



CERTIFICATION TEST REPORT

Report Number. : 12124121-E11V3

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

Model : A1920, A2099, A2100

FCC ID : BCG-E3218A

IC : 579C-E3218A

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	7/2/2018	Initial Issue	Chin Pang
V2	7/05/2018	Address TCB's Question	Chin Pang
V3	8/10/2018	Address TCB's Question	Jingang Li

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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: A1920, A2099, A2100

SERIAL NUMBER: C39WF004JVX8

DATE TESTED: MARCH 22, 2018– MAY 31, 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.

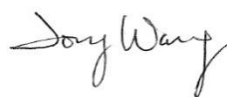
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. 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 is 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 A2099, A2100 is electrically identical to Model A1920. Three model numbers are allocated for marketing and logistic purposes only. A1920 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	21.11
		Reader	848	21.52

5.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was v16.30.67.7

5.5. 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 power supply and earphones. The worst case was determined to be the EUT with AC/DC adapter; 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

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Apple	Mac Book Pro	HRP007154	FCC Doc
Laptop AC/DC Adapter	Apple	A1343	ADP-85EBT V85	n/a
EUT AC/DC Adapter	Apple	A1385	D292365B2FQDHLHC7	n/a

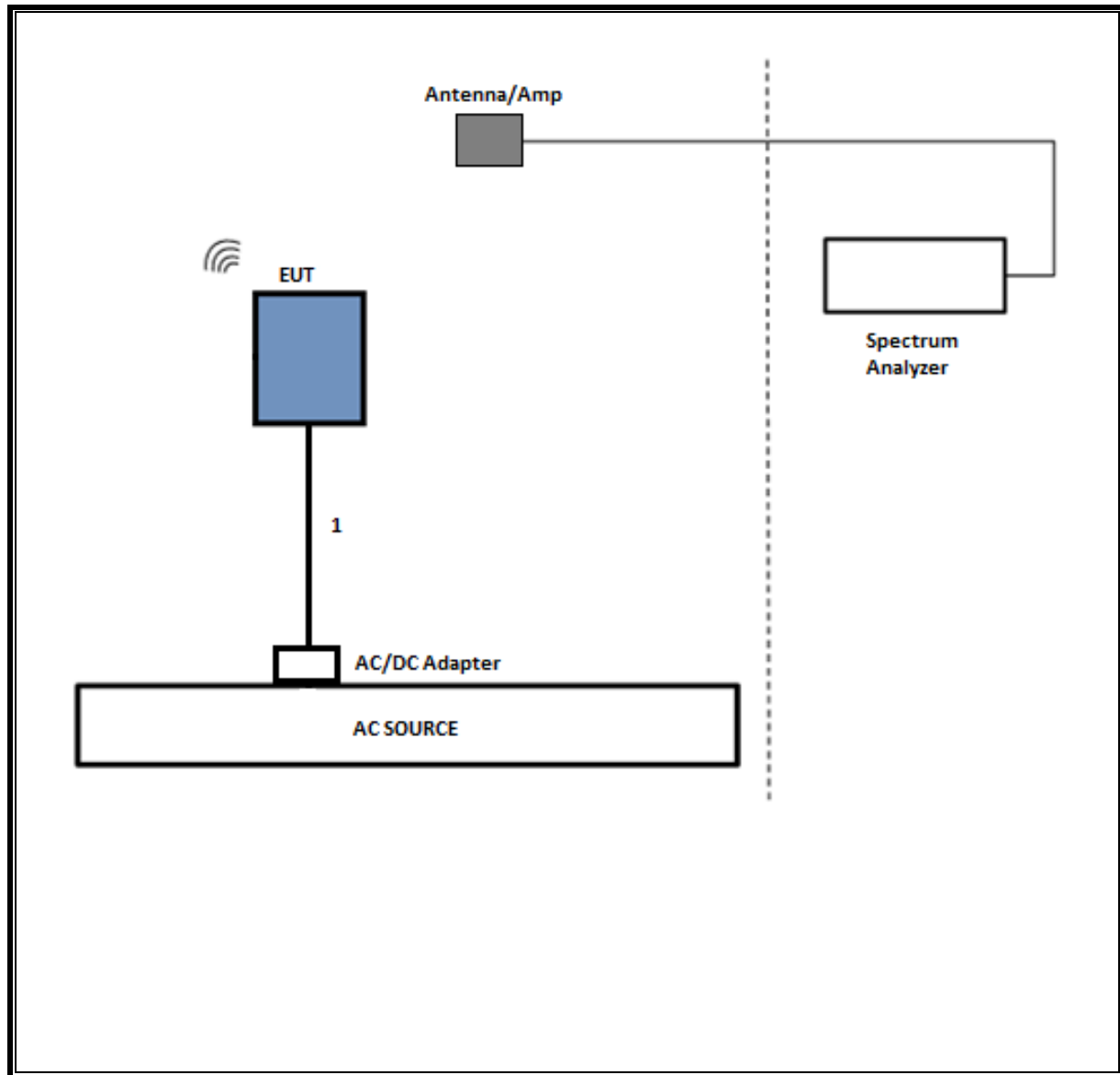
I/O CABLES

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

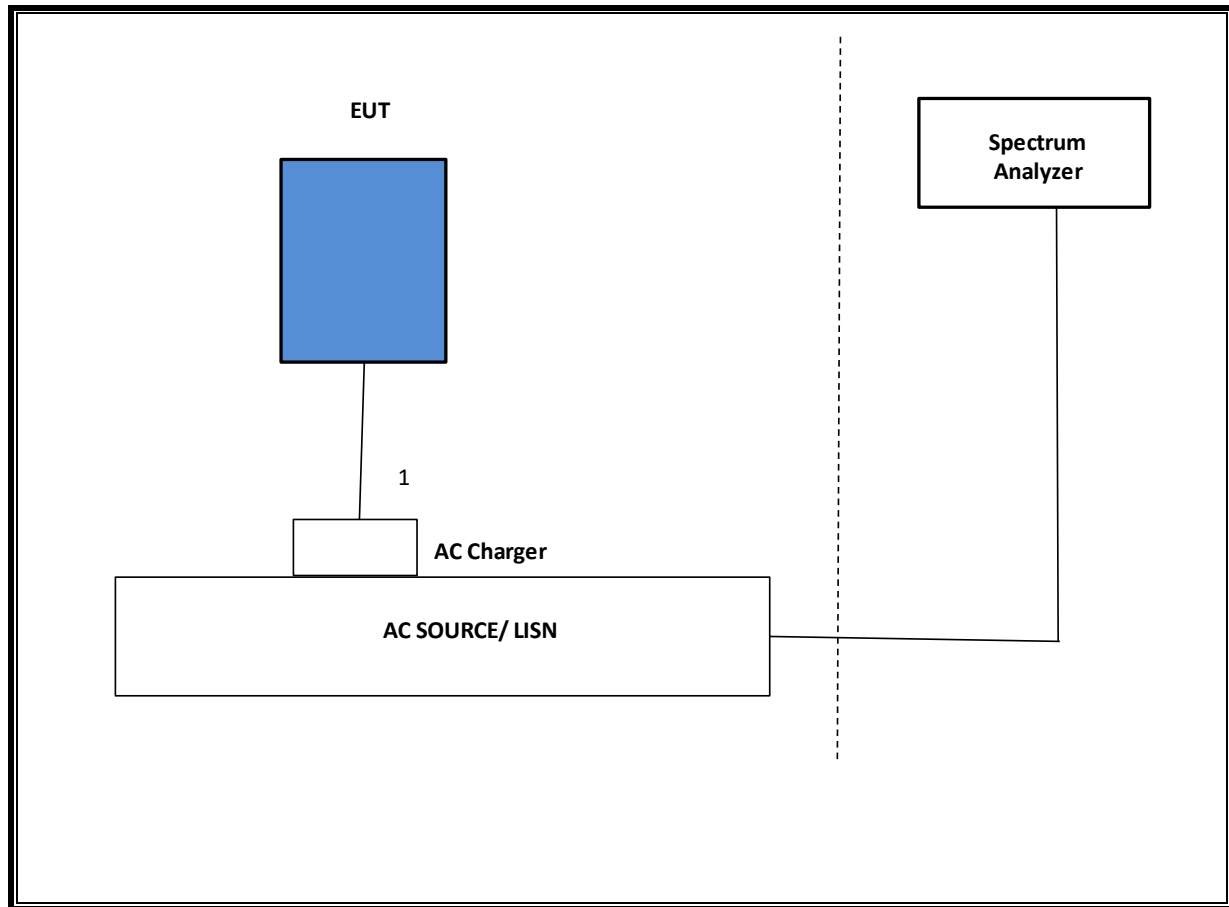
TEST SETUP

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	T122	03/08/2019
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-30MHz	ETS-Lindgren	6502	T1683	02/21/2019
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
Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent (Keysight) Technologies	E4446A	T177	04/12/2019
AC Line Conducted				
EMI Test Receiver 9KHz-7GHz	Rohde & Schwarz	ESCI7	T1436	01/25/2019
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/15/2018
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: * indicates automation software version used in the compliance certification testing

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

ID:	38602	Date:	4/12/18
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99% and 20dB BW

CE MODE

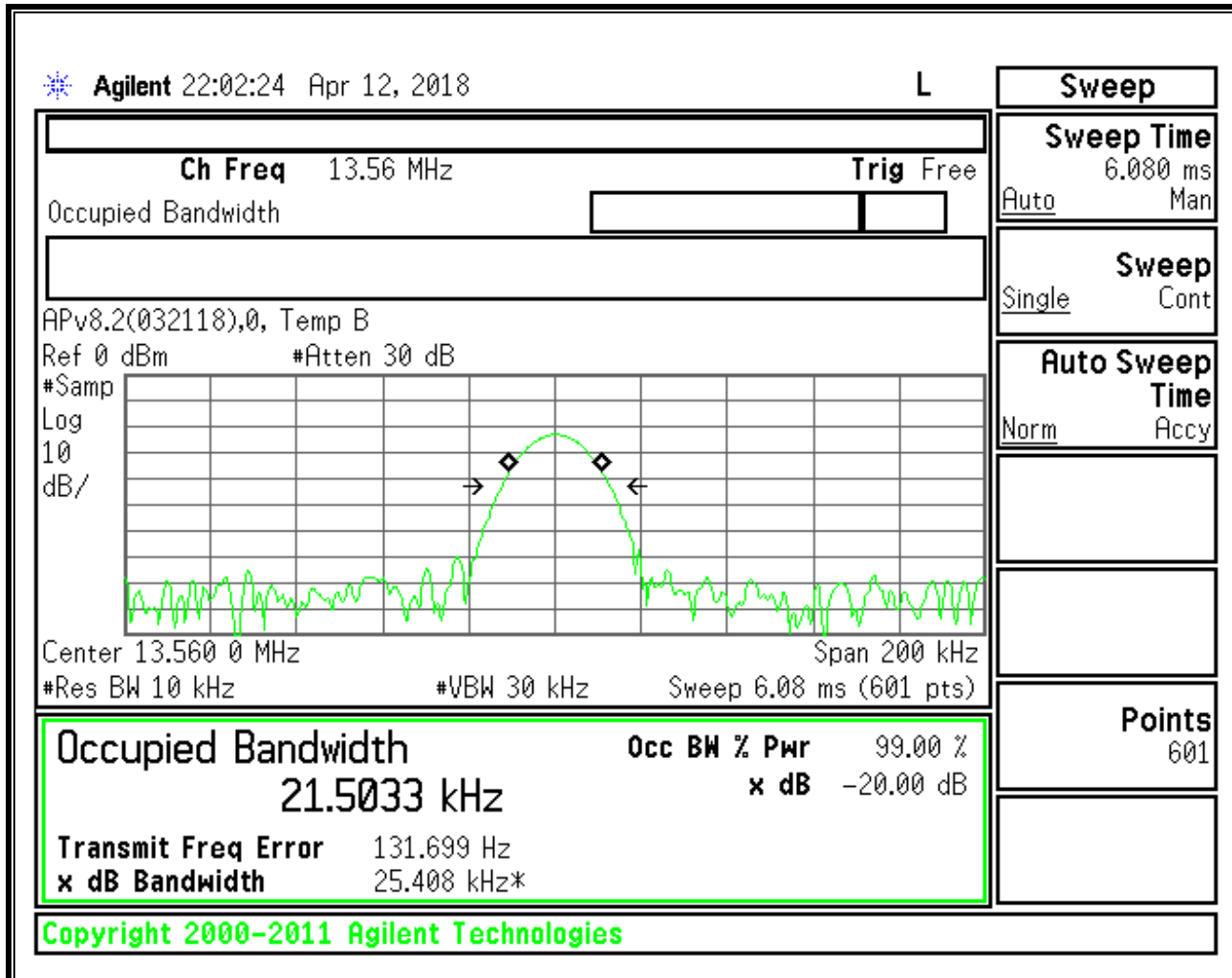
Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	21.503	25.408

READER MODE

Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	21.7453	25.181

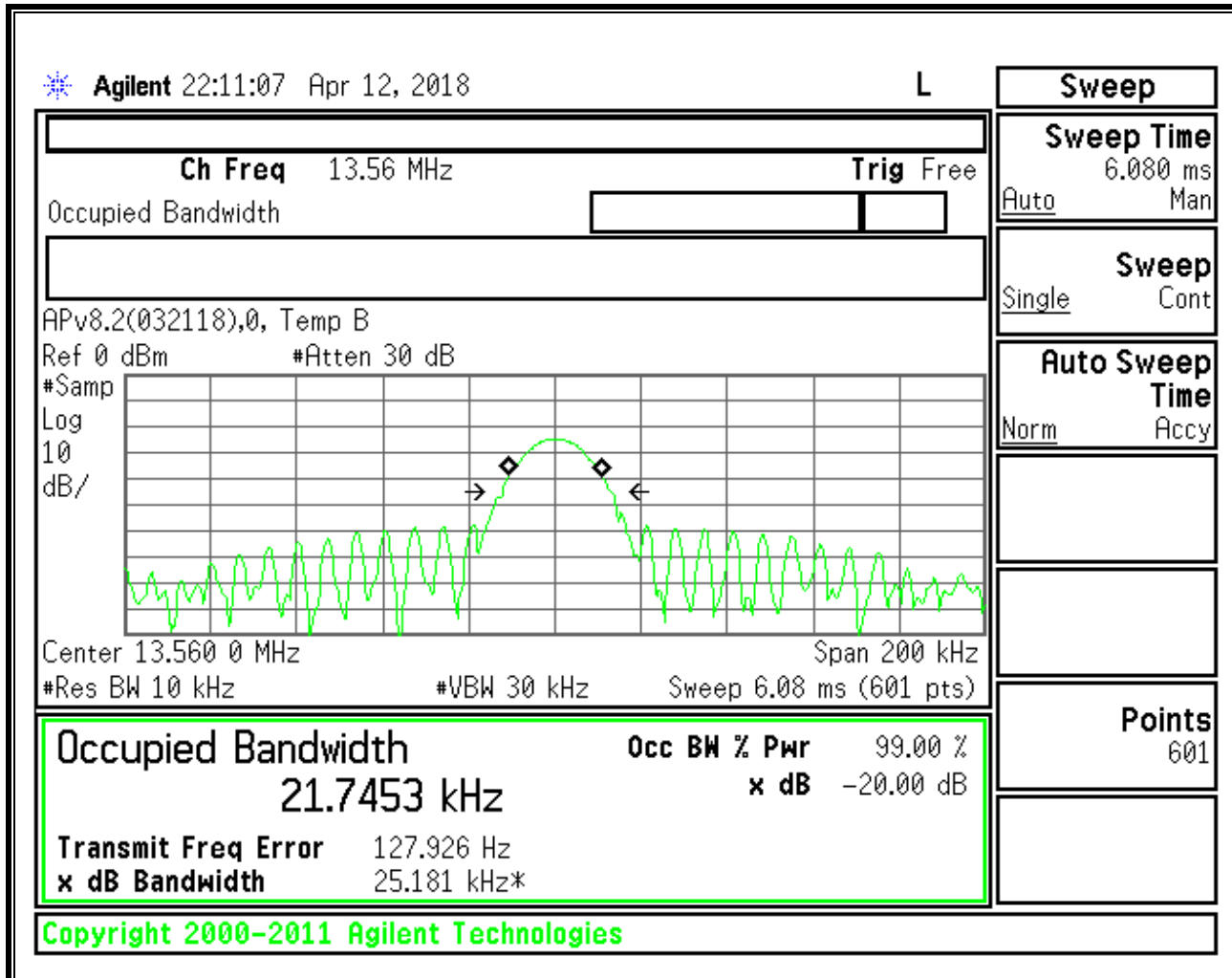
7.1. CE MODE

848Kbps



7.2. READER MODE

848Kbps



8. RADIATED EMISSION TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMIT

§15.225

IC RSS-210, Annex B.6

IC RSS-GEN, Section 8.9 (Transmitter)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (µV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100**	3
88 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the field strength from µV/m to dBµV/m is:

Limit (dBµV/m) = 20 log limit (µV/m)

In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

TEST PROCEDURE

ANSI C63.10, 2013

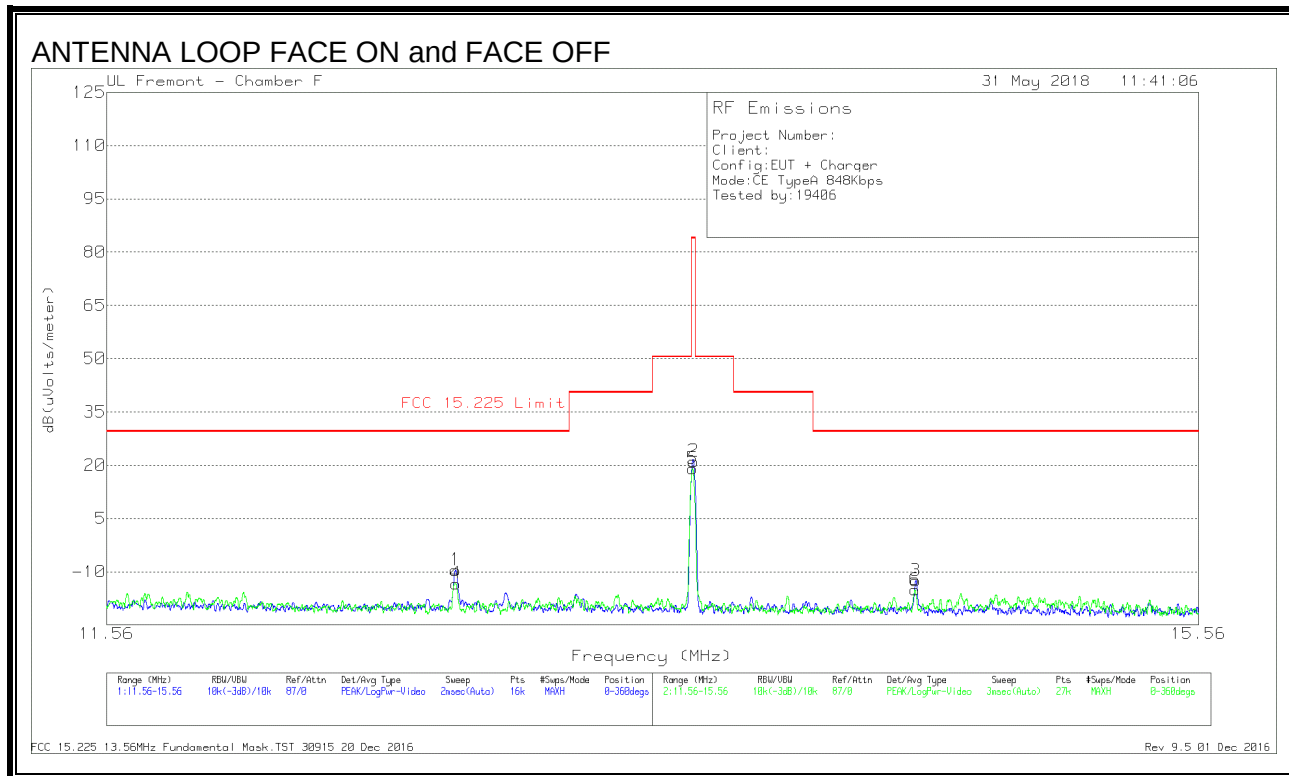
The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the 10th harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater.

RESULTS

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

8.2.1. CE MODE

FUNDAMENTAL 848Kbps

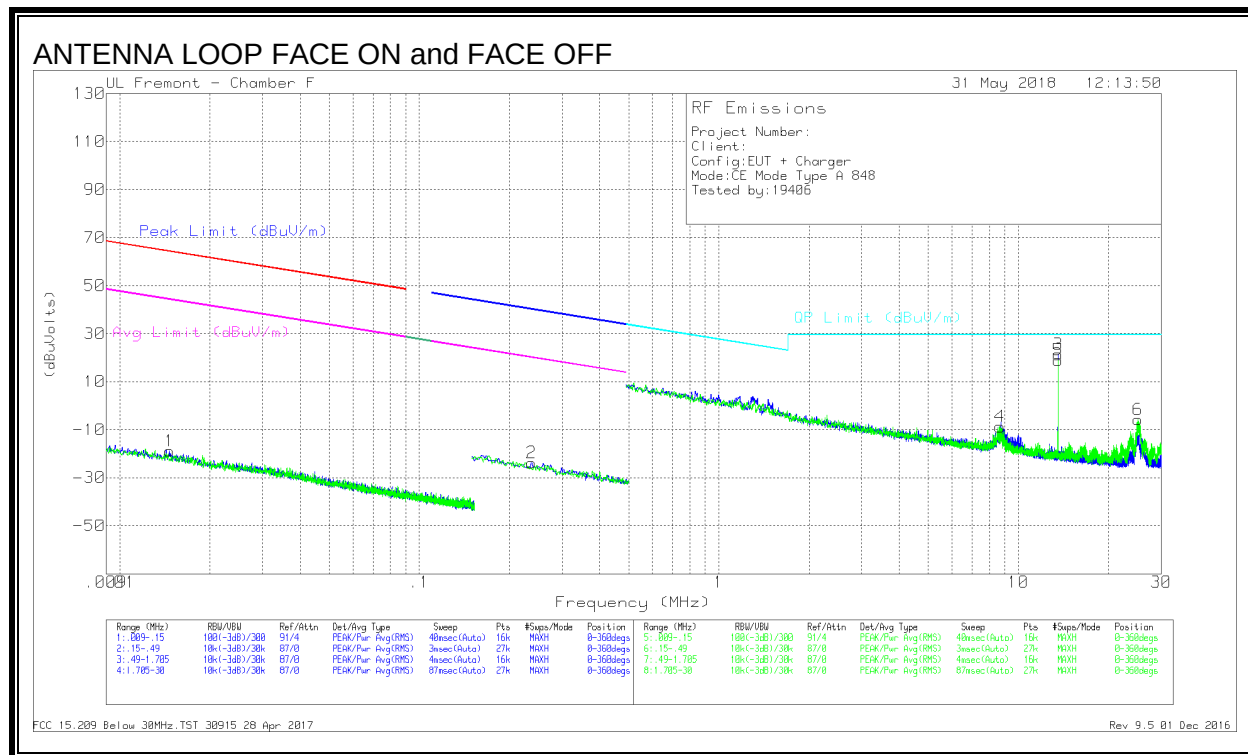


DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
1	12.71163	19.72	Pk	10.4	.4	-40	-9.48	29.54	-39.02	0-360
2	13.562	50.41	Pk	10.3	.4	-40	21.11	84	-62.89	0-360
3	14.40763	16.89	Pk	10.2	.4	-40	-12.51	29.54	-42.05	0-360
4	12.71225	15.89	Pk	10.4	.4	-40	-13.31	29.54	-42.85	0-360
5	13.55793	48.33	Pk	10.3	.4	-40	19.03	84	-64.97	0-360
6	14.4036	14.31	Pk	10.2	.4	-40	-15.09	29.54	-44.63	0-360

Pk - Peak detector

SPURIOUS EMISSION 848Kbps



DATA

Marker	Frequen cy (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	Correcte d Reading (dBuV/m)	Peak Limit (dBuV/ m)	Margin (dB)	Avg Limit (dBuV/ m)	Margin (dB)	Azimuth (Degs)
1	.01466	43.51	Pk	17.6	0	-80	-18.89	64.26	-83.15	44.26	-63.15	0-360
2	.2373	44.61	Pk	11.5	.1	-80	-23.79	40.11	-63.9	20.11	-43.9	0-360

Pk - Peak detector

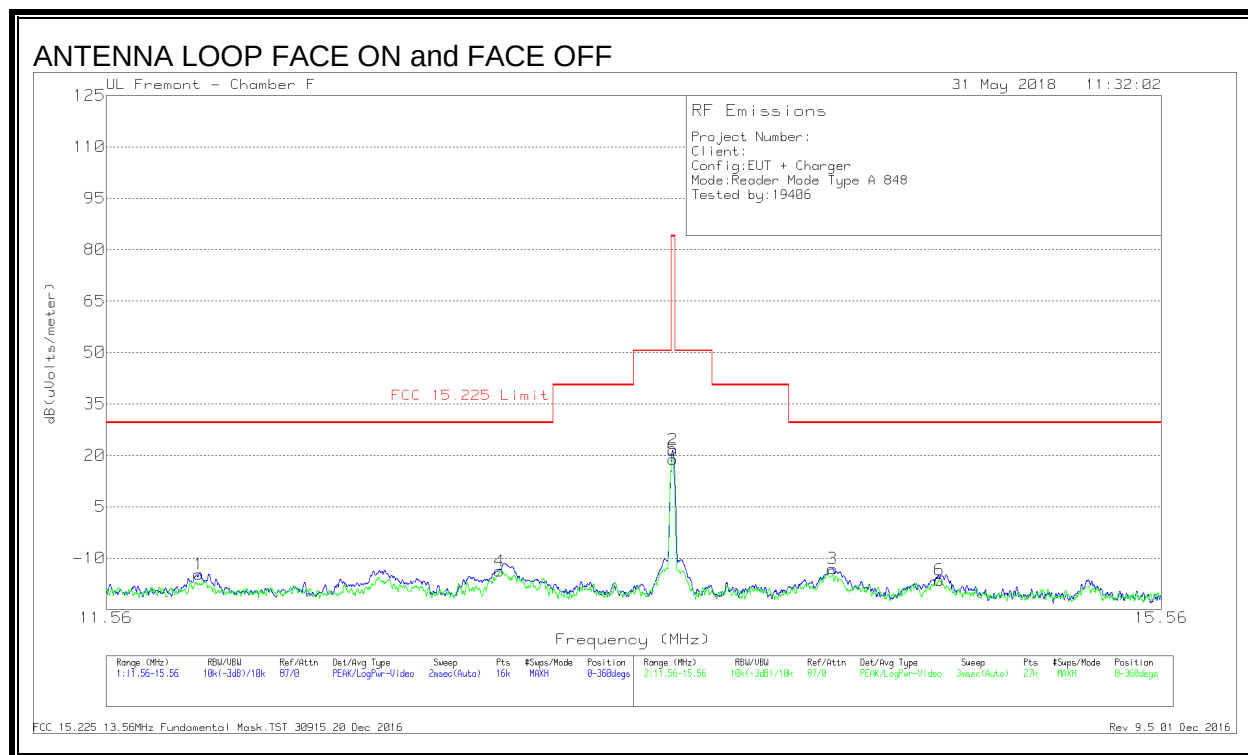
Marker	Frequenc y (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	8.68258	20.06	Pk	10.9	.3	-40	-8.74	29.5	-38.24	0-360
6	25.05234	24.79	Pk	8.8	.6	-40	-5.81	29.5	-35.31	0-360

Pk - Peak detector

Note: Marker 3 & 5 are the fundamental signal.

8.2.2. READER MODE

FUNDAMENTAL 848Kbps

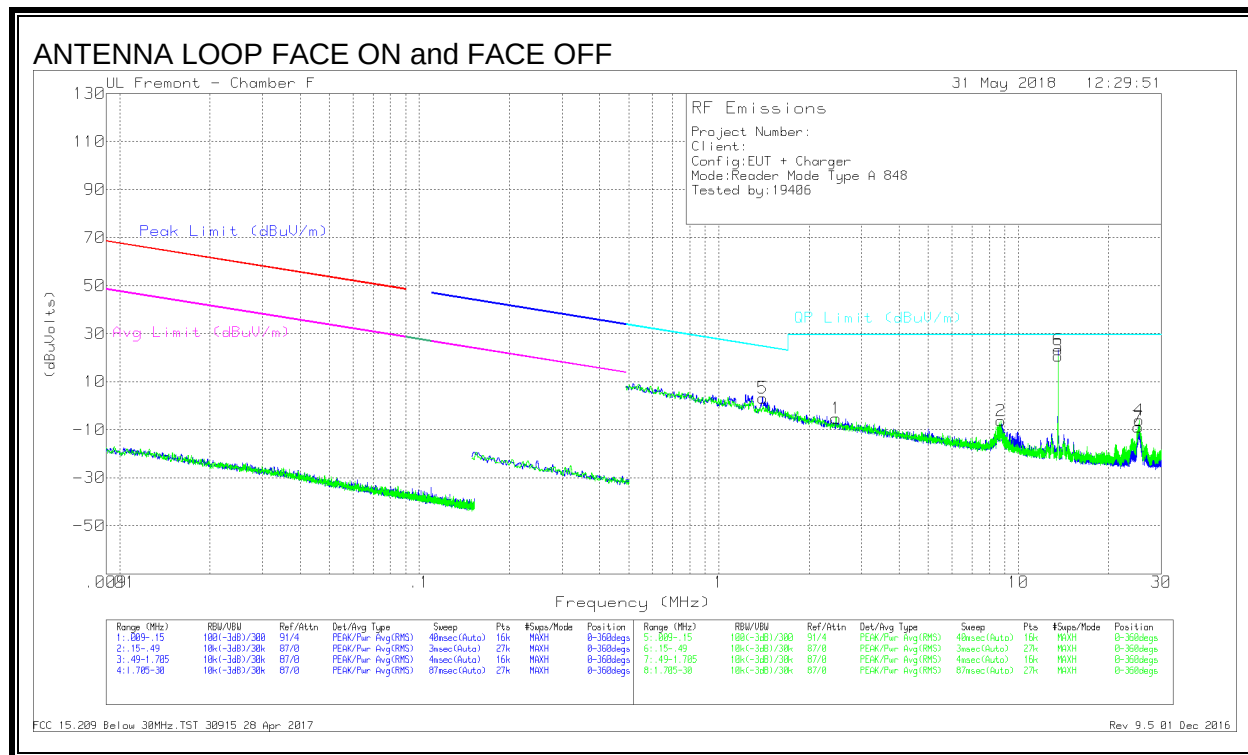


DATA

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	11.86625	14.42	Pk	10.5	.4	-40	-14.68	29.54	-44.22	0-360
2	13.56	50.82	Pk	10.3	.4	-40	21.52	84	-62.48	0-360
3	14.18463	16.33	Pk	10.2	.4	-40	-13.07	29.54	-42.61	0-360
4	12.91524	15.43	Pk	10.4	.4	-40	-13.77	29.54	-43.31	0-360
5	13.56007	48.11	Pk	10.3	.4	-40	18.81	84	-65.19	0-360
6	14.61761	13.1	Pk	10.1	.4	-40	-16.4	29.54	-45.94	0-360

Pk - Peak detector

SPURIOUS EMISSION 848Kbps



DATA

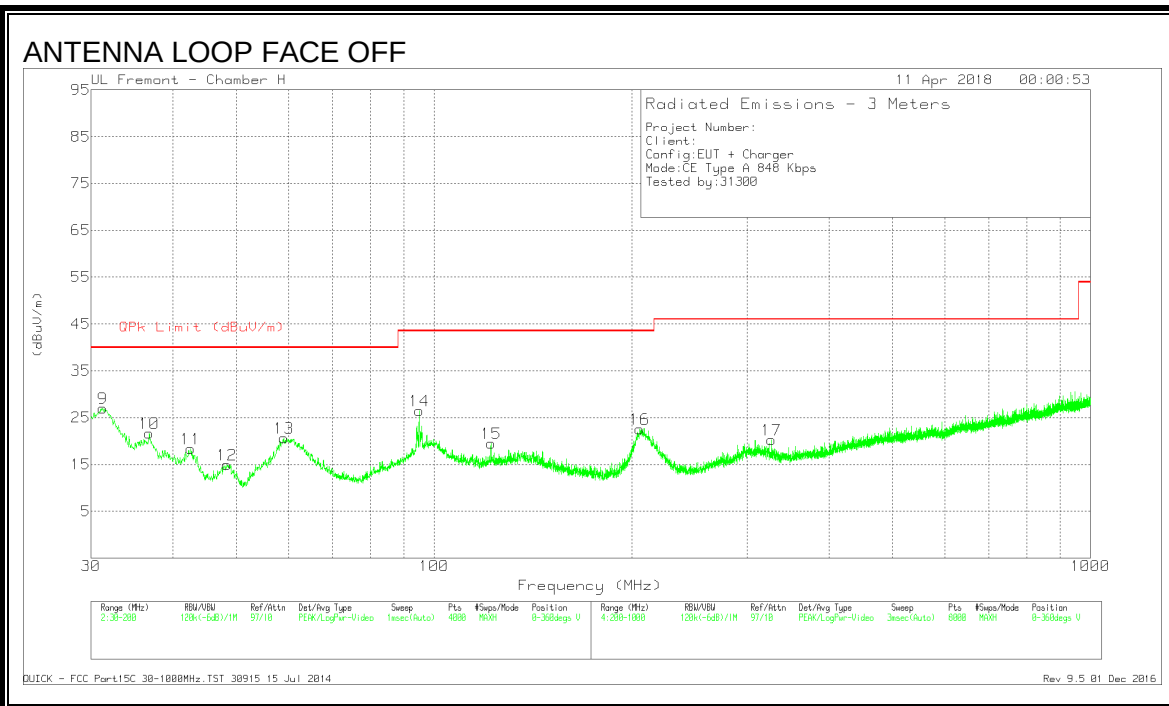
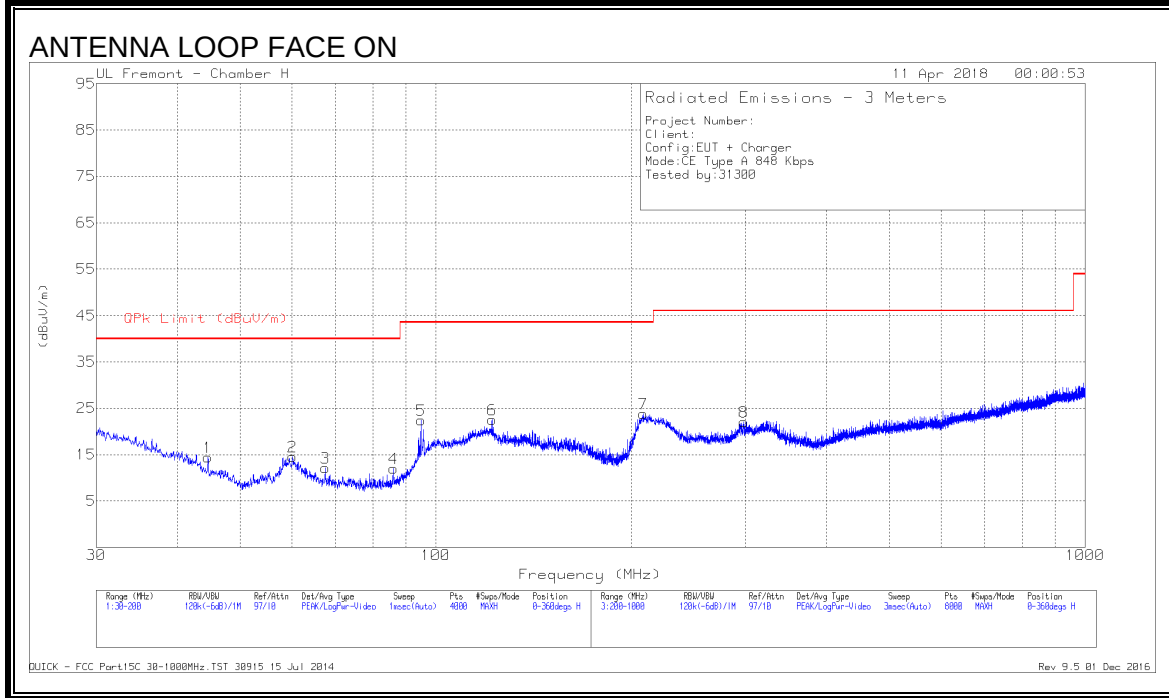
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 40Log (dB)	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
5	1.40185	31.47	Pk	11.6	.1	-40	3.17	24.7	-21.53	0-360
7	25.1299	21.7	Pk	8.8	.6	-40	-8.9	29.5	-38.4	0-360
1	2.4627	22.83	Pk	11.7	.2	-40	-5.27	29.5	-34.77	0-360
2	8.74704	22.47	Pk	10.9	.3	-40	-6.33	29.5	-35.83	0-360
4	25.33897	24.6	Pk	8.7	.6	-40	-6.1	29.5	-35.6	0-360

**marker 3 and 6 are the fundamental signal.

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

8.3.1. CE Mode

SPURIOUS EMISSION 848Kbps



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T122 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	* 122.0363	35.17	Pk	17.7	-30.3	22.57	43.52	-20.95	0-360	100	H
15	* 122.0576	32.07	Pk	17.7	-30.3	19.47	43.52	-24.05	0-360	100	V
17	* 326.8165	31.36	Pk	17.9	-29	20.26	46.02	-25.76	0-360	100	V
9	31.2753	35.4	Pk	22.9	-31.3	27	40	-13	0-360	100	V
10	36.8018	33.02	Pk	19.8	-31.2	21.62	40	-18.38	0-360	100	V
11	42.5833	33.15	Pk	16.4	-31.2	18.35	40	-21.65	0-360	100	V
1	44.5813	30.34	Pk	15.2	-31.1	14.44	40	-25.56	0-360	100	H
12	48.3222	33.06	Pk	12.9	-31	14.96	40	-25.04	0-360	100	V
13	58.9925	40.11	Pk	11.4	-30.9	20.61	40	-19.39	0-360	100	V
2	60.1616	34.14	Pk	11.3	-30.9	14.54	40	-25.46	0-360	100	H
3	67.5797	31.15	Pk	11.8	-30.8	12.15	40	-27.85	0-360	100	H
4	86.1145	31	Pk	11.6	-30.6	12	40	-28	0-360	100	H
5	94.9143	40.23	Pk	12.8	-30.6	22.43	43.52	-21.09	0-360	100	H
14	94.9143	44.34	Pk	12.8	-30.6	26.54	43.52	-16.98	0-360	100	V
16	205.6007	36.94	Pk	15.3	-29.7	22.54	43.52	-20.98	0-360	100	V
7	208.6011	38.98	Pk	14.6	-29.7	23.88	43.52	-19.64	0-360	100	H
8	297.8127	34	Pk	17.2	-29.1	22.1	46.02	-23.92	0-360	100	H

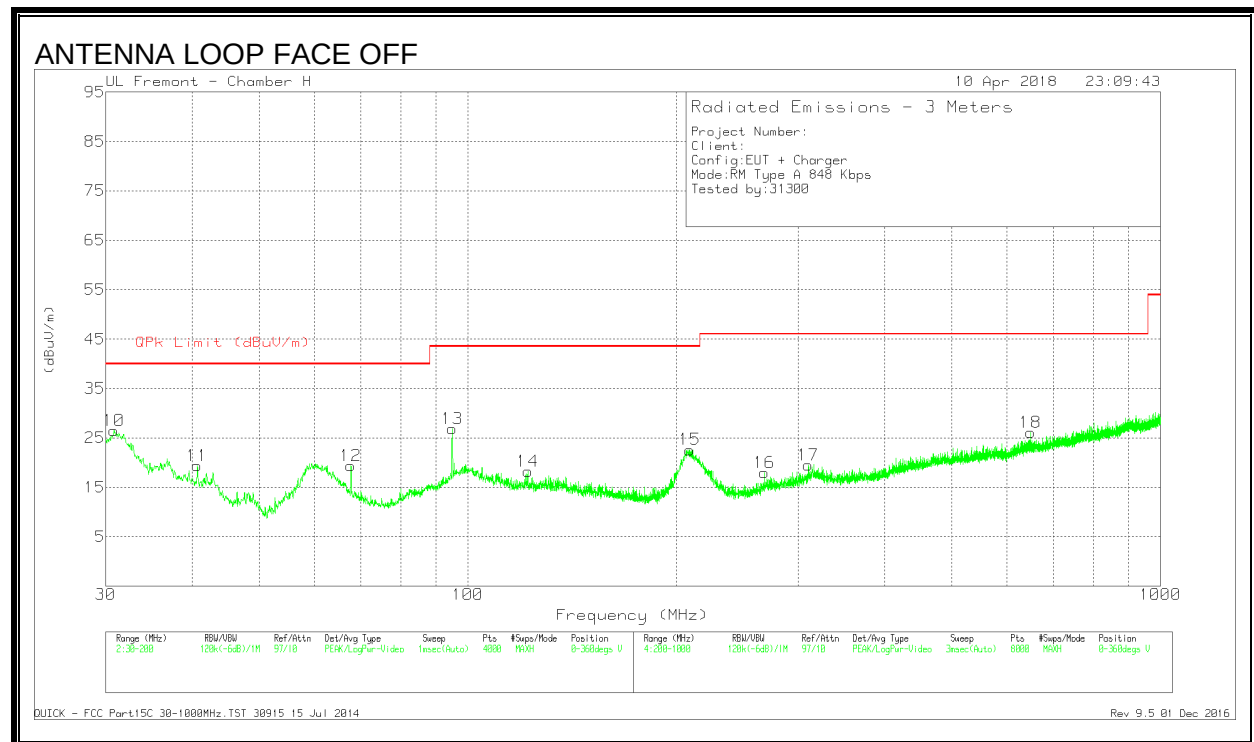
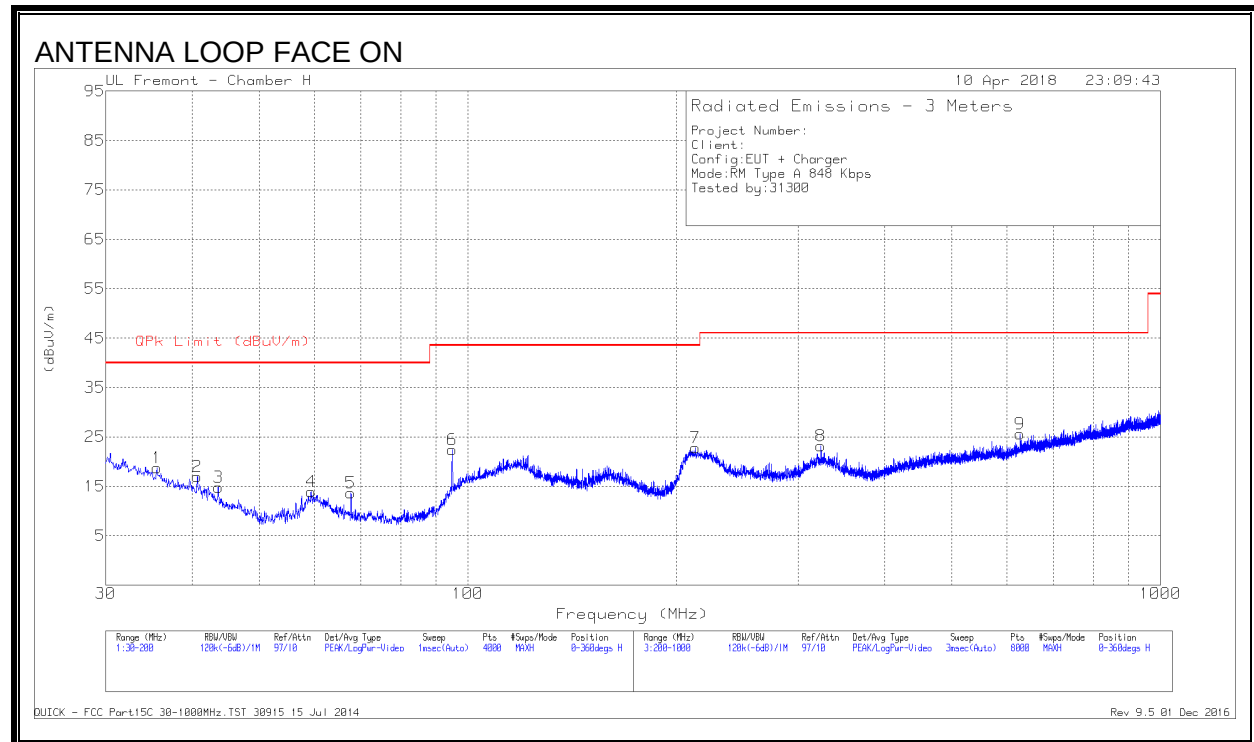
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

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

8.3.2. READER MODE

SPURIOUS EMISSION 848Kbps



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T122 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
14	* 122.0363	30.88	Pk	17.7	-30.3	18.28	43.52	-25.24	0-360	100	V
8	* 323.5161	34.24	Pk	17.8	-28.9	23.14	46.02	-22.88	0-360	100	H
16	* 267.8088	30.41	Pk	16.9	-29.3	18.01	46.02	-28.01	0-360	100	V
10	30.8077	34.6	Pk	23.2	-31.3	26.5	40	-13.5	0-360	100	V
1	35.5902	29.42	Pk	20.5	-31.2	18.72	40	-21.28	0-360	100	H
2	40.6703	30.55	Pk	17.6	-31.2	16.95	40	-23.05	0-360	100	H
11	40.6703	32.99	Pk	17.6	-31.2	19.39	40	-20.61	0-360	100	V
3	43.6035	30.12	Pk	15.8	-31.1	14.82	40	-25.18	0-360	100	H
4	59.3751	33.55	Pk	11.3	-30.9	13.95	40	-26.05	0-360	100	H
5	67.7923	32.65	Pk	11.8	-30.8	13.65	40	-26.35	0-360	100	H
12	67.7923	38.43	Pk	11.8	-30.8	19.43	40	-20.57	0-360	100	V
6	94.9143	40.22	Pk	12.8	-30.6	22.42	43.52	-21.1	0-360	100	H
13	94.9143	44.64	Pk	12.8	-30.6	26.84	43.52	-16.68	0-360	100	V
15	209.2012	37.82	Pk	14.5	-29.7	22.62	43.52	-20.9	0-360	100	V
7	213.0017	37.98	Pk	14.4	-29.6	22.78	43.52	-20.74	0-360	100	H
17	310.3143	31.14	Pk	17.5	-29.1	19.54	46.02	-26.48	0-360	100	V
9	627.1555	30.21	Pk	23.3	-27.9	25.61	46.02	-20.41	0-360	100	H
18	648.9584	30.2	Pk	23.7	-27.8	26.1	46.02	-19.92	0-360	100	V

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

Pk - Peak detector

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

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:	3/26/18
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9.1. CE MODE

848Kbps

Limit: ± 100 ppm = 1.35600 KHz										
Power Supply	Envir. Temp	Frequency Deviation Measured with Time Elapse								
(VAC)	(°C)	Startup (KHz)	Delta (ppm)	@ 2 mins (KHz)	Delta (ppm)	@ 5 mins (KHz)	Delta (ppm)	@ 10 mins (KHz)	Delta (ppm)	Limit (ppm)
3.80	50	13.5601266	-2.339	13.5601322	-2.754	13.5601392	-3.268	13.5601471	-3.851	± 100
	40	13.5600940	0.062	13.5600960	-0.087	13.5600986	-0.278	13.5601017	-0.508	± 100
	30	13.5600875	0.539	13.5600872	0.567	13.5600871	0.576	13.5600872	0.566	± 100
	20	13.5600949	0.000	13.5600942	0.046	13.5600935	0.097	13.5600930	0.140	± 100
	10	13.5601295	-2.558	13.5601250	-2.220	13.5601200	-1.856	13.5601154	-1.517	± 100
	0	13.5601031	-0.604	13.5601099	-1.113	13.5601181	-1.711	13.5601264	-2.323	± 100
	-10	13.5601440	-3.625	13.5601479	-3.911	13.5601517	-4.195	13.5601554	-4.465	± 100
	-20	13.5601626	-4.994	13.5601661	-5.254	13.5601693	-5.488	13.5601718	-5.671	± 100
3.23	20	13.5601024	-0.556	13.5600998	-0.361	13.5600971	-0.166	13.5600947	0.011	± 100
4.37	20	13.5601029	-0.593	13.5601014	-0.482	13.5600982	-0.246	13.5600955	-0.047	± 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 (KHz)	Delta (ppm)	@ 2 mins (KHz)	Delta (ppm)	@ 5 mins (KHz)	Delta (ppm)	@ 10 mins (KHz)	Delta (ppm)	Limit (ppm)
3.80	50	13.5601328	-3.023	13.5601394	-3.517	13.5601475	-4.112	13.5601566	-4.779	± 100
	40	13.5600958	-0.299	13.5600984	-0.488	13.5601017	-0.731	13.5601055	-1.017	± 100
	30	13.5600867	0.369	13.5600867	0.373	13.5600868	0.363	13.5600873	0.326	± 100
	20	13.5600918	0.000	13.5600917	0.001	13.5600911	0.050	13.5600908	0.070	± 100
	10	13.5600867	0.371	13.5600890	0.205	13.5600934	-0.121	13.5600995	-0.568	± 100
	0	13.5601135	-1.602	13.5601178	-1.917	13.5601225	-2.267	13.5601271	-2.610	± 100
	-10	13.5601418	-3.694	13.5601455	-3.964	13.5601492	-4.237	13.5601527	-4.494	± 100
	-20	13.5601650	-5.399	13.5601671	-5.555	13.5601691	-5.701	13.5601707	-5.821	± 100
3.23	20	13.5601002	-0.622	13.5600979	-0.450	13.5600955	-0.277	13.5600933	-0.116	± 100
4.37	20	13.5601008	-0.667	13.5600984	-0.490	13.5600966	-0.357	13.5600941	-0.173	± 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

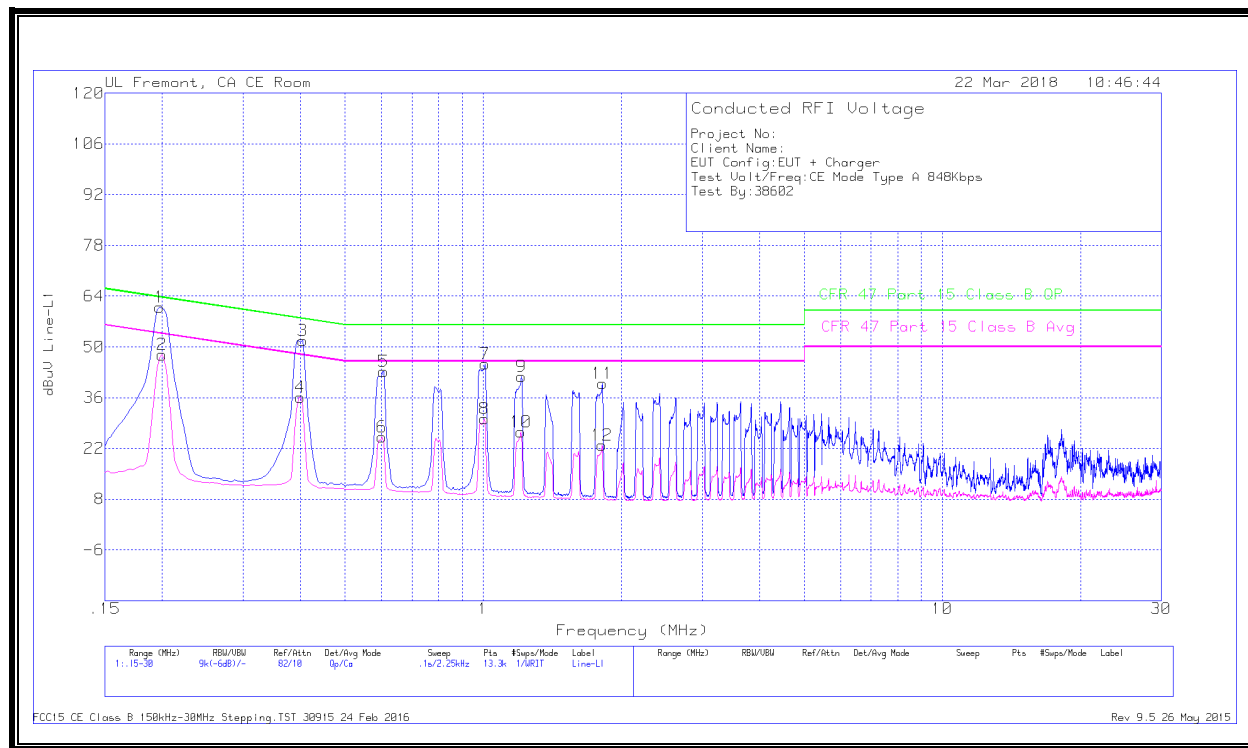
RESULTS

No non-compliance noted:

10.1. CE MODE, 848Kbps

10.1.1. NORMAL OPERATION WITH ANTENNA PORT TERMINATED

LINE 1 RESULTS



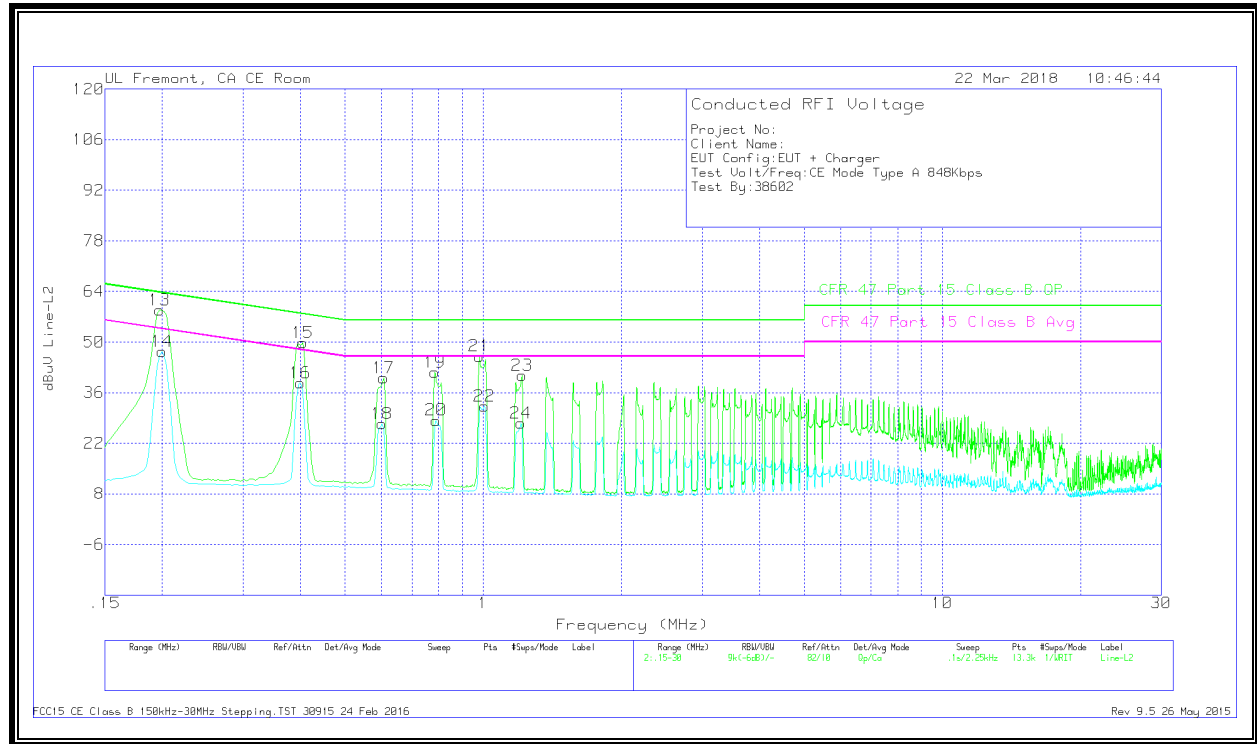
WORST EMISSIONS

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	.19725	50.9	Qp	0	0	10.1	61	63.73	-2.73	-	-
2	.1995	37.73	Ca	0	0	10.1	47.83	-	-	53.63	-5.8
3	.40425	41.66	Qp	0	0	10.1	51.76	57.77	-6.01	-	-
4	.39975	26.01	Ca	0	0	10.1	36.11	-	-	47.86	-11.75
5	.60675	33.12	Qp	0	0	10.1	43.22	56	-12.78	-	-
6	.60225	15.1	Ca	0	0	10.1	25.2	-	-	46	-20.8
7	1.0095	35.03	Qp	0	.1	10.1	45.23	56	-10.77	-	-
8	1.00725	19.92	Ca	0	.1	10.1	30.12	-	-	46	-15.88
9	1.212	31.7	Qp	0	.1	10.1	41.9	56	-14.1	-	-
10	1.2075	16.28	Ca	0	.1	10.1	26.48	-	-	46	-19.52
11	1.81725	29.75	Qp	0	.1	10.1	39.95	56	-16.05	-	-
12	1.815	12.64	Ca	0	.1	10.1	22.84	-	-	46	-23.16

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



WORST EMISSIONS

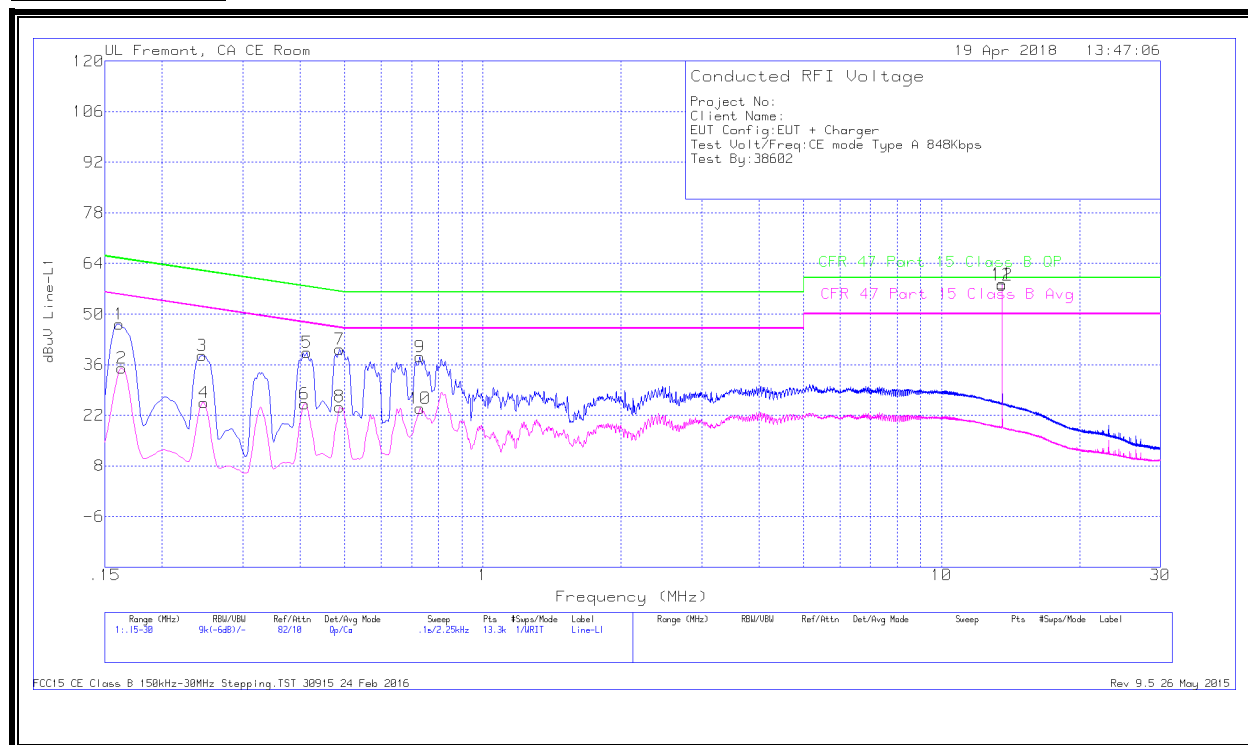
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.19725	48.84	Qp	0	0	10.1	58.94	63.73	-4.79	-	-
14	.1995	37.29	Ca	0	0	10.1	47.39	-	-	53.63	-6.24
15	.40425	39.78	Qp	0	0	10.1	49.88	57.77	-7.89	-	-
16	.39975	28.54	Ca	0	0	10.1	38.64	-	-	47.86	-9.22
17	.60675	29.92	Qp	0	0	10.1	40.02	56	-15.98	-	-
18	.60225	17.28	Ca	0	0	10.1	27.38	-	-	46	-18.62
19	.7845	31.6	Qp	0	0	10.1	41.7	56	-14.3	-	-
20	.789	18.26	Ca	0	0	10.1	28.36	-	-	46	-17.64
21	.9825	35.89	Qp	0	.1	10.1	46.09	56	-9.91	-	-
22	1.00725	22.1	Ca	0	.1	10.1	32.3	-	-	46	-13.7
23	1.21425	30.53	Qp	0	.1	10.1	40.73	56	-15.27	-	-
24	1.20975	17.3	Ca	0	.1	10.1	27.5	-	-	46	-18.5

Qp - Quasi-Peak detector

Ca - CISPR average detection

10.1.2. NORMAL OPERATION WITHOUT ANTENNA PORT TERMINATED

LINE 1 RESULTS



WORST EMISSIONS

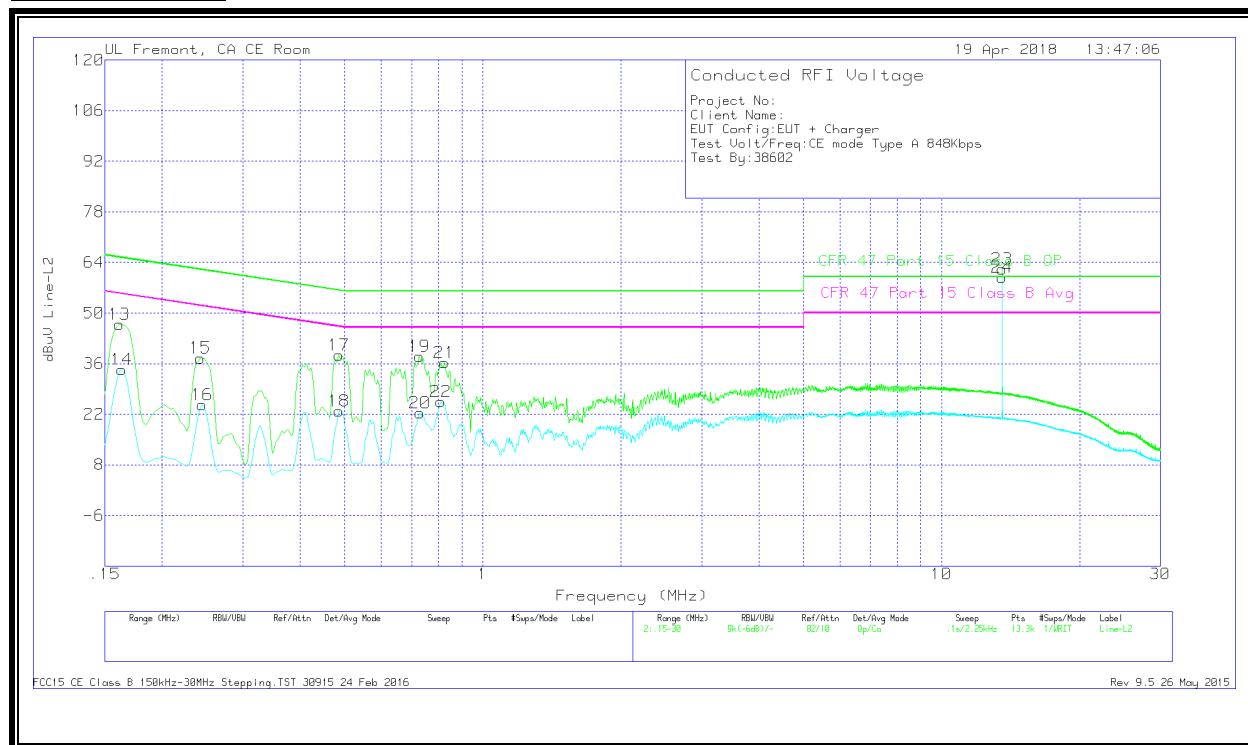
Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.16125	37.09	Qp	.1	0	10.1	47.29	65.4	-18.11	-	-
2	.1635	24.85	Ca	.1	0	10.1	35.05	-	-	55.28	-20.23
3	.2445	28.37	Qp	0	0	10.1	38.47	61.94	-23.47	-	-
4	.24675	15.45	Ca	0	0	10.1	25.55	-	-	51.87	-26.32
5	.41325	29.29	Qp	0	0	10.1	39.39	57.58	-18.19	-	-
6	.40875	15.07	Ca	0	0	10.1	25.17	-	-	47.67	-22.5
7	.4875	30.09	Qp	0	0	10.1	40.19	56.21	-16.02	-	-
8	.4875	14.26	Ca	0	0	10.1	24.36	-	-	46.21	-21.85
9	.7305	28.09	Qp	0	0	10.1	38.19	56	-17.81	-	-
10	.7305	13.78	Ca	0	0	10.1	23.88	-	-	46	-22.12
11	13.56	47.87	Qp	.1	.2	10.2	58.37	60	-1.63	-	-
12	13.56	47.58	Ca	.1	.2	10.2	58.08	-	-	50	8.08

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	.16125	36.82	Qp	0	0	10.1	46.92	65.4	-18.48	-	-
14	.1635	24.32	Ca	0	0	10.1	34.42	-	-	55.28	-20.86
15	.24225	27.47	Qp	0	0	10.1	37.57	62.02	-24.45	-	-
16	.2445	14.49	Ca	0	0	10.1	24.59	-	-	51.94	-27.35
17	.48525	28.28	Qp	0	0	10.1	38.38	56.25	-17.87	-	-
18	.48525	12.86	Ca	0	0	10.1	22.96	-	-	46.25	-23.29
19	.72825	27.89	Qp	0	0	10.1	37.99	56	-18.01	-	-
20	.7305	12.19	Ca	0	0	10.1	22.29	-	-	46	-23.71
21	.825	26.22	Qp	0	0	10.1	36.32	56	-19.68	-	-
22	.80925	15.32	Ca	0	0	10.1	25.42	-	-	46	-20.58
23	13.56	51.68	Qp	.1	.2	10.2	62.18	60	2.18	-	-
24	13.56	49.47	Ca	.1	.2	10.2	59.97	-	-	50	9.97

Qp - Quasi-Peak detector

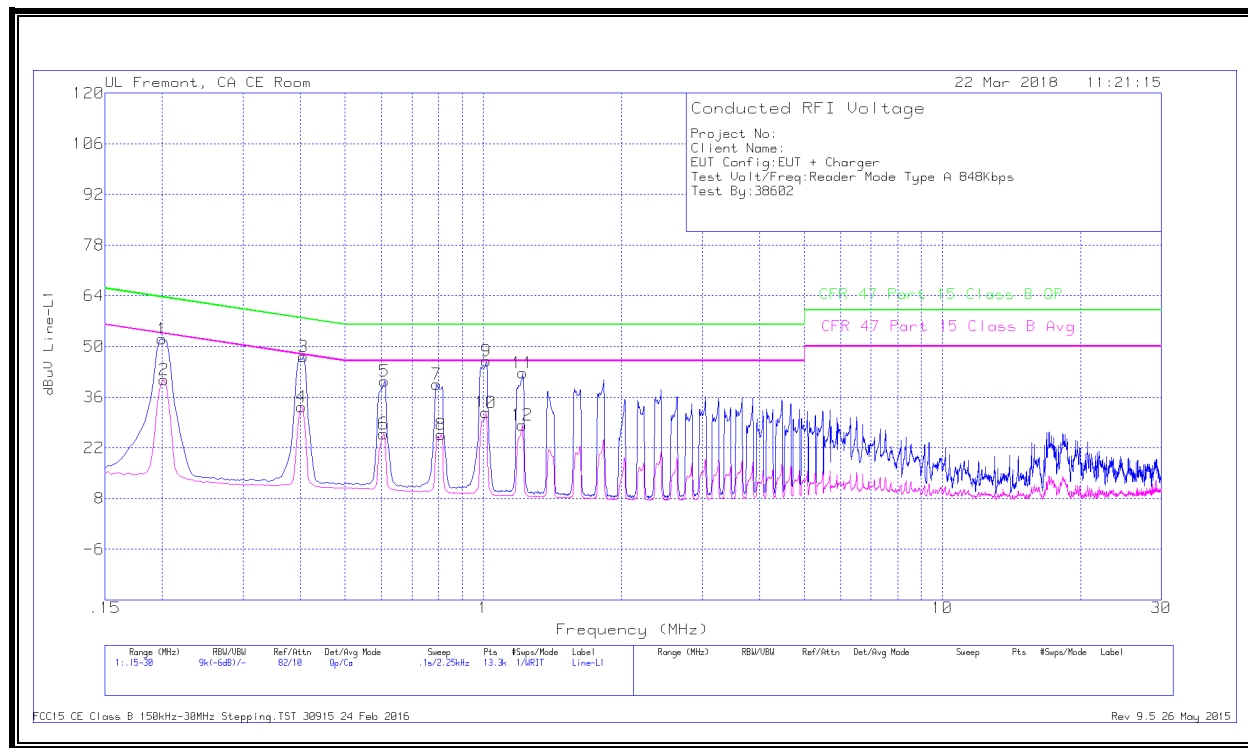
Ca - CISPR average detection

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, 848Kbps

10.2.1. NORMAL OPERATION WITH ANTENNA PORT TERMINATED,

LINE 1 RESULTS



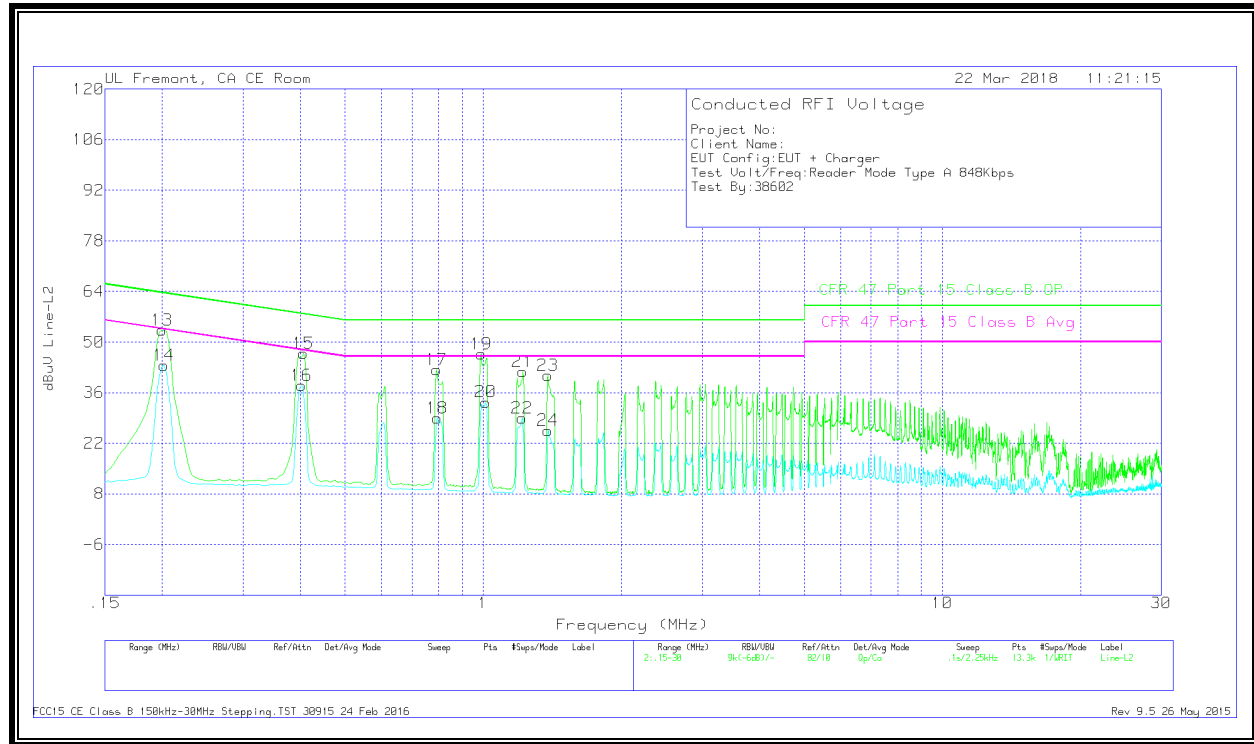
WORST EMISSIONS

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	.1995	41.93	Qp	0	0	10.1	52.03	63.63	-11.6	-	-
2	.20175	30.68	Ca	0	0	10.1	40.78	-	-	53.54	-12.76
3	.4065	37.09	Qp	0	0	10.1	47.19	57.72	-10.53	-	-
4	.402	23.21	Ca	0	0	10.1	33.31	-	-	47.81	-14.5
5	.609	30.36	Qp	0	0	10.1	40.46	56	-15.54	-	-
6	.60675	15.82	Ca	0	0	10.1	25.92	-	-	46	-20.08
7	.79125	29.39	Qp	0	0	10.1	39.49	56	-16.51	-	-
8	.80925	15.54	Ca	0	0	10.1	25.64	-	-	46	-20.36
9	1.01625	35.75	Qp	0	.1	10.1	45.95	56	-10.05	-	-
10	1.014	21.57	Ca	0	.1	10.1	31.77	-	-	46	-14.23
11	1.221	32.54	Qp	0	.1	10.1	42.74	56	-13.26	-	-
12	1.2165	18.04	Ca	0	.1	10.1	28.24	-	-	46	-17.76

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



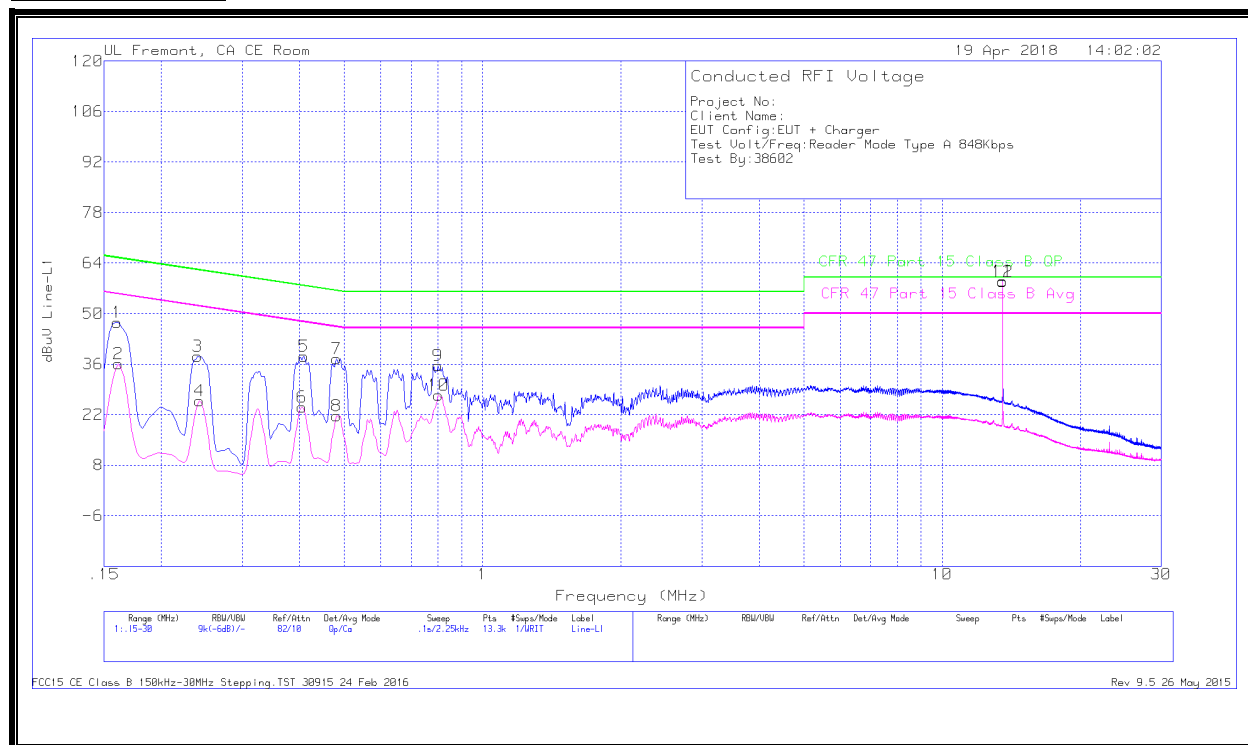
WORST EMISSIONS

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	.1995	43.26	Qp	0	0	10.1	53.36	63.63	-10.27	-	-
14	.20175	33.44	Ca	0	0	10.1	43.54	-	-	53.54	-10
15	.4065	36.73	Qp	0	0	10.1	46.83	57.72	-10.89	-	-
16	.402	27.89	Ca	0	0	10.1	37.99	-	-	47.81	-9.82
17	.79125	32.24	Qp	0	0	10.1	42.34	56	-13.66	-	-
18	.7935	18.91	Ca	0	0	10.1	29.01	-	-	46	-16.99
19	.98925	36.51	Qp	0	.1	10.1	46.71	56	-9.29	-	-
20	1.014	23.2	Ca	0	.1	10.1	33.4	-	-	46	-12.6
21	1.221	31.61	Qp	0	.1	10.1	41.81	56	-14.19	-	-
22	1.2165	18.74	Ca	0	.1	10.1	28.94	-	-	46	-17.06
23	1.383	30.56	Qp	0	.1	10.1	40.76	56	-15.24	-	-
24	1.38525	15.37	Ca	0	.1	10.1	25.57	-	-	46	-20.43

Qp - Quasi-Peak detector
Ca - CISPR average detection

10.2.2. NORMAL OPERATION WITHOUT ANTENNA PORT TERMINATED,

LINE 1 RESULTS



WORST EMISSIONS

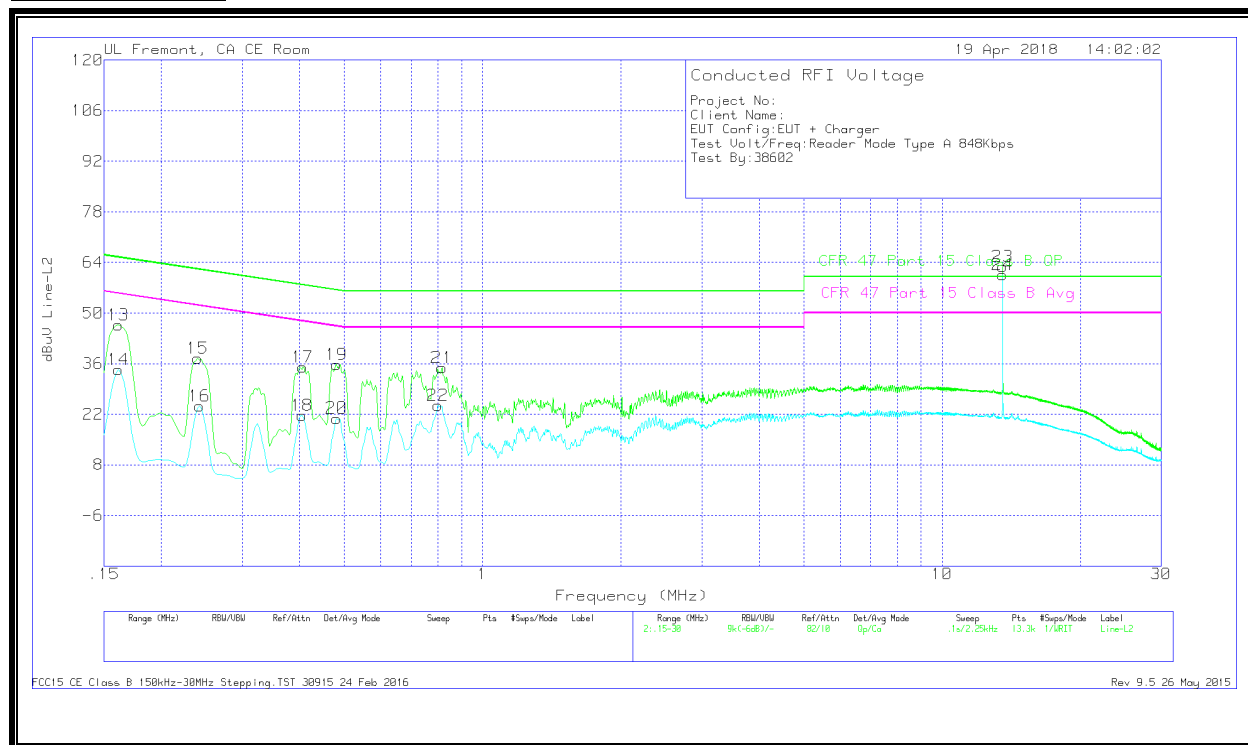
Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.16013	37.39	Qp	.1	0	10.1	47.59	65.46	-17.87	-	-
2	.16125	25.88	Ca	.1	0	10.1	36.08	-	-	55.4	-19.32
3	.24	28.13	Qp	0	0	10.1	38.23	62.1	-23.87	-	-
4	.24225	15.75	Ca	0	0	10.1	25.85	-	-	52.02	-26.17
5	.40875	28.06	Qp	0	0	10.1	38.16	57.67	-19.51	-	-
6	.40425	13.99	Ca	0	0	10.1	24.09	-	-	47.77	-23.68
7	.48075	27.39	Qp	0	0	10.1	37.49	56.33	-18.84	-	-
8	.48075	11.59	Ca	0	0	10.1	21.69	-	-	46.33	-24.64
9	.80025	25.5	Qp	0	0	10.1	35.6	56	-20.4	-	-
10	.8025	17.34	Ca	0	0	10.1	27.44	-	-	46	-18.56
11	13.56	48.56	Qp	.1	.2	10.2	59.06	60	-.94	-	-
12	13.56	48.32	Ca	.1	.2	10.2	58.82	-	-	50	8.82

Qp - Quasi-Peak detector

Ca - CISPR average detection

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

LINE 2 RESULTS



WORST EMISSIONS

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.16125	36.67	Qp	0	0	10.1	46.77	65.4	-18.63	-	-
14	.16125	24.33	Ca	0	0	10.1	34.43	-	-	55.4	-20.97
15	.24	27.36	Qp	0	0	10.1	37.46	62.1	-24.64	-	-
16	.24225	14.2	Ca	0	0	10.1	24.3	-	-	52.02	-27.72
17	.4065	24.94	Qp	0	0	10.1	35.04	57.72	-22.68	-	-
18	.40425	11.63	Ca	0	0	10.1	21.73	-	-	47.77	-26.04
19	.48075	25.66	Qp	0	0	10.1	35.76	56.33	-20.57	-	-
20	.48075	10.78	Ca	0	0	10.1	20.88	-	-	46.33	-25.45
21	.816	24.81	Qp	0	0	10.1	34.91	56	-21.09	-	-
22	.80025	14.38	Ca	0	0	10.1	24.48	-	-	46	-21.52
23	13.56	52.35	Qp	.1	.2	10.2	62.85	60	2.85	-	-
24	13.56	50.18	Ca	.1	.2	10.2	60.68	-	-	50	10.68

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 12124121-EP1V1 for setup photos