



SAR EVALUATION REPORT

**FCC 47 CFR § 2.1093
IEEE Std 1528-2013**

For
SMARTPHONE

FCC ID: BCG-E8428A, BCG-E8429A, BCG-E8430A

Model Name: A3089, A3090, A3092

**Report Number: 14523759-S1V1
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Revision History

| Rev. | Date | Revisions | Revised By |
|------|----------|---------------|------------|
| V1 | 7/6/2023 | Initial Issue | -- |
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1. Attestation of Test Results

| | | | | | | | |
|---|---|-------|-------|--|--|-------|-----------|
| Applicant Name | APPLE INC. | | | | | | |
| FCC ID | BCG-E8428A, BCG-E8429A, BCG-E8430A | | | | | | |
| Model Name | A3089, A3090, A3092 | | | | | | |
| Applicable Standards | FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013 | | | | | | |
| Exposure Category | SAR Limits (W/Kg) | | | | | | |
| | Peak spatial-average (1g of tissue) | | | | Extremities (hands, wrists, ankles, etc.) (10g of tissue) | | |
| General population / Uncontrolled exposure | 1.6 | | | | 4 | | |
| RF Exposure Conditions | Equipment Class - Highest Reported SAR (W/kg) | | | | | | |
| | TNE | PCE | CBE | DTS | NII | DSS | DXX (10g) |
| Worst Case from BCG-E8427A (A2846) | 0.930 | 0.950 | 0.934 | 1.121 | 1.136 | 0.885 | 0.005 |
| Variant Models | Worst-Case SAR for Variant Models | | | | | | |
| BCG-E8428A (A3089) | 0.906 | 0.726 | 0.812 | 0.970 | 0.944 | 0.776 | 0.005 |
| BCG-E8429A (A3090) | 0.776 | 0.718 | 0.941 | 0.971 | 0.677 | 0.717 | 0.002 |
| BCG-E8430A (A3092) | N/A | 0.842 | 0.853 | 1.119 | 0.805 | 0.827 | 0.005 |
| Date Tested | 6/8/2023 to 6/30/2023 | | | | | | |
| Test Results | Pass | | | | | | |
| <p>This application for certification is leveraging the data reuse procedure from TCB workshop April 2021; RF Exposure Procedures (Remarks on Test Reductions via Data Referencing for Closely Related Products) based on reference FCC ID: BCG-E8427A (UL report# 14523758-S1) to cover variants FCC ID: BCG-E8428A, BCG-E8429A, and BCG-E8430A. The major difference between the reference model and the variant models is the depopulation of the mmWave transmitter in the variant models. All other circuitry and features are identical. The data reuse test plan was approved via manufacturer KDB inquiry.</p> <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 can demonstrate compliance with the requirements as documented in this report.</p> <p>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.</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 considered 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 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: | | | |
|  | | | |  | | | |
| Devin Chang Senior Test Engineer UL Verification Services Inc. | | | | Coltyce Sanders Staff Laboratory 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** October 2020; 5G and RF Exposure Procedures (U-NII 6-7 GHz SAR Testing)
- **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

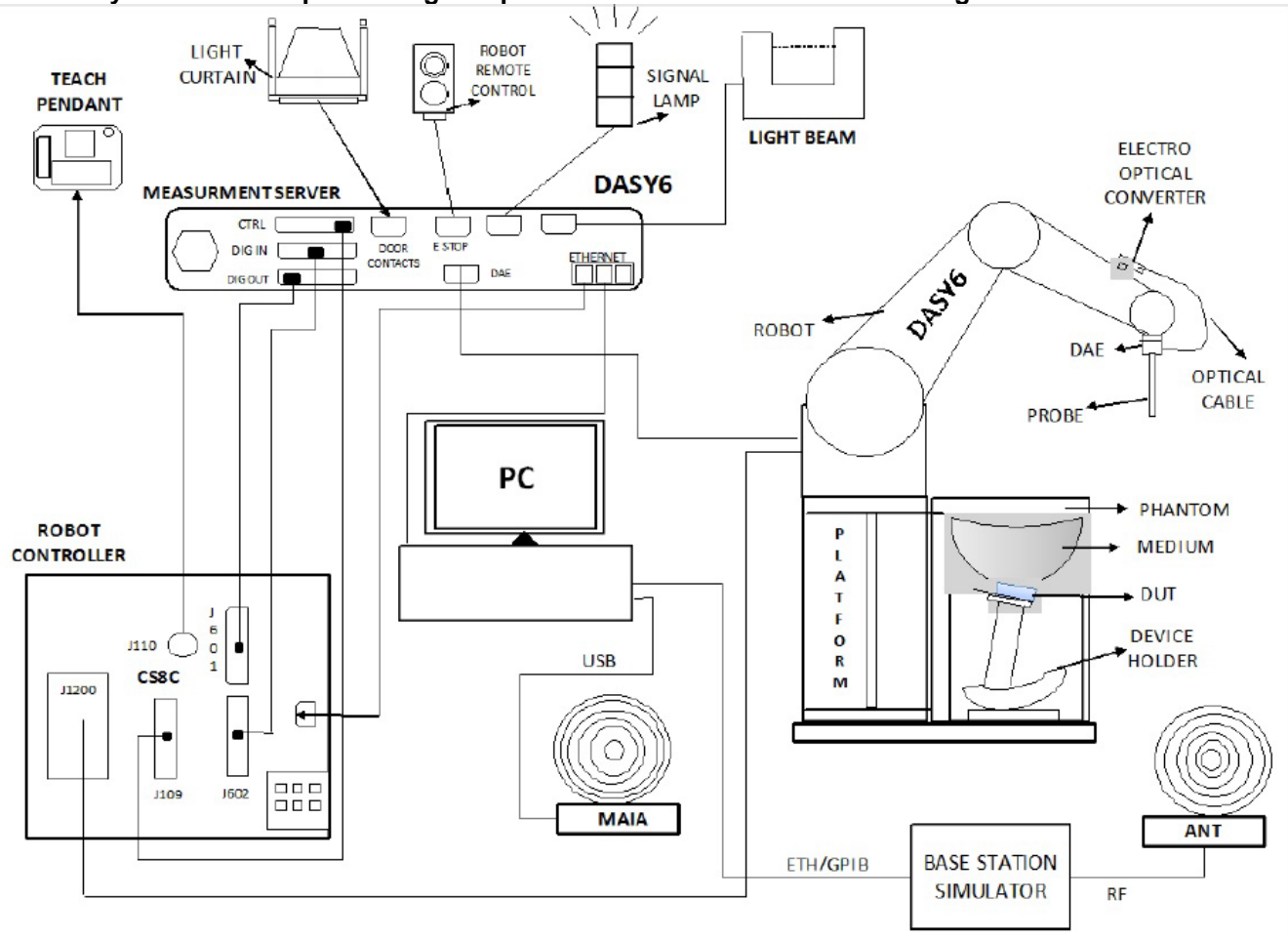
| | |
|----------------------|----------------------|
| 47173 Benicia Street | 47266 Benicia Street |
| SAR Labs A to I | SAR Labs 1 to 19 |

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

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 Win10 and the DASY6/8¹ 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 DASY6/8 software used: DASY6.16.2 or DASY8.16.2 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 IEC/IEEE 62209-1528, 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 | $\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ 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: $\Delta x_{Zoom}, \Delta y_{Zoom}$ | | ≤ 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 1 st 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 <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> 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.

Dielectric Property Measurements

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|-------------------------|----------------------|-------------------|---------------|---------------|
| Vector Network Analyzer | ROHDE & SCHWARZ | ZNLE6 | 101274-mn | 2/19/2024 |
| Dielectric Probe kit | SPEAG | DAK-3.5 | 1103 | 2/28/2024 |
| Shorting Block | SPEAG | DAK-1.2/3.5 Short | SM DAK 200 BA | 2/28/2024 |
| Thermometer | Fisher Scientific | Traceable | 122529162 | 8/9/2023 |
| Vector Network Analyzer | ROHDE & SCHWARZ | ZNLE6 | 101273-VA | 2/19/2024 |
| Dielectric Probe kit | SPEAG | DAK-3.5 | 1082 | 9/19/2023 |
| Dielectric Probe kit | SPEAG | DAK-12 | 1128 | 1/16/2024 |
| Shorting Block | SPEAG | DAK-1.2/3.5 Short | SM DAK 200 BA | 9/19/2023 |
| Shorting Block | SPEAG | DAK-12 Short | SM DAK 220 AC | 1/16/2024 |
| Thermometer | Fisher Scientific | Traceable | 140493798 | 4/30/2024 |
| Vector Network Analyzer | Copper Mountain Tech | R140N | 21130078 | 4/30/2024 |
| Dielectric Probe kit | SPEAG | DAK-3.5 | 1087 | 11/17/2023 |
| Shorting Block | SPEAG | DAK-1.2/3.5 Short | SM DAK 200 BA | 11/17/2023 |
| Thermometer | Fisher Scientific | Traceable | 170064398 | 4/10/2024 |

System Check

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|-----------------------------|--------------|------------------------|------------|---------------|
| MXG Analog Signal Generator | Agilent | N5181A | MY50140610 | 1/31/2024 |
| Power Meter | HP | 437B | 3125U11364 | 1/31/2024 |
| Power Meter | HP | 437B | 3125U11347 | 1/31/2024 |
| Power Sensor | HP | 8481A | 3318A92374 | 1/31/2024 |
| Power Sensor | HP | 8481A | 1926A27049 | 1/31/2024 |
| Amplifier | Miteq | AMF-4D-00400600-50-30P | 1795093 | N/A |
| Bi-directional coupler | Werlatone | C8060-102 | 2711 | N/A |
| DC Power Supply | Sorensen | XT 15-4 | 1802A01877 | N/A |
| MXG Analog Signal Generator | Agilent | N5181A | MY50140630 | 1/31/2024 |
| Power Meter | Keysight | N1912A | MY55196004 | 1/31/2024 |
| Power Sensor | Agilent | N1921A | MY53260010 | 1/31/2024 |
| Power Sensor | Agilent | N1921A | MY52260009 | 1/31/2024 |
| Amplifier | Miteq | AMF-4D-00400600-50-30P | 1795092 | N/A |
| Bi-directional coupler | Werlatone | C8060-102 | 2149 | N/A |
| DC Power Supply | Sorensen | XT 15-4 | PRE0178948 | N/A |
| Signal Generator | R&S | SMB 100A | 171706 | 2/29/2024 |
| Power Meter | Keysight | N1912A | MY55196007 | 1/31/2024 |
| Power Sensor | Agilent | N1921A | MY53020038 | 1/31/2024 |
| Power Sensor | R&S | NRP18A | 171503 | 2/29/2024 |
| Bi-directional coupler | Werlatone | C8060-102 | 4054 | N/A |
| Signal Generator | R&S | SMB 100A | 171705 | 2/29/2024 |
| Power Meter | HP | 437B | 3125U09248 | 1/31/2024 |
| Power Sensor | HP | 8481A | 2237A31744 | 1/31/2024 |
| Power Sensor | R&S | NRP8S | 199180 | 2/29/2024 |
| Bi-directional coupler | Werlatone | C8060-102 | 2710 | N/A |
| Signal Generator | R&S | SMB 100A | 171705 | 2/29/2024 |
| Power Meter | HP | 437B | 3125U09248 | 1/31/2024 |
| Power Sensor | R&S | NRP18A | 171443 | 2/29/2024 |
| Power Sensor | Agilent | 8481A | 2237A31744 | 1/26/2024 |
| Bi-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 | 3772 | 2/13/2024 |
| E-Field Probe (SAR Lab D) | SPEAG | EX3DV4 | 7587 | 4/18/2024 |
| E-Field Probe (SAR Lab F) | SPEAG | EX3DV4 | 7585 | 4/18/2024 |
| E-Field Probe (SAR Lab 2) | SPEAG | EX3DV4 | 3989 | 1/26/2024 |
| E-Field Probe (SAR Lab 13) | SPEAG | EX3DV4 | 3990 | 2/17/2024 |
| E-Field Probe (SAR Lab 19) | SPEAG | EX3DV4 | 7356 | 3/17/2024 |
| Data Acquisition Electronics (SAR Lab A) | SPEAG | DAE4 | 1359 | 1/24/2024 |
| Data Acquisition Electronics (SAR Lab D) | SPEAG | DAE4 | 1239 | 3/16/2024 |
| Data Acquisition Electronics (SAR Lab F) | SPEAG | DAE4 | 1797 | 4/3/2024 |
| Data Acquisition Electronics (SAR Lab 2) | SPEAG | DAE4 | 1257 | 9/20/2023 |
| Data Acquisition Electronics (SAR Lab 13) | SPEAG | DAE4 | 1545 | 2/14/2024 |
| Data Acquisition Electronics (SAR Lab 19) | SPEAG | DAE4 | 1798 | 5/2/2024 |
| Thermometer | TRACEABLE | 6530CC | 155512 | 2/29/2024 |
| Thermometer | TRACEABLE | 6530CC | 174046 | 2/29/2024 |
| Thermometer | TRACEABLE | 6530CC | 168571 | 2/29/2024 |
| Thermometer | TRACEABLE | 6530CC | 155354 | 2/29/2024 |
| Thermometer | TRACEABLE | 6530CC | 174045 | 2/29/2024 |
| Thermometer | TRACEABLE | 6530CC | 175732 | 2/29/2024 |

Lab Equipment

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|---------------------------|--------------|------------|------------|---------------|
| System Validation Dipole* | SPEAG | D1640V2 | 334 | 3/25/2023 |
| System Validation Dipole | SPEAG | D2300V2 | 1058 | 10/18/2023 |
| System Validation Dipole | SPEAG | D2450V2 | 706 | 1/20/2024 |
| System Validation Dipole | SPEAG | D2450V2 | 899 | 4/18/2024 |
| System Validation Dipole | SPEAG | D3700V2 | 1110 | 11/30/2023 |
| System Validation Dipole | SPEAG | D5GHzV2 | 1138 | 2/3/2024 |
| System Validation Dipole | SPEAG | CLA13 | 1008 | 1/12/2024 |

Note(s):

*Dipole Calibration Date has been extended past 1 year. Impedance measurements have been performed to validate Dipole performance. Refer to Appendix G for Dipole Impedance measurements.

Other

| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|-------------------------------------|--------------|------------|------------|---------------|
| Power Meter | Keysight | N1911A | MY55196015 | 1/31/2024 |
| Power Sensor | Agilent | N1921A | MY52270022 | 1/31/2024 |
| Wideband Radio Communication Tester | R&S | CMW500 | 85780 | 2/29/2024 |
| Wideband Radio Communication Tester | R&S | CMW500 | 85781 | 2/29/2024 |

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 $\leq 30\%$, 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 $\pm 2^\circ\text{C}$ 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 (ϵ_r) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within $\pm 5\%$ 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 ϵ_r and σ may be relaxed to $\pm 10\%$. 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 |

Dielectric Property Measurements

| SAR Lab | Date | Band (MHz) | Tissue Type | Frequency (MHz) | Relative Permittivity (ϵ_r) | | | Conductivity (σ) | | |
|---------|-----------|------------|-------------|-----------------|--|--------|--------|---------------------------|--------|--------|
| | | | | | Measured | Target | Delta | Measured | Target | Delta |
| A | 6/29/2023 | 2450 | Head | 2450 | 37.67 | 39.2 | -3.90% | 1.85 | 1.80 | 2.67% |
| | | | | 2400 | 37.79 | 39.3 | -3.83% | 1.80 | 1.75 | 2.93% |
| | | | | 2500 | 37.57 | 39.1 | -4.00% | 1.88 | 1.85 | 1.62% |
| D | 6/22/2023 | 2450 | Head | 2450 | 40.23 | 39.2 | 2.63% | 1.73 | 1.80 | -3.94% |
| | | | | 2400 | 40.24 | 39.3 | 2.40% | 1.69 | 1.75 | -3.41% |
| | | | | 2500 | 40.14 | 39.1 | 2.56% | 1.76 | 1.85 | -4.91% |
| F | 6/20/2023 | 5600 | Head | 5600 | 34.19 | 35.5 | -3.78% | 4.86 | 5.06 | -3.92% |
| | | | | 5500 | 34.42 | 35.6 | -3.44% | 4.78 | 4.96 | -3.61% |
| | | | | 5725 | 33.96 | 35.4 | -4.04% | 4.93 | 5.19 | -4.90% |
| 2 | 6/8/2023 | 13 | Head | 13 | 56.32 | 55.0 | 2.40% | 0.72 | 0.75 | -4.16% |
| | | | | 12 | 56.39 | 55.0 | 2.53% | 0.72 | 0.75 | -4.16% |
| | | | | 14 | 56.18 | 55.0 | 2.15% | 0.72 | 0.75 | -4.16% |
| 2 | 6/18/2023 | 1640 | Head | 1640 | 40.28 | 40.3 | 0.06% | 1.25 | 1.31 | -4.74% |
| | | | | 1625 | 40.30 | 40.3 | 0.06% | 1.24 | 1.30 | -4.66% |
| | | | | 1665 | 40.26 | 40.2 | 0.11% | 1.26 | 1.32 | -4.77% |
| 13 | 6/25/2023 | 3700 | Head | 3700 | 37.05 | 37.7 | -1.73% | 2.98 | 3.12 | -4.34% |
| | | | | 3600 | 37.21 | 37.8 | -1.60% | 2.88 | 3.01 | -4.31% |
| | | | | 3800 | 36.86 | 37.6 | -1.94% | 3.09 | 3.22 | -4.09% |
| 19 | 6/28/2023 | 2300 | Head | 2300 | 40.58 | 39.5 | 2.81% | 1.71 | 1.66 | 3.02% |
| | | | | 2350 | 40.49 | 39.4 | 2.81% | 1.75 | 1.71 | 2.30% |
| | | | | 2400 | 40.41 | 39.3 | 2.83% | 1.78 | 1.75 | 1.79% |

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 | 6/29/2023 | Head | D2450V2 SN: 706 | 1/20/2024 | 5.20 | 52.0 | 52.3 | -0.57% | 2.42 | 24.2 | 24.5 | -1.22% | 1 |
| D | 6/22/2023 | Head | D2450V2 SN: 899 | 4/18/2024 | 5.10 | 51.0 | 51.9 | -1.73% | 2.45 | 24.5 | 24.4 | 0.41% | 2 |
| F | 6/20/2023 | Head | D5GHzV2 SN: 1138 (5.60 GHz) | 2/3/2024 | 7.72 | 77.2 | 82.5 | -6.42% | 2.17 | 21.7 | 23.4 | -7.26% | 3 |
| 2 | 6/18/2023 | Head | D1640V2 SN: 334 | 3/25/2023 | 3.35 | 33.5 | 33.9 | -1.18% | 1.86 | 18.6 | 18.3 | 1.64% | 4 |
| 13 | 6/25/2023 | Head | D3700V2 SN: 1110 | 11/30/2023 | 5.87 | 58.7 | 64.1 | -8.41% | 2.19 | 21.9 | 23.6 | -7.20% | 5 |
| 19 | 6/28/2023 | Head | D2300V2 SN: 1058 | 10/18/2023 | 5.29 | 52.9 | 48.5 | 9.07% | 2.55 | 25.5 | 23.6 | 8.05% | 6 |
| 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. |
| 2 | 6/8/2023 | Head | CLA13 SN: 1008 | 1/12/2024 | Zoom Scan (1 W) | Normalize to 1 W | Target (Ref. Value) | Delta ±10 % | Zoom Scan (1 W) | Normalize to 1 W | Target (Ref. Value) | Delta ±10 % | |
| | | | | | 0.515 | 0.515 | 0.544 | -5.33% | 0.318 | 0.318 | 0.338 | -5.92% | 7 |

7. Test Rationale

7.1. Purpose

This application for certification is leveraging the data reuse procedure from TCB workshop April 2021; RF Exposure Procedures (Remarks on Test Reductions via Data Referencing for Closely Related Products) based on reference FCC ID: **BCG-E8427A** (UL report# **14523758-S1**) to cover variants FCC ID: **BCG-E8428A**, **BCG-E8429A**, and **BCG-E8430A**. The major difference between the reference model and the variant models is the depopulation of the mmWave transmitter in the variant models. All other circuitry and features are identical. The data reuse test plan was approved via manufacturer KDB inquiry.

7.2. Data Reuse Approach

Full RF exposure testing was performed on the reference model. The configurations with the highest SAR results for each equipment class were identified. These configurations were tested on the variant models.

The variation in SAR results was well within the uncertainty budget of the SAR test equipment. The variant SAR results and worst-case reference model SAR results are summarized in § 1.

8. Measured and Reported (Scaled) SAR Results

8.1. A3089 Spot Check Results

| Equipment Class | Technology | Band | Antenna | RF Exposure Condition | Mode | Power Mode | Dist (mm) | Test Position | Channel | Freq. (MHz) | RB Allocation | RB Offset | Duty Cycle (%) | Max Output Pwr (dBm) | Meas. (dBm) | 1-g Meas. (W/kg) | 1-g Scaled (W/kg) | 10-g Meas. (W/kg) | 10-g Scaled (W/kg) | Pilot No. |
|-----------------|-------------|----------|---------|-----------------------|----------------|-----------------------|-----------|---------------|---------|-------------|---------------|-----------|----------------|----------------------|-------------|------------------|-------------------|-------------------|--------------------|-----------|
| TNE | MSS | L-Band | 4 | Body & Hotspot | 1-PRB SC-FDMA | Mode B | 5 | Back | 262391 | 1617.6 | | | 100.0% | 20.5 | 20.5 | 0.906 | 0.906 | 0.415 | 0.415 | 1 |
| PCE | LTE | 30 | 1 | Body & Hotspot | QPSK | Mode B | 5 | Back | 27710 | 2310.0 | 25 | 12 | | 22.1 | 20.9 | 0.551 | 0.726 | 0.275 | 0.363 | 2 |
| CBE | LTE | 48 | 8 | Head | QPSK | Mode A | 0 | Left Tilt | 56207 | 3646.7 | 100 | 0 | | 22.2 | 21.9 | 0.758 | 0.812 | 0.224 | 0.240 | 3 |
| DTS | WiFi 2.4GHz | 2.4GHz | 4 | Head | 802.11b | Power State 1 Power A | 0 | Left Cheek | 1 | 2412.0 | | | 99.94% | 20.25 | 18.97 | 0.722 | 0.970 | 0.321 | 0.431 | 4 |
| U-NII | WiFi 5GHz | 5.5GHz | 5 | Hotspot | 802.11ac VHT80 | Power State 1 Power B | 5 | Edge Left | 122 | 5610.0 | | | 98.76% | 19.75 | 18.70 | 0.732 | 0.944 | 0.235 | 0.299 | 5 |
| DSSS | Bluetooth | 2.4GHz | 4 | Head | LE 1 Mbps | P-Standalone Mode A | 0 | Left Cheek | 19 | 2440.0 | | | | 20.5 | 19.44 | 0.608 | 0.776 | 0.263 | 0.336 | 6 |
| Equipment Class | Technology | Band | Antenna | RF Exposure Condition | Mode | Power Mode | Dist (mm) | Test Position | Channel | Freq. (MHz) | RB Allocation | RB Offset | Duty Cycle (%) | Max Output Pwr (dBm) | Meas. (dBm) | 1-g Meas. (W/kg) | 1-g Scaled (W/kg) | 10-g Meas. (W/kg) | 10-g Scaled (W/kg) | Pilot No. |
| DXX | NFC | 13.56MHz | Primary | Extremity | Tyoe A | N/A | 0 | Edge Top | N/A | 13.56 | | | | | | 0.015 | | 0.005 | | 7 |

8.2. A3090 Spot Check Results

| Equipment Class | Technology | Band | Antenna | RF Exposure Condition | Mode | Power Mode | Dist (mm) | Test Position | Channel | Freq. (MHz) | RB Allocation | RB Offset | Duty Cycle (%) | Max Output Pwr (dBm) | Meas. (dBm) | 1-g Meas. (W/kg) | 1-g Scaled (W/kg) | 10-g Meas. (W/kg) | 10-g Scaled (W/kg) | Pilot No. |
|-----------------|-------------|----------|---------|-----------------------|----------------|-----------------------|-----------|---------------|---------|-------------|---------------|-----------|----------------|----------------------|-------------|------------------|-------------------|-------------------|--------------------|-----------|
| TNE | MSS | L-Band | 4 | Body & Hotspot | 1-PRB SC-FDMA | Mode B | 5 | Back | 262391 | 1617.6 | | | 100.0% | 20.5 | 20.5 | 0.776 | 0.776 | 0.365 | 0.365 | 8 |
| PCE | LTE | 30 | 1 | Body & Hotspot | QPSK | Mode B | 5 | Back | 27710 | 2310.0 | 25 | 12 | | 22.1 | 20.9 | 0.545 | 0.718 | 0.276 | 0.364 | 9 |
| CBE | LTE | 48 | 8 | Head | QPSK | Mode A | 0 | Left Tilt | 56207 | 3646.7 | 100 | 0 | | 22.2 | 21.9 | 0.878 | 0.941 | 0.251 | 0.269 | 10 |
| DTS | WiFi 2.4GHz | 2.4GHz | 4 | Head | 802.11b | Power State 1 Power A | 0 | Left Cheek | 1 | 2412.0 | | | 99.94% | 20.25 | 18.97 | 0.723 | 0.971 | 0.328 | 0.440 | 11 |
| U-NII | WiFi 5GHz | 5.5GHz | 5 | Hotspot | 802.11ac VHT80 | Power State 1 Power B | 5 | Edge Left | 122 | 5610.0 | | | 98.76% | 19.75 | 18.70 | 0.525 | 0.677 | 0.174 | 0.222 | 12 |
| DSSS | Bluetooth | 2.4GHz | 4 | Head | LE 1 Mbps | P-Standalone Mode A | 0 | Left Cheek | 19 | 2440.0 | | | | 20.5 | 19.44 | 0.562 | 0.717 | 0.252 | 0.322 | 13 |
| Equipment Class | Technology | Band | Antenna | RF Exposure Condition | Mode | Power Mode | Dist (mm) | Test Position | Channel | Freq. (MHz) | RB Allocation | RB Offset | Duty Cycle (%) | Max Output Pwr (dBm) | Meas. (dBm) | 1-g Meas. (W/kg) | 1-g Scaled (W/kg) | 10-g Meas. (W/kg) | 10-g Scaled (W/kg) | Pilot No. |
| DXX | NFC | 13.56MHz | Primary | Extremity | Tyoe A | N/A | 0 | Edge Top | N/A | 13.56 | | | | | | 0.005 | | 0.002 | | 14 |

8.3. A3092 Spot Check Results

| Equipment Class | Technology | Band | Antenna | RF Exposure Condition | Mode | Power Mode | Dist (mm) | Test Position | Channel | Freq. (MHz) | RB Allocation | RB Offset | Duty Cycle (%) | Max Output Pwr (dBm) | Meas. (dBm) | 1-g Meas. (W/kg) | 1-g Scaled (W/kg) | 10-g Meas. (W/kg) | 10-g Scaled (W/kg) | Pilot No. |
|-----------------|-------------|----------|---------|-----------------------|----------------|-----------------------|-----------|---------------|---------|-------------|---------------|-----------|----------------|----------------------|-------------|------------------|-------------------|-------------------|--------------------|-----------|
| PCE | LTE | 30 | 1 | Body & Hotspot | QPSK | Mode B | 5 | Back | 27710 | 2310.0 | 25 | 12 | | 22.1 | 20.9 | 0.639 | 0.842 | 0.315 | 0.415 | 15 |
| CBE | LTE | 48 | 8 | Head | QPSK | Mode A | 0 | Left Tilt | 56207 | 3646.7 | 100 | 0 | | 22.2 | 21.9 | 0.796 | 0.853 | 0.242 | 0.259 | 16 |
| DTS | WiFi 2.4GHz | 2.4GHz | 4 | Head | 802.11b | Power State 1 Power A | 0 | Left Cheek | 1 | 2412.0 | | | 99.94% | 20.25 | 18.97 | 0.833 | 1.119 | 0.362 | 0.486 | 17 |
| U-NII | WiFi 5GHz | 5.5GHz | 5 | Hotspot | 802.11ac VHT80 | Power State 1 Power B | 5 | Edge Left | 122 | 5610.0 | | | 98.76% | 19.75 | 18.70 | 0.624 | 0.805 | 0.203 | 0.259 | 18 |
| DSSS | Bluetooth | 2.4GHz | 4 | Head | LE 1 Mbps | P-Standalone Mode A | 0 | Left Cheek | 19 | 2440.0 | | | | 20.5 | 19.44 | 0.648 | 0.827 | 0.284 | 0.363 | 19 |
| Equipment Class | Technology | Band | Antenna | RF Exposure Condition | Mode | Power Mode | Dist (mm) | Test Position | Channel | Freq. (MHz) | RB Allocation | RB Offset | Duty Cycle (%) | Max Output Pwr (dBm) | Meas. (dBm) | 1-g Meas. (W/kg) | 1-g Scaled (W/kg) | 10-g Meas. (W/kg) | 10-g Scaled (W/kg) | Pilot No. |
| DXX | NFC | 13.56MHz | Primary | Extremity | Tyoe A | N/A | 0 | Edge Top | N/A | 13.56 | | | | | | 0.016 | | 0.005 | | 20 |

Appendixes

Refer to separated files for the following appendixes.

Appendix A: SAR Setup Photos

Appendix B: SAR System Check Plots

Appendix C: SAR Highest Test Plots

Appendix D: SAR Tissue Ingredients

Appendix E: SAR Probe Certificates

Appendix F: SAR Dipole Certificates

Appendix G: Dipole Impedance Measurement

END OF REPORT