



FCC CFR47 PART 15 SUBPART C
BLUETOOTH LOW ENERGY
C2PC CERTIFICATION TEST REPORT
FOR

GSM/WCDMA/LTE Phone + Bluetooth & DTS b/g/n

MODEL NUMBER: LGL31L, L31L, LG-L31L

FCC ID: ZNFL31L

REPORT NUMBER: 14U17021-3

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Prepared for
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: LG ELECTRONICS MOBILECOMM U.S.A., INC.

EUT DESCRIPTION: GSM/WCDMA/LTE Phone + Bluetooth & DTS b/g/n

MODEL: LGL31L, L31L, LG-L31L

SERIAL NUMBER: 1792208-VS

DATE TESTED: MARCH 27, 2014

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	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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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

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:

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

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 18000 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/LTE Phone + Bluetooth & DTS b/g/n.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402-2480	BLE	2.02	1.59

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of 0.1dBi.

5.4. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	LG	N/A	N/A	N/A
Earphone	LG	N/A	N/A	N/A

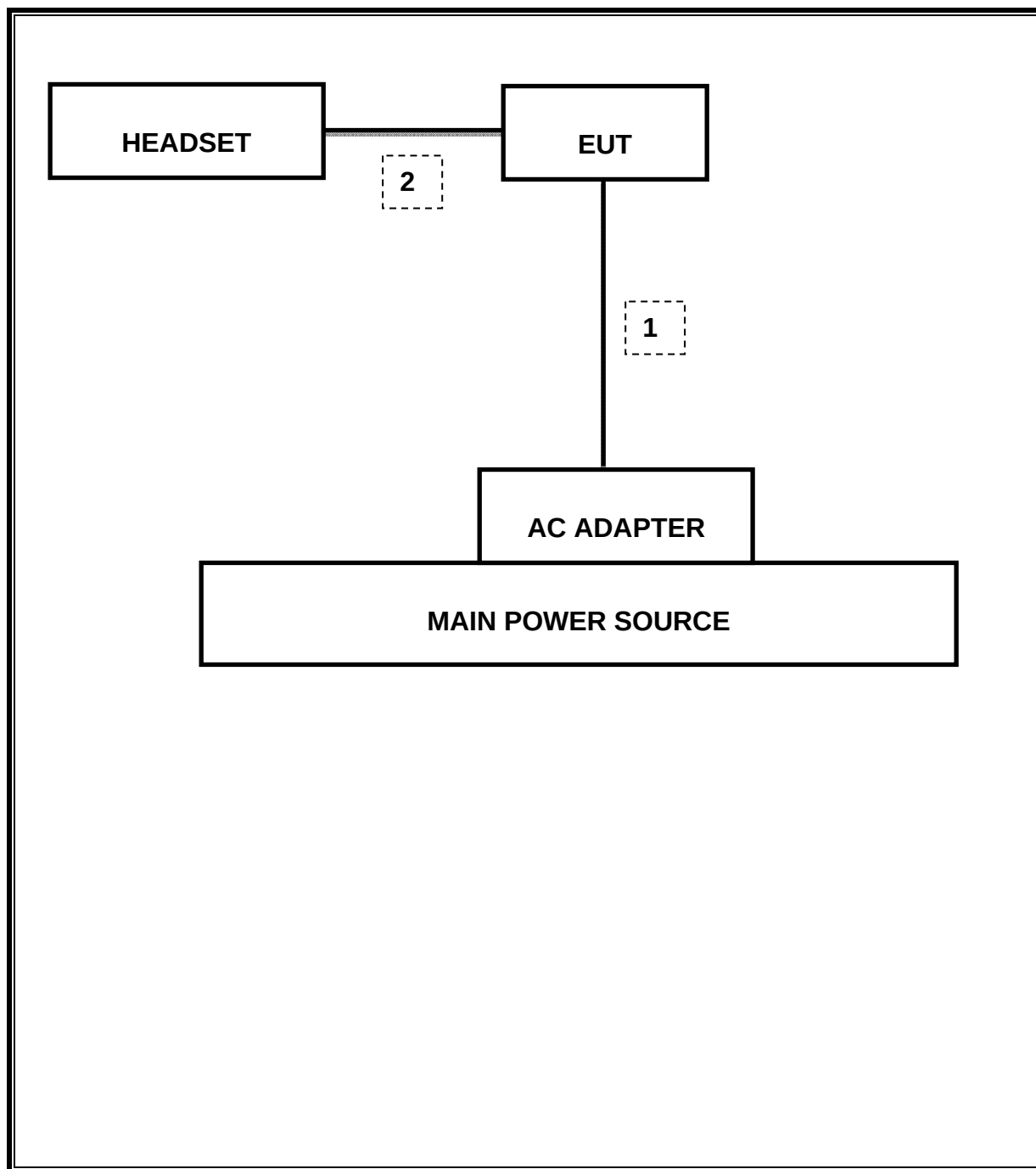
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Mini-USB	Shielded	1.2m	N/A
2	Audio	1	Mini-Jack	Unshielded	1m	N/A

TEST SETUP

The EUT is continuously communicating to the Bluetooth tester during the tests. EUT was set in the Hidden menu mode to enable BLE communications.

SETUP DIAGRAM FOR TESTS



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
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	C01171	02/13/15
Antenna, Horn, 18GHz	EMCO	3115	C00783	10/25/14
Antenna, Horn, 25.5 GHz	ARA	MWH-1826/B	C00980	11/14/14
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	01/28/15
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	10/22/14
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/20/14
CBT Bluetooth Tester	R & S	CBT	None	07/12/14
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/14
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/14
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/15
Reject Filter, 2.4GHz	Micro-Tronics	BRM50702	N02684	CNR

7. SUMMARY

FCC Part Section	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Worst Case
15.247 (a)(2)	RSS-210 A8.2(a)	Occupied Band width (6dB)	>500KHz	Conducted	Pass	See original
2.1051, 15.247 (d)	RSS-210 A8.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass	See original
15.247	RSS-210 A8.4	TX conducted output power	<30dBm		Pass	See original
15.247	RSS-210 A8.2	PSD	<8dBm		Pass	See original
15.207 (a)	RSS-GEN 7.2.2	AC Power Line conducted emissions	Section 10	Radiated	Pass	See original
15.205, 15.209	RSS-210 Clause 2.6, RSS-210 Clause 6	Radiated Spurious Emission	< 54dBuV/m		Pass	43.78 dBuV/m

8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4 - 2009. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and add duty cycle factor for average measurements. Duty cycle factor = $10 \log (1/x)$. For this sample: DCF = $10 \log (1/x) = 2.1 \text{ dB}$

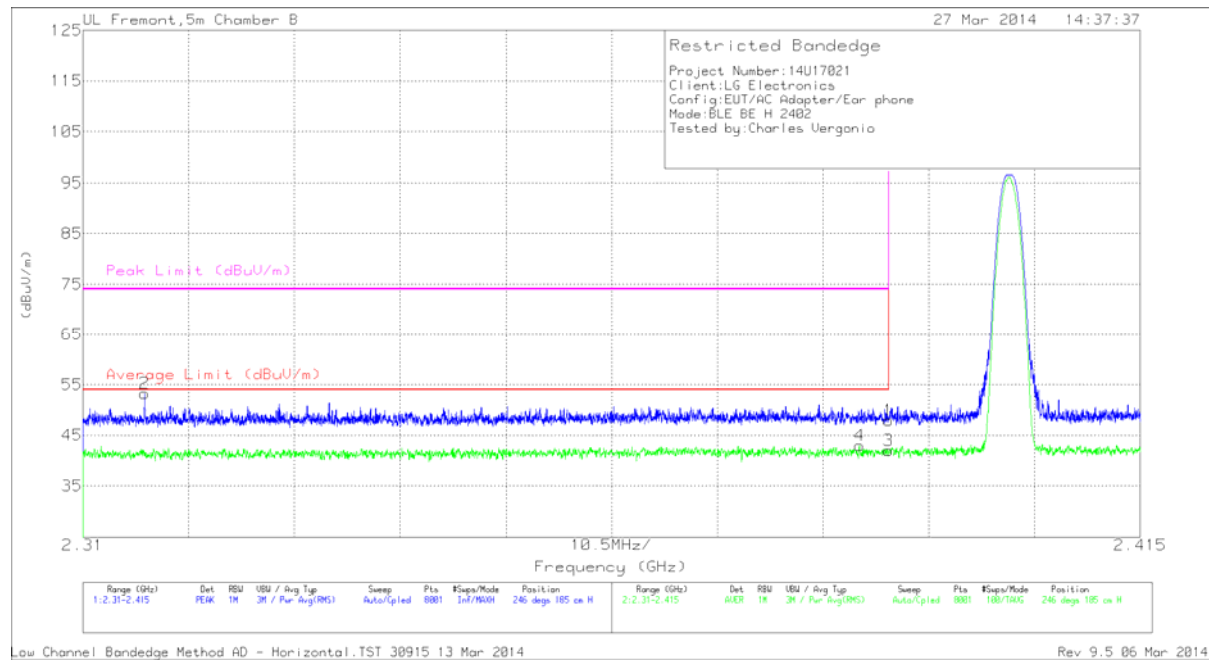
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

8.2. TRANSMITTER ABOVE 1 GHz

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



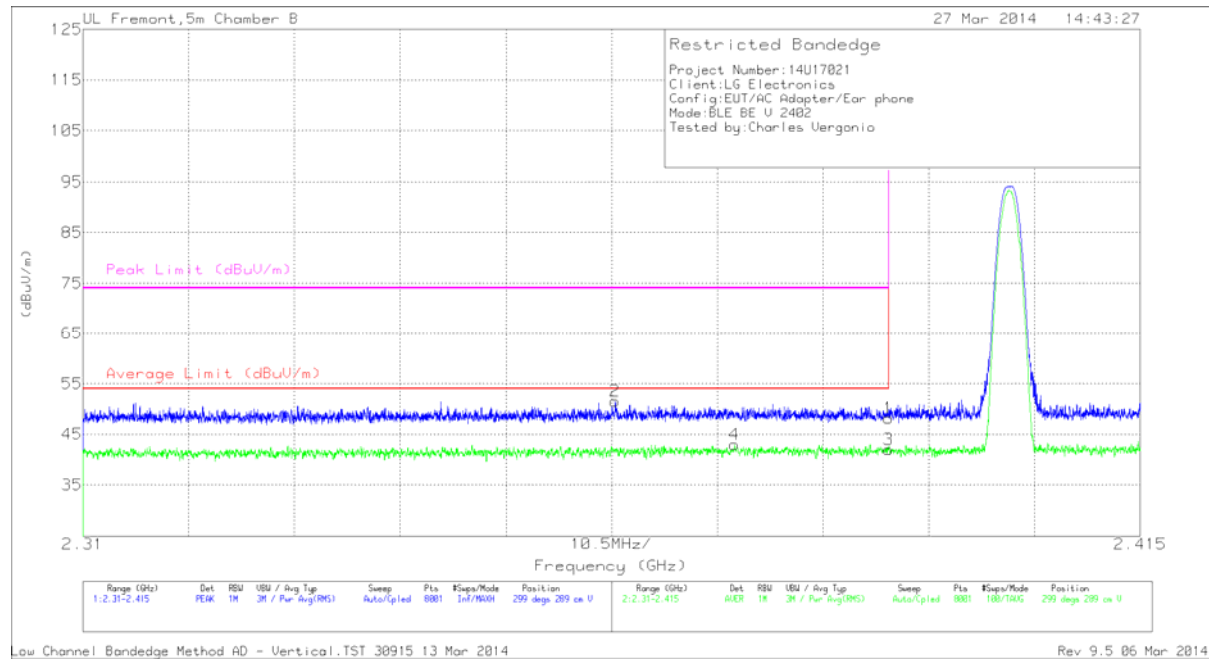
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*2.39	38.75	PK	32.1	-22.9	0	47.95	-	-	74	-26.05	246	185	H
2	*2.316	44.57	PK	31.7	-23	0	53.27	-	-	74	-20.73	246	185	H
3	*2.39	30.66	RMS	32.1	-22.9	2.1	41.96	54	-12.04	-	-	246	185	H
4	*2.387	31.71	RMS	32.1	-22.9	2.1	43.01	54	-10.99	-	-	246	185	H

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

PK - Peak detector

RMS - RMS detection

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



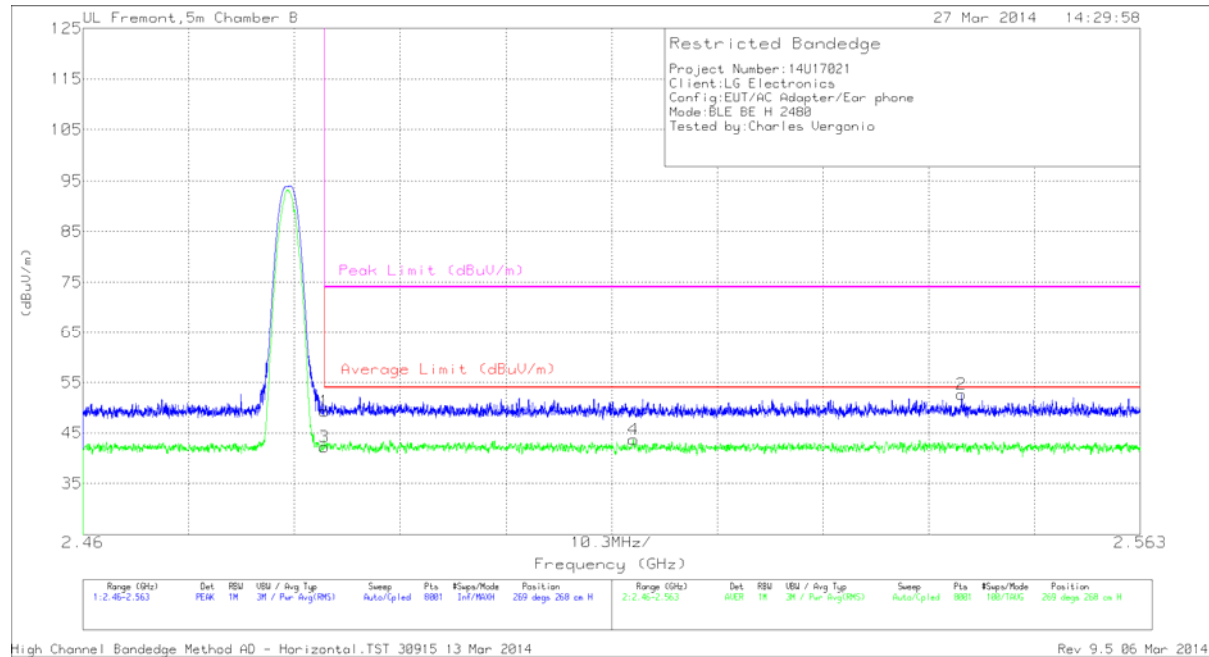
Marker	Frequenc y (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/FI tri/Pad (dB)	DC Corr (dB)	Correcte d Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	38.99	PK	32.1	-22.9	0	48.19	-	-	74	-25.81	299	289	V
2	* 2.363	42.4	PK	32	-22.9	0	51.5	-	-	74	-22.5	299	289	V
3	* 2.39	30.65	RMS	32.1	-22.9	2.1	41.95	54	-12.05	-	-	299	289	V
4	* 2.375	31.63	RMS	32	-22.8	2.1	42.93	54	-11.07	-	-	299	289	V

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

PK - Peak detector

RMS - RMS detection

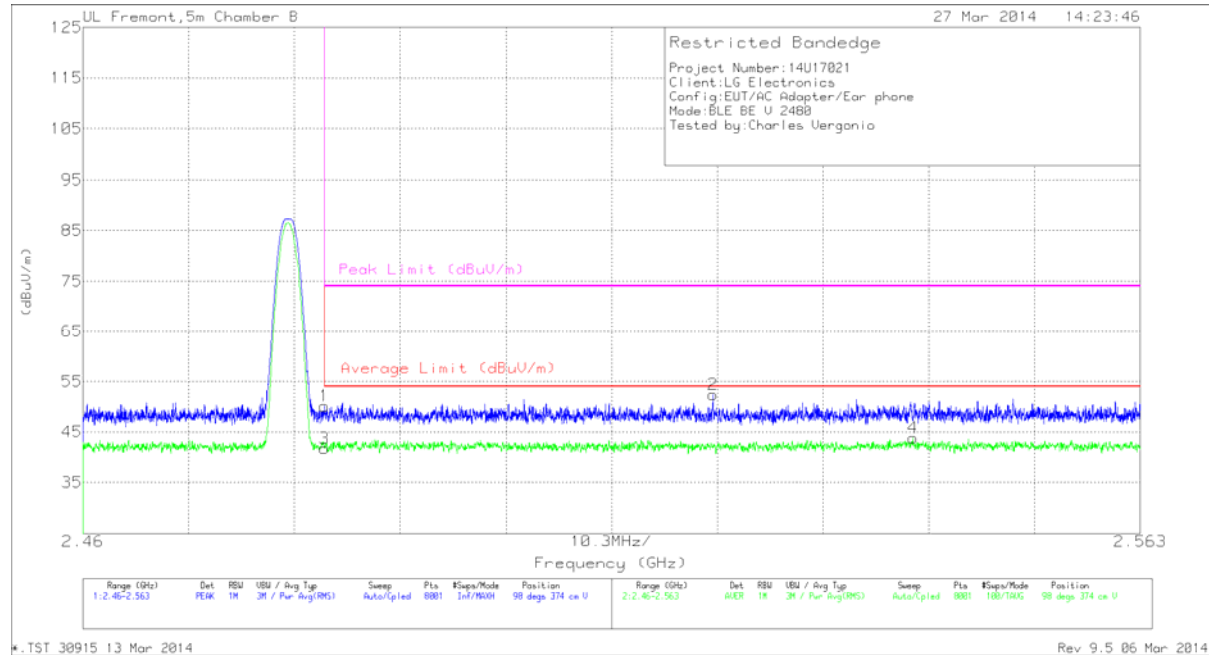
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Marker	Frequenc y (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	DC Corr (dB)	Correcte d Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	39.51	PK	32.4	-22.6	0	49.31	-	-	74	-24.69	269	268	H
3	* 2.484	30.28	RMS	32.4	-22.6	2.1	42.18	54	-11.82	-	-	269	268	H
4	2.514	31.92	RMS	32.5	-22.8	2.1	43.72	54	-10.28	-	-	269	268	H
2	2.546	42.79	PK	32.5	-22.6	0	52.69	-	-	74	-21.31	269	268	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector
RMS - RMS detection

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Marker	Frequenc y (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	DC Corr (dB)	Correcte d Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.31	PK	32.4	-22.6	0	50.11	-	-	74	-23.89	98	374	V
3	* 2.484	29.78	RMS	32.4	-22.6	2.1	41.68	54	-12.32	-	-	98	374	V
2	2.521	42.65	PK	32.5	-22.6	0	52.35	-	-	74	-21.65	98	374	V
4	2.541	31.68	RMS	32.5	-22.5	2.1	43.78	54	-10.22	-	-	98	374	V

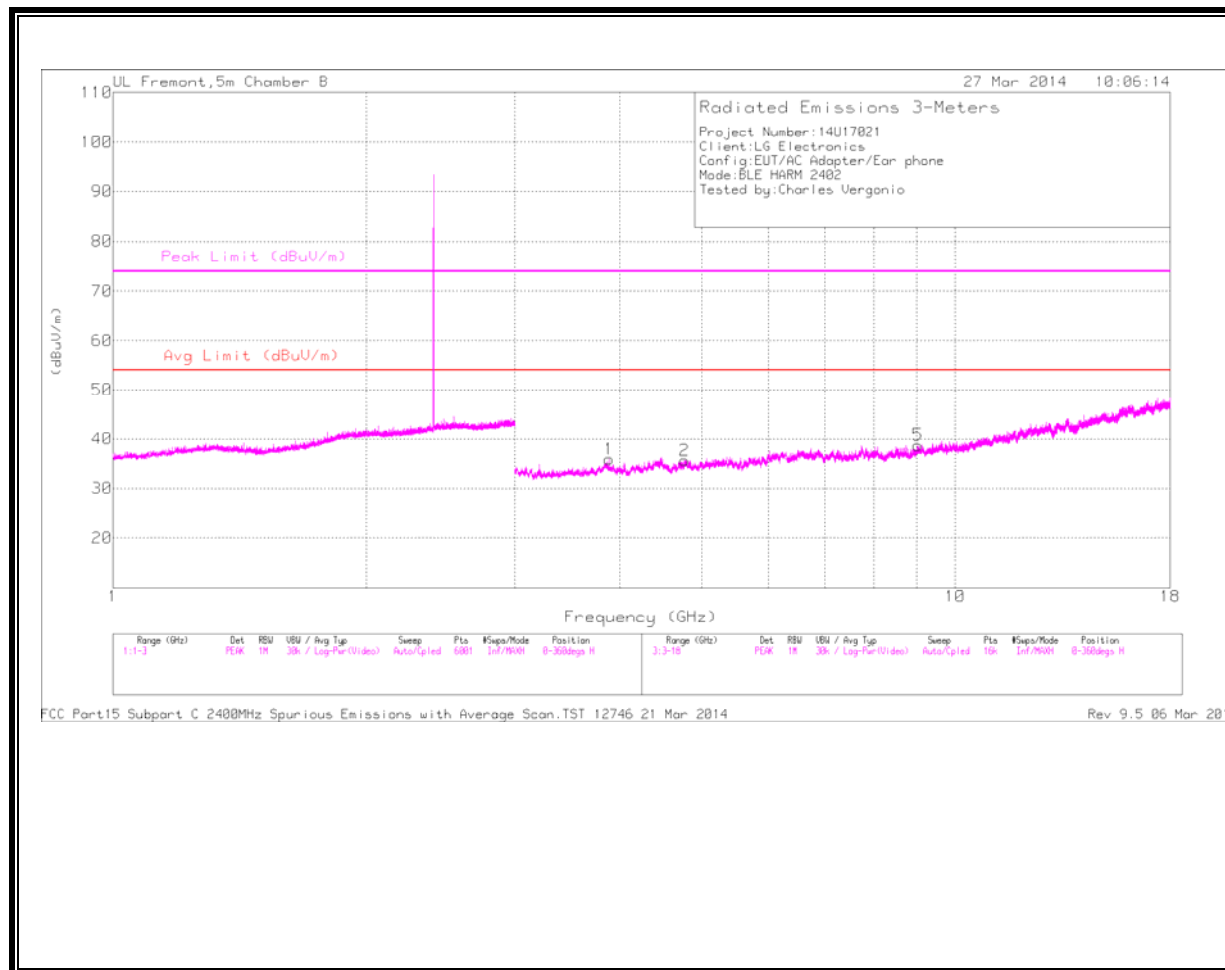
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

RMS - RMS detection

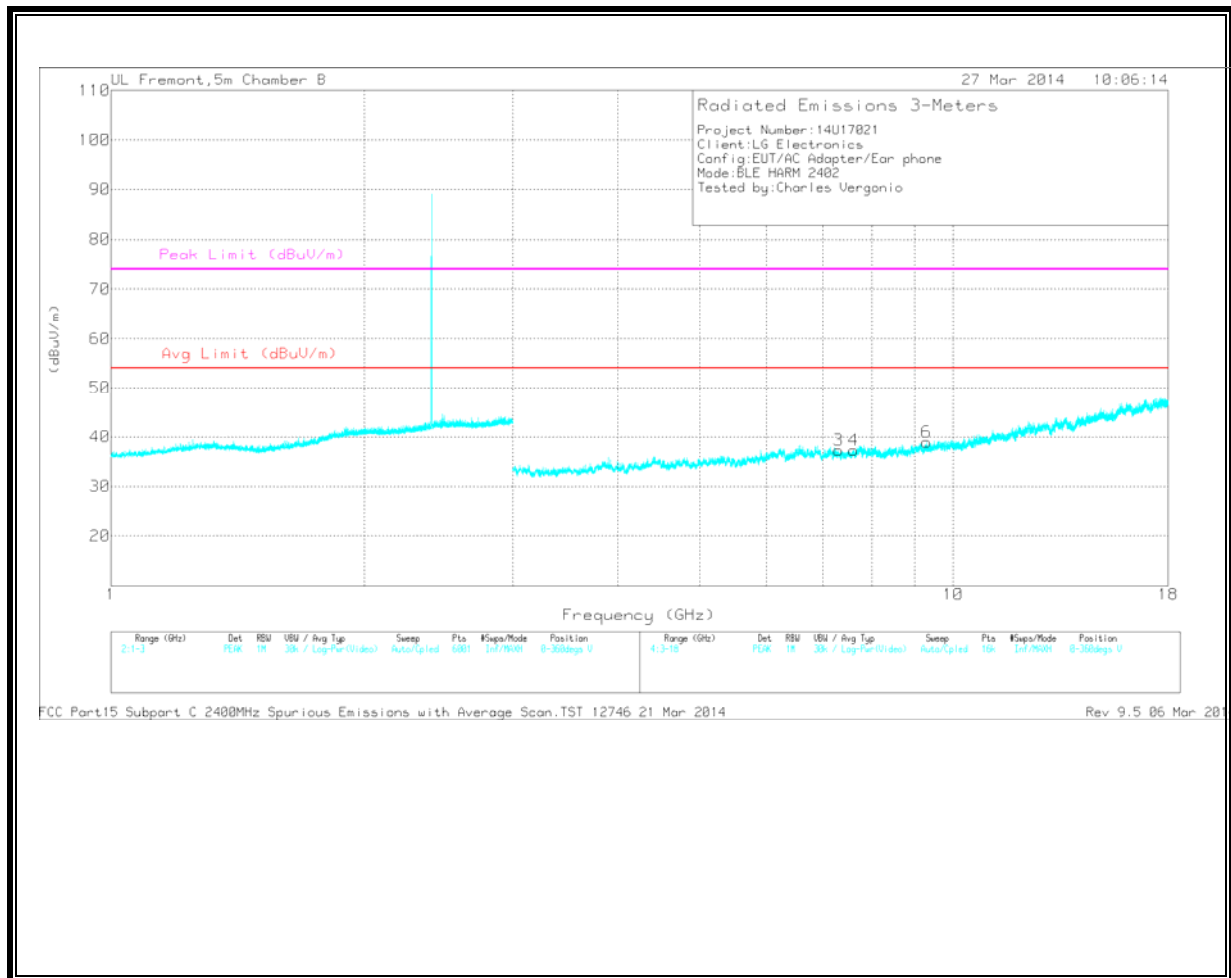
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

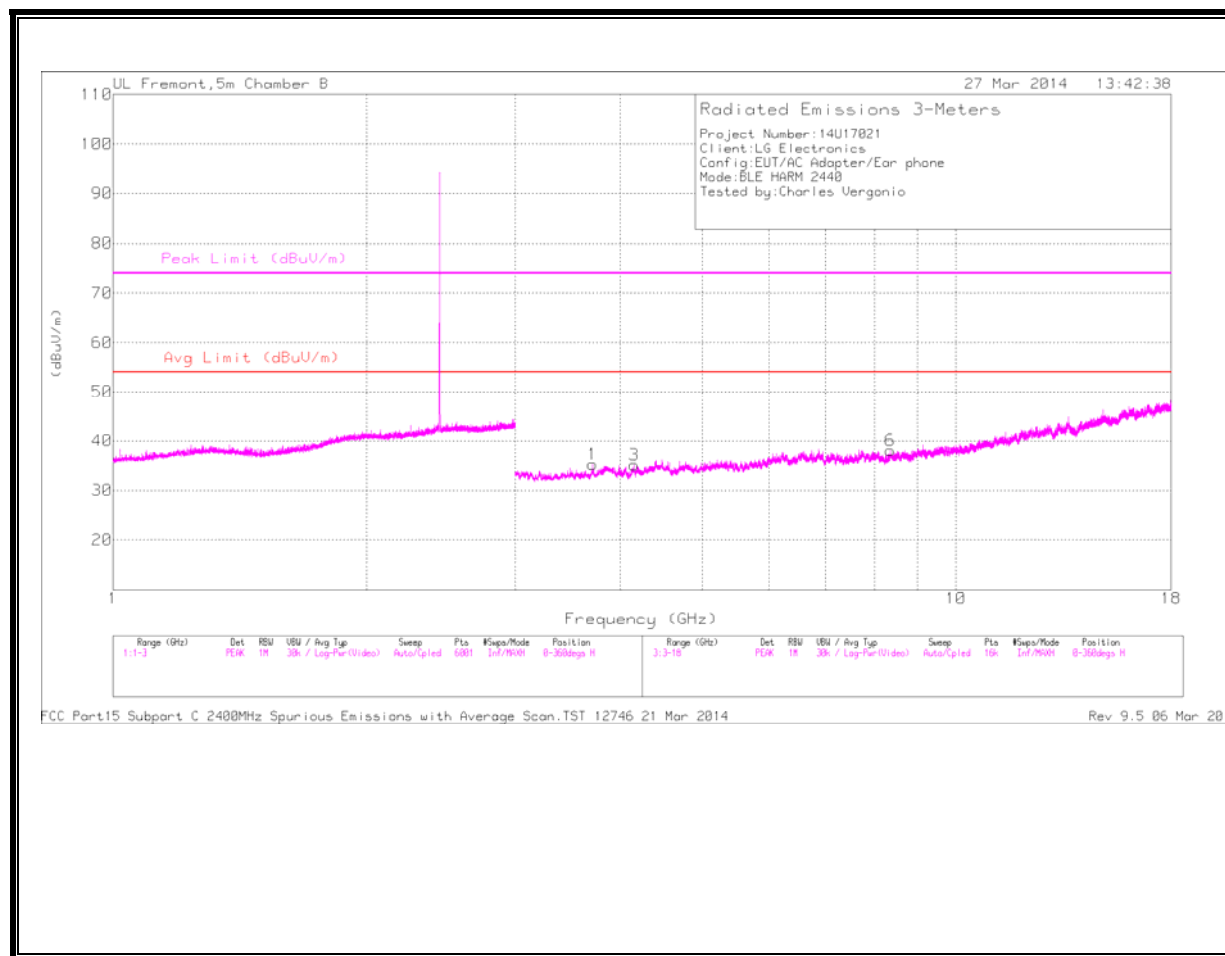
LOW CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.881	32.27	PK	33.8	-30.2	35.87	54	-18.13	74	-38.13	0-360	99	H
2	* 4.775	30.8	PK	34.2	-29.3	35.7	54	-18.3	74	-38.3	0-360	99	H
5	* 9.032	27.46	PK	36.2	-24.9	38.76	54	-15.24	74	-35.24	0-360	202	H
3	* 7.312	29.41	PK	35.6	-27.7	37.31	54	-16.69	74	-36.69	0-360	202	V
4	* 7.619	29.34	PK	35.7	-27.7	37.34	54	-16.66	74	-36.66	0-360	202	V
6	* 9.305	27.23	PK	36.4	-24.7	38.93	54	-15.07	74	-35.07	0-360	99	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector

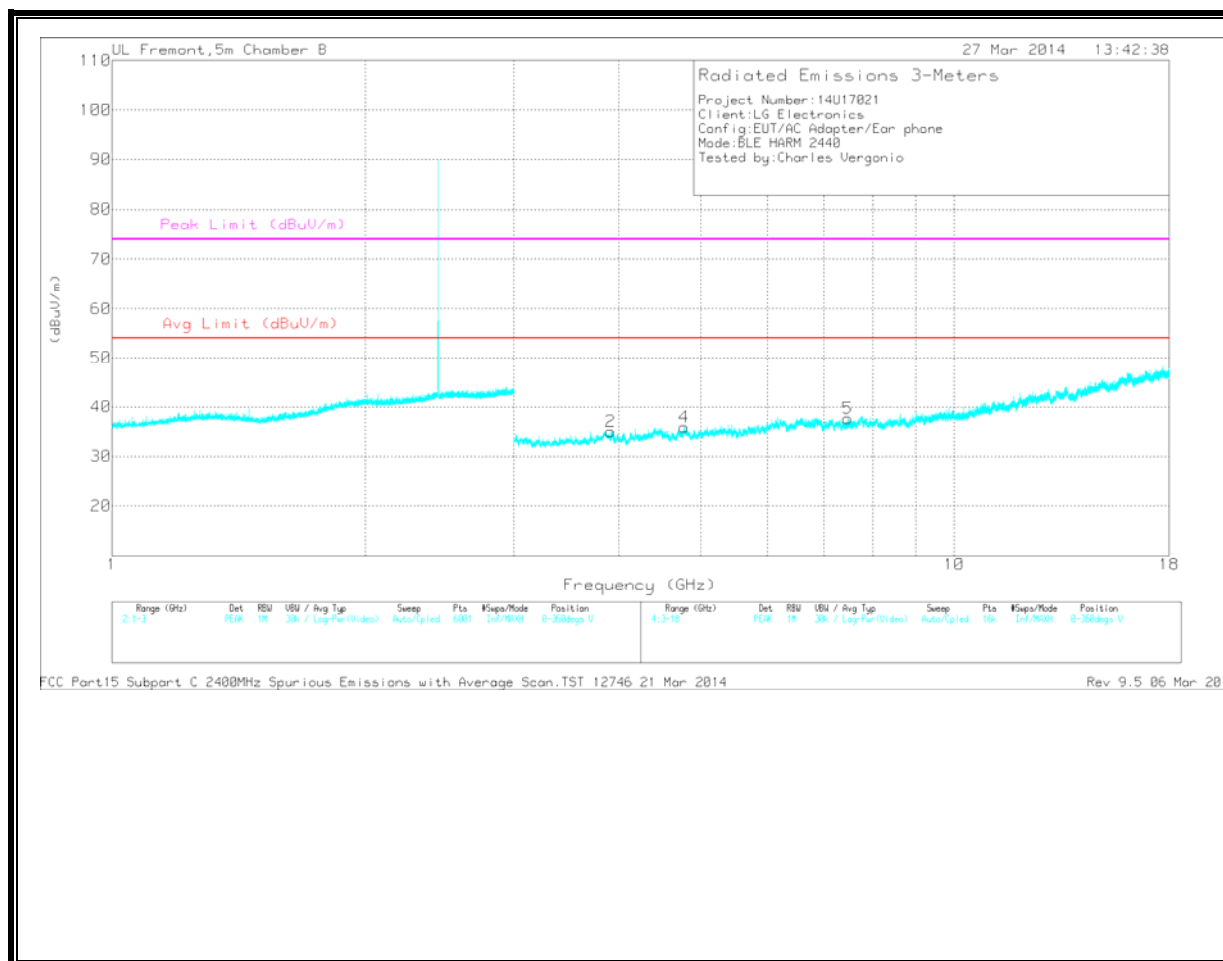
MID CHANNEL

HORIZONTAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

VERTICAL



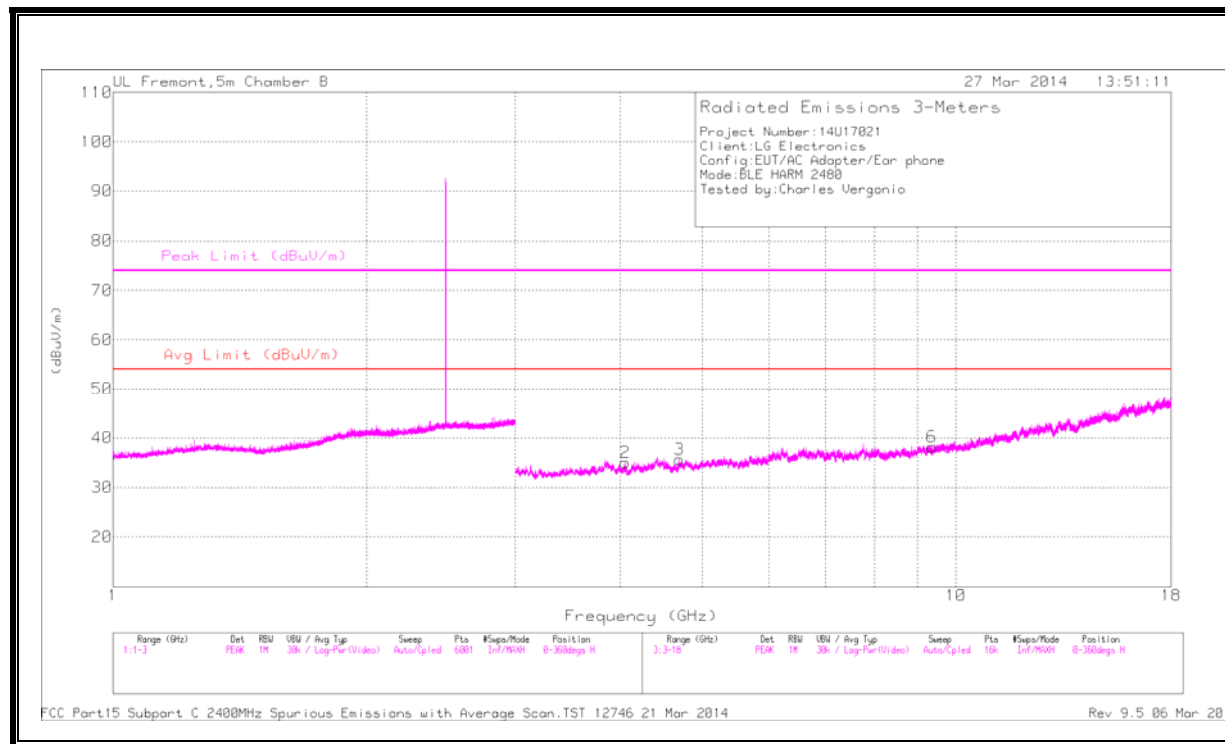
Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

MID CHANNEL DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/ Filt/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 3.708	32.95	PK	33.4	-31.1	35.25	54	-18.75	74	-38.75	0-360	202	H
3	* 4.153	31.36	PK	33.6	-29.8	35.16	54	-18.84	74	-38.84	0-360	99	H
6	* 8.364	27.77	PK	35.7	-25.4	38.07	54	-15.93	74	-35.93	0-360	202	H
2	* 3.908	31.85	PK	33.8	-30.6	35.05	54	-18.95	74	-38.95	0-360	99	V
4	* 4.781	30.69	PK	34.2	-29	35.89	54	-18.11	74	-38.11	0-360	99	V
5	* 7.473	28.87	PK	35.6	-26.8	37.67	54	-16.33	74	-36.33	0-360	99	V

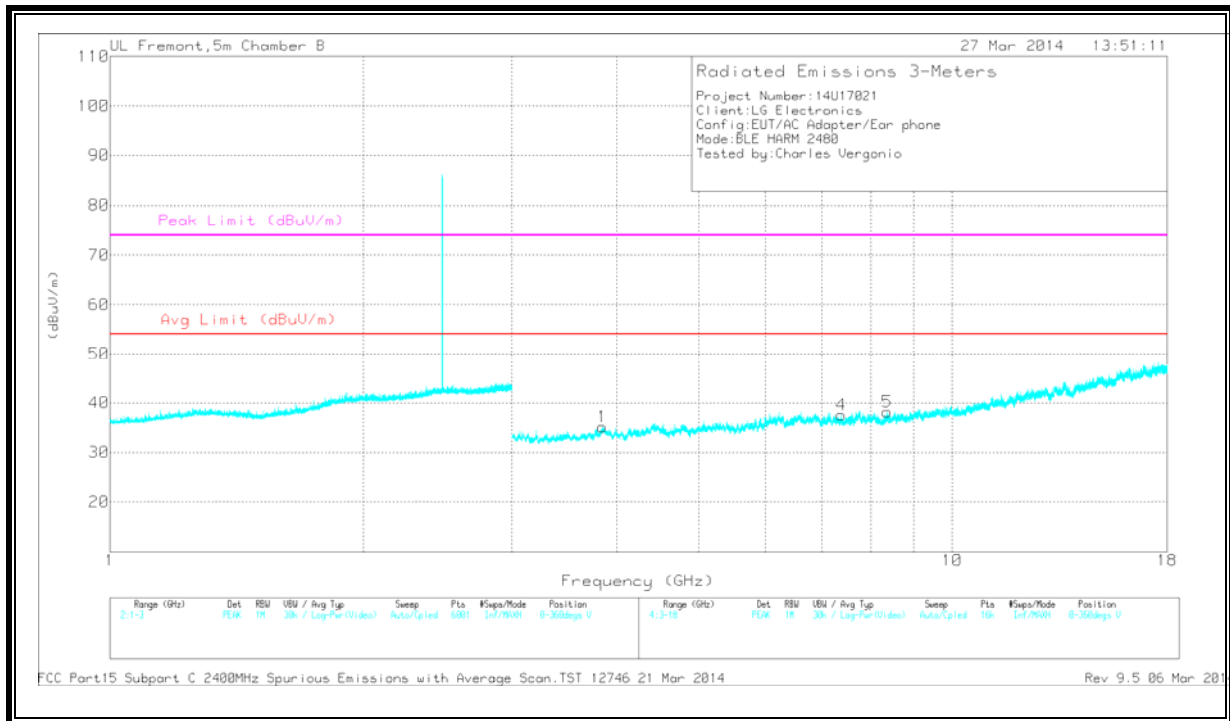
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector

HIGH CHANNEL
HORIZONTAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

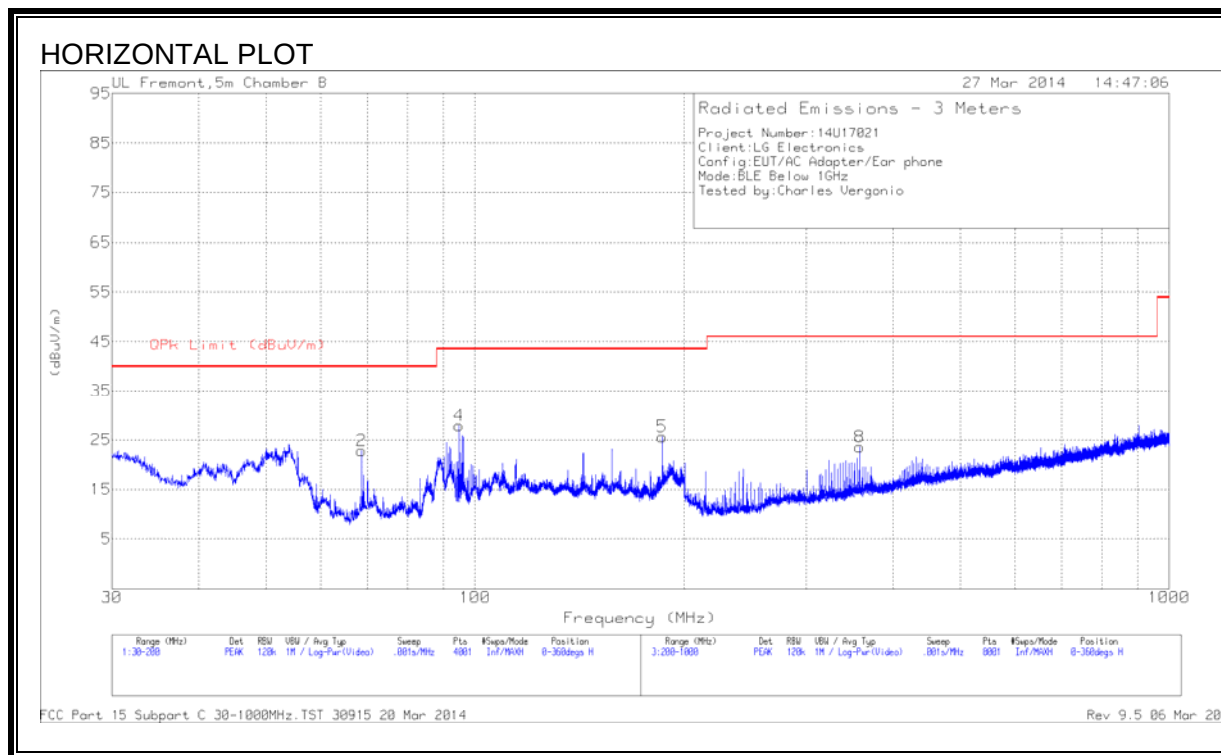
HIGH CHANNEL DATA

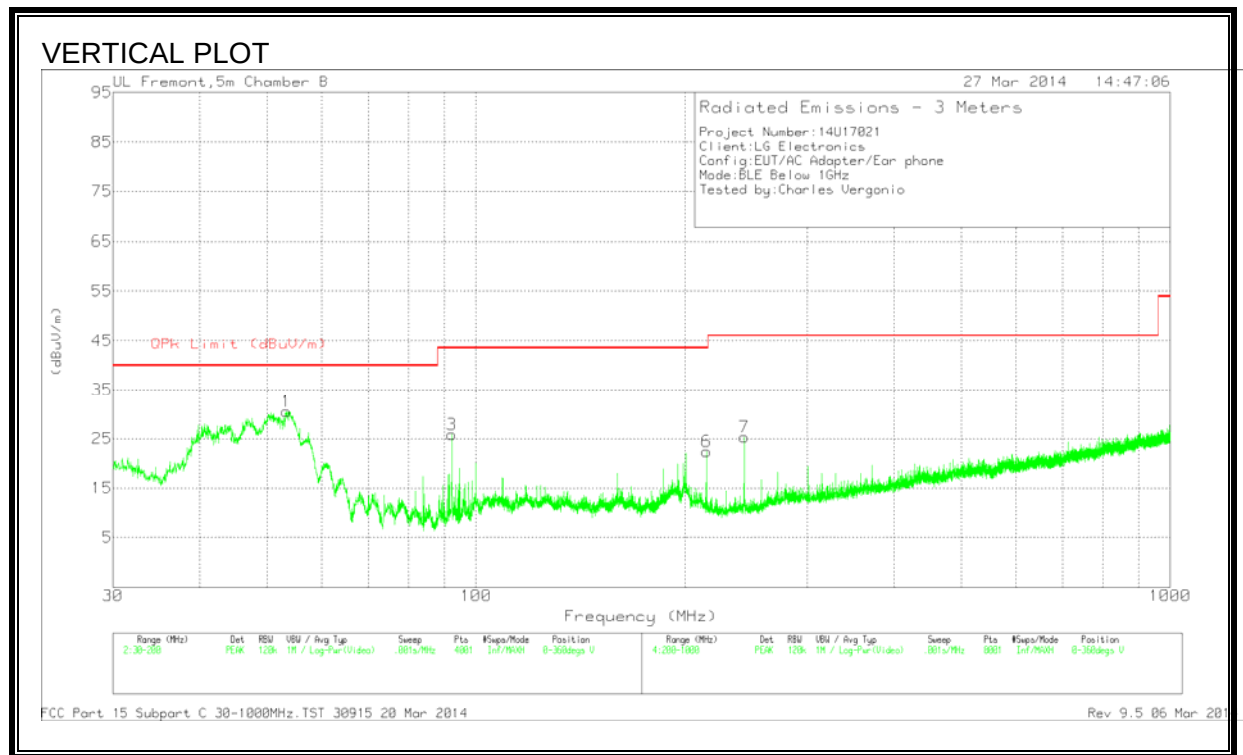
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T345 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 4.056	32.23	PK	33.6	-30.8	35.03	54	-18.97	74	-38.97	0-360	99	H
3	* 4.697	31.31	PK	34.2	-29.9	35.61	54	-18.39	74	-38.39	0-360	202	H
6	* 9.358	26.24	PK	36.5	-24.6	38.14	54	-15.86	74	-35.86	0-360	99	H
1	* 3.84	31.63	PK	33.7	-30.2	35.13	54	-18.87	74	-38.87	0-360	99	V
4	* 7.391	29.34	PK	35.6	-27.4	37.54	54	-16.46	74	-36.46	0-360	202	V
5	* 8.37	27.98	PK	35.7	-25.5	38.18	54	-15.82	74	-35.82	0-360	99	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
PK - Peak detector

8.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)





Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	* 243.4	40.3	PK	11.5	-26.5	25.3	46.02	-20.72	0-360	200	V
1	53.3325	52.06	PK	7.1	-28.6	30.56	40	-9.44	0-360	101	V
2	68.6325	43.06	PK	8.1	-28.4	22.76	40	-17.24	0-360	200	H
3	92.305	45.78	PK	8.2	-28.1	25.88	43.52	-17.64	0-360	101	V
4	94.8125	47.15	PK	8.8	-28.1	27.85	43.52	-15.67	0-360	200	H
5	186.1025	41.46	PK	11.3	-27.1	25.66	43.52	-17.86	0-360	101	H
6	214.8	38.86	PK	10.4	-26.8	22.46	43.52	-21.06	0-360	200	V
8	357.9	34.65	PK	14.7	-25.8	23.55	46.02	-22.47	0-360	200	H

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

PK - Peak detector