FCC SAR Test Report

FCC ID:OL3AT10DONGLE

Report No.	:	BTL-FCC SAR-1-2301G001
Equipment	:	Dongle
Model Name	:	AT10DONGLE
Brand Name	:	Alcatel-Lucent Enterprise
Applicant	:	ALE International
Address	:	32, Avenue Kléber – 92700 Colombes – FRANCE
Radio Function	:	Bluetooth
Standard(s)	:	**KDB447498 D04** Interim General RF Exposure Guidance v01 **KDB865664 D01** SAR measurement 100 MHz to 6 GHz v01r04 **KDB865664 D02** SAR Reporting v01r02 **KDB447498 D02** Procedures for Dongle Xmtr V02 **FCC§2.1093** Radiofrequency radiation exposure evaluation: portable devices **IEEE C95.1:2019** Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz. **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
Date of Receipt	:	Jan. 6, 2023
Date of Test	:	Jun. 7, 2023
Issued Date	:	Aug. 14, 2023

The above equipment has been tested and found in compliance with the requirement of the above standards by BTL Inc.

Prepared by :

Jerry Chuang, Supervisor

Testing Laboratory
0659

Approved by :

Peter Chen, Assistant Manager

BTL Inc.
No.18, Ln. 171, Sec. 2, Jiuzong Rd., Neihu Dist., Taipei City 114, Taiwan
Tel: +886-2-2657-3299 Fax: +886-2-2657-3331 Web: www.newbtl.com

Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

Table of Contents

REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	2023/6/9
R01	Add test picture and Add power supply method of EUT.	2023/7/28
R02	Add HVIN、FVIN & Add System Check photo.	2023/8/2
R03	Add Section 9.1 BLE ERP note.	2023/8/7
R04	Add FCC DN number & System Check Normalized to 1W	2023/8/14

1. GENERAL INFORMATION

1.1. GENERAL DESCRIPTION OF EUT

<table>
<tr><td>Equipment</td><td colspan="3">Dongle</td></tr>
<tr><td>Model Name</td><td colspan="3">AT10DONGLE</td></tr>
<tr><td>Brand Name</td><td colspan="3">Alcatel-Lucent Enterprise</td></tr>
<tr><td>Power Sourece</td><td colspan="3">DC voltage supplied from USB port.</td></tr>
<tr><td>Power Rating</td><td colspan="3">DC 5V</td></tr>
<tr><td>Products Covered</td><td colspan="3">N/A</td></tr>
<tr><td>HVIN</td><td colspan="3">AT10DONGLE</td></tr>
<tr><td>FVIN</td><td colspan="3">N/A</td></tr>
<tr><td rowspan="4">Operation Frequency</td><td>Function</td><td>Band</td><td>Frequency (MHz)</td></tr>
<tr><td rowspan="3">Bluetooth</td><td>Basic Rate (BR)</td><td>TX : 2402 - 2480 MHz</td></tr>
<tr><td>Enhance Data Rate</td><td>TX : 2402 - 2480 MHz</td></tr>
<tr><td>Bluetooth Low Energy</td><td>TX : 2402 - 2480 MHz</td></tr>
<tr><td>Sample Status</td><td colspan="3">Engineering Sample</td></tr>
<tr><td>EUT Modification(s)</td><td colspan="3">N/A</td></tr>
</table>

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc. The test data, data evaluation, and equipment configuration contained in our test report were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO/IEC 17025 quality assessment standard and technical standard(s).

2. RF EMISSIONS MEASUREMENT

2.1. TEST FACILITY

The test locations stated below are under the TAF Accreditation Number 0659.
The test location(s) used to collect the test data in this report is:
No. 68-1, Ln. 169, Sec.2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan.
(FCC DN: TW0659)

☒SAR 01 ☐SAR 02 ☐SAR 03

2.2. MEASUREMENT UNCERTAINTY

Uncertainty Budget for Frequency range of 300 MHz to 3 GHz

Error Description	Uncertainty Value (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g)	Standard Uncertainty (10g)	Vi V_{eff}
Measurement System								
Probe Calibration	6.0	Normal	1	1	1	± 6.0 %	± 6.0 %	∞
Axial Isotropy	4.7	Rectangular	$\sqrt{3}$	0.7	0.7	± 1.9 %	± 1.9 %	∞
Hemispherical Isotropy	9.6	Rectangular	$\sqrt{3}$	0.7	0.7	± 3.9 %	± 3.9 %	∞
Boundary Effects	1	Rectangular	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∞
Linearity	4.7	Rectangular	$\sqrt{3}$	1	1	± 2.7 %	± 2.7 %	∞
Detection Limits	1	Rectangular	$\sqrt{3}$	1	1	± 0.6 %	± 0.6 %	∞
Modulation response	2.4	Rectangular	$\sqrt{3}$	1	1	± 1.4 %	± 1.4 %	∞
Readout Electronics	0.3	Normal	1	1	1	± 0.3 %	± 0.3 %	∞
Response Time	0.8	Rectangular	$\sqrt{3}$	1	1	± 0.5%	± 0.5 %	∞
Integration Time	2.6	Rectangular	$\sqrt{3}$	1	1	± 1.5 %	± 1.5 %	∞
RF Ambient – Noise	3	Rectangular	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∞
RF Ambient–Reflections	3	Rectangula	$\sqrt{3}$	1	1	± 1.7 %	± 1.7 %	∞
Probe Positioner	0.02	Rectangular	$\sqrt{3}$	1	1	± 0.0 %	± 0.0 %	∞
Probe Positioning	0.4	Rectangular	$\sqrt{3}$	1	1	± 0.2 %	± 0.2 %	∞
Max.SAR Evaluation	2	Rectangular	$\sqrt{3}$	1	1	± 1.2 %	± 1.2 %	∞
Test Sample Related								
Device Positioning	2.9	Normal	1	1	1	± 2.9 %	± 2.9 %	145
Device Holder	3.6	Normal	1	1	1	± 3.6 %	± 3.6 %	5
Power Drift	5.0	Rectangular	$\sqrt{3}$	1	1	± 2.9 %	± 2.9 %	∞
Phantom and Setup								
Phantom Production Tolerances	6.1	Rectangular	$\sqrt{3}$	1	1	± 3.5 %	± 3.5 %	∞
SAR correction	1.9	Rectangular	$\sqrt{3}$	1	0.84	± 1.9 %	± 1.6 %	
Liquid Conductivity (mea.)	2.5	Rectangular	$\sqrt{3}$	0.78	0.71	± 2.0 %	± 1.8 %	∞
Liquid Permittivity (mea.)	2.5	Rectangular	$\sqrt{3}$	0.26	0.26	± 0.6 %	± 0.7 %	∞
Temp. unc. - Conductivity	3.4	Rectangular	$\sqrt{3}$	0.78	0.71	± 1.5 %	± 1.4 %	∞
Temp. unc. - Permittivity	0.4	Rectangular	$\sqrt{3}$	0.23	0.26	± 0.1 %	± 0.1 %	∞
Combined Standard Uncertainty (K = 1)						± 11.28 %	± 11.19 %	361
Expanded Uncertainty (K = 2)						**± 22.56 %**	**± 22.37 %**	

2.3. BLUETOOTH ANTENNA INFORMATION:

Ant.	Brand	Model	Type	Frequency Range (MHz)	Gain (dBi)
Bluetooth	Shenzhen HamyWe Technology Co., Ltd.	HM3216ANT2450-HM02	Internal Antenna	2400 MHz ~2480MHz	4.34

Note:
The above Antenna information are derived from the antenna data sheet provided by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

2.4. THE MAXIMUM SAR-1G VALUES

Band	Mode	Highest Body Reported SAR-1g(W/kg)
FHSS	Bluetooth_3DH5	0.010

Note:

1) The device is in compliance with Specific Absorption Rate(SAR)for general population uncontrolled exposure limits according to the FCC rule §2.1093, the ANSI C95.1:2019/IEEE C95.1:2019, the NCRP Report Number 86 for uncontrolled environment and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013.

2) Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

2.5. LABORATORY ENVIRONMENT

Temperature	Min. = 18ºC, Max. = 25ºC
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

2.6. MAIN TEST INSTRUMENTS

Item	Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Interval
1	DASY5	Speag	DASY 5(Version 52.10.4.1527)	N/A	N/A	N/A
2	Data Acquisition Electronics	Speag	DAE4	1764	Jan. 3, 2023	1 Year
3	E-field Probe	Speag	EX3DV4	7369	May. 22, 2023	1 Year
4	System Validation Dipole	Speag	D2450V2	973	Feb. 08, 2021	3 Year
5	ELI4 Phantom	Speag	ELI4 Phantom V8.0	2149	N/A	N/A
6	ENA Network Analyzer	Agilent	E5071C	MY46524658	Mar. 17, 2023	1 Year
7	Signal Generator	R&S	SMR40	100502	Feb. 23, 2023	1 Year
8	Spectrum Analyzer	Agilent	N9010A	MY54200240	Jun. 09, 2022	1 Year
9	Power Meter	Keysight	8990B	MY5100517	May. 15, 2023	1 Year
10	Power Sensor	Keysight	N1923A	MY58310005	May. 15, 2023	1 Year
11	Dielectric Probe Kit	Agilent	85070E	2593	N/A	N/A
12	Low pass filter	Mini-Circuits	SLP-2950+	M108294	N/A	N/A
13	Power Amplifier	Mini-Circuits	ZVE-2W-272+	N650001538	N/A	N/A
14	Power Amplifier	Mini-Circuits	ZVE-8G+	N628801631	N/A	N/A
15	Power Amplifier	EMCI	EMC053035	980869	N/A	N/A
16	Thermometer	PA	TA298	h001	Mar. 21, 2023	1 Year
17	Directional Coupler	Woken	50W Coupler	DOM5CIW3E2	N/A	N/A
18	Attenuator	Woken	WATT-518FS-10	N/A	N/A	N/A

Remark:“N/A” denotes no model name, serial No. or calibration specified.

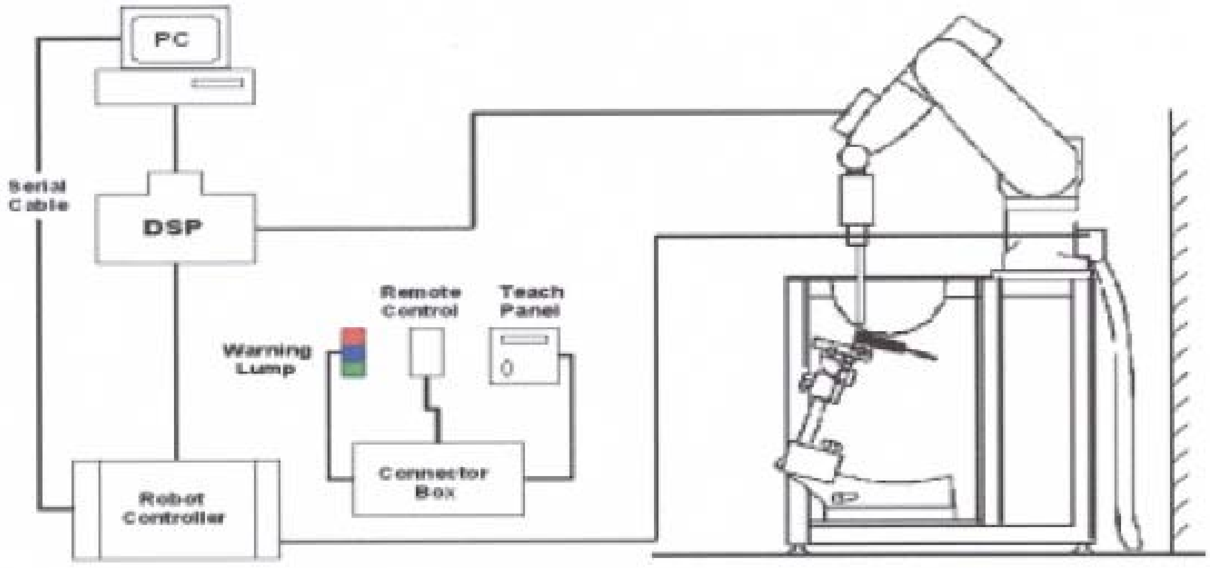
3. SAR MEASUREMENTS SYSTEM CONFIGURATION

3.1. SAR MEASUREMENT SETUP

The DASY5 system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronic (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.
4. A unit to operate the optical surface detector which is connected to the EOC.
5. The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
6. The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows.
7. DASY5 software and SEMCAD data evaluation software.
8. Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling the testing of left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. System validation dipoles allowing to validate the proper functioning of the system.

3.1.1. TEST SETUP LAYOUT

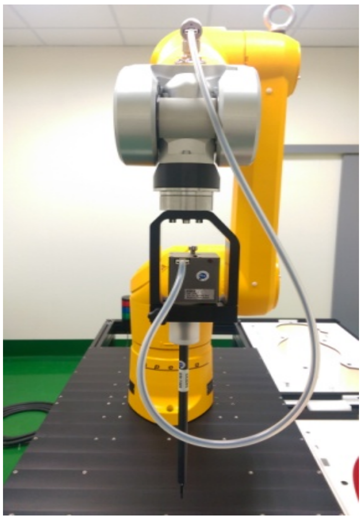


3.2. DASY5 E-FIELD PROBE SYSTEM

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

3.2.1. EX3DV4 PROBE SPECIFICATION

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.0 mm



EX3DV4 E-field Probe

3.2.2. E-FIELD PROBE CALIBRATION

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than ±10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C\frac{\Delta T}{\Delta t}$$

Where: Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

ΔT = Temperature increase due to RF exposure.

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

Where: σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m3).

3.2.3. OTHER TEST EQUIPMENT

3.2.3.1. DEVICE HOLDER FOR TRANSMITTERS

Construction: Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.) It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI4 and SAM v6.0 Phantoms.
Material: POM, Acrylic glass, Foam

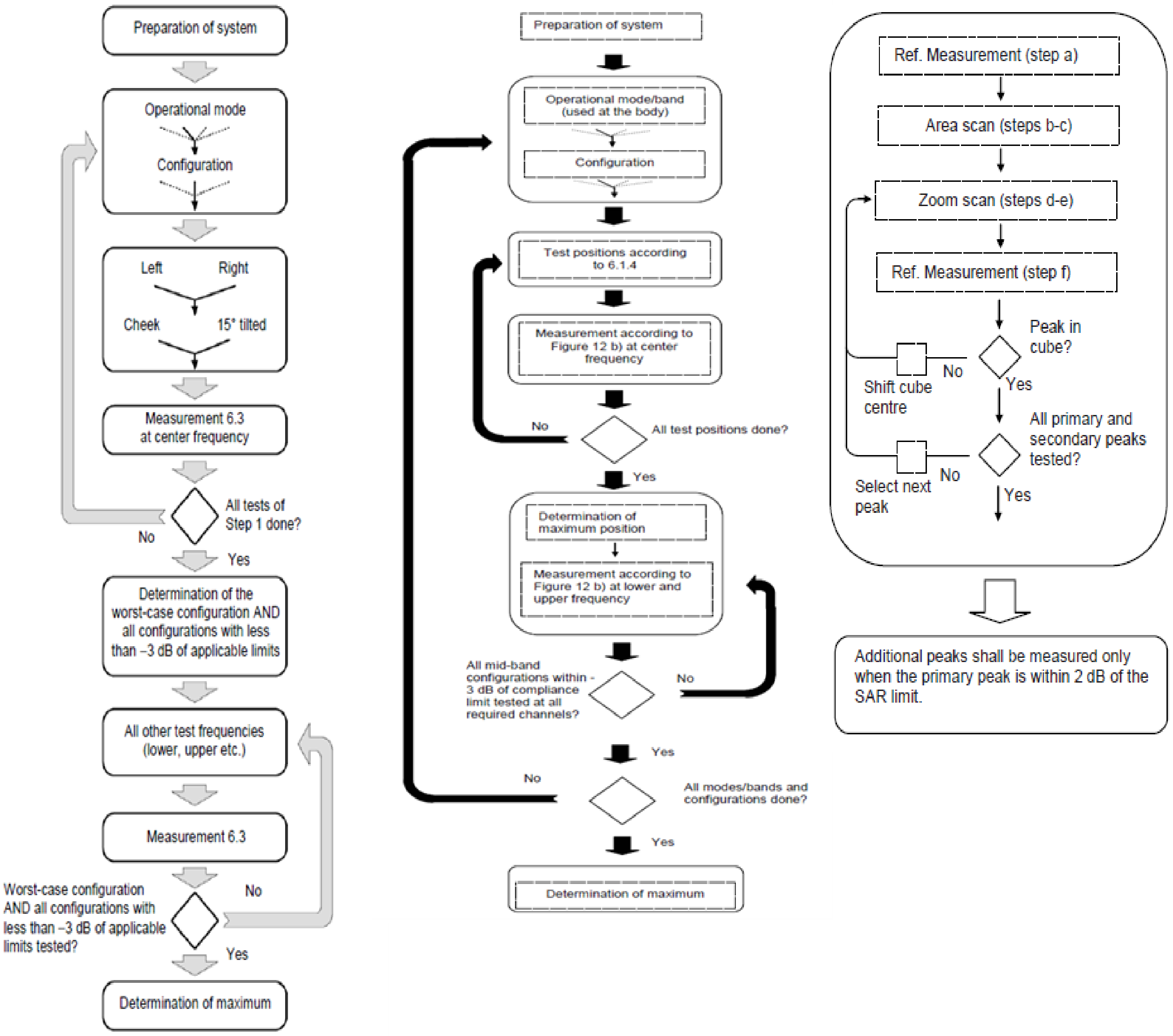
3.2.3.2 PHANTOM

Model	ELI4 Phantom
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.
Shell Thickness	2±0.1 mm
Filling Volume	Approx. 30 liters
Dimensions	Length: 600 mm ; Width: 190mm Height: adjustable feet
Aailable	Special

Model	Twin SAM
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.
Shell Thickness	2 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length:1000mm; Width: 500mm Height: adjustable feet
Aailable	Special

3.2.4. SCANNING PROCEDURE

The SAR test against the head and body-worn phantom was carried out as follow:



After an area scan has been done at a fixed distance of 1.4mm from the surface of the phantom on the source side, a 3D scan is set up around the location of the maximum spot SAR. First, a point within the scan area is visited by the probe and a SAR reading taken at the start of testing. At the end of testing, the probe is returned to the same point and a second reading is taken. Comparison between these start and end readings enables the power drift during measurement to be assessed.

Above is the scanning procedure flow chart and table from the IEEE1528 standard.

This is the procedure for which all compliant testing should be carried out to ensure that all variations of the device position and transmission behavior are tested.

3.2.5. DATA STORAGE AND EVALUATION

3.2.5.1 DATA STORAGE

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “DAE4”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

3.2.6. DATA EVALUATION BY SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	Sensitivity	Normi, a_{i0}, a_{i1}, a_{i2}
	Conversion factor	$ConvF_i$
	Diode compression point	Dcp_i
Device parameters:	Frequency	f
	Crest factor	cf
Media parameters:	Conductivity	
	Density	

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

With

V_i	= compensated signal of channel i	(i = x, y, z)
U_i	= input signal of channel i	(i = x, y, z)
cf	= crest factor of exciting field	(DASY parameter)
dcpi	= diode compression point	(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes: $Ei = (Vi / Normi \cdot ConvF)^{1/2}$

H-field probes: $Hi = (Vi)^{1/2} \cdot (ai0 + ai1\, f + a_i 2f^2) / f$

With
- Vi = compensated signal of channel i (i = x, y, z)
- $Norm_i$ = sensor sensitivity of channel i (i = x, y, z) $[mV/(V/m)^2]$ for E-field Probes
- ConvF = sensitivity enhancement in solution
- aij = sensor sensitivity factors for H-field probes
- f = carrier frequency [GHz]
- Ei = electric field strength of channel i in V/m
- Hi = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$Etot = (EX^2 + EY^2 + EZ^2)^{1/2}$$

The primary field data are used to calculate the derived field units.

$$SAR = (Etot)^2 \cdot \sigma / (\rho \cdot 1000)$$

With
- SAR = local specific absorption rate in mW/g
- E_{tot} = total field strength in V/m
- = conductivity in [mho/m] or [Siemens/m]
- = equivalent tissue density in g/cm^3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \text{ or } P_{pwe} = H_{tot}^2 \cdot 37.7$$

With
- P_{pwe} = equivalent power density of a plane wave in mW/cm^2
- E_{tot} = total field strength in V/m
- H_{tot} = total magnetic field strength in A/m

4. TISSUE-EQUIVALENT LIQUID

4.1. TISSUE-EQUIVALENT LIQUID INGREDIENTS

The liquid is consisted of water, salt and Glycol, Sugar, Preventol and Cellulose. The liquid has previously been proven to be suited for worst-case. The measured conductivity and relative permittivity should be within ±5% of the target values. The below table shows the detail solution. It’s satisfying the latest tissue dielectric parameters requirements proposed by the IEC 62209.

Composition of the Tissue Equivalent Matter

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
Head 2450	-	45.0	-	0.1	-	-	54.9	-

4.2. TISSUE-EQUIVALENT LIQUID PROPERTIES

Dielectric Performance of Tissue Simulating Liquid

Tissue Verification									
Date	Tissue Type	Frequency (MHz)	Conductivity (σ)	Permittivity (εr)	Targeted Conductivity (σ)	Targeted Permittivity (εr)	Deviation Conductivity (σ) (%)	Deviation Permittivity (εr) (%)	Limit (%) ±5
2023/6/7	Head	2402	1.83	38.39	1.76	39.29	4.05	-2.29	±5
2023/6/7	Head	2412	1.84	38.31	1.77	39.27	4.26	-2.44	±5
2023/6/7	Head	2422	1.85	38.25	1.78	39.25	4.50	-2.56	±5
2023/6/7	Head	2437	1.87	38.19	1.79	39.22	4.73	-2.62	±5
2023/6/7	Head	2441	1.88	38.18	1.79	39.21	4.75	-2.62	±5
2023/6/7	Head	2450	1.89	38.17	1.80	39.20	4.85	-2.62	±5
2023/6/7	Head	2452	1.89	38.17	1.80	39.19	4.86	-2.60	±5
2023/6/7	Head	2457	1.90	38.17	1.81	39.19	4.87	-2.60	±5
2023/6/7	Head	2462	1.90	38.17	1.81	39.18	4.89	-2.58	±5
2023/6/7	Head	2467	1.91	38.16	1.82	39.17	4.85	-2.57	±5
2023/6/7	Head	2472	1.91	38.15	1.82	39.17	4.87	-2.60	±5
2023/6/7	Head	2480	1.92	38.13	1.83	39.16	4.86	-2.64	±5

Note:

1)The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.
2)KDB 865664 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the EUT frequencies.
3)The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies. The SAR test plots may slightly differ from the table above since the DASY rounds to three significant digits.
4) According to FCC TCB workshop April, 2019 RF Exposure Procedures Update(Effective February 19,2019, FCC has permitted the use of single head-tissue simulating liquid specified in IEEE 62209-1- for all SAR tests.

5. SYSTEM CHECK

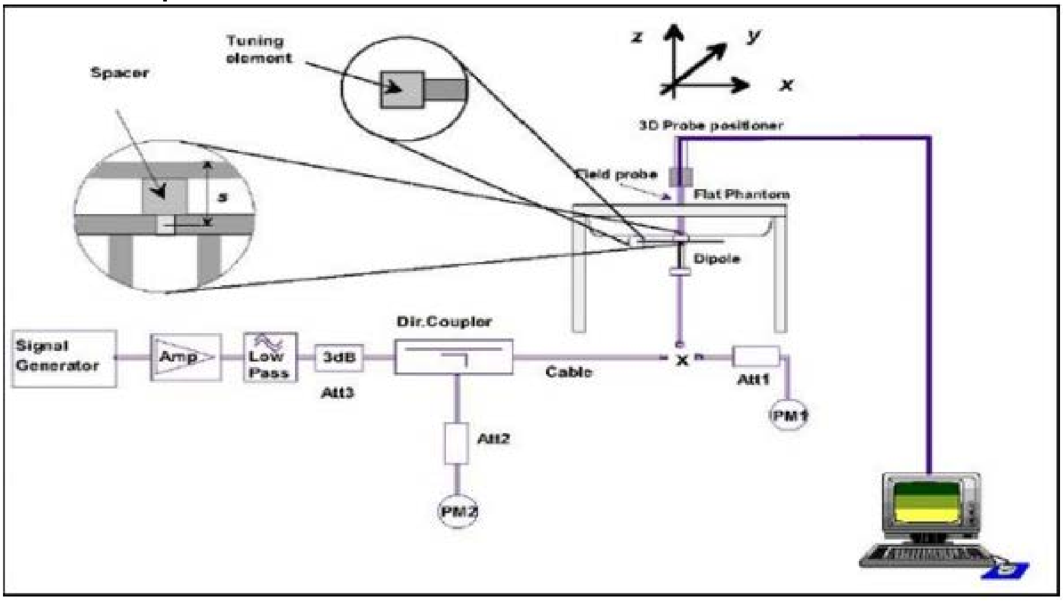
5.1. DESCRIPTION OF SYSTEM CHECK

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW(below 3GHz) or 100mW(3-6GHz), which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the 6.2.

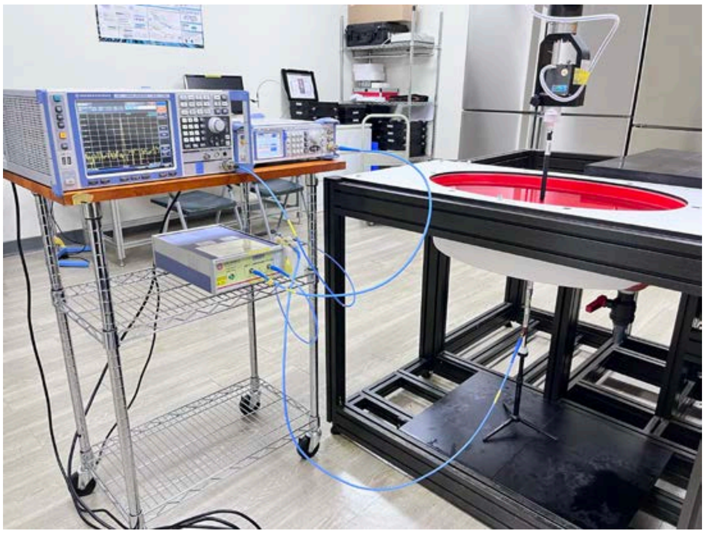
System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.

System Check Set-up



System Check photo



5.2. DESCRIPTION OF SYSTEM CHECK

System Check in Tissue Simulating Liquid

The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands and tissue liquids used during the tests.

Date	System Dipole			Parameters	Target [W/kg]	Measured [W/kg]	Normalized to 1W [W/kg]	Deviation [%]	Limited [%]
	Type	Serial No.	Liquid						
2023/6/7	D2450V2	973	Head	1g SAR	52.5	13.1	52.4	-0.19	± 10

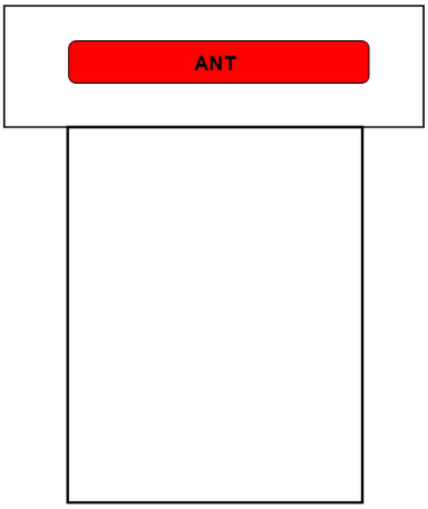
6. OPERATIONAL CONDITIONS DURING TEST

6.1. TEST POSITION

Test all USB orientations [see figure below: (A) Horizontal-Up, (B) Horizontal-Down, (C) Vertical-Front, and (D) Vertical-Back and Tip] with a device-to-phantom separation distance of 5 mm.

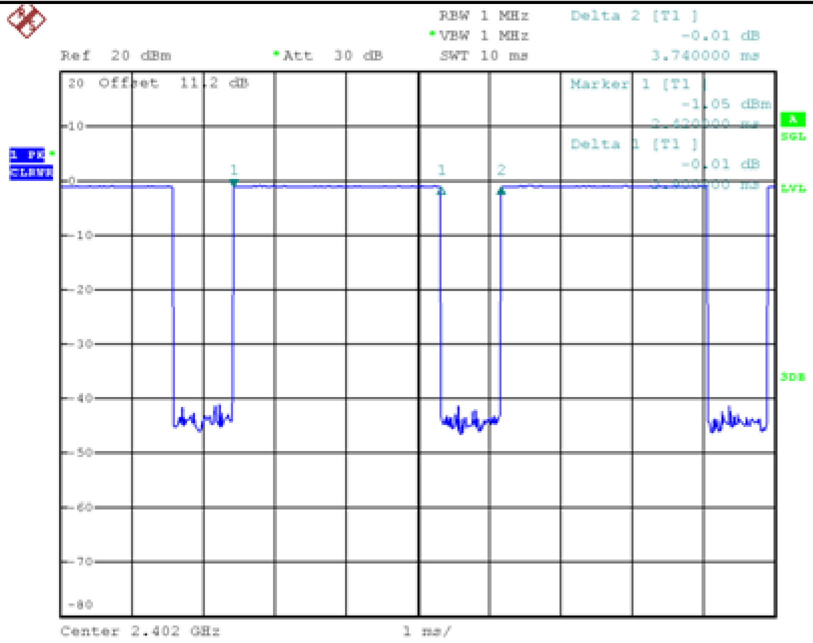
(A) Horizontal-Up | (B) Horizontal-Down | (C) Vertical-Front | (D) Vertical-Back

6.2. ANTENNA LOCATION

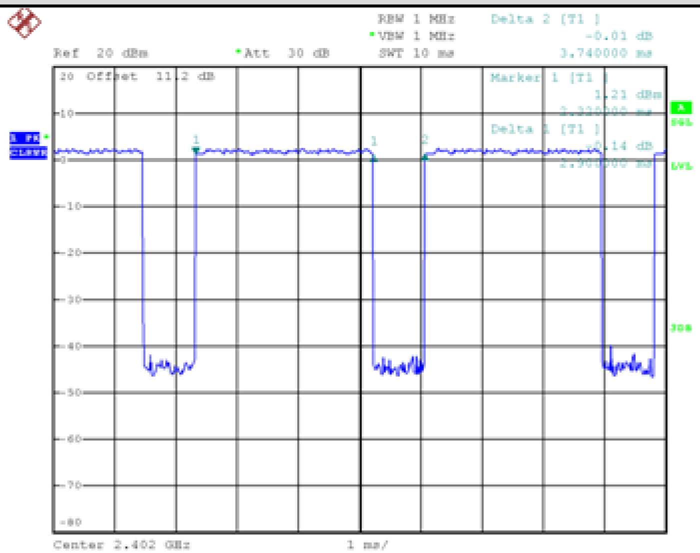


Mode	Bluetooth BR	Bluetooth EDR	BLE 1M	BLE 2M
Duty cycle	77.5%	77.5%	85.5%	57.4%
Crest factor	1.29	1.29	1.17	1.74

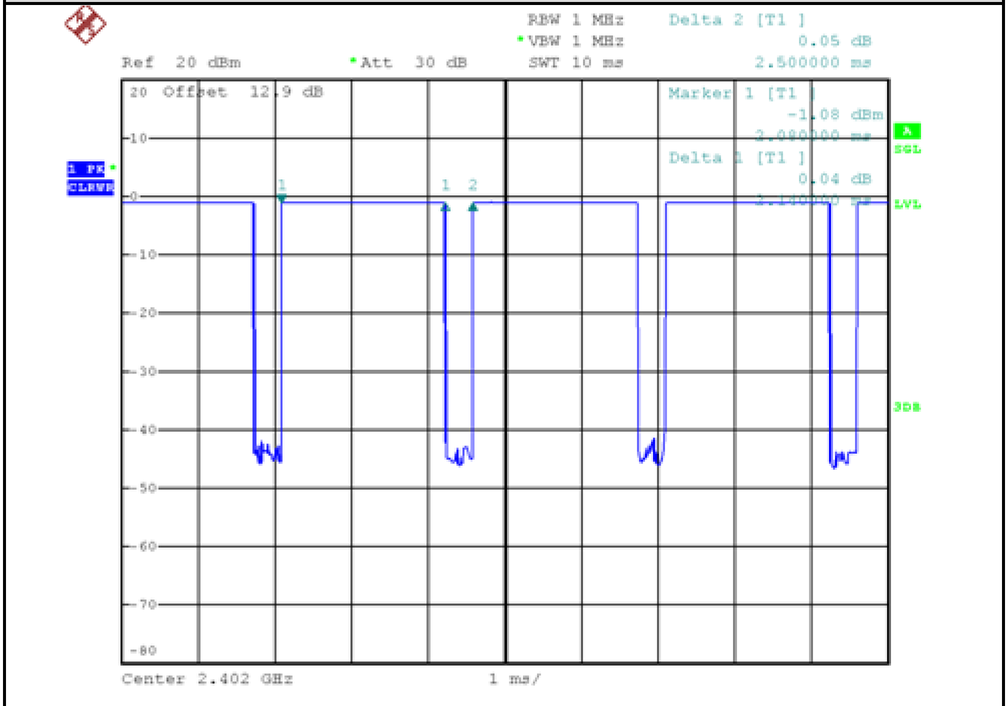
Bluetooth BR



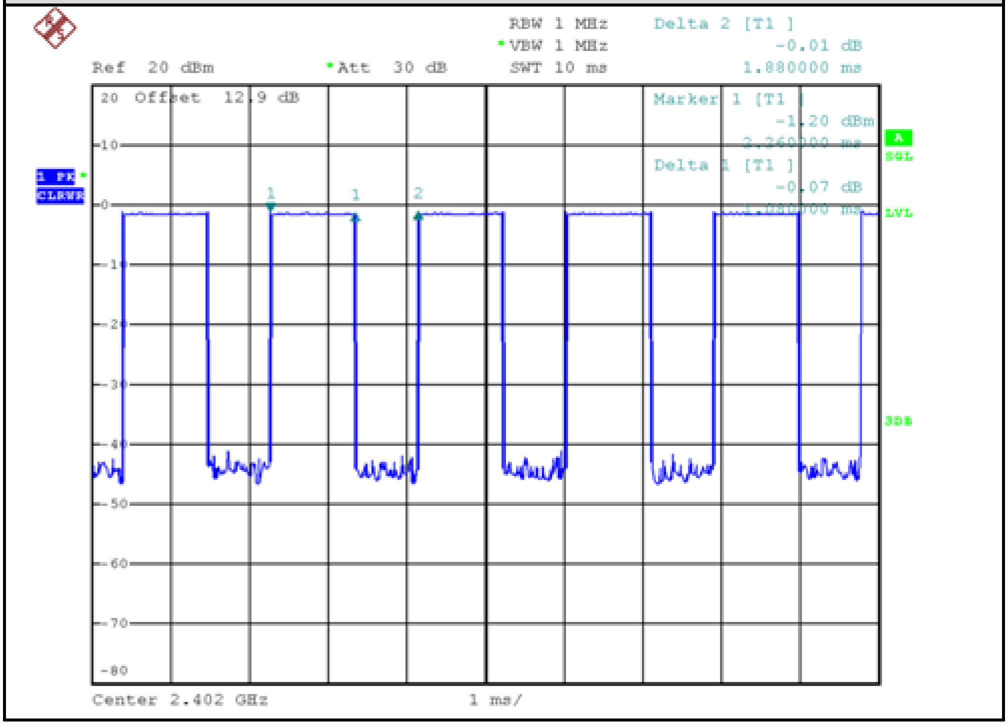
Bluetooth EDR



BLE 1M


RBW 1 MHz
VBW 1 MHz
SWT 10 ms
Delta 2 [T1]
0.05 dB
2.500000 ms
Ref 20 dBm
Att 30 dB
Offset 12.9 dB
Marker 1 [T1]
-1.08 dBm
Delta 1 [T1]
0.04 dB
1 PK
CLRWR
SGL
LVL
3DB
Center 2.402 GHz
1 ms/

BLE 2M


RBW 1 MHz
VBW 1 MHz
SWT 10 ms
Delta 2 [T1]
-0.01 dB
1.880000 ms
Ref 20 dBm
Att 30 dB
Offset 12.9 dB
Marker 1 [T1]
-1.20 dBm
Delta 1 [T1]
-0.07 dB
1 PK
CLRWR
SGL
LVL
3DB
Center 2.402 GHz
1 ms/

7. SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

7.1. SAR MEASUREMENT VARIABILITY

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

The detailed repeated measurement results are shown in Section 8.2.

8. CONDUCTED POWER RESULTS

8.1. CONDUCTED POWER MEASUREMENT RESULTS OF BLUETOOTH

Band	Mode	Channel	Frequency (MHz)	Max Power (dBm)	AVG Power (dBm)
BR	DH5	0	2402	2.00	1.73
		39	2441	2.00	1.95
		78	2480	2.00	1.81
EDR	2DH5	0	2402	3.00	2.55
		39	2441	3.00	2.58
		78	2480	3.00	2.53
	3DH5	0	2402	3.00	2.49
		39	2441	3.00	2.62
		78	2480	3.00	2.47
BLE	1M	0	2402	1.00	0.83
		19	2440	1.00	0.65
		39	2480	1.00	-0.36
	2M	0	2402	1.00	0.81
		19	2440	1.00	0.48
		39	2480	1.00	0.10

8.2. SAR TEST RESULTS

General Notes:

1. Per KDB447498 D04, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demonstrate compliant.
2. Per KDB447498 D04, 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. When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.
3. Per KDB865664 D01,for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg; if the deviation among the repeated measurement is ≤20%,and the measured SAR <1.45W/kg, only one repeated measurement is required.

9. SAR TEST RESULTS

9.1. BODY SAR TEST RESULTS

SAR test results of Bluetooth

Mode	Channel	Test Position	Distance	Max Tune-up (dBm)	AVG Power (dBm)	SAR 1g (W/kg)	Duty Cycel %	Duty Factor	Reported SAR 1g(W/kg)
Bluetooth_3DH5	39	Horizontal Up	5mm	3.00	2.62	0.007	77.50%	1.29	**0.010**
	39	Horizontal Down	5mm	3.00	2.62	0.006	77.50%	1.29	0.009
	39	Vertical Front	5mm	3.00	2.62	0.005	77.50%	1.29	0.006
	39	Vertical Back	5mm	3.00	2.62	0.004	77.50%	1.29	0.006
	39	Top Side	5mm	3.00	2.62	0.004	77.50%	1.29	0.006

Note:

BLE Mode: EIRP= 1.0dBm+4.34dBi=5.34dBm(3.42mW), ERP=5.34dBm-2.14=3.2dBm(2.09mW). Aaccording the FCC KDB 447798 D04 Appendix B.4, the max ERP power for BLE mode is less than 3mW, so there is no need to test sar.

10. TEST LAYOUT

Specific Absorption Rate Test Layout

Liquid depth in the flat Phantom (≥15cm depth)

HSL(2450MHz)

Appendix A. SAR Plots of System Verification

(Pls See BTL-FCC SAR-1-2301G001_Appendix A.)

Appendix B. SAR Plots of SAR Measurement

(Pls See BTL-FCC SAR-1-2301G001_Appendix B.)

Appendix C. Calibration Certificate

(Pls See BTL-FCC SAR-1-2301G001_Appendix C.)

Appendix D. Photographs of the Test Set-Up

(Pls See BTL-FCC SAR-1-2301G001_Appendix D.)

End of Test Report