SAR TEST REPORT

No. 25T04Z200036-005

For

Samsung Electronics. Co., Ltd.

Bluetooth Headset

Model Name: SM-R410

with

Hardware Version: REV1.0

Software Version: R410.001

FCC ID: ZCASMR410R

Issued Date: 2025-04-10

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

Test Laboratory:

CTTL, Telecommunication Technology Labs, CAICT

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REPORT HISTORY

Report Number	Revision	Issue Date	Description
25T04Z200036-005	Rev.0	2025-04-10	Initial creation of test report

TABLE OF CONTENT

1 Test Laboratory

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2017 accredited test laboratory under American Association for Laboratory Accreditation (A2LA) with lab code 7049.01, and is also an FCC accredited test laboratory (CN1349), and ISED accredited test laboratory (CAB identifier:CN0066). The detail accreditation scope can be found on A2LA website.

1.2. Testing Location

Location 1: CTTL(huayuan North Road)

Address:	No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China 100191

1.3. Testing Environment

Normal Temperature:	18-25℃
Relative Humidity:	30-70%

1.4. Project data

Testing Start Date:	2025-03-19
Testing End Date:	2025-03-24

1.5. Signature

Wang Tian

(Prepared this test report)

Lin Jun

(Reviewed this test report)

Qi Dianyuan

Deputy Director of the laboratory

(Approved this test report)

2 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for Samsung Electronics Co., Ltd. Bluetooth Headset SM-R410 are as follows:

Table 2.1: Highest Reported SAR (1g)

Mode	**Highest Reported SAR (1g)**
BT	0.32

The SAR values found for the Mobile Phone are below the maximum recommended levels of 1.6 W/kg as averaged over any 1g tissue according to the ANSI C95.1-1992.

For body operation, this device has been tested and meets FCC RF exposure guidelines when used with any accessory that contains no metal and which provides a minimum separation distance of 10 mm for hotspot and 15mm for body worn between this device and the body of the user. Use of other accessories may not ensure compliance with FCC RF exposure guidelines.

The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output.

The measurement together with the test system set-up is described in annex C. A detailed description of the equipment under test can be found in chapter 4 of this test report. The highest reported SAR value is obtained at the case of (Table 2.1), and the values are:

0.32 W/kg(1g)

3 Client Information

3.1 Applicant Information

Company Name:	Samsung Electronics Co., Ltd.
City:	19 Chapin Rd.,Building D Pine Brook, NJ 07058
Contact Person:	Jenni Chun
E-mail:	j1.chun@samsung.com
Telephone:	+1-201-937-4203
Fax:	N/A

3.2 Manufacturer Information

Company Name:	Samsung Electronics Co., Ltd.
Address /Post:	"Samsung R5, Maetan dong 129, Samsung ro Youngtong gu, Suwon city 443 742, Korea"
Contact Person:	Sunghoon Cho
E-mail:	ggobi.cho@samsung.com
Telephone:	+82-10-2722-4159
Fax:	N/A

4 Equipment Under Test (EUT) and Ancillary Equipment (AE)

4.1 About EUT

Description:	Bluetooth Headset
Model name:	SM-R410
Operating mode(s):	BT
Tested Tx Frequency:	2402 – 2480 MHz (Bluetooth)

4.2 Internal Identification of EUT used during the test

EUT ID*	IMEI	HW	SW Version
EUT1	25T04Z200036UT08A	REV1.0	R410.001
EUT2	25T04Z200036UT14A	REV1.0	R410.001

*EUT ID: is used to identify the test sample in the lab internally.

4.3 Internal Identification of AE used during the test

AE ID*	Description	Model	SN	Manufacturer
AE1	Battery	JN043	/	EVE ENERGY CO., LTD

*AE ID: is used to identify the test sample in the lab internally.

5 TEST METHODOLOGY

5.1 Applicable Limit Regulations

FCC47 CFR Part2 (2.1093）: Radiofrequency radiation exposure evaluation: portable devices

ANSI C95.1–1992:IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

It specifies the maximum exposure limit of **1.6 W/kg** as averaged over any 1 gram of tissue for portable devices being used within 20 cm of the user in the uncontrolled environment.

5.2 Applicable Measurement Standards

IEEE Std 1528–2013: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

5.3 KDB Procedures

KDB447498 D01: General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

KDB865664 D01SAR measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz.

KDB865664 D02RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations

6 Specific Absorption Rate (SAR)

6.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

6.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

$$SAR = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dv}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$SAR = c\left(\frac{\delta T}{\delta t}\right)$$

Where: C is the specific head capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

$$SAR = \frac{\sigma |E|^2}{\rho}$$

Where: σ is the conductivity of the tissue, ρ is the mass density of tissue and E is the RMS electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

7 Tissue Simulating Liquids

The temperature of the tissue-equivalent medium used during measurement must also be within 18 ºC to 25 ºC and within ± 2 ºC 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.

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.

7.1 Targets for tissue simulating liquid

Table 7.1: Targets for tissue simulating liquid

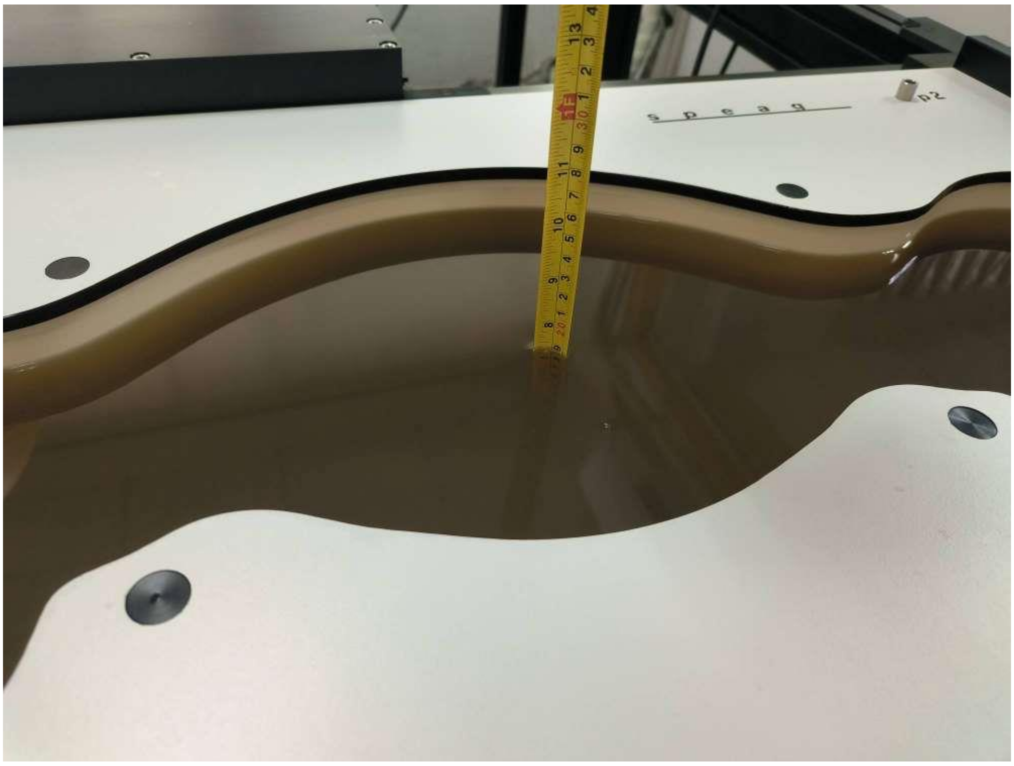
Frequency(MHz)	Liquid Type	Conductivity(σ)	±10% Range	Permittivity(ε)	± 10% Range
750	Head	0.89	0.80～0.98	41.94	37.75～46.13
835	Head	0.90	0.81～0.99	41.5	37.35～45.65
1750	Head	1.37	1.26～1.54	40.0	36～44
1900	Head	1.40	1.26～1.54	40.0	36～44
2450	Head	1.80	1.62～1.98	39.2	35.28～43.12
2600	Head	1.96	1.76～2.16	39.01	35.11～42.91
Frequency(MHz)	Liquid Type	Conductivity(σ)	±5% Range	Permittivity(ε)	± 5% Range
3500	Head	2.91	2.76～3.06	37.93	36.03～39.83
3700	Head	3.22	3.06～3.38	37.6	35.72～39.48
3900	Head	3.32	3.15～3.49	37.5	35.63～39.38
5250	Head	4.71	4.47～4.95	35.93	34.13～37.73
5600	Head	5.07	4.82～5.32	35.53	33.8～37.3
5750	Head	5.22	4.96～5.48	35.36	33.59～37.13

7.2 Dielectric Performance

Table 7.2: Dielectric Performance of Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2025/3/21	Head	2450 MHz	40.4	3.06	1.85	2.78

Note: The liquid temperature is 22.0ºC

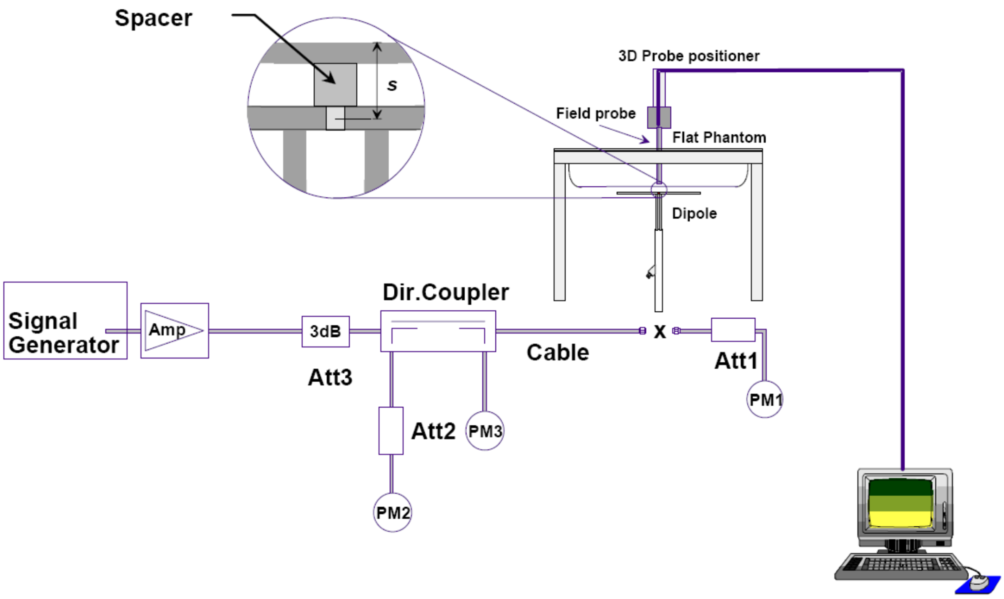


Picture 7-1 Liquid depth in the Head Phantom

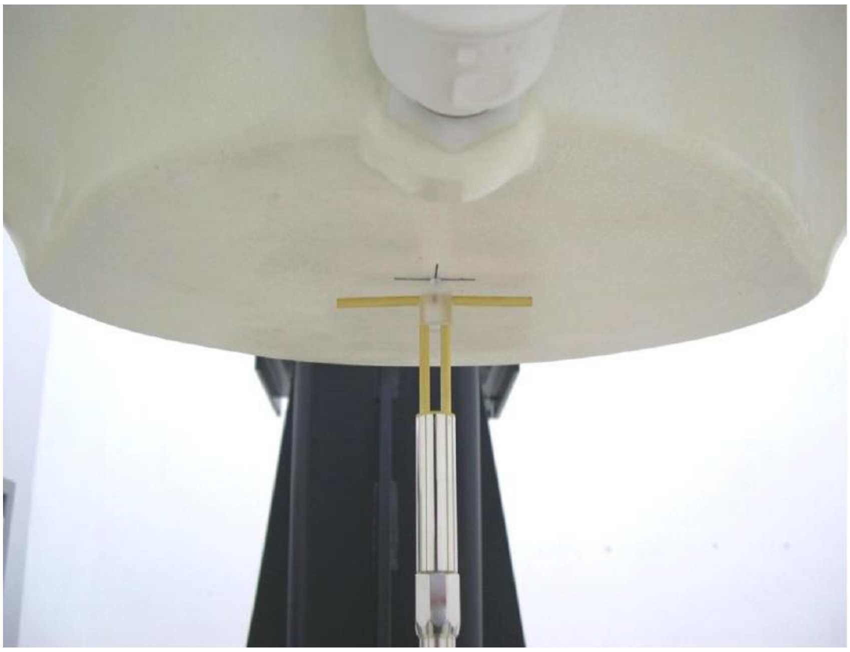
8 System verification

8.1 System Setup

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:



Picture 8.1 System Setup for System Evaluation



Picture 8.2 Photo of Dipole Setup

8.2 System Verification

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.

Table 8.1: System Verification of Head

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value(W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2025/3/21	2450 MHz	24.5	52.2	24.9	53.0	1.71%	1.46%

9 General Measurement Procedure

9.1 *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. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

9.2 *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 found in the scanned area, within a range of the global maximum. The range (in dB0 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 FCC KDB 865664 D01v01r04 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.	

9.3 *Zoom Scan*

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10g 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

<table>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 22 mm</td></tr>
<tr><td colspan="5">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 <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 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>

9.4 *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 9.1.

10 Measurement Procedure for different technologies

10.1 Bluetooth & Wi-Fi Measurement Procedures for SAR

Normal network operating configurations are not suitable for measuring the SAR of 802.11 transmitters in general. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure that the results are consistent and reliable.

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in a test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

11 Conducted Output Power

11.1 BT Measurement result

The maximum output power(Tune-up Limit)

	Burst-Averaged output power				
	Target power	**Lower To**	**Upper To**	**Min**	**Max**
BDR（GFSK)	10.5dBm	-2dB	2dB	8.5dBm	12.5dBm
EDR 2DH5（π/4-DQPSK)	10dBm	-2dB	2dB	8dBm	12dBm
EDR 3DH5(8DPSK)	10dBm	-2dB	2dB	8dBm	12dBm
BLE(GFSK)	9.5dBm	-2dB	2dB	7.5dBm	11.5dBm

The average conducted power for BT is as following:

BR/EDR									
	GFSK			EDR2M-4_DQPSK			EDR3M-8DPSK		
	Ch0	Ch 39	Ch 78	Ch 0	Ch 39	Ch 78	Ch 0	Ch 39	Ch 78
Maximum Transmit Power(<20dBm)	10.72	11.37	11.59	10.74	11.36	11.67	10.71	11.34	11.67

BLE 1M			
	Channel 0	Channel 19	Channel 39
Maximum Transmit Power(<20dBm)	9.83	10.33	10.68
BLE 2M			
	Channel 0	Channel 19	Channel 39
Maximum Transmit Power(<20dBm)	8.83	10.37	10.67

12 Antenna Location

12.1 Transmit Antenna Separation Distances

The detail for transmit antenna separation distances is described in the additional document:

Appendix to test report No. 25T04Z200036-005

The photos of SAR test

13 SAR Test Result

The calculated SAR is obtained by the following formula:

$$\text{Reported SAR} = \text{Measured SAR} \times 10^{(P_{Target} - P_{Measured})/10}$$

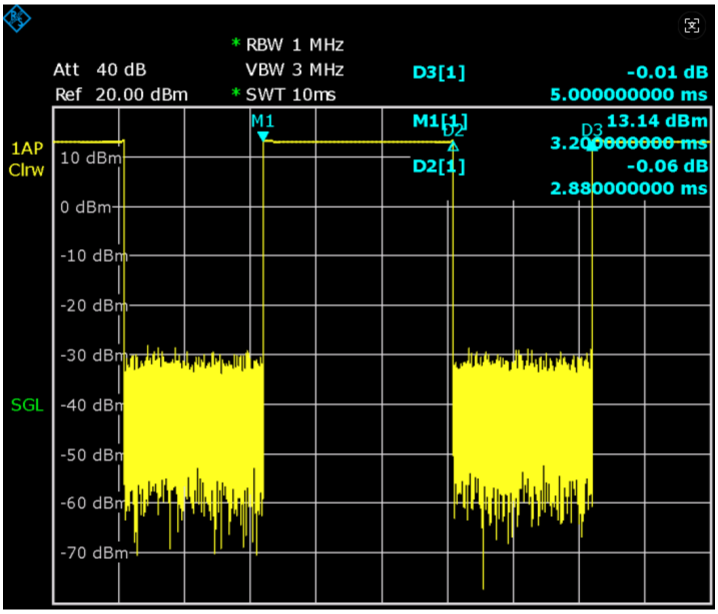
Where P_{Target} is the power of manufacturing upper limit;

$P_{Measured}$ is the measured power in chapter 11.

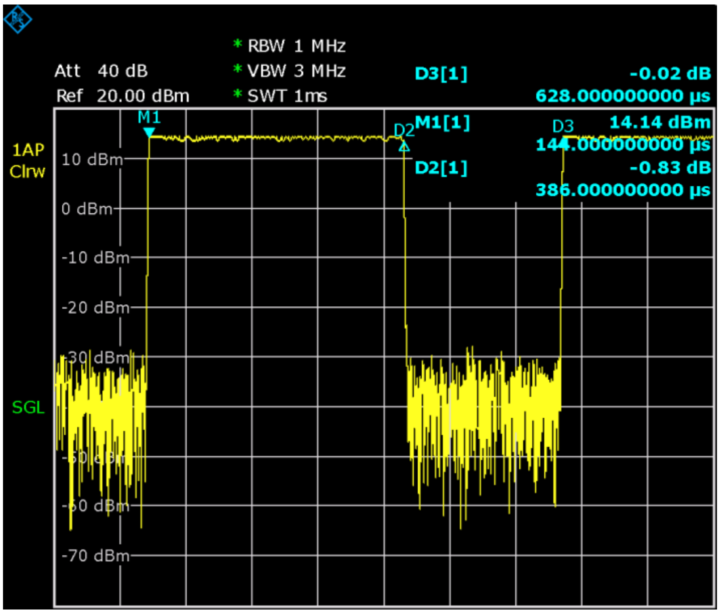
Ambient Temperature: 21.5-23.5 ℃ Liquid Temperature: 21.5-23.5 ℃

13.1 Duty cycle

BR



BLE



Note： The product claims to achieve a maximum duty cycle of 76%

13.2 SAR results for BT

Test Position	Frequency Band	Channel Number	Frequency (MHz)	Mode	Test Position	Distance	Figure No./Note	EUT Measured Power (dBm)	Tune up (dBm)	Duty Cycle	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Power Drift
Right													
Body	BT	78	2480	GFSK	Front	0mm	Fig A.1	11.56	12.5	57.6%	0.196	0.32	-0.09
Body	BT	78	2480	GFSK	Rear	0mm	\	11.56	12.5	57.6%	0.032	0.05	-0.11
Body	BT	78	2480	GFSK	Left	0mm	\	11.56	12.5	57.6%	0.038	0.06	-0.19
Body	BT	78	2480	GFSK	Right	0mm	\	11.56	12.5	57.6%	0.147	0.24	-0.03
Body	BT	78	2480	GFSK	Bottom	0mm	\	11.56	12.5	57.6%	0.045	0.07	-0.12
Body	BT	78	2480	GFSK	Top	0mm	\	11.56	12.5	57.6%	0.043	0.07	-0.05
BLE Right													
Body	BT	39	2441	GFSK	Front	0mm	\	10.52	11.5	61.5%	0.086	0.13	0.13
Body	BT	39	2441	GFSK	Rear	0mm	\	10.52	11.5	61.5%	0.009	0.01	0.19
Body	BT	39	2441	GFSK	Left	0mm	\	10.52	11.5	61.5%	0.035	0.05	0.12
Body	BT	39	2441	GFSK	Right	0mm	\	10.52	11.5	61.5%	0.054	0.08	-0.02
Body	BT	39	2441	GFSK	Bottom	0mm	\	10.52	11.5	61.5%	0.022	0.03	-0.19
Body	BT	39	2441	GFSK	Top	0mm	\	10.52	11.5	61.5%	0.022	0.03	0.14

14 Measurement Uncertainty

14.1 Measurement Uncertainty for Normal SAR Tests (300MHz~3GHz)

No.	Error Description	Type	Uncertainty value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement system										
1	Probe calibration	B	6.0	N	1	1	1	6.0	6.0	∞
2	Isotropy	B	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
3	Boundary effect	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
4	Linearity	B	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
5	Detection limit	B	1.0	N	1	1	1	0.6	0.6	∞
6	Readout electronics	B	0.3	R	$\sqrt{3}$	1	1	0.3	0.3	∞
7	Response time	B	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
8	Integration time	B	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
9	RF ambient conditions-noise	B	0	R	$\sqrt{3}$	1	1	0	0	∞
10	RFambient conditions-reflection	B	0	R	$\sqrt{3}$	1	1	0	0	∞
11	Probe positioned mech. restrictions	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
12	Probe positioning with respect to phantom shell	B	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Post-processing	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Test sample related										
14	Test sample positioning	A	3.3	N	1	1	1	3.3	3.3	71
15	Device holder uncertainty	A	3.4	N	1	1	1	3.4	3.4	5
16	Drift of output power	B	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up										
17	Phantom uncertainty	B	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
18	Liquid conductivity (target)	B	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
19	Liquid conductivity (meas.)	A	2.06	N	1	0.64	0.43	1.32	0.89	43
20	Liquid permittivity (target)	B	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.4	∞
21	Liquid permittivity (meas.)	A	1.6	N	1	0.6	0.49	1.0	0.8	521

Combined standard uncertainty	$u_c^{'} = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$					9.55	9.43	257
Expanded uncertainty (confidence interval of 95 %)	$u_e = 2u_c$					19.1	18.9	

15 MAIN TEST INSTRUMENTS

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	N5239A	MY55491241	May 21, 2024	One year
02	Power sensor	NRP50S	101488	June 5, 2024	One year
03	Power sensor	NRP50S	101489		
04	Signal Generator	MG3700A	6201052605	June 12 2024	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	DAE	SPEAG DAE4	1556	January 07,2025	One year
07	E-field Probe	SPEAG EX3DV4	7548	January 06,2025	One year
08	Dipole Validation Kit	SPEAG D2450V2	853	July 10,2024	One year

END OF REPORT BODY

Appendixes

Refer to separated files for the following appendixes

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ANNEX B System Verification Results

ANNEX C SAR Measurement Setup

ANNEX D Position of the wireless device in relation to the phantom

ANNEX E Equivalent Media Recipes

ANNEX F System Validation

ANNEX G Probe Calibration Certificate

ANNEX H Dipole Calibration Certificate

ANNEX I Accreditation Certificate