



EX3DV4- SN:3617

January 30, 2020

10700	1 4 4 5	50 ND (0D 05DM 50% DD 50 MH 000% 45 MH)	EQ UD ED4	0.10	
10782	AAB	5G NR (CP-OFDM, 50% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.43	± 9.6 %
10783	AAB	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.31	± 9.6 %
10784	AAB	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.29	± 9.6 %
10785	AAB	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.40	± 9.6 %
10786	AAB	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10787	AAB	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.44	± 9.6 %
10788	AAB	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	± 9.6 %
10789	AAB	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10790	AAB	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	± 9.6 %
10791	AAB	5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.83	± 9.6 %
10792	AAB	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.92	± 9.6 %
10793	AAB	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.95	± 9.6 %
10794	AAB	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.82	± 9.6 %
10795	AAB	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.84	± 9.6 %
10796	AAB	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.82	± 9.6 %
10797	AAB	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.01	± 9.6 %
10798	AAB	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.89	± 9.6 %
10799	AAB	5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.93	± 9.6 %
10801	AAB	5G NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.89	± 9.6 %
10802	AAB	5G NR (CP-OFDM, 1 RB, 90 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.87	± 9.6 %
10803	AAB	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.93	± 9.6 %
10805	AAB	5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10806	AAB	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10809	AAB	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10810	AAB	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10812	AAB	5G NR (CP-OFDM, 50% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10817	AAB	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10818	AAB	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10819	AAB	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.33	± 9.6 %
10820	AAB	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.30	± 9.6 %
10821	AAB	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10822	AAB	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10823	AAB	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.36	± 9.6 %

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10824	AAB	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.39	± 9.6 %
10825	AAB	5G NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10827	AAB	5G NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.42	± 9.6 %
10828	AAB	5G NR (CP-OFDM, 100% RB, 90 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.43	± 9.6 %
10829	AAB	5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.40	± 9.6 %
10830	AAB	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.63	± 9.6 %
10831	AAB	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.73	± 9.6 %
10832	AAB	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.74	± 9.6 %
10833	AAB	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.70	± 9.6 %
10834	AAB	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.75	± 9.6 %
10835	AAB	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.70	± 9.6 %
10836	AAB	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.66	± 9.6 %
10837	AAB	5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.68	± 9.6 %
10839	AAB	5G NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 60 kHz)	5G NR FR1	7.70	± 9.6 %
10840	AAB	5G NR (CP-OFDM, 1 RB, 90 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.67	± 9.6 %
10841	AAB	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 60 kHz)	5G NR FR1	7.71	± 9.6 %
10843	AAB	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1	8.49	± 9.6 %
10844	AAB	5G NR (CP-OFDM, 50% RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1	8.34	± 9.6 %
10846	AAB	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1	8.41	± 9.6 %
10854	AAB	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10855	AAB	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1	8.36	± 9.6 %
10856	AAB	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1	8.37	± 9.6 %
10857	AAB	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 60 kHz)	5G NR FR1	8.35	± 9.6 %
10858	AAB	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1	8.36	± 9.6 %
10859	AAB	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 60 kHz)	5G NR FR1	8.34	± 9.6 %
10860	AAB	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 60 kHz)	5G NR FR1	8.41	± 9.6 %
10861	AAB	5G NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 60 kHz)	5G NR FR1	8.40	± 9.6 %
10863	AAB	5G NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 60 kHz)	5G NR FR1	8.41	± 9.6 %
10864	AAB	5G NR (CP-OFDM, 100% RB, 90 MHz, QPSK, 60 kHz)	5G NR FR1	8.37	± 9.6 %
10865	AAB	5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 60 kHz)	5G NR FR1	8.41	± 9.6 %
10866	AAB	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1	5.68	± 9.6 %
10868	AAB	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1	5.89	± 9.6 %
10869	AAC	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2	5.75	± 9.6 %

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10870	AAC	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	5.86	± 9.6 %
10871	AAC	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	5.75	± 9.6 %
10872	AAC	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	6.52	± 9.6 %
10873	AAC	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.61	± 9.6 %
10874	AAC	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.65	± 9.6 %
10875	AAC	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	7.78	± 9.6 %
10876	AAC	5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	8.39	± 9.6 %
10877	AAC	5G NR (CP-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	7.95	± 9.6 %
10878	AAC	5G NR (CP-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2	8.41	± 9.6 %
10879	AAC	5G NR (CP-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.12	± 9.6 %
10880	AAC	5G NR (CP-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.38	± 9.6 %
10881	AAC	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2	5.75	± 9.6 %
10882	AAC	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	5.96	± 9.6 %
10883	AAC	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2	6.57	± 9.6 %
10884	AAC	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2	6.53	± 9.6 %
10885	AAC	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2	6.61	± 9.6 %
10886	AAC	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2	6.65	± 9.6 %
10887	AAC	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2	7.78	± 9.6 %
10888	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	8.35	± 9.6 %
10889	AAC	5G NR (CP-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	8.02	± 9.6 %
10890	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2	8.40	± 9.6 %
10891	AAC	5G NR (CP-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2	8.13	± 9.6 %
10892	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2	8.41	± 9.6 %

<sup>&</sup>lt;sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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#### **ANNEX H Dipole Calibration Certificate**

## **750 MHz Dipole Calibration Certificate**

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





Schweizerischer Kalibrierdienst S Service suisse d'étalonnage С 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

CALIBRATION C	ERTIFICATI		
Object	D750V3 - SN:10	17	
Calibration procedure(s)	QA CAL-05.v11	adver for CAR Well all 10	
	Calibration Froci	edure for SAR Validation Source	s between 0.7-3 GHz
Calibration date:	July 24, 2020		
This calibration certificate docume	nts the traceability to nat	ional standards, which realize the physical u	nits of measurements (SI)
The measurements and the uncert	ainties with confidence p	probability are given on the following pages a	nd are part of the certificate.
All calibrations have been conduct	ed in the closed laborato	ry facility: environment temperature (22 ± 3)	°C and humidity < 70%.
Calibration Equipment used (M&TI	E critical for calibration)		
Primany Standarda	Lip ii	20200	
Primary Standards Power meter NRP	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power sensor NRP-Z91	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Reference 20 dB Attenuator	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination Reference Probe EX3DV4	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
DAE4	SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Jun-21
JAE4	SN: 601	27-Dec-19 (No. DAE4-601_Dec19)	Dec-20
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
ower sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
letwork Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20
	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	1/1// -
			M.Nex
	Ketie Delevit	Technical Manager	111
approved by:			
pproved by:	Katja Pokovic	recrificat Mariager	see all
pproved by:	каца Рокоуіс	rechnical Manager	alle .

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





Schweizerischer Kalibrierdienst 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

#### Glossarv:

TSL tissue simulating liquid ConvF sensitivity in TSL / NORM x,y,z 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%.

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## **Measurement Conditions**

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

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	V52.10.4
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	With Opacer
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	42.3 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.47 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.53 W/kg ± 16.5 % (k=2)

### **Body TSL parameters**

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.5 ± 6 %	0.97 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	8.85 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.47 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	5.84 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 transferments (	
Impedance, transformed to feed point	53.0 Ω - 0.9 jΩ
Return Loss	- 30.4 dB

## Antenna Parameters with Body TSL

Impedance, transformed to feed point	40.00	
Return Loss	48.3 Ω - 4.1 jΩ	
2000	- 26.9 dB	

## General Antenna Parameters and Design

	Electrical Delay (one direction)	
ı	entrained Boldy (one direction)	1.035 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

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	
manadared by	SPEAG
	OI EAG

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## **DASY5 Validation Report for Head TSL**

Date: 24.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1017

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

Medium parameters used: f = 750 MHz;  $\sigma = 0.91$  S/m;  $\varepsilon_r = 42.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

## DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(9.97, 9.97, 9.97) @ 750 MHz; Calibrated: 29.06.2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 27.12.2019

Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001

DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

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

Reference Value = 59.46 V/m; Power Drift = -0.02 dB

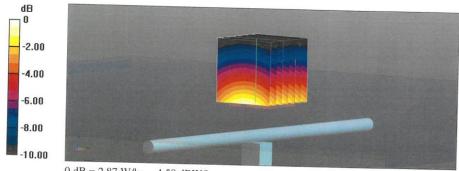
Peak SAR (extrapolated) = 3.26 W/kg

## SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.40 W/kg

Smallest distance from peaks to all points 3 dB below = 17.5 mm

Ratio of SAR at M2 to SAR at M1 = 65.7%

Maximum value of SAR (measured) = 2.87 W/kg



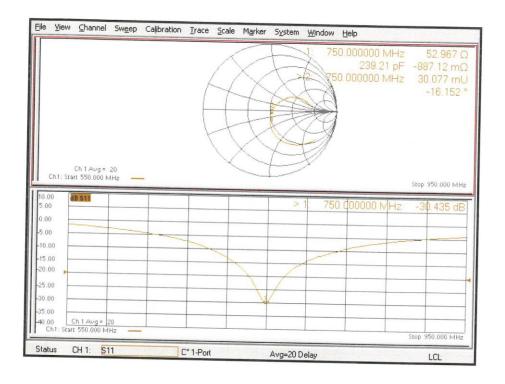
0 dB = 2.87 W/kg = 4.58 dBW/kg

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## Impedance Measurement Plot for Head TSL



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## DASY5 Validation Report for Body TSL

Date: 22.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1017

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

Medium parameters used: f = 750 MHz;  $\sigma = 0.97$  S/m;  $\varepsilon_r = 55.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

#### DASY52 Configuration:

• Probe: EX3DV4 - SN7349; ConvF(9.98, 9.98, 9.98) @ 750 MHz; Calibrated: 29.06.2020

- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

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

Reference Value = 55.53 V/m; Power Drift = -0.00 dB

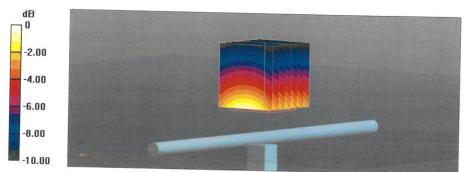
Peak SAR (extrapolated) = 3.31 W/kg

SAR(1 g) = 2.23 W/kg; SAR(10 g) = 1.47 W/kg

Smallest distance from peaks to all points 3 dB below = 18.6 mm

Ratio of SAR at M2 to SAR at M1 = 67.4%

Maximum value of SAR (measured) = 2.95 W/kg



0 dB = 2.95 W/kg = 4.70 dBW/kg

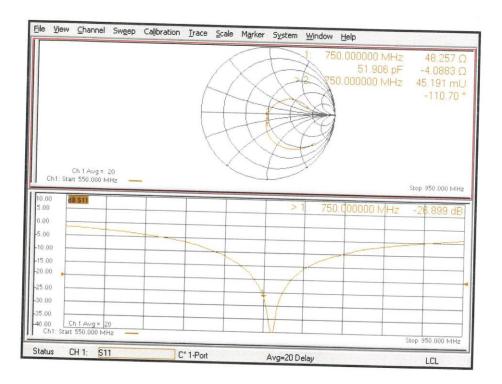
Certificate No: D750V3-1017\_Jul20

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## Impedance Measurement Plot for Body TSL



Certificate No: D750V3-1017\_Jul20

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### 835 MHz Dipole Calibration Certificate

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





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

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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

Client CT

CTTL-BJ (Auden)

Certificate No: D835V2-4d069\_Jul20

Object	D835V2 - SN:4de	069	
Calibration procedure(s)	QA CAL-05.v11		
building procedure(s)		edure for SAR Validation Sources	hetween 0.7-3 GHz
	Gambration 1 1000	date for GATT validation Sources	between 0.7-5 and
Calibration date:	July 24, 2020		
	,,		
his calibration contitionts decrees	-4- M- 4		
his calibration certificate docume	nts the traceability to nati	ional standards, which realize the physical un robability are given on the following pages ar	its of measurements (SI).
to measurements and the uncert	diffies with confidence p	robability are given on the following pages ar	id are part of the certificate.
Il calibrations have been conduct	ed in the closed laborator	ry facility: environment temperature (22 ± 3)°(	C and humidity < 70%
	od in the blood laborator	ry lacinty. environment temperature (22 ± 3)	o and number v 70%.
alibration Equipment used (M&TE	E critical for calibration)		
rimary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
ower meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
ower sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Wei selisoi Wili -231			Apr-21
	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
ower sensor NRP-Z91	SN: 103245 SN: BH9394 (20k)		ACC \$ 400 TO C.
ower sensor NRP-Z91 reference 20 dB Attenuator		01-Apr-20 (No. 217-03101)	Apr-21
ower sensor NRP-Z91 eference 20 dB Attenuator ype-N mismatch combination	SN: BH9394 (20k)	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106)	Apr-21 Apr-21
ower sensor NRP-Z91 deference 20 dB Attenuator ype-N mismatch combination deference Probe EX3DV4	SN: BH9394 (20k) SN: 310982 / 06327	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104)	Apr-21 Apr-21 Apr-21
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20)	Apr-21 Apr-21 Apr-21 Jun-21
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Secondary Standards Power meter E4419B	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19)	Apr-21 Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Recondary Standards Power meter E4419B	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house)	Apr-21 Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20
Rower sensor NRP-Z91 Reference 20 dB Attenuator Reference 20 dB Attenuator Reference Probe EX3DV4 RAE4 Recondary Standards Rower meter E4419B Rower sensor HP 8481A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19)	Apr-21 Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20
ower sensor NRP-Z91 leference 20 dB Attenuator ype-N mismatch combination leference Probe EX3DV4 lAE4 lecondary Standards ower meter E4419B ower sensor HP 8481A ower sensor HP 8481A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19)  Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18)	Apr-21 Apr-21 Apr-21 Jun-21 Dec-20 Scheduled Check In house check: Oct-20 In house check: Oct-20 In house check: Oct-20
tower sensor NRP-Z91 teference 20 dB Attenuator type-N mismatch combination teference Probe EX3DV4 tAE4 tecondary Standards tower meter E4419B tower sensor HP 8481A tower sensor HP 8481A till generator R&S SMT-06	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18)	Apr-21 Apr-21 Apr-21 Jun-21 Dec-20  Scheduled Check In house check: Oct-2( In house check: Oct-2( In house check: Oct-2( In house check: Oct-2(
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4 Recondary Standards	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19)  Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18)	Apr-21 Apr-21 Apr-21 Jun-21 Dec-20  Scheduled Check In house check: Oct-20
ower sensor NRP-Z91 leference 20 dB Attenuator ype-N mismatch combination eference Probe EX3DV4 AE4  econdary Standards ower meter E4419B ower sensor HP 8481A ower sensor HP 8481A F generator R&S SMT-06 etwork Analyzer Agilent E8358A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601  ID #  SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477  Name	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19)  Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19)	Apr-21 Apr-21 Apr-21 Jun-21 Dec-20
tower sensor NRP-Z91 teference 20 dB Attenuator ype-N mismatch combination teference Probe EX3DV4 tAE4 tecondary Standards tower meter E4419B tower sensor HP 8481A tower sensor HP 8481A til generator R&S SMT-06 tetwork Analyzer Agilent E8358A	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601 ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19)  Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19)	Apr-21 Apr-21 Apr-21 Jun-21 Dec-20  Scheduled Check In house check: Oct-20
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 Calibrated by:	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601  ID # SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477  Name Michael Weber	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19) Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19)  Function Laboratory Technician	Apr-21 Apr-21 Apr-21 Jun-21 Dec-20  Scheduled Check In house check: Oct-2(
Power sensor NRP-Z91 Reference 20 dB Attenuator Type-N mismatch combination Reference Probe EX3DV4 DAE4  Secondary Standards Power meter E4419B Power sensor HP 8481A RF generator R&S SMT-06	SN: BH9394 (20k) SN: 310982 / 06327 SN: 7349 SN: 601  ID #  SN: GB39512475 SN: US37292783 SN: MY41092317 SN: 100972 SN: US41080477  Name	01-Apr-20 (No. 217-03101) 31-Mar-20 (No. 217-03106) 31-Mar-20 (No. 217-03104) 29-Jun-20 (No. EX3-7349_Jun20) 27-Dec-19 (No. DAE4-601_Dec19)  Check Date (in house) 30-Oct-14 (in house check Feb-19) 07-Oct-15 (in house check Oct-18) 15-Jun-15 (in house check Oct-18) 31-Mar-14 (in house check Oct-19)	Apr-21 Apr-21 Apr-21 Jun-21 Dec-20  Scheduled Check In house check: Oct-2(

Certificate No: D835V2-4d069\_Jul20

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





S Schweizerischer Kalibrierdienst C 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: D835V2-4d069\_Jul20

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#### **Measurement Conditions**

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

AST System configuration, as far as not	giveri on page 1.	
DASY Version	DASY5	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

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.2 ± 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 <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.45 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.60 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.25 W/kg ± 16.5 % (k=2)

### **Body TSL parameters**

he following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.4 ± 6 %	1.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

## SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.74 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.63 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.39 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	$51.5 \Omega - 1.7 j\Omega$	
Return Loss	- 33.0 dB	

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 Ω - 5.3 jΩ	
Return Loss	- 24.1 dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.392 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: D835V2-4d069\_Jul20

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#### **DASY5 Validation Report for Head TSL**

Date: 24.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d069

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

Medium parameters used: f = 835 MHz;  $\sigma = 0.93$  S/m;  $\varepsilon_r = 42.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

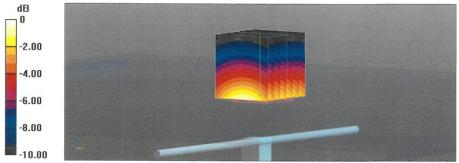
Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 63.14 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.65 W/kg

SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.59 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 66.9%Maximum value of SAR (measured) = 3.26 W/kg



0 dB = 3.26 W/kg = 5.13 dBW/kg

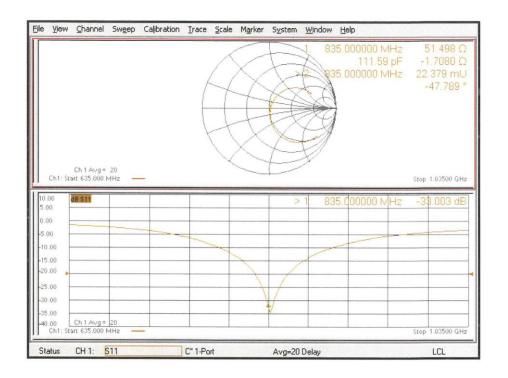
Certificate No: D835V2-4d069 Jul20

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#### Impedance Measurement Plot for Head TSL



Certificate No: D835V2-4d069\_Jul20

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#### **DASY5 Validation Report for Body TSL**

Date: 22.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

## DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d069

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

Medium parameters used: f = 835 MHz;  $\sigma = 1.00$  S/m;  $\epsilon_r = 55.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

#### DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(9.65, 9.65, 9.65) @ 835 MHz; Calibrated: 29.06.2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 27.12.2019

Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005

• DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

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

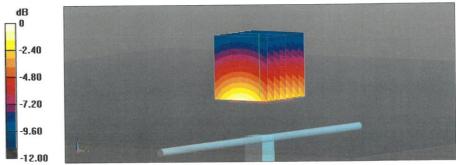
Reference Value = 57.60 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.68 W/kg

SAR(1 g) = 2.49 W/kg; SAR(10 g) = 1.63 W/kg

Smallest distance from peaks to all points 3 dB below = 16.6 mm

Ratio of SAR at M2 to SAR at M1 = 67.5% Maximum value of SAR (measured) = 3.30 W/kg



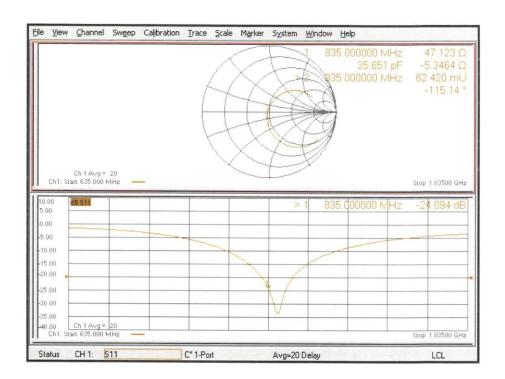
0 dB = 3.30 W/kg = 5.19 dBW/kg

Certificate No: D835V2-4d069\_Jul20





#### Impedance Measurement Plot for Body TSL



Certificate No: D835V2-4d069\_Jul20 Page 8 of 8





### 1750 MHz Dipole Calibration Certificate

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





S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S wiss 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 CTTL-BJ (Auden)

Certificate No. D1750V2-1003 Jul20

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 01-Apr-20 (No. 217-03100/03101) Apr-21  SN: 103244 01-Apr-20 (No. 217-03100) Apr-21  Power sensor NRP-Z91 SN: 103244 01-Apr-20 (No. 217-03101) Apr-21  Reference 20 dB Attenuator SN: 8H9394 (20k) 31-Mar-20 (No. 217-03106) Apr-21  Fype-N mismatch combination SN: 310982 / 06327 31-Mar-20 (No. 217-03104) Apr-21  Reference Probe EX3DV4 SN: 7349 29-Jun-20 (No. EX3-7349_Jun20) Jun-21  DAE4 SN: 601 27-Dec-19 (No. DAE4-601_Dec19) Dec-20  Secondary Standards  ID # Check Date (in house) Scheduled Check  Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Feb-19) In house check: Oct-20  Secondary Standards  ID # Check Date (in house) In house check: Oct-20  Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-18) In house check: Oct-20  Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-18) In house check: Oct-20  Name Function Signature  Calibrated by:  Apr-21  Laboratory Technician				
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz  Calibration date:  July 24, 2020  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 Apr-21  SN: 104778 01-Apr-20 (No. 217-03100/03101) Apr-21  Power sensor NRP-Z91 SN: 103244 01-Apr-20 (No. 217-03100) Apr-21  Power sensor NRP-Z91 SN: 103244 01-Apr-20 (No. 217-03100) Apr-21  Paference 20 dB Attenuator SN: BH9394 (20k) 31-Mar-20 (No. 217-03101) Apr-21  Paference Probe EX3DV4 SN: 7349 29-Jun-20 (No. 217-03104) Apr-21  Paference Probe EX3DV4 SN: 7349 29-Jun-20 (No. 217-03104) Apr-21  Paference Probe EX3DV4 SN: 601 27-Dec-19 (No. DAE4-601_Dec19) Dec-20  Secondary Standards  DB # Check Date (in house) Scheduled Check  Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Oct-18) In house check: Oct-20  Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Oct-18) In house check: Oct-20  Network Analyzer Agilent E8358A SN: 100972 15-Jun-15 (in house check Oct-18) In house check: Oct-20  Name Function Signature	Object	D1750V2 - SN:10	003	
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  Power meter NRP  SN: 104778  01-Apr-20 (No. 217-03100/03101)  Apr-21  Power sensor NRP-Z91  SN: 103244  01-Apr-20 (No. 217-03100)  Apr-21  Power sensor NRP-291  SN: 103245  01-Apr-20 (No. 217-03101)  Apr-21  Reference 20 dB Attenuator  SN: BH9394 (20k)  31-Mar-20 (No. 217-03104)  Apr-21  Apr-21  Type-N mismatch combination  SN: 310982 / 06327  SN: 310982 / 06327  31-Mar-20 (No. 217-03104)  Apr-21  Apr-21  Daced  Secondary Standards  ID #  Check Date (in house)  Scheduled Check  Power meter E4419B  SN: GB39512475  30-Oct-14 (in house check Peb-19)  In house check: Oct-20  Secondary Standards  ID #  Check Date (in house)  Scheduled Check  Power sensor HP 8481A  SN: US37292783  07-Oct-15 (in house check Oct-18)  In house check: Oct-20  Set only Standards  In house check: Oct-20  Network Analyzer Agilent E8358A  SN: US41080477  31-Mar-14 (in house check Oct-19)  In house check: Oct-20  Name  Function  Signature	Calibration procedure(s)		edure for SAR Validation Sources	s between 0.7-3 GHz
Power meter NRP Power sensor NRP-Z91 SN: 104778 O1-Apr-20 (No. 217-03100/03101) Apr-21 Power sensor NRP-Z91 SN: 103244 O1-Apr-20 (No. 217-03100) Apr-21 Apr-21 Power sensor NRP-Z91 SN: 103245 O1-Apr-20 (No. 217-03101) Apr-21 Apr-21 Reference 20 dB Attenuator SN: BH9394 (20k) 31-Mar-20 (No. 217-03104) Apr-21 SN: 310982 / 06327 31-Mar-20 (No. 217-03104) Apr-21 SN: 310982 / 06327 31-Mar-20 (No. 217-03104) Apr-21 SN: 601 SN: 7349 S9-Jun-20 (No. EX3-7349-Jun20) Jun-21 DAE4 SN: 601 Z7-Dec-19 (No. DAE4-601_Dec19) Dec-20 Secondary Standards ID # Check Date (in house) Scheduled Check Power meter E4419B SN: GB39512475 30-Oct-14 (in house check Feb-19) In house check: Oct-20 RF generator R&S SMT-06 SN: 100972 SN: 100972 15-Jun-15 (in house check Oct-18) In house check: Oct-20 Name Function Signature	Calibration date:	July 24, 2020		
SN: 104778	The measurements and the uncert	ainties with confidence p	robability are given on the following pages ar	nd are part of the certificate.
Power meter NRP	Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power sensor NRP-Z91         SN: 103244         01-Apr-20 (No. 217-03100)         Apr-21           Power sensor NRP-Z91         SN: 103245         01-Apr-20 (No. 217-03101)         Apr-21           Reference 20 dB Attenuator         SN: BH9394 (20k)         31-Mar-20 (No. 217-03106)         Apr-21           Type-N mismatch combination         SN: 310982 / 06327         31-Mar-20 (No. 217-03104)         Apr-21           Reference Probe EX3DV4         SN: 7349         29-Jun-20 (No. EX3-7349_Jun20)         Jun-21           DAE4         SN: 601         27-Dec-19 (No. DAE4-601_Dec19)         Dec-20           Secondary Standards         ID #         Check Date (in house)         Scheduled Check           Power meter E4419B         SN: GB39512475         30-Oct-14 (in house check Feb-19)         In house check: Oct-20           Power sensor HP 8481A         SN: US37292783         07-Oct-15 (in house check Oct-18)         In house check: Oct-20           PF generator R&S SMT-06         SN: 100972         15-Jun-15 (in house check Oct-18)         In house check: Oct-20           Network Analyzer Agilent E8358A         SN: US41080477         31-Mar-14 (in house check Oct-19)         In house check: Oct-20	Power meter NRP	SN: 104778		
SN: 103245   01-Apr-20 (No. 217-03101)   Apr-21	ower sensor NRP-Z91	SN: 103244		0.00
SN: BH9394 (20k)   31-Mar-20 (No. 217-03106)   Apr-21	ower sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	
SN: 7349   29-Jun-20 (No. EX3-7349   Jun-21   Jun-21   Dec-20	Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
SN: 601   27-Dec-19 (No. DAE4-601_Dec19)   Dec-20	ype-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
D # Check Date (in house)   Scheduled Check		SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Jun-21
SN: GB39512475   30-Oct-14 (in house check Feb-19)   In house check: Oct-20	AE4	SN: 601	27-Dec-19 (No. DAE4-601_Dec19)	Dec-20
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RF generator R&S SMT-06 SN: 100972 15-Jun-15 (in house check Oct-18) In house check: Oct-20				In house check: Oct-20
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Approved by: Michael Weber Laboratory Technician MileseT  Katja Pokovic Technical Manager		Name	Function	
Approved by: Katja Pokovic Technical Manager	Calibrated by:	Michael Weber	Laboratory Technician	MINESES
all as	Approved by:	Katja Pokovic	Technical Manager	delles

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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 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) 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%.

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#### **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	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.4 ± 6 %	1.35 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.02 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.5 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.1 W/kg ± 16.5 % (k=2)

#### **Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.0 ± 6 %	1.47 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.31 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	37.6 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.95 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	19.9 W/kg ± 16.5 % (k=2)

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