



CERTIFICATION TEST REPORT

Report Number. : 12204524-E11V2

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

Model : A2102

FCC ID : BCG-E3235A

IC : 579C-E3235A

EUT Description : SMARTPHONE

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

Date Of Issue:
August 10, 2018

Prepared by:
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	8/7/2018	Initial Issue	Chin Pang
V2	8/10/2018	Address TCB's Questions	Tri Pham

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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: A2102

SERIAL NUMBER: C39WW011KFYQ

DATE TESTED: APRIL 16, 2018 – MAY 25, 2018

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.

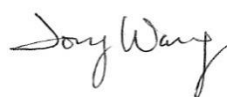
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section.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

Approved & Released For
UL Verification Services Inc. By:



Chin Pang
Senior Test Engineer
UL VERIFICATION SERVICES INC.

Prepared By:



Tony Wang
LAB ENGINEER
UL VERIFICATION SERVICES INC.

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
☐ Chamber A (ISED:2324B-1)	☒ Chamber D (ISED:22541-1)
☐ Chamber B (ISED:2324B-2)	☐ Chamber E (ISED:22541-2)
☐ Chamber C (ISED:2324B-3)	☐ Chamber F (ISED:22541-3)
	☐ Chamber G (ISED:22541-4)
	☒ 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

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, Bluetooth, GPS and NFC. All models support at least one UICC based SIM. The second SIM 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. 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	CE	848	22.06
		Reader	848	22.14

5.3. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was v16.30.67.7

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.

Radiated test was investigated on EUT with RX antenna face-on, face-off and horizontal, (parallel to the ground plane). The worst case was determined to be the EUT with AC/DC adapter on face-on and face-off orientation; therefore, all final tests were performed on the EUT with AC/DC adapter

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 A was determined to be the worst case and therefore Type A 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	C02P41RZG086	FCC DoC
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
EUT AC Adapter	Apple	A1385	D292365CDYADHLHC3	NA

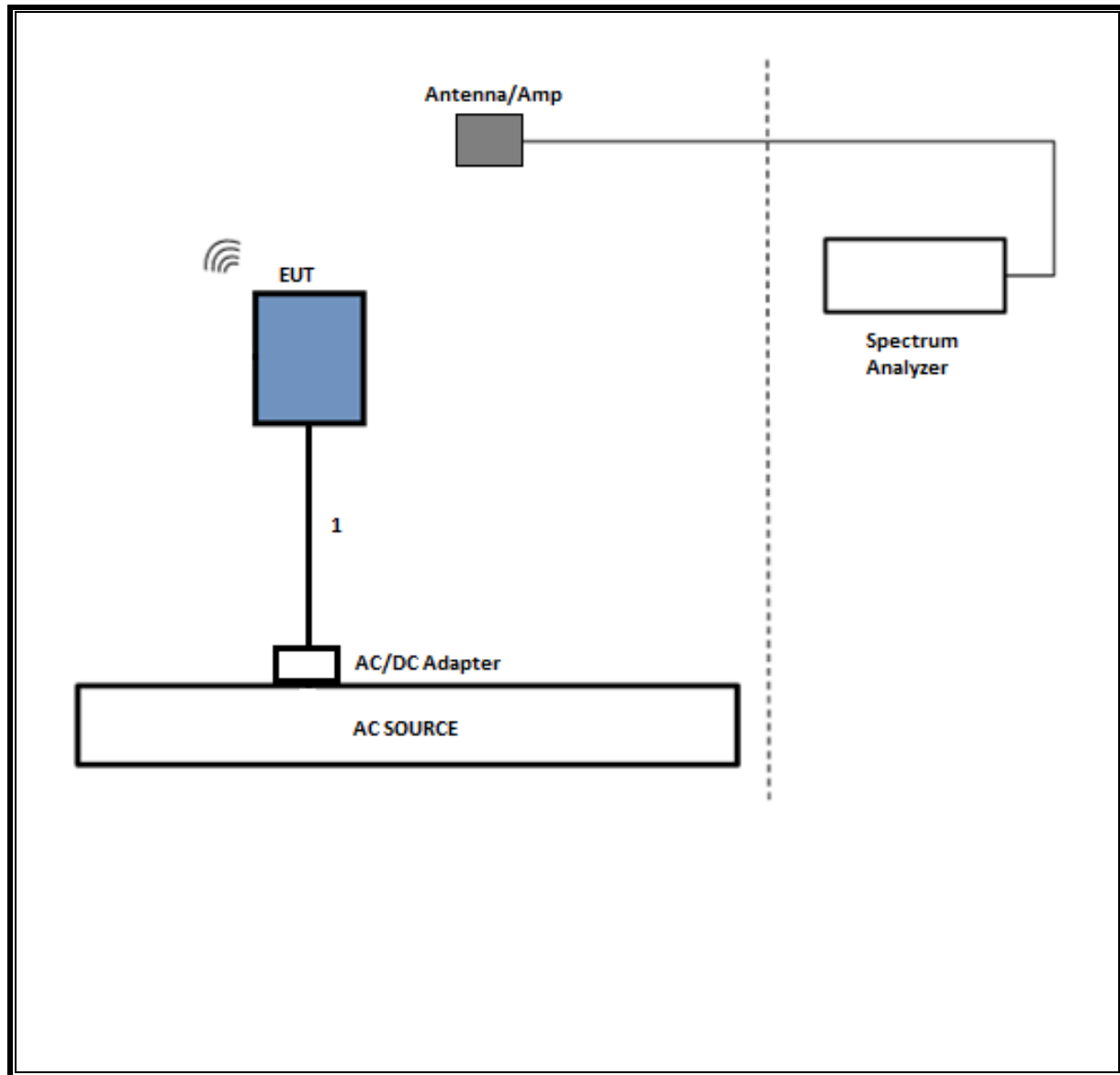
I/O CABLES

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

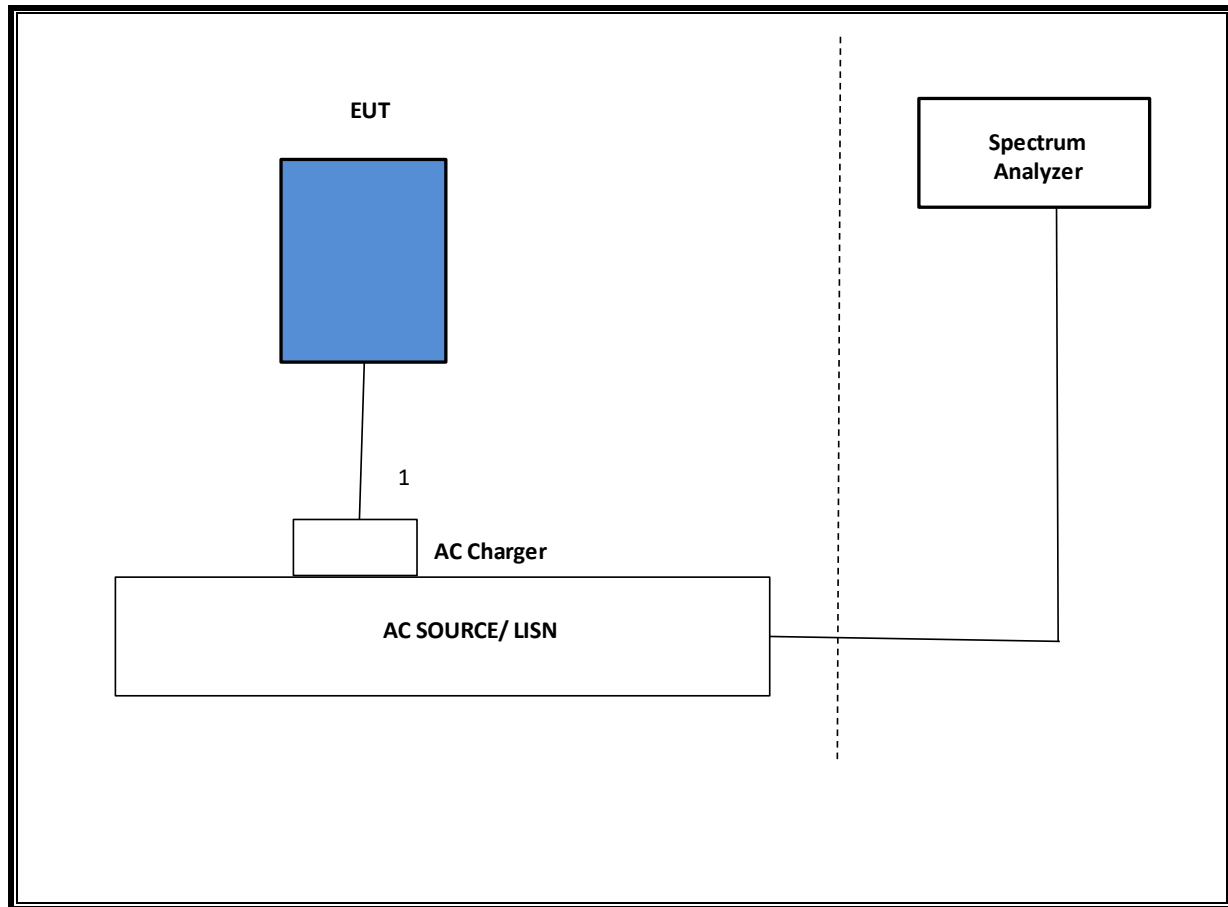
TEST SETUP

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 AC 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	T185	04/19/2019
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T835	06/24/2018
Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent (Keysight) Technologies	E4446A	T177	04/12/2019
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T757	09/14/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T342	02/22/2019
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T754	09/05/2018
AC Line Conducted				
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESCI7	T1436	01/25/2019
Power Cable, Line Conducted Emissions	UL	PG1	T861	08/31/2018
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/15/2018
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	

Note: *Testing is 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 since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW

ESULTS

99% and 20dB BW

TYPE A (CE MODE)

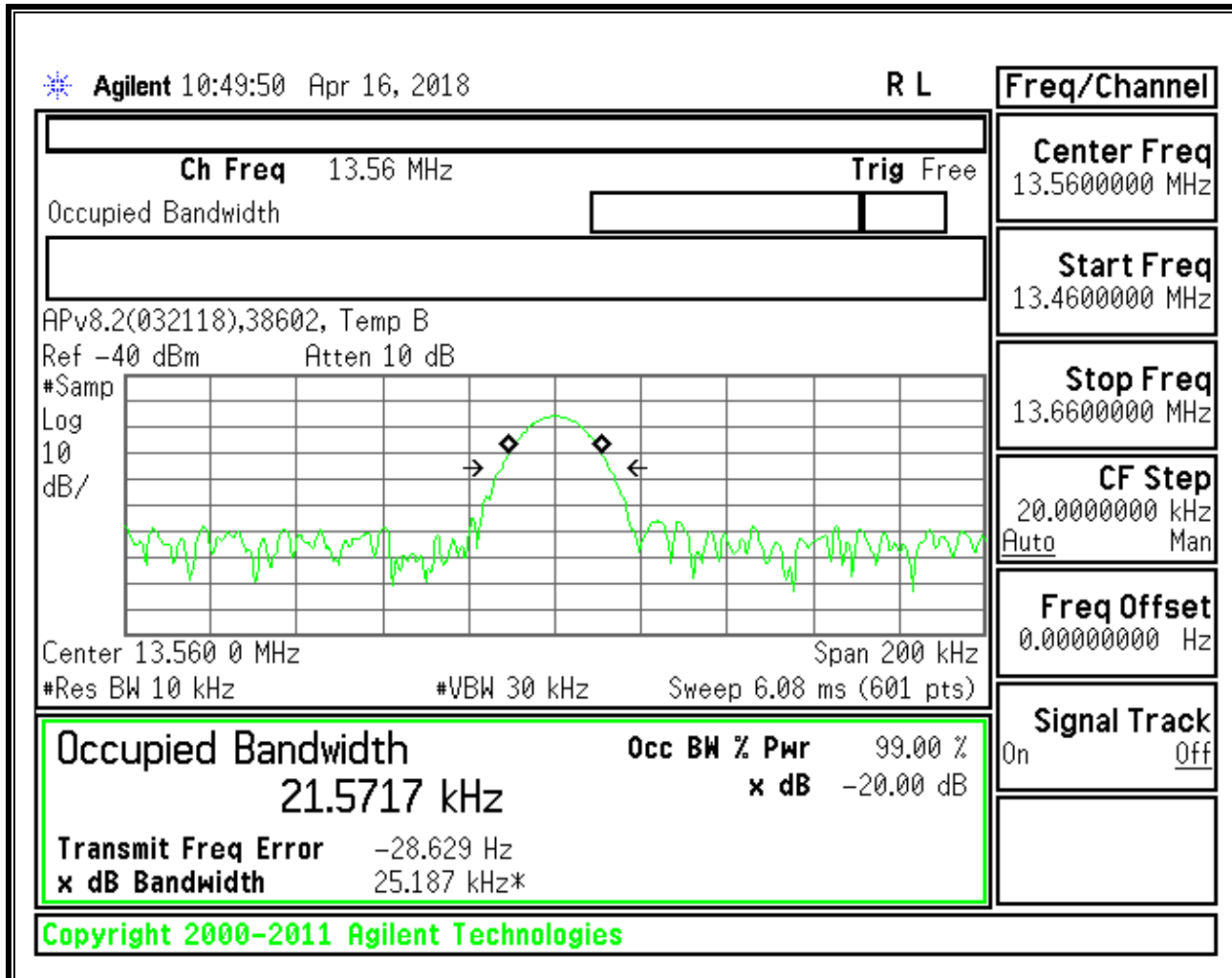
Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	21.5717	25.187

TYPE A (READER MODE)

Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	21.9393	25.410

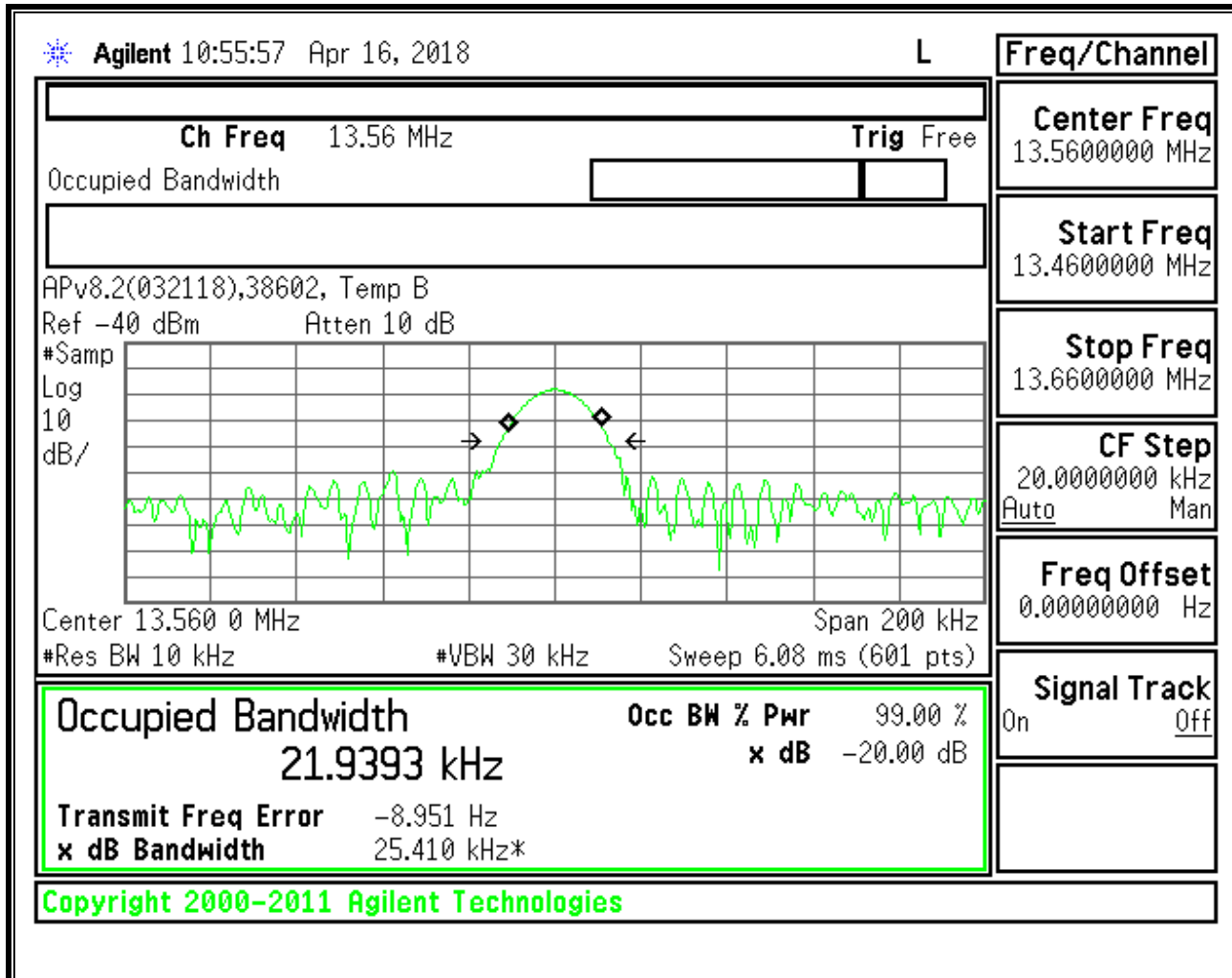
7.1. CE MODE

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 dBuV/m is:

Limit (dBuV/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

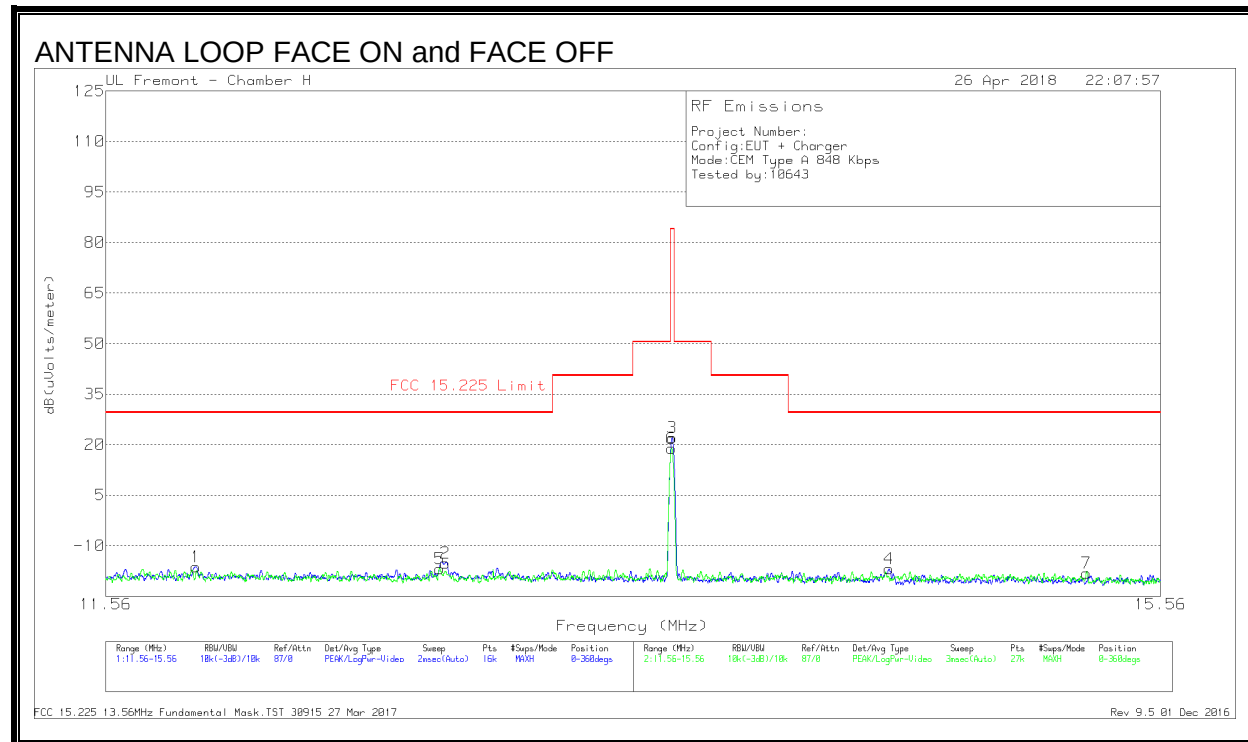
The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the 10th harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater.

RESULTS

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

8.2.1. CE MODE

FUNDAMENTAL 848Kbps



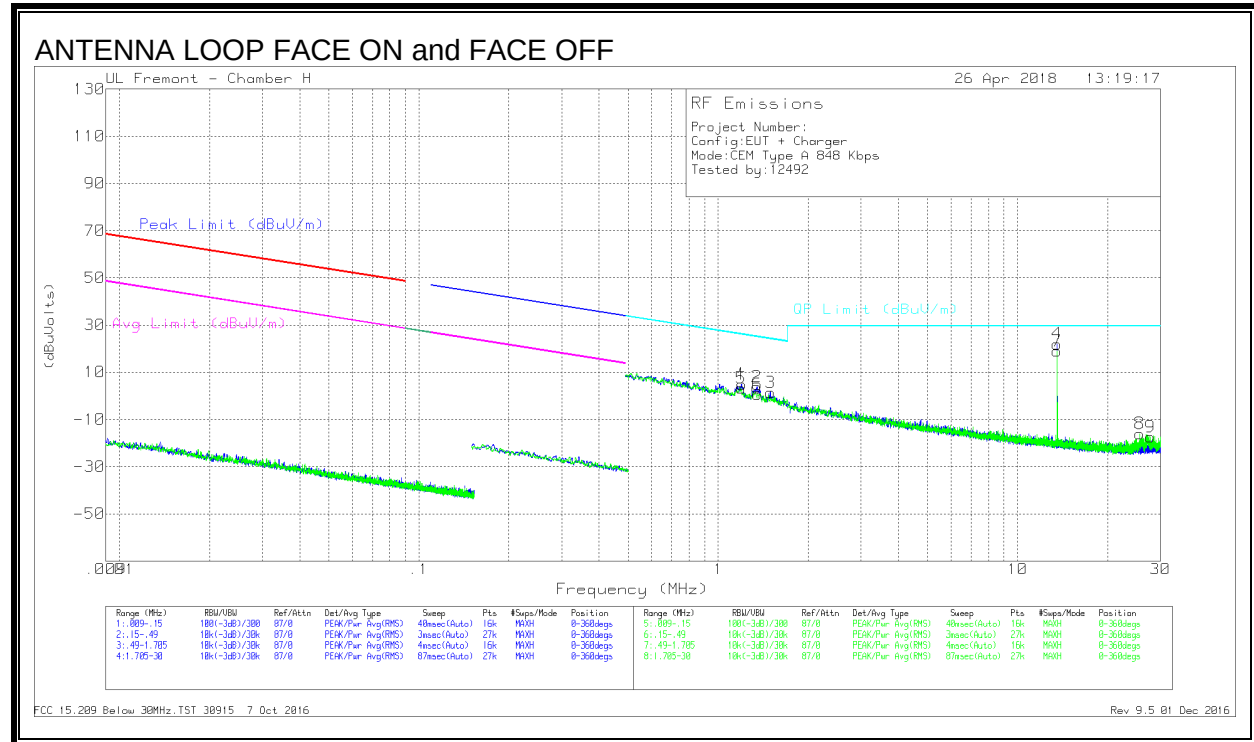
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
1	11.85713	12.57	Pk	10.8	.4	-40	-16.23	29.54	-45.77	0-360
5	12.70138	11.94	Pk	10.8	.4	-40	-16.86	29.54	-46.4	0-360
2	12.721	13.56	Pk	10.8	.4	-40	-15.24	29.54	-44.78	0-360
6	13.55807	47.78	Pk	10.7	.4	-40	18.88	84	-65.12	0-360
3	13.56025	50.96	Pk	10.7	.4	-40	22.06	84	-61.94	0-360
4	14.41413	11.96	Pk	10.7	.4	-40	-16.94	29.54	-46.48	0-360
7	15.2378	10.71	Pk	10.7	.4	-40	-18.19	29.54	-47.73	0-360

Pk - Peak detector

FCC 15.225 13.56MHz Fundamental Mask.TST 30915 27 Mar 2017

Rev 9.5 01 Dec 2016

SPURIOUS EMISSION 848Kbps



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)
5	1.19167	31.32	PK	11.8	.1	-40	3.22	26.1	-22.88	0-360
1	1.19653	33.12	PK	11.8	.1	-40	5.02	26.07	-21.05	0-360
2	1.34705	31.9	PK	11.8	.1	-40	3.8	25.04	-21.24	0-360
6	1.35427	28.75	PK	11.8	.1	-40	.65	24.99	-24.34	0-360
3	1.49548	29.53	PK	11.8	.1	-40	1.43	24.14	-22.71	0-360
8	25.57006	14.43	PK	9	.6	-40	-15.97	29.5	-45.47	0-360
9	27.73942	13.25	PK	8.7	.6	-40	-17.45	29.5	-46.95	0-360

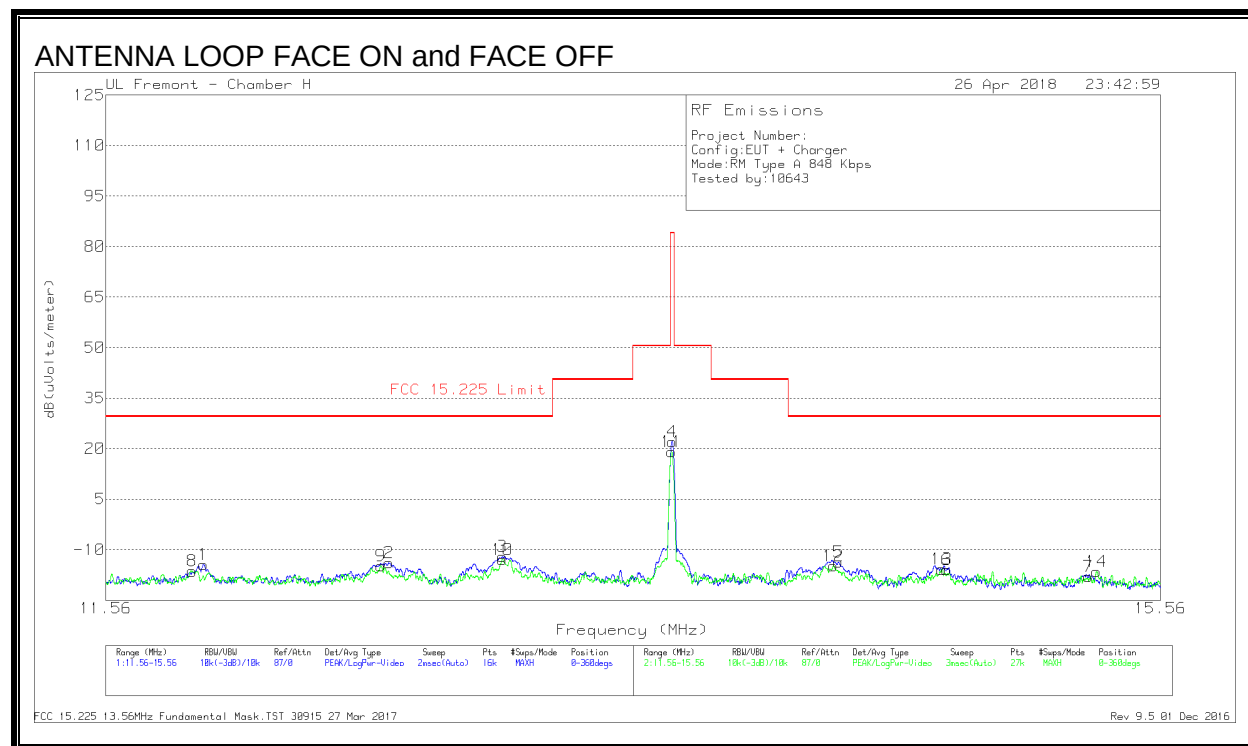
Pk - Peak detector

FCC 15.209 Below 30MHz.TST 30915 7 Oct 2016
Rev 9.5 01 Dec 2016

Note: Marker 4 & 7 are the fundamental signal.

8.2.2. READER MODE

FUNDAMENTAL 848Kbps



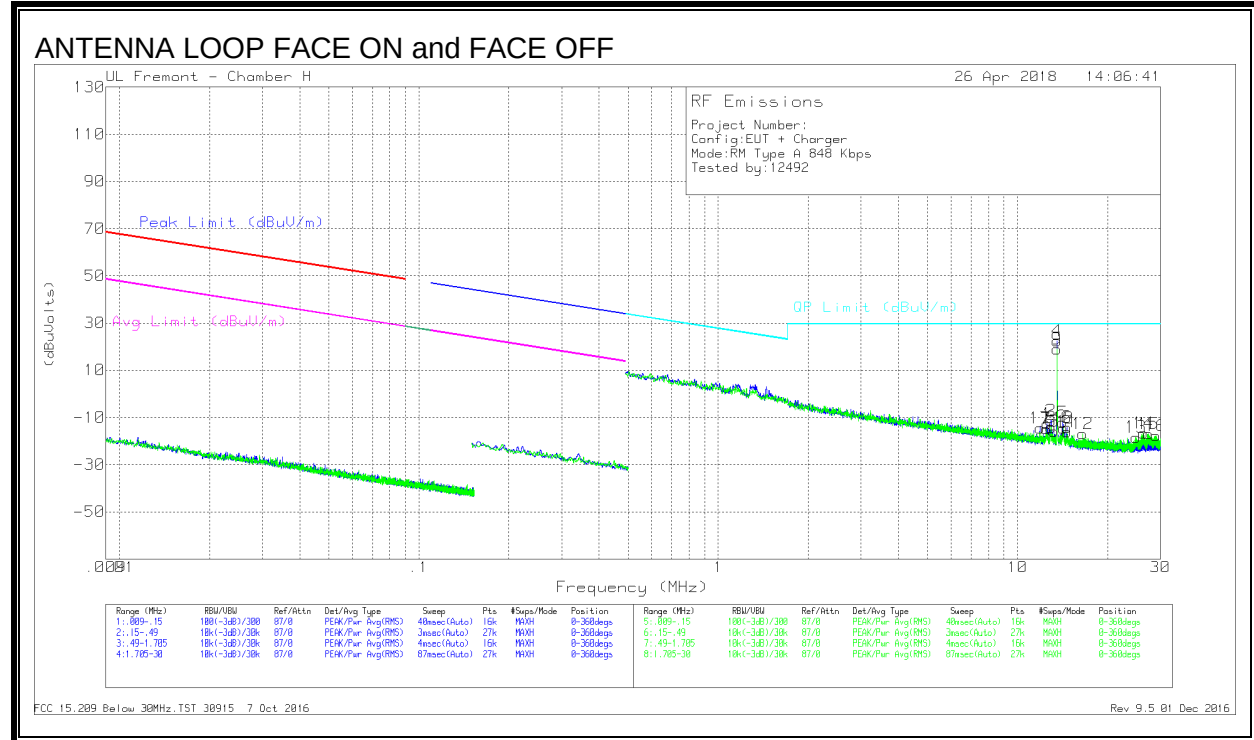
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
8	11.84557	12.41	Pk	10.8	.4	-40	-16.39	29.54	-45.93	0-360
1	11.88338	14.38	Pk	10.8	.4	-40	-14.42	29.54	-43.96	0-360
9	12.49077	13.99	Pk	10.8	.4	-40	-14.81	29.54	-44.35	0-360
2	12.51988	14.9	Pk	10.8	.4	-40	-13.9	29.54	-43.44	0-360
3	12.92738	16.71	Pk	10.8	.4	-40	-12.09	29.54	-41.63	0-360
10	12.92759	15.88	Pk	10.8	.4	-40	-12.92	29.54	-42.46	0-360
11	13.55711	47.99	Pk	10.7	.4	-40	19.09	84	-64.91	0-360
4	13.56025	51.04	Pk	10.7	.4	-40	22.14	84	-61.86	0-360
12	14.18892	14.02	Pk	10.7	.4	-40	-14.88	29.54	-44.42	0-360
5	14.21	15.18	Pk	10.7	.4	-40	-13.72	29.54	-43.26	0-360
13	14.62893	13.07	Pk	10.7	.4	-40	-15.83	29.54	-45.37	0-360
6	14.6505	13.04	Pk	10.7	.4	-40	-15.86	29.54	-45.4	0-360
7	15.247	10.9	Pk	10.7	.4	-40	-18	29.54	-47.54	0-360
14	15.28287	12.43	Pk	10.7	.4	-40	-16.47	29.54	-46.01	0-360

Pk - Peak detector

FCC 15.225 13.56MHz Fundamental Mask.TST 30915 27 Mar 2017

Rev 9.5 01 Dec 2016

SPURIOUS EMISSION 848Kbps



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)
17	11.88108	14.4	Pk	10.8	.4	-40	-14.4	29.5	-43.9	0-360
7	12.49206	13.98	Pk	10.8	.4	-40	-14.82	29.5	-44.32	0-360
1	12.5235	16.19	Pk	10.7	.4	-40	-12.71	29.5	-42.21	0-360
2	12.93484	17.66	Pk	10.7	.4	-40	-11.24	29.5	-40.74	0-360
8	12.93537	14.71	Pk	10.7	.4	-40	-14.19	29.5	-43.69	0-360
3	13.23143	13.02	Pk	10.7	.4	-40	-15.88	29.5	-45.38	0-360
5	14.16153	16.99	Pk	10.6	.4	-40	-12.01	29.5	-41.51	0-360
10	14.1872	14.52	Pk	10.6	.4	-40	-14.48	29.5	-43.98	0-360
6	14.6326	14.99	Pk	10.5	.4	-40	-14.11	29.5	-43.61	0-360
11	14.63994	13.06	Pk	10.5	.4	-40	-16.04	29.5	-45.54	0-360
12	16.48704	12.39	Pk	10.3	.4	-40	-16.91	29.5	-46.41	0-360
13	24.89462	11.94	Pk	9.1	.6	-40	-18.36	29.5	-47.86	0-360
14	26.31676	13.79	Pk	8.9	.6	-40	-16.71	29.5	-46.21	0-360
15	27.36161	13.81	Pk	8.8	.6	-40	-16.79	29.5	-46.29	0-360
16	28.97396	13.14	Pk	8.5	.6	-40	-17.76	29.5	-47.26	0-360

Pk - Peak detector

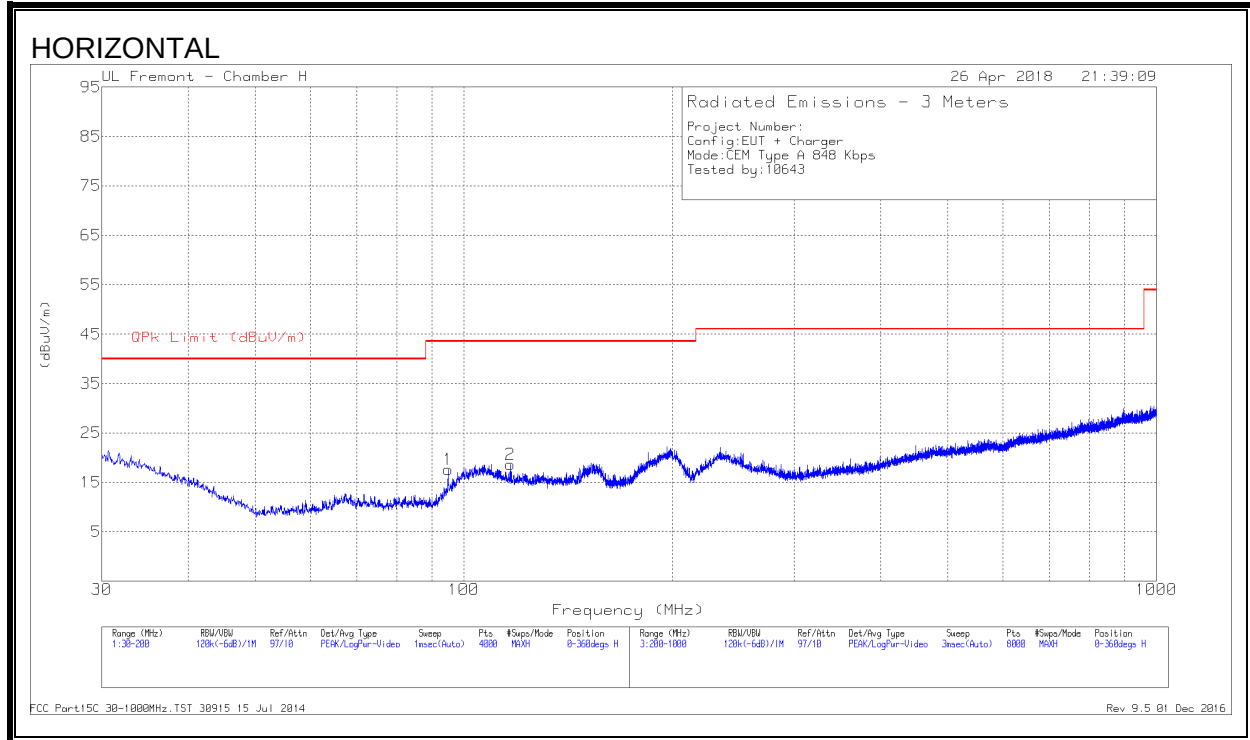
FCC 15.209 Below 30MHz.TST 30915 7 Oct 2016
Rev 9.5 01 Dec 2016

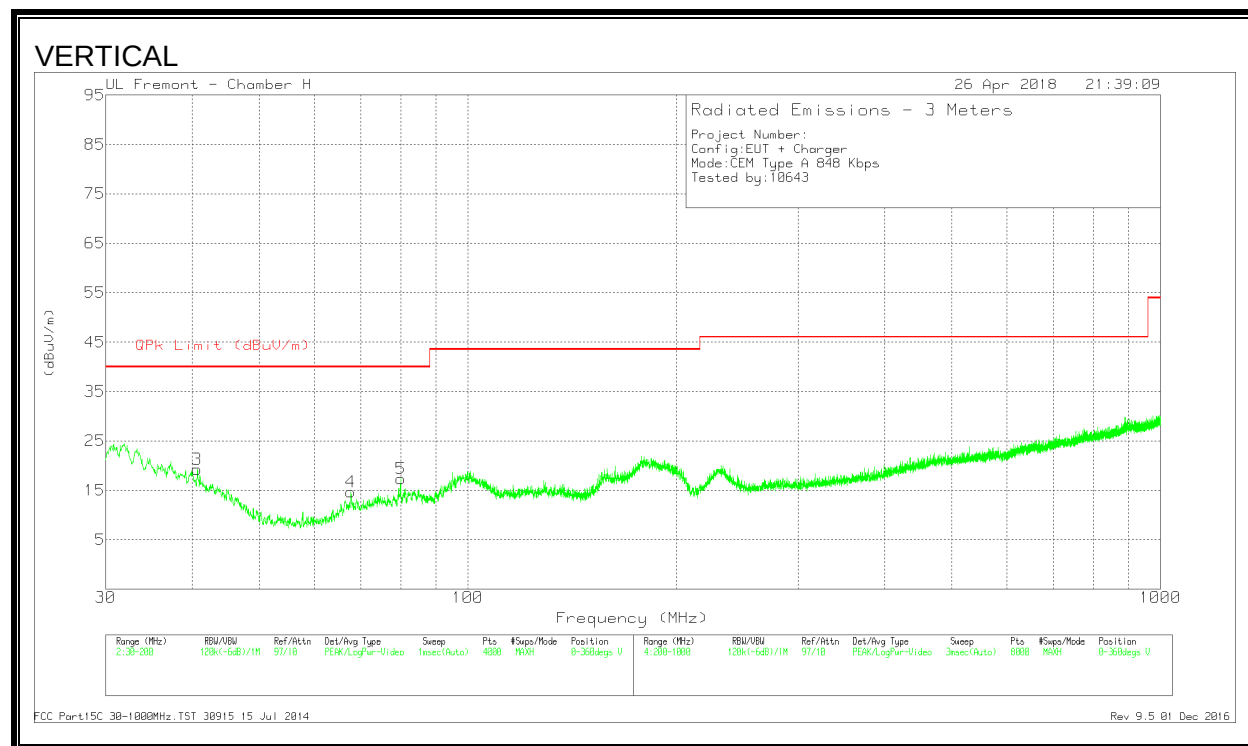
Note: Marker 4 & 9 are the fundamental signal.

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

8.3.1. CE MODE

SPURIOUS EMISSION 848Kbps





Marker	Frequency (MHz)	Meter Reading (dBUV)	Det	AF T185 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBUV/m)	QPk Limit (dBUV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 116.6799	31.69	Pk	17.3	-30.4	18.59	43.52	-24.93	0-360	299	H
3	40.6703	32.89	Pk	17.6	-31.2	19.29	40	-20.71	0-360	100	V
4	67.7923	33.65	Pk	11.8	-30.8	14.65	40	-25.35	0-360	100	V
5	80.0354	36.46	Pk	11.6	-30.7	17.36	40	-22.64	0-360	100	V
1	94.9143	35.4	Pk	12.8	-30.6	17.6	43.52	-25.92	0-360	199	H

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

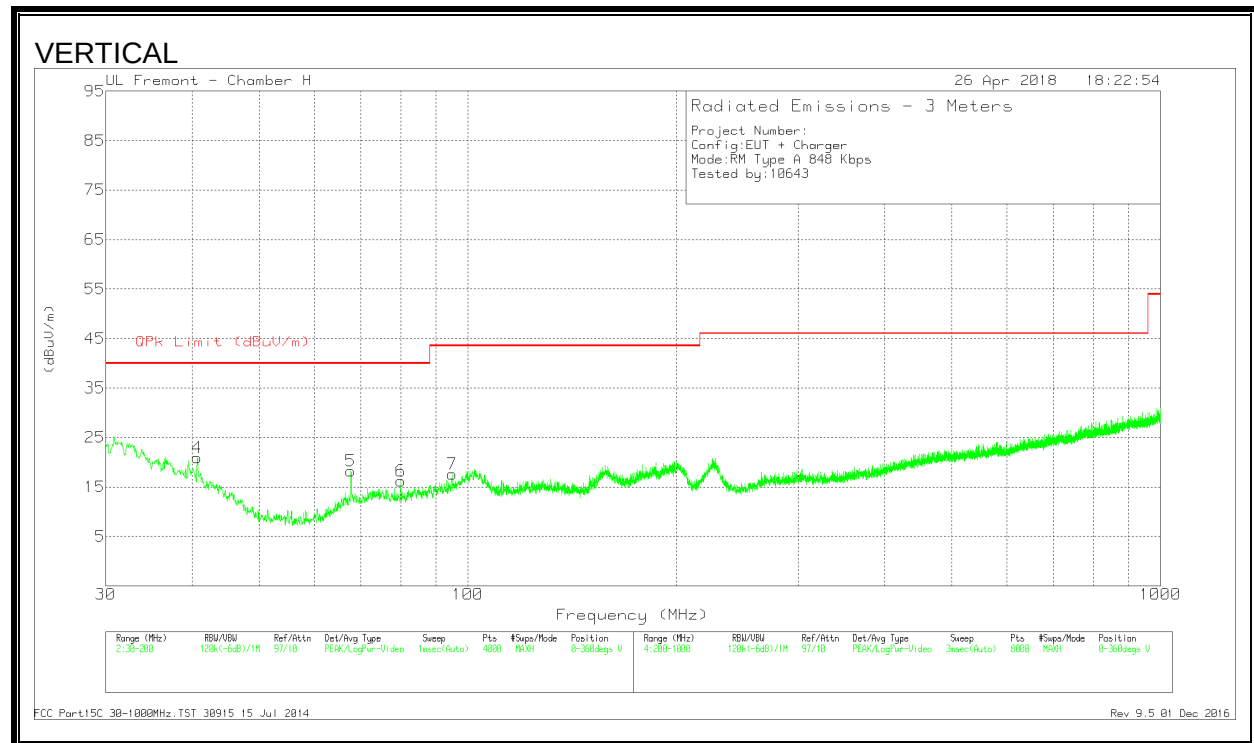
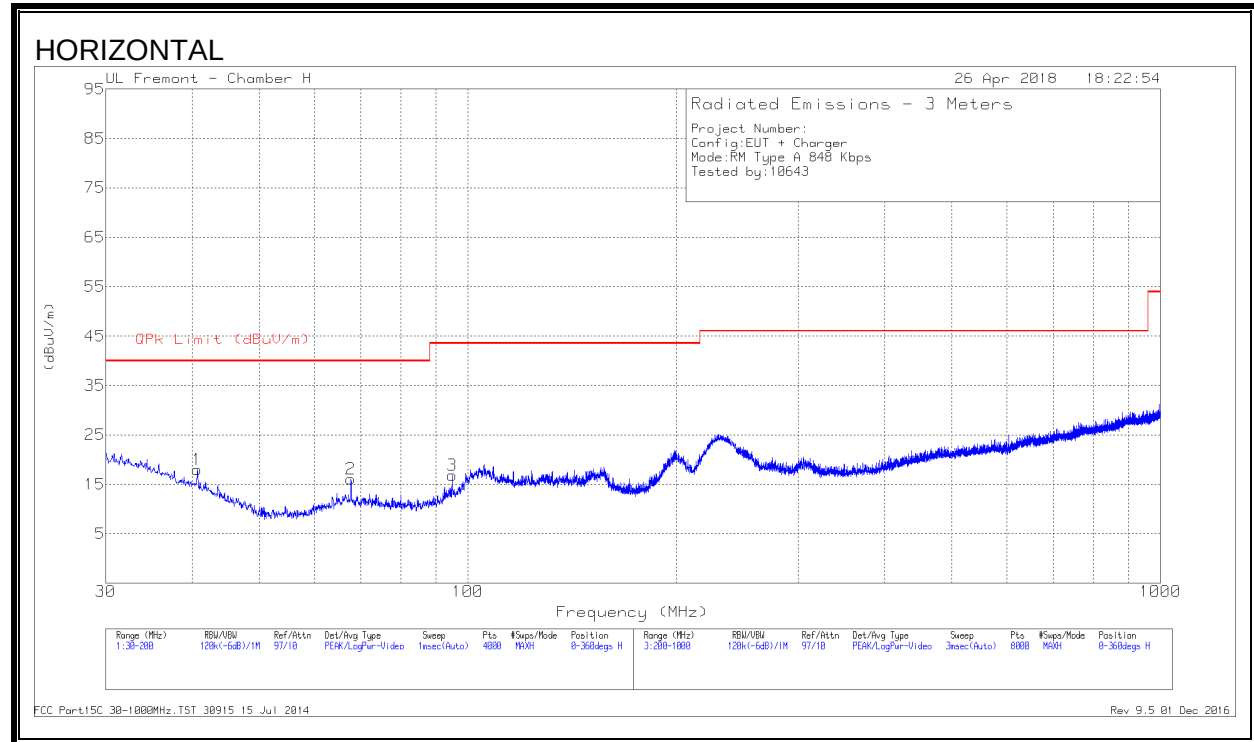
Pk - Peak detector

FCC Part15C 30-1000MHz.TST 30915 15 Jul 2014

Rev 9.5 01 Dec 2016

8.3.2. READER MODE

SPURIOUS EMISSION 848Kbps



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T185 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	40.6703	31.61	Pk	17.6	-31.2	18.01	40	-21.99	0-360	399	H
4	40.6703	34.49	Pk	17.6	-31.2	20.89	40	-19.11	0-360	100	V
2	67.7923	35.04	Pk	11.8	-30.8	16.04	40	-23.96	0-360	299	H
5	67.7923	37.28	Pk	11.8	-30.8	18.28	40	-21.72	0-360	100	V
6	79.9929	35.35	Pk	11.6	-30.7	16.25	40	-23.75	0-360	100	V
7	94.893	35.46	Pk	12.8	-30.6	17.66	43.52	-25.86	0-360	100	V
3	94.9143	34.6	Pk	12.8	-30.6	16.8	43.52	-26.72	0-360	199	H

Pk - Peak detector

FCC Part15C 30-1000MHz.TST 30915 15 Jul 2014

Rev 9.5 01 Dec 2016

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 $\pm 0.01\%$ (± 100 ppm).

TEST PROCEDURE

ANSI C63.10-2013 Clause 6.8

RESULTS

No non-compliance noted.

ID:	38602	Date:	4/17/18
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9.1. CE MODE

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	13.5599396	1.389	13.5599416	1.236	13.5599444	1.029	13.5599478	0.780	± 100
	40	13.5599340	1.798	13.5599335	1.839	13.5599331	1.865	13.5599331	1.867	± 100
	30	13.5599467	0.863	13.5599447	1.013	13.5599427	1.159	13.5599412	1.267	± 100
	20	13.5599584	0.000	13.5599596	-0.091	13.5599579	0.040	13.5599587	-0.025	± 100
	10	13.5599519	0.476	13.5599599	-0.113	13.5599698	-0.843	13.5599802	-1.606	± 100
	0	13.5600025	-3.252	13.5600078	-3.641	13.5600133	-4.046	13.5600184	-4.423	± 100
	-10	13.5600394	-5.976	13.5600430	-6.242	13.5600466	-6.507	13.5600499	-6.748	± 100
	-20	13.5600617	-7.622	13.5600630	-7.715	13.5600641	-7.792	13.5600648	-7.845	± 100
3.23	20	13.5599590	-0.047	13.5599592	-0.062	13.5599595	-0.079	13.5599597	-0.096	± 100
4.37	20	13.5599598	-0.101	13.5599598	-0.100	13.5599599	-0.107	13.5599600	-0.122	± 100

9.2. READER MODE

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	13.5599401	2.083	13.5599418	1.959	13.5599440	1.793	13.5599447	1.744	± 100
	40	13.5599378	2.250	13.5599371	2.306	13.5599364	2.356	13.5599360	2.385	± 100
	30	13.5599533	1.112	13.5599511	1.272	13.5599488	1.440	13.5599467	1.598	± 100
	20	13.5599683	0.000	13.5599670	0.100	13.5599672	0.082	13.5599679	0.035	± 100
	10	13.5599615	0.506	13.5599705	-0.156	13.5599806	-0.906	13.5599876	-1.423	± 100
	0	13.5600097	-3.052	13.5600146	-3.414	13.5600198	-3.796	13.5600247	-4.155	± 100
	-10	13.5600415	-5.398	13.5600450	-5.652	13.5600485	-5.912	13.5600518	-6.153	± 100
	-20	13.5600636	-7.022	13.5600652	-7.144	13.5600666	-7.250	13.5600677	-7.327	± 100
3.23	20	13.5599680	0.025	13.5599681	0.018	13.5599682	0.007	13.5599683	0.002	± 100
4.37	20	13.5599684	-0.005	13.5599686	-0.019	13.5599688	-0.034	13.5599691	-0.056	± 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 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

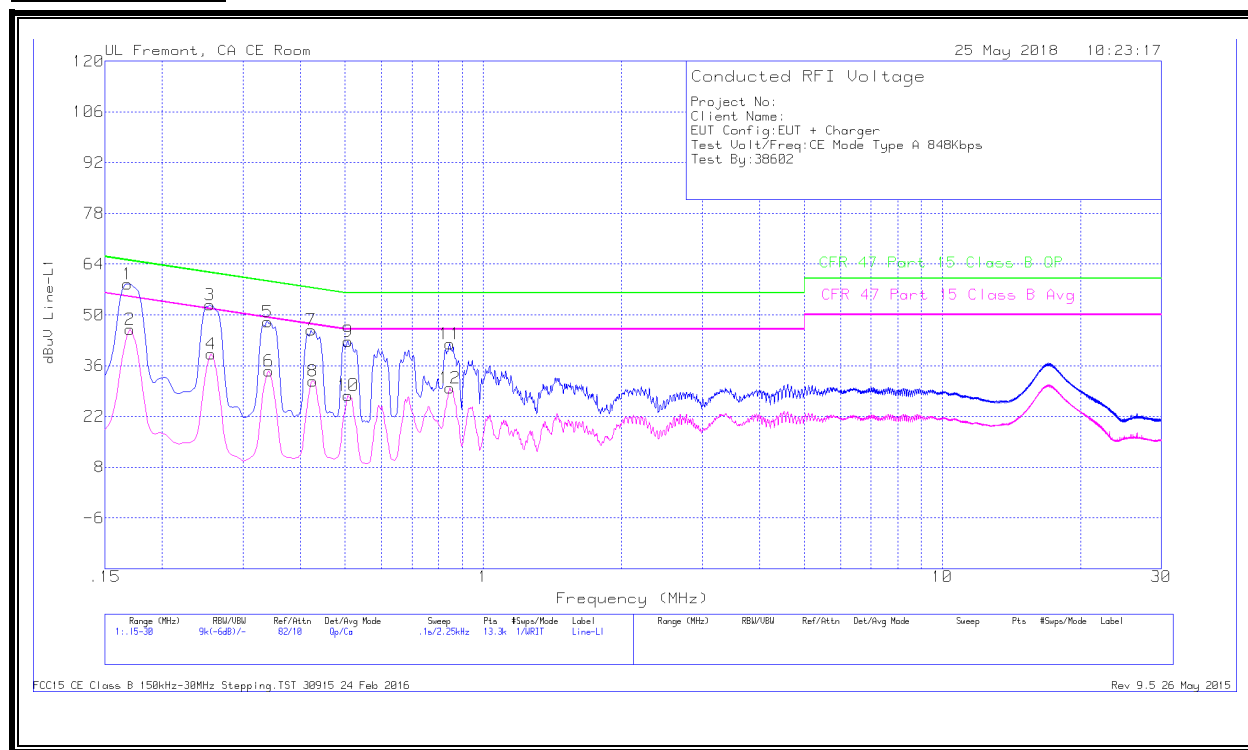
RESULTS

No non-compliance noted:

10.1. CE MODE

10.1.1. WITH ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS



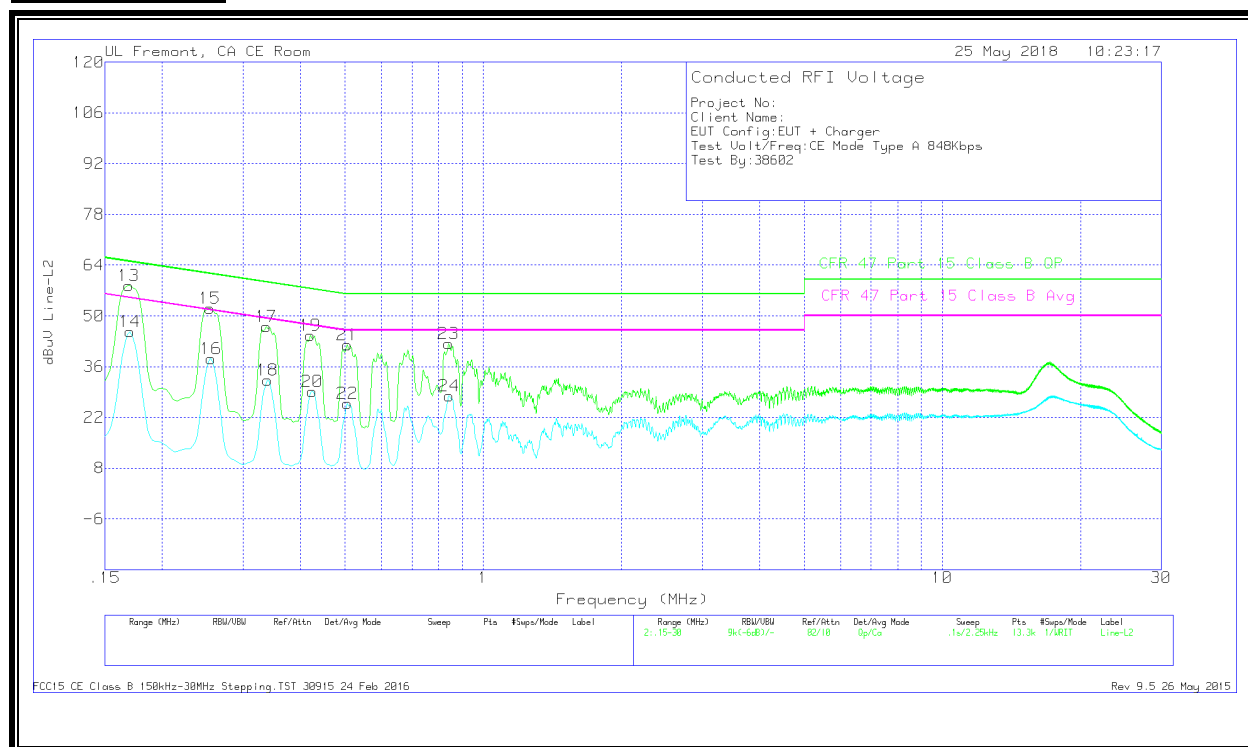
WORST EMISSIONS

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	.168	48.3	Qp	.1	0	10.1	58.5	65.06	-6.56	-	-
2	.17025	35.84	Ca	0	0	10.1	45.94	-	-	54.95	-9.01
3	.2535	42.67	Qp	0	0	10.1	52.77	61.64	-8.87	-	-
4	.25575	29.17	Ca	0	0	10.1	39.27	-	-	51.57	-12.3
5	.339	37.99	Qp	0	0	10.1	48.09	59.23	-11.14	-	-
6	.34125	24.42	Ca	0	0	10.1	34.52	-	-	49.17	-14.65
7	.42225	35.72	Qp	0	0	10.1	45.82	57.4	-11.58	-	-
8	.42562	21.63	Ca	0	0	10.1	31.73	-	-	47.34	-15.61
9	.50775	32.66	Qp	0	0	10.1	42.76	56	-13.24	-	-
10	.50775	17.73	Ca	0	0	10.1	27.83	-	-	46	-18.17
11	.84525	31.84	Qp	0	0	10.1	41.94	56	-14.06	-	-
12	.84525	19.7	Ca	0	0	10.1	29.8	-	-	46	-16.2

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	.16913	48.21	Qp	0	0	10.1	58.31	65	-6.69	-	-
14	.17025	35.49	Ca	0	0	10.1	45.59	-	-	54.95	-9.36
15	.2535	42.04	Qp	0	0	10.1	52.14	61.64	-9.5	-	-
16	.25575	28.08	Ca	0	0	10.1	38.18	-	-	51.57	-13.39
17	.33675	36.92	Qp	0	0	10.1	47.02	59.28	-12.26	-	-
18	.339	22.22	Ca	0	0	10.1	32.32	-	-	49.23	-16.91
19	.42	34.5	Qp	0	0	10.1	44.6	57.45	-12.85	-	-
20	.4245	19.04	Ca	0	0	10.1	29.14	-	-	47.36	-18.22
21	.5055	31.88	Qp	0	0	10.1	41.98	56	-14.02	-	-
22	.5055	15.72	Ca	0	0	10.1	25.82	-	-	46	-20.18
23	.84075	32.23	Qp	0	0	10.1	42.33	56	-13.67	-	-
24	.843	17.9	Ca	0	0	10.1	28	-	-	46	-18

Qp - Quasi-Peak detector

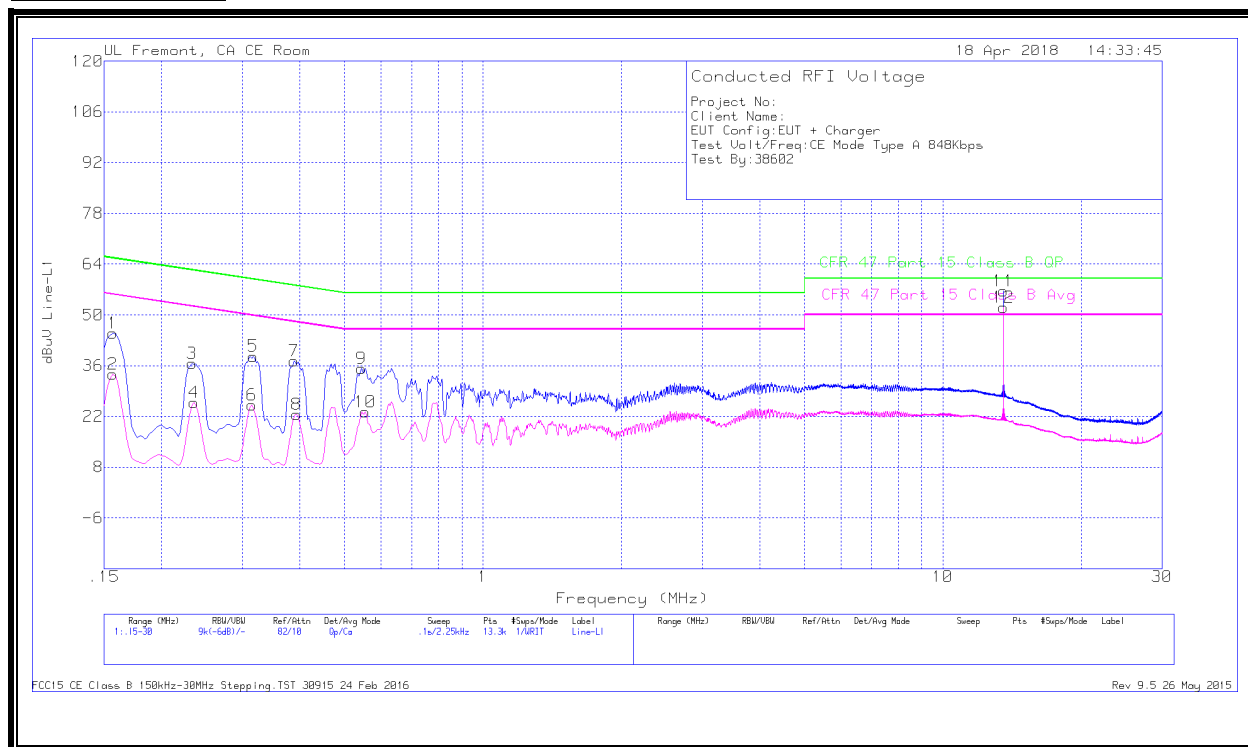
Ca - CISPR average detection

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

Rev 9.5 26 May 2015

10.1.2. NORMAL OPERATION WITHOUT ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS



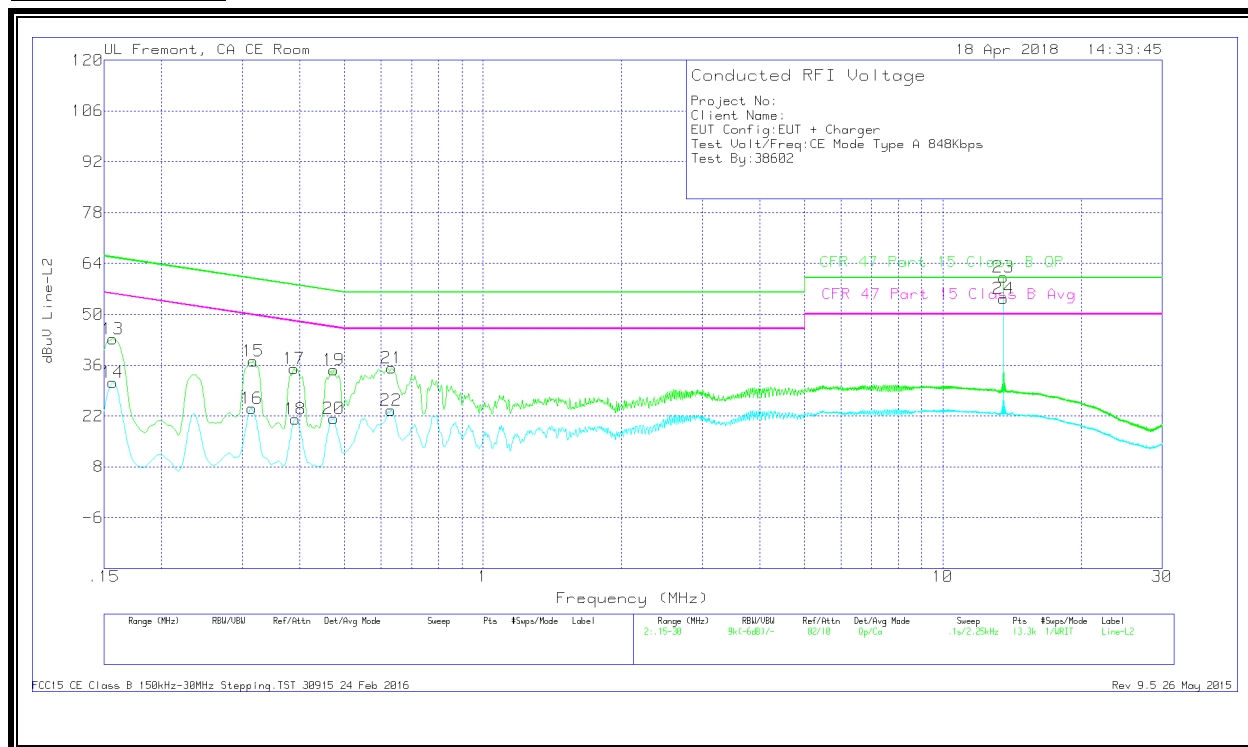
WORST EMISSIONS

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	.15675	34.74	Qp	.1	0	10.1	44.94	65.63	-20.69	-	-
2	.15675	23.42	Ca	.1	0	10.1	33.62	-	-	55.63	-22.01
3	.23325	26.58	Qp	0	0	10.1	36.68	62.33	-25.65	-	-
4	.2355	15.71	Ca	0	0	10.1	25.81	-	-	52.25	-26.44
5	.3165	28.51	Qp	0	0	10.1	38.61	59.8	-21.19	-	-
6	.31425	14.99	Ca	0	0	10.1	25.09	-	-	49.86	-24.77
7	.3885	27.18	Qp	0	0	10.1	37.28	58.1	-20.82	-	-
8	.393	12.49	Ca	0	0	10.1	22.59	-	-	48	-25.41
9	.54375	25.17	Qp	0	0	10.1	35.27	56	-20.73	-	-
10	.555	13.14	Ca	0	0	10.1	23.24	-	-	46	-22.76
11	13.56	46.11	Qp	.1	.2	10.2	56.61	60	-3.39	-	-
12	13.56	41.57	Ca	.1	.2	10.2	52.07	-	-	50	2.07

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	.15675	33.08	Qp	0	0	10.1	43.18	65.63	-22.45	-	-
14	.15675	21.15	Ca	0	0	10.1	31.25	-	-	55.63	-24.38
15	.3165	26.97	Qp	0	0	10.1	37.07	59.8	-22.73	-	-
16	.31425	14.03	Ca	0	0	10.1	24.13	-	-	49.86	-25.73
17	.3885	25.01	Qp	0	0	10.1	35.11	58.1	-22.99	-	-
18	.39075	11.1	Ca	0	0	10.1	21.2	-	-	48.05	-26.85
19	.474	24.67	Qp	0	0	10.1	34.77	56.44	-21.67	-	-
20	.474	11.18	Ca	0	0	10.1	21.28	-	-	46.44	-25.16
21	.63375	25.08	Qp	0	0	10.1	35.18	56	-20.82	-	-
22	.6315	13.49	Ca	0	0	10.1	23.59	-	-	46	-22.41
23	13.56	49.83	Qp	.1	.2	10.2	60.33	60	.33	-	-
24	13.56	43.83	Ca	.1	.2	10.2	54.33	-	-	50	4.33

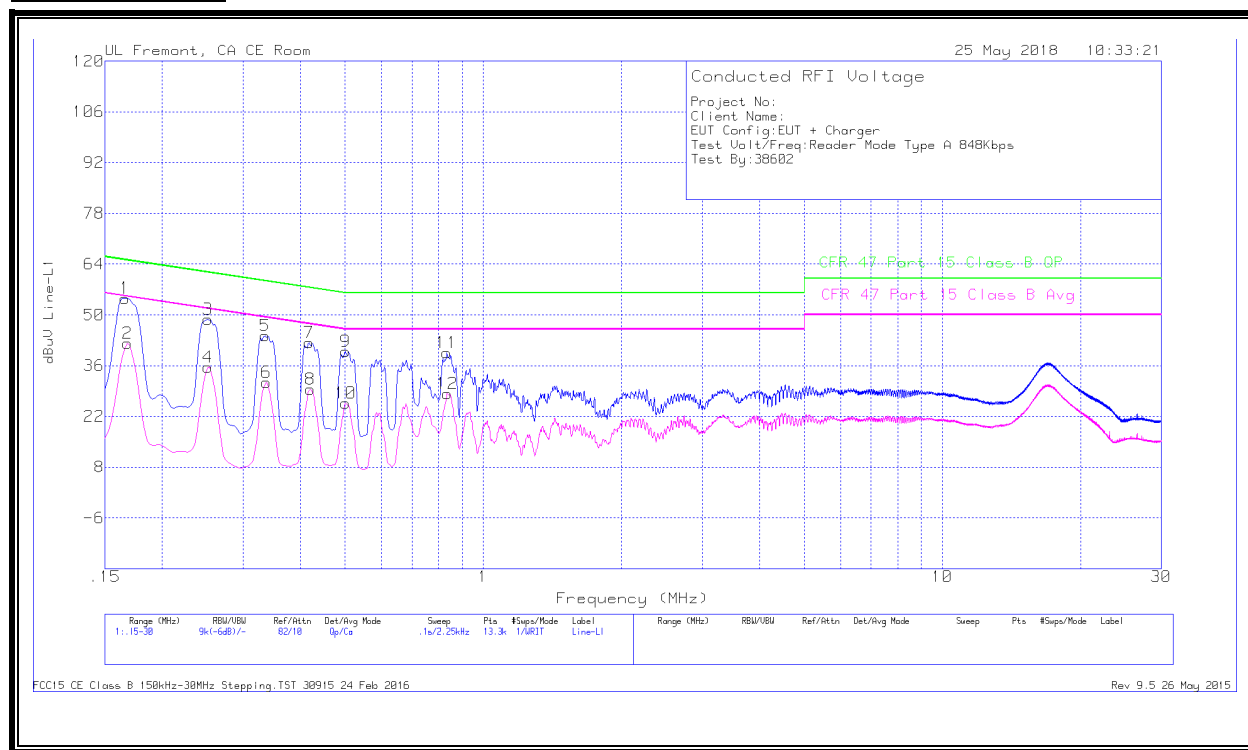
Qp - Quasi-Peak detector
Ca - CISPR average detection

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. WITH ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS

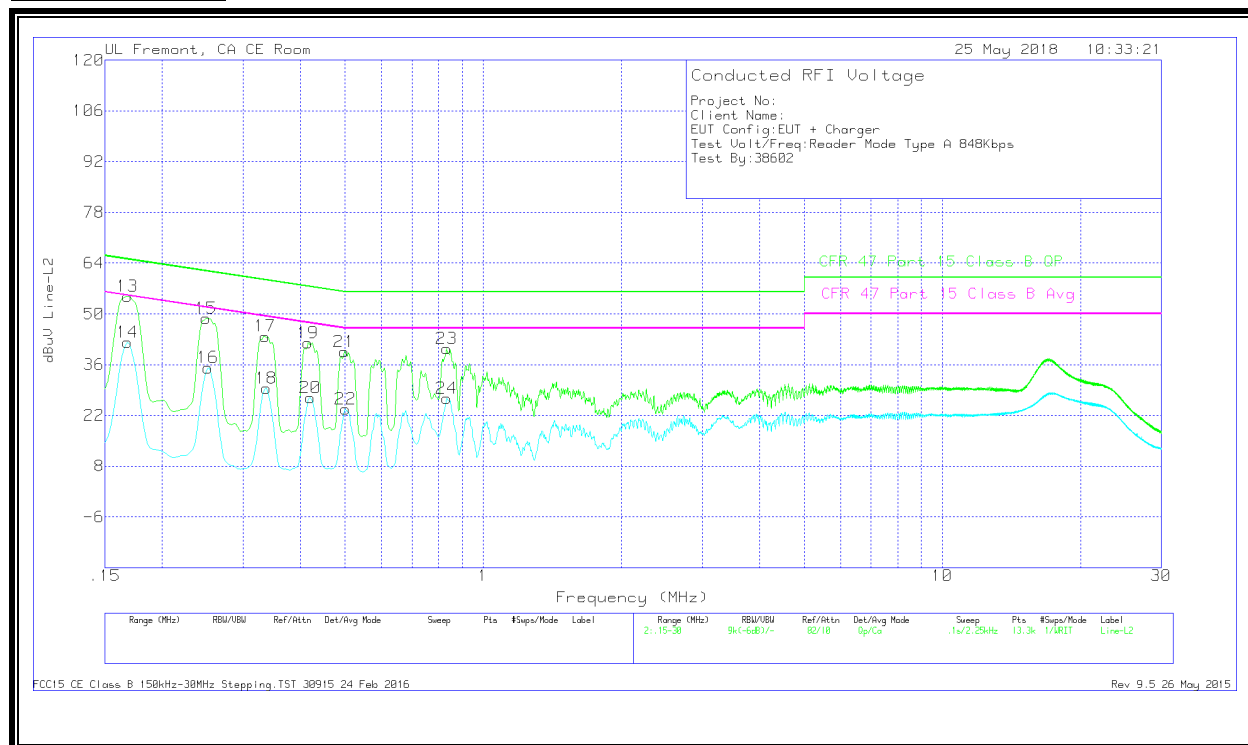


WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequenc y (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	44.4	Qp	.1	0	10.1	54.6	65.17	-10.57	-	-
2	.168	31.97	Ca	.1	0	10.1	42.17	-	-	55.06	-12.89
3	.25125	38.74	Qp	0	0	10.1	48.84	61.72	-12.88	-	-
4	.25125	25.51	Ca	0	0	10.1	35.61	-	-	51.72	-16.11
5	.3345	34.14	Qp	0	0	10.1	44.24	59.34	-15.1	-	-
6	.33675	21.29	Ca	0	0	10.1	31.39	-	-	49.28	-17.89
7	.41775	32.27	Qp	0	0	10.1	42.37	57.49	-15.12	-	-
8	.42	19.34	Ca	0	0	10.1	29.44	-	-	47.45	-18.01
9	.501	29.87	Qp	0	0	10.1	39.97	56	-16.03	-	-
10	.501	15.57	Ca	0	0	10.1	25.67	-	-	46	-20.33
11	.834	29.45	Qp	0	0	10.1	39.55	56	-16.45	-	-
12	.83625	18.24	Ca	0	0	10.1	28.34	-	-	46	-17.66

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



WORST EMISSIONS

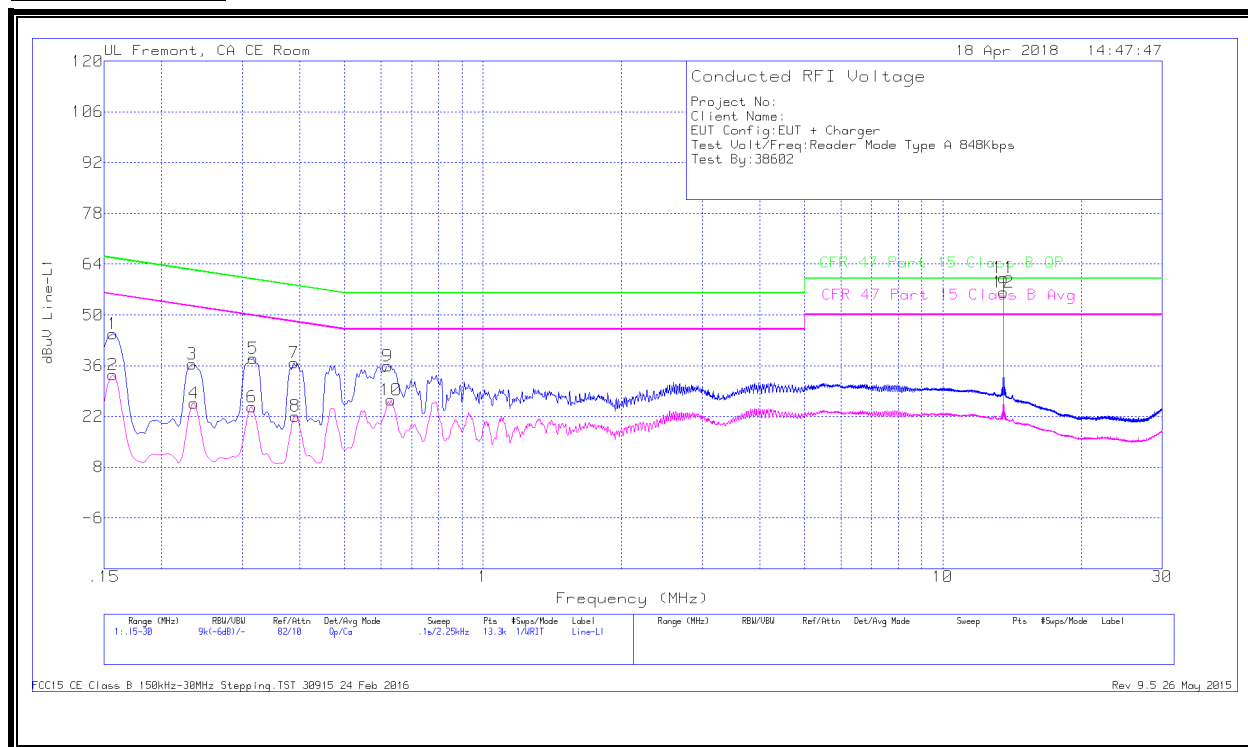
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limit (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.168	44.75	Qp	0	0	10.1	54.85	65.06	-10.21	-	-
14	.168	32.12	Ca	0	0	10.1	42.22	-	-	55.06	-12.84
15	.249	38.74	Qp	0	0	10.1	48.84	61.79	-12.95	-	-
16	.25125	25.04	Ca	0	0	10.1	35.14	-	-	51.72	-16.58
17	.3345	33.73	Qp	0	0	10.1	43.83	59.34	-15.51	-	-
18	.33675	19.38	Ca	0	0	10.1	29.48	-	-	49.28	-19.8
19	.4155	31.96	Qp	0	0	10.1	42.06	57.54	-15.48	-	-
20	.42	16.72	Ca	0	0	10.1	26.82	-	-	47.45	-20.63
21	.49875	29.52	Qp	0	0	10.1	39.62	56.02	-16.4	-	-
22	.501	13.61	Ca	0	0	10.1	23.71	-	-	46	-22.29
23	.83175	30.37	Qp	0	0	10.1	40.47	56	-15.53	-	-
24	.834	16.61	Ca	0	0	10.1	26.71	-	-	46	-19.29

Qp - Quasi-Peak detector

Ca - CISPR average detection

10.2.2. NORMAL OPERATION WITHOUT ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS



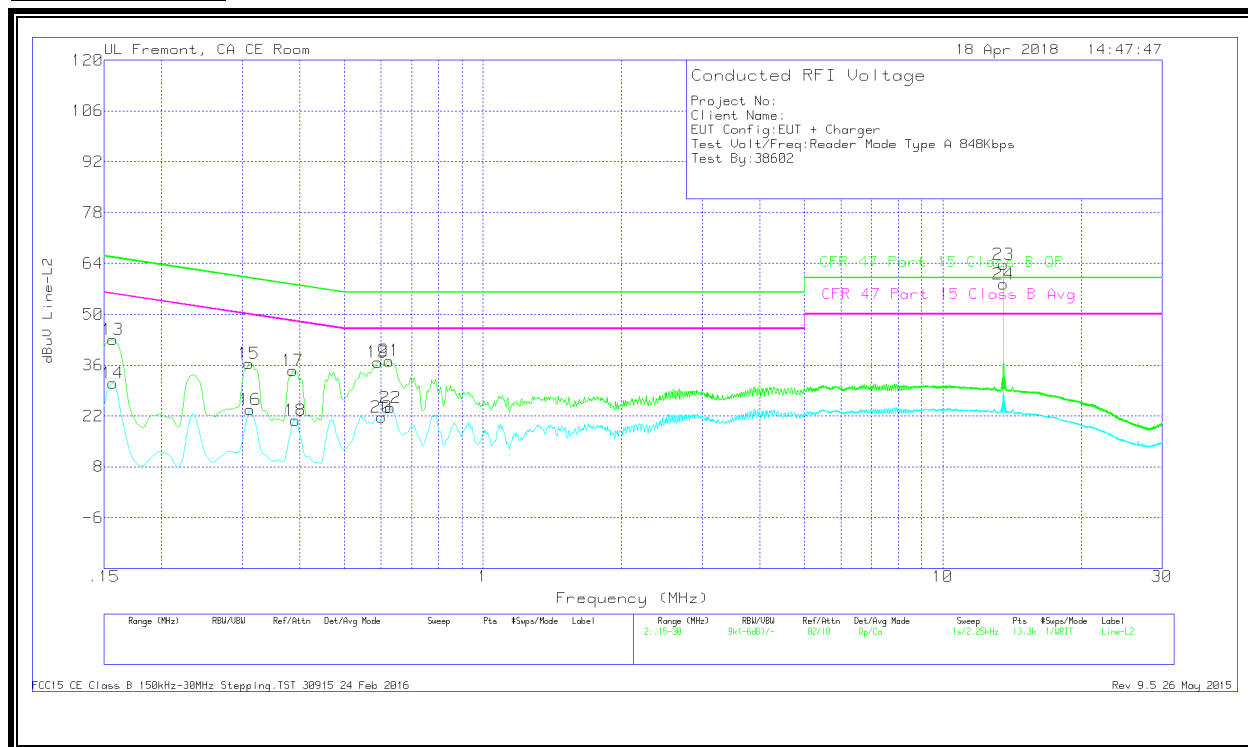
WORST EMISSIONS

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	.15675	34.54	Qp	.1	0	10.1	44.74	65.63	-20.89	-	-
2	.15675	23.25	Ca	.1	0	10.1	33.45	-	-	55.63	-22.18
3	.23325	26.37	Qp	0	0	10.1	36.47	62.33	-25.86	-	-
4	.2355	15.57	Ca	0	0	10.1	25.67	-	-	52.25	-26.58
5	.3165	27.95	Qp	0	0	10.1	38.05	59.8	-21.75	-	-
6	.31425	14.45	Ca	0	0	10.1	24.55	-	-	49.86	-25.31
7	.3885	26.67	Qp	0	0	10.1	36.77	58.1	-21.33	-	-
8	.39075	12	Ca	0	0	10.1	22.1	-	-	48.05	-25.95
9	.62025	25.84	Qp	0	0	10.1	35.94	56	-20.06	-	-
10	.6315	16.36	Ca	0	0	10.1	26.46	-	-	46	-19.54
11	13.56	49.75	Qp	.1	.2	10.2	60.25	60	.25	-	-
12	13.56	45.83	Ca	.1	.2	10.2	56.33	-	-	50	6.33

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	.15675	32.87	Qp	0	0	10.1	42.97	65.63	-22.66	-	-
14	.15675	20.96	Ca	0	0	10.1	31.06	-	-	55.63	-24.57
15	.30975	26.28	Qp	0	0	10.1	36.38	59.98	-23.6	-	-
16	.312	13.62	Ca	0	0	10.1	23.72	-	-	49.92	-26.2
17	.38625	24.4	Qp	0	0	10.1	34.5	58.14	-23.64	-	-
18	.39075	10.74	Ca	0	0	10.1	20.84	-	-	48.05	-27.21
19	.591	26.65	Qp	0	0	10.1	36.75	56	-19.25	-	-
20	.60225	11.56	Ca	0	0	10.1	21.66	-	-	46	-24.34
21	.62475	27.12	Qp	0	0	10.1	37.22	56	-18.78	-	-
22	.62925	14.21	Ca	0	0	10.1	24.31	-	-	46	-21.69
23	13.56	53.3	Qp	.1	.2	10.2	63.8	60	3.8	-	-
24	13.56	47.82	Ca	.1	.2	10.2	58.32	-	-	50	8.32

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 12204524-EP1V1 for setup photos