CERTIFICATION TEST REPORT

Report Number. : 12696945-E12V2

Applicant	:	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA. 95014, U.S.A.
Model	:	A2221
FCC ID	:	BCG-E3304A
IC	:	579C-E3304A
EUT Description	:	SMARTPHONE
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C INDUSTRY CANADA RSS-210 ISSUE 9

Date Of Issue:
July 23, 2019

Prepared by:
UL Verification Services Inc.
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	7/19/2019	Initial Issue	Chin Pang
V2	7/23/2019	Address TCB questions	Chin Pang

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: SMARTPHONE

MODEL: A2221

SERIAL NUMBER: C7CYG03EMCHT

DATE TESTED: MAY 1, 2019 – July 03, 2019

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Complies
ISED RSS-210 Issue 9, Annex B	Complies
ISED RSS-GEN Issue 5	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
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Prepared By:

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 5, and RSS-210 Issue 9.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☐ Chamber A (ISED:2324B-1)	☒ Chamber D (ISED:22541-1)
☐ Chamber B (ISED:2324B-2)	☐ Chamber E (ISED:22541-2)
☐ Chamber C (ISED:2324B-3)	☐ Chamber F (ISED:22541-3)
	☐ Chamber G (ISED:22541-4)
	☒ Chamber H (ISED:22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through C are covered under ISED company address code 2324B with site numbers 2324B -1 through 2324B-3, respectively. Chambers D through H are covered under ISED Canada company address code 22541 with site numbers 22541 -1 through 22541-5, respectively.

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at NVLAP Lab Search.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, TD-SCDMA, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wide band, GPS and NFC. All models support at least one UICC based SIM. The second SIM, if present, is either UICC based pSIM (physical SIM) or e-SIM (electronic SIM). The device has a built-in inductive charging receiver. The rechargeable battery is also not user accessible.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode		Kbps	E Field at 30m distance (dBuV/m)
13.56	Type B	CE	848	23.04
		Reader	848	25.36

5.3. 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

5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
laptop	Apple	A1398	C02PM012G3QD	QDS-BRCM1069
Laptop AC/DC adapter	Liteon Technology	PA-1450-BA1	B123	NA
EUT AC Adapter	Apple	A1385	D29325SM03XDHLHC9	NA

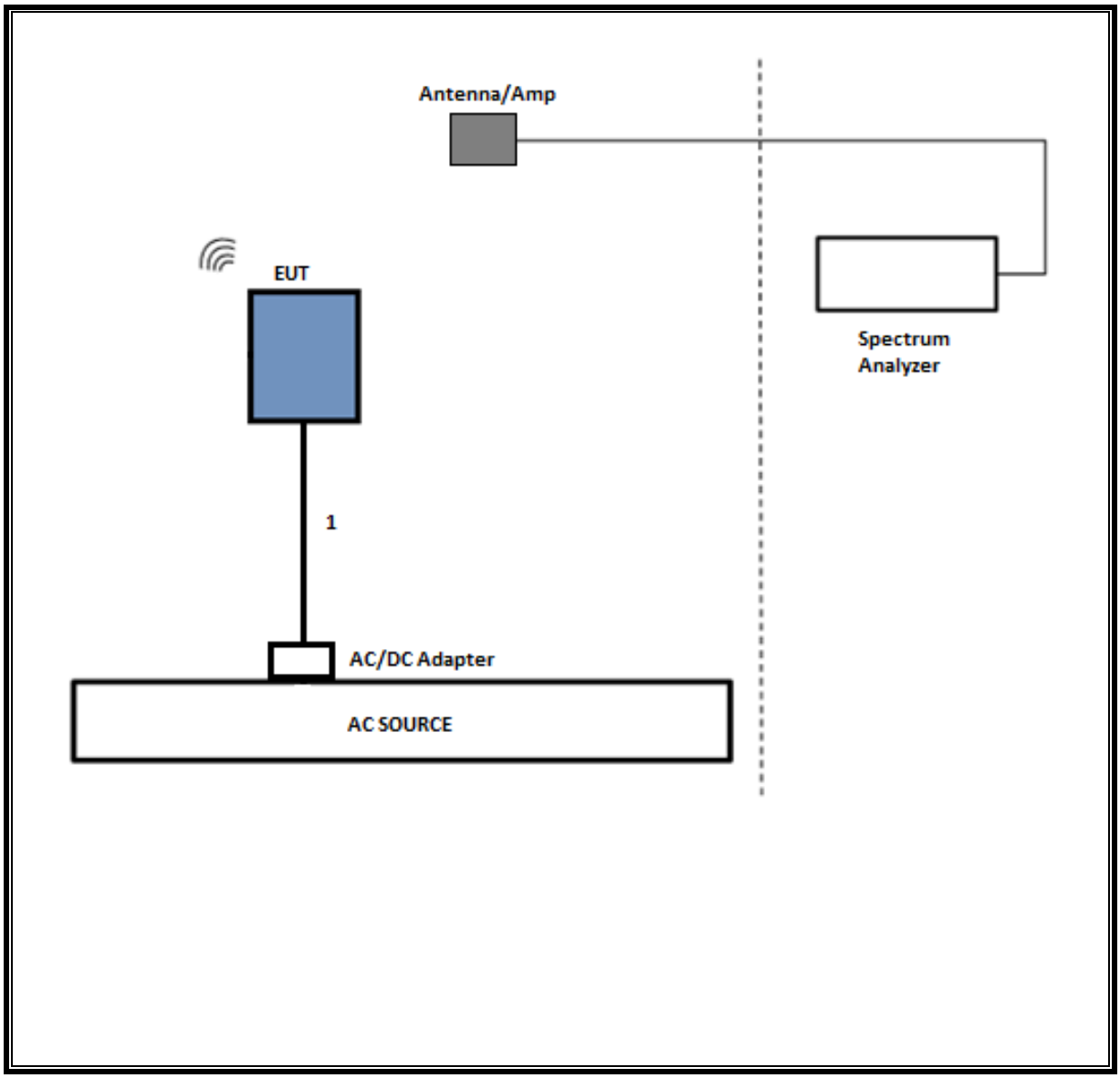
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	AC	Un-Shielded	1	N/A

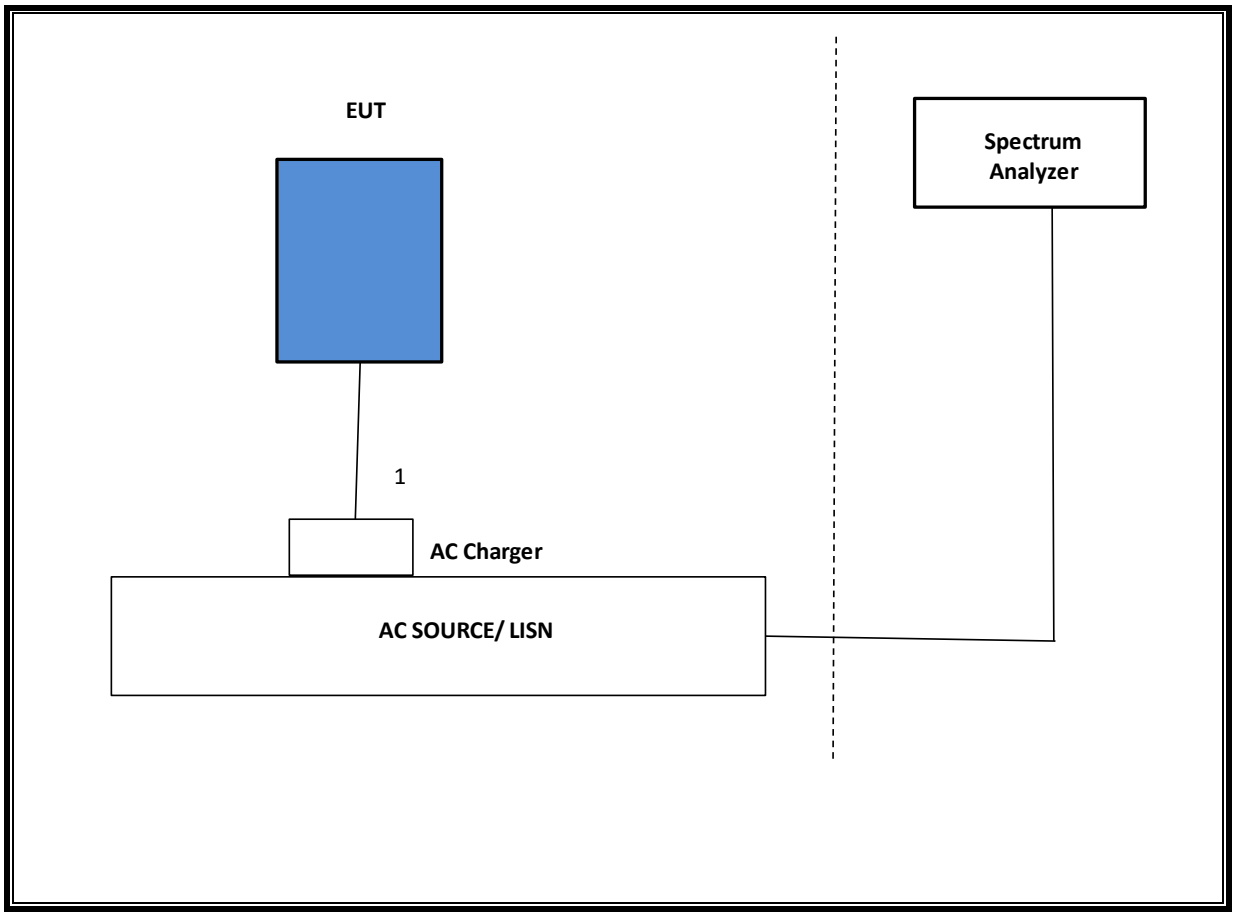
TEST SETUP

The EUT is installed in a host laptop computer during the tests. Test software exercised the EUT.

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:

Description	Manufacturer	Model	ID Num	Cal Due
Hybrid Antenna, 30-3Ghz	SunAR rf Motion	JB3	PRE0181574	08/01/2019
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	T15	08/15/2019
Spectrum Analyzer, PSA, 3Hz to 44GHz	Agilent (Keysight) Technologies	E4446A	T123	01/28/2020
Chamber, Environmental	Cincinnati Sub Zero	ZPHS-8-3.5-SCT/WC	T754	08/15/2019
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T757	09/25/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T459	07/25/2019
AC Line Conducted				
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ESCI7	T1436	02/14/2020
Power Cable, Line Conducted Emissions	UL	PG1	T861	08/31/2019
*LISN for Conducted Emissions CISPR-16	Fischer	50/250-25-2-01	T1310	06/19/2019
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, April 26, 2016	
Conducted Software	UL	UL EMC	Ver 5.4, October 13, 2016	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

*Testing is completed before equipment expiration date.

7. OCCUPIED BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

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

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

RESULTS

99% and 20dB BW

CE MODE

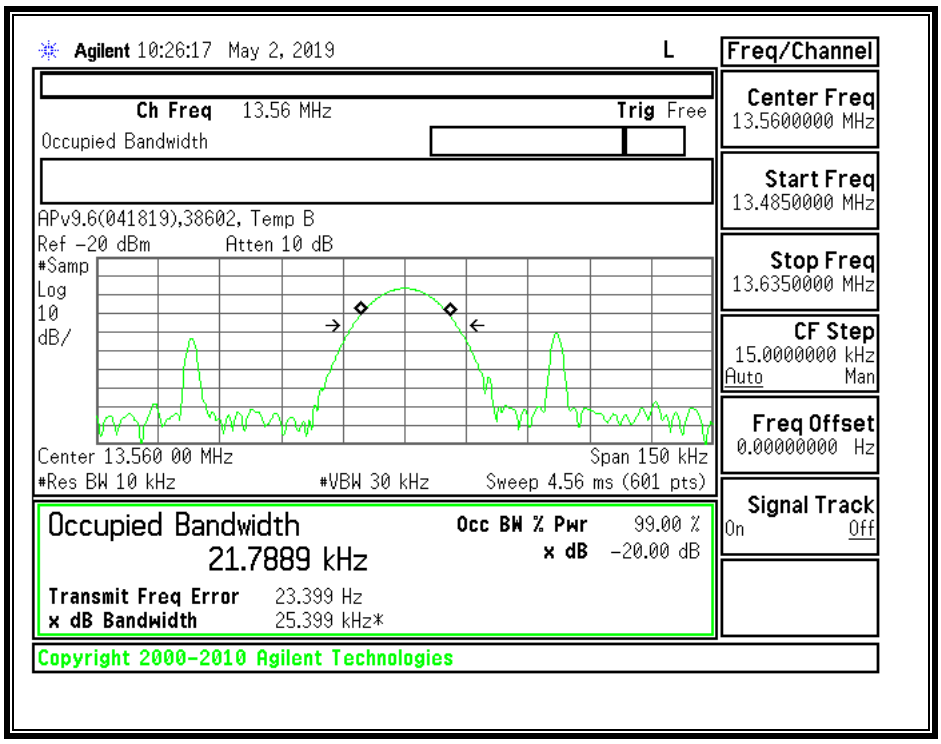
Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	21.7889	25.399

READER MODE

Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
848	13.56	21.6524	25.597

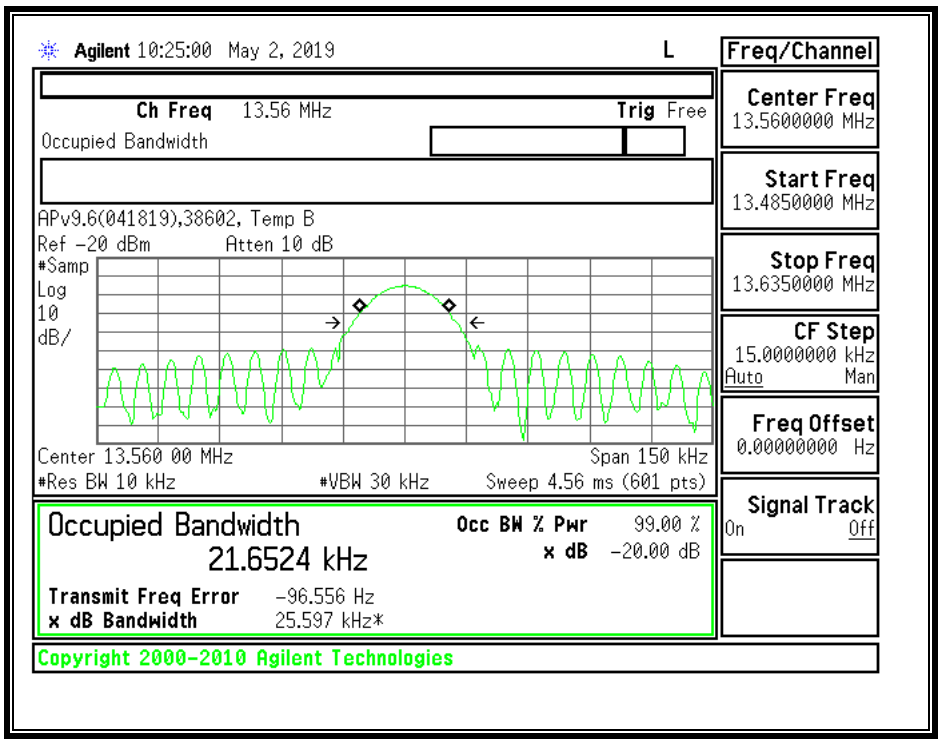
7.1. CE MODE

848Kbps



7.2. READER MODE

848Kbps



8. RADIATED EMISSION TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMIT

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

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

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

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

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:
§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

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

Formula for converting the 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.

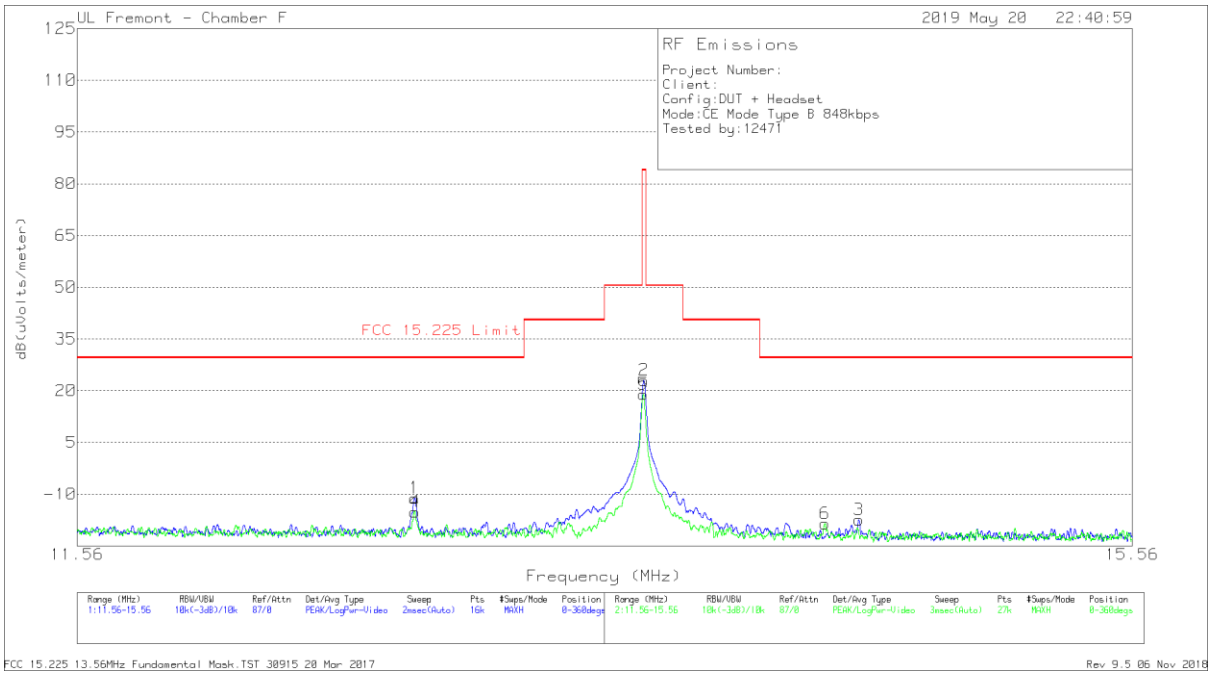
RESULTS

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

8.2.1. CE MODE

FUNDAMENTAL 848Kbps

ANTENNA LOOP FACE ON and FACE OFF



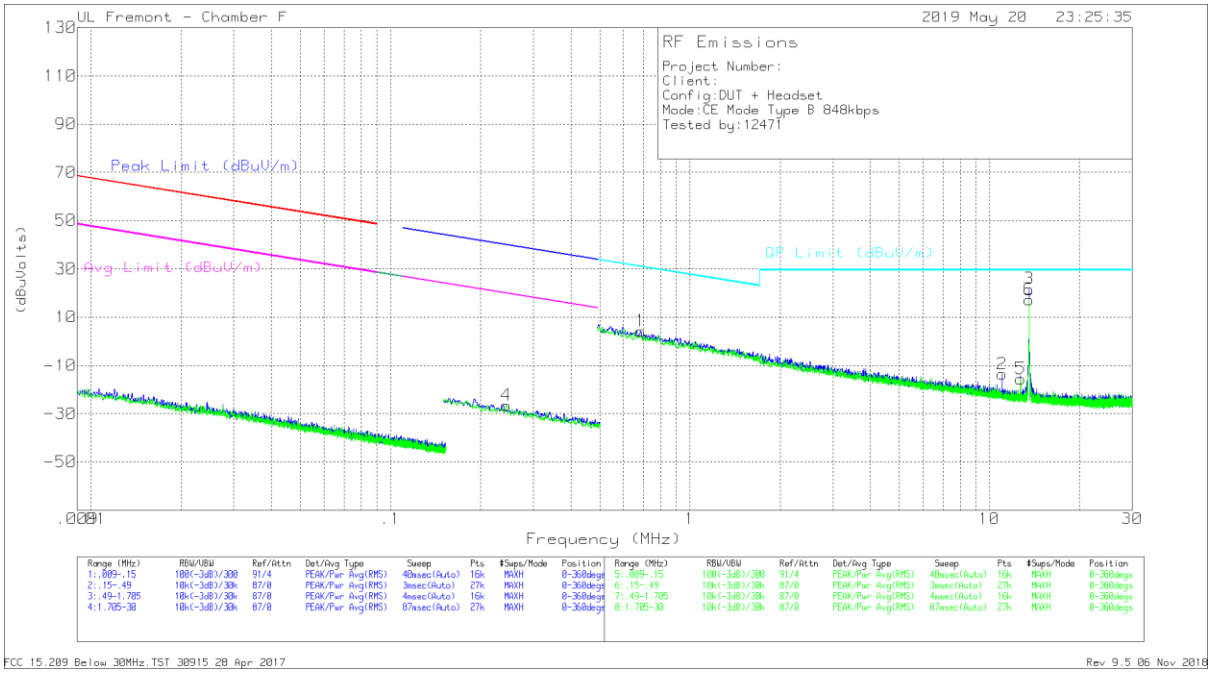
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/ meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
1	12.71238	17.97	Pk	10.5	.4	-40	-11.13	29.54	-40.67	0-360
2	13.55988	52.24	Pk	10.4	.4	-40	23.04	84	-60.96	0-360
3	14.40613	11.86	Pk	10.3	.4	-40	-17.44	29.54	-46.98	0-360
4	12.71307	13.97	Pk	10.5	.4	-40	-15.13	29.54	-44.67	0-360
5	13.55785	48.17	Pk	10.4	.4	-40	18.97	84	-65.03	0-360
6	14.26966	10.77	Pk	10.3	.4	-40	-18.53	29.54	-48.07	0-360

Pk - Peak detector

FCC 15.225 13.56MHz Fundamental Mask.TST 30915 20 Mar 2017
Rev 9.5 06 Nov 2018

SPURIOUS EMISSION 848Kbps

ANTENNA LOOP FACE ON and FACE OFF



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	.24411	41.89	Pk	11.5	.1	-80	-26.51	39.86	-66.37	19.86	-46.37	0-360

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	.68521	32.68	Pk	11.5	.1	-40	4.28	30.9	-26.62	0-360
2	11.01648	15.34	Pk	10.7	.4	-40	-13.56	29.5	-43.06	0-360
5	12.71424	13.58	Pk	10.5	.4	-40	-15.52	29.5	-45.02	0-360

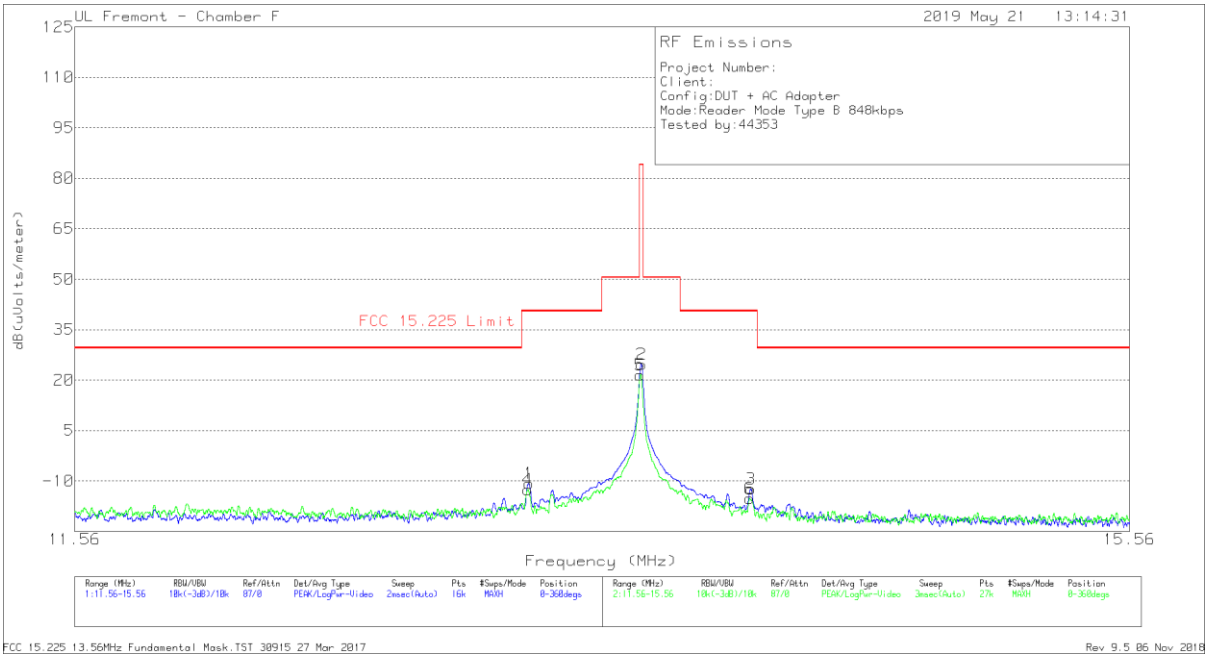
Pk - Peak detector
FCC 15.209 Below 30MHz.TST 30915 28 Apr 2017
Rev 9.5 06 Nov 2018

Note: Marker 3 and 6 are the fundamental signal.

8.2.2. READER MODE

FUNDAMENTAL 848Kbps

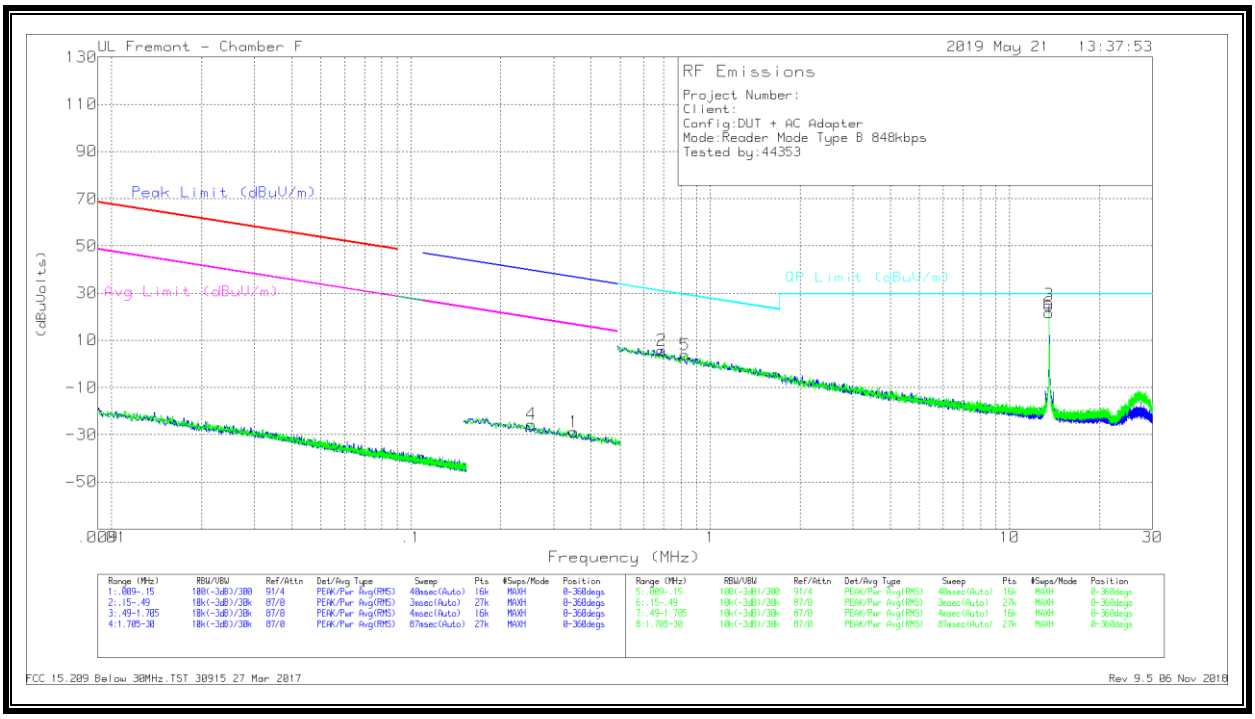
ANTENNA LOOP FACE ON and FACE OFF



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/ meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
1	13.13763	18.71	Pk	10.1	.4	-40	-10.79	40.51	-51.3	0-360
2	13.5615	54.56	Pk	10.4	.4	-40	25.36	84	-58.64	0-360
3	13.98475	17.22	Pk	10	.4	-40	-12.38	40.51	-52.89	0-360
4	13.13391	16.94	Pk	10.1	.4	-40	-12.56	40.51	-53.07	0-360
5	13.55637	50.97	Pk	10.1	.4	-40	21.47	84	-62.53	0-360
6	13.98061	14.39	Pk	10	.4	-40	-15.21	40.51	-55.72	0-360

Pk - Peak detector
FCC 15.225 13.56MHz Fundamental Mask.TST 30915 27 Mar 2017
Rev 9.5 06 Nov 2018

SPURIOUS EMISSION 848Kbps



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.35079	40.24	Pk	10.7	.1	-80	-28.96	36.71	-65.67	16.71	-45.67	0-360
4	.25278	43.66	Pk	10.7	.1	-80	-25.54	39.56	-65.1	19.56	-45.1	0-360

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)
2	.68828	35.07	Pk	10.6	.1	-40	5.77	30.86	-25.09	0-360
5	.82349	33.16	Pk	10.6	.1	-40	3.86	29.3	-25.44	0-360

Pk - Peak detector
FCC 15.209 Below 30MHz.TST 30915 27 Mar 2017
Rev 9.5 06 Nov 2018

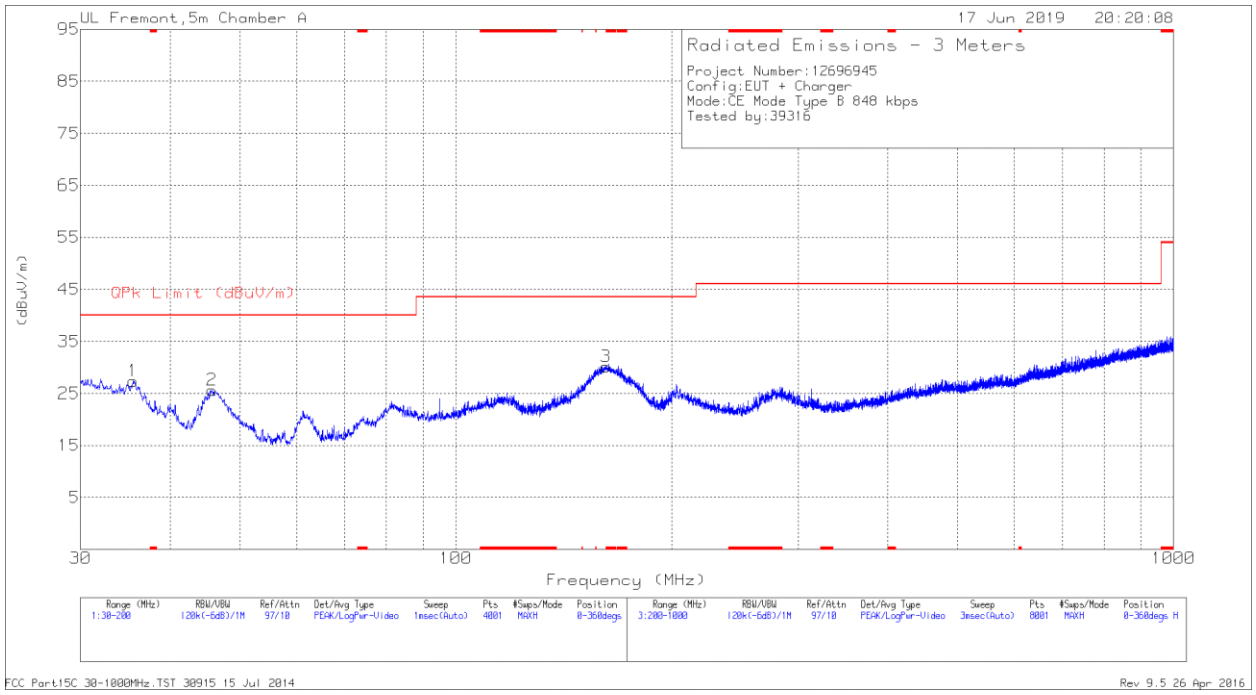
Note: Marker 3 and 6 are the fundamental signal.

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

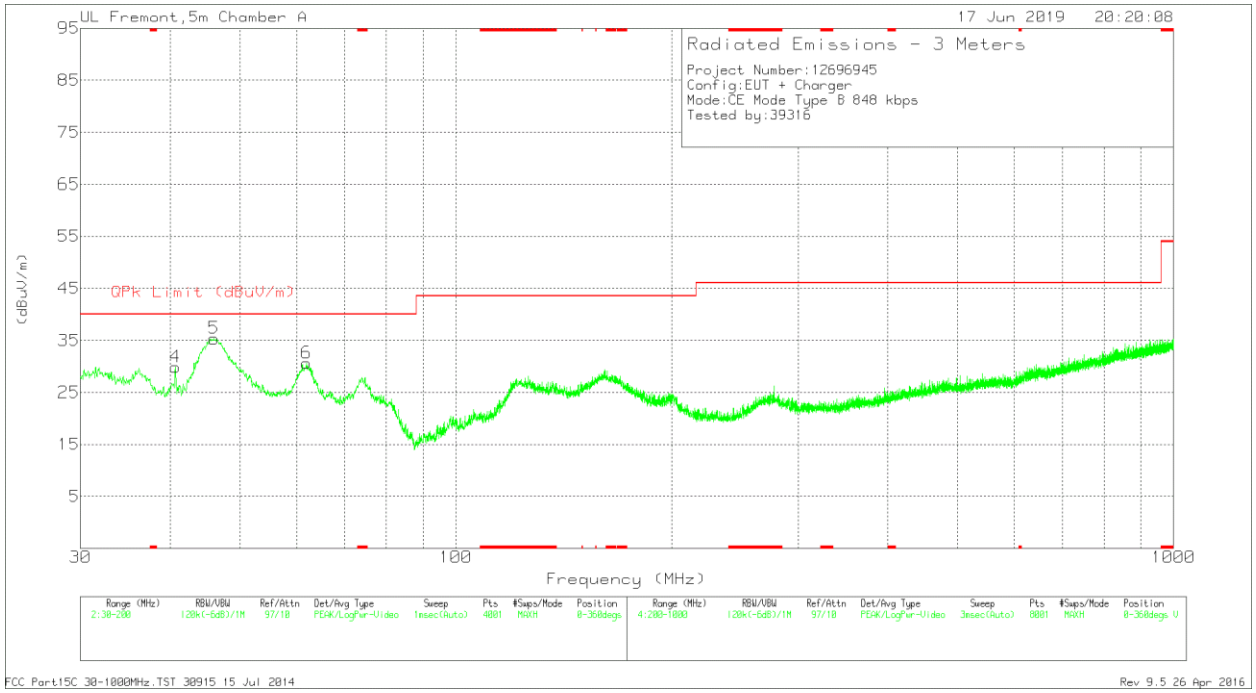
8.3.1. CE MODE

SPURIOUS EMISSION 848Kbps

HORIZONTAL



VERTICAL



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181574 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	35.525	31.47	Pk	23.1	-27.2	27.37	40	-12.63	0-360	200	H
4	40.6675	38.04	Pk	18.9	-27.1	29.84	40	-10.16	0-360	100	V
2	45.7675	37.02	Pk	15.6	-27	25.62	40	-14.38	0-360	300	H
5	46.0225	46.84	Pk	15.5	-27	35.34	40	-4.66	0-360	100	V
6	61.96	43.79	Pk	13.6	-26.8	30.59	40	-9.41	0-360	100	V
3	161.75	37.63	Pk	18.1	-25.6	30.13	43.52	-13.39	0-360	200	H

Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181574 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
46.5025	43.36	Qp	15.2	-27	31.56	40	-8.44	358	116	V

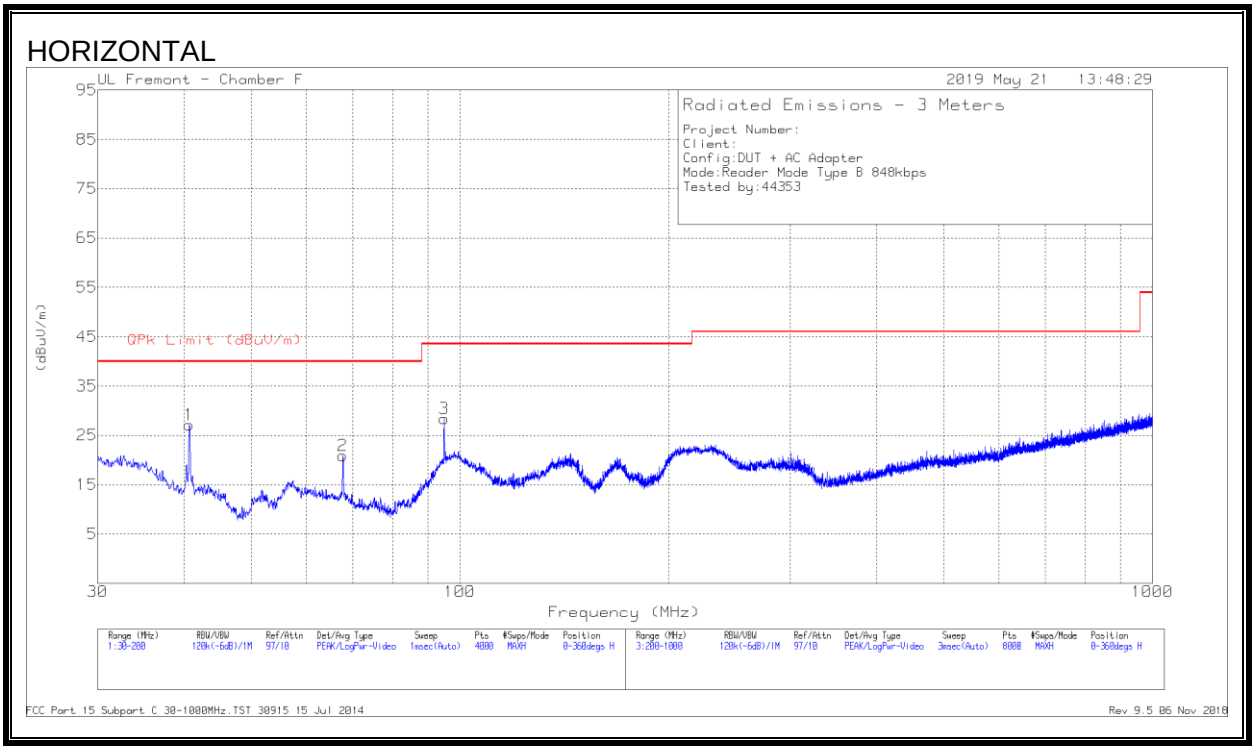
Qp - Quasi-Peak detector
FCC Part15C 30-1000MHz.TST 30915 15 Jul 2014
Rev 9.5 26 Apr 2016

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

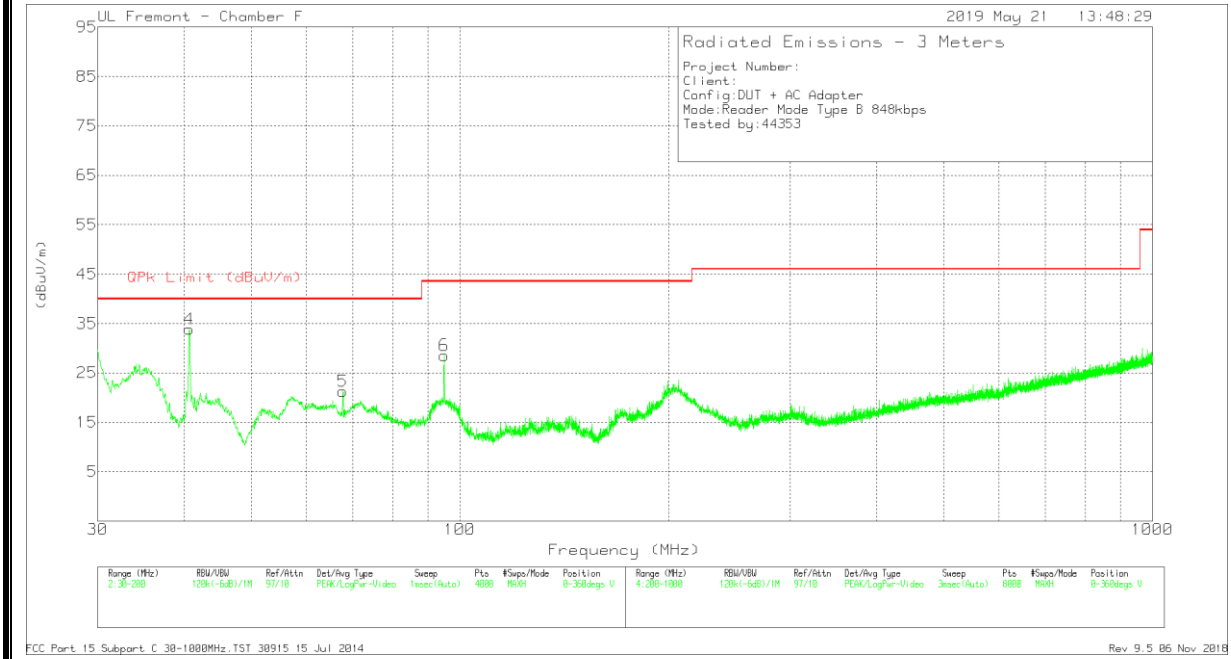
8.3.2. READER MODE

SPURIOUS EMISSION 848Kbps

HORIZONTAL



VERTICAL



Frequency (MHz)	Meter Reading (dBuV)	Det	AF T900 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
40.6895	40.53	Qp	17.8	-31.8	26.53	40	-13.47	122	305	H
67.8	39.33	Qp	12.2	-31.5	20.03	40	-19.97	109	215	H
94.9186	46.23	Qp	12.7	-31.2	27.73	43.52	-15.79	125	184	H
40.678	47.09	Qp	17.8	-31.8	33.09	40	-6.91	203	100	V
67.8038	39.45	Qp	12.2	-31.5	20.15	40	-19.85	154	124	V
94.9234	45.81	Qp	12.7	-31.2	27.31	43.52	-16.21	108	103	V

Qp - Quasi-Peak detector
FCC Part 15 Subpart C 30-1000MHz.TST 30915 15 Jul 2014
Rev 9.5 06 Nov 2018

9. FREQUENCY STABILITY

LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

IC RSS-210, Annex B.6
Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

TEST PROCEDURE

ANSI C63.10-2013 Clause 6.8

RESULTS

No non-compliance noted.

ID:	38602	**Date:**	5/3/19

9.1. CE MODE

CE MODE TYPE B 848Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC										
Limit: ± 100 ppm = 1.35600 KHz										
Power Supply	Envir. Temp	Frequency Deviation Measureed with Time Elapse								
(VAC)	(ºC)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
	50	13.5600253	5.974	13.5597224	-16.370	13.5597184	-16.664	13.5597119	-17.143	± 100
	40	13.5598777	-4.911	13.5598744	-5.154	13.5598710	-5.406	13.5598674	-5.675	± 100
	30	13.5597463	-14.600	13.5597518	-14.200	13.5597587	-13.689	13.5597658	-13.165	± 100
3.80	***20***	***13.5601254***	***13.352***	***13.5599761***	***2.345***	***13.5599776***	***2.452***	***13.5599793***	***2.581***	***± 100***
	10	13.5600519	7.929	13.5600472	7.586	13.5600429	7.272	13.5600385	6.942	± 100
	0	13.5600901	10.749	13.5602363	21.530	13.5602334	21.320	13.5602305	21.101	± 100
	-10	13.5600647	8.876	13.5600699	9.259	13.5600748	9.624	13.5600790	9.929	± 100
	-20	13.5599664	1.626	13.5601169	12.729	13.5601176	12.782	13.5601178	12.793	± 100
3.23	20	13.5600415	6.185	13.5600499	5.568	13.5600563	5.096	13.5600625	4.635	± 100
4.37	20	13.5599542	12.621	13.5599505	12.897	13.5599460	13.230	13.5599404	13.645	± 100

9.2. READER MODE

READER MODE TYPE B 848Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC										
Limit: ± 100 ppm = 1.35600 KHz										
Power Supply	Envir. Temp	Frequency Deviation Measureed with Time Elapse								
(VAC)	(ºC)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
	50	13.5598491	7.021	13.5598474	7.145	13.5598458	7.266	13.5598443	7.378	± 100
	40	13.5598777	4.911	13.5598744	5.154	13.5598710	5.406	13.5598674	5.675	± 100
	30	13.5599170	2.013	13.5599129	2.316	13.5599085	2.639	13.5599041	2.969	± 100
3.80	***20***	***13.5599443***	***0.000***	***13.5599444***	***-0.008***	***13.5599447***	***-0.025***	***13.5599451***	***-0.058***	***± 100***
	10	13.5599348	0.701	13.5599459	-0.113	13.5599577	-0.982	13.5599702	-1.910	± 100
	0	13.5600051	-4.484	13.5600134	-5.093	13.5600219	-5.721	13.5600306	-6.361	± 100
	-10	13.5600647	-8.876	13.5600699	-9.259	13.5600748	-9.624	13.5600790	-9.929	± 100
	-20	13.5601009	-11.543	13.5601031	-11.709	13.5601054	-11.876	13.5601075	-12.037	± 100
3.23	20	13.5599809	-2.697	13.5599921	-3.522	13.5600043	-4.420	13.5600178	-5.420	± 100
4.37	20	13.5599225	1.610	13.5599118	2.400	13.5599067	2.772	13.5599021	3.117	± 100

10. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207
IC RSS-GEN, Section 8.8

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Notes: 1. The lower limit shall apply at the transition frequencies 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

TEST PROCEDURE

ANSI C63.10:2013

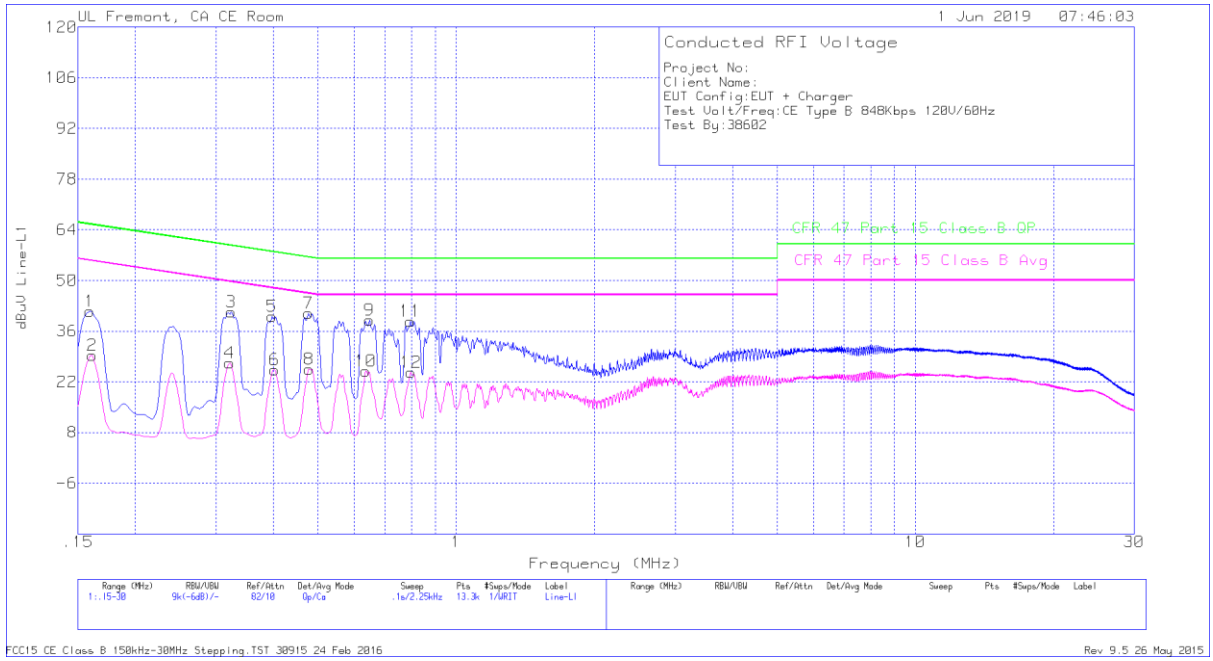
RESULTS

No non-compliance noted:

10.1. CE MODE

10.1.1. NORMAL OPERATION WITH ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS

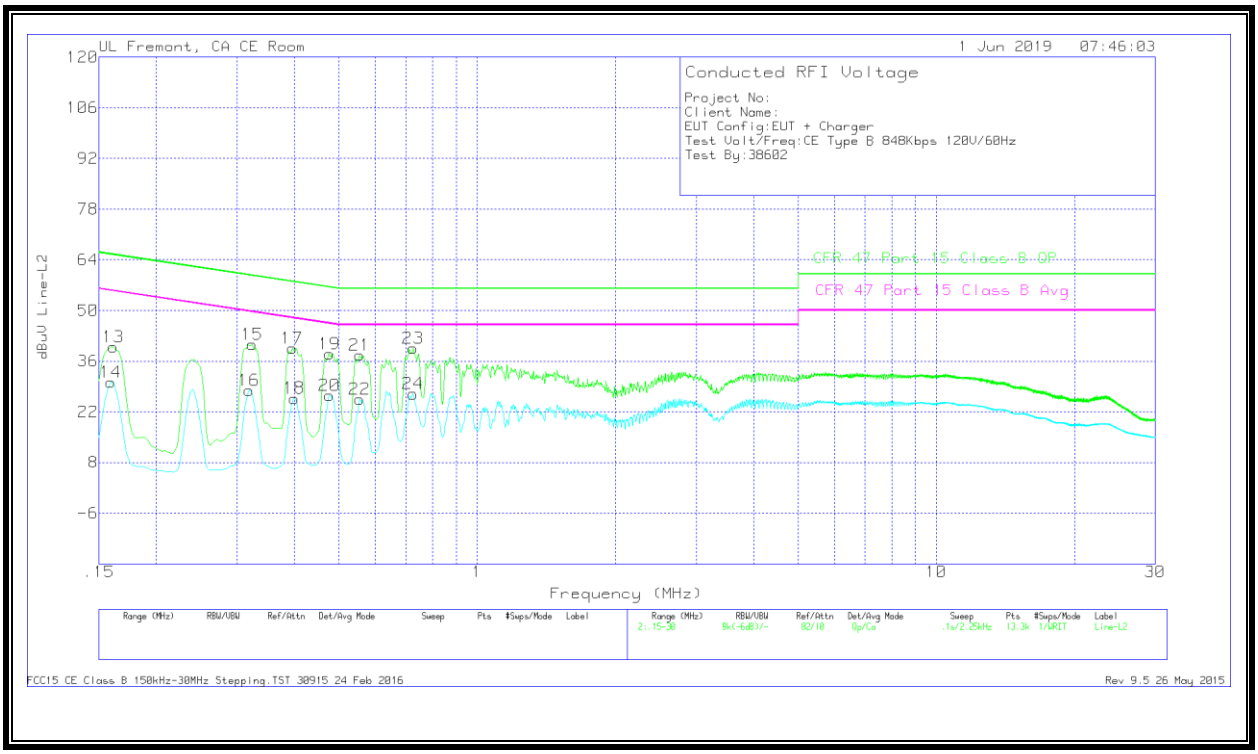


WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.159	31.34	Qp	.1	0	10.1	41.54	65.52	-23.98	-	-
2	.16125	19.12	Ca	.1	0	10.1	29.32	-	-	55.4	-26.08
3	.32325	31.21	Qp	0	0	10.1	41.31	59.62	-18.31	-	-
4	.321	17.11	Ca	0	0	10.1	27.21	-	-	49.68	-22.47
5	.3975	29.99	Qp	0	0	10.1	40.09	57.91	-17.82	-	-
6	.402	15.15	Ca	0	0	10.1	25.25	-	-	47.81	-22.56
7	.47625	30.81	Qp	0	0	10.1	40.91	56.4	-15.49	-	-
8	.4785	15.44	Ca	0	0	10.1	25.54	-	-	46.37	-20.83
9	.64725	28.98	Qp	0	0	10.1	39.08	56	-16.92	-	-
10	.636	14.89	Ca	0	0	10.1	24.99	-	-	46	-21.01
11	.7935	28.68	Qp	0	0	10.1	38.78	56	-17.22	-	-
12	.79575	14.51	Ca	0	0	10.1	24.61	-	-	46	-21.39

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



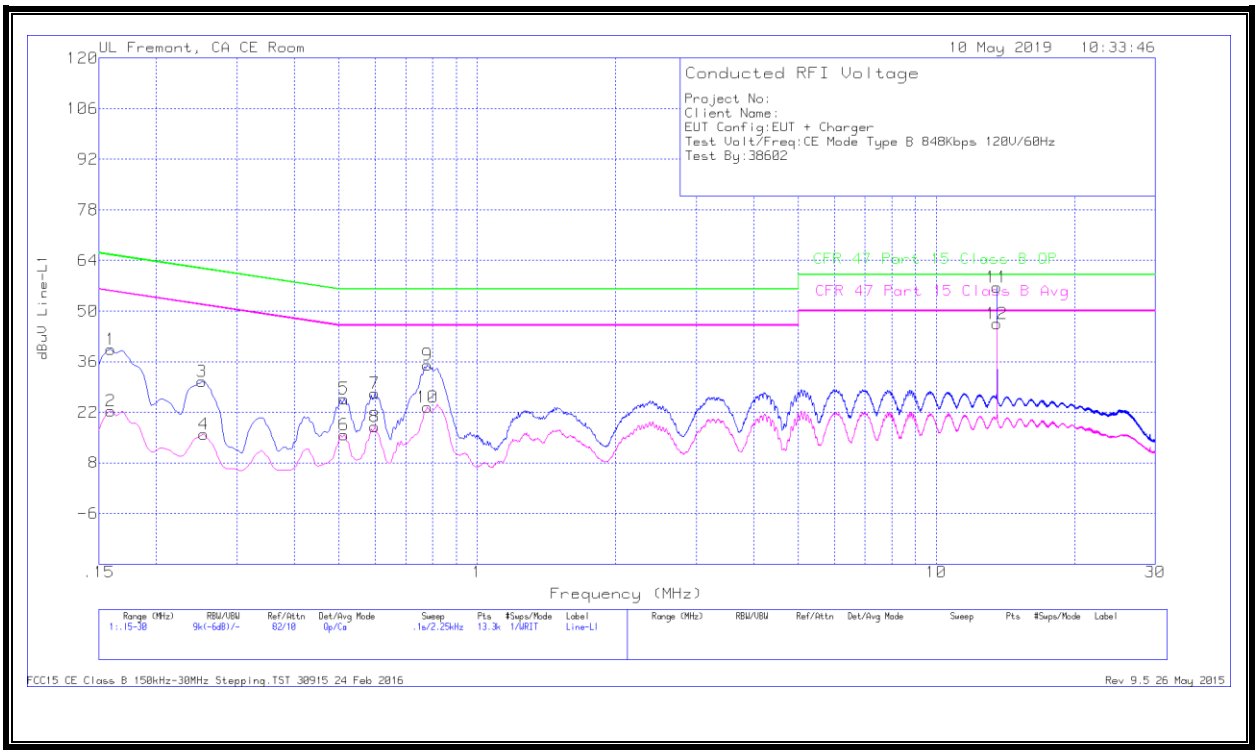
WORST EMISSIONS

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.16125	29.79	Qp	.1	0	10.1	39.99	65.4	-25.41	-	-
14	.159	19.99	Ca	.1	0	10.1	30.19	-	-	55.52	-25.33
15	.32325	30.55	Qp	0	0	10.1	40.65	59.62	-18.97	-	-
16	.31875	17.85	Ca	0	0	10.1	27.95	-	-	49.74	-21.79
17	.39525	29.42	Qp	0	0	10.1	39.52	57.95	-18.43	-	-
18	.39975	15.65	Ca	0	0	10.1	25.75	-	-	47.86	-22.11
19	.47625	27.98	Qp	0	0	10.1	38.08	56.4	-18.32	-	-
20	.47625	16.42	Ca	0	0	10.1	26.52	-	-	46.4	-19.88
21	.555	27.54	Qp	0	0	10.1	37.64	56	-18.36	-	-
22	.555	15.41	Ca	0	0	10.1	25.51	-	-	46	-20.49
23	.726	29.4	Qp	0	0	10.1	39.5	56	-16.5	-	-
24	.726	16.87	Ca	0	0	10.1	26.97	-	-	46	-19.03

Qp - Quasi-Peak detector
Ca - CISPR average detection

10.1.2. NORMAL OPERATION WITHOUT ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS



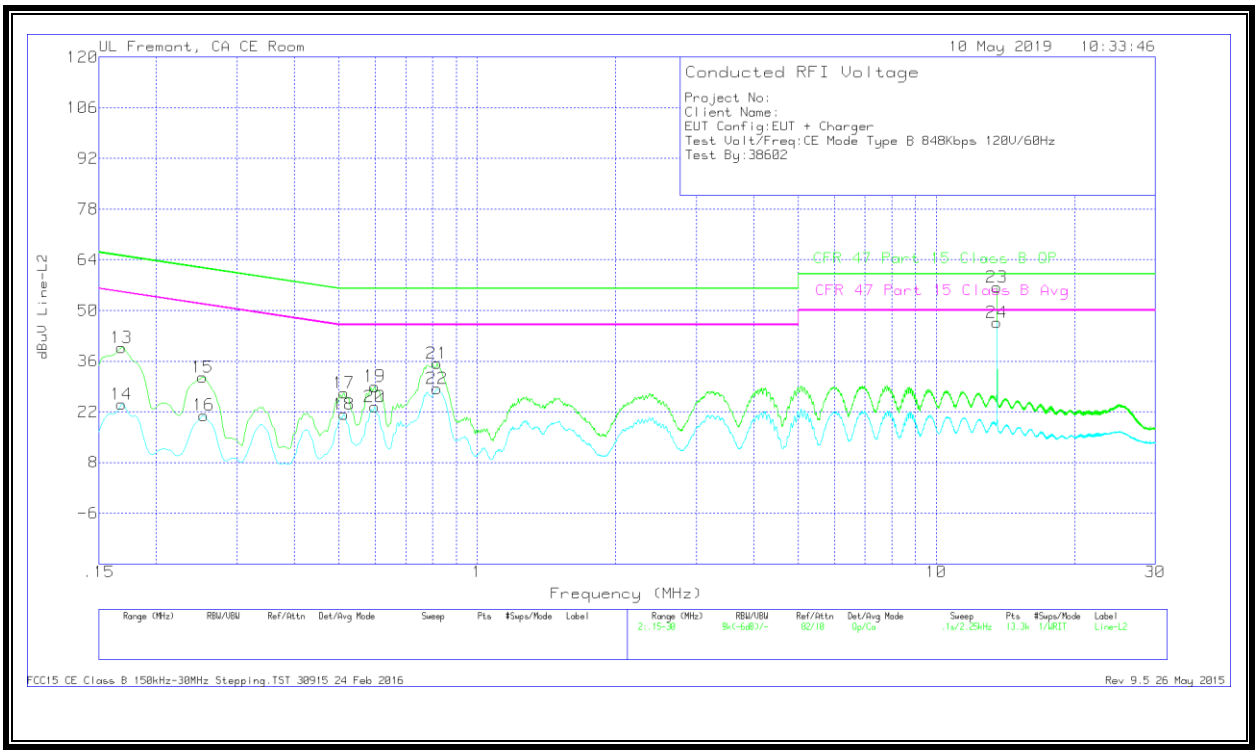
WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.159	29.14	Qp	.1	0	10.1	39.34	65.52	-26.18	-	-
2	.159	12.1	Ca	.1	0	10.1	22.3	-	-	55.52	-33.22
3	.25125	20.48	Qp	0	0	10.1	30.58	61.72	-31.14	-	-
4	.2535	5.79	Ca	0	0	10.1	15.89	-	-	51.64	-35.75
5	.51225	15.65	Qp	0	0	10.1	25.75	56	-30.25	-	-
6	.51225	5.68	Ca	0	0	10.1	15.78	-	-	46	-30.22
7	.59775	17.13	Qp	0	0	10.1	27.23	56	-28.77	-	-
8	.59775	7.98	Ca	0	0	10.1	18.08	-	-	46	-27.92
9	.78	25.03	Qp	0	0	10.1	35.13	56	-20.87	-	-
10	.78	13.24	Ca	0	0	10.1	23.34	-	-	46	-22.66
11	13.56	46.04	Qp	.1	.2	10.2	56.54	60	-3.46	-	-
12	13.56	36.08	Ca	.1	.2	10.2	46.58	-	-	50	-3.42

Qp - Quasi-Peak detector
Ca - CISPR average detection

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

LINE 2 RESULTS



WORST EMISSIONS

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.168	29.5	Qp	.1	0	10.1	39.7	65.06	-25.36	-	-
14	.168	13.87	Ca	.1	0	10.1	24.07	-	-	55.06	-30.99
15	.25238	21.49	Qp	0	0	10.1	31.59	61.68	-30.09	-	-
16	.2535	10.96	Ca	0	0	10.1	21.06	-	-	51.64	-30.58
17	.51225	17.18	Qp	0	0	10.1	27.28	56	-28.72	-	-
18	.51225	11.14	Ca	0	0	10.1	21.24	-	-	46	-24.76
19	.59775	18.95	Qp	0	0	10.1	29.05	56	-26.95	-	-
20	.59775	13.33	Ca	0	0	10.1	23.43	-	-	46	-22.57
21	.81825	25.32	Qp	0	0	10.1	35.42	56	-20.58	-	-
22	.81825	18.36	Ca	0	0	10.1	28.46	-	-	46	-17.54
23	13.56	45.94	Qp	.1	.2	10.2	56.44	60	-3.56	-	-
24	13.56	36.16	Ca	.1	.2	10.2	46.66	-	-	50	-3.34

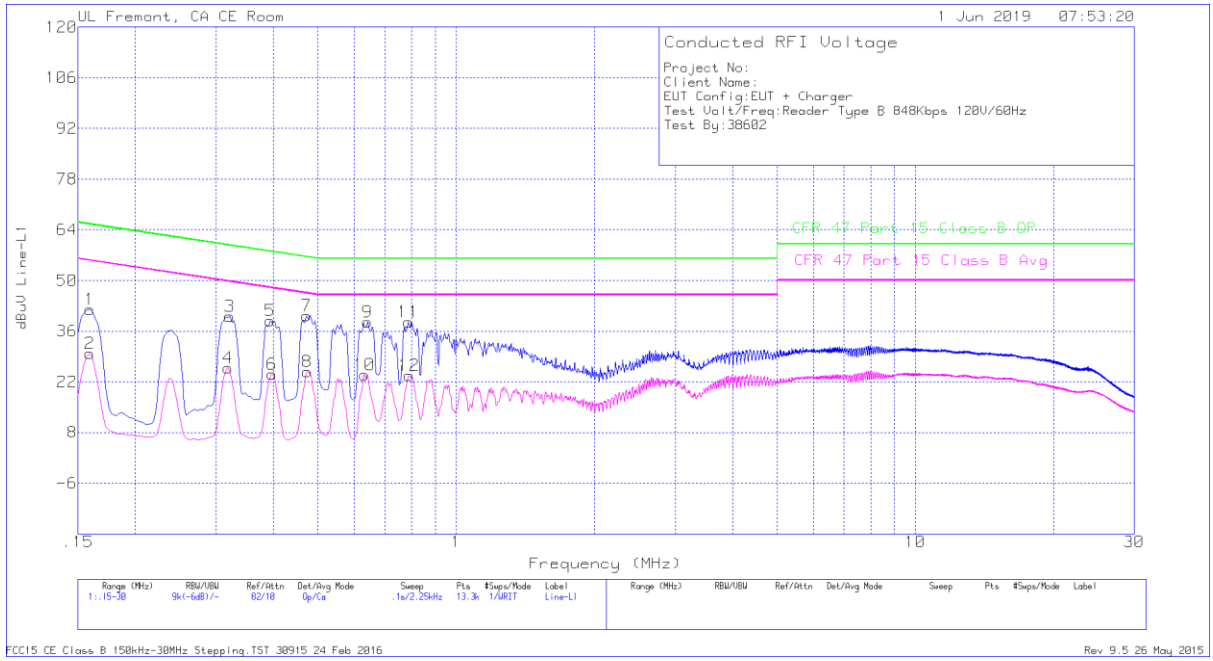
Qp - Quasi-Peak detector
Ca - CISPR average detection

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

10.2. READER MODE

10.2.1. NORMAL OPERATION WITH ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS

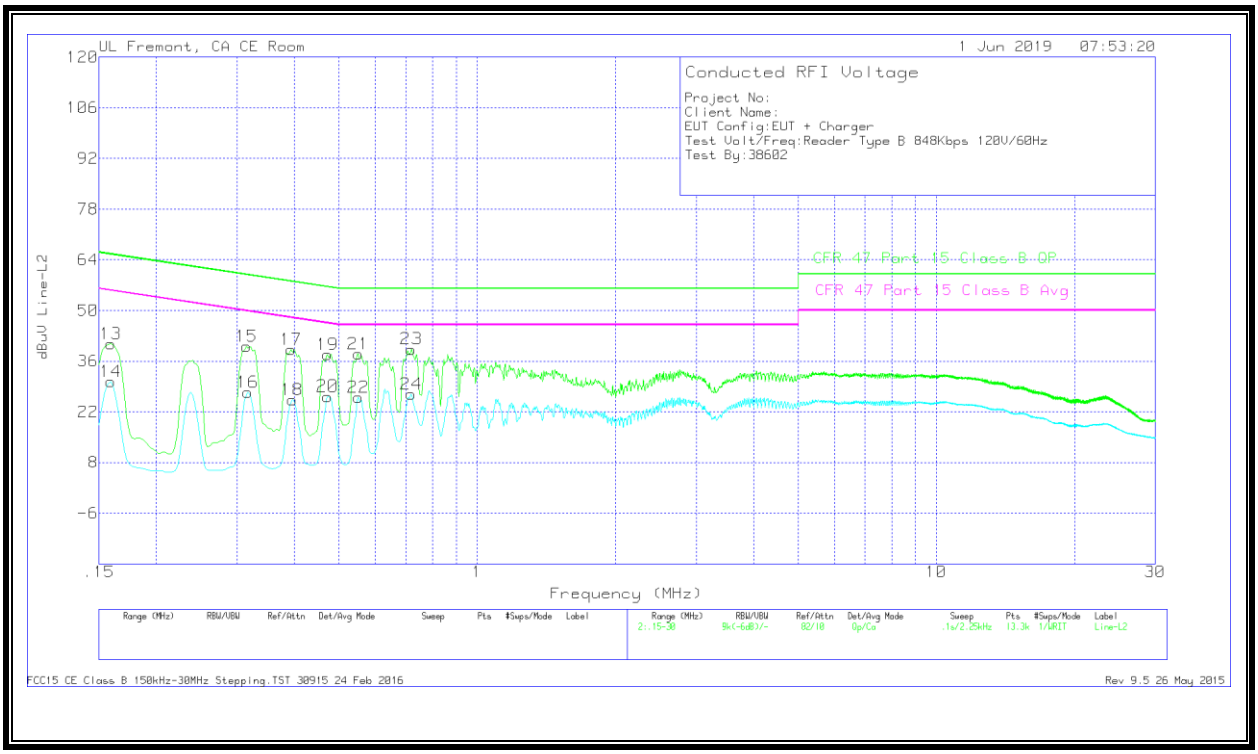


WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.159	31.77	Qp	.1	0	10.1	41.97	65.52	-23.55	-	-
2	.159	19.68	Ca	.1	0	10.1	29.88	-	-	55.52	-25.64
3	.321	29.98	Qp	0	0	10.1	40.08	59.68	-19.6	-	-
4	.31875	15.66	Ca	0	0	10.1	25.76	-	-	49.74	-23.98
5	.393	28.8	Qp	0	0	10.1	38.9	58	-19.1	-	-
6	.3975	13.98	Ca	0	0	10.1	24.08	-	-	47.91	-23.83
7	.47175	30.21	Qp	0	0	10.1	40.31	56.48	-16.17	-	-
8	.474	14.69	Ca	0	0	10.1	24.79	-	-	46.44	-21.65
9	.6405	28.36	Qp	0	0	10.1	38.46	56	-17.54	-	-
10	.6315	13.88	Ca	0	0	10.1	23.98	-	-	46	-22.02
11	.78675	28.46	Qp	0	0	10.1	38.56	56	-17.44	-	-
12	.789	13.61	Ca	0	0	10.1	23.71	-	-	46	-22.29

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



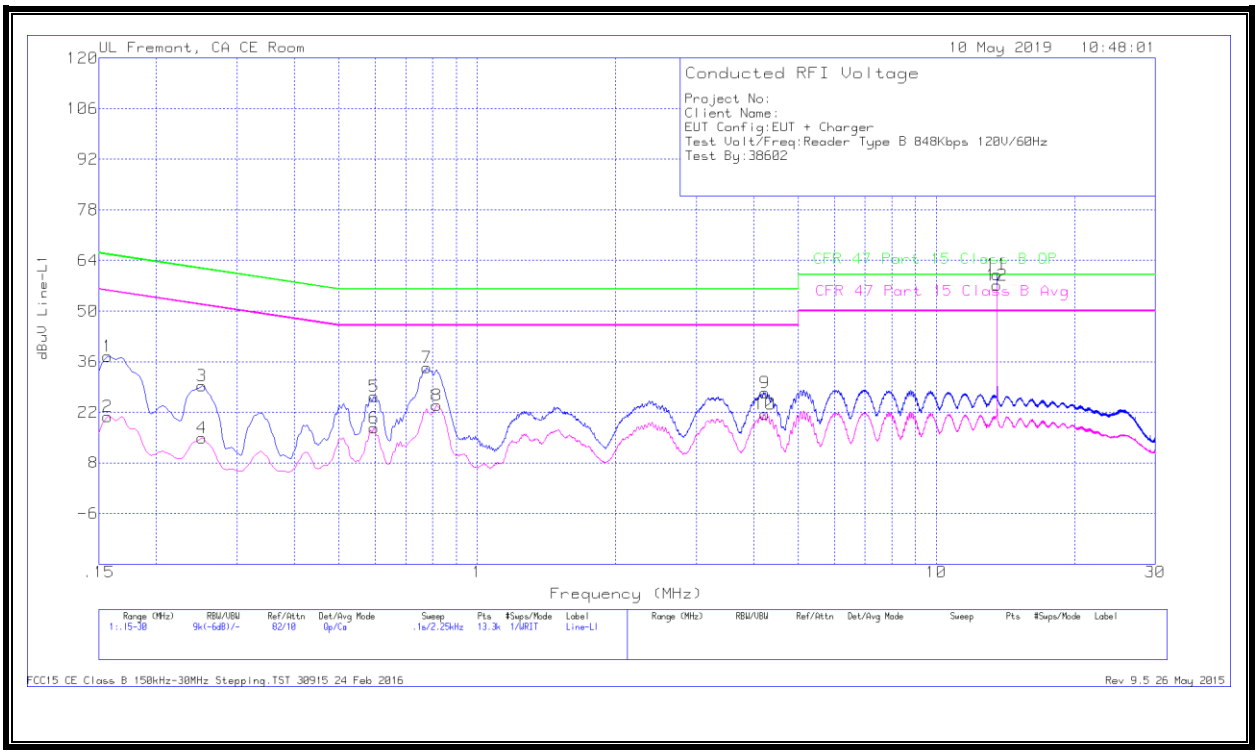
WORST EMISSIONS

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.159	30.51	Qp	.1	0	10.1	40.71	65.52	-24.81	-	-
14	.159	20.11	Ca	.1	0	10.1	30.31	-	-	55.52	-25.21
15	.31425	29.96	Qp	0	0	10.1	40.06	59.86	-19.8	-	-
16	.3165	17.35	Ca	0	0	10.1	27.45	-	-	49.8	-22.35
17	.393	29.17	Qp	0	0	10.1	39.27	58	-18.73	-	-
18	.39525	15.23	Ca	0	0	10.1	25.33	-	-	47.95	-22.62
19	.47175	27.75	Qp	0	0	10.1	37.85	56.48	-18.63	-	-
20	.47175	16.17	Ca	0	0	10.1	26.27	-	-	46.48	-20.21
21	.5505	27.91	Qp	0	0	10.1	38.01	56	-17.99	-	-
22	.5505	15.88	Ca	0	0	10.1	25.98	-	-	46	-20.02
23	.71925	29.21	Qp	0	0	10.1	39.31	56	-16.69	-	-
24	.71925	16.8	Ca	0	0	10.1	26.9	-	-	46	-19.1

Qp - Quasi-Peak detector
Ca - CISPR average detection

10.2.2. NORMAL OPERATION WITHOUT ANTENNA PORT TERMINATED, 848Kbps

LINE 1 RESULTS



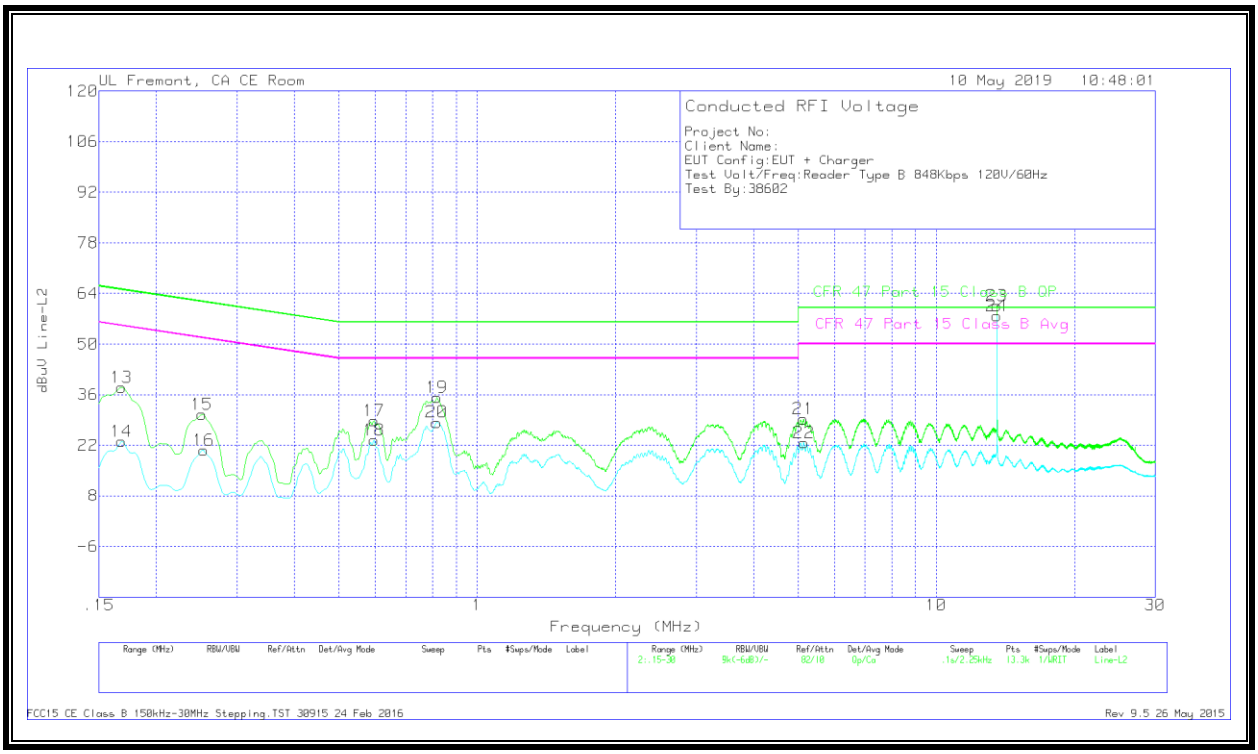
WORST EMISSIONS

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
1	.15675	27.23	Qp	.1	0	10.1	37.43	65.63	-28.2	-	-
2	.15675	10.6	Ca	.1	0	10.1	20.8	-	-	55.63	-34.83
3	.25125	19.22	Qp	0	0	10.1	29.32	61.72	-32.4	-	-
4	.25125	4.82	Ca	0	0	10.1	14.92	-	-	51.72	-36.8
5	.5955	16.27	Qp	0	0	10.1	26.37	56	-29.63	-	-
6	.5955	7.57	Ca	0	0	10.1	17.67	-	-	46	-28.33
7	.77775	24.23	Qp	0	0	10.1	34.33	56	-21.67	-	-
8	.816	13.76	Ca	0	0	10.1	23.86	-	-	46	-22.14
9	4.2315	17.28	Qp	0	.1	10.1	27.48	56	-28.52	-	-
10	4.23038	11.23	Ca	0	.1	10.1	21.43	-	-	46	-24.57
11	13.56	49.55	Qp	.1	.2	10.2	60.05	**60**	**.05**	-	-
12	13.56	46.59	Ca	.1	.2	10.2	57.09	-	-	**50**	**7.09**

Qp - Quasi-Peak detector
Ca - CISPR average detection

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

LINE 2 RESULTS



WORST EMISSIONS

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR)Margin (dB)
13	.168	27.87	Qp	.1	0	10.1	38.07	65.06	-26.99	-	-
14	.168	12.82	Ca	.1	0	10.1	23.02	-	-	55.06	-32.04
15	.25125	20.5	Qp	0	0	10.1	30.6	61.72	-31.12	-	-
16	.2535	10.53	Ca	0	0	10.1	20.63	-	-	51.64	-31.01
17	.5955	18.73	Qp	0	0	10.1	28.83	56	-27.17	-	-
18	.5955	13.32	Ca	0	0	10.1	23.42	-	-	46	-22.58
19	.81825	25.06	Qp	0	0	10.1	35.16	56	-20.84	-	-
20	.816	18.26	Ca	0	0	10.1	28.36	-	-	46	-17.64
21	5.136	19.03	Qp	0	.1	10.1	29.23	60	-30.77	-	-
22	5.145	12.53	Ca	0	.1	10.1	22.73	-	-	50	-27.27
23	13.56	50.11	Qp	.1	.2	10.2	60.61	**60**	**.61**	-	-
24	13.56	47.25	Ca	.1	.2	10.2	57.75	-	-	**50**	**7.75**

Qp - Quasi-Peak detector

Ca - CISPR average detection

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

END OF REPORT

11. SETUP PHOTOS

Please refer to 12696945-EP1V1 for setup photos