S T S L A B

FCC SAR TEST REPORT

Report No: STS1412052H01

Issued for

TIETONG Electronics(Group)

No.13 zihua Street Jiangnan Hi-tech Industrial area Licheng District QuanZhou City Fujian Province

Product Name:	Portable Digital Radio
Brand Name:	TIETONG
Model No.:	T928
Series Model:	T906,T908,T916,T828,T816,TT-820,TT-810
FCC ID:	2AD7HT928
Test Standard:	IEEE 1528:2003; ANSI/IEEE C95.1-1999
	IEC 62209-2: 2010
Max. SAR (1g):	Head:2.884 W/kg
	Body:6.709 W/kg

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Shenzhen STS Test Services Co., Ltd.
1/F, Building B, Zhuoke Science Park, Chongqing Road, Fuyong, Baoan District, Shenzhen, China
TEL: +86-755 3688 6288   FAX: +86-755 3688 6277   E-mail:sts@stsapp.com

Test Report Certification

Applicant's name .... : TIETONG Electronics(Group)

Address .... : No.13 zihua Street Jiangnan Hi-tech Industrial area Licheng District QuanZhou City Fujian Province

Manufacture's Name............ : TIETONG Electronics(Group)

Address .... : No.13 zihua Street Jiangnan Hi-tech Industrial area Licheng District QuanZhou City Fujian Province

Product description

Product name .... : Portable Digital Radio

Trademark .... : TIETONG

Model and/or type reference : T928

Serial Model： T906,T908,T916,T828,T816,TT-820, TT-810

Standards .... : IEEE 1528:2003; ANSI/IEEE C95.1-1999
IEC 62209-2: 2010

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

Date of Test ....:

Date (s) of performance of tests ....: 27/03/2015

Date of Issue...: 30/03/2015

Test Result...: **Pass**

Testing Engineer : Allen Chen
(Allen Chen)

Technical Manager : John Zou
(John Zou)

Authorized Signatory : Bovey Yang
(Bovey Yang)

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1. General Information

1.1 EUT Description

Equipment:	Portable Digital Radio
Brand Name:	TIETONG
Model No.:	T928
Serial Model:	T906,T908,T916,T828,T816,TT-820, TT-810
FCC ID:	2AD7HT928
Model Difference:	The appearance of different
Adapter:	Input: AC100-240V, 0.5 A, 50/60 Hz Output: DC 12V, 1.0A
Battery:	Model Name: T928 Rated Voltage: 7.4V Capacity: 2000mAh
Rated Power:	UHF: 4W/1W
Hardware Version:	T928V01
Software Version:	T928V02
Frequency Range:	400-470MHz
Channel Spacing:	12.5KHz
Max. Reported SAR(1g):	with 50% duty cycle 12.5KHz: Head: 2.884 W/kg; Body: 6.709 W/kg
Modulation Type:	4FSK/FM
Test channel:	406.1MHz – 435.325MHz –469.975MHz
Exposure Category:	Occupational/Controlled Exposure

2 Test Environment

2.1 Environmental conditions

Ambient conditions in the SAR laboratory:

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

2.2 Test Facility

The Testing and Technology Center for Industrial Products of Shenzhen Entry-Exit Inspection and Quarantine Bureau

Add. : No.289, 8th Industry Road, Nanshan District, Shenzhen, Guangdong, China

2.3 TEST ENVIRONMENT

No.	Identity	Document Title
1	IEEE 1528:2003	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
2	ANSI/IEEE C95.1-1999	standard for safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 KHz to 300 GHz.
3	IEC62209-2	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 2: Procedure to determine the Specific Absorption Rate (SAR) in the head and body for 30MHz to 6GHz Handheld and Body-Mounted Devices used in close proximity to the body.

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for Occupational/Controlled Exposure should be applied for this device, it is 8.0 W/kg as averaged over any 1 gram of tissue.

NOTE
GENERAL POPULATION/UNCONTROLLED EXPOSURE
PARTIAL BODY LIMIT
8.0 W/kg

2.4 Equipments Used during the Test

Test Equipment	Manufacturer	Type/Model	Serial Number	Calibration	
				Last Calibration	Calibration Interval
Data Acquisition Electronics DAEx	SPEAG	DAE4	1315	2014/07/22	1
E-field Probe	SPEAG	EX3DV4	3842	2014/06/06	1
System Validation Dipole D450V3	SPEAG	D450V3	1079	2014/02/28	3
Network analyzer	Agilent	8753E	US37390562	2014/10/26	1
Signal generator	IFR	2032	203002/100	2014/10/27	1
Amplifier	AR	75A250	302205	2014/10/27	1
Power Meter	R&S	NRP	100510	2014/10/25	1
Power Sensor	R&S	NRP-Z11	101919	2014/10/25	1
Power Meter	Agilent	E4416A	GB41292714	2015/03/18	1
Power Sensor	Agilent	E9327A	Us40441788	2015/03/18	1

3. SAR Measurement System

3.1 SAR Measurement Set-up

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

A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).

A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

A data acquisition electronic (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. A unit to operate the optical surface detector which is connected to the EOC.

The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.

The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003.

DASY5 software and SEMCAD data evaluation software.

Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

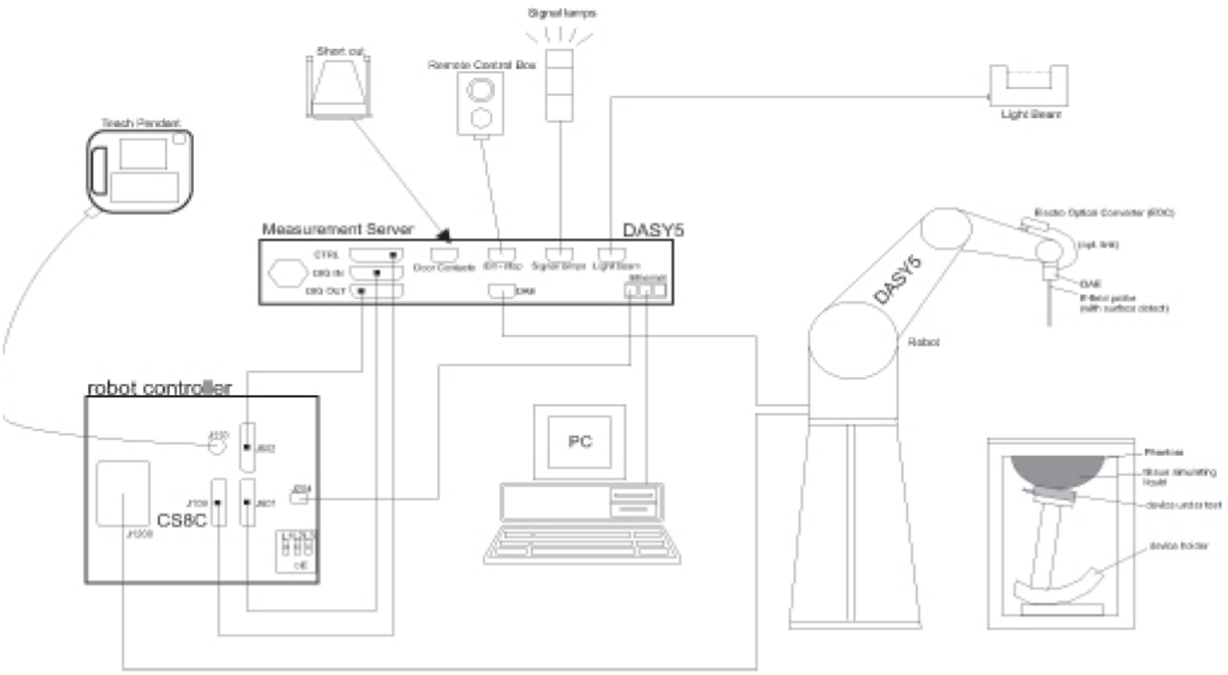
The generic twin phantom enabling the testing of left-hand and right-hand usage.

The device holder for handheld mobile phones.

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles allowing to validate the proper functioning of the system.

1/F, Building B, Zhuoke Science Park, Chongqing Road, Fuyong, Bao'an District, Shenzhen,China
Tel: 0755-36886288 Fax: 0755-36886277 Http://www.stsapp.com E-mail: sts@stsapp.com



3.2 DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe ES3DV3 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

Probe Specification

Construction — Symmetrical design with triangular core
Interleaved sensors
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration — ISO/IEC 17025 calibration service available.

Frequency — 10 MHz to 4 GHz;
Linearity: ± 0.2 dB (30 MHz to 4 GHz)

Directivity — ± 0.2 dB in HSL (rotation around probe axis)
± 0.3 dB in tissue material (rotation normal to probe axis)

Dynamic Range — 5 μW/g to > 100 mW/g;
Linearity: ± 0.2 dB

Dimensions — Overall length: 337 mm (Tip: 20 mm)
Tip diameter: 3.9 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 2.0 mm

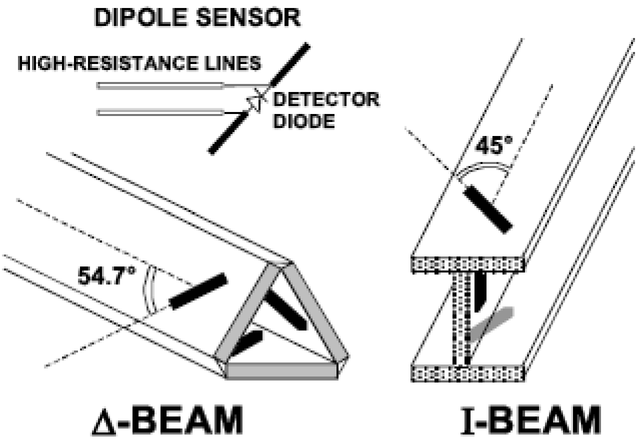
Application — General dosimetry up to 4 GHz
Dosimetry in strong gradient fields
Compliance tests of mobile phones

Compatibility — DASY3, DASY4, DASY52 SAR and higher,
EASY4/MRI

Isotropic E-Field Probe

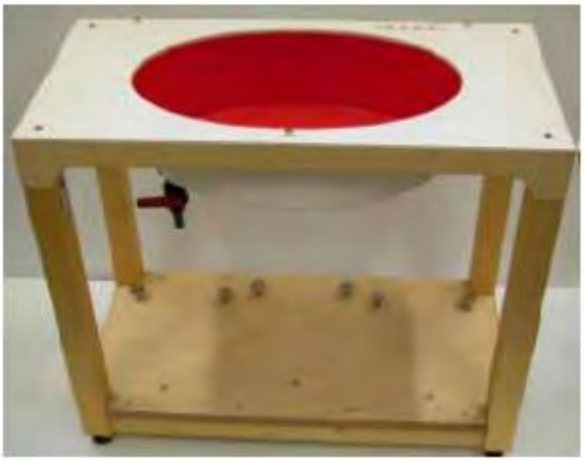
The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



3.3 Phantoms

Flat phantom a fiberglass shell flat phantom with 2mm+/- 0.2 mm shell thickness. It has only one measurement area for Flat phantom



ELI Phantom

3.4 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system. The DASY device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

Device holder supplied by SPEAG

4. 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 of 15 mm x 15 mm is set. During the 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
Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume

containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

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. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the ELI phantom in 5mm steps.

4.1 Data Storage and Evaluation

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 “.DA4”. 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 setup, 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 lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation
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	Normi, ai0, ai1, ai2
	- Conversion factor	ConvFi
	- Diode compression point	Dcpi
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 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:

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

With Vi = compensated signal of channel i (i = x, y, z)
Ui = input signal of channel i (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcpi = diode compression point (DASY parameter)

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

$$\mathrm{E-fieldprobes:} \qquad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

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

With Vi = compensated signal of channel i (i = x, y, z)
Normi = sensor sensitivity of channel i (i = x, y, z)
[mV/(V/m)2] for E-field Probes
ConvF = sensitivity enhancement in solution
aij = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strength of channel i in V/m
Hi = magnetic field strength of channel i in A/m

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

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

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

with SAR = local specific absorption rate in mW/g
Etot = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm3

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.

4.2 Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (Nacl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (s/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

IEEE SCC-34/SC-2 P1528 Recommended Tissue Dielectric Parameters

Frequency (MHz)	Head Tissue		Body Tissue	
	εr	σ (S/m)	εr	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

4.3 Dielectric Performance

Dielectric Performance of Head Tissue Simulating Liquid

Measurement is made at temperature 22.0℃ and relative humidity 55%.			
Liquid temperature during the test: 22.0℃			
Measurement Date: 450 MHz Mar 27th, 2015			
/	Frequency	Frequency ε	Conductivity σ (S/m)
Measurement value	450 MHz	44.04	0.87

Dielectric Performance of Body Tissue Simulating Liquid

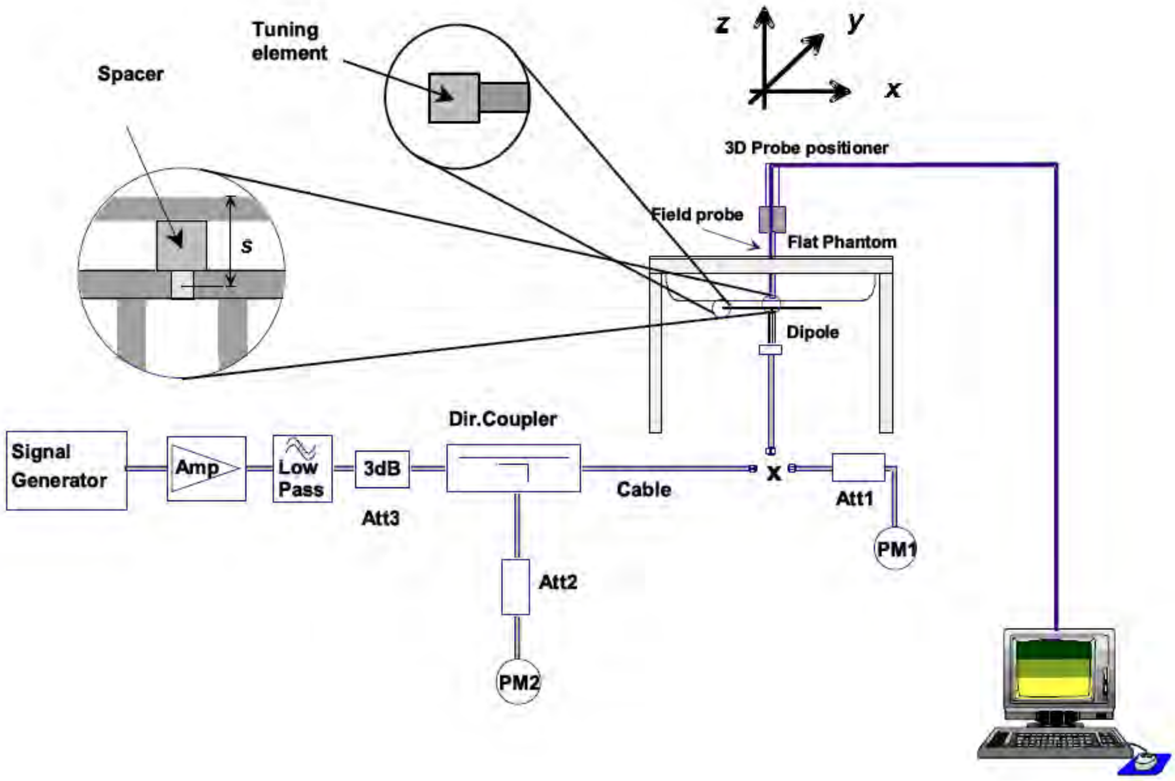
Measurement is made at temperature 22.0℃ and relative humidity 55%.			
Liquid temperature during the test: 22.0℃			
Measurement Date: 450 MHz Mar 27th, 2015			
/	Frequency	Frequency ε	Conductivity σ (S/m)
Measurement value	450 MHz	56.46	0.94

4.4 System Check

The purpose of the system check is to verify that the system operates within its specifications at the decice test frequency.The system check is simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

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.



The output power on dipole port must be calibrated to 26 dBm (398mW) before dipole is connected.

Photo of Dipole Setup

System Validation of Head

Measurement is made at temperature 22.0 ℃ and relative humidity 55%.				
Measurement is made at temperature 22.0 ℃ and relative humidity 55%.				
Measurement Date: 450 MHz Mar 27th, 2015				
Verification results	Frequency (MHz)	Target value (W/kg)	Measured value (W/kg)	Deviation

		1 g Average	10 g Average	1 g Average	10 g Average	1 g Average	10 g Average
	450	1.81	1.21	1.75	1.17	-3.31%	-3.31%

System Validation of Body

Measurement is made at temperature 22.0 ℃ and relative humidity 55%.							
Measurement is made at temperature 22.0 ℃ and relative humidity 55%.							
Measurement Date: 450 MHz Mar 27th, 2015							
Verification results	Frequency (MHz)	Target value (W/kg)		Measured value (W/kg)		Deviation	
		1 g Average	10 g Average	1 g Average	10 g Average	1 g Average	10 g Average
	450	1.74	1.16	1.69	1.11	-2.87	-4.31%

4.5 Measurement Procedures

Tests to be performed

In order to determine the highest value of the peak spatial-average SAR of a handset, all device positions, configurations and operational modes shall be tested for each frequency band according to steps 1 to 3 below. A flowchart of the test process is shown in Picture 11

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

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

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

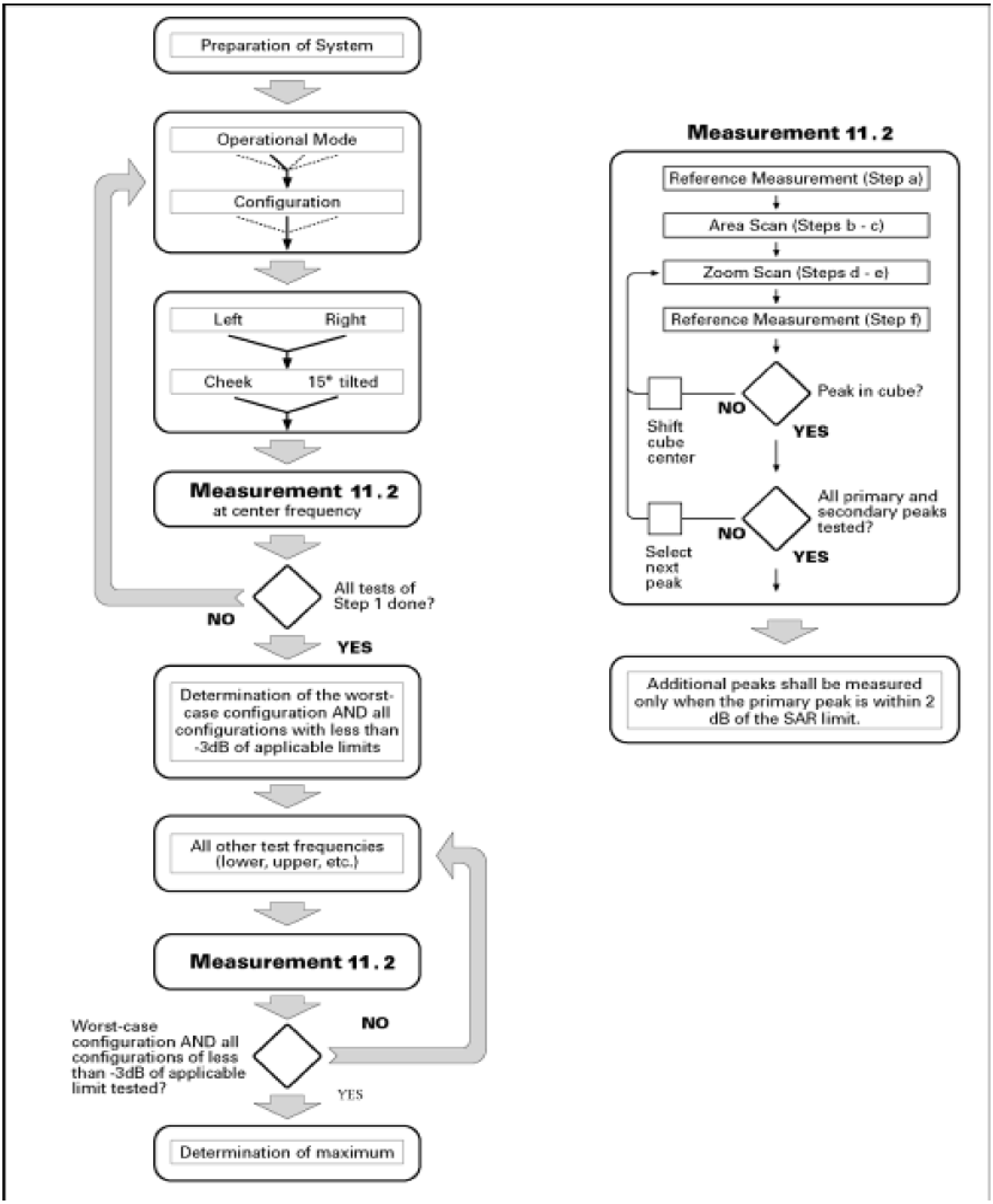
c) all operational modes, e.g., analogue and digital, for each device position in a) and configuration in b) in each frequency band.

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

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

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

1/F, Building B, Zhuoke Science Park, Chongqing Road, Fuyong, Bao'an District, Shenzhen,China
Tel: 0755-36886288 Fax: 0755-36886277 Http://www.stsapp.com E-mail: sts@stsapp.com



Picture 11 Block diagram of the tests to be performed

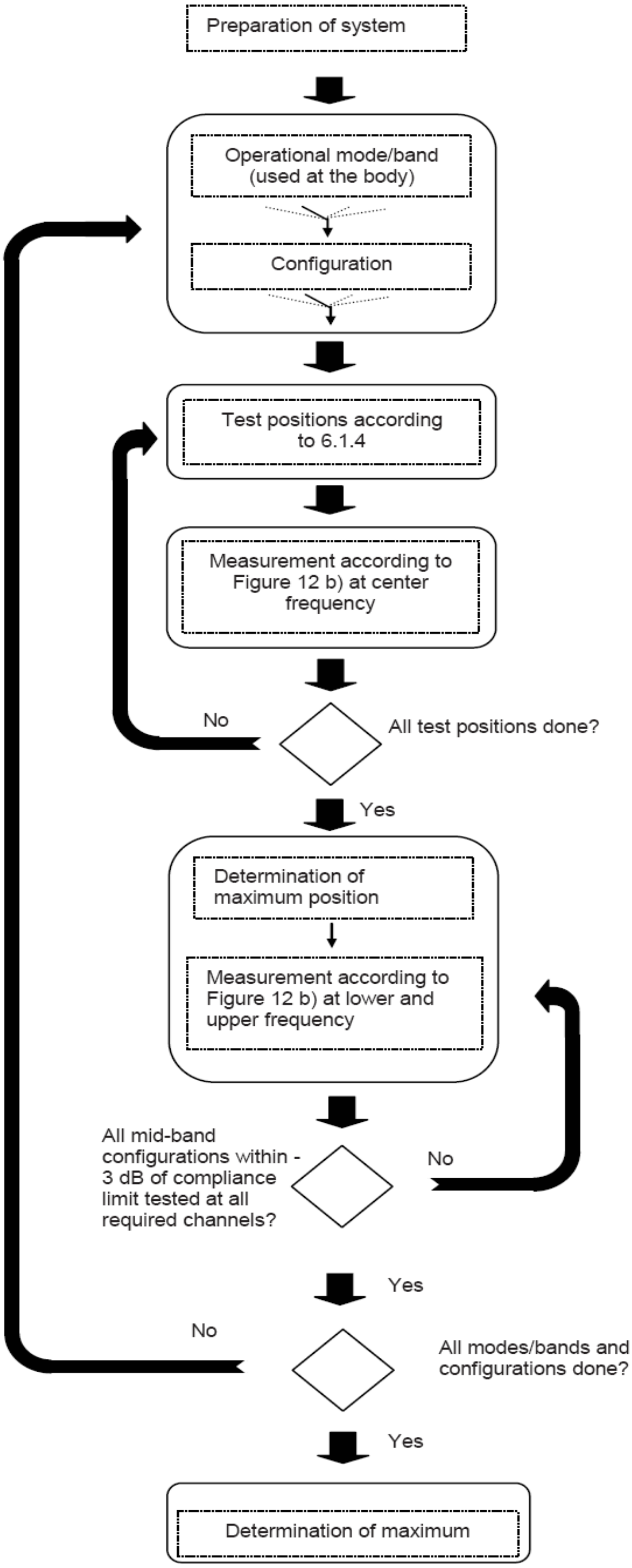


Figure 12a – Tests to be performed

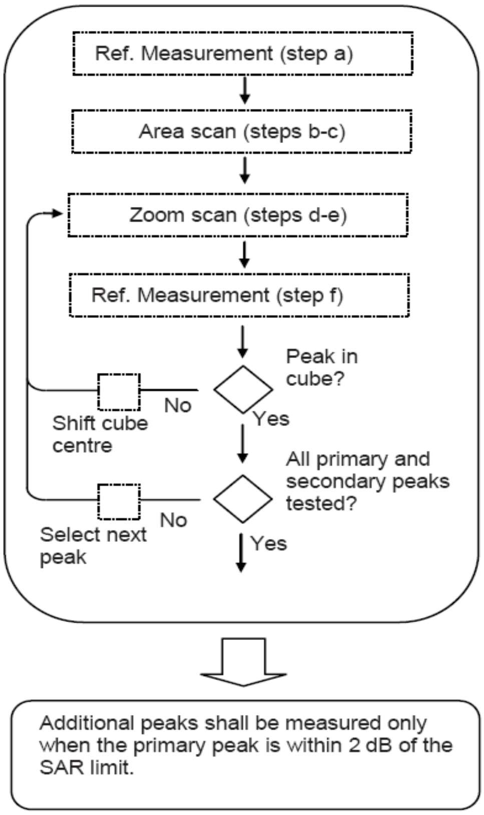


Figure 12b – General procedure

Picture 12 Block diagram of the tests to be performed

4.6 Measurement procedure

The following procedure shall be performed for each of the test conditions (see Picture 11) described in 11.1:

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

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

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

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

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

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

4.7 Power Drift

To control the output power stability during the SAR test, DASY5 system calculates the power drift by measuring the E-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in Table 2 to Table 6 labeled as: (Power Drift [dB]). This ensures that the power drift during one measurement is within 5%.

5. TEST CONDITIONS AND RESULTS

5.1 Conducted Power Results

Conducted power measurement results

Mode	Frequency (MHz)	Channel Spacing	Turn-up Power	Means.Output power(dBm) 5W
4FSK	406.1	12.5KHz (maximum rated power)	35±1	35.64
	435.325			35.76
	469.975			35.72
FM	406.1	12.5KHz (maximum rated power)	35±1	35.23
	435.325			35.43
	469.975			35.14

5.2 SAR Measurement Results

Test Frequency	Mode/Band	Test Configuration	Average SAR over1g(W/kg) (Including power drift)		Scaling Factor	Average SAR over1g(W/kg) (Including Power Drift and Scaling factor)		SAR limit 1g (W/kg)	Ref. Plot #
MHz			100% Duty Cycle	50% Duty Cycle		100% Duty Cycle	50% Duty Cycle		
The EUT display towards phantom for 4FSK 12.5KHz maximum rated power									
406.1	12.5KHz 4FSK	Face Held	5.340	2.670	1.08	5.767	2.884	8.0	4
435.325			4.850	2.425	1.06	5.141	2.571	8.0	5
469.975			5.020	2.510	1.07	5.371	2.686	8.0	6
The EUT display towards ground with belt clip for 4FSK 12.5KHz maximum rated power									
406.1	12.5KHz 4FSK	Body-worn	10.200	5.100	1.08	11.016	5.508	8.0	1
435.325			10.220	5.110	1.06	10.833	5.417	8.0	2
469.975			12.540	6.270	1.07	13.418	6.709	8.0	3
The EUT display towards phantom for FM 12.5KHz maximum rated power									
406.1	12.5KHz FM	Face Held	4.870	2.435	1.19	5.795	2.898	8.0	-
435.325			4.270	2.135	1.14	4.868	2.434	8.0	-
469.975			4.620	2.310	1.22	5.636	2.818	8.0	-
The EUT display towards ground with belt clip for FM 12.5KHz maximum rated power									
406.1	12.5KHz FM	Body-worn	7.840	3.920	1.19	9.330	4.665	8.0	-
435.325			7.230	3.615	1.14	8.242	4.121	8.0	-
469.975			8.370	4.185	1.22	10.211	5.106	8.0	-

Note : 1.The value with bile color is the maximum SAR value of each test band;
2.The exposure category about EUT:controlled environment /Occupational,so the SAR limit is 8.0 W/kg averaged over any 1g of tissue.

5.3 Measurement Uncertainty

Uncertainty Component	Unc. vaule ±%	Prob Dist.	Div.	C_i 1g	C_i 10g	Std.Unc. ±%.1g	Std.Unc. ±%.10g	V_i
Measurement System								
Probe Calibration	5.9	N	1	1	1	5.9	5.9	∞
Axial Isotropy	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	9.6	R	$\sqrt{3}$	0.7	0.7	3.9	3.9	∞
Boundary Effect	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Linearity	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
System Detection Limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Readout Electronics	0.3	N	1	1	1	0.3	0.3	∞
Response Time	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
Integration Time	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
RF Ambient Conditions - Noise	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
Probe Positioning with respect to Phantom Shell	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
Test Sample Related								
Test Sample Positioning	2.1	N	1	1	1	2.1	2.1	150
Device Holder Uncertainty	3.6	N	1	1	1	3.6	3.6	5
Output Power Variation - SAR drift measurement	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and Tissue Parameters								
Phantom Uncertainty (shape and thickness tolerances)	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
Conductivity Target - tolerance	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
Conductivity - measurement uncertainty	2.5	N	1	0.64	0.43	1.6	1.1	∞
Permittivity Target - tolerance	5.0	R	$\sqrt{3}$	0.60	0.49	1.7	1.4	∞
Permittivity - measurement uncertainty	1.9	N	1	0.60	0.49	1.5	1.2	5
Combined Standard Uncertainty		R				**±11.2%**	**±10.8%**	387
Coverage Factor for 95%			2					
Expanded STD Uncertainty						**+22.4%**	**±21.6%**	

5.4 System Check Results

System Performance Check at 450 MHz Head TSL

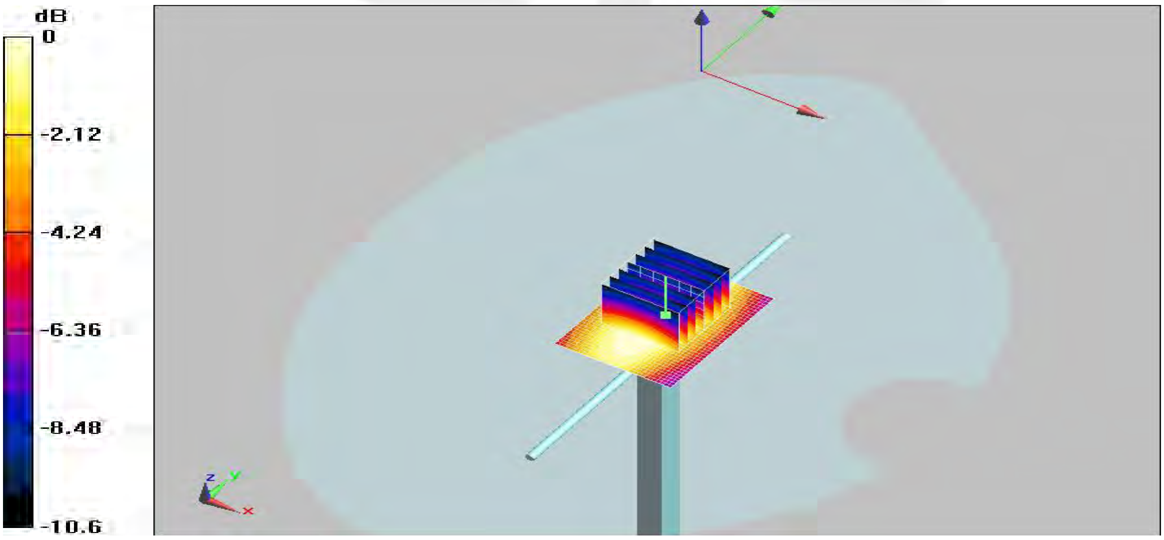
DUT: Dipole450 MHz; Type: D450V3; Serial: 1079
Date/Time: 27/03/2015

Communication System: DuiJiangJi; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 450 MHz; σ = 0.87 S/m; ε_r = 44.04; ρ = 1000 kg/m
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV4 - SN3842; ConvF(10.00, 10.00, 10.00); Calibrated: 06/06/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
Phantom: ELI 1; Type: ELI;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)
Area Scan (41x131x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 2.14 W/kg
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.453 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.24 mW/g
SAR(1 g) = 1.75 mW/g; SAR(10 g) = 1.17 mW/g

Maximum value of SAR (measured) = 3.24 W/kg



0 dB = 3.24mW/g

System Performance Check 450MHz 398mW

System Performance Check at 450 MHz Body TSL

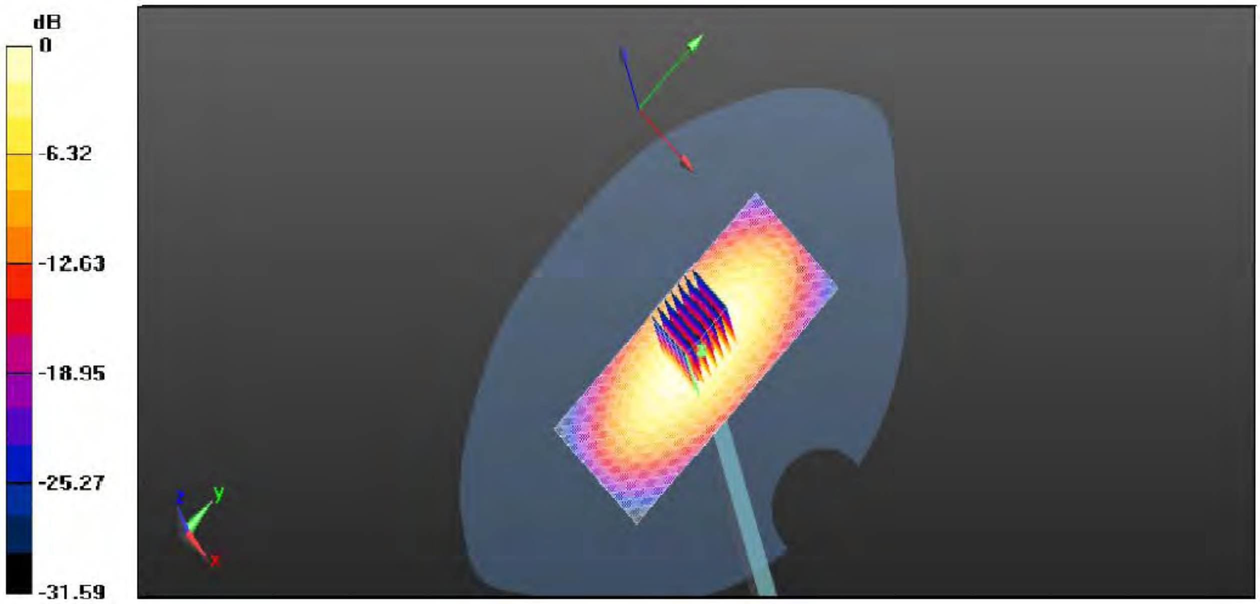
DUT: Dipole 450 MHz; Type: D450V3; Serial: 1079
Date/Time: 27/03/2015

Communication System: DuiJiangJi; Frequency: 450 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 450 MHz; σ = 0.94 S/m; ε_r = 56.46; ρ = 1000 kg/m
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV4 - SN3842; ConvF(10.34, 10.34, 10.34); Calibrated: 06/06/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
Phantom: ELI 1; Type: ELI;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)
Area Scan (41x131x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 1.83 W/kg
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 50.358 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.64 mW/g
SAR(1 g) = 1.69 mW/g; SAR(10 g) = 1.11 mW/g

Maximum value of SAR (measured) = 2.64 W/kg



0 dB = 2.64mW/g

System Performance Check 450MHz 398mW

5.5 SAR Test Graph Results

Body-worn, Back towards Phantom for 12.5KHz 406.1MHz

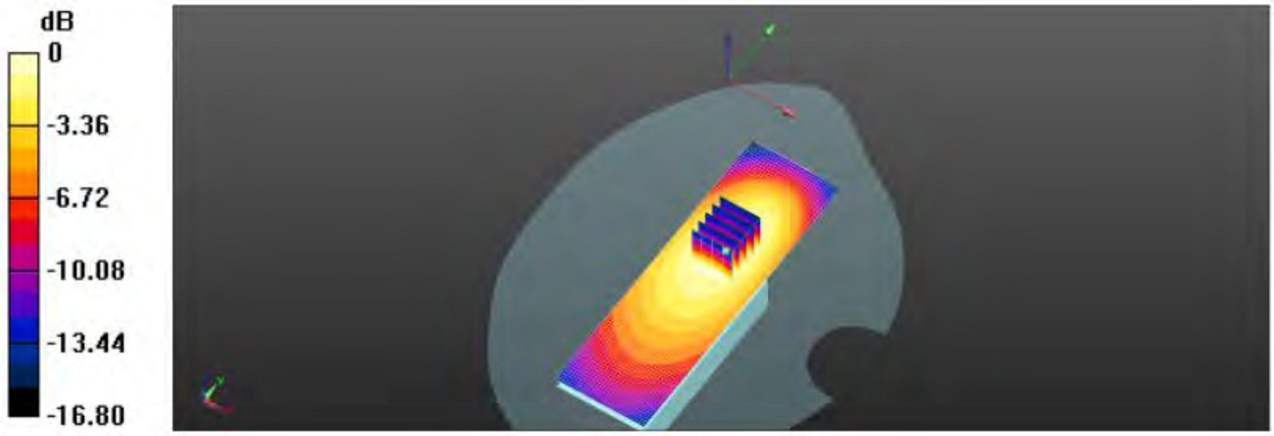
DUT: Portable Digital Radio; Type: T928; Serial: /
Date/Time: 27/03/2015

Communication System: DuiJiangJi; Frequency: 406.1 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 406.1 MHz; σ = 0.95 mho/m; ε_r = 57.30; ρ = 1000 kg/m
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV4 - SN3842; ConvF(10.34, 10.34, 10.34); Calibrated: 06/06/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
Phantom: ELI 1; Type: ELI;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)
Area Scan (51x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 11.26 W/kg
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.24 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 13.90 mW/g
SAR(1 g) = 10.20 W/Kg; SAR(10 g) = 7.32 W/Kg

Maximum value of SAR (measured) = 11.96 W/kg



0 dB = 11.96 W/kg

Figure 1: Body-worn,Back towards Phantom for 12.5KHz 406.1 MHz

Body-worn,Back towards Phantom for 12.5KHz 435.325MHz

DUT: Portable Digital Radio; Type: T928; Serial: /
Date/Time: 27/03/2015

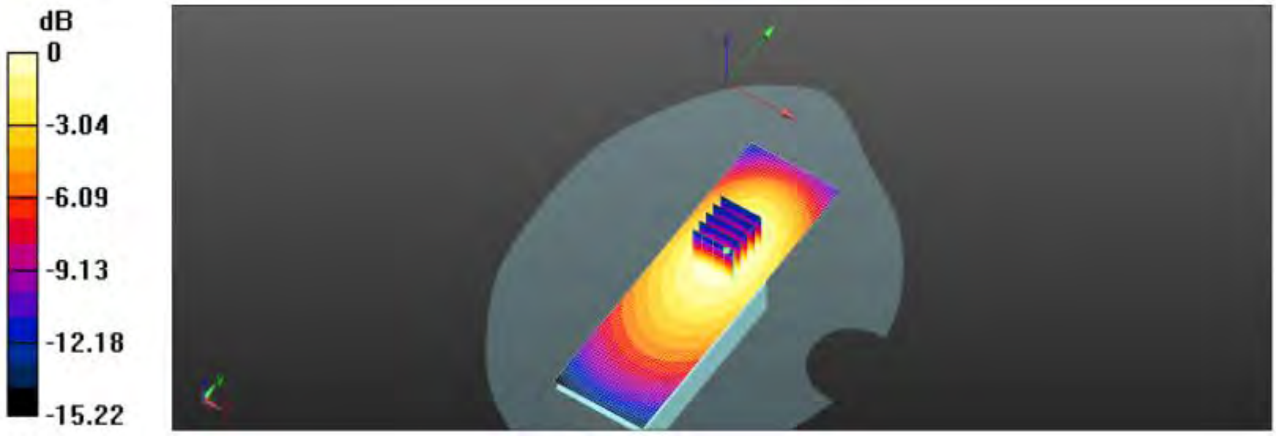
Communication System: DuiJiangJi; Frequency: 435.325 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 435.325 MHz; σ = 0.98 mho/m; ε_r = 55.14; ρ = 1000 kg/m
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV4 - SN3842; ConvF(10.34, 10.34, 10.34); Calibrated: 06/06/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
Phantom: ELI 1; Type: ELI;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)
Area Scan (51x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) =11.37 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.23 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 14.74 mW/g
SAR(1 g) = 10.22 W/Kg; SAR(10 g) = 7.47 W/Kg

Maximum value of SAR (measured) = 11.63 W/kg



0 dB = 11.63 W/kg

Figure 2: Body-worn,Back towards Ground for 12.5KHz 435.325MHz

Body-worn,Back towards Phantom for 12.5KHz 469.975MHz

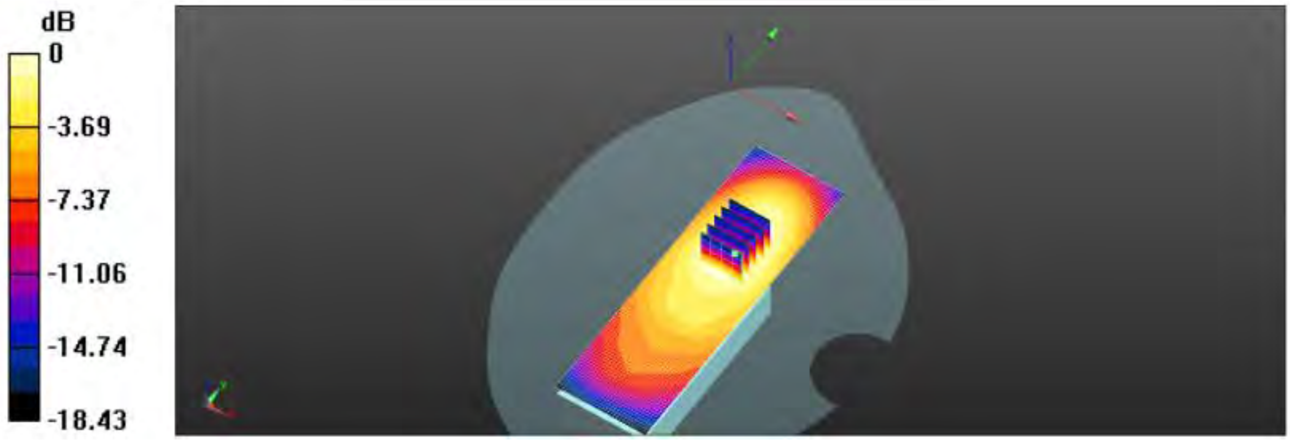
DUT: Portable Digital Radio; Type: T928; Serial: /
Date/Time: 27/03/2015

Communication System: DuiJiangJi; Frequency: 469.975 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 469.975 MHz; σ = 0.96 mho/m; ε_r = 55.92; ρ = 1000 kg/m
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV4 - SN3842; ConvF(10.34, 10.34, 10.34); Calibrated: 06/06/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
Phantom: ELI 1; Type: ELI;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)
Area Scan (51x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 12.47 W/kg
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 112.24 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 15.46 mW/g
SAR(1 g) = 12.54 W/Kg; SAR(10 g) = 8.49 W/Kg

Maximum value of SAR (measured) = 13.89 W/kg



0 dB = 13.89 W/kg

Figure 3: Body-worn,Back towards Phantom for 12.5KHz 469.975MHz

Face Held, Back towards Ground for 12.5KHz 406.1MHz

DUT: Portable Digital Radio; Type: T928; Serial: /
Date/Time: 27/03/2015

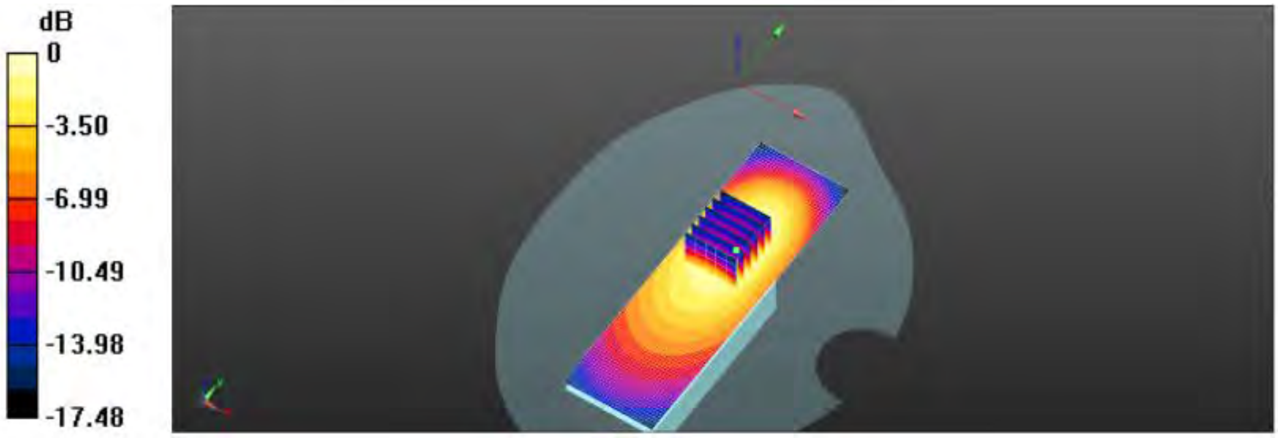
Communication System: DuiJiangJi; Frequency:406.1 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 406.1 MHz; σ = 0.95 mho/m; ε_r = 55.89; ρ = 1000 kg/m
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV4 - SN3842; ConvF(10.00, 10.00, 10.00); Calibrated: 06/06/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
Phantom: ELI 1; Type: ELI;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (51x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) =5.92 W/kg
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 64.972 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 7.16 mW/g
SAR(1 g) = 5.34 W/Kg; SAR(10 g) = 3.52 W/Kg

Maximum value of SAR (measured) = 7.13 W/kg



0 dB = 7.13 W/kg

Figure 4: Face Held,Back towards Ground for 12.5KHz 406.1MHz

Face Held,Back towards Ground for 12.5KHz 435.325MHz

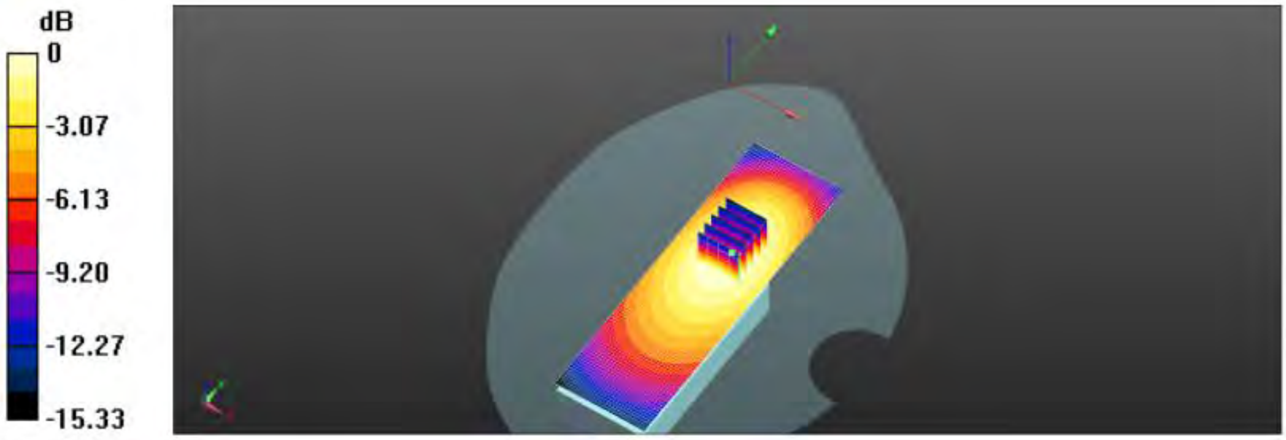
DUT: Portable Digital Radio; Type: T928; Serial: /
Date/Time: 27/03/2015

Communication System: DuiJiangJi; Frequency: 435.325 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 435.325 MHz; σ = 0.99 mho/m; ε_r = 56.74; ρ = 1000 kg/m
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV4 - SN3842; ConvF(10.00, 10.00, 10.00); Calibrated: 06/06/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
Phantom: ELI 1; Type: ELI;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)
Area Scan (51x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 5.03 W/kg
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 66.53 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 5.72 mW/g
SAR(1 g) = 4.85 W/Kg; SAR(10 g) = 2.96 W/Kg

Maximum value of SAR (measured) = 5.77 W/kg



0 dB = 5.77 W/kg

Figure 5: Face Held,Back towards Ground for 12.5KHz 435.325MHz

Face Held,Back towards Ground for 12.5KHz 469.975MHz

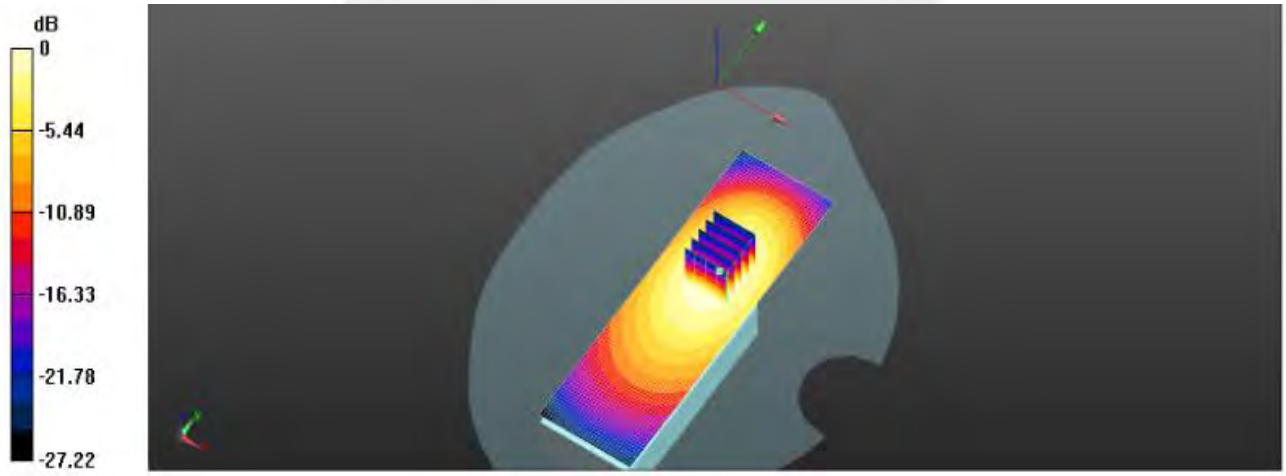
DUT: Portable Digital Radio; Type: T928; Serial: /
Date/Time: 27/03/2015

Communication System: DuiJiangJi; Frequency: 469.975 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 469.975 MHz; σ = 0.99 mho/m; ε_r = 56.74; ρ = 1000 kg/m
Phantom section: Flat Section

DASY5 Configuration:
Probe: ES3DV4 - SN3842; ConvF(10.00, 10.00, 10.00); Calibrated: 06/06/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 22/07/2014
Phantom: ELI 1; Type: ELI;

Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)
Area Scan (51x101x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 5.47 W/kg
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 73.58 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 6.38 mW/g
SAR(1 g) = 5.02 W/Kg; SAR(10 g) = 3.18 W/Kg

Maximum value of SAR (measured) = 6.38 W/kg



0 dB = 6.38 W/kg

Figure 6: Face Held,Back towards Ground for 12.5KHz 469.975 MHz

6 Calibration Certificate

6.1 Probe Calibration Certicate

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
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 108**

Client **CIQ-SZ (Auden)**

Certificate No: **EX3-3842_Jun13**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3842

Calibration procedure(s): QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: June 6, 2014

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 E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: June 6, 2014

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

Certificate No: EX3-3842_Jun13 Page 1 of 11

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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 108**

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.e., ϑ = 0 is normal to probe axis

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", December 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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect 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 with CW signal (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; Dx,y,z; VRx,y,z: A, B, C, D* 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 ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values 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 ± 50 MHz to ± 100 MHz.
- *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.

Probe EX3DV4

SN:3842

Manufactured: October 25, 2011
Repaired: June 3, 2014
Calibrated: June 6, 2014

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3842

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.35	0.52	0.42	± 10.1 %
DCP (mV)[B]	104.7	100.4	100.5	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	132.3	±3.5 %
		Y	0.0	0.0	1.0		162.7	
		Z	0.0	0.0	1.0		147.6	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3842

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	Depth (mm)	Unct. (k=2)
450	43.5	0.87	10.00	10.00	10.00	0.15	1.10	± 13.4 %
835	41.5	0.91	8.83	8.83	8.83	0.28	1.07	± 12.0 %
900	41.5	0.97	8.78	8.78	8.78	0.32	1.00	± 12.0 %
1810	40.0	1.40	7.68	7.68	7.68	0.38	0.88	± 12.0 %
1900	40.0	1.40	7.55	7.55	7.55	0.50	0.77	± 12.0 %
2450	39.2	1.80	7.26	7.26	7.26	0.71	0.63	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies 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.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3842

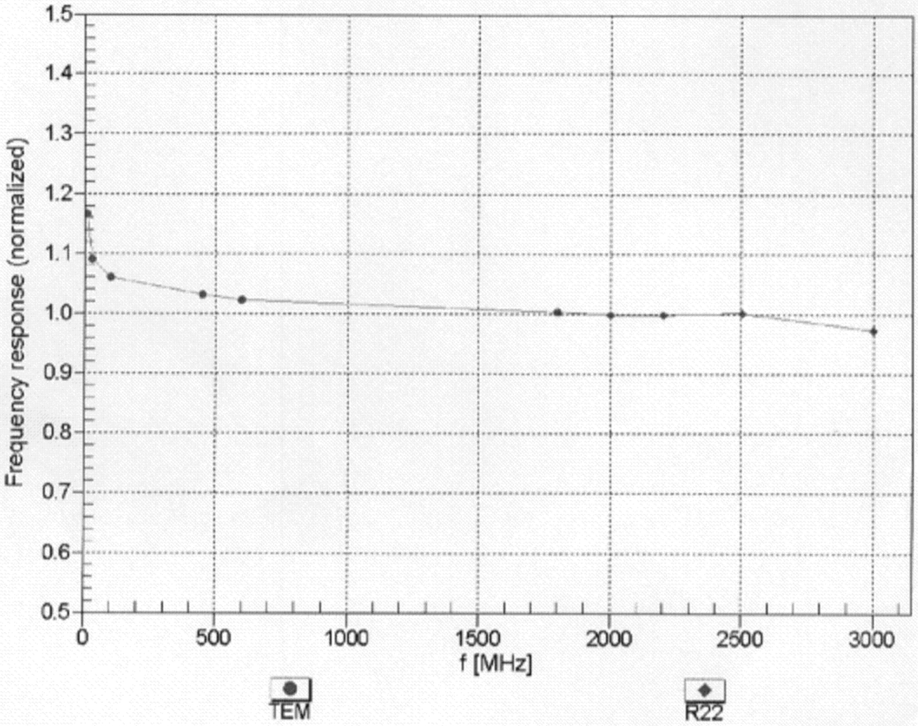
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	10.34	10.34	10.34	0.09	1.00	± 13.4 %
835	55.2	0.98	9.09	9.09	9.09	0.42	0.84	± 12.0 %
900	55.0	1.05	9.16	9.16	9.16	0.47	0.79	± 12.0 %
1810	53.3	1.52	7.78	7.78	7.78	0.50	0.81	± 12.0 %
1900	53.3	1.52	7.43	7.43	7.43	0.29	1.07	± 12.0 %
2450	52.7	1.95	6.93	6.93	6.93	0.80	0.59	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies 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.

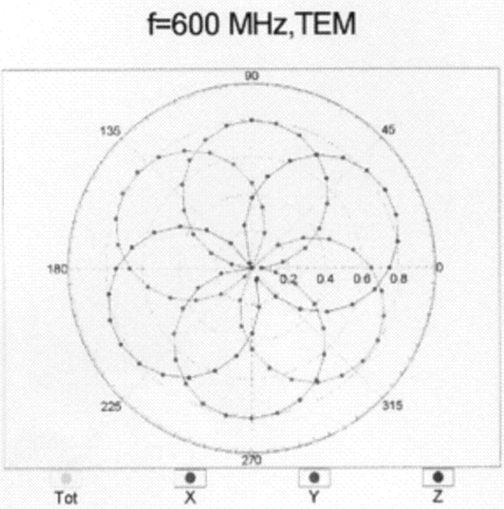
Frequency Response of E-Field

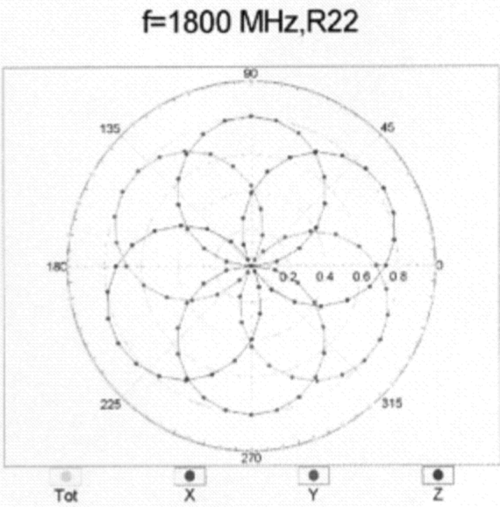
(TEM-Cell:ifi110 EXX, Waveguide: R22)

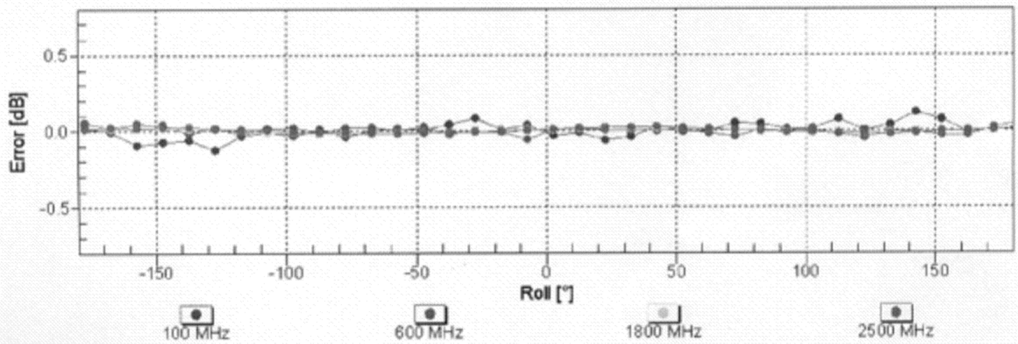


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



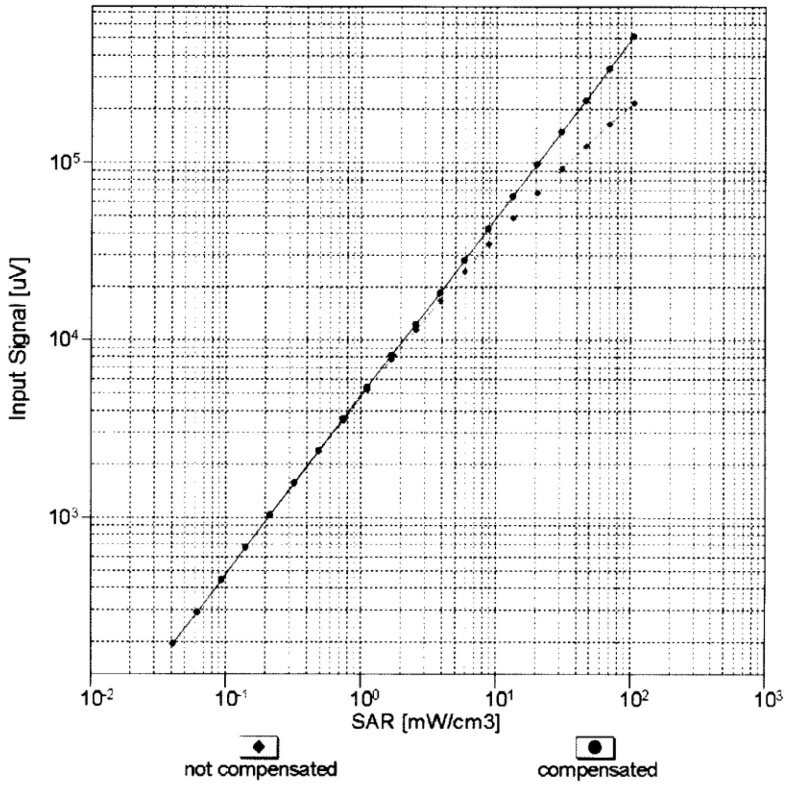


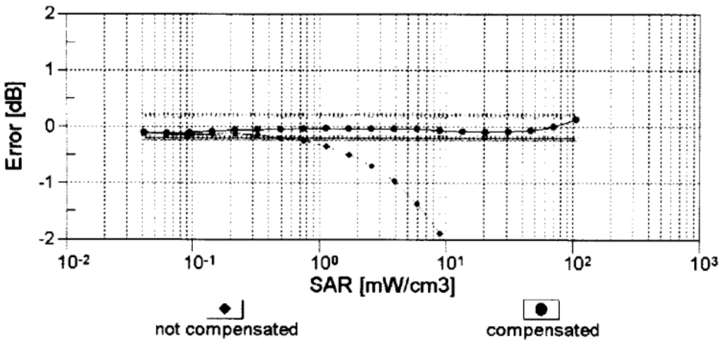


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

EX3DV4– SN:3842 June 6, 2014

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



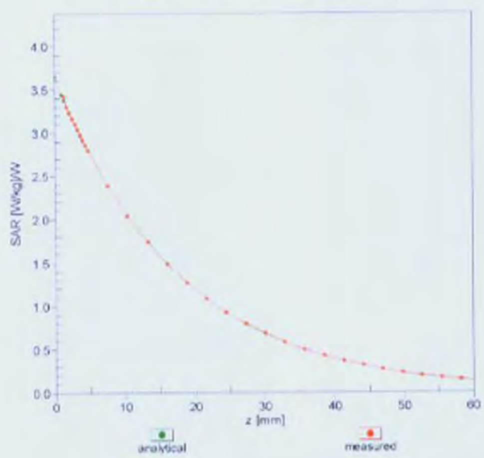


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

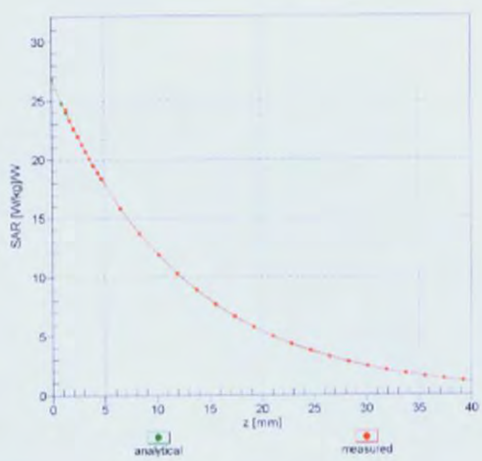
EX3DV4– SN:3842 June 6, 2014

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

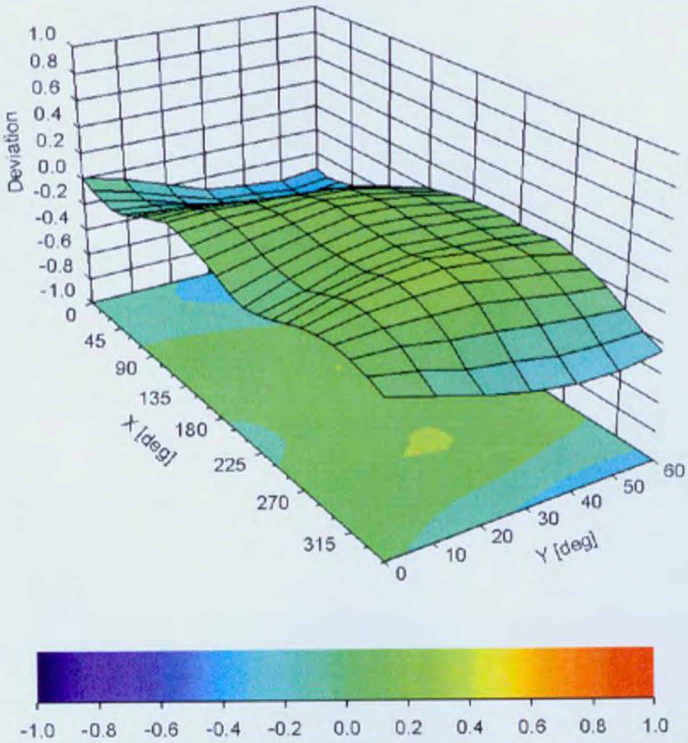


f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

1/F, Building B, Zhuoke Science Park, Chongqing Road, Fuyong, Bao'an District, Shenzhen,China
Tel: 0755-36886288 Fax: 0755-36886277 Http://www.stsapp.com E-mail: sts@stsapp.com

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3842

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-117.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

6.2 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 108**

Client **CIQ SZ (Auden)**

Certificate No: **D450V3-1079_Feb13**

CALIBRATION CERTIFICATE

Object	D450V3 - SN: 1079
Calibration procedure(s)	QA CAL-15.v6 Calibration procedure for dipole validation kits below 700 MHz
Calibration date:	February 28, 2014

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 E4419B	GB41293874	31-Mar-12 (No. 217-01372)	Apr-13
Power sensor E4412A	MY41498087	31-Mar-12 (No. 217-01372)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-12 (No. 217-01369)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-12 (No. 217-01367)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	29-Mar-12 (No. 217-01168)	Apr-13
Reference Probe ET3DV6	SN: 1507	30-Dec-12 (No. ET3-1507_Dec11)	Dec-13
DAE4	SN: 654	03-May-12 (No. DAE4-654_May11)	May-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: February 28, 2013

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

Certificate No: D450V3-1079_Feb13 Page 1 of 8

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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 108**

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 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
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) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end 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 the nominal SAR result.

Shenzhen STS Test Services Co., Ltd.
1/F, Building B, Zhuoke Science Park, Chongqing Road, Fuyong, Bao'an District, Shenzhen,China
Tel: 0755-36886288 Fax: 0755-36886277 Http://www.stsapp.com E-mail: sts@stsapp.com

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
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	43.6 ± 6 %	0.85 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	398 mW input power	1.81 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**4.63 mW /g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	398 mW input power	1.21 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**3.09 mW /g ± 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	55.0 ± 6 %	0.91 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	398 mW input power	1.74 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**4.45 mW / g ± 18.1 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	398 mW input power	1.16 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**2.97 mW / g ± 17.6 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	59.8 Ω - 0.5 jΩ
Return Loss	- 21.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	56.4 Ω - 5.9 jΩ
Return Loss	- 21.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.350 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/Time: 28.02.2014

Test Laboratory: SPEAG

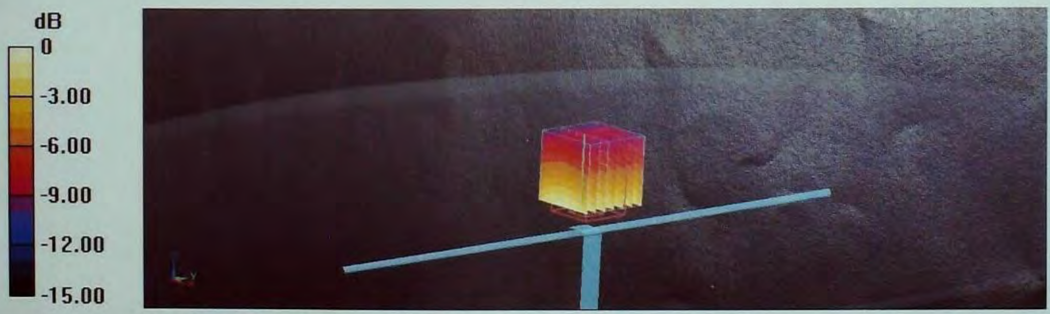
DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1079

Communication System: CW; Frequency: 450 MHz
Medium parameters used: f = 450 MHz; σ = 0.85 mho/m; ε_r = 43.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

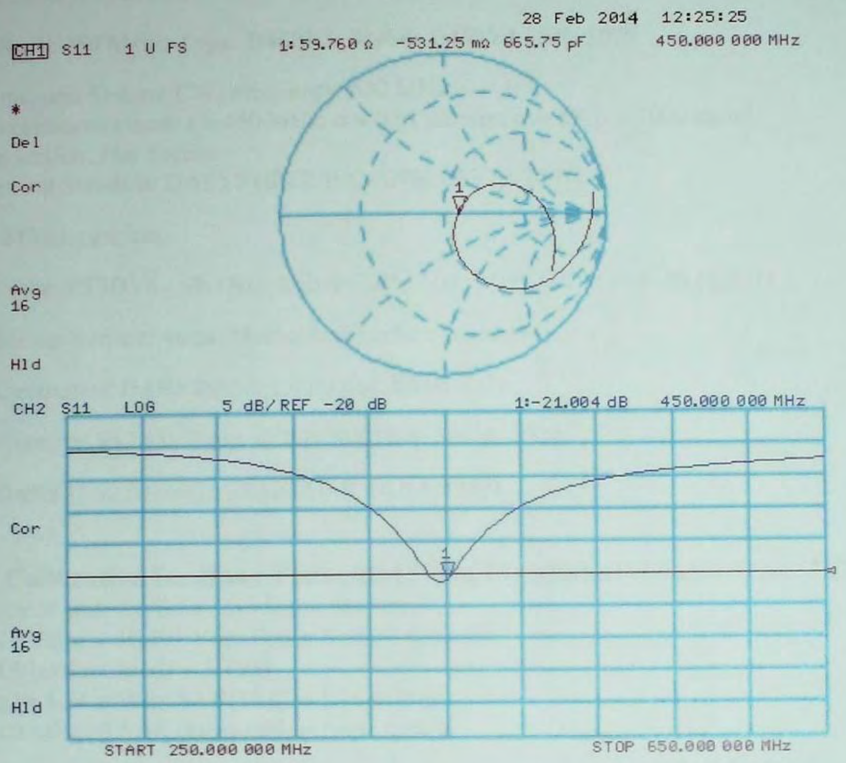
- Probe: ET3DV6 - SN1507; ConvF(6.59, 6.59, 6.59); Calibrated: 30.12.2013
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 03.05.2013
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Head Tissue/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 49.699 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 2.7560
SAR(1 g) = 1.81 mW/g; SAR(10 g) = 1.21 mW/g
Maximum value of SAR (measured) = 1.936 mW/g



0 dB = 1.940mW/g = 5.76 dB mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 28.02.2014

Test Laboratory: SPEAG

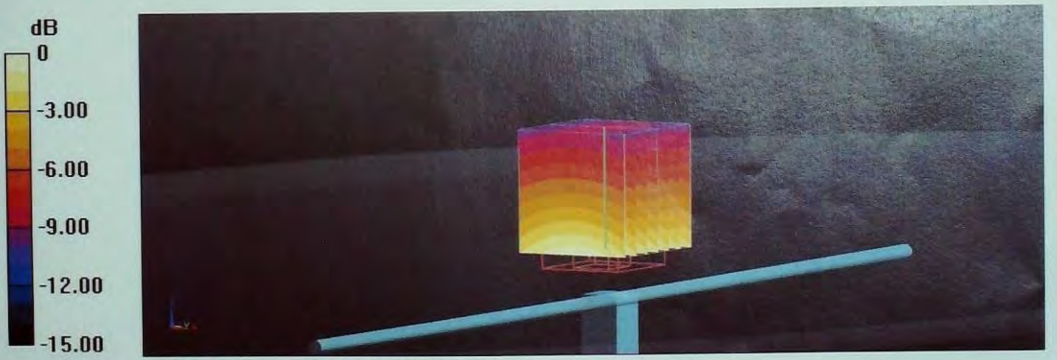
DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN: 1079

Communication System: CW; Frequency: 450 MHz
Medium parameters used: f = 450 MHz; σ = 0.91 mho/m; ε_r = 55; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(7.05, 7.05, 7.05); Calibrated: 30.12.2013
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 03.05.2013
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1003
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

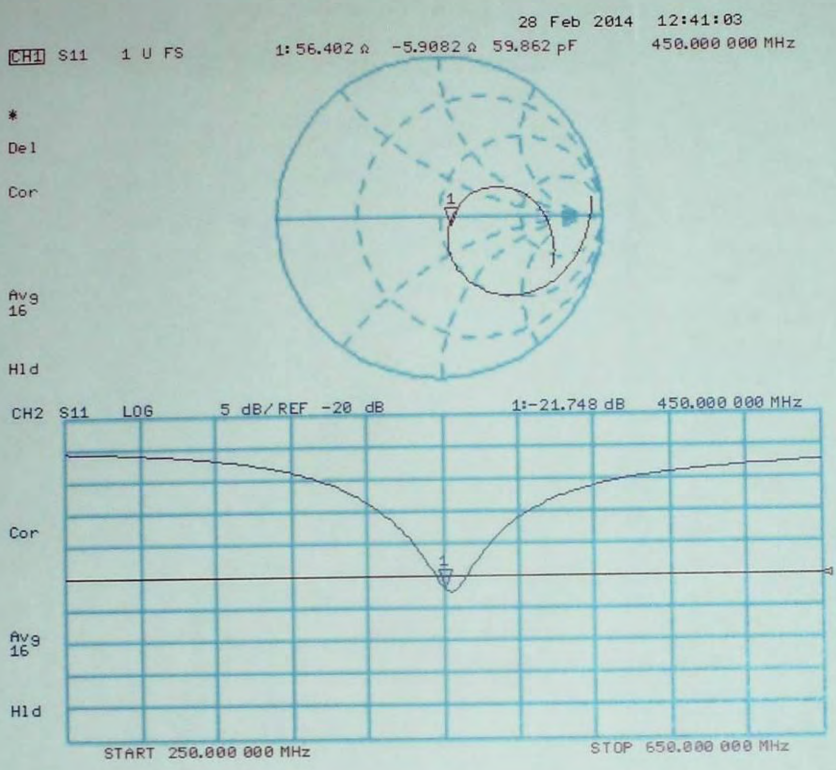
Dipole Calibration for Body Tissue/d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 46.491 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 2.7360
SAR(1 g) = 1.74 mW/g; SAR(10 g) = 1.16 mW/g
Maximum value of SAR (measured) = 1.861 mW/g



0 dB = 1.860mW/g = 5.39 dB mW/g

Shenzhen STS Test Services Co., Ltd.
1/F, Building B, Zhuoke Science Park, Chongqing Road, Fuyong, Bao'an District, Shenzhen,China
Tel: 0755-36886288 Fax: 0755-36886277 Http://www.stsapp.com E-mail: sts@stsapp.com

Impedance Measurement Plot for Body TSL



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Tel: 0755-36886288 Fax: 0755-36886277 Http://www.stsapp.com E-mail: sts@stsapp.com

6.3 DAE4 Calibration Certificate

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

CNAS CALIBRATION No. L0570

Client : CIQ-SZ(Auden) Certificate No: Z14-97066

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1315
Calibration Procedure(s)	TMC-OS-E-01-198 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	July 22, 2014

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
Documenting Process Calibrator 753	1971018	01-July-14 (CTTL, No:J14X02147)	July-15

	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 23, 2014

TTL In Collaboration with s p e a g CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

ilac-MRA CNAS CALIBRATION No. L0570

Glossary:

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

Methods Applied and Interpretation of Parameters:

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

In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

CALIBRATION
No. L0570

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

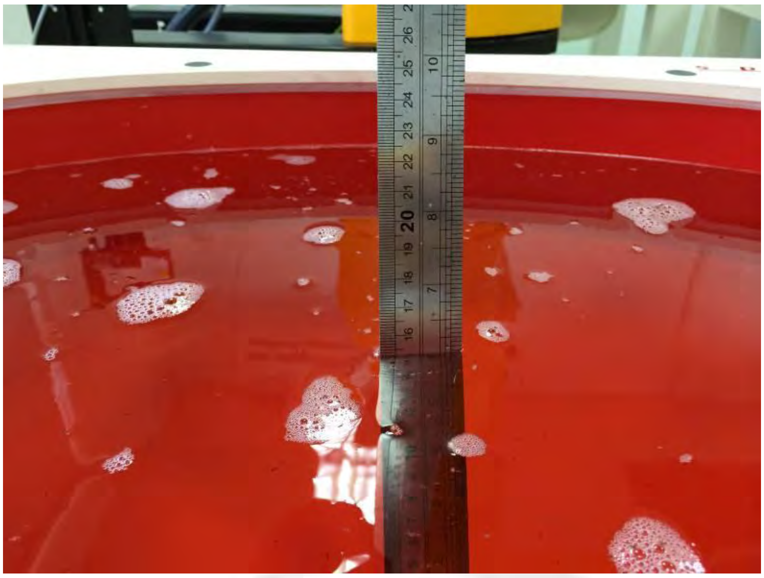
DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	405.162 ± 0.15% (k=2)	405.006 ± 0.15% (k=2)	404.963 ± 0.15% (k=2)
Low Range	3.99072 ± 0.7% (k=2)	3.98481 ± 0.7% (k=2)	3.98836 ± 0.7% (k=2)

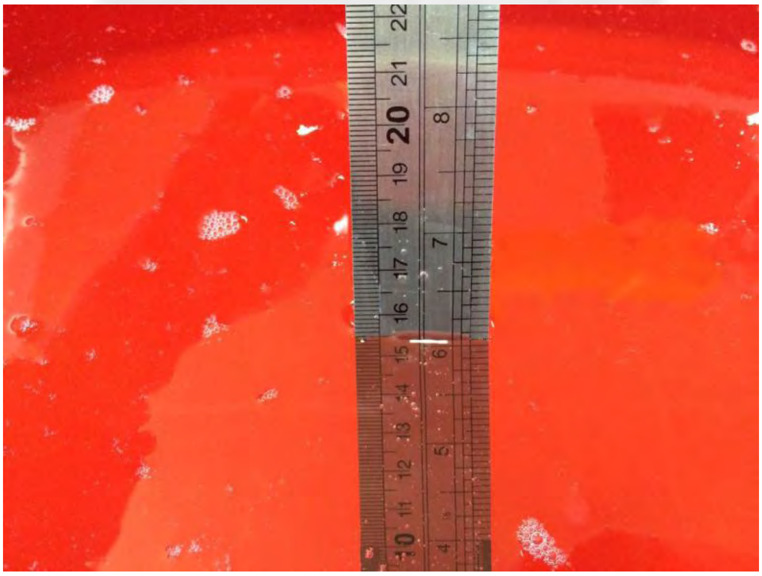
Connector Angle

Connector Angle to be used in DASY system	22° ± 1 °

7. Test Setup Photos

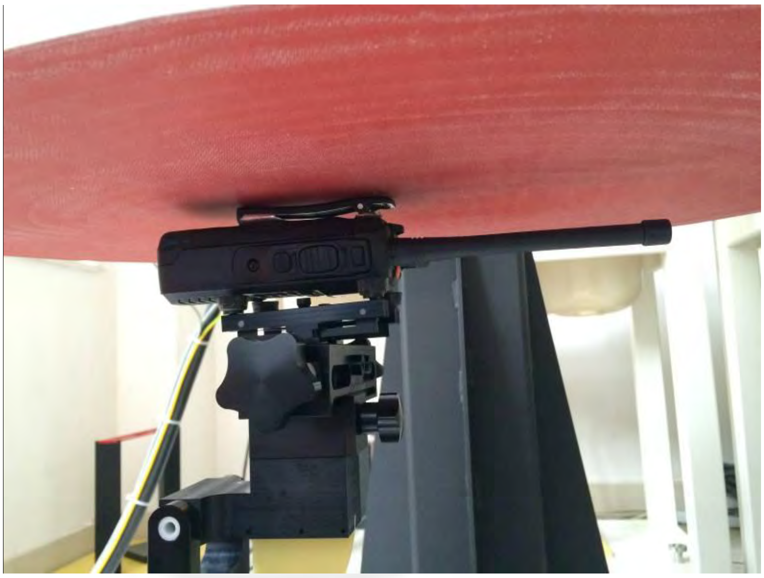


450MHz Liquid of Body



450MHz Liquid of Head

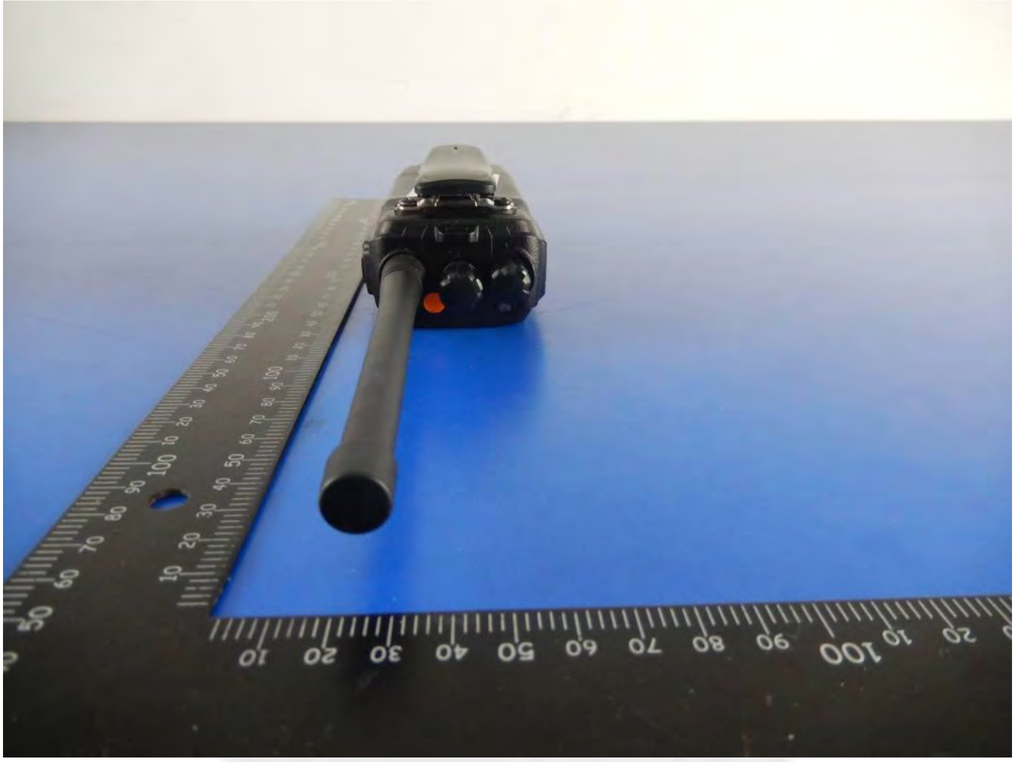

Face-held,The EUT display towards phantom 25mm


Body-worn, The EUT display towards ground,belt clip attach the phantom 0 mm

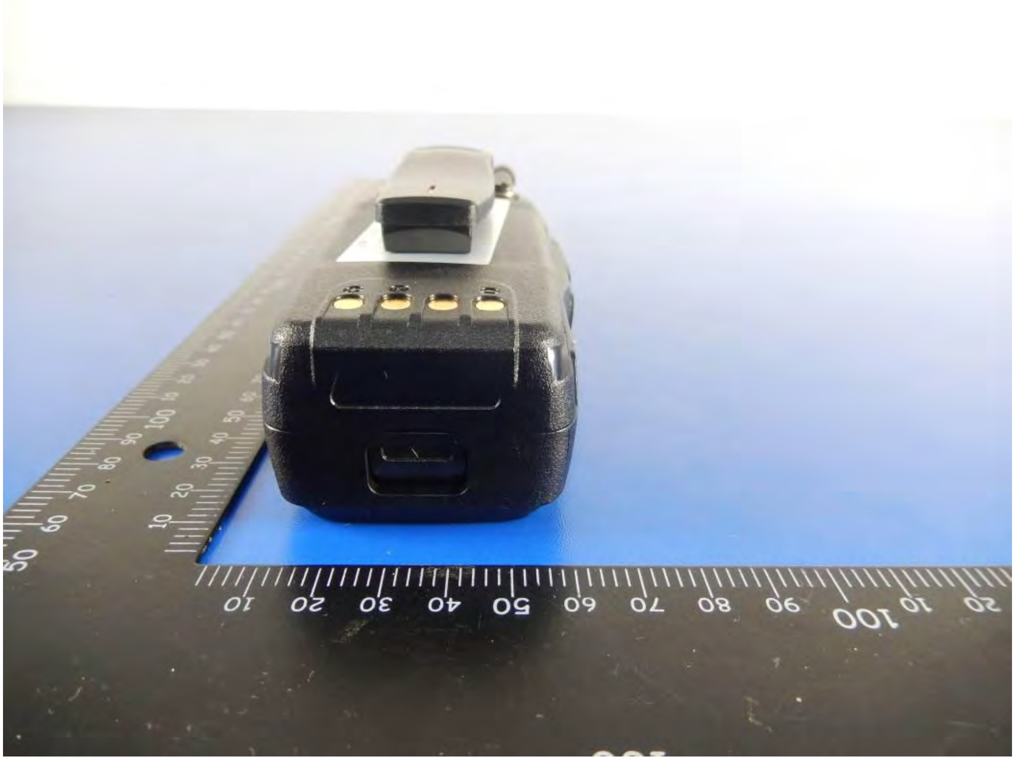
8. EUT Photos

Front side

Back side



Top side



Bottom side

Left side

Right side