



**FCC 47 CFR PART 15 SUBPART C  
CERTIFICATION TEST C2PC REPORT  
FOR**

**GSM850~1900 + WCDMA 850~1900 + LTE SMART PHONE  
with BLUETOOTH + BLE and WLAN 2.4GHz**

**MODEL NUMBER: LGMS659, LG-MS659, MS659, LG-P659,  
LGP659, P659**

**FCC ID: ZNFMS659**

**REPORT NUMBER: 13U14990-4**

**ISSUE DATE: May 16, 2013**

*Prepared for*  
**LG ELECTRONICS MOBILECOMM U.S.A., INC.  
1000 SYLVAN AVENUE  
ENGLEWOOD CLIFFS, NEW JERSEY 07632**

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**NVLAP LAB CODE 200065-0**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** LG ELECTRONICS MOBILECOMM U.S.A., INC.  
1000 SYLVAN AVENUE  
ENGLEWOOD CLIFFS, NEW JERSEY 07632

**EUT DESCRIPTION:** GSM850~1900 + WCDMA 850~1900 + LTE SMART PHONE with  
BLUETOOTH + BLE and WLAN 2.4GHz

**MODEL:** LGMS659, LG-MS659, MS659, LG-P659, LGP659, P659

**SERIAL NUMBER:** 302KPTM334913

**DATE TESTED:** May 15 – 16, 2013

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.

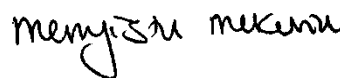
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. 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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UL Verification Services Inc.

Tested By:



MENGISTU MEKURIA  
WiSE EMC ENGINEER  
UL Verification Services Inc.

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2009, RSS-GEN Issue 3, and RSS-210 Issue 8.

## 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.ccssemc.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:

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

### 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 an LTE Phone with Bluetooth and WLAN capability that is manufactured by LG Electronics.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	BT LE	6.40	4.37

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an INTEGRATED antenna, with a maximum gain of -0.5 dBi.

### 5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was MS659\_LAP8930JR130425.

### 5.5. 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 Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation with AC adapter.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Power Adapter	LG	MCS-01WR	RB310020452	DoC
Headphones	Cresyn	EAB62410801	NA	NA

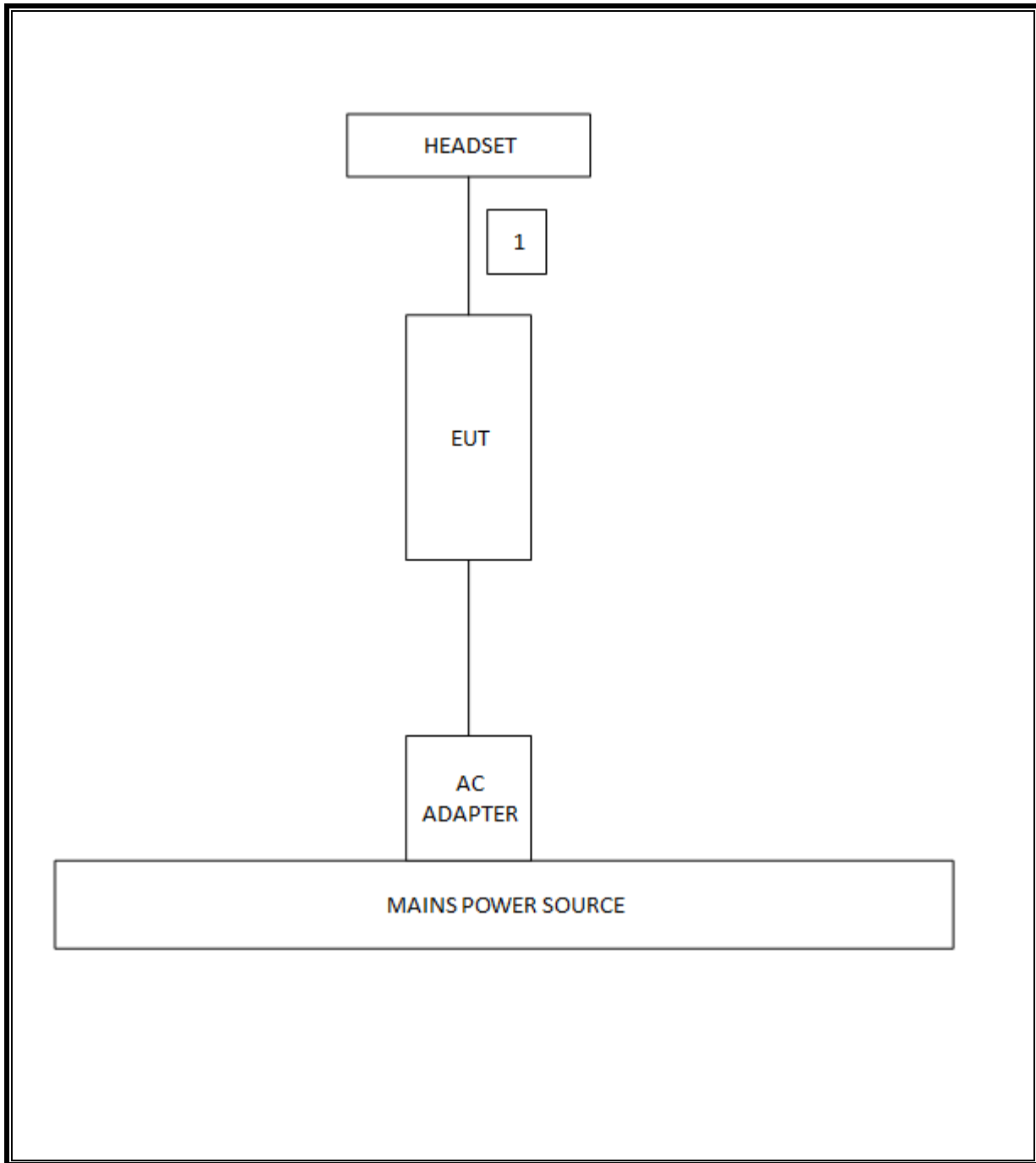
### I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB	Shielded	1.6m	N/A
2	Headset	1	Audio	Shielded	1.5m	N/A

### TEST SETUP

The EUT is a stand-alone unit that was tested in the worst case orientation and configuration, where applicable, during the tests. Test software exercised the radio.

**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 Date	Cal Due
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	12/13/2012	12/13/2013
Antenna, Horn, 18 GHz	ETS	3117	C01022	2/21/2013	2/21/2014
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	10/22/2012	10/22/2013
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	02/21/12	02/21/14
Power Sensor, 18 GHz	Agilent / HP	8481A	N02781	9/24/2012	9/24/2013
Power Meter	Agilent / HP	437B	NA	8/9/2012	8/9/2013
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	NA	CNR
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	C01011	3/6/2013	3/6/2014
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/13	01/14/14

## 7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

### LIMITS

None; for reporting purposes only.

### PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

#### 7.1.1. ON TIME AND DUTY CYCLE RESULTS

2.4GHz	B (msec)	(msec)	x (linear)	Cycle (%)	Correction Factor (dB)	Minimum VBW (kHz)
BLE	98.33	625	0.157	15.7%	8.03	0.010

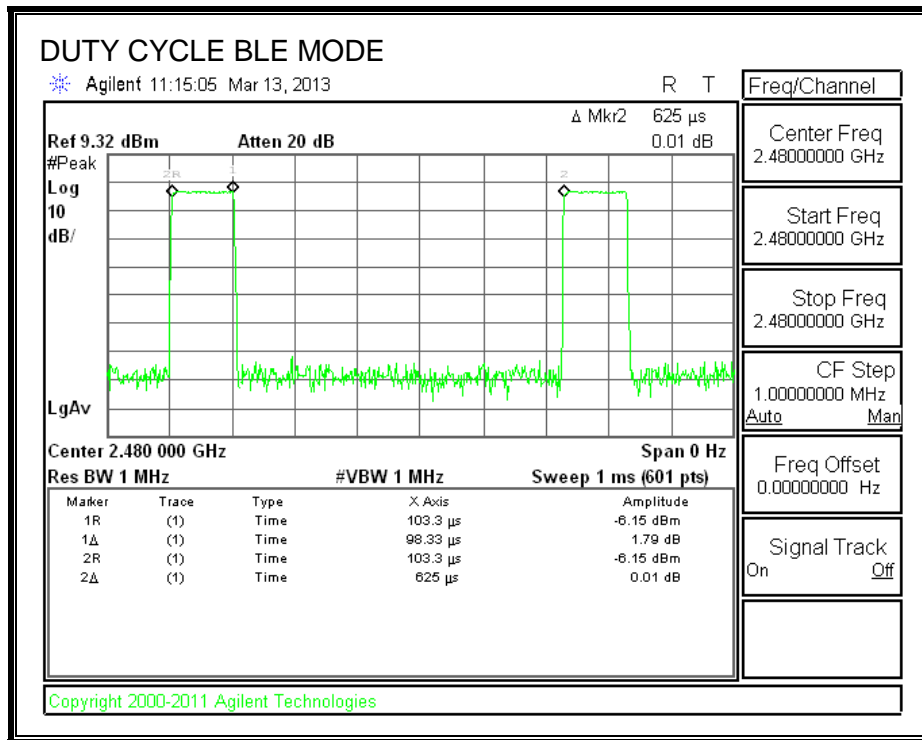
#### 7.1.2. MEASUREMENT METHOD FOR POWER AND PPSD

The Duty Cycle is less than 98% and consistent therefore KDB 789033 Method SA-2 is used.

#### 7.1.3. MEASUREMENT METHOD FOR AVERAGE SPURIOUS EMISSIONS ABOVE 1 GHz

The Duty Cycle is less than 98% and consistent, KDB 789033 Method AD with Power RMS Averaging and duty cycle correction is used.

### 7.1.4. DUTY CYCLE PLOTS



## 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.

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.

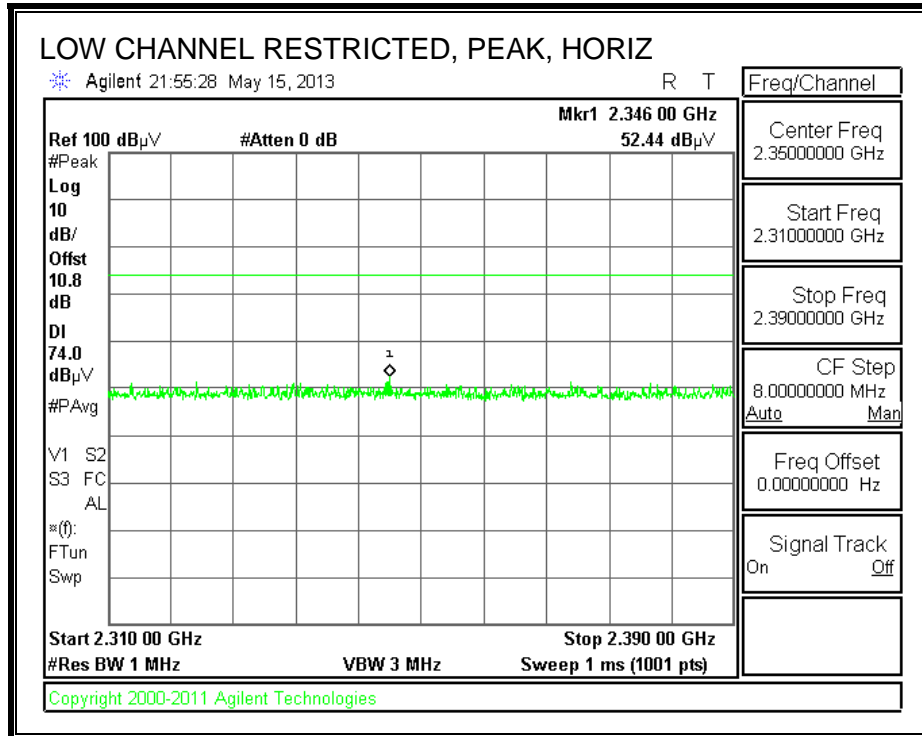
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 1 MHz for peak measurements and as applicable for average measurements.

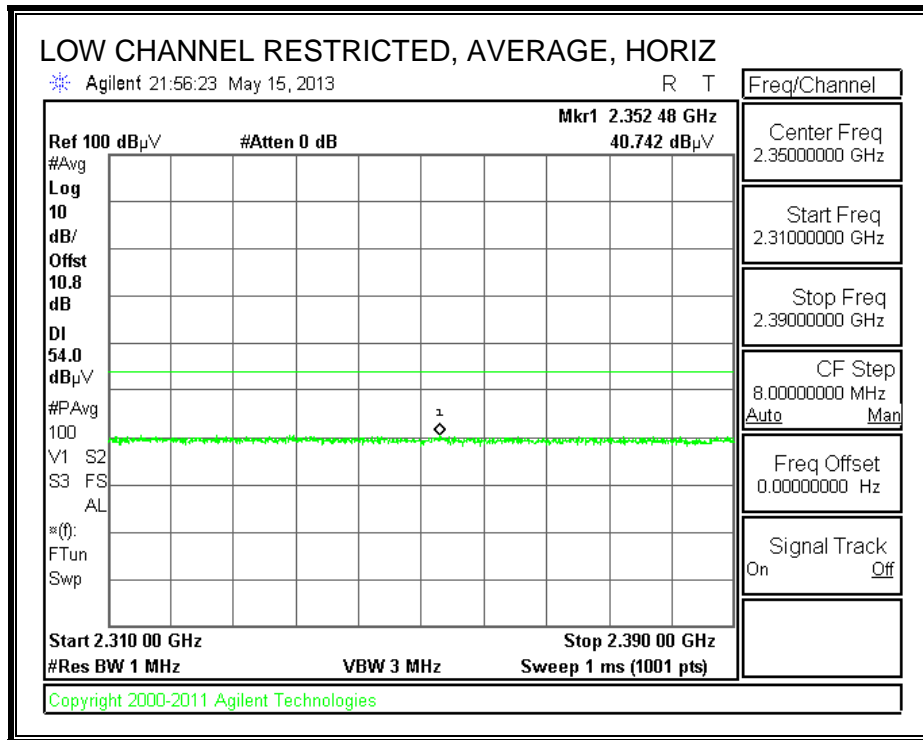
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

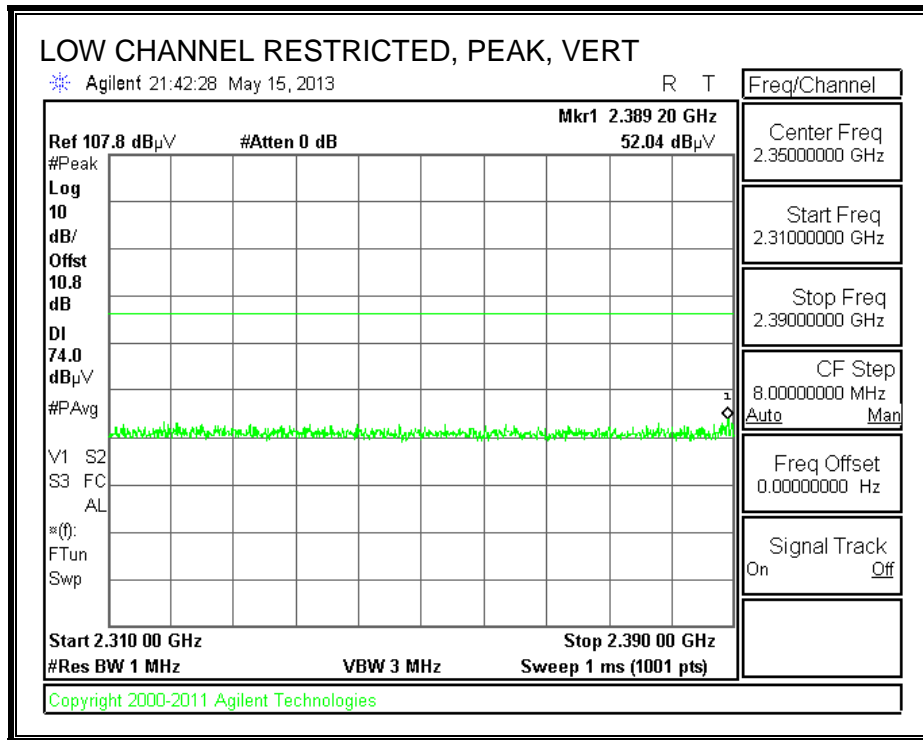
## 8.2. TX ABOVE 1 GHz FOR BLUETOOTH LOW ENERGY MODE IN THE 2.4 GHz BAND

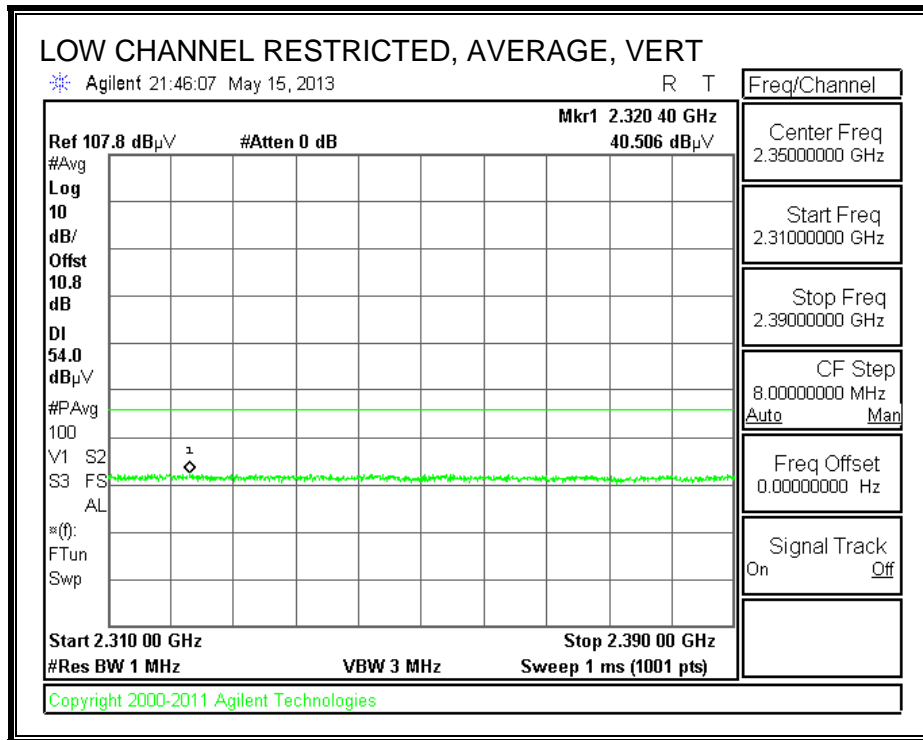
### RESTRICTED BANDEDGE (LOW CHANNEL)





**Actual Average** = Measured Average + Correction Factor  
 = 40.742 dBuV + 8.03  
 = 48.772 dBuV

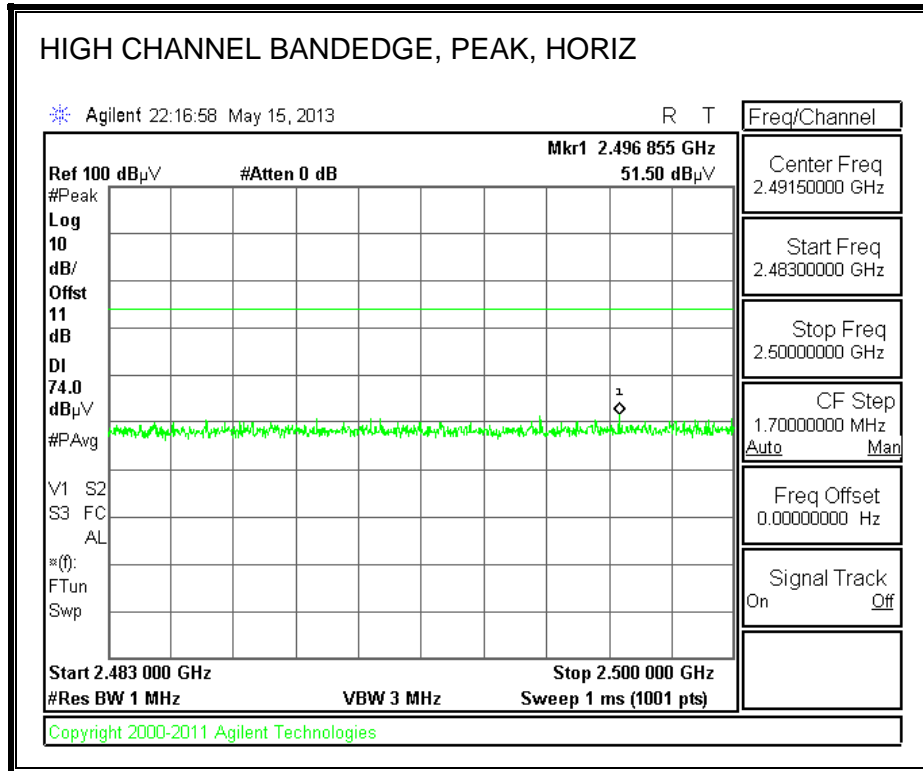


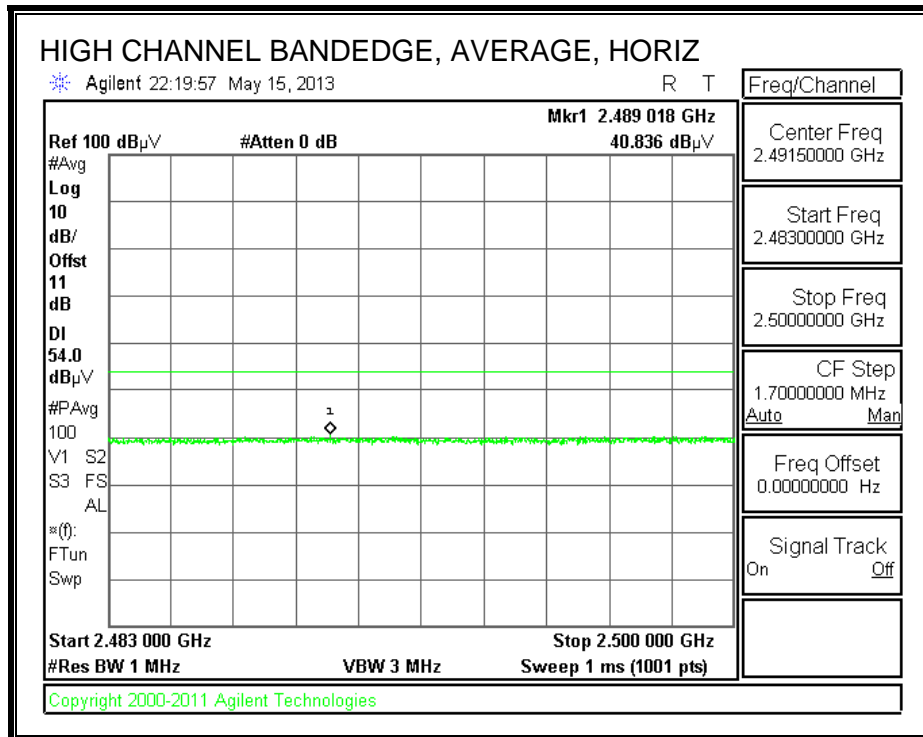


**Actual Average** = Measured Average + Correction Factor  
 = 40.506 dBuV + 8.03  
 = 48.536 dBuV

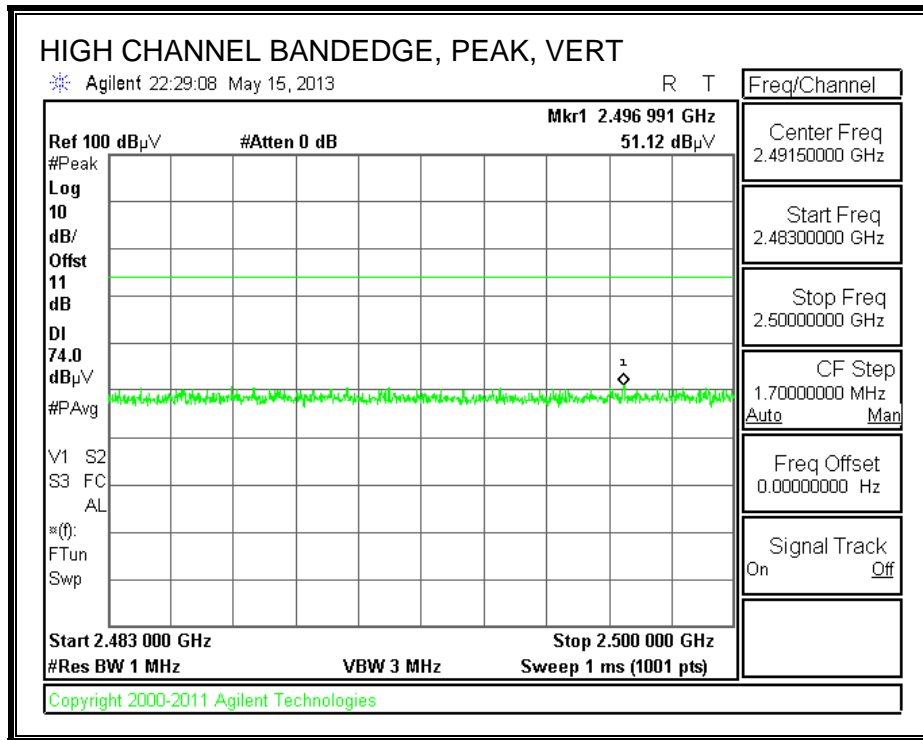


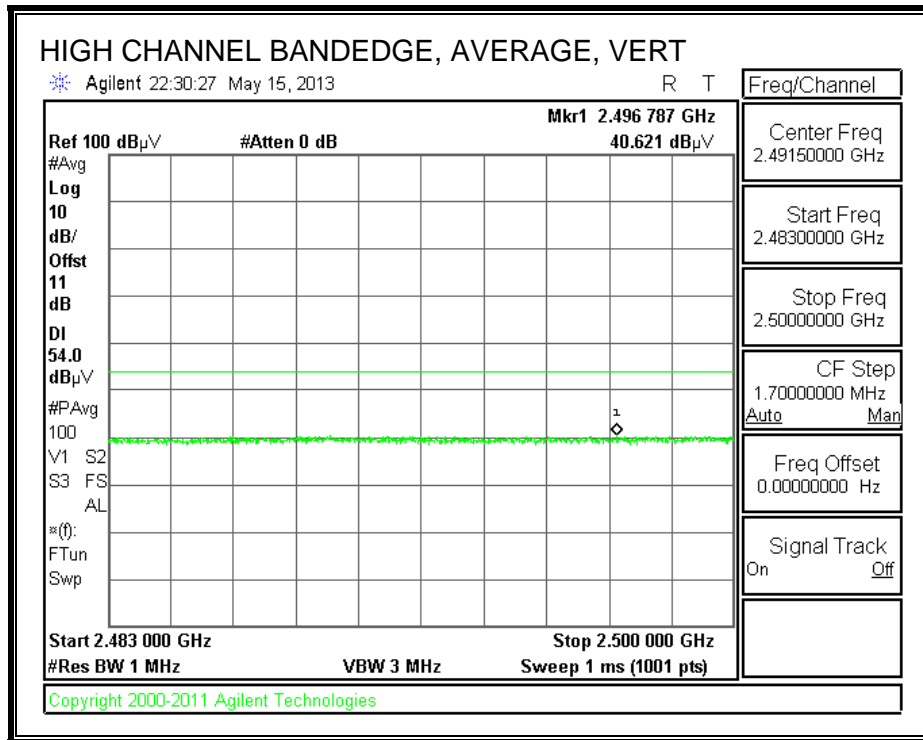
**RESTRICTED BANDEDGE (HIGH CHANNEL)**





$$\begin{aligned}
 \text{Actual Average} &= \text{Measured Average} + \text{Correction Factor} \\
 &= 40.836 \text{ dB}\mu\text{V} + 8.03 \\
 &= 48.866 \text{ dB}\mu\text{V}
 \end{aligned}$$

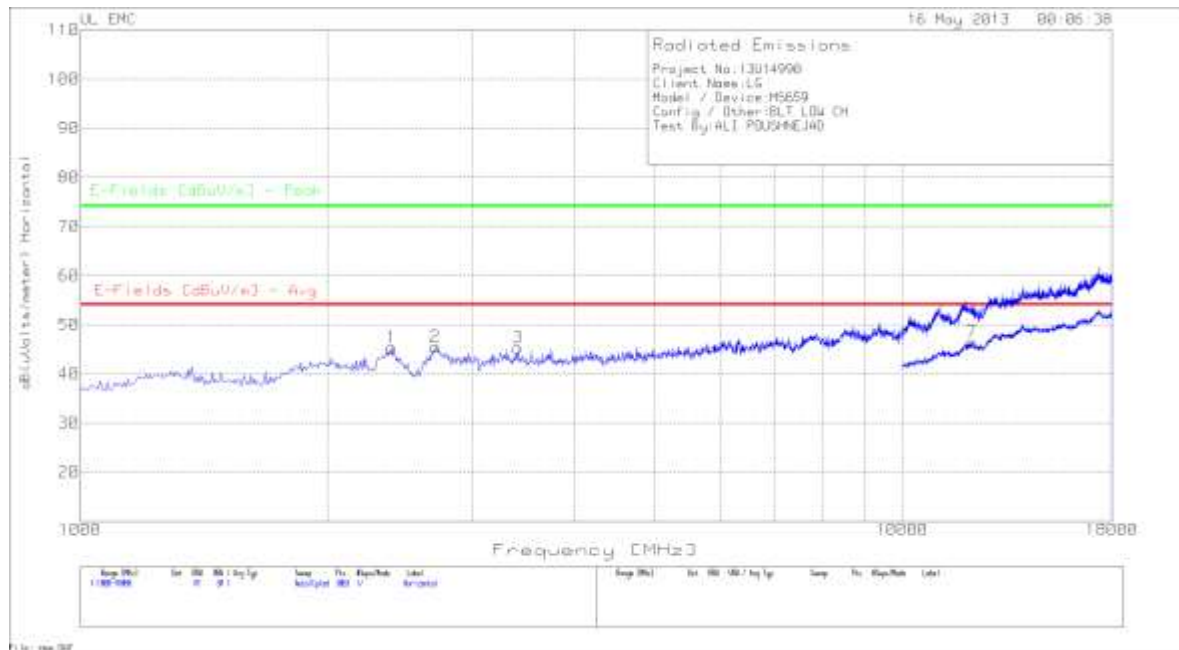




**Actual Average** = Measured Average + Correction Factor  
 = 40.621 dBuV + 8.03  
 = 48.631 dBuV

**HARMONICS AND SPURIOUS EMISSIONS**

**LOW CHANNEL HORIZONTAL**



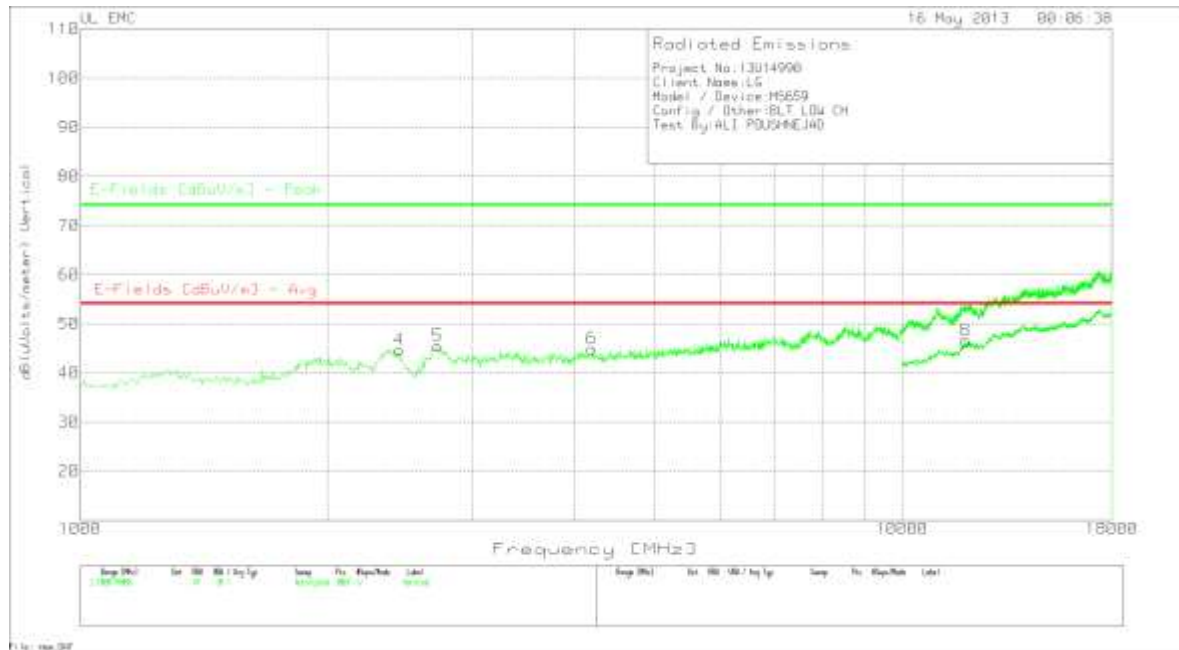
Project No:13U14990  
 Client Name:LG  
 Model / Device:MS659  
 Config / Other:BLT LOW CH  
 Test By:ALI POUHNEJAD

Marker No.	Test Frequency	Meter Reading	Detector	T119 Ant Factor [dB/m]	T34 Preamp/ Cable Loss [dB]	T160 BRF [dB]	dB(uVolt s/meter)	E-Fields [dBuV/m ] - Avg	Margin (dB)	E-Fields [dBuV/m ] - Peak	Margin (dB)	Height [cm]	Polarity
Horizontal 1000 - 18000MHz													
1	2393.071	42.05	PK	32.1	-29.7	0.9	45.35	53.97	-8.62	74	-28.65	99	Horz
2	2704.53	40.98	PK	32.6	-29	0.9	45.48	53.97	-8.49	74	-28.52	99	Horz
3	3406.729	39.42	PK	32.9	-27.5	0.5	45.32	53.97	-8.65	74	-28.68	201	Horz
Horizontal 10000 - 18000MHz													
7	12150.925	25.57	PK	39.1	-18.9	0.7	46.47	53.97	-7.5	74	-27.53	99	Horz

PK - Peak detector  
 QP - Quasi-Peak detector  
 Av - Average detector

Note: Second line displayed below the first line is average measurement.

**LOW CHANNEL VERTICAL**



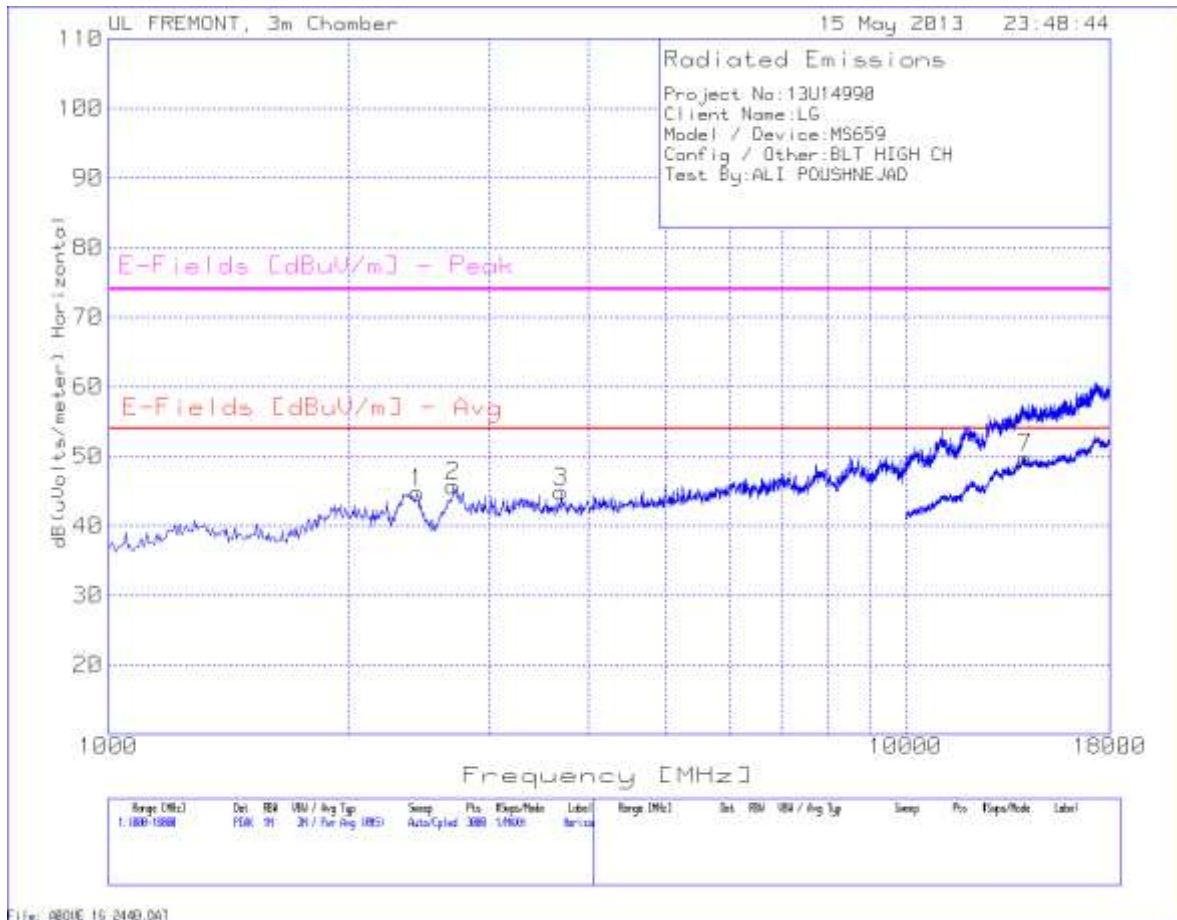
Project No:13U14990  
 Client Name:LG  
 Model / Device:MS659  
 Config / Other:BLT LOW CH  
 Test By:ALI POUHNEJAD

Marker No.	Test Frequency	Meter Reading	Detector	T119 Ant Factor [dB/m]	T34 Preamp/ Cable Loss [dB]	T160 BRF [dB]	dB(uV/m) s/meter	E-Fields [dBuV/m] - Avg	Margin (dB)	E-Fields [dBuV/m] - Peak	Margin (dB)	Height [cm]	Polarity
Vertical 1000 - 18000MHz													
4	2444.037	41.17	PK	32.2	-29.6	0.9	44.67	53.97	-9.3	74	-29.33	99	Vert
5	2721.519	40.94	PK	32.6	-29	0.9	45.44	53.97	-8.53	74	-28.56	99	Vert
6	4193.871	37.13	PK	33.5	-25.9	0.2	44.93	53.97	-9.04	74	-29.07	201	Vert
Vertical 10000 - 18000MHz													
8	11939.03	25.69	PK	39	-18.9	0.8	46.59	53.97	-7.38	74	-27.41	100	Vert

PK - Peak detector  
 QP - Quasi-Peak detector  
 Av - Average detector

Note: Second line displayed below the first line is average measurement.

**MID CHANNEL HORIZONTAL**



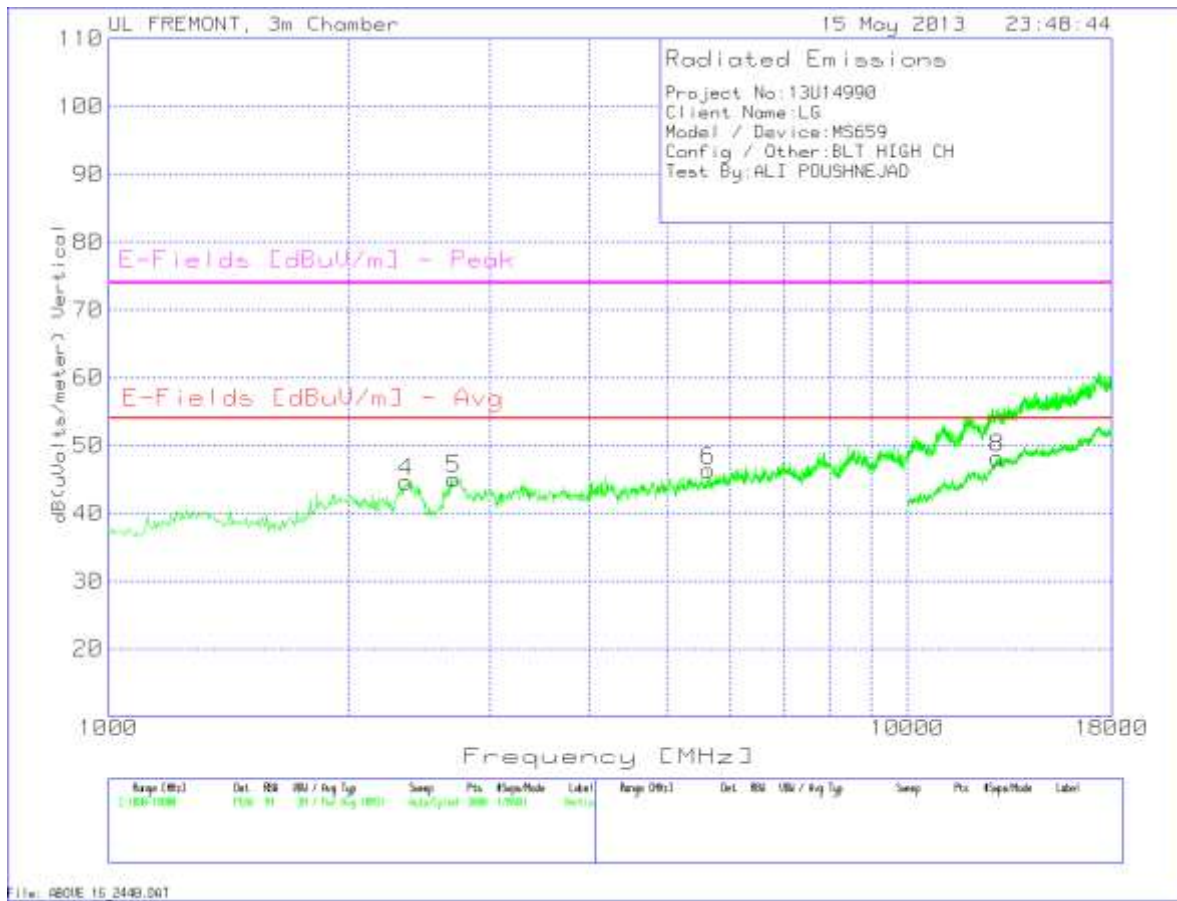
Project No:13U14990  
 Client Name:LG  
 Model / Device:MS659  
 Config / Other:BLT HIGH CH  
 Test By:ALI POUHNEJAD

Marker No.	Test Frequency	Meter Reading	Detector	T119 Ant Factor [dB/m]	T34 Preamp/Cable Loss [dB]	T160 BRF [dB]	dB(uV/s/meter)	E-Fields [dBuV/m] - Avg	Margin (dB)	E-Fields [dBuV/m] - Peak	Margin (dB)	Height [cm]	Polarity
Horizontal 1000 - 18000MHz													
1	2438.374	41.22	PK	32.2	-29.6	0.9	44.72	53.97	-9.25	74	-29.28	201	Horz
2	2710.193	41.21	PK	32.6	-29	0.9	45.71	53.97	-8.26	74	-28.29	201	Horz
3	3695.536	38.06	PK	33.2	-26.7	0.3	44.86	53.97	-9.11	74	-29.14	100	Horz
Horizontal 10000 - 18000MHz													
7	14109.945	26.14	PK	39	-15.8	0.4	49.74	53.97	-4.23	74	-24.26	100	Horz

PK - Peak detector  
 QP - Quasi-Peak detector  
 Av - Average detector

Note: Second line displayed below the first line is average measurement.

**MID CHANNEL VERTICAL**



Project No:13U14990  
 Client Name:LG  
 Model / Device:MS659  
 Config / Other:BLT HIGH CH  
 Test By:ALI POUHNEJAD

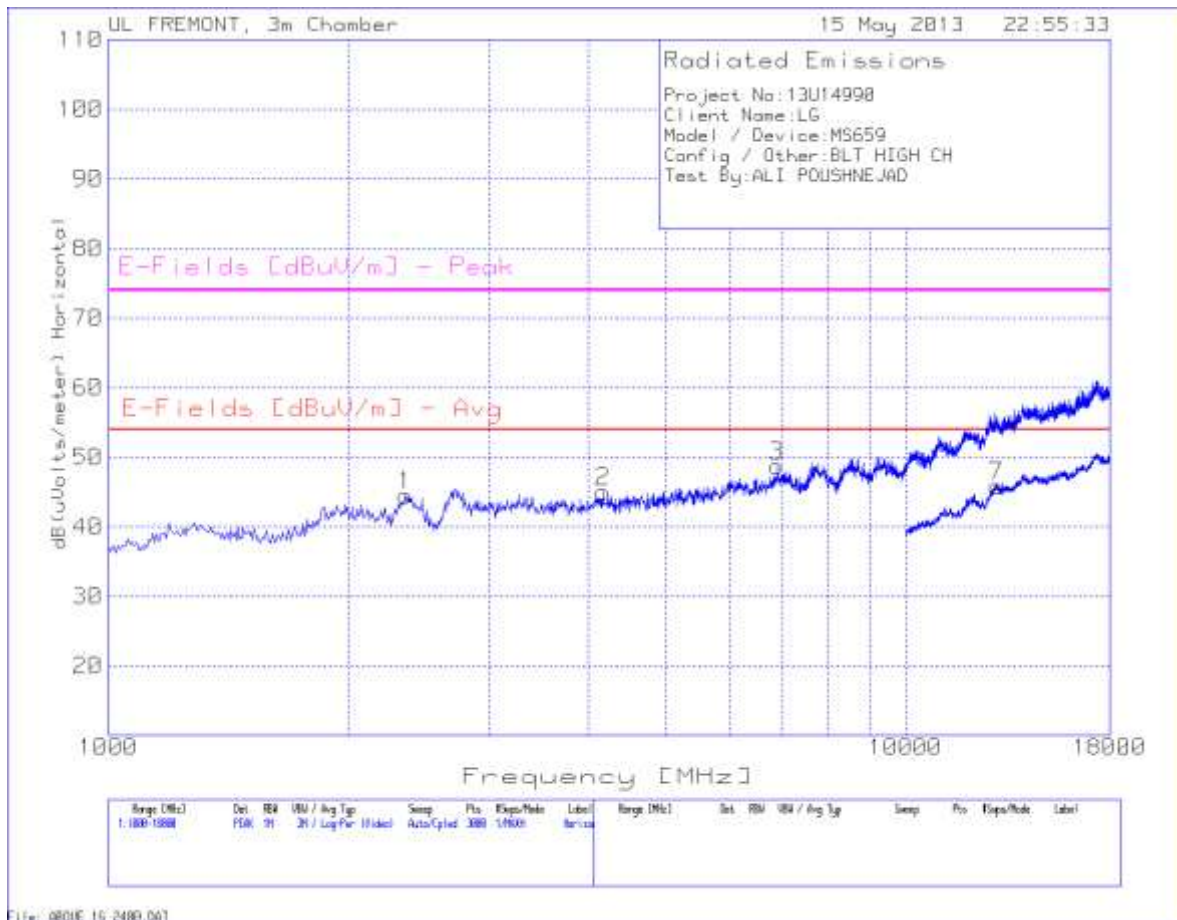
Marker No.	Test Frequency	Meter Reading	Detector	T119 Ant Factor [dB/m]	T34 Preamp/Cable Loss [dB]	T160 BRF [dB]	dB(uVolt s/meter)	E-Fields [dBuV/m ] - Avg	Margin (dB)	E-Fields [dBuV/m ] - Peak	Margin (dB)	Height [cm]	Polarity
Vertical 1000 - 18000MHz													
4	2359.094	41.41	PK	32	-29.7	0.9	44.61	53.97	-9.36	74	-29.39	201	Vert
5	2710.193	40.55	PK	32.6	-29	0.9	45.05	53.97	-8.92	74	-28.95	201	Vert
6	5632.245	35.87	PK	34.7	-24.4	0.2	46.37	53.97	-7.6	74	-27.63	201	Vert
Vertical 10000 - 18000MHz													
8	12974.513	25.82	PK	39.1	-17.1	0.4	48.22	53.97	-5.75	74	-25.78	100	Vert

PK - Peak detector  
 QP - Quasi-Peak detector  
 Av - Average detector

Note: Second line displayed below the first line is average measurement.



**HIGH CHANNEL HORIZONTAL**



Project No:13U14990  
 Client Name:LG  
 Model / Device:MS659  
 Config / Other:BLT HIGH CH  
 Test By:ALI POUHNEJAD

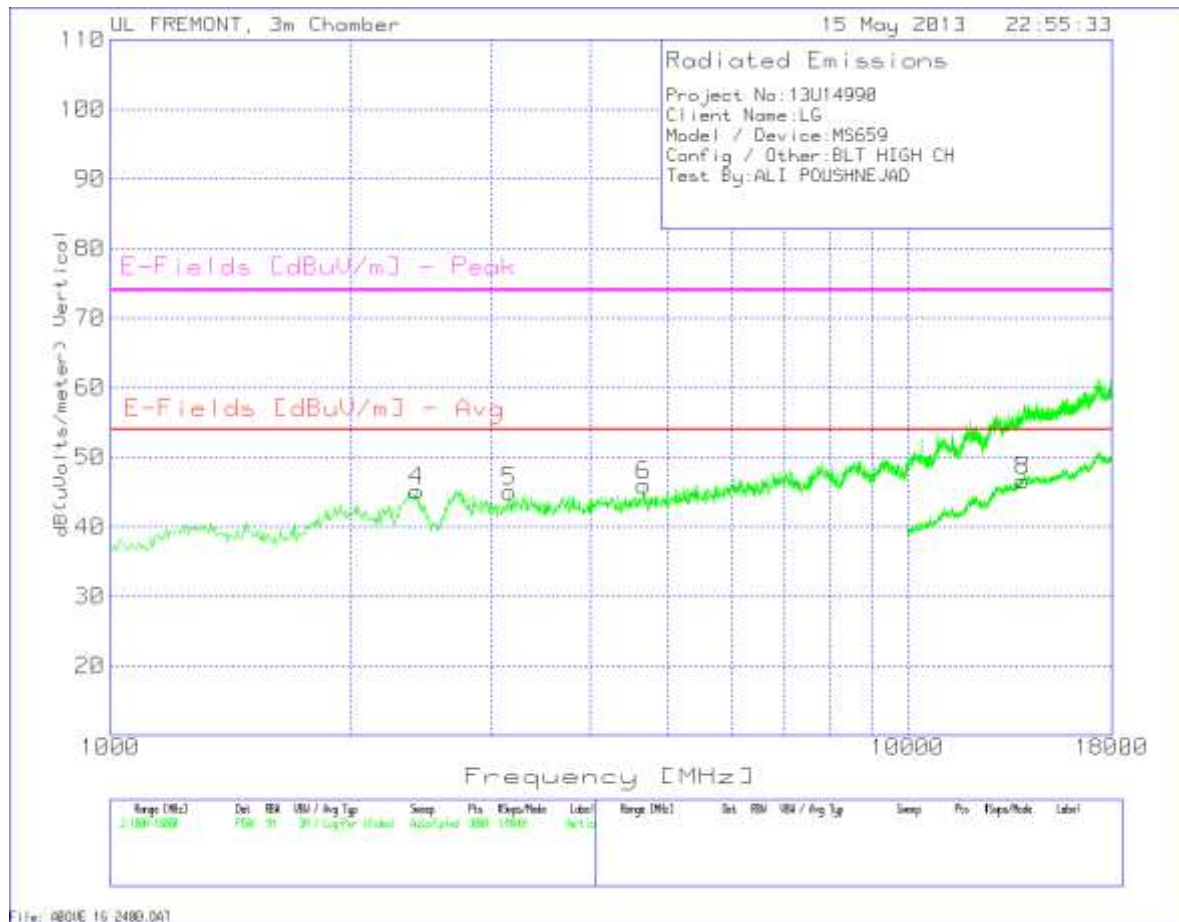
Marker No.	Test Frequency	Meter Reading	Detector	T119 Ant Factor [dB/m]	T34 Preamp/Cable Loss [dB]	T160 BRF [dB]	dB(uVolt s/meter)	E-Fields [dBuV/m] - Avg	Margin (dB)	E-Fields [dBuV/m] - Peak	Margin (dB)
<b>Horizontal 1000 - 18000MHz</b>											
1	2359.094	41.36	PK	32	-29.7	0.9	44.56	53.97	-9.41	74	-29.44
2	4171.219	37.17	PK	33.5	-25.9	0.3	45.07	53.97	-8.9	74	-28.93
3	6889.407	36.16	PK	35.6	-23.2	0.2	48.76	53.97	-6.21	74	-25.24
<b>Horizontal 10000 - 18000MHz</b>											
7	13006.497	23.49	PK	39.1	-17.1	0.4	45.89	53.97	-8.08	74	-28.11

PK - Peak detector  
 Av - Average detector

Note: Second line displayed below the first line is average measurement.



**HIGH CHANNEL VERTICAL**



File: 0801E 16 2400.DAT

Project No:13U14990  
 Client Name:LG  
 Model / Device:MS659  
 Config / Other:BLT HIGH CH  
 Test By:ALI POUSHNEJAD

Marker No.	Test Frequency	Meter Reading	Detector	T119 Ant Factor [dB/m]	T34 Preamp/ Cable Loss [dB]	T160 BRF [dB]	dB(uVolt s/meter)	E-Fields [dBuV/m] - Avg	Margin (dB)	E-Fields [dBuV/m] - Peak	Margin (dB)
<b>Vertical 1000 - 18000MHz</b>											
4	2421.386	41.74	PK	32.2	-29.7	0.9	45.14	53.97	-8.83	74	-28.86
5	3168.887	39.75	PK	32.9	-28.2	0.6	45.05	53.97	-8.92	74	-28.95
6	4658.228	36.96	PK	34.1	-25.4	0.3	45.96	53.97	-8.01	74	-28.04
<b>Vertical 10000 - 18000MHz</b>											
8	13926.037	23.26	PK	38.8	-15.9	0.4	46.56	53.97	-7.41	74	-27.44

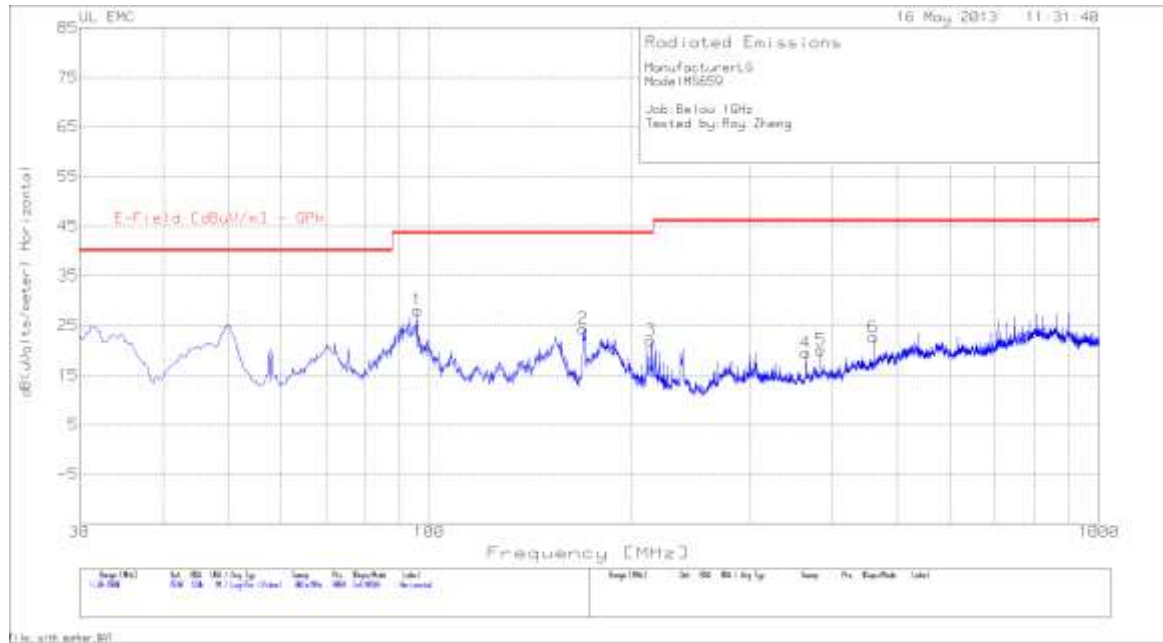
PK - Peak detector  
 Av - Average detector

Note: Second line displayed below the first line is average measurement.

**8.3. WORST-CASE BELOW 1 GHz**

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

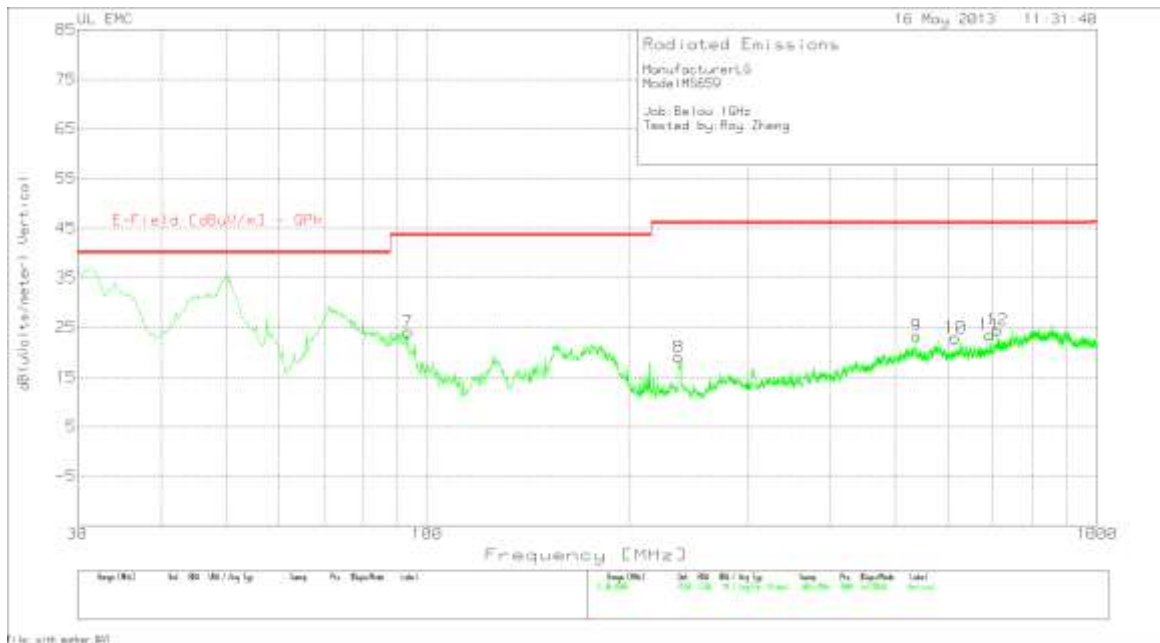
**HORIZONTAL PLOT**



Marker No.	Test Frequency	Meter Reading	Detector	T407 Ant Factor [dB/m]	T286 Preamp [dB]	Cable Factor [dB]	DC Corr [dB]	dB(uV/m) s/meter	E-Field [dBuV/m] - QPk	Margin (dB)	Height [cm]	Polarity
Horizontal 30 - 1000MHz												
1	95.9106	46.58	PK	9.1	-28.4	0.8	0	28.08	43.52	-15.44	201	Horz
2	169.5753	39.81	PK	11.8	-28.4	1.1	0	24.31	43.52	-19.21	98	Horz
3	214.1619	38.93	PK	10.5	-28.6	1.2	0	22.03	43.52	-21.49	201	Horz
4	364.8838	32.45	PK	15	-29.6	1.6	0	19.45	46.02	-26.57	98	Horz
5	384.027	32.39	PK	15	-29	1.7	0	20.09	46.02	-25.93	98	Horz
6	460.5996	33.08	PK	16.7	-29	1.9	0	22.68	46.02	-23.34	201	Horz

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

**VERTICAL PLOT**



Marker No.	Test Frequency	Meter Reading	Detector	T407 Ant Factor [dB/m]	T286 Preamp [dB]	Cable Factor [dB]	DC Corr [dB]	dB(uV/s/meter)	E-Field [dBuV/m] - QPk	Margin (dB)	Height [cm]	Polarity
Vertical 30 - 1000MHz												
7	93.4874	43.08	PK	8.6	-28.4	0.8	0	24.08	43.52	-19.44	100	Vert
8	237.1821	33.81	PK	11.4	-27.5	1.3	0	19.01	46.02	-27.01	300	Vert
9	537.6568	31.12	PK	18.2	-28	2	0	23.32	46.02	-22.7	100	Vert
10	614.4716	30.68	PK	19	-29	2.2	0	22.88	46.02	-23.14	100	Vert
11	691.2865	31.04	PK	19.5	-29.5	2.4	0	23.44	46.02	-22.58	100	Vert
12	710.4297	30.82	PK	20.4	-29.1	2.4	0	24.52	46.02	-21.5	100	Vert