

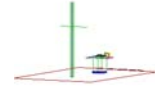


# PCTEST ENGINEERING LABORATORY, INC.

7185 Oakland Mills Road, Columbia, MD 21046 USA

Tel. 410.290.6652 / Fax 410.290.6654

<http://www.pctestlab.com>



## MEASUREMENT REPORT FCC Part 15.225 NFC

**Applicant Name:**

LG Electronics MobileComm U.S.A  
1000 Sylvan Avenue  
Englewood Cliffs, NJ 07632  
United States

**Date of Testing:**

2/3-3/15/2016

**Test Site/Location:**

PCTEST Lab, Columbia, MD, USA

**Test Report Serial No.:**

0Y1602020288.ZNF

**FCC ID:**

**ZNFK428**

**APPLICANT:**

**LG Electronics MobileComm U.S.A**

**Application Type:**

Certification

**Model(s):**

LGK428, LG-K428, K428, LG-MS428, LGMS428, MS428

**EUT Type:**

Portable Handset

**Frequency:**

13.56MHz

**FCC Classification:**

Low Power Communications Device Transmitter (DXX)

**FCC Rule Part(s):**

FCC Part 15 Subpart C (15.225)

**Test Procedure(s):**

ANSI C63.10-2013

The device bearing the FCC Identifier specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and has been tested in accordance with the measurement procedures specified in ANSI C63.10-2013 (See Test Report). These measurements were performed with no deviation from the standards. Test results reported herein relate only to the item(s) tested.

I authorize and 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.

*NVLAP accreditation does not constitute any product endorsement by NVLAP or any agency of the United States Government. This report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.*

  
Randy Ortanez  
President

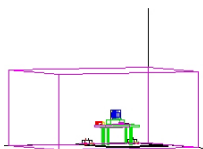
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Lab Code 100431-0

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## MEASUREMENT REPORT

### FCC Part 15.225



#### § 2.1033 General Information

**APPLICANT:** LG Electronics MobileComm U.S.A  
**APPLICANT ADDRESS:** 1000 Sylvan Avenue  
 Englewood Cliffs, NJ 07632  
 United States  
**TEST SITE:** PCTEST ENGINEERING LABORATORY, INC.  
**TEST SITE ADDRESS:** 7185 Oakland Mills Road, Columbia, MD 21046 USA  
**FCC RULE PART(S):** Part 15 Subpart C (15.225)  
**BASE MODEL:** LGK428  
**FCC ID:** ZNFK428  
**FCC CLASSIFICATION:** Low Power Communications Device Transmitter (DXX)  
**Test Device Serial No.:** 08507 ☐ Production ☒ Pre-Production ☐ Engineering  
**DATE(S) OF TEST:** 2/3-3/15/2016  
**TEST REPORT S/N:** 0Y1602020288.ZNF

#### Test Facility / Accreditations

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



- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451B-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451B-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

|                                             |                                                                                     |                                                              |                                                                                       |                                        |
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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 Industry Canada Certification and Engineering Bureau.

### 1.2 PCTEST Test Location

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity, the Baltimore-Washington Intern't'l (BWI) airport, the city of Baltimore and the Washington, DC area. (See Figure 1-1).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39° 10'23" N latitude and 76° 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2014 on January 22, 2015.

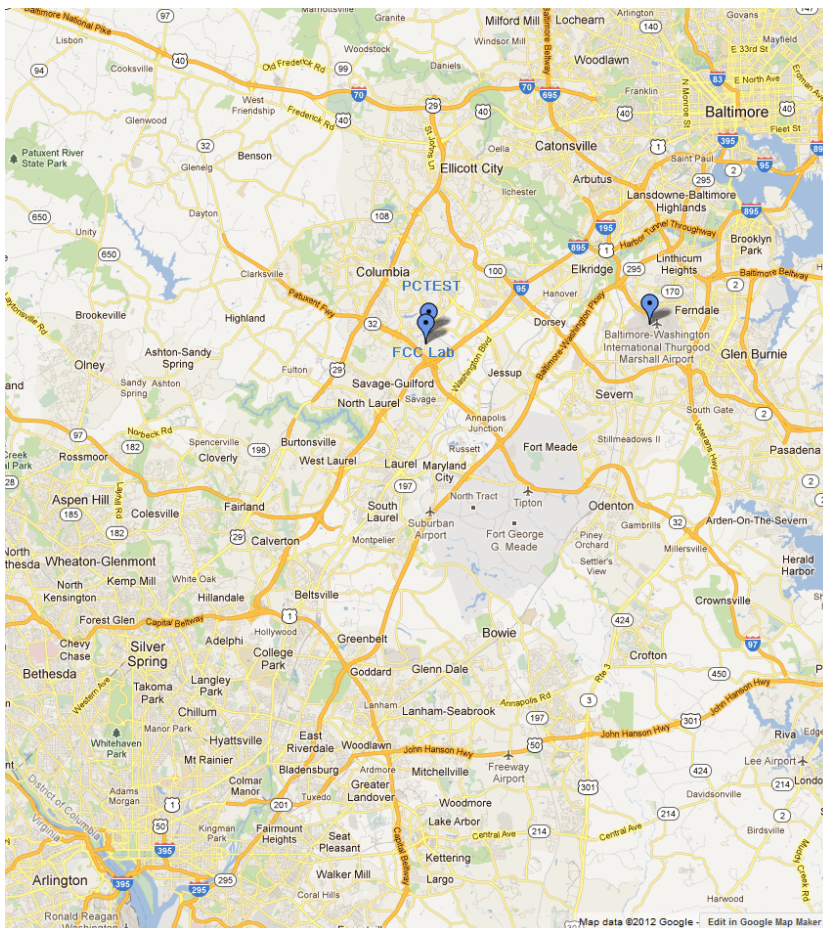


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
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## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **LG Portable Handset FCC ID: ZNFK428**. The test data contained in this report pertains only to the emissions due to the NFC transmitter of the EUT.

### 2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, Bluetooth (1x, EDR, LE), NFC

### 2.3 Test Configuration

The LG Portable Handset FCC ID: ZNFK428 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 and 3.3 of this test report for a description of the AC line conducted emissions and radiated emissions test setups, respectively.

### 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 for Testing Unlicensed Wireless Devices (ANSI C63.10-2013) was used in the measurement of the **LG Portable Handset FCC ID: ZNFK428**.

Deviation from measurement procedure.....None

### 3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by ETS Lindgren RF Enclosures. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an ETS Lindgren Model LPRX-4X30 (100dB Attenuation, 14kHz-18GHz) and the two EMI/RFI filters are ETS Lindgren Model LRW-2030-S1 (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

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 RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or resolution, clock or data exchange speed, scrolling H pattern to the EUT and/or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 8.6. The EMI Receiver mode of the Agilent MXE was used to perform AC line conducted emissions testing.

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
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### 3.3 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 in Clause 5 of ANSI C63.4-2014. For measurements above 1GHz 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 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 below 1GHz, a 72.4cm high PVC support structure is placed on top of the turntable. A 3" (~7.6cm) sheet of high density polystyrene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm. For measurements above 1GHz, a high density expanded polystyrene block 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(b)(1) 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, clock speed, mode of operation or video resolution, if applicable, 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.

### 3.4 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 LG Portable Handset are **permanently attached**.
- This unit was tested with its standard battery.

### Conclusion:

The **LG Portable Handset FCC ID: ZNFK428** 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 C63.4-2014. All measurement uncertainty values are shown with a coverage factor of  $k = 2$  to indicate a 95% level of confidence. The measurement data shown herein meets or exceeds the  $U_{\text{CISPR}}$  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) |
|------------------------------|----------------------------------|
| Line Conducted Disturbance   | 3.09                             |
| 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).

| Manufacturer    | Model    | Description                            | Cal Date   | Cal Interval | Cal Due    | Serial Number |
|-----------------|----------|----------------------------------------|------------|--------------|------------|---------------|
| -               | RE1      | Radiated Emissions Cable Set (UHF/EHF) | 4/28/2015  | Annual       | 4/28/2016  | RE1           |
| Agilent         | 8447D    | Broadband Amplifier                    | 6/12/2015  | Annual       | 6/12/2016  | 1937A03348    |
| Agilent         | N9020A   | MXA Signal Analyzer                    | 11/5/2015  | Annual       | 11/5/2016  | US46470561    |
| Agilent         | N9038A   | MXE EMI Receiver                       | 3/24/2015  | Annual       | 3/24/2016  | MY51210133    |
| Com-Power       | AL-130   | 9kHz - 30MHz Loop Antenna              | 7/30/2015  | Biennial     | 7/30/2017  | 121034        |
| Espec           | ESX-2CA  | Environmental Chamber                  | 3/17/2015  | Annual       | 3/17/2016  | 17620         |
| ETS-Lindgren    | 3816/2NM | Line Impedance Stabilization Network   | 11/11/2014 | Biennial     | 11/11/2016 | 114451        |
| Pasternack      | NMLC-1   | Line Conducted Emissions Cable (NM)    | 4/28/2015  | Annual       | 4/28/2016  | NMLC-1        |
| Rohde & Schwarz | ESU40    | EMI Test Receiver (40GHz)              | 7/17/2015  | Annual       | 7/17/2016  | 100348        |
| Sunol           | JB5      | Bi-Log Antenna (30M - 5GHz)            | 3/28/2014  | Biennial     | 3/28/2016  | A051107       |

**Table 6-1. Annual Test Equipment Calibration Schedule**

**Note:**

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
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## 7.0 SAMPLE CALCULATIONS

### 7.1 Conducted Emission Measurement Sample Calculation

@ 20.3 MHz

**Class B limit** = 60.0 dB $\mu$ V (Quasi-peak limit)  
**Reading** = - 57.8 dBm (calibrated quasi-peak level)  
**Convert to dB $\mu$ V** = - 57.8 + 107 = 49.2 dB $\mu$ V  
  
**Margin** = 49.2 - 60.0 = - 10.8 dB  
= 10.8 dB below limit

### 7.2 Radiated Emission Measurement Sample Calculation

@ 66.7 MHz

**Class B limit** = 100  $\mu$ V/m = 40.0 dB $\mu$ V/m  
**Reading** = - 76.0 dBm (calibrated level)  
**Convert to dB $\mu$ V** = - 76.0 + 107 = 31.0 dB $\mu$ V  
**Antenna Factor + Cable Loss** = 5.8 dB/m  
**Total** = 36.8 dB $\mu$ V/m  
  
**Margin** = 36.8 - 40.0 = - 3.2 dB  
= 3.2 dB below limit

#### Note:

$$\text{Level [dB}\mu\text{V]} = 20 \log_{10} (\text{Level } [\mu\text{V/m}])$$

$$\text{Level [dB}\mu\text{V]} = \text{Level [dBm]} + 107$$

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
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## 8.0 TEST DATA

### 8.1 Summary

Company Name: LG Electronics MobileComm U.S.A  
 FCC ID: ZNFK428  
 FCC Classification: Low Power Communications Device Transmitter (DXX)  
 Frequencies Examined: 13.56MHz

| FCC Part Section(s)          | Test Description                      | Test Limit                                                                                                                                                                              | Test Condition      | Test Result | Reference   |
|------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------|-------------|
| <b>TRANSMITTER MODE (Tx)</b> |                                       |                                                                                                                                                                                         |                     |             |             |
| 2.1049                       | 20 dB Bandwidth                       | N/A                                                                                                                                                                                     | RADIATED            | PASS        | Section 8.2 |
| 15.225 (a)(b)(c)             | In-Band Emissions                     | 15,848 $\mu$ V/m @ 30m<br>13.553 – 13.567 MHz<br>334 $\mu$ V/m @ 30m<br>13.410 – 13.553 MHz<br>13.567 – 13.710 MHz<br>106 $\mu$ V/m @ 30m<br>13.110 – 13.410 MHz<br>13.710 – 14.010 MHz |                     | PASS        | Section 8.4 |
| 15.225 (d)<br>15.209         | Out-of-Band Emissions                 | Emissions outside of the specified band (13.110 – 14.010 MHz) must meet the radiated limits detailed in 15.209                                                                          |                     | PASS        | Section 8.5 |
| 15.225 (e)                   | Frequency Stability Tolerance         | $\pm 0.01\%$ of Operating Frequency                                                                                                                                                     | Temperature Chamber | PASS        | Section 8.3 |
| 15.207                       | AC Conducted Emissions 150kHz – 30MHz | < FCC 15.207 limits                                                                                                                                                                     | LINE CONDUCTED      | PASS        | Section 8.6 |

**Table 8-1. Summary of Test Results**

**Note:**

This unit was tested with its standard battery.

|                                      |                                                                                     |                                                   |                                                                                       |                                 |
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## 8.2 20dB Bandwidth Measurement

\$2.1049

### Test Overview and Limit

The bandwidth at 20dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequency.

### Test Procedure Used

ANSI C63.10-2013 – Section 6.9.2

### Test Settings

1. Spectrum analyzer frequency is set to the nominal EUT channel center frequency.
2. RBW = 1 – 5% OBW
3. VBW  $\geq 3 \times$  RBW
4. Reference level set to keep signal from exceeding maximum input mixer level for linear operation.
5. Detector = Peak
6. Trace mode = max hold
7. Sweep = auto couple
8. The trace was allowed to stabilize
9. Using the marker-delta function, determine the “-20dB down amplitude” using [(highest in band spectral density) – 20dB].
10. Set a marker at the lowest frequency of the envelope of the spectral density, such that the marker is at or slightly below the “-20dB down amplitude” determined in Step 9.
11. Reset marker-delta function and move the marker to other side of the emission until the delta marker amplitude is the same level as reference level amplitude. The marker delta frequency reading at this point is the specified emission bandwidth.

### Test Notes

None.

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFK428                      |  | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                                                      | EUT Type:<br>Portable Handset                        | Page 13 of 31                                                                         |                                 |

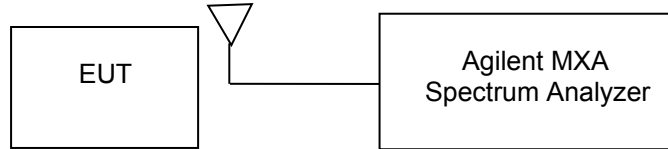


Figure 8-1. Test Instrument & Measurement Setup

| Frequency | 20dB Bandwidth |
|-----------|----------------|
| 13.56MHz  | 439kHz         |

Table 8-2. 20dB Bandwidth Measurement

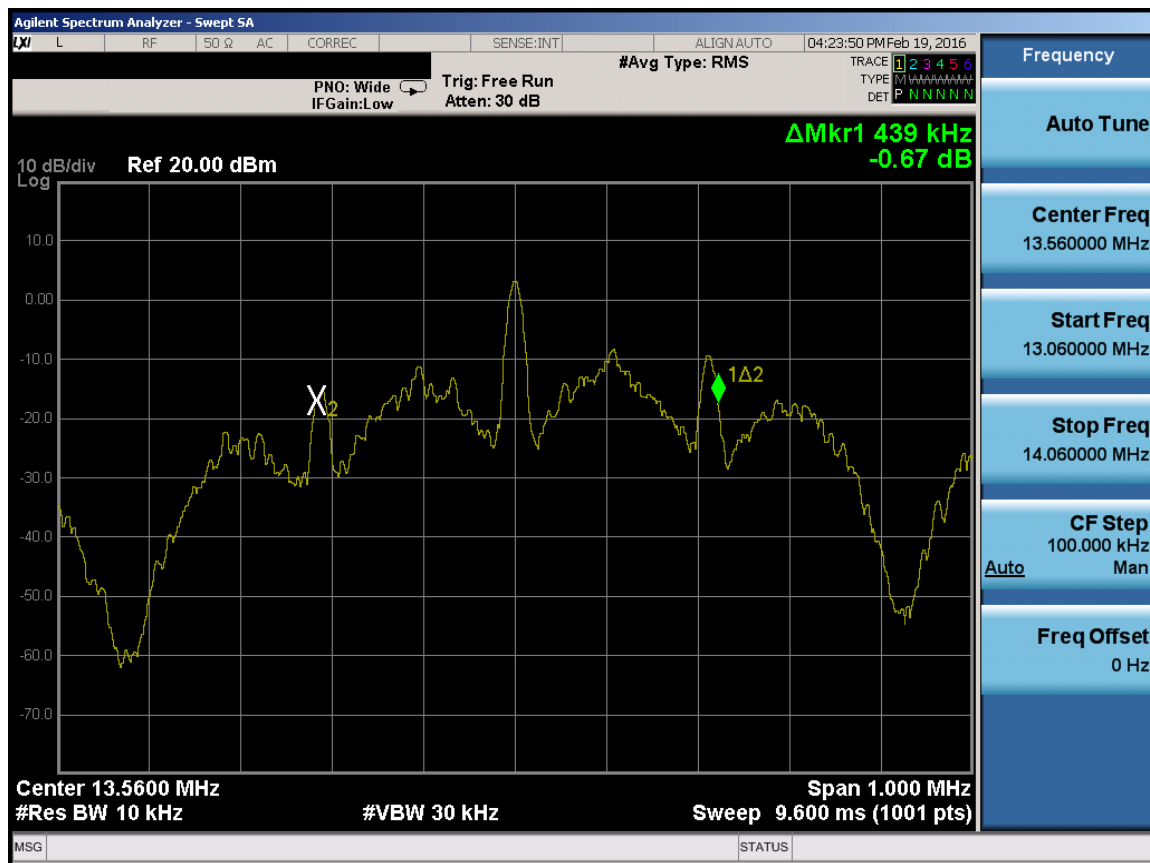


Figure 8-2. 20dB Bandwidth Plot

|                                      |                                               |                                                      |           |                                 |
|--------------------------------------|-----------------------------------------------|------------------------------------------------------|-----------|---------------------------------|
| FCC ID: ZNFK428                      | <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) | <b>LG</b> | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                | EUT Type:<br>Portable Handset                        |           | Page 14 of 31                   |



## 8.3 Frequency Stability Test Data

### §15.225

#### Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.10-2013. The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from -20°C to +50°C in 10°C increments using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

***For Part 15.225, the frequency stability of the transmitter shall be maintained within  $\pm 0.01\%$  of the center frequency.***

#### Test Procedure Used

ANSI C63.10-2013 – Section 6.8

#### Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -20°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

#### Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

#### Test Notes

None.

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFK428                      |  | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                                                      | EUT Type:<br>Portable Handset                        |                                                                                       | Page 15 of 31                   |

## Frequency Stability Test Data

§15.225

OPERATING FREQUENCY: 13,560,000 Hz

REFERENCE VOLTAGE: 3.80 VDC

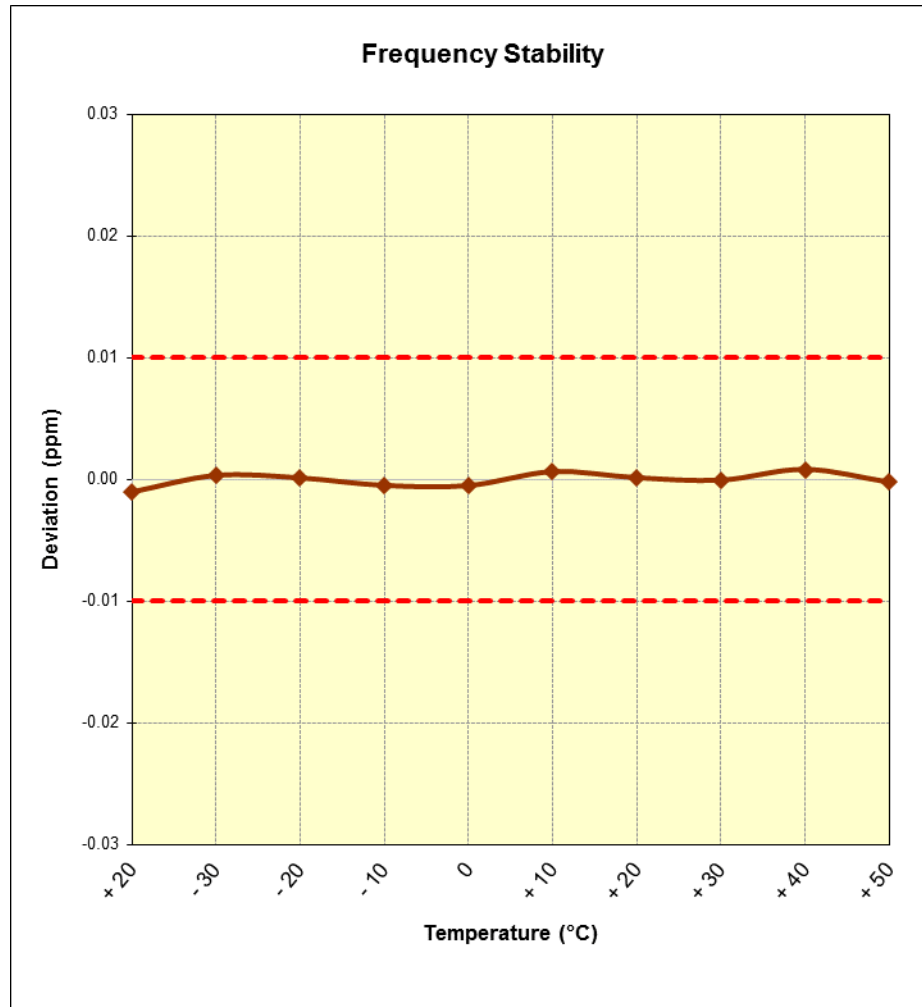
DEVIATION LIMIT:  $\pm 0.01 \% = 1356\text{Hz}$

| VOLTAGE (%)    | POWER (VDC) | TEMP (°C)  | FREQUENCY (Hz) | Freq. Dev. (Hz) | Deviation (%) |
|----------------|-------------|------------|----------------|-----------------|---------------|
| 100 %          | 3.80        | + 20 (Ref) | 13,559,867     | -133            | -0.0009808    |
| 100 %          |             | - 30       | 13,560,045     | 45              | 0.0003319     |
| 100 %          |             | - 20       | 13,560,019     | 19              | 0.0001401     |
| 100 %          |             | - 10       | 13,559,938     | -62             | -0.0004572    |
| 100 %          |             | 0          | 13,559,936     | -64             | -0.0004720    |
| 100 %          |             | + 10       | 13,560,086     | 86              | 0.0006342     |
| 100 %          |             | + 20       | 13,560,021     | 21              | 0.0001549     |
| 100 %          |             | + 30       | 13,559,995     | -5              | -0.0000369    |
| 100 %          |             | + 40       | 13,560,111     | 111             | 0.0008186     |
| 100 %          |             | + 50       | 13,559,973     | -27             | -0.0001991    |
| BATT. ENDPOINT | 3.40        | + 20       | 13,559,994     | -6              | -0.0000442    |

**Table 8-3. Frequency Stability Test Data**

## Frequency Stability Test Data

§15.225



**Figure 8-3. Frequency Stability Plot**

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFK428                      |  | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                                                      | EUT Type:<br>Portable Handset                        |                                                                                       | Page 17 of 31                   |

## 8.4 In-Band Radiated Spurious Emission Measurements

§15.225(a)(b)(c)

### 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 8-4.***

| Frequency<br>[MHz]                         | Field Strength<br>[ $\mu$ V/m] | Measured Distance<br>[Meters] |
|--------------------------------------------|--------------------------------|-------------------------------|
| 13.553-13.567 MHz                          | 15,848                         | 30                            |
| 13.410-13.553 MHz and<br>13.567-13.710 MHz | 334                            | 30                            |
| 13.110-13.410 MHz                          | 106                            | 30                            |

**Table 8-4. Radiated Limits**

### Test Procedures Used

ANSI C63.10-2013 – Section 6.4.7

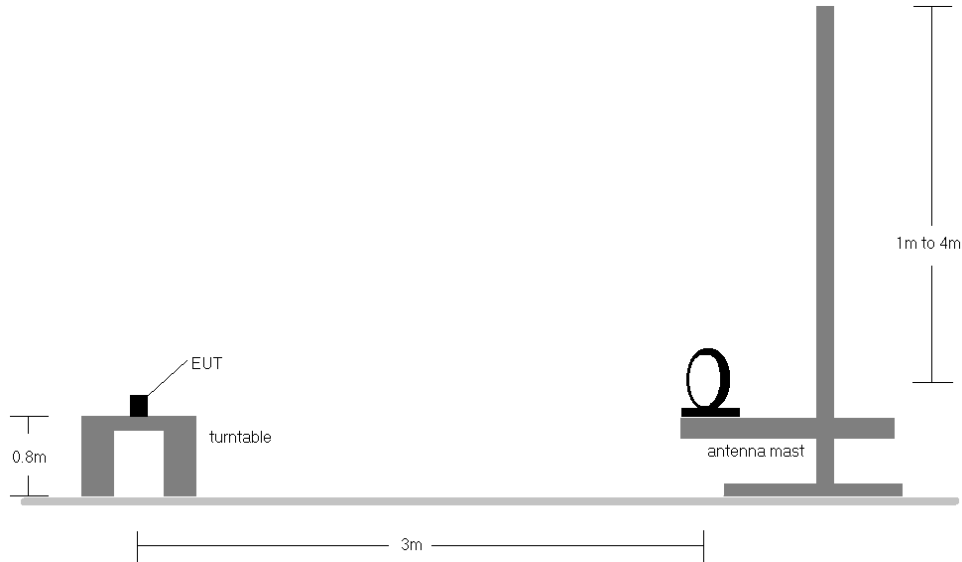
### Test Settings

1. RBW = 9kHz
2. VBW  $\geq$  3 x RBW
3. Detector = peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFK428                      |  | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                                                      | EUT Type:<br>Portable Handset                        |                                                                                       | Page 18 of 31                   |

### Test Setup

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



**Figure 8-4. Radiated Test Setup**

### Test Notes:

1. All emissions lying in restricted bands specified in §15.225 are below the limit shown in Table 8-4.
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

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

|                                      |                                               |                                                      |    |                                 |
|--------------------------------------|-----------------------------------------------|------------------------------------------------------|----|---------------------------------|
| FCC ID: ZNFK428                      | <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) | LG | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                | EUT Type:<br>Portable Handset                        |    | Page 19 of 31                   |

## In-Band Radiated Spurious Emission Measurements

### §15.225(a)(b)(c)

Frequency: 13.56MHz

Measurement Distance: 3 Meters

| Frequency [MHz] | Antenna Position | 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] |
|-----------------|------------------|---------------------|----------------------------|-------------|-------------|----------------------------|-----------------------------|--------------|----------------|-------------|
| 13.132          | X                | -                   | -                          | -94.17      | 14.95       | 27.78                      | -12.22                      | 106.00       | 40.51          | -52.73      |
| 13.211          | X                | -                   | -                          | -94.21      | 14.94       | 27.73                      | -12.27                      | 106.00       | 40.51          | -52.77      |
| 13.411          | X                | -                   | -                          | -93.84      | 14.94       | 28.10                      | -11.90                      | 334.00       | 50.47          | -62.38      |
| 13.560          | X                | 100                 | 183                        | -70.61      | 14.93       | 51.32                      | 11.32                       | 15848.00     | 84.00          | -72.68      |
| 13.732          | X                | -                   | -                          | -93.85      | 14.93       | 28.08                      | -11.92                      | 106.00       | 40.51          | -52.43      |
| 13.801          | X                | -                   | -                          | -94.13      | 14.92       | 27.79                      | -12.21                      | 106.00       | 40.51          | -52.71      |
| 13.870          | X                | -                   | -                          | -94.03      | 14.92       | 27.89                      | -12.11                      | 106.00       | 40.51          | -52.61      |

**Table 8-5. In-Band Radiated Measurements**

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFK428                      |  | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                                                      | EUT Type:<br>Portable Handset                        |                                                                                       | Page 20 of 31                   |

## 8.5 Radiated Spurious Emission Measurements, Out-of-Band §15.209 §15.225(d)

### 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 8-6 per Section 15.209.*

| Frequency         | Field Strength<br>[μV/m] | Measured Distance<br>[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 8-6. Radiated Limits – Out of band**

### Test Procedures Used

ANSI C63.10-2013 – Section 6.5.4

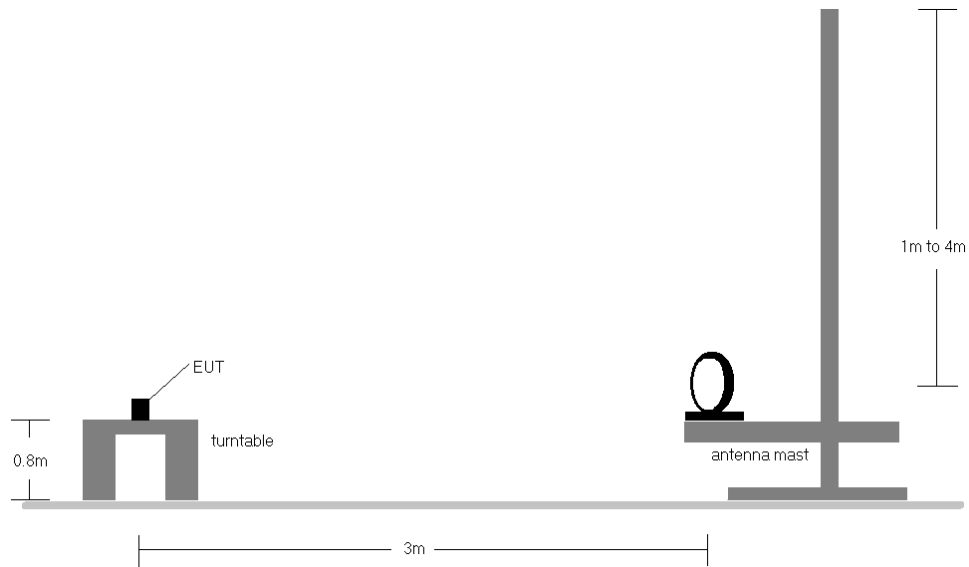
### Test Settings

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

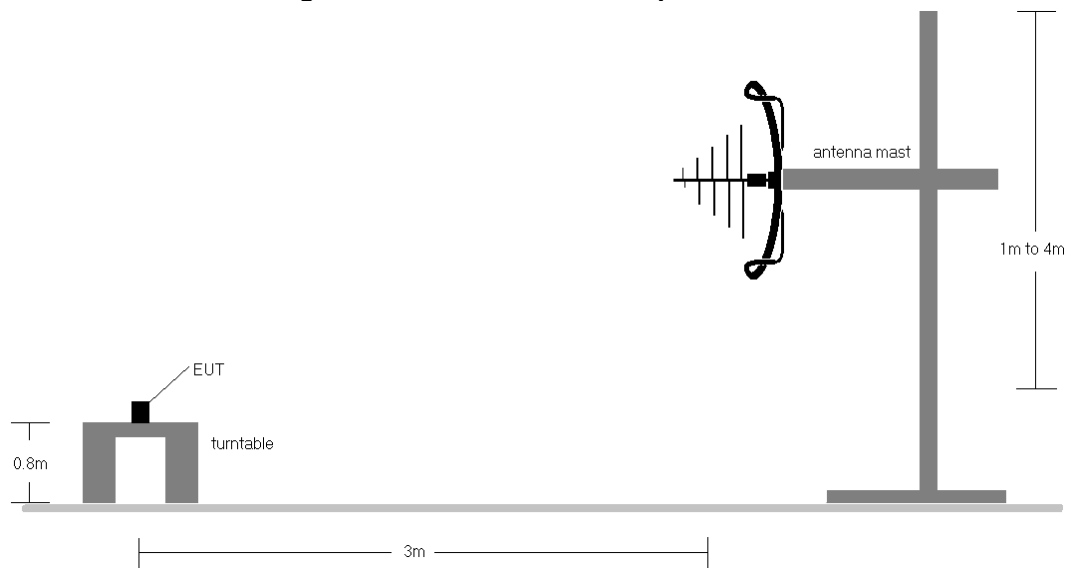
|                                      |                                                                                     |                                                      |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFK428                      |  | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                                                      | EUT Type:<br>Portable Handset                        |                                                                                       | Page 21 of 31                   |

### Test Setup

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



**Figure 8-5. Radiated Test Setup < 30MHz**



**Figure 8-6. Radiated Test Setup > 30MHz**

|                                      |                                               |                                                      |           |                                 |
|--------------------------------------|-----------------------------------------------|------------------------------------------------------|-----------|---------------------------------|
| FCC ID: ZNFK428                      | <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) | <b>LG</b> | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                | EUT Type:<br>Portable Handset                        |           | Page 22 of 31                   |



### **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 10<sup>th</sup> 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**

- o Field Strength Level [dBμV/m] = Analyzer Level [dBm] + 107 + AFCL [dB/m]
- o AFCL [dB/m] = Antenna Factor [dB/m] + Cable Loss [dB]
- o Margin [dB] = Field Strength Level [dBμV/m] – Limit [dBμV/m]

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFK428                      |  | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                                                      | EUT Type:<br>Portable Handset                        |                                                                                       | Page 23 of 31                   |

## Radiated Spurious Emission Measurements, Out-of-Band §15.209 §15.225(d)

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               | -                   | -                          | -93.90      | 13.41       | 26.51                      | 69.54          | -43.04      |
| 33.28           | V               | -                   | -                          | -106.43     | 13.44       | 14.00                      | 40.00          | -26.00      |
| 61.89           | V               | -                   | -                          | -106.34     | 8.40        | 9.06                       | 40.00          | -30.94      |
| 68.86           | V               | -                   | -                          | -107.06     | 8.66        | 8.60                       | 40.00          | -31.40      |
| 104.61          | V               | -                   | -                          | -106.42     | 8.43        | 9.01                       | 43.52          | -34.52      |
| 148.00          | V               | -                   | -                          | -105.51     | 10.05       | 11.55                      | 43.52          | -31.98      |
| 199.00          | V               | -                   | -                          | -106.56     | 13.00       | 13.44                      | 43.52          | -30.09      |
| 787.00          | V               | 100                 | 14                         | -106.02     | 23.46       | 24.44                      | 46.02          | -21.58      |

Table 8-7. Radiated Measurements

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFK428                      |  | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                                                      | EUT Type:<br>Portable Handset                        |                                                                                       | Page 24 of 31                   |

## 8.6 Line Conducted Measurement Data

### §15.207

#### Test Overview and Limit

All AC line conducted spurious emissions are measured with a receiver connected to a grounded LISN 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 conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

*All conducted emissions must not exceed the limits shown in the table below, per 15.207.*

| Frequency of emission (MHz) | Conducted Limit (dBμV) |           |
|-----------------------------|------------------------|-----------|
|                             | Quasi-peak             | Average   |
| 0.15 – 0.5                  | 66 to 56*              | 56 to 46* |
| 0.5 – 5                     | 56                     | 46        |
| 5 – 30                      | 60                     | 50        |

**Table 8-8. Conducted Limits**

\*Decreases with the logarithm of the frequency.

#### Test Procedures Used

ANSI C63.10-2013, Section 6.2

#### Test Settings

##### Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

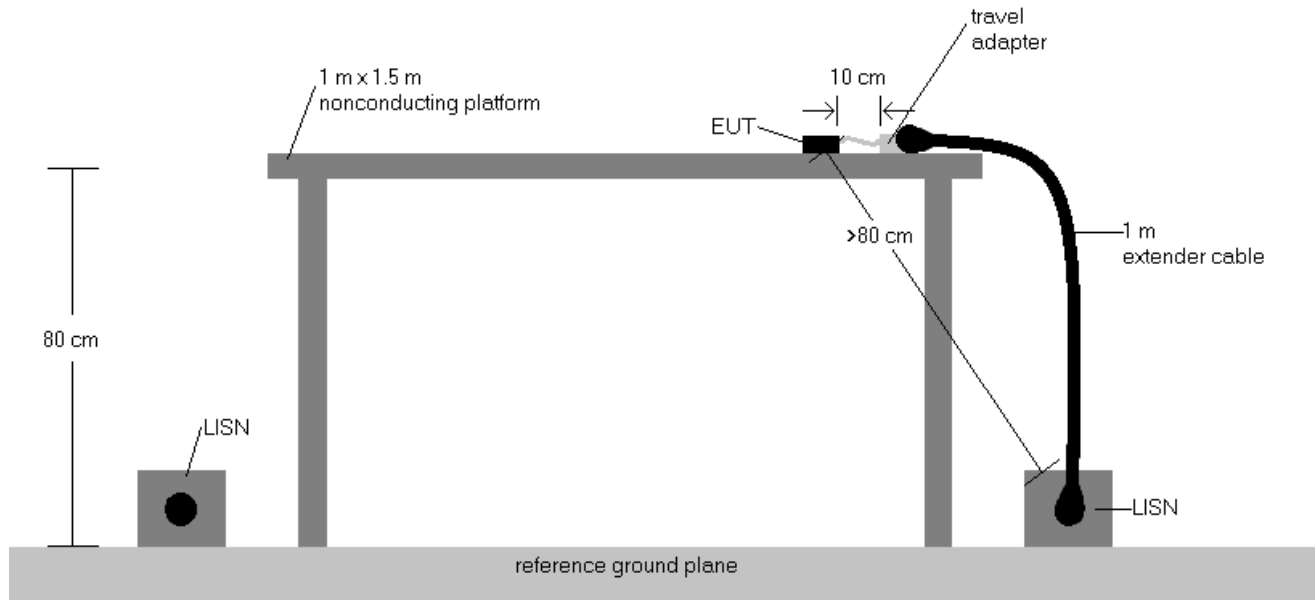
##### Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = RMS
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

|                                      |                                                                                     |                                                      |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFK428                      |  | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                                                      | EUT Type:<br>Portable Handset                        |                                                                                       | Page 25 of 31                   |

## Test Setup

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



**Figure 8-7. Test Instrument & Measurement Setup**

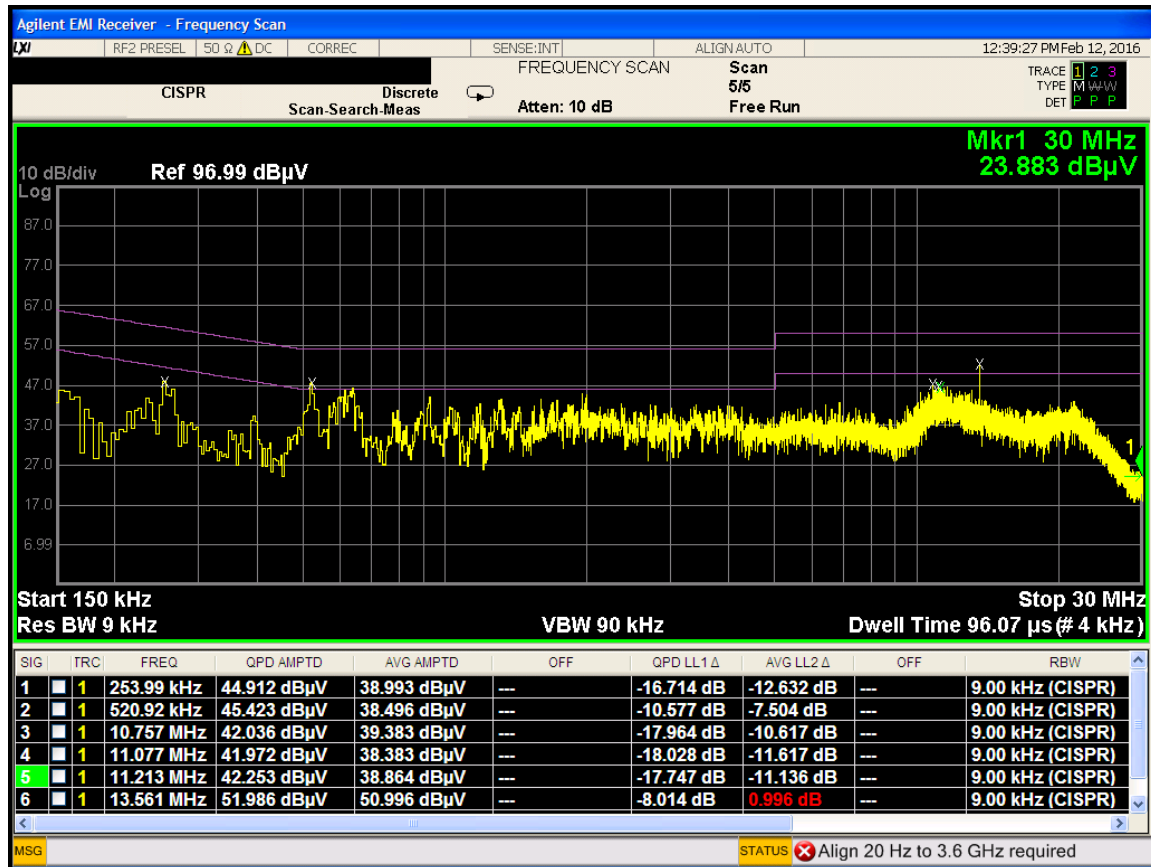
## Test Notes

1. All modes of operation were investigated and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
2. The limit for an intentional radiator from 150kHz to 30MHz are specified in RSS-Gen (8.8).
3.  $\text{Corr. (dB)} = \text{Cable loss (dB)} + \text{LISN insertion factor (dB)}$
4.  $\text{QP/AV Level (dB}\mu\text{V)} = \text{QP/AV Analyzer/Receiver Level (dB}\mu\text{V)} + \text{Corr. (dB)}$
5.  $\text{Margin (dB)} = \text{QP/AV Limit (dB}\mu\text{V)} - \text{QP/AV Level (dB}\mu\text{V)}$
6. Traces shown in plot are made using a peak detector.
7. Deviations to the Specifications: None.

|                                      |                                               |                                                      |           |                                 |
|--------------------------------------|-----------------------------------------------|------------------------------------------------------|-----------|---------------------------------|
| FCC ID: ZNFK428                      | <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) | <b>LG</b> | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                | EUT Type:<br>Portable Handset                        |           | Page 26 of 31                   |

## Line-Conducted Test Data

\$15.207

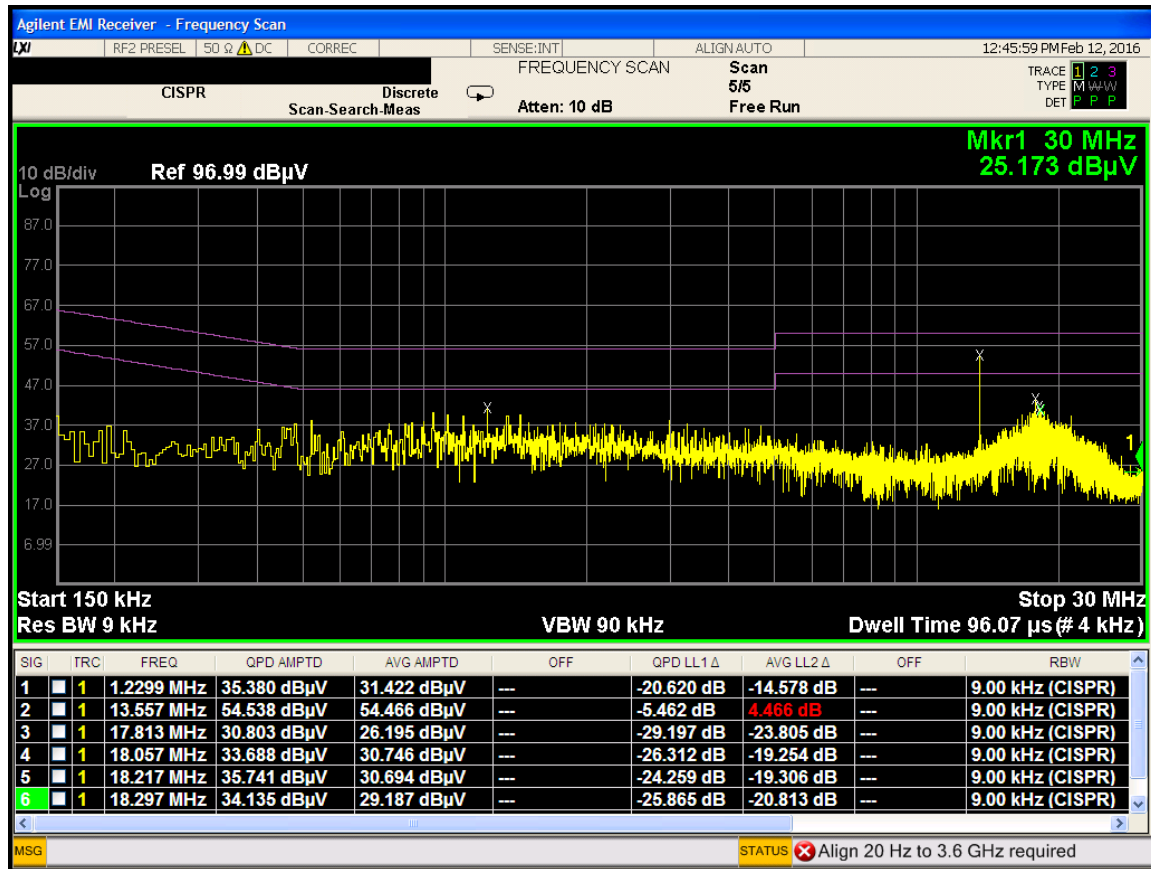


Plot 8-1. Line-Conducted Test Plot (L1)

|                                      |                                               |                                                      |  |                                 |
|--------------------------------------|-----------------------------------------------|------------------------------------------------------|--|---------------------------------|
| FCC ID: ZNFK428                      | <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                | EUT Type:<br>Portable Handset                        |  | Page 27 of 31                   |

## Line Conducted Measurement Data

\$15.207

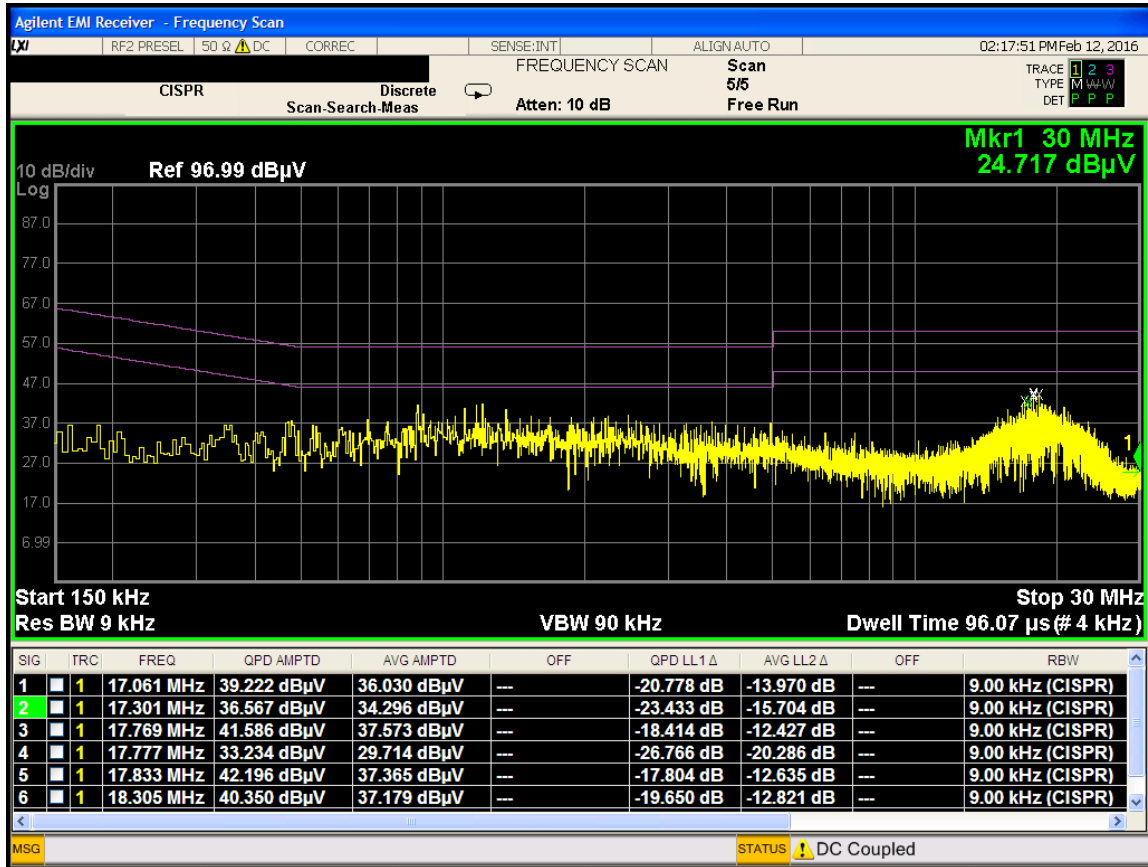


Plot 8-2. Line-Conducted Test Plot (N)

|                                      |                                               |                                                      |           |                                 |
|--------------------------------------|-----------------------------------------------|------------------------------------------------------|-----------|---------------------------------|
| FCC ID: ZNFK428                      | <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) | <b>LG</b> | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                | EUT Type:<br>Portable Handset                        |           | Page 28 of 31                   |

## Line-Conducted Test Data (RFID Antenna Removed)

\$15.207

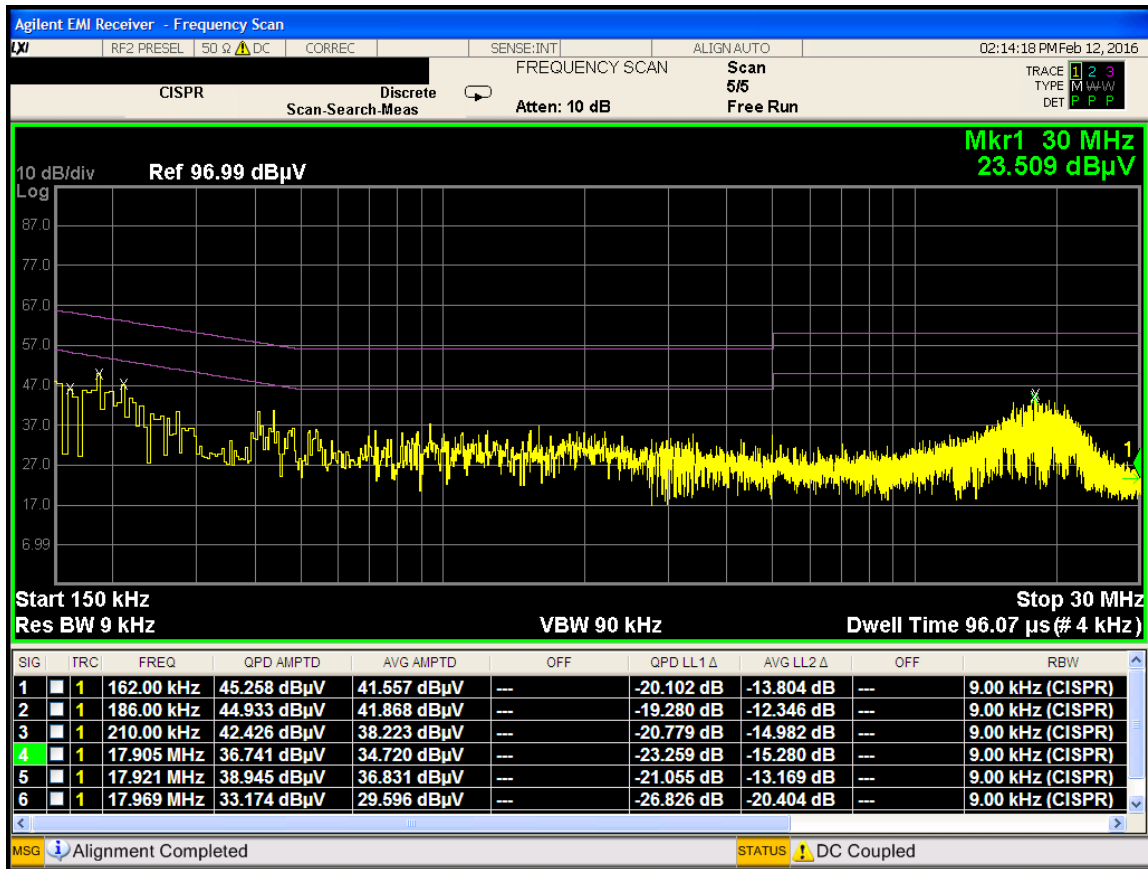


Plot 8-3. Line-Conducted Test Plot (L1)

|                                      |                                                                                                                                   |                               |                                                      |                                                                                       |                                 |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| FCC ID: ZNFK428                      |  <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. |                               | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                                                                                                    | EUT Type:<br>Portable Handset |                                                      |                                                                                       | Page 29 of 31                   |

## Line Conducted Measurement Data (RFID Antenna Removed)

**\$15.207**



**Plot 8-4. Line-Conducted Test Plot (N)**

|                                      |                                               |                                                      |  |                                 |
|--------------------------------------|-----------------------------------------------|------------------------------------------------------|--|---------------------------------|
| FCC ID: ZNFK428                      | <b>PCTEST</b><br>ENGINEERING LABORATORY, INC. | FCC Pt. 15.225 MEASUREMENT REPORT<br>(CERTIFICATION) |  | Reviewed by:<br>Quality Manager |
| Test Report S/N:<br>0Y1602020288.ZNF | Test Date(s):<br>2/3-3/15/2016                | EUT Type:<br>Portable Handset                        |  | Page 30 of 31                   |



## 9.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFK428** has been tested to show compliance with the requirements specified in §15.225 of the FCC Rules.

|                                             |                                                                                     |                                                              |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>FCC ID:</b> ZNFK428                      |  | <b>FCC Pt. 15.225 MEASUREMENT REPORT<br/>(CERTIFICATION)</b> |  | <b>Reviewed by:</b><br>Quality Manager |
| <b>Test Report S/N:</b><br>0Y1602020288.ZNF | <b>Test Date(s):</b><br>2/3-3/15/2016                                               | <b>EUT Type:</b><br>Portable Handset                         |                                                                                       | Page 31 of 31                          |