



TEST REPORT

Report Number. : 13019133-E11V2

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

Model : A2282

FCC ID : BCGA2282

EUT Description : NETWORK ADAPTER

Test Standard(s) : FCC CFR47 PART 15 SUBPART B,

Date Of Issue:

MAY 01, 2020

Prepared by:

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NVLAP Lab code: 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	4/29/2020	Initial Review	Chin Pang
V2	5/01/2020	Address TCB's questions	Chin Pang

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1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	APPLE INC. 1 APPLE PARK WAY CUPERTINO, CA 95014	
Model	A2282	
FCC ID	BCGA2282	
EUT Description	NETWORK ADAPTER	
Serial Number	F0TC3000PQD7	
Date Tested	February 04, 2020 to April 03, 2020	
Applicable Standards	PART 15 SUBPART B	
Test Results	COMPLIES	

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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 the U.S. government.

Approved & Released By:	Reviewed By:	Prepared By:
		
Thu Chan Operations Leader UL Verification Services Inc.	Chin Pang Senior Engineer UL Verification Services Inc.	Tom Chen Test Engineer UL Verification Services Inc.

2. TEST RESULTS SUMMARY

FCC Clause	Requirement	Result	Comment
15.109 (a) (b) (g)	Radiated Emissions	Complies	None.
15.107 (b)	AC Mains Conducted Emissions	Complies	None.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 15B

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. 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	47658 Kato Road
☐ Chamber A	☐ Chamber D	☐ Chamber I
☐ Chamber B	☐ Chamber E	☒ Chamber J
☐ Chamber C	☐ Chamber F	☐ Chamber K
	☐ Chamber G	☐ Chamber L
	☐ Chamber H	☐ Chamber M

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code: 2324A.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

5. DECISION RULES AND MEASUREMENT AND UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

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.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U _{Lab}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

5.4. SAMPLE CALCULATIONNT

RADIATED EMISSIONS

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The EUT is a Network Adapter. It has an integral battery, two Gigabit Ethernet port, lightning connector and antenna. The device supports IEEE 802.11b/g/n radio, Bluetooth radio, and GNSS. Network Adapter comes with 32 GB memory storage and 1GB RAM.

6.2. EUT OPERATION MODES

Mode #	Description
1	EUT in RX mode and wireless router linked via RJ45 cable, with GPS activated to remote GNSS simulator

6.3. WORST-CASE CONFIGURATION AND MODE

EUT was investigated with AC adapter/switch and EUT with Laptop/ switch configuration on below and above 1GHz radiated emissions test. The worst case was determined on EUT connected to laptop and Switch / router via ethernet cables in received mode with remote GNSS simulator GPS active during test.

6.4. EQUIPMENT USED DURING TEST

Use	Product Type	Manufacturer	Model	Comments
EUT	Network Adapter	Apple Inc.	A2282	None
AE	Wireless Router	Netgear	R6250	None
AE	Switch	Netgear	GS108T	None
AE	Laptop AC/DC Adapter	Apple	A1435	None
AE	EUT AC Adapter	Apple	A1401	None
AE	Laptop	Apple	MacBook Pro	None
AE	Laptop	Lenovo	20LTS12D00	None
AE	AC/DC Adapter	Lenovo	ADLX65YDC2A	None
Note: EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment or SIM - Simulator (Not Subjected to Test)				

6.5. INPUT / OUTPUT PORTS

Port #	Name	Type*	Cable Max. >2m (Y/N)	Cable Shielded (Y/N)	Comments
1	Mains	AC/DC	N	N	None
2, 4	Ethernet	RJ45	Y	N	None
3	USB	Kanzi Cable	N	N	None
*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical I/O = Signal Input or Output Port (Not Involved in Process Control) TP = Telecommunication Ports					

6.6. EUT INTERNAL OPERATING FREQUENCIES

Frequency (MHz)	Description
2480	Highest frequency generated

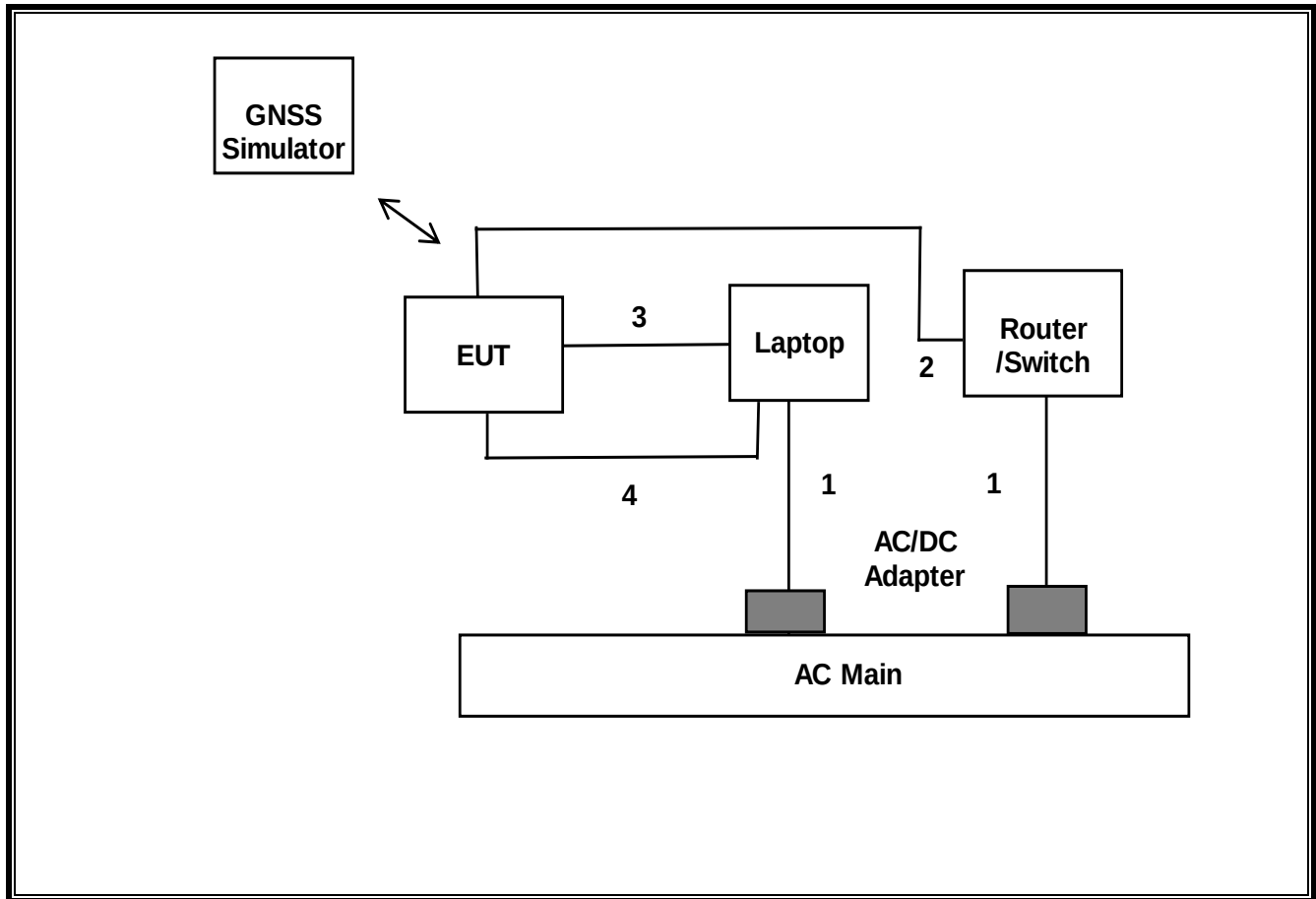
6.7. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was version 13.4.1, 17F28

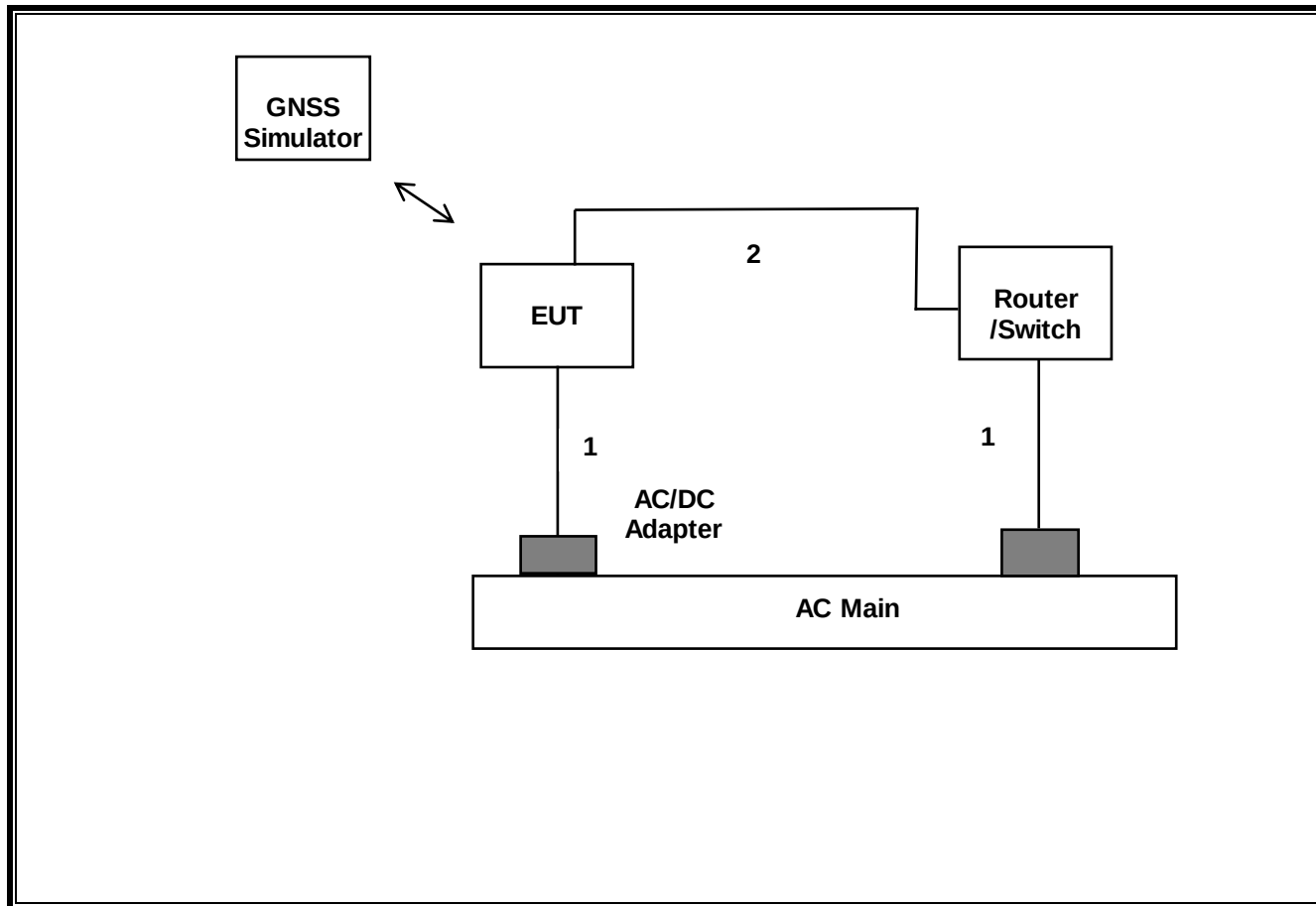
EUT was setup to continue pinging to Router/Switch and Bluetooth active and GPS was in received mode connected with remote GNSS simulator.

6.8. DESCRIPTION OF TEST SETUP

EUT with Laptop



EUT with AC Adapter



7. 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	ID Num	Last Cal	Cal Due
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T344	05/07/2019	05/07/2020
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1571	05/28/2019	05/28/2020
EMI Test Receiver	Rohde & Schwarz	ESW44	Pre0179367	05/16/2019	05/16/2020
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T899	08/23/2019	08/23/2020
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	Pre0180089	06/06/2019	06/06/2020
*EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESR	T1436	04/10/2019	04/10/2020
Power Cable, Line Conducted Emissions	UL	PR1	T861	10/27/2019	10/27/2020
LISN for Conducted Emissions CISPR-16	FISCHER CUSTOM COMMUNICATIONS	FCC-LISN-50/250-25-2-01	T1310	01/23/2020	01/23/2021

UL AUTOMATION SOFTWARE			
Radiated Software	UL	UL EMC	Ver 9.5, Mar 6, 2020
AC Line Conducted Software	UL	UL EMC	Ver 9.5, February 21, 2020

*Testing is completed before equipment expiration date

8. RADIATED TEST RESULTS

8.1. APPLICABLE LIMITS AND TEST RESULTS

TEST PROCEDURE

ANSI C63.4: 2014

LIMIT

§ 15.109 (a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of emission (MHz)	Field strength (microvolts/meter)
30-88	100
88-216	150
216-960	200
Above 960	500

(b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of emission (MHz)	Field strength (microvolts/meter)
30-88	90
88-216	150
216-960	210
Above 960	300

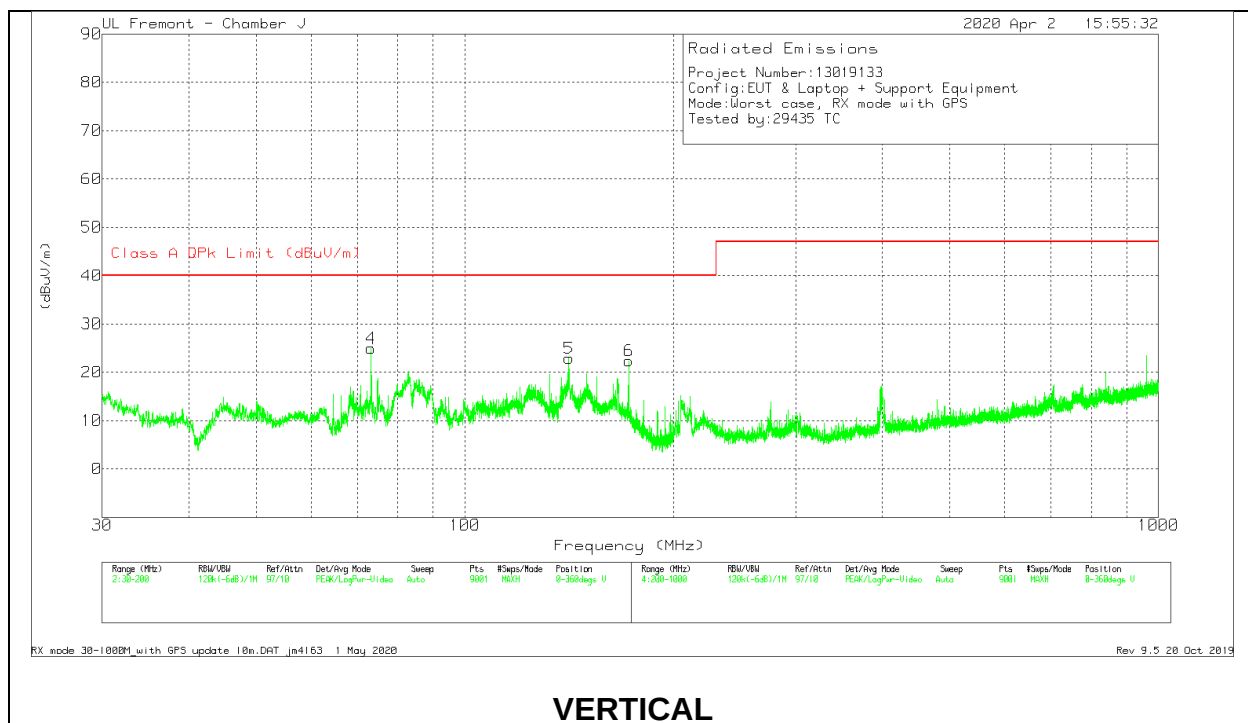
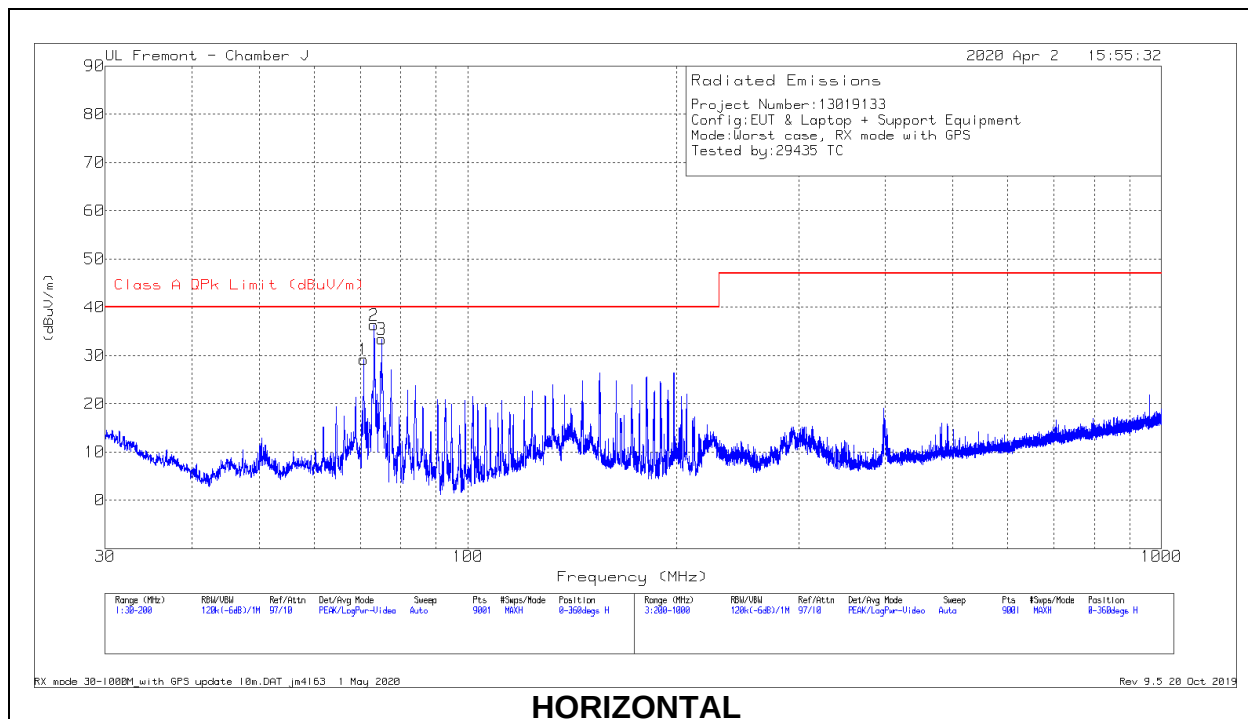
(g) As an alternative to the radiated emission limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, "Information Technology Equipment—Radio Disturbance Characteristics—Limits and Methods of Measurement".

Limits - Class A		
Frequency (MHz)	Limit (dBμV/m)	
CISPR Limits for radiated disturbance of Class A ITE at measuring distance of 10 m		
	Quasi-Peak	Average
30-230	40	NA
230-1000	47	NA

RESULTS

8.2. RADIATED EMISSIONS

30-1000MHz



Radiated Emissions

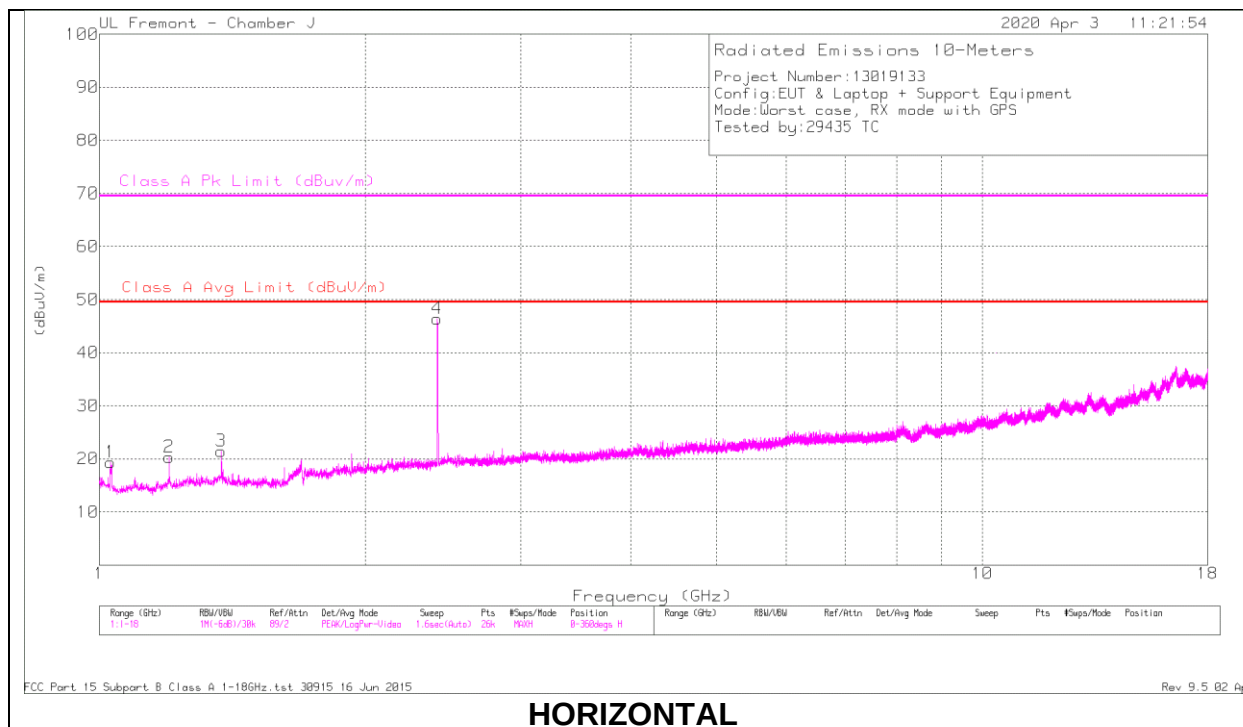
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T899 (dB/m)	Amp Cbl (dB)	Dist Corr (dB) 20Log	Corrected Reading (dBuV/m)	Class A QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarization
1	70.7625	56.85	Pk	14	-31.2	-10.5	29.15	40	-10.85	0-360	196	H
2	73.2477	66.13	Pk	13.9	-31.2	-10.5	38.33	40	-1.67	90	255	H
	73.2477	60.01	Qp	13.9	-31.2	-10.5	32.21	40	-7.79	90	255	
3	75.1301	61.46	Pk	13.7	-31.2	-10.5	33.46	40	-6.54	60	242	H
	75.1301	56.85	Qp	13.7	-31.2	-10.5	28.85	40	-11.15	60	242	
4	73.2369	52.7	Pk	13.9	-31.2	-10.5	24.9	40	-15.1	0-360	100	V
5	141.1995	45.07	Pk	19.1	-30.8	-10.5	22.87	40	-17.13	0-360	100	V
6	172.3286	45.77	Pk	17.7	-30.6	-10.5	22.37	40	-17.63	0-360	100	V

Pk - Peak detector

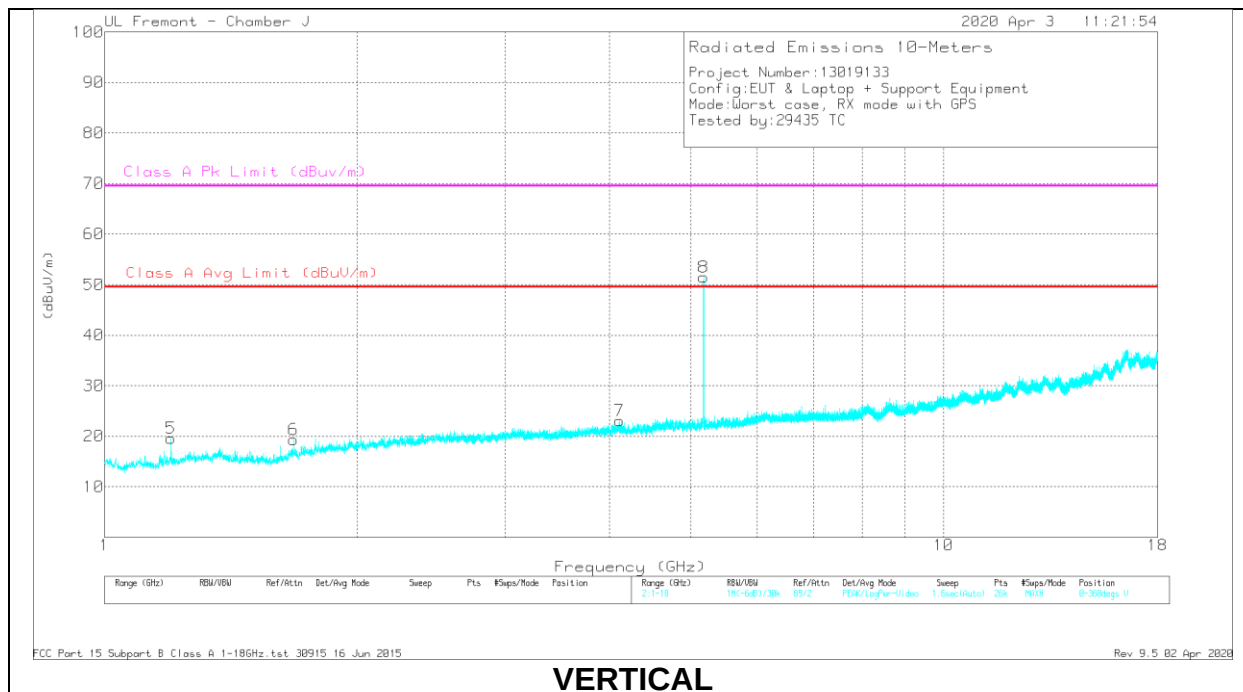
Qp - Quasi-Peak detector

RX mode 30-1000M_with GPS update 10m.DAT jm4163 1 May 2020
Rev 9.5 20 Oct 2019

ABOVE 1GHz



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cb I (dB)	Dist Corr (dB) 20Log	Corrected Reading (dBuV/m)	Class A Avg Limit (dBuV/m)	Margin (dB)	Class A Pk Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.02959	45.07	Pk	27.2	-35.4	-10.5	26.37	49.54	-23.17	69.5	-43.13	260	102	H
	1.02959	30.67	Av	27.2	-35.4	-10.5	11.97	49.54	-37.57	-	-	260	102	H
2	1.20003	45.87	Pk	28.2	-35.8	-10.5	27.77	49.54	-21.77	69.5	-41.73	107	153	H
	1.20003	35.87	Av	28.2	-35.8	-10.5	17.77	49.54	-31.77	-	-	107	153	H
3	1.37497	43.77	Pk	29.2	-35.8	-10.5	26.67	49.54	-22.87	69.5	-42.83	144	382	H
	1.37497	31.64	Av	29.2	-35.8	-10.5	14.54	49.54	-35	-	-	144	382	H
*4	2.41492	60.26	Avg	32.1	-35.5	-10.5	46.36	49.54	8	-	-	0-360	200	H
5	1.19994	48.19	Pk	28.2	-35.8	-10.5	30.09	49.54	-19.45	69.5	-39.41	30	124	V
	1.19934	32.97	Av	28.2	-35.8	-10.5	14.87	49.54	-34.67	-	-	30	124	V
6	1.68004	49.89	Pk	28.7	-35.8	-10.5	32.29	49.54	-17.25	69.5	-37.21	186	245	V
	1.68004	35.59	Av	28.7	-35.8	-10.5	17.99	49.54	-31.55	-	-	186	245	V
*8	5.17742	58.78	Avg	34.2	-31	-10.5	51.48	49.54		-	-	0-360	200	V

Pk - Peak detector

Av - Average detection

Note: *marker 4 & 8 are the Router fundamental frequencies.

FCC Part 15 Subpart B Class A 1-18GHz.tst 30915 16 Jun 2015

Rev 9.5 02 Apr 2020

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.107 (b)

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	79	66
0.5-30	73	60

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4

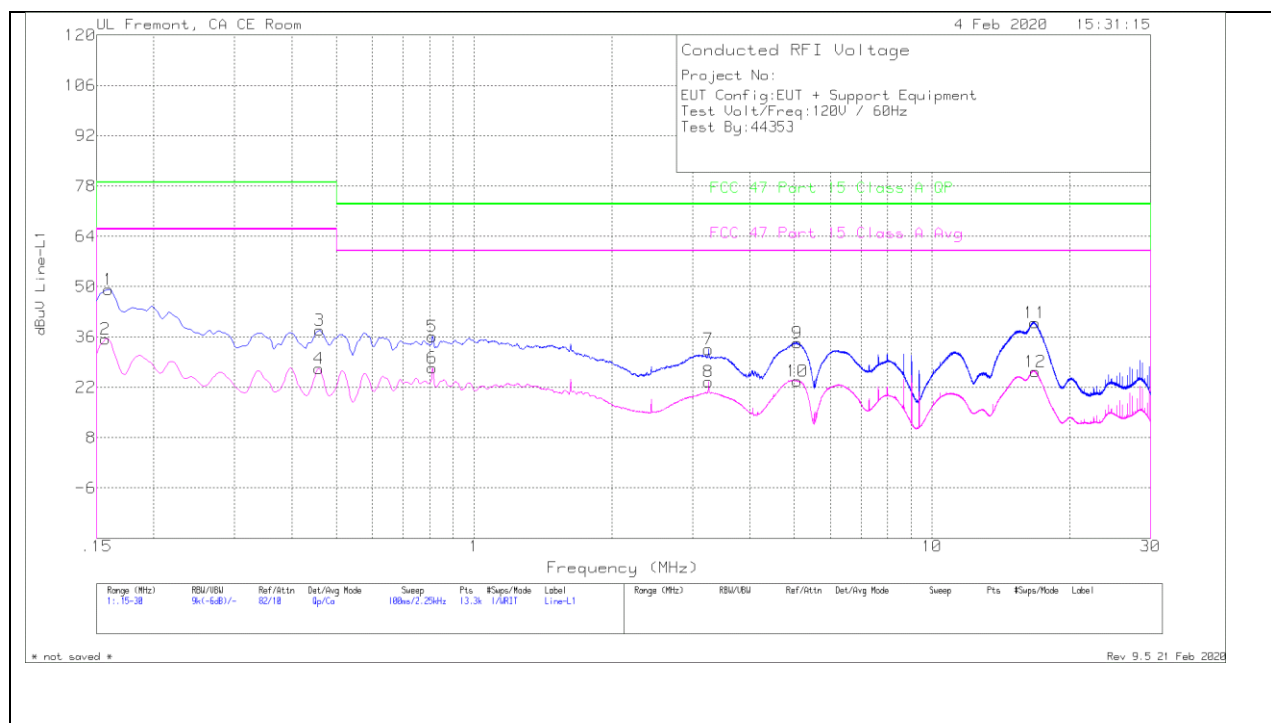
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

9.1. AC LINE HOST

LINE 1 RESULTS

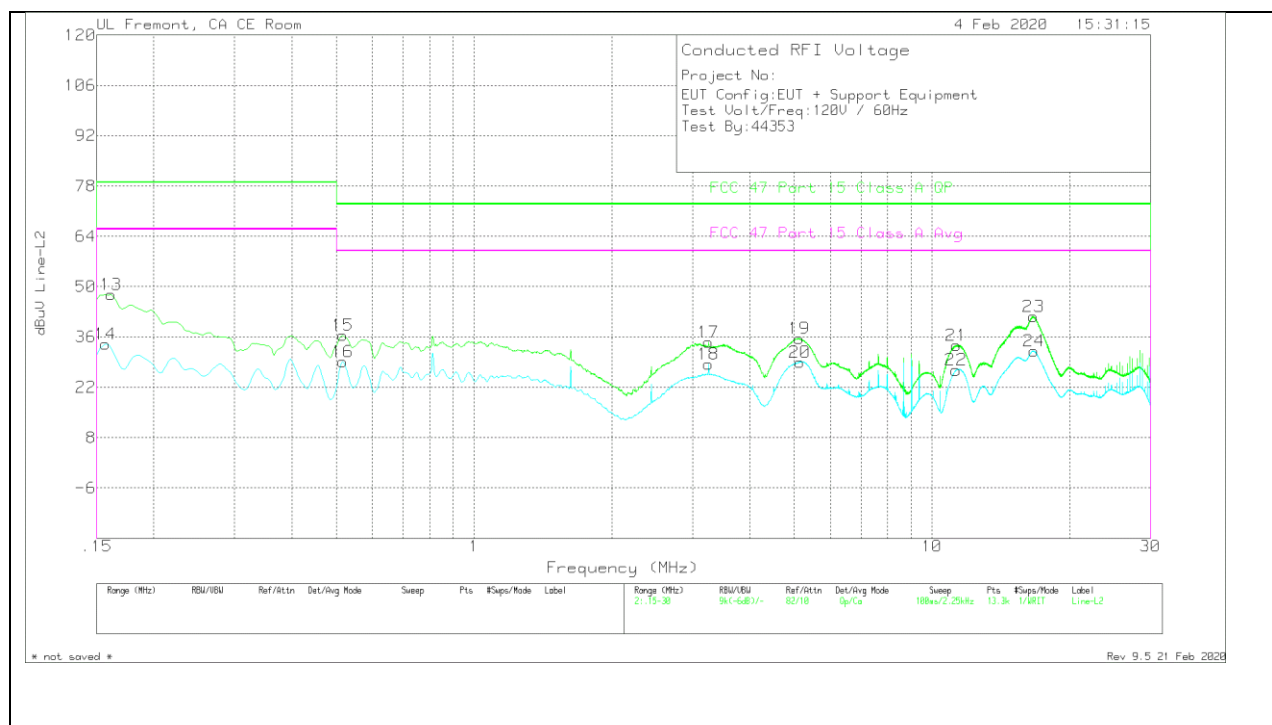


Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1 (dB)	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	FCC 47 Part 15 Class A QP	Margin (dB)	FCC 47 Part 15 Class A Avg	Margin (dB)
1	.159	39.12	Qp	.1	0	10	49.22	79	-29.78	66	-16.78
2	.15675	25.4	Ca	.1	0	10	35.5	79	-43.5	66	-30.5
3	.4605	27.81	Qp	0	0	10	37.81	79	-41.19	66	-28.19
4	.45825	17.18	Ca	0	0	10	27.18	79	-51.82	66	-38.82
5	.8115	26.08	Qp	0	0	10	36.08	73	-36.92	60	-23.92
6	.8115	17.34	Ca	0	0	10	27.34	73	-45.66	60	-32.66
7	3.2505	22.45	Qp	0	.1	10	32.55	73	-40.45	60	-27.45
8	3.2505	13.48	Ca	0	.1	10	23.58	73	-49.42	60	-36.42
9	5.073	24.14	Qp	0	.1	10.1	34.34	73	-38.66	60	-25.66
10	5.08425	13.55	Ca	0	.1	10.1	23.75	73	-49.25	60	-36.25
11	16.77975	29.48	Qp	0	.3	10.2	39.98	73	-33.02	60	-20.02
12	16.79213	15.84	Ca	0	.3	10.2	26.34	73	-46.66	60	-33.66

Qp - Quasi-Peak detector
Ca - CISPR average detection

* not saved *
Rev 9.5 21 Feb 2020

LINE 2 RESULTS



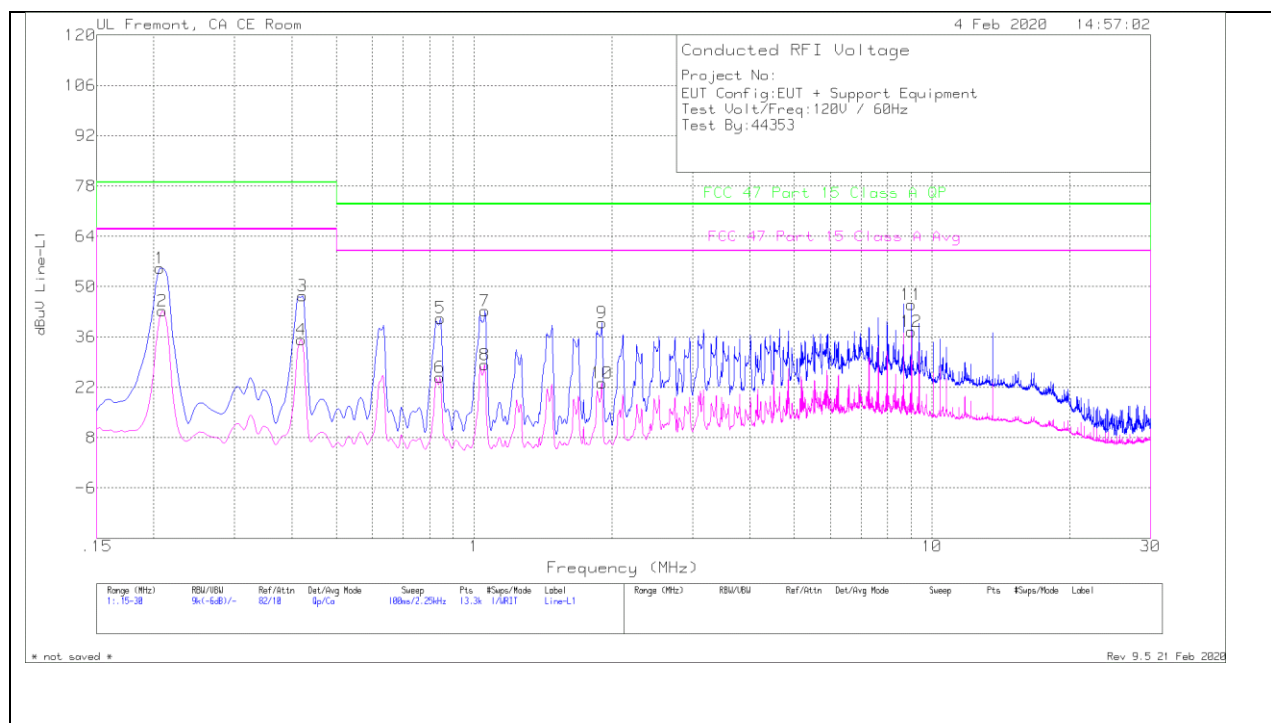
Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2 (dB)	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	FCC 47 Part 15 Class A QP	Margin (dB)	FCC 47 Part 15 Class A Avg	Margin (dB)
13	.16125	37.78	Qp	0	0	10	47.78	79	-31.22	66	-18.22
14	.15675	23.96	Ca	.1	0	10	34.06	79	-44.94	66	-31.94
15	.51675	26.51	Qp	0	0	10	36.51	73	-36.49	60	-23.49
16	.51675	19.12	Ca	0	0	10	29.12	73	-43.88	60	-30.88
17	3.2505	24.4	Qp	0	.1	10	34.5	73	-38.5	60	-25.5
18	3.2505	18.41	Ca	0	.1	10	28.51	73	-44.49	60	-31.49
19	5.13375	25.36	Qp	0	.1	10.1	35.56	73	-37.44	60	-24.44
20	5.13825	18.82	Ca	0	.1	10.1	29.02	73	-43.98	60	-30.98
21	11.29875	23.32	Qp	0	.2	10.1	33.62	73	-39.38	60	-26.38
22	11.28525	16.49	Ca	0	.2	10.1	26.79	73	-46.21	60	-33.21
23	16.674	31.13	Qp	0	.3	10.2	41.63	73	-31.37	60	-18.37
24	16.6785	21.62	Ca	0	.3	10.2	32.12	73	-40.88	60	-27.88

Qp - Quasi-Peak detector
Ca - CISPR average detection

* not saved *
Rev 9.5.21 Feb 2020

9.2. AC LINE NORM

LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1 (dB)	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	FCC 47 Part 15 Class A QP	Margin (dB)	FCC 47 Part 15 Class A Avg	Margin (dB)
1	.20625	45.22	Qp	0	0	10	55.22	79	-23.78	66	-10.78
2	.2085	33.35	Ca	0	0	10	43.35	79	-35.65	66	-22.65
3	.42225	37.51	Qp	0	0	10	47.51	79	-31.49	66	-18.49
4	.42	25.22	Ca	0	0	10	35.22	79	-43.78	66	-30.78
5	.84525	31.27	Qp	0	0	10	41.27	73	-31.73	60	-18.73
6	.843	14.82	Ca	0	0	10	24.82	73	-48.18	60	-35.18
7	1.05675	33.21	Qp	0	.1	10	43.31	73	-29.69	60	-16.69
8	1.0545	18.2	Ca	0	.1	10	28.3	73	-44.7	60	-31.7
9	1.90275	29.8	Qp	0	.1	10	39.9	73	-33.1	60	-20.1
10	1.9005	13.18	Ca	0	.1	10	23.28	73	-49.72	60	-36.72
11	9.0195	34.75	Qp	0	.2	10.1	45.05	73	-27.95	60	-14.95
12	9.0195	27.22	Ca	0	.2	10.1	37.52	73	-35.48	60	-22.48

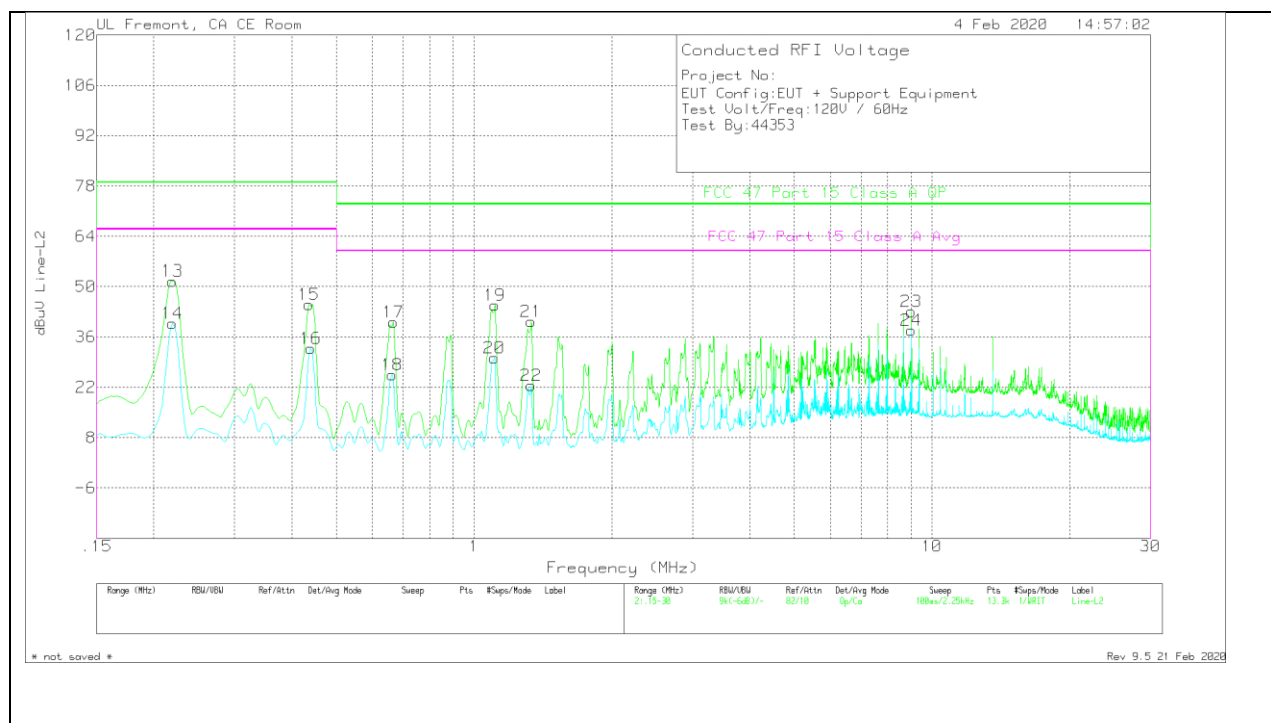
Qp - Quasi-Peak detector

Ca - CISPR average detection

* not saved *

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LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2 (dB)	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	FCC 47 Part 15 Class A QP	Margin (dB)	FCC 47 Part 15 Class A Avg	Margin (dB)
13	.21975	41.56	Qp	0	0	10	51.56	79	-27.44	66	-14.44
14	.21975	29.81	Ca	0	0	10	39.81	79	-39.19	66	-26.19
15	.43575	35.06	Qp	0	0	10	45.06	79	-33.94	66	-20.94
16	.44025	22.84	Ca	0	0	10	32.84	79	-46.16	66	-33.16
17	.6675	30.17	Qp	0	0	10	40.17	73	-32.83	60	-19.83
18	.663	15.49	Ca	0	0	10	25.49	73	-47.51	60	-34.51
19	1.11075	34.79	Qp	0	.1	10	44.89	73	-28.11	60	-15.11
20	1.1085	20.08	Ca	0	.1	10	30.18	73	-42.82	60	-29.82
21	1.3335	30.2	Qp	0	.1	10	40.3	73	-32.7	60	-19.7
22	1.3335	12.42	Ca	0	.1	10	22.52	73	-50.48	60	-37.48
23	9.0195	32.72	Qp	0	.2	10.1	43.02	73	-29.98	60	-16.98
24	9.0195	27.59	Ca	0	.2	10.1	37.89	73	-35.11	60	-22.11

Qp - Quasi-Peak detector

Ca - CISPR average detection

* not saved *

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10. SETUP PHOTOS

Please refer to 13019133-EP2V1 FCC 15B Setup Photos

END OF REPORT