RF EXPOSURE EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
SMARTPHONE

FCC ID: BCG-E8139A
Model Name: A2632

Report Number: 14040868-S9V1
Issue Date: 8/18/2022

Prepared for
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Prepared by

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ACCREDITED
CERT #0751.05

Revision History

Rev.	Date	Revisions	Revised By
V1	8/18/2022	Initial Issue	

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1. Attestation of Test Results

Applicant Name	APPLE, INC.
FCC ID	BCG-E8139A
Model Name	A2632
Applicable Standards	FCC 47 CFR § 2.1093, Published RF exposure KDB procedures, IEEE Std 1528-2013
Date Tested	8/8/2022 to 8/16/2022
Test Results	Pass

This test report is supplemental to UL SAR report 14040868-S1. It contains SAR and PD test data obtained while the DUT was transmitting WPT energy to a MagSafe compatible battery pack (FCCID BCG-A2384). Refer to section 7 for a description of the modes tested.

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.

This report contains data provided by the customer which can impact the validity of results. UL Verification Services Inc. is only responsible for the validity of results after the integration of the data provided by the customer.

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:	Prepared By:
Dave Weaver Operations Leader UL Verification Services Inc.	Chakrit Thammanavarat Senior Test Engineer UL Verification Services Inc.

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528-2013, the following FCC Published RF exposure **KDB** procedures:

- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D01 General RF Exposure Guidance v06
- 447498 D03 Supplement C Cross-Reference v01
- 648474 D04 Handset SAR v01r03
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02
- 941225 D01 3G SAR Procedures v03r01
- 941225 D05 SAR for LTE Devices v02r05
- 941225 D05A LTE Rel.10 KDB Inquiry Sheet v01r02
- 941225 D06 Hotspot Mode v02r01

In addition to the above, the following information was used:

- **TCB workshop** October 2014; RF Exposure Procedures (Other LTE Considerations)
- **TCB workshop** April 2015; RF Exposure Procedures (Overlapping LTE Bands)
- **TCB workshop** October 2015; RF Exposure Procedures (KDB 941225 D05A)
- **TCB workshop** April 2016; RF Exposure Procedures (LTE Carrier Aggregation for DL)
- **TCB workshop** October 2016; RF Exposure Procedures (LTE Carrier Aggregation for UL)
- **TCB workshop** October 2016; RF Exposure Procedures (Bluetooth Duty Factor)
- **TCB workshop** October 2016; RF Exposure Procedures (DUT Holder Perturbations)
- **TCB workshop** May 2017; RF Exposure Procedures (Broadband Liquid Above 3 GHz)
- **TCB workshop** May 2017; RF Exposure Procedures (LTE Band 41 Power Class 2)
- **TCB workshop** November 2017; RF Exposure Procedures (LTE UL/DL Carrier Aggregation SAR)
- **TCB workshop** April 2018; RF Exposure Procedures (LTE DL CA SAR Test Exclusion)
- **TCB workshop** October 2018; RF Exposure Procedures (LTE Inter-Band Uplink Carrier Aggregation –Interim Procedures)
- **TCB workshop** April 2019; RF Exposure Procedures (802.11ax SAR Testing)
- **TCB workshop** November 2019; RF Exposure Policy Updates (5G NR FR1 NSA EN-DCUE SAR Evaluations)
- **TCB workshop** April 2021; RF Exposure Procedures (Remarks on Test Reductions via Data Referencing for Closely Related Products)

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

47173 Benicia Street	47266 Benicia Street
SAR Lab A	SAR Lab 1
SAR Lab B	SAR Lab 2
SAR Lab C	SAR Lab 3
SAR Lab D	SAR Lab 4
SAR Lab E	SAR Lab 5
SAR Lab F	SAR Lab 6
SAR Lab G	SAR Lab 8
SAR Lab H	SAR Lab 9
	SAR Lab 10
	SAR Lab 11
	SAR Lab 12
	SAR Lab 13

UL Verification Services Inc. is accredited by A2LA, Certificate Number 0751.05

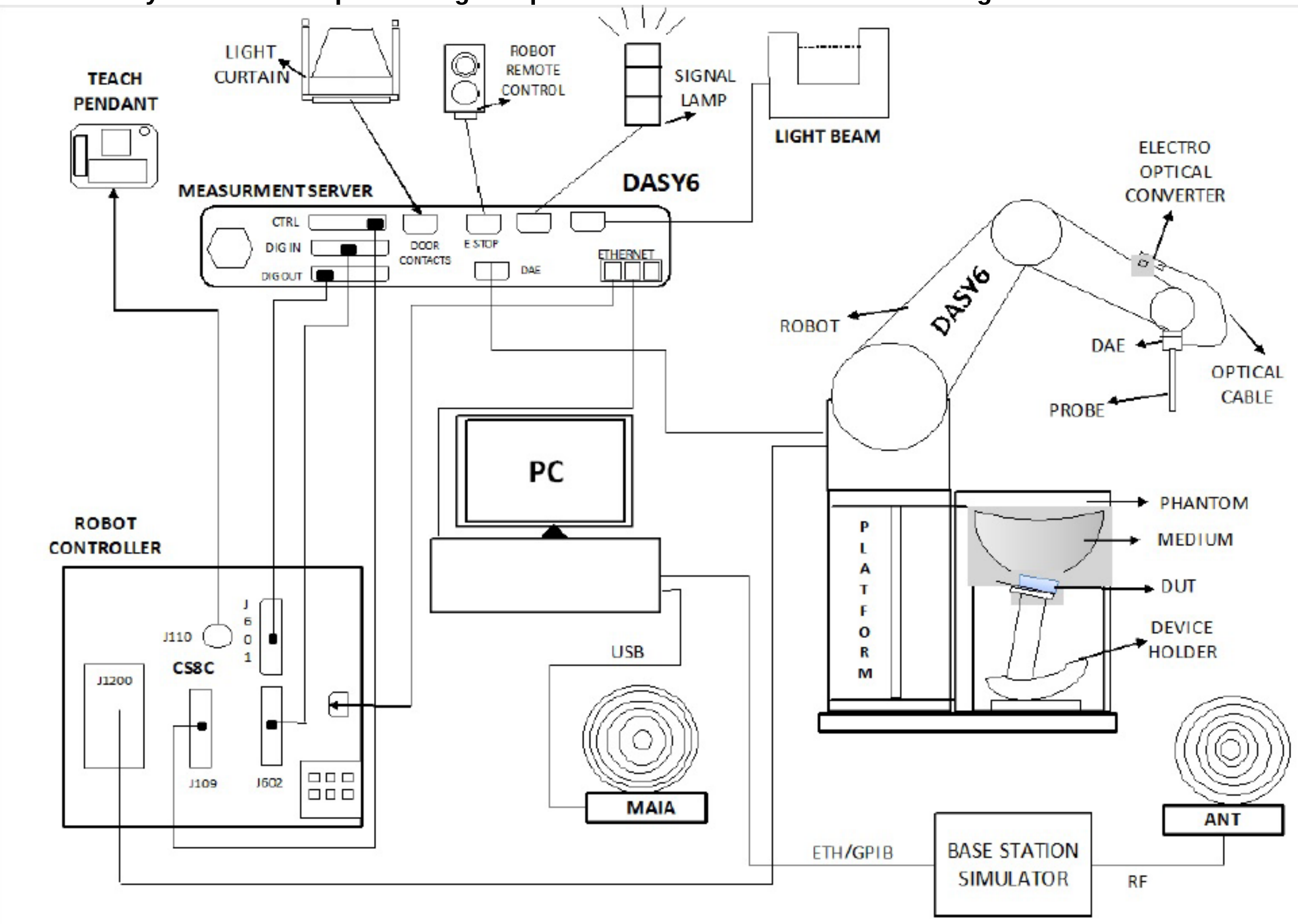
The Test Lab Conformity Assessment Body Identifier (CABID)

Location	CABID	Company Number
47173 Benicia Street, Fremont, CA, 94538 UNITED STATES	US0104	2324A
47266 Benicia Street, Fremont, CA, 94538 UNITED STATES		22541

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7, Win10 and the DASY52[1] and DASY6[2] software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

[1] DASY52 software used: DASY52.10.4 & S 14.6.14 and older generations.

[2] DASY6 software used: DASY6.14 & S 14.6.14 and older generations.

4.2. SAR Scan Procedures

Step 1: Power Reference Measurement
The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan
The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

4.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	R&S	ZNLE6	13230012K56-101274-mn	2/15/2023
Dielectric Probe Kit	SPEAG	DAK 3.5mm Probe	1082	9/19/2022
Shorting Block	SPEAG	DAK-3.5 Short	SM DAK 200 BA	9/19/2022
Thermometer	Fisher Scientific	Z540	170064398	9/1/2022
Vector Reflectometer	Copper Mountain	DAKS VNA R140	170514	4/25/2023

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Synthesized Signal Generator	Agilent	N5181A	MY50140610	1/26/2023
Power Meter	Keysignt	N1912a	MY55196007	1/25/2023
Power Sensor	Agilent	N1921A	MY52270022	1/25/2023
Power Sensor	Agilent	N1921A	MY5220012	1/25/2023
Amplifier	Miteq	147117-1E	1795093	N/A
Directional Coupler	SMA	C8060-102	2717	N/A
DC Power Supply	Sorensen	XT15-4	1817A02680	N/A
Power Sensor	Rohde & Schwarz	NRP18A	1424 6815K02-100992-iu	2/19/2023
Synthesized Signal Generator	Rohde & Schwarz	SMB 100A	1406.6000K03-180969-Yc	2/16/2023
Power Meter	Keysight	N1911A	MY55196015	1/26/1023
Power Sensor	Agilent	N1921A	MY53260001	1/25/2023
Power Sensor	Rohde & Schwarz	NRP18A	1424.6815K02-100994-RE	2/19/2023
Directional Coupler	Werlatone	C8060-102	2710	N/A

Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
E-Field Probe (SAR Lab A)	SPEAG	EX3DV4	7501	3/25/2023
E-Field Probe (SAR Lab C)	SPEAG	EX3DV4	7500	3/25/2023
E-Field Probe (SAR Lab D)	SPEAG	EX3DV4	7587	4/27/2023
E-Field Probe (SAR Lab E)	SPEAG	EX3DV4	3885	9/23/2022
E-Field Probe (SAR Lab G)	SPEAG	EX3DV4	7585	4/27/2023
E-Field Probe (SAR Lab 5)	SPEAG	EUmmWV4	9496	2/24/2023
Data Acquisition Electronics (SAR Lab A)	SPEAG	DAE4	1546	3/22/2023
Data Acquisition Electronics (SAR Lab C)	SPEAG	DAE4	1545	3/23/2023
Data Acquisition Electronics (SAR Lab D)	SPEAG	DAE4	1239	3/21/2023
Data Acquisition Electronics (SAR Lab E)	SPEAG	DAE4	1377	9/20/2022
Data Acquisition Electronics (SAR Lab G)	SPEAG	DAE4	1472	1/7/2023
Data Acquisition Electronics (SAR Lab 5)	SPEAG	DAE4	1619	4/21/2023

Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
System Validation Dipole	SPEAG	D835V2	4d002	11/24/2023
System Validation Dipole	SPEAG	D1900V2	5d163	9/29/2022
System Validation Dipole	SPEAG	D2450V2	748	2/22/2023
System Validation Dipole	SPEAG	D2600V2	1006	9/29/2022
System Validation Dipole	SPEAG	D5GHzv2	1003	2/23/2023
System Validation Dipole	SPEAG	5G Verification Source 30GHz	1003	9/16/2022

OTHER

Name of Equipment	Manufacturer	Type/Model	T Number	Serial No.	Cal. Due Date
Wideband Radio Communication Tester	R&S	CMW 500	85719	135390	2/20/2023
Wideband Radio Communication Tester	R&S	CMW 500	80580	132910	2/19/2023
Wideband Radio Communication Tester	R&S	CMW 500	85698	135393	2/18/2023
Wideband Radio Communication Tester	R&S	CMW 500	209235	170415	2/22/2023

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

Therefore, the measurement uncertainty is not required.

6. Dielectric Property Measurements & System Check

6.1. Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

The dielectric constant (εr) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within ± 5% of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for εr and σ may be relaxed to ± 10%. This is limited to frequencies ≤ 3 GHz.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

IEC 62209-1

Refer to Table A.3 within the IEC 62209-1

Dielectric Property Measurements Results:

SAR Lab	Date	Band (MHz)	Tissue Type	Frequency (MHz)	Relative Permittivity (εr)			Conductivity (σ)		
					Measured	Target	Delta	Measured	Target	Delta
A	8/12/2022	835	Head	835	39.96	41.50	-3.71%	0.88	0.90	-2.27%
				805	39.97	41.68	-4.10%	0.87	0.90	-3.13%
				850	39.94	41.50	-3.76%	0.89	0.92	-3.22%
C	8/9/2022	1900	Head	1900	40.09	40.00	0.23%	1.45	1.40	3.57%
				1850	40.13	40.00	0.33%	1.43	1.40	2.14%
				1920	40.09	40.00	0.23%	1.46	1.40	4.29%
D	8/12/2022	2600	head	2600	40.19	39.01	3.02%	1.88	1.96	-4.14%
				2495	40.36	39.14	3.11%	1.79	1.85	-3.12%
				2690	40.02	38.90	2.89%	1.96	2.06	-4.98%
E	8/8/2022	2450	Head	2450	39.58	39.20	0.97%	1.80	1.80	-0.28%
				2400	39.66	39.30	0.92%	1.75	1.75	0.02%
				2500	39.49	39.14	0.90%	1.83	1.85	-1.19%
G	8/9/2022	5250	Head	5250	36.60	35.93	1.86%	4.48	4.70	-4.77%
				5150	36.77	36.05	2.01%	4.37	4.60	-4.97%
				5350	36.44	35.82	1.73%	4.59	4.80	-4.38%

6.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10 mm (above 1 GHz) and 15 mm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
  For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube was chosen for the cube.
- Distance between probe sensors and phantom surface was set to 3 mm.
  For 5 GHz band - Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was 100 mW.
- The results are normalized to 1 W input power.

System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within ±10% of the manufacturer calibrated dipole SAR target. Refer to Appendix B for the SAR System Check Plots.

SAR Lab	Date	Tissue Type	Dipole Type & Serial Number	Dipole Cal. Due Date	Measured results for 1-g SAR				Measured results for 10-g SAR				Plot No.
					Zoom Scan at 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10%	Zoom Scan at 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10%	
A	8/12/2022	Head	D835V2 SN:4d002	11/24/2022	0.989	9.89	9.71	1.85%	0.657	6.57	6.41	2.50%	1
C	8/9/2022	Head	D1900V2 SN:5d163	9/29/2022	3.900	39.00	40.61	-3.96%	2.000	20.00	21.02	-4.85%	2
D	8/12/2022	Head	D2600V2 SN:1006	9/29/2022	5.450	54.50	54.94	-0.80%	2.470	24.70	25.24	-2.14%	3
E	8/8/2022	Head	D2450V2 SN:748	2/22/2023	5.050	50.50	52.40	-3.63%	2.370	23.70	24.40	-2.87%	4
G	8/9/2022	Head	D5GHzV2 SN:1003 (5.25 GHz)	2/23/2023	8.610	86.10	81.70	5.39%	2.520	25.20	23.30	8.15%	5

6.3. Measurement Setup and General Information

The SAR measurement are recorded in UL *FCC SAR Test Report* (Report No. 14040863-S1).

This section provides the details of the test setup used for PD measurement.

6.3.1. Test Environment

Test Location	UL Verification Services
Ambient Temperature	22 ± 2°C

6.3.2. Power Density Measurement System

The power density measurement system is constructed based on the DASY6 platform by SPEAG. The DASY6 with EUmmWv2 and 5G software module can measure the electromagnetic exposure (electromagnetic and power density) up to 110GHz as close as 2mm from any transmitter.

6.3.3. Power Density Probe

The novel EUmmWV3 & EUmmWV4 probe is used in the power density measurement. It is designed for precise near-field measurements in the mm-wave range by Schmid & Partner Engineering AG of Zurich, Switzerland. The specifications are:

- Frequency range: 0.75 ~ 110 GHz
- Dynamic range: <50 – 3000 V/m (up to 10000 V/m with additional PRE-10 voltage divider)
- Linearity: < ± 0.2 dB
- Supports sensor model calibration (SMC)
- ISO17025 accredited calibration

6.3.4. Power Density Measurement System Verification

The power density system verification is performed using the SPEAG verification device. It consists of a ka-band horn antenna with a corresponding gun oscillator packaged within a cube-shaped housing.

The specification of the verification device is:

- Calibrated frequency: 30 GHz at 5.55 mm from the case surface
- Frequency accuracy: ± 100 MHz
- E-field polarization: linear
- Harmonics: -20 dBc (typ)
- Total radiated power: 14 dBm (typ)
- Power stability: 0.05 dB
- Power consumption: 5 W (max)
- Size: 100 × 100 × 100 mm
- Weight: 1 kg

The measured power density (PD) value is within ±10% of target level; for the 5G verification source’s uncertainty, please refer to Appendix B.

SAR Lab	Date	Frequency (GHz)	5G Verification Source SN	Source Cal. Due Data	Result Incident power (mW/cm2) over 4cm²	$Target_n$ (Ref. Value)	Deviation (dB)	Delta ±10 %	Result Total power (mW/cm2) over 4cm²	$Target_{Tot}$ (Ref. Value)	Deviation (dB)	Delta ±10 %	Plot No.
SAR 5	8/15/2022	30	1003	9/16/2022	33.2	33.08	0.02	0%	33.8	33.53	0.03	1%	6

7. Test Results

7.1. Measured and Reported (Scaled) SAR Results

The DUT supports an inductive charging system in both Tx and Rx modes. The DUT only supports Tx mode while it is connected to an external power supply via the lightning connector.

SAR testing was performed on the worst case Head position for each supported technology based upon FCC guidance. Body testing was deemed unnecessary as the body-worn scenario would not be supported while the DUT is plugged in to the external power supply.

Technology	Exposure Condition	Mode	RB	Antenna	Test Position	Ch.	Frequency	Max. Tune-up	Measured Pwr	Duty cycle (%)	Original SAR (scaled)	1g SAR Measured Result (With Battery Pack) (W/kg)	Scaled 1g SAR Reported (W/kg)	Scaled Baseline vs Orig. Reported	Plot
GSM1900	Head While Phone Charging	GPRS 2 Slots		2	Right Touch	661	1880.0	24.90	24.20		0.941	0.713	0.838	-11%	1
W-CDMA B5	Head While Phone Charging	Rel 99 RMC 12.2 kbps		2	Right Touch	4132	826.4	22.50	21.80		0.929	0.789	0.927	0%	2
LTE B7	Head While Phone Charging	QPSK	50,24	2	Left Touch	21350	2560.0	16.90	16.60		0.940	0.875	0.938	0%	3
n41	Head While Phone Charging	π/2 BPSK	135,67	2	Left Tilt	518598	2593.0	16.60	16.50		0.948	0.895	0.916	-3%	4
WIFI 2.4GHz	Head While Phone Charging	802.11b		4	Left Touch	6	2437.0	20.50	19.29	100.0%	1.078	0.655	0.865	-20%	5
WIFI 5.3 GHz	Head While Phone Charging	802.11n HT40		6	Right Touch	54	5270	18.75	17.63	96.1%	1.138	0.742	0.999	-12%	6

7.2. Measured PD Results

The DUT supports an inductive charging system in both Tx and Rx modes. The DUT only supports Tx mode while it is connected to an external power supply via the lightning connector.

As PD testing does not use a specific head phantom testing was performed on the worst case position.

														Original		Measured			
RF Exposure Conditions	Cell Protocol & Band	Mode	Antenna	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Beam ID1 (V)	Beam ID2 (H)	Bandwidth (MHz)	RB Allocation	RB Offset	Pwr Setting (dBm)	Normal psPD (mW/cm^2)	Total psPD mW/cm^2	Normal psPD (mW/cm^2)	Total psPD mW/cm^2	Original vs Measured Total psPD	Plot No.
Standalone	n260	QPSK	SF	2	Right	2229167	37050.0	48	N/A	100	1	33	1.1	3.450	5.530	4.110	4.570	-19%	7

Appendixes

Refer to separated files for the following appendixes.

Appendix A: Setup Photos

Appendix B: System Check Plots

Appendix C: Highest Test Plots

Appendix D: SAR Tissue Ingredients

Appendix E: SAR Probe Certificates

Appendix F: SAR Dipole Certificates

END OF REPORT