



MOBILE DEVICES BUSINESS

**PRODUCT SAFETY AND COMPLIANCE
EMC LABORATORY**

EMC TEST REPORT - Addendum

Test Report Number –25111-1 WLAN-Radiated

Report Date –2012-08-23

The test results contained herein relate only to the model(s) identified. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.

Signature:

Name: Hongpeng Yin

Title: EMC Project Manager

Test: 2012-07-23 to 2012-08-23

As the responsible test lab manager, I hereby declare that the model tested as specified in this report conforms to the requirements indicated.

Signature:

Name: Danny Palaniswami

Title: Test Lab Manager

Date: 2012-08-24

This report must not be reproduced, except in full, without written approval from this laboratory.

FCC Registration Number: 402854

IC Registration Number: 109AW-1

ADR Testing Service location ADR BJ
ISO/IEC-17025:2005 accredited by UKAS



UKAS CertificateNumber: 2404

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Test Report Details

Tests Performed by: Motorola (China) Technologies Ltd.
Asia Global Compliance Labs
No. 1 Wang Jing East Road
Chao Yang District
Beijing, 100102, P. R. China
Phone: +86 10 8499 5891
FCC Registration Number: 402854
IC Registration Number: 109AW-1

Tests Requested by: Motorola Mobility LLC.
Mobile Devices business
600 North US Hwy 45
Libertyville, IL 60048
U. S. A.

Product Type: Cellular phone

Signaling Capability: GSM 850/1900, EDGE 850/1900,
Bluetooth+EDR,
802.11a/802.11b/802.11g/802.11n

Serial Numbers: 352524050008534

FCC ID: IHDT56NS6

Project number: 25111-1

Testing Complete Date: 2012-08-24

Applicable Standards

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

- Part 15 Subpart C – Intentional Radiators
- Part 22 Subpart H - Public Mobile Services
- Part 24 - Personal Communications Services
- Part 27 - Wireless Communications Service
- Part 90 - Private Land Mobile Radio Service

Applicable Standards: ANSI C63.4-2003, RSS-Gen Issue 3, RSS-210 Issue 8.

DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems" published by the Federal Communications Commission was also used in the testing of this product.

The following tests were performed according to the regulations:

- The **spurious radiated emission** requirements of **§ 15.247 and § 15.249 and of CFR47 Part 15 2007**, specifically" radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
- Under this project 30 to 1000 MHz, 1 to 26.5 GHz radiated and radiated band-edge measurements were performed.
- For frequencies below 1 GHz a 100 kHz RBW (6 dB) is used and above 1 GHz a 1 MHz RBW (6 dB) is used.

Summary of Testing

Test	Test Name	Pass/Fail
1	Field Strength of Spurious Emissions	Pass
2	Band-edge Compliance of RF Radiated Emissions	Pass

Test	Test Name	Results
1	Field Strength of Spurious Emissions	See plots
2	Band-edge Compliance of RF Radiated Emissions	See plots

The margin with respect to the limit is the minimum margin for all modes and bands.

General and Special Conditions

The test sample was tested using a fully charged internal battery when applicable. Where a battery could not be used due to the need for a controlled variation of input voltage, an external power supply was utilized.

Special test SW was used for these tests. Radiated testing was done in the following modes:

- 802.11 b mode @ 5.5 Mbps
- 802.11 g mode @ 6 Mbps
- 802.11 n mode 2.4G 400ns GI @ 7.2 Mbps
- 802.11 n mode 2.4G 800ns GI @ 6.5 Mbps
- 802.11 a mode subband4 @ 6 Mbps
- 802.11 n mode 5G subband4 400ns GI @ 14 Mbps
- 802.11 n mode 5G subband4 800ns GI @ 13 Mbps

All testing was done in an indoor controlled environment with an average temperature of 25 ° C ± 1 ° C and relative humidity of 45 % ± 6 % over the dates used for testing.

Radiated emissions was measured from 9kHz to 30MHz and all emission were 20dB below the limit.

Equipment and Cable Configurations

The EUT was tested in a stand-alone configuration that is representative of typical use.

Measuring Equipment and Calibration Information

Equipment related to the semi-anechoic chamber testing:

Equipment	Model/type	Serial number	Operational range	Date of calibration
EMI Receiver	ESU 40	100036	20 Hz – 40 GHz	11.08.2011
Pre Amplifiers	PA-02-0001:	2007343	10 kHz – 3 GHz	N/A
	PA-02-218	2007344	3 GHz – 18 GHz	N/A
	PA-02-5	2007345	18 GHz – 40 GHz	N/A
Band Reject Filter	WRCG	N/A	ISM band	N/A
	4N45-24241/3/6	N/A	WLAN	N/A

The antennas used in the various tests are listed in the below table.

Antenna	Type	Serial number	Operational range	Date of calibration
Hybrid-log periodic	TDK HLP 3003C	130361	30 MHz – 3 GHz	01.14.2011
Double ridged Horn	TDK HRN0118	130303	1 GHz – 18 GHz	11.22.2011
Double ridged Horn	ETS HRN3116	00071938	18 GHz – 40 GHz	07.13.2011
FMZB1513	Loop Antenna	1513-105	9KHz – 30MHz	04.01.2012

Note that the hybrid antenna and horn antenna are on a three-year calibration cycle. All other equipments are on a one-year calibration cycle.

Description of WLAN (WiFi) Transmitter

The 25082-1 test sample offers WLAN as a feature. The WLAN direct sequence spread-spectrum transceiver is designed to operate between 2400 and 2483 MHz. The WLAN antenna is mounted on the PCB inside of the EUT. The antenna installation is permanent. For a more thorough description of the functionality please refer to Exhibit 12 of this package.

As a WLAN transmitter, it is designed operate with other WLAN devices as defined by industrial standard. In this application, the device is battery-operated.

There is a switch in the Bluetooth/WLAN (BT/WiFi) module that switches between BT and WiFi. They share the same antenna, and you are able to use a BT headset while in a WiFi VoIP call, however, they do not transmit and receive at the same time. There is a 20 ms delay (for switching between the two systems in time domain) using an intelligent multiplexing scheme. Even though they share the same antenna they are **NOT ON** at the same time. The WiFi is therefore tested as a standalone transmitter.

Measurement Procedures and Data

FIELD STRENGTH OF SPURIOUS EMISSIONS

CFR Part 2.1053, 15.247, 15.249, 15.407

Measurement Procedure

The Equipment-Under-Test is placed inside the semi-anechoic chamber on a polystyrene table at the turntable center. For each spurious frequency, the antenna mast is raised and lowered from 1 to 4 meters and the turntable is rotated 360 degrees to obtain a maximum reading on the spectrum analyzer. This is repeated for both horizontal and vertical polarizations of the receive antenna.

The field strength of each radiated emission is calculated by correcting the EMI receiver level for cable loss, amplifier gain, and antenna correction factors.

For 30 MHz – 18 GHz:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{EMI Receiver Level (dB}\mu\text{V)} + \text{Cable Loss (dB)} - \text{Amplifier Gain (dB)} + \text{Filter loss (dB)} + \text{Antenna Correction Factor (3/m)}$$

For 18 GHz – 40 GHz:

$$\text{Field Strength (dB}\mu\text{V/m)} = \text{EMI Receiver Level (dB}\mu\text{V)} + \text{Cable Loss (dB)} - \text{Amplifier Gain (dB)} + \text{Filter loss (dB)} + \text{Antenna Correction Factor (1/m)}$$

For frequencies below 1GHz, using the following spectrum analyzer setting:

1. Detector Mode = Peak/QP
2. For Peak detector, RBW=100 kHz (6dB), VBW=Auto; For QP detector, RBW=120 kHz (6dB), VBW=Auto.

For frequencies above 1GHz, using the following spectrum analyzer setting:

1. Detector Mode = Peak/AV
2. For Peak detector, RBW=1 MHz (6dB), VBW=Auto; For AV detector, RBW=1 MHz (6dB), VBW=Auto.

A fully charged battery was used for the supply voltage.

The test sample was operated during the measurements under the following conditions:

- Tests were performed at low, mid and high channels.
- Tests were performed in both horizontal and vertical polarity.
- Tests were performed in both operational WiFi bands (b), (g) and (n)
- Tests were performed in X, Y and Z polarizations.

Measurement Results

Comments:

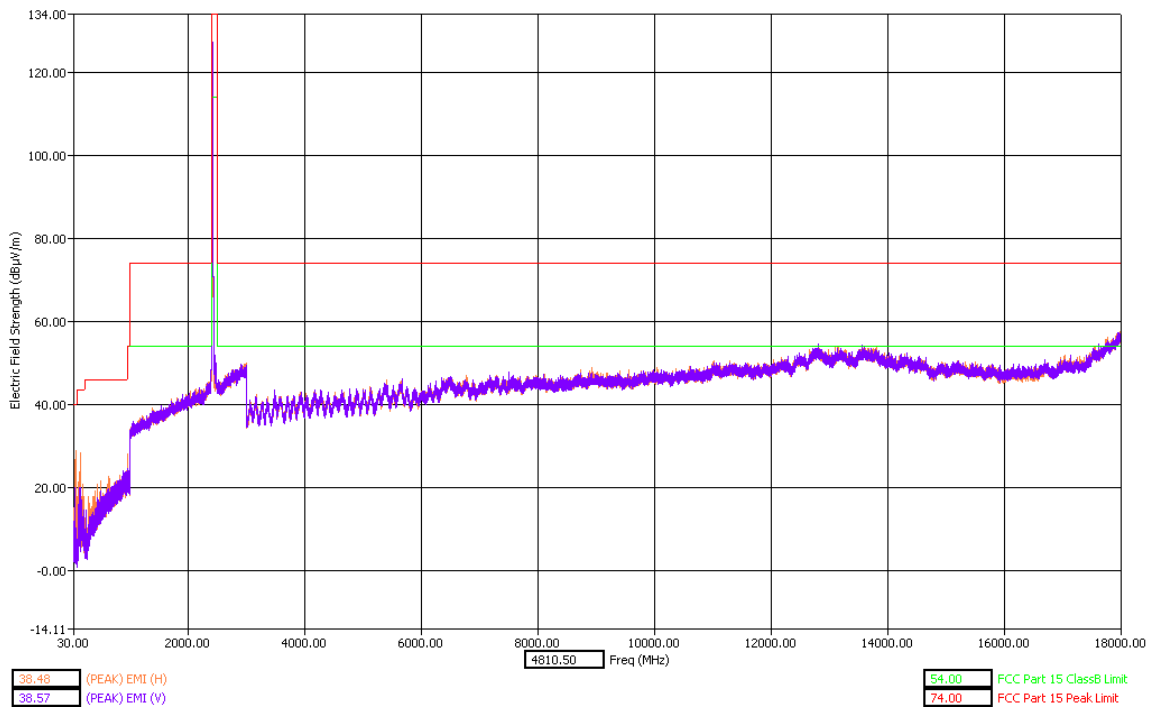
The band edge measurements crossing the corner for the low channel with respect to the average limit line is acceptable when applying the FCC rule specified in CFR 15.35(b) for the use of peak detector above 1 GHz. The peak detector limit line has been added to the graphical plots.

For peak emissions detected above 1 GHz, only those emissions that are higher than the AVG limit line plus 8 dB are selected for final emission analysis.

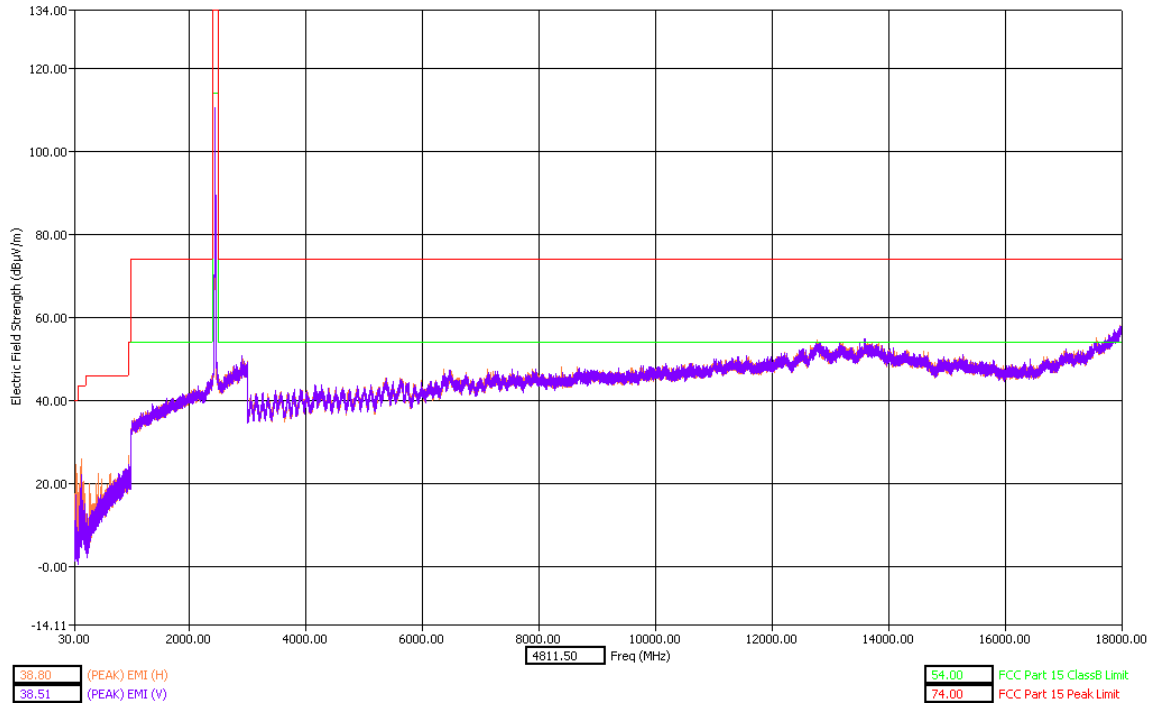
Radiated emissions was measured from 9 kHz to 30 MHz and all emissions were 20 dB below the limit.

WLAN Band (b)

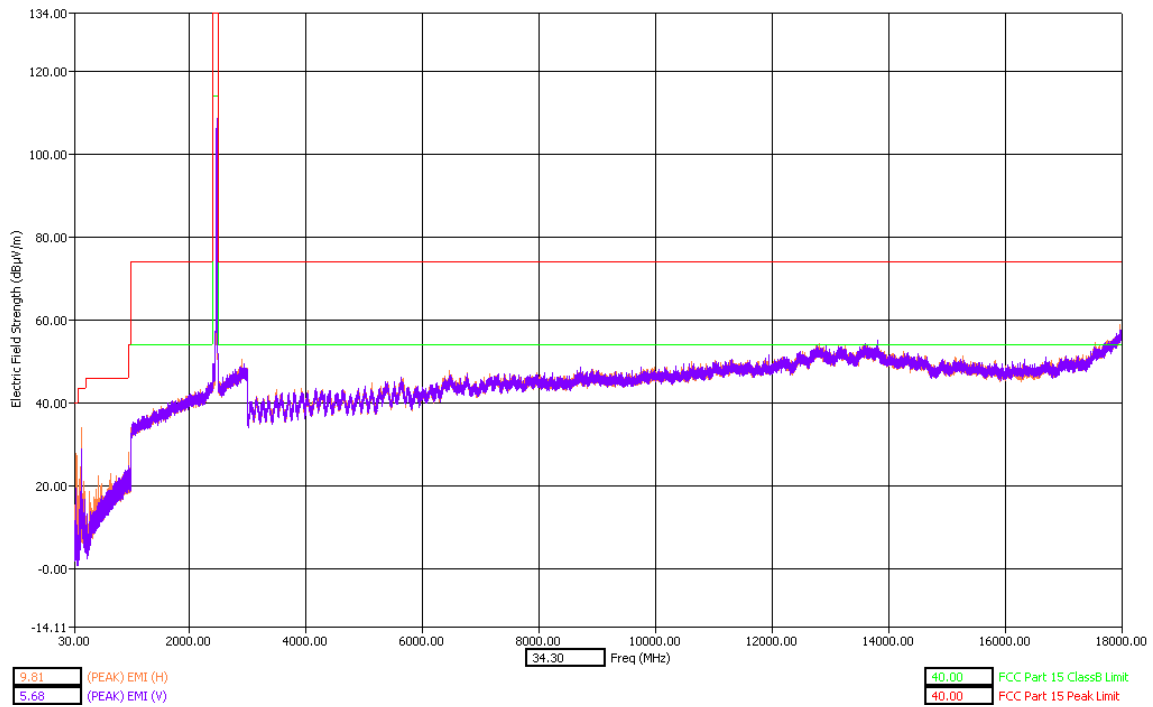
Only the worst field strength of spurious emissions for each channel is displayed for WLAN (b).



Low Channel Dual Polarization X



Middle Channel Dual Polarization X

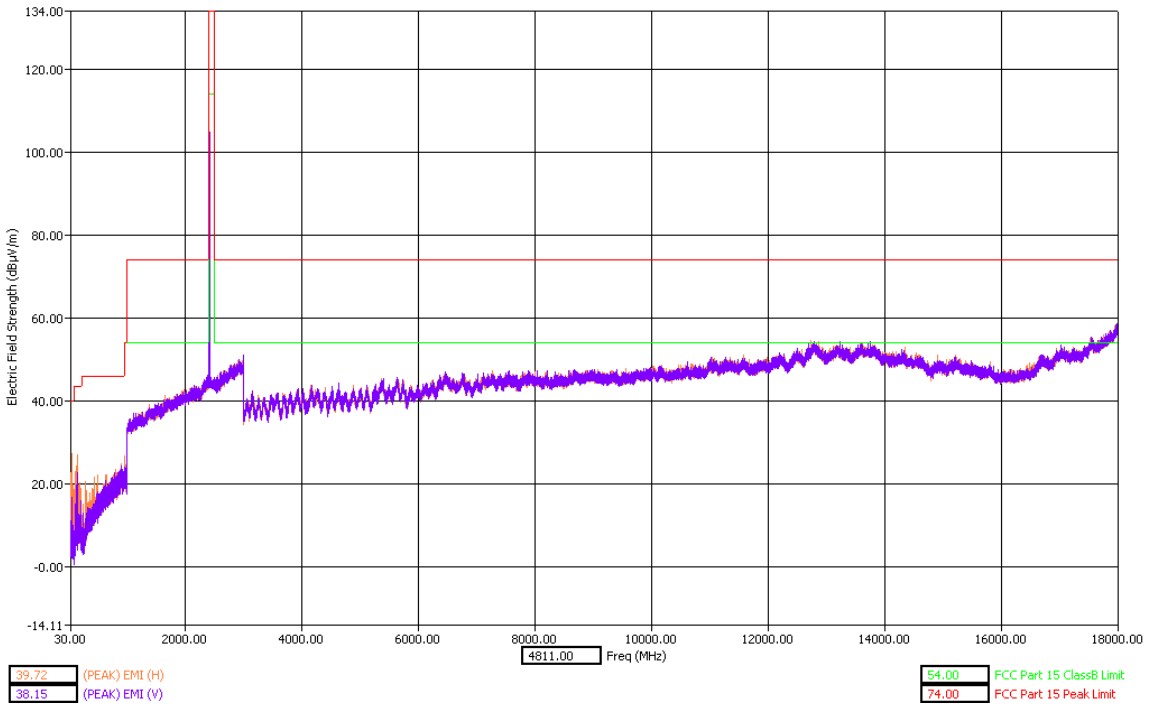


High Channel Dual Polarization X

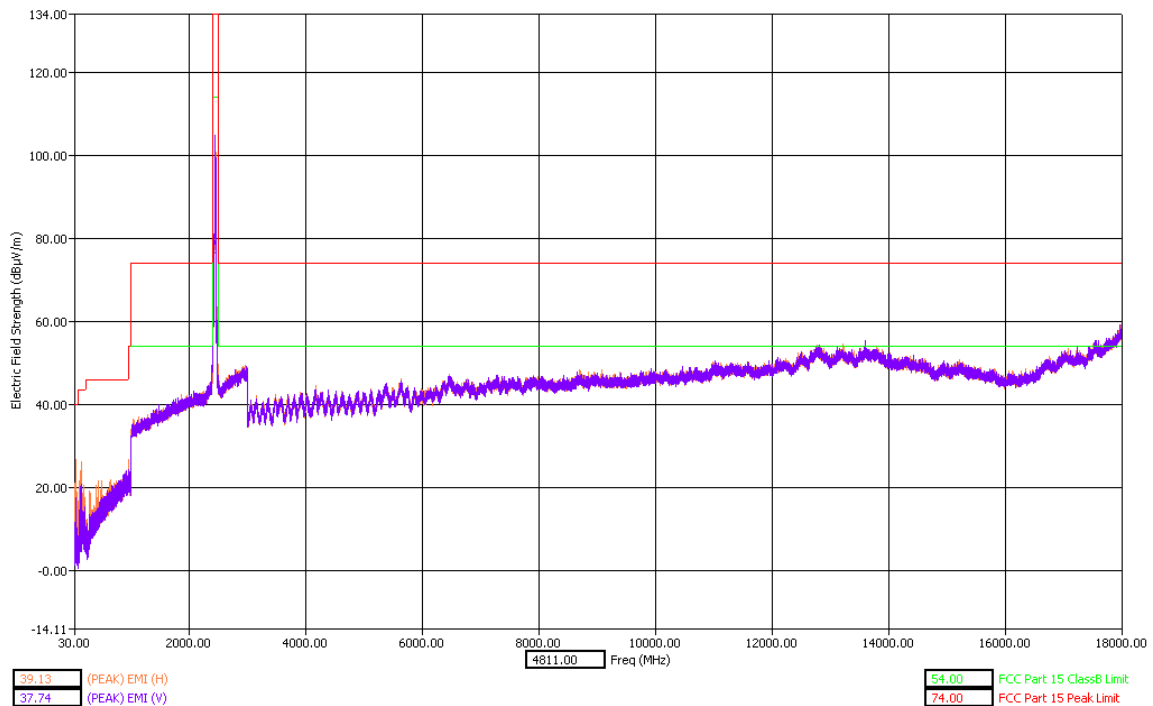
There were no discernible emissions above the noise floor for 18-26.5 GHz for Low, Mid and High Channels and all polarizations in WLAN band

WLAN Band (g)

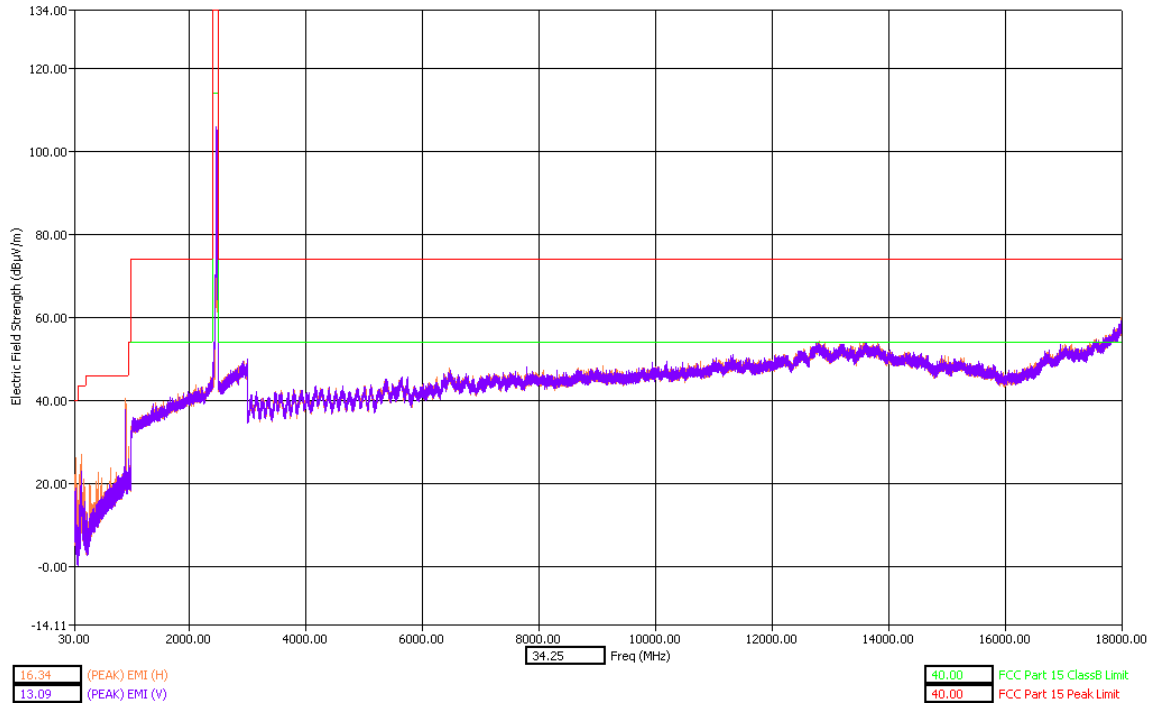
Only the worst field strength of spurious emissions for each channel is displayed for WLAN (g).



Low Channel Dual Polarization X



Middle Channel Dual Polarization X



High Channel Dual Polarization X

There were no discernible emissions above the noise floor for 18-26.5 GHz for Low, Mid and High Channels and all polarizations in WLAN band

WLAN Band (a)

Only the worst field strength of spurious emissions for each channel is displayed for WLAN (a) sub band 4

Freq (MHz)	(PEAK) EMI (dBm)	Limit (dBm)	(PEAK) Margin (dB)	Ttbl Agl (deg)	Twr Ht (cm)	Pol
11490.00	-46.70	-27.00	-19.70	18.70	100.00	H
11490.00	-46.92	-27.00	-19.92	64.40	100.00	V

Low Channel Dual Polarization X

Freq (MHz)	(PEAK) EMI (dBm)	Limit (dBm)	(PEAK) Margin (dB)	Ttbl Agl (deg)	Twr Ht (cm)	Pol
11570.00	-43.29	-27.00	-16.29	0.00	100.00	H
11570.00	-43.39	-27.00	-16.39	0.00	100.00	V

Middle Channel Dual Polarization X

Freq (MHz)	(PEAK) EMI (dBm)	Limit (dBm)	(PEAK) Margin (dB)	Ttbl Agl (deg)	Twr Ht (cm)	Pol
11610.00	-43.35	-27.00	-16.35	0.00	100.00	H
11610.00	-42.97	-27.00	-15.97	0.00	100.00	V

High Channel Dual Polarization X

The spectrum is measured from 30MHz to 10th harmonic and the worst-case emissions are reported.

There are no discernible emissions are found beyond the 2nd harmonic for this device.

WLAN Band (n)@5G

Only the worst field strength of spurious emissions for each channel is displayed for WLAN (n) 5G sub band 4, Bandwidth 20M

Freq (MHz)	(PEAK) EMI (dBm)	Limit (dBm)	(PEAK) Margin (dB)	Ttbl Agl (deg)	Twr Ht (cm)	Pol
11490.00	-46.83	-27.00	-19.83	282.60	100.00	H
11490.00	-46.72	-27.00	-19.72	43.80	100.00	V

Low Channel Dual Polarization X

Freq (MHz)	(PEAK) EMI (dBm)	Limit (dBm)	(PEAK) Margin (dB)	Ttbl Agl (deg)	Twr Ht (cm)	Pol
11570.00	-45.63	-27.00	-18.63	308.00	100.00	H
11570.00	-45.13	-27.00	-18.13	300.10	100.00	V

Middle Channel Dual Polarization X

Freq (MHz)	(PEAK) EMI (dBm)	Limit (dBm)	(PEAK) Margin (dB)	Ttbl Agl (deg)	Twr Ht (cm)	Pol
11610.00	-45.55	-27.00	-18.55	360.20	100.00	H
11610.00	-45.39	-27.00	-18.39	12.50	100.00	V

High Channel Dual Polarization X

WLAN (n) 5G sub band 4, Bandwidth 40M

Freq (MHz)	Freq (Max) (MHz)	(PEAK) EMI (dBm)	Limit (dBm)	(PEAK) Margin (dB)	Ttbl Agl (deg)	Twr Ht (cm)	Pol
11510.00	11507.20	-46.84	-27.00	-19.84	202.60	100.00	H
11510.00	11504.87	-46.12	-27.00	-19.12	10.30	100.00	V

Low Channel Dual Polarization X

Freq (MHz)	(PEAK) EMI (dBm)	Limit (dBm)	(PEAK) Margin (dB)	Ttbl Agl (deg)	Twr Ht (cm)	Pol
11590.00	-45.34	-27.00	-18.34	350.80	100.00	H
11590.00	-46.01	-27.00	-19.01	-0.00	100.00	V

Middle Channel Dual Polarization X

Freq (MHz)	Freq (Max) (MHz)	(PEAK) EMI (dBm)	Limit (dBm)	(PEAK) Margin (dB)	Ttbl Agl (deg)	Twr Ht (cm)	Pol
11630.00	11630.97	-45.95	-27.00	-18.95	145.60	100.00	H
11630.00	11631.38	-45.82	-27.00	-18.82	311.90	100.00	V

High Channel Dual Polarization X

The spectrum is measured from 30MHz to 10th harmonic and the worst-case emissions are reported.
There are no discernible emissions are found beyond the 2nd harmonic for this device.

BAND-EDGE COMPLIANCE OF RF RADIATED EMISSIONS

CFR 47 Part 15.247

Measurement Procedure

The test sample is placed inside the semi-anechoic chamber on a wooden table at the turntable center. For each spurious frequency, the antenna mast is raised and lowered from 1 to 4 meters and the turntable is rotated 360 degrees to obtain a maximum reading on the spectrum analyzer. This is repeated for both horizontal and vertical polarizations of the receive antenna.

For 30 MHz – 18 GHz:

Field Strength (dB μ V/m) = EMI Receiver Level (dB μ V) + Cable Loss (dB) - Amplifier Gain (dB) + Filter loss (dB) + Antenna Correction Factor (3/m)

For 18 GHz – 26.5 GHz:

Field Strength (dB μ V/m) = EMI Receiver Level (dB μ V) + Cable Loss (dB) - Amplifier Gain (dB) + Filter loss (dB) + Antenna Correction Factor (1/m)

For Band-edge radiated Emission test, using the following spectrum analyzer setting:

1. Detector Mode = Peak/AV
2. For Peak detector, RBW=1 MHz (6dB), VBW=10 kHz; For AV detector, RBW=1 MHz (6dB), VBW=10 kHz.

The test sample WLAN transmitter was enabled using a test script.

A fully charged battery was used for the supply voltage.

Measurement Results

Comments:

The band edge measurements crossing the corner for the low/high channel with respect to the average limit line is acceptable when applying the FCC rule specified in CFR 47 part 15.35(b) for the use of peak detector above 1 GHz. The peak detector limit line has been added to the graphical plots.

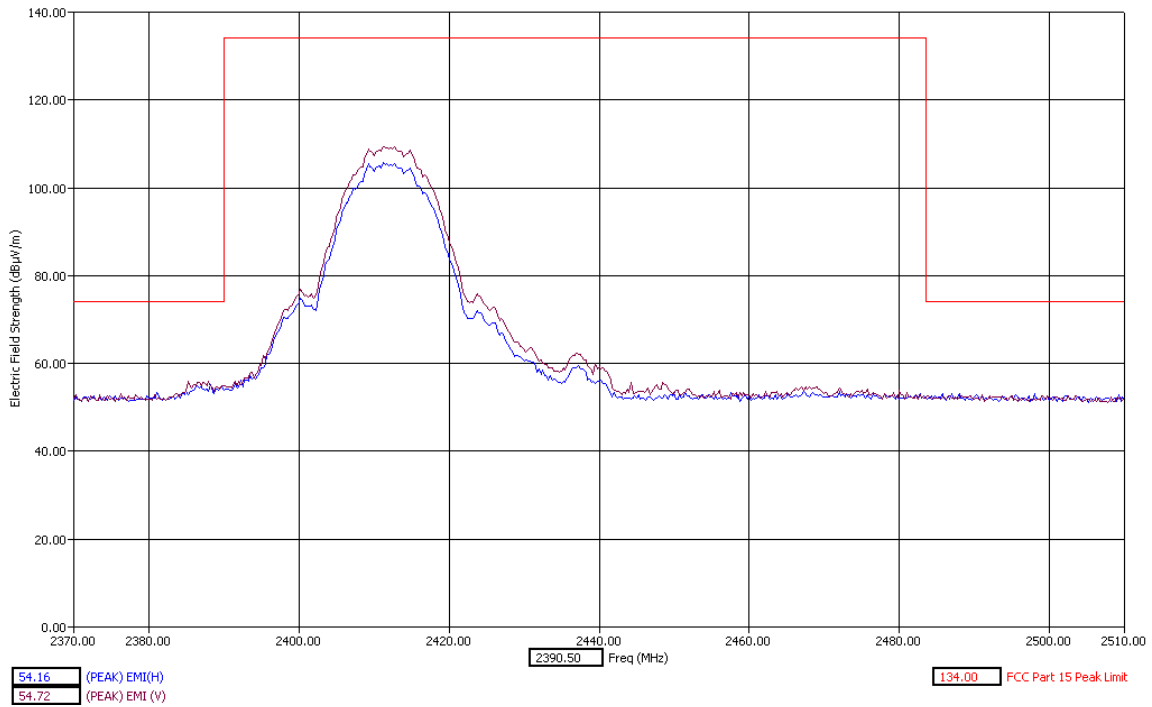
All data rates were evaluated and worst results are reported. All three orthogonal planes were investigated and worst results are reported.

Note: No WLAN band notch filters were used.

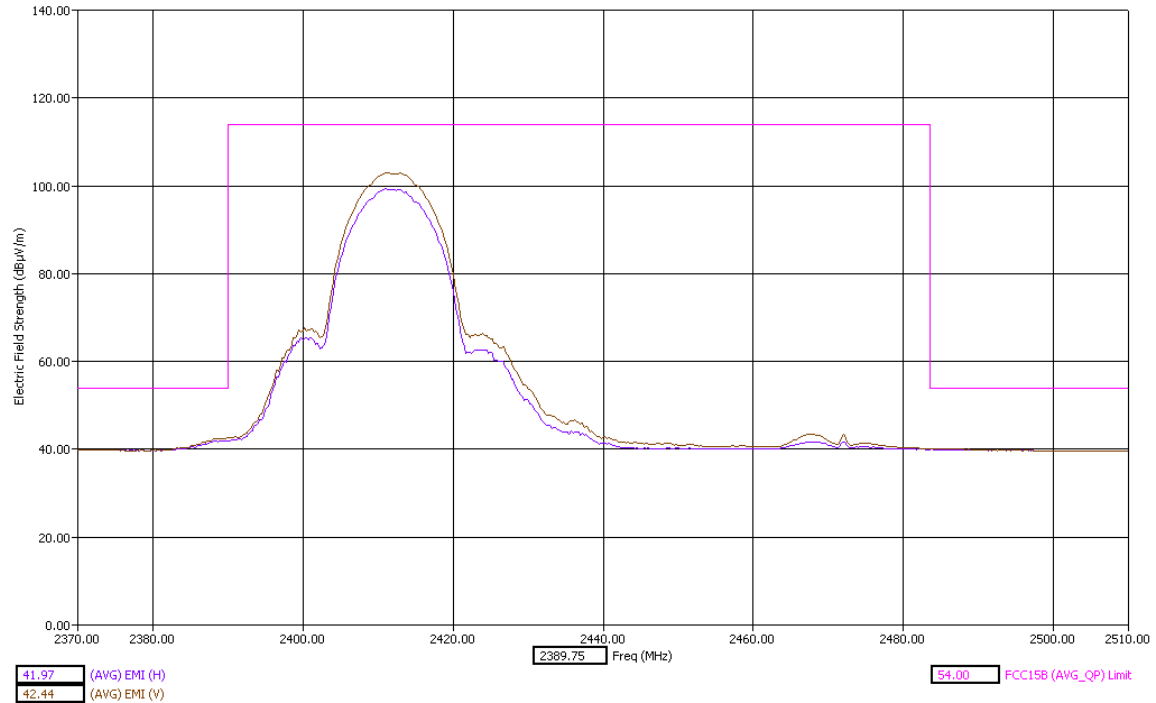
See below attached plots for the measurement results with both peak detector and average detector:

WLAN Band (b)

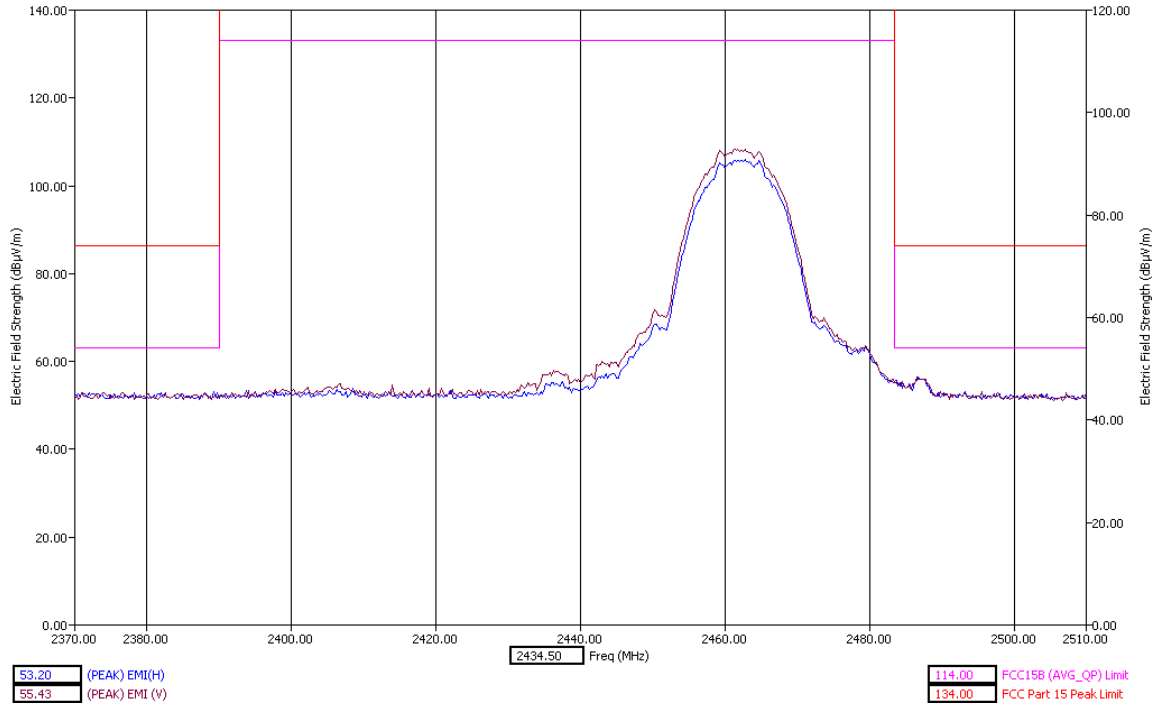
Only the worst band edge is displayed for WLAN band (b)



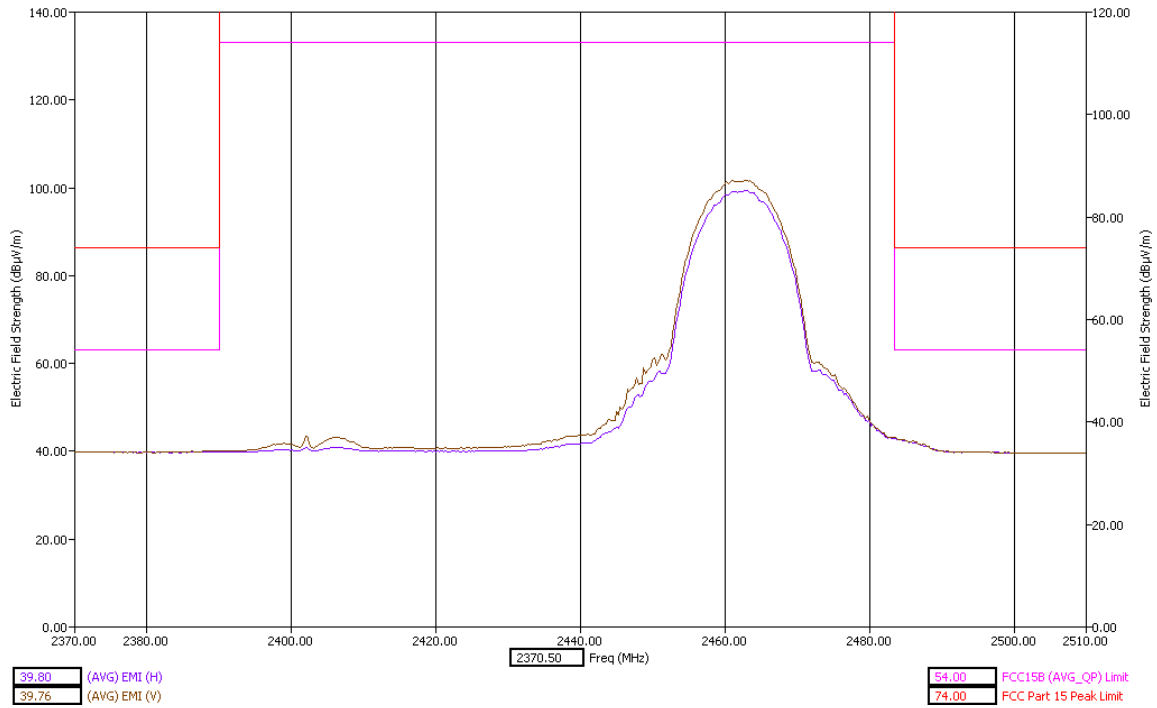
Low Band Edge - Peak Detector



Low Band Edge - AVG Detector



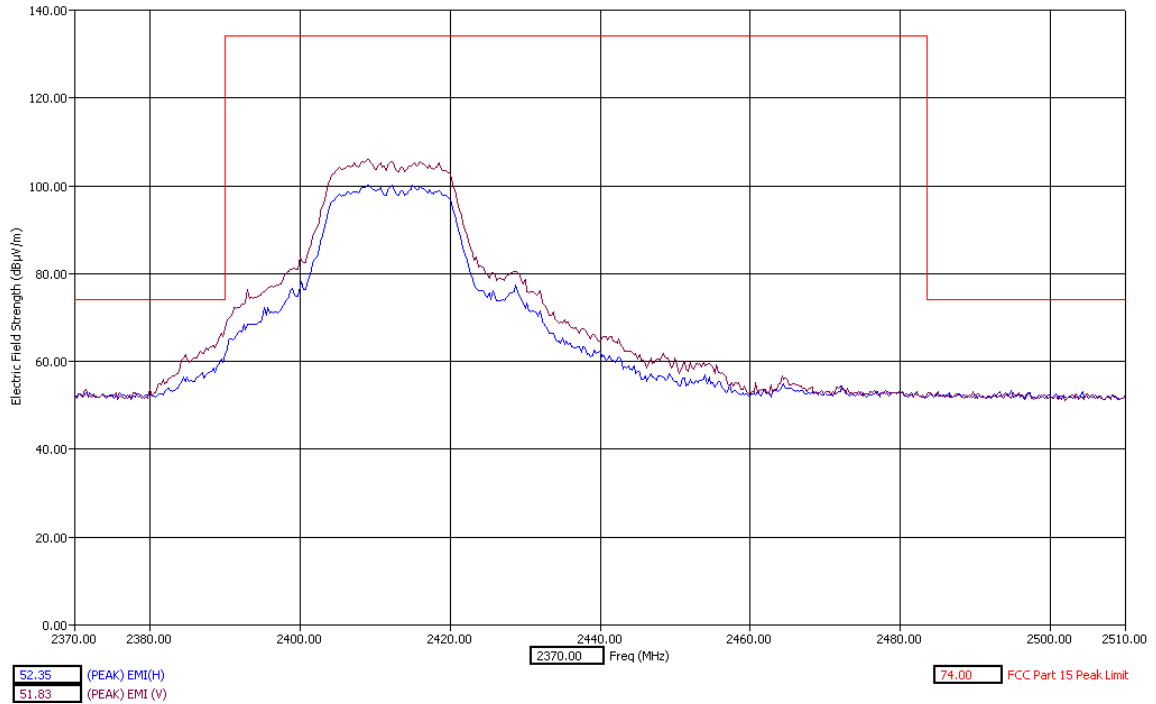
High Band Edge - Peak Detector



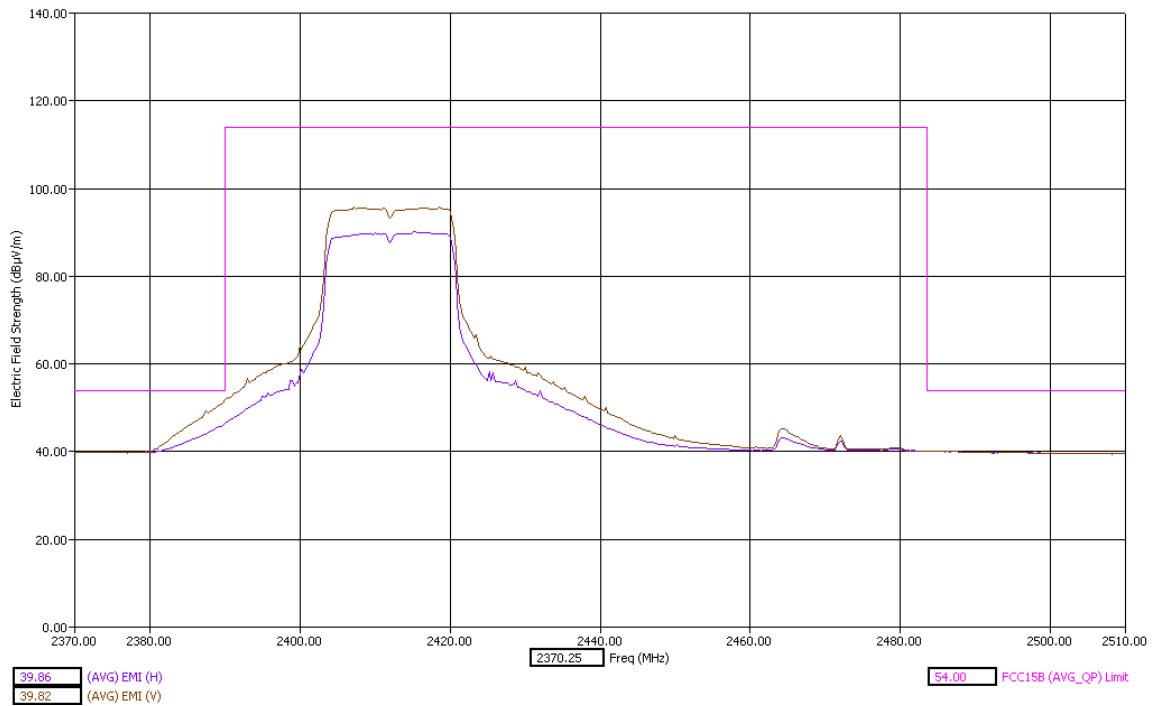
High Band Edge - AVG Detector

WLAN Band (g)

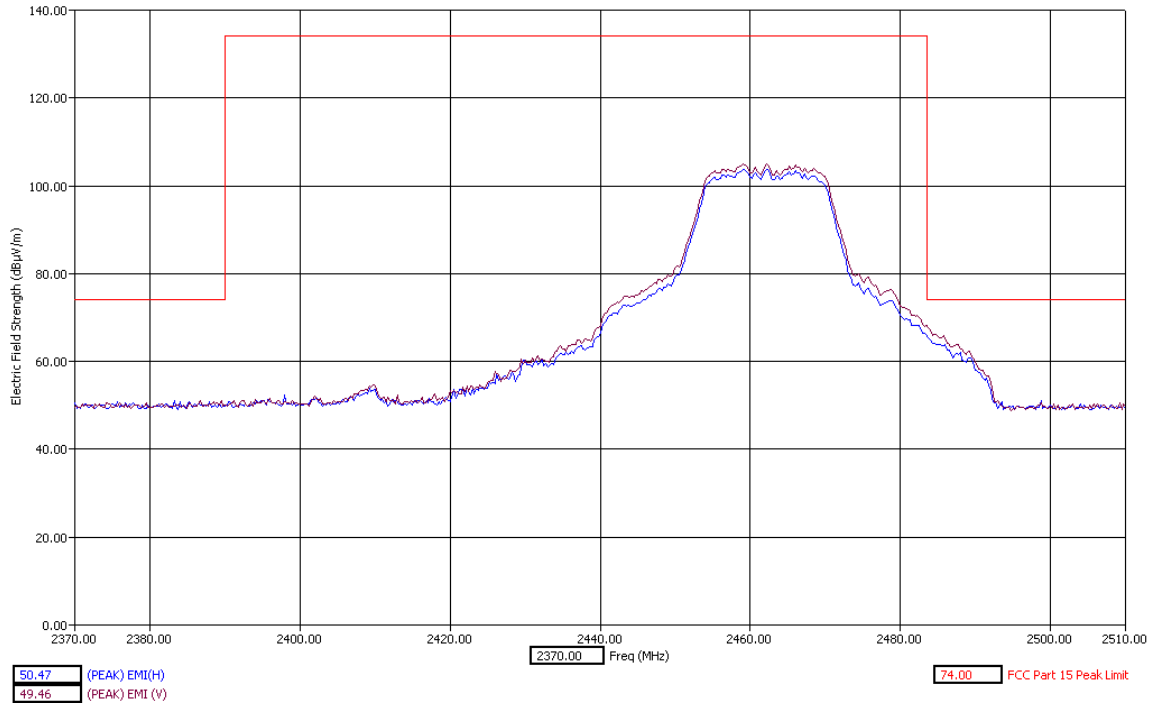
Only the worst band edge is displayed for WLAN band (g)



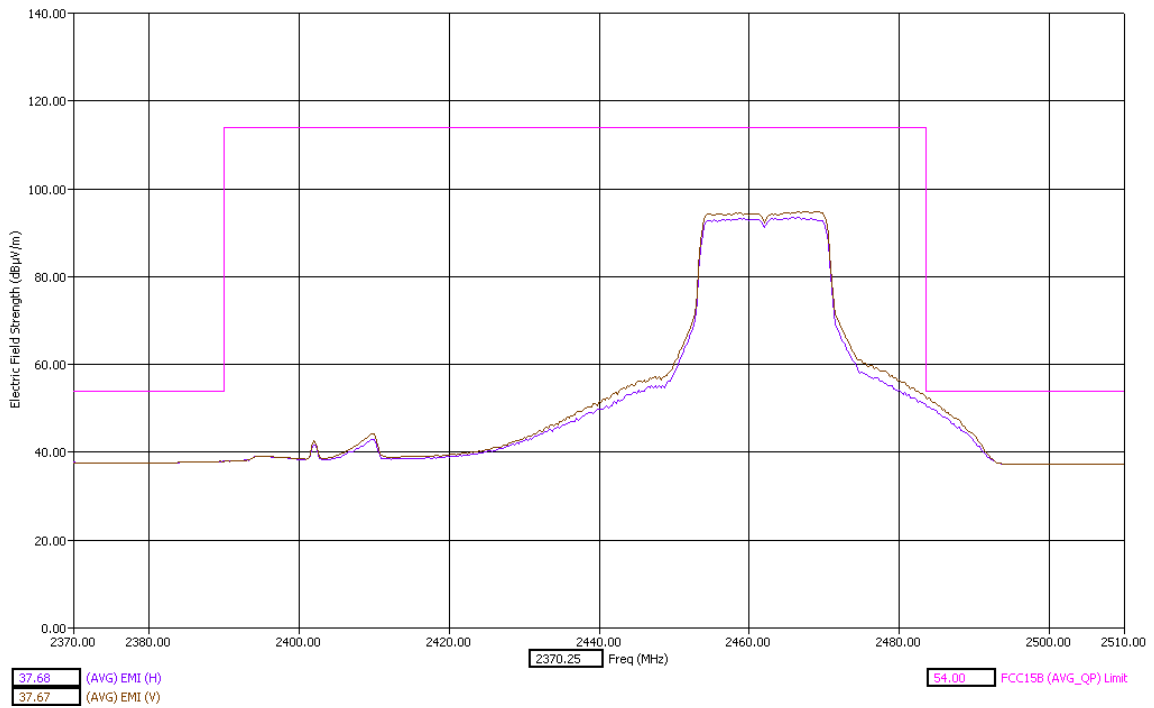
Low Band Edge - Peak Detector



Low Band Edge - AVG Detector



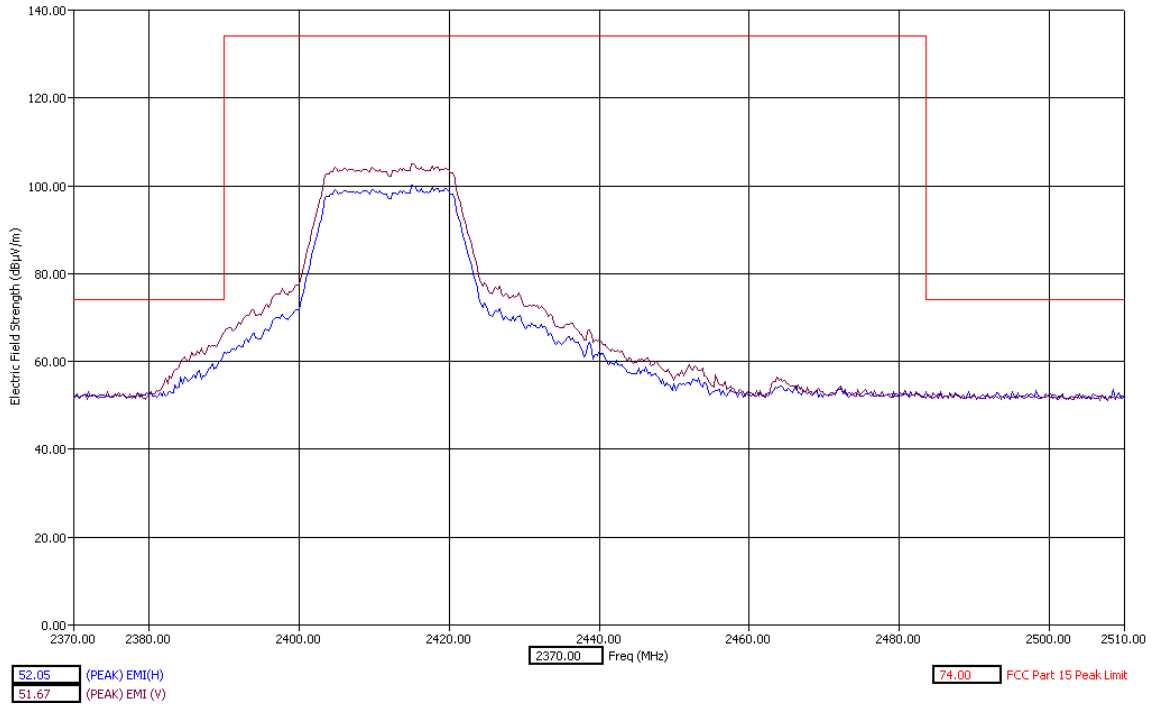
High Band Edge - Peak Detector



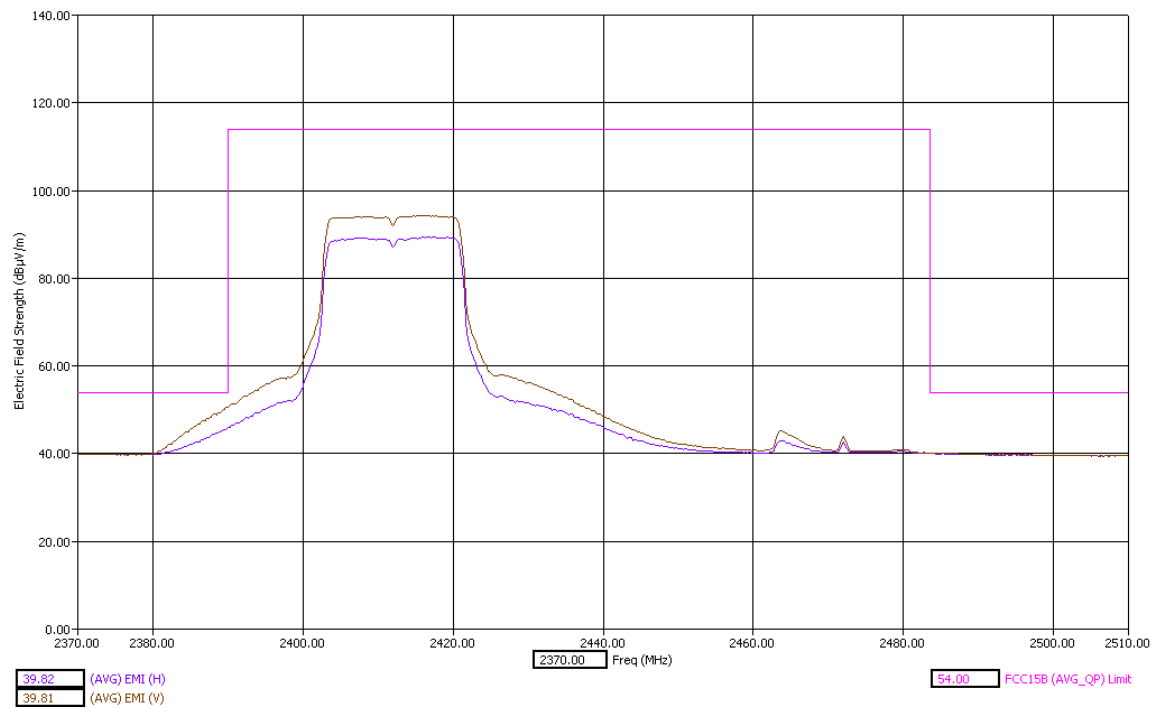
High Band Edge - AVG Detector

WLAN Band (n) 2.4G 400ns GI

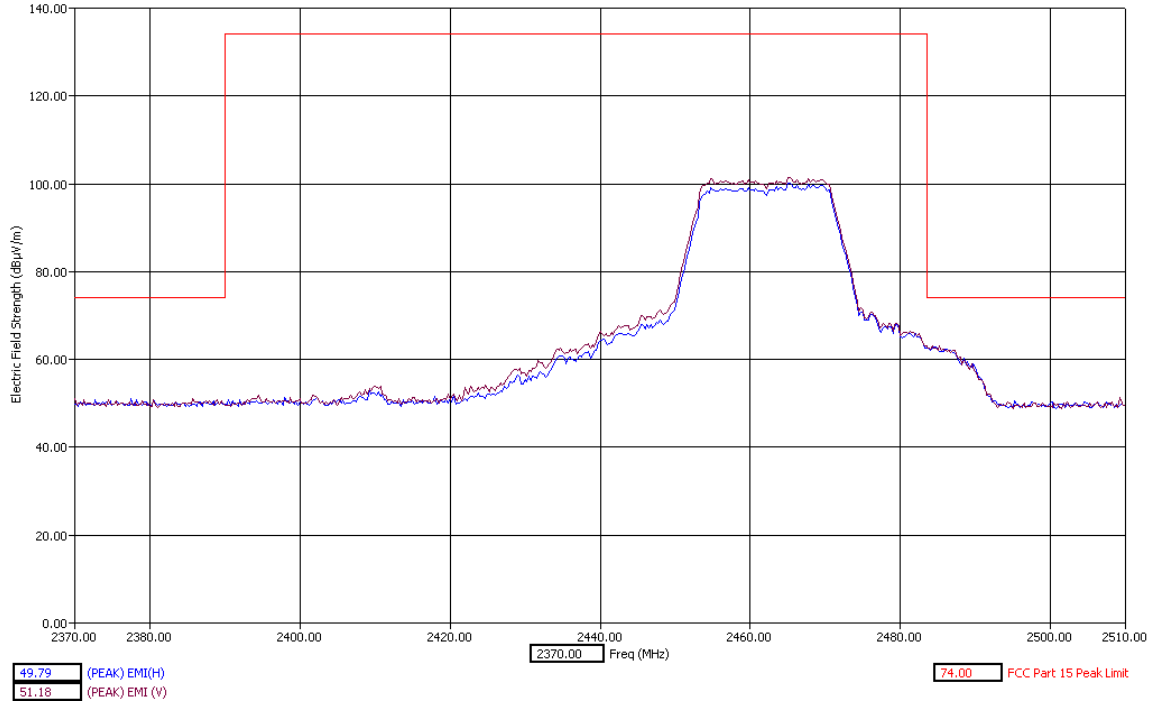
Only the worst band edge is displayed for WLAN band (n)



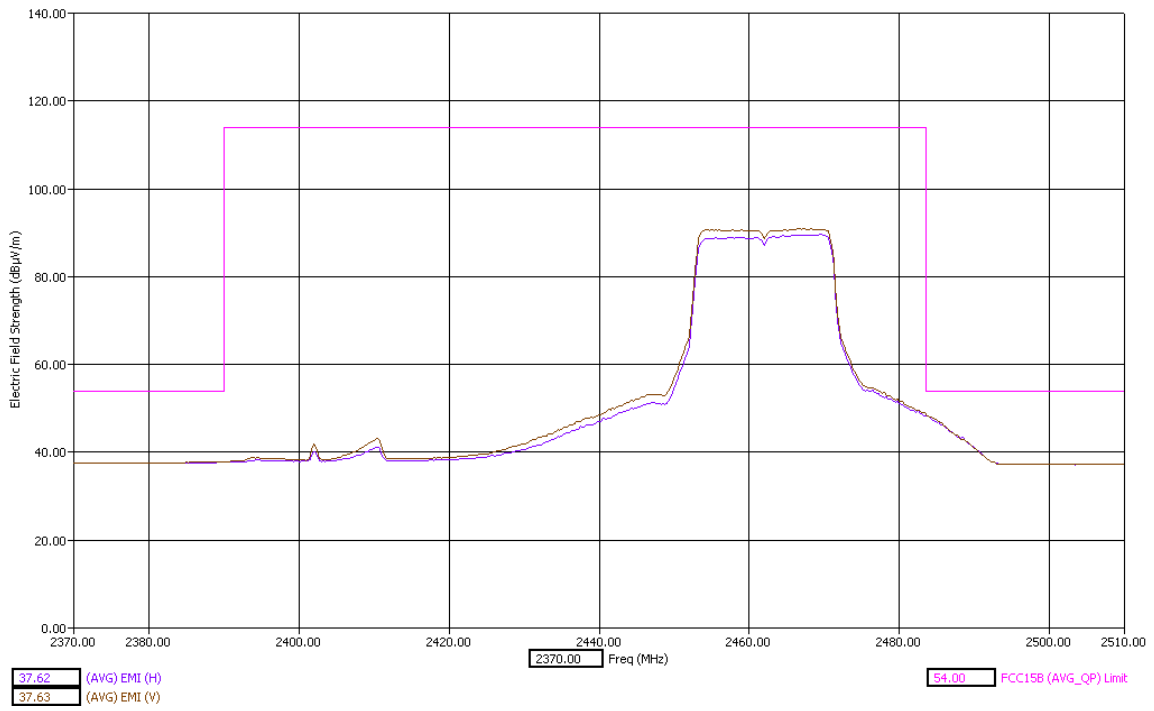
Low Band Edge - Peak Detector



Low Band Edge - AVG Detector



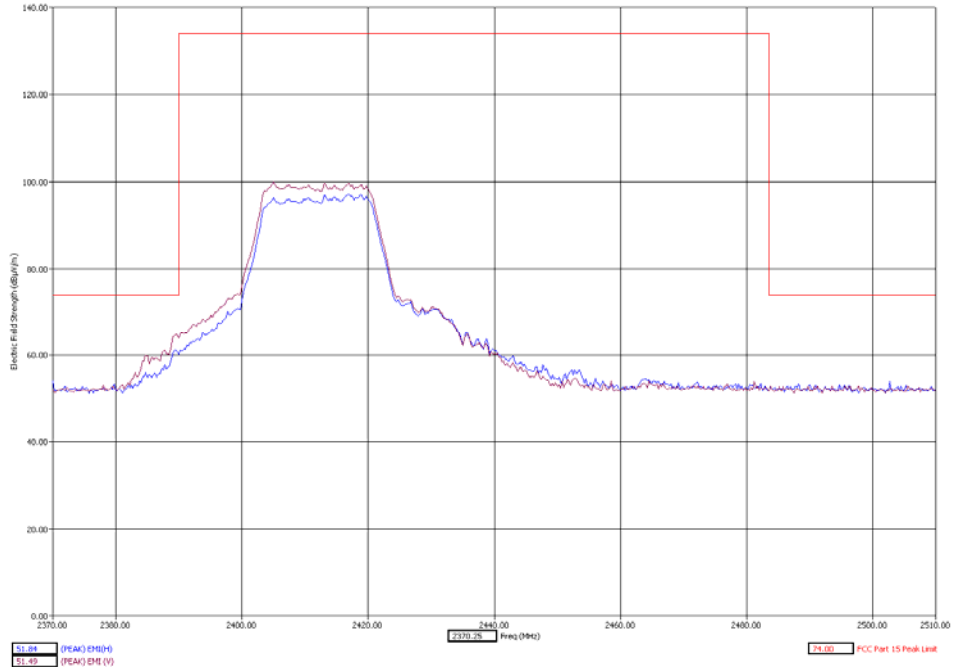
High Band Edge - Peak Detector



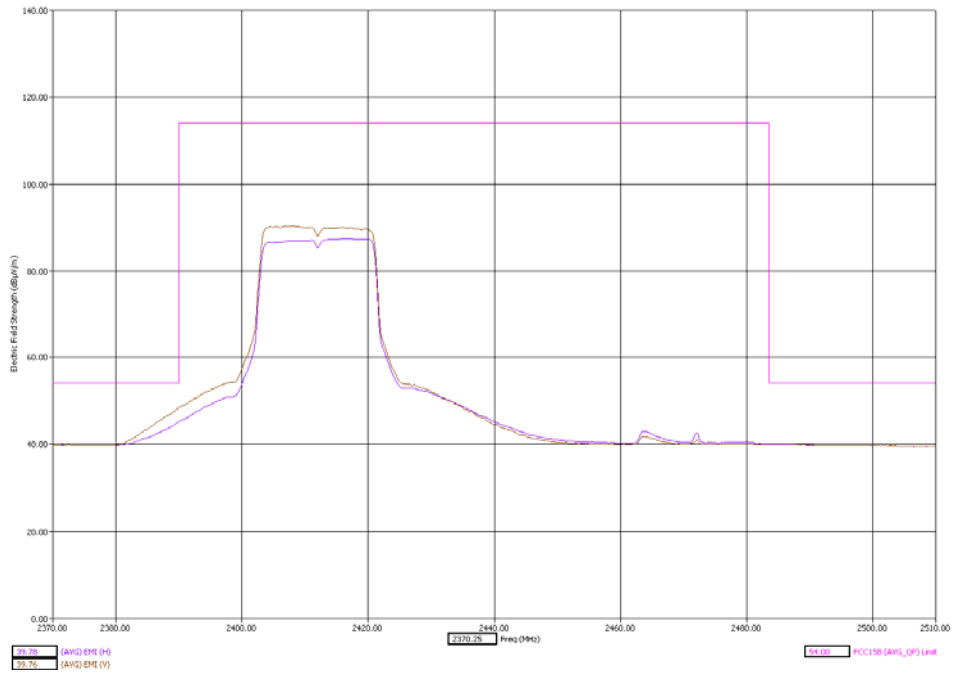
High Band Edge - AVG Detector

WLAN Band (n) 2.4G 800ns GI

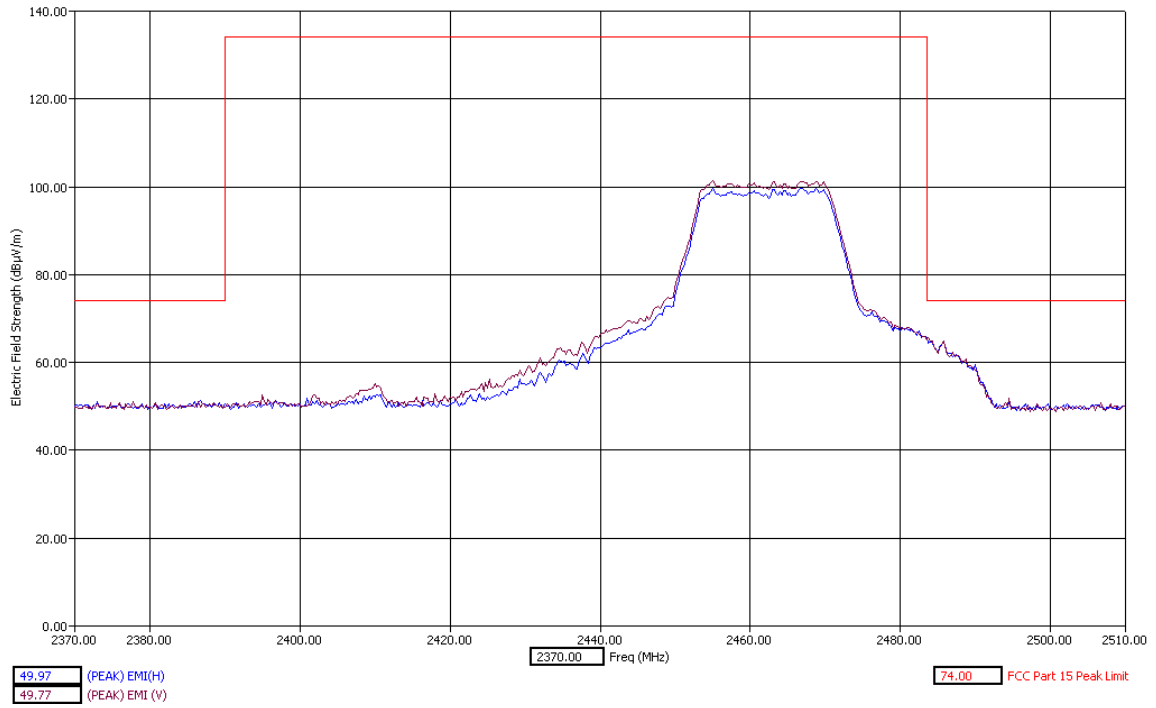
Only the worst band edge is displayed for WLAN band (n).



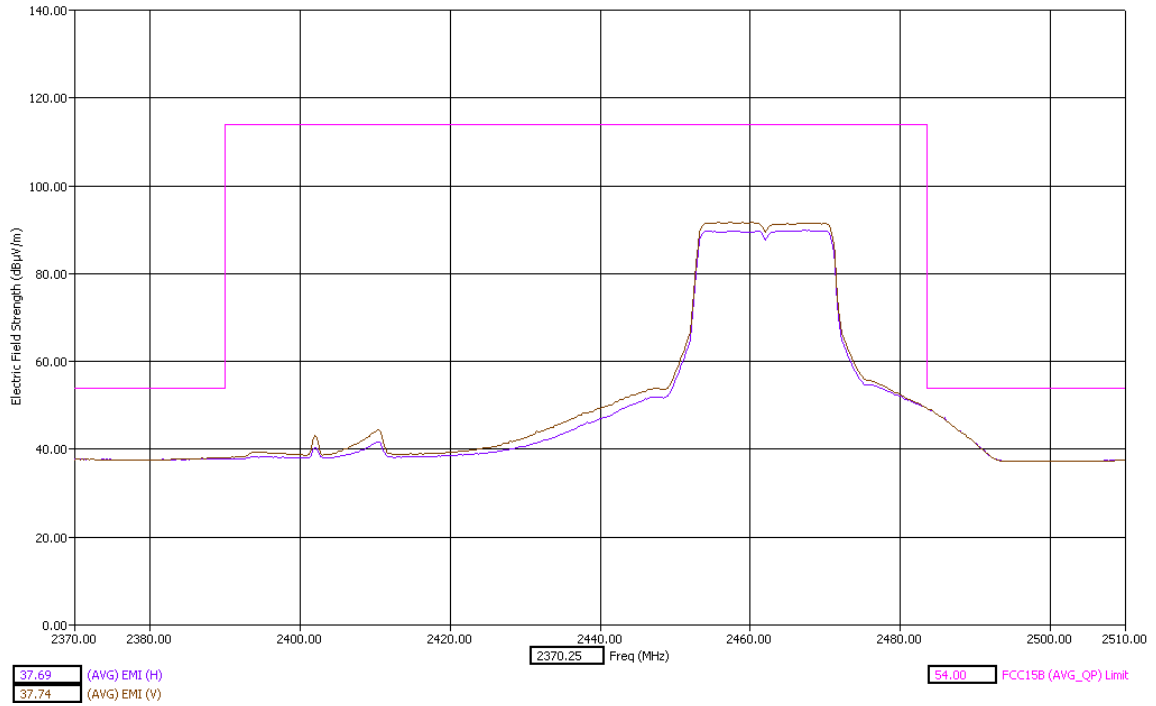
Low Band Edge - Peak Detector



Low Band Edge - AVG Detector



High Band Edge - Peak Detector



High Band Edge - AVG Detector

End of Test Report