## ANSI/IEEE Std. C95.1-1992
## In accordance with the requirements of FCC Report and Order:
## ET Docket 93-62；FCC 47 CFR Part 2 ( 2.1093)

# FCC SAR TEST REPORT

**For**

**Product Name:** GSM FIXED WIRELESS PHONE
**Brand Name:** AKUA
**Model No.:** DESK66
**Series Model:** N/A
**Test Report Number:** C180320S01-SF

**Issued for**

**Aqua Trading (Shenzhen) Limited**
**No.22D, NEO Building Block B, No.6011.Shennan aven., Shenzhen, China.**

**Issued by**

**Compliance Certification Services Inc.**
**Kun Shan Laboratory**
**No.10 Weiye Rd., Innovation park, Eco&Tec,**
**Development Zone, Kunshan City, Jiangsu, China**
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TESTING CERT #2541.01

# Revision History

| Revision | REPORT No. | Date | Page Revised | Contents |
|---|---|---|---|---|
| Original | C180320S01-SF | March 28, 2018 | N/A | N/A |

## TABLE OF CONTENTS

# 1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

| | |
|---|---|
| **Product Name:** | GSM FIXED WIRELESS PHONE |
| **Brand Name:** | AKUA |
| **Model Name.:** | DESK66 |
| **Series Model:** | N/A |
| **Devices supporting GPRS/EDGE：** | N/A |
| **Description Test Modes(worst case ):** | SIM Card |
| **Device Category:** | Protable DEVICES |
| **Exposure Category:** | GENERAL POPULATION/UNCONTROLLED EXPOSURE |
| **Date of Test:** | March 26, 2018 |
| **Applicant:**<br>**Address:** | **Aqua Trading (Shenzhen) Limited**<br>No.22D, NEO Building Block B, No.6011.Shennan aven., Shenzhen, China. |
| **Manufacturer:**<br>**Address:** | **Aqua Trading (Shenzhen) Limited**<br>No.22D, NEO Building Block B, No.6011.Shennan aven., Shenzhen, China. |
| **Application Type:** | Certification |

**APPLICABLE STANDARDS AND TEST PROCEDURES**

| STANDARDS AND TEST PROCEDURES | TEST RESULT |
|---|---|
| KDB 865664 D01 | No non-compliance noted |

**Deviation from Applicable Standard**

None

The device was tested by Compliance Certification Services Inc. in accordance with the measurement methods and procedures specified in KDB 865664 The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

| ***Approved by:*** | ***Tested by:*** |
|---|---|
| Jeff fang | Sam. ye. |
| Jeff.fang<br>RF Manager<br>Compliance Certification Services Inc. | Sam.ye<br>Test Engineer<br>Compliance Certification Services Inc. |

## 2. EUT DESCRIPTION

| | |
|---|---|
| **Product Name:** | GSM FIXED WIRELESS PHONE |
| **Brand Name:** | AKUA |
| **Model Name.:** | DESK66 |
| **Series Model:** | N/A |
| **Model Discrepancy:** | N/A |
| **FCC ID:** | 2AGE2-DESK66 |
| **Software version** | G611M_FWP_YTL_SINGLE_6688_0001 |
| **Hardware version** | 0.2 2017/08/29 |
| **IMEI:** | 354043090223690 |
| **Power reduction:** | NO0.2 2017/08/29 |
| **DTM Description:** | N/A |
| **Device Category:** | Production unit |
| **Frequency Range:** | GSM 850: 824.2 ~ 848.8 MHz<br>GSM1900: 1850.2 ~ 1909.8 MHz |
| **Max. Reported SAR(1g):** | Body:<br>GSM 850: 1.171 W/kg<br>GSM1900: 1.097 W/kg |
| **Modulation Technique:** | GSM: GMSK |
| **Accessories:** | Battery(rating):<br>Model:Desk66-010318<br>Capacitance: 800 mAh(2.96Wh)<br>Rated Voltage: 3.7 V |
| **Antenna Specification:** | GSM: Dipole Antenna |
| **Operating Mode:** | Maximum continuous output |
| **Remark**：The product details information please refer to the product specification | |

# 3. REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC

The US Federal Communications Commission has released the report and order “Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 W/Kg for an uncontrolled environment and 8.0 W/Kg for an occupational/controlled environment as recommended by the ANSI/IEEE standard C95.1-1992.

# 4. TEST METHODOLOGY

The Specific Absorption Rate (SAR) testing specification, method and procedure for this device is in accordance with the following standards:

☒ FCC 47 CFR Part 2 ( 2.1093)
☒ ANSI/IEEE C95.1-1992
☒ IEEE 1528-2013
☒ KDB 447498 D01v06 General RF Exposure Guidance
☒ KDB 865664 D01v01r04 Measurement 100 MHz to 6 GHz
☒ KDB 865664 D02 v01r02 RF Exposure Reporting

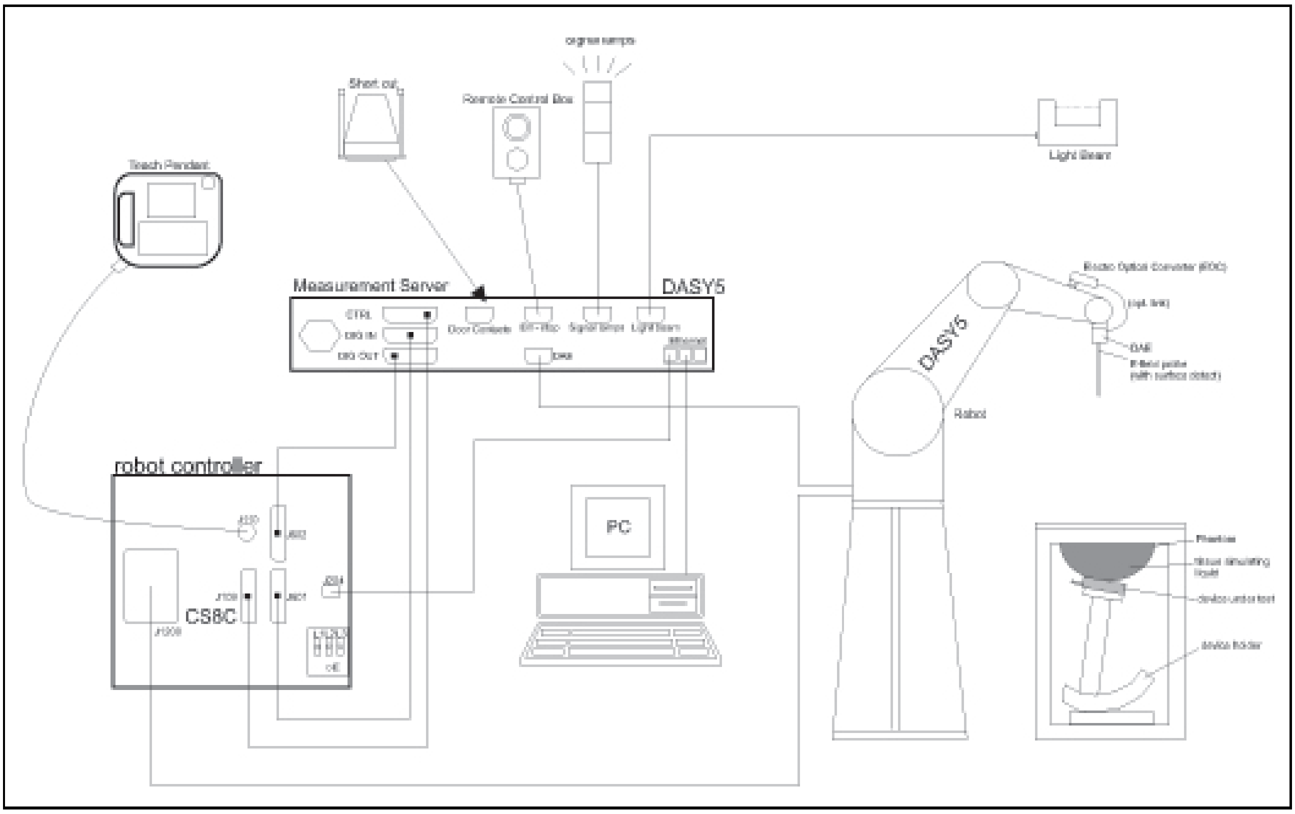
# 5. TEST CONFIGURATION

For WWAN SAR testing The device was controlled by using a base station emulator R&S CMU200. Communication between the device and the emulator was established by air link. The distance between the DUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of DUT. The DUT was set from the emulator to radiate maximum output power during all tests.

# 6. DOSIMETRIC ASSESSMENT SETUP

These measurements were performed with the automated near-field scanning system DASY 5 from SPEAG. The system is based on a high precision robot (working range greater than 0.9 m), which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the E-field PROBE EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [7] with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in [8] and found to be better than ±0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEEE 1528 and CENELEC EN 62209.

## 6.1 MEASUREMENT SYSTEM DIAGRAM



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

- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- 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 between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected 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.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7.
- DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

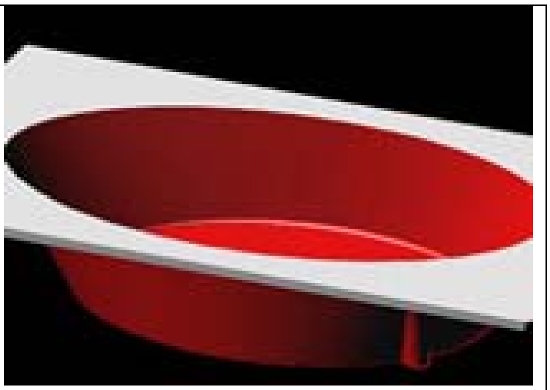
•

## 6.2 SYSTEM COMPONENTS

| | |
|---|---|
|  | The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV celeron, 128MB chip-disk and 128 MB RAM. The necessary circuits for communication with either the DAE4(or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board.<br>The measurement server performs all real-time data evaluation for 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 two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required. |
| **Data Acquisition Electronics (DAE)** | |
|  | The data acquisition electronics (DAE4) consists 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 and 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 DAE4 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB. |
| **EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements** | |

| | |
|---|---|
|  | **Construction:** Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE)<br>**Calibration:** Basic Broad Band Calibration in air: 10-3000 MHz.<br>Conversion Factors (CF) for HSL 900 and HSL 1800<br>CF-Calibration for other liquids and frequencies upon request.<br>**Frequency:** 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)<br>**Directivity:** ± 0.3 dB in HSL (rotation around probe axis)<br>± 0.5 dB in HSL (rotation normal to probe axis)<br>**Dynamic Range:** 10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB<br>(noise: typically < 1 µW/g) |

| | |
|---|---|
| **Dimensions:** Overall length: 337 mm (Tip: 9 mm)<br>Tip diameter: 2.5 mm (Body: 10 mm)<br>Distance from probe tip to dipole centers: 1 mm<br>**Application:** High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%. | <br>Interior of probe |
| **SAM Twin Phantom** | |
| **Construction:**<br>The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50360 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.<br>**Shell Thickness:** 2 ±0.2 mm<br>**Filling Volume:** Approx. 25 liters<br>**Dimensions:** Height: 850mm; Length: 1000mm; Width: 750mm |  |
| **SAM Phantom (ELI4 v4.0)** | |

| | |
|---|---|
| **Description Construction:**<br>Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY4/DASY5.5 and higher and is compatible with all SPEAG dosimetric probes and dipoles<br>**Shell Thickness:** 2.0 ± 0.2 mm (sagging: <1%)<br>**Filling Volume:** Approx. 25 liters<br>**Dimensions:** Major ellipse axis: 600 mm<br>**Minor axis:** 400 mm 500mm |  |

| **Device Holder for SAM Twin Phantom** | |
|---|---|
| **Construction:** In combination with the Twin SAM Phantom, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom). |  |
| **System Validation Kits for SAM Twin Phantom** | |
| **Construction:** Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.<br>**Frequency:** 900,1800,2450,5800 MHz<br>**ReTune loss:** > 20 dB at specified validation position<br>**Power capability:** > 100 W (f < 1GHz); > 40 W (f > 1GHz)<br>**Dimensions:**<br>D835V2: dipole length: 161 mm; overall height: 340 mm<br>D1800V2: dipole length: 72.5 mm; overall height: 300 mm<br>D1900V2: dipole length: 67.7 mm; overall height: 300 mm<br>D2450V2: dipole length: 51.5 mm; overall height: 290 mm<br>D5GHzV2: dipole length: 20.6 mm; overall height: 300mm |  |
| **System Validation Kits for ELI4 phantom** | |

| | | |
|---|---|---|
| **Construction:** | Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor. |  |
| **Frequency:** | 900, 1800, 2450, 5800 MHz | |
| **ReTune loss:** | > 20 dB at specified validation position | |
| **Power capability:** | > 100 W (f < 1GHz); > 40 W (f > 1GHz) | |
| **Dimensions:** | D835V2: dipole length: 161 mm; overall height: 340 mm<br>D1800V2: dipole length: 72.5 mm; overall height: 300 mm<br>D1900V2: dipole length: 67.7 mm; overall height: 300 mm<br>D2450V2: dipole length: 51.5 mm; overall height: 290 mm<br>D5GHzV2: dipole length: 20.6 mm; overall height:300 mm | |

# 7. EVALUATION PROCEDURES

**DATA EVALUATION**

The DASY 5 post processing 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 | $Norm_i$, $a_{i0}$, $a_{i1}$, $a_{i2}$ |
| | - Conversion factor | $ConvF_i$ |
| | - Diode compression point | $dcp_i$ |
| Device parameters: | - Frequency | $f$ |
| | - Crest factor | $cf$ |
| Media parameters: | - Conductivity | $\sigma$ |
| | - Density | $\rho$ |

These parameters must be set correctly in the software. They can be found in the component documents or be imported into the software from the configuration files issued for the DASY 5 components. In the direct measuring mode of the multi-meter 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:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with $V_i$ = Compensated signal of channel i (i = x, y, z)
$U_i$ = Input signal of channel i (i = x, y, z)
$cf$ = Crest factor of exciting field (DASY 5 parameter)
$dcp_i$ = Diode compression point (DASY 5 parameter)

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

E-field probes:

$$E_i = \sqrt{\frac{V_i}{Norm_i \bullet ConvF}}$$

H-field probes:

$$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

with $V_i$ = Compensated signal of channel i (i = x, y, z)
$Norm_i$ = Sensor sensitivity of channel i (i = x, y, z)
μV/(V/m)$^2$ for E0field Probes
$ConvF$ = Sensitivity enhancement in solution
$aij$ = Sensor sensitivity factors for H-field probes
$f$ = Carrier frequency (GHz)
$Ei$ = Electric field strength of channel i in V/m
$Hi$ = Magnetic field strength of channel i in A/m

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

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with $SAR$ = local specific absorption rate in mW/g

$E_{tot}$ = total field strength in V/m

$\sigma$ = conductivity in [mho/m] or [Siemens/m]

$\rho$ = equivalent tissue density in g/cm$^3$

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

The power flow density is calculated assuming the excitation field as a free space field.

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

with $P_{pwe}$ = Equivalent power density of a plane wave in mW/cm$^2$

$E_{tot}$ = total electric field strength in V/m

$H_{tot}$ = total magnetic field strength in A/m

## SAR EVALUATION PROCEDURES

The procedure for assessing the peak spatial-average SAR value consists of the following steps:

- **Power Reference Measurement**

  The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

- **Area Scan**

  The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY 5 software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, grid was at to 15 mm by 15 mm and can be edited by a user.

- **Zoom Scan**

  Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

- **Power Drift measurement**

  The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have DASY 5 software stop the measurements if this limit is exceeded.

- **Z-Scan**

  The Z Scan job measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. A user can anchor the grid to the current probe location. As with any other grids, the local Z-axis of the anchor location establishes the Z-axis of the grid.

**SPATIAL PEAK SAR EVALUATION**

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1529 standard. It can be conducted for 1 g and 10 g.

The DASY 5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maximum searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

**Extrapolation**

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.

Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Cube Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 5x5x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1 g and 10 g cubes.

**Boundary effect**

For measurements in the immediate vicinity of a phantom surface, the field coupling effects between the probe and the boundary influence the probe characteristics. Boundary effect errors of different dosimetric probe types have been analyzed by measurements and using a numerical probe model. As expected, both methods showed an enhanced sensitivity in the immediate vicinity of the boundary. The effect strongly depends on the probe dimensions and disappears with increasing distance from the boundary. The sensitivity can be approximately given as:

$$S \approx S_o + S_b exp(-\frac{z}{a}) cos(\pi \frac{z}{\lambda})$$

Since the decay of the boundary effect dominates for small probes (a<<λ), the cos-term can be omitted. Factors *Sb* (parameter Alpha in the DASY 5 software) and *a* (parameter Delta in the DASY 5 software) are assessed during probe calibration and used for numerical compensation of the boundary effect. Several simulations and measurements have confirmed that the compensation is valid for different field and boundary configurations.

This simple compensation procedure can largely reduce the probe uncertainty near boundaries. It works well as long as:

- the boundary curvature is small
- the probe axis is angled less than 30_ to the boundary normal
- the distance between probe and boundary is larger than 25% of the probe diameter
- the probe is symmetric (all sensors have the same offset from the probe tip)

Since all of these requirements are fulfilled in a DASY 5 system, the correction of the probe boundary effect in the vicinity of the phantom surface is performed in a fully automated manner via the measurement data extraction during post processing.

# 8. MEASUREMENT UNCERTAINTY

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04,when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

# 9. EXPOSURE LIMIT

(A). Limits for Occupational/Controlled Exposure (W/kg)

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|---|---|---|
| 0.4 | 8.0 | 20.0 |

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

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

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

**Population/Uncontrolled Environments** are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

**Occupational/Controlled Environments** are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

**NOTE**
**GENERAL POPULATION/UNCONTROLLED EXPOSURE**
**PARTIAL BODY LIMIT**
**1.6 W/kg**

# 10. EUT ARRANGEMENT

Please refer to IEC62209 illustration below.

## 10.1 EUT TESTING POSITION

This EUT tests shall be performed if applicable in both the horizontal and vertical positions relative to the phantom, and with the antenna oriented away from the body of the DUT (Figure1) and/or with the antenna extended and retracted such as to obtain the highest exposure condition.

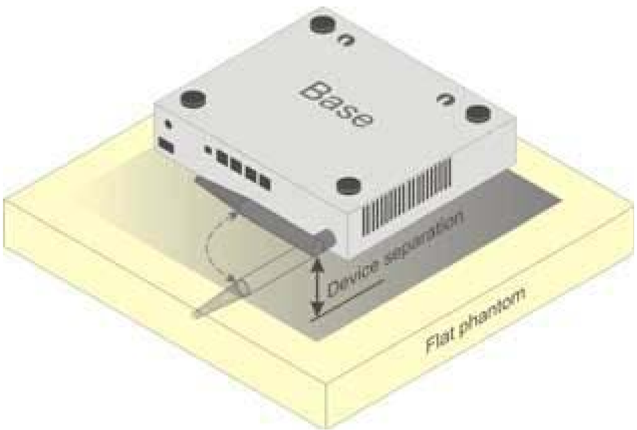



**Figure1 – Device with swivel antenna**

# 11. MEASUREMENT RESULTS

## 11.1 TEST LIQUIDS CONFIRMATION

### SIMULATED TISSUE LIQUID PARAMETER CONFIRMATION

The dielectric parameters were checked prior to assessment using the HP85070C dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

### KDB865664 D01 RECOMMENDED TISSUE DIELECTRIC PARAMETERS

The head and Body tissue dielectric parameters recommended by the KDB865664 D01 have been incorporated in the following table.

| Target Frequency (MHz) | Head | | Body | |
|---|---|---|---|---|
| | $\varepsilon_r$ | σ (S/m) | $\varepsilon_r$ | σ (S/m) |
| 150 | 52.3 | 0.76 | 61.9 | 0.80 |
| 300 | 45.3 | 0.87 | 58.2 | 0.92 |
| 450 | 43.5 | 0.87 | 56.7 | 0.94 |
| 835 | 41.5 | 0.90 | 55.2 | 0.97 |
| 900 | 41.5 | 0.97 | 55.0 | 1.05 |
| 915 | 41.5 | 0.98 | 55.0 | 1.06 |
| 1450 | 40.5 | 1.20 | 54.0 | 1.30 |
| 1610 | 40.3 | 1.29 | 53.8 | 1.40 |
| 1800-2000 | 40.0 | 1.40 | 53.3 | 1.52 |
| 2450 | 39.2 | 1.80 | 52.7 | 1.95 |
| 3000 | 38.5 | 2.40 | 52.0 | 2.73 |
| 5800 | 35.3 | 5.27 | 48.2 | 6.00 |

($\varepsilon_r$ = relative permittivity, σ = conductivity and ρ = 1000 $kg/m^3$)

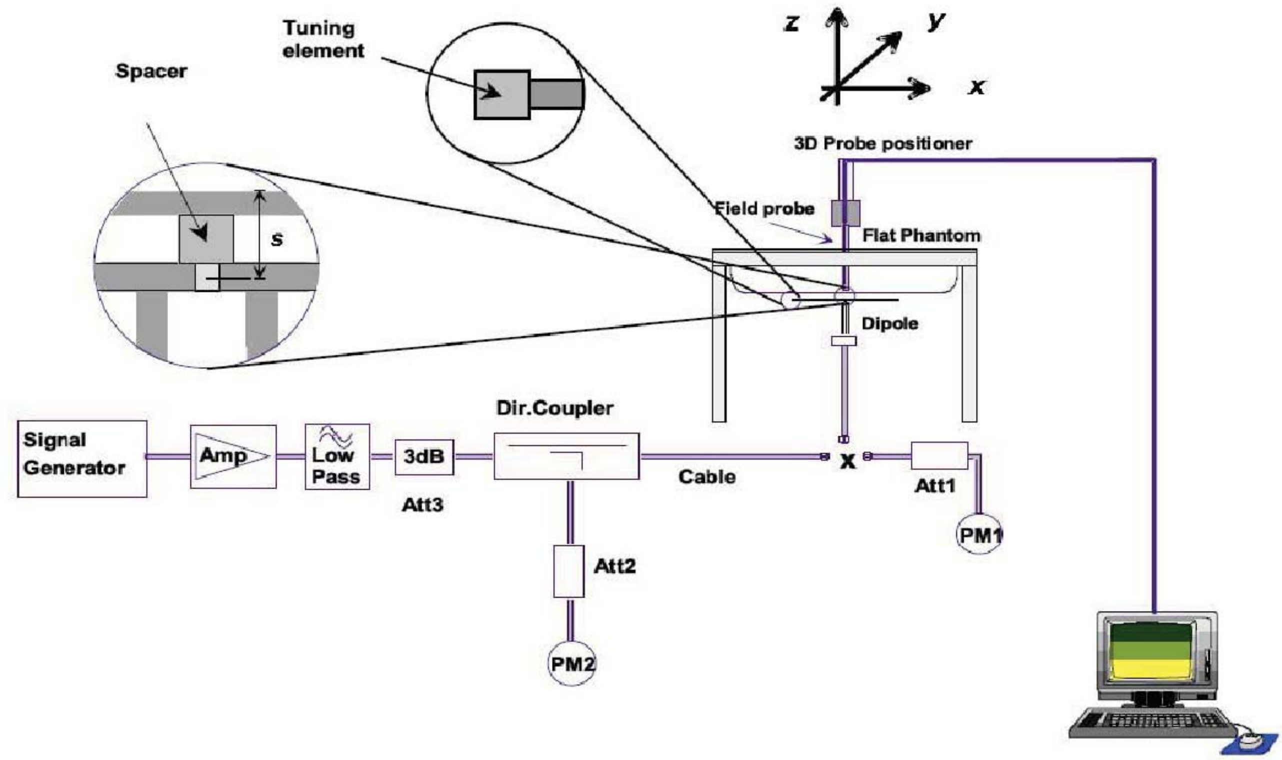
## 11.2 LIQUID MEASUREMENT RESULTS

**The following table show the measuring results for simulating liquid:**

| Liquid Type | Liquid Temp. (°C) | Parameters | Target | Measured | Deviation (%) | Limited (%) | Measured Date |
|---|---|---|---|---|---|---|---|
| Body835 | 21.5 | Permitivity(ε ) | 55.20 | 55.34 | 0.25 | ± 5 | 2018/3/26 |
| | | Conductivity(σ) | 0.97 | 0.98 | 0.62 | ± 5 | |
| Body1900 | 21.5 | Permitivity(ε ) | 53.30 | 52.32 | -1.84 | ± 5 | 2018/3/26 |
| | | Conductivity(σ) | 1.52 | 1.56 | 2.70 | ± 5 | |

## 11.3 SYSTEM PERFORMANCE CHECK

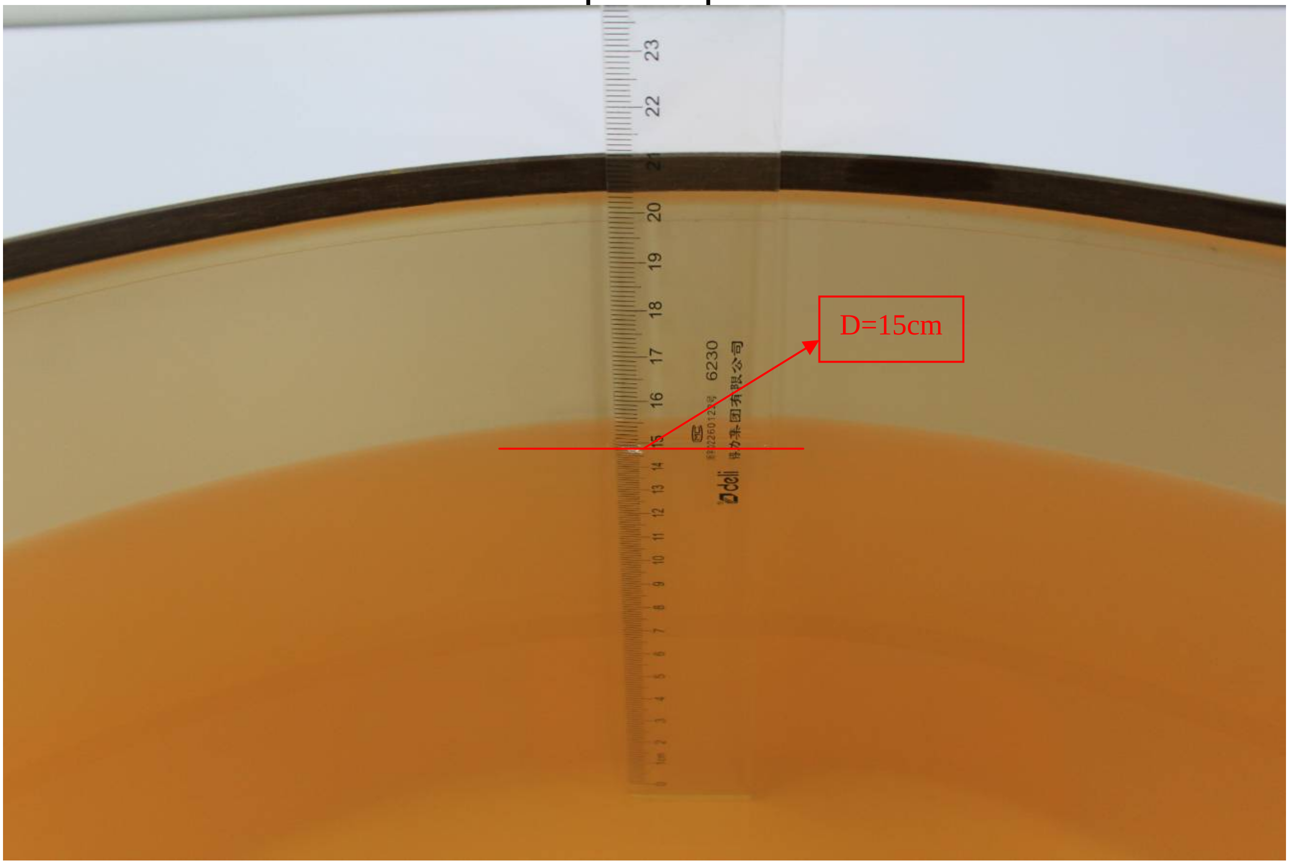
The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications of ±10%. The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.
System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.




### SYSTEM PERFORMANCE CHECK MEASUREMENT CONDITIONS

- The measurements were performed in the flat section of the SAM twin phantom filled with head and body simulating liquid of the following parameters.
- The DASY5 system withan E-fileld probe EX3DV4 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15 cm (below 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 10mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube integration (dx= 5 mm, dy= 5 mm, dz= 5 mm).
- Distance between probe sensors and phantom surface was set to 2 mm.
- The dipole input power was 250mW±3%.
- The results are normalized to 1 W input power.

**Depth of Liquid**



**The following table gives the recipes for tissue simulating liquids.**

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.

| Frequency | water | sugar | cellulose | Salt | bactericide | DGBE | conductivity | permittivity |
|---|---|---|---|---|---|---|---|---|
| For Head | | | | | | | | |
| 835 | 40.3 | 57.9 | 0.2 | 1.4 | 0.2 | 0 | 0.90 | 41.5 |
| 1800,1900,2000 | 55.2 | 0 | 0 | 0.3 | 0 | 44.5 | 1.40 | 40.0 |
| 2450 | 55.0 | 0 | 0 | 0 | 0 | 45.0 | 1.80 | 39.2 |
| For Body | | | | | | | | |
| 835 | 50.6 | 48.2 | 0.2 | 0.9 | 0.1 | 0 | 0.97 | 55.2 |
| 1800,1900,2000 | 70.2 | 0 | 0 | 0.4 | 0 | 29.4 | 1.52 | 53.3 |
| 2450 | 68.6 | 0 | 0 | 0 | 0 | 31.4 | 1.95 | 52.7 |

alt: 99+% Pure Sodium Chloride Sugar: 98+% Pure Sucrose
DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

**<Tissue Dielectric Parameter Check Results>**

| Liquid Type | Ambient Temp. (°C) | Liquid Temp. (°C) | Input Power (W) | Measured $SAR_{1g}$ (W/Kg) | 1W Target $SAR_{1g}$(W/Kg) | 1W Normalized $SAR_{1g}$(W/Kg) | Deviation (%) | Limited (%) | Date |
|---|---|---|---|---|---|---|---|---|---|
| Body835 | 22 | 21.5 | 0.25 | 2.42 | 9.59 | 9.68 | 0.94 | ± 10 | 2018-3-26 |
| Body1900 | 22 | 21.5 | 0.25 | 9.86 | 40.70 | 39.44 | -3.10 | ± 10 | 2018-3-26 |

## 11.4 EUT TUNE-UP PROCEDURES AND TEST MODE

The following procedure had been used to prepare the EUT for the SAR test.
To setup the desire channel frequency and the maximum output power. A Radio Communication Tester "CMU200 " was used to program the EUT.

**General Note:**

1. Per KDB 447498 D01, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. For head SAR testing, the EUT was set in GSM Voice for GSM850 and GSM1900 due to its highest frame-average power.

**GSM Conducted output power(dBm):**

| Band | GSM 850 | | | GSM 1900 | | |
|---|---|---|---|---|---|---|
| Channel | 128 | 190 | 251 | 512 | 661 | 810 |
| Frequency(MHz) | 824.2 | 836.6 | 848.8 | 1850.2 | 1880.0 | 1909.8 |
| Maximum Burst-Averaged Output Power | | | | | | |
| GSM(GMSK,1Uplink) | 32.40 | **32.51** | 32.44 | 28.69 | 28.64 | **28.78** |
| Maximum Frame-Averaged Output Power | | | | | | |
| GSM(GMSK,1Uplink) | 23.38 | 23.49 | 23.42 | 19.67 | 19.62 | 19.76 |

**Remark:** The frame-averaged power is linearly scaled the maximum burst-averaged power based on time slots. The calculated methods are shown as below:
Frame-averaged power = Burst-averaged power (1 Uplink) – 9.03 dBm
Frame-averaged power = Burst averaged power (2 Uplink) – 6.02 dBm
Frame-averaged power = Burst-averaged power (3 Uplink) – 4.26 dBm
Frame-averaged power = Burst averaged power (4 Uplink) – 3.01 dBm

**Note:**

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.

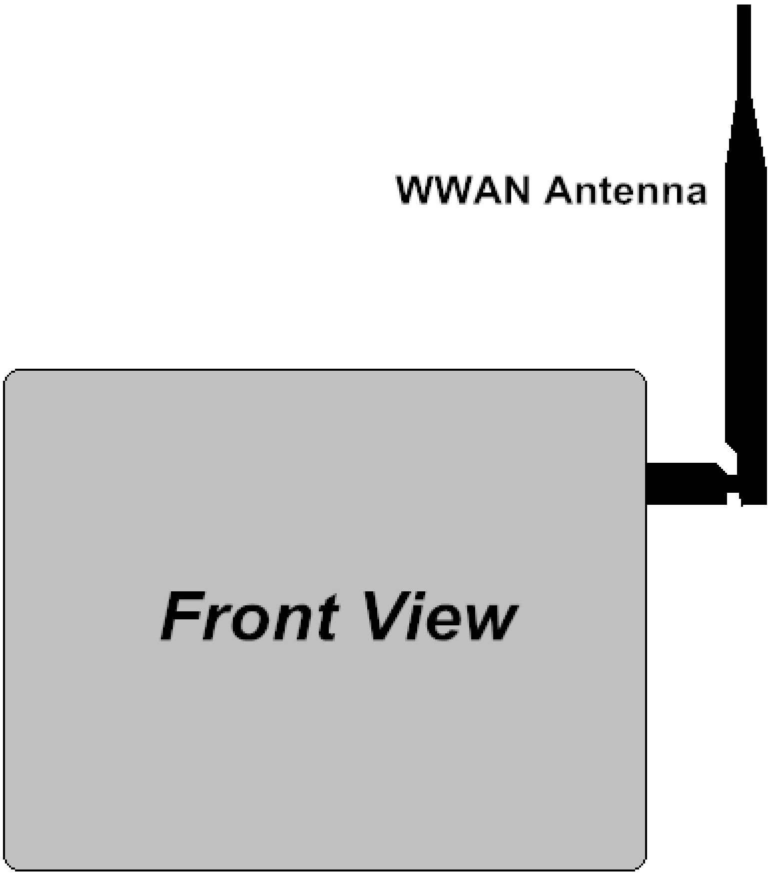
2. Per KDB 447498 D01, the maximum output power channel is used for SAR testing and for further SAR test reduction.

**Maximum Burst-Averaged output power for Product unit**

| Mode | The Tune-up Maximum Power(Customer Declared)(dBm) | Tune up limit | Measured Conduct Maximum Power(dBm) |
|---|---|---|---|
| GSM 850 | 32+/-1 | 33 | 32.51 |
| GSM 1900 | 28+/-1 | 29 | 28.78 |

So, they are in tune-up range and complied.

## 11.5 ANTENNA POSITION




| Antenna | Wireless Interface |
|---|---|
| WWAN Antenna | GSM850/GSM1900 |

**Test Mode**

| | |
|---|---|
| GSM 850/GSM1900 | Voice mode(GSM) |

## 11.6 EUT SETUP PHOTOS

## BODY SUPPORT TEST POSITION

| Body position Horizontal View | Body position Vertical View |
|---|---|
|  |  |
| **EUT Setup Configuration 1** | **EUT Setup Configuration 2** |
| **Body position Tip** | **Body position End** |
|  |  |
| **EUT Setup Configuration 3** | **EUT Setup Configuration 4** |

## 11.7 SAR MEASUREMENT RESULTS

### SAR for Body Test Records

| Band | Mode | Test Position | Dist. (mm) | Ch. | Freq. (MHZ) | max Power (dBm) | Tune-Up Limit (dBm) | Scaling Factor | Power Drift (dB) | SAR1g (mW/g) | Scaled SAR1g (mW/g) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GSM850 | GSM | Horizontal | 0 | 128 | 824.2 | 32.40 | 33 | 1.148 | -0.06 | 0.991 | 1.138 |
| GSM850 | GSM | Horizontal | 0 | 190 | 836.6 | 32.51 | 33 | 1.119 | -0.11 | 0.917 | 1.027 |
| GSM850 | GSM | Horizontal | 0 | 251 | 848.8 | 32.44 | 33 | 1.138 | -0.08 | 0.878 | 0.999 |
| GSM850 | GSM | Vertical | 0 | 190 | 836.6 | 32.51 | 33 | 1.119 | 0.03 | 0.673 | 0.753 |
| GSM850 | GSM | Tip | 0 | 190 | 836.6 | 32.51 | 33 | 1.119 | -0.08 | 0.030 | 0.034 |
| GSM850 | GSM | End | 0 | 190 | 836.6 | 32.51 | 33 | 1.119 | 0.10 | 0.100 | 0.112 |
| GSM1900 | GSM | Horizontal | 0 | 512 | 1850.2 | 28.69 | 29 | 1.074 | 0.09 | 0.905 | 0.972 |
| GSM1900 | GSM | Horizontal | 0 | 661 | 1880 | 28.64 | 29 | 1.086 | 0.05 | 1.01 | 1.097 |
| GSM1900 | GSM | Horizontal | 0 | 810 | 1909.8 | 28.78 | 29 | 1.052 | 0.14 | 1.04 | 1.094 |
| GSM1900 | GSM | Vertical | 0 | 810 | 1909.8 | 28.78 | 29 | 1.052 | -0.08 | 0.874 | 0.919 |
| GSM1900 | GSM | Tip | 0 | 810 | 1909.8 | 28.78 | 29 | 1.052 | -0.06 | 0.023 | 0.024 |
| GSM1900 | GSM | End | 0 | 810 | 1909.8 | 28.78 | 29 | 1.052 | 0.02 | 0.342 | 0.360 |

## Repeated SAR Test Records

| Band | Mode | Test Position | Dist. (mm) | Ch. | Freq. (MHZ) | max Power (dBm) | Tune-Up Limit (dBm) | Scaling Factor | Power Drift (dB) | SAR1g (mW/g) | Scaled SAR1g (mW/g) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GSM850 | GSM | Horizontal | 0 | 128 | 824.2 | 32.40 | 33 | 1.148 | -0.05 | 1.02 | 1.171 |
| GSM1900 | GSM | Horizontal | 0 | 810 | 1909.8 | 28.78 | 29 | 1.052 | 0.09 | 1.04 | 1.094 |

## 11.8 REPEATED SAR MEASUREMENT

| Band | Mode | Test Position | Dist. (mm) | Ch. | Original Measured SAR1g (mW/g) | 1st Repeated SAR1g (mW/g) | Ratio | Original Measured SAR1g (mW/g) | 2nd Repeated SAR1g (mW/g) | Ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| GSM850 | GSM | Horizontal | 0 | 128 | 0.991 | 1.02 | 1.029 | -- | -- | -- |
| GSM1900 | GSM | Horizontal | 0 | 810 | 1.04 | 1.04 | 1.000 | -- | -- | -- |

**Note:**

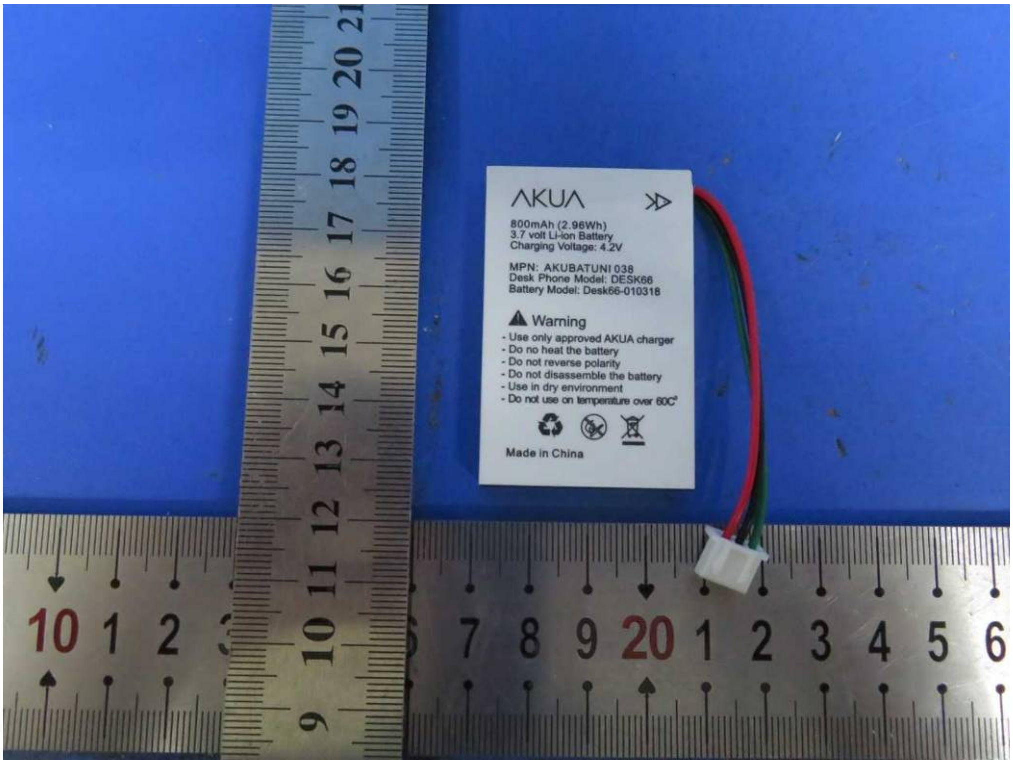
1. Per KDB 865664 D01,for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8W/Kg
2. Per KDB 865664 D01,if the ratio of largest to smallest SAR for the original and first repeated measurement is ≤1.2 and the measured SAR ＜1.45W/Kg,only one repeated measurement is required.
3. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg
4. The ratio is the difference in percentage between original and repeated measured SAR.

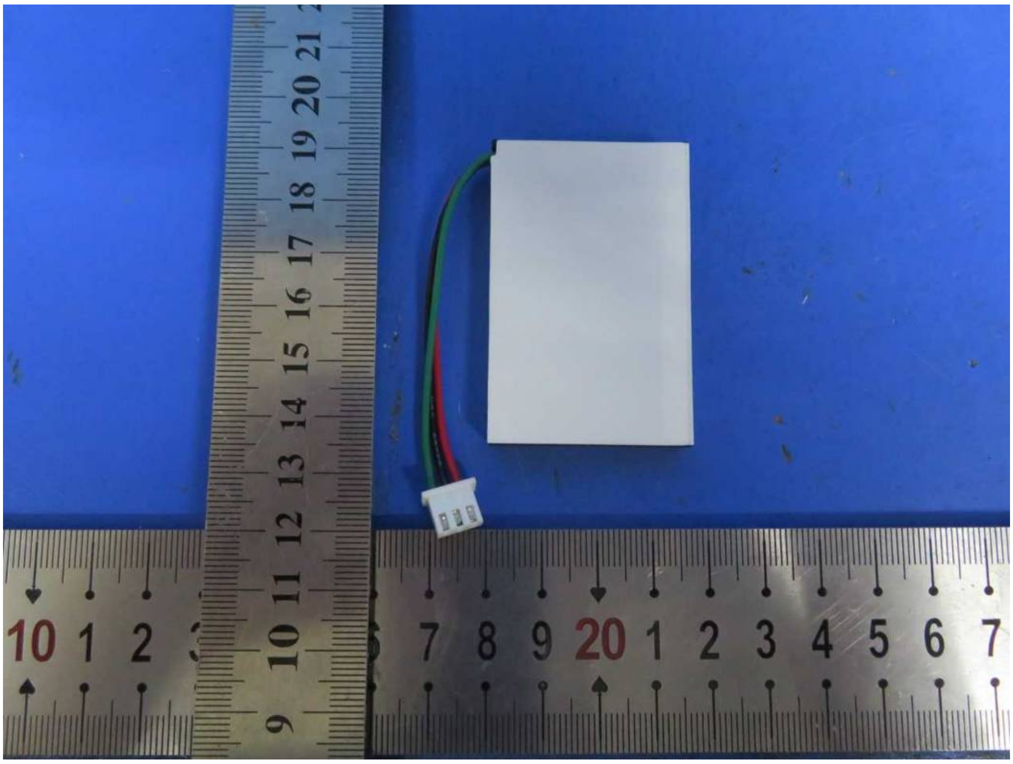
# 12. SAR HANDSETS MULTI XMITER ASSESSMENT

| | Position | Applicable Combination |
|---|---|---|
| Simultaneous Transmission | Body | N/A |

# 13. EUT PHOTO


MENU
SMS
OK
ON/OFF
TALK/RD
H-F


AKUA
800mAh (2.96Wh)
3.7 volt Li-ion Battery
Charging Voltage: 4.2V
MPN: AKUBATUNI 038
Desk Phone Model: DESK66
Battery Model: Desk66-010318
Warning
- Use only approved AKUA charger
- Do no heat the battery
- Do not reverse polarity
- Do not disassemble the battery
- Use in dry environment
- Do not use on temperature over 60C°
Made in China



# 14. EQUIPMENT LIST & CALIBRATION STATUS

| Name of Equipment | Manufacturer | Type/Model | Serial Number | Last Calibration | Calibration Due |
|---|---|---|---|---|---|
| P C | HP | Core(rm)3.16G | CZCO48171H | N/A | N/A |
| Signal Generator | Agilent | E8257C | US37101915 | 2/26/2018 | 2/25/2019 |
| S-Parameter Network Analyzer | Agilent | E5071B | MY42301382 | 2/26/2018 | 2/25/2019 |
| Wireless Communication Test Set | R&S | CMU200 | SN:109525 | 12/27/2017 | 12/26/2018 |
| Power meter | Anritsu | ML2495A | 1445010 | 4/26/2017 | 4/25/2018 |
| Power sensor | Anritsu | MA2411B | 1339220 | 4/26/2017 | 4/25/2018 |
| E-field PROBE | SPEAG | EX3DV4 | 3798 | 7/26/2017 | 7/25/2018 |
| DAE | SPEAG | DEA4 | 1245 | 7/20/2017 | 7/19/2018 |
| DIPOLE 835MHZ ANTENNA | SPEAG | D835V2 | 4d114 | 5/30/2016 | 5/26/2019 |
| DIPOLE 1900MHZ ANTENNA | SPEAG | D1900V2 | 5d136 | 5/25/2016 | 5/21/2019 |
| Electro Thermometer | DTM | DTM3000 | 3030 | 12/26/2017 | 12/25/2018 |
| 3db ATTENUATOR | MINI | MCL BW-S3W5 | 0533 | N/A | N/A |
| DUMMY PROBE | SPEAG | DP_2 | SPDP2001AA | N/A | N/A |
| SAM PHANTOM (ELI4 v4.0) | SPEAG | QDOVA001BB | 1102 | N/A | N/A |
| Twin SAM Phantom | SPEAG | QD000P40CD | 1609 | N/A | N/A |
| ROBOT | SPEAG | TX60 | F10/5E6AA1/A101 | N/A | N/A |
| ROBOT KRC | SPEAG | CS8C | F10/5E6AA1/C101 | N/A | N/A |
| LIQUID CALIBRATION KIT | ANTENNESSA | 41/05 OCP9 | 00425167 | N/A | N/A |

# 15. FACILITIES

All measurement facilities used to collect the measurement data are located at

☒ No.10, Weiye Rd., Innovation Park, Eco & Tec. Development Part, Kunshan City, Jiangsu Province, China.

# 16. REFERENCES

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## APPENDIX A: PLOTS OF PERFORMANCE CHECK

**The plots are showing as followings.**

Test Laboratory: Compliance Certification Services Inc. Date: 3/26/2018

**SystemPerformanceCheck-Body D835**

**DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d114**

Communication System: UID 0, CW; Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;Duty Cycle: 1:1

Medium parameters used: f = 835 MHz; σ = 0.976 S/m; $\varepsilon_r$ = 55.336; ρ = 1000 kg/$m^3$

Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(9.35, 9.35, 9.35); Calibrated: 7/26/2017;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/20/2017
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

**System Performance Check at Frequencies Low 1 GHz/dist=15mm, Pin=250 mW(EX-Probe)/Area Scan (7x12x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 3.43 W/kg

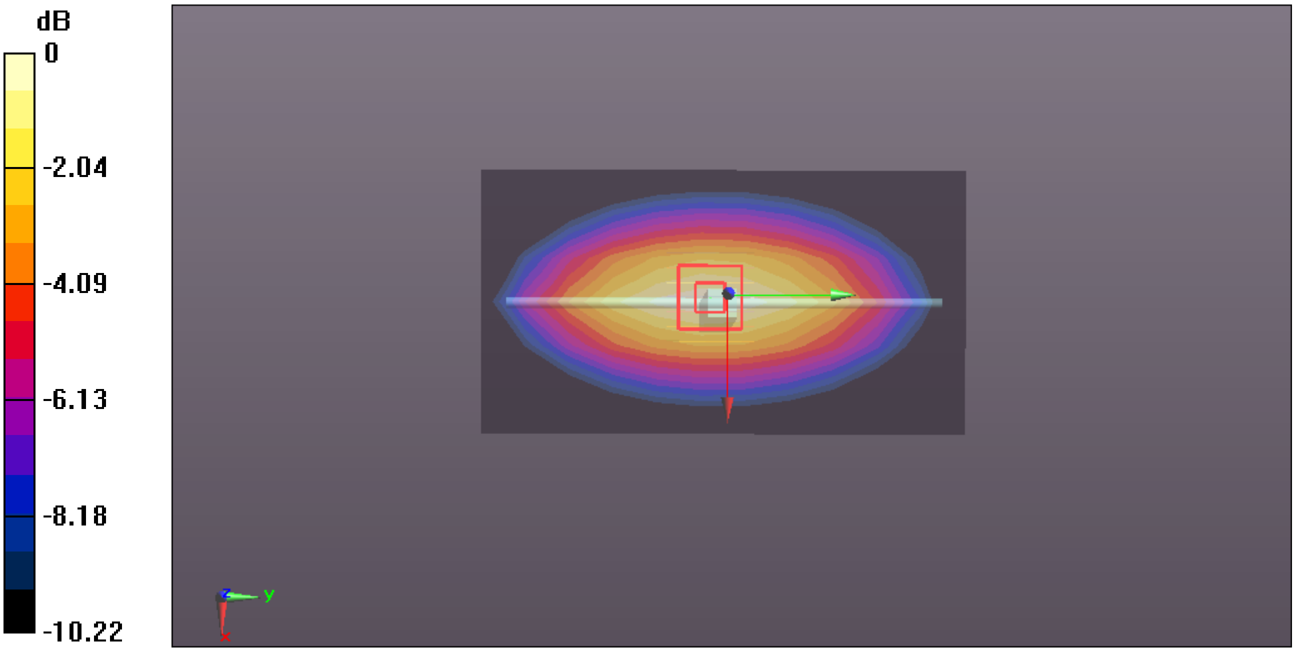
**System Performance Check at Frequencies Low 1 GHz/dist=15mm, Pin=250 mW(EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 61.37 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 4.04 W/kg

**SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.52 W/kg**

Maximum value of SAR (measured) = 3.16 W/kg




0 dB = 3.16 W/kg = 5.00 dBW/kg

Test Laboratory: Compliance Certification Services Inc. Date: 3/26/2018

**SystemPerformanceCheck-Body D1900**

**DUT: Dipole 1900 MH; Type: D1900V2; Serial: 5d136**

Communication System: UID 0, CW; Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;Duty Cycle: 1:1

Medium parameters used: f = 1900 MHz; $\sigma$ = 1.561 S/m; $\varepsilon_r$ = 52.321; $\rho$ = 1000 kg/$m^3$

Room Ambient Temperature: 22°C; Liquid Temperature: 21.5°C

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3798; ConvF(7.75, 7.75, 7.75); Calibrated: 7/26/2017;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 7/20/2017
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:xxxx
- DASY52 52.8.8(1222);
- SEMCAD X Version 14.6.10 (7331)

**System Performance Check at Frequencies above 1 GHz/Pin=250 mW, dist=10mm (EX-Probe)/Area Scan (7x8x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 13.2 W/kg

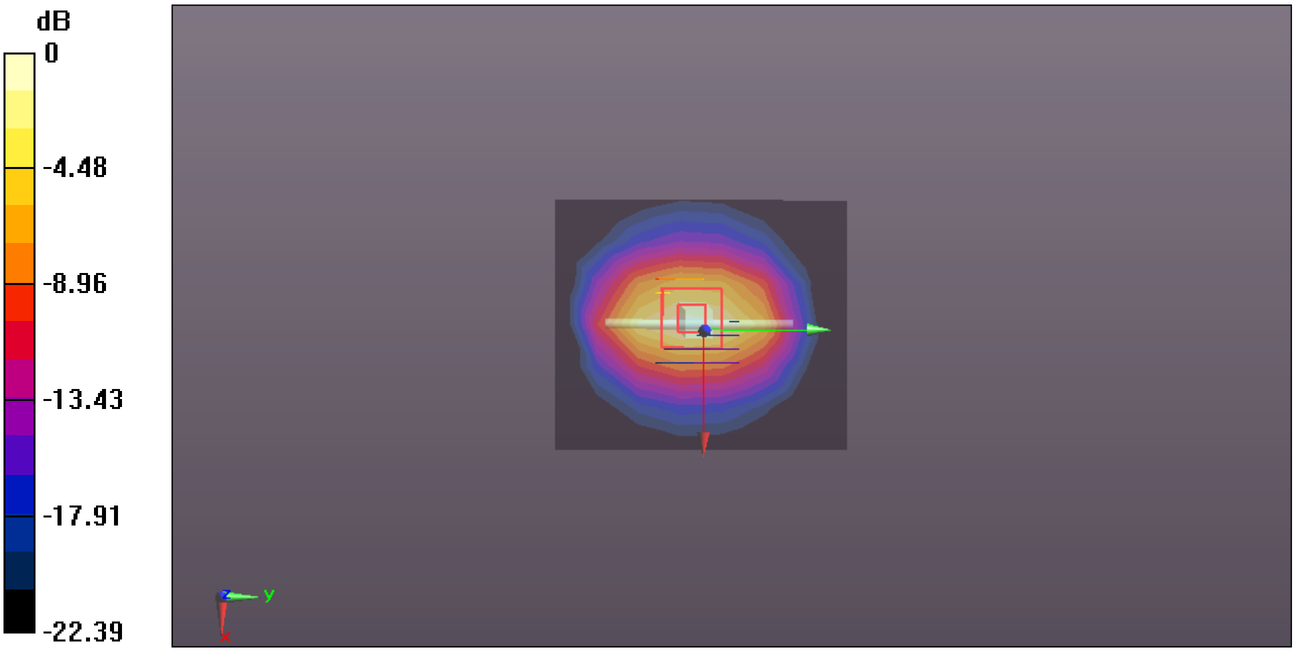
**System Performance Check at Frequencies above 1 GHz/Pin=250 mW, dist=10mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.71 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 19.5 W/kg

**SAR(1 g) = 9.86 W/kg; SAR(10 g) = 4.59 W/kg**

Maximum value of SAR (measured) = 14.8 W/kg




0 dB = 14.8 W/kg = 11.70 dBW/kg

## APPENDIX B: DASY CALIBRATION CERTIFICATE

**The DASY Calibration Certificates are showing in the file named Appendix B DASY Calibration Certificate .**

## APPENDIX C: PLOTS OF SAR TEST RESULT

**The plots are showing in the file named Appendix C Plots of SAR Test Result**

**END REPORT**