



TEST REPORT

Report Number: 13587906-E8V2

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

Model : A2641, A2643, A2644, AND A2645

Brand : APPLE

FCC ID : BCG-E4005A, BCG-E4035A, BCG-E4036A

EUT Description : SMARTPHONE

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

Date Of Issue:
AUGUST 10, 2021

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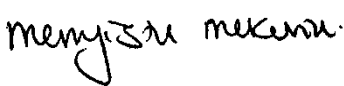
Revision History

Rev.	Issue Date	Revisions	Revised By
V1	8/6/2021	Initial Review	Tony Li
V2	8/10/2021	Updated Section 5 according to TCB Feedback. Removed reference to setup photos, as that is covered by referenced report in appendix A.	John Thompson

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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	A2641, A2643, A2644, AND A2645	
Brand	APPLE	
FCC ID	BCG-E4005A, BCG-E4035A, BCG-E4036A	
EUT Description	SMARTPHONE	
Serial Number	MODEL (A2641): C07116600N90G3C3 (CONDUCTED), J9CP2T29W6 (RADIATED) MODEL (A2643): C071175015X18J31 (CONDUCTED), Q63F0Y0HYH (RADIATED) MODEL (A2645): C071173000K18J61 (CONDUCTED), M4D6RLJQ25 (RADIATED)	
Sample Receipt Date	JUNE 04, 2021	
Date Tested	JUNE 09, 2021 to AUGUST 06, 2021	
Applicable Standards	FCC CFR47 PART 2, 22H, 24E, 27, 90S, 90R, AND 96	
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 A2LA, NIST, any agency of the Federal Government, or any agency of the U.S. government.		
Approved & Released By:	Reviewed By:	Prepared By:
		
Mengistu Mekuria Lead Test Engineer UL Verification Services Inc.	John Thompson Laboratory Engineer UL Verification Services Inc.	Tony Li 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
☐	Building 1: 47173 Benicia Street, Fremont, CA 94538, USA	US0104	2324A	208313
☒	Building 2: 47266 Benicia Street, Fremont, CA 94538, USA	US0104	22541	208313
☒	Building 4: 47658 Kato Rd, Fremont, CA 94538, USA	US0104	2324B	208313

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 Radiated Disturbance, 9KHz to 30 MHz	2.87 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:

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

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, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS, and NFC. 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-E4003A to cover variant model FCC ID: BCG-E4005A, FCC ID: BCG-E4035A, and FCC ID: BCG-E4036A. 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 A2484, A2641, A2643, A2644, and A2645.

A2484, A2641, A2643, A2644, and A2645 are highly similar, with the only differences being listed on the table below.

Model	FCC ID	Model Changes
A2484	BCG-E4003A	Main Reference Model
A2641	BCG-E4005A	FR2 removed
A2643	BCG-E4035A	FR2 and B14/71 removed
A2644*	BCG-E4036A	FR2 and B14/71 removed
A2645	BCG-E4036A	FR2 and B14/71 removed

*Note: Model only support (pSIM + pSIM) instead of (pSIM + eSIM). A2644 is electrically identical to A2645.

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 A2641, A2643, A2644, and A2645 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/ISED Technical Limits. The results documented for model A2484 may be applied as representative to models A2641, A2643, A2644, and A2645.

5.4. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A2641

A2641 SPOT CHECK RESULTS							
Technology	Worst Mode	Test Item	Measured	Original Model: A2484	Sub Model: A2641	Delta (dB)	Remarks
			Frequency (MHz)	FCC ID: BCG-E4003A (dBm)	FCC ID: BCG-E4005A (dBm)		
5G NR BAND N5	BPSK @ 20 MHz BW	Cond Power	824-849	25.7	25.7	0	Noise Floor
	BPSK @ highest BW	RSE		-53.08	-54.15	-1.07	
LTE BAND 7	QPSK @ 20 MHz BW	Cond Power	2500-2570	25.7	25.7	0	Noise Floor
	QPSK @ highest BW	RSE		-48.95	-49.01	-0.06	
5G NR BAND N7	BPSK @ 20 MHz BW	Cond Power	2500-2570	25.7	25.7	0	
LTE BAND 12	QPSK @ 10 MHz BW	Cond Power	699-716	25.7	25.7	0	
5G NR BAND N12	BPSK @ 15 MHz BW	Cond Power	699-716	25.7	25.7	0	
LTE BAND 13	QPSK @ 10 MHz BW	Cond Power	777-787	25.7	25.7	0	
LTE BAND 14	QPSK @ 10 MHz BW	Cond Power	788-798	25.7	25.7	0	
LTE BAND 17	QPSK @ 10 MHz BW	Cond Power	704-716	25.7	25.7	0	
LTE BAND 25	QPSK @ 20 MHz BW	Cond Power	1850-1915	25.7	25.7	0	Noise Floor
	QPSK @ highest BW	RSE		-50.71	-51.58	-0.87	
5G NR BAND N25	BPSK @ 20 MHz BW	Cond Power	1850-1915	25.7	25.7	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	25.7	25.7	0	
LTE BAND 30	QPSK @ 10 MHz BW	Cond Power	2305-2315	25	25	0	
5G NR BAND N30	BPSK @ 5 MHz BW	Cond Power	2305-2315	25	25	0	
LTE BAND 41	QPSK @ 20 MHz BW	Cond Power	2496-2690	27.5	27.5	0	
5G NR BAND N41	BPSK @ 100 MHz BW	Cond Power	2496-2690	27.7	27.7	0	
LTE BAND 48	QPSK @ 20 MHz BW	Cond Power	3550-3700	24.8	24.8	0	Noise Floor
	QPSK @ highest BW	RSE		-52.55	-61.11	-8.56	
LTE BAND 66	QPSK @ 20 MHz BW	Cond Power	1710-1780	25.7	25.7	0	
5G NR BAND N66	BPSK @ 20 MHz BW	Cond Power	1710-1780	25.7	25.7	0	
LTE BAND 71	QPSK @ 20 MHz BW	Cond Power	663-698	25.7	25.7	0	
5G NR BAND n71	BPSK @ 20 MHz BW	Cond Power	663-698	25.7	25.7	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3450-3550	27.7	27.7	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3700-3980	27.7	27.7	0	

5.5. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A2643

A2643 SPOT CHECK RESULTS							
Technology	Worst Mode	Test Item	Measured Frequency (MHz)	Original Model: A2484 FCC ID: BCG-E4003A (dBm)	Sub Model: A2643 FCC ID: BCG-E4035A (dBm)	Delta (dB)	Remarks
5G NR BAND N5	BPSK @ 20 MHz BW	Cond Power	824-849	25.7	25.7	0	
	BPSK @ highest BW	RSE		-51.97	-52.88	-0.91	Noise Floor
LTE BAND 7	QPSK @ 20 MHz BW	Cond Power	2500-2570	25.7	25.7	0	
	QPSK @ highest BW	RSE	7528.74	-48.61	-49.08	-0.47	Noise Floor
5G NR BAND N7	BPSK @ 20 MHz BW	Cond Power	2500-2570	25.7	25.7	0	
LTE BAND 12	QPSK @ 10 MHz BW	Cond Power	699-716	25.7	25.7	0	
5G NR BAND N12	BPSK @ 15 MHz BW	Cond Power	699-716	25.7	25.7	0	
LTE BAND 13	QPSK @ 10 MHz BW	Cond Power	777-787	25.7	25.7	0	
LTE BAND 17	QPSK @ 10 MHz BW	Cond Power	704-716	25.7	25.7	0	
LTE BAND 25	QPSK @ 20 MHz BW	Cond Power	1850-1915	25.7	25.7	0	
	QPSK @ highest BW	RSE		-51.35	-51.96	-0.61	Noise Floor
5G NR BAND N25	BPSK @ 20 MHz BW	Cond Power	1850-1915	25.7	25.7	0	
LTE BAND 26 (90S)	QPSK @10 MHz BW	Cond Power	814-824	25.7	25.7	0	
LTE BAND 26 (Part 22)	QPSK @10 MHz BW	Cond Power	824-849	25.7	25.7	0	
LTE BAND 30	QPSK @ 10 MHz BW	Cond Power	2305-2315	25	25	0	
5G NR BAND N30	BPSK @ 5 MHz BW	Cond Power	2305-2315	25	25	0	
LTE BAND 41	QPSK @ 20 MHz BW	Cond Power	2496-2690	27.5	27.5	0	
5G NR BAND N41	BPSK @ 100 MHz BW	Cond Power	2496-2690	27.7	27.7	0	
LTE BAND 48	QPSK @ 20 MHz BW	Cond Power	3550-3700	24.8	24.8	0	
	QPSK @ highest BW	RSE		-52.55	-53.63	-1.08	Noise Floor
LTE BAND 66	QPSK @ 20 MHz BW	Cond Power	1710-1780	25.7	25.7	0	
5G NR BAND N66	BPSK @ 20 MHz BW	Cond Power	1710-1780	25.7	25.7	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3450-3550	27.7	27.7	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3700-3980	27.7	27.7	0	

5.6. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A2644 AND A2645

A2644 AND A2645 SPOT CHECK RESULTS							
Technology	Worst Mode	Test Item	Measured	Original Model: A2484	Sub Model: A2644 and A2645	Delta (dB)	Remarks
			Frequency (MHz)	FCC ID: BCG-E4003A (dBm)	FCC ID: BCG-E4036A (dBm)		
5G NR BAND N5	BPSK @ 20 MHz BW	Cond Power	824-849	25.7	25.7	0	
	BPSK @ highest BW	RSE		-53.5	-54.15	-0.65	Noise Floor
LTE BAND 7	QPSK @ 20 MHz BW	Cond Power	2500-2570	25.7	25.7	0	
	QPSK @ highest BW	RSE	7528.74	-48.61	-48.66	-0.05	Noise Floor
5G NR BAND N7	BPSK @ 20 MHz BW	Cond Power	2500-2570	25.7	25.7	0	
LTE BAND 12	QPSK @ 10 MHz BW	Cond Power	699-716	25.7	25.7	0	
5G NR BAND N12	BPSK @ 15 MHz BW	Cond Power	699-716	25.7	25.7	0	
LTE BAND 13	QPSK @ 10 MHz BW	Cond Power	777-787	25.7	25.7	0	
LTE BAND 17	QPSK @ 10 MHz BW	Cond Power	704-716	25.7	25.7	0	
LTE BAND 25	QPSK @ 20 MHz BW	Cond Power	1850-1915	25.7	25.7	0	
	QPSK @ highest BW	RSE		-50.71	-51.25	-0.54	Noise Floor
5G NR BAND N25	BPSK @ 20 MHz BW	Cond Power	1850-1915	25.7	25.7	0	
LTE BAND 26 (90S)	QPSK @ 10 MHz BW	Cond Power	814-824	25.7	25.7	0	
LTE BAND 26 (Part 22)	QPSK @ 10 MHz BW	Cond Power	824-849	25.7	25.7	0	
LTE BAND 30	QPSK @ 10 MHz BW	Cond Power	2305-2315	25	25	0	
5G NR BAND N30	BPSK @ 5 MHz BW	Cond Power	2305-2315	25	25	0	
LTE BAND 41	QPSK @ 20 MHz BW	Cond Power	2496-2690	27.5	27.5	0	
5G NR BAND N41	BPSK @ 100 MHz BW	Cond Power	2496-2690	27.7	27.7	0	
LTE BAND 48	QPSK @ 20 MHz BW	Cond Power	3550-3700	24.8	24.8	0	
	QPSK @ highest BW	RSE		-44.08	-49.39	-5.31	Noise Floor
LTE BAND 66	QPSK @ 20 MHz BW	Cond Power	1710-1780	25.7	25.7	0	
5G NR BAND N66	BPSK @ 20 MHz BW	Cond Power	1710-1780	25.7	25.7	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3450-3550	27.7	27.7	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3700-3980	27.7	27.7	0	

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-E4003A	13573771-E8	BCG-E4005A	FCC LTE Report/ All Sections
PCE, CBE, TNE	BCG-E4003A	13573771-E8	BCG-E4035A	FCC LTE Report/ All Sections except LTE/5GnR Band 14/71 sections
PCE, CBE, TNE	BCG-E4003A	13573771-E8	BCG-E4036A	FCC LTE Report/ All Sections except LTE/5GnR Band 14/71 sections

5.8. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version 0.21.02-1

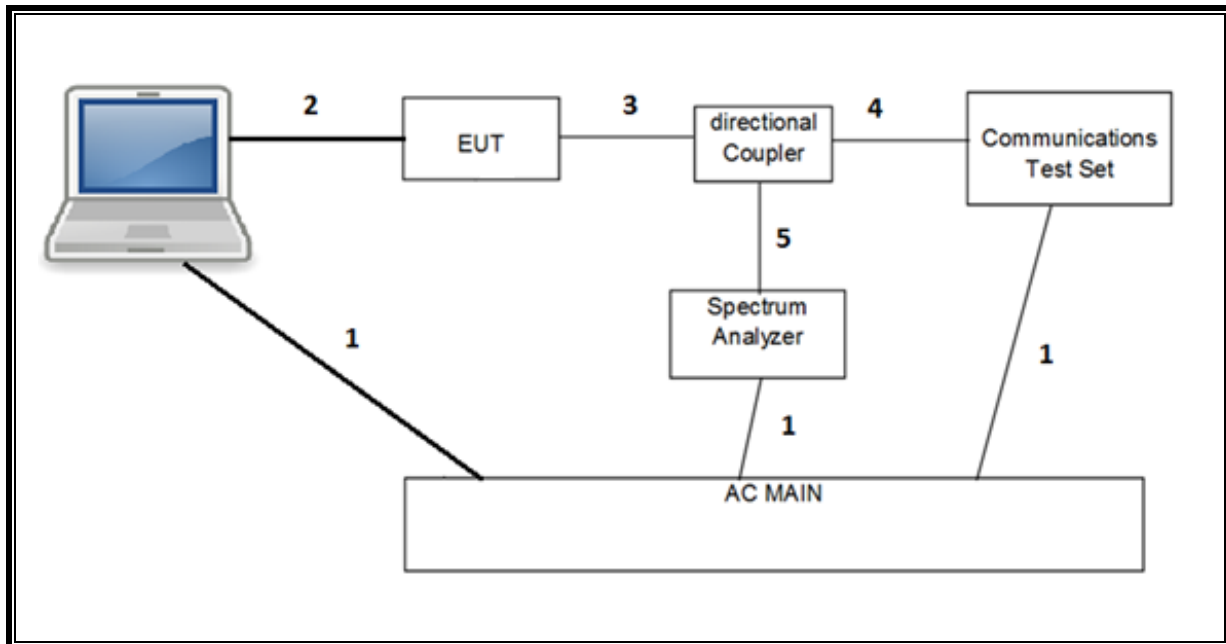
5.9. SPOT CHECK WORST-CASE CONFIGURATION AND MODE

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

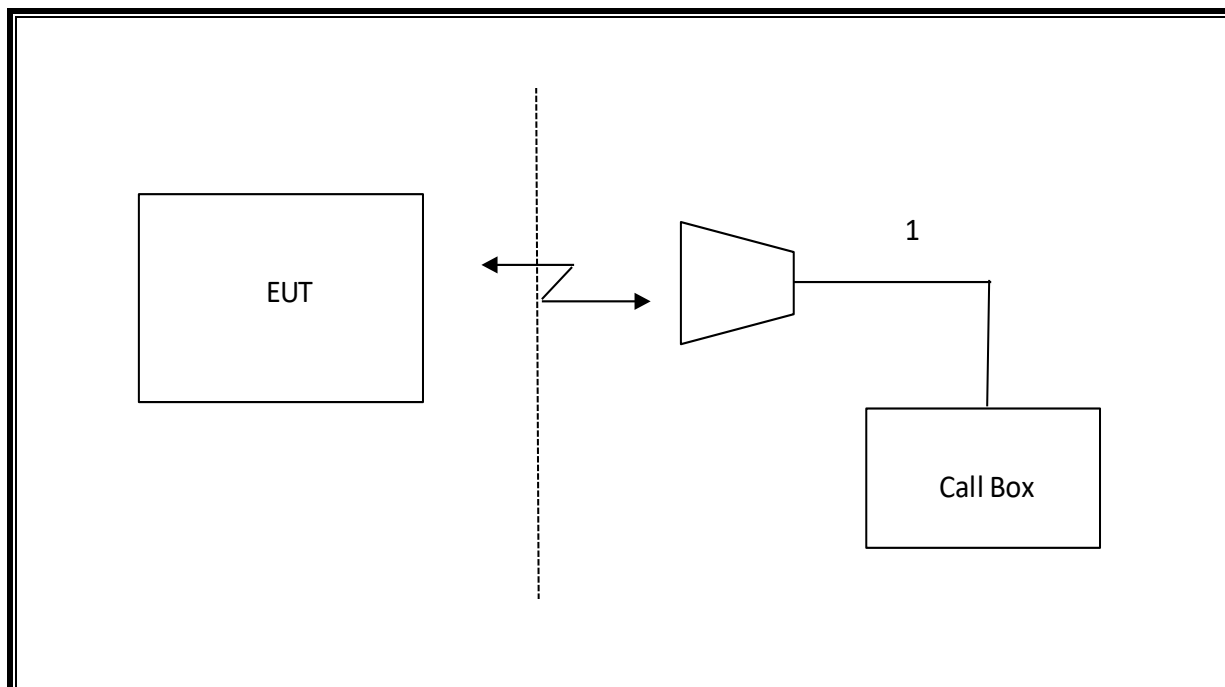
5.10. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description		Manufacturer	Model	Serial Number		FCC ID/ DoC
Laptop		A1398	C02PM012G3QD	QDS-BRCM1069		A1398
AC/DC adapter		PA-1450-BA1	B123	N/A		PA-1450-BA1
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
Antenna, Horn 1-18GHz	ETS Lindgren	3117	PRE0213833	02/16/2022
RF Device, Active, Amplifier	AMPLICAL	AMP0.1G18-47-20	206055	05/13/2022
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201500	0/2/26/2022
*Filter, BR 2495 to 2690MHz	Micro-Tronics	BRM50709-02	T1790	06/23/2021
Filter, 2.7 to 18GHz High Pass	Micro-Tronics	H2G518G6	198714	04/22/2022
*Filter, Highpass 1.2GHz	Micro-Tronics	HPM50108	T1737	6/23/2021
Directional Coupler	KRYTAR	152610	T1161	09/16/2021
Directional Coupler	KRYTAR	152613	T1537	09/16/2021
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	T703	02/20/2022
Wideband Communication Test Set, Call Box	R&S GmbH & Co. KG	CMW500	T972	02/20/2022
Power Meter, P-series single channel	Keysight	N1912A	T1245	01/21/2022
Power Sensor	Keysight	N1921A	T1225	01/28/2022
UL AUTOMATION SOFTWARE				
CLT Software	UL	UL RF	Ver 3.2.5, 4/13/2021	
Power Measurement Software	UL	UL RF	Ver 3.1.2 5/17/2021	
Radiated test software	UL	UL RF	Ver 9.5, 4/14/2021	

NOTES:

* Testing is completed before equipment expiration date.

Appendix A – Reference Test Report

Attached is the test report (13573771-E8) containing the reference data from the parent model as detailed in section 5.7.