



# **CERTIFICATION TEST REPORT**

**Report Number. :** 13018918-E12V2

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

**Model :** A2296

**FCC ID :** BCG-E3501A

**IC :** 579C-E3501A

**EUT Description :** SMARTPHONE

**Test Standard(s) :** FCC 47 CFR PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 10

**Date Of Issue:**  
March 23, 2020

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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>
V1	2/10/2020	Initial Issue	Tony Wang
V2	3/23/2020	Addressed TCB Questions	Chris Xiong

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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:** A2296

**SERIAL NUMBER:** FFMZW00APM7C, FFMZW06XPM62

**DATE TESTED:** SEPTEMBER 30 – JANUARY 08, 2020

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Complies
ISED RSS-210 Issue 10, 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.

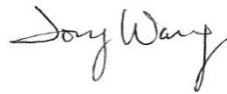
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section.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

Approved & Released For  
UL Verification Services Inc. By:



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Prepared By:



Tony Wang  
Test Engineer  
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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 10.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, 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	47658 Kato Rd.
<input type="checkbox"/> Chamber A (IC:2324B-1)	<input type="checkbox"/> Chamber D (IC:22541-1)	<input type="checkbox"/> Chamber I (IC: 2324A-5)
<input type="checkbox"/> Chamber B (IC:2324B-2)	<input type="checkbox"/> Chamber E (IC:22541-2)	<input type="checkbox"/> Chamber J (IC: 2324A-6)
<input type="checkbox"/> Chamber C (IC:2324B-3)	<input checked="" type="checkbox"/> Chamber F (IC:22541-3)	<input type="checkbox"/> Chamber K (IC: 2324A-1)
	<input checked="" type="checkbox"/> Chamber G (IC:22541-4)	<input type="checkbox"/> Chamber L (IC: 2324A-3)
	<input type="checkbox"/> Chamber H (IC:22541-5)	<input type="checkbox"/> Chamber M (IC: 2324A-2)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

## 4. DECISION RULES AND MEASUREMENT UNCERTAINTY

### 4.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

### 4.2 DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement)

### 4.3 MEASUREMENT UNCERTAINTY

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

PARAMETER	U <sub>LAB</sub>
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The 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, 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 which is not user accessible. The rechargeable battery is also not user accessible.

### 5.2. 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	Reader	848	26.42
		CE	848	24.63

### 5.3. WORST-CASE CONFIGURATION AND MODE

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

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, EUT with Tag and without Tag was investigated with Type A, B and F with CE mode and Reader mode data rates and ISO 15693 configuration to determine the worst case based on the highest power and spurious emissions. Type B without Tag was determined to be the worst case and therefore Type B was selected for all final tests.

For below 30MHz testing, investigation was done on three antenna orientations: RX antenna Face-on, Face-off and horizontal (parallel to ground). The worst-case configurations were determined on RX antenna Face-on and Face-off; therefore, all final tests were performed using these two orientations.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 meter 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.

## 5.4. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
laptop	Apple	Macbook Pro	C02P41RZG086	FCC DoC
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
EUT AC Adapter	Apple	A1385	D292365CDYADHLHC3	NA

### I/O CABLES

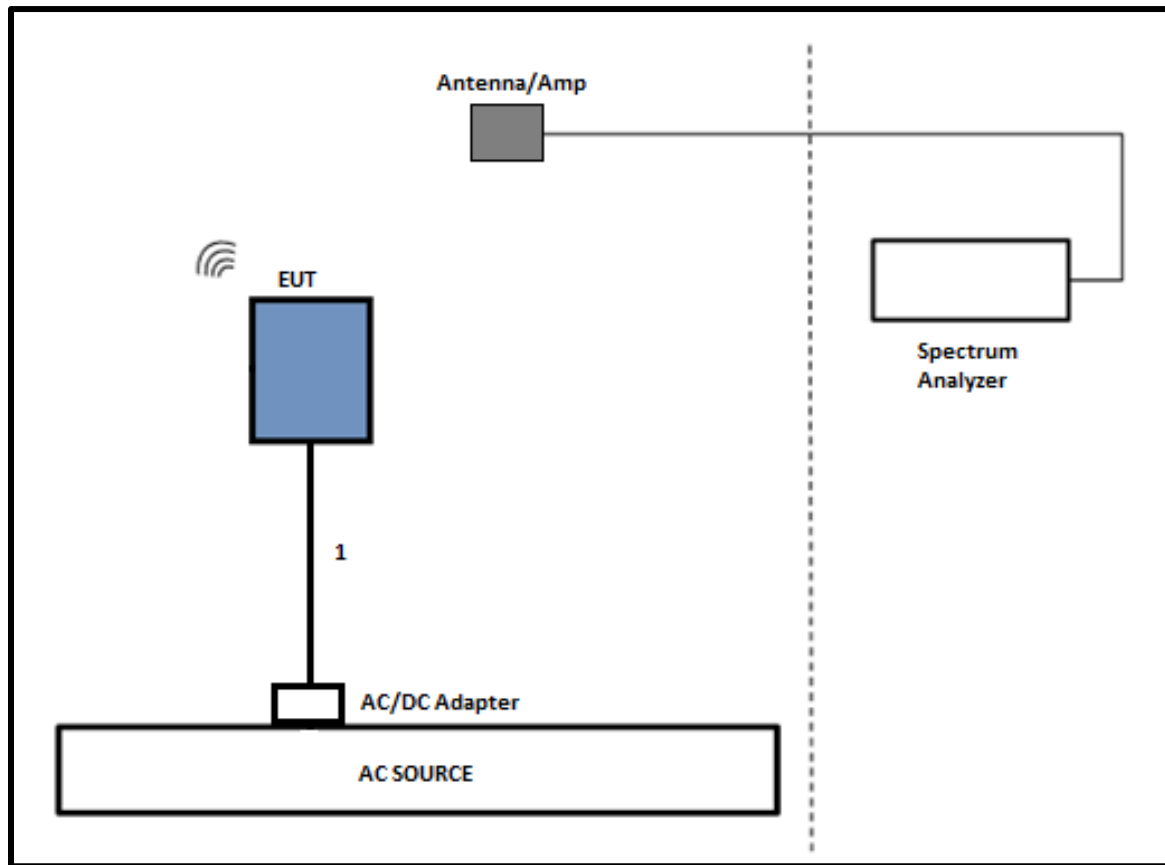
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-Shielded	1	N/A

### TEST SETUP

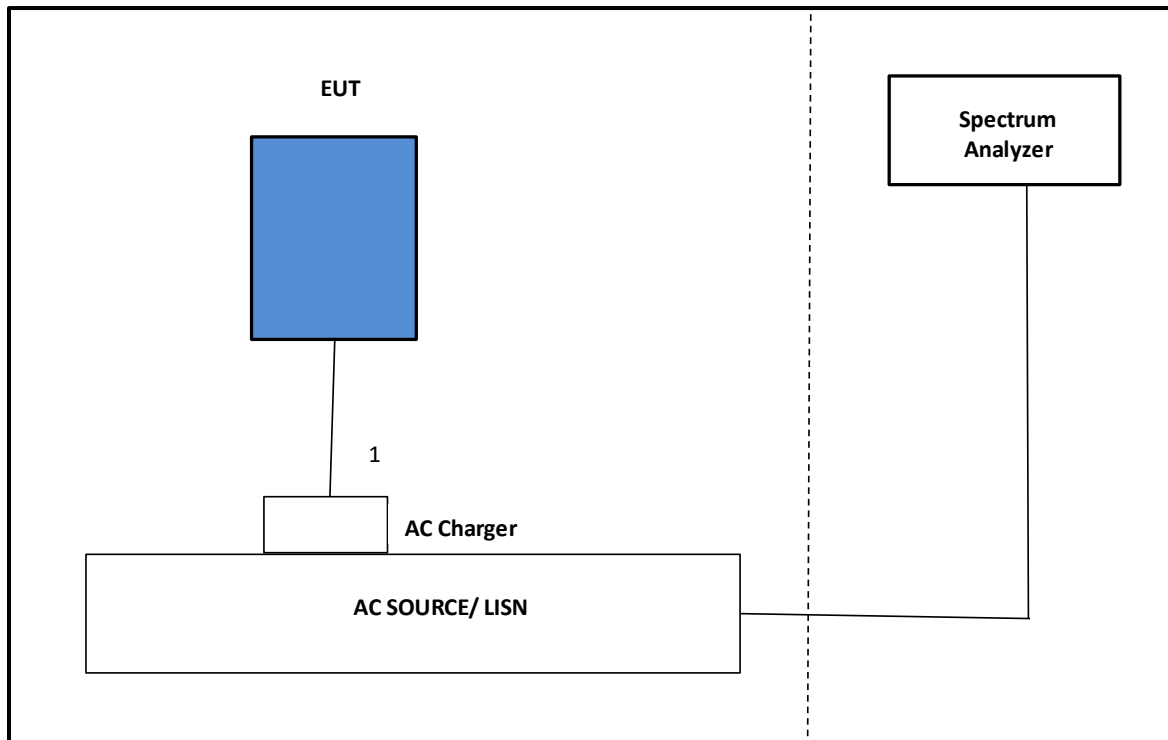
The EUT is installed in a host laptop computer during the tests. Test software exercised the radio card.



**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 Corp.	JB3	T900	08/09/2020
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T834	06/01/2020
*Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent (Keysight) Technologies	E4446A	T123	01/28/2020
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T754	07/28/2020
Antenna, Active Loop 9KHz to 30MHz	EMCO	6502	T35	06/06/2020
*Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T340	01/22/2020
*Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1210	02/27/2020
<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	10/27/2020
*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 was completed before equipment expiration date.

## 7. OCCUPIED BANDWIDTH

### LIMITS

None; for reporting purposes only.

### TEST PROCEDURE

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. Measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.

### RESULTS

<b>ID:</b>	38602	<b>Date:</b>	11/8/2019
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#### 99% and 20dB BW, Type B 848Kbs

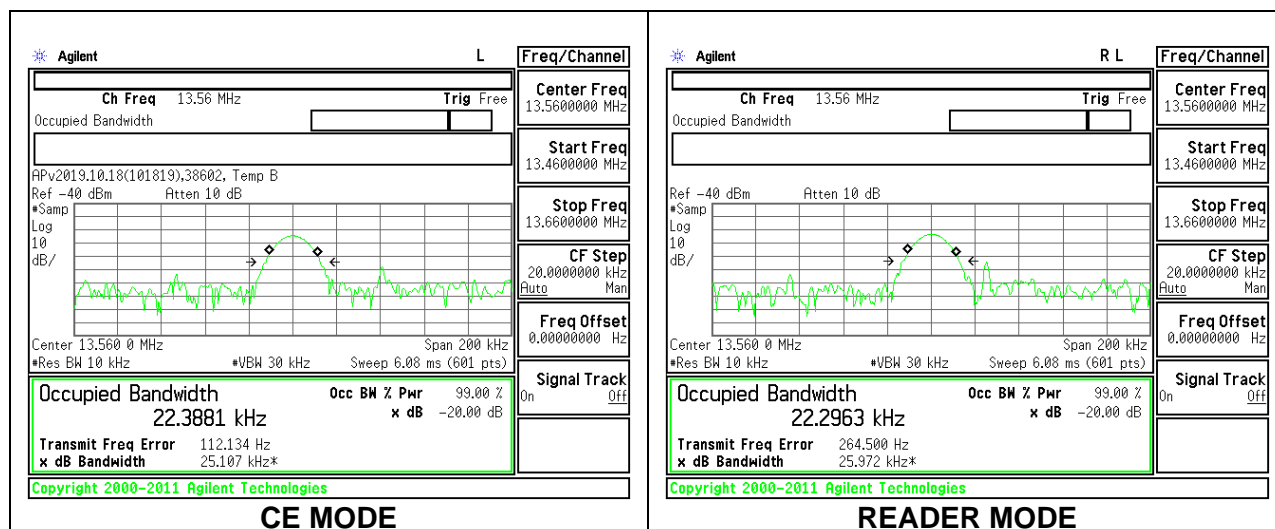
##### **CE Mode**

<b>Mode Kbps</b>	<b>Frequency (MHz)</b>	<b>99% Bandwidth (KHz)</b>	<b>20dB Bandwidth (KHz)</b>
848	13.56	22.3881	25.107

##### **Reader Mode**

<b>Mode Kbps</b>	<b>Frequency (MHz)</b>	<b>99% Bandwidth (KHz)</b>	<b>20dB Bandwidth (KHz)</b>
848	13.56	22.2963	25.972

## Data



## 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

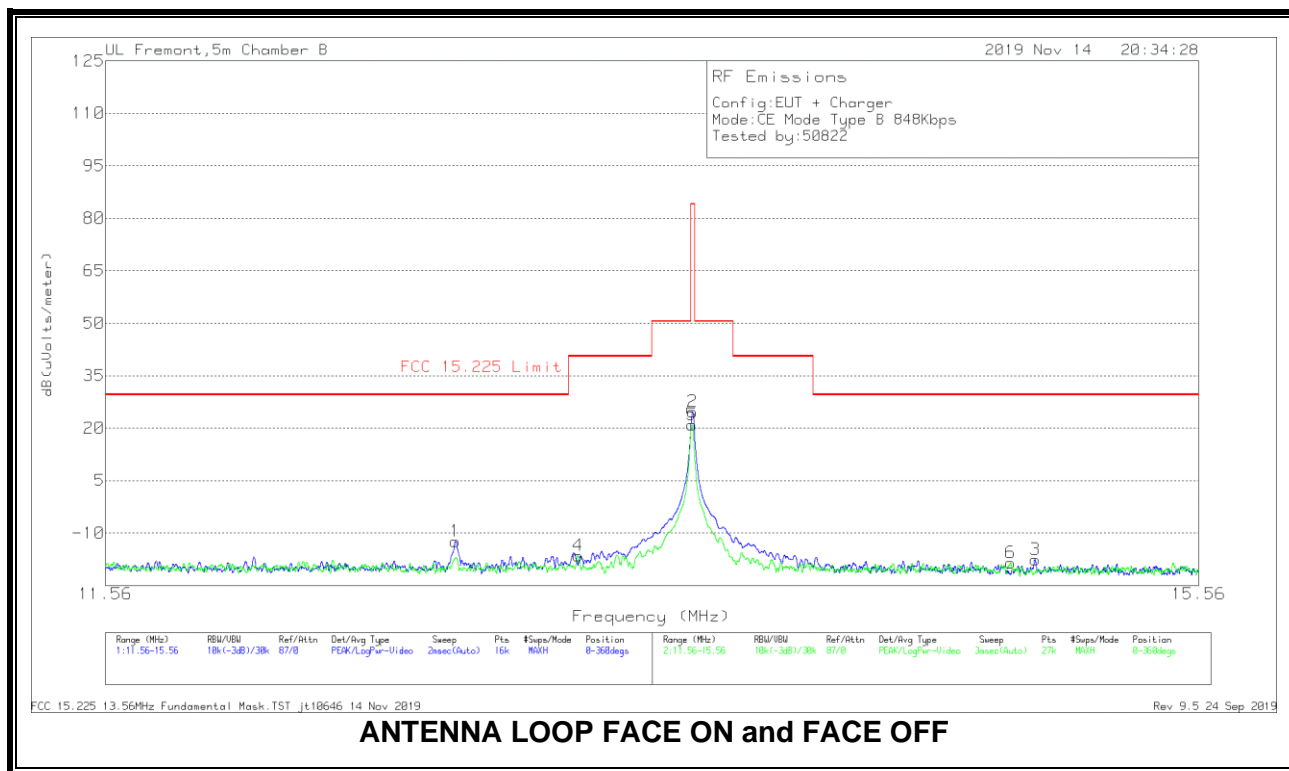
The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the 10<sup>th</sup> harmonic of the highest fundamental frequency, or 1000 MHz, whichever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

### **RESULTS**

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

### 8.2.1. CE MODE, TYPE B 848Kbps

#### FUNDAMENTAL

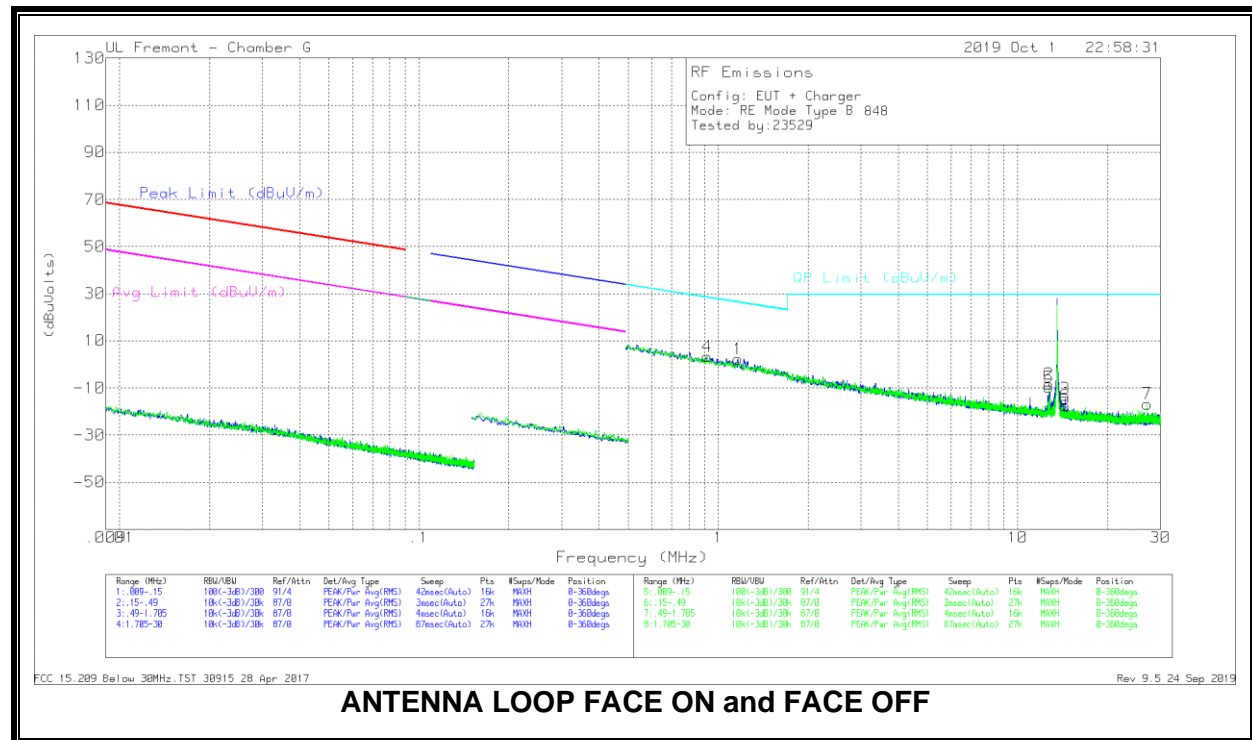


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
1	12.71413	16.46	Pk	10.7	.5	-40	-12.34	29.54	-41.88	0-360
4	13.14471	12.31	Pk	10.7	.5	-40	-16.49	40.51	-57	0-360
5	13.55793	49.85	Pk	10.6	.5	-40	20.95	84	-63.05	0-360
2	13.55925	53.53	Pk	10.6	.5	-40	24.63	84	-59.37	0-360
6	14.78455	10.39	Pk	10.6	.5	-40	-18.51	29.54	-48.05	0-360
3	14.88325	11.29	Pk	10.6	.5	-40	-17.61	29.54	-47.15	0-360

Pk - Peak detector



## SPURIOUS EMISSION

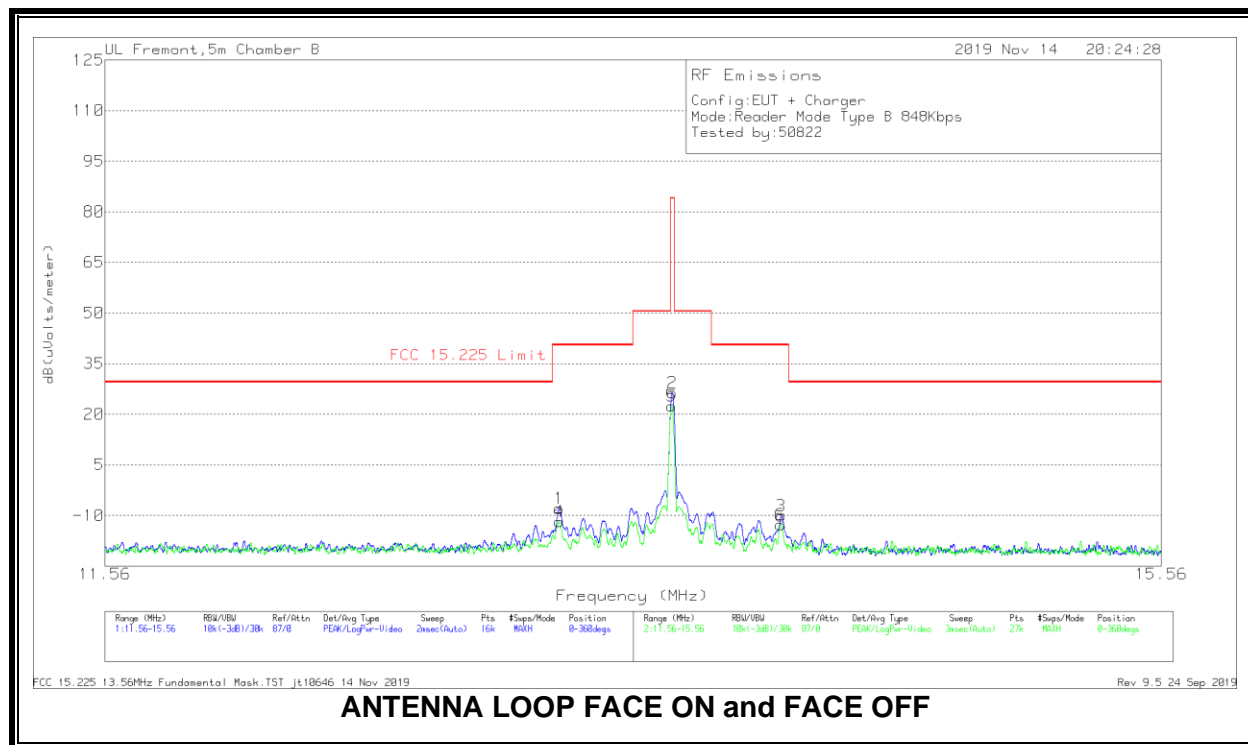


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	.91746	32.07	Pk	11.1	.1	-40	3.27	28.37	-25.1	0-360
1	1.16363	30.86	Pk	11.3	.1	-40	2.26	26.31	-24.05	0-360
5	12.71214	19.2	Pk	10.7	.4	-40	-9.7	29.5	-39.2	0-360
2	12.71372	20.52	Pk	10.7	.4	-40	-8.38	29.5	-37.88	0-360
6	14.40362	11.62	Pk	10.6	.4	-40	-17.38	29.5	-46.88	0-360
3	14.40781	14.58	Pk	10.6	.4	-40	-14.42	29.5	-43.92	0-360
7	27.11795	13.83	Pk	8.8	.6	-40	-16.77	29.5	-46.27	0-360

Pk - Peak detector

## 8.2.2. READER MODE, TYPE B 848Kbps

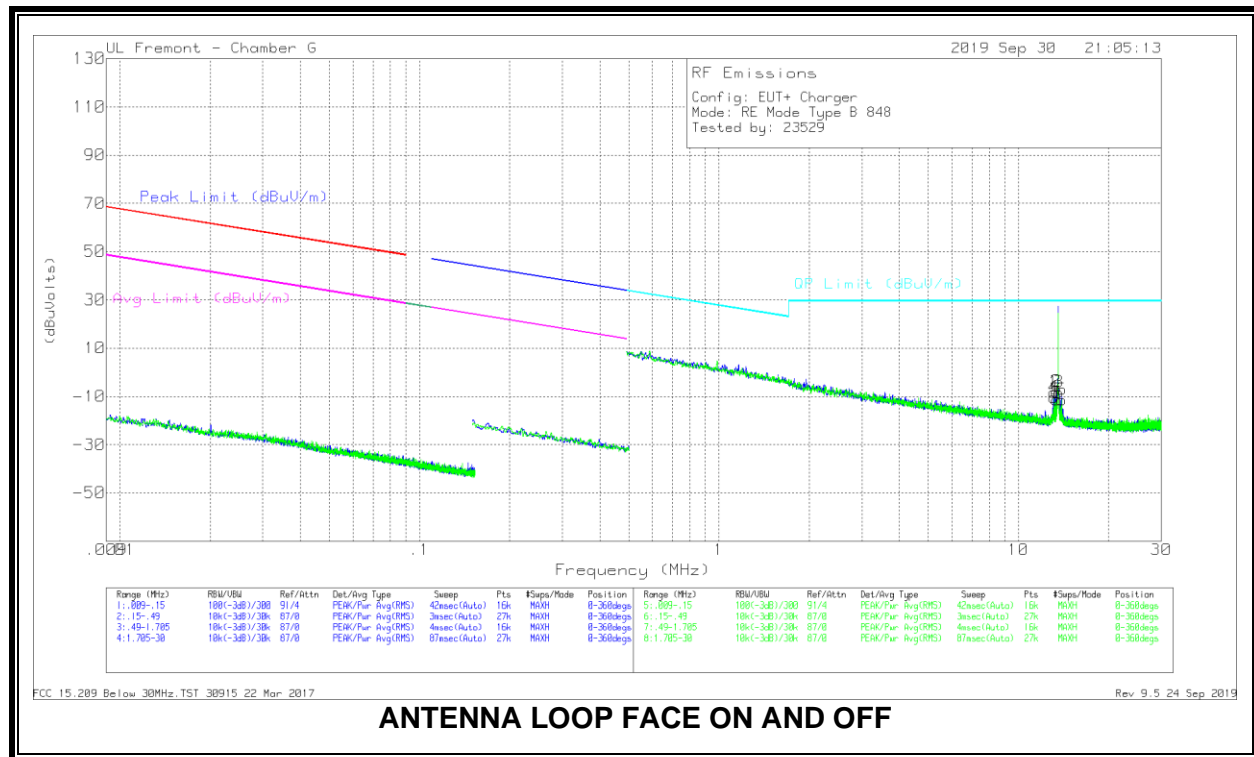
### FUNDAMENTAL



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
4	13.13539	16.9	Pk	10.7	.5	-40	-11.9	40.51	-52.41	0-360
1	13.13588	20.91	Pk	10.7	.5	-40	-7.89	40.51	-48.4	0-360
5	13.55793	51.37	Pk	10.6	.5	-40	22.47	84	-61.53	0-360
2	13.55963	55.32	Pk	10.6	.5	-40	26.42	84	-57.58	0-360
6	13.98017	16.17	Pk	10.6	.5	-40	-12.73	40.51	-53.24	0-360
3	13.98238	18.7	Pk	10.6	.5	-40	-10.2	40.51	-50.71	0-360

Pk - Peak detector

## SPURIOUS EMISSION



## ANTENNA LOOP FACE ON AND OFF

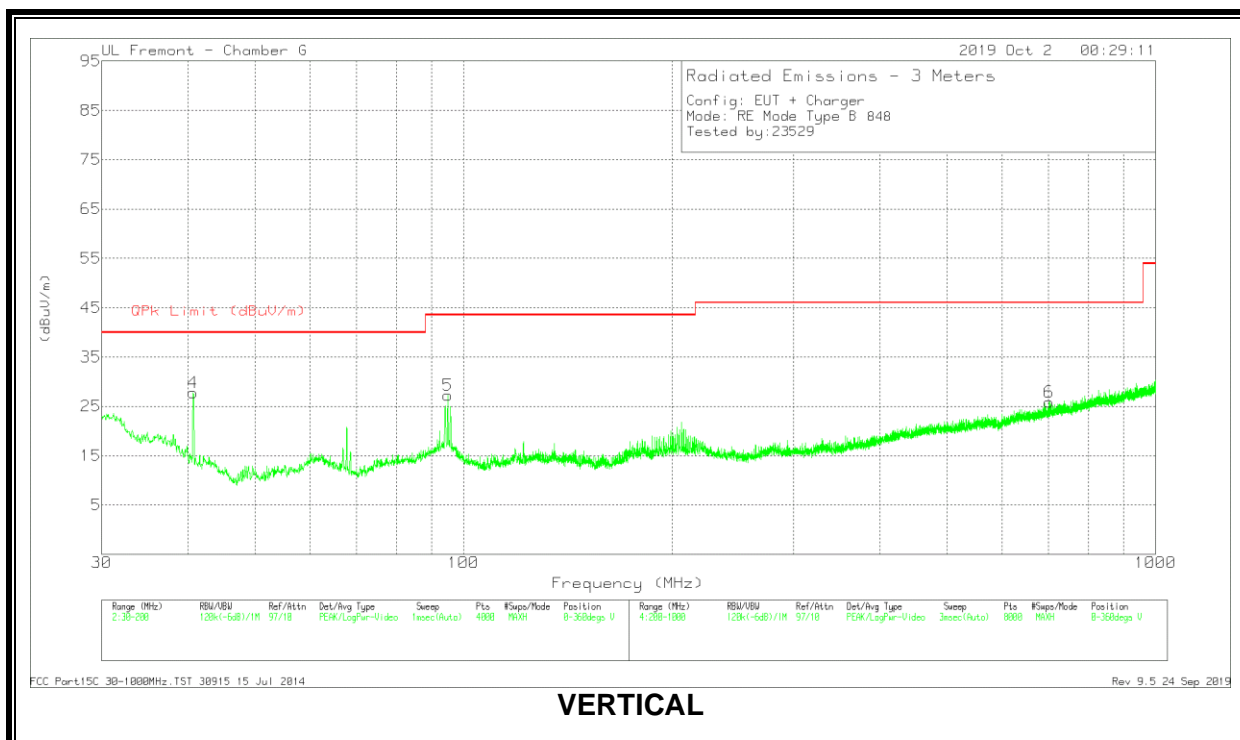
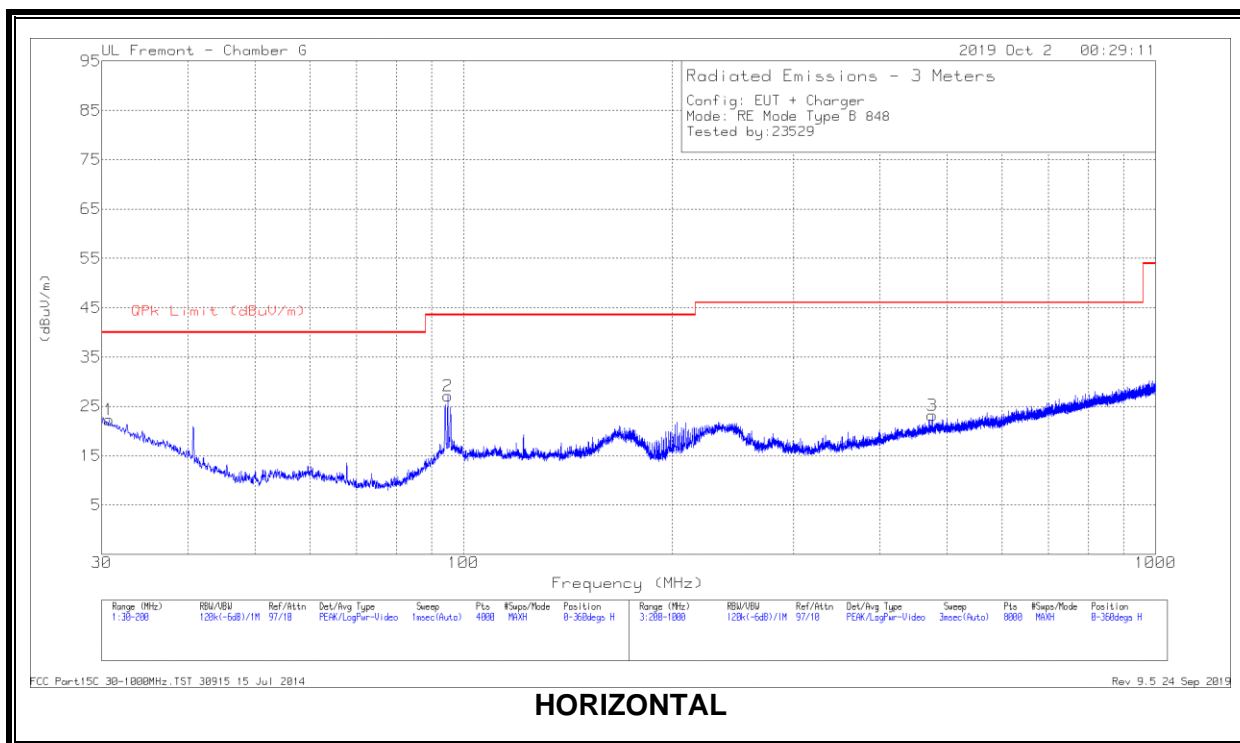
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 30m	Corrected Reading (dBuV/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	13.13344	20.51	Pk	10.8	.4	-40	-8.29	29.5	-37.79	0-360
4	13.13554	18.41	Pk	10.8	.4	-40	-10.39	29.5	-39.89	0-360
2	13.40278	20.94	Pk	10.8	.4	-40	-7.86	29.5	-37.36	0-360
5	13.42164	17.5	Pk	10.8	.4	-40	-11.3	29.5	-40.8	0-360
3	13.65325	20.69	Pk	10.7	.4	-40	-8.21	29.5	-37.71	0-360
6	13.98546	17.57	Pk	10.7	.4	-40	-11.33	29.5	-40.83	0-360

Pk - Peak detector

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

#### 8.3.1. CE MODE, TYPE B 848Kbps

##### SPURIOUS EMISSION



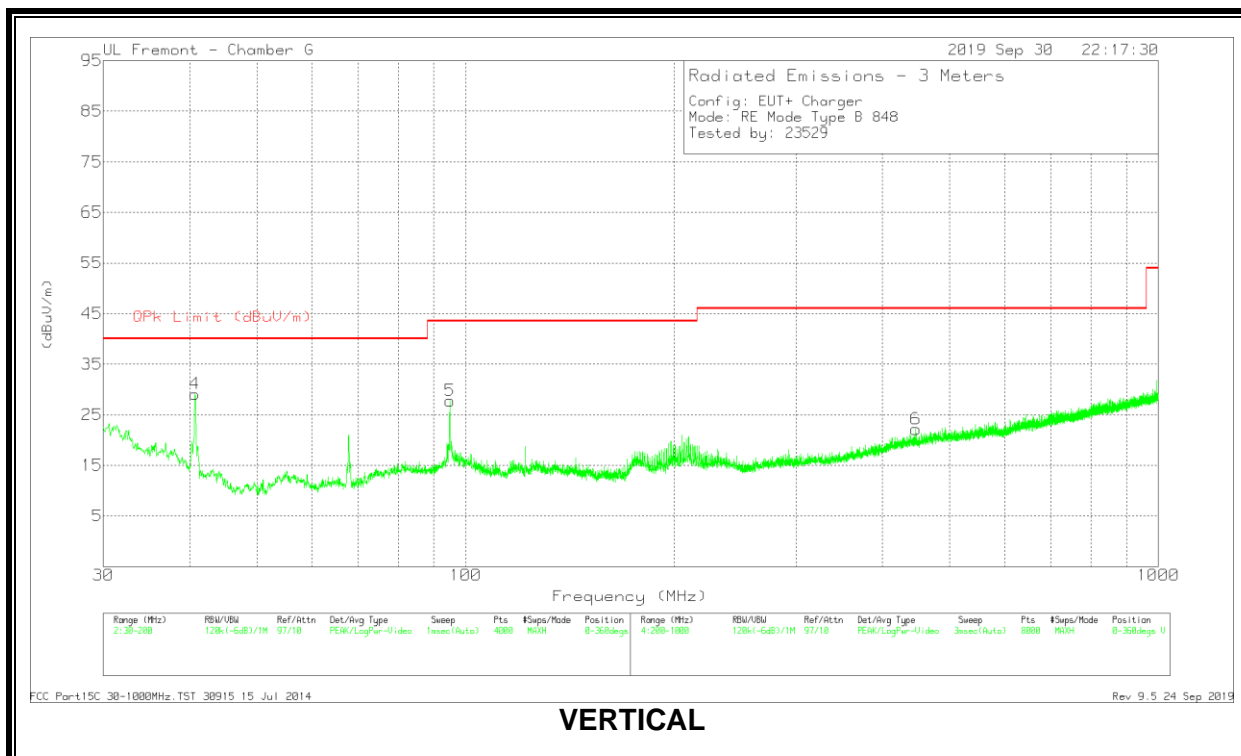
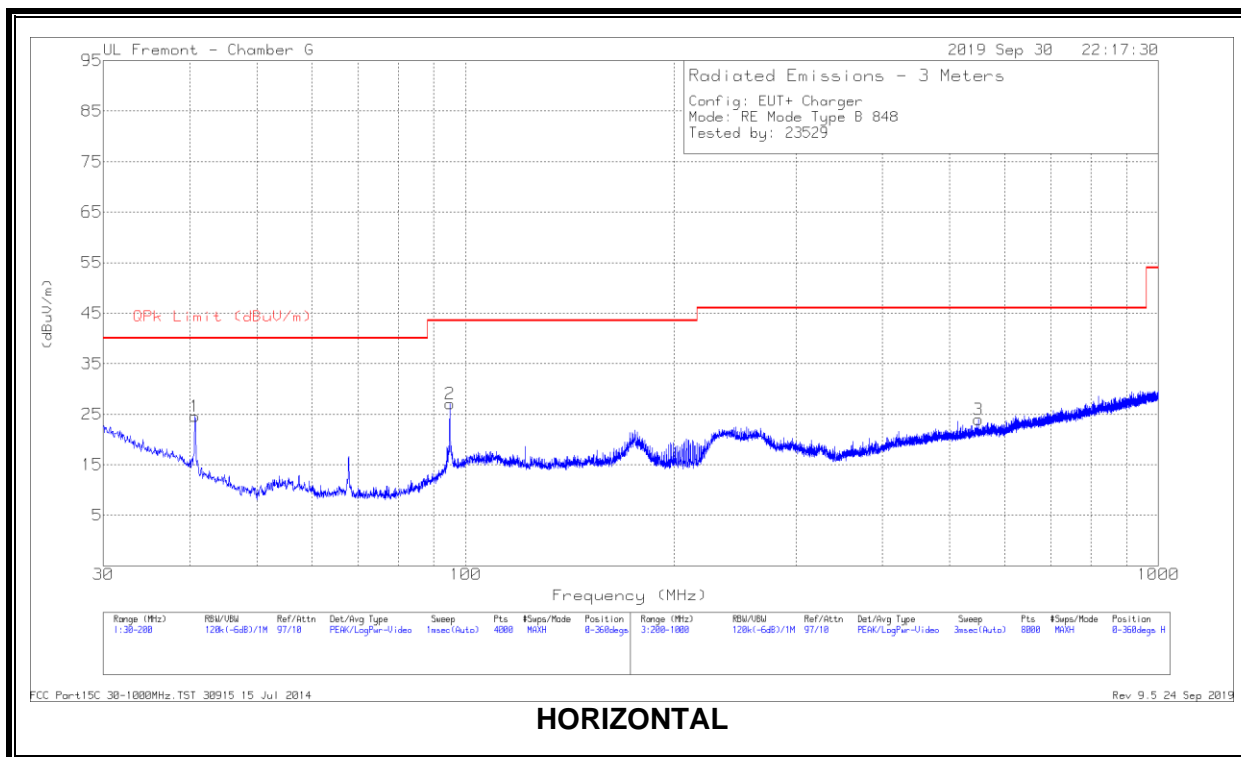
## DATA

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	30.7227	28.79	Pk	24.8	-31.3	22.29	40	-17.71	0-360	400	H
4	40.6703	41.18	Pk	17.8	-31.2	27.78	40	-12.22	0-360	100	V
2	94.9143	44.98	Pk	12.8	-30.6	27.18	43.52	-16.34	0-360	300	H
5	94.9143	45.01	Pk	12.8	-30.6	27.21	43.52	-16.31	0-360	100	V
3	475.7358	30.21	Pk	21.4	-28.4	23.21	46.02	-22.81	0-360	200	H
6	701.7652	29.39	Pk	24.2	-27.7	25.89	46.02	-20.13	0-360	300	V

Pk - Peak detector

### 8.3.2. READER MODE, TYPE B 848Kbps

#### SPURIOUS EMISSION



## 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	37.95	Pk	17.8	-31.2	24.55	40	-15.45	0-360	400	H
4	40.6703	42.52	Pk	17.8	-31.2	29.12	40	-10.88	0-360	100	V
2	94.9143	44.84	Pk	12.8	-30.6	27.04	43.52	-16.48	0-360	300	H
5	94.9143	45.56	Pk	12.8	-30.6	27.76	43.52	-15.76	0-360	100	V
6	446.8321	30.06	Pk	20.7	-28.6	22.16	46.02	-23.86	0-360	300	V
3	549.9455	29.84	Pk	22.2	-28.1	23.94	46.02	-22.08	0-360	100	H

Pk - Peak detector

## 8.4. 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.

<b>ID:</b>	38602	<b>Date:</b>	10/30/2019
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### 8.4.1. CE 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	13.5596279	3.715	13.5589597	52.993	13.5598100	-9.714	13.5589434	54.196	$\pm 100$
	40	13.5587496	68.486	13.5591986	35.372	13.5591986	35.374	13.5591346	40.092	$\pm 100$
	30	13.5594621	15.945	13.5588306	62.514	13.5589201	55.911	13.5589419	54.308	$\pm 100$
	<b>20</b>	<b>13.5596783</b>	<b>0.000</b>	<b>13.5591822</b>	<b>36.581</b>	<b>13.5593452</b>	<b>24.566</b>	<b>13.5594465</b>	<b>17.093</b>	<b><math>\pm 100</math></b>
	10	13.5591053	42.257	13.5590402	47.054	13.5587199	70.677	13.5591884	36.126	$\pm 100$
	0	13.5602800	-44.376	13.5597896	-8.211	13.5602409	-41.492	13.5599942	-23.301	$\pm 100$
	-10	13.5599582	10.281	13.5608674	-87.693	13.5609440	-93.343	13.5594465	17.093	$\pm 100$
	-20	13.5599594	-20.733	13.5603730	-51.236	13.5602111	-39.291	13.5599799	-22.243	$\pm 100$
3.23	20	13.5592694	30.153	13.5592235	33.538	13.5590446	46.731	13.5597347	-4.161	$\pm 100$
4.37	20	13.5593408	24.888	13.5590725	44.674	13.5599013	-16.447	13.5593947	20.913	$\pm 100$

### 8.4.2. 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	13.5598016	3.485	13.5598042	3.298	13.5598067	3.107	13.5597997	3.625	$\pm 100$
	40	13.5598107	2.811	13.5598144	2.541	13.5598090	2.942	13.5598043	3.287	$\pm 100$
	30	13.5598051	3.230	13.5598108	2.805	13.5598052	3.221	13.5598135	2.612	$\pm 100$
	<b>20</b>	<b>13.5598489</b>	<b>0.000</b>	<b>13.5598561</b>	<b>-0.530</b>	<b>13.5598497</b>	<b>-0.058</b>	<b>13.5598534</b>	<b>-0.331</b>	<b><math>\pm 100</math></b>
	10	13.5598518	-0.216	13.5598642	-1.129	13.5598730	-1.779	13.5599022	-3.934	$\pm 100$
	0	13.5598691	-1.495	13.5598825	-2.479	13.5598895	-2.998	13.5599051	-4.150	$\pm 100$
	-10	13.5599414	-6.822	13.5599554	-7.857	13.5599611	-8.278	13.5599659	-8.628	$\pm 100$
	-20	13.5599503	-7.483	13.5599519	-7.600	13.5599692	-8.871	13.5599742	-9.244	$\pm 100$
3.23	20	13.5594382	30.285	13.5596287	16.236	13.5592170	46.598	13.5596192	16.937	$\pm 100$
4.37	20	13.5594493	29.466	13.5598752	-1.942	13.5599041	-4.073	13.5592158	46.686	$\pm 100$

## 9. AC MAINS LINE CONDUCTED EMISSIONS

### LIMITS

§15.207

IC RSS-GEN, Section 8.8

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

Frequency range (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

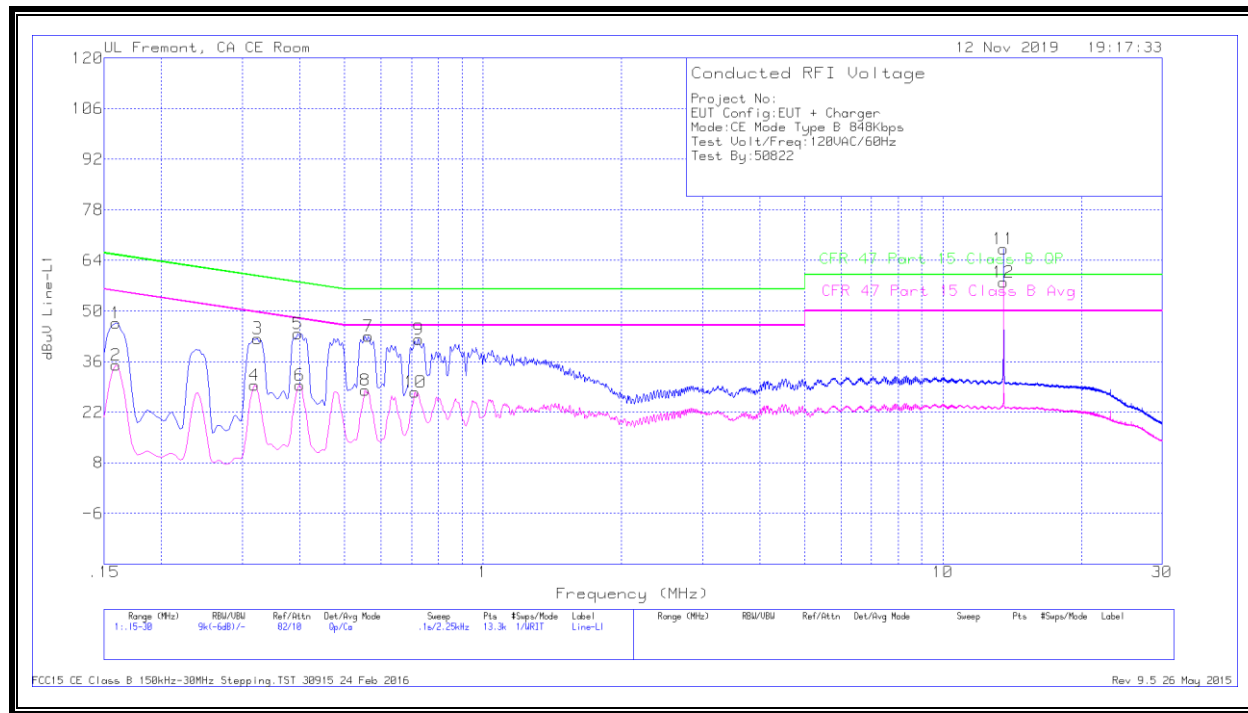
### RESULTS

No non-compliance noted:

## 9.1. CE MODE, TYPE B 848Kbps

### 9.1.1. NORMAL OPERATION

#### LINE 1 RESULTS



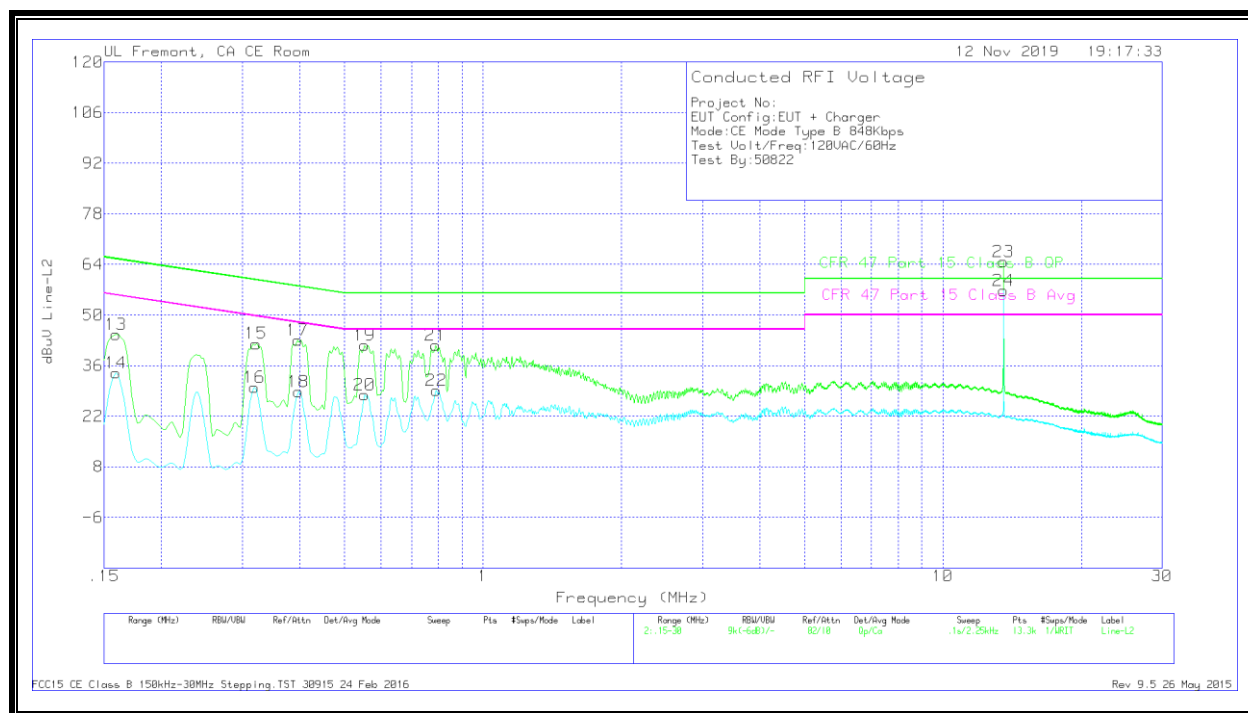
#### Worst Emission

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	.159	36.48	Qp	.1	0	10.1	46.68	65.52	-18.84	-	-
2	.159	24.85	Ca	.1	0	10.1	35.05	-	-	55.52	-20.47
3	.32325	32.33	Qp	0	0	10.1	42.43	59.62	-17.19	-	-
4	.31875	19.39	Ca	0	0	10.1	29.49	-	-	49.74	-20.25
5	.39525	33.64	Qp	0	0	10.1	43.74	57.95	-14.21	-	-
6	.39975	19.32	Ca	0	0	10.1	29.42	-	-	47.86	-18.44
7	.564	32.97	Qp	0	0	10.1	43.07	56	-12.93	-	-
8	.555	17.99	Ca	0	0	10.1	28.09	-	-	46	-17.91
9	.726	32.04	Qp	0	0	10.1	42.14	56	-13.86	-	-
10	.7125	17.43	Ca	0	0	10.1	27.53	-	-	46	-18.47
11	13.56	56.73	Qp	.1	.2	10.2	67.23	60	7.23	-	-
12	13.56	47.45	Ca	.1	.2	10.2	57.95	-	-	50	7.95

Qp - Quasi-Peak detector  
Ca - CISPR average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data under the following Section 9.1.2 indicate that when the antenna terminal is terminated, the fundamental amplitude is lowered below the limit line.

## LINE 2 RESULTS



## Worst Emission

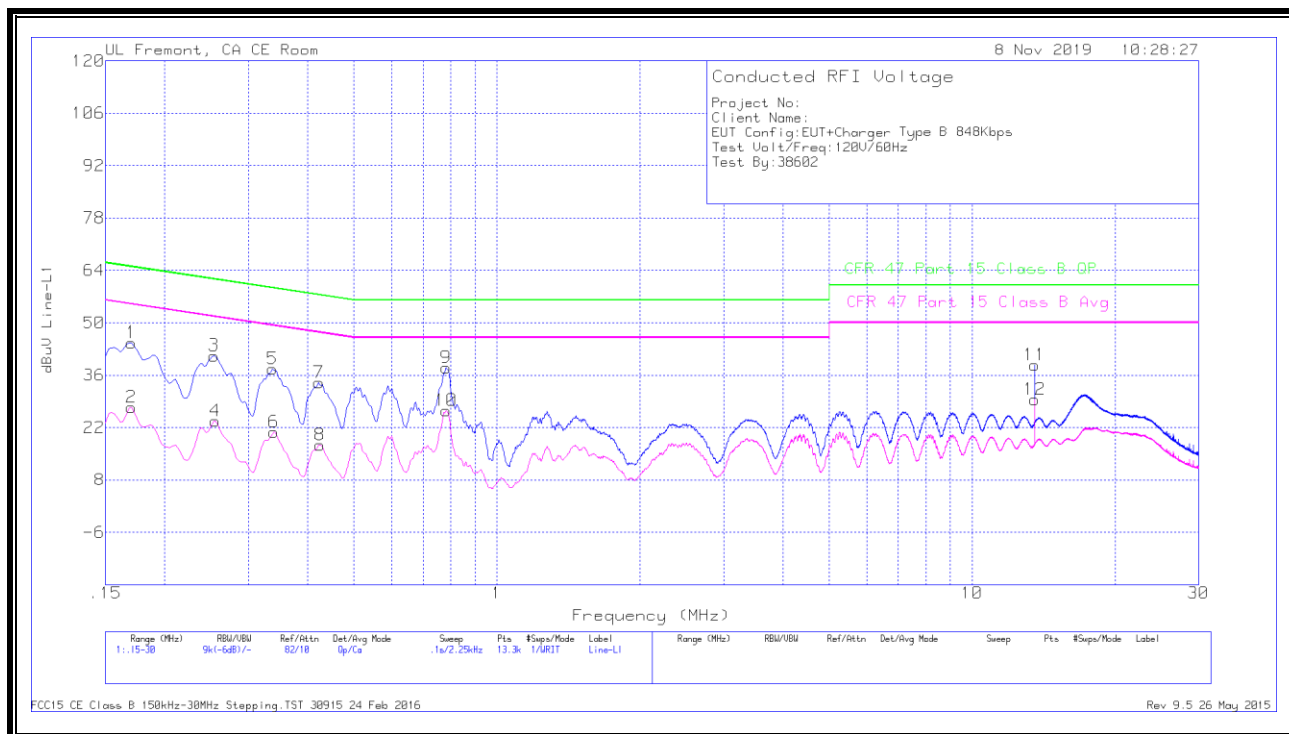
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.159	34.46	Qp	.1	0	10.1	44.66	65.52	-20.86	-	-
14	.159	23.79	Ca	.1	0	10.1	33.99	-	-	55.52	-21.53
15	.321	31.99	Qp	0	0	10.1	42.09	59.68	-17.59	-	-
16	.31875	19.88	Ca	0	0	10.1	29.98	-	-	49.74	-19.76
17	.39525	33	Qp	0	0	10.1	43.1	57.95	-14.85	-	-
18	.3975	18.71	Ca	0	0	10.1	28.81	-	-	47.91	-19.1
19	.55275	31.62	Qp	0	0	10.1	41.72	56	-14.28	-	-
20	.55275	17.84	Ca	0	0	10.1	27.94	-	-	46	-18.06
21	.789	31.5	Qp	0	0	10.1	41.6	56	-14.4	-	-
22	.79125	19.05	Ca	0	0	10.1	29.15	-	-	46	-16.85
23	13.56	54.31	Qp	.1	.2	10.2	64.81	60	4.81	-	-
24	13.56	46.31	Ca	.1	.2	10.2	56.81	-	-	50	6.81

Qp - Quasi-Peak detector  
Ca - CISPR average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data under the following Section 9.1.2 indicate that when the antenna terminal is terminated, the fundamental amplitude is lowered below the limit line.

## 9.1.2. NORMAL OPERATION WITH ANTENNA PORT TERMINATED

### LINE 1 RESULTS



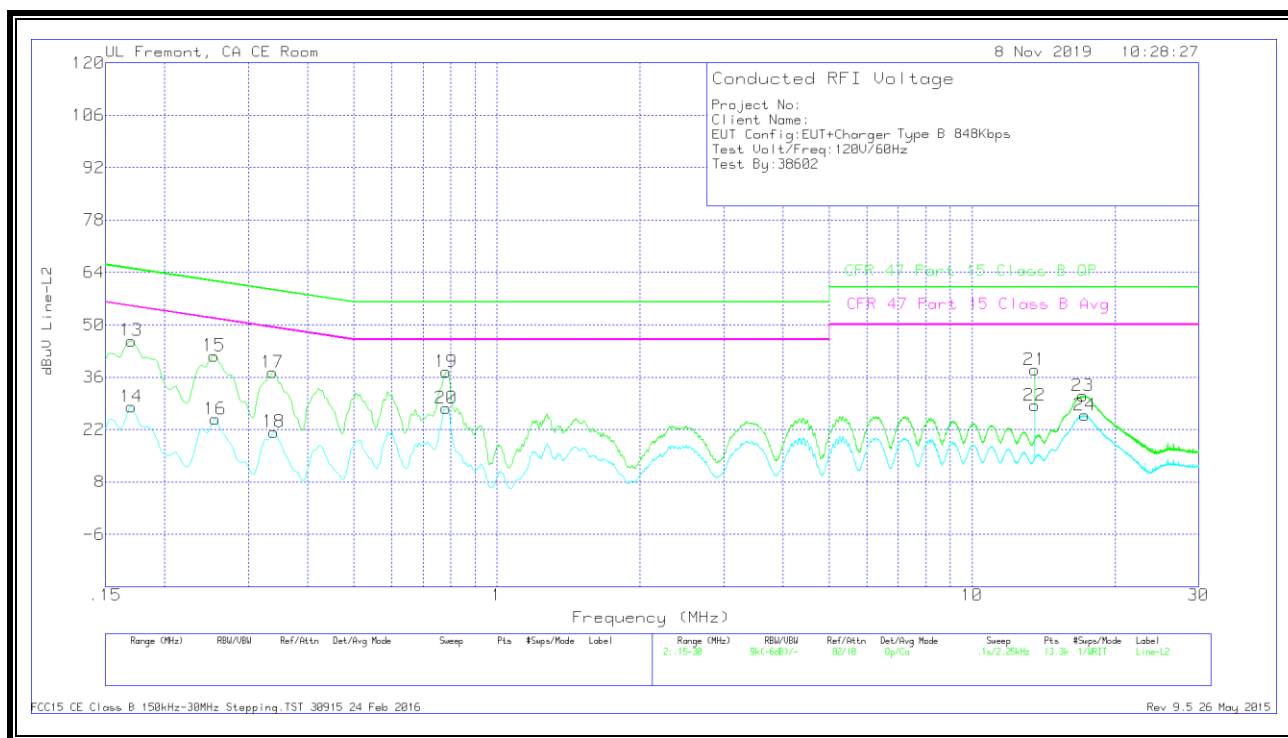
### Worst Emission

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	.17025	34.59	Qp	0	0	10.1	44.69	64.95	-20.26	-	-
2	.17025	17.38	Ca	0	0	10.1	27.48	-	-	54.95	-27.47
3	.2535	31.12	Qp	0	0	10.1	41.22	61.64	-20.42	-	-
4	.25575	13.72	Ca	0	0	10.1	23.82	-	-	51.57	-27.75
5	.33675	27.55	Qp	0	0	10.1	37.65	59.28	-21.63	-	-
6	.339	10.65	Ca	0	0	10.1	20.75	-	-	49.23	-28.48
7	.42225	23.88	Qp	0	0	10.1	33.98	57.4	-23.42	-	-
8	.4245	7.2	Ca	0	0	10.1	17.3	-	-	47.36	-30.06
9	.78225	27.89	Qp	0	0	10.1	37.99	56	-18.01	-	-
10	.78225	16.36	Ca	0	0	10.1	26.46	-	-	46	-19.54
11	13.56	28.19	Qp	.1	.2	10.2	38.69	60	-21.31	-	-
12	13.56	18.98	Ca	.1	.2	10.2	29.48	-	-	50	-20.52

Qp - Quasi-Peak detector

Ca - CISPR average detection

## LINE 2 RESULTS



## Worst Emission

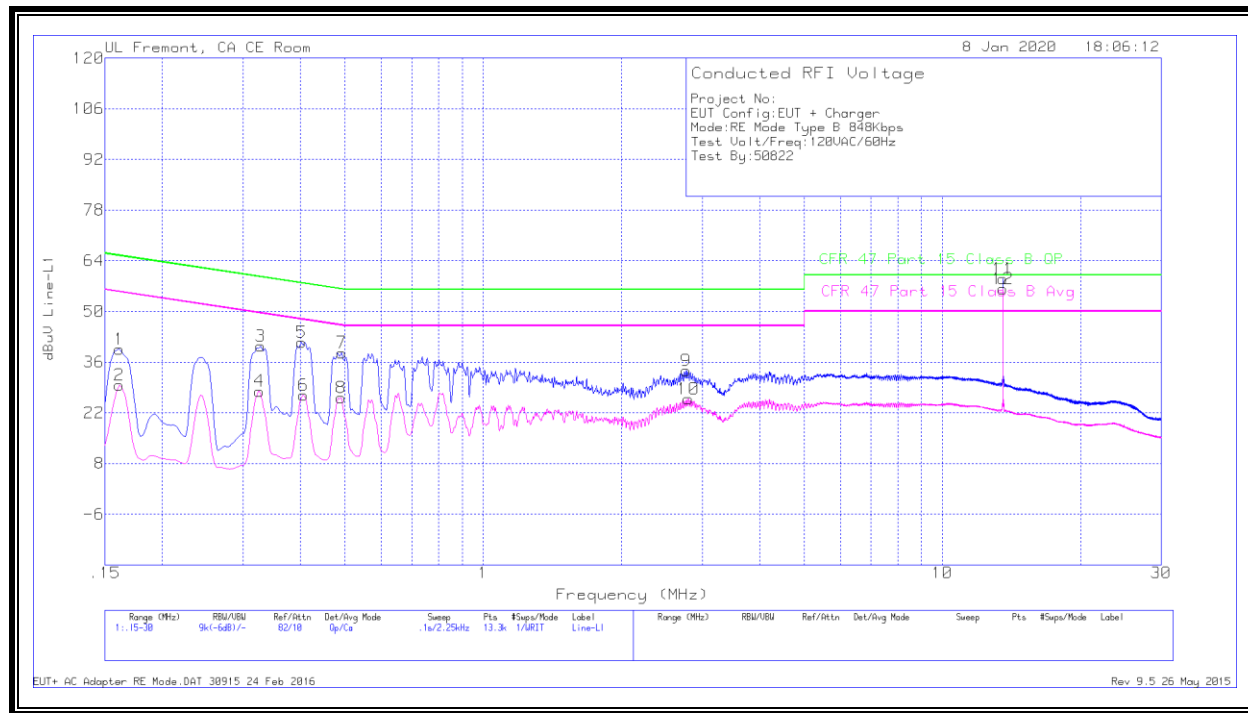
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.17025	35.64	Qp	0	0	10.1	45.74	64.95	-19.21	-	-
14	.17025	17.97	Ca	0	0	10.1	28.07	-	-	54.95	-26.88
15	.2535	31.64	Qp	0	0	10.1	41.74	61.64	-19.9	-	-
16	.25575	14.68	Ca	0	0	10.1	24.78	-	-	51.57	-26.79
17	.33675	27.15	Qp	0	0	10.1	37.25	59.28	-22.03	-	-
18	.339	11.3	Ca	0	0	10.1	21.4	-	-	49.23	-27.83
19	.78225	27.33	Qp	0	0	10.1	37.43	56	-18.57	-	-
20	.78225	17.68	Ca	0	0	10.1	27.78	-	-	46	-18.22
21	13.56	27.43	Qp	.1	.2	10.2	37.93	60	-22.07	-	-
22	13.56	17.9	Ca	.1	.2	10.2	28.4	-	-	50	-21.6
23	17.0902	20.31	Qp	.1	.3	10.3	31.01	60	-28.99	-	-
24	17.2815	15.08	Ca	.1	.3	10.3	25.78	-	-	50	-24.22

Qp - Quasi-Peak detector  
Ca - CISPR average detection

## 9.2. READER MODE, TYPE B 848Kbps

### 9.2.1. NORMAL OPERATION

#### LINE 1 RESULTS



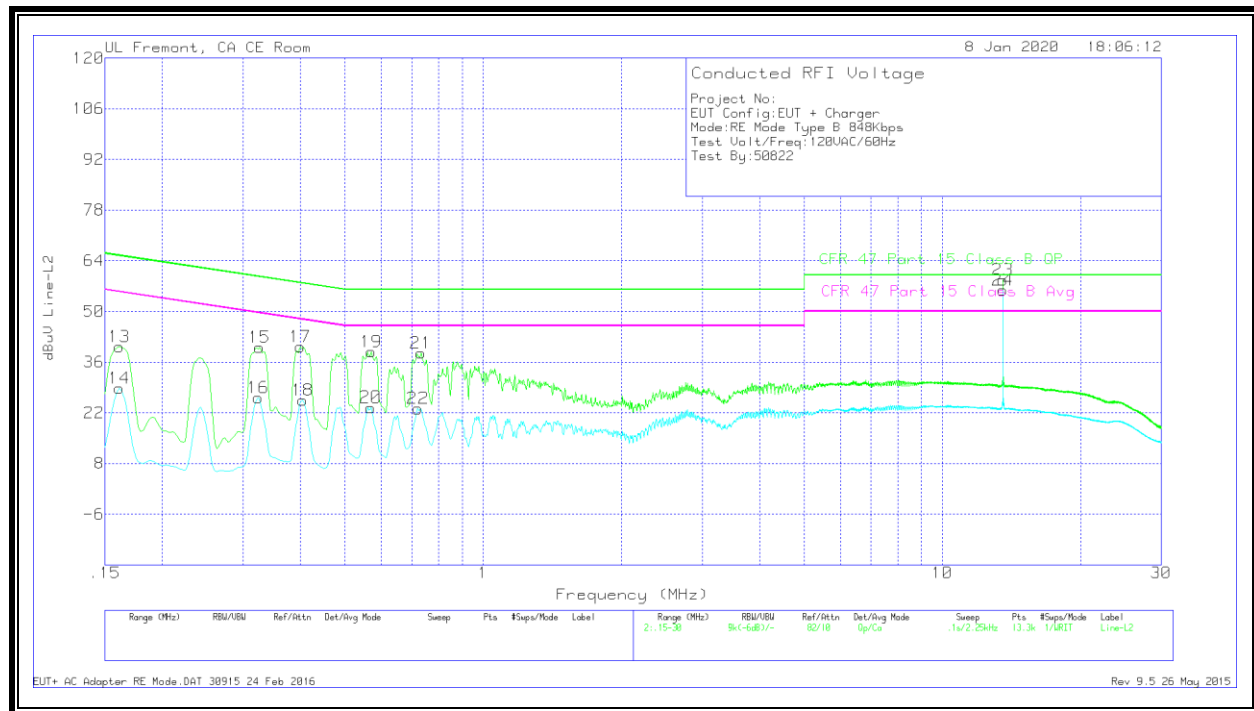
#### Worst Emission

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	29.44	Qp	.1	0	10.1	39.64	65.4	-25.76	-	-
2	.16125	19.5	Ca	.1	0	10.1	29.7	-	-	55.4	-25.7
3	.32775	30.3	Qp	0	0	10.1	40.4	59.51	-19.11	-	-
4	.3255	17.91	Ca	0	0	10.1	28.01	-	-	49.57	-21.56
5	.402	31.33	Qp	0	0	10.1	41.43	57.81	-16.38	-	-
6	.4065	16.75	Ca	0	0	10.1	26.85	-	-	47.72	-20.87
7	.492	28.51	Qp	0	0	10.1	38.61	56.13	-17.52	-	-
8	.48975	16.1	Ca	0	0	10.1	26.2	-	-	46.17	-19.97
9	2.77125	23.45	Qp	0	.1	10.1	33.65	56	-22.35	-	-
10	2.79825	15.59	Ca	0	.1	10.1	25.79	-	-	46	-20.21
11	13.56	48.55	Qp	.1	.2	10.2	59.05	60	-.95	-	-
12	13.56	45.78	Ca	.1	.2	10.2	56.28	-	-	50	6.28

Qp - Quasi-Peak detector  
Ca - CISPR average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data under the following Section 9.2.2 indicate that when the antenna terminal is terminated, the fundamental amplitude is lowered below the limit line.

## LINE 2 RESULTS



## Worst Emission

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	.16125	30.09	Qp	.1	0	10.1	40.29	65.4	-25.11	-	-
14	.16125	18.64	Ca	.1	0	10.1	28.84	-	-	55.4	-26.56
15	.3255	30.07	Qp	0	0	10.1	40.17	59.57	-19.4	-	-
16	.32325	16.12	Ca	0	0	10.1	26.22	-	-	49.62	-23.4
17	.39975	30.12	Qp	0	0	10.1	40.22	57.86	-17.64	-	-
18	.40425	15.31	Ca	0	0	10.1	25.41	-	-	47.77	-22.36
19	.57075	28.85	Qp	0	0	10.1	38.95	56	-17.05	-	-
20	.5685	13.39	Ca	0	0	10.1	23.49	-	-	46	-22.51
21	.73275	28.44	Qp	0	0	10.1	38.54	56	-17.46	-	-
22	.7215	13.05	Ca	0	0	10.1	23.15	-	-	46	-22.85
23	13.56	48.11	Qp	.1	.2	10.2	58.61	60	-1.39	-	-
24	13.56	45.34	Ca	.1	.2	10.2	55.84	-	-	50	5.84

Qp - Quasi-Peak detector

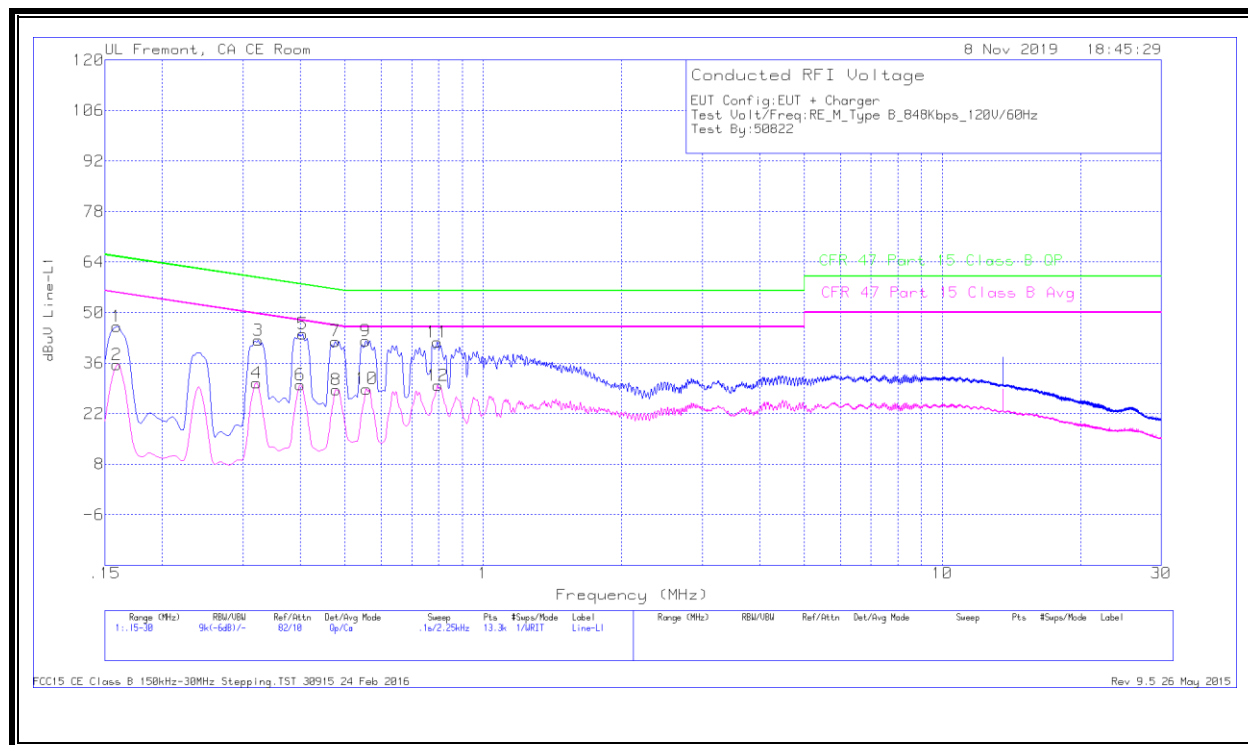
Ca - CISPR average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data under the following Section 9.2.2 indicate that when the antenna terminal is terminated, the fundamental amplitude is lowered below the limit line.



## 9.2.2. NORMAL OPERATION WITH ANTENNA PORT TERMINATED

### LINE 1 RESULTS



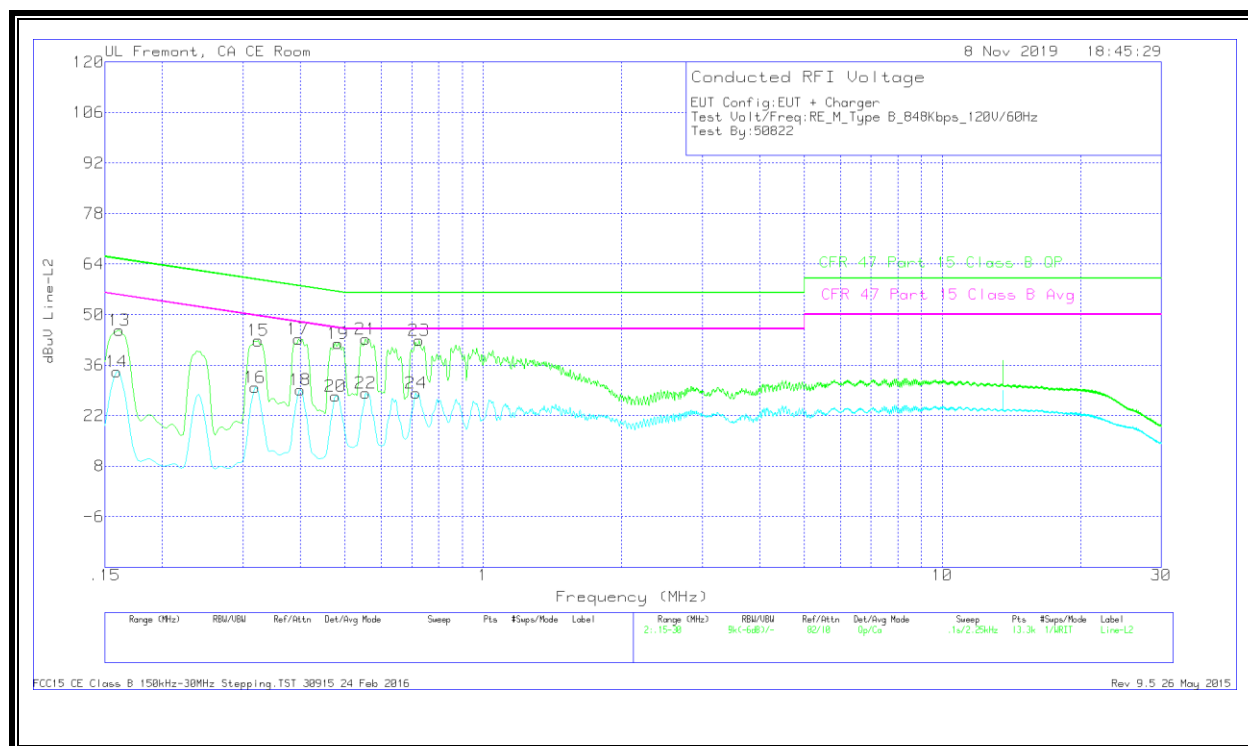
### Worst Emission

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	.159	36.03	Qp	.1	0	10.1	46.23	65.52	-19.29	-	-
2	.159	25.44	Ca	.1	0	10.1	35.64	-	-	55.52	-19.88
3	.32325	32.31	Qp	0	0	10.1	42.41	59.62	-17.21	-	-
4	.321	20.46	Ca	0	0	10.1	30.56	-	-	49.68	-19.12
5	.40425	34	Qp	0	0	10.1	44.1	57.77	-13.67	-	-
6	.39975	19.89	Ca	0	0	10.1	29.99	-	-	47.86	-17.87
7	.47625	31.99	Qp	0	0	10.1	42.09	56.4	-14.31	-	-
8	.4785	18.49	Ca	0	0	10.1	28.59	-	-	46.37	-17.78
9	.555	32.14	Qp	0	0	10.1	42.24	56	-13.76	-	-
10	.55725	18.78	Ca	0	0	10.1	28.88	-	-	46	-17.12
11	.7935	31.7	Qp	0	0	10.1	41.8	56	-14.2	-	-
12	.79575	19.76	Ca	0	0	10.1	29.86	-	-	46	-16.14

Qp - Quasi-Peak detector

Ca - CISPR average detection

## LINE 2 RESULTS



## Worst Emission

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	.16125	35.38	Qp	.1	0	10.1	45.58	65.4	-19.82	-	-
14	.159	23.94	Ca	.1	0	10.1	34.14	-	-	55.52	-21.38
15	.32325	32.69	Qp	0	0	10.1	42.79	59.62	-16.83	-	-
16	.31875	19.75	Ca	0	0	10.1	29.85	-	-	49.74	-19.89
17	.39525	33.04	Qp	0	0	10.1	43.14	57.95	-14.81	-	-
18	.39975	19.11	Ca	0	0	10.1	29.21	-	-	47.86	-18.65
19	.483	31.97	Qp	0	0	10.1	42.07	56.29	-14.22	-	-
20	.47625	17.34	Ca	0	0	10.1	27.44	-	-	46.4	-18.96
21	.555	33.18	Qp	0	0	10.1	43.28	56	-12.72	-	-
22	.555	18.2	Ca	0	0	10.1	28.3	-	-	46	-17.7
23	.726	32.79	Qp	0	0	10.1	42.89	56	-13.11	-	-
24	.71475	18.15	Ca	0	0	10.1	28.25	-	-	46	-17.75

Qp - Quasi-Peak detector  
Ca - CISPR average detection

## 10. SETUP PHOTOS

Please refer to 13018918-EP1V1 for setup photos.

**END OF TEST REPORT**