

Global EMC Inc. Labs EMC & RF Test Report

As per

RSS 210 Issue 6:2005

&

FCC Part 15 Subpart C:2006

Unlicensed Intentional Radiators

On the

VWG40



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Testing produced for



See Appendix A for full customer & EUT details.





Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

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Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Report Scope

This report addresses the EMC verification testing and test results of the VWG40, 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 6:2005 / FCC Part 15 Subpart C 15:2006

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 – VWG40
EUT Industry Canada Certification #, IC:	7591A – VWG40
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Ashwani Malhotra

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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 See Justification
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 Justification
FCC 15.247(d) RSS-210 A8.5	Antenna conducted spurious	< 20 dBc	Pass
FCC 15.247(e) RSS-210 A8.2(b)	Spectral Density	< 8 dBm (3 kHz BW)	Pass
FCC 15.247(i) IC Safety code 6	Maximum Permissible Exposure	> 20 cm separation.	Pass See justification and calculations
Overall Result			PASS

For Spurious radiated emissions two ferrites were used on the DC power and RJ-45 ethernet cable. (Steward 28A0434-0A2 with no turns i.e. straight through).

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All tests were performed by Ashwani Malhotra

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), the unit uses reverse polarity SMA connector on the VWG40.

For the Restricted Bands of operation, the EUT is designed to only operate between 2400 – 2483.5MHz.

For the Antenna gain, the unit uses a 3 dbi antenna. There is a provision to use the antenna with an extension cable approximately 5.0 foot in length. The unit was tested for spurious emissions with this cable and results are recorded below. The effective gain of the antenna (with cable losses) ends up being less than the setup without the cable.


For maximum permissible exposure, this device operates at less than 1 Watt at 2400 – 2483.5 MHz and is designed to operate greater than 20 cm from personnel during normal operation. No testing is required, however worst case calculated exposure compliance follows later in this report.

For Spurious radiated emissions two ferrites were used on the DC power and RJ-45 ethernet cable. (Steward 28A0434-0A2 with no turns i.e. straight through).

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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
- CFR 47 FCC 15 - Code of Federal Regulations – Radio Frequency Devices
- CISPR 22:1997 - Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
- ICES-003:2004 - Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
- ISO 17025:2005 - General Requirements for the competence of testing and calibration laboratories
- RSS 210:2005 - Issue 6: Spectrum Management and Telecommunications Policy. Radio Standards Specification Low Power Licence-Exempt Radiocommunication 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 - June 3, 2008 Initial release

Revision 2 - June 9, 2008 Editorial modifications.

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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 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 –

Date	Test	Init.	Temperature (°C)	Humidity (%)	Pressure (kPa)
May 7 – 21, 2008	All	AM	20-25°C	30-45%	100 -103kPa

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Detailed Test Results Section

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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 C63.4:2003.


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

All unintentional emissions must also meet the ‘Spurious Conducted Emissions’ requirements of -20 dBc or greater. See also ‘Spurious Conducted Emissions’ for further details.

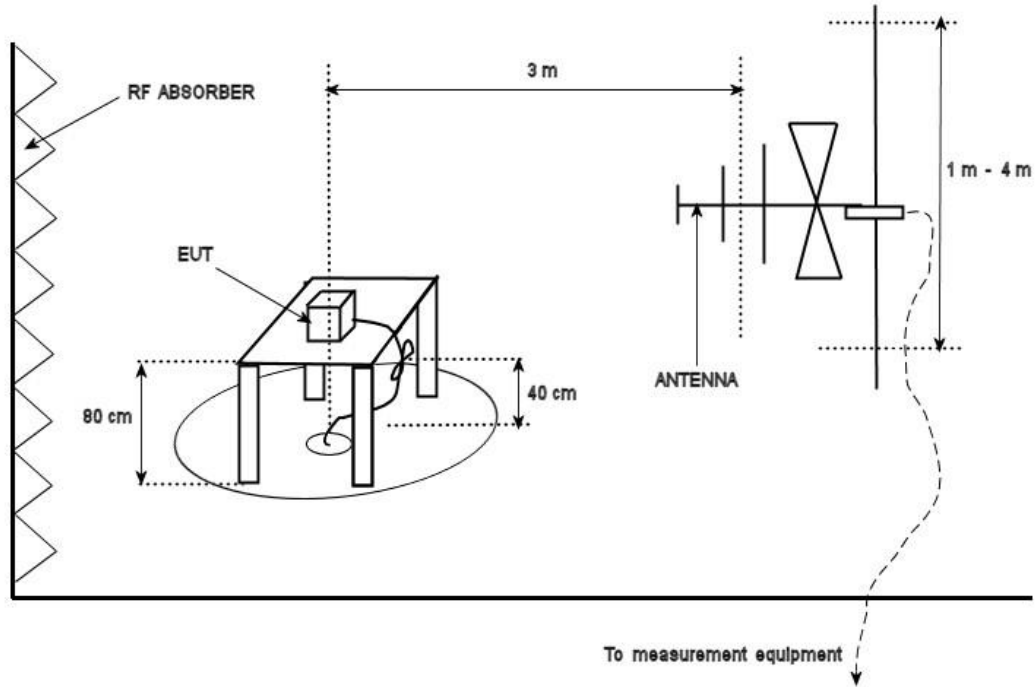
30 MHz – 88 MHz, 100 uV/m (40.0 dBuV/m¹) at 3 m
 88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m¹) at 3 m
 216 MHz – 960 MHz, 200 uV/m (46.4 dBuV/m¹) at 3 m
 Above 960 MHz, 500 uV/m (54.0 dBuV/m¹) at 3 m
 Above 1000 MHz, 500 uV/m (54.0 dBuV/m²) at 3m


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

²Limit is with 1 MHz measurement bandwidth and using an Average detector, scanned in accordance with 15.33 to above the 10th harmonic.

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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 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.

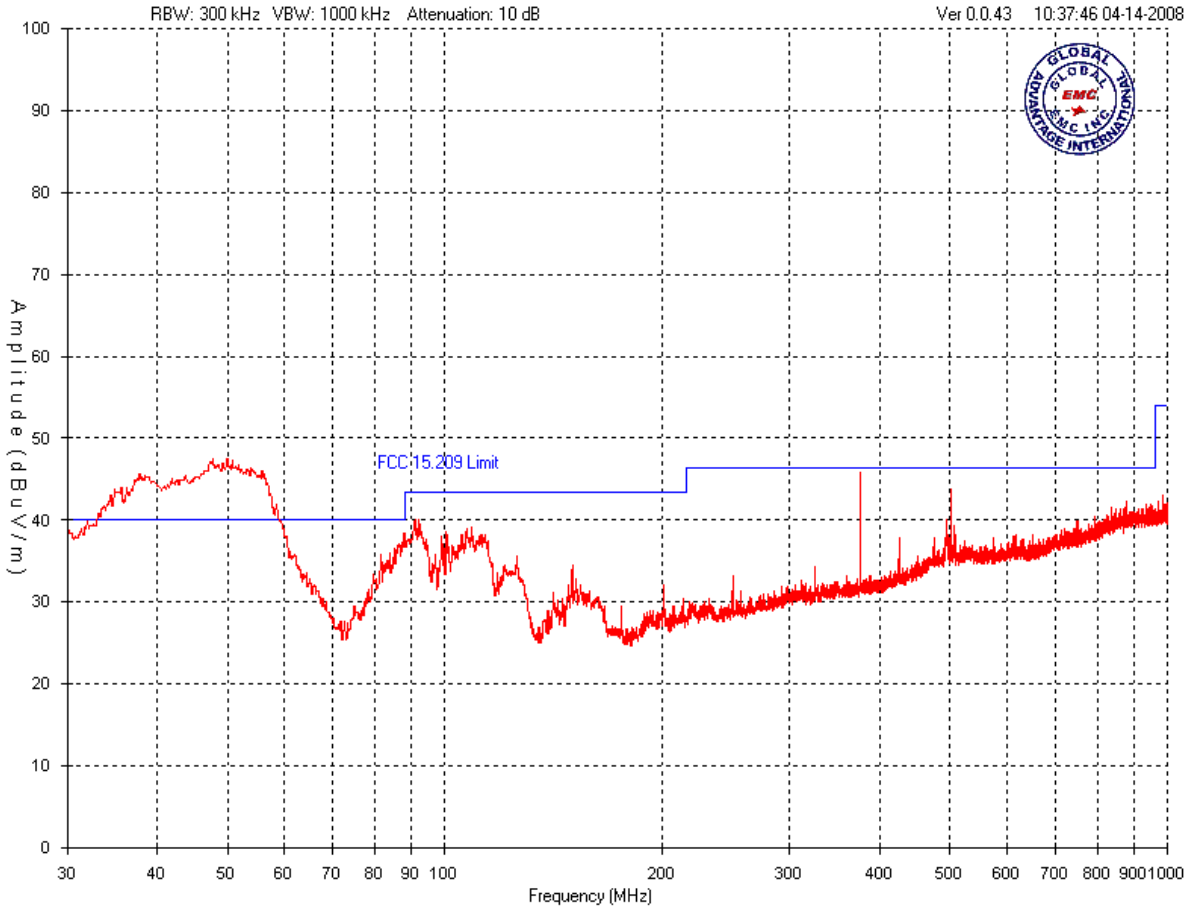
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to a minimum of a 25 GHz.

For Spurious radiated emissions two ferrites were used on the DC power and RJ-45 ethernet cable. (Steward 28A0434-0A2 with no turns i.e. straight through).

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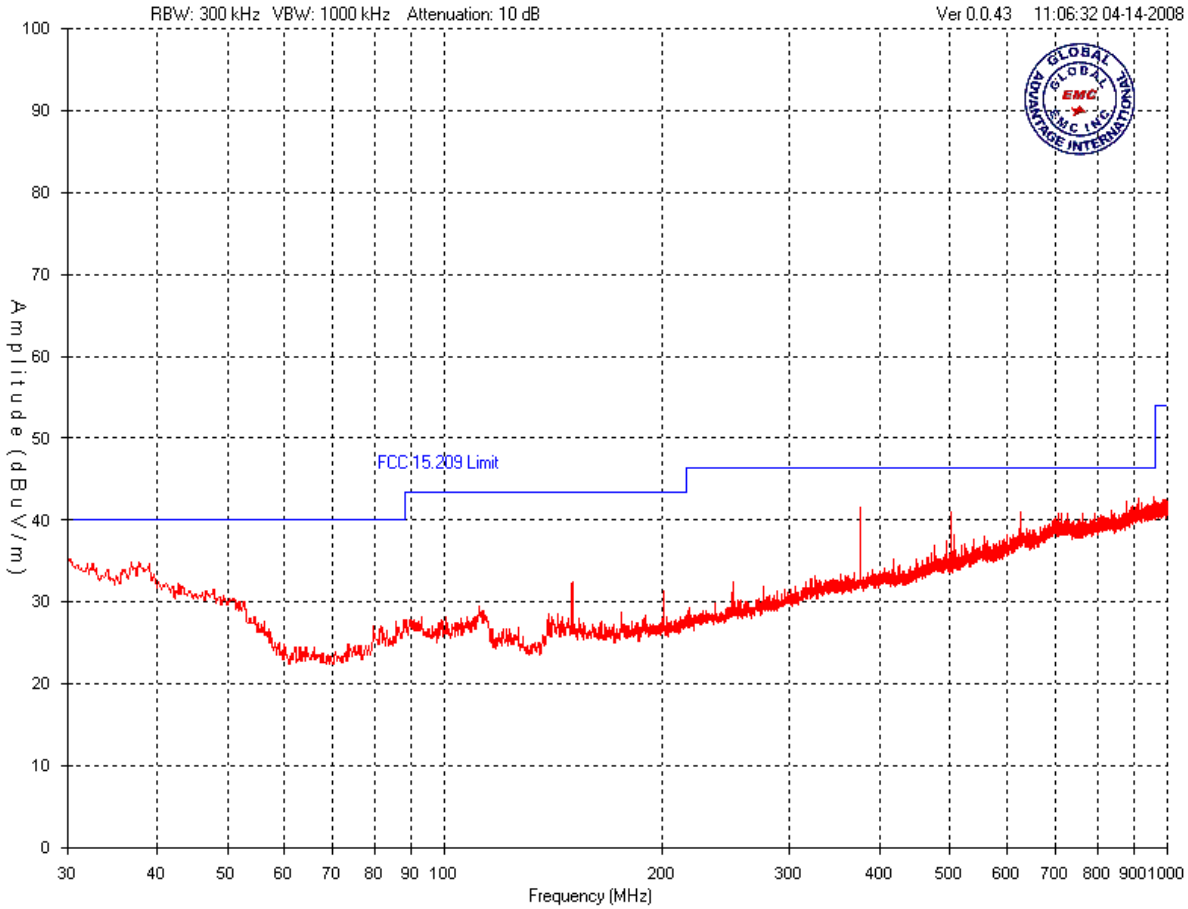
Low Channel – Without cable 30MHz – 1 GHz
 Vertical – Peak Emissions Graph



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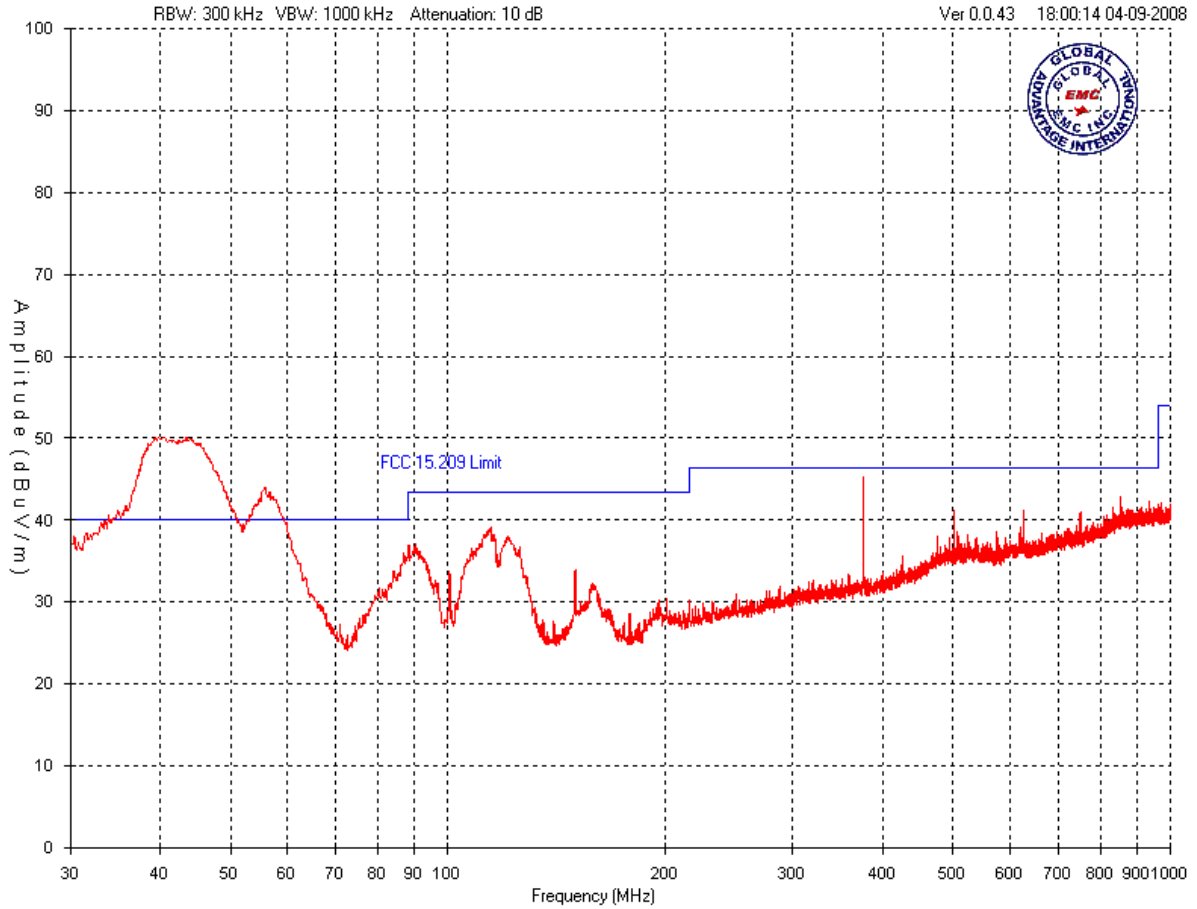
Low Channel – Without cable 30MHz – 1 GHz
Horizontal – Peak Emissions Graph



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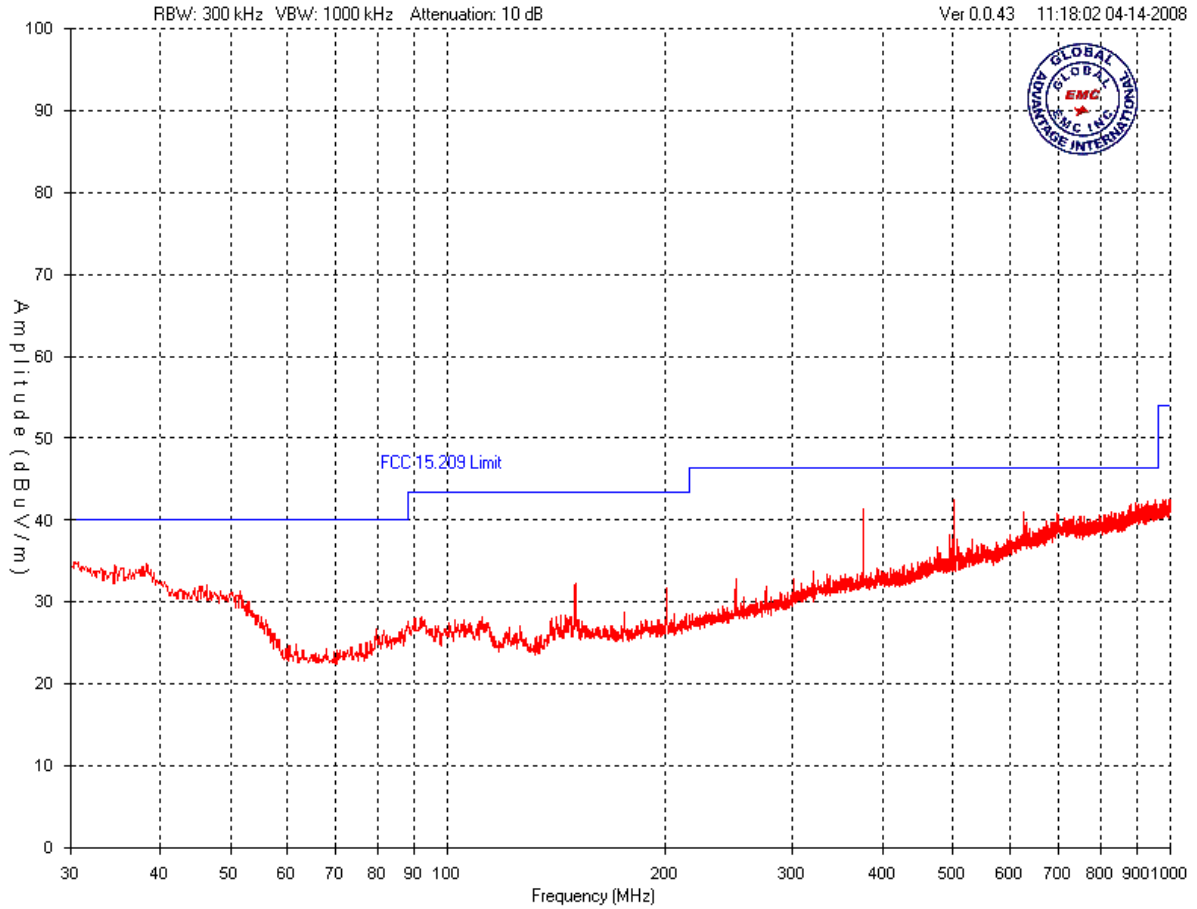
Mid Channel – Without cable 30MHz – 1 GHz
Vertical – Peak Emissions Graph



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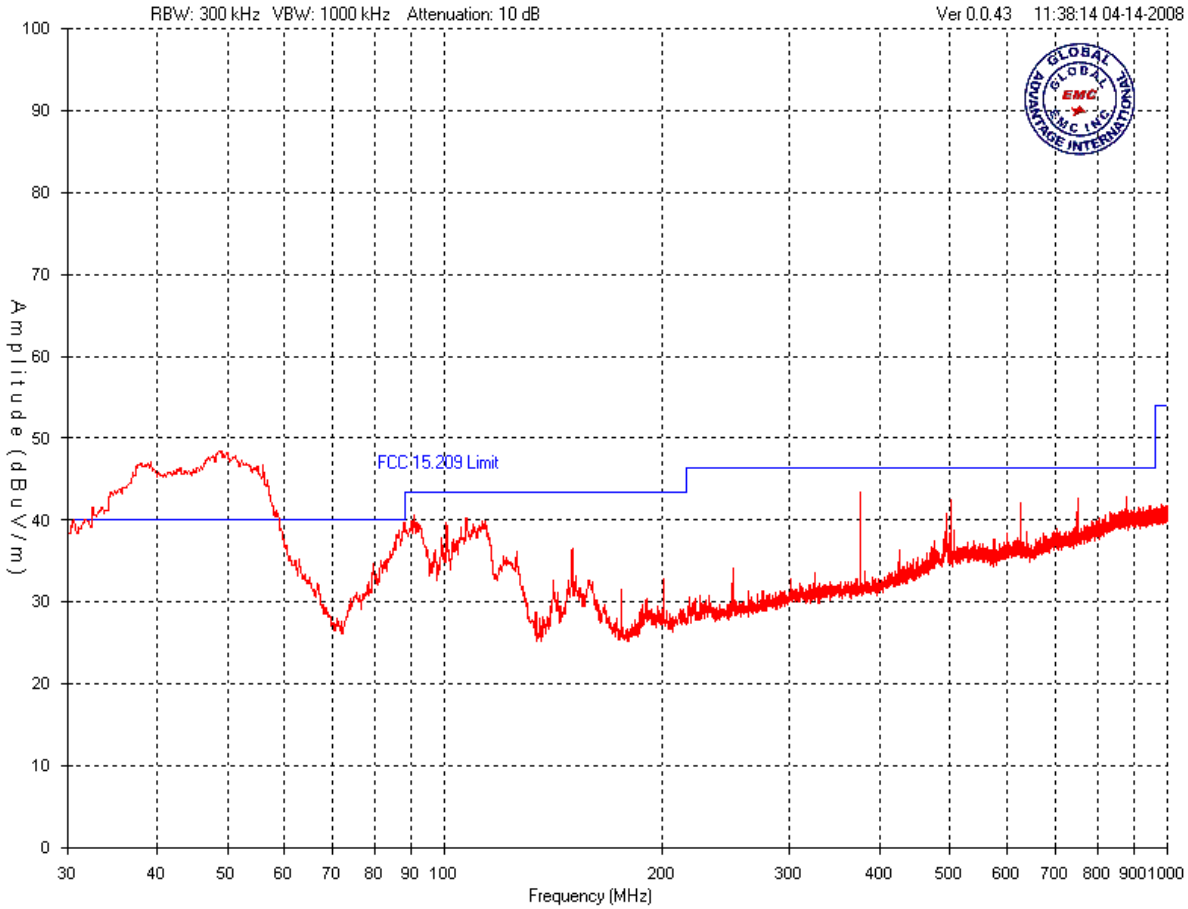
Mid Channel – Without cable 30MHz – 1 GHz
Horizontal – Peak Emissions Graph



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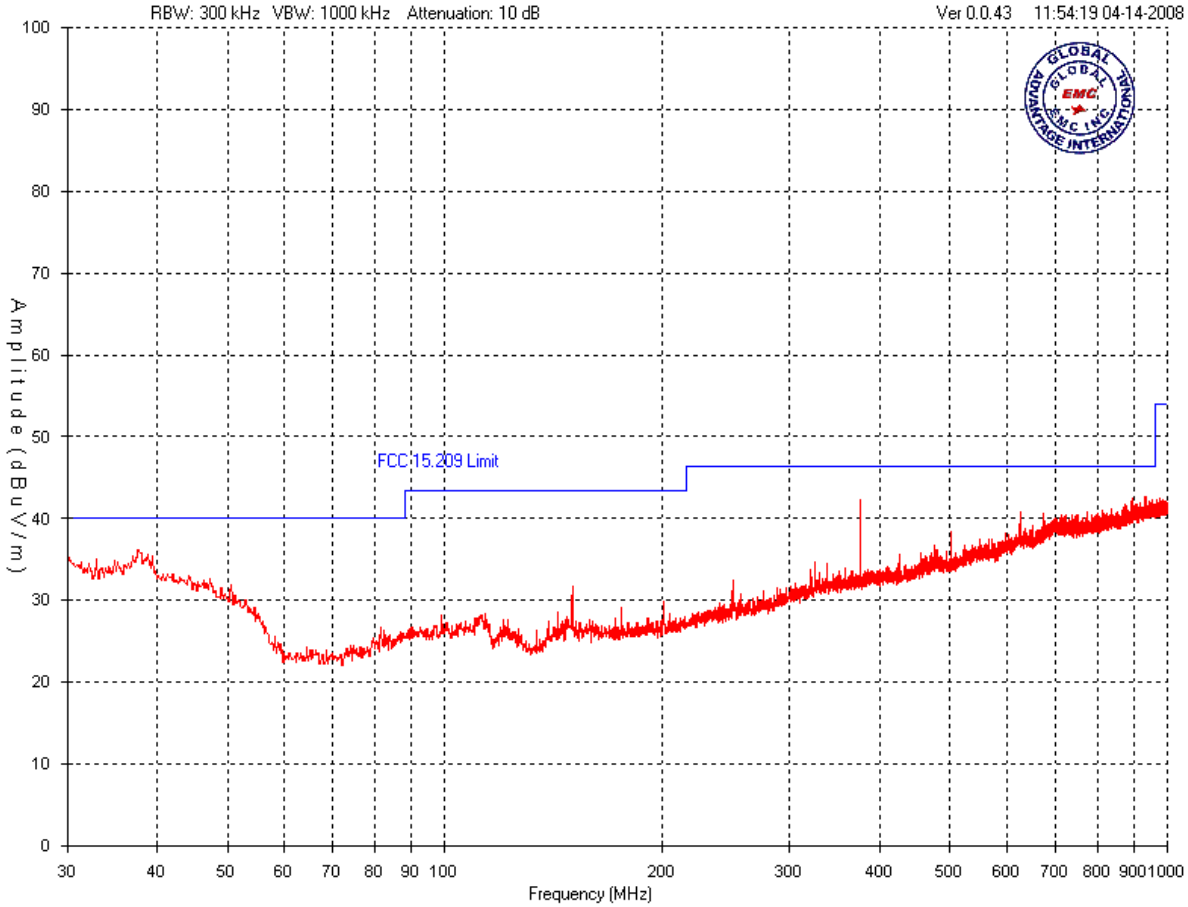
Hi Channel – Without cable 30MHz – 1 GHz
 Vertical – Peak Emissions Graph



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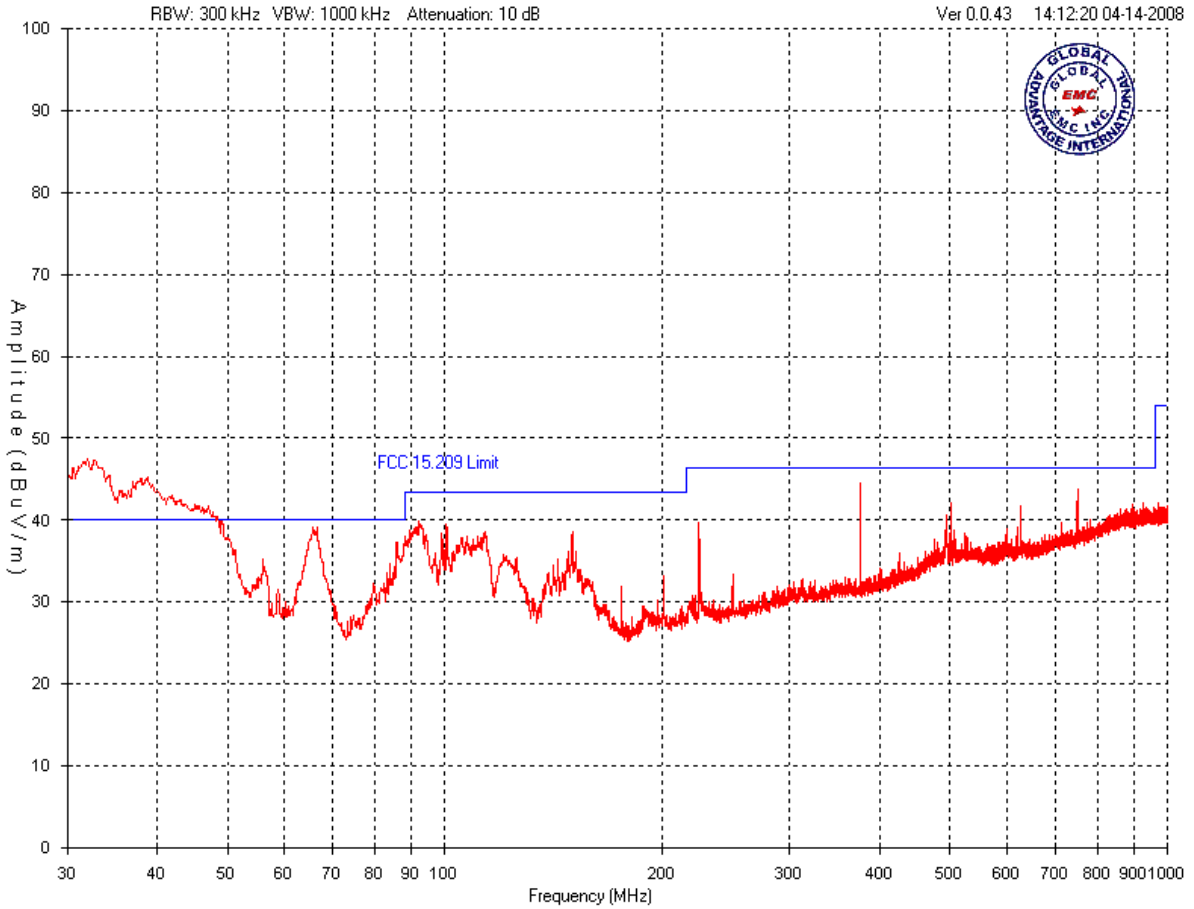
Hi Channel – Without cable 30MHz – 1 GHz
Horizontal – Peak Emissions Graph



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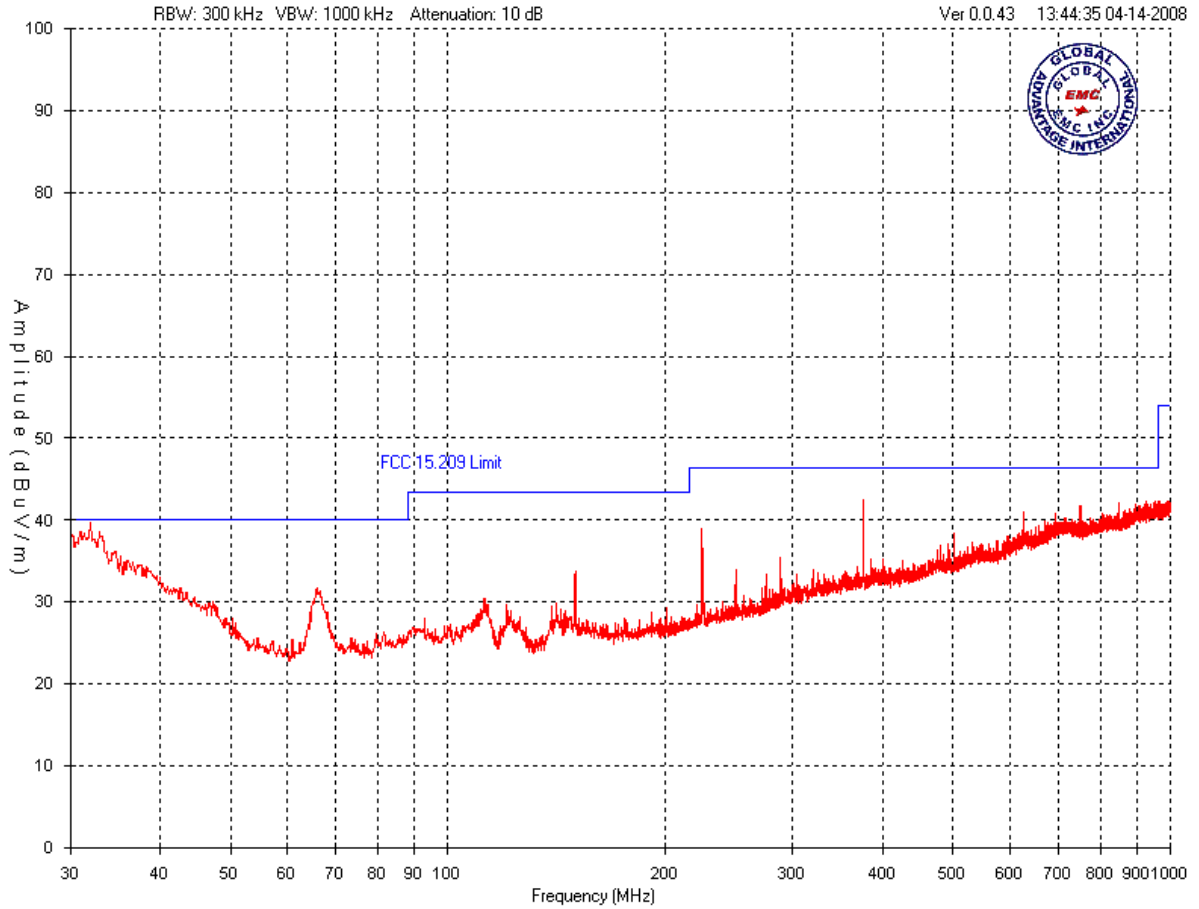
Low Channel – With cable 30MHz – 1 GHz
Vertical – Peak Emissions Graph



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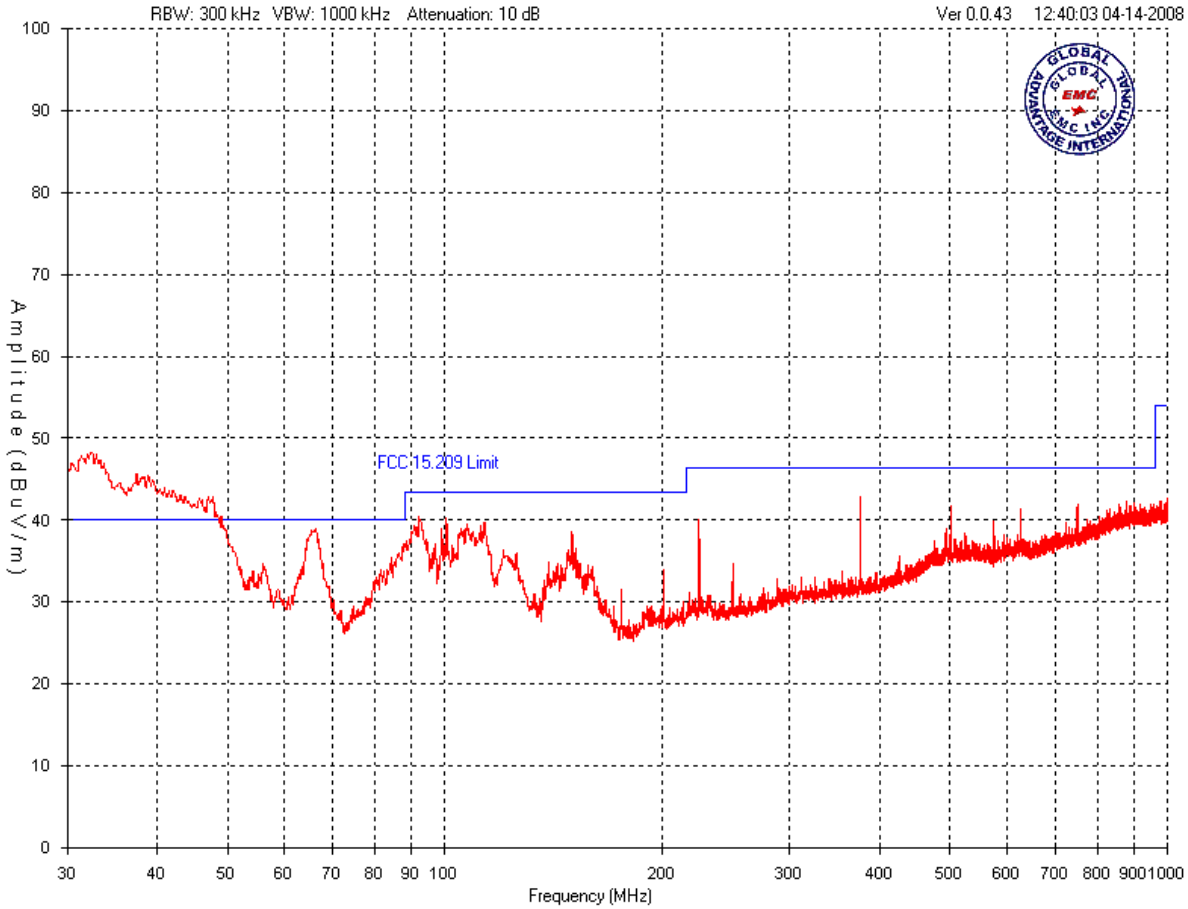
Low Channel – With cable 30MHz – 1 GHz
Horizontal – Peak Emissions Graph



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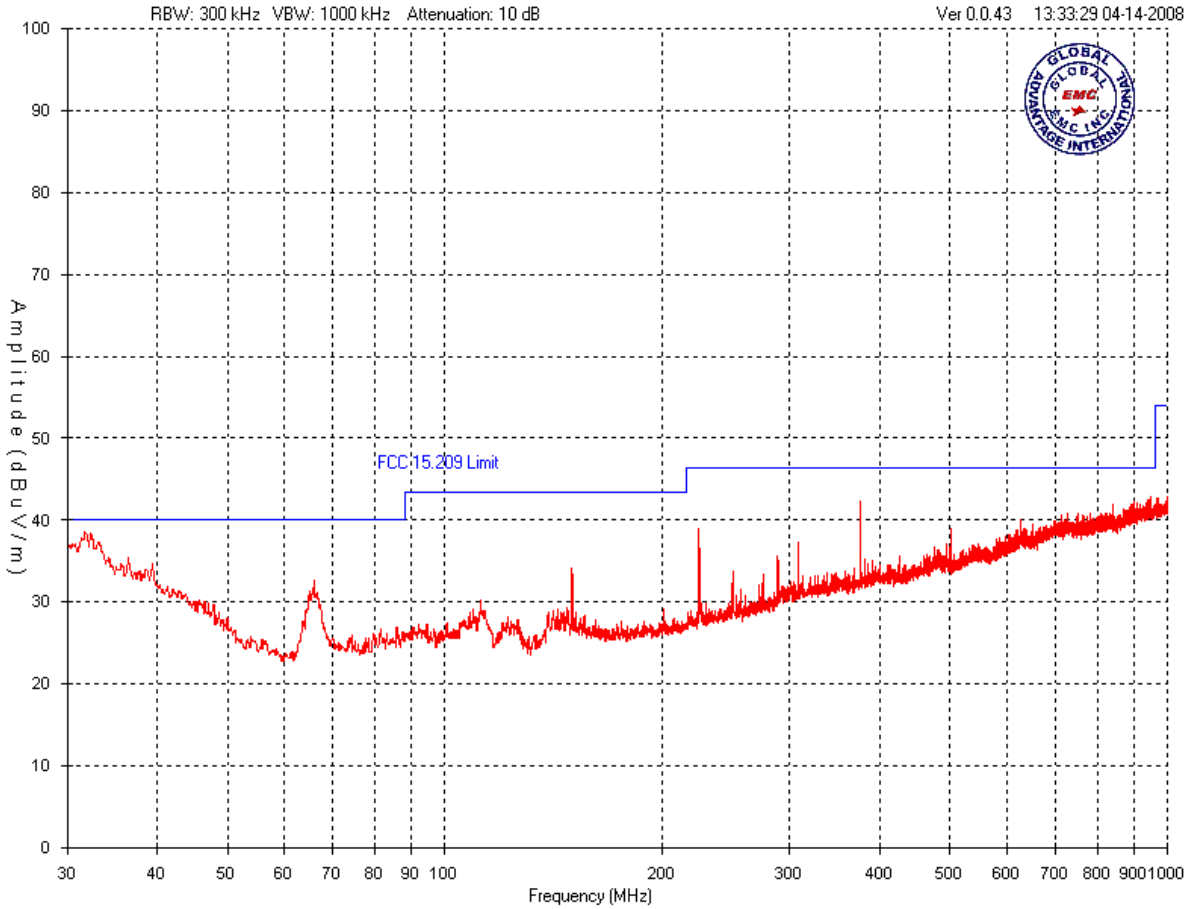
Mid Channel – With cable 30MHz – 1 GHz
Vertical – Peak Emissions Graph



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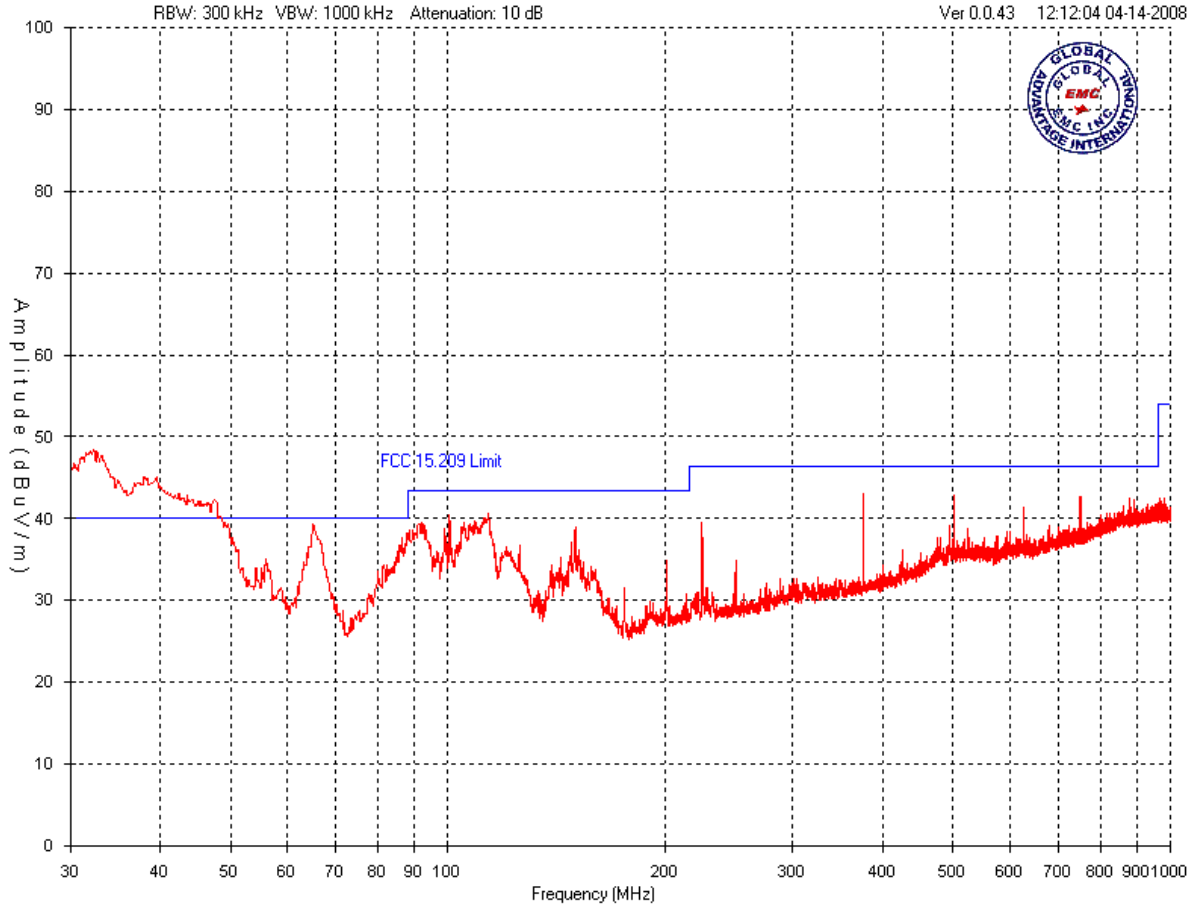
Mid Channel – With cable 30MHz – 1 GHz
Horizontal – Peak Emissions Graph



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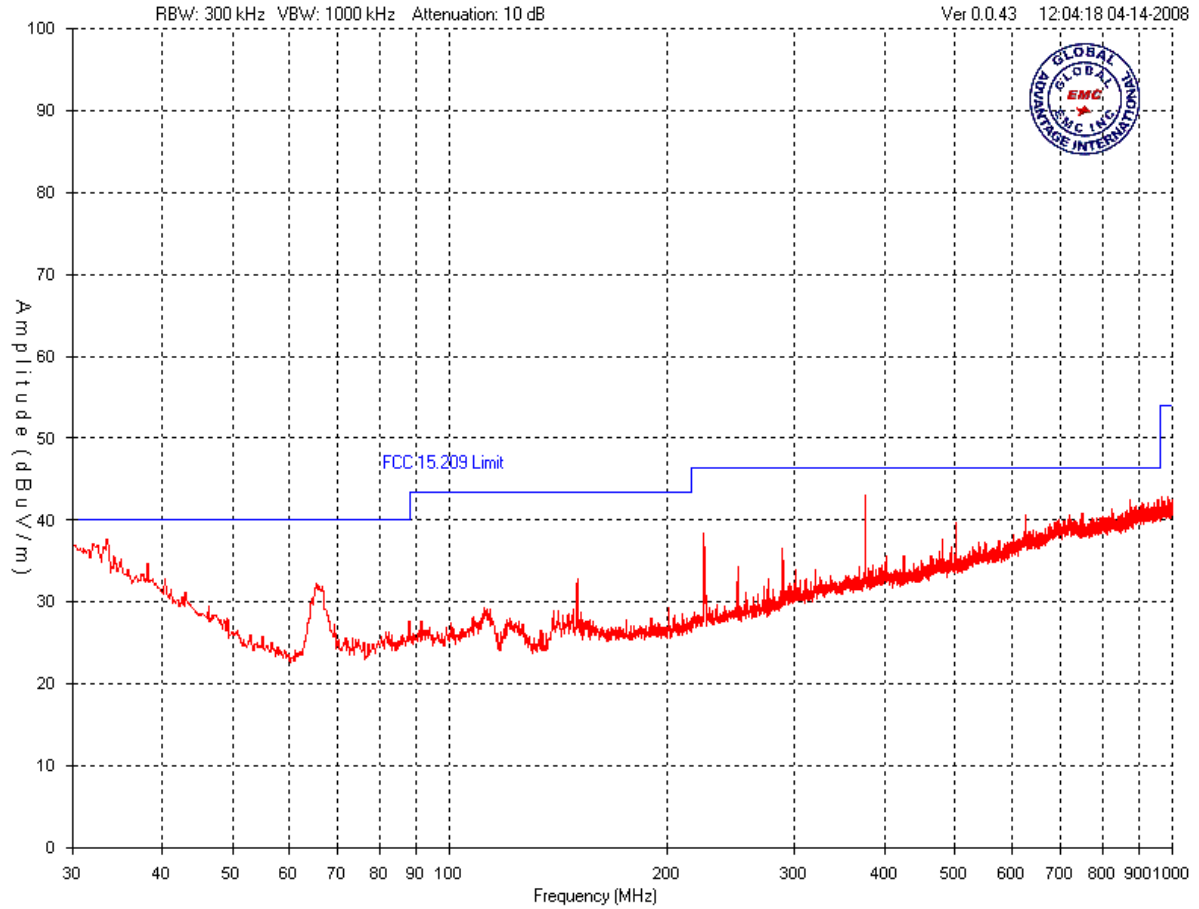
Hi Channel – With cable 30MHz – 1 GHz
Vertical – Peak Emissions Graph



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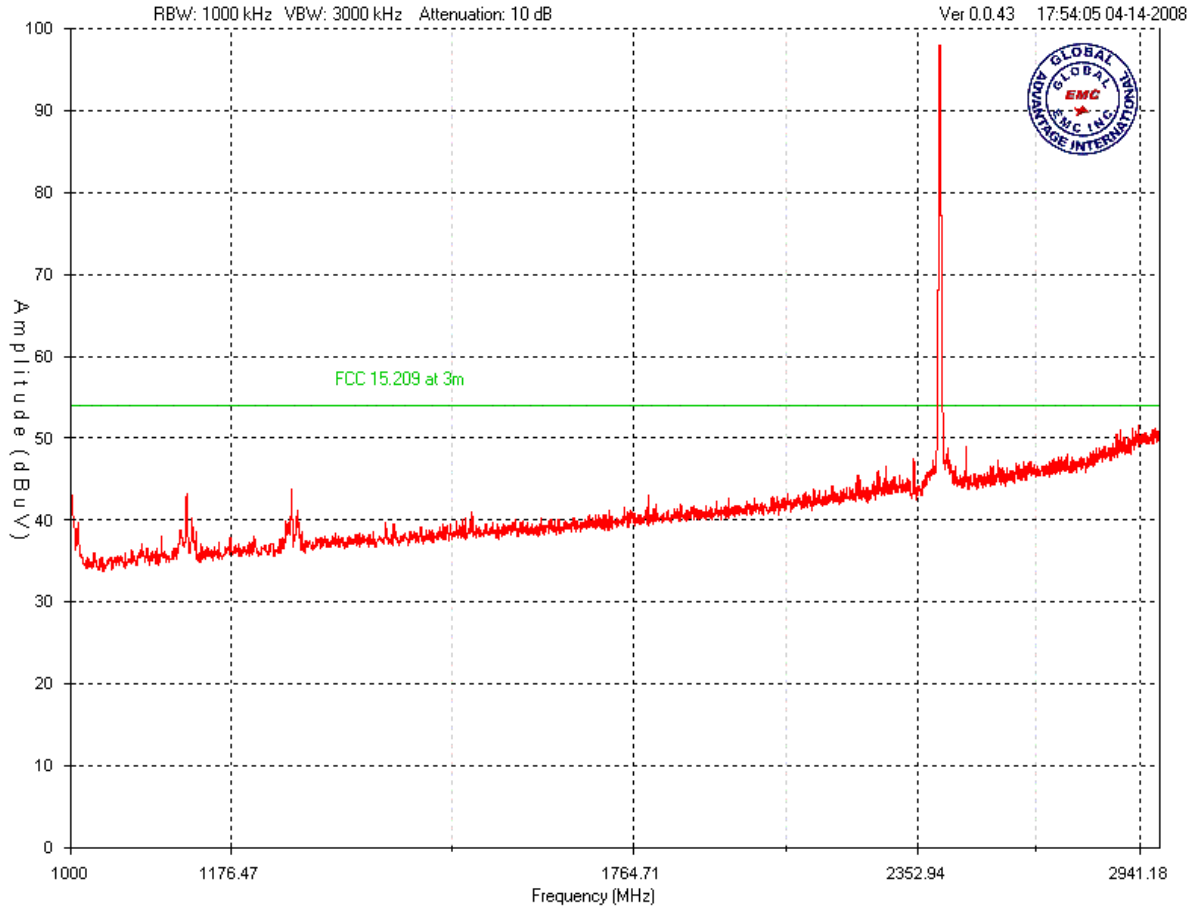
Hi Channel – With cable 30MHz – 1 GHz
Horizontal – Peak Emissions Graph



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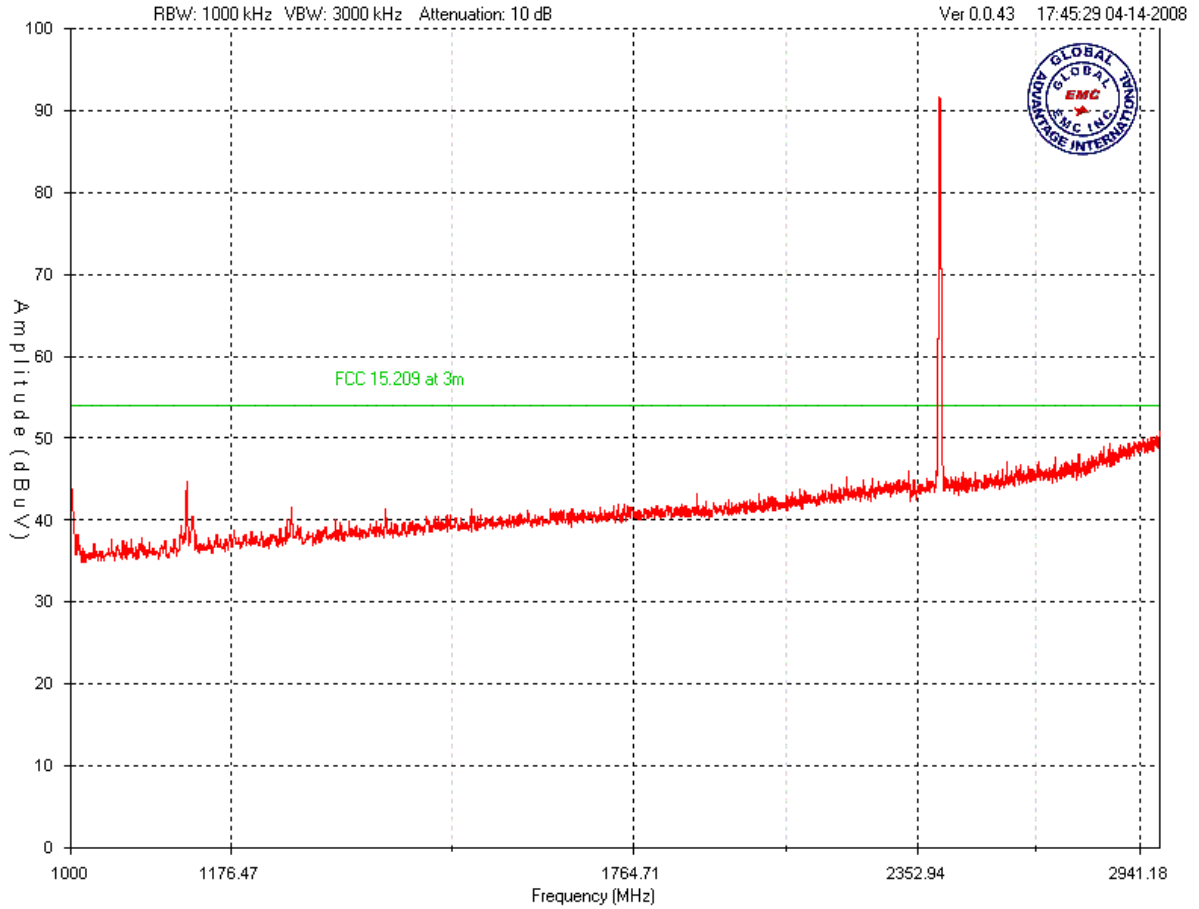
Low Channel – Without cable 1 – 3GHz
Vertical – Peak Emissions Graph



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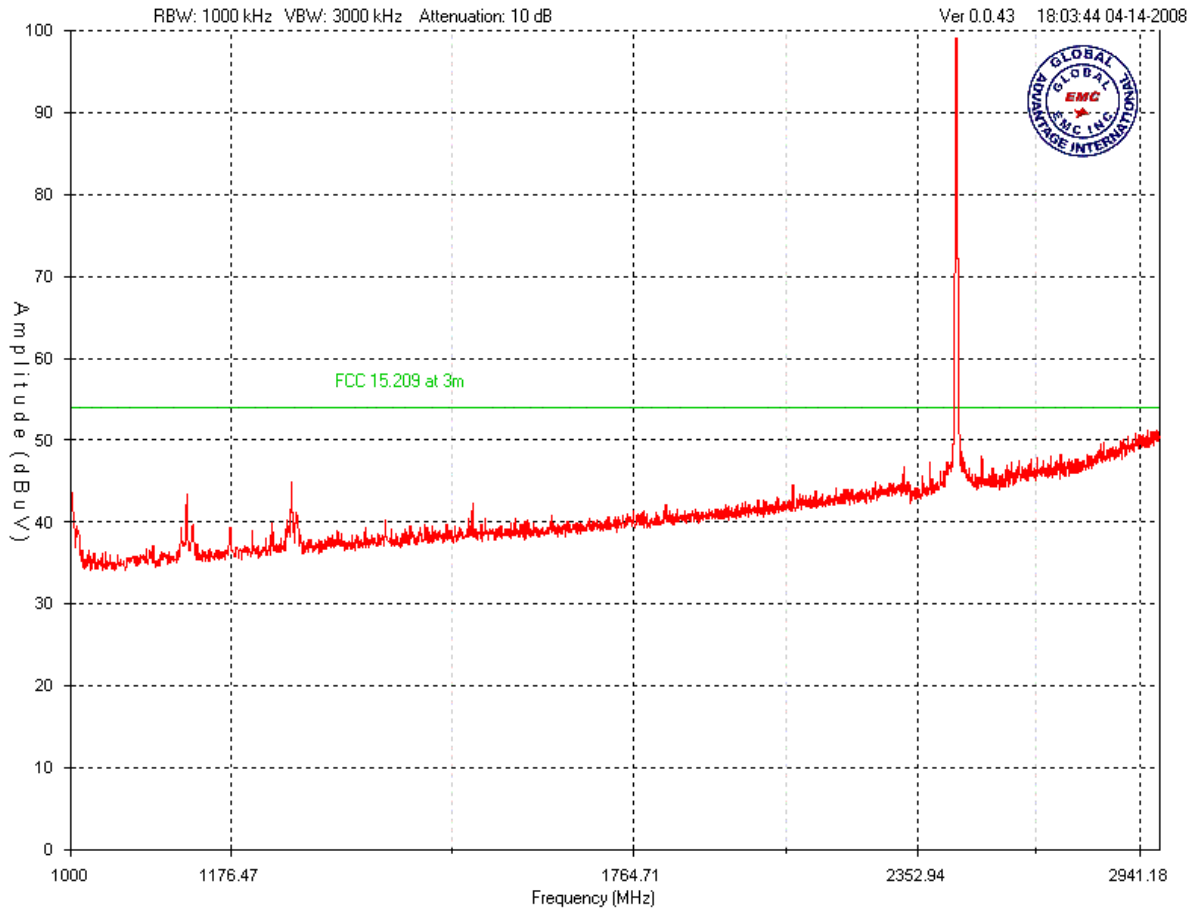
Low Channel – Without cable 1 – 3GHz
Horizontal – Peak Emissions Graph



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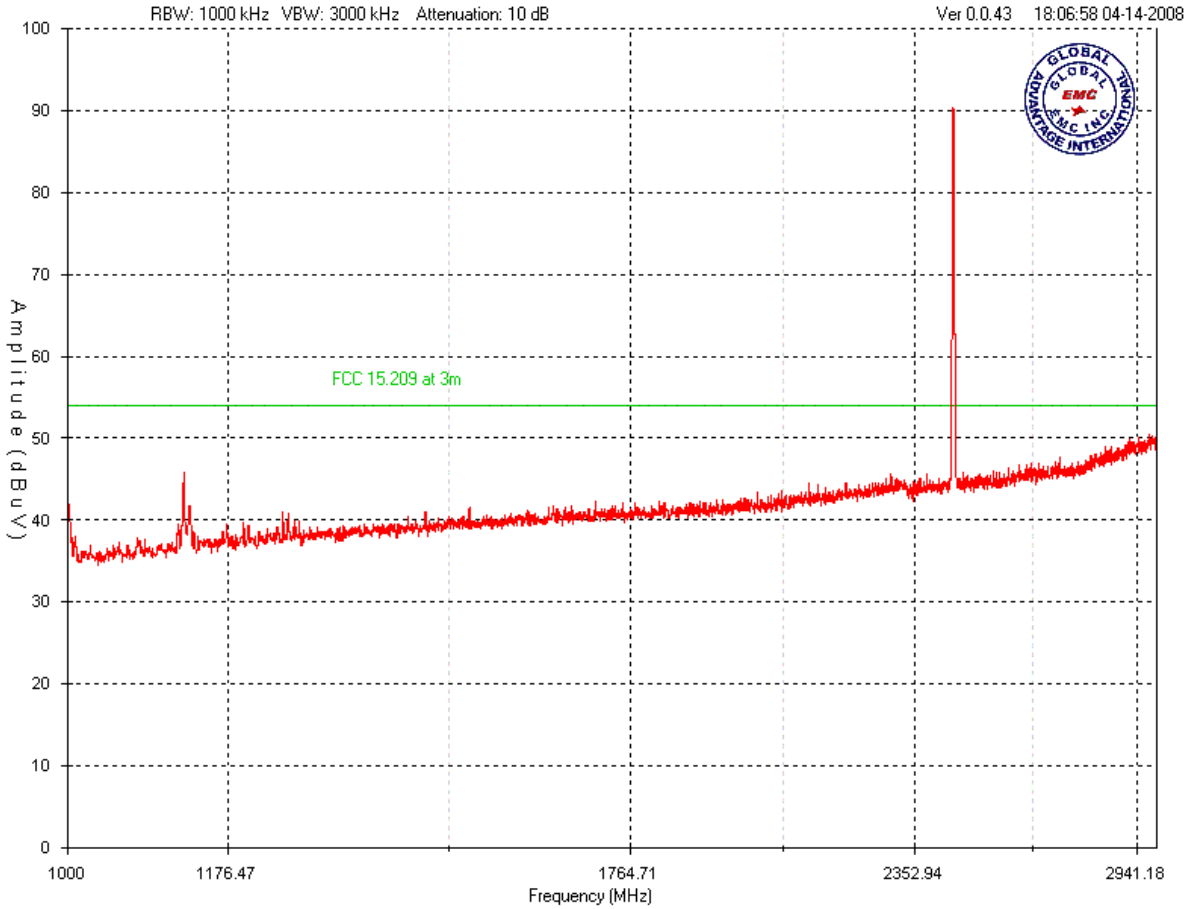
Mid Channel – Without cable 1 – 3GHz
Vertical – Peak Emissions Graph



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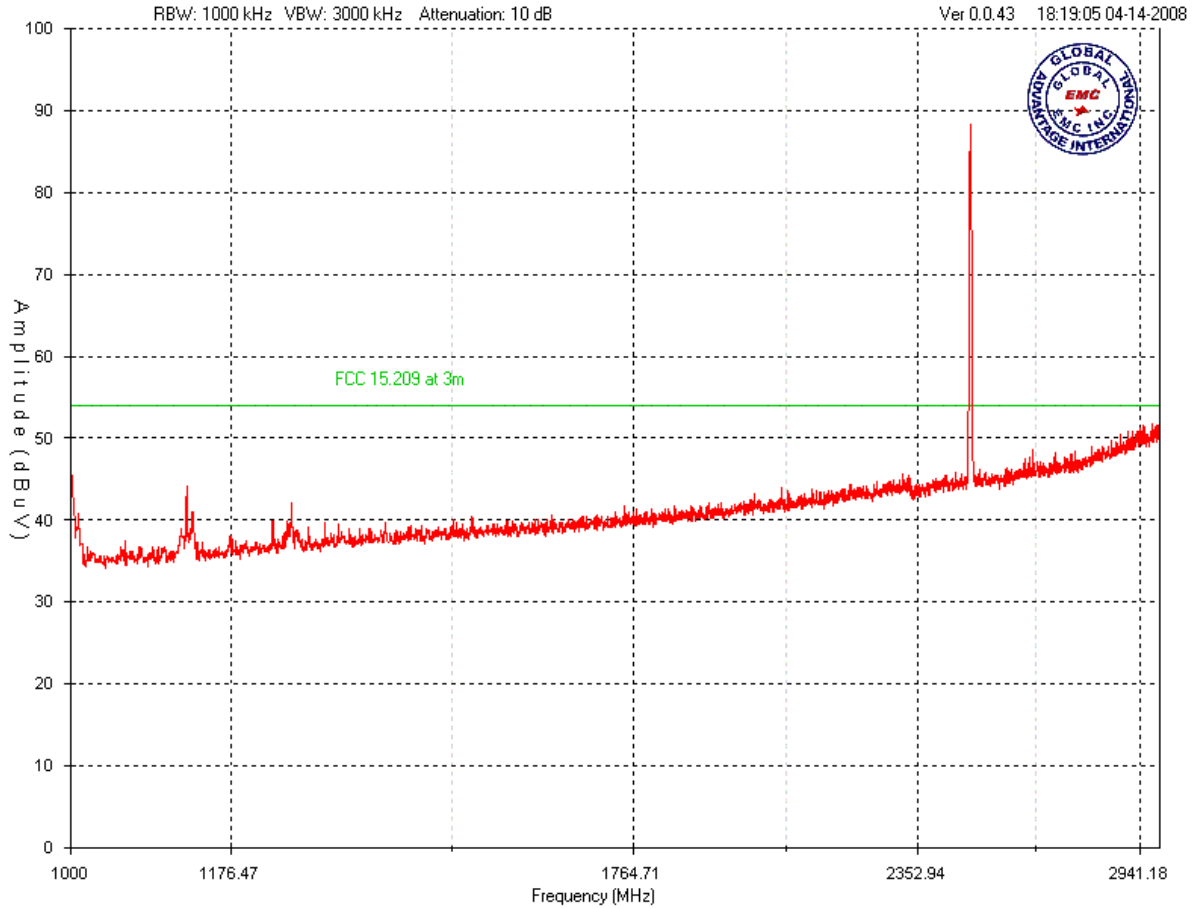
Mid Channel – Without cable 1 – 3GHz
Horizontal – Peak Emissions Graph



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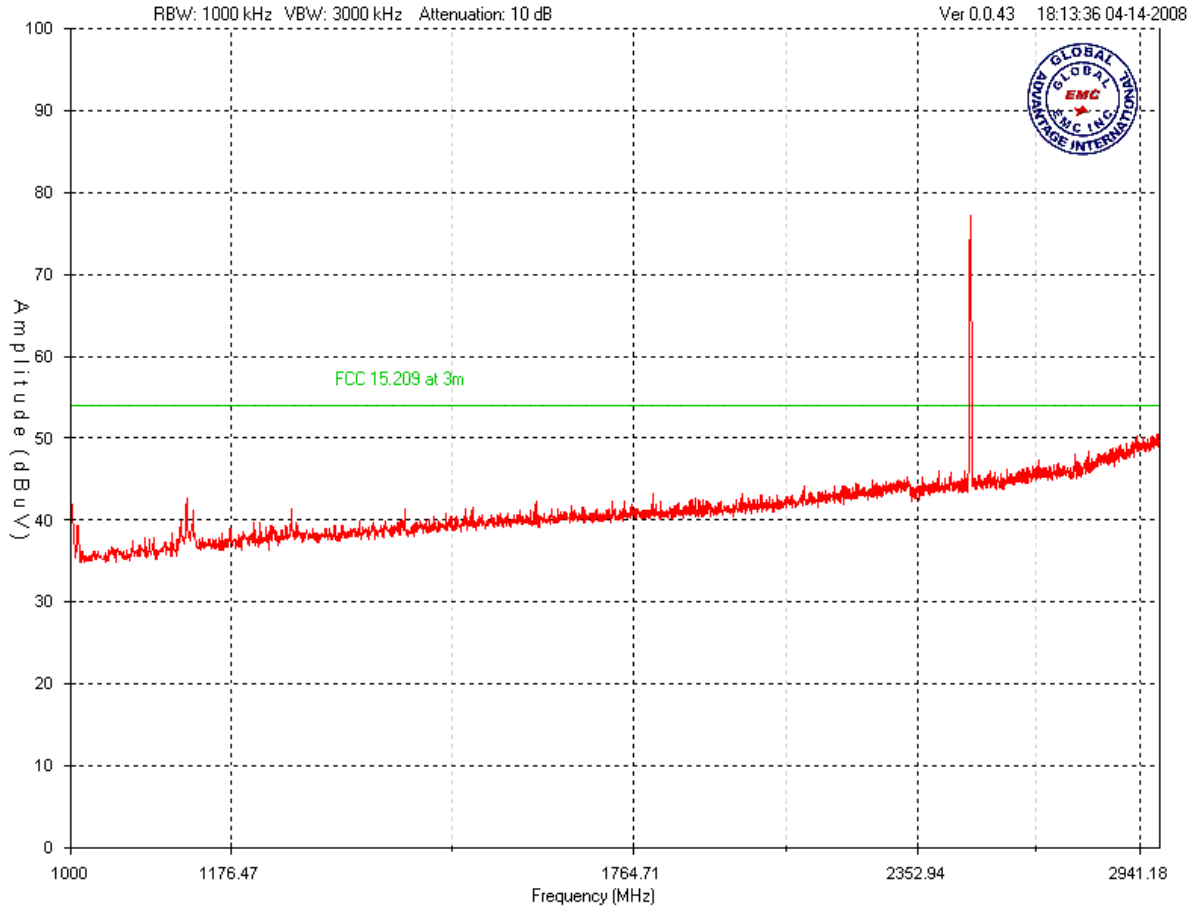
Hi Channel – Without cable 1 – 3GHz
 Vertical – Peak Emissions Graph



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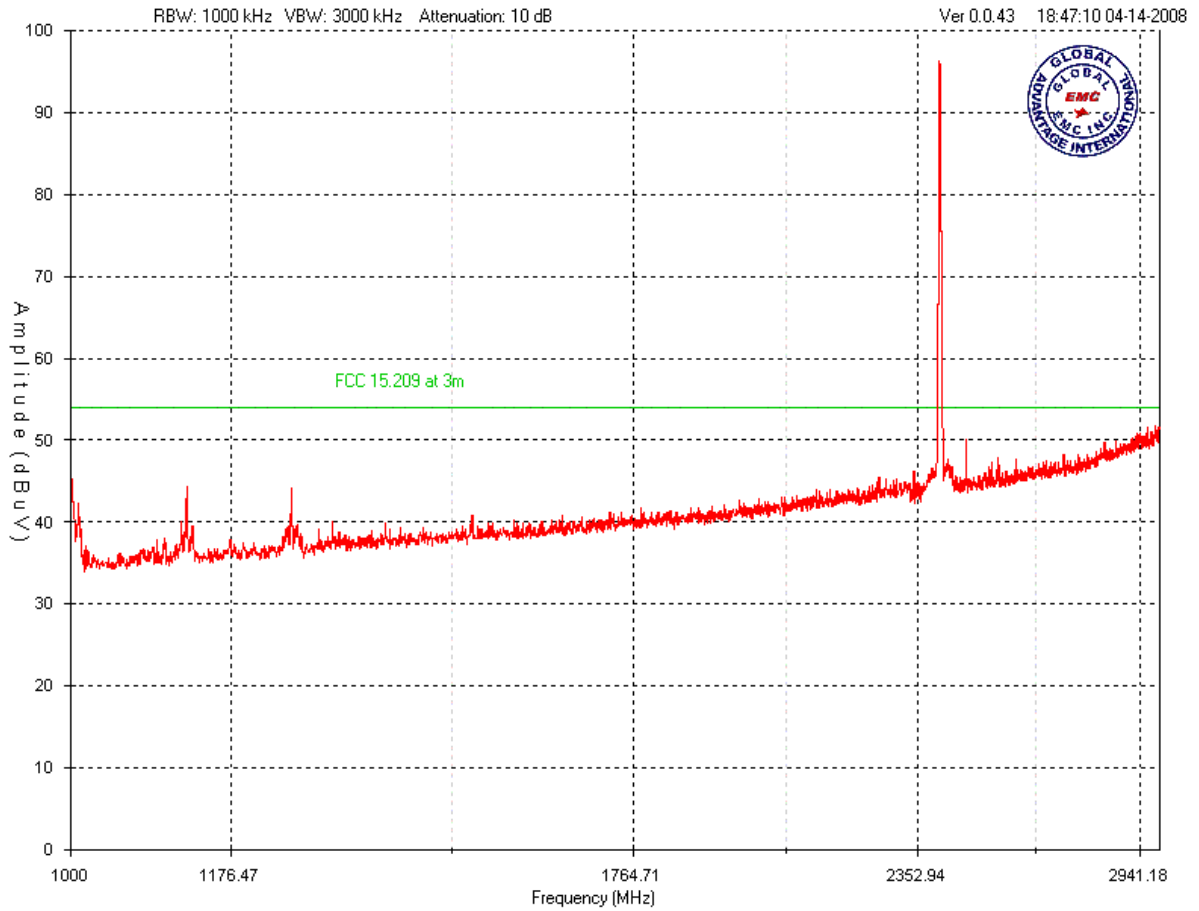
Hi Channel – Without cable 1 – 3GHz
Horizontal – Peak Emissions Graph



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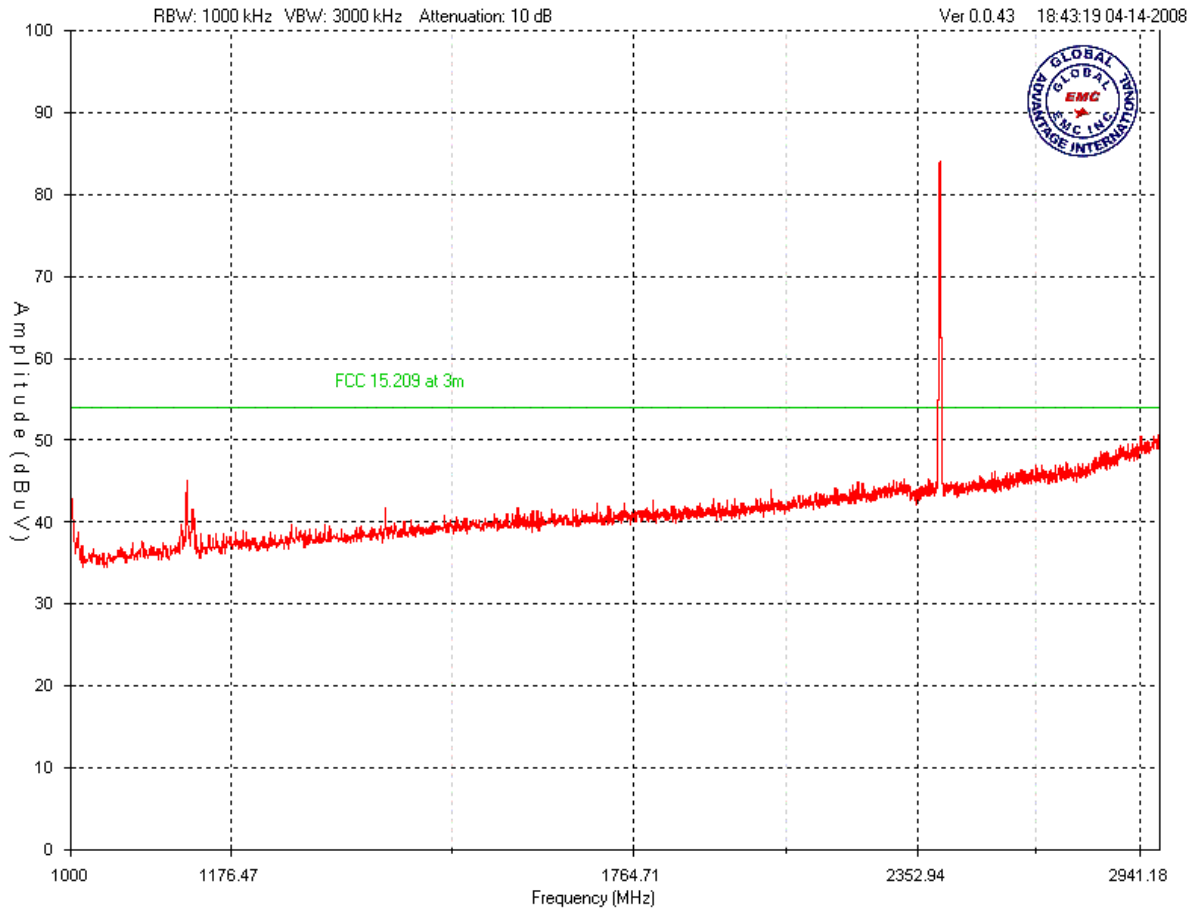
Low Channel – With cable 1 – 3GHz
Vertical – Peak Emissions Graph




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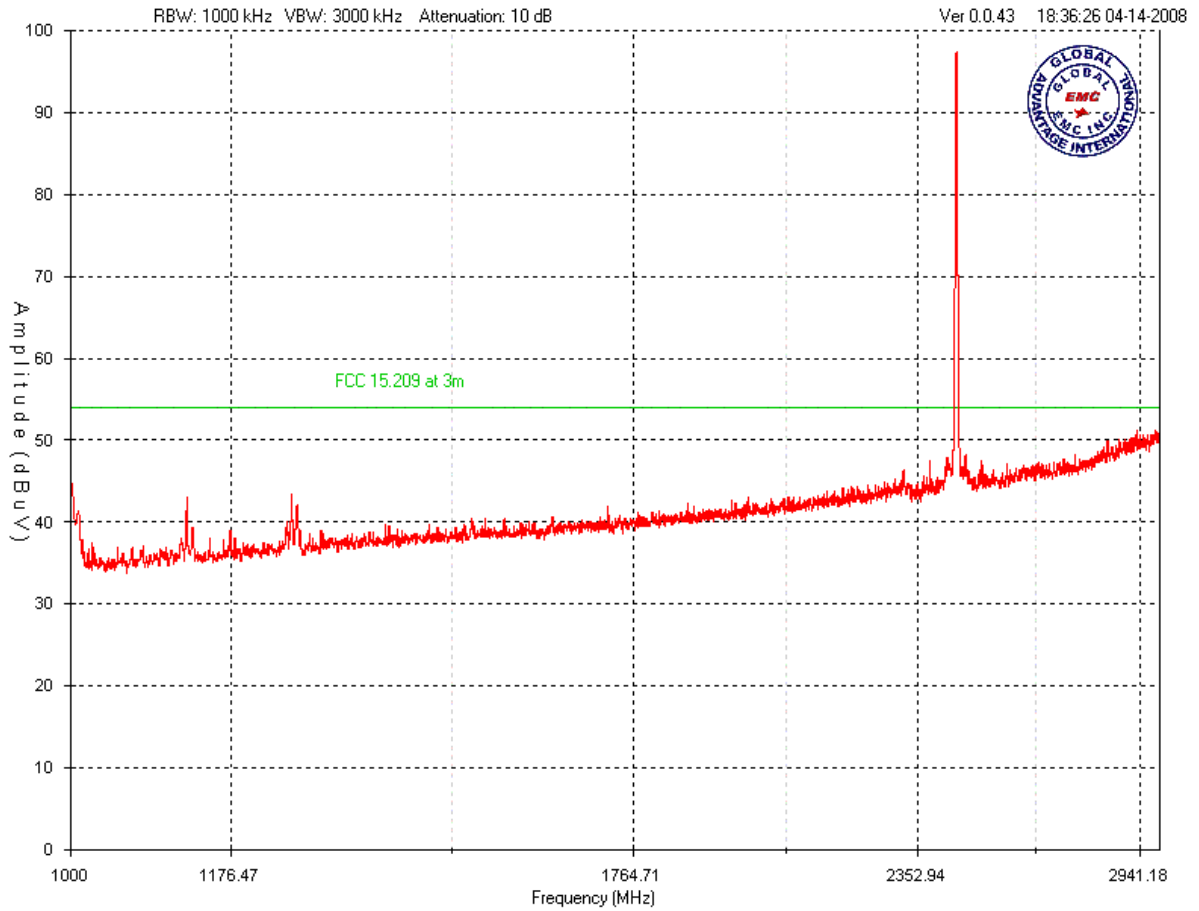


Low Channel – With cable 1 – 3GHz
Horizontal – Peak Emissions Graph



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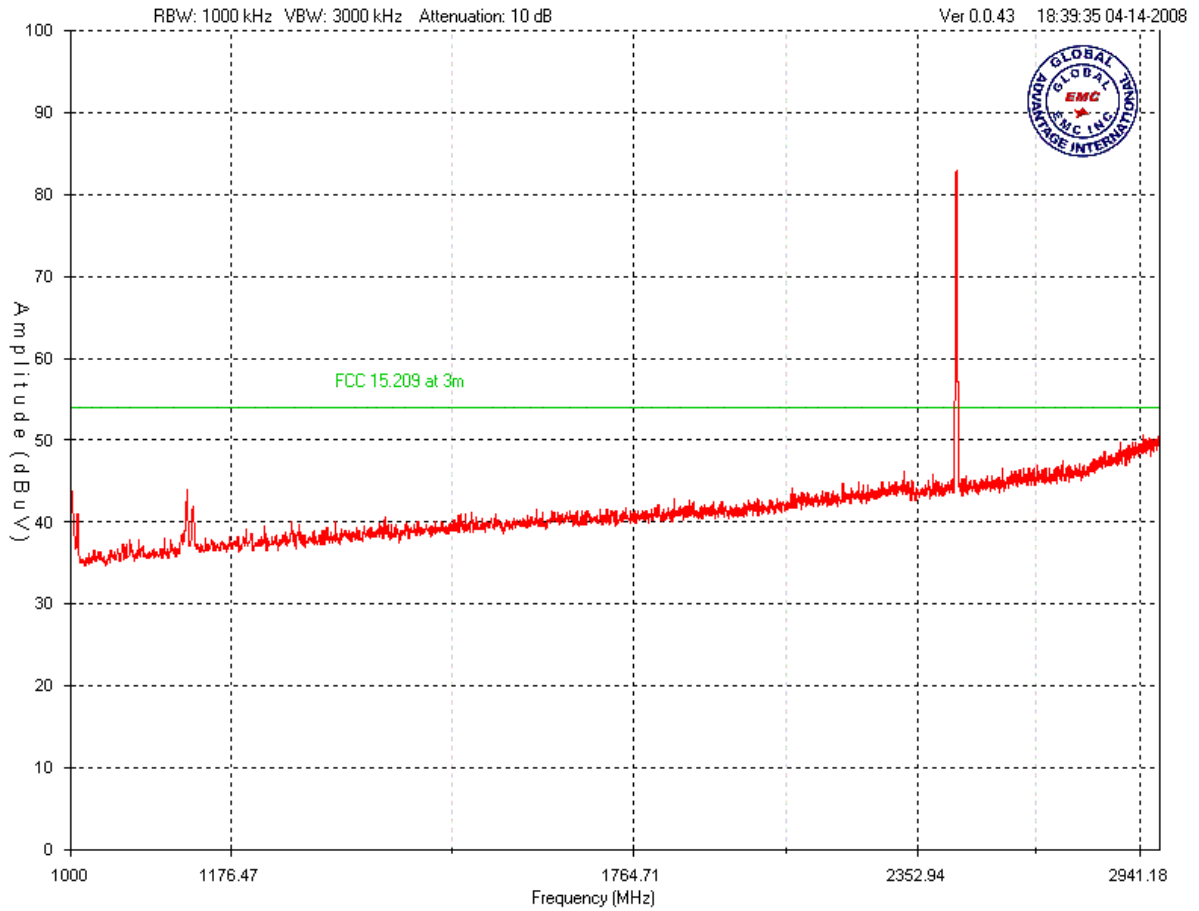
Mid Channel – With cable 1 – 3GHz
Vertical – Peak Emissions Graph



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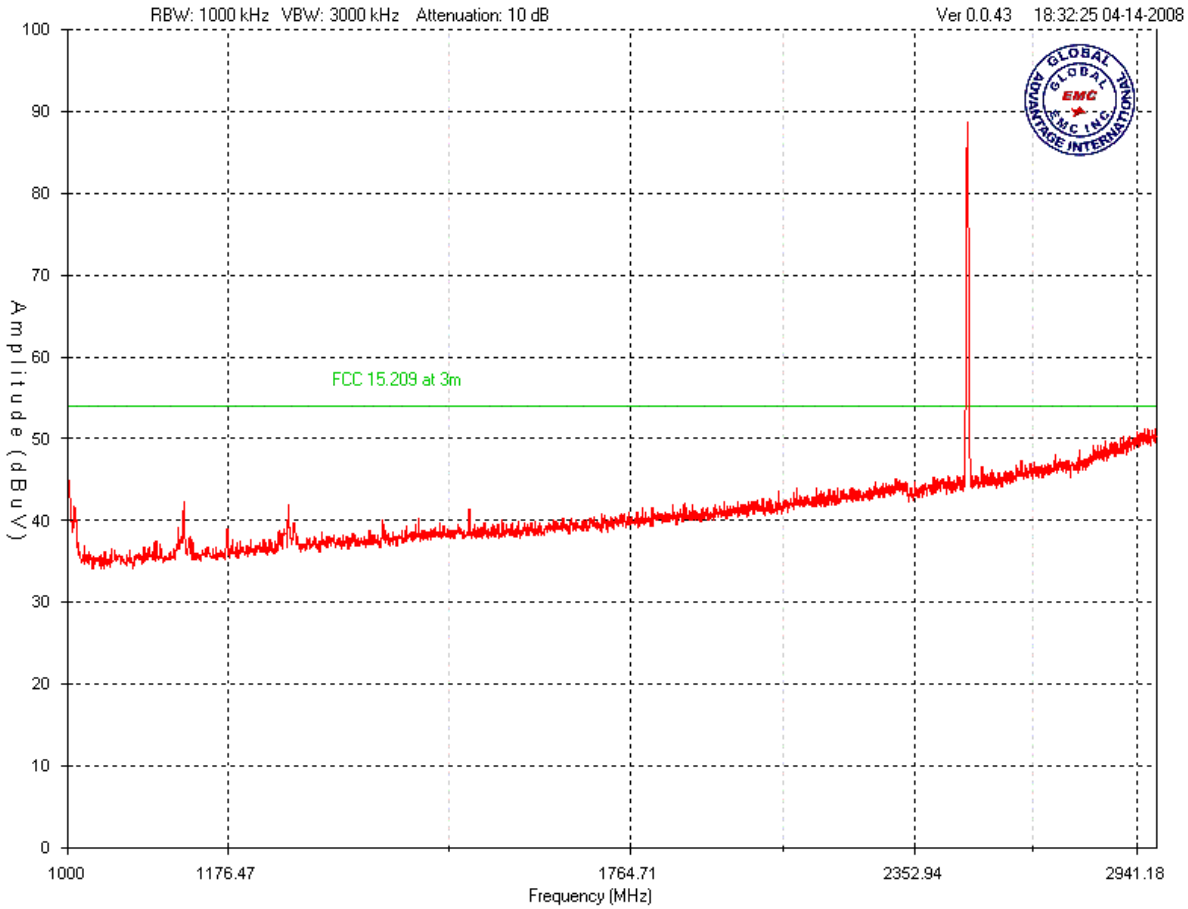
Mid Channel – With cable 1 – 3GHz
Horizontal – Peak Emissions Graph



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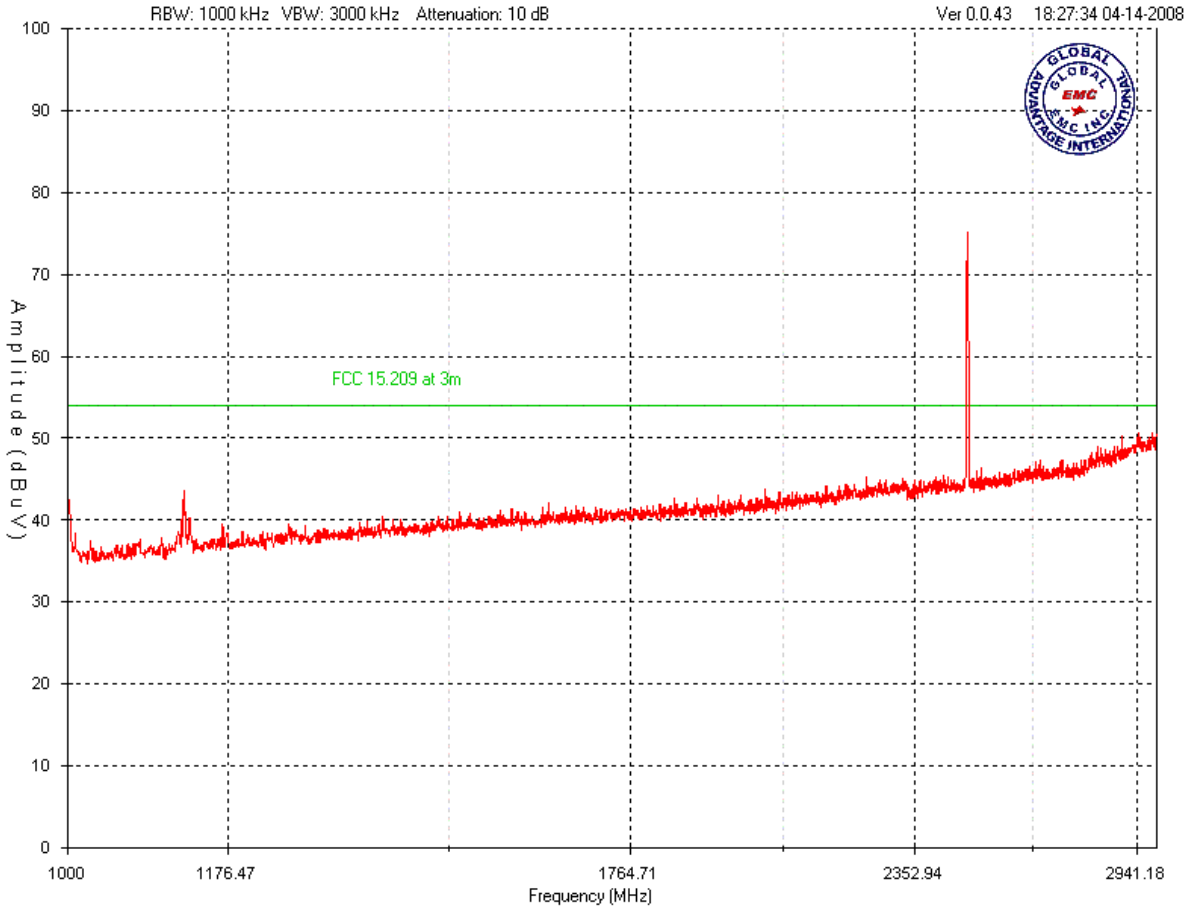
Hi Channel – With cable 1 – 3GHz
 Vertical – Peak Emissions Graph




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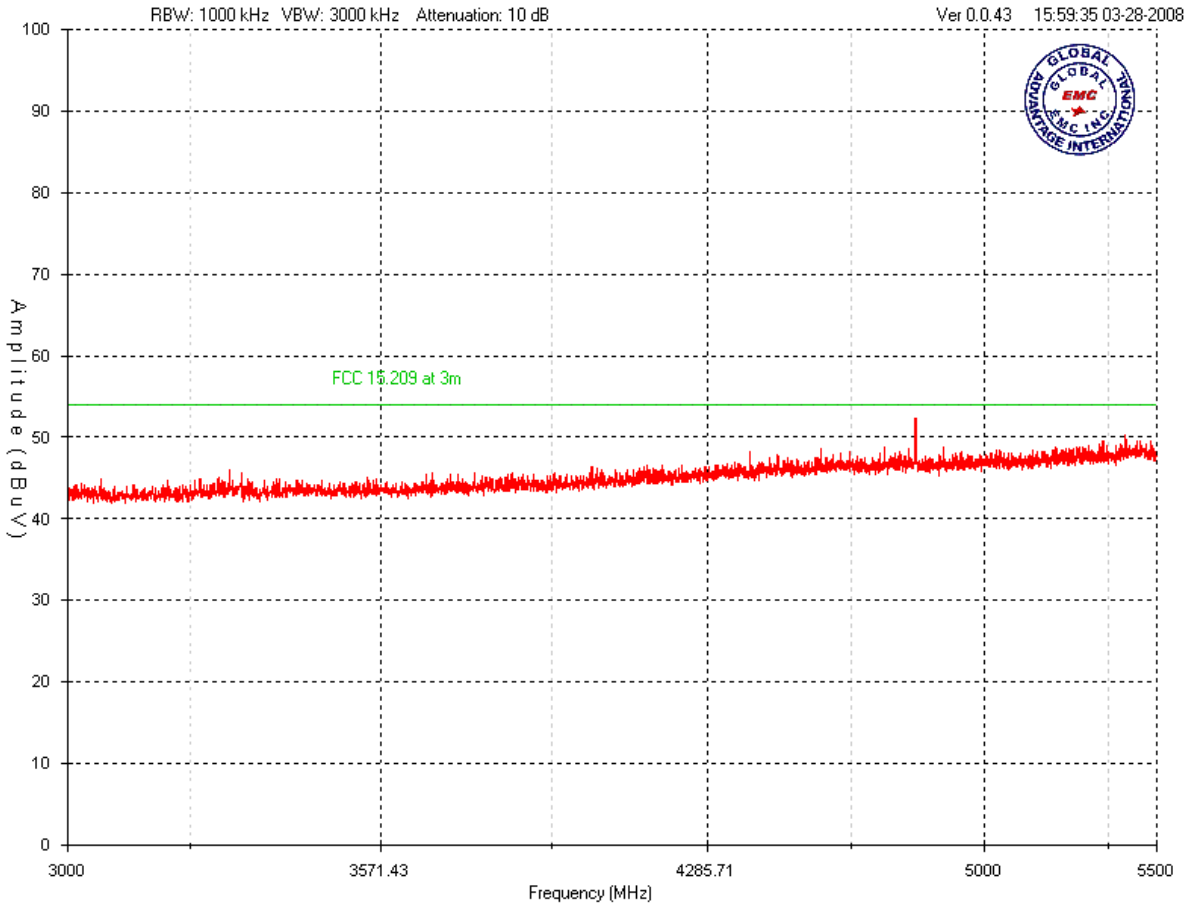


Hi Channel – With cable 1 – 3GHz
Horizontal – Peak Emissions Graph



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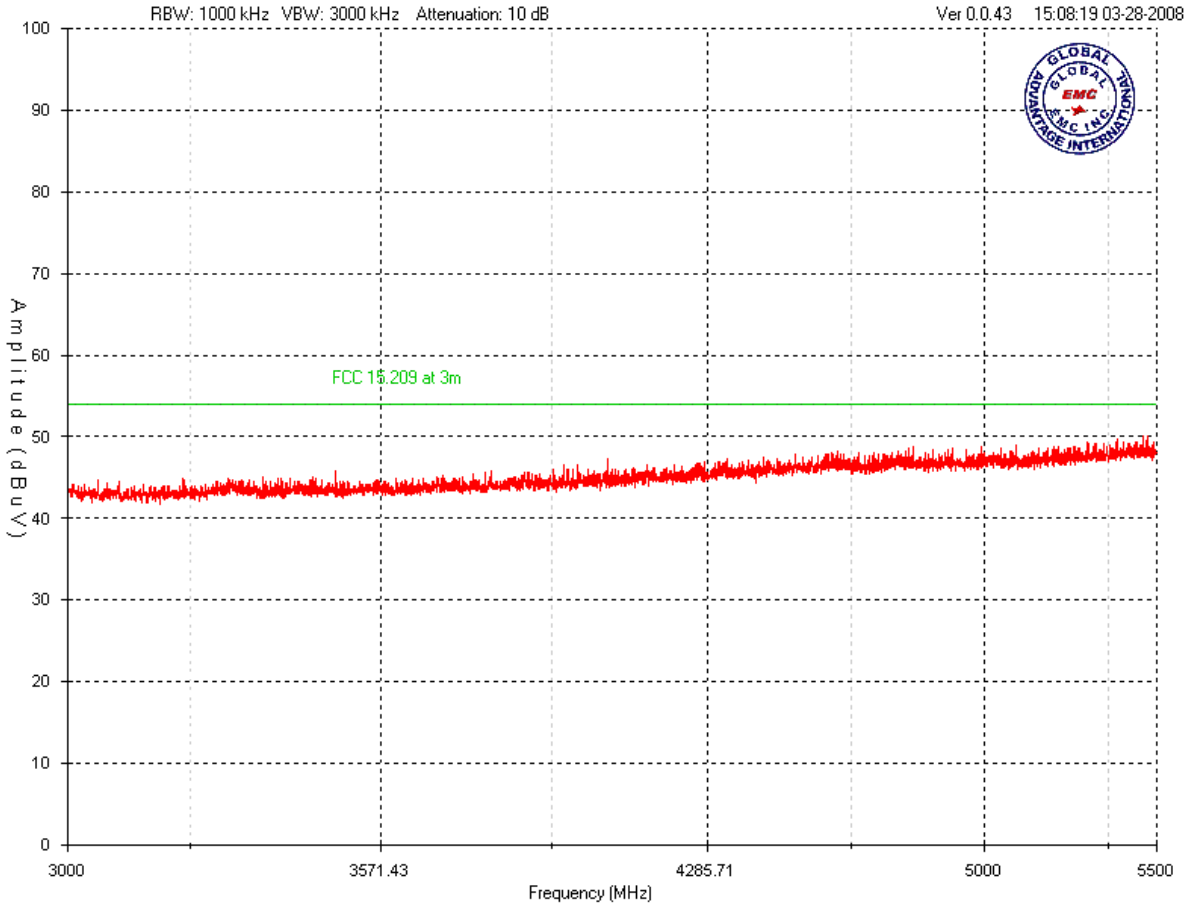
Lo Channel – Without cable 3 – 5.5 GHz
 Vertical – Peak Emissions Graph



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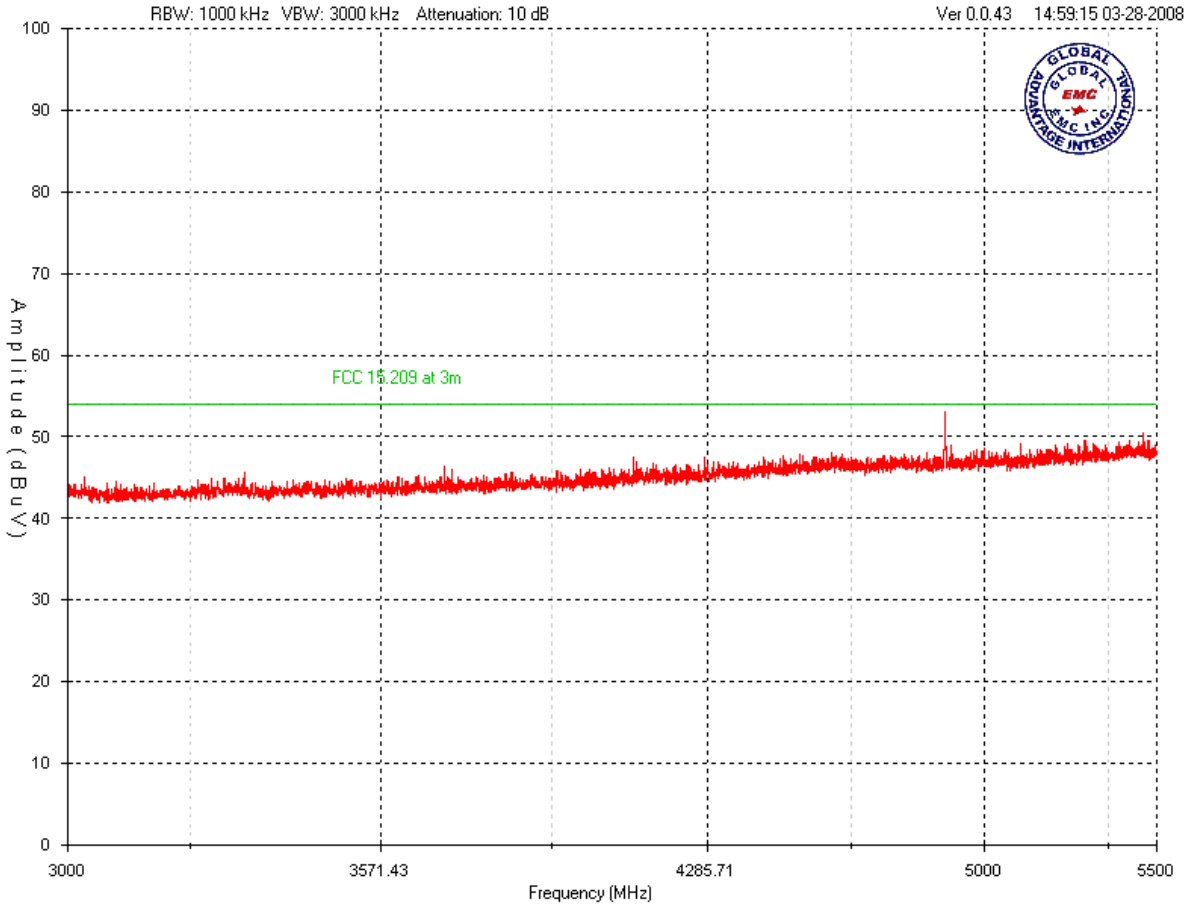
Lo Channel – Without cable 3 – 5.5 GHz
Horizontal – Peak Emissions Graph



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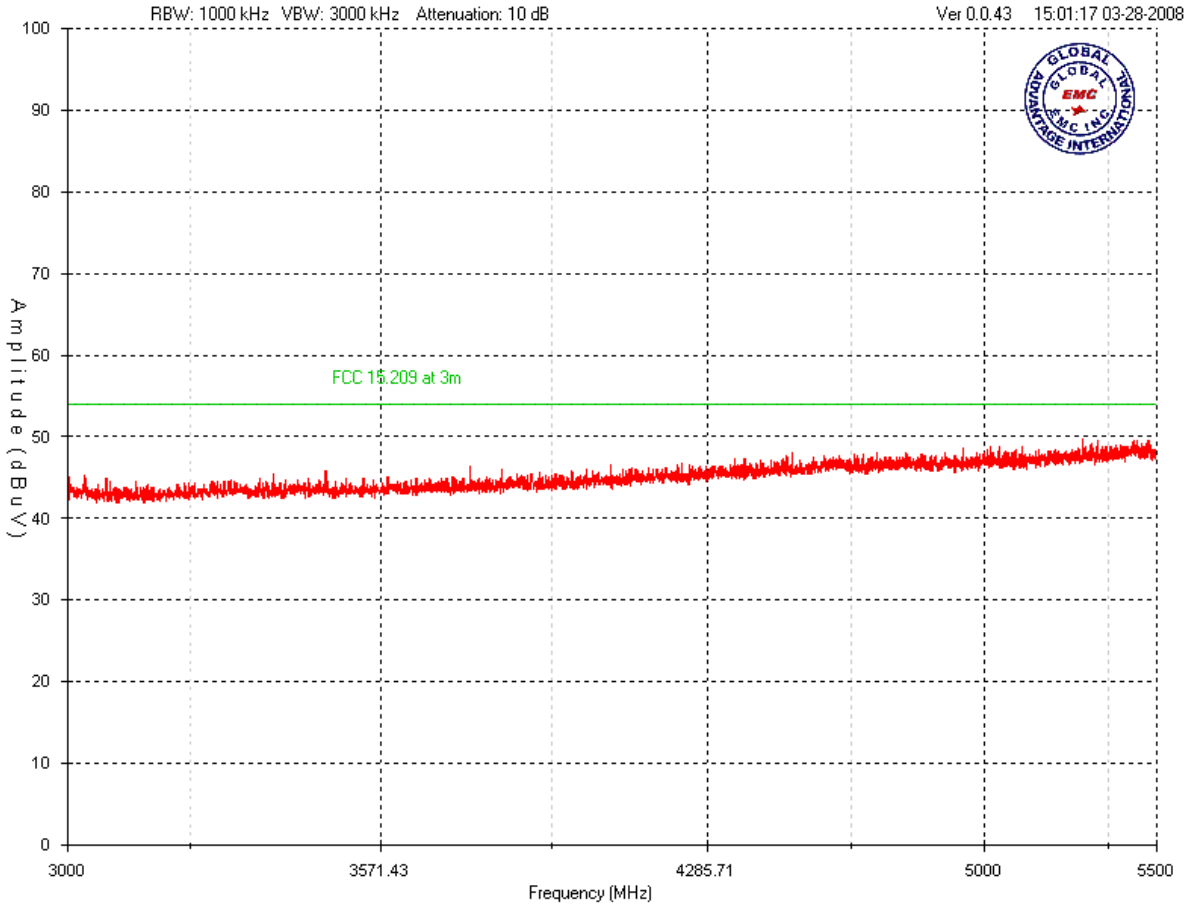
Mid Channel – Without cable 3 – 5.5 GHz
Vertical – Peak Emissions Graph



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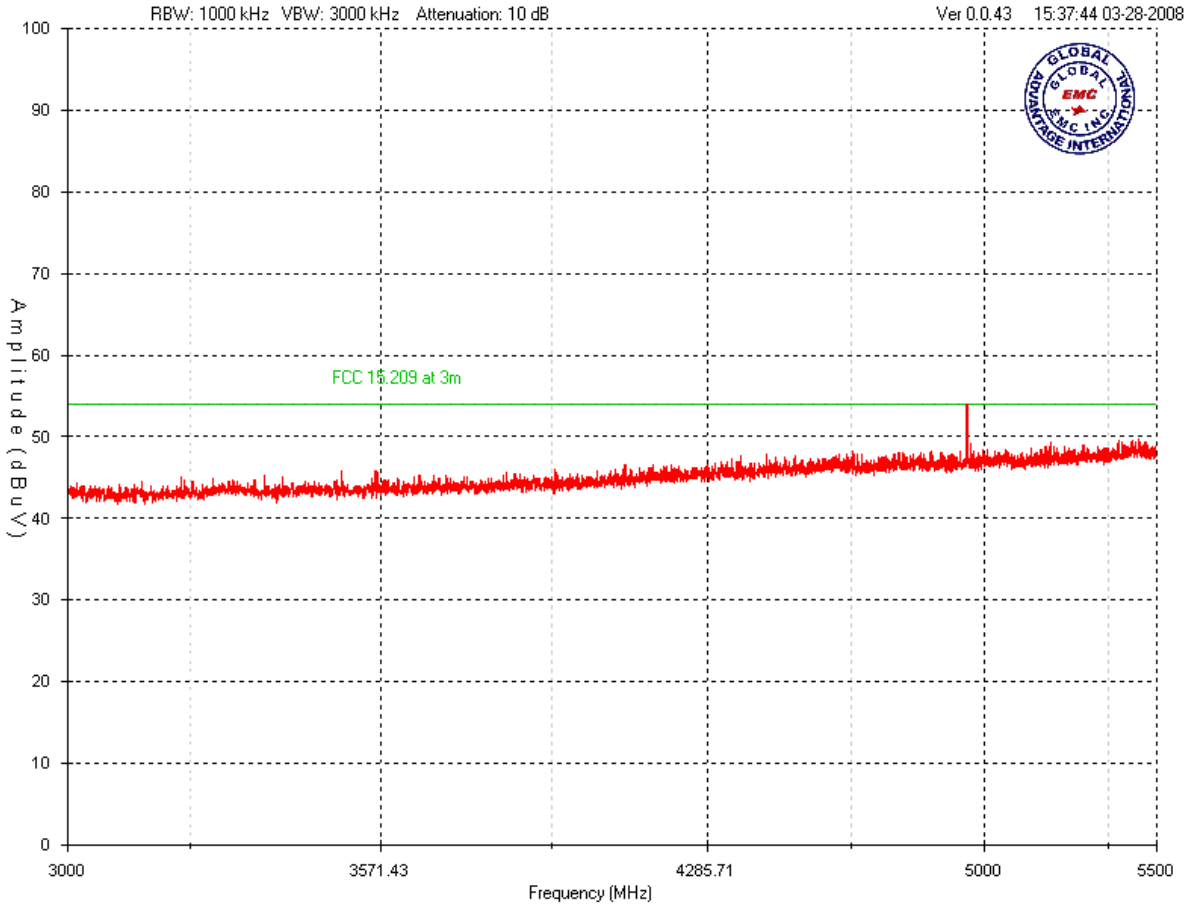
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Horizontal – Peak Emissions Graph




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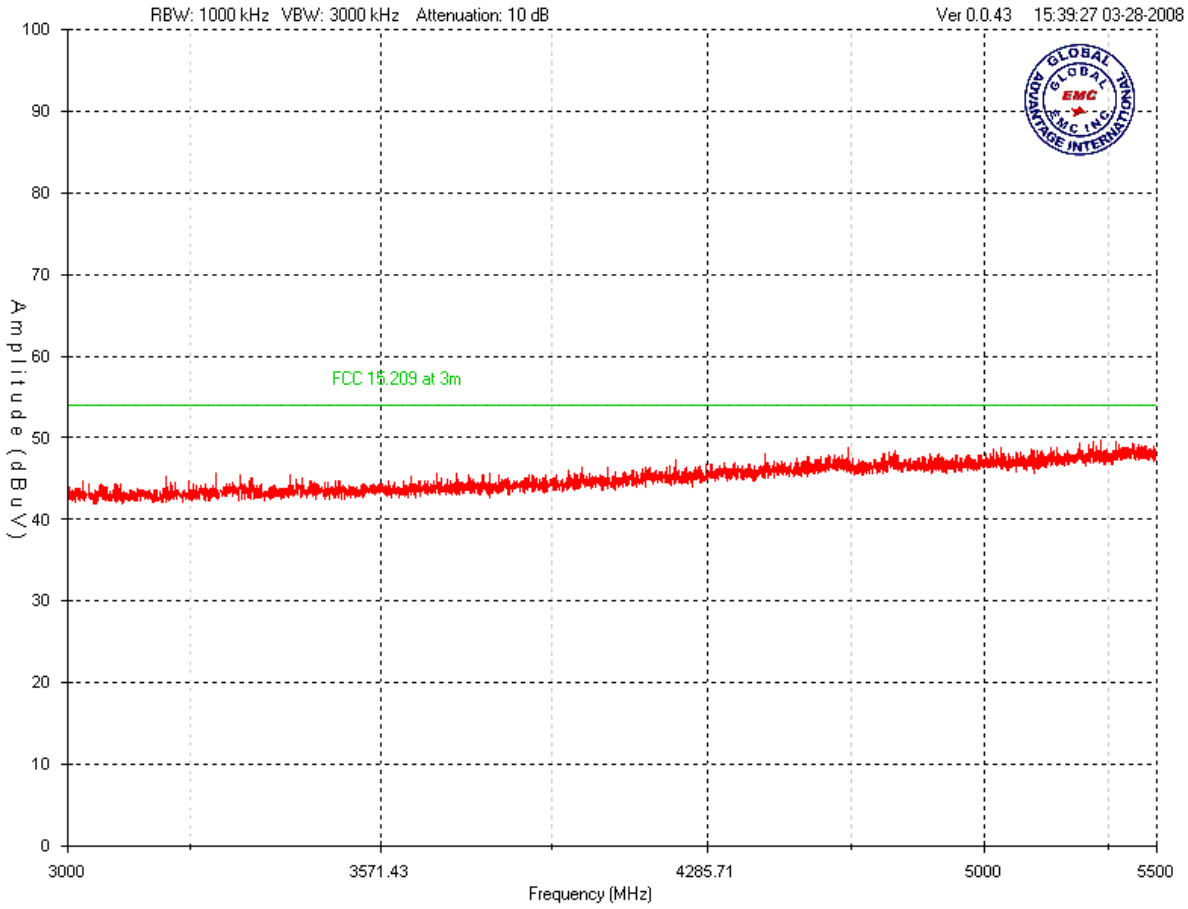


Hi Channel – Without cable 3 – 5.5 GHz
Vertical – Peak Emissions Graph



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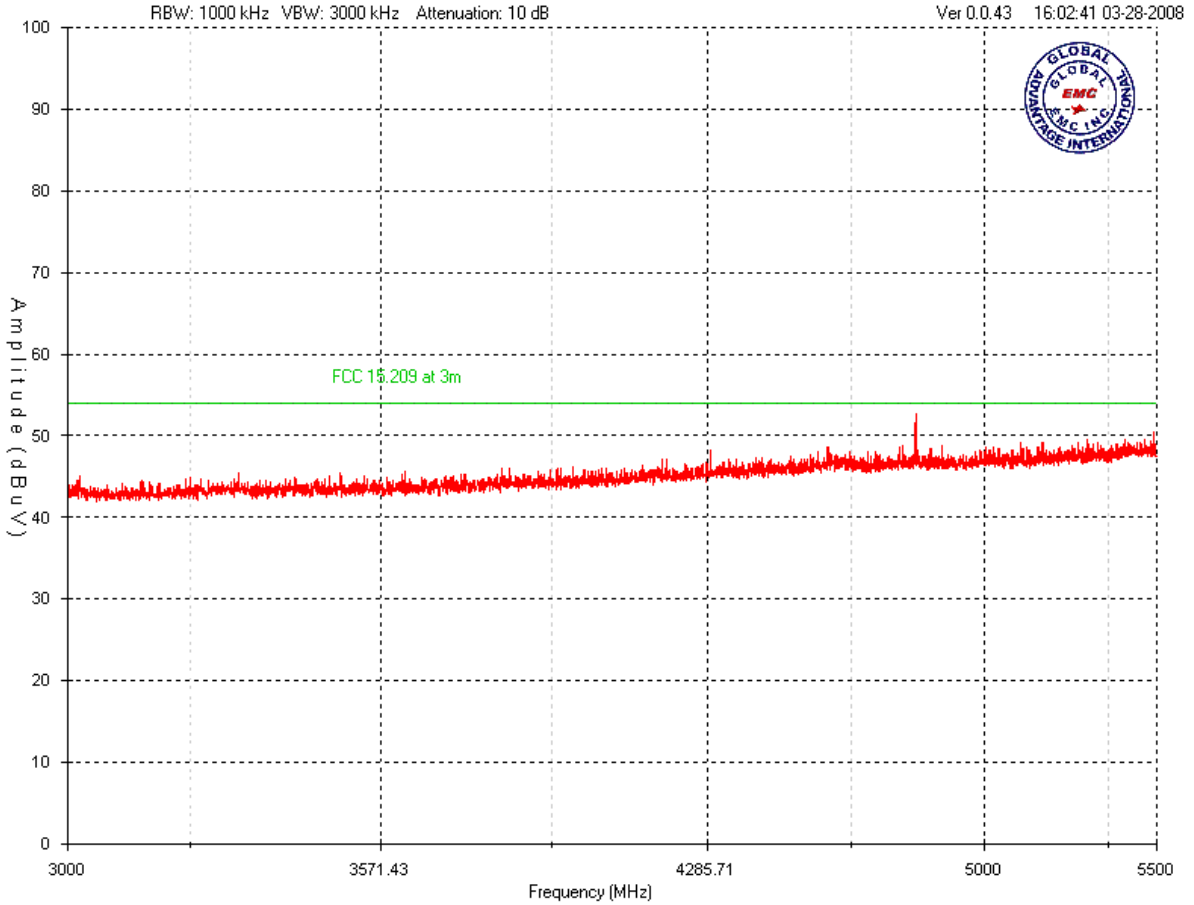
Hi Channel – Without cable 3 – 5.5 GHz
Horizontal – Peak Emissions Graph



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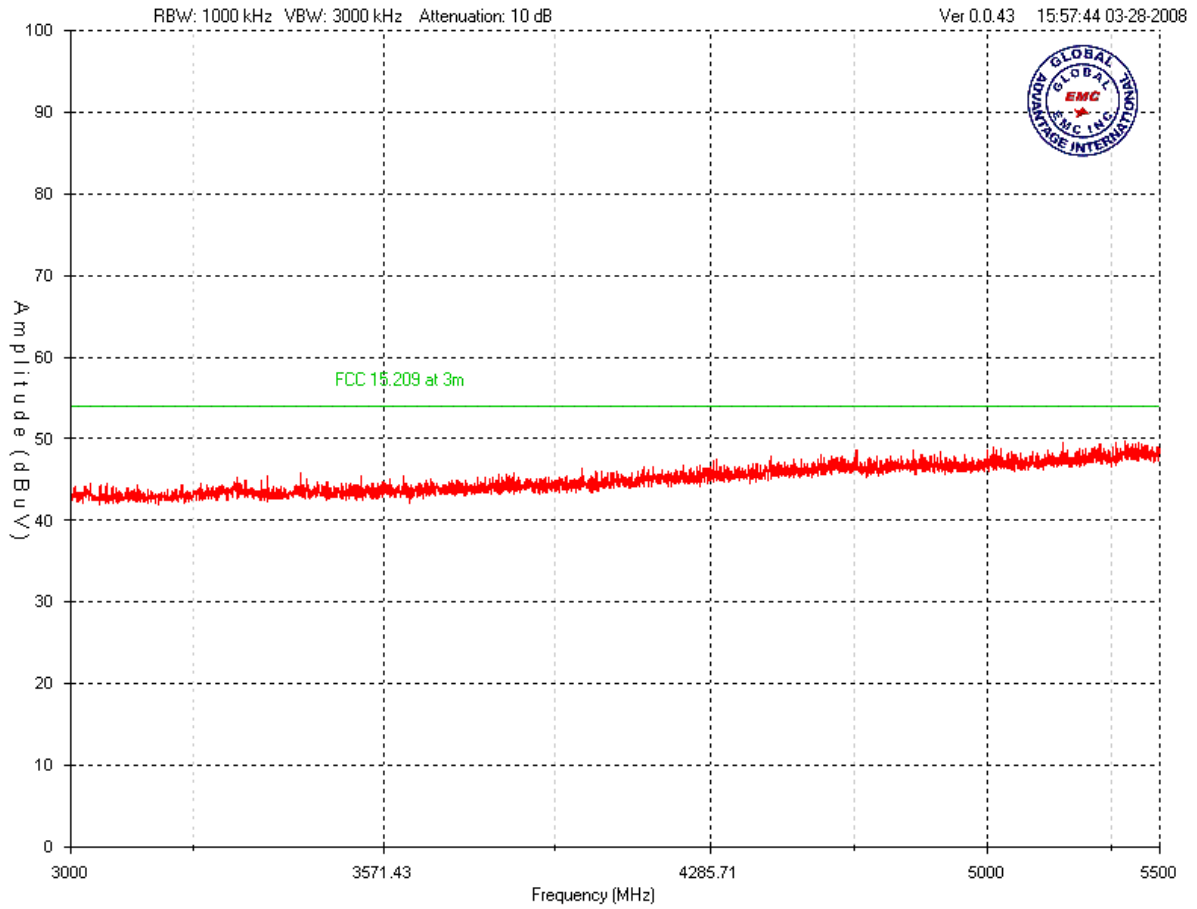
Lo Channel – With cable 3 – 5.5 GHz
Vertical – Peak Emissions Graph




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Product	VWG 40
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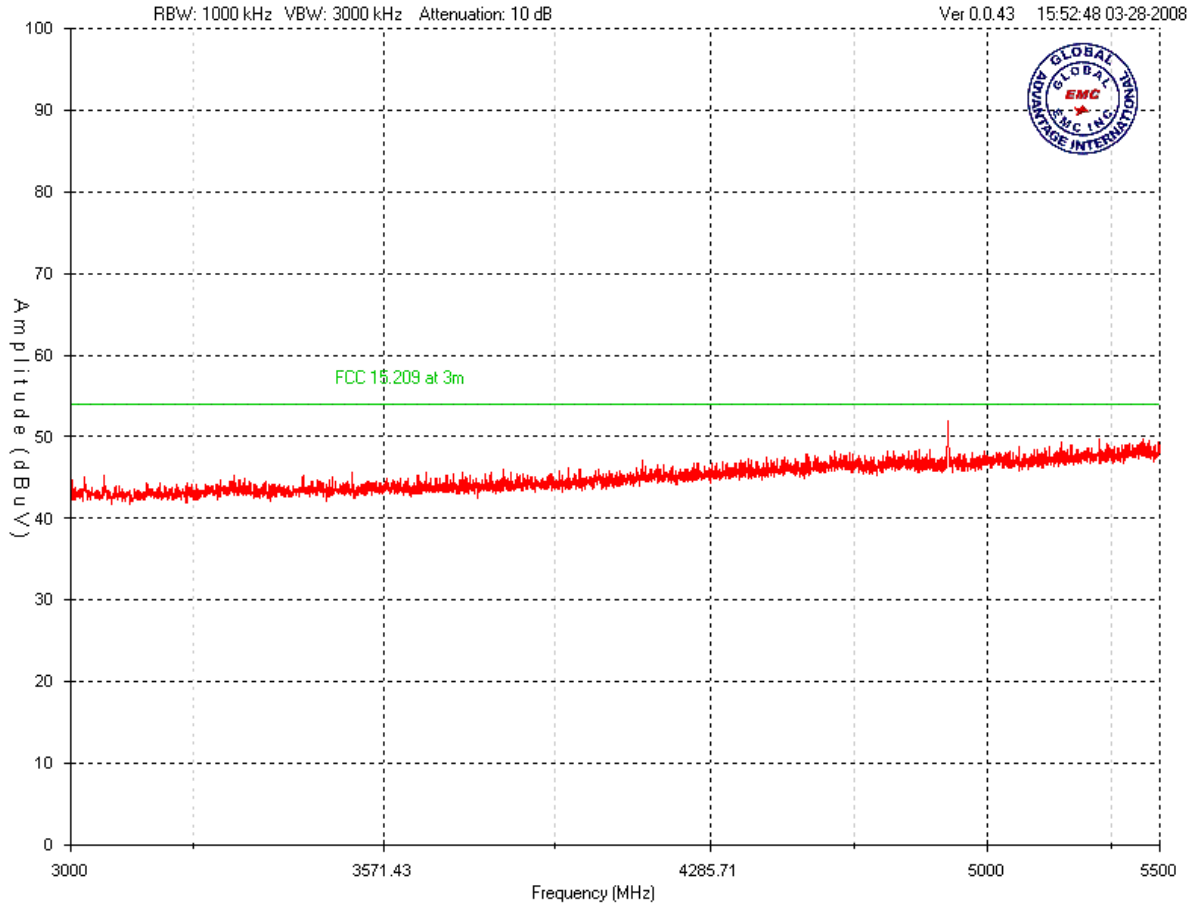


Lo Channel – With cable 3 – 5.5 GHz
Horizontal – Peak Emissions Graph



Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

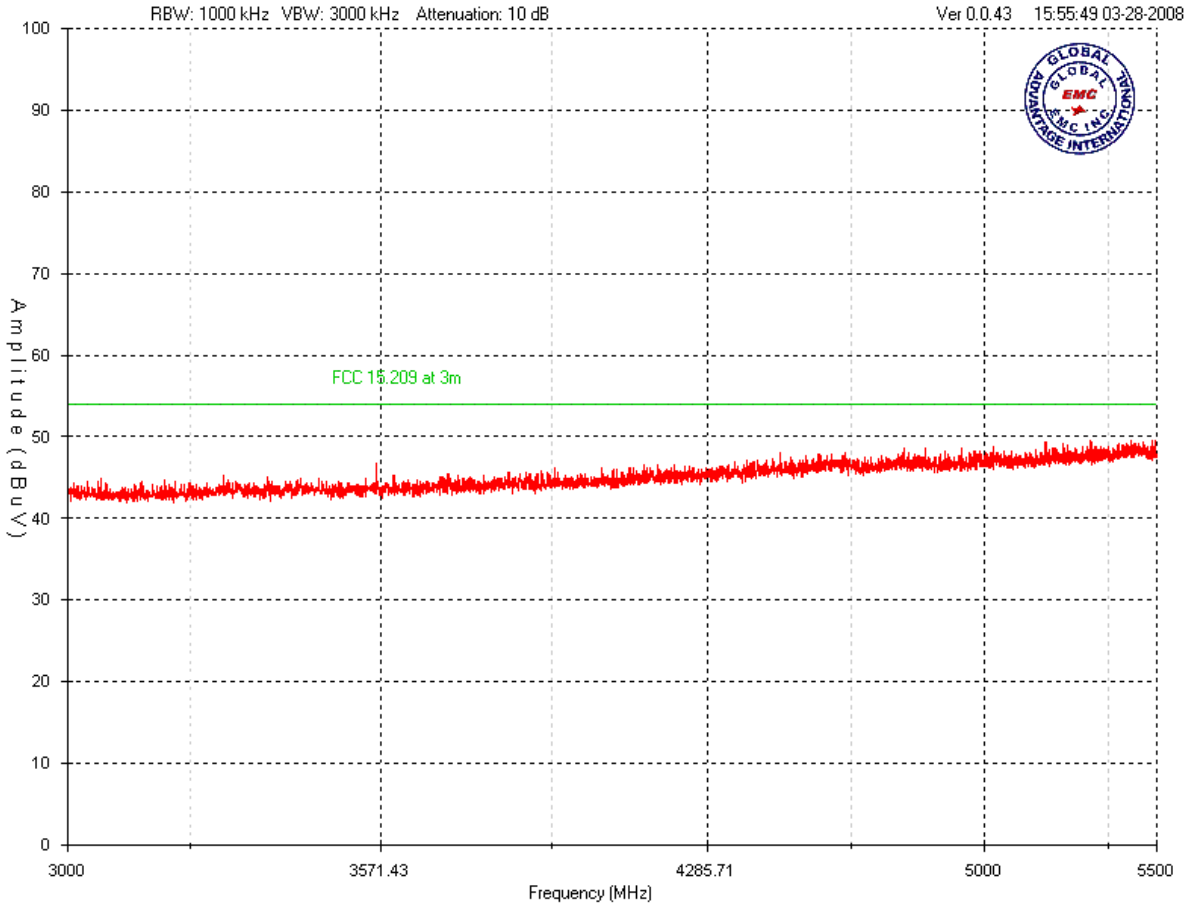
Mid Channel – With cable 3 – 5.5 GHz
Vertical – Peak Emissions Graph



Client	Viconics
Product	VWG 40
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006



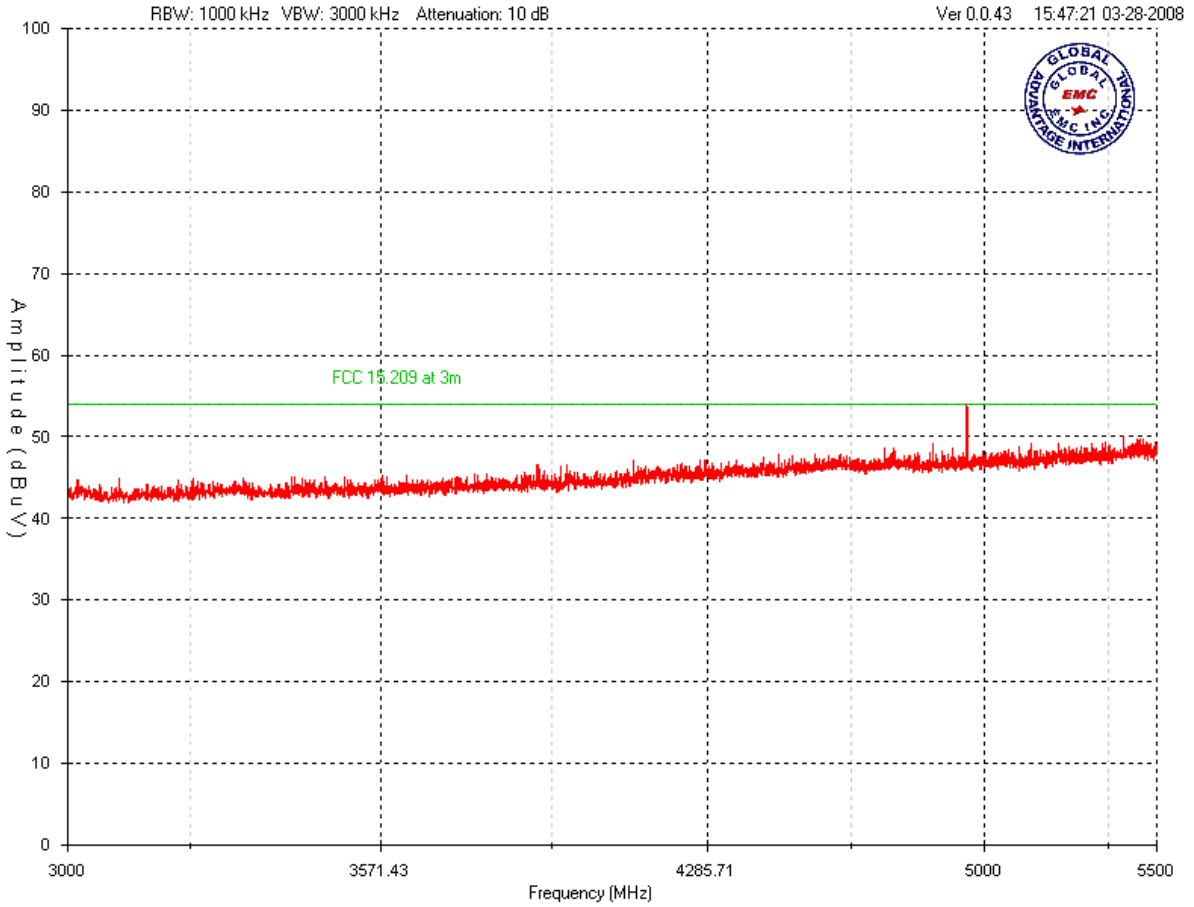
Mid Channel – With cable 3 – 5.5 GHz
Horizontal – Peak Emissions Graph



Client	Viconics
Product	VWG 40
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006



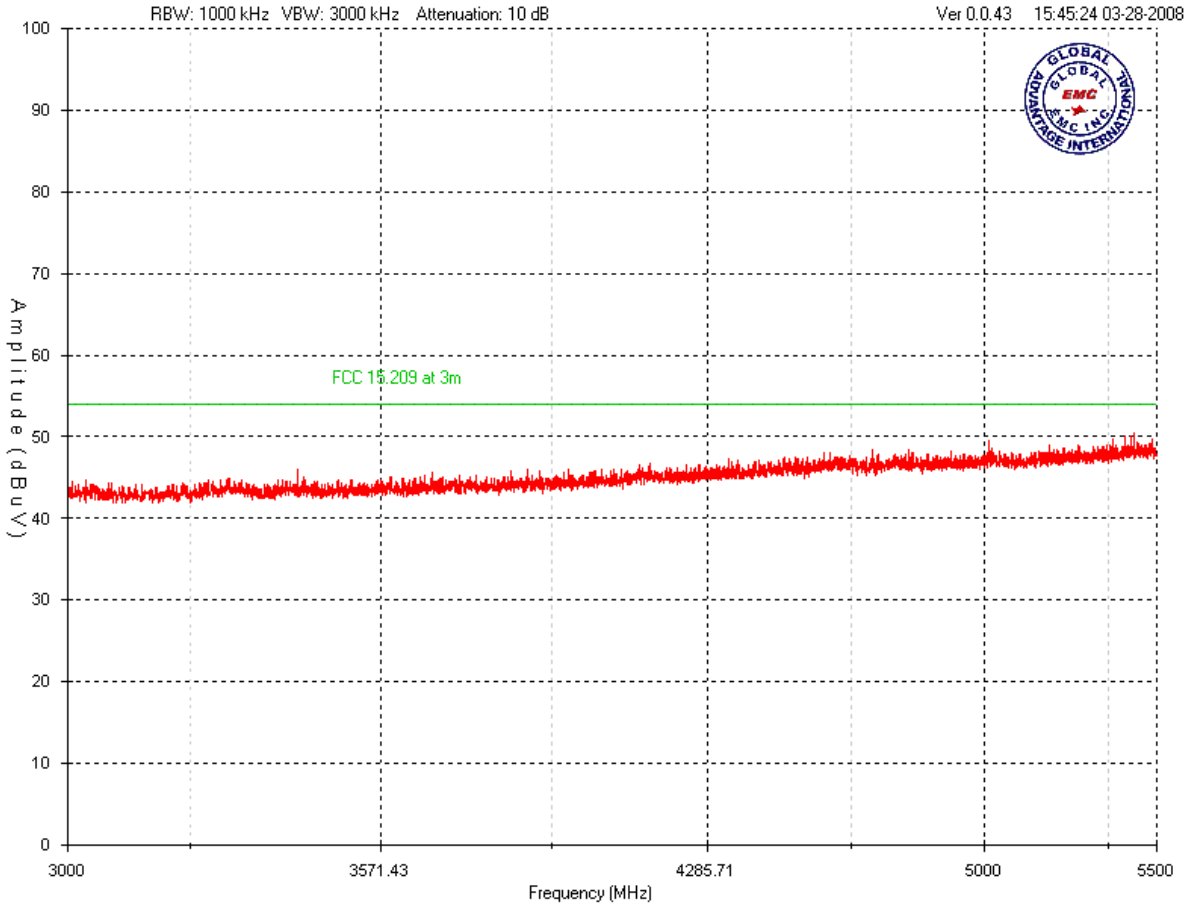
Hi Channel – With cable 3 – 5.5 GHz
 Vertical – Peak Emissions Graph




Client	Viconics
Product	VWG 40
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006

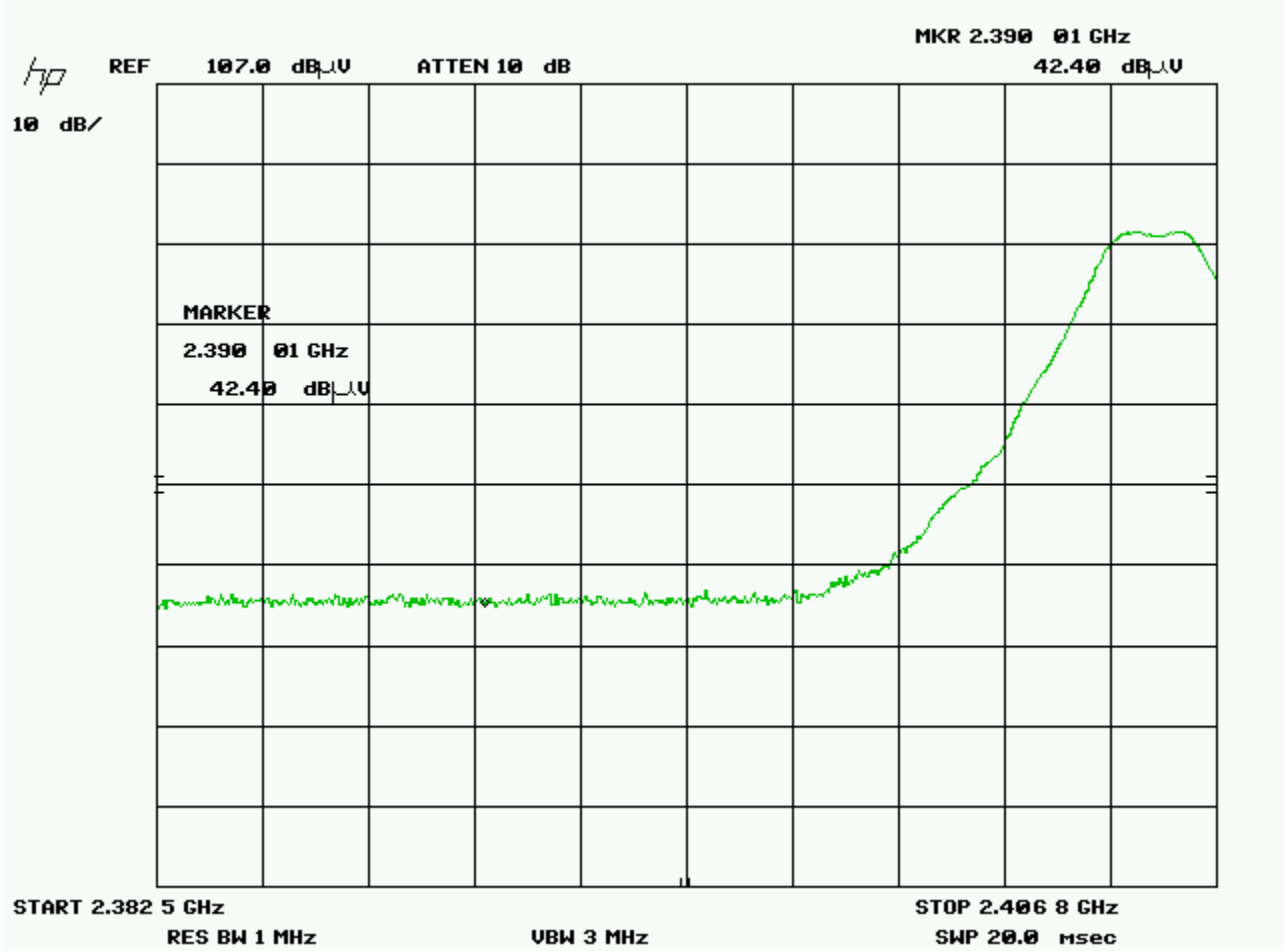



Hi Channel – With cable 3 – 5.5 GHz Horizontal – Peak Emissions Graph



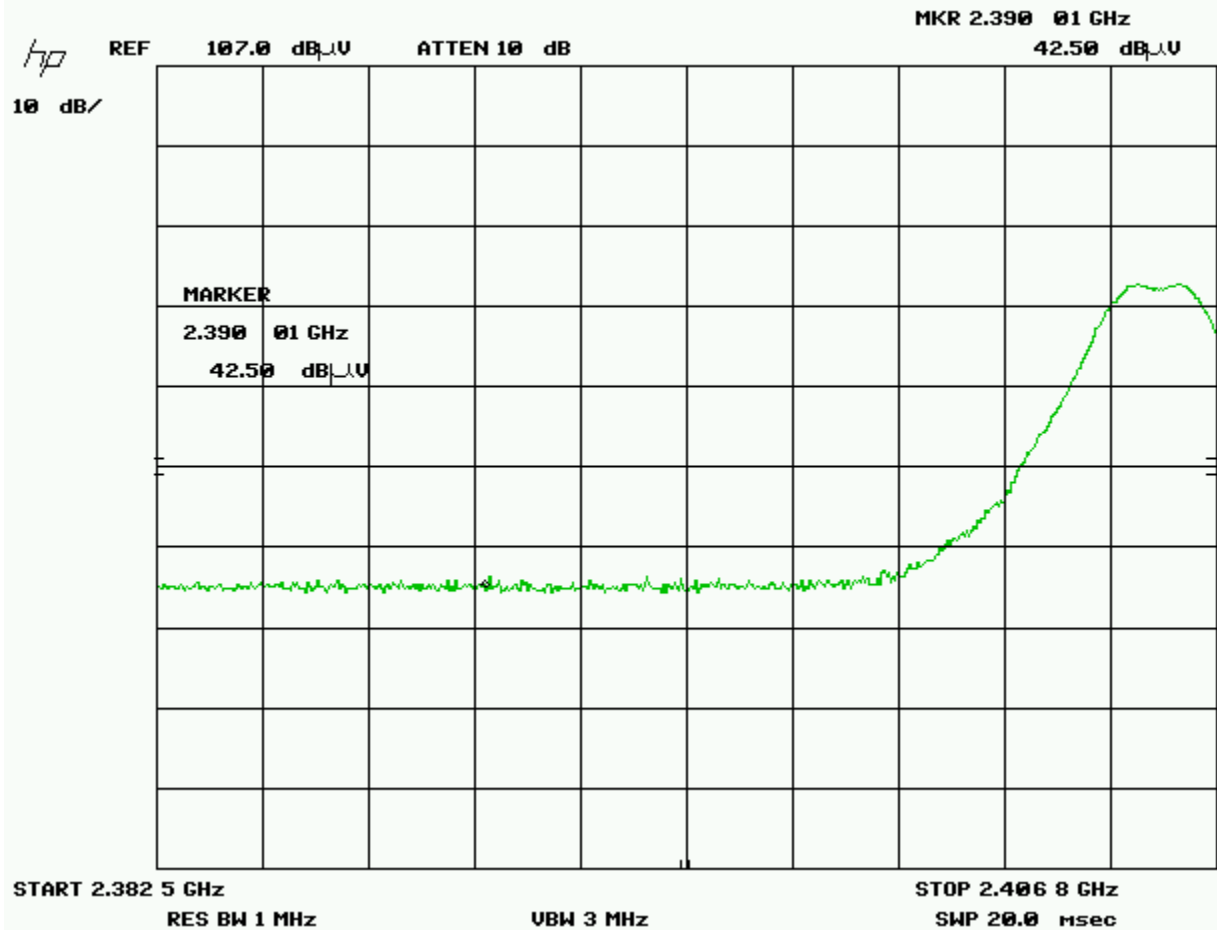
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


Band Edge – Low channel
Vertical peak emissions



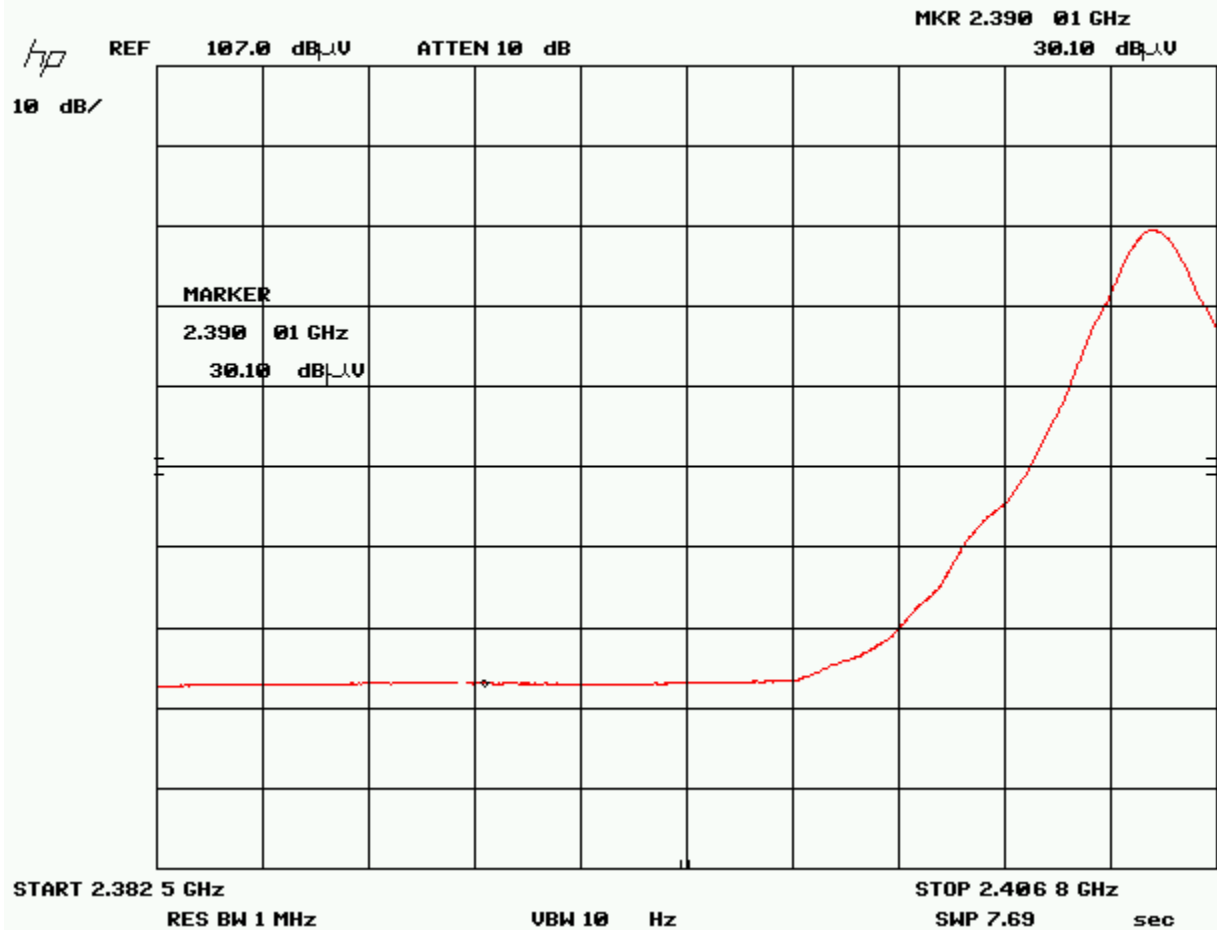
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


Band Edge – Low channel
Horizontal peak emissions



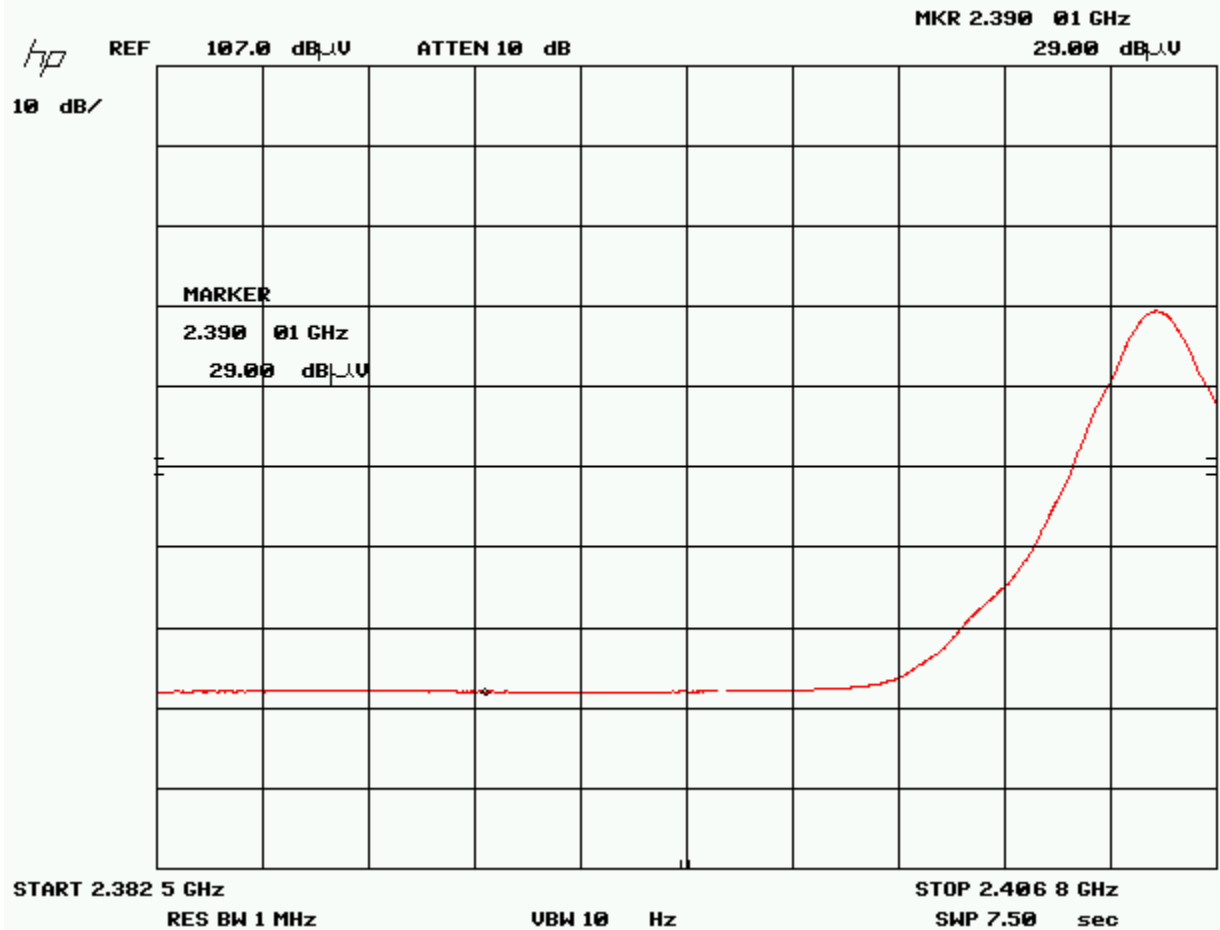
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


Band Edge – Low channel
Vertical Average emissions



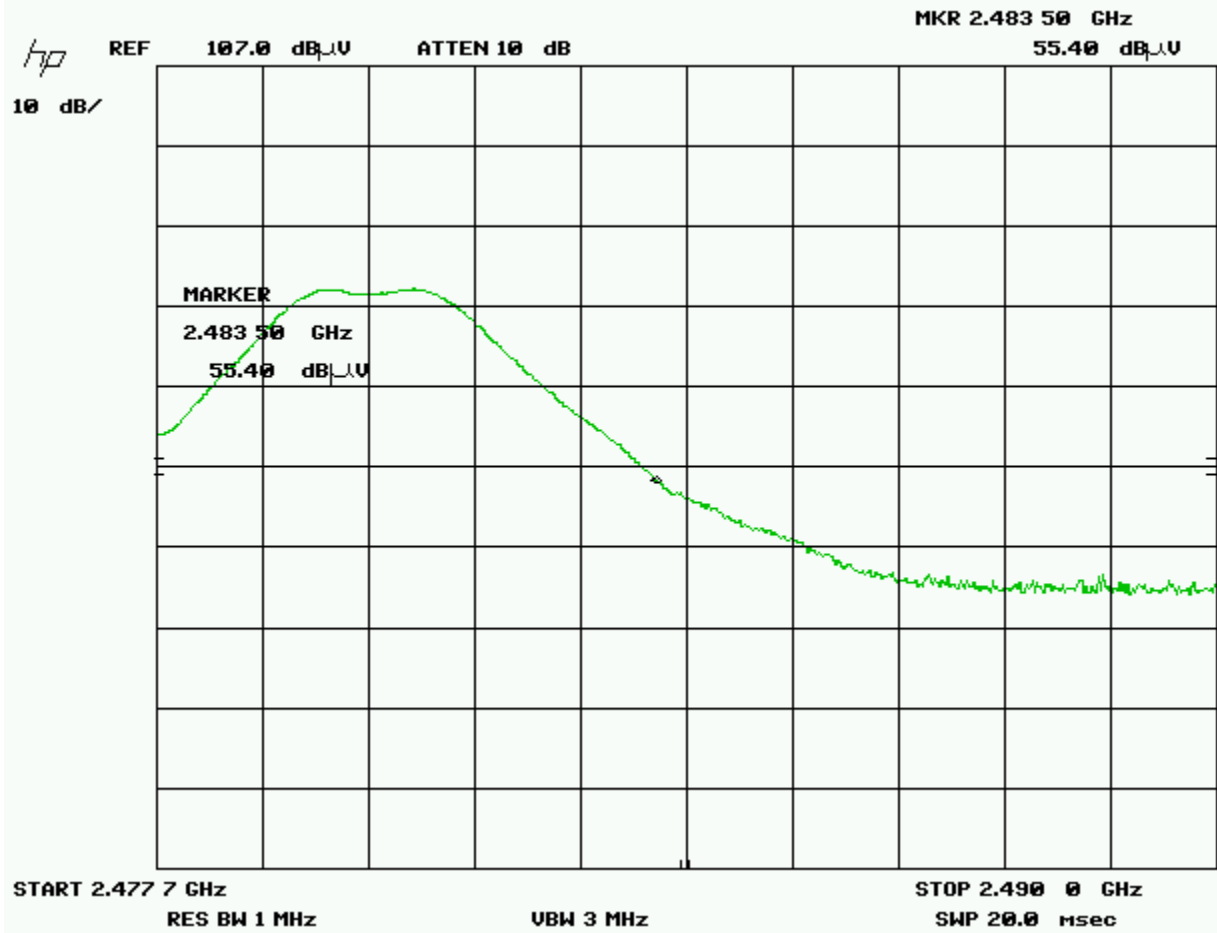
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


Band Edge – Low channel
Horizontal Average emissions



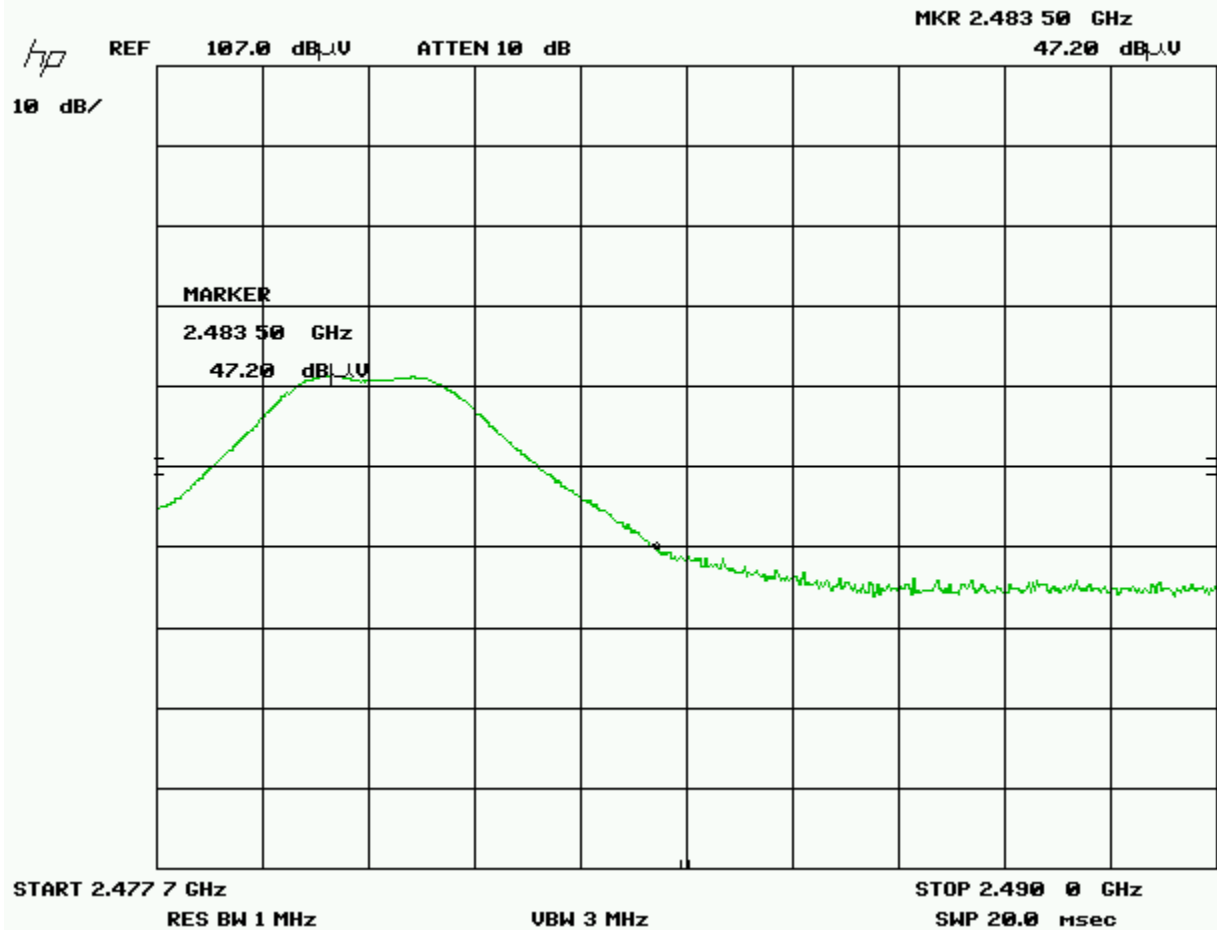
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


Band Edge – Hi channel
Vertical peak emissions



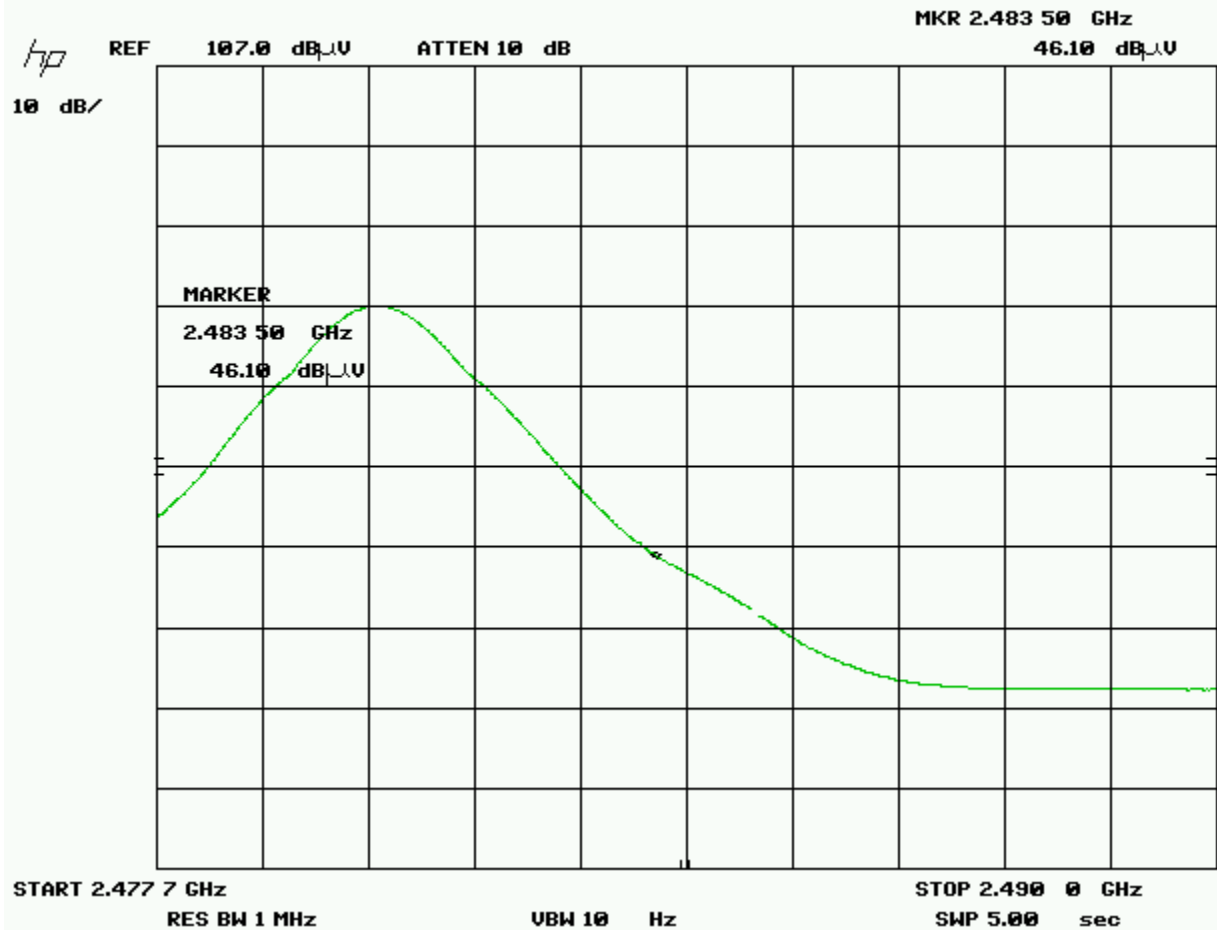
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


Band Edge – Hi channel
Horizontal peak emissions



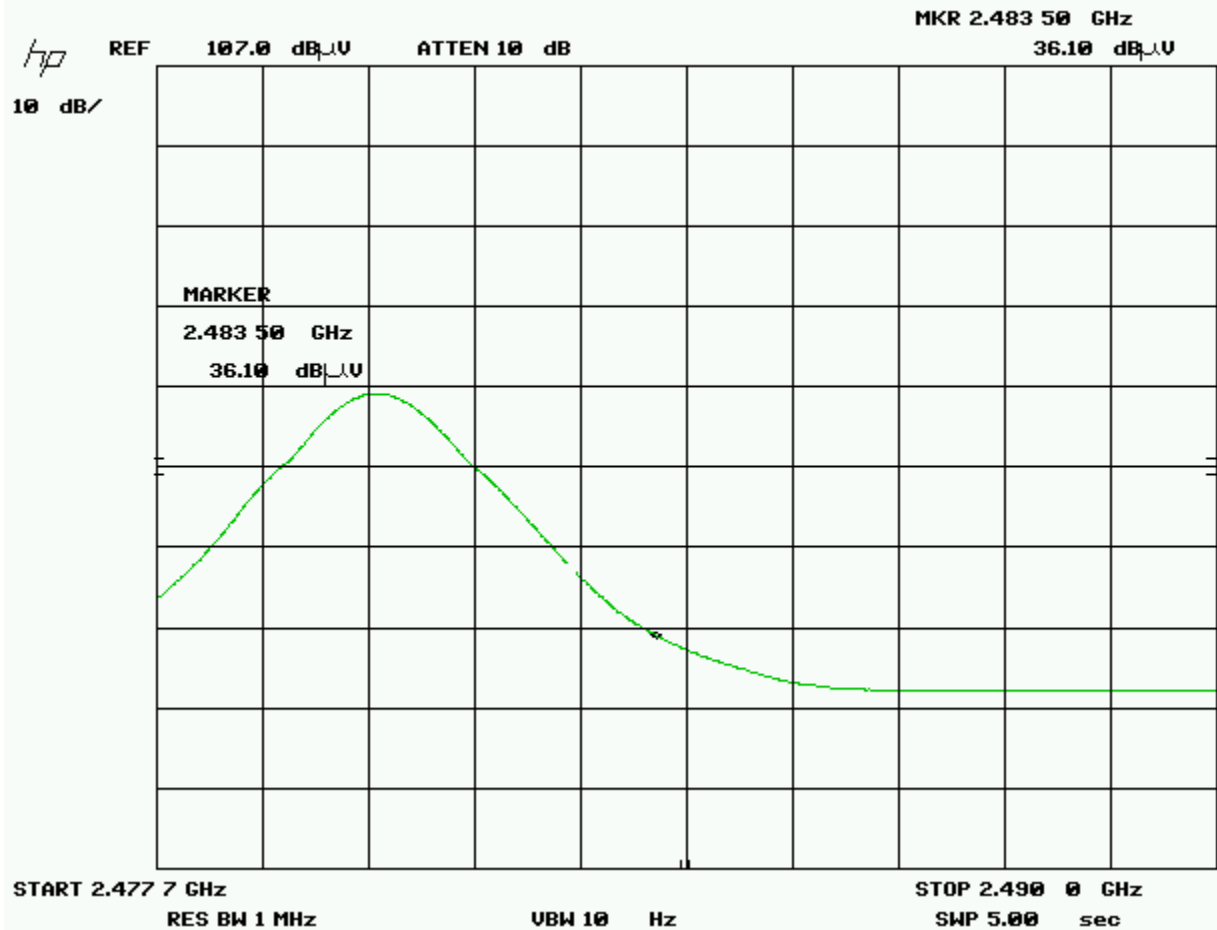
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Band Edge – Hi channel
Vertical Average emissions




Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Band Edge – Hi channel
Horizontal Average emissions



Note: For Band edge the readings were higher without the cable connected and hence plots for those setups are shown above.

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

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 requirement of -20dBc is verified by the conducted method, please see ‘Spurious Antenna Conducted Emissions’ section of this report.

Some of the frequencies shown on the peak graph do 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 99.7 dBuV/m at 3 meters, and none of the unintentional radiated emissions that fall outside of the restricted bands exceeded the -20dBc (or 79.7dBuV/m) requirement.


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

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


Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Radiated Emissions Measurements


Product category		FCC 15.247 Spurious Radiated Emissions									
Project Name / Number		Jene									
Test Frequency (MHz)	Detection mode (Q-Peak)	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 - without Cable											
2405	Peak	Vert	88.6	31.5	2.4	10.0	36.8	95.7			
2405	Avg	Vert	86.5	31.5	2.4	10.0	36.8	93.6			
2390	Peak	Vert	42.4	31.5	2.4	10.0	36.8	49.5	74.0	24.5	PASS
2390	Avg	Vert	30.1	31.5	2.4	10.0	36.8	37.2	54.0	16.8	PASS
2405	Peak	Horz	79.7	31.6	2.4	10.0	36.8	86.9			
2405	Avg	Horz	76.4	31.6	2.4	10.0	36.8	83.6			
2390	Peak	Horz	42.5	31.6	2.4	10.0	36.8	49.7	74.0	24.3	PASS
2390	Avg	Horz	29.0	31.6	2.4	10.0	36.8	36.2	54.0	17.8	PASS
Hi Channel - without Cable											

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


2480	Peak	Horz	69.0	31.6	2.4	10.0	36.8	76.2			
2480	Avg	Horz	66.2	31.6	2.4	10.0	36.8	73.4			
2483.5	Peak	Horz	47.2	31.6	2.4	10.0	36.8	54.4	74.0	19.6	PASS
2483.5	Avg	Horz	36.1	31.6	2.4	10.0	36.8	43.3	54.0	10.7	PASS
2480	Peak	Vert	79.6	31.5	2.4	10.0	36.8	86.7			
2480	Avg	Vert	76.5	31.5	2.4	10.0	36.8	83.6			
2483.5	Peak	Vert	55.4	31.5	2.4	10.0	36.8	62.5	74.0	11.5	PASS
2483.5	Avg	Vert	46.1	31.5	2.4	10.0	36.8	53.1	54.0	0.9	PASS
Mid Channel - Without Cable											
2444	Peak	Horz	84.8	31.6	0.0	10.0	36.8	89.6			
2445	Avg	Horz	82.0	31.6	2.4	10.0	36.8	89.2			
2445	Peak	Vert	92.6	31.5	2.4	10.0	36.8	99.7			
2445	Avg	Vert	84.0	31.5	2.4	10.0	36.8	91.1			
Hi Channel - With Cable (Note: Margins with cable are better as it adds losses)											
2480	Peak	Horz	67.1	31.6	2.4	10.0	36.8	74.3			
2480	Avg	Horz	64.8	31.6	2.4	10.0	36.8	72.0			
2483.5	Peak	Horz	45.9	31.6	2.4	10.0	36.8	53.1	74.0	20.9	PASS
2483.5	Avg	Horz	35.5	31.6	2.4	10.0	36.8	42.7	54.0	11.3	PASS
2480	Peak	Vert	77.4	31.5	2.4	10.0	36.8	84.5			
2480	Avg	Vert	75.2	31.5	2.4	10.0	36.8	82.3			

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


2483.5	Peak	Vert	53.8	31.5	2.4	10.0	36.8	60.9	74.0	13.1	PASS
2483.5	Avg	Vert	44.4	31.5	2.4	10.0	36.8	51.5	54.0	2.5	PASS
4890	Peak	Vert	51.2	33.0	4.0	10.0	36.0	62.2	74.0	11.8	PASS
4890	Avg	Vert	35.5	33.0	4.0	10.0	36.0	46.5	54.0	7.5	PASS
7335	Peak	Vert	51.9	37.0	5.0	10.0	35.5	68.4	74.0	5.6	PASS
7335	Avg	Vert	34.7	37.0	5.0	10.0	35.5	51.2	54.0	2.8	PASS
4810	Peak	Vert	45.3	33.0	4.0	10.0	36.0	56.3	74.0	17.7	PASS
4810	Avg	Vert	35.3	33.0	4.0	10.0	36.0	46.3	54.0	7.7	PASS
7215	Peak	Vert	51.1	37.0	5.0	10.0	35.5	67.6	74.0	6.4	PASS
7215	Avg	Vert	34.1	37.0	5.0	10.0	35.5	50.6	54.0	3.4	PASS
4950	Peak	Vert	50.5	37.0	5.0	10.0	35.5	67.0	74.0	7.0	PASS
4950	Avg	Vert	36.5	37.0	5.0	10.0	35.5	53.0	54.0	1.0	PASS
7425	Peak	Vert	48.4	37.0	5.0	10.0	35.5	64.9	74.0	9.1	PASS
7425	Avg	Vert	35.1	37.0	5.0	10.0	35.5	51.6	54.0	2.4	PASS
Low channel Without Cable Spurious											
374.7	Peak	Vert	50.4	15.1	1.1	3.0	21.8	47.8	66.0	18.2	PASS
375	QP	Vert	47.1	15.1	1.1	3.0	21.8	44.5	46.0	1.5	PASS
501	Peak	Vert	45.0	18.7	1.3	3.0	21.8	46.2	66.0	19.8	PASS
500	QP	Vert	36.5	18.7	1.3	3.0	21.8	37.7	46.0	8.3	PASS
37.5	Peak	Vert	49.9	17.8	0.9	3.0	21.8	49.8	60.0	10.2	PASS

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


37.5	QP	Vert	35.4	17.8	0.9	3.0	21.8	35.3	40.0	4.7	PASS
38.25	Peak	Vert	50.4	17.8	0.9	3.0	21.8	50.3	66.0	15.7	PASS
38.25	QP	Vert	35.2	17.8	0.9	3.0	21.8	35.1	40.0	4.9	PASS
108	Peak	Vert	47.8	6.7	1.1	3.0	21.8	36.8	63.5	26.7	PASS
108	QP	Vert	32.2	6.7	1.1	3.0	21.8	21.2	43.5	22.3	PASS
Mid channel Without Cable Spurious											
374.7	Peak	Vert	49.3	15.1	1.1	3.0	21.8	46.7	66.0	19.3	PASS
375	QP	Vert	46.8	15.1	1.1	3.0	21.8	44.2	46.0	1.8	PASS
501	Peak	Vert	39.4	18.7	1.3	3.0	21.8	40.6	66.0	25.4	PASS
500	QP	Vert	36.9	18.7	1.3	3.0	21.8	38.1	46.0	7.9	PASS
37.5	Peak	Vert	49.4	17.8	0.9	3.0	21.8	49.3	60.0	10.7	PASS
37.5	QP	Vert	36.4	17.8	0.9	3.0	21.8	36.3	40.0	3.7	PASS
38.25	Peak	Vert	50.3	17.8	0.9	3.0	21.8	50.2	60.0	9.8	PASS
38.25	QP	Vert	37.2	17.8	0.9	3.0	21.8	37.1	40.0	2.9	PASS
108	Peak	Vert	47.6	6.7	1.1	3.0	21.8	36.6	63.5	26.9	PASS
108	QP	Vert	36.8	6.7	1.1	3.0	21.8	25.8	43.5	17.7	PASS
54	Peak	Vert	54.5	7.6	0.9	3.0	21.8	44.2	60.0	15.8	PASS
54	QP	Vert	39.9	7.6	0.9	3.0	21.8	29.6	40.0	10.4	PASS
Hi channel Without Cable Spurious											
376	Peak	Vert	45.8	15.1	1.1	3.0	21.8	43.2	66.0	22.8	PASS

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


375	QP	Vert	48.0	15.1	1.1	3.0	21.8	45.4	46.0	0.6	PASS
501	Peak	Vert	39.9	18.7	1.3	3.0	21.8	41.1	66.0	24.9	PASS
500	QP	Vert	37.9	18.7	1.3	3.0	21.8	39.1	46.0	6.9	PASS
37.5	Peak	Vert	50.8	17.8	0.9	3.0	21.8	50.7	60.0	9.3	PASS
37.5	QP	Vert	36.6	17.8	0.9	3.0	21.8	36.5	40.0	3.5	PASS
38.25	Peak	Vert	51.4	17.8	0.9	3.0	21.8	51.3	60.0	8.7	PASS
38.25	QP	Vert	37.3	17.8	0.9	3.0	21.8	37.2	40.0	2.8	PASS
108	Peak	Vert	48.9	6.7	1.1	3.0	21.8	37.9	63.5	25.6	PASS
108	QP	Vert	35.9	6.7	1.1	3.0	21.8	24.9	43.5	18.6	PASS
121.94	Peak	Vert	46.6	6.9	1.1	3.0	21.8	35.8	63.5	27.7	PASS
121.94	QP	Vert	35.1	6.9	1.1	3.0	21.8	24.3	43.5	19.2	PASS
56.1	Peak	Vert	55.7	7.6	0.9	3.0	21.8	45.4	60.0	14.6	PASS
56	QP	Vert	41.7	7.6	0.9	3.0	21.8	31.4	40.0	8.6	PASS
Hi channel With Cable Spurious											
37.5	Peak	Vert	47.9	17.8	0.9	3.0	21.8	47.8	60.0	12.2	PASS
37.5	QP	Vert	35.8	17.8	0.9	3.0	21.8	35.7	40.0	4.3	PASS
38.25	Peak	Vert	48.9	17.8	0.9	3.0	21.8	48.8	60.0	11.2	PASS
38.25	QP	Vert	35.3	17.8	0.9	3.0	21.8	35.2	40.0	4.8	PASS
73	Peak	Vert	37.4	8.0	0.9	3.0	21.8	27.5	60.0	32.5	PASS
73	QP	Vert	25.7	8.0	0.9	3.0	21.8	15.8	40.0	24.2	PASS

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


75.2	Peak	Vert	38.4	8.0	0.9	3.0	21.8	28.5	60.0	31.5	PASS
75.2	QP	Vert	27.6	8.0	0.9	3.0	21.8	17.7	40.0	22.3	PASS
108	Peak	Vert	48.5	6.7	1.1	3.0	21.8	37.5	63.5	26.0	PASS
108	QP	Vert	34.8	6.7	1.1	3.0	21.8	23.8	43.5	19.7	PASS
121.94	Peak	Vert	46.9	6.9	1.1	3.0	21.8	36.1	63.5	27.4	PASS
121.94	QP	Vert	35.5	6.9	1.1	3.0	21.8	24.7	43.5	18.8	PASS
123	Peak	Vert	46.4	6.9	1.1	3.0	21.8	35.6	63.5	27.9	PASS
123	QP	Vert	34.2	6.9	1.1	3.0	21.8	23.4	43.5	20.1	PASS
150	Peak	Vert	48.6	9.0	1.1	3.0	21.8	39.9	63.5	23.6	PASS
150	QP	Vert	45.4	9.0	1.1	3.0	21.8	36.7	43.5	6.8	PASS
375	Peak	Vert	48.5	15.1	1.1	3.0	21.8	45.9	66.0	20.1	PASS
375	QP	Vert	48.2	15.1	1.1	3.0	21.8	45.6	46.0	0.4	PASS
500	Peak	Vert	40.3	18.7	1.3	3.0	21.8	41.5	66.0	24.5	PASS
500	QP	Vert	39.4	18.7	1.3	3.0	21.8	40.6	46.0	5.4	PASS
624	Peak	Vert	37.8	19.5	1.3	3.0	21.8	39.8	66.0	26.2	PASS
625	QP	Vert	33.0	19.5	1.3	3.0	21.8	35.0	46.0	11.0	PASS
750	Peak	Vert	38.1	20.7	1.6	3.0	21.8	41.6	66.0	24.4	PASS
750	QP	Vert	34.6	20.7	1.6	3.0	21.8	38.1	46.0	7.9	PASS
825	Peak	Vert	38.1	22.2	1.6	3.0	21.8	43.1	66.0	22.9	PASS
825	QP	Vert	27.2	22.2	1.6	3.0	21.8	32.2	46.0	13.8	PASS

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


Mid channel WITH CABLE Spurious											
37.5	Peak	Vert	48.7	17.8	0.9	3.0	21.8	48.6	60.0	11.4	PASS
37.5	QP	Vert	35.7	17.8	0.9	3.0	21.8	35.6	40.0	4.4	PASS
38.25	Peak	Vert	49.2	17.8	0.9	3.0	21.8	49.1	60.0	10.9	PASS
38.25	QP	Vert	35.0	17.8	0.9	3.0	21.8	34.9	40.0	5.1	PASS
73	Peak	Vert	36.3	8.0	0.9	3.0	21.8	26.4	60.0	33.6	PASS
73	QP	Vert	25.7	8.0	0.9	3.0	21.8	15.8	40.0	24.2	PASS
75.2	Peak	Vert	38.7	8.0	0.9	3.0	21.8	28.8	60.0	31.2	PASS
75.2	QP	Vert	27.7	8.0	0.9	3.0	21.8	17.8	40.0	22.2	PASS
108	Peak	Vert	48.9	6.7	1.1	3.0	21.8	37.9	63.5	25.6	PASS
108	QP	Vert	34.8	6.7	1.1	3.0	21.8	23.8	43.5	19.7	PASS
121.94	Peak	Vert	46.4	6.9	1.1	3.0	21.8	35.6	63.5	27.9	PASS
121.94	QP	Vert	35.1	6.9	1.1	3.0	21.8	24.3	43.5	19.2	PASS
123	Peak	Vert	46.2	6.9	1.1	3.0	21.8	35.4	63.5	28.1	PASS
123	QP	Vert	34.0	6.9	1.1	3.0	21.8	23.2	43.5	20.3	PASS
150	Peak	Vert	46.6	9.0	1.1	3.0	21.8	37.9	63.5	25.6	PASS
150	QP	Vert	45.2	9.0	1.1	3.0	21.8	36.5	43.5	7.0	PASS
375	Peak	Vert	48.3	15.1	1.1	3.0	21.8	45.7	66.0	20.3	PASS
375	QP	Vert	47.6	15.1	1.1	3.0	21.8	45.0	46.0	1.0	PASS
500	Peak	Vert	39.9	18.7	1.3	3.0	21.8	41.1	66.0	24.9	PASS

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


500	QP	Vert	37.9	18.7	1.3	3.0	21.8	39.1	46.0	6.9	PASS
625	Peak	Vert	38.3	19.5	1.3	3.0	21.8	40.3	66.0	25.7	PASS
625	QP	Vert	35.0	19.5	1.3	3.0	21.8	37.0	46.0	9.0	PASS
750	Peak	Vert	38.8	20.7	1.6	3.0	21.8	42.3	66.0	23.7	PASS
750	QP	Vert	34.7	20.7	1.6	3.0	21.8	38.2	46.0	7.8	PASS
875	Peak	Vert	37.0	22.8	1.6	3.0	21.8	42.6	66.0	23.4	PASS
875	QP	Vert	31.7	22.8	1.6	3.0	21.8	37.3	46.0	8.7	PASS
37.5	Peak	Horz	37.1	18.9	0.9	3.0	21.8	38.1	60.0	21.9	PASS
37.5	QP	Horz	26.1	18.9	0.9	3.0	21.8	27.1	40.0	12.9	PASS
38.25	Peak	Horz	38.2	18.9	0.9	3.0	21.8	39.2	60.0	20.8	PASS
38.25	QP	Horz	25.8	18.9	0.9	3.0	21.8	26.8	40.0	13.2	PASS
Low channel WITH CABLE Spurious											
37.5	Peak	Vert	47.8	17.8	0.9	3.0	21.8	47.7	60.0	12.3	PASS
37.5	QP	Vert	35.4	17.8	0.9	3.0	21.8	35.3	40.0	4.7	PASS
38.25	Peak	Vert	48.7	17.8	0.9	3.0	21.8	48.6	60.0	11.4	PASS
38.25	QP	Vert	34.8	17.8	0.9	3.0	21.8	34.7	40.0	5.3	PASS
73	Peak	Vert	36.4	8.0	0.9	3.0	21.8	26.5	60.0	33.5	PASS
73	QP	Vert	25.7	8.0	0.9	3.0	21.8	15.8	40.0	24.2	PASS
75.2	Peak	Vert	38.1	8.0	0.9	3.0	21.8	28.2	60.0	31.8	PASS
75.2	QP	Vert	27.6	8.0	0.9	3.0	21.8	17.7	40.0	22.3	PASS

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

108	Peak	Vert	47.7	6.7	1.1	3.0	21.8	36.7	63.5	26.8	PASS
108	QP	Vert	36.7	6.7	1.1	3.0	21.8	25.7	43.5	17.8	PASS
121.94	Peak	Vert	46.7	6.9	1.1	3.0	21.8	35.9	63.5	27.6	PASS
121.94	QP	Vert	34.9	6.9	1.1	3.0	21.8	24.1	43.5	19.4	PASS
123	Peak	Vert	46.1	6.9	1.1	3.0	21.8	35.3	63.5	28.2	PASS
123	QP	Vert	33.8	6.9	1.1	3.0	21.8	23.0	43.5	20.5	PASS
150	Peak	Vert	48.0	9.0	1.1	3.0	21.8	39.3	63.5	24.2	PASS
150	QP	Vert	44.9	9.0	1.1	3.0	21.8	36.2	43.5	7.3	PASS
375	Peak	Vert	48.2	15.1	1.1	3.0	21.8	45.6	66.0	20.4	PASS
375	QP	Vert	46.7	15.1	1.1	3.0	21.8	44.1	46.0	1.9	PASS
500	Peak	Vert	40.9	18.7	1.3	3.0	21.8	42.1	66.0	23.9	PASS
500	QP	Vert	37.7	18.7	1.3	3.0	21.8	38.9	46.0	7.1	PASS
625	Peak	Vert	37.2	19.5	1.3	3.0	21.8	39.2	66.0	26.8	PASS
625	QP	Vert	34.4	19.5	1.3	3.0	21.8	36.4	46.0	9.6	PASS
750	Peak	Vert	36.8	20.7	1.6	3.0	21.8	40.3	66.0	25.7	PASS
750	QP	Vert	34.6	20.7	1.6	3.0	21.8	38.1	46.0	7.9	PASS
875	Peak	Vert	36.6	22.8	1.6	3.0	21.8	42.2	66.0	23.8	PASS
875	QP	Vert	30.6	22.8	1.6	3.0	21.8	36.2	46.0	9.8	PASS
37.5	Peak	Horz	37.0	18.9	0.9	3.0	21.8	38.0	60.0	22.0	PASS
37.5	QP	Horz	26.1	18.9	0.9	3.0	21.8	27.1	40.0	12.9	PASS


Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

38.25	Peak	Horz	37.4	18.9	0.9	3.0	21.8	38.4	60.0	21.6	PASS
38.25	QP	Horz	26.2	18.9	0.9	3.0	21.8	27.2	40.0	12.8	PASS
1000	Peak	Vert	57.7	23.1	2.4	0.0	36.8	46.4	73.0	26.6	PASS
1000	Avg	Vert	50.6	23.1	2.4	0.0	36.8	39.3	53.0	13.7	PASS
1125	Peak	Vert	53.7	23.6	2.4	0.0	36.8	42.9	73.0	30.1	PASS
1125	Avg	Vert	48.1	23.6	2.4	0.0	36.8	37.3	53.0	15.7	PASS
1249	Peak	Vert	48.7	25.2	2.4	0.0	36.8	39.5	73.0	33.5	PASS
1249	Avg	Vert	40.4	25.2	2.4	0.0	36.8	31.2	53.0	21.8	PASS
1000	Peak	Horz	53.4	24.0	2.4	0.0	36.8	43.0	73.0	30.0	PASS
1000	Avg	Horz	42.2	24.0	2.4	0.0	36.8	31.8	53.0	21.2	PASS
1125	Peak	Vert	54.2	23.6	2.4	0.0	36.8	43.4	73.0	29.6	PASS
1125	Avg	Vert	41.4	23.6	2.4	0.0	36.8	30.6	53.0	22.4	PASS
4810	Peak	Vert	55.5	33.0	4.0	0.0	36.0	56.5	74.0	17.5	PASS
4810	Avg	Vert	47.0	33.0	4.0	0.0	36.0	48.0	54.0	6.0	PASS
7217	Peak	Vert	51.6	37.0	5.0	0.0	35.5	58.1	74.0	15.9	PASS
7215	Avg	Vert	37.8	37.0	5.0	0.0	35.5	44.3	54.0	9.7	PASS
4889	Peak	Vert	57.7	33.0	4.0	0.0	36.0	58.7	74.0	15.3	PASS
4889	Avg	Vert	47.6	33.0	4.0	0.0	36.0	48.6	54.0	5.4	PASS
7334	Peak	Vert	55.4	37.0	5.0	0.0	35.5	61.9	74.0	12.1	PASS
7334	Avg	Vert	44.5	37.0	5.0	0.0	35.5	51.0	54.0	3.0	PASS

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

4960	Peak	Vert	49.8	33.0	4.0	0.0	36.0	50.8	74.0	23.2	PASS
4960	Avg	Vert	46.4	33.0	4.0	0.0	36.0	47.4	54.0	6.6	PASS


Note: Radiated emissions measurements above 3.0 GHz were performed at a 1 meter test distance, and in accordance with FCC 15.31(f)(1) an extrapolation factor of 9.5 dB was applied. No emissions above the 3rd harmonic were detected at 1 meter.

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
BiLog Antenna	3142-C	ETS	2006-08-06	2008-08-06	GEMC 8
Horn Antenna	6878/24	Q-Par	On file	2008-08-01	GEMC 65
1-26G pre-amp	HP 8449B	HP	On file	2008-08-01	GEMC 68
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Pre-Amplifier	PA-2.5-26	Vican	2006-09-12	2008-09-12	GEMC 9
IFR Spectrum Analyzer	AN940	IFR	May 4/2006	May 4/2008	GEMC 6350
Horn Antenna	SAS-572	AH	NCR	NCR	GEMC 6371
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev2.doc"

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

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

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

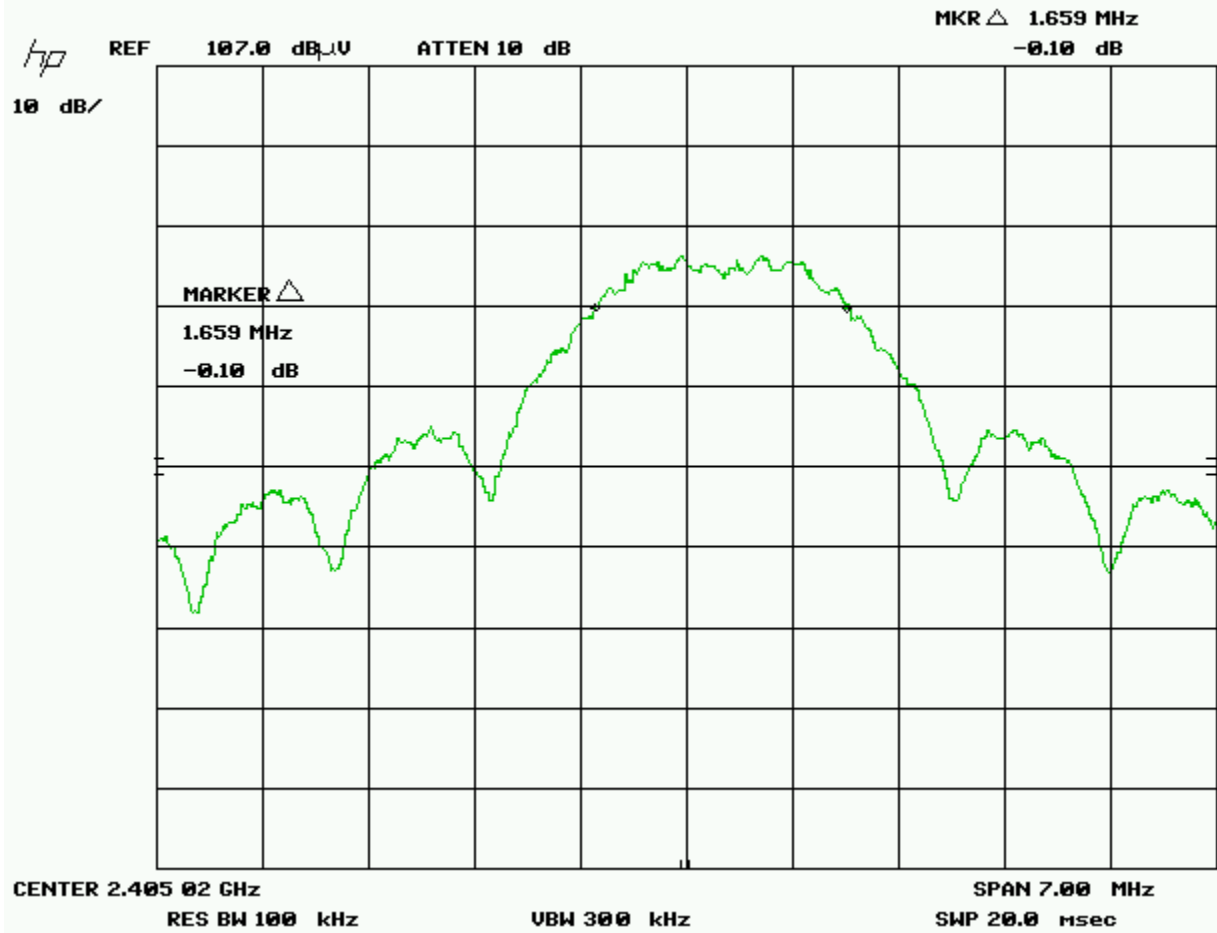
The EUT passed. The 20 dB BW measured was 1.622MHz.


Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Graph(s)

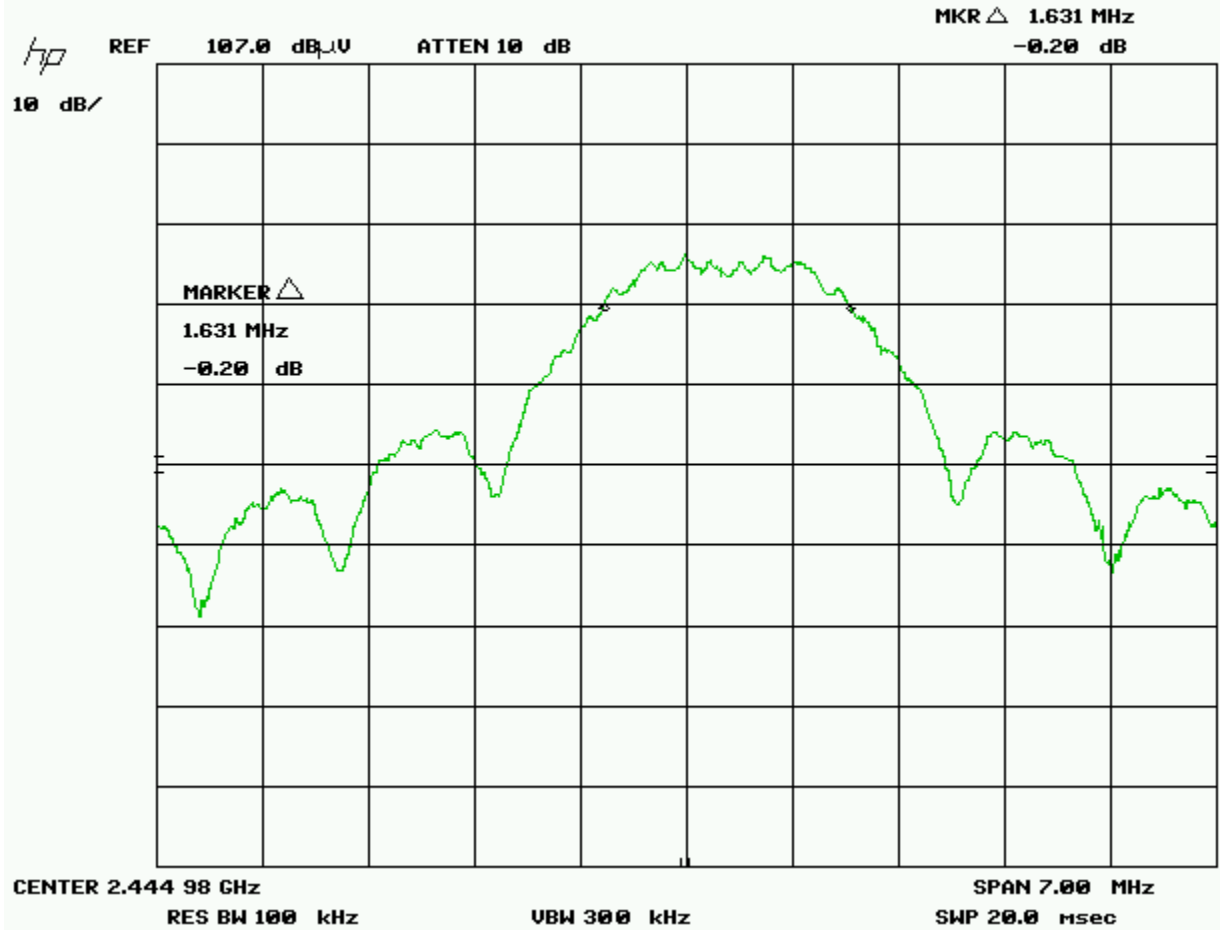
The graphs shown below show the channel spacing during the operation of the device. This is measured by a max hold on the spectrum analyzer. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.


Low Channel



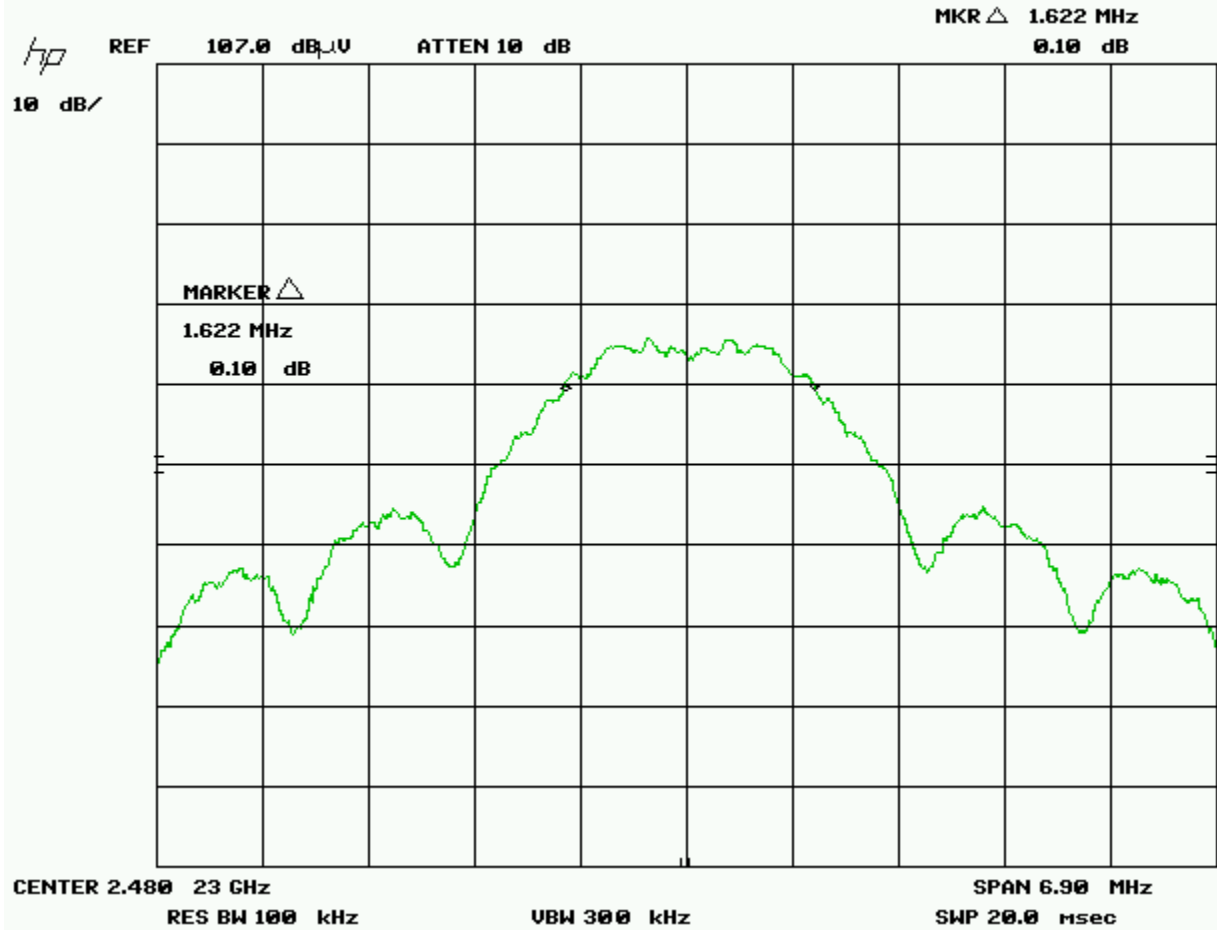
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Medium Channel




Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

High Channel




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

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

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

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

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 15.247(b).

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands, the peak limit is 1 watt.

Results

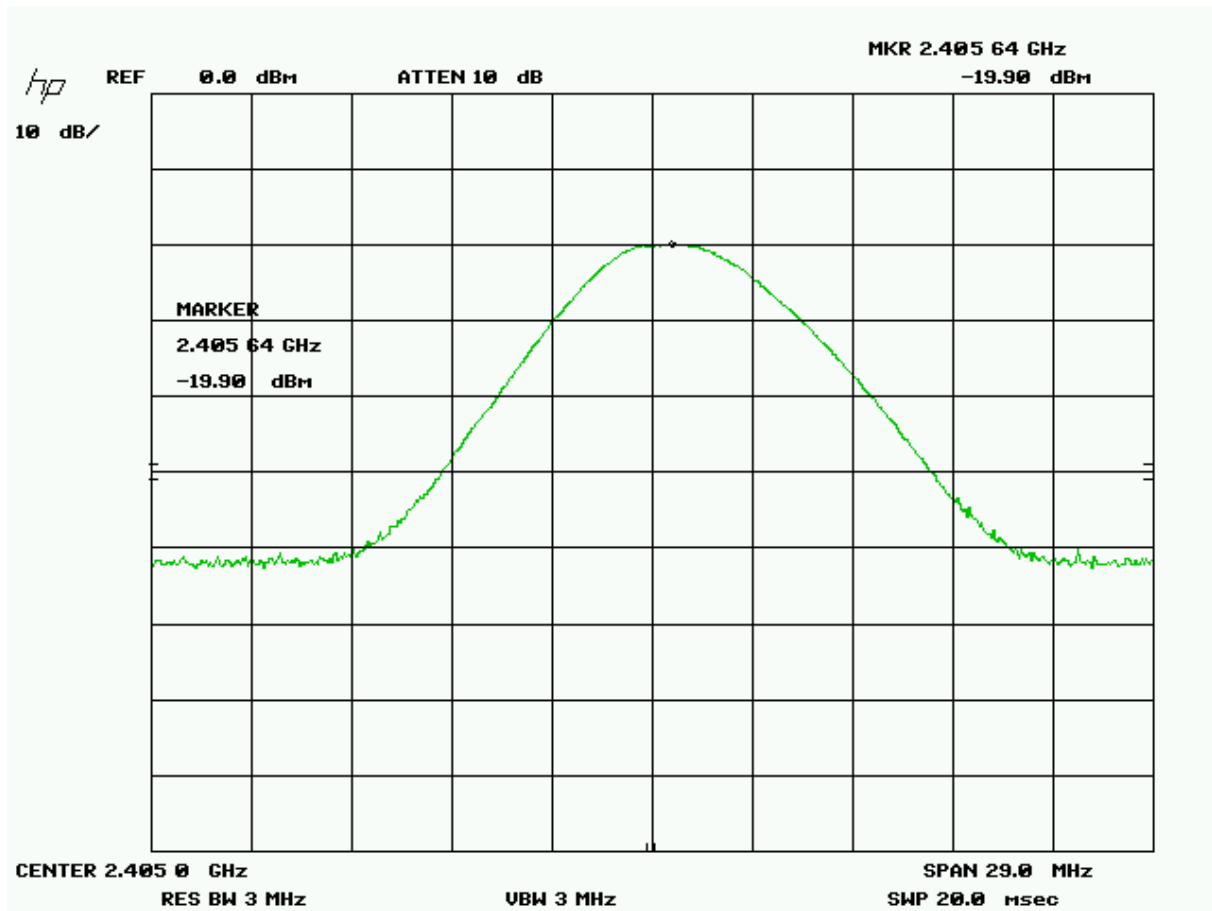
The EUT passed. The peak power measured was 0.1 dBm (1.023mW).


Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Table(s)

The tables shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 20 dB of external attenuation taken during this measurement.


Low channel



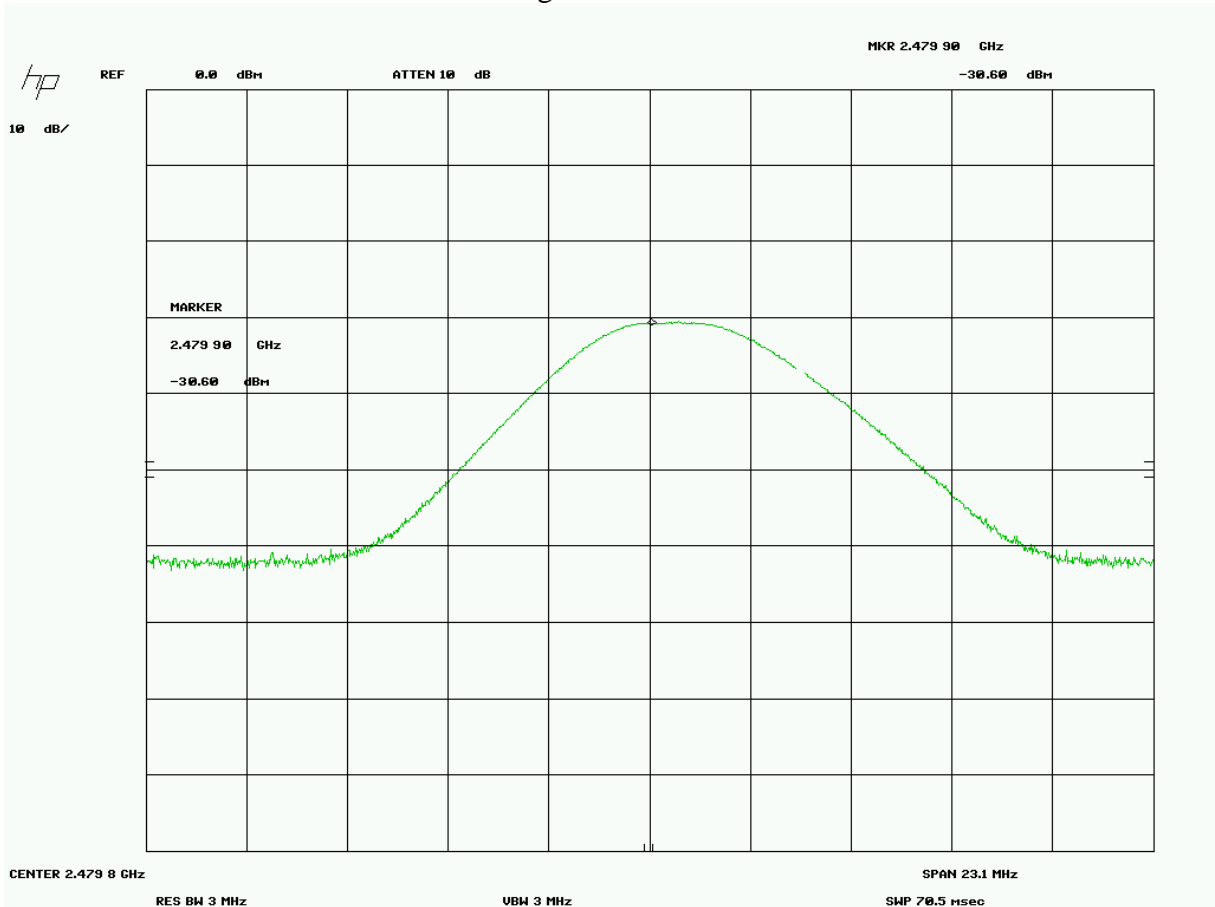
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Medium channel




Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

High channel



The calculated value is:
 $-19.9 \text{ dBm} + 20 \text{ dB (attenuator)}$
 $= 0.1 \text{ dbm}$


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

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Power Head	PH 2000	AR	2006-10-13	2008-10-13	GEMC 15
Power meter	PM 2002	AR	2006-10-13	2008-10-13	GEMC 16
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

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

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

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 10th harmonic. This -20 dBc requirement also applies at the 'band edge' or 2.4 GHz and 2.4835 GHz.

Results

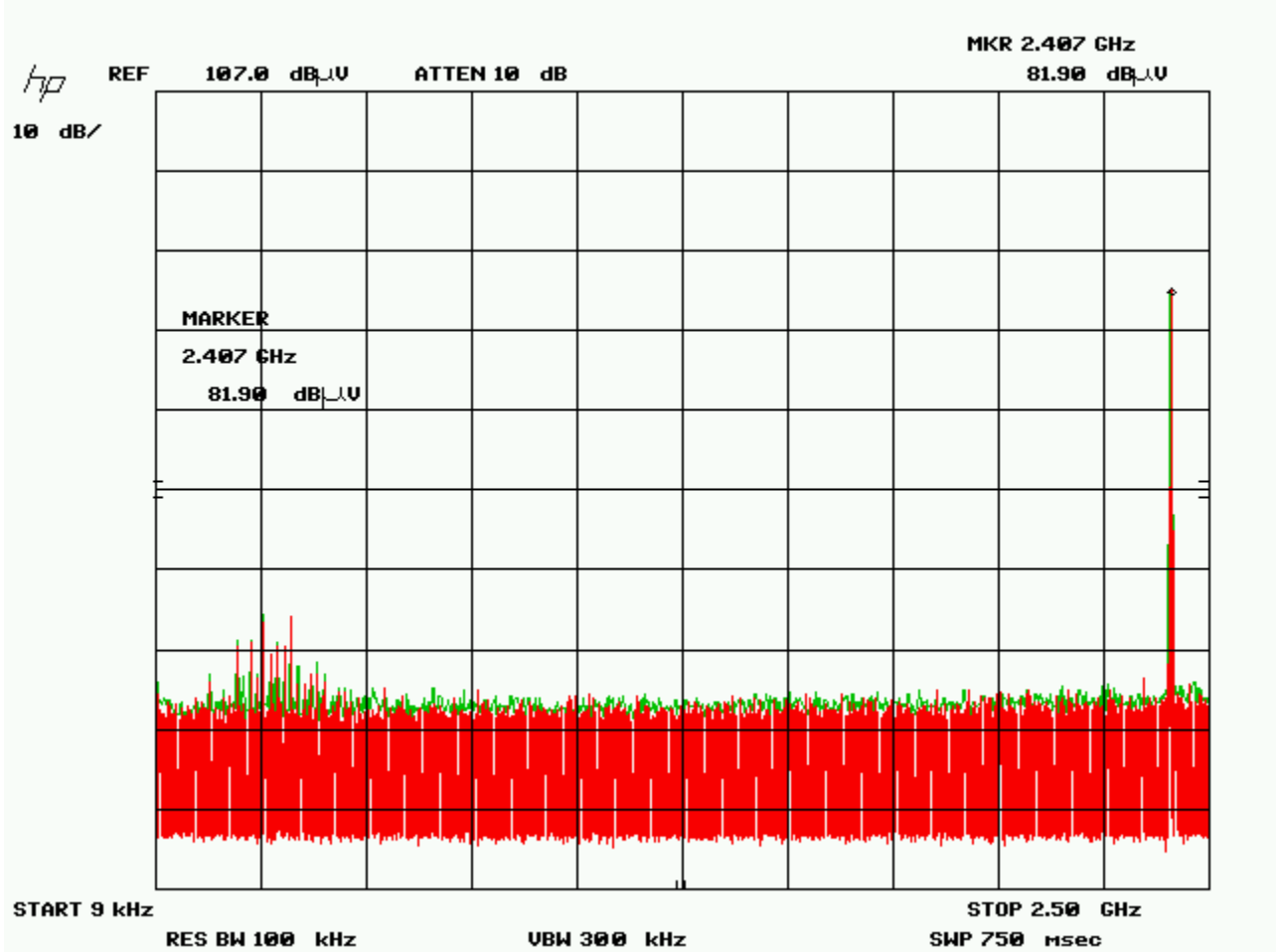
The EUT passed the limits. Low, middle and high band was measured. The worst case for each mode is presented as a graph for the spectrum. The -20 dBc requirement is shown for the lower band edge at 2.4 GHz in the low band. The -20 dBc requirement is also shown for the higher band edge at 2.4835 GHz in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

Graph(s)

The graphs shown below shows the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT. Note there was 20 dB of external attenuation taken during this measurement.

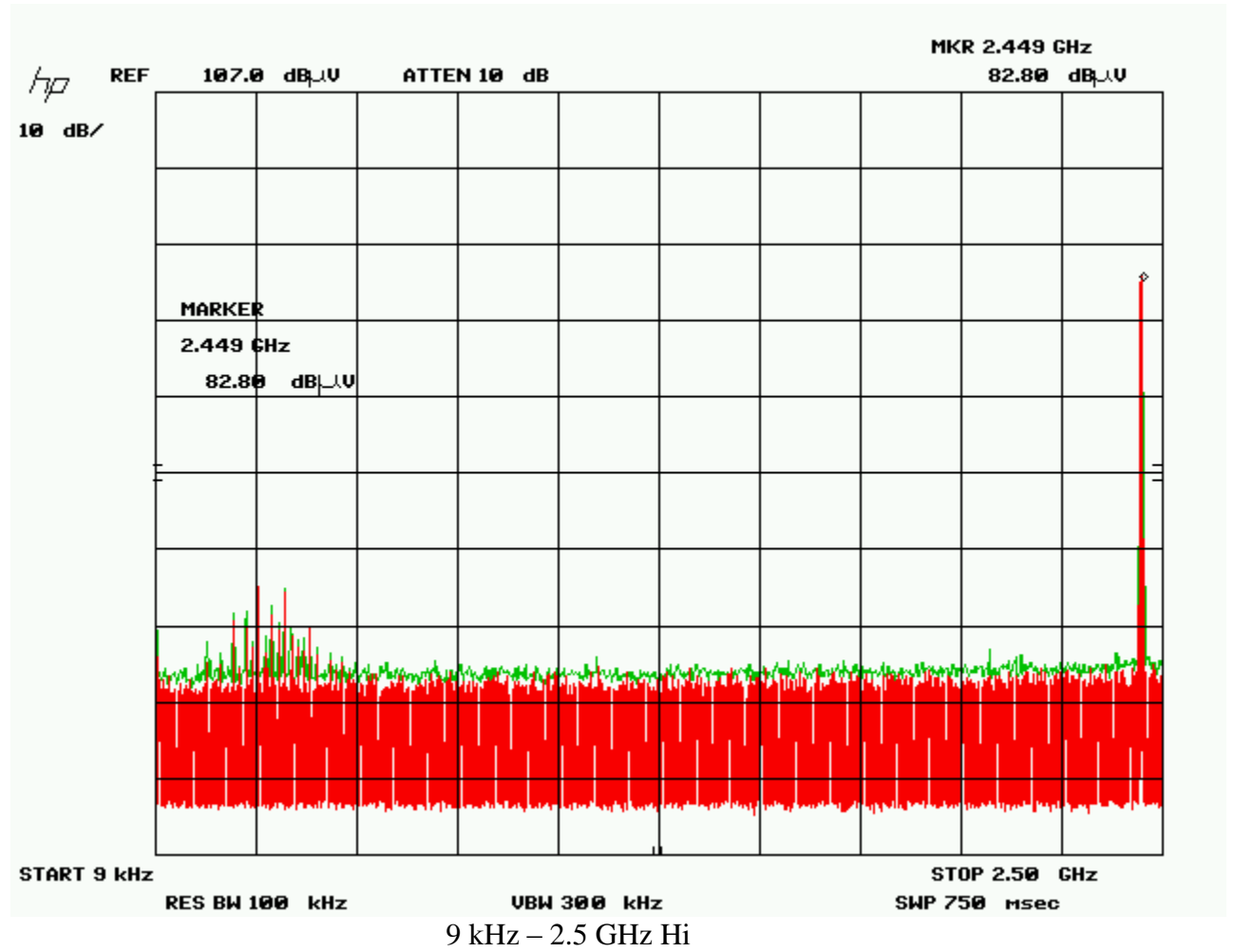
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

9 kHz – 2.5 GHz Lo

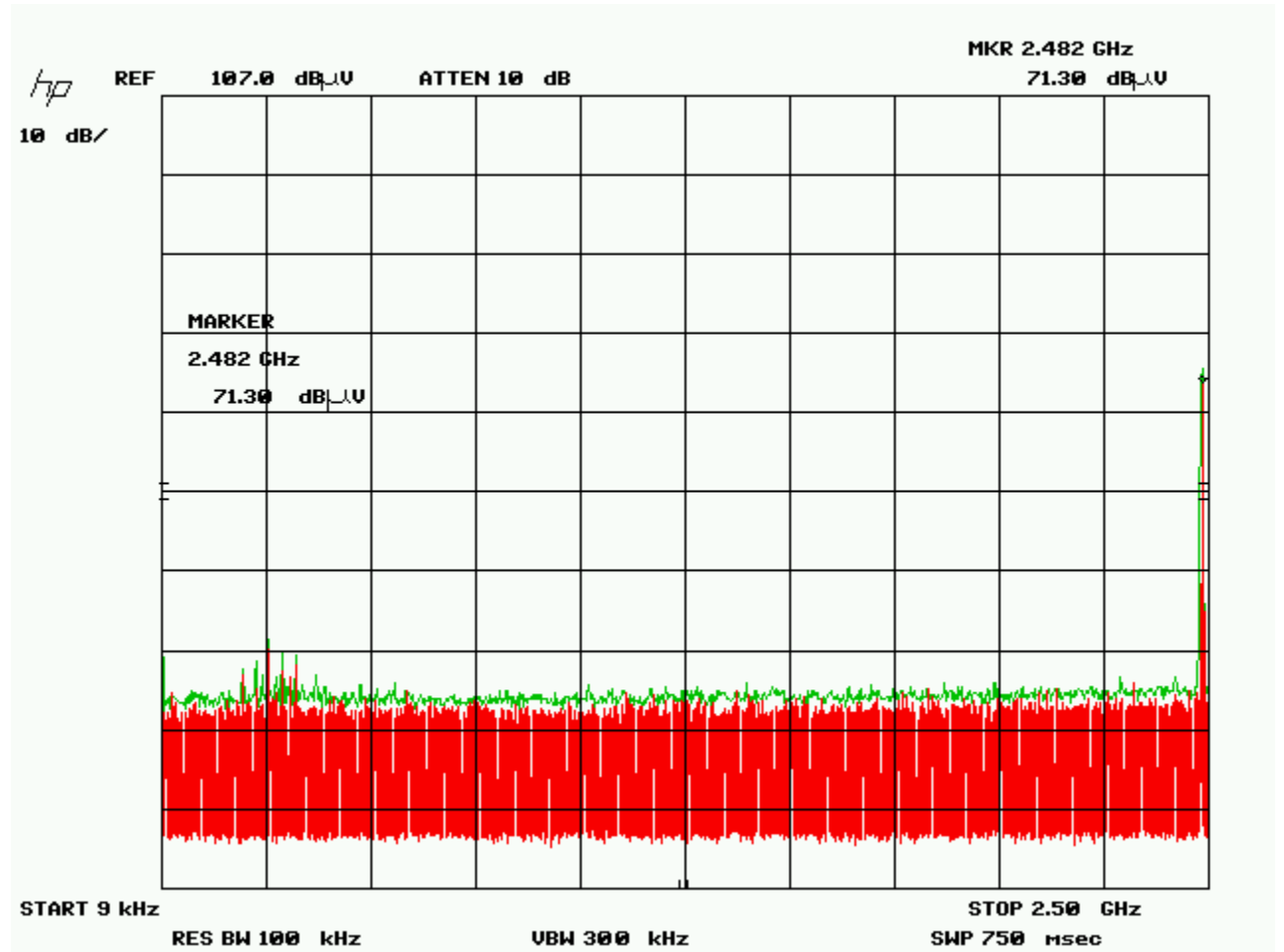


9 kHz – 2.5 GHz Med


Client	Viconics
Product	VWG 40
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006

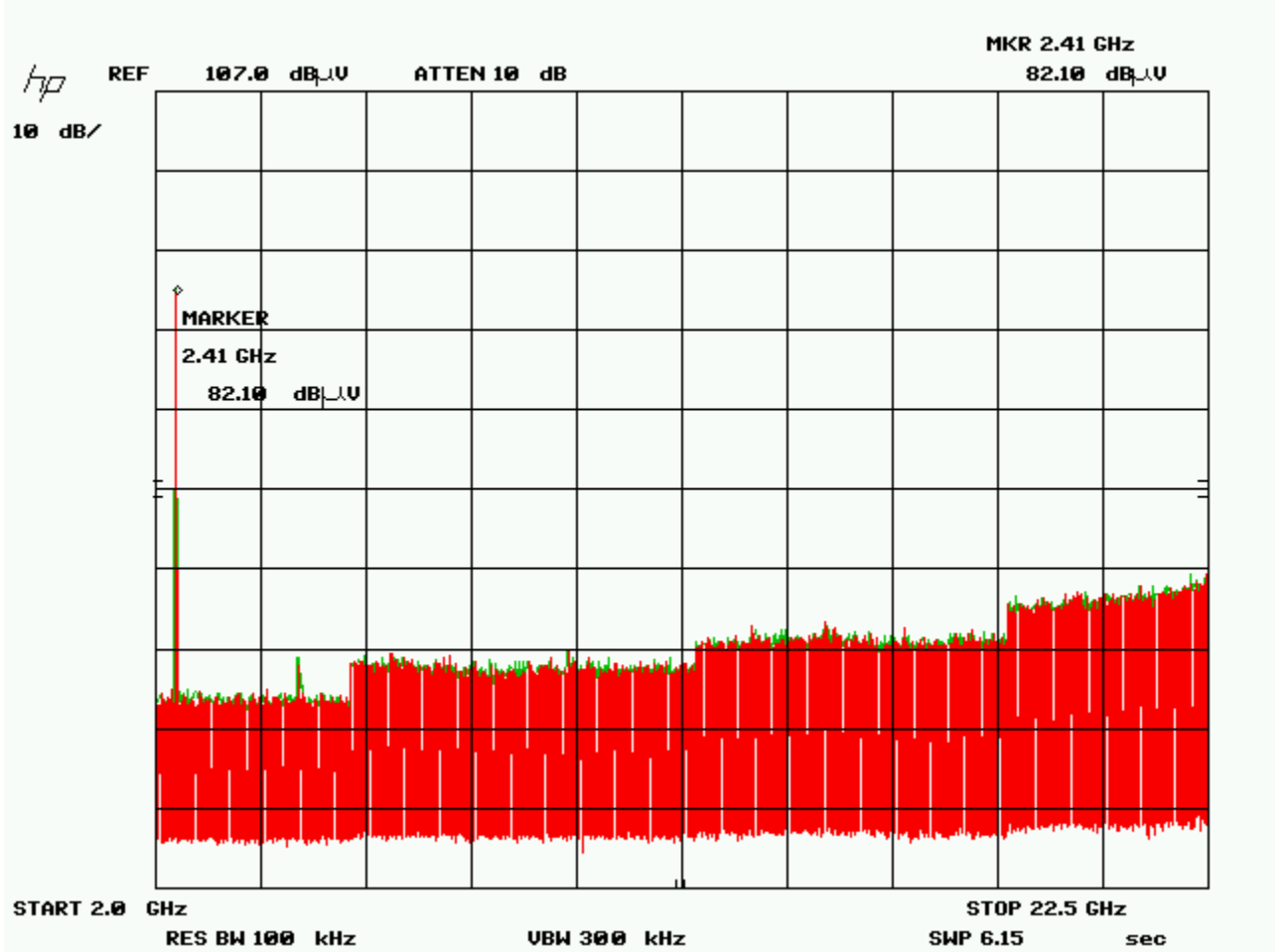



Client	Viconics
Product	VWG 40
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006

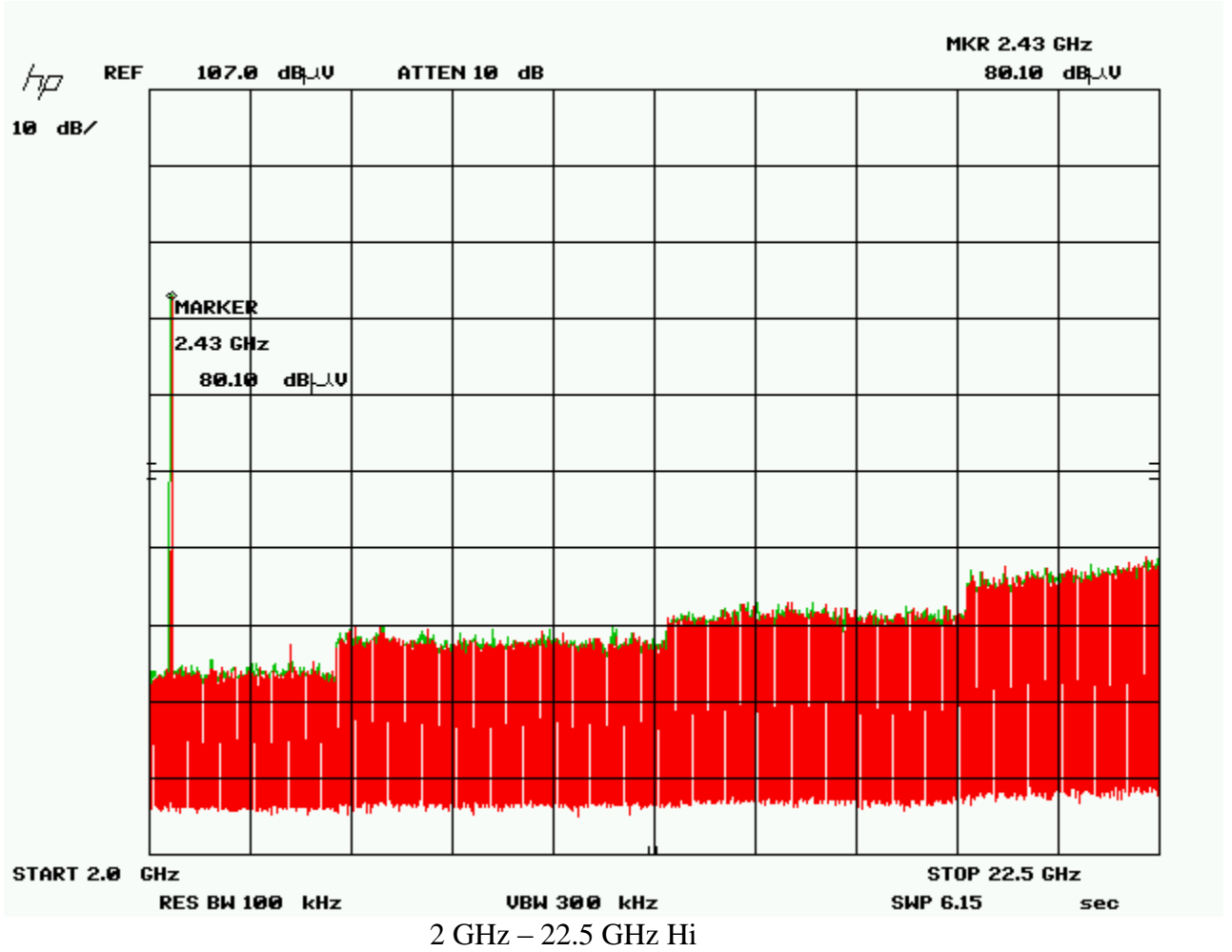


2 GHz – 22.5 GHz Lo

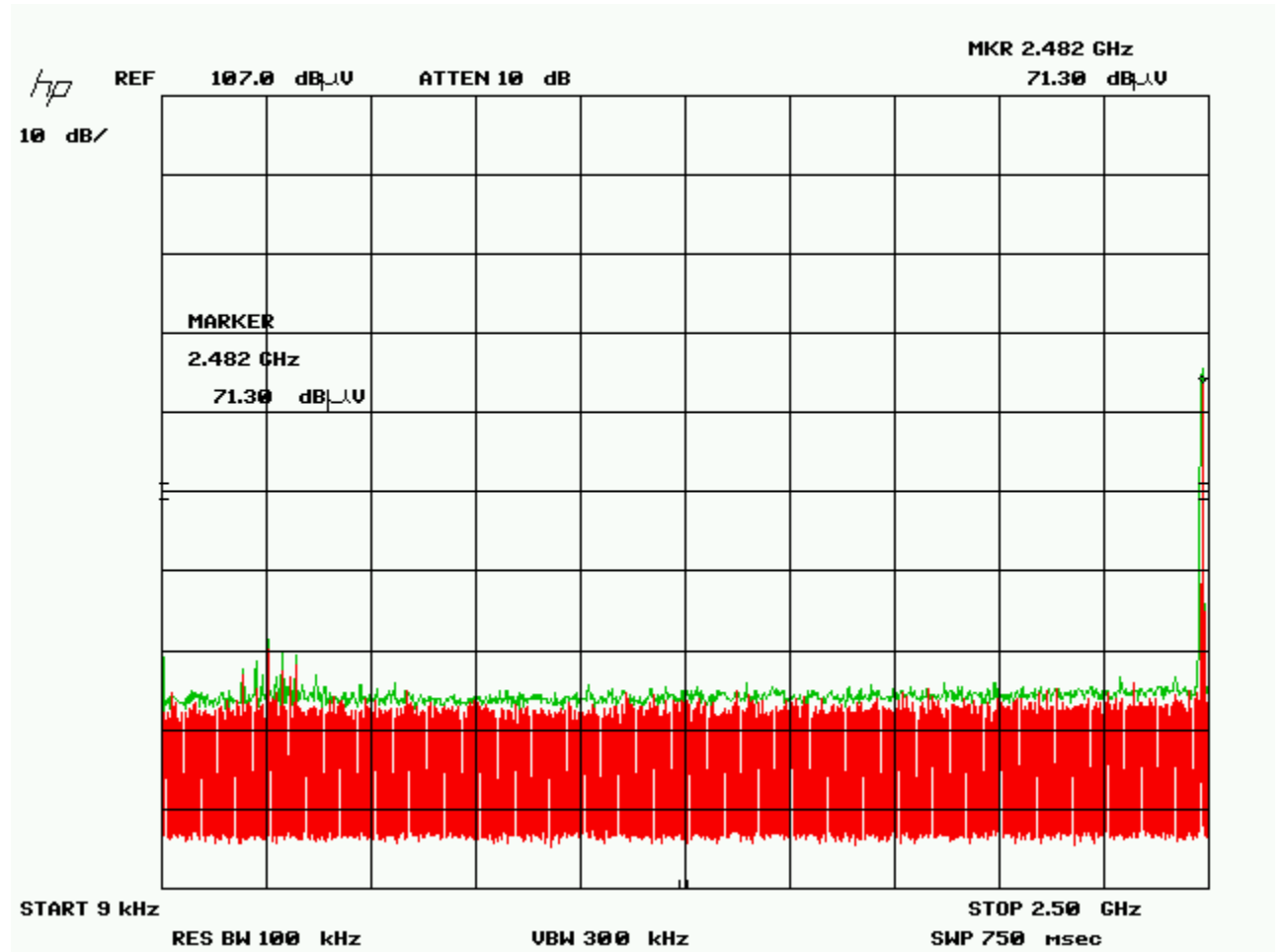
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	




Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

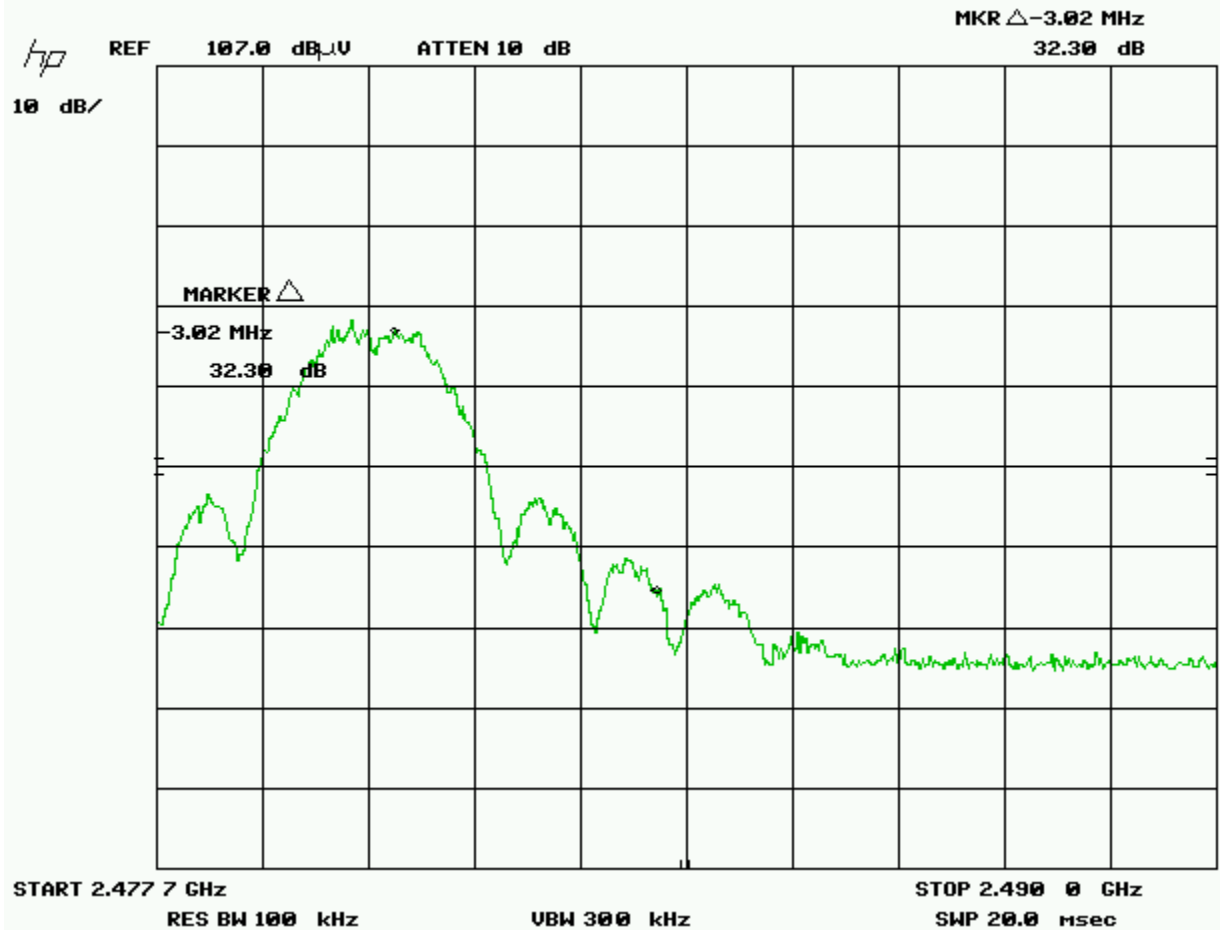



Client	Viconics
Product	VWG 40
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006



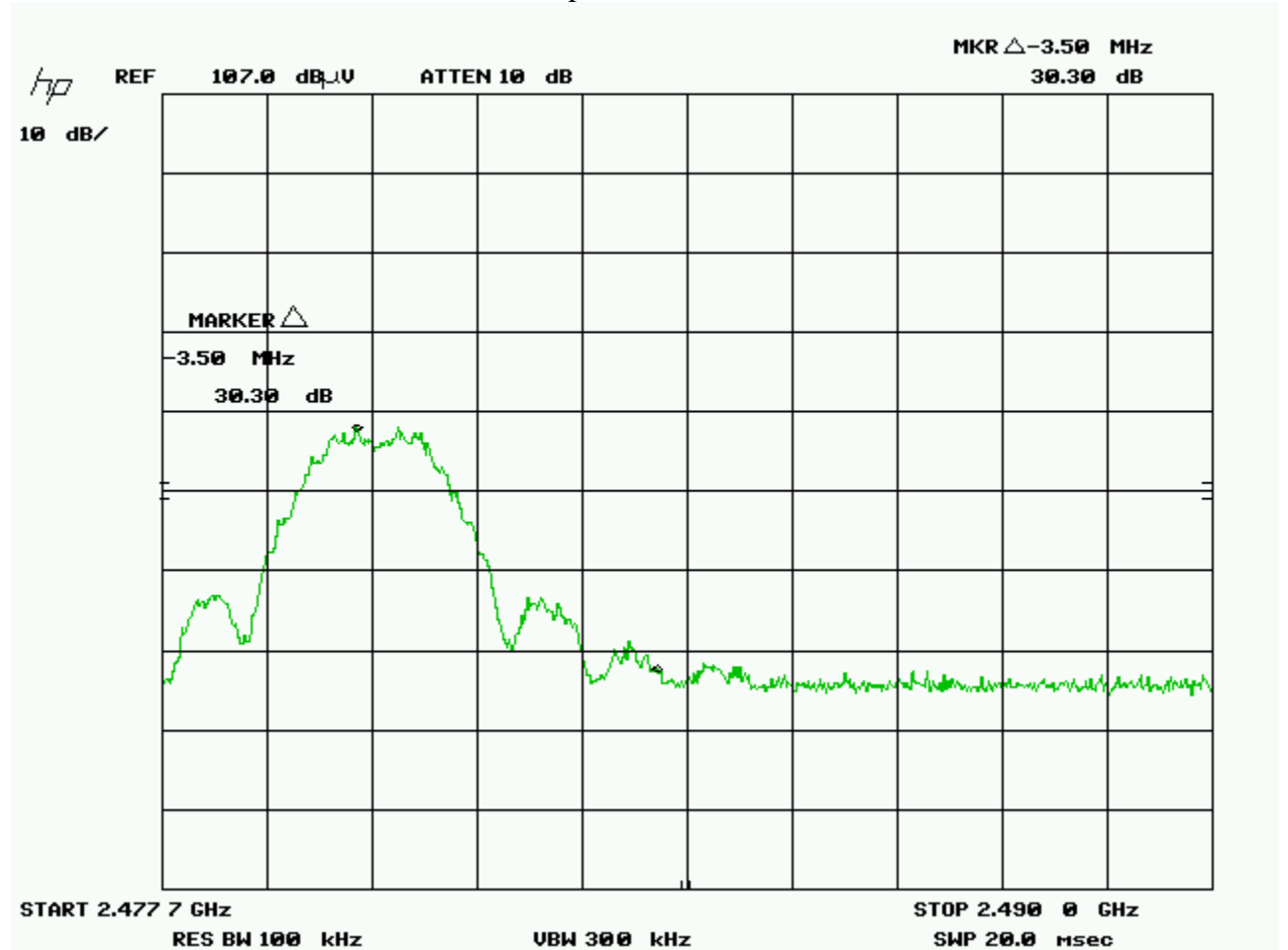
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


2483.5 MHz Band edge
Vertical peak emissions



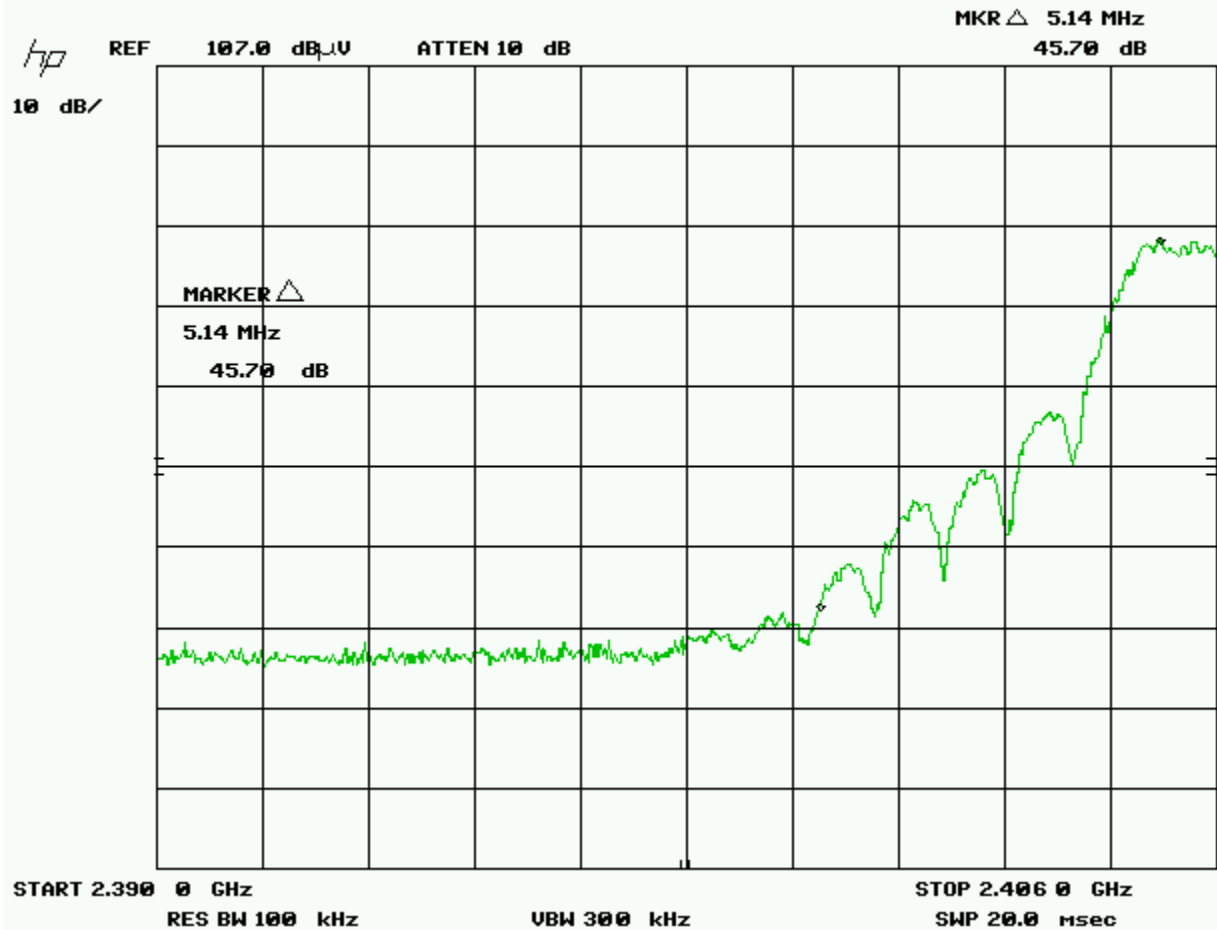
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


2483.5 MHz Band edge
Horizontal peak emissions



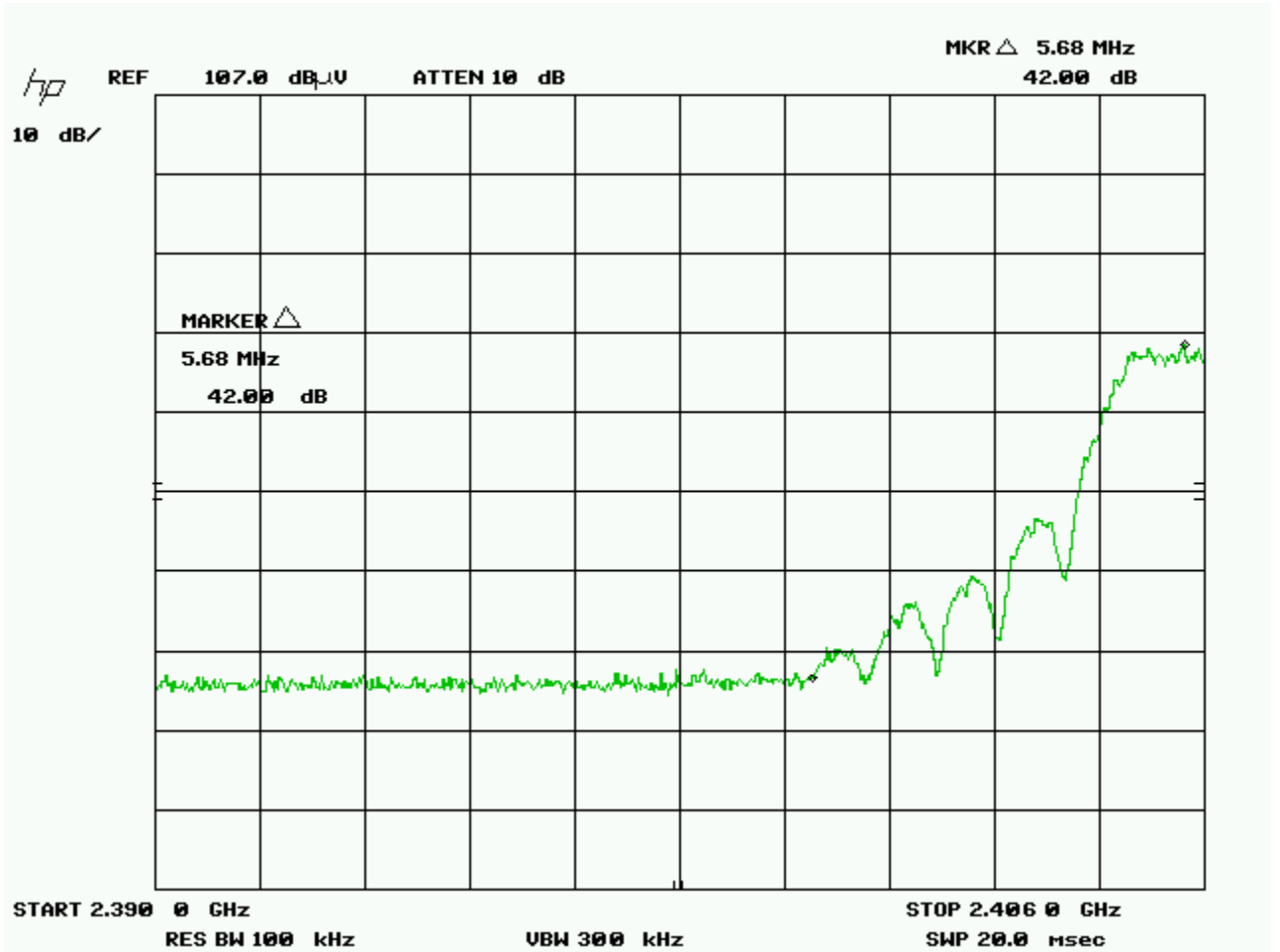
Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	


2390 MHz Band edge
Vertical peak emissions



Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

2390 MHz Band edge
Horizontal peak emissions



Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

The frequency range of 22.5 – 25 GHz, the 10th harmonic and 9th harmonic where applicable, was additionally scanned using an alternate spectrum analyzer, in low, middle and high band for each mode. No emissions were detected at the 9th and 10th harmonic.


The band edge requirement was conducted using the radiated emission setup. The plots show raw data and no correction factors are applied. They simply show a 20dbc differential between the peak and the band edge. For actual values measured refer to spurious emissions section above in this report.

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

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Attenuator 1 dB	FP-50-1	Trilithic	NCR	NCR	GEMC 38
Attenuator 3 dB	FP-50-3	Trilithic	NCR	NCR	GEMC 40
Attenuator 6 dB	FP-50-6	Trilithic	NCR	NCR	GEMC 41
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42
Attenuator 20 dB	FP-50-20	Trilithic	NCR	NCR	GEMC 43
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
IFR Spectrum Analyzer	AN940	IFR	May 4/2006	May 4/2008	GEMC 6350
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

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

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Power Spectral Density

Purpose

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


Limits

The limits are defined in 15.247(e).

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

Results

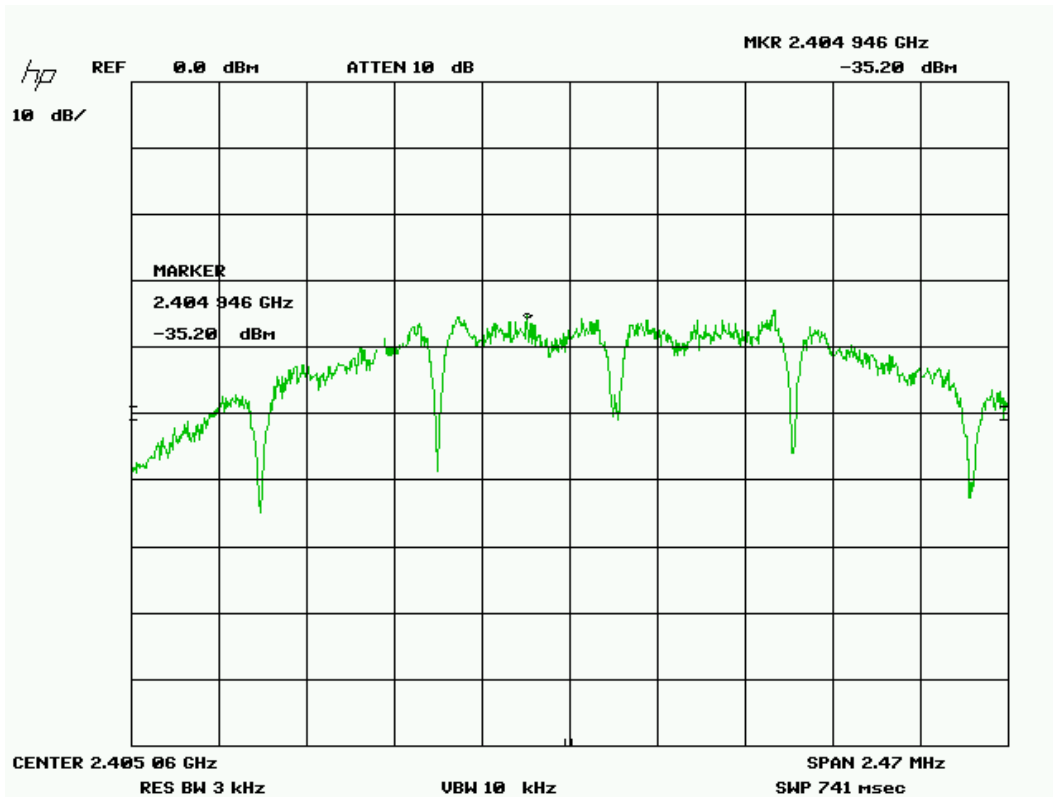
The EUT passed. Each mode was tested at low, medium, and high band. The worst case value is -15.2 dbm { -35.2 + 20 dbm (attenuator) = -15.2 dbm }.

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Graph(s)

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

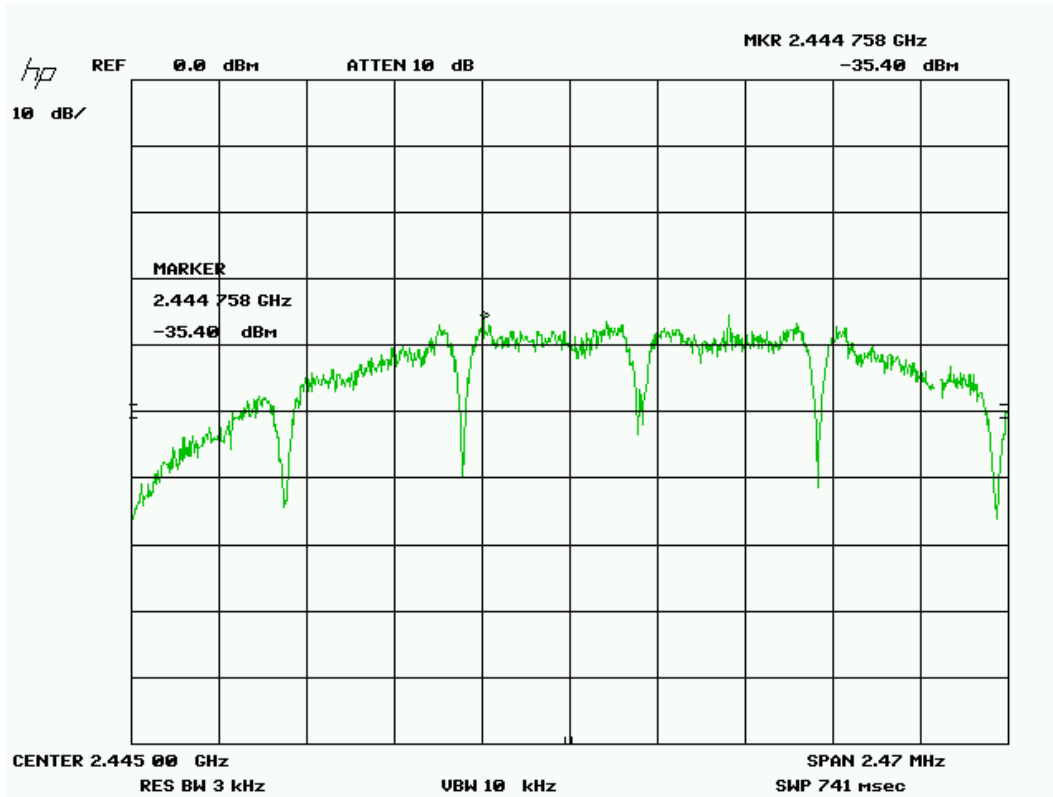
Low channel




Client	Viconics
Product	VWG 40
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006

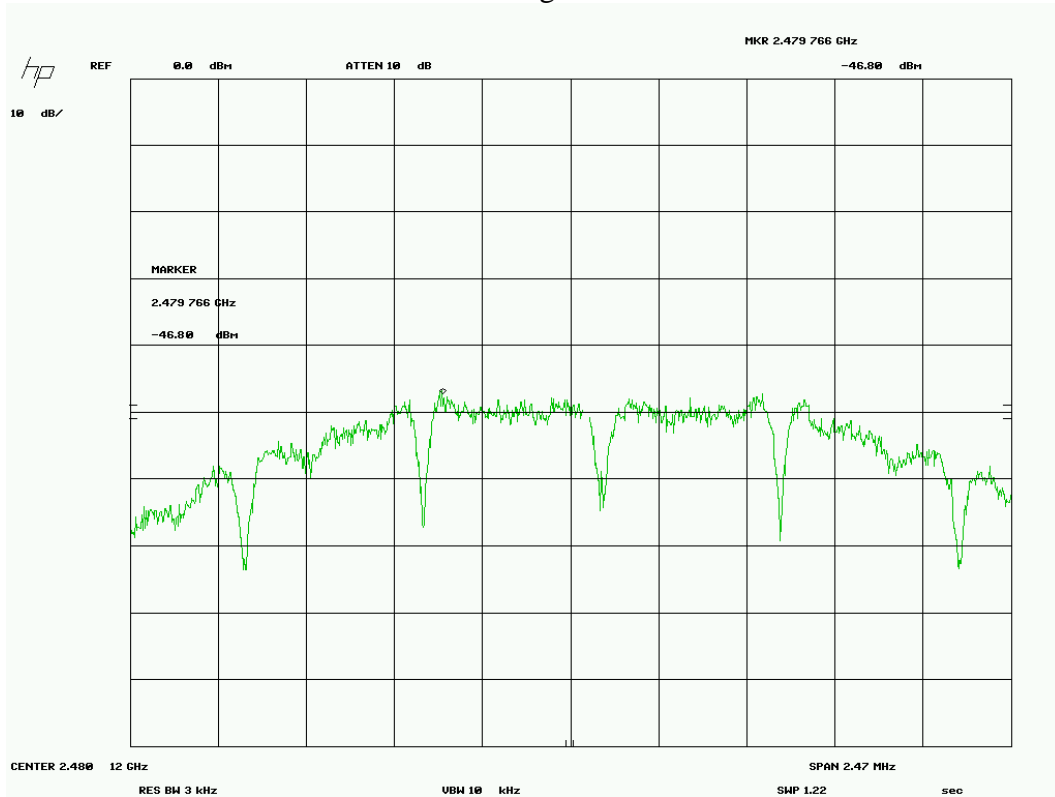


Med channel



Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

High channel




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

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Power Attenuator 20 dB	25-A-FFN-20	Bird / Hutton	NCR	NCR	GEMC 49

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

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Maximum Permissible Exposure

Purpose

The purpose of this test is to ensure that the RF energy intentionally transmitted, in terms of power density emitted from the EUT at a stated operating distance does not exceed the limits listed below as defined in the applicable test standard, as calculated based upon readings obtained during testing. This helps protect human exposure to excessive RF fields.

Limit(s) and Method

The limits, as defined in FCC 15.247(i) and FCC 1.1310 Table 1 (B) limits for general public exposure was applied. The limit for the frequency range of 1.5 GHz to 100 GHz was applied. This is a limit of 1.0 mW/cm². The distance used for calculations was 20cm, as this is the minimum distance an operator will be from the EUT during normal operation, as stated by the manufacturer.

Results

The EUT passed the requirements. The worst case calculated power density was 0.0004 mW/cm², this is significantly under the 1.0 mW/cm² requirement.

Calculations

Method 1 (conducted power)

$$P_d = (P_t * G) / (4 * \pi * R^2)$$

Where P_t = 0.1 or 1.023mW as per Peak power conducted output


Where G = 3 dBi, or numerically 2

Where R = 20 cm

$$P_d = (1.023 \text{ mW} * 2) / (4 * \pi * 20\text{cm}^2)$$

$$P_d = 2.041 \text{ mW} / 5026 \text{ cm}^2$$

$$P_d = 0.0004 \text{ mW/cm}^2$$

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

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

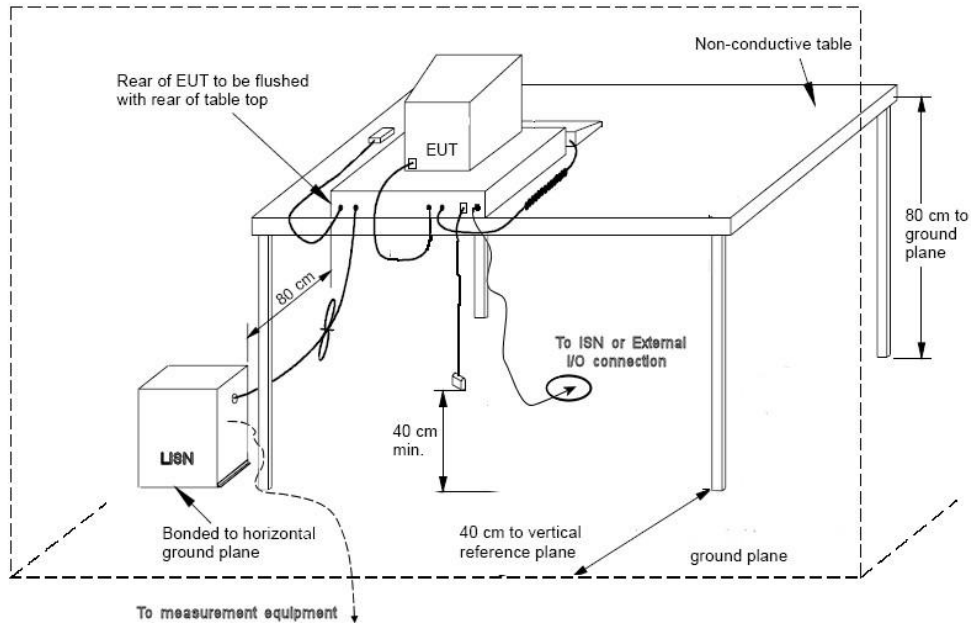
The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

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.

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Typical Setup Diagram



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

Measurement Uncertainty

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

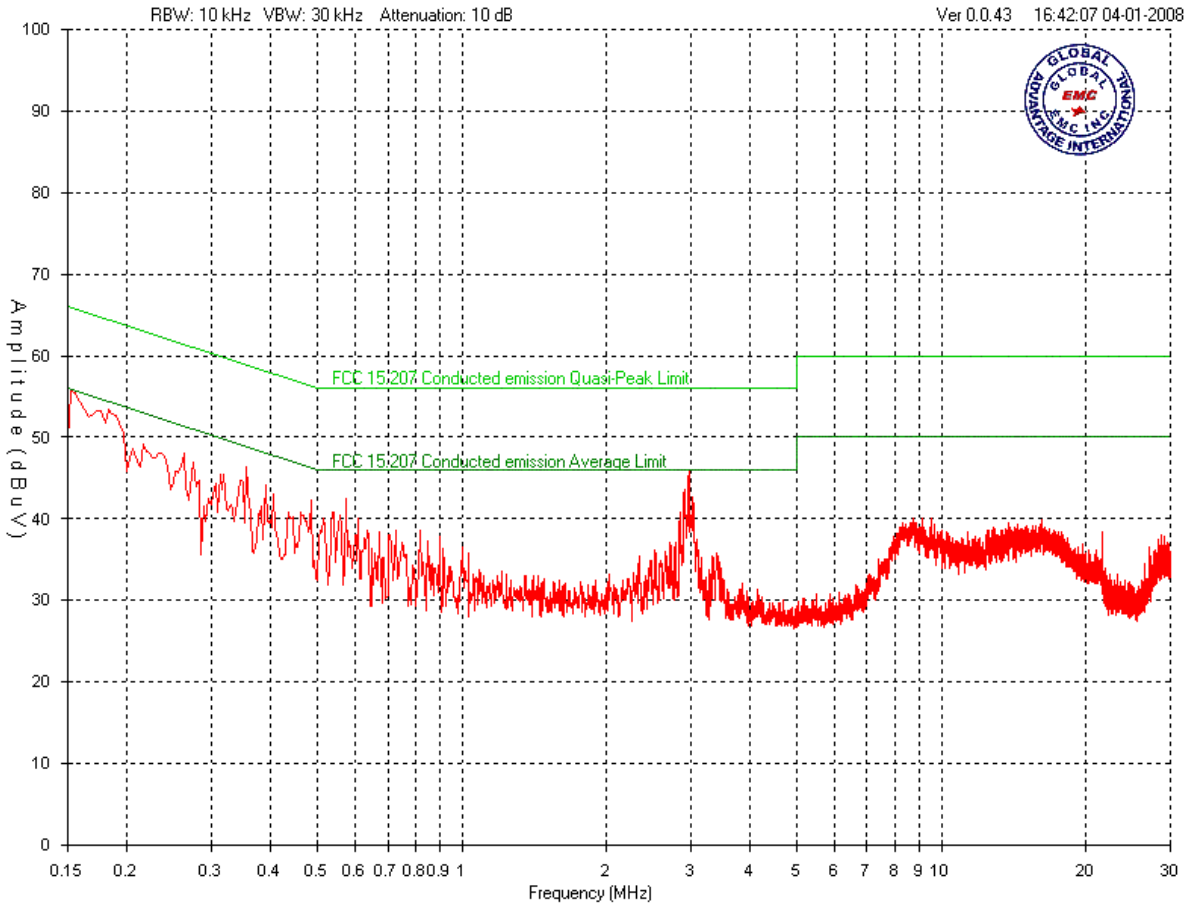
Preliminary Graphs

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

Client	Viconics
Product	VWG 40
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006



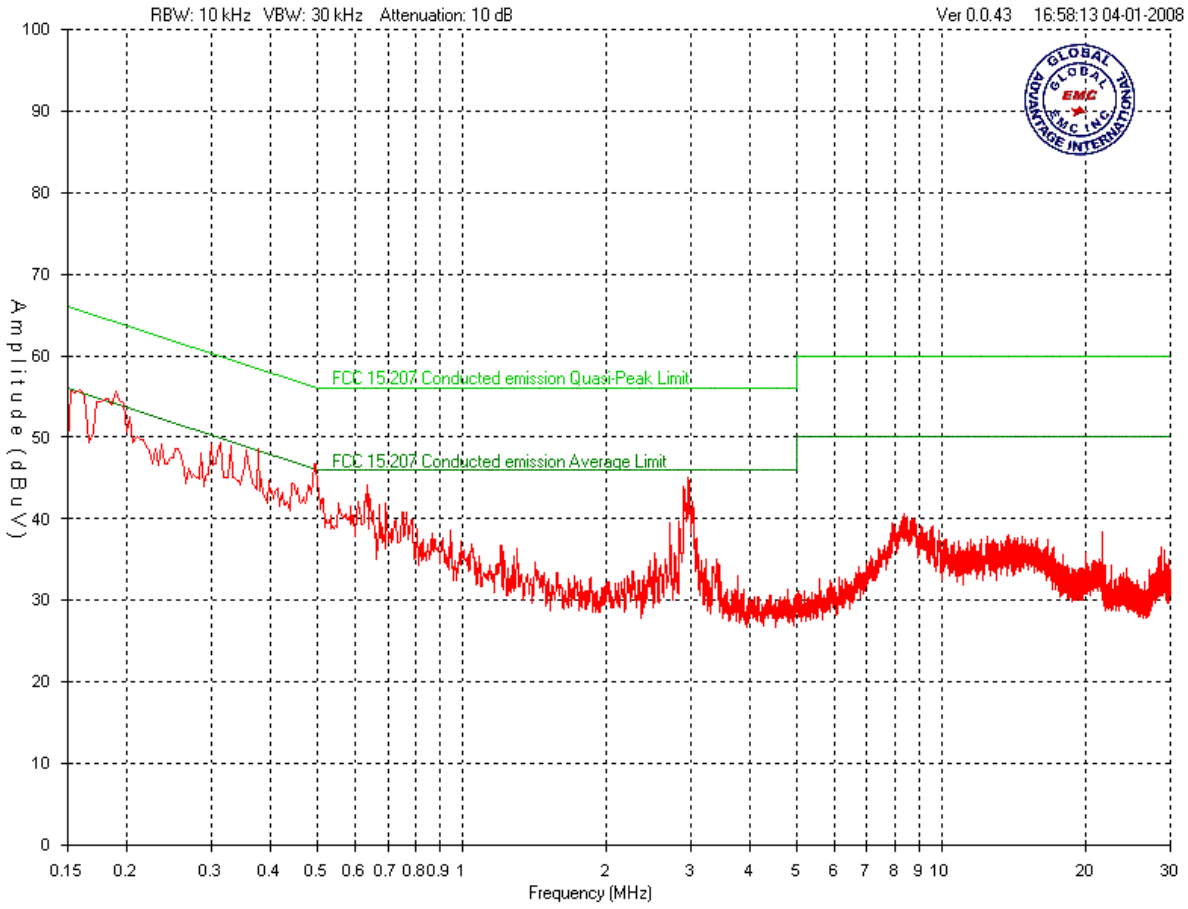
120V Line Peak emissions




Client	Viconics
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Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006



120V Neutral Peak emissions




Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Final Measurements

Average Emissions Table


Product category	FCC 15.207								
Project	Viconics Zigbee Module Average limits met using QP								
Test Frequency (MHz)	Detection mode (Q-Peak / Avg)	Raw signal (dBuV)	Cable loss (dB)	Attenuator (dB)	LISN factor (dB)	Received signal (dBuV)	Emission limit (dBuV)	Margin (dBuV)	Result
120V 60Hz Line									
0.15	QP	36.7	0.2	10	1.75	48.65	56	7.35	PASS
0.187	QP	36.5	0.2	10	1.75	48.45	55	6.55	PASS
0.248	QP	31	0.2	10	1	42.2	54	11.8	PASS
0.309	QP	31.5	0.2	10	0.6	42.3	52	9.7	PASS
2.96	QP	32.9	0.2	10	0.25	43.35	46	2.65	PASS
2.904	QP	31	0.2	10	0.25	41.45	46	4.55	PASS
3.033	QP	29.8	0.2	10	0.3	40.3	46	5.7	PASS

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

120V 60Hz Neutral									
0.15	QP	38.1	0.2	10	1.75	50.05	56	5.95	PASS
0.187	QP	35.3	0.2	10	1.75	47.25	55	7.75	PASS
0.248	QP	30.9	0.2	10	1	42.1	54	11.9	PASS
0.309	QP	31.4	0.2	10	0.6	42.2	52	9.8	PASS
2.96	QP	33	0.2	10	0.25	43.45	46	2.55	PASS
2.902	QP	31.3	0.2	10	0.25	41.75	46	4.25	PASS
3.033	QP	30.2	0.2	10	0.3	40.7	46	5.3	PASS

Note:


1. All readings were recorded using QP detector and compared against Average limits.
2. See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up for the highest line conducted emission

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	2006-08-09	2008-08-09	GEMC 6
Quasi Peak Adapter	85650A	HP	2006-08-07	2008-08-07	GEMC 7
LISN	LISN 275-25-1	Vican	2006-09-12	2008-09-12	GEMC 12
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
Attenuator 10 dB	FP-50-10	Trilithic	NCR	NCR	GEMC 42

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


Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Appendix A – EUT Summary


General EUT Description

Client	
Organization	Viconics
Contact	Paolo Primiani
Phone	1-800-563-5660
Email	paolo@viconics.com
EUT Details	
EUT Model number	VWG 40
Equipment Category	Thermostat control equipment.
Basic EUT Functionality	Viconics Wireless Gateway (VWG-40) and associated thermostats with wireless mesh network adapter, has been specifically designed to target the automation-less retrofit market equipped with stand-alone electromechanical or electronic controls. The Viconics wireless product line provides significant reduction in installed costs through the elimination of additional field communication wiring, allowing you to reuse the existing equipment-to-controller wiring infrastructure.
Input Voltage and Frequency	120V 60Hz
Connectors available on EUT	2 X RJ 45 ports, DB-9 Male, Power ports, RF antenna port
Peripherals Required for Test	RJ-45 connected to a laptop to program the EUT for operation.
Release type	Final
Intentional Radiator Frequency	2400 – 2483.5 MHz for Zigbee protocol.
I/O cable description	2 X RJ 45 ports, DB-9 Male

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	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

Appendix B – EUT and Test Setup Photographs

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

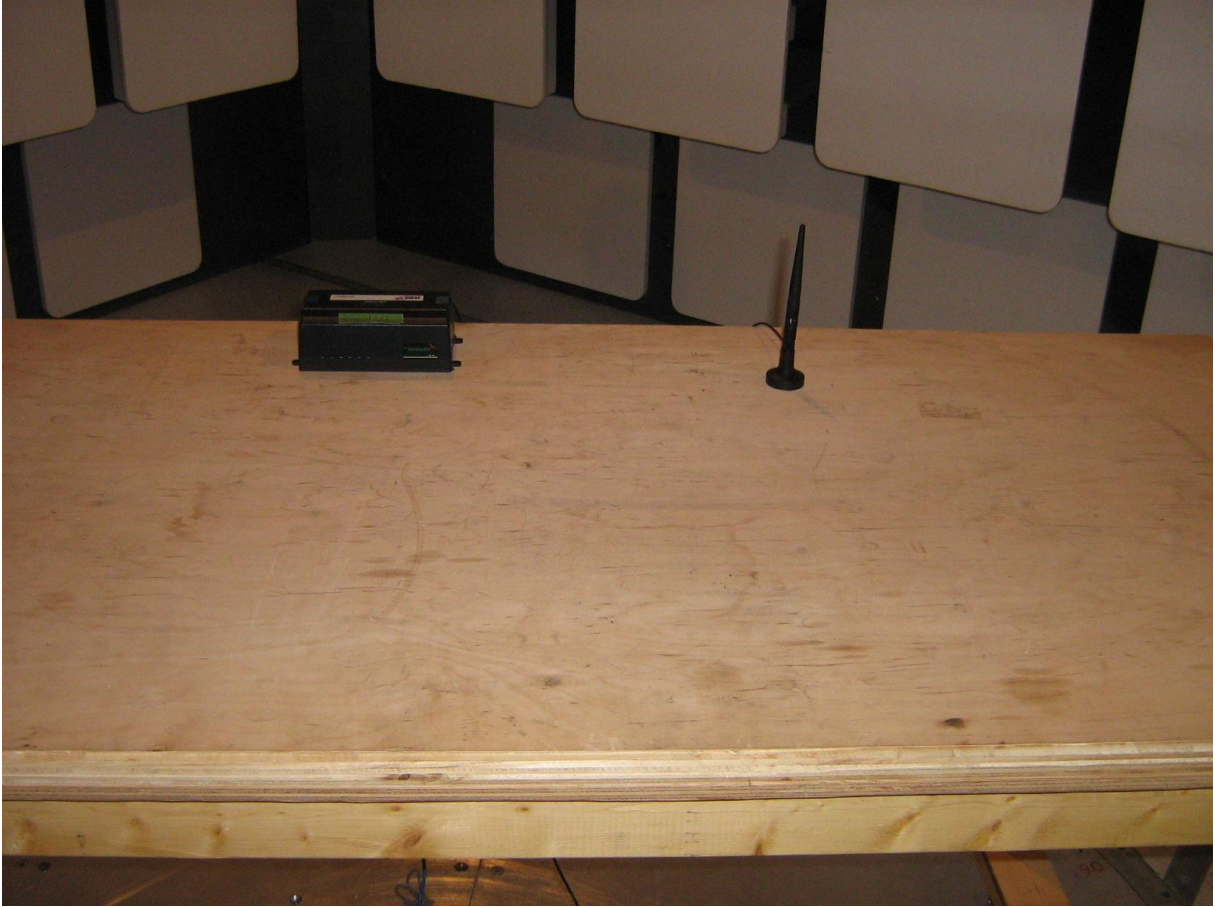


Figure 1 – EUT with extended cable antenna option



Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	



Figure 2 – Radiated emission setup

Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	

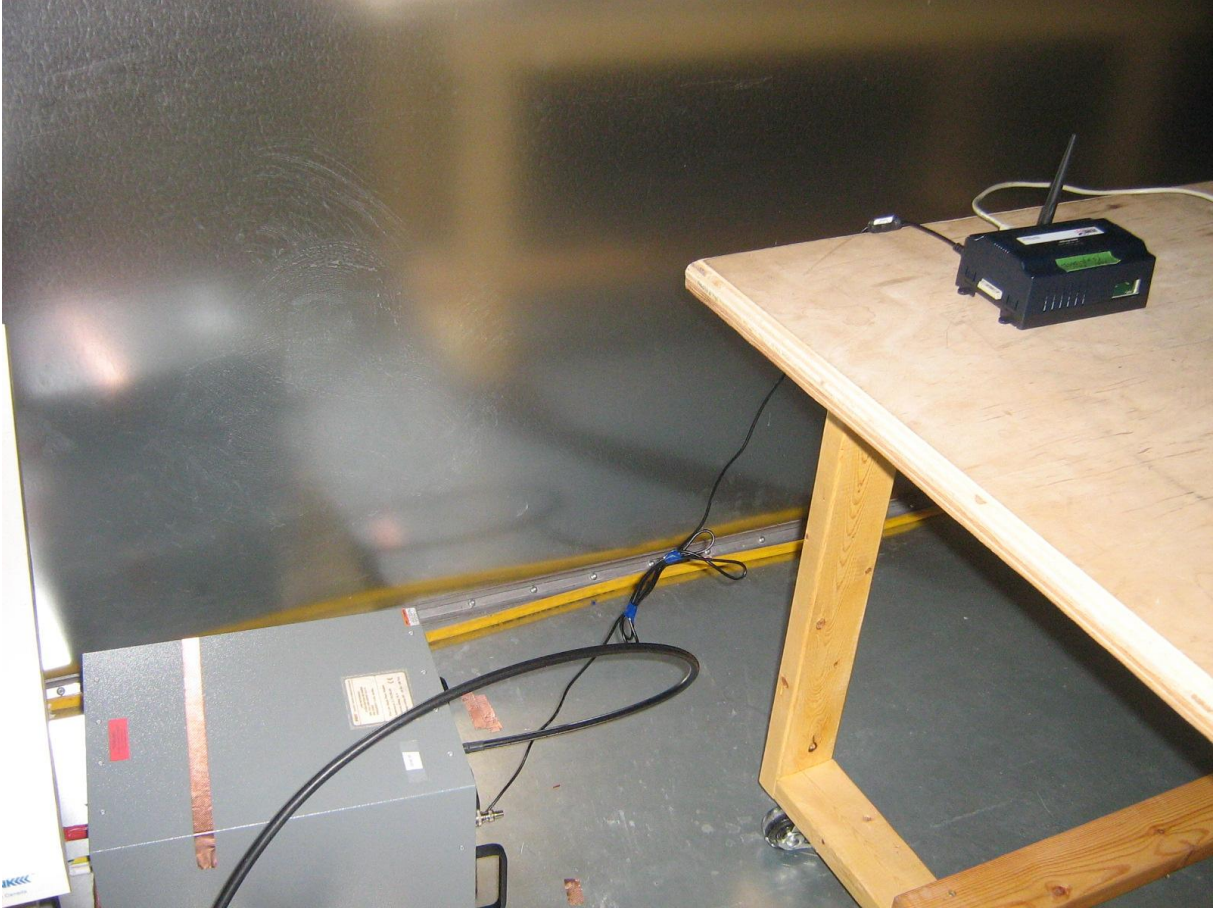


Figure 3 – Power line conducted emissions


Client	Viconics	
Product	VWG 40	
Standard(s)	RSS 210 Issue 6:2005 / FCC Part 15 Subpart C 15:2006	



Figure 4 – Conducted power emissions

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