



**FCC 47 CFR PART 15 SUBPART C**

**CERTIFICATION TEST REPORT**

**FOR**

**GSM/WCDMA/CDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n/ac & NFC**

**MODEL NUMBER: LG-VS986, VS986, LGVS986, LG-AS986, AS986, LGAS986**

**FCC ID: ZNFVS986**

**IC: 2703C-VS986**

**REPORT NUMBER: 15I20402-E8**

**ISSUE DATE: April 16, 2015**

*Prepared for*

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**NVLAP LAB CODE 200065-0**

Revision History

| Rev. | Issue<br>Date | Revisions     | Revised By |
|------|---------------|---------------|------------|
| --   | 04/16/15      | Initial Issue | P. Zhang   |

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** LG ELECTRONICS MOBILECOMM U.S.A., INC.  
**EUT DESCRIPTION:** GSM/WCDMA/CDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n/ac & NFC  
**MODEL:** LG-VS986, VS986, LGVS986, LG-AS986, AS986, LGAS986  
**SERIAL NUMBER:** 0298-0469 (Conducted), 0298-0459 (Radiated)  
**DATE TESTED:** MAR 25 – APR 16, 2015

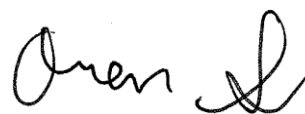
| APPLICABLE STANDARDS            |              |
|---------------------------------|--------------|
| STANDARD                        | TEST RESULTS |
| FCC PART 15 SUBPART C           | Pass         |
| INDUSTRY CANADA RSS-210 ISSUE 8 | Pass         |
| INDUSTRY CANADA RSS-GEN Issue 4 | Pass         |

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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UL VERIFICATION SERVICES INC

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2 and FCC CFR 47 Part 15C.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 47173 Benicia Street                                       | 47266 Benicia Street                            |
|------------------------------------------------------------|-------------------------------------------------|
| <input checked="" type="checkbox"/> Chamber A(IC: 2324B-1) | <input type="checkbox"/> Chamber D(IC: 2324B-4) |
| <input checked="" type="checkbox"/> Chamber B(IC: 2324B-2) | <input type="checkbox"/> Chamber E(IC: 2324B-5) |
| <input checked="" type="checkbox"/> Chamber C(IC: 2324B-3) | <input type="checkbox"/> Chamber F(IC: 2324B-6) |
|                                                            | <input type="checkbox"/> Chamber G(IC: 2324B-7) |
|                                                            | <input type="checkbox"/> Chamber H(IC: 2324B-8) |

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned}\text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable} \\ &\text{Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m}\end{aligned}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER                             | UNCERTAINTY |
|---------------------------------------|-------------|
| Conducted Disturbance, 0.15 to 30 MHz | 3.52 dB     |
| Radiated Disturbance, 30 to 1000 MHz  | 4.94 dB     |

Uncertainty figures are valid to a confidence level of 95%.

## **5. EQUIPMENT UNDER TEST**

### **5.1. DESCRIPTION OF EUT**

The EUT is a GSM/WCDMA/CDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n/ac & NFC

### **5.2. MAXIMUM OUTPUT POWER**

The testing was performed at 1meter. The transmitter maximum E-field at 30m distance is 14.50 dBuV/m which convert from the 1 meters data.

### **5.3. WORST-CASE CONFIGURATION AND MODE**

The NFC function was tested at its' fundamental and only operational frequency of 13.56MHz. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that the Z-orientation with cover opened was the worst-case orientation; therefore all final radiated testing was performed with the EUT in the Z-orientation with cover opened while generating continuous emissions.

### **5.4. MODIFICATIONS**

No modifications were made during testing.

## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

| Support Equipment List |              |           |                    |        |
|------------------------|--------------|-----------|--------------------|--------|
| Description            | Manufacturer | Model     | Serial Number      | FCC ID |
| AC Adapter             | LG           | MCS-04WD2 | EAY62991904        | N/A    |
| Smart Case Cover       | LG           | LG-P1     | DK0227             | N/A    |
| Wireless Charger       | LG           | WCD-110   | LF1212625283010049 | N/A    |
| Earphone               | LG           | N/A       | N/A                | N/A    |

### I/O CABLES

#### Radiated Emissions above 30 MHz, AC Line Conducted Emissions:

| I/O Cable List |          |                      |                |             |                  |         |
|----------------|----------|----------------------|----------------|-------------|------------------|---------|
| Cable No       | Port     | # of identical ports | Connector Type | Cable Type  | Cable Length (m) | Remarks |
| 1              | DC Power | 1                    | Micro-USB      | Shielded    | 1 m              | None    |
| 2              | Audio    | 1                    | Mini-Jack      | Un-Shielded | 1 m              | None    |

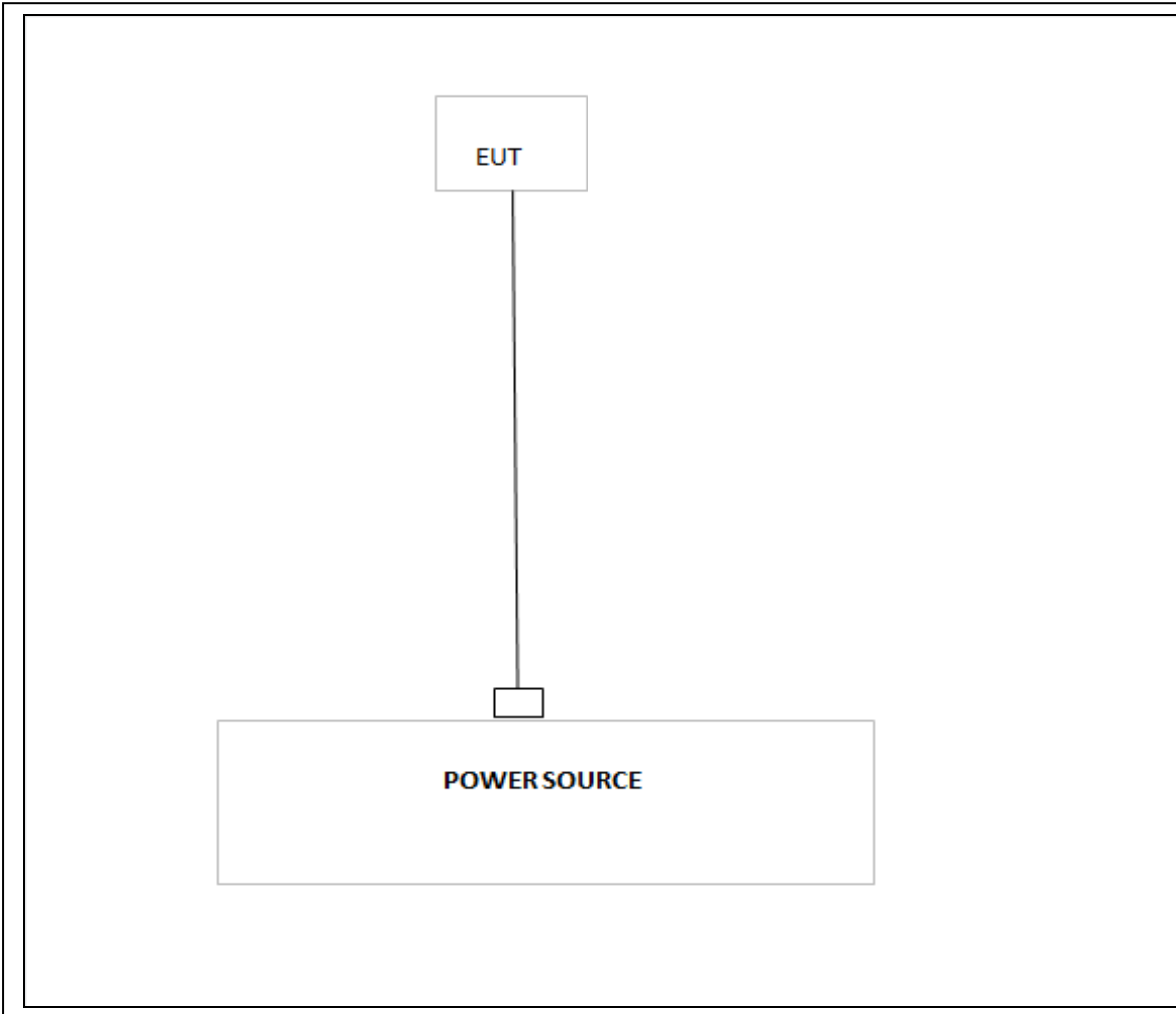
### TEST SETUP

The EUT is a stand-alone device configured and tested in a worst-case setup.

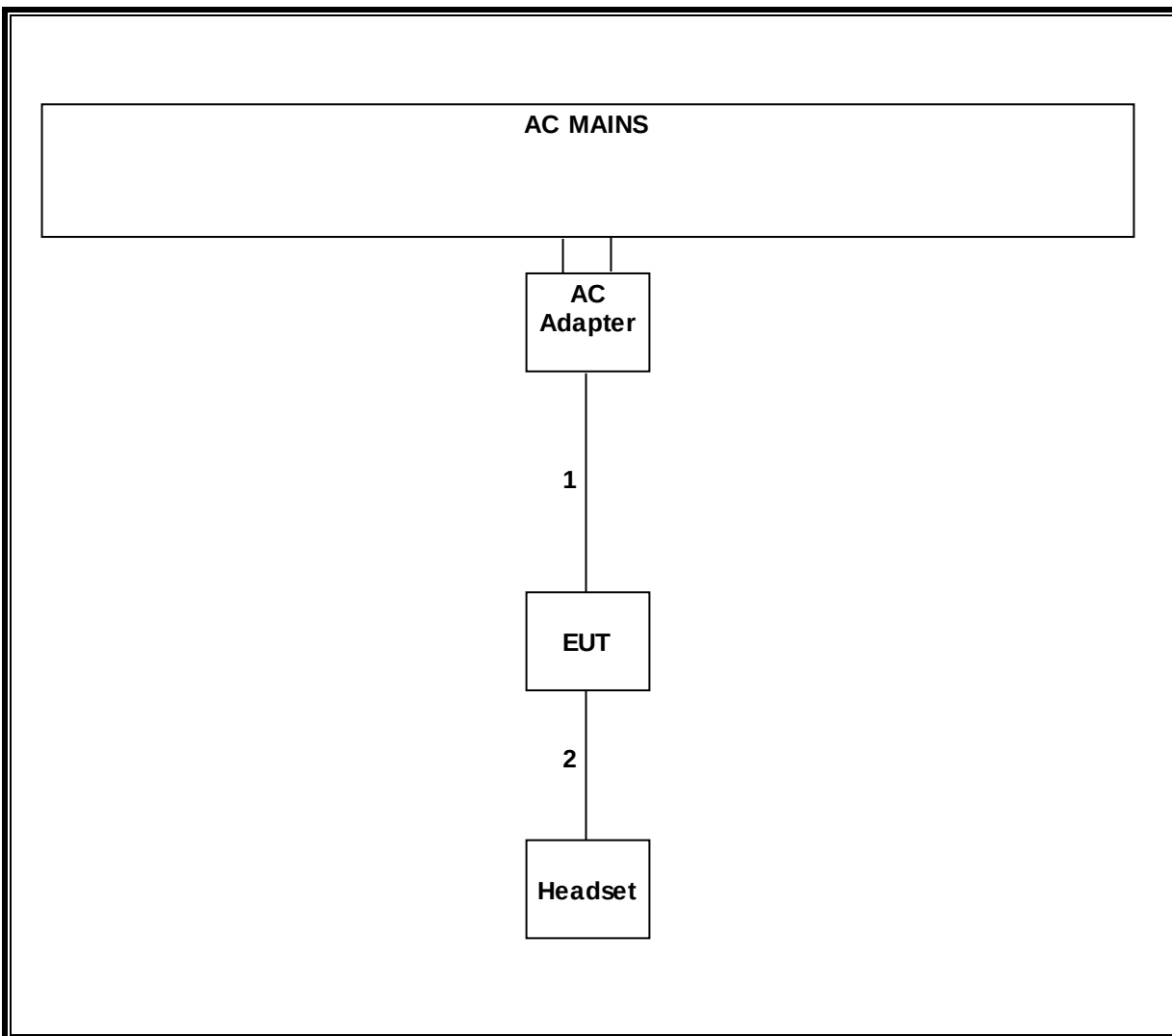
Note: worst case is using worst case orientation with AC charger and headset attached to the EUT with NFC signal continuously transmitting.

**SETUP DIAGRAM FOR TESTS**

**Radiated Emissions Below 30 MHz:**



**Radiated Emissions above 30 MHz, AC Line Conducted Emissions:**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| Test Equipment List                       |                |             |        |          |
|-------------------------------------------|----------------|-------------|--------|----------|
| Description                               | Manufacturer   | Model       | Asset  | Cal Due  |
| ESA-E Spectrum Analyzer,<br>9kHz-26.5 GHz | Agilent / HP   | E4407B      | C01098 | 04/04/16 |
| Antenna, Loop, 30 MHz                     | EMCO           | 6502        | C00593 | 02/20/16 |
| Antenna, Bilog, 30MHz-1 GHz               | Sunol Sciences | JB1         | C01011 | 03/23/16 |
| Preamplifier, 1300 MHz                    | Agilent / HP   | 8447D       | C00580 | 04/03/16 |
| EMI Test Receiver, 30 MHz                 | R & S          | ESHS 20     | N02396 | 08/08/15 |
| LISN, 30 MHz                              | FCC            | 50/250-25-2 | C00626 | 01/16/16 |
| DMM                                       | Fluke          | 77-11       | N02303 | 10/31/15 |
| Temperature Chamber                       | CSZ            | 2PHS-8-3    | T267   | 03/04/16 |

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## 7. OCCUPIED BANDWIDTH

### RULE PART(S)

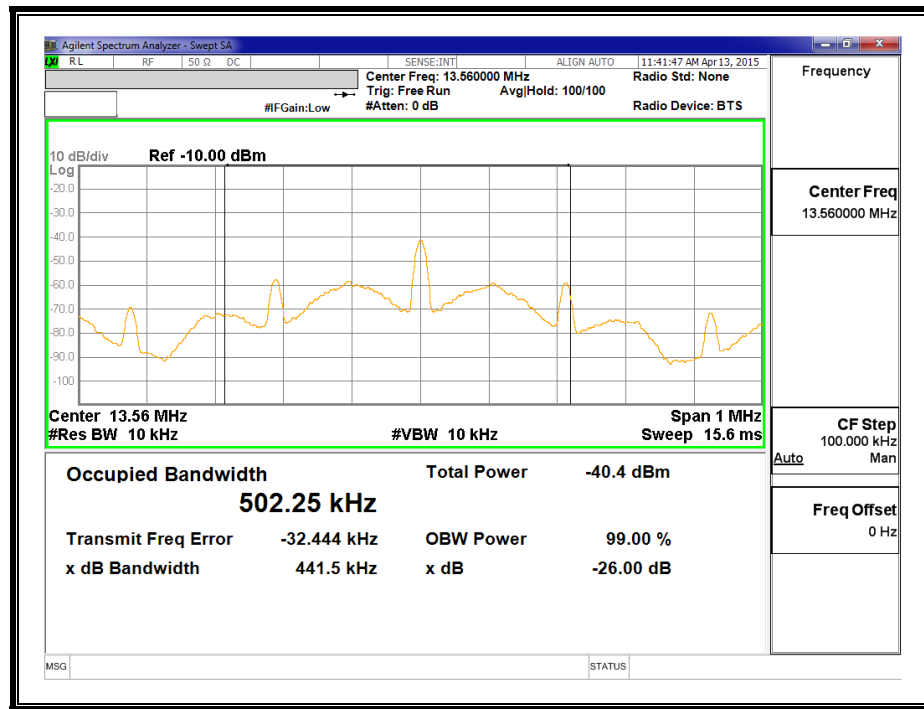
IC RSS 210 Issue 8

### LIMITS

For reporting purposes only

### RESULTS

| Channel | Frequency<br>(KHz) | 99% Bandwidth<br>(KHz) |
|---------|--------------------|------------------------|
| Low     | 13.56              | 502.250                |



## 8. RADIATED EMISSION TEST RESULTS

### 8.1. LIMITS AND PROCEDURE

#### LIMIT

§15.225

IC RSS-210, Annex 2, Section A2.6 (Transmitter)

IC RSS-GEN, Section 6 (Receiver)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Limits for radiated disturbance of an intentional radiator |                 |                          |
|------------------------------------------------------------|-----------------|--------------------------|
| Frequency range (MHz)                                      | Limits (µV/m)   | Measurement Distance (m) |
| 0.009 – 0.490                                              | 2400 / F (kHz)  | 300                      |
| 0.490 – 1.705                                              | 24000 / F (kHz) | 30                       |
| 1.705 – 30.0                                               | 30              | 30                       |
| 30 – 88                                                    | 100**           | 3                        |
| 88 - 216                                                   | 150**           | 3                        |
| 216 – 960                                                  | 200**           | 3                        |
| Above 960                                                  | 500             | 3                        |

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:

Limit (dBuV/m) = 20 log limit (uV/m)

In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

#### **TEST PROCEDURE**

ANSI C63.10-2013

The EUT is an intentional radiator that incorporates a digital device. The highest fundamental frequency generated or used in the device is 13.56 MHz. The frequency range was investigated from 0.15 MHz to the 10<sup>th</sup> harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater (1000MHz)

#### **RESULTS**

No non-compliance noted:

### 8.1.1. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz) (Normal Battery Cover)

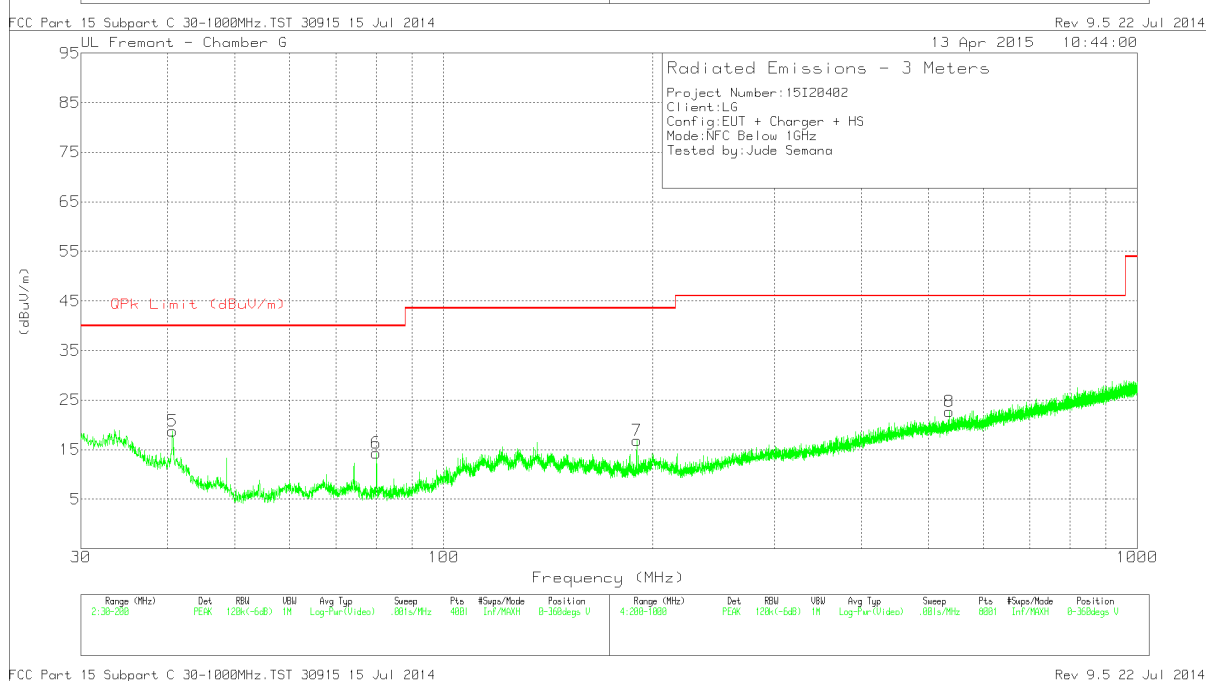
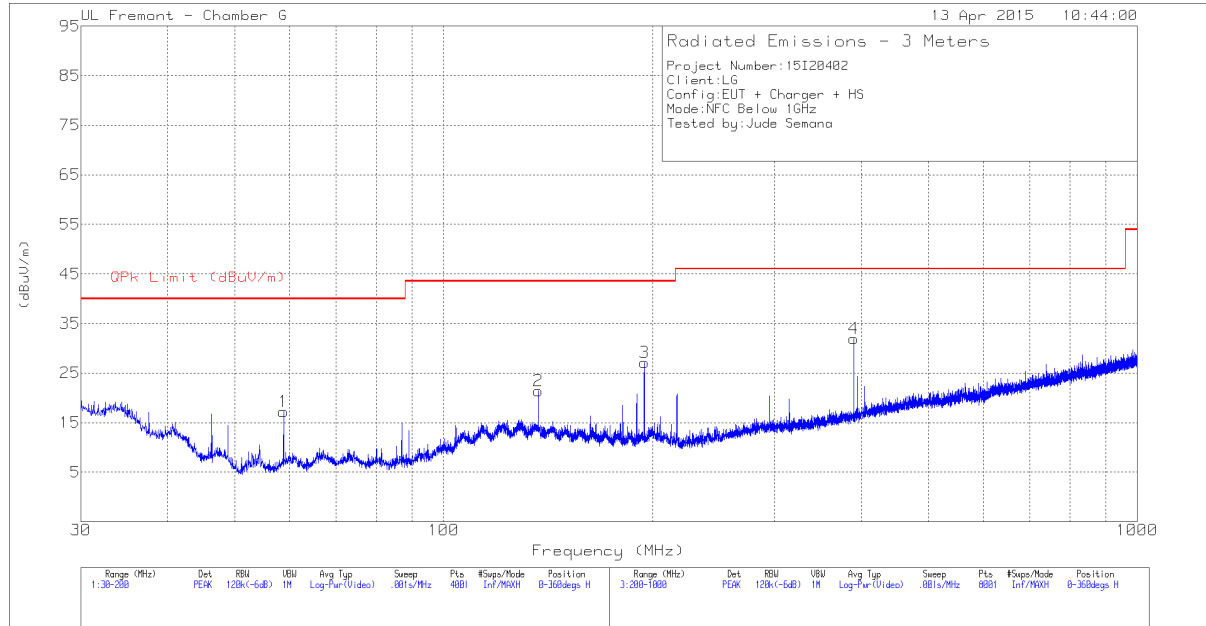
| FCC Part 15, Subpart B & C 1 Meter Distance Measurement At Emissions Chamber                                                                                                                                                                                              |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|----------|--------------|--------------------------|-------------------------------|-------------------------------|-------------------|-------------------|---------------------------------|
| Company: LG                                                                                                                                                                                                                                                               |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| Project #: 15I20402                                                                                                                                                                                                                                                       |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| Model #: (X72)_LG-VS986                                                                                                                                                                                                                                                   |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| Tester: Jude Semana                                                                                                                                                                                                                                                       |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| Date: 4/13/2015                                                                                                                                                                                                                                                           |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| Frequency (MHz)                                                                                                                                                                                                                                                           | PK (dBuV) | QP (dBuV) | AV (dBuV) | AF (dBm) | Distance (m) | Distance Correction (dB) | PK Corrected Reading (dBuV/m) | AV Corrected Reading (dBuV/m) | QP Limit (dBuV/m) | AV Limit (dBuV/m) | Notes                           |
| Loop Antenna Face On: Z Position                                                                                                                                                                                                                                          |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| Fundamental Field Strength & Within Bands:                                                                                                                                                                                                                                |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| 13.56                                                                                                                                                                                                                                                                     | 63.03     | --        | --        | 10.56    | 1            | -59.08                   | 14.50                         | --                            | 84.00             | --                | Fundamental @ 30m Dist          |
| 13.454                                                                                                                                                                                                                                                                    | 50.9      | --        | --        | 10.55    | 1            | -59.08                   | 2.30                          | --                            | 50.48             | --                | 13.41-13.553MHz Spurious @ 30m  |
| 13.553                                                                                                                                                                                                                                                                    | 53.05     | --        | --        | 10.56    | 1            | -59.08                   | 4.55                          | --                            | 50.48             | --                | 13.41-13.553MHz Spurious @ 30m  |
| 13.567                                                                                                                                                                                                                                                                    | 55.52     | --        | --        | 10.56    | 1            | -59.08                   | 6.99                          | --                            | 50.48             | --                | 13.567-13.710MHz Spurious @ 30m |
| 13.665                                                                                                                                                                                                                                                                    | 50.33     | --        | --        | 10.57    | 1            | -59.08                   | 1.81                          | --                            | 40.51             | --                | 13.567-13.710MHz Spurious @ 30m |
| 13.137                                                                                                                                                                                                                                                                    | 35.84     | --        | --        | 10.51    | 1            | -59.08                   | -12.73                        | --                            | 40.51             | --                | 13.110-13.410MHz Spurious @ 30m |
| 13.348                                                                                                                                                                                                                                                                    | 39.03     | --        | --        | 10.53    | 1            | -59.08                   | -9.52                         | --                            | 40.51             | --                | 13.110-13.410MHz Spurious @ 30m |
| 13.772                                                                                                                                                                                                                                                                    | 45.81     | --        | --        | 10.58    | 1            | -59.08                   | -2.90                         | --                            | 40.51             | --                | 13.710-14.010MHz Spurious @ 30m |
| 13.984                                                                                                                                                                                                                                                                    | 33.82     | --        | --        | 10.6     | 1            | -59.08                   | -14.67                        | --                            | 29.54             | --                | 13.710-14.010MHz Spurious @ 30m |
| Loop Antenna Face Off: Z Position                                                                                                                                                                                                                                         |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| Fundamental Field Strength & Within Bands:                                                                                                                                                                                                                                |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| 13.56                                                                                                                                                                                                                                                                     | 61.77     | --        | --        | 10.56    | 1            | -59.08                   | 13.24                         | --                            | 84.00             | --                | Fundamental @ 30m Dist          |
| 13.454                                                                                                                                                                                                                                                                    | 50.2      | --        | --        | 10.55    | 1            | -59.08                   | 1.66                          | --                            | 50.48             | --                | 13.41-13.553MHz Spurious @ 30m  |
| 13.553                                                                                                                                                                                                                                                                    | 51.44     | --        | --        | 10.56    | 1            | -59.08                   | 2.91                          | --                            | 50.48             | --                | 13.41-13.553MHz Spurious @ 30m  |
| 13.567                                                                                                                                                                                                                                                                    | 54.81     | --        | --        | 10.56    | 1            | -59.08                   | 6.28                          | --                            | 50.48             | --                | 13.567-13.710MHz Spurious @ 30m |
| 13.665                                                                                                                                                                                                                                                                    | 48.23     | --        | --        | 10.57    | 1            | -59.08                   | -0.29                         | --                            | 40.51             | --                | 13.567-13.710MHz Spurious @ 30m |
| 13.138                                                                                                                                                                                                                                                                    | 34.99     | --        | --        | 10.51    | 1            | -59.08                   | -13.58                        | --                            | 40.51             | --                | 13.110-13.410MHz Spurious @ 30m |
| 13.348                                                                                                                                                                                                                                                                    | 36.98     | --        | --        | 10.53    | 1            | -59.08                   | -11.57                        | --                            | 40.51             | --                | 13.110-13.410MHz Spurious @ 30m |
| 13.772                                                                                                                                                                                                                                                                    | 44.81     | --        | --        | 10.58    | 1            | -59.08                   | -3.90                         | --                            | 40.51             | --                | 13.710-14.010MHz Spurious @ 30m |
| 13.983                                                                                                                                                                                                                                                                    | 31.28     | --        | --        | 10.6     | 1            | -59.08                   | -17.21                        | --                            | 29.54             | --                | 13.710-14.010MHz Spurious @ 30m |
| Loop Antenna Face On: Z Position                                                                                                                                                                                                                                          |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| Spurious Emissions 9kHz - 490kHz:                                                                                                                                                                                                                                         |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| 0.01                                                                                                                                                                                                                                                                      | 63.7      | --        | --        | 18.7     | 1            | -99.08                   | -16.68                        | -16.68                        | 67.60             | 47.60             | 9kHz-10kHz Spurious @ 30m       |
| 0.1                                                                                                                                                                                                                                                                       | 50.95     | --        | --        | 10.5     | 1            | -99.08                   | -37.63                        | -37.63                        | 47.60             | 27.60             | 10kHz-100kHz Spurious @ 30m     |
| 0.109                                                                                                                                                                                                                                                                     | 49.67     | --        | --        | 10.49    | 1            | -99.08                   | -38.92                        | -38.92                        | 46.86             | 26.86             | 100kHz-489kHz Spurious @ 30m    |
| Spurious Emissions 490kHz - 30MHz:                                                                                                                                                                                                                                        |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| 0.49                                                                                                                                                                                                                                                                      | 37.365    | --        | --        | 10.21    | 1            | -59.08                   | -11.51                        | --                            | 33.80             | --                | 489kHz-490kHz Spurious @ 30m    |
| 1                                                                                                                                                                                                                                                                         | 28.5      | --        | --        | 10.3     | 1            | -59.08                   | -20.28                        | --                            | 27.60             | --                | 490kHz-1MHz Spurious @ 30m      |
| 1.366                                                                                                                                                                                                                                                                     | 28.132    | --        | --        | 10.28    | 1            | -59.08                   | -20.67                        | --                            | 24.90             | --                | 1MHz-1.705MHz Spurious @ 30m    |
| 4.133                                                                                                                                                                                                                                                                     | 19.442    | --        | --        | 10.2     | 1            | -59.08                   | -29.44                        | --                            | 29.54             | --                | 1.705MHz-5MHz Spurious @ 30m    |
| 6.27                                                                                                                                                                                                                                                                      | 24.41     | --        | --        | 10.2     | 1            | -59.08                   | -24.47                        | --                            | 29.54             | --                | 5-10MHz Spurious @ 30m          |
| 24.05                                                                                                                                                                                                                                                                     | 28.99     | --        | --        | 9.49     | 1            | -59.08                   | -20.60                        | --                            | 29.54             | --                | 20-30MHz Spurious @ 30m         |
| * No more emissions were found up to 30MHz                                                                                                                                                                                                                                |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 10000Mhz. Radiated emission limits in these three bands are based on measurements employing an average detector. |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| P.K. = Peak                                                                                                                                                                                                                                                               |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| Q.P. = Quasi Peak Readings                                                                                                                                                                                                                                                |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| A.F. = Antenna factor                                                                                                                                                                                                                                                     |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |
| Rev. 11.21.14                                                                                                                                                                                                                                                             |           |           |           |          |              |                          |                               |                               |                   |                   |                                 |

## 8.1.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz) (Smart Cover)

| FCC Part 15, Subpart B & C 1 Meter Distance Measurement At Emissions Chamber                                                                                                                                                                                              |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------------------|--------------|------------|-----------------|-----------------------------|----------------------------------|----------------------------------|----------------------|----------------------|-------------------|-------------------|---------------------------------|
| Company:                                                                                                                                                                                                                                                                  |              | LG                                |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| Project #:                                                                                                                                                                                                                                                                |              | 15I20402                          |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| Model #:                                                                                                                                                                                                                                                                  |              | (X72)_LG-VS986 (with Smart Cover) |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| Tester:                                                                                                                                                                                                                                                                   |              | Jude Semana                       |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| Date:                                                                                                                                                                                                                                                                     |              | 4/13/2015                         |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| Frequency<br>(MHz)                                                                                                                                                                                                                                                        | PK<br>(dBuV) | QP<br>(dBuV)                      | AV<br>(dBuV) | AF<br>dB/m | Distance<br>(m) | Distance<br>Correction (dB) | PK Corrected<br>Reading (dBuV/m) | AV Corrected<br>Reading (dBuV/m) | QP Limit<br>(dBuV/m) | AV Limit<br>(dBuV/m) | PK Margin<br>(dB) | AV Margin<br>(dB) | Notes                           |
| Loop Antenna Face On: Z Position                                                                                                                                                                                                                                          |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| Fundamental Field Strength & Within Bands:                                                                                                                                                                                                                                |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| 13.56                                                                                                                                                                                                                                                                     | 65.24        | --                                | --           | 10.56      | 1               | -59.08                      | 16.71                            | --                               | 84.00                | --                   | -67.3             | --                | Fundamental @ 30m Dist          |
| 13.454                                                                                                                                                                                                                                                                    | 48.03        | --                                | --           | 10.55      | 1               | -59.08                      | -0.51                            | --                               | 50.48                | --                   | -51.0             | --                | 13.41-13.553MHz Spurious @ 30m  |
| 13.553                                                                                                                                                                                                                                                                    | 55.02        | --                                | --           | 10.56      | 1               | -59.08                      | 6.49                             | --                               | 50.48                | --                   | -44.0             | --                | 13.41-13.553MHz Spurious @ 30m  |
| 13.567                                                                                                                                                                                                                                                                    | 56.81        | --                                | --           | 10.56      | 1               | -59.08                      | 8.28                             | --                               | 50.48                | --                   | -42.2             | --                | 13.567-13.710MHz Spurious @ 30m |
| 13.666                                                                                                                                                                                                                                                                    | 50.52        | --                                | --           | 10.57      | 1               | -59.08                      | 2.00                             | --                               | 40.51                | --                   | -38.5             | --                | 13.567-13.710MHz Spurious @ 30m |
| 13.137                                                                                                                                                                                                                                                                    | 36.41        | --                                | --           | 10.51      | 1               | -59.08                      | -12.16                           | --                               | 40.51                | --                   | -52.7             | --                | 13.110-13.410MHz Spurious @ 30m |
| 13.348                                                                                                                                                                                                                                                                    | 47.57        | --                                | --           | 10.53      | 1               | -59.08                      | -0.98                            | --                               | 40.51                | --                   | -41.5             | --                | 13.110-13.410MHz Spurious @ 30m |
| 13.772                                                                                                                                                                                                                                                                    | 44.62        | --                                | --           | 10.58      | 1               | -59.08                      | -3.89                            | --                               | 40.51                | --                   | -44.4             | --                | 13.710-14.010MHz Spurious @ 30m |
| 13.984                                                                                                                                                                                                                                                                    | 32.34        | --                                | --           | 10.6       | 1               | -59.08                      | -16.15                           | --                               | 29.54                | --                   | -45.7             | --                | 13.710-14.010MHz Spurious @ 30m |
| Loop Antenna Face Off: Z Position                                                                                                                                                                                                                                         |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| Fundamental Field Strength & Within Bands:                                                                                                                                                                                                                                |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| 13.56                                                                                                                                                                                                                                                                     | 61.67        | --                                | --           | 10.56      | 1               | -59.08                      | 13.14                            | --                               | 84.00                | --                   | -70.9             | --                | Fundamental @ 30m Dist          |
| 13.454                                                                                                                                                                                                                                                                    | 31.92        | --                                | --           | 10.55      | 1               | -59.08                      | -16.62                           | --                               | 50.48                | --                   | -67.1             | --                | 13.41-13.553MHz Spurious @ 30m  |
| 13.553                                                                                                                                                                                                                                                                    | 35.41        | --                                | --           | 10.56      | 1               | -59.08                      | -13.12                           | --                               | 50.48                | --                   | -63.6             | --                | 13.41-13.553MHz Spurious @ 30m  |
| 13.567                                                                                                                                                                                                                                                                    | 37.41        | --                                | --           | 10.56      | 1               | -59.08                      | -11.12                           | --                               | 50.48                | --                   | -61.6             | --                | 13.567-13.710MHz Spurious @ 30m |
| 13.665                                                                                                                                                                                                                                                                    | 30.24        | --                                | --           | 10.57      | 1               | -59.08                      | -18.28                           | --                               | 40.51                | --                   | -58.8             | --                | 13.567-13.710MHz Spurious @ 30m |
| 13.138                                                                                                                                                                                                                                                                    | 20.3         | --                                | --           | 10.51      | 1               | -59.08                      | -28.27                           | --                               | 40.51                | --                   | -68.8             | --                | 13.110-13.410MHz Spurious @ 30m |
| 13.348                                                                                                                                                                                                                                                                    | 28.17        | --                                | --           | 10.53      | 1               | -59.08                      | -20.38                           | --                               | 40.51                | --                   | -60.9             | --                | 13.110-13.410MHz Spurious @ 30m |
| 13.772                                                                                                                                                                                                                                                                    | 25.88        | --                                | --           | 10.58      | 1               | -59.08                      | -22.63                           | --                               | 40.51                | --                   | -63.1             | --                | 13.710-14.010MHz Spurious @ 30m |
| 13.983                                                                                                                                                                                                                                                                    | 19.79        | --                                | --           | 10.6       | 1               | -59.08                      | -28.70                           | --                               | 29.54                | --                   | -58.2             | --                | 13.710-14.010MHz Spurious @ 30m |
| Loop Antenna Face On: Z Position                                                                                                                                                                                                                                          |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| Spurious Emissions 9kHz - 490kHz:                                                                                                                                                                                                                                         |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| 0.01                                                                                                                                                                                                                                                                      | 61.56        | --                                | --           | 18.7       | 1               | -99.08                      | -18.82                           | -18.82                           | 67.60                | 47.60                | -86.4             | -66.4             | 9kHz-10kHz Spurious @ 30m       |
| 0.1                                                                                                                                                                                                                                                                       | 50.8         | --                                | --           | 10.5       | 1               | -99.08                      | -37.78                           | -37.78                           | 47.60                | 27.60                | -85.4             | -65.4             | 10kHz-100kHz Spurious @ 30m     |
| 0.109                                                                                                                                                                                                                                                                     | 50.291       | --                                | --           | 10.49      | 1               | -99.08                      | -38.30                           | -38.30                           | 46.86                | 26.86                | -85.2             | -65.2             | 100kHz-489kHz Spurious @ 30m    |
| Spurious Emissions 490kHz - 30MHz:                                                                                                                                                                                                                                        |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| 0.49                                                                                                                                                                                                                                                                      | 36.06        | --                                | --           | 10.21      | 1               | -59.08                      | -12.82                           | --                               | 33.80                | --                   | -46.6             | --                | 489kHz-490kHz Spurious @ 30m    |
| 1                                                                                                                                                                                                                                                                         | 29.11        | --                                | --           | 10.3       | 1               | -59.08                      | -19.67                           | --                               | 27.60                | --                   | -47.3             | --                | 490kHz-1MHz Spurious @ 30m      |
| 1.366                                                                                                                                                                                                                                                                     | 27.91        | --                                | --           | 10.28      | 1               | -59.08                      | -20.89                           | --                               | 24.90                | --                   | -45.8             | --                | 1MHz-1.705MHz Spurious @ 30 m   |
| 4.133                                                                                                                                                                                                                                                                     | 25.06        | --                                | --           | 10.2       | 1               | -59.08                      | -23.82                           | --                               | 29.54                | --                   | -53.4             | --                | 1.705MHz-5MHz Spurious @ 30m    |
| 6.27                                                                                                                                                                                                                                                                      | 17.796       | --                                | --           | 10.2       | 1               | -59.08                      | -31.09                           | --                               | 29.54                | --                   | -60.6             | --                | 5-10MHz Spurious @ 30m          |
| 24.05                                                                                                                                                                                                                                                                     | 32           | --                                | --           | 9.49       | 1               | -59.08                      | -17.59                           | --                               | 29.54                | --                   | -47.1             | --                | 20-30MHz Spurious @ 30m         |
| * No more emissions were found up to 30MHz                                                                                                                                                                                                                                |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| Note: The emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 10000Mhz. Radiated emission limits in these three bands are based on measurements employing an average detector. |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| P.K. = Peak                                                                                                                                                                                                                                                               |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| Q.P. = Quasi Peak Readings                                                                                                                                                                                                                                                |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| A.F. = Antenna factor                                                                                                                                                                                                                                                     |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |
| Rev. 11.21.14                                                                                                                                                                                                                                                             |              |                                   |              |            |                 |                             |                                  |                                  |                      |                      |                   |                   |                                 |

## 8.2. TX SPURIOUS EMISSION 30 TO 1000 MHz

### EMI PLOT



## Trace Markers

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AF T899 (dB/m) | Amp Cbl (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degr) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|--------------|----------------------------|--------------------|-------------|----------------|-------------|----------|
| 2      | * 136.845       | 35.07                | PK  | 16.5           | -30.1        | 21.47                      | 43.52              | -22.05      | 0-360          | 201         | H        |
| 5      | 40.6675         | 33.1                 | PK  | 16.8           | -31.1        | 18.8                       | 40                 | -21.2       | 0-360          | 100         | V        |
| 1      | 58.7725         | 37.59                | PK  | 10.5           | -30.9        | 17.19                      | 40                 | -22.81      | 0-360          | 201         | H        |
| 6      | 79.98           | 34.71                | PK  | 10.3           | -30.7        | 14.31                      | 40                 | -25.69      | 0-360          | 100         | V        |
| 7      | 189.8425        | 32.4                 | PK  | 14.3           | -29.8        | 16.9                       | 43.52              | -26.62      | 0-360          | 100         | V        |
| 3      | 194.645         | 42.04                | PK  | 14.7           | -29.6        | 27.14                      | 43.52              | -16.38      | 0-360          | 98          | H        |
| 4      | 390.3           | 42.09                | PK  | 18.2           | -28.4        | 31.89                      | 46.02              | -14.13      | 0-360          | 301         | H        |
| 8      | 536.1           | 29.62                | PK  | 20.9           | -27.8        | 22.72                      | 46.02              | -23.3       | 0-360          | 301         | V        |

\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

## 9. AC MAINS LINE CONDUCTED EMISSIONS

### LIMITS

§15.207

IC RSS-GEN, Section 8.8

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

| Frequency range<br>(MHz) | Limits (dB $\mu$ V) |          |
|--------------------------|---------------------|----------|
|                          | Quasi-peak          | Average  |
| 0.15 to 0.50             | 66 to 56            | 56 to 46 |
| 0.50 to 5                | 56                  | 46       |
| 5 to 30                  | 60                  | 50       |

Notes:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### TEST PROCEDURE

ANSI C63.10-2013

### RESULTS

No non-compliance noted:

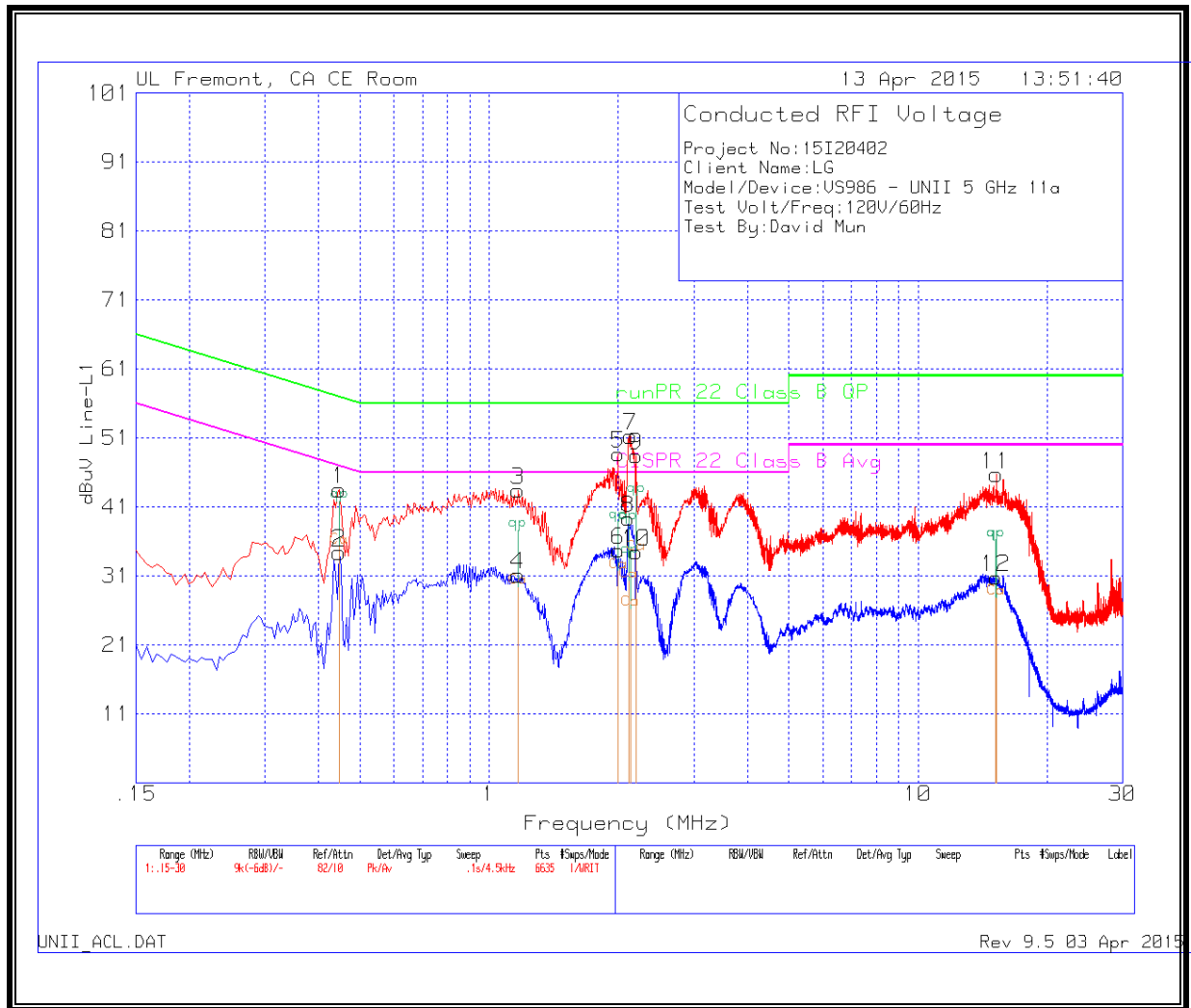
## 6 WORST EMISSIONS

| Range 1: Line-L1 .15 - 30MHz |                 |                      |     |           |               |                        |                     |             |                      |             |
|------------------------------|-----------------|----------------------|-----|-----------|---------------|------------------------|---------------------|-------------|----------------------|-------------|
| Marker                       | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L1 | LC Cables 1&3 | Corrected Reading dBuV | runPR 22 Class B QP | Margin (dB) | CISPR 22 Class B Avg | Margin (dB) |
| 1                            | .447            | 43.11                | Pk  | .4        | 0             | 43.51                  | 56.93               | -13.42      | -                    | -           |
| 2                            | .447            | 34.02                | Av  | .4        | 0             | 34.42                  | -                   | -           | 46.93                | -12.51      |
| 3                            | 1.167           | 43.13                | Pk  | .2        | .1            | 43.43                  | 56                  | -12.57      | -                    | -           |
| 4                            | 1.167           | 30.83                | Av  | .2        | .1            | 31.13                  | -                   | -           | 46                   | -14.87      |
| 5                            | 1.9995          | 48.4                 | Pk  | .2        | .1            | 48.7                   | 56                  | -7.3        | -                    | -           |
| 6                            | 1.9995          | 34.41                | Av  | .2        | .1            | 34.71                  | -                   | -           | 46                   | -11.29      |
| 7                            | 2.1345          | 50.98                | Pk  | .2        | .1            | 51.28                  | 56                  | -4.72       | -                    | -           |
| 8                            | 2.112           | 39.06                | Av  | .2        | .1            | 39.36                  | -                   | -           | 46                   | -6.64       |
| 9                            | 2.202           | 48.14                | Pk  | .2        | .1            | 48.44                  | 56                  | -7.56       | -                    | -           |
| 10                           | 2.202           | 34.16                | Av  | .2        | .1            | 34.46                  | -                   | -           | 46                   | -11.54      |
| 11                           | 15.2205         | 45.22                | Pk  | .3        | .2            | 45.72                  | 60                  | -14.28      | -                    | -           |
| 12                           | 15.189          | 30.31                | Av  | .3        | .2            | 30.81                  | -                   | -           | 50                   | -19.19      |
| Range 2: Line-L2 .15 - 30MHz |                 |                      |     |           |               |                        |                     |             |                      |             |
| Marker                       | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L2 | LC Cables 2&3 | Corrected Reading dBuV | runPR 22 Class B QP | Margin (dB) | CISPR 22 Class B Avg | Margin (dB) |
| 13                           | .4515           | 38.82                | Pk  | .4        | 0             | 39.22                  | 56.85               | -17.63      | -                    | -           |
| 14                           | .4515           | 27.68                | Av  | .4        | 0             | 28.08                  | -                   | -           | 46.85                | -18.77      |
| 15                           | 1.1265          | 40.42                | Pk  | .3        | .1            | 40.82                  | 56                  | -15.18      | -                    | -           |
| 16                           | 1.1265          | 24.64                | Av  | .3        | .1            | 25.04                  | -                   | -           | 46                   | -20.96      |
| 17                           | 2.022           | 43.28                | Pk  | .2        | .1            | 43.58                  | 56                  | -12.42      | -                    | -           |
| 18                           | 1.986           | 27.76                | Av  | .2        | .1            | 28.06                  | -                   | -           | 46                   | -17.94      |
| 19                           | 2.0805          | 39.22                | Pk  | .2        | .1            | 39.52                  | 56                  | -16.48      | -                    | -           |
| 20                           | 2.0895          | 23.85                | Av  | .2        | .1            | 24.15                  | -                   | -           | 46                   | -21.85      |
| 21                           | 2.247           | 39.47                | Pk  | .2        | .1            | 39.77                  | 56                  | -16.23      | -                    | -           |
| 22                           | 2.2425          | 23.19                | Av  | .2        | .1            | 23.49                  | -                   | -           | 46                   | -22.51      |
| 23                           | 14.856          | 38.67                | Pk  | .2        | .2            | 39.07                  | 60                  | -20.93      | -                    | -           |
| 24                           | 14.8515         | 22.35                | Av  | .2        | .2            | 22.75                  | -                   | -           | 50                   | -27.25      |

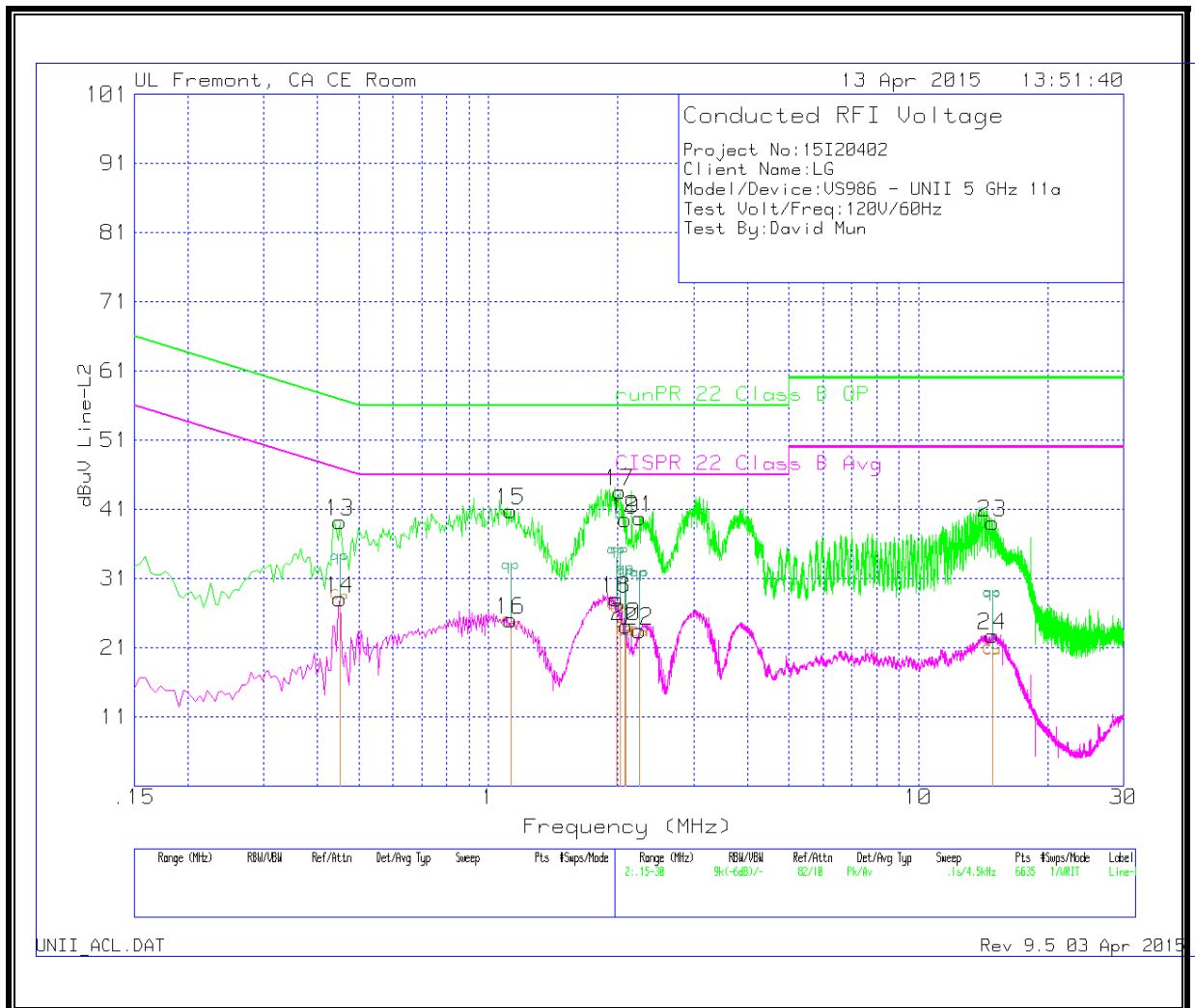
Pk - Peak detector

Av - Average detection

**LINE 1 RESULTS**



**LINE 2 RESULTS**



## 10. FREQUENCY STABILITY

### LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### TEST PROCEDURE

ANSI C63.4 Section 13

### RESULTS

No non-compliance noted.

| Reference Frequency: EUT Channel 13.560000 MHz @ 20°C |                                 |                                               |              |                             |
|-------------------------------------------------------|---------------------------------|-----------------------------------------------|--------------|-----------------------------|
| Limit: $\pm 100$ ppm = 1.356 kHz                      |                                 |                                               |              |                             |
| Power Supply<br>(Vdc)                                 | Environment<br>Temperature (°C) | Frequency Deviation Measured with Time Elapse |              |                             |
|                                                       |                                 | (MHz)                                         | Delta (ppm)  | Limit (ppm)                 |
| 3.80                                                  | 50                              | 13.5601000                                    | -7.375       | $\pm 100$                   |
| 3.80                                                  | 40                              | 13.5602000                                    | -14.749      | $\pm 100$                   |
| 3.80                                                  | 30                              | 13.5601200                                    | -8.850       | $\pm 100$                   |
| 3.80                                                  | <b>20</b>                       | <b>13.5600000</b>                             | <b>0.000</b> | <b><math>\pm 100</math></b> |
| 3.80                                                  | 10                              | 13.5601000                                    | -7.375       | $\pm 100$                   |
| 3.80                                                  | 0                               | 13.5602000                                    | -14.749      | $\pm 100$                   |
| 3.80                                                  | -10                             | 13.5601000                                    | -7.375       | $\pm 100$                   |
| 3.80                                                  | -20                             | 13.5604000                                    | -29.499      | $\pm 100$                   |
| 3.80                                                  | -30                             | 13.5602000                                    | -14.749      | $\pm 100$                   |
| End of volt 3.3                                       | 20                              | 13.5599000                                    | 7.375        | $\pm 100$                   |
| 4.37                                                  | 20                              | 13.5598000                                    | 14.749       | $\pm 100$                   |