SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std 1528-2013

For
802.11 a/b/g/n/ac

FCC ID: SXE-BDEM01
Model Name: BDEM-01

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Table of Contents

1. Attestation of Test Results 4

2. Test Specification, Methods and Procedures 5

3. Facilities and Accreditation 6

4. SAR Measurement System & Test Equipment 7

4.1. SAR Measurement System 7

4.2. SAR Scan Procedures 8

4.3. Test Equipment 10

5. Measurement Uncertainty 11

6. Device Under Test (DUT) Information 12

6.1. DUT Description 12

6.2. Wireless Technologies 13

6.3. Nominal and Maximum Output Power 14

7. RF Exposure Conditions (Test Configurations) 15

7.1. Standalone SAR Test Exclusion Considerations 15

7.2. Required Test Configurations 17

8. Dielectric Property Measurements & System Check 18

8.1. Dielectric Property Measurements 18

8.2. System Check 20

9. Conducted Output Power Measurements 22

9.1. Wi-Fi 2.4GHz (DTS Band) 22

9.2. Wi-Fi 5GHz (U-NII Bands) 23

10. Measured and Reported (Scaled) SAR Results 24

10.1. Wi-Fi_Body (DTS Band) 25

10.2. Wi-Fi_ Body (U-NII Band) 25

11. Simultaneous Transmission SAR Analysis 26

Appendixes 27

4788637943-US-S1-V0 Appendix A: SAR Setup Photos 27

4788637943-US-S1-V0 Appendix B: SAR System Check Plots 27

4788637943-US-S1-V0 Appendix C: Highest SAR Test Plots 27

4788637943-US-S1-V0 Appendix D: SAR Probe and Dipole Calibration Certificates 27

1. Attestation of Test Results

Applicant Name	Barco NV	
FCC ID	SXE-BDEM01	
Model Name	BDEM-01	
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)	
General population	1.6	
RF Exposure Conditions	Equipment Class - Highest Reported SAR (W/kg)	
	DTS	NII
Body-worn	0.059	0.820
Date Tested	11/27/2018 to 11/29/2018	
Test Results	Pass	

Underwriters Laboratories Taiwan Co., Ltd., tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd., based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd., and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd., 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 TAF or any agency of any government. This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Authorized by:	Prepared By:
Stanley Wu Senior Project Engineer Underwriters Laboratories Taiwan Co., Ltd.	Evelyn Lee Project Handler Underwriters Laboratories Taiwan Co., Ltd.

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
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02

3. Facilities and Accreditation

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

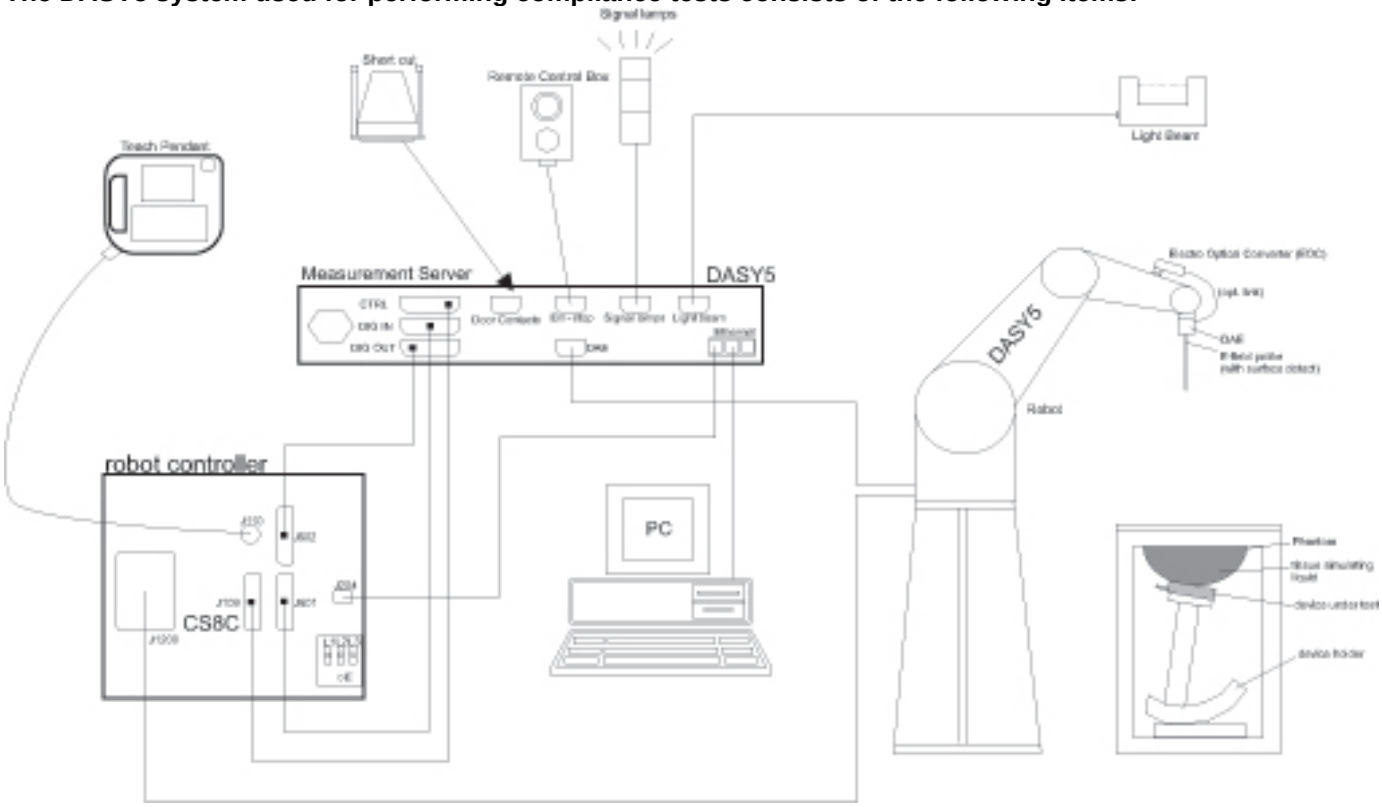
Underwriters Laboratories Taiwan Co., Ltd.,
SAR Room

Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY5 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 WinXP or Win7 and the DASY5 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.

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.

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction.

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. Date
Network Analyzer	Agilent	MS46322B	1740002	2018/12/26
Dielectric Assessment Kit	SPEAG	DAK-3.5	1250	2018/9/19
Thermometer	DER EE	DE-3003	P0006880	2018/1/3

System Check

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Date
EXG-B RF Vector Signal Generator	Keysight Technologies	N5182B	MY56200244	2018/1/8
Power Meter	Keysight	N1914A	MY56360007	2018/12/14
Power Meter	ANRITSU	ML2495A	1645002	2017/12/14
Power Sensor	Keysight	N8481H	MY56350009	2018/12/14
Power Sensor	ANRITSU	MA2411B	1531202	2017/12/14
Power Amplifier	Mini-Circuits	ZVE-8G+	088201629	N/A
20dB Directional coupler	N/A	N/A	150820087	N/A
DC Power Supply	GW Insrek	GPD-2303S	GEQ902177	2018/4/9
10dB Attenuator	Agilent	8491A	MY39266158	2018/12/13
Dosimetric E-Field Probe	SPEAG	EX3DV4	3901	2018/9/27
Data Acquisition Electronice	SPEAG	DAE4	910	2018/6/21
System Validation Dipole	SPEAG	D2450V2	835	2018/6/19
System Validation Dipole	SPEAG	D5GHzV2	1040	2018/6/28
Humidity/Temp meter	TECPEL	DTM-20	M/A	2018/4/6
Thermometer	DER EE	DE-3003	P0006880	2018/1/3

UL Software

Software Version
DASY 52.8.8
SEMCAD-X 14.6.10

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. Device Under Test (DUT) Information

6.1. DUT Description

Product Name	Skin scanner-Lumos
Model Name	BDEM-01
Device Dimension	Overall (Length x Width): 143 mm x 221 mm
Back Cover	☐ Normal Battery Cover ☐ Normal Battery Cover with NFC ☐ Wireless Charger Battery Cover ☐ Wireless Charger Battery Cover with NFC ☒ The Back Cover is not removable.
Battery Options	☒ Standard – Lithium-ion battery, 5000 mAh ☐ Extended (large capacity) ☒ The rechargeable battery is not user accessible.
Wireless Router (Hotspot)	Wi-Fi Hotspot mode permits the device to share its cellular data connection with other Wi-Fi-enabled devices. ☐ Mobile Hotspot (Wi-Fi 2.4 GHz) ☐ Mobile Hotspot (Wi-Fi 5 GHz)
Wi-Fi Direct	Wi-Fi Direct enabled devices transfer data directly between each other ☒ Wi-Fi Direct (Wi-Fi 2.4 GHz) ☒ Wi-Fi Direct (Wi-Fi 5 GHz)
Hardware Version	N/A
Software Version	Android version : 8.1.0 Kernel version : 3.18.71-g18d2fa8 (gcc version 4.9.x 20150123 (prerelase) (GCC)) Snapdragon Camera Version 2.0.002

6.2. Wireless Technologies

Wireless technologies	Frequency bands	Operating mode	Duty Cycle used for SAR testing
Wi-Fi	2.4 GHz	802.11b 802.11g 802.11n (HT20) 802.11n (HT40)	97.62% (802.11b) 87.33% (802.11g) 86.32% (802.11n 20MHz BW) 76.02% (802.11n 40MHz BW)
	5 GHz	802.11a 802.11n (HT20) 802.11n (HT40) 802.11ac (VHT80)	87.28% (802.11a) 86.62% (802.11n 20MHz BW) 75.98% (802.11n 40MHz BW) 55.68% (802.11ac 80MHz BW)
	Does this device support bands 5.60 ~ 5.65 GHz? ☒ Yes ☐ No		
	Does this device support Band gap channel? ☐ Yes ☒ No		

6.3. Nominal and Maximum Output Power

At the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.

Band/ Mode		Tune up Power (dBm)
2.4 GHz	802.11b	17
	802.11g	10
	802.11n (HT20)	10
	802.11n (HT40)	9
5 GHz	802.11a	17.5
	802.11n (HT20)	13.5
	802.11n (HT40)	12.5
	802.11ac (VHT80)	10.5

7. RF Exposure Conditions (Test Configurations)

Refer to Appendix A for the specific details of the antenna-to-edge(s) distances.

7.1. Standalone SAR Test Exclusion Considerations

Since the *Dedicated Host Approach* is applied, the standalone SAR test exclusion procedure in KDB 447498 § 4.3.1 is applied in conjunction with KDB 616217 § 4.3 to determine the minimum test separation distance:

- When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.
- When the separation distance from the antenna to an adjacent edge is > 5 mm, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion.

SAR Test Exclusion Calculations for WLAN

Antennas < 50mm to adjacent edges

Tx Interface	Frequency (MHz)	Output Power		Separation Distances (mm)						Calculated Threshold Value					
		dBm	mW	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front	Rear	Edge 1	Edge 2	Edge 3	Edge 4	Front
Wi-Fi Main Antenna															
Wi-Fi 2.4 GHz	2437	16.73	47	65	17.1	14.1	162	117.5	9.4	> 50 mm	4.3 -MEASURE-	5.2 -MEASURE-	> 50 mm	> 50 mm	8.2 -MEASURE-
Wi-Fi 5.2 GHz	5220	16.34	43	65	17.1	14.1	162	117.5	9.4	> 50 mm	5.8 -MEASURE-	7 -MEASURE-	> 50 mm	> 50 mm	10.9 -MEASURE-
Wi-Fi 5.3 GHz	5320	16.29	43	65	17.1	14.1	162	117.5	9.4	> 50 mm	5.8 -MEASURE-	7.1 -MEASURE-	> 50 mm	> 50 mm	11 -MEASURE-
Wi-Fi 5.5 GHz	5700	16.87	49	65	17.1	14.1	162	117.5	9.4	> 50 mm	6.9 -MEASURE-	8.4 -MEASURE-	> 50 mm	> 50 mm	13 -MEASURE-
Wi-Fi 5.8 GHz	5825	16.99	50	65	17.1	14.1	162	117.5	9.4	> 50 mm	7.1 -MEASURE-	8.6 -MEASURE-	> 50 mm	> 50 mm	13.4 -MEASURE-

Note(s):

According to KDB 447498, if the calculated threshold value is >3 then SAR testing is required.

Antennas > 50mm to adjacent edges

Wi-Fi Main Antenna															
Wi-Fi 2.4 GHz	2437	16.73	47	65	17.1	14.1	162	117.5	9.4	246.1 mW -EXEMPT-	< 50 mm	< 50 mm	1216.1 mW -EXEMPT-	771.1 mW -EXEMPT-	< 50 mm
Wi-Fi 5.2 GHz	5220	16.34	43	65	17.1	14.1	162	117.5	9.4	215.7 mW -EXEMPT-	< 50 mm	< 50 mm	1185.7 mW -EXEMPT-	740.7 mW -EXEMPT-	< 50 mm
Wi-Fi 5.3 GHz	5320	16.29	43	65	17.1	14.1	162	117.5	9.4	215 mW -EXEMPT-	< 50 mm	< 50 mm	1185 mW -EXEMPT-	740 mW -EXEMPT-	< 50 mm
Wi-Fi 5.5 GHz	5700	16.87	49	65	17.1	14.1	162	117.5	9.4	212.8 mW -EXEMPT-	< 50 mm	< 50 mm	1182.8 mW -EXEMPT-	737.8 mW -EXEMPT-	< 50 mm
Wi-Fi 5.8 GHz	5825	16.99	50	65	17.1	14.1	162	117.5	9.4	212.2 mW -EXEMPT-	< 50 mm	< 50 mm	1182.2 mW -EXEMPT-	737.2 mW -EXEMPT-	< 50 mm

Note(s):

According to KDB 447498, if the calculated Power threshold is less than the output power then SAR testing is required.

7.2. Required Test Configurations

The table below identifies the standalone test configurations required for this device according to the findings in Section 7.1:

Test Configurations	Rear	Edge 1 (Top Edge)	Edge 2 (Right Edge)	Edge 3 (Bottom Edge)	Edge 4 (Left Edge)	Front
Wi-Fi 2.4 GHz SISO	No	Yes	Yes	No	No	Yes
Wi-Fi 5 GHz SISO	No	Yes	Yes	No	No	Yes

Note(s):

Yes = Testing is required.

No = Testing is not required.

8. Dielectric Property Measurements & System Check

8.1. 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

Dielectric Property Measurements Results:

Date	Band (MHz)	Tissue Type	Frequency (MHz)	Relative Permittivity (εr)			Conductivity (σ)		
				Measured	Target	Delta (%)	Measured	Target	Delta (%)
2018/11/28	2450	Body	2400	51.99	52.77	-1.47	1.96	1.90	2.92
			2450	51.89	52.70	-1.54	2.01	1.95	2.83
			2480	51.86	52.66	-1.52	2.04	1.99	2.15
2018/11/29	5200	Body	5180	46.98	49.04	-4.20	5.29	5.28	0.18
			5200	46.94	49.01	-4.23	5.32	5.30	0.39
			5260	46.84	48.93	-4.28	5.39	5.37	0.39
2018/11/29	5600	Body	5500	46.28	48.61	-4.79	5.56	5.65	-1.65
			5600	46.13	48.47	-4.83	5.71	5.77	-1.02
			5700	45.94	48.34	-4.96	5.84	5.88	-0.77
2018/11/29	5800	Body	5740	46.32	48.28	-4.06	6.02	5.93	1.45
			5800	46.18	48.20	-4.19	6.09	6.00	1.53
			5830	46.11	48.20	-4.34	6.14	6.00	2.27

8.2. 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.

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 %	
2018/11/28	Body	D2450V2_835	2019/6/18	12.30	49.20	49.80	-1.20	5.76	23.04	23.60	-2.37	1
2018/11/29	Body	D5300V2_1040	2019/6/27	7.09	70.90	76.40	-7.20	2.01	20.10	21.40	-6.07	2
2018/11/29	Body	D5600V2_1040	2019/6/27	7.58	75.80	81.50	-6.99	2.10	21.00	22.70	-7.49	3
2018/11/29	Body	D5800V2_1040	2019/6/27	7.44	74.40	77.30	-3.75	2.07	20.70	21.30	-2.82	4

9. Conducted Output Power Measurements

9.1. Wi-Fi 2.4GHz (DTS Band)

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Meas. Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)
2.4	802.11b	1 Mbps	1	2412	16.5	17	Yes
			6	2437	16.7		
			11	2462	16.5		
	802.11g	6 Mbps	1	2412	Not Required	10	No
			6	2437			
			11	2462			
	802.11n (HT20)	MCS0	1	2412		10	No
			6	2437			
			11	2462			
	802.11n (HT40)	MCS0	3	2422		7.5	No
			6	2437			
			9	2452			

Note(s):

1. SAR is not required for 802.11g/n modes when the adjusted SAR for 802.11b is < 1.2 W/kg.
2. For “Not required”, SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.

9.2. Wi-Fi 5GHz (U-NII Bands)

Measured Results

Band (GHz)	Mode	Data Rate	Ch #	Freq. (MHz)	Meas. Avg Pwr (dBm)	Max Output Power (dBm)	SAR Test (Yes/No)
5.2 (U-NII 1)	802.11a	6 Mbps	36	5180	16.3	17.5	No
			44	5220	16.3		
			48	5240	16.1		
	802.11n (HT20)	MCS0	36	5180	12.2	13.5	No
			44	5220	12.2		
			48	5240	12.1		
	802.11n (HT40)	MCS0	38	5190	Not Required	12.5	No
			46	5230			
	802.11ac (VHT80)	MCS0	42	5210	Not Required	10.5	No
			58	5290			
5.3 (U-NII 2A)	802.11a	6 Mbps	52	5260	16.3	17.5	Yes
			60	5300	16.2		
			64	5320	16.3		
	802.11n (HT20)	MCS0	52	5260	12.1	13.5	No
			60	5300	12.2		
			64	5320	12.2		
	802.11n (HT40)	MCS0	54	5270	Not Required	12.5	No
			62	5310			
	802.11ac (VHT80)	MCS0	54	5270	Not Required	10.5	No
			62	5310			
5.5 (U-NII 2C)	802.11a	6 Mbps	100	5500	16.5	17.5	Yes
			116	5580	16.6		
			120	5600	16.6		
			140	5700	16.9		
	802.11n (HT20)	MCS0	100	5500	12.4	13.5	No
			116	5580	12.4		
			120	5600	12.5		
			140	5700	12.6		
	802.11n (HT40)	MCS0	102	5510	Not Required	12.5	No
			110	5550			
			134	5670			
	802.11ac (VHT80)	MCS0	106	5530	Not Required	10.5	No
5.8 (U-NII 3)	802.11a	6 Mbps	149	5745	16.9	17.5	Yes
			157	5785	16.9		
			165	5825	17.0		
	802.11n (HT20)	MCS0	149	5745	12.7	13.5	No
			157	5785	12.8		
			165	5825	12.9		
	802.11n (HT40)	MCS0	151	5755	Not Required	12.5	No
			159	5795			
	802.11ac (VHT80)	MCS0	122	5610	Not Required	10.5	No
			155	5775			

Note(s):

1. For “Not required”, SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.
2. When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n then ac) is selected.
3. When the specified maximum output power is the same for both UNII band I and UNII band 2A, begin SAR measurement in UNII band 2A; and if the highest *reported* SAR for UNII band 2A is
   - ≤ 1.2 W/kg, SAR is not required for UNII band I
   - > 1.2 W/kg, both bands should be tested independently for SAR.

10. Measured and Reported (Scaled) SAR Results

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

KDB 248227 D01 SAR meas for 802.11:

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the *initial test position(s)* by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The *initial test position(s)* is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the *reported* SAR for the *initial test position* is:

- ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the *initial test position* to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the *reported* SAR is ≤ 0.8 W/kg or all required test positions are tested.
  - For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.
  - When it is unclear, all equivalent conditions must be tested.
- For all positions/configurations tested using the *initial test position* and subsequent test positions, when the *reported* SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the *reported* SAR is ≤ 1.2 W/kg or all required test channels are considered.
  - The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.
- When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.
- When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

10.1. Wi-Fi_Body (DTS Band)

Frequency Band	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
2.4GHz	802.11b 1 Mbps	0	Front	6	2437.0	17.0	16.73	0.018	0.019	0.007	0.007	
			Edge 1	6	2437.0	17.0	16.73	0.031	0.033	0.012	0.013	
			Edge 2	6	2437.0	17.0	16.73	0.055	0.059	0.025	0.027	1

10.2. Wi-Fi_ Body (U-NII Band)

Frequency Band	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
5.3 GHz U-NII 2A	802.11a 6 Mbps	0	Front	64	5320.0	17.5	16.29	0.127	0.168	0.038	0.050	
			Edge 1	64	5320.0	17.5	16.29	0.124	0.164	0.039	0.052	
			Edge 2	64	5320.0	17.5	16.29	0.260	0.344	0.091	0.120	2
Frequency Band	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
5.5 GHz U-NII 2C	802.11a 6 Mbps	0	Front	140	5700.0	17.5	16.87	0.149	0.172	0.054	0.062	
			Edge 1	140	5700.0	17.5	16.87	0.099	0.114	0.035	0.040	
			Edge 2	140	5700.0	17.5	16.87	0.539	0.623	0.175	0.202	3
Frequency Band	Mode	Dist. (mm)	Test Position	Ch #.	Freq. (MHz)	Power (dBm)		1-g SAR (W/kg)		10-g SAR (W/kg)		Plot No.
						Tune-up limit	Meas.	Meas.	Scaled	Meas.	Scaled	
5.8 GHz U-NII 3	802.11a 6 Mbps	0	Front	165	5825.0	17.5	16.99	0.154	0.173	0.053	0.060	
			Edge 1	165	5825.0	17.5	16.99	0.151	0.170	0.051	0.057	
			Edge 2	157	5785.0	17.5	16.93	0.649	0.740	0.212	0.242	
				165	5825.0	17.5	16.99	0.729	0.820	0.240	0.270	4

11. Simultaneous Transmission SAR Analysis

The main transmitter of the antenna on the device is not simultaneously transmitting with 2.4GHz and 5GHz

Appendixes

Refer to separated files for the following appendixes.

4788637943-US-S1-V0 Appendix A: SAR Setup Photos

4788637943-US-S1-V0 Appendix B: SAR System Check Plots

4788637943-US-S1-V0 Appendix C: Highest SAR Test Plots

4788637943-US-S1-V0 Appendix D: SAR Probe and Dipole Calibration Certificates

END OF REPORT