TCT 通测检测 TESTING CENTRE TECHNOLOGY

SAR TEST REPORT

FCC ID................................:	2AM8GCHAMELEON7
Test Report No.....................:	TCT220921E031
Date of issue.........................:	14th Oct. 2022
Testing laboratory...............:	SHENZHEN TONGCE TESTING LAB
Testing location/ address.....:	2101 & 2201, Zhenchang Factory Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China
Applicant's name.................:	Guangzhou Lie Dun Electronics Technology CO., Ltd.
Address................................:	No. 4 plant of No. 43 South International Trade Avenue, Hualong Town, Panyu District, Guangzhou, Guangdong, China
Manufacturer's name ....:	Guangzhou Lie Dun Electronics Technology CO., Ltd.
Address................................:	No. 4 plant of No. 43 South International Trade Avenue, Hualong Town, Panyu District, Guangzhou, Guangdong, China
Product Name......................:	RUGGEDIZED HAND-HELD DEVICE
Trade Mark..........................:	CHAMELEON
Model/Type reference..........:	CHAMELEON 7
SAR Max. Values..............:	**0.797 W/Kg (1g) for Hotspot/body-worn,** **0.143 W/Kg (1g) for Front-of-face**
Date of receipt of test item..:	16th Sept. 2022
Date (s) of performance of test...:	10th Oct. 2022 to 13th Oct. 2022
Tested by (+signature).........:	Karl WANG
Check by (+signature).........:	Beryl Zhao
Approved by (+signature)...:	Tomsin

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1. General Product Information

1.1. EUT description

Product Name:	RUGGEDIZED HAND-HELD DEVICE
Model :	CHAMELEON 7
Trade Mark:	CHAMELEON
Sample No.	BTFSN220921E004
Power Supply:	Rechargeable Battery Rated Voltage 3.85V
3G	
Operation Band:	FDD Band II & FDD Band IV & FDD Band V
Power Class:	Power Class 3
Modulation Type:	QPSK for WCDMA/HSDPA/HSUPA
WCDMA Release Version:	R99
HSDPA Release Version:	Release 5
HSUPA Release Version:	Release 6
DC-HSUPA Release Version:	Not Supported
LTE	
Operation Band:	LTE Band 2 & LTE Band 4 & LTE Band 5 & LTE Band 7 & LTE Band 12 & LTE Band 13 & LTE Band 17 & LTE Band 25 & LTE Band 26 & LTE Band 41 & LTE Band 66 & LTE Band 71
Power Class:	Power Class 3
Modulation Type:	QPSK &16-QAM for LTE
Wi-Fi 2.4G	
Supported type:	802.11b/802.11g/802.11n
Modulation:	802.11b: DSSS 802.11g/802.11n:OFDM
Operation frequency:	802.11b/802.11g/802.11n(HT20/HT40):2412MHz~2462MHz;
Channel number:	802.11b/802.11g/802.11n(HT20/HT40):11
Channel separation:	5MHz
Wi-Fi 5G	
Operation Frequency:	Band 1: 5150 MHz ~ 5250 MHz Band 2A: 5250 MHz ~ 5350 MHz Band 2C: 5500 MHz ~ 5700 MHz Band 3: 5725 MHz ~ 5850 MHz
Channel Bandwidth:	802.11a: 20MHz 802.11n: 20MHz, 40MHz 802.11ac: 20MHz, 40MHz, 80MHz
Modulation Technology:	Orthogonal Frequency Division Multiplexing(OFDM)
Modulation Type	256QAM, 64QAM, 16QAM, BPSK, QPSK
Bluetooth	
Bluetooth Version:	Supported 5.0
Modulation:	GFSK(1Mbps) , π/4-DQPSK(2Mbps) , 8-DPSK(3Mbps)
Operation frequency:	2402MHz~2480MHz
Channel number:	79/40
Channel separation:	1MHz/2MHz

1.2. Model(s) list

No.	Model No.	Tested with
1	CHAMELEON 7	☒
Other models	N/A	☐

Note: CHAMELEON 7 is tested model, other models are derivative models. The models are identical in circuit and PCB layout, only different on the model names. So the test data of CHAMELEON 7 can represent the remaining models.

2. Test standard

The tests were performed according to following standards:
FCC 47 CFR §2.1093
IEEE1528-2013: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate in the Human Head from Wireless Communications Devices: Measurement Techniques
KDB447498 D01: General RF Exposure Guidance v06
KDB447498 D04: Interim General RF Exposure Guidance v01
KDB865664 D01: SAR measurement 100MHz to 6GHz v01r04
KDB865664 D02: RF Exposure Reporting v01r02.
KDB941225 D01: 3G SAR Procedures v03r01
KDB941225 D05: SAR for LTE Devices v02r05
KDB248227 D01: 802.11 Wi-Fi SAR v02r02
KDB941225 D06: Hotspot Mode v02r01
KDB690783 D01: SAR Listings on Grant v01r03

3. Facilities and Accreditations

3.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 645098
  Shenzhen Tongce Testing Lab
  The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.
- IC - Registration No.: 10668A-1
  The 3m Semi-anechoic chamber of Shenzhen Tongce Testing Lab.. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

3.2. Location

SHENZHEN TONGCE TESTING LAB.
Address: 2101 & 2201, Zhenchang Factory Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China

3.3. Environment Condition:

Temperature:	18°C ~25°C
Humidity:	35%~75% RH
Atmospheric Pressure:	1011 mbar

4. Test Result Summary

The maximum results of Specific Absorption Rate (SAR) found during test as bellows:
<Highest Reported standalone SAR Summary>

Exposure Position	Frequency Band	Reported SAR (W/kg)	Equipment Class	Highest Reported SAR (W/kg)
Hotspot/Body-worn 1-g SAR (10 mm Gap)	WCDMA Band II	0.423	PCB	**0.797**
	WCDMA Band IV	0.268		
	WCDMA Band V	0.218		
	LTE Band 2	0.564		
	LTE Band 4	0.383		
	LTE Band 5	0.424		
	LTE Band 7	0.173		
	LTE Band 12	0.132		
	LTE Band 13	0.149		
	LTE Band 17	0.190		
	LTE Band 25	0.395		
	LTE Band 26	0.438		
	LTE Band 41	0.307		
	LTE Band 66	0.753		
	LTE Band 71	0.648		
	2.4G WIFI	**0.797**	DTS	
	5G WIFI U-NII-1	0.634	NII	
	5G WIFI U-NII-2a	0.414		
	5G WIFI U-NII-2c	0.560		
	5G WIFI U-NII-3	0.197		
Exposure Position	**Frequency Band**	**Reported SAR (W/kg)**	**Equipment Class**	**Highest Reported SAR (W/kg)**
Front-of-face 1-g SAR (25 mm Gap)	WCDMA Band II	0.080	PCB	**0.143**
	WCDMA Band IV	0.069		
	WCDMA Band V	0.088		
	LTE Band 2	0.090		
	LTE Band 4	0.057		
	LTE Band 5	0.080		
	LTE Band 7	0.084		
	LTE Band 12	0.086		
	LTE Band 13	0.118		
	LTE Band 17	0.061		
	LTE Band 25	0.130		
	LTE Band 26	**0.143**		
	LTE Band 41	0.115		
	LTE Band 66	0.097		
	LTE Band 71	0.097		
	2.4G WIFI	0.095	DTS	
	5G WIFI U-NII-1	0.098	NII	
	5G WIFI U-NII-2a	0.102		
	5G WIFI U-NII-2c	0.088		
	5G WIFI U-NII-3	0.110		

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<Highest Reported simultaneous SAR Summary>

Exposure Position	Frequency Band	Highest Reported Simultaneous Transmission SAR (W/kg)
Hotspot/Body-worn 1-g SAR (10 mm Gap)	LTE Band 66 + 2.4 G Wifi	1.550
Front-of-face 1-g SAR (25 mm Gap)	LTE Band 26 + 5 G Wifi	0.253

Note:

1. The highest simultaneous transmission is scalar summation of Reported standalone SAR per FCC KDB 690783 D01 v01r03, and scalar SAR summation of all possible simultaneous transmission scenarios are < 1.6W/kg.
2. This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.

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5. RF Exposure Limit

Type Exposure	SAR (W/kg) Uncontrolled Exposure Limit
Spatial Peak SAR (averaged over any 1 g of tissue)	1.60
Spatial Peak SAR (hands/wrists/feet/ankles averaged over 10g)	4.00
Spatial Peak SAR (averaged over the whole body)	0.08

Note:

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

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6. SAR Measurement System Configuration

6.1. SAR Measurement Set-up

The OPENSAR system for performing compliance tests consist of the following items:

A standard high precision 6-axis robot (KUKA) with controller and software.

KUKA Control Panel (KCP)

A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with a Video Positioning System (VPS).

The stress sensor is composed with mechanical and electronic when the electronic part detects a change on the electro-mechanical switch; it sends an "Emergency signal" to the robot controller that to stop robot's moves A computer operating Windows XP.

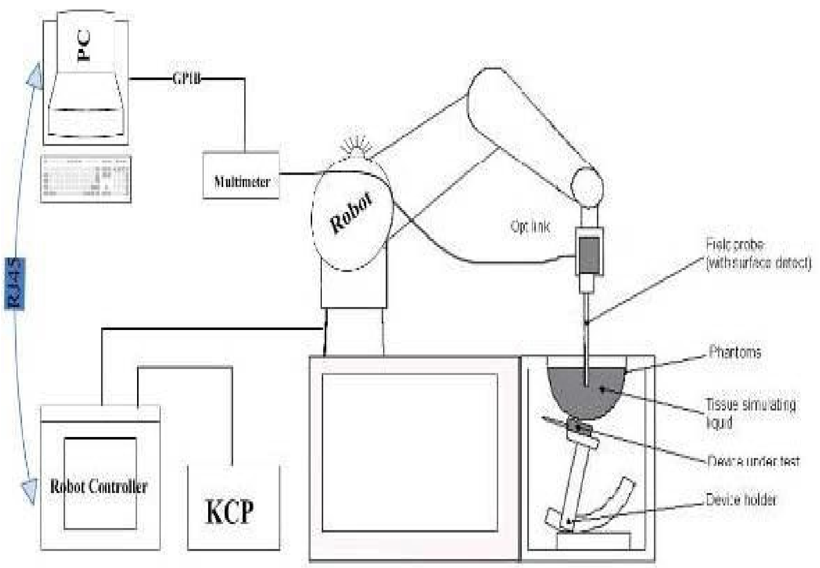
OPENSAR software Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.

The SAM phantom enabling testing left-hand right-hand and body usage.

The Position device for handheld EUT

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles to validate the proper functioning of the system.



KUKA SAR Test Sysytem Configuration

6.2. E-field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by MVG).
The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.
This probe has a built in optical surface detection system to prevent from collision with phantom.

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.

Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	SN 36/20 EPGO346
Frequency Range of Probe	0.15 GHz-6GHz
Resistance of Three Dipoles at Connector	Dipole 1:R1=0.217MΩ Dipole 2:R3=0.245MΩ Dipole 3:R3=0.219MΩ

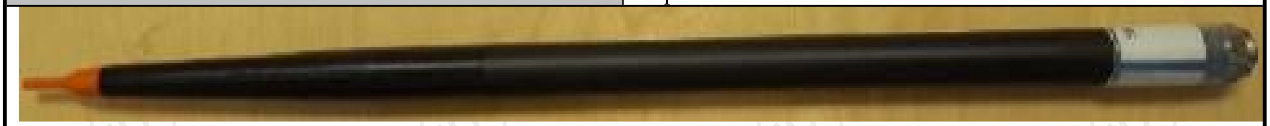
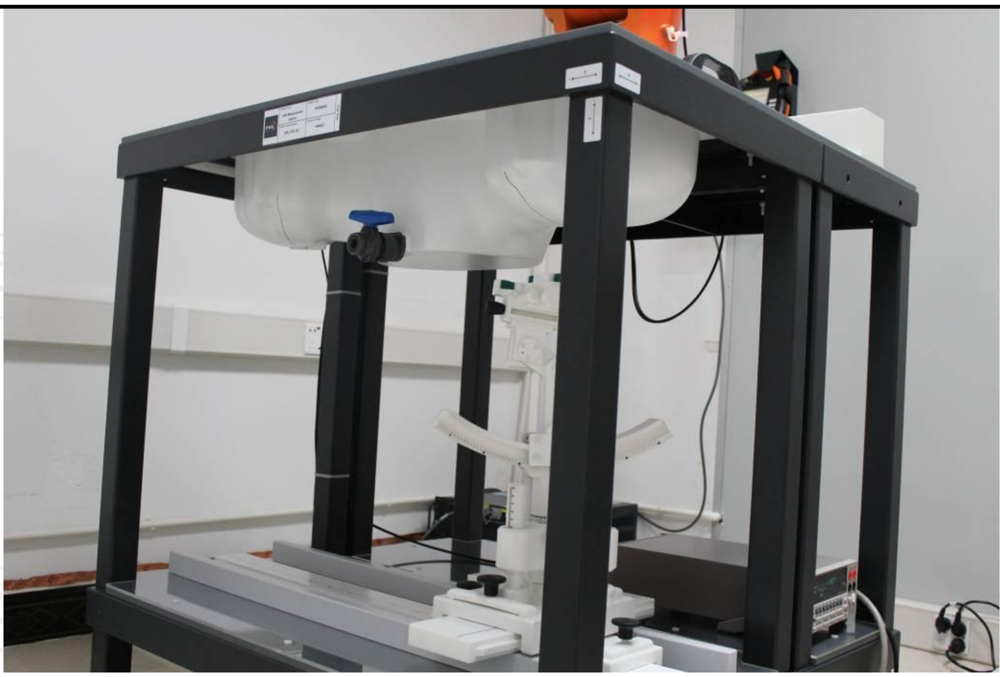


Photo of E-Field Probe

6.3. Phantom

The SAM Phantom SAM120 is constructed of a fiberglass shell integrated in a wooden table. The shape of the shell is in compliance with the specification set in IEEE P1528 and CENELEC IEC 62209-1, IEC 62209-2:2010.
The phantom 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 the evaporation of the liquid.
Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections.
Body SAR testing also used the flat section between the head profiles.

Name: COMOSAR IEEE SAM PHANTOM
S/N: SN 19/15 SAM 120
Manufacture: MVG

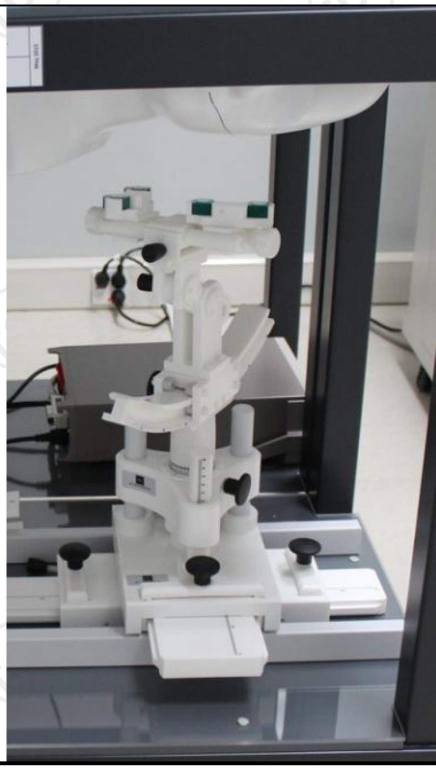


SAM Twin Phantom

6.4. Device Holder

In combination with the Generic Twin Phantom SAM120, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening.
The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications.
The device holder can be locked at different phantom locations (left head, right head, flat phantom).

COMOSAR Mobile phone positioning system



6.5. Data Storage and Evaluation

Data Storage

The OPENSAR 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. 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.

Data Evaluation

The OPENSAR 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, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

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 OPENSAR components. In the direct measuring mode of the millimeter 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 (MVG parameter)
dcpi = diode compression point (MVG parameter)

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

E-field probes: $E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$

H-field probes: $H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f$

With V_i = 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]
E_i = electric field strength of channel i in V/m
H_i = magnetic field strength of channel i in A/m

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

$$E_{tot} = (E_x^2 + E_Y^2 + E_z^2)^{1/2}$$

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
Etot = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm3

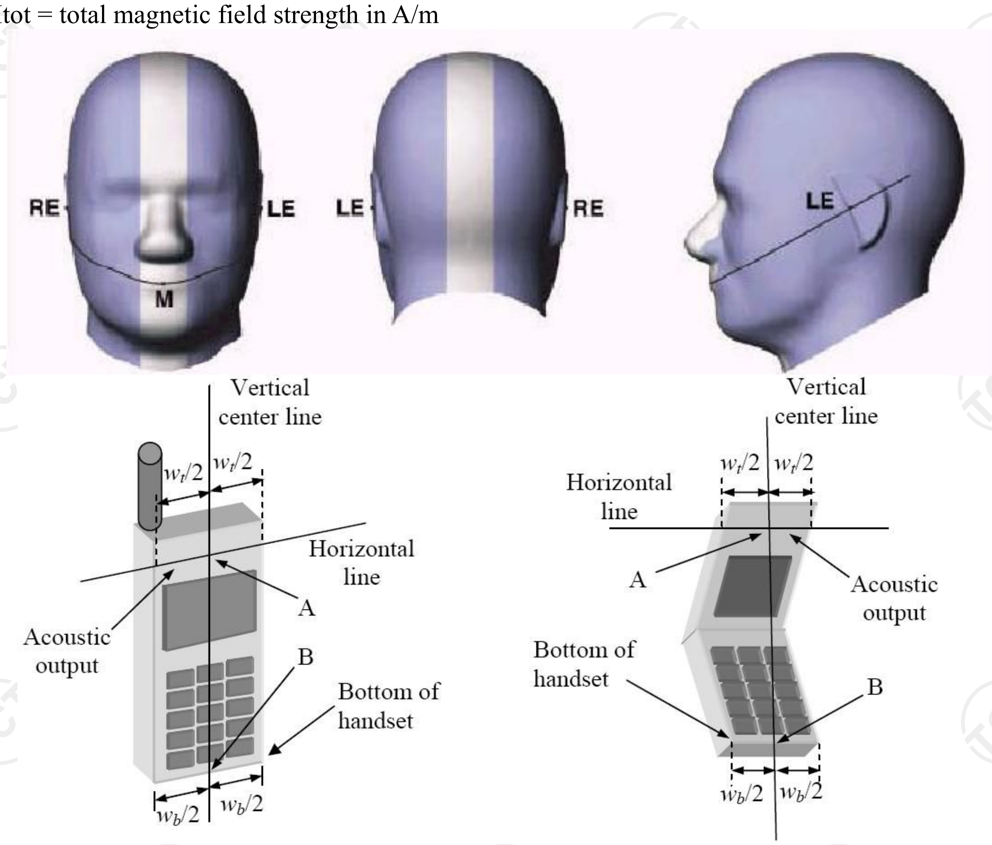
Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

6.6. Position of the wireless device in relation to the phantom

Handset Reference Points

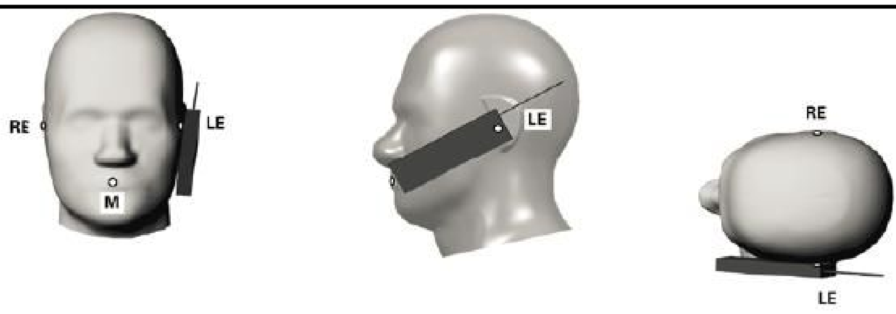
$$Ppwe = Etot^2 / 3770 \text{ or } Ppwe = Htot^2 \cdot 37.7$$

With Ppwe = equivalent power density of a plane wave in mW/cm2
Etot = total electric field strength in V/m
Htot = total magnetic field strength in A/m

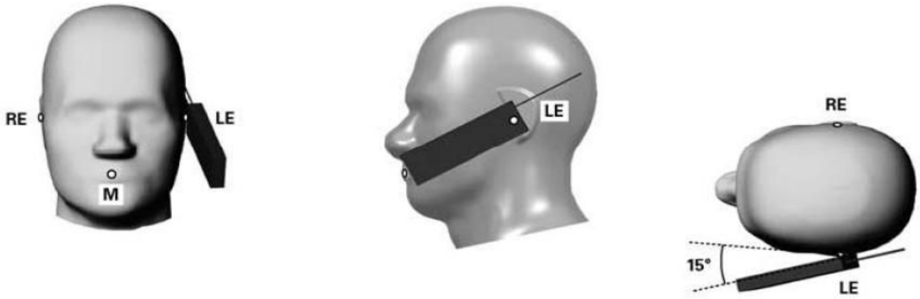


Wt Width of the handset at the level of the acoustic
Wb Width of the bottom of the handset
A Midpoint of the width wt of the handset at the level of the acoustic output
B Midpoint of the width wb of the bottom of the handset

Positioning for Cheek / Touch



Positioning for Ear / 15º Tilt



Body Worn Accessory Configurations
To position the device parallel to the phantom surface with either keypad up or down.
To adjust the device parallel to the flat phantom.
To adjust the distance between the device surface and the flat phantom to 15mm or holster surface and the flat phantom to 0 mm.

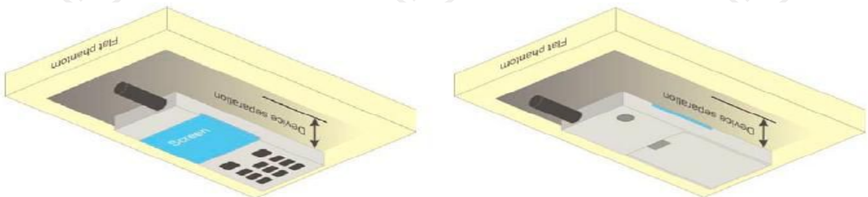


Illustration for Body Worn Position

Wireless Router（Hotspot）Configurations
Some battery-operated handsets have the capability to transmit and receive internet connectivity through simultaneous transmission of WIFI in conjunction with a separate licensed transmitter. The FCC has provided guidance in KDB Publication 941225 D06 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10 mm from the front, back and edges of the device with antennas 2.5 cm or closer to the edge of the device, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions. Therefore, SAR must be evaluated for each frequency transmission and mode separately and summed with the WIFI transmitter according to KDB 648474 publication procedures. The "Portable Hotspot" feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.

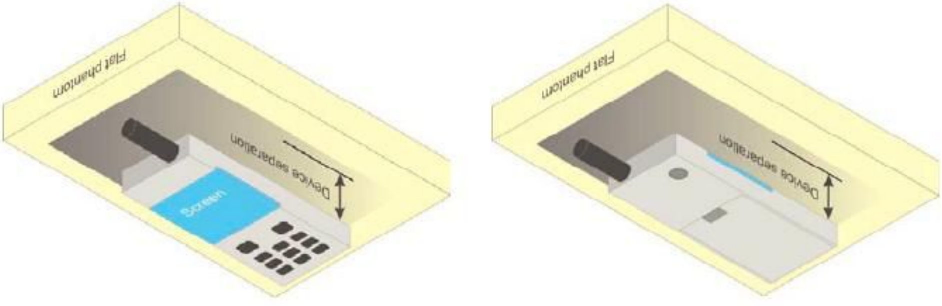
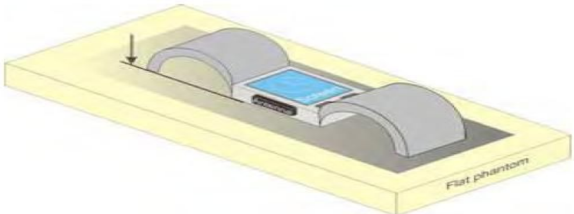


Illustration for Hotspot Position

Limb-worn device

A limb-worn device is a unit whose intended use includes being strapped to the arm or leg of the user while transmitting (except in idle mode). It is similar to a body-worn device. Therefore, the test positions of 6.1.4.4 also apply. The strap shall be opened so that it is divided into two parts as shown in Figure 9. The device shall be positioned directly against the phantom surface with the strap straightened as much as possible and the back of the device towards the phantom.

If the strap cannot normally be opened to allow placing in direct contact with the phantom surface, it may be necessary to break the strap of the device but ensuring to not damage the antenna.

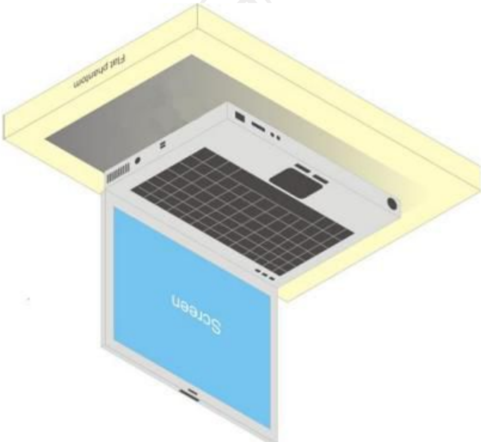


Test position for limb-worn devices

Laptop devices

For laptop PC, according to KDB 616217 D04, SAR evaluation is required for the bottom surface of the keyboard.

This EUT was tested in the base of EUT directly against the flat phantom. The required minimum test separation distance for incorporating transmitters and antennas into laptop computer display is determined with the display screen opened at an angle of 90° to the keyboard compartment.



Test position for laptop devices

6.7. Tissue Dielectric Parameters

The liquid used for the frequency range of 100MHz-6G consisted of water, sugar, salt and Cellulose. The liquid has been previously proven to be suited for worst-case. The following Table shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by the IEEE 1528 and IEC 62209.
The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the determine of the dielectric parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ±5% of the target values.
The following materials are used for producing the tissue-equivalent materials

Targets for tissue simulating liquid

Frequency (MHz)	Liquid Type	Liquid Type (σ)	± 5% Range	Permittivity (ε)	± 5% Range
750	Body	0.96	0.91~1.01	55.50	52.73~58.28
835	Body	0.97	0.92~1.02	55.20	52.44~57.96
1800-2000	Body	1.52	1.44~1.60	53.30	50.64~55.97
2450	Body	1.95	1.85~2.05	52.70	50.07~55.34
2600	Body	2.16	2.05~2.27	52.50	49.88~55.13
5200	Body	5.30	5.04~5.57	49.00	46.55~51.45
5400	Body	5.53	5.25~5.81	48.70	46.27~51.14
5600	Body	5.77	5.48~6.06	48.50	46.08~50.93
5800	Body	6.00	5.70~6.30	48.20	45.79~50.61

(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)

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6.8. Tissue-equivalent Liquid Properties

Test Date dd/mm/yy	Temp ℃	Tissue Type	Measured Frequency (MHz)	εr	σ(s/m)	Dev εr(%)	Dev σ(%)
10/10/2022	22℃	750B	750	55.38	0.92	0.22	4.17
10/10/2022	22℃	835B	825	55.26	0.93	-0.11	4.12
			835	55.24	0.94	-0.07	3.09
			850	55.21	0.97	-0.02	0.00
10/11/2022	22℃	1800B	1710	54.65	1.49	-2.53	1.97
			1720	54.64	1.50	-2.51	1.32
			1750	54.62	1.51	-2.48	0.66
			1800	54.59	1.53	-2.42	-0.66
10/11/2022	22℃	1900B	1850	53.27	1.55	0.06	-1.97
			1880	53.25	1.56	0.09	-2.63
			1900	53.24	1.57	0.11	-3.29
			1910	53.23	1.58	0.13	-3.95
10/12/2022	22℃	2450B	2410	52.21	1.97	0.93	-1.03
			2435	52.16	1.98	1.02	-1.54
			2450	52.15	2.01	1.04	-3.08
			2460	52.14	2.03	1.06	-4.10
10/12/2022	22℃	2600B	2510	52.04	2.10	0.88	2.78
			2535	51.99	2.11	0.97	2.31
			2600	51.94	2.13	1.07	1.39
10/13/2022	22℃	5200B	5200	49.52	5.40	-1.06	-1.89
10/13/2022	22℃	5400B	5400	47.96	5.51	-1.52	-0.36
10/13/2022	22℃	5600B	5600	47.80	5.53	1.44	4.16
10/13/2022	22℃	5800B	5800	47.59	5.95	1.27	0.83