

Appendix (Additional assessments outside the scope of SCS108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.7 Ω - 6.2 $\mu\Omega$
Return Loss	- 24.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6 Ω - 5.4 $\mu\Omega$
Return Loss	- 23.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.150 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	May 13, 2008

DASY5 Validation Report for Head TSL

Date: 08.12.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1025

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.02$ S/m; $\epsilon_r = 39.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.46, 4.46, 4.46); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

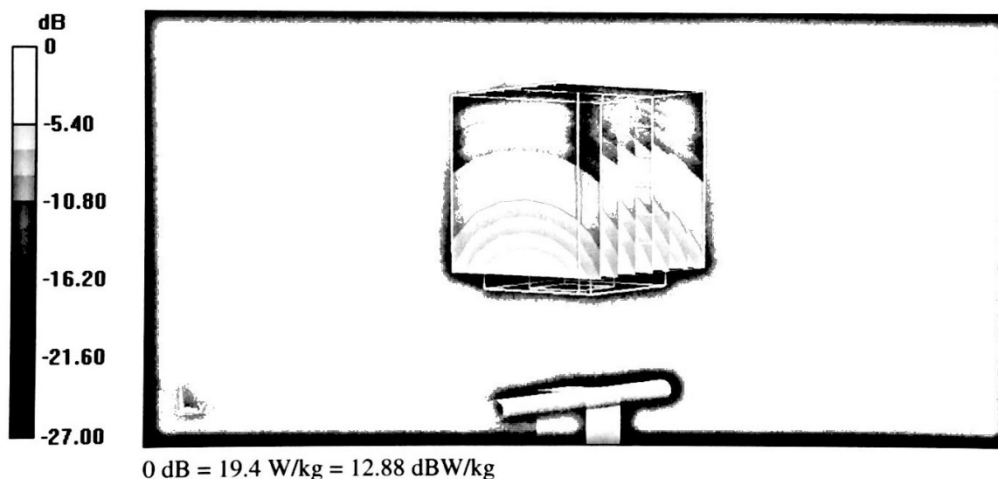
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.3 V/m; Power Drift = 0.03 dB

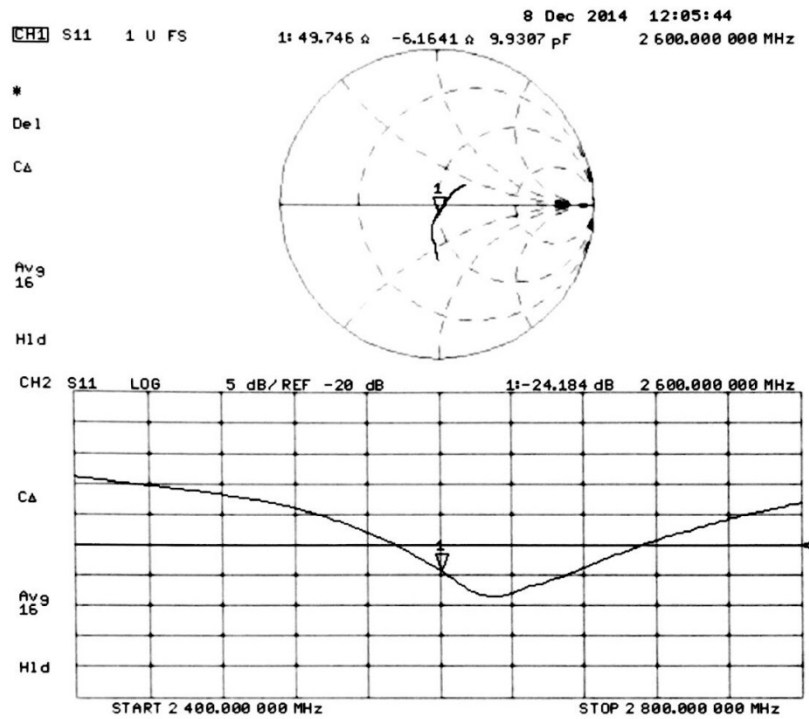
Peak SAR (extrapolated) = 30.9 W/kg

SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.4 W/kg

Maximum value of SAR (measured) = 19.4 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.12.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1025

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.22$ S/m; $\epsilon_r = 50.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.24, 4.24, 4.24); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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

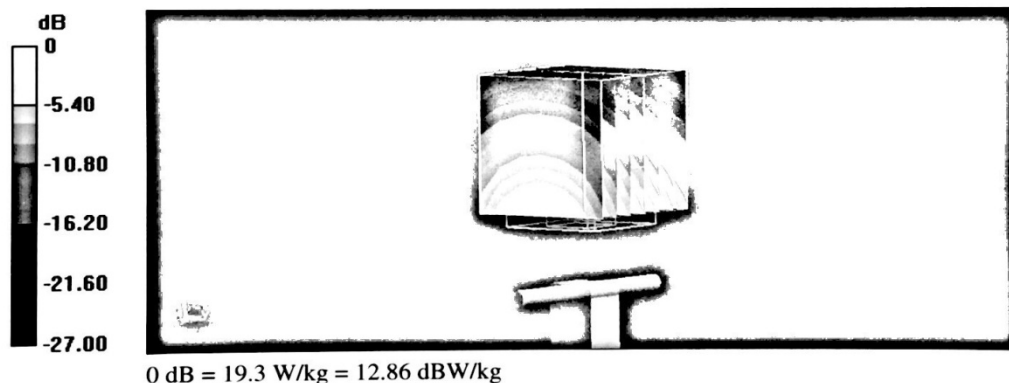
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.72 V/m; Power Drift = 0.02 dB

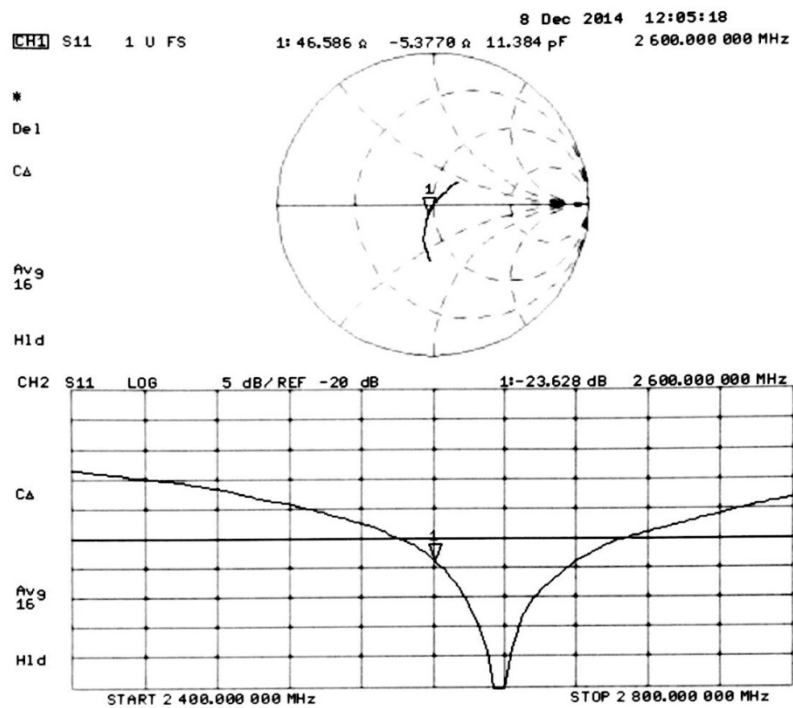
Peak SAR (extrapolated) = 30.9 W/kg

SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.36 W/kg

Maximum value of SAR (measured) = 19.3 W/kg



Impedance Measurement Plot for Body TSL



**ANNEX J: DAE4 Calibration Certificate**

**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 **TA-SH (Auden)**Certificate No: **DAE4-1317_Jan15****CALIBRATION CERTIFICATE**Object **DAE4 - SD 000 D04 BM - SN: 1317**Calibration procedure(s) **QA CAL-06.v29
Calibration procedure for the data acquisition electronics (DAE)**Calibration date: **January 29, 2015**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-14 (No:15573)	Oct-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit Calibrator Box V2.1	SE UWS 053 AA 1001	06-Jan-15 (in house check)	In house check: Jan-16
	SE UMS 006 AA 1002	06-Jan-15 (in house check)	In house check: Jan-16

Calibrated by:	Name Dominique Steffen	Function Technician	Signature
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Approved by:	Fin Bomholt	Deputy Technical Manager	
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Issued: January 29, 2015

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
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**

Glossary

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

Methods Applied and Interpretation of Parameters

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

**DC Voltage Measurement**

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	404.087 $\pm$ 0.02% (k=2)	405.149 $\pm$ 0.02% (k=2)	404.286 $\pm$ 0.02% (k=2)
Low Range	3.99359 $\pm$ 1.50% (k=2)	3.99071 $\pm$ 1.50% (k=2)	3.98868 $\pm$ 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	116.0 $^{\circ}$ $\pm$ 1 $^{\circ}$
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1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	200024.75	-6.34	-0.00
Channel X + Input	20003.94	0.73	0.00
Channel X - Input	-20001.98	3.53	-0.02
Channel Y + Input	200025.28	-5.38	-0.00
Channel Y + Input	20001.43	-1.84	-0.01
Channel Y - Input	-20005.03	0.56	-0.00
Channel Z + Input	200026.19	-11.26	-0.01
Channel Z + Input	20000.52	-2.67	-0.01
Channel Z - Input	-20006.04	-0.41	0.00

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	1999.98	0.16	0.01
Channel X + Input	200.50	0.64	0.32
Channel X - Input	-198.91	1.20	-0.60
Channel Y + Input	2000.74	0.91	0.05
Channel Y + Input	199.51	-0.28	-0.14
Channel Y - Input	-200.05	0.14	-0.07
Channel Z + Input	2000.14	0.29	0.01
Channel Z + Input	198.92	-0.94	-0.47
Channel Z - Input	-201.14	-0.93	0.47

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	23.60	21.70
	- 200	-20.28	-21.97
Channel Y	200	-21.95	-21.73
	- 200	21.29	21.06
Channel Z	200	-22.01	-22.53
	- 200	20.76	20.55

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	-	2.01	-4.05
Channel Y	200	8.95	-	3.72
Channel Z	200	10.39	5.45	-

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	15924	15409
Channel Y	16562	17298
Channel Z	16343	16649

5. Input Offset Measurement

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

Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.90	-1.99	0.19	0.50
Channel Y	0.41	-0.73	1.70	0.55
Channel Z	-1.83	-3.90	0.56	0.55

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

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

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

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

9. Power Consumption (Typical values for information)

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

ANNEX K: The EUT Appearances and Test Configuration



Front Side



Back Side

a: EUT



b: Battery



c: Antenna

Picture 13: Constituents of EUT



Picture 14: Left Hand Touch Cheek Position



Picture 15: Left Hand Tilt 15 Degree Position



Picture 16: Right Hand Touch Cheek Position



Picture 17: Right Hand Tilt 15 Degree Position



Picture 18: Back Side, the distance from handset to the bottom of the Phantom is 10mm



Picture 19: Front Side, the distance from handset to the bottom of the Phantom is 10mm



Picture 20: Left Side, the distance from handset to the bottom of the Phantom is 10mm



Picture 21: Right Side, the distance from handset to the bottom of the Phantom is 10mm



Picture 22: Top Side, the distance from handset to the bottom of the Phantom is 10mm



Picture 23: Bottom Side, the distance from handset to the bottom of the Phantom is 10mm



Picture 24: Back Side with Earphone, the distance from handset to the bottom of the Phantom is 10mm



Picture 25: Front Side with Earphone, the distance from handset to the bottom of the Phantom is 10mm