**ANSI/IEEE Std. C95.1-1992** In accordance with the requirements of FCC Report and Order: ET Docket 93-62, and OET Bulletin 65 Supplement C

# **FCC SAR TEST REPORT**

For

Product Name: Mobile Phone Brand Name: GcWU Model No.: : 6 % \$% Series Model: N/A **Test Report Number:** 

KS120507A01-SF

Issued for

GcWTU 'AcVTYHYYWca a i b]WUhlcbg' 

Issued by

**Compliance Certification Services Inc.** 

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# **TABLE OF CONTENTS**

| 1.  | CERTIFICATE OF COMPLIANCE (SAR EVALUATION)             | 3  |
|-----|--|----|
| 2.  | EUT DESCRIPTION  | 4  |
| 3.  | REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC | 5  |
| 4.  | TEST METHODOLOGY                                       | 5  |
| 5.  | TEST CONFIGURATION                                     | 5  |
| 6.  | DOSIMETRIC ASSESSMENT SETUP                            | 5  |
|     | 6.1 MEASUREMENT SYSTEM DIAGRAM                         | 7  |
|     | 6.2 SYSTEM COMPAEGNTS                                  | 8  |
| 7.  | EVALUATION PROCEDURES                                  | 11 |
| 8.  | MEASUREMENT UNCERTAINTY                                | 14 |
| 9.  | EXPOSURE LIMIT   | 15 |
| 10. | EUT ARRANGEMENT  | 16 |
|     | 10.1 ANTHROPOMORPHIC HEAD PHANTOM                      | 16 |
|     | 10.2 DEFINITION OF THE "CHEEK/TOUCH" POSITION          | 17 |
|     | 10.3 DEFINITION OF THE "TILTED" POSITION               | 18 |
| 11. | MEASUREMENT RESULTS                                    | 19 |
|     | 11.1 TEST LIQUIDS CONFIRMATION                         | 19 |
|     | 11.2 LIQUID MEASUREMENT RESULTS                        | 19 |
|     | 11.3 SYSTEM PERFORMANCE CHECK                          | 20 |
|     | 11.4 EUT TUNE-UP PROCEDURES AND TEST MODE              | 23 |
|     | 11.5 SAR HANDSETS MULTI XMITER ASSESSMENT              |    |
|     | 11.6 EUT SETUP PHOTOS                                  |    |
|     | 11.7 SAR MEASUREMENT RESULTS                           |    |
| 12. |  |    |
| 13. |  |    |
| 14. | FACILITIES   | 35 |
| 15. | REFERENCES   | 36 |
| 16. | ATTACHMENTS  | 37 |
| App | pendix A: Plots of Performance Check                   | 38 |
| App | pendix B: DASY Calibration Certificate                 | 43 |
| Apr | pendix C: Plots of SAR Test Result                     | 82 |

# 1. CERTIFICATE OF COMPLIANCE (SAR EVALUATION)

| Product Name:                              | Mobile Phone  |   |  |  |  |
|--|---|---|--|--|--|
| Trade Name:                                | Ù[ &ãæ  |   |  |  |  |
| Model Name.:                               | ØÓF€F   |   |  |  |  |
| Series Model:                              | N/A   |   |  |  |  |
| Applicant<br>Discrepancy:                  | Initial   |   |  |  |  |
| Devices supporting GPRS:                   | Class B   |   |  |  |  |
| Description Test<br>Modes(worst<br>case ): | SIM 1 and SIM2 is a chipse                                | et unit and tested as single chipset                                |  |  |  |
| Device Category:                           | PORTABLE DEVICES  |   |  |  |  |
| Exposure Category:                         | GENERAL POPULATION/                                       | JNCONTROLLED EXPOSURE   |  |  |  |
| Date of Test:                              | May 8, 2012   |   |  |  |  |
| Applicant:                                 | GcW[UʿAcV]`Y`HY`YWcaai<br>ì€FÅ⊳ÒÁFÎïœÑUŒÂUˇãe^ÁÀHF        | <b>b]WUjcbg</b><br>TÊp[¦c@ÁTãæ;ãÁÓ^æ&®ŽÁÓŠÁHFÎGŽÁVÙŒ                |  |  |  |
| Manufacturer:                              | <b>G_mbYhiHYW(bc`c[mi@]a]h</b><br>Ü[[{ÁGGFFËGGFÍÊX@}*•@}Æ | X<br>Óælå^} ÉTÔænnamænj ÁÜ[ænhÉMeð cananj ÁÖardaRuGÉN)@}:@} ÉTÔ@njæ |  |  |  |
| Application Type:                          | Certification   |   |  |  |  |
| AF   | PLICABLE STANDARDS A                                      | ND TEST PROCEDURES  |  |  |  |
| STANDARDS AND                              | TEST PROCEDURES   | TEST RESULT   |  |  |  |
| FCC OET 65                                 | Supplement C  | No non-compliance noted   |  |  |  |
|  | Deviation from Applicable Standard                        |   |  |  |  |
| NAEG                                       |   |   |  |  |  |

The device was tested by Compliance Certification Services Inc. in accordance with the measurement methods and procedures specified in OET Bulletin 65 Supplement C(Edition 01-01). The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Tested by:

Hadiif Hoo RF Manager

Compliance Certification Services Inc.

Ladist . 400

Sean Yu Test Engineer

Compliance Certification Services Inc.

Sean . yu

# 2. EUT DESCRIPTION

| Product Name:"              | "Mobile Phone  |
|-----------------------------|--|
| Model Name:                 | ØÓF€F  |
| Series Model:               | N/A  |
| Model Discrepancy:          | N/A  |
| Brand Name:                 | Ù[ &ãæ   |
| FCC ID:                     | ZÎ ÜÙT ØÓF€F   |
| GPRS Level:                 | Multi-Class 1€   |
| Multi-slot Class:           | 2 Up +3 Down   |
| Power reduction:            | NO   |
| DTM Description:            | N/A  |
| Device Category:            | Production unit  |
| Frequency Range:            | GSM 850: 824.2 ~ 848.8 MHz<br>GSM1900: 1850.2 ~ 1909.8MHz<br>GPRS850: 850: 824.2 ~ 848.8 MHz<br>GPRS1900:1850.2 ~ 1909.8 MHz<br>Bluetooth: 2402 ~ 2480 MHz                             |
| Transmit<br>Power(Average): | GSM 850 Band: GSM 850: 32.Ï HdBm GPRS 850: HŒ HÁBM GSM 1900 Band: GSM 1900: 29.Ï Ì dBm GPRS 1900: 2JĒÎ dBm Bluetooth:0.56 dBm  |
| Max. SAR:                   | GSM 850 Head: 0.742 W/kg Body: 0.743 W/kg GSM 1900 Head: 0.523W/kg Body: 0.684W/kg GPRS 850: 0.460 W/kg GPRS 1900: 0.504 W/kg  |
| Modulation Technique:       | GSM / GPRS : GMSK<br>Bluetooth:FHSS (GFSK)   |
| Accessories:                | Power supply and ADP (rating):  MODEL: ÚÔÆ€F  BRAND: Ù[ &æ  INPUT: AC 100-240V 50/60Hz 150mA  OUTPUT: DC 5V 500mA  Battery (rating):  BRAND: Ù[ &æ  MODEL: ÓÚF€F  Capacitance: Î 00mAh |
| Antenna Specification:      | GSM: PIFA antenna<br>Bluetooth : Dipole antenna  |
| Operating Mode:             | Maximum continuous output  |

# 3. REQUIREMENTS FOR COMPLIANCE TESTING DEFINED BY THE FCC

The US Federal Communications Commission has released the report and order "Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telePhones. For consumer products, the applicable limit is 1.6 mW/g for an uncontrolled environment and 8.0 mW/g for an occupational/controlled environment as recommended by the ANSI/IEEE standard C95.1-1992. According to the Supplement C of OET Bulletin 65 "Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

# 4. TEST METHODOLOGY

| The Specific Absorption Rate (SAR) testing specification, method and procedure for this     |
|---|
| GSM Mobile Phone is in accordance with the following standards:                             |
|   |
|   |
| ☐ KDB 248227 D01 SAR measurement procedures for 802.11 b/g transmitters                     |
|   |
| antennas  |
| ☐KDB 447498 D01 Mobile Portable RF Exposure   |
| ⊠OET Bulletin 65 Supplement C (Edition 01-01)   |
| ☐ Preliminary Guidance for Reviewing Applications for Certification of 3G Device. May 2006. |
|   |

# 5. TEST CONFIGURATION

The device was controlled by using a base station emulator R&S CMU200. Communication between the device and the emulator was established by air link. The distance between the DUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of DUT. The DUT was set from the emulator to radiate maximum output power during all tests.

Measurements were performed on the lowest, middle, and highest channel for each testing position.

For SAR testing, EUT is in GSM/GPRS link mode. In GSM link mode, its crest factor is 8, In GPRS link mode, its crest factor is 2, because EUT is set in GPRS multi-slot class 12 with 4 uplink slots.

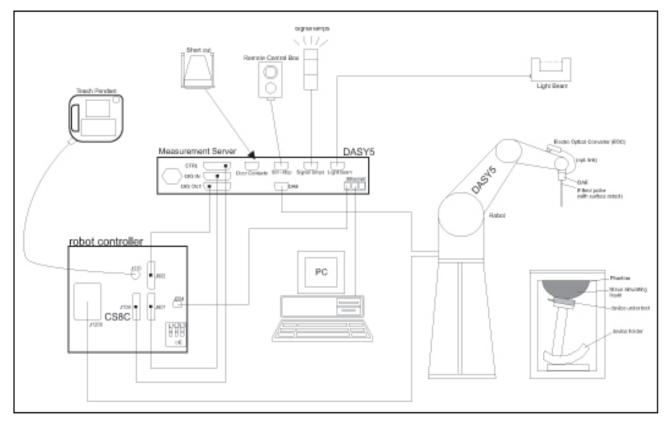
# 6. DOSIMETRIC ASSESSMENT SETUP

These measurements were performed with the automated near-field scanning system DASY 5 from ATTENNESSA. The system is based on a high precision robot (working range greater than 0.9 m), which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the E-field PROBE EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [7] with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure described in [8] and found to be better than ±0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEE P1528 and CENELEC EN 62209.

The Tissue simulation liquid used for each test is in according with the FCC OET65 supplement C as listed below.

| Ingredients         | Frequency<br>(MHz) |       |       |      |       |       |       |      |      |      |
|---------------------|--------------------|-------|-------|------|-------|-------|-------|------|------|------|
| (% by weight)       | 4                  | 50    | 83    | 35   | 9     | 15    | 19    | 00   | 24   | 50   |
| Tissue Type         | Head               | Body  | Head  | Body | Head  | Body  | Head  | Body | Head | Body |
| Water               | 38.56              | 51.16 | 41.45 | 52.4 | 41.05 | 56.0  | 54.9  | 40.4 | 62.7 | 73.2 |
| Salt (NaCl)         | 3.95               | 1.49  | 1.45  | 1.4  | 1.35  | 0.76  | 0.18  | 0.5  | 0.5  | 0.04 |
| Sugar               | 56.32              | 46.78 | 56.0  | 45.0 | 56.5  | 41.76 | 0.0   | 58.0 | 0.0  | 0.0  |
| HEC                 | 0.98               | 0.52  | 1.0   | 1.0  | 1.0   | 1.21  | 0.0   | 1.0  | 0.0  | 0.0  |
| Bactericide         | 0.19               | 0.05  | 0.1   | 0.1  | 0.1   | 0.27  | 0.0   | 0.1  | 0.0  | 0.0  |
| Triton X-100        | 0.0                | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 0.0   | 0.0  | 36.8 | 0.0  |
| DGBE                | 0.0                | 0.0   | 0.0   | 0.0  | 0.0   | 0.0   | 44.92 | 0.0  | 0.0  | 26.7 |
| Dielectric Constant | 43.42              | 58.0  | 42.54 | 56.1 | 42.0  | 56.8  | 39.9  | 54.0 | 39.8 | 52.5 |
| Conductivity (S/m)  | 0.85               | 0.83  | 0.91  | 0.95 | 1.0   | 1.07  | 1.42  | 1.45 | 1.88 | 1.78 |

# **6.1 MEASUREMENT SYSTEM DIAGRAM**



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

- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition 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 between optical and electrical
  of the signals for the digital communication to the DAE and for the analog signal from the
  optical surface detection. The EOC is connected 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.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile Phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

Report No: KS120507A01-SF

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## **6.2 SYSTEM COMPAEGNTS**



The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV celeron, 128MB chip-disk and 128 MB RAM. The necessary circuits for communication with either the DAE4(or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

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



The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

#### Data Acquisition Electronics (DAE)



The data acquisition electronics (DAE4) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gainswitching multiplexer, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The 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 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

## EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements



Construction: Symmetrical design with triangular core

Built-in shielding against static charges

PEEK enclosure material (resistant to organic solvents.

e.g., DGBE)

Calibration: Basic Broad Band Calibration in air: 10-3000 MHz.

> Conversion Factors (CF) for HSL 900 and HSL 1800 CF-Calibration for other liquids and frequencies upon

request.

Frequency: 10 MHz to > 6 GHz; Linearity:  $\pm$  0.2 dB (30 MHz to 3

GHz)

Directivity: ± 0.3 dB in HSL (rotation around probe axis)

± 0.5 dB in HSL (rotation normal to probe axis)

**Dynamic Range:** 10 μW/g to > 100 mW/g; Linearity: ± 0.2 dB

(noise: typically  $< 1 \mu W/g$ )

**Dimensions:** Overall length: 337 mm (Tip: 9 mm)

Tip diameter: 2.5 mm (Body: 10 mm)
Distance from probe tip to dipole centers:

1 mm

**Application:** High precision dosimetric measurements

in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6

GHz with precision of better 30%.

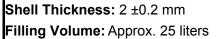


Interior of probe

#### SAM Twin Phantom

#### Construction:

The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50360 and IEC 62209. It enables the dosimetric evaluation of left and right hand Phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.



**Dimensions:** Height: 850mm; Length: 1000mm; Width:

750mm



#### **Description Construction:**

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY4/DASY5.5 and higher and is compatible with all SPEAG dosimetric probes and dipoles

Shell Thickness: 2.0 ± 0.2 mm (sagging: <1%)

Filling Volume: Approx. 25 liters

**Dimensions:** Major ellipse axis: 600 mm

Minor axis: 400 mm 500mm



Report No: KS120507A01-SF

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#### Device Holder for SAM Twin Phantom

Construction: In combination with the Twin SAM Phantom, the

Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positiAEGd according to IEC, IEEE, CENELEC, FCC or other specifications. The

device holder can be locked at different phantom locations (left head, right head, and flat phantom).



#### System Validation Kits for SAM Twin Phantom

**Construction:** Symmetrical dipole with I/4 balun Enables

measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance

holder and tripod adaptor.

900,1800,2450,5800 MHz Frequency:

Return loss: > 20 dB at specified validation position **Power capability:** > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions:

D835V2: dipole length: 161 mm; overall height: 340 mm D1800V2: dipole length: 72.5 mm; overall height: 300 mm D1900V2: dipole length: 67.7 mm; overall height: 300 mm D2450V2: dipole length: 51.5 mm; overall height: 290 mm

D5GHzV2: dipole length: 20.6 mm; overall height: 300mm



Construction: Symmetrical dipole with I/4 balun Enables

> measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance

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Frequency: 900, 1800, 2450, 5800 MHz

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D1900V2: dipole length: 67.7 mm; overall height: 300 mm D2450V2: dipole length: 51.5 mm; overall height: 290 mm

D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm



# 7. EVALUATION PROCEDURES

#### **DATA EVALUATION**

The DASY 5 post processing software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters: - Sensitivity Norm<sub>i</sub>,  $a_{i0}$ ,  $a_{i1}$ ,  $a_{i2}$ 

- Conversion factor ConvF<sub>i</sub>

- Diode compression point dcpi

Device parameters: - Frequency f

- Crest factor cf

 $\mbox{Media parameters: - Conductivity} \qquad \qquad \sigma$ 

- Density ho

These parameters must be set correctly in the software. They can be found in the compAEGnt documents or be imported into the software from the configuration files issued for the DASY 5 compAEGnts. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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

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

with  $V_i$  = Compensated signal of channel i(i = x, y, z)

 $U_i$  = Input signal of channel i (i = x, y, z)

cf = Crest factor of exciting field (DASY 5 parameter) dcp<sub>i</sub> = Diode compression point (DASY 5 parameter)

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

E-field probes:

$$E_{i} = \sqrt{\frac{V_{i}}{Norm_{i} \cdot ConvF}}$$

H-field probes:

$$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11}f + a_{i12}f^2}{f}$$

with  $V_i$  = Compensated signal of channel i(i = x, y, z)

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

 $\mu V/(V/m)^2$  for E0field Probes

ConvF = Sensitivity enhancement in solution

*aij* = Sensor sensitivity factors for H-field probes

f = Carrier frequency (GHz)

*Ei* = Electric field strength of channel i in V/m

Hi = Magnetic field strength of channel i in A/m

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

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

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

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

with SAR = local specific absorption rate in mW/g

 $E_{tot}$  = total field strength in V/m

 $\sigma$  = conductivity in [mho/m] or [Siemens/m]

 $\rho$  = equivalent tissue density in g/cm<sup>3</sup>

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

The power flow density is calculated assuming the excitation field as a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770}$$
 or  $P_{pwe} = H_{tot}^2 \cdot 37.7$ 

with  $P_{pwe}$  = Equivalent power density of a plane wave in mW/cm<sup>2</sup>

 $E_{tot}$  = total electric field strength in V/m

 $H_{tot}$  = total magnetic field strength in A/m

## **SAR EVALUATION PROCEDURES**

The procedure for assessing the peak spatial-average SAR value consists of the following steps:

#### • Power Reference Measurement

The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

#### 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 hot spot. The sophisticated interpolation routines implemented in DASY 5 software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, grid was at to 15 mm by 15 mm and can be edited by a user.

#### Zoom Scan

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures 5 x 5 x 7 points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then AEG maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

#### • Power Drift measurement

The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for AEG reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have DASY 5 software stop the measurements if this limit is exceeded.

#### SPATIAL PEAK SAR EVALUATION

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1529 standard. It can be conducted for 1 g and 10 g.

The DASY 5 system allows evaluations that combine measured data and robot positions, such as:

- · maximum search
- extrapolation
- · boundary correction
- · peak search for averaged SAR

During a maximum search, global and local maximum searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

#### **Extrapolation**

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.

Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Cube Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 5x5x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1 g and 10 g cubes.

# **Boundary effect**

For measurements in the immediate vicinity of a phantom surface, the field coupling effects between the probe and the boundary influence the probe characteristics. Boundary effect errors of different dosimetric probe types have been analyzed by measurements and using a numerical probe model. As expected, both methods showed an enhanced sensitivity in the immediate vicinity of the boundary. The effect strongly depends on the probe dimensions and disappears with increasing distance from the boundary. The sensitivity can be approximately given as:

$$S \approx S_o + S_b exp(-\frac{z}{a})cos(\pi \frac{z}{\lambda})$$

Since the decay of the boundary effect dominates for small probes ( $a << \lambda$ ), the cos-term can be omitted. Factors Sb (parameter Alpha in the DASY 5 software) and a (parameter Delta in the DASY 5 software) are assessed during probe calibration and used for numerical compensation of the boundary effect. Several simulations and measurements have confirmed that the compensation is valid for different field and boundary configurations.

This simple compensation procedure can largely reduce the probe uncertainty near boundaries. It works well as long as:

- the boundary curvature is small
- the probe axis is angled less than 30 to the boundary normal
- the distance between probe and boundary is larger than 25% of the probe diameter
- the probe is symmetric (all sensors have the same offset from the probe tip)

Since all of these requirements are fulfilled in a DASY 5 system, the correction of the probe boundary effect in the vicinity of the phantom surface is performed in a fully automated manner via the measurement data extraction during post processing.

# 8. MEASUREMENT UNCERTAINTY

| UNCERTAIN                       | NTY BUDGE               | ACCORDING                | G TO IEE | EE 152 | 28-2003                 |                                    |
|---------------------------------|-------------------------|--------------------------|----------|--------|-------------------------|------------------------------------|
| Error Description               | Uncertainty<br>Value ±% | Probability distribution | Divisor  | C₁ 1g  | Standard<br>unc.(1g) ±% | V <sub>1</sub> or V <sub>eff</sub> |
| Measurement System              |                         |                          |          |        |                         |                                    |
| Probe calibration               | ±5.5                    | normal                   | 1        | 1      | ±5.5                    | ∞                                  |
| Axial isotropy of probe         | ±4.7                    | rectangular              | √3       | 0.7    | ±1.9                    | ∞                                  |
| Hemispherical Isotropy of probe | ±9.6                    | rectangular              | √3       | 0.7    | ±3.9                    | ∞                                  |
| Probe linearity                 | ±4.7                    | rectangular              | √3       | 1      | ±2.7                    | ∞                                  |
| Detection Limit                 | ±1.0                    | rectangular              | √3       | 1      | ±0.6                    | ∞                                  |
| Boundary effects                | ±1.0                    | rectangular              | √3       | 1      | ±0.6                    | ∞                                  |
| Readout electronics             | ±0.3                    | normal                   | 1        | 1      | ±0.3                    | ∞                                  |
| Response time                   | ±0.8                    | rectangular              | √3       | 1      | ±0.5                    | ∞                                  |
| Integration time                | ±2.6                    | rectangular              | √3       | 1      | ±1.5                    | ∞                                  |
| Probe positioning               | ±2.9                    | rectangular              | √3       | 1      | ±1.7                    | ∞                                  |
| Probe positiAEGr                | ±0.4                    | rectangular              | √3       | 1      | ±0.2                    | ∞                                  |
| RF ambient Noise                | ±3.0                    | rectangular              | √3       | 1      | ±1.7                    | ∞                                  |
| RF ambient Reflections          | ±3.0                    | rectangular              | √3       | 1      | ±1.7                    | ∞                                  |
| Max.SAR Eval                    | ±1.0                    | rectangular              | √3       | 1      | ±0.6                    | ∞0                                 |
| Test Sample Related             |                         |                          |          |        |                         |                                    |
| Device positioning              | ±2.9                    | normal                   | 1        | 1      | ±2.9                    | 145                                |
| Device holder uncertainty       | ±3.6                    | normal                   | 1        | 1      | ±3.6                    | 5                                  |
| Power drift                     | ±5.0                    | rectangular              | √3       | 1      | ±2.9                    | ∞                                  |
| Phantom and Set up              |                         |                          |          |        |                         |                                    |
| Phantom uncertainty             | ±4.0                    | rectangular              | √3       | 1      | ±2.3                    | ∞                                  |
| Liquid conductivity(target)     | ±5.0                    | rectangular              | √3       | 0.64   | ±1.8                    | ∞                                  |
| Liquid conductivity(meas.)      | ±2.5                    | rectangular              | 1        | 0.64   | ±1.6                    | ∞                                  |
| Liquid permittivity(target)     | ±5.0                    | rectangular              | √3       | 0.6    | ±1.7                    | ∞                                  |
| Liquid permittivity(meas.)      | ±2.5                    | rectangular              | 1        | 0.6    | ±1.5                    | ∞                                  |
| Combined Standard Uncertainty   | ,                       |                          |          |        | ±10.7                   | 387                                |
| Coverage Factor for 95%         |                         | kp=2                     |          |        |                         |                                    |
| Expanded Standard Uncertainty   | ,                       |                          |          |        | ±21.4                   |                                    |

Table: Worst-case uncertainty for DASY5 assessed according to IEEE1528-2003.

The budge is valid for the frequency range 300 MHz to 6G Hz and represents a worst-case analysis.

# 9. EXPOSURE LIMIT

(A). Limits for Occupational/Controlled Exposure (W/kg)

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|------------|--------------|--------------------------------|
| 0.4        | 8.0          | 20.0                           |

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

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

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

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

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

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

Report No: KS120507A01-SF

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# 10. EUT ARRANGEMENT

Please refer to IEEE1528-2003 illustration below.

#### 10.1 ANTHROPOMORPHIC HEAD PHANTOM

Figure 7-1a shows the front, back and side views of SAM. The point "M" is the reference point for the center of mouth, "LE" is the left ear reference point (ERP), and "RE" is the right ERP. The ERPs are 15 mm posterior to the entrance to ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 7-1b. The plane passing through the two ear reference points and M is defined as the Reference Plane. The line N-F (Neck-Front) perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 7-1c). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines should be marked on the external phantom shell to facilitate handset positioning. Posterior to the N-F line, the thickness of the phantom shell with the shape of an ear is a flat surface 6 mm thick at the ERPs. Anterior to the N-F line, the ear is truncated as illustrated in Figure 7-1b. The ear truncation is introduced to avoid the handset from touching the ear lobe, which can cause unstable handset positioning at the cheek.

Figure 7-1a
Front, back and side view of SAM (model for the phantom shell)

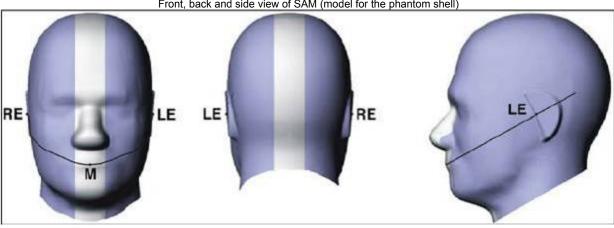


Figure 7-1b
Close up side view of phantom showing the ear region

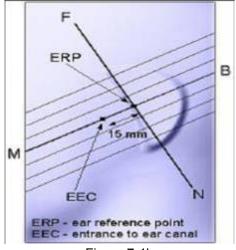


Figure 7-1b
Close up side view of phantom showing the ear region

Figure 7-1c
Side view of the phantom showing relevant markings and the 7
cross sectional plane locations

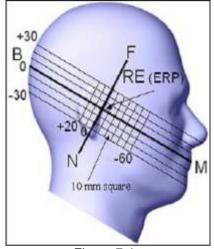


Figure 7-1c
Side view of the phantom showing relevant markings and the 7
cross sectional plane locations

#### 10.2 DEFINITION OF THE "CHEEK/TOUCH" POSITION

The "cheek" or "touch" position is defined as follows:

- a. Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece, open the cover. (If the handset can also be used with the cover closed both configurations must be tested.)
- b. Define two imaginary lines on the handset: the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset: the midpoint of the width wt of the handset at the level of the acoustic output (point A on Figures 7-2a and 7-2b), and the midpoint of the width wb of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 7-2a). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 7-2b), especially for clamshell handsets, handsets with flip pieces, and other irregularly-shaped handsets.
- c. Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 7-2c), such that the plane defined by the vertical center line and the horizontal line of the handset is approximately parallel to the sagittal plane of the phantom.
- d. Translate the handset towards the phantom along the line passing through RE and LE until the handset touches the pinna.
- e. e) While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is in the plane normal to MB-NF including the line MB (called the reference plane).
- f. Rotate the handset around the vertical centerline until the handset (horizontal line) is symmetrical with respect to the line NF.
- g. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE and maintaining the handset contact with the pinna, rotate the handset about the line NF until any point on the handset is in contact with a phantom point below the pinna (cheek). See Figure 7-2c. The physical angles of rotation should be noted.

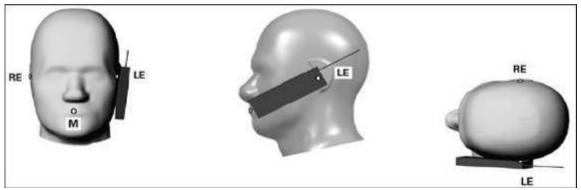


Figure 7.2c

Phone "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for handset positioning, are indicated.

Report No: KS120507A01-SF ØÔÔÁØHÆÎÜÙTØÓF€FÁWWWWWWWÖæe^Áj-ÁQ•~^ÁKÍÞ[ç^{ à^¦ÁFŒÂG€FGÁ

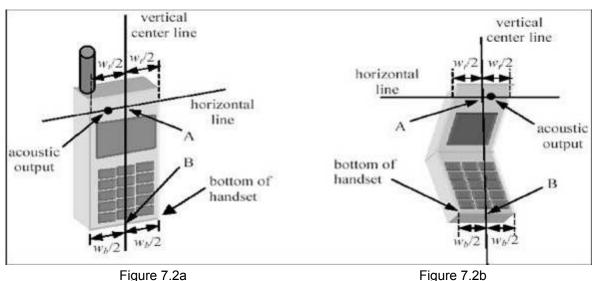


Figure 7.2a

#### 10.3 DEFINITION OF THE "TILTED" POSITION

The "tilted" position is defined as follows:

- a. Repeat steps (a) (g) of 7.2 to place the device in the "cheek position."
- b. While maintaining the orientation of the handset move the handset away from the pinna along the line passing through RE and LE in order to enable a rotation of the handset by 15 degrees.
- c. Rotate the handset around the horizontal line by 15 degrees.
- d. While maintaining the orientation of the handset, move the handset towards the phantom on a line passing through RE and LE until any part of the handset touches the ear. The tilted position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna (e.g., the antenna with the back of the phantom head), the angle of the handset should be reduced. In this case, the tilted position is obtained if any part of the handset is in contact with the pinna as well as a second part of the handset is contact with the phantom (e.g., the antenna with the back of the head).

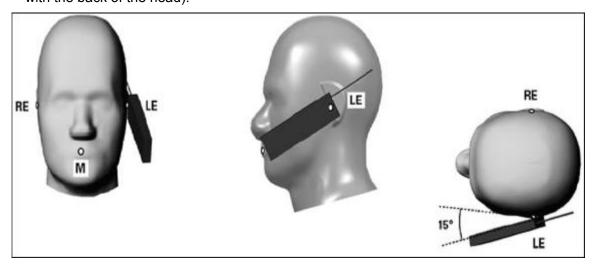


Figure 7-3 Phone "tilted" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for handset positioning, are indicated.

# 11. MEASUREMENT RESULTS

## 11.1 TEST LIQUIDS CONFIRMATION

#### SIMULATED TISSUE LIQUID PARAMETER CONFIRMATION

The dielectric parameters were checked prior to assessment using the HP85070C dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

#### IEEE SCC-34/SC-2 P1528 RECOMMENDED TISSUE DIELECTRIC PARAMETERS

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

equations and extrapolated according to the head parameters specified in P1528 Head Body **Target Frequency** (MHz)  $\sigma$  (S/m)  $\sigma$  (S/m)  $\epsilon_{\text{r}}$  $\epsilon_{\text{r}}$ 150 52.3 0.76 61.9 0.80 300 45.3 0.87 58.2 0.92 450 43.5 0.87 56.7 0.94 835 41.5 0.90 55.2 0.97 900 41.5 0.97 55.0 1.05 915 55.0 41.5 0.98 1.06 1450 40.5 1.20 54.0 1.30 1610 40.3 1.29 53.8 1.40 1800-2000 40.0 1.40 53.3 1.52 2450 39.2 52.7 1.80 1.95 52.0 3000 38.5 2.40 2.73 5800 45.3 5.27 48.2 6.00

 $(\varepsilon_r = \text{relative permittivity}, \sigma = \text{conductivity and } \rho = 1000 \text{ kg/m}^3)$ 

# 11.2 LIQUID MEASUREMENT RESULTS

Ambient condition: Temperature: 21 °C Relative humidity: 58%

| Liquid Type | Frequency         | Temp. [°C] | Parameters   | Target | Measured | Deviation[%] | Limited[%] | Measured Date |
|-------------|-------------------|------------|--------------|--------|----------|--------------|------------|---------------|
| 10.50       | 050 1411          | 21         | Permitivity  | 41.50  | 41.52    | 0.05         | ± 5        | 2012-5-8      |
| Head850     | 850 MHz           | 21         | Conductivity | 0.90   | 0.89     | -1.11        | ± 5        | 2012-5-8      |
| Body850     | 850 MHz           | 21         | Permitivity  | 55.20  | 55.24    | 0.07         | ± 5        | 2012-5-8      |
| Bodyoso     | 850 MHZ           | 21         | Conductivity | 0.97   | 0.98     | 1.03         | ± 5        | 2012-5-8      |
| Head1900    | Head1900 1900 MHz | 21         | Permitivity  | 40.00  | 40.16    | 0.40         | ± 5        | 2012-5-8      |
| Tieau 1900  | 1900 1011 12      | 21         | Conductivity | 1.40   | 1.39     | -0.71        | ± 5        | 2012-5-8      |
| Body1900    | 1900 MHz          | 21         | Permitivity  | 53.30  | 54.24    | 1.76         | ± 5        | 2012-5-8      |
| B00y 1900   | 1900 MINZ         | 21         | Conductivity | 1.52   | 1.54     | 1.32         | ± 5        | 2012-5-8      |

#### 11.3 SYSTEM PERFORMANCE CHECK

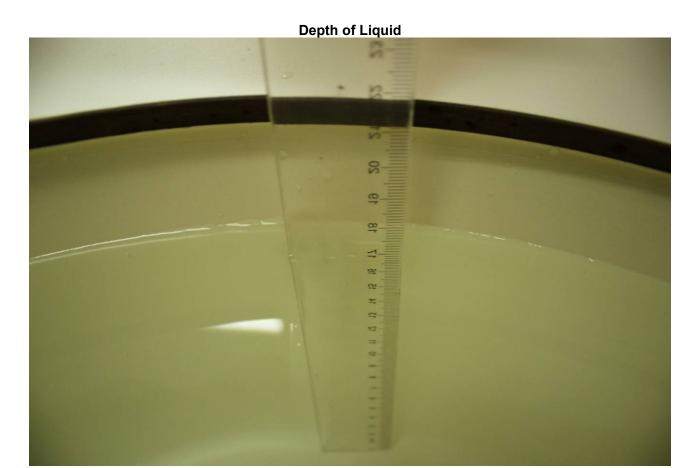
The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications of  $\pm 10\%$ . The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

#### SYSTEM PERFORMANCE CHECK MEASUREMENT CONDITIONS

- The measurements were performed in the flat section of the SAM twin phantom filled with head and body simulating liquid of the following parameters.
- The DASY5 system withan E-fileld probe EX3DV4 SN: 3755 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positiAEGd below
  the center marking of the flat phantom section and the dipole was oriented parallel to the body
  axis (the long side of the phantom). The standard measuring distance was
  15 mm (below 1 GHz) and 10 mm (above 1 GHz) from dipole center to the simulating liquid
  surface.
- The coarse grid with a grid spacing of 10mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube integration (dx= 5 mm, dy= 5 mm, dz= 5 mm).
- Distance between probe sensors and phantom surface was set to 2.5 mm.
- The dipole input power was 1W±3%.
- The results are normalized to 1 W input power.

Report No: KS120507A01-SF

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Note: For SAR testing, the depth is larger than 15cm shown above

# **Reference SAR values**

The reference SAR values were using measurement results indicated in the dipole calibration document (see table below)

| Frequency<br>(MHz) | 1g SAR | 10g SAR | Local SAR at Surface (Above Feed Point) | Local SAR at Surface<br>(y = 2cm offset from feed point) |  |  |
|--------------------|--------|---------|---|--|--|--|
| 850 Head           | 9.57   | 6.23    | 14.1                                    | 4.9  |  |  |
| 850 Body           | 9.92   | 6.55    | 14.1                                    | 4.9  |  |  |
| 1900 Head          | 40.50  | 21.10   | 67.6                                    | 6.6  |  |  |
| 1900 Body          | 39.70  | 21.10   | 07.0                                    | 6.6  |  |  |

Report No: KS120507A01-SF ØÔÔÁKÖKÁZÎÜÙTØÓF€FÁWWWWWWWWWWWÖæe^kja√AQe·\*^AKÁP[ç^{ à^¦ÁFŒÁŒFGÁ

#### SYSTEM PERFORMANCE CHECK RESULTS

**Ambient conduction** 

Temperature: 21 °C Relative humidity: 58%

System Validation Dipole: <u>D835V2-SN:4d114</u> **Date**: May 8, 2012

| Head Simulatinf Liquid |            | Parameters Target |        | Measured | Deviation[%] | Limited[%]  |
|------------------------|------------|-------------------|--------|----------|--------------|-------------|
| Frequency              | Temp. [°C] | rafailleters      | Target | weasureu | Deviation[%] | Liiiileu[%] |
| 850 MHz                | 20.30      | 1g SAR            | 9.57   | 9.88     | 3.24         | ±10         |
| 030 MITZ               |            | 10g SAR           | 6.23   | 6.32     | 1.44         | ±10         |

Temperature: 21 °C Relative humidity: 58%

System Validation Dipole: D835V2-SN:4d114 **Date**: May 8, 2012

| Body Simulatinf Liquid |            | Parameters | Target | Magaurad | Dovintion[9/1 | Limitad[9/1  |  |
|------------------------|------------|------------|--------|----------|---------------|--------------|--|
| Frequency              | Temp. [°C] |            | Target | Measured | Deviation[%]  | Liiiiilea[%] |  |
| 850 MHz                | 20.30      | 1g SAR     | 9.92   | 10.04    | 1.21          | ±10          |  |
| 030 W HZ               | 20.30      | 10g SAR    | 6.55   | 6.56     | 0.15          | ±10          |  |

Temperature: 21 °C Relative humidity: 58%

System Validation Dipole: D1900V2-SN:5d136 **Date**: May 8, 2012

| Head Simulatinf Liquid |            | Parameters | Target | Measured | Deviation[%]   | Limited[%]   |
|------------------------|------------|------------|--------|----------|----------------|--------------|
| Frequency              | Temp. [°C] |            | Target | Measureu | Deviation[//s] | Liiiiileu[%] |
| 1900 MHz 20.30         |            | 1g SAR     | 40.50  | 40.16    | -0.84          | ±10          |
| 1900 101112            | 20.30      | 10g SAR    | 21.10  | 21.12    | 0.09           | ±10          |

Temperature: 21 °C Relative humidity: 58%

System Validation Dipole: <u>D1900V2-SN:5d136</u> **Date**: May 8, 2012

| Body Simulatinf Liquid |            | Param otors | Target | Measured | Deviation[%]   | Limited[%]  |  |
|------------------------|------------|-------------|--------|----------|----------------|-------------|--|
| Frequency              | Temp. [°C] |             |        | Measureu | Deviation[///] | Liiiiteu[%] |  |
| 1900 MHz 20.30         |            | 1g SAR      | 39.70  | 41.44    | 4.38           | ±10         |  |
| 1900 101112            | 20.30      | 10g SAR     | 21.10  | 20.56    | -2.56          | ±10         |  |

## 11.4 EUT TUNE-UP PROCEDURES AND TEST MODE

The following procedure had been used to prepare the EUT for the SAR test.

To setup the desire channel frequency and the maximum output power. A Radio Communication Tester "CMU200" was used to program the EUT.

# **GSM 850 / GPRS850:**

Network Support: GSM only / GPRS

Main Service: Circuit Switched / Packet data

Power Setting: 33dBm / 33dBm

**GSM 1900 / GPRS 1900:** 

Network Support: GSM only / GPRS

Main Service: Circuit Switched / Packet data

Power Setting: 30dBm / 30dBm

Maximum conducted power was measured by replacing the antenna with an adapter for conductive measurement.

#### Conducted output power (Average):

|         | Frequency |        | GSM mode   |   |  |
|---------|-----------|--------|--|---|--|
| GSM     | Channel   | MHz    | before   | after   |  |
|         | 128       | 824.2  | 32.I G <del>////////////////////////////////////</del> | ₩₩₩₩ 32.H8  |  |
| GSM850  | 190       | 836.6  | 32.Î I <i>Ж</i>  | <i>‱</i> 32.Î 2                                   |  |
|         | 251       | 848.8  | 32.+'  | ·····H2.Î 6                                       |  |
| GSM     | Freq      | uency  | GSM  | mode  |  |
| GSIVI   | Channel   | MHz    | before   | after   |  |
|         | 512       | 1850.2 | 29.+,  | 29.Î 7  |  |
| GSM1900 | 661       | 1880.0 | 29.Î Ï   | / <del>////////////////////////////////////</del> |  |
|         | 810       | 1909.8 | 29.Î J   | <i>‱</i> 29.Î 8                                   |  |

Report No: KS120507A01-SF ØÔÔÁÖÖHÁZÎÜÙTØÓF€FÆÆWWWWWWÖŒ®ĄĹÆQ∙\*^ÁKAP[ç^{ à^¦ÆFŒÆGEFGÁ

For GPRS: It support GPRS CLASS 12:

| System and Channel  | Power values<br>(dbm) | Average<br>factor<br>(db) | Time average<br>(dbm)<br>(before) | Time average<br>(dbm)<br>(after) |
|---------------------|-----------------------|---------------------------|-----------------------------------|----------------------------------|
| GSM850 CH251(1TS)   |                       |                           |                                   |                                  |
| GPRS850 CH251       |                       |                           |                                   |                                  |
| 1TS                 | 32.24                 | -9.03                     | 23.21                             |                                  |
| 2TS                 | 32.1 3                | -6.02                     | 26.4%                             | 26.31                            |
| GSM1900 Ch 512(1TS) |                       |                           |                                   |                                  |
| GPRS1900 Ch 512     |                       |                           |                                   |                                  |
| 1TS                 | 30.14                 | -9.03                     | 21.11                             |                                  |
| 2TS                 | 29.F6                 | -6.02                     | 23.%                              | 23.\$6                           |

NOTE: 1)For GSM ,complete set of tests are performed ,For GPRS ,only the modes with maximum time average power values need to be tested respectively, So GPRS 850 only 2timeslot mode and GPRS 1900 only 2timeslot mode are tested.

2)For GPRS ,the test modes are the worst case of GSM modes

3)GSM has 8 timeslot

Average factor: when 1TS: 10\*LOG1/8=-9.03

2TS: 10\*LOG2/8=-6.02 3TS: 10\*LOG3/8=-4.26 4TS: 10\*LOG4/8=-3.01

Time average power: when 1TS=Power value+ Average factor=32.24+(-9.03)=23.21dbm 2TS,3TS and 4TS in a similar way

#### **GSM Multi-slot classes supported by the devices:**

| Multislot | Max Slot Allocation |        | Allowable | Max Data Rate |                                       |
|-----------|---------------------|--------|-----------|---------------|---------------------------------------|
| Class     | Downlink            | Uplink | Active    | Configuration | Max Data Nate                         |
|           |                     |        |           | 1 up; 4 down  | 8-12K bps Send<br>32-48K bps Receive  |
| 10        | 4                   | 2      | 5         | 2 up; 3 down  | 16-24K bps Send<br>24-36K bps Receive |

#### **Bluetooth**

- a. The client supplied a special driver to program the EUT, allowing it to continually transmit the specified maximum power and change the channel frequency.
- b. Maximum conducted power was measured by replacing the antenna with an adapter for conductive measurement.
- c. The conducted power was measured at the high, middle and low channel frequency before and after the SAR measurement.
- d. During SAR test, the highest output channel per band measured first, and then if necessary, the other channels were measured according to the normal procedures.

Bluetooth output power (Average)(dBm)

| Mode      | <b>3</b> -7() |          |  |  |
|-----------|---------------|----------|--|--|
|           | DATA1 1M      | DATA3 3M |  |  |
| Frequency |               |          |  |  |
| 2402 MHz  | 0.56          | 0.44     |  |  |
| 2441 MHz  | 0.42          | 0.34     |  |  |
| 2480 MHz  | 0.35          | 0.36     |  |  |

Ps.

WI-FI and BT Antenna distance<2.5cm, BT power 0.56 dBm(=1.138mW) ≤Pref ,so BT stand-alAEG SAR is not required .

# 11.5 SAR HANDSETS MULTI XMITER ASSESSMENT

|                      | GSM 850 head             | GSM 850 body             | GPRS 850 body            |
|----------------------|--------------------------|--------------------------|--------------------------|
| GSM 850 SAR(worst)   | 0.742                    | 0.743                    | 0.460                    |
| Bluetooth SAR(worst) | 0                        | 0                        | 0                        |
| Σ1g-SAR              | 0.742                    | 0.743                    | 0.460                    |
| remark               | Less than 1.6W/kg(limit) | Less than 1.6W/kg(limit) | Less than 1.6W/kg(limit) |

|                      | GSM 1900 head            | GSM 1900 body            | GPRS 1900 body           |
|----------------------|--------------------------|--------------------------|--------------------------|
| GSM 1900 SAR(worst)  | 0.523                    | 0.684                    | 0.504                    |
| Bluetooth SAR(worst) | 0                        | 0                        | 0                        |
| Σ1g-SAR              | 0.523                    | 0.684                    | 0.504                    |
| remark               | Less than 1.6W/kg(limit) | Less than 1.6W/kg(limit) | Less than 1.6W/kg(limit) |

#### KDB 648474 simultaneous SAR evaluation:

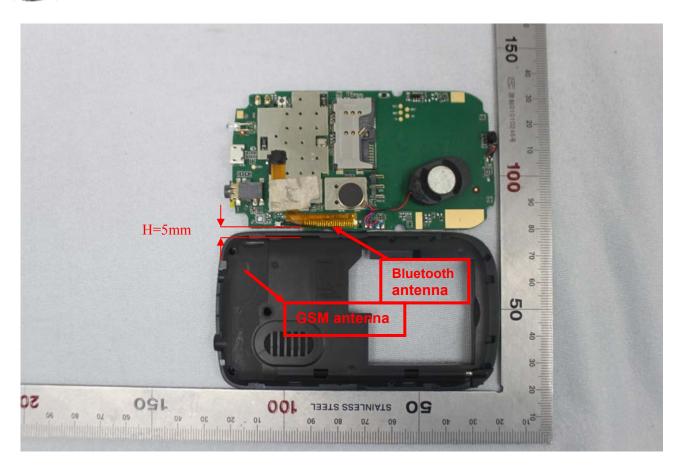
#### **Antenna Location:**

| antenna1 | antenna2  | GSM to<br>Bluetooth<br>antenna<br>distance(cm) | remark                     |
|----------|-----------|--|----------------------------|
| GSM      | Bluetooth | 0.5cm  | Please refer<br>to page 27 |
|          |           |  | to page 27                 |

| Device mode, f  | P, dBm | stand-along SAR(W/kg)           |
|-----------------|--------|---------------------------------|
| GSM 850,251     | 31.21  | Yes, Please refer to page 23;29 |
| GSM 1900,512    | 28.61  | Yes, Please refer to page 23;29 |
| GPRS 850,251    | 24.34  | Yes, Please refer to page 24;30 |
| GPRS 1900,512   | 22.66  | Yes, Please refer to page 24;30 |
| Bluetooth, 2402 | 0.56   | No, Please refer to page 25     |

| (x,y)                                       | d <sub>xy</sub> , cm | simultaneous Tx SAR | remarks   |
|---|----------------------|---------------------|---|
| GSM to Bluetooth<br>antenna<br>distance(cm) | 0.5 cm               | No                  | GSM/BT , Antenna distance is less than 2.5cm ,the sum of BT and GSM SAR is less than 1.6 W/kg. so no Simultaneous SAR needed. |





Report No: KS120507A01-SF

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# 11.6 EUT SETUP PHOTOS

Cheek device with right head phantom.





**EUT Setup Configuration 1** 

Cheek device with left head phantom.

**EUT Setup Configuration 2** 

Tilt device with left head phantom



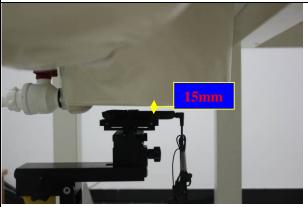
**UT Setup Configuration 3** 

Up in body position

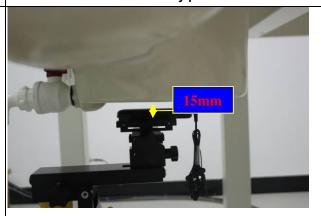


**EUT Setup Configuration 4** 

Down in body position



**EUT Setup Configuration 5** 



**EUT Setup Configuration 6** 

#### 11.7 SAR MEASUREMENT RESULTS

**Head Position mode: EUT Configuration 1&2&3&4**Date of Measurement: May 8, 2012

| Test mode: <b>GSM 850</b> , Duty Cycle: 12.5%, Crest Factor: 8 |   |                |               |              |         |                  |  |
|--|---|----------------|---------------|--------------|---------|------------------|--|
| EUT Setup Condition  |   | Frequency      |               | Liquid       | SAR(1g) | Limit            |  |
| Position   | Antenna   | Channel        | MHz           | Temp<br>[°C] | (W/kg)  | (W/kg)           |  |
|  |   | 128            | 824.2         | 20.0         | 0.711   |                  |  |
| Right Check  | Fixed   | 190            | 836.6         | 20.0         | 0.723   |                  |  |
|  |   | 251            | 848.8         | 20.0         | 0.742   | 1.6              |  |
| Right Title  | Fixed   | 251            | 848.8         | 20.0         | 0.708   | 1.0              |  |
| Left Check   | Fixed   | 251            | 848.8         | 20.0         | 0.699   |                  |  |
| Left Title   | Fixed   | 251            | 848.8         | 20.0         | 0.685   |                  |  |
| Test mode: DC  | <b>S1900</b> , Du   | ty Cycle: 12.5 | 5%, Crest Fac | ctor: 8      |         |                  |  |
| EUT Setup C  | Condition   | Frequency      |               | Liquid       | SAR(1g) |                  |  |
| Position   | Antenna   | Channel        | MHz           | Temp<br>[°C] | (W/kg)  | Limit<br>(W/kg)  |  |
|  |   | 512            | 1850.2        | 20.0         | 0.523   | ( <b>**</b> /Ng) |  |
| Right Check  | Fixed   | 661            | 1880.0        | 20.0         | 0.428   |                  |  |
|  |   | 810            | 1909.8        | 20.0         | 0.515   | 1.6              |  |
| Right Title  | Fixed   | 512            | 1850.2        | 20.0         | 0.469   |                  |  |
| Left Check   | Fixed   | 512            | 1850.2        | 20.0         | 0.485   |                  |  |
| Left Title   | Fixed   | 512            | 1850.2        | 20.0         | 0.359   |                  |  |
| Remarks: For   | Remarks: For SAR testing, EUT is in GSM link mode. In GSM850/1900 link mode, its crest factor is 8. |                |               |              |         |                  |  |

Date of Measurement: May 8, 2012

(Duty cycle: 1:8)

Body Position mode: EUT Configuration 5&6

**GSM 850 & GPRS 850** 

| GOINI GOG & C                                       | JI 110 000 |              |        |              |         |        |  |
|---|------------|--------------|--------|--------------|---------|--------|--|
| Test mode: G  | SM 850 EUT | Configuratio | n 5:UP |              |         |        |  |
| EUT Setup Condition                                 |            | Frequency    |        | Liquid       | SAR(1g) | Limit  |  |
| Position  | Antenna    | Channel      | MHz    | Temp<br>[°C] | (W/kg)  | (W/kg) |  |
| Flat(1.5cm)   | Fixed      | 251          | 848.8  | 20.0         | 0.287   | 1.6    |  |
| Test mode: <b>GSM 850</b> EUT Configuration 6:Down  |            |              |        |              |         |        |  |
| EUT Setup Condition                                 |            | Frequency    |        | Liquid       | SAR(1g) | Limit  |  |
| Position  | Antenna    | Channel      | MHz    | Temp<br>[°C] | (W/kg)  | (W/kg) |  |
| Flat(1.5cm)   | Fixed      | 128          | 824.2  | 20.0         | 0.452   | 1.6    |  |
|   |            | 190          | 836.6  | 20.0         | 0.683   |        |  |
|   |            | 251          | 848.8  | 20.0         | 0.743   |        |  |
| Test mode: GPRS 850 CLASS 12 EUT Configuration 5:UP |            |              |        |              |         |        |  |
| EUT Setup Condition                                 |            | Frequency    |        | Liquid       | SAR(1g) | Limit  |  |
| Position  | Antenna    | Channel      | MHz    | Temp<br>[°C] | (W/kg)  | (W/kg) |  |

| Flat(1.5cm)   | Fixed   | 251       | 848.8 | 20.0         | 0.168   | 1.6    |  |
|---|---------|-----------|-------|--------------|---------|--------|--|
| Test mode: GPRS 850 CLASS 12 EUT Configuration 6:Down |         |           |       |              |         |        |  |
| EUT Setup Condition                                   |         | Frequency |       | Liquid       | SAR(1g) | Limit  |  |
| Position  | Antenna | Channel   | MHz   | Temp<br>[°C] | (W/kg)  | (W/kg) |  |
| Flat(1.5cm)   | Fixed   | 251       | 848.8 | 20.0         | 0.460   | 1.6    |  |

Remarks: For SAR testing, In GSM link mode, its crest factor is 8. (Duty cycle: 1:8); In GPRS link mode, its crest factor is 2. (Duty cycle: 1:2)

# **GSM 1900 & GPRS 1900**

| Test mode: <b>GSM 1900</b> EUT Configuration 5:UP  |  |           |           |              |         |        |  |  |
|--|--|-----------|-----------|--------------|---------|--------|--|--|
| EUT Setup Condition  |  | Frequency |           | Liquid       | SAR(1g) | Limit  |  |  |
| Position   | Antenna  | Channel   | MHz       | Temp<br>[°C] | (W/kg)  | (W/kg) |  |  |
| Flat(1.5cm)  | Fixed  | 512       | 1850.2    | 20.0         | 0.454   | 1.6    |  |  |
| Test mode: <b>GSM 1900</b> EUT Configuration 6:Down  |  |           |           |              |         |        |  |  |
| EUT Setup  | EUT Setup Condition                                    |           | Frequency |              | SAR(1g) | Limit  |  |  |
| Position   | Antenna  | Channel   | MHz       | Temp<br>[°C] | (W/kg)  | (W/kg) |  |  |
|  | Fixed  | 512       | 1850.2    | 20.0         | 0.684   |        |  |  |
| Flat(1.5cm)  |  | 661       | 1880.0    | 20.0         | 0.657   | 1.6    |  |  |
|  |  | 810       | 1909.8    | 20.0         | 0.662   |        |  |  |
| Test mode: G   | Test mode: GPRS 1900 CLASS 12 EUT Configuration 5:UP   |           |           |              |         |        |  |  |
| EUT Setup  | EUT Setup Condition                                    |           | Frequency |              | SAR(1g) | Limit  |  |  |
| Position   | Antenna  | Channel   | MHz       | Temp<br>[°C] | (W/kg)  | (W/kg) |  |  |
| Flat(1.5cm)  | Fixed  | 512       | 1850.2    | 20.0         | 0.207   | 1.6    |  |  |
| Test mode: G   | Test mode: GPRS 1900 CLASS 12 EUT Configuration 6:Down |           |           |              |         |        |  |  |
| EUT Setup Condition  |  | Frequency |           | Liquid       | SAR(1g) | Limit  |  |  |
| Position   | Antenna  | Channel   | MHz       | Temp<br>[°C] | (W/kg)  | (W/kg) |  |  |
| Flat(1.5cm)  | Fixed  | 512       | 1850.2    | 20.0         | 0.504   | 1.6    |  |  |
| Remarks: For SAR testing, In GSM link mode, its crest factor is 8. (Duty cycle: 1:8);<br>In GPRS link mode, its crest factor is 2. (Duty cycle: 1:2) |  |           |           |              |         |        |  |  |

# 12. EUT PHOTO













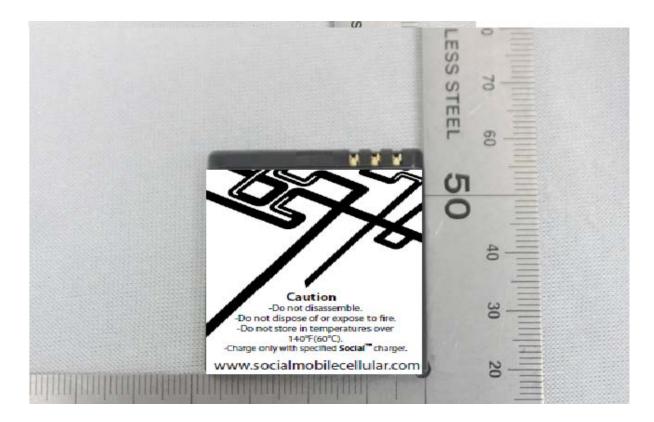






Report No: KS120507A01-SF ØÔÔÁÖÖKÁZÎ ÜÙT ØÓF€FÁWWWWWWWWÖæe^Á,ÁQ● ^ÁKÁÞ[ç^{ à^¦ÁFGÆGEFGÁ





# 13. EQUIPMENT LIST & CALIBRATION STATUS

| Name of Equipment                  | Manufacturer | Type/Model    | Serial Number   | Calibration Due |
|------------------------------------|--------------|---------------|-----------------|-----------------|
| P C                                | HP           | Core(rm)3.16G | CZCO48171H      | N/A             |
| Signal Generator                   | Agilent      | E8257C        | MY43321570      | 05/13/2012      |
| S-Parameter Network<br>Analyzer    | Agilent      | E5071B        | MY42301382      | 03/16/2013      |
| Wireless Communication<br>Test Set | R&S          | CMU200        | SN:B23-03291    | 05/13/2012      |
| Power Meter                        | Agilent      | E4416A        | QB41292714      | 03/16/2013      |
| Peak & Average sensor              | Agilent      | E9327A        | CF0001          | 03/16/2013      |
| E-field PROBE                      | SPEAG        | EX3DV4        | 3755            | 01/20/2013      |
| DIPOLE 835MHZ<br>ANTENNA           | SPEAG        | D835V2        | 4d114           | 01/10/2013      |
| DIPOLE 1900MHZ<br>ANTENNA          | SPEAG        | D1900V2       | 5d136           | 01/05/2013      |
| DIPOLE 2450MHZ<br>ANTENNA          | SPEAG        | D2450V2       | 817             | 01/26/2013      |
| DUMMY PROBE                        | SPEAG        | DP_2          | SPDP2001AA      | N/A             |
| SAM PHANTOM<br>(ELI4 v4.0)         | SPEAG        | QDOVA001BB    | 1102            | N/A             |
| Twin SAM Phantom                   | SPEAG        | QD000P40CD    | 1609            | N/A             |
| ROBOT                              | SPEAG        | TX60          | F10/5E6AA1/A101 | N/A             |
| ROBOT KRC                          | SPEAG        | CS8C          | F10/5E6AA1/C101 | N/A             |
| LIQUID CALIBRATION KIT             | ANTENNESSA   | 41/05 OCP9    | 00425167        | N/A             |
| DAE                                | SD000D04BJ   | DEA4          | 1245            | 01/11/2013      |

# 14. FACILITIES

All measurement facilities used to collect the measurement data are located at

No.10, Weiye Rd., Innovation Park, Eco & Tec. Development Part, Kunshan City, Jiangsu Province, China.

Page 35 of 82

# 15. REFERENCES

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# 16. ATTACHMENTS

| Exhibit | Content   |
|---------|---|
| 1       | System Performance Check Plots                  |
| 2       | SAR Test Plots                                  |
| 3       | Probe calibration report EX3DV4 SN3755          |
| 4       | Dipole calibration report D835V2 SN:4d114       |
| 5       | Dipole calibration report D1900V2-SN:5d136      |
| 6       | DAE calibration report DEA4 SD000D04BJ SN: 1245 |

# **APPENDIX A: PLOTS OF PERFORMANCE CHECK**

The plots are showing as followings.

Page 38 of 82

Test Laboratory: Compliance Certification Services Inc.

### System Performance Head Check-D850 2012.05.08

DUT: Dipole 850 MHz D835V2; Type: D835V2; SN:4d114

Communication System: CW; Frequency: 850 MHz

Medium parameters used: f = 850 MHz;  $\sigma$  = 0.89 mho/m;  $\varepsilon_r$  = 41.52;  $\rho$  = 1000 kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN3755; ConvF(8.99, 8.99, 8.99); Calibrated: 1/20/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 1/11/2012
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
- Measurement SW: DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

# System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=3.0mm (EX-Probe)/Area Scan (7x12x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 3.356mW/g

# System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=3.0mm (EX-Probe)/Zoom Scan (7x7x7) /Cube 0:

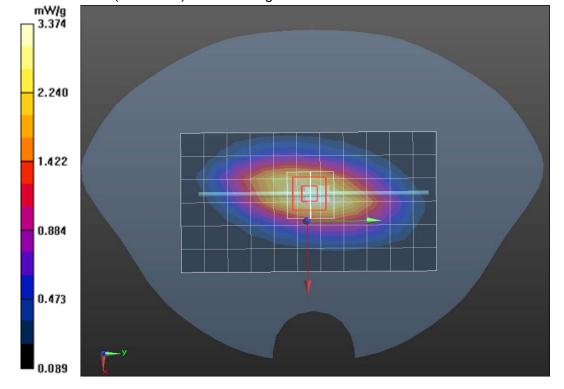
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.77 V/m; Power Drift = 0.051 dB

Peak SAR (extrapolated) = 3.595W/kg

SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.58 mW/g

Maximum value of SAR (measured) =3.374 mW/g



Report No: KS120507A01-SF

Test Laboratory: Compliance Certification Services Inc.

# System Performance Body Check-D850\_2012.05.08

DUT: Dipole 850 MHz D835V2; Type: D835V2; SN:4d114

Communication System: CW; Frequency: 850 MHz

Medium parameters used: f = 850 MHz;  $\sigma$  = 0.98 mho/m;  $\varepsilon_r$  = 55.24;  $\rho$  = 1000 kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN3755; ConvF(9.07, 9.07, 9.07); Calibrated: 1/20/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 1/11/2012
- Phantom: Twin SAM Phantom; Type: QD 000 P40 CD; Serial: 1609
   Measurement SW: DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

# System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=3.0mm (EX-Probe)/Area Scan (7x12x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 3.271mW/g

# System Performance Check at Frequencies below 1 GHz/d=15mm, Pin=250 mW, dist=3.0mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0:

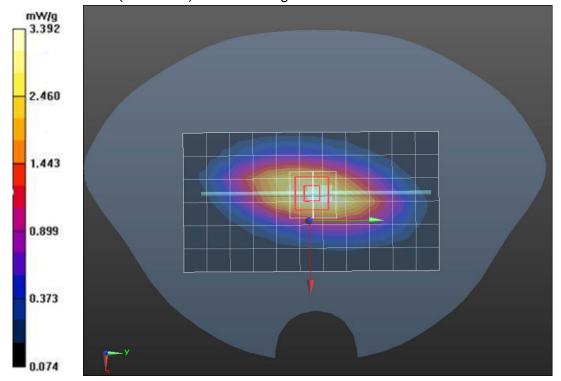
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.83 V/m; Power Drift = 0.0022 dB

Peak SAR (extrapolated) = 3.428 W/kg

### SAR(1 g) = 2.51 mW/g; SAR(10 g) = 1.64 mW/g

Maximum value of SAR (measured) = 3.392 mW/g



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Test Laboratory: Compliance Certification Services Inc.

# System Performance Head Check-D1900\_2012.05.08

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:5d136

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: f = 1900 MHz;  $\sigma$  = 1.39 mho/m;  $\varepsilon_r$  = 40.16;  $\rho$  = 1000 kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN3755; ConvF(7.84, 7.84, 7.84); Calibrated: 1/20/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 1/11/2012
- Phantom: SAM1; Type: SAM; Serial: 1609
- Measurement SW: DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

# System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=3.0mm (EX-Probe) 2/Area Scan (7x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 11.958 mW/g

# System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=3.0mm (EX-Probe) 2/Zoom Scan (7x7x7) /Cube 0:

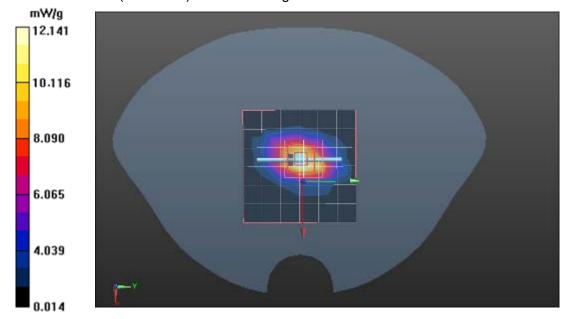
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.61 V/m; Power Drift = 0.0033 dB

Peak SAR (extrapolated) = 17.549 W/kg

### SAR(1 g) = 10.04 mW/g; SAR(10 g) = 5.28 mW/g

Maximum value of SAR (measured) = 12.141 mW/g



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Test Laboratory: Compliance Certification Services Inc.

### System Performance Body Check-D1900\_2012.05.08

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:5d136

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: f = 1900 MHz;  $\sigma$  = 1.54mho/m;  $\varepsilon_r$  = 54.24;  $\rho$  = 1000 kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN3755; ConvF(7.23, 7.23, 7.23); Calibrated: 1/20/2012
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1245; Calibrated: 1/11/2012
- Phantom: SAM1; Type: SAM; Serial: 1609
- Measurement SW: DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

# System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=250 mW, dist=3.0mm (EX-Probe) 2/Area Scan (7x7x1):

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 12.986mW/g

# System Performance Check at Frequencies above 1 GHz/d=10mm, Pin=xx mW, dist=3.0mm (EX-Probe) 2/Zoom Scan (7x7x7) /Cube 0:

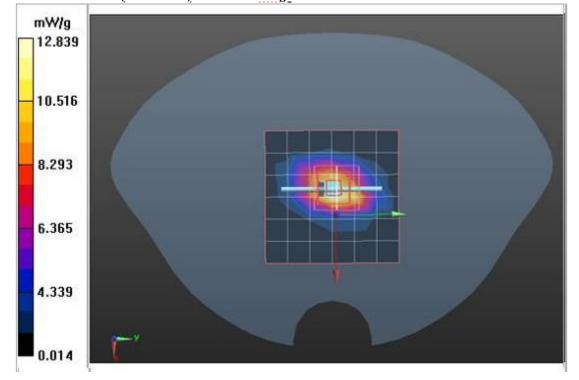
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.5V/m; Power Drift = 0.012 dB

Peak SAR (extrapolated) = 16.529 W/kg

## SAR(1 g) = 10.36 mW/g; SAR(10 g) = 5.14 mW/g

Maximum value of SAR (measured) = 12.839mW/g



# **APPENDIX B: DASY CALIBRATION CERTIFICATE**

The DASY Calibration Certificates are showing as followings .

Page 43 of 82

# Compliance Certification Services Inc.

Report No: KS120507A01-SF

ØÔÔÁØÖKÁZÎÜÙTØÓF€FÄWWWWWWWWÖŒ¢ÁĮÁ®• `^ÁKÁÞ[ç^{ à^¦ÁFŒÊØ€FGÁ

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





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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA

Multilateral Agreement for the recognition of calibration certificates

Client

CCS (Auden)

Accreditation No.: SCS 108

Certificate No: D835V2-4d114 Jan11

#### CALIBRATION CERTIFICATE

Object

D835V2 - SN: 4d114

Calibration procedure(s)

QA CAL-05.v8

Calibration procedure for dipole validation kits

Calibration date:

January 10, 2011

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           | 10.4               | Car Date (Certificate No.)        | Scheduled Calibration  |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power meter EPM-442A        | G837480704         | 06-Oct-10 (No. 217-01266)         | Oct-11                 |
| Power sensor HP 8481A       | US37292783         | 06-Oct-10 (No. 217-01266)         | Oct-11                 |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 30-Mar-10 (No. 217-01158)         | Mar-11                 |
| Type-N mismatch combination | SN: 5047.2 / 08327 | 30-Mar-10 (No. 217-01162)         | Mer-11                 |
| Reference Probe ES3DV3      | SN: 3205           | 30-Apr-10 (No. ES3-3205_Apr10)    | Apr-11                 |
| DAE4                        | SN: 601            | 10-Jun-10 (No. DAE4-601_Jun10)    | Jun-11                 |
| Secondary Standards         | ID#                | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
|                             |                    |                                   |                        |
| RF generator R&S SMT-06     | 100005             | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |

Calibrated by:

Name Function

Jeton Kastrati Laboratory Technician

Approved by:

Katja Pokovic Technical Manager

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

Issued: January 10, 2011

Signature

Certificate No: D835V2-4d114\_Jan11

Page 1 of 9

# Compliance Certification Services Inc.

Report No: KS120507A01-SF

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#### Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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

S Swiss Calibration Service

Accreditation No.: SCS 108

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

#### Glossary:

TSL

tissue simulating liquid

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

#### Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

#### Additional Documentation:

d) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

Certificate No: D835V2-4d114 Jan11

Page 2 of 9

#### **Measurement Conditions**

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

| DASY Version                 | DASY5                     | V52.6       |
|------------------------------|---------------------------|-------------|
| Extrapolation                | Advanced Extrapolation    |             |
| Phantom                      | Modular Flat Phantom V4.9 |             |
| Distance Dipole Center - TSL | 15 mm                     | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm         |             |
| Frequency                    | 835 MHz ± 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 ± 0.2) °C | 41.3 ± 6 %   | 0.89 mho/m ± 6 % |
| Head TSL temperature during test | (21.0 ± 0.2) °C | ****         | 4880             |

#### SAR result with Head TSL

| SAR averaged over 1 cm3 (1 g) of Head TSL | Condition          |                           |
|---|--------------------|---------------------------|
| SAR measured                              | 250 mW input power | 2.38 mW / g               |
| SAR normalized                            | normalized to 1W   | 9.52 mW / g               |
| SAR for nominal Head TSL parameters       | normalized to 1W   | 9.57 mW /g ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                           |
|---|--------------------|---------------------------|
| SAR measured  | 250 mW input power | 1.55 mW / g               |
| SAR normalized  | normalized to 1W   | 6.20 mW / g               |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 6.23 mW /g ± 16.5 % (k=2) |

Certificate No: D835V2-4d114\_Jan11

Page 3 of 9

#### **Body TSL parameters**

no 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 ± 0.2) °C | 54.1 ± 6 %   | 0.99 mha/m ± 6 % |
| Body TSL temperature during test | (21.6 ± 0.2) °C | ****         |                  |

#### SAR result with Body TSL

| SAR averaged over 1 cm3 (1 g) of Body TSL | Condition          |                            |
|---|--------------------|----------------------------|
| SAR measured                              | 250 mW input power | 2.53 mW / g                |
| SAR normalized                            | normalized to 1W   | 10.1 mW / g                |
| SAR for nominal Body TSL parameters       | normalized to 1W   | 9.92 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm3 (10 g) of Body TSL | condition          |                            |
|---|--------------------|----------------------------|
| SAR measured                                | 250 mW input power | 1.66 mW / g                |
| SAR normalized                              | normalized to 1W   | 6.64 mW / g                |
| SAR for nominal Body TSL parameters         | normalized to 1W   | 6.55 mW / g ± 16.5 % (k=2) |

Certificate No: D835V2-4d114\_Jan11

Page 4 of 9

Report No: KS120507A01-SF

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#### **Appendix**

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 52.3 Ω - 2.6  Ω |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 29.5 dB       |  |

#### Antenna Parameters with Body TSL

| Impedance, transformed to feed point | 47.6 Ω - 4.6 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 25.5 dB       |

#### General Antenna Parameters and Design

| Electrical Delay (one direction) | 1,400 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.

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 | June 29, 2010 |  |

Certificate No: D835V2-4d114\_Jan11

Page 5 of 9

#### **DASY5 Validation Report for Head TSL**

Date/Time: 03.01.2011 14:35:06

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d114

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL900

Medium parameters used: f = 835 MHz;  $\sigma = 0.89$  mho/m;  $\epsilon r = 40.9$ ;  $\rho = 1000$  kg/m3

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

#### DASY5 Configuration:

- Probe: ES3DV3 SN3205; ConvF(6.03, 6.03, 6.03); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

#### Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement

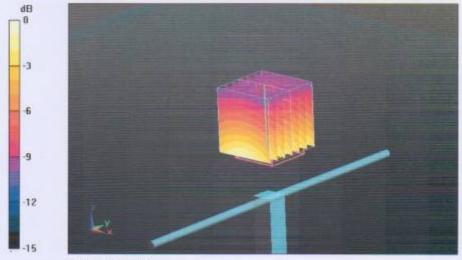
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.3 V/m; Power Drift = 0.000428 dB

Peak SAR (extrapolated) = 3.59 W/kg

SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.55 mW/g

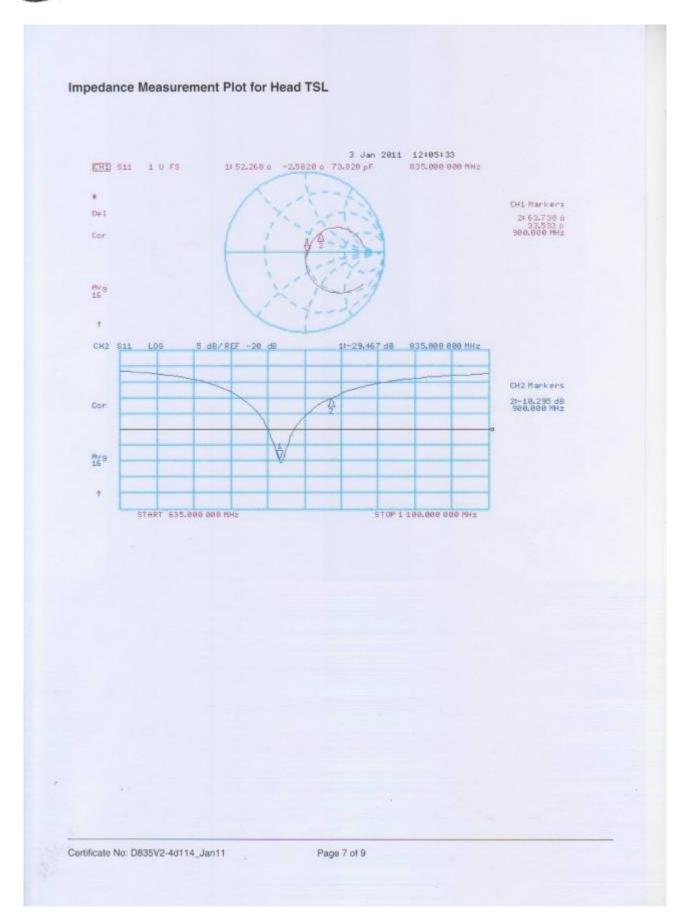
Maximum value of SAR (measured) = 2.56 mW/g



0 dB = 2.56 mW/g

Certificate No: D835V2-4d114\_Jan11

Page 6 of 9



Page 50 of 82

Rev. 01

#### **DASY5 Validation Report for Body**

Date/Time: 10.01.2011 10:33:12

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d114

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL900

Medium parameters used: f = 835 MHz;  $\sigma = 0.99 \text{ mho/m}$ ;  $\varepsilon_r = 54.1$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

#### DASY5 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5.86, 5.86, 5.86); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

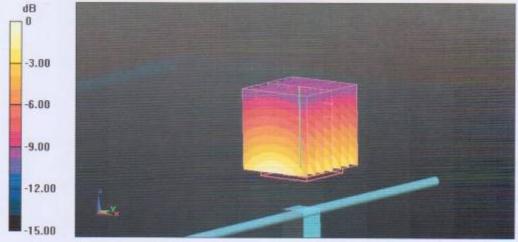
Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement

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

Peak SAR (extrapolated) = 3.727 W/kg

SAR(1 g) = 2.53 mW/g; SAR(10 g) = 1.66 mW/g

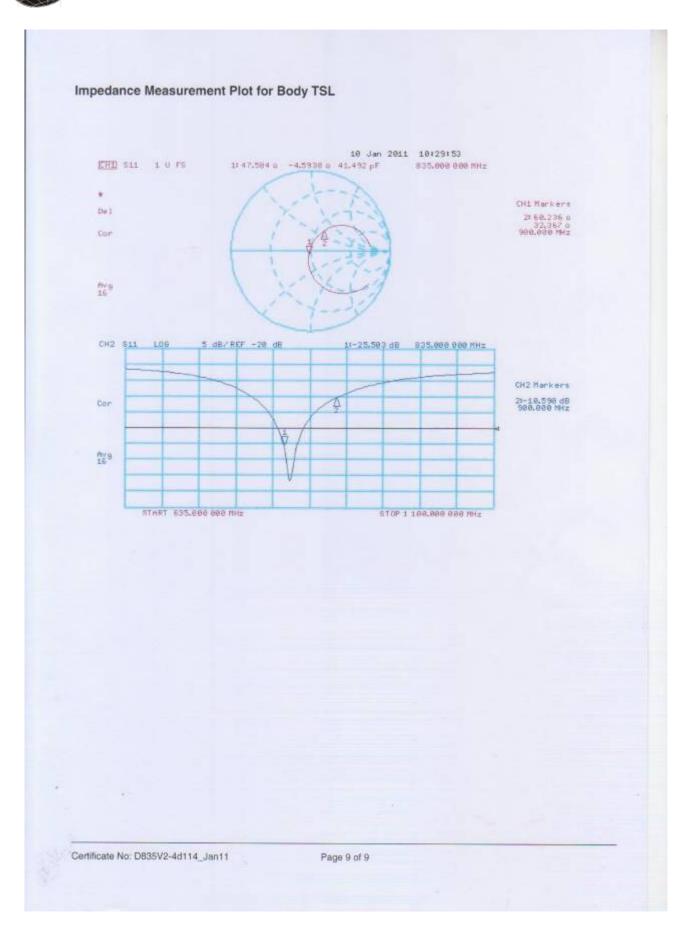
Maximum value of SAR (measured) = 2.944 mW/g



0 dB = 2.940 mW/g

Certificate No: D835V2-4d114\_Jan11

Page 8 of 9



# **DASY Calibration Certificate-Extended Dipole-835MHz Calibrations**

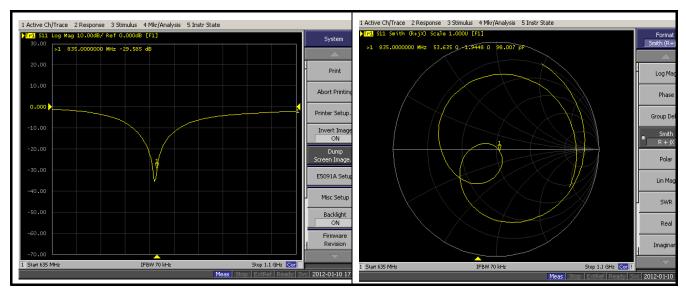
According to KDB 450824 D02, Dipoles must be recalibrated at least once every three years; however, immediate re-calibration is required for the following conditions. The test laboratory must ensure that the required supporting information and documentation have been included in the SAR report to qualify for the extended 3-year calibration interval

1)When the most recent return-loss, measured at least annually, deviates by more than 20% from the previous measurement (i.e. 0.2 of the dB value) or not meeting the required -20 dB return-loss specification

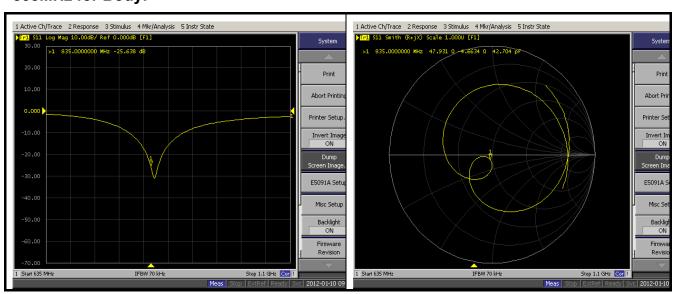
2)When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, deviates by more than 5  $\Omega$  from the previous measurement

Dipole Verification plot: D835V2 S/N:4d114

835MHz for Head:



#### 835MHz for Body:



| D835V2 S/N:4d114 For HEAD |                           |                          |                |                               |                |                |
|---------------------------|---------------------------|--------------------------|----------------|-------------------------------|----------------|----------------|
| Return-Loss<br>(dB)       | Deviate<br>(dB)           | Real<br>Impedance<br>(Ω) | Deviate<br>(Ω) | Imaginary<br>Impedance<br>(Ω) | Deviate<br>(Ω) | Calibrate Date |
| -29.466                   |                           | 52.262                   |                | -2.5822                       |                | 2012-01-10     |
| -29.585                   | 0.119                     | 53.635                   | 1.373          | -1.9448                       | 0.6374         | 2012-01-10     |
|                           | D835V2 S/N:4d114 For BODY |                          |                |                               |                |                |
| Return-Loss<br>(dB)       | Deviate<br>(dB)           | Real<br>Impedance<br>(Ω) | Deviate<br>(Ω) | Imaginary<br>Impedance<br>(Ω) | Deviate<br>(Ω) | Calibrate Date |
| -25.505                   |                           | 47.585                   |                | -4.5941                       |                | 2012-01-10     |
| -25.638                   | 0.133                     | 47.931                   | 0.346          | -4.6634                       | 0.0693         | 2012-01-10     |

According to up table, the return loss is <-20dB, deviates by less than 20% from the previous measurement; the Real Impedance and Imaginary Impedance are all within  $5~\Omega$  compared to the previous measurement.

So, the verification result should extended calibration.

# Compliance Certification Services Inc.

Report No: KS120507A01-SF

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### Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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Client

CCS (Auden)

Accreditation No.: SCS 108

Certificate No: D1900V2-5d136\_Jan11

## **CALIBRATION CERTIFICATE**

Object

D1900V2 - SN: 5d136

Calibration procedure(s)

QA CAL-05.v8

Calibration procedure for dipole validation kits

Calibration date:

Primary Standards

January 05, 2011

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)

| Power meter EPM-442A        | GB37480704         | 06-Oct-10 (No. 217-01266)         | Oct-11                 |
|-----------------------------|--------------------|-----------------------------------|------------------------|
| Power sensor HP 8481A       | US37292783         | 06-Oct-10 (No. 217-01268)         | Oct-11                 |
| Reference 20 dB Attenuator  | SN: 5086 (20g)     | 30-Mar-10 (No. 217-01158)         | Mar-11                 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 30-Mar-10 (No. 217-01162)         | Mar-11                 |
| Reference Probe ES3DV3      | SN: 3205           | 30-Apr-10 (No. ES3-3205_Apr10)    | Apr-11                 |
| DAE4                        | SN: 601            | 10-Jun-10 (No. DAE4-601_Jun10)    | Jun-11                 |
| Secondary Standards         | ID#                | Check Date (in house)             | Scheduled Check        |
| Power sensor HP 8481A       | MY41092317         | 18-Oct-02 (in house check Oct-09) | In house check: Oct-11 |
| RF generator R&S SMT-06     | 100005             | 4-Aug-99 (in house check Oct-09)  | In house check: Oct-11 |
| Network Analyzer HP 8753E   | US37390585 S4206   | 18-Oct-01 (in house check Oct-10) | In house check: Oct-11 |
|                             | Name               | Function                          | Signature              |
| Calibrated by:              | Jeton Kastrati     | Laboratory Technician             | f-pe                   |
| Approved by:                | Katia Pokovic      | Technical Manager                 | 100 111                |

Cal Date (Certificate No.)

\*\*

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Issued: January 5, 2011

Scheduled Calibration

Certificate No: D1900V2-5d136\_Jan11

Page 1 of 9

# Compliance Certification Services Inc.

#### Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerischer Kalibrierdienst

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S Swiss Calibration Service

Accreditation No.: SCS 108

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

#### Glossary:

TSL

tissue simulating liquid

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

#### Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

#### Additional Documentation:

d) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

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

Certificate No: D1900V2-5d136\_Jan11

Page 2 of 9

#### Measurement Conditions

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

| DASY Version                 | DASY5                     | V52.6       |
|------------------------------|---------------------------|-------------|
| Extrapolation                | Advanced Extrapolation    |             |
| Phantom                      | Modular Flat Phantom V5.0 |             |
| Distance Dipole Center - TSL | 10 mm                     | with Spacer |
| Zoom Scan Resolution         | dx, dy, dz = 5 mm         |             |
| Frequency                    | 1900 MHz ± 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 ± 0.2) "C | 38.5 ± 6 %   | 1.43 mho/m ± 6 % |
| Head TSL temperature during test | (20.6 ± 0.2) °C | ****         |                  |

#### SAR result with Head TSL

| SAR averaged over 1 cm3 (1 g) of Head TSL | Condition          |                           |
|---|--------------------|---------------------------|
| SAR measured                              | 250 mW input power | 10.3 mW / g               |
| SAR normalized                            | normalized to 1W   | 41.2 mW / g               |
| SAR for nominal Head TSL parameters       | normalized to 1W   | 40.5 mW /g ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL | condition          |                           |
|---|--------------------|---------------------------|
| SAR measured  | 250 mW input power | 5.33 mW / g               |
| SAR normalized  | normalized to 1W   | 21.3 mW / g               |
| SAR for nominal Head TSL parameters                     | normalized to 1W   | 21.1 mW /g ± 16.5 % (k=2) |

Certificate No: D1900V2-5d136\_Jan11

Page 3 of 9

#### **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 ± 0.2) °C | 52.9 ± 6 %   | 1.56 mha/m ± 6 % |
| Body TSL temperature during test | (21.2 ± 0.2) °C | ****         | ****             |

#### SAR result with Body TSL

| SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL | Condition          |                            |
|---|--------------------|----------------------------|
| SAR measured  | 250 mW input power | 10.1 mW/g                  |
| SAR normalized  | normalized to 1W   | 40.4 mW / g                |
| SAR for nominal Body TSL parameters                   | normalized to 1W   | 39.7 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL | condition          |                            |
|---|--------------------|----------------------------|
| SAR measured  | 250 mW input power | 5.31 mW / g                |
| SAR normalized  | normalized to 1W   | 21.2 mW / g                |
| SAR for nominal Body TSL parameters                     | normalized to 1W   | 21.1 mW / g ± 16.5 % (k=2) |

Certificate No: D1900V2-5d136\_Jan11

Page 4 of 9

#### Appendix

#### Antenna Parameters with Head TSL

| Impedance, transformed to feed point | 52.7 Ω + 8.2 jΩ |  |
|--------------------------------------|-----------------|--|
| Return Loss                          | - 21.5 dB       |  |

#### Antenna Parameters with Body TSL

| Impedance, transformed to feed point | 47.2 Ω + 7.6 jΩ |
|--------------------------------------|-----------------|
| Return Loss                          | - 21.6 dB       |

#### General Antenna Parameters and Design

| Electrical Delay (one direction) | Electrical Delay (one direction) | 1.204 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.

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 | April 14, 2010 |

Certificate No: D1900V2-5d136\_Jan11

Page 5 of 9

#### **DASY5 Validation Report for Head TSL**

Date/Time: 04.01.2011 11:58:06

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d136

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL U12 BB

Medium parameters used: f = 1900 MHz;  $\sigma = 1.42 \text{ mho/m}$ ;  $\varepsilon_r = 38.7$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

#### DASY5 Configuration:

- Probe: ES3DV3 SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6 Build (401)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement

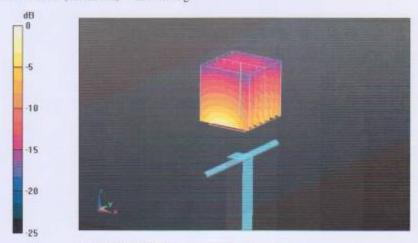
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.7 V/m; Power Drift = 0.035 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.33 mW/g

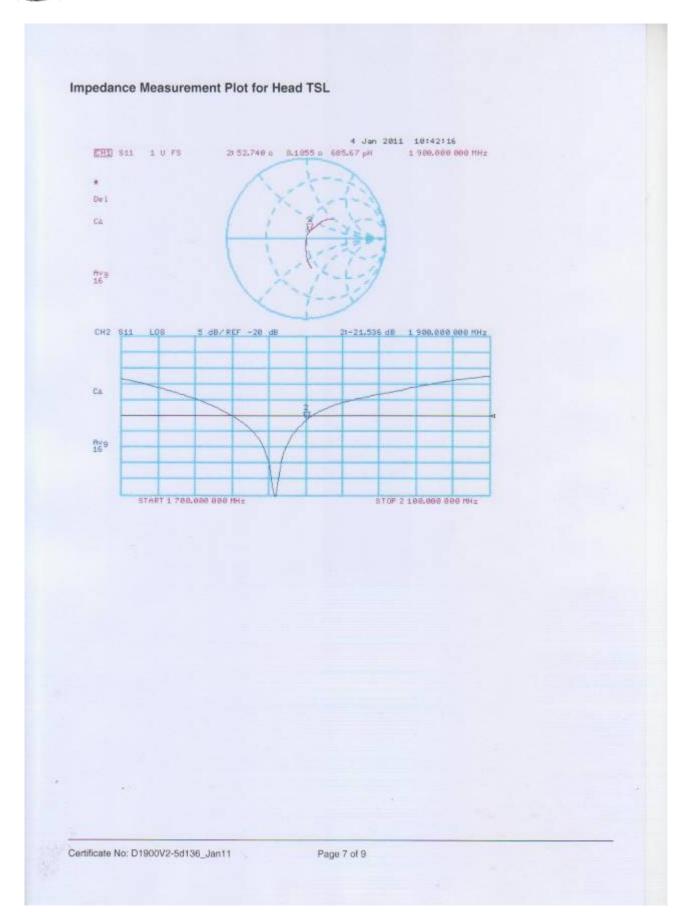
Maximum value of SAR (measured) = 12.9 mW/g



0 dB = 12.9 mW/g

Certificate No: D1900V2-5d136\_Jan11

Page 6 of 9



#### **DASY5 Validation Report for Body**

Date/Time: 05.01.2011 10:43:48

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d136

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL U12 BB

Medium parameters used: f = 1900 MHz;  $\sigma = 1.56 \text{ mho/m}$ ;  $\varepsilon_r = 53$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

#### DASY5 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6 Build (401)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

### Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement

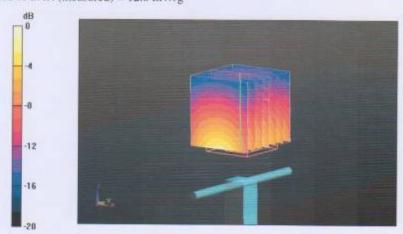
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.3 V/m; Power Drift = -0.054 dB

Peak SAR (extrapolated) = 17.3 W/kg

SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.31 mW/g

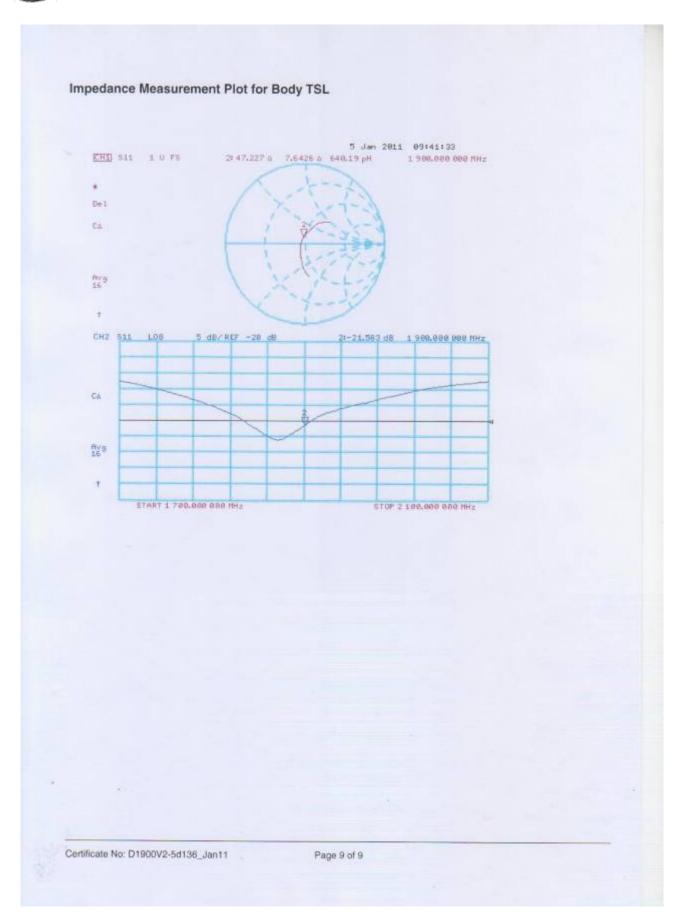
Maximum value of SAR (measured) = 12.8 mW/g



0 dB = 12.8 mW/g

Certificate No: D1900V2-5d136\_Jan11

Page 8 of 9



Page 63 of 82

Rev. 01

# **DASY Calibration Certificate-Extended Dipole-1900MHz Calibrations**

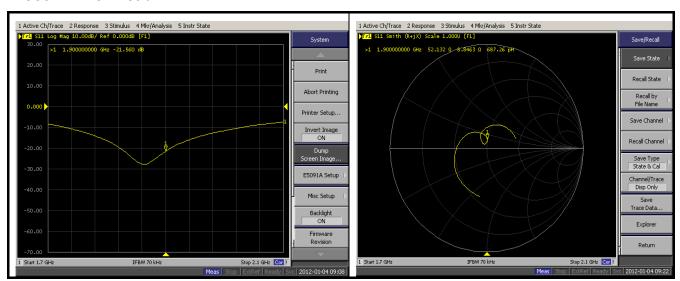
According to KDB 450824 D02, Dipoles must be recalibrated at least once every three years; however, immediate re-calibration is required for the following conditions. The test laboratory must ensure that the required supporting information and documentation have been included in the SAR report to qualify for the extended 3-year calibration interval

1)When the most recent return-loss, measured at least annually, deviates by more than 20% from the previous measurement (i.e. 0.2 of the dB value) or not meeting the required -20 dB return-loss specification

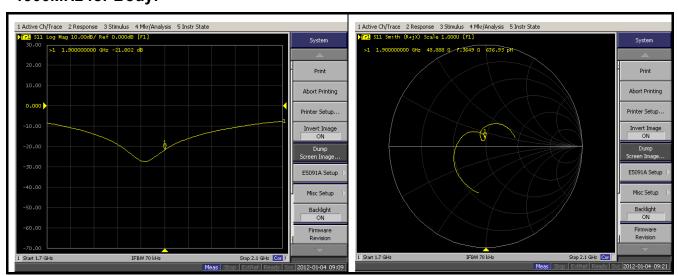
2)When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, deviates by more than 5  $\Omega$  from the previous measurement

### Dipole Verification plot: D1900V2-S/N:5d136

#### 1900MHz for Head:



#### 1900MHz for Body:



| D1900V2-S/N:5d136 For HEAD |                 |                          |                |                               |                |                |
|----------------------------|-----------------|--------------------------|----------------|-------------------------------|----------------|----------------|
| Return-Loss<br>(dB)        | Deviate<br>(dB) | Real<br>Impedance<br>(Ω) | Deviate<br>(Ω) | Imaginary<br>Impedance<br>(Ω) | Deviate<br>(Ω) | Calibrate Date |
| -21.536                    |                 | 52.740                   |                | 8.1855                        |                | 2012-01-04     |
| -21.560                    | 0.024           | 52.132                   | 0.608          | 8.8463                        | 0.6608         | 2012-01-04     |
| D1900V2-S/N:5d136 For BODY |                 |                          |                |                               |                |                |
| Return-Loss<br>(dB)        | Deviate<br>(dB) | Real<br>Impedance<br>(Ω) | Deviate<br>(Ω) | Imaginary<br>Impedance<br>(Ω) | Deviate<br>(Ω) | Calibrate Date |
| -21.583                    |                 | 47.227                   |                | 7.6426                        |                | 2012-01-05     |
| -21.802                    | 0.219           | 48.888                   | 1.661          | 7.3649                        | 0.2777         | 2012-01-04     |

According to up table, the return loss is <-20dB, deviates by less than 20% from the previous measurement; the Real Impedance and Imaginary Impedance are all within  $5~\Omega$  compared to the previous measurement.

So, the verification result should extended calibration.

Report No: KS120507A01-SF

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#### Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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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

CCS (Auden)

Accreditation No.: SCS 108

Certificate No: EX3-3755\_Jan12

#### CALIBRATION CERTIFICATE

Calibration procedure(s)

QA CAL-01.v7, QA CAL-14.v3, QA CAL-23.v4 and QA CAL-25.v3

Calibration procedure for dosimetric E-field probes

Calibration date

Primary Standards

Power meter E44198

January 20, 2012

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.

Cal Date (Certificate No.)

1-Apr-11 (No. 217-01136)

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)

10#

GB41293874

| Power sensor E4412A        | MY41495277      | 1-Apr-11 (No. 217-01136)       |
|----------------------------|-----------------|--------------------------------|
| Power sensor E4412A        | MY41498087      | 1-Apr-11 (No. 217-01136)       |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 30-Mar-11 (No. 217-01159)      |
| Reference 20 dB Attenuator | SN: S5088 (20b) | 30-Mar-11 (No. 217-01161)      |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 38-Mar-11 (No. 217-01160)      |
| Reference Probe ES3DV2     | SN: 3013        | 29-Dec-11 (No. ES3-3013_Dec11) |
| DAE4                       | SN: 660         | 20-Apr-11 (No. DAE4-680_Apr11) |
| Secondary Standards        | 10#             | Check Date (in house)          |

Scheduled Check RF generator HP 8648C US3642U01700 4-Aug-99 (in house check Oct-10) In house check: Oct-12 Network Analyzer HP 8753E US37390585 18-Oct-01 (in house check Oct-11) In house check: Oct-12

Calibrated by:

Katja Poković

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

Technical Manager

Approved by

Niels Kuster Quality Manager

issued: January 20, 2012

Scheduled Calibration

Apr-12 Apr-12 Mar-12 Mar-12 Mar-12 Dec-12 Apr-12

Signature

Certificate No: EX3-3755\_Jan12

Page 1 of 11

Page 66 of 82

Rev 01



Report No: KS120507A01-SF

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#### Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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Swiss Calibration Service

Accreditation No.: SCS 108

Accredited by the Swiss Accreditation Service (SAS)

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#### Glossary:

TSL tissue simulating liquid NORMx,y.z sensitivity in free space ConvF sensitivity in TSL / NORMx,y.z DCP diode compression point

CF crest factor (1/duty\_cycle) of the RF signal A, B, C modulation dependent linearization parameters

Polarization φ o rotation around probe axis

Polarization 9 9 rotation around an axis that is in the plane normal to probe axis (at measurement center),

i.e.,  $\theta = 0$  is normal to probe axis

#### Calibration is Performed According to the Following Standards:

- i IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- EC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)". February 2005

#### Methods Applied and Interpretation of Parameters:

- NORMx,y,z: Assessed for E-field polarization 9 = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,y,z \* frequency\_response (see Frequency Response Chart). This linearization is
  implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included
  in the stated uncertainty of ConvF.
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z; A, B, C are numerical linearization parameters assessed based on the data of
  power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the
  maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx, y, z \* CanvF 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.

Certificate No. EX3-3755 Jan 12

Page 2 of 11

January 20, 2012

# Probe EX3DV4

SN:3755

Manufactured: Calibrated:

March 16, 2010 January 20, 2012

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: EX3-3755\_Jan12

Page 3 of 11

January 20, 2012

### DASY/EASY - Parameters of Probe: EX3DV4 SN:3755

#### **Basic Calibration Parameters**

|  | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|--|----------|----------|----------|-----------|
| Norm (μV/(V/m) <sup>2</sup> ) <sup>A</sup> | 0.49     | 0.47     | 0.50     | ± 10.1%   |
| DCP (mV) <sup>8</sup>                      | 99.9     | 99.3     | 101.0    |           |

#### **Modulation Calibration Parameters**

| UID   | Communication System Name | PAR  |   | A<br>dB | B<br>dBuV | С    | VR<br>mV | Unc <sup>1</sup><br>(k=2) |
|-------|---------------------------|------|---|---------|-----------|------|----------|---------------------------|
| 10000 | CW                        | 0.00 | X | 0.00    | 0.00      | 1.00 | 157.0    | ±2.4%                     |
|       |                           |      | Y | 0.00    | 0.00      | 1.00 | 147.8    |                           |
|       |                           |      | Z | 0.00    | 0.00      | 1.00 | 157.0    |                           |

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%.

Certificate No: EX3-3755\_Jan12

Page 4 of 11

<sup>\*</sup> The uncertainties of NormX, Y, Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

Numerical linearization parameter uncertainty not required.

Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the held value

January 20, 2012

# DASY/EASY - Parameters of Probe: EX3DV4 SN:3755

Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz] | Validity [MHz] <sup>C</sup> | Permittivity   | Conductivity   | ConvF X Co | nvFY Co | nvF Z | Alpha | Depth Unc (k≈2) |
|---------|-----------------------------|----------------|----------------|------------|---------|-------|-------|-----------------|
| 835     | ±50/±100                    | 41.5 ± 5%      | 0.90 ± 5%      | 8.99       | 8.99    | 8.99  | 0.64  | 0.68 ± 11.0%    |
| 1750    | ± 50 / ± 100                | 40.1 ± 5%      | 1.36 ± 5%      | 8.18       | 8.18    | 8.18  | 0.74  | 0.63 ± 11.0%    |
| 1900    | ±50/±100                    | 40.0 ± 5%      | 1.40 ± 5%      | 7.84       | 7.84    | 7.84  | 0.63  | 0.66 ± 11.0%    |
| 2000    | ±50/±100                    | 40.0 ± 5%      | 1.40 ± 5%      | 7.78       | 7.78    | 7.78  | 0.45  | 0.80 ± 11.0%    |
| 2450    | ±50/±100                    | 39.2 ± 5%      | 1.80 ± 5%      | 7.07       | 7.07    | 7.07  | 0.30  | 1.02 ± 11.0%    |
| 5200    | ±50/±100                    | 36.0 ± 5%      | 4.67 ± 5%      | 4.64       | 4.64    | 4.64  | 0.40  | 1.80 ± 13.1%    |
| 5300    | ±50/±100                    | $35.9 \pm 5\%$ | 4.78 ± 5%      | 4.48       | 4.48    | 4.48  | 0.40  | 1.80 ± 13.1%    |
| 5500    | ±50/±100                    | 35.6 ± 5%      | 4.96 ± 5%      | 4.45       | 4.45    | 4.45  | 0.45  | 1.80 ± 13.1%    |
| 5600    | ±50/±100                    | 35.5 ± 5%      | $5.07 \pm 5\%$ | 4.15       | 4.15    | 4.15  | 0.50  | 1.80 ± 13.1%    |
| 5800    | ± 50 / ± 100                | 35.3 ± 5%      | 5.28 ± 5%      | 4.31       | 4.31    | 4.31  | 0.45  | 1.80 ± 13.1%    |

The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). This uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band

Certificate No: EX3-3755\_Jan12

Page 5 of 11

January 20, 2012

### DASY/EASY - Parameters of Probe: EX3DV4 SN:3755

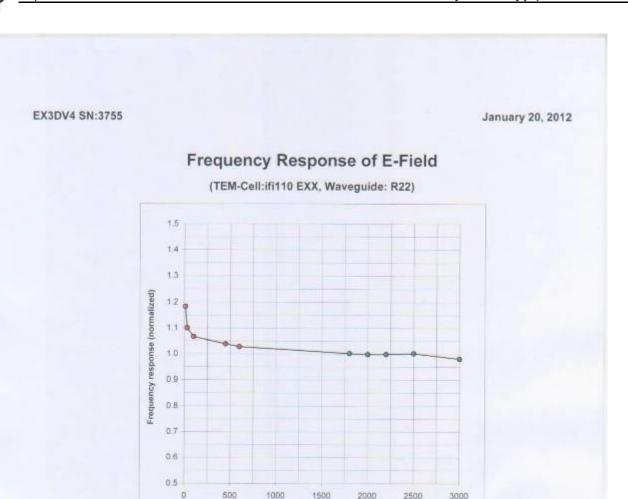
Calibration Parameter Determined in Body Tissue Simulating Media

| f [MHz] | Validity [MHz] <sup>C</sup> | Permittivity   | Conductivity   | ConvF X | ConvF Y | ConvF Z | Alpha | Depth Unc (k=2) |
|---------|-----------------------------|----------------|----------------|---------|---------|---------|-------|-----------------|
| 835     | ±50/±100                    | 55.2 ± 5%      | 0.98 ± 5%      | 9.07    | 9.07    | 9.07    | 0.66  | 0.68 ± 11.0%    |
| 1750    | ±50/±100                    | 53.4 ± 5%      | 1.49 ± 5%      | 7.48    | 7.48    | 7.48    | 0.91  | 0.60 ± 11.0%    |
| 1900    | ±50/±100                    | 53.3 ± 5%      | 1.52 ± 5%      | 7.23    | 7.23    | 7.23    | 0.60  | 0,72 ± 11.0%    |
| 2000    | ±50/±100                    | 53.3 ± 5%      | 1.52 ± 5%      | 7.31    | 7.31    | 7.31    | 0.58  | 0.74 ± 11.0%    |
| 2450    | ±50/±100                    | 52.6 ± 5%      | 1.95 ± 5%      | 7.06    | 7.06    | 7.06    | 0.58  | 0.72 ± 11.0%    |
| 5200    | ±50/±100                    | $49.0 \pm 5\%$ | $5.29 \pm 5\%$ | 4.02    | 4.02    | 4.02    | 0.50  | 1.90 ± 13.1%    |
| 5300    | ± 50 / ± 100                | $48.9 \pm 5\%$ | 5.42 ± 5%      | 3.86    | 3.86    | 3.86    | 0.50  | 1.90 ± 13.1%    |
| 5500    | ±50/±100                    | 48.6 ± 5%      | 5.66 ± 5%      | 3.62    | 3.62    | 3.62    | 0.55  | 1.90 ± 13.1%    |
| 5600    | ±50/±100                    | 48.5 ± 5%      | 5.78 ± 5%      | 3.26    | 3.26    | 3.26    | 0.65  | 1.90 ± 13.1%    |
| 5800    | ± 50 / ± 100                | 48.2 ± 5%      | 6.00 ± 5%      | 3.78    | 3.78    | 3.78    | 0.60  | 1.90 ± 13.1%    |

The velidity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calculation frequency and the uncertainty for the indicated frequency band.

Certificate No. EX3-3755 Jan 12

Page 6 of 11



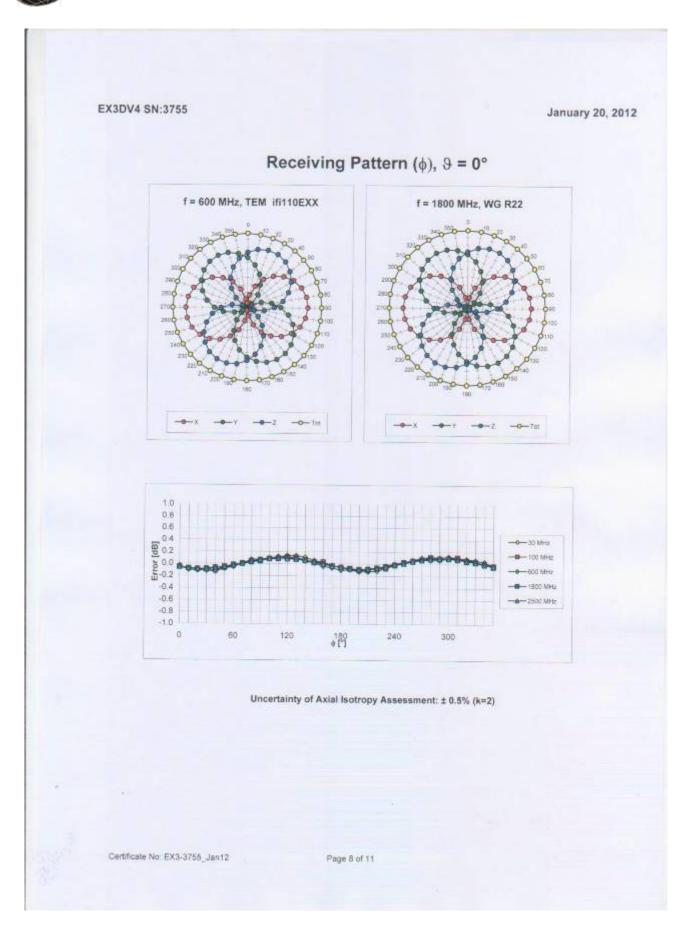
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

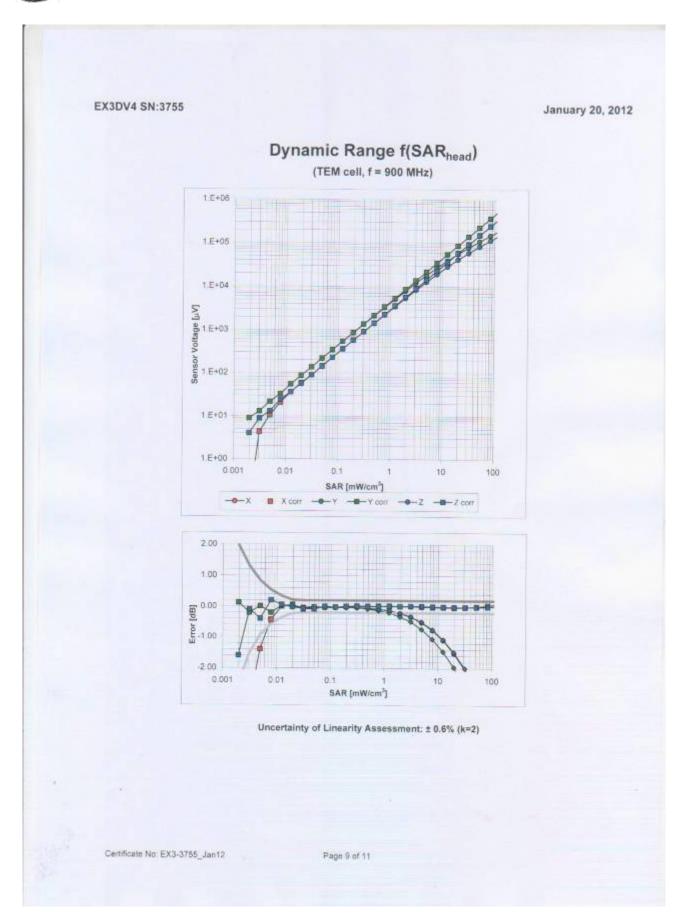
- TEM

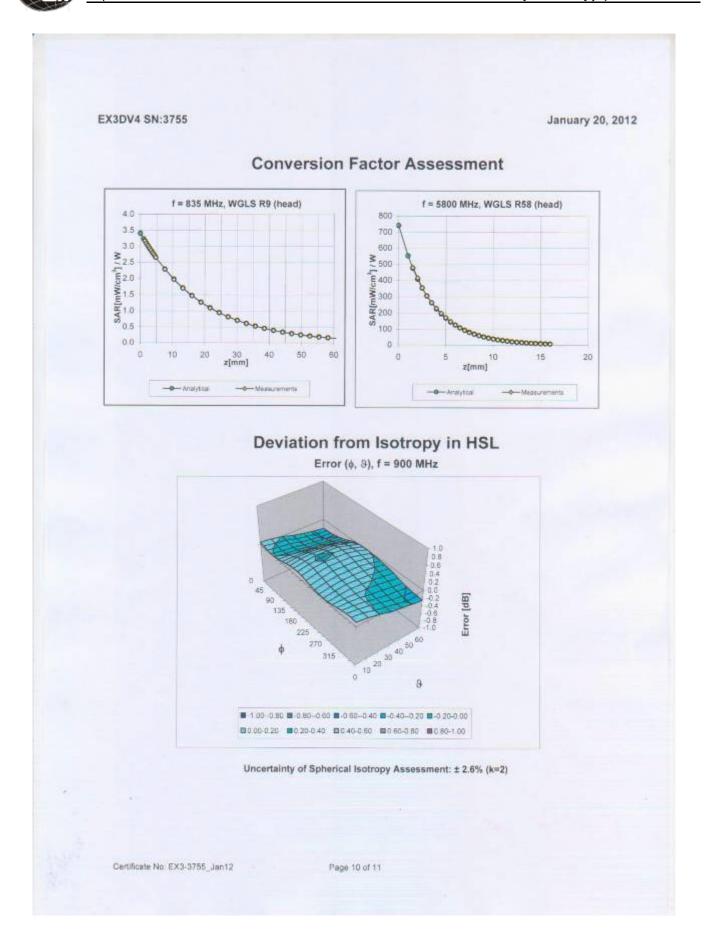
f [MHz]

Certificate No. EX3-3755\_Jan12

Page 7 of 11









January 20, 2012

### Other Probe Parameters

| Sensor Arrangement                            | Triangular     |
|---|----------------|
| Connector Angle (*)                           | Not applicable |
| Mechanical Surface Detection Mode             | enabled        |
| Optical Surface Detection Mode                | disabled       |
| Probe Overall Length                          | 337 mm         |
| Probe Body Diameter                           | 10 mm          |
| Tip Length                                    | 9 mm           |
| Tip Diameter                                  | 2.5 mm         |
| Probe Tip to Sensor X Calibration Point       | 1 mm           |
| Probe Tip to Sensor Y Calibration Point       | 1 mm           |
| Probe Tip to Sensor Z Calibration Point       | 1 mm           |
| Recommended Measurement Distance from Surface | 2 mm           |

Certificate No: EX3-3755\_Jan12

Page 11 of 11

# Compliance Certification Services Inc.

Report No: KS120507A01-SF

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





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Multilateral Agreement for the recognition of calibration certificates

Client

CCS (Auden)

Accreditation No.: SCS 108

Certificate No: DAE4-1245 Jan12

### **CALIBRATION CERTIFICATE**

Object

DAE4 - SD 000 D04 BJ - SN: 1245

Calibration procedure(s)

QA CAL-06.v22

Calibration procedure for the data acquisition electronics (DAE)

Calibration date:

January 11, 2012

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             | 10 #   | Cal Date (Certificate No.) | Scheduled Calibration |
|-------------------------------|--|----------------------------|-----------------------|
| Keithley Multimeter Type 2001 | SN: 0810278  | 28-Sep-11 (No:10376)       | Sep-12                |
| Secondary Standards           | ID#  | Check Date (in house)      | Scheduled Check       |
| overmany otorioerae           | The state of the s | Original David Millians    | . Out todated bitteen |

Calibrated by:

Name Eric Hainfeld Function Technician Signature

Approved by:

Fin Bomholt

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

R&D Director

Issued: January 11, 2012

Certificate No: DAE4-1245\_Jan12

Page 1 of 5

# Calibration Laboratory of

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland





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S Swiss Calibration Service

Accreditation No.: SCS 108

Accredited by the Swiss Accreditation Service (SAS)

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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.

Certificate No: DAE4-1245\_Jan12

Page 2 of 5

#### DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB =  $6.1\mu V$ , full range =  $-100...+300 \, mV$ Low Range: 1LSB =  $6.1\mu V$ , full range = -1......+3mVDASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X                    | Y                    | Z                    |
|---------------------|----------------------|----------------------|----------------------|
| High Range          | 405.949 ± 0.1% (k=2) | 404.668 ± 0.1% (k=2) | 405.811 ± 0.1% (k=2) |
| Low Range           | 3.99652 ± 0.7% (k=2) | 3.99470 ± 0.7% (k=2) | 3.98099 ± 0.7% (k=2) |

#### Connector Angle

| Connector Angle to be used in DASY system 32.0 °±1 ° | Connector Angle to be used in DASY system | 32.0 ° ± 1 ° |
|--|---|--------------|
|--|---|--------------|

Certificate No: DAE4-1245 Jan12

Page 3 of 5

#### **Appendix**

#### 1. DC Voltage Linearity

| High Range        | Reading (µV) | Difference (µV) | μV) Error (%) |  |
|-------------------|--------------|-----------------|---------------|--|
| Channel X + Input | 199999.6     | -1.22           | -0.00         |  |
| Channel X + Input | 20001.67     | 2.27            | 0.01          |  |
| Channel X - Input | -19997.79    | 1.81            | -0.01         |  |
| Channel Y + Input | 200009.5     | -0.71           | -0.00         |  |
| Channel Y + Input | 20000.17     | 0.67            | 0.00          |  |
| Channel Y - Input | -19998.63    | 0.87            | -0.00         |  |
| Channel Z + Input | 200008.1     | -1.41           | -0.00         |  |
| Channel Z + Input | 19999.37     | -0.03           | -0.00         |  |
| Channel Z - Input | -19999.79    | -0.39           | 0.00          |  |

| Low Range         | Reading (µV) | Difference (µV) | Error (%) |
|-------------------|--------------|-----------------|-----------|
| Channel X + Input | 1999.1       | -0.69           | -0.03     |
| Channel X + Input | 199.90       | -0.10           | -0.05     |
| Channel X - Input | -200.48      | -0.38           | 0.19      |
| Channel Y + Input | 2000.3       | 0.29            | 0.01      |
| Channel Y + Input | 199.10       | -1.00           | -0.50     |
| Channel Y - Input | -201.03      | -1.23           | 0.62      |
| Channel Z + Input | 2000.0       | 0.05            | 0.00      |
| Channel Z + Input | 198.48       | -1.52           | -0.76     |
| Channel Z - Input | -201.27      | -1.27           | 0.64      |
|                   |              |                 |           |

#### 2. Common mode sensitivity

Auto Zero Time: 3 sec: Messuring time:

|           | Common mode<br>Input Voltage (mV) | High Range<br>Average Reading (μV) | Low Range<br>Average Reading (μV) |
|-----------|-----------------------------------|------------------------------------|-----------------------------------|
| Channel X | 200                               | -7.88                              | -9.62                             |
|           | - 200                             | 10.45                              | 8.89                              |
| Channel Y | 200                               | -7.79                              | -7.99                             |
|           | - 200                             | 6.00                               | 6.40                              |
| Channel Z | 200                               | -6.22                              | -6.24                             |
|           | - 200                             | 5.35                               | 5.19                              |
|           |                                   |                                    |                                   |

#### 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                | -              | 2.91           | -0.13          |
| Channel Y | 200                | 2.57           |                | 4.74           |
| Channel Z | 200                | 1.27           | -0.99          |                |

Certificate No: DAE4-1245 Jan12

Page 4 of 5

#### 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 | 15884            | 14899           |
| Channel Y | 16498            | 15256           |
| Channel Z | 15933            | 16202           |

#### 5. Input Offset Measurement

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

|           | Average (μV) | min. Offset (μV) | max. Offset (μV) | Std. Deviation<br>(µV) |
|-----------|--------------|------------------|------------------|------------------------|
| Channel X | -0.03        | -1.14            | 1.28             | 0.46                   |
| Channel Y | -0.76        | -2.25            | 0.38             | 0.45                   |
| Channel Z | -1.13        | -3.14            | 0.64             | 0.59                   |

#### 6. Input Offset Current

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

7. Input Resistance (Typical values for Information)

|           | Zerolng (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                |

# **APPENDIX C: PLOTS OF SAR TEST RESULT**

The plots are showing in the file named Appendix C Plots of SAR Test Result

**END REPORT**