

FCC SAR Test Report

Product : 7"Tablet PC
Trade mark : DragonTouch, KINGPAD,
KINGSLIM, AKASO
Model/Type reference : S7, S70, S7 PLUS, S7 PRO,
S7X, S7 KIDS
Serial Number : NA
Report Number : EED32I00225105
FCC ID : S5V-D07S70
Date of Issue: : Nov. 18, 2016
Test Standards : Refer to Section 1.5
Test result : PASS

Prepared for:

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Modified History

REV.	Modification Description	Issued Date	Remark
REV.1.0	Initial Test Report Release	Nov. 18, 2016	

1 General information

1.1 Notes

The test results of this test report relate exclusively to the test item specified in this test report.

Centre Testing International Group Co., Ltd. does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report is not to be reproduced or published in full without the prior written permission.

1.2 Application details

Date of receipt of test item: 2016-08-11

Start of test: 2016-09-09

End of test: 2016-10-11

1.3 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for PROEXPRESS DISTRIBUTOR LLC. Model Name: S7 are as below:

Band	MAX Reported SAR _{1-g} (W/kg)	
	1-g Head	1-g Body (0mm)
GSM850	0.051	0.727
GSM1900	0.125	0.941
UMTS Band V	0.052	0.634
UMTS Band II	0.213	0.703
The highest simultaneous SAR is 1.313W/kg per KDB 690783 D01		

Note:

For body worn operation, this device has been tested and meets FCC/IC RF exposure guidelines when used with any accessory that contains no metal and that positions the handset a minimum of 15mm from the body. Use of other accessories may not ensure compliance with FCC/IC RF exposure guidelines.

The device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits according to the FCC rule §2.1093, the ANSI/IEEE C95.1:1992, the NCRP Report Number 86 for uncontrolled environment, according to the Industry Canada Radio Standards Specification RSS-102 for General Population/Uncontrolled exposure, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013

1.4 EUT Information

Device Information:			
Product Name:	7"Tablet PC		
Model:	S7, S70, S7 PLUS, S7 PRO, S7X, S7 KIDS		
Test Model No.:	S7		
FCC ID:	S5V-D07S70		
SN:	NA		
Device Type:	Portable device		
Exposure Category:	uncontrolled environment / general population		
Hardware version:	N/A		
Software version :	N/A		
Antenna Type :	internal antenna		
Device Operating Configurations:			
Supporting Mode(s) :	GSM850/1900,UMTS Band V/II(tested), WiFi 2.4G,BT		
Duty Cycle used for SAR testing	WiFi: 100%		
Modulation:	GMSK, QPSK, DSSS,OFDM, GFSK, $\pi/4$ DQPSK, 8DPSK		
Operating Frequency Range(s)	Band	TX(MHz)	RX(MHz)
	GSM850	824-849	869-894
	GSM1900	1850-1910	1930-1990
	UMTS Band V	824-849	869-894
	UMTS Band II	1850-1910	1930-1990
	WIFI 2.4G	2412~2462	
	BT	2402~2480	
GPRS class level:	GPRS class 12		
Test Channels (low-mid-high):	128-190-251 (GSM850)		
	512-661-810 (GSM1900)		
	4132-4182-4233 (UMTS Band V)		
	9262-9400-9538 (UMTS Band II)		
	1-6-11 (WiFi 2.4G)		
	0-39-78 (BT)		
Power Source:	Li-ion 3.7V 2700mAH		

Remark: The tested samples and the sample information are provided by the client.

Report No.: EED32I00225105

Model No.: S7, S70, S7 PLUS, S7 PRO, S7X, S7 KIDS

Only the model S7 was tested, the PCB, Schematic, Hardware etc were identical for the above models, Only different model name due to difference agent and marketing purposes.

1.5 Test standard/s

ANSI Std C95.1-1992	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.
IEEE Std 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
RSS-102	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands (Issue 5 of March 2015)
KDB 248227 D01	SAR guidance for IEEE 802.11(Wi-Fi) transmitters v02r02
KDB 447498 D01	General RF Exposure Guidance v06
KDB 648474 D04	Handset SAR v01r03
KDB616217 D04	SAR for laptop and tablets v01r02
KDB 690783 D01	SAR Listings on Grants v01r03
KDB 865664 D01	SAR Measurement 100 MHz to 6 GHz v01r04
KDB 865664 D02	RF Exposure Reporting v01r02
KDB 941225 D01	3G SAR Procedures v03r01

1.6 RF exposure limits

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR* (Brain/Body/Arms/Legs)	1.60 mW/g	8.00 mW/g
Spatial Average SAR** (Whole Body)	0.08 mW/g	0.40 mW/g
Spatial Peak SAR*** (Hands/Feet/Ankle/Wrist)	4.00 mW/g	20.00 mW/g

The limit applied in this test report is shown in bold letters

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

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

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

1.7 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dW) absorbed by(dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ).

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

SAR is expressed in units of watts per kilogram (W/kg). SAR can be related to the electric field at a point by

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

where:

σ = conductivity of the tissue (S/m)
 ρ = mass density of the tissue (kg/m³)
 E = rms electric field strength (V/m)

1.8 Testing laboratory

Test Site	Centre Testing International Group Co., Ltd.
Test Location	Hongwei Industrial Zone, Bao'an 70 District, Shenzhen, Guangdong, China
Telephone	+86 (0) 755 3368 3668
Fax	+86 (0) 755 3368 3385

1.9 Test Environment

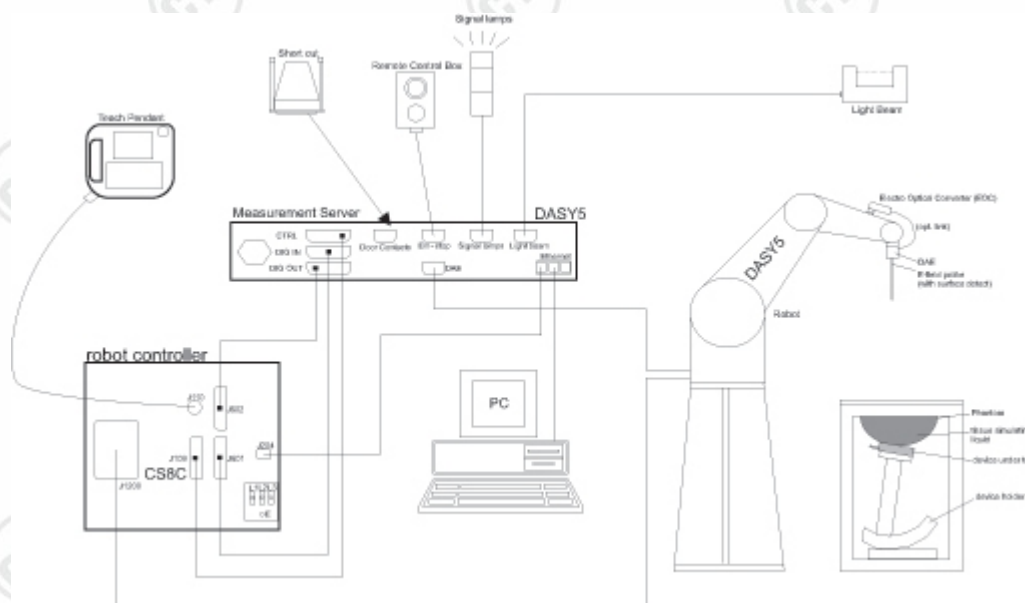
	Required	Actual
Ambient temperature:	18 – 25 °C	21.5 ± 2.0 °C
Tissue Simulating liquid:	18 – 25 °C	21.5 ± 2.0 °C
Relative humidity content:	30 – 70 %	30 – 70 %

1.10 Applicant and Manufacturer

Applicant/Client Name	PROEXPRESS DISTRIBUTOR LLC
Applicant Address	11011 Greenwood Ave N 11011 Greenwood Ave N, Seattle Washington United States
Manufacturer	PROEXPRESS DISTRIBUTOR LLC
Address of Manufacturer	11011 Greenwood Ave N 11011 Greenwood Ave N, Seattle Washington United States
Factory	PROEXPRESS DISTRIBUTOR LLC
Address of Factory	11011 Greenwood Ave N 11011 Greenwood Ave N, Seattle Washington United States

2 SAR Measurement System Description and Setup

2.1 The Measurement System Description



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

- A standard high precision 6-axis robot (Stäubli TX/RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running Win7 profesional operating system and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

2.2 Probe description

Dosimetric Probes: These probes are specially designed and calibrated for use in liquids with high permittivities. They should not be used in air, since the spherical isotropy in air is poor(± 2 dB). The dosimetric probes have special calibrations in various liquids at different frequencies.

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 6 GHz; Linearity: ± 0.2 dB
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Dynamic range	5 μ W/g to 100 mW/g; Linearity: ± 0.2 dB

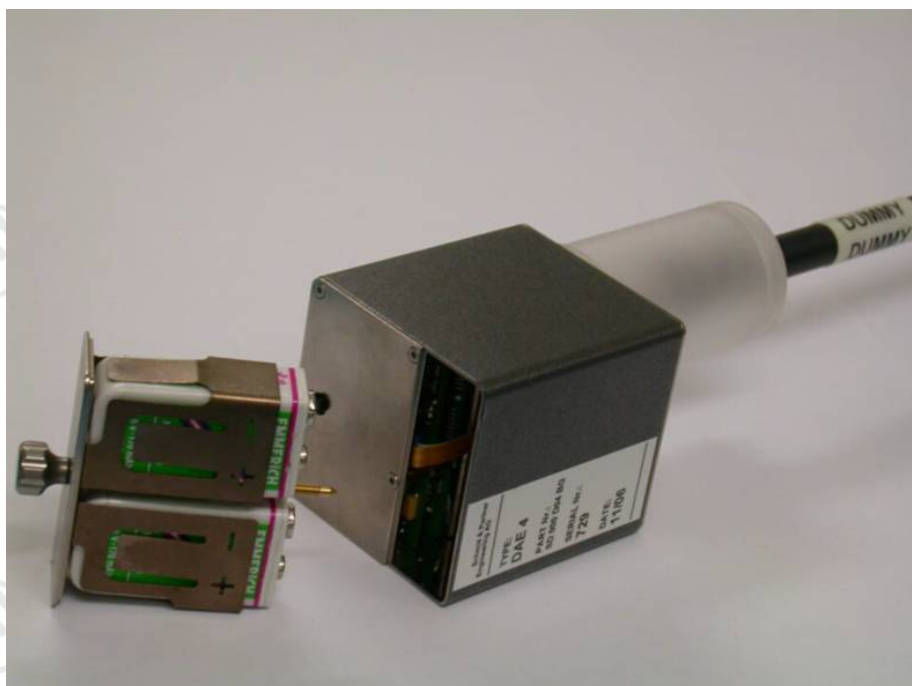


2.3 Data Acquisition Electronics description

The data acquisition electronics (DAE4) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE4 box is 200M Ω ; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Batteries: The DAE works with either two standard 9V batteries or two 9V (actually 8.4V or 9.6 V) rechargeable batteries. Because the electronics automatically power-down unused components during braking or between measurements, the battery lifetime depends on system usage. Typical lifetimes are >20 hours for batteries and >10 hours for accus. Remove the batteries if you do not plan to use the DAE for a long period of time.



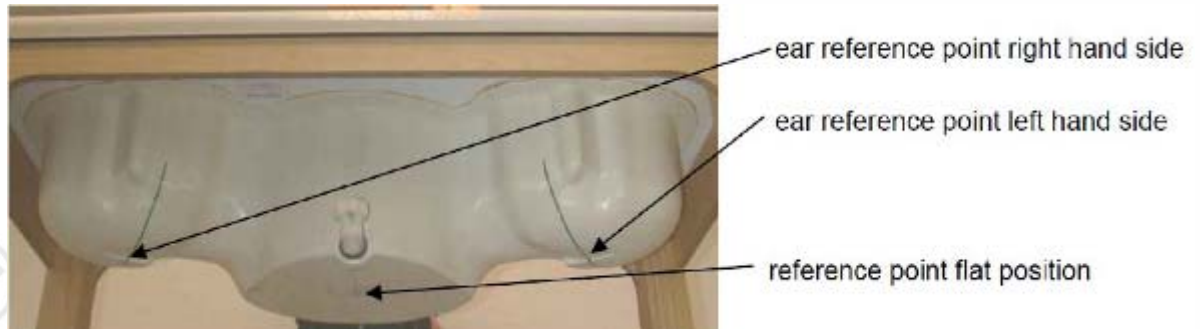
2.4 SAM Twin Phantom description

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6 mm). The phantom has three measurement areas:

◆ Left hand

◆ Right hand

◆ Flat phantom



The phantom table for the DASY systems have the size of 100 x 50 x 85 cm (L x W x H). These tables are reinforced for mounting of the robot onto the table. For easy dislocation these tables have fork lift cut outs at the bottom.

The bottom plate contains three pairs of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections.

A white cover is provided to cover the phantom during off-periods to prevent water evaporation and changes in the liquid parameters.

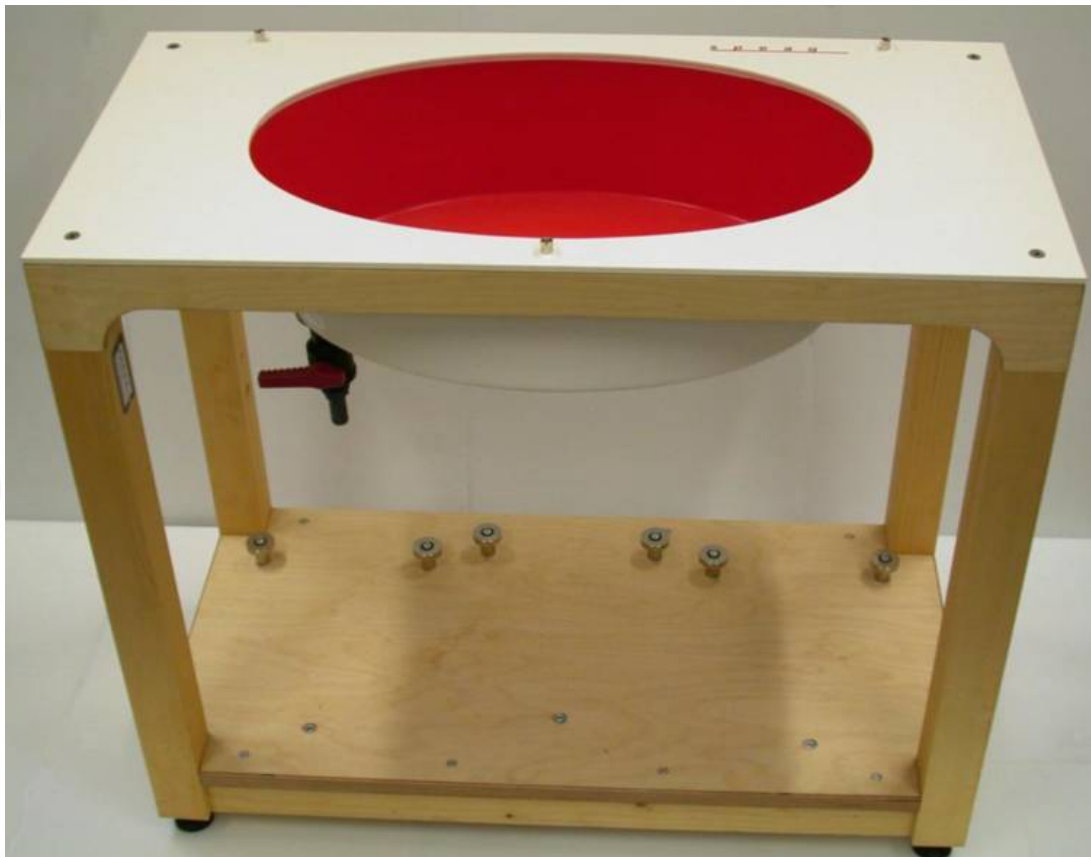
Three reference marks are provided on the phantom counter. These reference marks are used to teach the absolute phantom position relative to the robot.



2.5 ELI4 Phantom description

The ELI4 phantom is intended for compliance testing of handheld and body mounted wireless devices in the frequency range of 30MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209-2 and all known tissue simulating liquids.

ELI4 has been optimized regarding its performance and can be integrated into a SPEAG standard phantom table. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points



2.6 Device Holder description

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5mm distance, a positioning uncertainty of $\pm 0.5\text{mm}$ would produce a SAR uncertainty of $\pm 20\%$. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

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

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.



3 SAR Test Equipment List

To simplify the identification of the test equipment and/or ancillaries which were used, the reporting of the relevant test cases only refer to the test item number as specified in the table below.

	Manufacturer	Device Type	Type(Model)	Serial number	Date of last calibration	Valid period
☒	SPEAG	E-Field Probe	EX3DV4	7328	2016-02-29	One year
☒	SPEAG	835 MHz Dipole	D835V2	4d193	2015-02-02	Three years
☐	SPEAG	1750 MHz Dipole	D1750V2	1134	2015-02-05	Three years
☒	SPEAG	1900 MHz Dipole	D1900V2	5d198	2015-02-06	Three years
☐	SPEAG	2000 MHz Dipole	D2000V2	1078	2015-02-05	Three years
☐	SPEAG	2450 MHz Dipole	D2450V2	959	2015-02-05	Three years
☐	SPEAG	2600 MHz Dipole	D2600V2	1101	2015-02-05	Three years
☐	SPEAG	5 GHz Dipole	D5GHzV2	1208	2015-02-03	Three years
☒	SPEAG	DAKS probe	DAKS-3.5	1052	2015-01-27	Three years
☒	SPEAG	Planar R140 Vector Reflectometer	DAKS-VNA R140	0200514	2015-01-27	Three years
☒	SPEAG	Data acquisition electronics	DAE4	1458	2016-02-26	One year
☒	SPEAG	Software	DASY 5	NA	NCR	NCR
☒	SPEAG	Twin Phantom	SAM V5.0	1875	NCR	NCR
☒	SPEAG	Flat Phantom	ELI V6.0	2024	NCR	NCR
☒	BALUN	Power Amplifier and directional coupler	SU319W	BLSZ1550140	NCR	NCR
☒	R & S	Universal Radio Communication Tester	CMU200	101553	2016-04-01	One year
☒	Agilent	Signal Generator	E4438C	MY45095744	2016-04-01	One year
☒	Agilent	Power Meter	E4418B	MY45104044	2015-12-01	One year
☒	Agilent	Power Meter Sensor	E9300A	MY41496140	2015-12-01	One year
☒	Agilent	Power Meter	PM2002	312901	2015-12-31	One year
☒	Agilent	Power Meter Sensor	51011A-EMC	36252	2015-12-31	One year

Note:

- 1) Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.
 - a) There is no physical damage on the dipole;
 - b) System check with specific dipole is within 10% of calibrated value;
 - c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.
 - d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.

4 SAR Measurement Procedures

4.1 Spatial Peak SAR Evaluation

The DASY5 software includes all numerical procedures necessary to evaluate the spatial peak SAR values. The base for the evaluation is a "cube" measurement in a volume of 30mm^3 ($7 \times 7 \times 7$ points). The measured volume must include the 1 g and 10 g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan. If the 10g cube or both cubes are not entirely inside the measured volumes, the system issues a warning regarding the evaluated spatial peak values within the Postprocessing engine (SEMCAD X). This means that if the measured volume is shifted, higher values might be possible. To get the correct values you can use a finer measurement grid for the area scan. In complicated field distributions, a large grid spacing for the area scan might miss some details and give an incorrectly interpolated peak location. The entire evaluation of the spatial peak values is performed within the Postprocessing engine (SEMCAD X). The system always gives the maximum values for the 1 g and 10 g cubes.

The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. extraction of the measured data (grid and values) from the Zoom Scan
2. calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. generation of a high-resolution mesh within the measured volume
4. interpolation of all measured values from the measurement grid to the high-resolution grid
5. extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. calculation of the averaged SAR within masses of 1 g and 10 g

4.2 Data Storage and Evaluation

Data Storage

The DASY5 software stores the measured voltage acquired by the Data Acquisition Electronics (DAE) as raw data together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and communication system parameters) in measurement files with the extension .da5x. The postprocessing software evaluates the data every time the data is visualized or exported. This allows the verification and modification of the setup after completion of the measurement. For example, if a measurement has been performed with an incorrect crest factor, the parameter can be corrected afterwards and the data can be reevaluated.

To avoid unintentional parameter changes or data manipulations, the parameters in measured files are locked. In the administrator access mode of the software, the parameters can be unlocked. After changing the parameters, the measured scans can be reevaluated in the postprocessing engine. The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., E-field, H-field, SAR). Some of these units are not available in certain situations or give 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 fields and SAR are calculated from the measured voltage (probe voltage acquired by the DAE) and the following parameters:

Probe parameters:

- Sensitivity

norm_i, a_{i0}, a_{i1}, a_{i2}

- Conversion Factor

convF_i

- Diode Compression Point

dcp_i

- Probe Modulation Response Factors

a_i, b_i, c_i, d

Device parameters:

- Frequency

f

- Crest factor

cf

Media parameters:

- Conductivity

σ

- Relative Permittivity

ρ

This parameters are stored in the DASY5 V52 measurement file.

These parameters must be correctly set in the DASY5 V52 software setup. They are available as configuration file and can be imported into the measurement file. The values displayed in the multimeter window are assessed using the parameters of the actual system setup. In the scan visualization and export modes, the parameters stored in the measurement file are used.

The measured voltage is not proportional to the exciting. It must be first linearized.

Approximated Probe Response Linearization using Crest Factor.

This linearization method is enabled when a custom defined communication system is measured. The compensation applied is a function of the measured voltage, the detector diode compression point and the crest factor of the measured signal.

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

with V_i = linearized voltage of channel i (uV) (i = x,y,z)
 U_i = measured voltage of channel i (uV) (i = x,y,z)
 cf = crest factor of exciting field (DASY parameter)
 dcp_i = diode compression point of channel i (uV) (Probe parameter, i = x,y,z)

Field and SAR Calculation

The primary field data for each channel are calculated using the linearized voltage:

$$E - \text{fieldprobes : } E_i = \sqrt{\frac{V_i}{\text{Norm}_i \cdot \text{ConvF}}}$$

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

with V_i = linearized voltage of channel i (i = x,y,z)

Norm_i = sensor sensitivity of channel i (i = x,y,z)

$\mu\text{V}/(\text{V}/\text{m})^2$ for E-field Probes

ConvF = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

H_i = magnetic field strength of channel i in A/m

The RMS 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

E_{tot} = 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 set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

Spatial Peak SAR for 1 g and 10 g

The DASY5 software includes all numerical procedures necessary to evaluate the spatial peak SAR values. The base for the evaluation is a "cube" measurement at the points of the fine cube grid consisting of 5 x 5 x 7 points (with 8mm horizontal resolution) or 7 x 7 x 7 points (with 5mm horizontal resolution) or 8 x 8 x 7 points (with 4mm horizontal resolution). The entire evaluation of the spatial peak values is performed within the Postprocessing engine (SEMCAD X). The system always gives the maximum values for the 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. extraction of the measured data (grid and values) from the Zoom Scan.
2. calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters).
3. generation of a high-resolution mesh within the measured volume.
4. interpolation of all measured values from the measurement grid to the high-resolution grid
5. extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface.
6. calculation of the averaged SAR within masses of 1 g and 10 g.

4.3 Data Storage and Evaluation

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. 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.

Step 1: Power reference measurement

The Power Reference Measurement and Power Drift Measurement are for monitoring the power drift of the device under test in the batch process. The Minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. By default, the Minimum distance of probe sensors to surface is 4 mm. This distance can be modified by the user, but cannot be smaller than the Distance of sensor calibration points to probe tip as defined in the probe properties. The SAR measurement was taken at a selected spatial reference point to monitor power variations during testing. This fixed location point was measured and used as a reference value.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hotspot. The sophisticated interpolation routines implemented in DASY5 software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2003 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Step 3: Zoom Scan

The Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The default Zoom Scan is defined in the following table. DASY5 is also able to perform repeated zoom scans if more than 1 peak is found during area scan. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Area scan and Zoom scan resolutions per FCC KDB Publication 865664 D01:

Frequency	Maximun Area Scan resolution ($\Delta x_{Area}, \Delta y_{Area}$)	Maximun Zoom Scan spatial resolution ($\Delta x_{Zoom}, \Delta y_{Zoom}$)	Maximun Zoom Scan spatial resolution			Minimum zoom scan volume (x,y,z)
			Uniform Grid	Graded Grad		
			$\Delta z_{Zoom}(n)$	$\Delta z_{Zoom}(1)^*$	$\Delta z_{Zoom}(n>1)^*$	
$\leq 2\text{GHz}$	$\leq 15\text{mm}$	$\leq 8\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 1.5 * \Delta z_{Zoom}(n-1)$	$\geq 30\text{mm}$
2-3GHz	$\leq 12\text{mm}$	$\leq 5\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 1.5 * \Delta z_{Zoom}(n-1)$	$\geq 30\text{mm}$
3-4GHz	$\leq 12\text{mm}$	$\leq 5\text{mm}$	$\leq 4\text{mm}$	$\leq 3\text{mm}$	$\leq 1.5 * \Delta z_{Zoom}(n-1)$	$\geq 28\text{mm}$
4-5GHz	$\leq 10\text{mm}$	$\leq 4\text{mm}$	$\leq 3\text{mm}$	$\leq 2.5\text{mm}$	$\leq 1.5 * \Delta z_{Zoom}(n-1)$	$\geq 25\text{mm}$
5-6GHz	$\leq 10\text{mm}$	$\leq 4\text{mm}$	$\leq 2\text{mm}$	$\leq 2\text{mm}$	$\leq 1.5 * \Delta z_{Zoom}(n-1)$	$\geq 22\text{mm}$

Step 4: Power Drift Monitoring

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement job within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. If the value changed by more than 5%, the evaluation should be retested.

5 SAR Verification Procedure

5.1 Tissue Verification

The following materials are used for producing the tissue-equivalent materials.

(Liquids used for tests are marked with ☒):

Ingredients (% of weight)	Frequency (MHz)						
	Head Tissue						
Tissue Type	Head Tissue						
frequency band	835	900	1800	2000	2300	2450	2600
Water	41.45	40.92	52.64	54.9	62.82	62.7	55.242
Salt (NaCl)	1.45	1.48	0.36	0.18	0.51	0.5	0.306
Sugar	56.0	56.5	0.0	0.0	0.0	0.0	0.0
HEC	1.0	1.0	0.0	0.0	0.0	0.0	0.0
Bactericide	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	47.0	44.92	36.67	0.0	44.452
Ingredients (% of weight)	Body Tissue						
	Body Tissue						
frequency band	835	1750	1900	2450	2600		
Water	52.5	69.91	69.91	73.20	64.50		
Salt (NaCl)	1.40	0.13	0.13	0.04	0.02		
Sugar	45.0	0.0	0.0	0.0	0.0		
HEC	1.0	0.0	0.0	0.0	0.0		
Bactericide	0.1	0.0	0.0	0.0	0.0		
Triton X-100	0.0	0.0	0.0	0.0	0.0		
DGBE	0.0	29.96	29.96	26.76	35.48		

Salt: 99+% Pure Sodium Chloride

Sugar: 98+% Pure Sucrose

Water: De-ionized, 16MΩ+ resistivity

HEC: Hydroxyethyl Cellulose

DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100(ultra pure): Polyethylene glycol mono [4-(1,1,3,3-tetramethylbutyl)phenyl]ether

Tissue simulating liquids: parameters:

Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Liquid Temp.	Test Date
		ϵ_r (+/-5%)	σ (S/m) (+/-5%)	ϵ_r	σ (S/m)		
835 Head	825	41.60 (39.52~43.68)	0.90 (0.86~0.95)	40.230	0.909	21.16°C	2016/09/09
	835	41.50 (39.43~43.58)	0.90 (0.86~0.95)	40.140	0.915		
	850	41.50 (39.43~43.58)	0.92 (0.87~0.96)	40.110	0.923		
835 Body	825	55.20 (52.44~57.96)	0.97 (0.92~1.02)	54.140	0.962	21.39°C	2016/10/10

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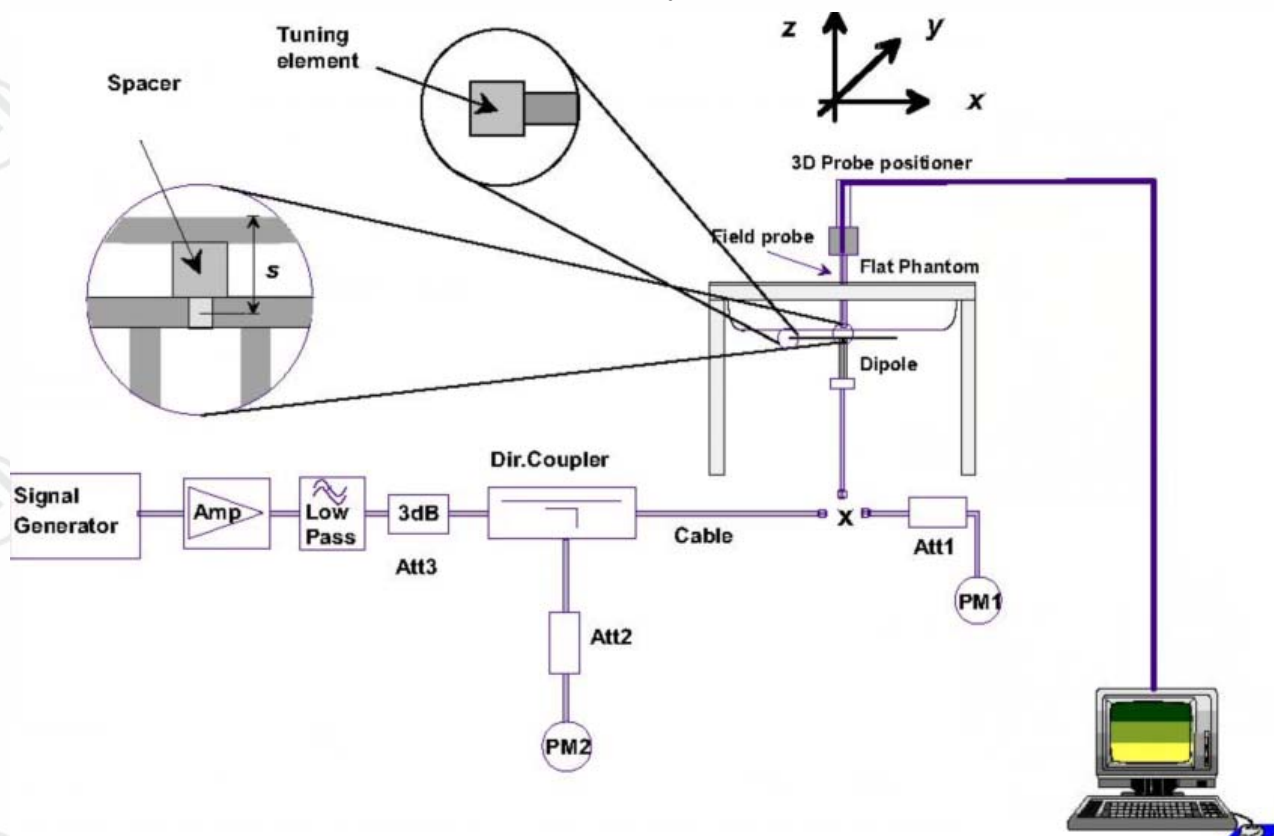
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	835	55.20 (52.44~57.96)	0.97 (0.92~1.02)	54.120	0.967		
	850	55.20 (52.44~57.96)	0.99 (0.94~1.04)	53.990	0.977		
1900 Head	1850	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.33	1.339	20.63°C	2016/09/12
	1880	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.13	1.366		
	1900	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.03	1.384		
	1910	40.00 (38.00~42.00)	1.40 (1.33~1.47)	39.03	1.386		
1900 Body	1850	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.49	1.443	20.90°C	2016/10/09
	1880	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.43	1.485		
	1900	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.37	1.513		
	1910	53.30 (50.64~55.97)	1.52 (1.44~1.60)	51.32	1.516		
ϵ_r = Relative permittivity, σ = Conductivity							

5.2 System check procedure

The System check is performed by using a System check dipole which is positioned parallel to the planar part of the SAM phantom at the reference point. The distance of the dipole to the SAM phantom is determined by a spacer. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 250mW. To adjust this power a power meter is used. The power sensor is connected to the cable before the System check to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the validation to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).

System check results have to be equal or near the values determined during dipole calibration (target SAR in table above) with the relevant liquids and test system.



5.3 System check results

The system Check is performed for verifying the accuracy of the complete measurement system and performance of the software. The following table shows System check results for all frequency bands and tissue liquids used during the tests (plot(s) see annex A).

System Check (MHz)	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (mW/g)	10-g (mW/g)	1-g (mW/g)	10-g (mW/g)		
D835V2 Head	9.13 (8.22~10.04)	5.96 (5.36~6.56)	9.44	6.20	21.16°C	2016/09/09
D1900V2 Head	40.60 (36.54~44.66)	21.40 (19.26~23.54)	38.12	20.00	20.63°C	2016/09/12
D835V2 Body	9.30 (8.37~10.23)	6.10 (5.49~6.71)	9.40	6.24	21.39°C	2016/10/10
D1900V2 Body	41.00 (36.90~45.10)	21.70 (19.53~23.87)	42.40	22.56	20.90°C	2016/10/09
Note: All SAR values are normalized to 1W forward power.						

6 SAR Measurement variability and uncertainty

6.1 SAR measurement variability

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

6.2 SAR measurement uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

7 SAR Test Configuration

7.1 GSM Test Configurations

SAR tests for GSM850 and GSM1900, a communication link is set up with a base station by air link. Using CMU200 the power lever is set to “5” and “0” in SAR of GSM850 and GSM1900. The tests in the band of GSM850 and GSM1900 are performed in the mode of GPRS function. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5.

When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.

7.2 UMTS Test Configurations

1) RMC

As the SAR body tests for WCDMA Band II/V, we established the radio link through call processing. The maximum output power were verified on high, middle and low channels for each test band according to 3GPP TS 34.121 with the following configuration:

- 1) 12.2kbps RMC, 64,144,384 kbps RMC with TPC set to ‘all 1’.
- 2) Test loop Mode 1.

For the output power, the configurations for the DPCCH and DPDCH₁ are as followed (EUT do not support the DPDCH_{2-n})

	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	Spreading Factor	Spreading Code Number	Bits/Slot
DPCCH	15	15	256	0	10
DPDCH ₁	15	15	256	64	10
	30	30	128	32	20
	60	60	64	16	40
	120	120	32	8	80
	240	240	16	4	160
	480	480	8	2	320
	960	960	4	1	640
DPDCH _n	960	960	4	1, 2, 3	640

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits configured to all “1s”. SAR for other spreading codes and multiple DPDCH_n, when supported by the

EUT, are not required when the maximum average outputs of each RF channel, for each spreading code and DPDCHn configuration, are less than ¼ dB higher than those measured in 12.2 kbps RMC.

2) HSDPA

SAR for body exposure configurations is measured according to the "Body SAR Measurements" procedures of 3G device. In addition, body SAR is also measured for HSDPA when the maximum average outputs of each RF channel with HSDPA active is at ¼ dB higher than that measured without HSDPA using 12.2kbps RMC or the maximum SAR 12.2kbps RMC is above 75% of the SAR limit. Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA.

HSDPA should be configured according to UE category of a test device. The number of HS-DSCH/ HS-PDSCHs, HAPRQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission condition, QPSK is used in the H-set for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 4ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. The β_c and β_d gain factors for DPCCH and DPDCH were set according to the values in the below table, β_{hs} for HS-DPCCH is set automatically to the correct value when ΔACK , $\Delta NACK$, $\Delta CQI = 8$. The variation of the β_c / β_d ratio causes a power reduction at sub-tests 2 - 4.

Sub-test	$b\beta_c$	$b\beta_d$	$b\beta_d$ (SF)	$b\beta_c / \beta_d$	$b\beta_{hs}$ (1)	CM(dB)(2)	MPR (dB)
1	2/15	15/15	64	2/15	4/15	0.0	0
2	12/15(3)	15/15(3)	64	12/15(3)	24/15	1.0	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: ΔACK , $\Delta NACK$ and $\Delta CQI = 8 \Rightarrow A_{hs} = \beta_{hs} / \beta_c = 30/15 \Rightarrow \beta_{hs} = 30/15 * \beta_c$

Note 2 : CM=1 for $\beta_c / \beta_d = 12/15$, $\beta_{hs} / \beta_c = 24/15$. 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 3 : 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 $\beta_c = 11/15$ and $\beta_d = 15/15$

The measurements were performed with a Fixed Reference Channel (FRC) and H-Set 1 QPSK.

Parameter	Value
Nominal average inf. bit rate	534 kbit/s
Inter-TTI Distance	3 TTI's
Number of HARQ Processes	2 Processes
Information Bit Payload	3202 Bits
MAC-d PDU size	336 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	4800 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	9600 SMLs
Coding Rate	0.67
Number of Physical Channel Codes	5

Note: settings of required H-Set 1 QPSK acc. to 3GPP 34.121

HS-DSCH Category	Maximum HS-DSCH Codes Received	Minimum Inter-TTI Interval	Maximum HS-DSCH Transport Block Bits/HS-DSCH TTI	Total Soft Channel Bits
1	5	3	7298	19200
2	5	3	7298	28800
3	5	2	7298	28800
4	5	2	7298	38400
5	5	1	7298	57600
6	5	1	7298	67200
7	10	1	14411	115200
8	10	1	14411	134400
9	15	1	25251	172800
10	15	1	27952	172800
11	5	2	3630	14400
12	5	1	3630	28800
13	15	1	34800	259200
14	15	1	42196	259200
15	15	1	23370	345600
16	15	1	27952	345600

3) HSUPA

Body SAR is also measured for HSDPA when the maximum average outputs of each RF channel with HSDPA active is at ¼ dB higher than that measured without HSDPA using 12.2kbps RMC or the maximum SAR 12.2kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-set 1 and QPSK for FRC and 12.2kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA.

Due to inner loop power control requirements in HSDPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSDPA should be configured according to the b values indicated below as well as other applicable procedures described in the 'UMTS Handset' and 'Release 5 HSDPA Data Device' sections of 3G device.

Sub-test	$b\beta_c$	$b\beta_d$	β_d (SF)	$b\beta_c/\beta_d$	$b\beta_{hs}^{(1)}$	$b\beta_{ec}$	$b\beta_{ed}$	β_{ec} (SF)	β_{ed} (code)	CM ⁽²⁾ (dB)	MPR (dB)	AG ⁽⁴⁾ Index	E-TFC I
1	11/15 ⁽³⁾	15/15 ⁽³⁾	64	11/15 ⁽³⁾	22/15	209/225	1039/225	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	$\beta_{ed1}:4/7/15$ $\beta_{ed2}:4/7/15$	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 ⁽⁴⁾	15/15 ⁽⁴⁾	64	15/15 ⁽⁴⁾	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: ΔACK , $\Delta NACK$ and $\Delta CQI = 8P_{A_{hs}} = \beta_{hs}/\beta_c = 30/15P_{\beta_{hs}} = 30/15 * \beta_c$

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. 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 $\beta_c = 10/15$ and $\beta_d = 15/15$

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 $\beta_c = 14/15$ and $\beta_d = 15/15$

Note 5 : Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to

TS 25.306 Table 5.1g

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

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI(ms)	Minimum Spreading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	10	2SF2&2SF 4	11484	5.76
	4	4	2		20000	2.00
7 (No DPDCH)	4	8	2	2SF2&2SF 4	22996	?
	4	4	10		20000	?

NOTE: When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4. UE categories 1 to 6 support QPSK only. UE category 7 supports QPSK and 16QAM. (TS25.306-7.3.0)

7.3 WIFI 2.4G Test Configurations

For WiFi SAR testing, a communication link is set up with the testing software for WiFi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. The RF signal utilized in SAR measurement has 100% duty cycle and its crest factor is 1. The test procedures in KDB 248227D01 v02r02 are applied.

Per KDB 248227 D01 802.11 Wi-Fi SAR v02r02, SAR Test Reduction criteria are as follows:

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel

bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the initial test position(s) by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The relative SAR levels of multiple exposure test positions can be established by area scan measurements on the highest measured output power channel to determine the initial test position. The area scans must be measured using the same SAR measurement configurations, including test channel, maximum output power, probe tip to phantom distance, scan resolution etc.

When the reported SAR for the initial test position is:

- 1) ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.
- 2) > 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.
- 3) For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, measure the SAR for these positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required test channels are considered.

SAR is not required for the following 2.4 GHz OFDM conditions.

- 1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
- 2) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

8 SAR Test Results

8.1 Conducted Power Measurements

1. For the measurements a Rohde & Schwarz Radio Communication Tester CMU200 was used.
2. Establish communication link between emulator and EUT and set EUT to operate at maximum output power all the time.
3. Source-based Time Averaged Burst Power Calculation:
 For TDMA, the following duty cycle factor was used to calculate the Source-based Time Averaged power.

Number of Time slot	1	2	3	4
Duty cycle	1:8.3	1:4.1	1:2.77	1:2.08
Duty cycle factor	-9.19	-6.13	-4.42	-3.18

8.1.1 Conducted Power of GSM850

GSM850(SIM1)		Burst-Averaged output Power (dBm)			Division Factors	Source Based time Average Power(dBm)		
		128CH	190CH	251CH		128CH	190CH	251CH
GSM(CS)		33.77	33.89	33.90	-9.19	24.58	24.70	24.71
GPRS/ EDGE (GMSK)	1 Tx Slot	33.78	33.88	33.90	-9.19	24.59	24.69	24.71
	2 Tx Slots	30.78	30.87	30.91	-6.13	24.65	24.74	24.78
	3 Tx Slots	28.95	29.06	29.07	-4.42	24.53	24.64	24.65
	4 Tx Slots	27.74	27.85	27.95	-3.18	24.56	24.67	24.77

Note: 1) The conducted power of GSM850 is measured with RMS detector.

2) Source Based time Average Power was calculated from the measured burst-averaged output power by converting the slot powers into linear units and calculating the energy over 8 timeslots.

3) The bolded GPRS 2Tx slots mode was selected for SAR testing according the highest Source Based time Average Power table.

4) channel/Frequency: 128/824.2, 190/836.6, 251/848.8

GSM850(SIM2)		Burst-Averaged output Power (dBm)			Division Factors	Source Based time Average Power(dBm)		
		128CH	190CH	251CH		128CH	190CH	251CH
GSM(CS)		33.34	33.44	33.49	-9.19	24.15	24.25	24.30
GPRS/ EDGE (GMSK)	1 Tx Slot	33.33	33.43	33.47	-9.19	24.14	24.24	24.28
	2 Tx Slots	30.31	30.41	30.44	-6.13	24.18	24.28	24.31
	3 Tx Slots	28.47	28.59	28.62	-4.42	24.05	24.17	24.20
	4 Tx Slots	27.29	27.41	27.39	-3.18	24.11	24.23	24.21

Note: 1) The conducted power of GSM850 is measured with RMS detector.

2) Source Based time Average Power was calculated from the measured burst-averaged output power by converting the slot powers into linear units and calculating the energy over 8 timeslots.

3) The bolded GPRS 4Tx slots mode was selected for SAR testing according the highest Source Based time Average Power table.

4) channel /Frequency: 128/824.2,190/836.6,251/848.8

8.1.2 Conducted Power of GSM1900

GSM1900(SIM1)		Burst-Averaged output Power (dBm)			Division Factors	Source Based time Average Power(dBm)		
		512CH	661CH	810CH		512CH	661CH	810CH
GSM(CS)		31.41	31.43	31.34	-9.19	22.22	22.24	22.15
GPRS/ EDGE (GMSK)	1 Tx Slot	31.42	31.43	31.35	-9.19	22.23	22.24	22.16
	2 Tx Slots	28.42	28.41	28.30	-6.13	22.29	22.28	22.17
	3 Tx Slots	26.50	26.55	26.44	-4.42	22.08	22.13	22.02
	4 Tx Slots	25.27	25.24	25.16	-3.18	22.09	22.06	21.98

Note: 1) The conducted power of GSM1900 is measured with RMS detector.

2) Source Based time Average Power was calculated from the measured burst-averaged output power by converting the slot powers into linear units and calculating the energy over 8 timeslots.

3) The bolded GPRS 2Tx slots mode was selected for SAR testing according the highest Source Based time Average Power table.

4) channel/Frequency: 512/1850.2,661/1880,810/1909.8

GSM1900(SIM2)		Burst-Averaged output Power (dBm)			Division Factors	Source Based time Average Power(dBm)		
		512CH	661CH	810CH		512CH	661CH	810CH
GSM(CS)		31.40	31.42	31.32	-9.19	22.21	22.23	22.13
GPRS/ EDGE (GMSK)	1 Tx Slot	31.42	31.43	31.33	-9.19	22.23	22.24	22.14
	2 Tx Slots	28.41	28.44	28.30	-6.13	22.28	22.31	22.17
	3 Tx Slots	26.55	26.54	26.41	-4.42	22.13	22.12	21.99
	4 Tx Slots	25.27	25.26	25.16	-3.18	22.09	22.08	21.98

Note: 1) The conducted power of GSM1900 is measured with RMS detector.

2) Source Based time Average Power was calculated from the measured burst-averaged output power by converting the slot powers into linear units and calculating the energy over 8 timeslots.

3) The bolded GPRS 2Tx slots mode was selected for SAR testing according the highest Source Based time Average Power table.

4) channel/Frequency: 512/1850.2,661/1880,810/1909.8

8.1.3 Conducted Power of UMTS Band II

UMTS Band II(SIM1)		Conducted Power (dBm)		
		9262CH	9400CH	9538CH
WCDMA	12.2kbps RMC	24.69	24.80	25.00
HSDPA	Subtest 1	24.53	24.78	24.89
	Subtest 2	24.60	24.67	24.79
	Subtest 3	24.61	24.55	24.92
	Subtest 4	24.65	24.72	24.88
HSUPA	Subtest 1	23.61	23.69	23.99
	Subtest 2	23.29	23.37	23.67
	Subtest 3	23.02	23.09	23.40
	Subtest 4	23.76	23.83	24.10
	Subtest 5	24.46	24.65	24.82

Note: 1) channel /Frequency: 9262/1852.4,9400/1800,9538/1907.6

UMTS Band II(SIM2)		Conducted Power (dBm)		
		9262CH	9400CH	9538CH
WCDMA	12.2kbps RMC	24.59	24.73	24.94
HSDPA	Subtest 1	24.50	24.70	24.85
	Subtest 2	24.61	24.66	24.67
	Subtest 3	24.55	24.51	24.83
	Subtest 4	24.62	24.75	24.81
HSUPA	Subtest 1	23.63	23.66	23.85
	Subtest 2	23.25	23.32	23.60
	Subtest 3	23.11	23.15	23.35
	Subtest 4	23.76	23.80	24.03
	Subtest 5	24.41	24.53	24.65

Note: 1) channel /Frequency: 9262/1852.4,9400/1800,9538/1907.6

8.1.4 Conducted Power of UMTS Band V

UMTS Band V(SIM1)		Conducted Power (dBm)		
		4132CH	4182CH	4233CH
WCDMA	12.2kbps RMC	24.20	24.23	24.19
HSDPA	Subtest 1	24.21	24.20	24.01
	Subtest 2	24.16	24.13	24.10
	Subtest 3	24.11	24.18	23.94
	Subtest 4	23.84	24.15	23.97
HSUPA	Subtest 1	22.92	23.20	23.02
	Subtest 2	22.64	22.89	22.72
	Subtest 3	22.36	22.58	22.45
	Subtest 4	22.90	23.06	23.01
	Subtest 5	23.53	23.77	23.39

Note: 1) channel /Frequency: 4132/826.4,4182/836.4,4233/846.6

UMTS Band V(SIM2)		Conducted Power (dBm)		
		4132CH	4182CH	4233CH
WCDMA	12.2kbps RMC	23.98	24.15	23.99
HSDPA	Subtest 1	24.02	24.12	23.95
	Subtest 2	24.10	24.09	23.98
	Subtest 3	24.00	24.11	23.89
	Subtest 4	23.80	24.11	23.85
HSUPA	Subtest 1	22.88	23.25	23.15
	Subtest 2	22.76	22.95	22.89
	Subtest 3	22.40	22.57	22.76
	Subtest 4	22.92	23.08	22.92
	Subtest 5	23.50	23.65	23.35

Note: 1) channel /Frequency: 4132/826.4,4182/836.4,4233/846.6

8.1.5 Conducted Power of WiFi 2.4G

The output power of WiFi 2.4G is as following:

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Tune-up	Average Power(dBm)	SAR Test (Yes/No)
802.11b	1	2412	1	9.5	8.88	No
	6	2437		9.5	8.65	No
	11	2462		9.5	8.39	No
802.11g	1	2412	6	9.5	Not Required	No
	6	2437		9.5	Not Required	No
	11	2462		9.5	Not Required	No
802.11n (HT20)	1	2412	6.5	8.5	Not Required	No
	6	2437		8.5	Not Required	No
	11	2462		8.5	Not Required	No

Note: 1) An entry of "Not Required" means power measurement is not required according to the default power measurement procedures in KDB248227D01.

8.1.6 Conducted Power of BT

The output power of BT antenna is as following:

For BT 3.0:

Average Conducted Power(dBm)			
Channel	0CH	39CH	78CH
GFSK	0.60	1.88	2.49
$\pi/4$ DQPSK	1.55	2.60	3.14
8DPSK	1.41	2.46	3.02

Note: 1) channel /Frequency: 0/2402, 39/2441, 78/2480

For BT 4.0:

Average Conducted Power(dBm)			
Channel	0CH	19CH	39CH
BT	0.76	1.86	2.38

Note: 1) channel /Frequency: 0/2402, 19/2440, 39/2480.

8.2 SAR test results

Notes:

1) Per KDB447498 D01v06, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is: ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz. When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel must be used.

2) Per KDB447498 D01v06, All measurement SAR result is scaled-up to account for tune-up tolerance is compliant.

3) Per KDB865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/Kg; if the deviation among the repeated measurement is $\leq 20\%$, and the measured SAR < 1.45 W/Kg, only one repeated measurement is required.

4) Per KDB865664 D02v01r02, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing (Refer to appendix B for details).

5) The Conducted Power of SIM1 was worse than the Conducted Power of SIM2, tested with SIM1 at all the position, then tested with SIM2 at the worst position of SIM1.

8.2.1 Results overview of GSM850

Test Position of Body With 0mm	Test channel /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up power (dBm)	Scaled SAR _{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Back Side	190/836.6	GPRS 2TS	0.482	0.240	-0.140	30.87	31.50	0.557	21.39°C
Left Side	190/836.6	GPRS 2TS	0.036	0.024	0.180	30.87	31.50	0.042	21.39°C
Right Side	190/836.6	GPRS 2TS	0.046	0.027	0.180	30.87	31.50	0.053	21.39°C
Top Side	190/836.6	GPRS 2TS	0.012	0.008	-0.170	30.87	31.50	0.014	21.39°C
Bottom Side	190/836.6	GPRS 2TS	0.258	0.149	0.150	30.87	31.50	0.298	21.39°C
Back Side	251/848.8	GPRS 2TS	0.374	0.187	0.010	30.91	31.50	0.428	21.39°C
Back Side	128/824.2	GPRS 2TS	0.554	0.289	0.100	30.78	31.50	0.654	21.39°C
Tested with SIM2 at the worst position									
Back Side	128/824.2	GPRS 2TS	0.553	0.289	-0.120	30.31	31.50	0.727	21.39°C
Test Position of Head	Test channel /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up power (dBm)	Scaled SAR _{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Left Hand Touched	190/836.6	GSM	0.044	0.035	0.050	33.89	34.50	0.051	21.16°C
Left Hand Tilted 15°	190/836.6	GSM	0.032	0.024	0.040	33.89	34.50	0.037	21.16°C
Right Hand Touched	190/836.6	GSM	0.033	0.027	-0.110	33.89	34.50	0.038	21.16°C
Right Hand Tilted 15°	190/836.6	GSM	0.029	0.023	0.030	33.89	34.50	0.033	21.16°C
Tested with SIM2 at the worst position									
Left Hand Touched	190/836.6	GSM	0.039	0.031	0.140	33.44	34.50	0.050	21.16°C

8.2.2 Results overview of GSM1900

Test Position of Body With 0mm	Test channel /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up power (dBm)	Scaled SAR _{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Back Side	661/1880	GPRS 2TS	0.620	0.354	-0.040	28.41	29.50	0.797	20.9°C
Left Side	661/1880	GPRS 2TS	0.015	0.008	-0.100	28.41	29.50	0.019	20.9°C
Right Side	661/1880	GPRS 2TS	0.115	0.058	0.150	28.41	29.50	0.148	20.9°C
Top Side	661/1880	GPRS 2TS	0.008	0.005	-0.090	28.41	29.50	0.011	20.9°C
Bottom Side	661/1880	GPRS 2TS	0.074	0.041	0.190	28.41	29.50	0.095	20.9°C
Back Side	810/1909.8	GPRS 2TS	0.714	0.398	0.020	28.30	29.50	0.941	20.9°C
Back Side	512/1850.2	GPRS 2TS	0.557	0.307	-0.120	28.42	29.50	0.714	20.9°C
Tested with SIM2 at the worst position									
Back Side	810/1909.8	GPRS 2TS	0.663	0.360	-0.110	28.30	29.50	0.874	20.9°C
Test Position of Head	Test channel /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up power (dBm)	Scaled SAR _{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Left Hand Touched	661/1880	GSM	0.052	0.035	0.040	31.43	32.50	0.067	20.63°C
Left Hand Tilted 15°	661/1880	GSM	0.035	0.023	-0.180	31.43	32.50	0.045	20.63°C
Right Hand Touched	661/1880	GSM	0.098	0.063	-0.020	31.43	32.50	0.125	20.63°C
Right Hand Tilted 15°	661/1880	GSM	0.018	0.011	-0.060	31.43	32.50	0.023	20.63°C
Tested with SIM2 at the worst position									
Right Hand Touched	661/1880	GSM	0.097	0.063	0.110	31.42	32.50	0.124	20.63°C

8.2.3 Results overview of UMTS Band V

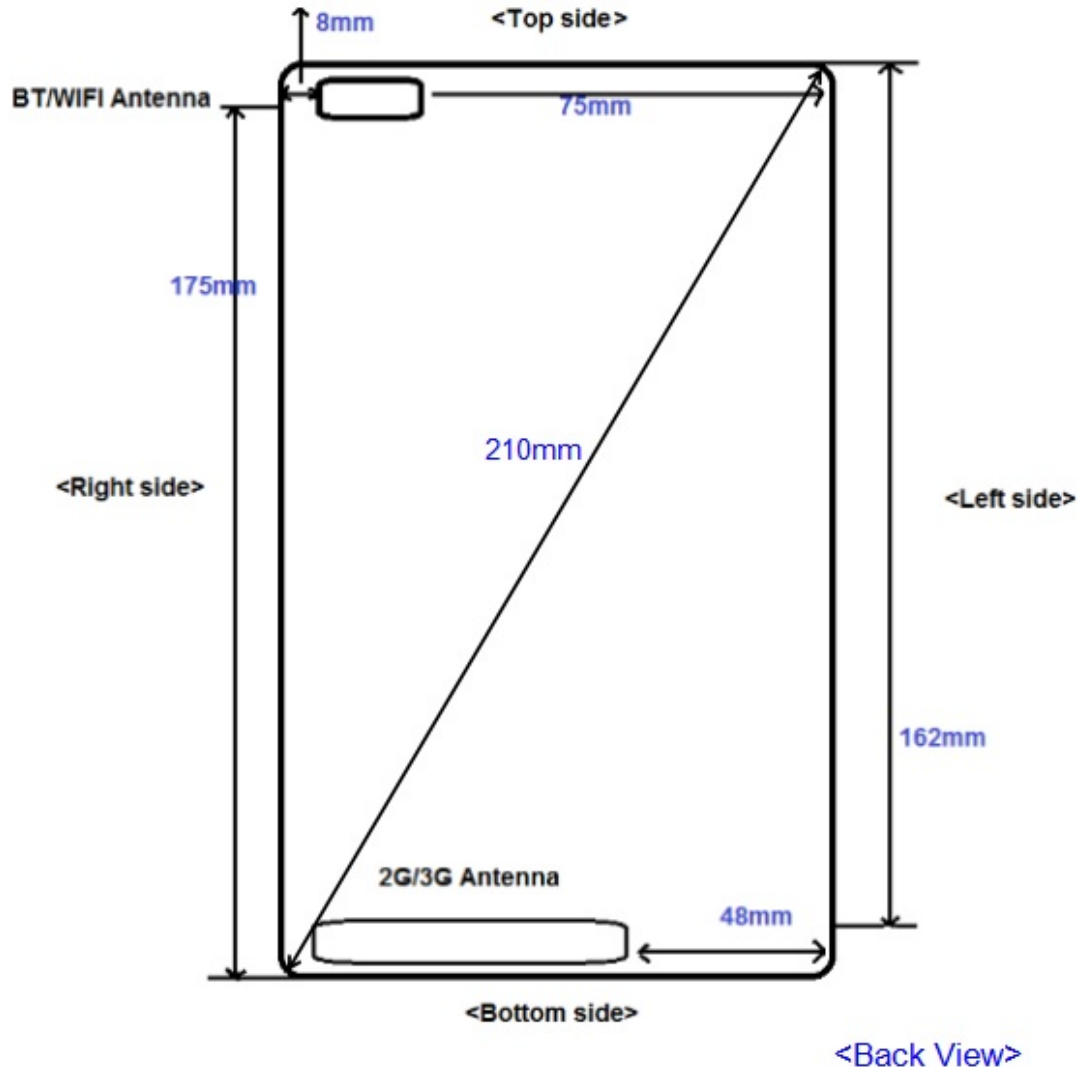
Test Position of Body With 0mm	Test channel /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up power (dBm)	Scaled SAR _{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Back Side	4182/836.4	RMC	0.473	0.237	0.150	24.23	25.50	0.634	21.39°C
Left Side	4182/836.4	RMC	0.029	0.019	-0.110	24.23	25.50	0.039	21.39°C
Right Side	4182/836.4	RMC	0.037	0.022	0.040	24.23	25.50	0.050	21.39°C
Top Side	4182/836.4	RMC	0.012	0.008	-0.010	24.23	25.50	0.016	21.39°C
Bottom Side	4182/836.4	RMC	0.240	0.138	0.090	24.23	25.50	0.322	21.39°C
Back Side	4233/846.6	RMC	0.359	0.181	0.140	24.19	25.50	0.485	21.39°C
Back Side	4132/826.4	RMC	0.348	0.174	0.140	24.20	25.50	0.469	21.39°C
Tested with SIM2 at the worst position									
Back Side	4182/836.4	RMC	0.347	0.173	0.190	24.15	25.50	0.474	21.39°C
Test Position of Head	Test channel /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up power (dBm)	Scaled SAR _{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Left Hand Touched	4182/836.4	RMC	0.039	0.031	0.150	24.23	25.50	0.052	21.16°C
Left Hand Tilted 15°	4182/836.4	RMC	0.027	0.020	0.170	24.23	25.50	0.036	21.16°C
Right Hand Touched	4182/836.4	RMC	0.026	0.022	-0.010	24.23	25.50	0.035	21.16°C
Right Hand Tilted 15°	4182/836.4	RMC	0.023	0.019	0.180	24.23	25.50	0.031	21.16°C
Tested with SIM2 at the worst position									
Left Hand Touched	4182/836.4	RMC	0.031	0.024	-0.060	24.15	25.50	0.042	21.16°C

8.2.4 Results overview of UMTS Band II

Test Position of Body With 0mm	Test channel /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up power (dBm)	Scaled SAR _{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Back Side	9400/1880	RMC	0.539	0.298	-0.120	24.80	25.50	0.633	20.9°C
Left Side	9400/1880	RMC	0.012	0.007	-0.180	24.80	25.50	0.014	20.9°C
Right Side	9400/1880	RMC	0.101	0.051	0.020	24.80	25.50	0.119	20.9°C
Top Side	9400/1880	RMC	0.007	0.004	-0.030	24.80	25.50	0.009	20.9°C
Bottom Side	9400/1880	RMC	0.077	0.042	-0.110	24.80	25.50	0.090	20.9°C
Back Side	9538/1907.6	RMC	0.623	0.345	0.170	25.00	25.50	0.699	20.9°C
Back Side	9262/1852.4	RMC	0.536	0.291	0.070	24.69	25.50	0.646	20.9°C
Tested with SIM2 at the worst position									
Back Side	9538/1907.6	RMC	0.618	0.343	0.090	24.94	25.50	0.703	20.9°C
Test Position of Head	Test channel /Freq.(MHz)	Test Mode	SAR Value (W/kg)		Power Drift (dB)	Conducted Power (dBm)	Tune-up power (dBm)	Scaled SAR _{1-g} (W/kg)	Liquid Temp.
			1-g	10-g					
Left Hand Touched	9400/1880	RMC	0.095	0.064	-0.020	24.80	25.50	0.112	20.63°C
Left Hand Tilted 15°	9400/1880	RMC	0.069	0.045	0.100	24.80	25.50	0.081	20.63°C
Right Hand Touched	9400/1880	RMC	0.181	0.118	-0.030	24.80	25.50	0.213	20.63°C
Right Hand Tilted 15°	9400/1880	RMC	0.061	0.039	0.060	24.80	25.50	0.072	20.63°C
Tested with SIM2 at the worst position									
Right Hand Touched	9400/1880	RMC	0.177	0.115	0.070	24.73	25.50	0.211	20.63°C

8.3 Multiple Transmitter Information

The location of the antennas inside S7 is shown as below picture:



Note:

1) Per KDB 616217, because the diagonal Length is $> 200\text{mm}$, it is considered a "tablet" device and need to test 0mm 1g Body SAR.

2) The device has telephone receiver, so additional Head SAR testing is also considered per KDB616217D04 and KDB648474D04.

8.4 Stand-alone SAR

Per FCC KDB 447498D01:

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

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [f(\text{GHz})] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where}$$

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

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

- 2) At 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following:

a) $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{test separation distance} - 50 \text{ mm}) \cdot (f(\text{MHz})/150)]\}$ mW, at 100 MHz to 1500 MHz

b) $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{test separation distance} - 50 \text{ mm}) \cdot 10]\}$ mW at > 1500 MHz and ≤ 6 GHz

(Antennas < 50 mm to adjacent sides)

Band	Exposure Condition	f(GHz)	Pmax		Seperation Distance(mm)					Calculated Value					SAR Test (Yes or No)				
			dBm	mW	Back Side	Left Side	Right Side	Top Side	Bottom Side	Back Side	Left Side	Right Side	Top Side	Bottom Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
GSM850	Body 0mm	0.850	34.5	2818.38	5.0	48.0	5.0	162.0	5.0	519.68	54.13	519.68	>50mm	519.68	Yes	Yes	Yes	>50mm	Yes
GSM1900	Body 0mm	1.900	32.5	1778.28	5.0	48.0	5.0	162.0	5.0	490.24	51.07	490.24	>50mm	490.24	Yes	Yes	Yes	>50mm	Yes
UMTS B5	Body 0mm	0.850	25.5	354.81	5.0	48.0	5.0	162.0	5.0	65.42	6.82	65.42	>50mm	65.42	Yes	Yes	Yes	>50mm	Yes
UMTS B2	Body 0mm	1.900	25.5	354.81	5.0	48.0	5.0	162.0	5.0	97.82	10.19	97.82	>50mm	97.82	Yes	Yes	Yes	>50mm	Yes
WiFi 2.4G	Body 0mm	2.450	9.5	8.91	5.0	75.0	8.0	5.0	175.0	2.79	>50mm	1.74	2.79	>50mm	NO	>50mm	NO	NO	>50mm
BT	Body 0mm	2.450	4	2.51	5.0	75.0	8.0	5.0	175.0	0.79	>50mm	0.49	0.79	>50mm	NO	>50mm	NO	NO	>50mm

(Antennas > 50 mm to adjacent sides)

Band	Exposure Condition	f(GHz)	Pmax		Seperation Distance(mm)					Calculated Value					SAR Test (Yes or No)				
			dBm	mW	Back Side	Left Side	Right Side	Top Side	Bottom Side	Back Side	Left Side	Right Side	Top Side	Bottom Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
GSM850	Body 0mm	0.850	34.5	2818.38	5.0	48.0	5.0	162.0	5.0	<50mm	<50mm	<50mm	798.67	<50mm	<50mm	<50mm	<50mm	Yes	<50mm
GSM1900	Body 0mm	1.900	32.5	1778.28	5.0	48.0	5.0	162.0	5.0	<50mm	<50mm	<50mm	1229.00	<50mm	<50mm	<50mm	<50mm	Yes	<50mm
UMTS B5	Body 0mm	0.850	25.5	354.81	5.0	48.0	5.0	162.0	5.0	<50mm	<50mm	<50mm	798.67	<50mm	<50mm	<50mm	<50mm	Yes	<50mm
UMTS B2	Body 0mm	1.900	25.5	354.81	5.0	48.0	5.0	162.0	5.0	<50mm	<50mm	<50mm	1229.00	<50mm	<50mm	<50mm	<50mm	Yes	<50mm
WiFi 2.4G	Body 0mm	2.450	9.5	8.91	5.0	75.0	8.0	5.0	175.0	<50mm	346.00	<50mm	<50mm	1346.00	<50mm	NO	<50mm	<50mm	NO
BT	Body 0mm	2.450	4	2.51	5.0	75.0	8.0	5.0	175.0	<50mm	346.00	<50mm	<50mm	1346.00	<50mm	NO	<50mm	<50mm	NO

- 3) When the standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion:

(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[$\sqrt{f(\text{GHz})/x}$] W/kg for test separation distances ≤ 50 mm, where $x = 7.5$ for 1-g SAR.

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

Mode	Position	Pmax(dBm)	Pmax(mW)	Distance(mm)	f(GHz)	X	Estimated SAR(W/Kg)
BT	Body 0mm	4	2.51	5.00	2.45	7.50	0.105
WIFI	Body 0mm	9.5	8.91	5.00	2.45	7.50	0.372
BT	Head 0mm	4	2.51	5.00	2.45	7.50	0.105
WIFI	Head 0mm	9.5	8.91	5.00	2.45	7.50	0.372

Note: 1) maximum possible output power (including tune-up tolerance) declared by manufacturer

- 4) When the minimum test separation distance is > 50 mm, the estimated SAR value is 0.4 W/kg.

For conditions where the estimated SAR is overly conservative for certain conditions, the test lab may choose to perform standalone SAR measurements and use the measured SAR to determine simultaneous transmission SAR test exclusion.

Band	Exposure Condition	f(GHz)	Pmax	Pmax	Seperation Distance(mm)					Estimated 1-g SARvalue (W/kg)				
			dBm	mW	Back Side	Left Side	Right Side	Top Side	Bottom Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
GSM850	Body 0mm	0.850	34.5	2818.38	5.0	48.0	5.0	162.0	5.0	Measure	Measure	Measure	Measure	Measure
GSM1900	Body 0mm	1.900	32.5	1778.28	5.0	48.0	5.0	162.0	5.0	Measure	Measure	Measure	Measure	Measure
UIMTS B5	Body 0mm	0.850	25.5	354.81	5.0	48.0	5.0	162.0	5.0	Measure	Measure	Measure	Measure	Measure
UIMTS B2	Body 0mm	1.900	25.5	354.81	5.0	48.0	5.0	162.0	5.0	Measure	Measure	Measure	Measure	Measure
WiFi 2.4G	Body 0mm	2.450	9.5	8.91	5.0	75.0	8.0	5.0	175.0	0.372	0.400	0.372	0.372	0.400
BT	Body 0mm	2.450	4	2.51	5.0	75.0	8.0	5.0	175.0	0.105	0.400	0.105	0.105	0.400

Note: maximum possible output power (including tune-up tolerance) declared by manufacturer

8.5 Simultaneous Transmission Possibilities

The Simultaneous Transmission Possibilities of this device are as below:

Simultaneous Tx Combination	Configuration	Head	Body
1	GSM/GPRS + WiFi 2.4G	YES	YES
2	GSM/GPRS + BT	YES	YES
3	UMTS + WiFi 2.4G	YES	YES
4	UMTS + BT	YES	YES

Note: The device does not support simultaneous BT and WiFi 2.4G, because the BT and WiFi 2.4G share the same antenna and can't transmit simultaneously.

8.6 SAR Summation Scenario

Test Position		2G/3G Antenna SAR _{max}				WIFI/BT Antenna SAR _{max}		Σ1-g SAR	SPLSR
		GSM850	GSM1900	UMTS Band V	UMTS Band II	WIFI 2.4G	BT		
Head	Left Touched	0.051	0.067	0.052	0.112	0.400	0.400	0.512	NO
	Left Tilted 15°	0.037	0.045	0.036	0.081	0.400	0.400	0.481	NO
	Right Touched	0.038	0.125	0.035	0.213	0.400	0.400	0.613	NO
	Right Tilted 15°	0.033	0.023	0.031	0.072	0.400	0.400	0.472	NO
Body 0mm	Back Side	0.727	0.941	0.634	0.703	0.372	0.105	1.313	NO
	Left Side	0.042	0.019	0.039	0.014	0.400	0.400	0.442	NO
	Right Side	0.053	0.148	0.050	0.119	0.372	0.105	0.520	NO
	Top Side	0.014	0.011	0.016	0.009	0.372	0.105	0.388	NO
	Bottom Side	0.298	0.095	0.322	0.090	0.400	0.400	0.722	NO

Note: Simultaneous Tx Combination of 2G/3G antenna and 2.4G WiFi/BT.

8.7 Simultaneous Transmission Conclusion

The above numeral summed SAR results is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore simultaneous transmission SAR with Volume Scans is not required per KDB 447498 D01v06

Annex A: Appendix A: SAR System performance Check Plots

(Please See Appendix A)

Annex B: Appendix B: SAR Measurement results Plots

(Please See Appendix B)

Annex C: Appendix C: Calibration reports

(Please See Appendix C)

Annex D: Appendix D: Photo documentation

(Please See Appendix D)

——END OF REPORT——

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CTI, this report can't be reproduced except in full.

Appendix A:SAR System performance Check Plots
Table of contents
System Performance Check-D835-Head
System Performance Check-D1900-Head
System Performance Check-D835-Body
System Performance Check-D1900-Body

Test Laboratory: CTI SAR Lab

Systemcheck 835-Head**DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:4d193**

Communication System: UID 0, CW (0); Communication System Band: D835(835.0 MHz); Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835$ MHz; $\sigma = 0.915$ S/m; $\epsilon_r = 40.136$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(10.17, 10.17, 10.17); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: Twin SAM V5.0; Type: QD000P40CD; Serial: 1875
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/d=15mm,Pin=25mW/Area Scan (8x12x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 2.82 W/kg

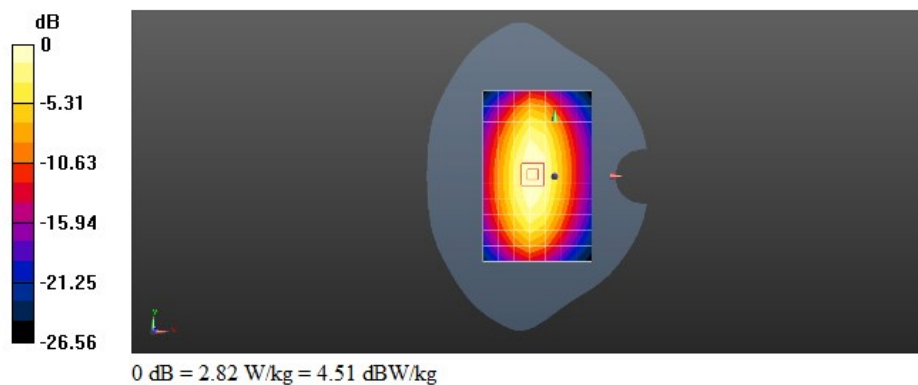
Configuration/d=15mm,Pin=25mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 51.14 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.48 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.55 W/kg

Maximum value of SAR (measured) = 2.99 W/kg



Test Laboratory: CTI SAR Lab

Systemcheck-835-Body

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:4d193

Communication System: UID 0, CW (0); Communication System Band: D835(835.0 MHz); Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835$ MHz; $\sigma = 0.967$ S/m; $\epsilon_r = 54.119$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(9.67, 9.67, 9.67); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: 2024
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/d=15mm,Pin=25mW/Area Scan (8x12x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 2.56 W/kg

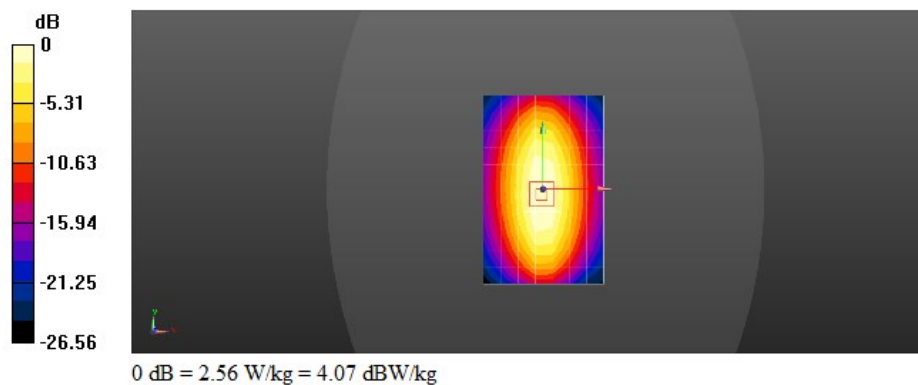
Configuration/d=15mm,Pin=25mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 52.87 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 3.40 W/kg

SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.56 W/kg

Maximum value of SAR (measured) = 2.94 W/kg



Test Laboratory: CTI SAR Lab

Systemcheck 1900-Head**DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:5d198**

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.384$ S/m; $\epsilon_r = 39.034$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(8.16, 8.16, 8.16); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: Twin SAM V5.0; Type: QD000P40CD; Serial: 1875
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/d=10mm,Pin=25mW/Area Scan (8x8x1); Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 9.16 W/kg

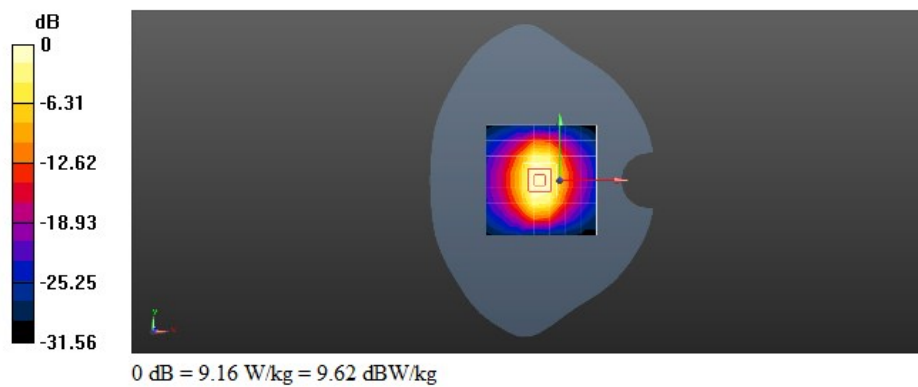
Configuration/d=10mm,Pin=25mW/Zoom Scan (5x5x7)/Cube 0; Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 84.30 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 17.1 W/kg

SAR(1 g) = 9.53 W/kg; SAR(10 g) = 5 W/kg

Maximum value of SAR (measured) = 13.6 W/kg



Test Laboratory: CTI SAR Lab

Systemcheck 1900-Body**DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:5d198**

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.513$ S/m; $\epsilon_r = 51.365$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(7.8, 7.8, 7.8); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: 2024
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/d=10mm,Pin=25mW/Area Scan (8x8x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 10.6 W/kg

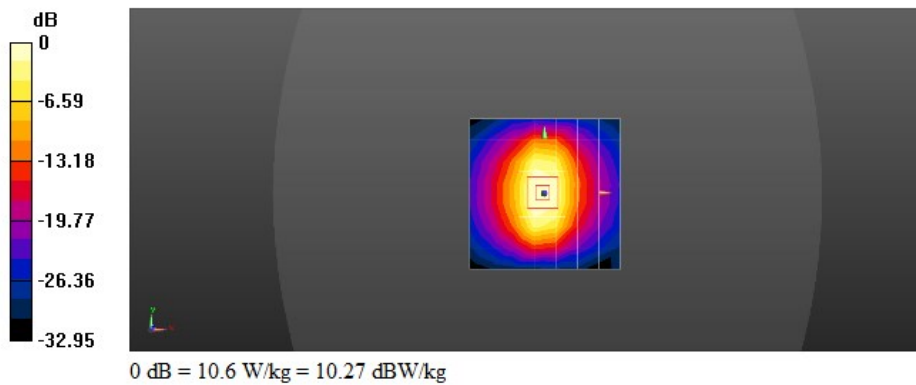
Configuration/d=10mm,Pin=25mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 88.09 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 18.7 W/kg

SAR(1 g) = 10.6 W/kg; SAR(10 g) = 5.64 W/kg

Maximum value of SAR (measured) = 15.1 W/kg



Appendix B:SAR Measurement results Plots

Table of contents
GSM850-Head
GSM850-Body
GSM1900-Head
GSM1900-Body
UMTS Band V-Head
UMTS Band V-Body
UMTS Band II-Head
UMTS Band II-Body

Test Laboratory: CTI SAR Lab

S7 GSM850 190CH Left Hand Touch Cheek

DUT: 7" Tablet PC; Type: S7; Serial: NA

Communication System: UID 0, Generic GSM (0); Communication System Band: GSM 850 (824.0 - 849.0 MHz); Frequency: 836.6 MHz; Duty Cycle: 1:8.30042

Medium parameters used: $f = 837$ MHz; $\sigma = 0.917$ S/m; $\epsilon_r = 40.161$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(10.17, 10.17, 10.17); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: Twin SAM V5.0; Type: QD000P40CD; Serial: 1875
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Head/Area Scan (10x15x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.0479 W/kg

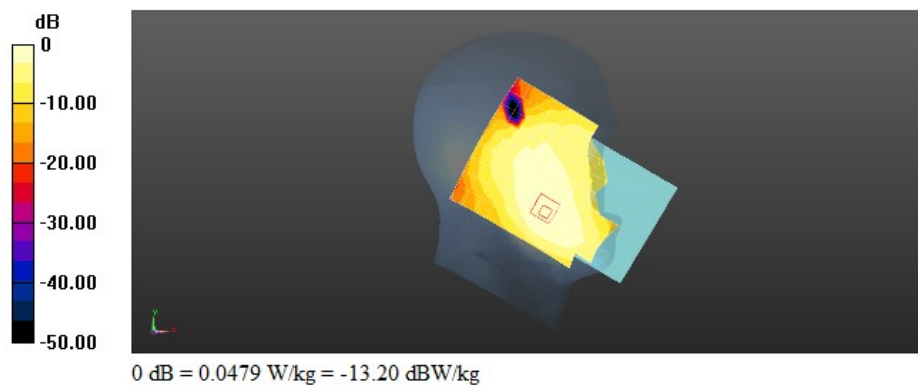
Configuration/Head/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 2.787 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.0540 W/kg

SAR(1 g) = 0.044 W/kg; SAR(10 g) = 0.035 W/kg

Maximum value of SAR (measured) = 0.0495 W/kg



Test Laboratory: CTI SAR Lab

S7 GSM850 GPRS 2TS 128CH Back Side with SIM2 0mm

DUT: 7" Tablet PC; Type: S7; Serial: NA

Communication System: UID 0, GPRS 2TS (0); Communication System Band: GSM850 GPRS 2TS; Frequency: 824.2 MHz; Duty Cycle: 1:4.10015

Medium parameters used (interpolated): $f = 824.2$ MHz; $\sigma = 0.96$ S/m; $\epsilon_r = 54.148$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(9.67, 9.67, 9.67); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: 2024
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (10x15x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.716 W/kg

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

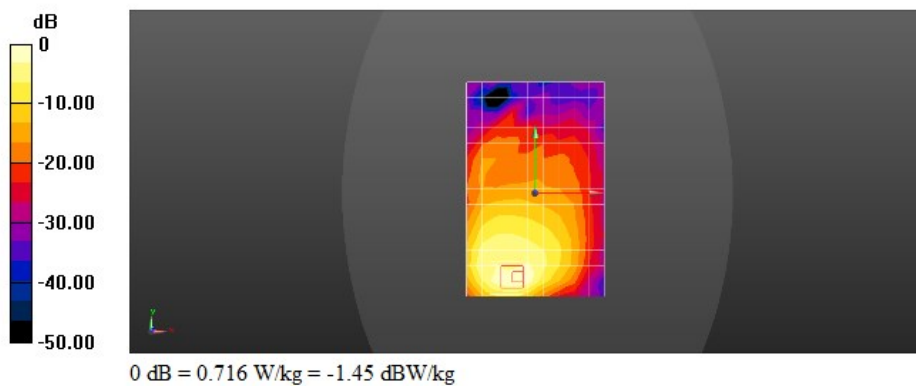
Reference Value = 4.836 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 1.30 W/kg

SAR(1 g) = 0.553 W/kg; SAR(10 g) = 0.289 W/kg

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.833 W/kg



Test Laboratory: CTI SAR Lab

S7 GSM1900 661CH Right Hand Touch Cheek

DUT: 7" Tablet PC; Type: S7; Serial: NA

Communication System: UID 0, Generic GSM (0); Communication System Band: PCS 1900 (1850.0 - 1910.0 MHz); Frequency: 1880 MHz; Duty Cycle: 1:8.30042

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.366$ S/m; $\epsilon_r = 39.134$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(8.16, 8.16, 8.16); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: Twin SAM V5.0; Type: QD000P40CD; Serial: 1875
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Head/Area Scan (10x15x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.109 W/kg

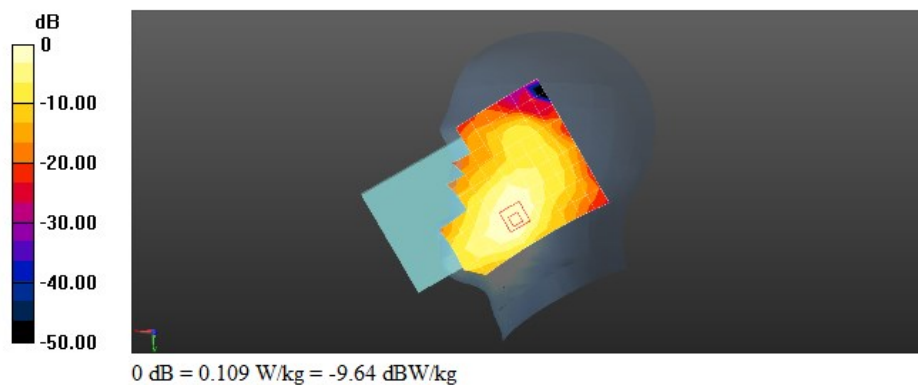
Configuration/Head/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 1.982 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 0.135 W/kg

SAR(1 g) = 0.098 W/kg; SAR(10 g) = 0.063 W/kg

Maximum value of SAR (measured) = 0.119 W/kg



Test Laboratory: CTI SAR Lab

S7 GSM1900 GPRS 2TS 810CH Back Side 0mm

DUT: 7" Tablet PC; Type: S7; Serial: NA

Communication System: UID 0, GPRS 2TS (0); Communication System Band: GSM1900 GPRS 2TS; Frequency: 1909.8 MHz; Duty Cycle: 1:4.10015

Medium parameters used: $f = 1910$ MHz; $\sigma = 1.516$ S/m; $\epsilon_r = 51.324$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(7.8, 7.8, 7.8); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: 2024
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (10x15x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 1.12 W/kg

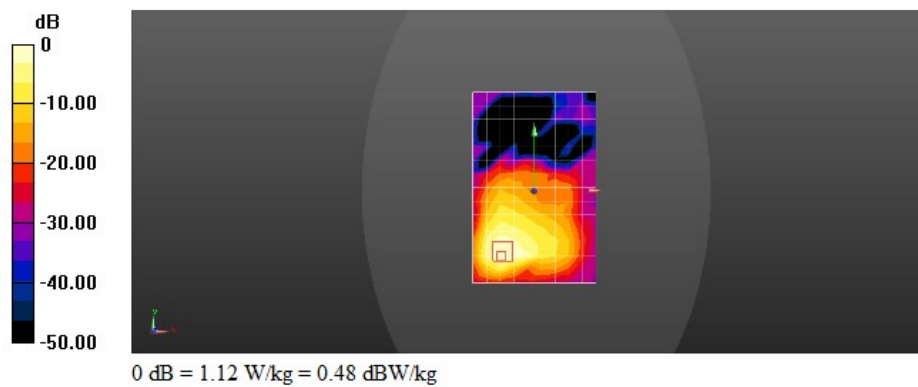
Configuration/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 3.299 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.68 W/kg

SAR(1 g) = 0.714 W/kg; SAR(10 g) = 0.398 W/kg

Maximum value of SAR (measured) = 1.14 W/kg



Test Laboratory: CTI SAR Lab

S7 UMTS Band V 4182CH Left Hand Touch Cheek

DUT: 7" Tablet PC; Type: S7; Serial: NA

Communication System: UID 0, UMTS-FDD(WCDMA) (0); Communication System Band: Band V; Frequency: 836.4 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.917$ S/m; $\epsilon_r = 40.198$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(10.17, 10.17, 10.17); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: Twin SAM V5.0; Type: QD000P40CD; Serial: 1875
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Head/Area Scan (10x15x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.0429 W/kg

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

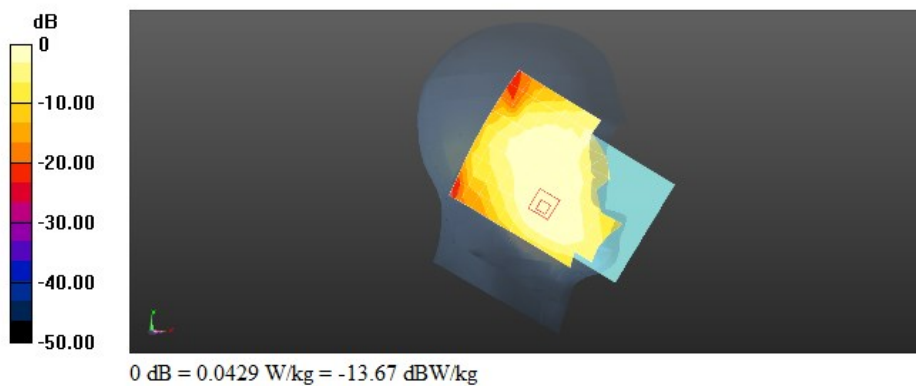
Reference Value = 3.019 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.0460 W/kg

SAR(1 g) = 0.039 W/kg; SAR(10 g) = 0.031 W/kg

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.0426 W/kg



Test Laboratory: CTI SAR Lab

S7 UMTS Band V 4182CH Back Side 0mm

DUT: 7" Tablet PC; Type: S7; Serial: NA

Communication System: UID 0, UMTS-FDD(WCDMA) (0); Communication System Band: Band V; Frequency: 836.4 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 836.4$ MHz; $\sigma = 0.968$ S/m; $\epsilon_r = 54.098$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(9.67, 9.67, 9.67); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: 2024
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (10x15x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.716 W/kg

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

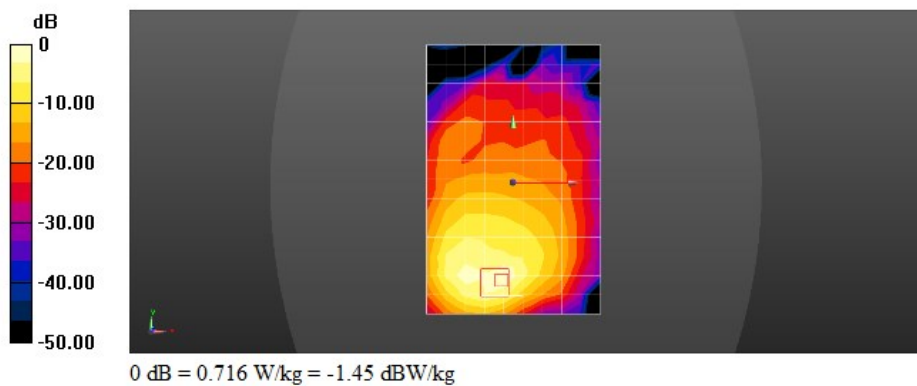
Reference Value = 4.540 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 1.20 W/kg

SAR(1 g) = 0.473 W/kg; SAR(10 g) = 0.237 W/kg

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.675 W/kg



Test Laboratory: CTI SAR Lab

S7 UMTS Band II 9400CH Right Hand Touch Cheek

DUT: 7" Tablet PC; Type: S7; Serial: NA

Communication System: UID 0, UMTS-FDD(WCDMA) (0); Communication System Band: Band II; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.366$ S/m; $\epsilon_r = 39.134$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(8.16, 8.16, 8.16); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: Twin SAM V5.0; Type: QD000P40CD; Serial: 1875
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Head/Area Scan (10x15x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.204 W/kg

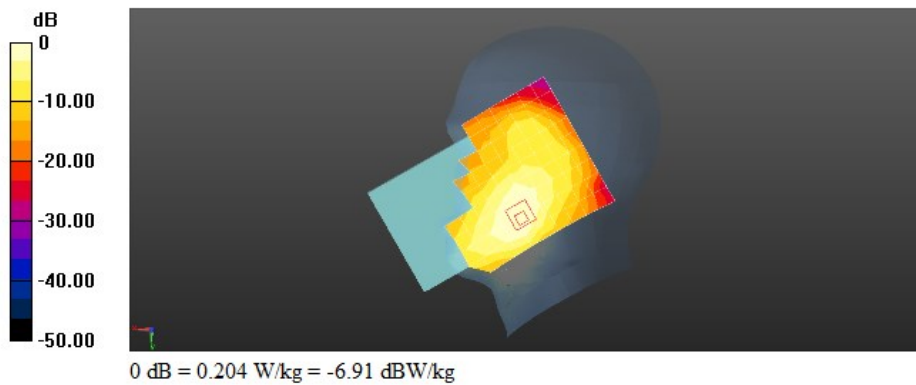
Configuration/Head/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 3.382 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.249 W/kg

SAR(1 g) = 0.181 W/kg; SAR(10 g) = 0.118 W/kg

Maximum value of SAR (measured) = 0.216 W/kg



Test Laboratory: CTI SAR Lab

S7 UMTS Band II 9538CH Back Side 0mm

DUT: 7" Tablet PC; Type: S7; Serial: NA

Communication System: UID 0, UMTS-FDD(WCDMA) (0); Communication System Band: Band II; Frequency: 1907.6 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1908$ MHz; $\sigma = 1.512$ S/m; $\epsilon_r = 51.291$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY Configuration:

- Probe: EX3DV4 - SN7328; ConvF(7.8, 7.8, 7.8); Calibrated: 2/19/2016;
- Sensor-Surface: 2mm (Mechanical Surface Detection), $z = 1.0, 31.0$
- Electronics: DAE4 Sn1458; Calibrated: 2/26/2016
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: 2024
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (10x15x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

Maximum value of SAR (measured) = 0.821 W/kg

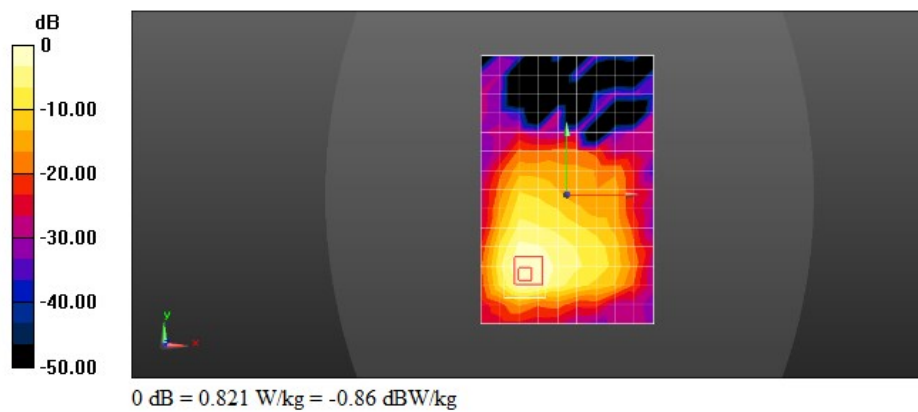
Configuration/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 4.442 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 1.31 W/kg

SAR(1 g) = 0.623 W/kg; SAR(10 g) = 0.345 W/kg

Maximum value of SAR (measured) = 0.923 W/kg



Report Number:EED32I00225105

Appendix C: Calibration reports

Table of contents
Probe EX3DV4 SN:7328
DAE4 SN:1458
Dipole D835V2 SN:4d193
Dipole D1900V2 SN:5d198



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 0108**

The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Client **CTI cert (Auden)**

Certificate No: **EX3-7328_Feb16**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7328**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6**
Calibration procedure for dosimetric E-field probes

Calibration date: **February 19, 2016**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
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-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

Calibrated by:	Name	Function	Signature
	Claudio Leubler	Laboratory Technician	
Approved by:	Name	Function	Signature
	Katja Pokovic	Technical Manager	
			Issued: February 20, 2016

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Accreditation No.: **SCS 0108**

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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., $\vartheta = 0$ 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:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,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 $f \leq 800$ 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 NORM_{x,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.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe EX3DV4

SN:7328

Manufactured: December 11, 2014
Calibrated: February 19, 2016

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7328

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.40	0.43	0.47	$\pm 10.1 \%$
DCP (mV) ^B	103.6	97.6	98.5	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	172.3	$\pm 3.3 \%$
		Y	0.0	0.0	1.0		198.6	
		Z	0.0	0.0	1.0		182.2	

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 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:7328

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)	Unc (k=2)
835	41.5	0.90	10.17	10.17	10.17	0.38	1.04	± 12.0 %
1750	40.1	1.37	8.52	8.52	8.52	0.46	0.80	± 12.0 %
1900	40.0	1.40	8.16	8.16	8.16	0.44	0.84	± 12.0 %
2000	40.0	1.40	8.19	8.19	8.19	0.43	0.80	± 12.0 %
2450	39.2	1.80	7.39	7.39	7.39	0.38	0.88	± 12.0 %
2600	39.0	1.96	7.23	7.23	7.23	0.50	0.80	± 12.0 %
5200	36.0	4.66	5.22	5.22	5.22	0.40	1.80	± 13.1 %
5300	35.9	4.76	5.02	5.02	5.02	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.61	4.61	4.61	0.45	1.80	± 13.1 %
5600	35.5	5.07	4.29	4.29	4.29	0.50	1.80	± 13.1 %
5800	35.3	5.27	4.39	4.39	4.39	0.50	1.80	± 13.1 %

^C Frequency validity above 300 MHz 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. 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 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.

^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 frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7328

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)	Unc (k=2)
835	55.2	0.97	9.67	9.67	9.67	0.31	1.19	± 12.0 %
1750	53.4	1.49	8.10	8.10	8.10	0.49	0.80	± 12.0 %
1900	53.3	1.52	7.80	7.80	7.80	0.43	0.80	± 12.0 %
2000	53.3	1.52	7.92	7.92	7.92	0.43	0.82	± 12.0 %
2450	52.7	1.95	7.45	7.45	7.45	0.41	0.86	± 12.0 %
2600	52.5	2.16	7.13	7.13	7.13	0.32	0.95	± 12.0 %
5200	49.0	5.30	4.38	4.38	4.38	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.22	4.22	4.22	0.50	1.90	± 13.1 %
5500	48.6	5.65	3.77	3.77	3.77	0.55	1.90	± 13.1 %
5600	48.5	5.77	3.54	3.54	3.54	0.60	1.90	± 13.1 %
5800	48.2	6.00	3.72	3.72	3.72	0.60	1.90	± 13.1 %

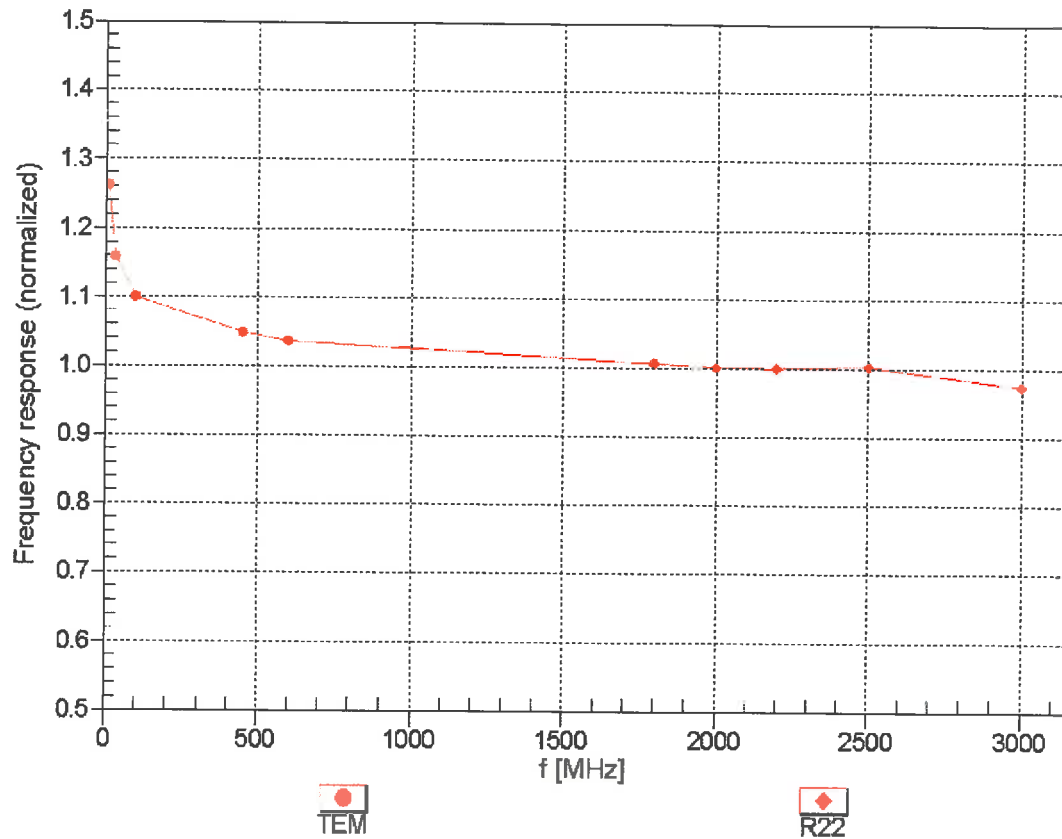
^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 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 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.

^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 frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

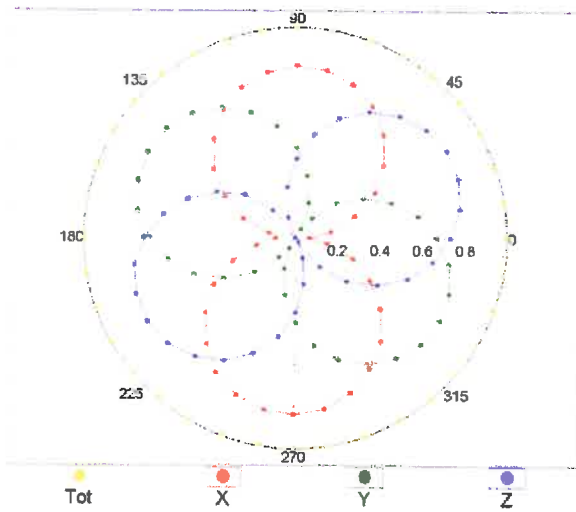
(TEM-Cell:ifi110 EXX, Waveguide: R22)



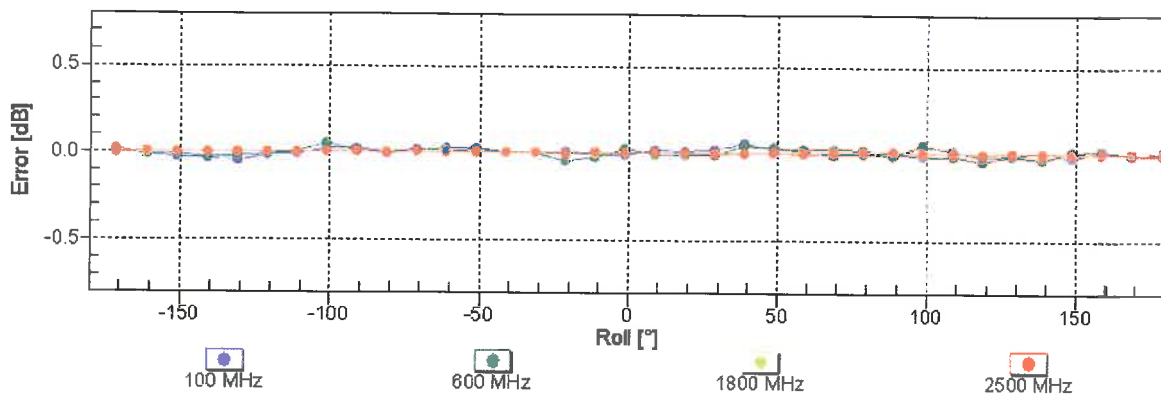
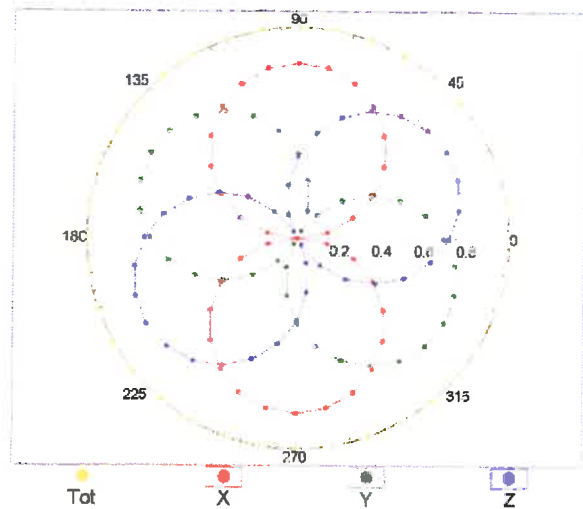
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$

f=600 MHz,TEM

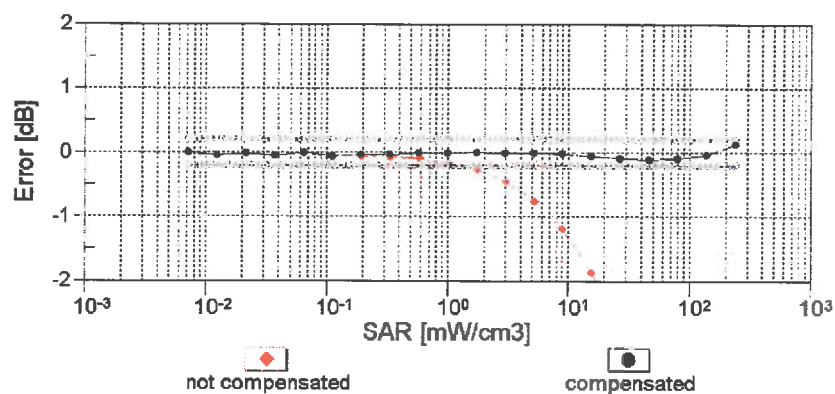
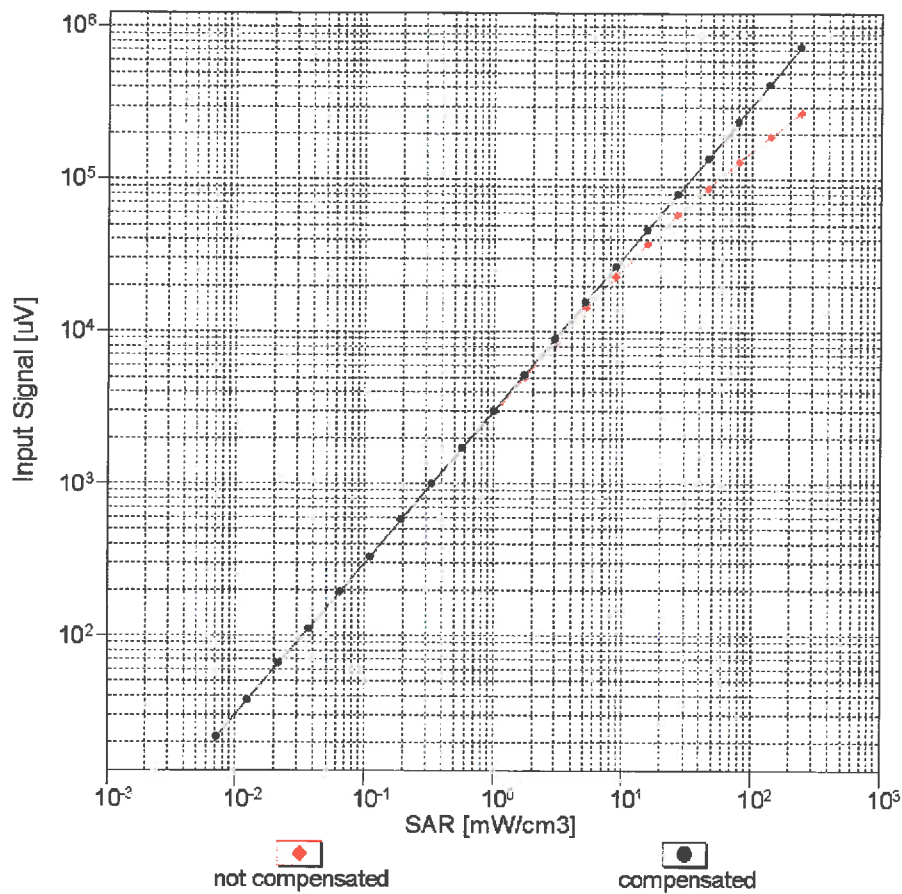


f=1800 MHz,R22



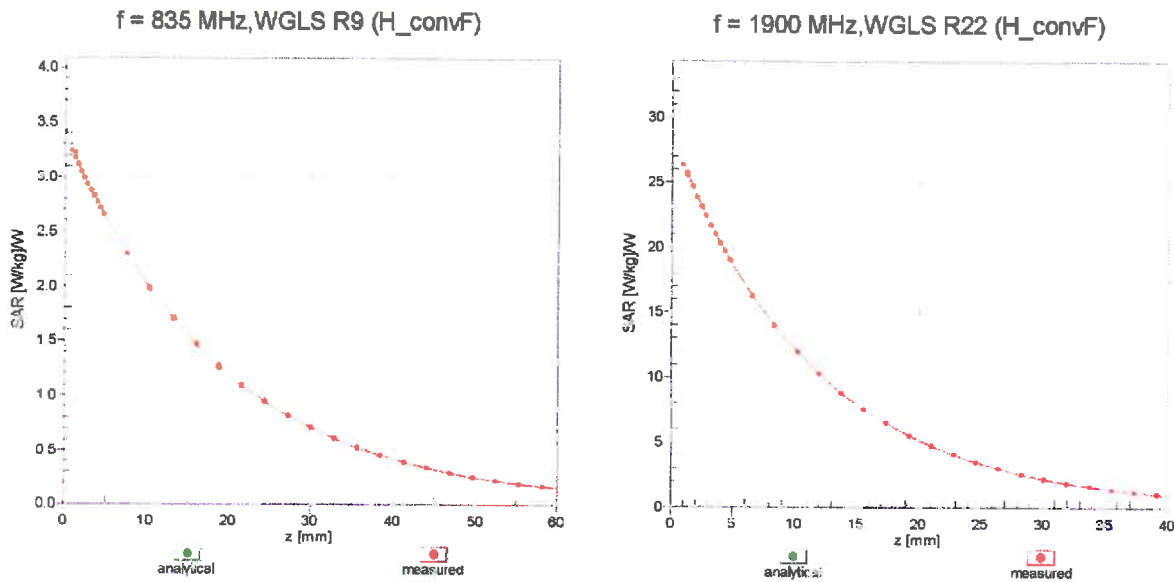
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f_{\text{eval}} = 1900 \text{ MHz}$)

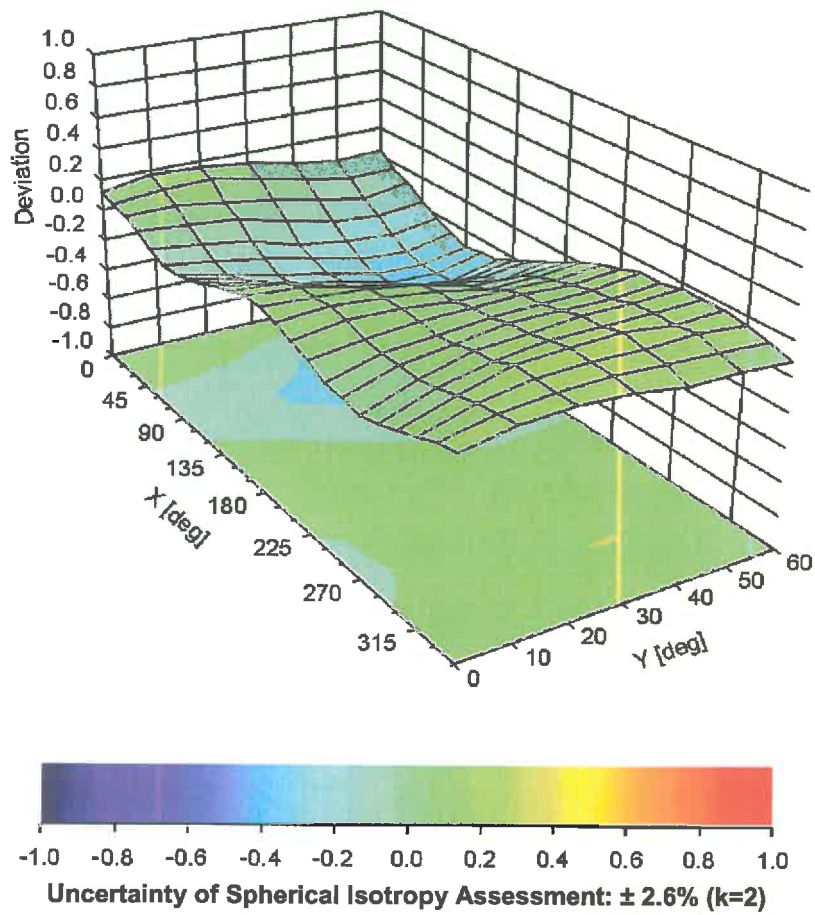


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, ϑ), $f = 900 \text{ MHz}$



DASY/EASY - Parameters of Probe: EX3DV4 - SN:7328

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	118.7
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	1.4 mm

1458

IMPORTANT NOTICE

USAGE OF THE DAE 4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:

Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:

Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:

To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.



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Accreditation No.: **SCS 0108**

Client **CTI cert (Auden)**

Certificate No: **DAE4-1458_Feb16**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 1458**

Calibration procedure(s) **QA CAL-06.v29**
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: **February 26, 2016**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	09-Sep-15 (No:17153)	Sep-16
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	05-Jan-16 (in house check)	In house check: Jan-17
Calibrator Box V2.1	SE UMS 006 AA 1002	05-Jan-16 (in house check)	In house check: Jan-17

Calibrated by:	Name R. Mayoraz	Function Technician	Signature
Approved by:	Fin Bomholt	Deputy Technical Manager	

Issued: February 26, 2016

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Glossary

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

Methods Applied and Interpretation of Parameters

- **DC Voltage Measurement:** Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- **Connector angle:** The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - **DC Voltage Measurement Linearity:** Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - **Common mode sensitivity:** Influence of a positive or negative common mode voltage on the differential measurement.
 - **Channel separation:** Influence of a voltage on the neighbor channels not subject to an input voltage.
 - **AD Converter Values with inputs shorted:** Values on the internal AD converter corresponding to zero input voltage
 - **Input Offset Measurement:** Output voltage and statistical results over a large number of zero voltage measurements.
 - **Input Offset Current:** Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - **Input resistance:** Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - **Low Battery Alarm Voltage:** Typical value for information. Below this voltage, a battery alarm signal is generated.
 - **Power consumption:** Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V , full range = -100...+300 mV

Low Range: 1LSB = 61 nV , full range = -1.....+3mV

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

Calibration Factors	X	Y	Z
High Range	404.357 $\pm$ 0.02% (k=2)	404.348 $\pm$ 0.02% (k=2)	404.579 $\pm$ 0.02% (k=2)
Low Range	3.99060 $\pm$ 1.50% (k=2)	3.95834 $\pm$ 1.50% (k=2)	3.96178 $\pm$ 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	334.0 ° $\pm$ 1 °
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Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	200029.05	-2.61	-0.00
Channel X + Input	20002.74	-1.16	-0.01
Channel X - Input	-20003.37	1.85	-0.01
Channel Y + Input	200037.70	0.70	0.00
Channel Y + Input	20003.11	-0.75	-0.00
Channel Y - Input	-20007.07	-1.69	0.01
Channel Z + Input	200029.13	-7.99	-0.00
Channel Z + Input	20002.60	-1.22	-0.01
Channel Z - Input	-20007.23	-1.82	0.01

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2000.10	-0.38	-0.02
Channel X + Input	200.81	0.25	0.13
Channel X - Input	-198.85	0.63	-0.32
Channel Y + Input	2000.25	-0.15	-0.01
Channel Y + Input	199.69	-0.83	-0.41
Channel Y - Input	-199.69	-0.21	0.10
Channel Z + Input	1999.84	-0.55	-0.03
Channel Z + Input	198.93	-1.60	-0.80
Channel Z - Input	-201.41	-1.78	0.89

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	20.68	18.72
	- 200	-18.32	-19.98
Channel Y	200	-4.77	-4.88
	- 200	3.81	3.30
Channel Z	200	-1.97	-1.91
	- 200	-0.55	-0.32

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	0.20	-5.28
Channel Y	200	8.61	-	2.12
Channel Z	200	9.96	5.87	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	16323	15393
Channel Y	15751	15672
Channel Z	16844	15985

5. Input Offset Measurement

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

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	0.27	-1.78	1.84	0.64
Channel Y	0.93	-1.29	2.12	0.55
Channel Z	-1.08	-2.94	0.61	0.76

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9



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Accreditation No.: **SCS 0108**

Client **Dgiele (Vitec)**

Certificate No: **D835V2-4d193_Feb15**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d193**

Calibration procedure(s) **QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz**

Calibration date: **February 02, 2015**

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: February 6, 2015

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- 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.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.5 $\pm$ 6 %	0.93 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.13 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.52 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.96 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	55.8 $\pm$ 6 %	1.01 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.39 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.30 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.10 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.4 Ω - 3.4 j Ω
Return Loss	- 28.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8 Ω - 5.3 j Ω
Return Loss	- 23.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.386 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	November 27, 2014

DASY5 Validation Report for Head TSL

Date: 02.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d193

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.93 \text{ S/m}$; $\epsilon_r = 41.5$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.2, 6.2, 6.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

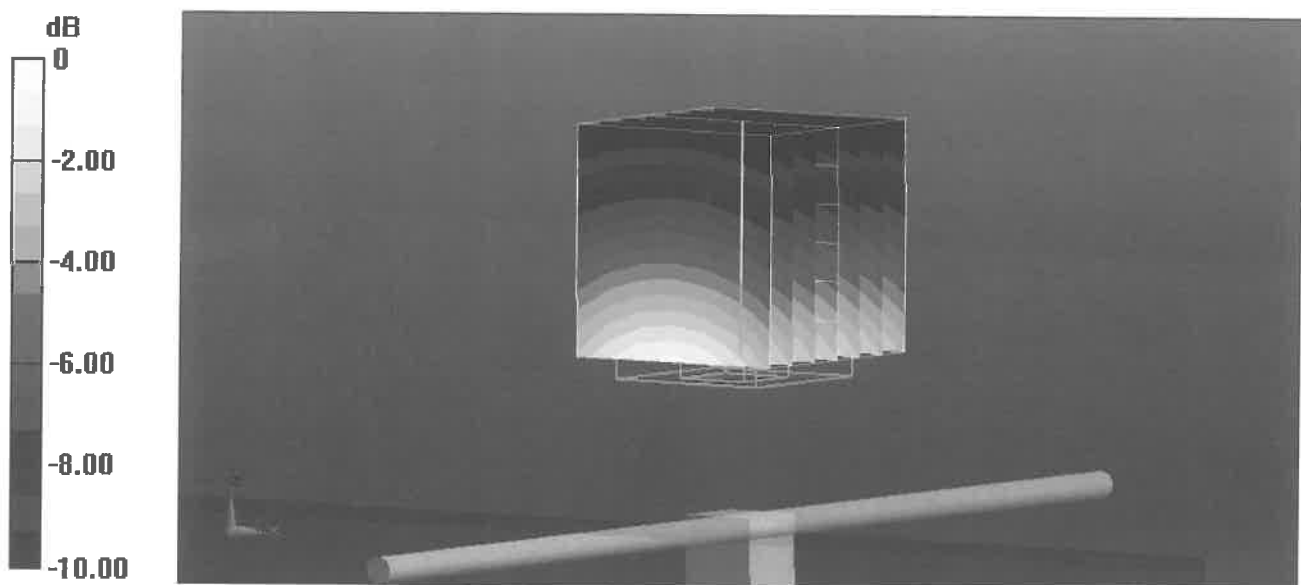
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.28 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.50 W/kg

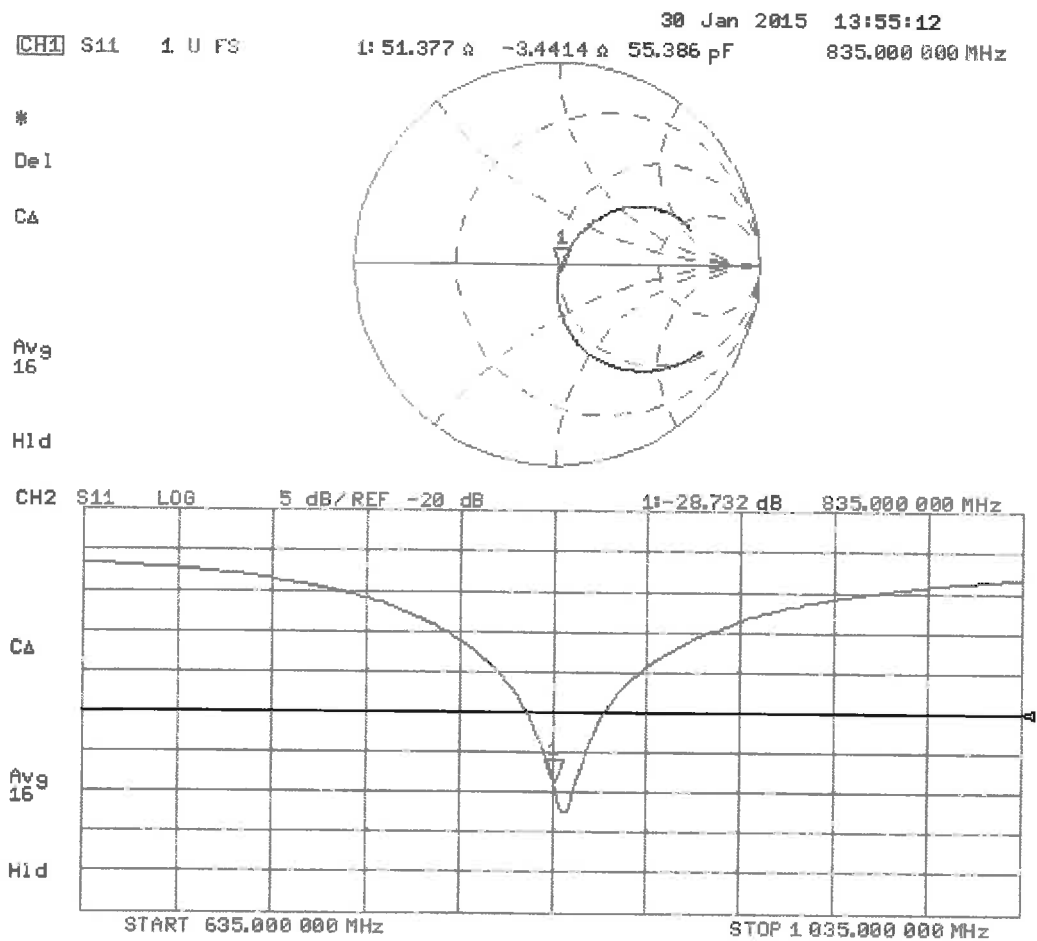
SAR(1 g) = 2.34 W/kg; SAR(10 g) = 1.52 W/kg

Maximum value of SAR (measured) = 2.74 W/kg



0 dB = 2.74 W/kg = 4.38 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 02.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d193

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 1.01 \text{ S/m}$; $\epsilon_r = 55.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.17, 6.17, 6.17); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

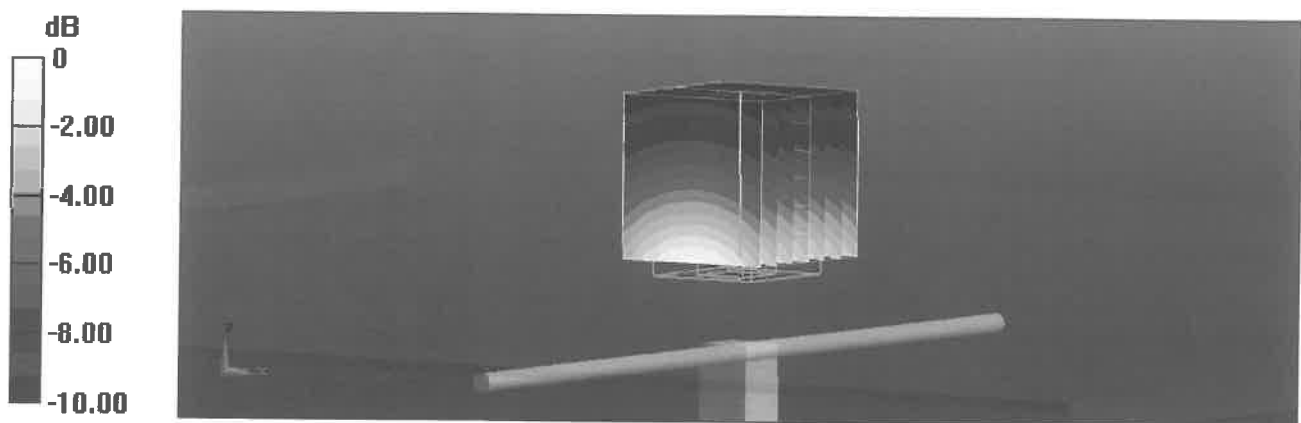
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 54.46 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.55 W/kg

SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.56 W/kg

Maximum value of SAR (measured) = 2.80 W/kg

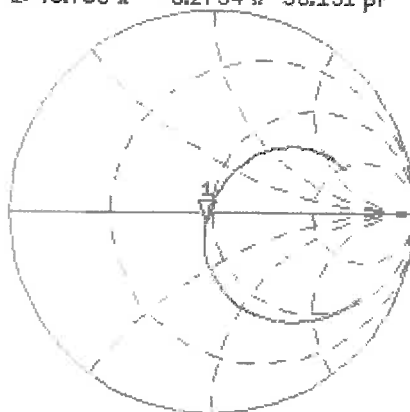


0 dB = 2.80 W/kg = 4.47 dBW/kg

Impedance Measurement Plot for Body TSL

30 Jan 2015 12:50:07
CH1 S11 1 U FS 1: 46.760 Ω -5.2754 Ω 36.131 pF 835.000 000 MHz

*
 De1
 CA



Avg
 16

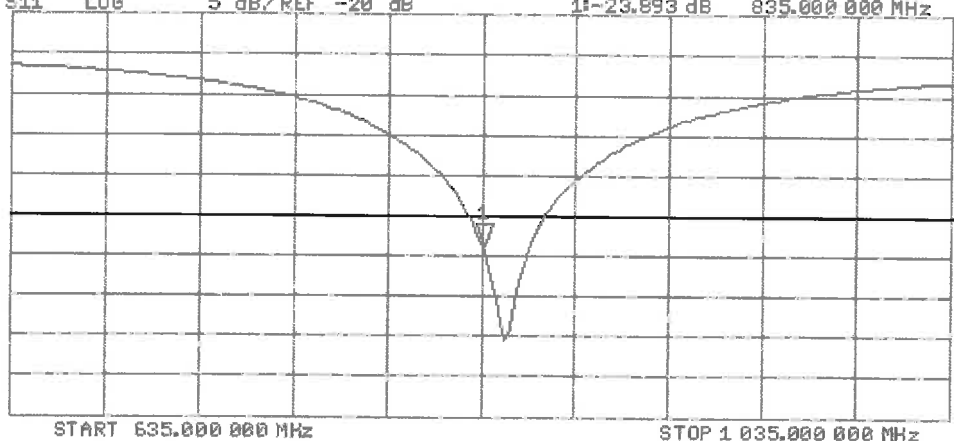
H1d

CH2 S11 LOG 5 dB/REF. -20 dB 1: -23.893 dB 835.000 000 MHz

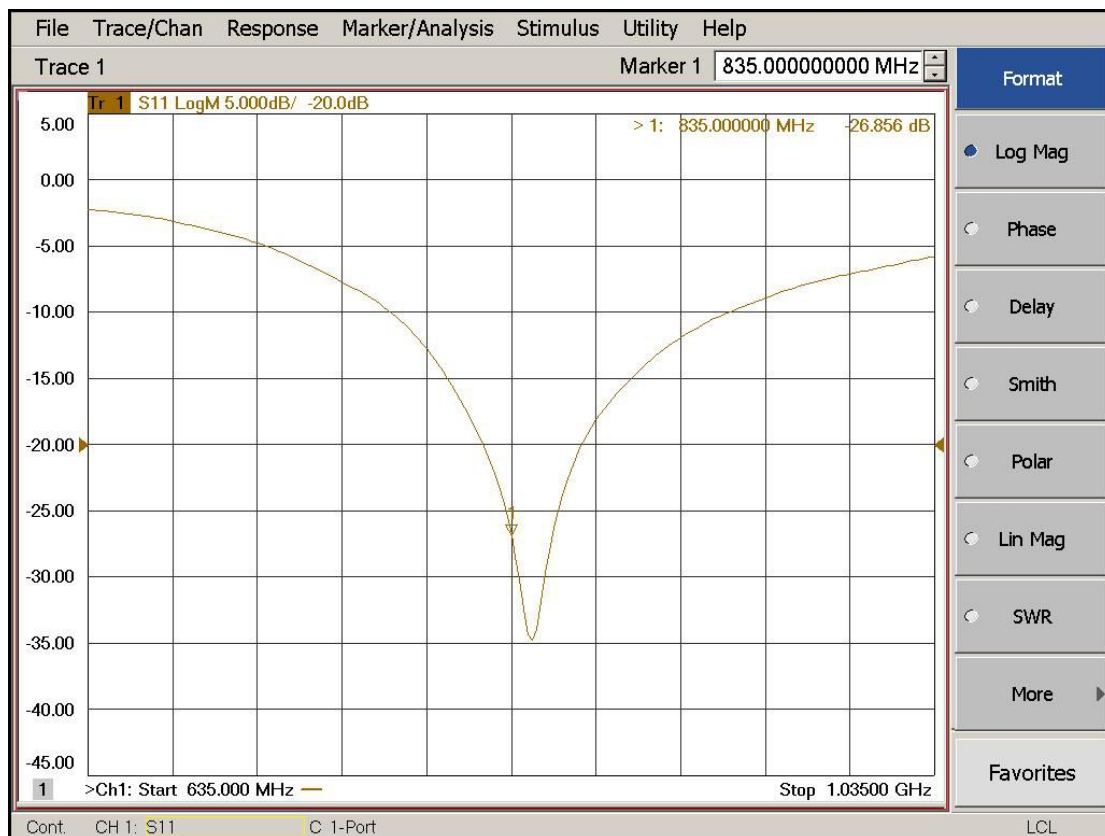
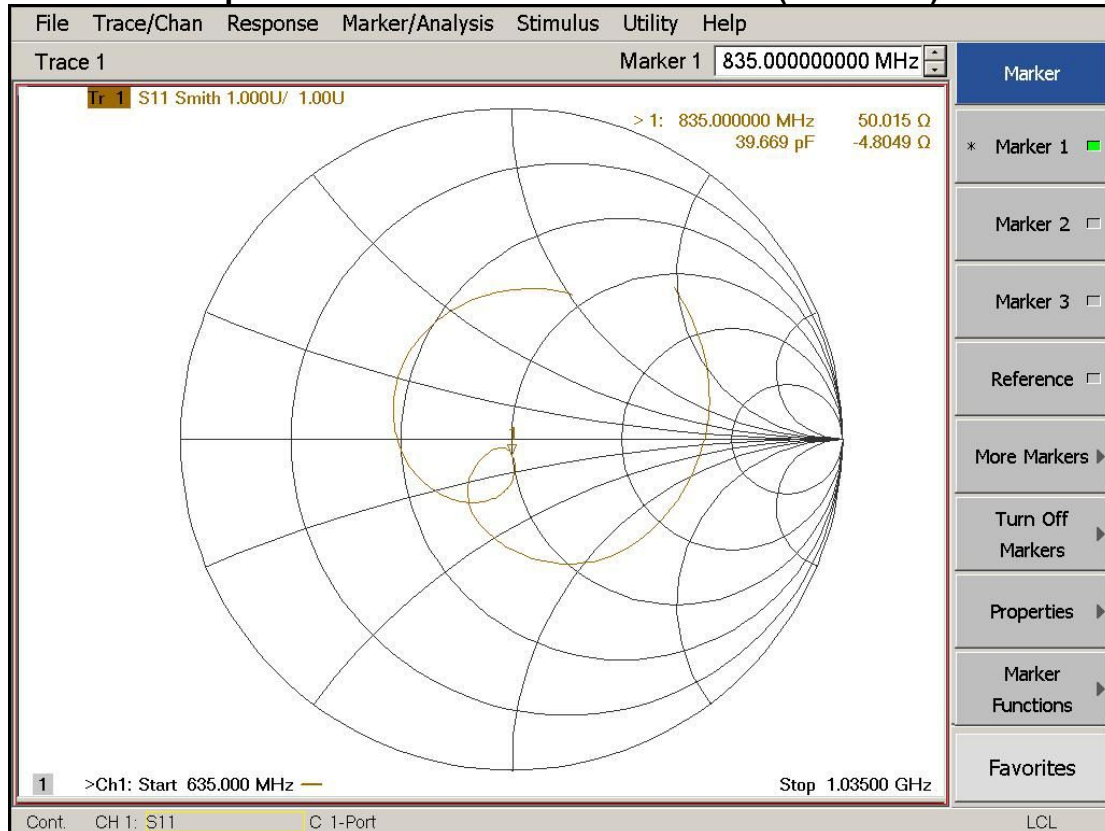
CA

Avg
 16

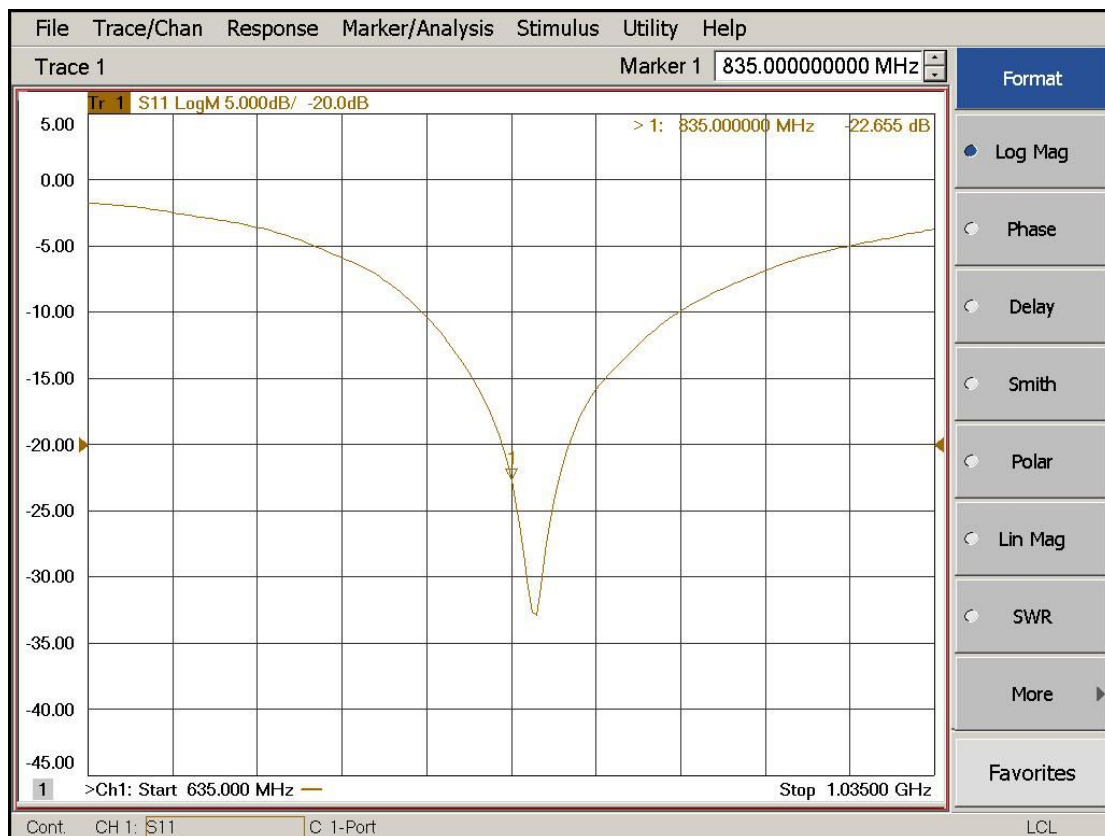
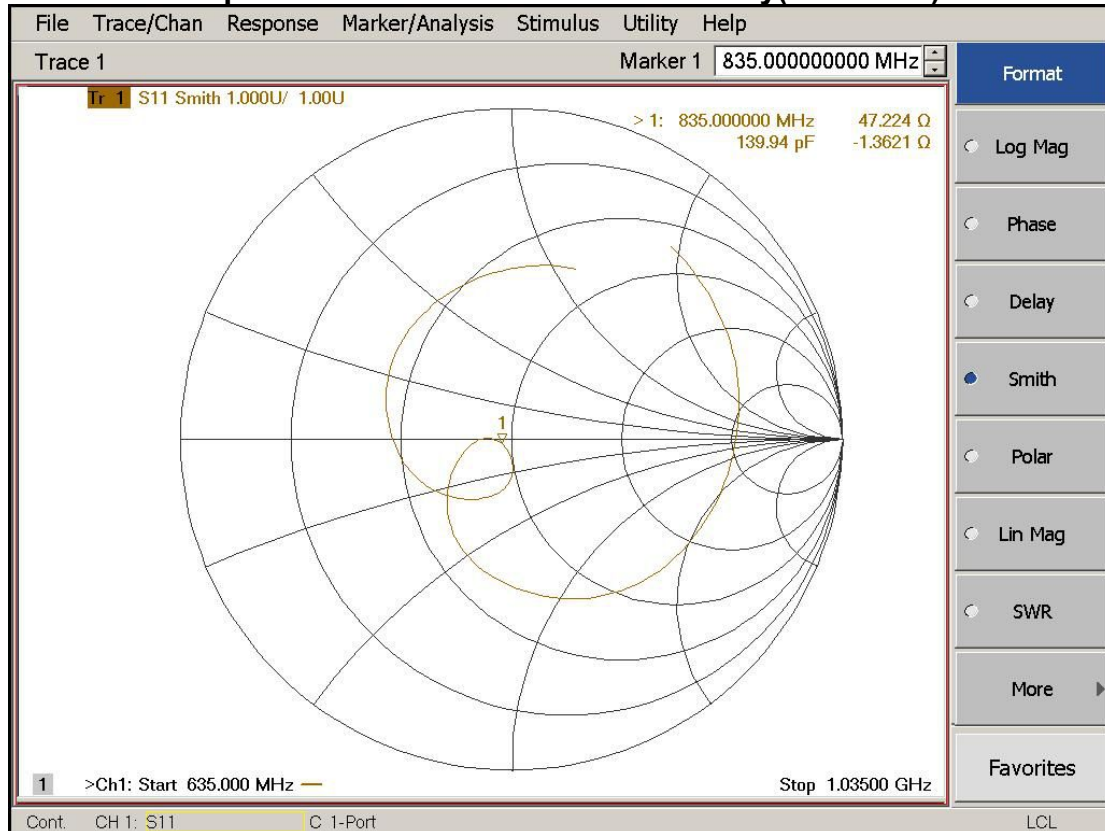
H1d



Impedance and Return Loss Test-Head(2016.2.19)



Impedance and Return Loss Test-Body(2016.2.19)





Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Dgieie (Vitec)**

Certificate No: **D1900V2-5d198_Feb15**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d198**

Calibration procedure(s) **QA CAL-05.v9**
Calibration procedure for dipole validation kits above 700 MHz

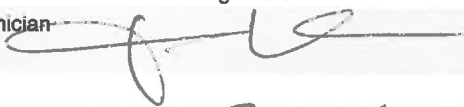
Calibration date: **February 06, 2015**

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 EPM-442A	GB37480704	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: February 9, 2015

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



Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

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:

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

Additional Documentation:

- 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.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.1 $\pm$ 6 %	1.42 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.6 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.4 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.1 $\pm$ 6 %	1.53 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	41.0 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.7 W/kg $\pm$ 16.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.6 Ω + 4.5 j Ω
Return Loss	- 25.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.4 Ω + 5.7 j Ω
Return Loss	- 24.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 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	May 06, 2014

DASY5 Validation Report for Head TSL

Date: 06.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d198

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.42$ S/m; $\epsilon_r = 39.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5, 5, 5); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

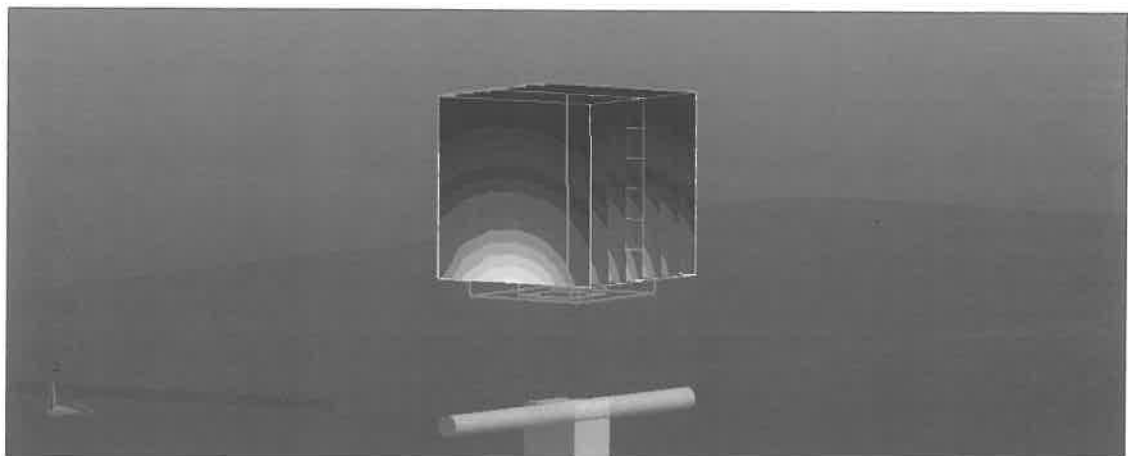
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.65 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 19.1 W/kg

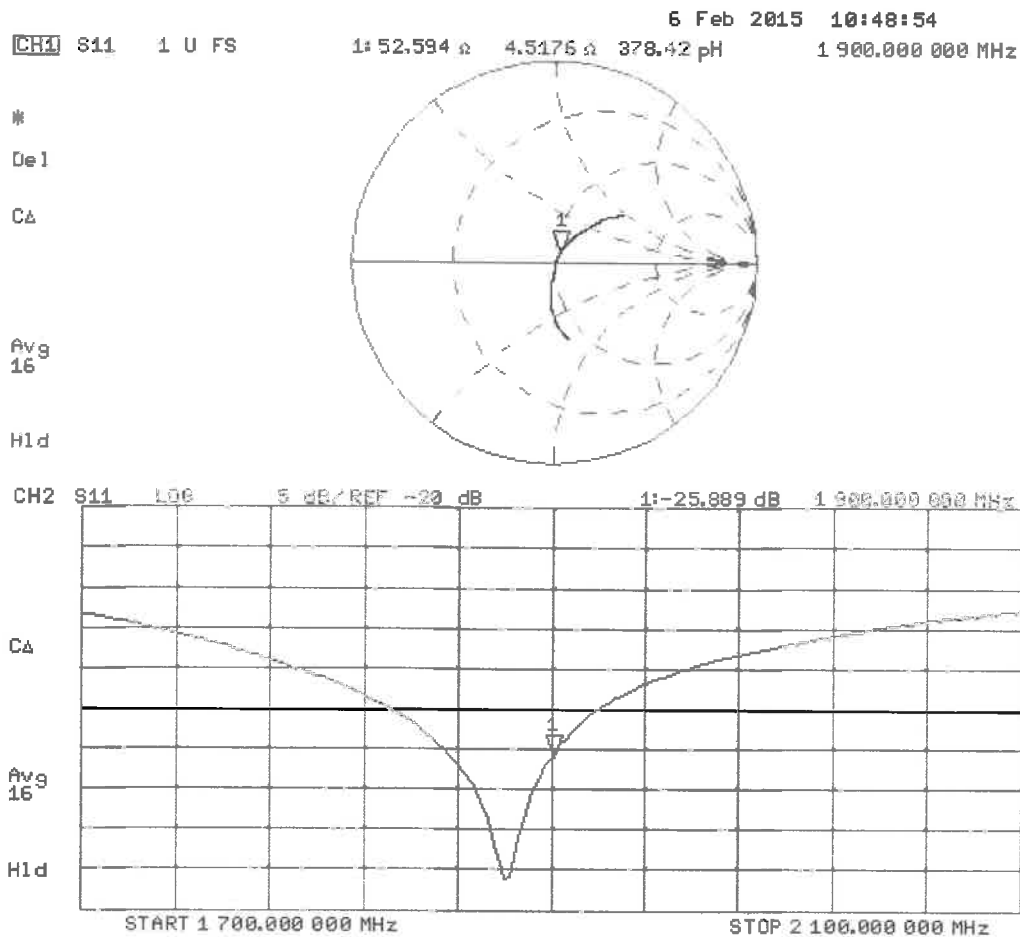
SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.39 W/kg

Maximum value of SAR (measured) = 13.1 W/kg



0 dB = 13.1 W/kg = 11.17 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 06.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d198

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.53$ S/m; $\epsilon_r = 53.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

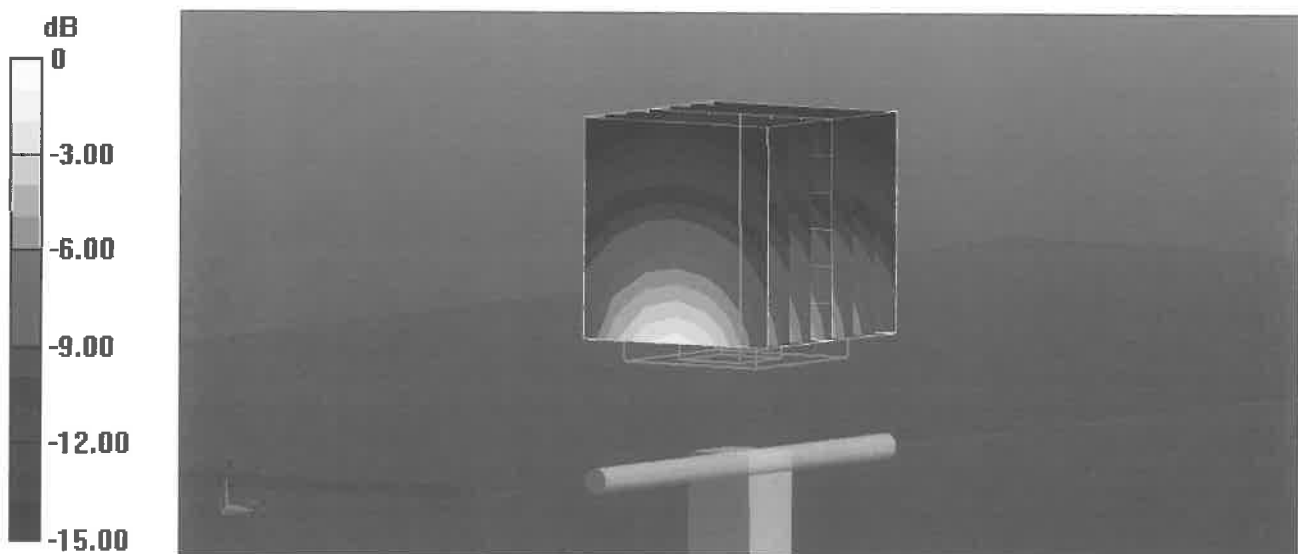
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.22 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 17.5 W/kg

SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.43 W/kg

Maximum value of SAR (measured) = 13.0 W/kg

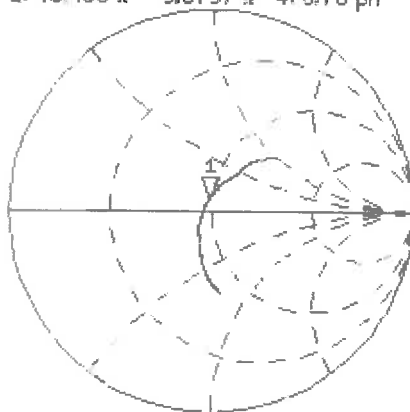


0 dB = 13.0 W/kg = 11.14 dBW/kg

Impedance Measurement Plot for Body TSL

6 Feb 2015 10:48:01
 CH1 S11 1 U FS 1: 48.400 Ω 5.6797 Ω 475.76 pF 1 900.000 000 MHz

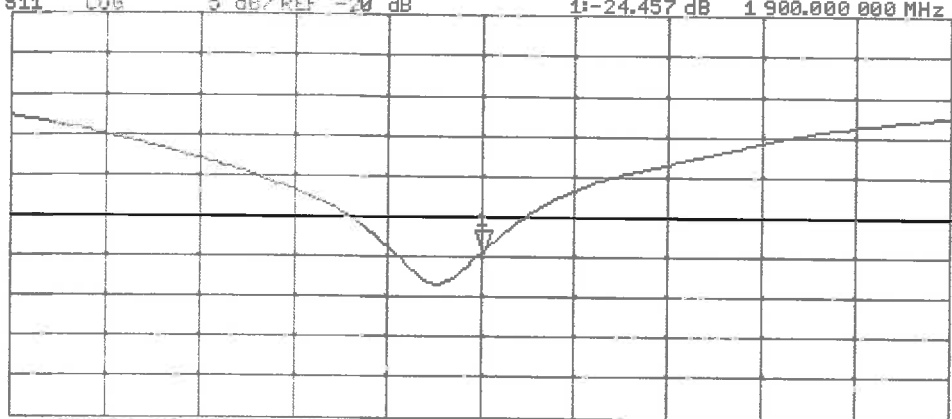
*
 De1
 CA



Avg
 16
 H1d

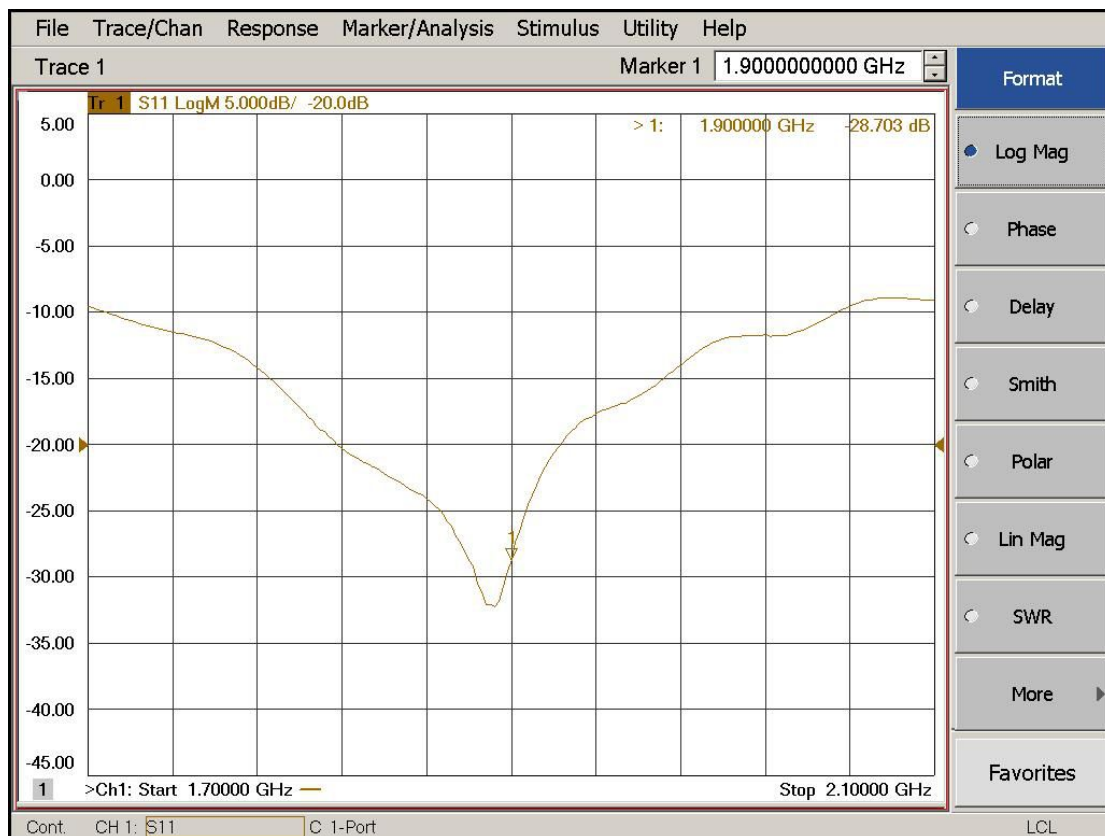
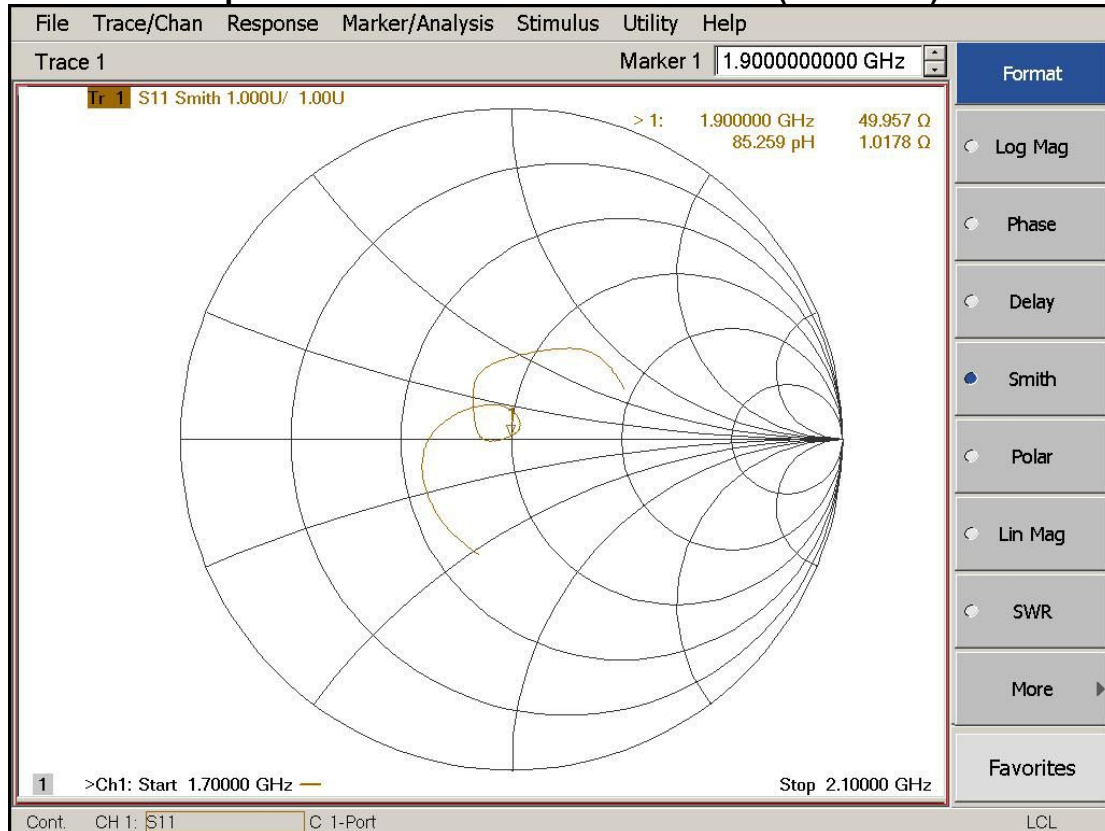
CH2 S11 LOG 3 dB/REF -20 dB 1:-24.457 dB 1 900.000 000 MHz

CA

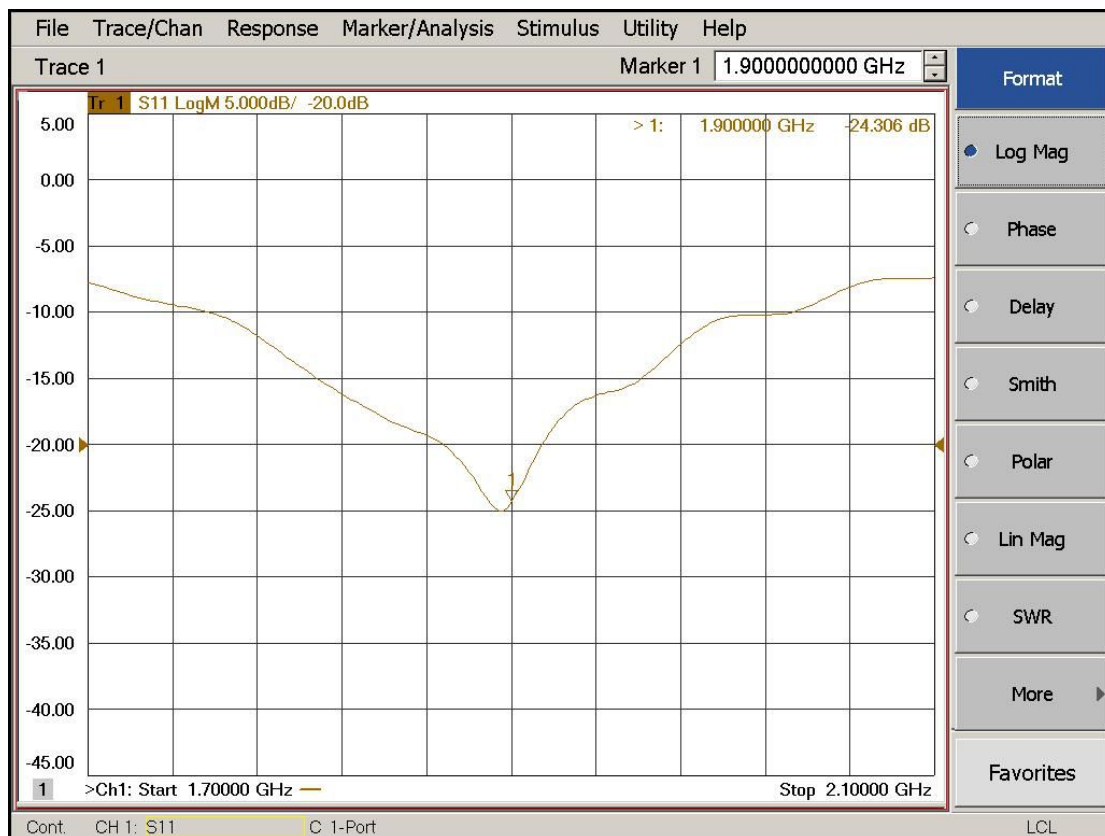
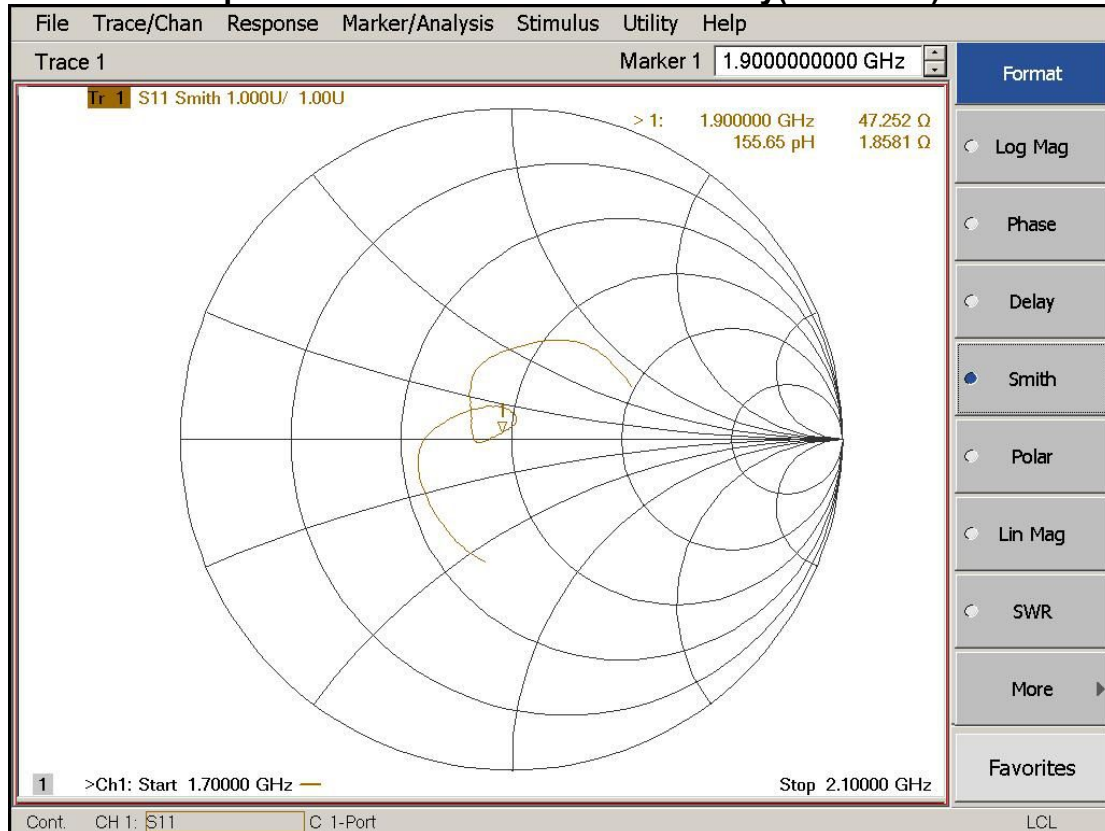


Avg
 16
 H1d

Impedance and Return Loss Test-Head(2016.2.19)



Impedance and Return Loss Test-Body(2016.2.19)



Appendix D: Photo documentation

Photo 1: Measurement System DASY5 SAR



Photo 2: Front view



Photo 3: Rear View



Photo 4: Left Hand Touched

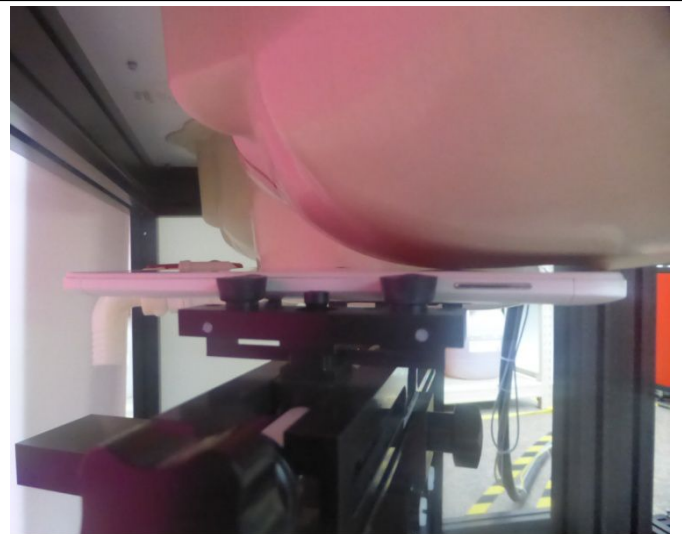


Photo 5: Left Hand Tilted 15°



Photo 6: Right Hand Touched



Photo 7: Right Hand Tilted 15°



Photo 8:Back Side 0mm



Photo 9:Left Side 0mm

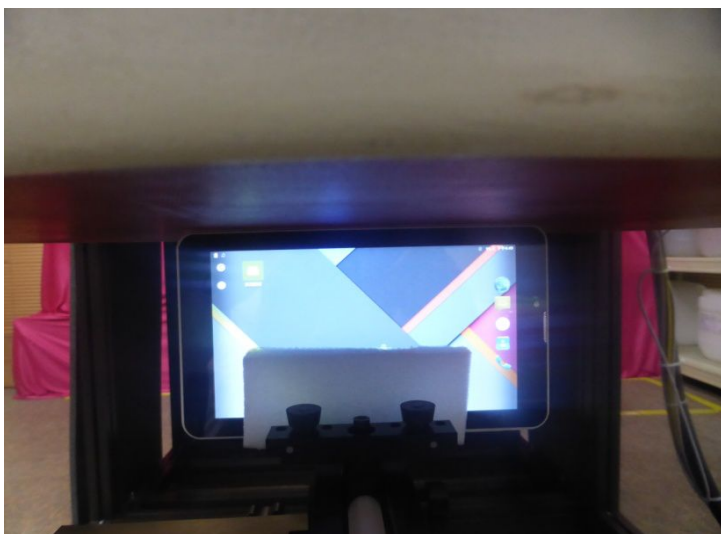


Photo 10:Right Side 0mm



Photo 11:Top Side 0mm

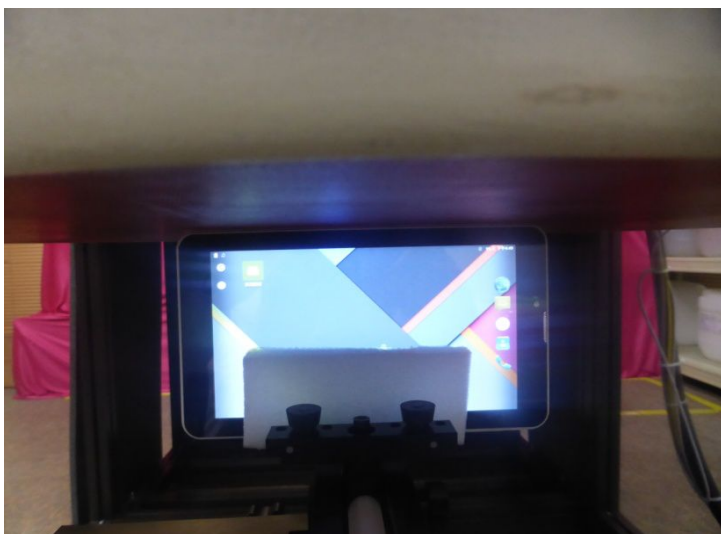


Photo 12:Bottom Side0mm



