



# **CERTIFICATION TEST REPORT**

**Report Number. :** 12696946 E11V2

**Applicant :** APPLE, INC.  
1 APPLE PARK WAY  
CUPERTINO, CA. 95014, U.S.A.

**Model :** A2111, A2222 AND A2223

**FCC ID :** BCG-E3309A

**IC :** 579C-E3309A

**EUT Description :** SMARTPHONE

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 9

**Date Of Issue:**

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	7/18/2019	Initial Issue	Chin Pang
V2	7/24/2019	Address TCB's Questions	Chin Pang

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE, INC.  
1 APPLE PARK WAY  
CUPERTINO, CA 95014, U.S.A.

**EUT DESCRIPTION:** SMARTPHONE

**MODEL:** A2111, A2222 AND A2223

**SERIAL NUMBER:** C7CYP0F0MT5Q

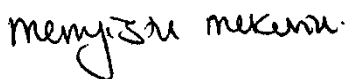
**DATE TESTED:** MAY 1, 2019 – JUNE 17, 2019

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Complies
ISED RSS-210 Issue 9, Annex B	Complies
ISED RSS-GEN Issue 5	Complies

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 C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 5, and RSS-210 Issue 9.

## 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 (ISED:2324B-1)	<input type="checkbox"/> Chamber D (ISED:22541-1)
<input type="checkbox"/> Chamber B (ISED:2324B-2)	<input type="checkbox"/> Chamber E (ISED:22541-2)
<input type="checkbox"/> Chamber C (ISED:2324B-3)	<input checked="" type="checkbox"/> Chamber F (ISED:22541-3)
	<input type="checkbox"/> Chamber G (ISED:22541-4)
	<input type="checkbox"/> Chamber H (ISED:22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through C are covered under ISED company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under ISED Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at [NVLAP Lab Search](#).

## 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
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

EUT is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, TD-SCDMA, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wide band, GPS and NFC. All models support at least one UICC based SIM. The second SIM, if present, is either UICC based pSIM (physical SIM) or e-SIM (electronic SIM). The device has a built-in inductive charging receiver. The rechargeable battery is also not user accessible.

### 5.2. DIFFERENCE IN MODEL NUMBER

Model A2111, A2222 and A2223 is electrically identical to Model AA2111. Three model numbers are allocated for marketing and logistic purposes only. A2111 was used to perform all final tests.

### 5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak radiated magnetic field strength as follows:

Frequency Range (MHz)	Mode		Kbps	E Field at 30m distance (dBuV/m)
13.56	Type B	CE	848	22.99
		Reader	848	23.58

### 5.4. WORST-CASE CONFIGURATION AND MODE

The fundamental of the EUT was investigated under three orthogonal orientations X (Flatbed), Y (Landscape), and Z (Portrait). The Y (Landscape orientation) was determined to be the worst-case orientation for CE mode and X (Flatbed) orientation for Reader mode.

The worst case position of the EUT was investigated under two configurations: EUT with power supply, EUT with earphones. The EUT with power supply configuration was determined to be worst-case configurations; therefore, all final tests were performed on the EUT with power supply.

In addition, Type A, B and F with CE mode and Reader mode data rates and ISO 15693 were investigated to determine the worst case based on the highest power and spurious emissions. Type B was determined to be the worst case and therefore Type B was selected for all final tests.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788



## 5.5. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
laptop	Apple	Macbook Pro	C02V90P8G8WL	QDS-BRCM1069
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
EUT AC Adapter	Apple	A1385	D292365CDYADHLHC3	NA

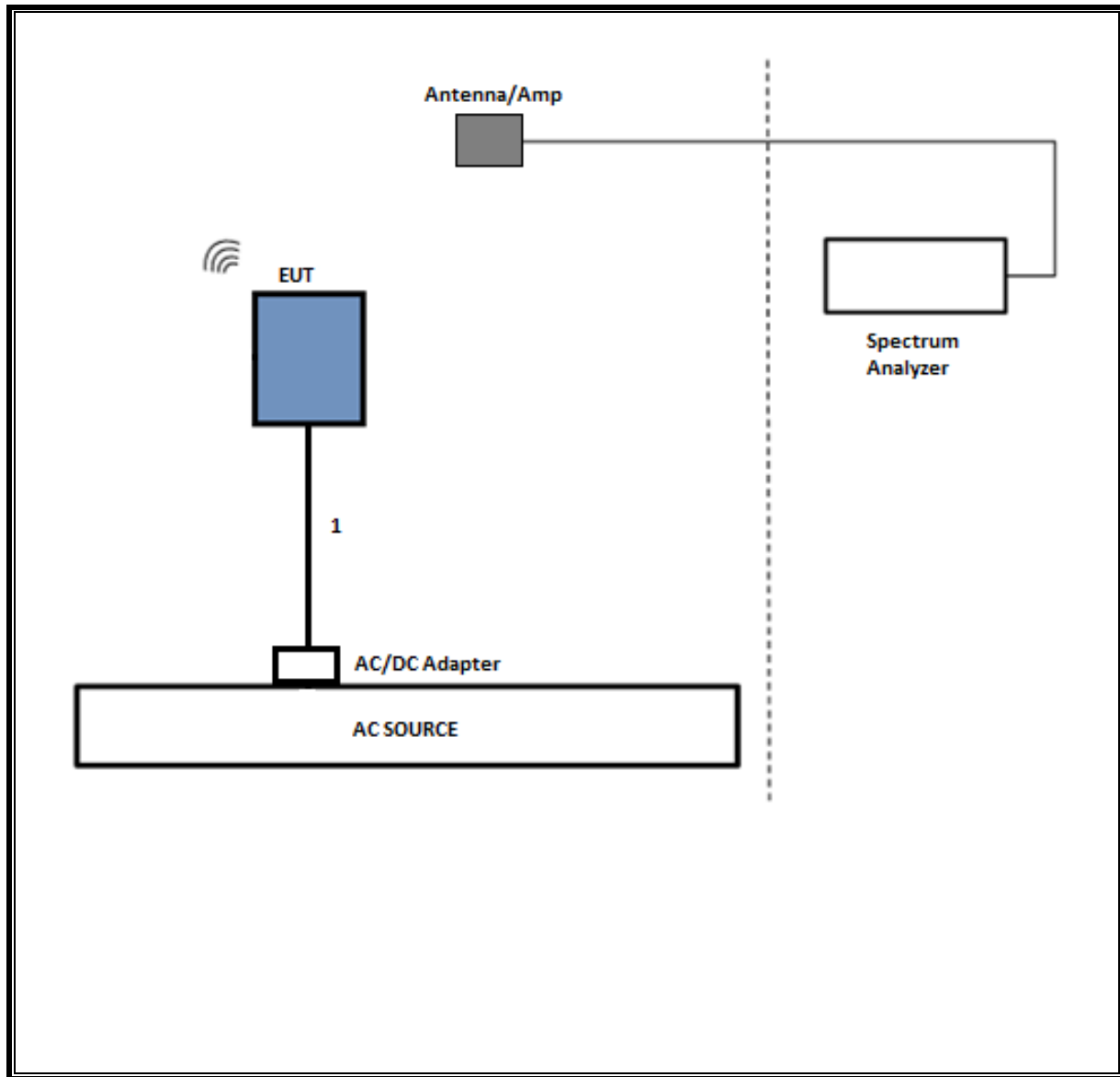
### I/O CABLES

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

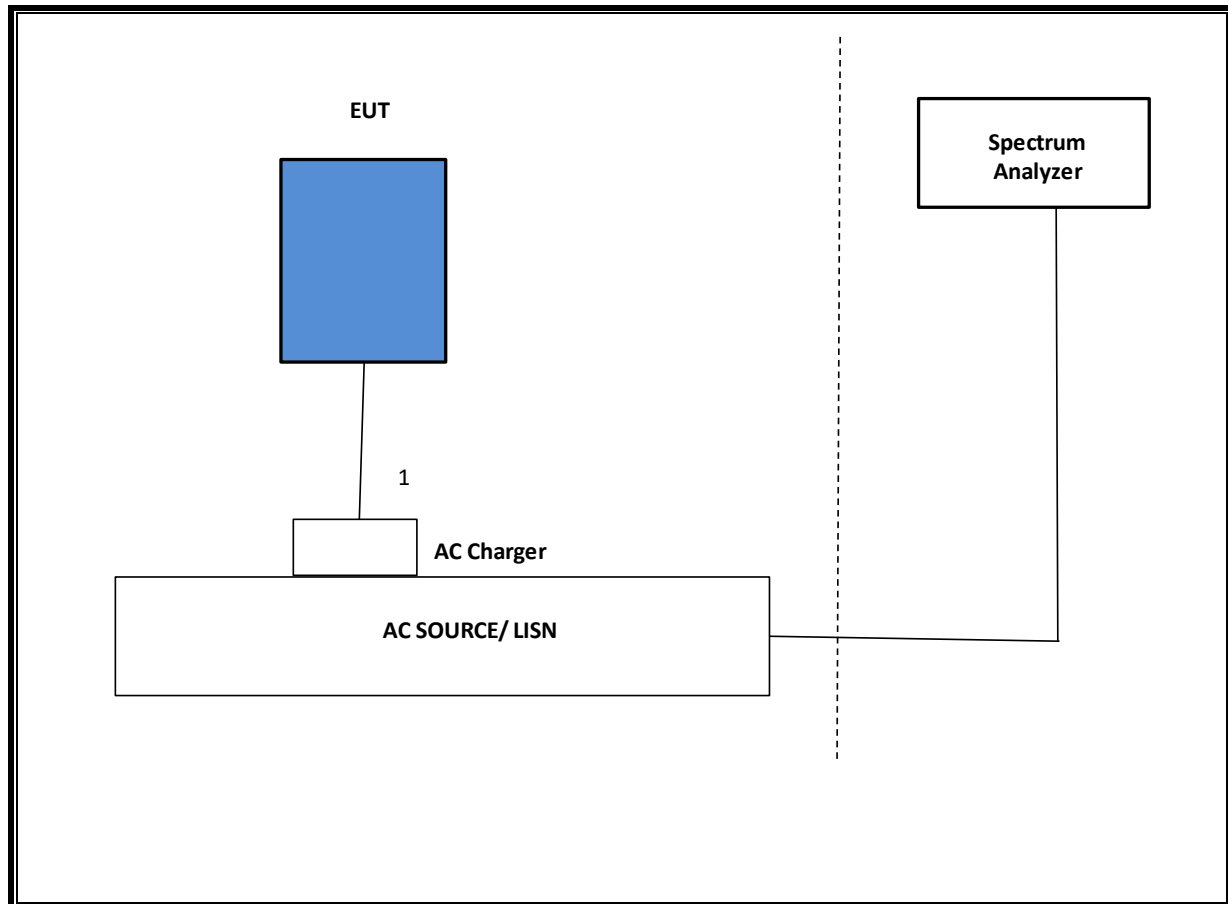
### TEST SETUP

The EUT is installed in a host laptop computer during the tests. Test software exercised the EUT.

**SETUP DIAGRAM FOR RADIATED TESTS**



**SETUP DIAGRAM FOR LINE CONDUCTED TESTS**



## 6. TEST AND MEASUREMENT EQUIPMENT

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

Description	Manufacturer	Model	ID Num	Cal Due
*Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	T900	06/18/2019
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T173	07/06/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T342	01/23/2020
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T754	08/15/2019
*Antenna, Active Loop 9KHz to 30MHz	EMCO	6502	T35	06/06/2019
Spectrum Analyzer, PSA, 3Hz to 26.5GHz	Agilent (Keysight) Technologies	E4440A	T189	01/29/2020
<b>AC Line Conducted</b>				
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESCI7	T1436	02/14/2020
Power Cable, Line Conducted Emissions	UL	PG1	T861	08/31/2019
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	01/24/2020
<b>UL AUTOMATION SOFTWARE</b>				
Radiated Software	UL	UL EMC	Ver 9.5, April 26, 2016	
Conducted Software	UL	UL EMC	Ver 5.4, October 13, 2016	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

\*Testing is completed before equipment expiration date.

## 7. OCCUPIED BANDWIDTH

### LIMITS

None; for reporting purposes only.

### TEST PROCEDURE

Type A with highest data rate. The transmitter output is connected to the spectrum analyzer. The RBW is set to 10kHz. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

Note: Because the measured signal is CW or CW-like adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW

### RESULTS

#### 99% and 20dB BW

##### CE MODE

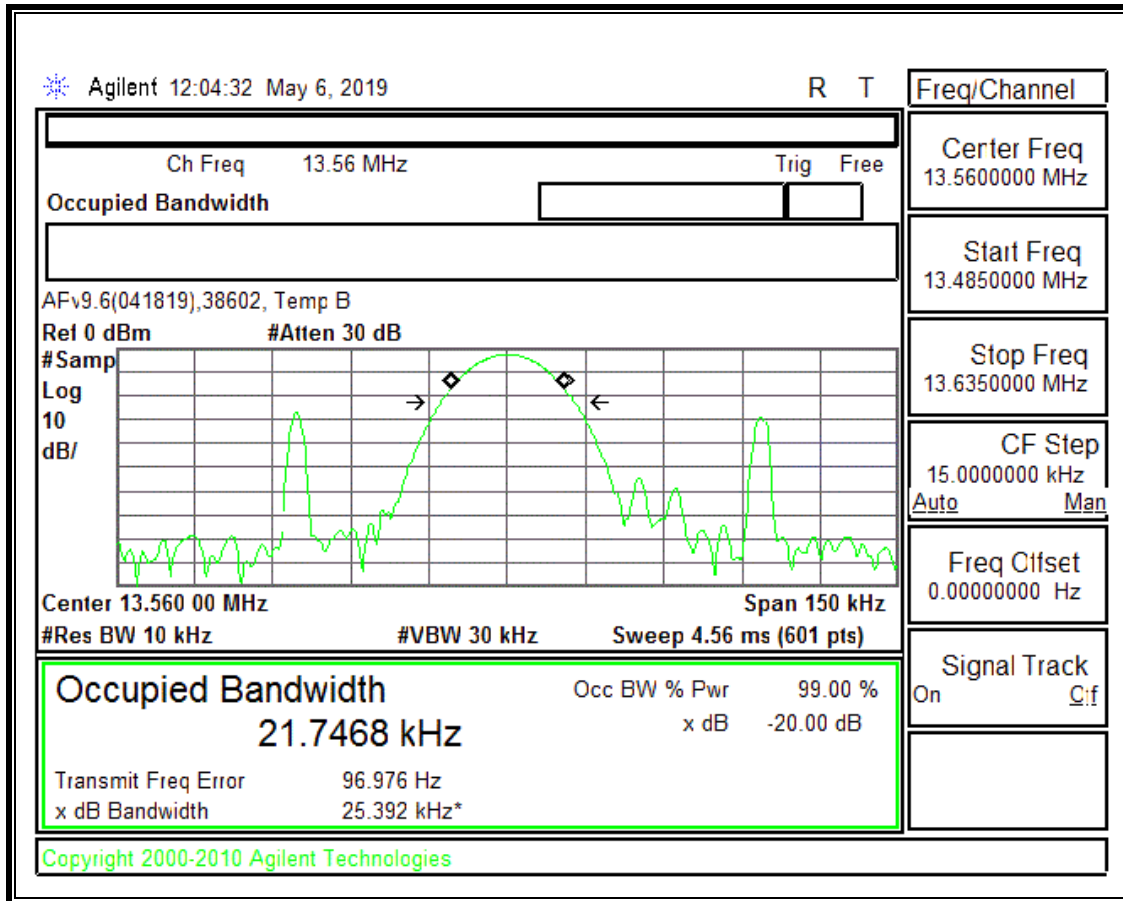
Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	21.7468	25.392

##### READER MODE

Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	21.8179	25.264

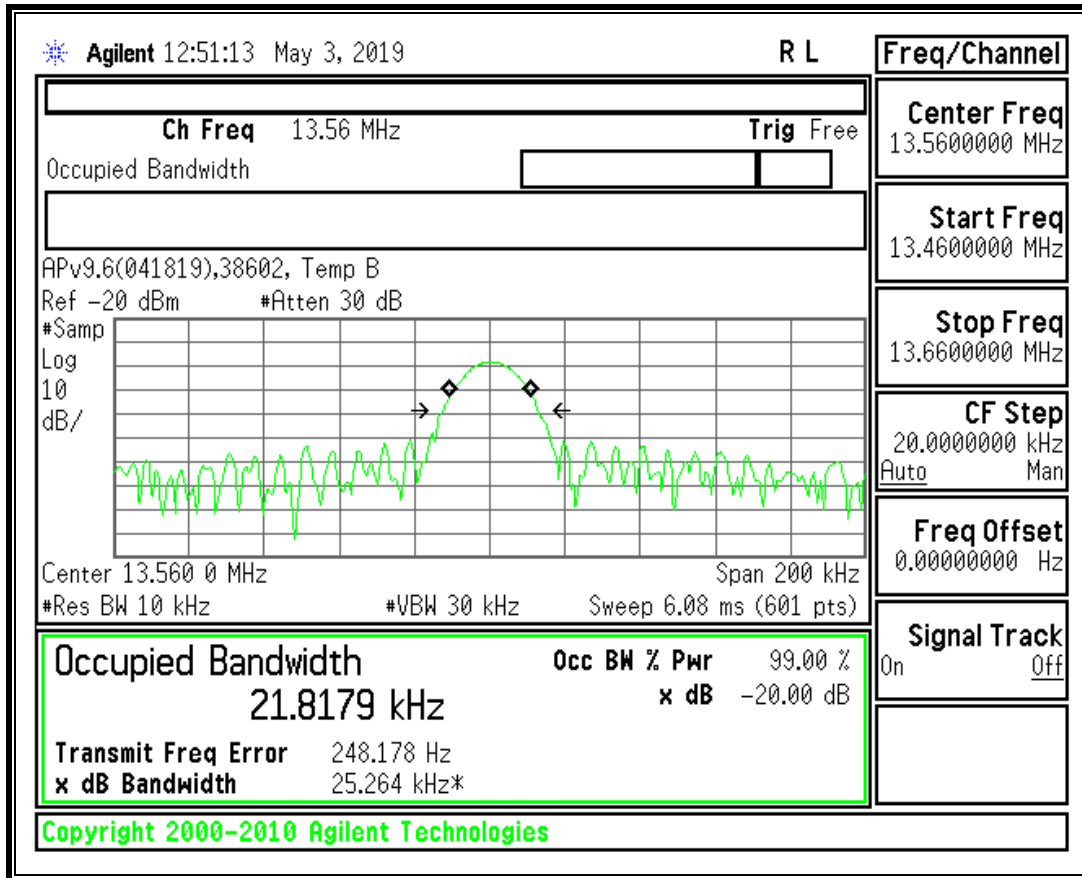
## 7.1. CE MODE

### 848Kbps



## 7.2. READER MODE

**848Kbps**



## 8. RADIATED EMISSION TEST RESULTS

### 8.1. LIMITS AND PROCEDURE

#### LIMIT

§15.225

IC RSS-210, Annex B.6

IC RSS-GEN, Section 8.9 (Transmitter)

(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 field strength from µV/m to dBµV/m is:

Limit (dBµV/m) = 20 log limit (µV/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

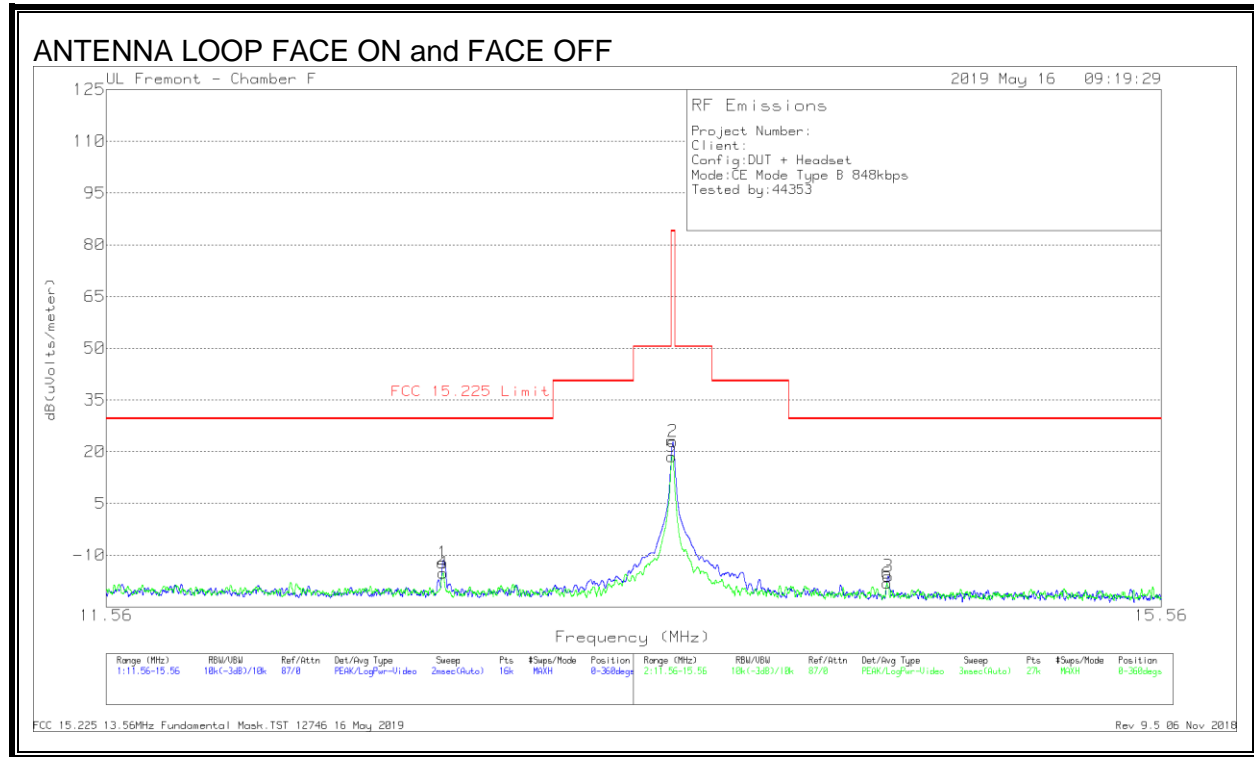
The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the 10<sup>th</sup> harmonic of the highest fundamental frequency, or 1000 MHz, whichever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

#### **RESULTS**

## 8.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 - 30 MHz), EUT WITH AC/DC ADAPTER

### 8.2.1. CE MODE

#### FUNDAMENTAL 848Kbps



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
1	12.70875	16.93	Pk	10.5	.4	-40	-12.17	29.54	-41.71	0-360
2	13.56	52.19	Pk	10.4	.4	-40	22.99	84	-61.01	0-360
3	14.40763	13.22	Pk	10.3	.4	-40	-16.08	29.54	-45.62	0-360
4	12.71003	13.95	Pk	10.5	.4	-40	-15.15	29.54	-44.69	0-360
5	13.55637	47.78	Pk	10.4	.4	-40	18.58	84	-65.42	0-360
6	14.4033	11.17	Pk	10.3	.4	-40	-18.13	29.54	-47.67	0-360

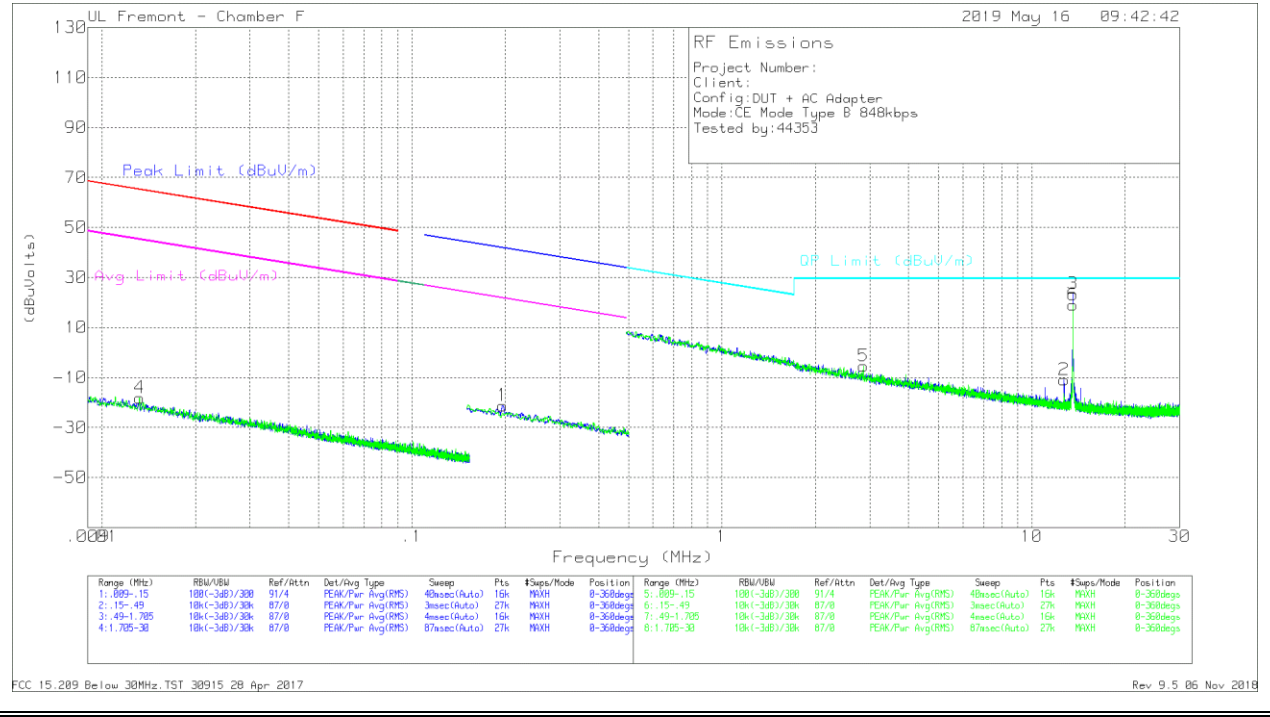
Pk - Peak detector

FCC 15.225 13.56MHz Fundamental Mask.TST 12746 16 May 2019

Rev 9.5 06 Nov 2018

# **SPURIOUS EMISSION 848Kbps**

## **ANTENNA LOOP FACE ON and FACE OFF**



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuV olts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.19614	47.02	Pk	11.6	.1	-80	-21.28	-	-	-	-	41.77	-63.05	21.77	-43.05	0-360
4	.01321	43.62	Pk	18.2	0	-80	-18.18	65.17	-83.35	45.17	-63.35	-	-	-	-	0-360

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuV olts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
2	12.71267	18.15	Pk	10.5	.4	-40	-10.95	29.5	-40.45	0-360
5	2.86199	22.59	Pk	11.7	.2	-40	-5.51	29.5	-35.01	0-360

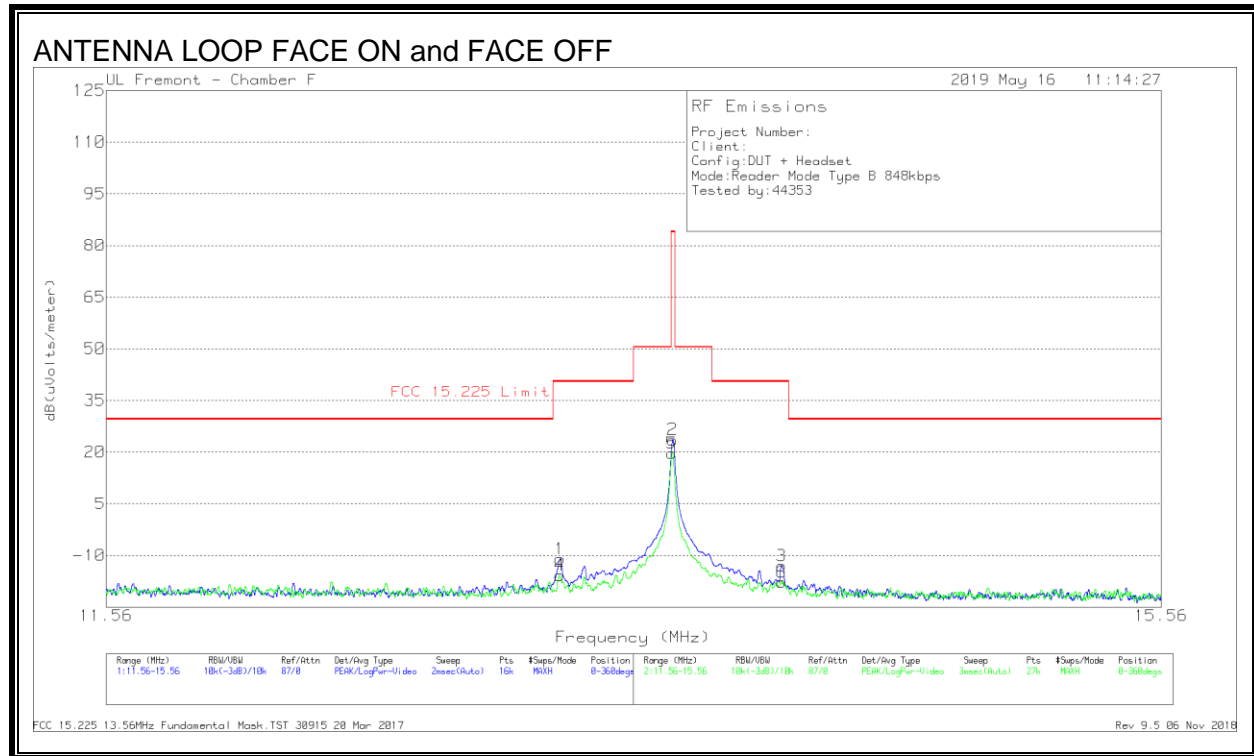
Pk - Peak detector

FCC 15.209 Below 30MHz.TST 30915 28 Apr 2017  
Rev 9.5 06 Nov 2018

Note: Marker 3 and 6 are the fundamental signal.

## 8.2.2. READER MODE

### FUNDAMENTAL 848Kbps



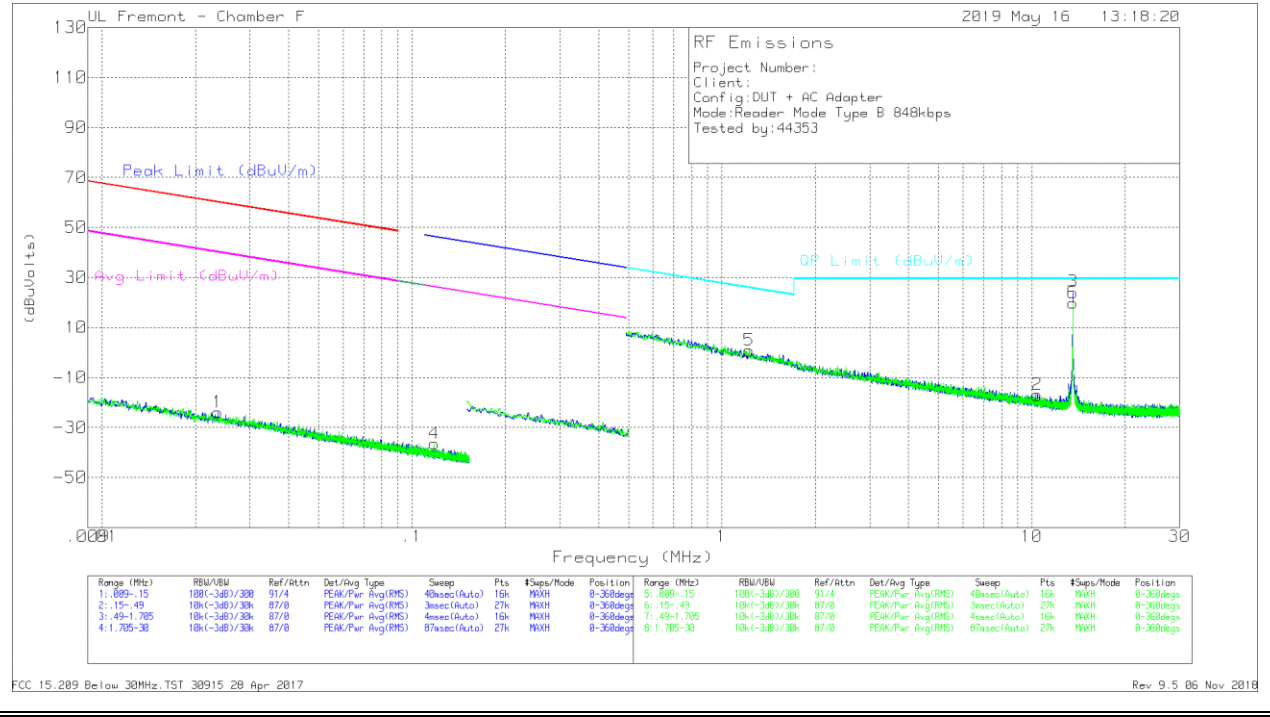
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
1	13.13613	18.15	Pk	10.4	.4	-40	-11.05	40.51	-51.56	0-360
2	13.55925	52.78	Pk	10.4	.4	-40	23.58	84	-60.42	0-360
3	13.98163	16.27	Pk	10.3	.4	-40	-13.03	40.51	-53.54	0-360
4	13.13442	13.41	Pk	10.4	.4	-40	-15.79	40.51	-56.3	0-360
5	13.55637	48.83	Pk	10.4	.4	-40	19.63	84	-64.37	0-360
6	13.98128	11.55	Pk	10.3	.4	-40	-17.75	40.51	-58.26	0-360

Pk - Peak detector

FCC 15.225 13.56MHz Fundamental Mask.TST 30915 20 Mar 2017  
Rev 9.5 06 Nov 2018

**SPURIOUS EMISSION 848Kbps**

**ANTENNA LOOP FACE ON and FACE OFF**



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
2	10.41178	11.78	Pk	10.8	.4	-40	-17.02	29.5	-46.52	0-360
5	1.22424	29.1	Pk	11.5	.1	-40	.7	25.87	-25.17	0-360

Pk - Peak detector

FCC 15.209 Below 30MHz.TST 30915 28 Apr 2017

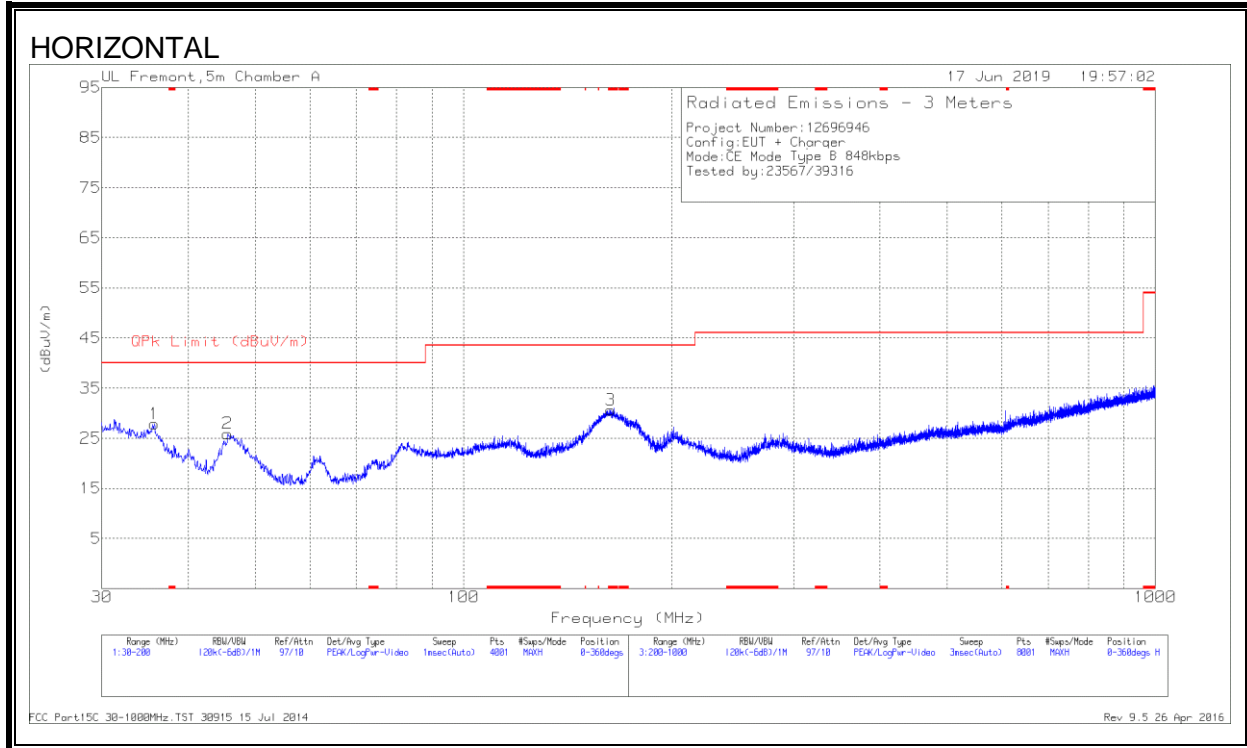
Rev 9.5 06 Nov 2018

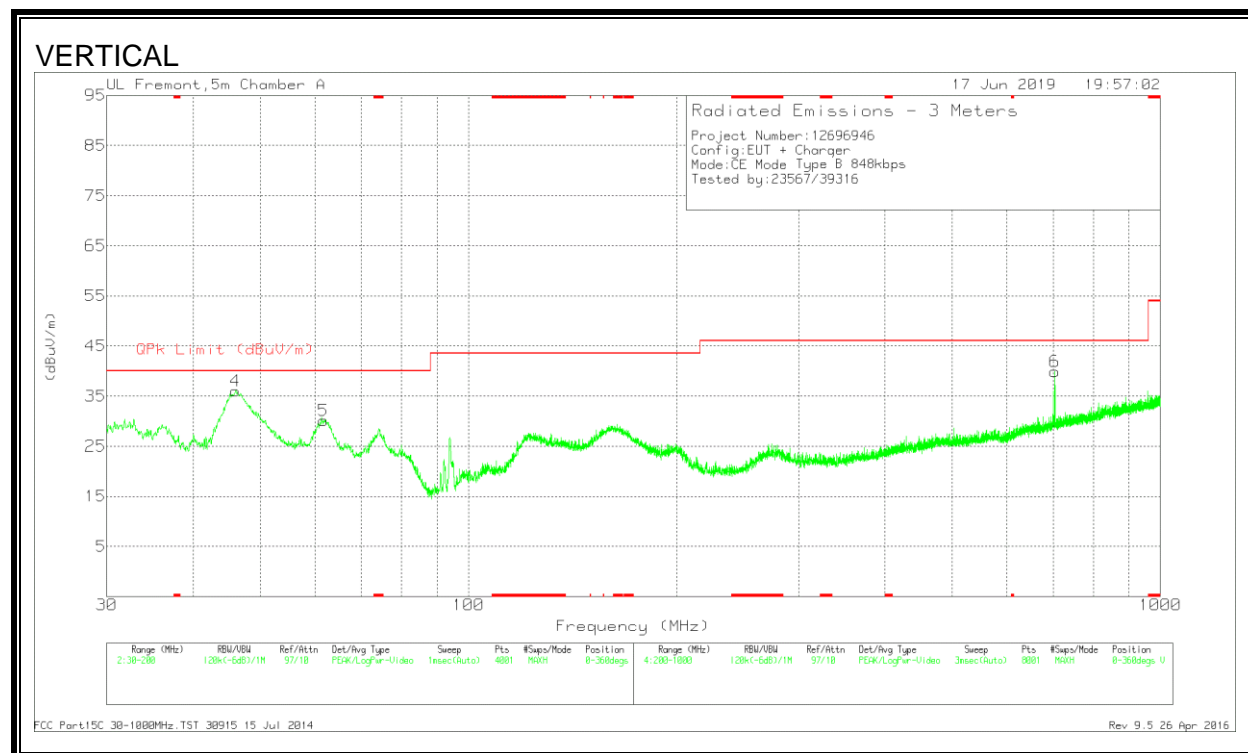
Note: Marker 3 and 6 are the fundamental signal.

### 8.3. TX SPURIOUS EMISSION 30 TO 1000 MHz, EUT WITH AC/DC ADAPTER

#### 8.3.1. CE MODE

##### SPURIOUS EMISSION 848Kbps





## DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181574 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 163.195	38.14	Pk	18.1	-25.6	30.64	43.52	-12.88	0-360	200	H
1	35.7375	32.13	Pk	22.9	-27.2	27.83	40	-12.17	0-360	200	H
2	45.5975	37.22	Pk	15.7	-27	25.92	40	-14.08	0-360	300	H
4	46.065	47.53	Pk	15.5	-27	36.03	40	-3.97	0-360	100	V
	46.625	43.49	Qp	15.2	-27	31.69	40	-8.31	344	106	V
5	61.6625	43.33	Pk	13.6	-26.8	30.13	40	-9.87	0-360	100	V
6	703.7	37.67	Pk	26.2	-24	39.87	46.02	-6.15	0-360	300	V

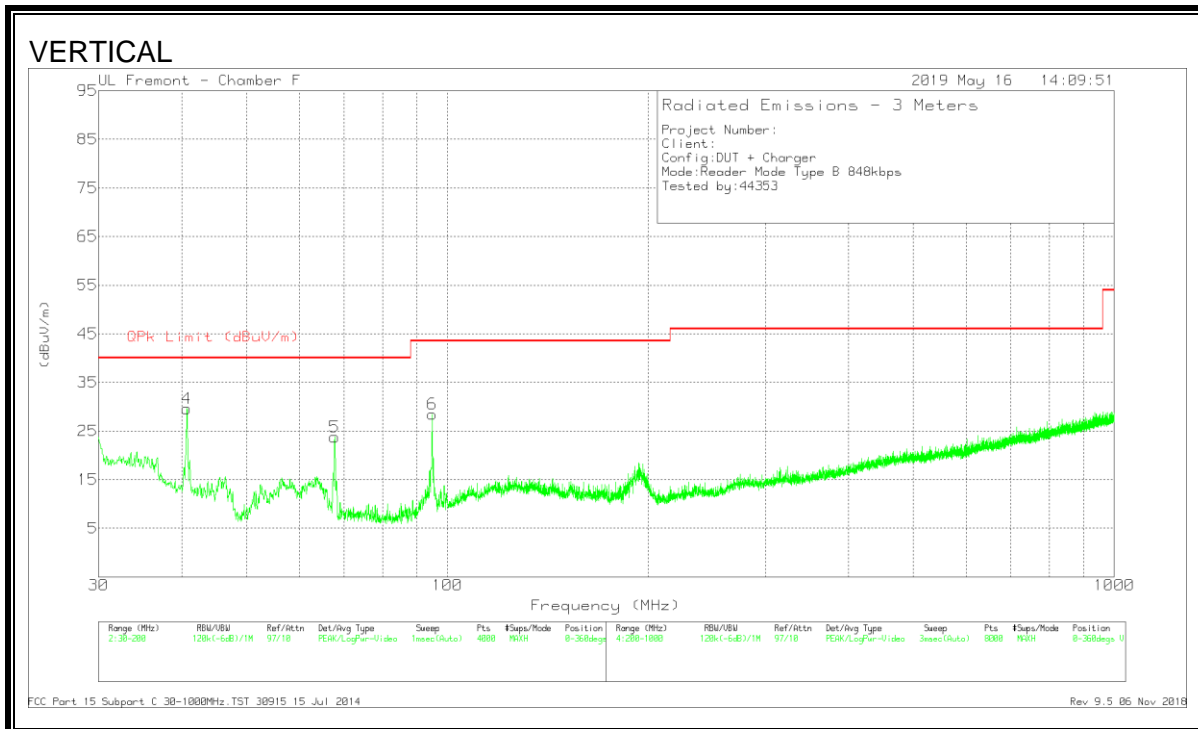
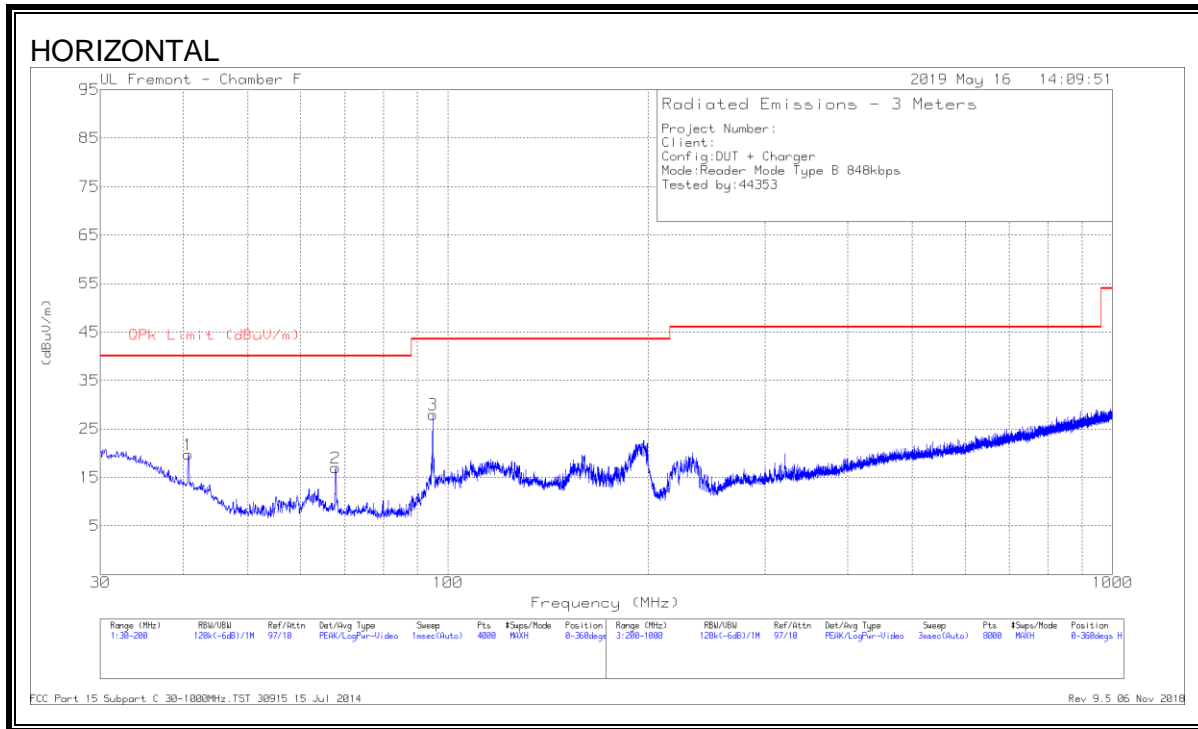
\* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

### 8.3.2. READER MODE

#### SPURIOUS EMISSION 848Kbps





## DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T900 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	40.6703	33.7	Pk	17.8	-31.8	19.7	40	-20.3	0-360	399	H
2	67.7923	36.27	Pk	12.2	-31.5	16.97	40	-23.03	0-360	199	H
3	94.9143	46.46	Pk	12.7	-31.2	27.96	43.52	-15.56	0-360	299	H
4	40.6703	43.63	Pk	17.8	-31.8	29.63	40	-10.37	0-360	100	V
	40.6713	43.05	Qp	17.8	-31.8	29.05	40	-10.95	0	101	V
5	67.7923	43.08	Pk	12.2	-31.5	23.78	40	-16.22	0-360	100	V
6	94.9143	46.99	Pk	12.7	-31.2	28.49	43.52	-15.03	0-360	100	V

Pk - Peak detector

Qp - Quasi-Peak detector

FCC Part 15 Subpart C 30-1000MHz.TST 30915 15 Jul 2014

Rev 9.5 06 Nov 2018

## 9. 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.

IC RSS-210, Annex B.6

Carrier frequency stability shall be maintained to  $\pm 0.01\%$  ( $\pm 100$  ppm).

### TEST PROCEDURE

ANSI C63.10-2013 Clause 6.8

### RESULTS

No non-compliance noted.

ID:	38602	Date:	5/6/19
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## 9.1. CE MODE

**848Kbps**

### CE MODE TYPE B 848 Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20°C										
Limit: $\pm 100$ ppm = 1.35600 KHz										
Power Supply	Envir. Temp	Frequency Deviation Measured with Time Elapse								
(VAC)	(°C)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
<b>3.80</b>	50	13.5604264	39.416	13.5604218	39.081	13.5604162	38.670	13.5603953	37.124	$\pm 100$
	40	13.5598919	0.000	13.5594003	-36.252	13.5593885	-37.121	13.5594097	-35.559	$\pm 100$
	30	13.5598942	0.171	13.5599034	0.847	13.5599436	3.814	13.5599451	3.927	$\pm 100$
	<b>20</b>	<b>13.5591303</b>	<b>-56.167</b>	<b>13.5600460</b>	<b>11.365</b>	<b>13.5601067</b>	<b>15.841</b>	<b>13.5600071</b>	<b>8.496</b>	<b><math>\pm 100</math></b>
	10	13.5593737	-38.213	13.5593475	-40.143	13.5593081	-43.054	13.5593657	-38.802	$\pm 100$
	0	13.5600102	8.728	13.5600763	13.602	13.5600974	15.159	13.5600449	11.284	$\pm 100$
	-10	13.5600482	-67.692	13.5600509	-67.890	13.5600533	-68.068	13.5600551	-68.204	$\pm 100$
	-20	13.5599032	-57.003	13.5600307	-66.407	13.5600284	-66.231	13.5600451	-67.463	$\pm 100$
3.23	20	13.5601858	-77.844	13.5601857	-77.836	13.5601849	-77.777	13.5601815	-77.524	$\pm 100$
4.37	20	13.5601164	-72.720	13.5598483	-52.952	13.5598483	-52.953	13.5598491	-53.011	$\pm 100$

## 9.2. READER MODE

**848Kbps**

### READER MODE TYPE B 848Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20°C										
Limit: $\pm 100$ ppm = 1.35600 KHz										
Power Supply	Envir. Temp	Frequency Deviation Measured with Time Elapse								
(VAC)	(°C)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
<b>3.80</b>	50	13.5598807	10.371	13.5598771	10.640	13.5598731	10.932	13.5598689	11.240	$\pm 100$
	40	13.5599267	6.980	13.5599216	7.358	13.5599158	7.783	13.5599097	8.232	$\pm 100$
	30	13.5599774	3.245	13.5599723	3.621	13.5599667	4.028	13.5599608	4.462	$\pm 100$
	<b>20</b>	<b>13.5600214</b>	<b>0.000</b>	<b>13.5600177</b>	<b>0.269</b>	<b>13.5600139</b>	<b>0.553</b>	<b>13.5600115</b>	<b>0.726</b>	<b><math>\pm 100</math></b>
	10	13.5599929	2.099	13.5600069	1.069	13.5600218	-0.035	13.5600371	-1.159	$\pm 100$
	0	13.5600722	-3.748	13.5600814	-4.431	13.5600912	-5.149	13.5601010	-5.876	$\pm 100$
	-10	13.5601306	-8.057	13.5601369	-8.519	13.5601430	-8.970	13.5601488	-9.398	$\pm 100$
	-20	13.5601700	-10.965	13.5601725	-11.147	13.5601749	-11.323	13.5601770	-11.476	$\pm 100$
3.23	20	13.5600258	-0.328	13.5600220	-0.044	13.5600199	0.107	13.5600181	0.239	$\pm 100$
4.37	20	13.5599880	2.458	13.5599846	2.711	13.5599831	2.823	13.5599821	2.897	$\pm 100$

## 10. 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 (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

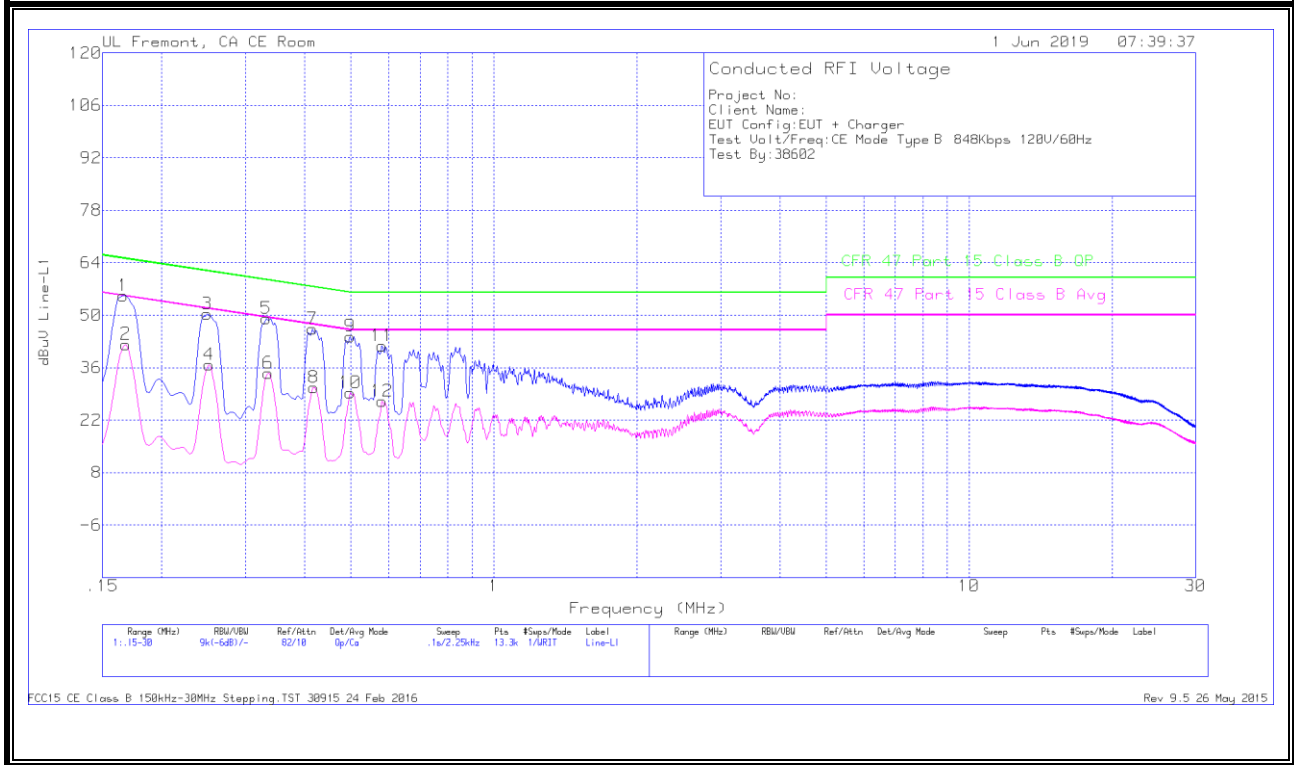
### RESULTS

No non-compliance noted:

## 10.1. CE MODE

### 10.1.1. NORMAL OPERATION WITH ANTENNA PORT TERMINATED, 848Kbps

#### LINE 1 RESULTS



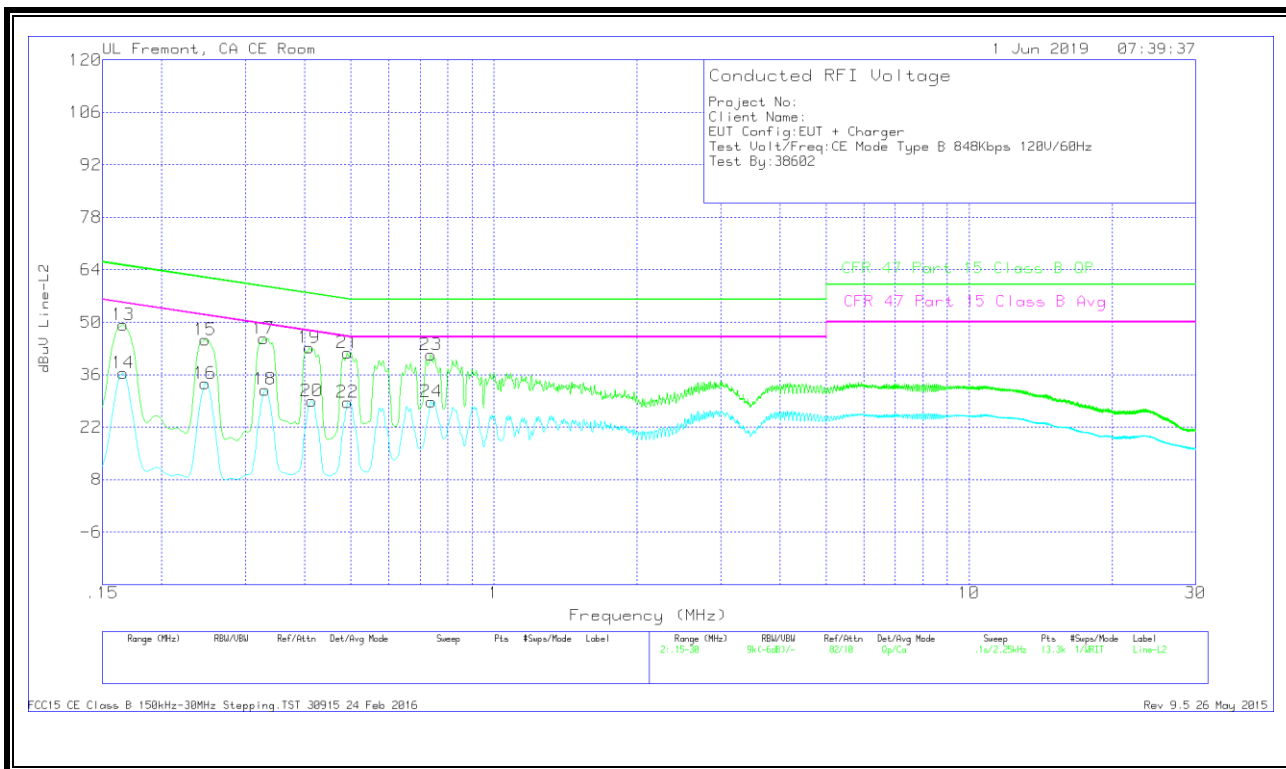
#### WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.16575	44.97	Qp	.1	0	10.1	55.17	65.17	-10	-	-
2	.168	32.06	Ca	.1	0	10.1	42.26	-	-	55.06	-12.8
3	.249	40.19	Qp	0	0	10.1	50.29	61.79	-11.5	-	-
4	.25125	26.75	Ca	0	0	10.1	36.85	-	-	51.72	-14.87
5	.33225	39.01	Qp	0	0	10.1	49.11	59.39	-10.28	-	-
6	.3345	24.47	Ca	0	0	10.1	34.57	-	-	49.34	-14.77
7	.4155	36.2	Qp	0	0	10.1	46.3	57.54	-11.24	-	-
8	.41775	20.62	Ca	0	0	10.1	30.72	-	-	47.49	-16.77
9	.49875	34.25	Qp	0	0	10.1	44.35	56.02	-11.67	-	-
10	.49875	19.17	Ca	0	0	10.1	29.27	-	-	46.02	-16.75
11	.582	31.66	Qp	0	0	10.1	41.76	56	-14.24	-	-
12	.582	16.9	Ca	0	0	10.1	27	-	-	46	-19

Qp - Quasi-Peak detector

Ca - CISPR average detection

## LINE 2 RESULTS



## WORST EMISSIONS

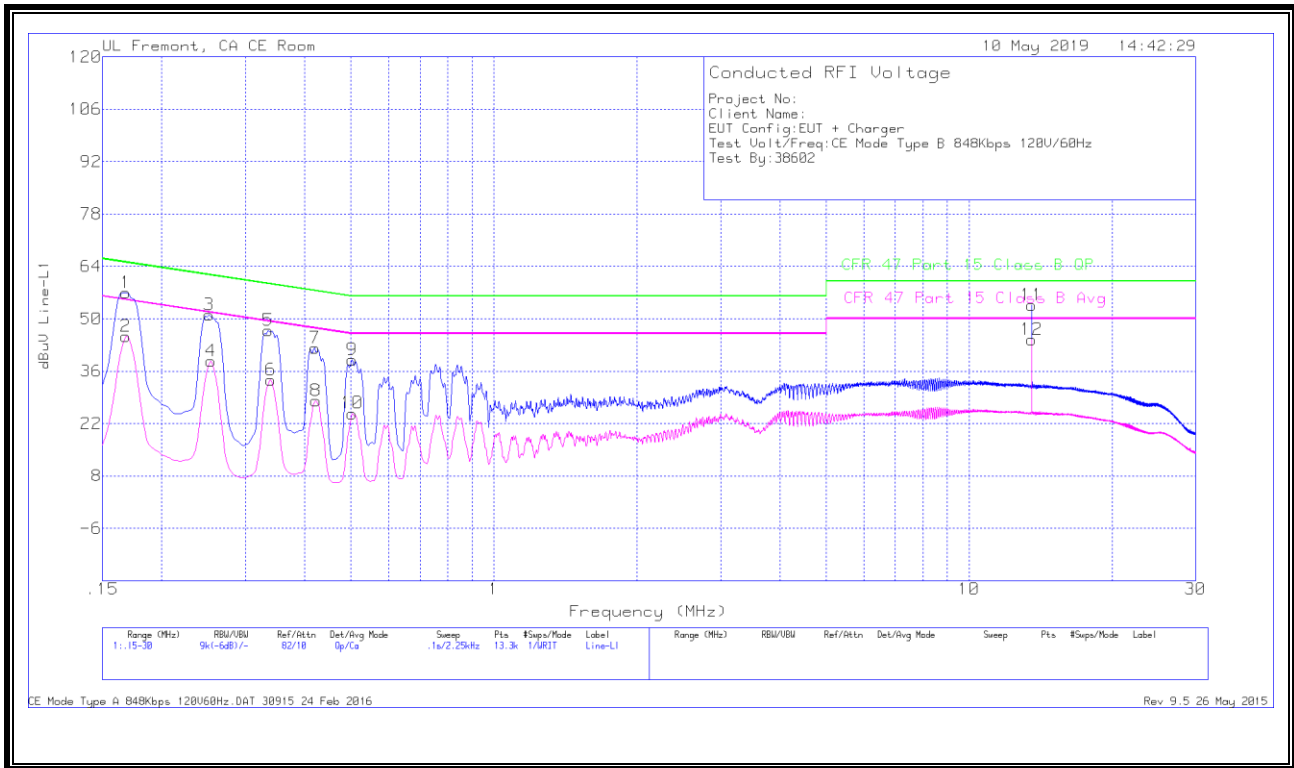
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.16575	39.08	Qp	.1	0	10.1	49.28	65.17	-15.89	-	-
14	.16575	26.27	Ca	.1	0	10.1	36.47	-	-	55.17	-18.7
15	.24675	35.27	Qp	0	0	10.1	45.37	61.87	-16.5	-	-
16	.24675	23.55	Ca	0	0	10.1	33.65	-	-	51.87	-18.22
17	.32775	35.61	Qp	0	0	10.1	45.71	59.51	-13.8	-	-
18	.33	21.91	Ca	0	0	10.1	32.01	-	-	49.45	-17.44
19	.40875	33.19	Qp	0	0	10.1	43.29	57.67	-14.38	-	-
20	.41325	18.81	Ca	0	0	10.1	28.91	-	-	47.58	-18.67
21	.492	31.71	Qp	0	0	10.1	41.81	56.13	-14.32	-	-
22	.492	18.5	Ca	0	0	10.1	28.6	-	-	46.13	-17.53
23	.73725	31.17	Qp	0	0	10.1	41.27	56	-14.73	-	-
24	.7395	18.64	Ca	0	0	10.1	28.74	-	-	46	-17.26

Qp - Quasi-Peak detector

Ca - CISPR average detection

## 10.1.2. NORMAL OPERATION WITHOUT ANTENNA PORT TERMINATED, 848Kbps

### LINE 1 RESULTS



### WORST EMISSIONS

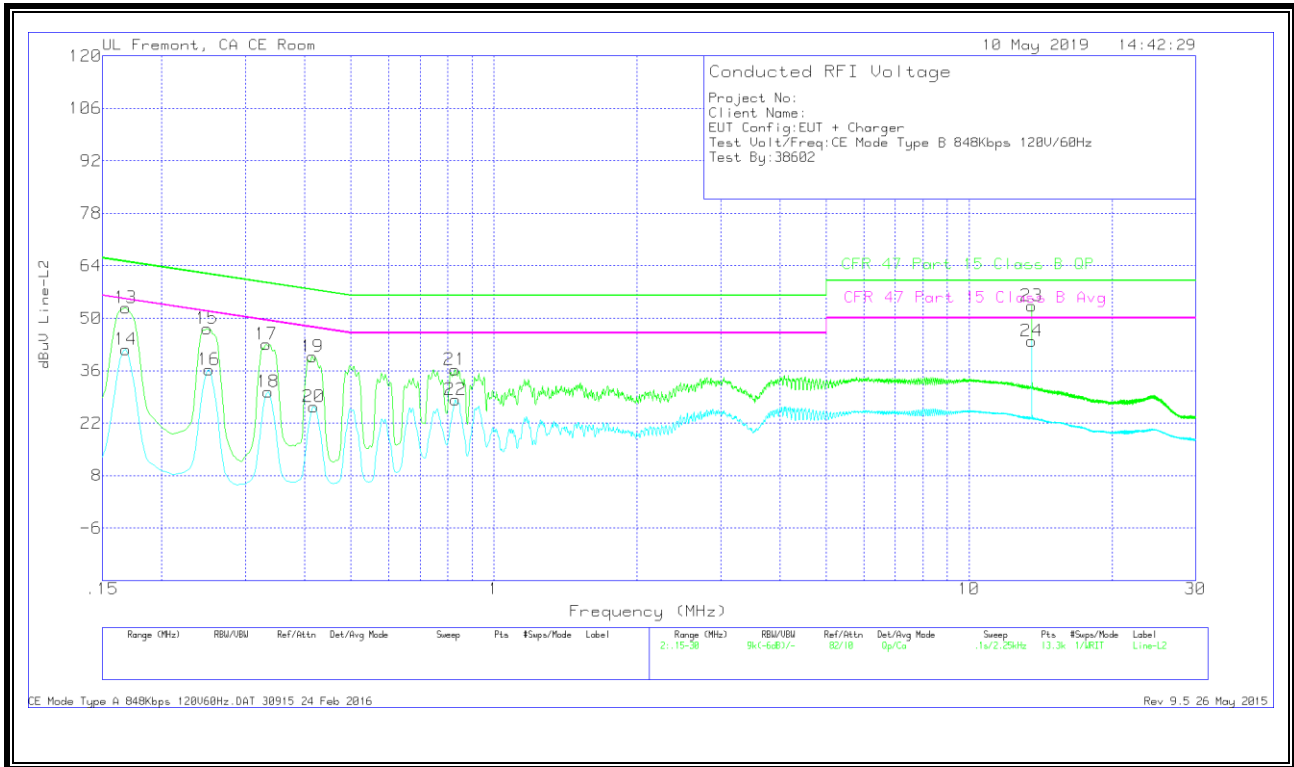
Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.168	46.81	Qp	.1	0	10.1	57.01	65.06	-8.05	-	-
2	.168	35.1	Ca	.1	0	10.1	45.3	-	-	55.06	-9.76
3	.25125	40.98	Qp	0	0	10.1	51.08	61.72	-10.64	-	-
4	.2535	28.56	Ca	0	0	10.1	38.66	-	-	51.64	-12.98
5	.3345	36.7	Qp	0	0	10.1	46.8	59.34	-12.54	-	-
6	.339	23.63	Ca	0	0	10.1	33.73	-	-	49.23	-15.5
7	.42	32.01	Qp	0	0	10.1	42.11	57.45	-15.34	-	-
8	.42225	17.96	Ca	0	0	10.1	28.06	-	-	47.4	-19.34
9	.50325	28.88	Qp	0	0	10.1	38.98	56	-17.02	-	-
10	.50325	14.61	Ca	0	0	10.1	24.71	-	-	46	-21.29
11	13.56	43.07	Qp	.1	.2	10.2	53.57	60	-6.43	-	-
12	13.56	33.94	Ca	.1	.2	10.2	44.44	-	-	50	-5.56

Qp - Quasi-Peak detector

Ca - CISPR average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data documented in above section, indicate that when the antenna terminal is terminated the fundamental amplitude is lowering below the limit line

## LINE 2 RESULTS



## WORST EMISSIONS

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.168	42.55	Qp	.1	0	10.1	52.75	65.06	-12.31	-	-
14	.168	31.44	Ca	.1	0	10.1	41.64	-	-	55.06	-13.42
15	.249	37.13	Qp	0	0	10.1	47.23	61.79	-14.56	-	-
16	.25125	26.16	Ca	0	0	10.1	36.26	-	-	51.72	-15.46
17	.33225	32.93	Qp	0	0	10.1	43.03	59.39	-16.36	-	-
18	.3345	20.3	Ca	0	0	10.1	30.4	-	-	49.34	-18.94
19	.4155	29.67	Qp	0	0	10.1	39.77	57.54	-17.77	-	-
20	.41775	16.33	Ca	0	0	10.1	26.43	-	-	47.49	-21.06
21	.82725	26.15	Qp	0	0	10.1	36.25	56	-19.75	-	-
22	.8295	18.13	Ca	0	0	10.1	28.23	-	-	46	-17.77
23	13.56	42.73	Qp	.1	.2	10.2	53.23	60	-6.77	-	-
24	13.56	33.36	Ca	.1	.2	10.2	43.86	-	-	50	-6.14

Qp - Quasi-Peak detector

Ca - CISPR average detection

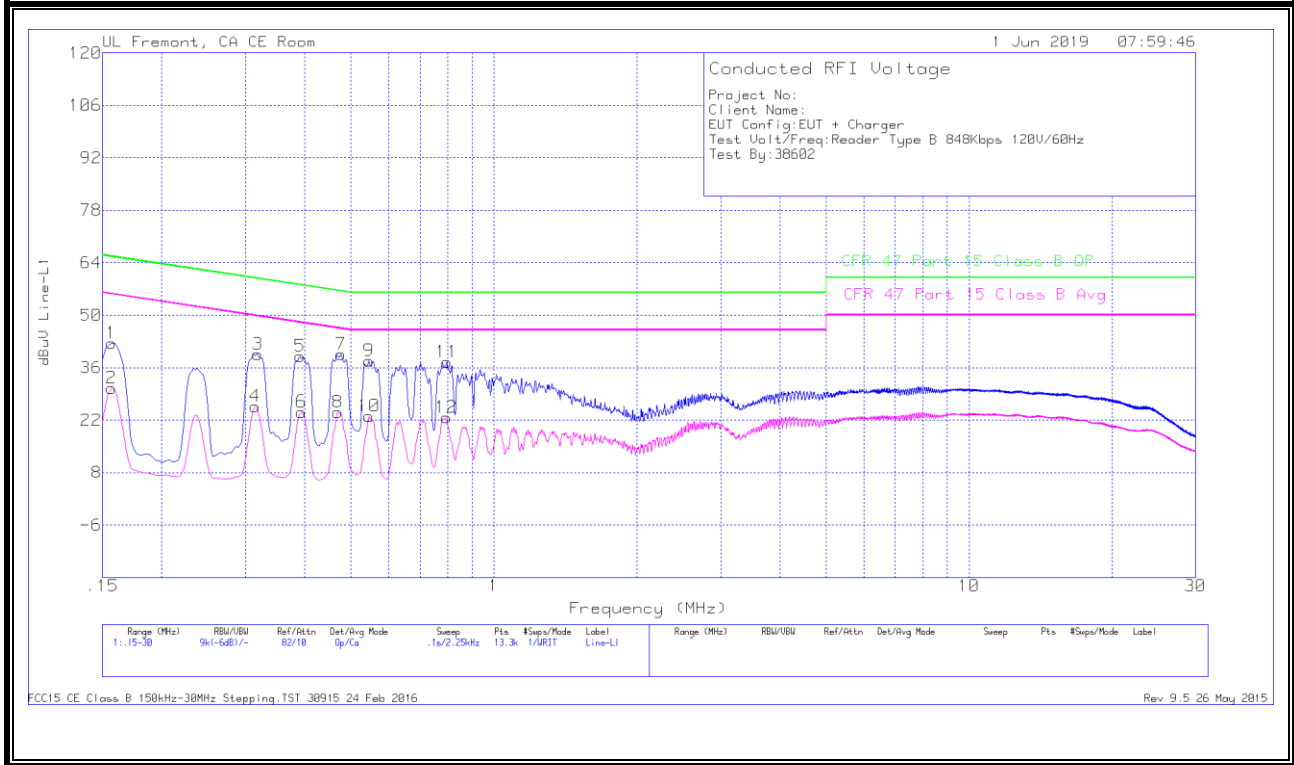
Note: 13.56MHz is a fundamental frequency of the EUT. Data documented in above section, indicate that when the antenna terminal is terminated the fundamental amplitude is lowering below the limit line



## 10.2. READER MODE

### 10.2.1. NORMAL OPERATION WITH ANTENNA PORT TERMINATED, 848Kbps

#### LINE 1 RESULTS

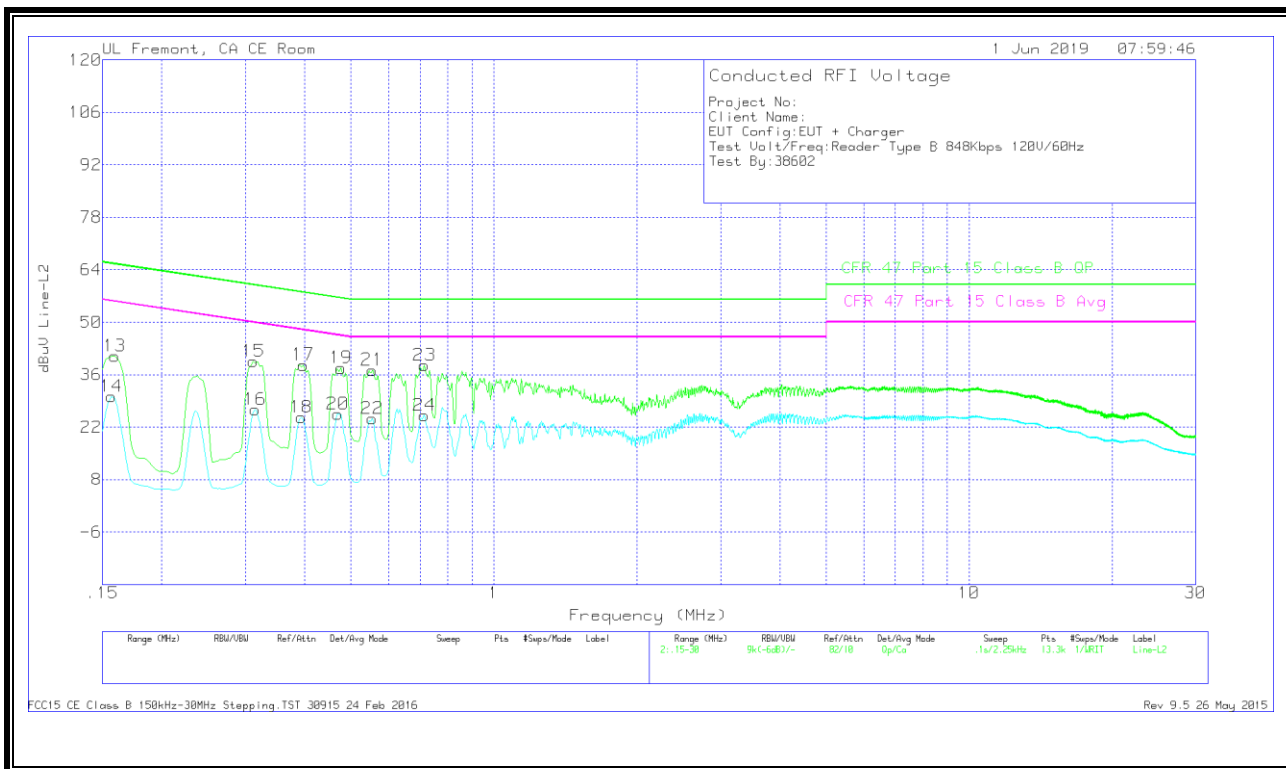


#### WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.15675	32.39	Qp	.1	0	10.1	42.59	65.63	-23.04	-	-
2	.15675	20.33	Ca	.1	0	10.1	30.53	-	-	55.63	-25.1
3	.31875	29.48	Qp	0	0	10.1	39.58	59.74	-20.16	-	-
4	.31425	15.49	Ca	0	0	10.1	25.59	-	-	49.86	-24.27
5	.39075	28.9	Qp	0	0	10.1	39	58.05	-19.05	-	-
6	.393	14.08	Ca	0	0	10.1	24.18	-	-	48	-23.82
7	.47625	29.5	Qp	0	0	10.1	39.6	56.4	-16.8	-	-
8	.4695	13.99	Ca	0	0	10.1	24.09	-	-	46.52	-22.43
9	.546	27.77	Qp	0	0	10.1	37.87	56	-18.13	-	-
10	.546	12.95	Ca	0	0	10.1	23.05	-	-	46	-22.95
11	.79575	27.43	Qp	0	0	10.1	37.53	56	-18.47	-	-
12	.7935	12.64	Ca	0	0	10.1	22.74	-	-	46	-23.26

Qp - Quasi-Peak detector  
Ca - CISPR average detection

## LINE 2 RESULTS



## WORST EMISSIONS

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.159	30.69	Qp	.1	0	10.1	40.89	65.52	-24.63	-	-
14	.15675	19.96	Ca	.1	0	10.1	30.16	-	-	55.63	-25.47
15	.312	29.41	Qp	0	0	10.1	39.51	59.92	-20.41	-	-
16	.31425	16.65	Ca	0	0	10.1	26.75	-	-	49.86	-23.11
17	.3975	28.51	Qp	0	0	10.1	38.61	57.91	-19.3	-	-
18	.393	14.45	Ca	0	0	10.1	24.55	-	-	48	-23.45
19	.47625	27.65	Qp	0	0	10.1	37.75	56.4	-18.65	-	-
20	.4695	15.43	Ca	0	0	10.1	25.53	-	-	46.52	-20.99
21	.555	27.12	Qp	0	0	10.1	37.22	56	-18.78	-	-
22	.555	14.24	Ca	0	0	10.1	24.34	-	-	46	-21.66
23	.71475	28.4	Qp	0	0	10.1	38.5	56	-17.5	-	-
24	.71475	15.06	Ca	0	0	10.1	25.16	-	-	46	-20.84

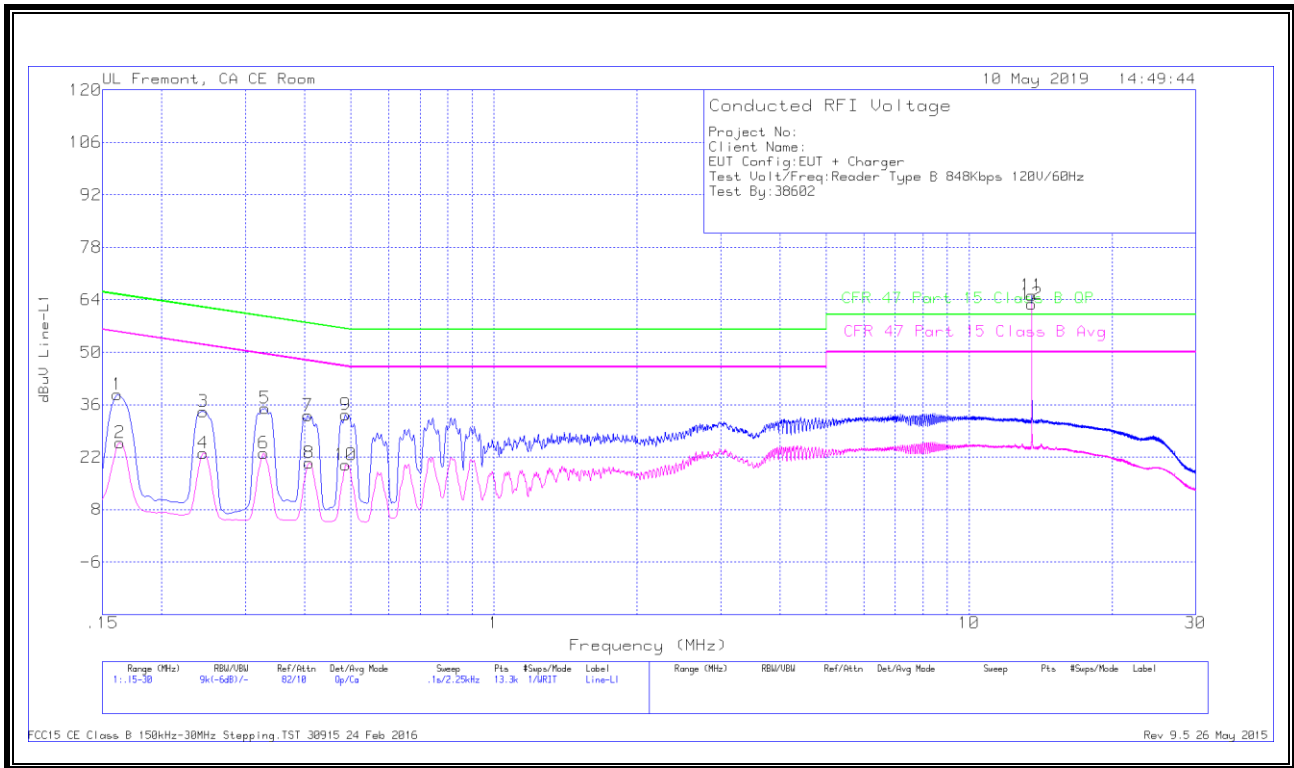
Qp - Quasi-Peak detector

Ca - CISPR average detection

FCC15 CE Class B 150kHz-30MHz Stepping.TST 30915 24 Feb 2016

## 10.2.2. NORMAL OPERATION WITHOUT ANTENNA PORT TERMINATED, 848Kbps

### LINE 1 RESULTS



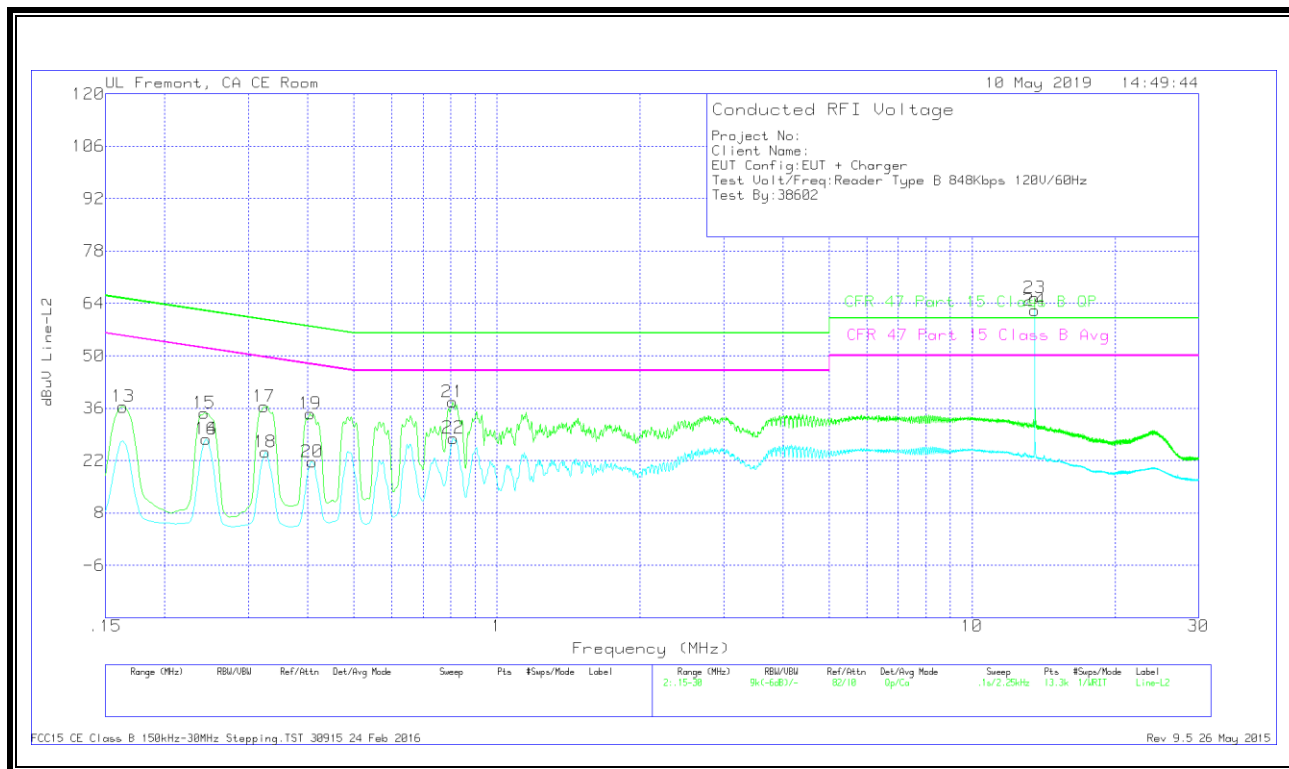
### WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.16125	28.47	Qp	.1	0	10.1	38.67	65.4	-26.73	-	-
2	.1635	15.56	Ca	.1	0	10.1	25.76	-	-	55.28	-29.52
3	.2445	24.12	Qp	0	0	10.1	34.22	61.94	-27.72	-	-
4	.2445	13.03	Ca	0	0	10.1	23.13	-	-	51.94	-28.81
5	.33	24.97	Qp	0	0	10.1	35.07	59.45	-24.38	-	-
6	.32775	12.97	Ca	0	0	10.1	23.07	-	-	49.51	-26.44
7	.4065	22.98	Qp	0	0	10.1	33.08	57.72	-24.64	-	-
8	.40875	10.3	Ca	0	0	10.1	20.4	-	-	47.67	-27.27
9	.4875	23.29	Qp	0	0	10.1	33.39	56.21	-22.82	-	-
10	.4875	9.82	Ca	0	0	10.1	19.92	-	-	46.21	-26.29
11	13.56	54.69	Qp	.1	.2	10.2	65.19	60	5.19	-	-
12	13.56	52.32	Ca	.1	.2	10.2	62.82	-	-	50	12.82

Qp - Quasi-Peak detector  
Ca - CISPR average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data documented in above section, indicate that when the antenna terminal is terminated the fundamental amplitude is lowering below the limit line

## LINE 2 RESULTS



## WORST EMISSIONS

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.1635	26.16	Qp	.1	0	10.1	36.36	65.28	-28.92	-	-
14	.2445	17.65	Ca	0	0	10.1	27.75	-	-	51.94	-24.19
15	.24225	24.67	Qp	0	0	10.1	34.77	62.02	-27.25	-	-
16	.2445	17.65	Ca	0	0	10.1	27.75	-	-	51.94	-24.19
17	.32325	26.38	Qp	0	0	10.1	36.48	59.62	-23.14	-	-
18	.3255	14.11	Ca	0	0	10.1	24.21	-	-	49.57	-25.36
19	.40425	24.5	Qp	0	0	10.1	34.6	57.77	-23.17	-	-
20	.40875	11.54	Ca	0	0	10.1	21.64	-	-	47.67	-26.03
21	.807	27.54	Qp	0	0	10.1	37.64	56	-18.36	-	-
22	.80925	17.91	Ca	0	0	10.1	28.01	-	-	46	-17.99
23	13.56	55.01	Qp	.1	.2	10.2	65.51	60	5.51	-	-
24	13.56	51.73	Ca	.1	.2	10.2	62.23	-	-	50	12.23

Qp - Quasi-Peak detector  
Ca - CISPR average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data documented in above section, indicate that when the antenna terminal is terminated the fundamental amplitude is lowering below the limit line

END OF REPORT

## 11. SETUP PHOTOS

Please refer to 12696946-EP1V1 for setup photos