



PCTEST ENGINEERING LABORATORY, INC.

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MEASUREMENT REPORT FCC PART 15.247 / IC RSS-210 Bluetooth

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

Date of Testing:
January 17 - 22, 2013
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
0Y1301150086.ZNF

FCC ID: ZNFVS870

APPLICANT: LG Electronics MobileComm U.S.A

Application Type: Class II Permissive Change
Model(s): VS870, LG-VS870, LGVS870, LG-AS870, LGAS870, AS870
EUT Type: Portable Handset
Frequency Range: 2402 – 2480MHz (Bluetooth for US)
Type of Modulation: GFSK, $\pi/4$ -DQPSK, 8DPSK
FCC Classification: FCC Part 15 Spread Spectrum Transmitter (DSS)
FCC Rule Part(s): Part 15 Subpart C (15.247)
IC Specification(s): RSS-210 Issue 8
Test Procedure(s): ANSI C63.10-2009, DA 00-705
Class II Permissive Change: Please see FCC change documents.
Original Grant Date: January 22, 2013

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2009 and DA 00-705. Test results reported herein relate only to the item(s) tested.

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


Randy Ortanez
President



FCC ID: ZNFVS870		FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 1 of 16

TABLE OF CONTENTS

FCC PART 15.247 MEASUREMENT REPORT.....	3
1.0 INTRODUCTION.....	4
1.1 SCOPE.....	4
1.2 PCTEST TEST LOCATION.....	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
2.5 LABELING REQUIREMENTS.....	5
3.0 DESCRIPTION OF TEST	6
3.1 EVALUATION PROCEDURE.....	6
3.2 RADIATED EMISSIONS	7
4.0 ANTENNA REQUIREMENTS	8
5.0 TEST EQUIPMENT CALIBRATION DATA.....	9
6.0 TEST RESULTS	10
6.1 SUMMARY	10
6.2 RADIATED SPURIOUS EMISSION MEASUREMENTS.....	11
6.3 RADIATED RESTRICTED BAND EDGE MEASUREMENTS	15
7.0 CONCLUSION	16

FCC ID: ZNFVS870		FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 2 of 16



MEASUREMENT REPORT

FCC Part 15.247



§ 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: 6660-B Dobbin Road, Columbia, MD 21045 USA
FCC RULE PART(S): Part 15 Subpart C (15.247)
IC SPECIFICATION(S): RSS-210 Issue 8
BASE MODEL: VS870
FCC ID: ZNFVS870
Test Device Serial No.: N/A ☐ Production ☒ Pre-Production ☐ Engineering
FCC CLASSIFICATION: FCC Part 15 Spread Spectrum Transmitter (DSS)
Method/System: Frequency Hopping Spread Spectrum (FHSS)
DATE(S) OF TEST: January 17 - 22, 2013
TEST REPORT S/N: 0Y1301150086.ZNF

Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21045, U.S.A.



- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) 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 (2451A-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 (2451A-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.

FCC ID: ZNFVS870		FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 3 of 16

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).

Testing was conducted at PCTEST Engineering Laboratory, Inc. facility located in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on January 10, 2012.

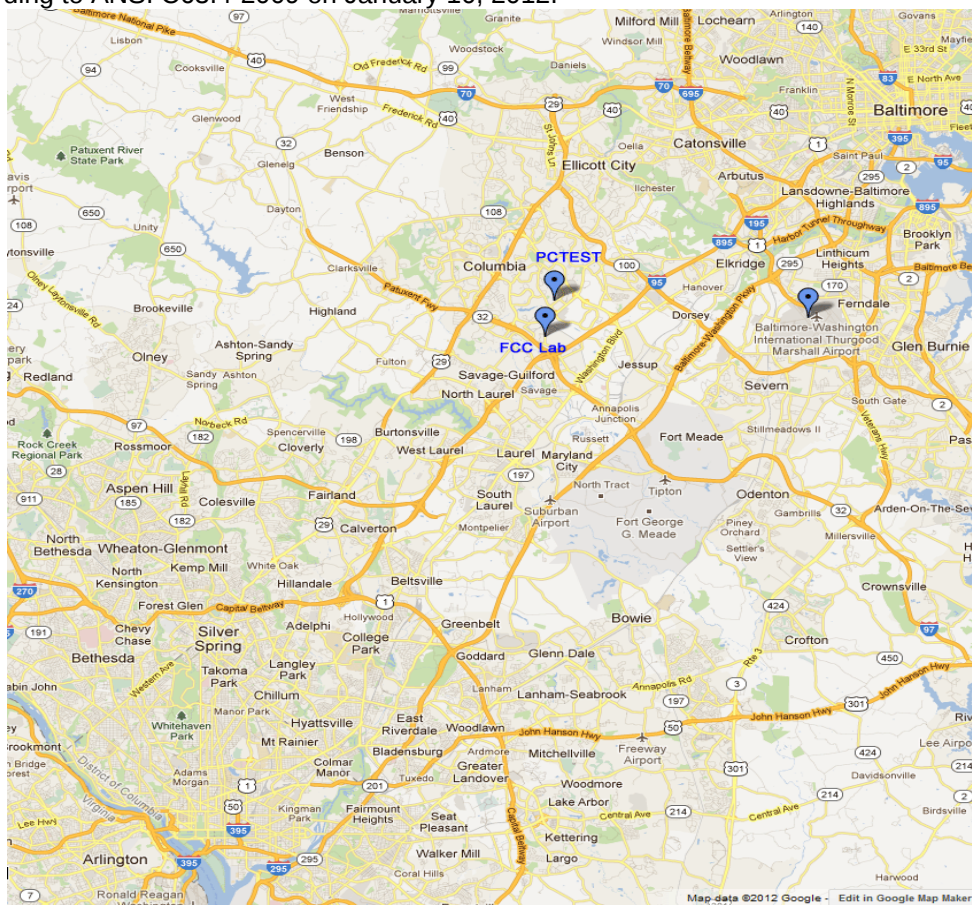


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

FCC ID: ZNFVS870	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)	LG	Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 4 of 16

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **LG Portable Handset FCC ID: ZNFVS870**. The test data contained in this report pertains only to the emissions due to the EUT's Bluetooth transmitter.

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following:
 - A) The hopping sequence is pseudorandom
 - B) All channels are used equally on average
 - C) The receiver input bandwidth equals the transmit bandwidth
 - D) The receiver hops in sequence with the transmit signal
- 15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) system.
- 15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.
- 15.247(h): The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 CDMA/EvDO Rev0/A (BC0, BC1), Band 13 LTE, 802.11a/b/g/n WLAN (DTS/NII), Bluetooth (1x,EDR,LE)

2.3 Test Configuration

The LG Portable Handset FCC ID: ZNFVS870 was tested per the guidance of ANSI C63.10-2009 and DA 00-705. See Sections 3.2, radiated emissions test setup.

2.4 EMI Suppression Device(s)/Modifications

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

2.5 Labeling Requirements

Per 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the trade name and FCC ID must be displayed on the device per Section 15.19(a)(5).

Please see attachment for FCC ID label and label location.

FCC ID: ZNFVS870		FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 5 of 16

3.0 DESCRIPTION OF TEST

3.1 Evaluation Procedure

The measurement procedure described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2009) and the "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems" (DA 00-705) were used in the measurement of the **LG Portable Handset FCC ID: ZNFVS870**.

Deviation from measurement procedure.....None

FCC ID: ZNFVS870	 FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE) 		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset	Page 6 of 16

3.2 Radiated Emissions

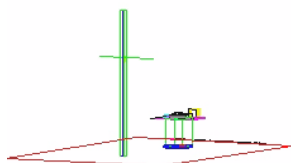


Figure 3-1. 3-Meter Test Site

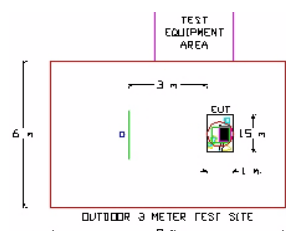


Figure 3-2. Dimensions of Outdoor Test Site

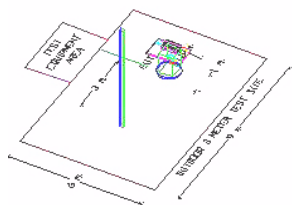


Figure 3-3. Turntable and System Setup

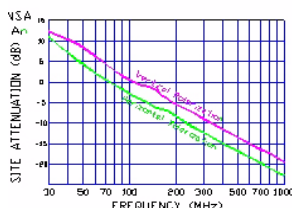


Figure 3-4. Normalized Site Attenuation Curves (H&V)

The radiated test facilities consisted of an indoor semi-anechoic chamber used for exploratory measurements and an open area test site (OATS) used for final measurements. 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 higher than the upper frequency range of the broadband antenna used for testing, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used.

Exploratory measurements were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies 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 a 0.8 meter high non-metallic 1 x 1.5 meter table (see Figure 3-3). 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, turntable azimuth, and receive antenna height was noted for each frequency found. To record the exploratory measurements, the analyzers' detector function was set to peak mode and the bandwidth was set to 100kHz.

Final measurements were made on the OATS at 3 meter test range using calibrated, linearly polarized broadband or horn antennas (see Figure 3-1). The measurement area is situated on an 18 meter x 20 meter galvanized 1/2" hardware cloth as the conducting ground plane. This material is sewn together in sections 4 feet wide and 60 feet long. A total of eighteen sections are required to cover the entire measurement area. Sections are laid across the width of the pad, overlapped 1" and sewn and soldered together at intervals of 3" (7.6 cm.) The terrain of the test site is reasonably flat and level. Power and cable to the test site are buried 18" deep into the ground outside the perimeter of the site. An all-weather non-metallic housing is situated on a 2 x 3 meter area adjacent to the measurement area to house the test equipment (see Figure 3-2). The test set-up was again placed on top of the same a 0.8 meter high non-metallic 1 x 1.5 meter table on the OATS as used for exploratory measurements in the indoor chamber. The test set-up was re-configured to the same setup that was previously determined through exploratory measurements to have produced the worst case emissions. The spectrum analyzer was set to the frequencies found to have caused the highest radiated disturbances with respect to the limit during preliminary radiated measurements. The turntable containing the system 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 re-maximized by varying: the mode of operation or resolution, clock or data exchange speed, scrolling H pattern to the EUT and/or support equipment, powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable, and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

FCC ID: ZNFVS870	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)	LG	Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 7 of 16

4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

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

- The antennas of the LG Portable Handset are **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The **LG Portable Handset FCC ID: ZNFVS870** unit complies with the requirement of §15.203.

Ch.	Frequency (MHz)
00	2402
:	:
39	2441
:	:
78	2480

Table 4-1. Frequency/ Channel Operations

FCC ID: ZNFVS870		FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 8 of 16

5.0 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
-	BT1	Bluetooth Cable Set	1/15/2013	Annual	1/15/2014	N/A
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	7/10/2012	Annual	7/10/2013	N/A
Agilent	8447D	Broadband Amplifier	5/8/2012	Annual	5/8/2013	2443A01900
Agilent	E4448A	PSA (3Hz-50GHz) Spectrum Analyzer	2/15/2012	Annual	2/15/2013	US42510244
Agilent	N9020A	MXA Signal Analyzer	10/10/2012	Annual	10/10/2013	US46470561
Agilent	N4010A	Wireless Connectivity Test Set	N/A		N/A	GB46170464
Agilent	N4010A	Wireless Connectivity Test Set	N/A		N/A	GB44450273
Agilent	N9030A	PXA Signal Analyzer	2/23/2012	Annual	2/23/2013	MY49432391
Anritsu	MA2411B	Power Sensor	3/5/2012	Annual	3/5/2013	846215
Anritsu	ML2495A	Power Meter	10/13/2012	Annual	10/13/2013	1039008
ETS Lindgren	3117	1-18 GHz DRG Horn (Medium)	7/22/2011	Biennial	7/22/2013	125518
Mini-Circuits	VHF-3100+	High Pass Filter	1/15/2012	Annual	1/15/2013	30841
Mini-Circuits	VHF-3100+	High Pass Filter	2/7/2012	Annual	2/7/2013	31144
Rohde & Schwarz	RS-PR18	1-18 GHz Pre-Amplifier	6/26/2012	Annual	6/26/2013	100071
Rohde & Schwarz	ESU26	EMI Test Receiver	12/15/2011	Annual	12/15/2012	100342
Solar Electronics	8012-50-R-24-BNC	LISN	6/23/2011	Biennial	6/23/2013	310233
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	1/26/2012	Biennial	1/26/2014	A051107

Table 5-1. Annual Test Equipment Calibration Schedule

Note:

Equipment used for signaling with a calibration date of "N/A" shown in this list was only used for maintaining a link between the piece of equipment and the EUT. This equipment was not used to make direct calibrated measurements.

FCC ID: ZNFVS870	 FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE) 		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset	Page 9 of 16

6.0 TEST RESULTS

6.1 Summary

Company Name: LG Electronics MobileComm U.S.A
 FCC ID: ZNFVS870
 Method/System: Frequency Hopping Spread Spectrum (FHSS)
 Number of Channels: 79

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (Tx)						
15.205 15.209	RSS-210 [A8.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-210 table 3 limits)	RADIATED	PASS	Section 6.2, Section Error! Reference source not found.

Table 6-1. 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.

FCC ID: ZNFVS870		FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 10 of 16

6.2 Radiated Spurious Emission Measurements

§15.205 & §15.209, §15.247 (d); RSS-210 (A8.5)

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

Table 6-2. Radiated Limits

Sample Calculation

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

Duty Cycle Correction Factor Calculation

- o Channel hop rate = 800 hops/second (AFH Mode)
- o Adjusted channel hop rate for DH5 mode = 133.33 hops/second
- o Time per channel hop = $1 / 133.33 \text{ hops/second} = 7.5 \text{ ms}$
- o Time to cycle through all channels = $7.5 \times 20 \text{ channels} = 150 \text{ ms}$
- o Number of times transmitter hits on one channel = $100 \text{ ms} / 150 \text{ ms} = 1 \text{ time(s)}$
- o Worst case dwell time = 7.5 ms
- o Duty cycle correction factor = $20\log_{10}(7.5\text{ms}/100\text{ms}) = -22.5 \text{ dB}$

FCC ID: ZNFVS870		FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 11 of 16

Test Notes

1. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 6-2.
2. No significant radiated emissions were found in the 2310 - 2390MHz restricted band.
3. Average measurements > 1GHz using RBW = 1MHz and VBW = 1kHz $\geq 1/\tau$ Hz, where τ = pulse width in seconds. Peak measurements > 1GHz using RBW = 1MHz and VBW = 3MHz.
4. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
5. The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
6. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. Emissions whose levels were not within 20dB of the respective limits were not reported.
7. Average levels at -135 dBm and peak levels at -125dBm represent the analyzer noise floor and signify that no emission was detected.

FCC ID: ZNFVS870	 FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE) 		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset	Page 12 of 16

Radiated Spurious Emission Measurements (Cont'd)

§15.205 & §15.209, §15.247 (d); RSS-210 (A8.5)

Worst Case Mode: Bluetooth
Worst Case Data Rate: 1Mbps
Measurement Distance: 3 Meters
Operating Frequency: 2402MHz
Channel: 0

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB]	Duty Cycle Correction [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4804.00	-104.61	Avg	H	34.44	-22.50	14.33	53.98	-39.65
4804.00	-92.36	Peak	H	34.44	0.00	49.08	73.98	-24.90
12010.00	-135.00	Avg	H	45.56	0.00	17.56	53.98	-36.41
12010.00	-125.00	Peak	H	45.56	0.00	27.56	73.98	-46.41

Table 6-3. Radiated Measurements

Worst Case Mode: Bluetooth
Worst Case Data Rate: 1Mbps
Measurement Distance: 3 Meters
Operating Frequency: 2441MHz
Channel: 39

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB]	Duty Cycle Correction [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4882.00	-101.05	Avg	H	34.52	-22.50	17.97	53.98	-36.01
4882.00	-88.95	Peak	H	34.52	0.00	52.57	73.98	-21.41
7323.00	-135.00	Avg	H	39.06	0.00	11.06	53.98	-42.92
7323.00	-125.00	Peak	H	39.06	0.00	21.06	73.98	-52.92
12205.00	-135.00	Avg	H	46.19	0.00	18.19	53.98	-35.79
12205.00	-125.00	Peak	H	46.19	0.00	28.19	73.98	-45.79

Table 6-4. Radiated Measurements

FCC ID: ZNFVS870		FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 13 of 16

Radiated Spurious Emission Measurements (Cont'd)

§15.205 & §15.209, §15.247 (d); RSS-210 (A8.5)

Worst Case Mode:	Bluetooth
Worst Case Data Rate:	1Mbps
Measurement Distance:	3 Meters
Operating Frequency:	2480MHz
Channel:	78

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB]	Duty Cycle Correction [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
4960.00	-103.27	Avg	H	34.68	-22.50	15.91	53.98	-38.07
4960.00	-91.10	Peak	H	34.68	0.00	50.58	73.98	-23.40
7440.00	-135.00	Avg	H	39.06	0.00	11.06	53.98	-42.92
7440.00	-125.00	Peak	H	39.06	0.00	21.06	73.98	-52.92
12400.00	-135.00	Avg	H	45.94	0.00	17.94	53.98	-36.03
12400.00	-125.00	Peak	H	45.94	0.00	27.94	73.98	-46.03

Table 6-5. Radiated Measurements

FCC ID: ZNFVS870	 FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)		 Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset	Page 14 of 16

6.3 Radiated Restricted Band Edge Measurements

§15.205 & §15.209, §15.247 (d); RSS-210 (A8.5)

Worst Case Mode: Bluetooth
Worst Case Data Rate: 1Mbps
Measurement Distance: 3 Meters
Operating Frequency: 2480MHz
Channel: 78

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol [H/V]	AFCL [dB]	Duty Cycle Correction [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
2483.50	-104.57	Avg	H	30.56	-22.50	10.48	53.98	-43.50
2483.50	-84.60	Peak	H	30.56	0.00	52.95	73.98	-21.03
2493.07	-106.60	Avg	H	30.58	-22.50	8.49	53.98	-45.49
2493.07	-94.89	Peak	H	30.58	0.00	42.69	73.98	-31.29
2498.33	-109.39	Avg	H	30.60	-22.50	5.72	53.98	-48.26
2498.33	-92.39	Peak	H	30.60	0.00	45.22	73.98	-28.76

Table 6-6. Radiated Restricted Band Edge Measurements at 3-meters

FCC ID: ZNFVS870		FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 15 of 16

7.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **LG Portable Handset FCC ID: ZNFVS870** is in compliance with Part 15 Subpart C (15.247) of the FCC Rules and RSS-210 of the Industry Canada Rules.

FCC ID: ZNFVS870		FCC Pt. 15.247 BLUETOOTH TEST REPORT (CLASS II PERMISSIVE CHANGE)		Reviewed by: Quality Manager
Test Report S/N: 0Y1301150086.ZNF	Test Dates: January 17 - 22, 2013	EUT Type: Portable Handset		Page 16 of 16