SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
SMARTPHONE

FCC ID: BCG E4034A, BCG-E4002A, BCG-E4033A
Model Name: A2640, A2639, A2636, A2638

Report Number: 13584004-S1V3
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Revision History

Rev.	Date	Revisions	Revised By
V1	8/12/2021	Initial Issue	-
V2	8/17/2021	Section 1 – Updated text	Dave Weaver
V3	9/13/2021	Section 1, 6.1, 6.2, 8.2 and 8.3 – Updated data. Appendixes B and C – Updated data.	Art Thammanavarat

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1. Attestation of Test Results

Applicant Name	APPLE, INC.					
FCC ID	BCG E4034A, BCG-E4002A, BCG-E4033A					
Model Name	A2640, A2639, A2636, A2638					
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
Worst Case from **BCG-E4000A**	0.959	0.959	0.956	1.198	1.186	1.194
Variant Models	Worst-Case SAR for Variant Models					
BCG-E4034A (A2640, A2639)	0.898	0.930	0.914	1.151	1.183	1.095
BCG-E4002A (A2636)	0.875	0.893	0.929	1.162	1.066	1.056
BCG-E4033A (A2638)	0.865	0.933	0.938	1.200	1.050	1.088
Date Tested	7/13/2021 to 8/4/2021					
Test Results	Pass					

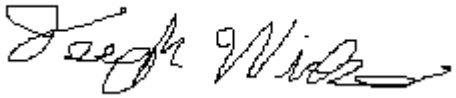
This application for certification is leveraging the data reuse procedure from TCB workshop April 2021; RF Exposure Procedures (Remarks on Test Reductions via Data Referencing for Closely Related Products) based on reference FCC ID: **BCG-E4000A** (UL report# 13571601-S1) to cover variant FCC ID: **BCG-E4034A, BCG-E4002A, BCG-E4033A.** The major difference between the parent/reference model and the variant model is the depopulation in the variant model of the mmWave transmitter. All other circuitry and features are identical. The data reuse test plan was approved via manufacturer KDB inquiry.

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:
	
Devin Chang Senior Test Engineer UL Verification Services Inc.	Joseph Wiebe 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 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
	SAR Lab 14
	SAR Lab 15
	SAR Lab 16

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

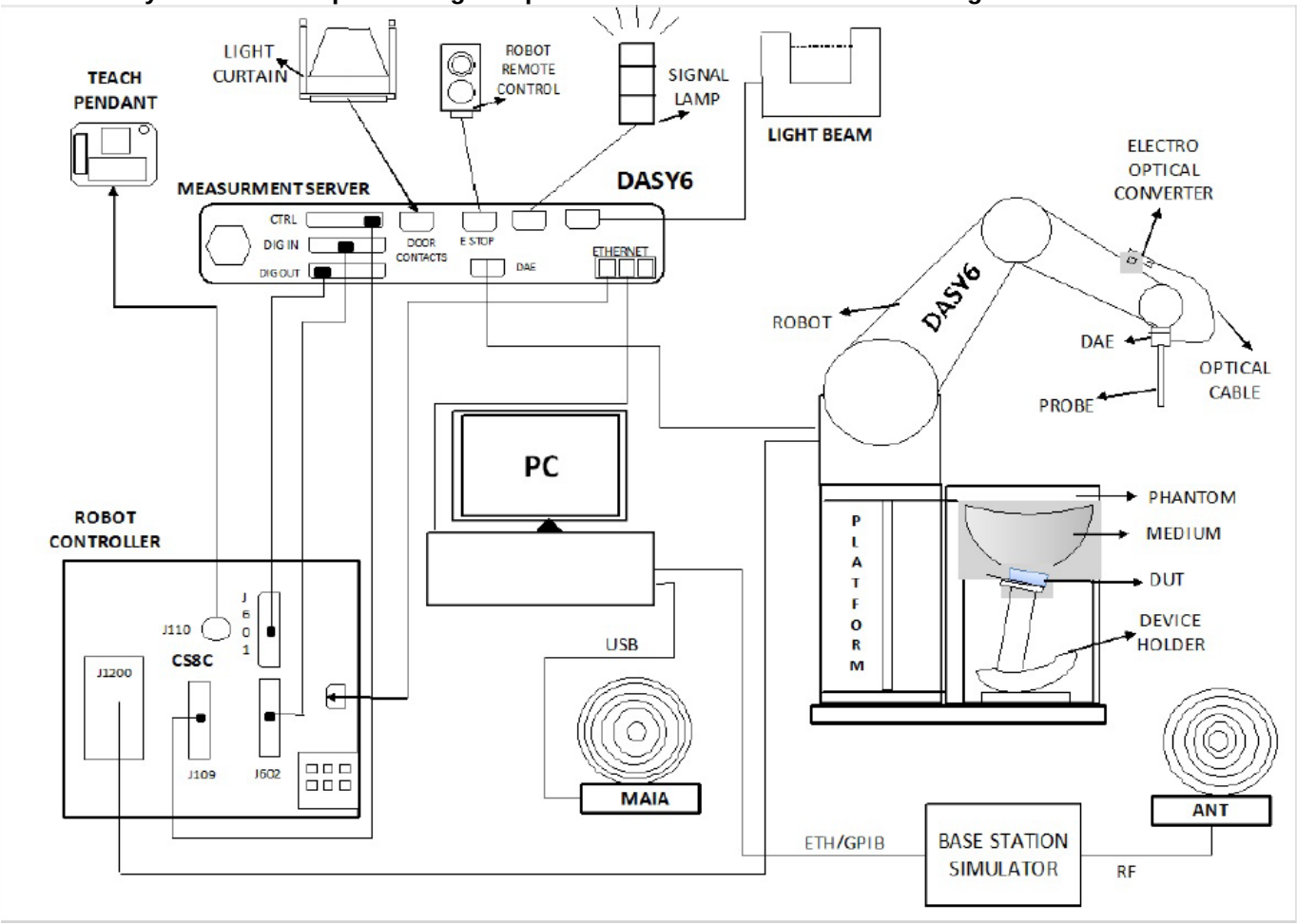
The Test Lab Conformity Assessment Body Identifier (CABID)

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	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
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.

Dielectric Property Measurements

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Network Analyzer	Rohde & Schwarz	ZNLE6	101273	2/26/2022
Dielectric Probe kit	SPEAG	DAK-3.5	1087	11/12/2021
Shorting block	SPEAG	DAK-3.5 Short	SM DAK200BA	11/12/2021
Thermometer	Fischer Scientific	4242	150378159	8/5/2021
Network Analyzer	Rohde & Schwarz	ZNLE6	101274	2/26/2022
Dielectric Probe kit	SPEAG	DAK-3.5	1082	9/9/2021
Shorting block	SPEAG	DAK-3.5 Short	SM DAK200DA	9/9/2021
Thermometer	Control Company	15-078-179	170064398	7/30/2021 *

Note(s):

*Equipment not used past calibration due date.

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
Signal Generator	Keysight Technologies	N5181A-506	MY50140610	1/21/2022
Power Meter	Keysight Technologies	N1912A	MY50001018	1/21/2022
Power Sensor	Keysight Technologies	N1921A	MY53020038	1/28/2022
DC Power Supply	Ametek	XT15-4	1802A01877	N/A
Amplifier	Miteq	AMF-4D-00400600-50-30P	1795092	N/A
Signal Generator	Rohde & Schwarz	SMB100A03	180969	2/16/2022
3-Path Diode Power Sensor	Rohde & Schwarz	NRP18A	100992	2/16/2022
Signal Generator	Rohde & Schwarz	SMB100A03	180970	2/16/2022
Power Meter	Keysight Technologies	437B	3125U11347	1/26/2022
3-Path Diode Power Sensor	Rohde & Schwarz	NRP18A	100995	2/26/2022
Bi-Directional Coupler	Werlatone	C8060-102	4063	N/A

Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
E-Field Probe (SAR Lab B)	SPEAG	EX3DV4	3773	2/25/2022
E-Field Probe (SAR Lab E)	SPEAG	EX3DV4	7500	3/18/2022
E-Field Probe (SAR Lab F)	SPEAG	EX3DV4	7356	3/19/2022
E-Field Probe (SAR Lab G)	SPEAG	EX3DV4	3902	3/18/2022
E-Field Probe (SAR Lab 4)	SPEAG	EX3DV4	3929	3/19/2022
E-Field Probe (SAR Lab 6)	SPEAG	EX3DV4	3990	2/5/2022
E-Field Probe (SAR Lab 10)	SPEAG	EX3DV4	7448	2/26/2022
E-Field Probe (SAR Lab 13)	SPEAG	EX3DV4	7581	3/1/2022
Data Acquisition Electronics (SAR Lab B)	SPEAG	DAE4	1357	1/28/2022
Data Acquisition Electronics (SAR Lab E)	SPEAG	DAE4	1540	1/27/2022
Data Acquisition Electronics (SAR Lab F)	SPEAG	DAE4	1433	2/24/2022
Data Acquisition Electronics (SAR Lab G)	SPEAG	DAE4	1258	3/18/2022
Data Acquisition Electronics (SAR Lab 4)	SPEAG	DAE4	1439	7/16/2021 *
Data Acquisition Electronics (SAR Lab 6)	SPEAG	DAE4	1259	7/16/2021 *
Data Acquisition Electronics (SAR Lab 10)	SPEAG	DAE4	1545	2/22/2022
Data Acquisition Electronics (SAR Lab 13)	SPEAG	DAE4	1261	2/24/2022

Lab Equipment

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
System Validation Dipole	SPEAG	D835V2	4d117	5/11/2022
System Validation Dipole	SPEAG	D1750V2	1077	10/16/2021
System Validation Dipole	SPEAG	D2450V2	899	4/13/2022
System Validation Dipole	SPEAG	D3700V2	1039	4/16/2022
System Validation Dipole	SPEAG	D5GHzV2	1168	11/27/2021

OTHER

Name of Equipment	Manufacturer	Type/Model	T Number	Serial No.	Cal. Due Date
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	959	137873-WG	2/19/2022

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 (%)
B	7/14/2021	1750	Head	1750	39.23	40.08	-2.13	1.36	1.37	-1.02
				1710	39.35	40.15	-1.98	1.33	1.35	-1.37
				1755	39.26	40.08	-2.04	1.36	1.37	-0.93
B	7/19/2021	1750	Head	1750	41.08	40.08	2.48	1.42	1.37	3.36
				1710	41.01	40.15	2.15	1.40	1.35	3.76
				1755	41.11	40.08	2.58	1.42	1.37	3.22
E	7/14/2021	2450	Head	2450	37.71	39.20	-3.80	1.86	1.80	3.06
				2400	38.05	39.30	-3.17	1.80	1.75	2.59
				2480	37.47	39.16	-4.32	1.90	1.83	3.69
E	7/26/2021	2450	Head	2450	39.24	39.20	0.10	1.81	1.80	0.67
				2400	39.44	39.30	0.36	1.77	1.75	1.05
				2480	39.09	39.16	-0.18	1.83	1.83	-0.02
E	8/3/2021	2450	Head	2450	37.84	39.20	-3.47	1.84	1.80	2.17
				2400	38.03	39.30	-3.22	1.78	1.75	1.73
				2480	37.73	39.16	-3.66	1.88	1.83	2.43
F	7/30/2021	5250	Head	5250	34.39	35.93	-4.29	4.82	4.70	2.55
				5150	34.66	36.05	-3.85	4.70	4.60	2.07
				5350	34.47	35.82	-3.77	4.89	4.80	1.72
G	7/17/2021	5250	Head	5250	36.33	35.93	1.10	4.64	4.70	-1.39
				5150	36.52	36.05	1.31	4.52	4.60	-1.65
				5350	36.14	35.82	0.90	4.75	4.80	-1.09
G	7/30/2021	5250	Head	5250	34.90	35.93	-2.88	4.67	4.70	-0.77
				5150	35.41	36.05	-1.77	4.46	4.60	-3.04
				5350	34.80	35.82	-2.85	4.73	4.80	-1.57
4	7/13/2021	3700	Head	3700	37.64	37.70	-0.16	3.07	3.12	-1.48
				3500	37.87	37.93	-0.16	2.86	2.91	-1.74
				3600	37.70	37.82	-0.31	2.96	3.01	-1.92
6	7/13/2021	3700	Head	3700	37.95	37.70	0.66	3.07	3.12	-1.42
				3500	38.24	37.93	0.82	2.88	2.91	-1.02
				3600	38.05	37.82	0.62	2.98	3.01	-1.12
10	7/26/2021	835	Head	835	39.93	41.50	-3.78	0.92	0.90	2.22
				805	39.77	41.68	-4.58	0.91	0.90	1.53
				850	40.04	41.50	-3.52	0.92	0.92	0.55
13	7/19/2021	835	Head	835	40.85	41.50	-1.57	0.93	0.90	2.91
				805	40.80	41.68	-2.11	0.92	0.90	2.01
				850	40.86	41.50	-1.54	0.93	0.92	1.64
13	7/22/2021	835	Head	835	40.21	41.50	-3.11	0.94	0.90	4.88
				805	40.54	41.68	-2.73	0.94	0.90	4.86
				850	40.15	41.50	-3.25	0.95	0.92	3.46

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 #	Dipole Cal. Due Data	Measured Results for 1g SAR				Measured Results for 10g SAR				Plot No.
					Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	Zoom Scan to 100 mW	Normalize to 1 W	Target (Ref. Value)	Delta ±10 %	
B	7/14/2021	Head	D1750V2 SN:1077	10/16/2021	3.690	36.90	35.15	4.98	1.970	19.70	18.71	5.29	1,2
B	7/19/2021	Head	D1750V2 SN:1077	10/16/2021	3.560	35.60	35.15	1.28	1.910	19.10	18.71	2.08	
E	7/14/2021	Head	D2450V2 SN:899	4/13/2022	5.150	51.50	50.96	1.06	2.320	23.20	23.89	-2.89	
E	7/26/2021	Head	D2450V2 SN:899	4/13/2022	5.570	55.70	50.96	9.30	2.510	25.10	23.89	5.06	3,4
E	8/3/2021	Head	D2450V2 SN:899	4/13/2022	5.390	53.90	50.96	5.77	2.420	24.20	23.89	1.30	
F	7/30/2021	Head	D5GHzV2 SN:1168 (5.25 GHz)	11/27/2021	7.720	77.20	80.80	-4.46	2.180	21.80	23.30	-6.44	5,6
G	7/17/2021	Head	D5GHzV2 SN:1168 (5.25 GHz)	11/27/2021	7.880	78.80	80.80	-2.48	2.270	22.70	23.30	-2.58	
G	7/30/2021	Head	D5GHzV2 SN:1168 (5.25 GHz)	11/27/2021	8.740	87.40	80.80	8.17	2.540	25.40	23.30	9.01	7,8
4	7/13/2021	Head	D3700V2 SN:1039	4/16/2022	6.720	67.20	66.40	1.20	2.540	25.40	24.00	5.83	9,10
6	7/13/2021	Head	D3700V2 SN:1039	4/16/2022	6.920	69.20	66.40	4.22	2.560	25.60	24.00	6.67	11,12
10	7/26/2021	head	D835V2 SN:4d117	5/11/2022	1.100	11.00	10.23	7.53	0.711	7.11	6.69	6.28	13,14
13	7/19/2021	Head	D835V2 SN:4d117	5/11/2022	0.973	9.73	10.23	-4.89	0.633	6.33	6.69	-5.38	15,16
13	7/22/2021	Head	D835V2 SN:4d117	5/11/2022	1.060	10.60	10.23	3.62	0.686	6.86	6.69	2.54	

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-E4000A to cover variant FCC ID: BCG-E4034A, BCG-E4002A, BCG-E4033A. The major difference between the parent/reference model and the variant model is the depopulation in the variant model of the mmWave transmitter. 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 parent model. The configurations with the highest SAR values for each equipment class were identified. These configurations were tested on the variant models.

The variation in SAR values was well within the uncertainty budget of the SAR test equipment. The variant SAR results and worst case parent SAR values are summarized in section 1.

8. Measured and Reported (Scaled) SAR Results

8.1. A2640, A2639 Spot Check Results

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
											Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
CDMA BC10	ANT2	Head	1xEv-Do Rel. 0	Mode A	0	Left Touch	560	820.0	N/A	N/A	24.70	24.20	0.800	0.898	0.525	0.589	1

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
											Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
W-CDMA BIV	ANT1	Hotspot	Rel 99 RMC 12.2kbps	Mode B	5	Edge 3	1513	1752.6	N/A	N/A	17.80	16.75	0.730	0.930	0.346	0.441	2

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
											Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
LTE B48	ANT8	Body & Hotspot	QPSK	Mode B	5	Rear	56640	3690.0	1	49	23.00	22.20	0.760	0.914	0.265	0.319	3

Wireless Technologies	Antenna	WWAN Power	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
												Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
WiFi 2.4 GHz	ANT4	Cell Off	Head	802.11b	Mode A	0	Left Touch	6	2437	1.380	100.0%	20.00	19.00	0.914	1.151	0.439	0.553	4

Wireless Technologies	Antenna	WWAN Power	Band	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
													Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
WiFi 5 GHz	ANT6	Cell OFF	U-NII-1	Body & Hotspot	802.11n HT40	Mode B	5	Rear	46	5230	1.510	97.9%	20.50	18.85	0.792	1.183	0.204	0.305	5

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
										Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Bluetooth	ANT4 $P_{standalone}$	Hotspot	GFSK	Mode B	5	Edge 2	0	2402	100.0%	20.00	18.63	0.799	1.095	0.338	0.463	6

8.2. A2636 Spot Check Results

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
											Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
CDMA BC10	ANT2	Head	1xEv-Do Rel. 0	Mode A	0	Left Touch	560	820.0	N/A	N/A	24.70	24.20	0.780	0.875	0.523	0.587	7

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
											Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
W-CDMA BIV	ANT1	Hotspot	Rel 99 RMC 12.2kbps	Mode B	5	Edge 3	1513	1752.6	N/A	N/A	17.80	16.75	0.701	0.893	0.324	0.413	8

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
											Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
LTE B48	ANT8	Body & Hotspot	QPSK	Mode B	5	Rear	56640	3690.0	1	49	23.00	22.20	0.773	0.929	0.267	0.321	9

Wireless Technologies	Antenna	WWAN Power	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
												Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
WiFi 2.4 GHz	ANT4	Cell Off	Head	802.11b	Mode A	0	Left Touch	6	2437	1.670	100.0%	20.00	19.00	0.923	1.162	0.433	0.545	10

Wireless Technologies	Antenna	WWAN Power	Band	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
													Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
WiFi 5 GHz	ANT6	Cell OFF	U-NII-1	Body & Hotspot	802.11n HT40	Mode B	5	Rear	46	5230	1.380	97.9%	20.50	18.85	0.714	1.066	0.189	0.282	11

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
										Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Bluetooth	ANT4 $P_{standalone}$	Hotspot	GFSK	Mode B	5	Edge 2	0	2402	100.0%	20.00	18.63	0.770	1.056	0.317	0.435	12

8.3. A2638 Spot Check Results

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
											Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
CDMA BC10	ANT2	Head	1xEv-Do Rel. 0	Mode A	0	Left Touch	560	820.0	N/A	N/A	24.70	24.20	0.771	0.865	0.510	0.572	13

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
											Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
W-CDMA BIV	ANT1	Hotspot	Rel 99 RMC 12.2kbps	Mode B	5	Edge 3	1513	1752.6	N/A	N/A	17.80	16.75	0.733	0.933	0.342	0.436	14

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	RB Allocation	RB offset	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
											Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
LTE B48	ANT8	Body & Hotspot	QPSK	Mode B	5	Rear	56640	3690.0	1	49	23.00	22.20	0.780	0.938	0.258	0.310	15

Wireless Technologies	Antenna	WWAN Power	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
												Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
WiFi 2.4 GHz	ANT4	Cell Off	Head	802.11b	Mode A	0	Left Touch	6	2437	1.400	100.0%	20.00	19.00	0.953	1.200	0.456	0.574	16

Wireless Technologies	Antenna	WWAN Power	Band	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Area Scan Max. SAR (W/kg)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
													Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
WiFi 5 GHz	ANT6	Cell OFF	U-NII-1	Body & Hotspot	802.11n HT40	Mode B	5	Rear	46	5230	1.300	97.9%	20.50	18.85	0.703	1.050	0.183	0.273	17

Wireless Technologies	Antenna	RF Exposure Conditions	Mode	Power Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Duty Cycle	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
										Tune-up Limit	Meas.	Meas.	Scaled	Meas.	Scaled	
Bluetooth	ANT4 $P_{standalone}$	Hotspot	GFSK	Mode B	5	Edge 2	0	2402	100.0%	20.00	18.63	0.794	1.088	0.327	0.448	18

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

END OF REPORT