

MEASUREMENT REPORT

FCC PART 15.247 WLAN 802.11b/g/n/ac/ax

Applicant Name:LG Electronics USA, Inc.
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States**Date of Testing:**

1/21 - 2/15/2020

Test Site/Location:

PCTEST Lab. Columbia, MD, USA

Test Report Serial No.:

1M1912300226-06.ZNF

FCC ID:**ZNFV600TM****APPLICANT:****LG Electronics USA, Inc.****Application Type:**

Class II Permissive Change

Model:

LM-V600TM

Additional Model(s):

LMV600TM, V600TM

EUT Type:

Portable Handset

Frequency Range:

2412 – 2462MHz

FCC Classification:

Digital Transmission System (DTS)

FCC Rule Part(s):

Part 15 Subpart C (15.247)

ISED Specification:

RSS-247 Issue 2

Test Procedure(s):ANSI C63.10-2013, KDB 558074 D01 v05r02,
KDB 662911 D01 v02r01, KDB 648474 D03 v01r04**Class II Permissive Change:**

Please see FCC change document

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013 and KDB 558074 D01 v05r02. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.


Randy Ortanez
President

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1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISSED Standards (RSS).
- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISSED.

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **LG Portable Handset FCC ID: ZNFV600TM**. The test data contained in this report pertains only to the emissions due to the EUT's WLAN (DTS) transmitter.

Test Device Serial No.: 04398, 04380

2.2 Device Capabilities

This device contains the following capabilities:

800/850/1900 CDMA/EvDO Rev0/A, 1x Advanced (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (n71, n66, n25, n2, n41(PC2)), 802.11b/g/n/ac/ax WLAN, 802.11a/n/ac/ax UNII, Bluetooth (1x, EDR, LE), NFC

Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

Table 2-1. Frequency/ Channel Operations

Note: The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section 6.0 b) of ANSI C63.10-2013 and KDB 558074 D01 v05r02. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Maximum Achievable Duty Cycles				
802.11 Mode/Band		Duty Cycle [%]		
		ANT1	ANT2	MIMO/CDD
2.4GHz	b	99.6	99.4	N/A
	g	99.3	99.3	N/A
	n	99.8	99.6	99.1
	ac	99.9	99.8	99.8
	ax	99.8	99.8	99.8

Table 2-2. Measured Duty Cycles

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The device employs MIMO technology. Below are the possible configurations.

WiFi Configurations		SISO		SDM		CCD	
		ANT1	ANT2	ANT1	ANT2	ANT1	ANT2
2.4GHz	11b	✓	✓	✗	✗	✗	✗
	11g	✓	✓	✗	✗	✓	✓
	11n	✓	✓	✓	✓	✓	✓
	11ac	✓	✓	✓	✓	✓	✓
	11ax	✓	✓	✓	✓	✓	✓

Table 2-3. Frequency / Channel Operations

✓ = Support ; ✗ = NOT Support

SISO = Single Input Single Output

SDM = Spatial Diversity Multiplexing – MIMO function

CDD = Cyclic Delay Diversity - 2Tx Function

Data Rates Supported: 1Mbps, 2Mbps, 5.5Mbps, 11Mbps (b)
6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps (g)
6.5/7.2Mbps, 13/14.4Mbps, 19.5/21.7Mbps, 26/28.9Mbps, 39/43.3Mbps,
52/57.8Mbps, 58.5/65Mbps, 65/72.2Mbps (n)
13/14.4Mbps, 26/28.9Mbps, 39/43.3Mbps, 52/57.8Mbps, 78/86.7Mbps,
104/115.6Mbps, 117/130Mbps, 130/144.4Mbps (MIMO n)

This device supports simultaneous transmission operation, which allows for two SISO channels to operate independent of one another in the 2.4GHz and 5GHz bands simultaneously on each antenna. The following tables show the worst case configurations determined during testing. The data for these configurations is contained in the UNII test report.

Configuration 1: ANT1 transmitting in 2.4GHz mode and ANT2 in 5GHz mode

Description	2.4 GHz Emission	5 GHz Emission
Antenna	1	2
Channel	1	36
Operating Frequency (MHz)	2412	5180
Data Rate (Mbps)	1	MCS0
Mode	802.11b	802.11n

Table 2-4. Config-1 (ANT1 2.4GHz & ANT2 5GHz)

Configuration 2: ANT1 transmitting in 5GHz mode and ANT2 in 2.4GHz mode

Description	2.4 GHz Emission	5 GHz Emission
Antenna	2	1
Channel	1	36
Operating Frequency (MHz)	2412	5180
Data Rate (Mbps)	1	MCS0
Mode	802.11b	802.11n

Table 2-5. Config-2 (ANT1 5GHz & ANT2 2.4GHz)

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Configuration 3: ANT1 and ANT2 both transmitting in 2.4GHz and 5GHz modes simultaneously

Description	2.4 GHz Emission	5 GHz Emission
Antenna	1, 2	1, 2
Channel	1	36
Operating Frequency (MHz)	2412	5180
Data Rate (Mbps)	MCS8	MCS8
Mode	802.11n	802.11n

Table 2-6. Config-3 (ANT1 MIMO & ANT2 MIMO)

2.3 Test Configuration

The EUT was tested per the guidance of KDB 558074 D01 v05r02. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing. See Section 3.2 for radiated emissions test setups.

The EUT was manipulated through three orthogonal planes of X-orientation (flatbed), Y-orientation (landscape), and Z-orientation (portrait) during the testing. Only the worst case emissions were reported in this test report. The worst orientation was found to be Y-orientation (landscape).

This device supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with the EUT lying flat on an authorized wireless charging pad (WCP) FCC ID: YZP-PWMAW815A while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

This device supports Dual Display (DD) Cover, which attaches to the device to provide a secondary display on the inside of the cover. The display was rotated through all possible orientations to determine worst case angle. The worst case radiated emission data with the Dual Display Cover is included in this report.

2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

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3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 558074 D01 v05r02 were used in the measurement of the EUT.

Deviation from measurement procedure.....None

3.2 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33 depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 474788 D01.

3.3 Environmental Conditions

The temperature is controlled within range of 15°C to 35°C. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- The antennas of the EUT are **permanently attached**.
- There are no provisions for connections to an external antenna.

Conclusion:

The EUT unit complies with the requirement of §15.203.

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty ($\pm$ dB)
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
Emco	3116	Horn Antenna (18 - 40GHz)	6/7/2018	Triennial	6/7/2021	9203-2178
Keysight Technologies	N9020A	MXA Signal Analyzer	4/29/2019	Annual	4/29/2020	MY54500644
Rohde & Schwarz	TS-PR18	18-26.5 GHz Pre-Amplifier	1/31/2020	Annual	1/31/2021	100040
Rohde & Schwarz	TS-PR40	26.5-40 GHz Pre-Amplifier	10/8/2019	Annual	10/8/2020	100037
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	6/5/2019	Annual	6/5/2020	100342
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/8/2019	Annual	7/8/2020	102133
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/11/2019	Annual	7/11/2020	102134
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	5/6/2019	Annual	5/6/2020	103200
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	4/19/2018	Biennial	4/19/2020	A051107

Table 6-1. Annual Test Equipment Calibration Schedule

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7.0 TEST RESULTS

7.1 Summary

Company Name: LG Electronics USA, Inc.
FCC ID: ZNFV600TM
FCC Classification: Digital Transmission System (DTS)

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.205 15.209	RSS-Gen [8.9]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-Gen [8.9])	RADIATED	PASS	Sections 7.2, 7.3

Table 7-1. Summary of Test Results

Notes:

All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.

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7.2 Radiated Spurious Emission Measurements – Above 1 GHz

§15.247(d) §15.205 & §15.209; RSS-Gen [8.9]

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR and Table 6 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-2 per Section 15.209 and RSS-Gen (8.9).

Frequency	Field Strength [$\mu\text{V/m}$]	Measured Distance [Meters]
Above 960.0 MHz	500	3

Table 7-2. Radiated Limits

Test Procedures Used

ANSI C63.10-2013 – Section 6.6.4.3

KDB 558074 D01 v05r02 – Sections 8.6, 8.7

Test Settings

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = power average (RMS)
5. Number of measurement points = 1001 (Number of points must be $\geq 2 \times \text{span/RBW}$)
6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

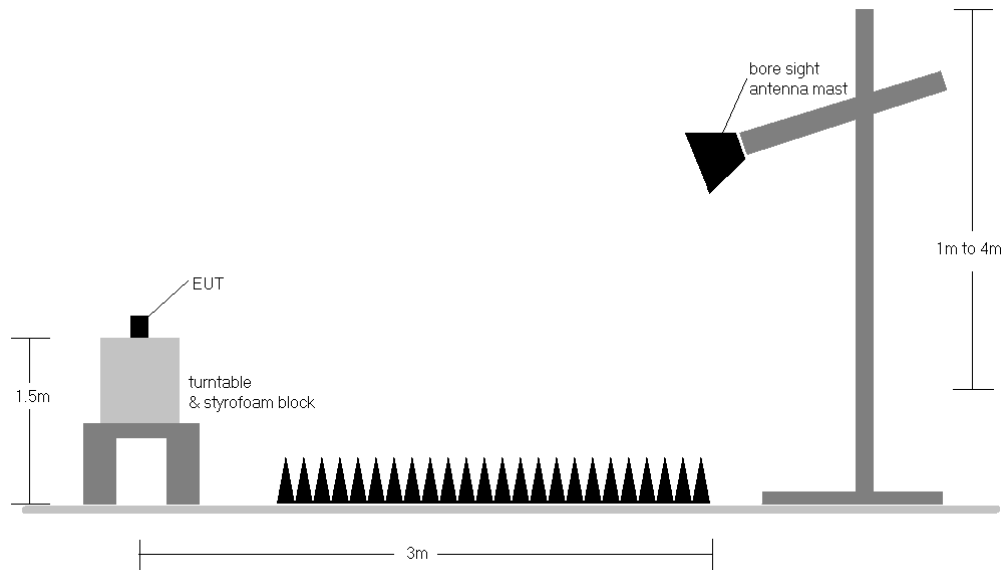


Figure 7-1. Test Instrument & Measurement Setup

Test Notes

1. The optional test procedures for antenna port conducted measurements of unwanted emissions per the guidance of KDB 558074 D01 v05r02 were not used to evaluate this device for compliance to radiated limits. All radiated spurious emissions levels were measured in a radiated test setup.
2. All emissions lying in restricted bands specified in Section 15.205 and Section 8.10 of RSS-Gen are below the limit shown in Table 7-2.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. This unit was tested with its standard battery.
5. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
6. Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
7. Radiated spurious emissions were investigated while operating in MIMO mode, however, it was determined that single antenna operation produced the worst case emissions. Since the emissions produced from MIMO operation were found to be more than 20dB below the limit, the MIMO emissions are not reported.

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8. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. Any emissions found to be within 20dB of the limit are fully investigated and the results are shown in this section.
9. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

Sample Calculations

Determining Spurious Emissions Levels

- Field Strength Level $_{[dB\mu V/m]} = \text{Analyzer Level }_{[dBm]} + 107 + \text{AFCL }_{[dB/m]}$
- $\text{AFCL }_{[dB/m]} = \text{Antenna Factor }_{[dB/m]} + \text{Cable Loss }_{[dB]}$
- $\text{Margin }_{[dB]} = \text{Field Strength Level }_{[dB\mu V/m]} - \text{Limit }_{[dB\mu V/m]}$

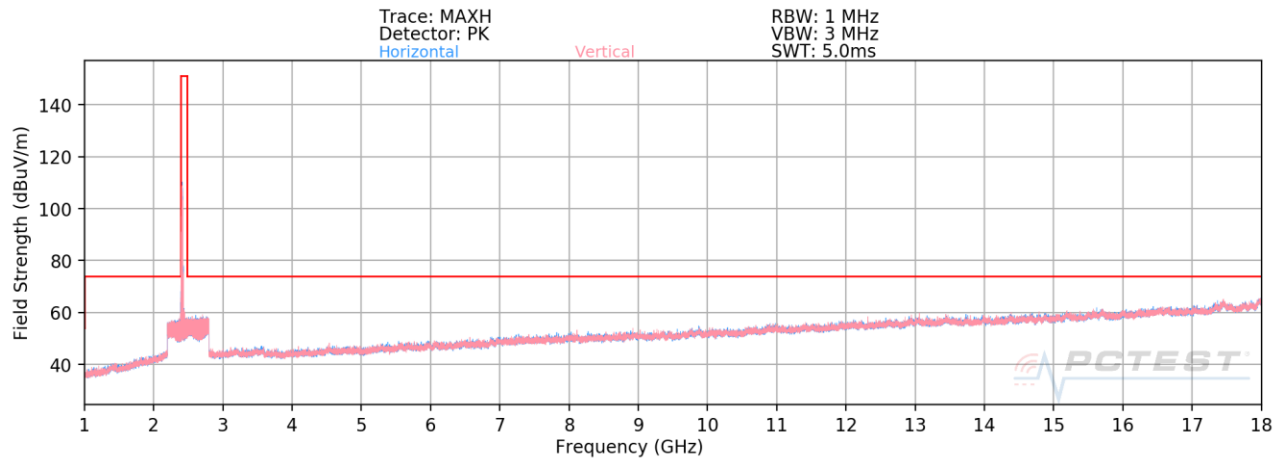
Radiated Band Edge Measurement Offset

- The amplitude offset shown in the radiated restricted band edge plots in Section 7.2 was calculated using the formula:
Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

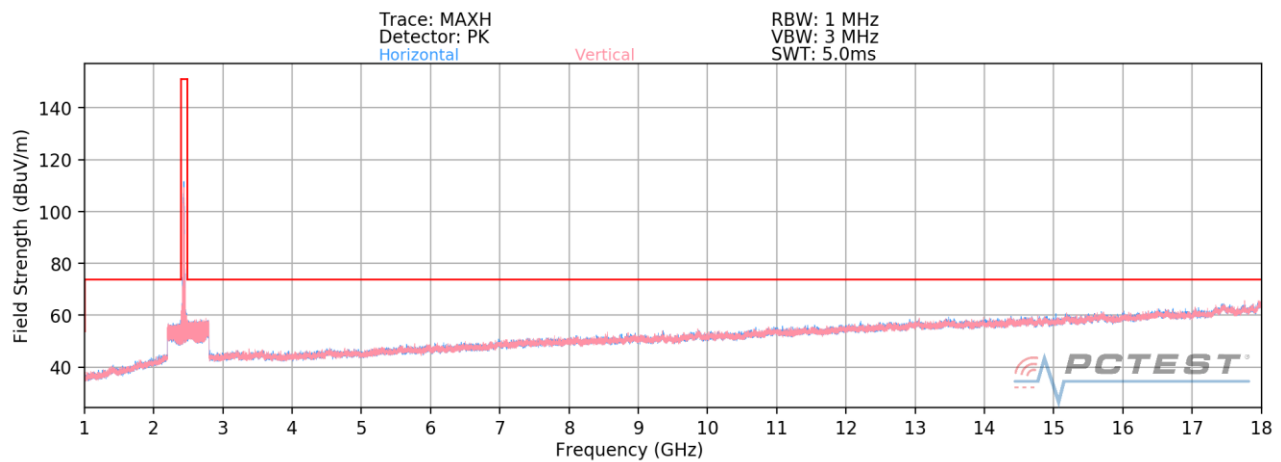
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7.2.1 SISO Antenna-1 Radiated Spurious Emission Measurements

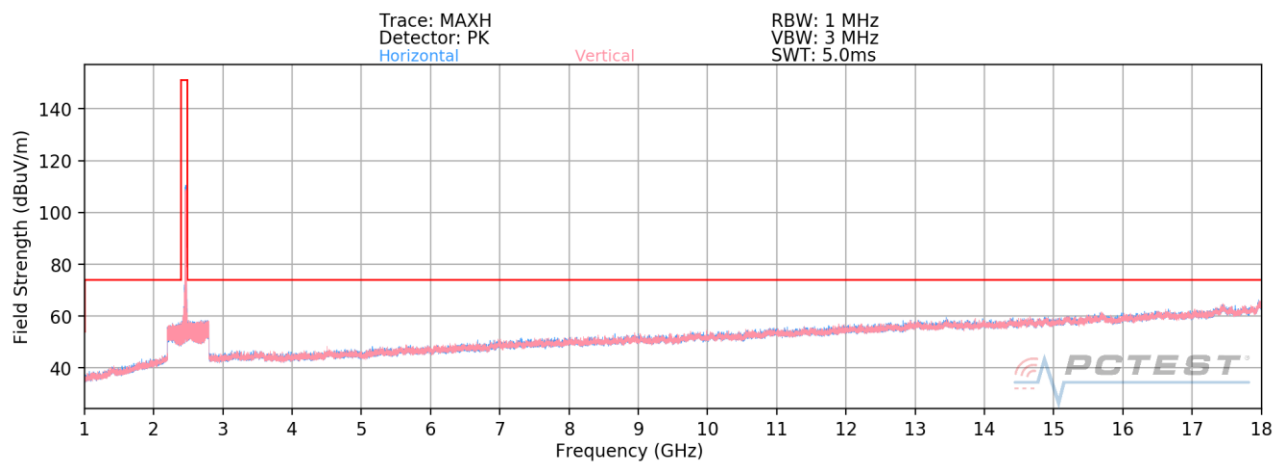
§15.247(d) §15.205 & §15.209; RSS-Gen [8.9]



Plot 7-1. Radiated Spurious Plot above 1GHz SISO ANT1 (802.11b – Ch. 1)



Plot 7-2. Radiated Spurious Plot above 1GHz SISO ANT1 (802.11b – Ch. 6)

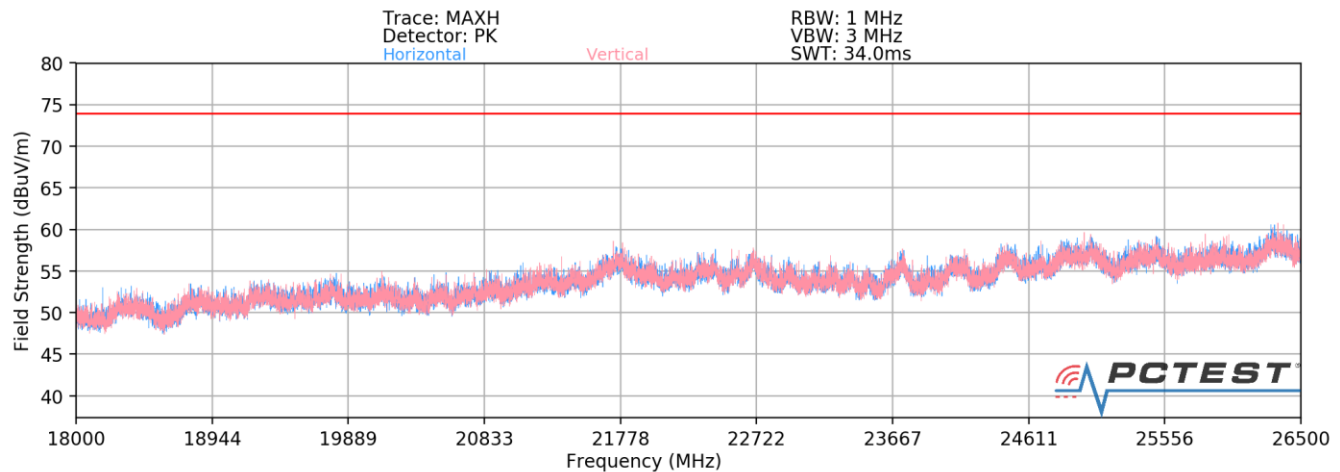


Plot 7-3. Radiated Spurious Plot above 1GHz SISO ANT1 (802.11b – Ch. 11)

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SISO Antenna-1 Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209; RSS-Gen [8.9]



Plot 7-4. Radiated Spurious Plot above 18GHz SISO ANT1

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SISO Antenna-1 Radiated Spurious Emission Measurements

§15.247(d) §15.205 & §15.209; RSS-Gen [8.9]

Worst Case Mode: 802.11b
Worst Case Transfer Rate: 1 Mbps
Distance of Measurements: 3 Meters
Operating Frequency: 2412MHz
Channel: 01

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4824.00	Avg	H	124	246	-79.73	6.53	33.80	53.98	-20.18
4824.00	Peak	H	124	246	-66.54	6.53	46.99	73.98	-26.99
12060.00	Avg	H	-	-	-83.62	18.54	41.92	53.98	-12.06
12060.00	Peak	H	-	-	-70.56	18.54	54.98	73.98	-19.00

Table 7-3. Radiated Measurements SISO ANT1

Worst Case Mode: 802.11b
Worst Case Transfer Rate: 1 Mbps
Distance of Measurements: 3 Meters
Operating Frequency: 2437MHz
Channel: 06

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4874.00	Avg	H	264	256	-80.72	7.11	33.39	53.98	-20.59
4874.00	Peak	H	264	256	-67.15	7.11	46.96	73.98	-27.02
7311.00	Avg	H	-	-	-82.18	12.56	37.38	53.98	-16.59
7311.00	Peak	H	-	-	-69.14	12.56	50.42	73.98	-23.55
12185.00	Avg	H	-	-	-82.98	18.54	42.56	53.98	-11.41
12185.00	Peak	H	-	-	-69.83	18.54	55.71	73.98	-18.26

Table 7-4. Radiated Measurements SISO ANT1

FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 17 of 39

Worst Case Mode: 802.11b
 Worst Case Transfer Rate: 1 Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 2462MHz
 Channel: 11

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4924.00	Avg	H	256	6	-79.96	6.93	33.97	53.98	-20.00
4924.00	Peak	H	256	6	-67.37	6.93	46.56	73.98	-27.41
7386.00	Avg	H	-	-	-81.91	12.01	37.10	53.98	-16.88
7386.00	Peak	H	-	-	-68.80	12.01	50.21	73.98	-23.77
12310.00	Avg	H	-	-	-83.85	18.68	41.83	53.98	-12.15
12310.00	Peak	H	-	-	-70.19	18.68	55.49	73.98	-18.49

Table 7-5. Radiated Measurements SISO ANT1

Worst Case Mode: 802.11b
 Worst Case Transfer Rate: 1 Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 2462MHz
 Channel: 11

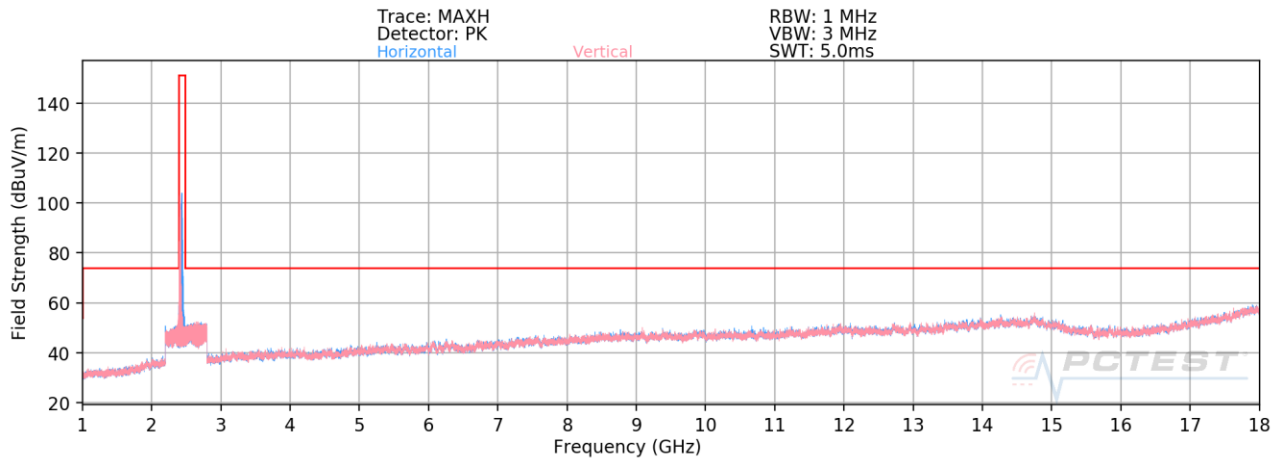
Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4924.00	Avg	H	-	-	-79.52	6.93	34.41	53.98	-19.56
4924.00	Peak	H	-	-	-67.85	6.93	46.08	73.98	-27.89
7386.00	Avg	H	-	-	-80.81	12.01	38.20	53.98	-15.78
7386.00	Peak	H	-	-	-68.93	12.01	50.08	73.98	-23.90
12310.00	Avg	H	-	-	-82.79	18.68	42.89	53.98	-11.09
12310.00	Peak	H	-	-	-69.80	18.68	55.88	73.98	-18.10

Table 7-6. Radiated Measurements SISO ANT1 with WCP + DD

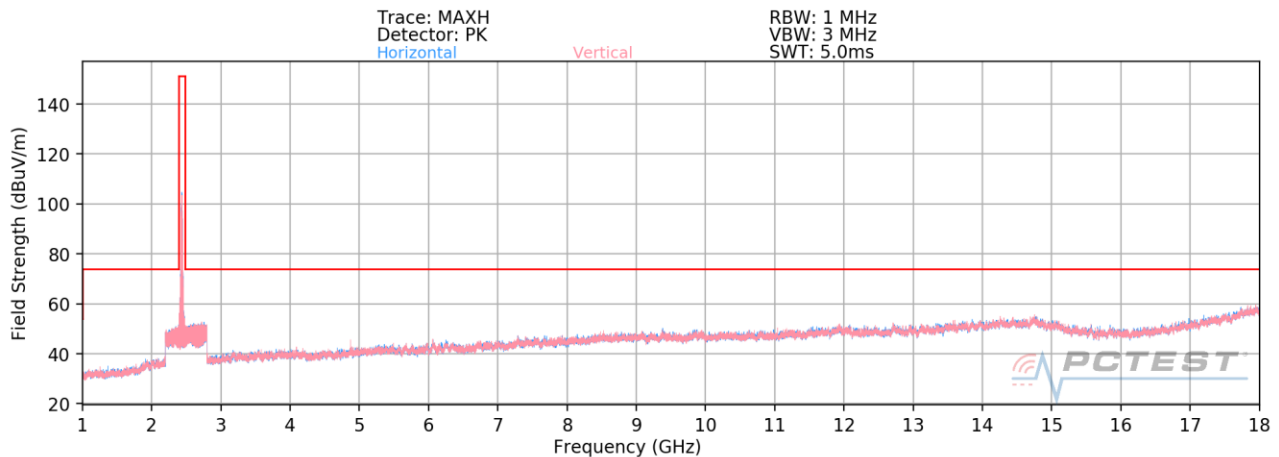
FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 18 of 39

7.2.2 SISO Antenna-2 Radiated Spurious Emission Measurements

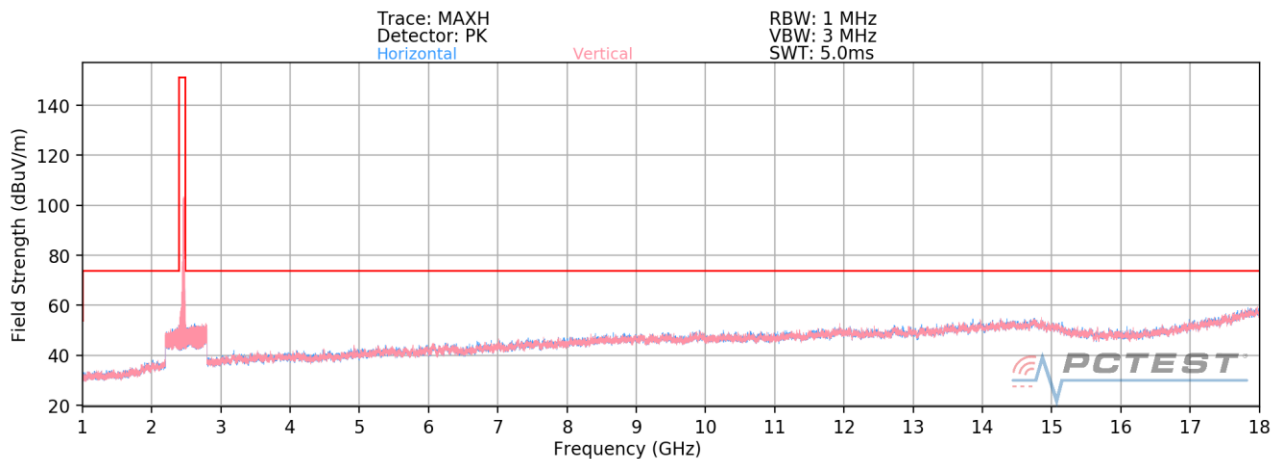
§15.247(d) §15.205 & §15.209; RSS-Gen [8.9]



Plot 7-5. Radiated Spurious Plot above 1GHz SISO ANT2 (802.11b – Ch. 1)



Plot 7-6. Radiated Spurious Plot above 1GHz SISO ANT2 (802.11b – Ch. 6)

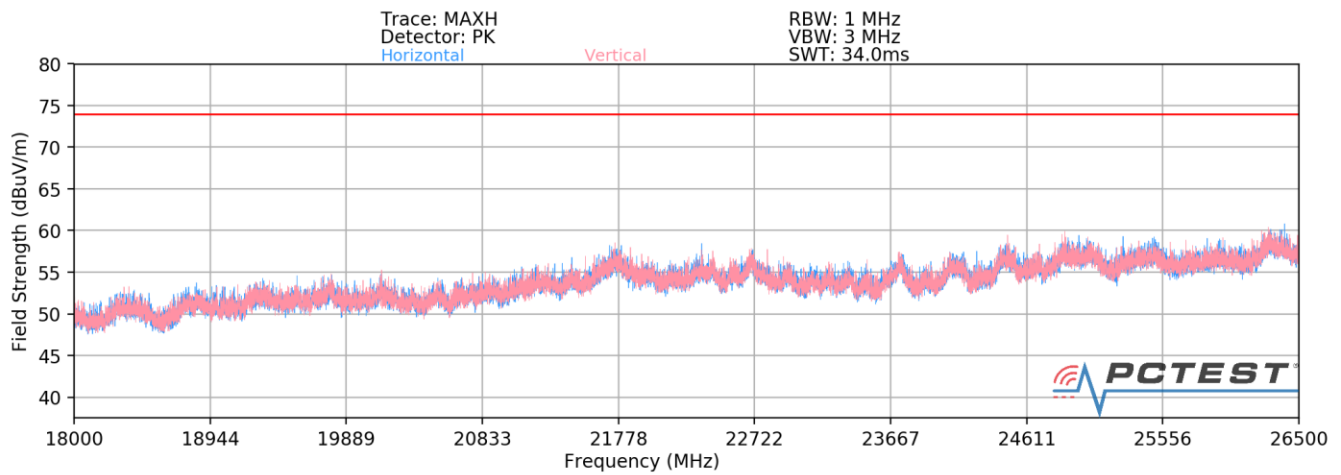


Plot 7-7. Radiated Spurious Plot above 1GHz SISO ANT2 (802.11b – Ch. 11)

FCC ID: ZNFV600TM	PCTEST	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 19 of 39

SISO Antenna-2 Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209; RSS-Gen [8.9]



Plot 7-8. Radiated Spurious Plot above 18GHz SISO ANT2

FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 20 of 39

SISO Antenna-2 Radiated Spurious Emission Measurements

§15.247(d) §15.205 & §15.209; RSS-Gen [8.9]

Worst Case Mode: 802.11b
Worst Case Transfer Rate: 1 Mbps
Distance of Measurements: 3 Meters
Operating Frequency: 2412MHz
Channel: 01

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4824.00	Avg	V	100	138	-72.01	6.53	41.52	53.98	-12.46
4824.00	Peak	V	100	138	-64.43	6.53	49.10	73.98	-24.88
12060.00	Avg	V	-	-	-82.50	18.54	43.04	53.98	-10.94
12060.00	Peak	V	-	-	-70.67	18.54	54.87	73.98	-19.11

Table 7-7. Radiated Measurements SISO ANT2

Worst Case Mode: 802.11b
Worst Case Transfer Rate: 1 Mbps
Distance of Measurements: 3 Meters
Operating Frequency: 2437MHz
Channel: 06

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4874.00	Avg	V	102	114	-73.51	7.11	40.60	53.98	-13.38
4874.00	Peak	V	102	114	-66.21	7.11	47.90	73.98	-26.08
7311.00	Avg	V	-	-	-81.10	12.56	38.46	53.98	-15.51
7311.00	Peak	V	-	-	-69.46	12.56	50.10	73.98	-23.87
12185.00	Avg	V	-	-	-82.09	18.54	43.45	53.98	-10.52
12185.00	Peak	V	-	-	-69.68	18.54	55.86	73.98	-18.11

Table 7-8. Radiated Measurements SISO ANT2

FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 21 of 39

Worst Case Mode: 802.11b
 Worst Case Transfer Rate: 1 Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 2462MHz
 Channel: 11

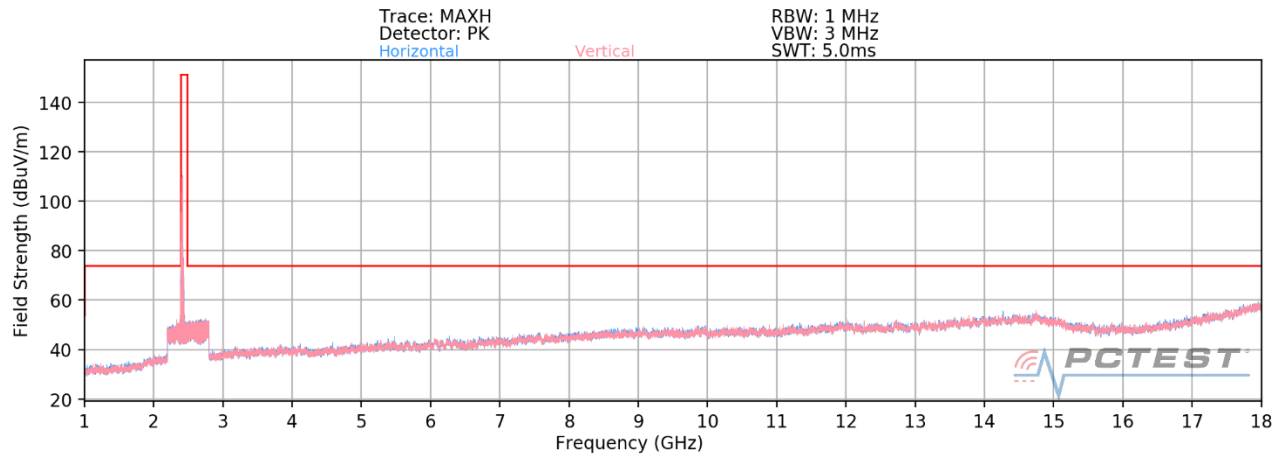
Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4924.00	Avg	V	107	133	-71.12	6.93	42.81	53.98	-11.16
4924.00	Peak	V	107	133	-64.37	6.93	49.56	73.98	-24.41
7386.00	Avg	V	104	254	-78.85	12.01	40.16	53.98	-13.82
7386.00	Peak	V	104	254	-67.00	12.01	52.01	73.98	-21.97
12310.00	Avg	V	-	-	-82.90	18.68	42.78	53.98	-11.20
12310.00	Peak	V	-	-	-71.18	18.68	54.50	73.98	-19.48

Table 7-9. Radiated Measurements SISO ANT2

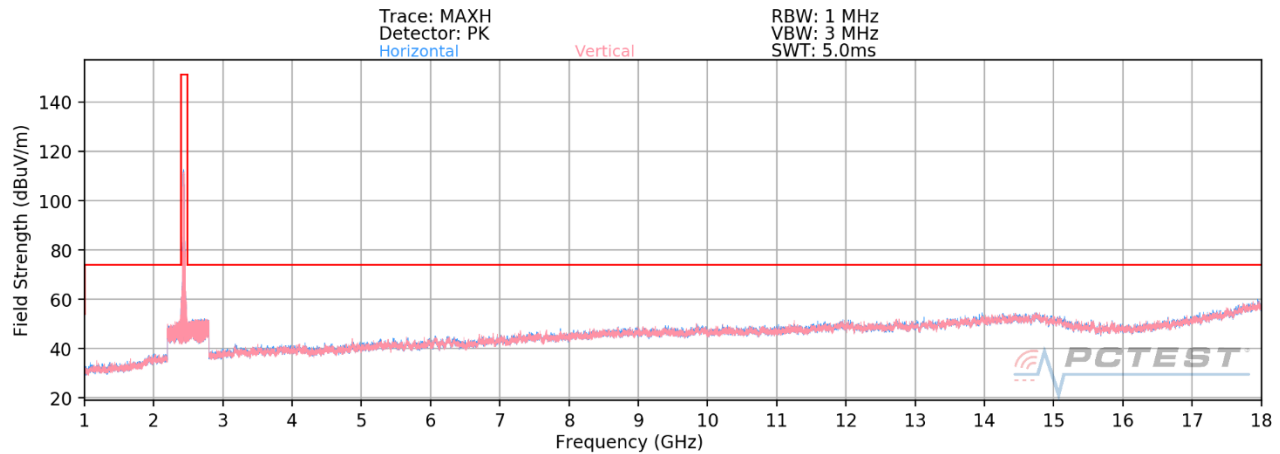
FCC ID: ZNFV600TM	 MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 22 of 39

7.2.3 MIMO/CDD Radiated Spurious Emission Measurements

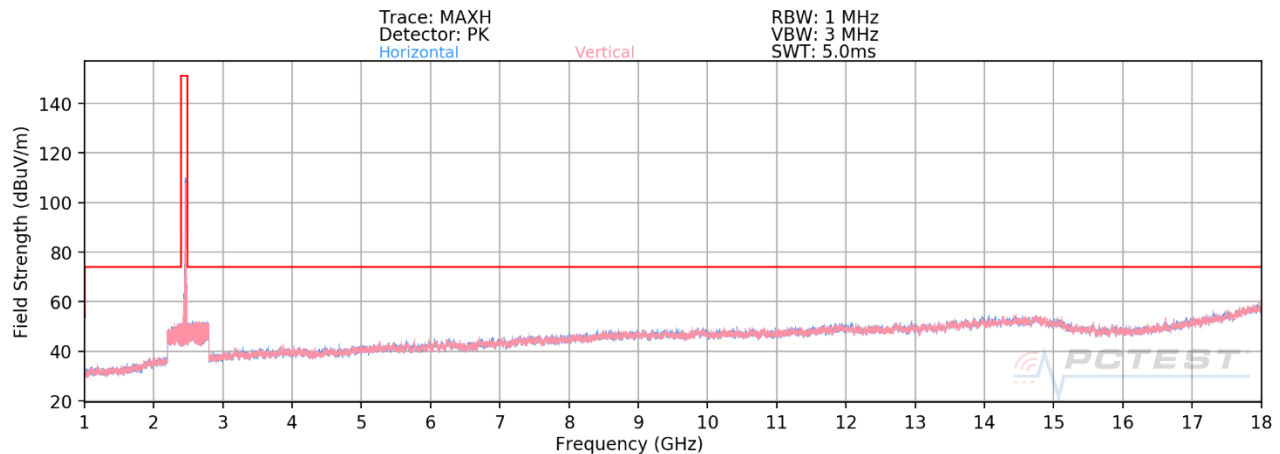
§15.247(d) §15.205 & §15.209; RSS-Gen [8.9]



Plot 7-9. Radiated Spurious Plot above 1GHz MIMO/CDD (802.11g – Ch. 1)



Plot 7-10. Radiated Spurious Plot above 1GHz MIMO/CDD (802.11g – Ch. 6)

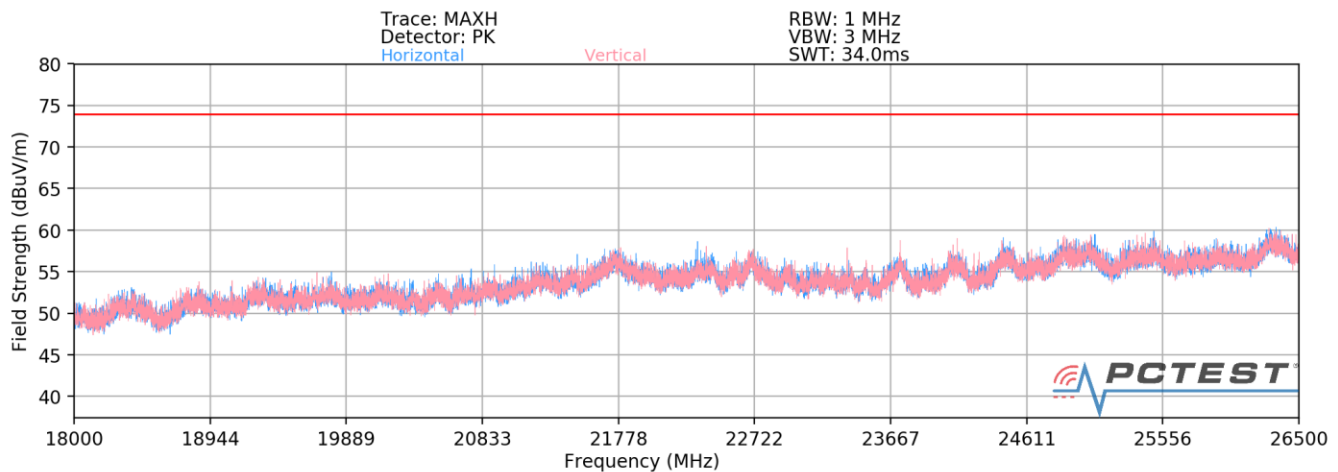


Plot 7-11. Radiated Spurious Plot above 1GHz MIMO/CDD (802.11g – Ch. 11)

FCC ID: ZNFV600TM	PCTEST	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 23 of 39

MIMO/CDD Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209; RSS-Gen [8.9]



Plot 7-12. Radiated Spurious Plot above 18GHz MIMO/CDD

FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 24 of 39

MIMO/CDD Radiated Spurious Emission Measurements

§15.247(d) §15.205 & §15.209; RSS-Gen [8.9]

Worst Case Mode: 802.11n
Worst Case Transfer Rate: MCS8
Distance of Measurements: 3 Meters
Operating Frequency: 2412MHz
Channel: 01

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4824.00	Avg	V	100	137	-77.13	6.53	36.40	53.98	-17.58
4824.00	Peak	V	100	137	-63.01	6.53	50.52	73.98	-23.46
12060.00	Avg	V	-	-	-82.40	18.54	43.14	53.98	-10.84
12060.00	Peak	V	-	-	-70.30	18.54	55.24	73.98	-18.74

Table 7-10. Radiated Measurements MIMO/CDD

Worst Case Mode: 802.11n
Worst Case Transfer Rate: MCS8
Distance of Measurements: 3 Meters
Operating Frequency: 2437MHz
Channel: 06

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4874.00	Avg	V	109	135	-76.24	7.11	37.87	53.98	-16.11
4874.00	Peak	V	109	135	-62.44	7.11	51.67	73.98	-22.31
7311.00	Avg	V	-	-	-81.22	12.56	38.34	53.98	-15.63
7311.00	Peak	V	-	-	-68.54	12.56	51.02	73.98	-22.95
12185.00	Avg	V	-	-	-82.01	18.54	43.53	53.98	-10.44
12185.00	Peak	V	-	-	-70.17	18.54	55.37	73.98	-18.60

Table 7-11. Radiated Measurements MIMO/CDD

FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 25 of 39

Worst Case Mode: 802.11n
Worst Case Transfer Rate: MCS8
Distance of Measurements: 3 Meters
Operating Frequency: 2462MHz
Channel: 11

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4924.00	Avg	V	107	132	-78.73	6.93	35.20	53.98	-18.77
4924.00	Peak	V	107	132	-65.89	6.93	48.04	73.98	-25.93
7386.00	Avg	V	-	-	-81.04	12.01	37.97	53.98	-16.01
7386.00	Peak	V	-	-	-68.52	12.01	50.49	73.98	-23.49
12310.00	Avg	V	-	-	-82.87	18.68	42.81	53.98	-11.17
12310.00	Peak	V	-	-	-70.40	18.68	55.28	73.98	-18.70

Table 7-12. Radiated Measurements MIMO/CDD

Worst Case Mode: 802.11n
Worst Case Transfer Rate: MCS8
Distance of Measurements: 3 Meters
Operating Frequency: 2437MHz
Channel: 06

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4874.00	Avg	V	117	53	-78.29	7.11	35.82	53.98	-18.16
4874.00	Peak	V	117	53	-66.60	7.11	47.51	73.98	-26.47
7311.00	Avg	V	-	-	-81.21	12.56	38.35	53.98	-15.62
7311.00	Peak	V	-	-	-69.47	12.56	50.09	73.98	-23.88
12185.00	Avg	V	-	-	-82.16	18.54	43.38	53.98	-10.59
12185.00	Peak	V	-	-	-70.46	18.54	55.08	73.98	-18.89

Table 7-13. Radiated Measurements MIMO/CDD with WCP + DD

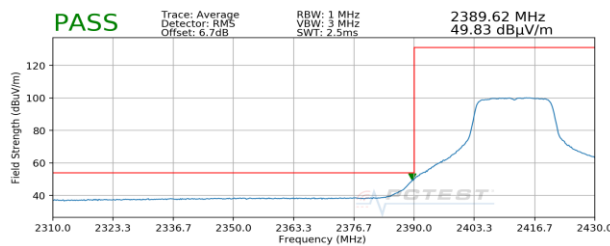
FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 26 of 39

7.2.4 SISO Antenna-1 Radiated Restricted Band Edge Measurements

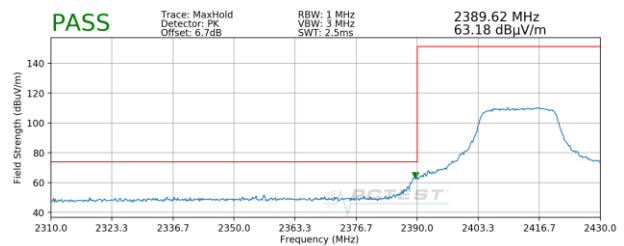
§15.205 §15.209; RSS-Gen [8.9]

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting.

Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2412MHz
Channel:	1

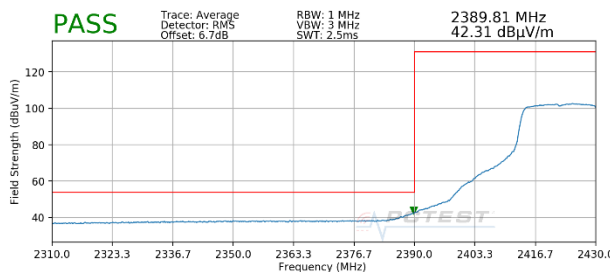


Plot 7-13. Radiated Restricted Lower Band Edge Measurement SISO ANT1 (Average)

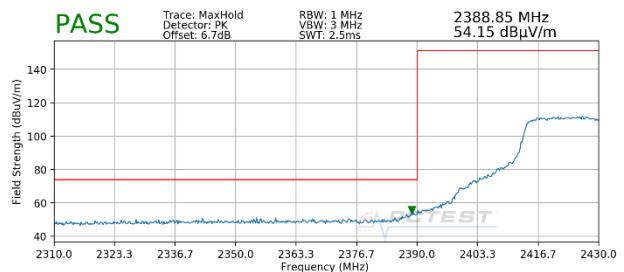


Plot 7-14. Radiated Restricted Lower Band Edge Measurement SISO ANT1 (Peak)

Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2422MHz
Channel:	3



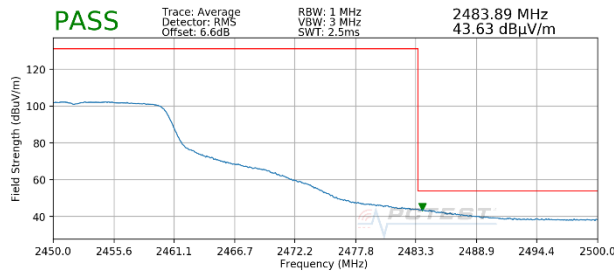
Plot 7-15. Radiated Restricted Lower Band Edge Measurement SISO ANT1 (Average)



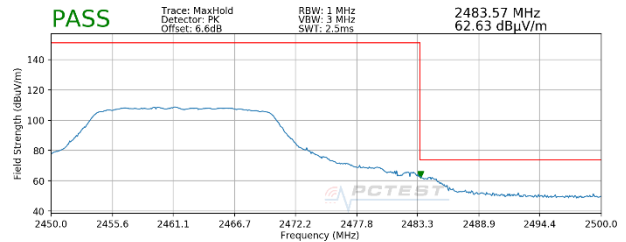
Plot 7-16. Radiated Restricted Lower Band Edge Measurement SISO ANT1 (Peak)

FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 27 of 39

Worst Case Mode: 802.11g
 Worst Case Transfer Rate: 6 Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 2452MHz
 Channel: 9

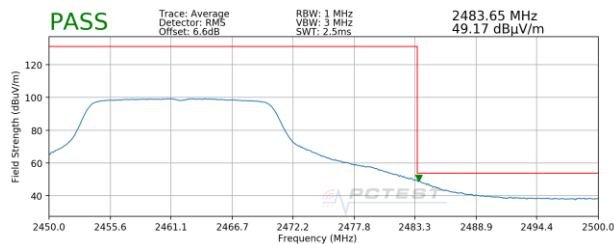


Plot 7-17. Radiated Restricted Lower Band Edge Measurement SISO ANT1 (Average)

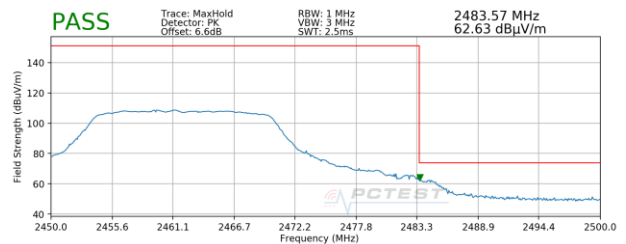


Plot 7-18. Radiated Restricted Lower Band Edge Measurement SISO ANT1 (Peak)

Worst Case Mode: 802.11g
 Worst Case Transfer Rate: 6 Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 2462MHz
 Channel: 11



Plot 7-19. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Average)



Plot 7-20. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Peak)

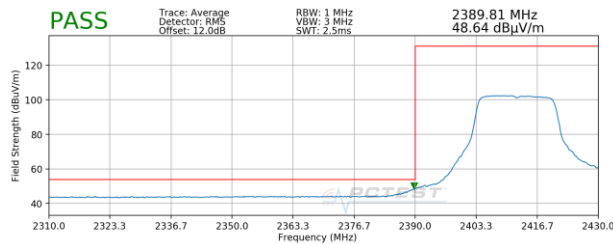
FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 28 of 39

7.2.5 SISO Antenna-2 Radiated Restricted Band Edge Measurements

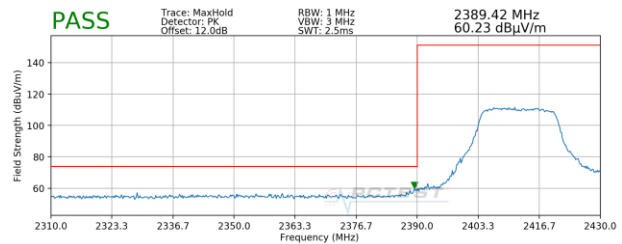
§15.205 §15.209; RSS-Gen [8.9]

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting.

Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2412MHz
Channel:	1

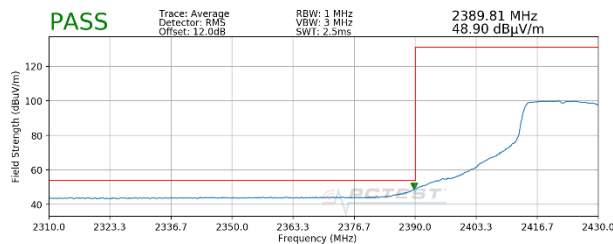


Plot 7-21. Radiated Restricted Lower Band Edge Measurement SISO ANT2 (Average)

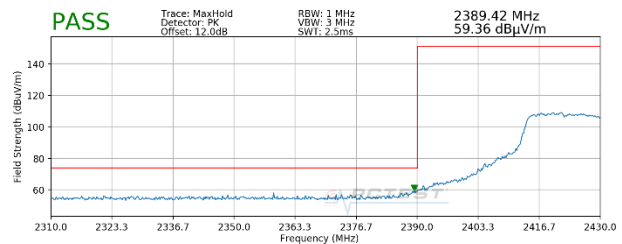


Plot 7-22. Radiated Restricted Lower Band Edge Measurement SISO ANT2 (Peak)

Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2422MHz
Channel:	3



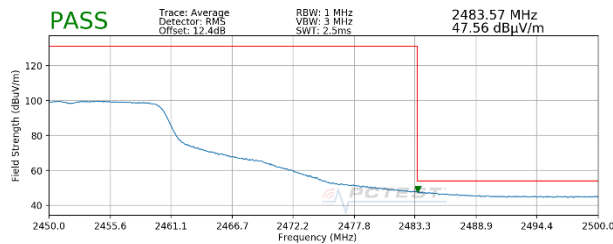
Plot 7-23. Radiated Restricted Lower Band Edge Measurement SISO ANT2 (Average)



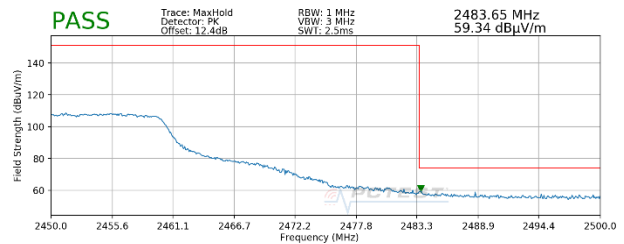
Plot 7-24. Radiated Restricted Lower Band Edge Measurement SISO ANT2 (Peak)

FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 29 of 39

Worst Case Mode: 802.11g
 Worst Case Transfer Rate: 6 Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 2452MHz
 Channel: 9

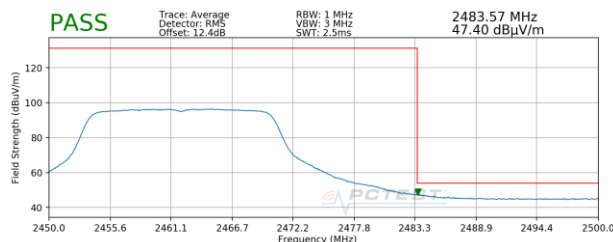


Plot 7-25. Radiated Restricted Lower Band Edge Measurement SISO ANT2 (Average)

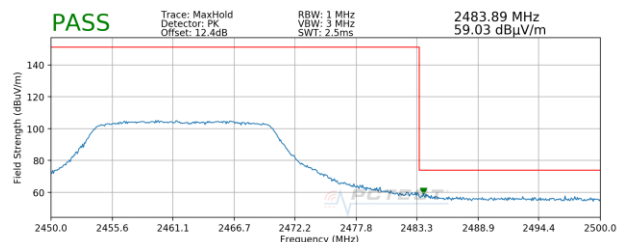


Plot 7-26. Radiated Restricted Lower Band Edge Measurement SISO ANT2 (Peak)

Worst Case Mode: 802.11g
 Worst Case Transfer Rate: 6 Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 2462MHz
 Channel: 11



Plot 7-27. Radiated Restricted Upper Band Edge Measurement SISO ANT2 (Average)



Plot 7-28. Radiated Restricted Upper Band Edge Measurement SISO ANT2 (Peak)

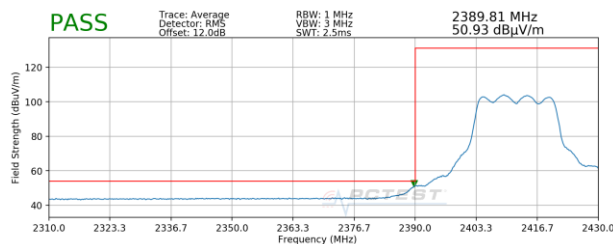
FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1912300226-06.ZNF	Test Dates: 1/21 - 2/15/2020	EUT Type: Portable Handset		Page 30 of 39

7.2.6 MIMO Radiated Restricted Band Edge Measurements

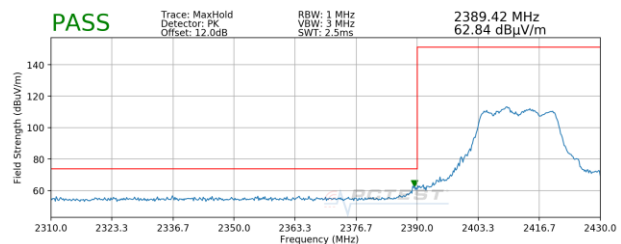
§15.205 §15.209; RSS-Gen [8.9]

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting.

Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2412MHz
Channel:	1

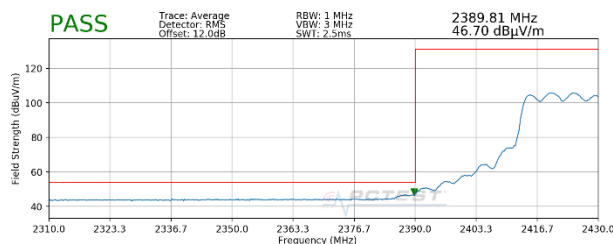


Plot 7-29. Radiated Restricted Lower Band Edge Measurement MIMO (Average)

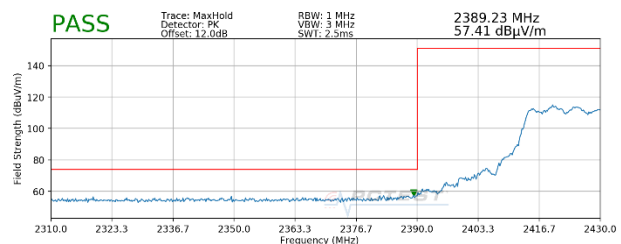


Plot 7-30. Radiated Restricted Lower Band Edge Measurement MIMO (Peak)

Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2422MHz
Channel:	3



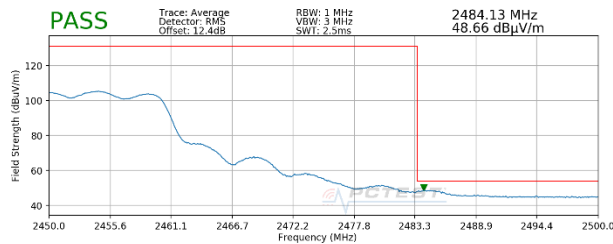
Plot 7-31. Radiated Restricted Lower Band Edge Measurement MIMO (Average)



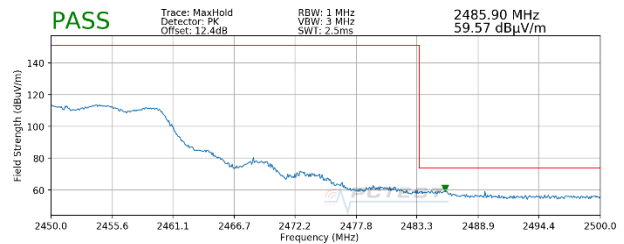
Plot 7-32. Radiated Restricted Lower Band Edge Measurement MIMO (Peak)

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Worst Case Mode: 802.11g
 Worst Case Transfer Rate: 6 Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 2452MHz
 Channel: 9

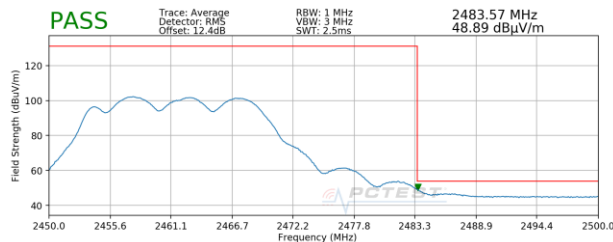


Plot 7-33. Radiated Restricted Lower Band Edge Measurement MIMO (Average)

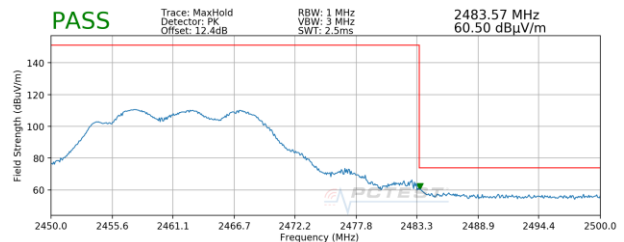


Plot 7-34. Radiated Restricted Lower Band Edge Measurement MIMO (Peak)

Worst Case Mode: 802.11g
 Worst Case Transfer Rate: 6 Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 2462MHz
 Channel: 11



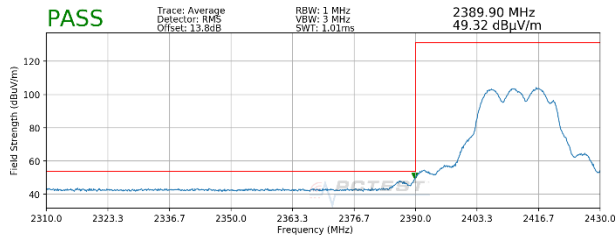
Plot 7-35. Radiated Restricted Upper Band Edge Measurement MIMO (Average)



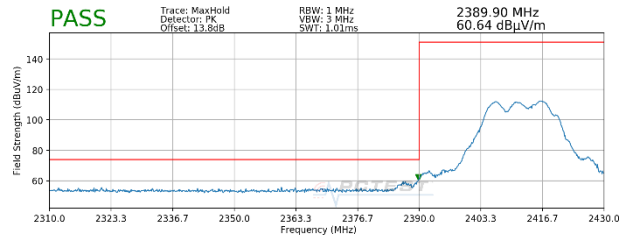
Plot 7-36. Radiated Restricted Upper Band Edge Measurement MIMO (Peak)

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Worst Case Mode: 802.11g
 Worst Case Transfer Rate: 6Mbps
 Distance of Measurements: 3 Meters
 Operating Frequency: 2412MHz
 Channel: 1



Plot 7-37. Radiated Restricted Band Edge Measurement MIMO with WCP + DD (Average)



Plot 7-38. Radiated Restricted Band Edge Measurement MIMO with WCP + DD (Peak)

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7.3 Radiated Spurious Emissions Measurements – Below 1GHz

§15.209; RSS-Gen [8.9]

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR and Table 6 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-14 per Section 15.209 and RSS-Gen (8.9).

Frequency	Field Strength [μ V/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-14. Radiated Limits

Test Procedures Used

ANSI C63.10-2013

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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Test Setup

The EUT and measurement equipment were set up as shown in the diagrams below.

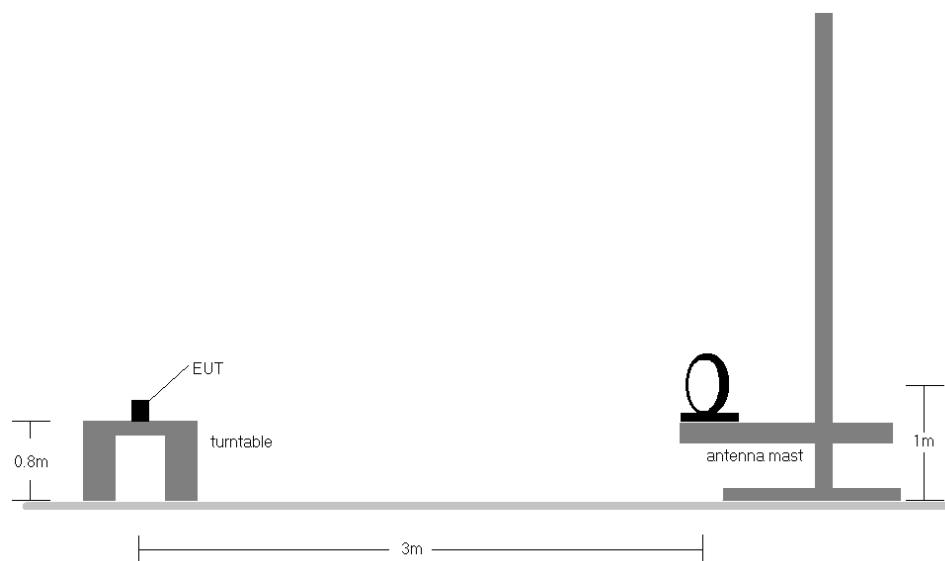


Figure 7-2. Radiated Test Setup < 30Mhz

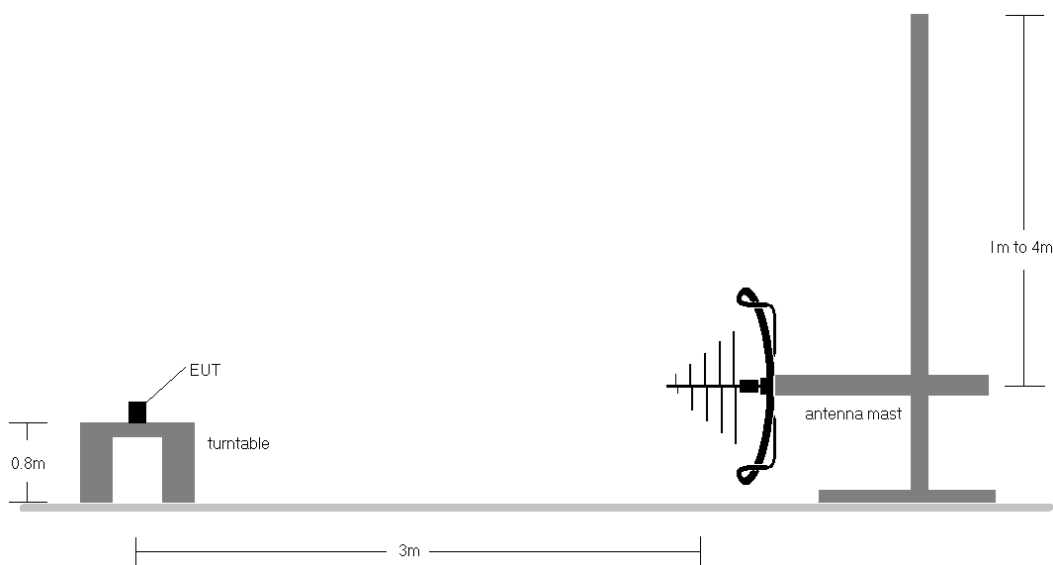


Figure 7-3. Radiated Test Setup < 1GHz

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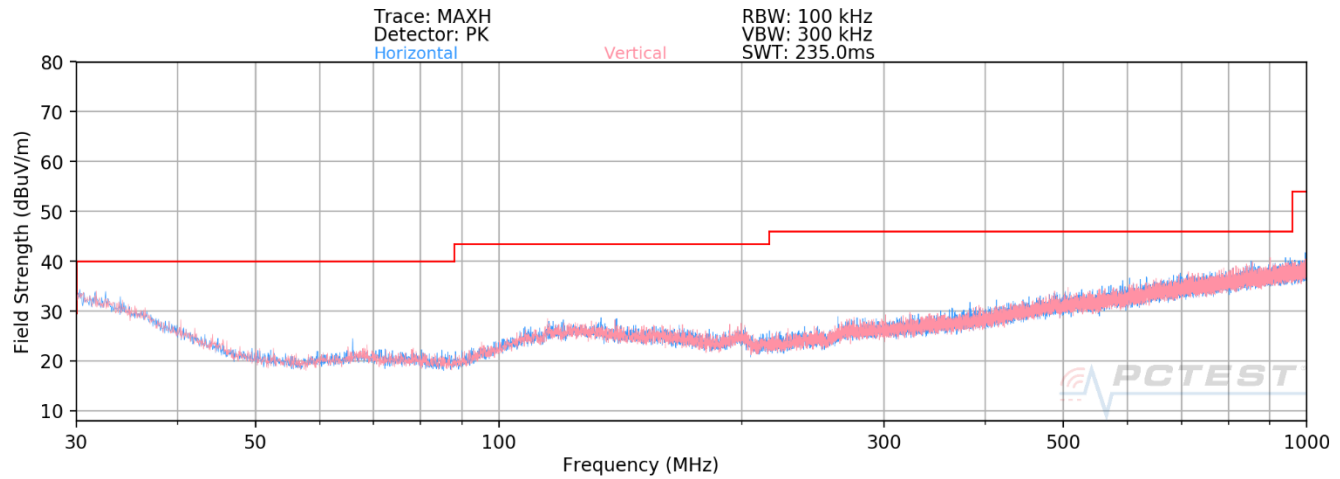
Test Notes

1. All emissions lying in restricted bands specified in §15.205 and RSS-Gen(8.10) are below the limit shown in Table 7-14.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
3. This unit was tested with its standard battery.
4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
5. Emissions were measured at a 3 meter test distance.
6. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
7. No spurious emissions were detected within 20dB of the limit below 30MHz.
8. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.
9. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. There were no emissions detected in the 30MHz – 1GHz frequency range, as shown in the subsequent plots.

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SISO Antenna-1 Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209; RSS-Gen [8.9]

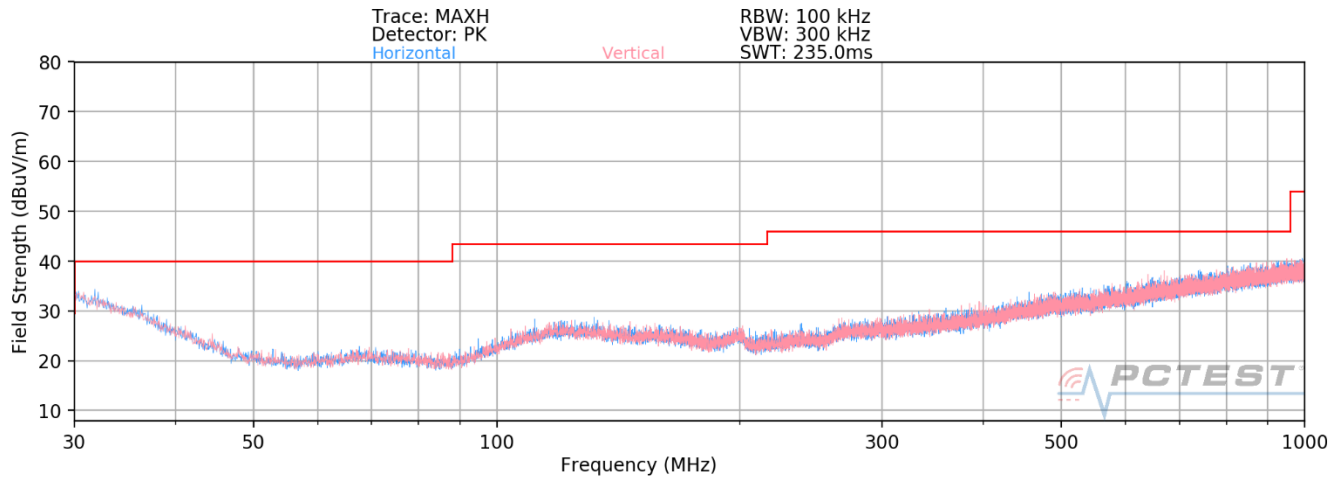


Plot 7-39. Radiated Spurious Plot below 1GHz SISO ANT1

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SISO Antenna-2 Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209; RSS-Gen [8.9]



Plot 7-40. Radiated Spurious Plot below 1GHz SISO ANT2

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8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFV600TM** is in compliance with Part 15 Subpart C (15.247) of the FCC Rules.

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