

Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 25.05.2022

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; $\sigma = 0.89$ S/m; $\epsilon_r = 40.9$; $\rho = 1000$ 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: 31.12.2021

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- 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 = 60.50 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.36 W/kg SAR(1 g) = 2.19 W/kg; SAR(10 g) = 1.43 W/kg

Smallest distance from peaks to all points 3 dB below = 17 mm Ratio of SAR at M2 to SAR at M1 = 65.3%

Maximum value of SAR (measured) = 2.93 W/kg



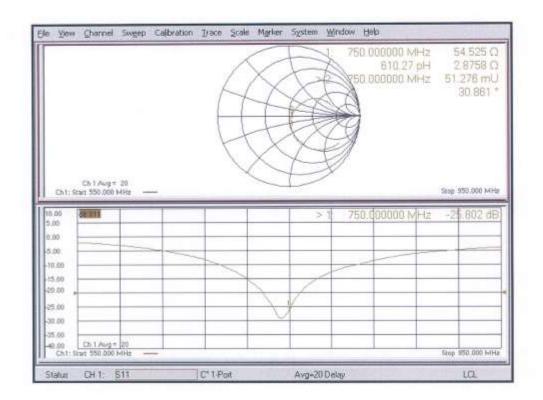
0 dB = 2.93 W/kg = 4.67 dBW/kg

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Impedance Measurement Plot for Head TSL



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

HCT (Dymstec)





Schweizerischer Kalibrierdienst S Service suisse d'étalonnage C Servizio svizzero di taratura 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: D835V2-441 Jul22

CALIBRATION CERTIFICATE Object D835V2 - SN:441 QA CAL-05.V11 Calibration procedure(s) Calibration Procedure for SAR Validation Sources between 0.7-3 GHz July 15, 2022 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 NRP SN: 104778 04-Apr-22 (No. 217-03525/03524) Apr-23 Power sensor NRP-Z91 SN: 103244 04-Apr-22 (No. 217-03524) Apr-23 Power sensor NRP-291 SN: 103245 04-Apr-22 (No. 217-03525) Apr-23 Reference 20 dB Attenuator SN: BH9394 (20k) 04-Apr-22 (No. 217-03527) Apr-23 Type-N mismatch combination SN: 310982 / 06327 04-Apr-22 (No. 217-03528) Apr-23 Reference Probe EX3DV4 SN: 7349 31-Dec-21 (No. EX3-7349_Dec21) Dec-22 DAE4 SN: 601 02-May-22 (No. DAE4-601_May22) May-23 Secondary Standards ID# Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Oct-20) In house check: Oct-22 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-20) In house check: Oct-22 Power sensor HP 8481A SN: MY41093315 07-Oct-15 (in house check Oct-20) in house check: Oct-22 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-20) In bouse check: Oct-22 Network Analyzer Aglient E8358A SN: US41080477 31-Mar-14 (in house check Oct-20) In house check: Oct-22 Calibrated by: Aidonia Georgiadou Laboratory Technician Approved by: Sven Kühn Technical Manager Issued: July 25, 2022 This calibration certificate shall not be reproduced except in full without written approval of the laboratory 하이 자 Certificate No: D835V2-441_Jul22 Page 1 of 6 ひ上ノ地な時 告证信 2021 08.10 2022.08,10



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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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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 mha/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.3 ± 6 %	0.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	_	_

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.51 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	6.33 W/kg ± 16.5 % (k=2)

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω + 5.5 jΩ		
Return Loss	- 24.7 dB		

General Antenna Parameters and Design

ſ	Electrical Delay (one direction)	1.372 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
	911 101 100

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DASY5 Validation Report for Head TSL

Date: 15.07.2022

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; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

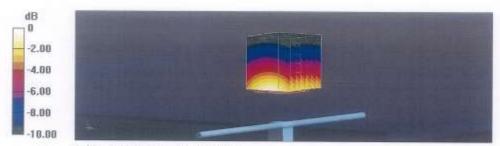
DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(9.69, 9.69, 9.69) @ 835 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- 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 = 64.34 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.83 W/kg
SAR(1 g) = 2.51 W/kg; SAR(10 g) = 1.62 W/kg
Smallest distance from peaks to all points 3 dB below = 16 mm
Patio of SAR at M2 to SAR at M1 = 65.494

Ratio of SAR at M2 to SAR at M1 = 65.4% Maximum value of SAR (measured) = 3.39 W/kg



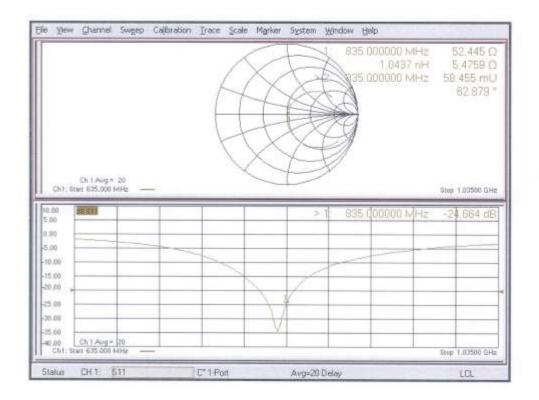
0 dB = 3.39 W/kg = 5.30 dBW/kg

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Impedance Measurement Plot for Head TSL



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Accreditation No.: SCS 0108

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Certificate No: D1800V2-2d007 Jul22

	CERTIFICATI		THE RESERVE TO A STREET TO A S
Object	D1800V2 - SN:2d007		
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0		between 0.7-3 GHz
Calibration date:	July 18, 2022		
he measurements and the unce	rtainties with confidence po	onal standards, which realize the physical unit robability are given on the following pages and ry facility: environment temperature $(22 \pm 3)^{\circ}$ C	d are part of the certificate.
rimary Standards	ID#	Call Date (Certificate No.)	Scheduled Calibration
ower meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)	Apr-23
ower sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
ower sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23
eference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
pe-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)	Apr-23
	SN: 7349	31-Dec-21 (No. EX3-7349_Dec21)	Dec-22
			AA (0.05)
	SN: 601	02-May-22 (No. DAE4-601_May22)	May-23
AE4	SN: 801	02-May-22 (No. DAE4-601_May22) Check Date (in house)	Scheduled Check
AE4 econdary Standards			Western S
AE4 econdary Standards twes meter E4419B twer sensor HP 8481A	ID#	Check Date (in house)	Scheduled Check
econdary Standards twer meter E4419B twer sensor HP 8481A tower sensor HP 8481A	ID # SN: GB38512475 SN: US37292783 SN: MY41093315	Check Date (in house) 30-Oct-14 (in house-check Oct-20)	Scheduled Check In house check: Oct-22
AE4 econdary Standards ower meter E4419B ower sensor HP 8481A ower sensor HP 8481A F generator R&S SMT-06	ID# SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972	Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20)	Scheduled Check In house check: Oct-22 In house check: Oct-22
AE4 econdary Standards ower meter E4419B ower sensor HP 8481A ower sensor HP 8481A F generator R&S SMT-06	ID# SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972	Check Date (in house) 30-Oct-14 (in house-check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
teterence Probe EX30V4 NAE4 econdary Standards tower meter E4419B tower sensor HP 8481A tower sensor HP 8481A F generator R&S SMT-06 tetwork Analyzer Agilent E8358A	ID# SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972	Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20)	Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
econdary Standards ower meter E4419B ower sensor HP 8481A ower sensor HP 8481A F generator R&S SMT-06	ID# SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 A SN: US41080477	Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Man-14 (in house check Oct-20)	Scheduled Check In house check: Oct-22



FCC ID: A3LSMM146B Report No: HCT-SR-2212-FC004-R2

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





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Glossary:

TSL tissue simulating liquid

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

Multilateral Agreement for the recognition of calibration certificates

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_Jul22

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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	38.4 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		_

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	38.2 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.95 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.8 W/kg ± 16.5 % (k=2)

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	46.5 Ω - 8.1 μΩ	
Return Loss	- 20.8 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.204 ns
anneuron erolog force amounting	1180917 1188

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 sccording 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: D1800V2-2d007_Jul22

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Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 18.07.2022

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; $\sigma = 1.38$ S/m; $\epsilon_c = 38.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

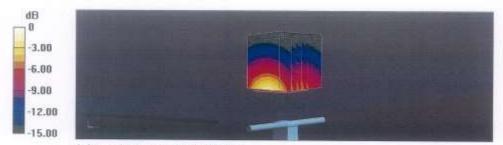
- Probe: EX3DV4 SN7349; ConvF(8.63, 8.63, 8.63) @ 1800 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05,2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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 = 108.9 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 18.1 W/kg SAR(1 g) = 9.55 W/kg; SAR(10 g) = 4.95 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm

Maximum value of SAR (measured) = 14.8 W/kg

Smallest distance from peaks to all points 3 dB below = 10 n Ratio of SAR at M2 to SAR at M1 = 53.2%



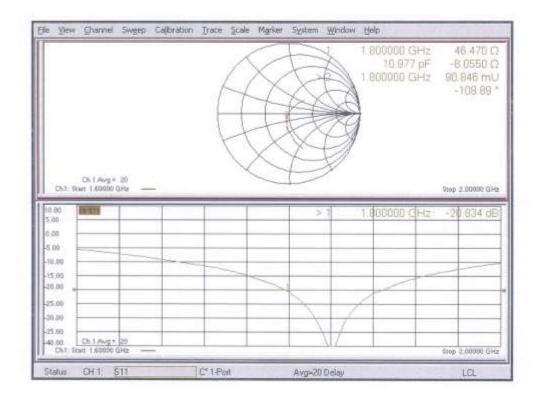
0 dB = 14.8 W/kg = 11.70 dBW/kg

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Impedance Measurement Plot for Head TSL



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Multilateral Agreement for the recognition of calibration certificates

HCT (Dymstec) Certificate No: D1900V2-5d032_Jan22

Object	D1900V2 - SN 5d032		
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz		
Calibration date:	January 28, 2022		
The measurements and the uncert	ainties with confidence pr	onal standards, which realize the physical uni robability are given on the following pages an y facility: environment temperature (22 \pm 3)°C	d are part of the certificate.
Calibration Equipment used (M&TE	E critical for calibration)		
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
ower meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
ower sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
	5N: 103245	09-Apr-21 (No. 217-03292)	Apr-22
ower sensor NRP-Z91			
	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k) SN: 310982 / 06327	09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344)	Apr-22 Apr-22
Reference 20 dB Attenuator Type-N mismatch combination] [F. 1984] P. N. S. 1984] T. H. S. 1985] D. N. N. H. M. H. M. H. N. 1985]	9.0000000000000000000000000000000000000
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: 310982 / 06327 SN: 7349	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21)	Apr-22 Dec-22
Seference 20 dB Attenuator ype-N mismatch combination Reference Probe EX3DV4 DAE4	SN: 310982 / 06327 SN: 7348 SN: 601	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21)	Apr-22 Dec-22 Nov-22
Reference 20 dB Attenuator (Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power mater E44198	SN: 310982 / 06327 SN: 7348 SN: 601	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house)	Apr-22 Dep-22: Nov-22 Scheduled Check
Reference 20 dB Attenuator (Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power mater E4419B Power sensor HP 8481A	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: G838512475	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Oct-14 (in house check Oct-20)	Apr-22 Dep-22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22
Reference 20 dB Attenuator ype-N mismatch combination Reference Probe EX3DV4 IAE4 Recondary Standards Power mater E4419B Power sensor HP 8481A Power sensor HP 8481A	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: G839512475 SN: U837292783	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	Apr.22 Dec.22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
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: 310982 / 06327 SN: 7349 SN: 601 ID # SN: G839512475 SN: U837292783 SN: MY41083315	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	Apr.22 Dec.22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
Reference 20 dB Attenuator Pype-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A RF generator R&S SMT-06	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: G838512475 SN: U837262783 SN: MY41083315 SN: 100972	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov-21) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20)	Apr-22 Deo-22: Nov-22 Scheduled Check In house check: Oct-22
Reference 20 dB Attenuator Pype-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A Reference HP 8481A Reference HP 8481A Reference HP 8481A	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB38512475 SN: US37292783 SN: MY41083315 SN: 100972 SN: US41080477	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Qct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	Apr-22 Dec-22: Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
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: 310982 / 06327 SN: 7348 SN: 601 ID # SN: G838512475 SN: US37282783 SN: MY41083315 SN: MY41083315 SN: US41080477 Name	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	Apr-22 Deo-22: Nov-22 Scheduled Check In house check: Oct-22
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-Q6 Network Analyzer Agilent E8358A Calibrated by: Approved by:	SN: 310982 / 06327 SN: 7348 SN: 601 ID # SN: G838512475 SN: US37282783 SN: MY41083315 SN: MY41083315 SN: US41080477 Name	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Qct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function Lisboratory Terminician	Apr-22 Deo-22: Nov-22 Scheduled Check In house check: Oct-22
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 Agrient E8358A Calibrated by:	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: G838512475 SN: US37282783 SN: WY41083315 SN: 100972 SN: US41080477 Name Joanna Lieshaj	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Qct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	Apr-22 Deo-22: Nov-22 Scheduled Check In house check: Oct-22

Certificate No: D1900V2-5d032_Jan22

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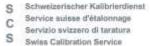


Report No: HCT-SR-2212-FC004-R2

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







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: D1900V2-5d032_Jan22

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Report No: HCT-SR-2212-FC004-R2

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	40.8	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 6 %	1.40 mho/m ± 6 %
Head TSL temperature change during test	< 0,5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.0 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ² (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5,23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.9 W/kg ± 16.5 % (k=2)

Certificate No: D1900V2-5d032_Jan22

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Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.8 Ω + 7.4 JΩ	
Return Loss	- 22.5 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.191 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
Manuactured by	SPEAG

Certificate No: D1900V2-5d032 Jan22

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Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 28.01.2022

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; $\sigma = 1.4$ S/m; $\epsilon_r = 39.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 31.12.2021
- · Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; 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

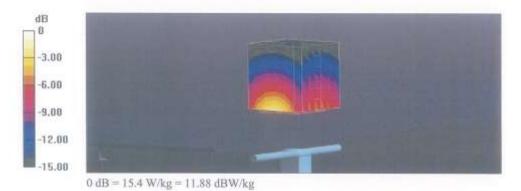
Reference Value = 109.8 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 18.3 W/kg

SAR(1 g) = 10.0 W/kg; SAR(10 g) = 5.23 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 55.2%

Maximum value of SAR (measured) = 15.4 W/kg

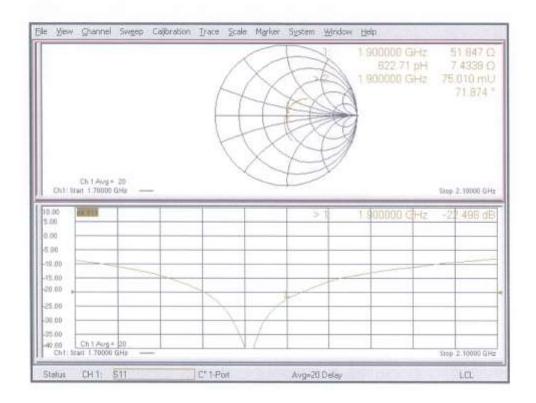


Certificate No: D1900V2-5d032_Jan22

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Report No: HCT-SR-2212-FC004-R2

Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d032_Jan22

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Report No: HCT-SR-2212-FC004-R2

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

Certificate No: D2450V2-743_May22 HCT (Dymstec)

	ERTIFICATE		당당자	화이자
Object	D2450V2 - SN:74		70 212 m/ 7/214 1022620	(7/ Mg/4)
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	dure for SAR Validation Sou		0.7-3 GHz
Calibration date:	May 31, 2022		2-301-91	
The measurements and the uncert	ainties with confidence pred in the closed laborator	onal standards, which realize the physic obability are given on the following pag y facility: environment temperature (22	ges and are part of th	e certificate.
Primary Standards	ID#	Cal Date (Certificate No.)	Schedu	uled Calibration
Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310882 / 06327	04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528)	Apr-23 Apr-23 Apr-23 Apr-23 Apr-23	
Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: 7349 SN: 601	31-Dec-21 (No. EX3-7349_Dec21) 02-May-22 (No. DAE4-601_May22)	Dec-22 May-23	
Reference Probe EX3DV4 DAE4	SN: 7349 SN: 601	31-Dec-21 (No. EX3-7349_Dec21) 02-May-22 (No. DAE4-601_May22)	Dec-22 May-23	1
Reference Probe EX3DV4	SN: 7349	31-Dec-21 (No. EX3-7349_Dec21)	Dec-22 May-23 Schedu In hous In hous In hous In hous	
Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 7349 SN: 601 ID # SN: G839512475 SN: US37292783 SN: MY41093315 SN: 100972	31-Dec-21 (No. EX3-7349_Dec21) 02-May-22 (No. DAE4-801_May22) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20)	Dec-22 May-23 Schedu In hous In hous In hous In hous	died Check be check: Oct-22 se check: Oct-22 se check: Oct-22 se check: Oct-22 se check: Oct-22
Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-05 Network Analyzer Agilent E83S8A	SN: 7349 SN: 801 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41080477	31-Dec-21 (No. EX3-7349_Dec21) 02-May-22 (No. DAE4-601_May22) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	Dec-22 May-2: Schedu In bous In hous In hous In hous	died Check be check: Oct-22 se check: Oct-22 se check: Oct-22 se check: Oct-22 se check: Oct-22
Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41080477 Name	31-Dec-21 (No. EX3-7349_Dec21) 02-May-22 (No. DAE4-601_May22) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	Dec-22 May-2: Schedu In bous In hous In hous In hous	died Check be check: Oct-22 se check: Oct-22 se check: Oct-22 se check: Oct-22 se check: Oct-22

Certificate No: D2450V2-743_May22

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FCC ID: A3LSMM146B Report No: HCT-SR-2212-FC004-R2

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





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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: D2450V2-743_May22

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Report No: HCT-SR-2212-FC004-R2

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	38.3 ± 6 %	1,84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.2 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.8 W/kg ± 16.5 % (k=2)

Certificate No: D2450V2-743_May22

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Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.7 Ω + 5.9 jΩ	
Return Loss	- 22.8 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.160 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

F	Manufactured by	SPEAG

Certificate No: D2450V2-743_May22

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Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 31.05.2022

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; $\sigma = 1.84$ S/m; $\epsilon_r = 38.3$; $\rho = 1000$ 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: 31.12.2021

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; 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:

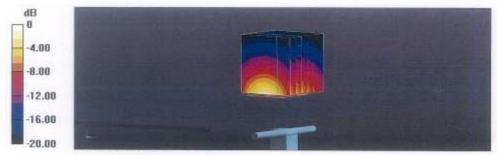
Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 116.2 V/m; Power Drift = 0.08 dB Peak SAR (extrapolated) = 27.0 W/kg

SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.26 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 50%

Maximum value of SAR (measured) = 22.1 W/kg



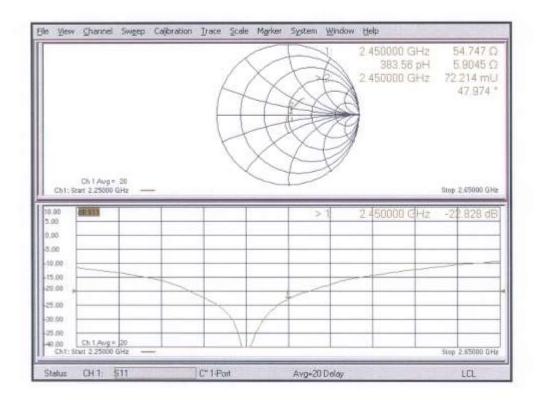
0 dB = 22.1 W/kg = 13.44 dBW/kg

Certificate No: D2450V2-743_May22

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Report No: HCT-SR-2212-FC004-R2

Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-743_May22

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Report No: HCT-SR-2212-FC004-R2

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





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S Swiss Calibration Service

Accreditation No.: SCS 0108

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The Swiss Accreditation Service is one of the signatories to the EA.

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client HCT (Dymstec)

Certificate No: D2600V2-1015_Jul22

		- 1				
Object	D2600V2 - SN:1015					
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources bet		between 0	.7-3 GHz	
Calibration date:	July 15, 2022					
This calibration certificate document The measurements and the uncert All calibrations have been conducte	ainties with confidence p	robability are given on the follow	wing pages an	d are part of the	e certificate.	
Calibration Equipment used (M&TE	a managang ang ang ang ang ang ang ang ang					
Primary Standards	1D #	Cal Date (Certificate No.)		Schedul	ed Calibration	
Power meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/0	3524)	Apr-23		
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)		Apr-23		
ower sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)		Apr-23		
Reference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)		Apr-23		
Type-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)		Apr-23		
Reference Probe EX3DV4	SN: 7349	31-Dec-21 (No. EX3-7349_Dec21)		Dec-22		
DAE4	SN: 601	02-May-22 (No. DAE4-601_)	May22)	May-23		
Secondary Standards	ID#	Check Date (In house)		Schedul	ed Check	
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)		In house check: Oct-22		
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check C	Oct-20)	In house	check: Oct-22	
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check C	Oct-20)	In house	check: Oct-22	
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check C	Xt1-20)	In house	check: Oct-22	
Network Analyzer Agilent EB358A	SN: US41080477	31-Mar-14 (in house check C	Oct-20)	In house	check: Oct-22	
	Name	Function		Signatur	re	
Calibrated by:	Aldonia Georgiadou	Laboratory Tech	nician	灰	51	
Approved by:	Sven Kunn	Deputy Manager		S	_	
				Issued; J	uly 25, 2022	
This calibration certificate shall not	be reproduced except in	full without written approval of	the laboratory	보자	화이자	
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S Swiss Calibration Service

Accreditation No.: SCS 0108

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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: D2600V2-1015_Jul22 Page 2 of 6



Report No: HCT-SR-2212-FC004-R2

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	37.3 ± 6 %	2.01 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	14.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	56.3 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ² (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.2 W/kg ± 16.5 % (k=2)

Certificate No: D2600V2-1015_Jul22

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Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.9 Ω - 4.5 μΩ	
Return Loss	- 26.6 dB	

General Antenna Parameters and Design

Electrical	Delay (one direction)	1.148 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

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Manufactured by	SPEAG
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Certificate No: D2600V2-1015_Jul22

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Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 15.07.2022

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; $\sigma = 2.01 \text{ S/m}$; $\epsilon_r = 37.3$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.84, 7.84, 7.84) @ 2600 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; 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 = 117.2 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 28.3 W/kg

SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.40 W/kg

Smallest distance from peaks to all points 3 dB below = 8.5 mm

Ratio of SAR at M2 to SAR at M1 = 50.6%

Maximum value of SAR (measured) = 23.7 W/kg



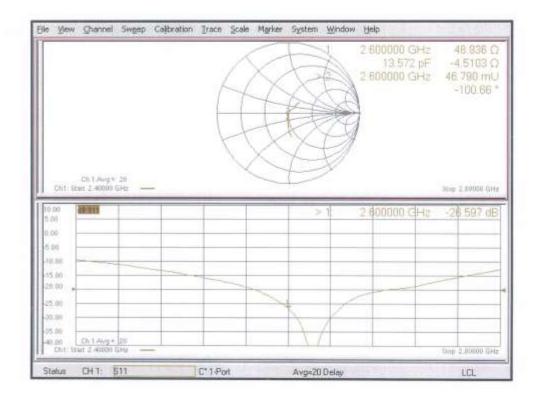
0 dB = 23.7 W/kg = 13.74 dBW/kg

Certificate No: D2600V2-1015_Jul22

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Report No: HCT-SR-2212-FC004-R2

Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1015_Jul22

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Report No: HCT-SR-2212-FC004-R2

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





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Accreditation No.: SCS 0108

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Client HCT (Dymstec)

Certificate No: D3500V2-1132 Jan22

D3500V2 - SN:11	32	
QA CAL-22.v6 Calibration Proce	dure for SAR Validation Sources	between 3-10 GHz
January 24, 2022		
tainties with confidence potential in the closed liaborator	robability are given on the following pages an	d are part of the certificate.
	Cal Date (Certificate No.)	Scheduled Calibration
SN: 104778	THE RESERVE OF THE PARTY OF THE	Apr-22
SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
SN: 3503	31-Dec-21 (No. EX3-3503_Dec21)	Dec-22
SN: 601	01-Nov-21 (No. DAE4-601_Nov21)	Nov-22
ID:#	Check Date (in house)	Scheduled Check
SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check; Oct-22
SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
SN: MY41093315	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
5N: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22
Name	Function	Signature
Michael Weber	Laboratory Technician	M.WESET
	Deputy Manager	
	QA CAL-22.v6 Calibration Proce January 24, 2022 Into the traceability to natitalities with confidence potential traceability to natitalities and national traceabilities and nati	QA CAL-22.v6 Calibration Procedure for SAR Validation Sources January 24, 2022 Interest the physical unitables with confidence probability are given on the following pages and sed in the closed laboratory facility: environment temperature (22 ± 3)°C E critical for calibration) ID # Cal Date (Certificate No.) SN: 104778 G9-Apr-21 (No. 217-03291/03292) SN: 103244 G9-Apr-21 (No. 217-03291) SN: 103245 G9-Apr-21 (No. 217-03343) SN: BH9394 (20k) G9-Apr-21 (No. 217-03344) SN: 310982 / 06327 G9-Apr-21 (No. EX3-3503 Dec21) SN: 3603 S1-Dec-21 (No. EX3-3503 Dec21) SN: 601 O1-Nov-21 (No. DAE4-601_Nov21) ID # Check Date (in house) SN: G899612475 30-Oct-14 (in house check Oct-20) SN: WY41083315 07-Oct-15 (in house check Oct-20) SN: US41080477 31-Mar-14 (in house check Oct-20) SN: US41080477 31-Mar-14 (in house check Oct-



FCC ID: A3LSMM146B Report No: HCT-SR-2212-FC004-R2

Calibration Laboratory of

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 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: D3500V2-1132_Jan22

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Report No: HCT-SR-2212-FC004-R2

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, $dy = 4$ mm, $dz = 1.4$ mm	Graded Ratio = 1.4 (Z direction)
Frequency	3500 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.9	2.91 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.3 ± 6 %	2.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	1511	17,000

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	65.2 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg ± 19.5 % (k=2)



Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.2 Ω - 5.5 JΩ	
Fleturn Loss	-24.7 dB	

General Antenna Parameters and Design

j	Electrical Delay (one direction)	1.130 ns
- 1	mountain being (one anastron)	11100112

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
	A 17 (A)

Certificate No: D3500V2-1132_Jan22

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Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 24.01.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1132

Communication System: UID 0 - CW; Frequency: 3500 MHz

Medium parameters used: f = 3500 MHz; $\sigma = 2.93 \text{ S/m}$; $\varepsilon_r = 37.3$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(7.91, 7.91, 7.91) @ 3500 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3500MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.40 V/m; Power Drift = -0.02 dB

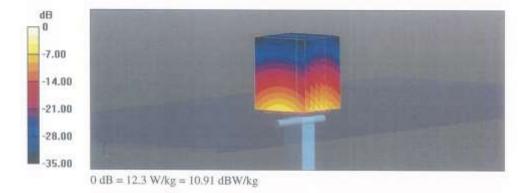
Peak SAR (extrapolated) = 17.3 W/kg

SAR(1 g) = 6.56 W/kg; SAR(10 g) = 2.46 W/kg

Smallest distance from peaks to all points 3 dB below = 8.4 mm

Ratio of SAR at M2 to SAR at M1 = 75.7%

Maximum value of SAR (measured) = 12.3 W/kg

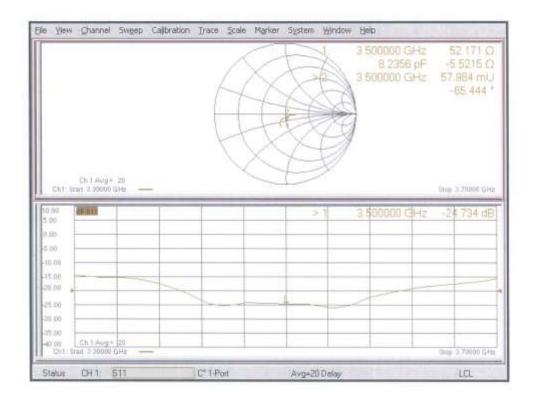


Certificate No: D3500V2-1132_Jan22

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Report No: HCT-SR-2212-FC004-R2

Impedance Measurement Plot for Head TSL



Certificate No: D3500V2-1132_Jan22

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Report No: HCT-SR-2212-FC004-R2

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Accreditation No.: SCS 0108

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

HCT (Dymstec) Certificate No: D3700V2-1066 Nov22 **CALIBRATION CERTIFICATE** Object D3700V2 - SN:1066 Calibration procedure(s) QA CAL-22.v6 Calibration Procedure for SAR Validation Sources between 3-10 GHz Calibration date: November 14, 2022 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 NRP 5N: 104778 04-Apr-22 (No. 217-03525/03524) Apr-23 Power sensor NRP-Z91 SN: 103244 04-Apr-22 (No. 217-03524) Apr-23 Power sensor NRP-Z91 SN: 103245 D4-Apr-22 (No. 217-03525) Apr-23 Reference 20 dB Attenuator SN: 8H9394 (20k) D4-Apr-22 (No. 217-03527) Apr-23 Type-N mismatch combination SN: 310982 / 06327 04-Apr-22 (No. 217-03528) Apr-23 Reference Probe EX3DV4 SN: 3503 08-Mar-22 (No. EX3-3503_Mar22) Mar-23 DAF4 SN: 601 31-Aug-22 (No. DAE4-601 Aug22) Aug-23 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: U541080477 31-Mar-14 (in house check Oct-22) In house check: Oct-24 Function Signature Calibrated by: Joanna Lleshe Laboratory Technician Approved by: Sven Kühn Technical Manager This calibration certificate shall not be reproduced except in full without written approval Certificate No: D3700V2-1066_Nov22 Page 1 of 6 65/49/2 ロレ/ レちなき



Report No: HCT-SR-2212-FC004-R2

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Accreditation No.: SCS 0108

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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: D3700V2-1066_Nov22

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Report No: HCT-SR-2212-FC004-R2

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 = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3700 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.7	3.12 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.1 ± 6 %	3.08 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	5 	_

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.7 W/kg ± 19.5 % (k=2)



Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.7 Ω + 0.6 jΩ	
Return Loss	- 36.9 dB	

General Antenna Parameters and Design

Children will receive the Co.	
Electrical Delay (one direction)	1.130 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

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Manufactured by	SPEAG

Certificate No: D3700V2-1066_Nov22

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Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 14.11.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1066

Communication System: UID 0 - CW; Frequency: 3700 MHz

Medium parameters used: f = 3700 MHz; $\sigma = 3.08$ S/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

Probe: EX3DV4 - SN3503; ConvF(7.73, 7.73, 7.73) @ 3700 MHz; Calibrated: 08.03.2022

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 31,08,2022

Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001

DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3700MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 69.55 V/m; Power Drift = 0.00 dB

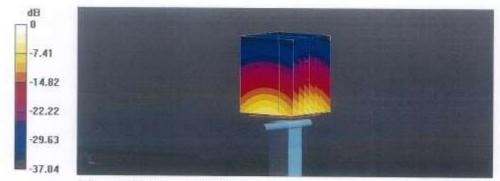
Peak SAR (extrapolated) = 18.5 W/kg

SAR(1 g) = 6.76 W/kg; SAR(10 g) = 2.46 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 74.4%

Maximum value of SAR (measured) = 13.0 W/kg



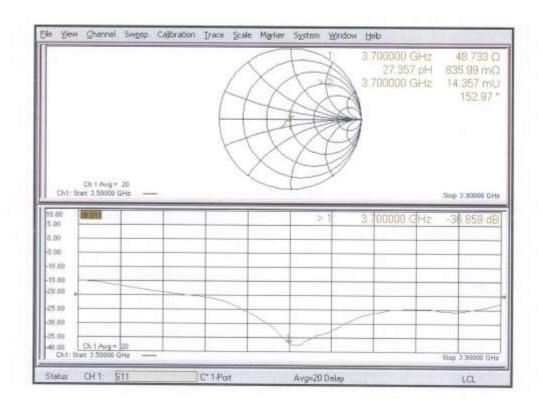
0 dB = 13.0 W/kg = 11.13 dBW/kg

Certificate No: D3700V2-1066_Nov22

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Report No: HCT-SR-2212-FC004-R2

Impedance Measurement Plot for Head TSL



Certificate No: D3700V2-1066_Nov22

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Report No: HCT-SR-2212-FC004-R2

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Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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Multilateral Agreement for the recognition of calibration certificates

Client HCT (Dymstec)

Certificate No: D3900V2-1086_May22

Object	D3900V2 - SN:10	/2 - SN:1086		
Calibration procedure(s)	QA CAL-22.v6 Calibration Proce	edure for SAR Validation Source	s between 3-10 GHz	
Calibration date:	May 25, 2022			
The measurements and the uncert All calibrations have been conduct	tainties with confidence p	ional standards, which realize the physical un robability are given on the following pages a ry facility: environment temperature (22 ± 3) ^o	nd are part of the certificate.	
Calibration Equipment used (M&Ti Primary Standards	E critical for calibration)	Cal Date (Certificate No.)	Scheduled Calibration	
Power meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)	Apr-23	
			1 day more	
	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23	
Power sensor NRP-Z91	55 15 6 6 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525)	Apr-23 Apr-23	
Power sensor NRP-Z91 Power sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23	
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	SN: 103245 SN: BH9394 (20k)	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527)	Apr-23 Apr-23	
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination	SN: 103245 SN: 8H9394 (20k) SN: 310962 / 06327	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528)	Apr-23 Apr-23 Apr-23	
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX30V4	SN: 103245 SN: BH9394 (20k)	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527)	Apr-23 Apr-23	
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar/22)	Apr-23 Apr-23 Apr-23 Mar-23	
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar/22) 02-May-22 (No. DAE4-601_May/22)	Apr-23 Apr-23 Apr-23 Mar-23 May-23	
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: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar/22) 02-May-22 (No. DAE4-601_May/22) Check Date (In house)	Apr-23 Apr-23 Apr-23 Mar-23 May-23 Scheduled Check	
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX30V4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar/22) 02-May-22 (No. DAE4-601_May/22) Check Date (In house) 30-Oct-14 (in house check Oct-20)	Apr-23 Apr-23 Apr-23 Mar-23 May-23 Scheduled Check In house check: Oct-22	
Power sensor NRIP-Z91 Power sensor NRIP-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	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503 Mar/22) 02-May-22 (No. DAE4-601 May/22) Check Date (In house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	Apr-23 Apr-23 Apr-23 Mar-23 May-23 Scheduled Check In house check: Oct-22 In house check; Oct-22	
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX30V4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A RF generator R&S SMT-06	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar22) 02-May-22 (No. DAE4-601_May22) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	Apr-23 Apr-23 Apr-23 Mar-23 May-23 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22	
Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX30V4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A RF generator R&S SMT-06	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar22) 02-May-22 (No. DAE4-601_May22) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20)	Apr-23 Apr-23 Apr-23 Mar-23 Mar-23 Scheduled Check In house check: Oct-22	
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-D8 Notwork Analyzer Agilent EB358A Calibrated by:	SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41093315 SN: 100972 SN: US41080477	04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 08-Mar-22 (No. EX3-3503_Mar/22) 02-May-22 (No. DAE4-601_May/22) Check Date (In house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	Apr-23 Apr-23 Apr-23 Mar-23 Mary-23 Scheduled Check In house check: Oct-22	



Report No: HCT-SR-2212-FC004-R2

Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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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%.

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Measurement Conditions

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

AST system configuration, as far as no	t given un page 1.	
DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Medular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, $dy = 4$ mm, $dz = 1.4$ mm	Graded Ratio = 1.4 (Z direction)
Frequency	3900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.5	3.32 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.3 ± 6 %	3.28 mha/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		****

SAR result with Head TSL

SAR averaged over 1 cm ⁵ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	68.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ² (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.9 W/kg ± 19.5 % (k=2)

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	45.4 Ω - 5.9 jΩ	
Return Loss	- 22.1 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.099 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.

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Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL

Date: 25.05.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3900 MHz; Type: D3900V2; Serial: D3900V2 - SN: 1086

Communication System: UID 0 - CW; Frequency: 3900 MHz

Medium parameters used: f = 3900 MHz; $\sigma = 3.28$ S/m; $\epsilon_r = 37.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

Probe: EX3DV4 - SN3503; ConvF(7.39, 7.39, 7.39) @ 3900 MHz; Calibrated: 08.03.2022

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 02.05.2022

Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001

DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3900MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.65 V/m; Power Drift = -0.00 dB

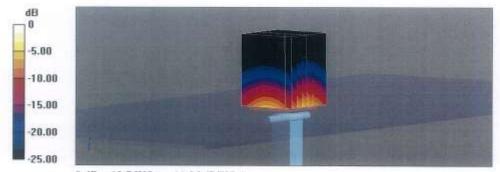
Peak SAR (extrapolated) = 19.8 W/kg

SAR(1 g) = 6.89 W/kg; SAR(10 g) = 2.40 W/kg

Smallest distance from peaks to all points 3 dB below = 8.2 mm

Ratio of SAR at M2 to SAR at M1 = 73.5%

Maximum value of SAR (measured) = 13.7 W/kg



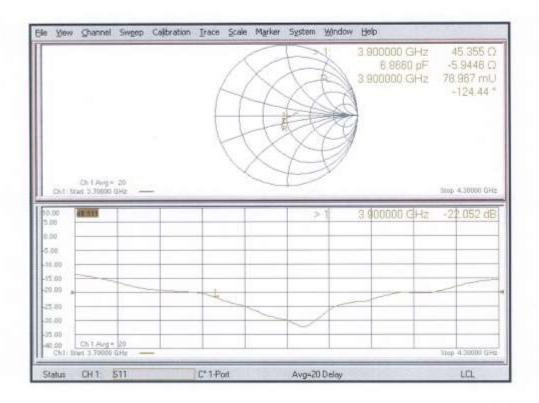
0 dB = 13.7 W/kg = 11.36 dBW/kg

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Impedance Measurement Plot for Head TSL



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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

Certificate No: D5GHzV2-1253 May22 HCT (Dymstec) Client CALIBRATION CERTIFICATE D5GHzV2 - SN:1253 Object 221.20 らいノソンは 재 Calibration procedure(s) QA CAL-22.v6 Calibration Procedure for SAR Validation Sources between 3-10 GHz May 31, 2022 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 NRP SN: 104778 04-Apr-22 (No. 217-03525/03524) Apr-23 Power sensor NRP-Z91 SN: 103244 04-Apr-22 (No. 217-03524) Apr-23 Power sensor NRP-Z91 SN: 103245 04-Apr-22 (No. 217-03525) Apr-23 Reference 20 dB Attenuator SN: BH9394 (20k) 04-Apr-22 (No. 217-03527) Apr-23 Type-N mismatch combination SN: 310982 / 06327 04-Apr-22 (No. 217-03528) Apr-23 Reference Probe EX3DV4 SN: 3503 08-Mar-22 (No. EX3-3503 Mar22) Mar-23 DAE4 SN: 601 02-May-22 (No. DAE4-601_May22) May-23 Secondary Standards ID# Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Oct-20) In house check: Oct-22 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-20) In house check: Oct-22 Power sensor HP 8481A SN: MY41093315 07-Oct-15 (in house check Oct-20) In house check: Oct-22 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-20) In house check: Oct-22 Network Analyzer Apilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-20) In house check: Oct-22 Function Signature Calibrated by: Joanna Llesha) Laboratory Technician Approved by: Sven Kühn Technical Manager Issued: June 3, 2022 This galibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D5GHzV2-1253_May22

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FCC ID: A3LSMM146B Report No: HCT-SR-2212-FC004-R2

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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 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%.

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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	

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	34.9 ± 6 %	4.52 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.9 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	34.4 ± 6 %	4.87 mho/m ± 6 %
Head TSL temperature change during test	< 0,5 °C		

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.28 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	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.5 W/kg ± 19.5 % (k=2)

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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	34.2 ± 6 %	5.02 mha/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	144	2440

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.9 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	22.6 W/kg ± 19.5 % (k=2)



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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	49.5 Ω - 3.2 μΩ	
Return Loss	- 29.8 dB	

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	52.2 Ω + 3.1 jΩ	
Return Loss	- 28.5 dB	

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	53.6 Ω + 2.9 JΩ	
Return Loss	-27.0 dB	

General Antenna Parameters and Design

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Electrical Delay (one direction)	1.196 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
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FCC ID: A3LSMM146B Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 31.05.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1253

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

MHz

Medium parameters used: f = 5250 MHz; $\sigma = 4.52$ S/m; $\epsilon_r = 34.9$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5600 MHz; $\sigma = 4.87$ S/m; $\epsilon_r = 34.4$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5750 MHz; $\sigma = 5.02$ S/m; $\epsilon_r = 34.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; 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, dy=4mm, dz=1.4mm

Reference Value = 75.61 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 28.5 W/kg

SAR(1 g) = 8.10 W/kg; SAR(10 g) = 2.31 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 69.6%

Maximum value of SAR (measured) = 18.4 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 = 75.75 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 31.2 W/kg

SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.37 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 66.7%

Maximum value of SAR (measured) = 19.7 W/kg

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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 = 73.51 V/m; Power Drift = 0.06 dB

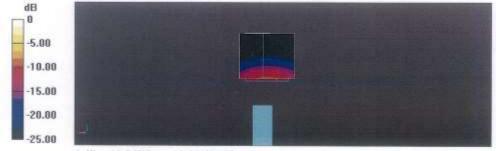
Peak SAR (extrapolated) = 32.3 W/kg

SAR(1 g) = 8.06 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 = 65.3%

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

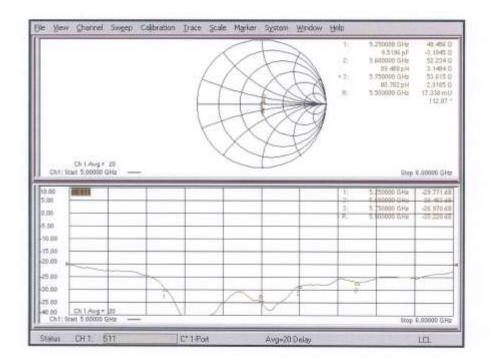


0 dB = 19.7 W/kg = 12.94 dBW/kg



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Impedance Measurement Plot for Head TSL



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S Swiss Calibration Service

Accreditation No.: SCS 0108

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Multilateral Agreement for the recognition of calibration certificates

Client HCT (Dymstec)

Certificate No: D750V3-1014_May22

CALIBRATION CERTIFICATE D750V3 - SN:1014 Object Calibration procedure(s) QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz May 25, 2022 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 Cal Date (Certificate No.) Scheduled Calibration Power meter NRP SN: 104778 04-Apr-22 (No. 217-03525/03524) Apr-23 Power sensor NRP-Z91 SN: 103244 04-Apr-22 (No. 217-03524) Apr-23 Power sensor NRP-Z91 SN: 103245 04-Apr-22 (No. 217-03525) Apr-23 Reference 20 dB Attenuator SN: BH9394 (20k) 04-Apr-22 (No. 217-03527) Apr-23 Type-N mismatch combination SN: 310962 / 06327 04-Apr-22 (No. 217-03528) Apr-23 Reference Probe EX3DV4 SN: 7349 31-Dec-21 (No. EX3-7349_Dec21) Dec-22 DAE4 SN: 601 02-May-22 (No. DAE4-601_May22) May-23 Secondary Standards ID W Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Oct-20) In house check: Oct-22 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-20) In house check: Oct-22 Power sensor HP 8481A SN: MY41093315 07-Oct-15 (in house check Oct-20) In house check: Oct-22 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-20) In house check: Oct-22 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-20) In house check: Oct-22 Aldonia Georgiadou Calibrated by: Laboratory Technician Approved by: Sven Kühn Technical Manager Issued: May 30, 2022 This calibration certificate shall not be reproduced except in full without written approval Certificate No: D750V3-1014_May22 Page 1 of 6 ひしノがなる 七アノかき 28 2-22.06.46 2022.06.16



Report No: HCT-SR-2212-FC004-R2

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





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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%.

Certificate No: D750V3-1014_May22

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Report No: HCT-SR-2212-FC004-R2

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.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	1444	

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW Input power	2.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.71 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1,43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.70 W/kg ± 16.5 % (k=2)

Certificate No: D750V3-1014_May22

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Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.5 Ω + 2.9 jΩ	
Return Loss	- 25.8 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.040 ns
Liebtifed Delay (one director)	1.040 115

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_May22

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Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 25.05.2022

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; $\sigma = 0.89$ S/m; $\epsilon_r = 40.9$; $\rho = 1000$ 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: 31.12.2021

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 02.05.2022

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 = 60.50 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.36 W/kg SAR(1 g) = 2.19 W/kg; SAR(10 g) = 1.43 W/kg

Smallest distance from peaks to all points 3 dB below = 17 mm

Ratio of SAR at M2 to SAR at M1 = 65,3% Maximum value of SAR (measured) = 2.93 W/kg



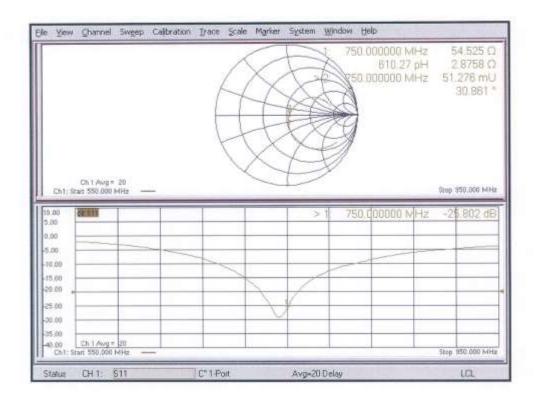
0 dB = 2.93 W/kg = 4.67 dBW/kg

Certificate No: D750V3-1014_May22

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Report No: HCT-SR-2212-FC004-R2

Impedance Measurement Plot for Head TSL



Certificate No: D750V3-1014_May22

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FCC ID: A3LSMM146B Report No: HCT-SR-2212-FC004-R2

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Accreditation No.: SCS 0108

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CALIBRATION C	ERTIFICATI				
Dbject	D835V2 - SN:44		-0		
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	edure for SAR Validati	on So	urces between 0.7-3 GH	Iz
Calibration date:	July 15, 2022		-159		
This calibration certificate document The measurements and the uncert All calibrations have been conduct	ainties with confidence p	robability are given on the follo	owing pa	ages and are part of the certificate	
Calibration Equipment used (M&TE	Ecritical for calibration)	Cal Date (Certificate No.)		Scheduled Calibra	tion
Power meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/	03524)	Apr-23	(A)
ower sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)		Apr-23	
ower sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)		Apr-23	
Reference 20 dB Attenuator	SN: 8H9394 (20k)	04-Apr-22 (No. 217-03527)		Apr-23	
Type-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)		Apr-23	
Reference Probe EX3DV4	SN: 7349	31-Dec-21 (No. EX3-7349)	The second		
DAE4	SN: 601	02-May-22 (No. DAE4-601	May22) May-23	
Secondary Standards	ID#	Check Date (in house)		Scheduled Check	
ower meter E4419B	SN: G839512475	30-Oct-14 (in house check	Oct-20)	In house check: Or	ct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check		In house check: Or	7 1000
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check		In house check: Or	ct-22
RF generator R&S SMT-08	SN: 100972	15-Jun-15 (in house check	Oct-20)	In house check: Or	rt-22
letwork Analyzer Aglient E8356A	5N; US41080477	31-Mar-14 (in house check	Oct-20)	In house check: Or	ct-22
	Name	Function		Signature	
	Aldonia Georgiadou	Laboratory Tox	mnician	The state of the s	
Calibrated by:					-
Calibrated by:	Sven Kühn	Technical Man	ager	54	
***************************************	Sven Kühn	Technical Man	ager	S. C.	12
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approved by: This calibration certificate shall not	be reproduced except in	full without written approval o	2000		22 자
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FCC ID: A3LSMM146B Report No: HCT-SR-2212-FC004-R2

Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8604 Zurich, Switzerland





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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: DB35V2-441_Jul22

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Report No: HCT-SR-2212-FC004-R2

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	C 1.0000191010
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 mha/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.3 ± 6 %	0.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	_

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.51 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	6.33 W/kg ± 16.5 % (k=2)

Certificate No: D835V2-441_Jul22

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Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω + 5.5 jΩ	
Return Loss	- 24.7 dB	

General Antenna Parameters and Design

-		
E	Electrical Delay (one direction)	1.372 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: D835V2-441_Jul22

Page 4 of 6



Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 15.07.2022

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; $\varepsilon_r = 40.3$; $\rho = 1000$ 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: 31.12.2021

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- 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:

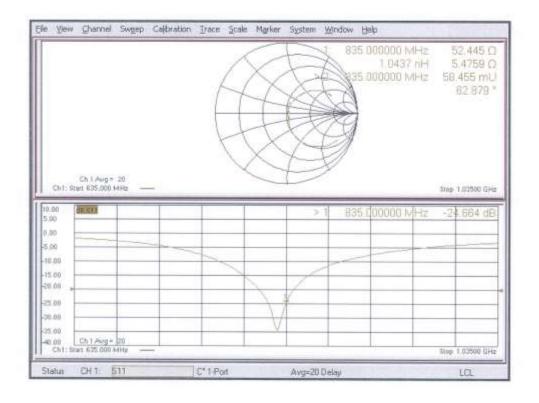
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 64.34 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.83 W/kg
SAR(1 g) = 2.51 W/kg; SAR(10 g) = 1.62 W/kg
Smallest distance from peaks to all points 3 dB below = 16 mm
Ratio of SAR at M2 to SAR at M1 = 65.4%
Maximum value of SAR (measured) = 3.39 W/kg



0 dB = 3.39 W/kg = 5.30 dBW/kg

Report No: HCT-SR-2212-FC004-R2

Impedance Measurement Plot for Head TSL



Certificate No: D835V2-441_Jul22

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Report No: HCT-SR-2212-FC004-R2

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Client HCT (Dymstec)





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Accreditation No.: SCS 0108

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Certificate No: D1800V2-2d007_Jul22

Object	D1800V2 - SN:2d007				
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	dure for SAR Validation	n Sources b	atween 0.7-3 GHz	
Calibration date:	July 18, 2022				
This calibration certificate document the measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE	sinties with confidence pr	obability are given on the follow	wing pages and a	re part of the certificate.	
Primary Standards	ID #	Cal Date (Certificate No.)		Scheduled Calibration	
Power meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)		Apr-23	
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)		Apr-23	
Power sensor NRP-Z91	5N: 103245	04-Apr-22 (No. 217-03525)		Apr-23	
Reference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)		Apr-23	
Type-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)		Apr-23	
Reference Probe EX3DV4	SN: 7349	31-Dec-21 (No. EX3-7349 D	ec21)	Dec-22	
DAE4	SN: 601	02-May-22 (No. DAE4-601_May22)		May-23	
Secondary Standards	ID#	Check Date (in house)		Scheduled Check	
ower meter E4419B	SN: GB39512475	30-Oct-14 (in house check C	kct-20)	In house check: Oct-22	
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)		In house check: Oct-22	
ower sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check O	lct-20)	In house check: Oct-22	
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (In house check Oct-20)		In house check: Oct-22	
letwork Analyzer Aglient E8358A	SN: US41080477	31-Mar-14 (In house check C	Oct-20)	In house check: Oct-22	
	Name	Function		Signature	
Calibrated by:	Joarina Liechej	Laboratory Tech	nidan	History	
Approved by:	Sven Kühn	Technical Masar	ger	5.2	80
				Issued: July 25, 2022	
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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%.

Certificate No: D1800V2-2d007_Jul22

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Report No: HCT-SR-2212-FC004-R2

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 mha/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.4 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	-

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	38.2 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.95 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.8 W/kg ± 16.5 % (k=2)

Certificate No: D1800V2-2d007_Jul22

Page 3 of 6



Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	46,5 Ω - 8.1 jΩ	
Return Loss	- 20.8 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.204 ns

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

The dipole is made of standard semingid 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: D1800V2-2d007_Jul22

Page 4 of 6



Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 18.07.2022

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; $\sigma = 1.38$ S/m; $\epsilon_c = 38.4$; $\rho = 1000$ 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: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05,2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; 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:

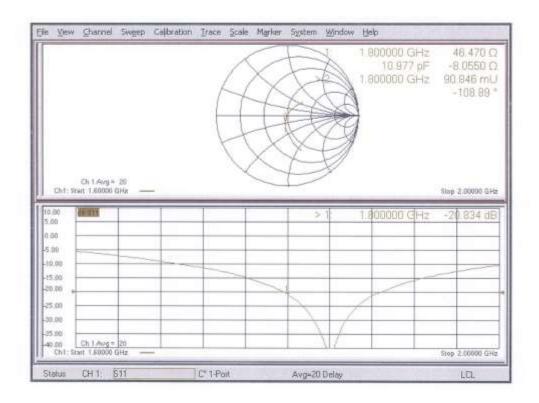
Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 108.9 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 18.1 W/kg SAR(1 g) = 9.55 W/kg; SAR(10 g) = 4.95 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 53.2% Maximum value of SAR (measured) = 14.8 W/kg



0 dB = 14.8 W/kg = 11.70 dBW/kg

Impedance Measurement Plot for Head TSL



Certificate No: D1800V2-2d007_Jul22

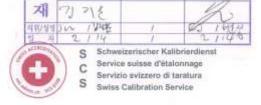
Page 6 of 6



Report No: HCT-SR-2212-FC004-R2

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





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

tient HCT (Dymstec) Certificate No: D1900V2-5d032_Jan22

Object	D1900V2 - SN:5d032		
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	dure for SAR Validation Sources	between 0.7-3 GHz
Calibration date:	January 28, 2022		
The measurements and the uncert	ainties with confidence pr	onal standards, which realize the physical uni robability are given on the following pages an y facility: environment temperature (22 \pm 3)°C	d are part of the certificate.
Calibration Equipment used (M&TE	E critical for calibration)		
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
ower meter NRP	SN: 104778	09-Apr-21 (No. 217-03291/03292)	Apr-22
ower sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
	5N: 103245	09-Apr-21 (No. 217-03292)	Apr-22
ower sensor NRP-Z91			
	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k) SN: 310982 / 06327	09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344)	Apr-22 Apr-22
Reference 20 dB Attenuator Type-N mismatch combination] [F. 1986] U. T. T. 1986] [T. H. 1987] [T.	9.0000000000000000000000000000000000000
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: 310982 / 06327 SN: 7349	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21)	Apr-22 Dec-22
Seference 20 dB Attenuator ype-N mismatch combination Reference Probe EX3DV4 DAE4	SN: 310982 / 06327 SN: 7348 SN: 601	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21)	Apr-22 Dec-22 Nov-22
Reference 20 dB Attenuator (Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power mater E44198	SN: 310982 / 06327 SN: 7348 SN: 601	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house)	Apr-22 Dep-22: Nov-22 Scheduled Check
Reference 20 dB Attenuator (Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power mater E4419B Power sensor HP 8481A	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: G838512475	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Oct-14 (in house check Oct-20)	Apr-22 Dep-22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22
Reference 20 dB Attenuator ype-N mismatch combination Reference Probe EX3DV4 IAE4 Recondary Standards Power mater E4419B Power sensor HP 8481A Power sensor HP 8481A	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: G839512475 SN: U837292783	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	Apr.22 Dec.22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
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: 310982 / 06327 SN: 7349 SN: 601 ID # SN: G839512475 SN: U837292783 SN: MY41083315	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	Apr.22 Dec.22 Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
Reference 20 dB Attenuator Pype-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A RF generator R&S SMT-06	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: G838512475 SN: U837262783 SN: MY41083315 SN: 100972	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov-21) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20)	Apr-22 Deo-22: Nov-22 Scheduled Check In house check: Oct-22
Reference 20 dB Attenuator Pype-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A Reference HP 8481A Reference HP 8481A Reference HP 8481A	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB38512475 SN: US37292783 SN: MY41083315 SN: 100972 SN: US41080477	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Qct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	Apr-22 Dec-22: Nov-22 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
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: 310982 / 06327 SN: 7348 SN: 601 ID # SN: G838512475 SN: US37282783 SN: MY41083315 SN: MY41083315 SN: US41080477 Name	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	Apr-22 Deo-22: Nov-22 Scheduled Check In house check: Oct-22
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-Q6 Network Analyzer Agilent E8358A Calibrated by: Approved by:	SN: 310982 / 06327 SN: 7348 SN: 601 ID # SN: G838512475 SN: US37282783 SN: MY41083315 SN: MY41083315 SN: US41080477 Name	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Qct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function Lisboratory Terminician	Apr-22 Deo-22: Nov-22 Scheduled Check In house check: Oct-22
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 Agrient E8358A Calibrated by:	SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: G838512475 SN: US37282783 SN: WY41083315 SN: 100972 SN: US41080477 Name Joanna Lieshaj	09-Apr-21 (No. 217-03344) 31-Dec-21 (No. EX3-7349_Dec21) 01-Nov-21 (No. DAE4-601_Nov21) Check Date (in house) 30-Qct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	Apr-22 Deo-22: Nov-22 Scheduled Check In house check: Oct-22

Certificate No: D1900V2-5d032_Jan22

Page 1 of 6



Report No: HCT-SR-2212-FC004-R2

Calibration Laboratory of

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





S Schweizerischer Kalibrierdienst
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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 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_Jan22	Page 2 of 6	



Report No: HCT-SR-2212-FC004-R2

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	40.8	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 6 %	1.40 mho/m ± 6 %
Head TSL temperature change during test	< 0,5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.0 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm2 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5,23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.9 W/kg ± 16.5 % (k=2)

Certificate No: D1900V2-5d032_Jan22

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Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.8 Ω + 7.4 JΩ	
Return Loss	- 22.5 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.191 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

ij	Manufactured by	SPEAG
- 73		VA-71-17-

Certificate No: D1900V2-5d032 Jan22

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Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 28.01.2022

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; $\alpha = 1.4 \text{ S/m}$; $\epsilon_f = 39.8$; $\rho = 1000 \text{ kg/m}^3$

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: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52,10.4(1535); SEMCAD X 14.6.14(7501)

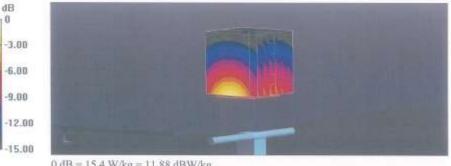
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 109.8 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 18.3 W/kg

SAR(1 g) = 10.0 W/kg; SAR(10 g) = 5.23 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 55.2% Maximum value of SAR (measured) = 15.4 W/kg



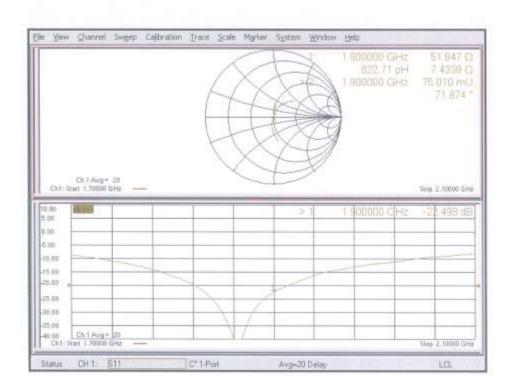
0 dB = 15.4 W/kg = 11.88 dBW/kg

Certificate No: D1900V2-5d032_Jan22

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Report No: HCT-SR-2212-FC004-R2

Impedance Measurement Plot for Head TSL



Certificate No: D1900V2-5d032_Jan22

Page 6 of 6



Report No: HCT-SR-2212-FC004-R2

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

Client HCT (Dymstec)





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

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SA5)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Certificate No: D2450V2-743_May22

CALIBRATION C	ERTIFICATE		당당자	화의자
		(祖)	71 211	1/2
Object	D2450V2 - SN:74	43	19 -14	1/1
		재	F12 / 1/23	15/4/42
	010000000000000000000000000000000000000	5.0	2024.6.20	2022 / 20
Calibration procedure(s)	QA CAL-05.v11		attended to the same	
	Calibration Proce	dure for SAR Validation So	urces between	0.7-3 GHz
	100000000000000000000000000000000000000			
Calibration date:	May 31, 2022			
	아이는 내용하는데 이번 없는데 어떻게 되었다. 안 없는데 없는데 없는데 없는데 없는데 없다면	onal standards, which realize the phys		
he measurements and the uncert	ainties with confidence pr	robability are given on the following pa	ges and are part of	the certificate.
il calibrations have been conducte	ed in the closed laborator	y facility: environment temperature (2)	2 ± 3)°C and humidit	y < 70%.
Calibration Equipment used (M&TE	critical for calibration)			
Primary Standards	ID#	Cal Date (Certificate No.)	Sche	duled Calibration
ower meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)	Apr-2	
ower sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-2	3
ower sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-63525)	Apr-2	3
eference 20 dB Attenuator	SN: 8H9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-2	
ype-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)	Apr-2	
Reference Probe EX3DV4	SN: 7349	31-Dec-21 (No. EX3-7349 Dec21)	Dec-2	
DAE4	SN: 601	02-May-22 (No. DAE4-801 May22)		
			2 0000	
econdary Standards	ID#	Check Date (in house)	Sche	duled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In ho	use check: Oct-22
ower sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In ho	use check: Oct-22
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-20)	In ho	use check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (In house check Oct-20)	In ho	ise check: Oct-22
Vetwork Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In ho	use check: Oct-22
	Name	Function	Sign	ature
	Joanna Lieshai	Laboratory Technician	- Olgra	Mary +
Calibrated by:			a	Afalang
Calibrated by:	Assessment and the second and the se			
Calibrated by:	Super William	Toolstool Manager		
Calibrated by:	Sven Kühn	Technical Manager	5	1-
	Sven Kühn	Technical Manager	5.	6
Sept. (#1)	Sven Kühn	Technical Manager		L June 3, 2022

Certificate No: D2450V2-743_May22

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Report No: HCT-SR-2212-FC004-R2

Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: SCS 0108

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: D2450V2-743_May22

Page 2 of 6



Report No: HCT-SR-2212-FC004-R2

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 mha/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.3 ± 6 %	1.84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.2 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW Input power	6.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.8 W/kg ± 16.5 % (k=2)

Certificate No: D2450V2-743_May22

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Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.7 Ω + 5.9 jΩ
Return Loss	- 22.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.160 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: D2450V2-743_May22

Page 4 of 6



Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 31.05.2022

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; $\sigma = 1.84$ S/m; $\epsilon_r = 38.3$; $\rho = 1000$ 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: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; 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 = 116.2 V/m; Power Drift = 0.08 dB Peak SAR (extrapolated) = 27.0 W/kg SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.26 W/kgSmallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 50%

Maximum value of SAR (measured) = 22.1 W/kg



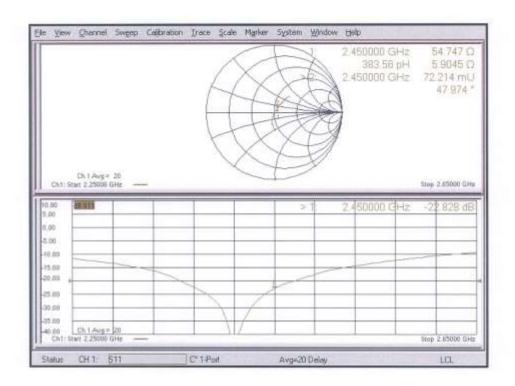
0 dB = 22.1 W/kg = 13.44 dBW/kg

Certificate No: D2450V2-743_May22

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Report No: HCT-SR-2212-FC004-R2

Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-743_May22

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Report No: HCT-SR-2212-FC004-R2

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





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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 (Dymstec)

Certificate No: D2600V2-1015 Jul22

Object	D2600V2 - SN:10	015		
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	edure for SAR Validation So	urces between 0.7-3 GHz	
Calibration date:	July 15, 2022			
The measurements and the uncert	ainties with confidence p	onal standards, which realize the phy- robability are given on the following po- ry facility: environment temperature (2)	ages and are part of the certificate.	
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration	
Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EXSDV4	SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349	04-Apr-22 (No. 217-03525/03524) 04-Apr-22 (No. 217-03524) 04-Apr-22 (No. 217-03525) 04-Apr-22 (No. 217-03527) 04-Apr-22 (No. 217-03528) 31-Dec-21 (No. EX3-7342_Dec21)	Apr-23 Apr-23 Apr-23 Apr-23 Apr-23 Onc-22	
DAE4	SN: 601	02-May-22 (No. DAE4-601_May22)	May-23	
Secondary Standards	ID#	Check Date (in house)	Scheduled Check	
Power meter E4419B	SN: GB39512475 SN: US37292783	30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) 07-Oct-15 (in house check Oct-20)	In house check: Oct-22	
Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E83S8A	SN: MY41083315 SN: 100972 SN: US41080477	15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)		
Power sensor HP 8481A RF generator R&S SMT-06	SN: 100972 SN: US41080477	15-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20)	In house check: Oct-22	
Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	SN: 100972	15-Jun-15 (in house check Oct-20)		
Power sensor HP 8481A RF generator R&S SMT-06	SN: 100972 SN: US41080477 Name	16-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function	In house check: Oct-22	
Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by: Approved by:	SN: 100972 SN: US41080477 Name Aldonia Georgiadou Sven Kilhn	16-Jun-16 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function Laboratory Technician Doputy Manager	In house check: Oct-22 Signature S. C. Sseued: July 25, 2022	
Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by: Approved by:	SN: 100972 SN: US41080477 Name Aldonia Georgiadou Sven Kilhn	16-Jun-15 (in house check Oct-20) 31-Mar-14 (in house check Oct-20) Function Laboratory Technician	In house check: Oct-22 Signature S. C. Sseued: July 25, 2022	



FCC ID: A3LSMM146B Report No: HCT-SR-2212-FC004-R2

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





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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: D2600V2-1015_Jul22 Page 2 of 6



Report No: HCT-SR-2212-FC004-R2

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 mha/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.3 ± 6 %	2.01 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	****	****

SAR result with Head TSL

SAR averaged over 1 cm ² (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	56.3 W/kg ± 17.0 % (k=2)

condition	
250 mW input power	6.40 W/kg
normalized to 1W	25.2 W/kg ± 16.5 % (k=2)
	250 mW input power



Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.9 Ω - 4.5 jΩ
Return Loss	- 26.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.148 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

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	Manufactured by	SPEAG
		101 00100

Certificate No: D2600V2-1015_Jul22

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Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 15.07.2022

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; $\sigma = 2.01 \text{ S/m}$; $\epsilon_r = 37.3$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(7.84, 7.84, 7.84) @ 2600 MHz; Calibrated: 31.12.2021

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; 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 = 117.2 V/m; Power Drift = 0.08 dB

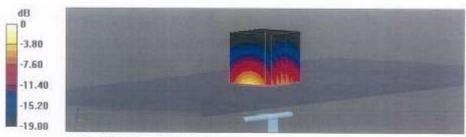
Peak SAR (extrapolated) = 28.3 W/kg

SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.40 W/kg

Smallest distance from peaks to all points 3 dB below = 8.5 mm

Ratio of SAR at M2 to SAR at M1 = 50.6%

Maximum value of SAR (measured) = 23.7 W/kg



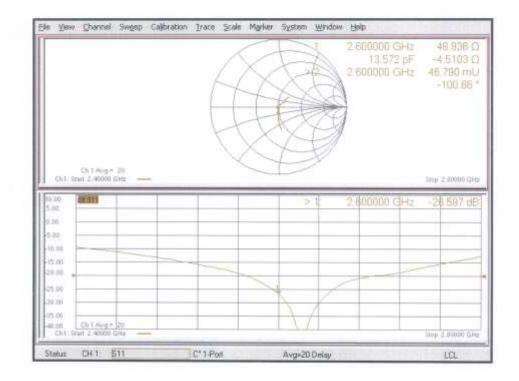
0 dB = 23.7 W/kg = 13.74 dBW/kg

Certificate No: D2600V2-1015_Jul22

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Report No: HCT-SR-2212-FC004-R2

Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1015_Jul22

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Report No: HCT-SR-2212-FC004-R2

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Client HCT (Dymstec)

Certificate No: D3900V2-1086_May22

	HARAGE REPORT THE PROPERTY.	HOUR TO THE RESERVE T			
Object	D3900V2 - SN:1086				
Calibration procedure(s)	QA CAL-22.v6 Calibration Proce	edure for SAR Validati	on Soi	urces between	3-10 GHz
Calibration date:	May 25, 2022				
This calibration certificate documer The measurements and the uncert All calibrations have been conducts Calibration Equipment used (M&TE	ainties with confidence p	robability are given on the foli	owing pa	ges and are part of t	he certificate.
Primary Standards	ID#	Cal Date (Certificate No.)		Sched	uled Calibration
Power meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/	03524)	Apr-23	
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	STREET,	Apr-23	
Power sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)		Apr-23	
Reference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)		Apr-23	
Type-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)		Apr-23	
Reference Probe EX3DV4	SN: 3503	08-Mar-22 (No. EX3-3503_Mar22)		Mar-23	
DAE4	SN: 601	02-May-22 (No. DAE4-601_May22)		May-23	3
Secondary Standards	ID#	Check Date (in house)		Sched	uled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)		In hous	se check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)		In hour	se check: Oct-22
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-20)		In hour	se check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)		In hous	se check: Oct-22
Network Analyzer Agilent EB358A	SN: US41080477	31-Mar-14 (in house check	Oct-20)	In hous	se check: Oct-22
	Name	Function		Signat	ure
Calibrated by:	Michael Weber	Laboratory Tec	hnician	M.	是女丁
Approved by:	Sven Kühn	Technical Man	ager	S.	4
				100000	Tr. Date Plant
				Issued;	May 25, 2022
This calibration certificate shall not	be reproduced except in	full without written approval o	the Jab	antor 당 자	확 인 자
This calibration certificate shall not	be reproduced except in	full without written approval o	the labo	ratdpl 당 자	확인자



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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: D3900V2-1086_May22

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Report No: HCT-SR-2212-FC004-R2

Measurement Conditions

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

DASY52	V52.10.4
Advanced Extrapolation	
Modular Flat Phantom	
10 mm	with Spacer
dx, $dy = 4$ mm, $dz = 1.4$ mm	Graded Ratio = 1.4 (Z direction)
3900 MHz ± 1 MHz	
	Advanced Extrapolation Modular Flat Phantom 10 mm dx, dy = 4 mm, dz = 1.4 mm

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.5	3.32 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.3 ± 6 %	3.28 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	****	

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.89 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	68.9 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters.	normalized to 1W	23.9 W/kg ± 19.5 % (k=2)

Certificate No: D3900V2-1086_May22

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Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	45.4 Ω - 5.9 jΩ	
Return Loss	- 22.1 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.099 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

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Manufactured by	SPEAG

Certificate No: D3900V2-1086_May22

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Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 25.05.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3900 MHz; Type: D3900V2; Serial: D3900V2 - SN: 1086

Communication System: UID 0 - CW; Frequency: 3900 MHz

Medium parameters used: f = 3900 MHz; $\sigma = 3.28$ S/m; $\epsilon_r = 37.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

Probe: EX3DV4 - SN3503; ConvF(7.39, 7.39, 7.39) @ 3900 MHz; Calibrated: 08.03.2022

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 02.05.2022

Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001

DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3900MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.65 V/m; Power Drift = -0.00 dB

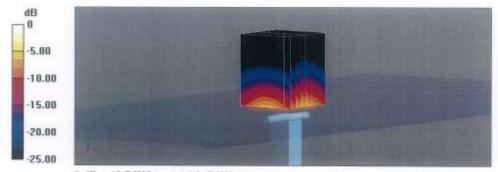
Peak SAR (extrapolated) = 19.8 W/kg

SAR(1 g) = 6.89 W/kg; SAR(10 g) = 2.40 W/kg

Smallest distance from peaks to all points 3 dB below = 8.2 mm

Ratio of SAR at M2 to SAR at M1 = 73.5%

Maximum value of SAR (measured) = 13.7 W/kg



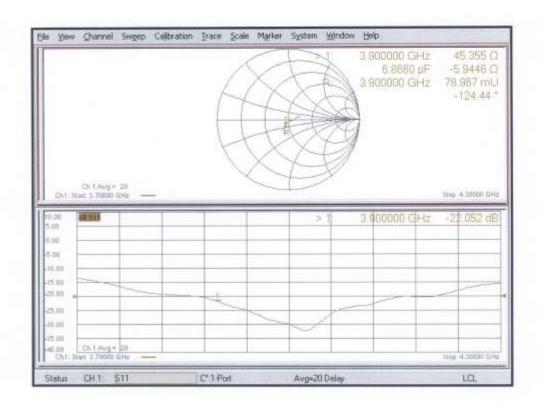
0 dB = 13.7 W/kg = 11.36 dBW/kg

Certificate No: D3900V2-1086_May22

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Impedance Measurement Plot for Head TSL



Certificate No: D3900V2-1086_May22

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FCC ID: A3LSMM146B Report No: HCT-SR-2212-FC004-R2

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Certificate No: D5GHzV2-1253 May22 HCT (Dymstec) Client **CALIBRATION CERTIFICATE** D5GHzV2 - SN:1253 Object 242 6.20 Su / 7/218 재 Calibration procedure(s) QA CAL-22.v6 Calibration Procedure for SAR Validation Sources between 3-10 GHz May 31, 2022 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 W Cal Date (Certificate No.) Scheduled Calibration Power meter NRP SN: 104778 04-Apr-22 (No. 217-03525/03524) Apr-23 Power sensor NRP-Z91 SN: 103244 04-Apr-22 (No. 217-83524) Apr-23 Power sensor NRP-Z91 SN: 103245 04-Apr-22 (No. 217-03525) Apr-23 Reference 20 dB Attenuator SN: BH9394 (20k) 04-Apr-22 (No. 217-03527) Apr-23 Type-N mismatch combination SN; 310982 / 06327 04-Apr-22 (No. 217-03528) Apr-23 Reference Probe EX3DV4 SN: 3503 08-Mar-22 (No. EX3-3503_Mar22) Mar-23 DAE4 SN: 601 02-May-22 (No. DAE4-601 May22) May-23 Secondary Standards ID# Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Oct-20) In house check: Oct-22 Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-20) In house check: Oct-22 Power sensor HP 8481A SN: MY41093315 07-Oct-15 (in house check Oct-20) In house check: Oct-22 RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-20) In house check: Oct-22 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-20) In house check: Oct-22 Function Signature Calibrated by: Joanna Weshal Laboratory Technician Approved by: Sven Kühn Technical Manager Issued: June 3, 2022 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D5GHzV2-1253_May22

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Report No: HCT-SR-2212-FC004-R2

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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: D5GHzV2-1253_May22

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FCC ID: A3LSMM146B Report No: HCT-SR-2212-FC004-R2

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	

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 mha/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.52 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8,10 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.9 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	34.4 ± 6 %	4.87 mha/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		-

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.1 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2:37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.5 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1253_May22



Report No: HCT-SR-2212-FC004-R2

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	34.2 ± 6 %	5.02 mha/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.06 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	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.6 W/kg ± 19.5 % (k=2)



Report No: HCT-SR-2212-FC004-R2

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	49.5 Ω - 3.2 jΩ	
Return Loss	- 29.8 dB	

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	52.2 Ω + 3.1 JΩ
Return Loss	- 28.5 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	53.6 Ω + 2.9 jΩ	
Return Loss	- 27.0 dB	j

General Antenna Parameters and Design

Electrical Delay (one direction)	1,196 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

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FCC ID: A3LSMM146B Report No: HCT-SR-2212-FC004-R2

DASY5 Validation Report for Head TSL

Date: 31.05.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1253

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

MHz

Medium parameters used: f = 5250 MHz; $\sigma = 4.52$ S/m; $\epsilon_r = 34.9$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5600 MHz; $\sigma = 4.87$ S/m; $\epsilon_r = 34.4$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5750 MHz; $\sigma = 5.02$ S/m; $\epsilon_r = 34.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; 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, dy=4mm, dz=1.4mm

Reference Value = 75.61 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 28.5 W/kg

SAR(1 g) = 8.10 W/kg; SAR(10 g) = 2.31 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 69.6%

Maximum value of SAR (measured) = 18.4 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 = 75.75 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 31.2 W/kg

SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.37 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 66.7%

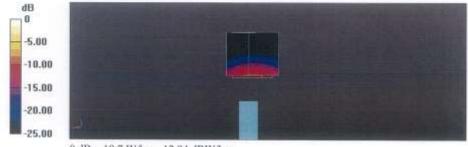
Maximum value of SAR (measured) = 19.7 W/kg

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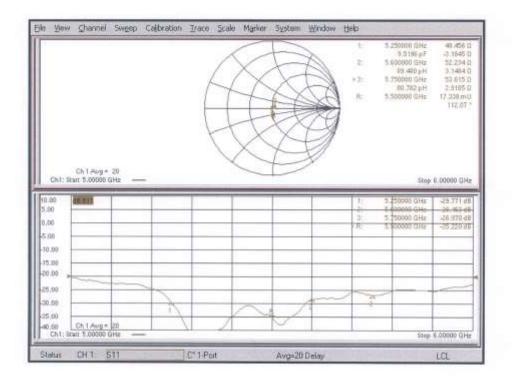
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.51 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 32.3 W/kg
SAR(1 g) = 8.06 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 65.3%



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

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Impedance Measurement Plot for Head TSL



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