



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

CERTIFICATION TEST REPORT

FOR

SMARTPHONE

MODEL NUMBER: A1901

**FCC ID: BCG-E3175A
IC: 579C-E3175A**

REPORT NUMBER: 11792137-E6V2

ISSUE DATE: AUGUST 17, 2017

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

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	8/10/2017	Initial Issue	Chin Pang
V2	8/17/2017	Addressed TCB Questions	Francisco Guarnero

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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: A1901

SERIAL NUMBER: C39TX006006J8QN

DATE TESTED: May 23, 2017 – JUNE 10, 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.

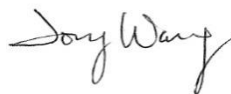
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. 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
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 EUT is a mobile phone with GSM, GPRS, EGPRS, UMTS, LTE and TD-SCDMA 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	28.65
	Reader Mode	B	28.28

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

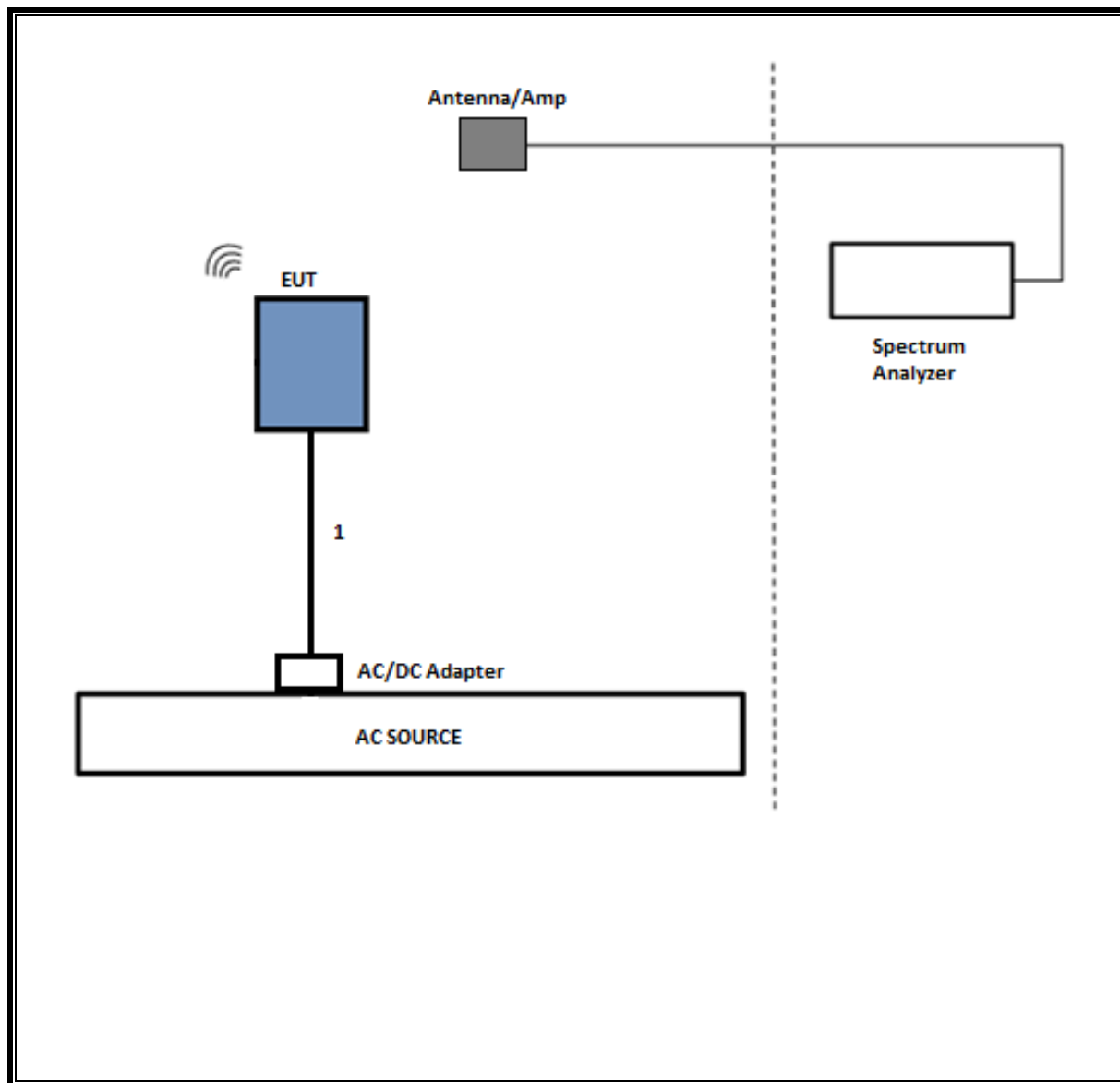
SUPPORT EQUIPMENT

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

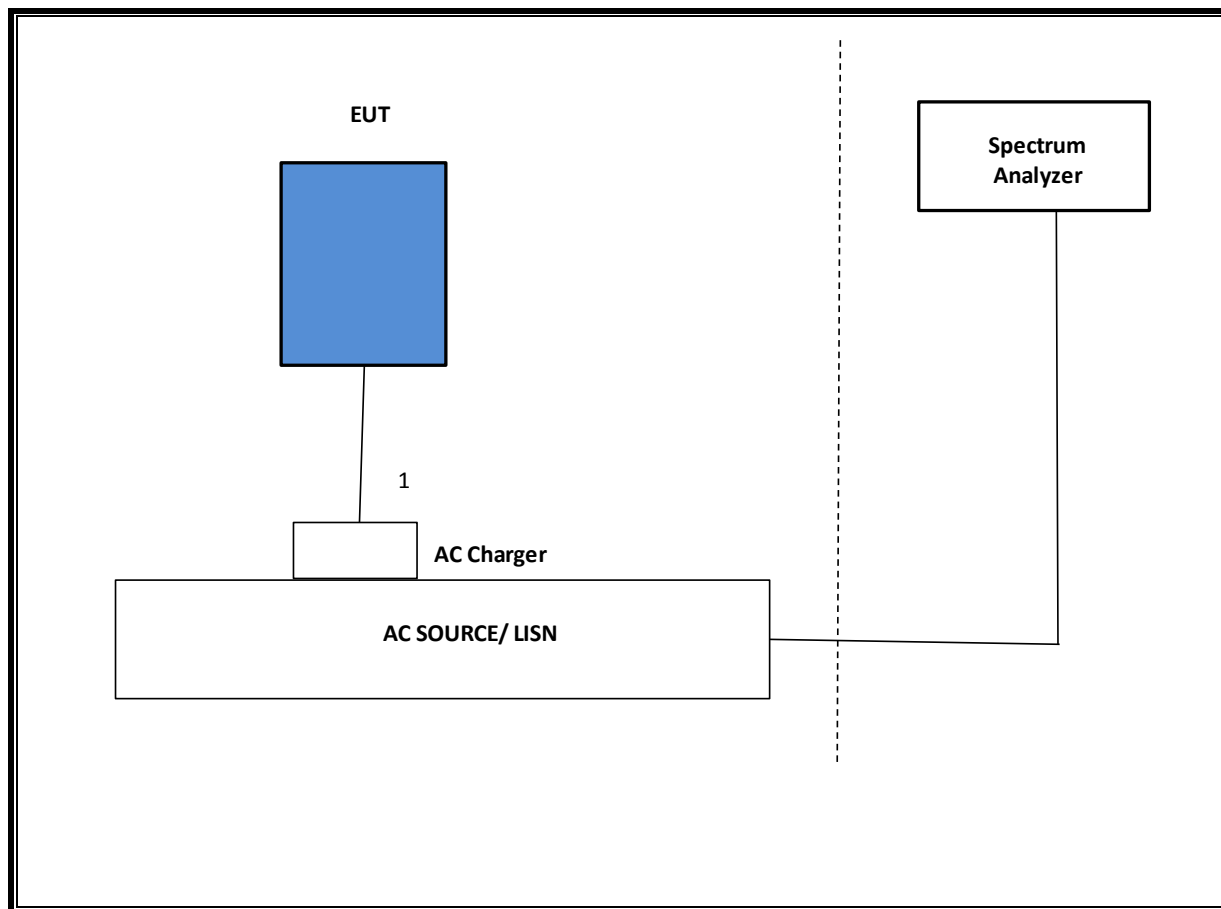
I/O CABLES

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
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T863	6/9/2018
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	T122	1/31/2018
Amplifier, 1 to 18GHz	Miteq	AFS42-00101800-25-S-42	T741	11/29/2017
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	

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 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:	5/24/17
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99% and 20dB BW

CE Mode

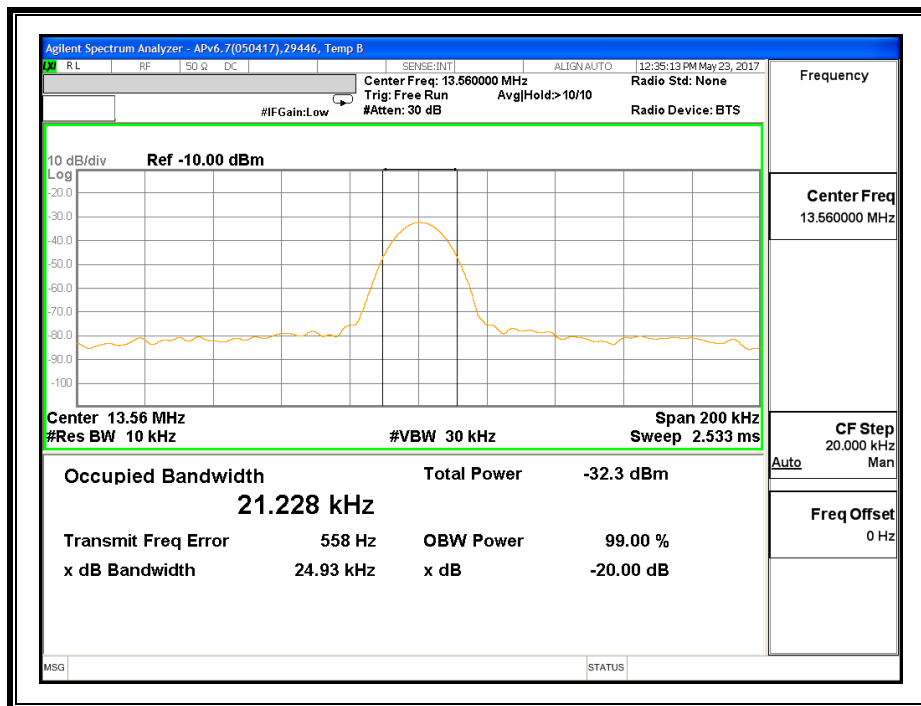
Moduation	Frequency	Data Rate	99% Bandwidth	20dB Bandwidth
	(MHz)	(Kbps)	(KHz)	(KHz)
Type B	13.56	848	21.228	24.93

READER

Moduation	Frequency	Data Rate	99% Bandwidth	20dB Bandwidth
	(MHz)	(Kbps)	(KHz)	(KHz)
Type B	13.56	848	21.712	24.85

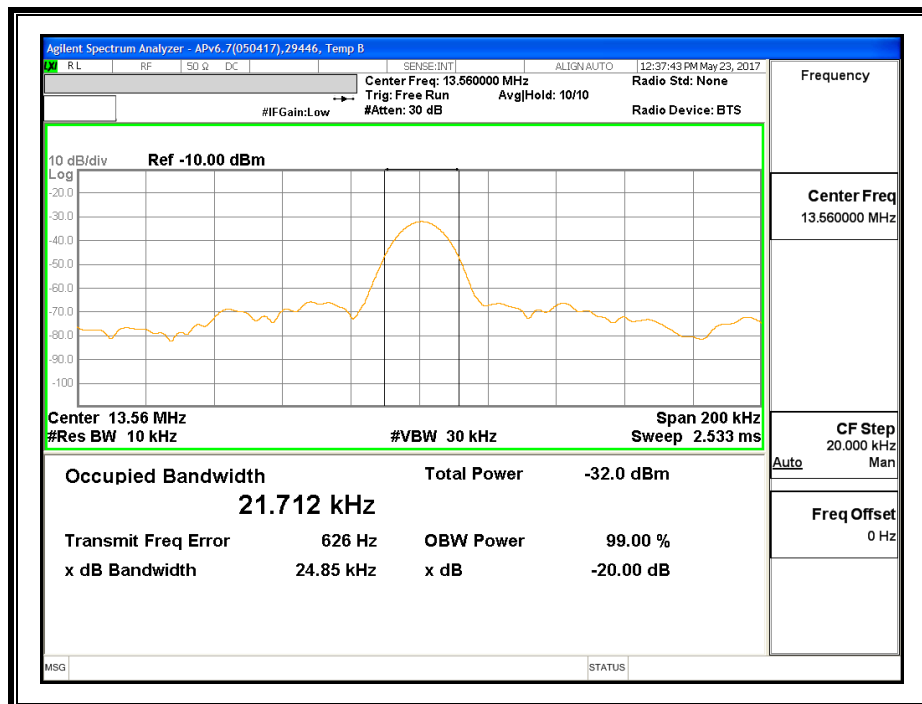
7.1. CE MODE

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.

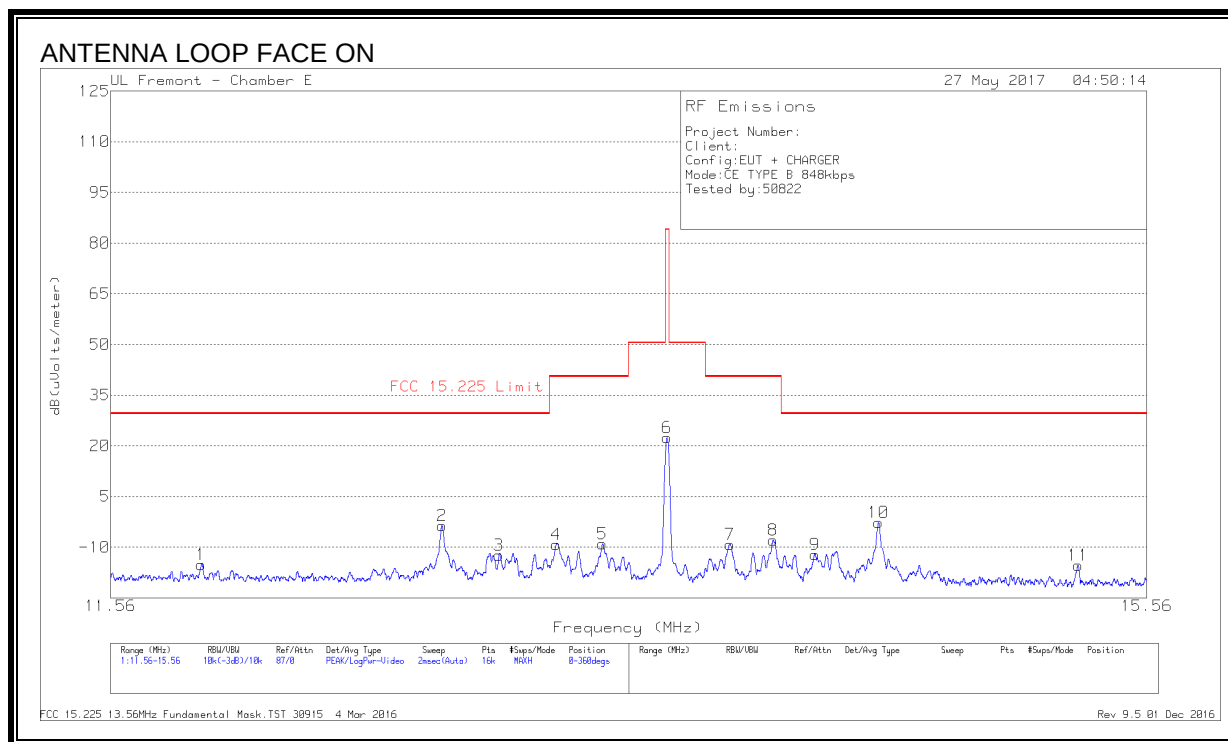
RESULTS

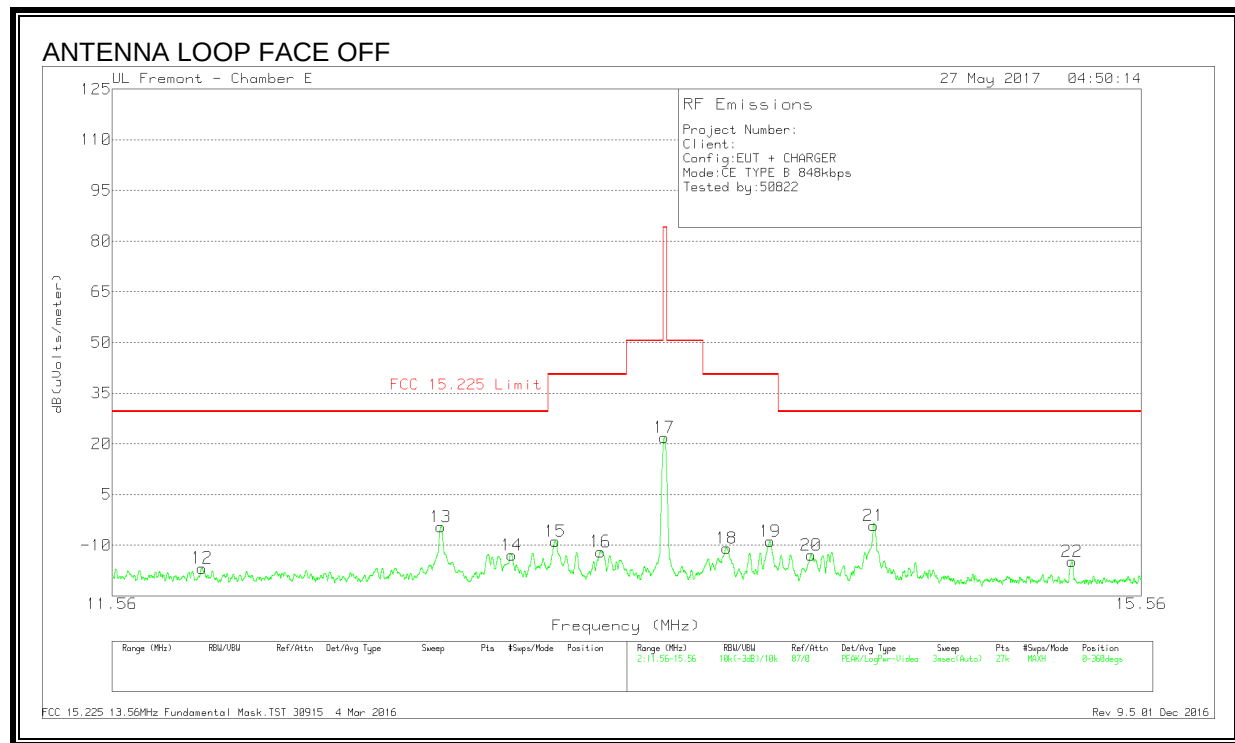
8.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)

8.2.1. CE MODE

TYPE B

848Kbps FUNDAMENTAL





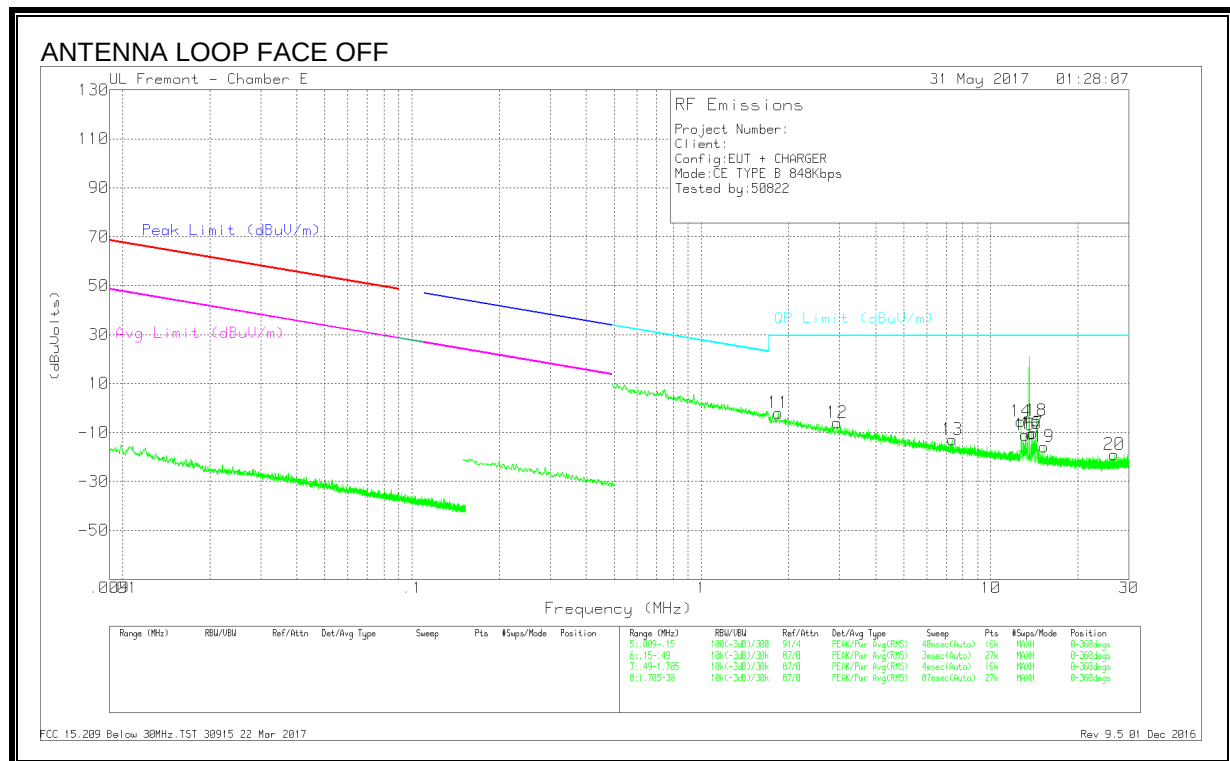
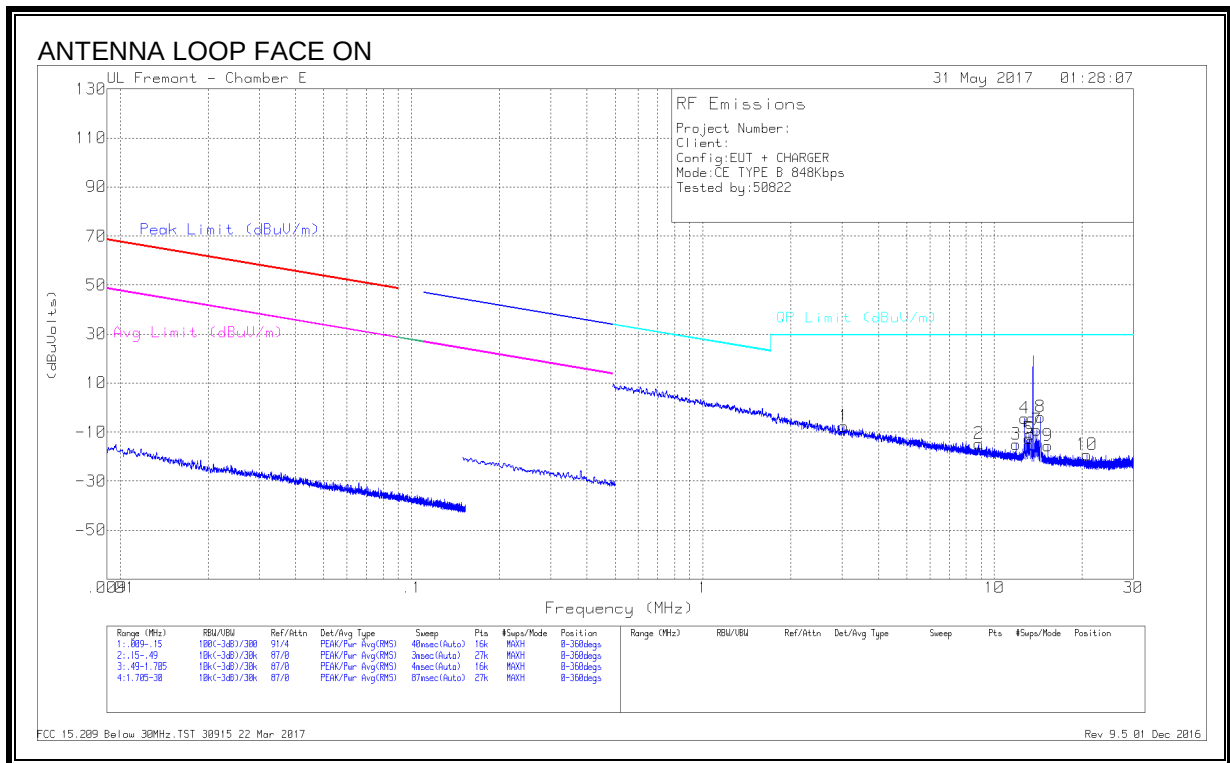
Trace Markers

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)
12	11.86347	11.93	Pk	10.8	.5	-40	-16.77	29.54	-46.31	0-360
1	11.8645	13.49	Pk	10.8	.5	-40	-15.21	29.54	-44.75	0-360
13	12.71011	24.17	Pk	10.7	.5	-40	-4.63	29.54	-34.17	0-360
2	12.71263	25.2	Pk	10.7	.5	-40	-3.6	29.54	-33.14	0-360
3	12.92175	16.49	Pk	10.7	.5	-40	-12.31	29.54	-41.85	0-360
14	12.97503	15.77	Pk	10.7	.5	-40	-13.03	29.54	-42.57	0-360
4	13.136	19.6	Pk	10.7	.5	-40	-9.2	40.51	-49.71	0-360
15	13.1382	19.92	Pk	10.7	.5	-40	-8.88	40.51	-49.39	0-360
16	13.31188	16.87	Pk	10.7	.5	-40	-11.93	40.51	-52.44	0-360
5	13.312	19.7	Pk	10.7	.5	-40	-9.1	40.51	-49.61	0-360
17	13.5583	50.8	Pk	10.6	.5	-40	21.9	84	-62.1	0-360
6	13.56013	51.33	Pk	10.6	.5	-40	22.43	84	-61.57	0-360
18	13.8056	18.02	Pk	10.6	.5	-40	-10.88	40.51	-51.39	0-360
7	13.80688	19.72	Pk	10.6	.5	-40	-9.18	40.51	-49.69	0-360
19	13.97825	20.11	Pk	10.6	.5	-40	-8.79	40.51	-49.3	0-360
8	13.9795	20.91	Pk	10.6	.5	-40	-7.99	40.51	-48.5	0-360
20	14.1466	15.99	Pk	10.6	.5	-40	-12.91	29.54	-42.45	0-360
9	14.148	16.77	Pk	10.6	.5	-40	-12.13	29.54	-41.67	0-360
21	14.4019	24.78	Pk	10.6	.5	-40	-4.12	29.54	-33.66	0-360
10	14.40813	26.2	Pk	10.6	.5	-40	-2.7	29.54	-32.24	0-360
22	15.25171	14.2	Pk	10.5	.5	-40	-14.8	29.54	-44.34	0-360
11	15.2575	13.57	Pk	10.5	.5	-40	-15.43	29.54	-44.97	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

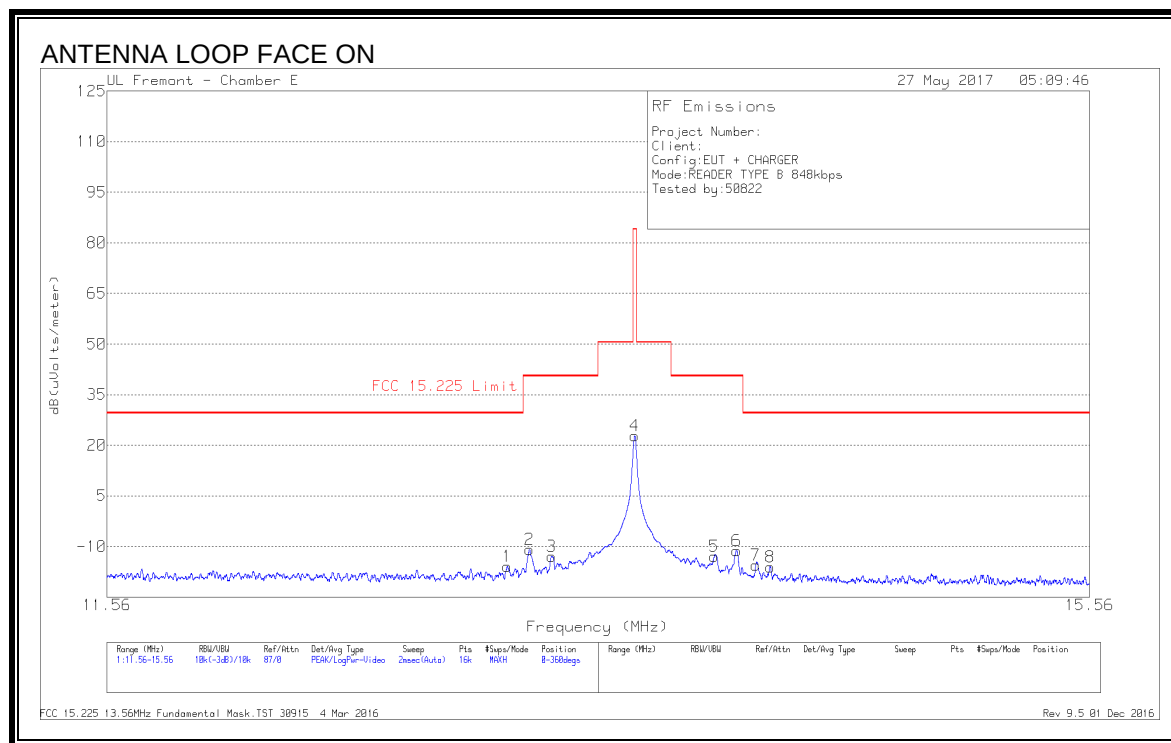
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
11	1.84648	26.11	Pk	11.7	.2	-40	-1.99	29.5	-31.49	0-360
12	2.94164	22.19	Pk	11.6	.2	-40	-6.01	29.5	-35.51	0-360
1	3.04696	20.69	Pk	11.6	.2	-40	-7.51	29.5	-37.01	0-360
13	7.36734	15.57	Pk	11.1	.4	-40	-12.93	29.5	-42.43	0-360
2	8.8314	13.86	Pk	10.9	.5	-40	-14.74	29.5	-44.24	0-360
3	11.86746	13.79	Pk	10.6	.5	-40	-15.11	29.5	-44.61	0-360
14	12.7111	23.64	Pk	10.5	.5	-40	-5.36	29.5	-34.86	0-360
4	12.71319	24.64	Pk	10.5	.5	-40	-4.36	29.5	-33.86	0-360
5	13.13134	16.29	Pk	10.5	.5	-40	-12.71	29.5	-42.21	0-360
15	13.14182	18.06	Pk	10.5	.5	-40	-10.94	29.5	-40.44	0-360
6	13.31474	18.18	Pk	10.5	.5	-40	-10.82	29.5	-40.32	0-360
16	13.80888	18.61	Pk	10.4	.5	-40	-10.49	29.5	-39.99	0-360
7	13.98127	20.02	Pk	10.4	.5	-40	-9.08	29.5	-38.58	0-360
17	13.98442	18.89	Pk	10.4	.5	-40	-10.21	29.5	-39.71	0-360
18	14.40466	23.9	Pk	10.4	.5	-40	-5.2	29.5	-34.7	0-360
8	14.40781	25.23	Pk	10.4	.5	-40	-3.87	29.5	-33.37	0-360
19	15.25564	13.4	Pk	10.3	.5	-40	-15.8	29.5	-45.3	0-360
9	15.25616	13.71	Pk	10.3	.5	-40	-15.49	29.5	-44.99	0-360
10	20.8027	10.38	Pk	9.6	.7	-40	-19.32	29.5	-48.82	0-360
20	26.75482	11.47	Pk	8.8	.7	-40	-19.03	29.5	-48.53	0-360

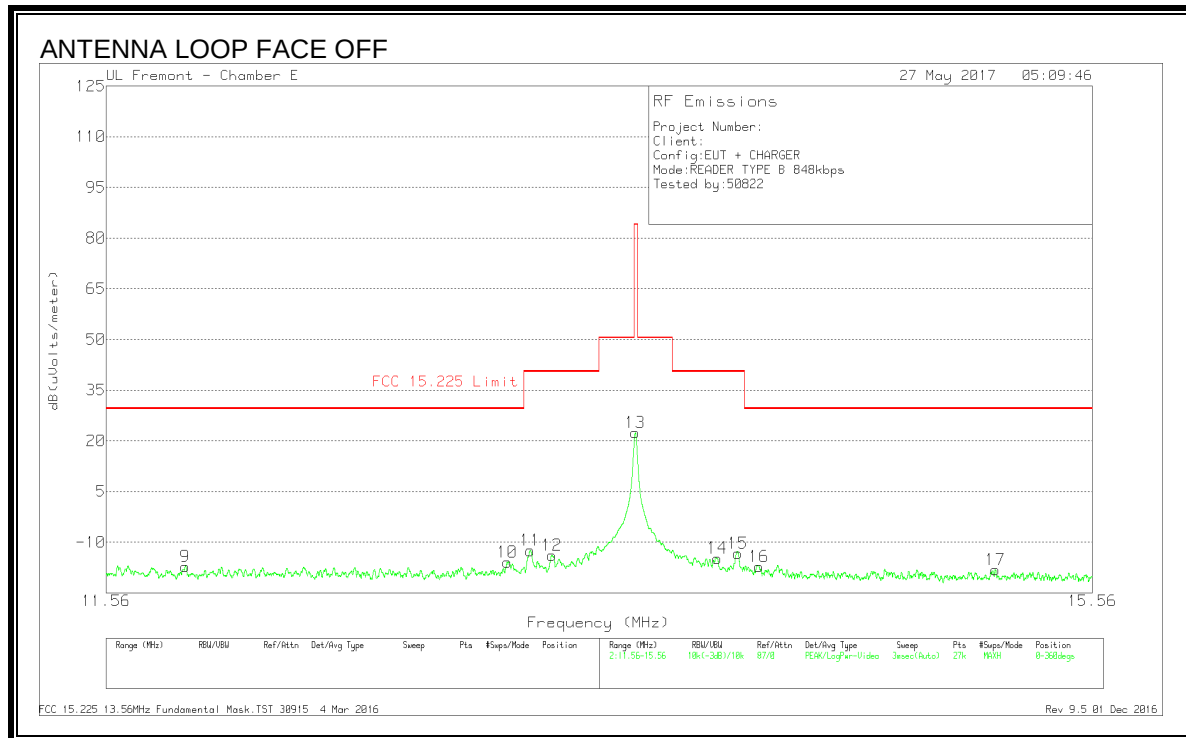
Pk - Peak detector

CE Type B 848Kbps.DAT 30915 7 Oct 2016
Rev 9.5 01 Dec 2016

8.2.2. READER MODE

Type B, 848Kbps FUNDAMENTAL





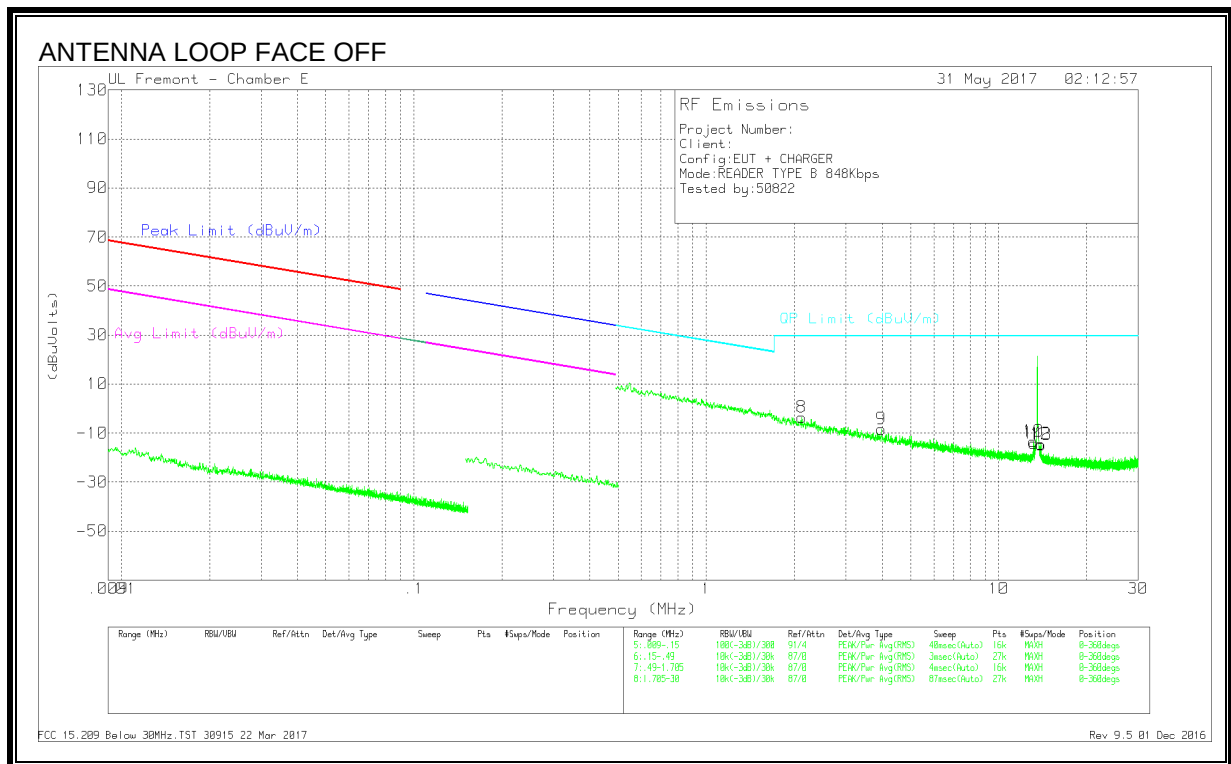
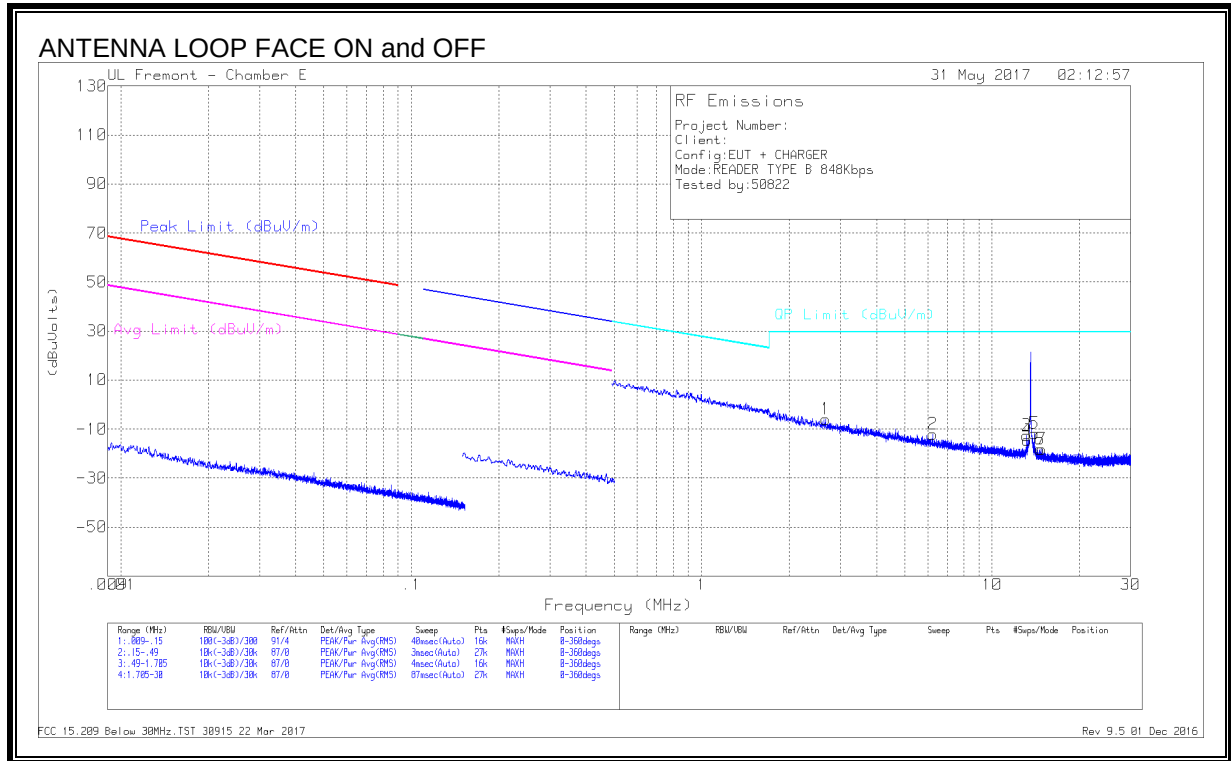
Trace Markers

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)
9	11.83839	11.52	Pk	10.8	.5	-40	-17.18	29.54	-46.72	0-360
10	13.04525	12.88	Pk	10.7	.5	-40	-15.92	29.54	-45.46	0-360
1	13.04838	12.84	Pk	10.7	.5	-40	-15.96	29.54	-45.5	0-360
2	13.13588	17.9	Pk	10.7	.5	-40	-10.9	40.51	-51.41	0-360
11	13.13664	16.32	Pk	10.7	.5	-40	-12.48	40.51	-52.99	0-360
12	13.22278	14.96	Pk	10.7	.5	-40	-13.84	40.51	-54.35	0-360
3	13.22438	15.9	Pk	10.7	.5	-40	-12.9	40.51	-53.41	0-360
13	13.55852	51.26	Pk	10.6	.5	-40	22.36	84	-61.64	0-360
4	13.56013	51.7	Pk	10.6	.5	-40	22.8	84	-61.2	0-360
5	13.8905	15.92	Pk	10.6	.5	-40	-12.98	40.51	-53.49	0-360
14	13.89699	14.18	Pk	10.6	.5	-40	-14.72	40.51	-55.23	0-360
15	13.98498	15.59	Pk	10.6	.5	-40	-13.31	40.51	-53.82	0-360
6	13.98513	17.62	Pk	10.6	.5	-40	-11.28	40.51	-51.79	0-360
7	14.06575	13.4	Pk	10.6	.5	-40	-15.5	29.54	-45.04	0-360
16	14.07422	11.59	Pk	10.6	.5	-40	-17.31	29.54	-46.85	0-360
8	14.128	12.84	Pk	10.6	.5	-40	-16.06	29.54	-45.6	0-360
17	15.11111	10.74	Pk	10.5	.6	-40	-18.16	29.54	-47.7	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)
8	2.1221	24.39	Pk	11.7	.2	-40	-3.71	29.5	-33.21	0-360
1	2.66968	22.29	Pk	11.6	.2	-40	-5.91	29.5	-35.41	0-360
9	3.96973	19.76	Pk	11.5	.3	-40	-8.44	29.5	-37.94	0-360
2	6.23812	16.24	Pk	11.2	.4	-40	-12.16	29.5	-41.66	0-360
3	13.13658	16.36	Pk	10.5	.5	-40	-12.64	29.5	-42.14	0-360
10	13.13816	15.67	Pk	10.5	.5	-40	-13.33	29.5	-42.83	0-360
4	13.22462	14.38	Pk	10.5	.5	-40	-14.62	29.5	-44.12	0-360
11	13.22566	14.85	Pk	10.5	.5	-40	-14.15	29.5	-43.65	0-360
12	13.89638	14.49	Pk	10.4	.5	-40	-14.61	29.5	-44.11	0-360
5	13.98127	17.24	Pk	10.4	.5	-40	-11.86	29.5	-41.36	0-360
13	13.98494	14.4	Pk	10.4	.5	-40	-14.7	29.5	-44.2	0-360
6	14.63732	11.03	Pk	10.3	.5	-40	-18.17	29.5	-47.67	0-360
7	14.8333	10.81	Pk	10.3	.6	-40	-18.29	29.5	-47.79	0-360

Pk - Peak detector

FCC 15.209 Below 30MHz.TST 30915 22 Mar 2017

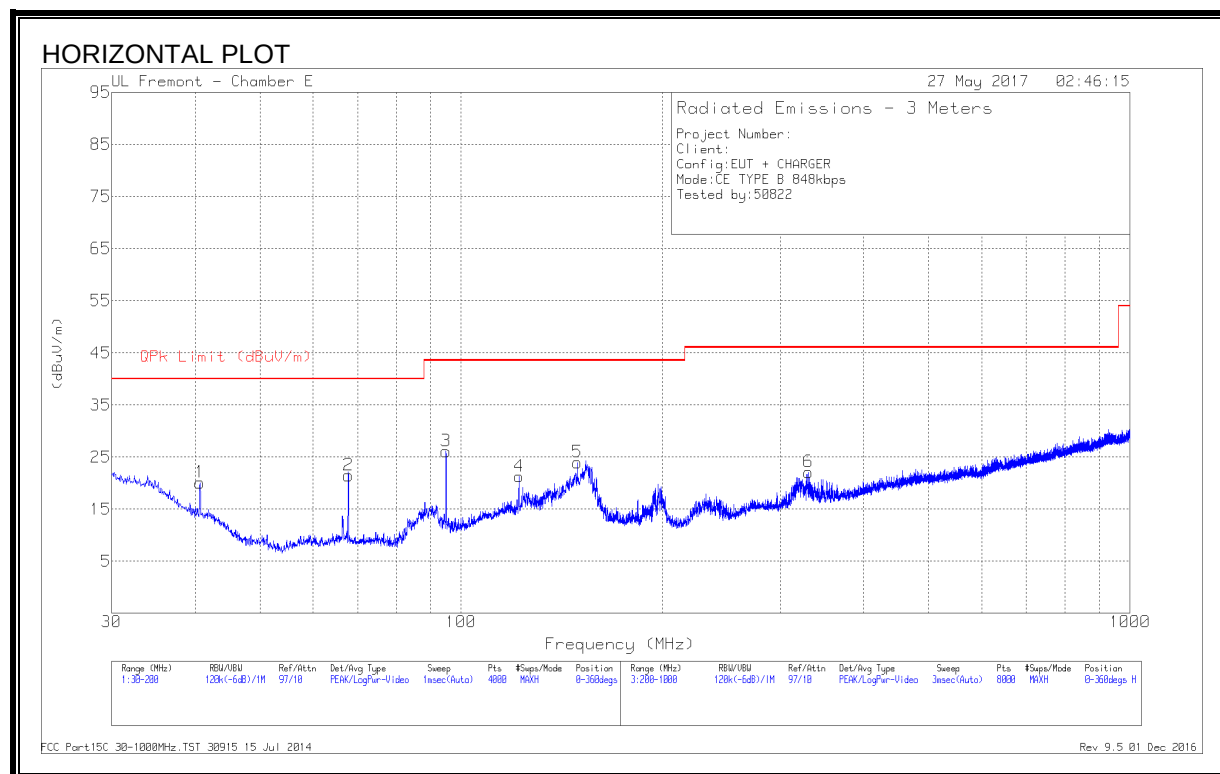
Rev 9.5 01 Dec 2016

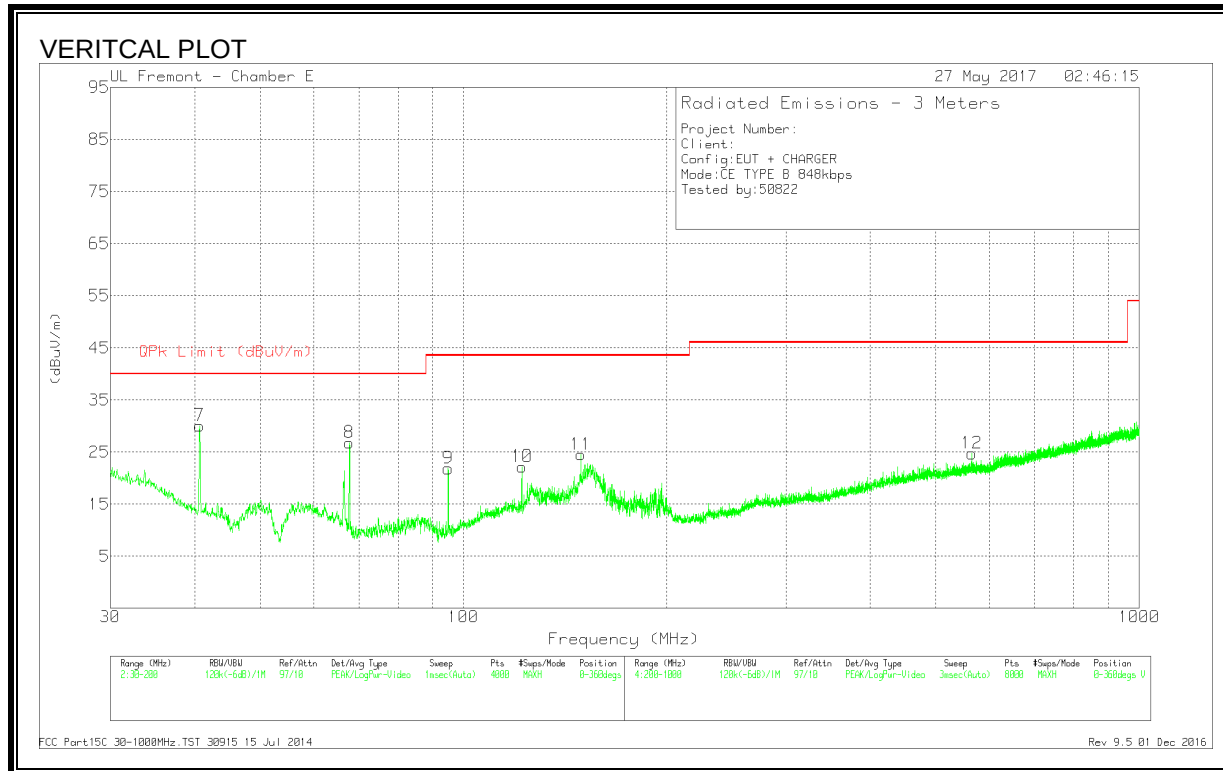
8.3. TX SPURIOUS EMISSION 30 TO 1000 MHz

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	* 122.0363	34.15	Pk	17.7	-30.6	21.25	43.52	-22.27	0-360	200	H
10	* 122.0363	35.07	Pk	17.7	-30.6	22.17	43.52	-21.35	0-360	100	V
6	* 330.517	33.3	Pk	17.9	-29.1	22.1	46.02	-23.92	0-360	100	H
1	40.6703	33.9	Pk	17.7	-31.5	20.1	40	-19.9	0-360	300	H
7	40.6703	43.85	Pk	17.7	-31.5	30.05	40	-9.95	0-360	100	V
8	67.7923	45.89	Pk	12.1	-31.2	26.79	40	-13.21	0-360	100	V
2	67.8348	40.58	Pk	12.1	-31.2	21.48	40	-18.52	0-360	400	H
3	94.9143	44.2	Pk	12.8	-30.9	26.1	43.52	-17.42	0-360	300	H
9	94.9143	39.96	Pk	12.8	-30.9	21.86	43.52	-21.66	0-360	100	V
5	149.1583	37.87	Pk	16.5	-30.4	23.97	43.52	-19.55	0-360	200	H
11	149.1583	38.4	Pk	16.5	-30.4	24.5	43.52	-19.02	0-360	100	V
12	565.4475	30.03	Pk	22.5	-27.8	24.73	46.02	-21.29	0-360	200	V

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

Pk - Peak detector

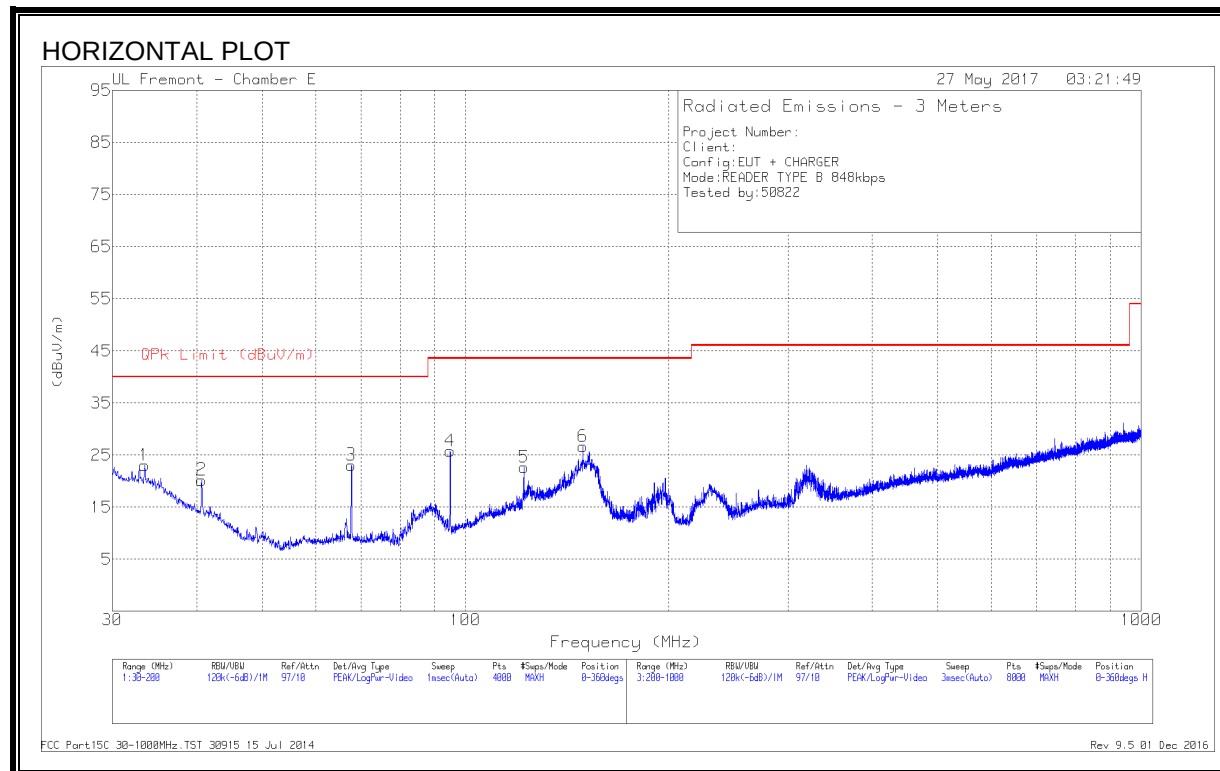
FCC Part15C 30-1000MHz.TST 30915 15 Jul 2014

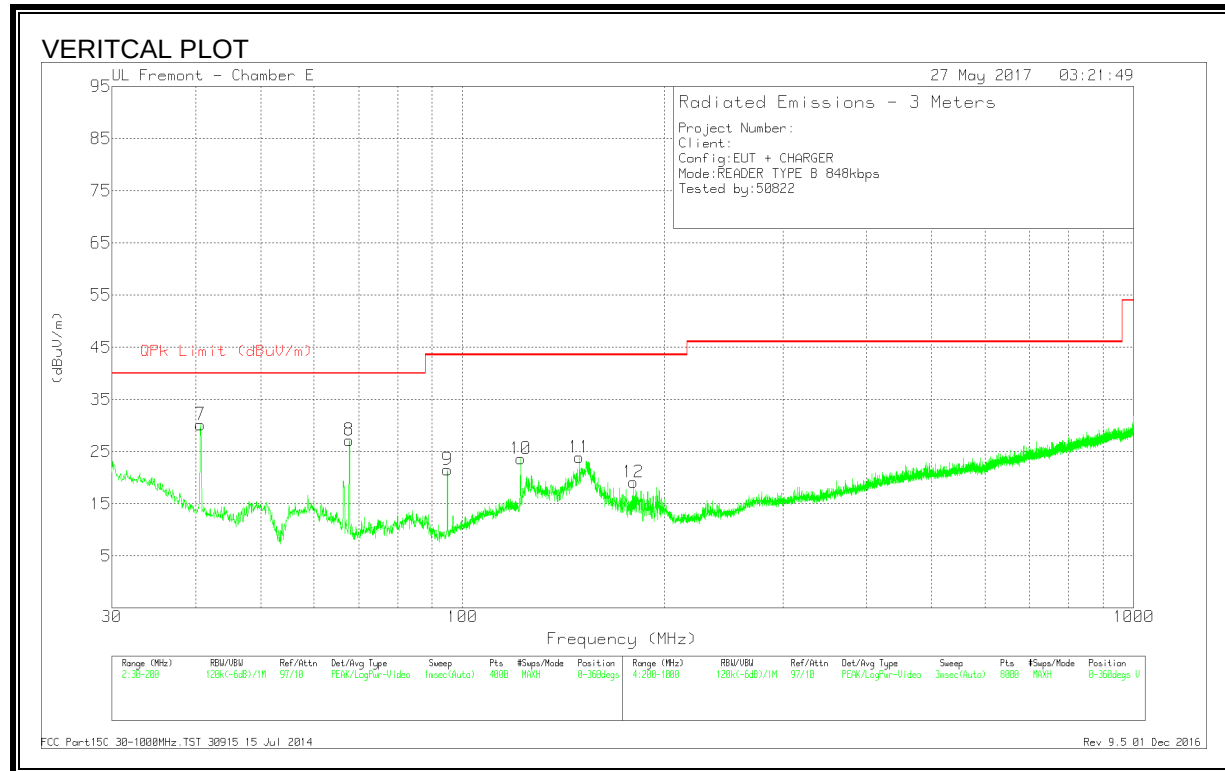
Rev 9.5 01 Dec 2016

8.3.2. READER MODE

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
5	* 122.0363	35.55	Pk	17.7	-30.6	22.65	43.52	-20.87	0-360	300	H
10	* 122.0363	36.56	Pk	17.7	-30.6	23.66	43.52	-19.86	0-360	100	V
1	33.4859	31.6	Pk	23	-31.6	23	40	-17	0-360	200	H
2	40.6703	34	Pk	17.7	-31.5	20.2	40	-19.8	0-360	300	H
7	40.6703	43.99	Pk	17.7	-31.5	30.19	40	-9.81	0-360	100	V
3	67.7923	42.15	Pk	12.1	-31.2	23.05	40	-16.95	0-360	400	H
8	67.7923	46.29	Pk	12.1	-31.2	27.19	40	-12.81	0-360	100	V
4	94.9143	43.88	Pk	12.8	-30.9	25.78	43.52	-17.74	0-360	300	H
9	94.9143	39.65	Pk	12.8	-30.9	21.55	43.52	-21.97	0-360	100	V
6	149.1583	40.55	Pk	16.5	-30.4	26.65	43.52	-16.87	0-360	200	H
11	149.1583	37.8	Pk	16.5	-30.4	23.9	43.52	-19.62	0-360	100	V
12	179.5962	34.05	Pk	15.2	-30.1	19.15	43.52	-24.37	0-360	100	V

* - 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 $\pm 0.01\%$ 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

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	13.5603449	0.028	13.5603448	0.036	13.5603447	0.043	13.5603447	0.047	± 100
	40	13.5603453	-0.001	13.5603454	-0.010	13.5603455	-0.010	13.5603454	-0.004	± 100
	30	13.5603451	0.019	13.5603452	0.010	13.5603451	0.014	13.5603453	0.002	± 100
	20	13.5603453	0.000	13.5603453	0.000	13.5603453	0.001	13.5603452	0.005	± 100
	10	13.5603448	0.039	13.5603448	0.040	13.5603449	0.034	13.5603451	0.019	± 100
	0	13.5603455	-0.017	13.5603456	-0.019	13.5603455	-0.017	13.5603456	-0.019	± 100
	-10	13.5603443	0.076	13.5603441	0.086	13.5603440	0.096	13.5603439	0.107	± 100
	-20	13.5603435	0.136	13.5603436	0.127	13.5603436	0.124	13.5603437	0.116	± 100
3.23	20	13.5603451	0.019	13.5603450	0.020	13.5603451	0.018	13.5603450	0.020	± 100
4.37	20	13.5603449	0.028	13.5603451	0.018	13.5603451	0.015	13.5603451	0.013	± 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	13.5603454	0.017	13.5603453	0.024	13.5603452	0.033	13.5603451	0.041	± 100
	40	13.5603457	-0.001	13.5603456	0.000	13.5603457	-0.007	13.5603458	-0.008	± 100
	30	13.5603453	0.024	13.5603452	0.029	13.5603453	0.023	13.5603454	0.021	± 100
	20	13.5603456	0.000	13.5603457	-0.001	13.5603457	-0.001	13.5603456	0.003	± 100
	10	13.5603452	0.034	13.5603451	0.043	13.5603451	0.041	13.5603453	0.025	± 100
	0	13.5603458	-0.010	13.5603459	-0.015	13.5603459	-0.017	13.5603458	-0.014	± 100
	-10	13.5603448	0.063	13.5603446	0.078	13.5603444	0.091	13.5603442	0.107	± 100
	-20	13.5603438	0.133	13.5603439	0.129	13.5603440	0.123	13.5603441	0.116	± 100
3.23	20	13.5603452	0.034	13.5603451	0.041	13.5603452	0.035	13.5603452	0.036	± 100
4.37	20	13.5603451	0.037	13.5603451	0.037	13.5603451	0.038	13.5603451	0.037	± 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	.159	26.89	Qp	0	.1	10.1	37.09	65.52	-28.43	-	-
2	.159	5.34	Ca	0	.1	10.1	15.54	-	-	55.52	-39.98
3	.25125	21.39	Qp	0	.1	10.1	31.59	61.72	-30.13	-	-
4	.25125	2.18	Ca	0	.1	10.1	12.38	-	-	51.72	-39.34
5	.78112	17.17	Qp	0	.1	10.1	27.37	56	-28.63	-	-
6	.78225	6.47	Ca	0	.1	10.1	16.67	-	-	46	-29.33
7	12.7118	26.93	Qp	.1	.2	10.2	37.43	60	-22.57	-	-
8	12.7118	19.14	Ca	.1	.2	10.2	29.64	-	-	50	-20.36
9	13.56	56.74	Qp	.1	.2	10.2	67.24	60	7.24	-	-
10	13.56	54.14	Ca	.1	.2	10.2	64.64	-	-	50	14.64
11	14.4083	30.08	Qp	0	.2	10.2	40.48	60	-19.52	-	-
12	14.4083	22.35	Ca	0	.2	10.2	32.75	-	-	50	-17.25

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	26.86	Qp	0	.1	10.1	37.06	64.95	-27.89	-	-
14	.17475	3.68	Ca	0	.1	10.1	13.88	-	-	54.73	-40.85
15	.25125	22.03	Qp	0	.1	10.1	32.23	61.72	-29.49	-	-
16	.25125	.52	Ca	0	.1	10.1	10.72	-	-	51.72	-41
17	12.7118	26.21	Qp	.1	.2	10.2	36.71	60	-23.29	-	-
18	12.7118	18.37	Ca	.1	.2	10.2	28.87	-	-	50	-21.13
19	13.56	57.39	Qp	.1	.2	10.2	67.89	60	7.89	-	-
20	13.56	53.38	Ca	.1	.2	10.2	63.88	-	-	50	13.88
21	14.4083	30.72	Qp	.1	.2	10.2	41.22	60	-18.78	-	-
22	14.4083	21.56	Ca	.1	.2	10.2	32.06	-	-	50	-17.94
23	17.7934	18.03	Qp	0	.3	10.3	28.63	60	-31.37	-	-
24	17.799	6.6	Ca	0	.3	10.3	17.2	-	-	50	-32.8

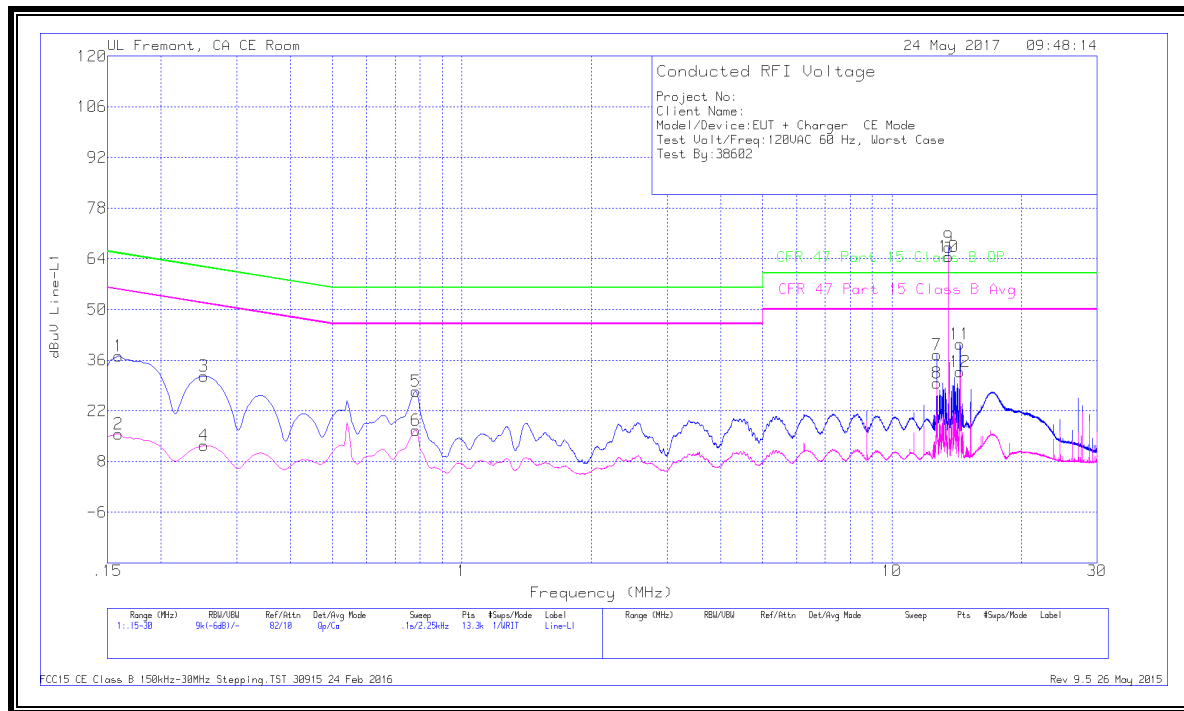
Qp - Quasi-Peak detector

Ca - CISPR average detection

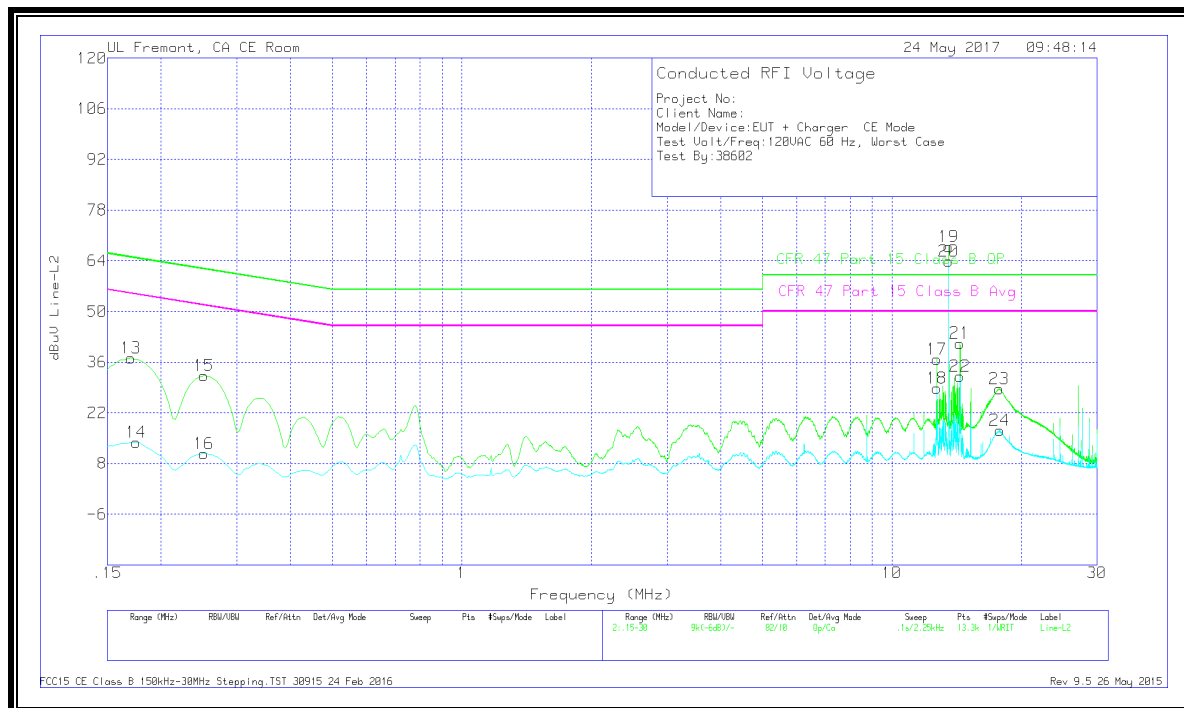
FCC15 CE Class B 150kHz-30MHz Stepping.TST 30915 24 Feb 2016

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	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	.16125	27.03	Qp	1.2	.1	10.1	38.43	65.4	-26.97	-	-
2	.16125	2.82	Ca	1.2	.1	10.1	14.22	-	-	55.4	-41.18
3	.258	21.76	Qp	.6	.1	10.1	32.56	61.5	-28.94	-	-
4	.258	-.66	Ca	.6	.1	10.1	10.14	-	-	51.5	-41.36
5	.34125	16.57	Qp	.4	.1	10.1	27.17	59.17	-32	-	-
6	.3435	-2.48	Ca	.4	.1	10.1	8.12	-	-	49.12	-41
7	.78225	13.27	Qp	.2	.1	10.1	23.67	56	-32.33	-	-
8	.78225	2.9	Ca	.2	.1	10.1	13.3	-	-	46	-32.7
9	13.56	7.64	Qp	.2	.2	10.2	18.24	60	-41.76	-	-
10	13.56	2.95	Ca	.2	.2	10.2	13.55	-	-	50	-36.45
11	25.2375	8.48	Qp	.3	.3	10.5	19.58	60	-40.42	-	-
12	25.6942	-.05	Ca	.3	.3	10.5	11.05	-	-	50	-38.95

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	26.65	Qp	1.2	.1	10.1	38.05	64.95	-26.9	-	-
14	.17025	1.49	Ca	1.2	.1	10.1	12.89	-	-	54.95	-42.06
15	.25575	21.97	Qp	.7	.1	10.1	32.87	61.57	-28.7	-	-
16	.26025	.39	Ca	.7	.1	10.1	11.29	-	-	51.42	-40.13
17	.3435	15.42	Qp	.5	.1	10.1	26.12	59.12	-33	-	-
18	.34462	-1.38	Ca	.5	.1	10.1	9.32	-	-	49.09	-39.77
19	.78225	16.23	Qp	.3	.1	10.1	26.73	56	-29.27	-	-
20	.78225	6.64	Ca	.3	.1	10.1	17.14	-	-	46	-28.86
21	13.56	6.41	Qp	.3	.2	10.2	17.11	60	-42.89	-	-
22	13.56	1.5	Ca	.3	.2	10.2	12.2	-	-	50	-37.8
23	23.1315	6.93	Qp	.3	.3	10.4	17.93	60	-42.07	-	-
24	23.1315	-.98	Ca	.3	.3	10.4	10.02	-	-	50	-39.98

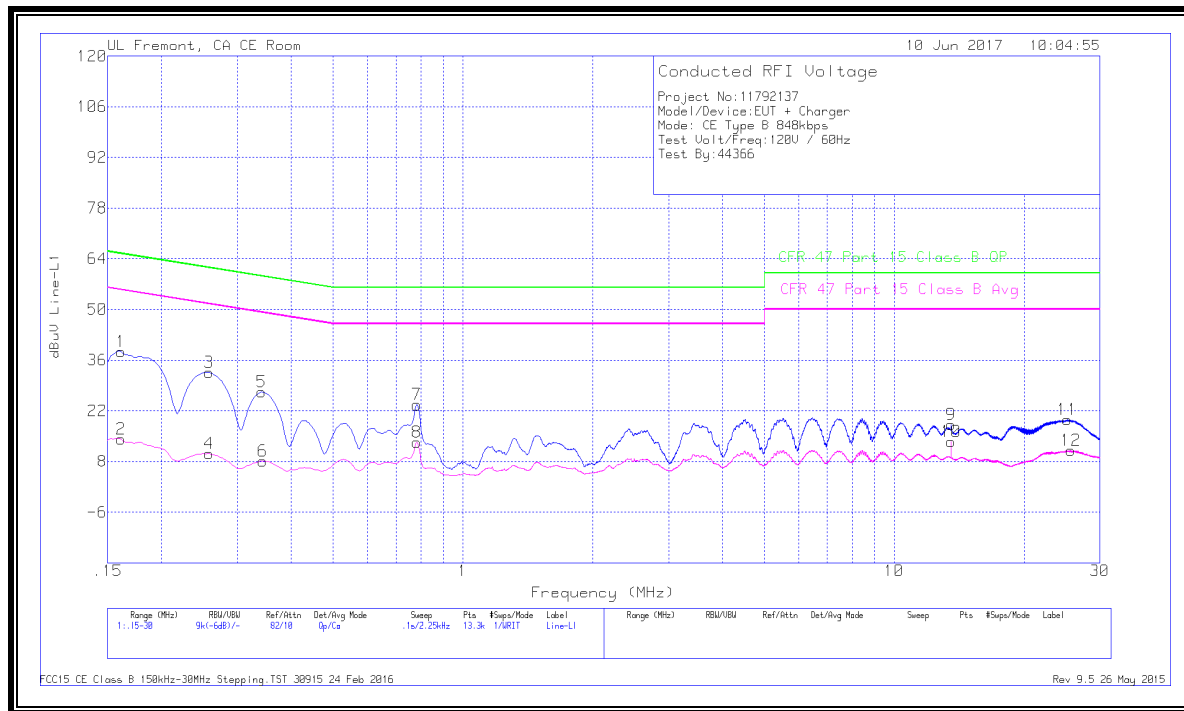
Qp - Quasi-Peak detector

Ca - CISPR average detection

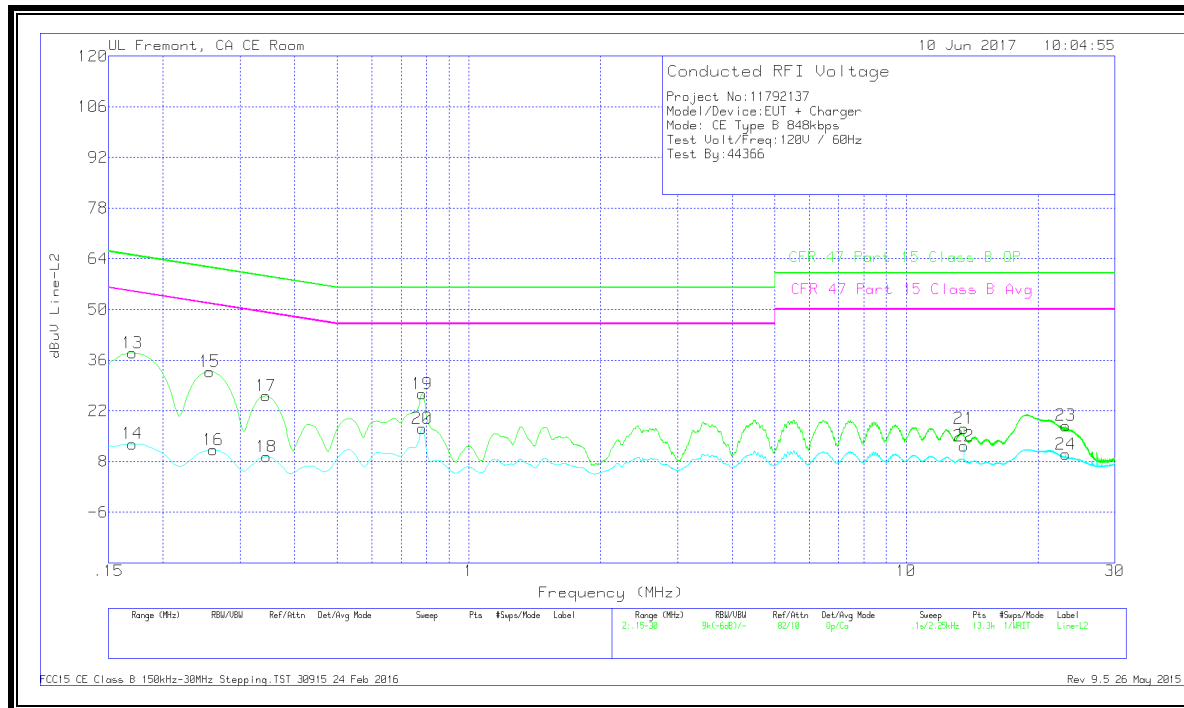
FCC15 CE Class B 150kHz-30MHz Stepping.TST 30915 24 Feb 2016

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	25.11	Qp	0	.1	10.1	35.31	65.52	-30.21	-	-
2	.159	4.07	Ca	0	.1	10.1	14.27	-	-	55.52	-41.25
3	.25125	19.77	Qp	0	.1	10.1	29.97	61.72	-31.75	-	-
4	.25125	1.27	Ca	0	.1	10.1	11.47	-	-	51.72	-40.25
5	.77775	17.06	Qp	0	.1	10.1	27.26	56	-28.74	-	-
6	.78	6.17	Ca	0	.1	10.1	16.37	-	-	46	-29.63
7	1.4055	8.17	Qp	0	.1	10.1	18.37	56	-37.63	-	-
8	1.39875	-1.29	Ca	0	.1	10.1	8.91	-	-	46	-37.09
9	13.56	57.26	Qp	.1	.2	10.2	67.76	60	7.76	-	-
10	13.56	54.5	Ca	.1	.2	10.2	65	-	-	50	15
11	17.1544	16.93	Qp	0	.2	10.3	27.43	60	-32.57	-	-
12	17.1465	5.28	Ca	0	.2	10.3	15.78	-	-	50	-34.22

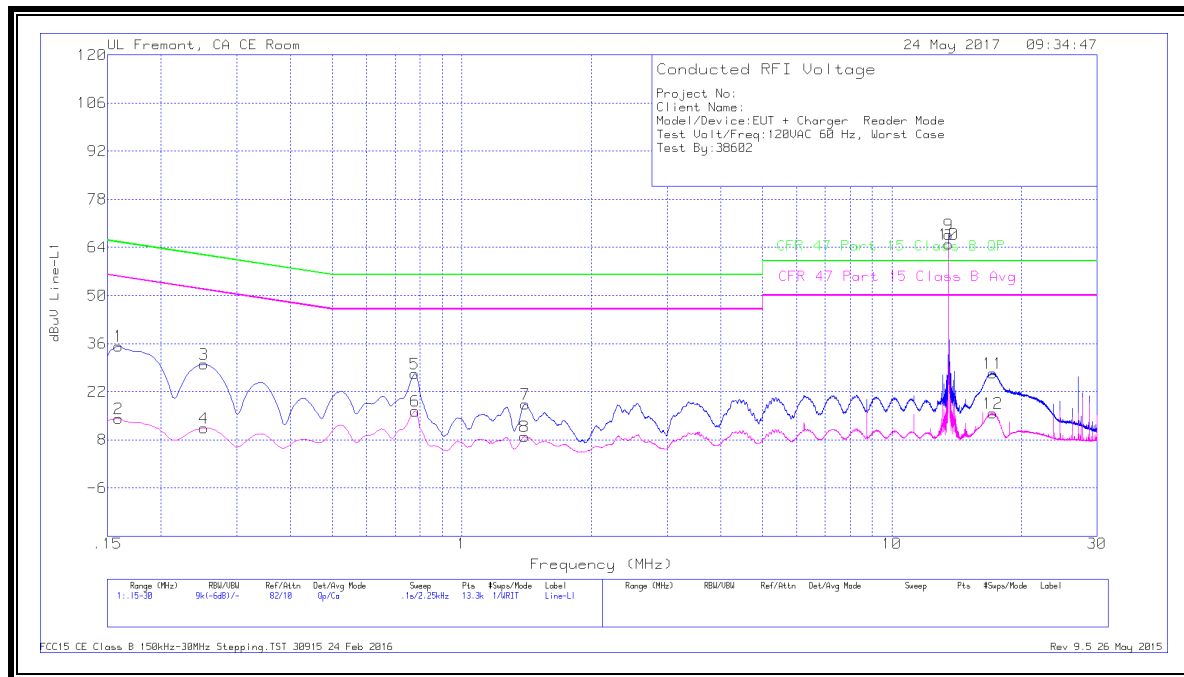
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.17025	25.02	Qp	0	.1	10.1	35.22	64.95	-29.73	-	-
14	.17025	2.3	Ca	0	.1	10.1	12.5	-	-	54.95	-42.45
15	.2535	20.4	Qp	0	.1	10.1	30.6	61.64	-31.04	-	-
16	.25125	-2.6	Ca	0	.1	10.1	9.94	-	-	51.72	-41.78
17	.339	14.36	Qp	0	.1	10.1	24.56	59.23	-34.67	-	-
18	.339	-2.76	Ca	0	.1	10.1	7.44	-	-	49.23	-41.79
19	.77775	13.65	Qp	0	.1	10.1	23.85	56	-32.15	-	-
20	.77887	2.73	Ca	0	.1	10.1	12.93	-	-	46	-33.07
21	13.56	57.72	Qp	.1	.2	10.2	68.22	60	8.22	-	-
22	13.56	53.86	Ca	.1	.2	10.2	64.36	-	-	50	14.36
23	17.7326	18.14	Qp	0	.3	10.3	28.74	60	-31.26	-	-
24	17.7495	6.55	Ca	0	.3	10.3	17.15	-	-	50	-32.85

Qp - Quasi-Peak detector

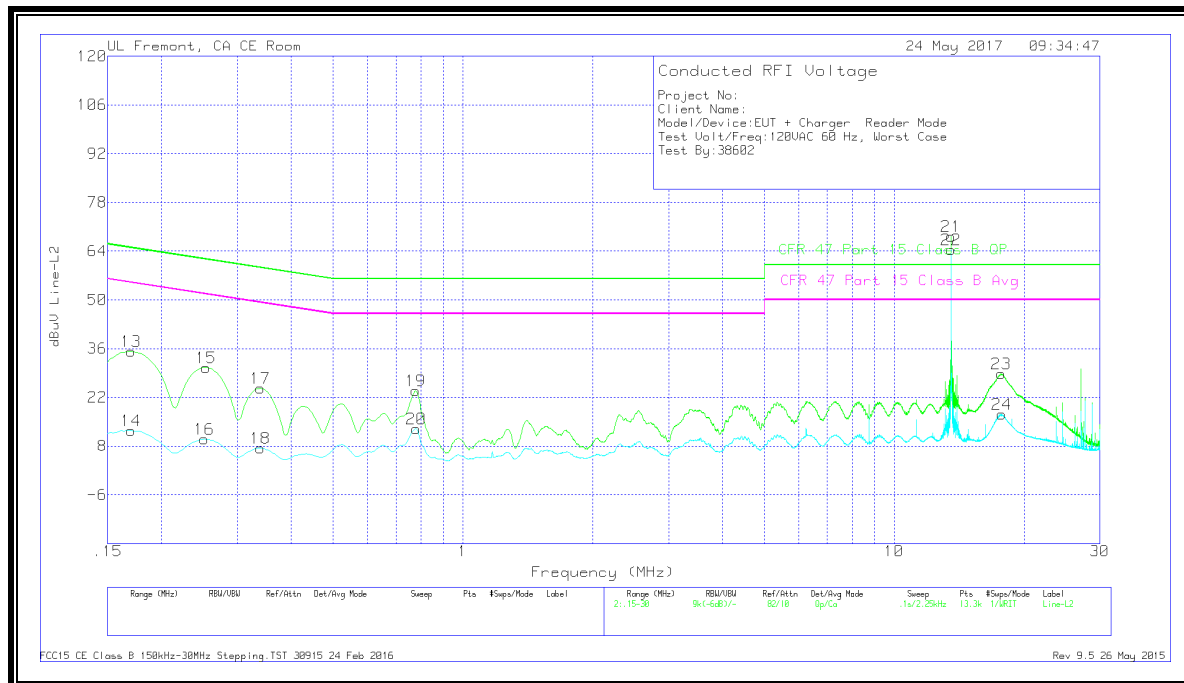
Ca - CISPR average detection

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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	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	26.86	Qp	1.2	.1	10.1	38.26	65.52	-27.26	-	-
2	.159	2.75	Ca	1.2	.1	10.1	14.15	-	-	55.52	-41.37
3	.25125	21.62	Qp	.6	.1	10.1	32.42	61.72	-29.3	-	-
4	.25125	-.69	Ca	.6	.1	10.1	10.11	-	-	51.72	-41.61
5	.357	15.42	Qp	.4	.1	10.1	26.02	58.8	-32.78	-	-
6	.357	-2.93	Ca	.4	.1	10.1	7.67	-	-	48.8	-41.13
7	.78225	13.4	Qp	.2	.1	10.1	23.8	56	-32.2	-	-
8	.78225	2.91	Ca	.2	.1	10.1	13.31	-	-	46	-32.69
9	13.56	7.73	Qp	.2	.2	10.2	18.33	60	-41.67	-	-
10	13.56	2.72	Ca	.2	.2	10.2	13.32	-	-	50	-36.68
11	26.2455	8.08	Qp	.3	.3	10.5	19.18	60	-40.82	-	-
12	26.6235	.44	Ca	.3	.3	10.5	11.54	-	-	50	-38.46

Range 2: Line-L2 .15 - 30MHz

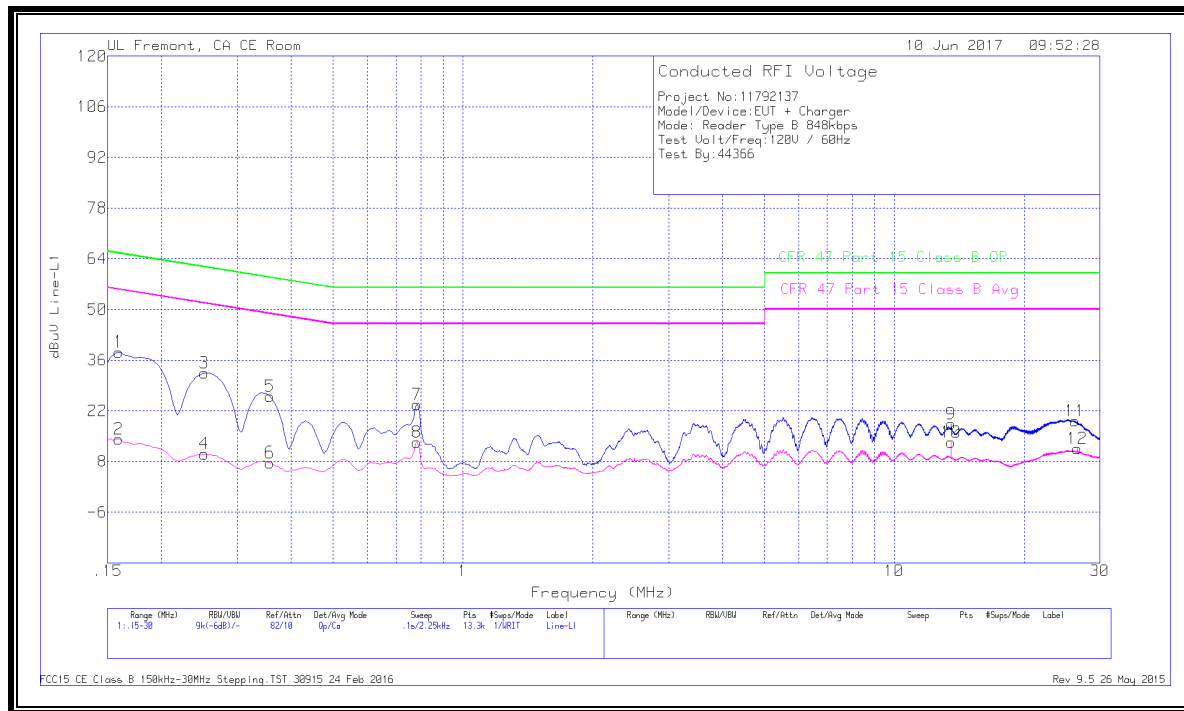
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.17025	26.43	Qp	1.2	.1	10.1	37.83	64.95	-27.12	-	-
14	.17925	2.37	Ca	1.2	.1	10.1	13.77	-	-	54.52	-40.75
15	.25575	21.77	Qp	.7	.1	10.1	32.67	61.57	-28.9	-	-
16	.258	.17	Ca	.7	.1	10.1	11.07	-	-	51.5	-40.43
17	.34125	15.23	Qp	.5	.1	10.1	25.93	59.17	-33.24	-	-
18	.339	-1.29	Ca	.5	.1	10.1	9.41	-	-	49.23	-39.82
19	.78225	16.19	Qp	.3	.1	10.1	26.69	56	-29.31	-	-
20	.78225	6.62	Ca	.3	.1	10.1	17.12	-	-	46	-28.88
21	13.56	5.99	Qp	.3	.2	10.2	16.69	60	-43.31	-	-
22	13.56	1.03	Ca	.3	.2	10.2	11.73	-	-	50	-38.27
23	21.2932	8.43	Qp	.3	.3	10.4	19.43	60	-40.57	-	-
24	21.3607	.36	Ca	.3	.3	10.4	11.36	-	-	50	-38.64

Qp - Quasi-Peak detector

Ca - CISPR average detection

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LINE 1 RESULTS



LINE 2 RESULTS

