CERTIFICATION TEST REPORT

Report Number. : 13336566-E13V2

Applicant	:	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	:	A2406
FCC ID	:	BCG-E3546A
IC	:	579C-E3546A
EUT Description	:	SMARTPHONE
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-216 ISSUE 2 ISED RSS-GEN ISSUE 5

Date of Issue:
September 23, 2020

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 319-4000
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NVLAP TESTING

NVLAP Lab code: 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	9/21/2020	Initial Issue	Chin Pang
V2	9/23/2020	Update TCB comments	Chin Pang

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
ONE APPLE PARK WAY
CUPERTINO, CA 95014,

EUT DESCRIPTION SMARTPHONE

MODEL: A2406

SERIAL NUMBER: (Original): G6TD200S04FR
(Spot Check): G6TD101004NG

DATE TESTED: JULY 28, 2020 TO AUGUST 07, 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
UL Verification Services Inc. By:

Chin Pang
Senior Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:

Joe Vang
Test Engineer
Consumer Technology Division
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, 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 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 ISED Site Code:	47266 Benicia Street ISED Site Code:	47658 Kato Rd ISED Site Code:
☐ 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)	

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

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	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	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. INTRODUCTION OF TEST DATA REUSE

5.1. EUT DESCRIPTION

The Apple iPhone is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, 5G, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS, NFC and WPT. All models support at least one UICC based SIM. The second SIM is either an UICC based p-SIM (physical SIM) or e-SIM (electronic SIM). The device supports a built-in inductive charging transmitter and receiver. The rechargeable battery is not user accessible.

5.2. INTRODUCTION

This application for certification is leveraging the data reuse procedures from KDB 484596 D01 based on reference FCC ID: BCG-E3545A, IC: 579C-E3545A to cover variant model BCG-E3546A, 579C-E3546A. The major difference between the parent/reference model and the variant model is the depopulation in the variant model of the mmWave transmitter. All other circuitry and features are identical. The data reuse test plan was approved via manufacturer KDB inquiry.

5.3. SPOT CHECK VERIFICATION RESULTS SUMMARY

Spot check verification has been done on device model A2406, FCC ID: BCG-E3546A, IC: 579C-E3546A for radiated spurious and fundamental in accordance with the Test Plan that was approved via KDB inquiry.

Item		Original model		Spot check model		Delta (dB)	
		A2341		A2406			
		BCG-E3545A, 579C-E3545A		BCG-E3546A, 579C-E3546A			
	Frequency	FCC	IC	FCC	IC	FCC	IC
Fundamental	360kHz	-17.59 dBuV/m	12.78 dBuA/m	-15.41 dBuV/m	12.35 dBuA/m	2.18	-0.43
RSE	190.49MHz (FCC) 157.5209 (IC)	28.18 dBuV/m	26.06 dBuV/m	28.25 dBuV/m	26.95 dBuV/m	0.07	0.89

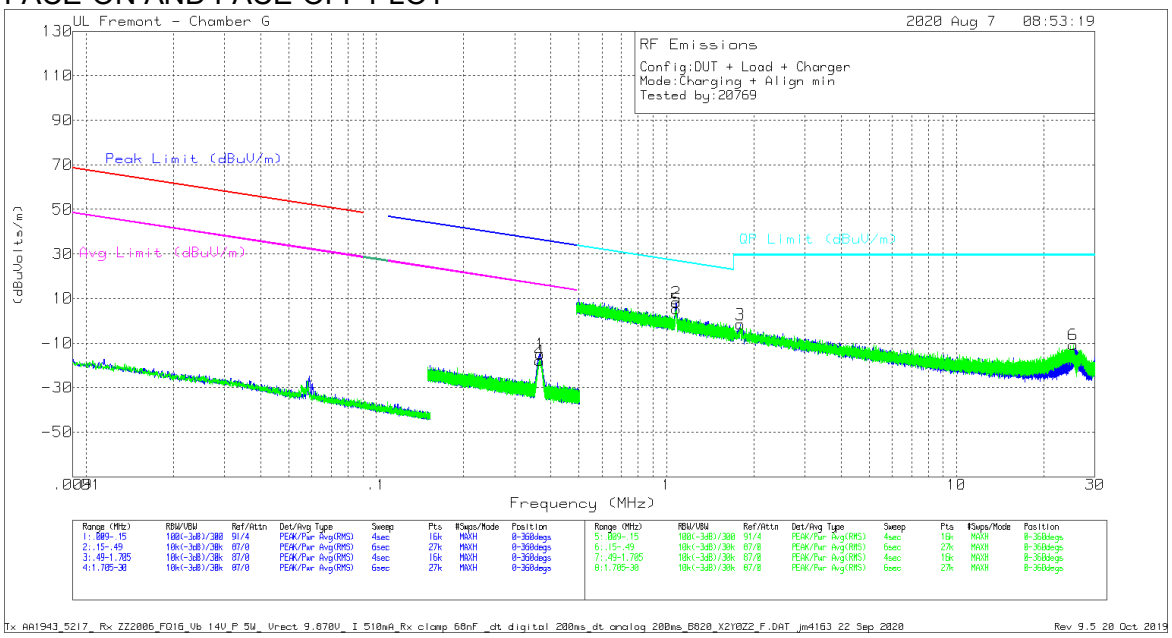
Comparison of the models, upper deviation is within 3dB range and all tests are under FCC Technical Limits. The test report for FCC ID BCG-E3545A, IC: 579C-E3545A is therefore being used to support the application for certification for FCC ID: BCG-E3546A & IC: 579C-E3546A.

SPOT CHECK DATA

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

OPERATING WITH LOAD

FACE-ON AND FACE-OFF PLOT



Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuVolts/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	.36579	51.09	Pk	10.8	.1	-80	-18.01	36.34	-54.35	16.34	-34.35	0-360
1	.36744	54.21	Pk	10.8	.1	-80	-14.89	36.3	-51.19	16.3	-31.19	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 30m	Corrected Reading (dBuVolts/m)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
5	1.08082	33.99	Pk	11.2	.1	-40	5.29	26.95	-21.66	0-360
2	1.08128	36.97	Pk	11.2	.1	-40	8.27	26.94	-18.67	0-360
3	1.79827	26.84	Pk	11.3	.2	-40	-1.66	29.5	-31.16	0-360
6	25.24727	19.13	Pk	9.3	.8	-40	-10.77	29.5	-40.27	0-360

Pk - Peak detector

Radiated Emissions

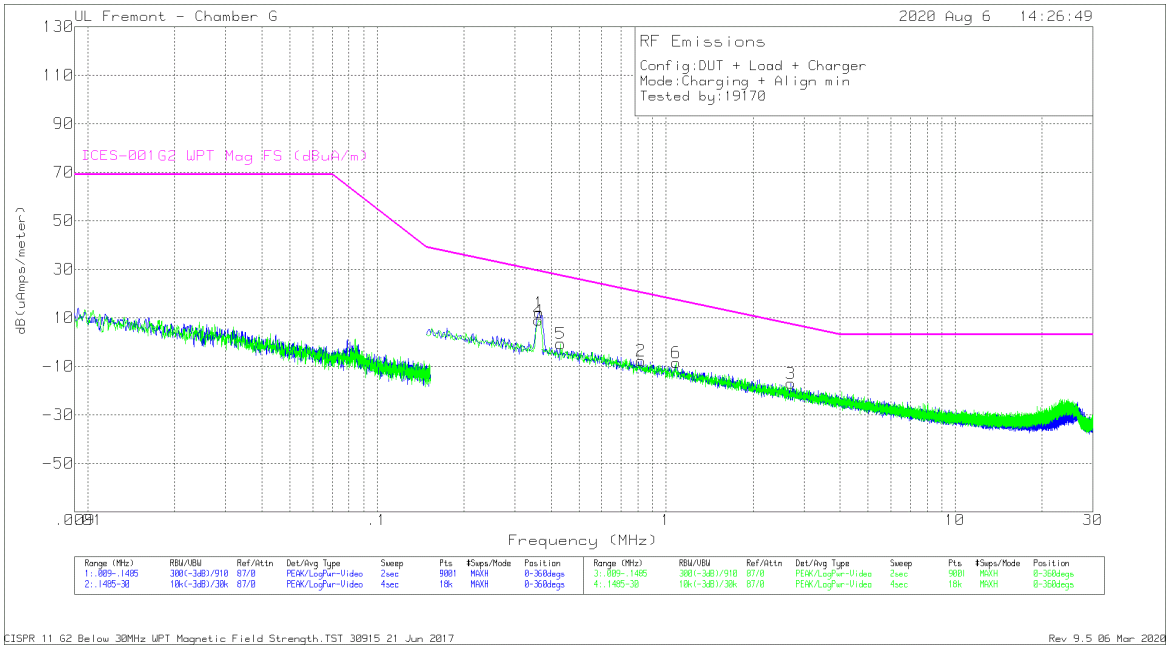
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuVolts/m)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
4	0.35966	50.33	Qp	10.8	0.1	-80	-18.77	36.34	-55.11	16.34	-35.11	333
1	0.36022	53.69	Qp	10.8	0.1	-80	-15.41	36.3	-51.71	16.3	-31.71	75

Qp - Quasi-Peak detector

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

OPERATING WITH LOAD

FACE-ON AND FACE-OFF PLOT



DATA

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)
.35982	49.24	Qp	-40.6	.1	8.74	29.33	-26.39	0
.36013	52.85	Qp	-40.6	.1	12.35	29.32	-26.04	194

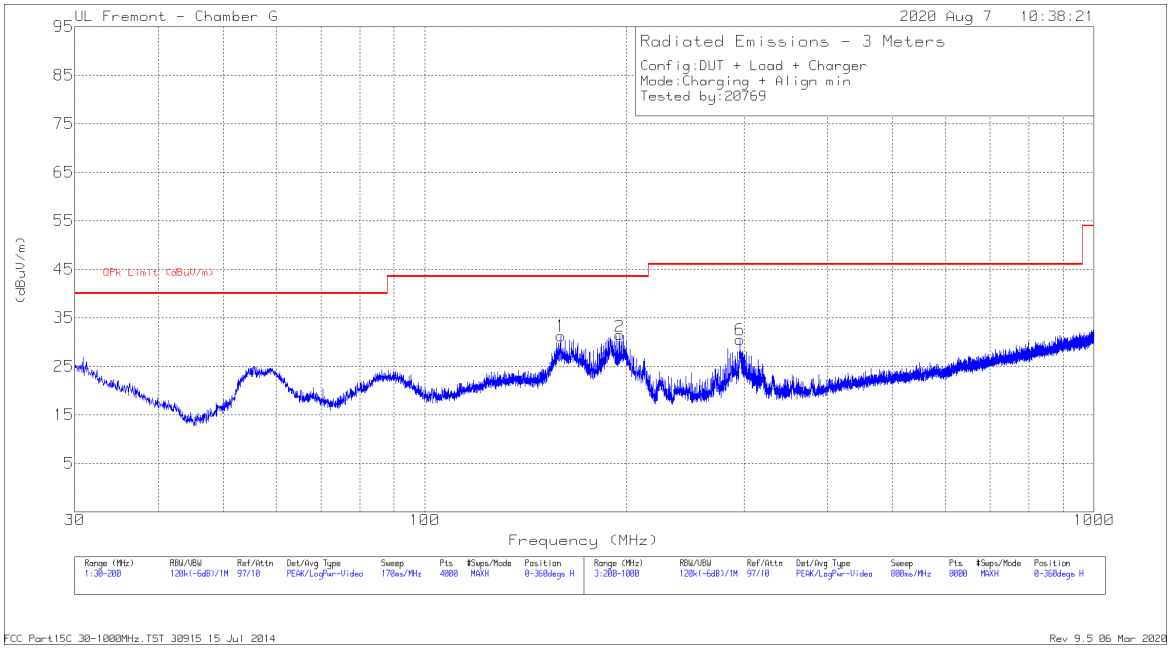
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Corrected Reading dB(uAmps/ meter)	CISPR11 G2 WPT Mag FS (dBuA/m)	Margin (dB)	Azimuth (Degs)
4	.35741	45.16	Pk	-40.6	.1	4.66	29.4	-24.74	0-360
1	.35907	46.98	Pk	-40.6	.1	6.48	29.35	-22.87	0-360
5	.43202	39.75	Pk	-40.5	.1	-.65	27.33	-27.98	0-360
2	.81833	32.69	Pk	-40.5	.1	-7.71	20.34	-28.05	0-360
6	1.08361	31.64	Pk	-40.2	.1	-8.46	17.28	-25.74	0-360
3	2.70514	22.82	Pk	-40.1	.2	-17.08	7.28	-24.36	0-360

Qp - Quasi-Peak detector

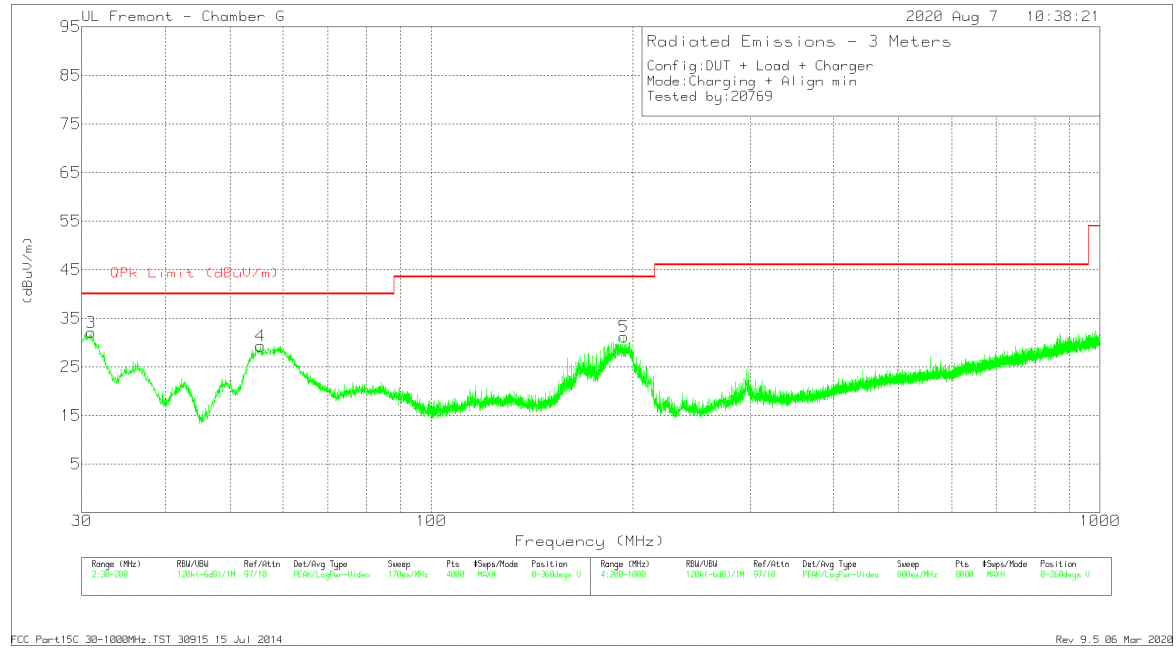
5.3.3. **FCC TX SPURIOUS EMISSION 30 TO 1000 MHz**

OPERATING WITH LOAD

HORIZONTAL PLOT



VERTICAL PLOT



DATA

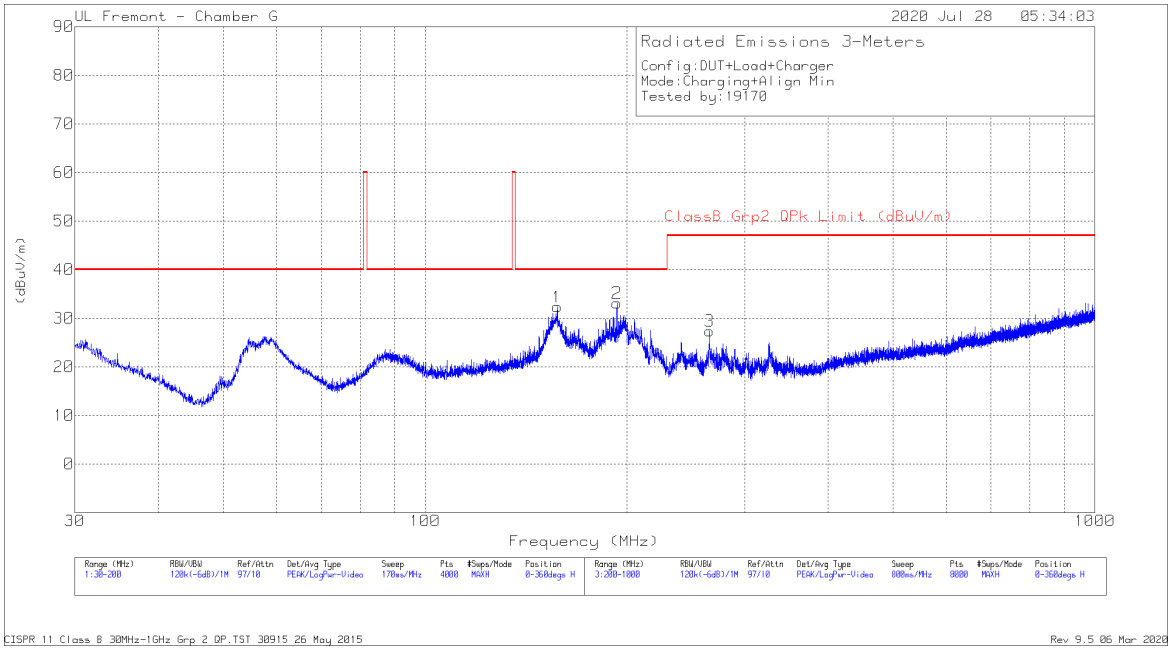
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	31.0203	34.4	QP	26.7	-30.1	32.1	40	-7.9	0-360	100	V
4	55.5066	42.81	QP	13.2	-30.7	25.31	40	-14.69	0-360	100	V
1	159.7861	39.82	QP	18.2	-29.8	28.22	43.52	-15.3	0-360	201	H
2	193.1147	40.25	QP	17.5	-29.5	28.25	43.52	-15.27	0-360	101	H
5	193.1572	38.5	QP	17.5	-29.5	26.5	43.52	-17.02	0-360	100	V
6	295.7124	37.01	QP	19.4	-28.9	27.51	46.02	-18.51	0-360	99	H

Pk - Peak detector

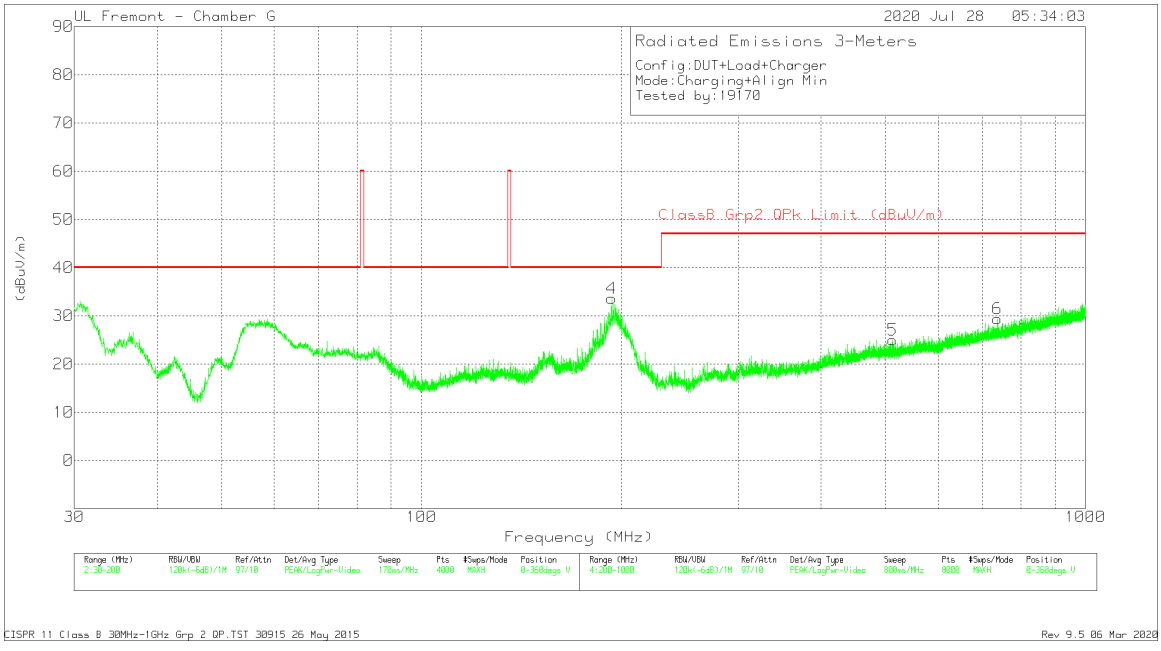
5.3.4. IC / CISPR 11 TX SPURIOUS EMISSION 30 TO 1000 MHz

OPERATING WITH LOAD

HORIZONTAL PLOT



VERTICAL PLOT



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
1	157.5623	39.29	Qp	18.3	-29.8	27.79	40	-12.21	106	172	H
2	193.234	37.51	Qp	17.5	-29.5	25.51	40	-14.49	175	103	V
4	193.2405	38.95	Qp	17.5	-29.5	26.95	40	-13.05	85	110	H
3	266.0488	29.61	Qp	18.9	-29.1	19.41	47	-27.59	145	100	H
5	512.2968	20	Qp	23.7	-27.9	15.8	47	-31.2	142	228	V
6	736.5543	19.72	Qp	26.7	-27.2	19.22	47	-27.78	153	177	V

Qp - Quasi-Peak detector

CISPR 11 Class B 30MHz-1GHz Grp 2 QP.TST 30915 26 May 2015
Rev 9.5 06 Mar 2020

5.4. REFERENCE DETAIL

Reference application that contains the reference data which is attached to this report in Appendix A.

Equipment Class	Reference FCC ID & IC	Reference Report	Report Title/Section
DCD	BCG-E3545A 579C-E3545A	13259315-E13	FCC IC_WPT Report / All sections

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT is a smartphone which connected to the AC/DC adapter via USB-C cable, and the inductive charging coil to charge WPT accessories. For the entire radiated emissions test, the EUT was performed based on the worst case on model A2341

Configuration	Descriptions
Operating	EUT and Load powered by AC/DC adapter

For below 30MHz testing, investigation was done on three antenna orientations: RX antenna Face-on, Face-off and horizontal (parallel to ground). The worst-case configurations were determined on RX antenna Face-on and Face-off; therefore, all final tests were performed using these two orientations.

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.

5.6. DESCRIPTION OF TEST SETUP

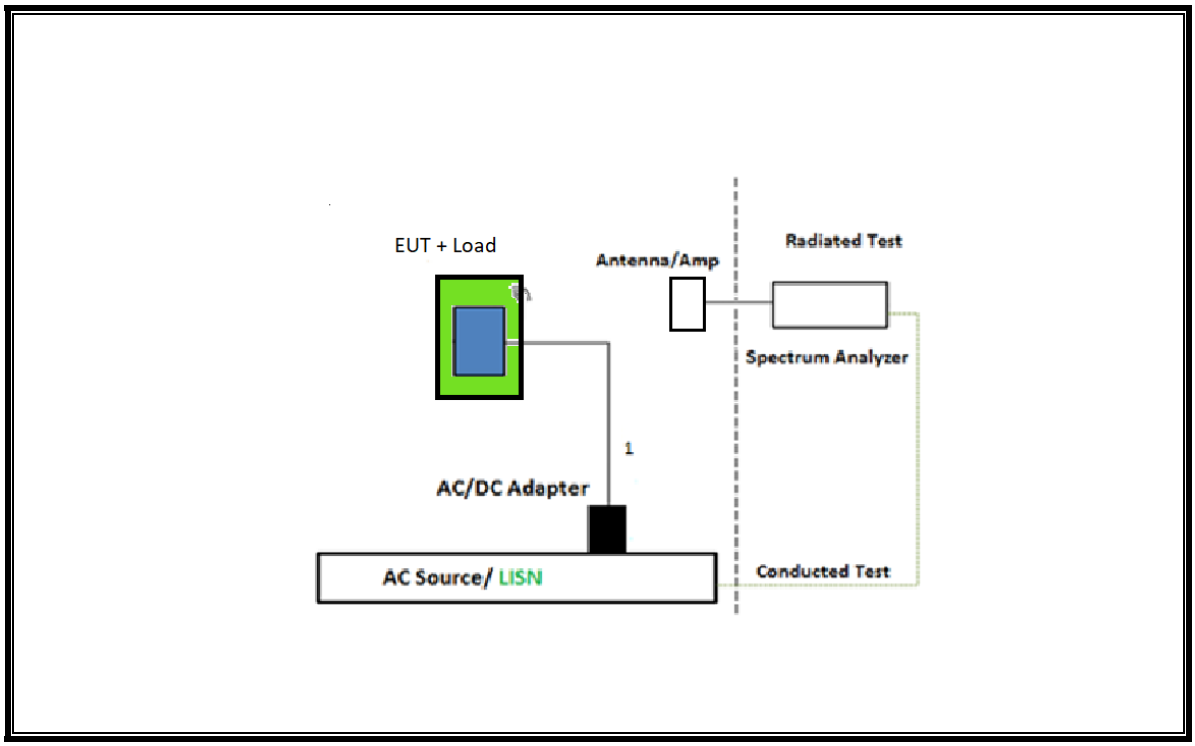
SUPPORT EQUIPMENT & PERIPHERALS

SUPPORT EQUIPMENT & PERIPHERALS LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC/DC adapter	Apple	A2305	N/A	N/A
Phone	Apple	A2095	D92YT005MWC4	BCG-A2095
WPT Accessory	Apple	N/A	N/A	N/A

I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC	1	USBC	Un-shielded	2	5W Power Supply

CONFIGURATION 1: OPERATING MODE PHONE WITH LOAD



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.	JB3	T477	09/04/2020	09/04/2019
Amplifier, 10kHz to 1GHz, 32dB	Sonoma Instrument	310N	T834	07/14/2021	07/14/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A-544	T1113	03/02/2021	03/02/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T342	01/23/2021	01/23/2020

UL AUTOMATION SOFTWARE			
Radiated Software	UL	UL EMC	Ver 9.5, Mar 6, 2020

*Testing is completed before equipment expiration date.

7. SETUP PHOTOS

Please refer to 13259315-EP1 for setup photos

Appendix A – Reference Test Report

Attached is the test report (13259315-E13) containing the reference data from the parent model as detailed in section 5.4.

CERTIFICATION TEST REPORT

Report Number. : 13259315-E13V2

Applicant	:	APPLE, INC. 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	:	A2341
FCC ID	:	BCG-E3545A
IC	:	579C-E3545A
EUT Description	:	SMARTPHONE
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-216 ISSUE 2

Date Of Issue:
September 19, 2020

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

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	8/26/2020	Initial Issue	Chin Pang
V2	9/19/2020	Address TCB's Questions	Chin Pang

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
ONE APPLE PARK WAY
CUPERTINO, CA 95014,

EUT DESCRIPTION: SMARTPHONE

MODEL: A2341

SERIAL NUMBER: G6TD201304PR

DATE TESTED: JULY 24, 2020 TO AUGUST 13, 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.

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Approved & Released For
UL Verification Services Inc. By:

Chin Pang
Senior Engineer
Consumer Technology Division
UL Verification Services Inc.

Prepared By:

Joe Vang
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, KDB 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 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 ISED Site Code:	47266 Benicia Street ISED Site Code:	47658 Kato Rd ISED Site Code:
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☐ 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)	

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

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	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
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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. 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 E-FIELD and H-FIELD

The transmitter has maximum 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	-17.59	12.78

5.3. WORST-CASE CONFIGURATION AND MODE

The EUT is a smartphone which connected to the AC/DC adapter via USB-C cable, and the inductive charging coil to charge WPT accessories. For the entire radiated emissions test, the EUT was investigated on the following configuration during the test: 1. At its natural orientation with EUT set at center location, 2. EUT offset 2mm left and right, 3. EUT with 2mm spacer to find out the worst case location. And the worst case was at 2mm offset to the right and 3mm spacer.

Mode	Descriptions
Operating	EUT and Load powered by AC/DC adapter

For below 30MHz & 1GHz tests EUT was connected to AC power adapter as the worst case, For AC line conducted emission, test was investigated with AC power adapter.

The EUT was tested as operation modes. During operational mode, EUT was tested with Phone and load.

For below 30MHz testing, investigation was done on three antenna orientations: RX antenna Face-on, Face-off and horizontal (parallel to ground). The worst-case configurations were determined on RX antenna Face-on and Face-off; therefore, all final tests were performed using these two orientations.

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.

5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT & PERIPHERALS

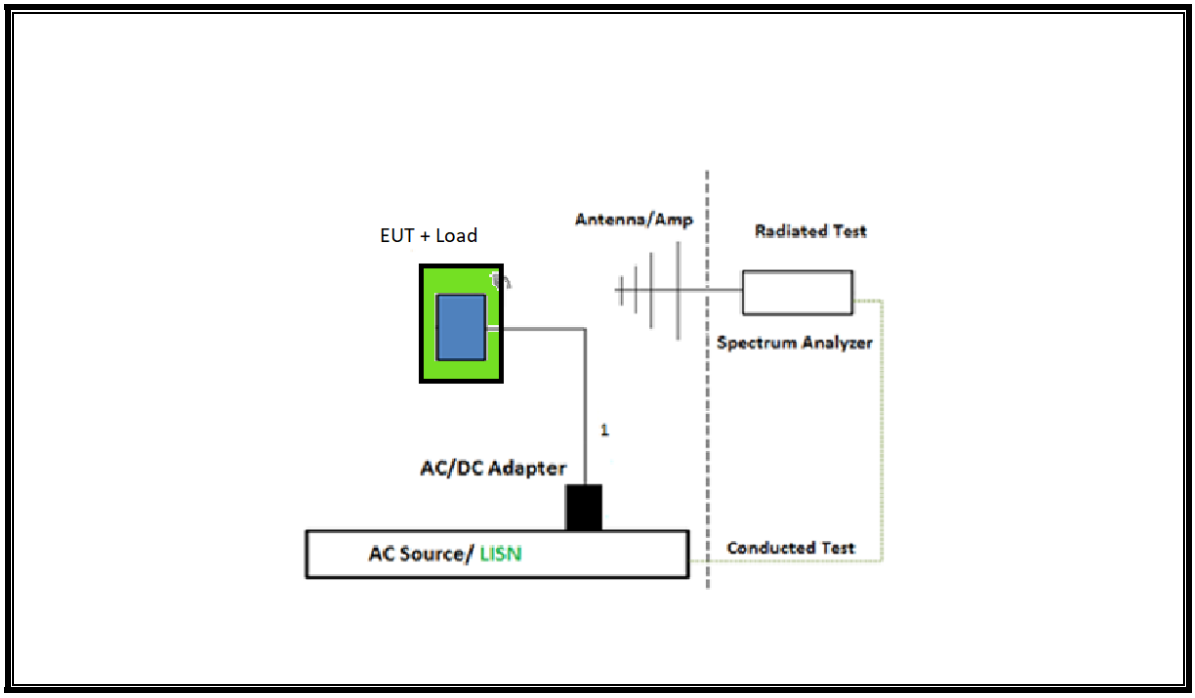
SUPPORT EQUIPMENT & PERIPHERALS LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC/DC adapter	Apple	A2305	N/A	N/A
Phone	Apple	A2095	D92YT005MWC4	BCG-A2095
WPT Accessory	Apple	N/A	N/A	N/A

I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC	1	USBC	Un-shielded	2	5W Power Supply

TEST SETUP

OPERATING MODE PHONE WITH LOAD



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.	JB3	T477	09/04/2020	09/04/2019
Amplifier, 10kHz to 1GHz, 32dB	Sonoma Instrument	310N	T834	07/14/2021	07/14/2020
Sniffer Probes	Electro Metrics	EM-6992	N/A	NA	NA
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A-544	T1113	03/02/2021	03/02/2020
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T342	1/23/2021	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		

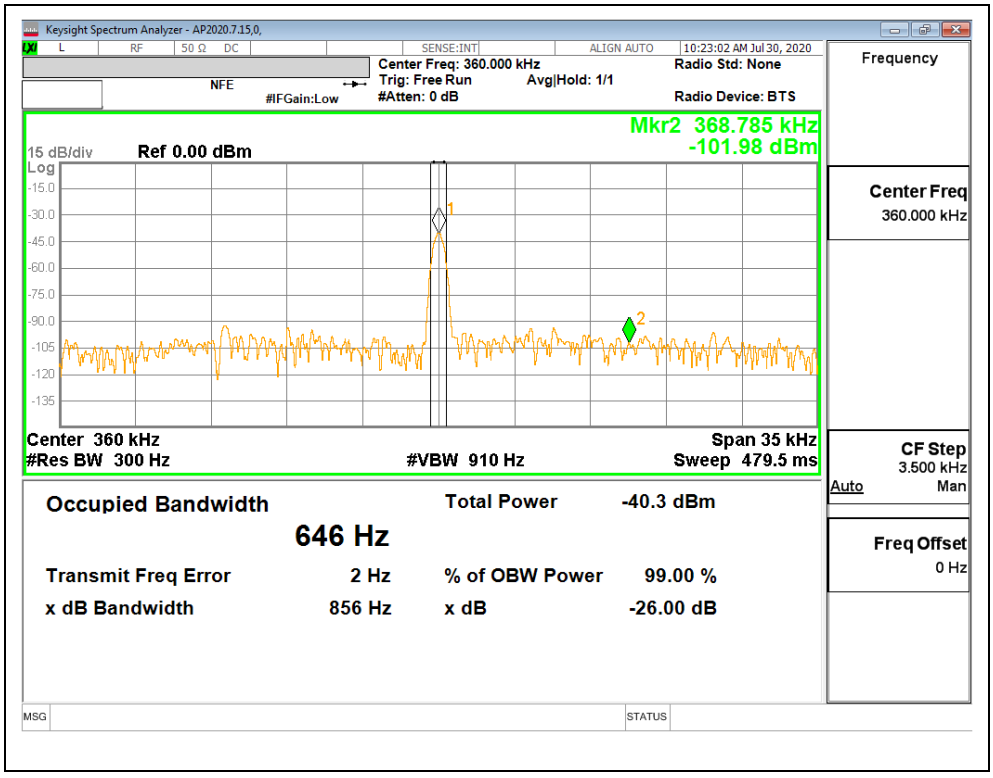
7. OCCUPIED BANDWIDTH

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.

RESULTS



8. RADIATED EMISSION TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.209 (a)
ICES-001 Section 3.3.4, 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.			

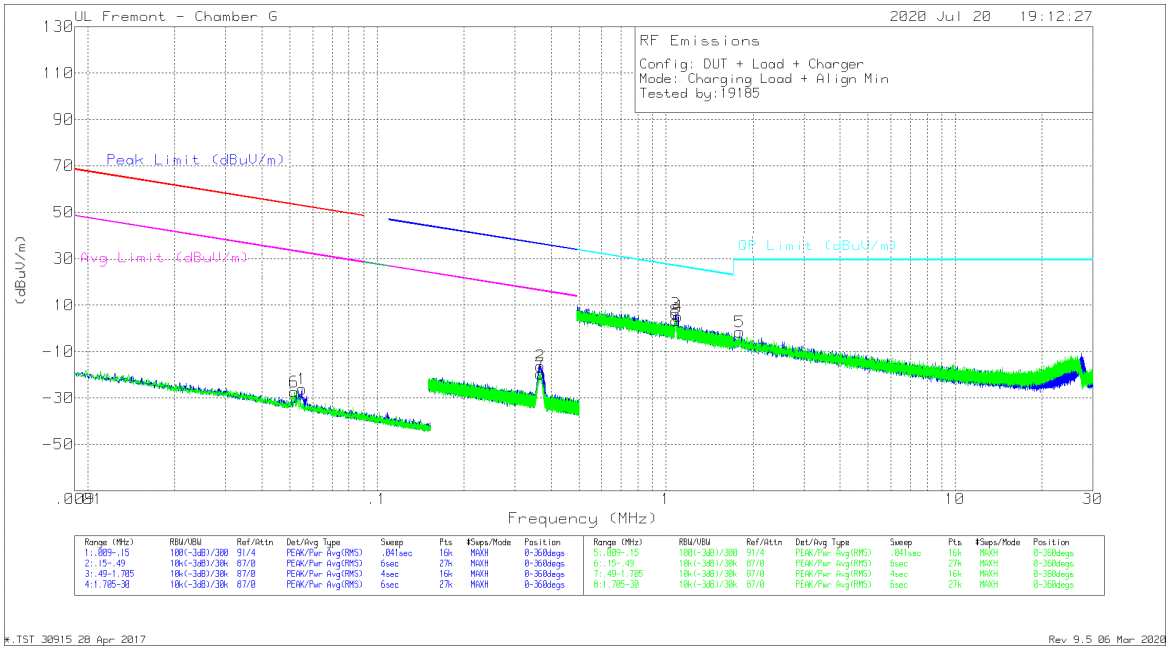
RESULTS

8.2. EUT With Load

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

OPERATING WITH LOAD

FACE-ON AND FACE-OFF PLOT



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
6	.03633	33.74	Qp	13.8	0	-80	-32.46	53.3	-85.76	175
1	.04199	34.18	Qp	13.2	0	-80	-32.62	52.78	-86.4	122
2	.35891	46.43	Qp	10.8	.1	-80	-22.67	36.31	-58.98	223
7	.36047	51.51	Qp	10.8	.1	-80	-17.59	36.29	-53.88	299

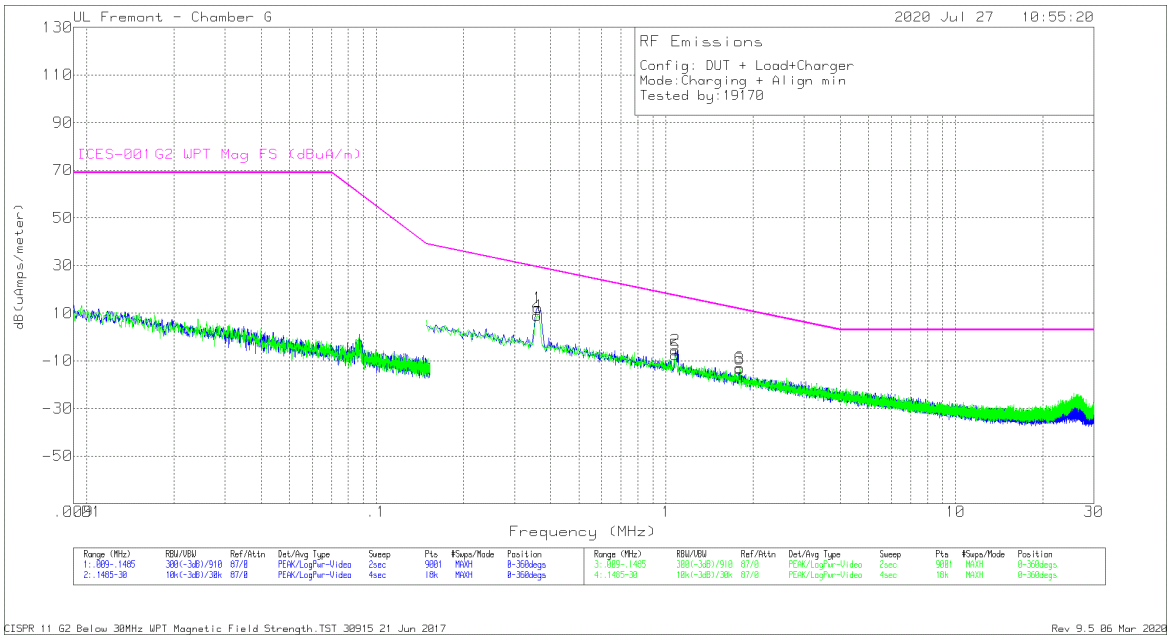
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dBm)	Cables (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	1.07972	29.34	QP	11.2	.1	-40	.64	26.96	-26.32	233
8	1.08151	32.12	QP	11.2	.1	-40	3.42	26.94	-23.52	107
4	1.10112	30.54	QP	11.2	.1	-40	1.84	26.79	-24.95	131
5	1.79827	24.65	QP	11.3	.1	-40	-3.95	29.5	-33.45	289

Qp - Quasi-Peak detector
*.TST 30915 28 Apr 2017
Rev 9.5 06 Mar 2020

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

OPERATING WITH LOAD

FACE-ON AND FACE-OFF PLOT



DATA

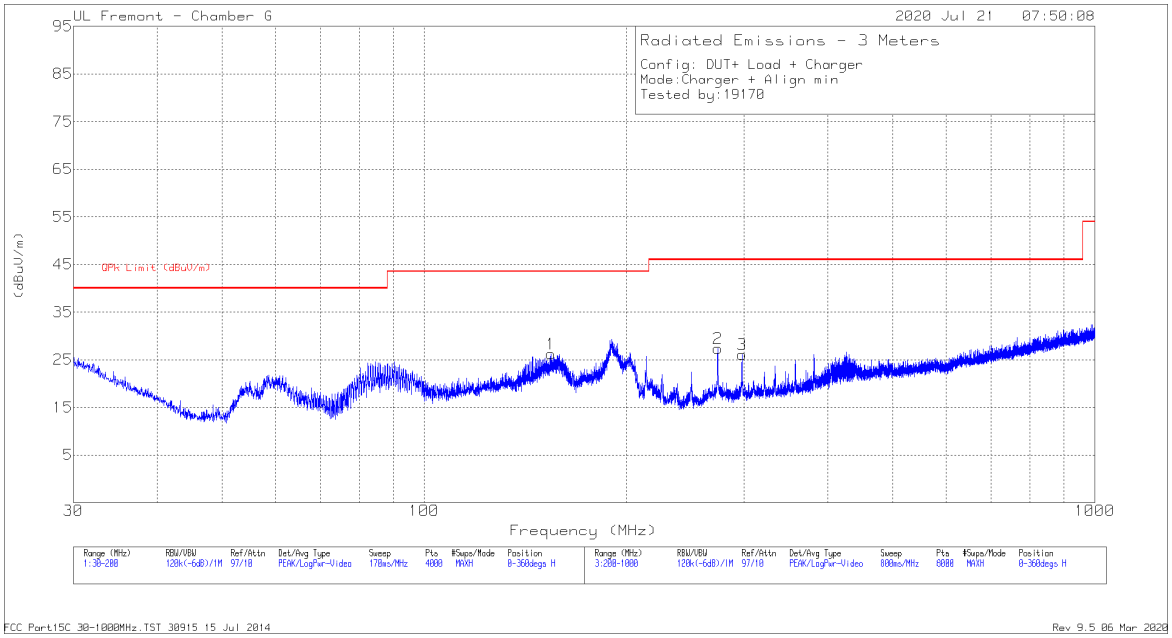
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Corrected Reading dB(uAmps/ meter)	CISPR11 G2 WPT Mag FS (dBuA/m)	Margin (dB)	Azimuth (Degs)
4	.35943	49.49	Qp	-40.6	.1	8.99	29.34	-20.35	331
1	.36042	53.28	Qp	-40.6	.1	12.78	29.31	-16.53	60
5	1.07806	28.25	Qp	-40.2	.1	-11.85	17.33	-29.18	103
2	1.07864	33.84	Qp	-40.2	.1	-6.26	17.33	-23.59	57
3	1.79994	22.4	Qp	-40.2	.2	-17.6	11.73	-29.33	350
6	1.80101	24.65	Qp	-40.2	.2	-15.35	11.72	-27.07	63

Qp - Quasi-Peak detector

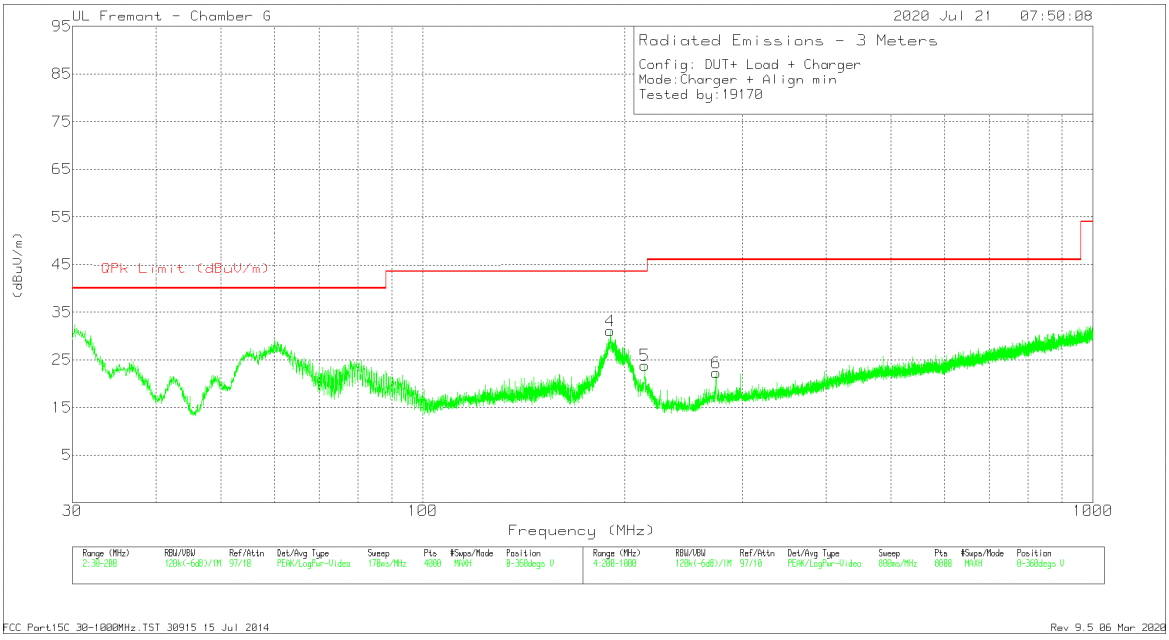
8.2.3. **FCC TX SPURIOUS EMISSION 30 TO 1000 MHz**

OPERATING WITH LOAD

HORIZONTAL PLOT



VERTICAL PLOT



DATA

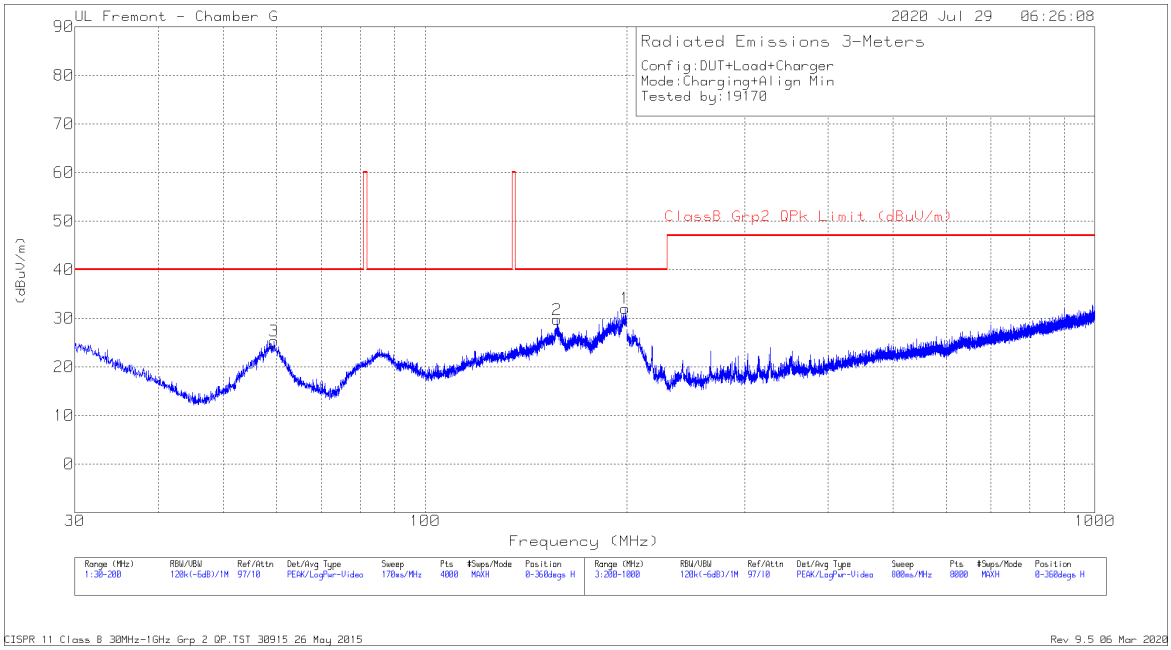
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T477 (dB/m)	Amp Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 273.948	35.64	Qp	19.3	-29.1	25.84	46.02	-20.18	334	199	H
6	* 273.8107	28.31	Qp	19.3	-29.1	18.51	46.02	-27.51	45	255	V
1	154.3165	31.3	Qp	18.3	-29.9	19.7	43.52	-23.82	245	269	H
4	190.49	39.93	Qp	17.3	-29.5	27.73	43.52	-15.79	229	106	V
5	214.411	34.05	Qp	16.5	-29.4	21.15	43.52	-22.37	213	116	V
3	297.898	33.13	Qp	19.4	-29	23.53	46.02	-22.49	333	154	H

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

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

OPERATING WITH LOAD

HORIZONTAL PLOT



VERTICAL PLOT

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	30.8233	28.05	Qp	26.8	-31	23.85	40	-16.15	9	102	V
3	59.2732	36.89	Qp	13.4	-30.7	19.59	40	-20.41	193	236	H
5	59.875	41.55	Qp	13.5	-30.7	24.35	40	-15.65	254	101	V
2	157.5209	37.56	Qp	18.3	-29.8	26.06	40	-13.94	256	155	H
6	196.2998	36.27	Qp	17.9	-29.5	24.67	40	-15.33	189	104	V
1	198.8126	36.53	Qp	18.3	-29.5	25.33	40	-14.67	76	183	H

Qp - Quasi-Peak detector

9. AC POWER 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 ANSI C63.10.

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

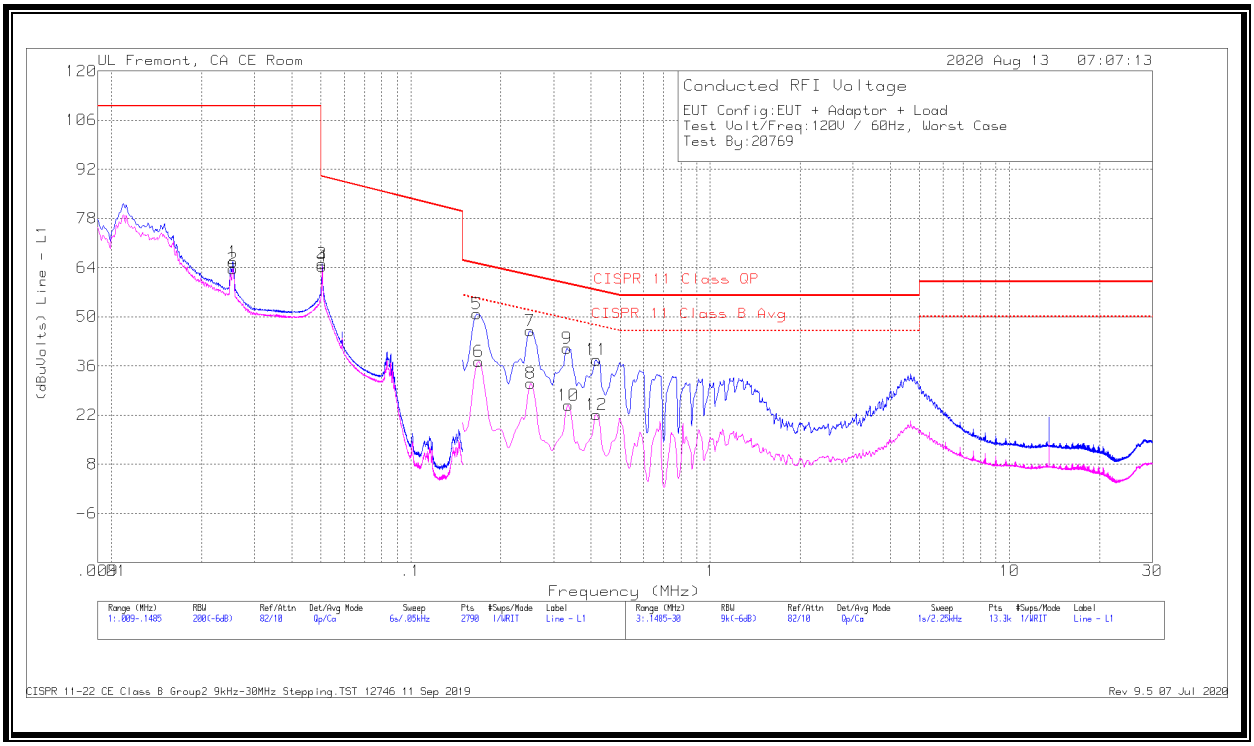
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

9.1. EUT With Load

9.1.1. OPERATING MODE WITH LOAD POWERED BY AC/DC ADAPTER

LINE 1 RESULTS



WORST EMISSIONS

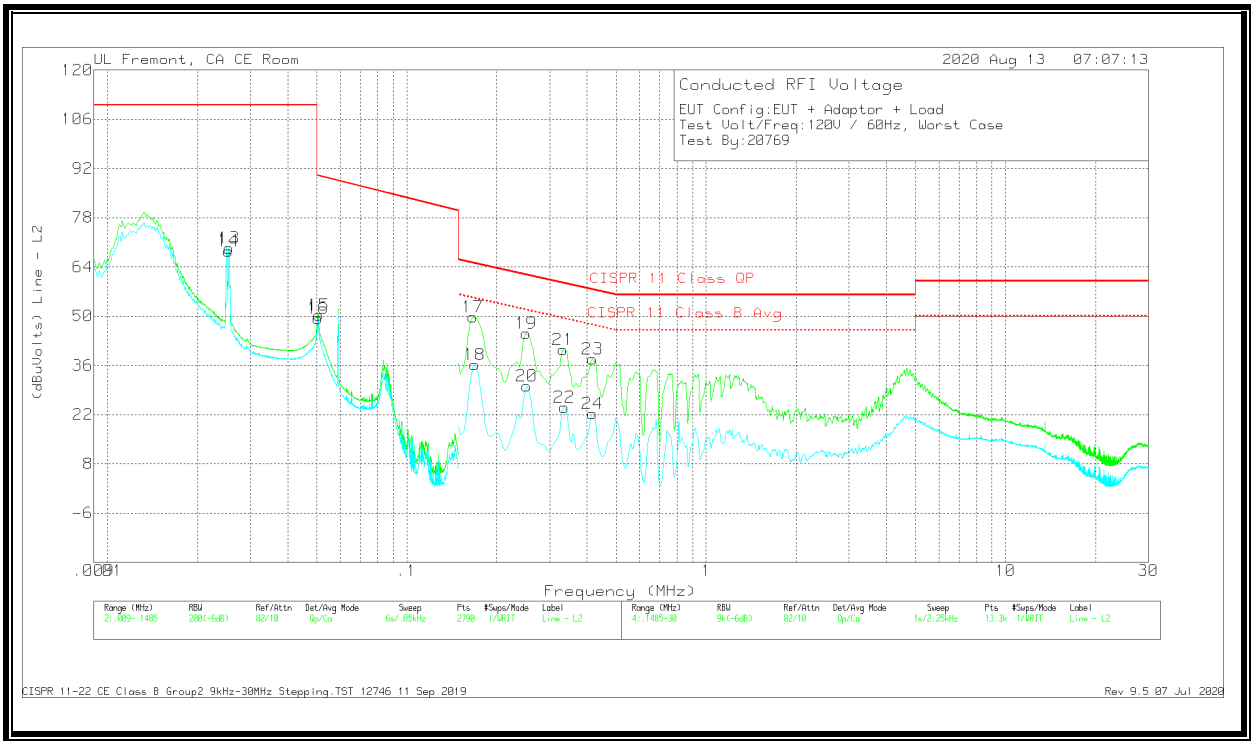
Range 1: Line-L1 .009 - 30MHz

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)
1	.02545	55.46	Qp	.1	0	10.1	65.66	110	-44.34	-	-
2	.02545	53.5	Ca	.1	0	10.1	63.7	-	-	-	-
3	.05055	54.95	Qp	.1	0	10	65.05	89.9	-24.85	-	-
4	.05055	54.26	Ca	.1	0	10	64.36	-	-	-	-
5	.1665	40.77	Qp	0	0	10	50.77	65.06	-14.29	-	-
6	.16875	27.25	Ca	0	0	10	37.25	-	-	55.02	-17.77
7	.24975	36.04	Qp	0	0	10	46.04	61.72	-15.68	-	-
8	.252	20.98	Ca	0	0	10	30.98	-	-	51.69	-20.71
9	.333	30.95	Qp	0	0	10	40.95	59.35	-18.4	-	-
10	.33525	14.72	Ca	0	0	10	24.72	-	-	49.32	-24.6
11	.41625	27.72	Qp	0	0	10	37.72	57.51	-19.79	-	-
12	.41625	12.15	Ca	0	0	10	22.15	-	-	47.52	-25.37

Qp - Quasi-Peak detector
Ca - CISPR average detection

*Indicates UL RFID signal. Not from device

LINE 2 RESULTS



WORST EMISSIONS

Range 2: Line-L2 .009 - 30MHz

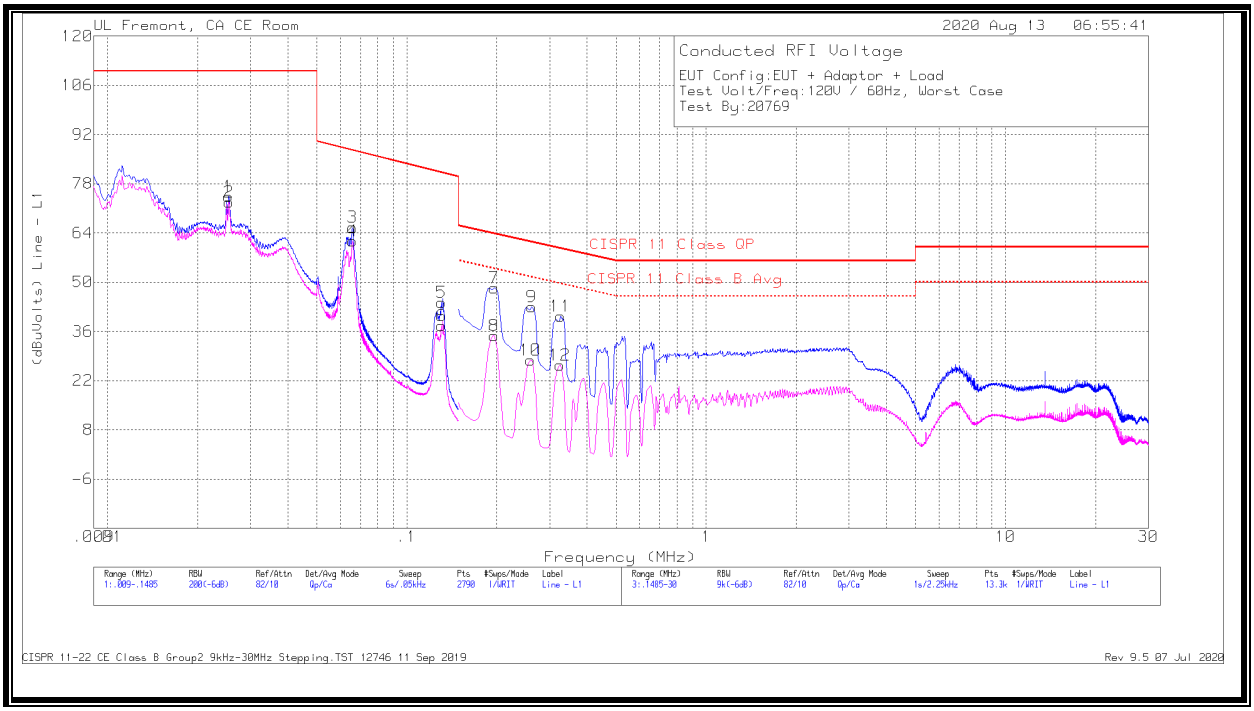
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	PRE0186446 LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading (dBuVolts)	CISPR 11 Class QP	Margin (dB)	CISPR 11 Class B Avg	Margin (dB)
13	.02545	59.1	Qp	.1	0	10.1	69.3	110	-40.7	-	-
14	.0254	58.38	Ca	.1	0	10.1	68.58	-	-	-	-
15	.05065	40.26	Qp	.1	0	10	50.36	89.88	-39.52	-	-
16	.0506	39.25	Ca	.1	0	10	49.35	-	-	-	-
17	.1665	39.79	Qp	0	0	10	49.79	65.06	-15.27	-	-
18	.16875	26.22	Ca	0	0	10	36.22	-	-	55.02	-18.8
19	.24975	35.15	Qp	0	0	10	45.15	61.72	-16.57	-	-
20	.252	20.13	Ca	0	0	10	30.13	-	-	51.69	-21.56
21	.333	30.44	Qp	0	0	10	40.44	59.35	-18.91	-	-
22	.33525	14.13	Ca	0	0	10	24.13	-	-	49.32	-25.19
23	.41625	27.79	Qp	0	0	10	37.79	57.51	-19.72	-	-
24	.41625	12.22	Ca	0	0	10	22.22	-	-	47.52	-25.3

Qp - Quasi-Peak detector
Ca - CISPR average detection

*Indicates UL RFID signal. Not from device

9.1.2. OPERATING MODE WITH LOAD POWERED BY HOST LAPTOP VIA USB CABLE

LINE 1 RESULTS



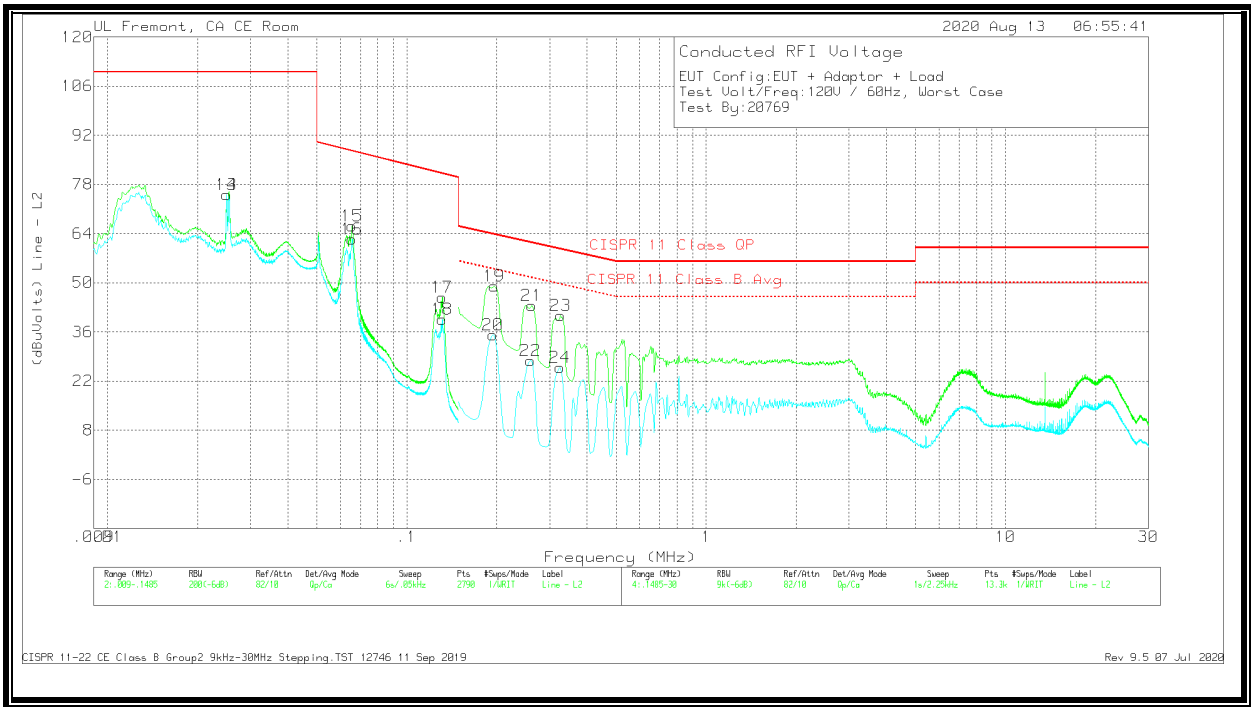
WORST EMISSIONS

Range 1: Line-L1 .009 - 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)
1	.0254	64.13	Qp	.1	0	10.1	74.33	110	-35.67	-	-
2	.02545	62.52	Ca	.1	0	10.1	72.72	-	-	-	-
3	.0659	55.45	Qp	.1	0	10	65.55	87.46	-21.91	-	-
4	.0659	51.54	Ca	.1	0	10	61.64	-	-	-	-
5	.1306	34.13	Qp	.1	0	10	44.23	81.18	-36.95	-	-
6	.1305	27.58	Ca	.1	0	10	37.68	-	-	-	-
7	.19575	38.4	Qp	0	0	10	48.4	63.72	-15.32	-	-
8	.19575	24.75	Ca	0	0	10	34.75	-	-	53.79	-19.04
9	.261	32.93	Qp	0	0	10	42.93	61.35	-18.42	-	-
10	.25875	17.79	Ca	0	0	10	27.79	-	-	51.47	-23.68
11	.32625	30.23	Qp	0	0	10	40.23	59.52	-19.29	-	-
12	.324	16.43	Ca	0	0	10	26.43	-	-	49.6	-23.17

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



WORST EMISSIONS

Range 2: Line-L2 .009 - 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)
13	.025	64.84	Qp	.1	0	10.1	75.04	110	-34.96	-	-
14	.025	64.91	Ca	.1	0	10.1	75.11	-	-	-	-
15	.06568	56	Qp	.1	0	10	66.1	87.49	-21.39	-	-
16	.06565	52.28	Ca	.1	0	10	62.38	-	-	-	-
17	.1314	35.77	Qp	.1	0	10	45.87	81.12	-35.25	-	-
18	.1314	29.45	Ca	.1	0	10	39.55	-	-	-	-
19	.19575	39.06	Qp	0	0	10	49.06	63.72	-14.66	-	-
20	.1935	25.09	Ca	0	0	10	35.09	-	-	53.88	-18.79
21	.261	33.5	Qp	0	0	10	43.5	61.35	-17.85	-	-
22	.25875	17.79	Ca	0	0	10	27.79	-	-	51.47	-23.68
23	.32625	30.62	Qp	0	0	10	40.62	59.52	-18.9	-	-
24	.324	15.79	Ca	0	0	10	25.79	-	-	49.6	-23.81

Qp - Quasi-Peak detector
Ca - CISPR average detection

10. SETUP PHOTOS

Please refer to 13259315-EP1 for setup photos