



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

CERTIFICATION TEST REPORT

FOR

SMARTPHONE

MODEL NUMBER: A1902

**FCC ID: BCG-E3176A
IC: 579C-E3176A**

REPORT NUMBER: 11792476-E6V1

ISSUE DATE: AUGUST 17, 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	8/17/2017	Initial Issue	Mengistu Mekuria

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
8.2.2. READER MODE	21
8.3. TX SPURIOUS EMISSION 30 TO 1000 MHz	25
8.3.1. CE MODE.....	25
8.3.2. READER MODE	27
8.4. FREQUENCY STABILITY	29
8.4.1. CE Mode	30
8.4.2. Reader Mode.....	30
9. AC MAINS LINE CONDUCTED EMISSIONS.....	31
9.1.1. CE MODE TYPE B	32
9.1.2. WITH ANTENNA PORT TERMINATED, 848 KBPS	34
9.1.3. READER MODE TYPE B	36
9.1.4. WITH ANTENNA PORT TERMINATED, 848 KBPS	38
10. 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: A1902

SERIAL NUMBER: C39TX005J954

DATE TESTED: MAY 25, 2017 – JULY 20, 2017

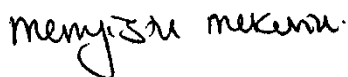
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	Pass
INDUSTRY CANADA RSS-210 Issue 9, Annex B.6.	Pass
INDUSTRY CANADA RSS-GEN Issue 4	Pass

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	± 0.45 %

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 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	18.24
	Reader Mode	B	22.35

* 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

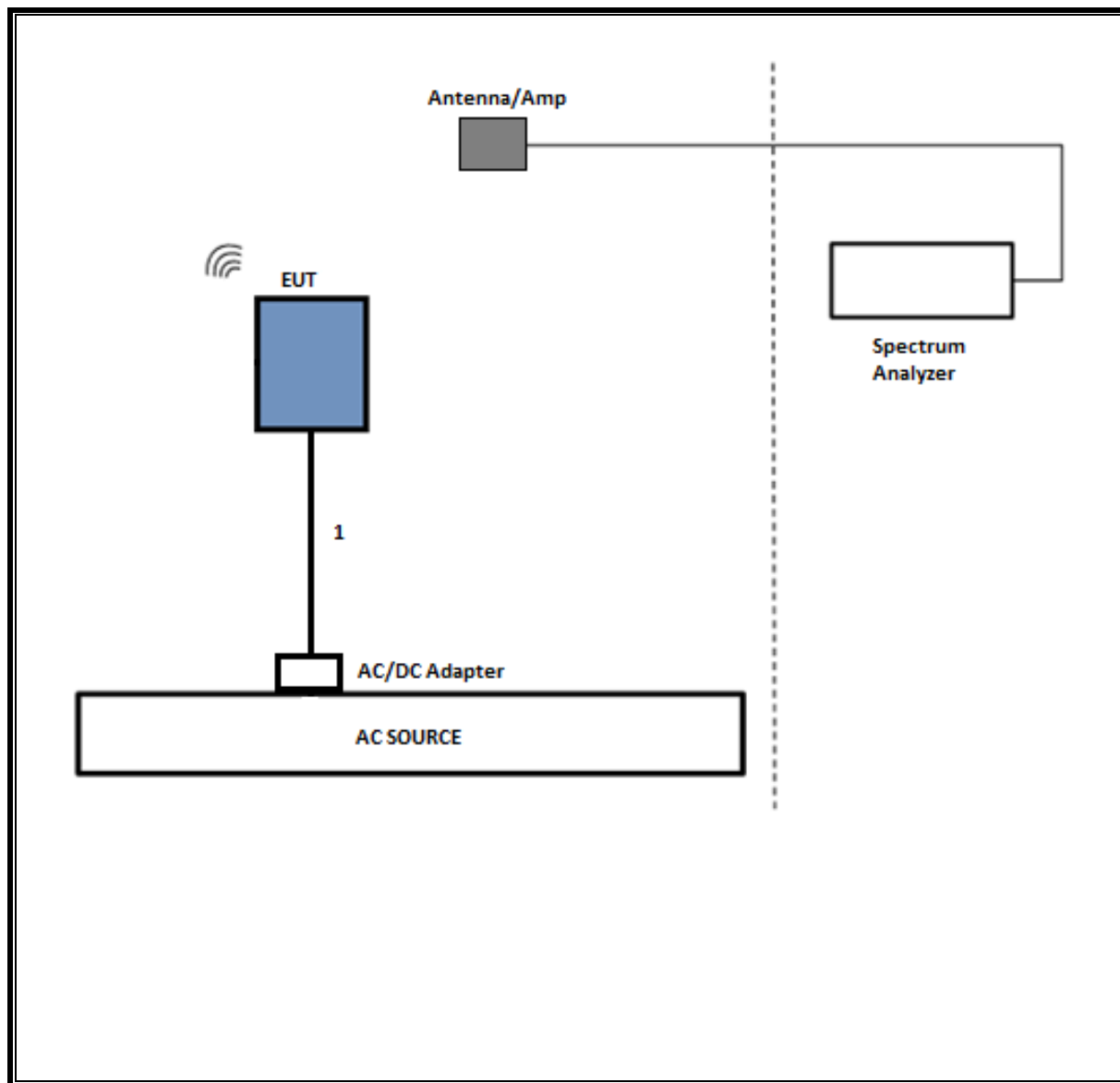
SUPPORT EQUIPMENT

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

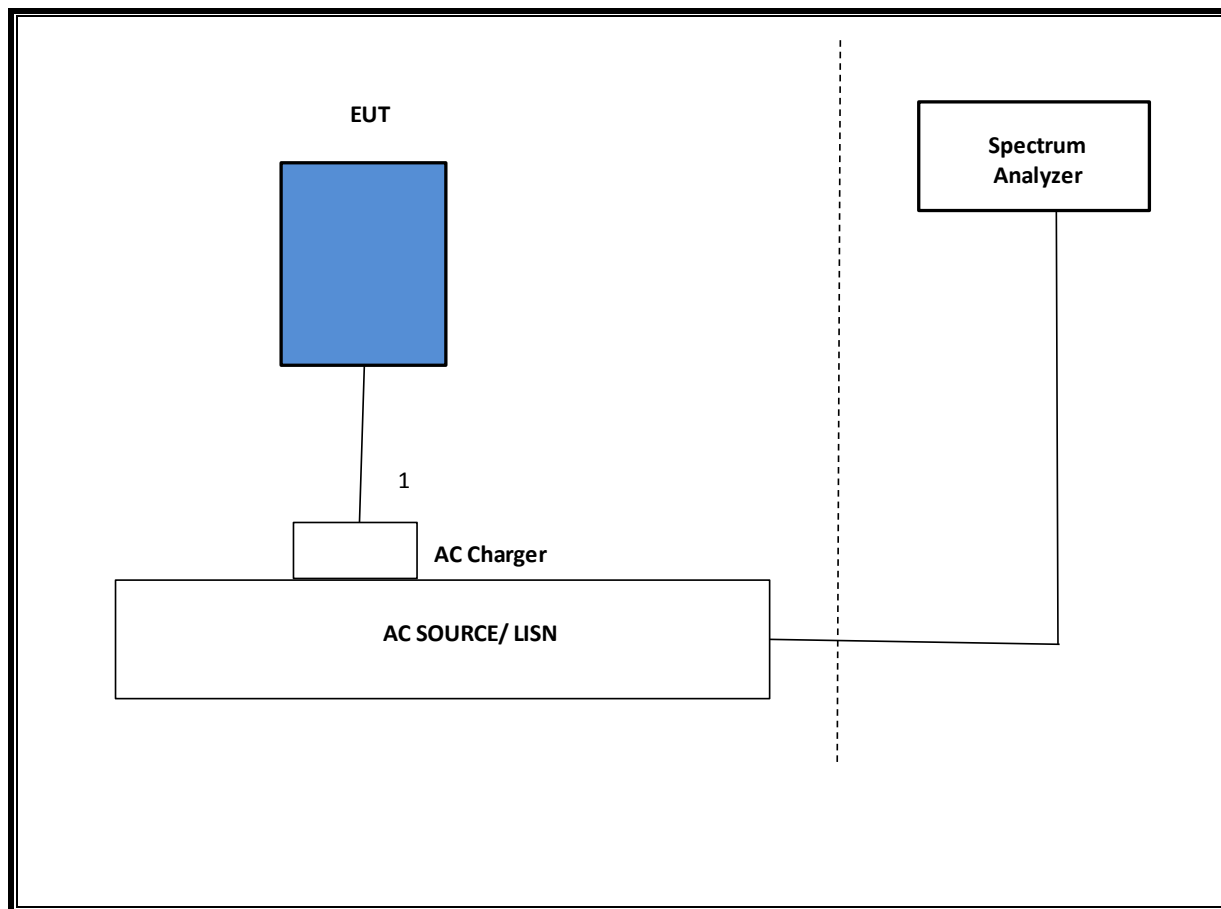
I/O CABLES

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	6/2/2018
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	1/6/2018
*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: *Testing is completed before equipment expiration date.

7. OCCUPIED BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

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

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

RESULTS

ID:	38602	Date:	5/25/17
------------	-------	--------------	---------

99% and 20dB BW

CE Mode

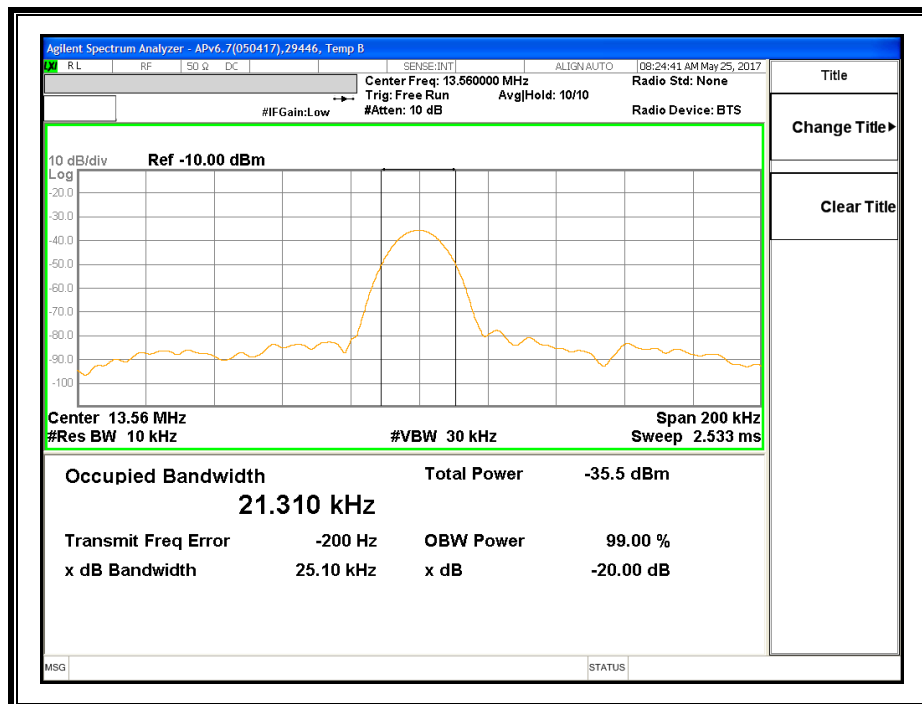
Moduation	Frequency	Data Rate	99% Bandwidth	20dB Bandwidth
	(MHz)	(Kbps)	(KHz)	(KHz)
Type B	13.56	848	21.31	25.10

READER

Moduation	Frequency	Data Rate	99% Bandwidth	20dB Bandwidth
	(MHz)	(Kbps)	(KHz)	(KHz)
Type B	13.56	848	21.755	24.84

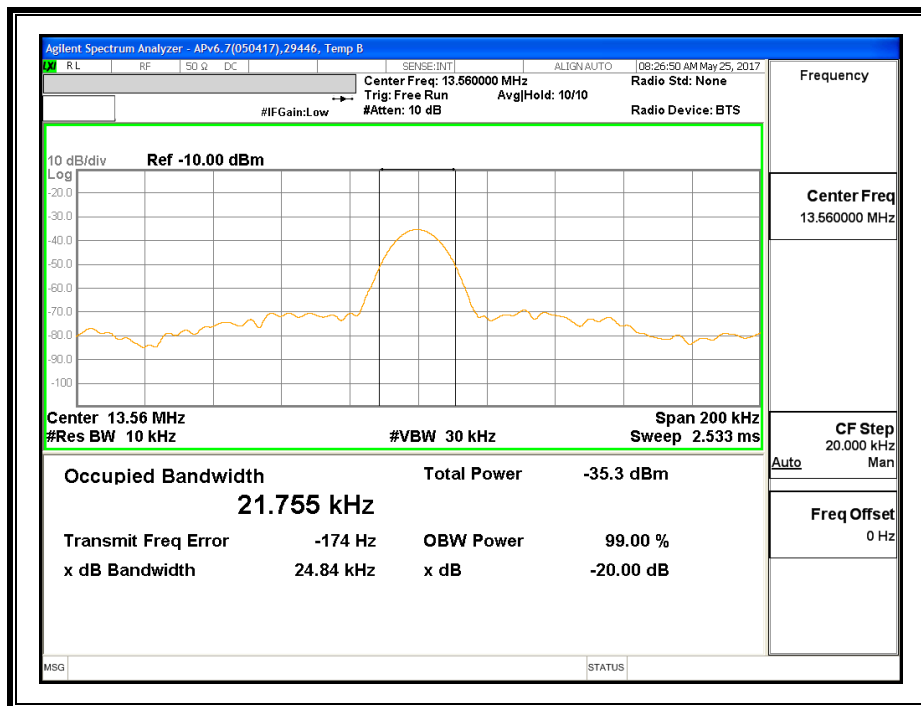
7.1. CE MODE

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.

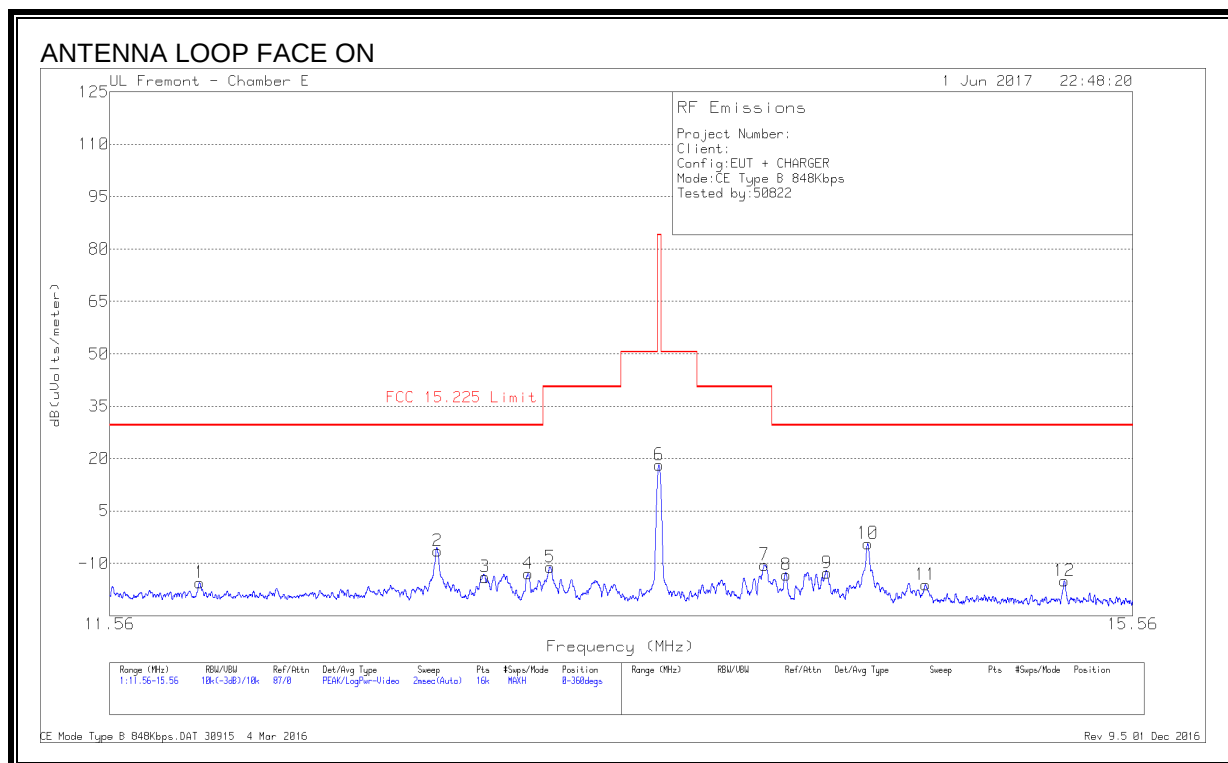
RESULTS

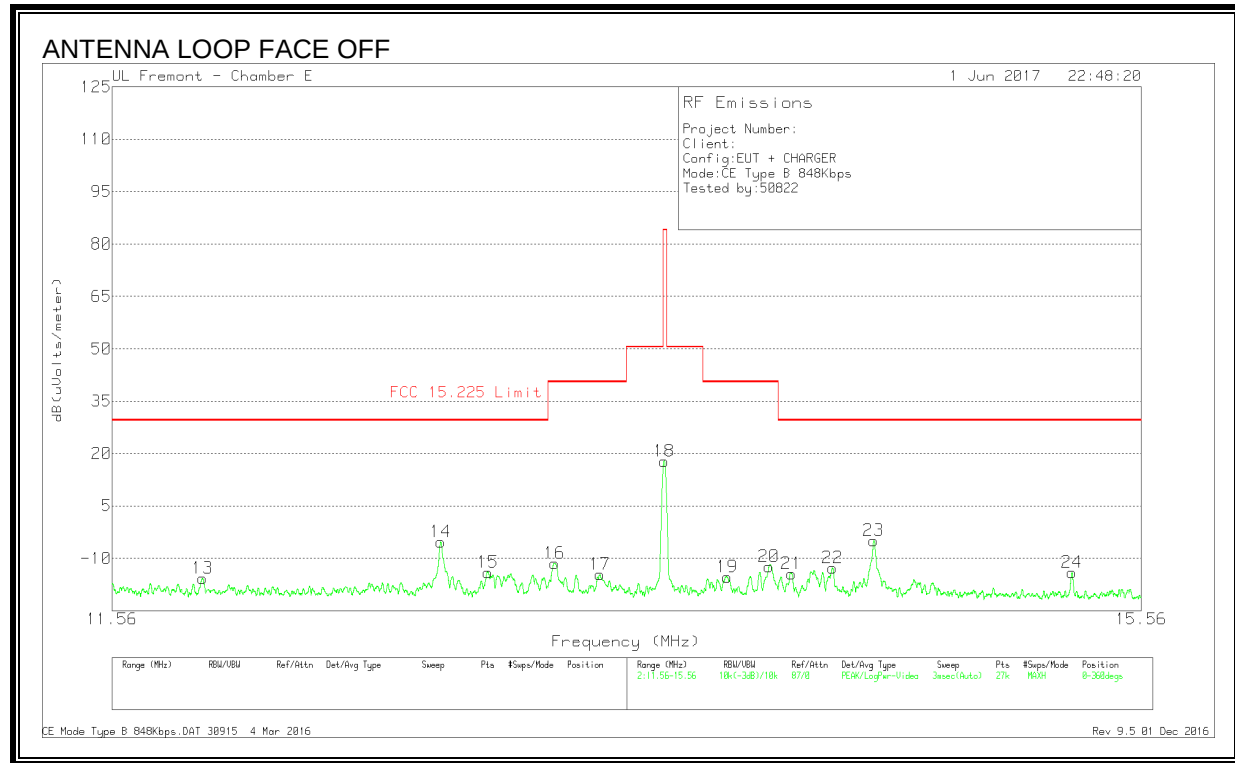
8.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)

8.2.1. CE MODE

TYPE B

848Kbps FUNDAMENTAL





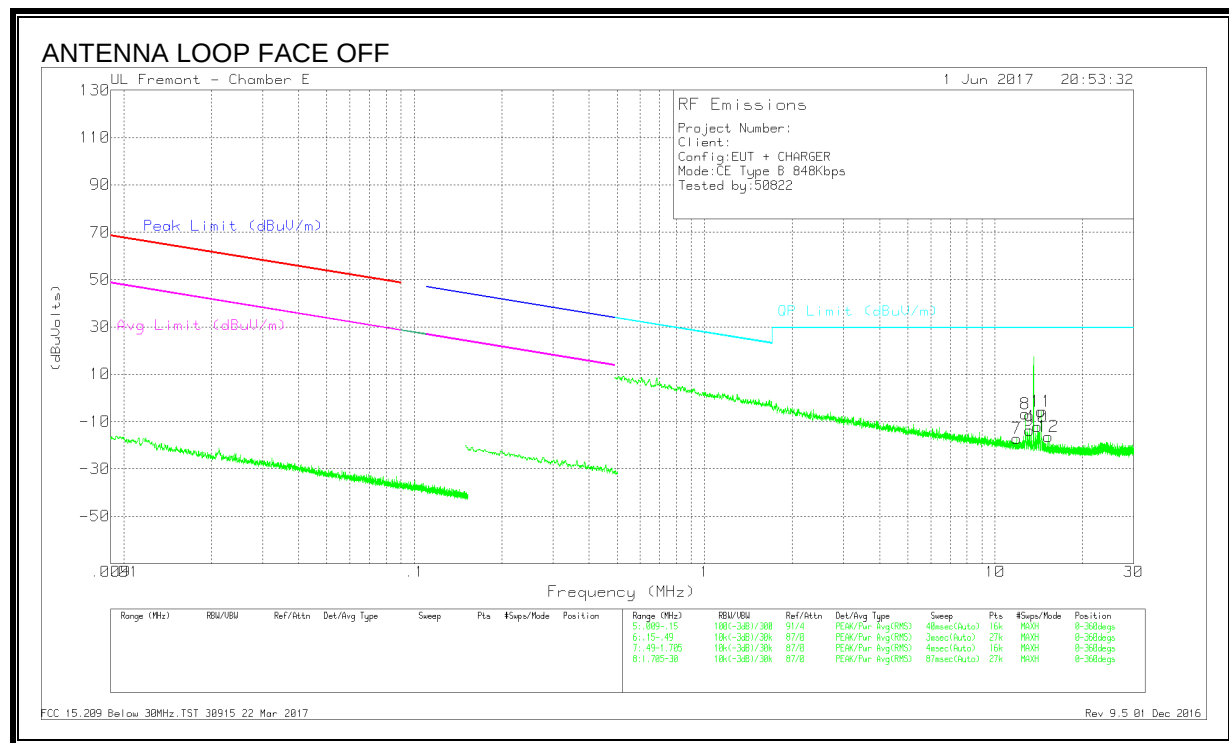
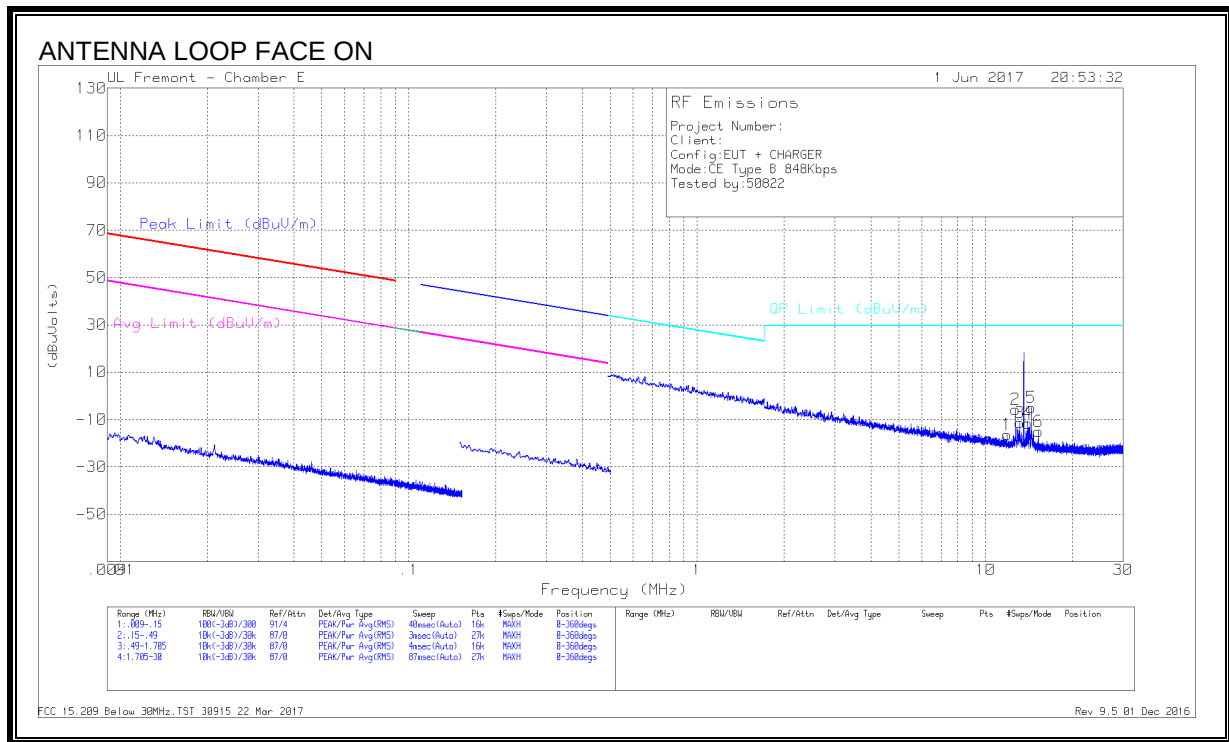
Trace Markers

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)
13	11.86555	12.99	Pk	10.8	.5	-40	-15.71	29.54	-45.25	0-360
1	11.86575	13.23	Pk	10.8	.5	-40	-15.47	29.54	-45.01	0-360
14	12.71011	23.48	Pk	10.7	.5	-40	-5.32	29.54	-34.86	0-360
2	12.71525	22.36	Pk	10.7	.5	-40	-6.44	29.54	-35.98	0-360
15	12.88593	14.7	Pk	10.7	.5	-40	-14.1	29.54	-43.64	0-360
3	12.89175	14.83	Pk	10.7	.5	-40	-13.97	29.54	-43.51	0-360
4	13.05488	15.86	Pk	10.7	.5	-40	-12.94	29.54	-42.48	0-360
16	13.13479	17.41	Pk	10.7	.5	-40	-11.39	40.51	-51.9	0-360
5	13.13713	17.79	Pk	10.7	.5	-40	-11.01	40.51	-51.52	0-360
17	13.30884	14.1	Pk	10.7	.5	-40	-14.7	40.51	-55.21	0-360
18	13.55889	46.66	Pk	10.6	.5	-40	17.76	84	-66.24	0-360
6	13.55963	47.14	Pk	10.6	.5	-40	18.24	84	-65.76	0-360
19	13.80812	13.45	Pk	10.6	.5	-40	-15.45	40.51	-55.96	0-360
20	13.97314	16.54	Pk	10.6	.5	-40	-12.36	40.51	-52.87	0-360
7	13.98238	18.46	Pk	10.6	.5	-40	-10.44	40.51	-50.95	0-360
21	14.06682	14.48	Pk	10.6	.5	-40	-14.42	29.54	-43.96	0-360
8	14.07075	15.64	Pk	10.6	.5	-40	-13.26	29.54	-42.8	0-360
22	14.2331	16.11	Pk	10.6	.5	-40	-12.79	29.54	-42.33	0-360
9	14.2385	16.2	Pk	10.6	.5	-40	-12.7	29.54	-42.24	0-360
23	14.40404	23.95	Pk	10.6	.5	-40	-4.95	29.54	-34.49	0-360
10	14.40688	24.61	Pk	10.6	.5	-40	-4.29	29.54	-33.83	0-360
11	14.652	12.82	Pk	10.5	.5	-40	-16.18	29.54	-45.72	0-360
24	15.25142	14.94	Pk	10.5	.5	-40	-14.06	29.54	-43.6	0-360
12	15.25475	13.98	Pk	10.5	.5	-40	-15.02	29.54	-44.56	0-360

Pk - Peak detector

FCC 15.225 13.56MHz Fundamental Mask.TST 30915 20 Dec 2016
Rev 9.5 01 Dec 2016

SPURIOUS EMISSION



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)
7	11.86484	11.72	Pk	10.6	.5	-40	-17.18	29.5	-46.68	0-360
1	11.86746	12.63	Pk	10.6	.5	-40	-16.27	29.5	-45.77	0-360
8	12.71214	22.15	Pk	10.5	.5	-40	-6.85	29.5	-36.35	0-360
2	12.71267	23.16	Pk	10.5	.5	-40	-5.84	29.5	-35.34	0-360
3	13.13658	17.75	Pk	10.5	.5	-40	-11.25	29.5	-40.75	0-360
9	13.14235	15.38	Pk	10.5	.5	-40	-13.62	29.5	-43.12	0-360
10	13.98022	17.03	Pk	10.4	.5	-40	-12.07	29.5	-41.57	0-360
4	13.98546	17.64	Pk	10.4	.5	-40	-11.46	29.5	-40.96	0-360
5	14.40781	24.28	Pk	10.4	.5	-40	-4.82	29.5	-34.32	0-360
11	14.40886	23.34	Pk	10.4	.5	-40	-5.76	29.5	-35.26	0-360
6	15.25616	14.07	Pk	10.3	.5	-40	-15.13	29.5	-44.63	0-360
12	15.25669	12.81	Pk	10.3	.5	-40	-16.39	29.5	-45.89	0-360

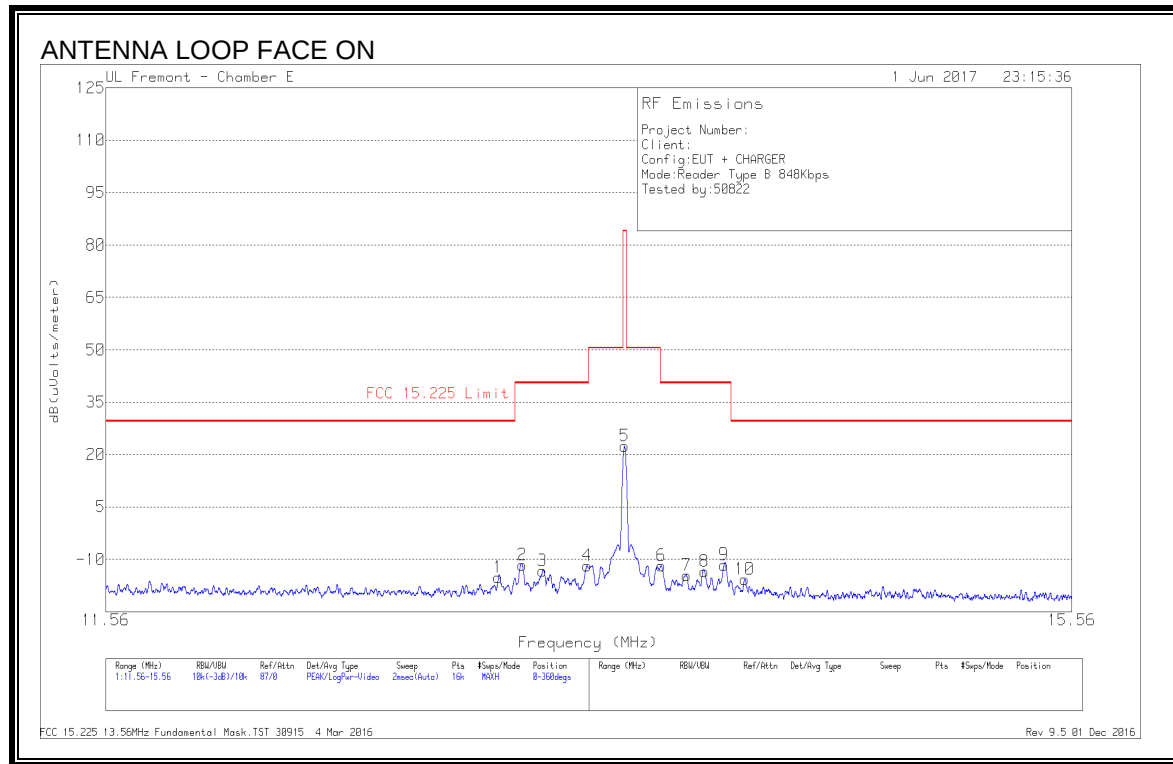
Pk - Peak detector

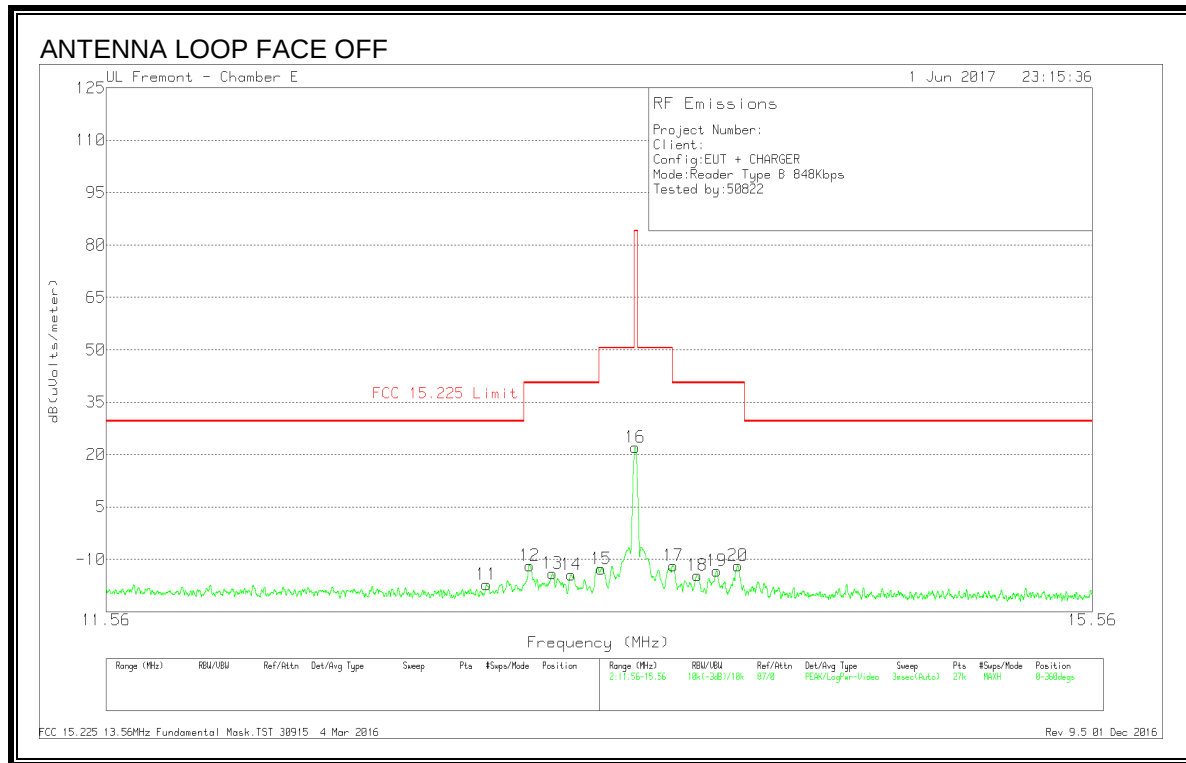
CE Type B 848Kbps.DAT 30915 7 Oct 2016

Rev 9.5 01 Dec 2016

8.2.2. READER MODE

Type B, 848Kbps FUNDAMENTAL





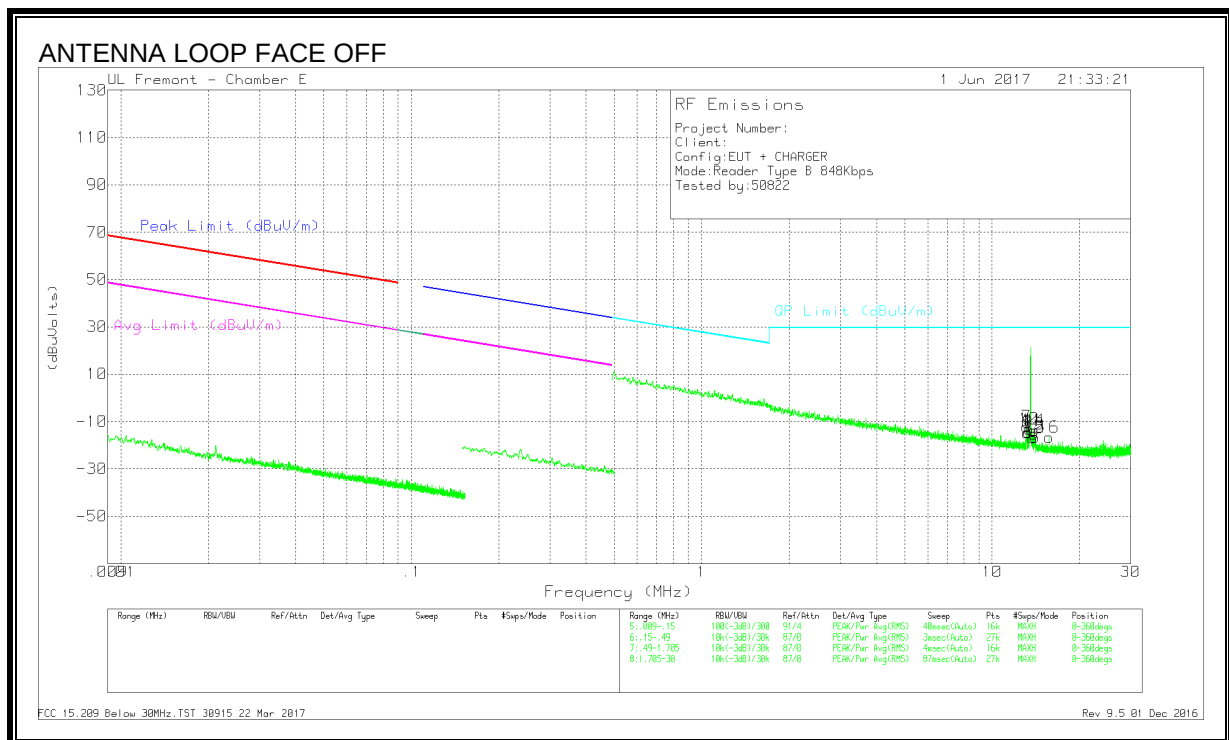
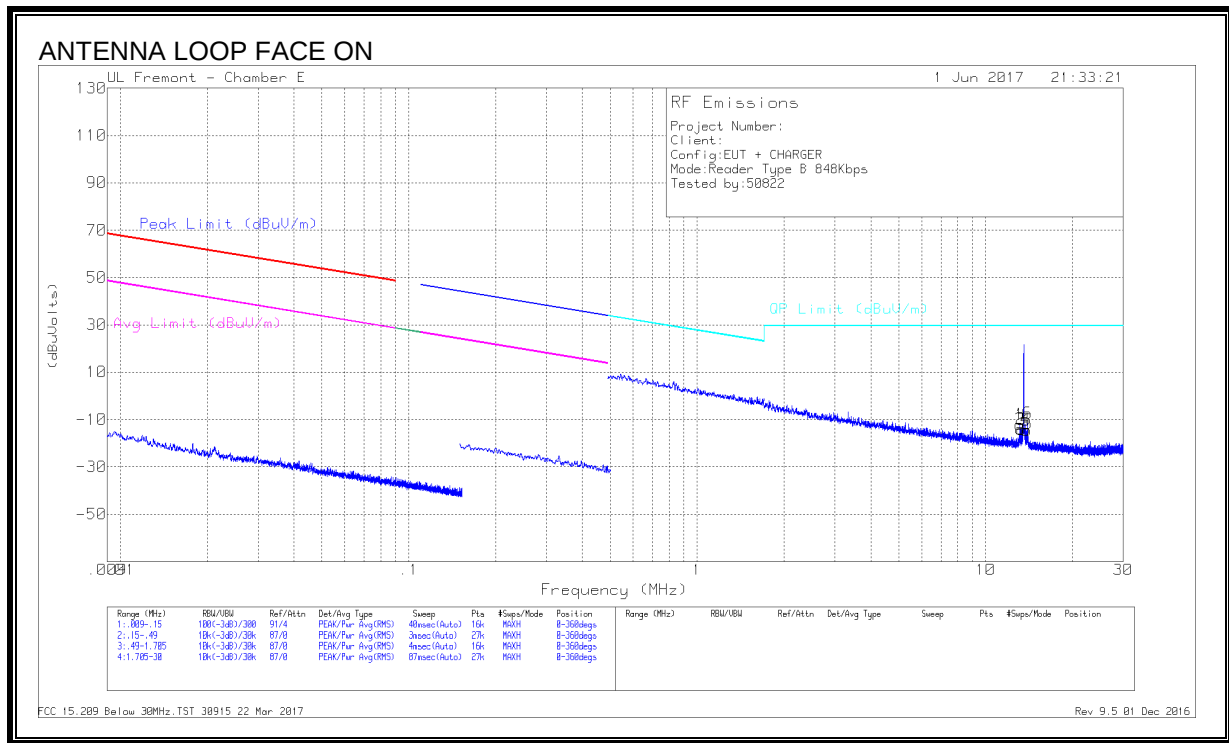
Trace Markers

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)
11	12.96385	11.49	Pk	10.7	.5	-40	-17.31	29.54	-46.85	0-360
1	13.0435	13.6	Pk	10.7	.5	-40	-15.2	29.54	-44.74	0-360
12	13.13428	17.05	Pk	10.7	.5	-40	-11.75	40.51	-52.26	0-360
2	13.14025	17.07	Pk	10.7	.5	-40	-11.73	40.51	-52.24	0-360
3	13.222	15.42	Pk	10.7	.5	-40	-13.38	40.51	-53.89	0-360
13	13.22337	14.65	Pk	10.7	.5	-40	-14.15	40.51	-54.66	0-360
14	13.29819	14.31	Pk	10.7	.5	-40	-14.49	40.51	-55	0-360
4	13.40525	16.89	Pk	10.7	.5	-40	-11.91	40.51	-52.42	0-360
15	13.41888	15.97	Pk	10.7	.5	-40	-12.83	50.5	-63.33	0-360
16	13.55778	51.01	Pk	10.6	.5	-40	22.11	84	-61.89	0-360
5	13.55963	51.25	Pk	10.6	.5	-40	22.35	84	-61.65	0-360
17	13.71436	16.99	Pk	10.6	.5	-40	-11.91	40.51	-52.42	0-360
6	13.7145	17.01	Pk	10.6	.5	-40	-11.89	40.51	-52.4	0-360
18	13.81545	14.26	Pk	10.6	.5	-40	-14.64	40.51	-55.15	0-360
7	13.82175	14.23	Pk	10.6	.5	-40	-14.67	40.51	-55.18	0-360
19	13.89448	15.54	Pk	10.6	.5	-40	-13.36	40.51	-53.87	0-360
8	13.89775	15.45	Pk	10.6	.5	-40	-13.45	40.51	-53.96	0-360
9	13.9815	17.34	Pk	10.6	.5	-40	-11.56	40.51	-52.07	0-360
20	13.98291	17.14	Pk	10.6	.5	-40	-11.76	40.51	-52.27	0-360
10	14.07088	13.24	Pk	10.6	.5	-40	-15.66	29.54	-45.2	0-360

Pk - Peak detector

FCC 15.225 13.56MHz Fundamental Mask.TST 30915 4 Mar 2016
Rev 9.5 01 Dec 2016

SPURIOUS EMISSION



DATA

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)
7	13.13292	16.82	Pk	10.5	.5	-40	-12.18	29.5	-41.68	0-360
1	13.13658	16.93	Pk	10.5	.5	-40	-12.07	29.5	-41.57	0-360
2	13.22147	15.1	Pk	10.5	.5	-40	-13.9	29.5	-43.4	0-360
8	13.22409	14.28	Pk	10.5	.5	-40	-14.72	29.5	-44.22	0-360
3	13.30322	14.67	Pk	10.5	.5	-40	-14.33	29.5	-43.83	0-360
9	13.30322	14.61	Pk	10.5	.5	-40	-14.39	29.5	-43.89	0-360
10	13.40487	15.78	Pk	10.5	.5	-40	-13.22	29.5	-42.72	0-360
11	13.7025	15.49	Pk	10.4	.5	-40	-13.61	29.5	-43.11	0-360
4	13.81464	14.74	Pk	10.4	.5	-40	-14.36	29.5	-43.86	0-360
12	13.81674	12.17	Pk	10.4	.5	-40	-16.93	29.5	-46.43	0-360
5	13.89743	14.51	Pk	10.4	.5	-40	-14.59	29.5	-44.09	0-360
13	13.90058	13.75	Pk	10.4	.5	-40	-15.35	29.5	-44.85	0-360
6	13.98232	17.46	Pk	10.4	.5	-40	-11.64	29.5	-41.14	0-360
14	13.98704	15.45	Pk	10.4	.5	-40	-13.65	29.5	-43.15	0-360
15	14.06773	12.53	Pk	10.4	.5	-40	-16.57	29.5	-46.07	0-360
16	15.68375	12.52	Pk	10.2	.6	-40	-16.68	29.5	-46.18	0-360

Pk - Peak detector

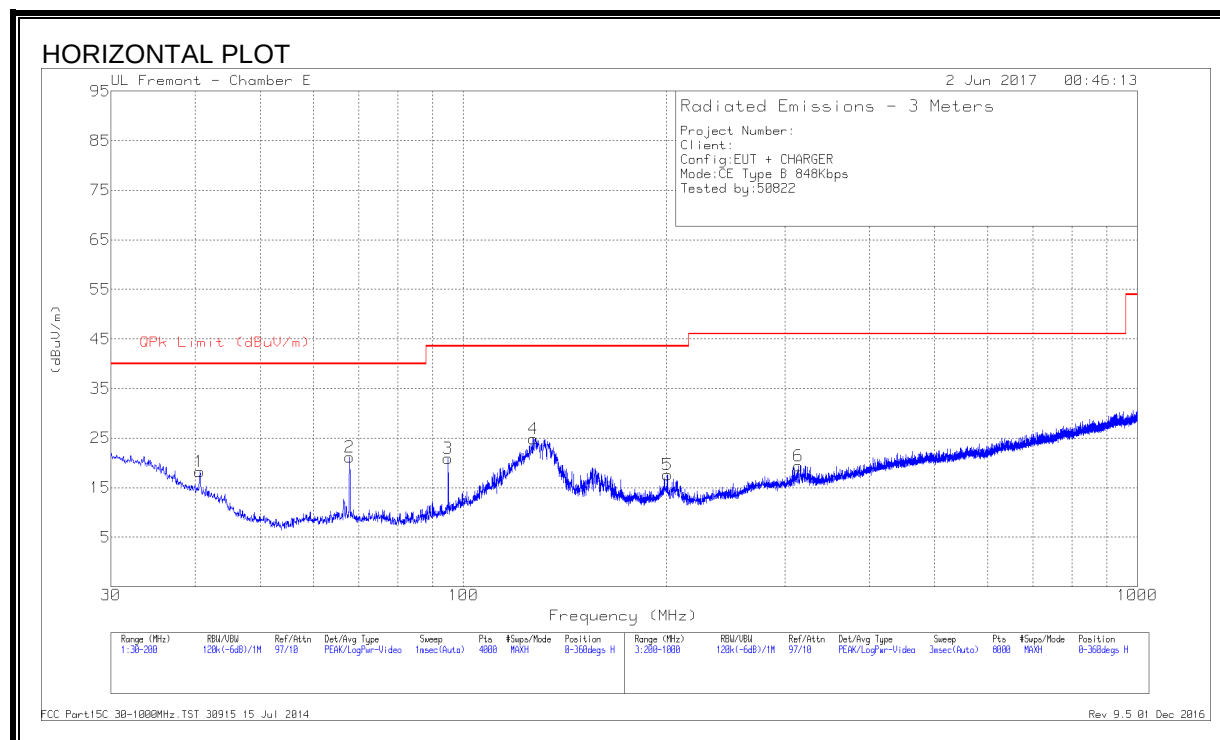
FCC 15.209 Below 30MHz.TST 30915 22 Mar 2017
Rev 9.5 01 Dec 2016

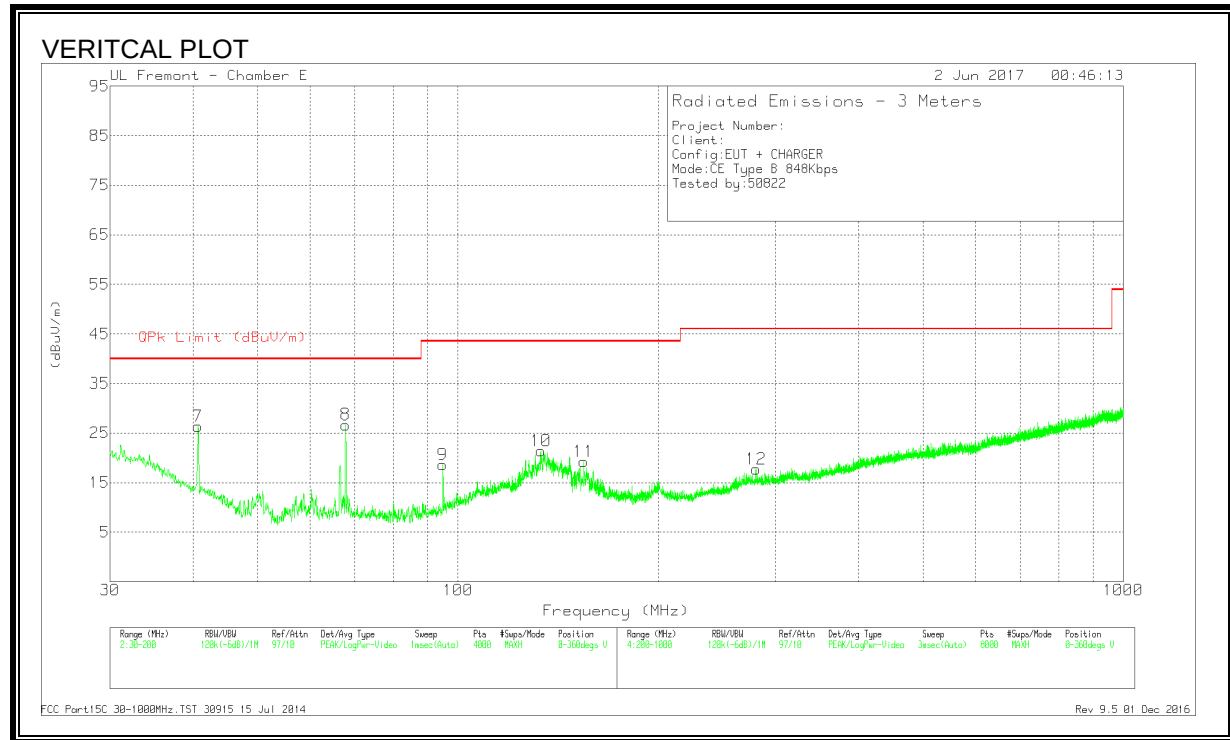
8.3. TX SPURIOUS EMISSION 30 TO 1000 MHz

8.3.1. CE 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	* 126.9463	37.73	Pk	17.7	-30.6	24.83	43.52	-18.69	0-360	200	H
10	* 133.238	34.46	Pk	17.5	-30.5	21.46	43.52	-22.06	0-360	100	V
12	* 280.4105	29.76	Pk	17.4	-29.4	17.76	46.02	-28.26	0-360	199	V
1	40.6278	32.03	Pk	17.7	-31.5	18.23	40	-21.77	0-360	200	H
7	40.6703	40.22	Pk	17.7	-31.5	26.42	40	-13.58	0-360	100	V
2	67.7923	40.21	Pk	12.1	-31.2	21.11	40	-18.89	0-360	400	H
8	67.7923	45.78	Pk	12.1	-31.2	26.68	40	-13.32	0-360	100	V
3	94.9143	38.99	Pk	12.8	-30.9	20.89	43.52	-22.63	0-360	300	H
9	94.9143	36.75	Pk	12.8	-30.9	18.65	43.52	-24.87	0-360	100	V
11	154.5997	33.46	Pk	16.1	-30.3	19.26	43.52	-24.26	0-360	100	V
5	200.8001	31.3	Pk	16.3	-30	17.6	43.52	-25.92	0-360	100	H
6	314.1148	30.79	Pk	17.8	-29.2	19.39	46.02	-26.63	0-360	100	H

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

Pk - Peak detector

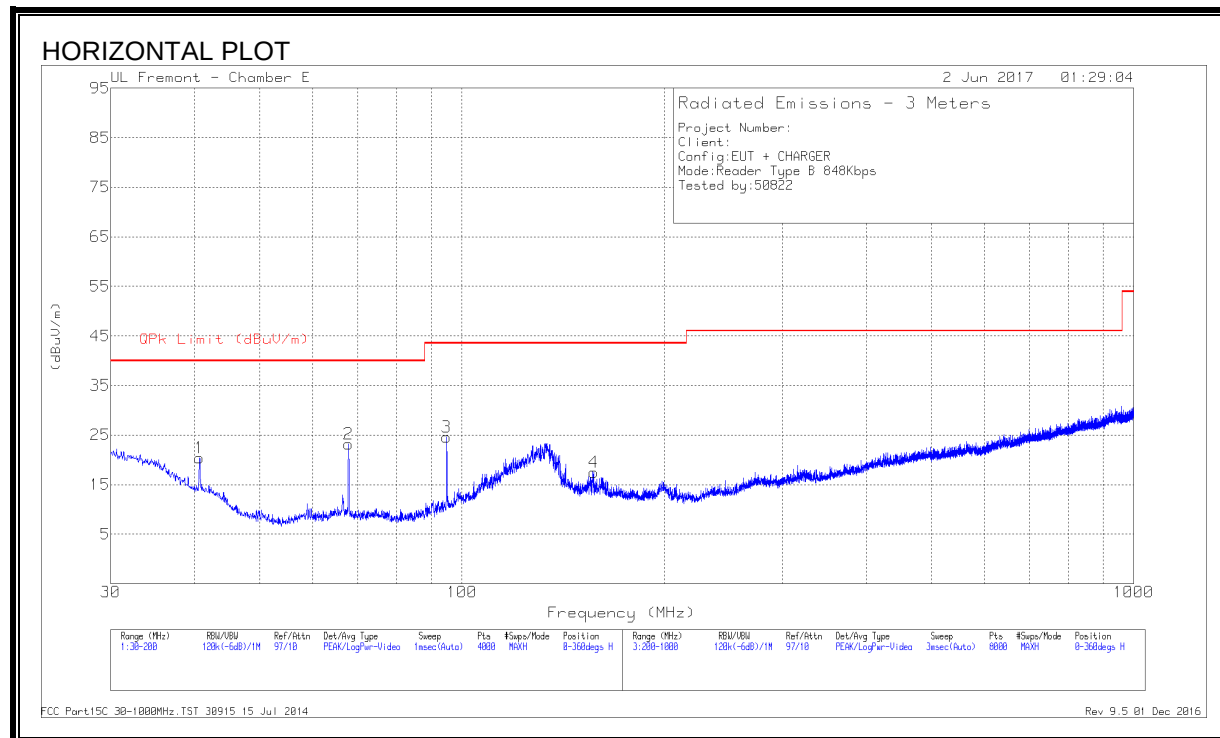
FCC Part15C 30-1000MHz.TST 30915 15 Jul 2014

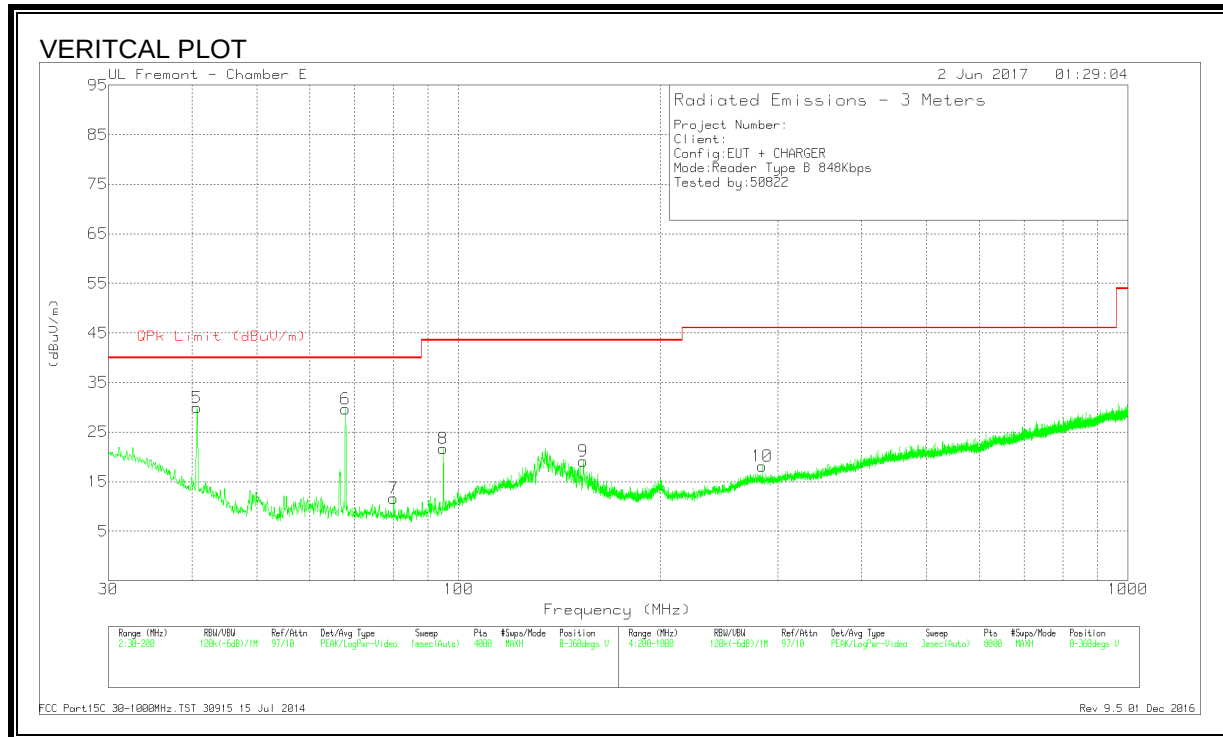
Rev 9.5 01 Dec 2016

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
10	* 284.2109	30.24	Pk	17.3	-29.4	18.14	46.02	-27.88	0-360	300	V
1	40.6703	34.15	Pk	17.7	-31.5	20.35	40	-19.65	0-360	400	H
5	40.6703	43.76	Pk	17.7	-31.5	29.96	40	-10.04	0-360	100	V
2	67.7923	42.31	Pk	12.1	-31.2	23.21	40	-16.79	0-360	400	H
6	67.7923	48.74	Pk	12.1	-31.2	29.64	40	-10.36	0-360	100	V
7	79.9929	31.45	Pk	11.2	-31	11.65	40	-28.35	0-360	100	V
3	94.9143	42.69	Pk	12.8	-30.9	24.59	43.52	-18.93	0-360	299	H
8	94.9143	39.81	Pk	12.8	-30.9	21.71	43.52	-21.81	0-360	100	V
9	153.707	33.28	Pk	16.2	-30.3	19.18	43.52	-24.34	0-360	100	V
4	157.0229	31.79	Pk	16	-30.3	17.49	43.52	-26.03	0-360	299	H

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

8.4. 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 C63.10:2013 Clause 6.8.1 and 6.8.2

RESULTS

No non-compliance noted.

8.4.1. CE Mode

ID:	38602	Date:	5/26/17
-----	-------	-------	---------

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	13.5596558	3.464	13.5596558	3.462	13.5596561	3.440	13.5596570	3.376	± 100
	40	13.5596691	2.480	13.5596668	2.654	13.5596642	2.844	13.5596615	3.042	± 100
	30	13.5596904	0.908	13.5596877	1.112	13.5596845	1.343	13.5596810	1.601	± 100
	20	13.5597028	0.000	13.5597028	-0.004	13.5597030	-0.016	13.5597032	-0.032	± 100
	10	13.5596801	1.673	13.5596881	1.081	13.5596977	0.375	13.5597090	-0.461	± 100
	0	13.5597423	-2.915	13.5597459	-3.179	13.5597499	-3.478	13.5597547	-3.829	± 100
	-10	13.5597731	-5.190	13.5597759	-5.393	13.5597787	-5.603	13.5597816	-5.818	± 100
	-20	13.5597921	-6.593	13.5597926	-6.629	13.5597931	-6.661	13.5597935	-6.691	± 100
3.23	20	13.5597477	-3.313	13.5597455	-3.150	13.5597442	-3.055	13.5597432	-2.981	± 100
4.37	20	13.5597430	-2.965	13.5597428	-2.956	13.5597428	-2.956	13.5597426	-2.938	± 100

8.4.2. 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	13.5597222	2.961	13.5597069	4.094	13.5596947	4.990	13.5596886	5.440	± 100
	40	13.5596888	5.423	13.5596892	5.392	13.5596894	5.378	13.5596892	5.394	± 100
	30	13.5596948	4.983	13.5596965	4.855	13.5596982	4.732	13.5596996	4.627	± 100
	20	13.5597624	0.000	13.5597556	0.499	13.5597488	1.003	13.5597423	1.477	± 100
	10	13.5597554	0.510	13.5597583	0.296	13.5597606	0.132	13.5597621	0.022	± 100
	0	13.5597802	-1.314	13.5597831	-1.527	13.5597855	-1.709	13.5597877	-1.866	± 100
	-10	13.5598026	-2.969	13.5598043	-3.091	13.5598058	-3.204	13.5598071	-3.300	± 100
	-20	13.5598120	-3.660	13.5598119	-3.655	13.5598117	-3.642	13.5598114	-3.617	± 100
3.23	20	13.5597417	1.524	13.5597417	1.522	13.5597417	1.527	13.5597416	1.531	± 100
4.37	20	13.5597418	1.513	13.5597419	1.512	13.5597417	1.522	13.5597417	1.525	± 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 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:

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	.16125	18.25	Qp	0	.1	10.1	28.45	65.4	-36.95	-	-
2	.15675	-53	Ca	0	.1	10.1	9.67	-	-	55.63	-45.96
3	.25575	13.65	Qp	0	.1	10.1	23.85	61.57	-37.72	-	-
4	.25125	-3.61	Ca	0	.1	10.1	6.59	-	-	51.72	-45.13
5	.78225	10.7	Qp	0	.1	10.1	20.9	56	-35.1	-	-
6	.78225	-2.73	Ca	0	.1	10.1	7.47	-	-	46	-38.53
7	12.7118	26.56	Qp	.1	.2	10.2	37.06	60	-22.94	-	-
8	12.7118	18.78	Ca	.1	.2	10.2	29.28	-	-	50	-20.72
9	13.56	56.99	Qp	.1	.2	10.2	67.49	60	7.49	-	-
10	13.56	54.11	Ca	.1	.2	10.2	64.61	-	-	50	14.61
11	14.4083	29.77	Qp	0	.2	10.2	40.17	60	-19.83	-	-
12	14.4083	21.84	Ca	0	.2	10.2	32.24	-	-	50	-17.76
13	17.6393	15.28	Qp	0	.2	10.3	25.78	60	-34.22	-	-
14	17.7968	-15	Ca	0	.2	10.3	10.35	-	-	50	-39.65

Qp - Quasi-Peak detector

Ca - CISPR average detection

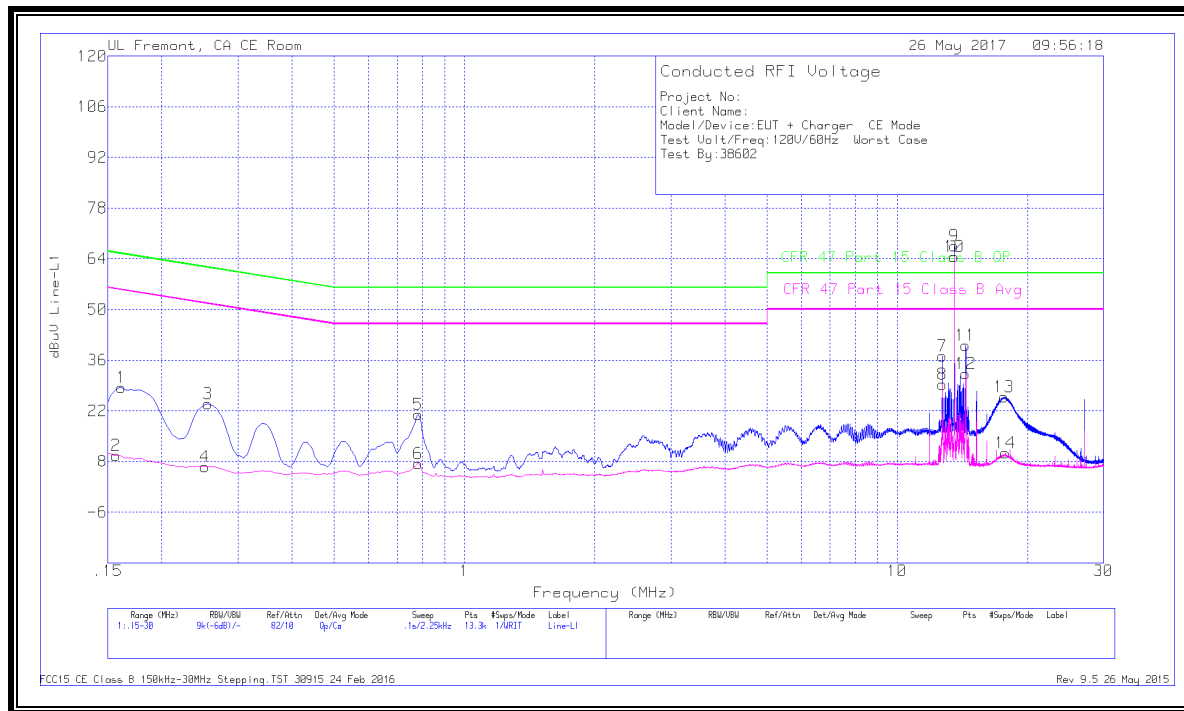
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
15	.17025	18.89	Qp	0	.1	10.1	29.09	64.95	-35.86	-	-
16	.15225	-2.75	Ca	0	0	10.1	7.35	-	-	55.88	-48.53
17	.258	14.41	Qp	0	.1	10.1	24.61	61.5	-36.89	-	-
18	.258	-4.5	Ca	0	.1	10.1	5.7	-	-	51.5	-45.8
19	.78225	12.7	Qp	0	.1	10.1	22.9	56	-33.1	-	-
20	.7845	-2.21	Ca	0	.1	10.1	7.99	-	-	46	-38.01
21	12.7118	24.22	Qp	.1	.2	10.2	34.72	60	-25.28	-	-
22	12.7118	17.27	Ca	.1	.2	10.2	27.77	-	-	50	-22.23
23	13.56	53.53	Qp	.1	.2	10.2	64.03	60	4.03	-	-
24	13.56	52.68	Ca	.1	.2	10.2	63.18	-	-	50	13.18
25	14.4083	27.35	Qp	.1	.2	10.2	37.85	60	-22.15	-	-
26	14.4083	20.41	Ca	.1	.2	10.2	30.91	-	-	50	-19.09
27	17.151	15	Qp	0	.2	10.3	25.5	60	-34.5	-	-
28	16.9508	1.07	Ca	0	.2	10.3	11.57	-	-	50	-38.43

Qp - Quasi-Peak detector

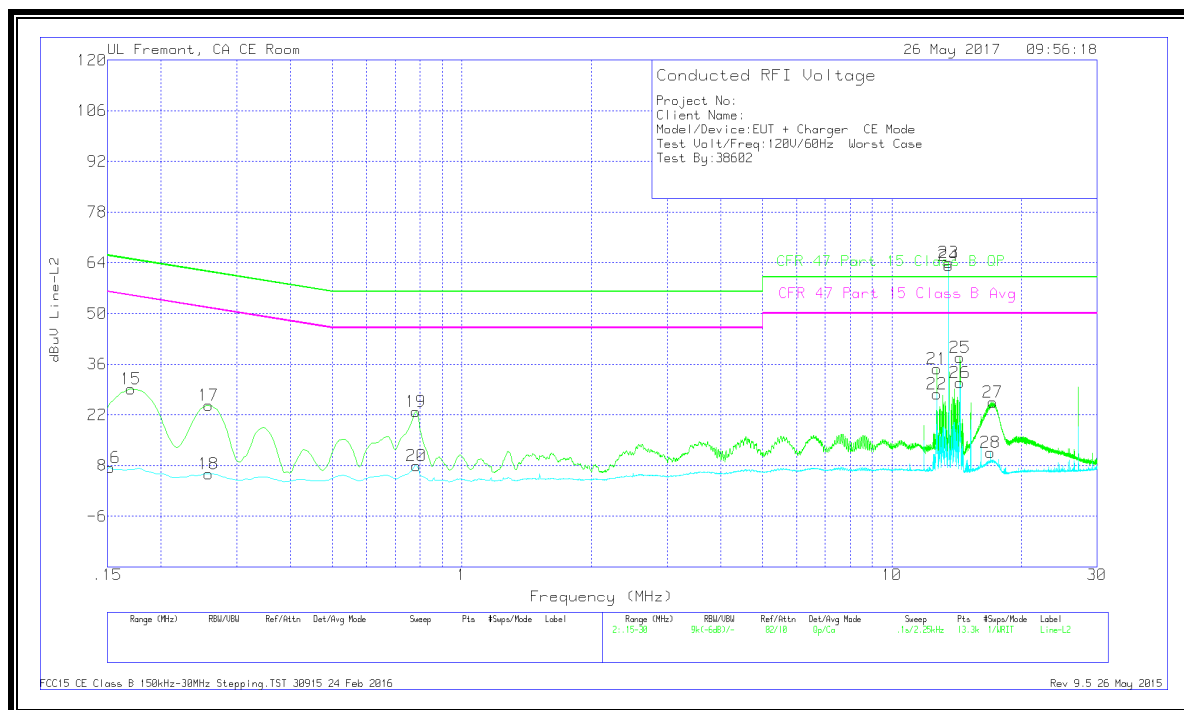
Ca - CISPR average detection

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	.16575	48.14	Qp	.1	0	10.1	58.34	65.17	-6.83	-	-
2	.168	36.2	Ca	.1	0	10.1	46.4	-	-	55.06	-8.66
3	.249	40	Qp	0	.1	10.1	50.2	61.79	-11.59	-	-
4	.25125	27.22	Ca	0	.1	10.1	37.42	-	-	51.72	-14.3
5	.339	36.1	Qp	0	.1	10.1	46.3	59.23	-12.93	-	-
6	.33675	22.17	Ca	0	.1	10.1	32.37	-	-	49.28	-16.91
7	.4155	31.11	Qp	0	.1	10.1	41.31	57.54	-16.23	-	-
8	.42	16.59	Ca	0	.1	10.1	26.79	-	-	47.45	-20.66
9	.49875	27.81	Qp	0	.1	10.1	38.01	56.02	-18.01	-	-
10	.50775	12.66	Ca	0	.1	10.1	22.86	-	-	46	-23.14
11	16.5154	20.71	Qp	0	.2	10.3	31.21	60	-28.79	-	-
12	16.9283	13.39	Ca	0	.2	10.3	23.89	-	-	50	-26.11

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	.16575	47.22	Qp	0	0	10.1	57.32	65.17	-7.85	-	-
14	.168	35.34	Ca	0	0	10.1	45.44	-	-	55.06	-9.62
15	.249	38.7	Qp	0	.1	10.1	48.9	61.79	-12.89	-	-
16	.25125	26.38	Ca	0	.1	10.1	36.58	-	-	51.72	-15.14
17	.33112	34.01	Qp	0	.1	10.1	44.21	59.42	-15.21	-	-
18	.3345	21.16	Ca	0	.1	10.1	31.36	-	-	49.34	-17.98
19	.41325	29.01	Qp	0	.1	10.1	39.21	57.58	-18.37	-	-
20	.41775	14.75	Ca	0	.1	10.1	24.95	-	-	47.49	-22.54
21	17.3445	21.4	Qp	0	.2	10.3	31.9	60	-28.1	-	-
22	17.34	13.54	Ca	0	.2	10.3	24.04	-	-	50	-25.96
23	24.3533	21.6	Qp	.1	.3	10.5	32.5	60	-27.5	-	-
24	24.3533	14.83	Ca	.1	.3	10.5	25.73	-	-	50	-24.27

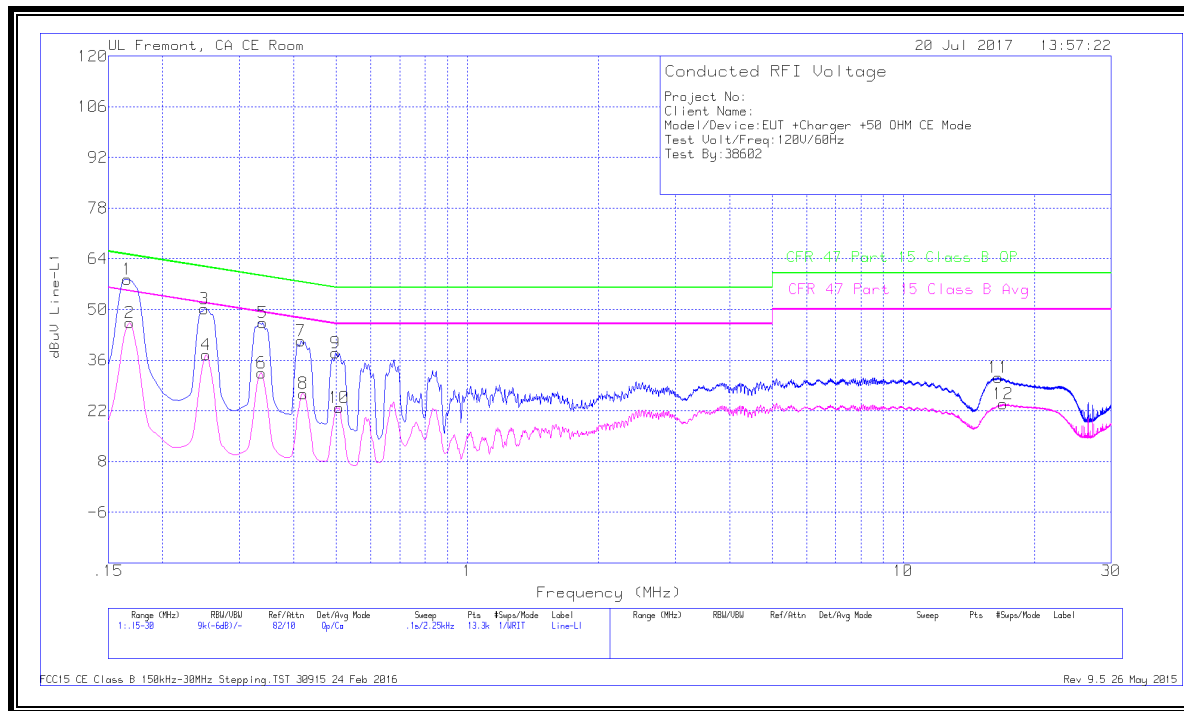
Qp - Quasi-Peak detector

Ca - CISPR average detection

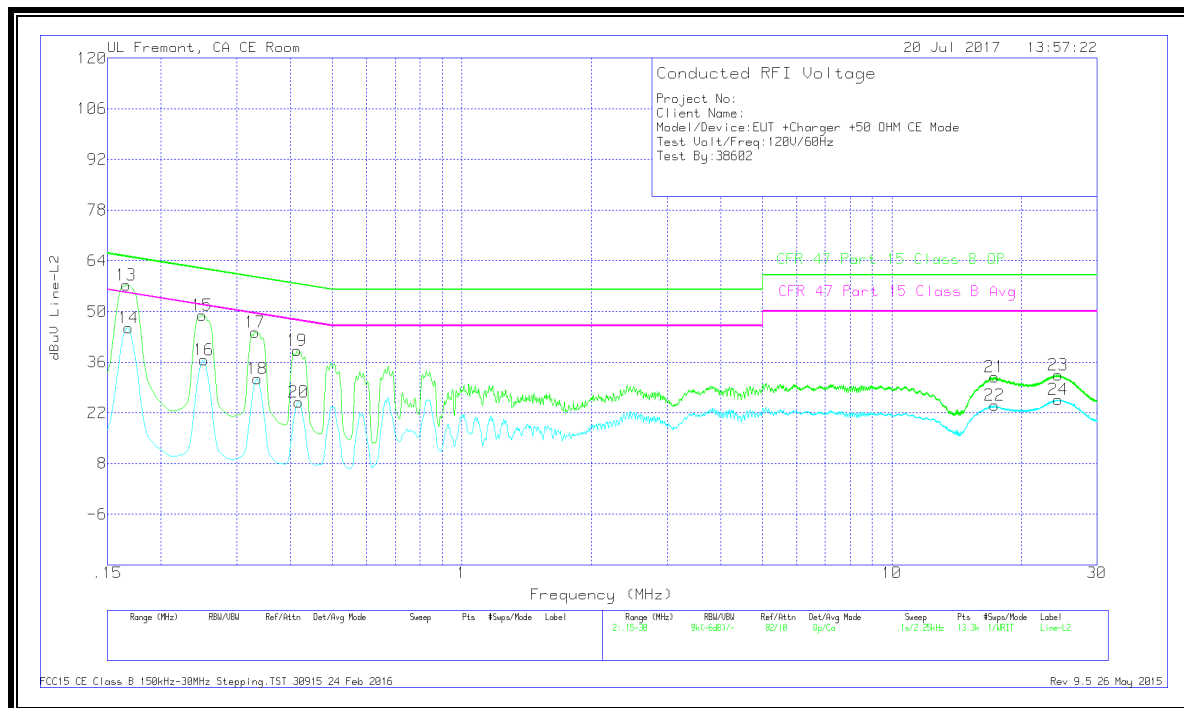
FCC15 CE Class B 150kHz-30MHz Stepping.TST 30915 24 Feb 2016

Rev 9.5 26 May 2015

LINE 1 RESULTS



LINE 2 RESULTS



9.1.3. 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	19.49	Qp	0	.1	10.1	29.69	65.52	-35.83	-	-
2	.15225	-0.03	Ca	.1	.1	10.1	10.27	-	-	55.88	-45.61
3	.25575	14.93	Qp	0	.1	10.1	25.13	61.57	-36.44	-	-
4	.2085	-3.19	Ca	0	.1	10.1	7.01	-	-	53.26	-46.25
5	.78225	11.07	Qp	0	.1	10.1	21.27	56	-34.73	-	-
6	.7845	-2.6	Ca	0	.1	10.1	7.6	-	-	46	-38.4
7	13.56	57.69	Qp	.1	.2	10.2	68.19	60	8.19	-	-
8	13.56	54.83	Ca	.1	.2	10.2	65.33	-	-	50	15.33
9	17.6449	16.14	Qp	0	.2	10.3	26.64	60	-33.36	-	-
10	17.6955	-0.08	Ca	0	.2	10.3	10.42	-	-	50	-39.58
11	27.1185	15.8	Qp	.1	.3	10.5	26.7	60	-33.3	-	-
12	27.1185	6.34	Ca	.1	.3	10.5	17.24	-	-	50	-32.76

Qp - Quasi-Peak detector

Ca - CISPR average detection

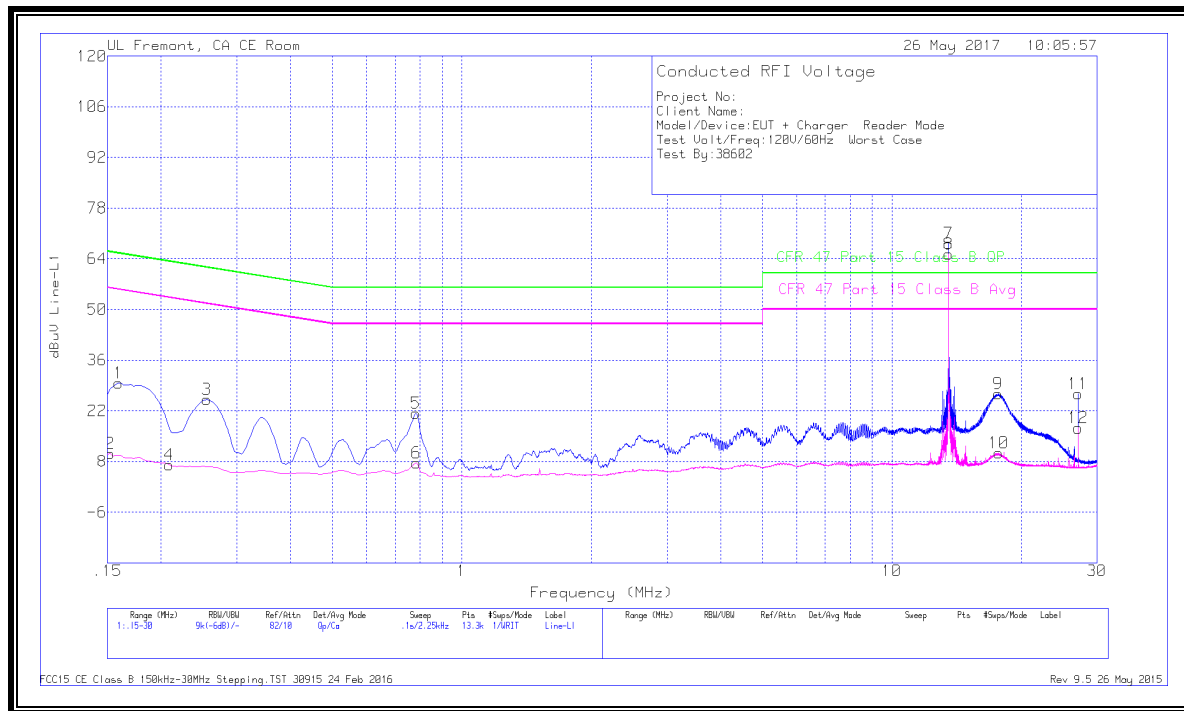
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.17025	20.66	Qp	0	.1	10.1	30.86	64.95	-34.09	-	-
14	.177	-1.96	Ca	0	.1	10.1	8.24	-	-	54.63	-46.39
15	.26025	15.79	Qp	0	.1	10.1	25.99	61.42	-35.43	-	-
16	.26475	-4.18	Ca	0	.1	10.1	6.02	-	-	51.28	-45.26
17	.78225	11.96	Qp	0	.1	10.1	22.16	56	-33.84	-	-
18	.7845	-2.51	Ca	0	.1	10.1	7.69	-	-	46	-38.31
19	13.56	54.15	Qp	.1	.2	10.2	64.65	60	4.65	-	-
20	13.56	53.31	Ca	.1	.2	10.2	63.81	-	-	50	13.81
21	17.1296	15.69	Qp	0	.3	10.3	26.29	60	-33.71	-	-
22	16.9485	-0.07	Ca	0	.2	10.3	10.43	-	-	50	-39.57
23	27.1185	20.21	Qp	.1	.3	10.5	31.11	60	-28.89	-	-
24	27.1185	9.01	Ca	.1	.3	10.5	19.91	-	-	50	-30.09

Qp - Quasi-Peak detector

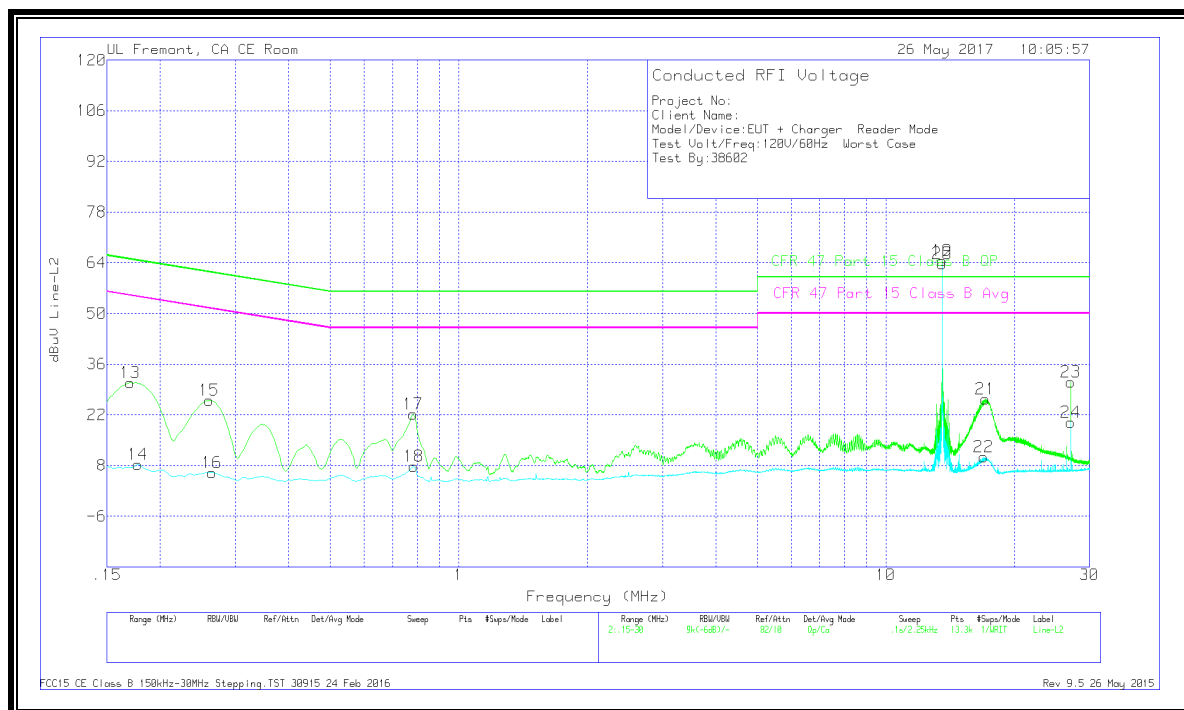
Ca - CISPR average detection

FCC15 CE Class B 150kHz-30MHz Stepping.TST 30915 24 Feb 2016
Rev 9.5 26 May 2015

LINE 1 RESULTS



LINE 2 RESULTS



9.1.4. 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 R)Margin (dB)
1	.16125	44.11	Qp	.1	.1	10.1	54.41	65.4	-10.99	-	-
2	.16575	31.5	Ca	.1	0	10.1	41.7	-	-	55.17	-13.47
3	.24675	35.25	Qp	0	.1	10.1	45.45	61.87	-16.42	-	-
4	.249	22.41	Ca	0	.1	10.1	32.61	-	-	51.79	-19.18
5	.32775	32.11	Qp	0	.1	10.1	42.31	59.51	-17.2	-	-
6	.33	18.18	Ca	0	.1	10.1	28.38	-	-	49.45	-21.07
7	.411	27.4	Qp	0	.1	10.1	37.6	57.63	-20.03	-	-
8	.41325	13.26	Ca	0	.1	10.1	23.46	-	-	47.58	-24.12
9	.492	24.65	Qp	0	.1	10.1	34.85	56.13	-21.28	-	-
10	.492	9.53	Ca	0	.1	10.1	19.73	-	-	46.13	-26.4
11	.83625	22.09	Qp	0	.1	10.1	32.29	56	-23.71	-	-
12	.834	12.66	Ca	0	.1	10.1	22.86	-	-	46	-23.14
13	16.431	21.3	Qp	0	.3	10.3	31.9	60	-28.1	-	-
14	16.7764	13.52	Ca	0	.2	10.3	24.02	-	-	50	-25.98

Qp - Quasi-Peak detector

Ca - CISPR average detection

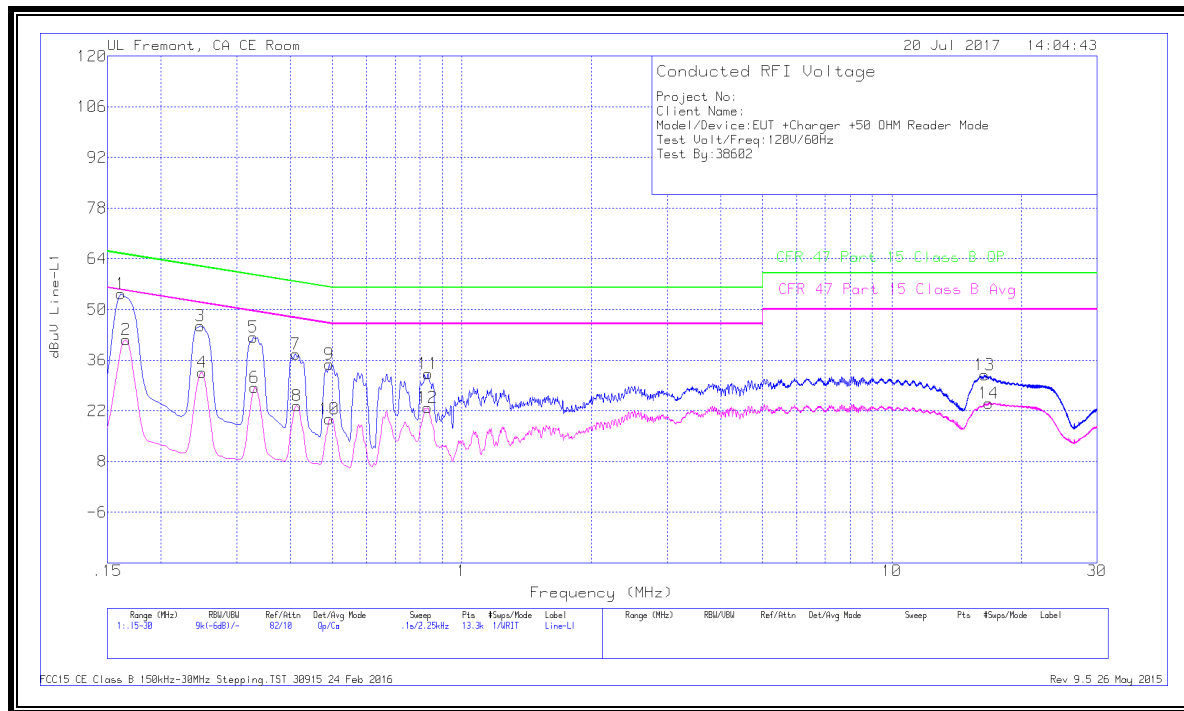
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR R)Margin (dB)
15	.1635	43.12	Qp	0	.1	10.1	53.32	65.28	-11.96	-	-
16	.16575	31.53	Ca	0	0	10.1	41.63	-	-	55.17	-13.54
17	.2445	34.72	Qp	0	.1	10.1	44.92	61.94	-17.02	-	-
18	.24675	23.01	Ca	0	.1	10.1	33.21	-	-	51.87	-18.66
19	.32775	30.77	Qp	0	.1	10.1	40.97	59.51	-18.54	-	-
20	.33	18.64	Ca	0	.1	10.1	28.84	-	-	49.45	-20.61
21	.40875	26.36	Qp	0	.1	10.1	36.56	57.67	-21.11	-	-
22	.411	12.32	Ca	0	.1	10.1	22.52	-	-	47.63	-25.11
23	.83175	23.57	Qp	0	.1	10.1	33.77	56	-22.23	-	-
24	.83175	15.73	Ca	0	.1	10.1	25.93	-	-	46	-20.07
25	17.2995	21.98	Qp	0	.2	10.3	32.48	60	-27.52	-	-
26	16.881	14.07	Ca	0	.2	10.3	24.57	-	-	50	-25.43
27	23.9528	21.56	Qp	0	.3	10.5	32.36	60	-27.64	-	-
28	23.955	14.91	Ca	0	.3	10.5	25.71	-	-	50	-24.29

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

