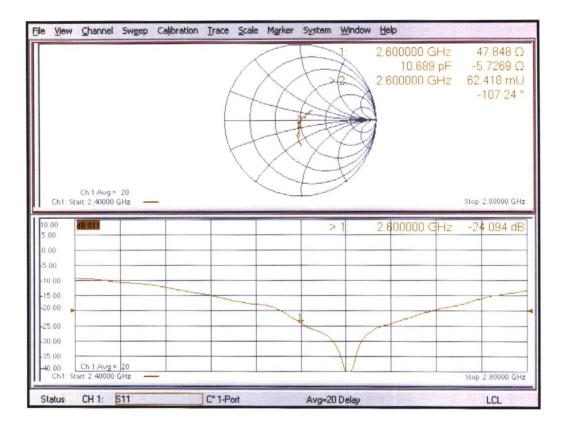




# Impedance Measurement Plot for Head TSL



Certificate No: D2600V2-1012\_Jul21

Page 6 of 6

Page 247 of 271





# 3700 MHz Dipole Calibration Certificate

	Switzerland	The state of the S	Service subse d etalomnage Servizio svizzero di taratura Swiss Calibration Service
ccredited by the Swiss Accreditation he Swiss Accreditation Service in autilateral Agreement for the rec	s one of the signatorie	s to the EA	ccreditation No.: SCS 0108
lient CTTL (Auden)		Certificate N	o: D3700V2-1004_Jun21
CALIBRATION C	ERTIFICATE		
Object	D3700V2 - SN:10	004	
Calibration procedure(s)	QA CAL-22.v6 Calibration Proce	edure for SAR Validation Sources	s between 3-10 GHz
Calibration date:	June 21, 2021		
			nd are part of the certificate.
Calibration Equipment used (M&TE	E critical for calibration)	ry facility: environment temperature $(22 \pm 3)^{\circ}$	C and humidity < 70%.
Calibration Equipment used (M&TE Primary Standards		Cal Date (Certificate No.)	C and humidity < 70%. Scheduled Calibration
Calibration Equipment used (M&TE Primary Standards Power meter NRP	E critical for calibration)	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292)	C and humidity < 70%. Scheduled Calibration Apr-22
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91	E critical for calibration)	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91	E critical for calibration) ID # SN: 104778 SN: 103244	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22
All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	ID #           SN: 104778           SN: 103244           SN: 103245           SN: BH9394 (20k)	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	ID #           SN: 104778           SN: 103244           SN: 103245           SN: BH9394 (20k)           SN: 310982 / 06327	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	ID #           SN: 104778           SN: 103244           SN: 103245           SN: BH9394 (20k)           SN: 310982 / 06327           SN: 3503	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 30-Dec-20 (No. EX3-3503_Dec20) 02-Nov-20 (No. DAE4-601_Nov20) Check Date (in house)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21
Calibration Equipment used (M&TE Primary Standards Power meter NRP 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	ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 310982 / 06327           SN: 3503           SN: 601	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 30-Dec-20 (No. EX3-3503_Dec20) 02-Nov-20 (No. DAE4-601_Nov20)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Nov-21
Calibration Equipment used (M&TE Primary Standards Power meter NRP 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	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783	Cal Date (Certificate No.) 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) 09-Apr-21 (No. 217-03344) 30-Dec-20 (No. EX3-3503_Dec20) 02-Nov-20 (No. DAE4-601_Nov20) Check Date (in house)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Nov-21 Scheduled Check
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317	Cal Date (Certificate No.)           09-Apr-21 (No. 217-03291/03292)           09-Apr-21 (No. 217-03291)           09-Apr-21 (No. 217-033292)           09-Apr-21 (No. 217-03343)           09-Apr-21 (No. 217-03344)           30-Dec-20 (No. EX3-3503_Dec20)           02-Nov-20 (No. DAE4-601_Nov20)           Check Date (in house)           30-Oct-14 (in house check Oct-20)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Nov-21 Scheduled Check In house check: Oct-22
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783	Cal Date (Certificate No.)           09-Apr-21 (No. 217-03291/03292)           09-Apr-21 (No. 217-03291)           09-Apr-21 (No. 217-03292)           09-Apr-21 (No. 217-03343)           09-Apr-21 (No. 217-03344)           30-Dec-20 (No. EX3-3503_Dec20)           02-Nov-20 (No. DAE4-601_Nov20)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Nov-21 Scheduled Check In house check: Oct-22 In house check: Oct-22
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	E critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317	Cal Date (Certificate No.)           09-Apr-21 (No. 217-03291/03292)           09-Apr-21 (No. 217-03291)           09-Apr-21 (No. 217-03292)           09-Apr-21 (No. 217-03343)           09-Apr-21 (No. 217-03344)           30-Dec-20 (No. EX3-3503_Dec20)           02-Nov-20 (No. DAE4-601_Nov20)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Nov-21 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 310982 / 06327           SN: 303           SN: 601           ID #           SN: GB39512475           SN: US37292783           SN: 10972           SN: US41080477           Name	Cal Date (Certificate No.)           09-Apr-21 (No. 217-03291/03292)           09-Apr-21 (No. 217-03291)           09-Apr-21 (No. 217-03292)           09-Apr-21 (No. 217-03292)           09-Apr-21 (No. 217-03343)           09-Apr-21 (No. 217-03344)           30-Dec-20 (No. EX3-3503_Dec20)           02-Nov-20 (No. DAE4-601_Nov20)           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)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Nov-21 Scheduled Check In house check: Oct-22 In house check: Oct-22
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	ID #           SN: 104778           SN: 103244           SN: 103245           SN: 103245           SN: 103245           SN: 310982 / 06327           SN: 310982 / 06327           SN: 3503           SN: 601           ID #           SN: GB39512475           SN: US37292783           SN: MY41092317           SN: 100972           SN: US41080477	Cal Date (Certificate No.)           09-Apr-21 (No. 217-03291/03292)           09-Apr-21 (No. 217-03291)           09-Apr-21 (No. 217-03292)           09-Apr-21 (No. 217-03292)           09-Apr-21 (No. 217-03343)           09-Apr-21 (No. 217-03344)           30-Dec-20 (No. EX3-3503_Dec20)           02-Nov-20 (No. DAE4-601_Nov20)           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)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Nov-21 Scheduled Check In house check: Oct-22 In house check: Oct-21
Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	ID #           SN: 104778           SN: 103244           SN: 103245           SN: 8H9394 (20k)           SN: 310982 / 06327           SN: 303           SN: 601           ID #           SN: GB39512475           SN: US37292783           SN: 10972           SN: US41080477           Name	Cal Date (Certificate No.)           09-Apr-21 (No. 217-03291/03292)           09-Apr-21 (No. 217-03291)           09-Apr-21 (No. 217-03292)           09-Apr-21 (No. 217-03292)           09-Apr-21 (No. 217-03343)           09-Apr-21 (No. 217-03344)           30-Dec-20 (No. EX3-3503_Dec20)           02-Nov-20 (No. DAE4-601_Nov20)           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)	C and humidity < 70%. Scheduled Calibration Apr-22 Apr-22 Apr-22 Apr-22 Dec-21 Nov-21 Scheduled Check In house check: Oct-22 In house check: Oct-21

Certificate No: D3700V2-1004\_Jun21

Page 1 of 7





## Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst Service suisse d'étalonnage 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

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

#### **Additional Documentation:**

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
  positioned under the liquid filled phantom. The impedance stated is transformed from the
  measurement at the SMA connector to the feed point. The Return Loss ensures low
  reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. 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: D3700V2-1004\_Jun21

Page 2 of 7





### **Measurement Conditions**

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

DASY Version	DASY5	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	3700 MHz ± 1 MHz 3800 MHz ± 1 MHz	

#### Head TSL parameters at 3700 MHz

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	36.8 ± 6 %	3.12 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

### SAR result with Head TSL at 3700 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.74 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	67.1 W/kg ± 19.9 % (k=2)
	L I	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.44 W/kg

#### Head TSL parameters at 3800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.6	3.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.6 ± 6 %	3.20 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

### SAR result with Head TSL at 3800 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	65.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.0 W/kg ± 19.5 % (k=2)

Certificate No: D3700V2-1004\_Jun21

Page 3 of 7





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

#### Antenna Parameters with Head TSL at 3700 MHz

Impedance, transformed to feed point	48.0 Ω - 6.9 jΩ	
Return Loss	- 22.7 dB	

### Antenna Parameters with Head TSL at 3800 MHz

Impedance, transformed to feed point	58.0 Ω - 4.9 jΩ
Return Loss	- 21.2 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.139 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: D3700V2-1004\_Jun21

Page 4 of 7





# **DASY5 Validation Report for Head TSL**

Date: 21.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1004

Communication System: UID 0 - CW; Frequency: 3700 MHz, Frequency: 3800 MHz Medium parameters used: f = 3700 MHz;  $\sigma$  = 3.12 S/m;  $\epsilon_r$  = 36.8;  $\rho$  = 1000 kg/m<sup>3</sup>, Medium parameters used: f = 3800 MHz;  $\sigma$  = 3.20 S/m;  $\epsilon_r$  = 36.6;  $\rho$  = 1000 kg/m<sup>3</sup> 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, ConvF(7.73, 7.73, 7.73) @ 3800 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 71.56 V/m; Power Drift = 0.01 dB Peak SAR (extrapolated) = 18.9 W/kg SAR(1 g) = 6.74 W/kg; SAR(10 g) = 2.44 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 74% Maximum value of SAR (measured) = 13.0 W/kg

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3800MHz/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 68.51 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 18.0 W/kg SAR(1 g) = 6.57 W/kg; SAR(10 g) = 2.41 W/kg Smallest distance from peaks to all points 3 dB below = 8.2 mm Ratio of SAR at M2 to SAR at M1 = 75% Maximum value of SAR (measured) = 12.6 W/kg

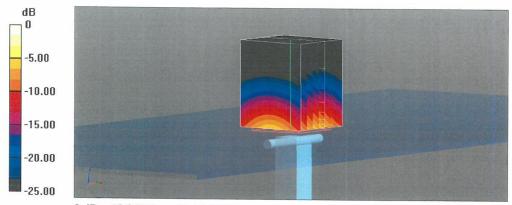
Certificate No: D3700V2-1004\_Jun21

Page 5 of 7

Page 252 of 271







0 dB = 13.0 W/kg = 11.15 dBW/kg

Certificate No: D3700V2-1004\_Jun21

Page 6 of 7

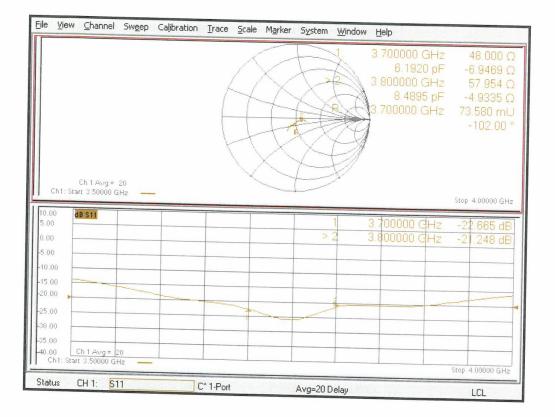
©Copyright. All rights reserved by CTTL.

Page 253 of 271





# Impedance Measurement Plot for Head TSL



Certificate No: D3700V2-1004\_Jun21

Page 7 of 7

Page 254 of 271





### 3900 MHz Dipole Calibration Certificate

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



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

Accreditation No.: SCS 0108

S

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: D3900V2-1024\_Jun21 **CTTL** (Auden) Client **CALIBRATION CERTIFICATE** D3900V2 - SN:1024 Object QA CAL-22.v6 Calibration procedure(s) Calibration Procedure for SAR Validation Sources between 3-10 GHz June 21, 2021 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) Scheduled Calibration Cal Date (Certificate No.) ID # Primary Standards 09-Apr-21 (No. 217-03291/03292) Apr-22 SN: 104778 Power meter NRP Apr-22 09-Apr-21 (No. 217-03291) Power sensor NRP-Z91 SN: 103244 Apr-22 09-Apr-21 (No. 217-03292) SN: 103245 Power sensor NRP-Z91 Apr-22 09-Apr-21 (No. 217-03343) SN: BH9394 (20k) Reference 20 dB Attenuator Apr-22 09-Apr-21 (No. 217-03344) SN: 310982 / 06327 Type-N mismatch combination Dec-21 30-Dec-20 (No. EX3-3503\_Dec20) SN: 3503 Reference Probe EX3DV4 Nov-21 02-Nov-20 (No. DAE4-601\_Nov20) SN: 601 DAE4 Scheduled Check Check Date (in house) ID # Secondary Standards In house check: Oct-22 30-Oct-14 (in house check Oct-20) SN: GB39512475 Power meter E4419B In house check: Oct-22 07-Oct-15 (in house check Oct-20) SN: US37292783 Power sensor HP 8481A 07-Oct-15 (in house check Oct-20) In house check: Oct-22 SN: MY41092317 Power sensor HP 8481A In house check: Oct-22 SN: 100972 15-Jun-15 (in house check Oct-20) RF generator R&S SMT-06 In house check: Oct-21 31-Mar-14 (in house check Oct-20) Network Analyzer Agilent E8358A SN: US41080477 Signature Function Name Laboratory Technician Jeffrey Katzman Calibrated by: Technical Manager Katja Pokovic Approved by: Issued: June 22, 2021 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D3900V2-1024\_Jun21

Page 1 of 8





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





Schweizerischer Kalibrierdienst S Service suisse d'étalonnage

- С 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

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

#### Additional Documentation:

e) DASY4/5 System Handbook

# Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. 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: D3900V2-1024\_Jun21

Page 2 of 8

©Copyright. All rights reserved by CTTL.

Page 256 of 271





#### **Measurement Conditions**

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

DASY Version	DASY5	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	3900 MHz ± 1 MHz 4000 MHz ± 1 MHz 4100 MHz ± 1 MHz	

#### Head TSL parameters at 3900 MHz

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	36.5 ± 6 %	3.29 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL at 3900 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.96 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	69.3 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 100 mW input power	2.42 W/kg

#### Head TSL parameters at 4000 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.4	3.43 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.4 ± 6 %	3.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL at 4000 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.86 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	68.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.8 W/kg ± 19.5 % (k=2)

Certificate No: D3900V2-1024\_Jun21

Page 3 of 8





Head TSL parameters at 4100 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.2	3.53 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	3.47 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL at 4100 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	68.0 W/kg ± 19.9 % (k=2)
	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	2.37 W/kg

Certificate No: D3900V2-1024\_Jun21

Page 4 of 8

Page 258 of 271





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

# Antenna Parameters with Head TSL at 3900 MHz

Impedance, transformed to feed point	46.0 Ω - 5.7 jΩ
Return Loss	- 22.8 dB

# Antenna Parameters with Head TSL at 4000 MHz

Impedance, transformed to feed point	51.9 Ω - 2.9 jΩ
Return Loss	- 29.4 dB

### Antenna Parameters with Head TSL at 4100 MHz

Impedance, transformed to feed point	58.8 Ω - 1.7 jΩ	
Return Loss	- 21.7 dB	

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.107 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: D3900V2-1024\_Jun21

Page 5 of 8





### DASY5 Validation Report for Head TSL

Date: 21.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3900 MHz; Type: D3900V2; Serial: D3900V2 - SN:1024

Communication System: UID 0 - CW; Frequency: 3900 MHz, Frequency: 4000 MHz, Frequency: 4100 MHz Medium parameters used: f = 3900 MHz;  $\sigma$  = 3.29 S/m;  $\varepsilon_r$  = 36.5;  $\rho$  = 1000 kg/m<sup>3</sup>, Medium parameters used: f = 4000 MHz;  $\sigma$  = 3.38 S/m;  $\varepsilon_r$  = 36.4;  $\rho$  = 1000 kg/m<sup>3</sup>, Medium parameters used: f = 4100 MHz;  $\sigma$  = 3.47 S/m;  $\varepsilon_r$  = 36.3;  $\rho$  = 1000 kg/m<sup>3</sup> 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, ConvF(7.39, 7.39, 7.39) @ 4000 MHz, ConvF(7.26, 7.26, 7.26) @ 4100 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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 = 73.72 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 19.8 W/kg SAR(1 g) = 6.96 W/kg; SAR(10 g) = 2.42 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 74.5% Maximum value of SAR (measured) = 13.7 W/kg

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=4000MHz/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 72.91 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 19.1 W/kg SAR(1 g) = 6.86 W/kg; SAR(10 g) = 2.39 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 75.1% Maximum value of SAR (measured) = 13.5 W/kg

Certificate No: D3900V2-1024\_Jun21

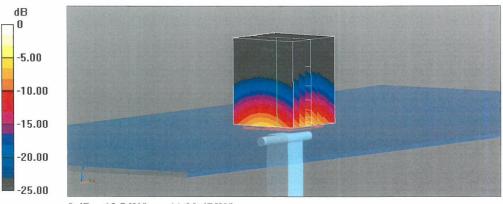
Page 6 of 8

Page 260 of 271





Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=4100MHz/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 71.37 V/m; Power Drift = -0.00 dB Peak SAR (extrapolated) = 19.3 W/kg SAR(1 g) = 6.82 W/kg; SAR(10 g) = 2.37 W/kg Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 75.1% Maximum value of SAR (measured) = 13.5 W/kg



0 dB = 13.7 W/kg = 11.38 dBW/kg

Certificate No: D3900V2-1024\_Jun21

Page 7 of 8

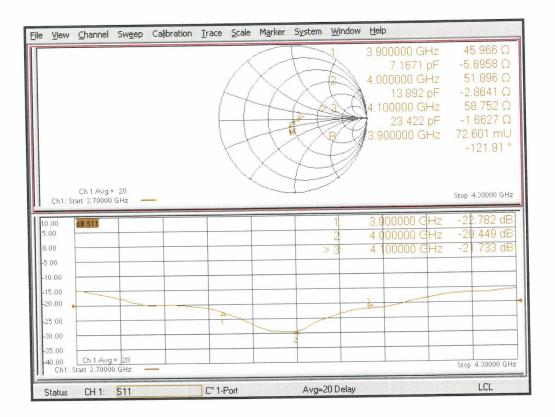
©Copyright. All rights reserved by CTTL.

Page 261 of 271





# Impedance Measurement Plot for Head TSL



Certificate No: D3900V2-1024\_Jun21

Page 8 of 8

©Copyright. All rights reserved by CTTL.





# 5 GHz Dipole Calibration Certificate

Schmid & Partner Engineering AG Leughausstrasse 43, 8004 Zurich,	of Switzerland	BCMRA CS	Schweizerischer Kalibrierdier Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service
Accredited by the Swiss Accreditatio The Swiss Accreditation Service is	s one of the signatories	s to the EA	ccreditation No.: SCS 0108
Multilateral Agreement for the reco Client CTTL (Auden)		Certificate No	» D5GHzV2-1262_Jan2
CALIBRATION C	D5GHzV2 - SN:1		
Object	DJGH2V2 - 5N.1	202	
Calibration procedure(s)	QA CAL-22.v5 Calibration Proce	dure for SAR Validation Sources	between 3-10 GHz
Calibration date:	January 18, 2021		
The measurements and the uncerta	ainties with confidence pr	obability are given on the following pages an y facility: environment temperature (22 ± 3)°C	
The measurements and the uncerta	ainties with confidence pr	obability are given on the following pages an	d are part of the certificate.
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778	obability are given on the following pages an         y facility: environment temperature (22 ± 3)°C         Cal Date (Certificate No.)         01-Apr-20 (No. 217-03100/03101)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-21
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244	Cal Date (Certificate No.)         01-Apr-20 (No. 217-03100)	d are part of the certificate. 2 and humidity < 70%. <u>Scheduled Calibration</u> Apr-21 Apr-21
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245	Cal Date (Certificate No.)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03101)	d are part of the certificate. 2 and humidity < 70%. <u>Scheduled Calibration</u> Apr-21 Apr-21 Apr-21
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	Cal Date (Certificate No.)           01-Apr-20 (No. 217-03100)(03101)           01-Apr-20 (No. 217-03100)	d are part of the certificate. C and humidity < 70%. <u>Scheduled Calibration</u> Apr-21 Apr-21 Apr-21 Apr-21 Apr-21
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327	Cal Date (Certificate No.)         01-Apr-20 (No. 217-03100/03101)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03101)         31-Mar-20 (No. 217-03106)         31-Mar-20 (No. 217-03104)	d are part of the certificate. C and humidity < 70%. <u>Scheduled Calibration</u> Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Apr-21
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k)	Cal Date (Certificate No.)           01-Apr-20 (No. 217-03100)(03101)           01-Apr-20 (No. 217-03100)	d are part of the certificate. C and humidity < 70%. <u>Scheduled Calibration</u> Apr-21 Apr-21 Apr-21 Apr-21 Apr-21
The measurements and the uncerta All calibrations have been conducte Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503	Cal Date (Certificate No.)         01-Apr-20 (No. 217-03100/03101)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03101)         31-Mar-20 (No. 217-03106)         31-Mar-20 (No. 217-03104)         30-Dec-20 (No. EX3-3503_Dec20)         02-Nov-20 (No. DAE4-601_Nov20)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Dec-21
The measurements and the uncertal All calibrations have been conducted Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601	Cal Date (Certificate No.)           01-Apr-20 (No. 217-03100/03101)           01-Apr-20 (No. 217-03100)           01-Apr-20 (No. 217-03100)           01-Apr-20 (No. 217-03100)           01-Apr-20 (No. 217-03100)           01-Apr-20 (No. 217-03101)           31-Mar-20 (No. 217-03104)           30-Dec-20 (No. EX3-3503_Dec20)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Dec-21 Nov-21
The measurements and the uncertal All calibrations have been conducted Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID #	Cal Date (Certificate No.)           01-Apr-20 (No. 217-03100/03101)           01-Apr-20 (No. 217-03100)           01-Apr-20 (No. 217-03101)           31-Mar-20 (No. 217-03106)           31-Mar-20 (No. 217-03104)           30-Dec-20 (No. EX3-3503_Dec20)           02-Nov-20 (No. DAE4-601_Nov20)           Check Date (in house)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Dec-21 Nov-21 Scheduled Check
The measurements and the uncertal All calibrations have been conducted Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317	Cal Date (Certificate No.)           01-Apr-20 (No. 217-03100/03101)           01-Apr-20 (No. 217-03100)           01-Apr-20 (No. 217-03104)           30-Dec-20 (No. 217-03104)           30-Dec-20 (No. EX3-3503_Dec20)           02-Nov-20 (No. DAE4-601_Nov20)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Dec-21 Nov-21 Scheduled Check In house check: Oct-22
The measurements and the uncertal All calibrations have been conducted Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972	Cal Date (Certificate No.)           01-Apr-20 (No. 217-03100/03101)           01-Apr-20 (No. 217-03100)           01-Apr-20 (No. 217-03104)           30-Dec-20 (No. 217-03104)           30-Dec-20 (No. 217-03104)           30-Dec-20 (No. 246-601_Nov20)           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)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Dec-21 Nov-21 Scheduled Check In house check: Oct-22 In house check: Oct-22
The measurements and the uncertal All calibrations have been conducted Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: BH9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317	Cal Date (Certificate No.)           01-Apr-20 (No. 217-03100/03101)           01-Apr-20 (No. 217-03100)           01-Apr-20 (No. 217-03104)           30-Dec-20 (No. 217-03104)           30-Dec-20 (No. EX3-3503_Dec20)           02-Nov-20 (No. DAE4-601_Nov20)           Check Date (in house)           30-Oct-14 (in house check Oct-20)           07-Oct-15 (in house check Oct-20)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Dec-21 Nov-21 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22
The measurements and the uncertal All calibrations have been conducted Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 013245 SN: 013245 SN: 310982 / 06327 SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WY41092317 SN: 100972 SN: US41080477 Name	Cal Date (Certificate No.)         01-Apr-20 (No. 217-03100/03101)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03104)         30-Dec-20 (No. 217-03104)         30-Dec-20 (No. 217-03104)         30-Dec-20 (No. 217-03104)         30-Dec-20 (No. 2A4-601_Nov20)         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-Mar-14 (in house check Oct-20)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Dec-21 Nov-21 Scheduled Check In house check: Oct-22 In house check: Oct-22
The measurements and the uncertal All calibrations have been conducted Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 013245 SN: 013245 SN: 310982 / 06327 SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WY41092317 SN: 100972 SN: US41080477	Cal Date (Certificate No.)           01-Apr-20 (No. 217-03100/03101)           01-Apr-20 (No. 217-03100)           01-Apr-20 (No. 217-03106)           31-Mar-20 (No. 217-03104)           30-Dec-20 (No. 2X3-3503_Dec20)           02-Nov-20 (No. DAE4-601_Nov20)           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)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Dec-21 Nov-21 Scheduled Check In house check: Oct-22 In house check: Oct-21
The measurements and the uncertal All calibrations have been conducted Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103245 SN: 013245 SN: 013245 SN: 310982 / 06327 SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WY41092317 SN: 100972 SN: US41080477 Name	Cal Date (Certificate No.)         01-Apr-20 (No. 217-03100/03101)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03104)         30-Dec-20 (No. 217-03104)         30-Dec-20 (No. 217-03104)         30-Dec-20 (No. 217-03104)         30-Dec-20 (No. 2A4-601_Nov20)         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-Mar-14 (in house check Oct-20)	d are part of the certificate. C and humidity < 70%. Scheduled Calibration Apr-21 Apr-21 Apr-21 Apr-21 Apr-21 Dec-21 Nov-21 Scheduled Check In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-22 In house check: Oct-21
The measurements and the uncertal All calibrations have been conducted Calibration Equipment used (M&TE Primary Standards Power meter NRP Power sensor NRP-Z91 Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power sensor HP 8481A Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by: Approved by:	ainties with confidence pr ad in the closed laborator critical for calibration) ID # SN: 104778 SN: 103244 SN: 103244 SN: 103245 SN: 8H9394 (20k) SN: 310982 / 06327 SN: 3503 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: WY41092317 SN: US37292783 SN: WY41092317 SN: US37292783 SN: WY41092317 SN: US3710972 SN: US41080477 Name Jeton Kastrati	Cal Date (Certificate No.)         01-Apr-20 (No. 217-03100/03101)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03100)         01-Apr-20 (No. 217-03101)         31-Mar-20 (No. 217-03106)         31-Mar-20 (No. 217-03106)         31-Mar-20 (No. 217-03106)         31-Mar-20 (No. 217-03104)         30-Dec-20 (No. EX3-3503_Dec20)         02-Nov-20 (No. EX3-3503_Dec20)         02-Nov-20 (No. DAE4-601_Nov20)         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)         07-Oct-15 (in house check Oct-20)         31-Mar-14 (in house check Oct-20)         Subscription         Laboratory Technician	d are part of the certificate. 2 and humidity < 70%. <u>Scheduled Calibration</u> Apr-21 Apr-21 Apr-21 Apr-21 Dec-21 Nov-21 <u>Scheduled Check</u> In house check: Oct-22 In house check: Oct-21 Signature <u>Journal</u> Support <u>Signature</u> <u>Journal</u> Journal Journa

©Copyright. All rights reserved by CTTL.

Page 263 of 271





### Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland



Schweizerischer Kalibrierdienst S

Service suisse d'étalonnage С

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

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

#### Additional Documentation:

e) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. 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: D5GHzV2-1262\_Jan21

Page 2 of 8