Lightcomm Technology Co., Ltd.

TEST REPORT

SCOPE OF WORK
FCC TESTING–100005206, MID7015

REPORT NUMBER
190604008SZN-001

ISSUE DATE | **[REVISED DATE]**
12 June 2019 | [---------------------]

PAGES
70

DOCUMENT CONTROL NUMBER
FCC SAR_b

SAR TEST REPORT

For

Lightcomm Technology Co., Ltd.

7"Tablet

Model No.: 100005206, MID7015

FCC ID: XMF-MID7015

Report No.: 190604008SZN-001

Issue Date: 12 June 2019

Prepared by

Intertek Testing Services Shenzhen Ltd. Longhua Branch
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Table of Contents

1 GENERAL INFORMATION

Applicant:	Lightcomm Technology Co., Ltd. UNIT 1306 13/F ARION COMMERCIAL CENTRE, 2-12 QUEEN'S ROAD WEST, SHEUNG WAN HK
Product Description:	7"Tablet
Brand Name:	onn
Model Number:	100005206, MID7015
File Number:	190604008SZN-001
Date of Test:	06 June 2019

The above equipment was tested by Intertek Testing Services Shenzhen Ltd. Longhua Branch. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in IEEE 1528-2013 and KDB 865664. This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in ANSI/IEEE C95.1-1992.

The test results of this report relate only to the tested sample identified in this report

Prepared and Checked by:

Damon Wang
Project Engineer

Approved by:

Sunny Zhou
Supervisor
12 June 2019

2 EQUIPMENT UNDER TEST (EUT) TECHNICAL DESCRIPTION

Characteristics	Description
Device type:	TABLET
Exposure Category:	Uncontrolled Environment / General Population
Test Mode(s):	802.11b
Test Modulation:	DSSS
Device Class:	B
Antenna Type:	FPC Antenna
Antenna Gain:	3.02dBi
Max. SAR:	0.64 W/Kg 1g Body Tissue
Max Simultaneous SAR	0.81 W/Kg
Power supply:	D.C. 3.7V, with battery
	D.C. 5V, 1A with adaptor
Product Software Version:	PPR1.180610.011 release-keys
Product Hardware Version:	LC-MT8167-REV 0.1

Note:

1. *For more details, please refer to the User's manual of the EUT.*
2. *The sample under test was selected by the Client.*

3 AUXILIARY EQUIPMENT DETAILS

AE	Battery
Manufacturer:	SHENZHEN UTILITY POWER SOURCE CO.,LTD
Brand:	onn
Model:	U306992P
S/N:	/
capacity:	2100mAh
Voltage:	3.7V

4 TEST FACILITY

Site Description		
EMC Lab.	:	The Laboratory has been assessed and proved to be in compliance with CNAS/CL01: 2006(identical to ISO/IEC17025: 2005) The Certificate Registration Number is L0327
		Accredited by FCC The Certificate Registration Number is CN1188
Name of Firm	:	Intertek Testing Services Shenzhen Ltd. Longhua Branch
Site Location	:	101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, ShenZhen, P.R. China

5 GUIDANCE STANDARD

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

☒**FCC 47CFR §2.1093** Radiofrequency Radiation Exposure Evaluation: Portable Devices

☒**ANSI C95.1, 1992**: Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.(IEEE Std C95.1-1991)

☒**IEEE Std 1528™-2013**: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

☒**KDB 865664 D01** SAR measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz

☒**KDB 447498 D01** Mobile Portable RF Exposure v06: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

☒**KDB 648474 D04** Handset SAR v01r03: SAR Evaluation Considerations for Wireless Handsets.

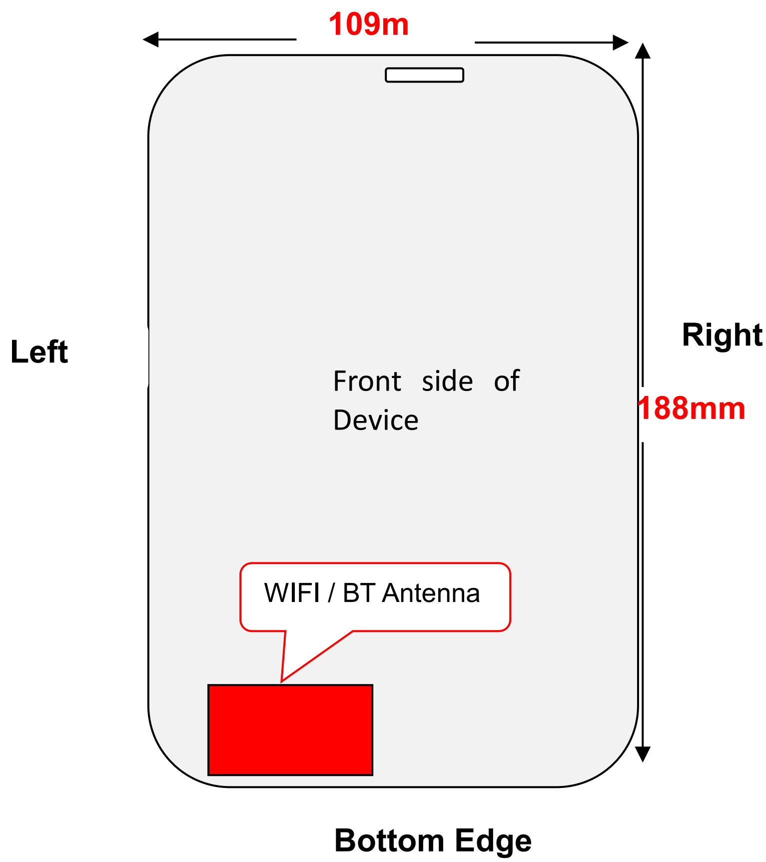
☒**KDB 941225 D06** Hotspot Mode v02r01: SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

☒**KDB 248227 D01** SAR measurement for 802.11 a b g v02r02: SAR Measurement Procedures for 802.11 a/b/g Transtitters

Remark:

This portable wireless equipment has been measured in all cases requested by the relevant standards. Test results in Chapter 11 of this test report are below limits specified in the relevant standards for the tested bands only.

6 EUT ANTENNA LOCATIONS



All Sides for SAR Testing Evaluation:

Mode	Location	Distance from ANT(mm)	Max. tune-up Power(mW)	Exemption with Max. Allowed Power (mW)	SAR Test
2.4G	Front Side	3	79.4	9.684	YES
	Back Side	5		9.684	YES
	Top Side	103		199.484	N/A
	Bottom Side	2		9.684	YES
	Left Side	18		34.861	YES
	Right Side	83		160.749	N/A

Note: SAR testing exemption according to KDB 447498 D01 Clause 4.3.1 with the following formula.

a) For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g SAR test exclusion thresholds are determined by the following:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance mm)] ·

[√f(GHz)] ≤ 3.0 for 1-g SAR,

*where f(GHz) is the RF channel transmit frequency in GHz

*When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

b) For 100 MHz to 6 GHz and test separation distances > 50 mm, the 1-g SAR test exclusion thresholds are determined by the following

{[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm)·10]} mW, for > 1500 MHz and ≤ 6 GHz

The Maximum reported SAR

Body SAR Configuration

Mode	Test Position	Channel/Frequency (MHz)	Limit SAR1g 1.6 W/kg	
			Measured SAR1g (W/kg)	Reported SAR1g (W/kg)
802.11b	Front Face	1 / 2412	0.571	0.64

Max Simultaneous SAR: 0.81W/Kg

7 RF EXPOSURE
7.1 LIMITS

Uncontrolled Environment

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

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

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

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

7.2 EVALUATION

☒According to FCC KDB447498 D01 and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,[16] where

   - $f_{(GHz)}$ is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation[17]
   - The result is rounded to one decimal place for comparison

   The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Routine SAR evaluation refers to that specifically required by § 2.1093, using measurements or computer simulation. Portable transmitters with output power greater than the applicable low threshold require SAR testing to qualify for TCB approval.

8 SPECIFIC ABSORPTION RATE (SAR)

8.1 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 ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

8.2 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 (ρ). 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, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

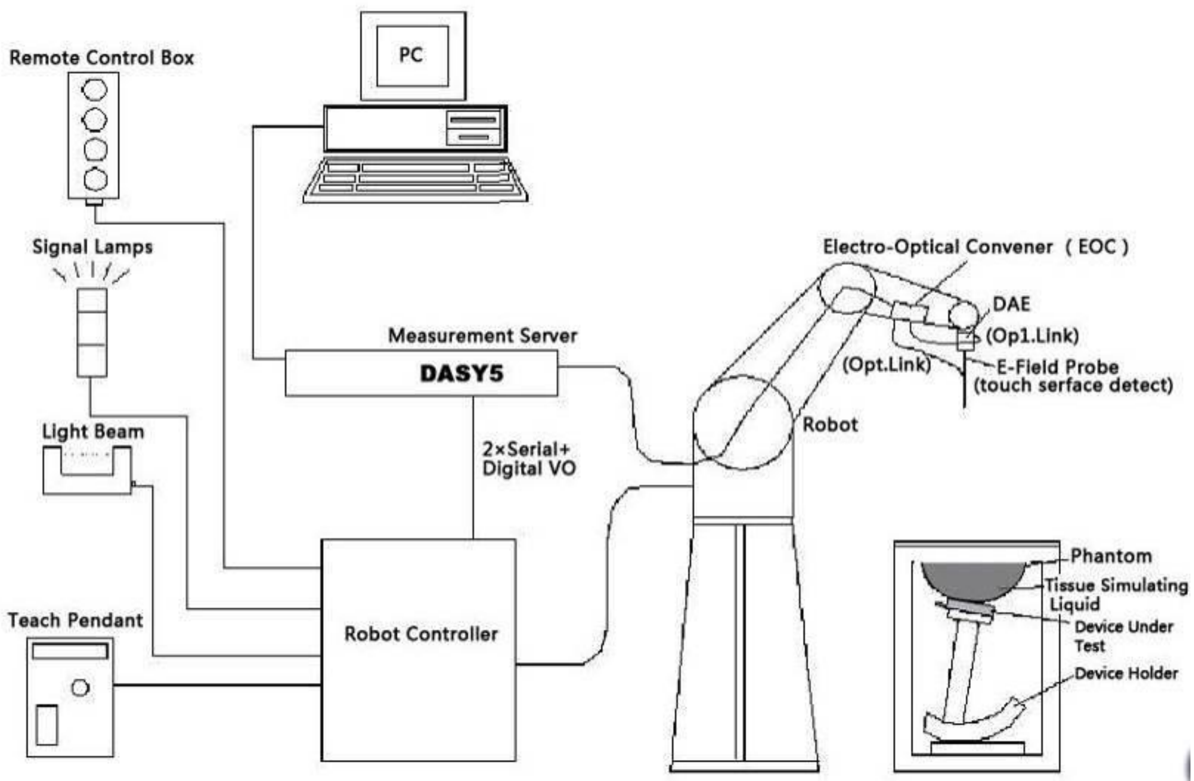
Where: σ is the conductivity of the tissue, ρ is the mass density of tissue and E is the RMS electrical field strength.

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

9 SAR MEASUREMENTS SYSTEM CONFIGURATION
9.1 SAR MEASUREMENT SET-UP

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

- 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 Win 7 profesional operating system and the DASY5 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.



Picture 1: SAR Lab Test Measurement Set-up

9.2 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 turning a software approach and looks for the maximum using 2nd ord curve fitting. The approach is stopped at reaching the maximum.

Probe Specifications:

Model: EX3DV4

Calibration: ISO/IEC 17025 calibration service available

Probe Length: 337 mm

Probe Tip Length: 9 mm

Body Diameter: 10 mm

Tip Diameter: 2.5 mm

Application: High Precision dosimetric measurements in any exposure scenario (e.g., very strong
Picture 2 E-field Probe gradient fields).

Picture 2: E-FIELD PROBE

9.3 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 the frequency 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:

Δt = Exposure time (30 seconds),
C = Heat capacity of tissue (brain or muscle),
ΔT = Temperature increase due to RF exposure.

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

Where:

σ = Simulated tissue conductivity,
ρ = Tissue density (kg/m^3).

9.4 OTHER TEST EQUIPMENT
9.4.1 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.

Picture 3: DAE

9.4.2 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX90XL) 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)

Picture 4: DASY 5

9.4.3 Measurement Server

The Measurement server is based on a PC/104 CPU broad with CPU (DASY5: 400 MHz, Intel Celeron), chip disk (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.

Picture 5: Server for DASY 5

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.

9.4.4 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 are 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 ε =3 and loss tangent δ =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>

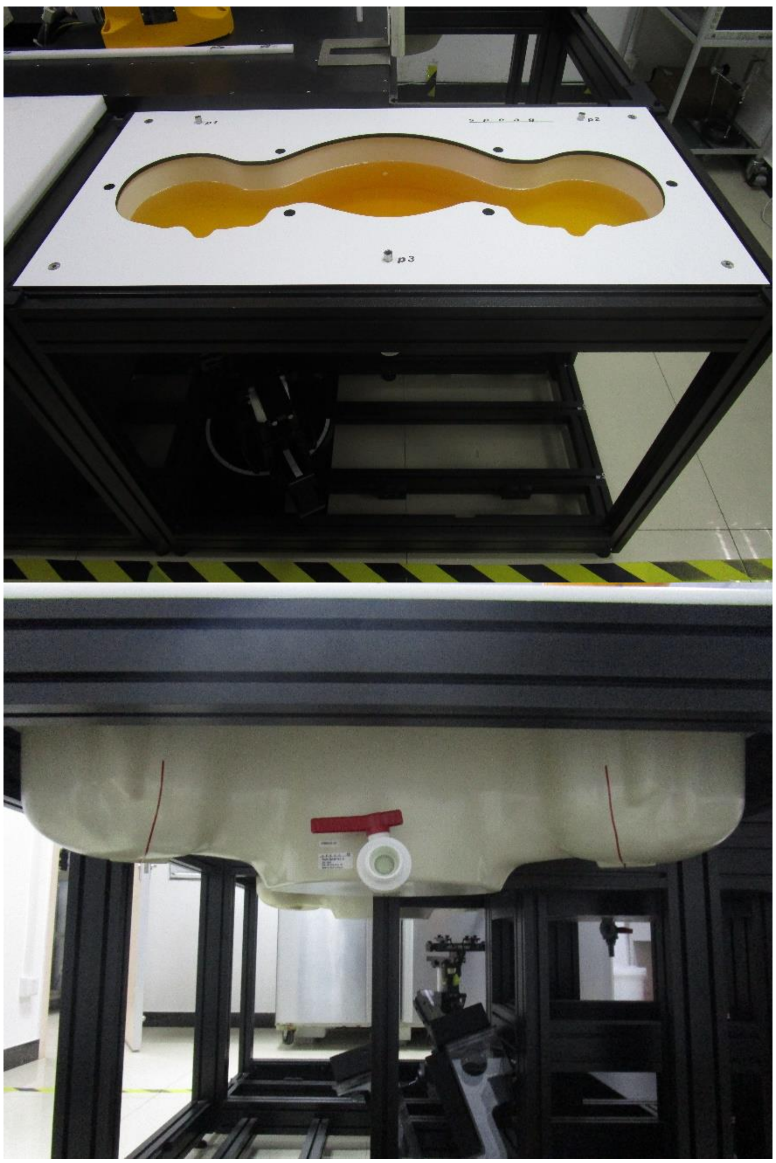
The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM and ELI phantoms.

Picture 6: Device Holder

9.4.5 Phantom

The SAM Twin Phantom V5.0 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).

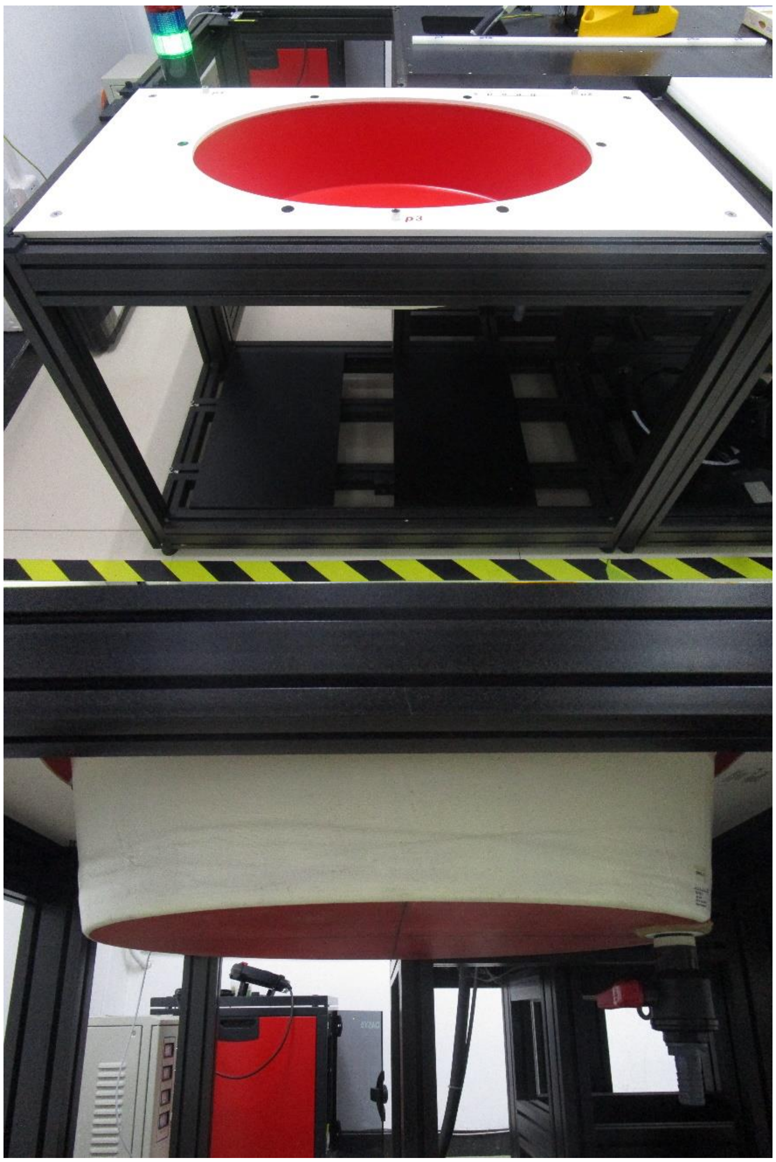
Shell Thickness: 2 ± 0. 2 mm
Filling Volume: Approx. 25 liters
Dimensions: 810 x l000 x 500 mm (H x L x W)
Available: Special



Picture 7: SAM Twin Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

Shell Thickness 2±0.2 mm
Filling Volume Approx. 30 liters
Dimensions 190×600×0 mm (H x L x W)



Picture 8: ELI4 Phantom

9.5 SCANNING PROCEDURE

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. ± 5 %.

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ± 0.1mm). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing is set according to FCC KDB Publication 865664. During scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

Zoom Scan

After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm.

Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 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 maxima 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 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 Zoom 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.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

Table 1: Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01

Frequency	Maximum Area Scan Resolution (mm) (Δxarea, Δyarea)	Maximum Zoom Scan Resolution (mm) (Δxzoom, Δyzoom)	Maximum Zoom Scan Spatial Resolution (mm) Δzzoom(n)	Minimum Zoom Scan Volume (mm) (x,y,z)
≤2 GHz	≤15	≤8	≤5	≥ 30
2-3 GHz	≤12	≤5	≤5	≥30
3-4 GHz	≤12	≤5	≤4	≥28
4-5 GHz	≤10	≤4	≤3	≥25
5-6 GHz	≤10	≤4	≤2	≥22

9.6 DATA STORAGE AND EVALUATION

9.6.1 Data Storage

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

The measured data can be visualized or exported in different units or formats, depending on the

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

9.6.2 Data Evaluation by SEMCAD

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

Probe parameters:
- Sensitivity $Norm_i$, 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
- Density

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

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

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

$\mathbf{V_i = U_i + U_i^2 \cdot c\,f / dcp_i}$
With $\mathbf{V_i}$ = compensated signal of channel i (i = x, y, z)
$\mathbf{U_i}$ = input signal of channel i (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
$\mathbf{dcp_i}$ = diode compression point (DASY parameter)
From the compensated input signals the primary field data for each channel can be

evaluated:
E-field probes: $\mathbf{E_i = (V_i / Norm_i \cdot ConvF)^{1/2}}$
H-field probes: $\mathbf{H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f}$
With $\mathbf{V_i}$ = compensated signal of channel i (i = x, y, z)
$\mathbf{Norm_i}$ = sensor sensitivity of channel i (i = x, y, z)
[mV/(V/m)2] for E-field Probes
ConvF = sensitivity enhancement in solution
$\mathbf{a_{ij}}$ **=** sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
$\mathbf{E_i}$ = electric field strength of channel i in V/m
$\mathbf{H_i}$ = magnetic field strength of channel i in A/m
The RSS value of the field components gives the total field strength (Hermitian magnitude):
$\mathbf{E_{tot} = (E_X^2 + E_Y^2 + E_Z^2)^{1/2}}$
The primary field data are used to calculate the derived field units.
$\mathbf{SAR = (E_{tot})\ 2 \cdot \sigma / (\rho \cdot 1000)}$
with **SAR** = local specific absorption rate in mW/g
$\mathbf{E_{tot}}$ = total field strength in V/m
= conductivity in [mho/m] or [Siemens/m]
= equivalent tissue density in g/cm^3

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

$\mathbf{P_{pwe} = E_{tot}^2 / 3770}$ **or** $\mathbf{P_{pwe} = H_{tot}^2 \cdot 37.7}$
with $\mathbf{P_{pwe}}$ = equivalent power density of a plane wave in mW/cm^2
$\mathbf{E_{tot}}$ = total electric field strength in V/m ;
$\mathbf{H_{tot}}$ = total magnetic field strength in A/m

9.7 TISSUE-EQUIVALENT LIQUID

9.7.1 Tissue-equivalent Liquid Ingredients

The liquid is consisted of water, salt and Glycol. The liquid has previously been proven to be suited for worst-case. The Table 2 shows the detail solution, Table 3 is target tissue dielectric parameters. It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB 865664 D01.

Table 2: Composition of the Head and Body Tissue Equivalent Matter

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
H750	0.2	-	0.2	1.4	57.0	-	41.1	-
H835	0.1	-	1.0	1.4	57.0	-	40.5	-
H900	0.1	-	1.0	1.5	56.5	-	40.9	-
H1450	-	45.5	-	0.7	-	-	53.8	-
H1640	-	45.8	-	0.5	-	-	53.7	-
H1750	-	44.5	-	0.3	-	-	55.2	-
H1800	-	44.9	-	0.2	-	-	54.9	-
H1900	-	44.9	-	0.2	-	-	54.9	-
H2000	-	50	-	-	-	-	50	-
H2300	-	44.9	-	0.1	-	-	55.0	-
H2450	-	45.0	-	0.1	-	-	54.9	-
H2600	-	45.1	-	0.1	-	-	54.8	-
H3500	-	8.0	-	0.2	-	20.0	71.8	-
H5G	-	-	-	-	-	17.2	65.52	17.3
B750	0.2	-	0.2	0.8	48.8	-	50.0	-
B835	0.2	-	0.2	0.9	48.5	-	50.2	-
B900	0.2	-	0.2	0.9	48.2	-	50.5	-
B1450	-	34.0	-	0.3	-	-	65.7	-
B1640	-	32.5	-	0.3	-	-	67.2	-
B1750	-	29.4	-	0.4	-	-	70.2	-
B1800	-	29.5	-	0.4	-	-	70.1	-
B1900	-	29.5	-	0.3	-	-	70.2	-
B2000	-	30.0	-	0.2	-	-	69.8	-
B2300	-	31.0	-	0.1	-	-	68.9	-
B2450	-	31.4	-	0.1	-	-	68.5	-
B2600	-	31.8	-	0.1	-	-	68.1	-
B3500	-	28.8	-	0.1	-	-	71.1	-
B5G	-	-	-	-	-	10.7	78.6	10.7

Table 3: Tissue Dielectric Parameters

Target Frequency	Head		Body	
(MHz)	ε_r	σ (S/m)	ε_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

9.7.2 Tissue-equivalent Liquid Properties

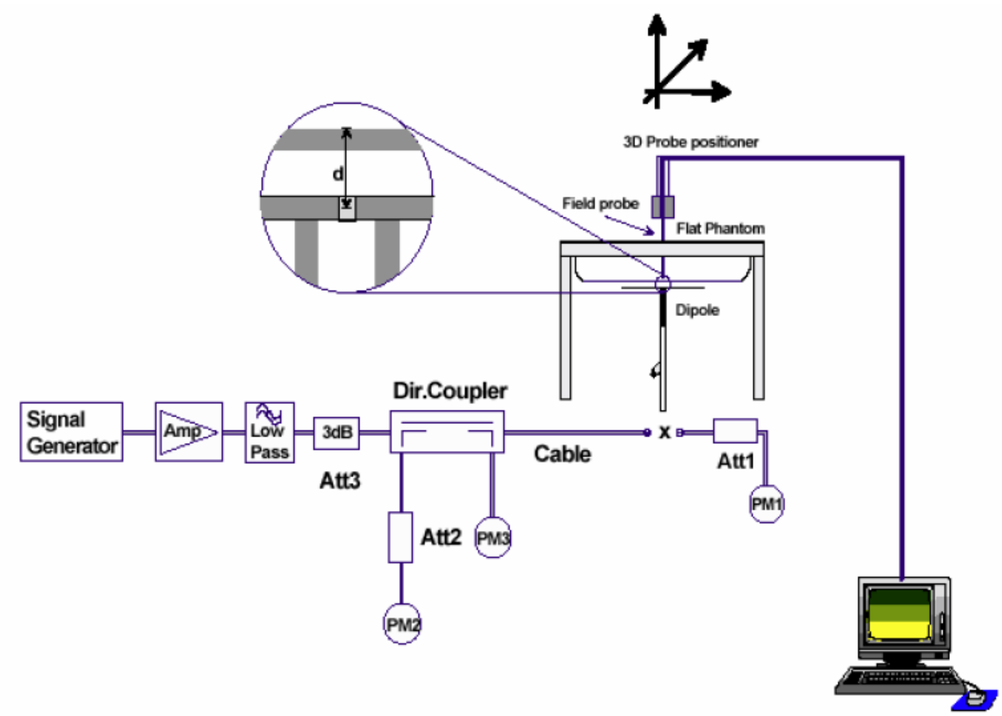
Table 4: Dielectric Performance of Tissue Simulating Liquid

Test Date	Frequency (MHz)	Tissue Type	Liquid Temp (℃)	Conductivity (σ)	Permittivity (εr)	Conductivity Target (σ)	Permittivity Target (εr)	Delta (σ) (%)	Delta (εr) (%)	Limit (%)
2019-06-06	2450	Body	21.5	2.016	52.379	1.95	52.7	3.38	-0.61	±5

9.8 SYSTEM CHECK

9.8.1 Description of System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the table 5. System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system (±10 %). System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



Picture 9: System Check Set-up

Justification for Extended SAR Dipole Calibrations

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< - 20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB 865664 D01:

Table 5: Antenna Parameters with Dipole

Dipole D2450V2 SN: 735				
Body Liquid				
Date of Measurement	Return Loss(dB)	Δ %	Impedance (Ω)	ΔΩ
2018-12-15	-23.6	-	54.9 + 4.9j	-

9.8.2 System Check Results

Table 6: System Check for Body Tissue Simulating Liquid

Frequency	Test Date	Dielectric Parameters		250mW Measured SAR_{1g}	1W Normalized SAR_{1g}	1W Target SAR_{1g}	Limit(±10% Deviation)
		εr	σ (s/m)	(W/kg)			
2450MHz	2019-06-06	52.379	2.016	12.70	50.80	50.60	0.40
Note: 1. The graph results see ANNEX B. 2. Target Values used derive from the calibration certificate.							

10 MEASUREMENT PROCEDURES

10.1 GENERAL DESCRIPTION OF TEST PROCEDURES

A communication link is set up with a System Simulator(SS) by air link, and a call is established. Then EUT is commanded to operate at maximum transmitting power.

Connection to the EUT is established via air interface with CMU 200, and the EUT is set to maximum output power . The EUT battery must be fully charged and checked periodically during the test to as certain uniform power output. The antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the EUT. The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the EUT by at least 30 dB.

10.2 MEASUREMENT VARIABILITY

Per FCC KDB Publication 865664 D01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

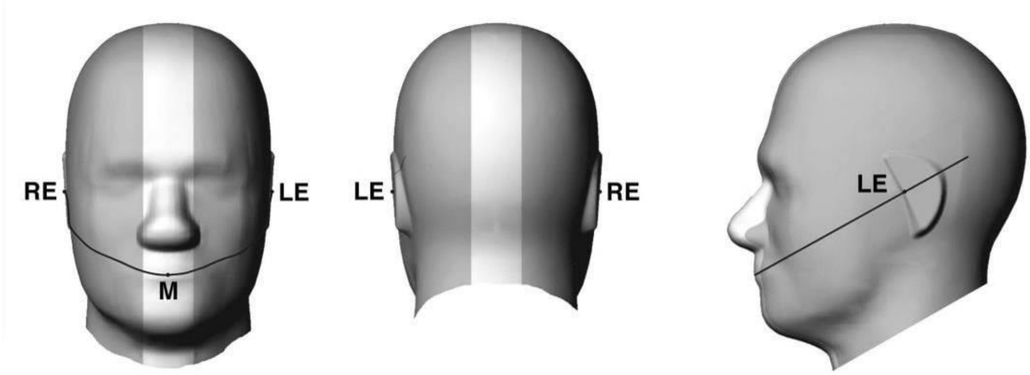
SAR Measurement Variability was assessed using the following procedures for each frequency band:

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

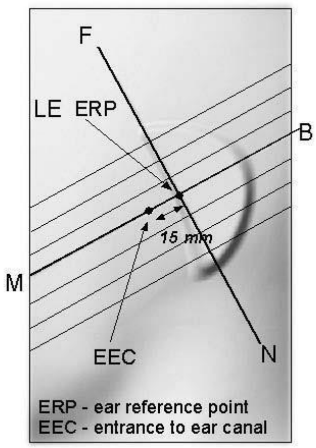
10.3 TEST POSITIONS REQUIREMENTS

(1) Ear and handset reference point

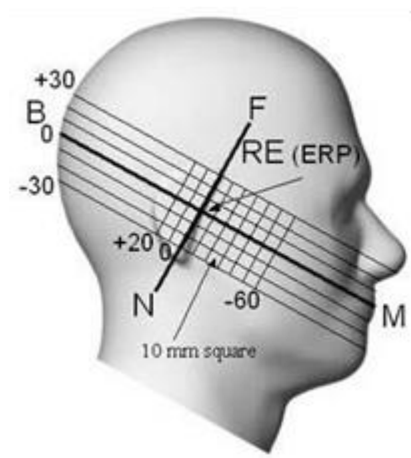
Picture11 shows the front, back, and side views of the SAM phantom. The center-of-mouth reference point is labeled “M,” the left ear reference point (ERP) is marked “LE,” and the right ERP is marked “RE.” Each ERP is 15 mm along the B-M (back-mouth) line behind the entrance-to-ear-canal (EEC) point, as shown in Picture12.The Reference Plane is defined as passing through the two ear reference points and point M. The line N-F (neck-front), also called the reference pivoting line, is normal to the Reference Plane and perpendicular to both a line passing through RE and LE and the B-M line (see Picture13). Both N-F and B-M lines should be marked on the exterior of the phantom shell to facilitate handset positioning. Posterior to the N-F line the ear shape is a flat surface with 6 mm thickness at each ERP, and forward of the N-F line the ear is truncated, as illustrated in Picture12. The ear truncation is introduced to preclude the ear lobe from interfering with handset tilt, which could lead to unstable positioning at the cheek.



Picture10: Front, back, and side views of SAM twin phantom



Picture11: Close-up side view of phantom showing the ear region.



Picture12: Side view of the phantom showing relevant markings and seven cross-sectional plane locations

(2) Definition of the cheek position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.

2. Define two imaginary lines on the handset—the vertical centerline and the horizontal line. The vertical centerline passes through two points on the Phantom Side of the handset—the midpoint of the width wt of the handset at the level of the acoustic output (point A in Picture 14 and Picture 15), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Picture 14). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Picture 15), especially for clamshell handsets, handsets with flip covers, and other irregularly-shaped handsets.

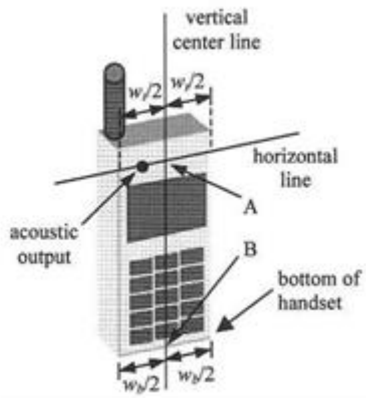
3. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Picture 16), such that the plane defined by the vertical centerline and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.

4. Translate the handset towards the phantom along the line passing through RE and LE until handset point A touches the pinna at the ERP.

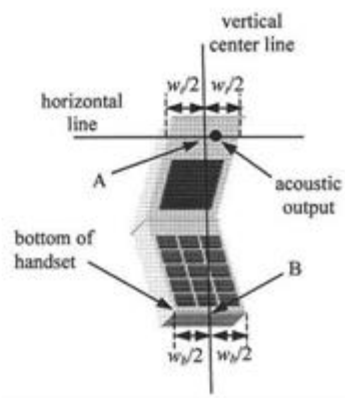
5. While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to the plane containing B-M and N-F lines, i.e., the Reference Plane.

6. Rotate the handset around the vertical centerline until the handset (horizontal line) is parallel to the N-F line.

7. While maintaining the vertical centerline in the Reference Plane, keeping point A on the line passing through RE and LE, and maintaining the handset contact with the pinna, rotate the handset about the N-F line until any point on the handset is in contact with a phantom point below the pinna on the cheek. See Picture 16. The actual rotation angles should be documented in the test report.



Picture13 Handset vertical and horizontal reference lines—"fixed case



Picture14 Handset vertical and horizontal reference lines—"clam-shell case"

Picture15 cheek or touch position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which establish the Reference Plane for handset positioning, are indicated.

(3) Definition of the tilt position

1. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece (flip cover), open the cover. If the handset can transmit with the cover closed, both configurations must be tested.

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

3. Rotate the handset around the horizontal line by 15°.

4. While maintaining the orientation of the handset, move the handset towards the phantom on the line passing through RE and LE until any part of the handset touches the ear. The tilt position is obtained when the contact point is on the pinna. See Picture 17. If contact occurs at any location other than the pinna, e.g., the antenna at the back of the phantom head, the angle of the handset should be reduced. In this case, the tilt position is obtained if any point

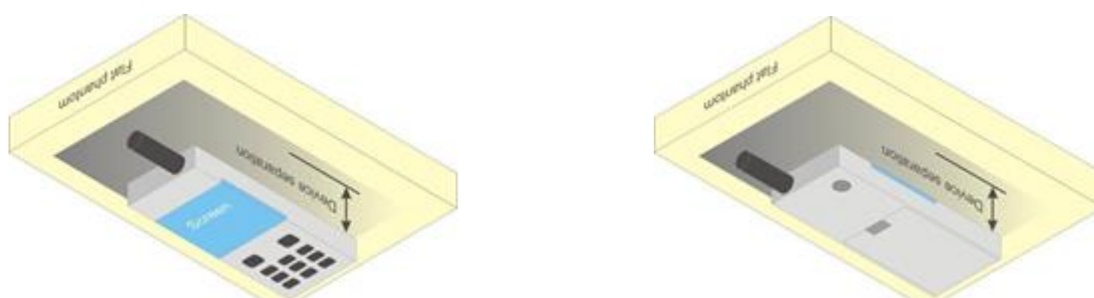
on the handset is in contact with the pinna and a second point

Picture16 Tilt position. The reference points for the right ear (RE), left ear (LE), and mouth (M), which define the Reference Plane for handset positioning, are indicated.

(4) Body Worn Accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Picture 18). Per KDB 648474 D04v01r02, 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 FCC KDB 447498 D01v05r02 should be 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 applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is < 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.



Picture17 Body Worn Position

(5)Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication

941225 D06v01r01 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10mm from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges, determined form general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v05r02 publication procedures. The “Portable Hotspot” feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

10.4 TEST COFIGURATION

10.4.1 GSM Test Configuration

SAR tests for GSM 850 and GSM 1900, a communication link is set up with a System Simulator (SS) by air link. Using CMU200 the power level is set to “5” for GSM 850, set to “0” for GSM 1900. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslots is 5.

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot. The allowed power reduction in the multi-slot configuration is as following: Output power of reductions:

Table 7: The allowed power reduction in the multi-slot configuration

Number of timeslots in uplink assignment	Permissible nominal reduction of maximum output power (dB)
1	0
2	0 to 3,0
3	1,8 to 4,8
4	3,0 to 6,0

10.4.2 UMTS Test Configuration

10.4.2.1 3G SAR Test Reduction Procedure

In the following procedures, the mode tested for SAR is referred to as the primary mode. The equivalent modes considered for SAR test reduction are denoted as secondary modes. Both primary and secondary modes must be in the same frequency band. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode.3 This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as “otherwise” in the applicable procedures; SAR measurement is required for the secondary mode.

10.4.2.2 Output power Verification

Maximum output power is verified on the high, middle and low channels according to procedures described in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all “1’s” for WCDMA/HSDPA or by applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HSDPA, HSPA) are requied in the SAR report. All configurations that are not supported by the handset or cannot be measured due to technical or equipment limitations must be clearly identified.

10.4.2.3 Head SAR

SAR for next to the ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”. The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure.

10.4.2.4 Body-Worn Accessory SAR

SAR for body-worn accessory configurations is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”. The 3G SAR test reduction procedure is applied to other spreading codes and multiple DPDCHn configurations supported by the handset with 12.2 kbps RMC as the primary mode.

Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreaing code or DPDCHn, for the highest reported body-worn accessory exposure SAR configuration in 12.2 kbps RMC. When more than 2 DPDCHn are supported by the handset, it may be necessary to configure additional DPDCHn using FTM (Factory Test Mode) or other chipset based test approaches with parameters similar to those used in 384 kbps and 768 kbps RMC.

11 TEST RESULTS

11.1 Conducted Power Results

Band	Mode	Channel / Frequency(MHz)	Power (dBm)	Tune up limited (dBm)
802.11b	DSSS	1/2412	18.51	18.0±1
		6/2437	17.68	
		11/2462	17.44	
BT	GFSK	1 / 2402	5.11	5.0 ± 1
		39 / 2441	5.88	
		78 / 2480	5.31	

11.2 Standalone SAR Test Exclusion Considerations

Per FCC KDB 447498 D01, the SAR exclusion threshold for distances <50mm is defined by the following equation:

(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm) ∗ Frequency (GHz) ≤3.0

The standalone SAR of BT is not required.

11.3 SAR TEST RESULTS

Test Position	Channel / Frequency (MHz)	Mode	Duty Cycle	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Drift ±0.21 dB	Limit SAR1g 1.6 W/kg		
						Drift (dB)	Measured SAR1g (W/kg)	Scaling Factor	Reported SAR1g (W/kg)
Test Position of Body (Distance 5mm)									
Front Face	1 / 2412	DSSS	1:1	19.0	18.51	-0.60	0.571	1.12	0.64
Rear Face	1 / 2412	DSSS	1:1	19.0	18.51	-0.20	0.303	1.12	0.34
Left Side	1 / 2412	DSSS	1:1	19.0	18.51	0.00	0.039	1.12	0.04
Bottom Side	1 / 2412	DSSS	1:1	19.0	18.51	-0.05	0.267	1.12	0.30
Repeated SAR of Worst Case Position									
-	-	-	-	-	-	-	-	-	-

Note:
1 When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
2 When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.
3 The EUT exercise program (provided by client) used during SAR testing was designed to exercise the various system components in a manner similar to a typical use. During the test, Channel and test mode software provided by the applicant was used to control the operating channel as well as the test mode. The worst case configuration is used in all specified testing.

Simultaneous Transmission Conditions

List of Mode for Simultaneous Multi-band Transmission:

No.	Applicable Simultaneous Transmission Combination
1.	WIFI+BT

Remark:

1. According to the KDB 447498 D01 v06, when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:
(max. power of channel, including tune-up tolerance, mW)/ (min. test separation distance, mm)] · [√f(GHz)/x] W/kg for test separation distances ≤50 mm; where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.
For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01 v06 as below:
Bluetooth:

Tune-Up Power (dBm)	Max. Power (mW)	Distance (mm)	Frequency(GHz)	X	SAR(1g) 5mm
6.0	3.98	5/10	2.480	7.5	0.17

2. The maximum SAR summation is calculated based on the same configuration and test position.

Maximum Summation:

position	WWAN	WIFI	BT	Summed SAR
	Mode	Max. Scaled SAR	Max. Scaled SAR	
Body 5mm	Front side	0.64	0.17	0.81
	Back side	0.34	0.17	0.51
	Left Side	0.04	0.17	0.21
	Bottom Side	0.30	0.17	0.47

11.4 MAXIMUM GRAPH RESULTS

The graph results see ANNEX C.

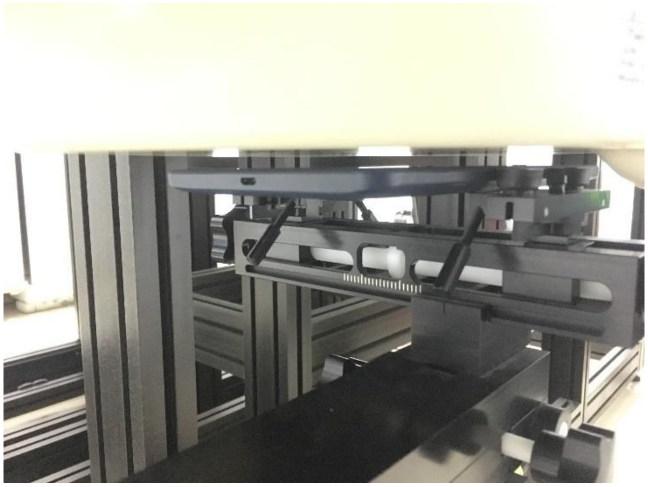
12 MEASUREMENT UNCERTAINTY

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.

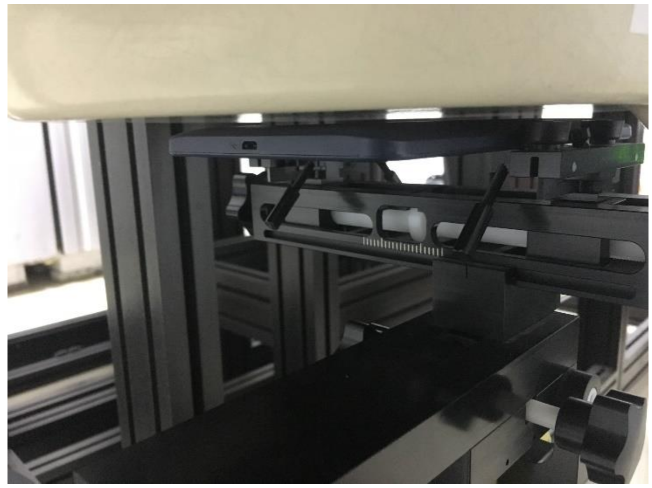
13 MAIN TEST INSTRUMENT

	Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
☒	SZ060-01	SAR Test System	SPEAG	DASY52 SAR TX90XL	F14/5YJ0B1/ A/01	N/A	N/A
☒	SZ060-01-01	E-Field Probe	SPEAG	EX3DV4	7322	8/30/2018	1 year
☒	SZ060-01-10	System Validation Dipole	SPEAG	D2450V2	735	12/15/2017	3 year
☒	SZ060-01-13	Data Acquisition Unit	SPEAG	DAE4	1473	8/29/2018	1 year
☒	SZ060-01-14	Dielectric Assessment Kit	SPEAG	DAKS 3.5	1056	N/A	N/A
☒	SZ060-01-15	Vector Reflectometer	Copper Mountain Technologies	Planar R140	0090614	N/A	N/A
☒	SZ060-01-16	Thermometer	LKM electronics GmbH	DTM3000	3477	8/10/2018	1 year
☒	SZ060-01-17	Power Amplifier	Mini Circuits	ZHL-42W+	QA1449003	N/A	N/A
☒	SZ060-01-18	Power Amplifier	Mini Circuits	ZVE-8G+	111701437	N/A	N/A
☒	SZ060-01-19	SAM Twin Phantom	SPEAG	SAM Twin Phantom V5.0	1888	N/A	N/A
☒	SZ060-01-20	SAM Twin Phantom	SPEAG	SAM Twin Phantom V5.0	1891	N/A	N/A
☒	SZ060-01-21	ELI Phantom	SPEAG	ELI Phantom NOTE.0	2033	N/A	N/A
☒	SZ180-13	MXG Vector Signal Generator	Keysight	N5182B	MY5305132 8	10/29/2018	1 year
☒	SZ070-04	Directional Bridge	Agilent	86205A	MY3140214 1	12/28/2018	1 year
☒	SZ182-02	RF Power Meter	Anritsu	ML2496A	1302005	5/28/2019	1 year
☒	SZ182-03	Average power sensor	R&S	NRP-Z22	101689	5/28/2019	1 year
☒	SZ065-04	Universal Radio Communicatio n Tester	R&S	CMU200	112012	5/28/2019	1 year
☒	N/A	Device Holder	SPEAG	N/A	N/A	N/A	N/A

ANNEX A : TEST LAYOUT AND SETUP



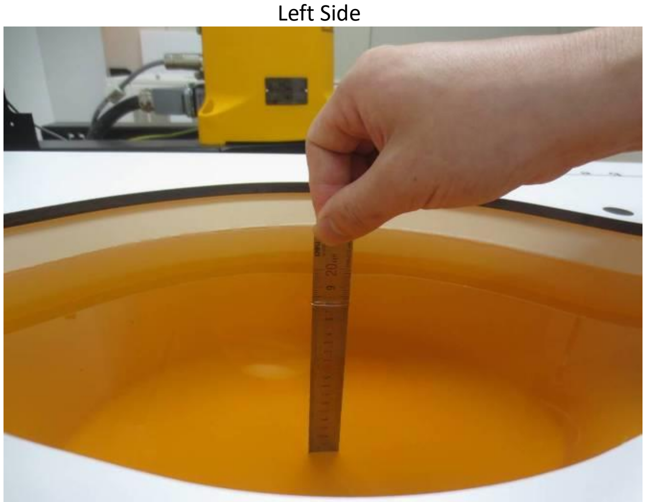
Front Face



Rear Face

Left Side

Bottom SIde



Liquid Depth in the flat phantom (2450MHz, 18.2cm)

ANNEX B : SYSTEM CHECK RESULTS

Date: 06/06/2019

Test Laboratory: Intertek Service

System Check 2450 Body

Communication System: UID 0, _CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used: f = 2450 MHz; σ = 2.016 S/m; ε_r = 52.379; ρ = 1000 kg/m^3
Phantom section: Flat Section

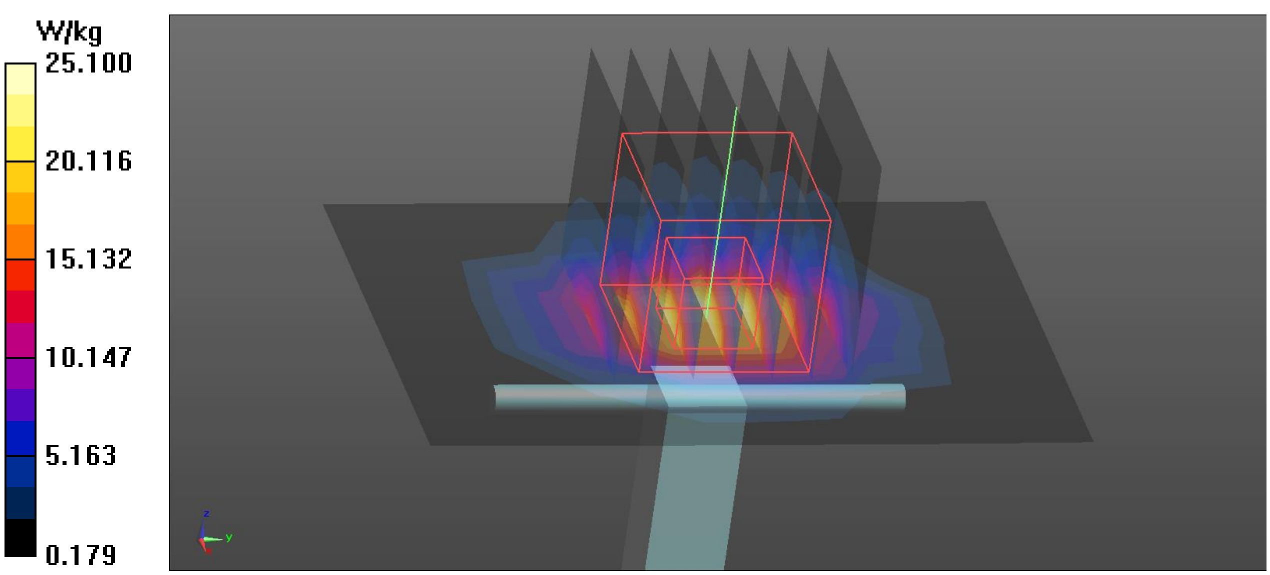
Ambient Temperature: 22.0 ℃; Liquid Temperature: 21.5 ℃

DASY Configuration:

- Probe: EX3DV4 - SN7322; ConvF(7.44, 7.44, 7.44) @ 2450 MHz; Calibrated: 5/29/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1305; Calibrated: 5/11/2018
- Phantom: SAM 2 V5.0 (30deg); Type: QD 000 P40 CD; Serial: 1888
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Area Scan (6x8x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 19.3 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 123.8 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 34.7 W/kg
SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.13 W/kg
Maximum value of SAR (measured) = 25.4 W/kg



ANNEX C : MAXIMUM GRAPH RESULTS

Date: Date: 06/06/2019

Test Laboratory: Intertek Service

WIFI_B_Front Face_5mm_1

Communication System: UID 0, WiFi 802.11 b (0); Frequency: 2412 MHz;Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used: f = 2412 MHz; σ = 1.968 S/m; εr = 52.51; ρ = 1000 kg/m3

Phantom section: Flat Section

Ambient Temperature: 22.0 ℃; Liquid Temperature: 21.5 ℃

DASY Configuration:

- Probe: EX3DV4 - SN7322; ConvF(7.3, 7.3, 7.3) @ 2412 MHz; Calibrated: 8/30/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1473; Calibrated: 8/29/2018
- Phantom: SAM 1 V5.0 (30deg); Type: QD 000 P40 CD; Serial: 1891
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Area Scan (121x181x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Reference Value = 3.484 V/m; Power Drift = -0.60 dB

Fast SAR: SAR(1 g) = 0.597 W/kg; SAR(10 g) = 0.287 W/kg

Maximum value of SAR (interpolated) = 1.01 W/kg

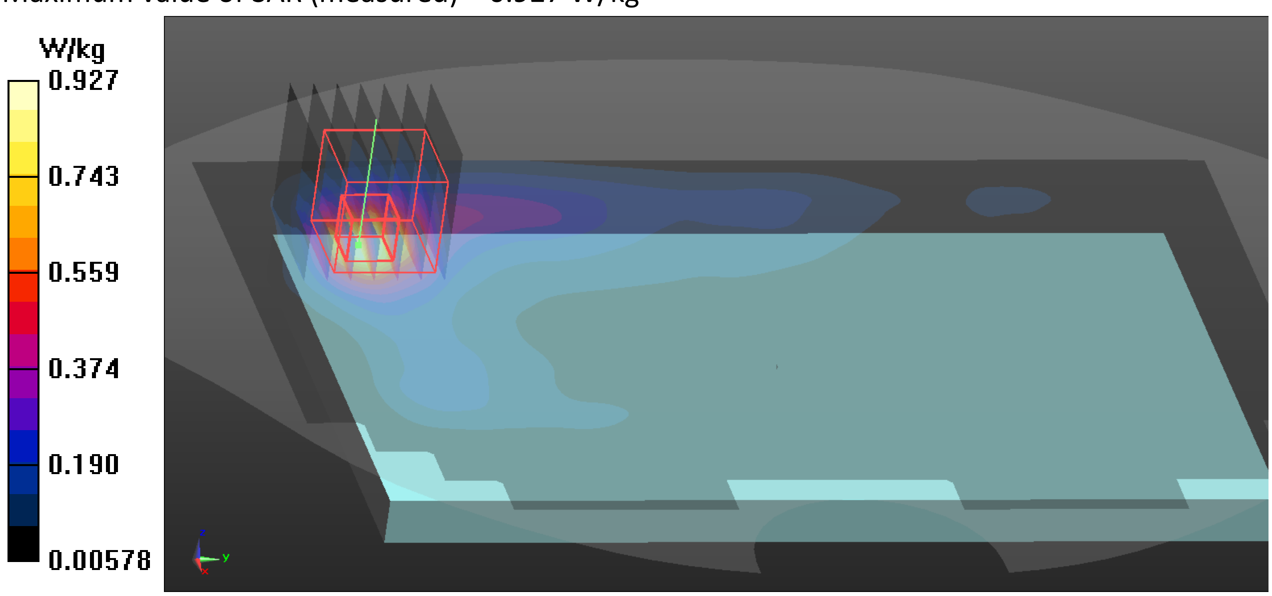
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.484 V/m; Power Drift = -0.60 dB

Peak SAR (extrapolated) = 1.14 W/kg

SAR(1 g) = 0.571 W/kg; SAR(10 g) = 0.276 W/kg

Maximum value of SAR (measured) = 0.927 W/kg



Test Laboratory: Intertek Service

WIFI_B_Rear Face_5mm_1

Communication System: UID 0, WiFi 802.11 b (0); Frequency: 2412 MHz;Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used: f = 2412 MHz; σ = 1.968 S/m; εr = 52.51; ρ = 1000 kg/m3

Phantom section: Flat Section

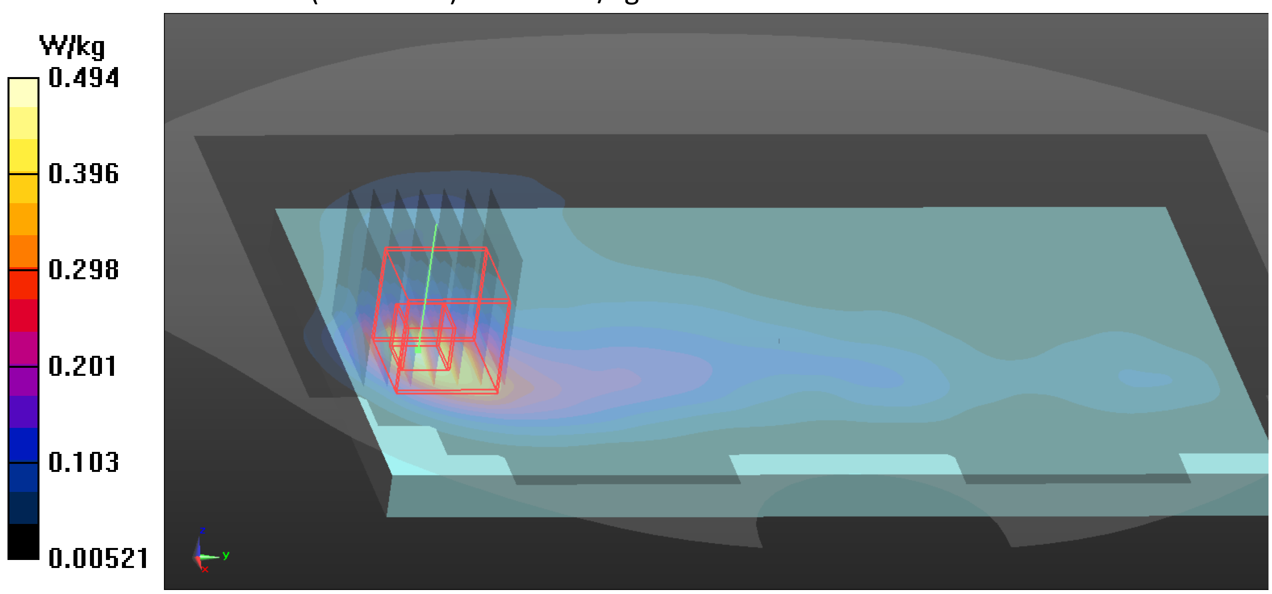
Ambient Temperature: 22.0 °C; Liquid Temperature: 21.5 °C

DASY Configuration:

Probe: EX3DV4 - SN7322; ConvF(7.3, 7.3, 7.3) @ 2412 MHz; Calibrated: 8/30/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1473; Calibrated: 8/29/2018
Phantom: SAM 1 V5.0 (30deg); Type: QD 000 P40 CD; Serial: 1891
DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Area Scan (121x181x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Reference Value = 4.846 V/m; Power Drift = -0.20 dB
Fast SAR: SAR(1 g) = 0.300 W/kg; SAR(10 g) = 0.153 W/kg
Maximum value of SAR (interpolated) = 0.493 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.846 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 0.606 W/kg
SAR(1 g) = 0.303 W/kg; SAR(10 g) = 0.152 W/kg
Maximum value of SAR (measured) = 0.494 W/kg



Test Laboratory: Intertek Service

WIFI_B_Left Side_5mm_1

Communication System: UID 0, WiFi 802.11 b (0);   Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used: f = 2412 MHz; σ = 1.968 S/m; εr = 52.51; ρ = 1000 kg/m3
Phantom section: Flat Section

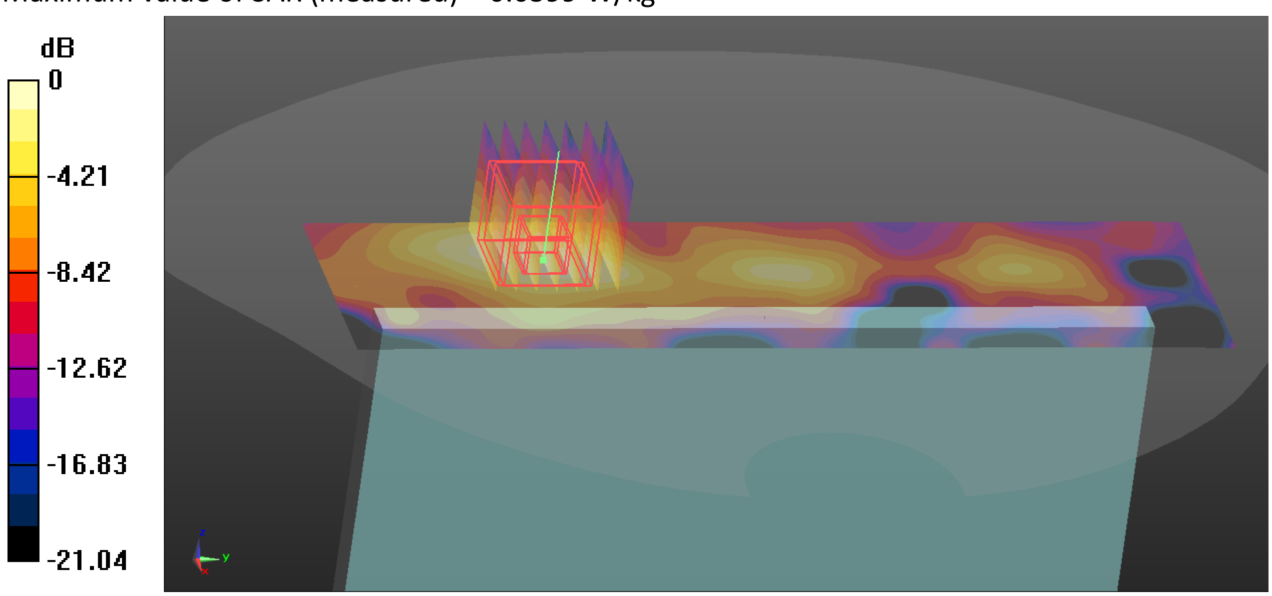
Ambient Temperature: 22.0 ℃; Liquid Temperature: 21.5 ℃

DASY Configuration:

Probe: EX3DV4 - SN7322; ConvF(7.3, 7.3, 7.3) @ 2412 MHz; Calibrated: 8/30/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1473; Calibrated: 8/29/2018
Phantom: SAM 1 V5.0 (30deg); Type: QD 000 P40 CD; Serial: 1891
DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Area Scan (51x181x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Reference Value = 3.579 V/m; Power Drift = -0.00 dB
Fast SAR: SAR(1 g) = 0.038 W/kg; SAR(10 g) = 0.020 W/kg
Maximum value of SAR (interpolated) = 0.0584 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.579 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 0.0720 W/kg
SAR(1 g) = 0.039 W/kg; SAR(10 g) = 0.021 W/kg
Maximum value of SAR (measured) = 0.0599 W/kg



Test Laboratory: Intertek Service

WIFI_B_Bottom Side_5mm_1

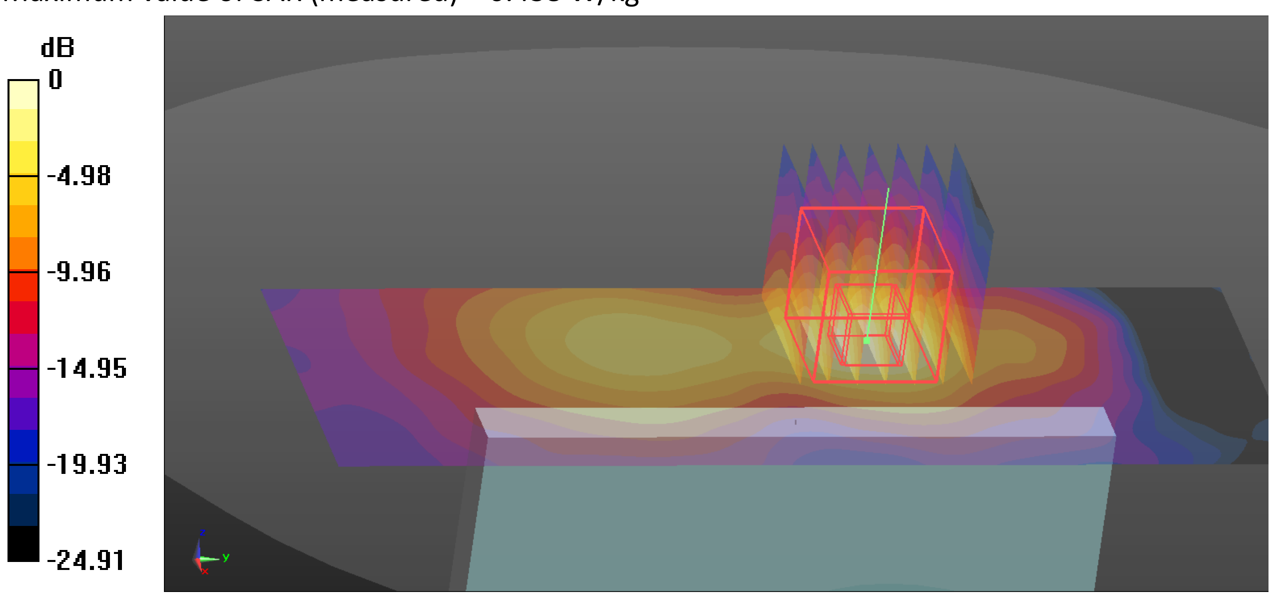
Communication System: UID 0, WiFi 802.11 b (0); Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used: f = 2412 MHz; σ = 1.968 S/m; εr = 52.51; ρ = 1000 kg/m3
Phantom section: Flat Section
Ambient Temperature: 22.0 °C; Liquid Temperature: 21.5 °C

DASY Configuration:

Probe: EX3DV4 - SN7322; ConvF(7.3, 7.3, 7.3) @ 2412 MHz; Calibrated: 8/30/2018
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1473; Calibrated: 8/29/2018
Phantom: SAM 1 V5.0 (30deg); Type: QD 000 P40 CD; Serial: 1891
DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

Area Scan (51x141x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Reference Value = 7.575 V/m; Power Drift = -0.05 dB
Fast SAR: SAR(1 g) = 0.253 W/kg; SAR(10 g) = 0.118 W/kg
Maximum value of SAR (interpolated) = 0.424 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.575 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.534 W/kg
SAR(1 g) = 0.267 W/kg; SAR(10 g) = 0.121 W/kg
Maximum value of SAR (measured) = 0.438 W/kg



ANNEX D : SYSTEM VALIDATION

The SAR system must be validated against its performance specifications before it is deployed. When SAR probes, system components or software are changed, upgraded or recalibrated, these must be validated with the SAR system(s) that operates with such components.

Table D.1: System Validation Part 1

System No.	Probe SN.	Liquid name	Validation date	Frequency point	Permittivity ε	Conductivity σ (S/m)
1	735	Body	2019-06-06	2450MHz	51.5	2.04

Table D.2: System Validation Part 2

CW Validation	**Sensitivity**	PASS	PASS
	Probe linearity	PASS	PASS
	Probe Isotropy	PASS	PASS
Mod Validation	**MOD.type**	QPSK	QPSK
	Duty factor	PASS	PASS
	PAR	PASS	PASS

ANNEX E : PROBE, DAE AND DIPOLE CALIBRATION CERTIFICATE

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

Client: Intertek Certificate No: Z18-60296

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:7322

Calibration Procedure(s): FF-Z11-004-01
Calibration Procedures for Dosimetric E-field Probes

Calibration date: August 30, 2018

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	20-Jun-18 (CTTL, No.J18X05032)	Jun-19
Power sensor NRP-Z91	101547	20-Jun-18 (CTTL, No.J18X05032)	Jun-19
Power sensor NRP-Z91	101548	20-Jun-18 (CTTL, No.J18X05032)	Jun-19
Reference10dBAttenuator	18N50W-10dB	09-Feb-18(CTTL, No.J18X01133)	Feb-20
Reference20dBAttenuator	18N50W-20dB	09-Feb-18(CTTL, No.J18X01132)	Feb-20
Reference Probe EX3DV4	SN 3846	25-Jan-18(SPEAG,No.EX3-3846_Jan18)	Jan-19
DAE4	SN 777	15-Dec-17(SPEAG, No.DAE4-777_Dec17)	Dec -18
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
SignalGeneratorMG3700A	6201052605	21-Jun-18 (CTTL, No.J18X05033)	Jun-19
Network Analyzer E5071C	MY46110673	14-Jan-18 (CTTL, No.J18X00561)	Jan -19

	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: August 31, 2018

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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), i 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).

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Probe EX3DV4

SN: 7322

Calibrated: August 30, 2018

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: Z18-60296 Page 3 of 11

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7322

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	0.45	0.55	0.53	±10.0%
DCP(mV)[B]	97.7	98.4	98.9	

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	160.7	±2.2%
		Y	0.0	0.0	1.0		176.7	
		Z	0.0	0.0	1.0		172.1	

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 5 and Page 6).
[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.

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7322

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)
835	41.5	0.90	9.54	9.54	9.54	0.17	1.36	±12.1%
1750	40.1	1.37	8.27	8.27	8.27	0.23	1.01	±12.1%
1900	40.0	1.40	7.89	7.89	7.89	0.26	0.95	±12.1%
2300	39.5	1.67	7.70	7.70	7.70	0.50	0.75	±12.1%
2450	39.2	1.80	7.48	7.48	7.48	0.54	0.73	±12.1%
2600	39.0	1.96	7.26	7.26	7.26	0.64	0.68	±12.1%
5250	35.9	4.71	5.28	5.28	5.28	0.50	1.25	±13.3%
5750	35.4	5.22	4.70	4.70	4.70	0.50	1.55	±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.

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7322

Calibration Parameter Determined in Body 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)
835	55.2	0.97	9.73	9.73	9.73	0.18	1.38	±12.1%
1750	53.4	1.49	7.90	7.90	7.90	0.20	1.13	±12.1%
1900	53.3	1.52	7.70	7.70	7.70	0.19	1.21	±12.1%
2450	52.7	1.95	7.30	7.30	7.30	0.58	0.74	±12.1%
2600	52.5	2.16	7.08	7.08	7.08	0.65	0.68	±12.1%
5250	48.9	5.36	4.75	4.75	4.75	0.50	1.40	±13.3%
5750	48.3	5.94	4.11	4.11	4.11	0.55	1.65	±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.

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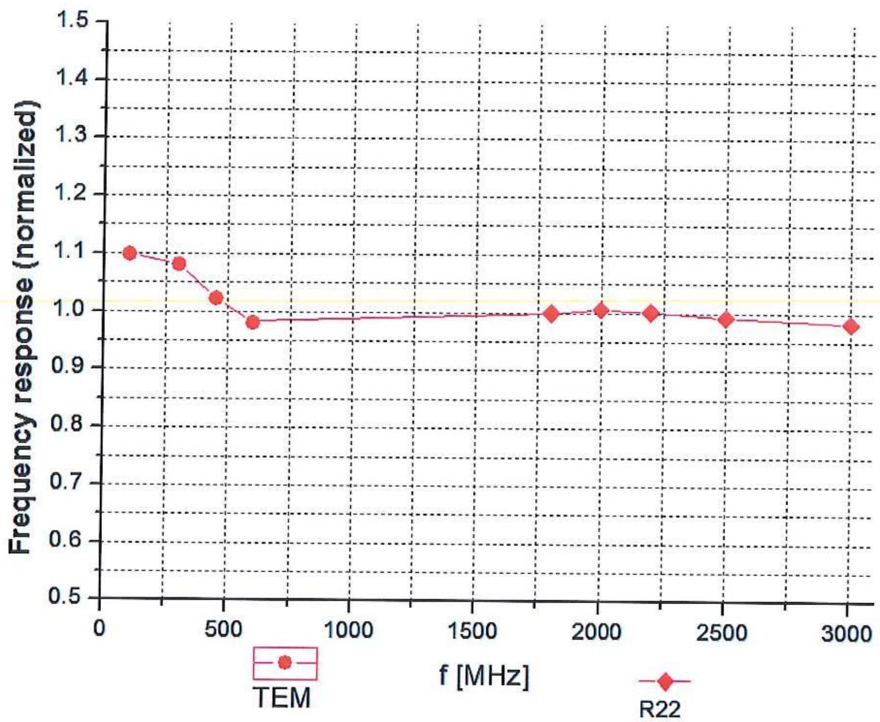
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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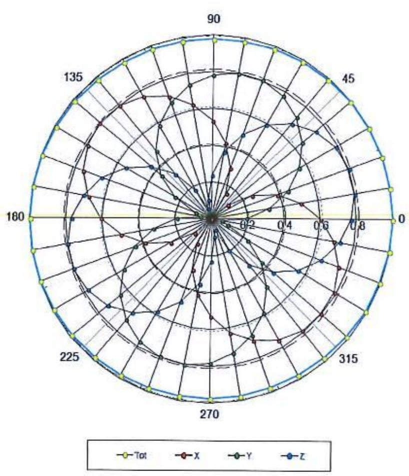
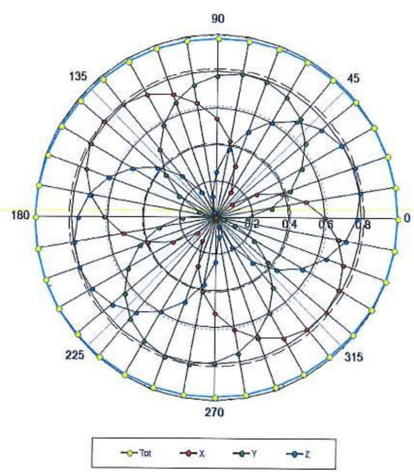
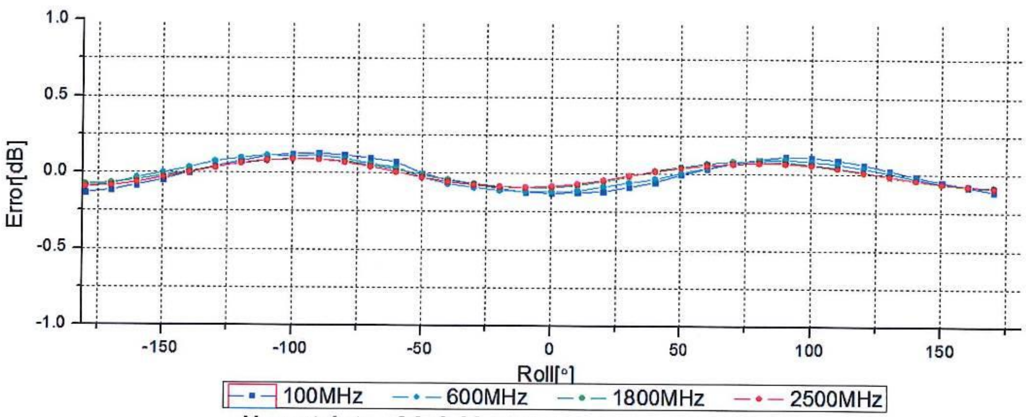
Receiving Pattern (Φ), θ=0°

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







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

Certificate No: Z18-60296 Page 8 of 11

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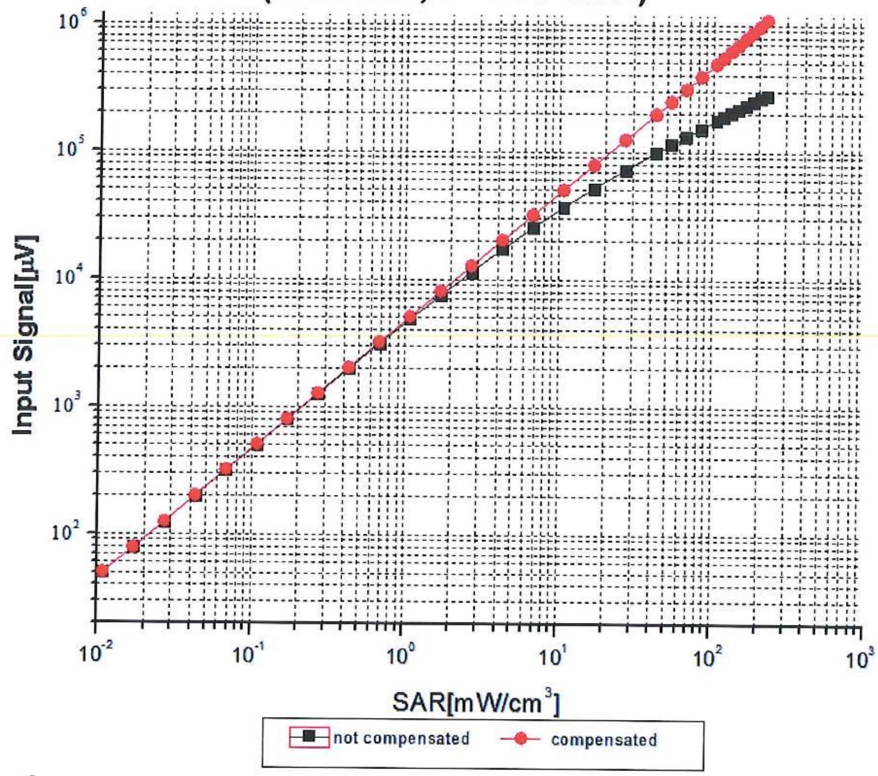
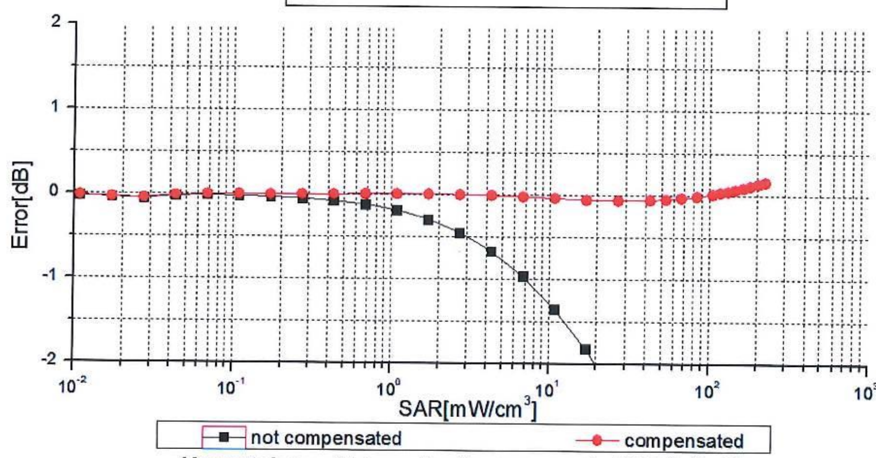
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)





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

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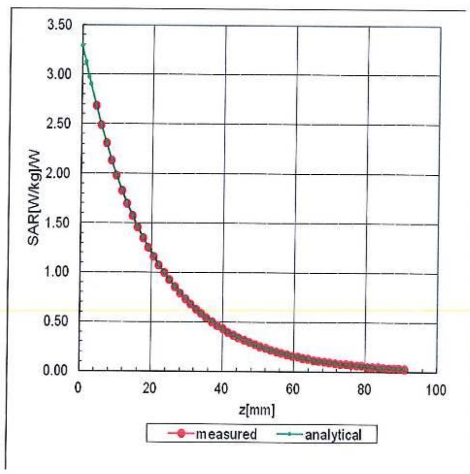
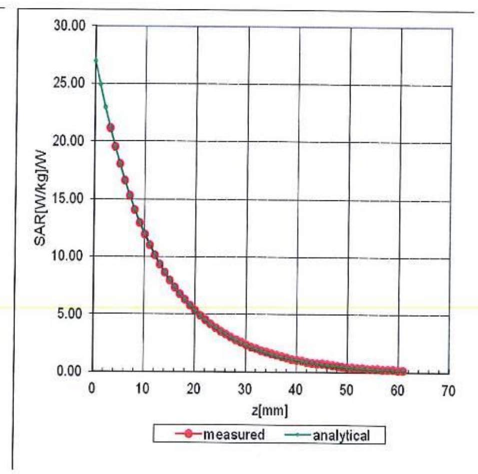
Conversion Factor Assessment

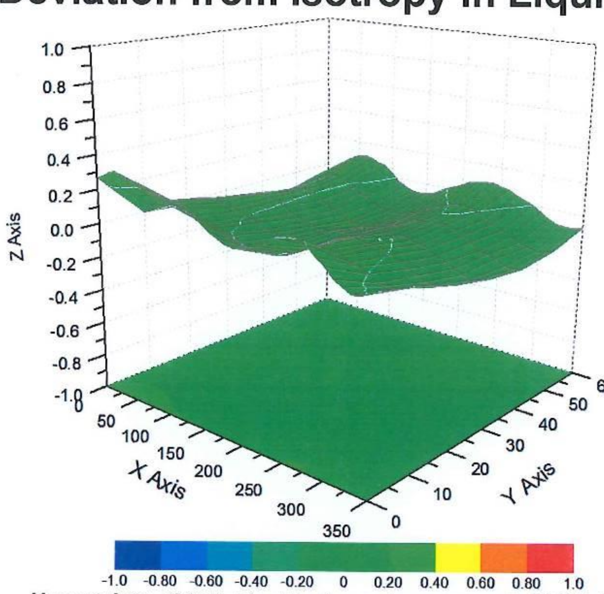
f=835 MHz, WGLS R9(H_convF)



f=1750 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±3.2% (K=2)

Certificate No: Z18-60296 Page 10 of 11

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7322

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	43.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

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Client : Intertek

Certificate No: Z18-60297

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1473
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	August 29, 2018

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
Process Calibrator 753	1971018	20-Jun-18 (CTTL, No.J18X05034)	June-19

	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: August 31, 2018