Certificate#4897.01

# TEST REPORT

**REPORT NUMBER: B23W00632-SAR-Rev2**

**ON**

| | |
|---|---|
| **Type of Equipment:** | GSM Mobile phone |
| **Type of Designation:** | T302D,T302X |
| **Brand Name:** | TCL |
| **Manufacturer:** | TCL Communication Ltd. |
| **FCC ID:** | 2ACCJB209 |

**ACCORDING TO**

**IEEE C95.1-2019**

**IEEE 1528-2013**

**Chongqing Academy of Information and Communication Technology**

***Month date, year***

*Jun. 12th, 2023*

***Signature***

向罗勇

**Xiang Luoyong**

***Director***

**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 Chongqing Academy of Information and Communications Technology.

**Chongqing Academy of Information and Communication Technology**
Address: No. 8,Yuma Road, Chayuan New City, Nan'an District, Chongqing, P. R. China,401336
Tel: 0086-23-88069965 FAX:0086-23-88608777

**Revision Version**

| Report Number | Revision | Date | Memo |
|---|---|---|---|
| B23W00632-SAR | 00 | 2023-05-26 | Initial creation of test report |
| B23W00632-SAR-Rev1 | 01 | 2023-06-09 | First change of test report |
| B23W00632-SAR-Rev2 | 02 | 2023-06-12 | Second change of test report |
| Note: This version has added the KDB941225 D01 3G SAR Procedures v03r01 standard in Page 10 and added designation number in Page 5. | | | |

TABLE OF CONTENT

1.Test Laboratory ..... 5
1.1 Testing Location ..... 5
1.2 Testing Environment ..... 5
1.3 Project Data ..... 5
1.4 Signature ..... 5
2. Statement of Compliance ..... 6
3.Client Information ..... 7
3.1 Applicant Information ..... 7
3.2 Manufacturer Information ..... 7
4. Equipment Under Test (EUT) and Ancillary Equipment (AE) ..... 8
4.1 About EUT ..... 8
4.2 Internal Identification of EUT used during the test ..... 9
4.3 Internal Identification of AE used during the test ..... 9
5.Reference Documents ..... 10
5.1 Applicable Limit Regulations ..... 10
5.2 Applicable Measurement Standards ..... 10
6.Specific Absorption Rate (SAR) ..... 11
6.1 Introduction ..... 11
6.2 SAR Definition ..... 11
7.SAR MEASUREMENT SETUP ..... 12
7.1 Measurement Set-up ..... 12
7.2 DASY5 E-field Probe System ..... 13
7.3 E-field Probe Calibration ..... 14
7.4 Other Test Equipment ..... 15
8.Position of the wireless device in relation to the phantom ..... 19
8.1 General considerations ..... 19
8.2 Body-worn device ..... 20
8.3 Desktop device ..... 21
8.4 DUT Setup Photo ..... 22
9.Tissue Simulating Liquids ..... 23
9.1 Equivalent Tissues ..... 23
9.2 Dielectric Performance ..... 24
10.System Validation ..... 26
10.1 System Validation ..... 26
10.2 System Setup ..... 26
11. Measurement Procedures ..... 28

11.1 Tests to be performed ........................................ 28
11.2 Measurement procedure ........................................ 30
11.3 GSM Measurement Procedures for SAR ........................................ 32
11.4 Bluetooth & Wi-Fi Measurement Procedures For SAR ........................................ 33
11.5 Power Drift ........................................ 33
12.Area Scan Based 1-g SAR ........................................ 34
12.1 Requirement of KDB ........................................ 34
12.2 Fast SAR Algorithms ........................................ 34
13.Conducted Output Power ........................................ 35
13.1 GSM Measurement Result ........................................ 35
13.2 BT Measurement Result ........................................ 36
14.Simultaneous TX SAR Considerations ........................................ 37
14.1 Introduction ........................................ 37
14.2 Transmit Antenna Position ........................................ 37
15.SAR Test Result ........................................ 39
15.1 SAR Result ........................................ 39
15.2. SAR Measurement Variability ........................................ 41
16. Measurement Uncertainty ........................................ 42
17. MAIN TEST INSTRUMENTS ........................................ 44
ANNEX A. GRAPH RESULTS ........................................ 45
ANNEX B. SYSTEM VALIDATION RESULTS ........................................ 51
ANNEX C. CALIBRATION REPORT ........................................ 54
ANNEX D. Extended Calibration SAR Dipole ........................................ 90
ANNEX E. Accreditation Certificate ........................................ 93

Chongqing Academy of Information and Communication Technology
Address：No. 8,Yuma Road, Chayuan New City, Nan'an District, Chongqing, P. R. China,401336
Tel: 0086-23-88069965 FAX:0086-23-88608777

# 1.Test Laboratory

## 1.1 Testing Location

| | |
|---|---|
| Company Name: | Chongqing Academy of Information andCommunications Technology |
| Designation Number: | CN1239 |
| Address: | No. 8,Yuma Road, Chayuan New City, Nan'an District, Chongqing, P. R. China |
| Postal Code: | 401336 |
| Telephone: | 0086-23-88069965/021-68866880 |
| Fax: | 0086-23-88608777 |

## 1.2 Testing Environment

| | |
|---|---|
| Normal Temperature: | 18℃-25℃ |
| Relative Humidity: | 30%-70% |
| Ambient noise & Reflection: | < 0.012 W/kg |

## 1.3 Project Data

| | |
|---|---|
| Testing Start Date: | 2023-5-12 |
| Testing End Date: | 2023-5-15 |

## 1.4 Signature

| | |
|---|---|
| 胡波 | **2023-06-09** |
| **Hu Bo**<br>**(Prepared this test report)** | **Date** |
| 喻春 | **2023-06-09** |
| **Yu Chun**<br>**(Reviewed this test report)** | **Date** |
| 向罗勇 | **2023-06-09** |
| **Xiang Luoyong**<br>**Director of the laboratory**<br>**(Approved this test report)** | **Date** |

## 2. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **TCL Communication Ltd. GSM Mobile phone T302D,T302X** are as follow:

**Table 2.1: Highest Reported SAR (1g, W/kg)**

| Technology Band | Head (1g,W/kg) | Body (1g,W/kg) |
|---|---|---|
| GSM 850 | 0.39 | 1.13 |
| PCS 1900 | 0.29 | 0.68 |
| BT 2.4GHz | 0.12 | 0.01 |

**Remark:** The SAR values found for the tracker are below the maximum recommended levels of 1.6 W/kg as averaged over any 1g tissue according to the IEEE C95.1-2019.

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 15 mm 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 maximum SAR value is obtained at the case of **Table 2.1**, and the values are**:**

**Body：1.13 W/kg (1g), Head：0.39W/kg (1g).**

# 3.Client Information

## 3.1 Applicant Information

| | |
|---|---|
| Company Name: | TCL Communication Ltd. |
| Address /Post: | 5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park,Shatin,NT,Hong Kong |
| Telephone: | +86 75536611621 |
| Fax: | +86 75536612000-81722 |
| Email: | nianxiang.jiang@tcl.com |
| Contact Person: | Annie Jiang |

## 3.2 Manufacturer Information

| | |
|---|---|
| Company Name: | TCL Communication Ltd. |
| Address /Post: | 5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park,Shatin,NT,Hong Kong |
| Telephone: | +86 75536611621 |
| Fax: | +86 75536612000-81722 |
| Email: | nianxiang.jiang@tcl.com |
| Contact Person: | Annie Jiang |

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

## 4.1 About EUT

| | |
|---|---|
| **Description:** | GSM Mobile phone |
| **Model name:** | T302D,T302X |
| **Operating mode(s):** | GSM 850/PCS 1900/BT |
| **Tested Tx Frequency:** | 824.2– 848.8MHz (GSM850) |
| | 1850.2– 1909.8MHz (PCS1900) |
| | 2402–2480 MHz (BT) |
| **Test device Production information:** | Production unit |
| **Device type:** | Portable device |
| **Antenna type:** | Integrated antenna |
| **Hotspot mode:** | Not support |

### 4.2 Internal Identification of EUT used during the test

| EUT ID* | SN or IMEI | HW Version | SW Version | Date of receipt |
|---|---|---|---|---|
| EUT1 | 351052820002331/351052820002349 | V1.0 | V1.1 | 2023-5-12 |
| EUT2 | 352734400000103 | V1.0 | V1.1 | 2023-5-12 |

*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 | TLi010EA | / | Zhongshan Tianmao Battery Co.,Ltd. |
| AE2 | Battery | TLi010CA | / | Zhongshan Tianmao Battery Co.,Ltd. |
| AE3 | Battery | TLi010CB | / | Shenzhen Aerospace Electronic Co., Ltd. |
| AE4 | Battery | TLi010EB | / | Shenzhen Aerospace Electronic Co., Ltd. |

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

# 5.Reference Documents

## 5.1 Applicable Limit Regulations

**IEEE C95.1: 2019** IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz 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 1528-2013**：Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

**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 D02 RF Exposure Reporting v01r02:** RF Exposure Compliance Reporting and Documentation Considerations.

**KDB941225 D01 3G SAR Procedures v03r01**：3G SAR MEAUREMENT PROCEDURES

Chongqing Academy of Information and Communication Technology
Address：No. 8,Yuma Road, Chayuan New City, Nan'an District, Chongqing, P. R. China,401336
Tel: 0086-23-88069965 FAX:0086-23-88608777

# 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 abilityto 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 ( $\rho$ ) . 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, $\delta T$ is the temperature rise and $\delta t$ is the exposure duration, or related to the electrical field in the tissue by

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

Where: $\sigma$ is the conductivity of the tissue, $\rho$ is the mass density of tissue and $E$ is the RMS electrical field strength.

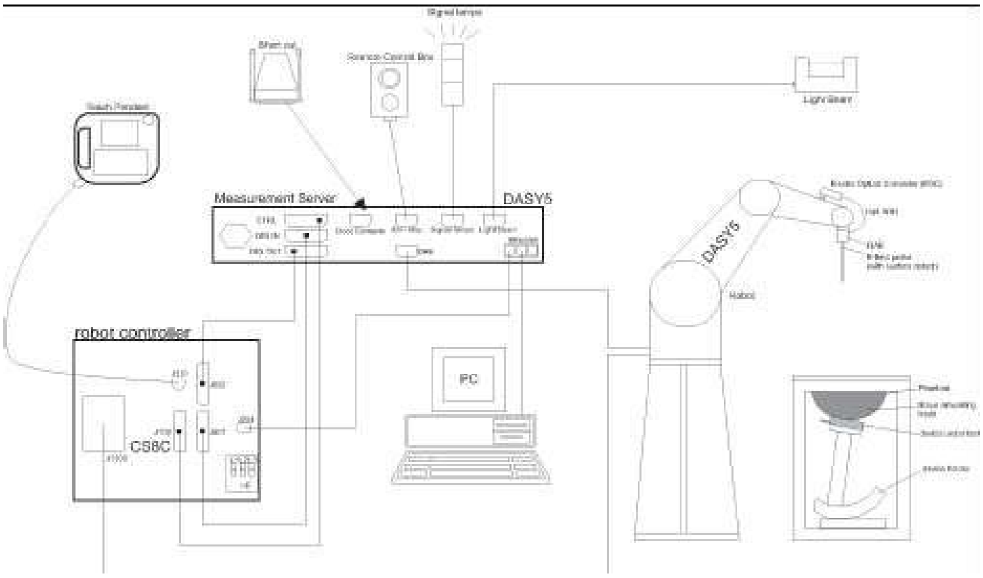
However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

Chongqing Academy of Information and Communication Technology
Address: No. 8,Yuma Road, Chayuan New City, Nan'an District, Chongqing, P. R. China,401336
Tel: 0086-23-88069965 FAX:0086-23-88608777

# 7.SAR MEASUREMENT SETUP

## 7.1 Measurement Set-up

The DASY5 system for performing compliance tests is illustrated above graphically. This system consists of the following items:




**Picture 7.1-1 SAR Lab Test Measurement Set-up**

- A standard high precision 6-axis robot (Stäubli TX=RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and theDASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as
- warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

## 7.2 DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe is constructed using the thick film technique; with printed resistive lines on ceramic substrates. The probe is equipped with an optical multifiber line ending at the front of the probe tip. It is connected to the EOC box on the robot arm and provides an automatic detection of the phantom surface. Half of the fibers are connected to a pulsed infrared transmitter, the other half to a synchronized receiver. As the probe approaches the surface, the reflection from the surface produces a coupling from the transmitting to the receiving fibers. This reflection increases first during the approach, reaches maximum and then decreases. If the probe is flatly touching the surface, the coupling is zero. The distance of the coupling maximum to the surface is independent of the surface reflectivity and largely independent of the surface to probe angle. The DASY5 software reads the reflection durning a software approach and looks for the maximum using $2^{nd}$ord curve fitting. The approach is stopped at reaching the maximum.

### Probe Specifications:

**Model:** EX3DV4

**Frequency:** 650MHz — 6GHz

**Calibration:** In head and body simulating tissue at Frequencies from 650 up to 4900MHz

**Linearity:** ± 0.2dB

**Dynamic Range:** 10mW/kg-100W/kg

**Probe Length:** 330 mm

**Probe Tip Length:** 20mm

**Body Diameter:** 12 mm

**Tip Diameter:** 2.5mm

**Tip-Center :** 1 mm

**Application:** SAR Dosimetry Test Compliance tests of trackers Dosimetry in strong gradient fields

**Picture 7-2 Near-field Probe**

**Picture 7-3 E-field Probe**

### 7.3 E-field Probe Calibration

Each E-Probe/Probe Amplifier combination has unique calibration parameters. A TEM cell calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 $mW/cm^2$) using an RF Signal generator, TEM cell, and RF Power Meter.

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if thefrequency is below 1 GHz and inn a waveguide or other methodologies 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 until the three channels show the maximum reading. The power density readings equates to 1 $mW/cm^2$..

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The E-field in the medium correlates with the temperature rise in the 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:

$\Delta t$ = Exposure time (30 seconds),

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

$\Delta T$ = Temperature increase due to RF exposure.

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

Where:

$\sigma$ = Simulated tissue conductivity,

$\rho$ = Tissue density ($kg/m^3$).

## 7.4 Other Test Equipment

### 7.4.1 Data Acquisition Electronics(DAE)

The data acquisition electronics consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

**Picture7.4.1-1: DAE**

### 7.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX90) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchron motors; no stepper motors)
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

**Picture7.4.2-1: DASY 5**

### 7.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU broad with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (DASY5: 128MB), RAM (DASY5: 128MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O broad, which is directly connected to the PC/104 bus of the CPU broad.

The measurement server performs all real-time data evaluation of field measurements and surface detection, controls robot movements and handles safety operation. The PC operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with an expansion port which is reserved for future applications. Please note that this expansion port does not have a standardized pinout, and therefore only devices provided by SPEAG can be connected. Devices from any other supplier could seriously damage the measurement server.


**Picture 7.4.3-1: Server for DASY 5**

### 7.4.4 Device Holder for Phantom

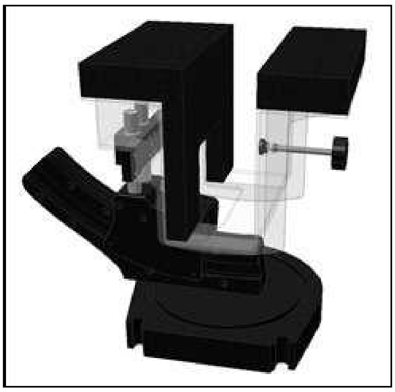
The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ±20%. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles. The DASY device holder is constructed of low-loss POM material having the following dielectric parameters:
relative permittivity=3 and loss tangent=0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

<Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with theTwin-SAM and ELI phantoms.

Picture7.4.4-1: Device Holder



Picture 7.4.4-2: Laptop Extension Kit

### 7.4.5 Phantom

The SAM Twin Phantom V4.0 is constructed of a fiberglass shell integrated in a table. The shape of the shell is based on data from an anatomical study designed to

Represent the 90th percentile of the population. The phantom enables the dissymmetric evaluation of SAR for both left and right handed handset usage, as well as body-worn usage using the flat phantom region. 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. The shell phantom has a 2mm shell thickness (except the ear region where shell thickness increases to 6 mm).

Shell Thickness: 2 ± 0. 2 mm

Filling Volume: Approx. 25 liters

Dimensions: 810 x l000 x 500 mm (H x L x W)

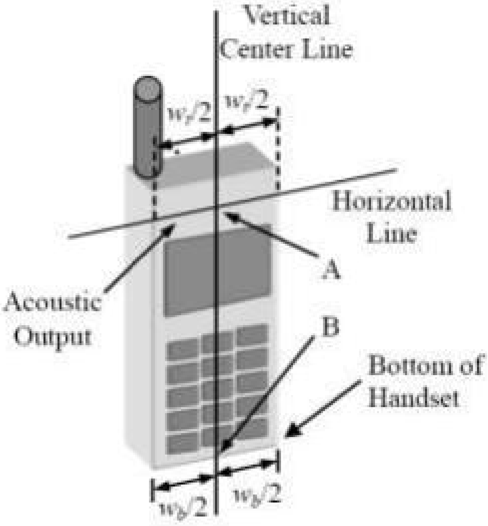
Available: Special

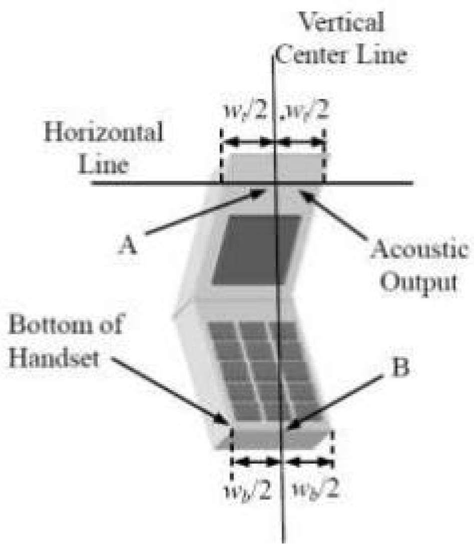
Picture 7.4.5-1: SAM Twin Phantom

# 8.Position of the wireless device in relation to the phantom

## 8.1 General considerations

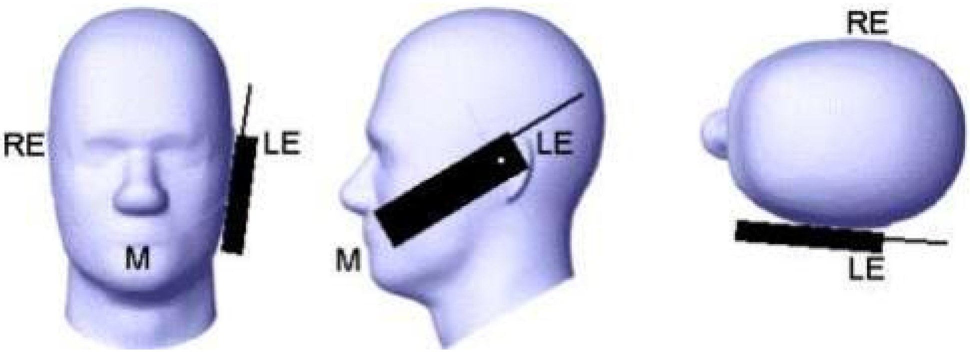
This standard specifies two handset test positions against the head phantom – the “cheek” position and the “tilt” position.



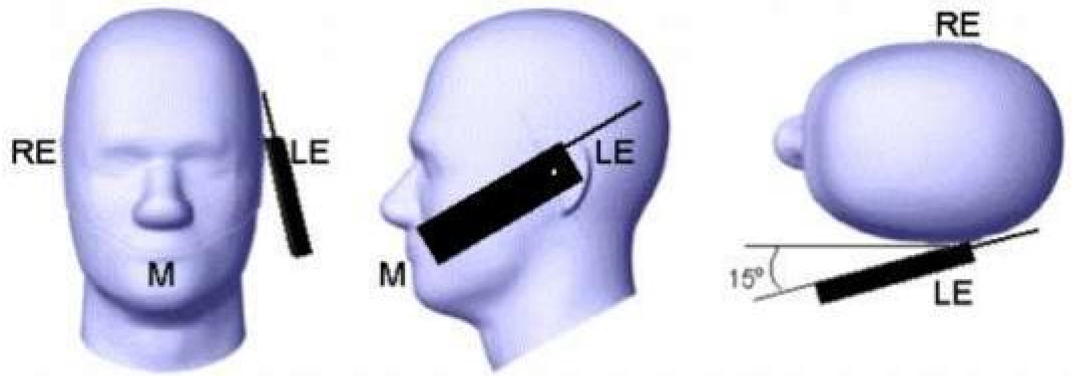




| | |
|---|---|
| $w_t$ | Width of the handset at the level of the acoustic |
| $w_b$ | Width of the bottom of the handset |
| A | Midpoint of the width $w_t$ of the handset at the level of the acoustic output |
| B | Midpoint of the width $W_b$ of the bottom of the handset |

**Picture 12-a Typical “fixed” case handset     Picture 12-b Typical “clam-shell” case handset**



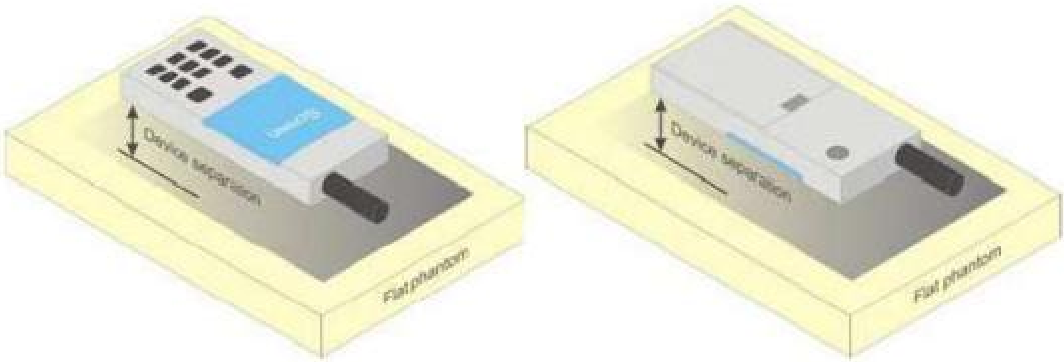

**Picture 8.1-1 Cheek position of the wireless device on the left side of SAM**




Picture 8.1-2 Tilt position of the wireless device on the left side of SAM

## 8.2 Body-worn device

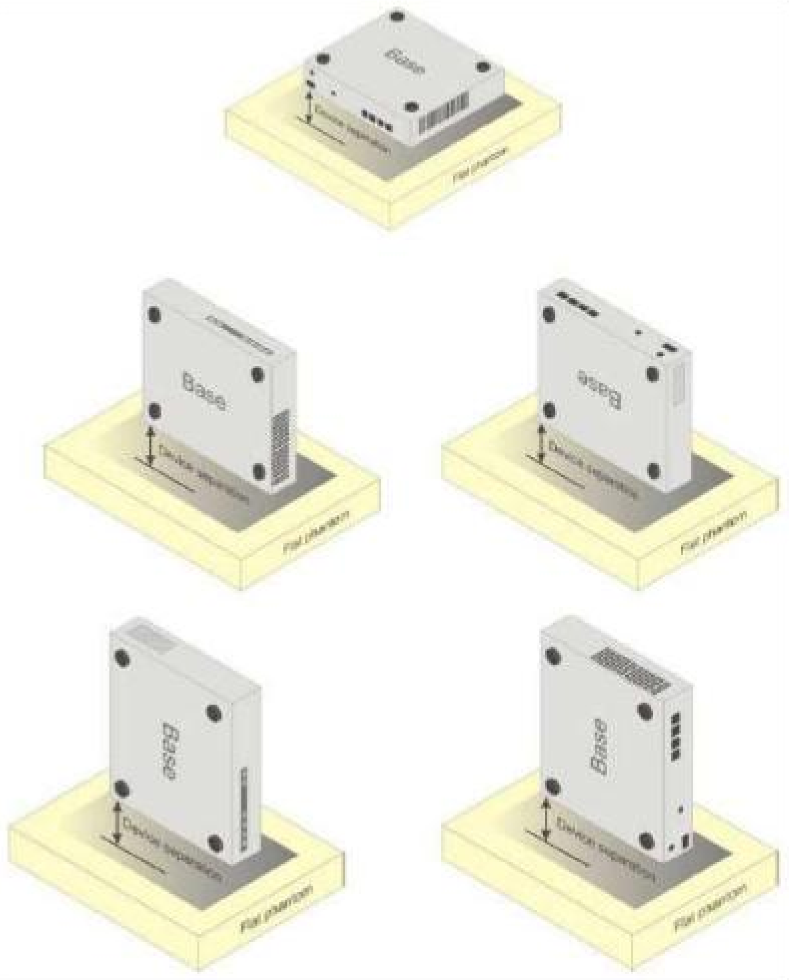
A typical example of a body-worn device is a tracker, wireless enabled PDA or other battery operated wireless device with the ability to transmit while mounted on a person's body using a carry accessory approved by the wireless device manufacturer.




Picture 8.2-1 Test positions for body-worn devices

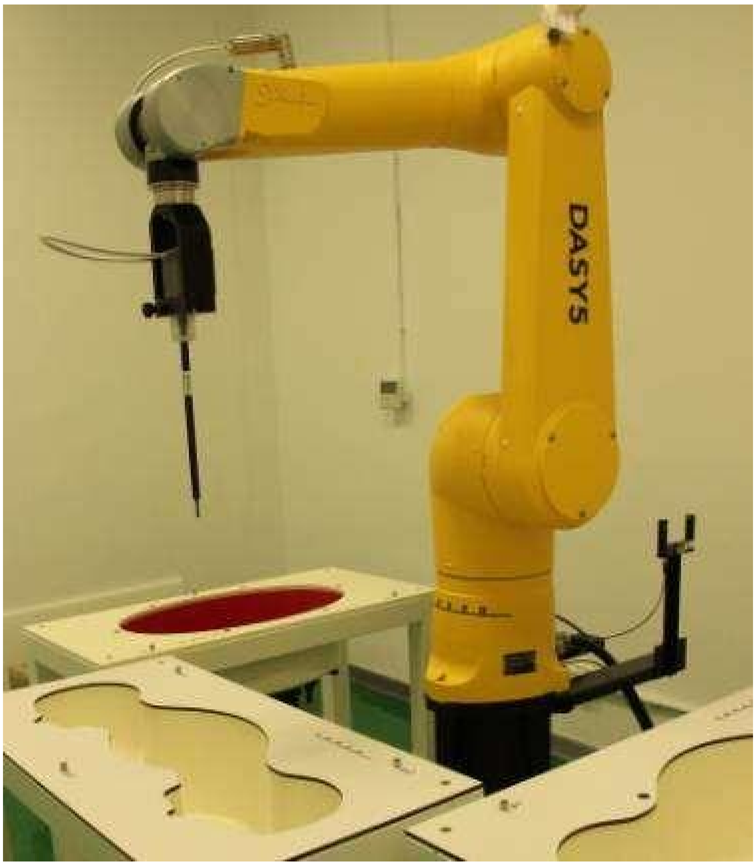
### 8.3 Desktop device

A typical example of a desktop device is a wireless enabled desktop computer placed on a table or desk when used.The DUT shall be positioned at the distance and in the orientation to the phantom that corresponds to the intended use as specified by the manufacturer in the user instructions. For devices that employ an external antenna with variable positions, tests shall be performed for all antenna positions specified. Picture16 show positions for desktop device SAR tests. If the intended use is not specified, the device shall be tested directly against the flat phantom.




**Picture8.3-1 Test positions for desktop devices**

### 8.4 DUT Setup Photo




**Picture 8.4-1: Specific Absorption Rate Test Layout**

# 9.Tissue Simulating Liquids

## 9.1 Equivalent Tissues

The liquid used for the frequency range of 750-3000 MHz consisted of water, sugar, salt and Cellulose. The liquid has been previously proven to be suited for worst-case. The Table 9.1-1 and 9.1-2 shows the detail solution. The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

**Table 9.1-1 Composition of the Head Tissue Equivalent Matter**

| Frequency (MHz) | 835 | 1900 | 2450 |
|---|---|---|---|
| Ingredients (% by weight) | | | |
| water | 41.45 | 54.89 | 58.79 |
| sugar | 56.00 | / | / |
| salt | 1.45 | 0.18 | 0.06 |
| preventol | 0.1 | / | / |
| cellulose | 1.0 | / | / |
| ClycolMonobutyl | / | 44.93 | 41.15 |
| Dielectric Parameters Target Value | f=835MHz<br>ε=41.5<br>σ=0.91 | f=1950MHz<br>ε=40.0<br>σ=1.40 | f=2450MHz<br>ε=39.20<br>σ=1.80 |

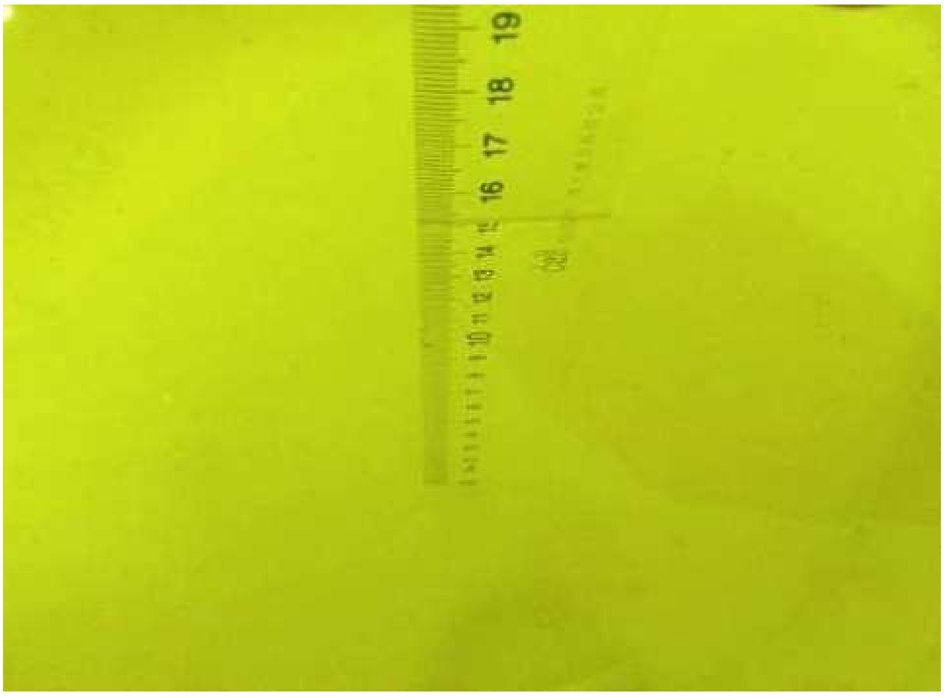
**Table 9.1-2 Targets for tissue simulating liquid**

| Frequency (MHz) | Liquid Type | Conductivity (σ) | ± 5% Range | Permittivity (ε) | ± 5% Range |
|---|---|---|---|---|---|
| 835 | Head | 0.910 | 0.865~0.956 | 41.555 | 39.477~43.632 |
| 1900 | Head | 1.40 | 1.330~1.470 | 40.000 | 38.000~42.000 |
| 2450 | Head | 1.800 | 1.710~1.890 | 39.200 | 37.240~41.160 |

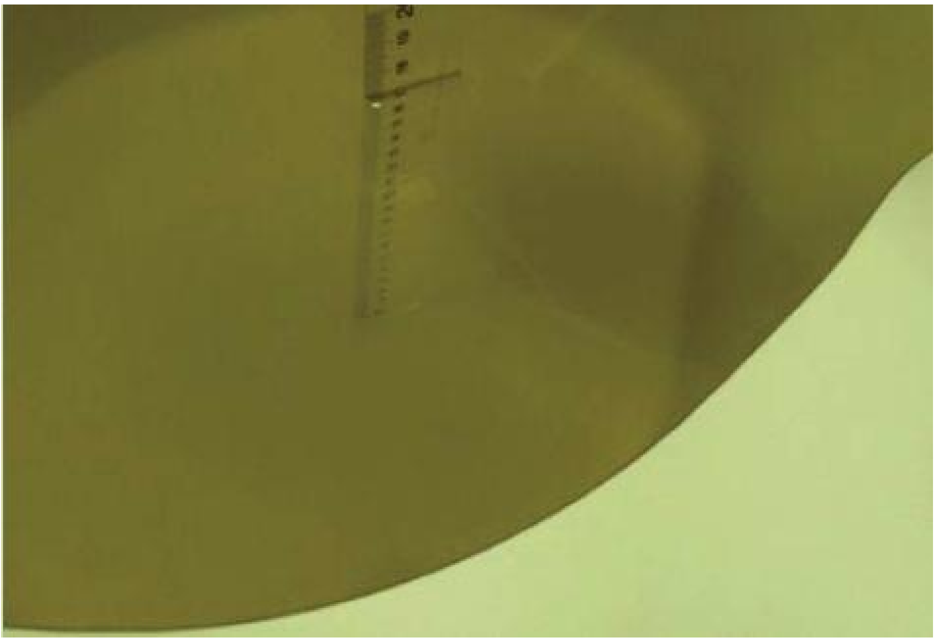
## 9.2 Dielectric Performance

**Table 9.2-1: Dielectric Performance of Head Tissue Simulating Liquid**

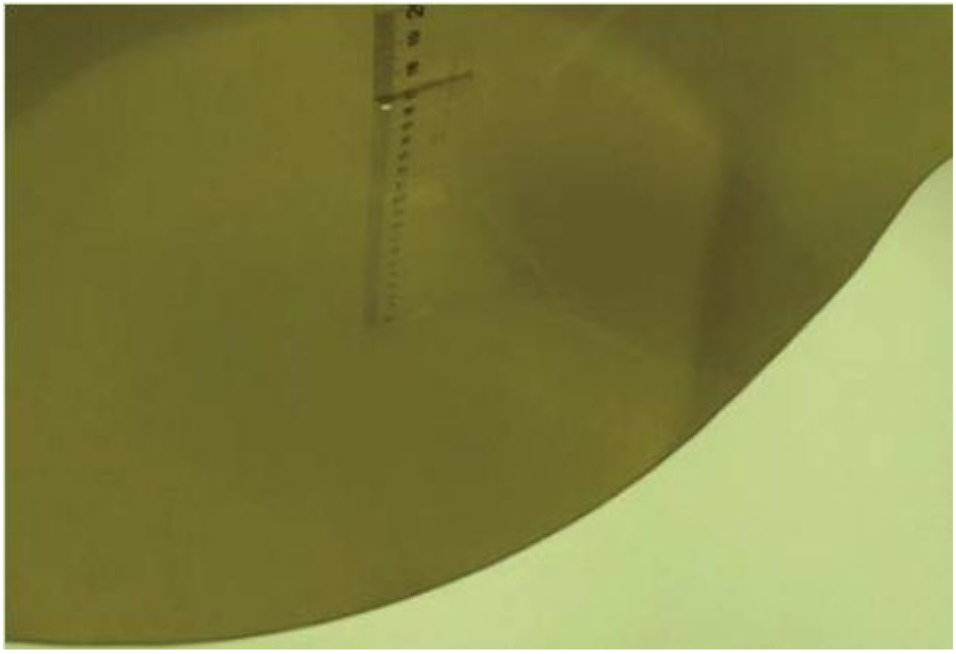
| Measurement Value | | | | | | |
|---|---|---|---|---|---|---|
| Liquid Temperature: 22.5℃ | | | | | | |
| Type | Frequency (MHz) | Permittivity ε | Drift (%) | Conductivity σ | Drift (%) | Test Date |
| Head | 835 | 41.963 | 0.98 | 0.904 | -0.66 | 2023-05-12 |
| Head | 1900 | 38.562 | -3.60 | 1.384 | -1.14 | 2023-05-13 |
| Head | 2450 | 40.446 | 3.18 | 1.886 | 4.78 | 2023-05-15 |




**Picture 9.2-1: Liquid depth in the Flat Phantom (Head 835 MHz )**



Picture 9.2-2: Liquid depth in the Flat Phantom ( Head 1900 MHz)



Picture 9.2-3: Liquid depth in the Flat Phantom ( Head 2450 MHz)

# 10.System Validation

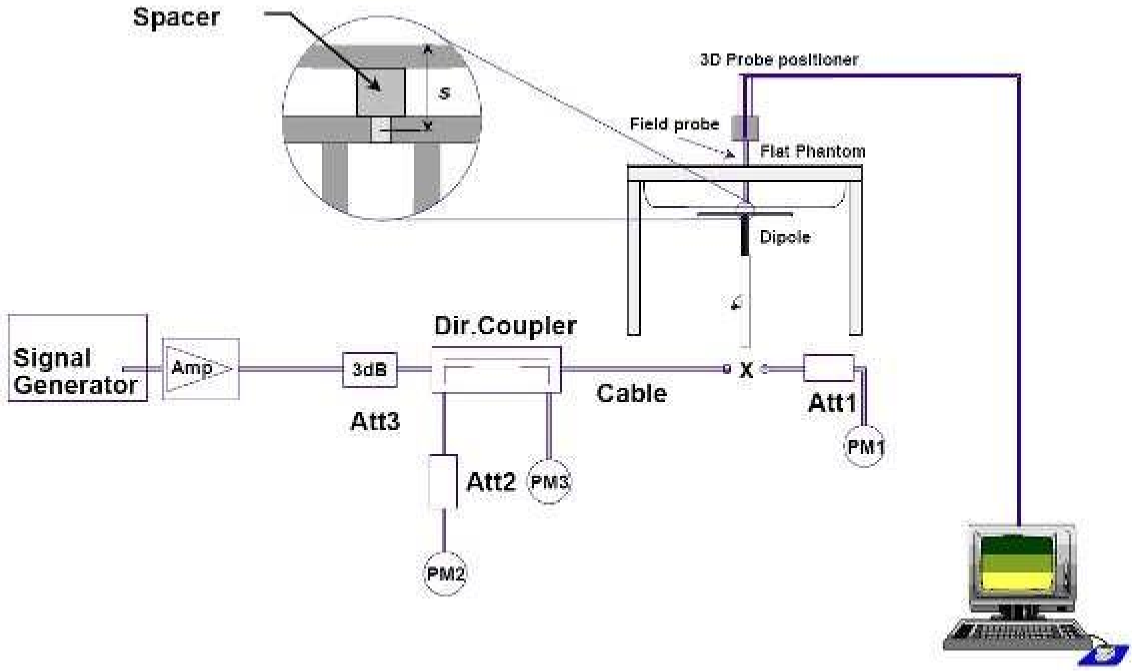
## 10.1 System Validation

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performace check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

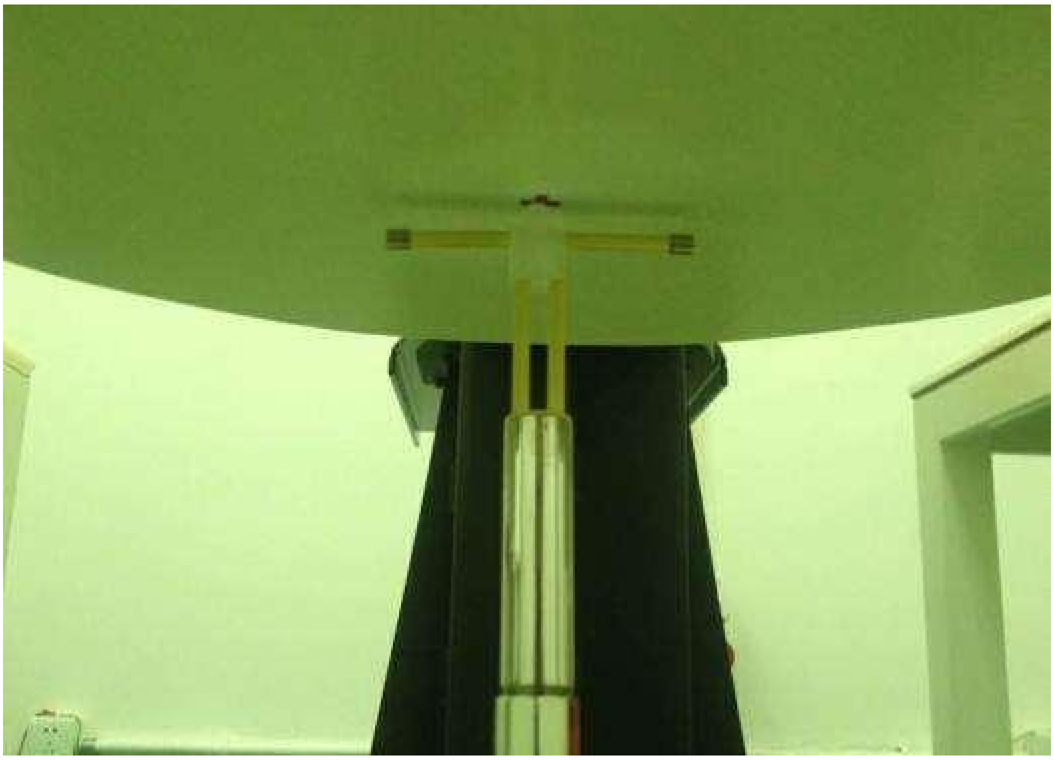
## 10.2 System Setup

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 10.2-1 System Setup for System Evaluation**




The output power on dipole port must be calibrated to 24 dBm (250mW) before dipole is connected. The results are normalized to 1 W input power.



**Picture 10.2-1: Photo of Dipole Setup**

**Table 10.2-1: System Validation of Head**

| Validation Results | | | | | | | |
|---|---|---|---|---|---|---|---|
| Input power level: 1W | | | | | | | |
| Frequency | Target value (W/kg) | | Measured value (W/kg) | | Deviation | | Test date |
| | 1 g Average | 10 g Average | 1 g Average | 10 g Average | 1 g Average(%) | 10 g Average(%) | |
| 835MHz | 2.4 | 1.6 | 2.530 | 1.570 | 5.42 | -1.91 | 2023-5-12 |
| 1900MHz | 9.78 | 5.04 | 9.460 | 4.900 | -3.27 | -2.78 | 2023-5-13 |
| 2450MHz | 13.5 | 6.18 | 13.2 | 5.98 | -2.27 | -3.34 | 2023-5-15 |

# 11. Measurement Procedures

## 11.1 Tests to be performed

In order to determine the highest value of the peak spatial-average SAR of a handset, all device positions, configurations and operational modes shall be tested for each frequency band according to steps 1 to 3 below. A flowchart of the test process is shown in Picture 19

**Step 1**: The tests described in 11.2 shall be performed at the channel that is closest to the centre of the transmit frequency band ($f_c$) for:

a) all device positions (cheek and tilt, for both left and right sides of the SAM phantom, as described in Chapter 8),

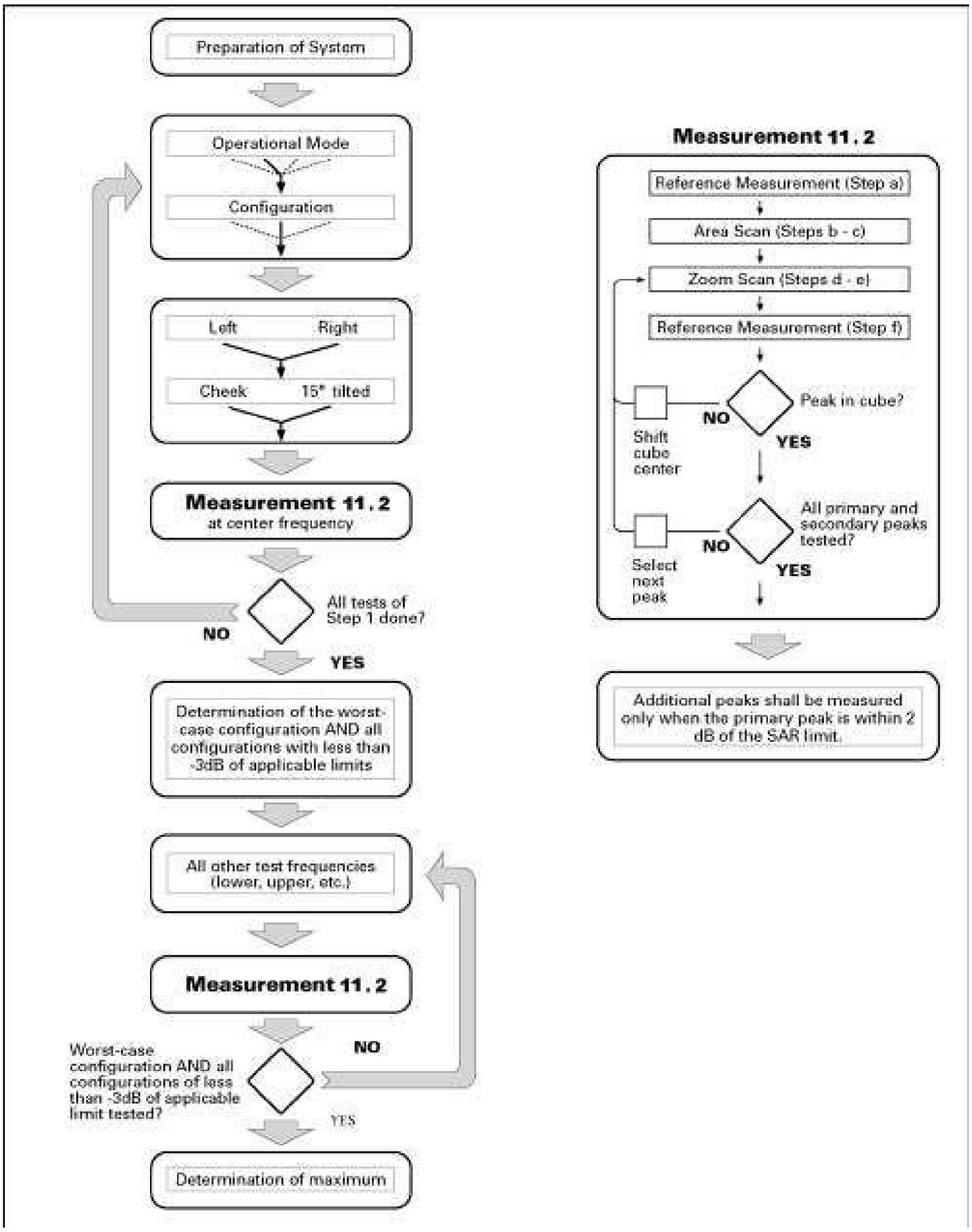
b) all configurations for each device position in a), e.g., antenna extended and retracted, and

c) all operational modes, e.g., analogue and digital, for each device position in a) and configuration in b) in each frequency band.

If more than three frequencies need to be tested according to 11.1 (i.e., $N_c$ > 3), then all frequencies, configurations and modes shall be tested for all of the above test conditions.

**Step 2**: For the condition providing highest peak spatial-average SAR determined in Step 1, perform all tests described in 11.2 at all other test frequencies, i.e., lowest and highest frequencies. In addition, for all other conditions (device position, configuration and operational mode) where the peak spatial-average SAR value determined in Step 1 is within 3 dB of the applicable SAR limit, it is recommended that all other test frequencies shall be tested as well.

**Step 3**: Examine all data to determine the highest value of the peak spatial-average SAR found in Steps 1 to 2.




**Picture 11.1-1: Block diagram of the tests to be performed**

## 11.2 Measurement procedure

The following procedure shall be performed for each of the test conditions (see Picture 19) described in 11.1:

a) Measure the local SAR at a test point within 8 mm or less in the normal direction from the inner surface of the phantom.

b) Measure the two-dimensional SAR distribution within the phantom (area scan procedure). The boundary of the measurement area shall not be closer than 20 mm from the phantom side walls. The distance between the measurement points should enable the detection of the location of local maximum with an accuracy of better than half the linear dimension of the tissue cube after interpolation. A maximum grip spacing of 20 mm for frequencies below 3 GHz and (60/f [GHz]) mm for frequencies of 3GHz and greater is recommended. The maximum distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be 5 mm for frequencies below 3 GHz andδIn(2)/2 mm for frequencies of 3 GHz and greater, whereδis the plane wave skin depth and In(x) is the natural logarithm. The maximum variation of the sensor-phantom surface shall be ±1 mm for frequencies below 3 GHz and ±0.5 mm for frequencies of 3 GHz and greater. At all measurement points the angle of the probe with respect to the line normal to the surface should be less than 5°. If this cannot be achieved for a measurement distance to the phantom inner surface shorter than the probe diameter, additional uncertainty evaluation is needed.

c) From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that are not within the zoom-scan volume; additional peaks shall be measured only when the primary peak is within 2 dB of the SAR limit. This is consistent with the 2 dB threshold already stated;

d) Measure the three-dimensional SAR distribution at the local maxima locations identified in step

e) The horizontal grid step shall be (24 / f[GHz] ) mm or less but not more than 8 mm. The minimum zoom size of 30 mm by 30 mm and 30 mm for frequencies below 3 GHz. For higher frequencies, the minimum zoom size of 22 mm by 22 mm and 22 mm. The grip step in the vertical direction shall be ( 8-f[GHz] ) mm or less but not more than 5 mm, if uniform spacing is used. If variable spacing is used in the vertical direction, the maximum spacing between the two closest measured points to the phantom shell shall be (12 / f[GHz]) mm or less but not more than 4 mm, and the spacing between father points shall increase by an incremental factor not exceeding 1.5. When variable spacing is used, extrapolation routines shall be tested with the same spacing as used in measurements. The maximum distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be 5 mm for frequencies below 3 GHz andδIn(2)/2 mm for frequencies of 3 GHz and greater, where δis the plane wave skin depth and In(x) is the natural logarithm. Separate grids shall be centered on each of the local SAR maxima found in step c). Uncertainties due to field distortion between the media boundary and the dielectric enclosure of the probe should also be minimized, which is achieved is the distance between the phantom surface and physical tip of the probe is larger than probe tip diameter. Other methods may utilize correction procedures for these boundary effects that enable high precision measurements closer than half the probe diameter. For all measurement points, the angle of the probe with respect to the flat phantom surface shall be less than 5°. If this cannot be achieved an additional uncertainty evaluation is needed.

f) Use post processing( e.g. interpolation and extrapolation ) procedures to determine the local SAR values at the spatial resolution needed for mass averaging.

### 11.3 GSM Measurement Procedures for SAR

The following procedures may be considered for each frequency band to determine SAR test reduction for devices operating in GSM/GPRS/EDGE modes to demonstrate RF exposure compliance. GSM voice mode transmits with 1 time slot. GPRS and EDGE may transmit up to 4 time slots in the 8 time-slot frame according to the multislot class implemented in a device.

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units, including tune-up tolerance. The data mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. GSM voice and GPRS data use GMSK, which is a constant amplitude modulation with minimal peak to average power difference within the time-slot burst. For EDGE, GMSK is used for MCS 1 – MCS 4 and 8-PSK is used for MCS 5 – MCS 9; where 8-PSK has an inherently higher peak-to-average power ratio. The GMSK and 8-PSK EDGE configurations are considered separately for SAR compliance. The GMSK EDGE configurations are grouped with GPRS and considered with respect to time-averaged maximum output power to determine compliance. The 3G SAR test reduction procedure is applied to 8-PSK EDGE with GMSK GPRS/EDGE as the primary mode.

## 11.4 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.

## 11.5 Power Drift

To control the output power stability during the SAR test, DASY5 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in Section 15 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

# 12.Area Scan Based 1-g SAR

## 12.1 Requirement of KDB

According to the KDB447498D01v06,when the implementation is based the specific polynomial it algorithm as presented at the 29th Bioelectromagnetics Society meeting (2007)and the estimated 1-g SARis≤1.2W/kg, a zoom scan measurement is not required provided it is also not needed For any other purpose ;for example, if the peak SAR location required for simultaneous transmission SAR test exclusion can be determined accurately by the SAR system or manually to discriminate between is tinctive peak sand scattered noisy SAR distributions from area scans.

There must not be any warning or alert messages due to various measurement concerns identified by the SAR system; for example, noise in measurements ,peaks too close to scan boundary, peaks are too sharp, spatial resolution and uncertainty issues etc. The SAR system verification must also demonstrate that the area scan estimated 1-gSAR is within 3%of the zoom scan 1-g SAR (See Annex A).When all the SAR results for each exposure condition in a frequency band and wireless mode are based on estimated 1-g SAR, the 1-g SAR for the highest SAR configuration must be determined by a zoom scan.

## 12.2 Fast SAR Algorithms

The approach is based on the area scan measurement applying a frequency dependent attenuation parameter. This attenuation parameter was empiri call determined by analyzing a large number of phones. The MOTOROLAFASTSAR was developed and validated by the MOTOROLA Research Group in Ft .Lauderdale.

In the initial study, an approximation algorithm based on Linearf it was developed. The accuracy of the algorithm has been demonstrated across abroad frequency range(136-2450 MHz)andforboth1-gand 10-g averaged SAR using a sample of 264 SARmeasurementsfrom55 wireless handsets. For the sample size studied, the root-mean-squared errors of the algorithmare1.2%and 5.8%for1-g and 10-g averaged SAR, respectively. The paper describing the algorith min detail is expected to be published inAugust2004 within the Special Issue of Transactions on MTT.

In the second step, the same research group optimized the fitting algorithm to an Polynomia lf it where by the frequency validity was extended to cover the range 30-6000MHz.Detailsof this study can be found in the BEMS2007 Proceedings.Both algorithms are implemented in DASY software.

# 13.Conducted Output Power

## 13.1 GSM Measurement Result

**Table 13.1-1: The conducted power measurement results-GSM850**

| GSM 850 Speech (GMSK) | Measured timeslot-averaged output power (dBm) | | | Tune up (dBm) | calculation | Source-based time-averaged output power (dBm) | | |
|---|---|---|---|---|---|---|---|---|
| | 128 | 190 | 251 | | | 128 | 190 | 251 |
| 1 Txslot | 32.86 | **32.98** | 32.91 | 33.5 | / | / | / | / |
| GSM 850 GPRS (GMSK) | Measured timeslot-averaged output power (dBm) | | | Tune up (dBm) | calculation | Source-based time-averaged output power (dBm) | | |
| | 128 | 190 | 251 | | | 128 | 190 | 251 |
| 1 Txslot | 32.78 | 32.94 | 32.87 | 33.5 | -9.03 | 23.75 | 23.91 | 23.84 |
| 2 Txslots | 30.68 | 30.88 | 30.5 | 31 | -6.02 | 24.66 | 24.86 | 24.48 |
| **3 Txslots** | 29.01 | 29.27 | 29.16 | 30 | -4.26 | **24.75** | **25.01** | **24.9** |
| 4 Txslots | 27.15 | 27.37 | 27.06 | 28 | -3.01 | 24.14 | 24.36 | 24.05 |

**Table 13.1-2: The conducted power measurement results-PCS1900**

| PCS1900 Speech (GMSK) | Measured timeslot-averaged output power (dBm) | | | Tune up (dBm) | calculation | Source-based time-averaged output power (dBm) | | |
|---|---|---|---|---|---|---|---|---|
| | 512 | 661 | 810 | | | 512 | 661 | 810 |
| 1 Txslot | 29.24 | 29.12 | **29.66** | 30.8 | / | / | / | / |
| PCS1900 GPRS (GMSK) | Measured timeslot-averaged output power (dBm) | | | Tune up (dBm) | calculation | Source-based time-averaged output power (dBm) | | |
| | 512 | 661 | 810 | | | 512 | 661 | 810 |
| 1 Txslot | 29.38 | 29.37 | 29.75 | 30.8 | -9.03 | 20.35 | 20.34 | 20.72 |
| 2 Txslots | 27.44 | 27.36 | 27.58 | 28.5 | -6.02 | 21.42 | 21.34 | 21.56 |
| **3 Txslots** | 25.61 | 25.70 | 26.27 | 27 | -4.26 | **21.35** | **21.44** | **22.01** |
| 4 Txslots | 23.66 | 23.56 | 24.36 | 25 | -3.01 | 20.65 | 20.55 | 21.35 |

NOTES:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

**According to the conducted power as above, the body measurements are performed with 3 Txslots for GSM850 and PCS1900.**

## 13.2 BT Measurement Result

| GFSK | | | |
|---|---|---|---|
| **Channel** | **Channel 0** | **Channel 39** | **Channel 78** |
| DH5 (dBm) | **8.53** | 8.31 | 8.31 |
| Tune up (dBm) | 9 | 9 | 9 |

| QDPSK | | | |
|---|---|---|---|
| **Channel** | **Channel 0** | **Channel 39** | **Channel 78** |
| 2DH5 (dBm) | 6.90 | 6.69 | 6.66 |
| Tune up (dBm) | 7.6 | 7.5 | 7.5 |

| 8DPSK | | | |
|---|---|---|---|
| **Channel** | **Channel 0** | **Channel 39** | **Channel 78** |
| 3DH5 (dBm) | 6.90 | 6.70 | 6.66 |
| Tune up(dBm) | 7.8 | 7.7 | 7.5 |

# 14.Simultaneous TX SAR Considerations

## 14.1 Introduction

The following procedures adopted from “FCC SAR Considerations for Cell Phones with Multiple Transmitters” are applicable to handsets with built-in unlicensed transmitters such as 802.11 a/b/g and Bluetooth devices which may simultaneously transmit with the licensed transmitter. For this device, bluetooth can transmit simultaneous with the other transmitters.

## 14.2 Transmit Antenna Position

For antenna location map, please see the photo file.

### 14.3 Simultaneous Transmission for EUT

**Table 14.3-1: The sum of SAR values for main antenna GSM850+BT (1g)**

| Test Position | | Main antenna GSM850 （W/kg） | BT （W/kg） | Sum （W/kg） |
|---|---|---|---|---|
| **Highest SAR value for Head** | Cheek Left | 0.39 | 0.08 | 0.47 |
| **Highest SAR value for Body** | Rear （15mm） | 1.13 | 0.01 | 1.14 |

**Table 14.3-2: The sum of SAR values for main antenna PCS1900+BT (1g)**

| Test Position | | Main antenna PCS1900 （W/kg） | BT （W/kg） | Sum （W/kg） |
|---|---|---|---|---|
| **Highest SAR value for Head** | Cheek Left | 0.29 | 0.08 | 0.37 |
| **Highest SAR value for Body** | Rear （15mm） | 0.68 | 0.01 | 0.69 |

**Conclusion:**
According to these above tables, the sum of reported SAR values is<1.6W/kg. So the simultaneous transmission SAR with volume scans is not required.

# 15.SAR Test Result

## 15.1 SAR Result

**There are some notes in the data table below:**

**Note1: The data is tested with the battery model of TLi010EA**

**Note2: The data is tested with the battery model of TLi010CA**

**Note3: The data is tested with the battery model of TLi010CB**

**Note4: The data is tested with the battery model of TLi010EB**

**Note5: The data is tested for the sample with single SIM card**

**Table 15.1-1: SAR Values( GSM 850MHz-Head)**

| Frequency | | Mode (number of timeslots) | Test Position | Distance (mm) | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) | Figure No. | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ch. | MHz | | | | | | | | | | |
| 190 | 836.6 | Speech | Cheek Left | 0 | 32.98 | 33.5 | 0.251 | 0.28 | -0.14 | / | Note1 |
| 128 | 824.2 | Speech | Cheek Left | 0 | 32.86 | 33.5 | 0.237 | 0.27 | -0.14 | / | Note1 |
| 251 | 848.8 | Speech | Cheek Left | 0 | 32.91 | 33.5 | 0.344 | **0.39** | 0.01 | Fig A.1 | Note1 |
| 190 | 836.6 | Speech | Tilt Left | 0 | 32.98 | 33.5 | 0.130 | 0.15 | -0.02 | / | Note1 |
| 190 | 836.6 | Speech | Cheek Right | 0 | 32.98 | 33.5 | 0.239 | 0.27 | 0.16 | / | Note1 |
| 190 | 836.6 | Speech | Tilt Right | 0 | 32.98 | 33.5 | 0.127 | 0.14 | -0.06 | / | Note1 |
| 251 | 848.8 | Speech | Cheek Left | 0 | 32.91 | 33.5 | 0.294 | 0.34 | -0.11 | / | Note2 |
| 251 | 848.8 | Speech | Cheek Left | 0 | 32.91 | 33.5 | 0.307 | 0.35 | -0.06 | / | Note3 |
| 251 | 848.8 | Speech | Cheek Left | 0 | 32.91 | 33.5 | 0.310 | 0.36 | -0.16 | / | Note4 |
| 251 | 848.8 | Speech | Cheek Left | 0 | 32.91 | 33.5 | 0.311 | 0.36 | -0.06 | / | Note5 |

**Table 15.1-2: SAR Values( GSM850MHz-Body)**

| Frequency | | Mode (number of timeslots) | Test Position | Distance (mm) | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) | Figure No. | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ch. | MHz | | | | | | | | | | |
| 190 | 836.6 | GPRS( 3TS ) | Front | 15 | 29.27 | 30 | 0.624 | 0.74 | 0.16 | / | Note1 |
| 190 | 836.6 | GPRS( 3TS ) | Rear | 15 | 29.27 | 30 | 0.892 | 1.06 | 0.12 | / | Note1 |
| 128 | 824.2 | GPRS( 3TS ) | Rear | 15 | 29.01 | 30 | 0.901 | **1.13** | -0.18 | Fig A.2 | Note1 |
| 251 | 848.8 | GPRS( 3TS ) | Rear | 15 | 29.16 | 30 | 0.821 | 1.00 | -0.13 | / | Note1 |
| 128 | 824.2 | GPRS( 3TS ) | Rear | 15 | 29.27 | 30 | 0.874 | 1.03 | -0.14 | / | Note2 |
| 128 | 824.2 | GPRS( 3TS ) | Rear | 15 | 29.27 | 30 | 0.855 | 1.01 | -0.13 | / | Note3 |
| 128 | 824.2 | GPRS( 3TS ) | Rear | 15 | 29.27 | 30 | 0.852 | 1.01 | -0.18 | / | Note4 |
| 128 | 824.2 | GPRS( 3TS ) | Rear | 15 | 29.27 | 30 | 0.859 | 1.02 | -0.13 | / | Note5 |

## Table 15.1-3: SAR Values( PCS 1900MHz-Head)

| Frequency | | Mode (number of timeslots) | Test Position | Distance (mm) | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) | Figure No. | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ch. | MHz | | | | | | | | | | |
| 810 | 1909.8 | Speech | Cheek Left | 0 | 29.66 | 30.8 | 0.169 | 0.22 | -0.02 | / | Note1 |
| 810 | 1909.8 | Speech | Tilt Left | 0 | 29.66 | 30.8 | 0.101 | 0.13 | 0.16 | / | Note1 |
| 810 | 1909.8 | Speech | Cheek Right | 0 | 29.66 | 30.8 | 0.135 | 0.18 | -0.06 | / | Note1 |
| 810 | 1909.8 | Speech | Tilt Right | 0 | 29.66 | 30.8 | 0.054 | 0.07 | 0.01 | / | Note1 |
| 661 | 1880 | Speech | Cheek Left | 0 | 29.12 | 30.8 | 0.155 | 0.23 | -0.06 | / | Note1 |
| 512 | 1850.2 | Speech | Cheek Left | 0 | 29.24 | 30.8 | 0.202 | **0.29** | -0.16 | Fig A.3 | Note1 |
| 512 | 1850.2 | Speech | Cheek Left | 0 | 29.24 | 30.8 | 0.200 | 0.29 | -0.04 | / | Note2 |
| 512 | 1850.2 | Speech | Cheek Left | 0 | 29.24 | 30.8 | 0.200 | 0.29 | 0.16 | / | Note3 |
| 512 | 1850.2 | Speech | Cheek Left | 0 | 29.24 | 30.8 | 0.198 | 0.28 | 0.07 | / | Note4 |
| 512 | 1850.2 | Speech | Cheek Left | 0 | 29.24 | 30.8 | 0.191 | 0.27 | 0.15 | / | Note5 |

## Table 15.1-4: SAR Values( PCS 1900MHz-Body)

| Frequency | | Mode (number of timeslots) | Test Position | Distance (mm) | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) | Figure No. | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ch. | MHz | | | | | | | | | | |
| 810 | 1909.8 | GPRS( 3TS ) | Front | 15 | 26.27 | 27 | 0.156 | 0.18 | -0.02 | / | Note1 |
| 810 | 1909.8 | GPRS( 3TS ) | Rear | 15 | 26.27 | 27 | 0.303 | 0.36 | -0.11 | / | Note1 |
| 512 | 1850.2 | GPRS( 3TS ) | Rear | 15 | 25.70 | 27 | 0.502 | **0.68** | 0.16 | Fig A.4 | Note1 |
| 661 | 1880 | GPRS( 3TS ) | Rear | 15 | 25.61 | 27 | 0.328 | 0.45 | -0.04 | / | Note1 |
| 512 | 1850.2 | GPRS( 3TS ) | Rear | 15 | 26.27 | 27 | 0.348 | 0.41 | 0.07 | / | Note2 |
| 512 | 1850.2 | GPRS( 3TS ) | Rear | 15 | 26.27 | 27 | 0.401 | 0.47 | 0.15 | / | Note3 |
| 512 | 1850.2 | GPRS( 3TS ) | Rear | 15 | 26.27 | 27 | 0.279 | 0.33 | -0.01 | / | Note4 |
| 512 | 1850.2 | GPRS( 3TS ) | Rear | 15 | 26.27 | 27 | 0.411 | 0.49 | 0.03 | / | Note5 |

## Table 15.1-5: SAR Values(BT-Head)

| Frequency | | Mode (number of timeslots) | Test Position | Distance (mm) | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) | Figure No. | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ch. | MHz | | | | | | | | | | |
| 0 | 2402 | GFSK | Cheek Left | 0 | 8.53 | 9 | 0.070 | 0.08 | 0.03 | / | Note1 |
| 0 | 2402 | GFSK | Tilt Left | 0 | 8.53 | 9 | 0.010 | 0.01 | 0.12 | / | Note1 |
| 0 | 2402 | GFSK | Cheek Right | 0 | 8.53 | 9 | 0.105 | **0.12** | 0.15 | Fig A.5 | Note1 |
| 0 | 2402 | GFSK | Tilt Right | 0 | 8.53 | 9 | 0.009 | 0.01 | 0.10 | / | Note1 |
| 0 | 2402 | GFSK | Cheek Right | 0 | 8.53 | 9 | 0.095 | 0.11 | 0.12 | / | Note4 |
| 0 | 2402 | GFSK | Cheek Right | 0 | 8.53 | 9 | 0.105 | 0.12 | 0.15 | / | Note3 |
| 0 | 2402 | GFSK | Cheek Right | 0 | 8.53 | 9 | 0.093 | 0.10 | 0.12 | / | Note2 |
| 0 | 2402 | GFSK | Cheek Right | 0 | 8.53 | 9 | 0.093 | 0.10 | -0.10 | / | Note5 |

## able 15.1-6: SAR Values(BT-Body)

| Frequency | | Mode (number of timeslots) | Test Position | Distance (mm) | Conducted Power (dBm) | Max. tune-up Power (dBm) | Measured SAR(1g) (W/kg) | Reported SAR(1g) (W/kg) | Power Drift (dB) | Figure No. | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ch. | MHz | | | | | | | | | | |
| 0 | 2402 | GFSK | Front | 15 | 8.53 | 9 | 0.012 | **0.01** | -0.16 | Fig A.6 | Note1 |
| 0 | 2402 | GFSK | Rear | 15 | 8.53 | 9 | 0.008 | 0.01 | 0.15 | / | Note1 |
| 0 | 2402 | GFSK | Front | 15 | 8.53 | 9 | 0.011 | 0.01 | 0.17 | / | Note2 |
| 0 | 2402 | GFSK | Front | 15 | 8.53 | 9 | 0.011 | 0.01 | 0.17 | / | Note3 |
| 0 | 2402 | GFSK | Front | 15 | 8.53 | 9 | 0.011 | 0.01 | 0.17 | / | Note4 |
| 0 | 2402 | GFSK | Front | 15 | 8.53 | 9 | 0.087 | 0.10 | 0.16 | / | Note5 |

## 15.2. SAR Measurement Variability

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. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium.

The following procedures are applied to determine if repeated measurements are required.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps2) 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 ≥1.45W/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.

**Table15.2-1 SAR Measurement Variability for Body (1g)**

| Frequency | | Mode | Test Position | Distance (mm) | Original Measured SAR(W/kg) | First Repeated measured SAR (W/kg) | The Ratio (%) | Note |
|---|---|---|---|---|---|---|---|---|
| Ch. | MHz | | | | | | | |
| 128 | 824.2 | GPRS（3TS） | Rear | 15 | 0.901 | 0.870 | 1.04 | battery model：TLi010EA |
| 251 | 848.8 | GPRS（3TS） | Rear | 15 | 0.821 | 0.792 | 1.04 | battery model：TLi010EA |
| 128 | 824.2 | GPRS（3TS） | Rear | 15 | 0.874 | 0.858 | 1.02 | battery model：TLi010CA |
| 128 | 824.2 | GPRS（3TS） | Rear | 15 | 0.855 | 0.814 | 1.05 | battery model：TLi010CB |
| 128 | 824.2 | GPRS（3TS） | Rear | 15 | 0.852 | 0.806 | 1.06 | battery model：TLi010EB |
| 128 | 824.2 | GPRS（3TS） | Rear | 15 | 0.859 | 0.861 | 1.00 | Single SIM card |

# 16. Measurement Uncertainty

**Measurement Uncertainty for Normal SAR Tests (below 3GHz)**

| Error Description | Uncert. Value | Prob. Dist. | Div. | (Ci) 1g | (Ci) 10g | Std. Unc.[%] (1g) | Std. Unc.[%] (10g) | (Ui) ueff |
|---|---|---|---|---|---|---|---|---|
| Measurement System | | | | | | | | |
| Probe Calibration | 12.1 | N | 2 | 1 | 1 | 6.05 | 6.05 | ∞ |
| Axial Isotropy | 4.7 | R | $\sqrt{3}$ | 0.7 | 0.7 | 1.90 | 1.90 | ∞ |
| Hemispherical Isotropy | 9.6 | R | $\sqrt{3}$ | 0.7 | 0.7 | 3.88 | 3.88 | ∞ |
| Boundary effects | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.58 | 0.58 | ∞ |
| Linearity | 4.7 | R | $\sqrt{3}$ | 1 | 1 | 2.71 | 2.71 | ∞ |
| System Detection Limits | 1.0 | R | $\sqrt{3}$ | 1 | 1 | 0.58 | 0.58 | ∞ |
| Readout Electronics | 0.3 | N | 1 | 1 | 1 | 0.30 | 0.30 | ∞ |
| Response Time | 0.8 | R | $\sqrt{3}$ | 1 | 1 | 0.50 | 0.50 | ∞ |
| Integration Time | 2.6 | R | $\sqrt{3}$ | 1 | 1 | 1.50 | 1.50 | ∞ |
| RF ambient conditions-noise | 0 | R | $\sqrt{3}$ | 1 | 1 | 0.00 | 0.00 | ∞ |
| RF ambient conditions-reection | 0 | R | $\sqrt{3}$ | 1 | 1 | 0.00 | 0.00 | ∞ |
| Probe Positioned mech.retrictions | 0.2 | R | $\sqrt{3}$ | 1 | 1 | 0.12 | 0.12 | ∞ |
| Probe Positioning with respect to phantom shell | 2.9 | R | $\sqrt{3}$ | 1 | 1 | 1.67 | 1.67 | ∞ |
| Post-processing | 4.0 | R | $\sqrt{3}$ | 1 | 1 | 2.31 | 2.31 | ∞ |
| Test Sample Related | | | | | | | | |
| Device Holder | 2.54 | N | 1 | 1 | 1 | 2.54 | 2.54 | 3 |
| Test dample Positioning | 0.5 | N | 1 | 1 | 1 | 0.50 | 0.50 | 63 |
| Power Drift | 5.0 | R | $\sqrt{3}$ | 1 | 1 | 2.89 | 2.89 | ∞ |
| Phantom and Setup | | | | | | | | |
| Phantom Uncertainty | 7.5 | R | $\sqrt{3}$ | 1 | 1 | 4.33 | 4.33 | ∞ |
| Liquid Conductivity (target) | 5.0 | R | $\sqrt{3}$ | 0.64 | 0.43 | 1.85 | 1.24 | ∞ |
| Liquid Conductivity (meas..) | 2.5 | N | 1 | 0.64 | 0.43 | 1.60 | 1.08 | ∞ |
| Liquid Permittivity (target) | 5.00 | R | $\sqrt{3}$ | 0.6 | 0.49 | 1.73 | 1.41 | ∞ |
| Liquid Permittivity (meas..) | 0.4 | N | 1 | 0.6 | 0.49 | 0.24 | 0.20 | ∞ |
| Combined Std. Uncertainty | $U_C^{'} = \sqrt{\sum_{i=1}^{23} Ci^2 Ui^2}$ | RSS | | | | 10.09 | 9.96 | |
| Expanded STD Uncertainty | $U_C = 2U_C^{'}$ | | | | | 20.18 | 19.93 | |

**Measurement Uncertainty for Fast SAR Tests (below 3GHz )**

| Error Description | Uncert. Value | Prob. Dist. | Div. | (Ci) 1g | (Ci) 10g | Std. Unc.[%] (1g) | Std. Unc.[%] (10g) | (Ui) ueff |
|---|---|---|---|---|---|---|---|---|
| Measurement System | | | | | | | | |
| Probe Calibration | 12.1 | N | 2 | 1 | 1 | 6.05 | 6.05 | ∞ |
| Axial Isotropy | 4.7 | R | √3 | 0.7 | 0.7 | 1.90 | 1.90 | ∞ |
| Hemispherical Isotropy | 9.6 | R | √3 | 0.7 | 0.7 | 3.88 | 3.88 | ∞ |
| Boundary effects | 1.0 | R | √3 | 1 | 1 | 0.58 | 0.58 | ∞ |
| Linearity | 4.7 | R | √3 | 1 | 1 | 2.71 | 2.71 | ∞ |
| System Detection Limits | 1.0 | R | √3 | 1 | 1 | 0.58 | 0.58 | ∞ |
| Readout Electronics | 0.3 | N | 1 | 1 | 1 | 0.30 | 0.30 | ∞ |
| Response Time | 0.8 | R | √3 | 1 | 1 | 0.50 | 0.50 | ∞ |
| Integration Time | 2.6 | R | √3 | 1 | 1 | 1.50 | 1.50 | ∞ |
| RF ambient conditions-noise | 0 | R | √3 | 1 | 1 | 0.00 | 0.00 | ∞ |
| RF ambient conditions-re ection | 0 | R | √3 | 1 | 1 | 0.00 | 0.00 | ∞ |
| Probe Positioned mech.retrictions | 0.2 | R | √3 | 1 | 1 | 0.12 | 0.12 | ∞ |
| Probe Positioning with respect to phantom shell | 2.9 | R | √3 | 1 | 1 | 1.67 | 1.67 | ∞ |
| Post-processing | 4.0 | R | √3 | 1 | 1 | 2.31 | 2.31 | ∞ |
| Fast SAR-Z-Approximation | 7.0 | R | √3 | 1 | 1 | 4.0 | 4.0 | ∞ |
| Test Sample Related | | | | | | | | |
| Device Holder | 2.54 | N | 1 | 1 | 1 | 2.54 | 2.54 | 3 |
| Test dample Positioning | 0.5 | N | 1 | 1 | 1 | 0.50 | 0.50 | 63 |
| Power Drift | 5.0 | R | √3 | 1 | 1 | 2.89 | 2.89 | ∞ |
| Phantom and Setup | | | | | | | | |
| Phantom Uncertainty | 7.5 | R | √3 | 1 | 1 | 4.33 | 4.33 | ∞ |
| Liquid Conductivity (target) | 5.0 | R | √3 | 0.64 | 0.43 | 1.85 | 1.24 | ∞ |
| Liquid Conductivity (meas..) | 2.5 | N | 1 | 0.64 | 0.43 | 1.60 | 1.08 | ∞ |
| Liquid Permittivity (target) | 5.00 | R | √3 | 0.6 | 0.49 | 1.73 | 1.41 | ∞ |
| Liquid Permittivity (meas..) | 0.4 | N | 1 | 0.6 | 0.49 | 0.24 | 0.20 | ∞ |
| Combined Std. Uncertainty | $U_C' = \sqrt{\sum_{i=1}^{23} Ci^2 Ui^2}$ | RSS | | | | 10.85 | 10.73 | |
| Expanded STD Uncertainty | $U_C = 2U_C'$ | | | | | 21.70 | 21.46 | |

# 17. MAIN TEST INSTRUMENTS

**Table 17-1: List of Main Instruments**

| No. | Name | Type | Serial Number | Software version | Hardware version | Calibration Date | Valid Period |
|---|---|---|---|---|---|---|---|
| 01 | Probe | EX3DV4 | 3844 | -- | -- | 2022-07-08 | 2023-07-07 |
| 02 | DAE | DAE4 | 797 | -- | -- | 2022-05-17 | 2023-05-16 |
| 03 | Power Meter | N1914A | MY50001660 | -- | -- | 2022-05-30 | 2023-5-29 |
| 04 | Radio Communication Analyzer | CMW500 | 109616 | -- | -- | 2022-05-30 | 2023-05-29 |
| 05 | Signal Generator | N5181A | MY50143363 | -- | -- | 2022-05-30 | 2023-5-29 |
| 06 | Power Sensor | E8481H | MY51020011 | -- | -- | 2022-05-30 | 2023-5-29 |
| 07 | Power Amplifier | ZHL | QA1202003 | -- | -- | 2022-05-30 | 2023-05-29 |
| 08 | Network Analyzer | E5071C | MY46212462 | A.10.0x | 8.0 | 2022-05-30 | 2023-5-29 |
| 09 | D835V2 | Dipole | 4d135 | -- | -- | 2020-10-14 | 2023-10-13 |
| 10 | D1900V2 | Dipole | 5d153 | -- | -- | 2020-10-14 | 2023-10-13 |
| 11 | D2450V2 | Dipole | 886 | -- | -- | 2020-10-14 | 2023-10-13 |

***END OF REPORT BODY***

# ANNEX A. GRAPH RESULTS

## GSM 850MHz Cheek Left

Date/Time: 2023/5/12
Electronics: DAE4 Sn797
Medium: Head 835MHz
Medium parameters used: f = 849 MHz; σ = 0.932S/m; εr = 42.13; ρ = 1000 kg/m3
Ambient Temperature:22.5°C    Liquid Temperature:22.1°C
Communication System: Generic GSM (0); Frequency: 848.8 MHz; Duty Cycle: 1:8.3
Probe: EX3DV4 - SN3844ConvF(9.96, 9.96, 9.96)
**Area Scan (8x14x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.314 W/kg
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.565 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 0.475 W/kg
**SAR(1 g) = 0.344 W/kg; SAR(10 g) = 0.235 W/kg**
Maximum value of SAR (measured) = 0.371 W/kg

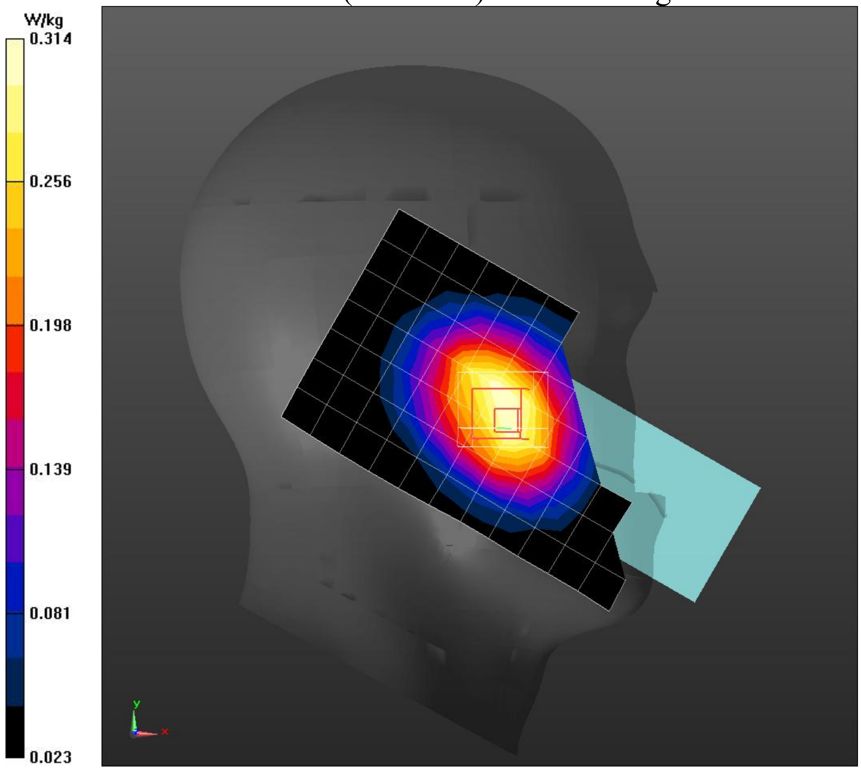



Fig A.1

**GSM 850MHz Body Rear**

Date/Time: 2023/5/12
Electronics: DAE4 Sn797
Medium: Head 835MHz
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.883S/m; εr = 41.836; ρ = 1000 kg/m3
Ambient Temperature:22.5°C Liquid Temperature:22.1°C
Communication System: Generic GSM (0); Frequency: 824.2 MHz; Duty Cycle: 1:2.67
Probe: EX3DV4 - SN3844ConvF(9.96, 9.96, 9.96)
**Area Scan (8x13x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.924 W/kg
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.82 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 1.74 W/kg
**SAR(1 g) = 0.901 W/kg; SAR(10 g) = 0.543 W/kg**
Maximum value of SAR (measured) = 0.771 W/kg

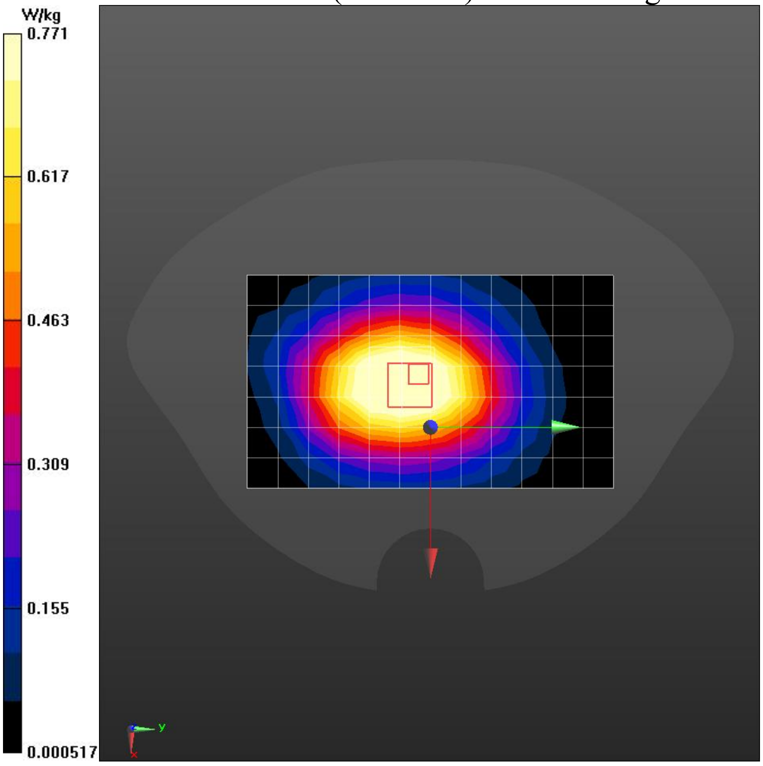
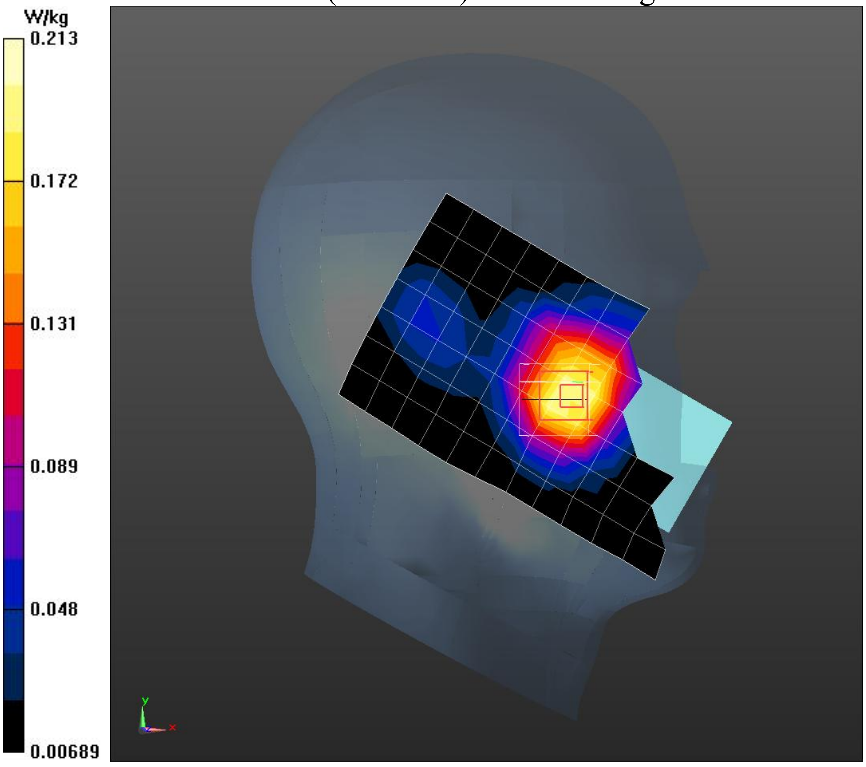



**Fig A.2**

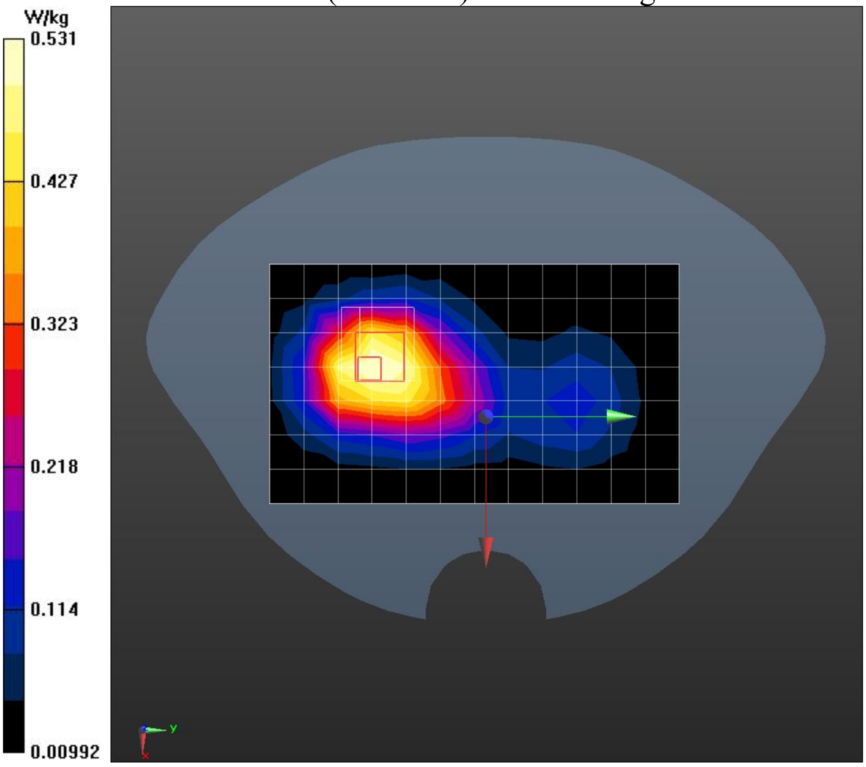
## PCS 1900MHz Cheek Left

Date/Time: 2023/5/13
Electronics: DAE4 Sn797
Medium: Head1900MHz
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.384 S/m; εr = 38.562; ρ = 1000 kg/m3
Ambient Temperature:22.5°C    Liquid Temperature:22.1°C
Communication System:  Generic GSM (0); Frequency: 1850.2 MHz; Duty Cycle: 1:8.3
Probe: EX3DV4 - SN3844ConvF(8.1, 8.1, 8.1)
**Area Scan (8x14x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.196 W/kg
**Zoom Scan (5x5x7)/Cube 0:**Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.201 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 0.281 W/kg
**SAR(1 g) = 0.202 W/kg; SAR(10 g) = 0.137 W/kg**
Maximum value of SAR (measured) = 0.213 W/kg



**PCS 1900MHz Body Rear**

Date/Time: 2023/5/13
Electronics: DAE4 Sn797
Medium: Head 1900MHz
Medium parameters used: f = 1880 MHz; σ = 1.384 S/m; εr = 38.562; ρ = 1000 kg/m3
Ambient Temperature:22.5°C    Liquid Temperature:22.1°C
Communication System:  Generic GSM (0); Frequency: 1880 MHz; Duty Cycle: 1:2.67
Probe: EX3DV4 - SN3844ConvF(8.1, 8.1, 8.1)
**Area Scan (8x13x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.547 W/kg
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.94 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.843 W/kg
**SAR(1 g) = 0.502 W/kg; SAR(10 g) = 0.309 W/kg**
Maximum value of SAR (measured) = 0.531 W/kg



## BT 2450MHz Cheek Right

Date/Time: 2023/5/15
Electronics: DAE4 Sn797
Medium: Head 2450MHz
Medium parameters used: f = 2402 MHz; σ = 1.886 S/m; εr = 40.446; ρ = 1000 kg/m3
Ambient Temperature:22.5°C  Liquid Temperature:22.1°C
Communication System: Bluetooth 2.4G (0); Frequency: 2402 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3844ConvF(7.69, 7.69, 7.69)
**Area Scan (10x17x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.0905 W/kg
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.9090 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 0.255 W/kg
**SAR(1 g) = 0.105 W/kg; SAR(10 g) = 0.043 W/kg**
Maximum value of SAR (measured) = 0.123 W/kg

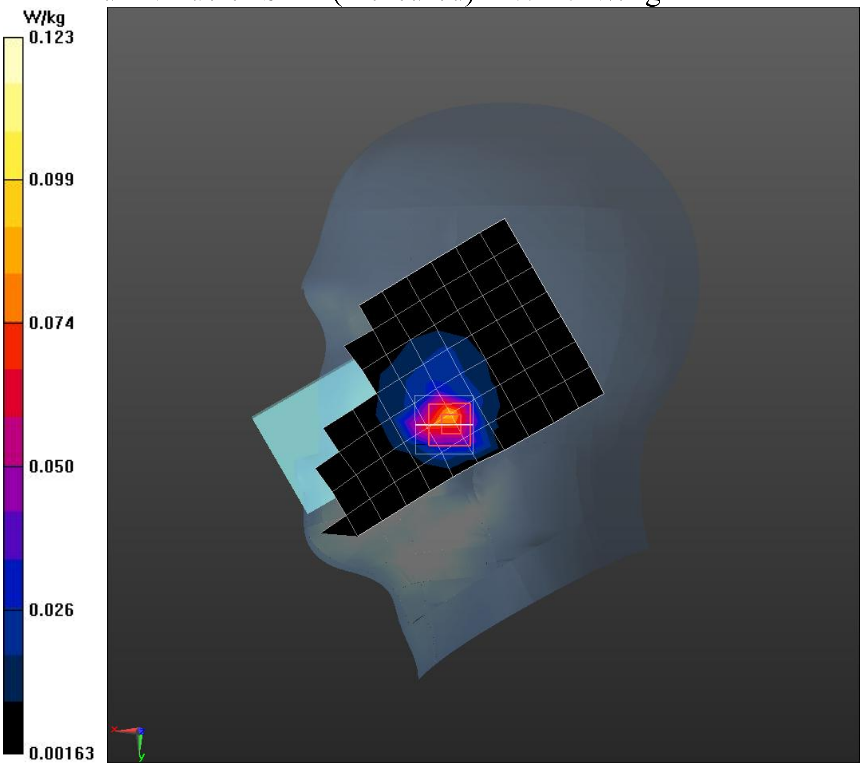



**Fig A.3**

**BT 2450MHz Body Front**
Date/Time: 2023/5/15
Electronics: DAE4 Sn797
Medium: Head 2450MHz
Medium parameters used: f = 2402 MHz; σ = 1.886 S/m; εr = 40.446; ρ = 1000 kg/m3
Ambient Temperature:22.5°C    Liquid Temperature:22.1°C
Communication System: Bluetooth 2.4G (0); Frequency: 2402 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3844ConvF(7.69, 7.69, 7.69)
**Area Scan (10x17x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.0135 W/kg
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.847 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 0.0370 W/kg
**SAR(1 g) = 0.012 W/kg; SAR(10 g) = 0.007W/kg**
Maximum value of SAR (measured) = 0.0139 W/kg

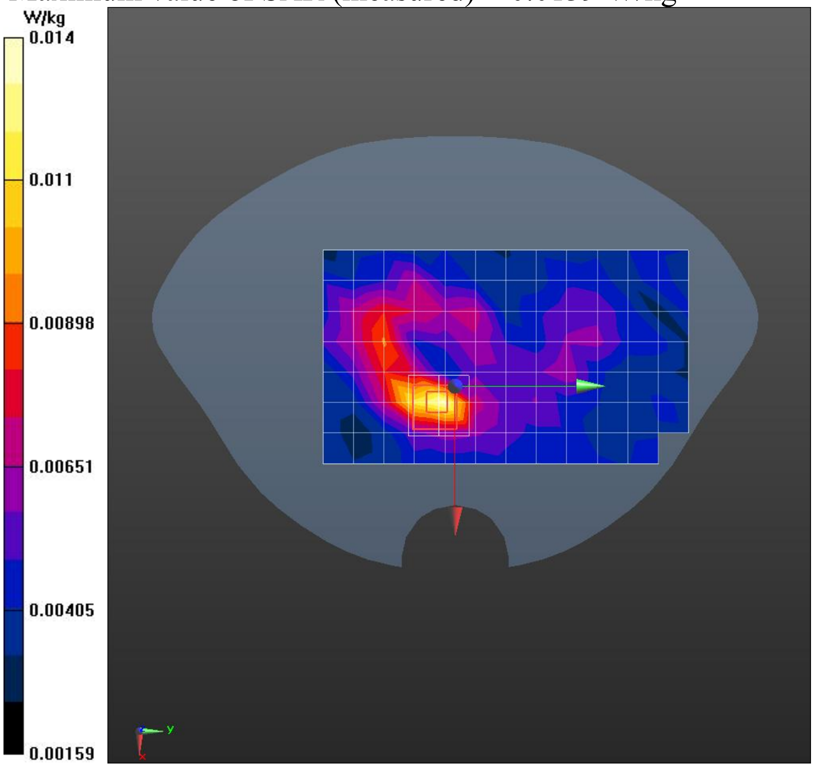
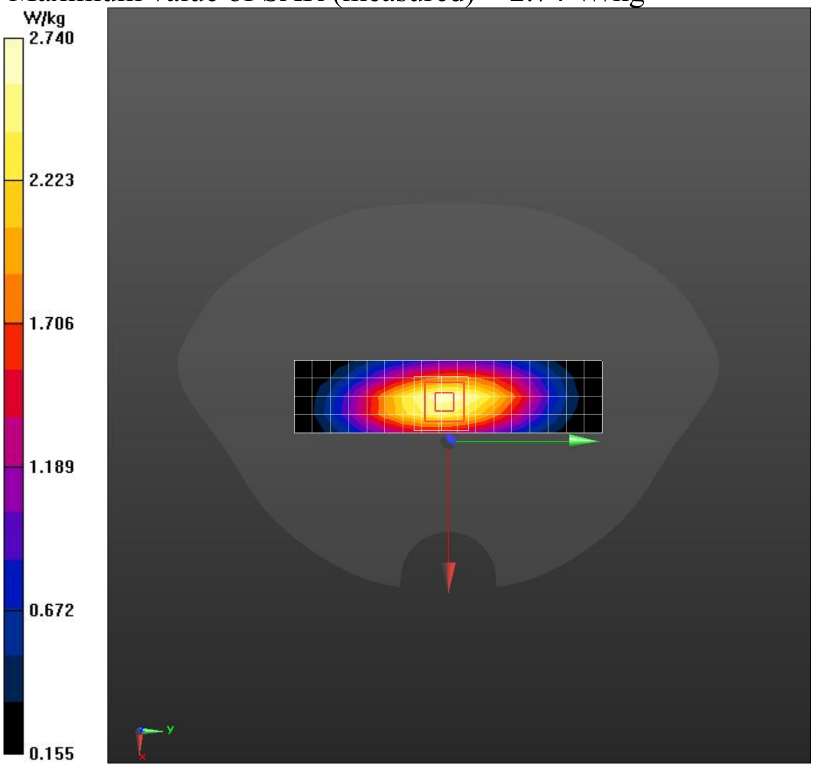



Fig A.4

# ANNEX B. SYSTEM VALIDATION RESULTS

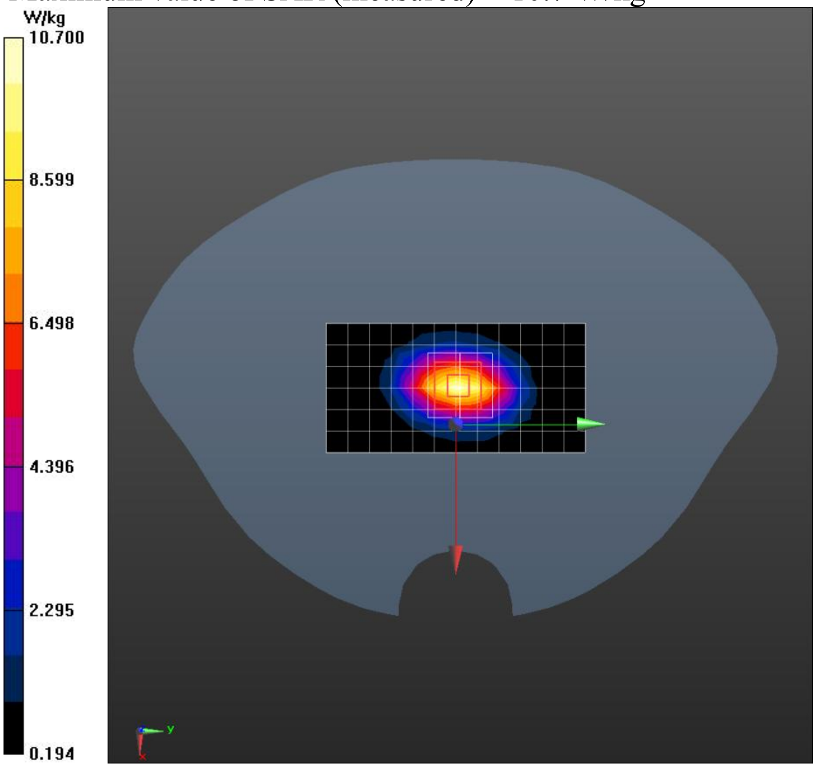
## System Validation 835MHz

Date/Time: 2023/5/12
Electronics: DAE4 Sn797
Medium: Head 835MHz
Medium parameters used: f = 835 MHz; σ = 0.904 S/m; εr = 41.963; ρ = 1000 kg/m3
Ambient Temperature:22.5°C  Liquid Temperature:22.1°C
Communication System: CW (0); Frequency: 835 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3844ConvF(9.96, 9.96, 9.96)
**Area Scan (5x18x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 2.67 W/kg
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.76 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 4.04 W/kg
**SAR(1 g) = 2.530 W/kg; SAR(10 g) = 1.570 W/kg**
Maximum value of SAR (measured) = 2.74 W/kg



## System Validation 1900MHz

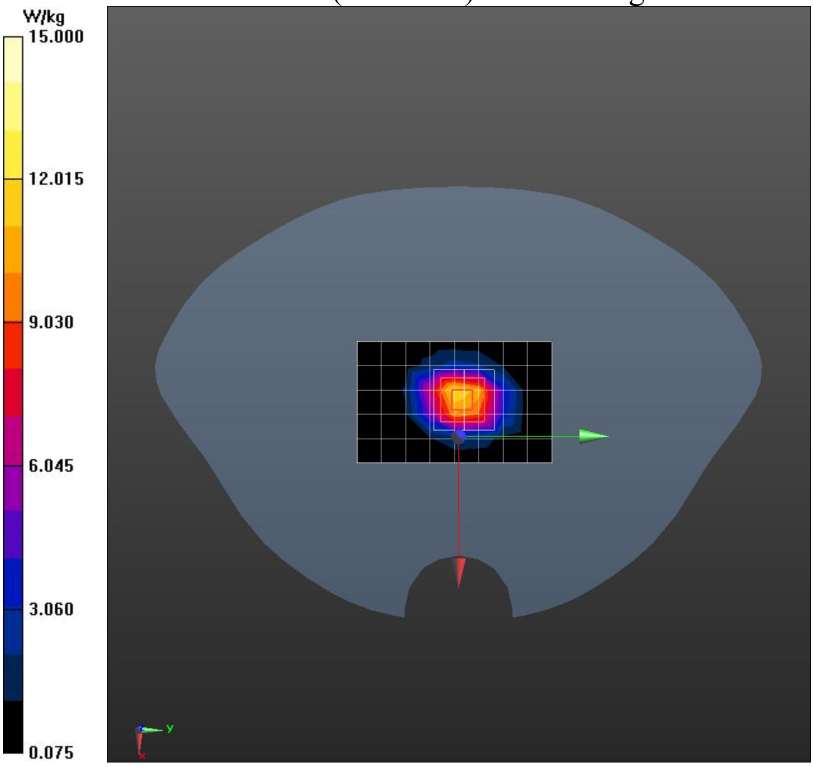
Date/Time: 2023/5/13
Electronics: DAE4 Sn797
Medium: Head 1900MHz
Medium parameters used: f = 1900 MHz; σ = 1.384 S/m; εr = 38.562; ρ = 1000 kg/m3
Ambient Temperature:22.5°C Liquid Temperature:22.1°C
Communication System: CW (0); Frequency: 1900 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3844ConvF(8.1, 8.1, 8.1)
**Area Scan (7x13x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 10.6 W/kg
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.59 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 18.0 W/kg
**SAR(1 g) = 9.460 W/kg; SAR(10 g) = 4.900 W/kg**
Maximum value of SAR (measured) = 10.7 W/kg




**Chongqing Academy of Information and Communication Technology**
Address: No. 8,Yuma Road, Chayuan New City, Nan'an District, Chongqing, P. R. China,401336
Tel: 0086-23-88069965 FAX:0086-23-88608777

## System Validation 2450MHz

Date/Time: 2023/5/15
Electronics: DAE4 Sn797
Medium: 2400-2500MHZ
Medium parameters used: f = 2450 MHz; σ = 1.886 S/m; εr = 40.446; ρ = 1000 kg/m3
Ambient Temperature:22.5°C    Liquid Temperature:22.1°C
Communication System: CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3844ConvF(7.69, 7.69, 7.69)
**Area Scan (6x9x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 12.2 W/kg
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.91 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 29.2 W/kg
**SAR(1 g) = 13.200 W/kg; SAR(10 g) = 5.980 W/kg**
Maximum value of SAR (measured) = 15.0 W/kg



# ANNEX C. CALIBRATION REPORT

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

中国认可 国际互认 校准 CALIBRATION CNAS L0570

Client : CATR(Chongqing) Certificate No: Z22-60163

## CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | DAE4 - SN: 797 |
| Calibration Procedure(s) | FF-Z11-002-01<br>Calibration Procedure for the Data Acquisition Electronics (DAEx) |
| Calibration date: | May 17, 2022 |

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Process Calibrator 753 | 1971018 | 15-Jun-21 (CTTL, No.J21X04465) | Jun-22 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Yu Zongying | SAR Test Engineer | |
| Reviewed by: | Lin Hao | SAR Test Engineer | |
| Approved by: | Qi Dianyuan | SAR Project Leader | |

Issued: May 23, 2022

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z22-60163 Page 1 of 3

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

**Glossary:**

| | |
|---|---|
| DAE | data acquisition electronics |
| Connector angle | information used in DASY system to align probe sensor X to the robot coordinate system. |

**Methods Applied and Interpretation of Parameters:**

- *DC Voltage Measurement*: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

## DC Voltage Measurement

A/D - Converter Resolution nominal
High Range: 1LSB = 6.1μV , full range = -100...+300 mV
Low Range: 1LSB = 61nV , full range = -1.......+3mV
DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X | Y | Z |
|---|---|---|---|
| High Range | 403.835 ± 0.15% (k=2) | 404.092 ± 0.15% (k=2) | 403.825 ± 0.15% (k=2) |
| Low Range | 3.95845 ± 0.7% (k=2) | 3.96789 ± 0.7% (k=2) | 3.97952 ± 0.7% (k=2) |

## Connector Angle

| | |
|---|---|
| Connector Angle to be used in DASY system | 43° ± 1 ° |

TTL In Collaboration with speag CALIBRATION LABORATORY
Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: cttl@chinattl.com http://www.caict.ac.cn

ilac-MRA CNAS 中国认可 国际互认 校准 CALIBRATION CNAS L0570 CAICT

Client CATR(Chongqing) Certificate No: Z22-60227

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | EX3DV4 - SN : 3844 |
| Calibration Procedure(s) | FF-Z11-004-02<br>Calibration Procedures for Dosimetric E-field Probes |
| Calibration date: | July 08, 2022 |

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date(Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power Meter NRP2 | 101919 | 14-Jun-22(CTTL, No.J22X04181) | Jun-23 |
| Power sensor NRP-Z91 | 101547 | 14-Jun-22(CTTL, No.J22X04181) | Jun-23 |
| Power sensor NRP-Z91 | 101548 | 14-Jun-22(CTTL, No.J22X04181) | Jun-23 |
| Reference 10dBAttenuator | 18N50W-10dB | 20-Jan-21(CTTL, No.J21X00486) | Jan-23 |
| Reference 20dBAttenuator | 18N50W-20dB | 20-Jan-21(CTTL, No.J21X00485) | Jan-23 |
| Reference Probe EX3DV4 | SN 7464 | 26-Jan-22(SPEAG, No.EX3-7464_Jan22) | Jan-23 |
| DAE4 | SN 1555 | 20-Aug-21(SPEAG, No.DAE4-1555_Aug21/2) | Aug-22 |
| **Secondary Standards** | **ID #** | **Cal Date(Calibrated by, Certificate No.)** | **Scheduled Calibration** |
| SignalGenerator MG3700A | 6201052605 | 14-Jun-22(CTTL, No.J22X04182) | Jun-23 |
| Network Analyzer E5071C | MY46110673 | 14-Jan-22(CTTL, No.J22X00406) | Jan-23 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Yu Zongying | SAR Test Engineer | |
| Reviewed by: | Lin Hao | SAR Test Engineer | |
| Approved by: | Qi Dianyuan | SAR Project Leader | |

Issued: July 20, 2022

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: cttl@chinattl.com http://www.caict.ac.cn

**Glossary:**

| | |
|---|---|
| TSL | tissue simulating liquid |
| NORMx,y,z | sensitivity in free space |
| ConvF | sensitivity in TSL / NORMx,y,z |
| DCP | diode compression point |
| CF | crest factor (1/duty_cycle) of the RF signal |
| A,B,C,D | modulation dependent linearization parameters |
| Polarization Φ | Φ rotation around probe axis |
| Polarization θ | θ rotation around an axis that is in the plane normal to probe axis (at measurement center), θ=0 is normal to probe axis |
| Connector Angle | information used in DASY system to align probe sensor X to the robot coordinate system |

**Calibration is Performed According to the Following Standards:**

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Methods Applied and Interpretation of Parameters:**

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the $E^2$-field uncertainty inside TSL (see below ConvF).
- *NORM(f)x,y,z = NORMx,y,z* frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- *Ax,y,z; Bx,y,z; Cx,y,z;VRx,y,z:*A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).



**Chongqing Academy of Information and Communication Technology**
Address: No. 8,Yuma Road, Chayuan New City, Nan'an District, Chongqing, P. R. China,401336
Tel: 0086-23-88069965 FAX:0086-23-88608777

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: cttl@chinattl.com http://www.caict.ac.cn

# DASY/EASY – Parameters of Probe: EX3DV4 – SN:3844

## Basic Calibration Parameters

| | Sensor X | Sensor Y | Sensor Z | Unc (*k*=2) |
|---|---|---|---|---|
| Norm(μV/(V/m)$^2$)[A] | 0.49 | 0.41 | 0.19 | ±10.0% |
| DCP(mV)[B] | 103.0 | 101.8 | 97.3 | |

## Modulation Calibration Parameters

| UID | Communication System Name | | A dB | B dB√μV | C | D dB | VR mV | Unc[E] (*k*=2) |
|---|---|---|---|---|---|---|---|---|
| 0 | CW | X | 0.0 | 0.0 | 1.0 | 0.00 | 162.7 | ±2.5% |
| | | Y | 0.0 | 0.0 | 1.0 | | 144.4 | |
| | | Z | 0.0 | 0.0 | 1.0 | | 85.6 | |

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor *k*=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X, Y, Z do not affect the $E^2$-field uncertainty inside TSL (see Page 4).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



Chongqing Academy of Information and Communication Technology
Address: No. 8,Yuma Road, Chayuan New City, Nan'an District, Chongqing, P. R. China,401336
Tel: 0086-23-88069965 FAX:0086-23-88608777

In Collaboration with
speag
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: cttl@chinattl.com http://www.caict.ac.cn

# DASY/EASY – Parameters of Probe: EX3DV4 – SN:3844

## Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz][C] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha[G] | Depth[G] (mm) | Unct. (k=2) |
|---|---|---|---|---|---|---|---|---|
| 750 | 41.9 | 0.89 | 9.96 | 9.96 | 9.96 | 0.21 | 1.17 | ±12.1% |
| 900 | 41.5 | 0.97 | 9.55 | 9.55 | 9.55 | 0.29 | 1.00 | ±12.1% |
| 1750 | 40.1 | 1.37 | 8.50 | 8.50 | 8.50 | 0.24 | 1.03 | ±12.1% |
| 1900 | 40.0 | 1.40 | 8.10 | 8.10 | 8.10 | 0.24 | 1.01 | ±12.1% |
| 2100 | 39.8 | 1.49 | 8.18 | 8.18 | 8.18 | 0.23 | 1.18 | ±12.1% |
| 2300 | 39.5 | 1.67 | 7.95 | 7.95 | 7.95 | 0.65 | 0.67 | ±12.1% |
| 2450 | 39.2 | 1.80 | 7.69 | 7.69 | 7.69 | 0.65 | 0.68 | ±12.1% |
| 2600 | 39.0 | 1.96 | 7.49 | 7.49 | 7.49 | 0.65 | 0.67 | ±12.1% |
| 3300 | 38.2 | 2.71 | 7.24 | 7.24 | 7.24 | 0.46 | 0.96 | ±13.3% |
| 3500 | 37.9 | 2.91 | 7.00 | 7.00 | 7.00 | 0.48 | 0.97 | ±13.3% |
| 3700 | 37.7 | 3.12 | 6.78 | 6.78 | 6.78 | 0.43 | 1.03 | ±13.3% |
| 3900 | 37.5 | 3.32 | 6.74 | 6.74 | 6.74 | 0.40 | 1.25 | ±13.3% |
| 5250 | 35.9 | 4.71 | 5.48 | 5.48 | 5.48 | 0.55 | 1.17 | ±13.3% |
| 5600 | 35.5 | 5.07 | 4.96 | 4.96 | 4.96 | 0.60 | 1.16 | ±13.3% |
| 5750 | 35.4 | 5.22 | 5.01 | 5.01 | 5.01 | 0.55 | 1.22 | ±13.3% |

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

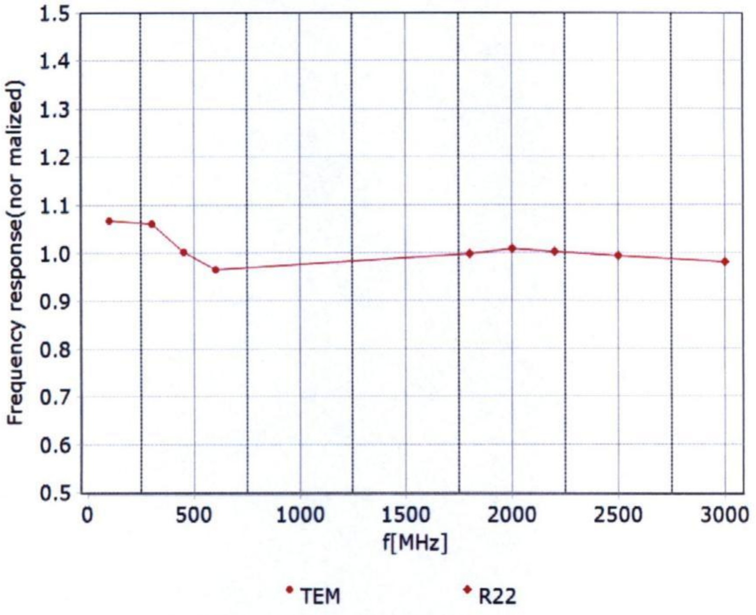
[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: cttl@chinattl.com http://www.caict.ac.cn

## Frequency Response of E-Field
### (TEM-Cell: ifi110 EXX, Waveguide: R22)



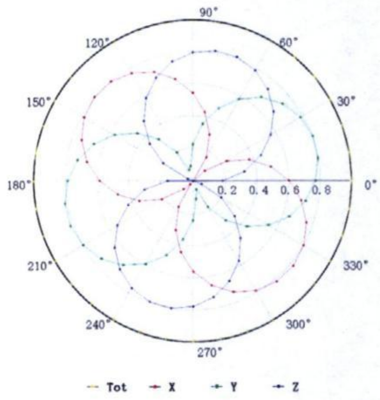

**Uncertainty of Frequency Response of E-field: ±7.4% (*k*=2)**

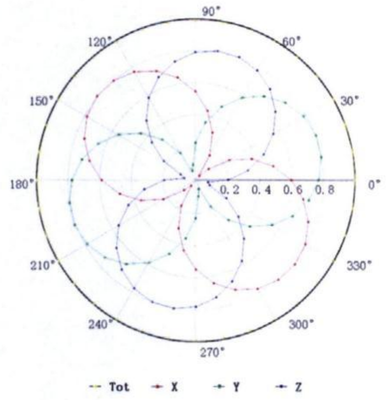
In Collaboration with
s p e a g
CALIBRATION LABORATORY

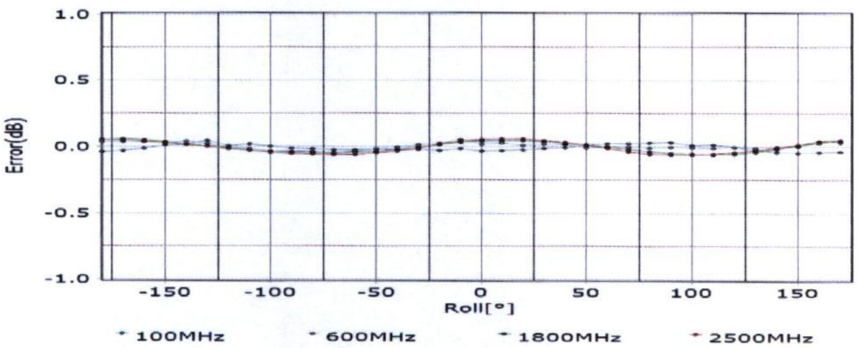
Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: cttl@chinattl.com http://www.caict.ac.cn

# Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM f=1800 MHz, R22



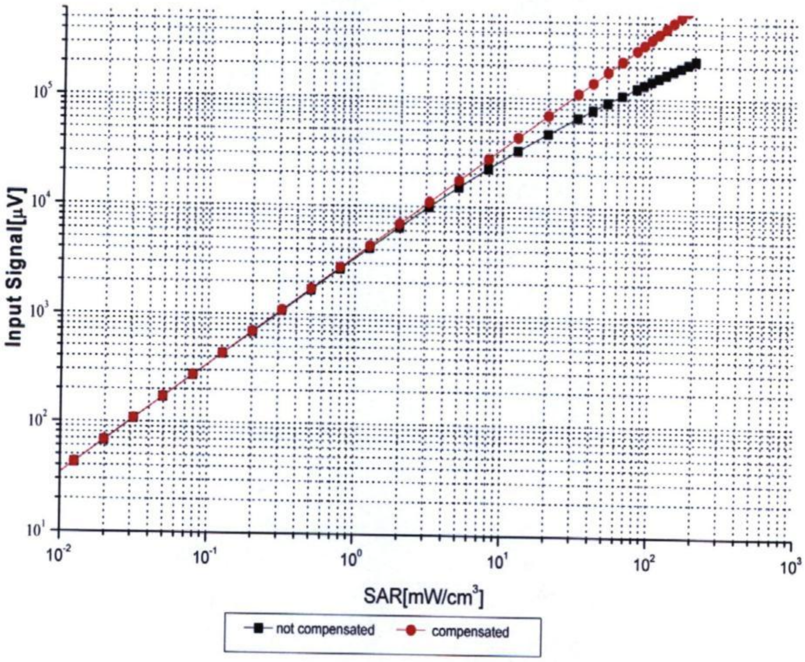

Uncertainty of Axial Isotropy Assessment: ±1.2% ($k$=2)

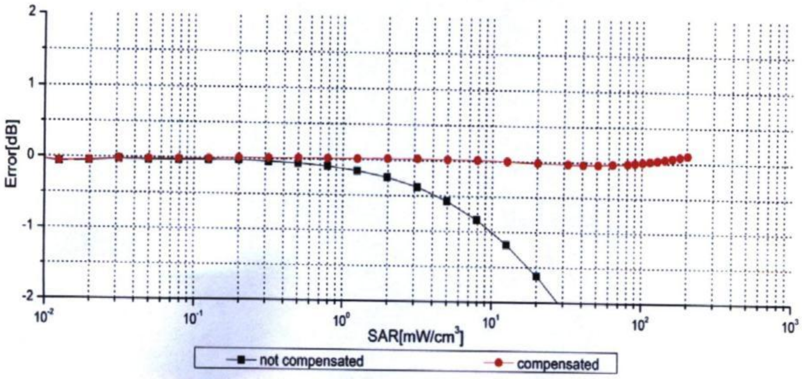
Certificate No:Z22-60227 Page 6 of 9

In Collaboration with
speag
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: cttl@chinattl.com http://www.caict.ac.cn

## Dynamic Range f(SAR$_{head}$)
## (TEM cell, f = 900 MHz)




**Uncertainty of Linearity Assessment: ±0.9% (*k*=2)**

Certificate No:Z22-60227 Page 7 of 9