



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

CERTIFICATION TEST REPORT

FOR

SMARTPHONE

MODEL NUMBER: A1906

**FCC ID: BCG-E3171A
IC: 579C-E3171A**

REPORT NUMBER: 11723997-E6V2

ISSUE DATE: JULY 28, 2017

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

Prepared by
**UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888**



NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	7/25/2017	Initial Issue	--
V2	7/28/2017	Updated report to address TCB's questions	Tina Chu

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	5
4.1. MEASURING INSTRUMENT CALIBRATION	5
4.2. SAMPLE CALCULATION	5
4.3. MEASUREMENT UNCERTAINTY.....	6
5. EQUIPMENT UNDER TEST.....	7
5.1. DESCRIPTION OF EUT	7
5.2. MAXIMUM OUTPUT POWER	7
5.3. SOFTWARE AND FIRMWARE.....	7
5.4. WORST-CASE CONFIGURATION AND MODE.....	7
5.5. DESCRIPTION OF TEST SETUP	8
6. TEST AND MEASUREMENT EQUIPMENT	11
7. OCCUPIED BANDWIDTH.....	12
7.1. CE MODE.....	13
7.2. READER MODE.....	14
8. RADIATED EMISSION TEST RESULTS	15
8.1. LIMITS AND PROCEDURE.....	15
8.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)	17
8.2.1. CE MODE.....	17
8.3. TX SPURIOUS EMISSION 30 TO 1000 MHz	25
8.3.1. CE MODE.....	25
8.3.2. READER MODE.....	27
9. FREQUENCY STABILITY	29
9.1. CE Mode	30
9.2. Reader Mode.....	30
10. AC MAINS LINE CONDUCTED EMISSIONS	31
10.1.1. CE MODE TYPE B.....	32
10.1.2. WITH ANTENNA PORT TERMINATED, 848 KBPS.....	34
10.1.3. READER MODE TYPE B.....	36
10.1.4. WITH ANTENNA PORT TERMINATED, 848 KBPS.....	38
11. SETUP PHOTOS	40

1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: SMARTPHONE

MODEL: A1906

SERIAL NUMBER: C7CTP001J5RX

DATE TESTED: MARCH 14, 2017 – MAY 30, 2017

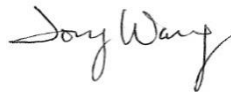
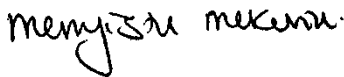
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Pass
INDUSTRY CANADA RSS-210 Issue 9, Annex B.6.	Pass
INDUSTRY CANADA RSS-GEN Issue 4	Pass

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:

Prepared By:



MENGISTU MEKURIA
SENIOR ENGINEER
UL Verification Services Inc.

TONY WANG
EMC 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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamplifier Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
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	± 0.02 %

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.

5.2. MAXIMUM OUTPUT POWER

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	24.68
	Reader Mode	B	24.83

* 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 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

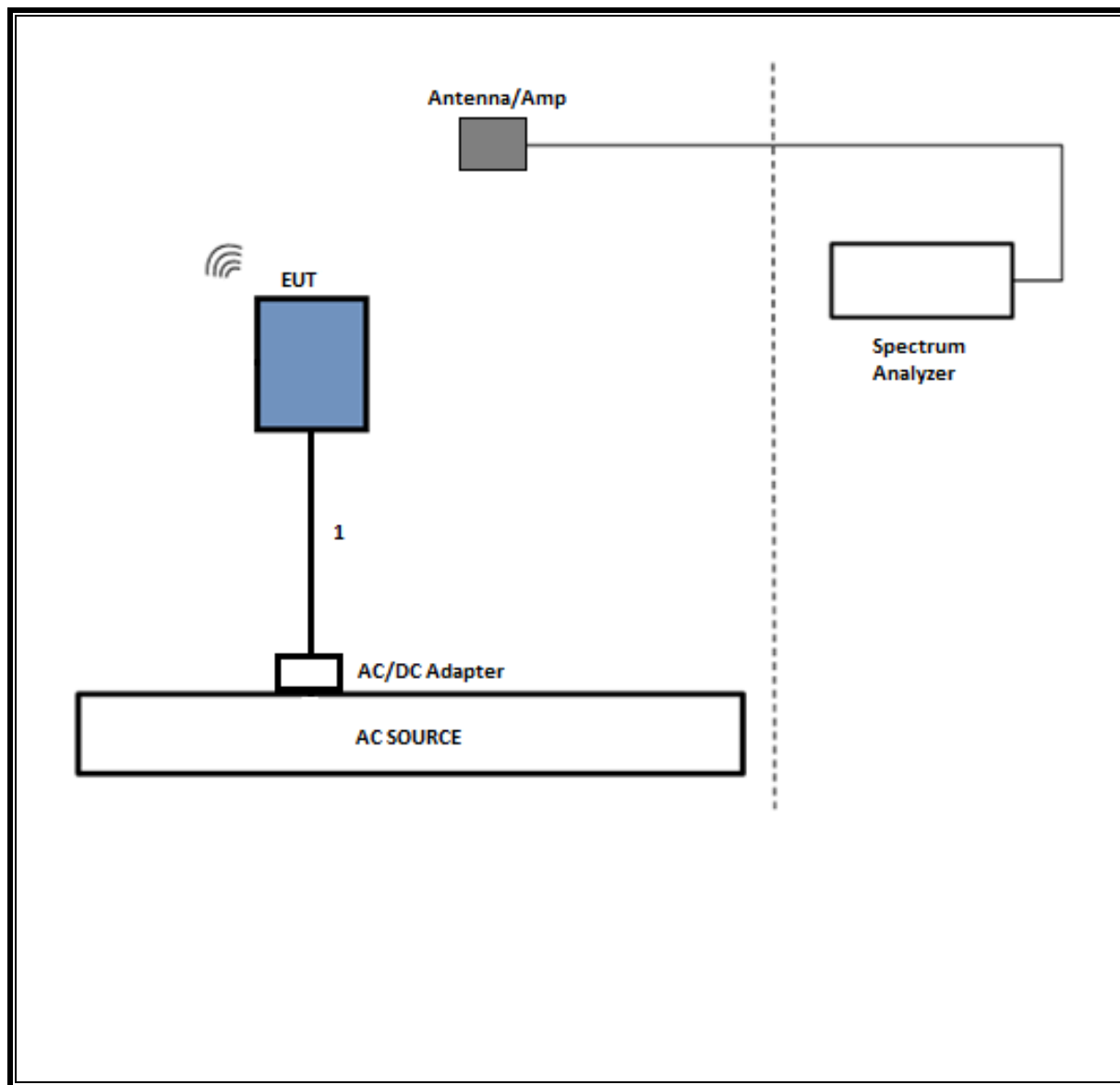
SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Apple	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

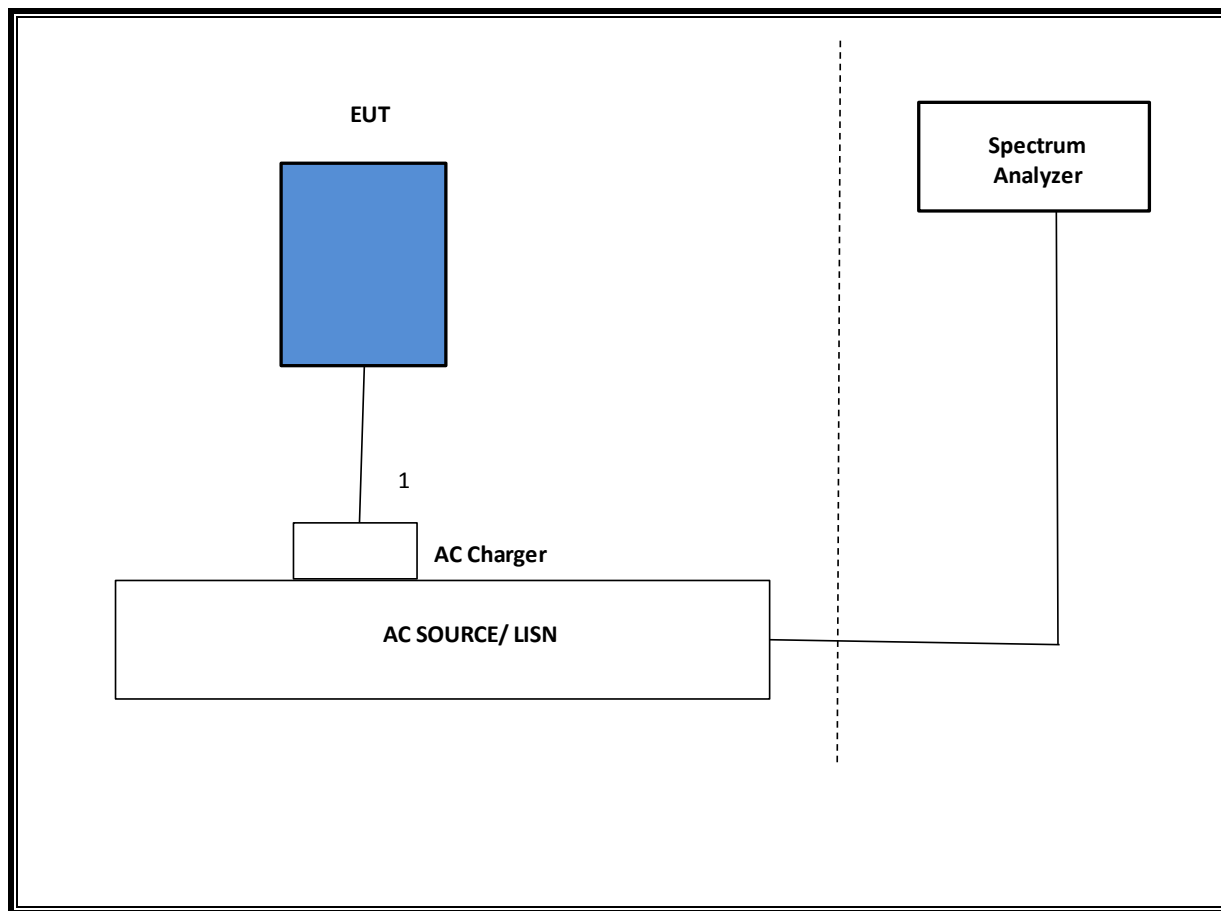
I/O CABLES (Radiated and AC Line)

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
*Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T286	5/4/2017
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	T285	6/20/2017
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	6/8/2017
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 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/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:	42851	Date:	5/4/17
-----	-------	-------	--------

99% and 20dB BW

CE Mode

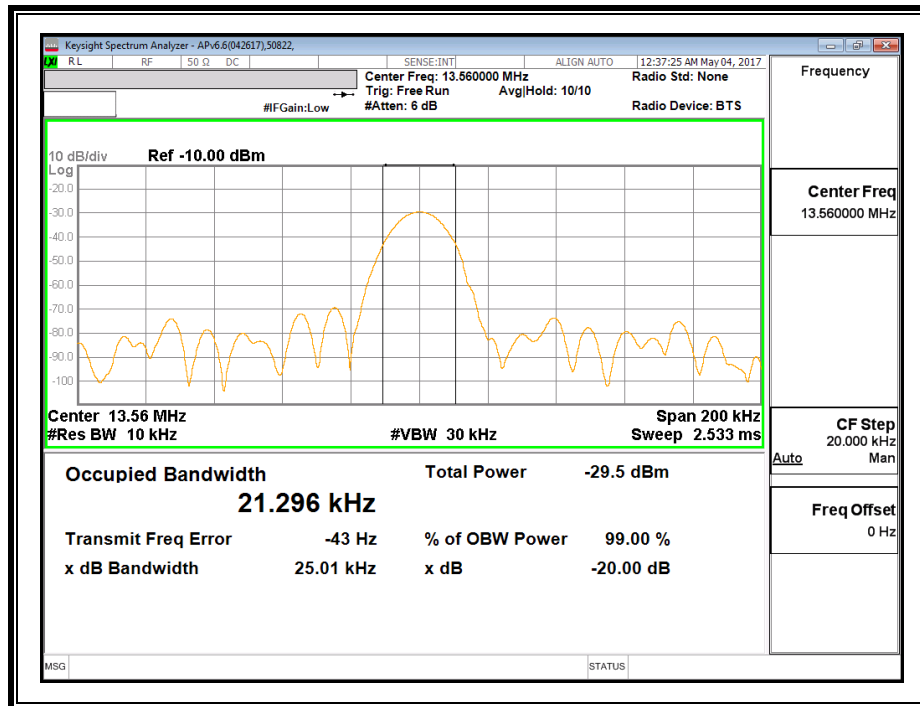
Modulation	Frequency	Data Rate	99% Bandwidth	20dB Bandwidth
	(MHz)	(Kbps)	(KHz)	(KHz)
Type B	13.56	848	21.296	25.01

READER

Modulation	Frequency	Data Rate	99% Bandwidth	20dB Bandwidth
	(MHz)	(Kbps)	(KHz)	(KHz)
Type B	13.56	848	21.887	25.53

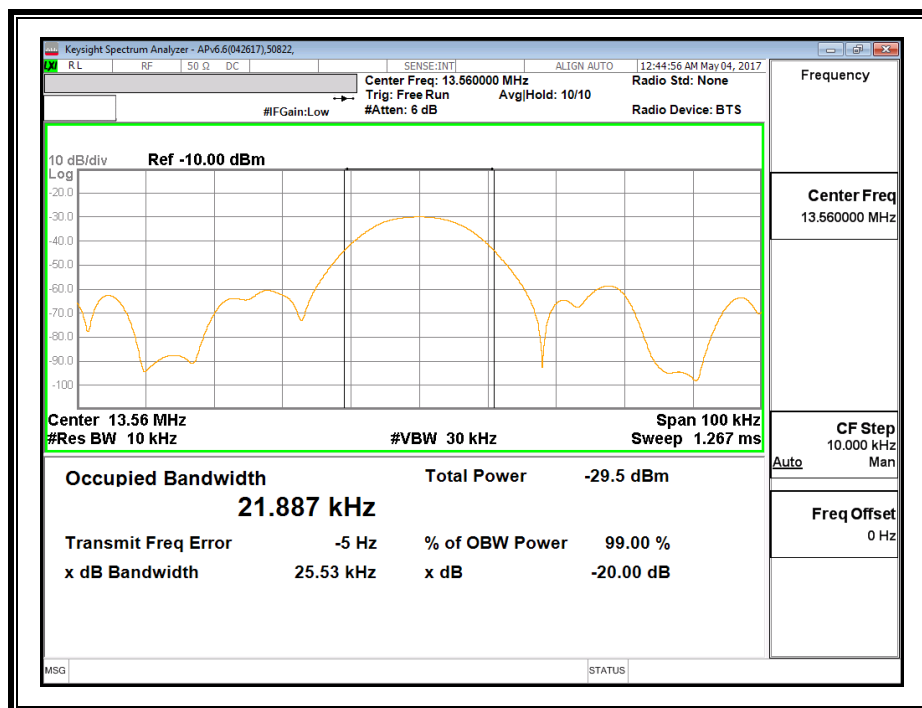
7.1. CE MODE

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.

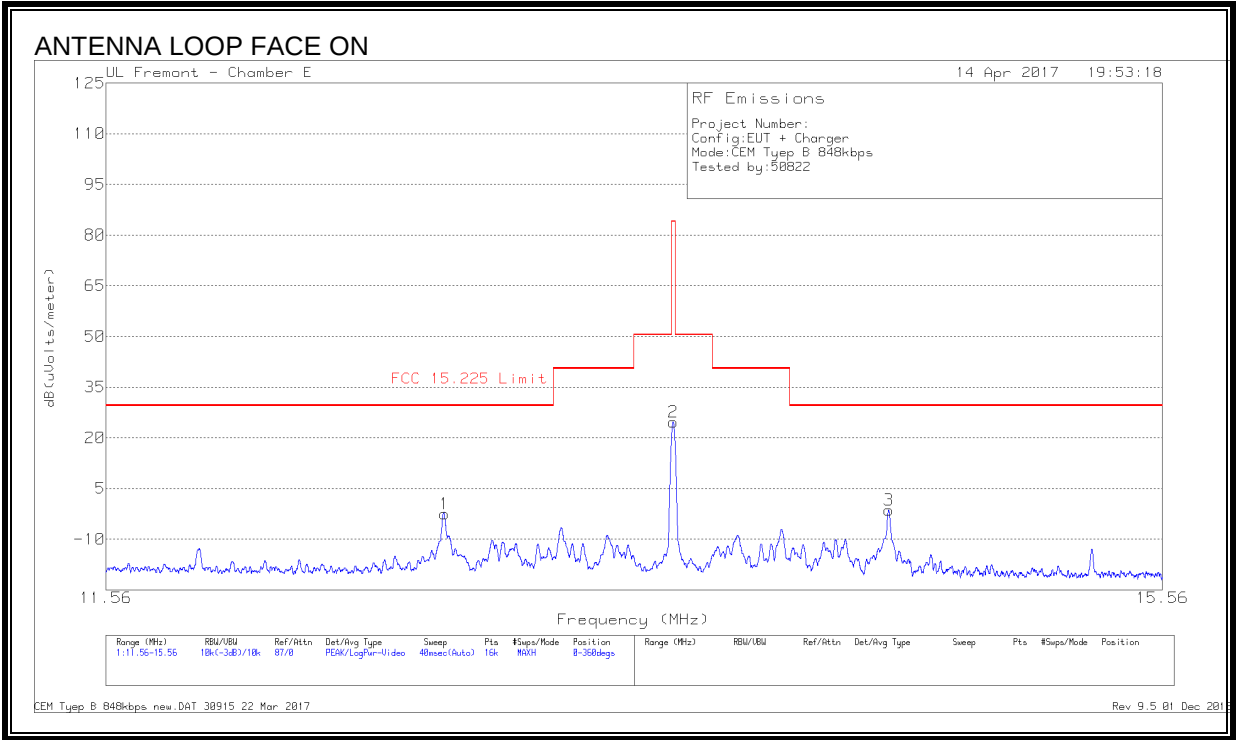
RESULTS

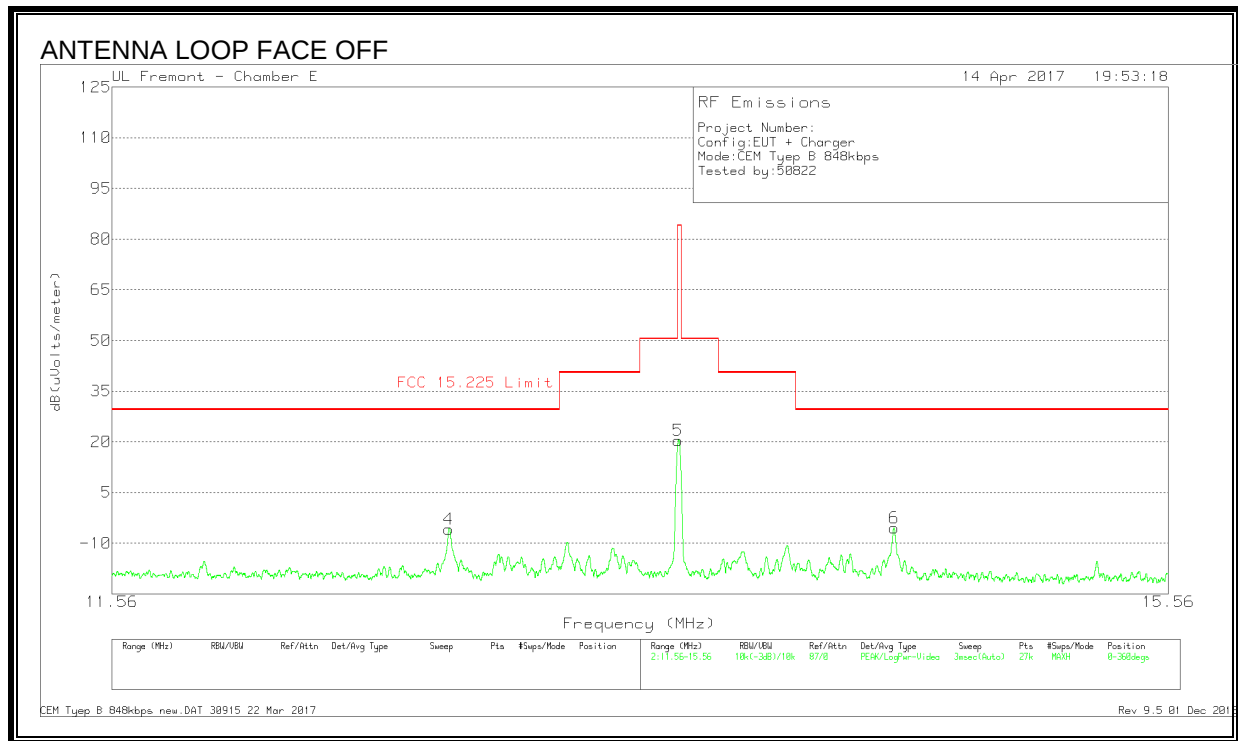
8.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)

8.2.1. CE MODE

TYPE B

848Kbps FUNDAMENTAL





Trace Markers

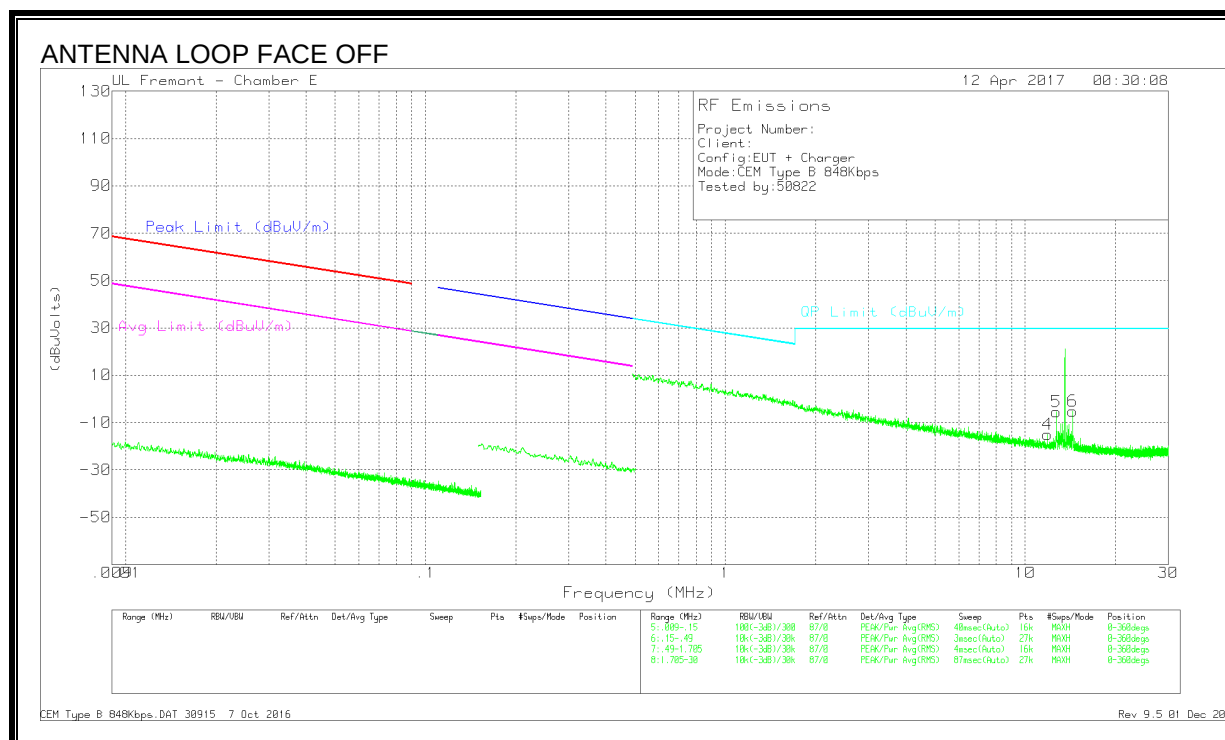
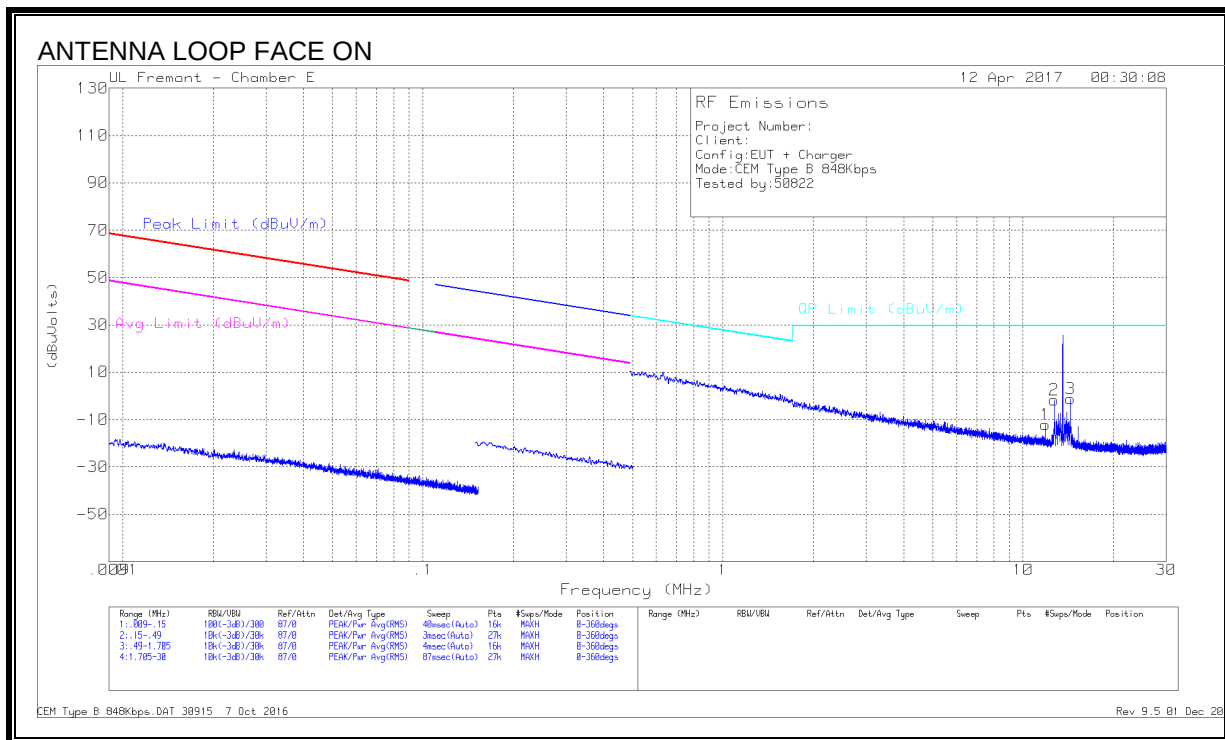
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
4	12.71092	23.46	Pk	10.5	.4	-40	-5.64	29.54	-35.18	0-360
1	12.71238	27.05	Pk	10.5	.4	-40	-2.05	29.54	-31.59	0-360
5	13.55682	49.78	Pk	10.4	.4	-40	20.58	84	-63.42	0-360
2	13.55963	53.88	Pk	10.4	.4	-40	24.68	84	-59.32	0-360
6	14.40589	23.37	Pk	10.4	.4	-40	-5.83	29.54	-35.37	0-360
3	14.40775	27.72	Pk	10.4	.4	-40	-1.48	29.54	-31.02	0-360

Pk - Peak detector

FCC 15.225 13.56MHz Fundamental Mask.TST 30915 22 Mar 2017

Rev 9.5 01 Dec 2016

SPURIOUS EMISSION



Trace Markers

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	11.86431	16.72	Pk	10.8	.4	-40	-12.08	29.5	-41.58	0-360
4	11.86641	13.68	Pk	10.8	.4	-40	-15.12	29.5	-44.62	0-360
5	12.71214	23.47	Pk	10.7	.4	-40	-5.43	29.5	-34.93	0-360
2	12.71319	27.25	Pk	10.7	.4	-40	-1.65	29.5	-31.15	0-360
3	14.40781	27.85	Pk	10.6	.4	-40	-1.15	29.5	-30.65	0-360
6	14.40781	23.89	Pk	10.6	.4	-40	-5.11	29.5	-34.61	0-360

Pk - Peak detector

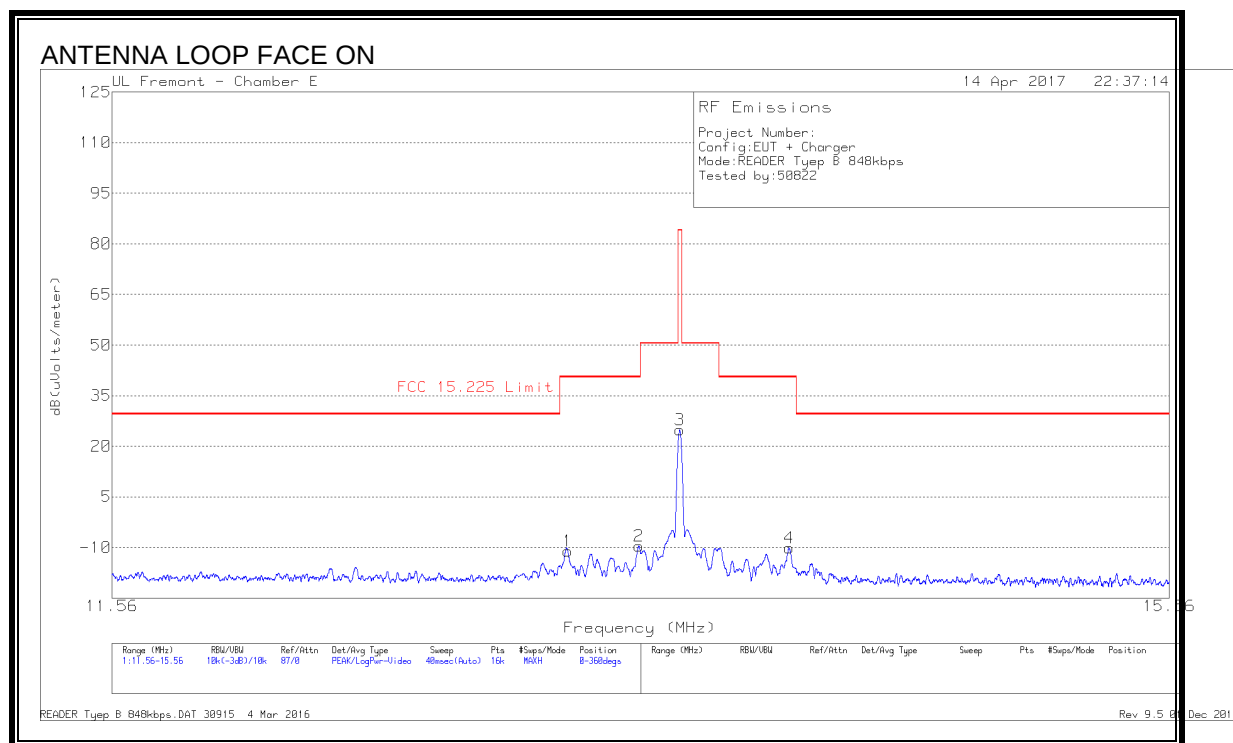
*.TST 30915 7 Oct 2016

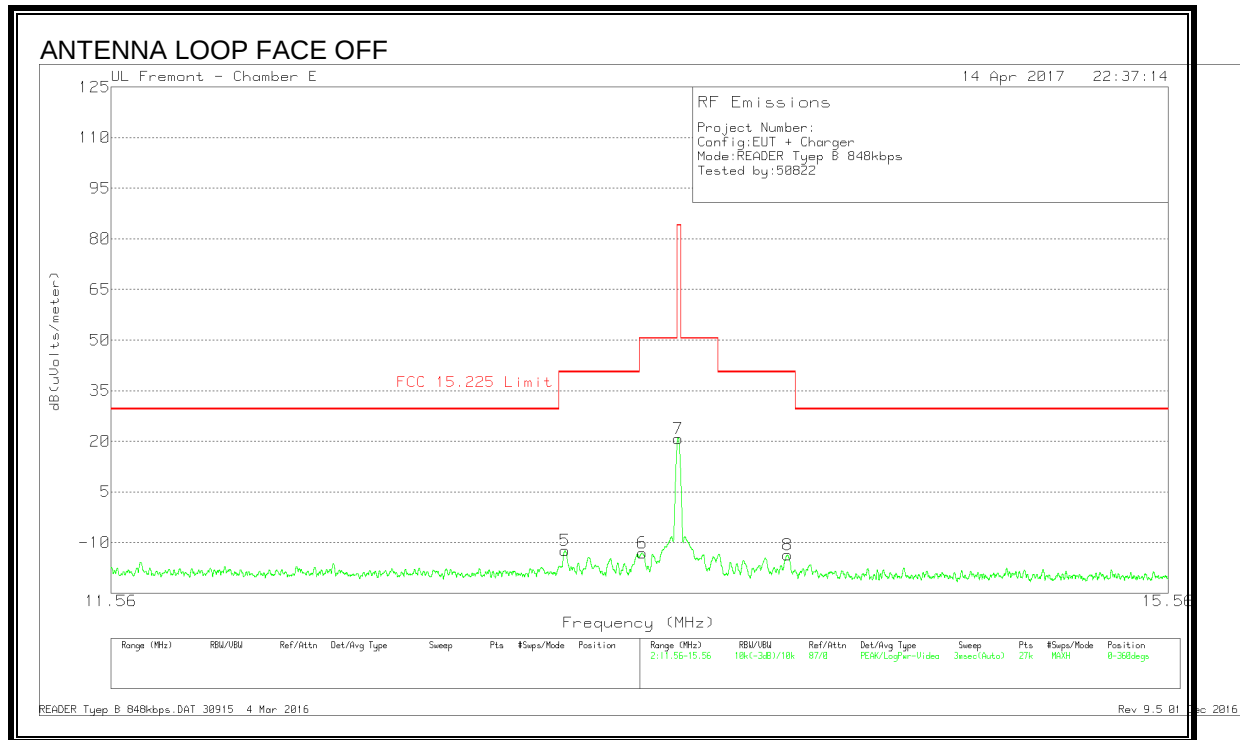
Rev 9.5 01 Dec 2016

READER MODE

TYPE B

848Kbps FUNDAMENTAL





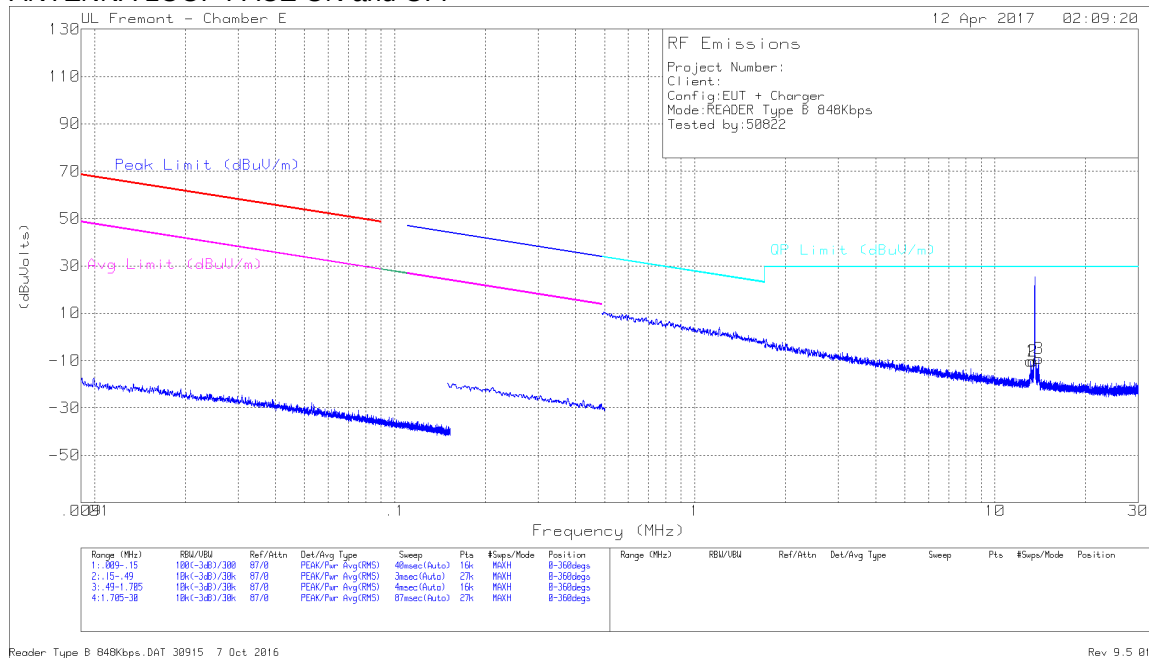
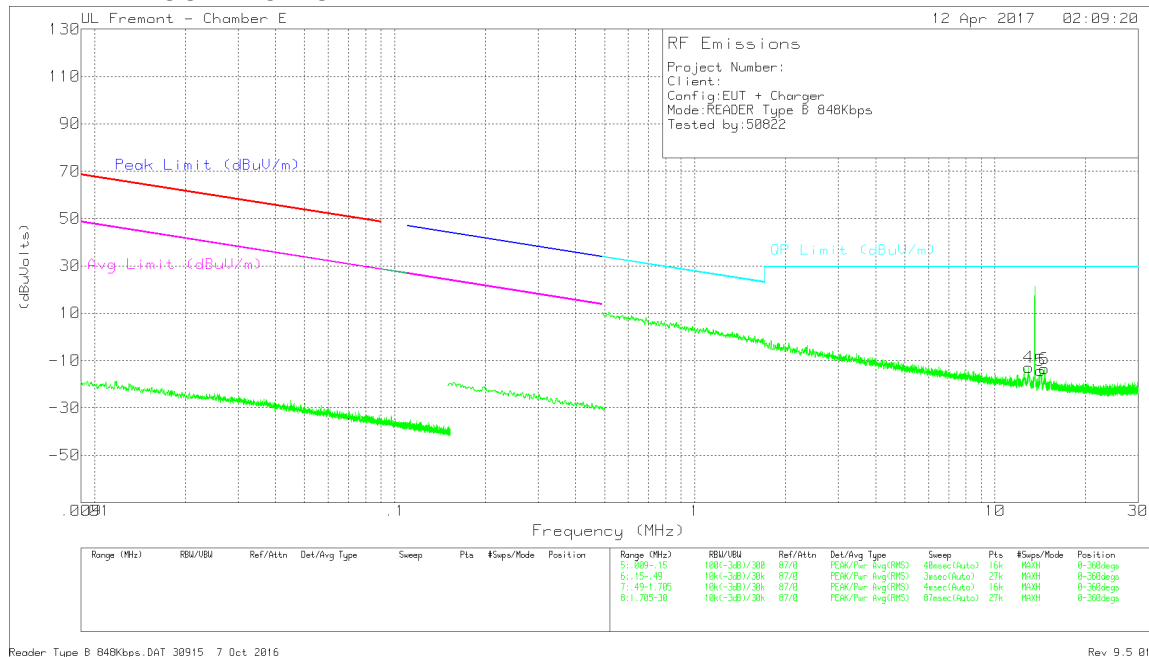
Trace Markers

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)
5	13.13376	16.44	Pk	10.7	.4	-40	-12.46	40.51	-52.97	0-360
1	13.13925	17.89	Pk	10.7	.4	-40	-11.01	40.51	-51.52	0-360
2	13.40513	19.33	Pk	10.7	.4	-40	-9.57	40.51	-50.08	0-360
6	13.42273	15.74	Pk	10.7	.4	-40	-13.16	50.5	-63.66	0-360
7	13.55889	49.8	Pk	10.6	.4	-40	20.8	84	-63.2	0-360
3	13.55938	53.83	Pk	10.6	.4	-40	24.83	84	-59.17	0-360
8	13.9815	15.26	Pk	10.6	.4	-40	-13.74	40.51	-54.25	0-360
4	13.98288	18.77	Pk	10.6	.4	-40	-10.23	40.51	-50.74	0-360

Pk - Peak detector

FCC 15.225 13.56MHz Fundamental Mask.TST 30915 4 Mar 2016

Rev 9.5 01 Dec 2016

ANTENNA LOOP FACE ON and OFF**ANTENNA LOOP FACE OFF**

Trace Markers

Marker	Frequenc y (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)
4	12.95423	16.09	Pk	10.7	.4	-40	-12.81	29.5	-42.31	0-360
1	13.13868	18.69	Pk	10.7	.4	-40	-10.21	29.5	-39.71	0-360
2	13.42059	18.76	Pk	10.7	.4	-40	-10.14	29.5	-39.64	0-360
3	13.98442	19.86	Pk	10.6	.4	-40	-9.14	29.5	-38.64	0-360
5	14.17882	14.8	Pk	10.6	.4	-40	-14.2	29.5	-43.7	0-360
6	14.6237	15.67	Pk	10.5	.4	-40	-13.43	29.5	-42.93	0-360

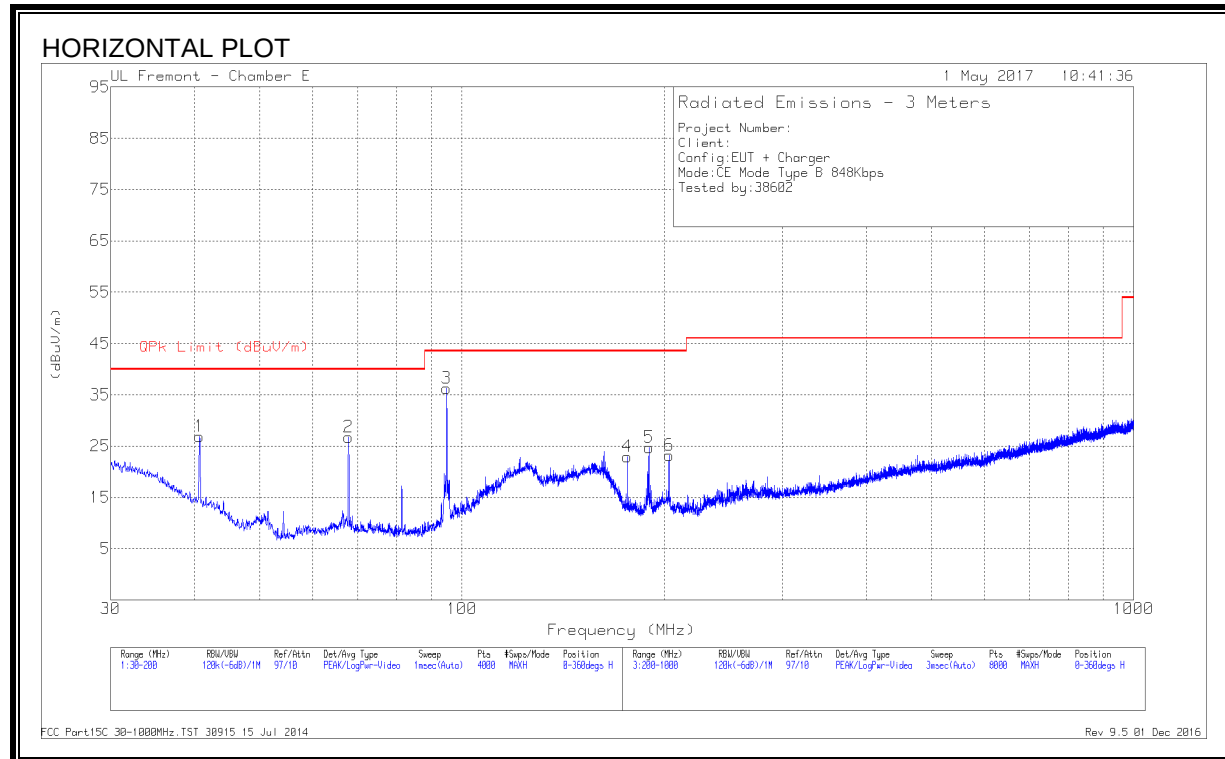
Pk - Peak detector
*.TST 30915 7 Oct 2016
Rev 9.5 01 Dec 2016

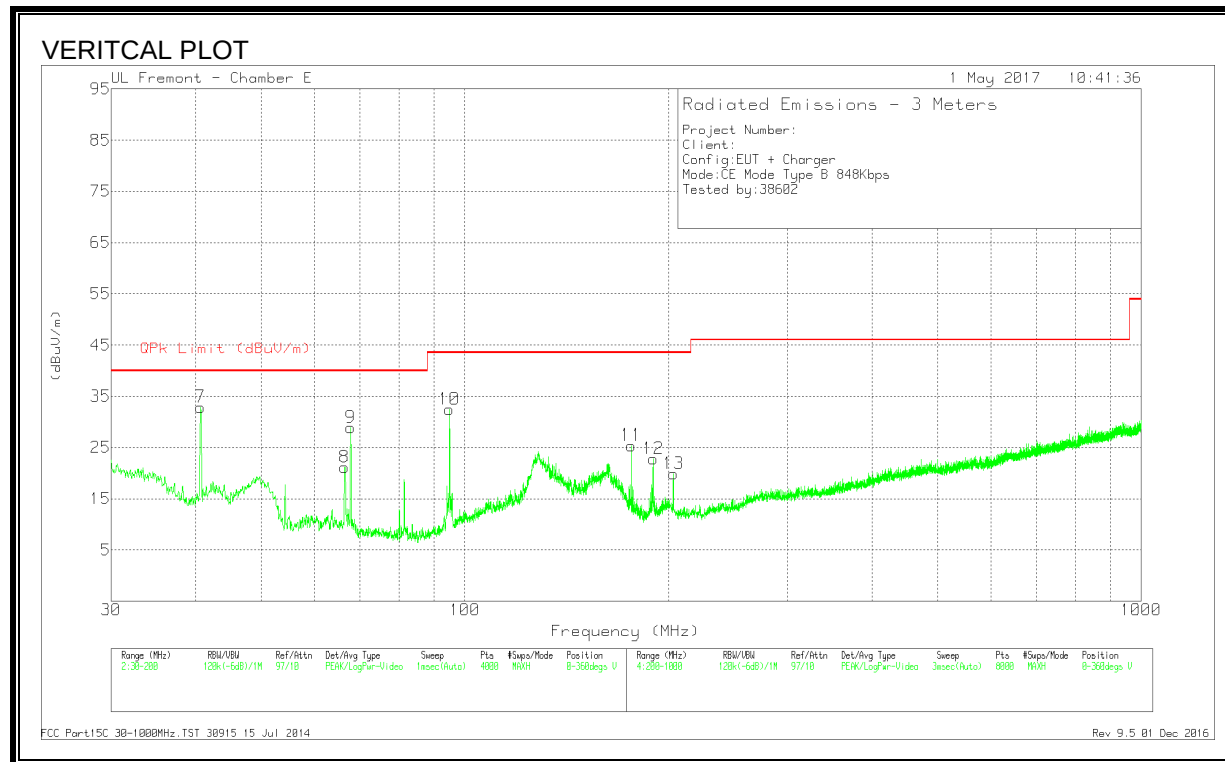
8.3. TX SPURIOUS EMISSION 30 TO 1000 MHz

8.3.1. CE MODE

TYPE B

848Kbps





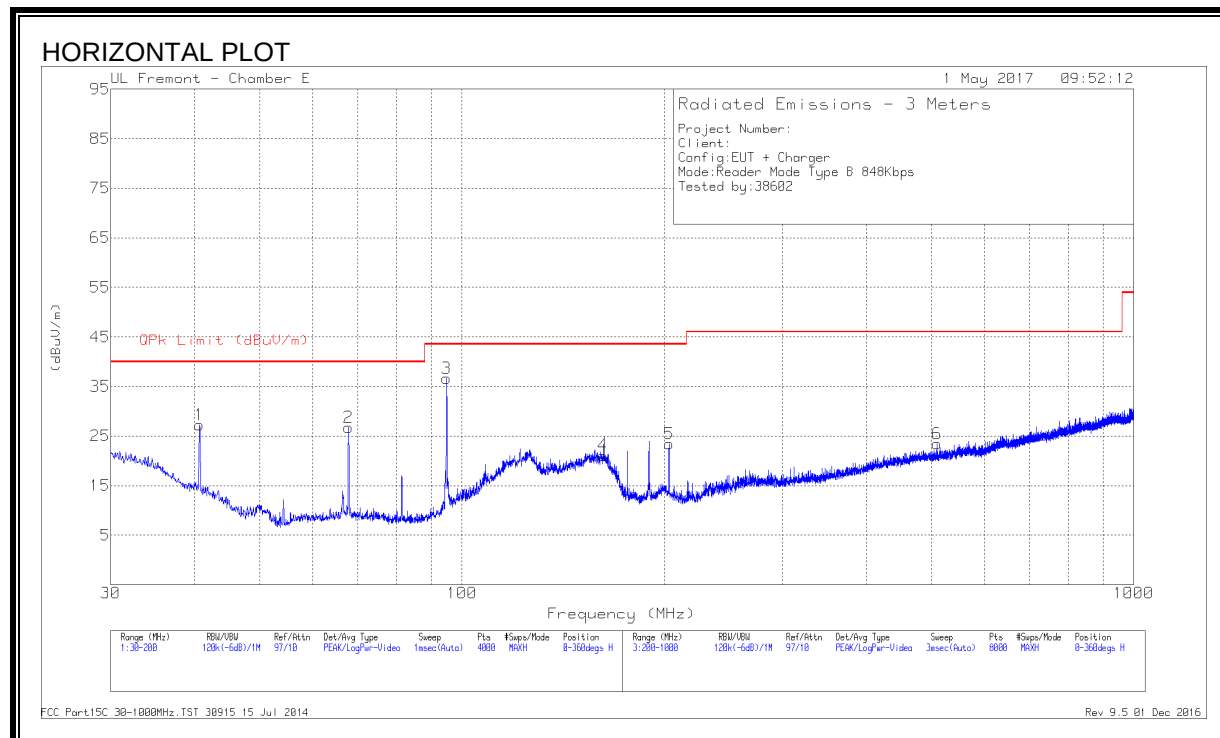
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T899 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	40.6703	40.63	Pk	17.7	-31.5	26.83	40	-13.17	0-360	299	H
7	40.6703	46.7	Pk	17.7	-31.5	32.9	40	-7.1	0-360	100	V
8	66.4319	40.24	Pk	12.1	-31.2	21.14	40	-18.86	0-360	100	V
2	67.7923	45.85	Pk	12.1	-31.2	26.75	40	-13.25	0-360	400	H
9	67.7923	48	Pk	12.1	-31.2	28.9	40	-11.1	0-360	100	V
3	94.9143	54.34	Pk	12.8	-30.9	36.24	43.52	-7.28	0-360	299	H
10	94.9143	50.57	Pk	12.8	-30.9	32.47	43.52	-11.05	0-360	100	V
4	176.2804	37.8	Pk	15.3	-30.2	22.9	43.52	-20.62	0-360	199	H
11	176.2804	40.31	Pk	15.3	-30.2	25.41	43.52	-18.11	0-360	100	V
5	189.8414	39.67	Pk	15.2	-30.1	24.77	43.52	-18.75	0-360	99	H
12	189.8414	37.74	Pk	15.2	-30.1	22.84	43.52	-20.68	0-360	100	V
6	203.4004	38.03	Pk	15.2	-30	23.23	43.52	-20.29	0-360	199	H
13	203.4004	34.64	Pk	15.2	-30	19.84	43.52	-23.68	0-360	100	V

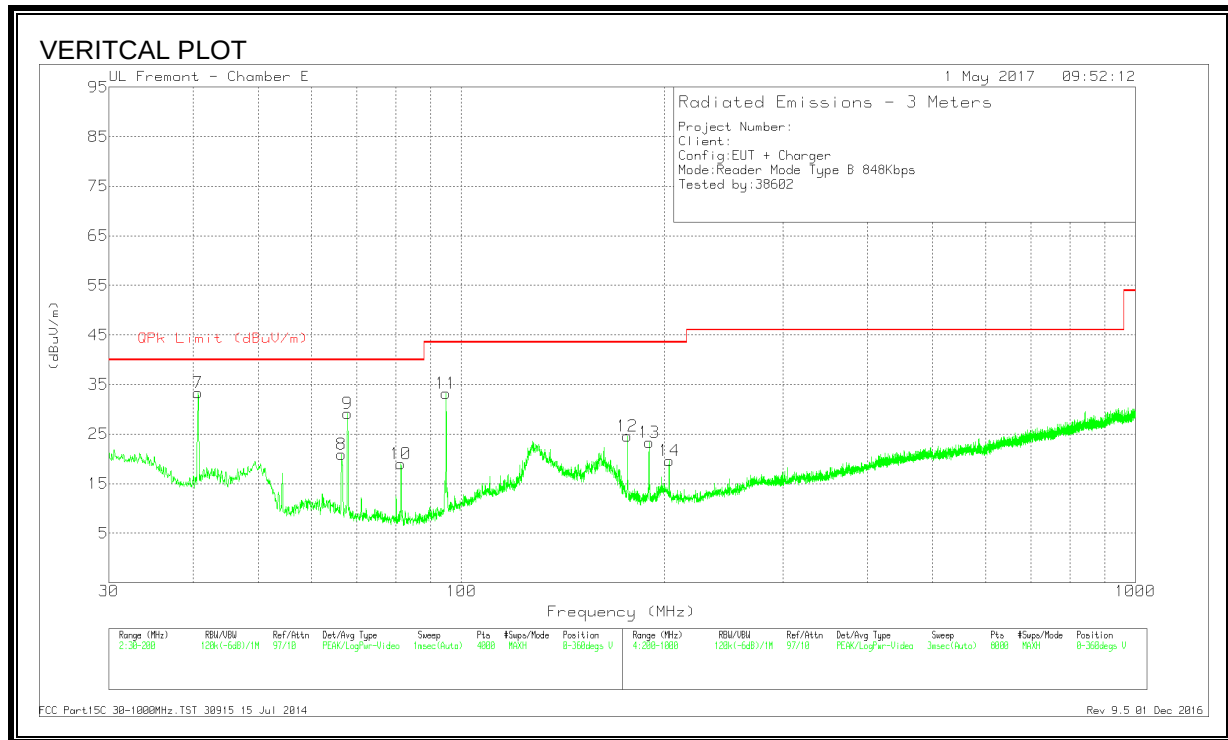
Pk - Peak detector

8.3.2. READER MODE

TYPE B

848Kbps





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	* 162.1667	35.39	Pk	15.9	-30.2	21.09	43.52	-22.43	0-360	199	H
1	40.6703	41.01	Pk	17.7	-31.5	27.21	40	-12.79	0-360	300	H
7	40.6703	47.16	Pk	17.7	-31.5	33.36	40	-6.64	0-360	100	V
8	66.3894	40	Pk	12.1	-31.2	20.9	40	-19.1	0-360	100	V
2	67.7923	45.82	Pk	12.1	-31.2	26.72	40	-13.28	0-360	300	H
9	67.7923	48.2	Pk	12.1	-31.2	29.1	40	-10.9	0-360	100	V
10	81.3533	38.95	Pk	11.1	-31	19.05	40	-20.95	0-360	100	V
3	94.9143	54.79	Pk	12.8	-30.9	36.69	43.52	-6.83	0-360	300	H
11	94.9143	51.37	Pk	12.8	-30.9	33.27	43.52	-10.25	0-360	100	V
12	176.2804	39.53	Pk	15.3	-30.2	24.63	43.52	-18.89	0-360	100	V
13	189.8414	38.17	Pk	15.2	-30.1	23.27	43.52	-20.25	0-360	100	V
5	203.4004	38.19	Pk	15.2	-30	23.39	43.52	-20.13	0-360	200	H
14	203.4004	34.47	Pk	15.2	-30	19.67	43.52	-23.85	0-360	100	V
6	509.8403	29.96	Pk	21.6	-28.1	23.46	46.02	-22.56	0-360	100	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

9. FREQUENCY STABILITY

Limit

RSS-210, Issue 9

§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.

TEST PROCEDURE

ANSI 603.10:2013 Clause 6.8.1 and 6.8.2

RESULTS

No non-compliance noted.

9.1. CE Mode

TYPE B 848Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20°C Limit: ± 100 ppm = 1.356 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	13.5596824	5.231	13.5596862	4.949	13.5596926	4.482	13.5597039	3.646	± 100
	40	13.5596775	5.592	13.5596761	5.699	13.5596749	5.786	13.5596745	5.815	± 100
	30	13.5597059	3.503	13.5597014	3.835	13.5596960	4.228	13.5596898	4.684	± 100
	20	13.5597534	0.000	13.5597466	0.498	13.5597382	1.120	13.5597277	1.892	± 100
	10	13.5596746	5.811	13.5596784	5.529	13.5596851	5.034	13.5596951	4.299	± 100
	0	13.5597144	2.871	13.5597204	2.431	13.5597277	1.894	13.5597367	1.230	± 100
	-10	13.5597533	0.008	13.5597586	-0.384	13.5597645	-0.825	13.5597714	-1.332	± 100
	-20	13.5597892	-2.642	13.5597910	-2.774	13.5597927	-2.901	13.5597942	-3.014	± 100
3.23	20	13.5597533	0.003	13.5597463	0.520	13.5597378	1.147	13.5597273	1.921	± 100
4.37	20	13.5597535	-0.011	13.5597465	0.505	13.5597381	1.125	13.5597278	1.885	± 100

9.2. Reader Mode

TYPE B 848Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20°C Limit: ± 100 ppm = 1.356 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	13.5596816	2.906	13.5596853	2.639	13.5596913	2.195	13.5597020	1.406	± 100
	40	13.5596770	3.249	13.5596758	3.338	13.5596748	3.409	13.5596746	3.424	± 100
	30	13.5596963	1.823	13.5596933	2.044	13.5596898	2.302	13.5596858	2.598	± 100
	20	13.5597210	0.000	13.5597188	0.164	13.5597160	0.375	13.5597121	0.661	± 100
	10	13.5596757	3.342	13.5596799	3.031	13.5596868	2.523	13.5596968	1.790	± 100
	0	13.5597200	0.074	13.5597254	-0.323	13.5597320	-0.805	13.5597402	-1.413	± 100
	-10	13.5597586	-2.772	13.5597631	-3.105	13.5597683	-3.483	13.5597741	-3.913	± 100
	-20	13.5597872	-4.880	13.5597895	-5.051	13.5597918	-5.215	13.5597936	-5.352	± 100
3.23	20	13.5597210	0.004	13.5597185	0.187	13.5597156	0.401	13.5597117	0.689	± 100
4.37	20	13.5597212	-0.012	13.5597187	0.172	13.5597158	0.386	13.5597124	0.637	± 100

10. 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 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

RESULTS

No non-compliance noted:

10.1.1. CE MODE TYPE B

NORMAL OPERATION, 848 KBPS

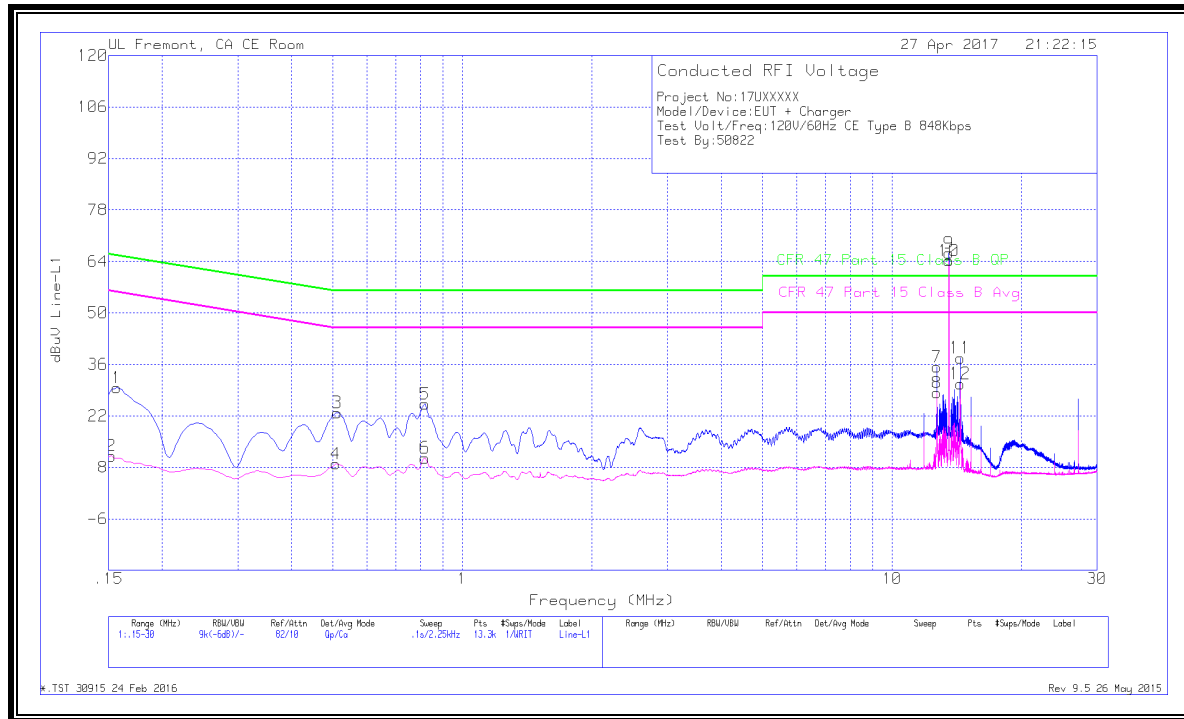
WORST EMISSIONS

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	.15675	19.46	Qp	0	.1	10.1	29.66	65.63	-35.97	-	-
2	.15225	.81	Ca	.1	.1	10.1	11.11	-	-	55.88	-44.77
3	.51112	12.66	Qp	0	.1	10.1	22.86	56	-33.14	-	-
4	.50775	-1.29	Ca	0	.1	10.1	8.91	-	-	46	-37.09
5	.81825	15	Qp	0	.1	10.1	25.2	56	-30.8	-	-
6	.81825	.37	Ca	0	.1	10.1	10.57	-	-	46	-35.43
7	12.7118	24.75	Qp	.1	.2	10.2	35.25	60	-24.75	-	-
8	12.7118	17.8	Ca	.1	.2	10.2	28.3	-	-	50	-21.7
9	13.56	55.77	Qp	.1	.2	10.2	66.27	60	6.27	-	-
10	13.56	53.67	Ca	.1	.2	10.2	64.17	-	-	50	14.17
11	14.4083	27.33	Qp	0	.2	10.2	37.73	60	-22.27	-	-
12	14.4083	20.33	Ca	0	.2	10.2	30.73	-	-	50	-19.27

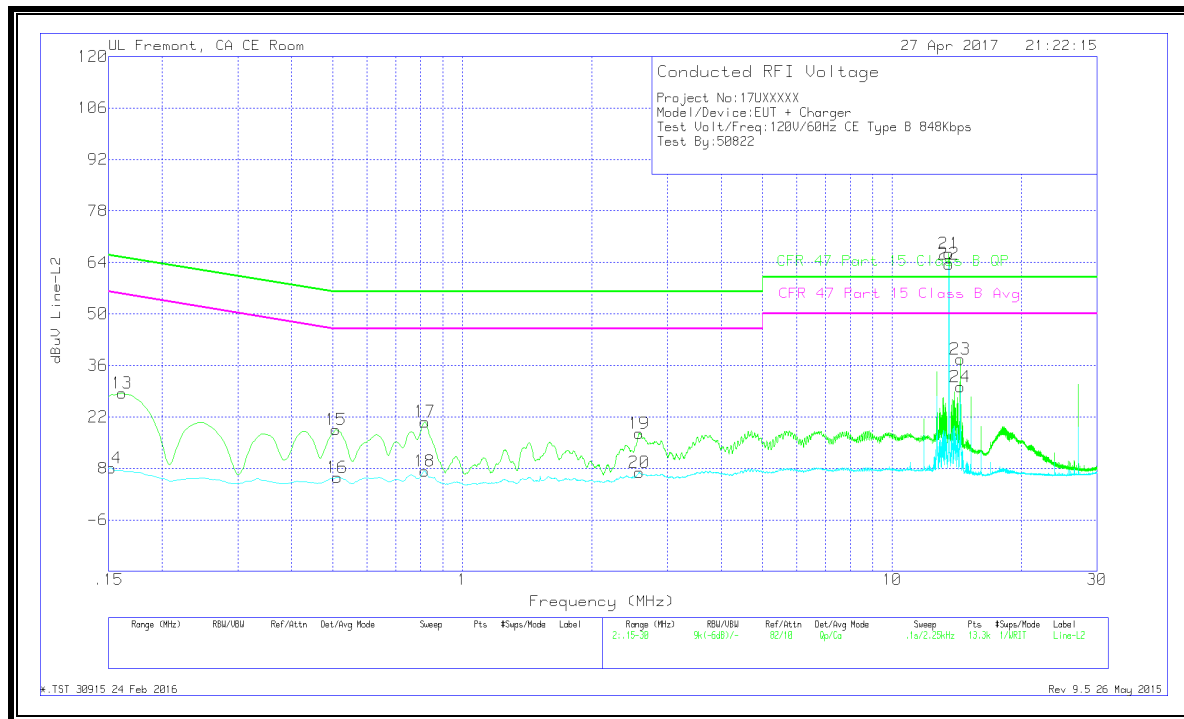
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.16125	18.23	Qp	0	.1	10.1	28.43	65.4	-36.97	-	-
14	.15225	-2.03	Ca	0	0	10.1	8.07	-	-	55.88	-47.81
15	.50775	8.29	Qp	0	.1	10.1	18.49	56	-37.51	-	-
16	.51112	-4.67	Ca	0	.1	10.1	5.53	-	-	46	-40.47
17	.81825	10.42	Qp	0	.1	10.1	20.62	56	-35.38	-	-
18	.816	-2.97	Ca	0	.1	10.1	7.23	-	-	46	-38.77
19	2.57775	7.28	Qp	0	.1	10.1	17.48	56	-38.52	-	-
20	2.58	-3.33	Ca	0	.1	10.1	6.87	-	-	46	-39.13
21	13.56	55.92	Qp	.1	.2	10.2	66.42	60	6.42	-	-
22	13.56	53.08	Ca	.1	.2	10.2	63.58	-	-	50	13.58
23	14.4083	27.2	Qp	.1	.2	10.2	37.7	60	-22.3	-	-
24	14.4083	19.67	Ca	.1	.2	10.2	30.17	-	-	50	-19.83

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 1 RESULTS



LINE 2 RESULTS



10.1.2. WITH ANTENNA PORT TERMINATED, 848 Kbps

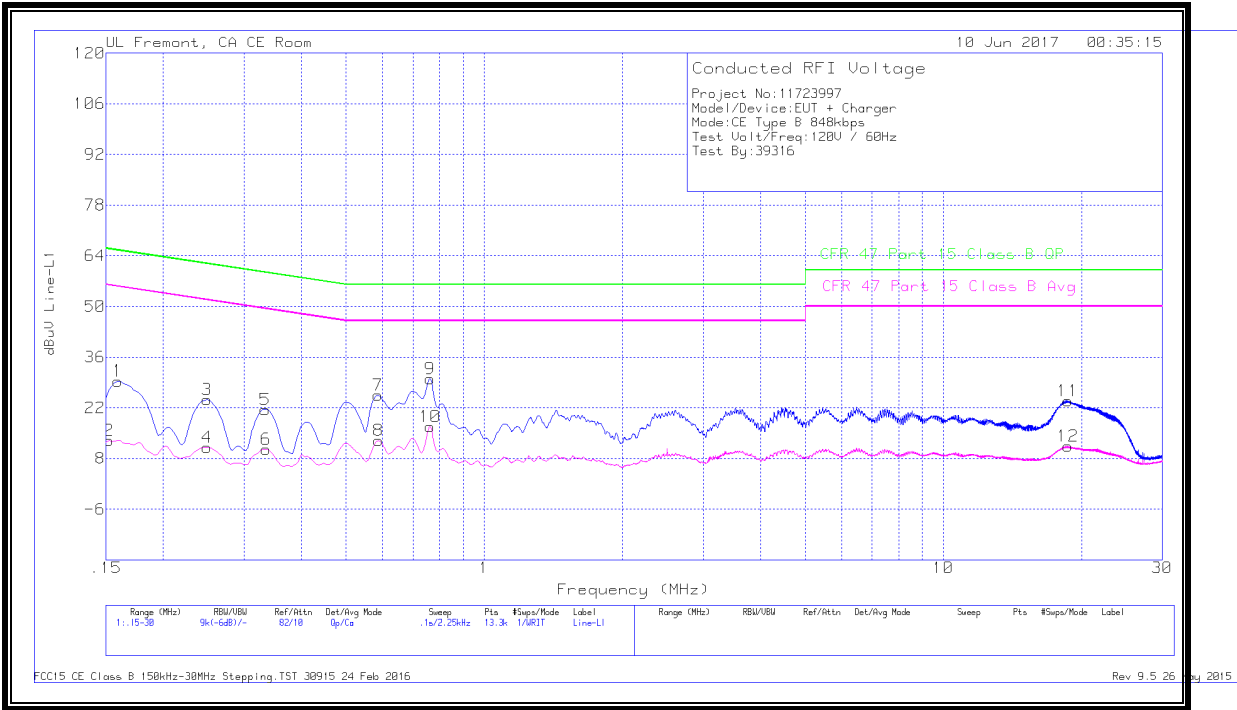
WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL 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	18	Qp	1.2	.1	10.1	29.4	65.52	-36.12	-	-
2	.15225	1.48	Ca	1.3	.1	10.1	12.98	-	-	55.88	-42.9
3	.249	13.41	Qp	.6	.1	10.1	24.21	61.79	-37.58	-	-
4	.249	.3	Ca	.6	.1	10.1	11.1	-	-	51.79	-40.69
5	.33337	10.97	Qp	.4	.1	10.1	21.57	59.37	-37.8	-	-
6	.3345	0	Ca	.4	.1	10.1	10.6	-	-	49.34	-38.74
7	.5865	14.91	Qp	.3	.1	10.1	25.41	56	-30.59	-	-
8	.58875	2.41	Ca	.3	.1	10.1	12.91	-	-	46	-33.09
9	.762	19.68	Qp	.2	.1	10.1	30.08	56	-25.92	-	-
10	.762	6.42	Ca	.2	.1	10.1	16.82	-	-	46	-29.18
11	18.6956	13.09	Qp	.2	.3	10.3	23.89	60	-36.11	-	-
12	18.699	.56	Ca	.2	.3	10.3	11.36	-	-	50	-38.64

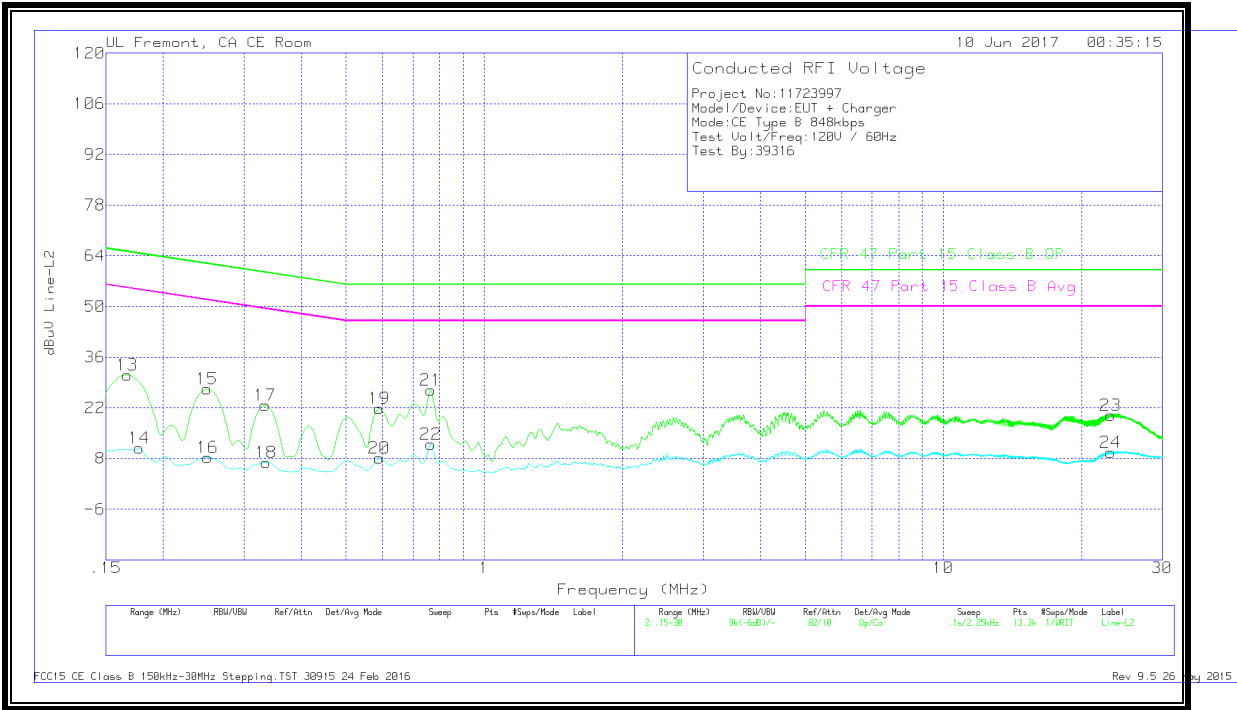
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.16688	19.65	Qp	1.3	0	10.1	31.05	65.11	-34.06	-	-
14	.177	-.49	Ca	1.2	.1	10.1	10.91	-	-	54.63	-43.72
15	.249	16.26	Qp	.7	.1	10.1	27.16	61.79	-34.63	-	-
16	.25013	-2.61	Ca	.7	.1	10.1	8.29	-	-	51.75	-43.46
17	.33337	11.97	Qp	.5	.1	10.1	22.67	59.37	-36.7	-	-
18	.3345	-3.73	Ca	.5	.1	10.1	6.97	-	-	49.34	-42.37
19	.591	11.36	Qp	.3	.1	10.1	21.86	56	-34.14	-	-
20	.591	-2.38	Ca	.3	.1	10.1	8.12	-	-	46	-37.88
21	.76425	16.37	Qp	.3	.1	10.1	26.87	56	-29.13	-	-
22	.76425	1.45	Ca	.3	.1	10.1	11.95	-	-	46	-34.05
23	23.163	8.97	Qp	.3	.3	10.4	19.97	60	-40.03	-	-
24	23.163	-1.25	Ca	.3	.3	10.4	9.75	-	-	50	-40.25

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 1 RESULTS



LINE 2 RESULTS



10.1.3. READER MODE TYPE B

NORMAL OPERATION, 848 KBPS

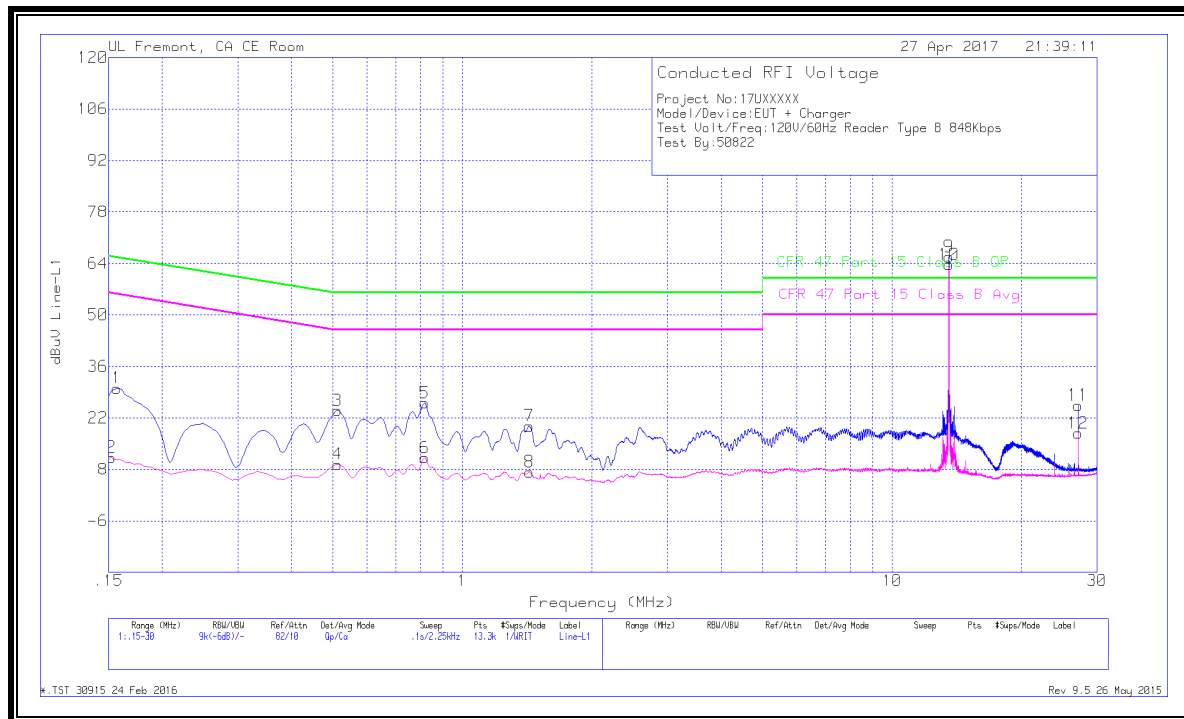
WORST EMISSIONS

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	.15675	19.87	Qp	0	.1	10.1	30.07	65.63	-35.56	-	-
2	.15225	.93	Ca	.1	.1	10.1	11.23	-	-	55.88	-44.65
3	.51225	13.78	Qp	0	.1	10.1	23.98	56	-32.02	-	-
4	.51225	-.82	Ca	0	.1	10.1	9.38	-	-	46	-36.62
5	.81712	15.85	Qp	0	.1	10.1	26.05	56	-29.95	-	-
6	.816	.99	Ca	0	.1	10.1	11.19	-	-	46	-34.81
7	1.43025	9.62	Qp	0	.1	10.1	19.82	56	-36.18	-	-
8	1.4325	-2.92	Ca	0	.1	10.1	7.28	-	-	46	-38.72
9	13.56	55.3	Qp	.1	.2	10.2	65.8	60	5.8	-	-
10	13.56	53.18	Ca	.1	.2	10.2	63.68	-	-	50	13.68
11	27.1185	14.53	Qp	.1	.3	10.5	25.43	60	-34.57	-	-
12	27.1185	6.93	Ca	.1	.3	10.5	17.83	-	-	50	-32.17

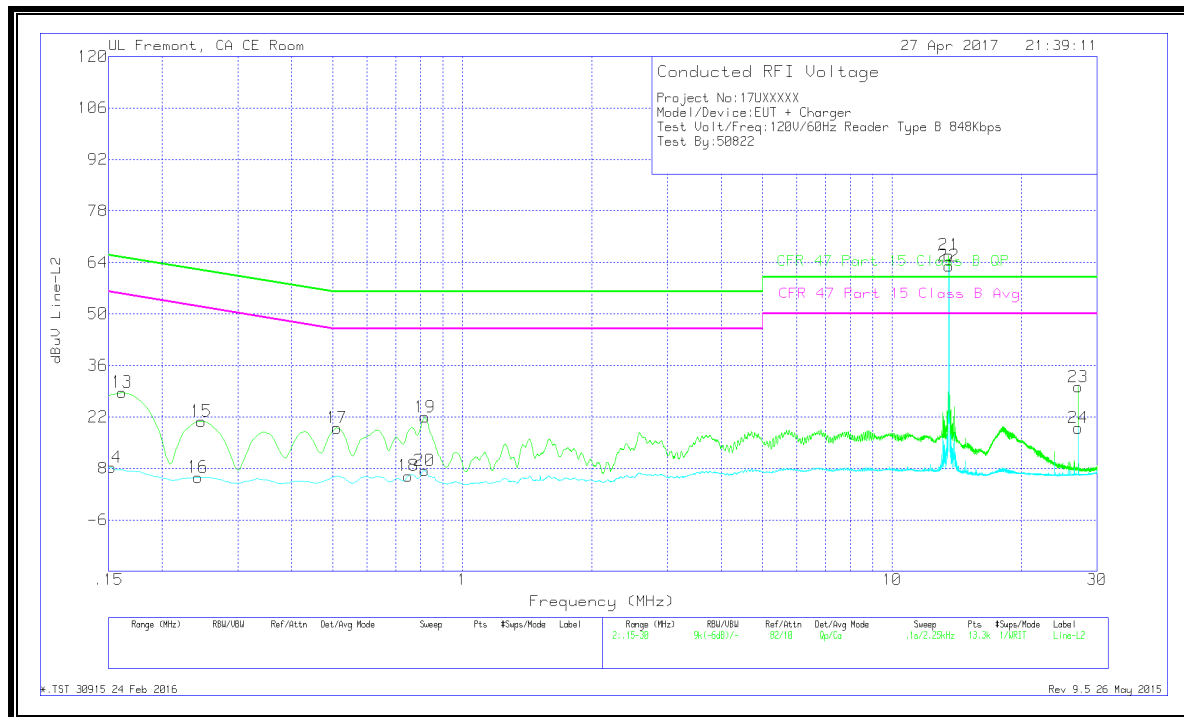
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.16125	18.5	Qp	0	.1	10.1	28.7	65.4	-36.7	-	-
14	.15225	-1.84	Ca	0	0	10.1	8.26	-	-	55.88	-47.62
15	.24675	10.58	Qp	0	.1	10.1	20.78	61.87	-41.09	-	-
16	.24225	-4.62	Ca	0	.1	10.1	5.58	-	-	52.02	-46.44
17	.51	8.79	Qp	0	.1	10.1	18.99	56	-37.01	-	-
18	.7485	-4.23	Ca	0	.1	10.1	5.97	-	-	46	-40.03
19	.81825	11.71	Qp	0	.1	10.1	21.91	56	-34.09	-	-
20	.816	-2.77	Ca	0	.1	10.1	7.43	-	-	46	-38.57
21	13.56	55.49	Qp	.1	.2	10.2	65.99	60	5.99	-	-
22	13.56	52.55	Ca	.1	.2	10.2	63.05	-	-	50	13.05
23	27.1185	19.23	Qp	.1	.3	10.5	30.13	60	-29.87	-	-
24	27.1185	8.1	Ca	.1	.3	10.5	19	-	-	50	-31

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 1 RESULTS



LINE 2 RESULTS



10.1.4. WITH ANTENNA PORT TERMINATED, 848 Kbps

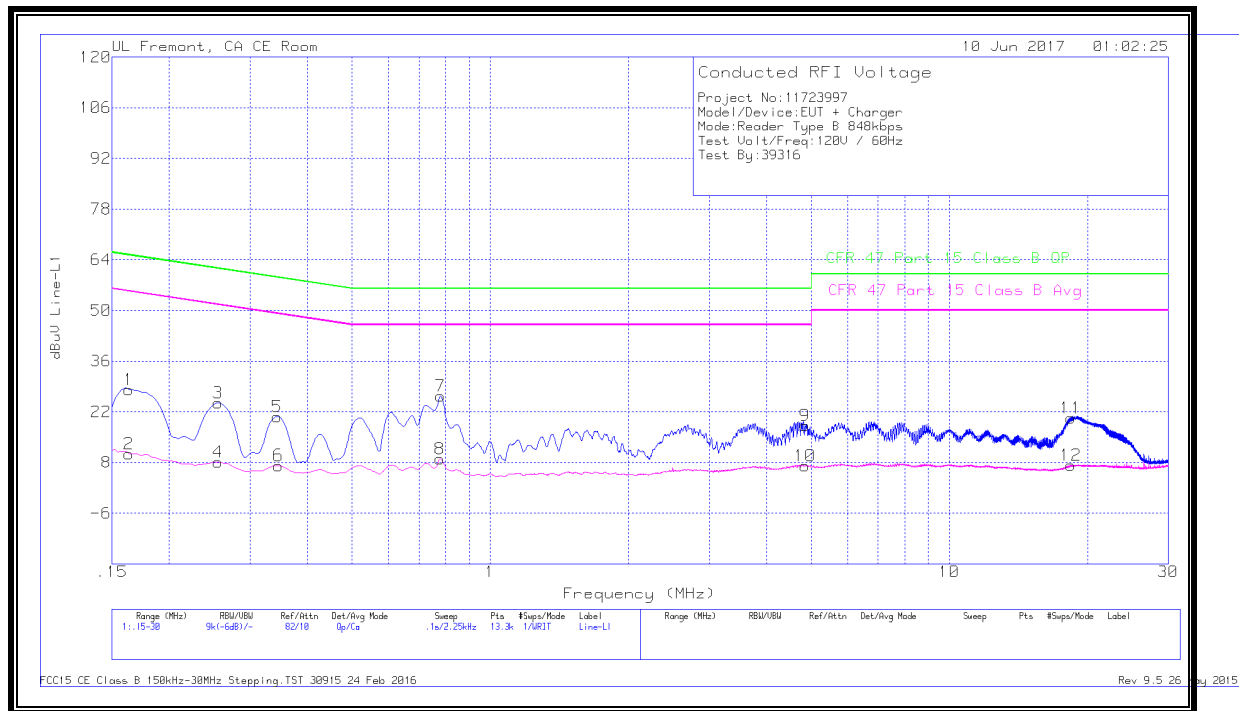
WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL 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	16.73	Qp	1.2	.1	10.1	28.13	65.28	-37.15	-	-
2	.1635	-98	Ca	1.2	.1	10.1	10.42	-	-	55.28	-44.86
3	.25575	13.72	Qp	.6	.1	10.1	24.52	61.57	-37.05	-	-
4	.25575	-2.77	Ca	.6	.1	10.1	8.03	-	-	51.57	-43.54
5	.3435	10.06	Qp	.4	.1	10.1	20.66	59.12	-38.46	-	-
6	.34575	-3.45	Ca	.4	.1	10.1	7.15	-	-	49.06	-41.91
7	.78	15.89	Qp	.2	.1	10.1	26.29	56	-29.71	-	-
8	.77775	-1.37	Ca	.2	.1	10.1	9.03	-	-	46	-36.97
9	4.84575	7.77	Qp	.2	.1	10.1	18.17	56	-37.83	-	-
10	4.8435	-3.38	Ca	.2	.1	10.1	7.02	-	-	46	-38.98
11	18.3919	9.46	Qp	.2	.3	10.3	20.26	60	-39.74	-	-
12	18.3863	-3.61	Ca	.2	.3	10.3	7.19	-	-	50	-42.81

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL 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	21.96	Qp	1.2	.1	10.1	33.36	64.95	-31.59	-	-
14	.16913	-2.56	Ca	1.3	.1	10.1	8.94	-	-	55	-46.06
15	.258	17.9	Qp	.7	.1	10.1	28.8	61.5	-32.7	-	-
16	.25575	-4.12	Ca	.7	.1	10.1	6.78	-	-	51.57	-44.79
17	.348	12	Qp	.5	.1	10.1	22.7	59.01	-36.31	-	-
18	.35025	-5.37	Ca	.5	.1	10.1	5.33	-	-	48.96	-43.63
19	.78225	10.76	Qp	.3	.1	10.1	21.26	56	-34.74	-	-
20	.78112	-4.07	Ca	.3	.1	10.1	6.43	-	-	46	-39.57
21	4.7355	7.14	Qp	.2	.1	10.1	17.54	56	-38.46	-	-
22	4.73438	-3.36	Ca	.2	.1	10.1	7.04	-	-	46	-38.96
23	7.77075	6.51	Qp	.2	.2	10.2	17.11	60	-42.89	-	-
24	7.77075	-3.28	Ca	.2	.2	10.2	7.32	-	-	50	-42.68

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 1 RESULTS



LINE 2 RESULTS

