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TEST REPORT

Report Reference No. ..... :	**TRE17080130**	R/C…….:	83800
FCC ID ..... :	**2ANH9-RWF189-TH1801**		
Applicant's name ..... :	**AMER international co., limited**		
Address.....:	23th Floor, Century Square,No. 3018 Shennan Road, Futian District, Shenzhen, China		
Manufacturer.....:	AMER international co., limited		
Address.....:	23th Floor, Century Square,No. 3018 Shennan Road, Futian District, Shenzhen, China		
Test item description ..... :	**TH 1801 mobile phone**		
Trade Mark .....:	TWO Mobile		
Model/Type reference.....:	TH 1801		
Listed Model(s) .....:	-		
Standard ..... :	**FCC 47 CFR Part2.1093** **ANSI/IEEEC95.1: 1999** **IEEE 1528: 2013**		
Date of receipt of test sample……..:	Aug. 22, 2017		
Date of testing……:	Aug. 22, 2017 - Sept. 01, 2017		
Date of issue……...:	Sept. 04, 2017		
Result..... ……..:	**PASS**		

Compiled by (position+printedname+signature)...:	File administrators: Edward Pan	Edward.Pan
Supervised by (position+printedname+signature)...:	Test Engineer: Edward Pan	Edward.Pan
Approved by (position+printedname+signature)...:	Manager: Hans Hu	Hans Hu

Testing Laboratory Name ..... :	**Shenzhen Huatongwei International Inspection Co., Ltd.**
Address.....:	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

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The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1 . Test Standards and Report version

1.1. Test Standards

The tests were performed according to following standards:

FCC 47 Part 2.1093 Radiofrequency Radiation Exposure Evaluation:Portable Devices
IEEE StdC95.1, 1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 KHz to 300 GHz.
IEEE Std 1528™-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.
KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting v01r02: RF Exposure Compliance Reporting and Documentation Considerations
KDB 447498 D01 General RF Exposure Guidance v06: Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB 648474 D04 Handset SAR v01r03: SAR Evaluation Considerations for Wireless Handsets
KDB941225 D013G SAR Procedures v03r01: SAR Measurement Procedures for 3G Devices

1.2. Report version

Version No.	Date of issue	Description
00	Sept. 04, 2017	Original

2. Summary

2.1. Client Information

Applicant:	AMER international co., limited
Address:	23th Floor, Century Square,No. 3018 Shennan Road, Futian District, Shenzhen, China
Manufacturer:	AMER international co., limited
Address:	23th Floor, Century Square,No. 3018 Shennan Road, Futian District, Shenzhen, China

2.2. Product Description

Name of EUT	TH 1801 mobile phone			
Trade Mark:	TWO Mobile			
Model No.:	TH 1801			
Listed Model(s):	-			
IMEI:	352273017386340			
Power supply:	DC 3.7V From exchange battery			
Adapter information:	Model: TH 1801 Input:100-240Va.c., 50/60Hz, 0.2A Output: 5Vd.c.,0.5A			
Device Category:	Portable			
Product stage:	Production unit			
RF Exposure Environment:	General Population / Uncontrolled			
Hardware version:	AMER_TH 1801_SC7701B_01_0.46			
Software version:	TELCEL_TWO MOBILE_TH 1801_3G_MX_V01			
Maximum SAR Value				
Separation Distance:	Head: 0mm Body: 10mm			
Max Report SAR Value (1g):	Test location:	PCE	DSS	Simultaneous
	Head:	0.533 mW/g	0.033 mW/g	0.566mW/g
	Body:	0.928 mW/g	0.017 mW/g	0.945mW/g
GSM				
Support Network:	GSM, GPRS, EGPRS			
Support Band:	GSM850, PCS1900			
Modulation:	GSM/GPRS/EGPRS: GMSK			
Transmit Frequency:	GSM850: 824.20MHz-848.80MHz PCS1900: 1850.20MHz-1909.80MHz			
Receive Frequency:	GSM850: 869.20MHz-893.80MHz PCS1900: 1930.20MHz-1989.80MHz			
GPRS Class:	12			
EGPRS Class:	12			
Antenna type:	Integral Antenna			

WCDMA	
Operation Band:	FDD Band II and FDD Band V
Power Class:	Power Class 3
Modilation Type:	QPSK/16QAM/64QAM/HSUPA/HSDPA
WCDMA Release Version:	FDD Band II and FDD Band V
Antenna type:	Integral Antenna
Bluetooth	
Version:	Supported BT4.0+EDR
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	Integral Antenna
Remark: *The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power*	

3. Test Environment

3.1. Address of the test laboratory

Laboratory:Shenzhen Huatongwei International Inspection Co., Ltd.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China
Phone: 86-755-26748019 Fax: 86-755-26748089

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 762235

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration No. 762235.

IC-Registration No.: 5377B-1

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B-1.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

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	2017/08/15	1
E-field Probe	SPEAG	EX3DV4	3842	2017/08/15	1
System Validation Dipole D835V2	SPEAG	D835V2	4d153	2016/06/16	3
System Validation Dipole D1750V2	SPEAG	D1750V2	1062	2015/07/25	3
System Validation Dipole D1900V2	SPEAG	D1900V2	5d101	2015/07/23	3
System Validation Dipole D2450V2	SPEAG	D2450V2	884	2015/09/01	3
Dielectric Probe Kit	Agilent	85070E	US44020288	/	/
Power meter	Agilent	E4417A	GB41292254	2016/10/25	1
Power sensor	Agilent	8481H	MY41095360	2016/10/25	1
Power sensor	Agilent	E9327A	US40441621	2016/10/25	1
Network analyzer	Agilent	8753E	US37390562	2016/10/24	1
Universal Radio Communication Tester	ROHDE & SCHWARZ	CMU200	112012	2016/10/22	1
Signal Generator	ROHDE & SCHWARZ	SMBV100A	258525	2016/10/22	1
Power Divider	ARRA	A3200-2	N/A	N/A	N/A
Dual Directional Coupler	Agilent	778D	50783	Note	
Attenuator 1	PE	PE7005-10	N/A	Note	
Attenuator 2	PE	PE7005-10	N/A	Note	
Attenuator 3	PE	PE7005-3	N/A	Note	
Power Amplifier	AR	5S1G4M2	0328798	Note	

Note:

1. *The Probe,Dipole and DAE calibration reference to the Appendix A.*

5. Measurement Uncertainty

Measurement Uncertainty										
No.	Error Description	Type	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System										
1	Probe calibration	B	6.0%	N	1	1	1	6.0%	6.0%	∞
2	Axial isotropy	B	4.70%	R	$\sqrt{3}$	0.7	0.7	1.90%	1.90%	∞
3	Hemispherical isotropy	B	9.60%	R	$\sqrt{3}$	0.7	0.7	3.90%	3.90%	∞
4	Boundary Effects	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
5	Probe Linearity	B	4.70%	R	$\sqrt{3}$	1	1	2.70%	2.70%	∞
6	Detection limit	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
7	RF ambient conditions-noise	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
8	RF ambient conditions-reflection	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
9	Response time	B	0.80%	R	$\sqrt{3}$	1	1	0.50%	0.50%	∞
10	Integration time	B	5.00%	R	$\sqrt{3}$	1	1	2.90%	2.90%	∞
11	RF ambient	B	3.00%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
12	Probe positioned mech. restrictions	B	0.40%	R	$\sqrt{3}$	1	1	0.20%	0.20%	∞
13	Probe positioning with respect to phantom shell	B	2.90%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
14	Max.SAR evalation	B	3.90%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
Test Sample Related										
15	Test sample positioning	A	1.86%	N	1	1	1	1.86%	1.86%	∞
16	Device holder uncertainty	A	1.70%	N	1	1	1	1.70%	1.70%	∞
17	Drift of output power	B	5.00%	R	$\sqrt{3}$	1	1	2.90%	2.90%	∞
Phantom and Set-up										
18	Phantom uncertainty	B	4.00%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
19	Liquid conductivity (target)	B	5.00%	R	$\sqrt{3}$	0.64	0.43	1.80%	1.20%	∞
20	Liquid conductivity (meas.)	A	0.50%	N	1	0.64	0.43	0.32%	0.26%	∞
21	Liquid permittivity (target)	B	5.00%	R	$\sqrt{3}$	0.64	0.43	1.80%	1.20%	∞
22	Liquid cpermittivity (meas.)	A	0.16%	N	1	0.64	0.43	0.10%	0.07%	∞
Combined standard uncertainty		$u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$		/	/	/	/	9.79%	9.67%	∞

Expanded uncertainty (confidence interval of 95 %)	$u_e = 2u_c$	R	K=2	/	/	19.57%	19.34%	∞

System Check Uncertainty										
No.	Error Description	Type	Uncertainty Value	Probably Distribution	Div.	(Ci) 1g	(Ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	Degree of freedom
Measurement System										
1	Probe calibration	B	6.0%	N	1	1	1	6.0%	6.0%	∞
2	Axial isotropy	B	4.70%	R	$\sqrt{3}$	0.7	0.7	1.90%	1.90%	∞
3	Hemispherical isotropy	B	9.60%	R	$\sqrt{3}$	0.7	0.7	3.90%	3.90%	∞
4	Boundary Effects	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
5	Probe Linearity	B	4.70%	R	$\sqrt{3}$	1	1	2.70%	2.70%	∞
6	Detection limit	B	1.00%	R	$\sqrt{3}$	1	1	0.60%	0.60%	∞
7	RF ambient conditions-noise	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
8	RF ambient conditions-reflection	B	0.00%	R	$\sqrt{3}$	1	1	0.00%	0.00%	∞
9	Response time	B	0.80%	R	$\sqrt{3}$	1	1	0.50%	0.50%	∞
10	Integration time	B	5.00%	R	$\sqrt{3}$	1	1	2.90%	2.90%	∞
11	RF ambient	B	3.00%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
12	Probe positioned mech. restrictions	B	0.40%	R	$\sqrt{3}$	1	1	0.20%	0.20%	∞
13	Probe positioning with respect to phantom shell	B	2.90%	R	$\sqrt{3}$	1	1	1.70%	1.70%	∞
14	Max.SAR evalation	B	3.90%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
System validation source-dipole										
15	Deviation of experimental dipole from numerical dipole	A	1.58%	N	1	1	1	1.58%	1.58%	∞
16	Dipole axis to liquid distance	A	1.35%	N	1	1	1	1.35%	1.35%	∞
17	Input power and SAR drift	B	4.00%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
Phantom and Set-up										
18	Phantom uncertainty	B	4.00%	R	$\sqrt{3}$	1	1	2.30%	2.30%	∞
20	Liquid conductivity (meas.)	A	0.50%	N	1	0.64	0.43	0.32%	0.26%	∞
22	Liquid cpermittivity (meas.)	A	0.16%	N	1	0.64	0.43	0.10%	0.07%	∞
Combined standard uncertainty		$u_c = \sqrt{\sum_{i=1}^{22} c_i^2 u_i^2}$		/	/	/	/	8.80%	8.79%	∞
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$		R	K=2	/	/	17.59%	17.58%	∞

6. SAR Measurements System Configuration

6.1. 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.

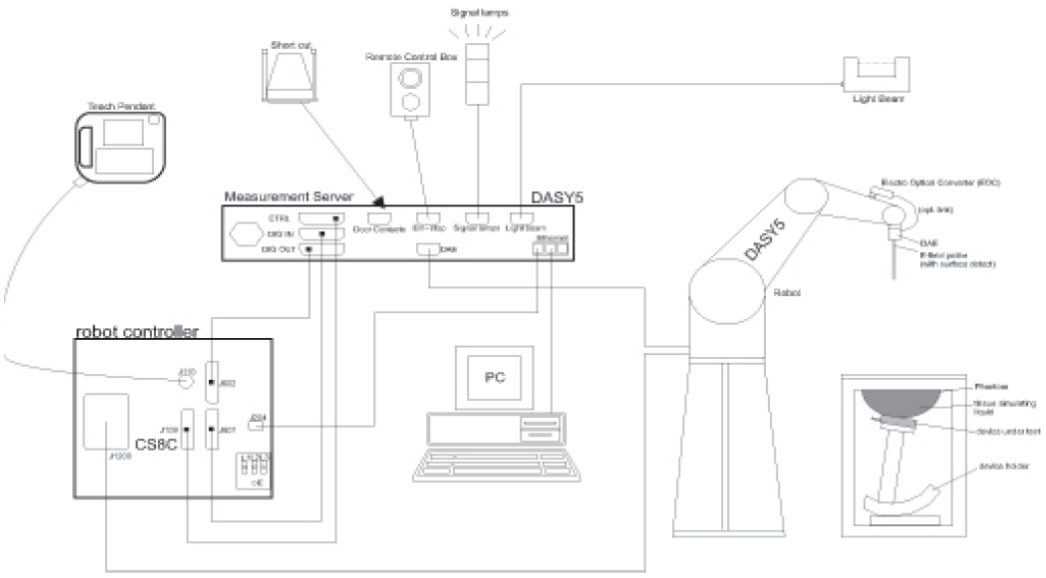
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

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.



6.2. 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)

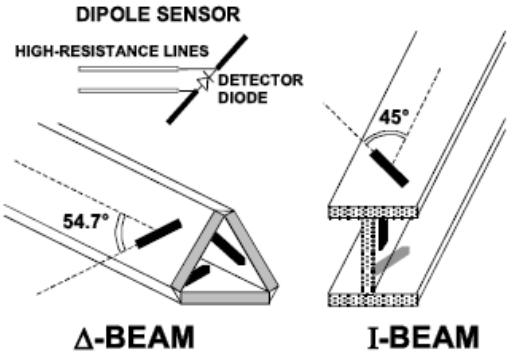
Calibration ISO/IEC 17025 calibration service available.

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:



6.3. Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).
System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

SAM Twin Phantom

6.4. 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

7. SAR Test Procedure

7.1. 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 7x7x5 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 7x7x5 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 7x7x5 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

7.2. 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),s 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:

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

Vi: compensated signal of channel (i = x, y, z)
Ui: input signal of channel (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:

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

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

Vi: compensated signal of channel (i = x, y, z)
Normi: sensor sensitivity of channel (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.

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

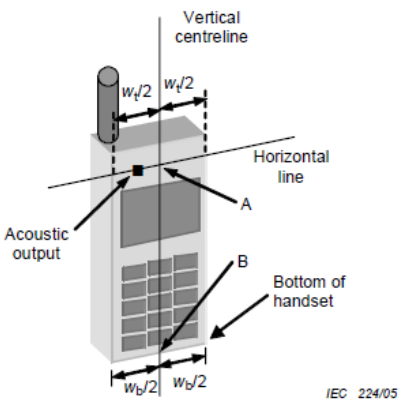
SAR: local specific absorption rate in mW/g
Etot: total field strength in V/m
σ: conductivity in [mho/m] or [Siemens/m]
ρ: equivalent tissue density in g/cm3

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.

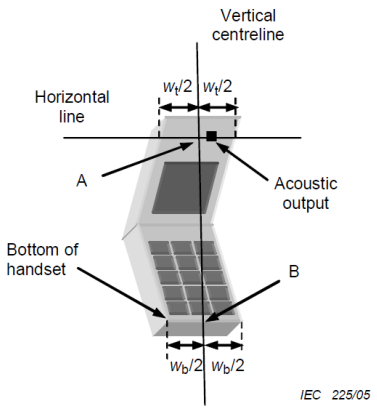
8. Position of the wireless device in relation to the phantom

8.1. Head Position

The wireless device define two imaginary lines on the handset, the vertical centreline and the horizontal line, for the handset in vertical orientation as shown in Figures 5a and 5b.
The vertical centreline 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 (point A in Figures 5a and 5b), and the midpoint of the width W_b of the bottom of the handset (point B).
The horizontal line is perpendicular to the vertical centreline and passes through the centre of the acoustic output (see Figures 5a and 5b). The two lines intersect at point A.
Note that for many handsets, point A coincides with the centre of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centreline is not necessarily parallel to the front face of the handset (see Figure 5b), especially for clam-shell handsets, handsets with flip cover pieces, and other irregularly shaped handsets.



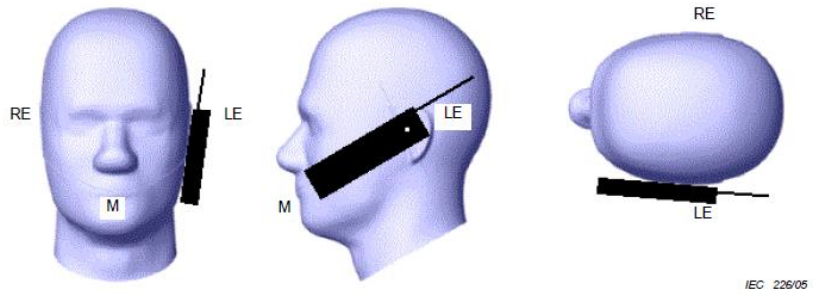
Figures 5a



Figures 5b

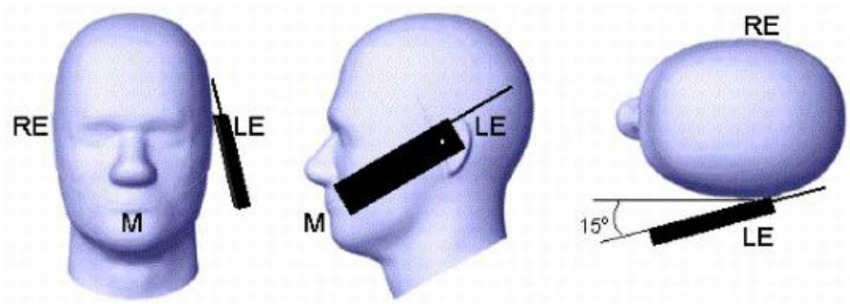
W_t	Width of the handset at the level of the acoustic
W_b	Width of the bottom of the handset
A	Midpoint of the widthwt of the handset at the level of the acoustic output
B	Midpoint of the width wb of the bottom of the handset

Cheek position



Picture 2 Cheek position of the wireless device on the left side of SAM

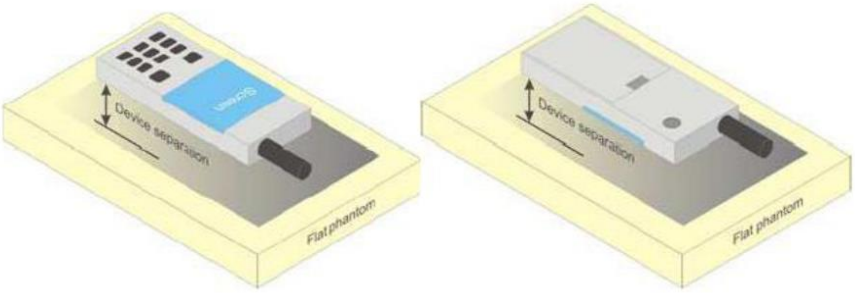
Tilt position



Picture 3 Tilt position of the wireless device on the left side of SAM

8.2. Body Position

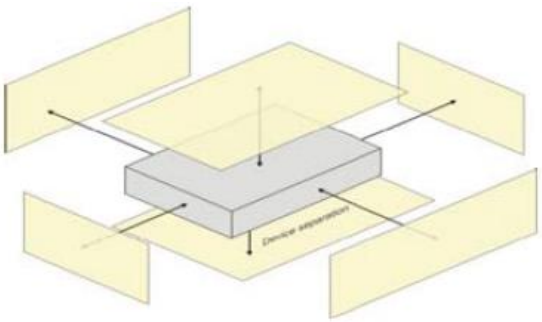
Devices that support transmission while used with body-worn accessories must be tested for body-worn accessory SAR compliance, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics.
Devices that are designed to operate on the body of users using lanyards and straps or without requiring additional body-worn accessories must be tested for SAR compliance using a conservative minimum test separation distance **≤ 5 mm** to support compliance



Picture 4 Test positions for body-worn devices

8.3. Hotspot Mode Exposure conditions

The hotspot mode and body-worn accessory SAR test configurations may overlap for handsets. When the same wireless mode transmission configurations for voice and data are required for SAR measurements, the more conservative configuration with a smaller separation distance should be tested for the overlapping SAR configurations. This typically applies to the back and front surfaces of a handset when SAR is required for both hotspot mode and body-worn accessory exposure conditions. Depending on the form factor and dimensions of a device, the test separation distance used for hotspot mode SAR measurement is either **10 mm** or that used in the body-worn accessory configuration, whichever is less for devices with dimension > 9 cm x 5 cm. For smaller devices with dimensions ≤ 9 cm x 5 cm because of a greater potential for next to body use a test separation of ≤ 5 mm must be used.



Picture 5 Test positions for Hotspot Mode

9. System Check

9.1. Tissue Dielectric Parameters

The liquid is consisted of water,salt,Glycol,Sugar,Preventol and Cellulose.The liquid has previously been proven to be suited for worst-case.The table 3 and table 4 show the detail solition.It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB865664.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
835	40.3	57.9	0.2	1.4	0.2	0	0.9	41.5
1800,1900,2000	55.2	0	0	0.3	0	44.5	1.4	40
2450	55	0	0	0	0	45	1.8	39.2
For Body								
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800.1900.2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7

Tissue dielectric parameters for head and body phantoms				
Target Frequency	Head		Body	
(MHz)	εr	σ(s/m)	εr	σ(s/m)
835	41.5	0.90	55.2	0.97
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95

Check Result:

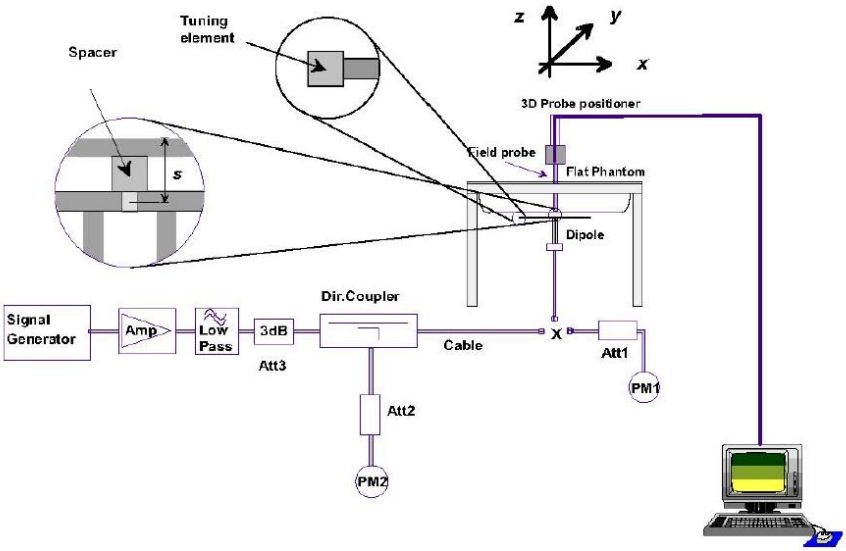
Dielectric performance of Head tissue simulating liquid				
Frequency (MHz)	Description	DielectricParameters		Temp
		εr	σ(s/m)	℃
835	Recommended result ±5% window	41.50 39.43 to 43.58	0.90 0.86 to 0.95	/
	Measurement value 2017-08-22	41.51	0.92	21
1900	Recommended result ±5% window	40.0 38.00 to 42.00	1.40 1.33 to 1.47	/
	Measurement value 2017-08-25	40.14	1.40	21

Dielectric performance of Body tissue simulating liquid				
Frequency (MHz)	Description	DielectricParameters		Temp
		εr	σ(s/m)	℃
835	Recommended result ±5% window	55.2 52.44 to 57.96	0.97 0.92 to 1.02	/
	Measurement value 2017-08-22	55.18	0.98	21
1900	Recommended result ±5% window	53.3 50.64 to 55.97	1.52 1.44 to 1.60	/
	Measurement value 2017-08-25	53.15	1.53	21

9.2. SAR 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 24 dBm (250mW) before dipole is connected.

Photo of Dipole Setup

Check Result:

Head				
Frequency (MHz)	Description	SAR(W/kg)		Temp
		1g	10g	℃
835	Recommended result ±5% window	2.41 2.29 - 2.53	1.57 1.49 - 1.65	/
	Measurement value 2017-08-22	2.41	1.57	21
1900	Recommended result ±5% window	10.10 9.60 - 10.61	5.34 5.07 - 5.61	/
	Measurement value 2017-08-25	9.78	5.19	21

Body				
Frequency (MHz)	Description	SAR(W/kg)		Temp
		1g	10g	℃
835	Recommended result ±5% window	2.47 2.35 - 2.59	1.64 1.55 - 1.71	/
	Measurement value 2017-08-22	2.50	1.63	21
1900	Recommended result ±5% window	10.20 9.69 – 10.71	5.47 5.20 – 5.74	/
	Measurement value 2017-08-25	10.31	5.38	21

Note:

1. *the graph results see follow.*
2. *Recommended Values used derive from the calibration certificate and 250 mW is used asfeeding power to the calibrated dipole.*

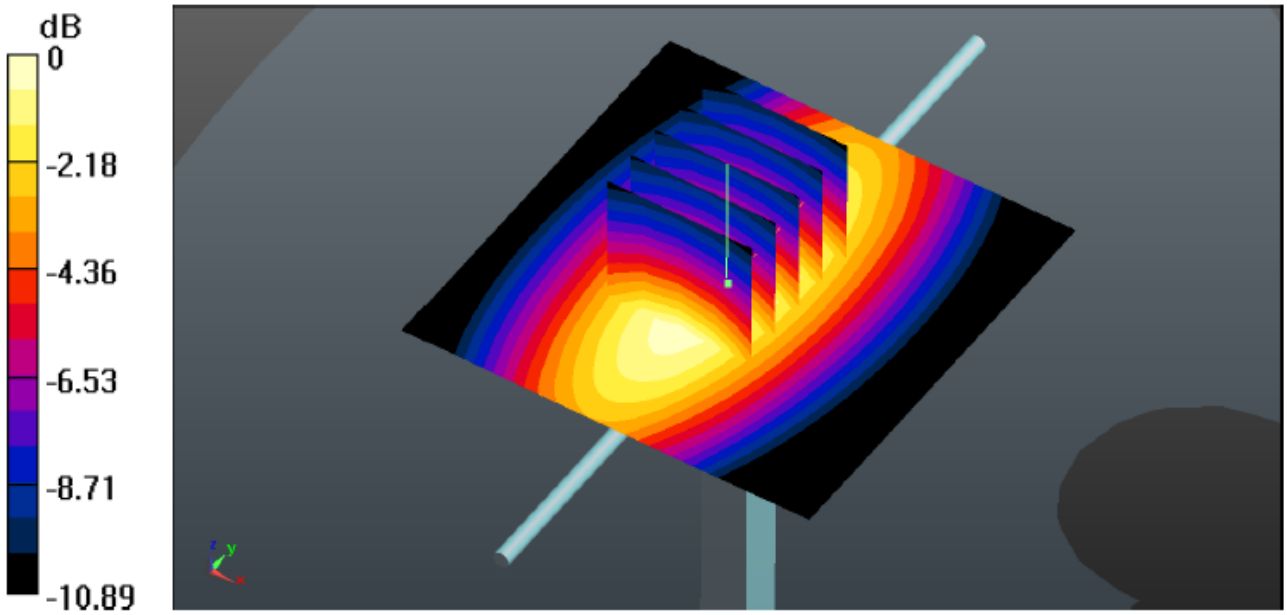
System Performance Check at 835 MHz Head

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d153
Date:2017-08-22
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 835 MHz; σ = 0.92 S/m; εr = 41.51; ρ = 1000 kg/m3
Phantom section: Flat Section

DASY5 Configuration:
•Probe: EX3DV4 - SN3842; ConvF(9.15, 9.15, 9.15); Calibrated: 15/08/2017;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (61x91x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 2.55 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7mm, dy=7mm, dz=5mm
Reference Value = 53.87 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 3.60 W/kg
SAR(1 g) = 2.41 mW/g; SAR(10 g) = 1.57 mW/g
Maximum value of SAR (measured) = 2.57mW/g



System Performance Check 835MHz Head 250mW

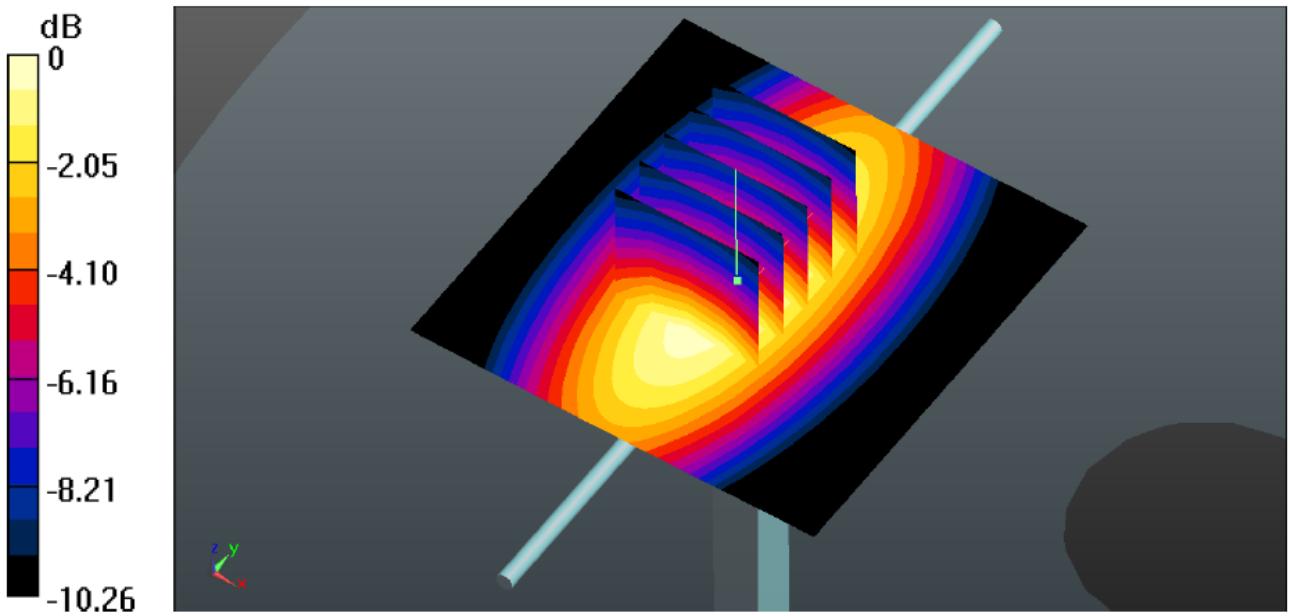
System Performance Check at 835 MHz Body

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d153
Date:2017-08-22
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 835 MHz; σ = 0.98 S/m; ε_r = 55.18; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:
•Probe: EX3DV4 - SN3842; ConvF(9.02, 9.02, 9.02); Calibrated: 15/08/2017;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (61x91x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 2.45 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7mm, dy=7mm, dz=5mm
Reference Value = 51.78 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.78 W/kg
SAR(1 g) = 2.50 mW/g; SAR(10 g) = 1.63 mW/g
Maximum value of SAR (measured) = 2.54 W/kg



System Performance Check 835MHz Body 250mW

System Performance Check at 1900 MHz Head

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d150
Date:2017-08-25
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1900 MHz; σ = 1.40S/m; εr = 40.14; ρ = 1000 kg/m3
Phantom section: Flat Section

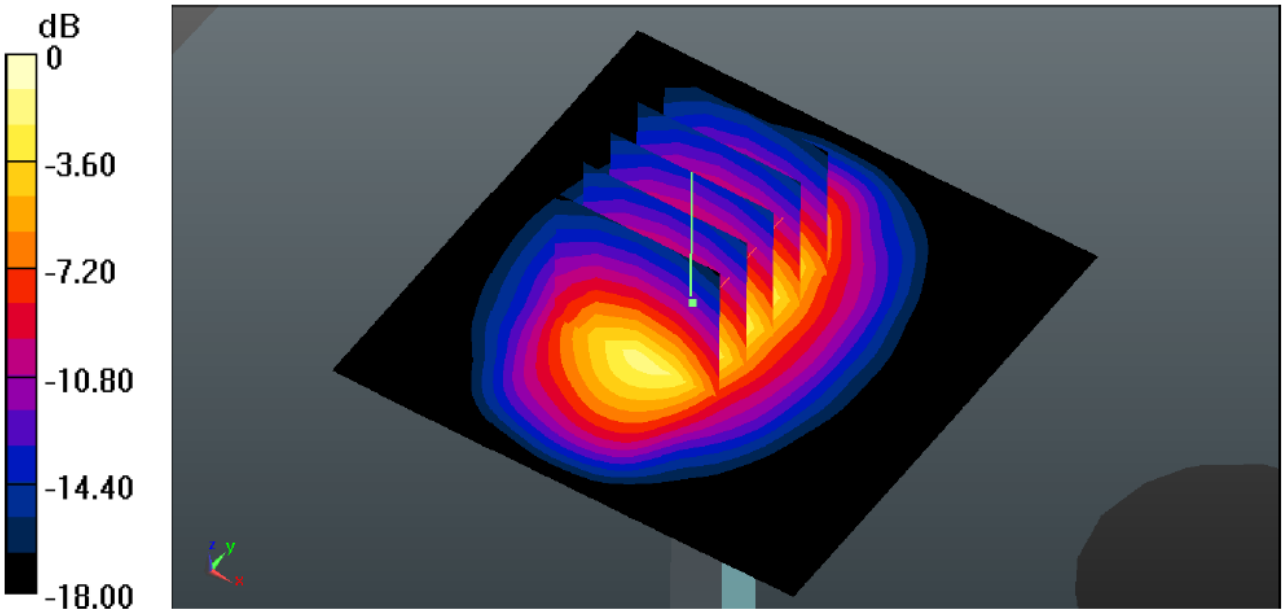
DASY5 Configuration:
Probe: EX3DV4 - SN3842; ConvF(7.58,7.58,7.58); Calibrated: 15/08/2017;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
Phantom: SAM 1; Type: SAM;
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Area Scan (61x91x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 10.64 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.74 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 10.34 W/kg

SAR(1 g) = 9.78 W/kg; SAR(10 g) = 5.19 W/kg

Maximum value of SAR (measured) = 11.17 W/kg



System Performance Check 1900MHz Head 250mW

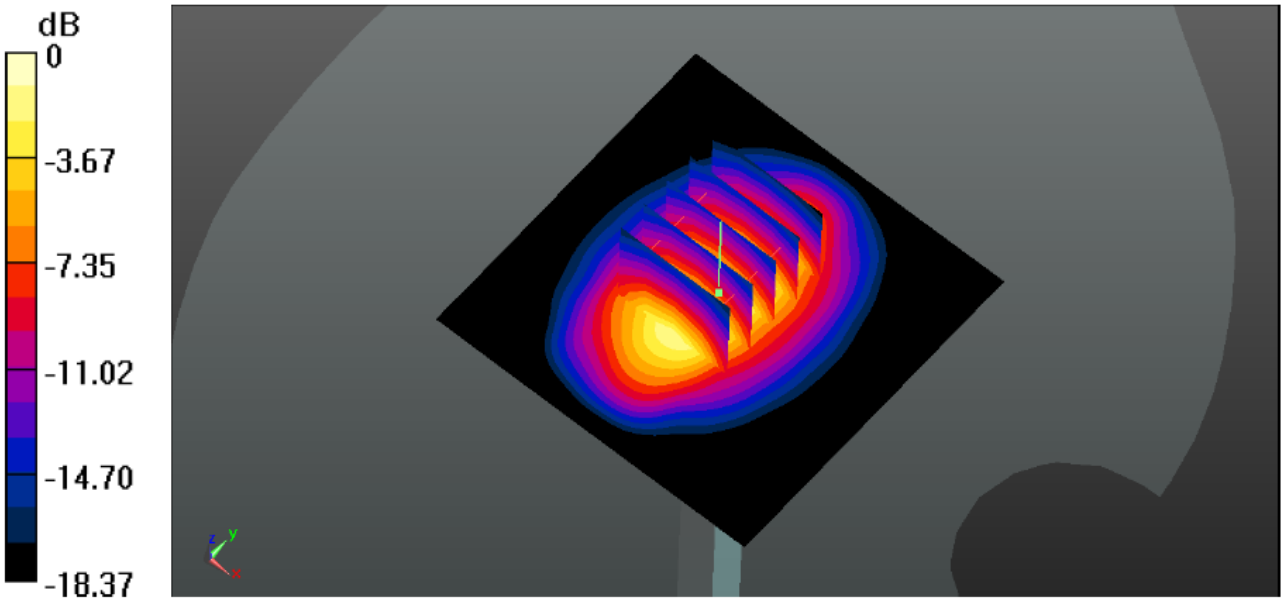
System Performance Check at 1900 MHz Body

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d150
Date:2017-08-25
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 1900 MHz; σ = 1.53S/m; εr = 53.15; ρ = 1000 kg/m3
Phantom section: Flat Section

DASY5 Configuration:
Probe: EX3DV4 - SN3842; ConvF(7.32,7.32,7.32); Calibrated: 15/08/2017;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
Phantom: SAM 1; Type: SAM;
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Area Scan (61x91x1): Measurement grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 15.87 mW/g
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 87.537 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 19.27 W/kg
SAR(1 g) = 10.31 mW/g; SAR(10 g) = 5.38 mW/g

Maximum value of SAR (measured) = 15.89 mW/g



System Performance Check 1900MHz Body250mW

10. SAR Exposure Limits

SAR assessments have been made in line with the requirements of ANSI/IEEE C95.1-1992

Type Exposure	Limit (mW/g)	
	General Population / Uncontrolled Exposure Environment	Occupational / Controlled Exposure Environment
Spatial Average SAR (whole body)	0.08	0.4
Spatial Peak SAR (1g cube tissue for head and trunk)	1.60	8.0
Spatial Peak SAR (10g for limb)	4.0	20.0

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

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

11. Conducted Power Measurement Results

GSM Conducted Power

1. *Per KDB 447498 D01, the maximum output power channel is used for SAR testing and further SAR test reduction*
2. *Per KDB 941225 D01, considering the possibility of e.g. 3rd party VoIP operation for Head and Body-worn SAR test reduction for GSM and GPRS modes is determined by the source-base time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the EUT was set in GPRS (4Tx slots) for GSM850 and GPRS (4Tx slots) for PCS1900.*
3. *Per KDB941225 D01, for hotspot SAR test reduction for GPRS modes is determined by the source-based time-averaged output power including tune-up tolerance, For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the EUT was set in GPRS (4Tx slots) for GSM850 and GPRS (4Tx slots) for PCS1900.*

Mode: GSM850		**Conducted Power (dBm)**			Division Factors	**Averager Power (dBm)**		
		CH128	CH190	CH251		CH128	CH190	CH251
		824.2MHz	836.6MHz	848.8MHz		824.2MHz	836.6MHz	848.8MHz
GSM		33.47	33.32	33.22	-9.03	24.44	24.29	24.19
GPRS (GMSK)	1TXslot	33.44	33.31	33.18	-9.03	24.41	24.28	24.15
	2TXslots	30.86	30.76	30.67	-6.02	24.84	24.74	24.65
	3TXslots	29.08	29.05	28.90	-4.26	24.82	24.79	24.64
	4TXslots	27.88	27.87	27.67	-3.01	24.87	24.86	24.66
EGPRS (GMSK)	1TXslot	33.43	33.31	33.12	-9.03	24.40	24.28	24.09
	2TXslots	30.64	30.61	30.53	-6.02	24.62	24.59	24.51
	3TXslots	28.88	28.90	28.77	-4.26	24.62	24.64	24.51
	4TXslots	27.69	27.72	27.54	-3.01	24.68	24.71	24.53
Mode: PCS1900		**Conducted Power (dBm)**			Division Factors	**Averager Power (dBm)**		
		CH512	CH661	CH810		CH512	CH661	CH810
		1850.2MHz	1880.0MHz	1909.8MHz		1850.2MHz	1880.0MHz	1909.8MHz
GSM		28.61	28.49	28.82	-9.03	19.58	19.46	19.79
GPRS (GMSK)	1TXslot	28.62	28.50	28.81	-9.03	19.59	19.47	19.78
	2TXslots	26.96	27.03	26.99	-6.02	20.94	21.01	20.97
	3TXslots	25.40	25.52	25.44	-4.26	21.14	21.26	21.18
	4TXslots	24.36	24.49	24.35	-3.01	21.35	21.48	21.34
EGPRS (GMSK)	1TXslot	28.64	28.50	28.84	-9.03	19.61	19.47	19.81
	2TXslots	26.38	26.30	26.60	-6.02	20.36	20.28	20.58
	3TXslots	24.85	24.83	25.07	-4.26	20.59	20.57	20.81
	4TXslots	23.83	23.83	24.00	-3.01	20.82	20.82	20.99

Note:

1) Division Factors

To average the power, the division factor is as follows:

1TX-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2TX-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3TX-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4TX-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

WCDMA Conducted Power

1. *The following tests were conducted according to the test requirements outlines in 3GPP TS34.121 specification.*
2. *The procedures in KDB 941225 D01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode to determine SAR test exclusion*

A summary of thest setting are illustrated belowe:

HSDPA Setup Configureation:

a) The EUT was connected to base station RS CMU200 referred to the setup configuration
b) The RF path losses were compensated into the measurements
c) A call was established between EUT and base station with following setting:
   i. Set Gain Factors (βc and βd) and parameters were set according to each specific sub-test in the following table, C10.1.4, Quoted from the TS 34.121
   ii. Set RMC 12.2Kbps + HSDPA mode
   iii. Set Cell Power=-86dBm
   iv. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
   v. Select HSDPA uplink parameters
   vi. Set Delta ACK, Delta NACK and Delta CQI=8
   vii. Set Ack-Nack repetition Factor to 3
   viii. Set CQI Feedback Cycle (K) to 4ms
   ix. Set CQI repetition factor to 2
   x. Power ctrl mode= all up bits
d) The transmitter maximum output power waw recorded.

Table C.10.1.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and Δ_{NACK} = 30/15 with β_{hs} = 30/15 * β_c, and Δ_{CQI} = 24/15 with β_{hs} = 24/15 * β_c.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15.

Setup Configuration

HSUPA Setup Configureation:

a) The EUT was connected to base station RS CMU200 referred to the setup configuration
b) The RF path losses were compensated into the measurements
c) A call was established between EUT and base station with following setting:
   i. Call configs = 5.2b, 5.9b, 5.10b, and 5.13.2B with QPSK
   ii. Set Gain Factors (βc and βd) and parameters (AG index) were set according to each specific sub-test in the following table, C11.1.3, Quoted from the TS 34.121
   iii. Set Cell Power=-86dBm
   iv. Set channel type= 12.2Kbps + HSPA mode
   v. Set UE Target power
   vi. Set Ctrl mode=Alternating bits
   vii. Set and observe the E-TFCI
   viii. Confirm that E-TFCI is equal the target E-TFCI of 75 for Sub-test 1, and other subtest's E-TFCI
d) The transmitter maximum output power waw recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1)	β_{ec}	β_{ed} (Note 5) (Note 6)	β_{ed} (SF)	β_{ed} (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed}1$: 47/15 $\beta_{ed}2$: 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 30/15 with β_{hs} = 30/15 * β_c .

Note 2: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS- DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 10/15 and β_d = 15/15.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 14/15 and β_d = 15/15.

Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly, it is set by Absolute Grant Value.

Setup Configuration

General Note:

1. Per KDB 941225 D01, SAR for Head / Hotsport / Body-worn Exposure is measured using a 12.2Kbps RMC with TPC bit ocnfigured to all 1s
2. Per KDB 941225 D01 RMC12.2Kbps setting is used to evaluate SAR. If the maximum output power and Tune-up tolerance specified for production units in HSDPA/HSUPA is ≦1/4dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio fo specified maximum output power and tune-up tolerance of HSDPA / HSUPA to RMC 12.2Kbps and the adjusted SAR is ≦1.2 mW/g, SAR measurement is not required for HSDPA / HSUPA.

Mode		WCDMA Band V			WCDMA Band II		
		Conducted Power (dBm)			Conducted Power (dBm)		
		CH4132	CH4183	CH4233	CH9262	CH9400	CH9538
		826.4	836.6	846.6	1852.4	1880.0	1907.6
AMR 12.2K		22.70	22.76	22.63	22.57	22.86	22.65
RMC 12.2K		22.72	22.79	22.64	22.59	22.89	22.66
HSDPA	Subtest-1	20.87	20.93	20.81	20.75	21.02	20.83
	Subtest-2	20.70	20.75	20.64	20.58	20.85	20.65
	Subtest-3	20.70	20.76	20.63	20.58	20.85	20.64
	Subtest-4	20.43	20.48	20.37	20.31	20.57	20.39
HSUPA	Subtest-1	20.32	20.37	20.25	20.20	20.46	20.27
	Subtest-2	20.16	20.21	20.10	20.04	20.30	20.11
	Subtest-3	20.07	20.12	20.00	19.95	20.21	20.02
	Subtest-4	20.01	20.06	19.95	19.89	20.15	19.96
	Subtest-5	19.96	20.01	19.89	19.84	20.10	19.91

Bluetooth Conducted Power

Bluetooth			
Mode	Channel	Frequency (MHz)	Conducted power (dBm)
GFSK	00	2402	-4.660
	39	2441	-2.381
	78	2480	-1.876
π/4QPSK	00	2402	-4.701
	39	2441	-2.325
	78	2480	-1.962
8DPSK	00	2402	-4.673
	39	2441	-3.212
	78	2480	-1.875

Per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100MHz to 6GHz at test separation distances ≦50mm 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

Band/Mode	F(GHz)	Position	SAR test exclusion threshold (mW)	RF output power		SAR test exclusion
				dBm	mW	
Bluetooth	2.45	Head	9.6	-1.00	0.033	Yes
		Body	19.20	-1.00	0.017	Yes

Per KDB 447498 D01, when the minimum test separation distance is <5mm, a distance of 5mm is applied to determine SAR test exclusion.
The test exclusion thereshold is ≦3, SAR testing is not required.

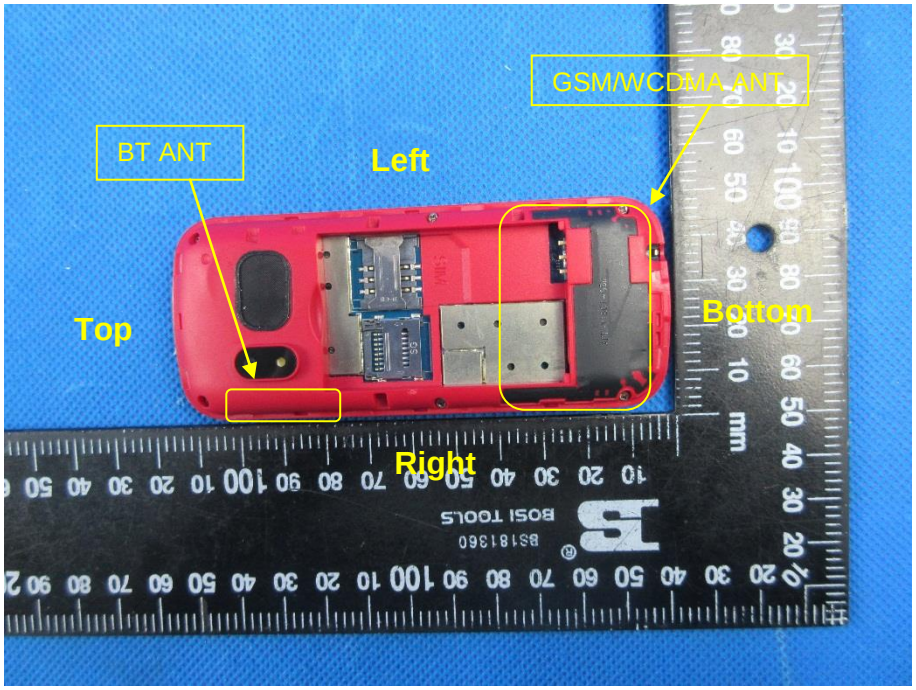
12. Maximum Tune-up Limit

Mode	Burst Average Power (dBm)	
	GSM850	PCS1900
GSM (GMSK, 1Tx Slot)	33.50	29.00
GPRS (GMSK, 1Tx Slot)	33.50	29.00
GPRS (GMSK, 2Tx Slot)	31.00	27.50
GPRS (GMSK, 3Tx Slot)	29.50	26.00
GPRS (GMSK, 4Tx Slot)	28.00	24.50
EGPRS (GMSK, 1Tx Slot)	33.50	29.00
EGPRS (GMSK, 2Tx Slot)	31.00	27.00
EGPRS (GMSK, 3Tx Slot)	29.50	25.50
EGPRS (GMSK, 4Tx Slot)	28.00	24.50

Mode	Burst Average Power (dBm)	
	WCDMA Band V	WCDMA Band II
AMR 12.2Kbps	23.00	23.00
RMC 12.2Kbps	23.00	23.00
HSDPA Subtest-1	21.00	21.50
HSDPA Subtest-2	21.00	21.00
HSDPA Subtest-3	21.00	21.00
HSDPA Subtest-4	21.00	21.00
HSUPA Subtest-1	20.50	20.50
HSUPA Subtest-2	20.50	20.50
HSUPA Subtest-3	20.50	20.50
HSUPA Subtest-4	20.50	20.50
HSUPA Subtest-5	20.50	20.50

BT	
Mode	Conducted Peak Power (dBm)
GFSK	-1.00
π /4QPSK	-1.00
8DPSK	-1.00

13. Antenna Location



14. SAR Measurement Results

Head SAR

GSM850										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (mW/g)	Report SAR(1g) (mW/g)	Test Plot
		CH	MHz							
GPRS (4Tx slot)	Left-Cheek	128	824.2	27.88	28.00	1.03	-	-	-	-
		190	836.6	27.87	28.00	1.03	0.07	0.517	0.533	H1
		251	848.8	27.67	28.00	1.08	-	-	-	-
	Left-Tilt	128	824.2	27.88	28.00	1.03	-	-	-	-
		190	836.6	27.87	28.00	1.03	-0.08	0.396	0.408	-
		251	848.8	27.67	28.00	1.08	-	-	-	-
	Right-Cheek	128	824.2	27.88	28.00	1.03	-	-	-	-
		190	836.6	27.87	28.00	1.03	-0.03	0.479	0.494	-
		251	848.8	27.67	28.00	1.08	-	-	-	-
	Right-Tilt	128	824.2	27.88	28.00	1.03	-	-	-	-
		190	836.6	27.87	28.00	1.03	0.04	0.382	0.394	-
		251	848.8	27.67	28.00	1.08	-	-	-	-

PCS1900										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (mW/g)	Report SAR(1g) (mW/g)	Test Plot
		CH	MHz							
GPRS (4Tx slot)	Left-Cheek	512	1850.2	24.36	24.50	1.03	-	-	-	-
		661	1880.0	24.49	24.50	1.00	-0.09	0.332	0.333	H2
		810	1909.8	24.35	24.50	1.03	-	-	-	-
	Left-Tilt	512	1850.2	24.36	24.50	1.03	-	-	-	-
		661	1880.0	24.49	24.50	1.00	-0.06	0.247	0.248	-
		810	1909.8	24.35	24.50	1.03	-	-	-	-
	Right-Cheek	512	1850.2	24.36	24.50	1.03	-	-	-	-
		661	1880.0	24.49	24.50	1.00	0.05	0.305	0.305	-
		810	1909.8	24.35	24.50	1.03	-	-	-	-
	Right-Tilt	512	1850.2	24.36	24.50	1.03	-	-	-	-
		661	1880.0	24.49	24.50	1.00	0.06	0.232	0.233	-
		810	1909.8	24.35	24.50	1.03	-	-	-	-

Note:
Per KDB865664 D01v01r04, Repeated measurement is not required when the original highest measured SAR is < 0.80 mW/g

WCDMA Band V										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (mW/g)	Report SAR(1g) (mW/g)	Test Plot
		CH	MHz							
RMC 12.2K bps	Left-Cheek	4132	826.4	22.70	23.00	1.07	-	-	-	-
		4183	836.6	22.76	23.00	1.06	-0.07	0.356	0.376	H3
		4233	846.6	22.63	23.00	1.09	-	-	-	-
	Left-Tilt	4132	826.4	22.70	23.00	1.07	-	-	-	-
		4183	836.6	22.76	23.00	1.06	-0.06	0.293	0.309	-
		4233	846.6	22.63	23.00	1.09	-	-	-	-
	Right-Cheek	4132	826.4	22.70	23.00	1.07	-	-	-	-
		4183	836.6	22.76	23.00	1.06	-0.09	0.340	0.359	-
		4233	846.6	22.63	23.00	1.09	-	-	-	-
	Right-Tilt	4132	826.4	22.70	23.00	1.07	-	-	-	-
		4183	836.6	22.76	23.00	1.06	0.03	0.286	0.302	-
		4233	846.6	22.63	23.00	1.09	-	-	-	-

WCDMA Band II										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (mW/g)	Report SAR(1g) (mW/g)	Test Plot
		CH	MHz							
RMC 12.2K bps	Left-Cheek	9262	1852.4	22.57	23.00	1.10	-	-	-	-
		9400	1880.0	22.86	23.00	1.03	0.13	0.372	0.384	H4
		9538	1907.6	22.65	23.00	1.08	-	-	-	-
	Left-Tilt	9262	1852.4	22.57	23.00	1.10	-	-	-	-
		9400	1880.0	22.86	23.00	1.03	0.07	0.299	0.309	-
		9538	1907.6	22.65	23.00	1.08	-	-	-	-
	Right-Cheek	9262	1852.4	22.57	23.00	1.10	-	-	-	-
		9400	1880.0	22.86	23.00	1.03	-0.18	0.359	0.371	-
		9538	1907.6	22.65	23.00	1.08	-	-	-	-
	Right-Tilt	9262	1852.4	22.57	23.00	1.10	-	-	-	-
		9400	1880.0	22.86	23.00	1.03	-0.07	0.282	0.292	-
		9538	1907.6	22.65	23.00	1.08	-	-	-	-

Note:
Per KDB865664 D01v01r04, Repeated measurement is not required when the original highest measured SAR is < 0.80 mW/g

Body SAR

GSM850										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (mW/g)	Report SAR(1g) (mW/g)	Test Plot
		CH	MHz							
GPRS (4Tx slot)	Front	128	824.2	27.88	28.00	1.03	-	-	-	-
		190	836.6	27.87	28.00	1.03	0.06	0.594	0.613	-
		251	848.8	27.67	28.00	1.08	-	-	-	-
	Back	128	824.2	27.88	28.00	1.03	-0.03	0.879	0.903	-
		190	836.6	27.87	28.00	1.03	-0.12	0.900	0.928	B1
		251	848.8	27.67	28.00	1.08	0.07	0.887	0.958	-

PCS1900										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (mW/g)	Report SAR(1g) (mW/g)	Test Plot
		CH	MHz							
GPRS (4Tx slot)	Front	512	1850.2	24.36	24.50	1.03	-	-	-	-
		661	1880.0	24.49	24.50	1.00	-0.05	0.386	0.387	-
		810	1909.8	24.35	24.50	1.03	-	-	-	-
	Back	512	1850.2	24.36	24.50	1.03	-	-	-	-
		661	1880.0	24.49	24.50	1.00	0.07	0.591	0.593	B2
		810	1909.8	24.35	24.50	1.03	-	-	-	-

WCDMA Band V										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (mW/g)	Report SAR(1g) (mW/g)	Test Plot
		CH	MHz							
RMC 12.2Kbps	Front	4132	826.4	22.70	23.00	1.07	-	-	-	-
		4183	836.6	22.76	23.00	1.06	0.03	0.445	0.470	-
		4233	846.6	22.63	23.00	1.09	-	-	-	-
	Back	4132	826.4	22.70	23.00	1.07	-	-	-	-
		4183	836.6	22.76	23.00	1.06	-0.08	0.625	0.661	B3
		4233	846.6	22.63	23.00	1.09	-	-	-	-

WCDMA Band II										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (mW/g)	Report SAR(1g) (mW/g)	Test Plot
		CH	MHz							
RMC 12.2Kbps	Front	9262	1852.4	22.57	23.00	1.10	-	-	-	-
		9400	1880.0	22.86	23.00	1.03	0.05	0.357	0.369	-
		9538	1907.6	22.65	23.00	1.08	-	-	-	-
	Back	9262	1852.4	22.57	23.00	1.10	-	-	-	-
		9400	1880.0	22.86	23.00	1.03	0.13	0.521	0.538	B4
		9538	1907.6	22.65	23.00	1.08	-	-	-	-

Note:

1. Per KDB865664 D01, Repeated measurement is not required when the original highest measured SAR is < 0.80 mW/g

SAR Test Data Plots

Test mode:	GSM850-GPRS 4TS	Test Position:	Left Head Cheek	Test Plot:	H1

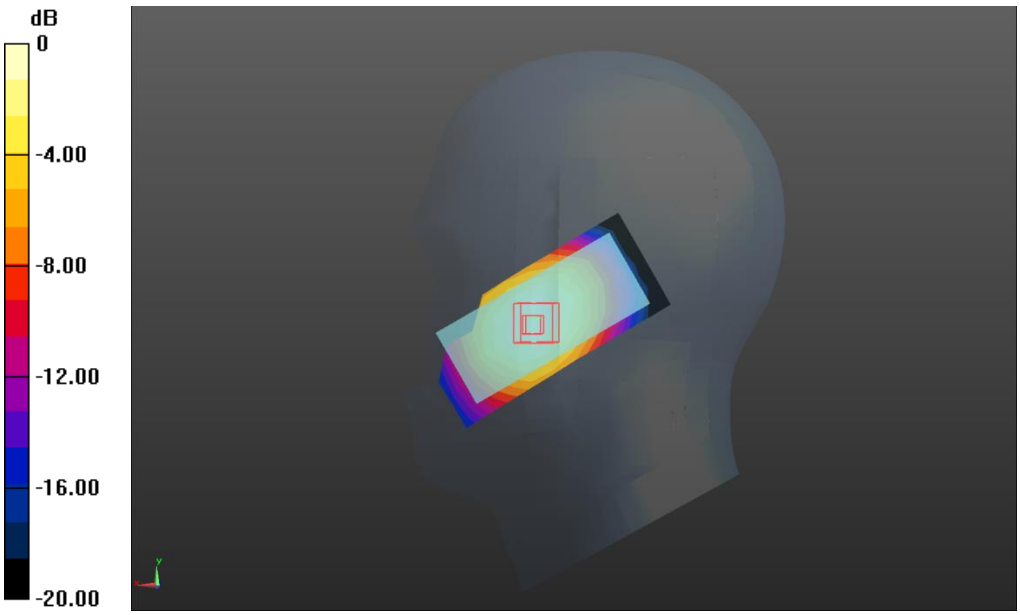
Date:2017-08-22
Communication System: Customer System; Frequency:836.6 MHz;Duty Cycle:1:2
Medium parameters used (interpolated): f=836.6 MHz; σ=0.92S/m; εr=41.51; ρ=1000 kg/m3
Phantom section: Left Head Section:

DASY 5 Configuration:
•Probe: EX3DVE - SN3842; ConvF(9.15, 9.15, 9.15); Calibrated: 15/08/2017;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (5x10x1): Interpolated grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 0.645 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.754 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.575 mW/g
SAR(1 g) = 0.517 mW/g; SAR(10 g) = 0.341 mW/g

Maximum value of SAR (measured) = 0.627 mW/g



Left Head Cheek (GSM850 GPRS 4TS Middle Channel)

Test mode:	PCS1900 GPRS 4TS	Test Position:	Left Head Cheek	Test Plot:	H2

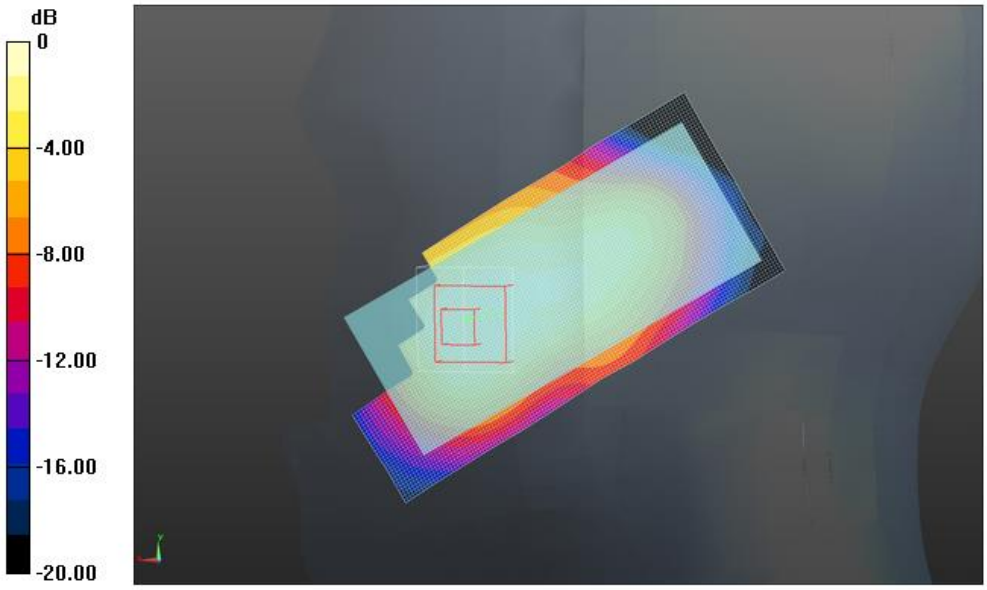
Date:2017-08-25
Communication System: Customer System; Frequency: 1880.0 MHz;Duty Cycle: 1:2
Medium parameters used (interpolated): f = 1880.0 MHz; σ = 1.40 mho/m; ε = 40.14; ρ = 1000 kg/m 3
Phantom section: Left Head Section

DASY5 Configuration:
•Probe: EX3DV4 - SN3842; ConvF(7.58,7.58,7.58); Calibrated: 15/08/2017;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (5x10x1): Interpolated grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 0.383 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.482 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.397 mW/g
SAR(1 g) = 0.332 mW/g; SAR(10 g) = 0.173 mW/g

Maximum value of SAR (measured) = 0.385 W/kg



Left Head (PCS1900 Middle Channel)

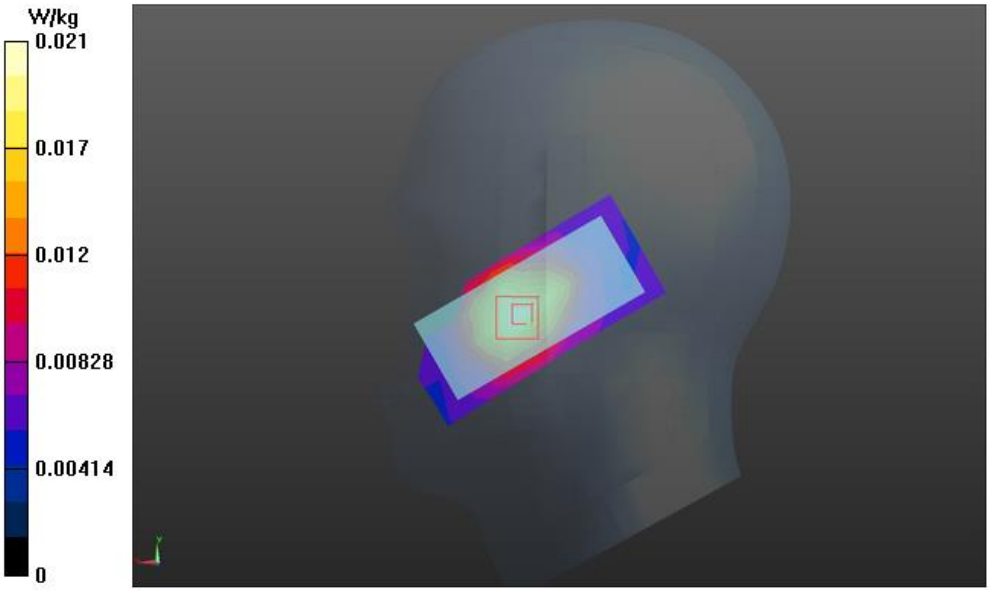
Test mode:	WCDMA Band V	Test Position:	Left Head Cheek	Test Plot:	H3

Date:2017-08-22
Communication System: Customer System; Frequency: 836.6 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f=836.6 MHz; σ=0.92S/m; εr=41.51; ρ=1000 kg/m3
Phantom section: Left Head Section:

DASY5 Configuration:
•Probe: EX3DV4 - SN3842; ConvF(9.15, 9.15, 9.15); Calibrated: 15/08/2017;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (5x10x1): Interpolated grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) =0.473 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.126 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.437 mW/g
SAR(1 g) = 0.356 mW/g; SAR(10 g) = 0.179 mW/g
Maximum value of SAR (measured) = 0.471 W/kg



Left Head Cheek (WCDMA Band V Middle Channel)

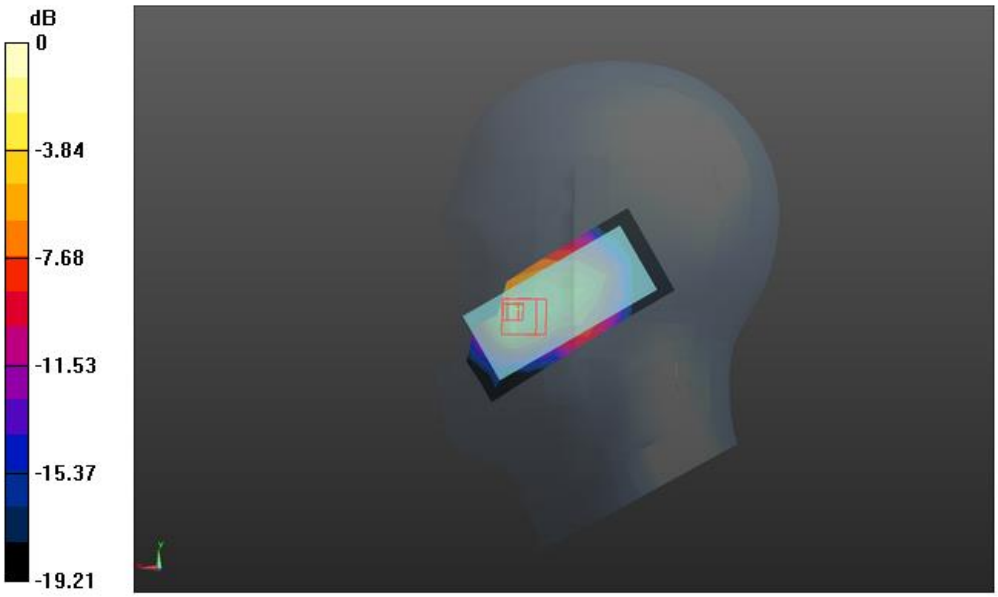
Test mode:	WCDMA Band II	Test Position:	Left Head Cheek	Test Plot:	H4

Date:2017-08-25
Communication System: Customer System; Frequency: 1880.0 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f =1880.0 MHz; σ = 1.40 mho/m; ε = 40.14; ρ=1000 kg/m3
Phantom section: Left Head Section:

DASY5 Configuration:
•Probe: EX3DV4 - SN3842; ConvF(7.58,7.58,7.58); Calibrated: 15/08/2017;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (5x10x1): Interpolated grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) =0.513mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.795 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.723 mW/g
SAR(1 g) = 0.372 mW/g; SAR(10 g) = 0.243 mW/g
Maximum value of SAR (measured) = 0.509 W/kg



Left Head Cheek (WCDMA Band II Middle Channel)

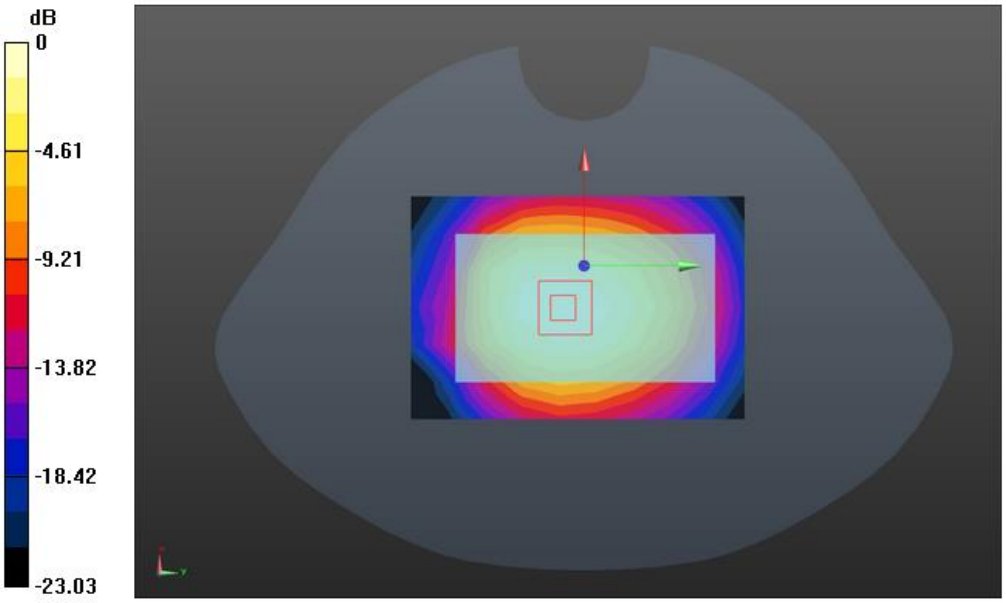
Test mode:	GSM850 GPRS 4TS	Test Position:	Rear Side	Test Plot:	B1

Date:2017-08-22
Communication System: Customer System; Frequency:836.6 MHz;Duty Cycle:1:2
Medium parameters used (interpolated): f=836.6 MHz; σ=0.98S/m; εr=55.18; ρ=1000 kg/m3
Phantom section: Flat Section:

DASY 5 Configuration:
•Probe: EX3DV4 - SN3842; ConvF(9.02, 9.02, 9.02); Calibrated: 15/08/2017;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (5x10x1): Interpolated grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 0.969 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.571 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.242 mW/g
SAR(1 g) = 0.900 mW/g; SAR(10 g) = 0.477 mW/g
Maximum value of SAR (measured) = 0.975 mW/g



Rear Side (GSM850 GPRS 4TS Middle Channel)

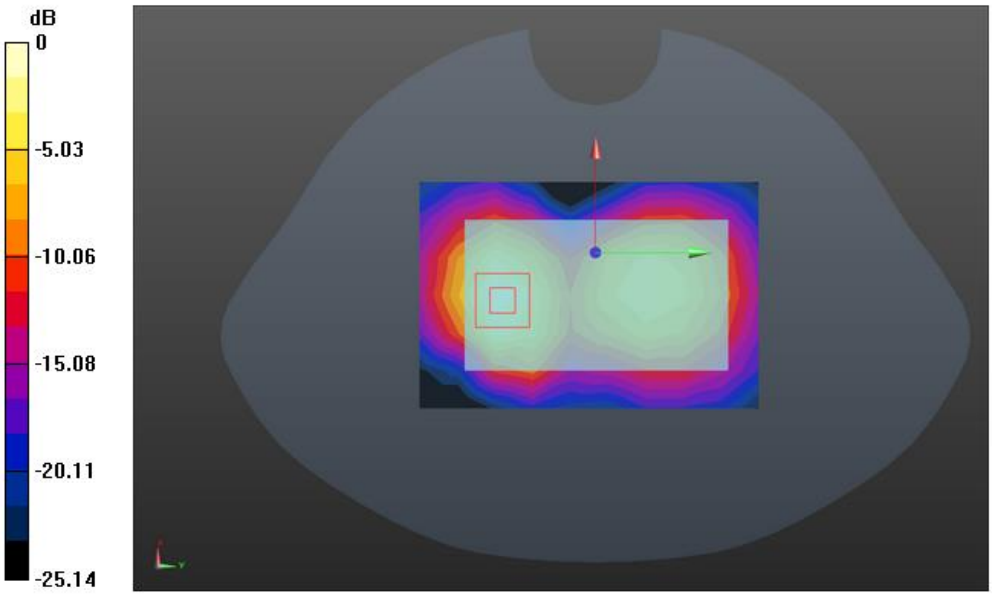
Test mode:	PCS1900 GPRS 4TS	Test Position:	Rear Side	Test Plot:	B2

Date:2017-08-25
Communication System: Customer System; Frequency: 1880.0 MHz;Duty Cycle: 1:2
Medium parameters used (interpolated): f = 1880.0 MHz; σ = 1.53 mho/m; ε = 53.15; ρ = 1000 kg/m 3
Phantom section: Flat Section

DASY5 Configuration:
•Probe: EX3DV4 - SN3842; ConvF(9.02, 9.02, 9.02); Calibrated: 15/08/2017;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (5x10x1): Interpolated grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 0.675 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.865 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.957 mW/g
SAR(1 g) = 0.591 mW/g; SAR(10 g) = 0.427 mW/g
Maximum value of SAR (measured) = 0.679 W/kg



Rear Side (PCS1900 GPRS 4TS Middle Channel)

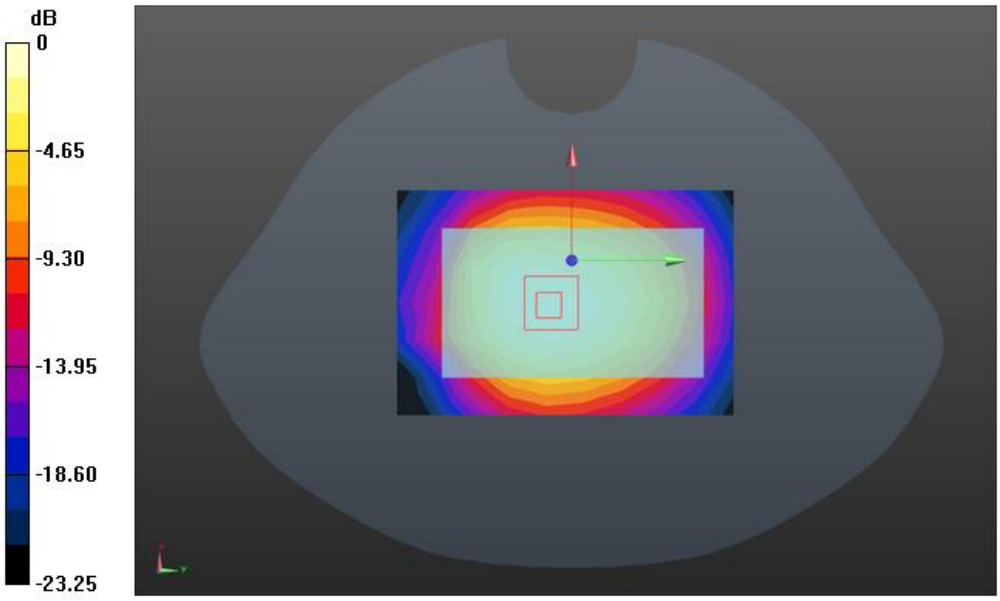
Test mode:	WCDMA Band V	Test Position:	Rear Side	Test Plot:	B3

Date:2017-08-22
Communication System: Customer System; Frequency: 836.6 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f=836.6 MHz; σ=0.98S/m; εr=55.18; ρ=1000 kg/m3
Phantom section: Flat Section

DASY5 Configuration:
•Probe: EX3DV4 - SN3842; ConvF(7.01, 7.01, 7.01); Calibrated: 15/08/2017;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (5x10x1): Interpolated grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) = 0.694mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.077 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.736 mW/g
SAR(1 g) = 0.625 mW/g; SAR(10 g) = 0.399 mW/g
Maximum value of SAR (measured) = 0.689 W/kg



Rear Side (WCDMA Band V Middle Channel)

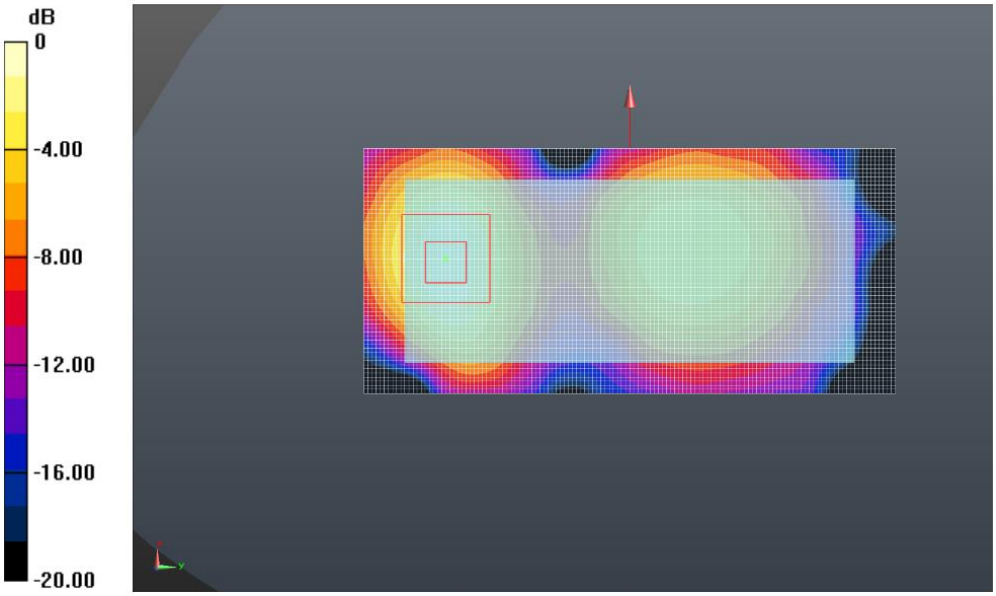
Test mode:	WCDMA Band II	Test Position:	Rear Side	Test Plot:	B4

Date:2017-08-25
Communication System: Customer System; Frequency: 1880.0 MHz;Duty Cycle:1:1
Medium parameters used (interpolated): f=1880.0 MHz; σ=1.51S/m; εr=53.21; ρ=1000 kg/m3
Phantom section: Flat Section

DASY5 Configuration:
•Probe: EX3DV4 - SN3842; ConvF(7.32,7.32,7.32); Calibrated: 15/08/2017;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn1315; Calibrated: 15/08/2017
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.6 (6824)

Area Scan (5x10x1): Interpolated grid: dx=15.00 mm, dy=15.00 mm
Maximum value of SAR (interpolated) =0.661 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.572 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 1.179 mW/g
SAR(1 g) = 0.521 mW/g; SAR(10 g) = 0.373 mW/g
Maximum value of SAR (measured) = 0.680 W/kg



Rear Side (WCDMA Band II Middle Channel)

15. Simultaneous Transmission analysis

No.	Simultaneous Transmission Configurations	Head	Body-worn	Hotspot	Note
1	GSM(voice) + Bluetooth (data)	Yes	Yes		
2	WCDMA(voice) + Bluetooth (data)	Yes	Yes		
3	GPRS (data) + Bluetooth (data)	Yes	Yes	NA	
4	WCDMA (data) + Bluetooth (data)	Yes	Yes	NA	

General note:

1. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
2. EUT will choose either GSM or WCDMA according to the network signal condition; therefore, they will not operate simultaneously at any moment.
3. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01 based on the formula below
   a) [(max. Power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)/x]mW/g for test separation distances ≦50mm; whetn x=7.5 for 1-g SAR, and x=18.75 for 10-g SAR.
   b) When the minimum separation distance is <5mm, the distance is used 5mm to determine SAR test exclusion
   c) 0.4 mW/g for 1-g SAR and 1.0mW/g for 10-g SAR, when the test separation distances is >50mm.

Bluetooth Max power	Exposure position	Head	Body worn
	Test separation	0mm	10mm
-1.00dBm	Estimated SAR (mW/g)	0.033 mW/g	0.017 mW/g

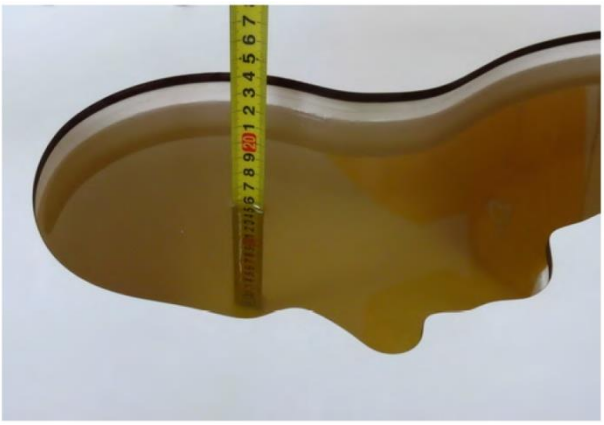
Head Exposure condition

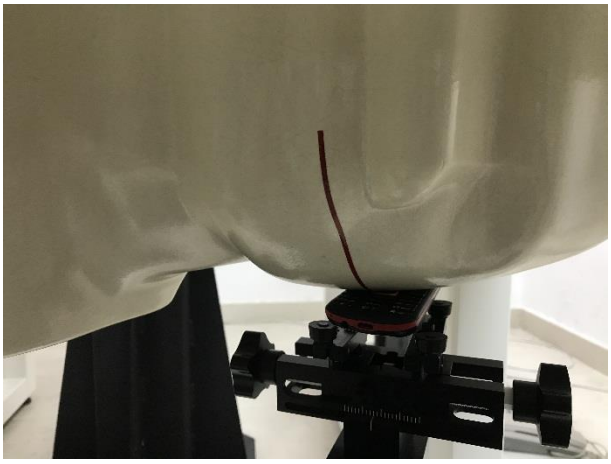
WWAN PCE + Bluetooth DSS					
WWAN Band		Exposure Position	Max SAR (mW/g)		Summed SAR (mW/g)
			WWAN PCS	Bluetooth DSS	
GSM	GSM850	Left Cheek	0.533	0.033	0.566
		Left Tilted	0.408	0.033	0.441
		Right Cheek	0.494	0.033	0.528
		Right Tilted	0.394	0.033	0.427
	PCS1900	Left Cheek	0.333	0.033	0.366
		Left Tilted	0.248	0.033	0.281
		Right Cheek	0.305	0.033	0.339
		Right Tilted	0.233	0.033	0.266
WCDMA	Band V	Left Cheek	0.376	0.033	0.409
		Left Tilted	0.309	0.033	0.343
		Right Cheek	0.359	0.033	0.392
		Right Tilted	0.302	0.033	0.335
	Band II	Left Cheek	0.384	0.033	0.417
		Left Tilted	0.309	0.033	0.342
		Right Cheek	0.371	0.033	0.404
		Right Tilted	0.292	0.033	0.325

Maximum reported SAR value for Body-worn

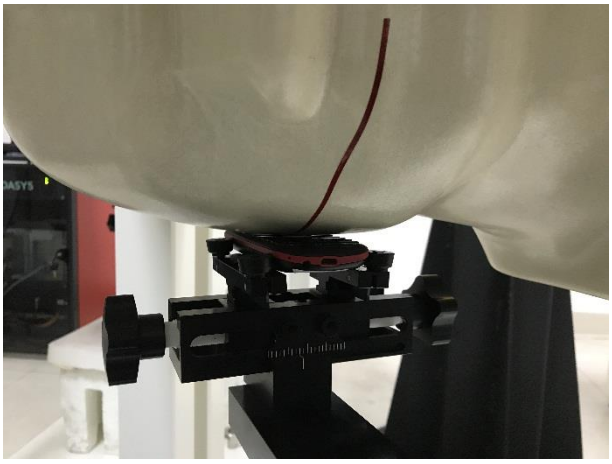
WWAN PCE + Bluetooth DSS					
WWAN Band		Exposure Position	Max SAR (mW/g)		Summed SAR (mW/g)
			WWAN PCS	Bleutooth DTS	
GSM	GSM850	Front	0.613	0.017	0.629
		Back	0.928	0.017	0.945
	PCS1900	Front	0.387	0.017	0.403
		Back	0.593	0.017	0.609
WCDMA	Band V	Front	0.470	0.017	0.487
		Back	0.661	0.017	0.677
	Band II	Front	0.369	0.017	0.386
		Back	0.538	0.017	0.555

16. TestSetup Photos

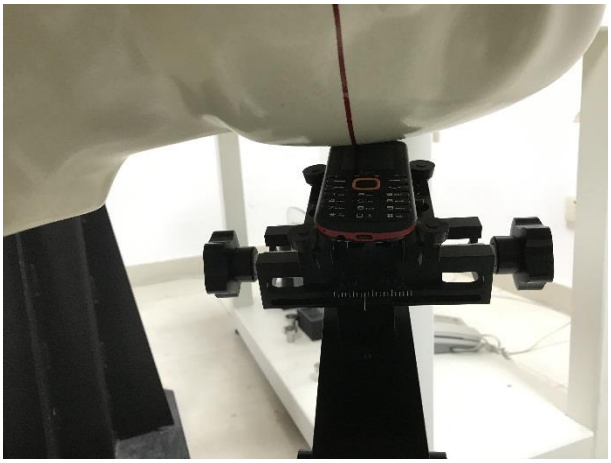
	
Liquid depth in the head phantom (835MHz)	Liquid depth in the body phantom (835MHz)
Liquid depth in the head phantom (1900MHz)	Liquid depth in the body phantom (1900MHz)



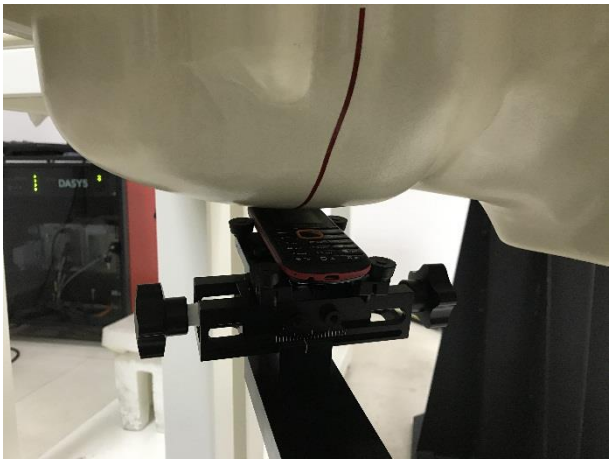
Left Head Touch



Right Head Touch



Left Head Tilt (15°)



Right Head Tilt (15°)

Body-worn Front Side (10mm)

Body-worn Rear Side (10mm)

17. External and Internal Photos of the EUT

Please reference to the report No.: TRE1708012901.

---------End of Report----------

1.1. Probe Calibration Certificate

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中国认可 国际互认 校准 CALIBRATION CNAS L0570

Client CIQ(Shenzhen) Certificate No: Z17-97110

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3842
Calibration Procedure(s)	FF-Z11-004-01 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	August 15, 2017

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-17 (CTTL, No.J17X05857)	Jun-18
Power sensor NRP-Z91	101547	27-Jun-17 (CTTL, No.J17X05857)	Jun-18
Power sensor NRP-Z91	101548	27-Jun-17 (CTTL, No.J17X05857)	Jun-18
Reference10dBAttenuator	18N50W-10dB	13-Mar-16(CTTL,No.J16X01547)	Mar-18
Reference20dBAttenuator	18N50W-20dB	13-Mar-16(CTTL, No.J16X01548)	Mar-18
Reference Probe EX3DV4	SN 7433	26-Sep-16(SPEAG,No.EX3-7433_Sep16)	Sep-17
DAE4	SN 549	13-Dec-16(SPEAG, No.DAE4-549_Dec16)	Dec -17
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
SignalGeneratorMG3700A	6201052605	27-Jun-17 (CTTL, No.J17X05858)	Jun-18
Network Analyzer E5071C	MY46110673	13-Jan-17 (CTTL, No.J17X00285)	Jan -18

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

Issued: August 16, 2017

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

Certificate No: Z17-97110 Page 1 of 11

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Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A,B,C,D	modulation dependent linearization parameters
Polarization Φ	Φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i θ=0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization θ=0 (f≤900MHz in TEM-cell; f>1800MHz: waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below ConvF).
- *NORM(f)x,y,z = NORMx,y,z* frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- *Ax,y,z; Bx,y,z; Cx,y,z;VRx,y,z:*A,B,C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f≤800MHz) and inside waveguide using analytical field distributions based on power measurements for f >800MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from±50MHz to±100MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset:* The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle:* The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

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Probe EX3DV4

SN: 3842

Calibrated: August 15, 2017

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	0.34	0.53	0.42	±10.0%
DCP(mV)[B]	102.3	102.6	101.2	

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	137.4	±2.1%
		Y	0.0	0.0	1.0		176.2	
		Z	0.0	0.0	1.0		153.3	

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: 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[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	9.41	9.41	9.41	0.30	0.90	±12.1%
900	41.5	0.97	9.15	9.15	9.15	0.16	1.37	±12.1%
1750	40.1	1.37	7.89	7.89	7.89	0.23	1.09	±12.1%
1900	40.0	1.40	7.58	7.58	7.58	0.20	1.19	±12.1%
2450	39.2	1.80	6.92	6.92	6.92	0.32	1.16	±12.1%
2600	39.0	1.96	6.78	6.78	6.78	0.40	0.93	±12.1%

[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: 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[G]	Depth[G] (mm)	Unct. (k=2)
750	55.5	0.96	9.31	9.31	9.31	0.30	0.90	±12.1%
900	55.0	1.05	9.02	9.02	9.02	0.24	1.15	±12.1%
1750	53.4	1.49	7.57	7.57	7.57	0.23	1.12	±12.1%
1900	53.3	1.52	7.32	7.32	7.32	0.22	1.21	±12.1%
2450	52.7	1.95	7.01	7.01	7.01	0.42	1.04	±12.1%
2600	52.5	2.16	6.97	6.97	6.97	0.42	1.01	±12.1%

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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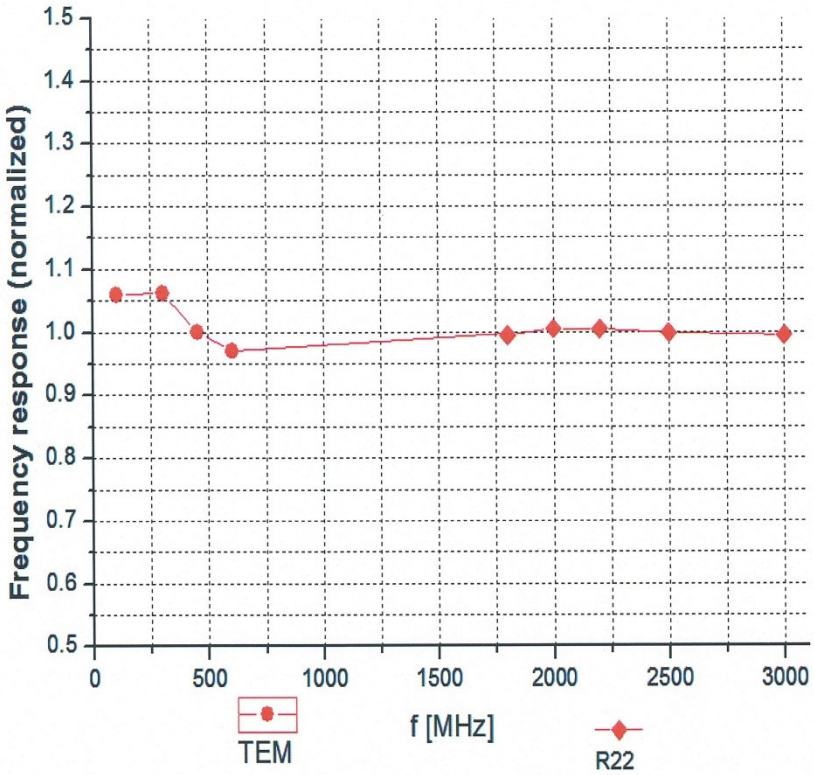
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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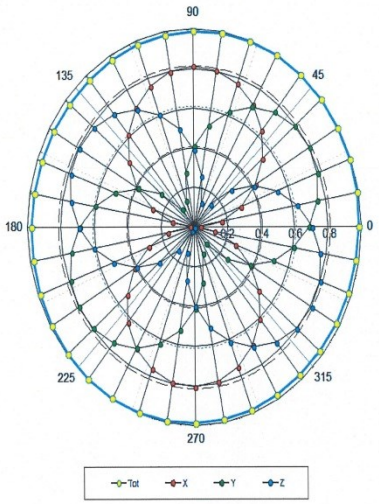
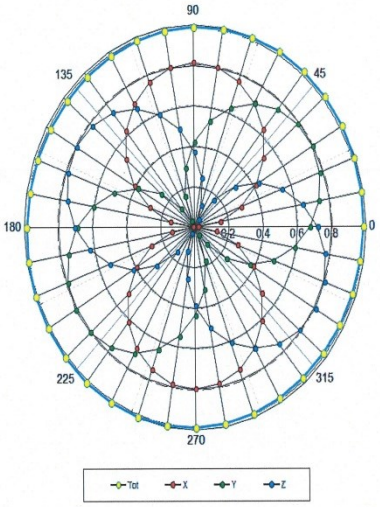
E-mail: cttl@chinattl.com Http://www.chinattl.cn

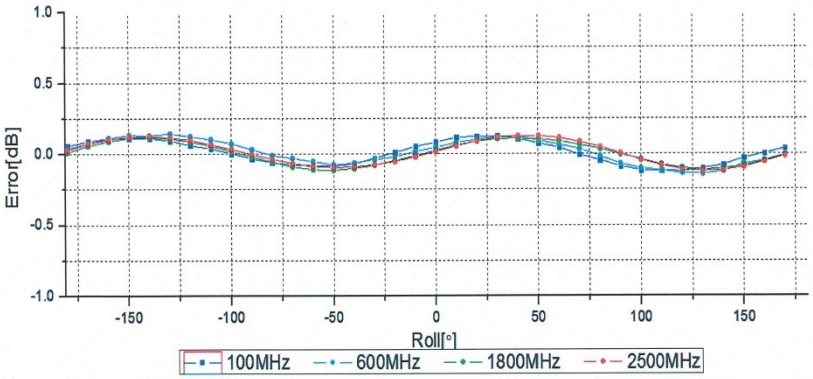
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





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