# SAR Test Report

## For

| | |
|---|---|
| **Applicant Name:** | **FOXX Development Inc.** |
| Address: | 3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA |
| EUT Name: | Smart Phone |
| Brand Name: | FOXXD |
| Model Number: | FOXXD S67 |

## Issued By

| | |
|---|---|
| **Company Name:** | **BTF Testing Lab (Shenzhen) Co., Ltd.** |
| Address: | F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China |
| Report Number: | BTF250513R00701 |
| Test Standards: | FCC 47 CFR§2.1093 IEC/IEEE 62209-1528: 2020<br>IEEE C95.1-2019 KDB447498 D04 KDB865664 D01<br>KDB865664 D02 KDB941225 D01 KDB941225 D05<br>KDB248227 D01 KDB941225 D06 KDB648474 D04<br>KDB690783 D01 |
| FCC ID: | 2AQRMS67 |
| Test Conclusion: | Pass |
| Date of Issue: | 2025-05-15 |
| Tested By: | Jim. Yin<br>Jim Yin / Tester |
| Prepared By: | Amenda Zhong<br>Amenda Zhong / Project Engineer |
| Date: | 2025-05-15 |
| Approved By: | Olic Huang<br>Olic Huang / EMC Manager |
| Date: | 2025-05-15 |

BTF Testing Lab (Shenzhen) Co., Ltd.

| Revision History | | |
|---|---|---|
| Version | Issue Date | Revisions Content |
| R_V0 | 2025-05-15 | The data is quoted from reports SZ25040036S01 and SZ25040036S02. |
| | | |
| | | |



BTF Testing Lab (Shenzhen) Co., Ltd.
F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China

**Table of Contents**

# 1. Introduction

## 1.1 Identification of Testing Laboratory

| | |
|---|---|
| Company Name: | BTF Testing Lab (Shenzhen) Co., Ltd. |
| Address: | F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China |
| Phone Number: | +86-0755-23146130 |
| Fax Number: | +86-0755-23146130 |

## 1.2 Identification of the Responsible Testing Location

| | |
|---|---|
| Test Location: | BTF Testing Lab (Shenzhen) Co., Ltd. |
| Address: | F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China |
| Description: | All measurement facilities used to collect the measurement data are located at F101,201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China |
| FCC Registration Number | 518915 |
| Designation Number | CN1409 |

## 1.3 Laboratory Condition

| | |
|---|---|
| Ambient Temperature: | 21℃ to 25℃ |
| Ambient Relative Humidity: | 48% to 59% |
| Ambient Pressure: | 100 kPa to 102 kPa |

## 1.4 Announcement

(1) The test report reference to the report template version v0.

(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.

(3) The test report is invalid if there is any evidence and/or falsification.

(4) This document may not be altered or revised in any way unless done so by BTF and all revisions are duly noted in the revisions section.

(5) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

(6) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

# 2. Product Information

## 2.1 Application Information

| | |
|---|---|
| Company Name: | FOXX Development Inc. |
| Address: | 3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA |

## 2.2 Manufacturer Information

| | |
|---|---|
| Company Name: | FOXX Development Inc. |
| Address: | 3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA |

## 2.3 Factory Information

| | |
|---|---|
| Company Name: | FOXX Development Inc. |
| Address: | 3480 Preston Ridge Road, Suite500, Alpharetta, GA 30005, USA |

## 2.4 General Description of Equipment under Test (EUT)

| | |
|---|---|
| EUT Name | Smart Phone |
| Under Test Model Name | FOXXD S67 |
| Sample No. | BTFSN250513008 |

## 2.5 Technical Information

| | |
|---|---|
| Network and Wireless connectivity | Data reference reports SZ25040036S01 and SZ25040036S02. |

The requirement for the following technical information of the EUT was tested in this report:

The data is quoted from reports SZ25040036S01 and SZ25040036S02.

# 3. Summary of Test Results

## 3.1 Test Standards

| No. | Identity | Document Title |
|---|---|---|
| 1 | 47 CFR Part 2.1093 | Radiofrequency radiation exposure evaluation: portable devices |
| 2 | IEC/IEEE 62209-1528: 2020 | Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz) |
| 3 | 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 |
| 4 | KDB447498 D04 | Interim General RF Exposure Guidance v01 |
| 5 | KDB865664 D01 | SAR measurement 100MHz to 6GHz v01r04 |
| 6 | KDB865664 D02 | RF Exposure Reporting v01r02 |
| 7 | KDB941225 D01 | 3G SAR Procedures v03r01 |
| 8 | KDB941225 D05 | SAR for LTE Devices v02r05 |
| 9 | KDB248227 D01 | 802.11 Wi-Fi SAR v02r02 |
| 10 | KDB941225 D06 | Hotspot Mode v02r01 |
| 11 | KDB648474 D04 | Handset SAR v01r03 |
| 12 | KDB690783 D01 | SAR Listings on Grant v01r03 |

## 3.2 Device Category and SAR Limit

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

| Body Position | SAR Value (W/Kg) | |
|---|---|---|
| | General Population/ Uncontrolled Exposure | Occupational/ Controlled Exposure |
| Whole-Body SAR (averaged over the entire body) | 0.08 | 0.4 |
| Partial-Body SAR (averaged over any 1 gram of tissue) | 1.60 | 8.0 |
| SAR for hands, wrists, feet and ankles (averaged over any 10 grams of tissue) | 4.0 | 20.0 |

NOTE:
**General Population/Uncontrolled Exposure**: Locations where there is the exposure of individuals who have no knowledge or control of their exposure. General population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment- related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

**Occupational/Controlled Exposure:** Locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

## 3.3 Test Result Summary

Data reference reports SZ25040036S01 and SZ25040036S02.



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## 3.4 Test Uncertainty

### 3.4.1 Measurement uncertainly evaluation for SAR test (300MHz to 6GHz)

| Uncertainty Budget of 1g/10gpsSAR for DUT with COMOSAR | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ambiente temperature: 18-25℃ & ΔT≤2℃<br>Humedity: 30-70%<br>Frequency range: 150MHz-7500MHz | | | | | | | | | | | |
| Symbol | Input quantity Xi (source of uncertainty) | PDF$_i$ | Unc. a(x$_i$) [±%] | Div. q$_i$ | u(x$_i$)= a(xi)/qi | c$_i$ 1g | c$_i$ 10 g | u(y)= c$_i$*u(xi) 1g [± %] | u(y)= c$_i$*u(xi) 10g [± %] | v$_i$ | Frequency range [MHz] |
| Measurement System errors | | | | | | | | | | | |
| CF | Probe calibration | N (k=2) | 11.00 | 2.00 | 5.50 | 1.00 | 1.00 | 5.50 | 5.50 | ∞ | 150-450 |
| | | | 14.00 | 2.00 | 7.00 | 1.00 | 1.00 | 7.00 | 7.00 | ∞ | 600-7500 |
| $CF_{drift}$ | Probe calibration drift | R | 2.30 | 1.73 | 1.33 | 1.00 | 1.00 | 1.33 | 1.33 | ∞ | 150-450 |
| | | | 4.00 | 1.73 | 2.31 | 1.00 | 1.00 | 2.31 | 2.31 | ∞ | 600-7500 |
| LIN | Probe linearity | R | 4.70 | 1.73 | 2.71 | 1.00 | 1.00 | 2.71 | 2.71 | ∞ | 150-7500 |
| | Detection limit | R | 1.00 | 1.73 | 0.58 | 1.00 | 1.00 | 0.58 | 0.58 | ∞ | |
| BBS | Broadband signal | R | 0.00 | 1.73 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | ∞ | |
| ISO | Axial Isotropy | R | 3.50 | 1.73 | 2.02 | 0.71 | 0.71 | 1.43 | 1.43 | ∞ | |
| | Hemispherical Isotropy | R | 5.90 | 1.73 | 3.41 | 0.71 | 0.71 | 2.41 | 2.41 | ∞ | |
| DAE | Boundary effect | R | 1.00 | 1.73 | 0.58 | 1.00 | 1.00 | 0.58 | 0.58 | ∞ | |
| | Integration time | R | 1.40 | 1.73 | 0.81 | 1.00 | 1.00 | 0.81 | 0.81 | ∞ | |
| | Response time | R | 0.00 | 1.73 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | ∞ | |
| | Readout electronics | N | 0.50 | 1.00 | 0.50 | 1.00 | 1.00 | 0.50 | 0.50 | ∞ | |
| AMB | Noise | R | 3.00 | 1.73 | 1.73 | 1.00 | 1.00 | 1.73 | 1.73 | ∞ | |
| | Reflections | R | 3.00 | 1.73 | 1.73 | 1.00 | 1.00 | 1.73 | 1.73 | ∞ | |
| $\Delta_{xyz}$ | Positioner Mechanical Tolerance | R | 1.40 | 1.73 | 0.81 | 0.14 | 0.14 | 0.12 | 0.12 | ∞ | ≥150 & ≤3000 |
| | | | 3.28 | 1.73 | 1.89 | 0.33 | 0.33 | 0.62 | 0.62 | ∞ | >3000 & ≤6000 |
| | | | 3.28 | 1.73 | 1.89 | 0.33 | 0.33 | 0.62 | 0.62 | ∞ | >6000 & ≤7500 |
| | Positioning with respect to Phantom Shell | R | 1.40 | 1.73 | 0.81 | 0.14 | 0.14 | 0.12 | 0.12 | ∞ | ≥150 & ≤3000 |
| | | | 3.28 | 1.73 | 1.89 | 0.33 | 0.33 | 0.62 | 0.62 | ∞ | >3000 & ≤6000 |
| | | | 3.28 | 1.73 | 1.89 | 0.33 | 0.33 | 0.62 | 0.62 | ∞ | >6000 & ≤7500 |
| DAT | Data processing errors | R | 2.30 | 1.73 | 1.33 | 1.00 | 1.00 | 1.33 | 1.33 | ∞ | 150-7500 |
| Phanom and DUTerros | | | | | | | | | | | |
| LIQ(σ,ε) | Conductivity measurement | N | 4.07 | 1.00 | 4.07 | 0.79 | 0.77 | 3.22 | 3.13 | 9 | 150-7500 |
| | Permitivity measurement | N | 5.06 | 1.00 | 5.06 | 0.23 | 0.26 | 1.16 | 1.32 | 9 | |
| LIQ($T_c$) | Liquid Conductivity - Temperature Uncertainty | R | 2.50 | 1.73 | 1.44 | 0.79 | 0.77 | 1.14 | 1.11 | ∞ | |
| | Liquid Permittivity - Temperature Uncertainty | R | 2.50 | 1.73 | 1.44 | 0.23 | 0.26 | 0.33 | 0.38 | ∞ | |
| EPS | Shell permittivity | R | 2.90 | 1.73 | 1.67 | 0.00 | 0.00 | 0.00 | 0.00 | ∞ | ≥150 & ≤3000 |
| | | | 2.90 | 1.73 | 1.67 | 0.25 | 0.25 | 0.42 | 0.42 | ∞ | >3000 & ≤6000 |
| | | | 2.90 | 1.73 | 1.67 | 0.50 | 0.50 | 0.84 | 0.84 | ∞ | >6000 & ≤7500 |
| DIS | Distance between the radiating element of the DUT and the phantom medium | N | 2.70 | 1.00 | 2.70 | 2.00 | 2.00 | 5.40 | 5.40 | ∞ | ≥150 & ≤3000 |
| | | | 2.70 | 1.00 | 2.70 | 2.00 | 2.00 | 5.40 | 5.40 | ∞ | >3000 & ≤6000 |
| | | | 3.20 | 1.00 | 3.20 | 2.00 | 2.00 | 6.40 | 6.40 | ∞ | >6000 & ≤7500 |
| $D_{xyz}$ | Repeatability of positioning the DUT or source against the phantom | N | 2.60 | 1.00 | 2.60 | 1.00 | 1.00 | 2.60 | 2.60 | 13 | 150-7500 |
| H | Device holder effects | N | 3.00 | 1.00 | 3.00 | 1.00 | 1.00 | 3.00 | 3.00 | 23 | |
| MOD | Effect of operating mode on probe sensitivity | R | 8.20 | 1.73 | 4.73 | 1.00 | 1.00 | 4.73 | 4.73 | ∞ | |
| $RF_{drift}$ | Variation in SAR due to drift in output of DUT | R | 5.00 | 1.73 | 2.89 | 1.00 | 1.00 | 2.89 | 2.89 | | |
| Corrections to the SAR result | | | | | | | | | | | |
| C(ε',σ) | Phantom deviation from target (ε',σ) | N | 1.90 | 1.00 | 1.90 | 1.00 | 1.00 | 1.90 | 1.90 | | 150-7500 |
| C(R) | SAR scaling | R | 5.00 | 1.73 | 2.89 | 1.00 | 1.00 | 2.89 | 2.89 | | |
| u(ΔSAR) | Combined uncertainty | | | | | | | 12.54 | 12.53 | | 150-450 |
| | | | | | | | | 13.40 | 13.40 | | ≥600 & ≤3000 |
| | | | | | | | | 13.44 | 13.43 | | >3000 & ≤6000 |
| | | | | | | | | 13.89 | 13.88 | | >6000 & ≤7500 |
| **U** | **Expanded uncertainty (95% confidence interval)** | | | | | | | **25.08** | **25.07** | | **150-450** |
| | | | | | | | | **26.80** | **26.79** | | **≥600 & ≤3000** |
| | | | | | | | | **26.87** | **26.86** | | **>3000 & ≤6000** |
| | | | | | | | | **27.77** | **27.76** | | **>6000 & ≤7500** |

## 3.4.2 Measurement uncertainly evaluation for system check

| Symbol | Input quantity Xi (source of uncertainty) | $PDF_i$ | Unc. $a(x_i)$ [±%] | Div. $q_i$ | $u(x_i)=a(xi)/qi$ | $c_i$ 1g | $c_i$ 10 g | $u(y)=c_i*u(xi)$ 1g [± %] | $u(y)=c_i*u(xi)$ 10g [± %] | $v_i$ | Frequency range [MHz] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Uncertainty Budget of 1g/10g psSAR for System Validation/Check COMOSAR** | | | | | | | | | | | |
| Ambiente temperature: 18-25°C & ΔT≤2°C | | | | | | | | | | | |
| Humedity: 30-70% | | | | | | | | | | | |
| Frequency range: 150MHz-7500MHz | | | | | | | | | | | |
| **Measurement System errors** | | | | | | | | | | | |
| CF | Probe calibration | N (k=2) | 11.00 | 2.00 | 5.50 | 1.00 | 1.00 | 5.50 | 5.50 | ∞ | 150-450 |
| | | | 14.00 | 2.00 | 7.00 | 1.00 | 1.00 | 7.00 | 7.00 | ∞ | 600-7500 |
| $CF_{drift}$ | Probe calibration drift | R | 2.30 | 1.73 | 1.33 | 1.00 | 1.00 | 1.33 | 1.33 | ∞ | 150-450 |
| | | | 4.00 | 1.73 | 2.31 | 1.00 | 1.00 | 2.31 | 2.31 | ∞ | 600-7500 |
| LIN | Probe linearity | R | 4.70 | 1.73 | 2.71 | 1.00 | 1.00 | 2.71 | 2.71 | ∞ | 150-7500 |
| | Detection limit | R | 1.00 | 1.73 | 0.58 | 1.00 | 1.00 | 0.58 | 0.58 | ∞ | |
| ISO | Axial Isotropy | R | 3.50 | 1.73 | 2.02 | 0.71 | 0.71 | 1.43 | 1.43 | ∞ | |
| | Hemispherical Isotropy | R | 5.90 | 1.73 | 3.41 | 0.71 | 0.71 | 2.41 | 2.41 | ∞ | |
| DAE | Boundary effect | R | 1.00 | 1.73 | 0.58 | 1.00 | 1.00 | 0.58 | 0.58 | ∞ | |
| | Integration time | R | 1.40 | 1.73 | 0.81 | 1.00 | 1.00 | 0.81 | 0.81 | ∞ | |
| | Response time | R | 0.00 | 1.73 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | ∞ | |
| | Readout electronics | N | 0.50 | 1.00 | 0.50 | 1.00 | 1.00 | 0.50 | 0.50 | ∞ | |
| AMB | Noise | R | 3.00 | 1.73 | 1.73 | 1.00 | 1.00 | 1.73 | 1.73 | ∞ | |
| | Reflections | R | 3.00 | 1.73 | 1.73 | 1.00 | 1.00 | 1.73 | 1.73 | ∞ | |
| $\Delta_{xyz}$ | Positioner Mechanical Tolerance | R | 1.40 | 1.73 | 0.81 | 0.14 | 0.14 | 0.12 | 0.12 | ∞ | ≥150 & ≤3000 |
| | | | 3.28 | 1.73 | 1.89 | 0.33 | 0.33 | 0.62 | 0.62 | ∞ | >3000 & ≤6000 |
| | | | 3.28 | 1.73 | 1.89 | 0.33 | 0.33 | 0.62 | 0.62 | ∞ | >6000 & ≤10000 |
| | Positioning with respect to Phantom Shell | R | 1.40 | 1.73 | 0.81 | 0.14 | 0.14 | 0.12 | 0.12 | ∞ | ≥150 & ≤3000 |
| | | | 3.28 | 1.73 | 1.89 | 0.33 | 0.33 | 0.62 | 0.62 | ∞ | >3000 & ≤6000 |
| | | | 3.28 | 1.73 | 1.89 | 0.33 | 0.33 | 0.62 | 0.62 | ∞ | >6000 & ≤10000 |
| DAT | Data processing errors | R | 2.30 | 1.73 | 1.33 | 1.00 | 1.00 | 1.33 | 1.33 | ∞ | 150-7500 |
| **Phanom and Dipoles erros** | | | | | | | | | | | |
| LIQ(σ,ε) | Conductivity measurement | N | 4.07 | 1.00 | 4.07 | 0.79 | 0.77 | 3.22 | 3.13 | 9 | 150-7500 |
| | Permitivity measurement | N | 5.06 | 1.00 | 5.06 | 0.23 | 0.26 | 1.16 | 1.32 | 9 | |
| $LIQ(T_c)$ | Liquid Conductivity - Temperature Uncertainty | R | 2.50 | 1.73 | 1.44 | 0.79 | 0.77 | 1.14 | 1.11 | ∞ | |
| | Liquid Permittivity - Temperature Uncertainty | R | 2.50 | 1.73 | 1.44 | 0.23 | 0.26 | 0.33 | 0.38 | ∞ | |
| EPS | Shell permittivity | R | 2.90 | 1.73 | 1.67 | 0.00 | 0.00 | 0.00 | 0.00 | ∞ | ≥150 & ≤3000 |
| | | | 2.90 | 1.73 | 1.67 | 0.25 | 0.25 | 0.42 | 0.42 | ∞ | >3000 & ≤6000 |
| | | | 2.90 | 1.73 | 1.67 | 0.50 | 0.50 | 0.84 | 0.84 | ∞ | >6000 & ≤10000 |
| DIS | Distance between the radiating element of the DUT and the phantom medium | N | 2.70 | 1.00 | 2.70 | 2.00 | 2.00 | 5.40 | 5.40 | ∞ | ≥150 & ≤3000 |
| | | | 2.70 | 1.00 | 2.70 | 2.00 | 2.00 | 5.40 | 5.40 | ∞ | >3000 & ≤6000 |
| | | | 3.20 | 1.00 | 3.20 | 2.00 | 2.00 | 6.40 | 6.40 | ∞ | >6000 & ≤10000 |
| VAL | Deviation of experimental antennas | N | 4.50 | 1.73 | 2.60 | 1.00 | 1.00 | 2.60 | 2.60 | | 150-7500 |
| | Other uncertainty contributions | R | 2.00 | 1.00 | 2.00 | 1.00 | 1.00 | 2.00 | 2.00 | | |
| $P_{in}$ | Uncertainty in accepted power | R | 3.00 | 1.73 | 1.73 | 1.00 | 1.00 | 1.73 | 1.73 | | |
| **Corrections to the SAR result** | | | | | | | | | | | |
| C(ε',σ) | Phantom deviation from target (ε',σ) | N | 1.90 | 1.00 | 1.90 | 1.00 | 1.00 | 1.90 | 1.90 | | 150-7500 |
| u(ΔSAR) | Combined uncertainty | | | | | | | 10.78 | 10.77 | | 150-450 |
| | | | | | | | | 11.77 | 11.76 | | ≥600 & ≤3000 |
| | | | | | | | | 11.81 | 11.80 | | >3000 & ≤6000 |
| | | | | | | | | 12.32 | 12.31 | | >6000 & ≤7500 |
| **U** | **Expanded uncertainty (95% confidence interval)** | | | | | | | **21.56** | **21.54** | | **150-450** |
| | | | | | | | | **23.54** | **23.52** | | **≥600 & ≤3000** |
| | | | | | | | | **23.62** | **23.60** | | **>3000 & ≤6000** |
| | | | | | | | | **24.64** | **24.62** | | **>6000 & ≤7500** |

# 4. Measurement System

## 4.1 Specific Absorption Rate (SAR) Definition

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

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

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

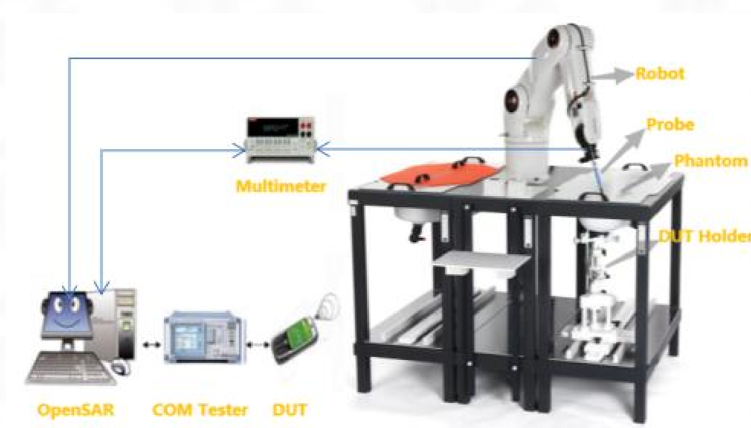
SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

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

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

## 4.2 MVG SAR System

### 4.2.1 SAR system diagram



### 4.2.2 Robot

A standard high precision 6-axis robot (Denso) with teaches pendant with Scanning System
· It must be able to scan all the volume of the phantom to evaluate the tridimensional distribution of SAR.
· Must be able to set the probe orthogonal of the surface of the phantom (±30°).
· Detects stresses on the probe and stop itself if necessary to keep the integrity of the probe.

### 4.2.3 E-Field Probe

For the measurements, the Specific Dosimetric SSE2 E-Field Probe with following specifications is used:

- Dynamic range: 0.01-100 W/kg
- Tip diameter: 2mm for SSE2
- Distance between probe tip and sensor centre: 1mm for SSE2
- Distance between sensor centre and the inner phantom surface: 2mm for f>=4GHz.
- Probe linearity: <0.25dB.
- Axial Isotropy: <0.25dB.
- Spherical Isotropy: <0.50dB.
- Calibration range: 150 to 6000 MHz for head & body simulating liquid
- Angle between probe axis (evaluation axis) and surface normal line: less than 20°.


### 4.2.4 Phantoms

**SAM Phantom**

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The probe scanning of the E-Field is done in the 2 halves of the normalized head. The normalized shape of the phantom corresponds to the dimensions of 90% of an adult head size. It enables the dosimetric evaluation of left and right-hand phone usage and includes an additional flat phantom part for the simplified body performance check.The phantom set-up includes a cover, which prevents the evaporation of the liquid.

SAM Phantom

The thickness of the phantom amounts to 2 mm±0.2 mm. The materials for the phantom do not affect the radiation of the device under test (DUT) : εr' <5
The head is filled with tissue simulating liquid. The hand do not have to be modeled.

| TWIN SAM phantom | | | |
|---|---|---|---|
| | Mechanical | Electrical | |
| Overall thickness | 2±0.2 mm(except ear area) | Relative permittivity | 3.4 |
| Dimensions | 1000 mm(L) x 500 mm(W) x 200 mm(H) | Loss tangent | 0.02 |
| Maximum volume | 27 L | | |
| Material | Fiberglass based | | |

**ELLIPTICAL Phantom**

The phantom is for Body performance check filled with tissue-equivalent liquid to a depth of at least 150 mm, whose shell material is resistant to damage or reaction with tissue-equivalent liquid chemicals.

**ELLI Phantom**

The shape of the phantom is an ellipse with length 600mm±5mm and width 400mm±5mm.
The phantom shell is made of low-loss and low-permittivity material, having loss tangent tanδ ≤ 0.05 and relative permittivity:
εr' ≤ 5 for f ≤ 3 GHz
3 ≤εr' ≤ 5 for f > 3 GHz
The thickness of the bottom-wall of the flat phantom is 2.0 mm with a tolerance of ± 0.2 mm.

| Technical & mechanical characteristics | |
|---|---|
| Shell thickness | 2 mm ± 0.2 mm |
| Filling volume | 25 L |
| Dimensions | 600 mm x 400 mm x 200mm |
| Permittivity | 4.4 |
| Loss tangent | 0.017 |



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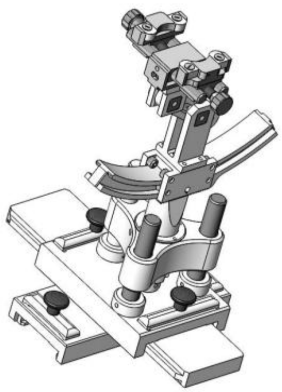
### 4.2.5 Device Holder



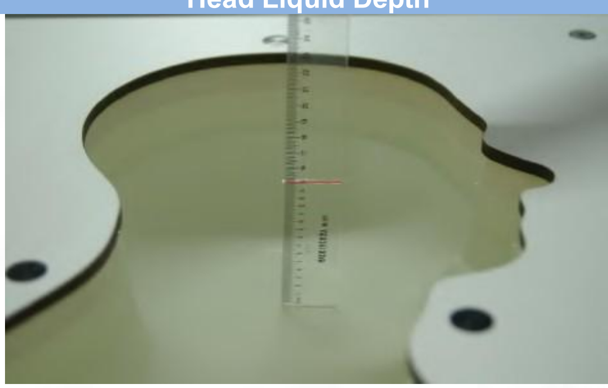
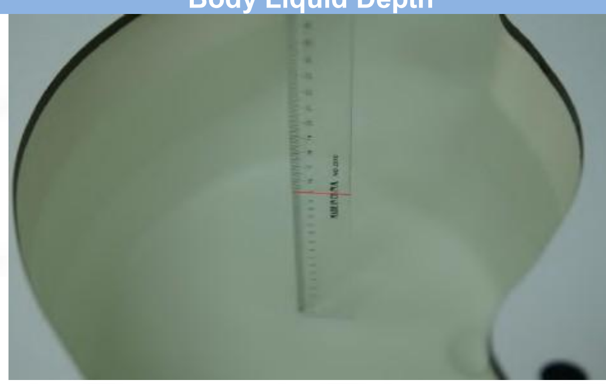
| System Material | Permittivity | Loss tangent |
|---|---|---|
| Delrin | 3.7 | 0.005 |

*(The positioning system allows obtaining cheek and tilting position with a very good accuracy. In compliance with CENELEC, the tilt angle uncertainty is lower than 1°.)*

| System Material | Permittivity | Loss tangent |
|---|---|---|
| PMMA | 2.9 | 0.028 |

### 4.2.6 Simulating Liquid

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5%.

| Head Liquid Depth | Body Liquid Depth |
|---|---|
|  |  |

The following table gives the recipes for tissue simulating liquid and the theoretical Conductivity/Permittivity.

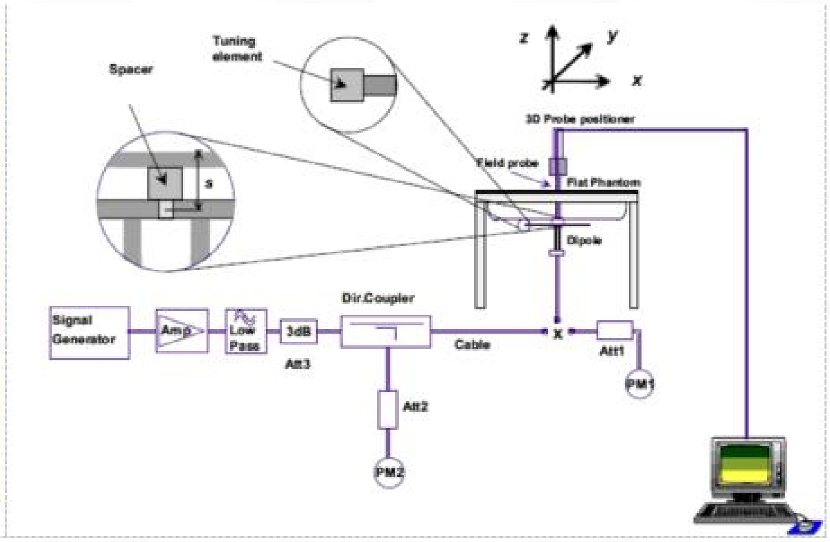
| Head (Reference IEEE1528) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Water (%) | Sugar (%) | Cellulose (%) | Salt (%) | Preventol (%) | DGBE (%) | Conductivity σ (S/m) | Permittivity ε |
| 750 | 41.1 | 57.0 | 0.2 | 1.4 | 0.2 | 0 | 0.89 | 41.9 |
| 835 | 40.3 | 57.9 | 0.2 | 1.4 | 0.2 | 0 | 0.90 | 41.5 |
| 900 | 40.3 | 57.9 | 0.2 | 1.4 | 0.2 | 0 | 0.97 | 41.5 |
| 1800, 1900, 2000 | 55.2 | 0 | 0 | 0.3 | 0 | 44.5 | 1.4 | 40.0 |
| 2450 | 55.0 | 0 | 0 | 0.1 | 0 | 44.9 | 1.80 | 39.2 |
| 2600 | 54.9 | 0 | 0 | 0.1 | 0 | 45.0 | 1.96 | 39.0 |
| Frequency (MHz) | Water (%) | Hexyl Carbitol (%) | | | Triton X-100 (%) | | Conductivity σ (S/m) | Permittivity ε |
| 5200 | 62.52 | 17.24 | | | 17.24 | | 4.66 | 36.0 |
| 5800 | 62.52 | 17.24 | | | 17.24 | | 5.27 | 35.3 |
| Body (From instrument manufacturer) | | | | | | | | |
| Frequency (MHz) | Water (%) | Sugar (%) | Cellulose (%) | Salt (%) | Preventol (%) | DGBE (%) | Conductivity σ (S/m) | Permittivity ε |
| 750 | 51.7 | 47.2 | 0 | 0.9 | 0.1 | 0 | 0.96 | 55.5 |
| 835 | 50.8 | 48.2 | 0 | 0.9 | 0.1 | 0 | 0.97 | 55.2 |
| 900 | 50.8 | 48.2 | 0 | 0.9 | 0.1 | 0 | 1.05 | 55.0 |
| 1800, 1900, 2000 | 70.2 | 0 | 0 | 0.4 | 0 | 29.4 | 1.52 | 53.3 |
| 2450 | 68.6 | 0 | 0 | 0.1 | 0 | 31.3 | 1.95 | 52.7 |
| 2600 | 68.2 | 0 | 0 | 0.1 | 0 | 31.7 | 2.16 | 52.5 |
| Frequency(MHz) | Water | DGBE (%) | | | Salt (%) | | Conductivity σ (S/m) | Permittivity ε |
| 5200 | 78.60 | 21.40 | | | / | | 5.30 | 49.00 |
| 5800 | 78.50 | 21.40 | | | 0.1 | | 6.00 | 48.20 |

# 5. System Verification

## 5.1 Purpose of System Check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. The setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

## 5.2 System Check Setup



# 6. TEST POSITION CONFIGURATIONS

According to KDB 648474 D04 Handset, handsets are tested for SAR compliance in head, body-worn accessory and other use configurations described in the following subsections.

## 6.1 Head Exposure Conditions

Head exposure is limited to next to the ear voice mode operations. Head SAR compliance is tested according to the test positions defined in IEC IEEE 62209-1528:2020 using the SAM phantom illustrated as below.

### 6.1.1 Definition of the cheek position

The cheek position is established using steps a) to j) as follows.

(a) Configure the DUT for voice operation, if necessary. For example, for a DUT with a flip.a)swivel, or slide cover piece, open the cover if this is consistent with voice operation. If the DUT can also be used with the cover closed, both configurations shall be tested.

(b) Define two imaginary lines on the DUT, the vertical centreline and the horizontal line, relative to the DUT in vertical orientation as shown in Figure 15.

(c) The vertical centreline passes through two points on the front side of the DUT: the midpoint of the width w of the DUT at the level of the acoustic output (Point A in Figure 15), and the midpoint of the width $w_t$ at the bottom of the DUT (Point B). The horizontal line is perpendicular to the vertical centerline, and passes through the centre of the acoustic output (Figure 15). The two lines intersect at Point A. Note that for many DUTs, Point A coincides with the centre of the acoustic output. However, the acoustic output could be located elsewhere on the horizontal line. Also note that the vertical centreline is not necessarily parallel to the front face of the DUT, especially for clamshell DUTs, DUTs with flip cover pieces, and other irregularly shaped DUTs.

(d) Position the DUT close to the surface of the phantom such that Point A is on the (virtual) extension of the line passing through points RE (right-ear ear reference point) and LE left-ear ear reference point) on the phantom (see Figure 16a) and Figure 16b)). The plane determined by the vertical centreline and the horizontal line of the DUT shall be parallel to the sagittal plane of the phantom.

(e) Translate the DUT towards the phantom along the line passing through RE and LE until the DUT touches the ear (see Figure 16c)).

(f) Rotate the DUT around the (virtual) LE-RE Line until the DUT vertical centreline is in the)reference plane(see Figure 16d)).

(g) Rotate the DUT around its vertical centreline until the plane established by the DUT vertical centreline and horizontal line is parallel to the N-F line (see Annex G), and then translate the DUT towards the phantom along the LE-RE line until DUT Point A touches the ear at the ERP (ear reference point) (see Figure 16e))

(h) While keeping Point A on the line passing through RE and LE and maintaining the DUT in contact with the pinna, rotate the DUT about the N-F line until any point on the DUT is in contact with a phantom point below the pinna (cheek) (see Figure 16f)). The physical angles of rotation shall be documented.

(i) While keeping DUT Point A in contact with the ERP rotate the DUT around a line perpendicular to the plane established by the DUT vertical centreline and horizontal line and passing through DUT Point A, until the DUT vertical centreline is in the reference plane(see Figure 16g)).

(j) Verify that the cheek position is correct as follows:
1) the N-F line is in the plane established by the DUT vertical centreline and horizontal line;
2) DUT Point A touches the pinna at the ERP
3) the DUT vertical centreline is in the reference plane.

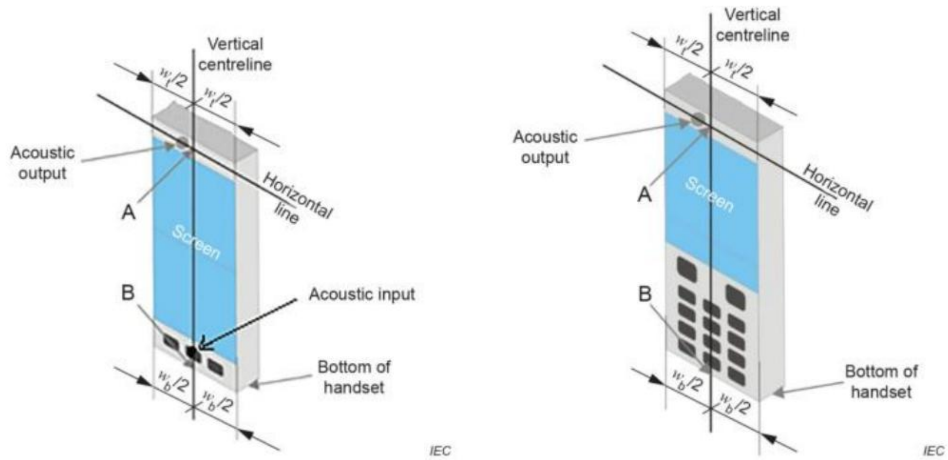
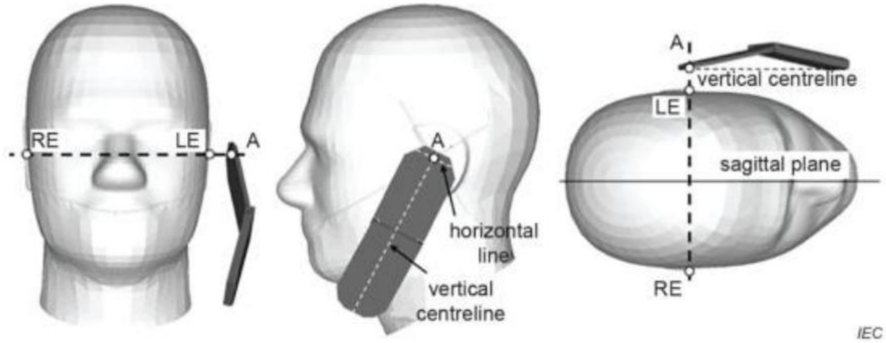


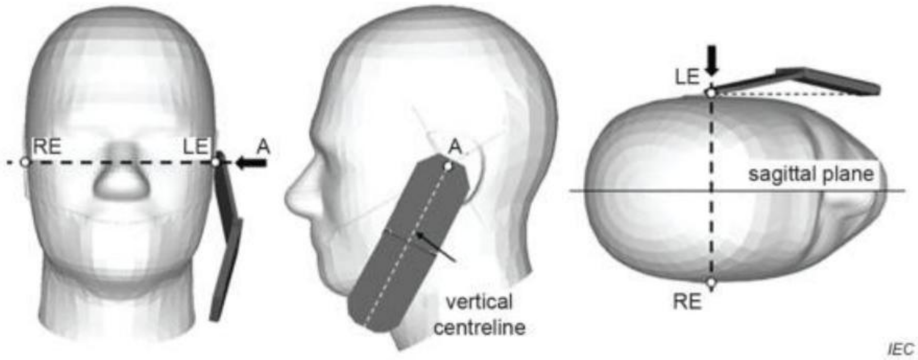

**Figure 15 - Vertical and horizontal reference lines and reference points A and B on two example device types: a full touch-screen smart phone (left) and a DUT with a keypad (right)**


NOTE The reference points for the right-ear ear reference point (RE), left-ear ear reference point (LE), and mouth (M), which establish the reference plane for DUT positioning, are indicated. This device position shall be maintained for the sagittal phantom test set-up shown in Figure G.4.

**a) Phone position 1 – cheek position**

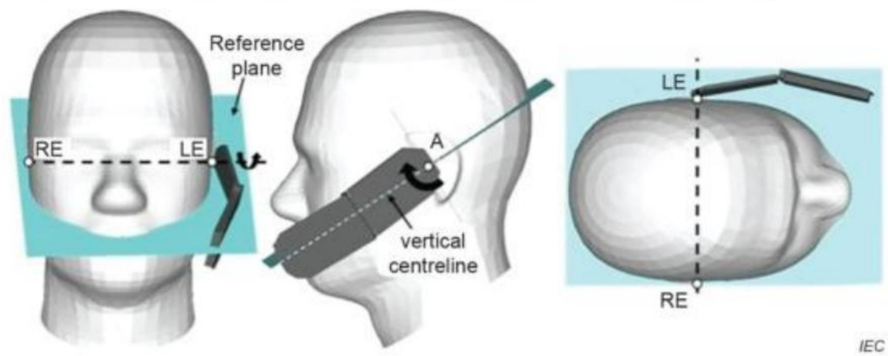



**b) One possible DUT position against the head after applying 7.2.4.2.2 c)**



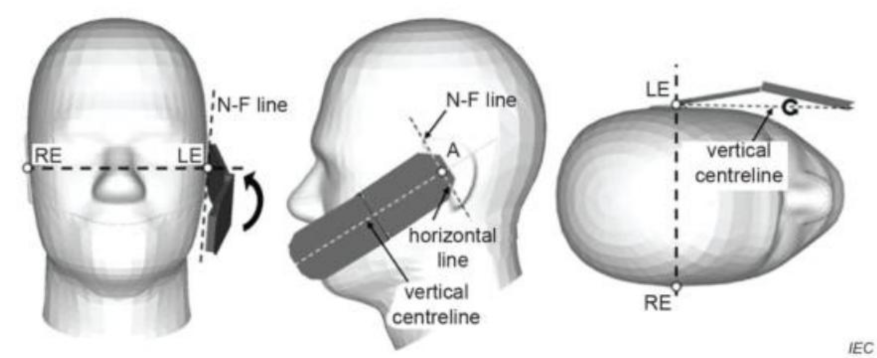

NOTE The black arrows show the direction of translation of the DUT for 7.2.4.2.2 d).

**c) DUT position after applying 7.2.4.2.2 d)**



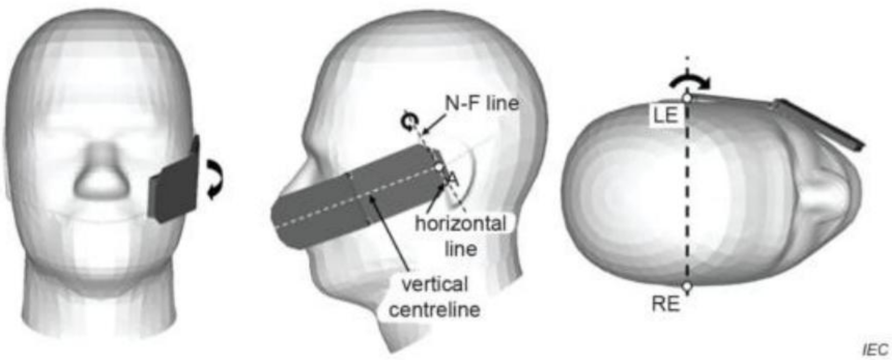

NOTE The curved black arrows show the direction of rotation of the DUT for 7.2.4.2.2 e).

**d) DUT position after applying 7.2.4.2.2 e)**




NOTE The curved black arrows show the direction of rotation of the DUT for 7.2.4.2.2 f).

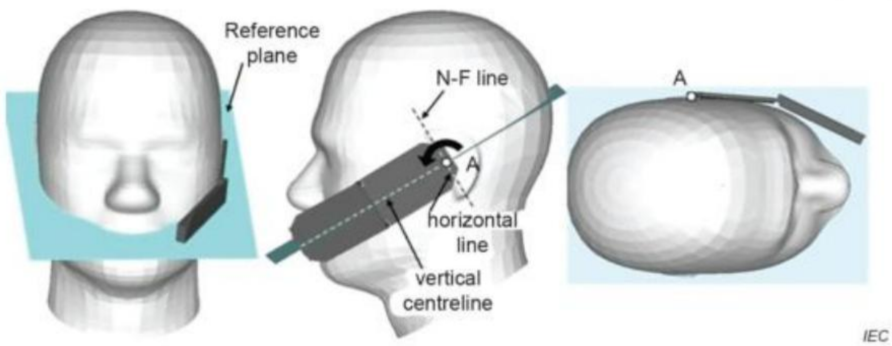
**e) DUT position after applying 7.2.4.2.2 f)**




NOTE The curved black arrows show the direction of rotation of the DUT for 7.2.4.2.2 g)

**f) DUT position after applying 7.2.4.2.2 g)**






NOTE The curved black arrows show the direction of rotation of the DUT for 7.2.4.2.2 h).

**g) DUT position after applying 7.2.4.2.2 h)**

**Figure 16 – Cheek position of the DUT on the left side of SAM where the device position shall be maintained for the phantom test set-up**

## 6.1.2 Definition of the tilt position

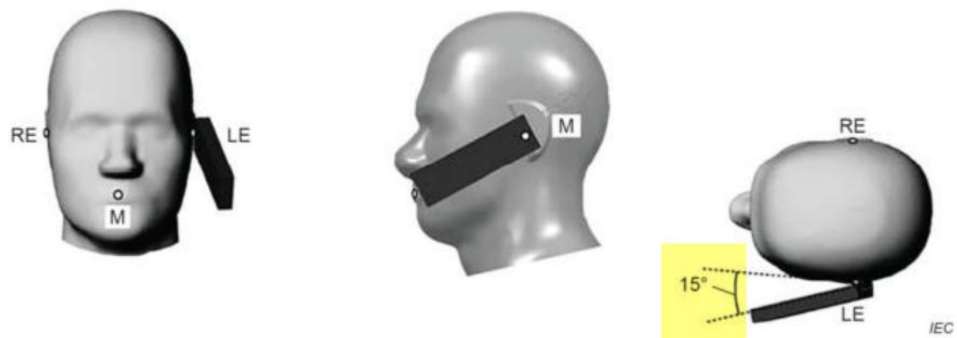
The tilt position is established using steps a) through d) as follows.

(a) Repeat steps a) through j) of 7.2.4.2.2 to place the DUT in the cheek position)(see Figure16).

(b) While maintaining the orientation of the DUT, move the DUT away from the pinna along the line passing through RE and LE far enough to allow a rotation of the DUT away from the cheek by 15°.

(c) Rotate the DUT around the horizontal line by 15°(see Figure 17).

(d) While maintaining the orientation of the DUT. move the DUT towards the phantom on a line passing through RE and LE until any part of the DUT touches the ear. The tilt position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, e.g. an extended antenna in contact with the back of the head phantom, the angle of the DUT shall be reduced. in this case, the tilt position is obtained if any part of the DUT is in contact with the pinna and a second point on the DUT is in contact with the phantom,e.g.the antenna in contact with the back of the head.




**Key**

M Mouth reference point

LE Left-ear ear reference point

RE Right-ear ear reference point

This device position shall be maintained for the phantom test set-up.

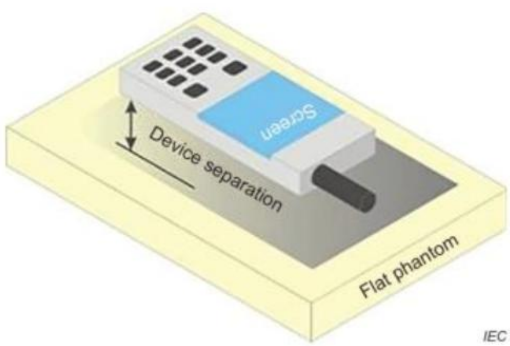
**Figure 17 – Tilt position of the DUT on the left side of SAM**

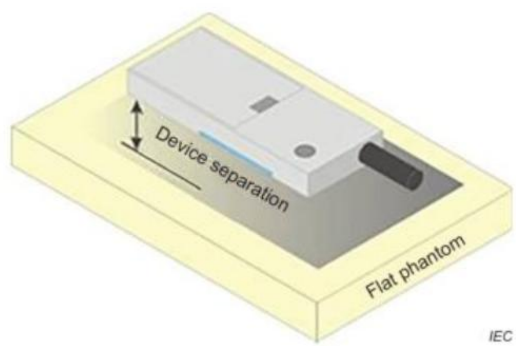
## 6.2 Body-worn Position Conditions

Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB 447498 are used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode. When the reported SAR for a body-worn accessory.

Body-worn accessories that do not contain metallic or conductive components may be tested according to worst-case exposure configurations, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics. All body-worn accessories containing metallic components are tested in conjunction with the host device.

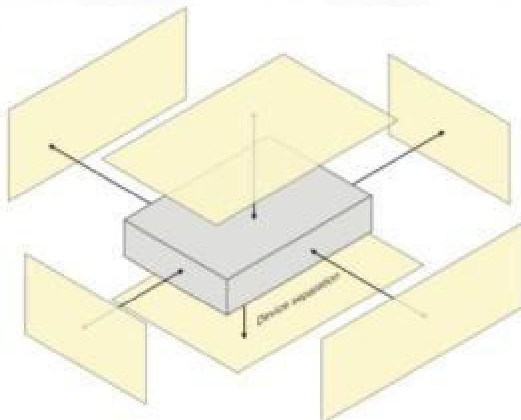
Body-worn accessory SAR compliance is based on a single minimum test separation distance for all wireless and operating modes applicable to each body-worn accessory used by the host, and according to the relevant voice and/or data mode transmissions and operations. If a body-worn accessory supports voice only operations in its normal and expected use conditions, testing of data mode for body-worn compliance is not required. A conservative minimum test separation distance for supporting off-the-shelf body-worn accessories that may be acquired by users of consumer handsets is used to test for body-worn accessory SAR compliance. This distance is determined by the handset manufacturer, according to the requirements of Supplement C 01-01. Devices that are designed to operate on the body of users using lanyards and straps, or without requiring additional body-worn accessories, will be tested using a conservative minimum test separation distance <= 5 mm to support compliance.



## 6.3 Hotspot Mode Exposure Position Conditions

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing functions, the relevant hand and body exposure conditions are tested according to the hotspot SAR procedures in KDB 941225. A test separation distance of 10 mm is required between the phantom and all surfaces and edges with a transmitting antenna located within 25 mm from that surface or edge. When the form factor of a handset is smaller than 9 cm x 5 cm, a test separation distance of 5 mm (instead of 10 mm) is required for testing hotspot mode. When the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface).




## 6.4 Product Specific 10g Exposure Consideration

According with FCC KDB 648474 D04, for smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear, unless it is confirmed otherwise through KDB inquiries, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless modes and frequency band. Devices marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance;

The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the body-equivalent tissue dielectric parameters in KDB 865664 to address interactive hand use exposure conditions. The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.



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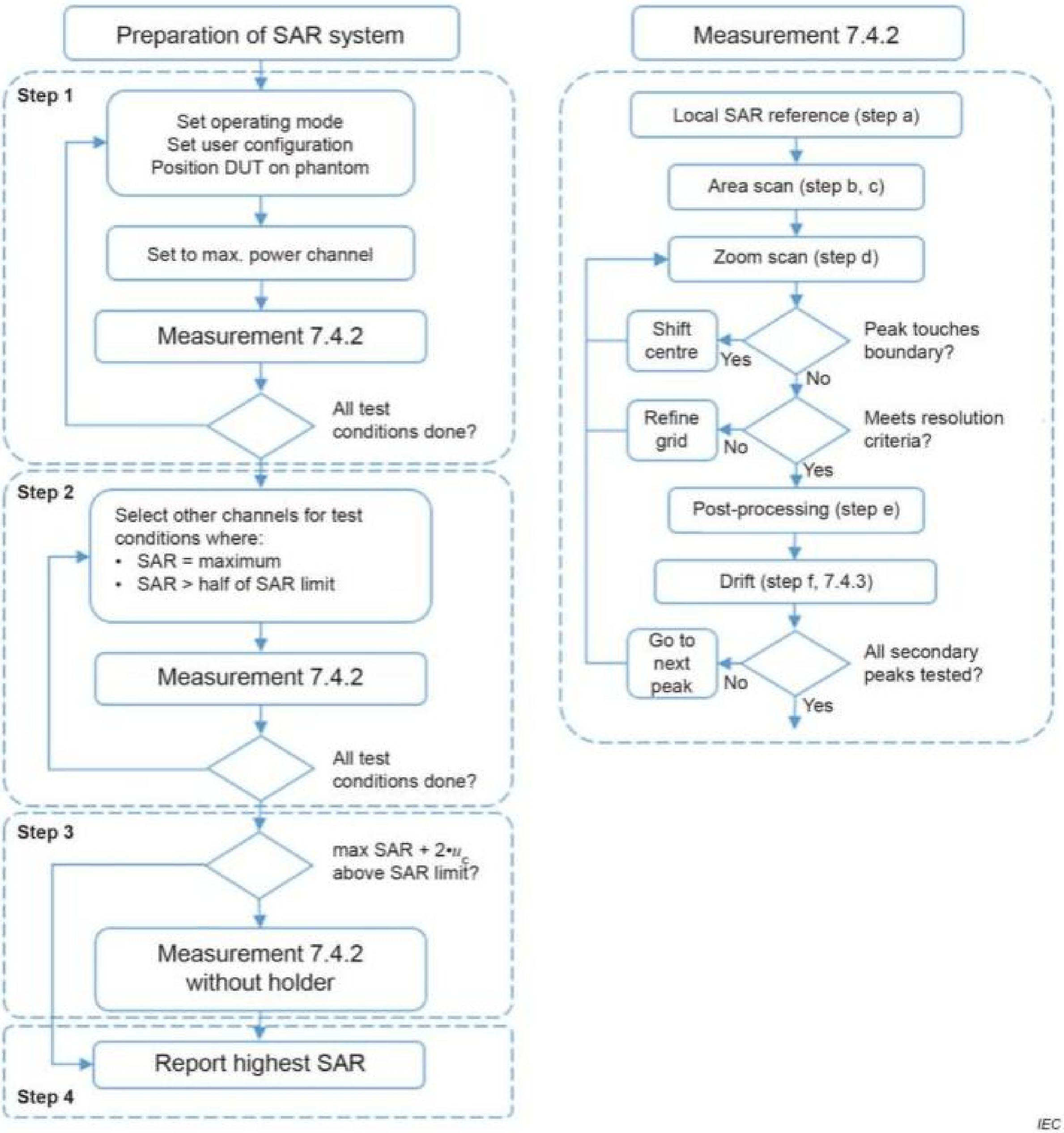
# 7. Measurement Procedure

## 7.1 Measurement Process Diagram

Body SAR



## 7.2 SAR Scan General Requirement

Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1 g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEC/IEEE 62209-1528: 2020.

**Table 3 – Area scan parameters**

| Parameter | DUT transmit frequency being tested | |
|---|---|---|
| | $f \leq 3$ GHz | 3 GHz < $f \leq 10$ GHz |
| Maximum distance between the measured points (geometric centre of the sensors) and the inner phantom surface ($z_{M1}$ in Figure 20 in mm) | 5 ± 1 | $\delta$ ln(2)/2 ± 0,5 [a] |
| Maximum spacing between adjacent measured points in mm (see O.8.3.1)[b] | 20, or half of the corresponding zoom scan length, whichever is smaller | 60 / $f$, or half of the corresponding zoom scan length, whichever is smaller |
| Maximum angle between the probe axis and the phantom surface normal ($\alpha$ in Figure 20)[c] | 5° (flat phantom only)<br>30° (other phantoms) | 5° (flat phantom only)<br>20° (other phantoms) |
| Tolerance in the probe angle | 1° | 1° |

[a] $\delta$ is the penetration depth for a plane-wave incident normally on a planar half-space.

[b] See Clause O.8 on how $\Delta x$ and $\Delta y$ may be selected for individual area scan requirements.

[c] The probe angle relative to the phantom surface normal is restricted due to the degradation in the measurement accuracy in fields with steep spatial gradients. The measurement accuracy decreases with increasing probe angle and increasing frequency. This is the reason for the tighter probe angle restriction at frequencies above 3 GHz.

**Table 4 – Zoom scan parameters**

| Parameter | DUT transmit frequency being tested | |
|---|---|---|
| | $f \leq 3$ GHz | 3 GHz < $f \leq 10$ GHz |
| Maximum distance between the closest measured points and the phantom surface ($z_{M1}$ in Figure 20 and Table 3, in mm) | 5 | $\delta$ ln(2)/2 [a] |
| Maximum angle between the probe axis and the phantom surface normal ($\alpha$ in Figure 20) | 5° (flat phantom only)<br>30° (other phantoms) | 5° (flat phantom only)<br>20° (other phantoms) |
| Maximum spacing between measured points in the $x$- and $y$-directions ($\Delta x$ and $\Delta y$, in mm) | 8 | 24 / $f$ [b] |
| For uniform grids:<br>Maximum spacing between measured points in the direction normal to the phantom shell ($\Delta z_1$ in Figure 20, in mm) | 5 | 10 / ($f$ − 1) |
| For graded grids:<br>Maximum spacing between the two closest measured points in the direction normal to the phantom shell ($\Delta z_1$ in Figure 20, in mm) | 4 | 12 / $f$ |
| For graded grids:<br>Maximum incremental increase in the spacing between measured points in the direction normal to the phantom shell ($R_z = \Delta z_2 / \Delta z_1$ in Figure 20) | 1,5 | 1,5 |
| Minimum edge length of the zoom scan volume in the $x$- and $y$-directions ($L_z$ in O.8.3.2, in mm) | 30 | 22 |
| Minimum edge length of the zoom scan volume in the direction normal to the phantom shell ($L_h$ in O.8.3.2 in mm) | 30 | 22 |
| Tolerance in the probe angle | 1° | 1° |

[a] $\delta$ is the penetration depth for a plane-wave incident normally on a planar half-space.

[b] This is the maximum spacing allowed, which might not work for all circumstances.

## 7.3 Measurement Procedure

The following steps are used for each test position

a. Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface

b. Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.

c. Measurement of the SAR distribution with a grid of 8 to 16mm * 8 to16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.

d. Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 *32 mm is assessed by measuring 5 or 8 * 5 or 8*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

## 7.4 Area & Zoom Scan Procedure

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

When the 1 g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

## 8. Conducted RF Output Power

Data reference reports SZ25040036S01 and SZ25040036S02.

## 9. Test Exclusion Consideration

Data reference reports SZ25040036S01 and SZ25040036S02.

## 10. Test Result

Data reference reports SZ25040036S01 and SZ25040036S02.

## 11. SAR Measurement Variability

Data reference reports SZ25040036S01 and SZ25040036S02.

## 12. Simultaneous Transmission

Data reference reports SZ25040036S01 and SZ25040036S02.

## 13. Test Equipment List

Data reference reports SZ25040036S01 and SZ25040036S02.

## ANNEX A Simulating Liquid Verification Result

Data reference reports SZ25040036S01 and SZ25040036S02.

## ANNEX B System Check Result

Data reference reports SZ25040036S01 and SZ25040036S02.

# ANNEX C SAR Dipole Calibrations

Data reference reports SZ25040036S01 and SZ25040036S02.

# ANNEX D Test Data

Data reference reports SZ25040036S01 and SZ25040036S02.

# ANNEX E SAR Test Setup Photos

Data reference reports SZ25040036S01 and SZ25040036S02.

# ANNEX F EUT External and Internal Photos

Please refer to RF Report.

# ANNEX G Calibration Information

Please refer to the document “Calibration.pdf”.

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**--END OF REPORT--**