MOTOROLA SOLUTIONS

SAMM 826

CERTIFICATE 2518.05

DECLARATION OF COMPLIANCE SAR ASSESSMENT Part 1 of 2

Motorola Solutions Inc.
EME Test Laboratory
Motorola Solutions Malaysia Sdn Bhd
Plot 2A, Medan Bayan Lepas,
Mukim 12 SWD 11900 Bayan Lepas Penang, Malaysia.

Date of Report: **08/04/2023**
Report Revision: **B**

Responsible Engineer:	Alfred Hoe (EME Engineer)
Report Author:	Muhammad Hizami bin Ismail (EME Senior Technician)
Date/s Tested:	06/08/23 – 06/25/23, 07/08/2023, 07/31/2023, 08/01/2023
Manufacturer:	Motorola Solutions Inc.
DUT Description:	Handheld Portable – TLK 25 Wi-Fi - WAVE PTX TWO-WAY RADIO
Test TX mode(s):	BT, WLAN
Max. Power output:	Refer table 3
Nominal Power:	Refer table 3
Tx Frequency Bands:	Refer table 3
Signaling type:	FHSS (Bluetooth / Bluetooth LE), 802.11b/g/n/a/ac (WLAN)
Model(s) Tested:	HK2198A (HKUN4317A)
Models(s) Certified:	Refer to Section 1.0 Introduction
Serial Number(s):	64222ZJ0081 & 64222ZJ0082
Classification:	General Population / Uncontrolled Environment
Firmware Version:	VANGOGH_BASE_ENG_D00.00.09_AP_D00.00.40_WNA
Applicant Name:	Motorola Solutions Inc.
Applicant Address:	8000 West Sunrise Boulevard, Fort Lauderdale, Florida 33322
FCC ID:	AZ499FT7172 This report contains results that are immaterial for FCC equipment approval, which are clearly identified.
FCC Test Firm Registration Number:	823256
IC:	109U-99FT7172 This report contains results that are immaterial for ISED equipment approval, which are clearly identified.
ISED Test Site registration:	24843

The test results clearly demonstrate compliance with Occupational/Controlled RF Exposure limits of 8 W/kg averaged over 1 gram per the requirements of FCC 47 CFR § 2.1093 and RSS-102 (Issue 5)

Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 4.0 of this report (no deviation from standard methods). This report shall not be reproduced without written approval from an officially designated representative of the Motorola Solutions Inc EME Laboratory. I attest to the accuracy of the data and assume full responsibility for the completeness of these measurements. This reporting format is consistent with the suggested guidelines of the TIA TSB-150 December 2004. The results and statements contained in this report pertain only to the device(s) evaluated.

Saw Sun Hock (Approval Signatory)
Approval Date: **8/6/2023**

Part 1 of 2

APPENDICES

A Measurement Uncertainty Budget
B Probe Calibration Certificates
C Dipole Calibration Certificates

Part 2 of 2

APPENDICES

D System Verification Check Scans
E DUT Scans
F DUT Test Position Photos
G DUT, Body worn and audio accessories Photos

Report Revision History

Date	Revision	Comments
08/01/2023	A	Initial release
08/04/2023	B	Update “Firmware Version” information at cover page and Table 3.

1.0 Introduction

This report details the utilization, test setup, test equipment, and test results of the Specific Absorption Rate (SAR) measurements performed at the Motorola Solutions Inc. EME Test Laboratory for handheld portable model number HK2198A (HKUN4317A). This device is classify as General Population/Uncontrolled and model certified is list as below:

Model(s) Certified

Model	Description
HK2198A (HKUN4317A)	TLK 25 Wi-Fi - WAVE PTX TWO-WAY RADIO
HK2206A (HKUN4332A)	TLK 25 Wi-Fi - WAVE PTX TWO-WAY RADIO

2.0 FCC SAR Summary

Table 1

Equipment Class	Frequency band (MHz)	Max Calc at Body (W/kg)
		1g-SAR
DSS	2402 - 2480 MHz	0.192
DTS	2412 – 2462 MHZ (WLAN 2.4 GHz)	0.953
NII	5180 – 5845 MHz (WLAN 5 GHz)	1.034
Simultaneous Results		*N/A

*Not applicable, refer to section 15.0 Simultaneous Transmission.

3.0 Abbreviations / Definitions

BT:	Bluetooth
CNR:	Calibration Not Required
DSS	Part 15 Spread Spectrum Transmitter
DSSS:	Direct Sequence Spread Spectrum
DUT:	Device Under Test
DTS	Digital Transmission System
EDR:	Enhanced Data Rate
EME:	Electromagnetic Energy
FHSS:	Frequency Hopping Spread Spectrum
GFSK:	Gaussian Frequency-Shift Keying
NA:	Not Applicable
OFDM:	Orthogonal Frequency Division Multiplexing
PTT:	Push to Talk
SAR:	Specific Absorption Rate

Audio accessories: These accessories allow communication while the DUT is worn on the body.

Body worn accessories: These accessories allow the DUT to be worn on the body of the user.

Maximum Power: Defined as the upper limit of the production line final test station

4.0 Referenced Standards and Guidelines

This product is designed to comply with the following applicable national and international standards and guidelines.

- Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65, FCC, Washington, D.C.: 1997.
- Institute of Electrical and Electronics Engineers (IEEE) C95.1-2019
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 2020
- Ministry of Health (Canada) Safety Code 6 (2015), Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
- RSS-102 (Issue 5) – Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)
- Australian Communications Authority Radio communications (Electromagnetic Radiation - Human Exposure) Standard (2014)
- ANATEL, Brazil Regulatory Authority, Resolution No 700 of September 28, 2018 "Approves the Regulation on the Assessment of Human Exposure to Electric, Magnetic and Electromagnetic Fields Associated with the Operation of Radio communication Transmitting Stations.
- IEC/IEEE 62209-1528-2020- Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)
- FCC KDB – 643646 D01 SAR Test for PTT Radios v01r03

- FCC KDB – 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB – 865664 D02 RF Exposure Reporting v01r02
- FCC KDB – 447498 D01 General RF Exposure Guidance v06
- FCC KDB – 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB - 648474 D04 Handset SAR v01r03

5.0 SAR Limits

Table 2

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average - ANSI - (averaged over the whole body)	0.08	0.4
Spatial Peak - ANSI - (averaged over any 1-g of tissue)	1.6	8.0
Spatial Peak – ICNIRP/ANSI - (hands/wrists/feet/ankles averaged over 10-g)	4.0	20.0
Spatial Peak - ICNIRP - (Head and Trunk 10-g)	2.0	10.0

6.0 Description of Device Under Test (DUT)

This portable device operates in WLAN technology for data applications and Bluetooth technology for short range wireless devices.

This device also incorporates a GFSK Bluetooth device which is a Frequency Hopping Spread Spectrum (FHSS) technology. The Bluetooth radio modem is used to wireless link audio accessories. The maximum actual transmission duty cycle is imposed by the Bluetooth standard. The maximum duty cycle for BT is 76.84%.

This device included WLAN 2.4GHz 802.11b/g/n operate using Direct Sequence Spread Spectrum(DSSS) and Orthogonal Frequency-Division Multiplexing(OFDM) with channel bandwidth of 20MHz & 40MHz. WLAN 5GHz 802.11 a/n/ac operate using Orthogonal Frequency-Division Multiplexing(OFDM) with channel bandwidth of 20MHz, 40MHz & 80MHz.

Table 3 below summarizes the technologies, bands, maximum duty cycles and maximum output powers. Maximum output powers are defined as upper limit of the production line final test station.

Table 3

Radio Type	Band (MHz)	Transmission	Duty Cycle (%)	Nominal Power (W)	Declared Max Power (W)
Bluetooth (Classic/EDR)	2402-2480	GFSK	76.68	0.0100	0.0158
Bluetooth (LE 1M)	2402-2480	GFSK	62.50	0.0063	0.0100
WLAN 802.11 b	2412-2462	DSSS	98.94	CH 01- 0.0316; CH 06 - 0.0224; CH 11 – 0.0200	CH 01- 0.0631; CH 06 - 0.0447; CH 11 - 0.0398
WLAN 802.11 g	2412-2462	OFDM	98.25	CH 01& CH 11 - 0.0224; CH 06 - 0.0251	CH 01 & CH 11 - 0.0447; CH 06 - 0.0501
WLAN 802.11 n (20MHz)	2412-2462	OFDM	97.92	CH 01& CH 11 - 0.0224; CH 06 - 0.0251	CH 01 & CH 11 - 0.0447; CH 06 - 0.0501
WLAN 802.11 n (40MHz)	2412-2462	OFDM	94.17	CH 03, CH 06 & CH 09 - 0.0178	CH 03, CH 06 & CH 09 - 0.0355
WLAN 802.11 a (20MHz)	5180-5825	OFDM	98.25	CH 36 & CH 149 - 0.0251; CH 40, CH 52, CH 56, CH 60, CH 157 & CH 165 - 0.0282; CH 44, CH 48, CH 64 & CH 140 - 0.0316; CH 100, CH 116 & CH 128 - 0.0355	CH 36 & CH 149 - 0.0501; CH 40, CH 52, CH 56, CH 60, CH 157 & CH 165 - 0.0562; CH 44, CH 48, CH 64 & CH 140 - 0.0631; CH 100, CH 116 & CH 128 - 0.0708

Table 3 (Continued)

Radio Type	Band (MHz)	Transmission	Duty Cycle (%)	Nominal Power (W)	Declared Max Power (W)
WLAN 802.11 ac (20MHz)	5180-5825	OFDM	98.02	CH 149 - 0.0158; CH 36, CH 52, CH 56, CH 60, CH 112 & CH 116 - 0.0178; CH 64 & CH 128 - 0.0200; CH 40, CH 44, CH 48 & CH 132 - 0.0224; CH 100 - 0.0251; CH 165 - 0.0282	CH 149 - 0.0316; CH 36, CH 52, CH 56, CH 60, CH 112 & CH 116 - 0.0355; CH 64 & CH 128 - 0.0398; CH 40, CH 44, CH 48 & CH 132 - 0.0447; CH 100 - 0.0501; CH 165 - 0.0562
WLAN 802.11 ac (40MHz)	5180-5825	OFDM	96.07	CH 38 - 0.0079; CH 62 - 0.0089; CH54 - 0.0125; CH 102, CH 142 & CH 151 - 0.0141; CH 46 - 0.0158; CH 110, CH 118 & CH 126 - 0.0178; CH 134 - 0.0224; CH 159 - 0.0251	CH 38 - 0.0158; CH 62 - 0.0178; CH54 - 0.0251; CH 102, CH 142 & CH 151 - 0.0282; CH 46 - 0.0316; CH 110, CH 118 & CH 126 - 0.0355; CH 134 - 0.0447; CH 159 - 0.0501
WLAN 802.11 ac (80MHz)	5180-5825	OFDM	91.67	CH 42 - 0.0063; CH 58 - 0.0071; CH 106 - 0.0089; CH 138 - 0.0158; CH 155 - 0.0224; CH 122 - 0.0251	CH 42 - 0.0125; CH 58 - 0.0141; CH 106 - 0.0178; CH 138 - 0.0316; CH 155 - 0.0447; CH 122 - 0.0501
WLAN 802.11 n (20MHz)	5180-5825	OFDM	97.92	CH 36 - 0.0178; CH 116, CH 132 & CH 149 - 0.0224; CH 52, CH 56, CH 60, CH 64, CH 100, CH 112 & CH 128 - 0.0251; CH 40, CH 44, CH 48 & CH 165 - 0.0282	CH 36 - 0.0355; CH 116, CH 132 & CH 149 - 0.0447; CH 52, CH 56, CH 60, CH 64, CH 100, CH 112 & CH 128 - 0.0501; CH 40, CH 44, CH 48 & CH 165 - 0.0562
WLAN 802.11 n (40MHz)	5180-5825	OFDM	96.03	CH 38 - 0.0079; CH 62 - 0.0089; CH 102 - 0.0141; CH 54 - 0.0178; CH 110, CH 118, CH 126 & CH 142 - 0.0200; CH 46, CH 151 & CH 159 - 0.0224; CH 134 - 0.0282	CH 38 - 0.0158; CH 62 - 0.0178; CH 102 - 0.0282; CH 54 - 0.0355; CH 110, CH 118, CH 126 & CH 142 - 0.0398; CH 46, CH 151 & CH 159 - 0.0447; CH 134 - 0.0562

The intended operating positions are “at the body” by means of the offered body worn accessories. Body worn audio and PTT operation is accomplished by means of optional remote accessories that are connected to the radio. Operation at the body without an audio accessory attached is possible by means of BT accessories.

7.0 Optional Accessories and Test Criteria

This device is offered with optional accessories. All accessories were individually evaluated during the test plan creation to determine if testing was required per the guidelines outlined in “SAR Test Reduction Considerations for Occupational PTT Radios” FCC KDB 643646 to assess compliance of this device. The following sections identify the test criteria and details for each accessory category. Refer to Exhibit 7B for antenna separation distances.

7.1 Antennas

Table 4

Antenna No.	Antenna Models	Description	Selected for test	Tested
1	LDS MDA-LB-008	BT/WLAN Antenna, ¼ wave, WiFi 2.4GHz/BT/BTLE, -2.1dBi, WiFi 5GHz (5150 – 5250MHz), 0.9dBi, WiFi 5GHz (5250-5350MHz), 1.3dBi, WiFi 5GHz (5470-5725MHz), 1.1 dBi, WiFi 5GHz (5725-5850MHz), 1.1 dBi	Yes	Yes

7.2 Battery

Table 5

Battery No.	Battery Models	Description	Selected for test	Tested	Comments
1	PMNN4602A	Embedded build in non removable	Yes	Yes	Default battery

7.3 Body worn Accessories

Table 6

Body worn No.	Body worn Models	Description	Selected for test	Tested	Comments
1	PMLN8537A	Carry Accessory- TLK 25 Holster Belt Clip	Yes	Yes	
2	PMLN8538A	Carry Accessory- TLK 25 Holster Badge Clip	Yes	Yes	

7.4 Audio Accessories

Table 7

Audio No.	Audio Acc. Models	Description	Selected for test	Tested	Comments
1	PMLN8536A	Earpiece, TLK 25 Earpiece with Cable Clip and Flag Label	Yes	Yes	Default Audio

8.0 Description of Test System

DASY5™ Test System

8.1 Descriptions of Robotics/Probes/Readout Electronics

Table 8

Dosimetric System type	System version	DAE type	Probe Type
Schmid & Partner Engineering AG SPEAG DASY 5	52.10.4.1527	DAE4	EX3DV4 (E-Field)

The **DASY5™ system** is operated per the instructions in the DASY5™ Users Manual. The complete manual is available directly from SPEAG™. All measurement equipment used to assess SAR compliance was calibrated according to ISO/IEC 17025 A2LA guidelines. Section 9.0 presents additional test equipment information. Appendices B and C present the applicable calibration certificates.

8.2 Description of Phantom(s)

Table 9

Phantom Type	Phantom(s) Used	Material Parameters	Phantom Dimensions LxWxD (mm)	Material Thickness (mm)	Support Structure Material	Loss Tangent (wood)
Triple Flat	NA	200MHz -6GHz; Er = 3-5, Loss Tangent = ≤0.05	280x175x175	2mm +/- 0.2mm	Wood	< 0.05
SAM	NA	300MHz -6GHz; Er = < 5, Loss Tangent = ≤0.05	Human Model			
Oval Flat	√	300MHz -6GHz; Er = 4+/- 1, Loss Tangent = ≤0.05	600x400x190			

8.3 Description of Simulated Tissue

The sugar based simulate tissue is produced by placing the correct measured amount of De-ionized water into a large container. Each of the dried ingredients are weighed and added to the water carefully to avoid clumping. If the solution has a high sugar concentration the water is pre-heated to aid in dissolving the ingredients. For Diacetin and similar type simulates, sugar and HEC ingredients are not needed. The solution is mixed thoroughly, covered, and allowed to sit overnight prior to use.

The simulated tissue mixture was mixed based on the Simulated Tissue Composition indicated in Table 10. During the daily testing of this product, the applicable mixture was used to measure the Di-electric parameters at each of the tested frequencies to verify that the Di-electric parameters were within the tolerance of the tissue specifications.

Simulated Tissue Composition (percent by mass)

Table 10

Ingredients	2450MHz (1)	5GHz (1)
	Head	Head
Sugar	NA	NA
Diacetin	NA	NA
De ionized –Water	NA	NA
Salt	NA	NA
HEC	NA	NA
Bact.	NA	NA

Note: (1) SPEAG provided Motorola proprietary stimulant ingredients.

9.0 Additional Test Equipment

The Table below lists additional test equipment used during the SAR assessment.

Table 11

Equipment Type	Model Number	Serial Number	Calibration Date	Calibration Due Date
SPEAG PROBE	EX3DV4	7486	06/18/2022	06/18/2025
SPEAG PROBE	EX3DV4	7519	02/28/2022	02/28/2025
SPEAG DAE	DAE4	850	04/14/2022	04/14/2025
SPEAG DAE	DAE4	684	02/22/2022	02/22/2025
POWER AMPLIFIER	5S1G4	312988	CNR	CNR
POWER AMPLIFIER	5S4G11	312664	CNR	CNR
POWER METER	E4418B	MY45100911	08/08/2022	08/08/2023
POWER METER	E4417A	GB41292245	11/11/2022	11/11/2023
POWER SENSOR	E4412A	MY61060011	04/10/2023	04/10/2024
POWER SENSOR	E4412A	MY61050006	04/12/2023	04/12/2024
POWER SENSOR	NRP-Z11	121252	08/13/2021	08/13/2023
BI-DIRECTIONAL COUPLER	3022	77115	07/20/2022	07/20/2023
BI-DIRECTIONAL COUPLER	3024	61182	06/30/2022	06/30/2023
VECTOR SIGNAL GENERATOR	E4438C	MY45091270	09/21/2022	09/21/2023
POWER SUORCE	SE UMS 160 CB	4302	11/10/2022	11/10/2023
THERMOMETER	HH806AU	080307	11/28/2022	11/28/2023
THERMOMETER	1523	3492108	11/04/2022	11/04/2023
TEMPERATURE PROBE	80PK-22	06032017	11/28/2022	11/28/2023
TEMPERATURE PROBE	PR-10L-4-100-1/4-6-BX	WNWR037791	11/04/2022	11/04/2023
DIELECTRIC ASSESSMENT KIT	DAK-3.5	1120	10/03/2022	10/03/2023
NETWORK ANALYZER	E5071B	MY42403218	09/24/2022	09/24/2023
DATA LOGGER	DSB	16398050	08/13/2022	08/13/2023
SPEAG DIPOLE	D2450V2	703	01/12/2023	01/12/2026
SPEAG DIPOLE	D2450V2	781	08/13/2021	08/13/2024
SPEAG DIPOLE	D5GHzV2	1027	02/10/2022	02/10/2025

10.0 SAR Measurement System Validation and Verification

DASY output files of the probe/dipole calibration certificates and system verification test results are included in appendices B, C & D respectively.

10.1 System Validation

The SAR measurement system was validated according to procedures in KDB 865664. The validation status summary Table is below.

Table 12

Dates	Probe Calibration Point		Probe SN	Measured Tissue Parameters		Validation		
				σ	ϵ_r	Sensitivity	Linearity	Isotropy
BT/WLAN								
06/08/2023	Head	2450	7519	1.77	36.60	Pass	Pass	Pass
03/01/2023	Head	2450	7486	1.76	38.50	Pass	Pass	Pass
03/02/2023	Head	5250		4.42	35.40	Pass	Pass	Pass
03/03/2023	Head	5600		4.75	33.90	Pass	Pass	Pass
03/04/2023	Head	5750		4.91	33.70	Pass	Pass	Pass

10.2 System Verification

System verification checks were conducted each day during the SAR assessment. The results are normalized to 1W. Appendix D includes DASY plots with the largest deviation from the qualified source SAR target for each dipole. The Table below summarizes the daily system check results used for the SAR assessment.

Table 13

Probe Serial #	Tissue Type	Dipole Kit / Serial #	Ref SAR @ 1W (W/kg)	System Check Results Measured (W/kg)	System Check Test Results when normalized to 1W (W/kg)	Tested Date
7519	IEEE/IEC Head	SPEAG D2450V2 / 703	52.30 +/- 10%	1.62	51.27	07/08/2023@
7486		SPEAG D2450V2 / 703	52.30 +/- 10%	14.0	56.00	06/14/2023
				23.8	55.20	06/25/2023@
		SPEAG D2450V2 / 781	52.70 +/- 10%	13.9	55.60	06/10/2023@
		SPEAG D5250V2 / 1027	80.50 +/- 10%	8.48	84.80	06/08/2023@
				8.52	85.20	06/15/2023
		SPEAG D5600V2 / 1027	84.70 +/- 10%	8.77	87.70	06/09/2023@
				9.21	92.10	06/15/2023
		SPEAG D5750V2 / 1027	80.90 +/- 10%	7.86	78.60	06/09/2023@
				8.68	86.80	06/24/2023@
				8.58	85.80	06/25/2023
				8.60	86.00	07/31/2023@
				8.75	87.50	08/01/2023

Note: '@' indicates that tissue test result covers next test day (within 24 hours)

10.3 Equivalent Tissue Test Results

Simulated tissue prepared for SAR measurements is measured daily and within 24 hours prior to actual SAR testing to verify that the tissue is within +/- 5% of target parameters at the center of the transmit band. This measurement is done using the applicable equipment indicated in section 9.0. The Table below summarizes the measured tissue parameters used for the SAR assessment.

Table 14

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
2402	IEEE/IEC Head	1.76 (1.67 – 1.85)	39.3 (35.4 – 43.2)	1.69	41.2	06/25/2023@
2412		1.77 (1.68 – 1.86)	39.3 (35.3 – 43.2)	1.76	41.5	07/08/2023
2437		1.79 (1.70 – 1.88)	39.2 (35.3 – 43.1)	1.78	41.5	07/08/2023
2441		1.79 (1.70 – 1.88)	39.2 (35.3 – 43.1)	1.73	42.9	06/10/2023@
				1.73	39.6	06/14/2023
2450		1.80 (1.71 – 1.89)	39.2 (35.3 – 43.1)	1.73	42.9	06/10/2023@
				1.74	39.6	06/14/2023
				1.73	41.2	06/25/2023@
				1.79	41.5	07/08/2023@
2462		1.81 (1.72 – 1.90)	39.2 (35.3 – 43.1)	1.80	41.4	07/08/2023@
2480		1.83 (1.74 – 1.92)	39.2 (35.2 – 43.1)	1.75	41.1	06/25/2023@
5250		4.71 (4.24 – 5.18)	36.0 (32.4 – 39.5)	4.49	38.3	06/08/2023@
				4.77	34.2	06/15/2023
5260		4.72 (4.25 – 5.19)	35.9 (32.3 – 39.5)	4.50	38.2	06/08/2023@
5300		4.76 (4.28 – 5.24)	35.9 (32.3 – 39.5)	4.55	38.2	06/08/2023@
5320		4.78 (4.30 – 5.26)	35.9 (32.3 – 39.5)	4.57	38.1	06/08/2023@
				4.85	34.1	06/15/2023
5500		4.97 (4.47 – 5.46)	35.7 (32.1 – 39.2)	4.55	37.8	06/09/2023@
				5.06	33.7	06/15/2023
5600		5.07 (4.56 – 5.58)	35.5 (32.0 – 39.1)	4.67	37.6	06/09/2023@
				5.18	33.4	06/15/2023
5640		5.11 (4.60 – 5.62)	35.5 (31.9 – 39.0)	4.71	37.5	06/09/2023@
5720		5.19 (4.67 – 5.71)	35.4 (31.8 – 38.9)	4.80	37.4	06/09/2023@
5745		5.22 (4.69 – 5.74)	35.4 (31.8 – 38.9)	4.77	37.8	06/24/2023@
				4.75	35.3	06/25/2023
5750		5.22 (4.70 – 5.74)	35.4 (31.8 – 38.9)	4.83	37.3	06/09/2023@
				4.26	38.6	06/24/2023@
				4.75	35.3	06/25/2023

Note: '@' indicates that tissue test result covers next test day (within 24 hours)

Table 14 (Continued)

Frequency (MHz)	Tissue Type	Conductivity Target (S/m)	Dielectric Constant Target	Conductivity Meas. (S/m)	Dielectric Constant Meas.	Tested Date
5750	IEEE/IEC Head	5.22 (4.70 – 5.74)	35.4 (31.8 – 38.9)	4.82	36.2	07/31/2023@
				4.86	38.0	08/01/2023
5785		5.26 (4.73 – 5.78)	35.3 (31.8 – 38.8)	4.82	37.7	06/24/2023@
				4.79	35.2	06/25/2023
5825		5.30 (4.77 – 5.83)	35.3 (31.7 – 38.8)	4.87	37.7	06/25/2023@

Note: '@' indicates that tissue test result covers next test day (within 24 hours)

11.0 Environmental Test Conditions

The EME Laboratory's ambient environment is well controlled resulting in very stable simulated tissue temperature and therefore stable dielectric properties. Simulated tissue temperature is measured prior to each scan to insure it is within +/ - 2ºC of the temperature at which the dielectric properties were determined. The liquid depth within the phantom used for measurements was at least 15cm. Additional precautions are routinely taken to ensure the stability of the simulated tissue such as covering the phantoms when scans are not actively in process in order to minimize evaporation. The lab environment is continuously monitored. The Table below presents the range and average environmental conditions during the SAR tests reported herein:

Table 15

	Target	Measured
Ambient Temperature	18 – 25 ˚C	Range: 21.3 – 23.4˚C Avg. 22.0 ˚C
Tissue Temperature	18 – 25 ˚C	Range: 20.7-22.6˚C Avg. 21.6˚C

Relative humidity target range is a recommended target

The EME Lab RF environment uses a Spectrum Analyzer to monitor for extraneous large signal RF contaminants that could possibly affect the test results. If such unwanted signals are discovered the SAR scans are repeated.

12.0 DUT Test Setup and Methodology

12.1 Measurements

SAR measurements were performed using the DASY system described in section 8.0 using zoom scans. Oval flat phantoms filled with applicable simulated tissue were used for body and face testing.

The Table below includes the step sizes and resolution of area and zoom scans per KDB 865664 requirements.

Table 16

<table>
<tr><th colspan="2">Description</th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="2">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="2">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="2" rowspan="2">Maximum area scan spatial resolution: ΔxArea, ΔyArea</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">Maximum zoom scan spatial resolution: ΔxZoom, ΔyZoom</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td>Maximum zoom scan spatial resolution, normal to phantom surface</td><td>uniform grid: ΔzZoom(n)</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td colspan="4">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.</td></tr>
</table>

12.2 DUT Configuration(s)

The DUT is a portable device operational at the face as described in section 6.0 while using the applicable accessories listed in section 7.0. All accessories listed in section 7.0 of this report were considered when implementing the guidelines specified in KDB 643646. KDB 248227 D01 applied to WLAN test configurations.

12.3 DUT Positioning Procedures

The positioning of the device for each body location is described below and illustrated in Appendix G.

12.3.1 Body

The DUT was positioned in normal use configuration against the phantom with the offered body worn accessory as well as with and without the offered audio accessories as applicable.

12.3.2 Head

Not applicable.

12.3.3 Face

Not applicable.

12.4 DUT Test Channels

The number of test channels was determined by using the following IEEE 1528 equation. The use of this equation produces the same or more test channels compared to the FCC KDB 447498 number of test channels formula.

$$N_c = 2 * roundup[10 * (f_{high} - f_{low}) / f_c] + 1$$

Where

N_c = Number of channels
F_{high} = Upper channel
F_{low} = Lower channel
F_c = Center channel

12.5 SAR Result Scaling Methodology

The calculated 1-gram and 10-gram averaged SAR results indicated as "Max Calc. 1g-SAR" in the data Tables is determined by scaling the measured SAR to account for power leveling variations and drift. Appendix F includes a shortened scan to justify SAR scaling for drift. For this device the "Max Calc. 1g-SAR" are scaled using the following formula:

$$Max\_Calc = SAR\_meas \cdot 10^{\frac{-Drift}{10}} \cdot \frac{P\_\max}{P\_\text{int}} \cdot DC$$

P_max = Maximum Power (W)
P_int = Initial Power (W)
Drift = DASY drift results (dB)
SAR_meas = Measured 1-g or 10-g Avg. SAR (W/kg)
DC = Transmission mode duty cycle in % where applicable
50% duty cycle is applied for PTT operation

Note: for conservative results, the following are applied:
If P_int > P_max, then P_max/P_int = 1.
Drift = 1 for positive drift

Additional SAR scaling was applied using the methodologies outlined in FCC KDB 865664 using tissue sensitivity values. SAR was scaled for conditions where the tissue permittivity was measured above the nominal target and for tissue conductivity that was measured below the nominal target. Negative or reduced SAR scaling is not permitted.

12.6 DUT Test Plan

The guidelines and requirements outlined in section 4.0 were used to assess compliance of this device. All modes of operation identified in section 6.0 were considered during the development of the test plan. Standalone and simultaneous BT testing were assessed in sections 13.14 and 14.0 per the guidelines of KDB 447498.

13.0 DUT Test Data for WLAN

SAR test reduction is applied using the following criteria according to KDB 248227:

a. For 2.4GHz 802.11 g/n SAR testing is not required when then highest reported SAR for DSSS is adjusted by ratio of OFDM to DSSS specified maximum output power and adjusted SAR is ≤1.2 W/kg.
b. U-NII-1 SAR testing not required when U-NII-2A band highest reported SAR for a test configuration is ≤1.2 W/kg.
c. For all positions/configurations, when reported SAR is >0.8W/kg, SAR is measured for these test 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 positions/configurations are tested.

13.1 Assessment for WLAN 2.4GHz (802.11 b/g/n)

Output Power Data

These power measurements were used to determine the necessary modes for SAR testing according to KDB 248227.

Table 17

Band	802.11	Ch. BW	Ch.	Freq. (MHz)	Measured conducted power (W)
2.4 GHz	b	20	1	2412	0.0542
			6	2437	0.0374
			11	2462	0.0356
	g	20	1	2412	0.0352
			6	2437	0.0400
			11	2462	0.0372
	n	20	1	2412	0.0344
			6	2437	0.0391
			11	2462	0.0362
		40	6	2437	0.0307

Assessments at the Body

DUT assessment with WLAN internal antenna, offered battery and with cable accessory attached against the phantom with the offered body worn accessories. SAR plots of the highest results per Table (bolded) are presented in the Appendix E.

Table 18

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
802.11b									
LDS MDA-LB-008	PMNN4602A	PMLN8537A	None	2412.0000	0.054	-0.10	0.103	0.139	IRA-AB-230708-05
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	2412.0000	0.054	-0.07	0.710	**0.953**	IRA-AB-230708-06
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	2437.0000	0.037	-0.08	0.385	0.750	IRA-AB-230708-07
Assessment for Additional Audio									
LDS MDA-LB-008	PMNN4602A	PMLN8538A	PMLN8536A	2412.0000	0.054	-0.19	0.612	0.844	ZIQ-AB-230708-08

Assessments for ISED Canada

Based on the assessment results for body, additional tests were not required for the Industry Canada frequency range (2412-2462 MHz) as the testing performed is in compliance with Industry Canada frequency range.

As per ISED Notice 2016-DRS001, additional tests were required for the low, mid and high frequency channels for the configuration with the highest SAR value. The SAR results are in Tables below. SAR plots of the highest results per Table (bolded) are presented in the Appendix E.

Table 19

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
802.11b									
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	2412.0000	0.054	-0.07	0.710	**0.953**	IRA-AB-230708-06
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	2437.0000	0.037	-0.08	0.385	0.750	IRA-AB-230708-07
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	2462.0000	0.036	-0.34	0.286	0.622	ZIQ-AB-230709-02@

13.2 Assessment for WLAN 5.0 GHz (802.11 a/n/ac)

Output Power Data

These power measurements were used to determine the necessary modes for SAR testing according to KDB 248227.

Table 20

Band	802.11	Ch. BW	Ch.	Freq. (MHz)	Measured conducted power (W)
U-NII-1 (5.15-5.25 GHz)	a	20	36	5180	0.0384
			40	5200	0.0450
			44	5220	0.0547
			48	5240	0.0527
	n	20	36	5180	0.0265
			40	5200	0.0444
			44	5220	0.0427
			48	5240	0.0409
		40	38	5190	0.0115
			46	5230	0.0435
	ac	20	36	5180	0.0277
			40	5200	0.0349
			44	5220	0.0339
			48	5240	0.0330
		40	38	5190	0.0112
			46	5230	0.0274
		80	42	5210	0.0101
U-NII-2A (5.25-5.35 GHz)	a	20	52	5260	0.0476
			56	5280	0.0475
			60	5300	0.0483
			64	5320	0.0520
	n	20	52	5260	0.0409
			56	5280	0.0413
			60	5300	0.0421
			64	5320	0.0410
		40	54	5270	0.0278
			62	5310	0.0164
	ac	20	52	5260	0.0270
			56	5280	0.0271
			60	5300	0.0275
			64	5320	0.0264
		40	54	5270	0.0242
			62	5310	0.0144
		80	58	5290	0.0122

Table 20 (Continued)

Band	802.11	Ch. BW	Ch.	Freq. (MH0z)	Measured conducted power (W)
U-NII-2C (5.47-5.625 GHz)	a	20	100	5500	0.0556
			116	5580	0.0527
			128	5640	0.0528
			140	5720	0.0479
	n	20	100	5500	0.0442
			112	5560	0.0400
			116	5580	0.0339
			128	5640	0.0366
		40	102	5510	0.0231
			110	5550	0.0295
			118	5590	0.0313
			126	5630	0.0310
	ac	20	100	5500	0.0360
			112	5560	0.0277
			116	5580	0.0291
			128	5640	0.0310
		40	102	5510	0.0229
			110	5550	0.0262
			118	5590	0.0284
			126	5630	0.0287
		80	106	5530	0.0153
			122	5610	0.0363
U-NII-3 (5.65-5.825 GHz)	a	20	149	5745	0.0406
			157	5785	0.0462
			165	5825	0.0445
	n	20	132	5660	0.0350
			149	5745	0.0313
			165	5825	0.0439
		40	134	5670	0.0442
			142	5710	0.0301
			151	5755	0.0335
			159	5795	0.0391
	ac	20	132	5660	0.0349
			149	5745	0.0235
			165	5825	0.0465
		40	134	5670	0.0377
			142	5710	0.0226
			151	5755	0.0251
			159	5795	0.0383
		80	138	5690	0.0229
			155	5775	0.0363

DUT assessment with WLAN internal antenna, offered battery and with cable accessory attached against the phantom with the offered body worn accessories. SAR plots of the highest results per Table (bolded) are presented in the Appendix E.

Assessments at the FCC Body U-NII-2A (5.25-5.35GHz)

Table 21

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
802.11a, 20MHz BW									
LDS MDA-LB-008	PMNN4602A	PMLN8537A	None	5320.0000	0.052	0.02	0.176	0.217	BL-AB-230609-12@
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5320.0000	0.052	-0.41	0.494	**0.671**	BL-AB-230609-13@
Assessment for Additional Audio									
LDS MDA-LB-008	PMNN4602A	PMLN8538A	PMLN8536A	5320.0000	0.052	0.40	0.404	0.499	EMR-AB-230615-14

Assessments at the FCC Body U-NII-2C (5.47-5.725GHz)

Table 22

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
802.11a, 20MHz BW									
LDS MDA-LB-008	PMNN4602A	PMLN8537A	None	5500.0000	0.056	0.12	0.051	0.066	EMR-AB-230609-20
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5500.0000	0.056	-0.24	0.432	**0.594**	EMR-AB-230610-01@
Assessment for Additional Audio									
LDS MDA-LB-008	PMNN4602A	PMLN8538A	PMLN8536A	5500.0000	0.056	-0.19	0.292	0.397	BL-AB-230615-16

Assessments at the FCC Body U-NII-3 (5.725-5.825GHz)

Table 23

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
802.11a, 20MHz BW									
LDS MDA-LB-008	PMNN4602A	PMLN8537A	None	5785.0000	0.046	-0.34	0.098	0.132	BL-AB-230625-02@
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5785.0000	0.046	0.16	0.645	0.800	BL-AB-230625-03@
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5825.0000	0.045	-0.02	0.667	**0.863**	BL-AB-230625-04@
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5745.0000	0.041	-0.11	0.500	0.646	BL-AB-230625-05@
Assessment for Additional Audio									
LDS MDA-LB-008	PMNN4602A	PMLN8538A	PMLN8536A	5825.0000	0.045	0.13	0.597	0.769	BL-AB-230801-01@

Assessments for ISED Canada

Based on the assessment results for body per KDB643646 D01, additional tests were not required for the Industry Canada frequency range (5GHz) as the testing performed is in compliance with Industry Canada frequency range.

As per ISED Notice 2016-DRS001, additional tests were required for the low, mid and high frequency channels for the configuration with the highest SAR value. The SAR results are in Tables below. SAR plots of the highest results per Table (bolded) are presented in the Appendix E.

Assessments at the Body U-NII-2A (5.25-5.35GHz)

Table 24

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
802.11a, 20MHz BW									
LDS MDA-LB-008	PMNN4602A	PMLN8537A	None	5260.0000	0.048	-0.36	0.753	0.983	BL-AB-230609-15@
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5300.0000	0.048	-0.42	0.793	**1.034**	BL-AB-230609-14@
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5320.0000	0.052	-0.41	0.494	0.671	BL-AB-230609-13@

Assessments at the Body U-NII-2C (5.47-5.725GHz)

Table 25

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
802.11a, 20MHz BW									
LDS MDA-LB-008	PMNN4602A	PMLN8537A	None	5500.0000	0.056	-0.24	0.432	0.594	EMR-AB-230610-01@
LDS MDA-LB-008	PMNN4602A	PMLN8537A	None	5640.0000	0.053	0.31	0.472	**0.646**	EMR-AB-230610-03@
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5720.0000	0.048	0.21	0.405	0.545	EMR-AB-230610-04@

Assessments at the Body U-NII-3 (5.725-5.825GHz)

Table 26

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
802.11a, 20MHz BW									
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5745.0000	0.041	-0.05	0.335	0.427	BL-AB-230801-06
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5785.0000	0.046	0.12	0.605	0.751	BL-AB-230801-07
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5825.0000	0.045	-0.02	0.667	**0.863**	BL-AB-230625-04@

14.0 DUT Test for Bluetooth

14.1 Assessment for Bluetooth Band

Output Power Data

These power measurements were used to determine the necessary modes for SAR testing according to KDB 248227.

Table 27

Ch.	Freq. (MHz)	Measured conducted power (W)
0	2402.0000	0.0124
39	2441.0000	0.0127
78	2480.0000	0.0125

Assessments at the Body

DUT assessment with WLAN internal antenna, offered battery and with cable accessory attached against the phantom with the offered body worn accessories. SAR plots of the highest results per Table (bolded) are presented in the Appendix E.

Table 28

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
LDS MDA-LB-008	PMNN4602A	PMLN8537A	None	2441.0000	0.013	0.21	0.029	0.036	SHM-AB-230611-02@
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	2441.0000	0.013	0.11	0.125	**0.156**	BL-AB-230614-11
Assessment of Additional Audio									
LDS MDA-LB-008	PMNN4602A	PMLN8538A	PMLN8536A	2441.0000	0.013	0.11	0.117	0.146	BL-AB-230614-12

Assessments for ISED Canada

Based on the assessment results for body and face per KDB643646 D01, additional tests were not required for the Industry Canada frequency range (2412-2480 MHz) as the testing performed is in compliance with Industry Canada frequency range.

As per ISED Notice 2016-DRS001, additional tests were required for the low, mid and high frequency channels for the configuration with the highest SAR value. The SAR results are in Tables below. SAR plots of the highest results per Table (bolded) are presented in the Appendix E.

Table 29

Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Init Pwr (W)	SAR Drift (dB)	Meas. 1g-SAR (W/kg)	Max Calc. 1g-SAR (W/kg)	Run#
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	2402.0000	0.012	-0.14	0.145	**0.192**	SHM-AB-230626-04@
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	2441.0000	0.013	0.11	0.125	0.156	BL-AB-230614-11
LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	2480.0000	0.013	-0.44	0.110	0.154	SHM-AB-230626-05@

15.0 Simultaneous Transmission

Simultaneous Transmission assessments is not required as this device is operate as below:

1. BT, WLAN 2.4GHz and WLAN 5GHz are sharing the same antenna, only one technology to transmit at one time.
2. WLAN 2.4GHz + BT and WLAN 5GHz + BT cannot be simultaneous transmit but will be time multiplexed.

16.0 Results Summary

Based on the test guidelines from section 4.0 and satisfying frequencies within FCC bands and ISED Canada Frequency bands, the highest Operational Maximum Calculated 1-gram average SAR values found for this filing:

Table 30

Designator	Frequency band (MHz)	Max Calc at Body (W/kg)
		1g-SAR
FCC		
BT	2412-2480	0.192
WLAN	2412-2462	0.953
	5180 - 5825	1.034
Simultaneous Result		*N/A
ISED		
BT	2412-2480	0.192
WLAN	2412-2462	0.953
	5180 - 5825	1.034
Simultaneous Result		*N/A

All results are scaled to the maximum output power.
*Not applicable, refer to section 15.0 Simultaneous Transmission.

The test results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits of 1.6 W/kg averaged over 1 gram per the requirements of FCC 47 CFR § 2.1093 and RSS-102 (Issue 5).

17.0 Variability Assessment

Per the guidelines in KDB 865664 SAR variability assessment is not required because SAR results for Bluetooth and WLAN 2.4GHz are below 0.8W/kg (General population). Variability assessments are required for 5GHz because SAR result are above 0.8W/kg (General population).

Table 31

Run#	Antenna	Battery	Carry Accessory	Cable Accessory	Test Freq (MHz)	Max Calc. 1g-SAR (W/kg)	Ratio	Comments
BL-AB-230609-14@	LDS MDA-LB-008	PMNN4602A	PMLN8538A	None	5300.0000	0.889	1.19	No additional repeat scans is required due to the ratio (SAR_{high}/SAR_{low}) < 1.20
BL-AB-230731-06						0.750		

18.0 System Uncertainty

A system uncertainty analysis is not required for this report per KDB 865664 because the highest report SAR value for General Population exposure is less than 1.5W/kg.

Per the guidelines of ISO/IEC 17025 a reported system uncertainty is required and therefore measurement uncertainty budget is included in Appendix A.

Appendix A

Measurement Uncertainty Budget

Uncertainty Budget for System Validation (dipole & flat phantom) for 800 MHz to 3 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t. Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	1.73	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	R	1.73	0.64	0.43	1.2	0.8	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	R	1.73	0.6	0.49	0.6	0.5	∞
Combined Standard Uncertainty			RSS				9	9	99999
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				18	17	

Notes for uncertainty budget Tables:
a) Column headings *a-k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty

h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

Uncertainty Budget for System Validation (dipole & flat phantom) for 3 to 6 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	7.0	N	1.00	1	1	7.0	7.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	1	1	2.7	2.7	∞
Spherical Isotropy	E.2.2	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effect	E.2.3	2.0	R	1.73	1	1	1.2	1.2	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	0.0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance	E.6.2	1.0	R	1.73	1	1	0.6	0.6	∞
Probe Positioning w.r.t. Phantom	E.6.3	4.0	R	1.73	1	1	2.3	2.3	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	2.1	R	1.73	1	1	1.2	1.2	∞
Dipole									
Dipole Axis to Liquid Distance	8, E.4.2	2.0	R	1.73	1	1	1.2	1.2	∞
Input Power and SAR Drift Measurement	8, 6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Dielectric Parameter Correction	--	1.4	N	1.00	1	0.79	1.4	1.1	∞
Liquid Conductivity (measurement)	E.3.3	3.3	R	1.73	0.64	0.43	1.2	0.8	∞
Liquid Permittivity (measurement)	E.3.3	1.9	R	1.73	0.6	0.49	0.6	0.5	∞
Combined Standard Uncertainty			RSS				10	10	9999 9
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				19	19	

Notes for uncertainty budget Tables:
a) Column headings *a-k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

Uncertainty Budget for Device Under Test, for 800 MHz to 3 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**ci (1 g)**	**ci (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**vi**
Measurement System									
Probe Calibration	E.2.1	6.0	N	1.00	1	1	6.0	6.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				11	11	419
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				22	22	

Notes for uncertainty budget Tables:

a) Column headings *a-k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty

Uncertainty Budget for Device Under Test for 3 to 6 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	**IEEE 1528 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	7.0	N	1.00	1	1	7.0	7.0	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	2.0	R	1.73	1	1	1.2	1.2	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	1.0	R	1.73	1	1	0.6	0.6	∞
Probe Positioning w.r.t Phantom	E.6.3	4.0	R	1.73	1	1	2.3	2.3	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	2.1	R	1.73	1	1	1.2	1.2	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Dielectric Parameter Correction	--	1.4	N	1.00	1	0.79	1.4	1.1	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				12	12	504
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				23	23	

Notes for uncertainty budget Tables:
a) Column headings *a-k* are given for reference.
b) Tol. - tolerance in influence quantity.
c) Prob. Dist. – Probability distribution
d) N, R - normal, rectangular probability distributions
e) Div. - divisor used to translate tolerance into normally distributed standard uncertainty
f) *ci* - sensitivity coefficient that should be applied to convert the variability of the uncertainty component into a variability of SAR.
g) *ui* – SAR uncertainty
h) *vi* - degrees of freedom for standard uncertainty and effective degrees of freedom for the expanded uncertainty