



TEST REPORT

Report Number: 14523746-E2V1

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

Model : A3102, A3104

Brand : APPLE

FCC ID : BCG-E8437A, BCG-E8438A

EUT Description : SMARTPHONE

Test Standard(s) : FCC 47 CFR PART 2, 22H, 24E, 27, 90S, 90R, AND 96

Date Of Issue:

2023-07-12

Prepared by:

UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538, U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888



Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	2023-07-12	Initial Review	Mengistu Mekuria

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. DECISION RULES AND MEASUREMENT UNCERTAINTY	6
4.1. METROLOGICAL TRACEABILITY.....	6
4.2. DECISION RULES.....	6
4.3. MEASUREMENT UNCERTAINTY.....	6
4.4. SAMPLE CALCULATION.....	6
5. INTRODUCTION OF TEST DATA REUSE	7
5.1. DESCRIPTION OF EUT.....	7
5.2. INTRODUCTION.....	7
5.3. MODEL DIFFERENCES.....	7
5.4. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A3102.....	8
5.5. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A3104.....	9
5.6. REFERENCE DETAIL.....	10
5.7. SOFTWARE AND FIRMWARE.....	10
5.8. SPOT CHECK WORST-CASE CONFIGURATION AND MODE.....	10
5.9. DESCRIPTION OF TEST SETUP.....	11
6. TEST AND MEASUREMENT EQUIPMENT	13
Appendix A – Reference Test Report	14

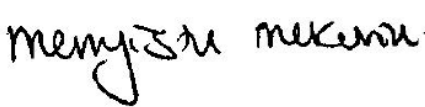


1. ATTESTATION OF TEST RESULTS

Applicant Name and Address	APPLE, INC 1 APPLE PARK WAY CUPERTINO, CA 95014, U.S.A.
Model	A3102, A3104
Brand	APPLE
FCC ID	BCG -E8437A, BCG -E8438A
EUT Description	SMARTPHONE
Serial Number	QR3JW3QCDP, K6QJ4RW7JN, HGQ77VL42V (CONDUCTED) AND F2MPN433KV, D241PJH9X5 (RADIATED)
Sample Receipt date	2023-05-23
Date Tested	2023-05-23 TO 2023-07-10
Applicable Standards	FCC 47 CFR 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: 
Choose an item. Staff Engineer UL LLC.	Tewodros Woldemichael Laboratory Engineer UL LLC.	Binod Sitaula Laboratory Engineer UL LLC.

2. TEST METHODOLOGY

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

- ANSI C63.26:2015
- FCC 47 CFR 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 v02r02](#): 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			
<input type="checkbox"/>	Building 3: 843 Auburn Court, Fremont, CA 94538, USA			
<input checked="" type="checkbox"/>	Building 4: 47658 Kato Rd, Fremont, CA 94538, USA			
<input checked="" type="checkbox"/>	Building 5: 47670 Kato Rd, Fremont, CA 94538, USA			

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}
Conducted Antenna Port Emission Measurement	1.940 db
Power Spectral Density	2.466 db
Time Domain Measurements Using SA	3.39 %
RF Power Measurement Direct Method Using Power Meter	0.450 db Peak 1.300 db Ave.
Radio Frequency (Spectrum Analyzer)	141.16 Hz
Occupied Bandwidth	1.22%
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.78 db
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.40 db
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

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

4.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$
$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

5. INTRODUCTION OF TEST DATA REUSE

5.1. DESCRIPTION OF EUT

The Apple iPhone is a smartphone with cellular GSM, GPRS, EGPRS, UMTS, LTE, 5GNR1, IEEE 802.11a/b/g/n/ac/ax, Bluetooth (BT), Ultra-Wideband (UWB), GPS, NFC, NB UNII, 802.15.4, 802.15ab-NB and MSS technologies. 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-E8436A to cover variant model FCC ID: BCG-E8437A, and FCC ID: BCG-E8438A. The major difference between the parent/reference model and the variant model is the depopulation of 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 A3101, A3102, and A3104

A3101, A3102, and A3104 are highly similar, with the only differences being listed on the table below:

Model	FCC ID	Model Changes
A3101	BCG-E8436A	Reference Model
A3102	BCG-E8437A	Variant model Removed LTE B11/14/29/71, and 5G NR n14/n71 from the reference model
A3104	BCG-E8438A	Variant model Removed MSS, LTE B11/14/29/71, and 5G NR n14/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 A3102, and A3104 in accordance with the test plan approved via KDB inquiry. Comparison of the models, upper deviation is within 0.5dB range of antenna port data, and all tests are under FCC Technical Limits. The results documented for model A3101 may be applied as representative to models A3102, A3104.

5.4. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A3102.

A3102 SPOT CHECK RESULTS							
Technology	Worst Mode	Test Item	Measured	Original Model: A3101	Sub Model: A3102	Delta (dB)	Remarks
			Frequency (MHz)	FCC ID: BCG-E8436A (dBm)	FCC ID: BCG-E8437A (dBm)		
LTE BAND 7	QPSK @ 20 MHz BW	Cond Power	2500-2570	25.70	25.70	0	Noise Floor
	QPSK @ highest BW	RSE		-44.28	-48.64	4.36	
5G NR BAND N7	BPSK @ 40 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	BPSK @ 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		-44.83	-36.79	8.04	
5G NR BAND N25	BPSK @ 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	
5G NR BAND N26 (90S)	BPSK @ 10 MHz BW	Cond Power	814-824	25.70	25.70	0	
LTE BAND 26 (P22)	QPSK @ 50 MHz BW	Cond Power	824-849	25.70	25.70	0	Noise Floor
	QPSK @ highest BW	RSE		-52.75	-40.18	12.57	
5G NR BAND N26 (P22)	QPSK @ 20 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	BPSK @ 10 MHz BW	Cond Power	2305-2315	25.20	25.20	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	
LTE BAND 48	QPSK @ 20 MHz BW	Cond Power	3550-3700	26.00	26.00	0	Noise Floor
		RSE		-50.51	-49.63	0.88	
5G NR BAND N48	BPSK @ 40 MHz BW	Cond Power	3550-3700	26.00	26.00	0	
LTE BAND 53	QPSK @ 10 MHz BW	Cond Power	2483.5-2495	20.70	20.70	0	
5G NR BAND N53	BPSK @ 10 MHz BW	Cond Power	2483.5-2495	20.70	20.70	0	
LTE BAND 66	QPSK @ 20 MHz BW	Cond Power	1710-1780	25.70	25.70	0	
5G NR BAND N66	BPSK @ 40 MHz BW	Cond Power	1710-1780	25.70	25.70	0	
5G NR BAND n70	BPSK @ 15 MHz BW	Cond Power	1695-1710	25.70	25.70	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3450-3550	28.70	28.70	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3700-3980	28.70	28.70	0	
5G NR BAND N79	BPSK @ 100 MHz BW	Cond Power	4940-4990	20.00	20.00	0	

5.5. SPOT CHECK VERIFICATION RESULTS SUMMARY FOR A3104.

A3104 SPOT CHECK RESULTS							
Technology	Worst Mode	Test Item	Measured	Original Model: A3101	Sub Model: A23104	Delta (dB)	Remarks
			Frequency (MHz)	FCC ID: BCG-E8436A (dBm)	FCC ID: BCG-E8438A (dBm)		
LTE BAND 7	QPSK @ 20 MHz BW	Cond Power	2500-2570	25.70	25.68	-0.02	
	QPSK @ highest BW	RSE		-44.28	-44.45	-0.56	Noise Floor
5G NR BAND N7	BPSK @ 40 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	BPSK @ 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		-44.83	-46.85	-2.02	Noise Floor
5G NR BAND N25	BPSK @ 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	
5G NR BAND N26 (90S)	BPSK @10 MHz BW	Cond Power	814-824	25.70	25.70	0	
LTE BAND 26 (P22)	QPSK @ 50 MHz BW	Cond Power	824-849	25.70	25.70	0	
	QPSK @ highest BW	RSE		-52.75	-53.56	-0.81	Noise Floor
5G NR BAND N26 (P22)	BPSK @20 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	BPSK @ 10 MHz BW	Cond Power	2305-2315	25.20	25.20	0	
LTE BAND 41	QPSK @ 20 MHz BW	Cond Power	2496-2690	28.70	28.64	-0.06	
5G NR BAND N41	BPSK @ 100 MHz BW	Cond Power	2496-2690	28.70	28.70	0	
LTE BAND 48	QPSK @ 20 MHz BW	Cond Power	3550-3700	26.00	26.00	0	
		RSE		-50.51	-51.96	-1.45	Noise Floor
5G NR BAND N48	BPSK @ 40 MHz BW	Cond Power	3550-3700	26.00	26.00	0	
LTE BAND 53	QPSK @ 10 MHz BW	Cond Power	2483.5-2495	20.70	20.70	0	
5G NR BAND N53	BPSK @ 10 MHz BW	Cond Power	2483.5-2495	20.70	20.70	0	
LTE BAND 66	QPSK @ 20 MHz BW	Cond Power	1710-1780	25.70	25.70	0	
5G NR BAND N66	BPSK @ 40 MHz BW	Cond Power	1710-1780	25.70	25.70	0	
5G NR BAND n70	QPSK @ 15 MHz BW	Cond Power	1695-1710	25.70	25.70	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3450-3550	28.70	28.70	0	
5G NR BAND N77	BPSK @ 100 MHz BW	Cond Power	3700-3980	28.70	28.70	0	
5G NR BAND N79	BPSK @ 50 MHz BW	Cond Power	4940-4990	20.00	20.00	0	

5.6. 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-E8436A	14523744-E18V1	BCG-E8437A	FCC LTE Report / All Sections except LTE/5G NR Band B14/71 sections
PCE, CBE, TNE			BCG-E8438A	FCC LTE Report / All Sections except LTE/5G NR Band B14/71 sections

5.7. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version:0.15.02

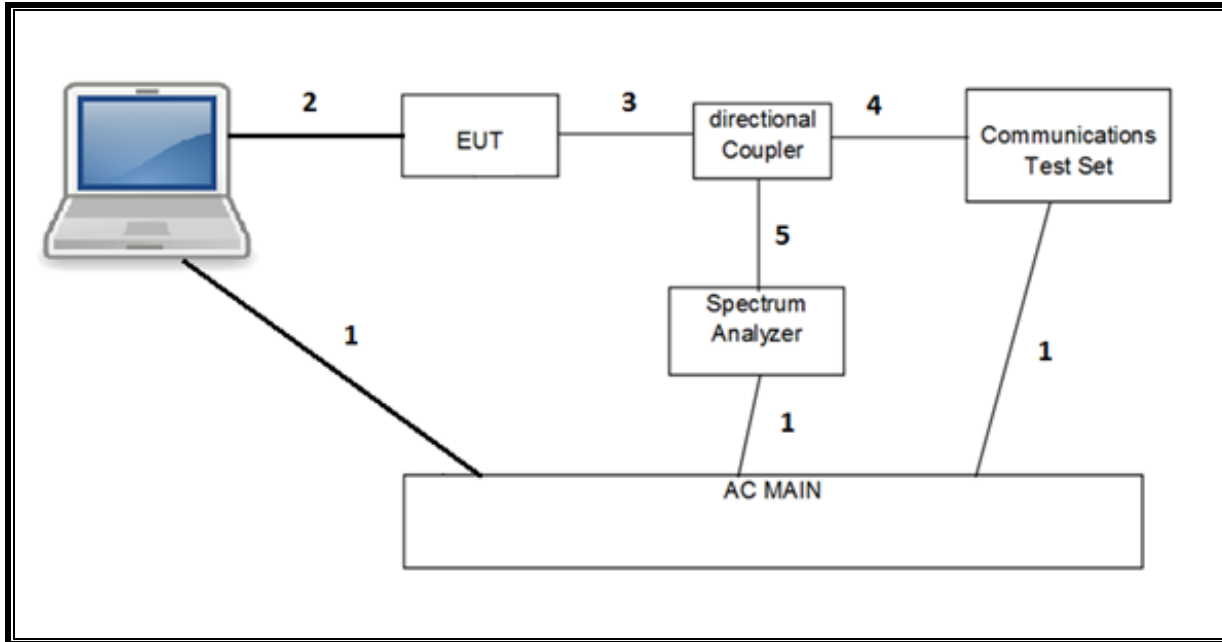
5.8. SPOT CHECK WORST-CASE CONFIGURATION AND MODE

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

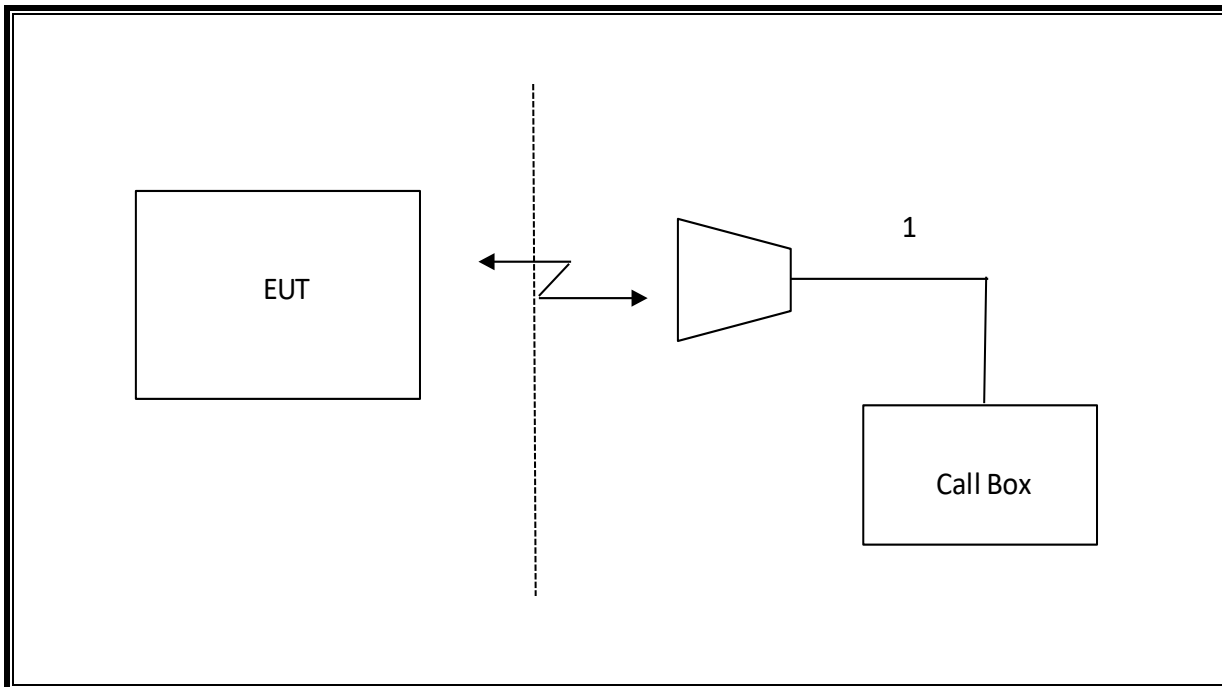
5.9. DESCRIPTION OF TEST SETUP

SUPPORT TEST EQUIPMENT						
Description	Manufacturer	Model	Serial Number	FCC ID/ DoC		
Laptop	Apple	MacBook Pro	HRP082673	BCGA1708		
AC/DC adapter	Apple	A1718	C4H64450HH3GN8RA6	--		
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	79834	06/08/2023
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	85151	04/30/2024
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	85313	02/29/2024
Spectrum Analyzer, PXA	Keysight	N9030B	222074	07/16/2023
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	85201	02/29/2024
Spectrum Analyzer, PXA	Keysight	N9030B	85214	07/18/2023
Spectrum Analyzer, PXA	Keysight	N9030B	222073	07/22/2023
PXA Signal Analyzer	Keysight	N9030B	222073	07/22/2023
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	230548	02/29/2024
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	201498	02/29/2024
Directional Coupler	KRYTAR	152610	198816	09/23/2023
Directional Coupler	KRYTAR	152610	198817	09/23/2023
Directional Coupler	KRYTAR	152610	135712	09/23/2023
Power Meter, P-series single channel	Keysight	N1912A	90630	01/24/2024
Power Meter, P-series single channel	Keysight	N1912A	90719	01/31/2024
Power Meter, P-series single channel	Agilent	N1911A	82174	01/31/2024
Power Sensor, P – series, 50MHz to 18GHz, Wideband	Keysight	N1921A	90389	01/31/2024
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	222792	02/29/2024
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	230298	02/29/2024
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	230295	02/29/2024
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	22796	02/29/2024
Wideband Communication Test Set, Call Box	Rohde & Schwarz	CMW500	230297	02/29/2024
*5G NR Communication Test Set, Call Box	Keysight	UXM	207269	01/31/2024
*5G NR Communication Test Set, Call Box	Keysight	UXM	199836	01/31/2024
*Amplifier, 218GHz to 26.5GHz	Ampical	AMP18G26.5-60	215705	02/26/2023
*Amplifier, 26.5GHz to 40GHz	Ampical	AMP26G40-65	172346	02/29/2024
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826/B	172362	03/31/2024
Antenna, Horn 26.5GHz to 40GHz	ARA	MWH-2640/B	172365	03/31/2024
*Antenna, Active Loop 100KHz to 30MHz	ELECTRO-METRICS	EM-6872	219911	05/10/2023
*Antenna, Active Loop 30Hz to 1MHz	ELECTRO-METRICS	EM-6871	219909	05/10/2023
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	236360	N/A
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	236285	N/A
10dB Fixed Attenuator	Pasternack Enterprises	PE7087-10	236355	N/A
UL AUTOMATION SOFTWARE				
CLT Software	UL	UL RF	Ver 3.4, May 20, 2022	
Power Measurement Software	UL	UL RF	Ver 3.1.4, April 29, 2022	
Radiated test software	UL	UL RF	Ver 9.5, Jan 21, 2022	

NOTES:

* Testing is completed before equipment expiration date.

Appendix A – Reference Test Report

Attached is the test report (14523744-E18) containing the reference data from the parent model as detailed in section 5.7.