

Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.0 ± 6 %	5.46 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.78 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	77.2 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.5 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.4 ± 6 %	5.93 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.99 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	79.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.24 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.2 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.2 ± 6 %	6.13 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.88 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	78.2 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.19 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.7 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	48.1 Ω - 3.0 j Ω
Return Loss	- 28.9 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	52.6 Ω + 4.0 j Ω
Return Loss	- 26.6 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	51.6 Ω + 3.2 j Ω
Return Loss	- 29.0 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	47.2 Ω - 0.7 j Ω
Return Loss	- 30.5 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	52.4 Ω + 4.8 j Ω
Return Loss	- 25.7 dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	51.9 Ω + 4.1 j Ω
Return Loss	- 27.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.200 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 19, 2017

DASY5 Validation Report for Head TSL

Date: 24.08.2017

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1267

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: $f = 5250$ MHz; $\sigma = 4.54$ S/m; $\epsilon_r = 36.3$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 4.91$ S/m; $\epsilon_r = 35.8$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5750$ MHz; $\sigma = 5.07$ S/m; $\epsilon_r = 35.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

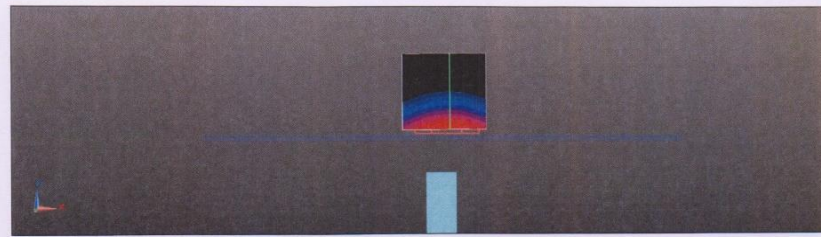
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.58, 5.58, 5.58); Calibrated: 31.12.2016, ConvF(5.09, 5.09, 5.09); Calibrated: 31.12.2016, ConvF(5.02, 5.02, 5.02); Calibrated: 31.12.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 28.03.2017
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 72.02 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 30.3 W/kg
SAR(1 g) = 8.2 W/kg; SAR(10 g) = 2.34 W/kg
Maximum value of SAR (measured) = 18.9 W/kg

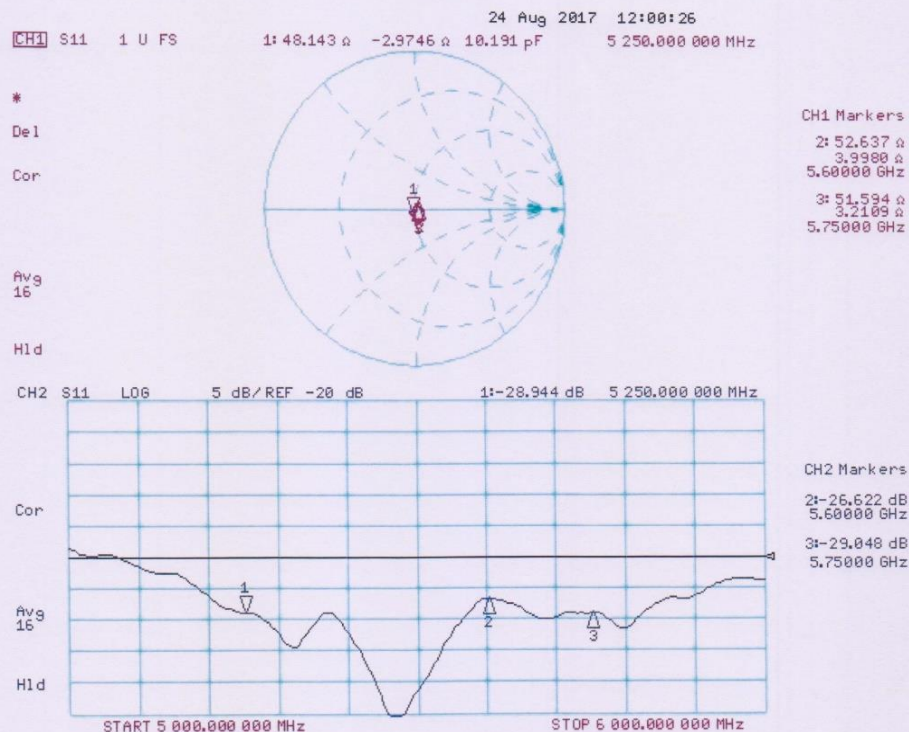
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.78 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 33.0 W/kg
SAR(1 g) = 8.49 W/kg; SAR(10 g) = 2.42 W/kg
Maximum value of SAR (measured) = 20.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 70.16 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 32.4 W/kg
SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.32 W/kg
Maximum value of SAR (measured) = 19.6 W/kg

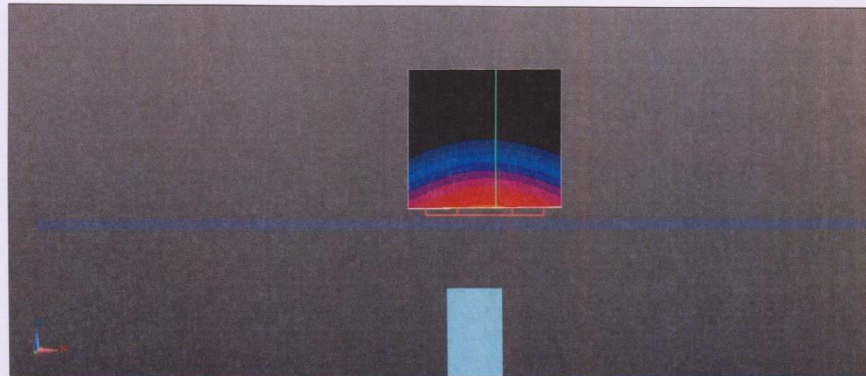


0 dB = 18.9 W/kg = 12.76 dBW/kg

Impedance Measurement Plot for Head TSL



dB
0
-5.00
-10.00
-15.00
-20.00
-25.00



0 dB = 18.1 W/kg = 12.58 dBW/kg

Annex E. DAE Calibration Report

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



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

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **SIEMIC Inc.**

Certificate No: DAE4-1522_Aug17

CALIBRATION CERTIFICATE

Object DAE4 - SD 000 D04 BM - SN: 1522

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

Calibration date: August 21, 2017

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

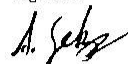
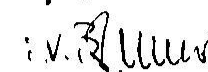
All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	09-Sep-16 (No:19065)	Sep-17
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	05-Jan-17 (in house check)	house check: Jan-18
Calibrator Box V2.1	SE UMS 006 AA 1002	05-Jan-17 (in house check)	house check: Jan-18

Calibrated by:	Name A. Gehring	Function Laboratory Technician
Approved by:	Sven Kühn	Deputy Manager

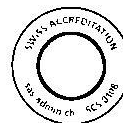
Signature

Issued: August 21, 2017

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

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



S Schweizerischer Kalibrierdienst
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S Servizio svizzero di taratura
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The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary

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

Methods Applied and Interpretation of Parameters

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

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	405.511 ± 0.02% (k=2)	405.067 ± 0.02% (k=2)	405.430 ± 0.02% (k=2)
Low Range	3.98281 ± 1.50% (k=2)	3.97871 ± 1.50% (k=2)	4.00295 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	94.5 ° ± 1 °
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