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Accreditation No.: **SCS 0108**

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Multilateral Agreement for the recognition of calibration certificates

Client **UL CCS USA**

Certificate No: **CLA6-1005\_Sep18**

## CALIBRATION CERTIFICATE

Object **CLA6 - SN: 1005**

Calibration procedure(s) **QA CAL-15.v8  
Calibration procedure for system validation sources below 700 MHz**

Calibration date: **September 13, 2018**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: 5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-18 (No. 217-02683)	Apr-19
Reference Probe EX3DV4	SN: 3877	30-Dec-17 (No. EX3-3877_Dec17)	Dec-18
DAE4	SN: 654	05-Jul-18 (No. DAE4-654_Jul18)	Jul-19

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	12-Jun-18 (No. 217-02285/02284)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	12-Jun-18 (No. 217-02285)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	12-Jun-18 (No. 217-02284)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-17)	In house check: Oct-18

Calibrated by: **Claudio Leubler** **Laboratory Technician**

Approved by: **Katja Pokovic** **Technical Manager**

Signature

Issued: September 14, 2018

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



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### Glossary:

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

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

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

### Additional Documentation:

- DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss:** This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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

## Measurement Conditions

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

<b>DASY Version</b>	DASY5	V52.10.1
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	ELI4 Flat Phantom	Shell thickness: $2 \pm 0.2$ mm
<b>EUT Positioning</b>	Touch Position	
<b>Zoom Scan Resolution</b>	$dx, dy = 4.0$ mm, $dz = 1.4$ mm	Graded Ratio = 1.4 (Z direction)
<b>Frequency</b>	$6 \text{ MHz} \pm 1 \text{ MHz}$	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	55.5	0.75 mho/m
<b>Measured Head TSL parameters</b>	$(22.0 \pm 0.2)$ °C	$53.7 \pm 6 \%$	$0.73 \text{ mho/m} \pm 6 \%$
<b>Head TSL temperature change during test</b>	$< 0.5$ °C	----	----

## SAR result with Head TSL

<b>SAR averaged over <math>1 \text{ cm}^3</math> (1 g) of Head TSL</b>	Condition	
SAR measured	1 W input power	0.194 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b><math>0.197 \text{ W/kg} \pm 18.4 \%</math> (k=2)</b>

<b>SAR averaged over <math>10 \text{ cm}^3</math> (10 g) of Head TSL</b>	condition	
SAR measured	1 W input power	0.119 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b><math>0.121 \text{ W/kg} \pm 18.0 \%</math> (k=2)</b>

## Appendix (Additional assessments outside the scope of SCS 0108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	$49.6\ \Omega + 10.0\ j\Omega$
Return Loss	- 20.0 dB

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	April 11, 2016



Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: CLA-6; Type: CLA-6; Serial: CLA6 - SN: 1005**

Communication System: UID 0 - CW; Frequency: 6 MHz

Medium parameters used:  $f = 6 \text{ MHz}$ ;  $\sigma = 0.73 \text{ S/m}$ ;  $\epsilon_r = 53.7$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

**DASY52 Configuration:**

- Probe: EX3DV4 - SN3877; ConvF(17.23, 17.23, 17.23) @ 6 MHz; Calibrated: 30.12.2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 05.07.2018
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.1(1476); SEMCAD X 14.6.11(7439)

**CLA Calibration for HSL-LF Tissue/CLA-6, touch cnfiguration, Pin=1W/Area Scan**

**(81x81x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) =  $0.302 \text{ W/kg}$

**CLA Calibration for HSL-LF Tissue/CLA-6, touch cnfiguration, Pin=1W/Zoom Scan,**

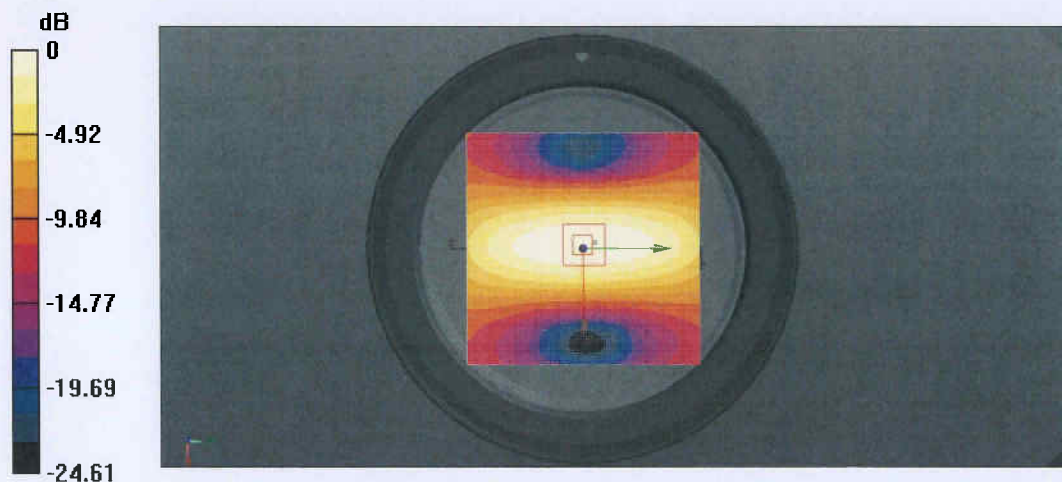
**dist=1.4mm (9x10x7)/Cube 0:** Measurement grid:  $dx=4\text{mm}$ ,  $dy=4\text{mm}$ ,  $dz=1.4\text{mm}$

Reference Value =  $20.08 \text{ V/m}$ ; Power Drift =  $-0.04 \text{ dB}$

Peak SAR (extrapolated) =  $0.394 \text{ W/kg}$

**SAR(1 g) =  $0.194 \text{ W/kg}$ ; SAR(10 g) =  $0.119 \text{ W/kg}$**

Maximum value of SAR (measured) =  $0.286 \text{ W/kg}$



0 dB =  $0.302 \text{ W/kg}$  =  $-5.20 \text{ dBW/kg}$

# Impedance Measurement Plot for Head TSL

