FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 9

CERTIFICATION TEST REPORT

FOR

SMARTPHONE

MODEL NUMBER: A1865, A1903

FCC ID: BCG-E3161A
IC: 579C-E3161A

REPORT NUMBER: 11792114-E6V2

ISSUE DATE: AUGUST 28, 2017

Prepared for
APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

Prepared by
UL VERIFICATION SERVICES INC.
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	8/17/2017	Initial Issue	Chin Pang
V2	8/28/2017	Address TCB's Questions	Chin Pang

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: SMARTPHONE

MODEL: A1865, A1903

SERIAL NUMBER: C39TN01XJ56T

DATE TESTED: MAY 23, 2017 – AUGUST 1, 2017

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Pass
INDUSTRY CANADA RSS-210 Issue 9, Annex B.6.	Pass
INDUSTRY CANADA RSS-GEN Issue 4	Pass

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 engineer
UL Verification Services Inc.

Prepared By:

Tony Wang
Test 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 4, 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 (IC:2324B-1)	☐ Chamber D (IC: 22541-1)
☐ Chamber B (IC:2324B-2)	☒ Chamber E (IC: 22541-2)
☐ Chamber C (IC:2324B-3)	☐ Chamber F (IC: 22541-3)
	☐ Chamber G (IC: 22541-4)
	☐ Chamber H (IC: 22541-5)

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 http://ts.nist.gov/standards/scopes/2000650.htm.

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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 9KHz to 0.15 MHz	± 3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	± 3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	± 3.15 dB
Radiated Disturbance, 30 to 1000 MHz	± 5.36 dB
Radiated Disturbance,1000 to 18000 MHz	± 4.32 dB
Radiated Disturbance,18000 to 26000 MHz	± 4.45 dB
Radiated Disturbance,26000 to 40000 MHz	± 5.24 dB
Occupied Channel Bandwidth	±0.39 %
Temperature	±0.9 °C
Supply voltages	±0.45 %
Time	±0.45 %

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The Equipment under Test is a mobile phone with GSM, GPRS, EGPRS, UMTS, LTE, TD-SCDMA and CDMA technologies. It also supports IEEE 802.11a/b/g/n/ac, Bluetooth®, GPS and NFC. The device has a built-in inductive charging receiver which is not user accessible. The rechargeable battery is not user accessible. CE mode is NFC Card Emulation Mode

5.2. MAXIMUM FIELD STRENGHT

The transmitter has a maximum peak radiated magnetic field strength as follows:

Frequency Range (MHz)	Mode	Type	E Field at 30m distance (dBuV/m)
13.56	*CE Mode	B	18.54
	Reader Mode	B	22.45

* CE mode is NFC Card Emulation Mode

5.3. SOFTWARE AND FIRMWARE

The test utility software used during testing was Firmware version 1.8 rev 55147 and Software tool version was NCI_UART_RTM4_B1_V1.07.

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, F and ISO 15693 with CE mode and Reader mode data rate were investigated to determine the worst case based on the highest power and spurious emissions. Type B was determined to be the worst case and therefore Type B 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 are 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

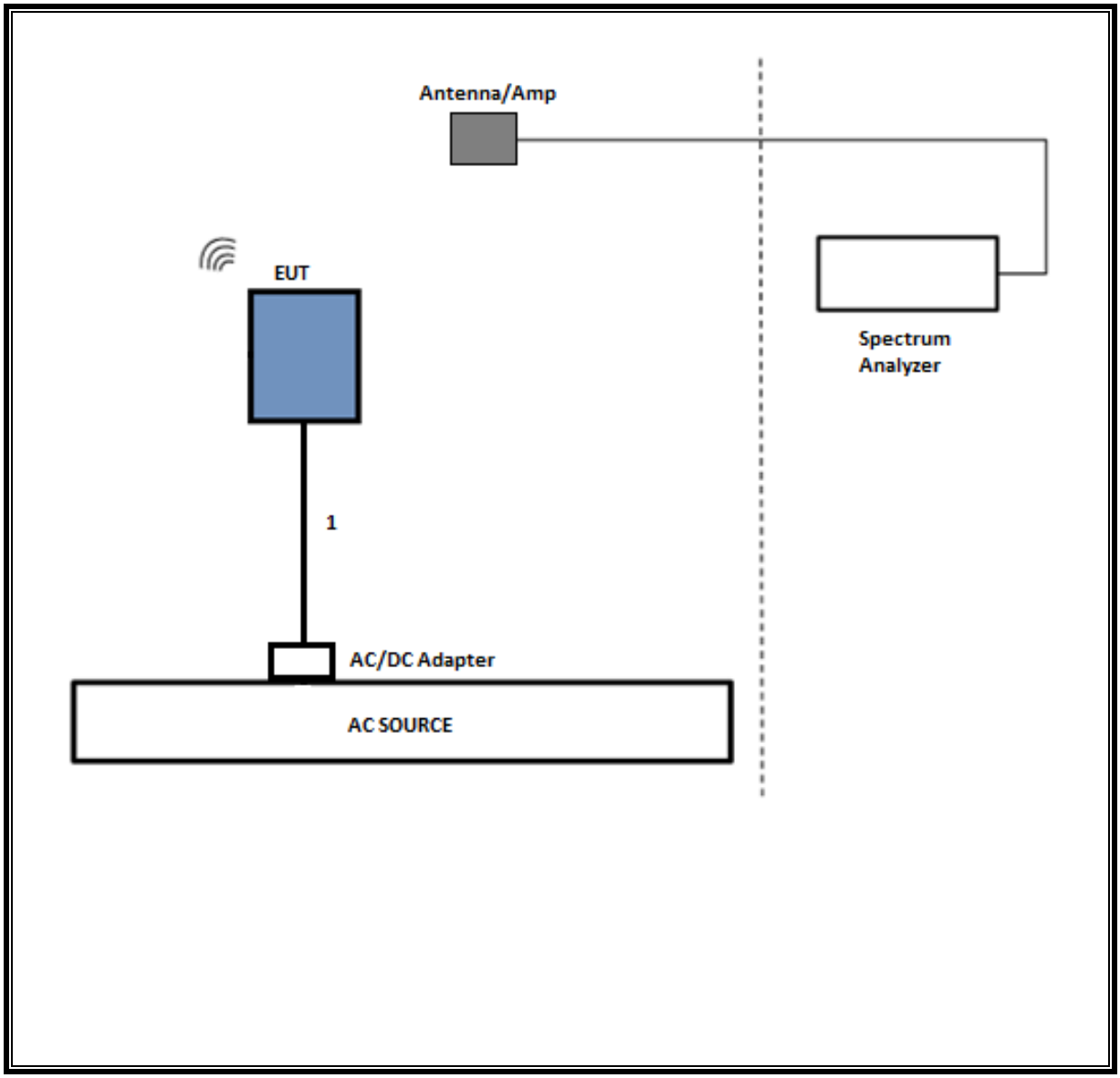
SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Apple	Mac Book Pro	D292365COYADHLHC3	n/a
Laptop AC/DC Adapter	Apple	A1436	N/A	n/a
EUT AC/DC Adapter	Apple	A1385	D292365B2FQDHLHC7	n/a

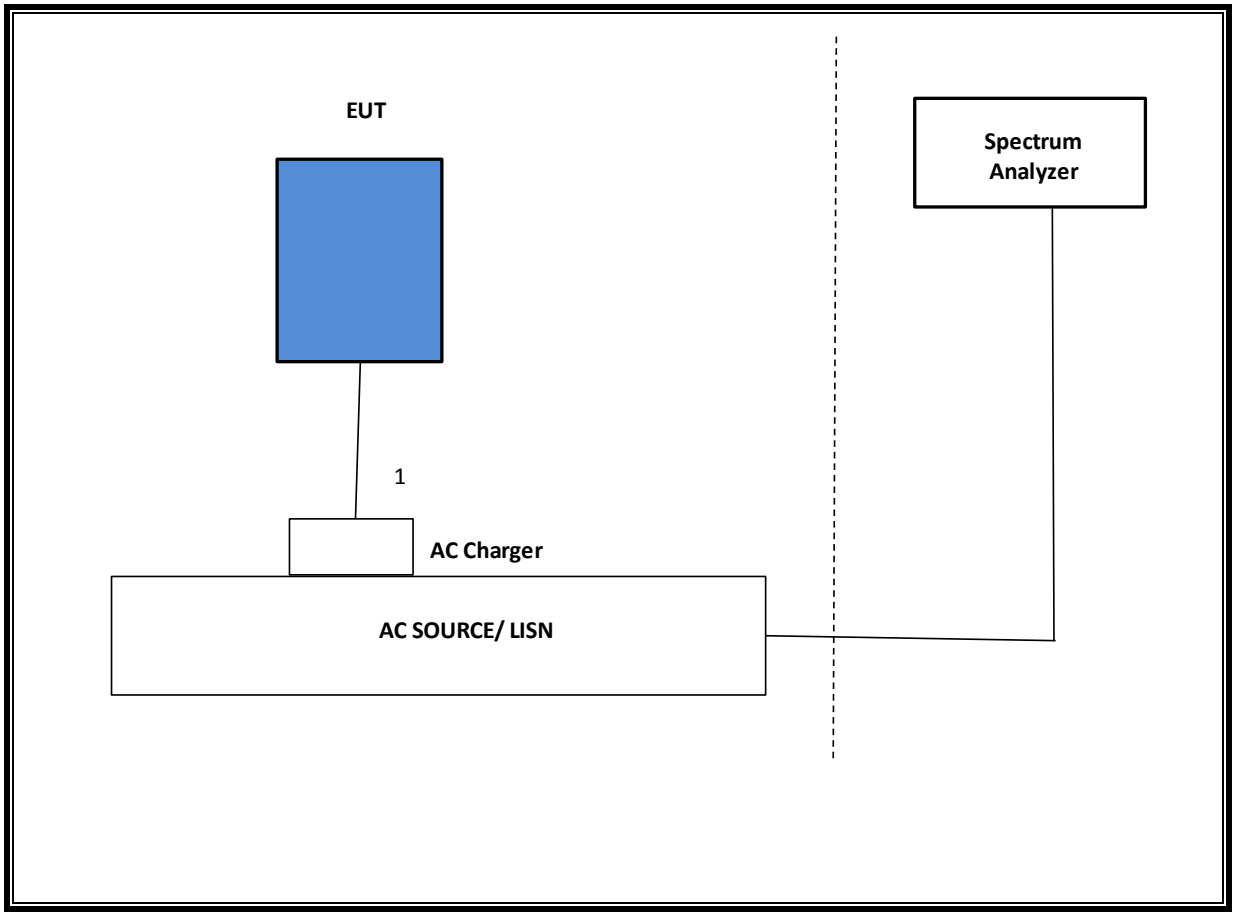
I/O CABLES (Radiated and AC Line)

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	USB	Un-shielded	1	n/a

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:

Test Equipment List				
Description	**Manufacturer**	**Model**	**T No.**	**Cal Date**
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T340	12/14/2017
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T426	9/23/2017
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T834	6/17/2017
Spectrum Analyzer, PXA 3Hz to 44GHz	Keysight	N9030A	T1113	12/20/2017
Antenna, Active Loop 9KHz to 30MHz	EMCO	6502	T1616	12/12/2017
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T754	9/10/2017
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ESCI7	T1436	12/12/2017
LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	6/15/2018
Line conducted Power cable ANSI 63.4	UL	PG1	861	9/1/2017
UL SOFTWARE				
**Radiated Software	UL	UL EMC	Fundamental mask, 5/7/15	
**Conducted Software	UL	UL EMC	Ver 2.2, March 31, 2015	
**Radiated Software	UL	UL EMC	Below 30Mhz, 6/24/15	
**Radiated Software	UL	UL EMC	Below 1Ghz, 7/15/14	
**AC Line Conducted Software	UL	UL EMC	Ver 9.5, April 3, 2015	

Note: ** indicates automation software version used in the compliance certification testing
*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 10 kHz. 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 Continuous Wave or Continuous Wave-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:	5/23/17

99% and 20dB BW

CE Mode

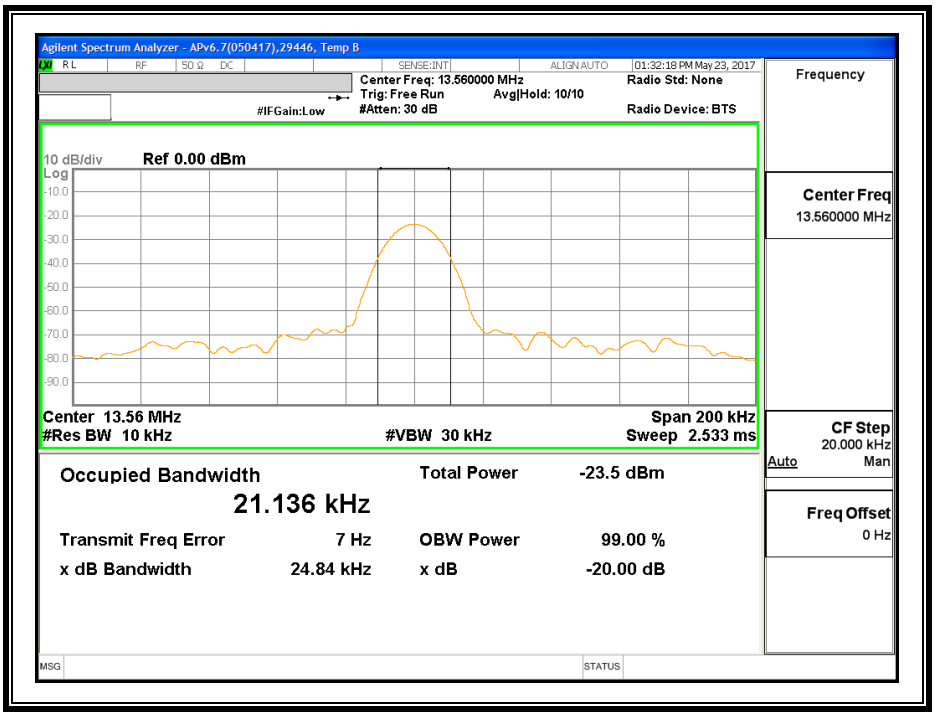
Moduation	Frequency	Data Rate	99% Bandwidth	20dB Bandwidth
	(MHz)	(Kbps)	(KHz)	(KHz)
Type B	13.56	848	21.136	24.84

READER

Moduation	Frequency	Data Rate	99% Bandwidth	20dB Bandwidth
	(MHz)	(Kbps)	(KHz)	(KHz)
Type B	13.56	848	21.643	24.69

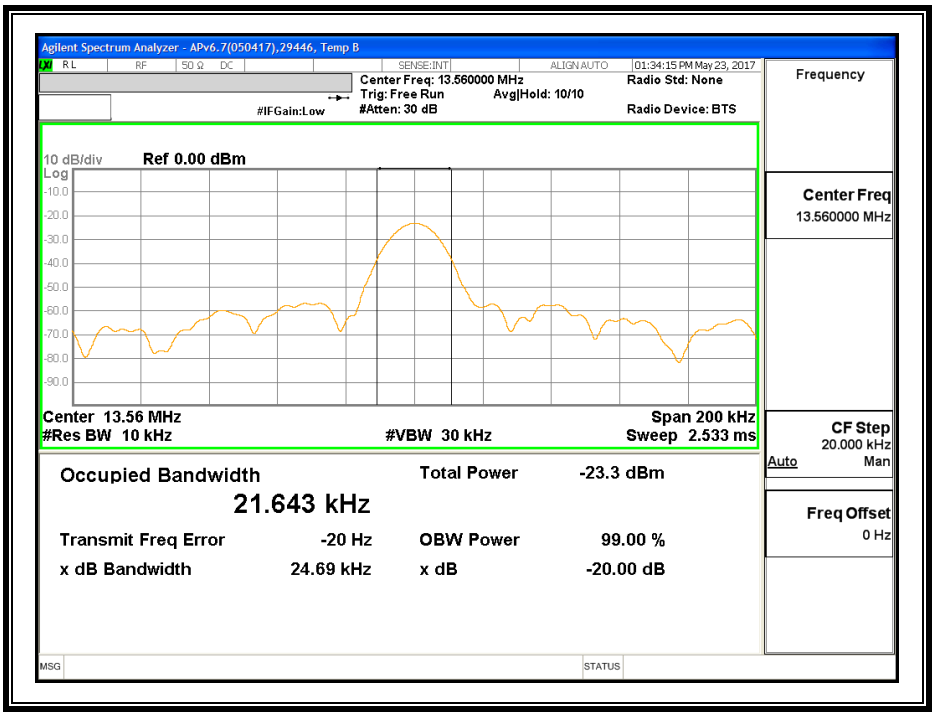
7.1. CE MODE

Type B, 848Kbps



7.2. READER MODE

Type B, 848Kbps



8. RADIATED EMISSION TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMIT

§15.225
IC RSS-210, Issue 9 Annex B.6.
IC RSS-GEN, Section 8.9 (Transmitter)
IC RSS-GEN, Section 7.1.2 (Receiver)

(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 filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/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.

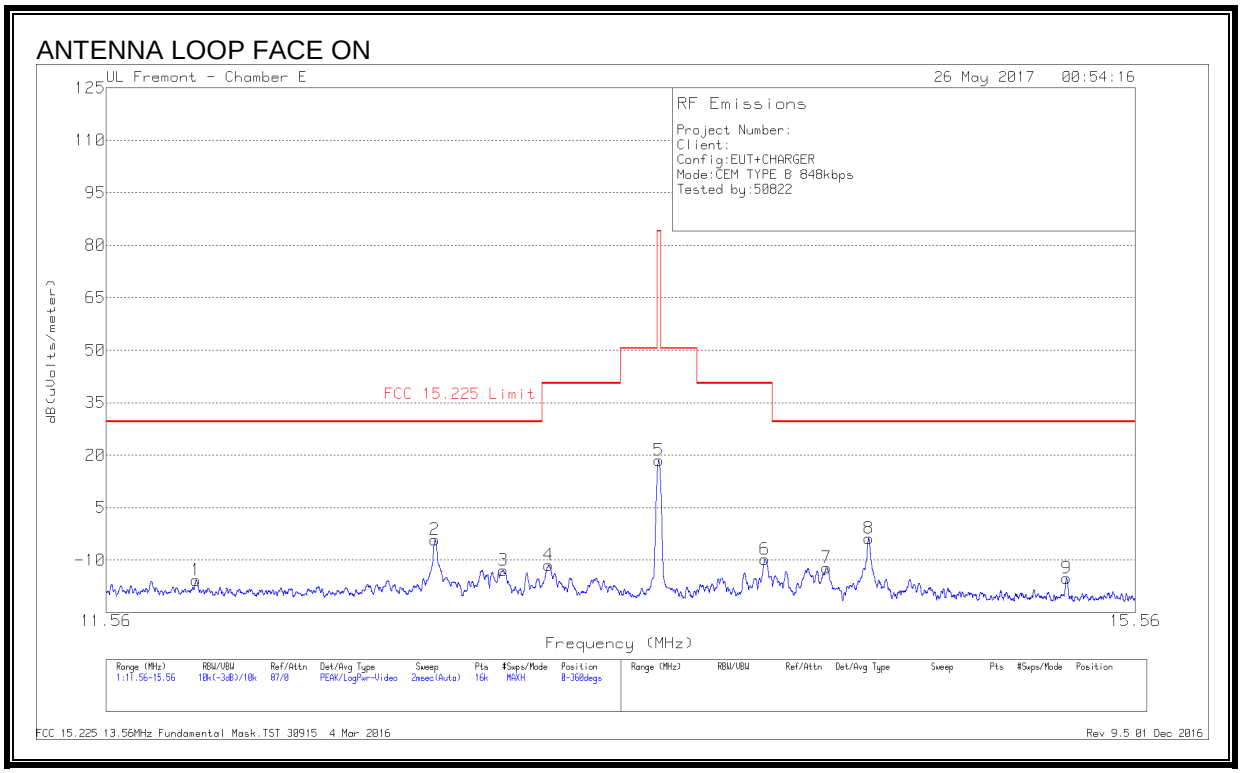
RESULTS

8.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)

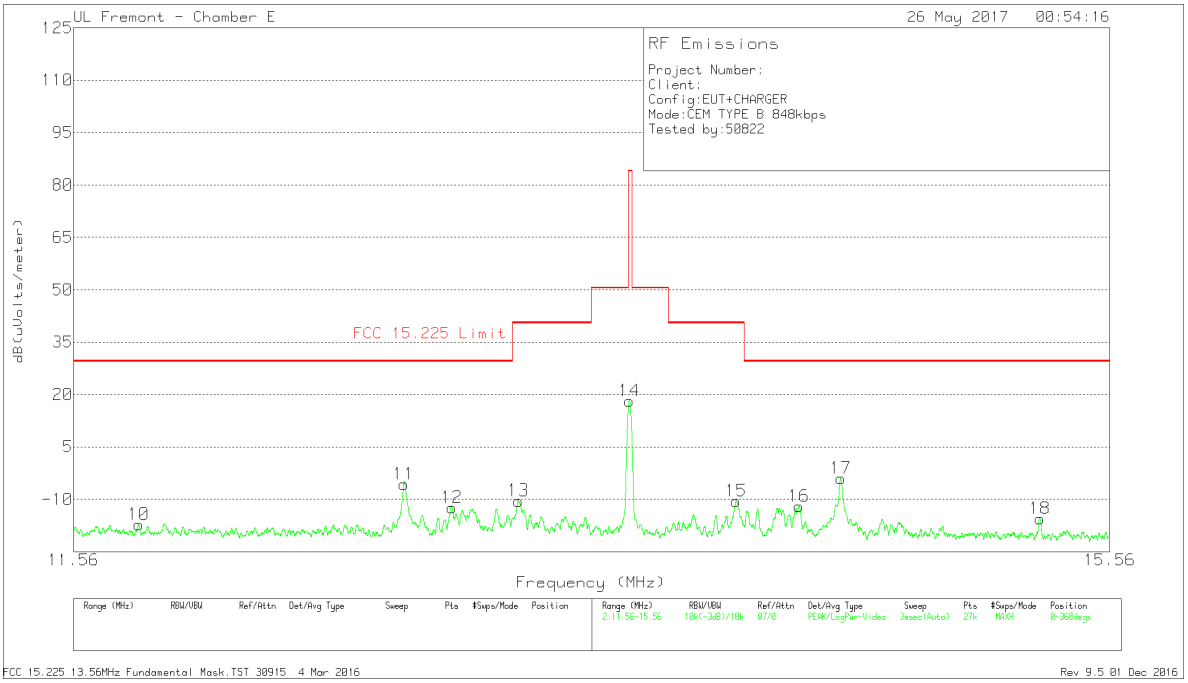
8.2.1. CE MODE

TYPE B

848Kbps FUNDAMENTAL



ANTENNA LOOP FACE OFF



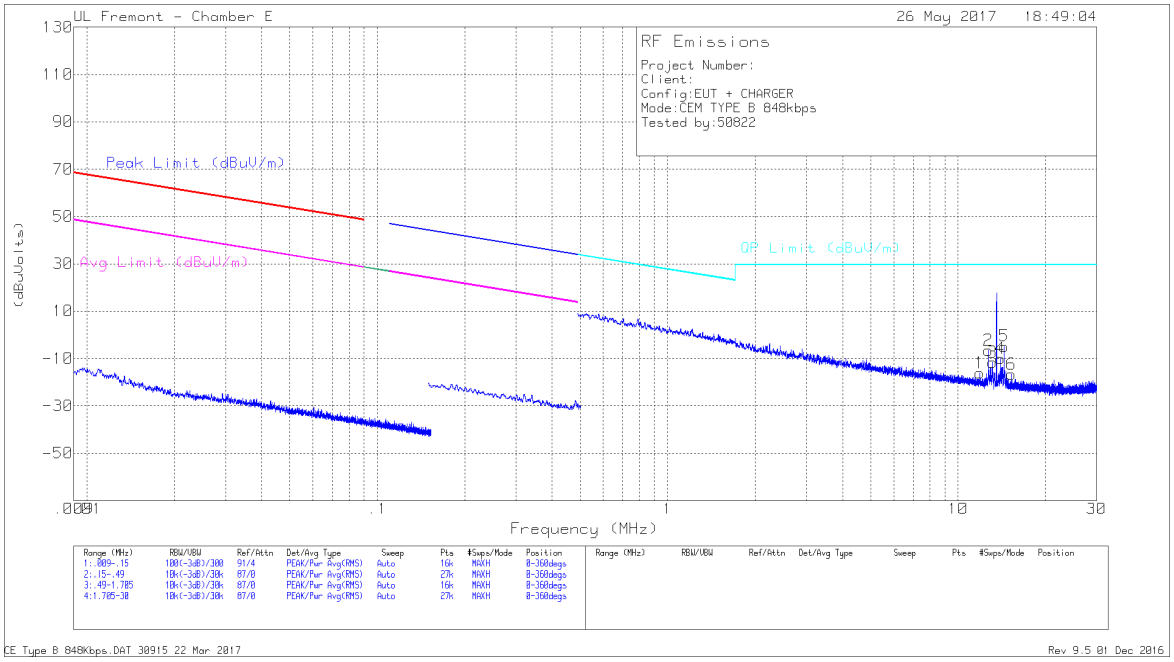
DATA

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)
10	11.77778	11.51	Pk	10.8	.5	-40	-17.19	29.54	-46.73	0-360
1	11.86463	13	Pk	10.8	.5	-40	-15.7	29.54	-45.24	0-360
11	12.70789	23.14	Pk	10.7	.5	-40	-5.66	29.54	-35.2	0-360
2	12.71175	24.61	Pk	10.7	.5	-40	-4.19	29.54	-33.73	0-360
12	12.88593	16.4	Pk	10.7	.5	-40	-12.4	29.54	-41.94	0-360
3	12.96413	15.92	Pk	10.7	.5	-40	-12.88	29.54	-42.42	0-360
13	13.13272	18.36	Pk	10.7	.5	-40	-10.44	40.51	-50.95	0-360
4	13.136	17.36	Pk	10.7	.5	-40	-11.44	40.51	-51.95	0-360
14	13.55889	47.05	Pk	10.6	.5	-40	18.15	84	-65.85	0-360
5	13.56	47.44	Pk	10.6	.5	-40	18.54	84	-65.46	0-360
15	13.97987	18.29	Pk	10.6	.5	-40	-10.61	40.51	-51.12	0-360
6	13.9815	19.13	Pk	10.6	.5	-40	-9.77	40.51	-50.28	0-360
7	14.23338	16.76	Pk	10.6	.5	-40	-12.14	29.54	-41.68	0-360
16	14.23436	16.9	Pk	10.6	.5	-40	-12	29.54	-41.54	0-360
17	14.40441	24.85	Pk	10.6	.5	-40	-4.05	29.54	-33.59	0-360
8	14.408	25	Pk	10.6	.5	-40	-3.9	29.54	-33.44	0-360
18	15.25304	13.36	Pk	10.5	.5	-40	-15.64	29.54	-45.18	0-360
9	15.25413	13.84	Pk	10.5	.5	-40	-15.16	29.54	-44.7	0-360

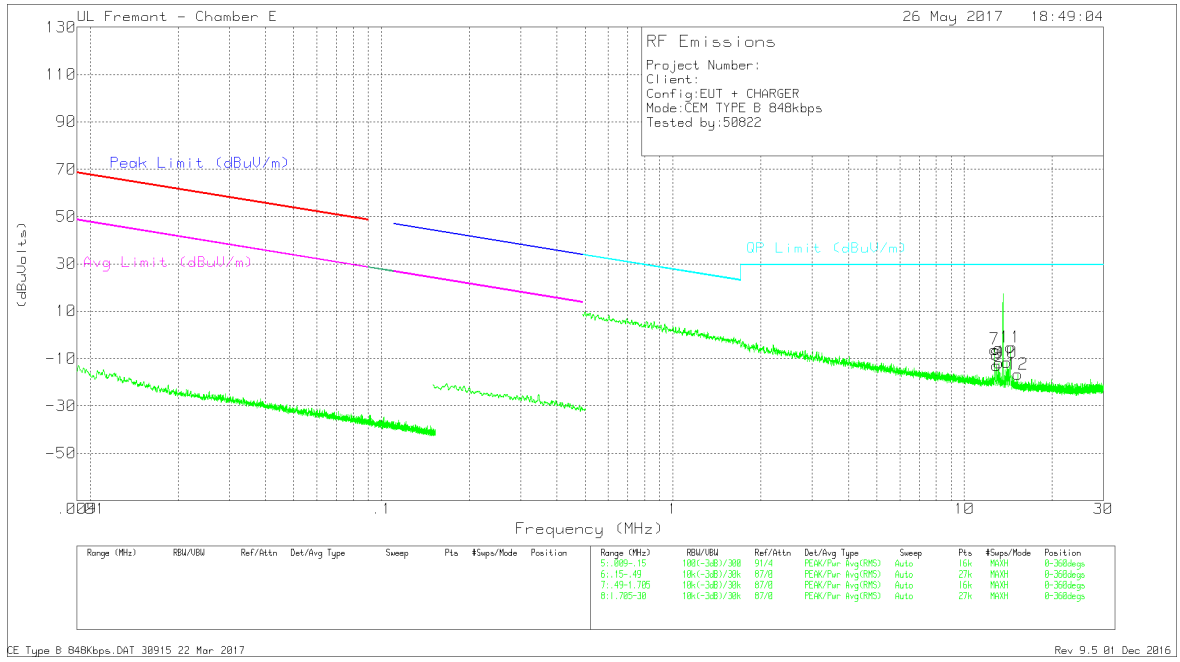
Pk - Peak detector

SPURIOUS EMISSION

ANTENNA LOOP FACE ON



ANTENNA LOOP FACE OFF



DATA

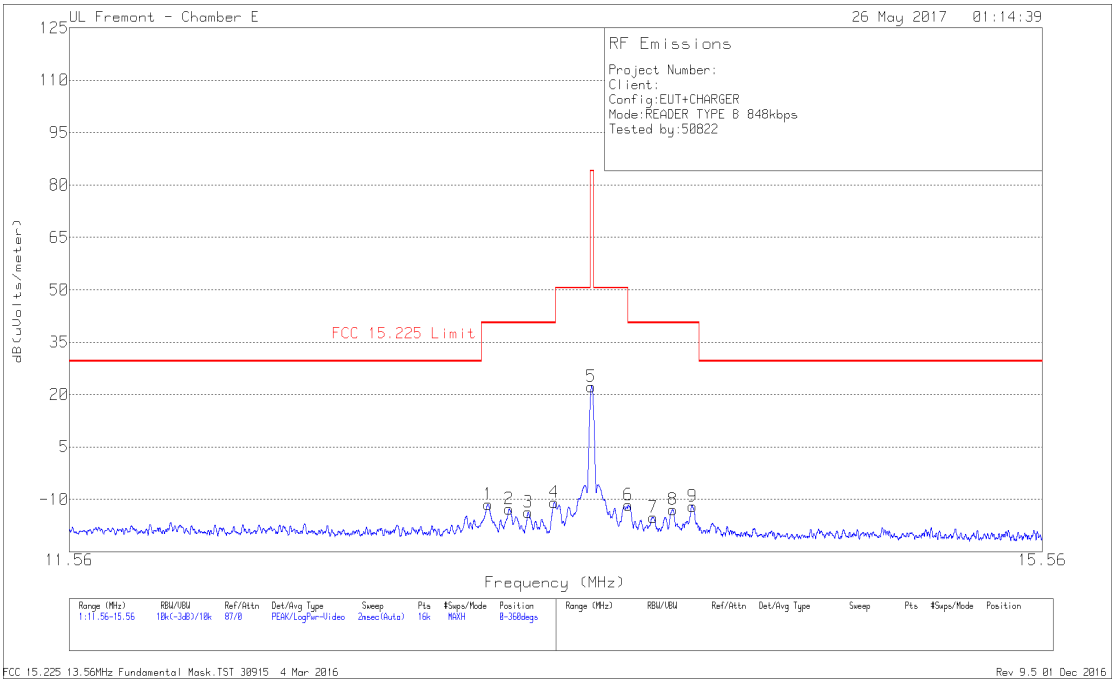
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	11.86693	12.75	Pk	10.6	.5	-40	-16.15	29.5	-45.65	0-360
2	12.7111	22.46	Pk	10.5	.5	-40	-6.54	29.5	-36.04	0-360
7	12.71424	22.87	Pk	10.5	.5	-40	-6.13	29.5	-35.63	0-360
8	12.88244	16.08	Pk	10.5	.5	-40	-12.92	29.5	-42.42	0-360
3	13.13658	17.48	Pk	10.5	.5	-40	-11.52	29.5	-41.02	0-360
9	13.13658	17.18	Pk	10.5	.5	-40	-11.82	29.5	-41.32	0-360
4	13.98022	19.03	Pk	10.4	.5	-40	-10.07	29.5	-39.57	0-360
10	13.98337	17.64	Pk	10.4	.5	-40	-11.46	29.5	-40.96	0-360
5	14.40781	24.3	Pk	10.4	.5	-40	-4.8	29.5	-34.3	0-360
11	14.40781	23.9	Pk	10.4	.5	-40	-5.2	29.5	-34.7	0-360
6	15.25354	12.51	Pk	10.3	.5	-40	-16.69	29.5	-46.19	0-360
12	15.25459	12.59	Pk	10.3	.5	-40	-16.61	29.5	-46.11	0-360

Pk - Peak detector

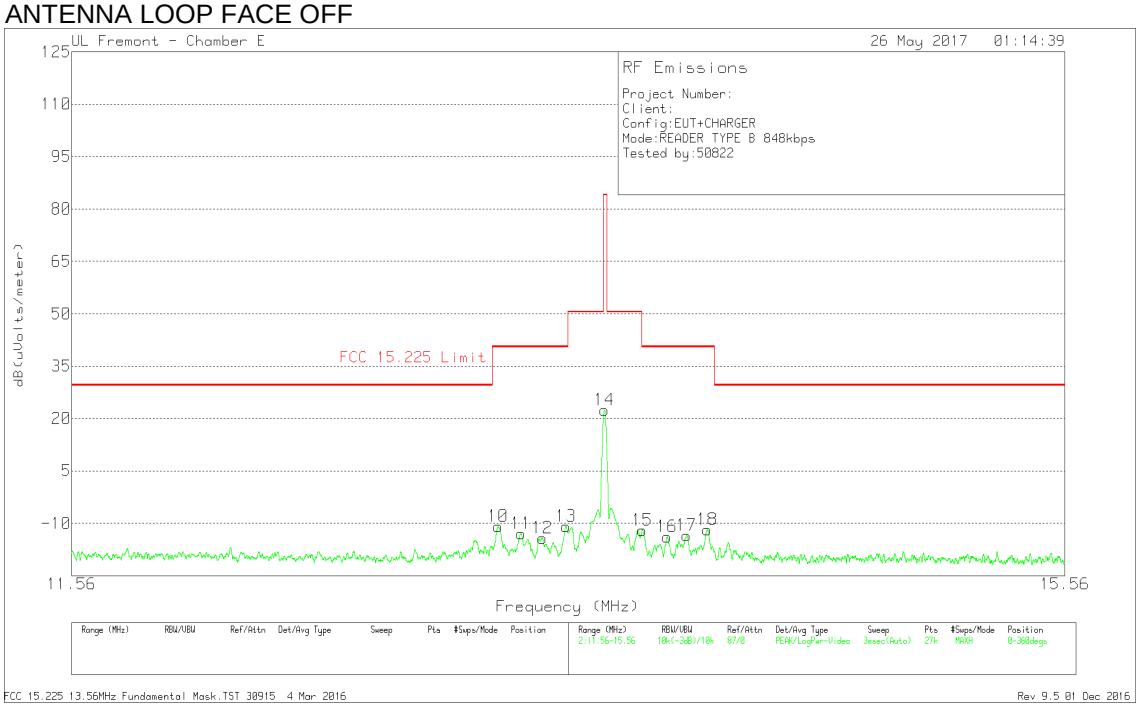
8.2.2. READER MODE

Type B, 848Kbps FUNDAMENTAL

ANTENNA LOOP FACE ON



ANTENNA LOOP FACE OFF



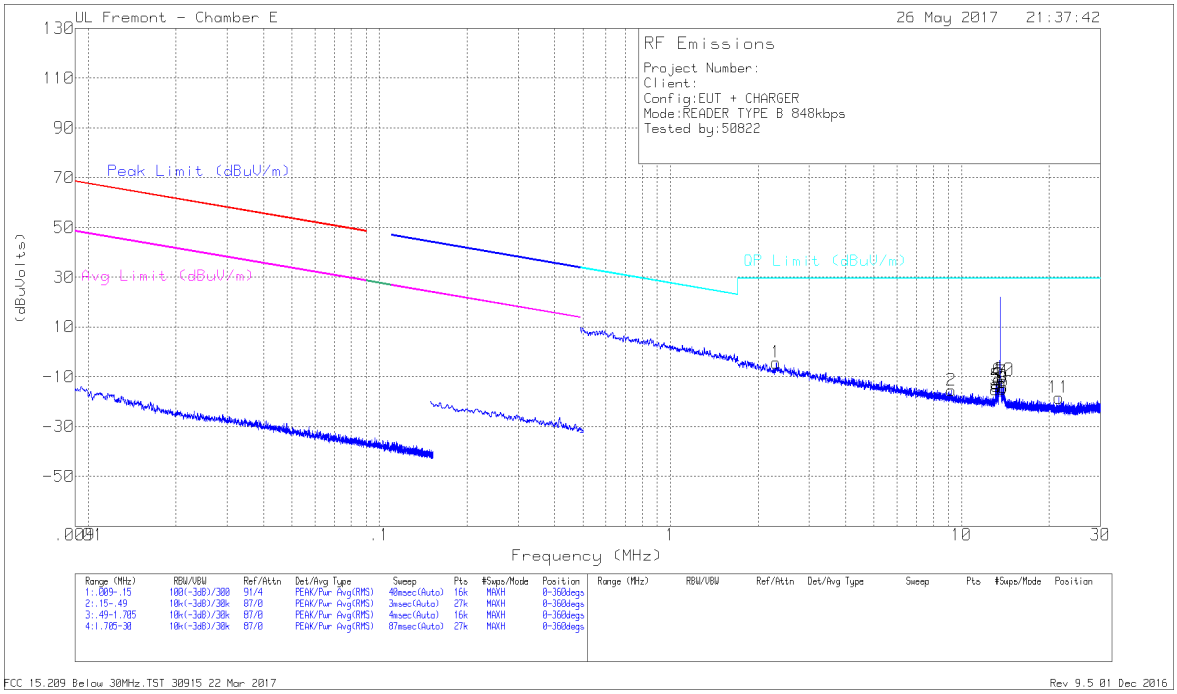
DATA

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)
10	13.13361	17.86	Pk	10.7	.5	-40	-10.94	40.51	-51.45	0-360
1	13.138	17.41	Pk	10.7	.5	-40	-11.39	40.51	-51.9	0-360
2	13.22288	16.06	Pk	10.7	.5	-40	-12.74	40.51	-53.25	0-360
11	13.2233	15.8	Pk	10.7	.5	-40	-13	40.51	-53.51	0-360
3	13.29913	15.07	Pk	10.7	.5	-40	-13.73	40.51	-54.24	0-360
12	13.3081	14.63	Pk	10.7	.5	-40	-14.17	40.51	-54.68	0-360
13	13.40282	17.86	Pk	10.7	.5	-40	-10.94	40.51	-51.45	0-360
4	13.4055	17.91	Pk	10.7	.5	-40	-10.89	40.51	-51.4	0-360
14	13.55778	51.35	Pk	10.6	.5	-40	22.45	84	-61.55	0-360
5	13.558	51.13	Pk	10.6	.5	-40	22.23	84	-61.77	0-360
15	13.71133	16.86	Pk	10.6	.5	-40	-12.04	40.51	-52.55	0-360
6	13.71238	17.19	Pk	10.6	.5	-40	-11.71	40.51	-52.22	0-360
16	13.81545	15.06	Pk	10.6	.5	-40	-13.84	40.51	-54.35	0-360
7	13.81688	13.72	Pk	10.6	.5	-40	-15.18	40.51	-55.69	0-360
17	13.89618	15.38	Pk	10.6	.5	-40	-13.52	40.51	-54.03	0-360
8	13.9	15.9	Pk	10.6	.5	-40	-13	40.51	-53.51	0-360
18	13.98261	17	Pk	10.6	.5	-40	-11.9	40.51	-52.41	0-360
9	13.984	16.86	Pk	10.6	.5	-40	-12.04	40.51	-52.55	0-360

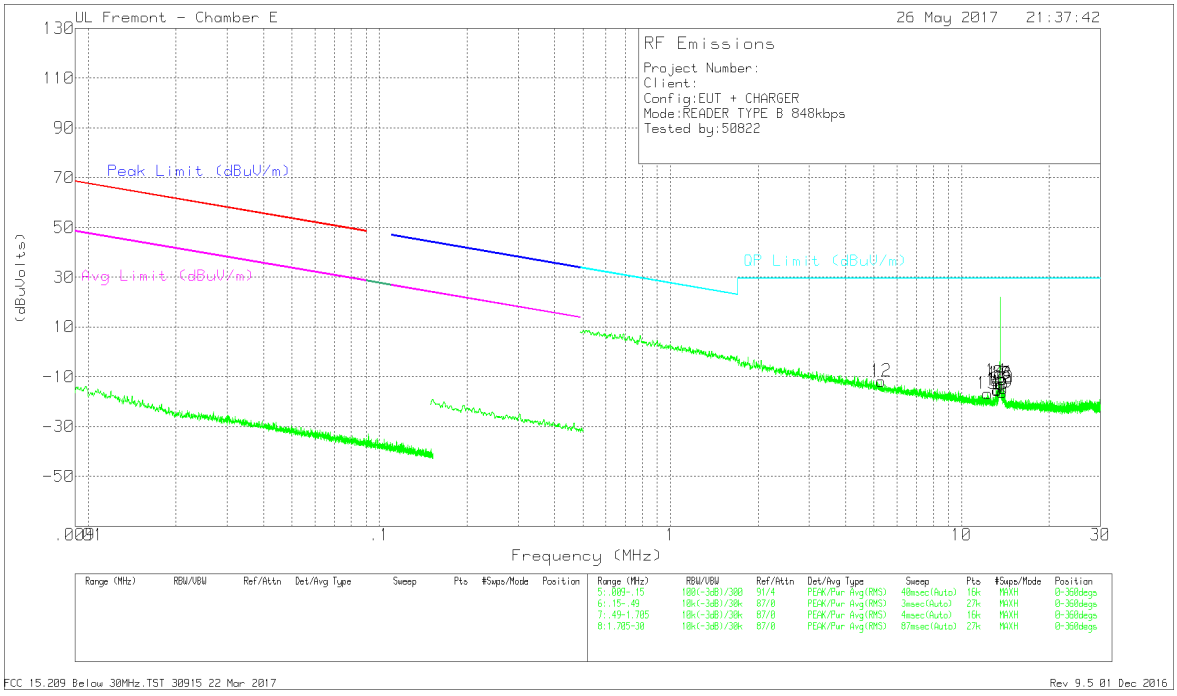
Pk - Peak detector

SPURIOUS EMISSION

ANTENNA LOOP FACE ON and OFF



ANTENNA LOOP FACE OFF



DATA

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)
1	2.3097	23.78	Pk	11.7	.2	-40	-4.32	29.5	-33.82	0-360
12	5.29335	16.64	Pk	11.3	.3	-40	-11.76	29.5	-41.26	0-360
2	9.23436	13.22	Pk	10.9	.4	-40	-15.48	29.5	-44.98	0-360
13	12.29399	12.14	Pk	10.6	.5	-40	-16.76	29.5	-46.26	0-360
3	13.05012	13.75	Pk	10.5	.5	-40	-15.25	29.5	-44.75	0-360
14	13.13449	17.4	Pk	10.5	.5	-40	-11.6	29.5	-41.1	0-360
4	13.14025	16.22	Pk	10.5	.5	-40	-12.78	29.5	-42.28	0-360
5	13.22566	15.17	Pk	10.5	.5	-40	-13.83	29.5	-43.33	0-360
15	13.23195	13.6	Pk	10.5	.5	-40	-15.4	29.5	-44.9	0-360
16	13.30636	13.78	Pk	10.5	.5	-40	-15.22	29.5	-44.72	0-360
17	13.40225	16.31	Pk	10.5	.5	-40	-12.69	29.5	-42.19	0-360
6	13.42216	18.01	Pk	10.5	.5	-40	-10.99	29.5	-40.49	0-360
7	13.71089	16.85	Pk	10.4	.5	-40	-12.25	29.5	-41.75	0-360
18	13.71456	16.18	Pk	10.4	.5	-40	-12.92	29.5	-42.42	0-360
19	13.81359	12.83	Pk	10.4	.5	-40	-16.27	29.5	-45.77	0-360
8	13.81412	14.35	Pk	10.4	.5	-40	-14.75	29.5	-44.25	0-360
20	13.89062	14.47	Pk	10.4	.5	-40	-14.63	29.5	-44.13	0-360
9	13.89638	15.01	Pk	10.4	.5	-40	-14.09	29.5	-43.59	0-360
21	13.98284	16.61	Pk	10.4	.5	-40	-12.49	29.5	-41.99	0-360
10	13.98337	17.66	Pk	10.4	.5	-40	-11.44	29.5	-40.94	0-360
11	21.58242	11.39	Pk	9.5	.7	-40	-18.41	29.5	-47.91	0-360

Pk - Peak detector

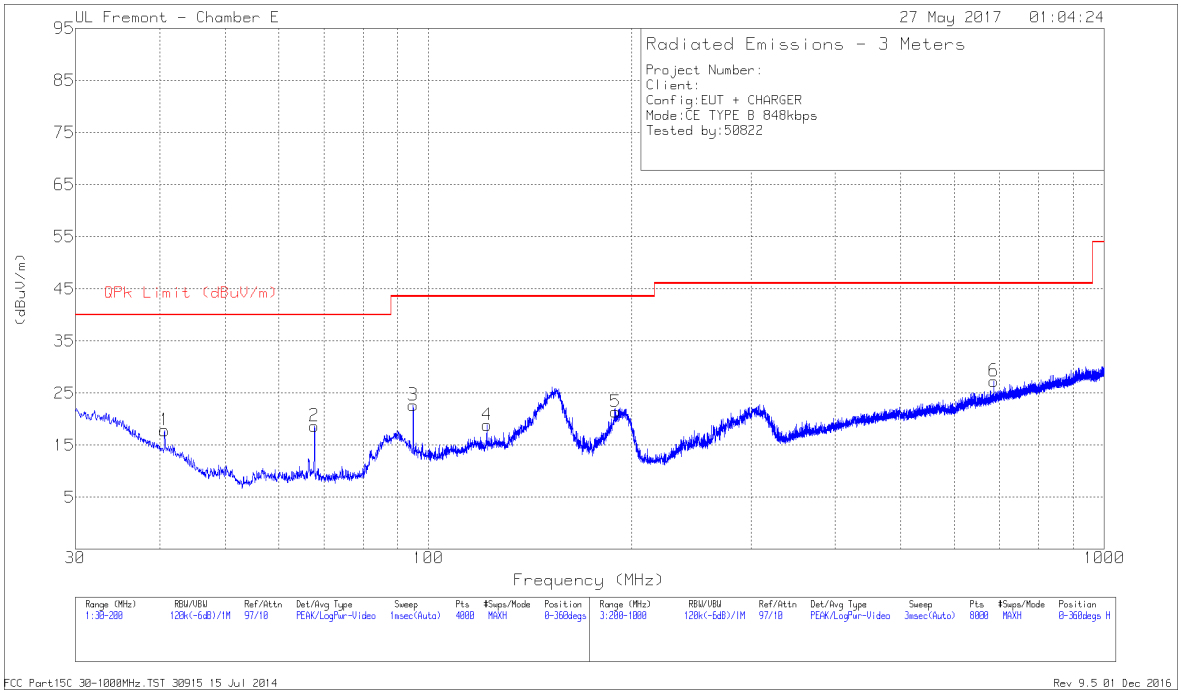
8.3. TX SPURIOUS EMISSION 30 TO 1000 MHz

8.3.1. CE MODE

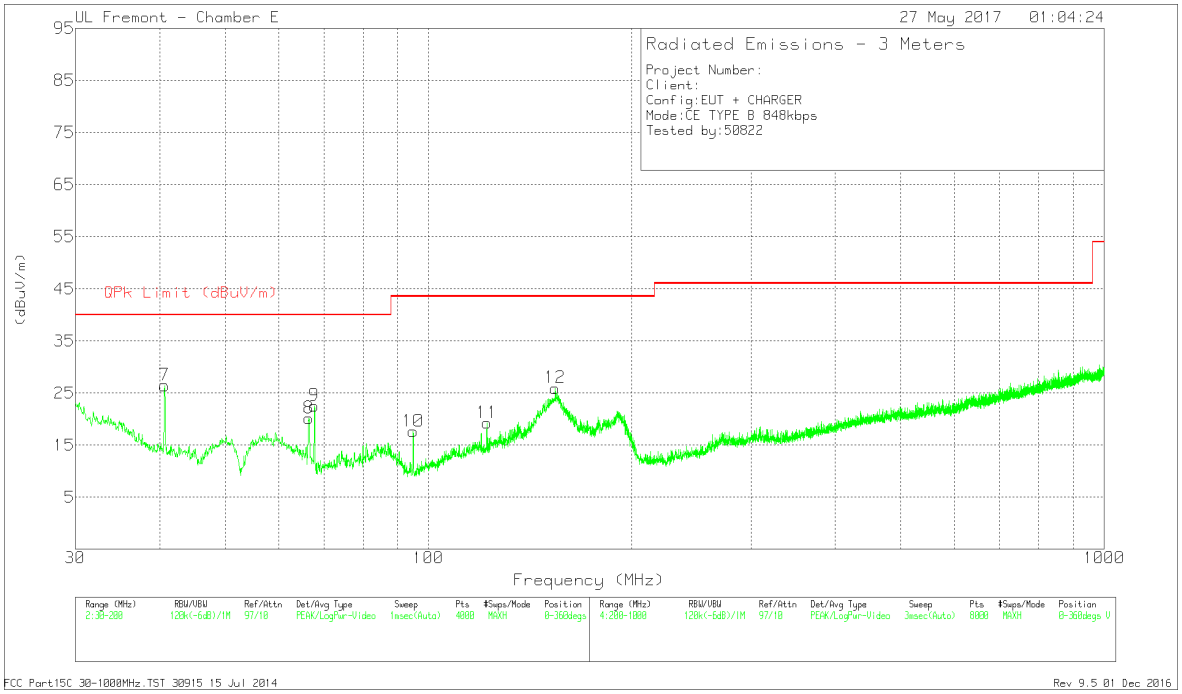
TYPE B

848Kbps

HORIZONTAL PLOT



VERITCAL PLOT



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T899 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 122.0363	31.77	Pk	17.7	-30.6	18.87	43.52	-24.65	0-360	200	H
11	* 122.0363	32.16	Pk	17.7	-30.6	19.26	43.52	-24.26	0-360	100	V
1	40.6703	31.65	Pk	17.7	-31.5	17.85	40	-22.15	0-360	300	H
7	40.6703	40.27	Pk	17.7	-31.5	26.47	40	-13.53	0-360	100	V
8	66.5169	39.27	Pk	12.1	-31.2	20.17	40	-19.83	0-360	100	V
2	67.7923	37.81	Pk	12.1	-31.2	18.71	40	-21.29	0-360	399	H
9	67.7923	41.68	Pk	12.1	-31.2	22.58	40	-17.42	0-360	100	V
3	94.9143	40.78	Pk	12.8	-30.9	22.68	43.52	-20.84	0-360	300	H
10	94.9143	35.75	Pk	12.8	-30.9	17.65	43.52	-25.87	0-360	100	V
12	154.0046	40.06	Pk	16.2	-30.3	25.96	43.52	-17.56	0-360	100	V
5	189.1187	36.37	Pk	15.1	-30.1	21.37	43.52	-22.15	0-360	200	H
6	686.4632	30.81	Pk	23.9	-27.4	27.31	46.02	-18.71	0-360	200	H

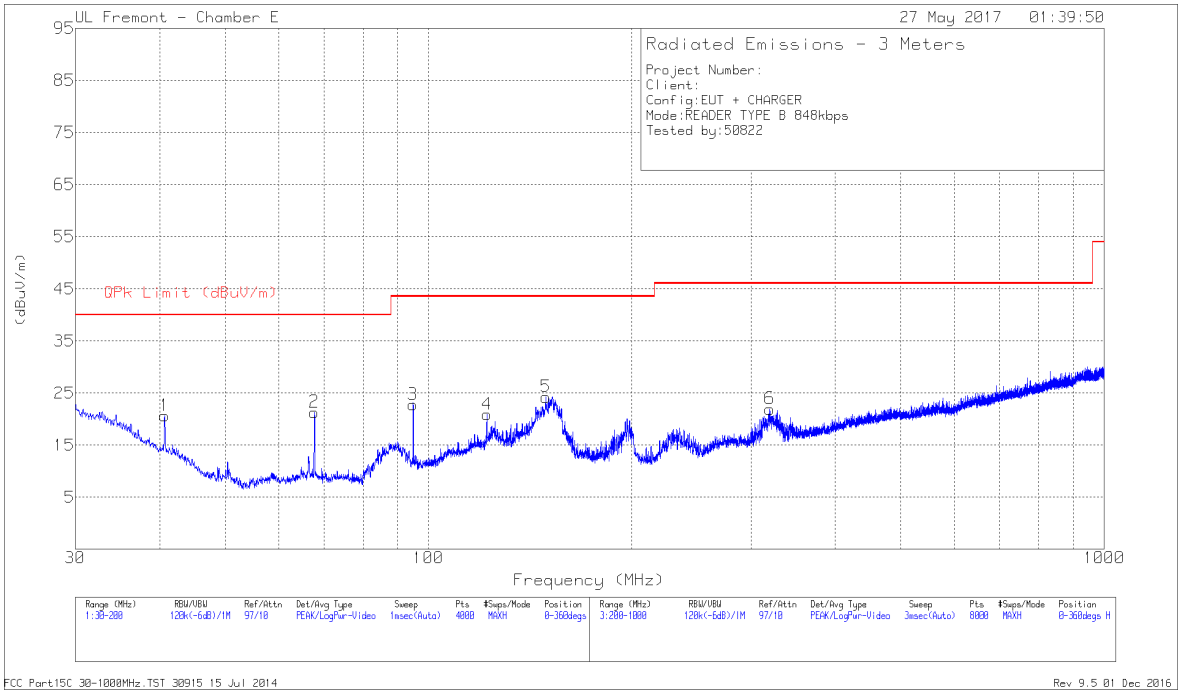
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
FCC Part15C 30-1000MHz.TST 30915 15 Jul 2014
Rev 9.5 01 Dec 2016

8.3.2. READER MODE

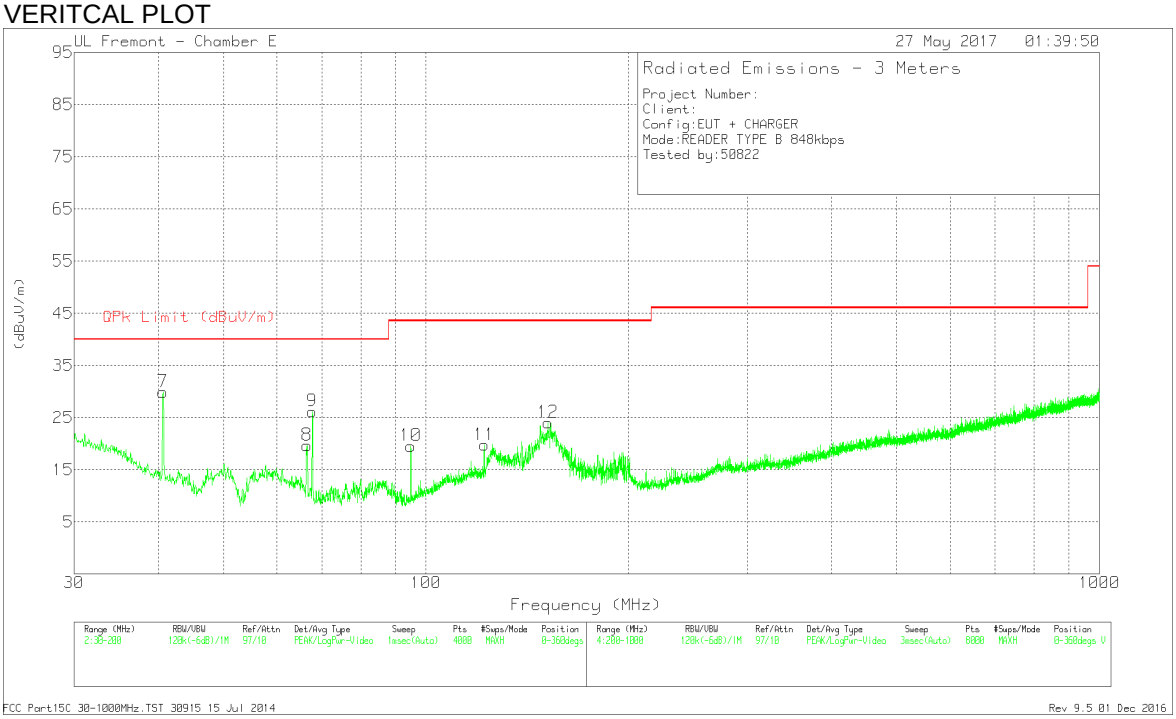
TYPE B

848Kbps

HORIZONTAL PLOT



VERITCAL PLOT



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T899 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* 122.0363	33.81	Pk	17.7	-30.6	20.91	43.52	-22.61	0-360	200	H
11	* 122.0363	32.65	Pk	17.7	-30.6	19.75	43.52	-23.77	0-360	100	V
1	40.6703	34.46	Pk	17.7	-31.5	20.66	40	-19.34	0-360	299	H
7	40.6703	43.72	Pk	17.7	-31.5	29.92	40	-10.08	0-360	100	V
8	66.5595	38.79	Pk	12.1	-31.2	19.69	40	-20.31	0-360	100	V
2	67.7923	40.43	Pk	12.1	-31.2	21.33	40	-18.67	0-360	400	H
9	67.7923	45.31	Pk	12.1	-31.2	26.21	40	-13.79	0-360	100	V
3	94.8718	40.87	Pk	12.8	-30.9	22.77	43.52	-20.75	0-360	299	H
10	94.9143	37.69	Pk	12.8	-30.9	19.59	43.52	-23.93	0-360	100	V
5	149.1158	38.13	Pk	16.5	-30.4	24.23	43.52	-19.29	0-360	99	H
12	151.709	38.15	Pk	16.3	-30.4	24.05	43.52	-19.47	0-360	100	V
6	320.0156	33.16	Pk	17.9	-29.1	21.96	46.02	-24.06	0-360	100	H

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

8.4. FREQUENCY STABILITY

Limit

RSS-210, Issue 9 Annex B.6

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±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.

TEST PROCEDURE

ANSI C63.10:2013 Clause 6.8.1 and 6.8.2

RESULTS

No non-compliance noted.

8.4.1. CE Mode

ID:	29446	Date:	5/26/17

TYPE B 848Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz										
Power Supply	Envir. Temp	Frequency Deviation Measureed with Time Elapse								
(VAC)	(ºC)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
	50	13.5597010	3.374	13.5596996	3.476	13.5596985	3.557	13.5596980	3.596	± 100
	40	13.5596987	3.545	13.5596990	3.524	13.5596992	3.510	13.5596994	3.492	± 100
	30	13.5597102	2.695	13.5597115	2.603	13.5597126	2.518	13.5597140	2.418	± 100
3.80	***20***	***13.5597468***	***0.000***	***13.5597446***	***0.156***	***13.5597440***	***0.201***	***13.5597444***	***0.171***	***± 100***
	10	13.5597615	-1.083	13.5597646	-1.319	13.5597685	-1.604	13.5597730	-1.936	± 100
	0	13.5597964	-3.662	13.5597998	-3.914	13.5598034	-4.175	13.5598096	-4.637	± 100
	-10	13.5598291	-6.073	13.5598316	-6.260	13.5598341	-6.442	13.5598367	-6.634	± 100
	-20	13.5598473	-7.414	13.5598485	-7.503	13.5598495	-7.574	13.5598503	-7.637	± 100
3.23	20	13.5597494	-0.197	13.5597473	-0.039	13.5597458	0.071	13.5597450	0.128	± 100
4.37	20	13.5597446	0.163	13.5597447	0.149	13.5597447	0.153	13.5597447	0.154	± 100

8.4.2. Reader Mode

TYPE B 848Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz										
Power Supply	Envir. Temp	Frequency Deviation Measureed with Time Elapse								
(VAC)	(ºC)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
	50	13.5596987	3.159	13.5596984	3.176	13.5596986	3.163	13.5596995	3.099	± 100
	40	13.5597107	2.275	13.5597084	2.441	13.5597060	2.621	13.5597034	2.807	± 100
	30	13.5597327	0.647	13.5597300	0.848	13.5597269	1.077	13.5597232	1.347	± 100
3.80	***20***	***13.5597415***	***0.000***	***13.5597422***	***-0.052***	***13.5597431***	***-0.119***	***13.5597442***	***-0.195***	***± 100***
	10	13.5597207	1.538	13.5597282	0.981	13.5597379	0.267	13.5597496	-0.600	± 100
	0	13.5597829	-3.052	13.5597872	-3.370	13.5597921	-3.733	13.5597982	-4.183	± 100
	-10	13.5598215	-5.897	13.5598246	-6.126	13.5598279	-6.373	13.5598318	-6.661	± 100
	-20	13.5598457	-7.683	13.5598471	-7.786	13.5598486	-7.894	13.5598500	-8.001	± 100
3.23	20	13.5597439	-0.177	13.5597440	-0.185	13.5597440	-0.184	13.5597440	-0.186	± 100
4.37	20	13.5597443	-0.209	13.5597442	-0.198	13.5597439	-0.178	13.5597439	-0.177	± 100

9. AC MAINS LINE CONDUCTED EMISSIONS

§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 50µH/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 (dBµV)	
	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

RESULTS

No non-compliance noted:

9.1.1. CE MODE TYPE B

NORMAL OPERATION, 848 KBPS

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	27.02	Qp	0	.1	10.1	37.22	65.52	-28.3	-	-
2	.159	5.35	Ca	0	.1	10.1	15.55	-	-	55.52	-39.97
3	.25125	21.58	Qp	0	.1	10.1	31.78	61.72	-29.94	-	-
4	.25125	2.23	Ca	0	.1	10.1	12.43	-	-	51.72	-39.29
5	.78225	17.15	Qp	0	.1	10.1	27.35	56	-28.65	-	-
6	.78225	6.44	Ca	0	.1	10.1	16.64	-	-	46	-29.36
7	6.198	25.07	Qp	0	.2	10.2	35.47	60	-24.53	-	-
8	6.198	19.59	Ca	0	.2	10.2	29.99	-	-	50	-20.01
9	13.56	57.28	Qp	.1	.2	10.2	67.78	**60**	**7.78**	-	-
10	13.56	54.57	Ca	.1	.2	10.2	65.07	-	-	**50**	**15.07**
11	14.4083	30.17	Qp	0	.2	10.2	40.57	60	-19.43	-	-
12	14.4083	22.31	Ca	0	.2	10.2	32.71	-	-	50	-17.29
13	17.115	17.38	Qp	0	.3	10.3	27.98	60	-32.02	-	-
14	16.9485	6.44	Ca	0	.2	10.3	16.94	-	-	50	-33.06
15	7.49175	9.11	Qp	0	.2	10.2	19.51	60	-40.49	-	-
16	7.53225	-.1	Ca	0	.2	10.2	10.3	-	-	50	-39.7

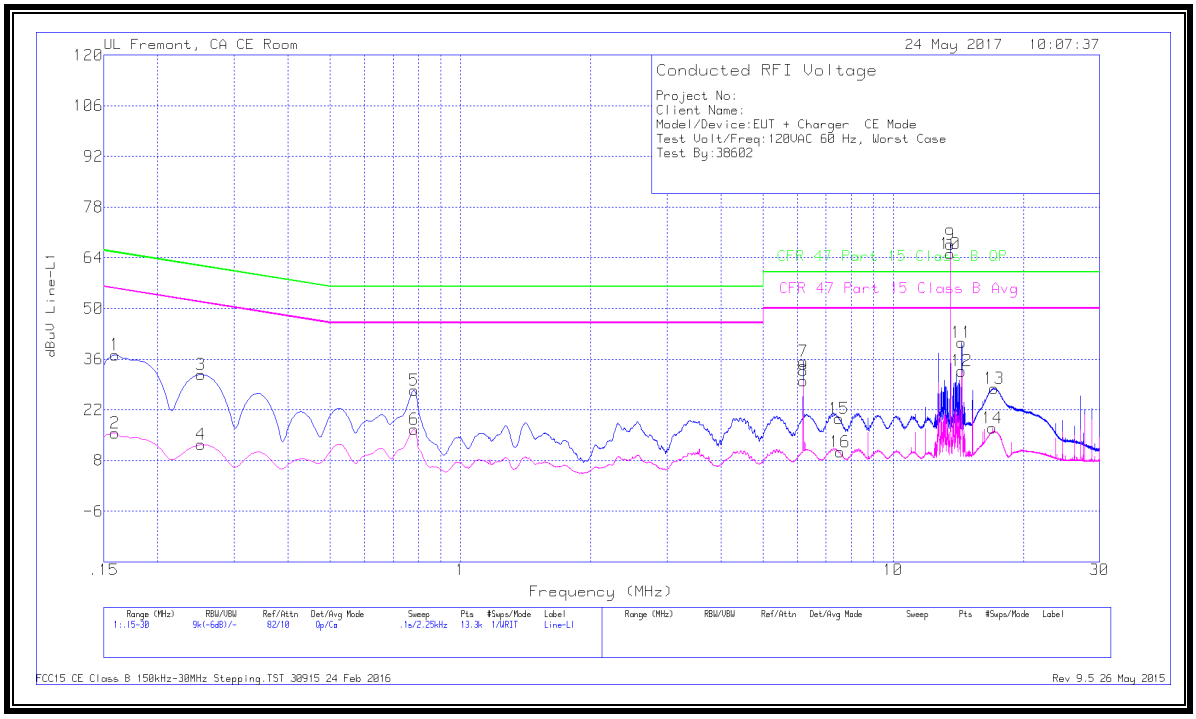
Qp - Quasi-Peak detector
Ca - CISPR average detection

Range 2: Line-L2 .15 - 30MHz

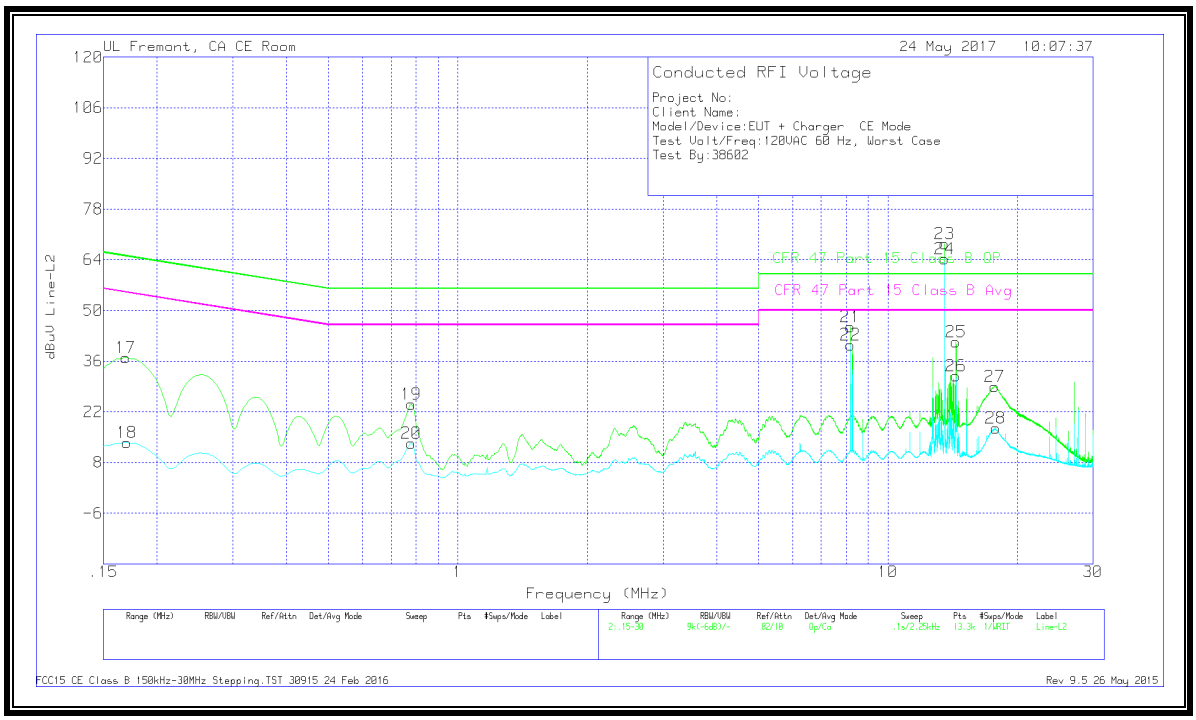
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
17	.16913	26.77	Qp	0	.1	10.1	36.97	65	-28.03	-	-
18	.17025	3.32	Ca	0	.1	10.1	13.52	-	-	54.95	-41.43
19	.78	13.89	Qp	0	.1	10.1	24.09	56	-31.91	-	-
20	.78	3.06	Ca	0	.1	10.1	13.26	-	-	46	-32.74
21	8.18925	35.1	Qp	0	.2	10.2	45.5	60	-14.5	-	-
22	8.18925	30.12	Ca	0	.2	10.2	40.52	-	-	50	-9.48
23	13.56	57.95	Qp	.1	.2	10.2	68.45	**60**	**8.45**	-	-
24	13.56	53.78	Ca	.1	.2	10.2	64.28	-	-	**50**	**14.28**
25	14.4083	30.86	Qp	.1	.2	10.2	41.36	60	-18.64	-	-
26	14.4083	21.47	Ca	.1	.2	10.2	31.97	-	-	50	-18.03
27	17.7405	18.42	Qp	0	.3	10.3	29.02	60	-30.98	-	-
28	17.799	6.83	Ca	0	.3	10.3	17.43	-	-	50	-32.57

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

LINE 1 RESULTS



LINE 2 RESULTS



9.1.2. WITH ANTENNA PORT TERMINATED, 848 KBPS

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	41.1	Qp	.1	.1	10.1	51.4	65.52	-14.12	-	-
2	.16125	29.07	Ca	.1	.1	10.1	39.37	-	-	55.4	-16.03
3	.24225	31.93	Qp	0	.1	10.1	42.13	62.02	-19.89	-	-
4	.2445	20.93	Ca	0	.1	10.1	31.13	-	-	51.94	-20.81
5	.32325	28.97	Qp	0	.1	10.1	39.17	59.62	-20.45	-	-
6	.3255	17.46	Ca	0	.1	10.1	27.66	-	-	49.57	-21.91
7	.40425	25.15	Qp	0	.1	10.1	35.35	57.77	-22.42	-	-
8	.4065	11.74	Ca	0	.1	10.1	21.94	-	-	47.72	-25.78
9	.82275	24.69	Qp	0	.1	10.1	34.89	56	-21.11	-	-
10	.8205	16.3	Ca	0	.1	10.1	26.5	-	-	46	-19.5
11	16.737	22.24	Qp	0	.2	10.3	32.74	60	-27.26	-	-
12	16.7393	13.87	Ca	0	.2	10.3	24.37	-	-	50	-25.63

Qp - Quasi-Peak detector

Ca - CISPR average detection

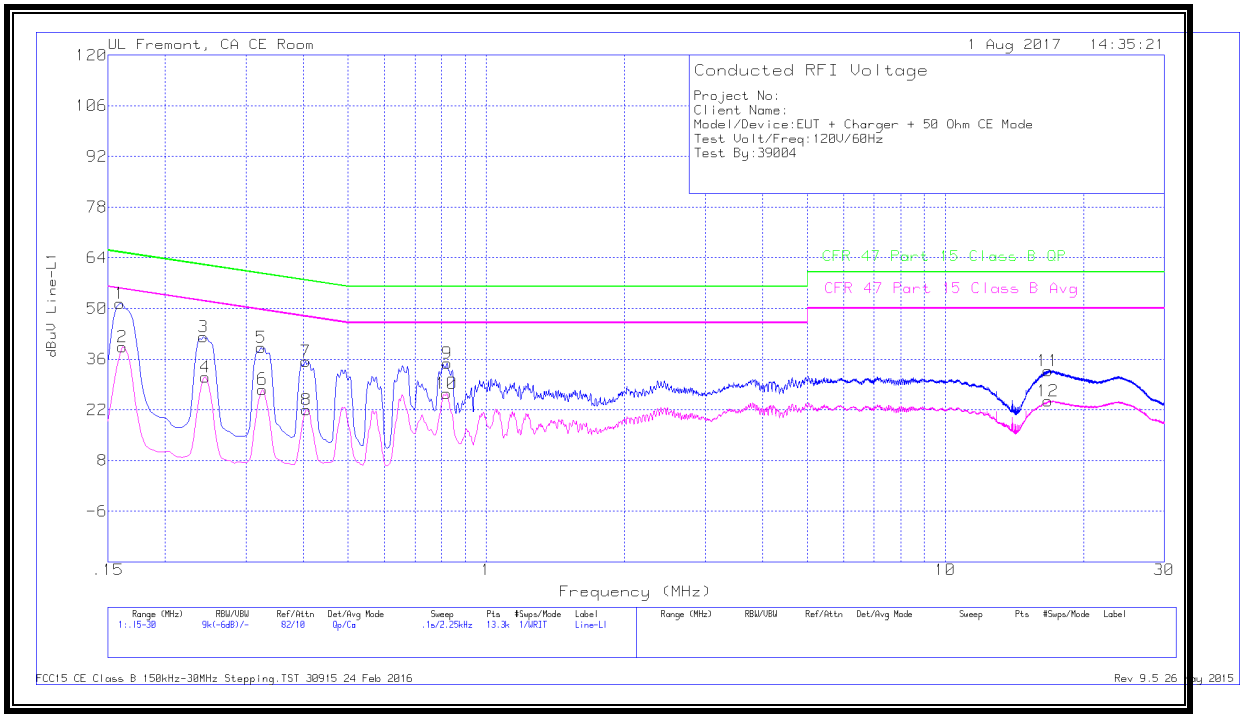
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.16125	40.22	Qp	0	.1	10.1	50.42	65.4	-14.98	-	-
14	.1635	28.2	Ca	0	.1	10.1	38.4	-	-	55.28	-16.88
15	.24225	32.45	Qp	0	.1	10.1	42.65	62.02	-19.37	-	-
16	.2445	19.67	Ca	0	.1	10.1	29.87	-	-	51.94	-22.07
17	.32325	29.05	Qp	0	.1	10.1	39.25	59.62	-20.37	-	-
18	.3255	15.17	Ca	0	.1	10.1	25.37	-	-	49.57	-24.2
19	.65625	22	Qp	0	.1	10.1	32.2	56	-23.8	-	-
20	.65625	12.13	Ca	0	.1	10.1	22.33	-	-	46	-23.67
21	.8205	22.5	Qp	0	.1	10.1	32.7	56	-23.3	-	-
22	.8205	12.68	Ca	0	.1	10.1	22.88	-	-	46	-23.12
23	16.3095	21.87	Qp	0	.2	10.3	32.37	60	-27.63	-	-
24	16.3253	13.47	Ca	0	.2	10.3	23.97	-	-	50	-26.03

Qp - Quasi-Peak detector

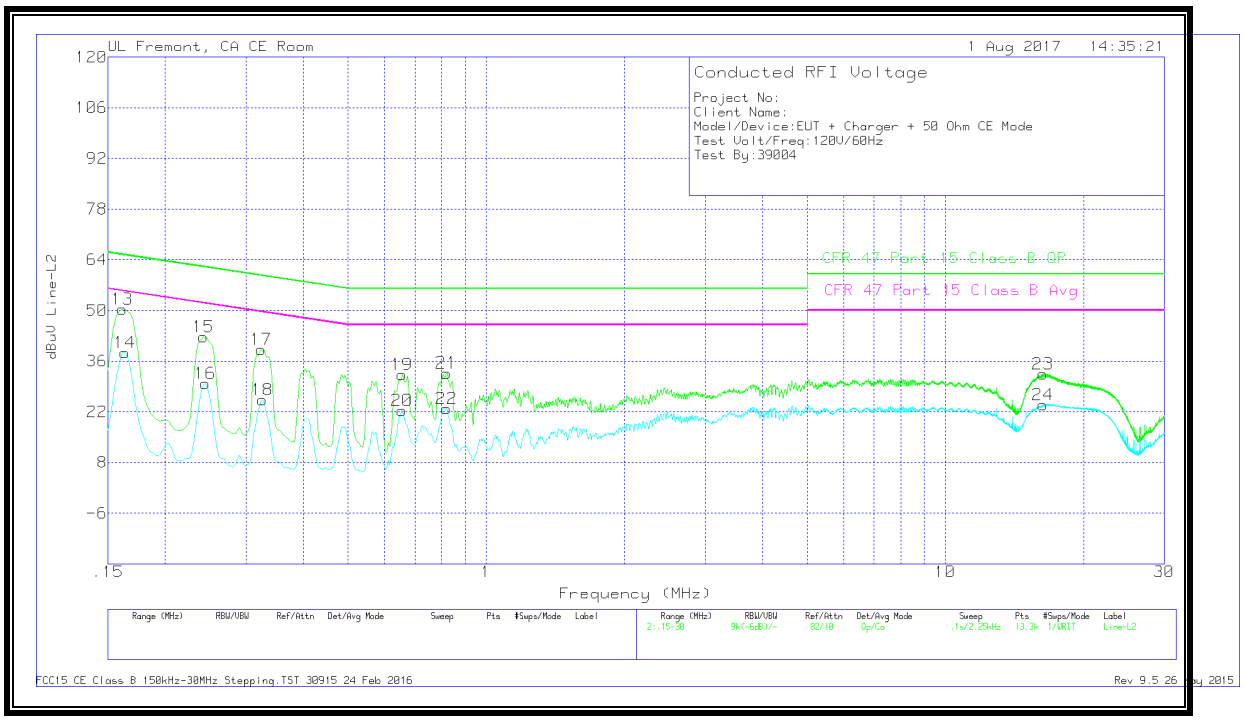
Ca - CISPR average detection

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

LINE 1 RESULTS



LINE 2 RESULTS



9.1.3. READER MODE TYPE B

NORMAL OPERATION, 848 KBPS

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	26.05	Qp	0	.1	10.1	36.25	65.52	-29.27	-	-
2	.159	3.86	Ca	0	.1	10.1	14.06	-	-	55.52	-41.46
3	.25125	20.69	Qp	0	.1	10.1	30.89	61.72	-30.83	-	-
4	.25125	1.14	Ca	0	.1	10.1	11.34	-	-	51.72	-40.38
5	.78	16.91	Qp	0	.1	10.1	27.11	56	-28.89	-	-
6	.78225	6.3	Ca	0	.1	10.1	16.5	-	-	46	-29.5
7	4.28888	9.57	Qp	0	.1	10.1	19.77	56	-36.23	-	-
8	4.27875	.16	Ca	0	.1	10.1	10.36	-	-	46	-35.64
9	13.56	56.64	Qp	.1	.2	10.2	67.14	**60**	**7.14**	-	-
10	13.56	53.97	Ca	.1	.2	10.2	64.47	-	-	**50**	**14.47**
11	17.1341	17.22	Qp	0	.3	10.3	27.82	60	-32.18	-	-
12	17.0441	5.61	Ca	0	.2	10.3	16.11	-	-	50	-33.89

Qp - Quasi-Peak detector
Ca - CISPR average detection

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.17025	26.36	Qp	0	.1	10.1	36.56	64.95	-28.39	-	-
14	.17025	2.87	Ca	0	.1	10.1	13.07	-	-	54.95	-41.88
15	.2535	21.67	Qp	0	.1	10.1	31.87	61.64	-29.77	-	-
16	.25238	.12	Ca	0	.1	10.1	10.32	-	-	51.68	-41.36
17	.59325	15.22	Qp	0	.1	10.1	25.42	56	-30.58	-	-
18	.59325	9.47	Ca	0	.1	10.1	19.67	-	-	46	-26.33
19	.78	13.72	Qp	0	.1	10.1	23.92	56	-32.08	-	-
20	.78	3.1	Ca	0	.1	10.1	13.3	-	-	46	-32.7
21	13.56	57.17	Qp	.1	.2	10.2	67.67	**60**	**7.67**	-	-
22	13.56	53.17	Ca	.1	.2	10.2	63.67	-	-	**50**	**13.67**
23	17.7383	18.4	Qp	0	.3	10.3	29	60	-31	-	-
24	17.6966	6.81	Ca	0	.2	10.3	17.31	-	-	50	-32.69

Qp - Quasi-Peak detector
Ca - CISPR average detection
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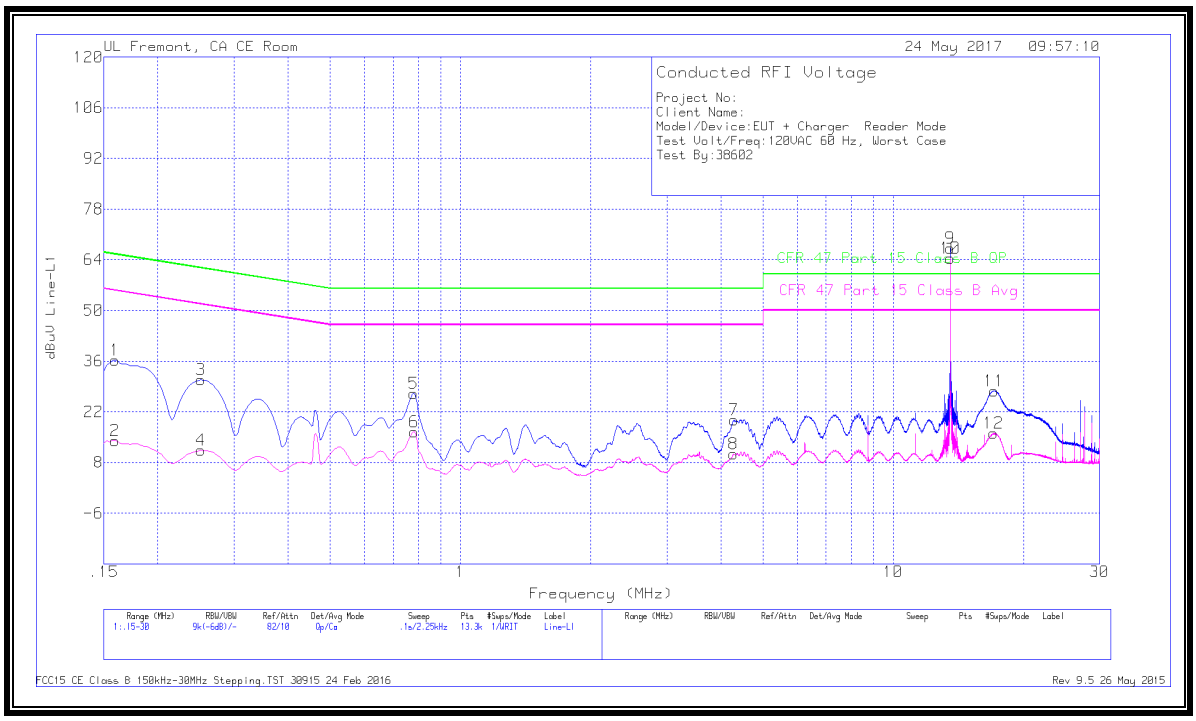
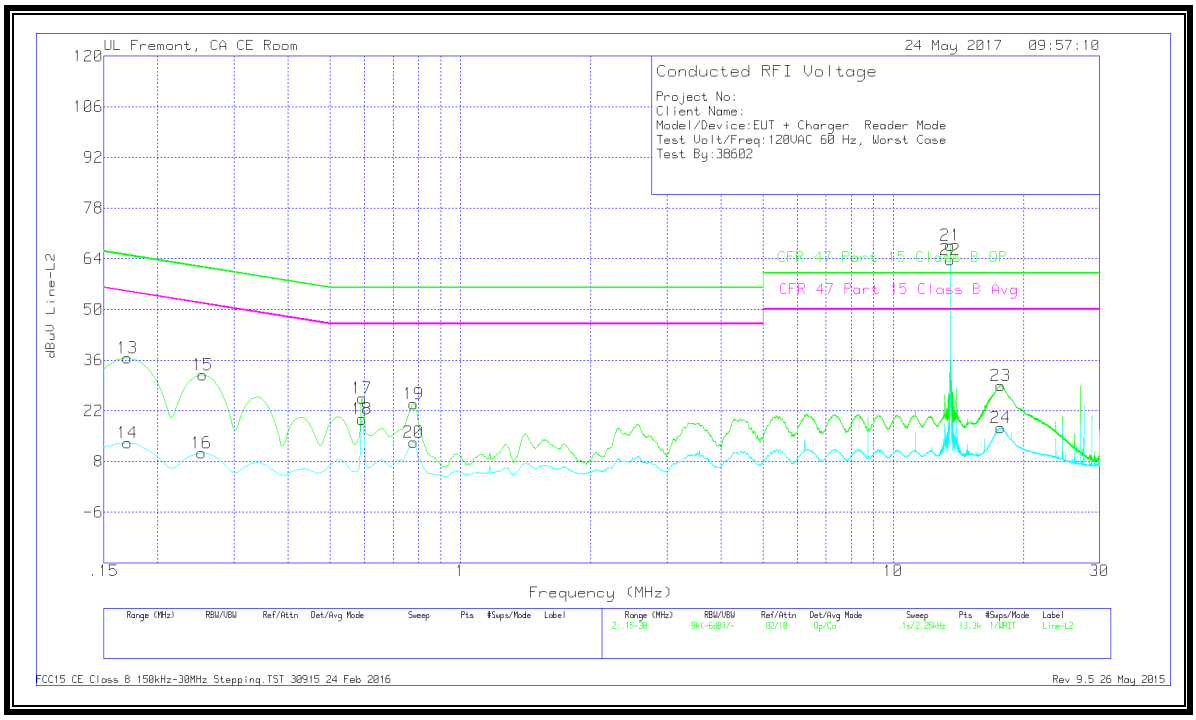
Rev 9.5 26 May 2015

LINE 1 RESULTS



LINE 2 RESULTS



9.1.4. WITH ANTENNA PORT TERMINATED, 848 KBPS

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	40.96	Qp	.1	.1	10.1	51.26	65.52	-14.26	-	-
2	.16125	28.94	Ca	.1	.1	10.1	39.24	-	-	55.4	-16.16
3	.24225	31.87	Qp	0	.1	10.1	42.07	62.02	-19.95	-	-
4	.2445	20.93	Ca	0	.1	10.1	31.13	-	-	51.94	-20.81
5	.32325	28.97	Qp	0	.1	10.1	39.17	59.62	-20.45	-	-
6	.3255	17.46	Ca	0	.1	10.1	27.66	-	-	49.57	-21.91
7	.6585	23.99	Qp	0	.1	10.1	34.19	56	-21.81	-	-
8	.65625	15.86	Ca	0	.1	10.1	26.06	-	-	46	-19.94
9	.82275	24.8	Qp	0	.1	10.1	35	56	-21	-	-
10	.8205	16.38	Ca	0	.1	10.1	26.58	-	-	46	-19.42
11	16.3613	21.34	Qp	0	.2	10.3	31.84	60	-28.16	-	-
12	16.3838	13.26	Ca	0	.2	10.3	23.76	-	-	50	-26.24

Qp - Quasi-Peak detector

Ca - CISPR average detection

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	40.15	Qp	0	.1	10.1	50.35	65.4	-15.05	-	-
14	.1635	28.14	Ca	0	.1	10.1	38.34	-	-	55.28	-16.94
15	.24225	32.35	Qp	0	.1	10.1	42.55	62.02	-19.47	-	-
16	.2445	19.57	Ca	0	.1	10.1	29.77	-	-	51.94	-22.17
17	.32325	28.93	Qp	0	.1	10.1	39.13	59.62	-20.49	-	-
18	.3255	15.02	Ca	0	.1	10.1	25.22	-	-	49.57	-24.35
19	.402	23.37	Qp	0	.1	10.1	33.57	57.81	-24.24	-	-
20	.4065	9.94	Ca	0	.1	10.1	20.14	-	-	47.72	-27.58
21	.8205	22.7	Qp	0	.1	10.1	32.9	56	-23.1	-	-
22	.8205	12.83	Ca	0	.1	10.1	23.03	-	-	46	-22.97
23	16.7325	21.72	Qp	0	.2	10.3	32.22	60	-27.78	-	-
24	16.7258	13.66	Ca	0	.2	10.3	24.16	-	-	50	-25.84

Qp - Quasi-Peak detector

Ca - CISPR average detection

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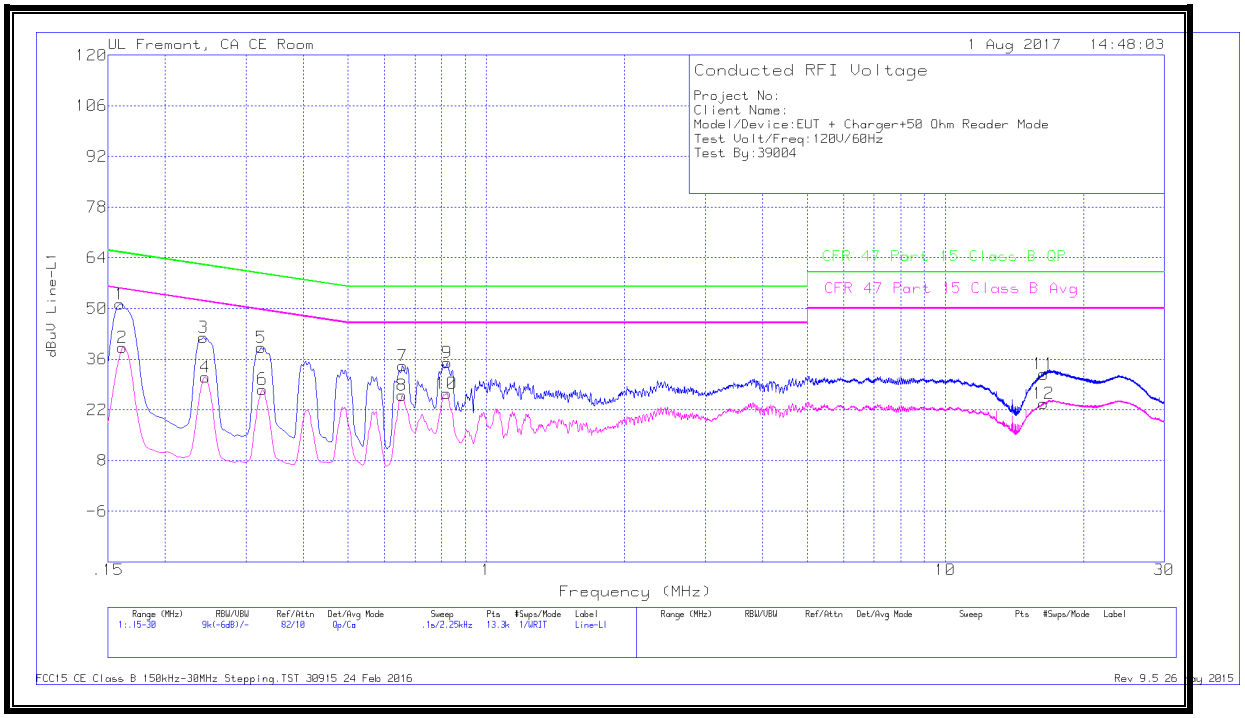
LINE 1 RESULTS



LINE 2 RESULTS