



FCC 47 CFR PART 15 SUBPART C  
INDUSTRY CANADA RSS-247 ISSUE 1

BLUETOOTH LOW ENERGY  
CERTIFICATION TEST REPORT

FOR

APPLE PENCIL

MODEL NUMBER: A1603

FCC ID: BCGA1603  
IC: 579C-A1603

REPORT NUMBER: 15U21631-E1V2

ISSUE DATE: OCTOBER 1, 2015

*Prepared for*  
APPLE, INC.  
1 INFINITE LOOP  
CUPERTINO, CA 95014, U.S.A.

*Prepared by*  
UL VERIFICATION SERVICES INC.  
47173 BENICIA STREET  
FREMONT, CA 94538, U.S.A.  
TEL: (510) 771-1000  
FAX: (510) 661-0888

NVLAP®

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	09/23/2015	Initial Issue	M. Mekuria
V2	10/01/2015	Addressed TCB Questions	E. Yu

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE, INC.  
1 INFINITE LOOP  
CUPERTINO, CA 95014, U.S.A.

**EUT DESCRIPTION:** APPLE PENCIL

**MODEL:** A1603

**SERIAL NUMBER:** C4MQC005GWJK (Radiated); C4MQC009GWJK (Conducted)

**DATE TESTED:** SEPTEMBER 10, 2015 - SEPTEMBER 11, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-247 Issue 1	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.

Approved & Released For  
UL Verification Services Inc. By:

*Mengistu Mekuria*

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MENGISTU MEKURIA  
SENIOR ENGINEER  
UL VERIFICATION SERVICES INC.

Tested By:

*Eric Yu*

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ERIC YU  
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, RSS-GEN Issue 4, and RSS-247 Issue 1, and ANSI C63.10-2013.

## 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 type="checkbox"/> Chamber A	<input checked="" type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F
	<input type="checkbox"/> Chamber G
	<input type="checkbox"/> Chamber H

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

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:

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

### 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	$\pm 3.52$ dB
Radiated Disturbance, 30 to 1000 MHz	$\pm 4.94$ dB
Radiated Disturbance, 1 to 6 GHz	$\pm 3.86$ dB
Radiated Disturbance, 6 to 18 GHz	$\pm 4.23$ dB
Radiated Disturbance, 18 to 26 GHz	$\pm 5.30$ dB
Radiated Disturbance, 26 to 40 GHz	$\pm 5.23$ dB

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is an Apple pencil with Bluetooth LE radio. The rechargeable battery is not user accessible.

### 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	7.44	5.55

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain
2.4	1.90

### 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was v172

## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Macbook AC/DC adapter	Apple	A12378	PSCV600120	NA
Macbook	Apple	N/A	N/A	NA

### I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer
2	USB	1	USB	Shielded	1	N/A
3	AC	1	AC	Un-shielded	2	N/A

### I/O CABLES (RADIATED ABOVE 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
None Used						

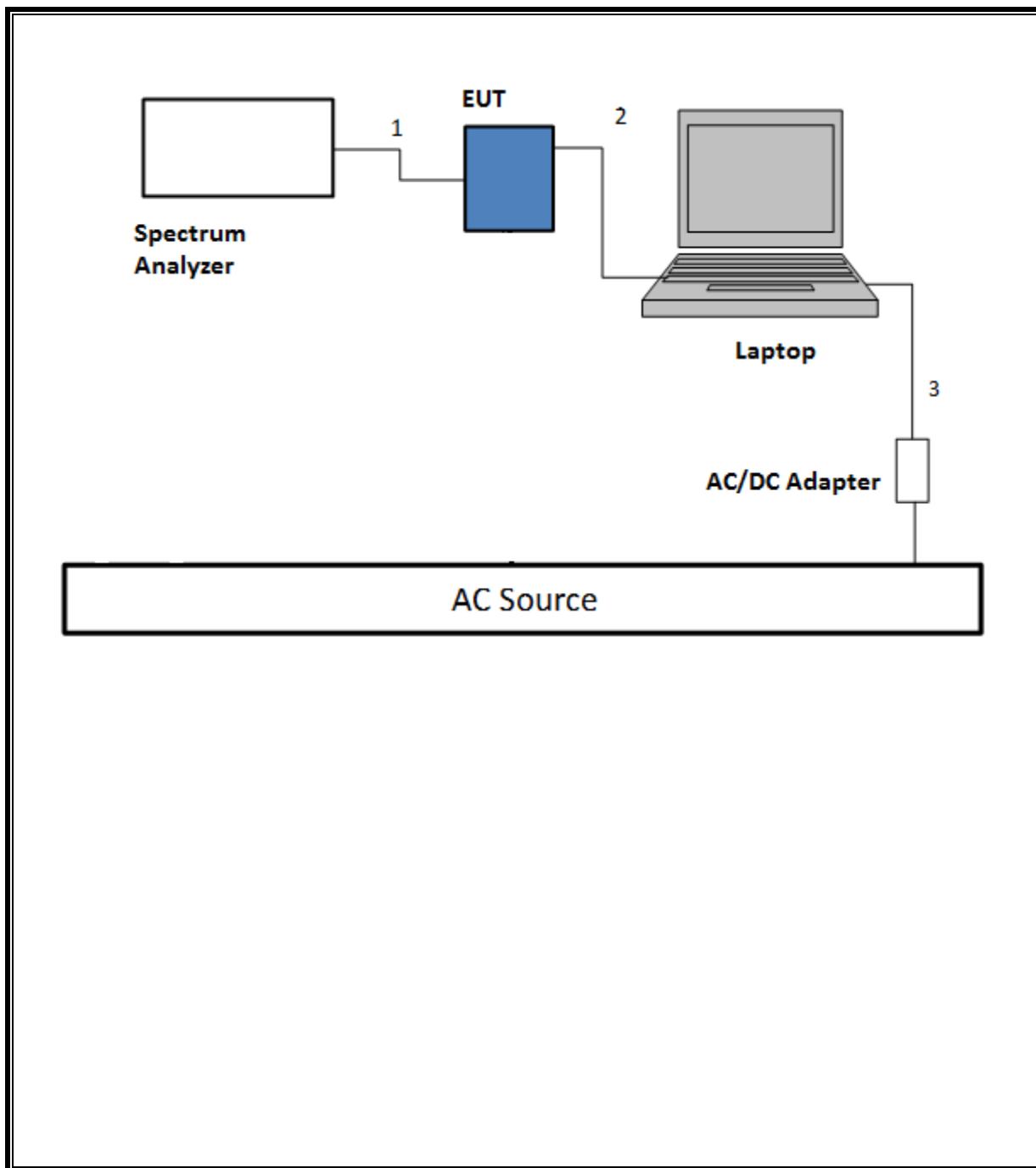
### I/O CABLES (RADIATED BELOW 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
None Used						

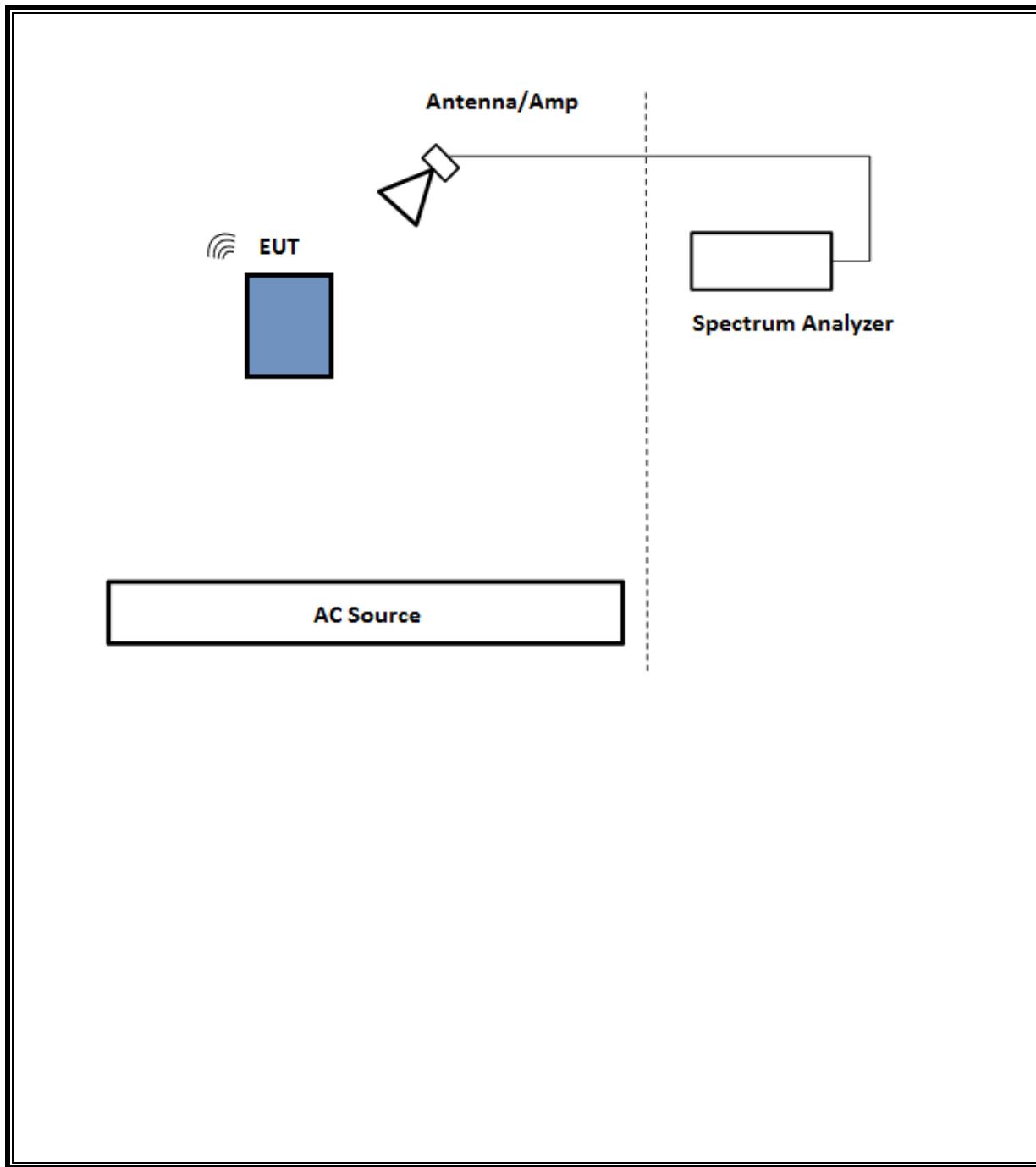
### I/O CABLES (AC LINE CONDUCTED: LAPTOP CONFIGUARTION)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB	Shielded	1	N/A
2	AC	1	AC	Un-shielded	3	N/A

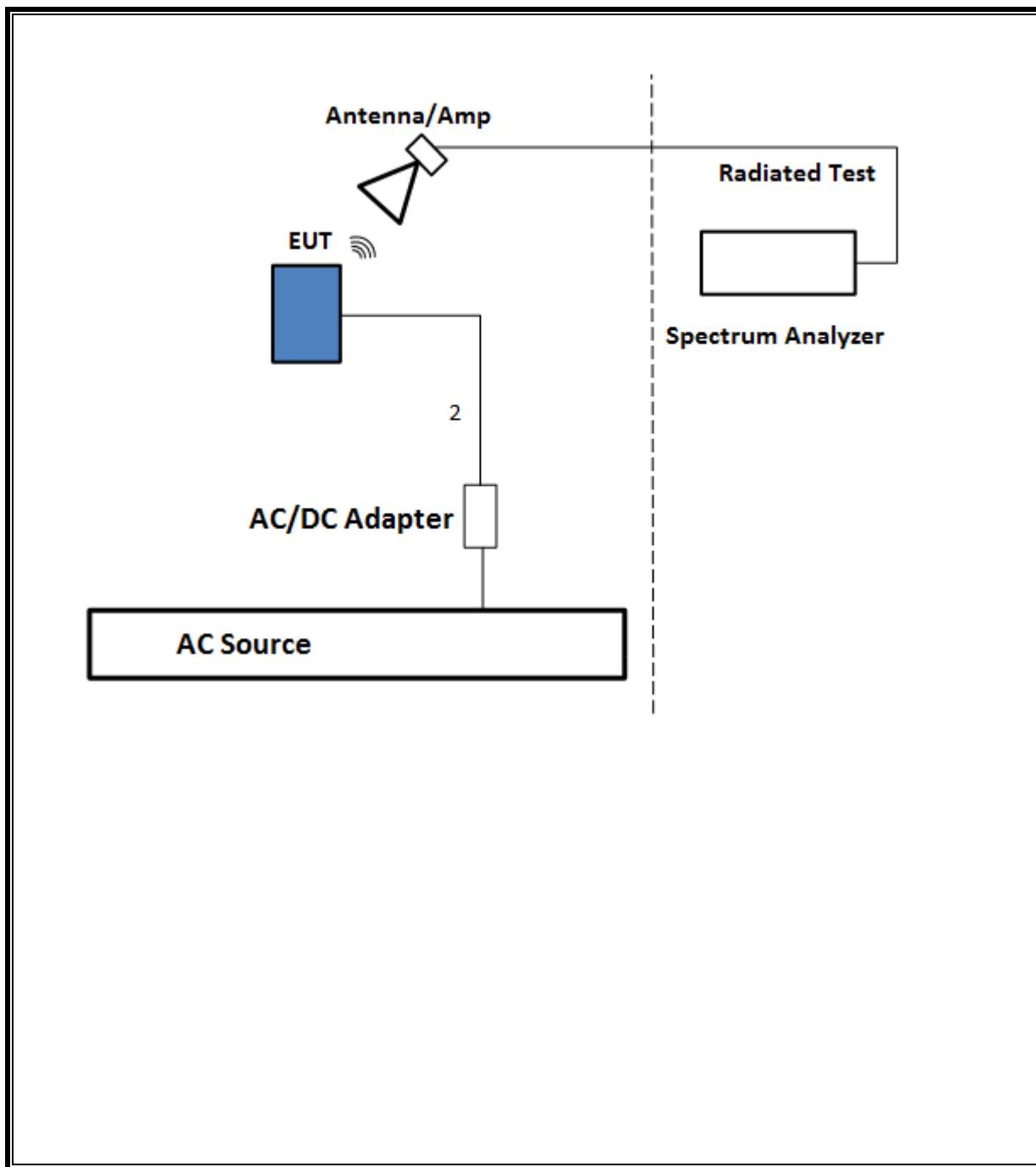
**SETUP DIAGRAM FOR CONDUCTED TESTS**



**SETUP DIAGRAM FOR RADIATED TESTS (ABOVE 1GHz)**



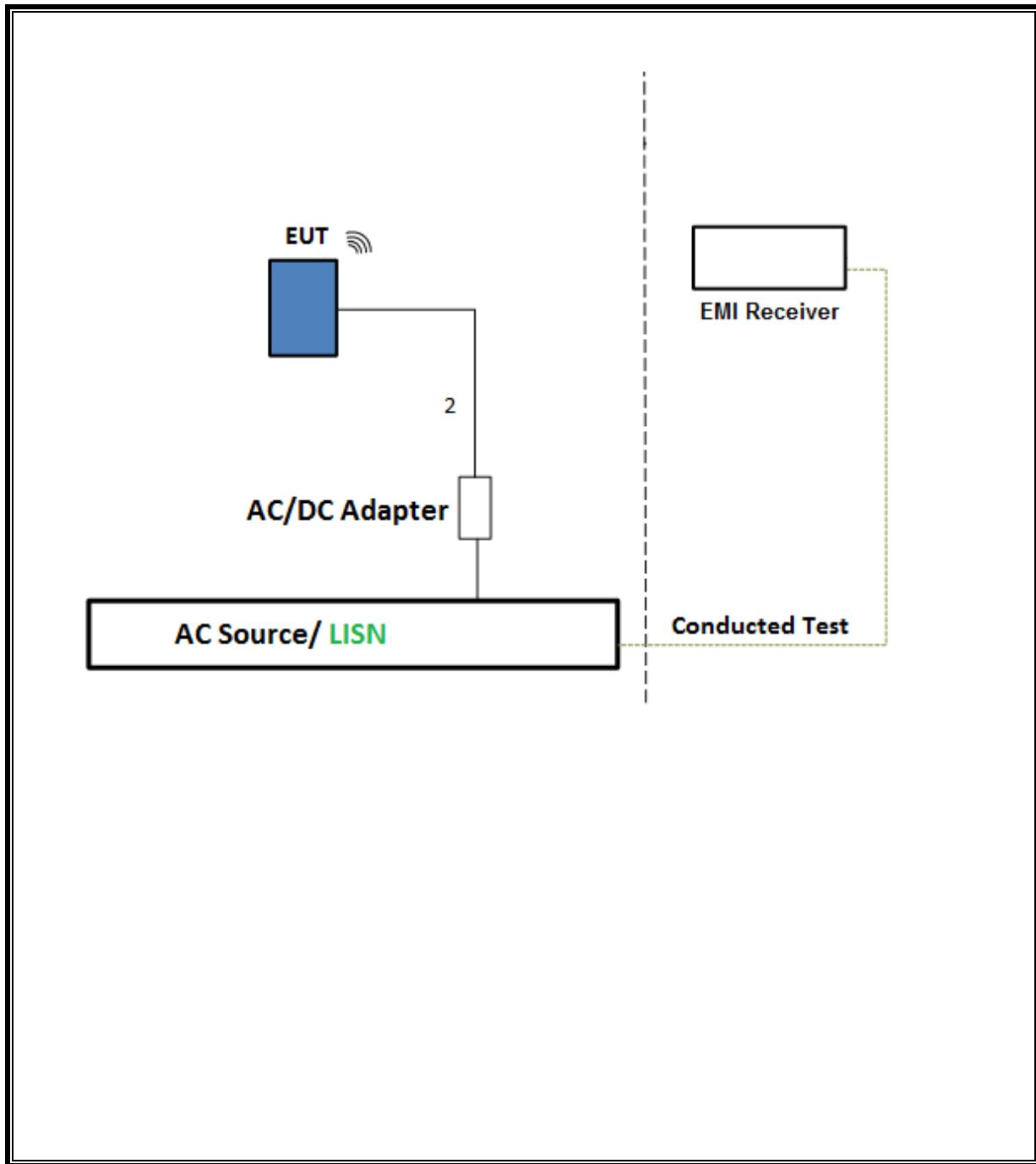
**SETUP DIAGRAM FOR RADIATED TESTS (BELOW 1GHz)**



**TEST SETUP- AC LINE CONDUCTED: AC/DC ADAPTER**

The EUT was tested with powered by AC/DC adapter via USB cable. Test software exercised the EUT.

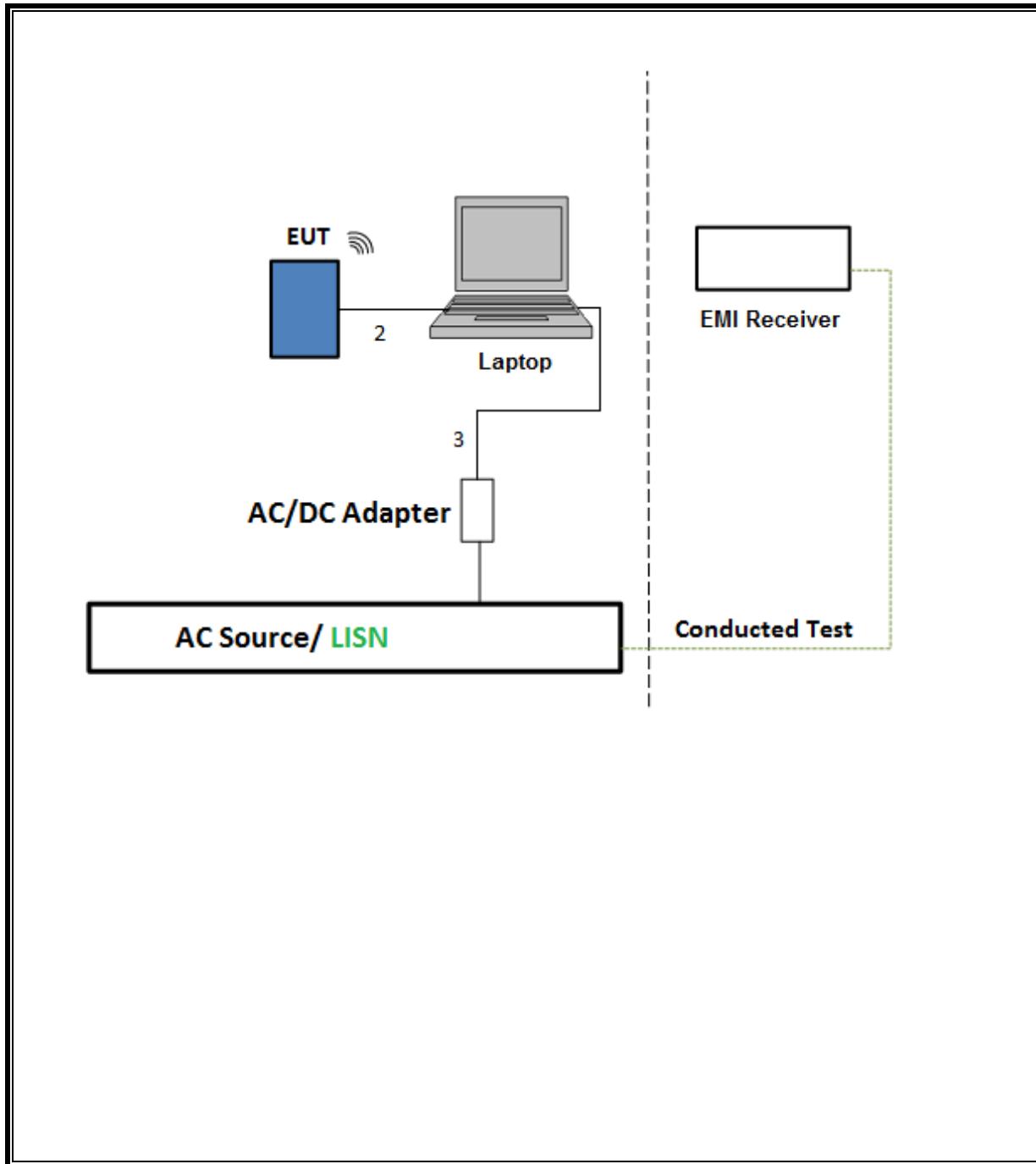
**SETUP DIAGRAM**



**TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION**

The EUT was tested with powered by host PC via USB cable. Test software exercised the EUT.

**SETUP DIAGRAM**



## 5.6. 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 X (Flatbed) orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in X orientation.

Worst-case data rates as provided by the client were:

Based on the baseline scan, the worst-case data rates were:

BLE: 1 Mbps.

## 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, Horn 1-18GHz	ETS Lindgren	3117	00143448	2/10/2016
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	A022813-1	1/14/2016
Amplifier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	1782158	1/26/2016
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	171202	11/1/2015
Spectrum Analyzer, PXA, 3Hz to 50GHz	Agilent	N9030A	MY52350427	9/13/2015
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	325118	2/14/2016
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	MY52350675	3/16/2016
Power Meter, P-series single channel	Agilent	N1911A	MY55196011	7/1/2016
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Agilent	N1921A	MY53260010	4/7/2016
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826	1049	12/17/2015
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Agilent	8449B	3008A01114	10/4/2015
AC Line Conducted				
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ESCI7	100935	9/16/2015
LISN for Conducted Emissions CISPR-16	FCC	50/250-25-2	114	1/16/2016
Power Cable, Line Conducted Emissions ANSI 63.4	UL	PG1	N/A	7/28/2016
UL SOFTWARE				
*Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014	
*Conducted Software	UL	UL EMC	Ver 2.2, March 31, 2015	
*AC Line Conducted Software	UL	UL EMC	Ver 9.5, April 3, 2015	

Note: \* indicates automation software version used in the compliance certification testing

## 7. ANTENNA PORT TEST RESULTS

### 7.1. MEASUREMENT METHODS

#### **MEASUREMENT METHODS**

6 dB BW: KDB 558074 D01 v03r03, Section 8.1.

Output Power: KDB 558074 D01 v03r03, Section 9.1.2.

Power Spectral Density: KDB 558074 D01 v03r03, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r03, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r03, Section 12.1.

Band-edge: KDB 558074 D01 v03r03, Section 12.1

## 7.2. ON TIME, DUTY CYCLE

### LIMITS

None; for reporting purposes only.

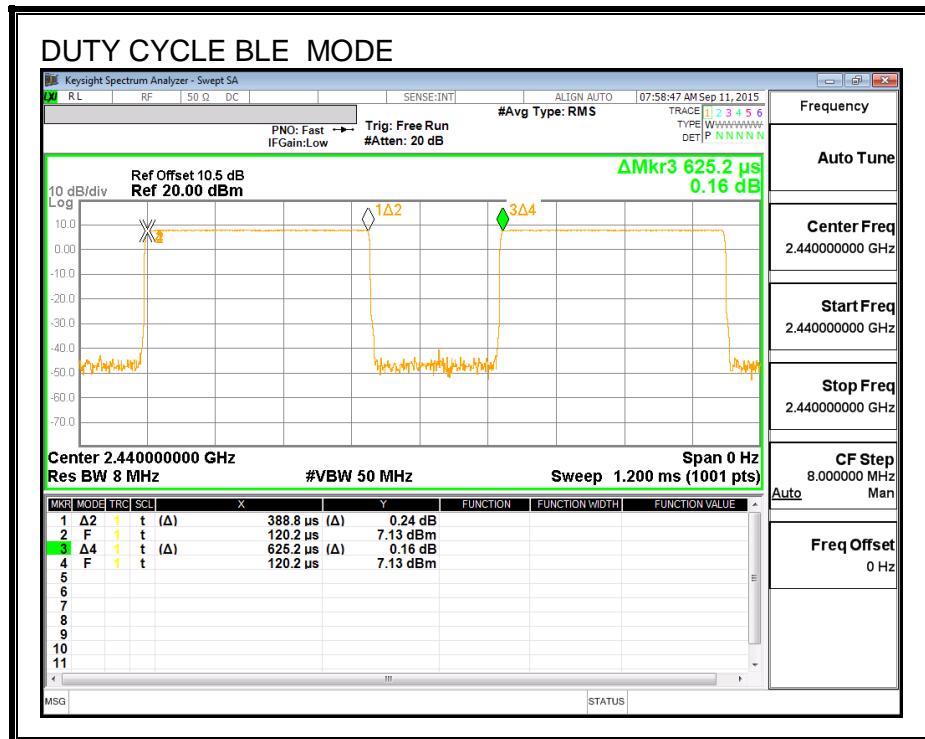
### PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

### ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
BLE	0.389	0.625	0.622	62.19%	2.06	2.572

## DUTY CYCLE PLOTS



### 7.3. 6 dB BANDWIDTH

#### LIMITS

FCC §15.247 (a) (2)

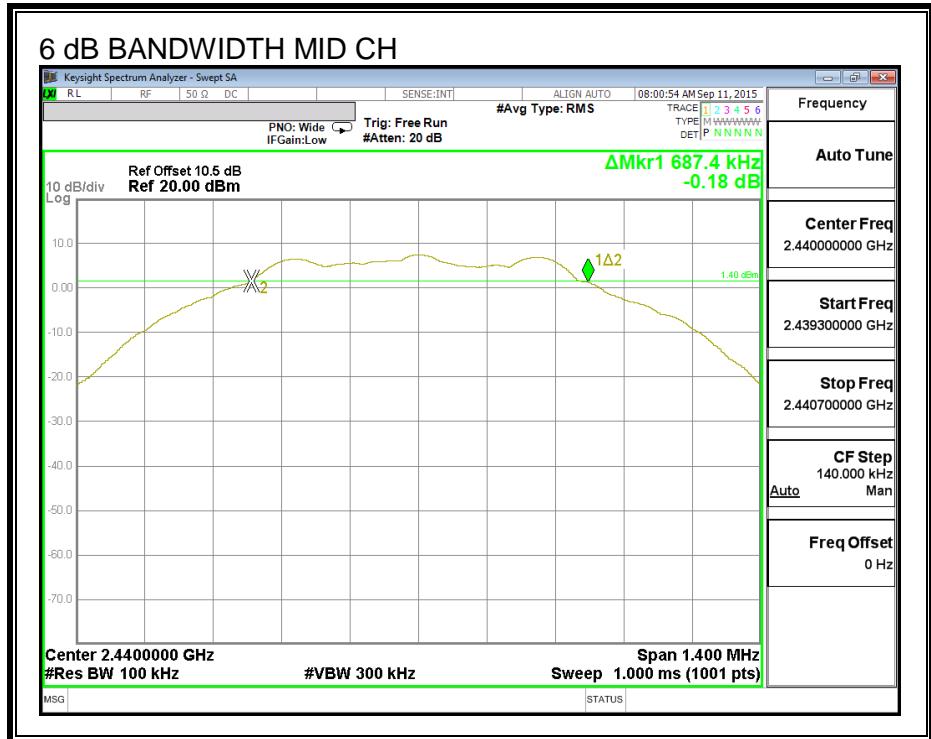
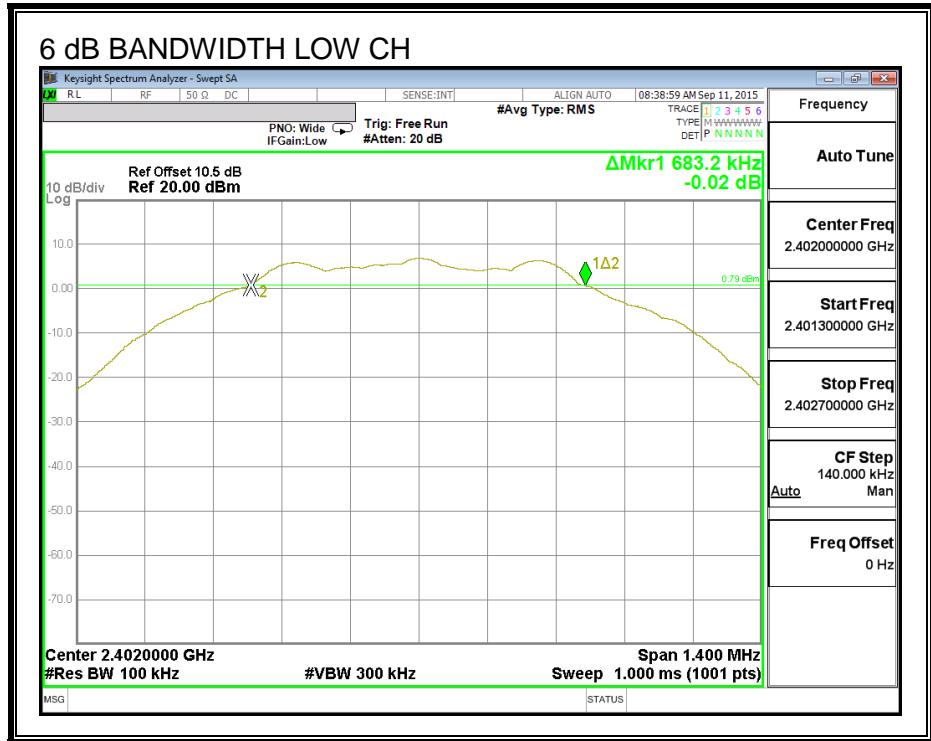
IC RSS-247 (5.2) (1)

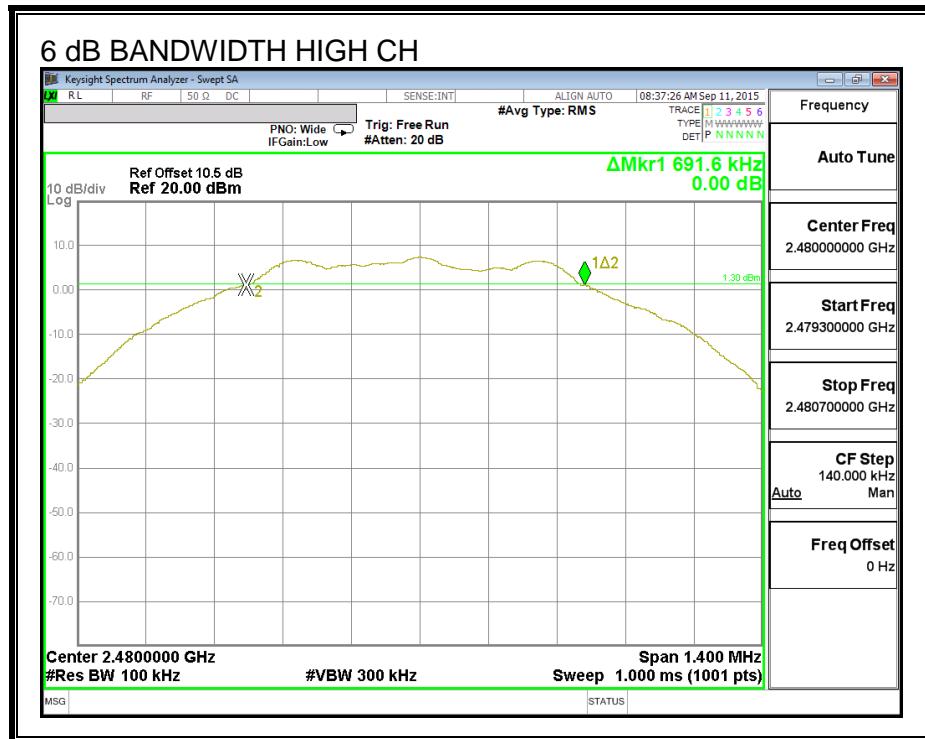
The minimum 6 dB bandwidth shall be at least 500 kHz.

#### RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.683	0.5
Middle	2440	0.687	0.5
High	2480	0.692	0.5

## 6 dB BANDWIDTH





## 7.4. 99% BANDWIDTH

### LIMITS

None; for reporting purposes only.

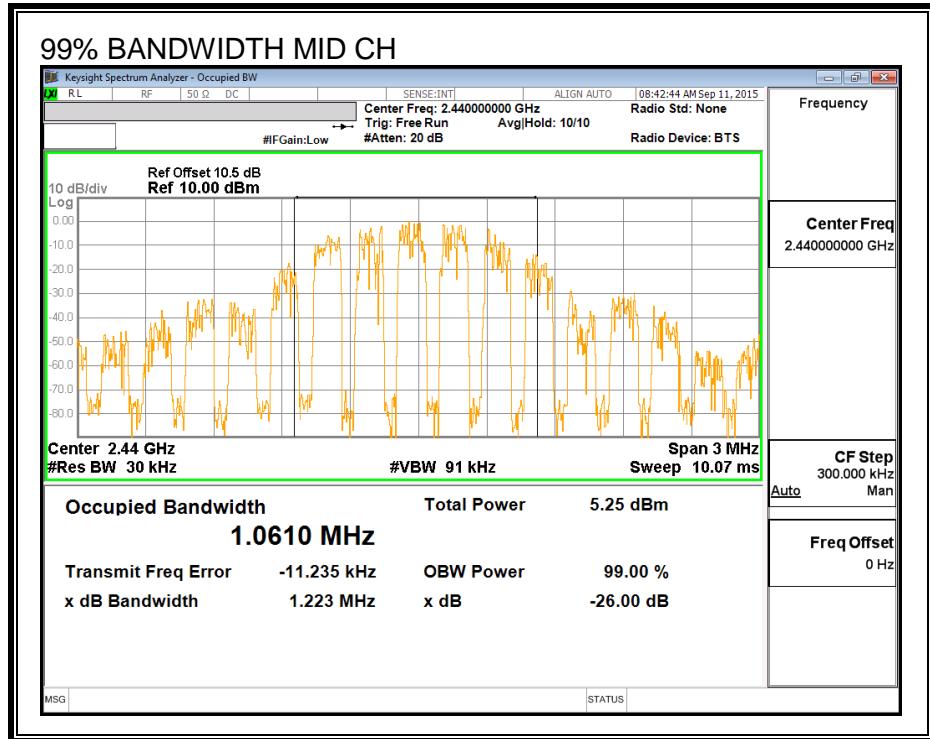
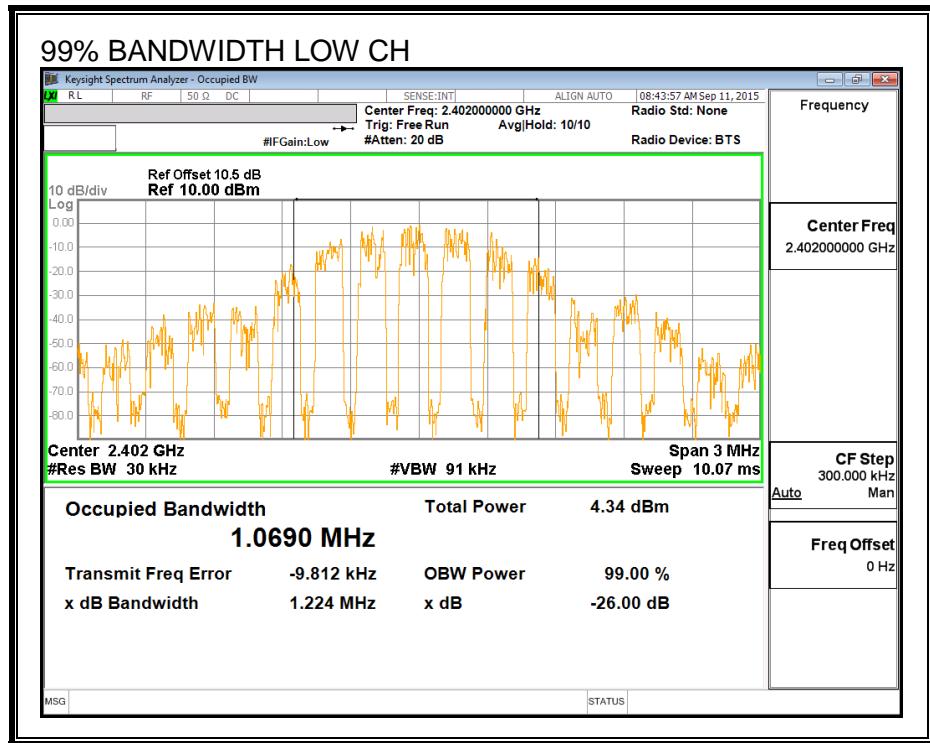
### TEST PROCEDURE

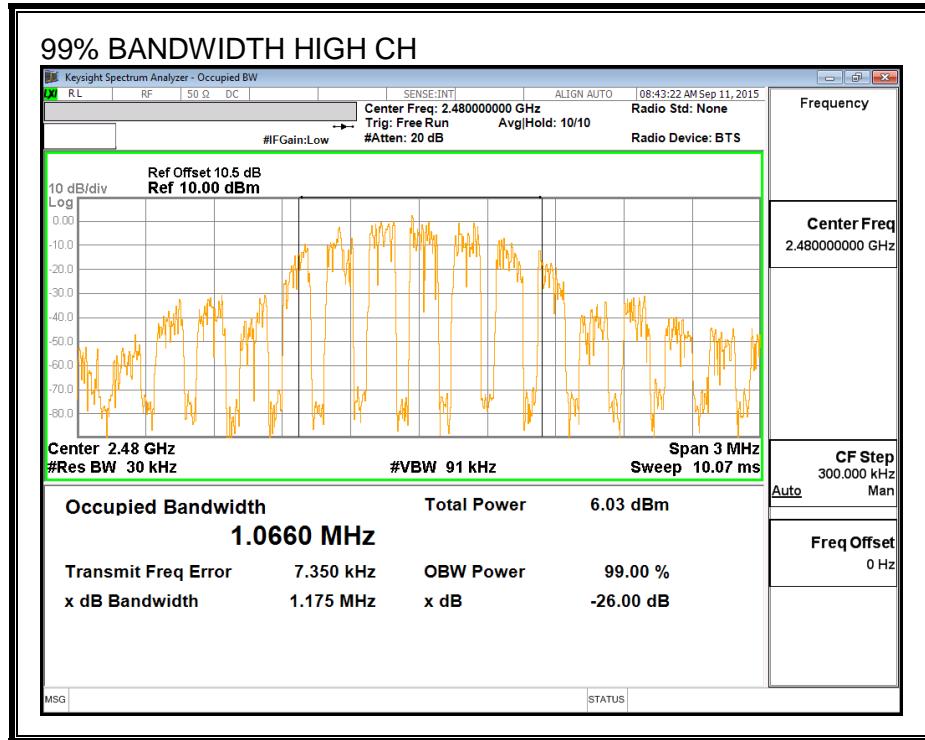
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0690
Middle	2440	1.0610
High	2480	1.0660

**99% BANDWIDTH**





## 7.5. AVERAGE POWER

### LIMITS

None; for reporting purposes only.

### RESULTS

The cable assembly insertion loss of 10.5 dB (including 10 dB pad and .5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	6.92
Middle	2440	6.97
High	2480	6.88

## 7.6. OUTPUT POWER

### LIMITS

FCC §15.247 (b)

IC RSS-247 (5.4) (4)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

### RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.34	30	-22.660
Middle	2440	7.44	30	-22.560
High	2480	7.33	30	-22.670

## 7.7. POWER SPECTRAL DENSITY

### LIMITS

FCC §15.247 (e)

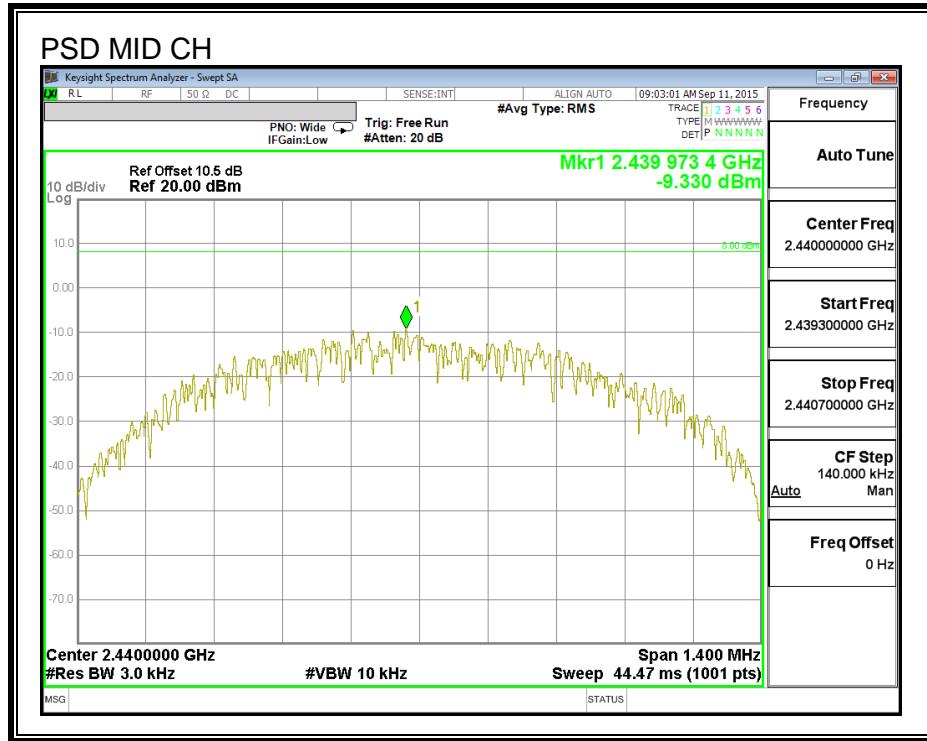
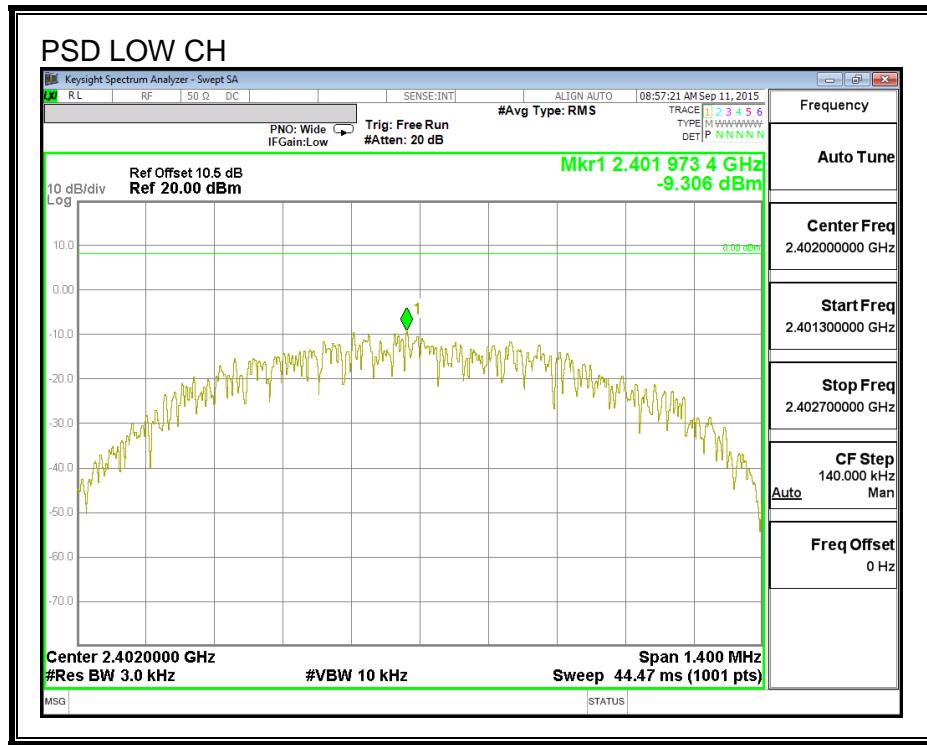
IC RSS-247 (5.2) (2)

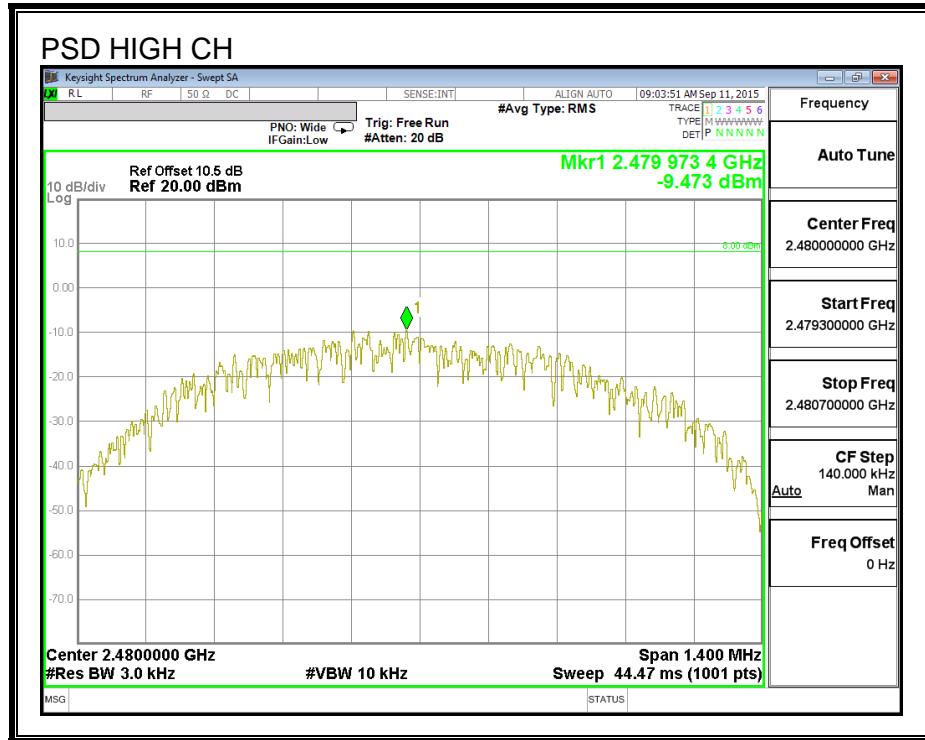
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### RESULTS

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-9.31	8	-17.31
Middle	2440	-9.33	8	-17.33
High	2480	-9.47	8	-17.47

## POWER SPECTRAL DENSITY





## 7.8. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

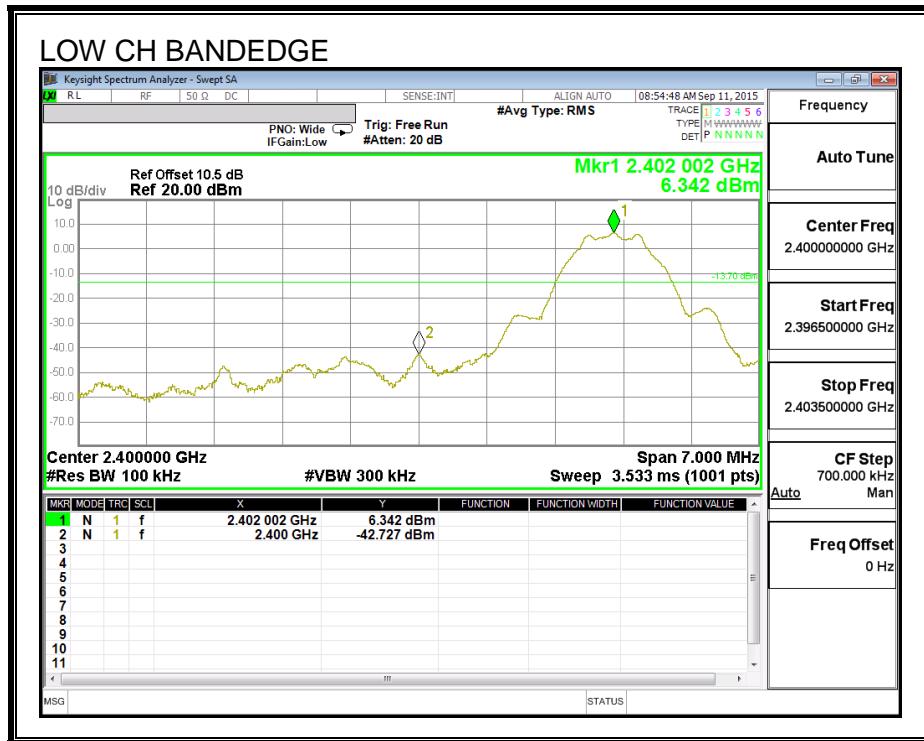
FCC §15.247 (d)

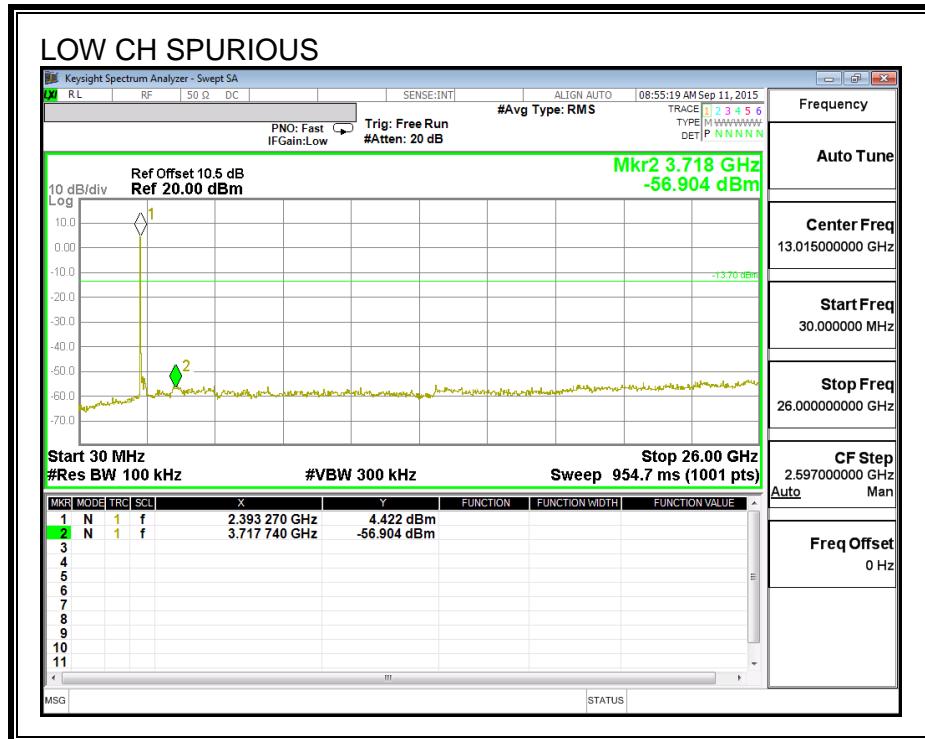
IC RSS-247 (5.5)

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

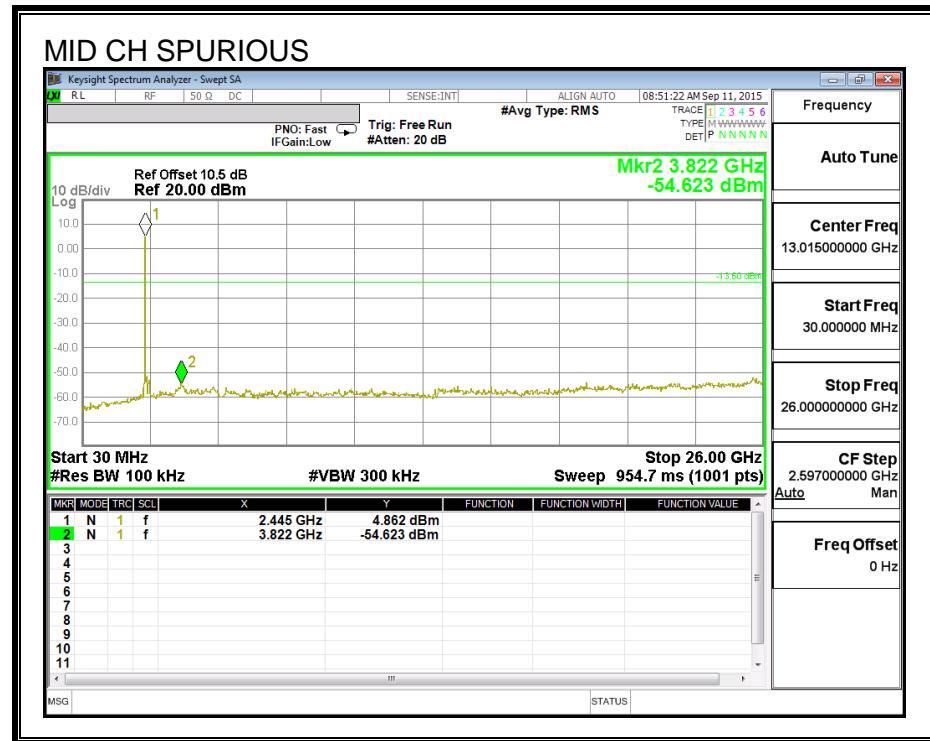
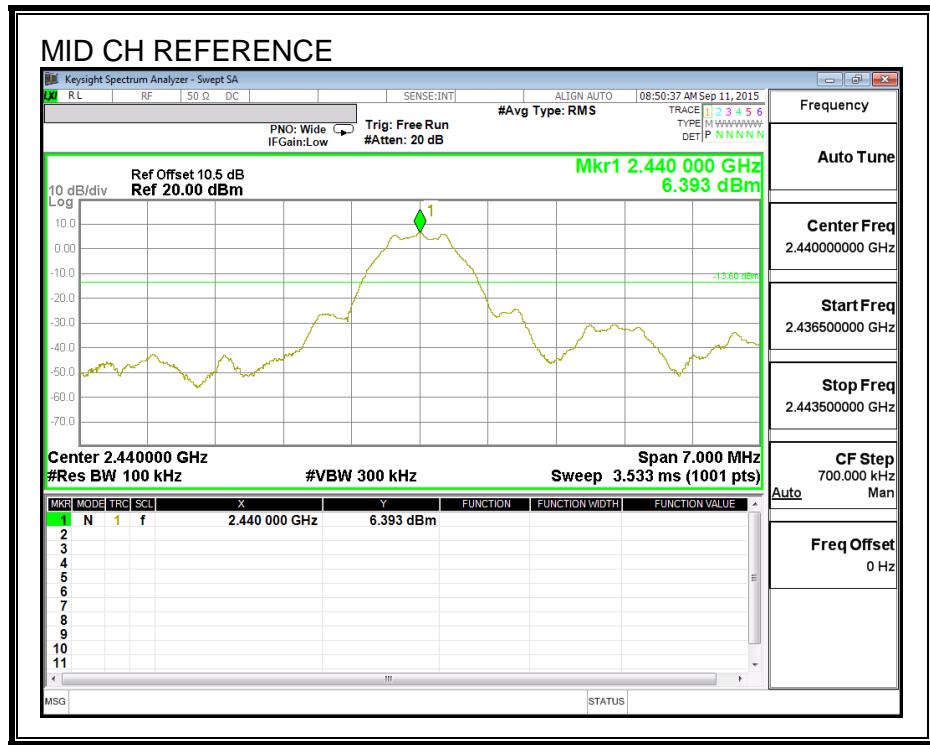
### RESULTS

#### SPURIOUS EMISSIONS, LOW CHANNEL

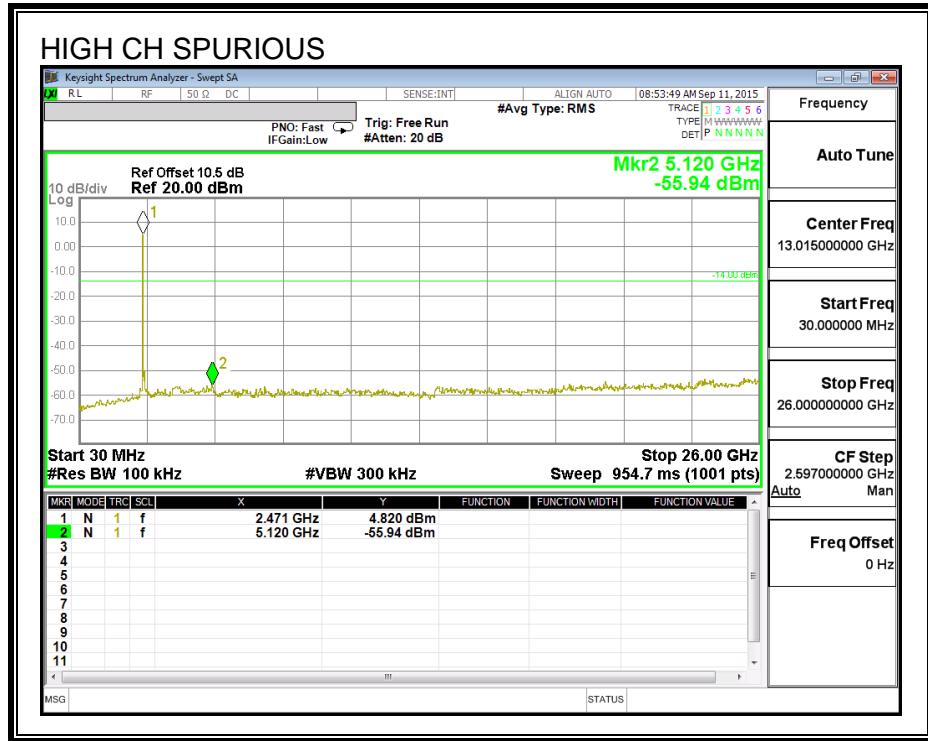
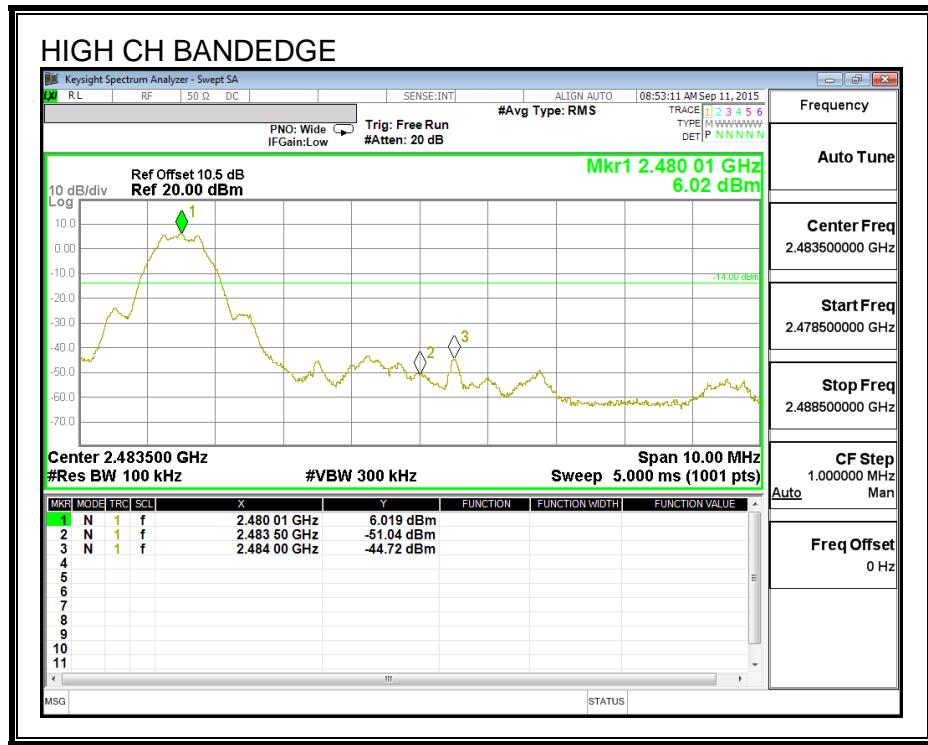




## SPURIOUS EMISSIONS, MID CHANNEL



## SPURIOUS EMISSIONS, HIGH CHANNEL



## 8. RADIATED TEST RESULTS

### 8.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

IC RSS-GEN, Section 8.9 and 8.10.

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 for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. 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.

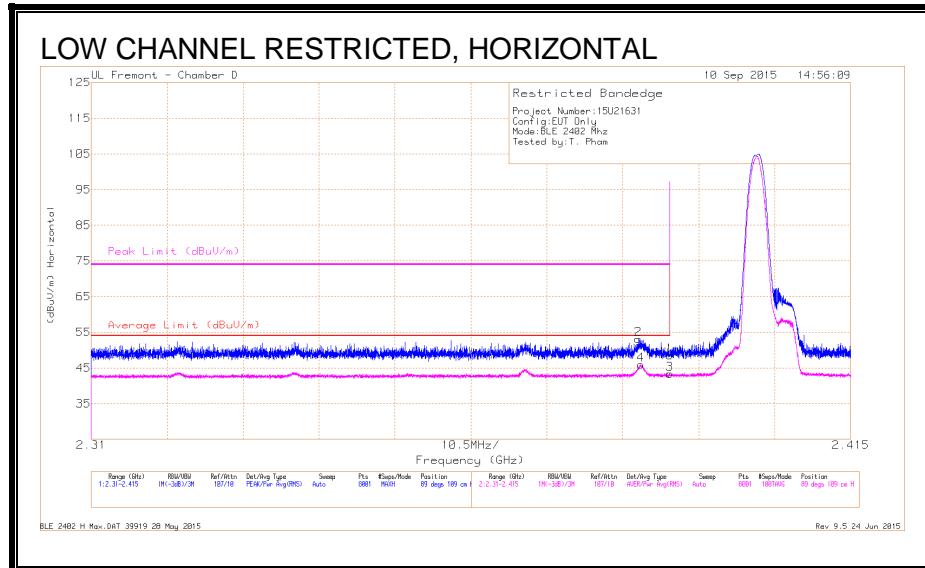
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 3MHz video bandwidth with average detector for average measurements.

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 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

### 8.2.1. RESTRICTED BANDEDGE



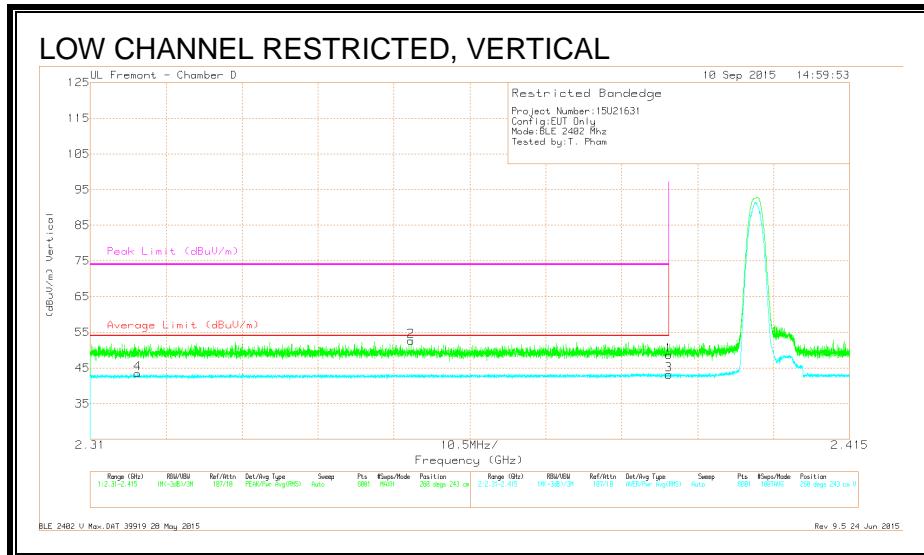
## DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cb/Filt r/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	37.13	Pk	32.1	-20.7	0	48.53	-	-	74	-25.47	89	109	H
2	* 2.386	41.79	Pk	32.1	-20.8	0	53.09	-	-	74	-20.91	89	109	H
3	* 2.39	29.91	RMS	32.1	-20.7	2.06	43.37	54	-10.63	-	-	89	109	H
4	* 2.386	32.56	RMS	32.1	-20.8	2.06	45.92	54	-8.08	-	-	89	109	H

\* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection



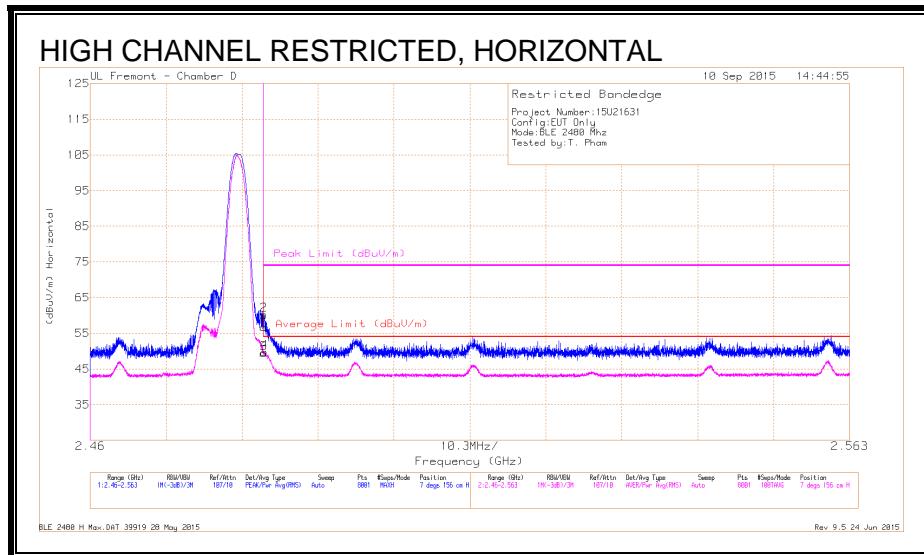
## DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cb/Fit r/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	37.24	Pk	32.1	-20.7	0	48.64	-	-	74	-25.36	260	243	V
2	* 2.354	41.54	Pk	32	-20.9	0	52.64	-	-	74	-21.36	260	243	V
3	* 2.39	29.65	RMS	32.1	-20.7	2.06	43.11	54	-10.89	-	-	260	243	V
4	* 2.317	30.39	RMS	32	-21	2.06	43.45	54	-10.55	-	-	260	243	V

\* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection



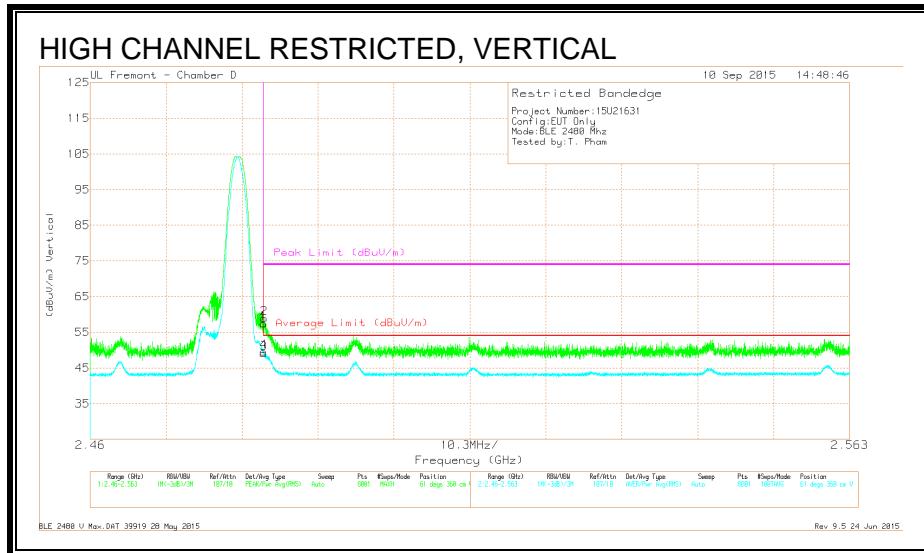
## DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Flt r/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	* 2.484	45.29	Pk	32.2	-20.8	0	56.69	-	-	74	-17.31	7	156	H
2	* 2.484	48.74	Pk	32.2	-20.8	0	60.14	-	-	74	-13.86	7	156	H
3	* 2.484	35.91	RMS	32.2	-20.8	2.06	49.37	54	-4.63	-	-	7	156	H
4	* 2.484	36.25	RMS	32.2	-20.8	2.06	49.71	54	-4.29	-	-	7	156	H

\* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection



## DATA

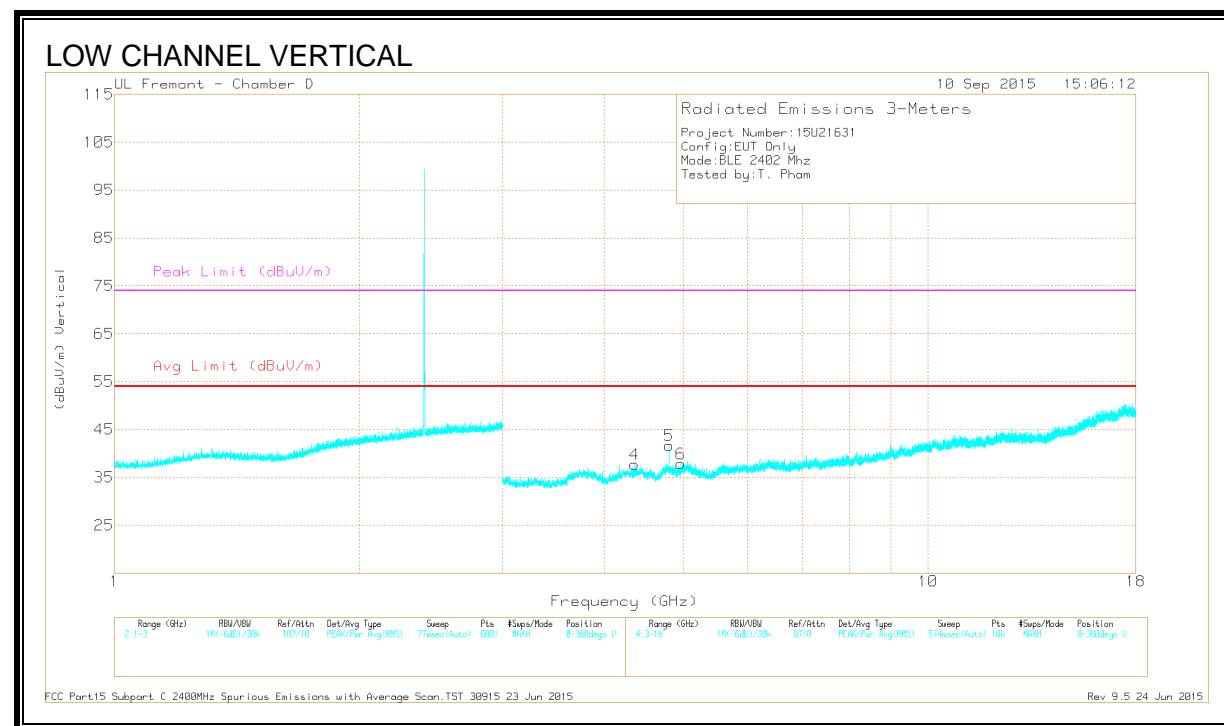
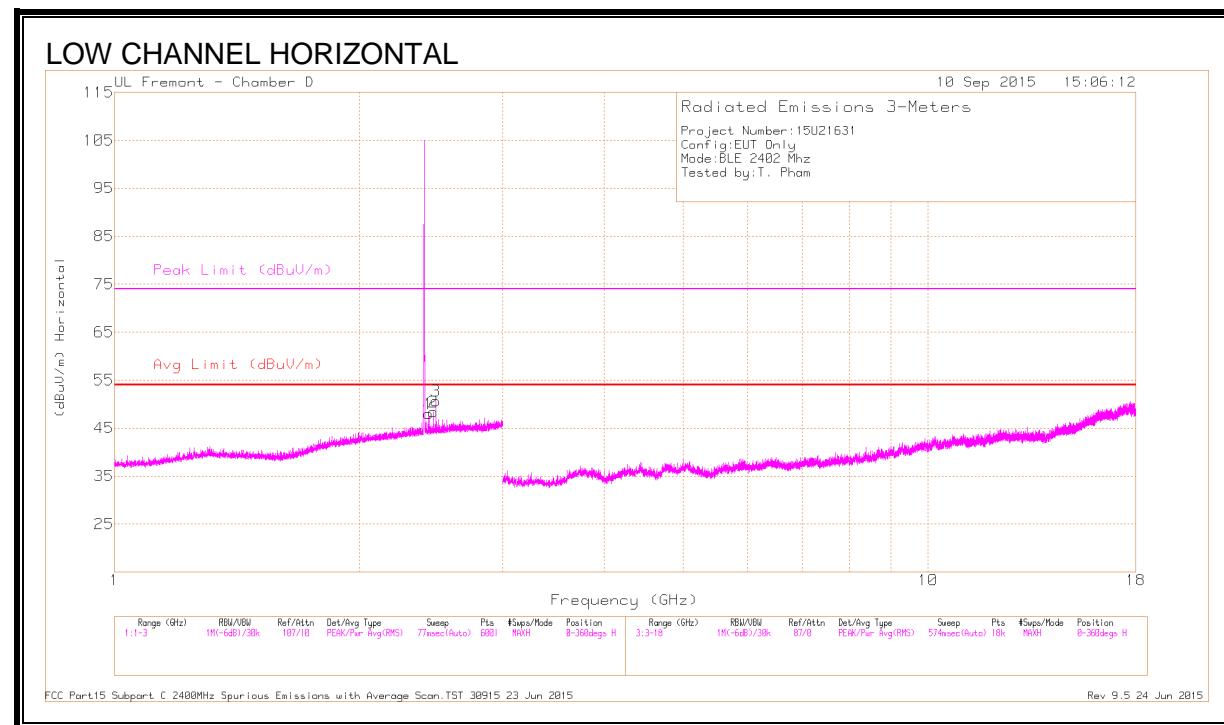
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Flt r/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	46.02	Pk	32.2	-20.8	0	57.42	-	-	74	-16.58	61	360	V
2	* 2.484	47.56	Pk	32.2	-20.8	0	58.96	-	-	74	-15.04	61	360	V
3	* 2.484	35.61	RMS	32.2	-20.8	2.06	49.07	54	-4.93	-	-	61	360	V
4	* 2.484	36.05	RMS	32.2	-20.8	2.06	49.51	54	-4.49	-	-	61	360	V

\* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection

## 8.2.2. HARMONICS AND SPURIOUS EMISSIONS



**DATA**

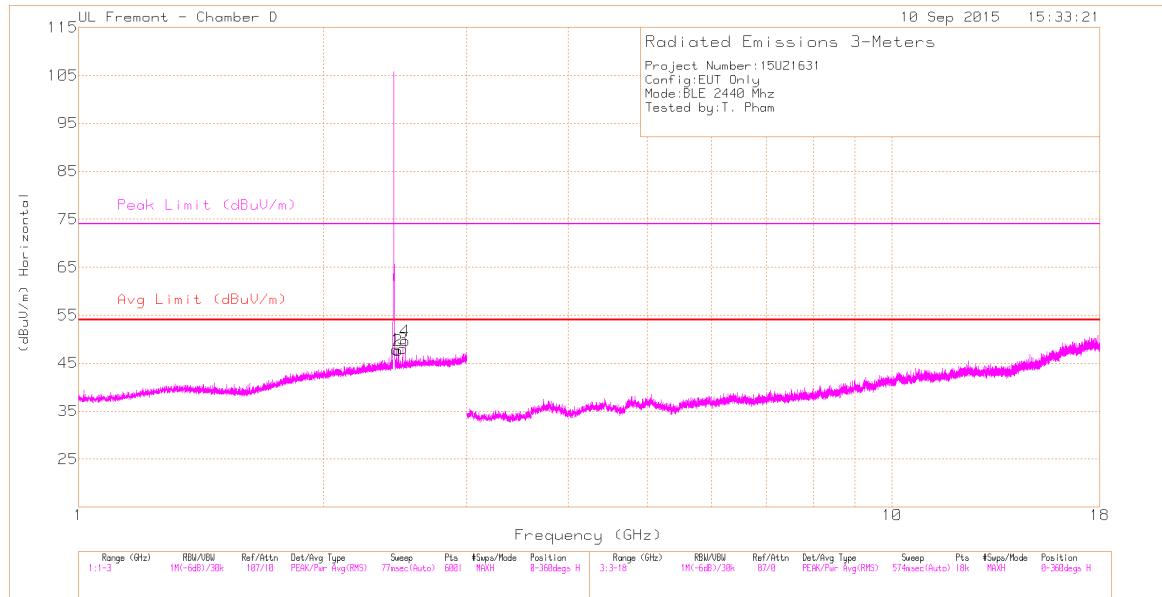
Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.355	38.84	PK2	33.7	-28.6	0	43.94	-	-	74	-30.06	122	147	V
* 4.356	27.22	MAv1	33.8	-28.6	2.06	34.48	54	-19.52	-	-	122	147	V
* 4.804	40.33	PK2	34.1	-27	0	47.43	-	-	74	-26.57	239	284	V
* 4.804	30.46	MAv1	34.1	-27	2.06	39.62	54	-14.38	-	-	239	284	V
* 4.962	37.91	PK2	34.2	-27.7	0	44.41	-	-	74	-29.59	262	256	V
* 4.961	26.57	MAv1	34.2	-27.7	2.06	35.13	54	-18.87	-	-	262	256	V
2.434	43.9	PK2	32.1	-20.9	0	55.1	-	-	-	-	179	169	H
2.434	32.94	MAv1	32.1	-20.9	2.06	46.2	-	-	-	-	179	169	H
2.466	43.97	PK2	32.2	-20.8	0	55.37	-	-	-	-	91	162	H
2.466	33.91	MAv1	32.2	-20.8	2.06	47.37	-	-	-	-	91	162	H
2.482	44.9	PK2	32.2	-20.8	0	56.3	-	-	-	-	91	162	H
2.482	35.37	MAv1	32.2	-20.8	2.06	48.83	-	-	-	-	91	162	H

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

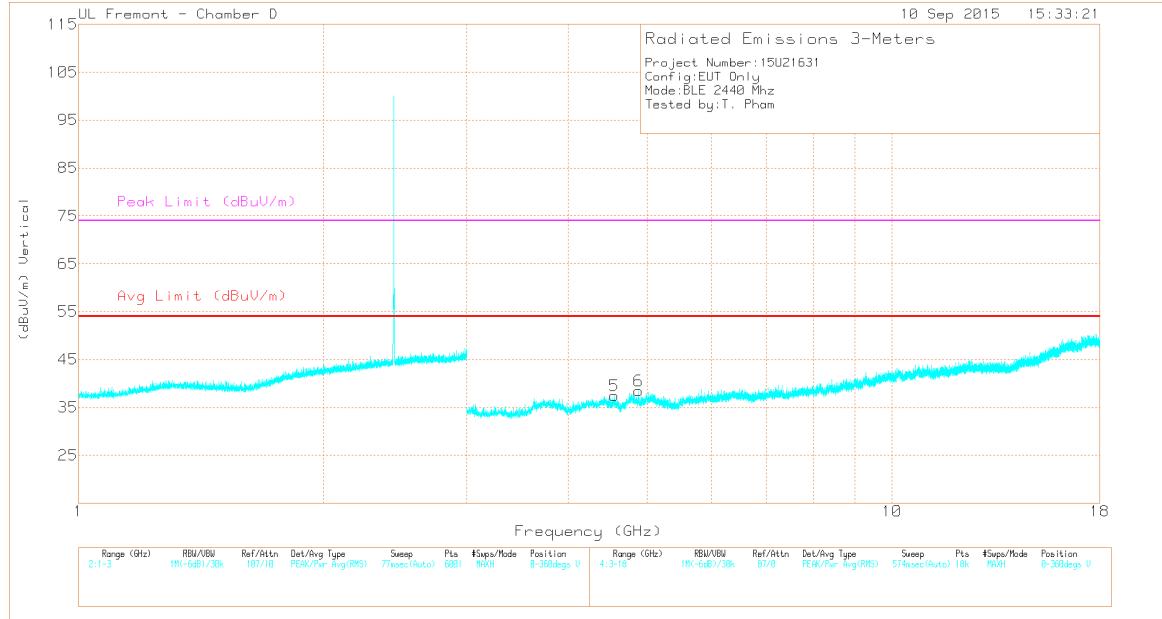
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

MID CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



**DATA**

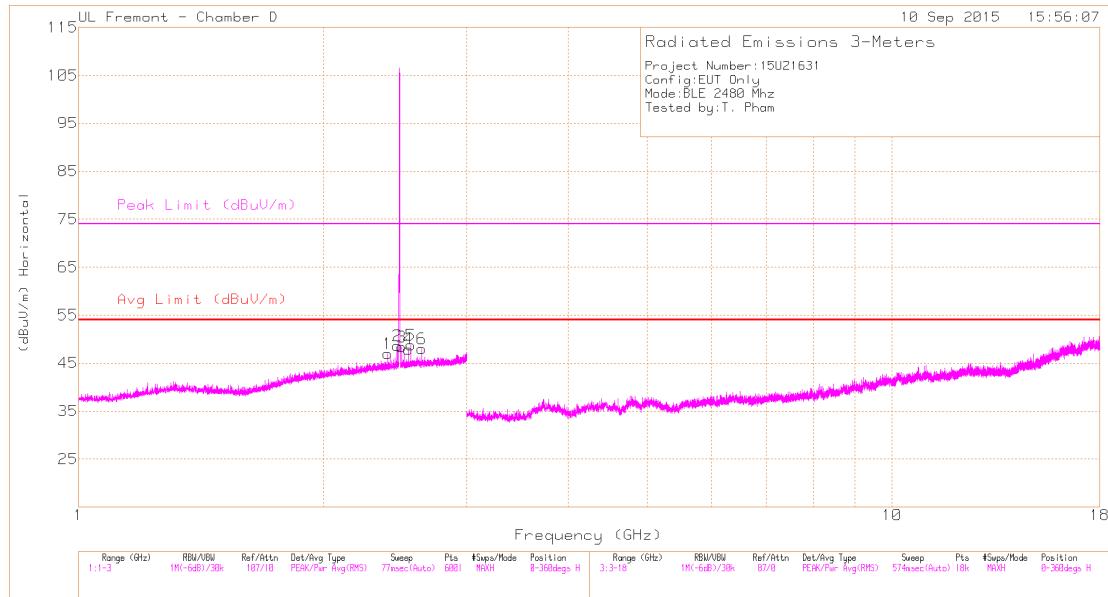
Frequen cy (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	DC Corr (dB)	Correcte d Reading (dBuV/m )	Avg Limit (dBuV/m )	Margin (dB)	Peak Limit (dBuV/m )	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.552	39.09	PK2	34.1	-28	0	45.19	-	-	74	-28.81	341	121	V
* 4.553	27.24	MAv1	34.1	-28	2.06	35.4	54	-18.6	-	-	341	121	V
* 4.88	38.85	PK2	34.1	-28.1	0	44.85	-	-	74	-29.15	347	142	V
* 4.88	26.74	MAv1	34.1	-28.1	2.06	34.8	54	-19.2	-	-	347	142	V
2.456	44.32	PK2	32.1	-20.8	0	55.62	-	-	-	-	358	102	H
2.456	33.12	MAv1	32.1	-20.8	2.06	46.48	-	-	-	-	358	102	H
2.472	43.94	PK2	32.2	-20.8	0	55.34	-	-	-	-	358	102	H
2.472	33.4	MAv1	32.2	-20.8	2.06	46.86	-	-	-	-	358	102	H
2.504	43.83	PK2	32.2	-20.7	0	55.33	-	-	-	-	358	102	H
2.504	33.67	MAv1	32.2	-20.7	2.06	47.23	-	-	-	-	358	102	H
2.52	44.75	PK2	32.2	-20.8	0	56.15	-	-	-	-	358	102	H
2.52	35.52	MAv1	32.2	-20.8	2.06	48.98	-	-	-	-	358	102	H

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

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

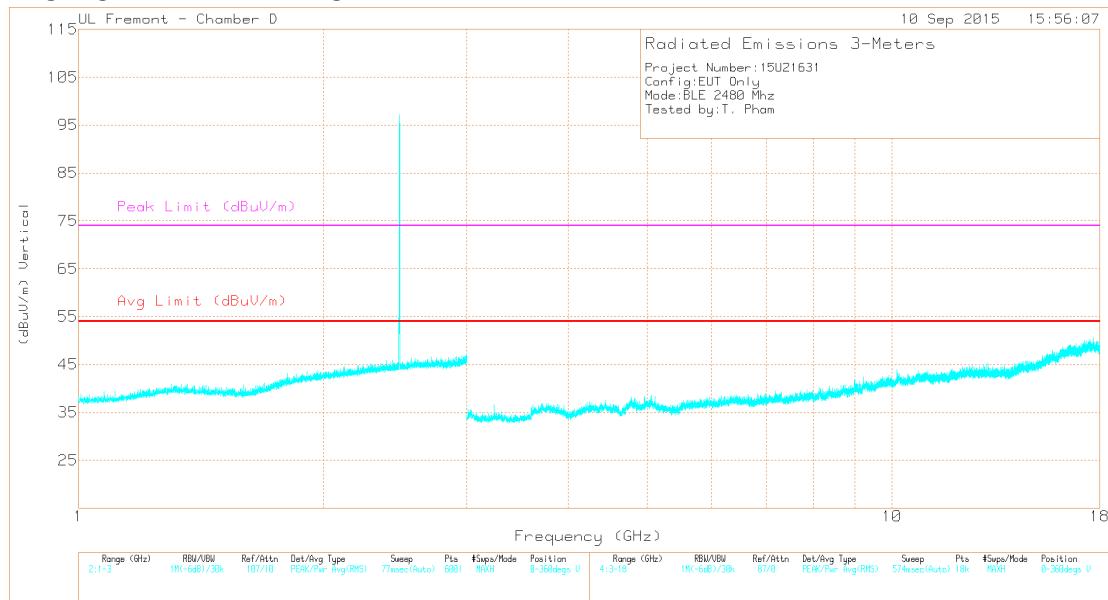
### HIGH CHANNEL HORIZONTAL



FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan.TST 30915 23 Jun 2015

Rev 9.5 24 Jun 2015

### HIGH CHANNEL VERTICAL



FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan.TST 30915 23 Jun 2015

Rev 9.5 24 Jun 2015

**DATA**

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 2.496	44.37	PK2	32.2	-20.8	0	55.77	-	-	74	-18.23	271	101	H
* 2.496	34.85	MAv1	32.2	-20.8	2.06	48.31	54	-5.69	-	-	271	101	H
2.4	43.72	PK2	32.1	-20.8	0	55.02	-	-	-	-	268	111	H
2.4	33.25	MAv1	32.1	-20.8	2.06	46.61	-	-	-	-	268	111	H
2.464	44.26	PK2	32.2	-20.8	0	55.66	-	-	-	-	271	101	H
2.464	34.37	MAv1	32.2	-20.8	2.06	47.83	-	-	-	-	271	101	H
2.544	44.35	PK2	32.3	-20.7	0	55.95	-	-	-	-	271	101	H
2.544	33.97	MAv1	32.3	-20.7	2.06	47.63	-	-	-	-	271	101	H
2.56	44.66	PK2	32.3	-20.7	0	56.26	-	-	-	-	271	106	H
2.56	35.1	MAv1	32.3	-20.7	2.06	48.76	-	-	-	-	271	106	H
2.64	43.41	PK2	32.4	-20.6	0	55.21	-	-	-	-	271	113	H
2.64	32.41	MAv1	32.4	-20.6	2.06	46.27	-	-	-	-	271	113	H

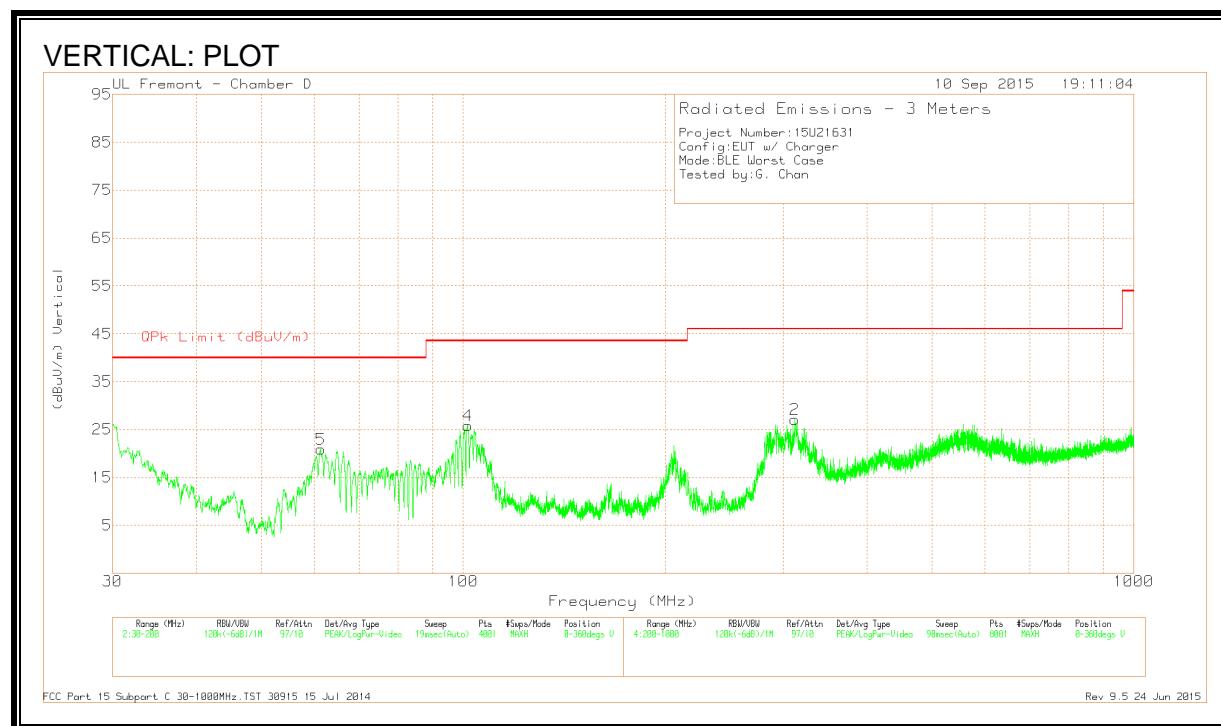
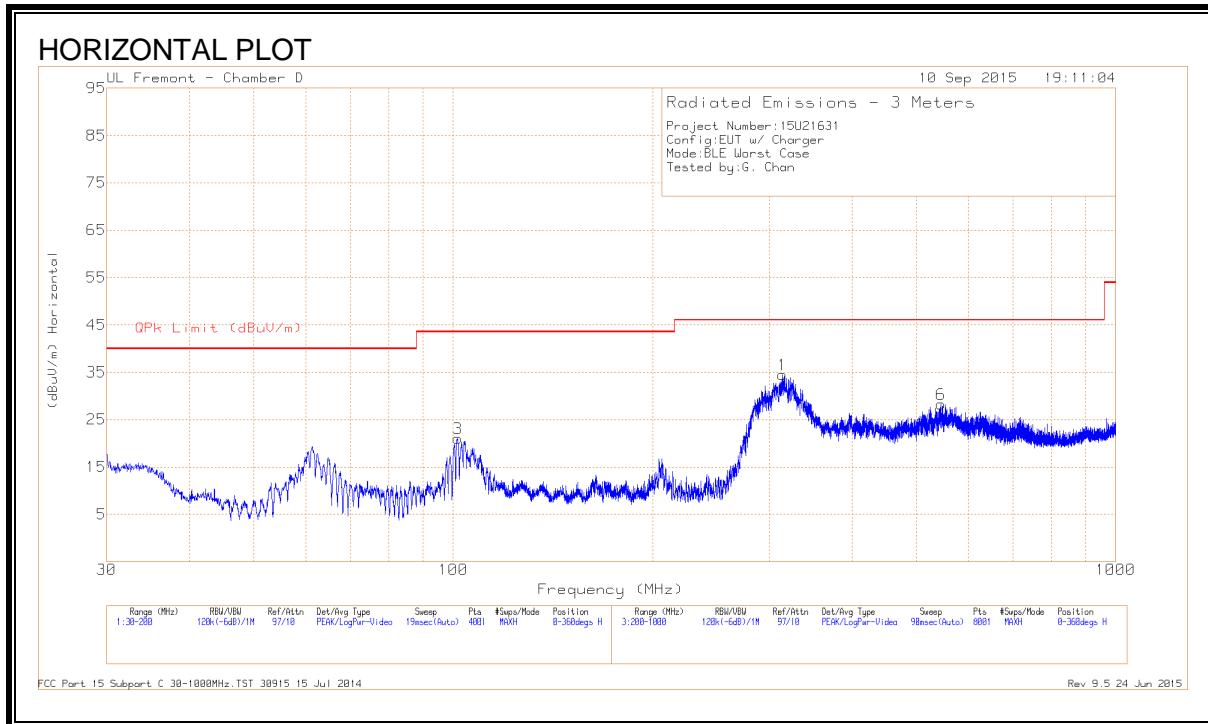
\* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

### 8.3. WORST-CASE BELOW 1 GHz

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



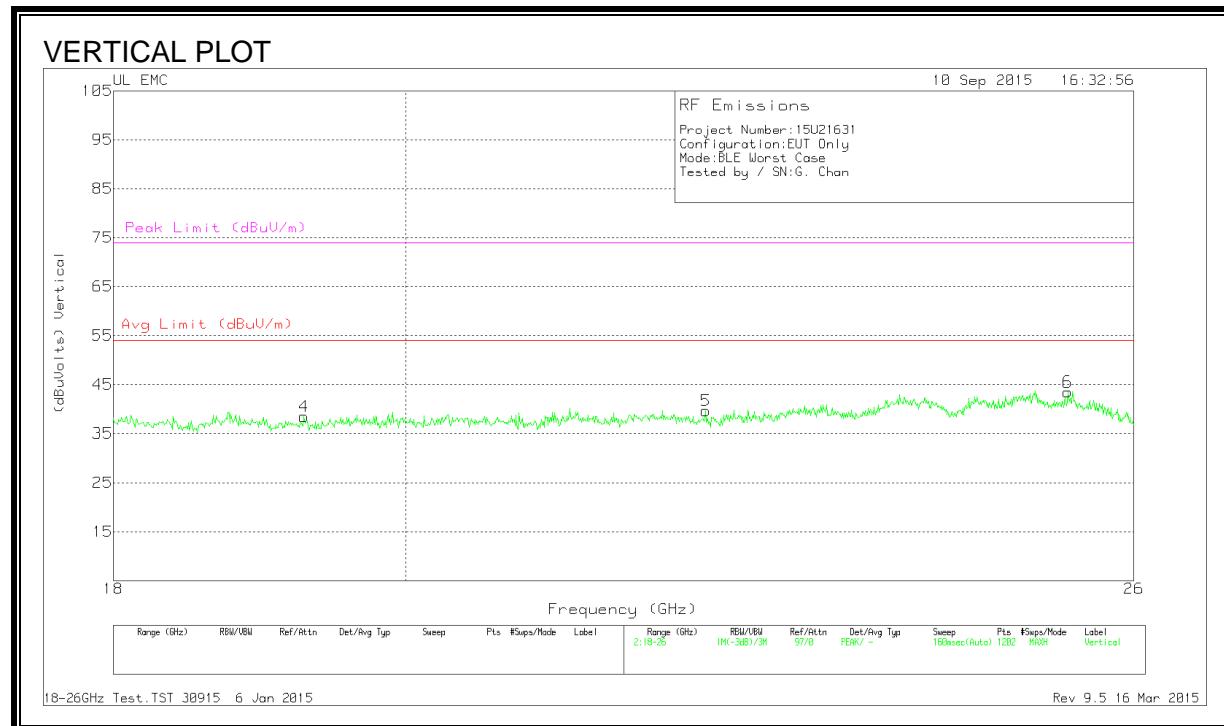
**DATA**

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	61.28	45.06	Pk	7.5	-31.7	20.86	40	-19.14	0-360	100	V
3	101.6125	41.93	Pk	10.5	-31.4	21.03	43.52	-22.49	0-360	301	H
4	101.6125	46.78	Pk	10.5	-31.4	25.88	43.52	-17.64	0-360	100	V
2	312.4	43.98	Pk	13.5	-30.4	27.08	46.02	-18.94	0-360	100	V
1	314.3	51.15	Pk	13.6	-30.3	34.45	46.02	-11.57	0-360	100	H
6	545.1	39.97	Pk	18	-29.7	28.27	46.02	-17.75	0-360	201	H

Pk - Peak detector

## 8.4. WORST-CASE 18 to 26 GHz

### SPURIOUS EMISSIONS 18 to 26 GHz (WORST-CASE CONFIGURATION)



**DATA**

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	24.974	42.93	Pk	34.1	-24.2	-9.5	43.33	54	-10.67	74	-30.67
2	18.693	41.03	Pk	32.5	-24.2	-9.5	39.83	54	-14.17	74	-34.17
3	20.991	42.37	Pk	32.4	-25.6	-9.5	39.67	54	-14.33	74	-34.33
4	19.279	40.4	Pk	32.3	-24.7	-9.5	38.5	54	-15.5	74	-35.5
5	22.283	40.97	Pk	32.8	-24.6	-9.5	39.67	54	-14.33	74	-34.33
6	25.387	43.6	Pk	33.7	-24.3	-9.5	43.5	54	-10.5	74	-30.5

Pk - Peak detector

## 9. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)		Conducted Limit (dB $\mu$ V)			
		Quasi-peak		Average	
0.15-0.5		66 to 56 *		56 to 46 *	
0.5-5		56		46	
5-30		60		50	

\*Decreases with the logarithm of the frequency.

### TEST PROCEDURE

ANSI C63.10

### RESULTS

#### EUT POWERED BY AC/DC ADAPTER VIA USB CABLE

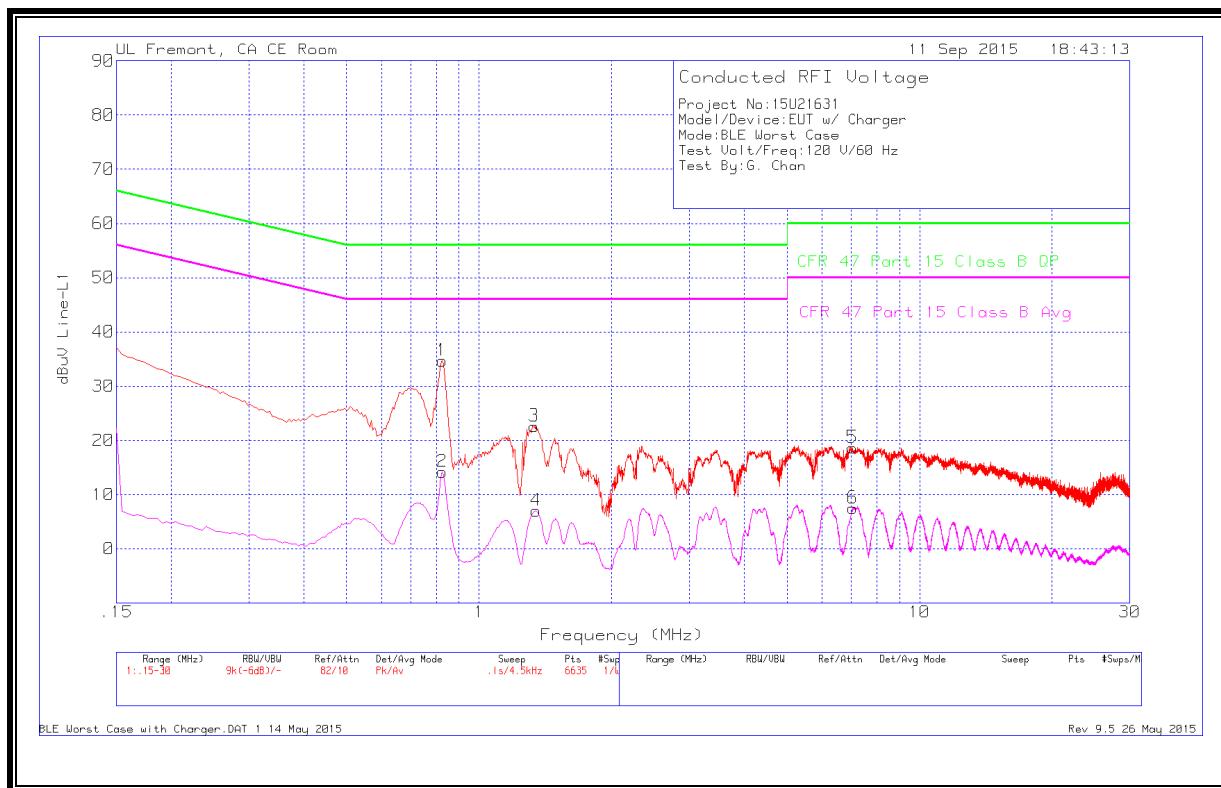
Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dB $\mu$ V)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dB $\mu$ V	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
1	.825	34.42	Pk	.3	0	34.72	56	-21.28	-	-
2	.825	13.93	Av	.3	0	14.23	-	-	46	-31.77
3	1.3335	22.3	Pk	.2	.1	22.6	56	-33.4	-	-
4	1.347	6.72	Av	.2	.1	7.02	-	-	46	-38.98
5	7.0485	18.33	Pk	.2	.1	18.63	60	-41.37	-	-
6	7.053	7.2	Av	.2	.1	7.5	-	-	50	-42.5

Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dB $\mu$ V)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dB $\mu$ V	CFR 47 Part 15 Class B QP	Margin (dB)	CFR 47 Part 15 Class B Avg	Margin (dB)
7	.8205	34.22	Pk	.3	0	34.52	56	-21.48	-	-
8	.825	17.2	Av	.3	0	17.5	-	-	46	-28.5
9	1.32	22.27	Pk	.2	.1	22.57	56	-33.43	-	-
10	1.3425	8.61	Av	.2	0	8.81	-	-	46	-37.19
11	3.426	17.92	Pk	.2	.1	18.22	56	-37.78	-	-
12	3.417	7.57	Av	.2	.1	7.87	-	-	46	-38.13

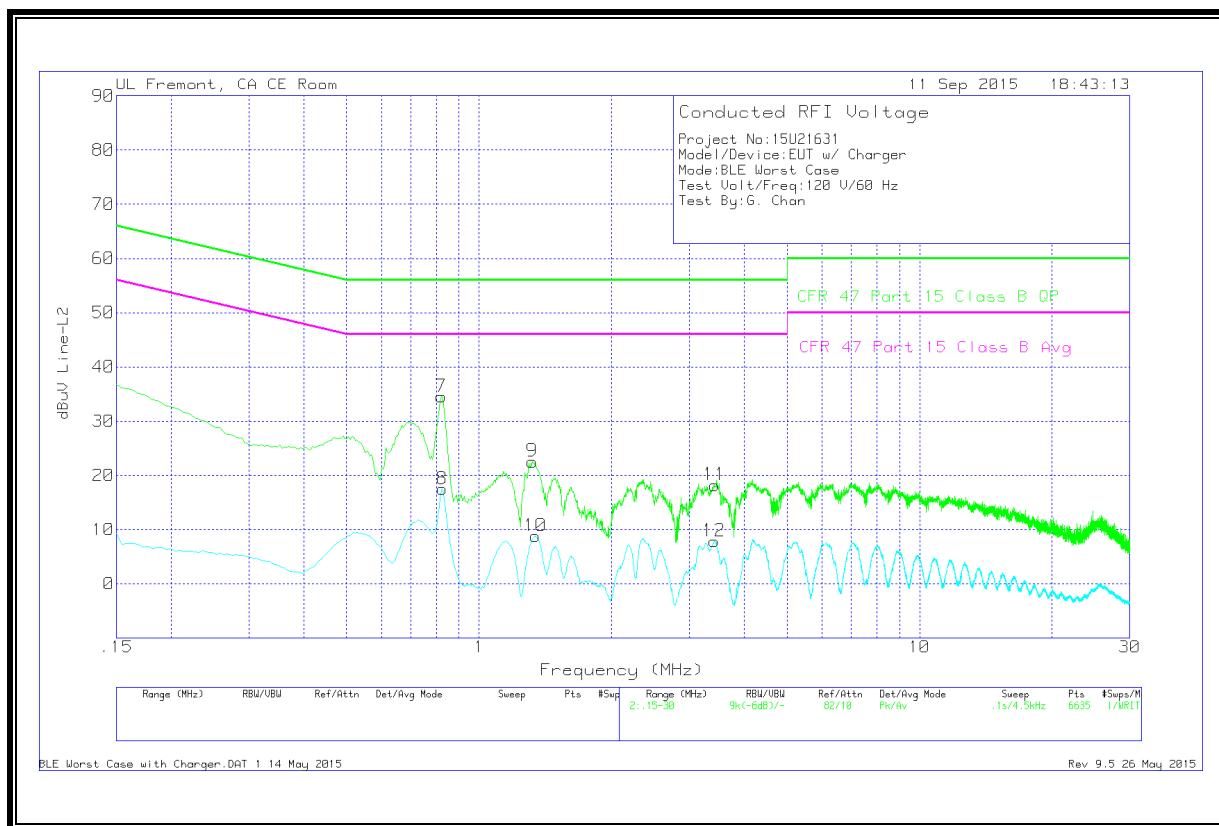
Pk - Peak detector

Av - Average detection

## LINE 1 RESULTS



## LINE 2 RESULTS



## 9.1. EUT POWERED BY HOST PC VIA USB CABLE

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CFR 47	Margin (dB)	CFR 47	Margin (dB)
							Part 15 Class B QP		Part 15 Class B	
1	.1545	56.15	Pk	1.3	0	57.45	65.75	-8.3	-	-
2	.1545	27.44	Av	1.3	0	28.74	-	-	55.75	-27.01
3	.366	43.72	Pk	.5	0	44.22	58.59	-14.37	-	-
4	.3705	32.43	Av	.4	0	32.83	-	-	48.49	-15.66
5	1.2885	40.44	Pk	.2	.1	40.74	56	-15.26	-	-
6	1.2795	16.8	Av	.2	.1	17.1	-	-	46	-28.9
7	2.571	31.95	Pk	.2	.1	32.25	56	-23.75	-	-
8	2.5755	20.06	Av	.2	.1	20.36	-	-	46	-25.64

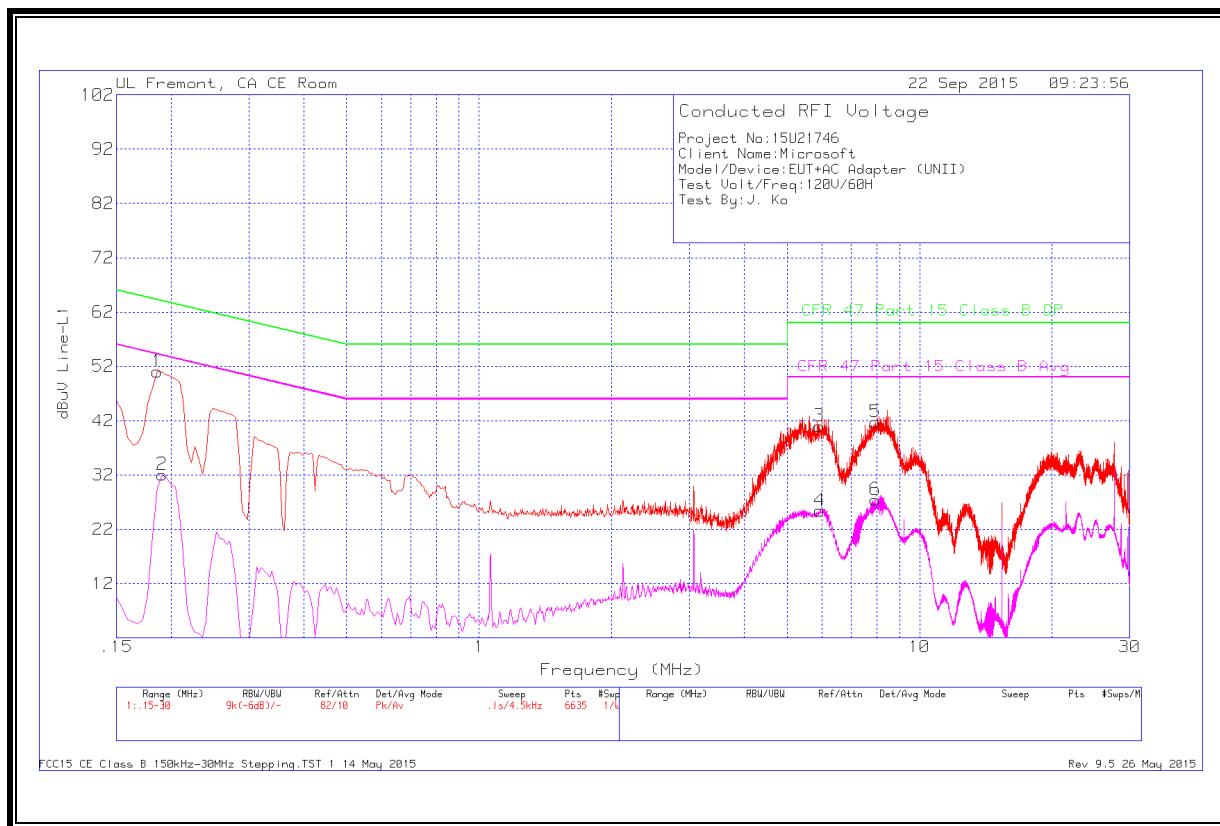
Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CFR 47	Margin (dB)	CFR 47	Margin (dB)
							Part 15 Class B QP		Part 15 Class B	
9	.3615	35	Pk	.5	0	35.5	58.69	-23.19	-	-
10	.357	25.4	Av	.5	0	25.9	-	-	48.8	-22.9
11	1.122	27.21	Pk	.3	.1	27.61	56	-28.39	-	-
12	1.1175	13.82	Av	.3	0	14.12	-	-	46	-31.88
13	13.8255	24.01	Pk	.2	.2	24.41	60	-35.59	-	-
14	13.848	17.55	Av	.2	.2	17.95	-	-	50	-32.05

Pk - Peak detector

Av - Average detection

**LINE 1 RESULTS**



**LINE 2 RESULTS**

