

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

Date: 18.07.2019

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;  $\sigma = 0.89$  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(10.07, 10.07, 10.07) @ 750 MHz; Calibrated: 29.05.2019

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn601; Calibrated: 30.04.2019

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

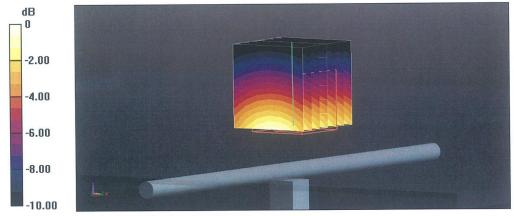
• DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

# 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 = 59.72 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.21 W/kg

SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.39 W/kgMaximum value of SAR (measured) = 2.84 W/kg



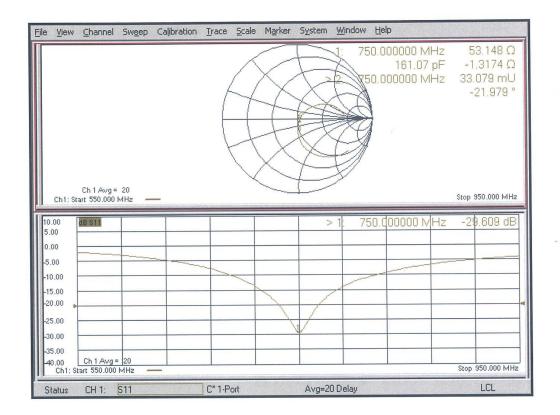
0 dB = 2.84 W/kg = 4.53 dBW/kg

Certificate No: D750V3-1017\_Jul19

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## Impedance Measurement Plot for Head TSL





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

Date: 18.07.2019

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;  $\sigma = 0.96$  S/m;  $\varepsilon_r = 55.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

### DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(10.4, 10.4, 10.4) @ 750 MHz; Calibrated: 29.05.2019

• Sensor-Surface: 1.4mm (Mechanical Surface Detection)

• Electronics: DAE4 Sn601; Calibrated: 30.04.2019

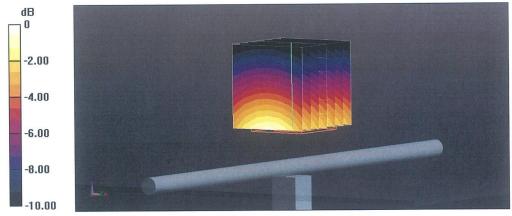
Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005

DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

# 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 = 55.74 V/m; Power Drift = -0.02 dB Peak SAR (extrapolated) = 3.18 W/kg

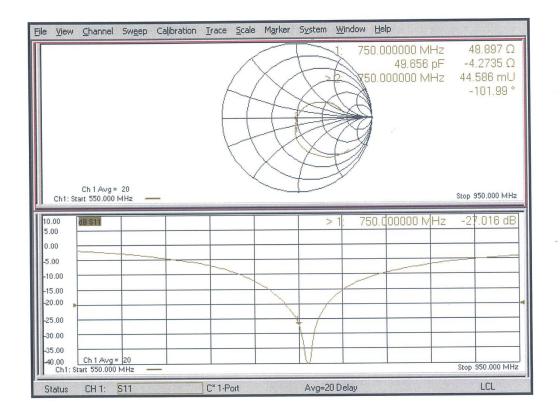
SAR(1 g) = 2.14 W/kg; SAR(10 g) = 1.41 W/kgMaximum value of SAR (measured) = 2.84 W/kg



0 dB = 2.84 W/kg = 4.53 dBW/kg



## Impedance Measurement Plot for Body TSL







## 835 MHz Dipole Calibration Certificate

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





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

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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

Multilateral Agreement for the recognition of calibration certificates

Client

CTTL (Auden)

Certificate No: D835V2-4d069\_Jul19

Calibration Procedure for SAR Validation Sources between 0.7-3 GHz  Calibration date:  July 18, 2019  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  D# Cal Date (Certificate No.) Scheduled Calibration  Power meter NRP  SN: 104778 03-Apr-19 (No. 217-02892/02893) Apr-20  SN: 103244 03-Apr-19 (No. 217-02892) Apr-20  SN: 103245 03-Apr-19 (No. 217-02892) Apr-20  Reference 20 6B Attenuator SN: 5058 (20k) 04-Apr-19 (No. 217-02894) Apr-20  Type-N mismatch combination SN: 5058 (20k) 04-Apr-19 (No. 217-02894) Apr-20  Reference Probe EX3DV4 SN: 7349 29-May-19 (No. 217-02894) Apr-20  Reference Probe EX3DV4 SN: 601 30-Apr-19 (No. 217-02894) May-20  Secondary Standards ID # Check Date (in house) Scheduled Check  SN: 601 30-Apr-19 (No. DAE4-601_Apr19) Apr-20  Reference Probe EX3DV4 SN: 601 30-Apr-19 (No. DAE4-601_Apr19) In house check: Oct-20  RPower sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Cot-18) In house check: Oct-20  RP generator R&S SMT-06 SN: 10972 15-Jun-15 (in house check Oct-18) In house check: Oct-20  Name Function Signature  Calibrated by: Calibrated by: Laboratory Technician	Object	D835V2 - SN:4d0	69	
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz  Calibration date:  July 18, 2019  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 03-Apr-19 (No. 217-02892/02893) Apr-20  SN: 103244 03-Apr-19 (No. 217-02892) Apr-20  Power sensor NRP-Z91 SN: 103245 03-Apr-19 (No. 217-02894) Apr-20  Reference 20 dB Attenuator  SN: 5058 (20k) 04-Apr-19 (No. 217-02894) Apr-20  Type-N mismatch combination  Reference Probe EX3DV4 SN: 7349 29-May-19 (No. DA27-394) May-20  SN: 5047.2 / 06327 04-Apr-19 (No. DA27-394) May-20  DAE4 SN: 601 30-Apr-19 (No. DA24-601_Apr19) May-20  Secondary Standards  ID # Check Date (in house) Scheduled Check  In house check: Oct-20  Power sensor HP 8481A SN: US37292783 07-Oct-15 (in house check Peb-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  Name Function Signature  Calibrated by: Claudio Leubler Laboratory Technician				
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  03-Apr-19 (No. 217-02892/02893) Apr-20  Power sensor NRP-Z91 SN: 103244  03-Apr-19 (No. 217-02892) Apr-20  Power sensor NRP-Z91 SN: 103245  SN: 50345  SN: 50345  SN: 50345  SN: 50345  SN: 5047.2 / 06327  17ye-N mismatch combination  Reference Probe EX3DV4  SN: 601  SN: 5047.2 / 06327  94-Apr-19 (No. 217-02895) Apr-20  Reference Probe EX3DV4  SN: 601  30-Apr-19 (No. 217-02895) Apr-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  In house check: Oct-20  Network Analyzer Agilent E8358A  Name  Function  Calibrated by:  Cal	Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	dure for SAR Validation Sources	between 0.7-3 GHz
Primary Standards	Calibration date:	July 18, 2019		
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 03-Apr-19 (No. 217-02892/02893) Apr-20  Apr-20  Power sensor NRP-Z91 SN: 103244 03-Apr-19 (No. 217-02892) Apr-20  Power sensor NRP-Z91 SN: 103245 03-Apr-19 (No. 217-02893) Apr-20  Reference 20 dB Attenuator SN: 5058 (20k) 04-Apr-19 (No. 217-02894) Apr-20  Reference 20 dB Attenuator SN: 5047.2 / 06327 04-Apr-19 (No. 217-02895) Apr-20  Reference Probe EX3DV4 SN: 7349 29-May-19 (No. EX3-7349_May19) May-20  ADAE4 SN: 601 30-Apr-19 (No. DAE4-601_Apr19) Apr-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  Reference RRS 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-18) In house check: Oct-20  Name Function Signature Claudio Leubler	his calibration certificate documen	nts the traceability to nati	onal standards, which realize the physical uni	ts of measurements (SI).
Calibration Equipment used (M&TE critical for calibration)   D#	he measurements and the uncertainty	ainties with confidence p	lobability are given on the following pages and	a aro part or the comments
Primary Standards   15	All calibrations have been conducted	ed in the closed laborator	y facility: environment temperature (22 ± 3)°C	and humidity < 70%.
Primary Standards				
Primary Standards   15	Calibration Equipment used (M& I E	critical for calibration)		
Power meter NRP	Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power sensor NRP-Z91         SN: 103244         03-Apr-19 (No. 217-02892)         Apr-20           Power sensor NRP-Z91         SN: 103245         03-Apr-19 (No. 217-02893)         Apr-20           Reference 20 dB Attenuator         SN: 5058 (20k)         04-Apr-19 (No. 217-02894)         Apr-20           Type-N mismatch combination         SN: 5047.2 / 06327         04-Apr-19 (No. 217-02895)         Apr-20           Reference Probe EX3DV4         SN: 7349         29-May-19 (No. EX3-7349_May19)         May-20           DAE4         SN: 601         30-Apr-19 (No. DAE4-601_Apr19)         Apr-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           RF 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-18)         In house check: Oct-19           Calibrated by:         Claudio Leubler         Laboratory Technician         Signature				Apr-20
SN: 103245   03-Apr-19 (No. 217-02893)   Apr-20		SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
SN: 5047.2 / 06327		SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Secondary Standards	Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Secondary Standards  ID # Check Date (in house)  Scheduled Check  Power meter E4419B  Power sensor HP 8481A  Power sensor HP 8481A  SN: MY41092317  SN: 100972  Network Analyzer Agilent E8358A  SN: US41080477  SN: US4108047	Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-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   Power 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   Network Analyzer Agilent E8358A   SN: US41080477   31-Mar-14 (in house check Oct-18)   In house check: Oct-20   In house check: Oct-20   In house check: Oct-20   In house check: Oct-20   In house check: Oct-19    Name   Function   Signature   Calibrated by:   Claudio Leubler   Laboratory Technician   Signature    Signature	Reference Probe EX3DV4	SN: 7349	29-May-19 (No. EX3-7349_May19)	May-20
Power meter E4419B Power sensor HP 8481A Power sensor HP 8481A SN: US37292783 O7-Oct-15 (in house check Oct-18) In house check: Oct-20 In house check: Oct-19  Name Function Calibrated by:  Claudio Leubler Laboratory Technician	DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20
Power meter E4419B Power sensor HP 8481A SN: US37292783 Power sensor HP 8481A SN: US37292783 Power sensor HP 8481A SN: MY41092317 SN: MY41092317 SN: 100972 SN: 100972 SN: US41080477  Name Function  Calibrated by:  SN: GB39512475 SN: GB39512475 SN: US37292783 O7-Oct-15 (in house check Oct-18) In house check: Oct-20 In house check: Oct-19  Name Function  Signature	Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power sensor HP 8481A Power sensor HP 8481A SN: US37292783 O7-Oct-15 (in house check Oct-18) In house check: Oct-20 In house check: Oct-19  Name Function Calibrated by:  Calibrate		SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer Agilent E8358A  Name  SN: MY41092317 O7-Oct-15 (in house check Oct-18) In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-20 In house check: Oct-19  Name Function Calibrated by:  Calibrated by:  Calibrated by:  Calibrated SN: MY41092317 O7-Oct-15 (in house check Oct-18) In house check: Oct-20 In house check: Oct-19  Name Function Laboratory Technician		SN: US37292783		In house check: Oct-20
RF generator R&S SMT-06 Network Analyzer Agilent E8358A  SN: 100972 SN: US41080477  SN: US41080477  Name  Function  Calibrated by:  SN: US41080477  Signature  Signature		1500	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-18) In house check: Oct-19  Name Function Signature  Calibrated by: Claudio Leubler Laboratory Technician	Power sensor HP 8481A	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Calibrated by:  Claudio Leubler  Laboratory Technician			31 Mar 14 (in house check Oct-18)	In house check: Oct-19
Calibrated by:  Claudio Leubler  Laboratory Technician	RF generator R&S SMT-06	SN: US41080477	31-Mai-14 (III flouse check Oct-10)	
	RF generator R&S SMT-06			Signature
Approved by: Katja Pokovic Technical Manager	RF generator R&S SMT-06 Network Analyzer Agilent E8358A	Name	Function	Signature
	RF generator R&S SMT-06 Network Analyzer Agilent E8358A	Name	Function	Signature
	RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	Name Claudio Leubler	Function Laboratory Technician	Signature
Issued: July 19, 2019	RF generator R&S SMT-06 Network Analyzer Agilent E8358A Calibrated by:	Name Claudio Leubler	Function Laboratory Technician	Mas

Certificate No: D835V2-4d069\_Jul19

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





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

Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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

Glossary:

TSL

tissue simulating liquid

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

Calibration is Performed According to the Following Standards:

 a) 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\_Jul19

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### **Measurement Conditions**

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

ASY system configuration, as far as not		V52.10.2
DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

## **Head TSL parameters**

The following parameters and calculations were applied.

The following parameters and datediations world app.	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	42.0 ± 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	2.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.70 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	1.58 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.29 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	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.9 ± 6 %	0.99 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	2.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.68 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	1.60 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.32 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	50.8 Ω - 2.4 jΩ
Return Loss	- 32.1 dB

## **Antenna Parameters with Body TSL**

Impedance, transformed to feed point	47.1 Ω - 3.9 jΩ
Return Loss	- 25.9 dB

## **General Antenna Parameters and Design**

Floatrical Dolay (one direction)	1.393 ns
Electrical Delay (one direction)	1.000 110

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



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

Date: 15.07.2019

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;  $\sigma = 0.91$  S/m;  $\epsilon_r = 42$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

#### DASY52 Configuration:

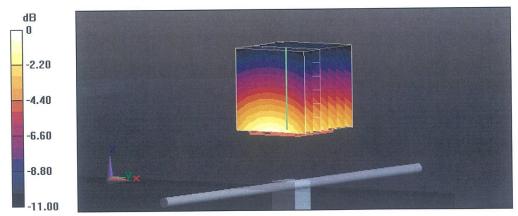
- Probe: EX3DV4 SN7349; ConvF(9.89, 9.89, 9.89) @ 835 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 4.9 (front); Type: QD 00L P49 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

# 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 = 63.48 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.58 W/kg

SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.58 W/kgMaximum value of SAR (measured) = 3.22 W/kg



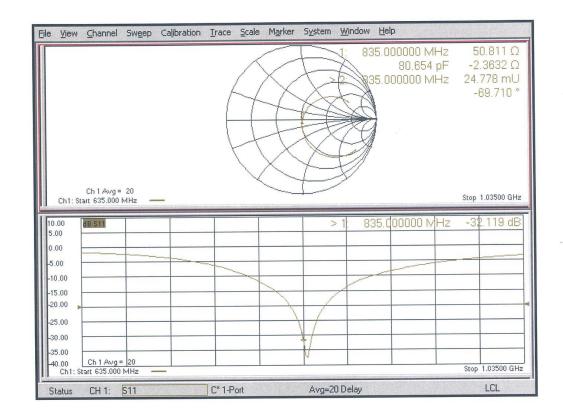
0 dB = 3.22 W/kg = 5.08 dBW/kg

Certificate No: D835V2-4d069\_Jul19

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## Impedance Measurement Plot for Head TSL





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

Date: 18.07.2019

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;  $\sigma = 0.99$  S/m;  $\varepsilon_r = 54.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

#### DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(10.16, 10.16, 10.16) @ 835 MHz; Calibrated: 29.05.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 4.9 (Back); Type: QD 00R P49 AA; Serial: 1005
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

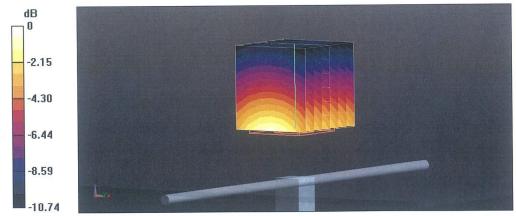
# Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 57.81 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.65 W/kg

SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.6 W/kg

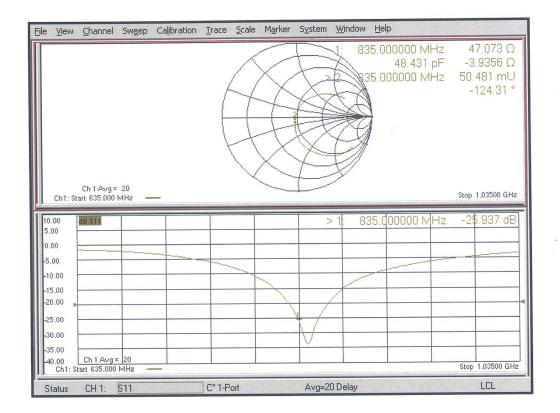
Maximum value of SAR (measured) = 3.28 W/kg



0 dB = 3.28 W/kg = 5.16 dBW/kg



## Impedance Measurement Plot for Body TSL







### 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 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

CTTL (Auden) Certificate No: D1750V2-1003\_Jul19 CALIBRATION CERTIFICATE Object D1750V2 - SN:1003 Calibration procedure(s) QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz Calibration date: July 16, 2019 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 03-Apr-19 (No. 217-02892/02893) Apr-20 Power sensor NRP-Z91 SN: 103244 03-Apr-19 (No. 217-02892) Apr-20 Power sensor NRP-Z91 SN: 103245 03-Apr-19 (No. 217-02893) Apr-20 Reference 20 dB Attenuator SN: 5058 (20k) 04-Apr-19 (No. 217-02894) Apr-20 Type-N mismatch combination SN: 5047.2 / 06327 04-Apr-19 (No. 217-02895) Apr-20 Reference Probe EX3DV4 SN: 7349 29-May-19 (No. EX3-7349 May19) May-20 DAE4 SN: 601 30-Apr-19 (No. DAE4-601\_Apr19) Apr-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 Power 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 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-18) In house check: Oct-19 Name Function Signature Calibrated by: Leif Klysner Laboratory Technician Approved by: Katja Pokovic Technical Manager Issued: July 17, 2019 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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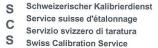




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#### Glossary:

TSL

tissue simulating liquid

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

#### Calibration is Performed According to the Following Standards:

- a) 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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