Excellence in Compliance Testing

Certification Test Report

FCC ID: LHL-215-1960

FCC Rule Part: 15.247

ACS Report Number: 10-0028.W04.11.A

Manufacturer: **MaxVision, LLC**
Model: **215-1960**

Test Begin Date: **October 8, 2010**
Test End Date: **November 5, 2010**

Report Issue Date: **November 15, 2010**

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200897-0

This report is not be used to claim certification, approval, or endorsement by NVLAP, NIST or any government agency.

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Reviewed by:

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This report contains 22 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations for a Class II Permissive change for adding an antenna.

1.2 Product description

The 215-1960 is a single modular device that provides Bluetooth 2.0 and a WiFi 802.11 b/g integrated onto one module.

Mode of Operation	Frequency Range (MHz)	Number of Channels	Channel Separation (kHz)	Data Rates Supported (kbps)
Bluetooth	2402-2480	79	1000	----
802.11b	2412-2462	11	5000	11000
802.11g	2412-2462	11	5000	54000

Manufacturer Information:
MaxVision, LLC
495 Production Ave
Madison, AL 35758
Voice: (256) 772-3058
Fax: (256) 772-3078

Antenna:

Test Sample Serial Number(s): MV000340889 (BPAC Host Device)

Test Sample Condition: The equipment was in good physical conditions with no noticeable damages. The Bluetooth and WiFi Transmitters were operating as designed and as intended for production.

1.3 Test Methodology and Considerations

The module was tested as integrated into the MaxVision BPAC mobile computer. The BPAC was powered from an internal battery for radiated spurious emissions and band-edge compliance measurements for the Bluetooth and WiFi transmitters. Preliminary radiated emissions were performed for the device set in three orthogonal orientations and the final measurements were performed in the orientation leading to maximum emissions.

The transmitters were set to test mode using the Labtool and Bluetest firmwares for the WiFi and Bluetooth modes of operation, respectively.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

FCC Test Firm Registration #: 581606
Industry Canada Lab Code: 4175C

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 200897-0. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated & Conducted Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl floor.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flushed with the chamber floor which it is connected to, around its circumference, with metallic loaded springs. An EMCO Model 1051 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

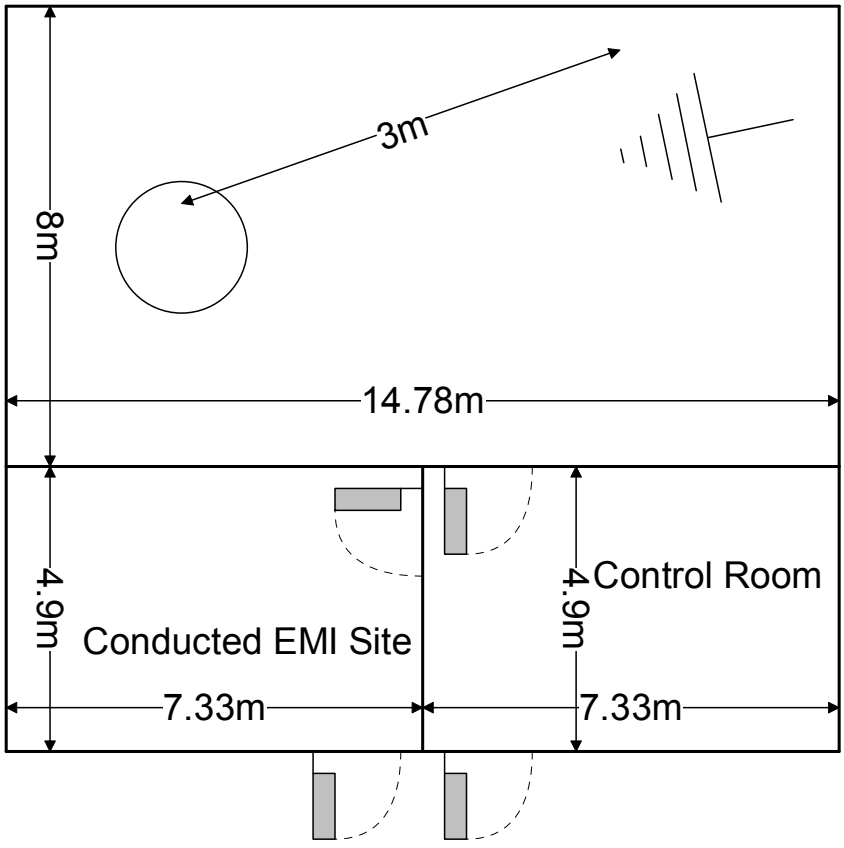


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m^3. As per ANSI C63.4 2003 requirements, the data were taken using two LISNs; a Solar Model 8028-50 50 Ω/50 µH and an EMCO Model 3825, which are installed as shown in Photograph 3. For 220 V, 50 Hz, a Polarad LISN (S/N 879341/048) is used in conjunction with a 1 kVA, 50 Hz/220 V EDGAR variable frequency generator, Model 1001B, to filter conducted noise from the generator.

A diagram of the room is shown below in figure 2.3.2-1:

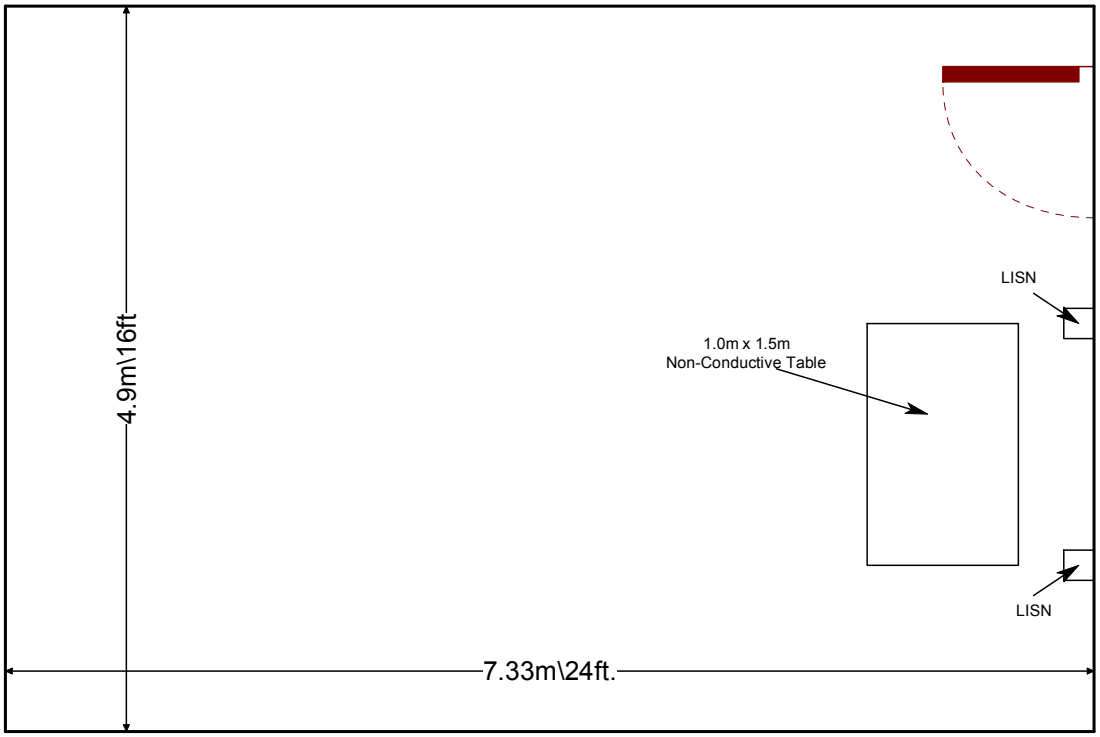


Figure 2.3.2-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2010
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2010
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000
- KDB 558074 - Measurement of Digital Transmission Systems Operating under Section 15.247, March 23, 2005

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Cal Due Date
2006	EMCO	3115	Antennas	2573	2/21/2011
2008	COM-Power	AH-826	Antennas	81009	N/A
2012	Hewlett-Packard	HP83017A	Amplifiers	3123A00324	12/30/2010
2013	Hewlett Packard	HP8566B	Spectrum Analyzers	2407A03233	8/5/2012
2014	Hewlett Packard	HP 85650A	Quasi Peak Adapter	2430A00559	8/5/2012
2037	ACS Boca	Chamber EMI Cable Set	Cable Set	2037	12/30/2010
2044	QMI	High Frequency Cable Set	Cables	2044	1/6/2011
2056	Hewlett Packard	11971K	Mixer	2332A00424	8/5/2012

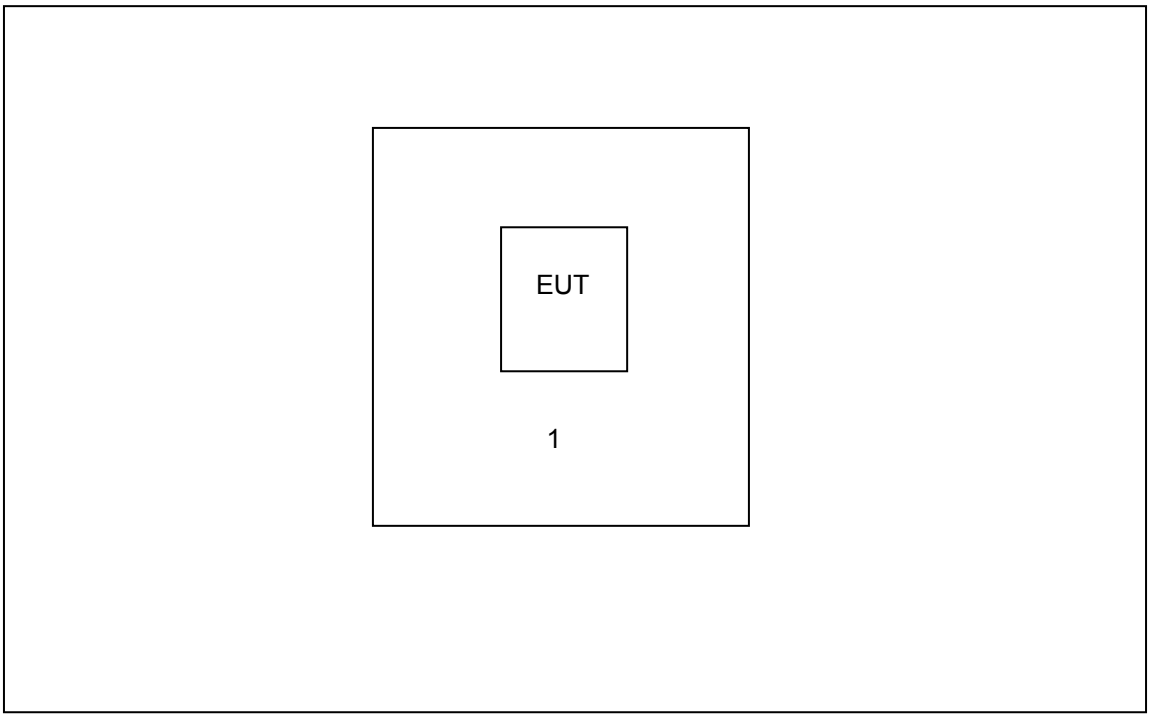
*Note:
The asset 2008 is a standard gain horn antenna. Hence, recurring calibration beyond initial calibration per the manufacturer is not required only in case of damage, suspected deterioration or use at distance closer than $2xa^2/\lambda$, as per ANSI C63.4 requirements.

5 SUPPORT EQUIPMENT

Table 5-1: Support Equipment

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Mobile Computer	MaxVision	BPAC	MV000340889

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM



7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC: Section 15.203

The 215-1960, as integrated into the BPAC host, utilizes a PCB providing two printed U-shaped antennas, feeding from the WiFi and Bluetooth ports, J42 and J41 respectively, through mini coaxial cables. The antenna is a full custom design, and is shorted at baseband, thus it is H-field (magnetic). Gain is 1dBi.

7.2 Radiated Emissions – FCC: Section 15.109(Unintentional Radiation)

7.2.1 Measurement Procedure

Radiated emissions tests were performed over the frequency range of 30MHz to 12.5GHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements above 30MHz and below 1GHz were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz using a Quasi-peak detector. Above 1GHz, peak and average measurements are taken with the RBW and VBW were set to 1MHz.

7.2.2 Measurement Results

Results of the test are given in Table 7.2-1 below:

Table 7.2-1: Radiated Emissions Tabulated Data

Frequency (MHz)	Measured Level (dBµV)		Antenna Polarization	Correction Factors	Corrected Level (dBµV/m)		Limit (dBµV/m)	Margin (dB)	
	Pk	Qpk/Av	(H/V)	(dB)	Pk	Qpk/Av	Qpk/Av	Pk	Qpk/Av
2900.00	43.00	36.00	H	-0.81	43.81	36.81	54.00	10.19	17.19
4500.00	40.53	29.75	H	-4.99	45.52	34.74	54.00	8.48	19.26

* Note: All emissions above 4500 MHz were attenuated below the permissible limit.

7.3 Band-Edge Compliance and Spurious Emissions-FCC 15.247d

7.3.1 Band-Edge Compliance of RF Conducted Emissions

7.3.1.1 Measurement Procedure

The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 100 kHz, and the VBW was set to 1000 kHz.

The emissions were maximized by rotating the EUT through 360° and the receive antenna height was varied from 1m to 4m.

7.3.1.2 Measurement Results

The attenuation from the fundamental emission outside of the frequency range of operation was at least 20 dB. The emissions falling within the restricted bands met the average limits of 54 dBµV/m. Results are shown in the figures 7.3.1.2-1 to 7.3.1.2-12 and tables 7.3.1.2-1 to 7.3.1.2-3 below.

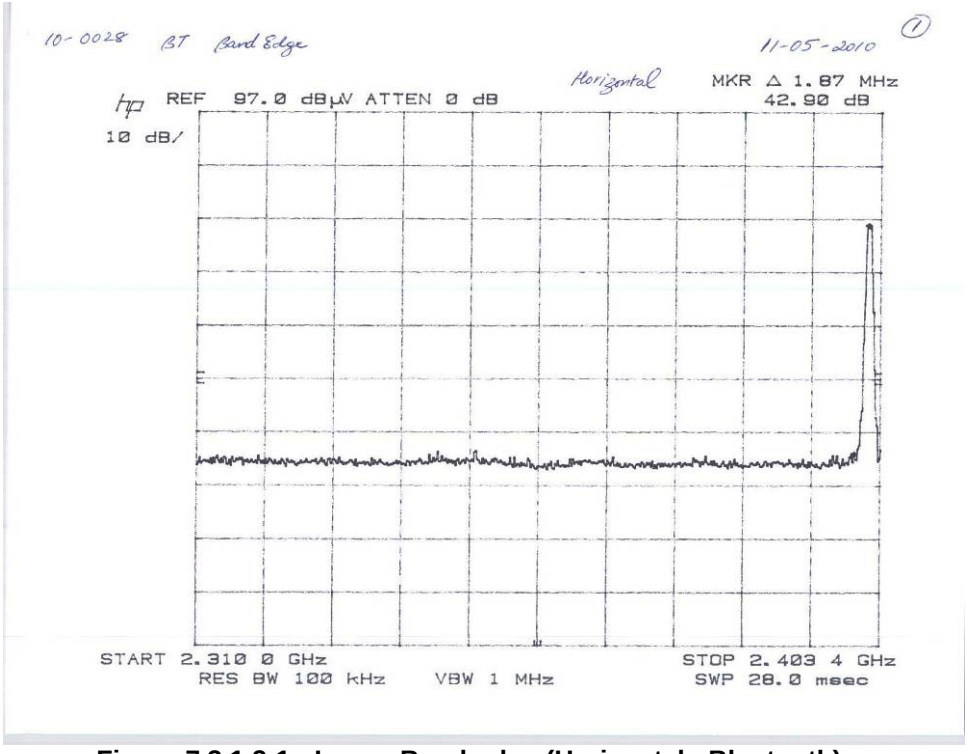


Figure 7.3.1.2-1: Lower Band-edge (Horizontal - Bluetooth)

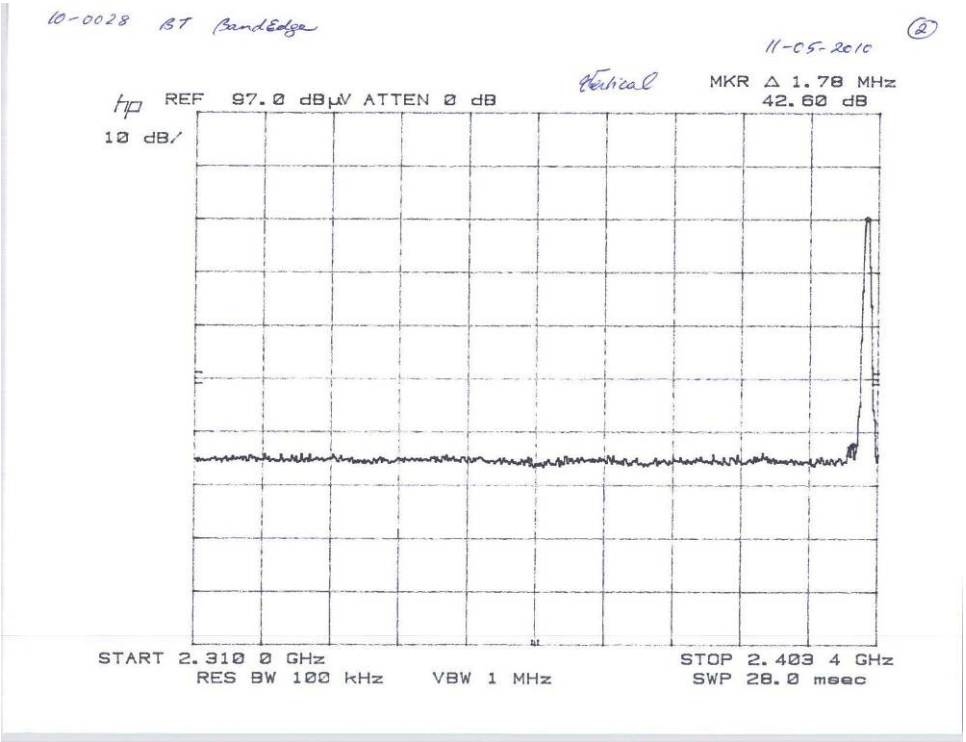


Figure 7.3.1.2-2: Lower Band-edge (Vertical - Bluetooth)

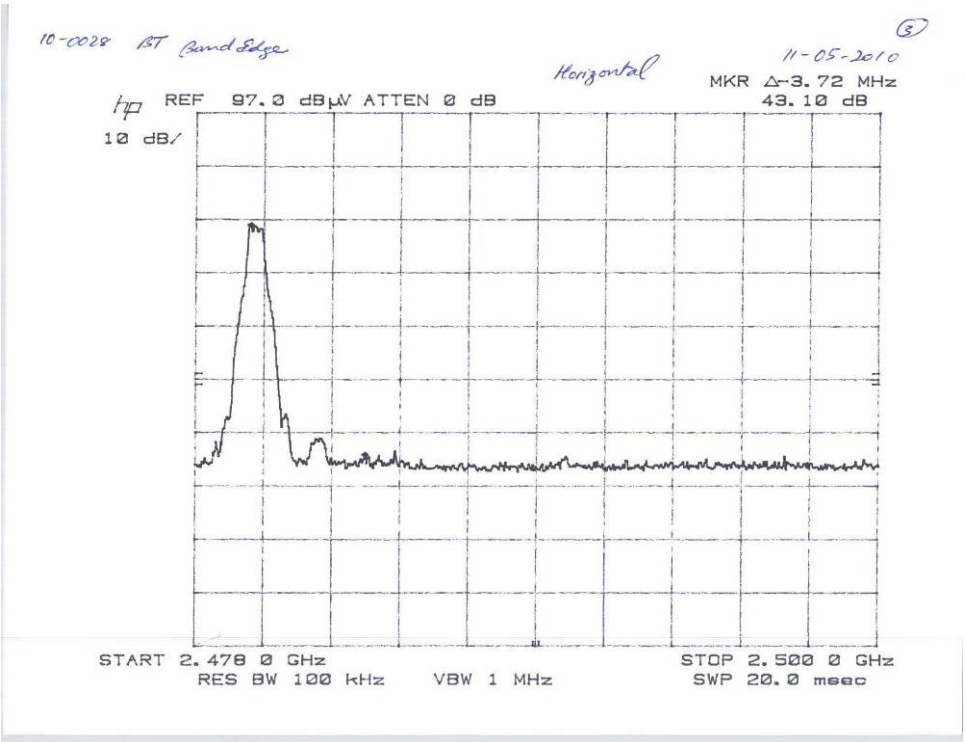


Figure 7.3.1.2-3: Upper Band-edge (Horizontal - Bluetooth)

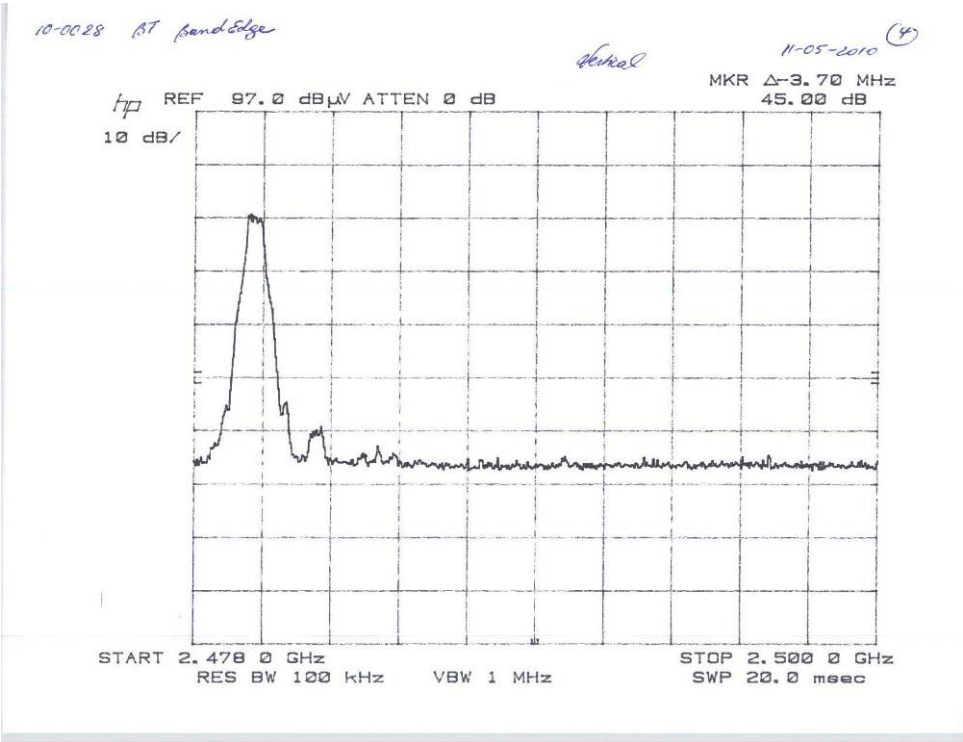


Figure 7.3.1.2-4: Upper Band-edge (Vertical - Bluetooth)

Table 7.3.1.2-1: Upper Channel Band Edge - Bluetooth

Frequency (MHz)	Measured Level (dBµV)		Antenna Polarization	Correction Factors	Corrected Level (dBµV/m)		Limit (dBµV/m)	Margin (dB)	
	Pk	Qpk/Av	(H/V)	(dB)	Pk	Qpk/Av	Qpk/Av	Pk	Qpk/Av
2483.50	40.60	---	V	-5.57	46.17	---	54.00	7.83	---
2483.50	41.00	---	H	-5.57	46.57	---	54.00	7.43	---

Notes:

1. **The measurements in Table 7.3.1.2-1 are performed with RBW = 1 MHz.**
2. **Since the peak emissions meet the Average Limits, the values reported were deemed sufficient to show compliance**

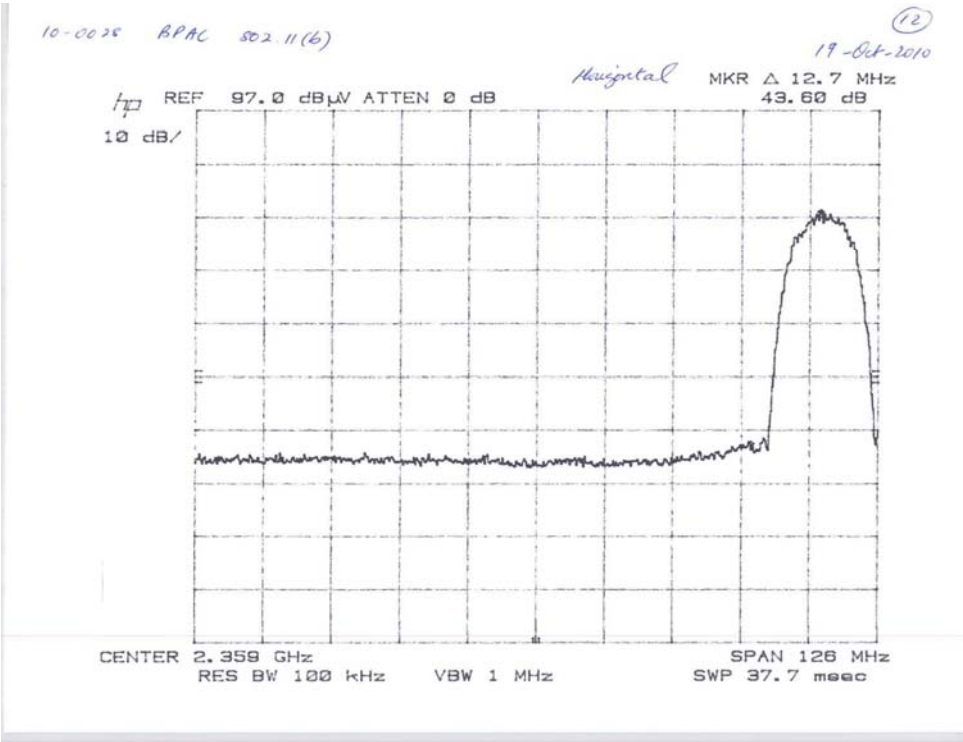


Figure 7.3.1.2-5: Lower Band-edge (Horizontal – 802.11 (b))

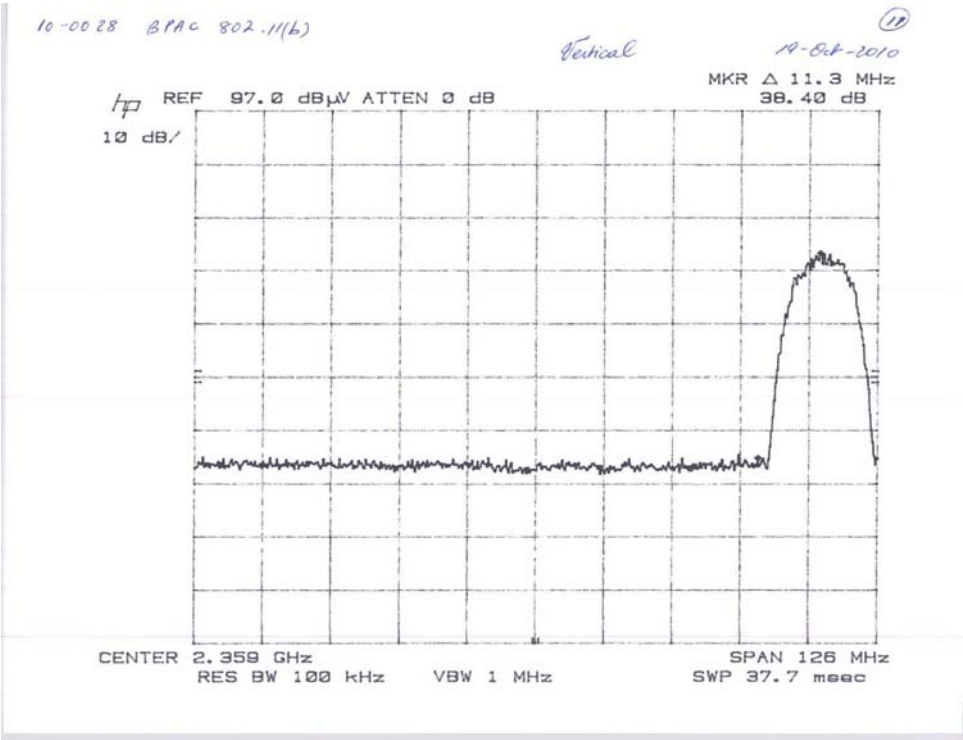


Figure 7.6.3.2-6: Lower Band-edge (Vertical - 802.11 (b))

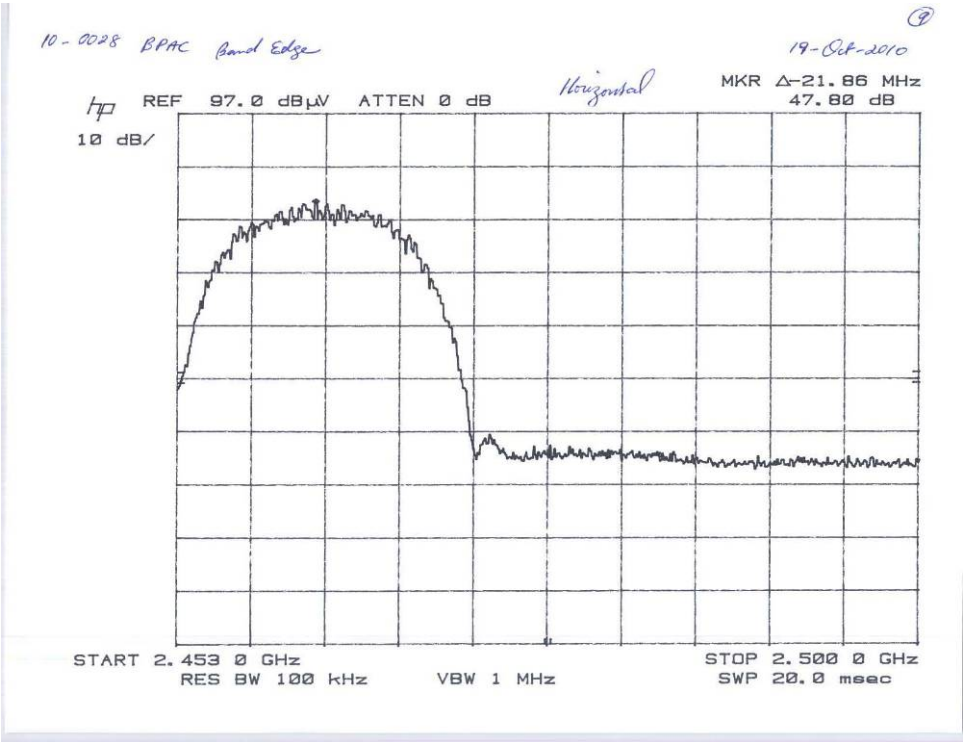


Figure 7.3.1.2-7: Upper Band-edge (Horizontal - 802.11 (b))

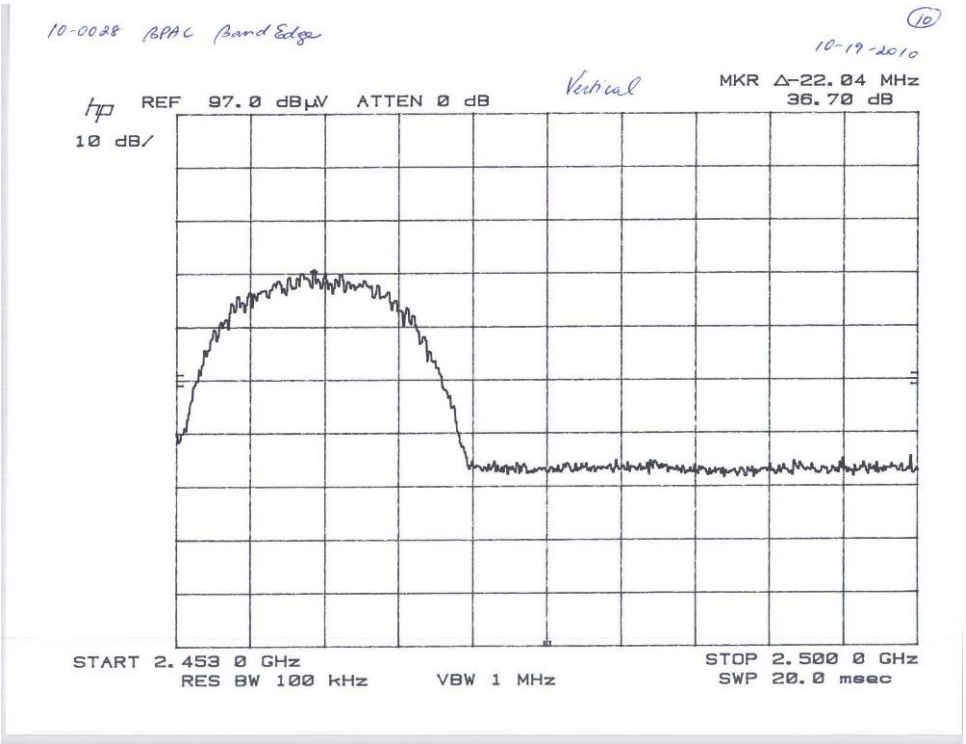


Figure 7.3.1.2-8: Upper Band-edge (Vertical - 802.11 (b))

Table 7.3.1.2-1: Upper Channel Band Edge -802.11(b)

Frequency (MHz)	Measured Level (dBuV)		Antenna Polarization	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	
	Pk	Qpk/Av	(H/V)	(dB)	Pk	Qpk/Av	Qpk/Av	Pk	Qpk/Av
2483.50	39.10	---	H	-5.57	44.67	---	54.00	9.33	---
2483.50	37.20	---	V	-5.57	42.77	---	54.00	11.23	---

Notes:

1. **The measurements in Table 7.3.1.2-2 are performed with RBW = 1 MHz.**
2. **The Marker Delta Method was applied for the measurement at the edges of the band.**
3. **Since the peak emissions meet the Average Limits, the values reported were deemed sufficient to show compliance**

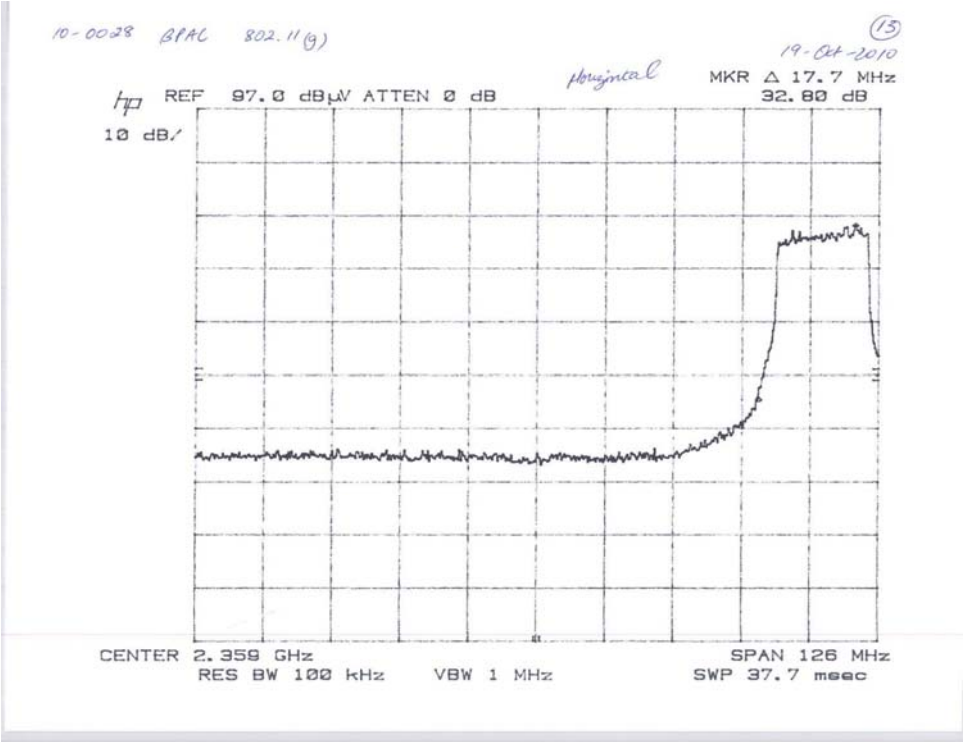


Figure 7.3.1.2-9: Lower Band-edge (Horizontal - 802.11 (g))

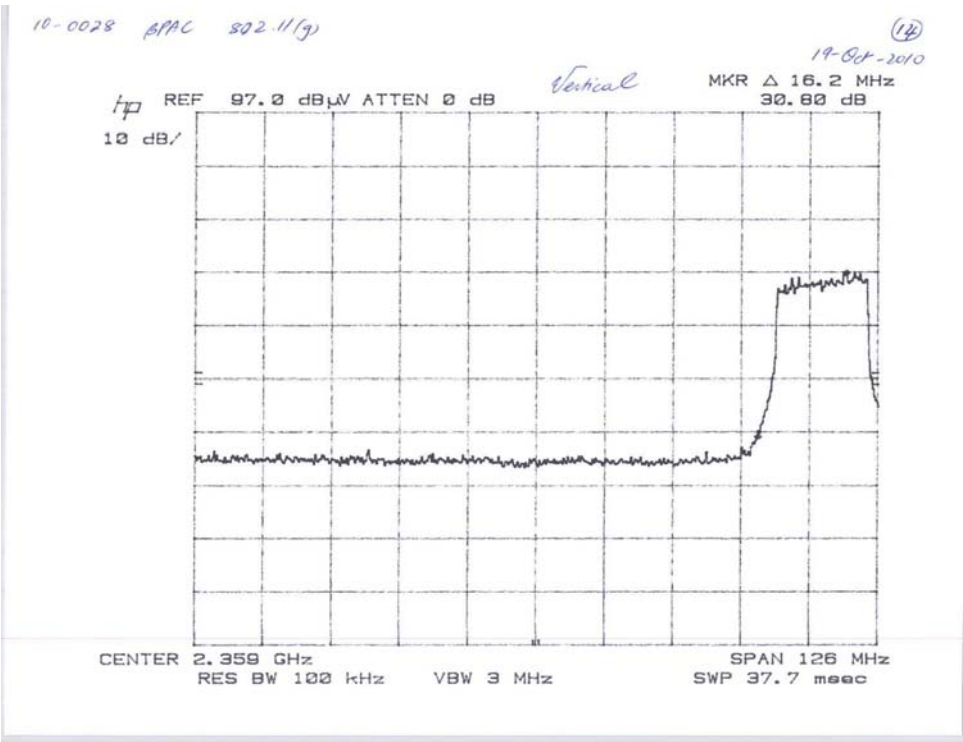


Figure 7.3.1.2-10: Lower Band-edge (Vertical - 802.11 (g))

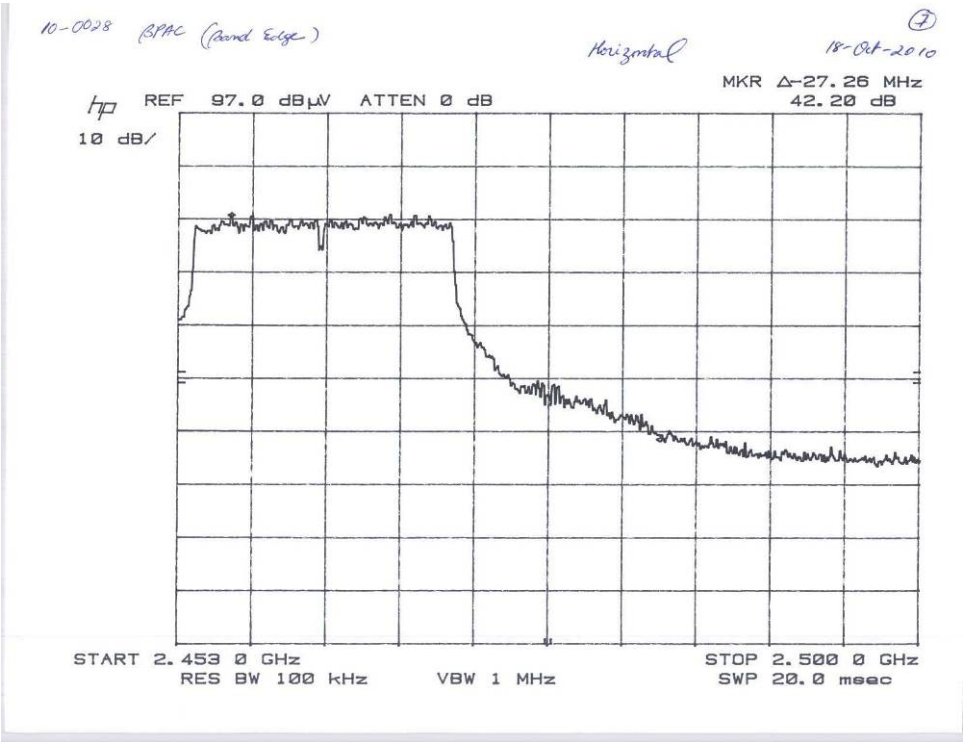


Figure 7.3.1.2-11: Upper Band-edge (Horizontal - 802.11 (g))

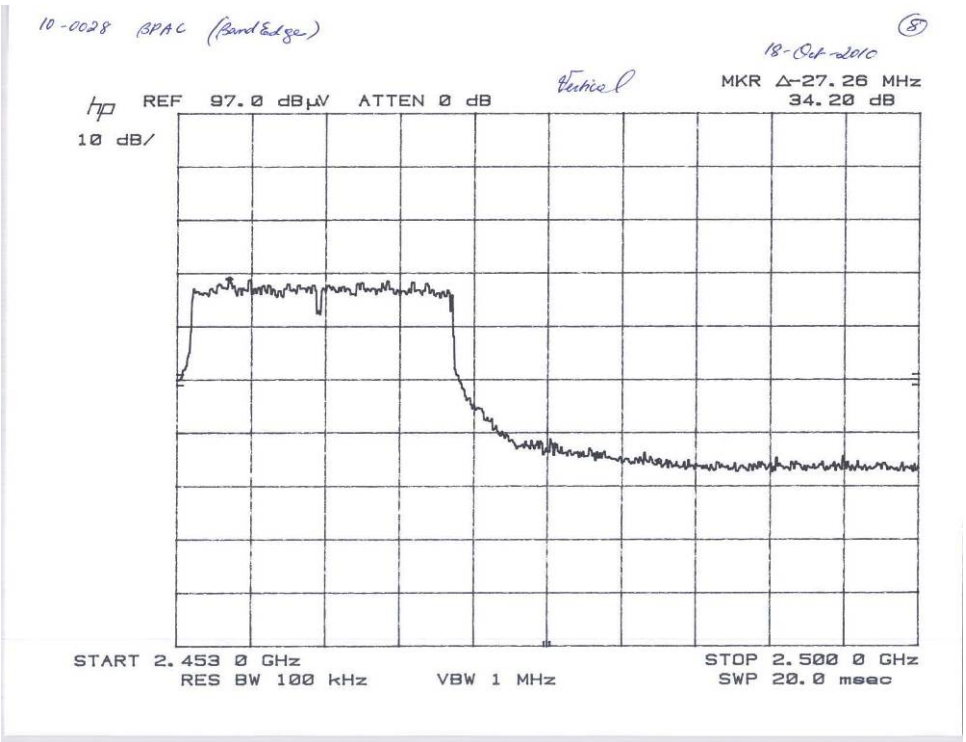


Figure 7.3.1.2-12: Upper Band-edge (Vertical - 802.11 (g))

Table 7.3.1.2-3: Upper Channel Band Edge – 802.11 (g)

Frequency (MHz)	Measured Level (dBuV)		Antenna Polarization	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	
	Pk	Qpk/Av	(H/V)	(dB)	Pk	Qpk/Av	Qpk/Av	Pk	Qpk/Av
2483.50	44.70	---	H	-5.57	50.27	---	54.00	3.73	---
2483.50	41.00	---	V	-5.57	46.57	---	54.00	7.43	---

Notes:

1. **The measurements in Table 7.3.1.2-3 are performed with RBW = 1 MHz.**
2. **The Marker Delta Method was applied for the measurement at the edges of the band.**
3. **Since the peak emissions meet the Average Limits, the values reported were deemed sufficient to show compliance**

7.3.2 Radiated Spurious Emissions - FCC Section 15.205

7.3.2.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30MHz to 25 GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements made with RBW and VBW of 1 MHz and 3MHz respectively.

The EUT was caused to generate a continuous carrier signal on the hopping channel.

7.3.2.2 Measurement Results

Radiated spurious emissions found in the band of 30MHz to 25 GHz are reported in the Table 7.6.3.2-1 to Table 7.6.3.2-3 below.

Table 7.6.3.2-1: Radiated Spurious Emissions Tabulated Data (Bluetooth)

Channel	Frequency (MHz)	Measured Level (dBµV)		Antenna Polarization	Correction Factors	Corrected Level (dBµV/m)		Limit (dBµV/m)	Margin (dB)	
		Pk	Qpk/Av	(H/V)	(dB)	Pk	Qpk/Av	Qpk/Av	Pk	Qpk/Av
Low	**4804.00**	47.57	42.00	H	-6.32	53.89	48.32	54.00	0.11	5.68
	4804.00	44.56	37.26	V	-6.32	50.88	43.58	54.00	3.12	10.42
	7206.00	43.73	32.76	H	-9.26	52.99	42.02	54.00	1.01	11.98
Middle	**4882.00**	42.28	31.93	H	-6.63	48.91	38.56	54.00	5.09	15.44
High	**4960.00**	43.78	34.76	H	-6.93	50.71	41.69	54.00	3.29	12.31
	4960.00	42.84	30.71	V	-6.93	49.77	37.64	54.00	4.23	16.36

* Note: All the peak emissions were attenuated below the average limit of 54 dBµV/m.
All emissions above 7206 MHz were attenuated below the permissible limit and the noise floor of the measurement equipment.

Table 7.6.3.2-2: Radiated Spurious Emissions Tabulated Data (802.11 (b))

Channel	Frequency (MHz)	Measured Level (dBµV)		Antenna Polarization	Correction Factors	Corrected Level (dBµV/m)		Limit (dBµV/m)	Margin (dB)	
		Pk	Qpk/Av	(H/V)	(dB)	Pk	Qpk/Av	Qpk/Av	Pk	Qpk/Av
Low	No spurious emissions could be detected above the noise floor of the measurement equipment									
Middle										
High										

* Notes: All peak emissions were attenuated below the noise floor of the measurement equipment and the average limit of 54 dBµV/m.

Table 7.6.3.2-3: Radiated Spurious Emissions Tabulated Data (802.11(g))

Channel	Frequency (MHz)	Measured Level (dBµV)		Antenna Polarization	Correction Factors	Corrected Level (dBµV/m)		Limit (dBµV/m)	Margin (dB)	
		Pk	Qpk/Av	(H/V)	(dB)	Pk	Qpk/Av	Qpk/Av	Pk	Qpk/Av
Low	No spurious emissions could be detected above the noise floor of the measurement equipment									
Middle										
High										

* Note: All peak emissions were attenuated below the noise floor of the measurement equipment and the average limit of 54 dBµV/m.

7.3.2.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak
Corrected Level: 47.57 + 6.32 = 53.89dBuV/m
Margin: 54dBuV/m – 53.89dBµV/m = 0.11dB

Example Calculation: Average
Corrected Level: 42 + 6.32 - 0= 48.32dBµV/m
Margin: 54dBuV/m – 48.32dBµV/m = 5.68dB

8 CONCLUSION

In the opinion of ACS, Inc. the 215-1960, manufactured by MaxVision, LLC meets the requirements of FCC Part 15 subpart C.

END REPORT