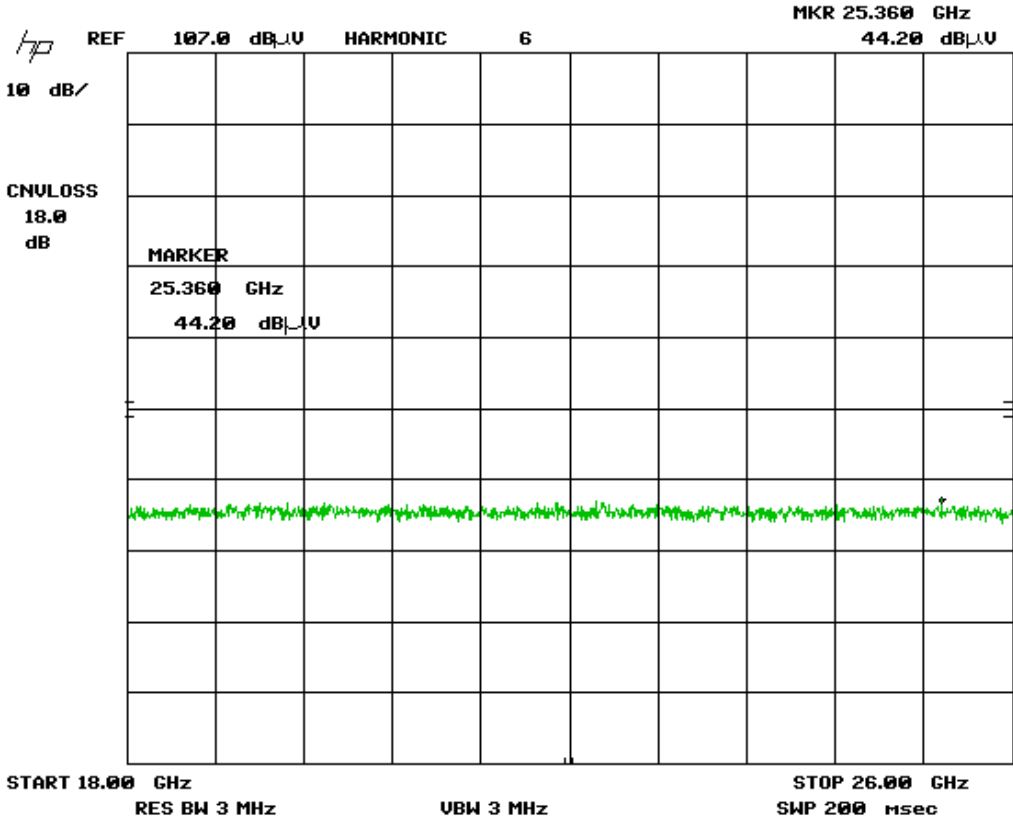
Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

Horizontal – Peak Emissions Graph  
 ANT - Middle Channel, BT – Low Channel  
 10 GHz – 18 GHz



Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	


Horizontal – Peak Emissions Graph  
 ANT - Middle Channel, BT – High Channel  
 18 GHz – 26 GHz



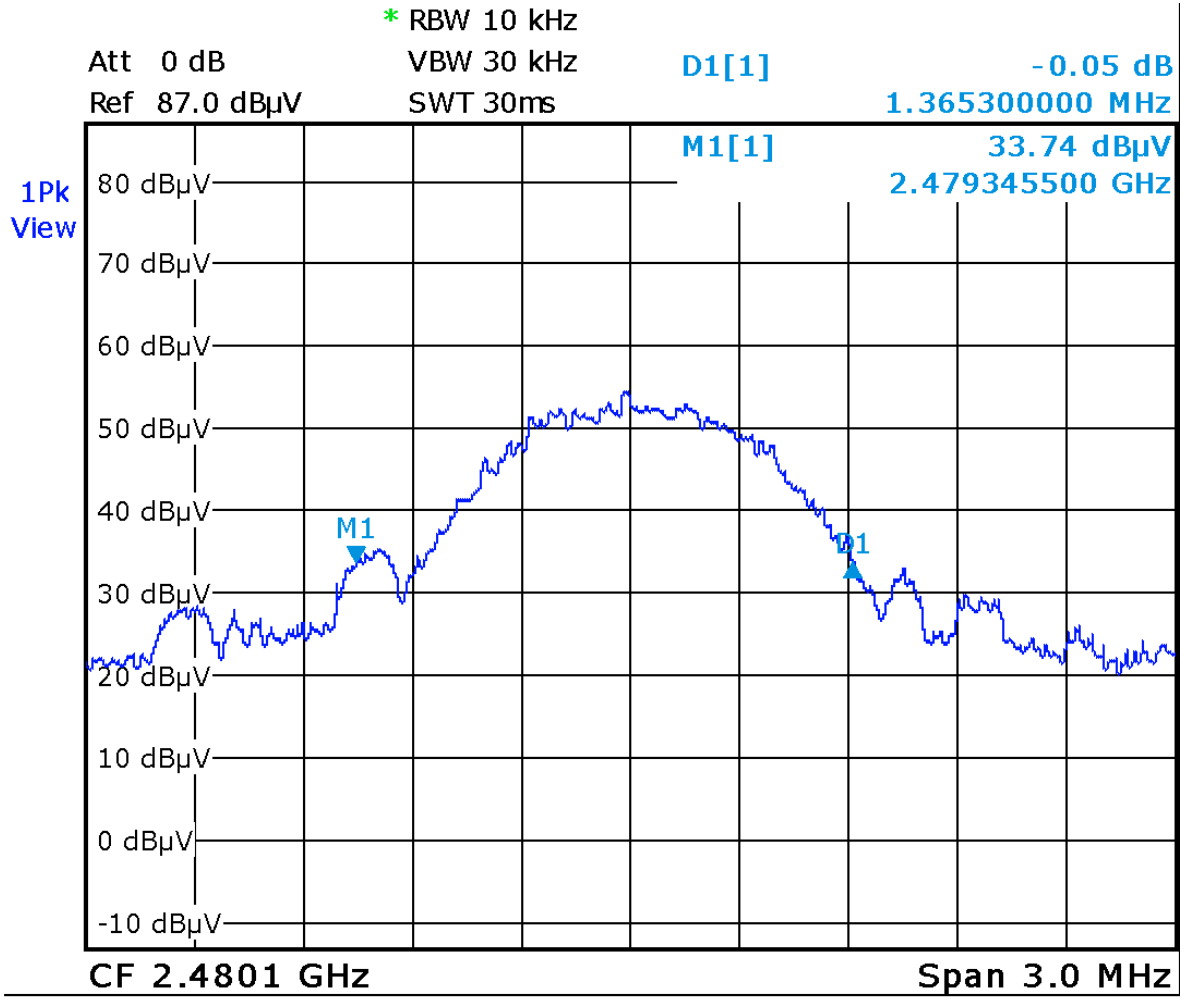
Notes:


All emissions above 5GHz have been verified to be below average limits.

Receiver mode was detected to be identical, with the exception of the fundamental and related harmonics.

Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

**Occupied Bandwidth  
Worst Case Shown**

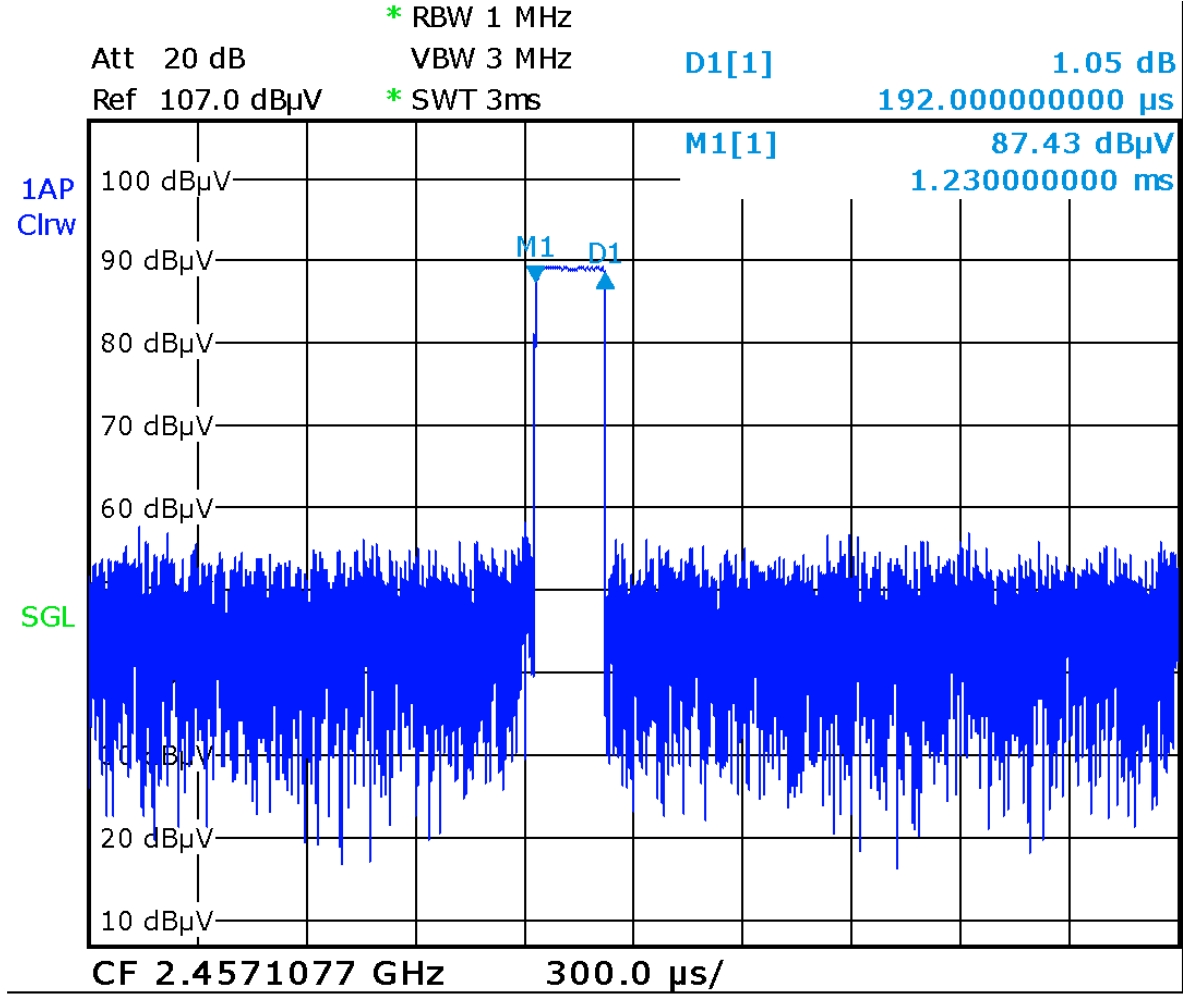



Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

### Calculation of Average Value

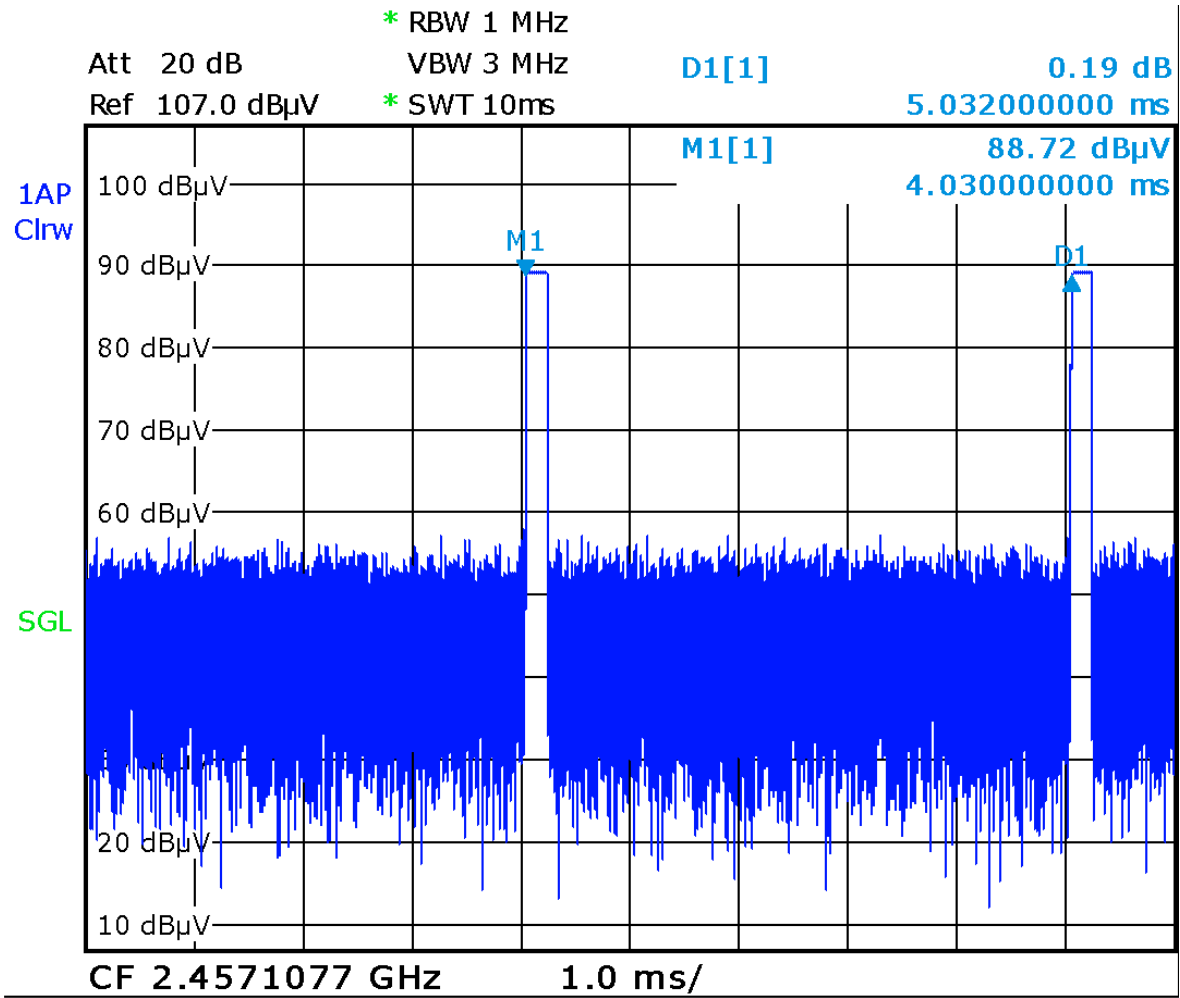
The averaging factor is to be calculated from the On Time per pulse train using  $20\log(\text{On Time}/\text{Period})$  as specified in ANSI C63.10. Based on results, a worst case maximum averaging factor of -20dB was applied to the peak.

ANT  
 Each pulse train is 0.192ms




Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

Period of pulse train = 5 mS

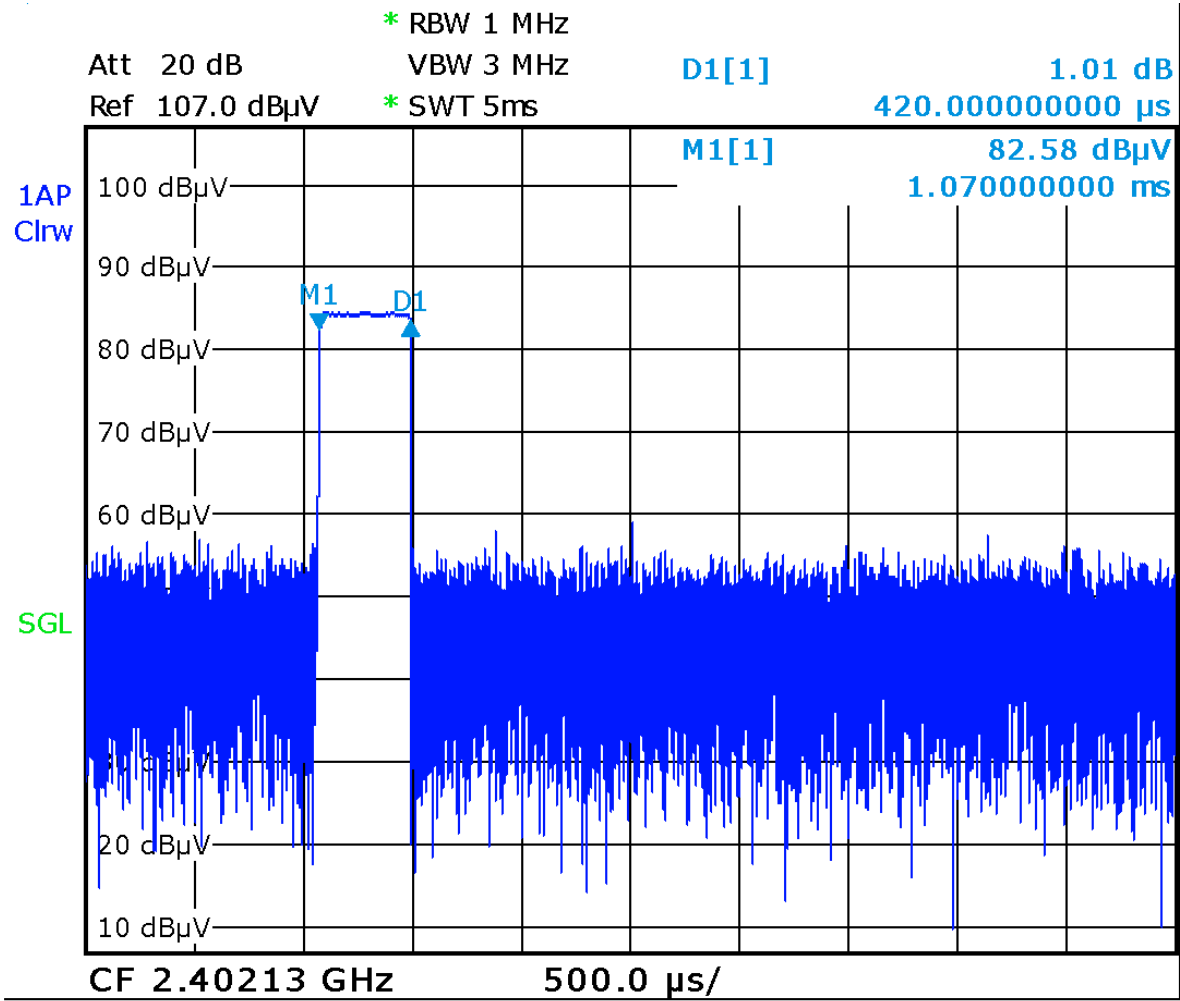



Averaging factor:  $20\log(0.192/5) = -28.3$

Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

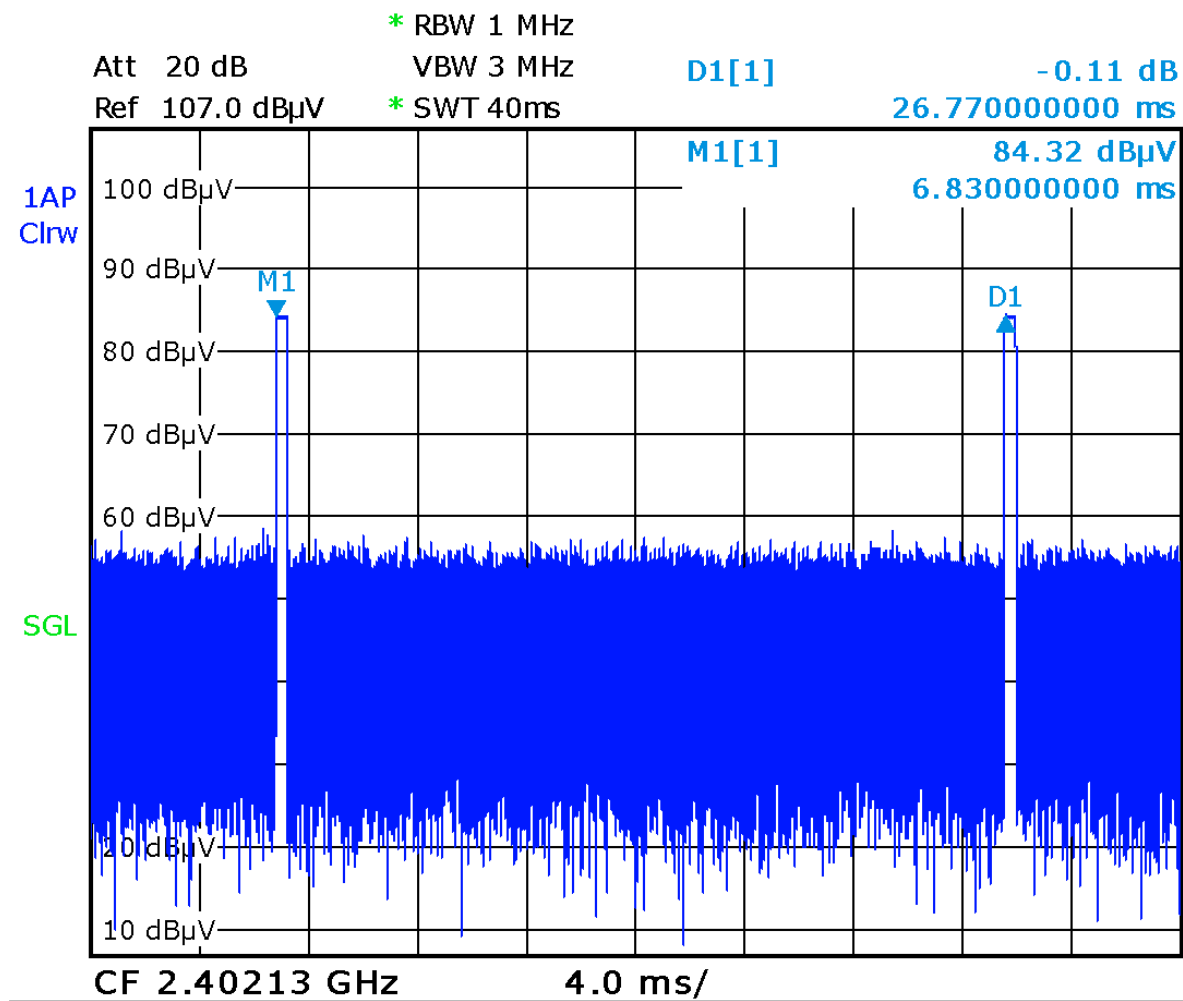
BT

Each pulse train is 0.420ms




Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

Period of pulse train = 26.7mS



Averaging factor:  $20\log(0.420/26.7) = -36.0$



Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

## Final Measurements


The max fundamental was measured to be 94 dBuV/m at 3 meters.

The following measurements show the values of the fundamental, harmonics, band edges, and spurious. All emissions above the third harmonic are below the noise floor

Maximum of -20dB duty cycle correction factor is applicable for calculating the average emissions of this unit.


### Fundamental and Harmonics Measurements

Project Name / Number	4iiii Innovation Viiiiva / 21198										
ANT on, BT off											
Test Frequency (MHz)	Detection mode	Antenna polarity (Horz/Vert)	Raw signal dB(µV)	Antenna factor dB	Cable loss dB	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
Low Channel											
2403	Peak	Horz	97.4	30.6	2.2	0.0	36.2	94.0	113.97	20.0	Pass
2403	Avg	Horz	77.4	30.6	2.2	0.0	36.2	74.0	93.97	20.0	Pass
2403	Peak	Vert	91.3	30.6	2.2	0.0	36.2	87.9	113.97	26.1	Pass
2403	Avg	Vert	71.3	30.6	2.2	0.0	36.2	67.9	93.97	26.1	Pass
4806	Peak	Horz	60.6	33.7	2.9	0.0	35.7	61.5	73.97	12.5	Pass
4806	Avg	Horz	40.6	33.7	2.9	0.0	35.7	41.5	53.97	12.5	Pass
4806	Peak	Vert	60.6	33.7	2.9	0.0	35.7	61.5	73.97	12.5	Pass
4806	Avg	Vert	40.6	33.7	2.9	0.0	35.7	41.5	53.97	12.5	Pass
7209	Peak	Vert	48.1	37.9	4.3	0.0	35.9	54.4	73.97	19.6	Pass
7209	Avg	Vert	28.1	37.9	4.3	0.0	35.9	34.4	53.97	19.6	Pass
7209	Peak	Horz	48.4	37.9	4.3	0.0	35.9	54.7	73.97	19.3	Pass
7209	Avg	Horz	28.4	37.9	4.3	0.0	35.9	34.7	53.97	19.3	Pass
Mid channel											
2440	Peak	Horz	94.2	30.6	2.2	0.0	36.2	90.8	113.97	23.1	Pass
2440	Avg	Horz	74.2	30.6	2.2	0.0	36.2	70.8	93.97	23.1	Pass
2440	Peak	Vert	93.3	30.6	2.2	0.0	36.2	89.9	113.97	24.1	Pass
2440	Avg	Vert	73.3	30.6	2.2	0.0	36.2	69.9	93.97	24.1	Pass
4880	Peak	Horz	62.0	33.7	2.9	0.0	35.7	62.9	73.97	11.1	Pass
4880	Avg	Horz	42.0	33.7	2.9	0.0	35.7	42.9	53.97	11.1	Pass
4880	Peak	Vert	60.7	33.7	2.9	0.0	35.7	61.6	73.97	12.4	Pass


Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

4880	Avg	Vert	40.7	33.7	2.9	0.0	35.7	41.6	53.97	12.4	Pass
7320	Peak	Vert	48.8	37.9	4.3	0.0	35.9	55.1	73.97	18.9	Pass
7320	Avg	Vert	28.8	37.9	4.3	0.0	35.9	35.1	53.97	18.9	Pass
7320	Peak	Horz	48.1	37.9	4.3	0.0	35.9	54.4	73.97	19.6	Pass
7320	Avg	Horz	28.1	37.9	4.3	0.0	35.9	34.4	53.97	19.6	Pass
<b>High channel</b>											
2480	Peak	Horz	92.7	30.6	2.2	0.0	36.2	89.3	113.97	24.7	Pass
2480	Avg	Horz	72.7	30.6	2.2	0.0	36.2	69.3	93.97	24.7	Pass
2480	Peak	Vert	90.5	30.6	2.2	0.0	36.2	87.1	113.97	26.9	Pass
2480	Avg	Vert	70.5	30.6	2.2	0.0	36.2	67.1	93.97	26.9	Pass
4960	Peak	Horz	61.3	33.7	2.9	0.0	35.7	62.2	73.97	11.7	Pass
4960	Avg	Horz	41.3	33.7	2.9	0.0	35.7	42.2	53.97	11.7	Pass
4960	Peak	Vert	61.5	33.7	2.9	0.0	35.7	62.4	73.97	11.6	Pass
4960	Avg	Vert	41.5	33.7	2.9	0.0	35.7	42.4	53.97	11.6	Pass
7440	Peak	Vert	49.3	37.9	4.3	0.0	35.9	55.6	73.97	18.4	Pass
7440	Avg	Vert	29.3	37.9	4.3	0.0	35.9	35.6	53.97	18.4	Pass
7440	Peak	Horz	49.1	37.9	4.3	0.0	35.9	55.4	73.97	18.6	Pass
7440	Avg	Horz	29.1	37.9	4.3	0.0	35.9	35.4	53.97	18.6	Pass

Project Name / Number	4iiii Innovation Viiiiva / 21198										
<b>BT on, ANT off</b>											
Test Frequency (MHz)	Detection mode	Antenna polarity (Horz/Vert)	Raw signal dB(µV)	Antenna factor dB	Cable loss dB	Attenuator dB	Pre-Amp Gain dB	Received signal dB(µV/m)	Emission limit dB(µV/m)	Margin dB(µV)	Result
<b>Low Channel</b>											
2403	Peak	Horz	95.4	30.6	2.2	0.0	36.2	92.0	113.97	22.0	Pass
2403	Avg	Horz	75.4	30.6	2.2	0.0	36.2	72.0	93.97	22.0	Pass
2403	Peak	Vert	90.3	30.6	2.2	0.0	36.2	86.9	113.97	27.0	Pass
2403	Avg	Vert	70.3	30.6	2.2	0.0	36.2	66.9	93.97	27.0	Pass
4806	Peak	Horz	59.8	33.7	2.9	0.0	35.7	60.7	73.97	13.2	Pass
4806	Avg	Horz	39.8	33.7	2.9	0.0	35.7	40.7	53.97	13.2	Pass
4806	Peak	Vert	59.7	33.7	2.9	0.0	35.7	60.6	73.97	13.4	Pass
4806	Avg	Vert	39.7	33.7	2.9	0.0	35.7	40.6	53.97	13.4	Pass
7209	Peak	Vert	49.0	37.9	4.3	0.0	35.9	55.3	73.97	18.7	Pass
7209	Avg	Vert	29.0	37.9	4.3	0.0	35.9	35.3	53.97	18.7	Pass
7209	Peak	Horz	48.9	37.9	4.3	0.0	35.9	55.2	73.97	18.8	Pass
7209	Avg	Horz	28.9	37.9	4.3	0.0	35.9	35.2	53.97	18.8	Pass
<b>Mid channel</b>											
2440	Peak	Horz	95.4	30.6	2.2	0.0	36.2	92.0	113.97	22.0	Pass

Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

2440	Avg	Horz	75.4	30.6	2.2	0.0	36.2	72.0	93.97	22.0	Pass
2440	Peak	Vert	88.7	30.6	2.2	0.0	36.2	85.3	113.97	28.7	Pass
2440	Avg	Vert	68.7	30.6	2.2	0.0	36.2	65.3	93.97	28.7	Pass
4880	Peak	Horz	61.4	33.7	2.9	0.0	35.7	62.3	73.97	11.7	Pass
4880	Avg	Horz	41.4	33.7	2.9	0.0	35.7	42.3	53.97	11.7	Pass
4880	Peak	Vert	61.2	33.7	2.9	0.0	35.7	62.1	73.97	11.9	Pass
4880	Avg	Vert	41.2	33.7	2.9	0.0	35.7	42.1	53.97	11.9	Pass
7320	Peak	Vert	48.5	37.9	4.3	0.0	35.9	54.8	73.97	19.2	Pass
7320	Avg	Vert	28.5	37.9	4.3	0.0	35.9	34.8	53.97	19.2	Pass
7320	Peak	Horz	48.2	37.9	4.3	0.0	35.9	54.5	73.97	19.5	Pass
7320	Avg	Horz	28.2	37.9	4.3	0.0	35.9	34.5	53.97	19.5	Pass
High channel											
2480	Peak	Horz	92.7	30.6	2.2	0.0	36.2	89.3	113.97	24.7	Pass
2480	Avg	Horz	72.7	30.6	2.2	0.0	36.2	69.3	93.97	24.7	Pass
2480	Peak	Vert	83.8	30.6	2.2	0.0	36.2	80.4	113.97	33.6	Pass
2480	Avg	Vert	63.8	30.6	2.2	0.0	36.2	60.4	93.97	33.6	Pass
4960	Peak	Horz	52.7	33.7	2.9	0.0	35.7	53.6	73.97	20.4	Pass
4960	Avg	Horz	32.7	33.7	2.9	0.0	35.7	33.6	53.97	20.4	Pass
4960	Peak	Vert	50.8	33.7	2.9	0.0	35.7	51.7	73.97	22.3	Pass
4960	Avg	Vert	30.8	33.7	2.9	0.0	35.7	31.7	53.97	22.3	Pass
7440	Peak	Vert	48.4	37.9	4.3	0.0	35.9	54.7	73.97	19.3	Pass
7440	Avg	Vert	28.4	37.9	4.3	0.0	35.9	34.7	53.97	19.3	Pass
7440	Peak	Horz	49.6	37.9	4.3	0.0	35.9	55.9	73.97	18.1	Pass
7440	Avg	Horz	29.6	37.9	4.3	0.0	35.9	35.9	53.97	18.1	Pass

Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	


### Bandedge Measurements

Project Name / Number	4iiii Innovation Viiiiva / 21198										
<b>BT on, ANT on</b>											
Test Frequency (MHz)	Detection mode	Antenna polarity (Horz/Vert)	Raw signal dB(μV)	Antenna factor dB	Cable loss dB	Attenuator dB	Pre-Amp Gain dB	Received signal dB(μV/m)	Emission limit dB(μV/m)	Margin dB(μV)	Result
Low Channel Bandedges – ANT and BT on											
2400	Peak	Horz	65.6	30.6	2.2	0.0	36.2	62.2	73.97	11.8	Pass
2400	Avg	Horz	45.6	30.6	2.2	0.0	36.2	42.2	53.97	11.8	Pass
2400	Peak	Vert	65.2	30.6	2.2	0.0	36.2	61.8	73.97	12.2	Pass
2400	Avg	Vert	45.2	30.6	2.2	0.0	36.2	41.8	53.97	12.2	Pass
High channel Bandedges – ANT and BT on											
2483.5	Peak	Horz	61.5	30.6	2.2	0.0	36.2	58.1	74.0	15.9	Pass
2483.5	Avg	Horz	41.5	30.6	2.2	0.0	36.2	38.1	54.0	15.9	Pass
2483.5	Peak	Vert	63.5	30.6	2.2	0.0	36.2	60.1	74.0	13.9	Pass
2483.5	Avg	Vert	43.5	30.6	2.2	0.0	36.2	40.1	54.0	13.9	Pass

Note: The measurements shown at 2400MHz is the worst case measurement between 2300 and 2400MHz.

### Spurious Emissions Measurements

Project Name / Number	4iiii Innovation Viiiiva / 21198									
Test Frequency (MHz)	Detection	Received signal dB(μV)	Antenna factor (dB)	Cable loss (dB)	Pre-Amp (dB)	Emission Level (dBuV/m)	Emission limit dB(μV/m)	Margin (dB)	Result	
<b>Vertical: ANT – Low channel, BT – Middle channel</b>										
2365	Avg	54.6	30	1.3	-36.2	49.7	54	4.3	Pass	
2477.7	Avg	46.9	30.2	1.3	-36.2	42.2	54	11.8	Pass	
<b>Vertical: ANT – Low channel, BT – High channel</b>										
2325	Avg	50.2	30	1.2	-36.2	45.2	54	8.8	Pass	
2557	Avg	43.3	30.2	1.3	-36.3	38.5	54	15.5	Pass	
<b>Vertical: ANT – Middle channel, BT – Low channel</b>										
2366.3	Avg	51.3	30	1.3	-36.2	46.4	54	7.6	Pass	

Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

2477	Avg	45.4	30.2	1.3	-36.2	40.7	54	13.3	Pass
<b>Vertical: ANT – Middle channel, BT – High channel</b>									
2399.3	Avg	54.2	30.6	1.3	-36.2	49.9	54	4.1	Pass
2519.7	Avg	47	30.8	1.3	-36.3	42.8	54	11.2	Pass
<b>Vertical: ANT – High channel, BT – Low channel</b>									
2327.7	Avg	51.8	30	1.3	-36.2	46.8	54	7.2	Pass
2557	Avg	46.8	30.2	1.3	-36.3	42	54	12	Pass
<b>Vertical: ANT – High channel, BT – Middle channel</b>									
2399.7	Avg	50.9	30.6	1.3	-36.2	46.6	54	7.4	Pass
2519	Avg	48.8	30.8	1.3	-36.3	44.6	54	9.4	Pass
<b>Horizontal: ANT – Low channel, BT – Middle channel</b>									
2365.7	Avg	54.2	30	1.3	-36.2	49.3	54	4.7	Pass
2477.7	Avg	48.1	30.2	1.3	-36.2	43.4	54	10.6	Pass
<b>Horizontal: ANT – Low channel, BT – High channel</b>									
2326.5	Avg	51.9	30	1.2	-36.2	46.9	54	7.1	Pass
2556.9	Avg	48.7	30.2	1.3	-36.3	43.9	54	10.1	Pass
<b>Horizontal: ANT – Middle channel, BT – Low channel</b>									
2366.3	Avg	53.9	30	1.3	-36.2	49	54	5	Pass
2477	Avg	48	30.2	1.3	-36.2	43.3	54	10.7	Pass
<b>Horizontal: ANT – Middle channel, BT – High channel</b>									
2399.3	Avg	53.4	30.6	1.3	-36.2	49.1	54	4.9	Pass
2518.7	Avg	49.3	30.8	1.3	-36.3	45.1	54	8.9	Pass
2360.3	Avg	38.8	30.6	1.3	-36.2	34.5	54	19.5	Pass
<b>Horizontal: ANT – High channel, BT – Low channel</b>									
2327.7	Avg	52.7	30	1.2	-36.2	47.7	54	6.3	Pass
2557	Avg	46.1	30.2	1.3	-36.3	41.3	54	12.7	Pass
<b>Horizontal: ANT – High channel, BT – Middle channel</b>									
2399	Avg	50.7	30.6	1.3	-36.2	46.4	54	7.6	Pass
2518.7	Avg	49.4	30.8	1.3	-36.3	45.2	54	8.8	Avg

Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	Dec 21, 2011	Dec 21, 2013	GEMC 141
Quasi-Peak Adapter	85650A	HP	Dec 21, 2011	Dec 21 2013	GEMC 7
BiLog Antenna	3142-C	ETS	Aug 28, 2012	Aug 28, 2014	GEMC 8
Loop Antenna 30Hz – 1MHz	EM 6871	Electro-Metrics	Jan 31, 2011	Jan 31, 2013	GEMC 70
Loop Antenna 100kHz – 30MHz	EM 6872	Electro-Metrics	Jan 31, 2011	Jan 31, 2013	GEMC 71
Q-Par Horn 1.5GHz -18 GHz	6878/24	Q-par	Aug 23, 2012	Aug 23, 2014	GEMC 6365
Horn Antenna 18 GHz - 26.5 GHz	SAS-572	A.H. Systems	Aug 27, 2012	Aug 27, 2014	GEMC 6371
18.0-26.5 GHz Harmonic Mixer	11970K	HP	Dec 21, 2011	Dec 21 2013	GEMC 158
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	Aug 29, 2012	Aug 29, 2014	GEMC 6403
Pre-amp 1-26GHz	HP 8449B	HP	Aug 22, 2012	Aug 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 - 15.209 - Radiated Emissions\_Rev1.doc"

Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	


## Appendix A – EUT Summary

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

### General EUT Description

Client Details	
Organization / Address	4iiii Innovations 228 River Avenue Cochrane, AB T4C 2C1
Contact	Andrea Dukeshire
Phone	403-660-4240
Email	Andrea@4iiii.com
EUT (Equipment Under Test) Details	
EUT Name	V100 - Viiiiva 100
EUT Model	V100
Equipment category	Athletic Heart Rate Monitor
EUT is powered using	CR2032 - Lithium Coin Battery
Input voltage range(s) (V)	3VDC (nominal)
Rated input current (A)	200mA
Transmits RF energy?	Yes, 2.403 to 2.480 GHz, Rx and Tx to sensors such as heart rate, speed, etc
Basic EUT functionality description	ZZNV100 is marketed by 4iiii as the Viiiiva. Viiiiva is a new heart rate monitor which communicates to both ANT+ and Bluetooth smart (BLE) sensors. This is accomplished by interfacing the two radios (Ant and BLE) to a single antenna with a splitter.
Frequency of all clocks present in EUT	32.768KHz, 16MHz
I/O cable description, length, and type	None
Available connectors on EUT	None
Peripherals required to exercise EUT	None
Dimensions of product	L 400mm W 2mm H 1mm


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	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	

## Appendix B – EUT and Test Setup Photographs


These photos are for information purposes only.  
 Also refer to photo documents that are separate from this test report.



Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	



EUT – View 1

Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	



EUT – View 2

Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	



Radiated Emissions Photo 1

Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	



Radiated Emissions Photo 2



Client	4iiii Innovations Inc.	
Product	V100 – Viiiiva 100	
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C 15:2011	



Radiated Emissions Photo 3