



# TEST REPORT

**Report Number:** 14282067-E8V2

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

**Model :** A2881, A2882, A2883, A2884

**Brand :** APPLE

**FCC ID :** BCG-E8142A, BCG-E8143A, BCG-E8144A

**EUT Description :** SMARTPHONE

**Test Standard(s) :** FCC CFR47 PART 2, 22H, 24E, 27, 90S, 90R, AND 96

**Date Of Issue:**  
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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	6/30/2022	Initial Review	Eric Ting
V2	8/22/2022	Updated section 5.1, 5.3, 5.7	Eric Ting

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# 1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	APPLE, INC 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.	
Model	A2881, A2882, A2883, A2884	
Brand	APPLE	
FCC ID	BCG-E8142A, BCG-E8143A, BCG-E8144A	
EUT Description	SMARTPHONE	
Serial Number	C07151400D11J163, C07151200K61JRJ2, C07151200JG1JRJ2 (CONDUCTED) P9KQM57X9J, XXP2C0H75V, DT24NDFYXD (RADIATED)	
Sample Receipt Date	1/27/2022	
Date Tested	APRIL 06, 2021	
Applicable Standards	FCC CFR47 2, 22H, 24E, 27, 90S, 90R, AND 96	
Test Results	COMPLIES	
<p>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.</p> <p>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.</p> <p>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 A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.</p>		
Approved & Released By:	Prepared By:	
		
Dan Corona Lead Test Engineer UL Verification Services Inc.	Eric Ting Test Engineer UL Verification Services Inc.	

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with the following:

- ANSI C63.26:2015
- FCC CFR 47 Part 2, Part 22, Part 24, Part 27, Part 90, and Part 96
- [FCC KDB 971168 D01 v03r01](#): Power Meas License Digital Systems
- [FCC KDB 971168 D02 v02r01](#): Misc Rev Approv License Devices
- [FCC KDB 412172 D01 v01r01](#): Determining ERP and EIRP

## 3. FACILITIES AND ACCREDITATION

UL Verification Services Inc. is accredited by A2LA, certification #0751.05, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
<input checked="" type="checkbox"/>	Building 1: 47173 Benicia Street, Fremont, CA 94538, USA	US0104	2324A	550739
<input checked="" type="checkbox"/>	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA	US0104	22541	550739
<input type="checkbox"/>	Building 4: 47658 Kato Rd, Fremont, CA 94538, USA	US0104	2324B	550739

## 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 <sub>Lab</sub>
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.84 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB
Occupied Channel Bandwidth	±1.22 %
Temperature	±2.26%
Supply voltages	±0.57 %
Time	±3.39 %

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

### 4.4. SAMPLE CALCULATION

#### RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

#### MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Final Voltage (dBuV)} = \text{Measured Voltage (dBuV)} + \text{Cable Loss (dB)} + \text{Limiter Factor (dB)} + \text{LISN Insertion Loss.}$$

$$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$$

## 5. INTRODUCTION OF TEST DATA REUSE

### 5.1. DESCRIPTION OF EUT

The Apple iPhone is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, 5G FR1, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS, NFC and MSS. All models except reference model 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.

Testing was performed on the parent model and is used to support the application for the parent and variants identified in this report based on the test plan submitted and approved via KDB inquiry by the FCC.

### 5.2. INTRODUCTION

This application for certification is leveraging the data reuse procedures from KDB 484596 D01 based on reference FCC ID: BCG- E8138A to cover variant model FCC ID: BCG- E8142A, FCC ID: BCG- E8143A, FCC ID: BCG- E8144A. The major difference between the parent/reference model and the variant model is the depopulation in the variant model of the mmWave transmitter and some LTE and 5G NR Bands. All other circuitry and features are identical. The data reuse test plan was approved via manufacturer KDB inquiry.

### 5.3. MODEL DIFFERENCES

The manufacturer hereby declares the following for models A2649, A2881, A2882, A2883, A2884.

A2649, A2881, A2882, A2883, and A2884 are highly similar, with the only differences being listed on the table below:

Model	FCC ID	Model Changes
A2649	BCG-E8138A	Reference Model
A2881	BCG- E8142A	Variant model Remove FR2 from the Reference Model
A2882	BCG- E8143A	Variant model Removed FR2, LTE B11/14/29/71, and 5G NR n14/n71 from the reference model
A2883/A2884	BCG- E8144A	Variant model Removed FR2, LTE B11/14/21/29/53/71, MSS, and 5G NR n14/n53/n71 from the reference model

\*Note:

They have the same PCB layout, design, common components, antennas, antenna locations and housing cases.

More specifically, their cellular modem, Wi-Fi, BT, NFC, WPT and UWB transmitters are identical, and removal of cellular bands is done by software and depopulation of band-specific components associated with the removed bands.

Spot check verification has been done on models A2881, A2882, A2883, and A2884 in accordance with the test plan approved via KDB inquiry. Comparison of the models, upper deviation is within 3dB range and all tests are under FCC Technical Limits. The results documented for model A2649 may be applied as representative to models A2881, A2882, A2883, and A2884.

### 5.4. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A2881

A2881 SPOT CHECK RESULTS							
Technology	Worst Mode	Test Item	Measured	Original Model: A2649	Sub Model: A2881	Delta (dB)	Remarks
			Frequency (MHz)	FCC ID: BCG-E8138A (dBm)	FCC ID: BCG-E8142A (dBm)		
5G NR BAND N5	BPSK @ 20 MHz BW	Cond Power	824-849	25.70	25.70	0	Noise Floor
	BPSK @ highest BW	RSE		-43.47	-41.92	1.55	
LTE BAND 7	QPSK @ 20 MHz BW	Cond Power	2500-2570	25.70	25.70	0	Noise Floor
	QPSK @ highest BW	RSE		-24.52	-23.41	1.11	
5G NR BAND N7	BPSK @ 20 MHz BW	Cond Power	2500-2570	25.70	25.70	0	
LTE BAND 12	QPSK @ 10 MHz BW	Cond Power	699-716	25.70	25.70	0	
5G NR BAND N12	QPSK @ 15 MHz BW	Cond Power	699-716	25.70	25.70	0	
LTE BAND 13	QPSK @ 10 MHz BW	Cond Power	777-787	25.70	25.70	0	
LTE BAND 14	QPSK @ 10 MHz BW	Cond Power	788-798	25.70	25.70	0	
LTE BAND 17	QPSK @ 10 MHz BW	Cond Power	704-716	25.70	25.70	0	
LTE BAND 25	QPSK @ 20 MHz BW	Cond Power	1850-1915	25.70	25.70	0	Noise Floor
	QPSK @ highest BW	RSE		-38.75	-35.07	3.68	
5G NR BAND N25	QPSK @ 40 MHz BW	Cond Power	1850-1915	25.70	25.70	0	
LTE BAND 26 (90S)	QPSK @10 MHz BW	Cond Power	814-824	25.70	25.70	0	
LTE BAND 26 (p22)	QPSK @10 MHz BW	Cond Power	824-849	25.70	25.70	0	
LTE BAND 30	QPSK @ 10 MHz BW	Cond Power	2305-2315	25.70	25.70	0	
5G NR BAND N30	QPSK @ 5 MHz BW	Cond Power	2305-2315	25.70	25.70	0	
LTE BAND 41	QPSK @ 20 MHz BW	Cond Power	2496-2690	28.70	28.70	0	
5G NR BAND N41	BPSK @ 100 MHz BW	Cond Power	2496-2690	28.70	28.70	0	Ant2
LTE BAND 48	QPSK @ 20 MHz BW	Cond Power	3550-3700	26.00	26.00	0	Ant7
		RSE		-5.35	-5.90	-0.55	Noise Floor
LTE BAND 66	QPSK @ 20 MHz BW	Cond Power	1710-1780	25.70	25.70	0	
5G NR BAND N66	BPSK @ 20 MHz BW	Cond Power	1710-1780	25.70	25.70	0	
LTE BAND 71	QPSK @ 20 MHz BW	Cond Power	663-698	25.70	25.70	0	
5G NR BAND n71	BPSK @ 20 MHz BW	Cond Power	663-698	25.70	25.70	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3450-3550	28.70	28.70	0	Ant7
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3700-3980	28.70	28.70	0	Ant7



### 5.5. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A2882

A2882 SPOT CHECK RESULTS							
Technology	Worst Mode	Test Item	Measured	Original Model: A2649	Sub Model: A2882	Delta (dB)	Remarks
			Frequency (MHz)	FCC ID: BCG-E8138A (dBm)	FCC ID: BCG-E8143A (dBm)		
5G NR BAND N5	QPSK @ 20 MHz BW	Cond Power	824-849	25.70	25.70	0	
	QPSK @ highest BW	RSE		-43.47	-42.79	0.68	Noise Floor
LTE BAND 7	QPSK @ 20 MHz BW	Cond Power	2500-2570	25.70	25.70	0	
	QPSK @ highest BW	RSE		-22.81	-22.84	0.03	Noise Floor
5G NR BAND N7	BPSK @ 20 MHz BW	Cond Power	2500-2570	25.70	25.70	0	
LTE BAND 12	QPSK @ 10 MHz BW	Cond Power	699-716	25.70	25.70	0	
5G NR BAND N12	QPSK @ 15 MHz BW	Cond Power	699-716	25.70	25.70	0	
LTE BAND 13	QPSK @ 10 MHz BW	Cond Power	777-787	25.70	25.70	0	
LTE BAND 17	QPSK @ 10 MHz BW	Cond Power	704-716	25.70	25.70	0	
LTE BAND 25	QPSK @ 20 MHz BW	Cond Power	1850-1915	25.70	25.70	0	
	QPSK @ highest BW	RSE		-38.75	-38.28	0.47	Noise Floor
5G NR BAND N25	QPSK @ 20 MHz BW	Cond Power	1850-1915	25.70	25.70	0	
LTE BAND 26 (90S)	QPSK @10 MHz BW	Cond Power	814-824	25.70	25.70	0	
LTE BAND 26 (p22)	QPSK @10 MHz BW	Cond Power	824-849	25.70	25.70	0	
LTE BAND 30	QPSK @ 10 MHz BW	Cond Power	2305-2315	25.70	25.70	0	
5G NR BAND N30	QPSK @ 5 MHz BW	Cond Power	2305-2315	25.70	25.70	0	
LTE BAND 41	16QAM @ 20 MHz BW	Cond Power	2496-2690	28.70	28.70	0	
5G NR BAND N41	BPSK @ 100 MHz BW	Cond Power	2496-2690	28.70	28.70	0	Ant2
LTE BAND 48	QPSK @ 20 MHz BW	Cond Power	3550-3700	26.00	26.00	0	Ant7
		RSE		-5.35	-4.71	0.64	Noise Floor
LTE BAND 66	QPSK @ 20 MHz BW	Cond Power	1710-1780	25.70	25.70	0	
5G NR BAND N66	BPSK @ 20 MHz BW	Cond Power	1710-1780	25.70	25.70	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3450-3550	28.70	28.70	0	Ant7
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3700-3980	28.70	28.70	0	Ant7

### 5.6. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A2883 and A2884

A2883 SPOT CHECK RESULTS							
Technology	Worst Mode	Test Item	Measured	Original Model: A2649	Sub Model: A2883/A2884	Delta (dB)	Remarks
			Frequency (MHz)	FCC ID: BCG-E8138A (dBm)	FCC ID: BCG-E8144A (dBm)		
5G NR BAND N5	QPSK @ 20 MHz BW	Cond Power	824-849	25.70	25.70	0	Noise Floor
	QPSK @ highest BW	RSE		-43.47	-40.93	2.54	
LTE BAND 7	QPSK @ 20 MHz BW	Cond Power	2500-2570	25.70	25.70	0	Noise Floor
	QPSK @ highest BW	RSE		-22.81	-22.43	0.38	
5G NR BAND N7	BPSK @ 20 MHz BW	Cond Power	2500-2570	25.70	25.70	0	
LTE BAND 12	QPSK @ 10 MHz BW	Cond Power	699-716	25.70	25.70	0	
5G NR BAND N12	QPSK @ 15 MHz BW	Cond Power	699-716	25.70	25.70	0	
LTE BAND 13	QPSK @ 10 MHz BW	Cond Power	777-787	25.70	25.70	0	
LTE BAND 17	QPSK @ 10 MHz BW	Cond Power	704-716	25.70	25.70	0	
LTE BAND 25	QPSK @ 20 MHz BW	Cond Power	1850-1915	25.70	25.70	0	Noise Floor
	QPSK @ highest BW	RSE		-38.75	-38.19	0.56	
5G NR BAND N25	QPSK @ 20 MHz BW	Cond Power	1850-1915	25.70	25.70	0	
LTE BAND 26 (90S)	QPSK @10 MHz BW	Cond Power	814-824	25.70	25.70	0	
LTE BAND 26 (p22)	QPSK @10 MHz BW	Cond Power	824-849	25.70	25.70	0	
LTE BAND 30	QPSK @ 10 MHz BW	Cond Power	2305-2315	25.70	25.70	0	
5G NR BAND N30	QPSK @ 5 MHz BW	Cond Power	2305-2315	25.70	25.70	0	
LTE BAND 41	QPSK @ 20 MHz BW	Cond Power	2496-2690	27.70	27.70	0	
5G NR BAND N41	BPSK @ 100 MHz BW	Cond Power	2496-2690	28.70	28.70	0	Ant2
LTE BAND 48	QPSK @ 20 MHz BW	Cond Power	3550-3700	26.00	26.00	0	Ant7
		RSE		-5.35	-5.09	0.26	Noise Floor
LTE BAND 66	QPSK @ 20 MHz BW	Cond Power	1710-1780	25.70	25.70	0	
5G NR BAND N66	BPSK @ 20 MHz BW	Cond Power	1710-1780	25.70	25.70	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3450-3550	28.70	28.70	0	Ant7
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3700-3980	28.70	28.70	0	Ant7

## 5.7. REFERENCE DETAIL

Reference application that contains the reused reference data.

Equipment Class	Reference FCC ID	Reference Application	Variant model FCC ID	Report Title/Section
PCE, CBE, TNE	BCG-E8138A	14040867-E8	BCG-E8142A	FCC LTE Report / All Sections
PCE, CBE, TNE			BCG-E8143A	FCC LTE Report / All Sections except LTE/5G NR Band B14/71 sections
PCE, CBE			BCG-E8144A	FCC LTE Report / All Sections except LTE/5G NR Band B14/71 sections

## **5.8. SOFTWARE AND FIRMWARE**

The EUT firmware installed during testing was version: 0.15.02.

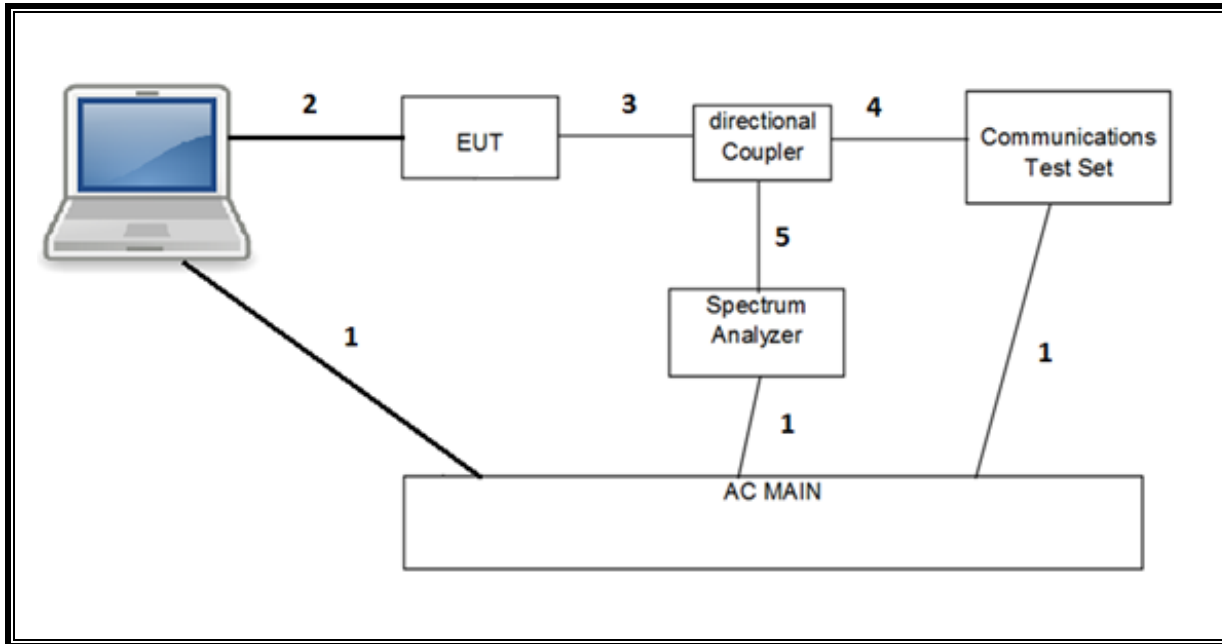
## **5.9. SPOT CHECK WORST-CASE CONFIGURATION AND MODE**

The spot checks were performed on the worst-case orientations and configurations based on the parent model of reference report.

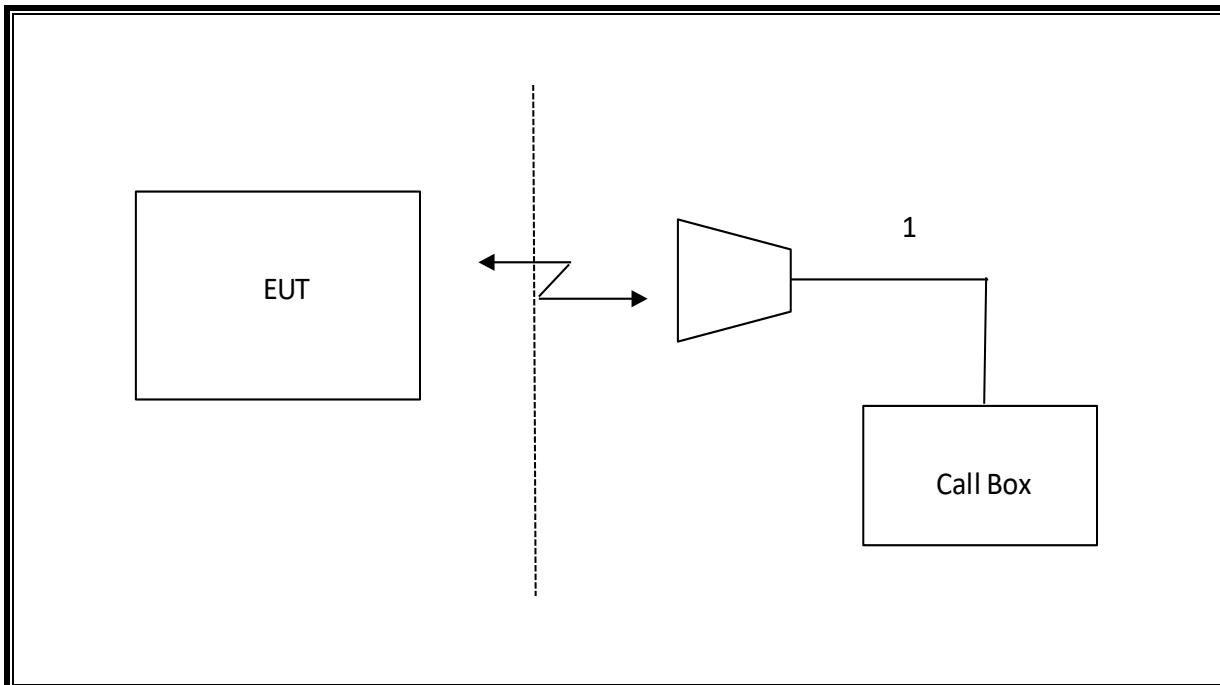
### 5.10. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description	Manufacturer	Model	Serial Number	FCC ID/ DoC		
Laptop	Apple	MacBook Pro	C02VD7SAH22	BCGA1708		
AC/DC adapter	Apple	A1718	C4H714302LCGN8RA5	--		
I/O CABLES (RF CONDUCTED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	3	US 115V	Un-shielded	2.0	N/A
2	USB	1	DC	Un-shielded	1.0	N/A
3	RF In/Out	1	EUT	Un-shielded	0.6	N/A
4	RF In/Out	1	Communication Test Set	Un-shielded	1.2	N/A
5	RF In/Out	1	Barrel	N/A	N/A	N/A
I/O CABLES (RF RADIATED TEST)						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	RF In/Out	1	Antenna	Un-shielded	5.0	N/A

### CONDUCTED SETUP



### RADIATED SETUP



## 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	Asset	Cal Due
Power Meter, P-series single channel	Keysight	N1911A	82174	1/24/2023
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight	N1921A	90388	1/24/2023
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	85806	2/22/2023
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	85214	2/2/2023
Directional Coupler	KRYTAR	152613	T1536	09/23/2022
UL AUTOMATION SOFTWARE				
CLT Software	UL	UL RF	Ver 3.7.6, Match 1, 2022	
Power Measurement Software	UL	UL RF	Ver 3.4.9, April 29, 2022	

### NOTES:

\* Testing is completed before equipment expiration date.

## Appendix A – Reference Test Report

Attached is the test report (14040867-E8) containing the reference data from the parent model as detailed in section 5.7.