



CERTIFICATION TEST REPORT

Report Number. : 13018973-E7V2

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

Model : A2275, A2297, A2298

FCC ID : BCG-E3500A

IC : 579C-E3500A

EUT Description : SMARTPHONE

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

Date Of Issue:
March 20, 2020

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NVLAP Lab code: 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2/10/2020	Initial Issue	Tony Wang
V2	3/20/2020	Address 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: A2275, A2297, A2298

SERIAL NUMBER: FFMZF01VP3C0

DATE TESTED: OCTOBER 14 – NOVEMBER 14, 2019

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.

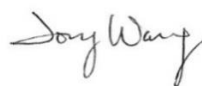
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. 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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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.
☐ Chamber A (IC:2324B-1)	☐ Chamber D (IC:22541-1)	☐ Chamber I (IC: 2324A-5)
☒ Chamber B (IC:2324B-2)	☐ Chamber E (IC:22541-2)	☐ Chamber J (IC: 2324A-6)
☐ Chamber C (IC:2324B-3)	☒ Chamber F (IC:22541-3)	☐ Chamber K (IC: 2324A-1)
	☒ Chamber G (IC:22541-4)	☐ Chamber L (IC: 2324A-3)
	☐ Chamber H (IC:22541-5)	☐ 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 _{LAB}
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 Apple iPhone, 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, electronic SIM (e-SIM), or second SIM is not present. The device has a built-in inductive charging receiver which is not user accessible. The rechargeable battery is not user accessible.

5.2. DIFFERENCE IN MODEL NUMBER

Models A2297 and A2298 are electronically identical to Model A2275. The three model numbers are allocated for marketing and logistic purposes only. Model A2275 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 A	Reader	848	26.38
		CE	848	24.99

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 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 and EUT with earphones. The EUT with power supply configuration was determined to be worst-case configuration; 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 A without Tag was determined to be the worst case and therefore Type A 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 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	C02P41RZG086	FCC DoC
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
EUT AC Adapter	Apple	A1385	D292365CDYADHLHC3	NA

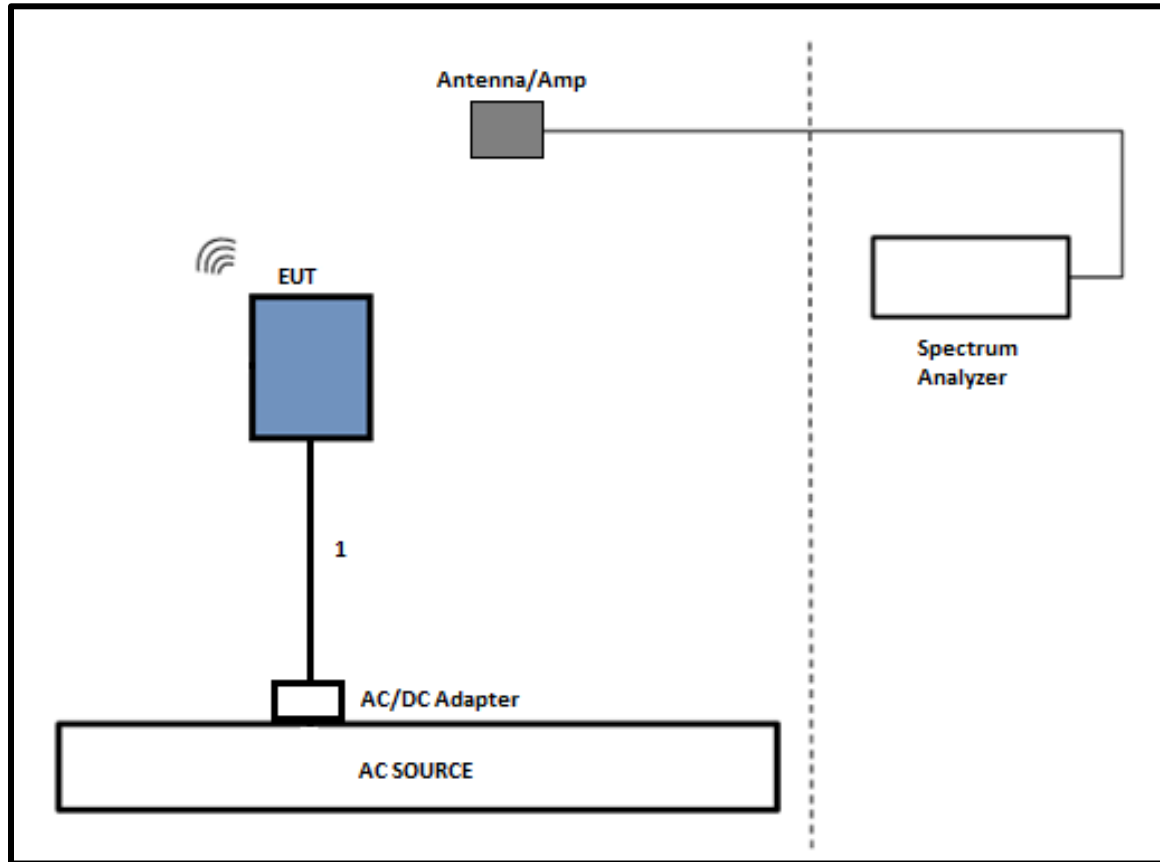
I/O CABLES

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

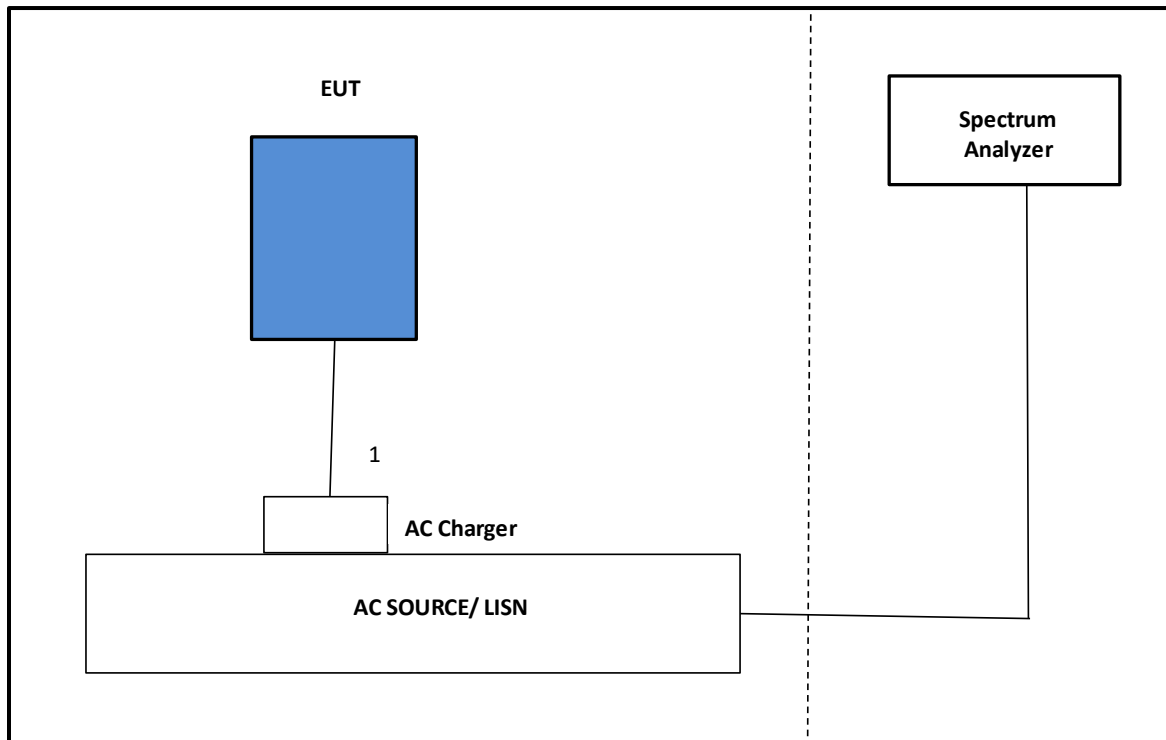
TEST SETUP

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	JB1	T407	05/11/2020
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T173	06/06/2020
*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	T342	01/23/2020
*Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/23/2020
*Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1210	02/27/2020
AC Line Conducted				
*EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESCI7	T1436	02/14/2020
*Power Cable, Line Conducted Emissions	UL	PG1	T861	11/12/2019
*LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	01/24/2020
UL AUTOMATION SOFTWARE				
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

ID:	38602	Date:	10/18/2019
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99% and 20dB BW

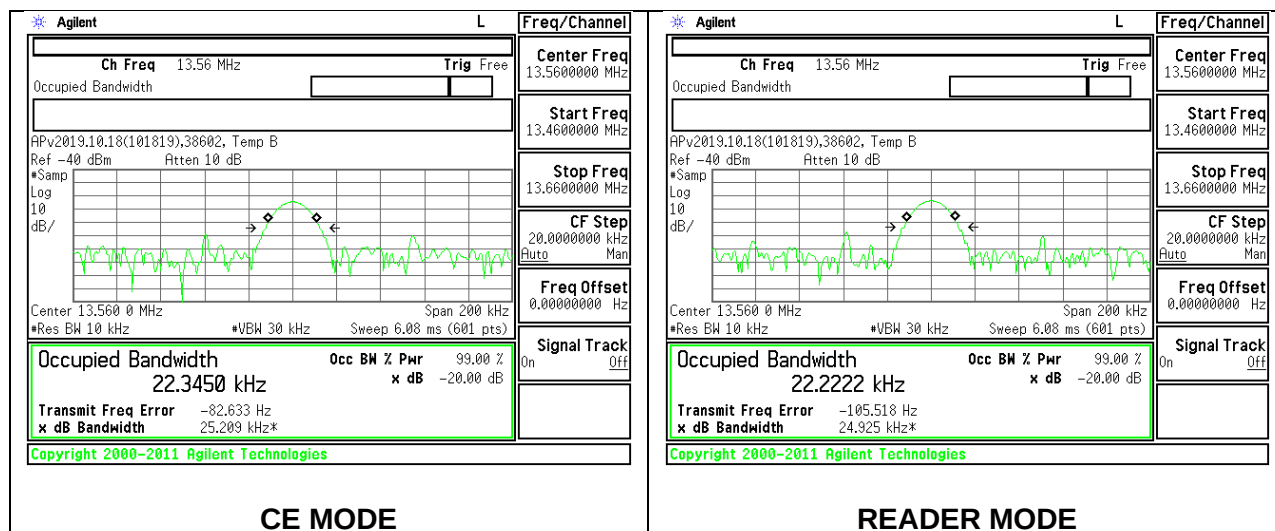
CE Mode

Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	22.3450	25.209

Reader Mode

Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	22.2222	24.925

Type A 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

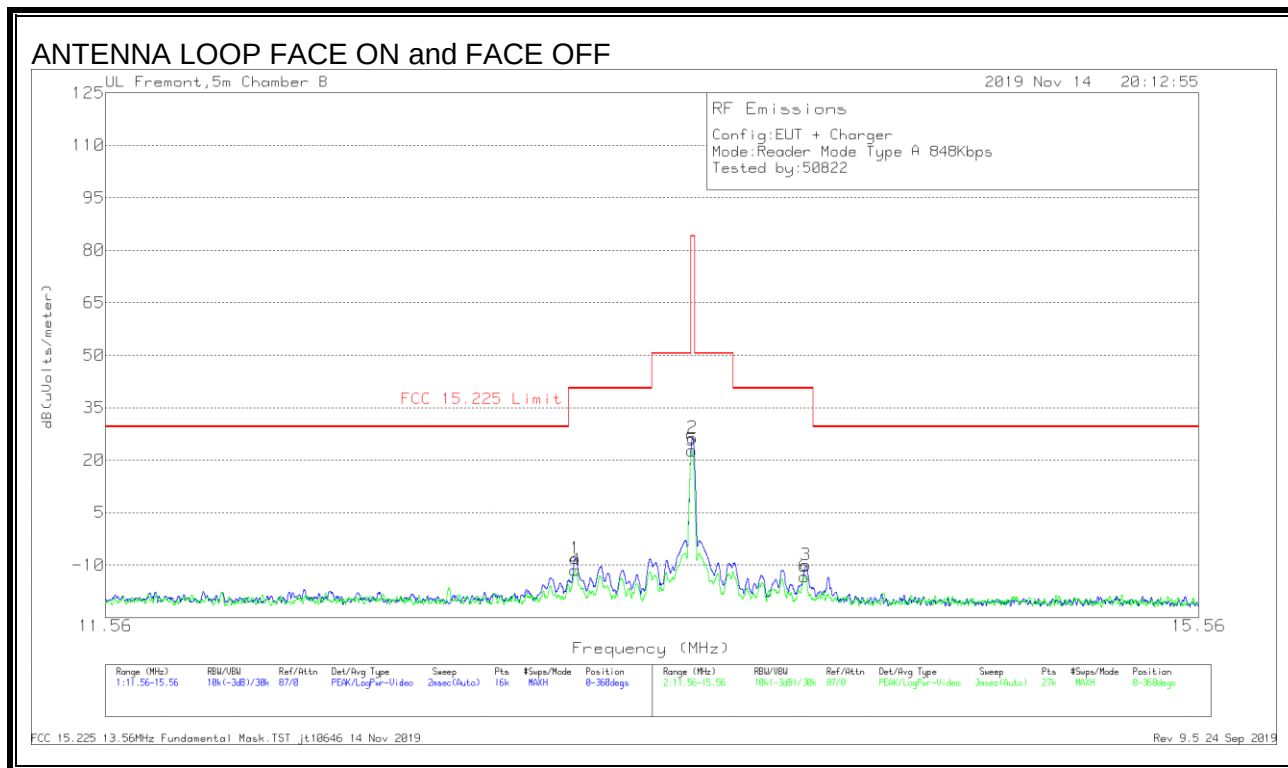
The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the 10th harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater.

RESULTS

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

8.2.1. READER MODE

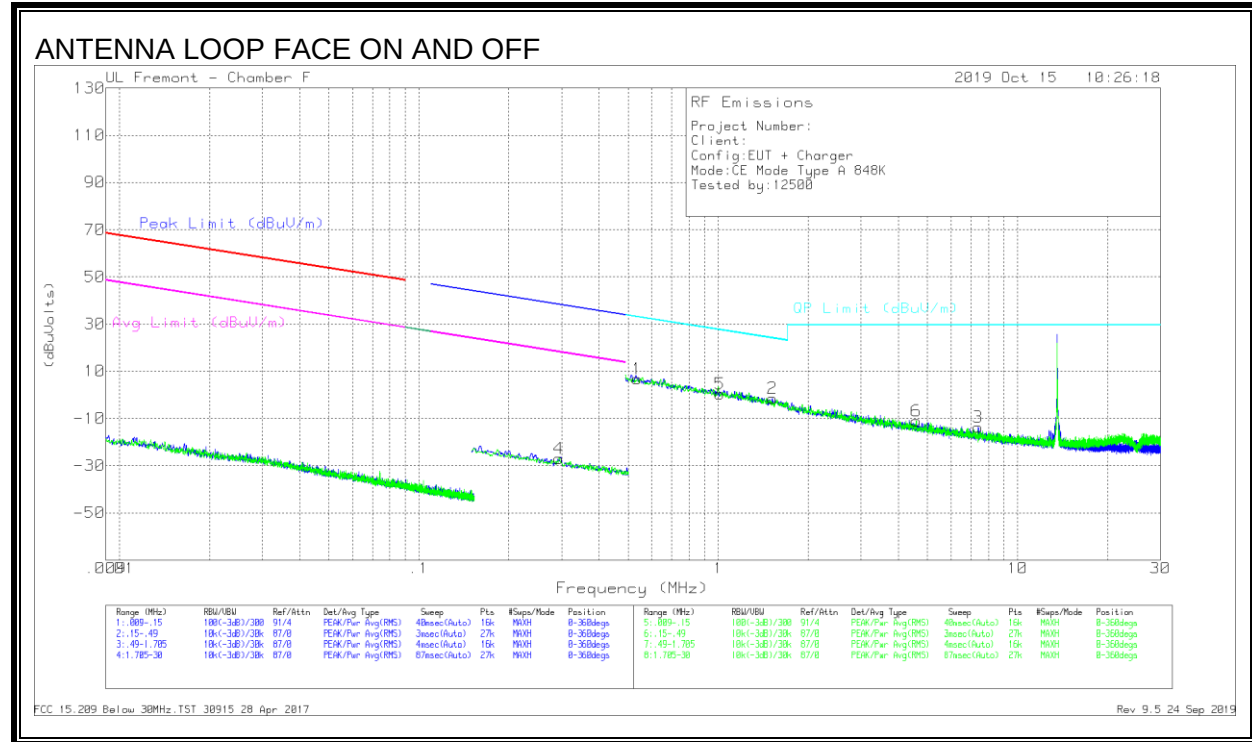
FUNDAMENTAL 848Kbps



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	13.1345	17.32	Pk	10.7	.5	-40	-11.48	40.51	-51.99	0-360
1	13.13463	20.66	Pk	10.7	.5	-40	-8.14	40.51	-48.65	0-360
5	13.55807	51.62	Pk	10.6	.5	-40	22.72	84	-61.28	0-360
2	13.55988	55.28	Pk	10.6	.5	-40	26.38	84	-57.62	0-360
6	13.97795	15.65	Pk	10.6	.5	-40	-13.25	40.51	-53.76	0-360
3	13.98413	18.92	Pk	10.6	.5	-40	-9.98	40.51	-50.49	0-360

Pk - Peak detector

SPURIOUS EMISSION 848Kbps



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	.29377	42.12	Pk	10.9	.1	-80	-26.88	38.25	-65.13	18.25	-45.13	0-360

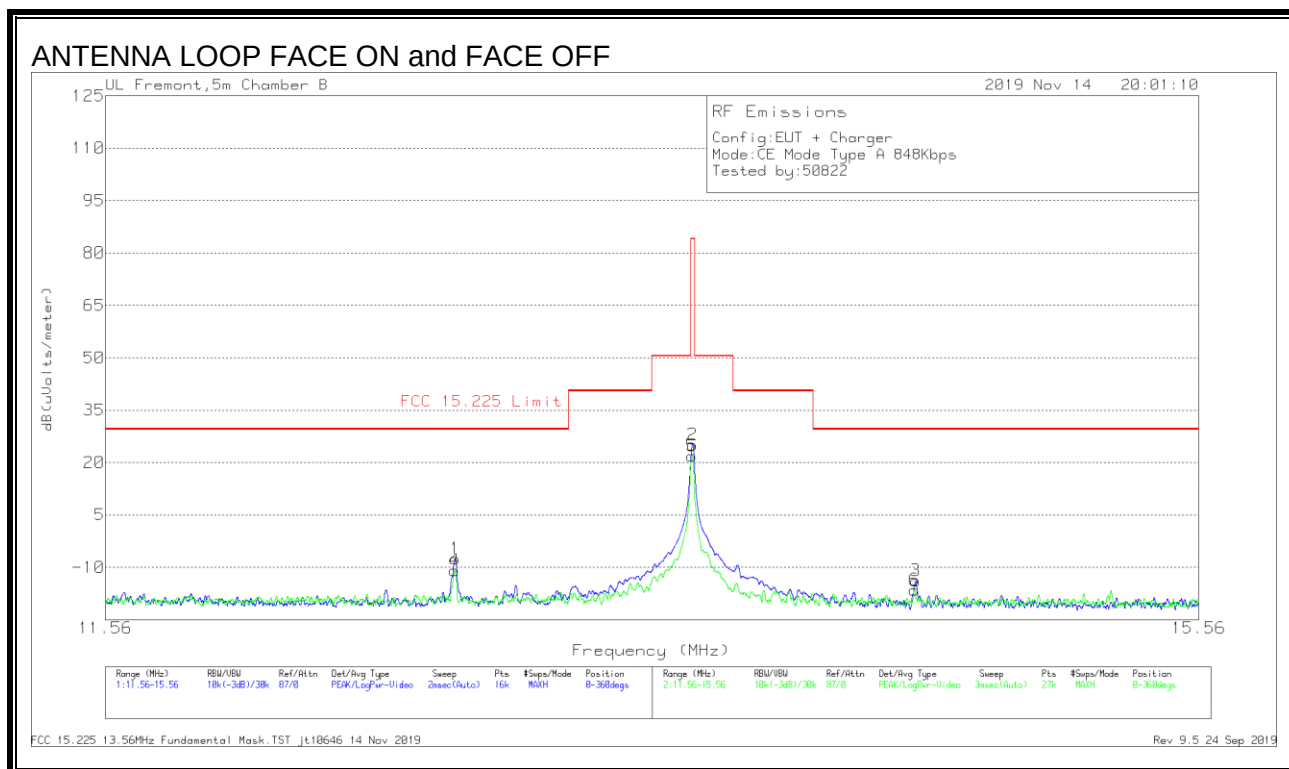
Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.53526	35.67	Pk	11.1	.1	-40	6.87	33.03	-26.16	0-360
2	1.51619	27.11	Pk	11.3	.1	-40	-1.49	24.02	-25.51	0-360
3	7.39354	15.07	Pk	11	.3	-40	-13.63	29.5	-43.13	0-360
5	1.01159	28.94	Pk	11.3	.1	-40	.34	27.52	-27.18	0-360
6	4.5891	17.4	Pk	11.3	.2	-40	-11.1	29.5	-40.6	0-360

Pk - Peak detector

8.2.2. CE MODE

FUNDAMENTAL 848Kbps



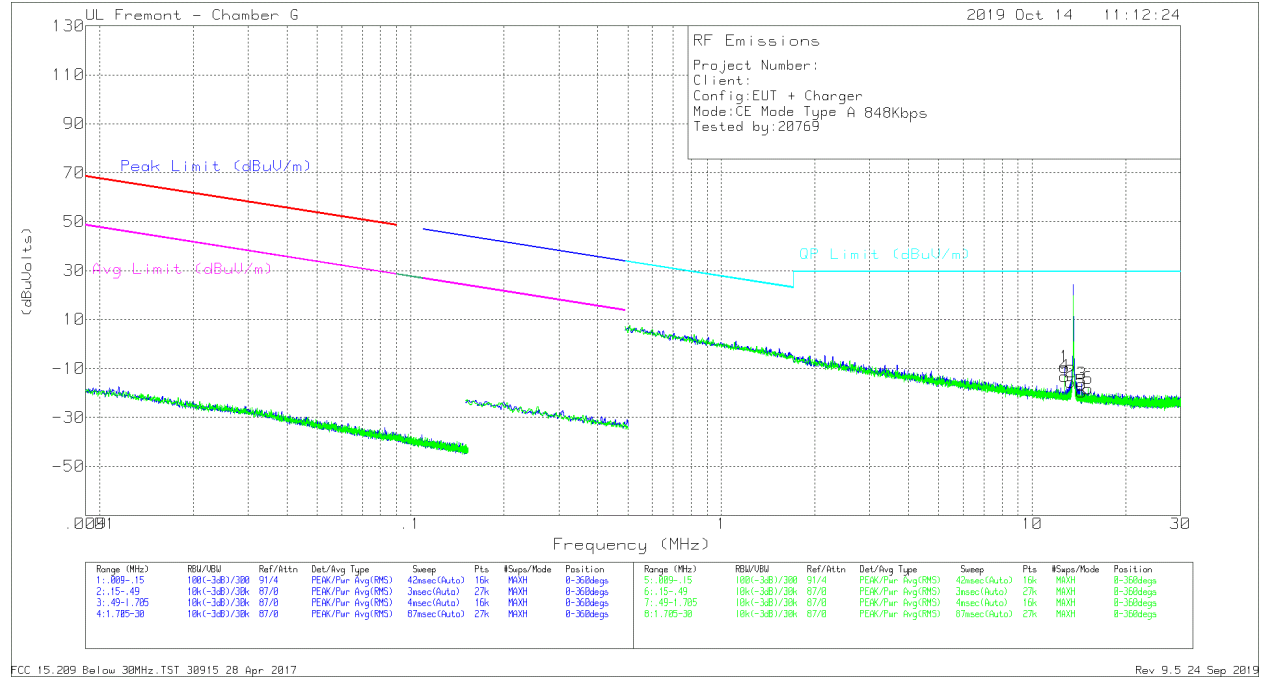
Trace Markers

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	12.71107	17.88	Pk	10.7	.5	-40	-10.92	29.54	-40.46	0-360
1	12.71213	21.26	Pk	10.7	.5	-40	-7.54	29.54	-37.08	0-360
5	13.55807	50.77	Pk	10.6	.5	-40	21.87	84	-62.13	0-360
2	13.5615	53.89	Pk	10.6	.5	-40	24.99	84	-59.01	0-360
6	14.4036	12.36	Pk	10.6	.5	-40	-16.54	29.54	-46.08	0-360
3	14.40813	14.96	Pk	10.6	.5	-40	-13.94	29.54	-43.48	0-360

Pk - Peak detector

SPURIOUS EMISSION 848Kbps

ANTENNA LOOP FACE ON AND OFF



Trace Markers

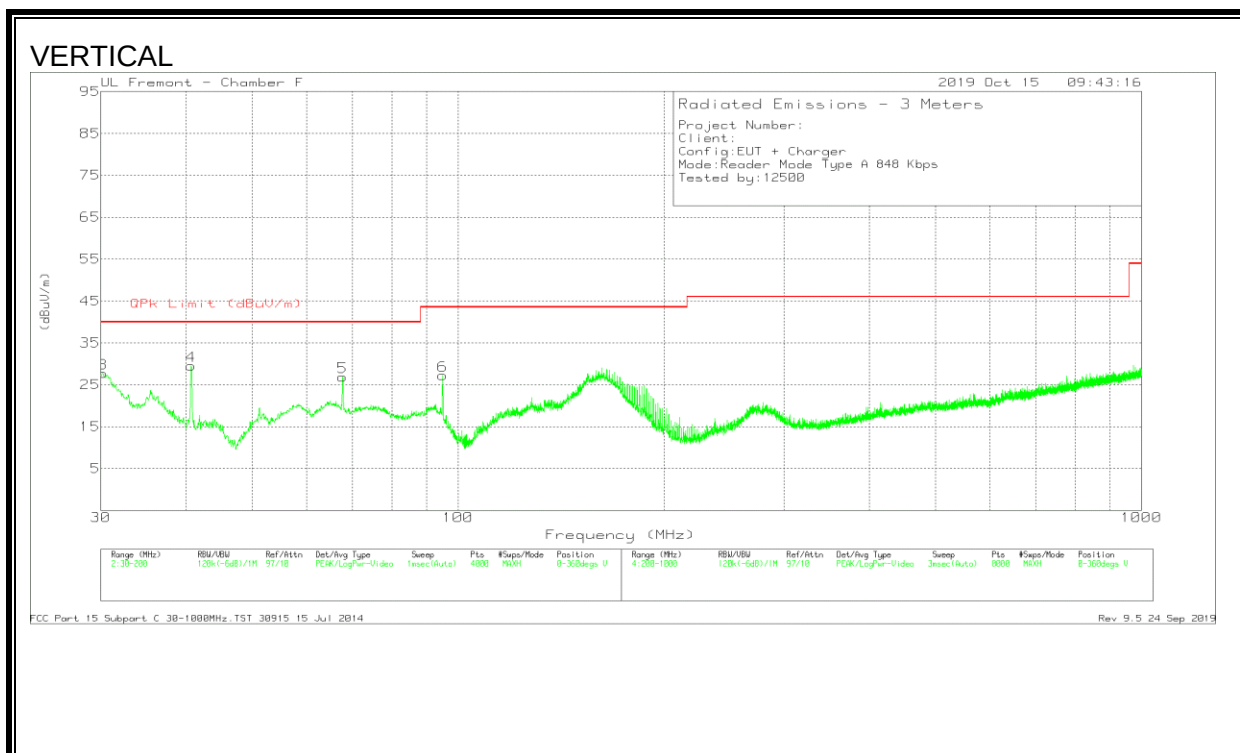
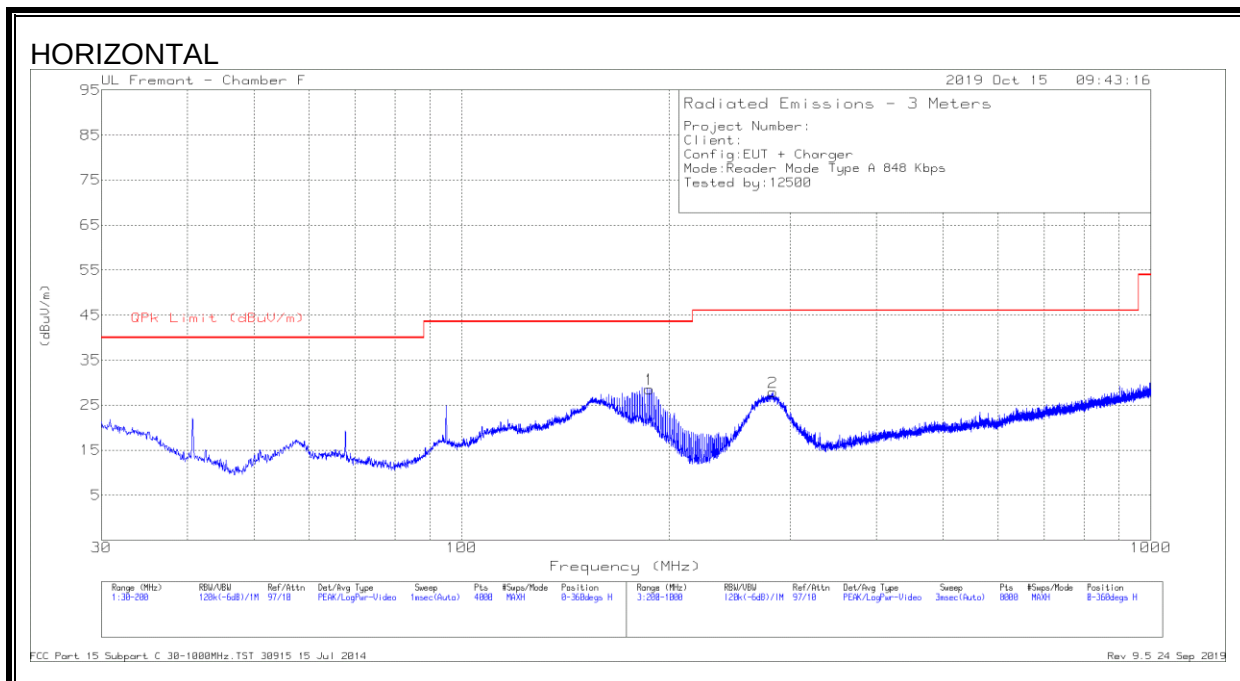
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	12.70271	12.93	Pk	10.7	.4	-40	-15.97	29.5	-45.47	0-360
1	12.71267	17.98	Pk	10.7	.4	-40	-10.92	29.5	-40.42	0-360
5	13.19737	10.73	Pk	10.7	.4	-40	-18.17	29.5	-47.67	0-360
2	13.31684	13.95	Pk	10.7	.4	-40	-14.95	29.5	-44.45	0-360
3	14.40728	11.85	Pk	10.6	.4	-40	-17.15	29.5	-46.65	0-360
6	15.38088	10.54	Pk	10.6	.4	-40	-18.46	29.5	-47.96	0-360

Pk - Peak detector

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

8.3.1. READER MODE

SPURIOUS EMISSION 848Kbps



Radiated Emissions

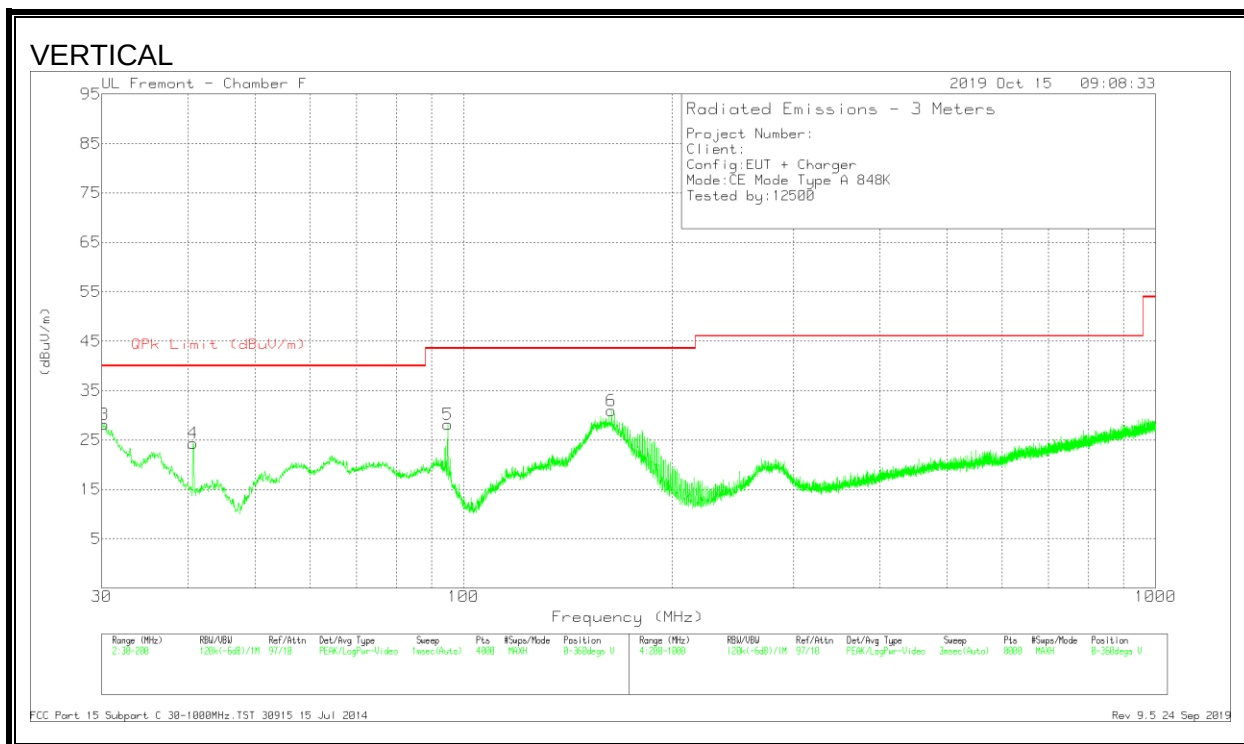
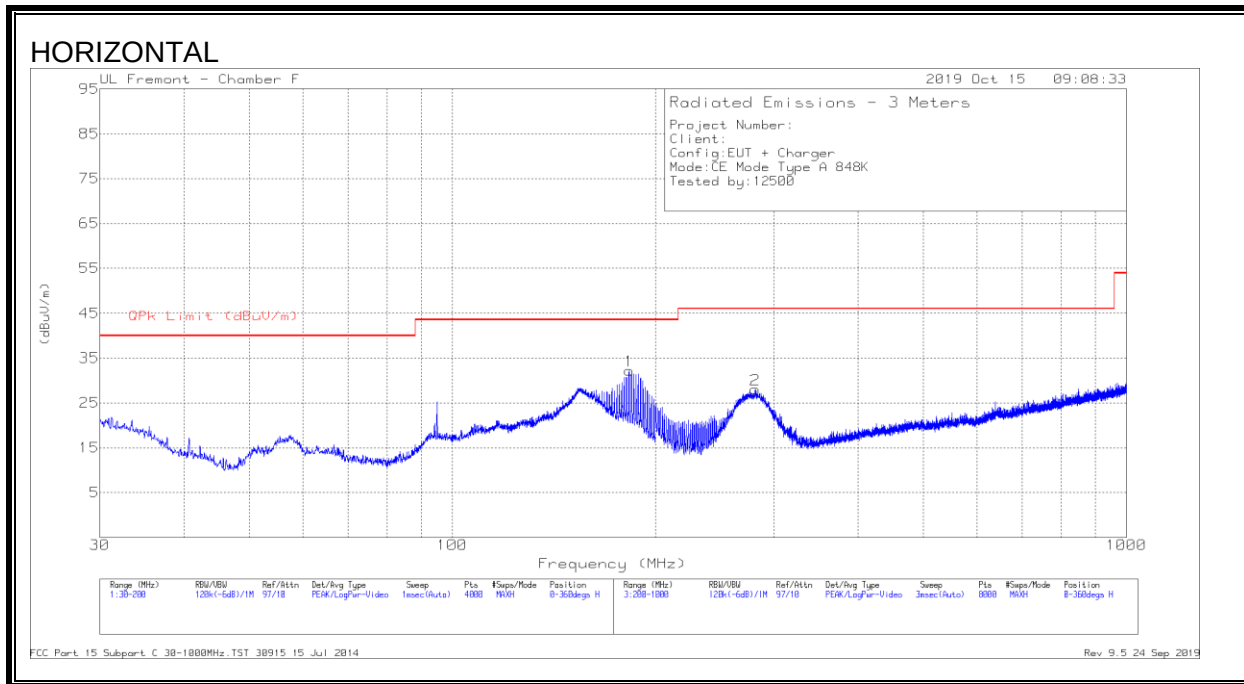
Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
187.1995	41.17	Qp	15.1	-30.6	25.67	43.52	-17.85	161	182	H
30.0627	30.93	Qp	25.3	-31.9	24.33	40	-15.67	182	100	V
40.6669	42.8	Qp	17.3	-31.8	28.3	40	-11.7	113	112	V
67.8019	44.86	Qp	12.1	-31.5	25.46	40	-14.54	80	104	V
94.9282	44.86	Qp	12.9	-31.2	26.56	43.52	-16.96	300	103	V
* 282.8292	36.61	Qp	17.3	-29.9	24.01	46.02	-22.01	56	100	H

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

Qp - Quasi-Peak detector

8.3.2. CE MODE

SPURIOUS EMISSION 848Kbps



Radiated Emissions

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
182.7886	43.66	Qp	15.1	-30.6	28.16	43.52	-15.36	164	193	H
30.181	30.99	Qp	25.2	-31.9	24.29	40	-15.71	100	102	V
40.6775	37.44	Qp	17.3	-31.8	22.94	40	-17.06	283	111	V
94.9095	45.13	Qp	12.9	-31.2	26.83	43.52	-16.69	57	110	V
* 163.6728	38.78	Qp	16	-30.8	23.98	43.52	-19.54	105	118	V
* 281.4644	36.82	Qp	17.3	-29.9	24.22	46.02	-21.8	54	100	H

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

Qp - Quasi-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 $\pm 0.01\%$ (± 100 ppm).

TEST PROCEDURE

ANSI C63.10-2013 Clause 6.8

RESULTS

No non-compliance noted.

ID:	38602	Date:	10/30/2019
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8.4.1. READER MODE

TYPE A 848Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20°C										
Limit: ± 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)
3.80	50	13.5598312	4.020	13.5598341	3.807	13.5598384	3.490	13.5598448	3.017	± 100
	40	13.5598304	4.080	13.5598277	4.278	13.5598255	4.441	13.5598242	4.535	± 100
	30	13.5598744	0.836	13.5598668	1.395	13.5598580	2.041	13.5598478	2.793	± 100
	20	13.5598857	0.000	13.5598834	0.167	13.5598806	0.380	13.5598780	0.571	± 100
	10	13.5598951	-0.694	13.5599016	-1.175	13.5599087	-1.696	13.5599157	-2.212	± 100
	0	13.5599430	-4.228	13.5599521	-4.900	13.5599616	-5.596	13.5599703	-6.241	± 100
	-10	13.5600014	-8.532	13.5600080	-9.021	13.5600141	-9.466	13.5600160	-9.611	± 100
	-20	13.5600307	-10.691	13.5600422	-11.544	13.5600547	-12.461	13.5600679	-13.435	± 100
3.23	20	13.5597520	9.861	13.5593322	40.819	13.5596064	20.598	13.5599701	-6.224	± 100
4.37	20	13.5595700	23.282	13.5597567	9.514	13.5595061	27.995	13.5590325	62.921	± 100

8.4.2. CE MODE

TYPE A 848Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20°C										
Limit: ± 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)
3.80	50	13.5603407	-20.876	13.5602804	-16.424	13.5604325	-27.648	13.5602551	-14.559	± 100
	40	13.5602619	-15.061	13.5600919	-2.524	13.5597025	26.190	13.5601289	-5.252	± 100
	30	13.5598870	12.587	13.5596787	27.946	13.5599102	10.876	13.5597882	19.874	± 100
	20	13.5600576	0.000	13.5600085	3.628	13.5601749	-8.646	13.5600573	0.023	± 100
	10	13.5600998	-3.112	13.5597002	26.360	13.5597002	26.360	13.5599464	8.208	± 100
	0	13.5600360	1.595	13.5596978	26.535	13.5600804	-1.681	13.5597124	25.458	± 100
	-10	13.5601020	10.281	13.5599887	5.081	13.5602818	-16.533	13.5596423	30.632	± 100
	-20	13.5596830	27.628	13.5596693	28.640	13.5593880	49.387	13.5593137	54.861	± 100
3.23	20	13.5595735	35.704	13.5598214	17.422	13.5592042	62.938	13.5599768	5.962	± 100
4.37	20	13.5596604	29.295	13.5599893	5.040	13.5591785	64.834	13.5592752	57.702	± 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 μ 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 μ 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

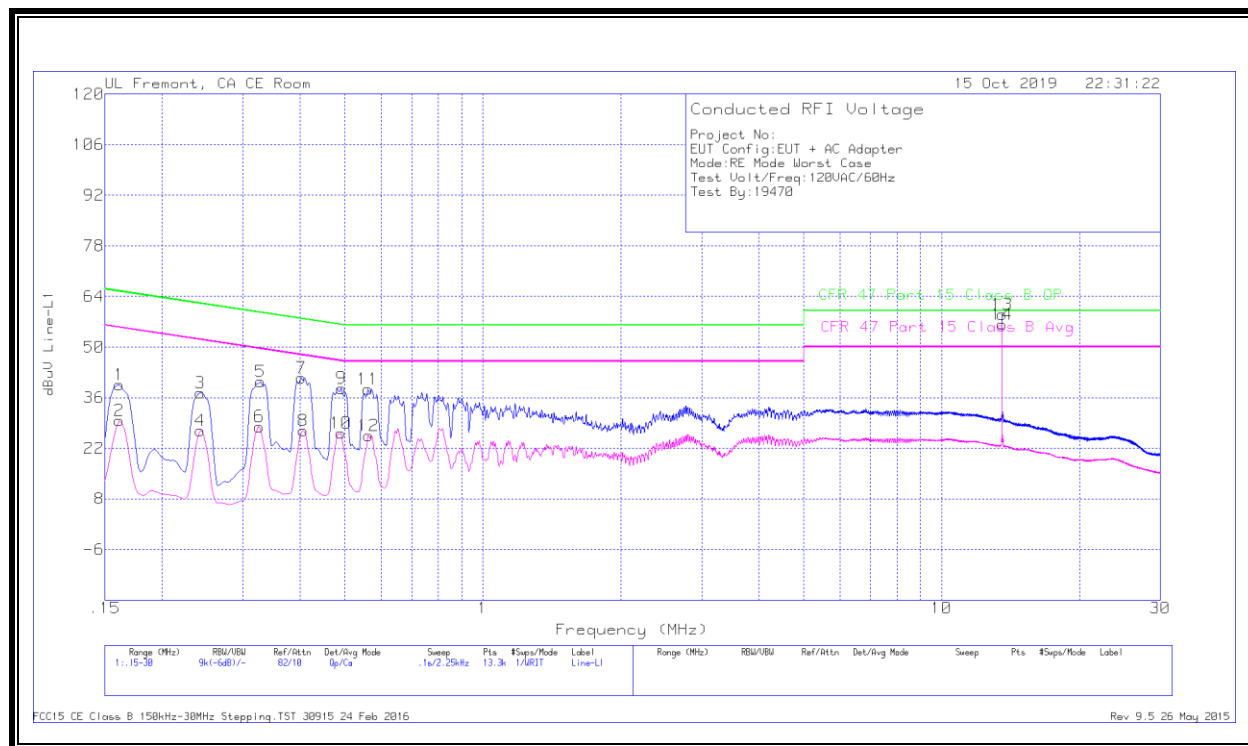
RESULTS

No non-compliance noted:

9.1. READER MODE

9.1.1. NORMAL OPERATION

LINE 1 RESULTS



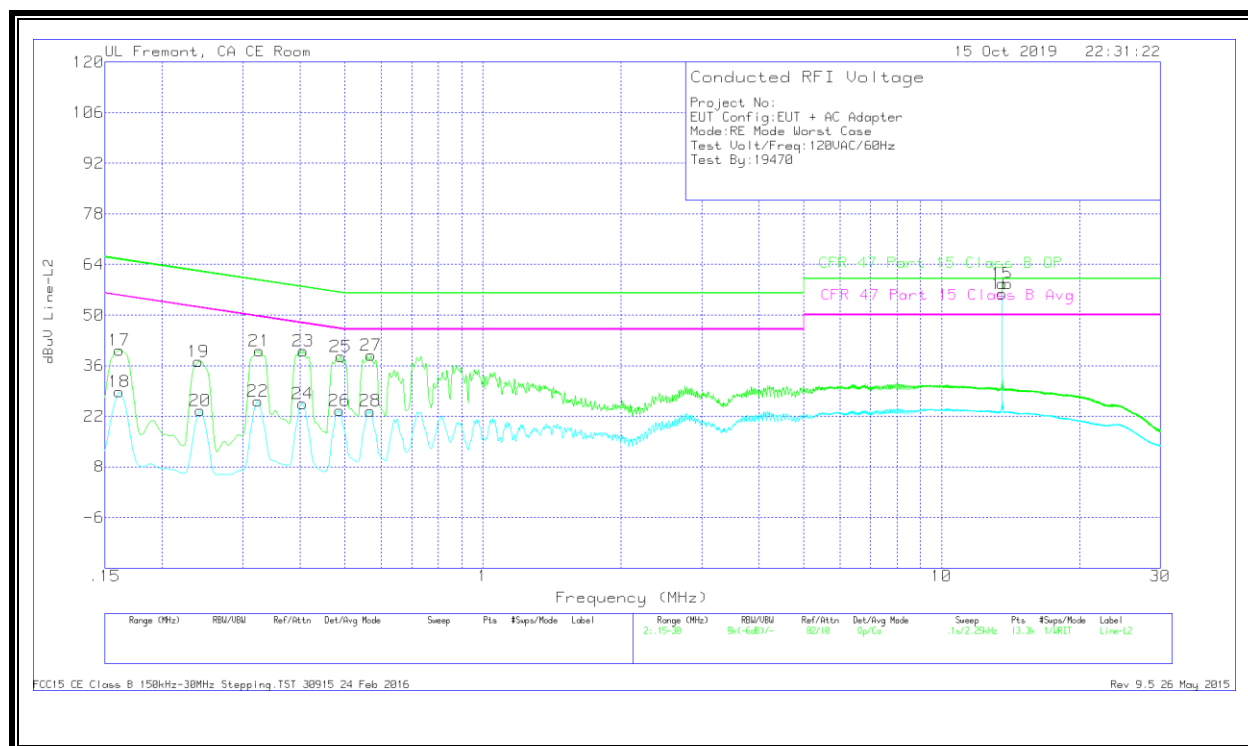
Worst Emission

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	.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	.24225	27.28	Qp	0	0	10.1	37.38	62.02	-24.64	-	-
4	.24225	16.77	Ca	0	0	10.1	26.87	-	-	52.02	-25.15
5	.32775	30.3	Qp	0	0	10.1	40.4	59.51	-19.11	-	-
6	.3255	17.91	Ca	0	0	10.1	28.01	-	-	49.57	-21.56
7	.402	31.33	Qp	0	0	10.1	41.43	57.81	-16.38	-	-
8	.4065	16.75	Ca	0	0	10.1	26.85	-	-	47.72	-20.87
9	.492	28.51	Qp	0	0	10.1	38.61	56.13	-17.52	-	-
10	.48975	16.1	Ca	0	0	10.1	26.2	-	-	46.17	-19.97
11	.56175	28.23	Qp	0	0	10.1	38.33	56	-17.67	-	-
12	.564	15.45	Ca	0	0	10.1	25.55	-	-	46	-20.45
13	13.56	48.55	Qp	.1	.2	10.2	59.05	60	-.95	-	-
14	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

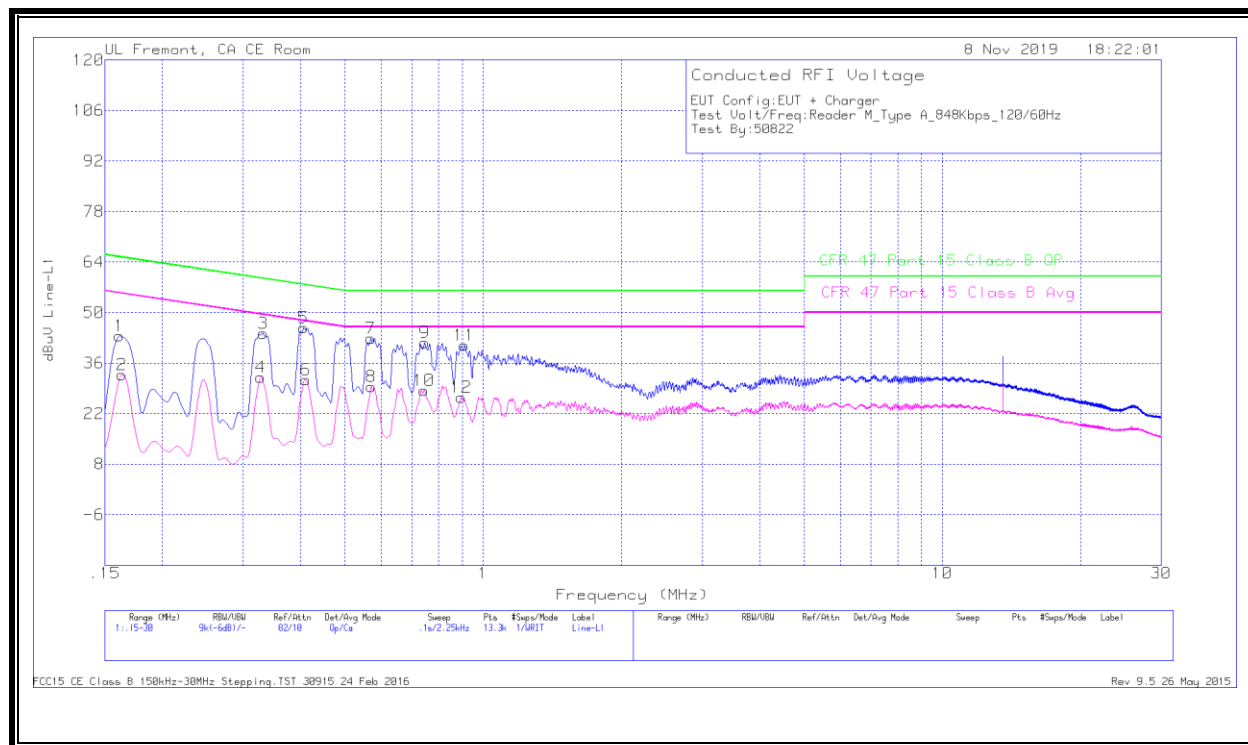
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
15	13.56	48.11	Qp	.1	.2	10.2	58.61	60	-1.39	-	-
16	13.56	45.34	Ca	.1	.2	10.2	55.84	-	-	50	5.84
17	.16125	30.09	Qp	.1	0	10.1	40.29	65.4	-25.11	-	-
18	.16125	18.64	Ca	.1	0	10.1	28.84	-	-	55.4	-26.56
19	.24	27.08	Qp	0	0	10.1	37.18	62.1	-24.92	-	-
20	.24225	13.4	Ca	0	0	10.1	23.5	-	-	52.02	-28.52
21	.3255	30.07	Qp	0	0	10.1	40.17	59.57	-19.4	-	-
22	.32325	16.12	Ca	0	0	10.1	26.22	-	-	49.62	-23.4
23	.4065	29.94	Qp	0	0	10.1	40.04	57.72	-17.68	-	-
24	.40425	15.31	Ca	0	0	10.1	25.41	-	-	47.77	-22.36
25	.48975	28.48	Qp	0	0	10.1	38.58	56.17	-17.59	-	-
26	.4875	13.43	Ca	0	0	10.1	23.53	-	-	46.21	-22.68
27	.57075	28.85	Qp	0	0	10.1	38.95	56	-17.05	-	-
28	.5685	13.39	Ca	0	0	10.1	23.49	-	-	46	-22.51

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.

9.1.2. NORMAL OPERATION WITH ANTENNA PORT TERMINATED

LINE 1 RESULTS

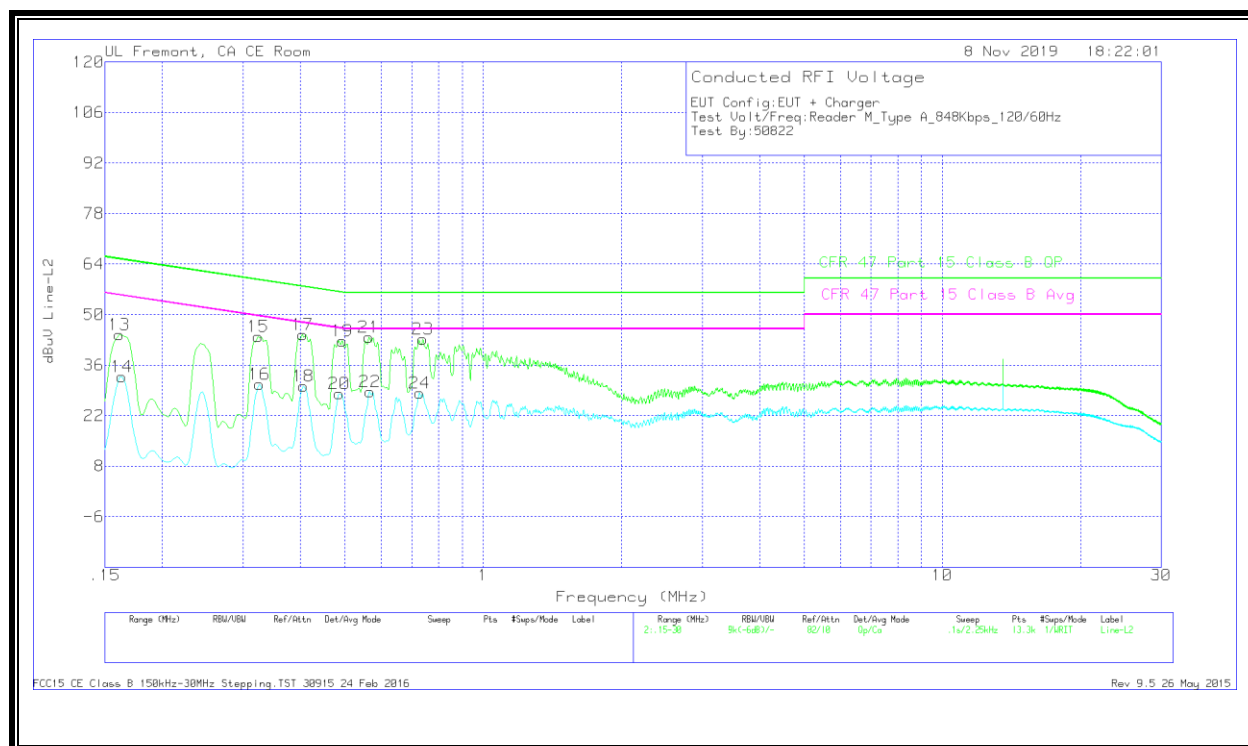


Worst Emission

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	.16125	33.36	Qp	.1	0	10.1	43.56	65.4	-21.84	-	-
2	.1635	22.66	Ca	.1	0	10.1	32.86	-	-	55.28	-22.42
3	.33225	34.16	Qp	0	0	10.1	44.26	59.39	-15.13	-	-
4	.32775	22	Ca	0	0	10.1	32.1	-	-	49.51	-17.41
5	.4065	35.72	Qp	0	0	10.1	45.82	57.72	-11.9	-	-
6	.411	21.3	Ca	0	0	10.1	31.4	-	-	47.63	-16.23
7	.5685	32.8	Qp	0	0	10.1	42.9	56	-13.1	-	-
8	.57075	19.35	Ca	0	0	10.1	29.45	-	-	46	-16.55
9	.74625	31.61	Qp	0	0	10.1	41.71	56	-14.29	-	-
10	.744	18.4	Ca	0	0	10.1	28.5	-	-	46	-17.5
11	.9105	30.91	Qp	0	0	10.1	41.01	56	-14.99	-	-
12	.89475	16.48	Ca	0	0	10.1	26.58	-	-	46	-19.42

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



Worst Emission

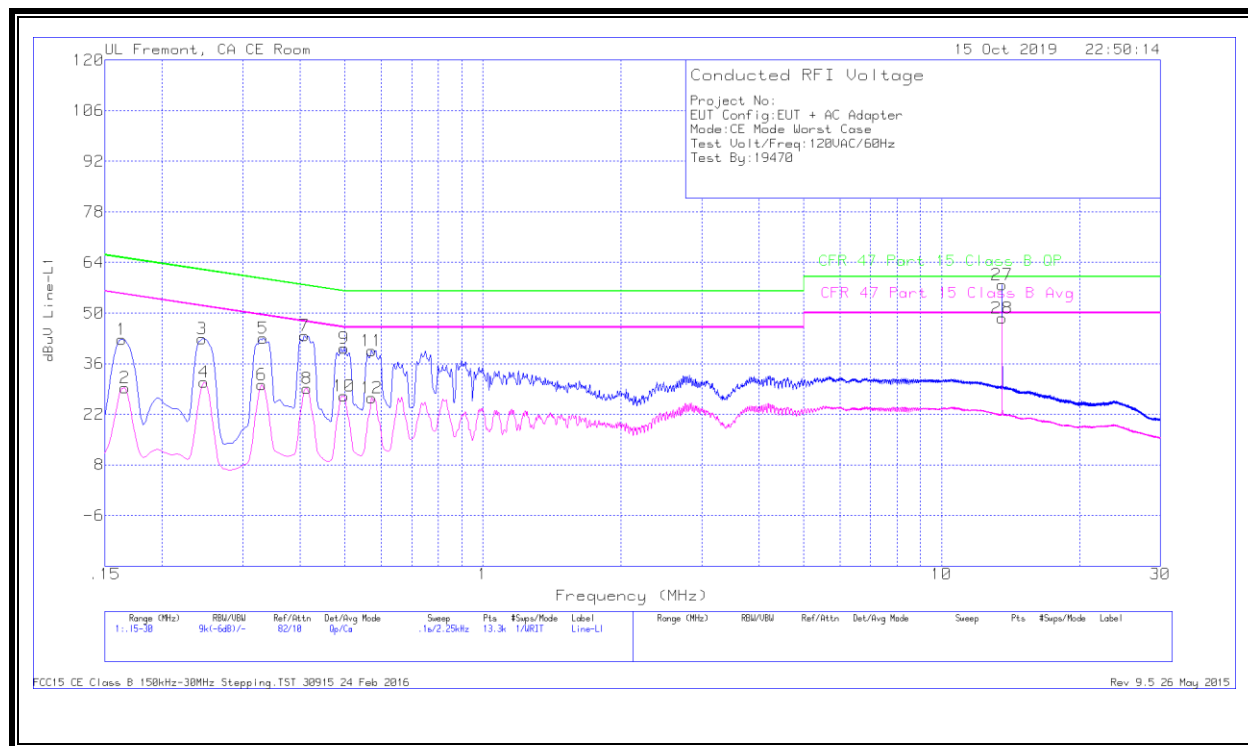
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.16125	34.17	Qp	.1	0	10.1	44.37	65.4	-21.03	-	-
14	.1635	22.63	Ca	.1	0	10.1	32.83	-	-	55.28	-22.45
15	.32325	33.77	Qp	0	0	10.1	43.87	59.62	-15.75	-	-
16	.3255	20.66	Ca	0	0	10.1	30.76	-	-	49.57	-18.81
17	.40425	34.39	Qp	0	0	10.1	44.49	57.77	-13.28	-	-
18	.4065	20.06	Ca	0	0	10.1	30.16	-	-	47.72	-17.56
19	.49425	32.61	Qp	0	0	10.1	42.71	56.1	-13.39	-	-
20	.48525	18.01	Ca	0	0	10.1	28.11	-	-	46.25	-18.14
21	.564	33.59	Qp	0	0	10.1	43.69	56	-12.31	-	-
22	.56625	18.55	Ca	0	0	10.1	28.65	-	-	46	-17.35
23	.7395	33.13	Qp	0	0	10.1	43.23	56	-12.77	-	-
24	.72825	18.13	Ca	0	0	10.1	28.23	-	-	46	-17.77

Qp - Quasi-Peak detector
Ca - CISPR average detection

9.2. CE MODE

9.2.1. NORMAL OPERATION, 848Kbps

LINE 1 RESULTS



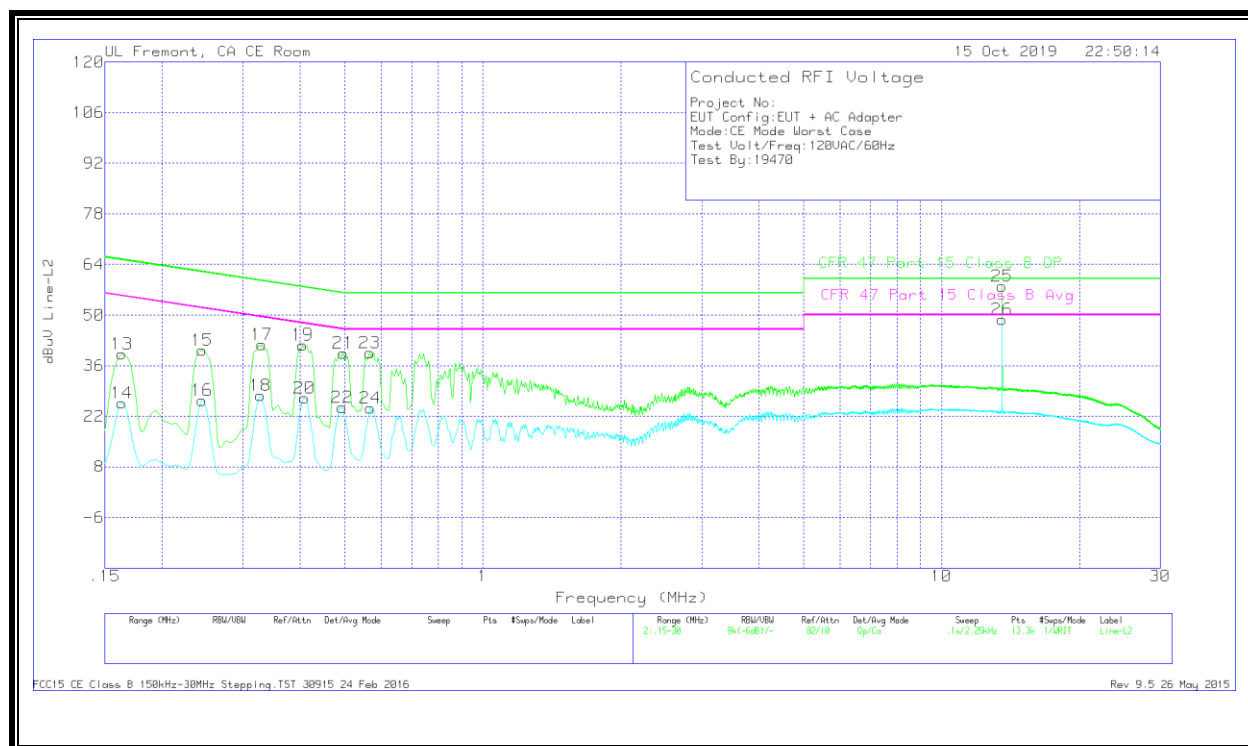
Worst Emission

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	.1635	32.44	Qp	.1	0	10.1	42.64	65.28	-22.64	-	-
2	.16575	19.05	Ca	.1	0	10.1	29.25	-	-	55.17	-25.92
3	.2445	32.79	Qp	0	0	10.1	42.89	61.94	-19.05	-	-
4	.24675	20.83	Ca	0	0	10.1	30.93	-	-	51.87	-20.94
5	.33225	32.9	Qp	0	0	10.1	43	59.39	-16.39	-	-
6	.33	20.1	Ca	0	0	10.1	30.2	-	-	49.45	-19.25
7	.40875	33.72	Qp	0	0	10.1	43.82	57.67	-13.85	-	-
8	.41325	19.01	Ca	0	0	10.1	29.11	-	-	47.58	-18.47
9	.49875	30.15	Qp	0	0	10.1	40.25	56.02	-15.77	-	-
10	.49875	16.99	Ca	0	0	10.1	27.09	-	-	46.02	-18.93
11	.573	29.52	Qp	0	0	10.1	39.62	56	-16.38	-	-
12	.573	16.36	Ca	0	0	10.1	26.46	-	-	46	-19.54
27	13.56	47.32	Qp	.1	.2	10.2	57.82	60	-2.18	-	-
28	13.56	38.03	Ca	.1	.2	10.2	48.53	-	-	50	-1.47

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

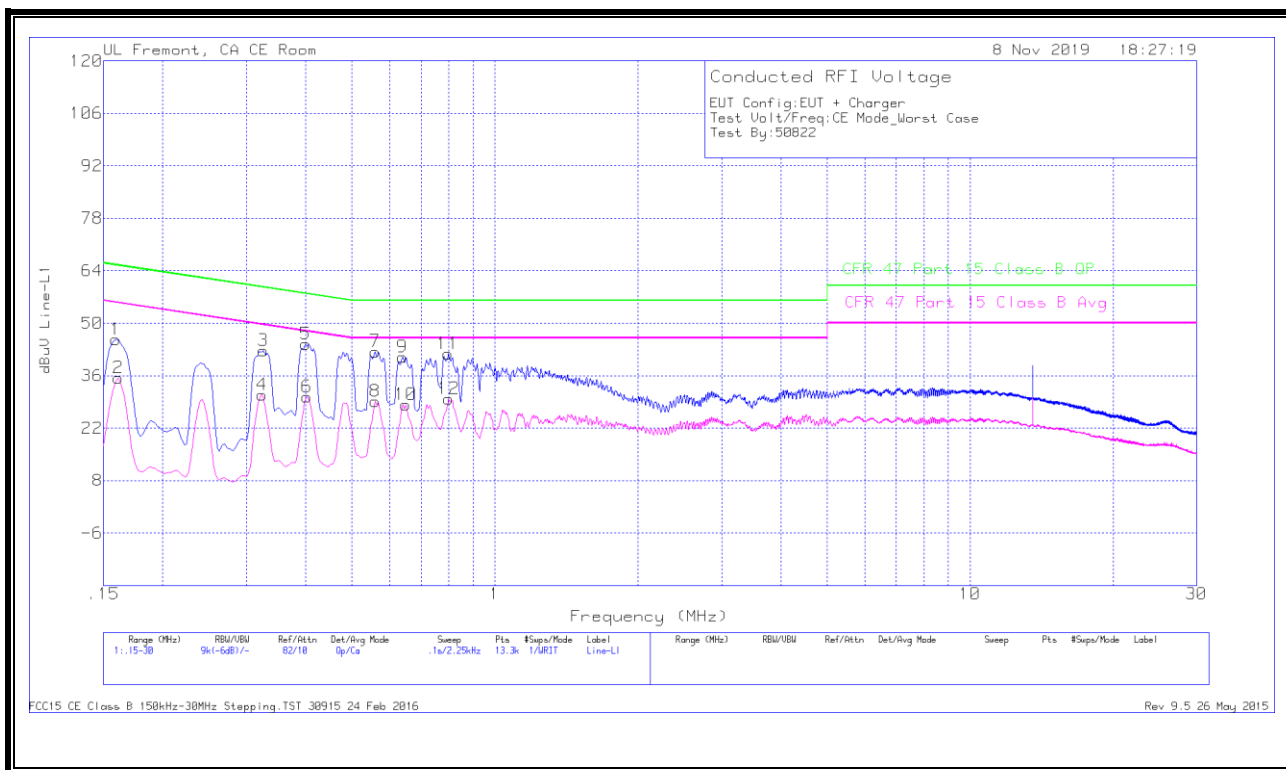
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.1635	28.95	Qp	.1	0	10.1	39.15	65.28	-26.13	-	-
14	.1635	15.53	Ca	.1	0	10.1	25.73	-	-	55.28	-29.55
15	.2445	30.11	Qp	0	0	10.1	40.21	61.94	-21.73	-	-
16	.2445	16.34	Ca	0	0	10.1	26.44	-	-	51.94	-25.5
17	.33	31.65	Qp	0	0	10.1	41.75	59.45	-17.7	-	-
18	.32775	17.61	Ca	0	0	10.1	27.71	-	-	49.51	-21.8
19	.40425	31.64	Qp	0	0	10.1	41.74	57.77	-16.03	-	-
20	.40875	16.92	Ca	0	0	10.1	27.02	-	-	47.67	-20.65
21	.4965	29.38	Qp	0	0	10.1	39.48	56.06	-16.58	-	-
22	.49425	14.37	Ca	0	0	10.1	24.47	-	-	46.1	-21.63
23	.56625	29.48	Qp	0	0	10.1	39.58	56	-16.42	-	-
24	.5685	14.2	Ca	0	0	10.1	24.3	-	-	46	-21.7
25	13.56	47.49	Qp	.1	.2	10.2	57.99	60	-2.01	-	-
26	13.56	38.22	Ca	.1	.2	10.2	48.72	-	-	50	-1.28

Qp - Quasi-Peak detector
Ca - CISPR average detection

Note: 13.56MHz is a fundamental frequency of the EUT. Data under the following Section 9.1.2 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, 848Kbps

LINE 1 RESULTS



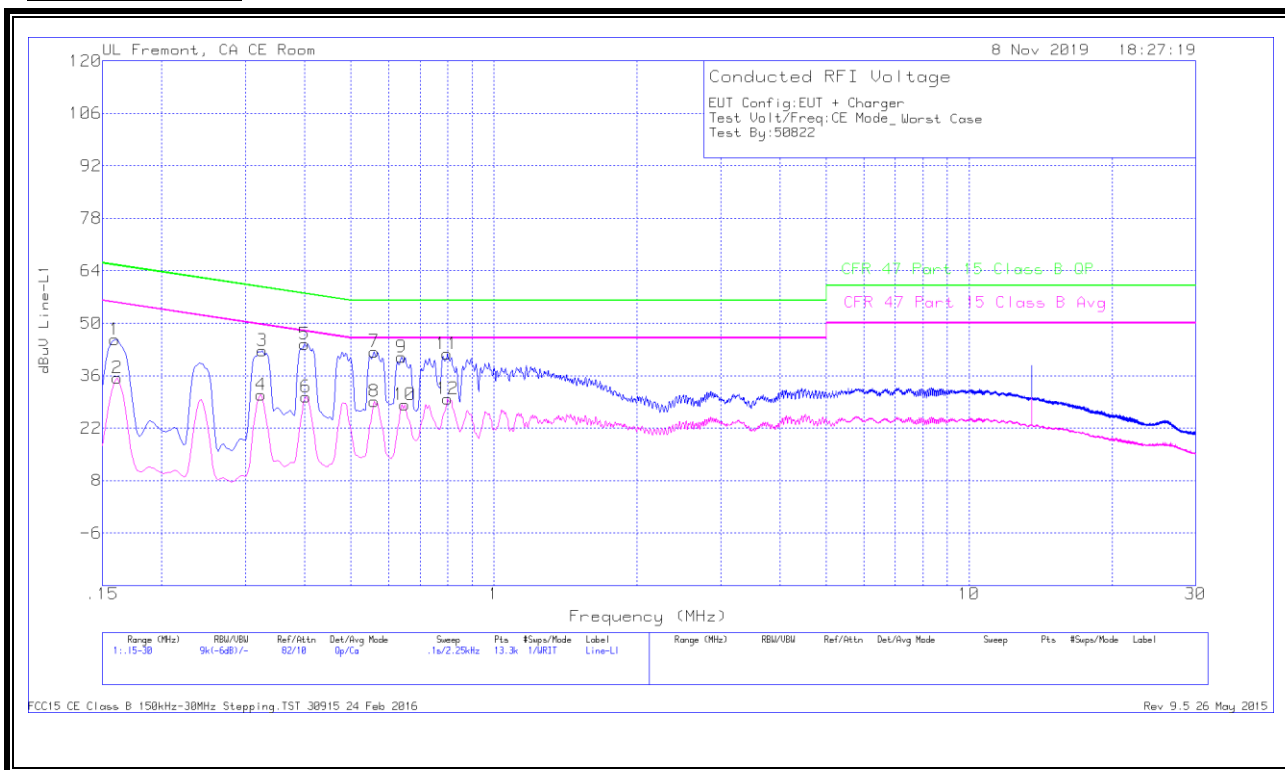
Worst Emission

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	35.48	Qp	.1	0	10.1	45.68	65.52	-19.84	-	-
2	.16125	25.2	Ca	.1	0	10.1	35.4	-	-	55.4	-20
3	.3255	32.63	Qp	0	0	10.1	42.73	59.57	-16.84	-	-
4	.32325	20.71	Ca	0	0	10.1	30.81	-	-	49.62	-18.81
5	.39975	34.41	Qp	0	0	10.1	44.51	57.86	-13.35	-	-
6	.402	20.18	Ca	0	0	10.1	30.28	-	-	47.81	-17.53
7	.5595	32.33	Qp	0	0	10.1	42.43	56	-13.57	-	-
8	.5595	19.03	Ca	0	0	10.1	29.13	-	-	46	-16.87
9	.63825	30.88	Qp	0	0	10.1	40.98	56	-15.02	-	-
10	.6495	18.19	Ca	0	0	10.1	28.29	-	-	46	-17.71
11	.798	31.71	Qp	0	0	10.1	41.81	56	-14.19	-	-
12	.80025	19.77	Ca	0	0	10.1	29.87	-	-	46	-16.13

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	35.21	Qp	.1	0	10.1	45.41	65.4	-19.99	-	-
14	.16125	23.9	Ca	.1	0	10.1	34.1	-	-	55.4	-21.3
15	.31875	32.83	Qp	0	0	10.1	42.93	59.74	-16.81	-	-
16	.321	19.97	Ca	0	0	10.1	30.07	-	-	49.68	-19.61
17	.3975	33.41	Qp	0	0	10.1	43.51	57.91	-14.4	-	-
18	.402	19.26	Ca	0	0	10.1	29.36	-	-	47.81	-18.45
19	.55725	33.31	Qp	0	0	10.1	43.41	56	-12.59	-	-
20	.55725	18.25	Ca	0	0	10.1	28.35	-	-	46	-17.65
21	.7305	32.88	Qp	0	0	10.1	42.98	56	-13.02	-	-
22	.717	18.08	Ca	0	0	10.1	28.18	-	-	46	-17.82
23	.8745	31.48	Qp	0	0	10.1	41.58	56	-14.42	-	-
24	.87675	16.32	Ca	0	0	10.1	26.42	-	-	46	-19.58

Qp - Quasi-Peak detector
Ca - CISPR average detection

10. SETUP PHOTOS

Please refer to 13018973-EP1V1 for setup photos

END OF TEST REPORT