

**MEASUREMENT REPORT**
FCC Part 90**Applicant Name:**LG Electronics USA, Inc.
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States**Date of Testing:**

3/28 - 4/18/2019

Test Site/Location:

PCTEST Lab. Columbia, MD

Test Report Serial No.:

1M1903280046-04-R1.ZNF

FCC ID:**ZNFQ720CS****APPLICANT:****LG Electronics USA, Inc.****Application Type:**

Certification

Model:

LM-Q720CS

Additional Model(s):

LMQ720CS, Q720CS

EUT Type:

Portable Handset

FCC Classification:

PCS Licensed Transmitter Held to Ear (PCE)

FCC Rule Part:

§2.1049, §90(R)

Test Procedure(s):

ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01

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 §2.947. Test results reported herein relate only to the item(s) tested.

This revised Test Report (S/N: 1M1903280046-04-R1.ZNF) supersedes and replaces the previously issued test report (S/N: 1M1903280046-04.ZNF) on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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.

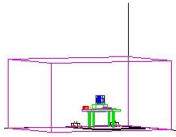

Randy Ortanez
President

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 1 of 35	

TABLE OF CONTENTS

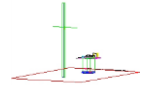
1.0	INTRODUCTION	4
1.1	Scope	4
1.2	PCTEST Test Location.....	4
1.3	Test Facility / Accreditations.....	4
2.0	PRODUCT INFORMATION.....	5
2.1	Equipment Description	5
2.2	Device Capabilities.....	5
2.3	Test Configuration	5
2.4	EMI Suppression Device(s)/Modifications	5
3.0	DESCRIPTION OF TESTS	6
3.1	Evaluation Procedure	6
3.2	Radiated Power and Radiated Spurious Emissions	6
4.0	MEASUREMENT UNCERTAINTY	7
5.0	TEST EQUIPMENT CALIBRATION DATA	8
6.0	SAMPLE CALCULATIONS	9
7.0	TEST RESULTS.....	10
7.1	Summary.....	10
7.2	Occupied Bandwidth	11
7.3	Spurious and Harmonic Emissions at Antenna Terminal	14
7.4	Band Edge Emissions at Antenna Terminal	20
7.5	Radiated Power (ERP)	25
7.6	Radiated Spurious Emissions Measurements	28
7.7	Frequency Stability / Temperature Variation	32
8.0	CONCLUSION.....	35

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 2 of 35	



MEASUREMENT REPORT

FCC Part 90



Mode	Tx Frequency (MHz)	Measurement	Max. Power (W)	Max. Power (dBm)	Emission Designator	Modulation
LTE Band 14	790.5 - 795.5	ERP	0.088	19.43	4M52G7D	QPSK
LTE Band 14	790.5 - 795.5	ERP	0.082	19.14	4M52W7D	16-QAM
LTE Band 14	793	ERP	0.093	19.70	8M98G7D	QPSK
LTE Band 14	793	ERP	0.083	19.19	8M98W7D	16-QAM

EUT Overview

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 3 of 35	

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.

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 4 of 35

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **LG Portable Handset FCC ID: ZNFQ720CS**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 90(R).

Test Device Serial No.: 00314, 00316

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, 802.11a/n/ac UNII, Bluetooth (1x, EDR, LE)

2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

2.4 EMI Suppression Device(s)/Modifications

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

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 5 of 35	

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the document titled “Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards” (ANSI/TIA-603-E-2016) and “Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems” (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

3.2 Radiated Power and Radiated Spurious Emissions

§2.1053, §90(R)

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. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a wooden turntable 80cm above the ground plane and 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Radiated power levels are also investigated with the receive antenna horizontally and vertically polarized. The maximized power level is recorded using the spectrum analyzer “Channel Power” function with the integration band set to the emissions’ occupied bandwidth, a RMS detector, RBW = 100kHz, VBW = 300kHz, and a 1 second sweep time over a minimum of 10 sweeps, per the guidelines of KDB 971168 D01 v03r01.

Per the guidance of ANSI/TIA-603-E-2016, a half-wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_d \text{ [dBm]} = P_g \text{ [dBm]} - \text{cable loss [dB]} + \text{antenna gain [dBd/dBi]}$$

Where, P_d is the dipole equivalent power, P_g is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to $P_g \text{ [dBm]} - \text{cable loss [dB]}$.

For fundamental radiated power measurements, the guidance of KDB 971168 D01 v03r01 is used to record the EUT power level that is subsequently matched via the aforementioned substitution method given in ANSI/TIA-603-E-2016.

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.

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 6 of 35	

4.0 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 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)
Conducted Bench Top Measurements	1.13
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 7 of 35

5.0 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
-	LTx3	Licensed Transmitter Cable Set	8/23/2018	Annual	8/23/2019	LTx3
Agilent	N9030A	PXA Signal Analyzer (44GHz)	5/25/2018	Annual	5/25/2019	MY52350166
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2017	Biennial	10/10/2019	121034
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
EMCO	3160-09	Small Horn (18 - 26.5GHz)	8/9/2018	Biennial	8/9/2020	135427
Espec	ESX-2CA	Environmental Chamber	4/28/2018	Annual	4/28/2019	17620
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	3/28/2018	Biennial	3/28/2020	128337
Mini Circuits	TVA-11-422	RF Power Amp	N/A			QA1317001
Mini Circuits	PWR-SEN-4GHS	USB Power Sensor	4/30/2018	Annual	4/30/2019	11401010036
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11208010032
Rohde & Schwarz	TC-TA18	Vivaldi Antenna	8/17/2018	Biennial	8/17/2020	101072
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	9/19/2018	Annual	9/19/2019	100040
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	5/21/2018	Annual	5/21/2019	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	8/9/2018	Annual	8/9/2019	100348
Rohde & Schwarz	CMW500	Radio Communication Tester	11/14/2018	Annual	11/14/2019	100976
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	6/18/2018	Annual	6/18/2019	102134
Sunol	DRH-118	Horn Antenna (1-18GHz)	8/11/2017	Biennial	8/11/2019	A050307
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	4/19/2018	Biennial	4/19/2020	A051107

Table 5-1. Test Equipment

Notes:

1. 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.
2. Equipment with a calibration date of "N/A" shown in this list was not used to make direct calibrated measurements.

FCC ID: ZNFQ720CS	 MEASUREMENT REPORT (CERTIFICATION) 		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 8 of 35

6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 8M62G7D

LTE BW = 8.62 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

QAM Modulation

Emission Designator = 8M45W7D

LTE BW = 8.45 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

Spurious Radiated Emission – LTE Band

Example: Middle Channel LTE Mode 2nd Harmonic (1564 MHz)

The average spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 1564 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.501 dBm so this harmonic was 25.501 dBm – (–24.80).

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 9 of 35

7.0 TEST RESULTS

7.1 Summary

Company Name: LG Electronics USA, Inc.
 FCC ID: ZNFQ720CS
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)
 Mode(s): LTE
 Band: Band 14

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1051 90(R)	Conducted Band Edge / Spurious Emissions	On all frequencies between 769-775 MHz and 799-805 MHz, attenuation by a factor not less than $65 + 10 \log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations. On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, attenuation by at least $43 + 10 \log(P)$ dB.		PASS	Sections 7.3, 7.4
2.1055 90.213	Frequency Stability	< 2.5 ppm		PASS	Section 7.7
90.542(a)(7)	Effective Radiated Power (Band 14)	< 3 Watts max. ERP	RADIATED	PASS	Section 7.5
2.1053 90(R)	Radiated Spurious Emissions	> $43 + 10 \log_{10}(P[\text{Watts}])$ for all out-of-band emissions except > $50 + 10 \log_{10}(P[\text{Watts}])$ at Band Edge and for all out-of-band emissions within 37.5kHz of Block Edge		PASS	Section 7.6

Table 7-1. Summary of Test Results

Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in Section 7.0 were taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
- 3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
- 4) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST "2G/3G Automation," Version 3.9.

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1-ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 10 of 35	

7.2 Occupied Bandwidth

§2.1049

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.2

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW $\geq 3 \times$ RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

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

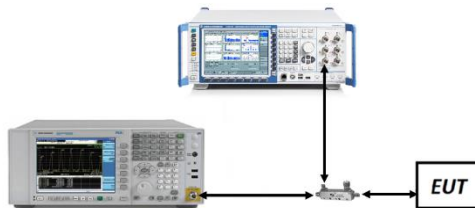


Figure 7-1. Test Instrument & Measurement Setup

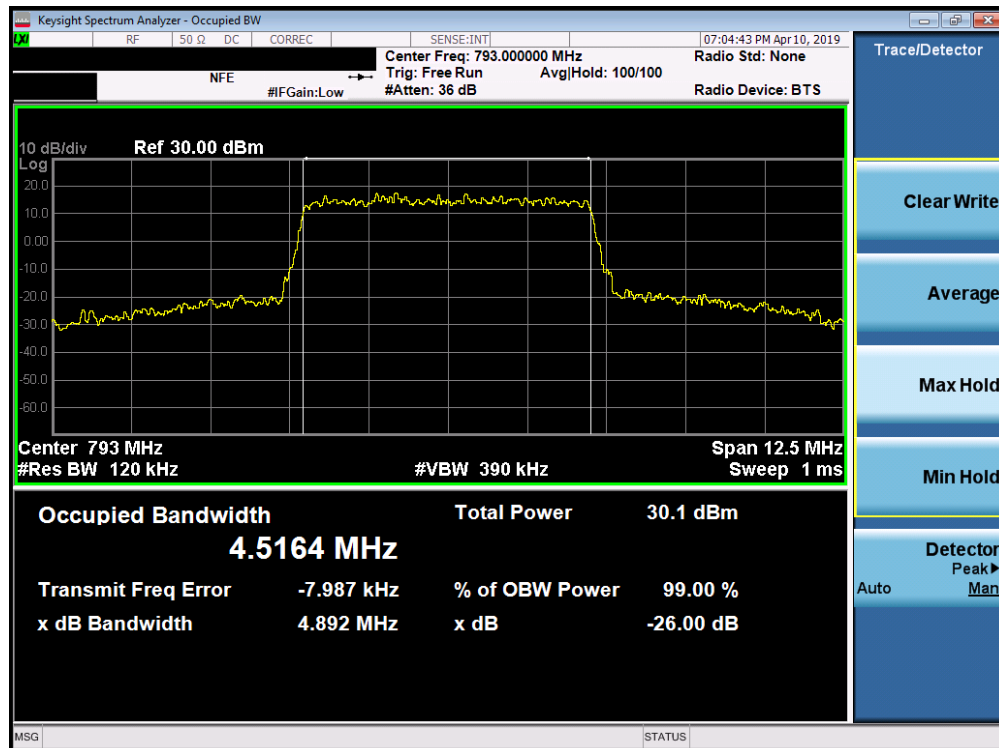
Test Notes

None.

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 11 of 35



Plot 7-1. Occupied Bandwidth Plot (LTE Band 14, 5MHz QPSK – RB Size 25)

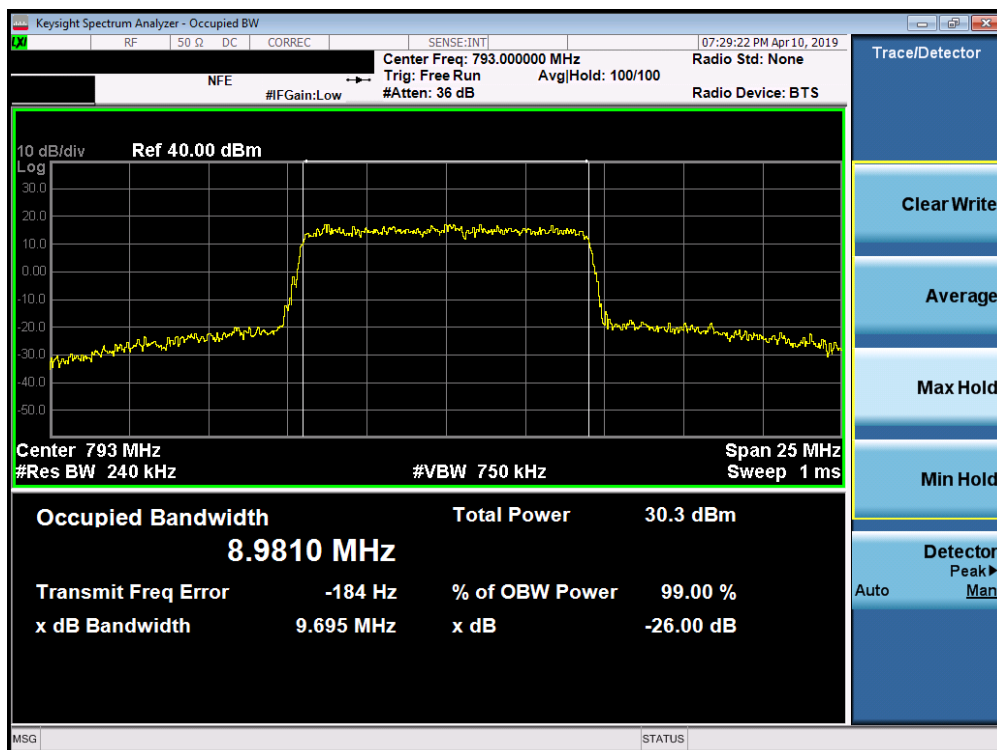


Plot 7-2. Occupied Bandwidth Plot (LTE Band 14, 5MHz 16-QAM – RB Size 25)

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 12 of 35



Plot 7-3. Occupied Bandwidth Plot (LTE Band 14, 10MHz QPSK – RB Size 50)



Plot 7-4. Occupied Bandwidth Plot (LTE Band 14, 10MHz 16-QAM – RB Size 50)

FCC ID: ZNFQ720CS	MEASUREMENT REPORT (CERTIFICATION)			Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1-ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 13 of 35

7.3 Spurious and Harmonic Emissions at Antenna Terminal

§2.1051 §90(R)

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is $43 + 10 \log_{10}(P_{\text{Watts}})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz (separated into at least two plots per channel)
2. RBW $\geq$ 1MHz
3. VBW $\geq$ 3 x RBW
4. Detector = RMS
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

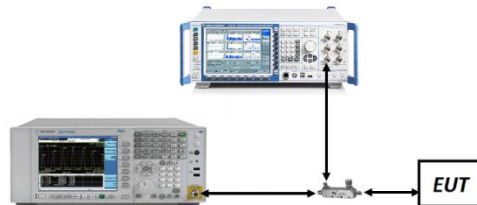
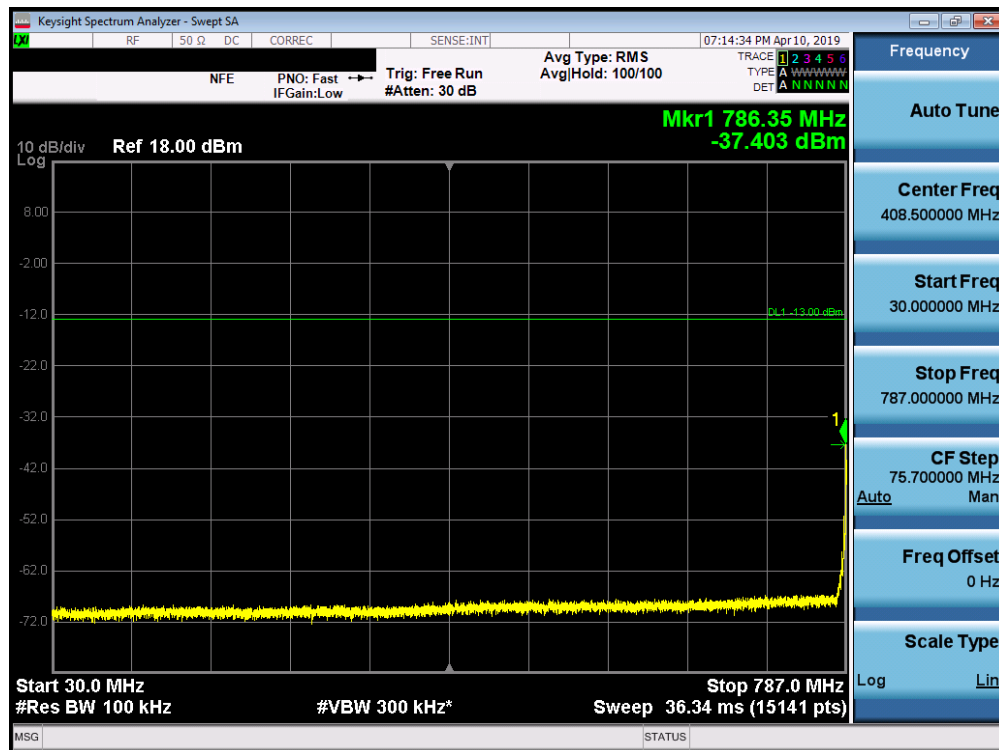


Figure 7-2. Test Instrument & Measurement Setup

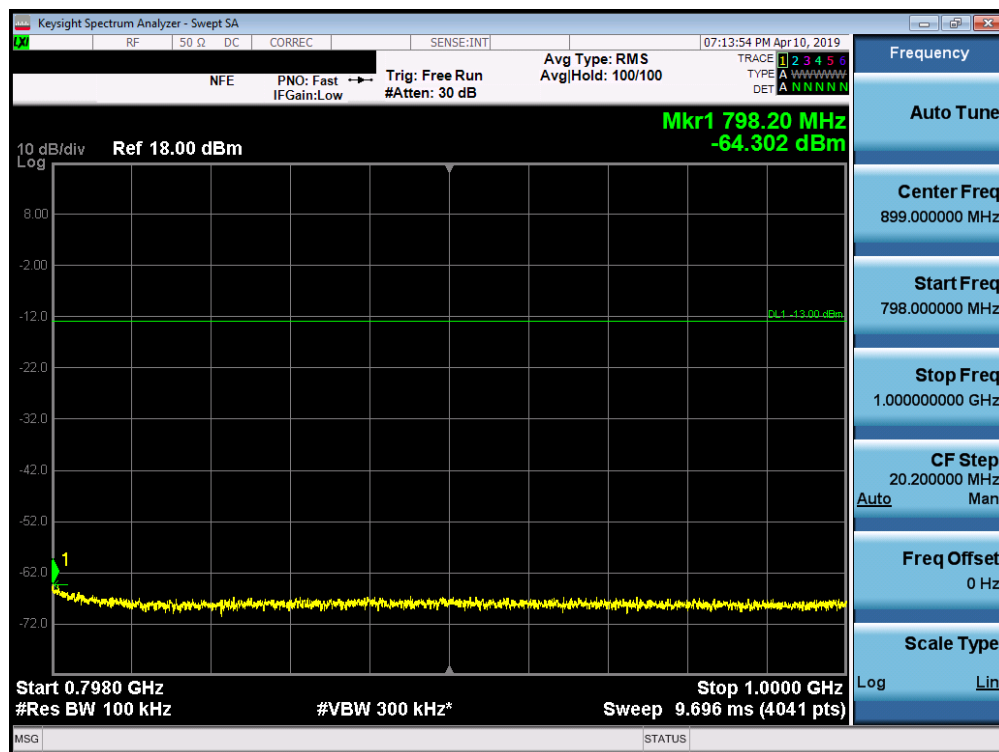
Test Notes

None.

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 14 of 35

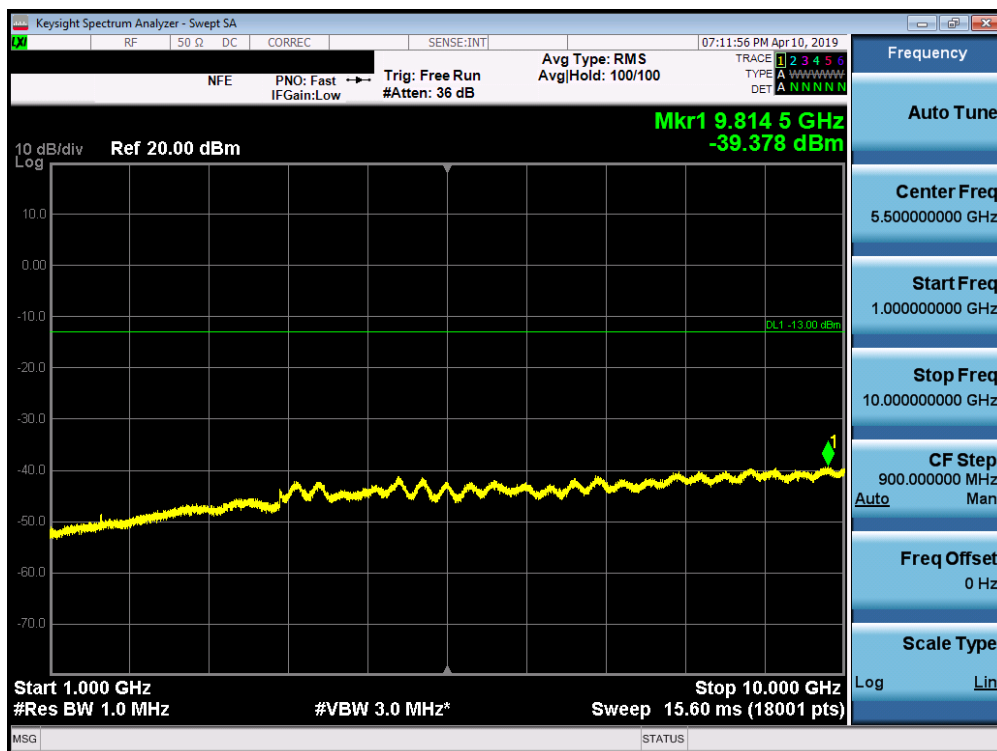


Plot 7-5. Conducted Spurious Plot (LTE Band 14, 5MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

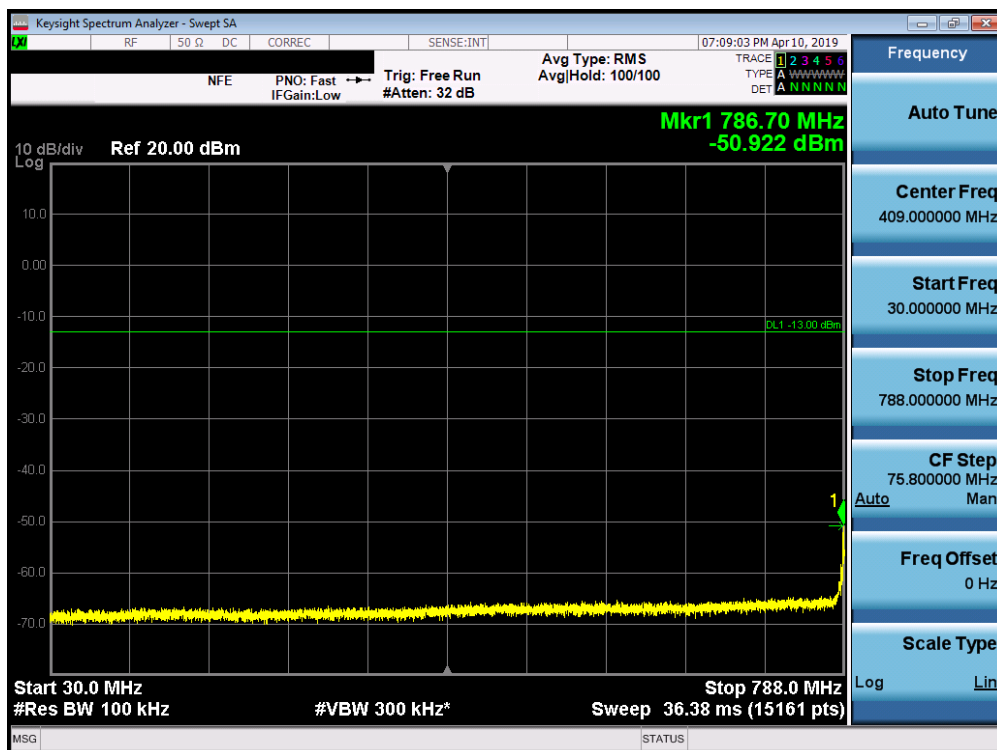


Plot 7-6. Conducted Spurious Plot (LTE Band 14, 5MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1-ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 15 of 35

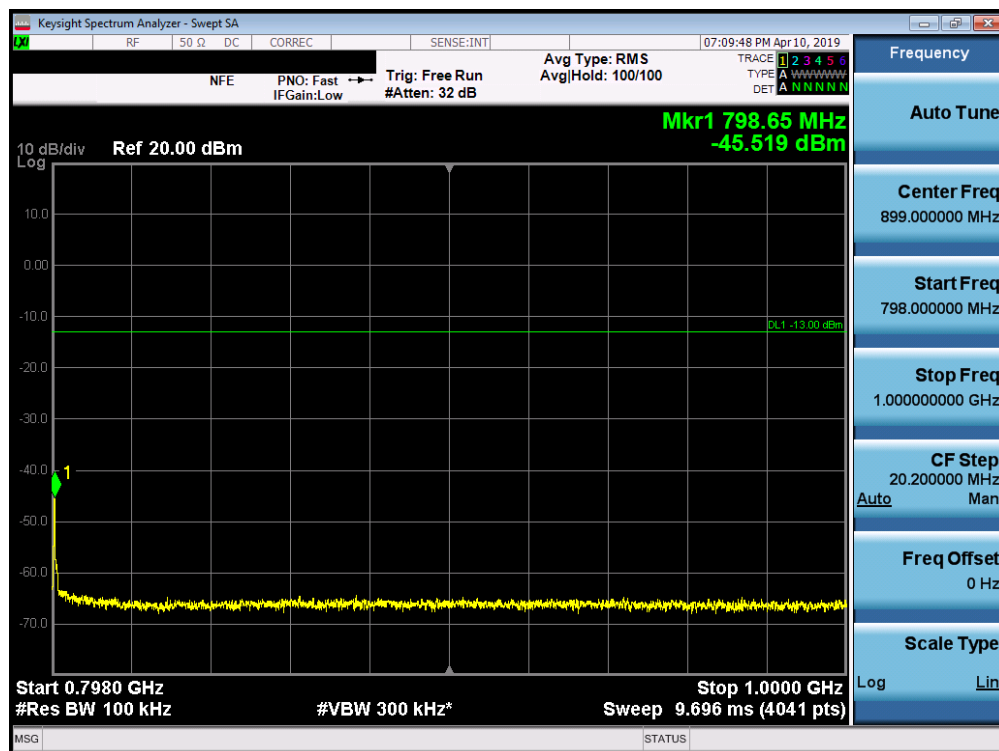


Plot 7-7. Conducted Spurious Plot (LTE Band 14, 5MHz QPSK – RB Size 1, RB Offset 0 – Low Channel)

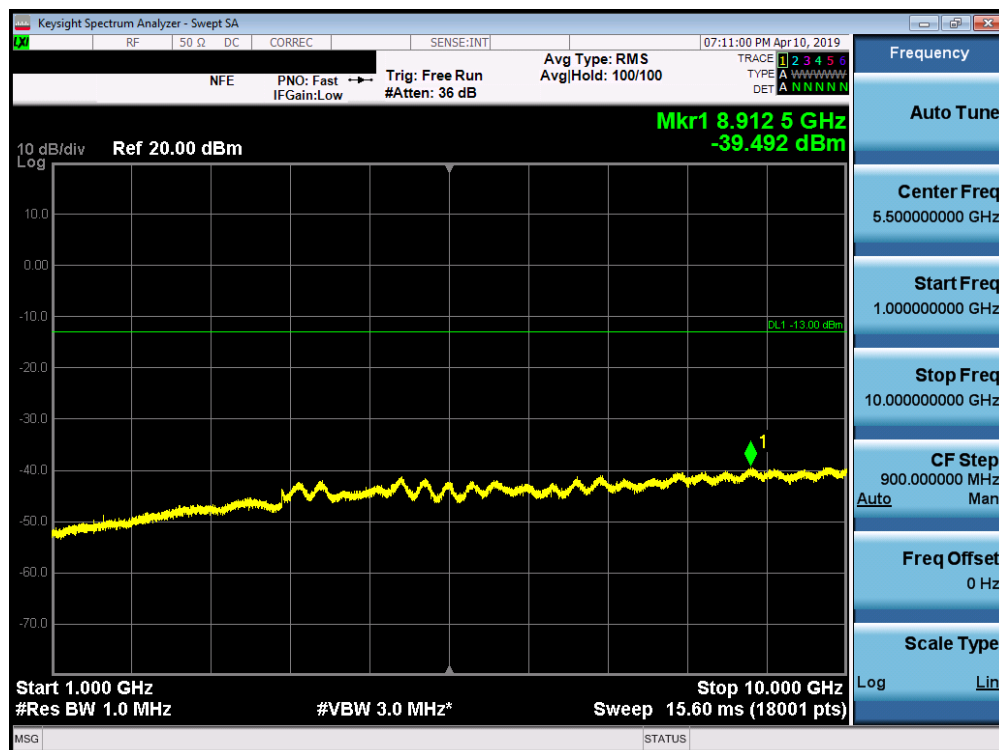


Plot 7-8. Conducted Spurious Plot (LTE Band 14, 5MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1-ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 16 of 35

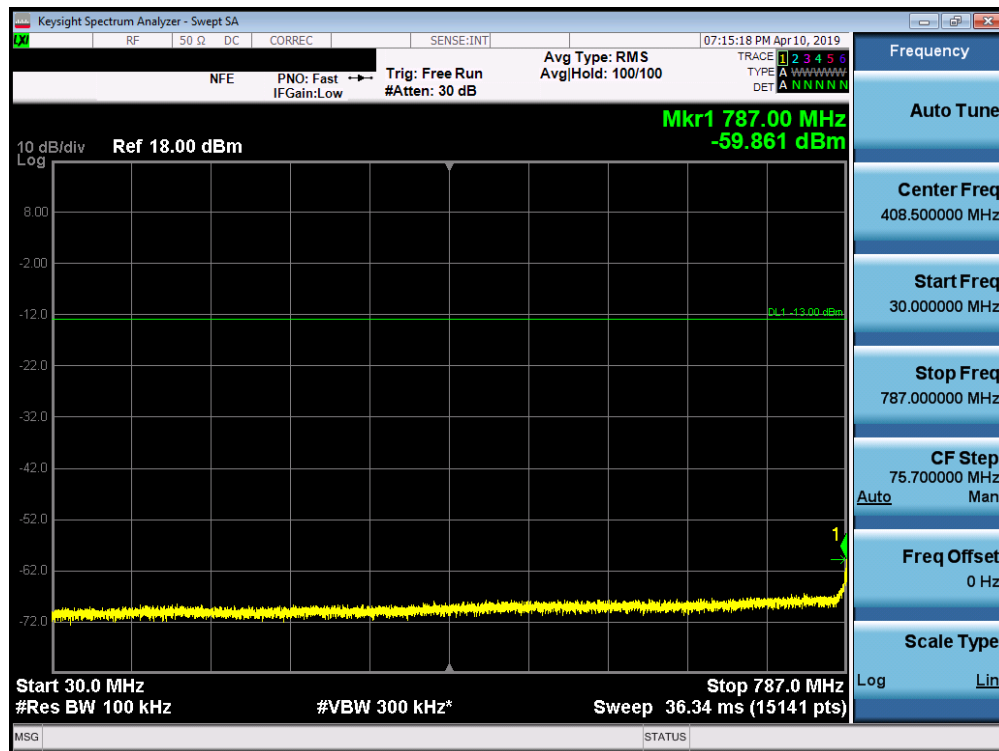


Plot 7-9. Conducted Spurious Plot (LTE Band 14, 5MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

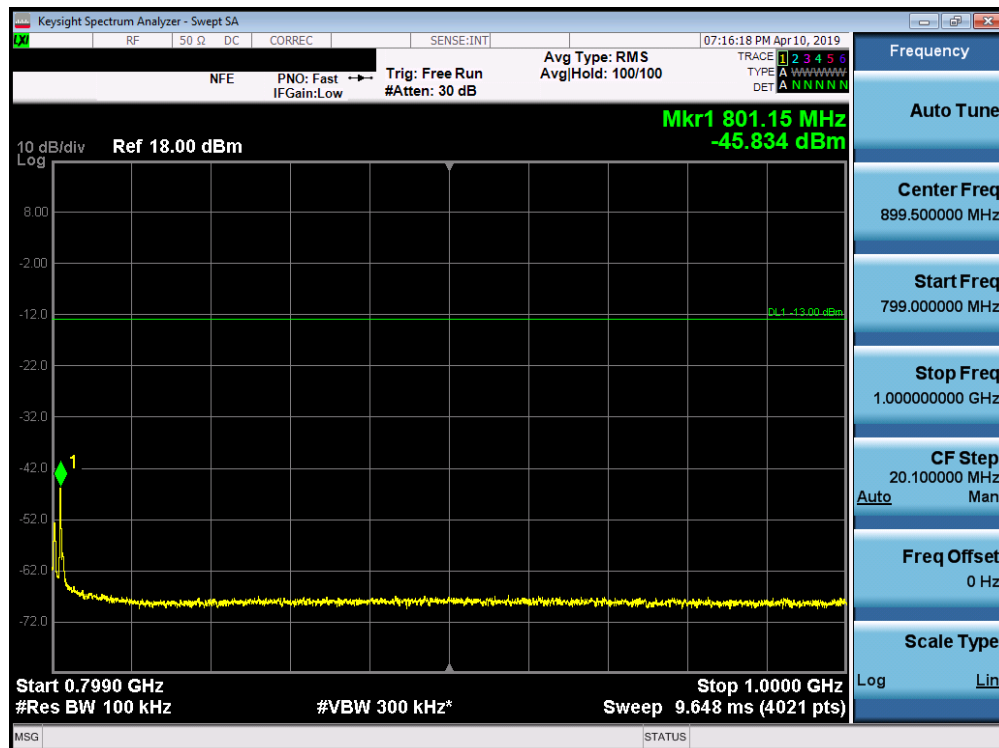


Plot 7-10. Conducted Spurious Plot (LTE Band 14, 5MHz QPSK – RB Size 1, RB Offset 0 – Mid Channel)

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1-ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 17 of 35



Plot 7-11. Conducted Spurious Plot (LTE Band 14, 5MHz QPSK – RB Size 1, RB Offset 0 – High Channel)



Plot 7-12. Conducted Spurious Plot (LTE Band 14, 5MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1-ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 18 of 35



Plot 7-13. Conducted Spurious Plot (LTE Band 14, 5MHz QPSK – RB Size 1, RB Offset 0 – High Channel)

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 19 of 35

7.4 Band Edge Emissions at Antenna Terminal

§2.1051 §90(R)

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by greater than 37.5 kHz is $43 + 10 \log_{10}(P_{\text{Watts}})$, where P is the transmitter power in Watts.

The minimum permissible attenuation level of any spurious emission removed from the EA licensee's frequency block by up to and including 37.5 kHz is $50 + 10 \log_{10}(P_{\text{Watts}})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Span was set large enough so as to capture all out of band emissions near the band edge
2. RBW = 100 kHz
3. VBW = 300 kHz
4. Detector = RMS
5. Trace mode = trace average
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

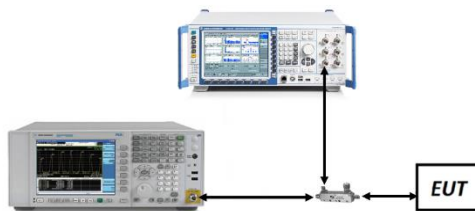
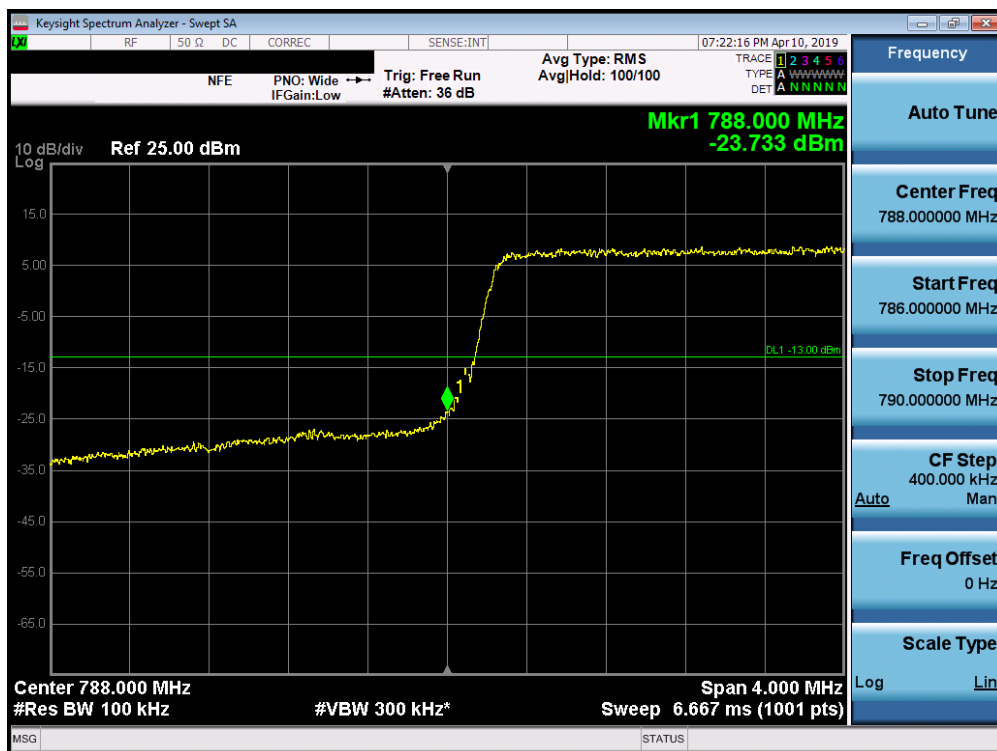


Figure 7-3. Test Instrument & Measurement Setup

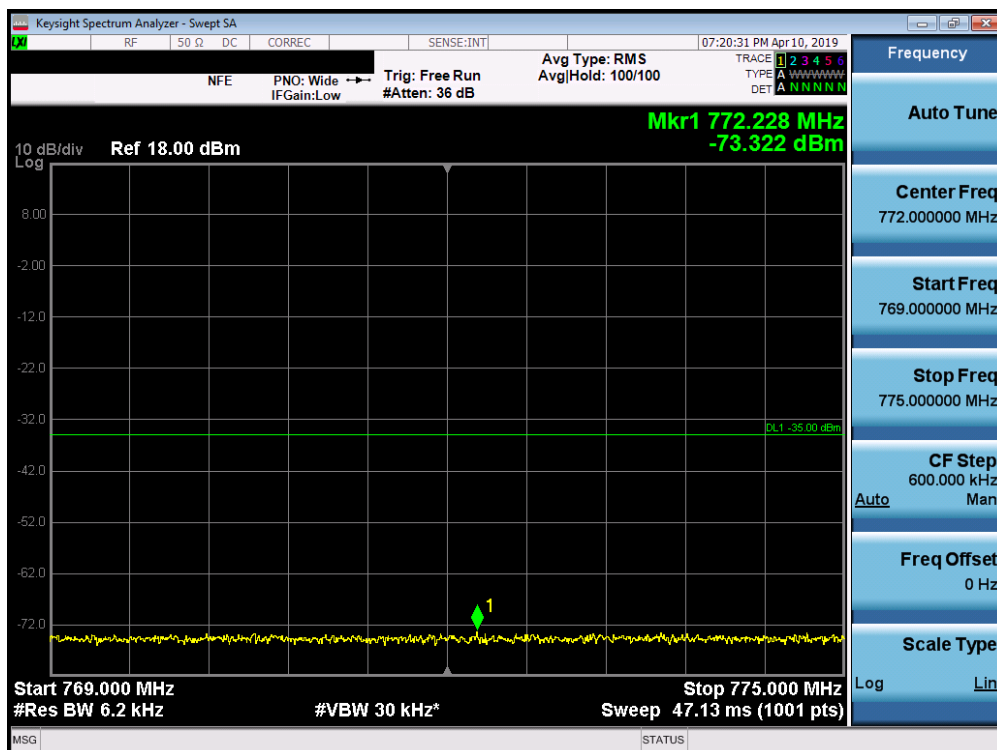
Test Notes

For channel edge emission, the signal analyzer's "ACP" measurement capability is used.

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 20 of 35

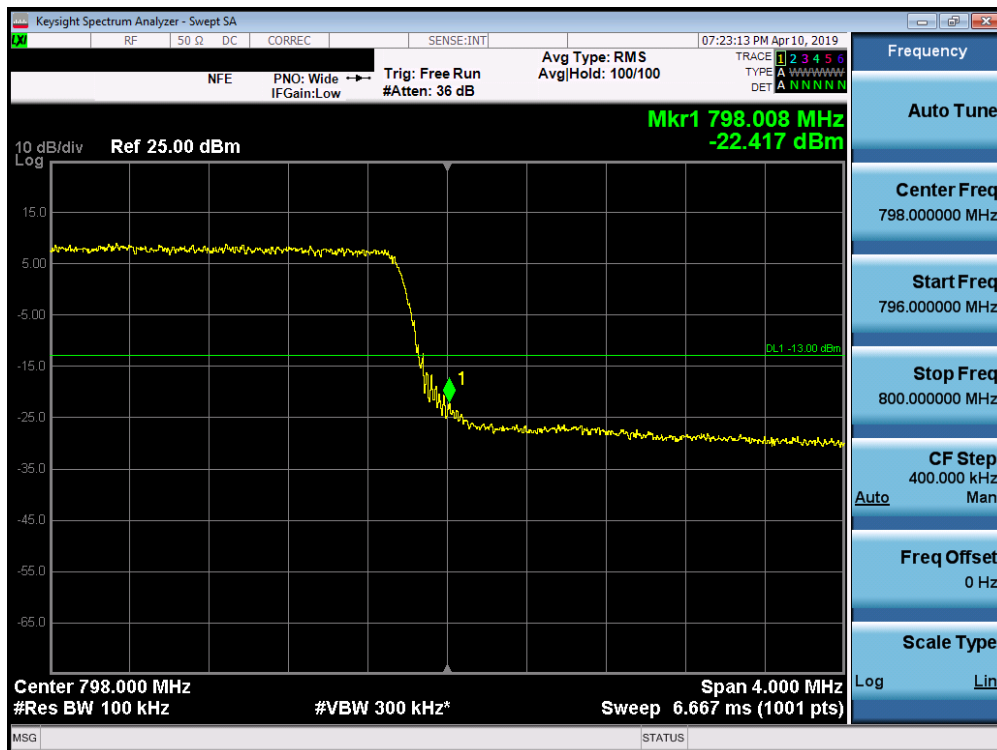


Plot 7-14. Lower Band Edge Plot (LTE Band 14, 5MHz QPSK – RB Size 25)



Plot 7-15. Lower Emission Mask Plot (LTE Band 14, 5MHz QPSK – RB Size 25)

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1-ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 21 of 35

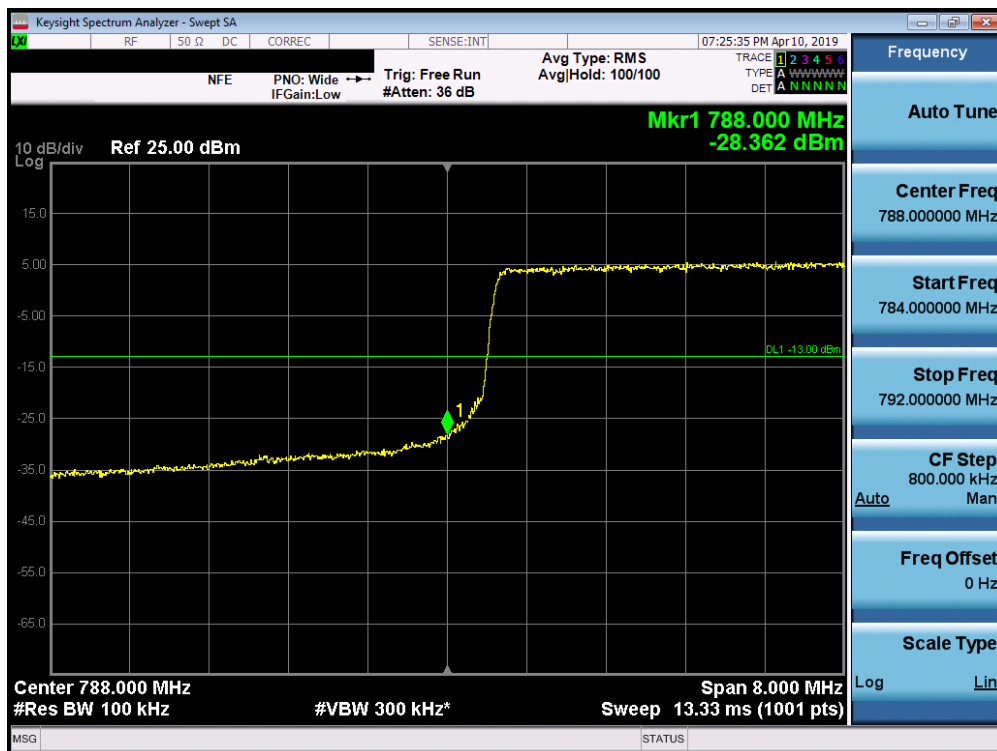


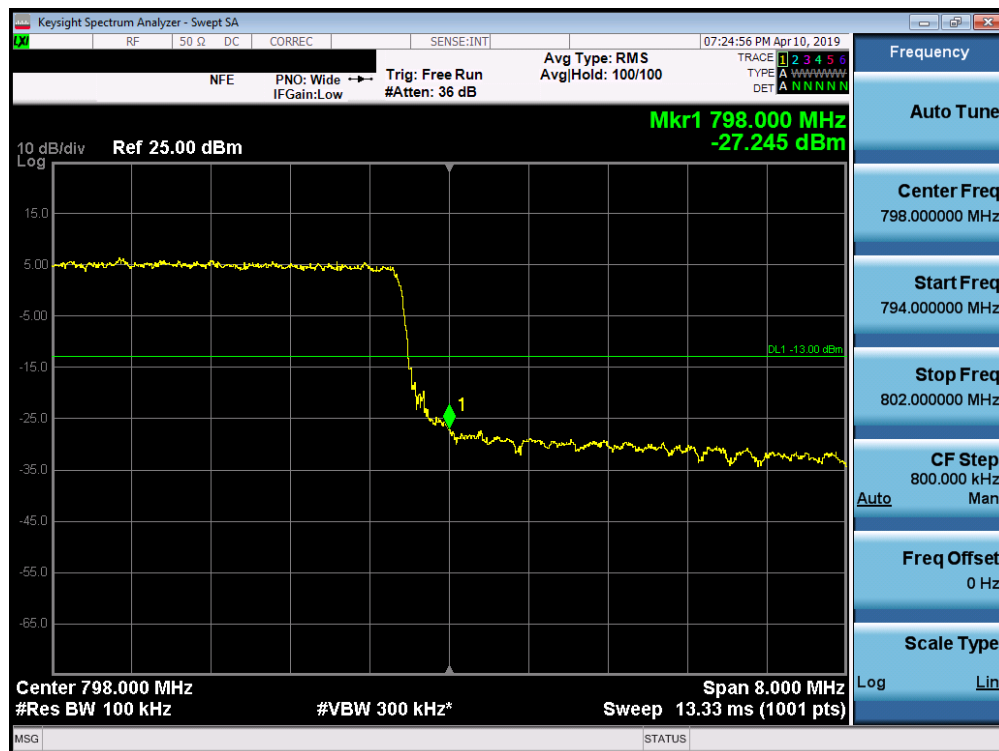
Plot 7-16. Upper Band Edge Plot (LTE Band 14, 5MHz QPSK – RB Size 25)



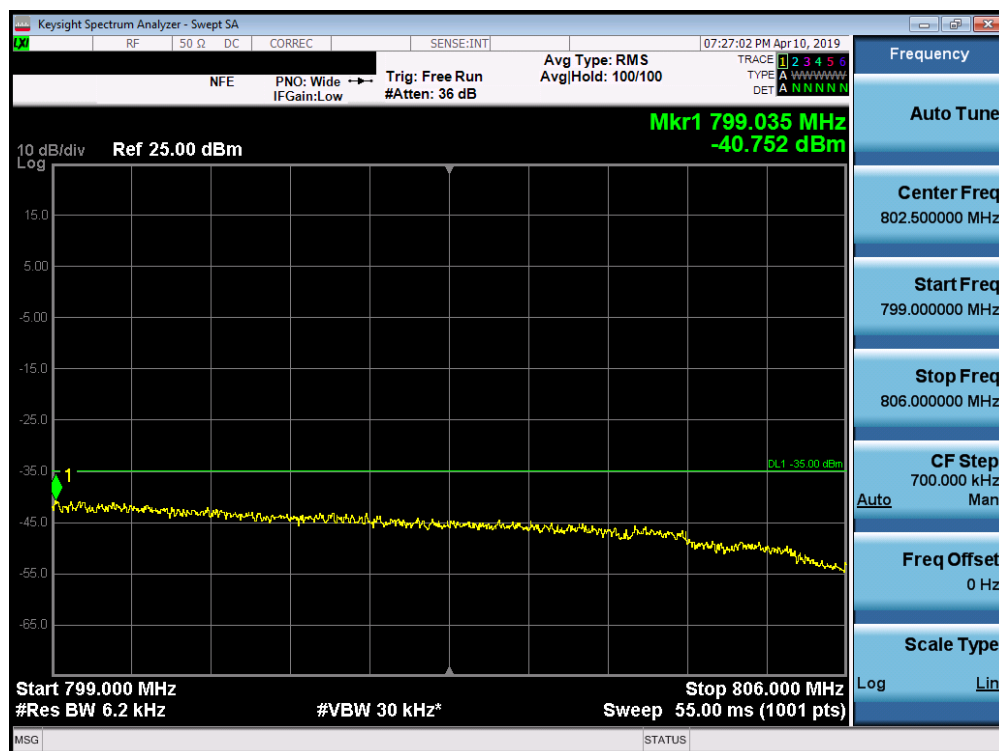
Plot 7-17. Upper Emission Mask Plot (LTE Band 14, 5MHz QPSK – RB Size 25)

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 22 of 35





Plot 7-20. Upper Band Edge Plot (LTE Band 14, 10MHz QPSK - RB Size 50)



Plot 7-21. Upper Emission Mask Plot (LTE Band 14, 10MHz QPSK - RB Size 50)

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1-ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 24 of 35

7.5 Radiated Power (ERP)

§90.542(a)(7)

Test Overview

Effective Radiated Power (ERP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI/TIA-603-E-2016 – Section 2.2.17

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW $\geq 3 \times$ RBW
4. Span = 1.5 times the OBW
5. No. of sweep points $\geq 2 \times$ span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 25 of 35

Test Setup

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

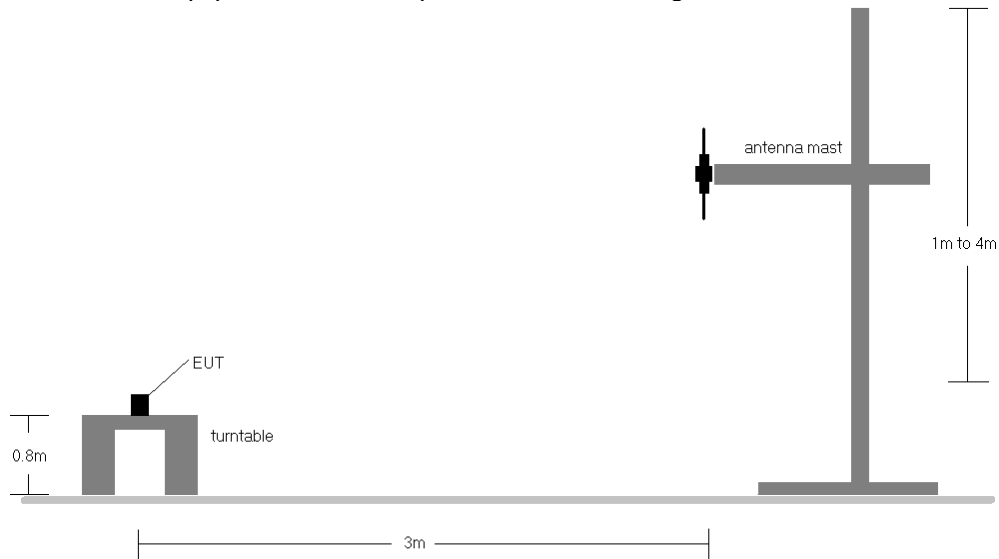


Figure 7-4. Radiated Test Setup <1GHz

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 26 of 35

Test Notes

- 1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
- 2) This unit was tested with its standard battery.

Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	RB Size/Offset	Substitute Level [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
790.50	5	QPSK	H	238	285	1 / 24	15.00	6.29	19.14	0.082	34.77	-15.63	21.29	0.135	36.99	-15.70
793.00	5	QPSK	H	226	283	1 / 24	15.24	6.34	19.43	0.088	34.77	-15.34	21.58	0.144	36.99	-15.41
795.50	5	QPSK	H	241	279	1 / 24	15.16	6.39	19.40	0.087	34.77	-15.38	21.55	0.143	36.99	-15.44
795.50	5	16-QAM	H	241	279	1 / 24	14.90	6.39	19.14	0.082	34.77	-15.64	21.29	0.134	36.99	-15.70
793.00	10	QPSK	H	231	286	1 / 49	15.51	6.34	19.70	0.093	34.77	-15.07	21.85	0.153	36.99	-15.14
793.00	10	16-QAM	H	231	286	1 / 49	15.00	6.34	19.19	0.083	34.77	-15.58	21.34	0.136	36.99	-15.65
793.00	10	QPSK	V	150	135	15.51	13.51	6.34	17.70	0.059	34.77	-17.07	19.85	0.097	36.99	-17.14

Table 7-22. ERP Data (Band 14)

FCC ID: ZNFQ720CS	 MEASUREMENT REPORT (CERTIFICATION) 		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 27 of 35

7.6 Radiated Spurious Emissions Measurements

§2.1053 §90(R)

Test Overview

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as peak measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

ANSI/TIA-603-E-2016 – Section 2.2.12

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW $\geq 3 \times$ RBW
3. Span = 1.5 times the OBW
4. No. of sweep points $\geq 2 \times$ span / RBW
5. Detector = RMS
6. Trace mode = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 28 of 35	

Test Setup

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

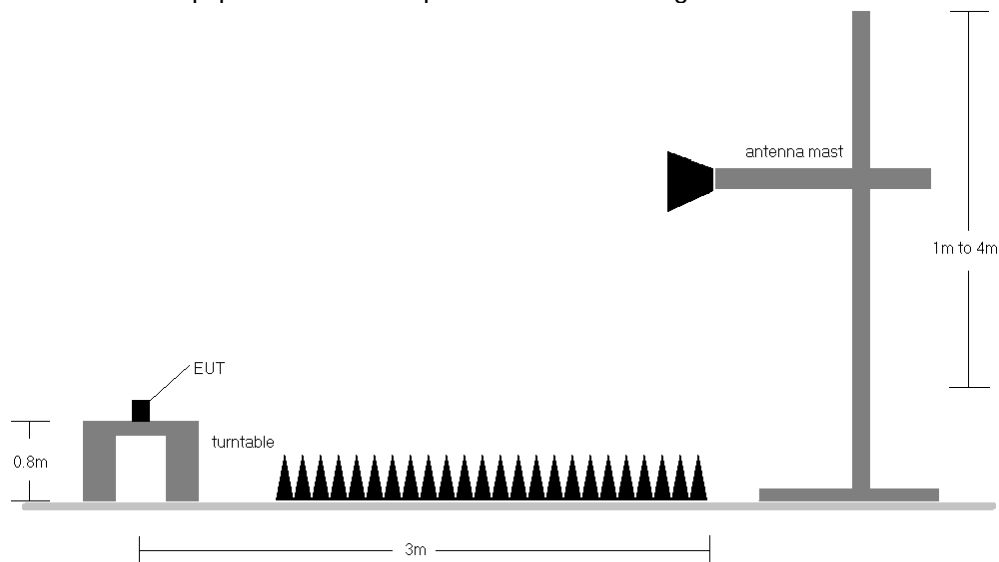
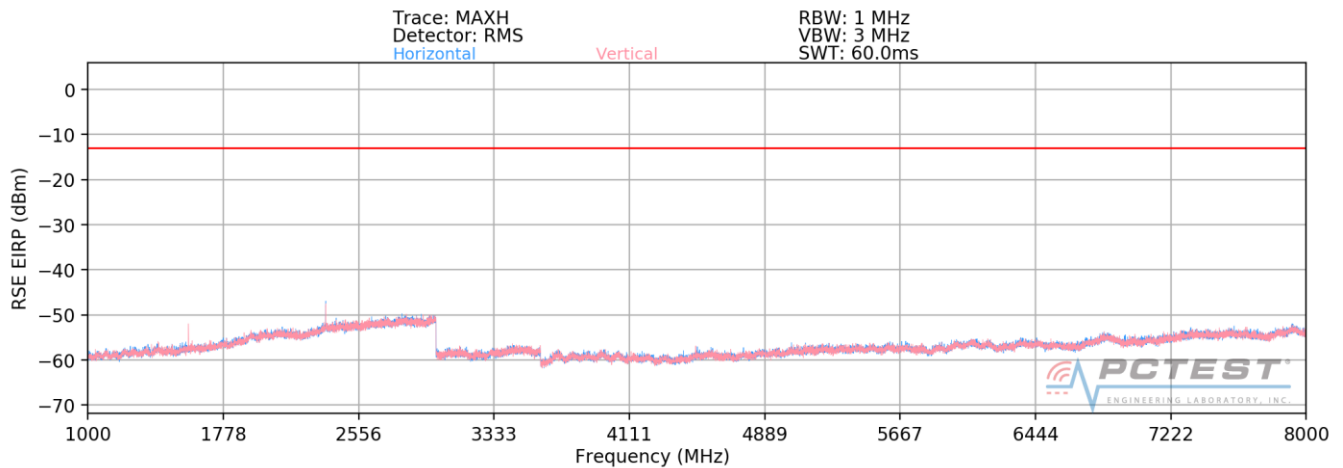


Figure 7-5. Test Instrument & Measurement Setup

Test Notes

1. This unit was tested with its standard battery.
2. The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case setup is reported in the tables below.
3. The "-" shown in the following RSE tables are used to denote a noise floor measurement.
4. Per 90(R)(f), emissions in the 1559 – 1610MHz band are subject to a limit of -40dBm/MHz for wideband signals. These emission measurements are shown in this section below.

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 29 of 35



Plot 7-23. Radiated Spurious Plot above 1GHz (LTE Band 14 – Mid Channel)

OPERATING FREQUENCY: 793.00 MHz
MODULATION SIGNAL: QPSK
BANDWIDTH: 10.0 MHz
DISTANCE: 3 meters
LIMIT: -13 dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
2379.00	H	152	203	-61.71	9.40	-52.31	-39.3
3172.00	H	-	-	-73.39	9.34	-64.06	-51.1

Table 7-2. Radiated Spurious Data (LTE Band 14 – Mid Channel)

FCC ID: ZNFQ720CS	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	LG	Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 30 of 35

MODULATION SIGNAL:	QPSK
BANDWIDTH:	10.00 MHz
DISTANCE:	3 meters
NARROWBAND EMISSION LIMIT:	-50 dBm
WIDEBAND EMISSION LIMIT:	-40 dBm/MHz

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
1586.00	H	152	226	-68.19	8.61	-59.58	-19.6

Table 7-3. Radiated Spurious Data (LTE Band 14 – Wide Band)

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 31 of 35

7.7 Frequency Stability / Temperature Variation

§2.1055 §90.213

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from -30°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.

The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency.

Test Procedure Used

ANSI/TIA-603-E-2016

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 -30°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: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 32 of 35	

Frequency Stability / Temperature Variation

§2.1055, §90.213

OPERATING FREQUENCY: 793,000,000 Hz

CHANNEL: 23330

REFERENCE VOLTAGE: 3.85 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	- 30	792,999,869	-131	-0.0000165
100 %		- 20	793,000,152	152	0.0000192
100 %		- 10	793,000,366	366	0.0000462
100 %		0	793,000,166	166	0.0000209
100 %		+ 10	793,000,058	58	0.0000073
100 %		+ 20	792,999,841	-159	-0.0000201
100 %		+ 30	793,000,234	234	0.0000295
100 %		+ 40	793,000,011	11	0.0000014
100 %		+ 50	793,000,061	61	0.0000077
BATT. ENDPOINT	3.40	+ 20	792,999,887	-113	-0.0000142

Table 7-4. LTE Band 14 Frequency Stability Data

Note:

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore, the device is determined to remain operating in band over the temperature and voltage range as tested.

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 33 of 35	

Frequency Stability / Temperature Variation

§2.1055, §90.213

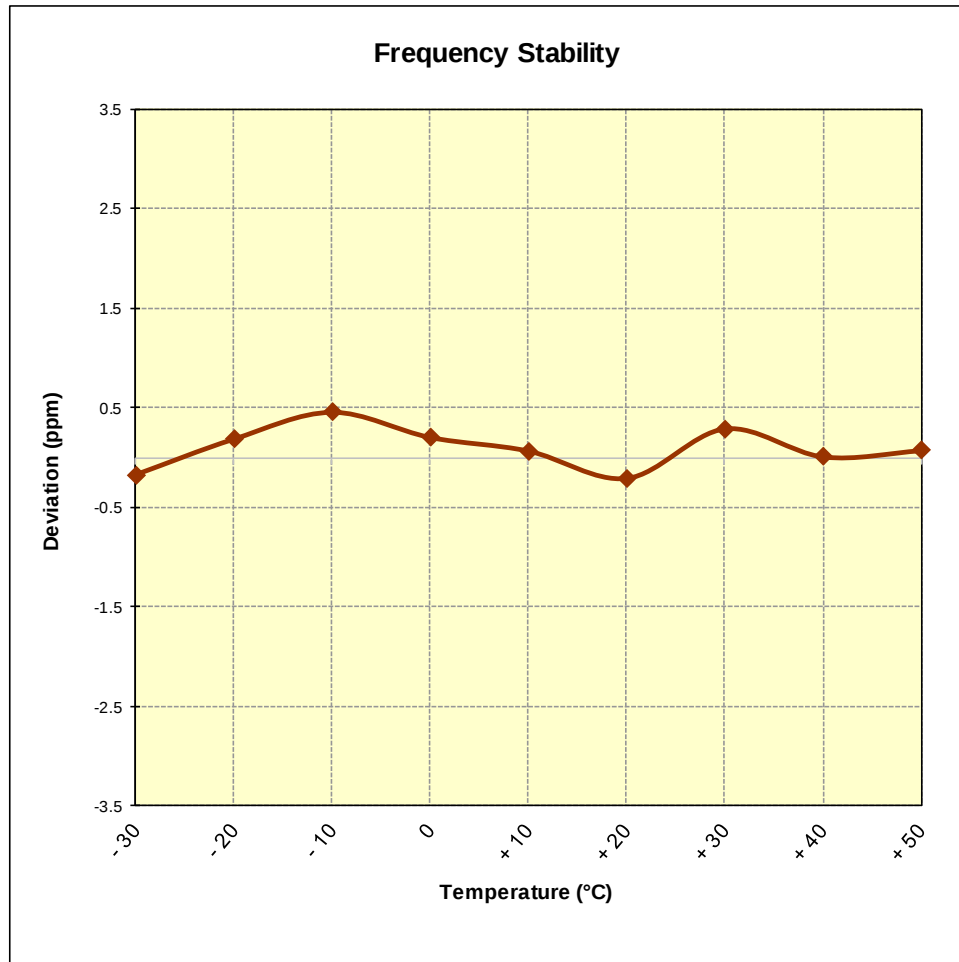


Table 7-5. LTE Band 14 Frequency Stability Data

FCC ID: ZNFQ720CS	 MEASUREMENT REPORT (CERTIFICATION) 		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset	Page 34 of 35

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFQ720CS** complies with all the requirements of Parts 90 of the FCC rules.

FCC ID: ZNFQ720CS		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Quality Manager
Test Report S/N: 1M1903280046-04-R1.ZNF	Test Dates: 3/28 - 4/18/2019	EUT Type: Portable Handset		Page 35 of 35