FCC SAR TEST REPORT

Client Name	:	Shenzhen Beijia Electronic Technology Co., Ltd.
Address	:	2/F, No. 20 Xinkang 2nd Road, Shatian Community, Kengzi Street, Pingshan District, Shenzhen, China
Product Name	:	Walkie talkie
Date	:	Mar. 21, 2019

Shenzhen Anbotek Compliance Laboratory Limited

Contents

TEST REPORT

Applicant	:	Shenzhen Beijia Electronic Technology Co., Ltd.
Manufacturer	:	Shenzhen Beijia Electronic Technology Co., Ltd.
Product Name	:	Walkie talkie
Model No.	:	T5
Trade Mark	:	N/A
Rating(s)	:	DC 6.0V from battery

Test Standard(s) : **IEEE 1528-2013; IEC 62209-2:2010;ANSI/IEEE C95.1:2005; FCC 47 CFR Part 2 (2.1093:2013);**

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the IEEE 1528-2013, IEC 62209-2:2010,
FCC 47 CFR Part 2 (2.1093:2013), ANSI/IEEE C95.1:2005 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Receipt	Mar,19, 2019
Date of Test	Mar. 20, 2019~ Mar. 20, 2019

Anbotek (SZ) Compliance Laboratory Limited — Anbotek Product Safety — * Approved *

Prepared By: Bobby Wang
(Engineer / Bobby Wang)

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Approved & Authorized Signer: Sally Zhang
(Manager / Sally Zhang)

Version

Version No.	Date	Description
01	Mar. 21, 2019	Original

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing are as follows.

<Highest SAR Summary>

Mode	Channel Separation	Frequency (MHz)	Position	Maximum Report SAR Results (W/kg)	
				100% duty cycle	50% duty cycle
FRS	12.5KHz	462.6375	Face-held	0.679	0.340
FRS	12.5KHz	462.6375	Body-Worn	1.260	0.630
FRS	12.5KHz	467.6375	Face-held	0.613	0.306
FRS	12.5KHz	467.6375	Body-Worn	1.288	0.644

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and IEC 62209-2:2010

2. General Information

2.1 Client Information

Applicant:	Shenzhen Beijia Electronic Technology Co., Ltd.
Address of Applicant:	2/F, No. 20 Xinkang 2nd Road, Shatian Community, Kengzi Street, Pingshan District, Shenzhen, China
Manufacture:	Shenzhen Beijia Electronic Technology Co., Ltd.
Address of Manufacture:	2/F, No. 20 Xinkang 2nd Road, Shatian Community, Kengzi Street, Pingshan District, Shenzhen, China

2.2 Testing Laboratory Information

Test Site:	Shenzhen Anbotek Compliance Laboratory Limited
Address:	1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China

2.3 Description of Equipment Under Test (EUT)

Name of EUT:	Walkie talkie
Model Number:	T5
Power Supply:	DC 6V from battery
Frequency Range:	FRS: 462.5625MHz~462.7125MHz FRS: 467.5625MHz~467.7125MHz
Rate Power:	0.5W
Modulation Type:	FM
Channel Separation:	12.5KHz
Antenna Type:	Integral antenna
Antennal Gain:	-9.7dBi

2.4 Device Category and SAR Limits

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. according to IEEE Std C95.1, 1999:((IEEE Standard for SafetyLevelswith Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz).

It specifies the maximum exposure limit of 1.6 W/kg as averaged over any 1 gram of tissue for portable devices bei ng used within 20 cm of the user in the uncontrolled environment.

2.5 Applied Standard

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

- IEEE 1528-2013
- FCC 47 CFR Part 2 (2.1093:2013)
- ANSI/IEEE C95.1:2005
- IEC 62209-2:2010
- KDB 447498 D01
- KDB 865664 D01
- KDB 865664 D02

2.6 Environment of Test Site

Items	Required	Actual
Temperature (℃)	18-25	22~23
Humidity (%RH)	30-70	55~65

2.7 Test Configuration

Face-Held Configuration

Face-held Configuration- per FCC KDB447498 "A test separation distance of 25 mm must be applied for in-front-of the face SAR test exclusion and SAR measurements."

Body-worn Configuration

Body-worn measurements-per FCC KDB447498 "When body-worn accessory SAR testing is required, the body-worn accessory requirements in section 4.2.2 should be applied. PTT two-way radios that support held-to-ear operating mode must also be tested according to the exposure configurations required for handsets. This generally does not apply to cellphones with PTT options that have already been tested in more conservative configurations in applicable wireless modes for SAR compliance at 100% duty factor."

3. Specific Absorption Rate (SAR)

3.1 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.

3.2 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:

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

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$\mathbf{SAR} = \mathbf{C}\left(\frac{\delta\mathbf{T}}{\delta\mathbf{t}}\right)$$

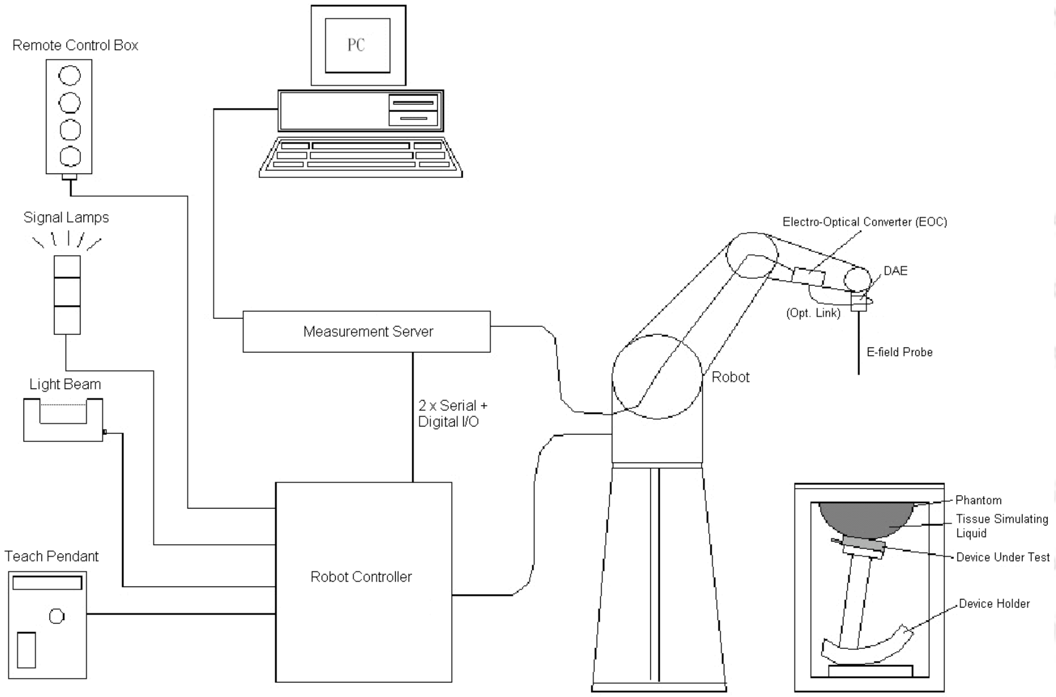
Where: C is the specific head capacity, δT is the temperature rise and δtisthe exposure duration, or related to the electrical field in the tissue by

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

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

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

4. SAR Measurement System



DASY System Configurations

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

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic (DAE) attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter (EOC) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows XP
- DASY software
- Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

components are described in details in the following sub-sections.

4.1 E-Field Probe

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

➢ **E-Field Probe Specification**

<EX3DV4 Probe>

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

Photo of EX3DV4

➢ **E-Field Probe Calibration**

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy shall be evaluated and within ± 0.25dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

4.2 Data Acquisition Electronics (DAE)

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

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

Photo of DAE

4.3 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX60XL) type from Stäubli SA (France). For the 6-axis controllersystem, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäublirobot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

Photo of DASY5

4.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (DASY5: 128 MB), RAM (DASY5: 128 MB). 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 board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.

Photo of Server for DASY5

4.5 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat Phantom	**Photo of SAM Phantom**

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI4 Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)	
Filling Volume	Approx. 30 liters	
Dimensions	Major ellipse axis: 600 mm Minor axis:400 mm	**Photo of ELI4 Phantom**

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

4.6 Device Holder

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 5 mm 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 different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (ERP).Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity 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.

Device Holder

4.7 Data Storage and Evaluation

- Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing 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 erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [mW/g]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

- Data Evaluation

The DASY post-processing software (SEMCAD) 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	σ
	- Density	ρ

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

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as：

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

with V_i= compensated signal of channel i, (i = x, y, z)
U_i = input signal of channel i, (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
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: $E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$

H-field Probes: $H_i = \sqrt{V_i} \cdot \frac{a_{i0}+a_{i1}f+a_{i2}f^2}{f}$

with V_i = compensated signal of channel i,(i = x, y, z)
$Norm_i$= sensor sensitivity of channel i, (i = x, y, z), $\mu V/(V/m)^2$ for E-field Probes
ConvF= sensitivity enhancement in solution
a_{ij}= sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
E_i= electric field strength of channel i in V/m
H_i= magnetic field strength of channel i in A/m

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

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

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

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

with SAR = local specific absorption rate in mW/g
E_{tot}= total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

5. Test Equipment List

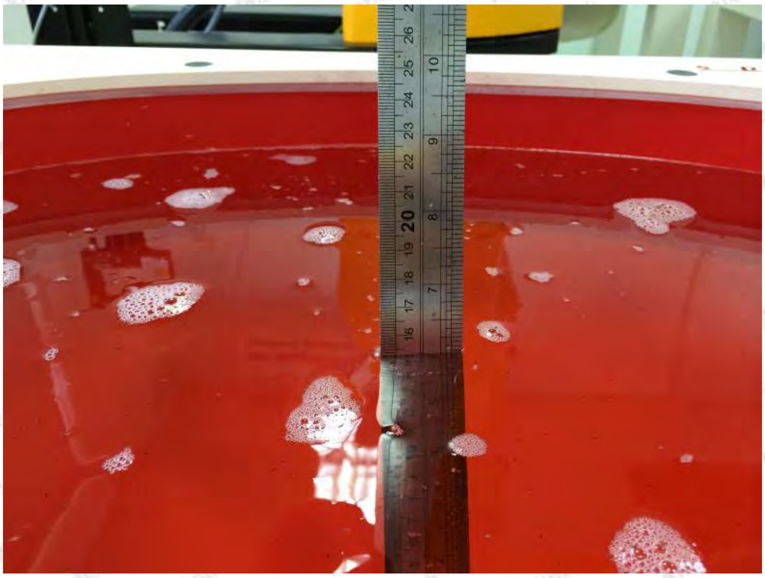
Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	E-field Probe	EX3DV4	3836	2018-07-07	2019-07-06
SPEAG	System Validation Dipole D450V3	D450V3	1079	2016-08-29	2019-08-28
SPEAG	Data Acquisition Electronics	DAE4	1373	2018-03-22	2019-03-21
Agilent	ENA Series Network Analyzer	E5071C	MY46317418	2018-05-23	2019-05-22
SPEAG	DAK	DAK-3.5	1226	NCR	NCR
SPEAG	SAM Twin Phantom	QD000P40CD	1802	NCR	NCR
SPEAG	ELI Phantom	QDOVA004AA	2058	NCR	NCR
AR	Amplifier	ZHL-42W	QA1118004	NCR	NCR
Agilent	Power Meter	N1914A	MY50001102	2018-05-22	2019-05-21
Agilent	Power Sensor	N8481H	MY51240001	2018-05-22	2019-05-21
R&S	Spectrum Analyzer	N9020A	MY51170037	2018-05-22	2019-05-21
Agilent	Signal Generation	N5182A	MY48180656	2018-05-22	2019-05-21
Worken	Directional Coupler	0110A05601O-10	COM5BNW1A2	2018-05-22	2019-05-21

Note:

1. The calibration certificate of DASY can be referred to appendix C of this report.
2. The dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
4. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Agilent.
5. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of 1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it

6. Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. 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, which is shown in Fig. 6.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown as followed:



Photograph of the depth in the Body Phantom (450MHz)

The following table gives the recipes for tissue simulating liquid.

Composition of the Head Tissue Equivalent Matter

Mixture %	Frequency (Brain) 450MHz
Water	38.56
Sugar	56.32
Salt	3.95
Preventol	0.10
Cellulose	1.07
Dielectric Parameters Target Value	f=450MHz ε_r=43.5 σ=0.87

Composition of the Body Tissue Equivalent Matter

Mixture %	Frequency (Brain) 450MHz
Water	56.16
Sugar	46.78
Salt	1.49
Preventol	0.10
Cellulose	0.47
Dielectric Parameters Target Value	f=450MHz ε_r=56.7 σ=0.94

The following table shows the measuring results for simulating liquid.

Dielectric Performance of Head Tissue Simulating Liquid

Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Dev. %		Liquid Temp.	Test Data
		ε_r	σ	ε_r	σ	ε_r	σ		
450H	450	43.5	0.87	43.3	0.85	-0.46%	-2.30%	22.2 degree	2019-03-20
450B	450	56.7	0.94	56.4	0.96	-0.53%	2.13%	22.2 degree	2019-03-20

7. System Verification Procedures

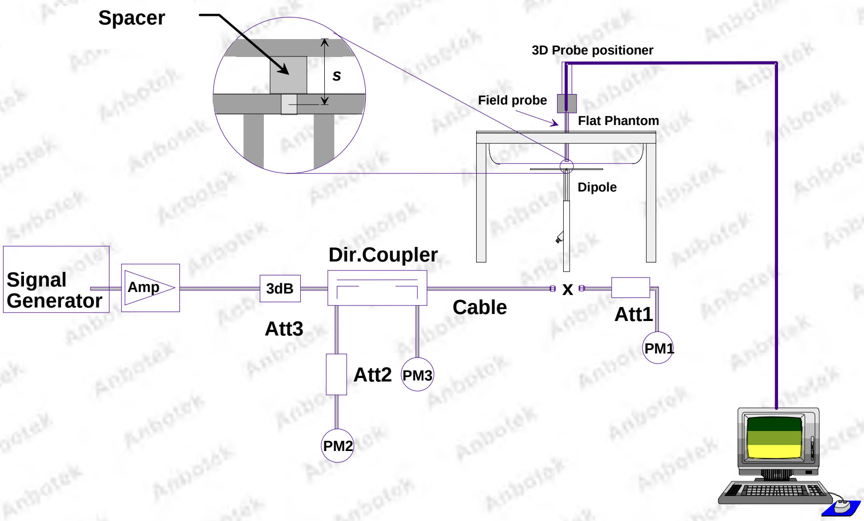
Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix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

- **Purpose of System Performance 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. This 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.

- **System Setup**

  In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:



System Setup for System Evaluation

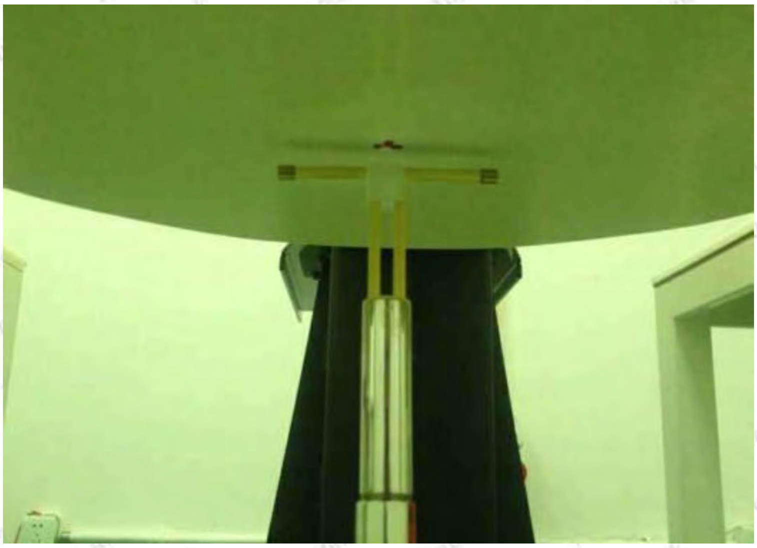


Photo of Dipole Setup

- **Validation Results**

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10 %. The table below shows the target SAR and measured SAR after normalized to 1W input power. It indicates that the system performance check can meet the variation criterion and the plots can be referred to Appendix A of this report.

System Check in Head Tissue Simulating Liquid

Freq	Test Date	Temp	250mW Measured		1W Normalized		1W Target		Limit (±10% Deviation)	
			SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
450MHz	2019/03/20	22.2	1.166	0.780	4.664	3.120	4.58	3.06	1.83%	1.96%

System Check in Body Tissue Simulating Liquid

Freq	Test Date	Temp	250mW Measured		1W Normalized		1W Target		Limit (±10% Deviation)	
			SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}	SAR_{1g}	SAR_{10g}
450MHz	2019/03/20	22.2	1.147	0.765	4.588	3.060	4.60	3.03	-0.26%	0.99%

Note:

1. The graph results see system check.
2. Target Values used derive from the calibration certificate

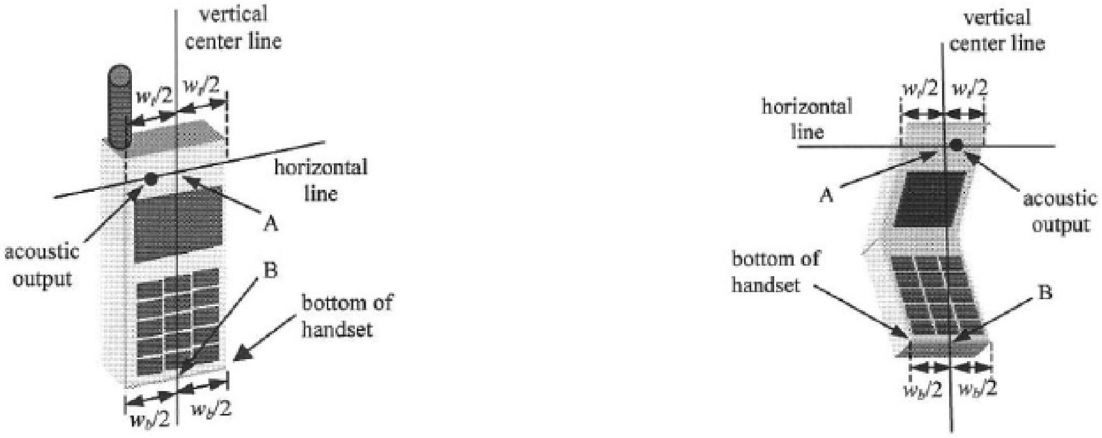
8. EUT Testing Position

8.1. Define two imaginary lines on the handset

(a) The vertical centerline passes through two points on the front side of the handset - the midpoint of the width w_t of the handset at the level of the acoustic output, and the midpoint of the width w_b of the bottom of the handset.

(b) The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of the handset at point A.

(c) 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, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.



Handset Vertical and Horizontal Reference Lines

8.2. Position for Cheek/Touch

(a) To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear, and LE: Left Ear) and align the center of the ear piece with the line RE-LE.

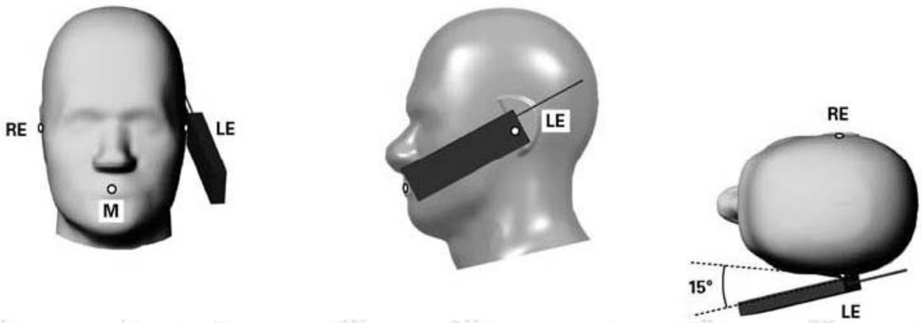
(b) To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost.

Cheek Position

8.3. Position for Ear / 15° Tilt

(a) To position the device in the “cheek” position described above.

(b) While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see Fig. 8.3).



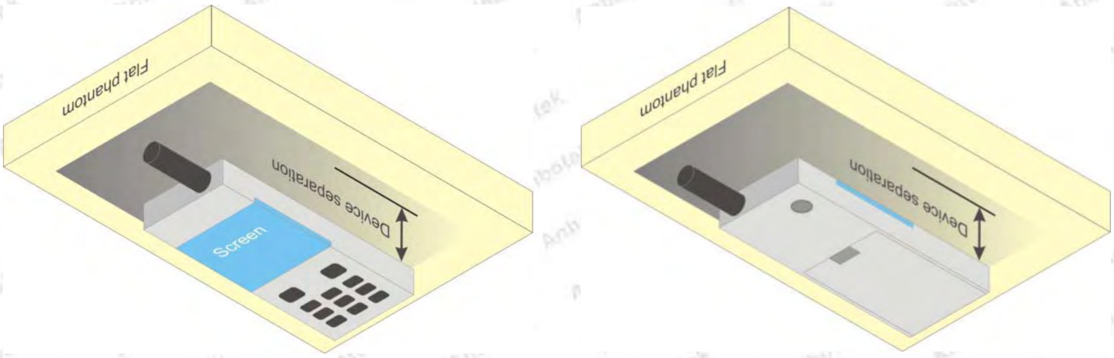
Tilt Position

8.4. Body Worn Position

(a) To position the device parallel to the phantom surface with either keypad up or down.

(b) To adjust the device parallel to the flat phantom.

(c) To adjust the distance between the device surface and the flat phantom to 0.5 cm.



Body Worn Position

9. Measurement Procedures

The measurement procedures are as follows:

(a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the middle channel.
(b) Keep EUT to radiate maximum output power or 100% duty factor (if applicable)
(c) Measure output power through RF cable and power meter.
(d) Place the EUT in the positions as setup photos demonstrates.
(e) Set scan area, grid size and other setting on the DASY software.
(f) Measure SAR transmitting at the middle channel for all applicable exposure positions.
(g) Identify the exposure position and device configuration resulting the highest SAR
(h) Measure SAR at the lowest and highest channels atthe worst exposure position and device configuration if applicable.

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

9.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to

surface

(f) Calculation of the averaged SAR within masses of 1g and 10g

9.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

9.3 Area & Zoom Scan Procedures

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing afine measurement around the hot spot. The sophisticated interpolation routines implemented in DASYsoftware can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEEstandard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed inaccordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only theabsolute maximum will be taken as reference. For cases where multiple maximums are detected, the numberof zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

9.4 Zoom Scan Procedures

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job’s label.

Zoom scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			$\leq$ 2 GHz: $\leq$ 8 mm 2 – 3 GHz: $\leq$ 5 mm*	3 – 4 GHz: $\leq$ 5 mm* 4 – 6 GHz: $\leq$ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\leq$ 5 mm	3 – 4 GHz: $\leq$ 4 mm 4 – 5 GHz: $\leq$ 3 mm 5 – 6 GHz: $\leq$ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	$\leq$ 4 mm	3 – 4 GHz: $\leq$ 3 mm 4 – 5 GHz: $\leq$ 2.5 mm 5 – 6 GHz: $\leq$ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		$\geq$ 30 mm	3 – 4 GHz: $\geq$ 28 mm 4 – 5 GHz: $\geq$ 25 mm 5 – 6 GHz: $\geq$ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

9.5 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

9.6 Power Drift Monitoring

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the same settings. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

10.E.I.R.P Power

<FRS ERP Power>

According KDB 447498 D01 General RF Exposure Guidance v06 ection 4.1 2) states that "Unless it is specified differently in the published RF exposure KDB procedures, these requirements also apply to test reduction and test exclusion considerations. Time-averaged maximum conducted output power applies to SAR and, as required by § 2.1091(c), time-averaged ERP applies to MPE. When an antenna port is not available on the device to support conducted power measurement, such as FRS and certain Part 15 transmitters with built-in integral antennas, the maximum output power allowed for production units should be used to determine RF exposure test exclusion and compliance."

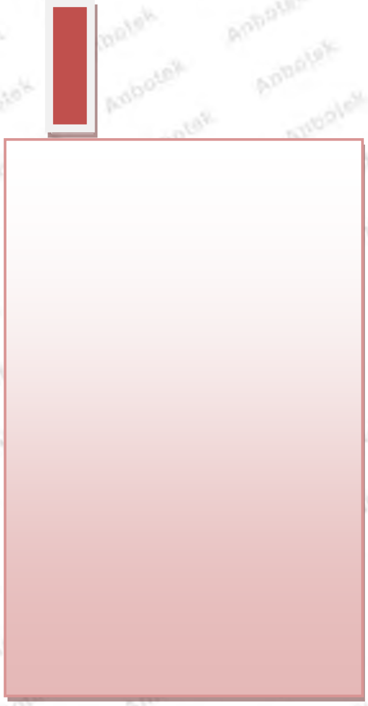
SAR may be scaled if radio is tested at lower power without overheating as invalid SAR results cannot be scaled to compensate for power droopaccording to October 2015TCB Workshop.

Modulation Type	Channel Separation	Test Frequency	Measured AverageERP Power	
			(dBm)	(Watts)
FM	12.5KHz	462.6375	26.54	0.451
FM	12.5KHz	467.6375	26.73	0.471

Manufacturing tolerance

	FRS (Average ERP Power)	
Frequency (MHz)	462.6375	467.6375
Target (dBm)	26.00	26.00
Tolerance ±(dB)	1.0	1.0

11. Transmit Antennas



12. Standalone SAR Test Exclusion Considerations

Per KDB447498 for standalone 1-g head or body SAR evaluation by measurement or numerical simulation is not required when the corresponding SAR Exclusion Threshold condition, listed below, is satisfied.

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)] ·[√ f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

●f(GHz) is the RF channel transmit frequency in GHz

●Power and distance are rounded to the nearest mW and mm before calculation

●The result is rounded to one decimal place for comparison

●3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

Standalone SAR test exclusion considerations							
Communication system	Frequency (MHz)	Configuration	Maximum Average Power (dBm)	Separation Distance (mm)	Calculation Result	SAR Exclusion Thresholds	Standalone SAR Exclusion
FRS	462.6375	Head Face	27	25	13.6	3.0	no
		Body worn	27	5	68.2	3.0	no
FRS	467.6375	Head Face	27	25	13.7	3.0	no
		Body worn	27	5	68.5	3.0	no

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

13. SAR Test Results Summary

General Note:

The calculated SAR is obtained by the following formula:

Reported SAR=Measured SAR × $10^{(P_{Target}-P_{Measured})/10}$

Where P_{Target} is the power of manufacturing upper limit;

$P_{Measured}$ is the measured power

Test Frequency MHz	Mode	Maximum Allowed Power (dBm)	Measured ERP (dBm)	Test Configuration	Measurement SAR_{1-g} (W/Kg)		Power drift	Scaling Factor	Reported SAR_{1-g} (W/kg)		SAR limit 1g (W/kg)	Ref. Plot
					100% Duty Cycle	50% Duty Cycle			100% Duty Cycle	50% Duty Cycle		
The EUT display towards ground for 12.5 KHz(Analog, face held)												
462.6375	FRS	27.00	26.54	Face Held	0.612	0.306	-0.05	1.11	0.679	0.340	1.60	1
467.6375	FRS	27.00	26.73	Face Held	0.578	0.289	-0.02	1.06	0.613	0.306	1.60	2
The EUT display towards ground for 12.5 KHz(Analog, Body-Worn)												
462.6375	FRS	27.00	26.54	Body Worn	1.135	0.568	-0.03	1.11	1.260	0.630	1.60	3
467.6375	FRS	27.00	26.73	Body Worn	1.215	0.608	0.04	1.06	1.288	0.644	1.60	4

14.SAR Measurement Variability

SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. The following procedures are applied to determine if repeated measurements are required.

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

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

Frequency (MHz)	Mode	Test Position	Repeated SAR (yes/no)	Highest Measured SAR_{1-g} (W/kg)	First Repeated	
					Measured SAR_{1-g} (W/kg)	Largest to Smallest SAR Ratio
462.6375	CW	Body-worn	yes	1.135	1.141	1.005
467.6375	CW	Body-worn	yes	1.215	1.221	1.005

15. Simultaneous Transmission Analysis

The DUT, with FRS function and only one antenna equipped, no simultaneous transmission need consideration.

16.Measurement Uncertainty

NO	Source	Uncert. ai（%）	Prob. Dist.	Div. k	ci (1g)	ci (10g)	Stand.Uncert. ui (1g)	Stand.Uncert. ui (10g)	*Veff*
1	Repeat	0. 4	N	1	1	1	0. 4	0. 4	9
Instrument									
2	Probe calibration	7	N	2	1	1	3.5	3.5	∞
3	Axial isotropy	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
4	Hemispherical isotropy	9.4	R	$\sqrt{3}$	0.7	0.7	3.9	3.9	∞
5	Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Linearity	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
7	Detection limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
8	Readout electronics	0.3	N	1	1	1	0.3	0.3	∞
9	Response time	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
10	Integration time	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
11	Ambient noise	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
12	Ambient reflections	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Probe positioner mech. restrictions	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
14	Probe positioning with respect to phantom shell	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
15	Max.SAR evaluation	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞

Test sample related									
16	Device positioning	3.8	N	1	1	1	3.8	3.8	99
17	Device holder	5.1	N	1	1	1	5.1	5.1	5
18	Drift of output power	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up									
19	Phantom uncertainty	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
20	Liquid conductivity (target)	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
21	Liquid conductivity (meas)	2.5	N	1	0.64	0.43	1.6	1.2	∞
22	Liquid Permittivity (target)	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.5	∞
23	Liquid Permittivity (meas)	2.5	N	1	0.6	0.49	1.5	1.2	∞
Combined standard			RSS	$U_C = \sqrt{\sum_{i=1}^{n} C_i^2 U_i^2}$			11.4%	11.3%	236
Expanded uncertainty(P=95%)			$U = k\,U_C$,k=2				**22.8%**	**22.6%**	

Appendix A. EUT Photos and Test Setup Photos

Face-held, the front of the EUT towards phantom (The distance was 25mm)

Body-worn, the front of the EUT towards ground (The distance was 0mm)

Appendix B. Plots of SAR System Check

System Performance Check at 450 MHz Head TSL

DUT: Dipole450 MHz; Type: D450V3; Serial: 1079
Date/Time: 03/20/2019
Communication System: PTT 450; Frequency: 450 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): f = 450 MHz; σ = 0.85 S/m; ε_r = 43.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

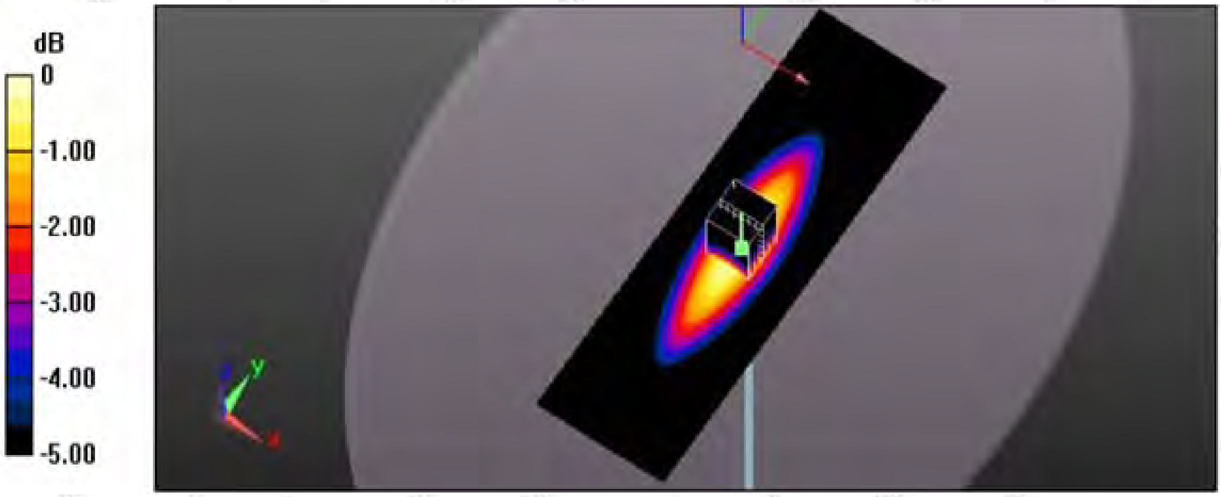
- Probe: ES3DV4 –SN3836; ConvF(7.12, 7.12, 7.12); Calibrated: 07/07/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03/22/2018
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (61x201x1): Interpolated grid: dx=1.500 mm, dy=1.50 mm
Maximum value of SAR (interpolated) = 1.37mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.85 V/m; Power Drift = -0.03dB
Peak SAR (extrapolated) = 1.54mW/g

SAR(1 g) =1.166 mW/g; SAR(10 g) = 0.780 mW/g

Maximum value of SAR (measured) = 1.57mW/g



0 dB = 1.57 mW/g

System Performance Check 450MHz Head 250mW

System Performance Check at 450 MHz Body TSL

DUT: Dipole450 MHz; Type: D450V3; Serial: 1079

Date/Time: 03/20/2019

Communication System: PTT 450; Frequency: 450 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 450 MHz; σ = 0.96 S/m; ε_r = 56.4; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: ES3DV4 –SN3836; ConvF(7.33, 7.33, 7.33); Calibrated: 07/07/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03/22/2018
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (61x201x1): Interpolated grid: dx=1.500 mm, dy=1.50 mm

Maximum value of SAR (interpolated) = 1.42mW/g

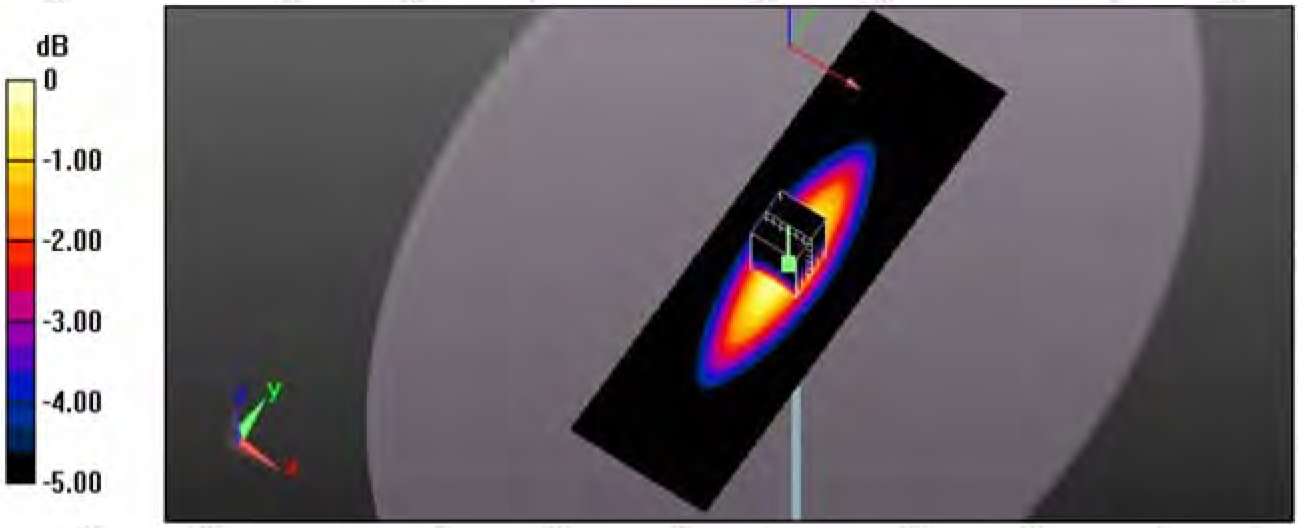
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 41.55 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.61mW/g

SAR(1 g) = 1.147 mW/g; SAR(10 g) = 0.765 mW/g

Maximum value of SAR (measured) = 1.75mW/g



0 dB = 1.75mW/g

System Performance Check 450MHz Body 250mW

Appendix C. Plots of SAR Test Data

SAR plots for **the highest measured SAR** in each ex
posure configuration, wireless mode and frequency band combination according to FCC KDB 865664 D02

Face Held for FM Modulation at 12.5KHz Channel Separation, Front towards Phantom 462.6375MHz

Date: 03/20/2019

Communication System: PTT 450; Frequency: 462.6375 MHz;Duty Cycle:1:1

Medium parameters used (interpolated): f = 463.0 MHz; σ = 0.88 S/m; ε_r = 43.7; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: ES3DV4 –SN3836; ConvF(7.12, 7.12, 7.12); Calibrated: 07/07/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03/22/2018
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (51x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.710 W/kg

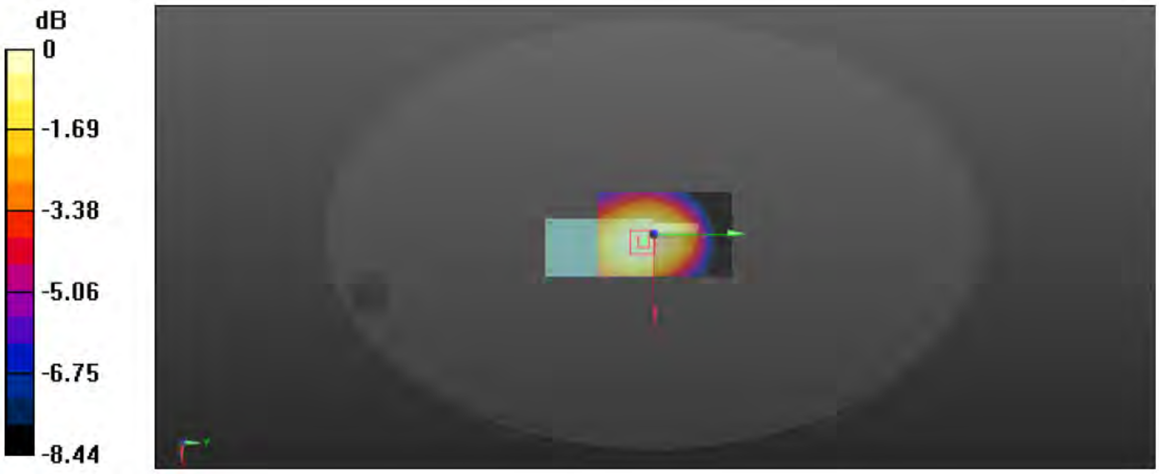
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.35 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 0.834 W/kg

SAR(1 g) = 0.612 W/kg; SAR(10 g) = 0.257 W/kg

Maximum value of SAR (measured) = 0.910 W/kg



0 dB = 0.910 W/kg

Figure 1: Face held for FM Modulation at 12.5KHz Channel Separation Front towards Phantom462.6375 MHz

Face Held for FM Modulation at 12.5KHz Channel Separation, Front towards Phantom 467.6375MHz

Date: 03/20/2019
Communication System: PTT 450; Frequency: 467.6375 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f = 468.0 MHz; σ = 0.89 S/m; ε_r = 43.8; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

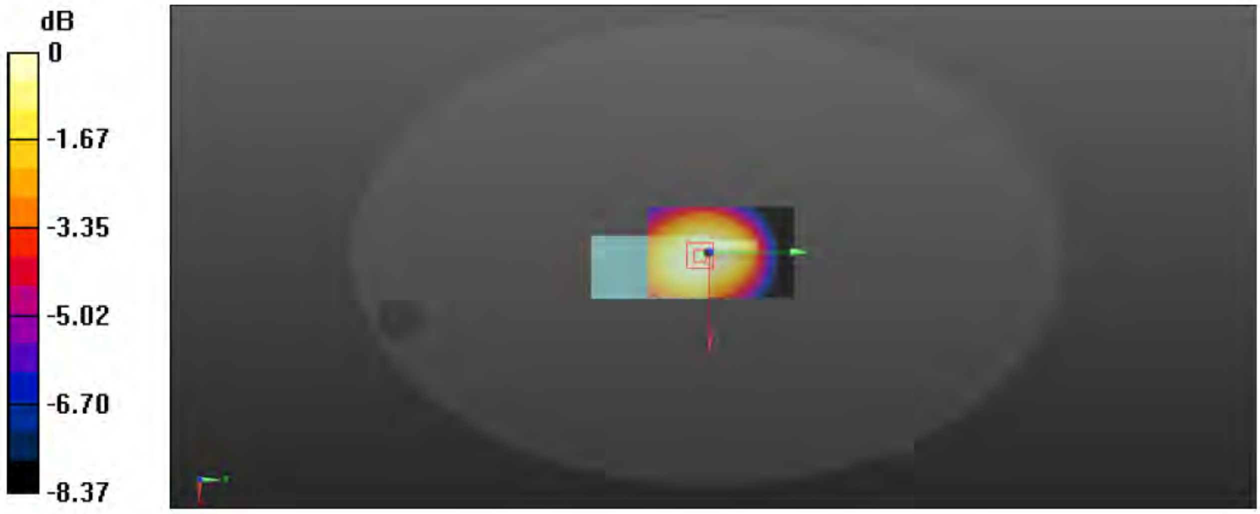
- Probe: ES3DV4 –SN3836; ConvF(7.12, 7.12, 7.12); Calibrated: 07/07/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03/22/2018
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (51x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.688 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.59 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.719 W/kg

SAR(1 g) = 0.578 W/kg; SAR(10 g) = 0.243 W/kg

Maximum value of SAR (measured) = 0.855 W/kg



0 dB = 0.855 W/kg

Figure 1: Face held for FM Modulation at 12.5KHz Channel Separation Front towards Phantom467.6375 MHz

Body- Worn FM Modulation at 12.5KHz Channel Separation, Front towards Ground 462.6375MHz

Date: 03/20/2019

Communication System: PTT 450; Frequency: 462.6375 MHz;Duty Cycle:1:1

Medium parameters used (interpolated): f = 463.0 MHz; σ = 0.97S/m; ε_r = 56.8; ρ = 1000 kg/m^3

Phantom section : Flat Section

DASY5 Configuration:

- Probe: ES3DV4 –SN3836; ConvF(7.33, 7.33, 7.33); Calibrated: 07/07/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03/22/2018
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (51x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.57 W/kg

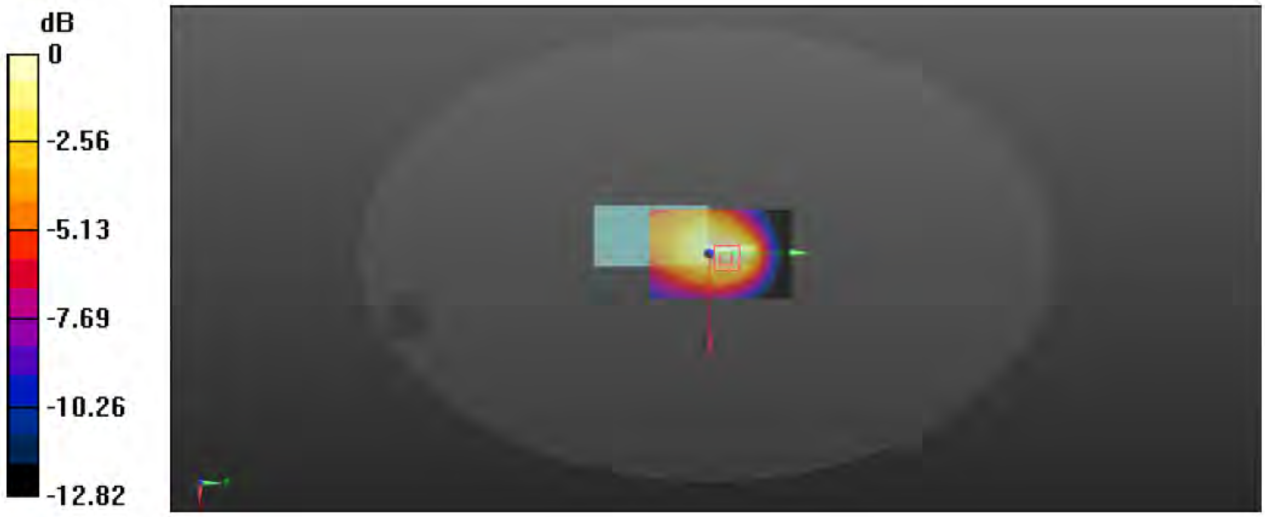
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 35.13 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.95 W/kg

SAR(1 g) = 1.135 W/kg; SAR(10 g) = 0.689 W/kg

Maximum value of SAR (measured) = 2.05 W/kg



0 dB = 2.05 W/kg

Figure 3: Body-worn for FM Modulation at 12.5KHz Channel Separation; Front towards Ground462.6375 MHz

Body- Worn FM Modulation at 12.5KHz Channel Separation, Front towards Ground 467.6375MHz

Date: 03/20/2019

Communication System: PTT 450; Frequency: 467.6375 MHz;Duty Cycle:1:1

Medium parameters used (interpolated): f = 468.0 MHz; σ = 0.98S/m; ε_r = 56.9; ρ = 1000 kg/m^3

Phantom section : Flat Section

DASY5 Configuration:

- Probe: ES3DV4 –SN3836; ConvF(7.33, 7.33, 7.33); Calibrated: 07/07/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 03/22/2018
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (51x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.65 W/kg

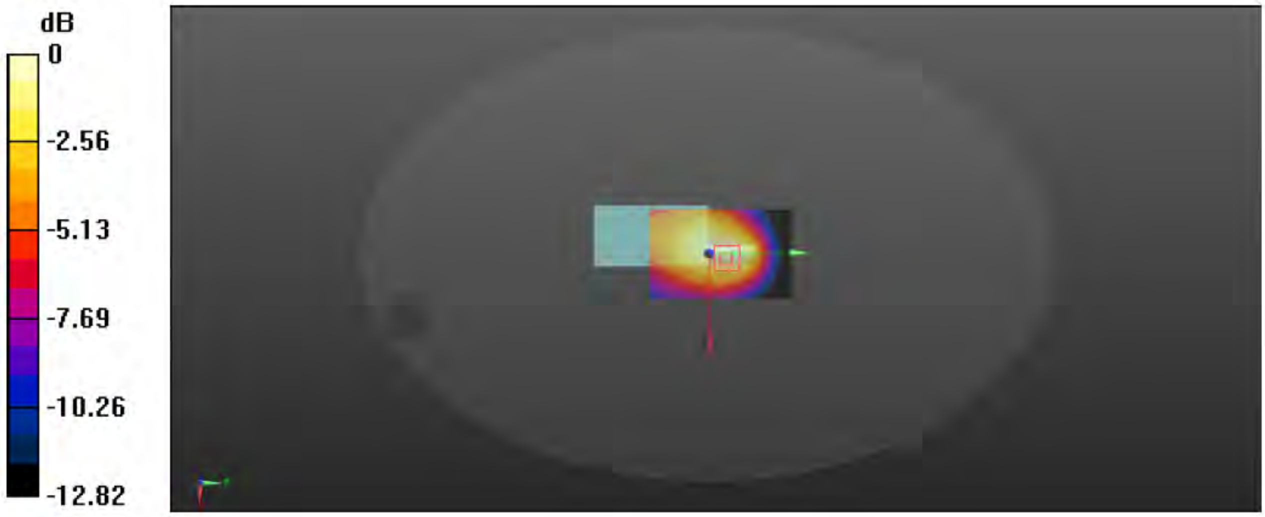
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 37.85 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 2.15 W/kg

SAR(1 g) = 1.215 W/kg; SAR(10 g) = 0.725 W/kg

Maximum value of SAR (measured) = 2.48 W/kg



0 dB = 2.48 W/kg

Figure 4: Body-worn for FM Modulation at 12.5KHz Channel Separation; Front towards Ground467.6375 MHz

Appendix D. DASY System Calibration Certificate

Probe Calibration Certificate

TTL In Collaboration with s p e a g CALIBRATION LABORATORY
ilac-MRA CNAS 中国认可 国际互认 校准 CALIBRATION CNAS L0570
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Client Sunway Certificate No: Z17-97101

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3836

Calibration Procedure(s): FD-Z11-2-004-01
Calibration Procedures for Dosimetric E-field Probes

Calibration date: July 07, 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	27-Jun-18 (CTTL, No.J18X04777)	Jun-19
Power sensor NRP-Z91	101547	27-Jun-18 (CTTL, No.J18X04777)	Jun-19
Power sensor NRP-Z91	101548	27-Jun-18 (CTTL, No.J18X04777)	Jun-19
Reference10dBAttenuator	18N50W-10dB	13-Mar-18(CTTL,No.J18X01547)	Mar-19
Reference20dBAttenuator	18N50W-20dB	13-Mar-18(CTTL, No.J18X01548)	Mar-19
Reference Probe EX3DV4	SN 3617	26-Aug-17(SPEAG,No.EX3-3617_Aug15)	Aug-18
DAE4	SN 1331	21-Jan-18(SPEAG, No.DAE4-1331_Jan16)	Jan -19
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	27-Jun-18 (CTTL, No.J18X04776)	Jun-19
Network Analyzer E5071C	MY46110673	26-Jan-18 (CTTL, No.J18X00894)	Jan -19

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: July 08, 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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005

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: 3836

Calibrated: July 07, 2018

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3836

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	0.40	0.46	0.43	±10.8%
DCP(mV)[B]	93.2	100.2	98.0	

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	167.8	±2.0%
		Y	0.0	0.0	1.0		182.5	
		Z	0.0	0.0	1.0		176.7	

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: 3836

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)
450	43.5	0.87	7.12	7.12	7.12	0.20	1.30	±13.3%
750	41.9	0.89	9.43	9.43	9.43	0.30	0.80	±12%
835	41.5	0.90	9.42	9.42	9.42	0.15	1.58	±12%
900	41.5	0.9	9.03	9.03	9.03	0.15	1.46	±12%
1750	40.1	1.37	8.04	8.04	8.04	0.14	1.63	±12%
1900	40.0	1.40	7.60	7.60	7.60	0.16	1.59	±12%
2300	39.5	1.67	7.45	7.45	7.45	0.53	0.68	±12%
2450	39.2	1.80	7.07	7.07	7.07	0.54	0.71	±12%
2600	39.0	1.96	6.96	6.96	6.96	0.61	0.66	±12%
5200	36.0	4.66	5.32	5.32	5.32	0.40	1.42	±13%
5300	35.9	4.76	5.13	5.13	5.13	0.40	1.40	±13%
5500	35.6	4.96	4.85	4.85	4.85	0.40	1.35	±13%
5600	35.5	5.07	4.59	4.59	4.59	0.40	1.45	±13%
5800	35.3	5.27	4.71	4.71	4.71	0.40	1.45	±13%

[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: 3836

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)
450	56.7	0.94	7.33	7.33	7.33	0.13	1.50	±13.3%
750	55.5	0.96	9.38	9.38	9.38	0.30	0.85	±12%
835	55.2	0.97	9.25	9.25	9.25	0.17	1.44	±12%
900	55.0	1.05	8.95	8.95	8.95	0.14	1.60	±12%
1750	53.4	1.49	7.64	7.64	7.64	0.17	1.71	±12%
1900	53.3	1.52	7.33	7.33	7.33	0.18	1.80	±12%
2300	52.9	1.81	7.45	7.45	7.45	0.51	0.80	±12%
2450	52.7	1.95	7.20	7.20	7.20	0.62	0.70	±12%
2600	52.5	2.16	6.99	6.99	6.99	0.52	0.79	±12%
5200	49.0	5.30	4.83	4.83	4.83	0.50	1.25	±13%
5300	48.9	5.42	4.60	4.60	4.60	0.50	1.35	±13%
5500	48.6	5.65	4.32	4.32	4.32	0.50	1.35	±13%
5600	48.5	5.77	4.20	4.20	4.20	0.50	1.40	±13%
5800	48.2	6.00	4.30	4.30	4.30	0.50	1.30	±13%

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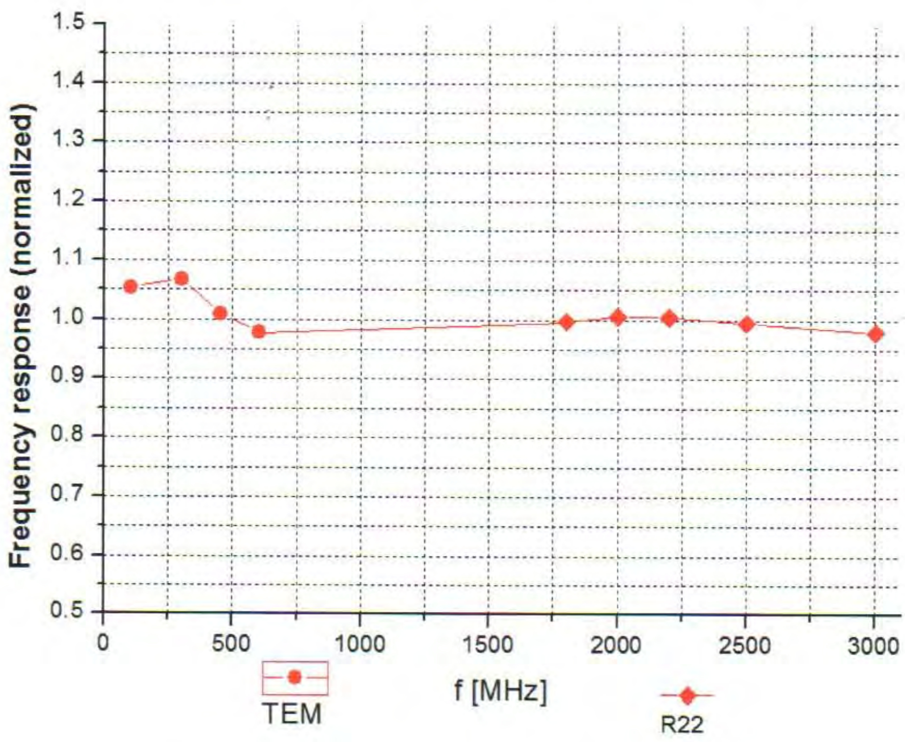
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.5% (k=2)

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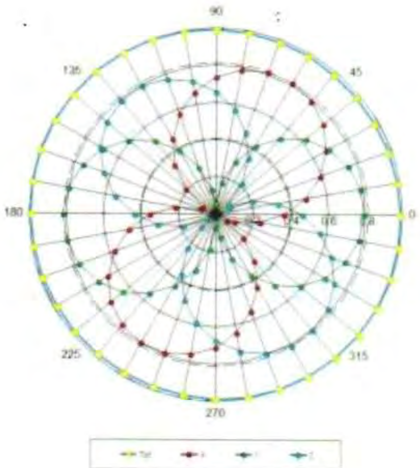
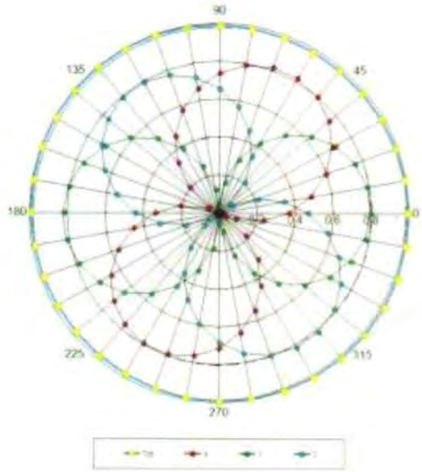
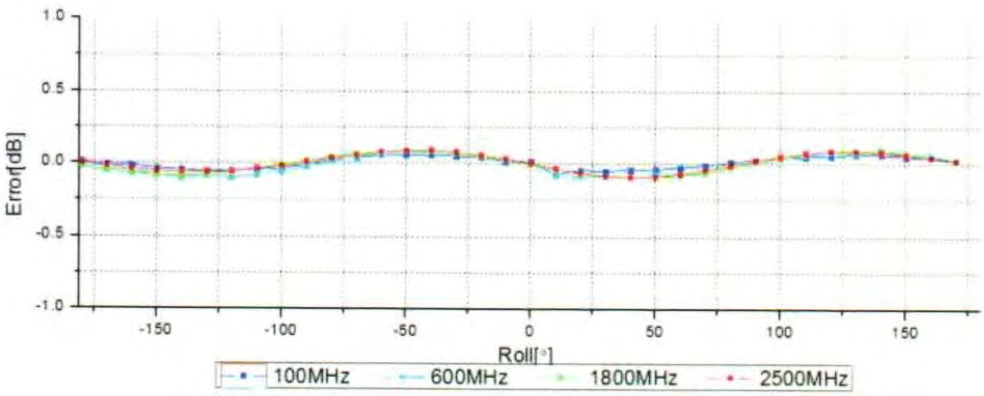
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





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

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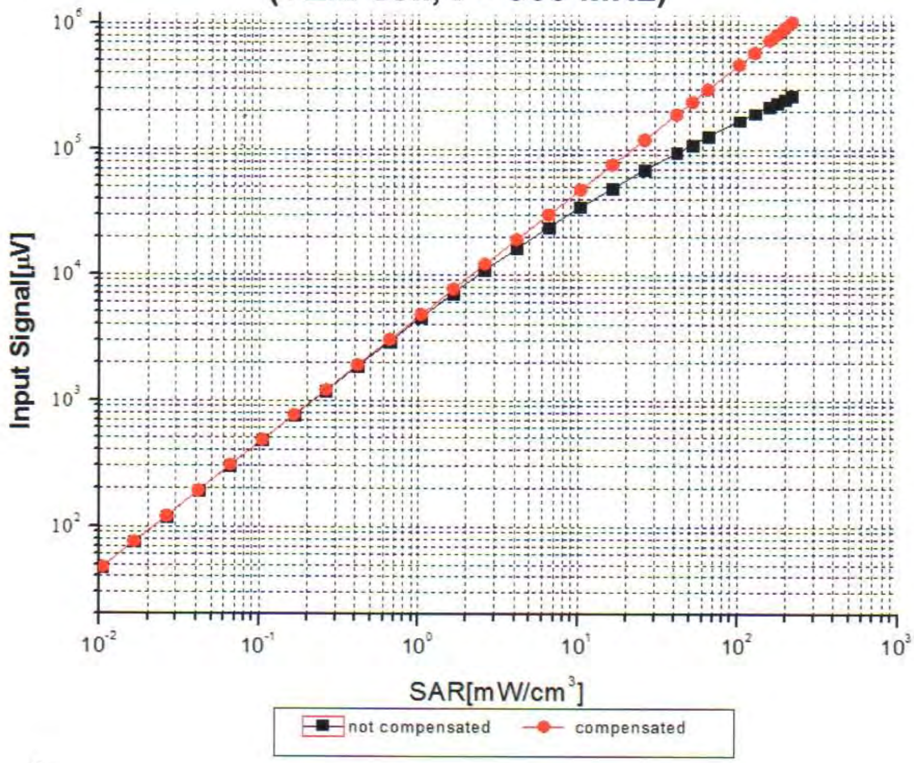
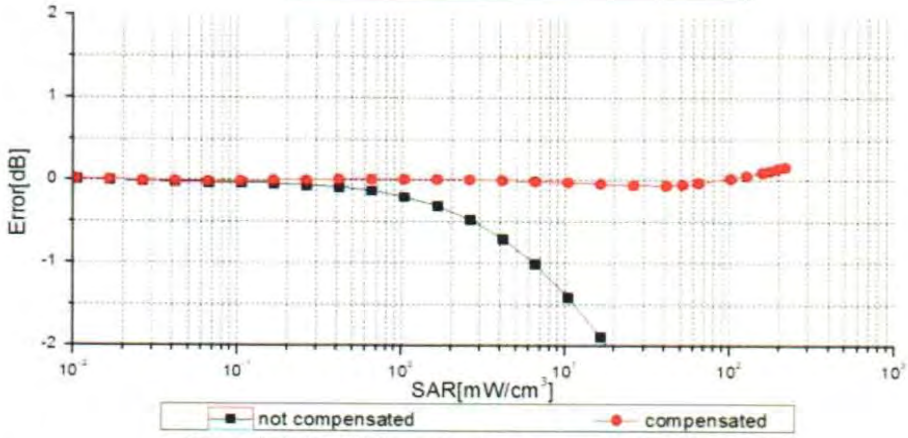
Dynamic Range f(SAR$_{head}$)
(TEM cell, f = 900 MHz)





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

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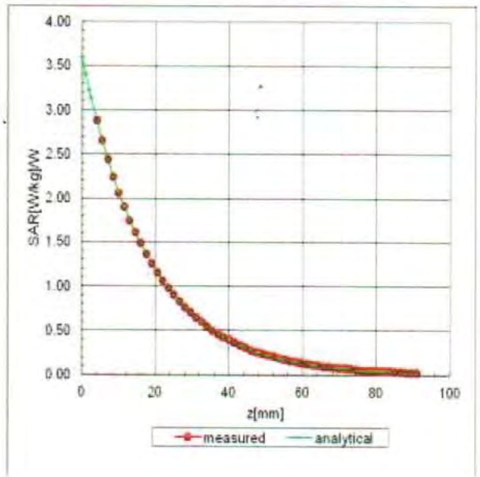
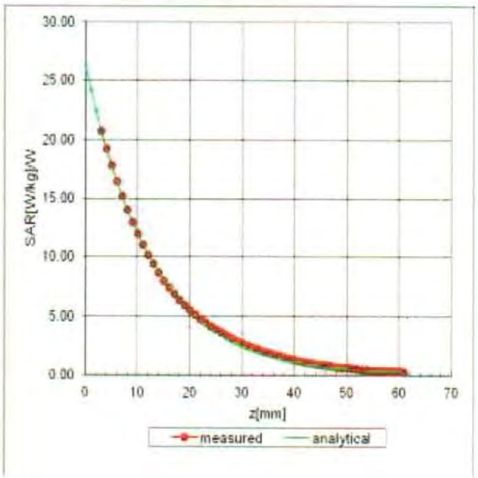
Conversion Factor Assessment

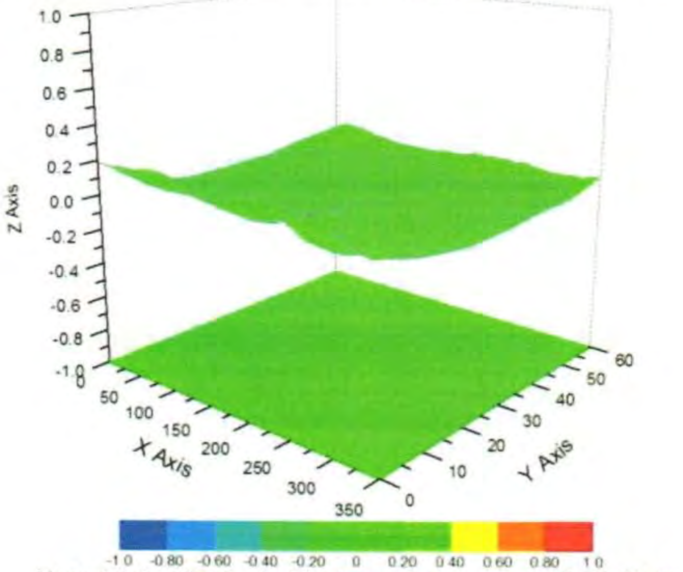
f=900 MHz, WGLS R9(H_convF)



f=1900 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±2.8% (K=2)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3836

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	47.9
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

D450V3 Dipole Calibration Certificate

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
C Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **CIQ-SZ (Auden)**

Certificate No: **D450V3-1079_Aug16**

CALIBRATION CERTIFICATE

Object	D450V3 - SN: 1079
Calibration procedure(s)	QA CAL-15.v8 Calibration procedure for dipole validation kits below 700 MHz
Calibration date:	August 29, 2016

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5277 (20x)	05-Apr-16 (No. 217-02293)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe ET3DV6	SN: 1507	31-Dec-15 (No. ET3-1507_Dec15)	Dec-16
DAE4	SN: 654	12-Aug-16 (No. DAE4-654_Aug16)	Aug-17

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (No. 217-02285/02284)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (No. 217-02285)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (No. 217-02284	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 30, 2016

Calibration Laboratory of
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Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
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"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the en of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate th nominal SAR result.

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%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	44.3 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**4.58 W/kg ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	0.775 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**3.06 W/kg ± 17.6 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	56.7 ± 6 %	0.95 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**4.60 W/kg ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	0.764 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**3.03 W/kg ± 17.6 % (k=2)**

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Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86)755-26066440 Fax:(86)755-26014772 Email:service@anbotek.com
Hotline 400-003-0500
www.anbotek.com

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	58.0 Ω - 2.9 jΩ
Return Loss	- 22.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	56.1 Ω - 5.8 jΩ
Return Loss	- -22.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.348 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 03, 2011

DASY5 Validation Report for Head TSL

Date: 29.08.:

Test Laboratory: SPEAG, Zurich, Switzerland

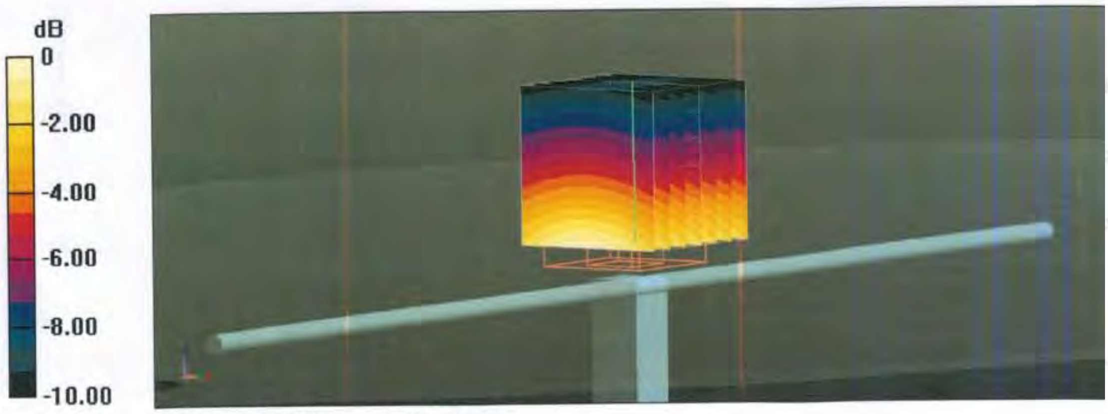
DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1079

Communication System: UID 0 - CW; Frequency: 450 MHz
Medium parameters used: f = 450 MHz; $\sigma = 0.89$ S/m; $\varepsilon_r = 44.3$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.58, 6.58, 6.58); Calibrated: 31.12.2015;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 12.08.2016
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

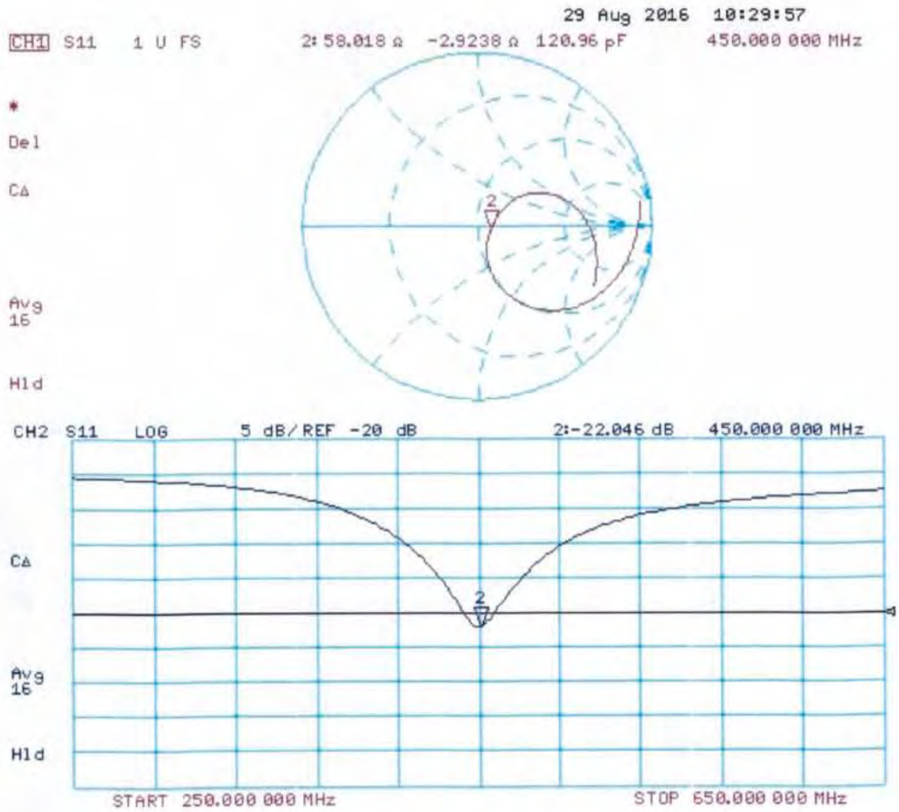
Dipole Calibration for Head Tissue/d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.87 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 1.69 W/kg
SAR(1 g) = 1.16 W/kg; SAR(10 g) = 0.775 W/kg
Maximum value of SAR (measured) = 1.26 W/kg



0 dB = 1.26 W/kg = 1.00 dBW/kg

Address: 1/F, Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86)755-26066440 Fax:(86)755-26014772 Email:service@anbotek.com
Hotline 400-003-0500 www.anbotek.com

Impedance Measurement Plot for Head TSL



S
Address: 1/F, Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86)755-26066440 Fax:(86)755-26014772 Email:service@anbotek.com
Hotline 400-003-0500
www.anbotek.com

DASY5 Validation Report for Body TSL

Date: 29.08.2016

Test Laboratory: SPEAG, Zurich, Switzerland

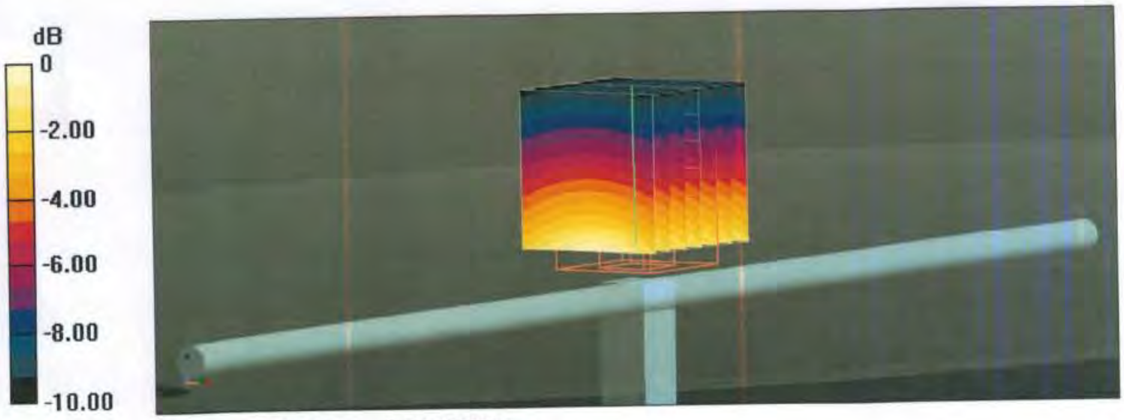
DUT: Dipole 450 MHz D450V3; Type: D450V3; Serial: D450V3 - SN:1079

Communication System: UID 0 - CW; Frequency: 450 MHz
Medium parameters used: f = 450 MHz; σ = 0.95 S/m; ε_r = 56.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

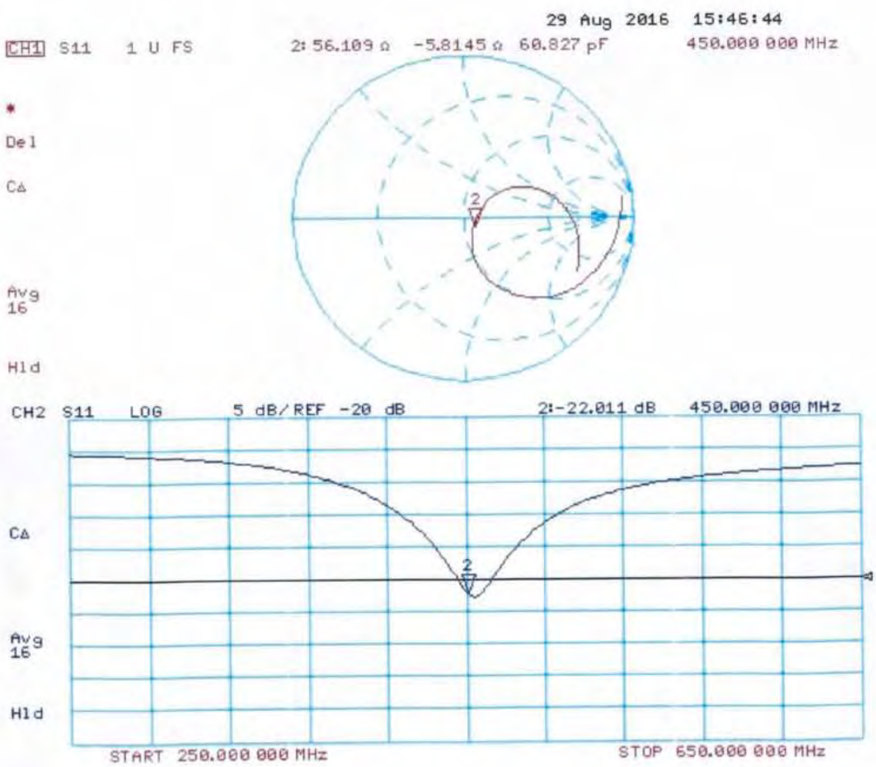
- Probe: ET3DV6 - SN1507; ConvF(6.99, 6.99, 6.99); Calibrated: 31.12.2015;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 12.08.2016
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 37.17 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.82 W/kg
SAR(1 g) = 1.16 W/kg; SAR(10 g) = 0.764 W/kg
Maximum value of SAR (measured) = 1.24 W/kg



0 dB = 1.24 W/kg = 0.93 dBW/kg

Impedance Measurement Plot for Body TSL



Certificate No: D450V3-1079_Aug16 Page 8 of 8

DAE4 Calibration Certificate

CTTL In Collaboration with s p e a g CALIBRATION LABORATORY
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中国认可 国际互认 校准 CALIBRATION CNAS L0570

Client : CCIS Certificate No: Z18-97054

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1373
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	March 22, 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	27-Jun-17 (CTTL, No.J17X05859)	June-18

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	[signature]
Reviewed by:	Lin Hao	SAR Test Engineer	[signature]
Approved by:	Qi Dianyuan	SAR Project Leader	[signature]

Issued: March 23, 2018

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

Certificate No: Z18-97054 Page 1 of 3

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Glossary:

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

Methods Applied and Interpretation of Parameters:

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

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DC Voltage Measurement

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

Calibration Factors	X	Y	Z
High Range	403.902 ± 0.15% (k=2)	403.864 ± 0.15% (k=2)	404.160 ± 0.15% (k=2)
Low Range	3.98605 ± 0.7% (k=2)	4.00729 ± 0.7% (k=2)	4.01146 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	219.5° ± 1 °

*****END OF REPORT*****