



CERTIFICATION TEST REPORT

Report Number. : 12124122-E11V3

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

Model : A1921, A2103, A2104

FCC ID : BCG-E3219A

IC : 579C-E3219A

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

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	8/2/2018	Initial Issue	Chin Pang
V2	8/6/2018	Address TCB's questions	Chin Pang
V3	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: A1921, A2103, A2104

SERIAL NUMBER: C39WK010K3WL

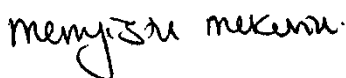
DATE TESTED: APRIL 16, 2018 – July 26, 2018

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.

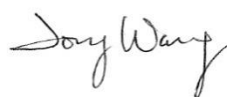
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section.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



Mengistu Mekuria
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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. DIFFERENCE IN MODEL NUMBER

Model A2103, A2104 is electrically identical to Model A1921. Three model numbers are allocated for marketing and logistic purposes only. A1921 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	CE	848	22.08
		Reader	848	20.75

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.

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

In addition, Type A, B and F with CE mode and Reader mode data rates and ISO 15693 were investigated to determine the worst case based on the highest power and spurious emissions. Type 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

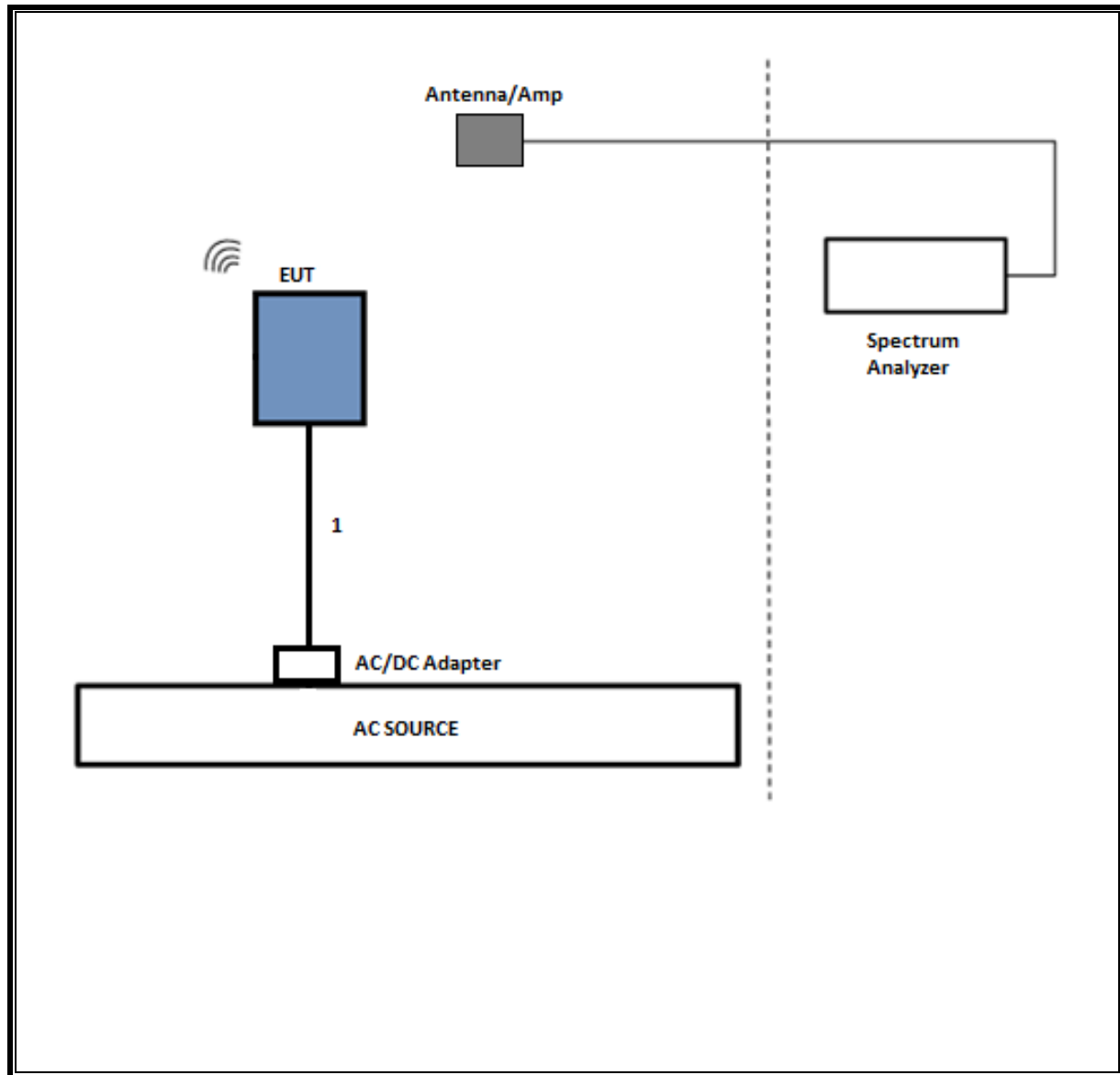
I/O CABLES

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

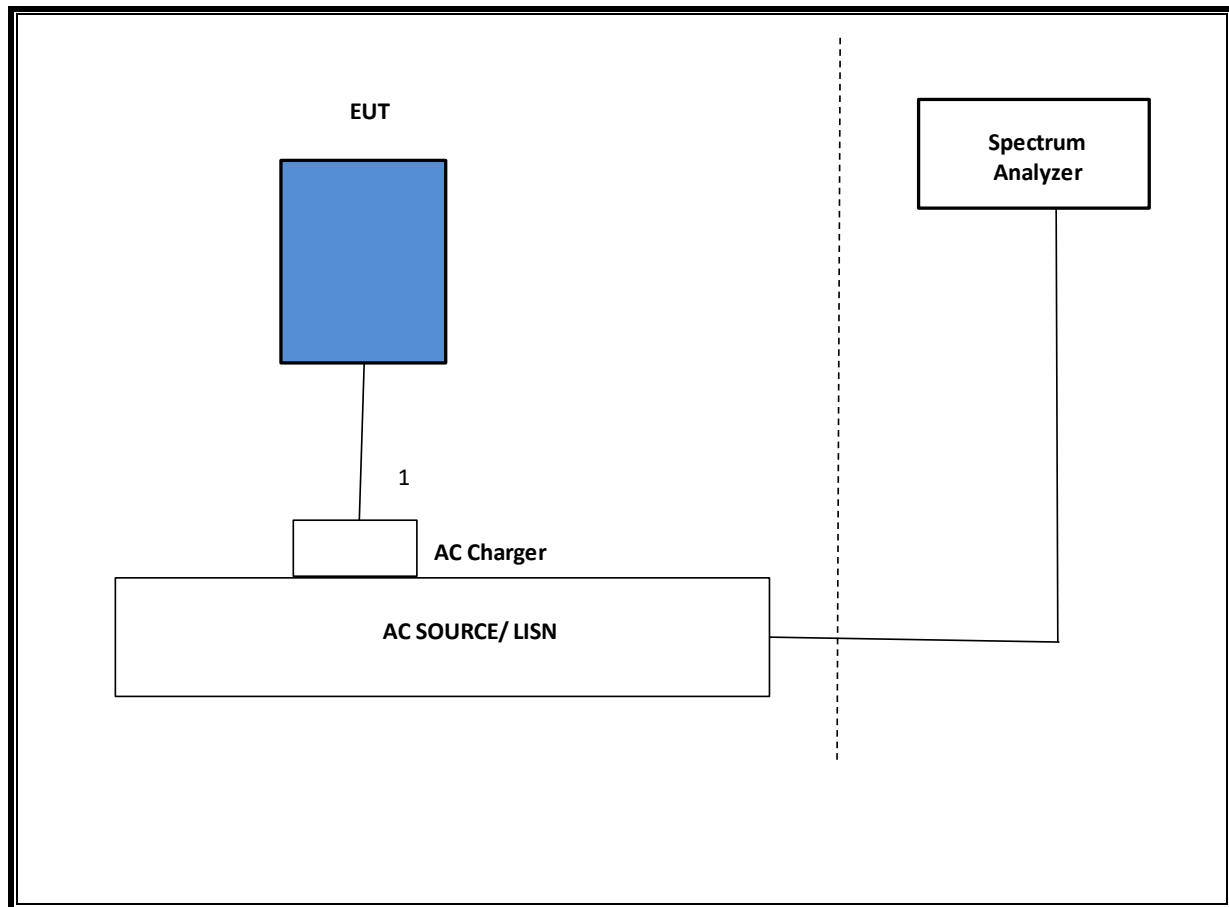
TEST SETUP

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

SETUP DIAGRAM FOR RADIATED TESTS



SETUP DIAGRAM FOR LINE CONDUCTED TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Description	Manufacturer	Model	ID Num	Cal Due
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	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
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T754	09/05/2018
Antenna, Active Loop 9KHz to 30MHz	EMCO	6502	T35	12/15/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T341	11/12/2018
AC Line Conducted				
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESC17	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	

*Testing is completed before equipment expiration date.

7. OCCUPIED BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

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

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

RESULTS

99% and 20dB BW

CE MODE

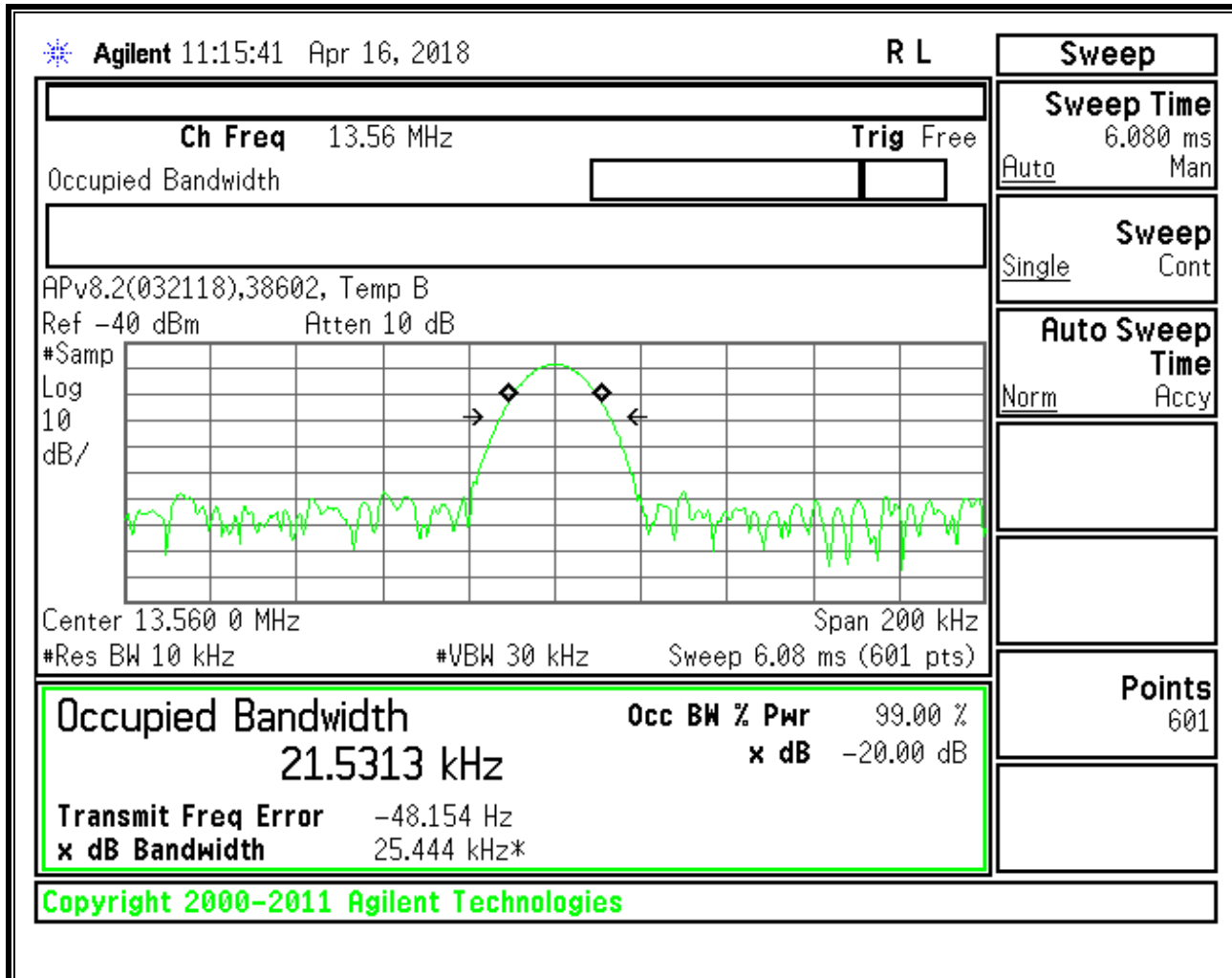
Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	21.5313	25.444

READER MODE

Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	21.7733	24.947

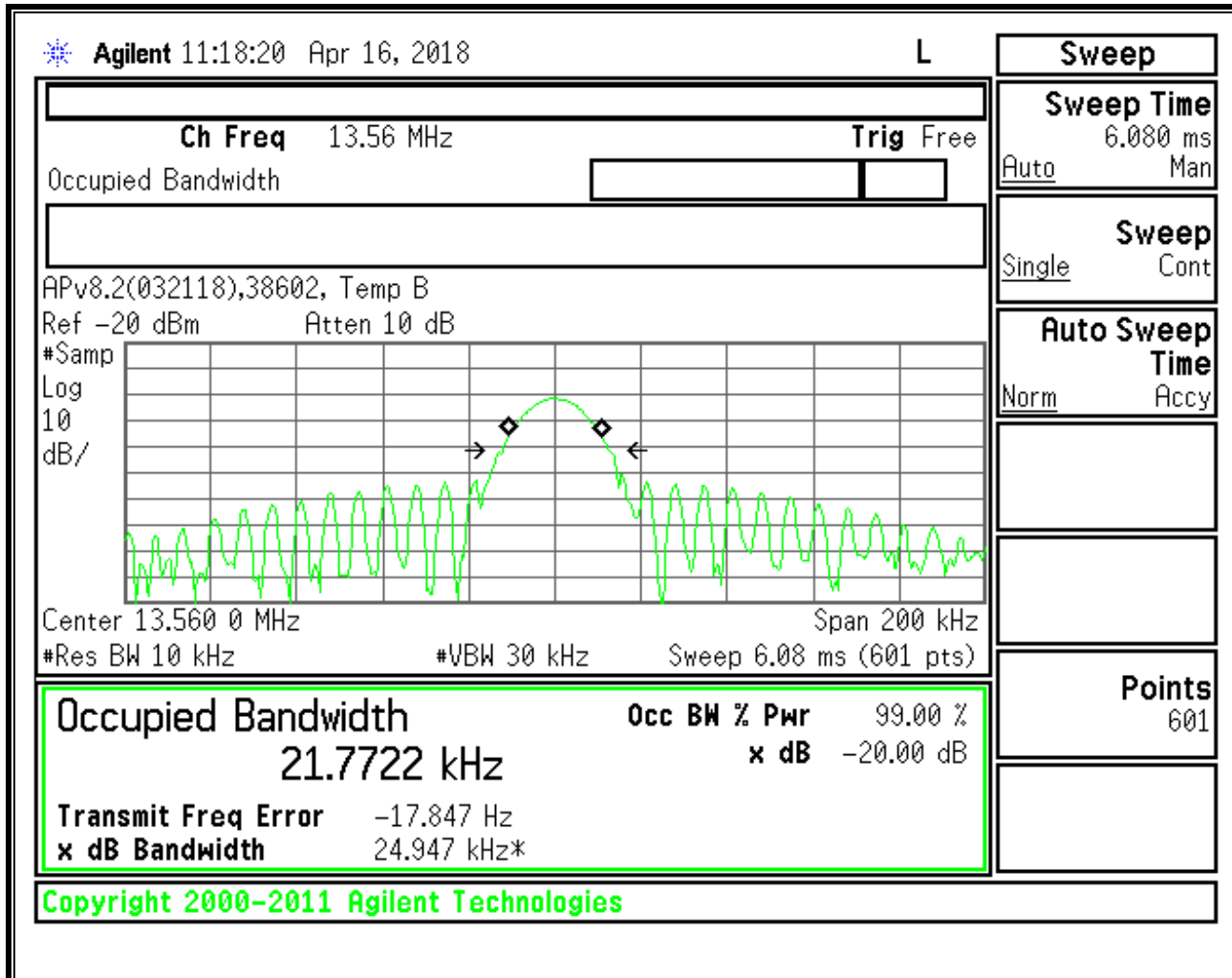
7.1. CE MODE

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

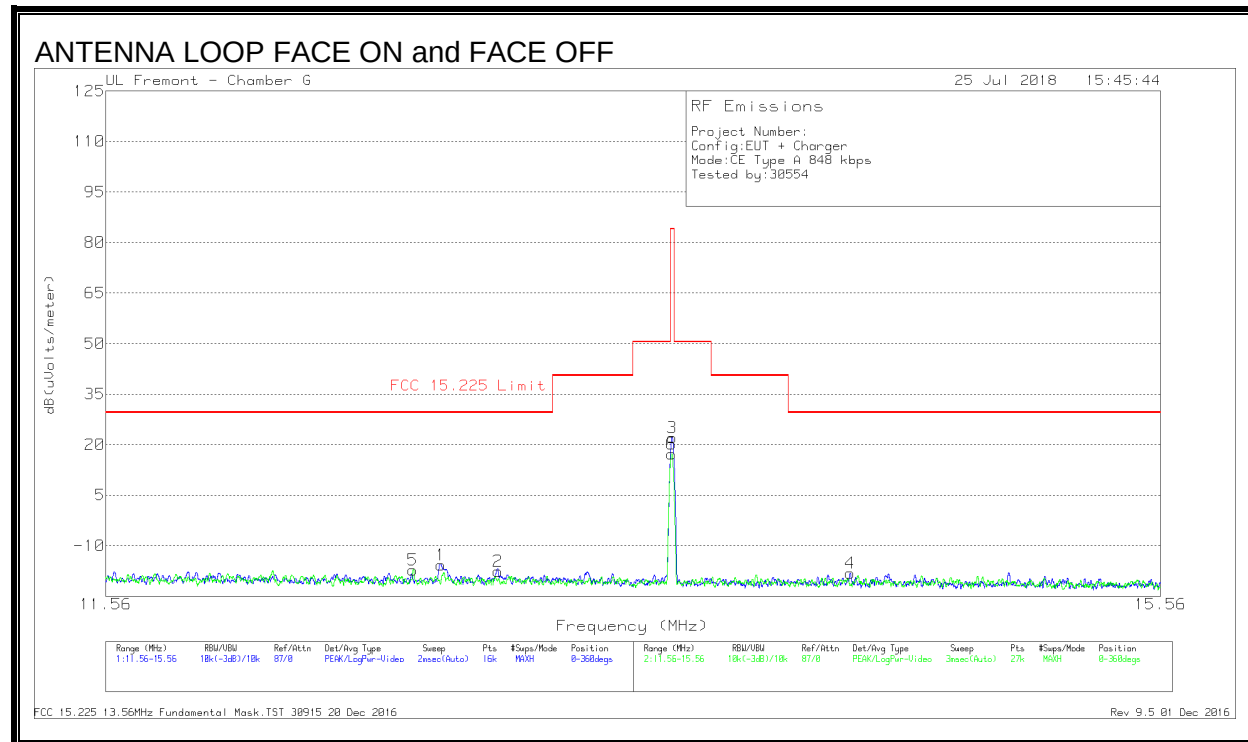
The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the 10th harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater.

RESULTS

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

8.2.1. CE MODE

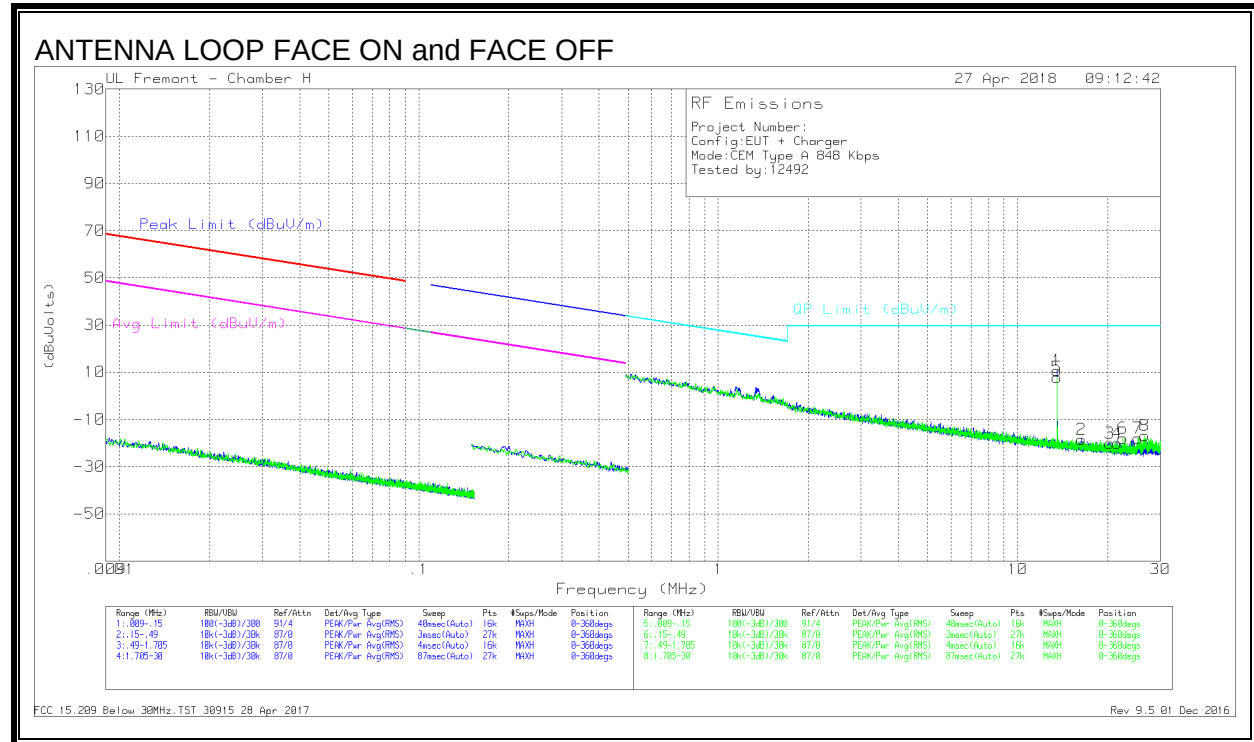
FUNDAMENTAL 848Kbps



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 30m	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
1	12.706	13.51	Pk	10.4	.4	-40	-15.69	29.54	-45.23	0-360
2	12.91175	11.6	Pk	10.4	.4	-40	-17.6	29.54	-47.14	0-360
3	13.55925	51.38	Pk	10.3	.4	-40	22.08	84	-61.92	0-360
4	14.25788	11.2	Pk	10.2	.4	-40	-18.2	29.54	-47.74	0-360
5	12.60532	12.01	Pk	10.4	.4	-40	-17.19	29.54	-46.73	0-360
6	13.55822	46.61	Pk	10.3	.4	-40	17.31	84	-66.69	0-360

Pk - Peak detector

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)
2	16.33613	11.12	Pk	10	.4	-40	-18.48	29.5	-47.98	0-360
3	20.30228	9.93	Pk	9.6	.5	-40	-19.97	29.5	-49.47	0-360
4	21.55045	10.08	Pk	9.4	.5	-40	-20.02	29.5	-49.52	0-360
6	22.4271	12.42	Pk	9.2	.5	-40	-17.88	29.5	-47.38	0-360
7	25.21793	12.71	Pk	8.8	.6	-40	-17.89	29.5	-47.39	0-360
8	26.53684	14.06	Pk	8.5	.6	-40	-16.84	29.5	-46.34	0-360

Pk - Peak detector

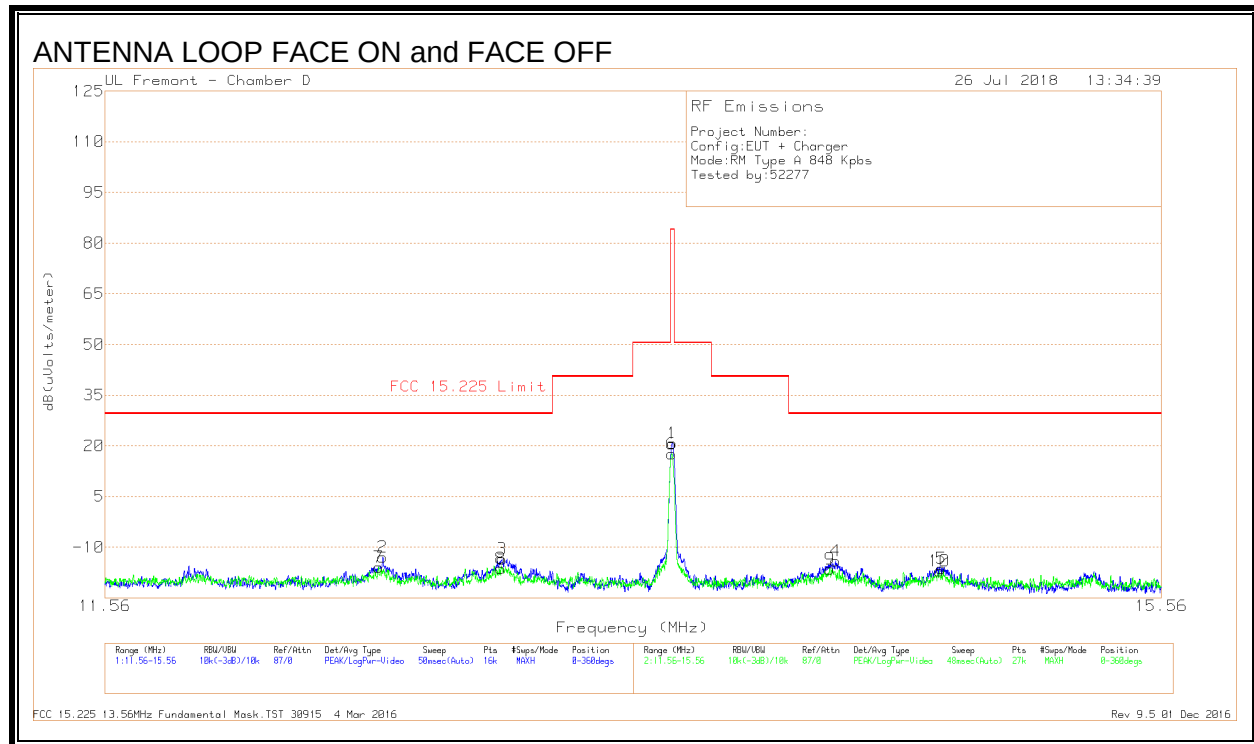
FCC 15.209 Below 30MHz.TST 30915 28 Apr 2017

Rev 9.5 01 Dec 2016

Note: Marker 1 and 5 are the fundamental signal.

8.2.2. READER MODE

FUNDAMENTAL 848Kbps

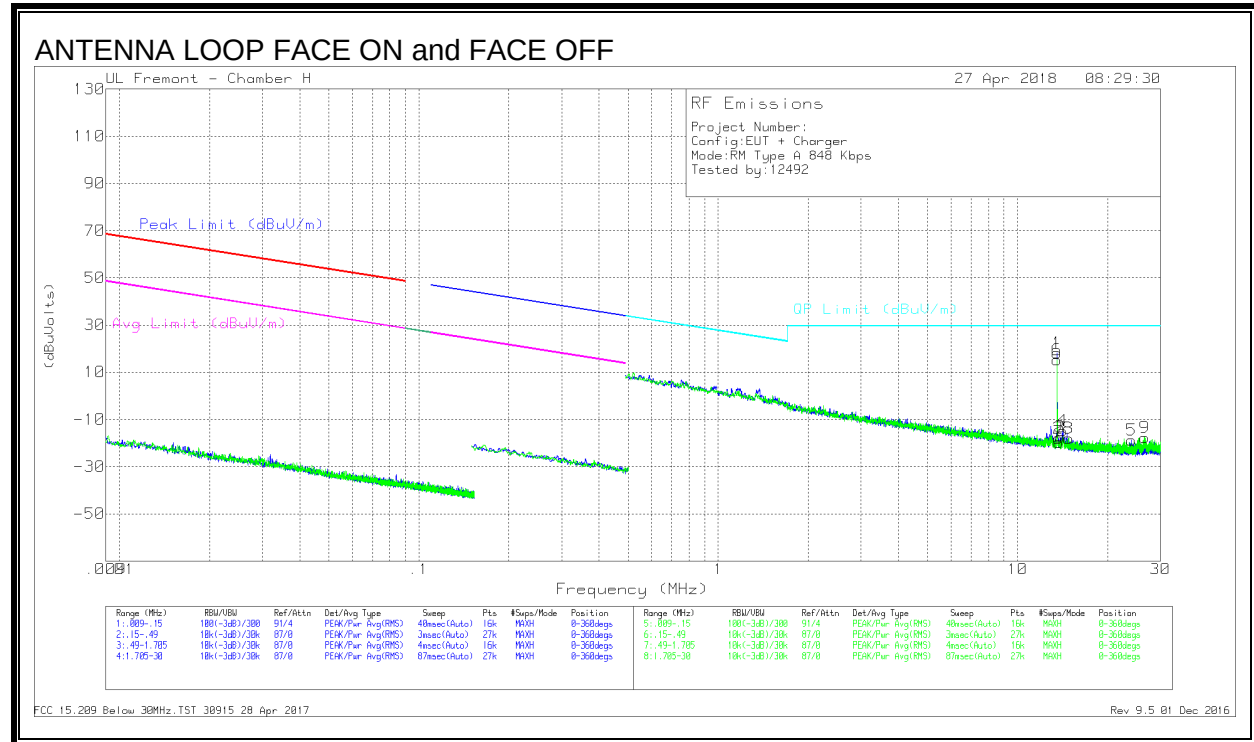


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 30m	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
7	12.48522	12.91	Pk	10.8	.4	-40	-15.89	29.54	-45.43	0-360
2	12.50013	15.91	Pk	10.7	.4	-40	-12.99	29.54	-42.53	0-360
8	12.92234	12.55	Pk	10.7	.4	-40	-16.35	29.54	-45.89	0-360
3	12.92563	15.47	Pk	10.7	.4	-40	-13.43	29.54	-42.97	0-360
6	13.5583	46.6	Pk	10.6	.4	-40	17.6	84	-66.4	0-360
1	13.55975	49.75	Pk	10.6	.4	-40	20.75	84	-63.25	0-360
9	14.17486	12.53	Pk	10.6	.4	-40	-16.47	29.54	-46.01	0-360
4	14.19788	14.99	Pk	10.6	.4	-40	-14.01	29.54	-43.55	0-360
10	14.61835	12.1	Pk	10.5	.4	-40	-17	29.54	-46.54	0-360
5	14.62725	12.72	Pk	10.5	.4	-40	-16.38	29.54	-45.92	0-360

Pk - Peak detector

FCC 15.225 13.56MHz Fundamental Mask.TST 30915 4 Mar 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)
2	13.7025	11.35	Pk	10.4	.4	-40	-17.85	29.5	-47.35	0-360
7	13.7198	9.52	Pk	10.4	.4	-40	-19.68	29.5	-49.18	0-360
3	13.89534	11.87	Pk	10.3	.4	-40	-17.43	29.5	-46.93	0-360
4	14.16467	14.63	Pk	10.3	.4	-40	-14.67	29.5	-44.17	0-360
8	14.8029	11.49	Pk	10.2	.4	-40	-17.91	29.5	-47.41	0-360
5	24.07823	11.83	Pk	8.9	.5	-40	-18.77	29.5	-48.27	0-360
9	26.64373	13.27	Pk	8.5	.6	-40	-17.63	29.5	-47.13	0-360

Pk - Peak detector

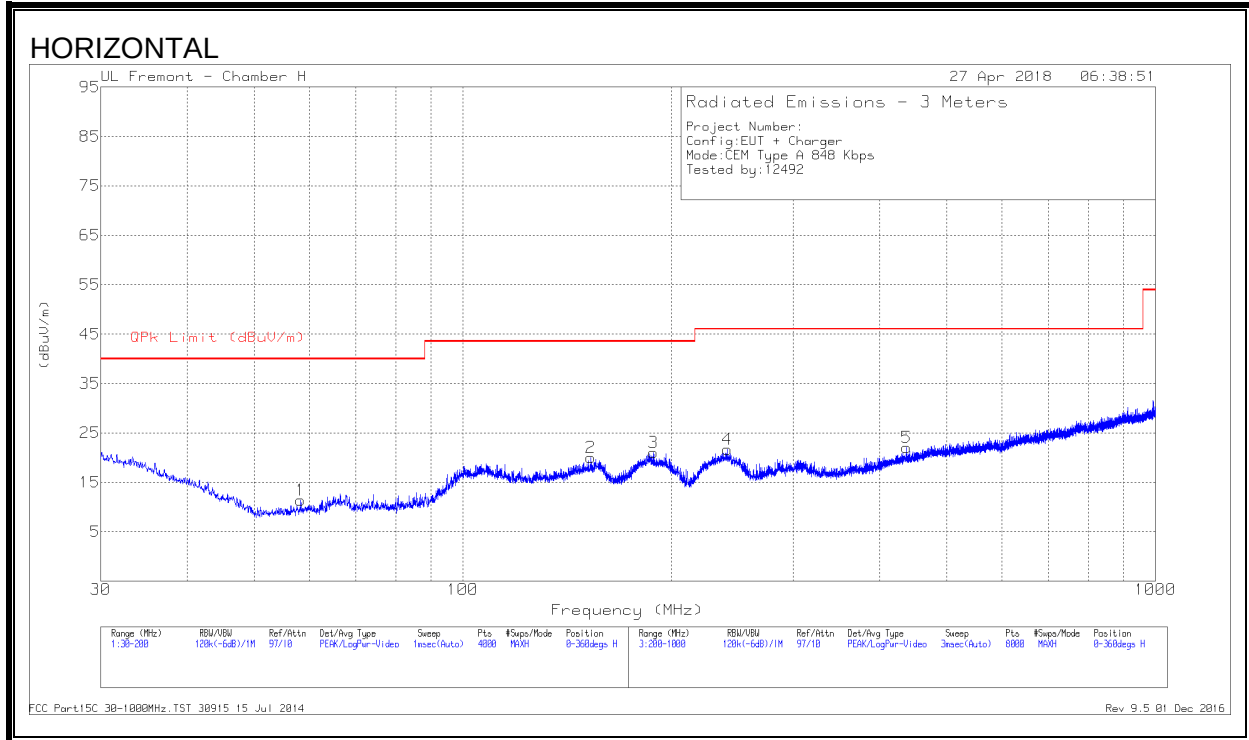
FCC 15.209 Below 30MHz.TST 30915 28 Apr 2017
Rev 9.5 01 Dec 2016

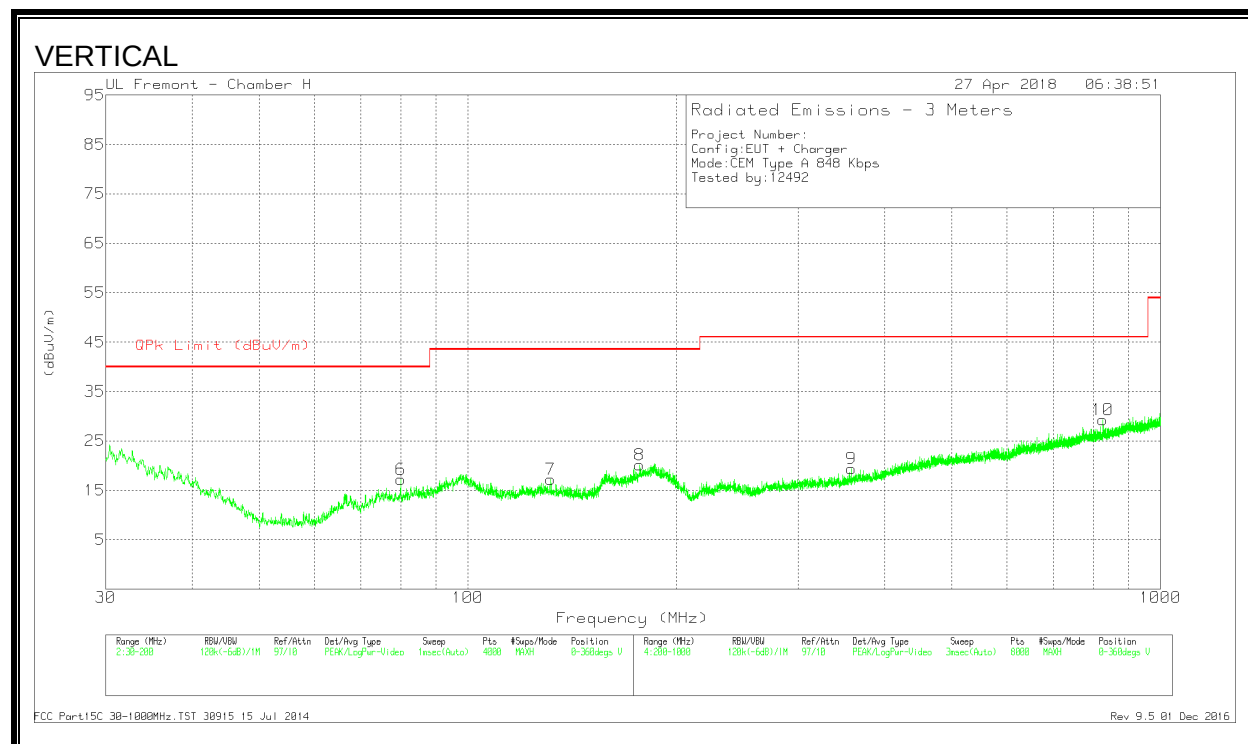
Note: Marker 1 and 6 are the fundamental signal.

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

8.3.1. CE MODE

SPURIOUS EMISSION 848Kbps





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
7	* 131.7713	29.78	Pk	17.7	-30.2	17.28	43.52	-26.24	0-360	100	V
4	* 240.9053	35.59	Pk	15.5	-29.4	21.69	46.02	-24.33	0-360	101	H
1	58.3548	30.9	Pk	11.4	-30.9	11.4	40	-28.6	0-360	299	H
6	79.9929	36.33	Pk	11.6	-30.7	17.23	40	-22.77	0-360	100	V
2	153.1119	33.96	Pk	16.2	-30.1	20.06	43.52	-23.46	0-360	199	H
8	177.0455	35	Pk	15.1	-29.9	20.2	43.52	-23.32	0-360	100	V
3	188.6085	35.74	Pk	15.1	-29.8	21.04	43.52	-22.48	0-360	199	H
9	357.9205	29.82	Pk	18.5	-28.9	19.42	46.02	-26.6	0-360	101	V
5	436.9308	30.18	Pk	20.4	-28.5	22.08	46.02	-23.94	0-360	101	H
10	825.0813	31.11	Pk	25.3	-27.1	29.31	46.02	-16.71	0-360	101	V

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

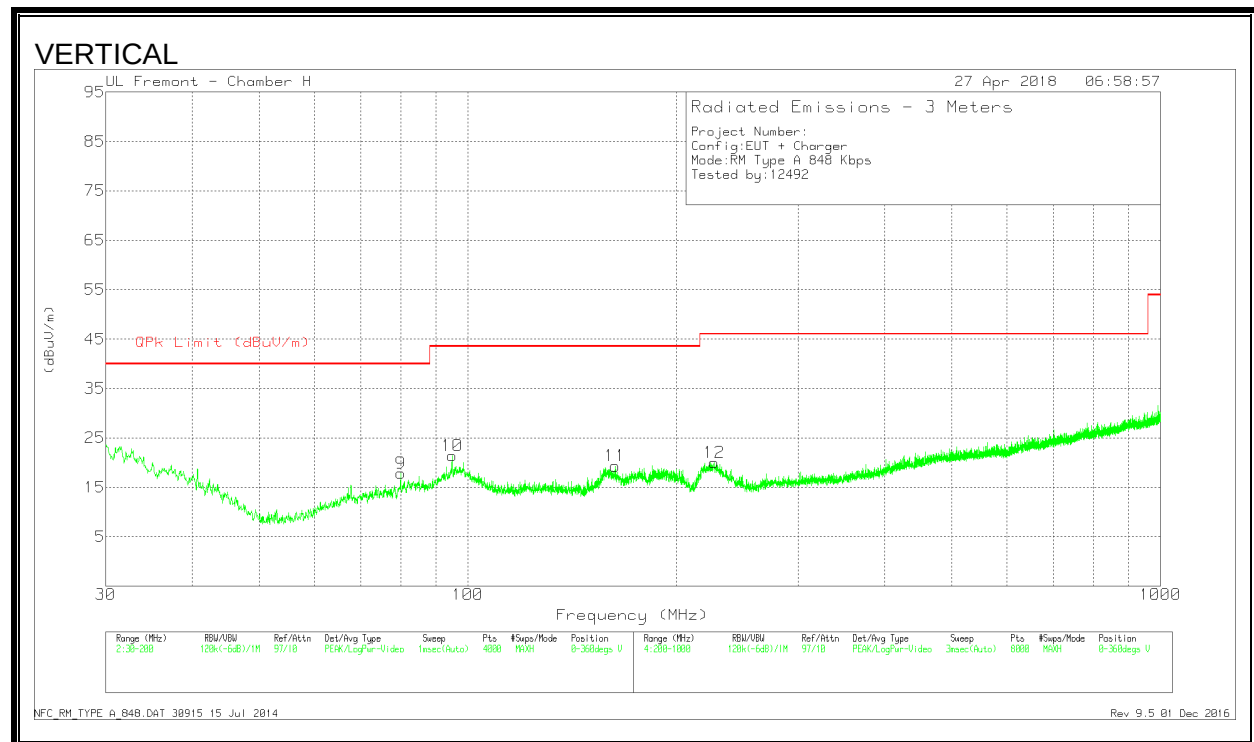
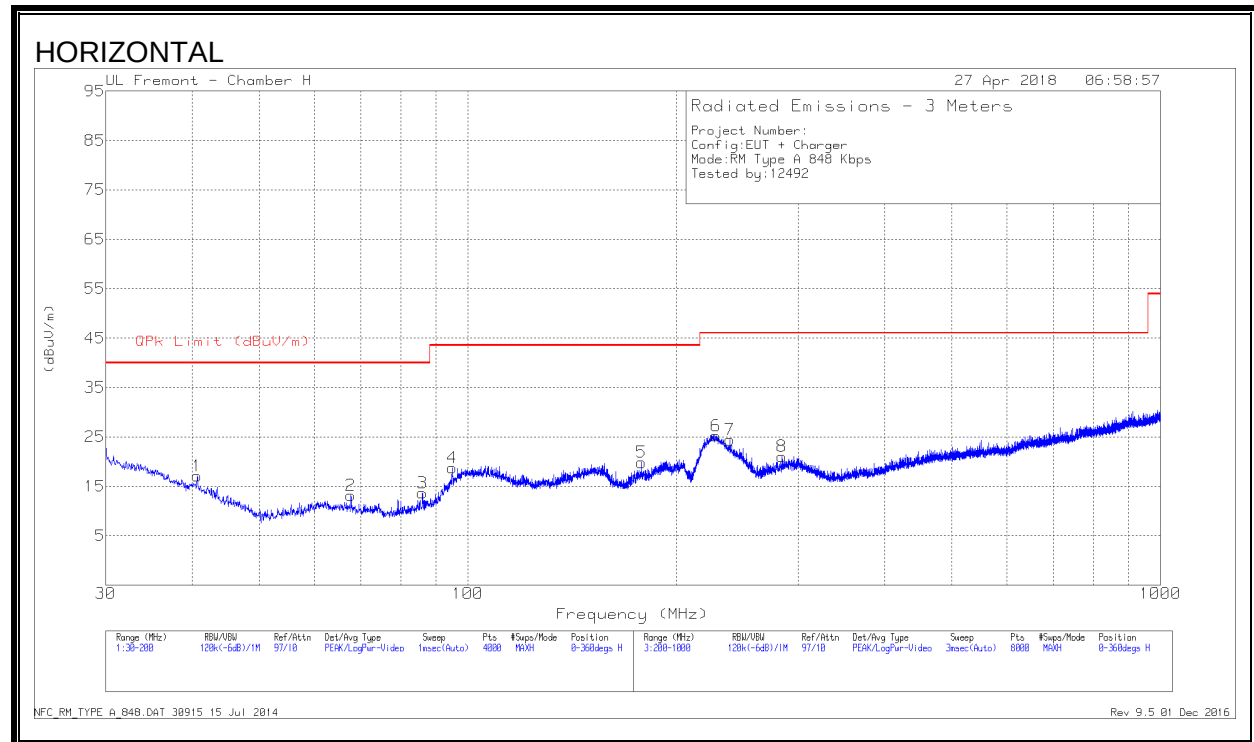
Pk - Peak detector

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
11	* 163.3145	33.52	Pk	15.8	-30	19.32	43.52	-24.2	0-360	100	V
8	* 283.9109	33.09	Pk	17.2	-29.2	21.09	46.02	-24.93	0-360	101	H
1	40.6703	30.68	Pk	17.6	-31.2	17.08	40	-22.92	0-360	199	H
2	67.7923	32.19	Pk	11.8	-30.8	13.19	40	-26.81	0-360	299	H
9	79.9929	36.96	Pk	11.6	-30.7	17.86	40	-22.14	0-360	100	V
3	85.987	32.64	Pk	11.6	-30.6	13.64	40	-26.36	0-360	299	H
4	94.9143	36.53	Pk	12.8	-30.6	18.73	43.52	-24.79	0-360	299	H
10	94.9143	39.24	Pk	12.8	-30.6	21.44	43.52	-22.08	0-360	100	V
5	178.0658	34.73	Pk	15	-29.9	19.83	43.52	-23.69	0-360	199	H
12	226.7035	34.71	Pk	14.9	-29.6	20.01	46.02	-26.01	0-360	199	V
6	228.4037	39.81	Pk	15	-29.6	25.21	46.02	-20.81	0-360	101	H
7	239.1051	38.4	Pk	15.5	-29.5	24.4	46.02	-21.62	0-360	101	H

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

Pk - Peak detector

NFC_RM_TYPE A_848.DAT 30915 15 Jul 2014

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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:	5/3/18
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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	13.5598817	3.633	13.5598812	3.670	13.5598811	3.681	13.5598816	3.643	± 100
	40	13.5598807	3.711	13.5598807	3.708	13.5598813	3.667	13.5598822	3.599	± 100
	30	13.5598878	3.184	13.5598905	2.987	13.5598939	2.734	13.5598976	2.461	± 100
	20	13.5599310	0.000	13.5599309	0.006	13.5599305	0.036	13.5599301	0.063	± 100
	10	13.5599415	-0.775	13.5599461	-1.115	13.5599512	-1.489	13.5599563	-1.864	± 100
	0	13.5599733	-3.121	13.5599782	-3.483	13.5599834	-3.862	13.5599881	-4.210	± 100
	-10	13.5600159	-6.261	13.5600159	-6.260	13.5600154	-6.223	13.5600145	-6.159	± 100
	-20	13.5600016	-5.210	13.5600051	-5.461	13.5600080	-5.682	13.5600107	-5.877	± 100
3.23	20	13.5599503	-1.422	13.5599489	-1.318	13.5599495	-1.367	13.5599502	-1.418	± 100
4.37	20	13.5599478	-1.241	13.5599481	-1.259	13.5599473	-1.203	13.5599465	-1.142	± 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	13.5598844	4.121	13.5598838	4.166	13.5598834	4.196	13.5598833	4.202	± 100
	40	13.5598983	3.096	13.5598961	3.256	13.5598940	3.414	13.5598920	3.560	± 100
	30	13.5599238	1.215	13.5599208	1.435	13.5599177	1.665	13.5599149	1.874	± 100
	20	13.5599403	0.000	13.5599409	-0.044	13.5599413	-0.076	13.5599417	-0.102	± 100
	10	13.5599316	0.643	13.5599421	-0.135	13.5599537	-0.985	13.5599647	-1.800	± 100
	0	13.5599882	-3.534	13.5599925	-3.852	13.5599970	-4.181	13.5600008	-4.459	± 100
	-10	13.5600137	-5.412	13.5600155	-5.547	13.5600170	-5.659	13.5600181	-5.741	± 100
	-20	13.5600176	-5.699	13.5600161	-5.592	13.5600143	-5.460	13.5600123	-5.311	± 100
3.23	20	13.5599387	0.120	13.5599431	-0.207	13.5599479	-0.560	13.5599526	-0.910	± 100
4.37	20	13.5599338	0.478	13.5599316	0.640	13.5599299	0.770	13.5599283	0.887	± 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

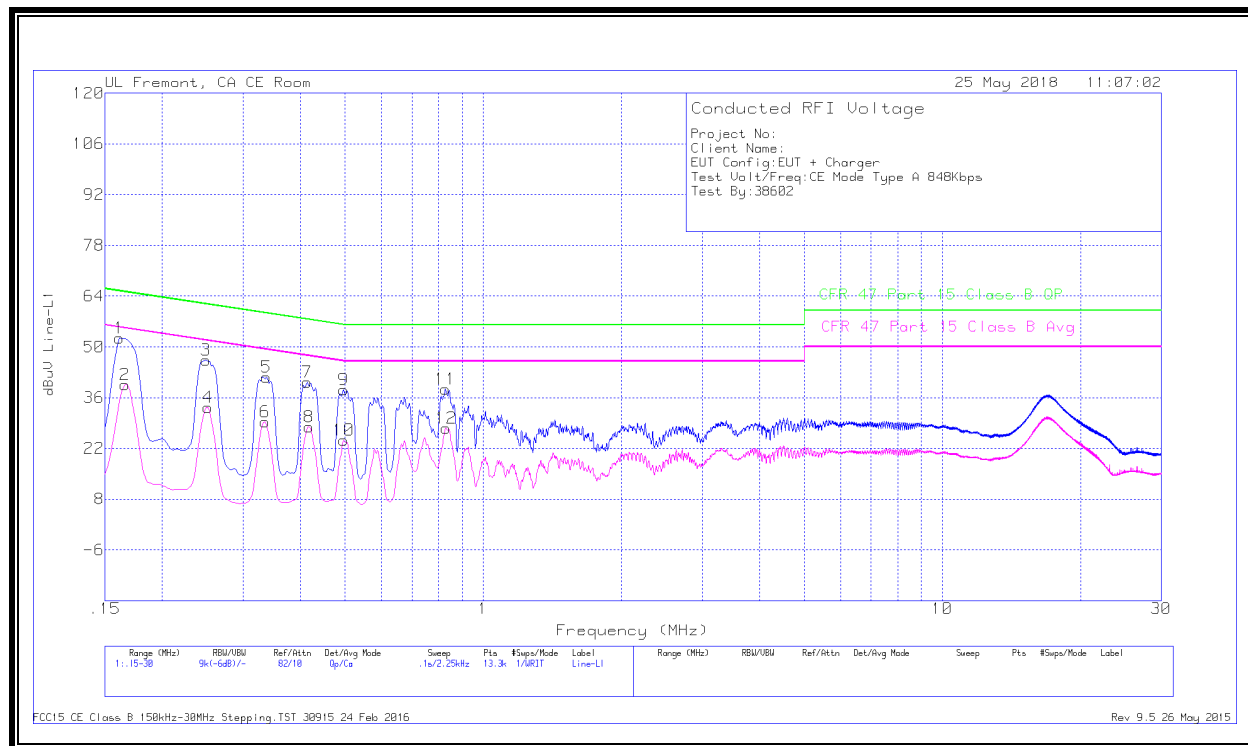
RESULTS

No non-compliance noted:

10.1. CE MODE

10.1.1. NORMAL OPERATION WITH ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS



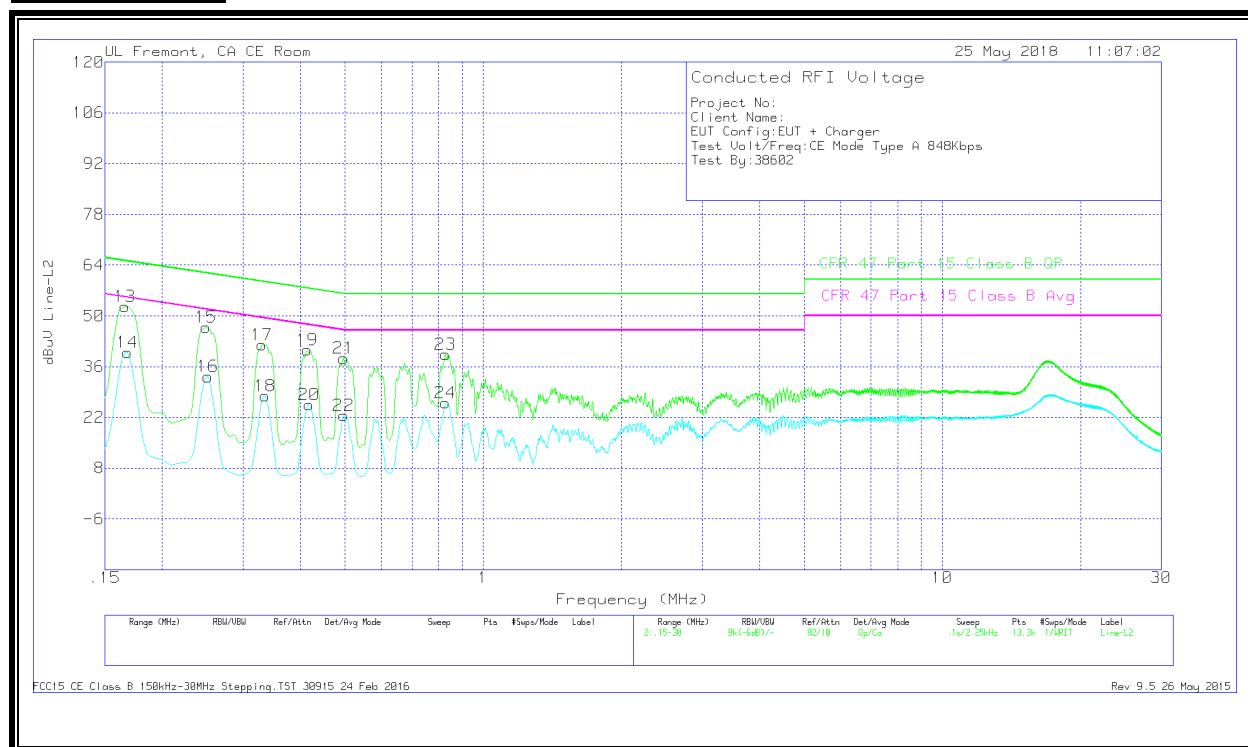
WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.16125	42.17	Qp	.1	0	10.1	52.37	65.4	-13.03	-	-
2	.16575	29.4	Ca	.1	0	10.1	39.6	-	-	55.17	-15.57
3	.249	36.29	Qp	0	0	10.1	46.39	61.79	-15.4	-	-
4	.25125	23.26	Ca	0	0	10.1	33.36	-	-	51.72	-18.36
5	.33675	31.63	Qp	0	0	10.1	41.73	59.28	-17.55	-	-
6	.3345	19.26	Ca	0	0	10.1	29.36	-	-	49.34	-19.98
7	.41325	30.17	Qp	0	0	10.1	40.27	57.58	-17.31	-	-
8	.41775	17.86	Ca	0	0	10.1	27.96	-	-	47.49	-19.53
9	.4965	28.04	Qp	0	0	10.1	38.14	56.06	-17.92	-	-
10	.4965	14.11	Ca	0	0	10.1	24.21	-	-	46.06	-21.85
11	.82725	28.31	Qp	0	0	10.1	38.41	56	-17.59	-	-
12	.8295	17.52	Ca	0	0	10.1	27.62	-	-	46	-18.38

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



WORST EMISSIONS

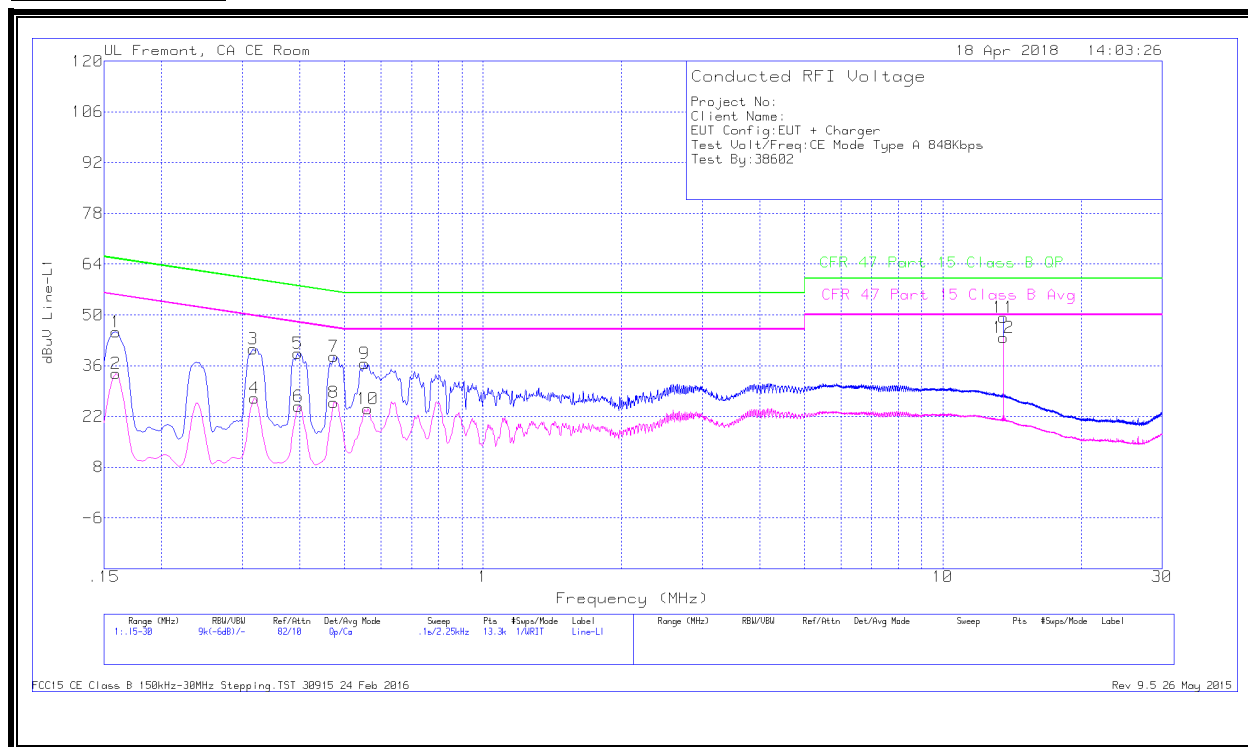
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.16575	42.55	Qp	0	0	10.1	52.65	65.17	-12.52	-	-
14	.168	29.82	Ca	0	0	10.1	39.92	-	-	55.06	-15.14
15	.249	36.7	Qp	0	0	10.1	46.8	61.79	-14.99	-	-
16	.25125	23.13	Ca	0	0	10.1	33.23	-	-	51.72	-18.49
17	.33	31.91	Qp	0	0	10.1	42.01	59.45	-17.44	-	-
18	.3345	17.76	Ca	0	0	10.1	27.86	-	-	49.34	-21.48
19	.41325	30.57	Qp	0	0	10.1	40.67	57.58	-16.91	-	-
20	.41775	15.44	Ca	0	0	10.1	25.54	-	-	47.49	-21.95
21	.4965	28.17	Qp	0	0	10.1	38.27	56.06	-17.79	-	-
22	.4965	12.45	Ca	0	0	10.1	22.55	-	-	46.06	-23.51
23	.82725	29.37	Qp	0	0	10.1	39.47	56	-16.53	-	-
24	.82725	15.86	Ca	0	0	10.1	25.96	-	-	46	-20.04

Qp - Quasi-Peak detector

Ca - CISPR average detection

10.1.2. NORMAL OPERATION WITHOUT ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS



WORST EMISSIONS

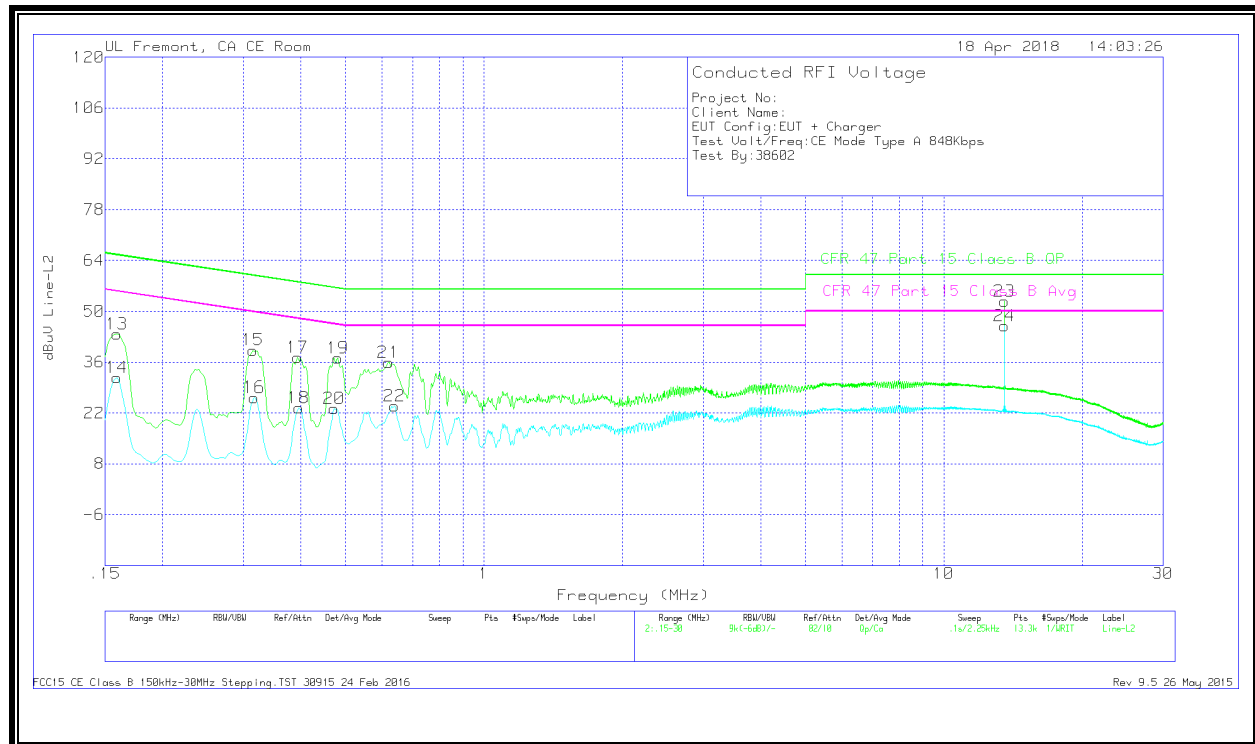
Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.159	35.17	Qp	.1	0	10.1	45.37	65.52	-20.15	-	-
2	.159	23.6	Ca	.1	0	10.1	33.8	-	-	55.52	-21.72
3	.3165	30.58	Qp	0	0	10.1	40.68	59.8	-19.12	-	-
4	.31875	16.96	Ca	0	0	10.1	27.06	-	-	49.74	-22.68
5	.39525	29.27	Qp	0	0	10.1	39.37	57.95	-18.58	-	-
6	.3975	14.62	Ca	0	0	10.1	24.72	-	-	47.91	-23.19
7	.474	28.41	Qp	0	0	10.1	38.51	56.44	-17.93	-	-
8	.474	15.79	Ca	0	0	10.1	25.89	-	-	46.44	-20.55
9	.55275	26.52	Qp	0	0	10.1	36.62	56	-19.38	-	-
10	.56175	13.93	Ca	0	0	10.1	24.03	-	-	46	-21.97
11	13.56	38.81	Qp	.1	.2	10.2	49.31	60	-10.69	-	-
12	13.56	33.22	Ca	.1	.2	10.2	43.72	-	-	50	-6.28

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	.159	33.66	Qp	0	0	10.1	43.76	65.52	-21.76	-	-
14	.159	21.66	Ca	0	0	10.1	31.76	-	-	55.52	-23.76
15	.31425	29.21	Qp	0	0	10.1	39.31	59.86	-20.55	-	-
16	.3165	16.17	Ca	0	0	10.1	26.27	-	-	49.8	-23.53
17	.393	27.18	Qp	0	0	10.1	37.28	58	-20.72	-	-
18	.39525	13.23	Ca	0	0	10.1	23.33	-	-	47.95	-24.62
19	.48075	27.03	Qp	0	0	10.1	37.13	56.33	-19.2	-	-
20	.47175	13.07	Ca	0	0	10.1	23.17	-	-	46.48	-23.31
21	.62025	25.84	Qp	0	0	10.1	35.94	56	-20.06	-	-
22	.63825	13.79	Ca	0	0	10.1	23.89	-	-	46	-22.11
23	13.56	42.2	Qp	.1	.2	10.2	52.7	60	-7.3	-	-
24	13.56	35.49	Ca	.1	.2	10.2	45.99	-	-	50	-4.01

Qp - Quasi-Peak detector

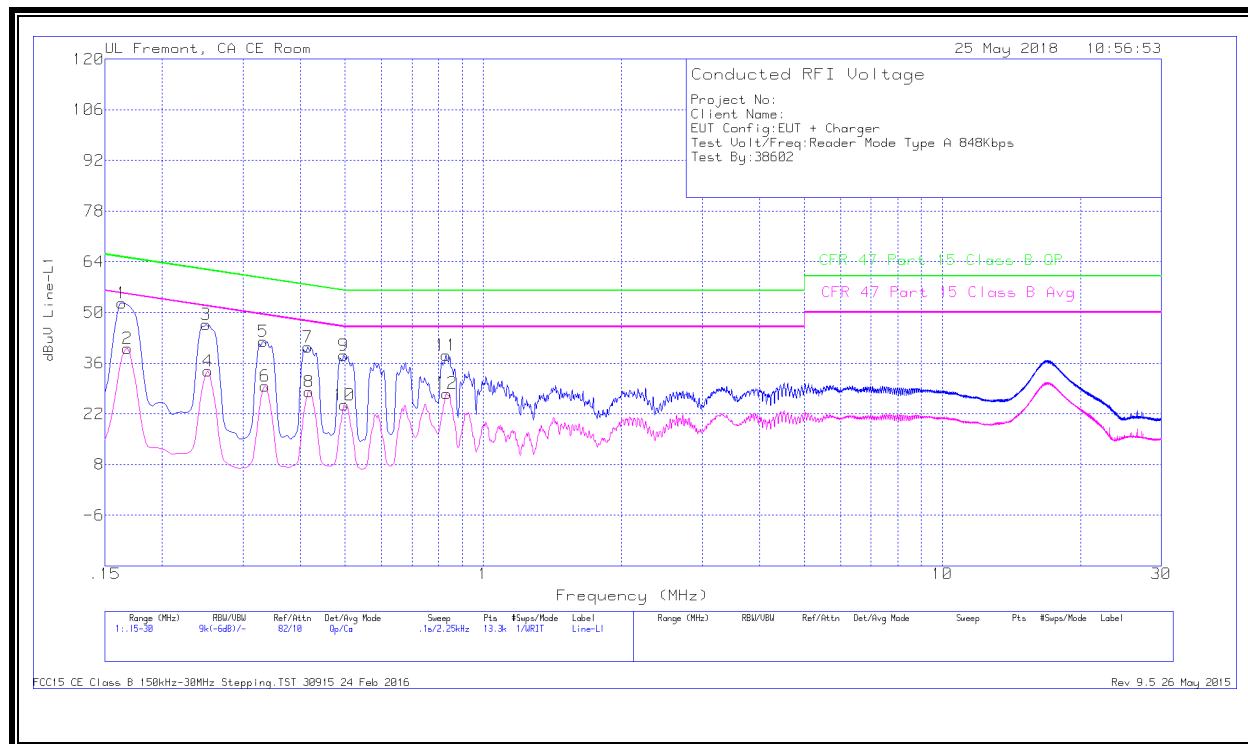
Ca - CISPR average detection

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

10.2. READER MODE

10.2.1. NORMAL OPERATION WITH ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS



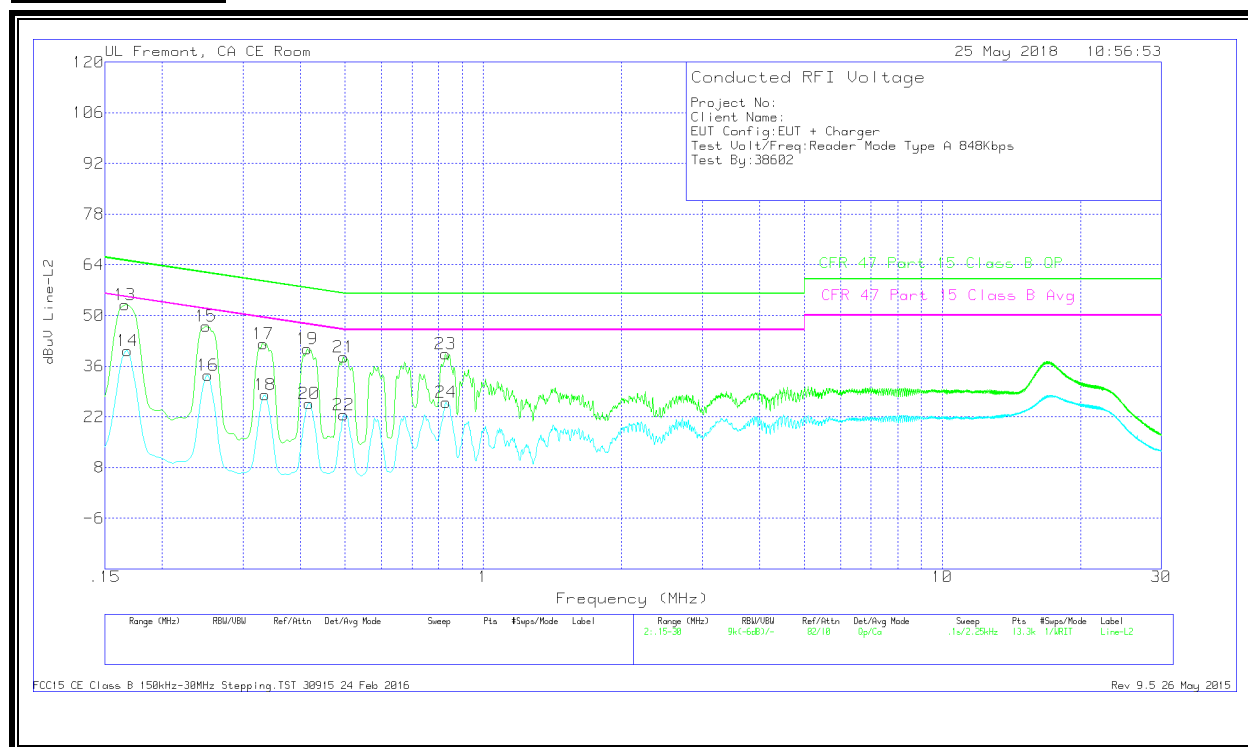
WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.1635	42.34	Qp	.1	0	10.1	52.54	65.28	-12.74	-	-
2	.168	29.82	Ca	.1	0	10.1	40.02	-	-	55.06	-15.04
3	.249	36.58	Qp	0	0	10.1	46.68	61.79	-15.11	-	-
4	.25125	23.69	Ca	0	0	10.1	33.79	-	-	51.72	-17.93
5	.33225	31.98	Qp	0	0	10.1	42.08	59.39	-17.31	-	-
6	.3345	19.54	Ca	0	0	10.1	29.64	-	-	49.34	-19.7
7	.4155	30.3	Qp	0	0	10.1	40.4	57.54	-17.14	-	-
8	.41775	18.01	Ca	0	0	10.1	28.11	-	-	47.49	-19.38
9	.4965	28.01	Qp	0	0	10.1	38.11	56.06	-17.95	-	-
10	.49875	14.29	Ca	0	0	10.1	24.39	-	-	46.02	-21.63
11	.8295	28.11	Qp	0	0	10.1	38.21	56	-17.79	-	-
12	.83175	17.56	Ca	0	0	10.1	27.66	-	-	46	-18.34

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



WORST EMISSIONS

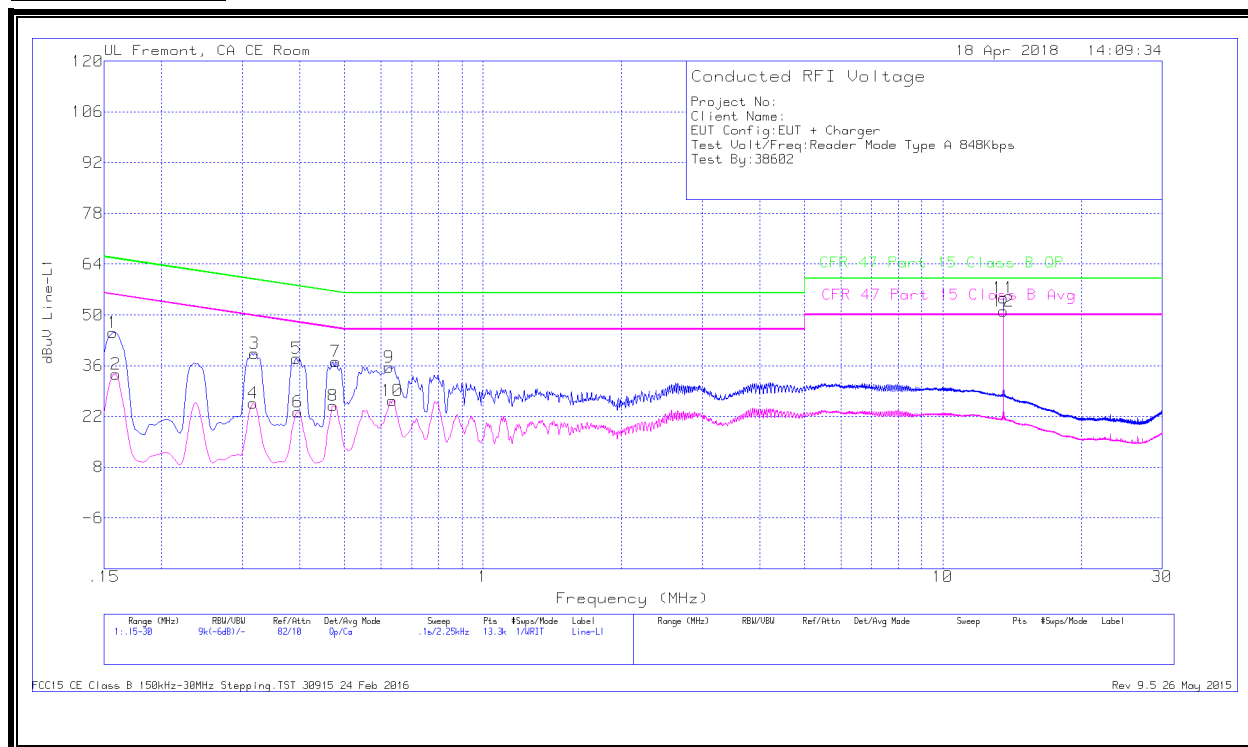
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.16575	42.8	Qp	0	0	10.1	52.9	65.17	-12.27	-	-
14	.168	30.2	Ca	0	0	10.1	40.3	-	-	55.06	-14.76
15	.249	36.97	Qp	0	0	10.1	47.07	61.79	-14.72	-	-
16	.25125	23.46	Ca	0	0	10.1	33.56	-	-	51.72	-18.16
17	.33225	32.14	Qp	0	0	10.1	42.24	59.39	-17.15	-	-
18	.3345	18.02	Ca	0	0	10.1	28.12	-	-	49.34	-21.22
19	.41325	30.67	Qp	0	0	10.1	40.77	57.58	-16.81	-	-
20	.41775	15.6	Ca	0	0	10.1	25.7	-	-	47.49	-21.79
21	.4965	28.4	Qp	0	0	10.1	38.5	56.06	-17.56	-	-
22	.4965	12.49	Ca	0	0	10.1	22.59	-	-	46.06	-23.47
23	.82725	29.37	Qp	0	0	10.1	39.47	56	-16.53	-	-
24	.8295	15.86	Ca	0	0	10.1	25.96	-	-	46	-20.04

Qp - Quasi-Peak detector

Ca - CISPR average detection

10.2.2. NORMAL OPERATION WITHOUT ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS



WORST EMISSIONS

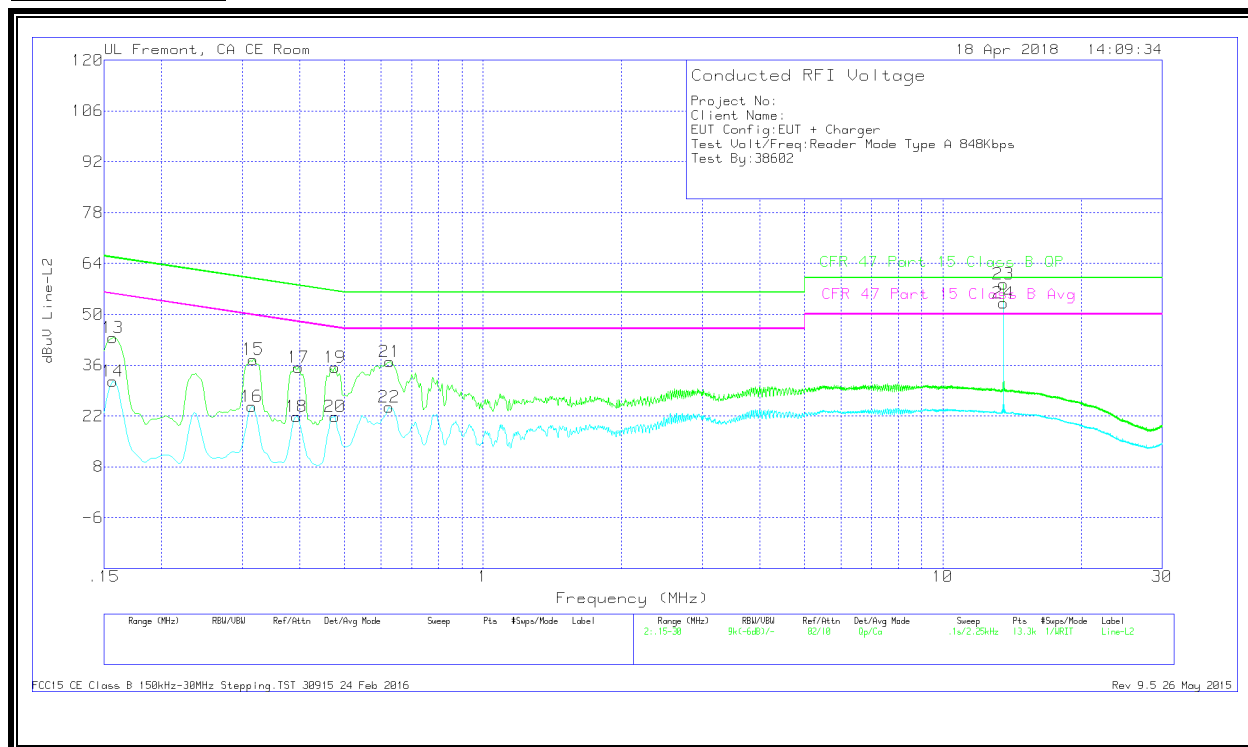
Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.15675	35.01	Qp	.1	0	10.1	45.21	65.63	-20.42	-	-
2	.159	23.52	Ca	.1	0	10.1	33.72	-	-	55.52	-21.8
3	.31875	29.27	Qp	0	0	10.1	39.37	59.74	-20.37	-	-
4	.3165	15.6	Ca	0	0	10.1	25.7	-	-	49.8	-24.1
5	.393	27.88	Qp	0	0	10.1	37.98	58	-20.02	-	-
6	.39525	13.14	Ca	0	0	10.1	23.24	-	-	47.95	-24.71
7	.4785	26.97	Qp	0	0	10.1	37.07	56.37	-19.3	-	-
8	.47175	14.89	Ca	0	0	10.1	24.99	-	-	46.48	-21.49
9	.62475	25.53	Qp	0	0	10.1	35.63	56	-20.37	-	-
10	.636	16.2	Ca	0	0	10.1	26.3	-	-	46	-19.7
11	13.56	44.18	Qp	.1	.2	10.2	54.68	60	-5.32	-	-
12	13.56	40.58	Ca	.1	.2	10.2	51.08	-	-	50	1.08

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	33.41	Qp	0	0	10.1	43.51	65.63	-22.12	-	-
14	.15675	21.41	Ca	0	0	10.1	31.51	-	-	55.63	-24.12
15	.3165	27.47	Qp	0	0	10.1	37.57	59.8	-22.23	-	-
16	.31425	14.58	Ca	0	0	10.1	24.68	-	-	49.86	-25.18
17	.3975	25.33	Qp	0	0	10.1	35.43	57.91	-22.48	-	-
18	.393	11.68	Ca	0	0	10.1	21.78	-	-	48	-26.22
19	.47625	25.37	Qp	0	0	10.1	35.47	56.4	-20.93	-	-
20	.47625	11.81	Ca	0	0	10.1	21.91	-	-	46.4	-24.49
21	.627	26.91	Qp	0	0	10.1	37.01	56	-18.99	-	-
22	.62475	14.31	Ca	0	0	10.1	24.41	-	-	46	-21.59
23	13.56	47.79	Qp	.1	.2	10.2	58.29	60	-1.71	-	-
24	13.56	42.64	Ca	.1	.2	10.2	53.14	-	-	50	3.14

Qp - Quasi-Peak detector

Ca - CISPR average detection

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

END OF REPORT

11. SETUP PHOTOS

Please refer to 12124122-EP1V1 for setup photos