

Appendix G. – Dipole Calibration Data

F-TP22-03 (Rev. 06) Page 1 of 55



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





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

Accreditation No.: SCS 0108

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 HCT

Certificate No. CLA13-1016_Nov24 Gyeonggi-do, Republic of Korea

		7/2/8	4 .
Object	CLA13 - SN: 101	6 50 13	P 1 0 14 12 0 3
Calibration procedure(s)	QA CAL-15.v11 Calibration Proce	dure for SAR Validation Sources	
Calibration date:	November 19, 20	24	
The measurements and the uncertainty	ainties with confidence pr	conal standards, which realize the physical unit robability are given on the following pages and by facility: environment temperature (22 \pm 3)°C	d are part of the certificate.
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
	Chi. Vonna i i	(1 E S 3 F 1 S 3 E F 1 E F 1 S 2 E F 2 E F 2 E F 2 E F 2 E F 2 E F 2 E F 2 E F 2 E F 2 E F 2 E F 2 E F 2 E F 2	
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
	SN: 103244 SN: 103245	26-Mar-24 (No. 217-04036) 26-Mar-24 (No. 217-04037)	Mar-25 Mar-25
Power sensor NRP-Z91			
Power sensor NRP-Z91 Reference 20 dB Attenuator	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: 103245 SN: CC2552 (20x)	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 10-Jan-24 (No. EX3-3877_Jan24)	Mar-25 Mar-25
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047)	Mar-25 Mar-25 Mar-25
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327 SN: 3877	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 10-Jan-24 (No. EX3-3877_Jan24)	Mar-25 Mar-25 Mar-25 Jan-25
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N miamatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter NRP2	SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327 SN: 3877 SN: 654 ID # SN: 107193	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 10-Jan-24 (No. EX3-3877 _Jan24) 18-Oct-24 (No. DAE4-654_Oct24) Check Date (In house) 08-Nov-21 (in house check Dec-22)	Mar-25 Mar-25 Jan-25 Oct-25 Scheduled Check In house check: Dec-24
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N miamatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter NRP2 Power sensor NRP-Z91	SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327 SN: 3877 SN: 654 ID # SN: 107193 SN: 100922	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 10-Jan-24 (No. EX3-3877_Jan24) 18-Oct-24 (No. DAE4-654_Oct24) Check Date (In house) 08-Nov-21 (in house check Dec-22) 15-Dec-09 (in house check Dec-22)	Mar-25 Mar-25 Jan-25 Joh-25 Oct-25 Scheduled Check In house check: Dec-24 In house check: Dec-24
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power mater NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91	SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327 SN: 3877 SN: 654 ID # SN: 107193 SN: 100922 SN: 100418	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 10-Jan-24 (No. EX3-3877_Jan24) 18-Oct-24 (No. DAE4-654_Oct24) Check Date (in house) 08-Nov-21 (in house check Dec-22) 15-Dec-09 (in house check Dec-22) 01-Jan-04 (in house check Dec-22)	Mar-25 Mar-25 Jan-25 Oct-25 Scheduled Check In house check: Dec-24 In house check: Dec-24 In house check: Dec-24
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 RF generator HP 8648C	SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327 SN: 3877 SN: 654 ID# SN: 107193 SN: 100922 SN: 100418 SN: US3642U01700	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 10-Jan-24 (No. EX3-3877 Jan24) 18-Oct-24 (No. DAE4-654 Oct24) Check Date (in house) 08-Nov-21 (in house check Dec-22) 15-Dec-09 (in house check Dec-22) 01-Jan-04 (in house check Dec-22) 04-Aug-99 (in house check Jun-24)	Mar-25 Mar-25 Jan-25 Jan-25 Oct-25 Scheduled Check In house check: Dec-24 In house check: Dec-24 In house check: Jun-25
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 RF generator HP 8648C	SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327 SN: 3877 SN: 654 ID # SN: 107193 SN: 100922 SN: 100418	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 10-Jan-24 (No. EX3-3877_Jan24) 18-Oct-24 (No. DAE4-654_Oct24) Check Date (in house) 08-Nov-21 (in house check Dec-22) 15-Dec-09 (in house check Dec-22) 01-Jan-04 (in house check Dec-22)	Mar-25 Mar-25 Jan-25 Oct-25 Scheduled Check In house check: Dec-24 In house check: Dec-24 In house check: Dec-24
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 RF generator HP 8648C	SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327 SN: 3877 SN: 654 ID# SN: 107193 SN: 100922 SN: 100418 SN: US3642U01700	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 10-Jan-24 (No. EX3-3877 Jan24) 18-Oct-24 (No. DAE4-654 Oct24) Check Date (in house) 08-Nov-21 (in house check Dec-22) 15-Dec-09 (in house check Dec-22) 01-Jan-04 (in house check Dec-22) 04-Aug-99 (in house check Jun-24)	Mar-25 Mar-25 Mar-25 Jan-25 Oct-25 Scheduled Check In house check: Dec-24 In house check: Dec-24 In house check: Dec-24 In house check: Jun-26
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter NRP-Z91 Power sensor NRP-Z91 RF generator HP 8648C Network Analyzer Agilent EB358A Calibrated by:	SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327 SN: 3877 SN: 654 ID# SN: 107193 SN: 100922 SN: 100418 SN: US3642U01700 SN: US41080477	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 10-Jan-24 (No. EX3-3877 Jan24) 18-Oct-24 (No. DAE4-654 Oct24) Check Date (In house) 08-Nov-21 (in house check Dec-22) 15-Dec-09 (in house check Dec-22) 01-Jan-04 (in house check Dec-22) 04-Aug-99 (in house check Sep-24) 31-Mar-14 (in house check Sep-24)	Mar-25 Mar-25 Jan-25 Cct-25 Scheduled Check In house check: Dec-24 In house check: Dec-24 In house check: Dec-24 In house check: Jun-26 In house check: Sep-26
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 RF generator HP 8648C Network Analyzer Agilent E8358A Calibrated by:	SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327 SN: 3877 SN: 654 ID # SN: 107193 SN: 100922 SN: 100418 SN: US3642U01700 SN: US41080477 Name Krešimir Franjić	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 10-Jan-24 (No. EX3-3877_Jan24) 18-Oct-24 (No. DAE4-654_Oct24) Check Date (In house) 08-Nov-21 (in house check Dec-22) 15-Dec-09 (in house check Dec-22) 01-Jan-04 (in house check Dec-22) 04-Aug-99 (in house check Sep-24) Function Laboratory Technician	Mar-25 Mar-25 Jan-25 Cct-25 Scheduled Check In house check: Dec-24 In house check: Dec-24 In house check: Dec-24 In house check: Jun-26 In house check: Sep-26
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 RF generator HP 8648C Network Analyzer Agilent E8358A	SN: 103245 SN: CC2552 (20x) SN: 310982 / 06327 SN: 3877 SN: 654 ID # SN: 107193 SN: 100922 SN: 100418 SN: US3642U01700 SN: US3642U01770 SN: US3642U01770	26-Mar-24 (No. 217-04037) 26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 10-Jan-24 (No. EX3-3877_Jan24) 18-Oct-24 (No. DAE4-654_Oct24) Check Date (In house) 08-Nov-21 (in house check Dec-22) 15-Dec-09 (in house check Dec-22) 01-Jan-04 (in house check Dec-22) 04-Aug-99 (in house check Sep-24) 31-Mar-14 (in house check Sep-24)	Mar-25 Mar-25 Jan-25 Cct-25 Scheduled Check In house check: Dec-24 In house check: Dec-24 In house check: Dec-24 In house check: Jun-26 In house check: Sep-26

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Page 1 of 6



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Accreditation No.: SCS 0108

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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) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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%.

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Page 2 of 6



Measurement Conditions

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

EUT Positioning Touch Position		V52.10.4
EUT Positioning Touch Position	Adva	
	EL	Shell thickness: 2 ± 0.2 mm
Zoom Scan Resolution dx, dy = 4.0 mm, dz = 1.4 mm Graded Ratio = 1.4	1	+
	lution dx, dy =	Graded Ratio = 1.4 (Z direction
Frequency 13 MHz ± 1 MHz	1:	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	55.0	0.75 mha/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	53.1 ± 6 %	0.72 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		****

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	1 W input power	0.540 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	0.554 W/kg ± 18.4 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	1 W input power	0.338 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	0.347 W/kg ± 18.0 % (k=2)

Certificate No: CLA13-1016_Nov24 Page 3 of 6



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.3 Ω - 1.0 μΩ	
Return Loss	- 29.5 dB	

Additional EUT Data

Manufactured by	SPEAG
Mainiscinied by	120,70000

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Page 4 of 6



DASY5 Validation Report for Head TSL

Date: 19.11.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: CLA13; Type: CLA13; Serial: CLA13 - SN: 1016

Communication System: UID 0 - CW; Frequency: 13 MHz

Medium parameters used: f = 13 MHz; $\sigma = 0.72$ S/m; $\epsilon_f = 53.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3877; ConvF(15.33, 15.33, 15.33) @ 13 MHz; Calibrated: 10.01.2024
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 18.10.2024
- Phantom: ELI v6.0; Type: QDOVA003AA; Serial: TP:2034
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

CLA Calibration for HSL-LF Tissue/CLA-13, touch configuration, Pin=1W/Zoom Scan,

dist=1.4mm (8x10x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 31.10 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.540 W/kg; SAR(10 g) = 0.338 W/kg

Smallest distance from peaks to all points 3 dB below = 22.7 mm

Ratio of SAR at M2 to SAR at M1 = 79.3%

Maximum value of SAR (measured) = 0.783 W/kg



0 dB = 0.783 W/kg = -1.06 dBW/kg

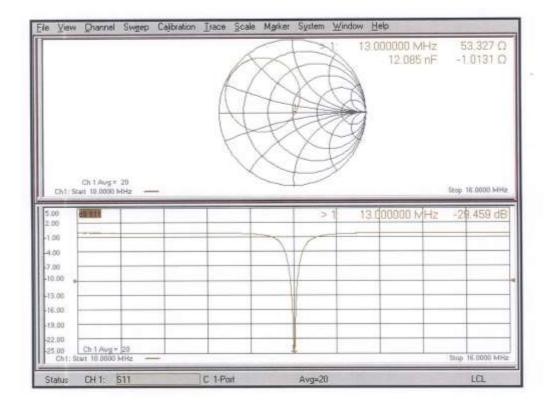
Certificate No: CLA13-1016_Nov24

Page 5 of 6

F-TP22-03 (Rev. 06) Page 6 of 55



Impedance Measurement Plot for Head TSL



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Page 6 of 6



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Accreditation No.: SCS 0108

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Client HCT oi-do. Republic of Korea

Certificate No. D750V3-1014_May24

CALIBRATION C	ERTIFICATE	31 N.	
Object	D750V3 - SN:101	4 SW	14 194 CJ 44371
Calibration procedure(s)	QA CAL-05.v12 Calibration Proce	dure for SAR Validation Sources	THE RESERVE OF THE PARTY OF THE PARTY.
Calibration date:	May 20, 2024		
The measurements and the uncertainty	ainties with confidence produced in the closed laborator	onal standards, which realize the physical uniobability are given on the following pages an y facility: environment temperature (22 ± 3)*0	d are part of the certificate.
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
Power sensor NRP-Z91	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Type-N mismatch combination	SN: 310982 / 08327	26-Mar-24 (No. 217-04047)	Mar-25
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nav-24
DAE4	SN: 781	16-Fev-24 (No. DAE4-781_Fev24)	Fev-25
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24 In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	in nouse check; Oct-24
	Name	Function	Signature
	Paulo Pina	Laboratory Technician	futto
Calibrated by:	S-MI-SHIE	The second secon	,
Calibrated by: Approved by:	Sven Kühn	Technical Manager	de

Certificate No: D750V3-1014_May24

Page 1 of 6



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S Swiss Calibration Service
Accreditation No.: SCS 0108

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 ConvF 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) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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%.

Certificate No: D750V3-1014_May24

Page 2 of 6



Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

With the state of	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mha/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	43.2 ± 6 %	0.88 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	1 444	

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.50 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1,37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.54 W/kg ± 16.5 % (k=2)



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.6 Ω + 2.7 $J\Omega$	
Return Loss	- 27.3 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.037 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

Certificate No: D750V3-1014_May24

Page 4 of 6



DASY5 Validation Report for Head TSL

Date: 20.05.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1014

Communication System: UID 0 - CW; Frequency: 750 MHz

Medium parameters used: f = 750 MHz; $\sigma = 0.88$ S/m; $\epsilon_r = 43.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.11, 10.11, 10.11) @ 750 MHz; Calibrated: 03.11.2023
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn781; Calibrated: 16.02.2024
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

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

Reference Value = 59.58 V/m; Power Drift = 0.03 dB

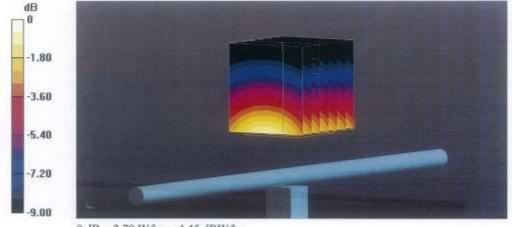
Peak SAR (extrapolated) = 3.13 W/kg

SAR(1 g) = 2.09 W/kg; SAR(10 g) = 1.37 W/kg

Smallest distance from peaks to all points 3 dB below = 24.1 mm

Ratio of SAR at M2 to SAR at M1 = 66.4%

Maximum value of SAR (measured) = 2.79 W/kg



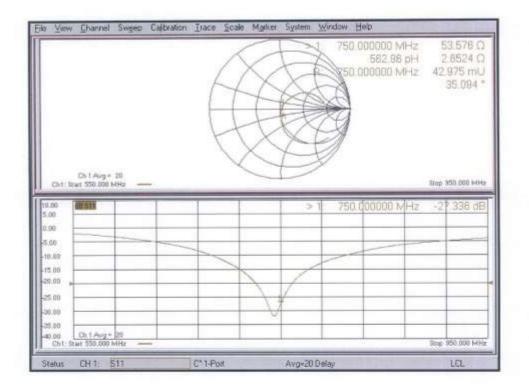
0 dB = 2.79 W/kg = 4.45 dBW/kg

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Page 5 of 6



Impedance Measurement Plot for Head TSL



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Page 6 of 6



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S Swiss Calibration Service

Accreditation No.: SCS 0108

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 HCT Certificate No. D835V2-441_Apr24
Gyeonggi-do, Republic of Korea

CALIBRATION CERTIFICATE Object D835V2 - SN:441 4 crs; 202133707 QA CAL-05.v12 Calibration procedure(s) Calibration Procedure for SAR Validation Sources between 0.7-3 GHz April 18, 2024 Calibration date: This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI), The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards ID# Cal Date (Certificate No.) Scheduled Calibration Power meter NRP2 SN: 104778 26-Mar-24 (No. 217-04036/04037) Mar-25 Power sensor NRP-Z91 SN: 103244 26-Mar-24 (No. 217-04036) Mar-25 Power sensor NRP-Z91 SN: 103245 26-Mar-24 (No. 217-04037) Mar-25 Reference 20 dB Attenuator SN: BH9394 (20k) 26-Mar-24 (No. 217-04046) Man-25 Type-N mismatch combination SN: 310982 / 06327 26-Mar-24 (No. 217-04047) Mar-25 Reference Probe EX3DV4 SN: 7349 03-Nov-23 (No. EX3-7349_Nov23) Nov-24 SN: 601 30-Jan-24 (No. DAE4-601_Jan24) Jan-25 Secondary Standards ID# Check Date (in house) Scheduled Check SN: GB39512475 Power meter E44198 30-Oct-14 (in house check Oct-22) In house check: Oct-24 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-22) In house check: Oct-24 Power sensor HP 8481A SN: MY41093315 07-Oct-15 (in house check Oct-22) In house check: Oct-24 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-22) In house check: Oct-24 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-22) In house check: Oct-24 Function Signature Calibrated by: Paulo Pina Laboratory Technician Approved by: Sven Kühn Technical Manager Issued: April 23, 2024 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D835V2-441_Apr24

Page 1 of 6



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Accreditation No.: SCS 0108

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

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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%.

Certificate No: D835V2-441_Apr24 Page 2 of 6



Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 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	42.6 ± 6 %	0.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	1	

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2,48 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.73 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.62 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.37 W/kg ± 16.5 % (k=2)



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.5 Ω - 2.5 JΩ
Return Loss	- 31.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.374 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
	ALT CONTROLS

22

Certificate No: D835V2-441_Apr24

Page 4 of 6



DASY5 Validation Report for Head TSL

Date: 18.04.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:441

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

Medium parameters used: f = 835 MHz; $\sigma = 0.93$ S/m; $\varepsilon_r = 42.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(9.69, 9.69, 9.69) @ 835 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (8x8x7)/Cube 0:

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

Reference Value = 63.37 V/m; Power Drift = 0.00 dB

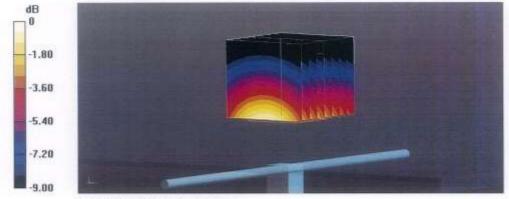
Peak SAR (extrapolated) = 3.71 W/kg

SAR(1 g) = 2.48 W/kg; SAR(10 g) = 1.62 W/kg

Smallest distance from peaks to all points 3 dB below = 16 mm

Ratio of SAR at M2 to SAR at M1 = 66.8%

Maximum value of SAR (measured) = 3.26 W/kg



0 dB = 3.26 W/kg = 5.14 dBW/kg

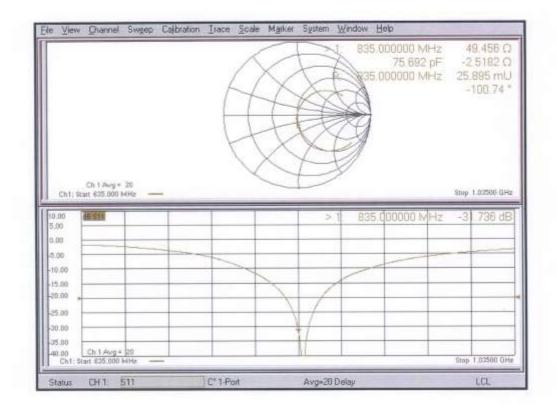
Certificate No: D835V2-441_Apr24

Page 5 of 6

F-TP22-03 (Rev. 06) Page 18 of 55



Impedance Measurement Plot for Head TSL



Certificate No: D835V2-441_Apr24

Page 6 of 6



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S Swiss Calibration Service

Accreditation No.: SCS 0108

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

Certificate No. D1800V2-2d007_Apr24 Client HCT Gyeonggi-do, Republic of Korea CALIBRATION CERTIFICATE D1800V2 - SN:2d007 Object EW 2024.75.01 QA CAL-05.v12 Calibration procedure(s) Calibration Procedure for SAR Validation Sources between 0.7-3 GHz April 15, 2024 Calibration date: 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 cartificate. 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) Scheduled Calibration Primary Standards ID# Cal Date (Certificate No.) SN: 104778 26-Mar-24 (No. 217-04036/04037) Mar-25 Power meter NRP2 SN: 103244 26-Mar-24 (No. 217-04036) Mar-25 Power sensor NRP-Z91 Power sensor NRP-Z91 SN: 103245 26-Mar-24 (No. 217-04037) Mar-25 Reference 20 dB Attenuator SN: BH9394 (20k) 26-Mar-24 (No. 217-04046) Mar-25 SN: 310982 / 06327 Type-N mismatch combination 26-Mar-24 (No. 217-04047) Mar-25 Reference Probe EX3DV4 SN: 7349 03-Nov-23 (No. EX3-7349 Nov23) Nov-24 DAE4 SN: 801 30-Jan-24 (No. DAE4-601_Jan24) Jan-25 Secondary Standards Check Date (in house): Scheduled Check In house check: Oct-24 Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Oct-22) Power sensor HP 8481A SN: US372927B3 07-Oct-15 (in house check Oct-22) In house check: Oct-24 SN: MY41093315 Power sensor HP 8481A 07-Oct-15 (in house check Oct-22) In house check: Oct-24 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-22) In house check: Oct-24 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-22) In house check: Oct-24 Signature Paulo Pina Laboratory Technician Calibrated by: Technical Manager Sven Kühn Approved by: Issued: April 23, 2024

Certificate No: D1800V2-2d007_Apr24

Page 1 of 6

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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:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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%.

Certificate No: D1800V2-2d007_Apr24

Page 2 of 6



Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 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	40.8 ± 6 %	1.39 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	_	****

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.67 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.0 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.08 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.4 W/kg ± 16.5 % (k=2)



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	45.9 Ω - 7.0 jΩ	
Return Loss	- 21.5 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.203 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG

Certificate No: D1800V2-2d007_Apr24

Page 4 of 6



DASY5 Validation Report for Head TSL

Date: 15.04.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:2d007

Communication System; UID 0 - CW; Frequency: 1800 MHz

Medium parameters used: f = 1800 MHz; $\sigma = 1.39$ S/m; $\epsilon_f = 40.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.63, 8.63, 8.63) @ 1800 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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 = 109.6 V/m; Power Drift = 0.05 dB

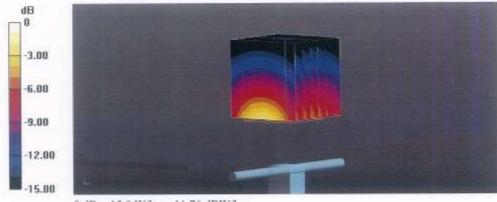
Peak SAR (extrapolated) = 17.9 W/kg

SAR(1 g) = 9.67 W/kg; SAR(10 g) = 5.08 W/kg

Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 54.5%

Maximum value of SAR (measured) = 15.0 W/kg



0 dB = 15.0 W/kg = 11.76 dBW/kg

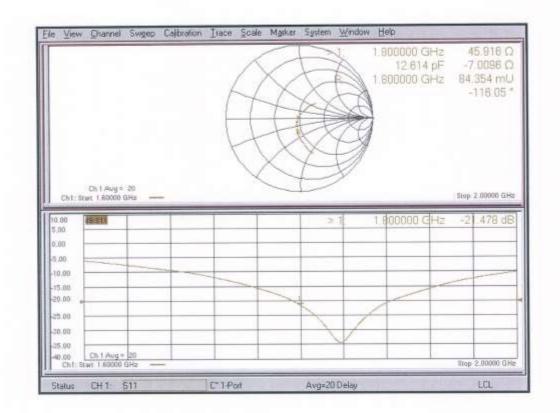
Certificate No: D1800V2-2d007_Apr24

Page 5 of 6

F-TP22-03 (Rev. 06) Page 24 of 55



Impedance Measurement Plot for Head TSL



Certificate No: D1800V2-2d007_Apr24

Page 6 of 6



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Client HCT

Gyeonggi-do, Republic of Korea

Certificate No. D1900V2-5d032 Jan24

CALIBRATION CERTIFICATE D1900V2 - SN:5d032 Object QA CAL-05.v12 Calibration procedure(s) Calibration Procedure for SAR Validation Sources between 0.7-3 GHz January 18, 2024 Calibration date: 机甘兴 2024. 52.07 3024.02.01 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 Cal Date (Certificate No.) Scheduled Calibration Power meter NRP2 SN: 104778 30-Mar-23 (No. 217-03804/03805) Mar-24 Power sensor NRP-Z91 SN: 103244 30-Mar-23 (No. 217-03804) Mar-24 Power sensor NRP-Z91 SN: 103245 30-Mar-23 (No. 217-03805) Mar-24 Reference 20 dB Attenuator SN: BH9394 (20k) 30-Mar-23 (No. 217-03809) Mar-24 Type-N mismatch combination SN: 310982 / 06327 30-Mar-23 (No. 217-03810) Mar-24 Reference Probe EX3DV4 SN: 7349 03-Nov-23 (No. EX3-7349_Nov23) Nov-24 DAE4 SN: 601 03-Oct-23 (No. DAE4-601_Oct23) Oct-24 Secondary Standards ID# Check Date (In house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Oct-22) In house check: Oct-24 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-22) In house check: Oct-24 Power sensor HP 8481A SN: MY41093315 07-Oct-15 (in house check Oct-22) In house check: Oct-24 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-22) In house check: Oct-24 Network Analyzer Agilent E8358A SN: US41080477 In house check: Oct-24 31-Mar-14 (in house check Oct-22) Name Function Signature Laboratory Technician Calibrated by: Paulo Pina Approved by: Sven Künn Technical Manager Issued: January 18, 2024 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D1900V2-5d032_Jan24

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

Calibration is Performed According to the Following Standards:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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%.

Certificate No: D1900V2-5d032_Jan24

Page 2 of 6



Measurement Conditions

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

DASY Version	DASY52	V52,10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 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	41.3 ± 6 %	1.40 mha/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	****	

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.2 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.0 W/kg ± 16.5 % (k=2)



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$50.2 \ \Omega + 6.8 \ j\Omega$	
Return Loss	- 23.4 dB	

General Antenna Parameters and Design

	1000000
Electrical Delay (one direction)	1.182 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Certificate No: D1900V2-5d032_Jan24

Page 4 of 6



DASY5 Validation Report for Head TSL

Date: 18.01.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d032

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

Medium parameters used: f = 1900 MHz; $\sigma = 1.4 \text{ S/m}$; $\epsilon_c = 41.3$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 03.10.2023
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

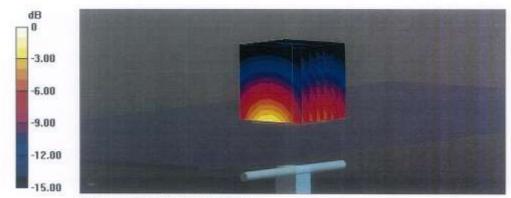
Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 109.9 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 18.3 W/kg

SAR(1 g) = 9.97 W/kg; SAR(10 g) = 5.22 W/kg

Smallest distance from peaks to all points 3 dB below = 9.8 mm

Ratio of SAR at M2 to SAR at M1 = 54.9% Maximum value of SAR (measured) = 15.5 W/kg



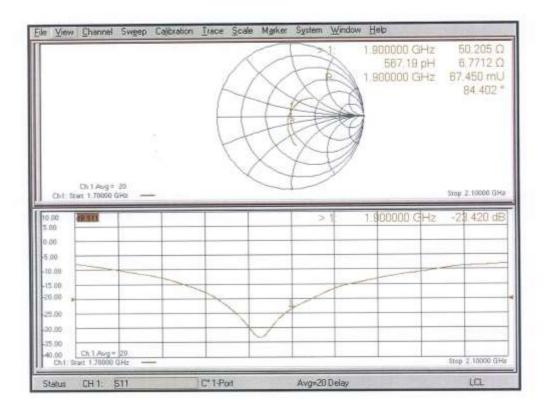
0 dB = 15.5 W/kg = 11.90 dBW/kg

Certificate No: D1900V2-5d032_Jan24

Page 5 of 6



Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d032_Jan24

Page 6 of 6



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Accreditation No.: SCS 0108

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Client HCT Gyeonggi-do, Republic of Korea Certificate No. D2450V2-743_Mar24

		전 보 보	지 하이자
Object	D2450V2 - SN:7	43 11/19 86 74 11 4 2024 24	
Calibration procedure(s)	QA CAL-05.v12 Calibration Proce	edure for SAR Validation Source	
Galibration date:	March 14, 2024		
The measurements and the uncer	taintles with confidence p	onal standards, which realize the physical un robability are given on the following pages ar y facility: environment temperature (22 \pm 3)"	nd are part of the certificate.
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
The state of the s	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power meter NRP2	SN: 104778 SN: 103244	30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804)	Mar-24 Mar-24
Power meter NRP2 Power sensor NRP-Z91	\$100 Per 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1.0000000000000000000000000000000000000
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	SN: 103244 SN: 103245	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805)	Mar-24 Mar-24
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination	SN: 103244 SN: 103245 SN: BH9394 (20k)	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809)	Mar-24 Mar-24 Mar-24
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810)	Mar-24 Mar-24 Mar-24 Mar-24
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 03-Nov-23 (No. EX3-7349_Nov-23)	Mar-24 Mar-24 Mar-24 Mar-24 Nov-24
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 03-Nov-23 (No. EX3-7348_Nov23) 30-Jan-24 (No. DAE4-601_Jan24)	Mar-24 Mar-24 Mar-24 Mar-24 Nov-24 Jan-25
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 03-Nov-23 (No. EX3-7349_Nov23) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house)	Mar-24 Mar-24 Mar-24 Mar-24 Nov-24 Jan-25 Scheduled Check
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A	SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 03-Nov-23 (No. EX3-7349_Nov23) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house) 30-Oct-14 (in house check Oct-22)	Mar-24 Mar-24 Mar-24 Mar-24 Nov-24 Jan-25 Scheduled Check In house check: Oct-24
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E44198 Power sensor HP 8481A	SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 03-Nov-23 (No. EX3-7348_Nov23) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22)	Mar-24 Mar-24 Mar-24 Mar-24 Nov-24 Jan-25 Scheduled Check In house check: Oct-24 In house check: Oct-24
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A RF generator R&S SMT-06	SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 03-Nov-23 (No. EX3-7349_Nov-23) 30-Jan-24 (No. DAE4-601_Jan-24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22)	Mar-24 Mar-24 Mar-24 Mar-24 Nov-24 Jan-25 Scheduled Check In house check: Oct-24 In house check: Oct-24
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41083315 SN: 100972	36-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 03-Nov-23 (No. EX3-7349_Nov-23) 30-Jan-24 (No. DAE4-601_Jan-24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22)	Mar-24 Mar-24 Mar-24 Mar-24 Mar-25 Scheduled Check In house check: Oct-24
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A RF generator R&S SMT-06	SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41083315 SN: 100972 SN: US41080477	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 03-Nov-23 (No. EX3-7349_Nov-23) 30-Jan-24 (No. DAE-4-601_Jan-24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22)	Mar-24 Mar-24 Mar-24 Mar-24 Mar-25 Scheduled Check In house check: Oct-24 In house check: Oct-24 In house check: Oct-24 In house check: Oct-24
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41080477 Name	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 03-Nov-23 (No. EX3-7349_Nov-23) 30-Jan-24 (No. DAE-4-601_Jan-24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22)	Mar-24 Mar-24 Mar-24 Mar-24 Mar-25 Scheduled Check In house check: Oct-24
Power meter NRP2 Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41080477 Name	30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 03-Nov-23 (No. EX3-7349_Nov-23) 30-Jan-24 (No. DAE-4-601_Jan-24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22)	Mar-24 Mar-24 Mar-24 Mar-24 Mar-25 Scheduled Check In house check: Oct-24

Certificate No: D2450V2-743_Mar24

Page 1 of 7



Schmid & Partner Engineering AG Zeughausstrasse 43, 9004 Zurich, Switzerland





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S Swiss Calibration Service

Accreditation No.: SCS 0108

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) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.5 ± 6 %	1.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		nees.

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	51.8 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.2 W/kg ± 16.5 % (k=2)



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.5 Ω + 6.1 jΩ	
Return Loss	- 22.8 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.159 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	

Certificate No: D2450V2-743_Mar24 Page 4 of 7

F-TP22-03 (Rev. 06) Page 35 of 55



DASY5 Validation Report for Head TSL

Date: 14.03.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:743

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: f = 2450 MHz; $\sigma = 1.83$ S/m; $\epsilon_r = 38.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 03.11.2023
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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 = 115.1 V/m; Power Drift = 0.07 dB

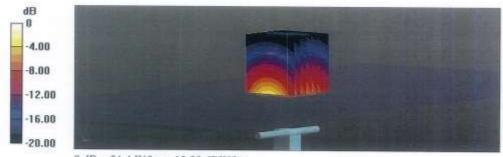
Peak SAR (extrapolated) = 26.4 W/kg

SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.09 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 50.1%

Maximum value of SAR (measured) = 21.4 W/kg



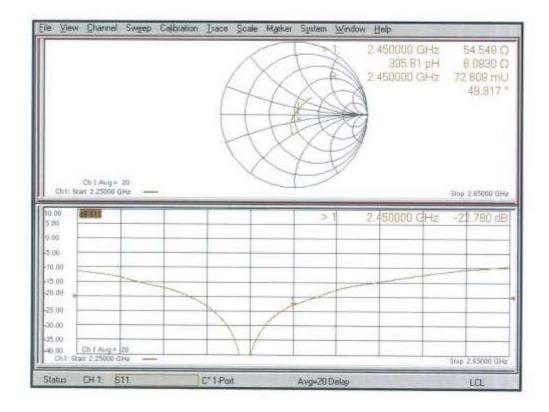
0 dB = 21.4 W/kg = 13.30 dBW/kg

Certificate No: D2450V2-743_Mar24

Page 5 of 7



Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-743_Mar24

Page 6 of 7



Appendix: Transfer Calibration at Four Validation Locations on SAM Head1

Evaluation Condition

0		
Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L

SAR result with SAM Head (Top ≅ C0)

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	55.2 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Mouth ≅ F90)

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	56.3 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm3 (10 g) of Head TSL	condition	

SAR result with SAM Head (Neck ≅ H0)

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	53.0 W/kg ± 17.5 % (k≃2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Ear ≅ D90)

SAH averaged over 1 cm ^a (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	34.0 W/kg ± 17.5 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

Certificate No: D2450V2-743_Mar24

Page 7 of 7

Additional assessments outside the current scope of SCS 0108



Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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

Accreditation No.: SCS 0108

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 HCT

Gyeonggi-do, Republic of Korea

Certificate No. D2600V2-1015_Apr24

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CALIBRATION CERTIFICATE Object D2600V2 - SN:1015 16 A PACKST, O) Calibration procedure(s) QA CAL-05.v12 2021-41 07 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz April 22, 2024 Calibration date: This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (St). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) Primary Standards ID # Cal Date (Certificate No.) Scheduled Calibration Power meter NRP2 SN: 104778 26-Mar-24 (No. 217-04036/04037) Mar-25 Pawer sensor NRP-Z91 SN: 103244 26-Mar-24 (No. 217-04036) Mar-25 Power sensor NRP-Z91 SN: 103245 26-Mar-24 (No. 217-04037) Mar-25 Reference 20 dB Attenuator SN: BH9394 (20k) 26-Mar-24 (No. 217-04046) Mar-25 Type-N mismatch combination SN: 310982 / 06327 26-Mar-24 (No. 217-04047) Mar-25 Reference Probe EX3DV4 SN: 7349 03-Nov-23 (No. EX3-7349_Nov23) Nov-24 DAE4 SN: 601 30-Jan-24 (No. DAE4-601_Jan24) Jan-25 Secondary Standards Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Oct-22) In house check: Oct-24 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-22) In house check: Oct-24 Power sensor HP 8481A SN: MY41093315 07-Oct-15 (in house check Oct-22) In house check: Oct-24 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-22) In house check: Oct-24 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-22) In house check: Oct-24 Function Calibrated by: Joanna Lieshai Laboratory Technician Approved by: Sven Kühn Technical Manager Issued: April 23, 2024 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D2600V2-1015_Apr24

Page 1 of 6



Calibration Laboratory of

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Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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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:

- a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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%.

Certificate No: D2600V2-1015_Apr24 Page 2 of 6



Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39,0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.4 ± 6 %	2.04 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	<u> </u>	****

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	56.4 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.2 W/kg ± 16.5 % (k=2)



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.4 Ω - 5.1 μΩ	
Return Loss	- 25.2 dB	

General Antenna Parameters and Design

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Electrical Delay (one direction)	1,150 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Certificate No: D2600V2-1015_Apr24

Page 4 of 6



DASY5 Validation Report for Head TSL

Date: 22.04,2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1015

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

Medium parameters used: f = 2600 MHz; $\sigma = 2.04$ S/m; $\epsilon_r = 37.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.84, 7.84, 7.84) @ 2600 MHz; Calibrated: 03.11.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

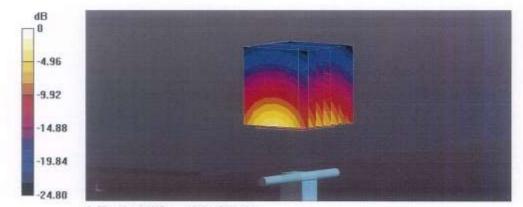
Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 119.3 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 29.4 W/kg

SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.41 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 49.4% Maximum value of SAR (measured) = 24.2 W/kg



0 dB = 24.2 W/kg = 13.84 dBW/kg

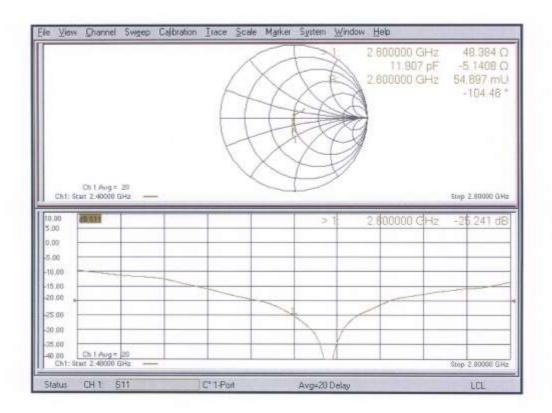
Certificate No: D2600V2-1015_Apr24

Page 5 of 6

F-TP22-03 (Rev. 06) Page 43 of 55



Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1015_Apr24 Page 6 of 6



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Gyeonggi-do, Republic of Korea

Certificate No. D5GHzV2-1107_Apr24

			10
Object	D5GHzV2 - SN:1	1107	1
		THE PROPERTY OF THE PARTY OF TH	II C MA
Calibration procedure(s)	QA CAL-22.v7	2 1 2124.01.01	
	Calibration Proce	edure for SAR Validation Sources	between 3-10 GHz
Calibration date:	April 19, 2024		
This calibration certificate documer	nts the traceability to nati	onal standards, which realize the physical uni	ts of measurements (SI).
The measurements and the uncert	ainties with confidence p	robability are given on the following pages an	d are part of the certificate.
All calibrations have been conducti	ed in the closed laborator	ry facility: environment temperature (22 ± 3)*C	and humidity < 70%
		· management and a series of the series of t	and the same
Calibration Equipment used (M&TE	critical for calibration)		
AND THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON OF TH			
Primary Standards	1D#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
	SN: 103245	26-Mar-24 (No. 217-04037)	Mar-25
Power sensor NRP-Z91			
	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Reference 20 dB Attenuator	Total Control of the	[16] a [18] [17] [18] [18] [18] [18] [18] [18] [18] [18	Mar-25 Mar-25
Reference 20 dB Attenuator Type-N mismatch combination	SN: BH9394 (20k)	26-Mar-24 (No. 217-04048) 26-Mar-24 (No. 217-04047)	Mar-25
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: BH9394 (20k) SN: 310982 / 06327	26-Mar-24 (No. 217-04046)	10000
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503	26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 07-Mar-24 (No. EX3-3503_Mar24)	Mar-25 Mar-25 Jan-25
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601	26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 07-Mar-24 (No. EX3-3503_Mar24) 30-Jan-24 (No. DAE4-601_Jan24)	Mar-25 Mar-25
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601	26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 07-Mar-24 (No. EX3-3503_Mar24) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house)	Mar-25 Mar-25 Jan-25 Scheduled Check
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A	SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID# SN: G839512475	26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 07-Mar-24 (No. EX3-3503_Mar24) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house) 30-Oct-14 (In house check Oct-22)	Mar-25 Mar-25 Jan-25 Scheduled Check In house check: Oct-24 In house check: Oct-24
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783	26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 07-Mar-24 (No. EX3-3503_Mar24) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22)	Mar-25 Mar-25 Jan-25 Scheduled Check In house check: Oct-24 In house check: Oct-24 In house check; Oct-24
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A	SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID# SN: GB39512475 SN: US37292783 SN: MY41093315	26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 07-Mar-24 (No. EX3-3503_Mar24) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22)	Mar-25 Mar-25 Jan-25 Scheduled Check In house check: Oct-24 In house check: Oct-24
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A RF generator R&S SMT-06	SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID# SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972	26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 07-Mar-24 (No. EX3-3503_Mar24) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house) 30-Oct-14 (In house check Oct-22) 07-Oct-15 (In house check Oct-22) 15-Jun-15 (In house check Oct-22)	Mar-25 Mar-25 Jan-25 Scheduled Check In house check: Oct-24 In house check: Oct-24 In house check: Oct-24 In house check: Oct-24
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A RF generator R&S SMT-06	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41080477	26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 07-Mar-24 (No. EX3-3503_Mar24) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22)	Mar-25 Mar-25 Jan-25 Scheduled Check In house check: Oct-24
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-08 Network Analyzer Agilent E8358A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41090477 Name	26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 07-Mar-24 (No. EX3-3503_Mar24) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22)	Mar-25 Mar-25 Jan-25 Scheduled Check In house check: Oct-24
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-08 Network Analyzer Agilent E8358A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41090477 Name	26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 07-Mar-24 (No. EX3-3503_Mar24) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22)	Mar-25 Mar-25 Jan-25 Scheduled Check In house check: Oct-24
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41090477 Name Paulo Pina	26-Mar-24 (No. 217-04046) 26-Mar-24 (No. 217-04047) 07-Mar-24 (No. EX3-3503_Mar24) 30-Jan-24 (No. DAE4-601_Jan24) Check Date (in house) 30-Oct-14 (in house check Oct-22) 07-Oct-15 (in house check Oct-22) 15-Jun-15 (in house check Oct-22) 31-Mar-14 (in house check Oct-22) Function Laboratory Technician	Mar-25 Mar-25 Jan-25 Scheduled Check In house check: Oct-24

Certificate No: D5GHzV2-1107_Apr24

Page 1 of 11



Calibration Laboratory of

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





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

Swiss Calibration Service

Accreditation No.: SCS 0108

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) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY 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%.

Certificate No: D5GHzV2-1107_Apr24

Page 2 of 11



Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.1 ± 6 %	4.65 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	120	

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.97 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.2 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg ± 19.5 % (k=2)



Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.5 ± 6 %	5.05 mha/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	22	2200

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.1 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.5 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	5.22 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.95 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.8 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1107_Apr24

Page 4 of 11



Head TSL parameters at 5800 MHz

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36,2 ± 6 %	5.27 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	10000	-

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.5 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1107_Apr24



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	49.0 Ω - 2.7 jΩ	
Return Loss	- 30.8 dB	

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.2 Ω + 1.9 jΩ
Return Loss	- 27.1 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	56.1 $Ω$ + 1.6 $jΩ$
Return Loss	- 24.6 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.3 Ω + 0.5 jΩ	
Return Loss	- 25.9 dB	

General Antenna Parameters and Design

The state of the s		20 MI 2010	_
Electrical Delay (one	direction)	1.196 ns	11

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

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Manufactured by	SPEAG

Certificate No: D5GHzV2-1107_Apr24

Page 6 of 11



DASY5 Validation Report for Head TSL

Date: 19.04.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1107

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750

MHz, Frequency: 5800 MHz

Medium parameters used: f = 5250 MHz; $\sigma = 4.65$ S/m; $\epsilon_r = 37.1$; $\rho = 1000$ kg/m³,

Medium parameters used: f = 5600 MHz; $\sigma = 5.05$ S/m; $\epsilon_r = 36.5$; $\rho = 1000$ kg/m³,

Medium parameters used: f = 5750 MHz; $\sigma = 5.22$ S/m; $\epsilon_r = 36.3$; $\rho = 1000$ kg/m³,

Medium parameters used: f = 5800 MHz; $\sigma = 5.27$ S/m; $\epsilon_r = 36.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.39, 5.39, 5.39) @ 5250 MHz, ConvF(5, 5, 5) @ 5600 MHz, ConvF(4.98, 4.98, 4.98) @ 5750 MHz, ConvF(4.86, 4.86, 4.86) @ 5800 MHz; Calibrated: 07.03.2024
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics; DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dv=4mm, dz=1.4mm

Reference Value = 73.63 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 26.9 W/kg

SAR(1 g) = 7.97 W/kg; SAR(10 g) = 2.29 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 70.9%

Maximum value of SAR (measured) = 18,2 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 = 72.81 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 30.3 W/kg

SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.33 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 68%

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

Certificate No: D5GHzV2-1107_Apr24

Page 7 of 11



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 = 71.06 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 30.9 W/kg

SAR(1 g) = 7.95 W/kg; SAR(10 g) = 2.26 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 66.2%

Maximum value of SAR (measured) = 19.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 71.08 V/m; Power Drift = 0.08 dB

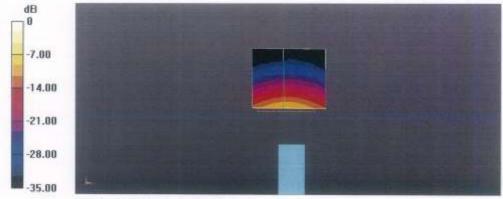
Peak SAR (extrapolated) = 31.1 W/kg

SAR(1 g) = 7.89 W/kg; SAR(10 g) = 2.24 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 65.8%

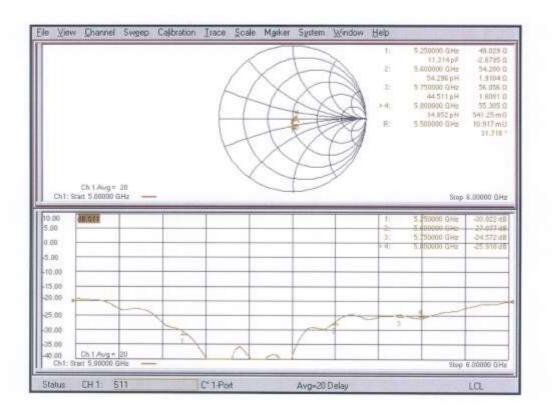
Maximum value of SAR (measured) = 19.2 W/kg



0 dB = 19.4 W/kg = 12.88 dBW/kg



Impedance Measurement Plot for Head TSL



Certificate No: D5GHzV2-1107_Apr24

Page 9 of 11



Appendix: Transfer Calibration at Four Validation Locations on SAM Head¹

Evaluation Conditions (f=5250 MHz)

Ī	Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L

SAR result with SAM Head (Top)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	85.8 W/kg ± 20.3 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Mouth)

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	85.0 W/kg ± 20.3 % (k=2)
SAR averaged over 10 cm ² (10 g) of Head TSL	condition	10

SAR result with SAM Head (Neck)

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	83.1 W/kg ± 20.3 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Ear)

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	53.8 W/kg ± 20.3 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

Certificate No: D5GHzV2-1107_Apr24

Page 10 of 11

Additional assessments outside the current scope of SCS 0108



Appendix: Transfer Calibration at Four Validation Locations on SAM Head²

Evaluation Conditions (f=5800 MHz)

Phantom	SAM Head Phantom	For usage with cSAR3DV2-R/L
A STATE OF THE PARTY OF THE PAR		

SAR result with SAM Head (Top)

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	82.4 W/kg ± 20.3 % (k=2)
		-/
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Mouth)

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	89.1 W/kg ± 20.3 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Neck)

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	79.5 W/kg ± 20.3 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR result with SAM Head (Ear)

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	normalized to 1W	56.6 W/kg ± 20.3 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

Certificate No: D5GHzV2-1107_Apr24

Page 11 of 11

F-TP22-03 (Rev. 06) Page 55 of 55

 $^{^{2}}$ Additional assessments outside the current scope of SCS 0108