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MEASUREMENT REPORT FCC PART 15.225 NFC

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.:

1M1912300226-13.ZNF

FCC ID:

ZNFV600TM

APPLICANT:

LG Electronics USA, Inc.

Application Type:

Certification

Model:

LM-V600TM

Additional Model(s):

LMV600TM, V600TM

EUT Type:

Portable Handset

Frequency:

13.56MHz

FCC Classification:

Low Power Communications Device Transmitter (DXX)

Test Procedure(s):

ANSI C63.10-2013

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. 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



FCC ID: ZNFV600TM		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
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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 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 NFC transmitter of the EUT.

Test Device Serial No.: 04349

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

2.3 Test Configuration

The EUT was set to continuously transmit at 13.56MHz. This was performed using manufacturer software loaded on the phone and a passive RFID tag to allow for continuous transmission. This device was tested in accordance with the guidance of ANSI C63.10-2013. See Sections 3.2 of this test report for a description of the radiated emissions test setups.

2.4 EMI Suppression Device(s)/Modifications

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

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3.0 DESCRIPTION OF TEST

3.1 Evaluation Procedure

The measurement procedure described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) was 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.

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 antenna of the EUT are **permanently attached**.
- This unit was tested with its standard battery.

Conclusion:

The EUT 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

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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
COM-Power	AL-130R	Active Loop Antenna	10/10/2019	Annual	10/10/2020	121085
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	6/5/2019	Annual	6/5/2020	100342
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 DATA

7.1 Summary

Company Name: LG Electronics USA, Inc.
 FCC ID: ZNFV600TM
 FCC Classification: Low Power Communications Device Transmitter (DXX)
 Frequencies Examined: 13.56MHz

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.225 (a)(b)(c)	RSS-210 [B.6]	In-Band Emissions	15,848µV/m @ 30m 13.553 – 13.567 MHz 334µV/m @ 30m 13.410 – 13.553 MHz 13.567 – 13.710 MHz 106µV/m @ 30m 13.110 – 13.410 MHz 13.710 – 14.010 MHz	RADIATED	PASS	Section 7.2
15.225 (d) 15.209	RSS-Gen [8.9]	Out-of-Band Emissions	Emissions outside of the specified band (13.110 – 14.010 MHz) must meet the radiated limits detailed in 15.209 (RSS-Gen [8.9])		PASS	Section 7.3

Table 7-1. Summary of Test Results

Note:

This unit was tested with its standard battery.

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7.2 In-Band Radiated Spurious Emission Measurements

§15.225(a)(b)(c); RSS-210 (B.6)

Test Overview and Limit

The EUT was tested from 13.110 – 14.010 MHz. All in-band radiated spurious emissions are measured with a spectrum analyzer connected to a loop antenna while the EUT is operating at appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All in-band emissions appearing in a restricted band as specified in Section 15.225 of the Title 47 CFR must not exceed the limits shown in Table 7-2.

Frequency [MHz]	Field Strength [μV/m]	Measured Distance [Meters]
13.553-13.567 MHz	15,848	30
13.410-13.553 MHz and 13.567-13.710 MHz	334	30
13.110-13.410 MHz and 13.710-14.010 MHz	106	30

Table 7-2. Radiated Limits

Test Procedures Used

ANSI C63.10-2013 – Section 6.4.7

Test Settings

1. RBW = 9kHz
2. VBW $\geq 3 \times$ RBW
3. Detector = 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 diagram below.

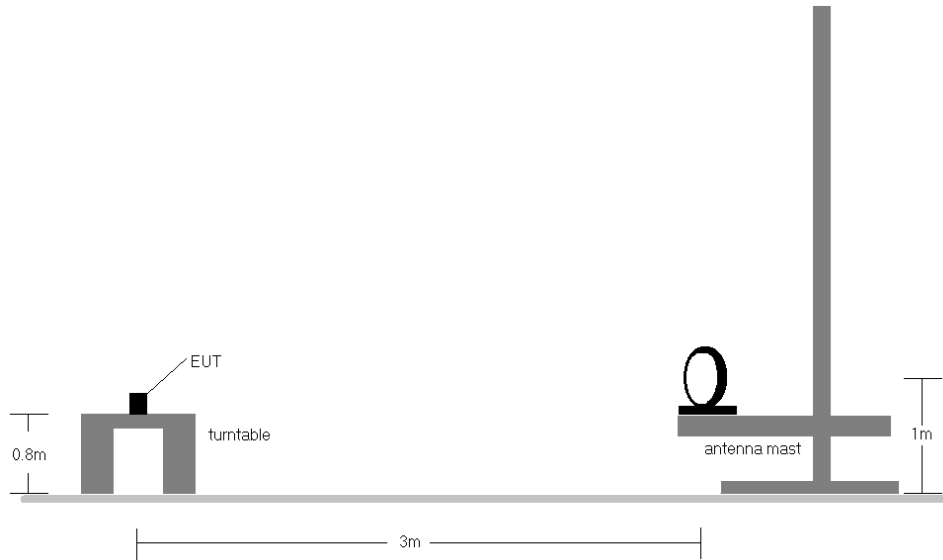


Figure 7-1. Radiated Test Setup

Test Notes:

1. All emissions lying in restricted bands specified in §15.225 and RSS-210 are below the limit shown in Table 7-2.
2. All measurements were performed using a loop antenna. The antenna was positioned in three orthogonal positions (X front, Y side, Z top) and the position with the highest emission level was recorded.
3. The EUT was positioned in three orthogonal planes to determine the orientation resulting in the worst case emissions.
4. Measurements were performed at 3m and the data was extrapolated to the specified measurement distance of 30m using the square of an inverse linear distance extrapolation factor (40 dB/decade) as specified in §15.31(f)(2). Extrapolation Factor = $20 \log_{10}(30/3)^2 = 40\text{dB}$.
5. The spectrum was investigated from 9kHz up to 30MHz using the loop antenna. Only the emissions shown in the table below were found to be significant.
6. All measurements were recorded using a spectrum analyzer employing a quasi-peak detector.
7. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

Sample Calculation

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

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In-Band Radiated Spurious Emission Measurements

§15.225(a)(b)(c); RSS-210 (B.6)

Frequency: 13.56MHz

Measurement Distance: 3 Meters

Frequency [MHz]	Ant. Pol. [X/Y/Z]	Antenna Height [cm]	Turntable Azimuth [degree]	Level [dBm]	AFCL [dB/m]	3m Field Strength [dBμV/m]	30m Field Strength [dBμV/m]	Limit [μV/m]	Limit [dBμV/m]	Margin [dB]
13.136	X	110	351	-89.23	15.11	32.88	-7.12	106.00	40.51	-47.63
13.348	X	110	351	-83.24	15.04	38.80	-1.20	106.00	40.51	-41.71
13.455	X	110	351	-80.07	15.01	41.94	1.94	334.00	50.47	-48.54
13.560	X	110	351	-69.43	14.98	52.55	12.55	15848.00	84.00	-71.45
13.664	X	110	351	-80.30	14.95	41.65	1.65	334.00	50.47	-48.83
13.773	X	110	351	-84.37	14.91	37.54	-2.46	106.00	40.51	-42.96
13.983	X	110	351	-90.50	14.85	31.35	-8.65	106.00	40.51	-49.15

Table 7-3. In-Band Radiated Measurements

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7.3 Radiated Spurious Emission Measurements, Out-of-Band

§15.209 §15.225(d); RSS-Gen (8.9)

Test Overview and Limit

The EUT was tested from 9kHz up to the 1GHz excluding the band 13.110 – 14.010 MHz. All measurements up to 960MHz were recorded with a spectrum analyzer employing a quasi-peak detector.

All out-of-band emissions appearing in a restricted band as specified in Section 15.225 of the Title 47 CFR must not exceed the limits shown in Table 7-4 per Section 15.209.

Frequency	Field Strength [μV/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 7-4. Radiated Limits – Out of band

Test Procedures Used

ANSI C63.10-2013 – Section 6.5.4

Test Settings

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 9kHz for emissions below 30MHz and 100kHz for emissions between 30MHz and 1GHz
3. VBW ≥ 3 x RBW
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.

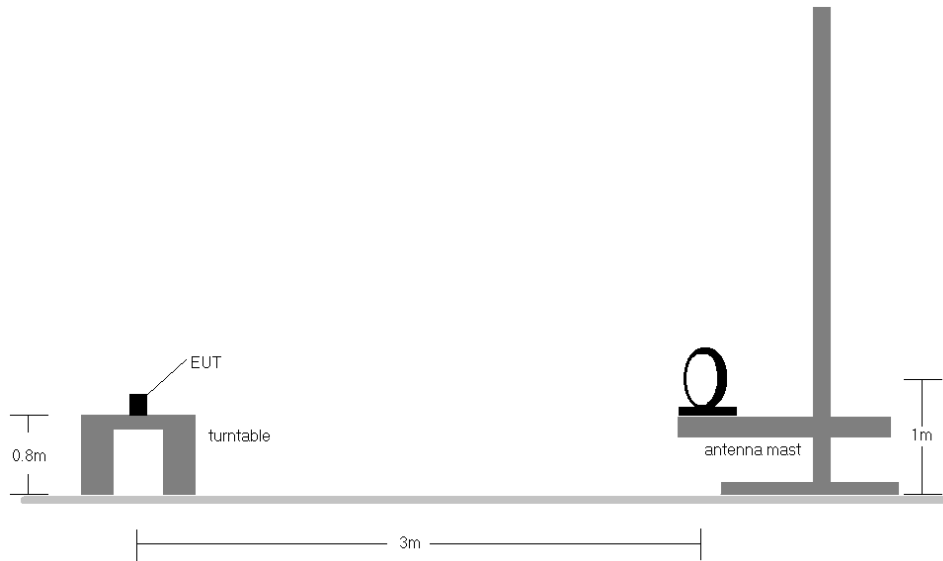


Figure 7-2. Radiated Test Setup < 30MHz

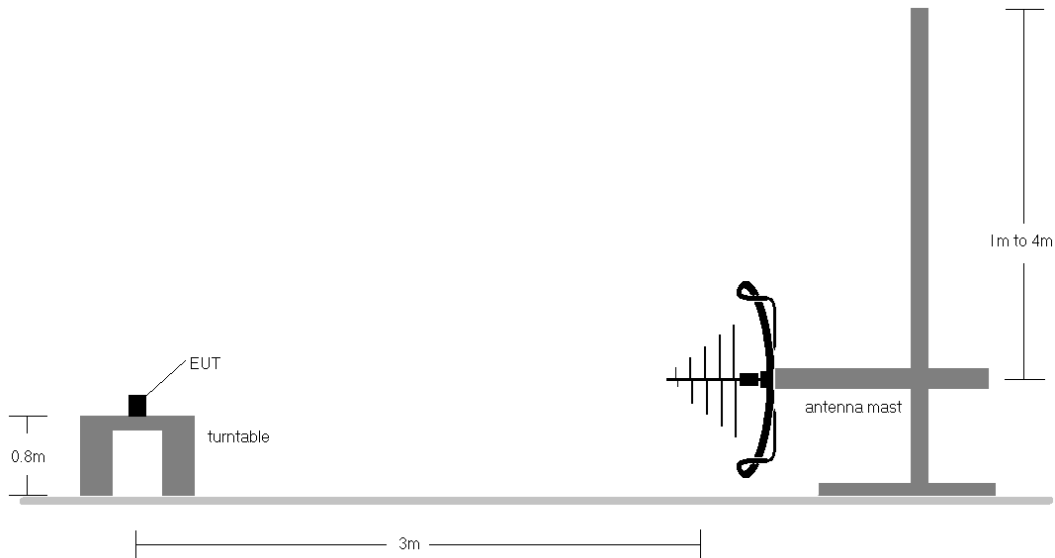


Figure 7-3. Radiated Test Setup > 30MHz

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Test Notes:

1. All measurements were recorded using a spectrum analyzer employing a quasi-peak detector for emissions below 960MHz.
2. A loop antenna was used to investigate emissions below 30MHz.
3. Both Vertical and Horizontal polarities of the receive antenna were evaluated with the worst case emissions being reported. Below 30MHz the loop antenna was positioned in 3 orthogonal planes (X front, Y side, Z top) to determine the orientation resulting in the worst case emissions.
4. The EUT was positioned in three orthogonal planes to determine the orientation resulting in the worst case emissions.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.
6. No spurious emissions levels were found to be greater than the level of the fundamental.
7. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

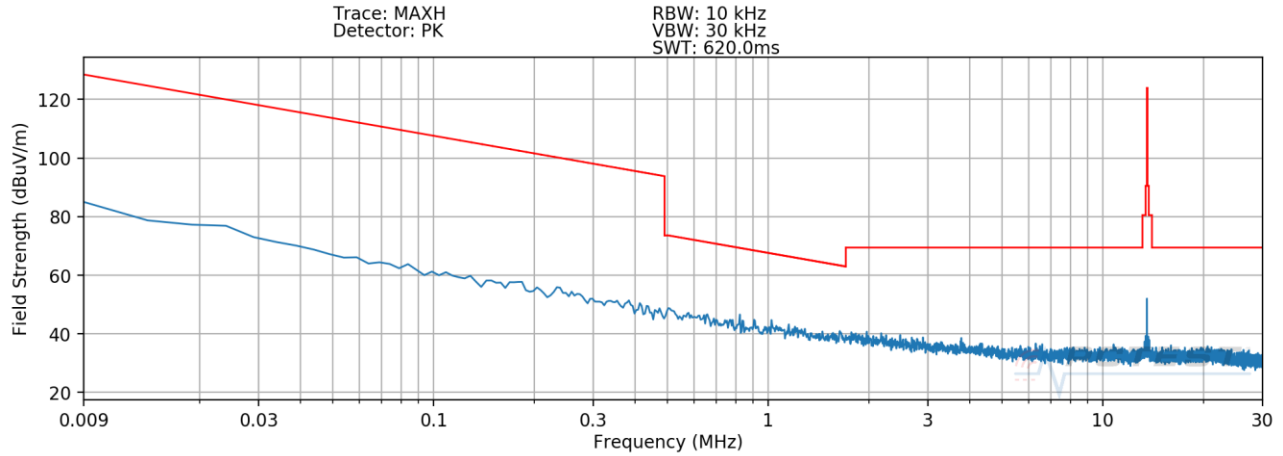
Sample Calculation

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

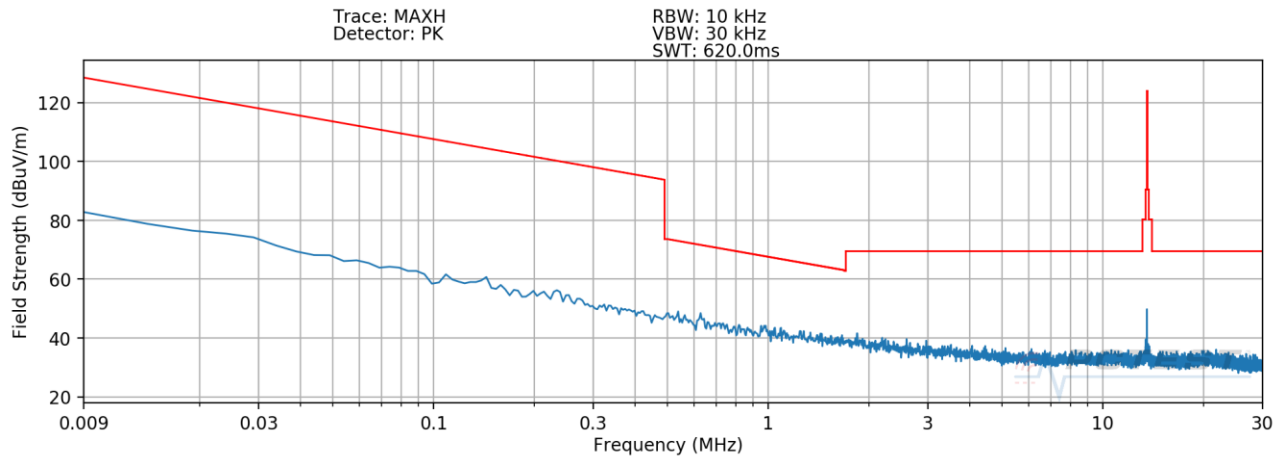
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Radiated Spurious Emission Measurements, Out-of-Band

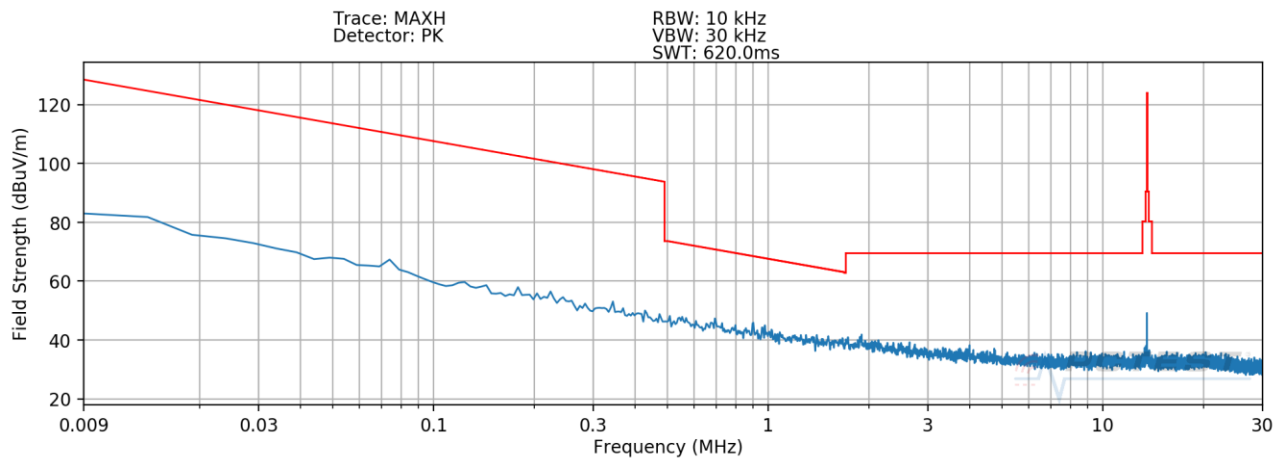
§15.209 §15.225(d); RSS-Gen (8.9)



Plot 7-1. Radiated Spurious Plot 9kHz – 30MHz (Pol. X)

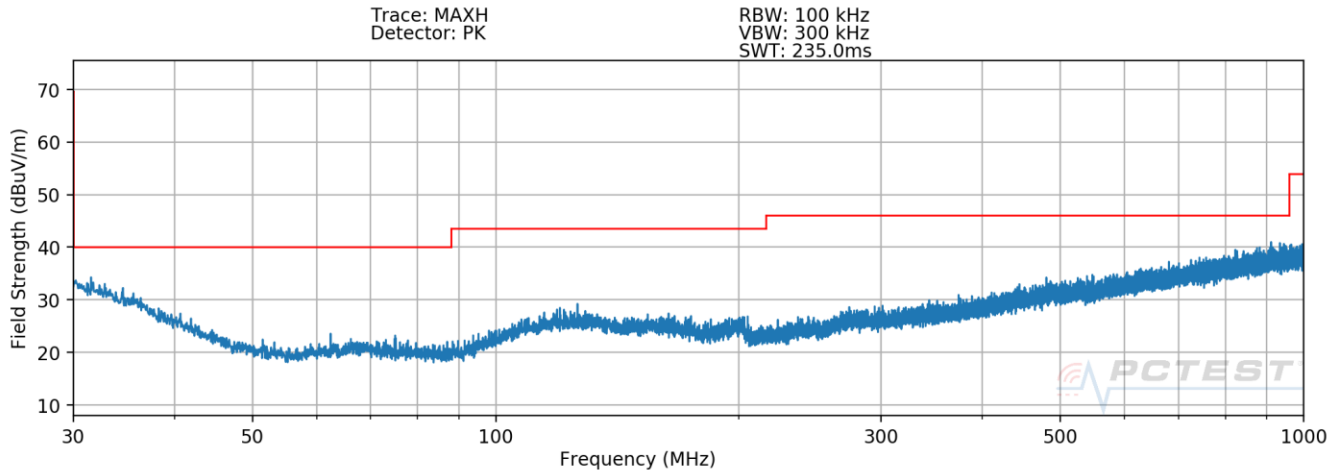


Plot 7-2. Radiated Spurious Plot 9kHz – 30MHz (Pol. Y)

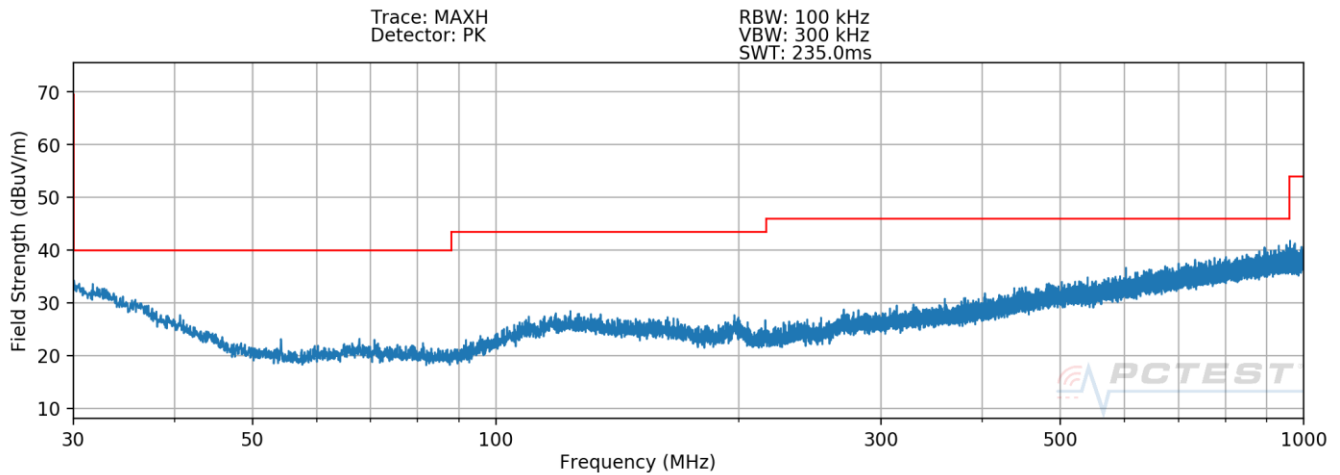


Plot 7-3. Radiated Spurious Plot 9kHz – 30MHz (Pol. Z)

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Plot 7-4. Radiated Spurious Plot 30MHz – 1GHz (Pol. H)



Plot 7-5. Radiated Spurious Plot 30MHz – 1GHz (Pol. V)

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Radiated Spurious Emission Measurements, Out-of-Band

§15.209 §15.225(d); RSS-Gen (8.9)

Tx Frequency 13.56MHz

Measurement Distance: 3 Meters

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level [dBm]	AFCL [dB/m]	3m Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
27.12	X	110	351	-91.47	13.26	28.79	69.54	-40.75
40.68	H	250	256	-98.54	19.71	28.17	40.00	-11.83
54.24	H	245	302	-99.08	14.04	21.96	40.00	-18.04
67.80	H	250	114	-98.54	15.04	23.50	40.00	-16.50
81.36	H	235	98	-97.99	14.66	23.67	40.00	-16.33
94.92	H	228	341	-98.13	15.97	24.84	43.52	-18.68
108.48	H	212	112	-98.10	19.40	28.30	43.52	-15.22

Table 7-5. Radiated Measurements

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8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFV600TM** has been tested to show compliance with Part 15 Subpart C (15.225) of the FCC Rules.

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