

# Global EMC Inc. Labs

## EMC & RF Test Report

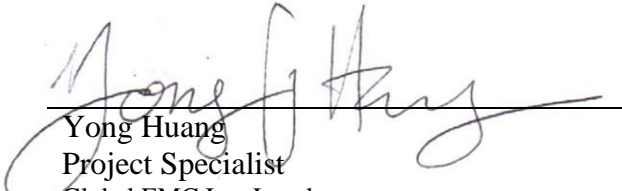
As per

### FCC Part 15 Subpart C

### Unlicensed Intentional Radiators

on the

### Wiser Air

  
Yong Huang  
Project Specialist  
Global EMC Inc. Laval  
2972 Joseph-A-Bombardier  
Laval, QC, H7P 6E3 CANADA  
Ph: (450) 687- 4976

Testing produced for




See Appendix A for full customer & EUT details.



Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

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## Report Scope

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

The EUT was tested for compliance against the following standards:

FCC Part 15 Subpart C 15

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.

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## Summary

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

EUT FCC Certification #, FCC ID:	V95-WIS
EUT Industry Canada Certification #, IC:	7591A-WIS
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Yong Huang

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## 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	> 20 cm separation.	Pass See justification and calculations
<b>Overall Result</b>			<b>PASS</b>

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 '\*'.

Client	Viconics Electronics Inc.	
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Standard(s)	FCC Part 15 Subpart C 15	

### ***Justifications, Descriptions, or Deviations***


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

The EUT was tested in both transmit and standby (receive) mode. No difference in emissions below 2 GHz were observed, and the worst case (transmit) mode is presented as representative for both modes. In standby mode, no emissions were detected above 2 GHz.

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


For the Antenna requirement specified in FCC 15.203 and RSS 210 section 5.5, this device uses a PCB trace antenna with a gain of 0 dBi.

For maximum permissible exposure, as per 447498 D01 General RF Exposure Guidance v05r02, section 4.3.1 this device operates at less than 3 mW between 2.4 GHz and 2.4835 MHz and is designed to operate greater than 5 mm or more from personnel during normal operation. No testing is required.

Client	Viconics Electronics Inc.	
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## ***Applicable Standards, Specifications and Methods***

ANSI C63.4:2014	- Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	- 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-003:2012	- 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-247:2015	- Issue 1: Digital Transmission Systems (DTSSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

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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 on June 23<sup>rd</sup>, 2015

Revision 2 - Released on August 12<sup>th</sup>, 2015. Revised as per TCB's request.



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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

**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 Montréal, Québec, 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>
May 7-June 5	all	YH	18-25°C	30-45%	100 -103kPa

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## Detailed Test Results Section

Client	Viconics Electronics Inc.	
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## ***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

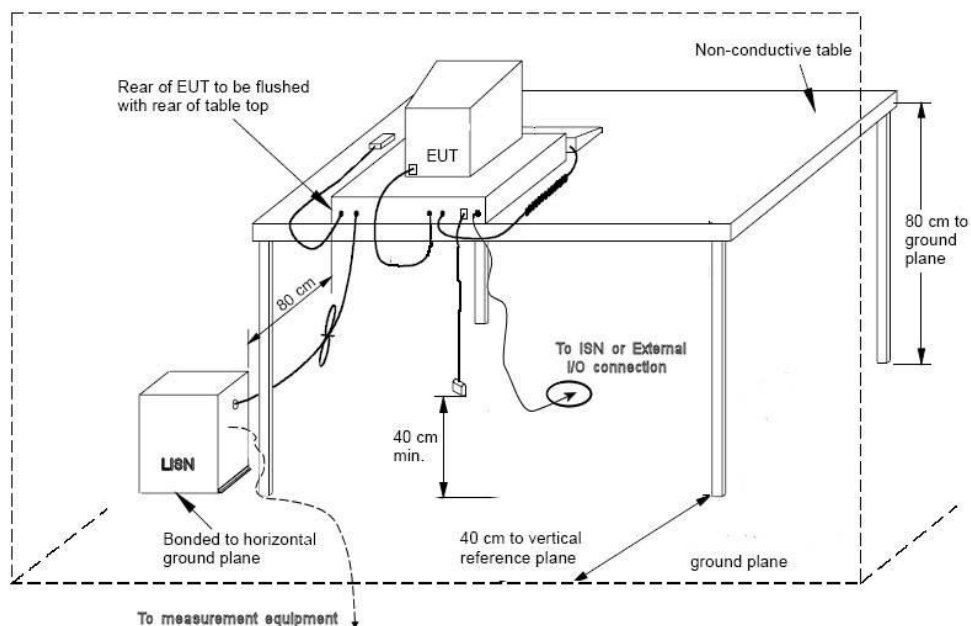
The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

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 .

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**Typical Setup Diagram**



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


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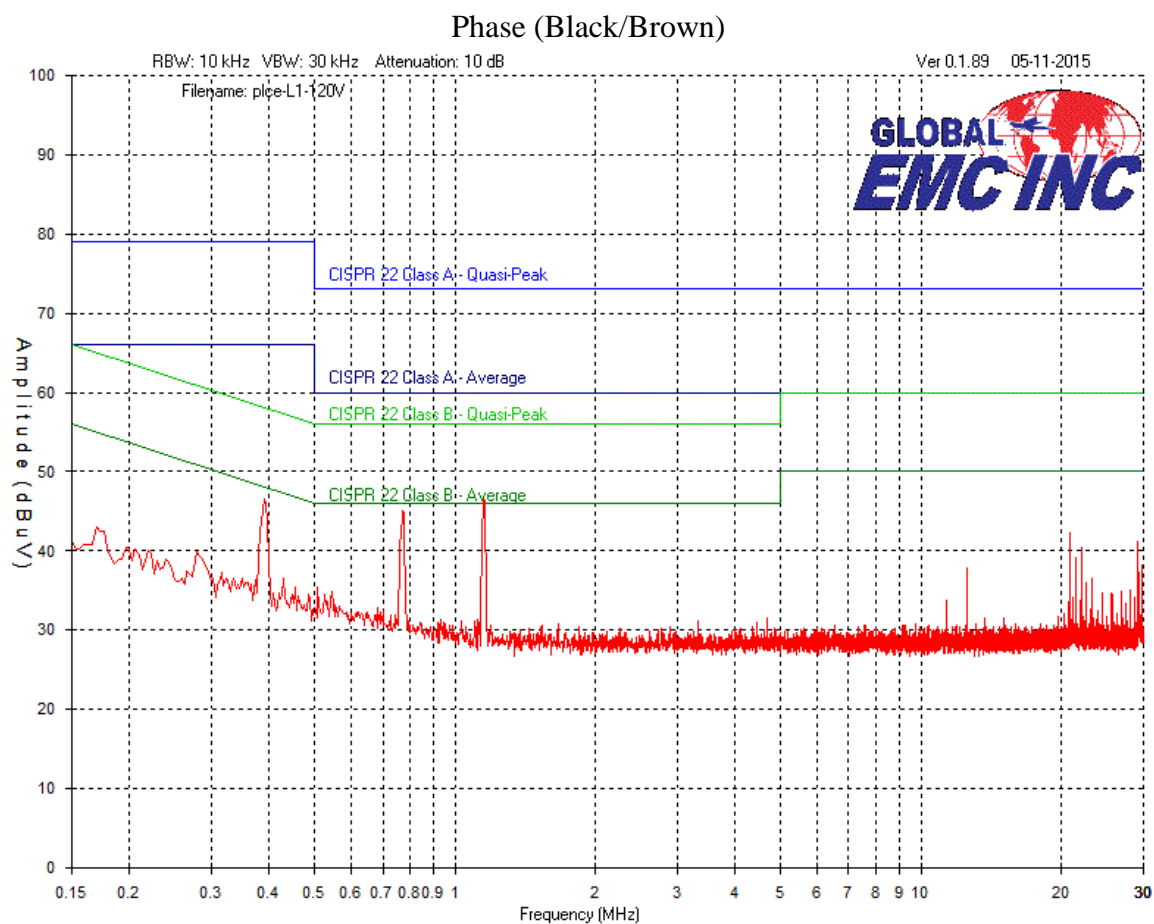
## Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is  $\pm 3.6$  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 than 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.

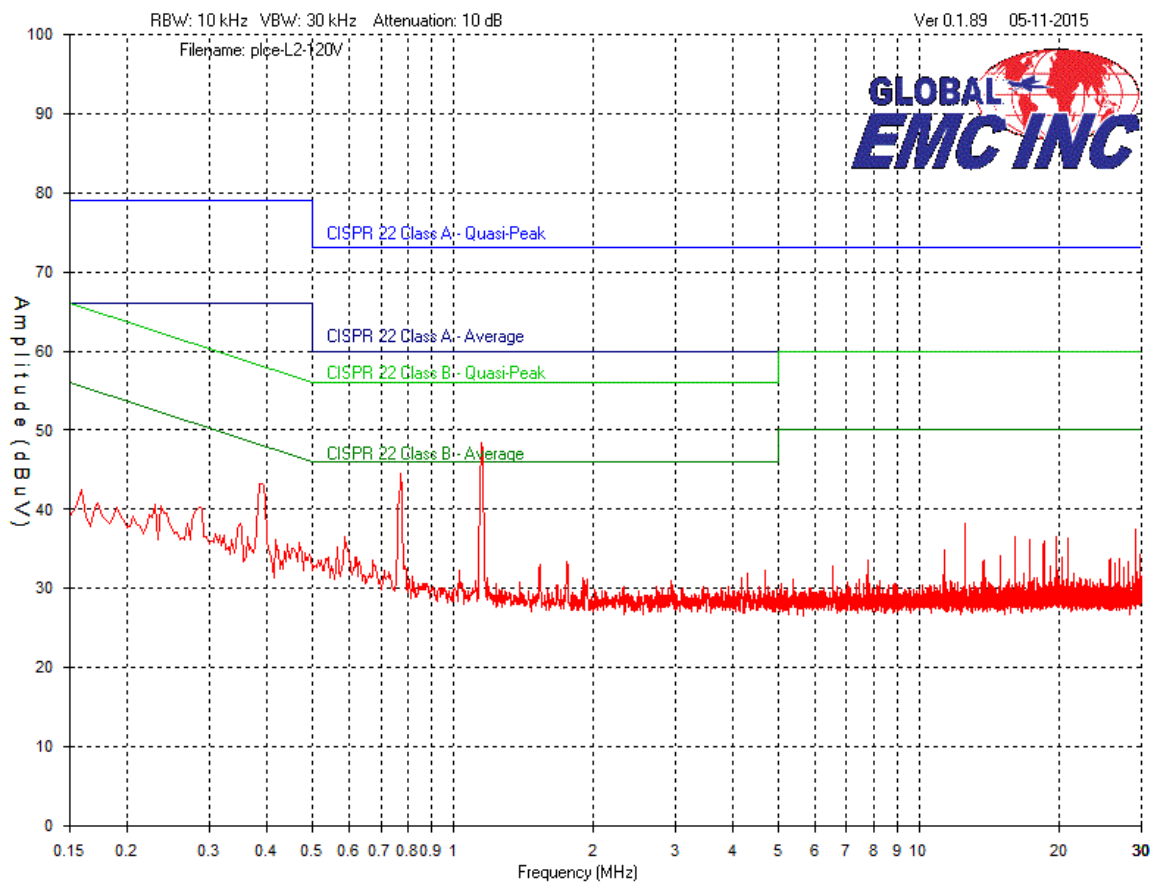
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### Neutral (White/Blue)



Client	Viconics Electronics Inc.	
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## Final Measurements

Emissions Reading Table - Line 1– 120Vac/60Hz


Test Frequency (MHz)	Det. Mode	Received signal (dBμV)	Attenuator (dB)	Cable loss (dB)	LISN factor (dB)	Emission Level (dBμV)	Emission limit (dBμV)	Margin (dB)	Result
1.155	AVG	25.4	10	0.1	0.2	35.7	46	10.3	PASS
0.7735	AVG	27.0	10	0	0.2	37.2	46	8.8	PASS
0.3888	AVG	26.7	10	0	0.2	36.9	48.1	11.2	PASS
20.9355	PEAK	31.6	10	0.2	0.5	42.3	50	7.7	PASS
29.2936	PEAK	30.5	10	0.3	0.5	41.3	50	8.7	PASS
22.1295	PEAK	29.7	10	0.2	0.5	40.4	50	9.6	PASS

Emissions Reading Table - Line 2– 120Vac/60Hz

Test Frequency (MHz)	Det. Mode	Received signal (dBμV)	Attenuator (dB)	Cable loss (dB)	LISN factor (dB)	Emission Level (dBμV)	Emission limit (dBμV)	Margin (dB)	Result
1.1516	AVG	27.3	10	0.1	0.2	37.6	46	8.4	PASS
0.7735	PEAK	34.3	10	0	0.2	44.5	46	1.5	PASS
0.3855	PEAK	32.9	10	0	0.2	43.1	48.2	5.1	PASS
12.5378	PEAK	27.8	10	0.2	0.3	38.3	50	11.7	PASS
29.2902	PEAK	26.7	10	0.3	0.5	37.5	50	12.5	PASS
1.7553	PEAK	23.1	10	0.1	0.2	33.4	46	12.6	PASS

No peak emissions exceeded the quasi-peak limits, therefore the unit was deemed to meet the quasi-peak requirements based on the peak emissions. The tables above represent the peak/average emissions readings with respect to the average limit.


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

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## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset#
HP Spectrum Analyzer	8566B	HP	1-28-15	1-28-17	4169
Spectrum Analyzer Display	8566B	HP	1-28-15	1-28-17	4168
Quasi Peak Adapter	85650A	HP	1-28-15	1-28-17	4170
LISN	FCC-LISN-50/250-16-2-01	FCC	3-20-15	3-20-17	4005
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	1-28-15	1-28-17	4025
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	1-28-15	1-28-17	4026
Attenuator 10 dB	FP-50-10	Trilithic	1-28-15	1-28-17	4027

1: For cables and attenuators, verification dates apply.

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## ***Spurious Radiated Emissions***

### **Purpose**

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

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

The method is as defined in ANSI C63.4 for tests below 1GHz, and ANSI C63.10 for tests above 1GHz.

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

All unintentional emissions (including band edge) must also meet the requirements of -20 dBc or greater


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 (54.0 dBuV/m<sup>2</sup>) at 3m

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

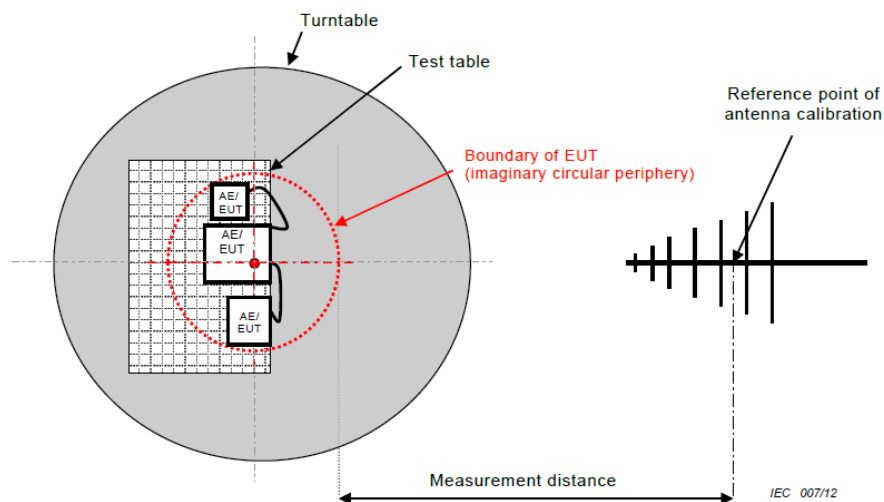
<sup>2</sup>Limit is with 1 MHz measurement bandwidth and using an Average detector, scanned in accordance with 15.33 to above the 10<sup>th</sup> harmonic (25 GHz).

### **Results**

The EUT passed the limits. Low, middle and high band was measured. 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. The -20 dBc requirement is also shown for the higher band edge at 2.4835 GHz in the high band.

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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  $\pm 4.4$  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 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. Final measurements are performed over a full 0-360 degrees rotation and 1 – 4 meter height of measurement antenna.

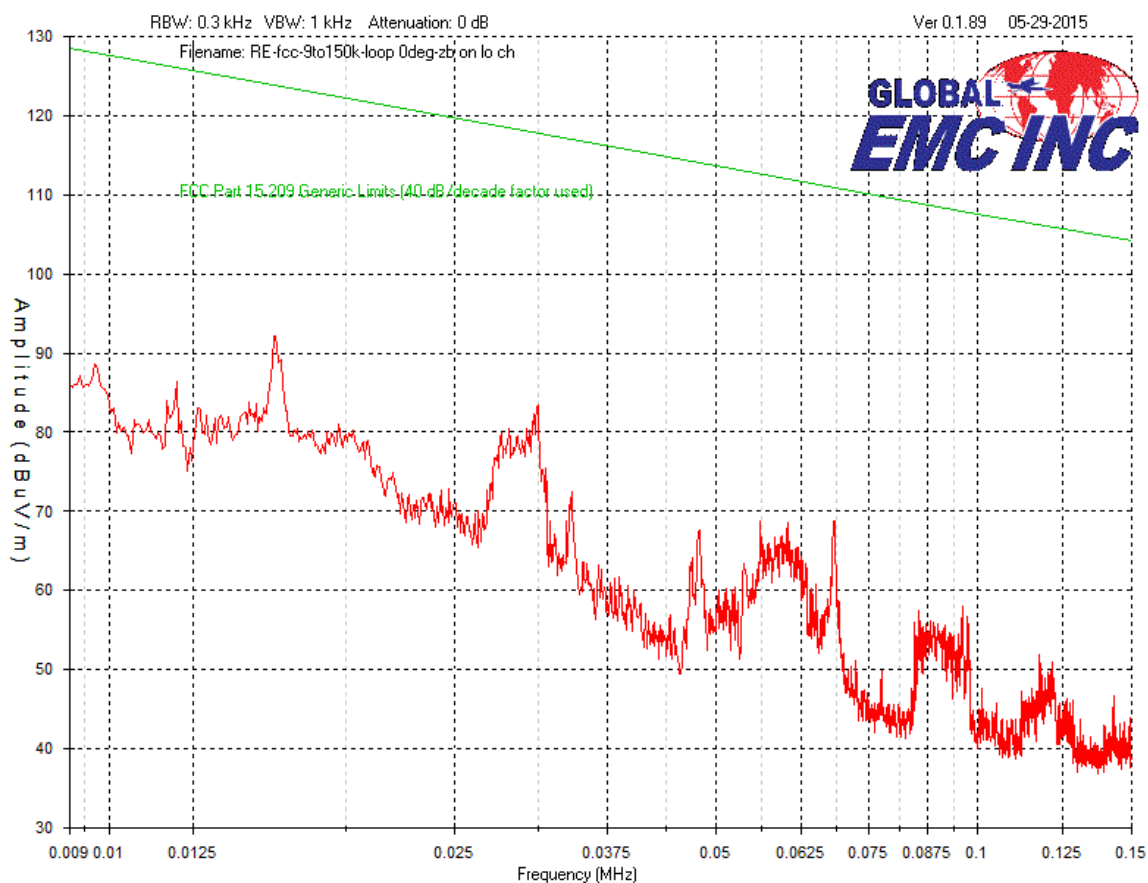
The worst case or representative mode graphs are shown for 30 MHz to 2 GHz, however the device was scanned at low, middle, and high channel.


In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to a minimum of a 25 GHz, no emission were found above 18GHz, while the noise floor was 6dB lower than the limit .

The graphs shown below shows the peak power output of the device during the radiated measurement at 300 kHz bandwidth during transmit operation of the EUT from 30 MHz – 1 GHz, since the RBW used is greater than the value required by the standard (100 kHz) this is a worst case reading and still complied with the limits. None of the spurious exceeded the 80.5 dbuV/m limit (-20dbc from max reading of 100.5 dbuV/m).

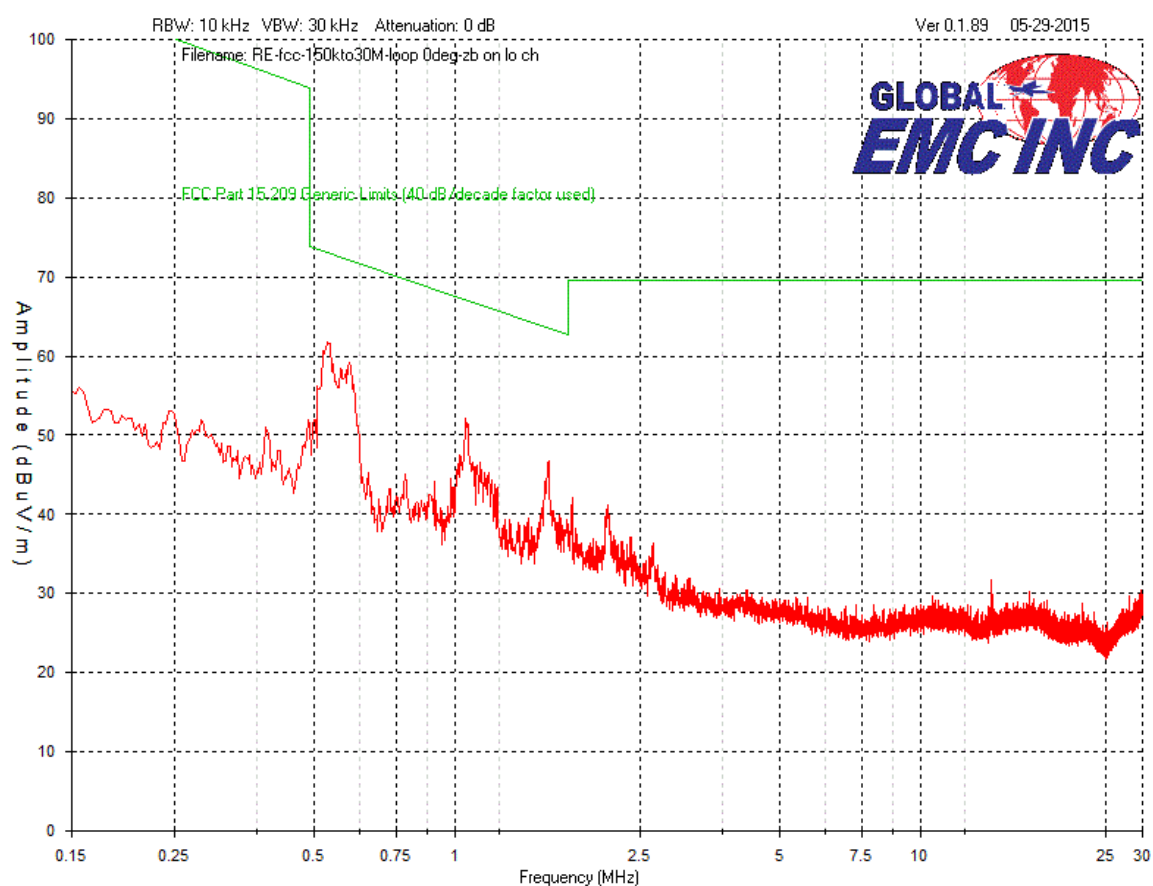
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Loop @ 0 degree – Peak Emissions Graph – 9kHz to 150kHz



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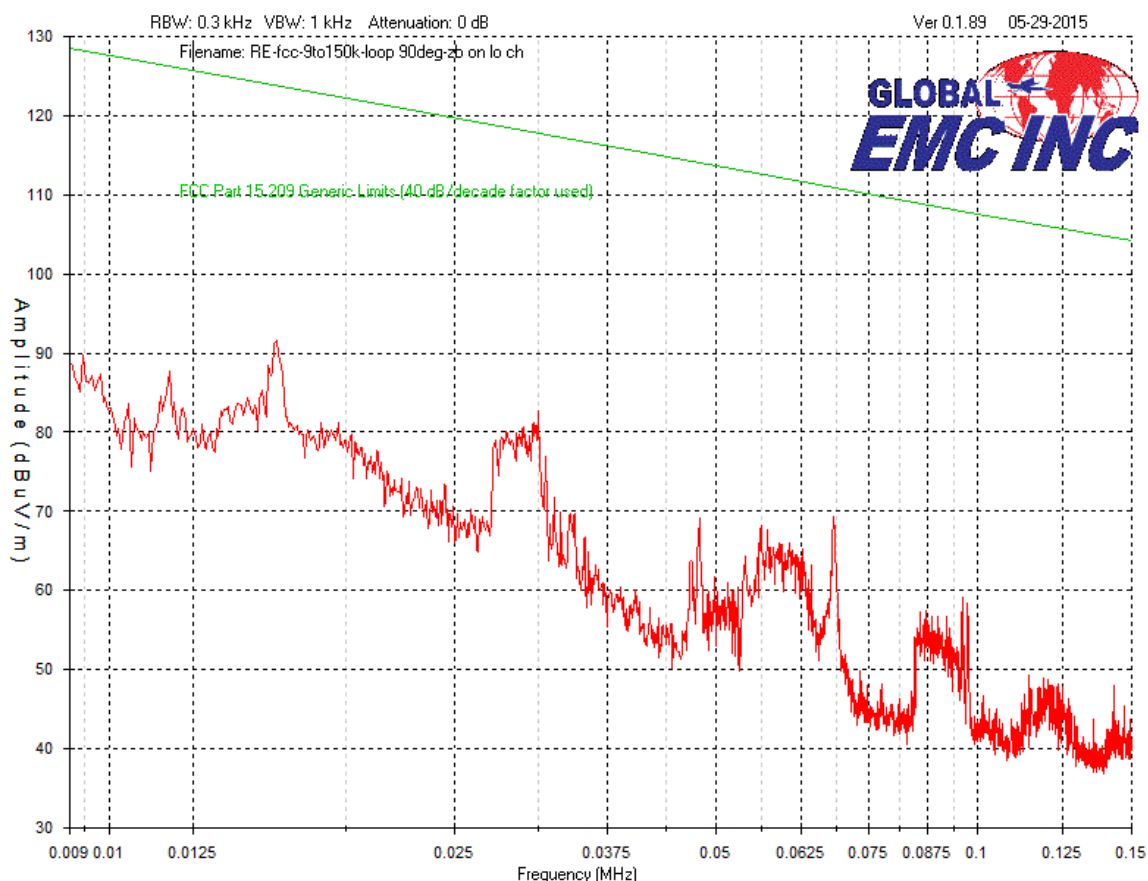
Loop @ 0 degree – Peak Emissions Graph – 150kHz to 30MHz





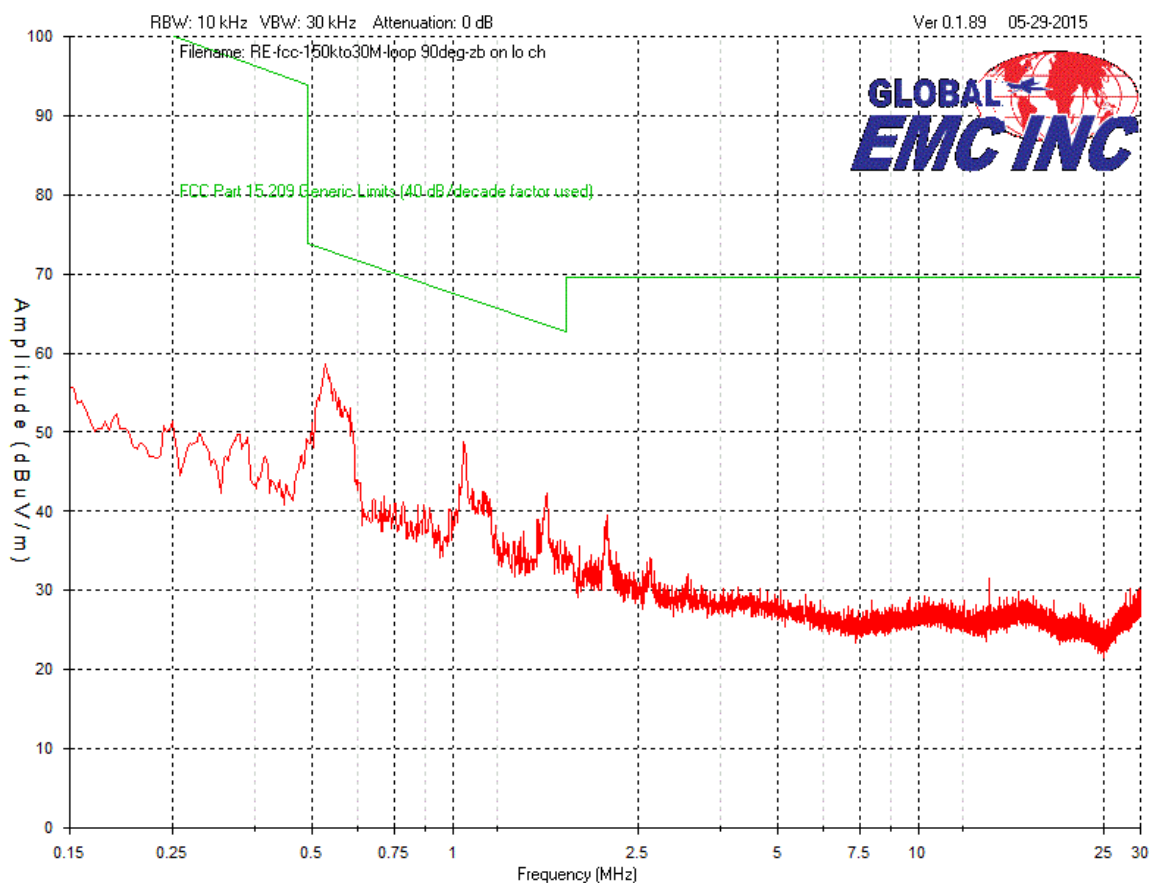
Client	Viconics Electronics Inc.	
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Loop @ 90 degree – Peak Emissions Graph – 9kHz to 150kHz



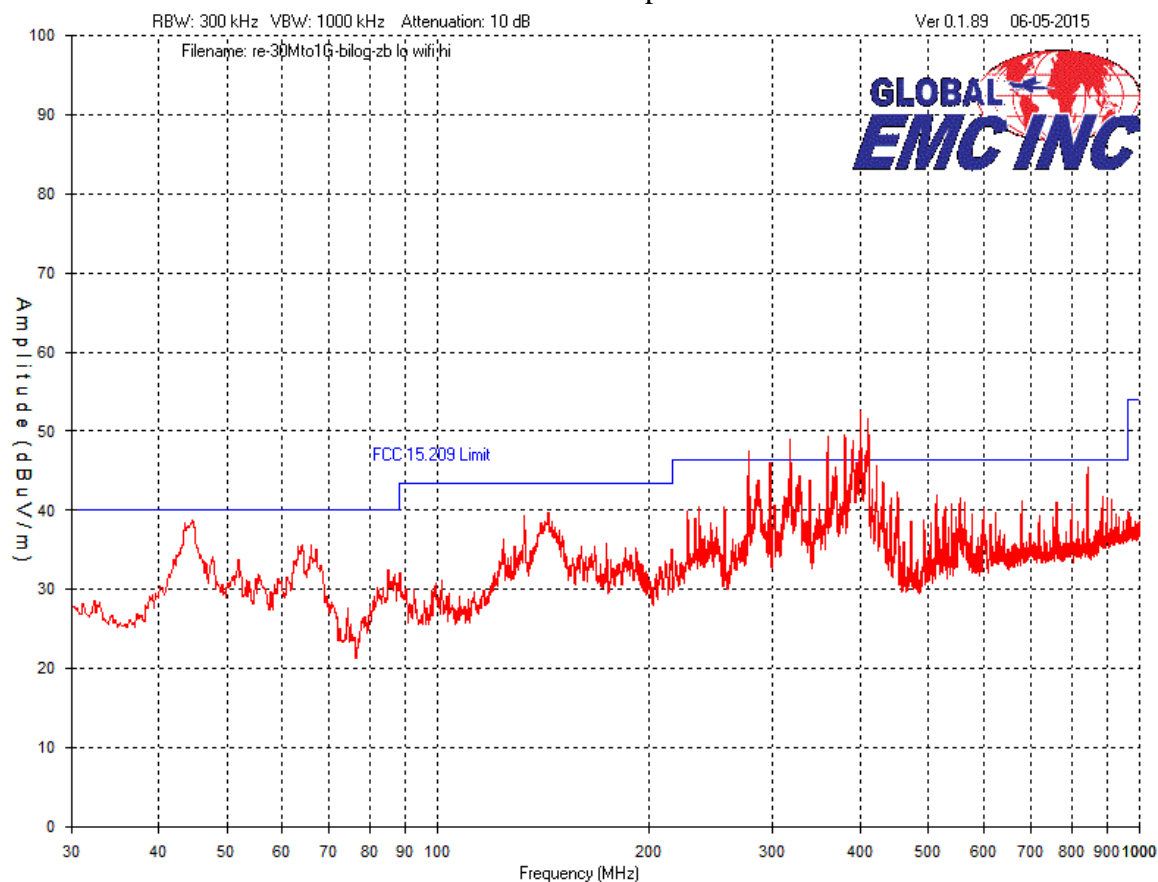
Client	Viconics Electronics Inc.	
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Standard(s)	FCC Part 15 Subpart C 15	

Loop @ 90 degree – Peak Emissions Graph – 150kHz to 30MHz



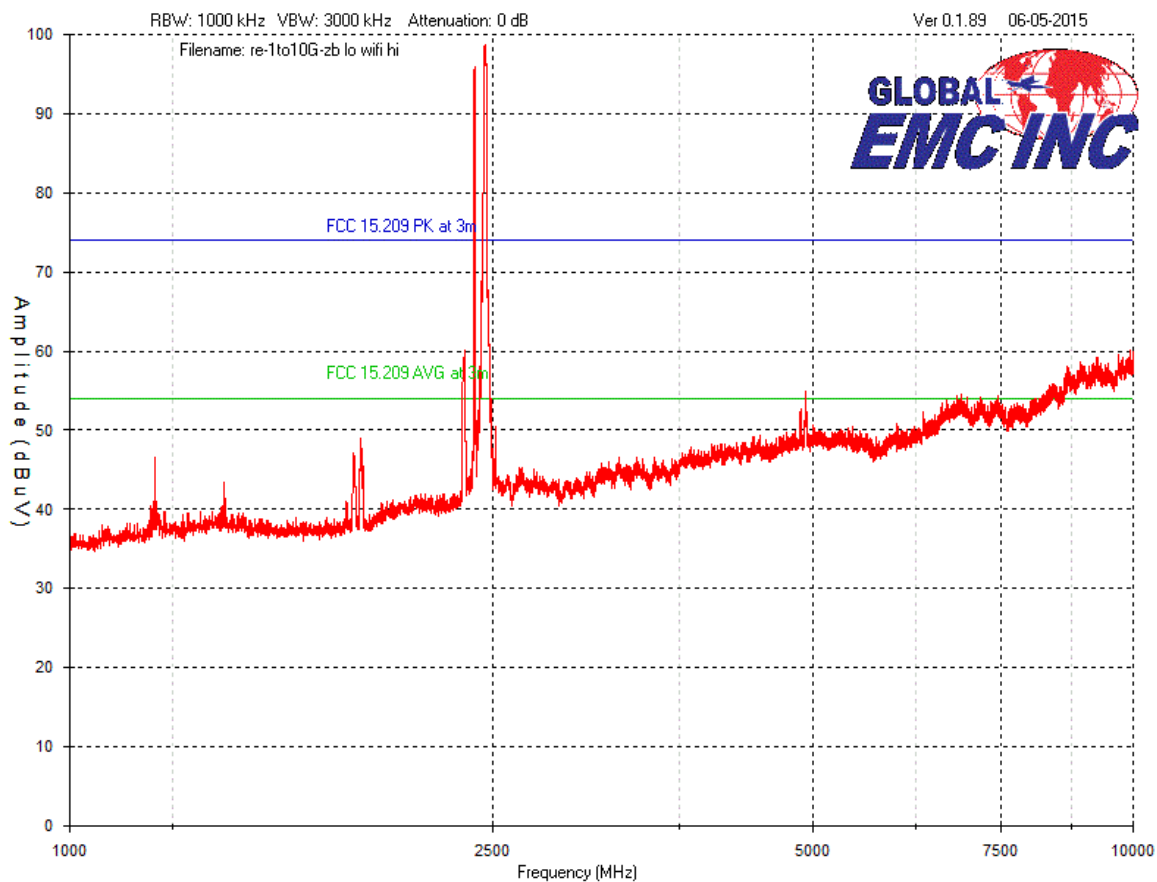
Client	Viconics Electronics Inc.	
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### Vertical – Peak Emissions Graph – 30MHz to 1GHz

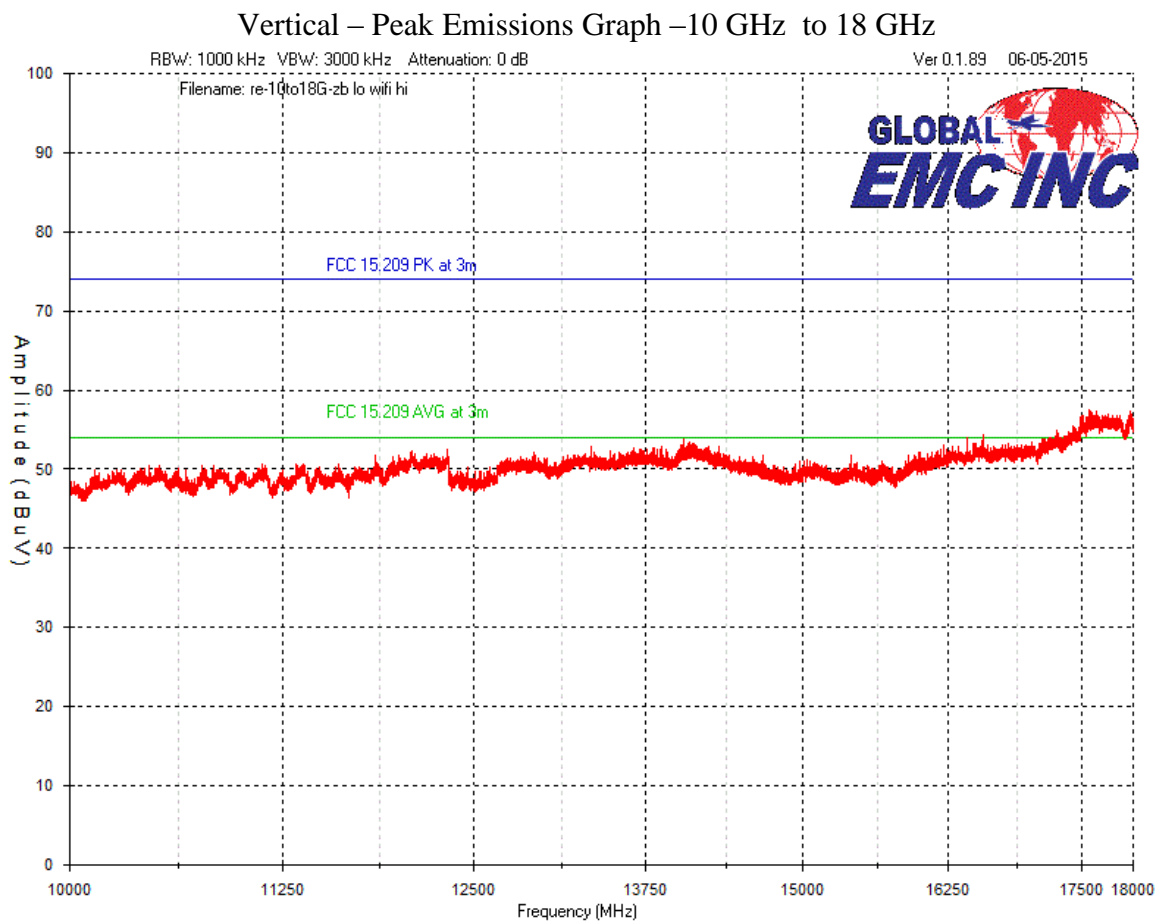



Client	Viconics Electronics Inc.	
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### Vertical – Peak Emissions Graph –1 GHz to 10 GHz

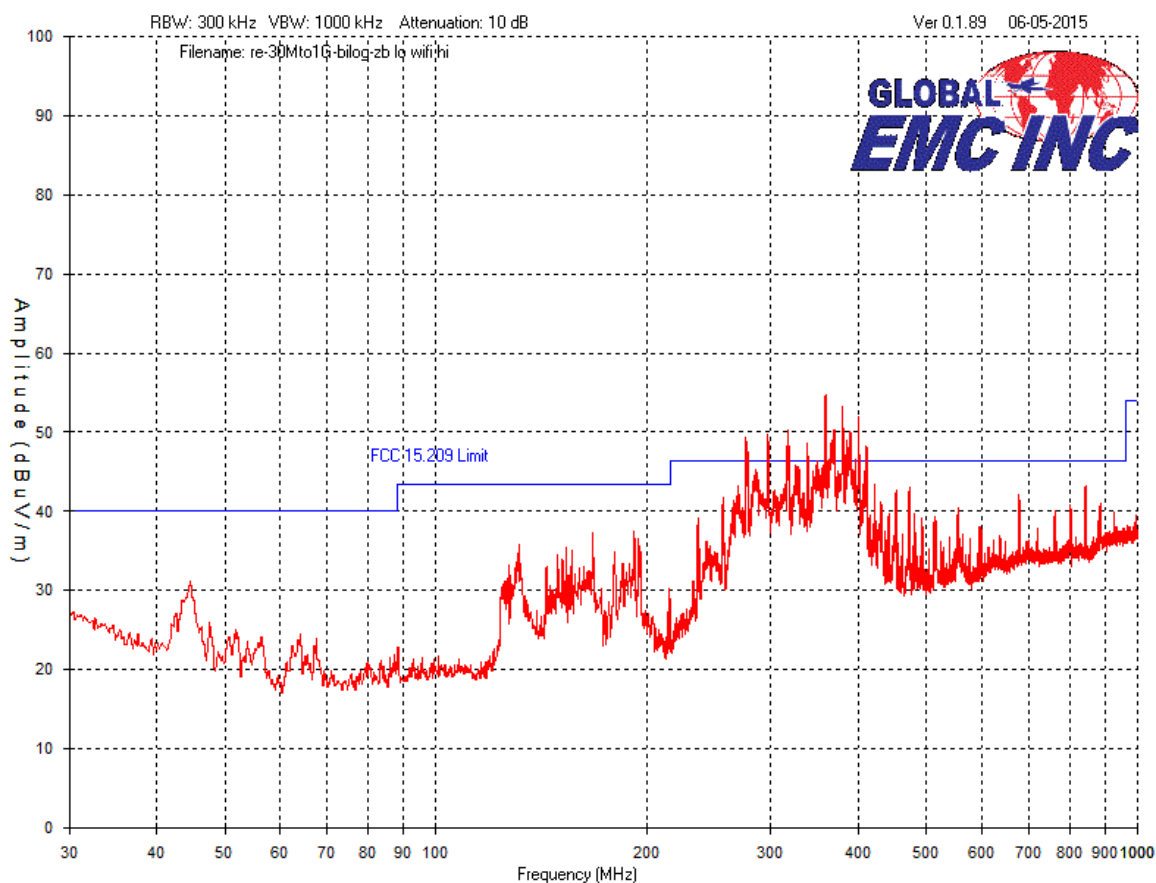



Client	Viconics Electronics Inc.	
Product	Wiser Air	
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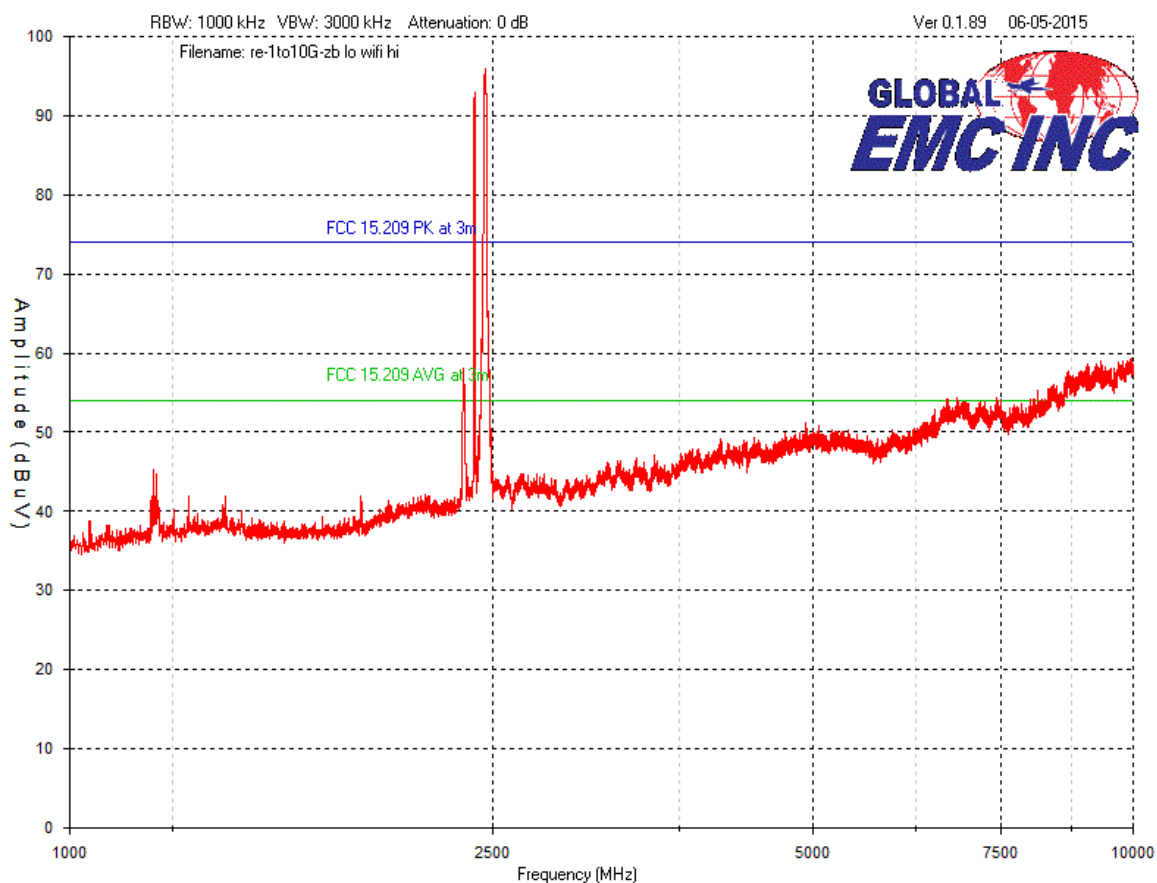
Client	Viconics Electronics Inc.	
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Standard(s)	FCC Part 15 Subpart C 15	


### Horizontal – Peak Emissions Graph – 30 MHz to 1 GHz



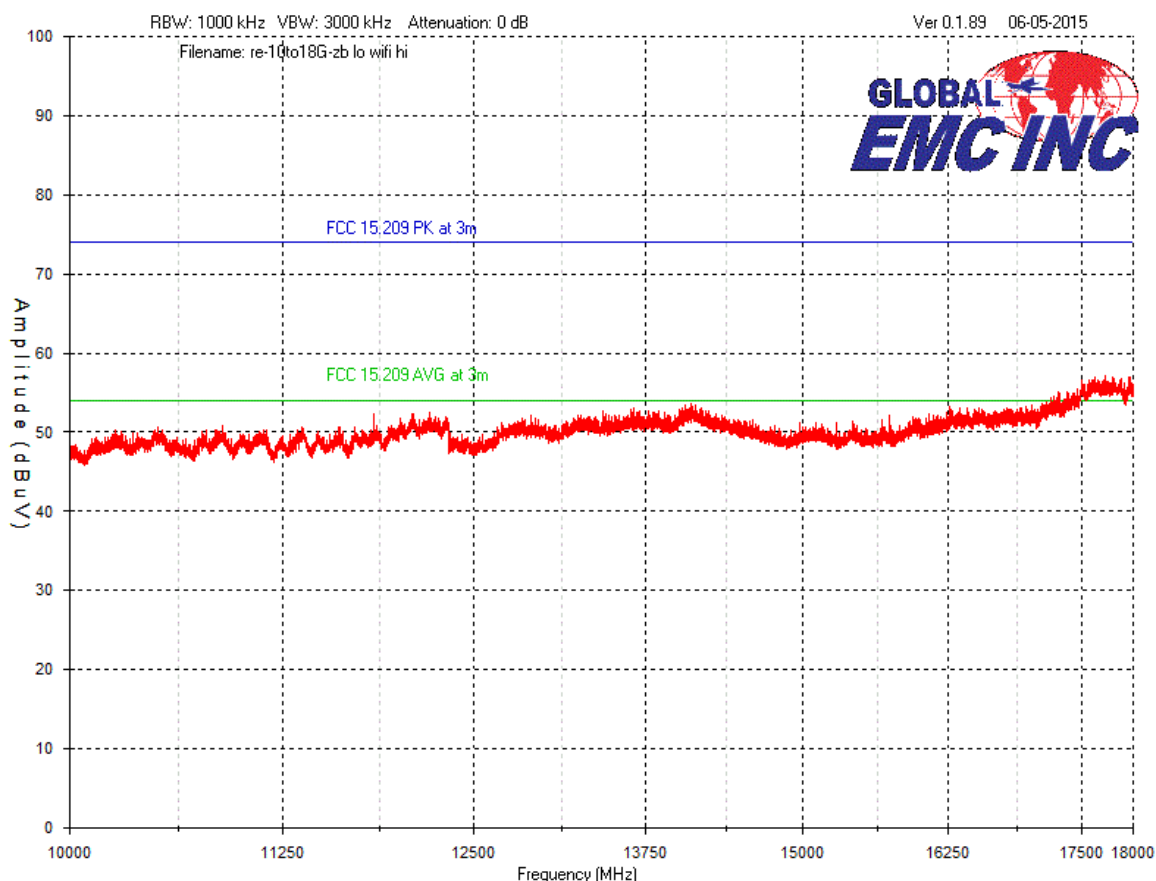
Client	Viconics Electronics Inc.	
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Standard(s)	FCC Part 15 Subpart C 15	

### Horizontal – Peak Emissions Graph – 1 GHz to 10 GHz




Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

### Horizontal – Peak Emissions Graph – 10 GHz to 18 GHz



Note: The EUT was configured as continuously transmitting of Zigbee and WIFI signals at low/middle/high channel. Different combinations of channels setting were investigated, only worst cases were presented.



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## Final Measurements

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

The frequency shown on the peak graph between does not fall within a restricted band as listed in FCC 15.205 and does not need to be verified.


For information purposes, the fundamental was measured to be 100.5 dBuV/m at 3 meters, and none of the unintentional radiated emissions that fall outside of the restricted bands exceeded the -20dBc (or 80.5 dBuV/m) requirement.

The following measurements were made at the harmonics shown in the above graphs.

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### Radiated Emissions Measurements


Test Frequency (MHz)	Detection mode (Q-Peak)	Antenna polarity (Horz/Vert)	Raw signal dB( $\mu$ V)	Antenna factor dB	Cable loss dB	Pre-Amp Gain dB	Received signal dB( $\mu$ V/m)	Emission limit dB( $\mu$ V/m)	Margin dB( $\mu$ V)	Result
Low Channel 11										
2405	Peak	Horz	99.6	28.9	5.1	33.1	100.5	n/a	n/a	PASS
2405	Avg	Horz	97.7	28.9	5.1	33.1	98.6	n/a	n/a	PASS
2405	Peak	Vert	96.8	28.9	5.1	33.1	97.7	n/a	n/a	PASS
2405	Avg	Vert	95.0	28.9	5.1	33.1	95.9	n/a	n/a	PASS
2390	Peak	Horz	63.0	28.9	5.1	33.1	63.9	74.0	10.1	PASS
2390	Avg	Horz	48.4	28.9	5.1	33.1	49.3	54.0	4.7	PASS
2390	Peak	Vert	62.5	28.9	5.1	33.1	63.4	74.0	10.6	PASS
2390	Avg	Vert	48.4	28.9	5.1	33.1	49.3	54.0	4.7	PASS
2400	Peak	Horz	63.5	28.9	5.1	33.1	64.4	74.0	9.6	PASS
2400	Avg	Horz	48.6	28.9	5.1	33.1	49.5	54.0	4.5	PASS
2400	Peak	Vert	63.1	28.9	5.1	33.1	64.0	74.0	10.0	PASS
2400	Avg	Vert	51.2	28.9	5.1	33.1	52.1	54.0	1.9	PASS
4810	Peak	Horz	61.2	33.3	5.1	32.8	66.8	74.0	7.2	PASS
4810	Avg	Horz	46.9	33.3	5.1	32.8	52.5	54.0	1.5	PASS
4810	Peak	Vert	61.4	33.3	5.1	32.8	67.0	74.0	7.0	PASS
4810	Avg	Vert	46.8	33.3	5.1	32.8	52.4	54.0	1.6	PASS
7215	Peak	Vert	47.6	37.6	5.1	33.0	57.3	74.0	16.7	PASS
7215	Avg	Vert	33.9	37.6	5.1	33.0	43.6	54.0	10.4	PASS
7215	Peak	Horz	47.5	37.3	5.1	33.0	56.9	74.0	17.1	PASS
7215	Avg	Horz	33.7	37.3	5.1	33.0	43.1	54.0	10.9	PASS
Mid channel 18										
2440	Peak	Horz	99.8	28.3	5.1	33.1	100.1	n/a	n/a	PASS
2440	Avg	Horz	98.1	28.3	5.1	33.1	98.4	n/a	n/a	PASS
2440	Peak	Vert	95.9	28.4	5.1	33.1	96.3	n/a	n/a	PASS
2440	Avg	Vert	94.1	28.4	5.1	33.1	94.5	n/a	n/a	PASS
4880	Peak	Horz	43.5	33.7	6.9	32.8	51.3	74.0	22.7	PASS
4880	Avg	Horz	33.9	33.7	6.9	32.8	41.7	54.0	12.3	PASS
4880	Peak	Vert	43.8	33.7	6.9	32.8	51.6	74.0	22.4	PASS
4880	Avg	Vert	34.1	33.7	6.9	32.8	41.9	54.0	12.1	PASS
7320	Peak	Vert	46.7	37.9	8.5	33.0	60.1	74.0	13.9	PASS
7320	Avg	Vert	33.9	37.9	8.5	33.0	47.3	54.0	6.7	PASS
7320	Peak	Horz	46.9	37.5	8.5	33.0	59.9	74.0	14.1	PASS

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

7320	Avg	Horz	33.5	37.5	8.5	33.0	46.5	54.0	7.5	PASS
High channel 25										
2475	Peak	Horz	97.3	28.3	5.1	33.1	97.6	n/a	n/a	PASS
2475	Avg	Horz	95.6	28.3	5.1	33.1	95.9	n/a	n/a	PASS
2475	Peak	Vert	94.4	28.4	5.1	33.1	94.8	n/a	n/a	PASS
2475	Avg	Vert	92.2	28.4	5.1	33.1	92.6	n/a	n/a	PASS
2483.5	Peak	Horz	48.4	28.3	5.1	33.1	48.7	74.0	25.3	PASS
2483.5	Avg	Horz	32.1	28.3	5.1	33.1	32.4	54.0	21.6	PASS
2483.5	Peak	Vert	52.5	28.4	5.1	33.1	52.9	74.0	21.1	PASS
2483.5	Avg	Vert	38.9	28.4	5.1	33.1	39.3	54.0	14.7	PASS
4950	Peak	Horz	45.9	33.7	6.9	32.8	53.7	74.0	20.3	PASS
4950	Avg	Horz	34.3	33.7	6.9	32.8	42.1	54.0	11.9	PASS
4950	Peak	Vert	50.9	33.7	6.9	32.8	58.7	74.0	15.3	PASS
4950	Avg	Vert	37.9	33.7	6.9	32.8	45.7	54.0	8.3	PASS
7425	Peak	Vert	46.9	37.9	8.5	33.0	60.3	74.0	13.7	PASS
7425	Avg	Vert	33.5	37.9	8.5	33.0	46.9	54.0	7.1	PASS
7425	Peak	Horz	48.4	37.5	8.5	33.0	61.4	74.0	12.6	PASS
7425	Avg	Horz	33.8	37.5	8.5	33.0	46.8	54.0	7.2	PASS

Note: No emissions above the 3<sup>rd</sup> harmonic were detected. In case the peak emissions exceeding the average limits, average detector emission measurements were made to ensure compliance.


Note: During the tests, EUT was operating in a continuous transmit in which it is transmitting at a 100% duty cycle.

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date <sup>1</sup>	Next Calibration Date <sup>1</sup>	Asset #
Spectrum Analyzer Display	8566B	HP	1-28-15	1-28-17	4168
Spectrum Analyzer	8566B	HP	1-28-15	1-28-17	4169
Quasi Peak Adapter	85650A	HP	1-28-15	1-28-17	4170
BiLog Antenna	3142-C	ETS	9-8-14	9-8-16	8
Horn Antenna	ATH1G18G	AR	4-23-15	4-23-17	4003
Biconical Antenna	EM-6913	Electro-Metrics	4/28/15	4/28/17	4060
Log Periodic Antenna	LPA-25	Electro-Metrics	4/14/15	4/14/17	4087
Attenuator 3 dB	FP-50-3	Trilithic	1-28-15	1-28-17	4028
9kHz-1GHz, 28dB preamp	LNA 6901	Teseq	8-6-13	8-6-15	4036
1-26.5GHz preamp	8449B	Agilent	9-9-14	9-9-16	6351
RF Cable 10m	LMR-400-10M-50OHM-MN-MN	LexTec	1-28-15	1-28-17	4025
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	1-28-15	1-28-17	4026
Emission software	0.1.87	Global EMC	1-28-15	1-28-17	58

1: For cables and attenuators, verification dates apply.

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## ***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<sup>th</sup> harmonic. This -20 dBc requirement also applies at the 'band edge' or 2.4 GHz and 2.4835 GHz.

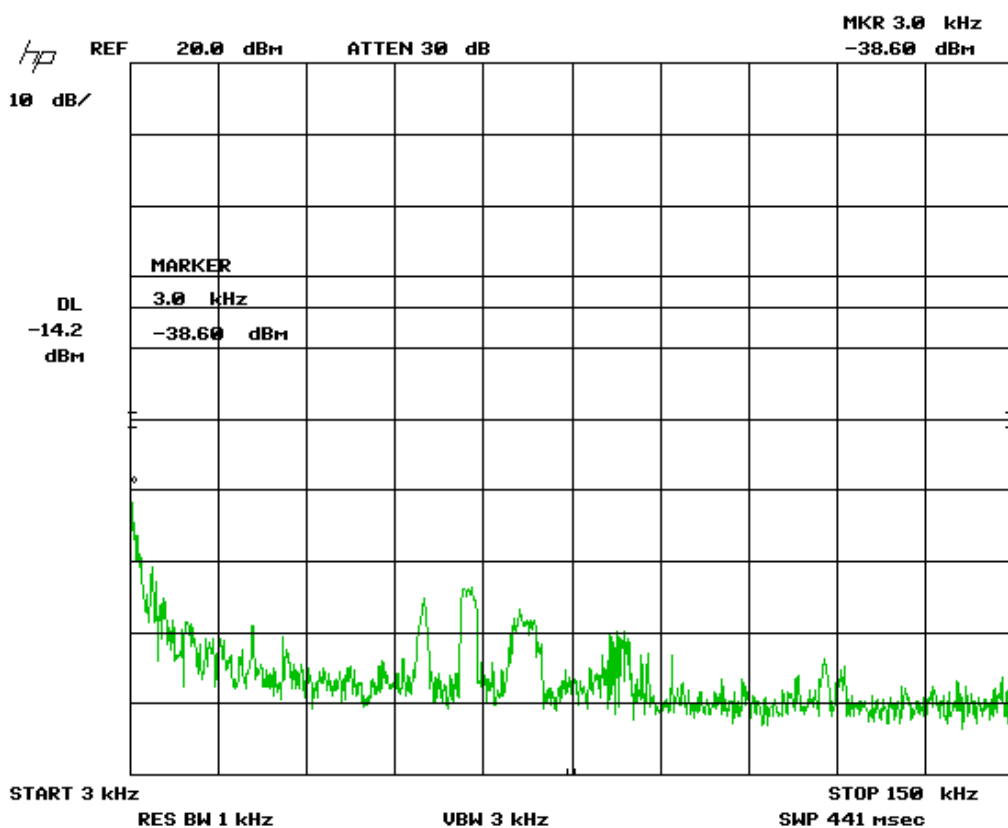
### **Results**


The EUT passed. Low, middle and high band was measured. The worst case for each mode is presented as a graph for the spectrum. The -20 dBc requirement is shown for the lower band edge at 2.4 GHz in the low band for both modes. The -20 dBc requirement is also shown for the higher band edge at 2.4835 GHz in the high band.

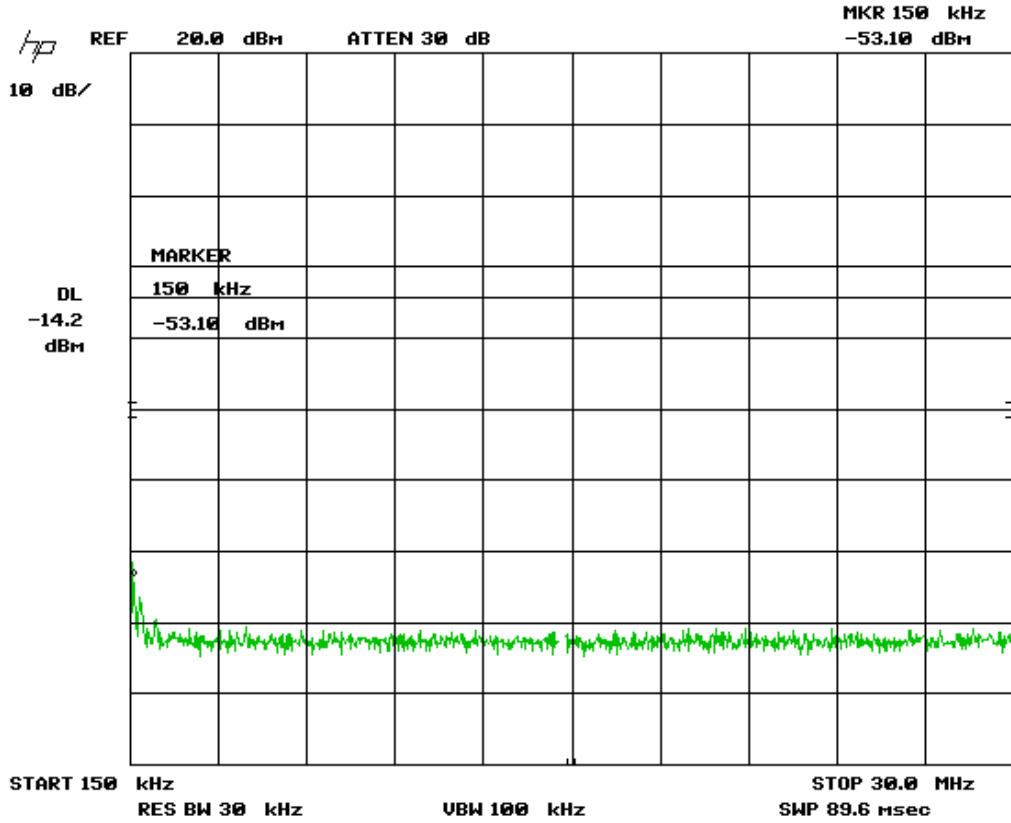
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	


## Graph(s)

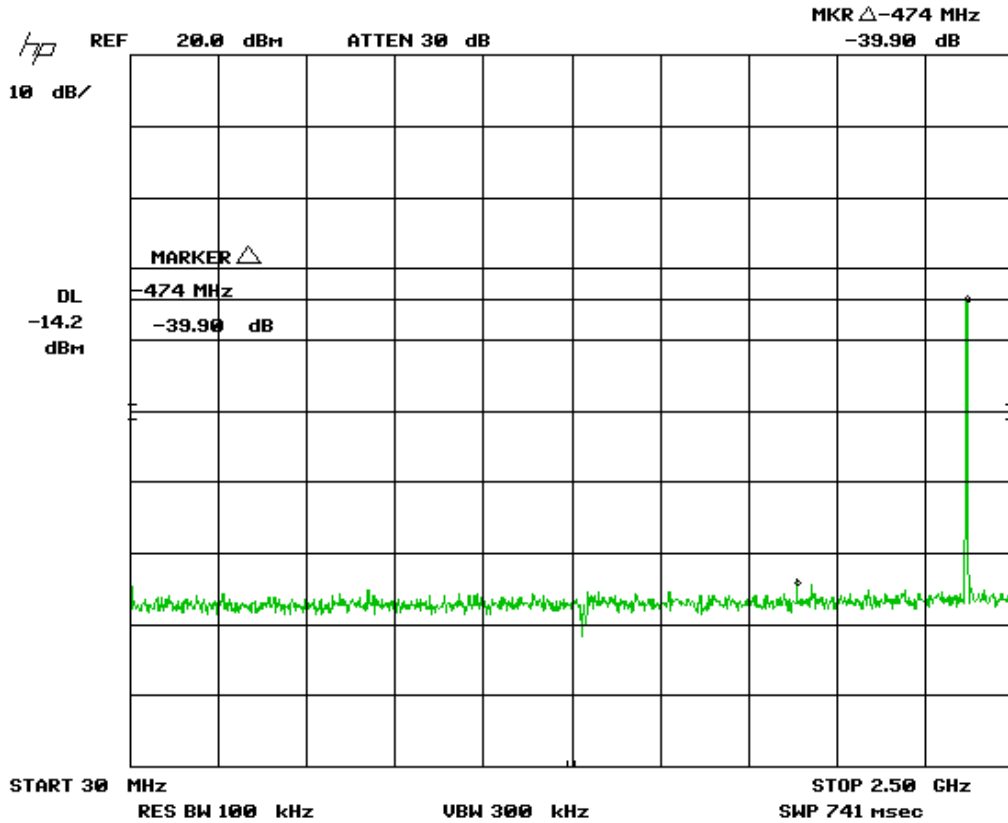
The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 10 dB of external attenuation and cable loss taken during this measurement.




Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

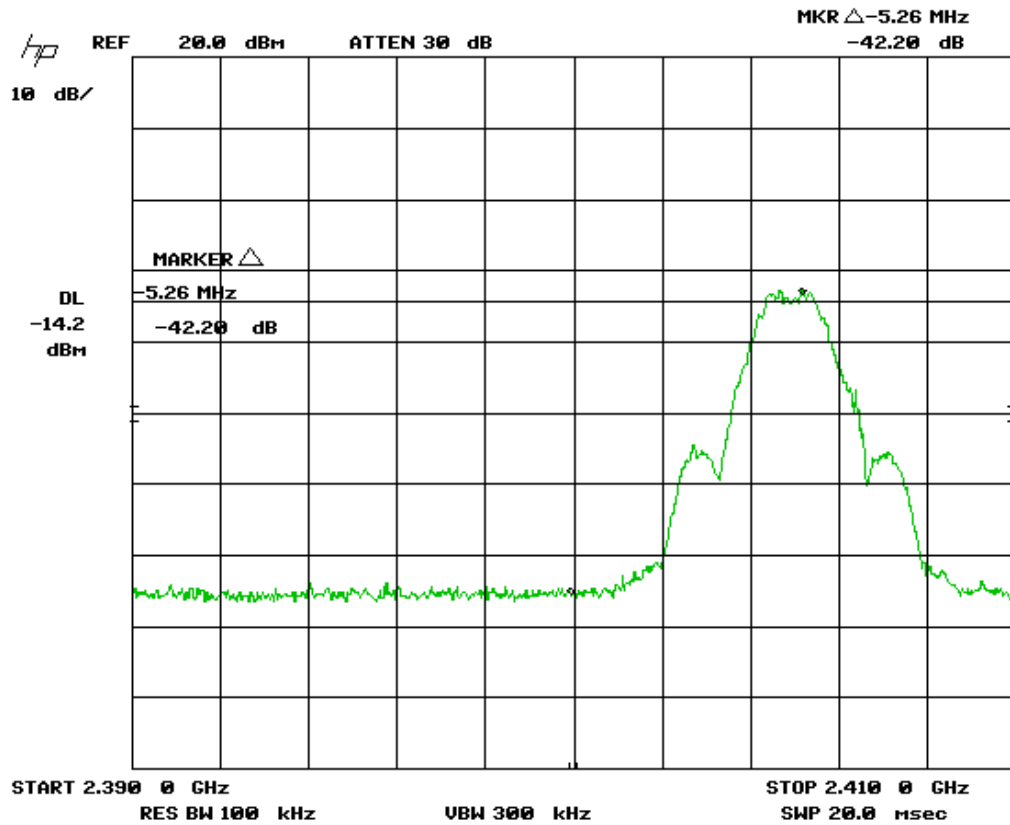



Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

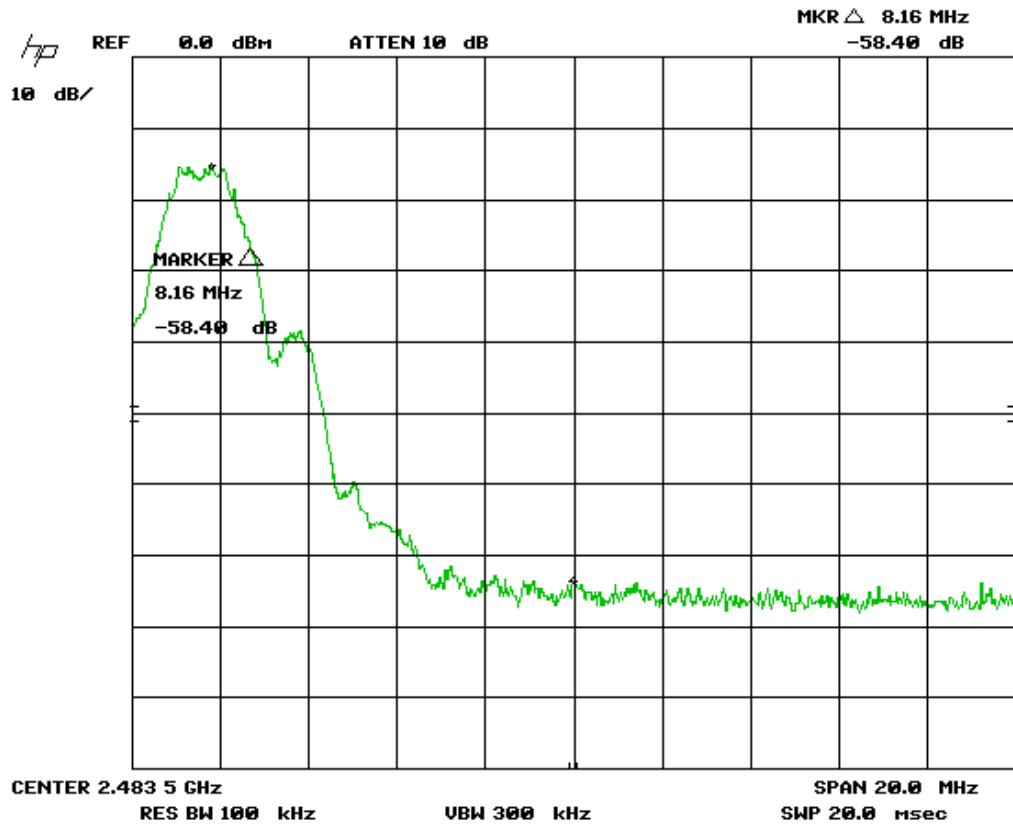





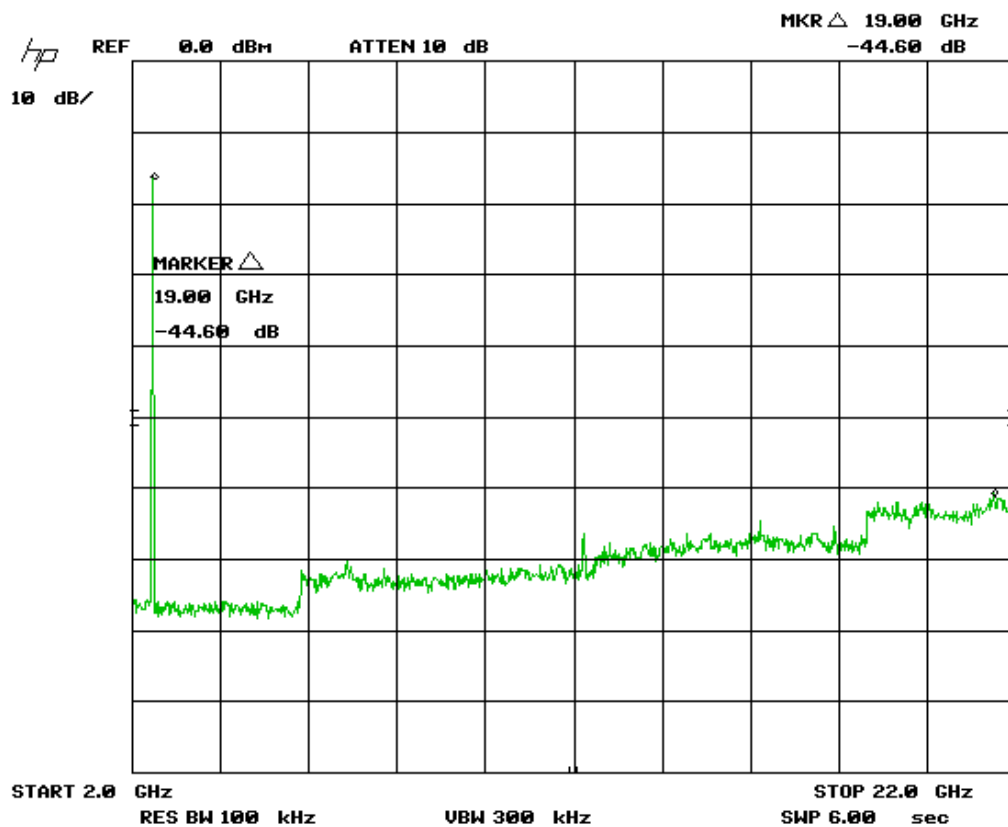
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	



Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	



Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	



Note: The applicable limit would be -20 dBc in any 100 kHz band, no emissions were detected and the noise floor was below -20dBc in any 100 kHz band.

The frequency range of 22 – 25 GHz, the 10<sup>th</sup> harmonic and 9<sup>th</sup> harmonic where applicable, was additionally scanned in radiated method as shown in previous section. No emissions were detected at the 9<sup>th</sup> and 10<sup>th</sup> harmonic.


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

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer Display	8566B	HP	1-28-15	1-28-17	4168
Spectrum Analyzer	8566B	HP	1-28-15	1-28-17	4169
Quasi Peak Adapter	85650A	HP	1-28-15	1-28-17	4170
Attenuator 10 dB	FP-50-10	Trilithic	1-28-15	1-28-17	4027

1: For cables and attenuators, verification dates apply.

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## ***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 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**

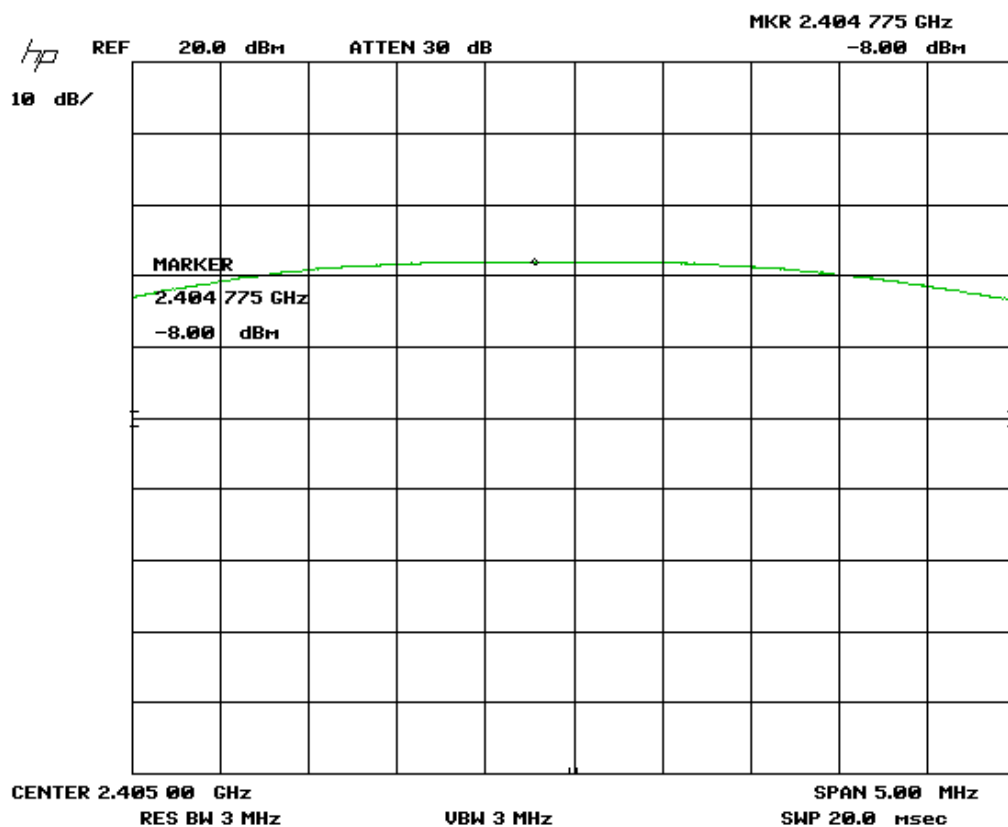
The EUT passed. The peak power measured was 2.0 dBm (1.585 mW).


Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## Graph(s)

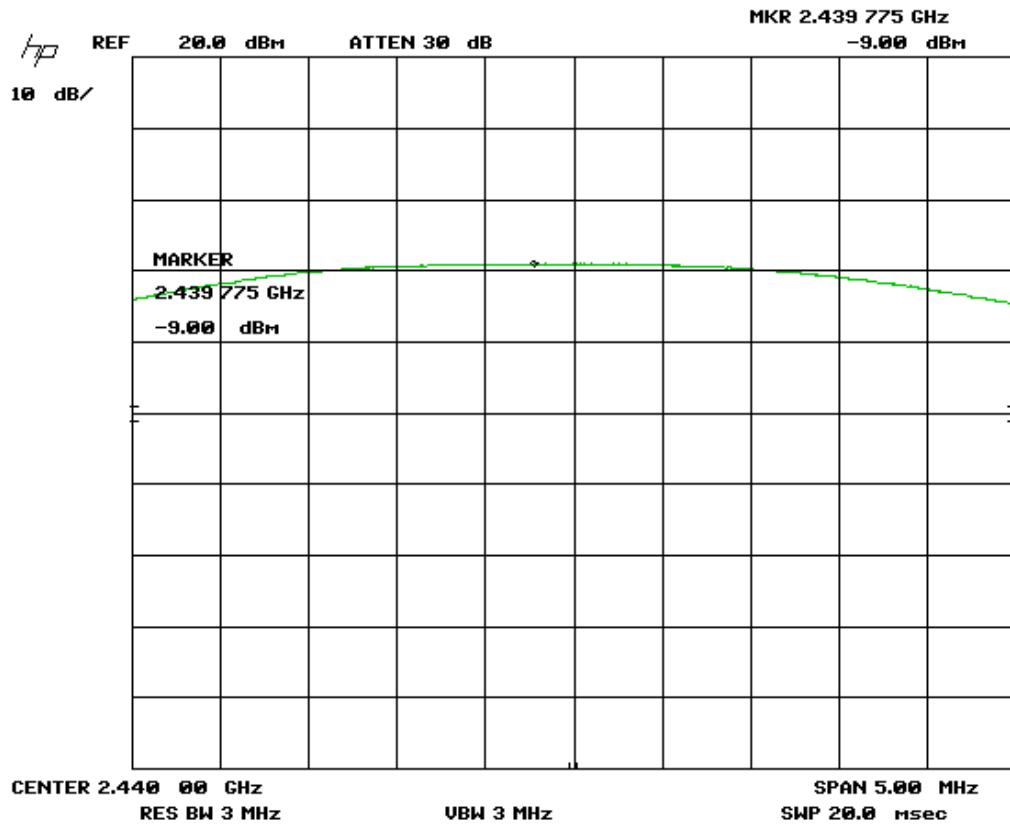
The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 10 dB of external attenuation taken during this measurement. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

Low Channel



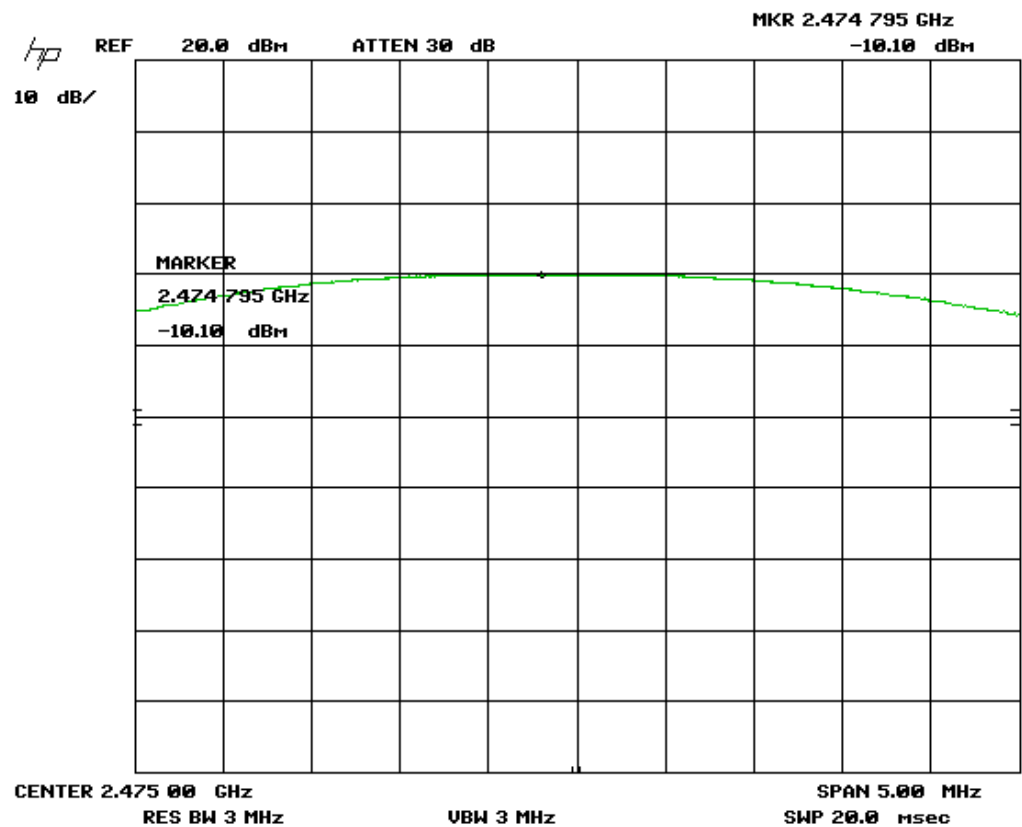
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## Mid Channel



Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

High Channel





Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

### 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.


Band	Channel	Frequency (GHz)	Reading (dBm)	Attn (dB)	Output Power (dBm)
Low	11	2405	-8.0	10	2.0
Medium	18	2440	-9.0	10	1.0
High	25	2475	-10.1	10	-0.1

The calculated value is:

-8.0 dBm + 10 dB (attenuator)

= -2.0dBm

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

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer Display	8566B	HP	1-28-15	1-28-17	4168
Spectrum Analyzer	8566B	HP	1-28-15	1-28-17	4169
Quasi Peak Adapter	85650A	HP	1-28-15	1-28-17	4170
Attenuator 10 dB	FP-50-10	Trilithic	1-28-15	1-28-17	4027

1: For cables and attenuators, verification dates apply.

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## ***6dB Bandwidth of Digitally Modulated Systems***

### **Purpose**

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

### **Limits**

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

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


### **Results**

The EUT passed. The 6 dB BW measured was 1.62 MHz. For information purposes, the 20 dB BW was measured to be 2.83 MHz

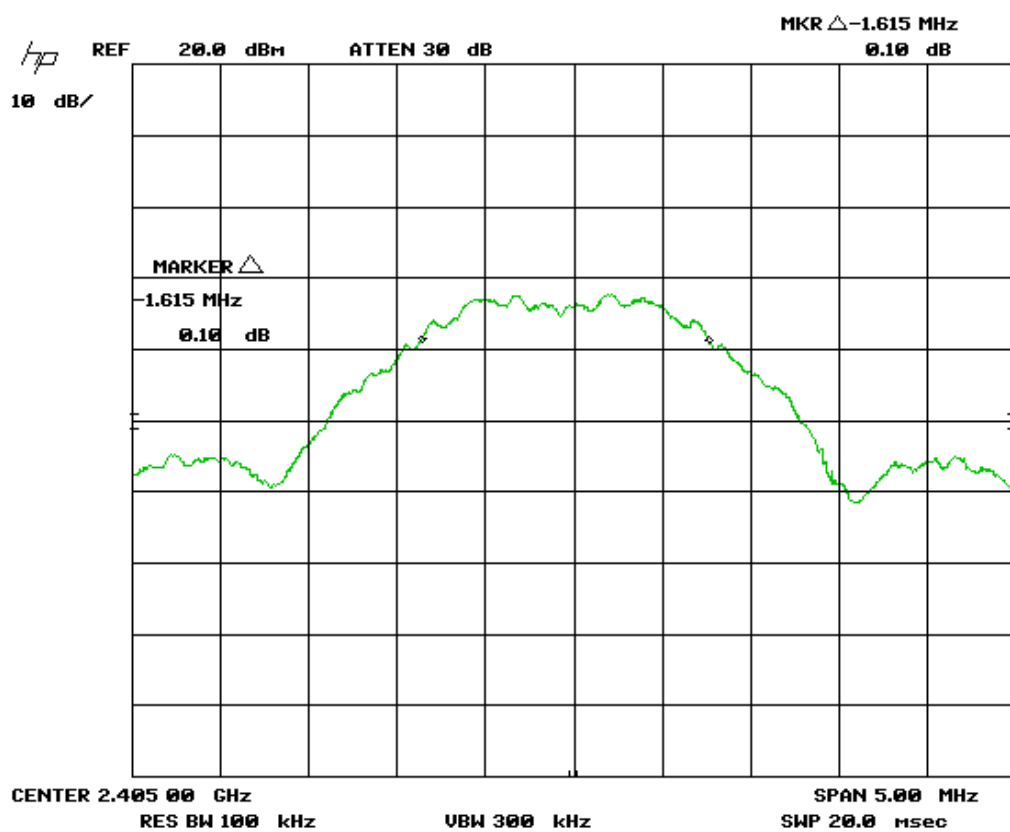
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

### 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 than 1 minute.

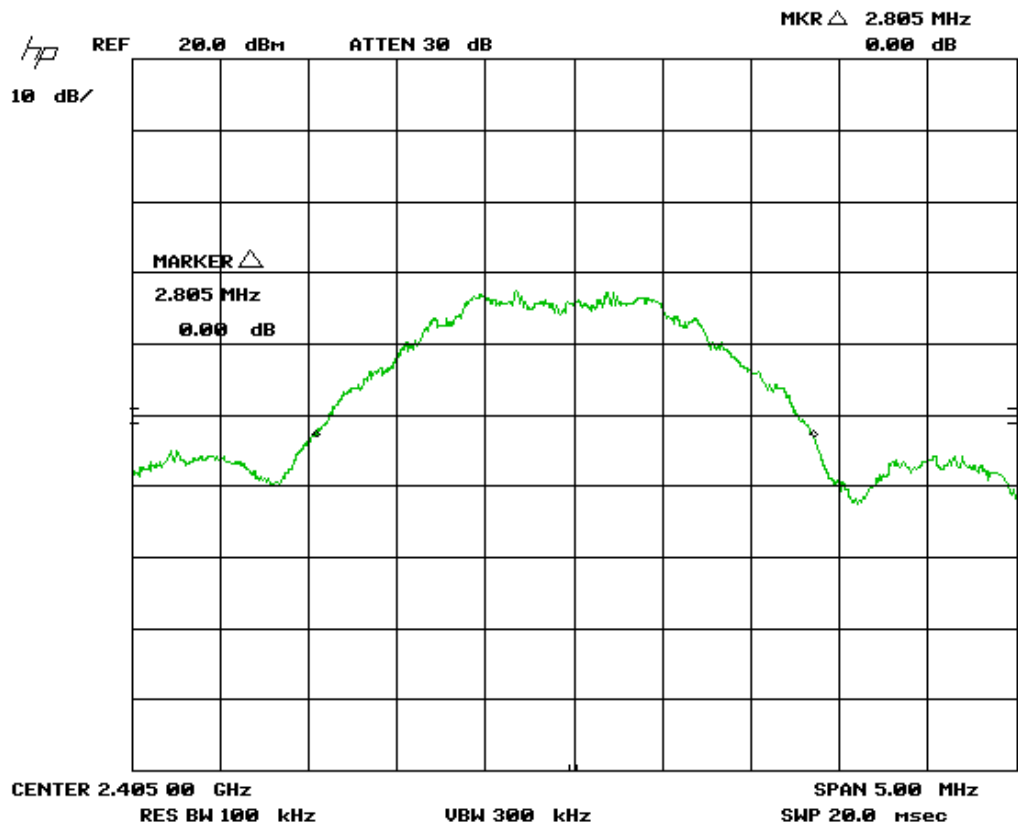
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

Low Channel:



6dB BW=1.62M

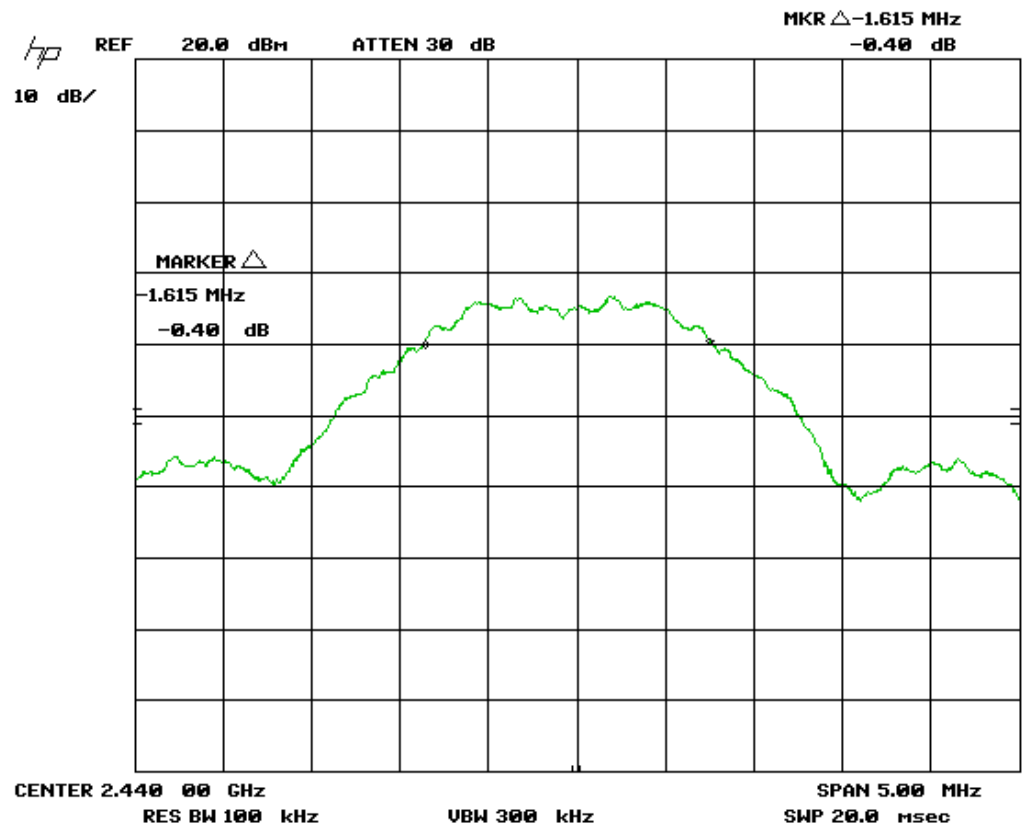
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	



20dB BW=2.81MHz

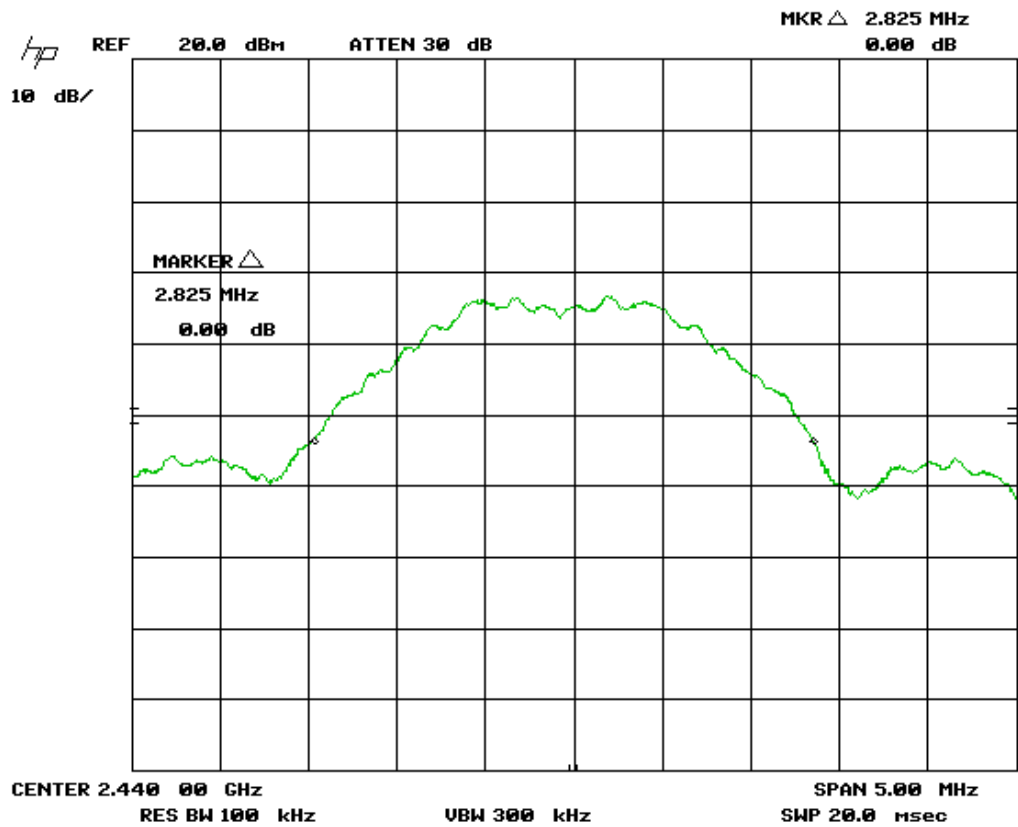
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

Mid Channel




6dB BW=1.62MHz

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

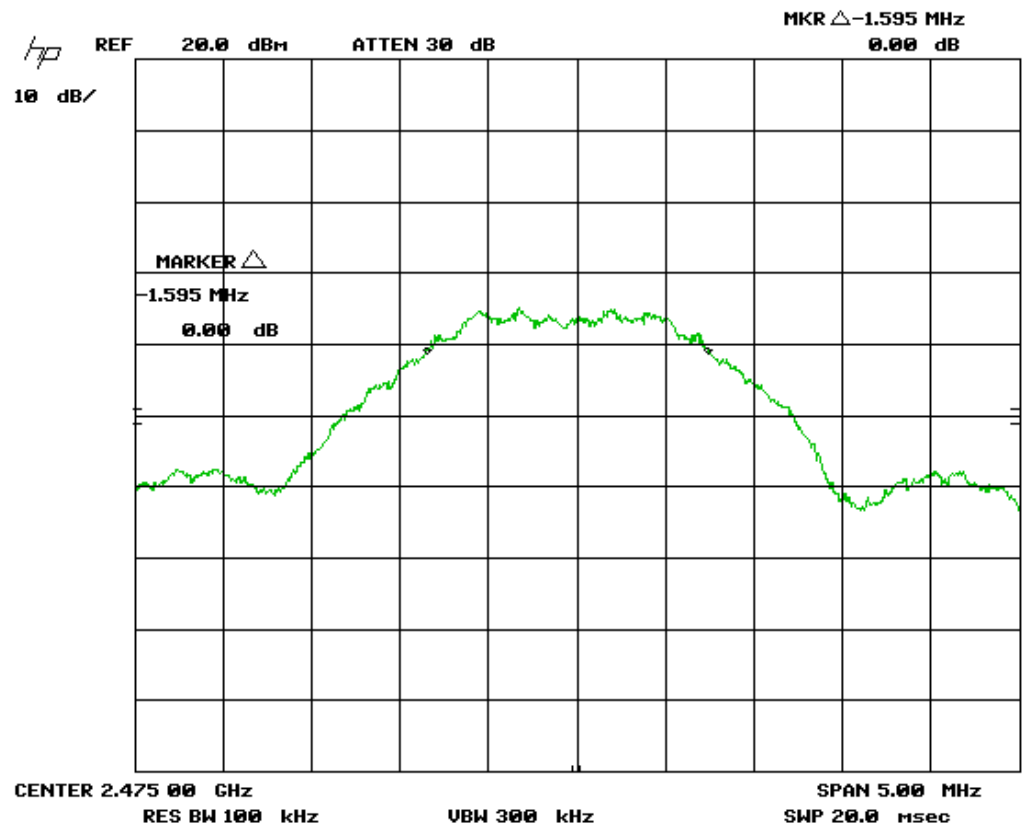


20dB BW=2.83MHz




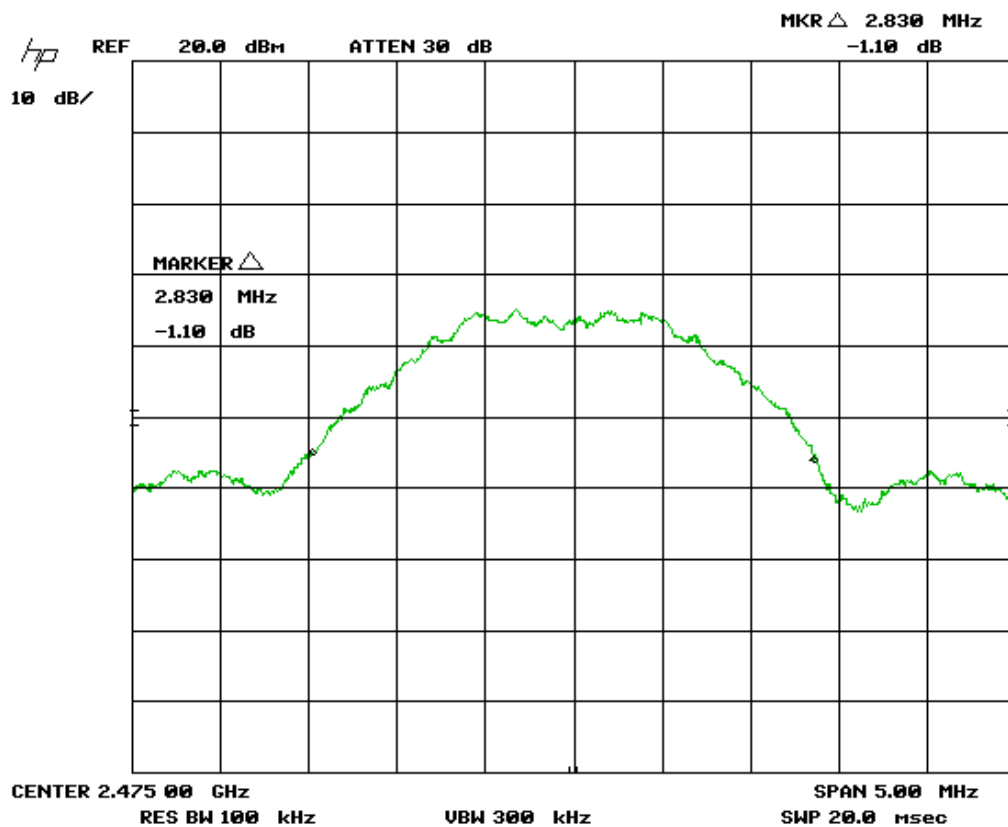
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

# High Channel




6dB BW=1.60MHz

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	



20dB BW=2.83MHz


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

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer Display	8566B	HP	1-28-15	1-28-17	4168
Spectrum Analyzer	8566B	HP	1-28-15	1-28-17	4169
Quasi Peak Adapter	85650A	HP	1-28-15	1-28-17	4170
Attenuator 10 dB	FP-50-10	Trilithic	1-28-15	1-28-17	4027

1: For cables and attenuators, verification dates apply.

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## ***Power Spectral Density - DM***

### **Purpose**

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

### **Limits**

The limits are defined in 15.247(e).

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.


### **Results**

The EUT passed. Each mode was tested at low, medium, and high band. The worst case value is -14.8 dBm as measured with a 3 kHz resolution bandwidth (peak power).

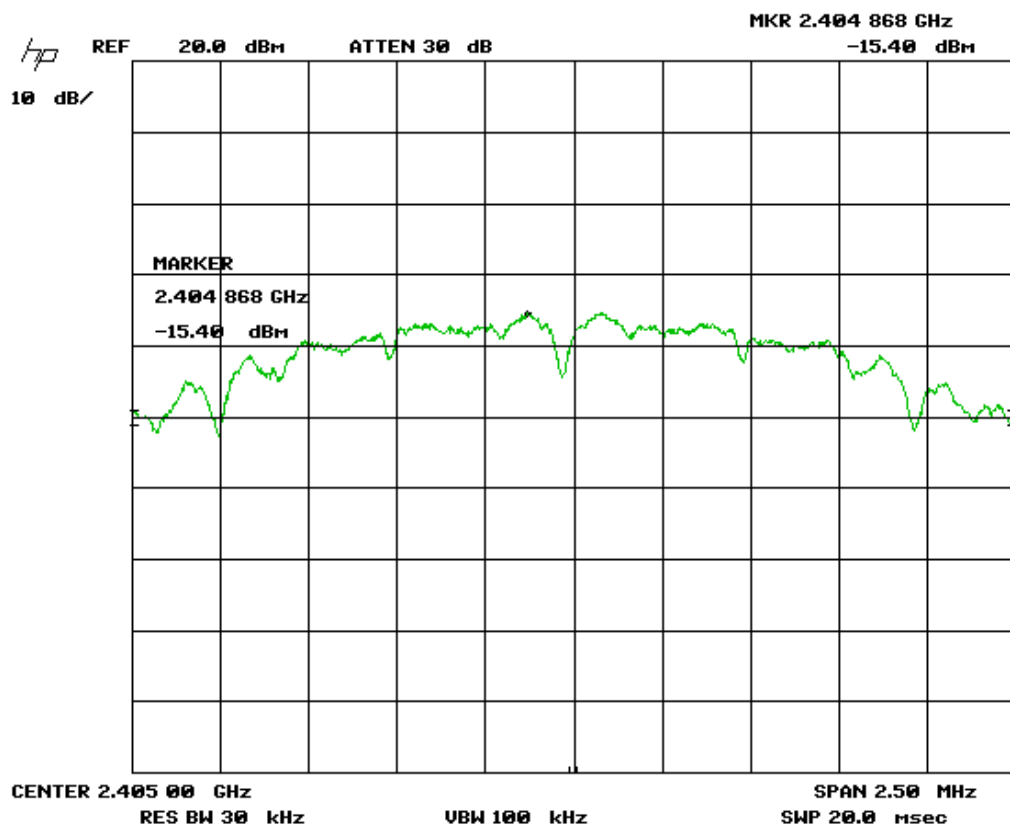
Band	Channel	Frequency (GHz)	Reading (dBuV/m)	Attn. (dB)	PSD (dBm)	Result
Low	11	2405	-15.4	10	-5.4	PASS
Medium	18	2440	-16.7	10	-6.7	PASS
High	25	2475	-17.8	10	-7.8	PASS

### **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, with the worst case being presented.

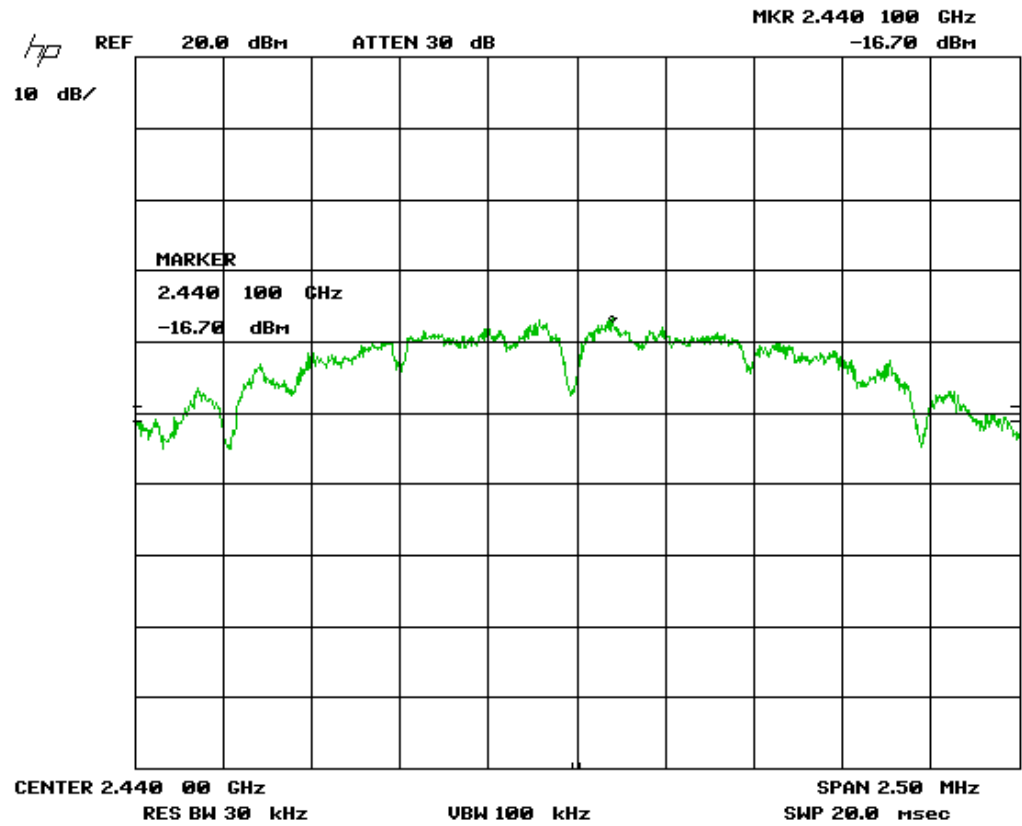
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	


## Low Channel



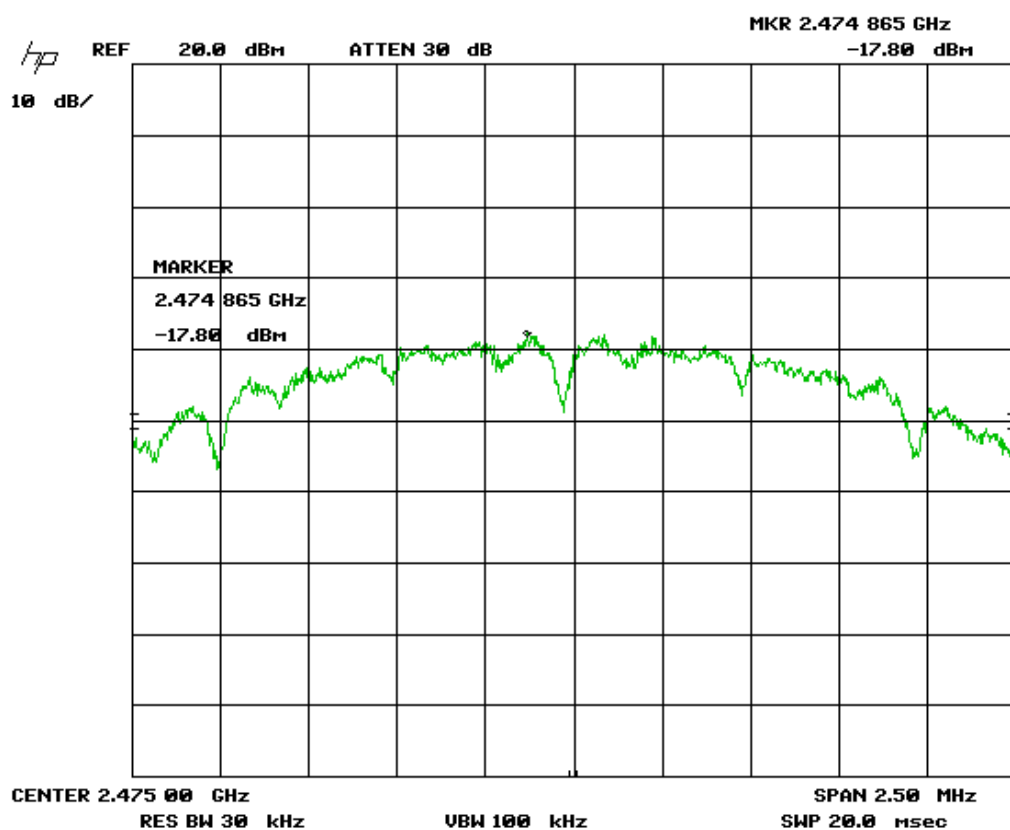
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

# Mid Channel



Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

### High Channel



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


Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer Display	8566B	HP	1-28-15	1-28-17	4168
Spectrum Analyzer	8566B	HP	1-28-15	1-28-17	4169
Quasi Peak Adapter	85650A	HP	1-28-15	1-28-17	4170
Attenuator 10 dB	FP-50-10	Trilithic	1-28-15	1-28-17	4027

1: For cables and attenuators, verification dates apply.



Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## Appendix A – EUT Summary


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

Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## General EUT Description

Client Details	
Organization / Address	Viconics Technologies Inc 9245 Langelier Blvd.
Contact	Emmanuel Stathopoulos
Phone	514-321-5660
Email	emmanuel.stathopoulos@schneider-electric.com
EUT (Equipment Under Test) Details	
EUT Name (for report title)	Wiser Air
EUT Model / SN (if known)	WISERAIR10WHTUS
EUT revision	001-0187-B1Click here...
Software version	0.9.0
Equipment category	Thermostat
EUT is powered using	Click here...
Input voltage range(s) (V)	24Vac
Frequency range(s) (Hz)	50/60Hz
Transmits RF energy? (describe)	WiFi & ZigBeeClick here...
Basic EUT functionality description	32
Frequency of all clocks present in EUT	32.7kHz, 24MHz, 32MHz crystals 600MHz Microprocessor 800MHz memory 2.4GHz Radios

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	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

## EUT Functional Description

## EUT Configuration

Please see Appendix B for a picture of the unit running in normal conditions and labels.

## Operational Setup

These devices are required to be attached to the EUT for its normal operation.

- None. The EUT was configured such that it provided it's own generation of data during testing. .

## Modifications for Compliance


The following modifications were made during testing for the sample to achieve compliance with the testing requirements:

None.

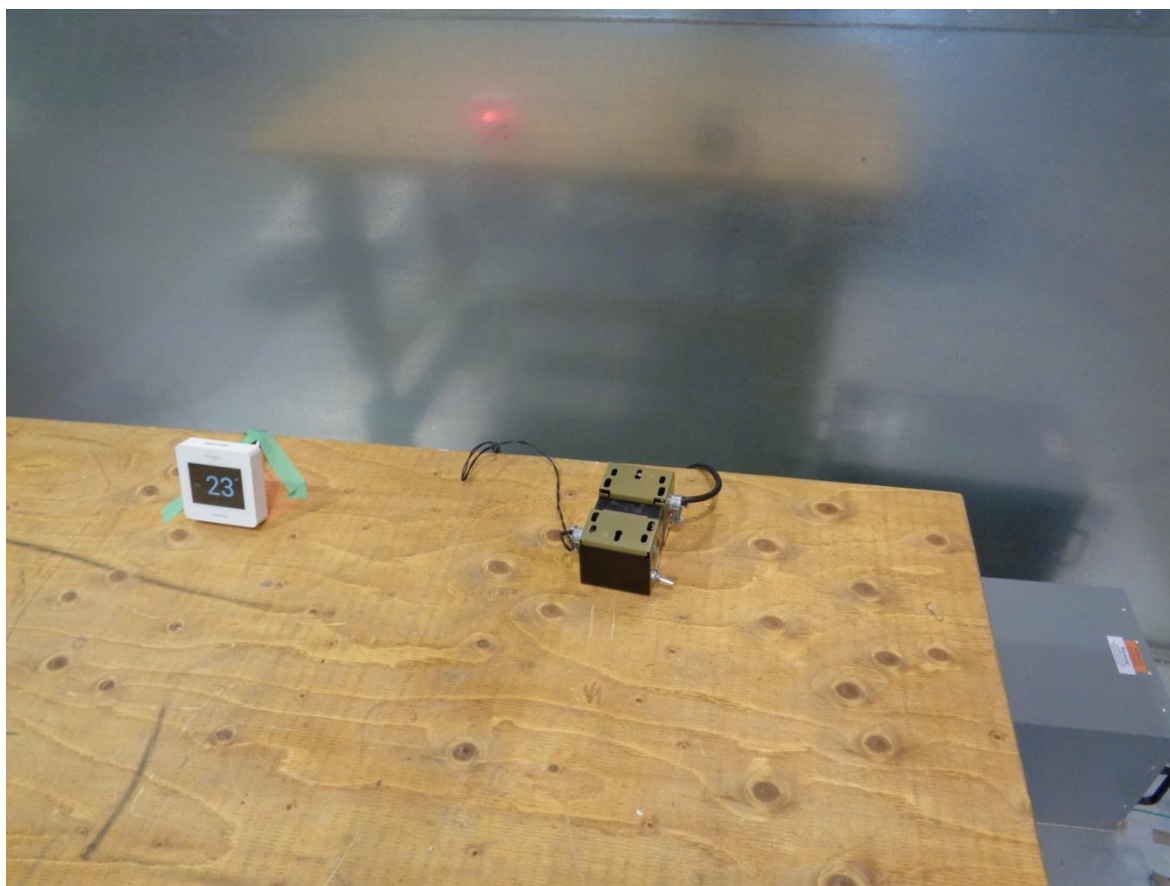
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	


## 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.

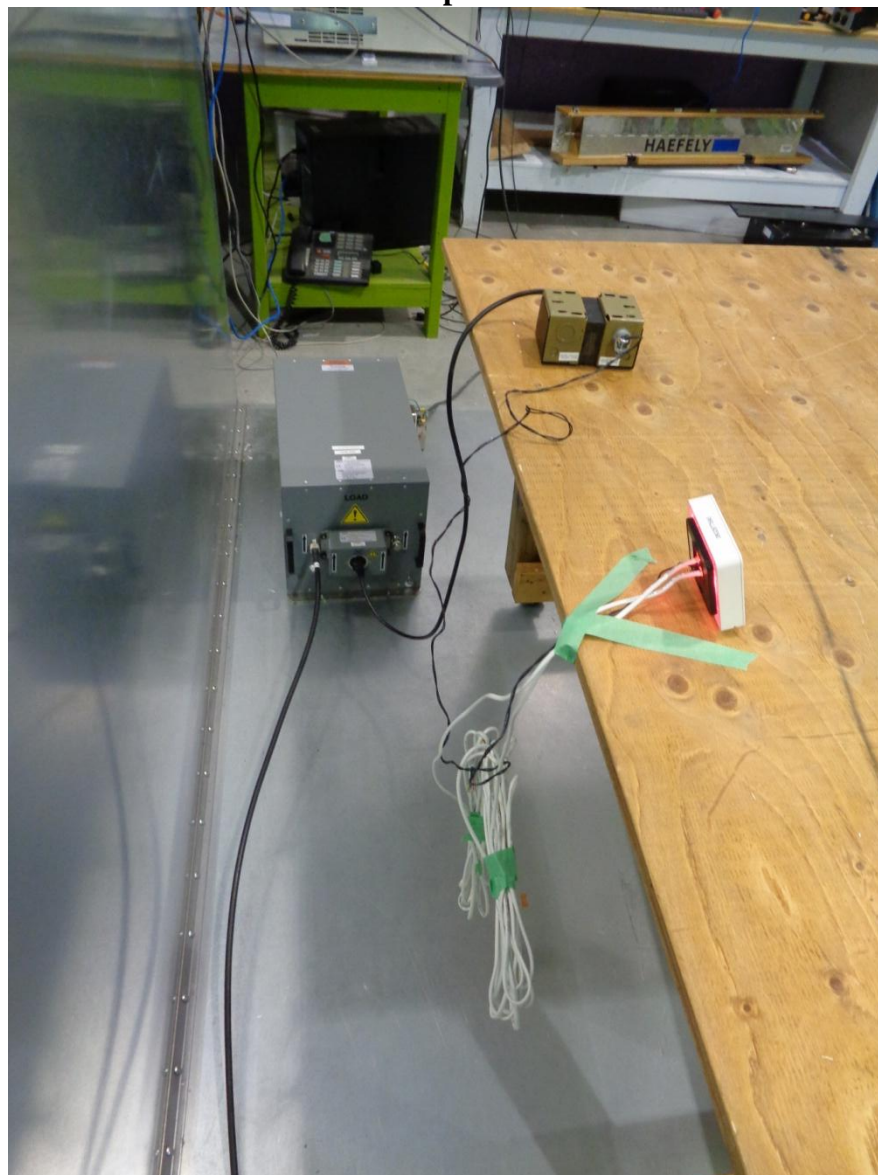
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

**Power Line Conducted Emission Test Setup Photo#1:**




Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

**Power Line Conducted Emission Test Setup Photo#2:**






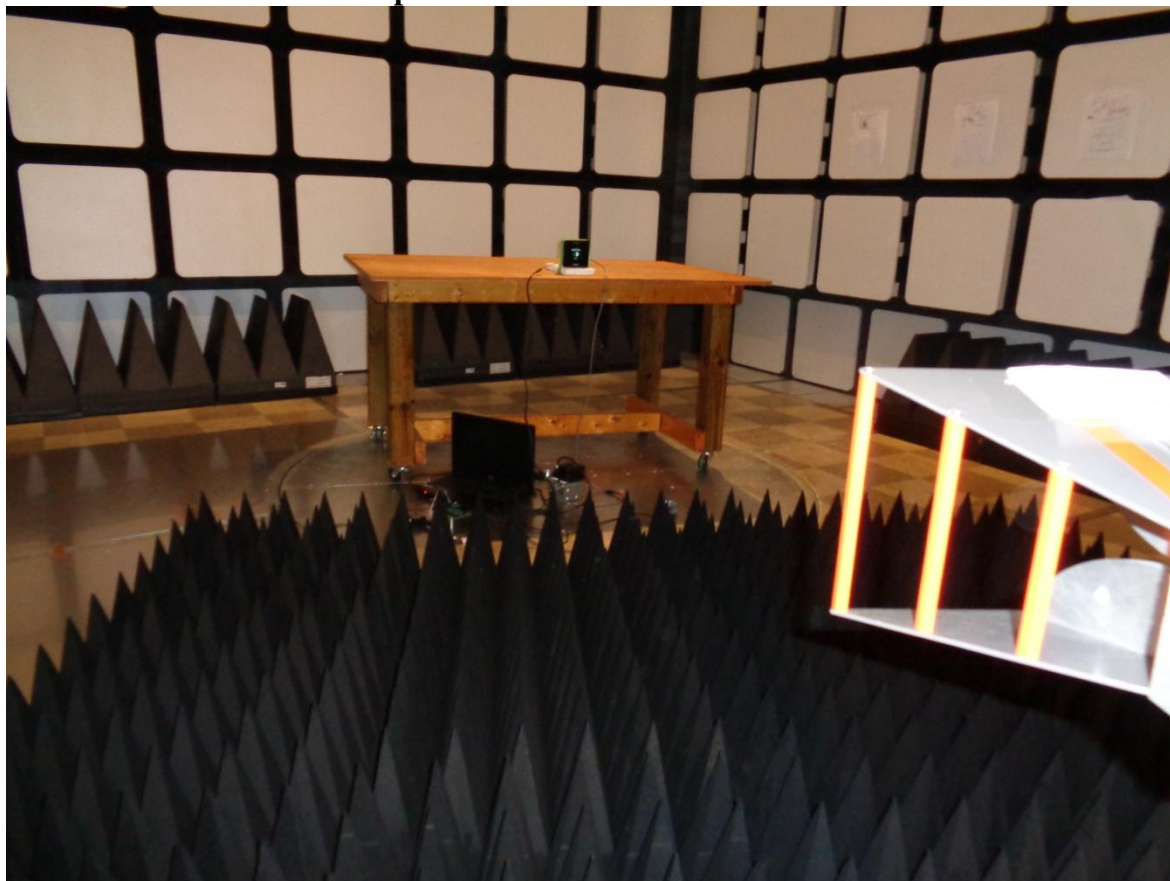
Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

**Radiated Emission Test Setup Photo #1:**




Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

**Radiated Emission Test Setup Photo #2:**





Client	Viconics Electronics Inc.	
Product	Wiser Air	
Standard(s)	FCC Part 15 Subpart C 15	

**Antenna Port Conducted Emission Test Setup Photo:**

