CERTIFICATION TEST REPORT

Report Number. : 13181006-E3V3

Applicant	:	APPLE INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A
Model	:	A2140
FCC ID	:	BCGA2140
IC	:	579C-A2140
EUT Description	:	WIRELESS CHARGER
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-216 ISSUE 2

Date Of Issue:
October 03, 2020

Prepared by:
UL Verification Services Inc.
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NVLAP TESTING ilac-MRA
NVLAP Lab code: 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	9/23/2020	Initial Issue	Chin Pang
V2	9/28/2020	Updated ICES-001 Limit Tables on Page 16	T. Chan
V3	10/3/2020	Updated ICES-001 Limit Tables on Page 35	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: WIRELESS CHARGER

MODEL: A2140

SERIAL NUMBER: DLCD42U106M2

DATE TESTED: AUGUST 17, 2020 – SEPTEMBER 04, 2020

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Complies
ISED RSS-216 Issue 2	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. 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 For
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, 414788 D01 Radiated Test Site v01r01, FCC CFR 47 Part 2, and FCC CFR 47 Part 15, RSS-GEN Issue 5 and RSS-216 Issue 2 January 2016.

3. 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. Line conducted emissions were measured at 47658 Kato RD 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	47658 Kato Rd.
☐ Chamber A (IC:2324B-1)	☐ Chamber D (IC:22541-1)	☐ Chamber I (IC: 2324A-5)
☐ Chamber B (IC:2324B-2)	☐ Chamber E (IC:22541-2)	☐ Chamber J (IC: 2324A-6)
☐ Chamber C (IC:2324B-3)	☐ Chamber F (IC:22541-3)	☐ Chamber K (IC: 2324A-1)
	☒ Chamber G (IC:22541-4)	☐ Chamber L (IC: 2324A-3)
	☐ Chamber H (IC:22541-5)	☐ Chamber M (IC: 2324A-2)

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.

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

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4. DECISION RULES AND MEASUREMENT UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

4.2. 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.)

4.3. 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%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a magnetic charger which inductively charge other wireless charging devices.The charging function operates at 127.7kHz (Qi) and 360.0kHz. The charger supports charging at 5W, 7.5W and 15W power and NFC tag operation. The charger doesn't have any internal battery.

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC	1	USB-C	Un-shielded	1	30W Power Supply
2	DC	1	Magnetic 5 pin	Un-shielded	3	60W Power Supply
3	USB	1	Lightening	Un-shielded	1	Communication

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5.2. MAXIMUM E-FIELD AND H-FIELD STRENGTH

The transmitter has maximum peak radiated electric and H-field strength as follows:

Fundamental Frequency (kHz)	Mode	E field (300m distance) FCC (dBuV/m)	H field (3m distance) IC (dBuA/m)
360	Operating mode	-13.85	16.33
127	Operating mode	1.58	31.02

5.3. SOFTWARE AND FIRMWARE

The firmware version installed in the EUT during testing is v87

5.4. WORST-CASE CONFIGURATION AND MODE

The EUT is a dual frequencies magnetic charger enclosed in a plastic case. For the entire radiated emissions test, the EUT was examining on the following configuration.

Config	Mode	Descriptions
1	Standby mode (Radiated Spurious Only)	EUT powered by AC/DC adapter via USB-C cable
2	Operating mode (EUT w/360kHz Fund @15W)	EUT powered by AC/DC adapter via USB-C cable with iPhone (15W) at charging mode
3	Operating mode (EUT w/127kHz Fund @7.5W)	EUT powered by AC/DC adapter via USB-C cable with iPhones (7.5W) at charging mode
4	Operating mode (EUT w/127kHz Fund @1W)	EUT powered by AC/DC adapter via USB-C cable with airpod at charging mode

EUT was tested as standby and operation modes. For worst case operational mode, EUT was tested with iPhones, with iPhone at 15W has a magnetic alignment and iPhones at 7.5W without magnetic alignment. Device being charged was at a state of 20 – 50% charged.

For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel); parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 300 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 D01.

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5.5. DESCRIPTION OF TEST SETUP

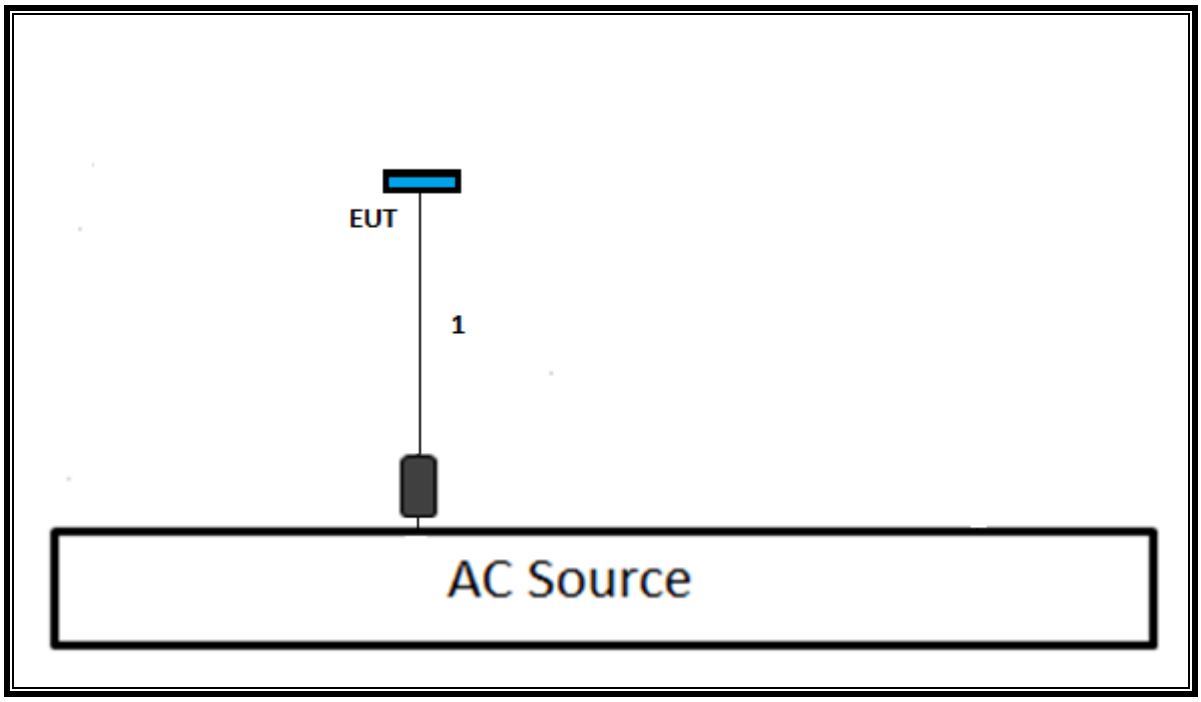
SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC/DC adapter	Apple	A1882	C4H748200RXH80MAY	N/A
Phone	Apple	iPhone	N/A	N/A
Laptop	Apple	MacBook Air	C2QLN093FKYR	DoC
Laptop Adapter	Apple	A1436	C045196GMGTG6HHAD	DoC

TEST SETUP

The EUT is directly connected to an AC/DC adapter via USB-C cable and magnetic connect to host phone on top of EUT. Host laptop computer is connected to host phone via USB / lightening cable during the tests. Test software exercised the radio card.

CONFIGURATION 1: STANDBY MODE



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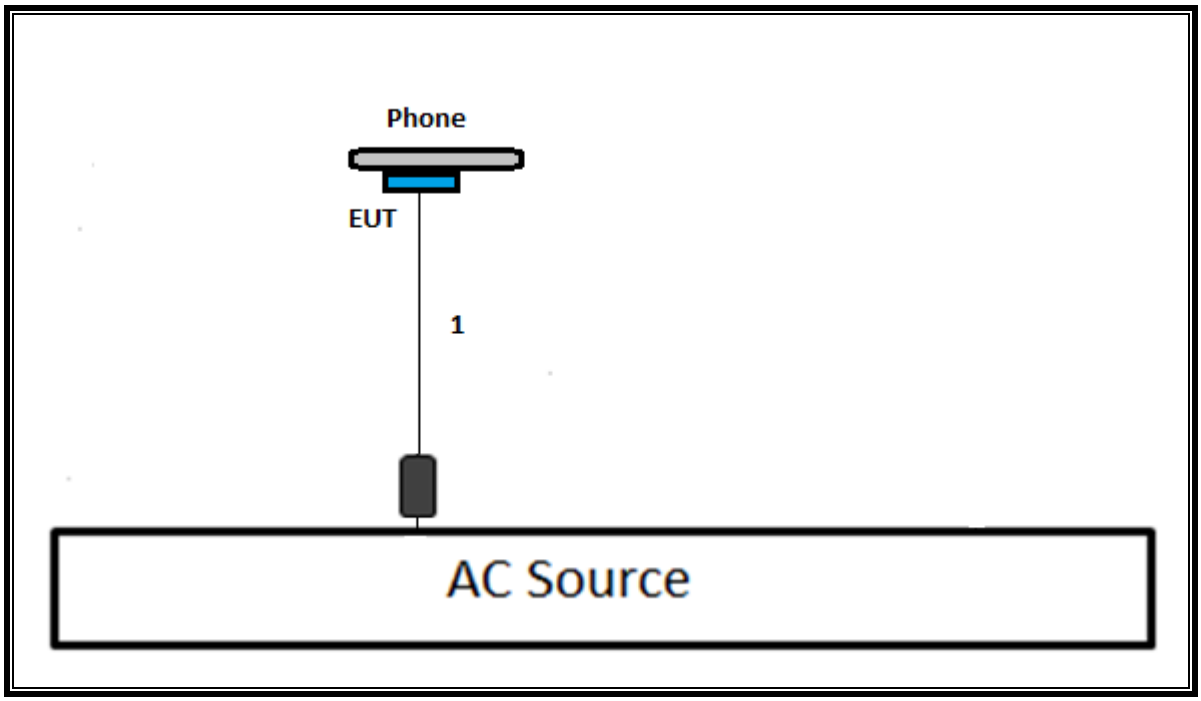
CONFIGURATION 2 & 3: OPERATING MODE WITH iPHONE



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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**	**ID Num**	**Cal Due**	**Last Cal**
Antenna, Active Loop 9KHz to 30MHz	ETS-Lindgren	6502	T1616	10/28/2020	10/28/2019
Antenna, Broadband Hybrid, 30MHz to 2000MHz w/4dB	Sunol Sciences Crop.	JB1	T243	04/15/2021	04/15/2020
Amplifier, 10kHz to 1GHz, 32dB	Sonoma Instrument	310N	T173	07/22/2021	07/22/2020
Sniffer Probes	Electro Metrics	EM-6992	N/A	N/A	N/A
Environmental Chamber	Cincinnati Sub-Zero	ZPHS-8-3.5-SCT/WC	T754	12/22/2020	12/22/2019
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A-544	T342	01/23/2021	01/23/2020

AC Line Conducted					
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**	**Last Cal**
EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESR	T1436	02/20/2021	02/20/2020
Power Cable, Line Conducted Emissions	UL	PR1	T861	10/27/2020	10/27/2019
LISN for Conducted Emissions CISPR-16	FISCHER CUSTOM COMMUNICATIONS	FCC-LISN-50/250-25-2-01	PRE0186446	01/23/2021	01/23/2020
UL AUTOMATION SOFTWARE					
Radiated Software	UL	UL EMC	Ver 9.5, Mar 6, 2020		
Conducted Software	UL	UL EMC	2020.2.26		
AC Line Conducted Software	UL	UL EMC	Ver 9.5, February 21, 2020		

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7. OCCUPIED BANDWIDTH

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 300Hz. 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-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.

Note that when the EUT was in standby mode the only signal that comes out from the EUT was the intentional charging signal of 326.5kHz. On the other hand, when the EUT was in operational mode there were two signals. One of the intentional charging signal of 326.5kHz and the other one the control signal of 340kHz that controls the communication/charging status between EUT and the client device-the watch.

EUT SETUP

Configuration 1: N/A due to no intended radiator.

Configuration 2: Charger with iPhone in operating mode, transmitting at 360kHz test.

Configuration 3: Charger with iPhone in operating mode, transmitting at 127kHz test.

Configuration 4: Charger with Airpod in operating mode, transmitting at 127kHz test

RESULTS

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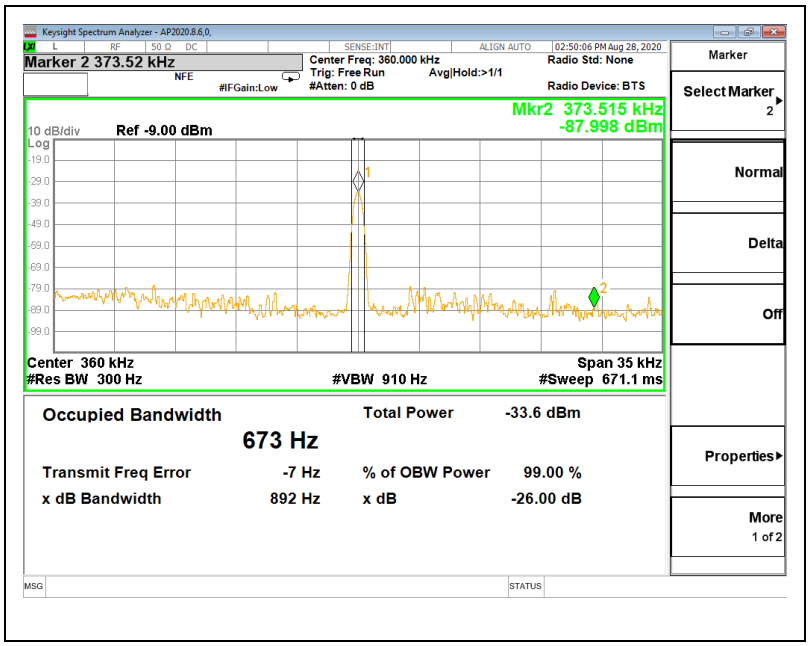
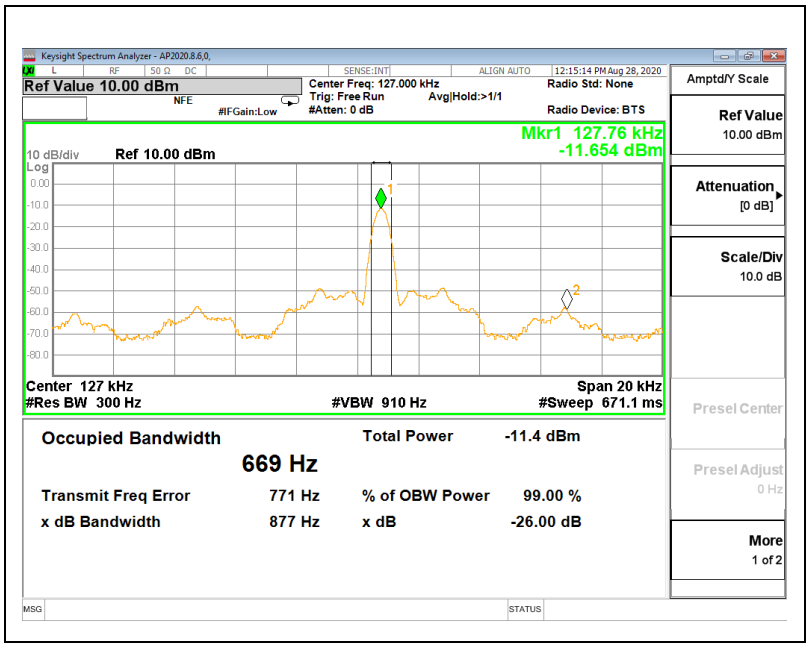
7.1. 360kHz

7.1.1. CONFIG 2



7.2. 127kHz

7.2.1. CONFIG 3



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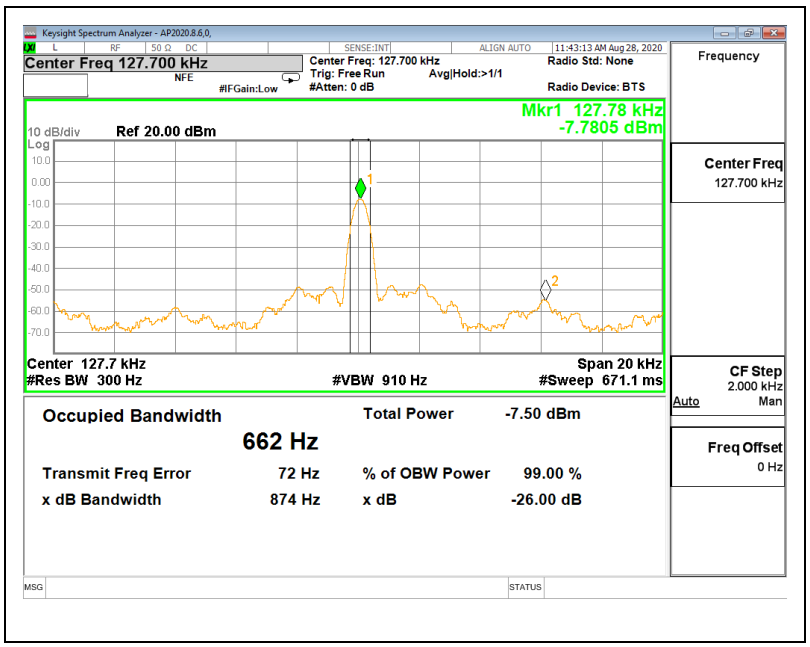
7.2.2. CONFIG 4



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8. RADIATED EMISSION TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMIT

FCC §15.209 (a)
ICES-001 Section 6.2, IC RSS-216 6.2.2, and IC RSS-GEN Sections 8.9 and 8.10.

Frequency (MHz)	Field Strength (microvolts/meter)	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 to 216	150	3
216 to 960	200	3
Above 960 MHz	500	3
Note: The lower limit shall apply at the transition frequency.		

ICES-001 Issue 5 Table 2 & Table 4:

Table 2: Magnetic field strength radiated emission limits for induction cooking appliances

Frequency range (MHz)	Quasi-peak, at 3 m distance (dBµA/m)
0.009 – 0.07	69
0.07 – 0.15	69 to 39 *
0.15 – 30	39 to 7 *
* The limit level in dBµA/m decreases linearly with the logarithm of frequency.	

Table 4: Electric field strength radiated emission limits for induction cooking appliances

Frequency range (MHz)	OATS or SAC * 10 m measurement distance Quasi-peak (dBµV/m)	OATS or SAC * 3 m measurement distance Quasi-peak (dBµV/m)	FAR * 3 m measurement distance Quasi-peak (dBµV/m)
30 – 230	30	40	42 to 35**
230 – 1000	37	47	42
Note: The more stringent limit applies at the transition frequency. * OATS = open-area test site, SAC = semi-anechoic chamber, FAR = fully-anechoic room (see CSA CISPR 11:19). ** The limit level in dBµV/m decreases linearly with the logarithm of frequency.			

RESULTS

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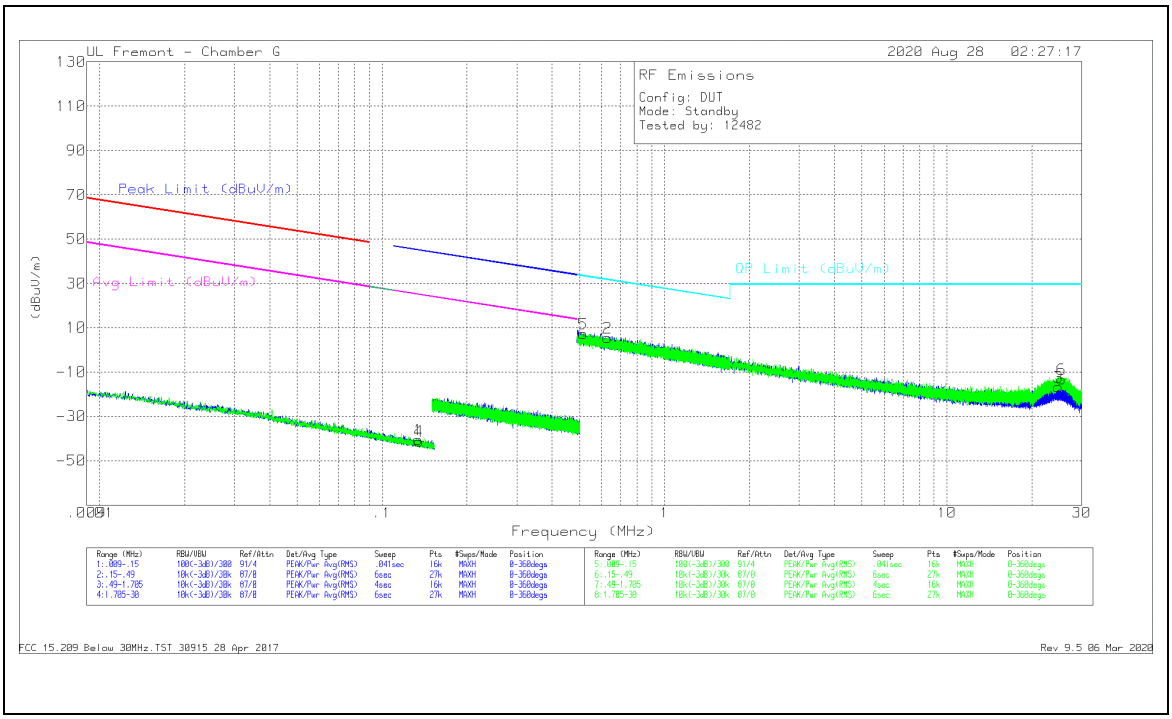
8.2. FCC TX FUNDAMENTAL AND SPURIOUS EMISSIONS FROM 9 kHz TO 30 MHz

8.2.1. CONFIG 1: STANDBY CONFIGURATION



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.12046	20.22	Av	11.2	.1	-80	-48.48	26.01	-74.49	272
4	.12239	20	Av	11.2	.1	-80	-48.7	25.87	-74.57	53

Av - Average detection

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
5	.50691	29.61	Qp	11	.1	-40	.71	33.51	-32.8	76
2	.61941	28.21	Qp	11	.1	-40	-.69	31.77	-32.46	206
3	24.8001	8.46	Qp	9.3	.8	-40	-21.44	29.5	-50.94	89
6	25.5034	12.05	Qp	9.2	.8	-40	-17.95	29.5	-47.45	130

Qp - Quasi-Peak detector

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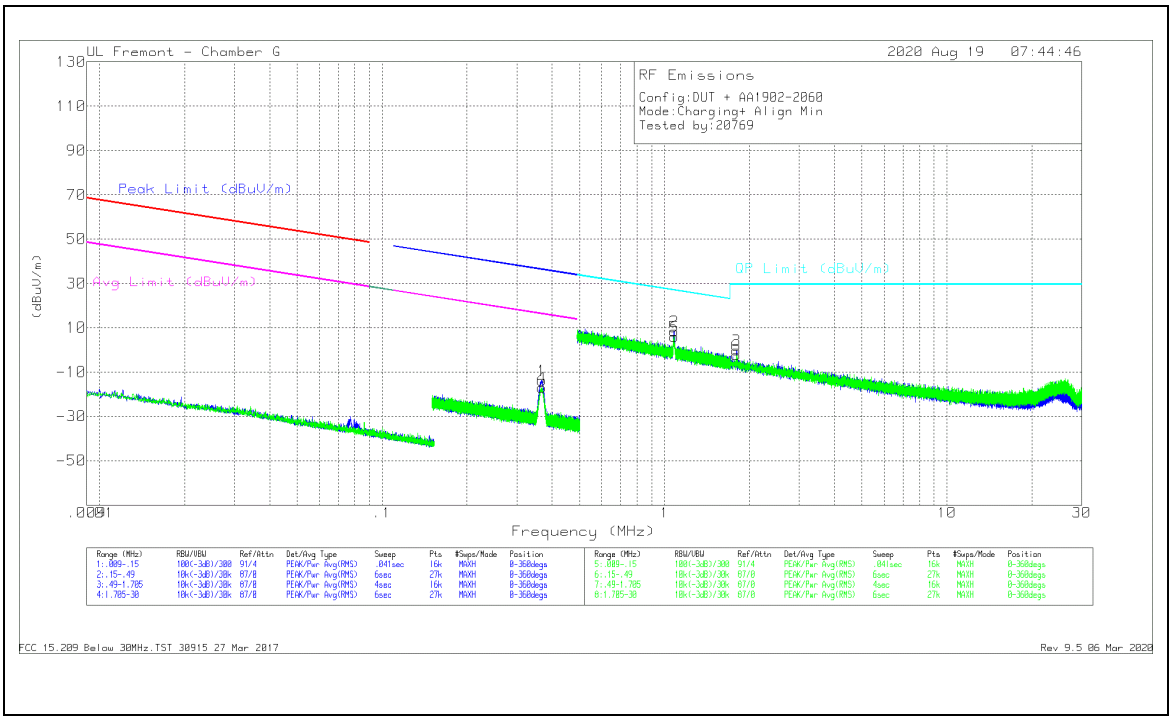
8.2.2. CONFIG 2: OPERATING WITH iPHONE 15W LOAD



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	.36774	51.72	QP	11.1	.1	-80	-17.75	36.3	-54.05	342
1	.36798	55.06	QP	11.1	.1	-80	-13.85	36.29	-50.14	266

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
2	1.07919	32.78	Qp	10.8	.1	-40	3.68	26.96	-23.28	336
5	1.07971	35.6	Qp	10.8	.1	-40	6.5	26.96	-20.46	235
6	1.79794	23.16	Qp	10.8	.2	-40	-5.84	29.5	-35.34	356
3	1.79958	25.51	Qp	10.8	.2	-40	-3.49	29.5	-32.99	275

Qp - Quasi-Peak detector

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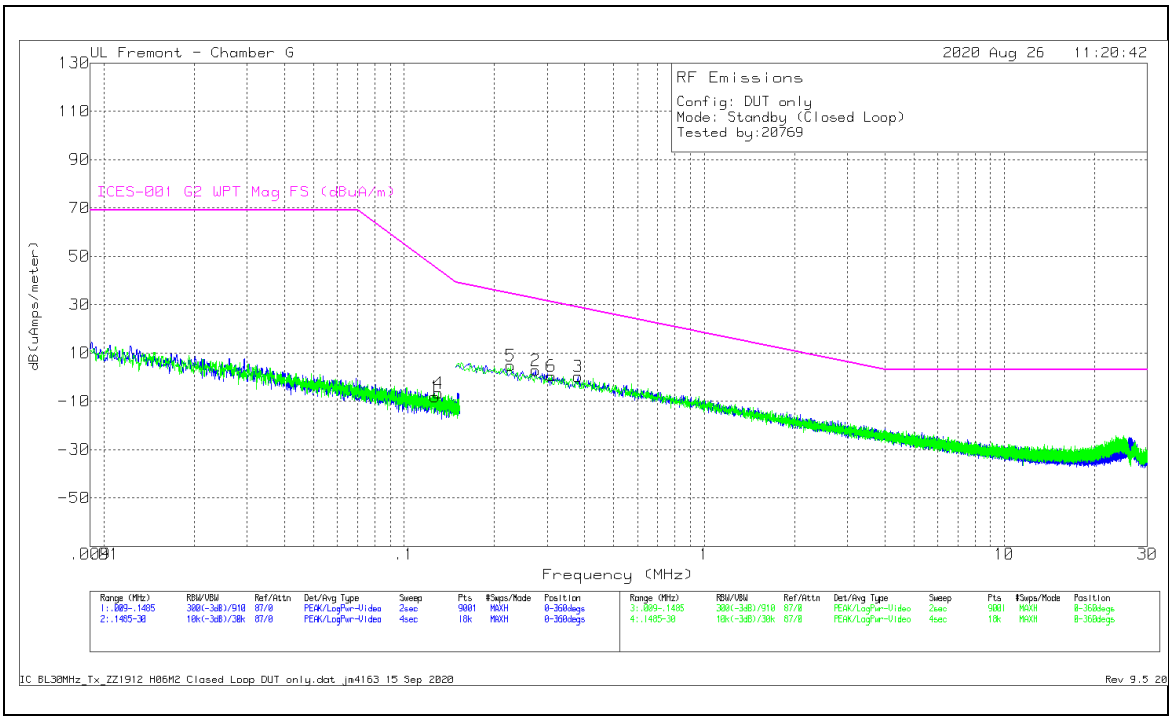
8.3. IC / CISPR 11 TX FUNDAMENTAL AND SPURIOUS EMISSIONS FROM 9 kHz TO 30 MHz

8.3.1. CONFIG 1: STANDBY CONFIGURATION



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Corrected Reading dB(uAmps/meter)	CISPR11 G2 WPT Mag FS (dBuA/m)	Margin (dB)	Azimuth (Degs)
1	.11066	44.43	Qp	-40.1	.1	4.43	50.73	-46.3	18
4	.12197	43.57	Qp	-40.2	.1	3.47	46.85	-43.38	107
5	.21305	39.12	Qp	-40.4	.1	-1.18	35.05	-36.23	341
2	.26546	37.43	Qp	-40.5	.1	-2.97	32.65	-35.62	101
6	.32398	35.84	Qp	-40.6	.1	-4.66	30.47	-35.13	81
3	.38253	34.22	Qp	-40.6	.1	-6.28	28.66	-34.94	253

Qp - Quasi-Peak detector

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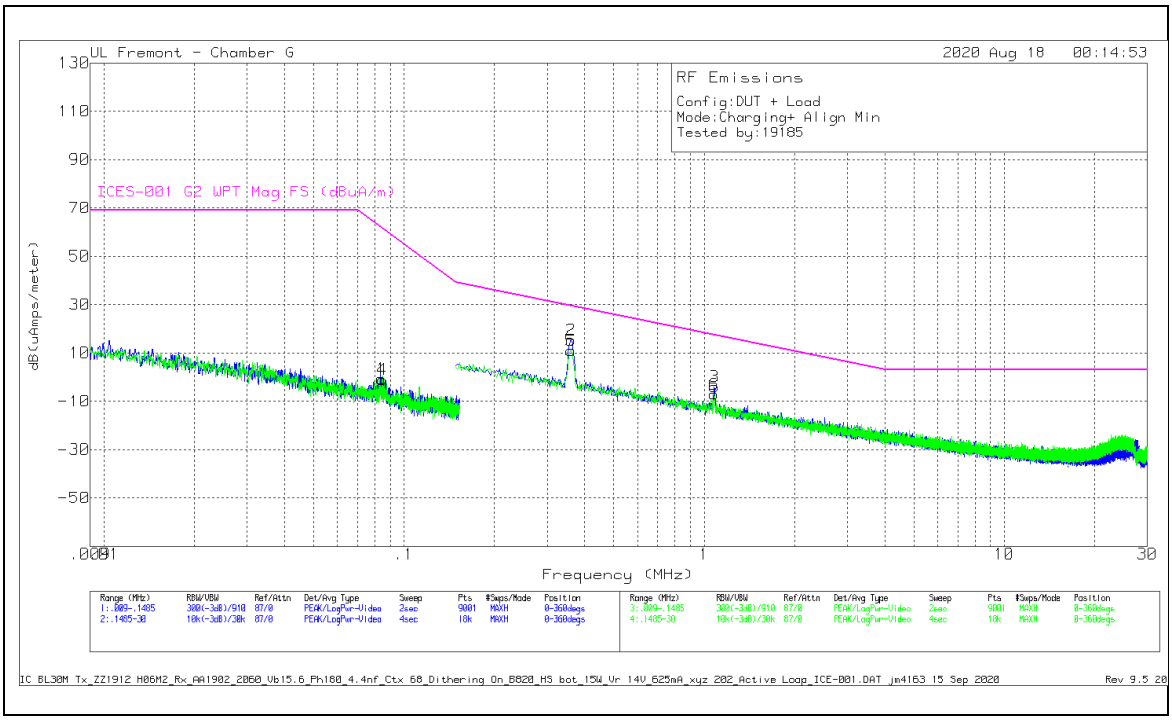
8.3.2. CONFIG 2: OPERATING WITH iPHONE @ 15W LOAD



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Corrected Reading dB(uAmps/meter)	CISPR11 G2 WPT Mag FS (dBuA/m)	Margin (dB)	Azimuth (Degs)
1	.06931	47.35	Qp	-39.5	.1	7.95	69	-61.05	224
	.01703	60.37	Pk	-35.2	.1	25.27	69	-43.73	224
4	.07328	46.97	Qp	-39.5	.1	7.57	67.17	-59.6	112
	.06729	52.93	Pk	-39.4	.1	13.63	69	-55.37	85
5	.36003	56.57	Qp	-40.6	.1	16.07	29.32	-13.25	249
	.35911	52.95	Pk	-40.6	.1	12.45	29.35	-16.9	154
2	.3601	52.57	Qp	-40.6	.1	12.07	29.32	-17.25	154
	.35955	56.83	Pk	-40.6	.1	16.33	29.33	-13	249
6	1.07904	33.53	Qp	-40.2	.1	-6.57	17.32	-23.89	346
	1.0791	34.97	Pk	-40.2	.1	-5.13	17.32	-22.45	346
3	1.08026	37.08	Qp	-40.2	.1	-3.02	17.31	-20.33	257
	1.0806	37.93	Pk	-40.2	.1	-2.17	17.31	-19.48	257

Pk - Peak detector
Qp - Quasi-Peak detector

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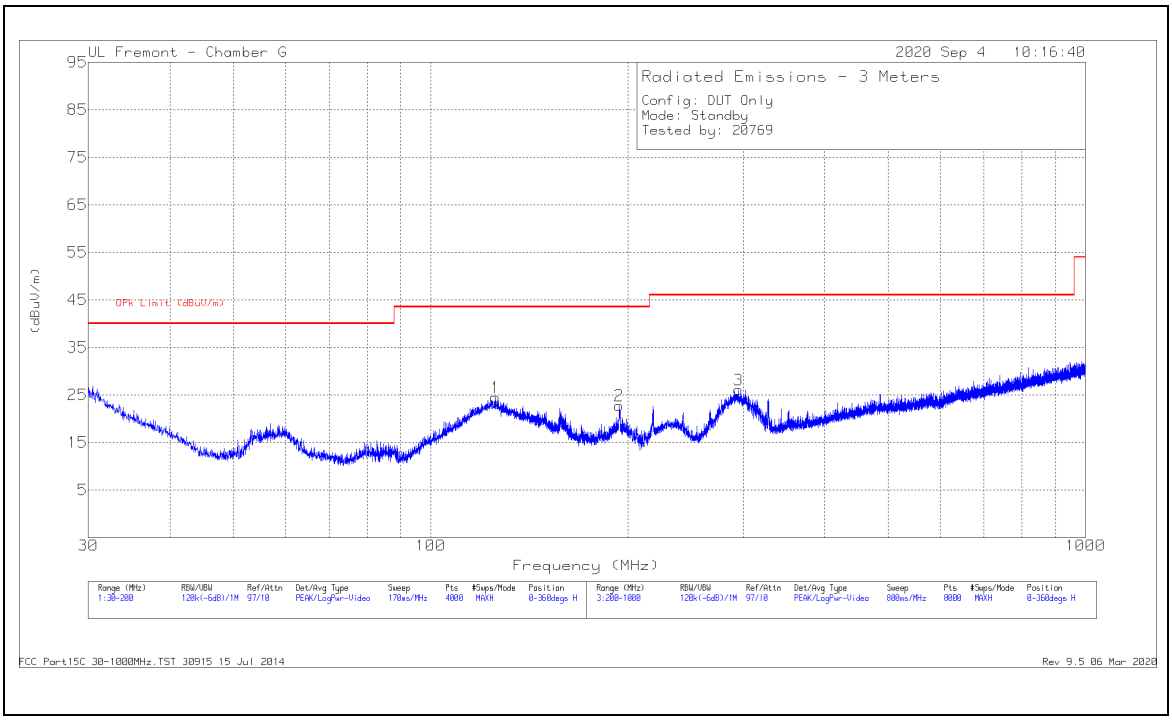
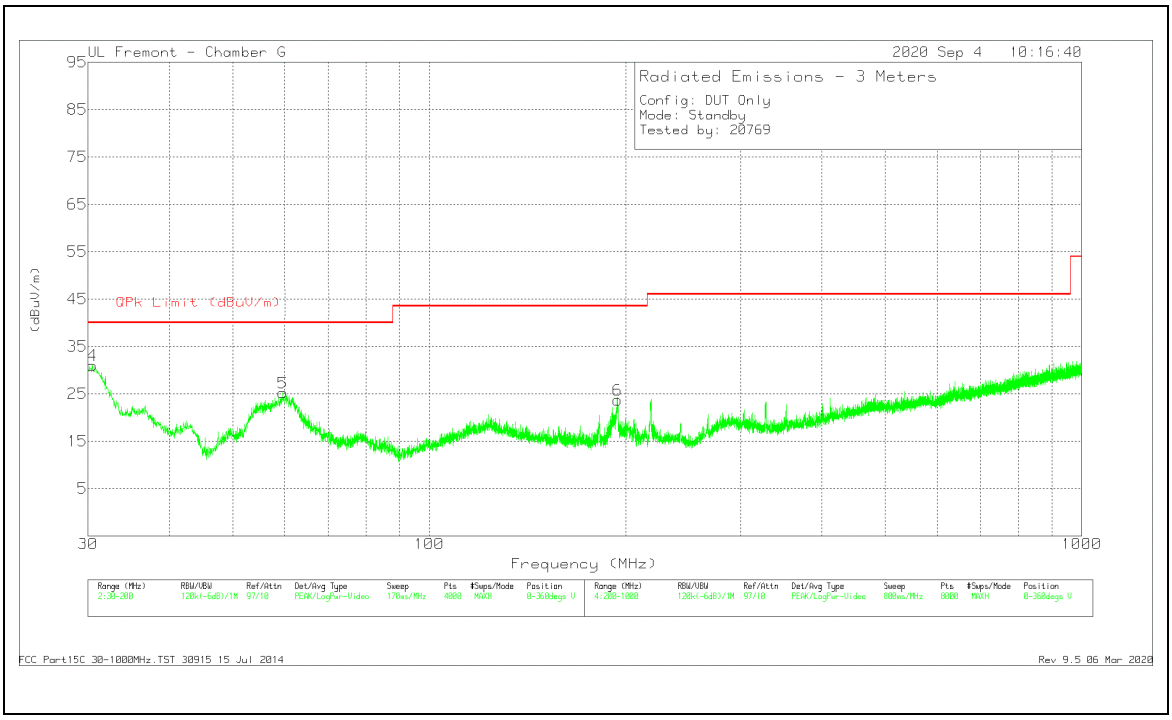
8.4. FCC TX SPURIOUS EMISSION 30 TO 1000 MHz FOR 360kHz

8.4.1. CONFIG 1: STANDBY

HORIZONTAL PLOT



VERTICAL PLOT



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DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 125.1207	28.89	Qp	19.8	-30	18.69	43.52	-24.83	11	198	H
4	30.7477	29.48	Qp	26.9	-31	25.38	40	-14.62	195	100	V
5	59.3927	37.17	Qp	13.4	-30.7	19.87	40	-20.13	82	100	V
6	194.0445	33.03	Qp	17.6	-29.5	21.13	43.52	-22.39	211	100	V
2	194.5034	31.34	Qp	17.7	-29.5	19.54	43.52	-23.98	211	137	H
3	296.0764	30.14	Qp	19.4	-28.9	20.64	46.02	-25.38	329	107	H

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

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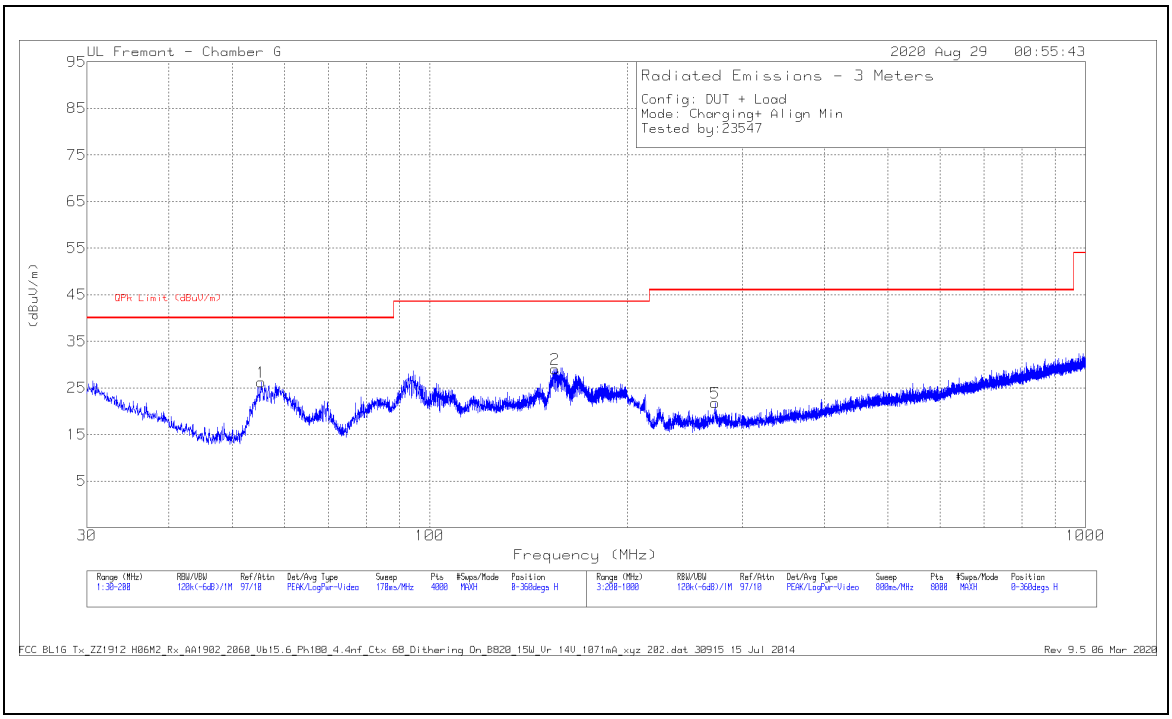
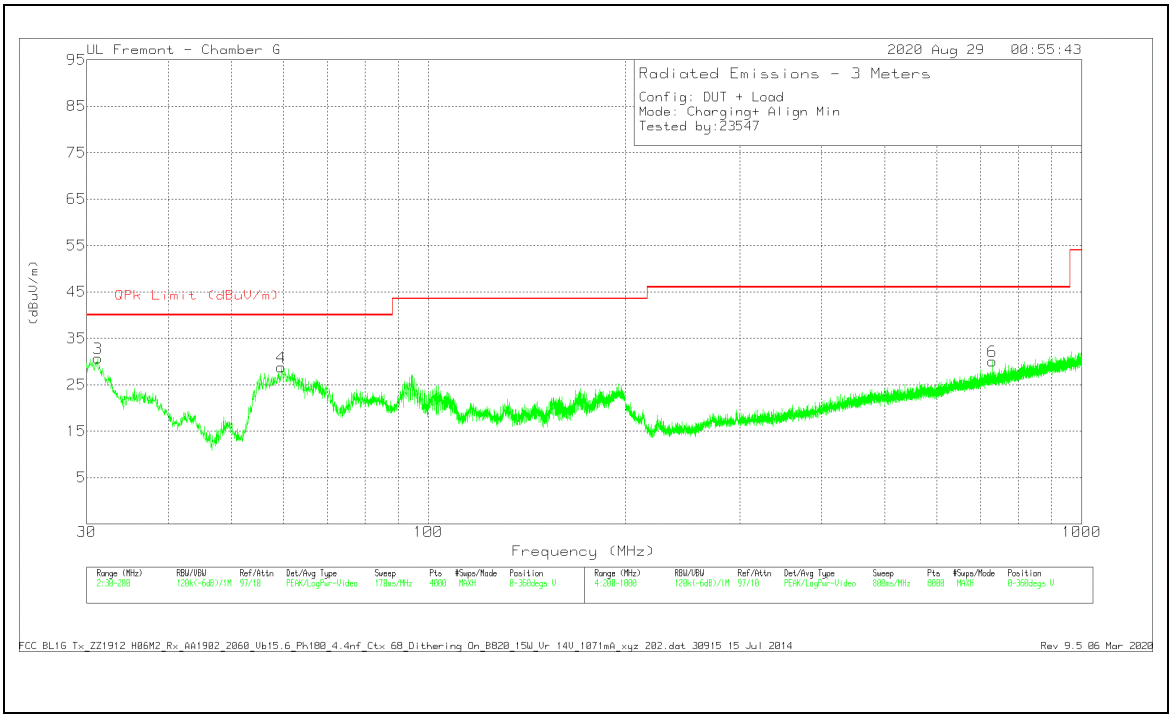
8.4.2. CONFIG 2: OPERATING WITH iPHONE @ 15W LOAD

HORIZONTAL PLOT



VERTICAL PLOT



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DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	* 272.1755	25.3	Qp	19.3	-29.1	15.5	46.02	-30.52	159	126	H
3	31.0242	29.51	Qp	26.7	-31	25.21	40	-14.79	227	104	V
1	55.4908	37.66	Qp	13.2	-30.7	20.16	40	-19.84	191	392	H
4	59.7726	41.75	Qp	13.5	-30.7	24.55	40	-15.45	108	116	V
2	155.0297	30.9	Qp	18.3	-29.9	19.3	43.52	-24.22	221	131	H
6	729.5334	19.96	Qp	26.7	-27.3	19.36	46.02	-26.66	121	202	V

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

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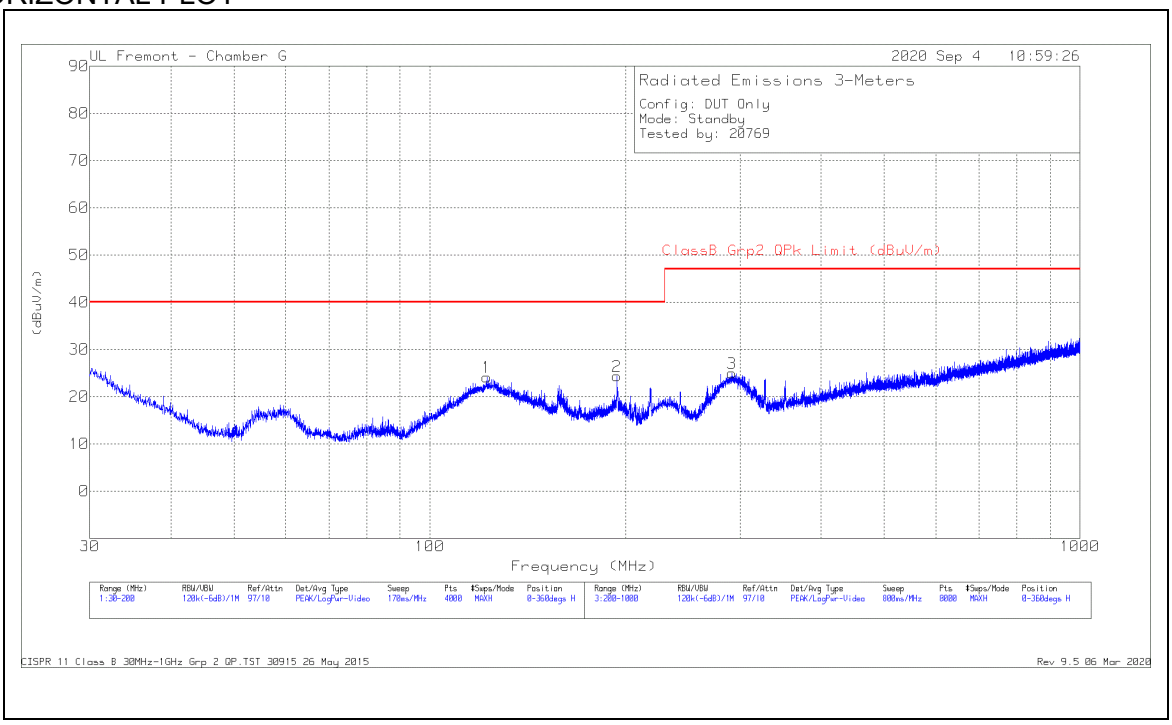
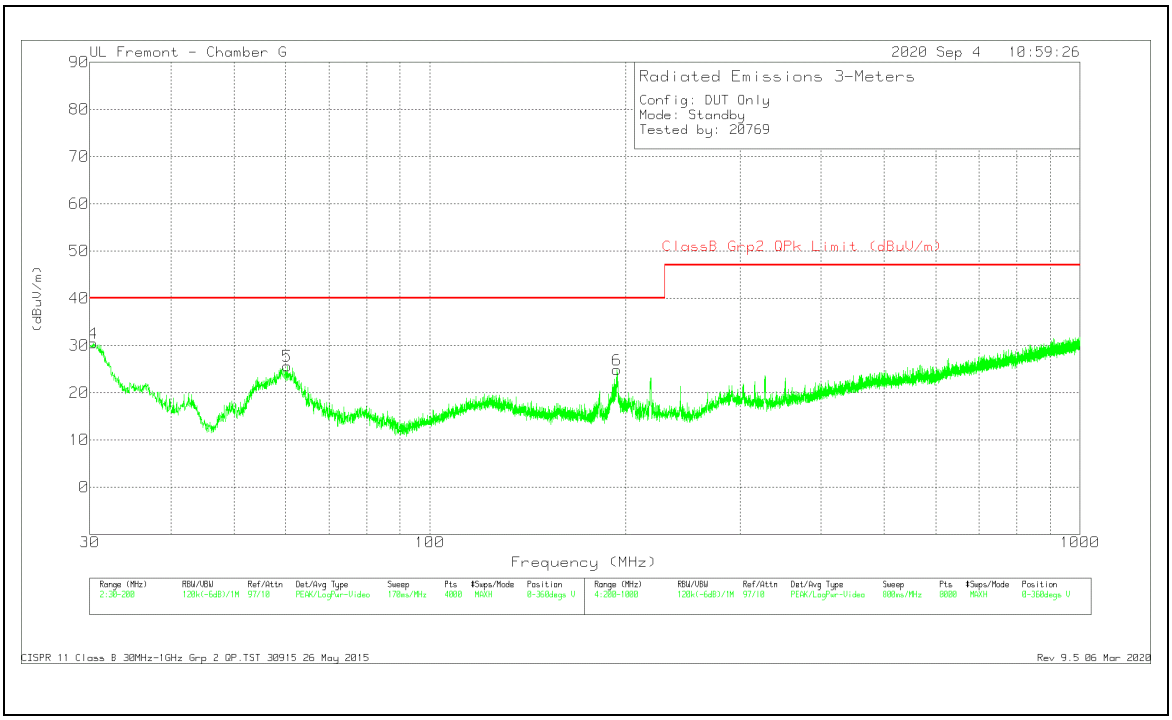
8.5. IC / CISPR 11 TX SPURIOUS EMISSION 30 TO 1000 MHz

8.5.1. CONFIG 1: STANDBY

HORIZONTAL PLOT



VERTICAL PLOT



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DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	ClassB Grp2 QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	30.7746	29.88	Qp	26.8	-31	25.68	40	-14.32	329	101	V
5	59.0689	36.67	Qp	13.4	-30.7	19.37	40	-20.63	139	124	V
1	123.9549	28.42	Qp	19.8	-30	18.22	40	-21.78	344	216	H
2	193.9274	31.64	Qp	17.6	-29.5	19.74	40	-20.26	211	194	H
6	193.9765	34.01	Qp	17.6	-29.5	22.11	40	-17.89	182	106	V
3	293.0199	29.91	Qp	19.4	-28.9	20.41	47	-26.59	331	100	H

Qp - Quasi-Peak detector

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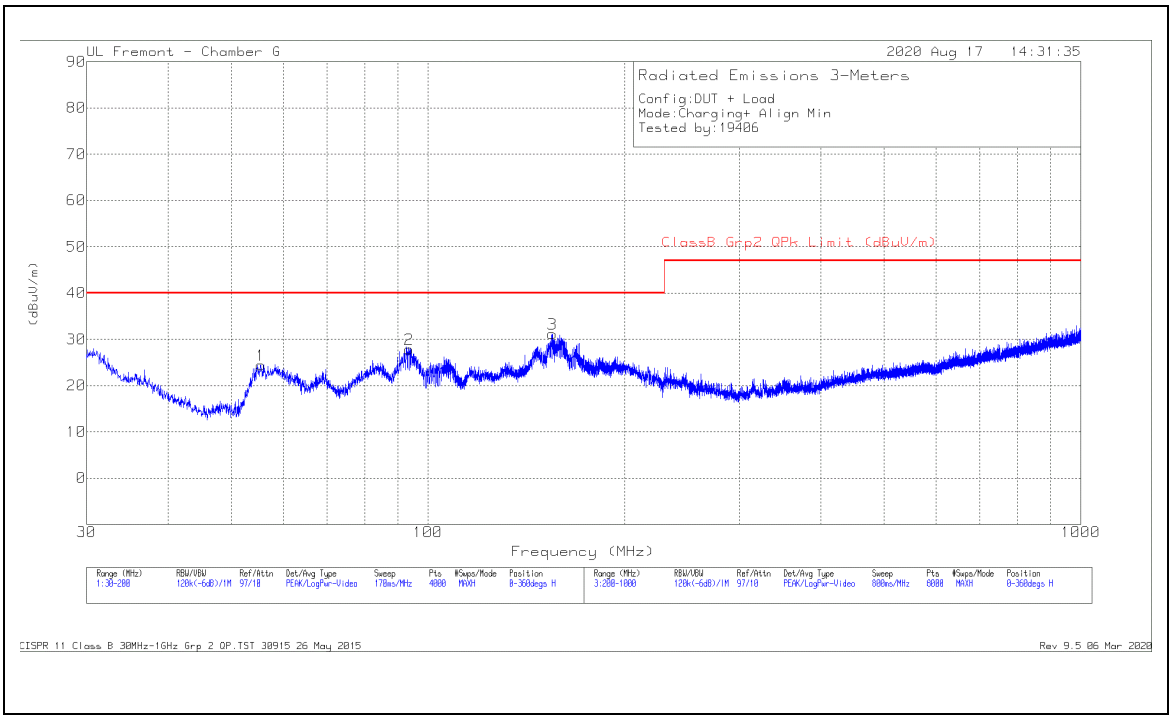
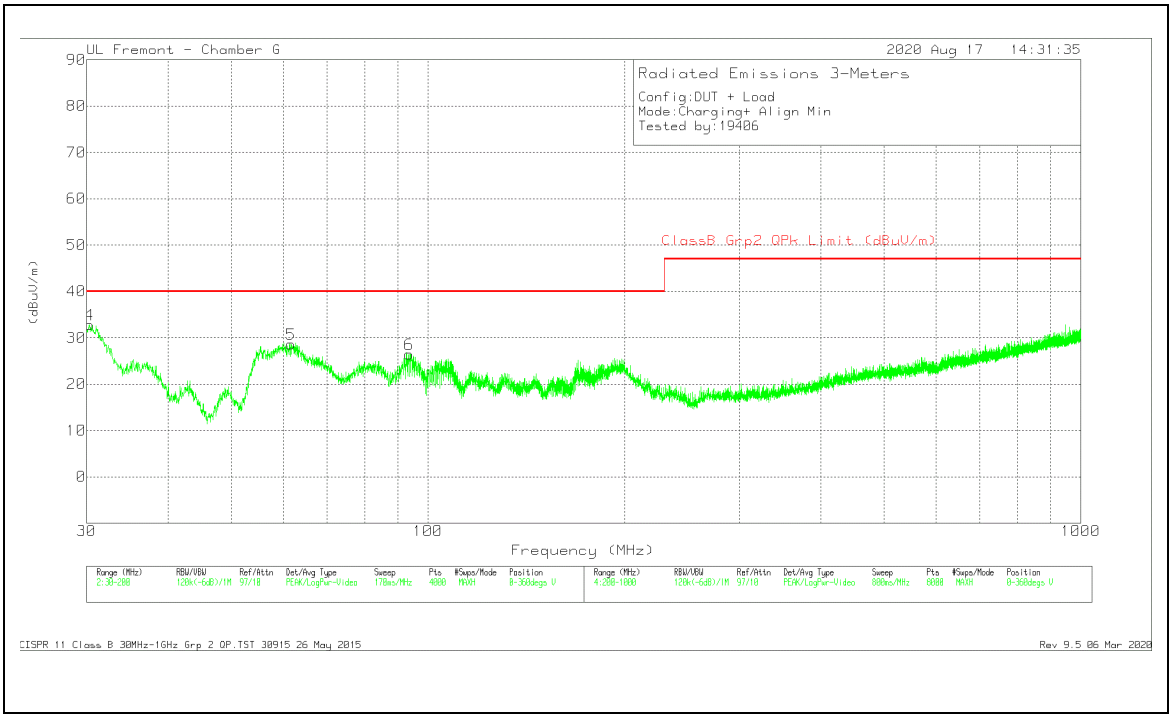
8.5.2. CONFIG 2: OPERATING WITH iPHONE @15W LOAD

HORIZONTAL PLOT



VERTICAL PLOT



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DATA

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	ClassB Grp2 QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
30.5261	32.27	Qp	27	-31	28.27	40	-11.73	251	100	V
55.2502	36.41	Qp	13.2	-30.7	18.91	40	-21.09	197	384	H
61.7151	41.46	Qp	13.7	-30.7	24.46	40	-15.54	109	106	V
93.2848	33.41	Qp	14.5	-30.4	17.51	40	-22.49	176	230	H
93.5653	28.77	Qp	14.5	-30.4	12.87	40	-27.13	222	100	V
155.0693	30.78	Qp	18.3	-29.9	19.18	40	-20.82	247	146	H

Qp - Quasi-Peak detector

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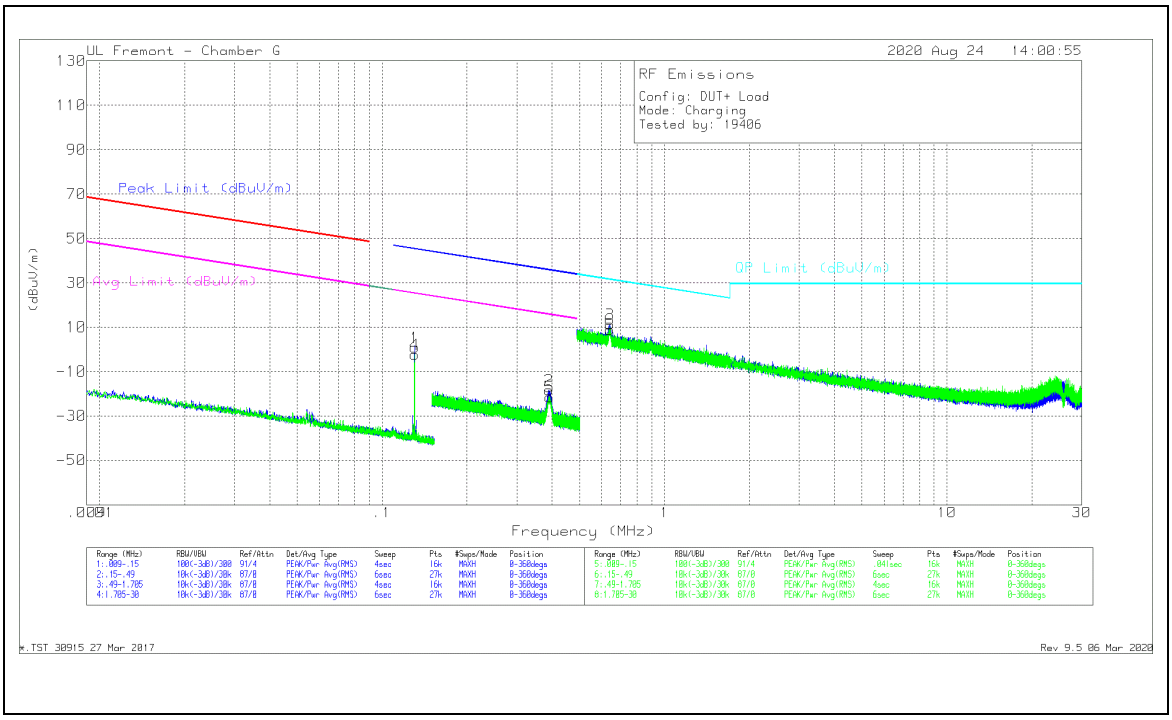
8.6. FCC TX FUNDAMENTAL AND SPURIOUS EMISSIONS FROM 9 kHz TO 30 MHz FOR 127kHz

8.6.1. OPERATING WITH iPHONE @ 7.5W LOAD



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 300 m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	PK Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.12742	69.68	Av	11.8	.1	-80	1.58	-	-	25.52	-23.94	245
	.12749	66.65	Pk	11.8	.1	-80	-1.45	45.52	-46.97	25.52	-26.97	340
4	.12781	64.71	Av	11.8	.1	-80	-3.39	-	-	25.49	-28.88	340
	.12825	70.62	Pk	11.8	.1	-80	2.52	45.46	-42.94	25.46	-22.94	245
2	.38258	43.38	Av	11	.1	-80	-25.52	-	-	15.95	-41.47	155
	.38295	47.34	Av	11	.1	-80	-21.56	-	-	15.95	-37.51	231
5	.38302	49.66	Pk	11	.1	-80	-19.24	35.94	-55.18	15.94	-35.18	231
	.38347	47.16	Pk	11	.1	-80	-21.74	35.93	-57.67	15.93	-37.67	155

Pk - Peak detector
Av - Average detection

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.63791	38.73	Qp	10.8	.1	-40	9.63	31.52	-21.89	251
6	.63942	34.92	Qp	10.8	.1	-40	5.82	31.49	-25.67	9

Qp - Quasi-Peak detector

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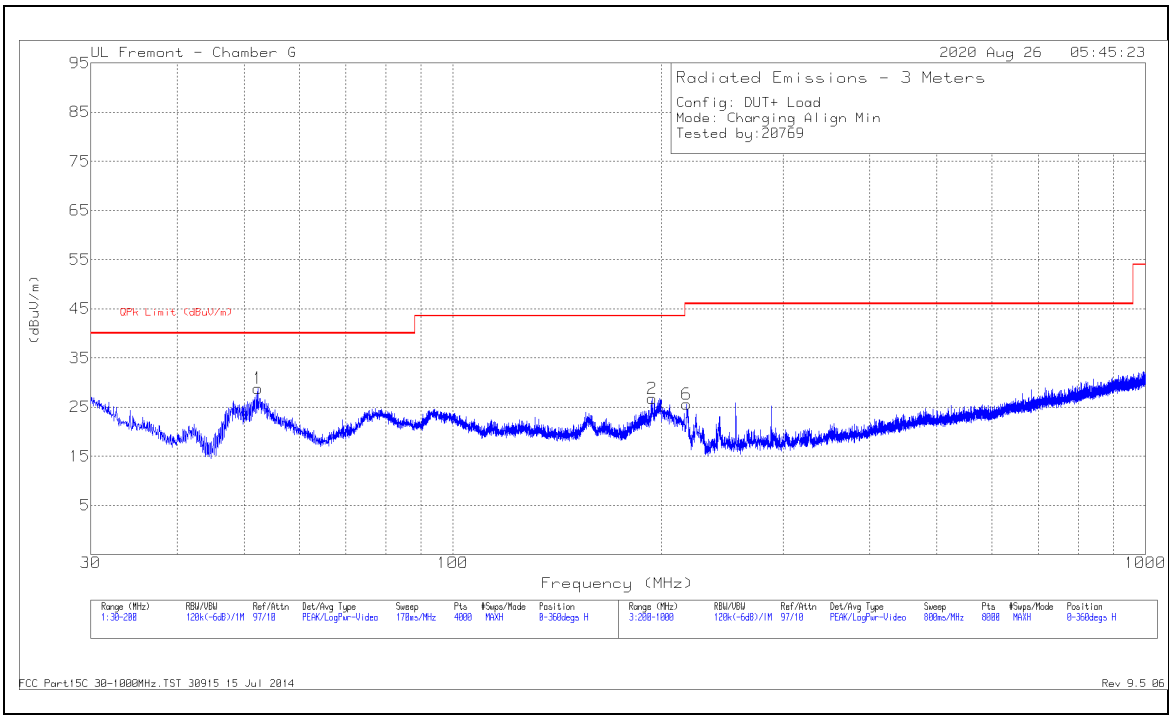
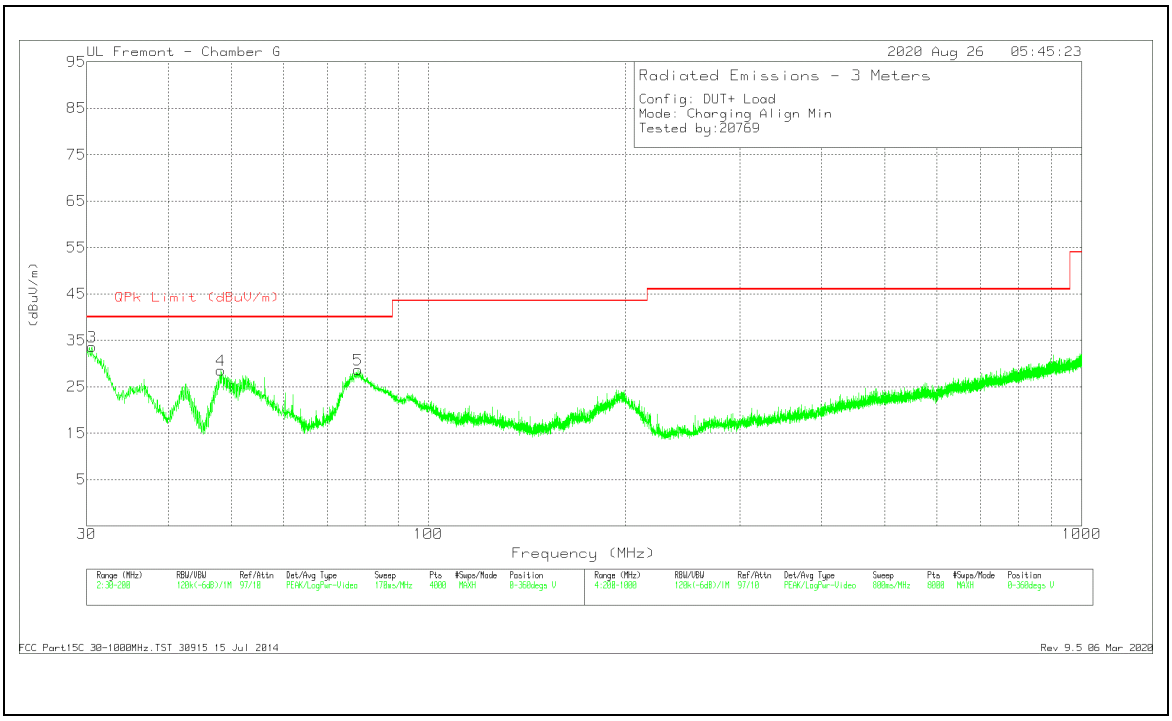
8.7. FCC TX SPURIOUS EMISSION 30 TO 1000 MHz FOR 127kHz

8.7.1. OPERATING WITH iPHONE @ 7.5W LOAD

HORIZONTAL PLOT



VERTICAL PLOT



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DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	30.4646	31.88	Qp	27	-31	27.88	40	-12.12	241	105	V
4	48.6922	41.62	Qp	14.3	-30.8	25.12	40	-14.88	303	101	V
1	52.6918	38.15	Qp	13.3	-30.8	20.65	40	-19.35	176	364	H
5	77.4174	40.85	Qp	13.9	-30.5	24.25	40	-15.75	80	100	V
2	193.9134	34.96	Qp	17.6	-29.5	23.06	43.52	-20.46	83	176	H
6	218.0743	38.89	Qp	16.6	-29.4	26.09	46.02	-19.93	67	100	H

Qp - Quasi-Peak detector

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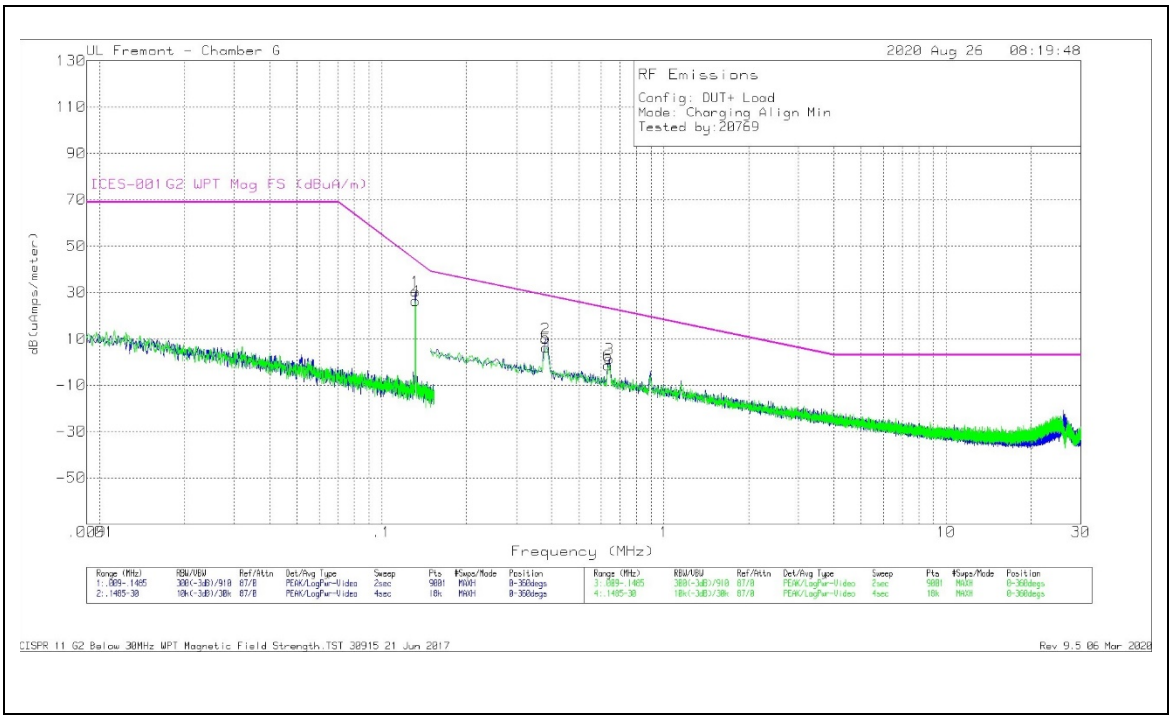
8.8. IC / CISPR 11 TX FUNDAMENTAL AND SPURIOUS EMISSIONS FROM 9 kHz TO 30 MHz FOR 127kHz

8.8.1. OPERATING WITH AIRPODS CHARGING CASE @ 1W LOAD



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Corrected Reading dB(uAmps/meter)	CISPR11 G2 WPT Mag FS (dBuA/m)	Margin (dB)	Azimuth (Degs)
1	.12779	71.12	Qp	-40.2	.1	31.02	44.99	-13.97	247
4	.12812	66.79	Qp	-40.2	.1	26.69	44.89	-18.2	329
2	.38322	50.18	Qp	-40.6	.1	9.68	28.64	-18.96	260
5	.38333	46.38	Qp	-40.6	.1	5.88	28.63	-22.75	342
3	.63776	41.28	Qp	-40.5	.1	.88	23.07	-22.19	257
6	.63915	37.78	Qp	-40.5	.1	-2.62	23.05	-25.67	157

Qp - Quasi-Peak detector

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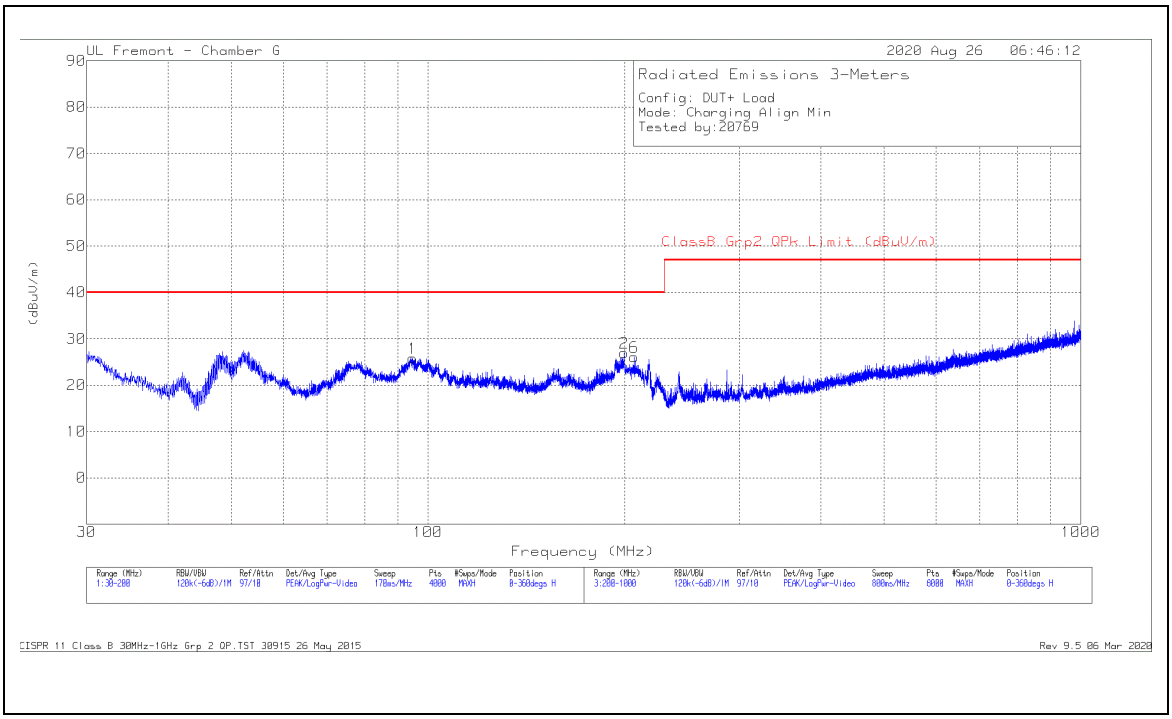
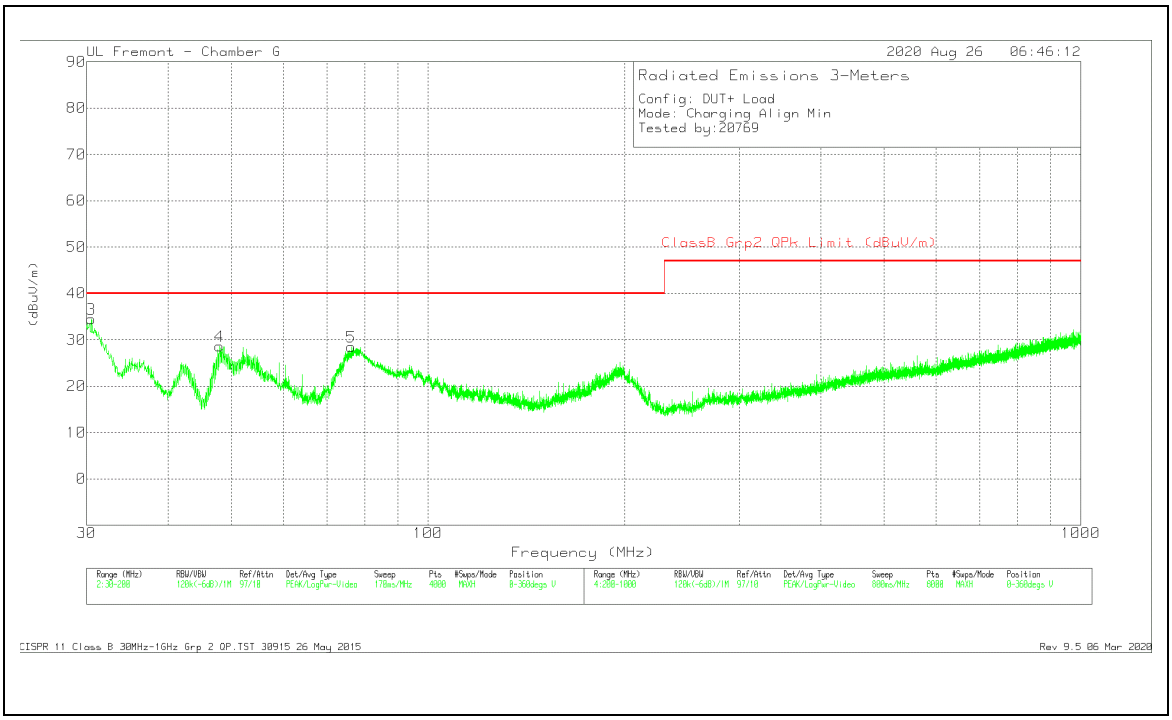
8.9. IC / CISPR 11 TX SPURIOUS EMISSION 30 TO 1000 MHz FOR 127kHz

8.9.1. OPERATING WITH AIRPODS CHARGING CASE @1W LOAD

HORIZONTAL PLOT



VERTICAL PLOT



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DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	ClassB Grp2 QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	30.5598	33.52	Qp	27	-31	29.52	40	-10.48	277	100	V
4	48.7156	41.92	Qp	14.2	-30.8	25.32	40	-14.68	304	100	V
5	76.5345	40.76	Qp	13.9	-30.5	24.16	40	-15.84	31	101	V
1	93.7937	39.33	Qp	14.6	-30.4	23.53	40	-16.47	181	314	H
2	198.3027	30.67	Qp	18.2	-29.5	19.37	40	-20.63	55	147	H
6	205.6049	34.87	Qp	16.8	-29.5	22.17	40	-17.83	91	169	H

Qp - Quasi-Peak detector

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9. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)
RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

ICES-001 Issue 5 Table 1:

Table 1: Conducted emission limits for induction cooking appliances (AC mains terminals)

Frequency range (MHz)	Appliances rated 100 V, without an earth connection Quasi-peak (dBµV)	Appliances rated 100 V, without an earth connection Average (dBµV)	All other appliances Quasi-peak (dBµV)	All other appliances Average (dBµV)
0.009 – 0.05	122	—	110	—
0.05 – 0.15	102 to 92 *	—	90 to 80 *	—
0.15 – 0.5	72 to 62 *	62 to 52 *	66 to 56 *	56 to 46 *
0.5 – 5	56	46	56	46
5 – 30	60	50	60	50

Note: The more stringent limit applies at transition frequencies.
* The limit level in dBµV decreases linearly with the logarithm of frequency.

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 ICES 01

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

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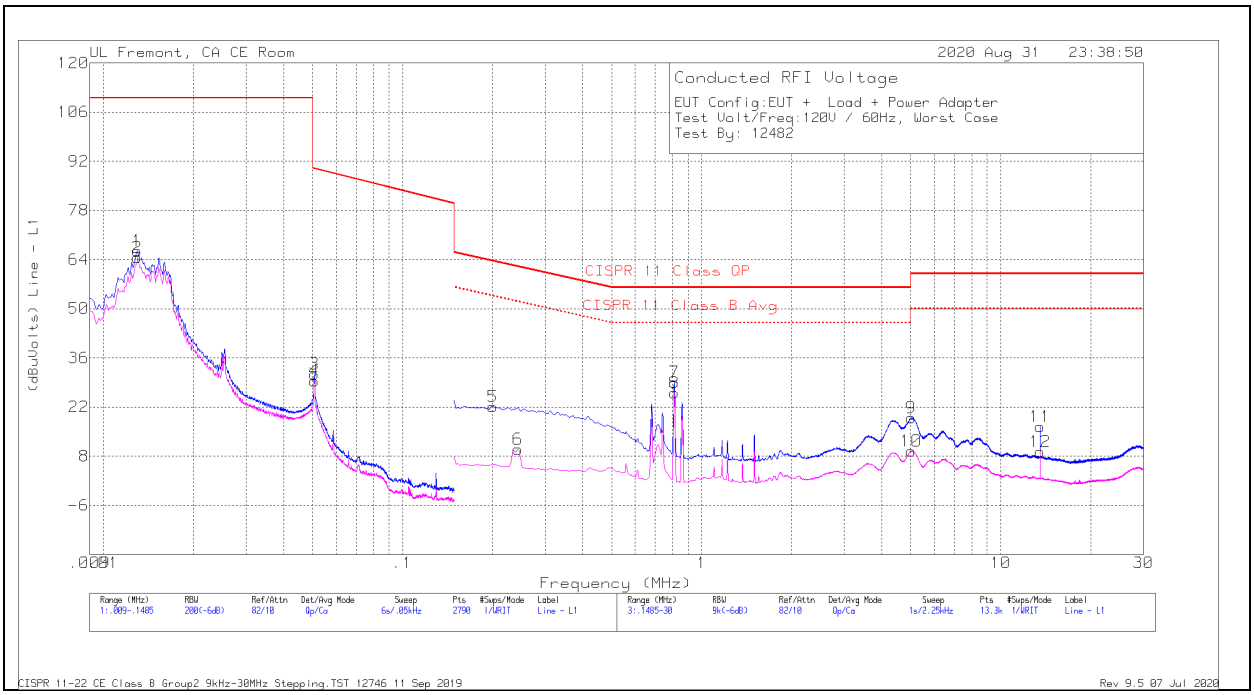
9.1.1. STANDBY MODE

LINE 1 RESULTS



WORST EMISSIONS

Range 1: Line - L1 .009 - .1485MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading (dBuVolts)	CISPR 11 Class QP	Margin (dB)	CISPR 11 Class B Avg	Margin (dB)
1	.013	56	Qp	.1	0	10.5	66.6	110	-43.4	-	-
2	.013	53.95	Ca	.1	0	10.5	64.55	-	-	-	-
3	.05075	21.37	Qp	.1	0	10	31.47	89.86	-58.39	-	-
4	.05075	19.41	Ca	.1	0	10	29.51	-	-	-	-

Range 3: Line - L1 .1485 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading (dBuVolts)	CISPR 11 Class QP	Margin (dB)	CISPR 11 Class B Avg	Margin (dB)
5	.20025	12.12	Qp	0	0	10	22.12	63.54	-41.42	-	-
6	.243	.03	Ca	0	0	10	10.03	-	-	51.99	-41.96
7	.81	19.06	Qp	0	0	10	29.06	56	-26.94	-	-
8	.81	16	Ca	0	0	10	26	-	-	46	-20
9	5.01975	8.72	Qp	0	.1	10.1	18.92	60	-41.08	-	-
10	5.01975	-.72	Ca	0	.1	10.1	9.48	-	-	50	-40.52
11	13.56075	6.04	Qp	.1	.2	10.1	16.44	60	-43.56	-	-
12	13.56075	-1.19	Ca	.1	.2	10.1	9.21	-	-	50	-40.79

Qp - Quasi-Peak detector
Ca - CISPR average detection

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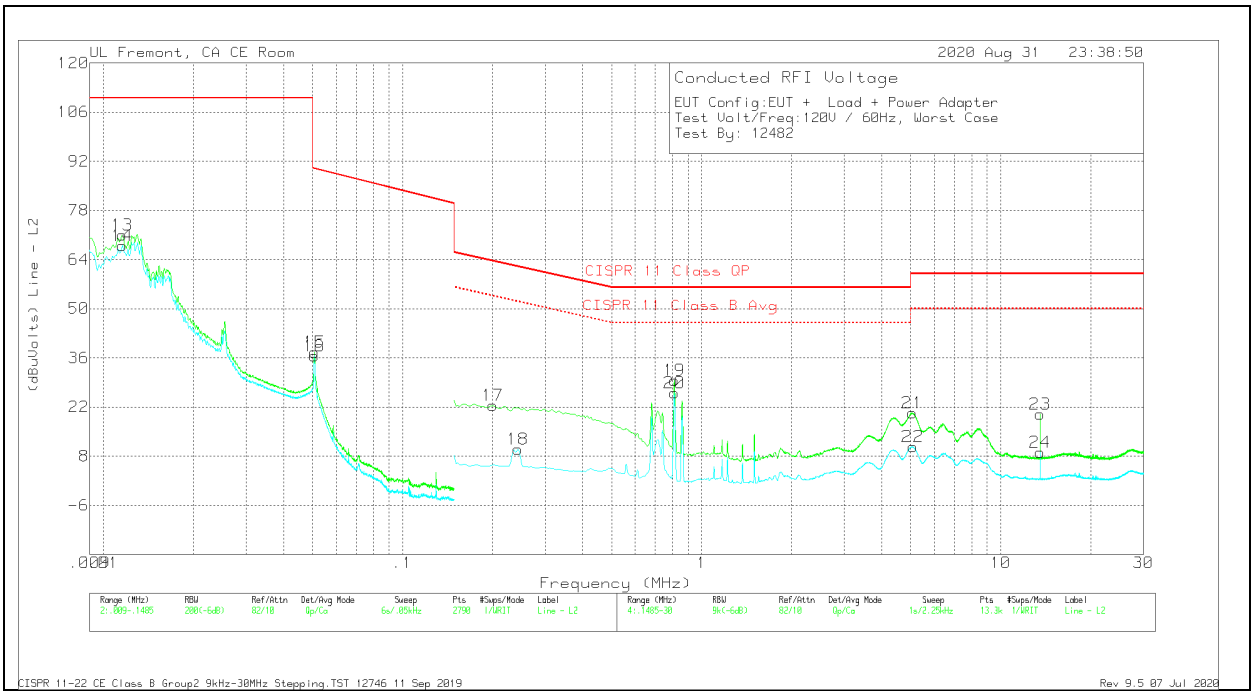
LINE 2 RESULTS



WORST EMISSIONS

Range 2: Line - L2 .009 - .1485MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading (dBuVolts)	CISPR 11 Class QP	Margin (dB)	CISPR 11 Class B Avg	Margin (dB)
13	.01155	60.38	Qp	.1	0	10.5	70.98	110	-39.02	-	-
14	.01155	57.36	Ca	.1	0	10.5	67.96	-	-	-	-
15	.05075	27.56	Qp	.1	0	10	37.66	89.86	-52.2	-	-
16	.05075	26.54	Ca	.1	0	10	36.64	-	-	-	-

Range 4: Line - L2 .1485 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading (dBuVolts)	CISPR 11 Class QP	Margin (dB)	CISPR 11 Class B Avg	Margin (dB)
17	.20025	12.48	Qp	0	0	10	22.48	63.54	-41.06	-	-
18	.243	-.09	Ca	0	0	10	9.91	-	-	51.99	-42.08
19	.81	19.53	Qp	0	0	10	29.53	56	-26.47	-	-
20	.81	16.1	Ca	0	0	10	26.1	-	-	46	-19.9
21	5.06025	10.1	Qp	0	.1	10.1	20.3	60	-39.7	-	-
22	5.07825	.46	Ca	0	.1	10.1	10.66	-	-	50	-39.34
23	13.56075	9.53	Qp	.1	.2	10.1	19.93	60	-40.07	-	-
24	13.56075	-1.29	Ca	.1	.2	10.1	9.11	-	-	50	-40.89

Qp - Quasi-Peak detector
Ca - CISPR average detection

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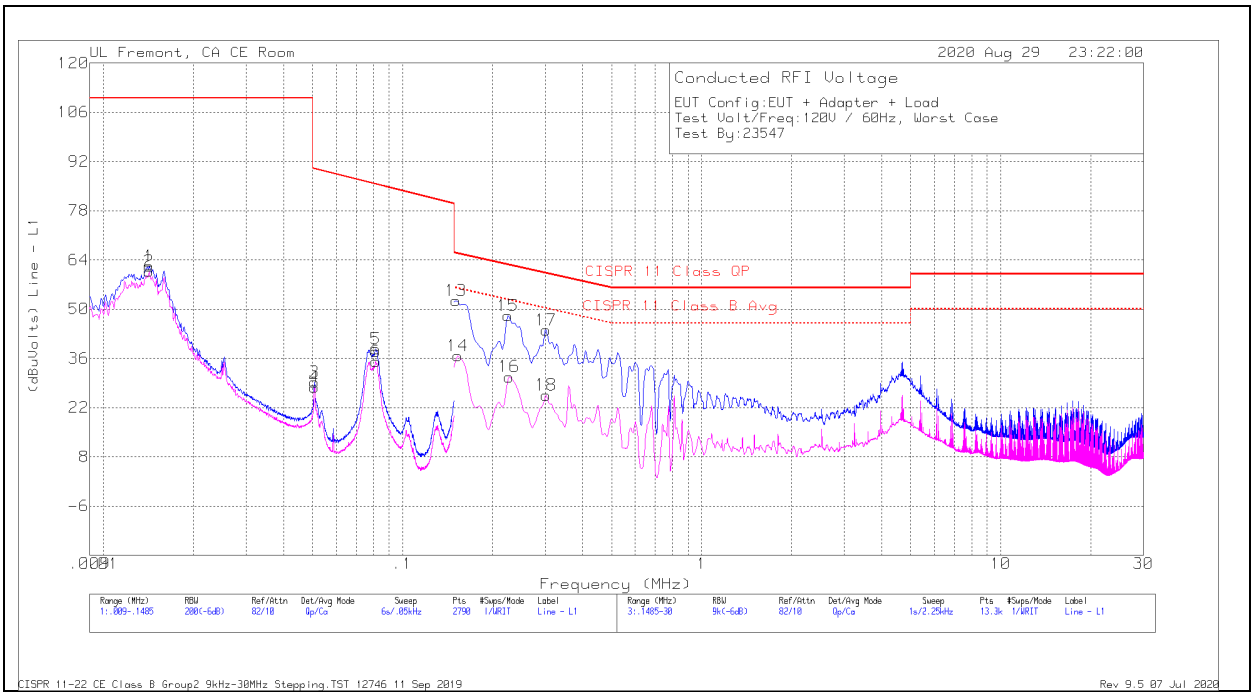
9.1.2. OPERATING MODE WITH iPHONE @ 15W LOAD

LINE 1 RESULTS



WORST EMISSIONS

Range 1: Line - L1 .009 - .1485MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading (dBuVolts)	CISPR 11 Class QP	Margin (dB)	CISPR 11 Class B Avg	Margin (dB)
1	.01425	51.82	Qp	.1	0	10.4	62.32	110	-47.68	-	-
2	.01425	50.26	Ca	.1	0	10.4	60.76	-	-	-	-
3	.0508	19.16	Qp	.1	0	10	29.26	89.85	-60.59	-	-
4	.05085	17.72	Ca	.1	0	10	27.82	-	-	-	-
5	.0814	28.59	Qp	.1	0	10	38.69	85.52	-46.83	-	-
6	.0813	25	Ca	.1	0	10	35.1	-	-	-	-

Range 3: Line - L1 .1485 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading (dBuVolts)	CISPR 11 Class QP	Margin (dB)	CISPR 11 Class B Avg	Margin (dB)
13	.15075	42.39	Qp	.1	0	10	52.49	65.88	-13.39	-	-
14	.153	26.66	Ca	.1	0	10	36.76	-	-	55.84	-19.08
15	.225	38.13	Qp	0	0	10	48.13	62.58	-14.45	-	-
16	.22725	20.76	Ca	0	0	10	30.76	-	-	52.55	-21.79
17	.3015	33.97	Qp	0	0	10	43.97	60.17	-16.2	-	-
18	.3015	15.58	Ca	0	0	10	25.58	-	-	50.2	-24.62

Qp - Quasi-Peak detector
Ca - CISPR average detection

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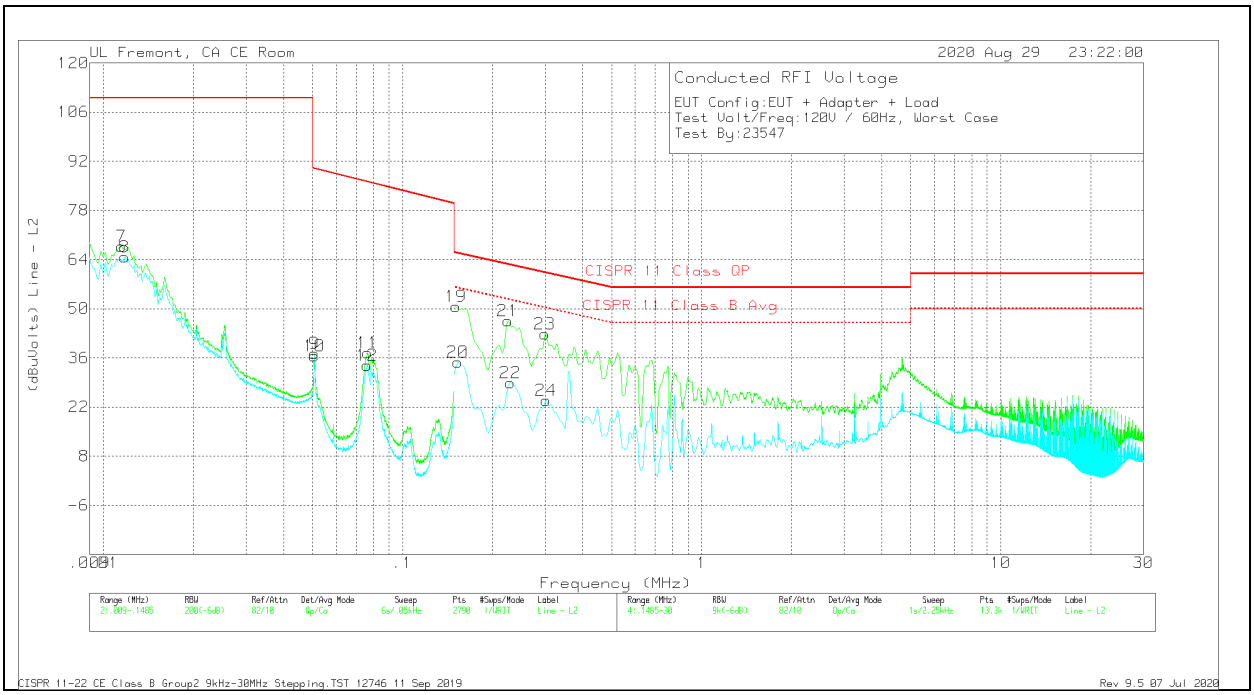
LINE 2 RESULTS



WORST EMISSIONS

Range 2: Line - L2 .009 - .1485MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading (dBuVolts)	CISPR 11 Class QP	Margin (dB)	CISPR 11 Class B Avg	Margin (dB)
7	.0115	57.17	Qp	.1	0	10.5	67.77	110	-42.23	-	-
8	.0118	54.18	Ca	.1	0	10.5	64.78	-	-	-	-
9	.05075	27.15	Qp	.1	0	10	37.25	89.86	-52.61	-	-
10	.05075	26.4	Ca	.1	0	10	36.5	-	-	-	-
11	.0763	27.29	Qp	.1	0	10	37.39	86.12	-48.73	-	-
12	.07625	23.76	Ca	.1	0	10	33.86	-	-	-	-

Range 4: Line - L2 .1485 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading (dBuVolts)	CISPR 11 Class QP	Margin (dB)	CISPR 11 Class B Avg	Margin (dB)
19	.15075	40.71	Qp	0	0	10	50.71	65.88	-15.17	-	-
20	.153	24.8	Ca	0	0	10	34.8	-	-	55.84	-21.04
21	.225	36.59	Qp	0	0	10	46.59	62.58	-15.99	-	-
22	.2295	18.91	Ca	0	0	10	28.91	-	-	52.47	-23.56
23	.29925	32.76	Qp	0	0	10	42.76	60.23	-17.47	-	-
24	.3015	13.83	Ca	0	0	10	23.83	-	-	50.2	-26.37

Qp - Quasi-Peak detector
Ca - CISPR average detection

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10. SETUP PHOTOS

Please refer to 13181006-EP1V1 for setup photos

END OF TEST REPORT

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