



No.I21Z60782-SEM03

### 1900 MHz Dipole Calibration Certificate

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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **CTTL-BJ (Auden)**

Certificate No: **D1900V2-5d101\_Jul20**

## CALIBRATION CERTIFICATE

Object: **D1900V2 - SN:5d101**

Calibration procedure(s): **QA CAL-05.v11  
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **July 28, 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
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-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
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-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 29, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D1900V2-5d101\_Jul20

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

**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:**

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- 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%.

**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	1900 MHz $\pm$ 1 MHz	

**Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.0 $\pm$ 6 %	1.39 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

**SAR result with Head TSL**

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	9.80 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>39.6 W/kg <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	5.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>20.6 W/kg <math>\pm</math> 16.5 % (k=2)</b>

**Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.8 $\pm$ 6 %	1.49 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

**SAR result with Body TSL**

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	9.73 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>39.5 W/kg <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	condition	
SAR measured	250 mW input power	5.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>20.8 W/kg <math>\pm</math> 16.5 % (k=2)</b>

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

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	50.4 $\Omega$ + 5.6 j $\Omega$
Return Loss	- 25.0 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	45.4 $\Omega$ + 5.7 j $\Omega$
Return Loss	- 22.3 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.202 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

**Additional EUT Data**

Manufactured by	SPEAG
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**DASY5 Validation Report for Head TSL**

Date: 28.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d101**

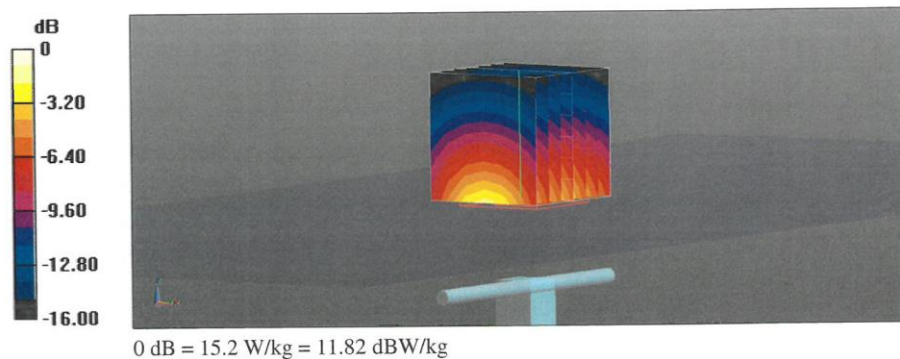
Communication System: UID 0 - CW; Frequency: 1900 MHz  
Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.39$  S/m;  $\epsilon_r = 41.0$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: Flat Section  
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

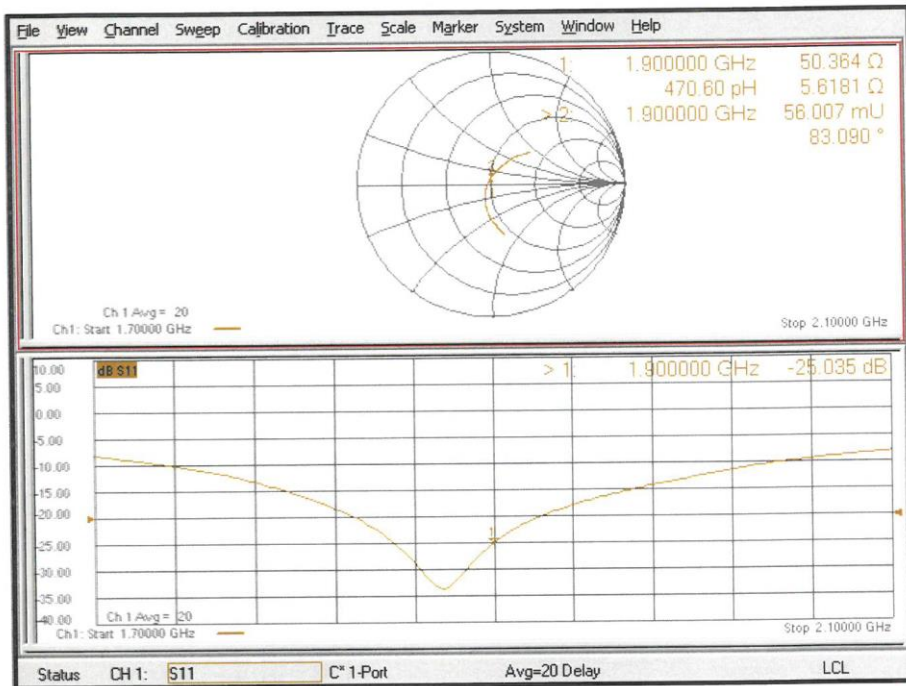
- Probe: EX3DV4 - SN7349; ConvF(8.26, 8.26, 8.26) @ 1900 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm  
Reference Value = 108.9 V/m; Power Drift = -0.04 dB  
Peak SAR (extrapolated) = 18.2 W/kg  
**SAR(1 g) = 9.80 W/kg; SAR(10 g) = 5.13 W/kg**  
Smallest distance from peaks to all points 3 dB below = 10 mm  
Ratio of SAR at M2 to SAR at M1 = 54.5%  
Maximum value of SAR (measured) = 15.2 W/kg



Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 24.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d101**

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

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.49$  S/m;  $\epsilon_r = 53.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(8.21, 8.21, 8.21) @ 1900 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

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

Reference Value = 103.4 V/m; Power Drift = -0.09 dB

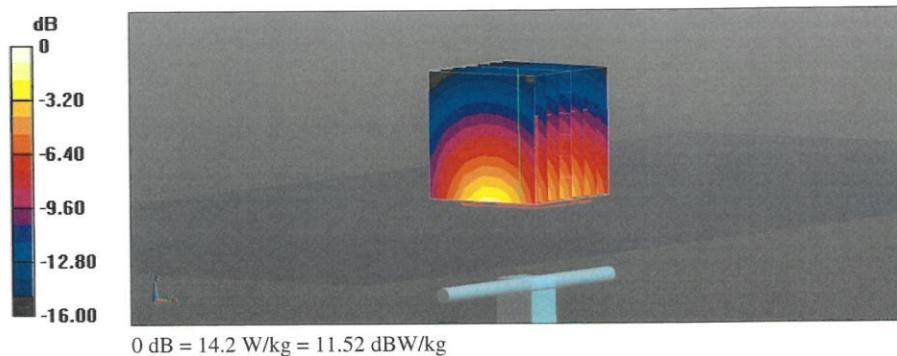
Peak SAR (extrapolated) = 16.8 W/kg

**SAR(1 g) = 9.73 W/kg; SAR(10 g) = 5.16 W/kg**

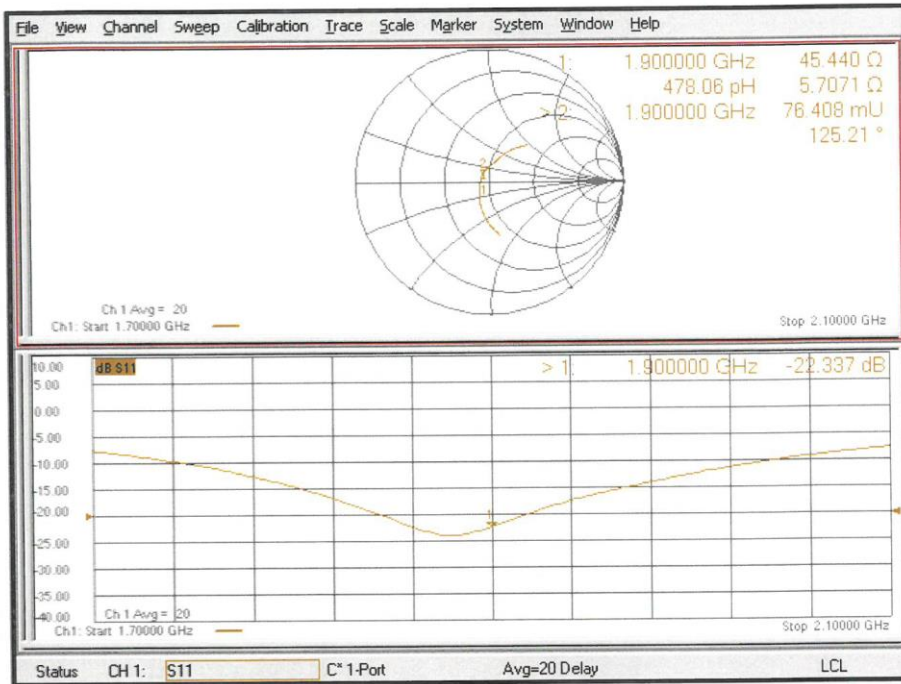
Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 59.5%

Maximum value of SAR (measured) = 14.2 W/kg



Impedance Measurement Plot for Body TSL







No.I21Z60782-SEM03

### 2450 MHz Dipole Calibration Certificate

**Calibration Laboratory of  
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Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: **SCS 0108**

Client **CTTL-BJ (Auden)**

Certificate No: **D2450V2-853\_Jul20**

## CALIBRATION CERTIFICATE

Object: **D2450V2 - SN:853**

Calibration procedure(s): **QA CAL-05.v11  
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz**

Calibration date: **July 21, 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
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-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
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-19)	In house check: Oct-20

Calibrated by:	Name <b>Jeffrey Katzman</b>	Function <b>Laboratory Technician</b>	Signature 
Approved by:	Name <b>Katja Pokovic</b>	Function <b>Technical Manager</b>	Signature 

Issued: July 23, 2020

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Accreditation No.: **SCS 0108**

**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:**

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- 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%.

**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	2450 MHz $\pm$ 1 MHz	

**Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	38.5 $\pm$ 6 %	1.84 mho/m $\pm$ 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	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>52.5 W/kg <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>24.5 W/kg <math>\pm</math> 16.5 % (k=2)</b>

**Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	51.4 $\pm$ 6 %	2.02 mho/m $\pm$ 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	13.4 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>52.4 W/kg <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.22 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>24.6 W/kg <math>\pm</math> 16.5 % (k=2)</b>

**Appendix (Additional assessments outside the scope of SCS 0108)****Antenna Parameters with Head TSL**

Impedance, transformed to feed point	54.6 $\Omega$ + 4.9 j $\Omega$
Return Loss	- 23.9 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	49.9 $\Omega$ + 5.6 j $\Omega$
Return Loss	- 25.0 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.162 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

**Additional EUT Data**

Manufactured by	SPEAG
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**DASY5 Validation Report for Head TSL**

Date: 21.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:853**

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.84$  S/m;  $\epsilon_r = 38.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.74, 7.74, 7.74) @ 2450 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- 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=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**

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

Reference Value = 118.2 V/m; Power Drift = -0.05 dB

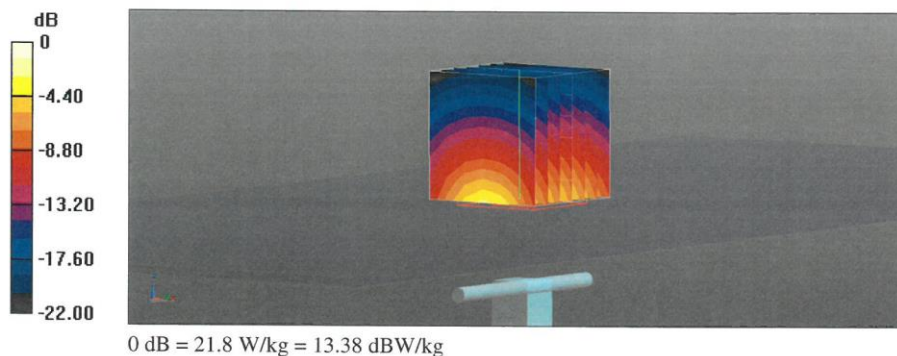
Peak SAR (extrapolated) = 26.2 W/kg

**SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.17 W/kg**

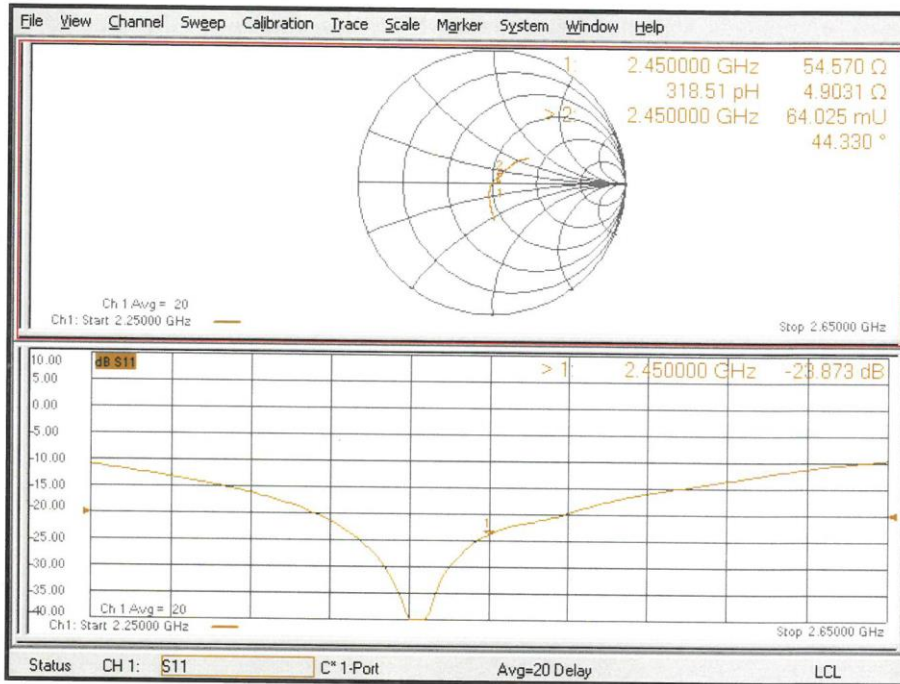
Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 51.1%

Maximum value of SAR (measured) = 21.8 W/kg



Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 21.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:853**

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

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.02$  S/m;  $\epsilon_r = 51.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.82, 7.82, 7.82) @ 2450 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

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

Reference Value = 111.1 V/m; Power Drift = -0.09 dB

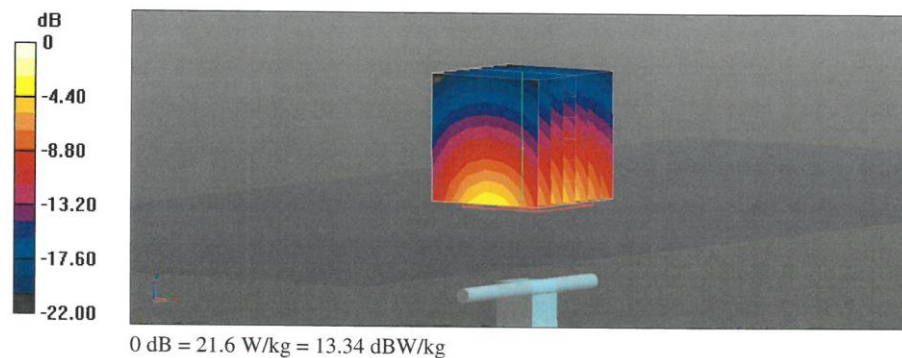
Peak SAR (extrapolated) = 25.7 W/kg

**SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.22 W/kg**

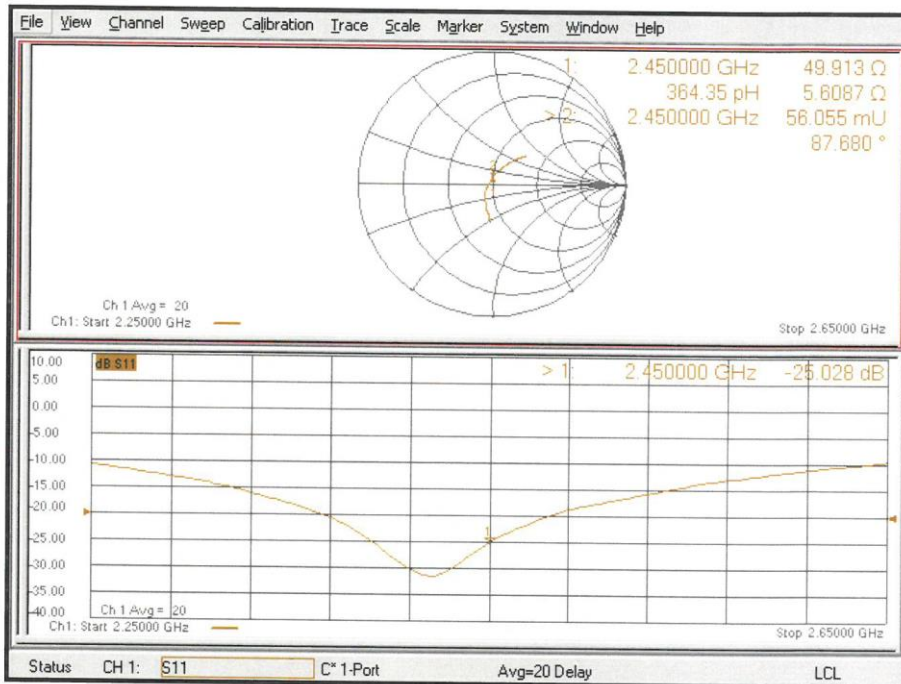
Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 52.9%

Maximum value of SAR (measured) = 21.6 W/kg



Impedance Measurement Plot for Body TSL







No.I21Z60782-SEM03

### 2600 MHz Dipole Calibration Certificate

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



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Accreditation No.: **SCS 0108**

Client **CTTL-BJ (Auden)**

Certificate No: **D2600V2-1012\_Jul20**

CALIBRATION CERTIFICATE			
Object	D2600V2 - SN:1012		
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz		
Calibration date:	July 21, 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)			
<b>Primary Standards</b>	<b>ID #</b>	<b>Cal Date (Certificate No.)</b>	<b>Scheduled Calibration</b>
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-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
<b>Secondary Standards</b>	<b>ID #</b>	<b>Check Date (in house)</b>	<b>Scheduled Check</b>
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-19)	In house check: Oct-20
Calibrated by:	Name Jeffrey Katzman	Function Laboratory Technician	Signature 
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature 
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			Issued: July 23, 2020

Certificate No: D2600V2-1012\_Jul20

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



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

Accreditation No.: **SCS 0108**

**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:**

- 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
- 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
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- 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%.

**Measurement Conditions**

DASYS 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	2600 MHz $\pm$ 1 MHz	

**Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.9 $\pm$ 6 %	2.01 mho/m $\pm$ 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	14.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>57.0 W/kg <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>25.3 W/kg <math>\pm</math> 16.5 % (k=2)</b>

**Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	51.0 $\pm$ 6 %	2.20 mho/m $\pm$ 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	14.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>55.1 W/kg <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	<b>24.6 W/kg <math>\pm</math> 16.5 % (k=2)</b>

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

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	47.0 $\Omega$ - 5.6 $j\Omega$
Return Loss	- 23.7 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	44.6 $\Omega$ - 4.4 $j\Omega$
Return Loss	- 22.7 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.152 ns
----------------------------------	----------

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

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

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

**Additional EUT Data**

Manufactured by	SPEAG
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**DASY5 Validation Report for Head TSL**

Date: 21.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1012**

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

Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.01$  S/m;  $\epsilon_r = 37.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.54, 7.54, 7.54) @ 2600 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- 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=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**

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

Reference Value = 121.2 V/m; Power Drift = -0.04 dB

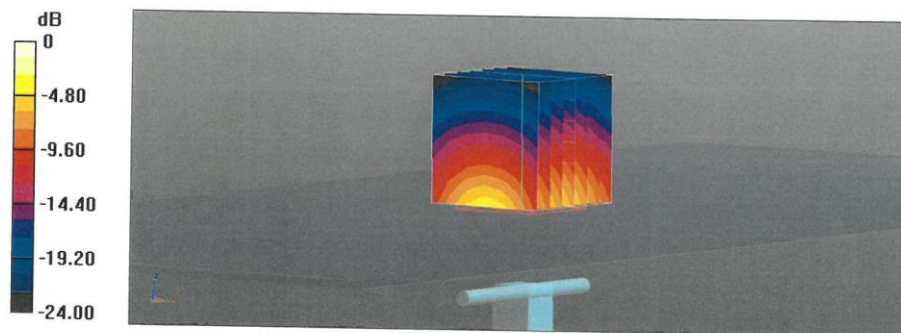
Peak SAR (extrapolated) = 29.3 W/kg

**SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.40 W/kg**

Smallest distance from peaks to all points 3 dB below = 8.9 mm

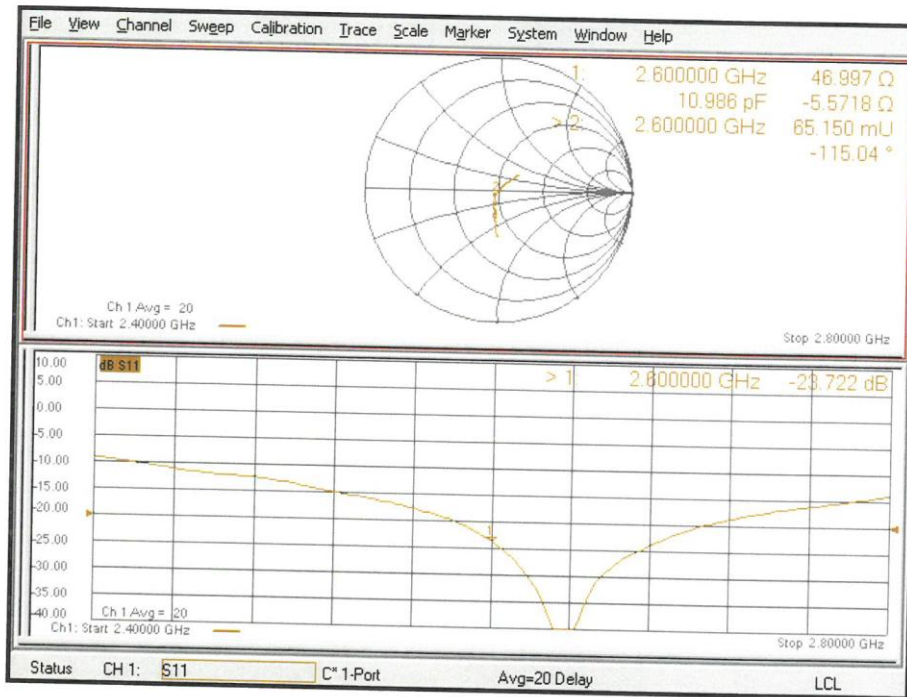
Ratio of SAR at M2 to SAR at M1 = 49.4%

Maximum value of SAR (measured) = 24.4 W/kg



0 dB = 24.4 W/kg = 13.87 dBW/kg

Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body TSL**

Date: 21.07.2020

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN:1012**

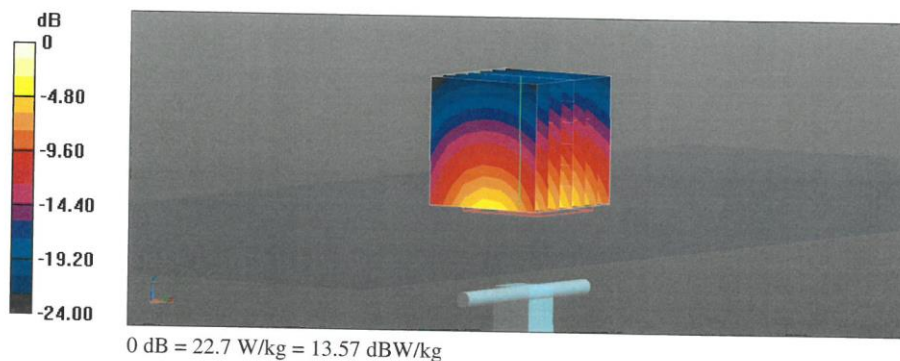
Communication System: UID 0 - CW; Frequency: 2600 MHz  
 Medium parameters used:  $f = 2600$  MHz;  $\sigma = 2.20$  S/m;  $\epsilon_r = 51.0$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: Flat Section  
 Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

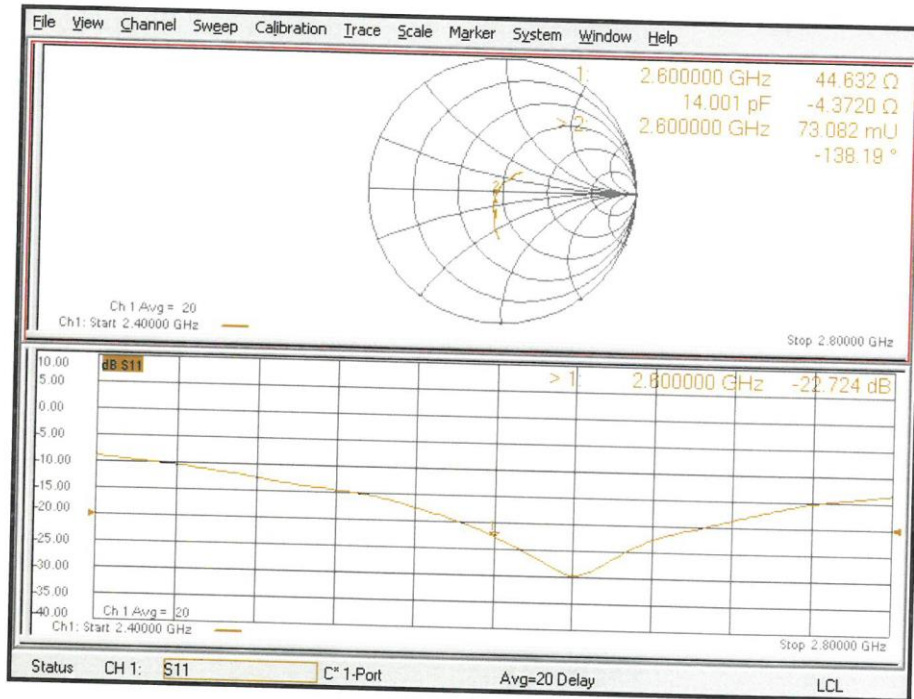
- Probe: EX3DV4 - SN7349; ConvF(7.68, 7.68, 7.68) @ 2600 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

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

Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm  
 Reference Value = 110.5 V/m; Power Drift = -0.09 dB  
 Peak SAR (extrapolated) = 28.0 W/kg  
**SAR(1 g) = 14.0 W/kg; SAR(10 g) = 6.20 W/kg**  
 Smallest distance from peaks to all points 3 dB below = 8 mm  
 Ratio of SAR at M2 to SAR at M1 = 50.8%  
 Maximum value of SAR (measured) = 22.7 W/kg



Impedance Measurement Plot for Body TSL





## ANNEX I SPOT CHECK

### I.1 Dielectric Performance and System Validation

**Table I.1-1: Dielectric Performance of Head Tissue Simulating Liquid**

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity $\epsilon$	Drift (%)	Conductivity $\sigma$ (S/m)	Drift (%)
2021/5/18	Head	750 MHz	45.04	7.39	0.809	-9.10
2021/5/8	Head	835 MHz	43.59	5.04	0.8689	-3.46
2021/5/7	Head	1750 MHz	41.35	3.17	1.44	5.11

**Table I.1-2: System Validation of Head**

Measurement Date (yyyy-mm-dd)	Frequency	Target value (W/kg)		Measured value(W/kg)		Deviation	
		10 g Average	1 g Average	10 g Average	1 g Average	10 g Average	1 g Average
2021/5/18	750 MHz	5.53	8.47	5.56	8.36	0.54%	-1.30%
2021/5/8	835 MHz	6.25	9.60	6.20	9.40	-0.80%	-2.08%
2021/5/7	1750 MHz	19.1	36.5	19.2	36.2	0.73%	-0.93%

### I.2 New frequency band

#### I.2.1 Conducted power of selected case

**Table I.2.1-1: Maximum Power Reduction (MPR) for LTE- Normal Power**

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]						MPR (dB)
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	2

**Table I.2.1-2: The tune up for LTE**

Band	Tune up
LTE Band 13	23.5

Band 13				
Bandwidth (MHz)	RB allocation	Frequency (MHz)	QPSK	16QAM
	RB offset (Start RB)		Actual output power (dBm)	Actual output power (dBm)
5 MHz	1RB High (24)	784.5	21.95	20.73
		782	22.01	20.51
		779.5	21.77	21.03
	1RB Middle (12)	784.5	22.50	20.80
		782	22.40	20.50
		779.5	22.12	20.67
	1RB Low (0)	784.5	22.25	20.68
		782	22.07	20.68
		779.5	21.76	20.55
	12RB High (13)	784.5	21.06	20.09
		782	21.11	20.03
		779.5	20.97	20.05
	12RB Middle (6)	784.5	21.23	20.19
		782	21.10	19.83
		779.5	21.05	20.01
	12RB Low (0)	784.5	21.10	20.13
		782	21.01	19.95
		779.5	21.02	20.02
	25RB (0)	784.5	21.16	20.14
		782	21.01	20.18
		779.5	20.99	19.99
10 MHz	1RB High (49)	782	22.23	21.31
	1RB Middle (24)	782	22.36	21.45
	1RB Low (0)	782	22.01	21.04
	25RB High (25)	782	21.19	20.07
	25RB Middle (12)	782	21.07	19.98
	25RB Low (0)	782	20.96	19.89
	50RB (0)	782	21.05	19.97

**I.2.2 SAR Test Result**

**Table I.2.2-1: SAR Values (LTE Band13 - Head)**

Frequency		Ambient Temperature: 22.9°C					Liquid Temperature: 22.5°C					
Ch.	MHz	Mode	Side	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)
23230	782	1RB_Mid	Left	Touch	/	22.36	23.50	0.305	<b>0.40</b>	0.462	<b>0.60</b>	-0.05
23230	782	1RB_Mid	Left	Tilt	/	22.36	23.50	0.173	<b>0.22</b>	0.226	<b>0.29</b>	-0.08
23230	782	1RB_Mid	Right	Touch	Fig.1	22.36	23.50	0.355	<b>0.46</b>	0.554	<b>0.72</b>	-0.18
23230	782	1RB_Mid	Right	Tilt	/	22.36	23.50	0.197	<b>0.26</b>	0.256	<b>0.33</b>	-0.15
23230	782	25RB_High	Left	Touch	/	21.19	22.50	0.232	<b>0.31</b>	0.351	<b>0.47</b>	0.12
23230	782	25RB_High	Left	Tilt	/	21.19	22.50	0.136	<b>0.18</b>	0.178	<b>0.24</b>	0.15
23230	782	25RB_High	Right	Touch	/	21.19	22.50	0.291	<b>0.39</b>	0.452	<b>0.61</b>	-0.03
23230	782	25RB_High	Right	Tilt	/	21.19	22.50	0.155	<b>0.21</b>	0.201	<b>0.27</b>	-0.10

Note1: The LTE mode is QPSK\_10MHz.

**Table 1 I.2.2-2: SAR Values (LTE Band13 - Body)**

Frequency		Ambient Temperature: 22.9°C					Liquid Temperature: 22.5°C					
Ch.	MHz	Mode	Test Position	Figure No.	Conducted Power (dBm)	Max. tune-up Power (dBm)	Measured SAR(10g) (W/kg)	Reported SAR(10g) (W/kg)	Measured SAR(1g) (W/kg)	Reported SAR(1g) (W/kg)	Power Drift (dB)	
23230	782	1RB_Mid	Front	/	22.36	23.50	0.142	<b>0.18</b>	0.181	<b>0.24</b>	-0.15	
23230	782	1RB_Mid	Rear	/	22.36	23.50	0.304	<b>0.40</b>	0.427	<b>0.56</b>	-0.12	
23230	782	1RB_Mid	Rear unfold	Fig.2	22.36	23.50	0.412	<b>0.54</b>	0.597	<b>0.78</b>	-0.12	
23230	782	1RB_Mid	Left	/	22.36	23.50	0.080	<b>0.10</b>	0.110	<b>0.14</b>	0.13	
23230	782	1RB_Mid	Right	/	22.36	23.50	0.227	<b>0.30</b>	0.313	<b>0.41</b>	-0.15	
23230	782	1RB_Mid	Bottom	/	22.36	23.50	0.060	<b>0.08</b>	0.095	<b>0.12</b>	0.13	
23230	782	25RB_High	Front	/	21.19	22.50	0.108	<b>0.15</b>	0.138	<b>0.19</b>	0.14	
23230	782	25RB_High	Rear	/	21.19	22.50	0.221	<b>0.30</b>	0.309	<b>0.42</b>	0.19	
23230	782	25RB_High	Rear unfold	/	21.19	22.50	0.284	<b>0.38</b>	0.414	<b>0.56</b>	-0.06	
23230	782	25RB_High	Left	/	21.19	22.50	0.056	<b>0.08</b>	0.078	<b>0.11</b>	-0.10	
23230	782	25RB_High	Right	/	21.19	22.50	0.175	<b>0.24</b>	0.244	<b>0.33</b>	0.12	
23230	782	25RB_High	Bottom	/	21.19	22.50	0.049	<b>0.07</b>	0.079	<b>0.11</b>	-0.09	

Note1: The distance between the EUT and the phantom bottom is 10mm

Note2: The LTE mode is QPSK\_10MHz.

### I.3 Spot Check

#### I.3.1 Conducted power of selected case

Table I.3.1-1: The conducted Power for WCDMA

Item	band	FDDV result			Tune up
	ARFCN	4233 (846.6MHz)	4182 (836.4MHz)	4132 (826.4MHz)	
WCDMA	\	22.26	/	/	24.00
Item	band	FDDIV result			
	ARFCN	1513 (1752.6MHz)	1412 (1732.4MHz)	1312 (1712.4MHz)	
WCDMA	\	/	/	22.98	24.00

#### I.3.2 Measurement results

Test Position	Phantom position L/R/F	Frequency Band	Channel Number	Frequency (MHz)	Test setup	EUT Measured Power (dBm)	Tune up (dBm)	Measured SAR 10g (W/kg)	Calculated SAR 10g (W/kg)	Measured SAR 1g (W/kg)	Calculated SAR 1g (W/kg)	Power Drift
Cheek	R	WCDMA 850	4233	846.6		22.26	24	0.234	0.35	0.378	0.56	-0.08
Body	F	WCDMA1700	1312	1712.4	Rear 15mm	22.98	24	0.494	0.62	0.867	1.10	-0.02

#### I.3.3 Reported SAR Comparison

Table I.3.3-1: Highest Reported SAR (1g)

Exposure Configuration	Technology Band	Reported SAR 10g(W/kg) Original	Reported SAR 10g(W/kg) Spot check
Head (Separation Distance 0mm)	GSM 850	0.54	/
	PCS 1900	0.29	/
	UMTS FDD 2	0.61	/
	UMTS FDD 4	0.61	/
	UMTS FDD 5	0.78	0.56
	LTE Band 12	0.61	/
	LTE Band 25	0.49	/
	LTE Band 26	0.65	/
	LTE Band 41 PC2	0.37	/
	LTE Band 41 PC3	0.26	/
	LTE Band 66	0.44	/
	LTE Band 71	0.47	/
	WLAN 2.4 GHz	0.64	/
Hotspot (Separation Distance 10mm)	GSM 850	0.75	/
	PCS 1900	1.24	/
	UMTS FDD 2	1.13	/
	UMTS FDD 4	1.23	/
	UMTS FDD 5	0.97	/
	LTE Band 12	0.77	/
	LTE Band 25	1.17	/
	LTE Band 26	0.66	/
	LTE Band 41 PC2	1.03	/
	LTE Band 41 PC3	0.72	/
	LTE Band 66	1.13	/
	LTE Band 71	0.69	/
	WLAN 2.4 GHz	0.23	/

Body-worn (Separation Distance 15mm)	UMTS FDD 2	1.25	/
	UMTS FDD 4	<b>1.27</b>	1.10
	LTE Band 25	1.01	/
	LTE Band 66	1.07	/

**Note: The spot check results marked by blue are larger than the original result. So they replace the original result and others are shared.**

#### I.4 List of Main Instruments

**Table I.4-1: List of Main Instruments**

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	E5071C	MY46110673	January 14, 2021	One year
02	Power meter	NRVD	102083	October 23, 2020	One year
03	Power sensor	NRV-Z5	100542		
04	Signal Generator	E4438C	MY49071430	February 1, 2021	One Year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	CMW500	159890	January 25 2021	One year
07	E-field Probe	SPEAG EX3DV4	7600	November 30, 2020	One year
08	E-field Probe	SPEAG EX3DV4	7548	June 16, 2020	One year
09	DAE	SPEAG DAE4	1525	September 2, 2020	One year
10	DAE	SPEAG DAE4	1331	September 2, 2020	One year
11	Dipole Validation Kit	SPEAG D750V3	1017	July 24,2020	One year
12	Dipole Validation Kit	SPEAG D835V2	4d069	July 24,,2020	One year
13	Dipole Validation Kit	SPEAG D1750V2	1003	July 24, 2020	One year

## I.5 GRAPH RESULTS

### WCDMA850-BV\_CH4233 Right Cheek

Date: 5/8/2021

Electronics: DAE4 Sn1525

Medium: H835

Medium parameters used (interpolated):  $f = 846.6$  MHz;  $\sigma = 0.874$  S/m;  $\epsilon_r = 43.54$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3oC      Liquid Temperature: 22.5oC

Communication System: WCDMA850(B5) Frequency: 846.6 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7600 ConvF(10.88, 10.88, 10.88)

Configuration/Right Cheek/Area Scan (81x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.524 W/kg

Configuration/Right Cheek/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.051 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.700 W/kg

SAR(1 g) = 0.378 W/kg; SAR(10 g) = 0.234 W/kg

Maximum value of SAR (measured) = 0.584 W/kg

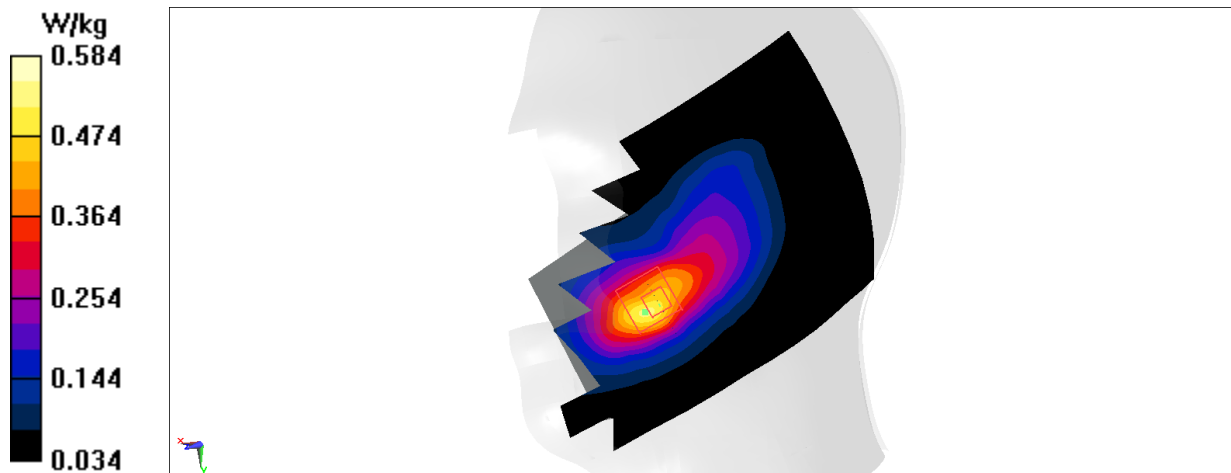


Fig I.5.1

**WCDMA1700-BIV\_CH1312 Rear**

Date/Time: 5/7/2021

Electronics: DAE4 Sn1331

Medium: H1750

Medium parameters used (interpolated):  $f = 1712.4$  MHz;  $\sigma = 1.418$  S/m;  $\epsilon_r = 41.471$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3oC      Liquid Temperature: 22.5oC

Communication System: WCDMA1700(B4) Frequency: 1712.4 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7548 ConvF(8.24, 8.24, 8.24)

Area Scan (81x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.35 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.08 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.54 W/kg

SAR(1 g) = 0.867 W/kg; SAR(10 g) = 0.494 W/kg

Maximum value of SAR (measured) = 1.28 W/kg

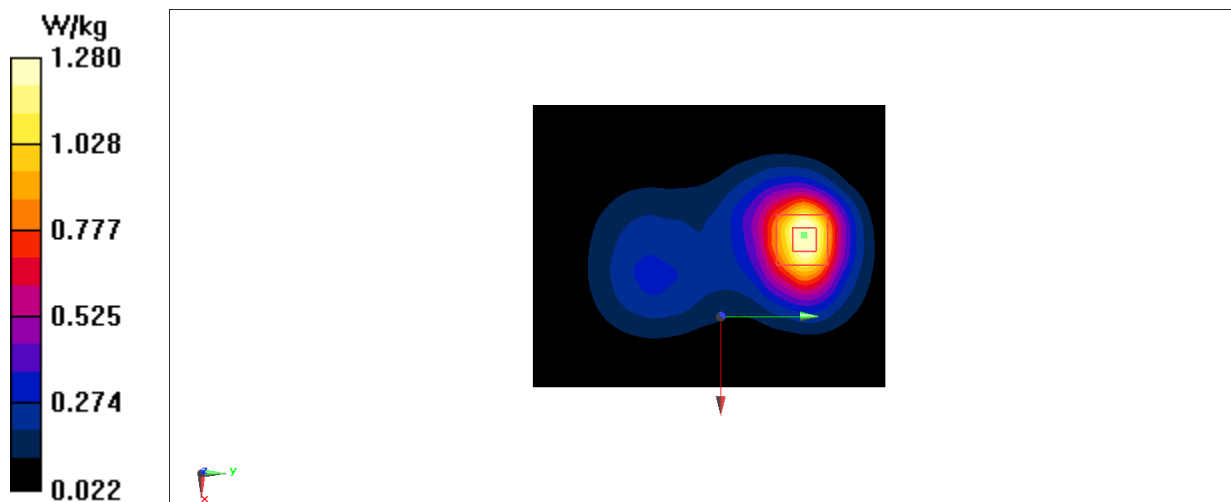


Fig I.5.2

**LTE Band13\_CH23230 Right Cheek**

Date: 5/18/2021

Electronics: DAE4 Sn1525

Medium: H750

Medium parameters used (interpolated):  $f = 782 \text{ MHz}$ ;  $\sigma = 0.823 \text{ S/m}$ ;  $\epsilon_r = 44.917$ ;  $\rho = 1000 \text{ kg/m}^3$

Ambient Temperature: 23.3oC      Liquid Temperature: 22.5oC

Communication System: LTE Band13    Frequency: 782 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7600 ConvF(10.88, 10.88, 10.88)

Area Scan (71x131x1): Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.713 W/kg

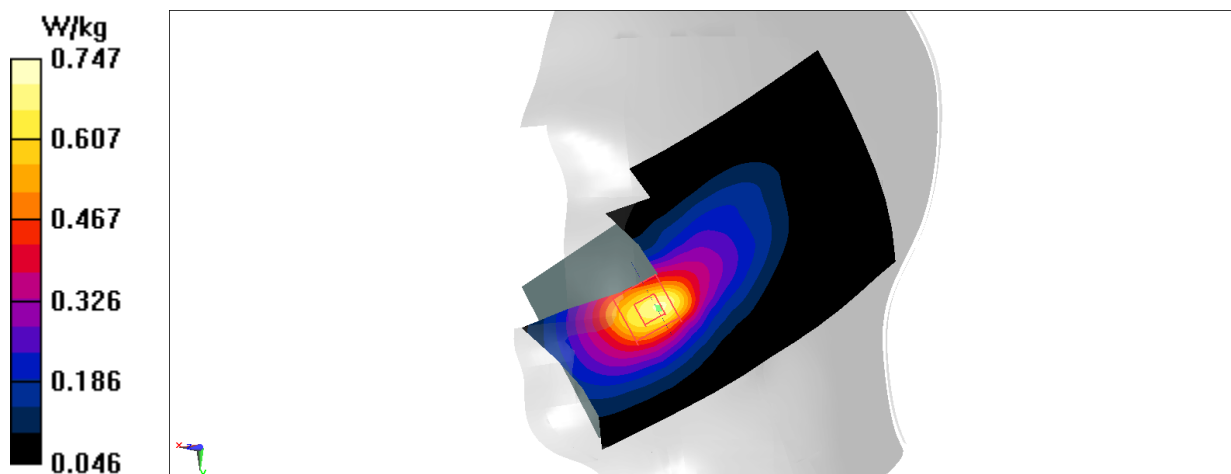
Zoom Scan (6x6x7)/Cube 0: Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 6.879 V/m; Power Drift = -0.18 dB

Peak SAR (extrapolated) = 0.881 W/kg

SAR(1 g) = 0.554 W/kg; SAR(10 g) = 0.355 W/kg

Maximum value of SAR (measured) = 0.747 W/kg



**Fig I.5.3**



**LTE Band13\_CH23230 Rear unfold**

Date: 5/18/2021

Electronics: DAE4 Sn1525

Medium: H750

Medium parameters used (interpolated):  $f = 782 \text{ MHz}$ ;  $\sigma = 0.823 \text{ S/m}$ ;  $\epsilon_r = 44.917$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Ambient Temperature: 23.3oC      Liquid Temperature: 22.5oC

Communication System: LTE Band13    Frequency: 782 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7600 ConvF(10.88, 10.88, 10.88)

Area Scan (71x131x1): Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$ 

Maximum value of SAR (interpolated) = 0.841 W/kg

Zoom Scan (6x6x7)/Cube 0: Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$ 

Reference Value = 31.86 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.883 W/kg

SAR(1 g) = 0.597 W/kg; SAR(10 g) = 0.412 W/kg

Maximum value of SAR (measured) = 0.778 W/kg

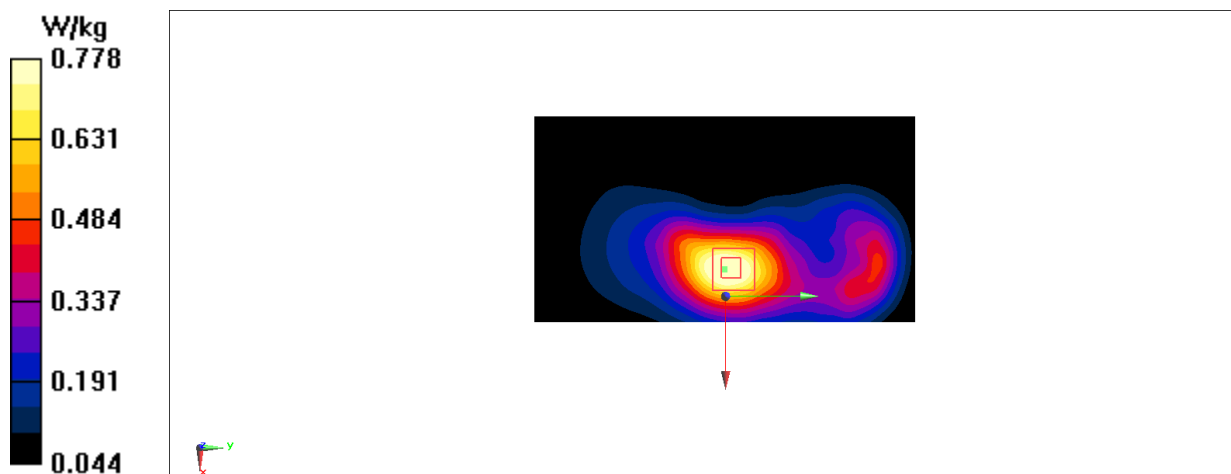


Fig I.5.4

## I.6 System Verification Results

### 750 MHz

Date: 5/18/2021

Electronics: DAE4 Sn1525

Medium: H750

Medium parameters used:  $f = 750$  MHz;  $\sigma = 0.809$  S/m;  $\epsilon_r = 45.039$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.3oC      Liquid Temperature: 22.5oC

Communication System: Frequency: 750 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7600 ConvF(10.88, 10.88, 10.88)

Area Scan (51x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 44.87 V/m; Power Drift = 0.16 dB

Fast SAR: SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.45 W/kg

Maximum value of SAR (interpolated) = 2.91 W/kg

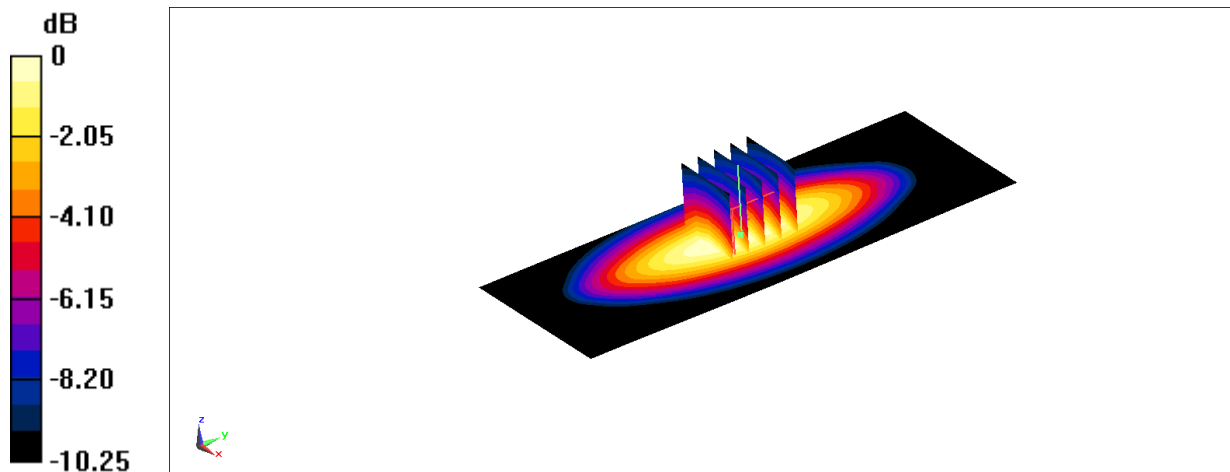
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 44.87 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 3.34 W/kg

SAR(1 g) = 2.09 W/kg; SAR(10 g) = 1.39 W/kg

Maximum value of SAR (measured) = 2.84 W/kg



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

**Fig.I.6.1 validation 750 MHz 250Mw**

## 835 MHz

Date: 5/8/2021

Electronics: DAE4 Sn1525

Medium: H835

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.869$  S/m;  $\epsilon_r = 43.586$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.30C

Liquid Temperature: 22.50C

Communication System: Frequency: 835 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7600 ConvF(10.88, 10.88, 10.88)

Area Scan (51x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 47.60 V/m; Power Drift = 0.15 dB

Fast SAR: SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.53 W/kg

Maximum value of SAR (interpolated) = 3.01 W/kg

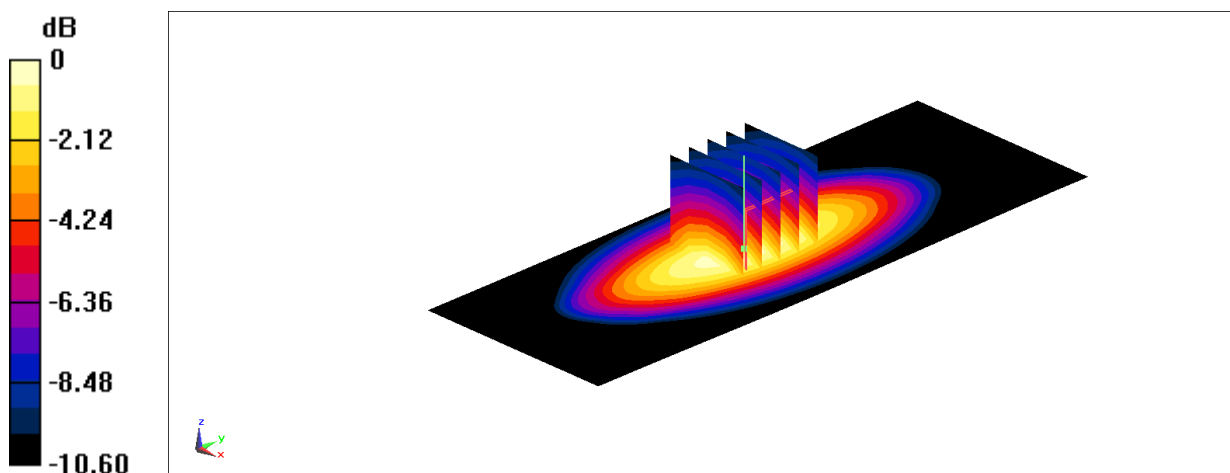
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 47.60 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 3.67 W/kg

SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.55 W/kg

Maximum value of SAR (measured) = 3.13 W/kg



0 dB = 3.13 W/kg = 4.96 dBW/kg

**Fig.I.6.2 validation 835 MHz 250Mw**

## 1750 MHz

Date/Time: 5/7/2021 9:09:44 AM

Electronics: DAE4 Sn1331

Medium: H1750

Medium parameters used:  $f = 1750$  MHz;  $\sigma = 1.44$  S/m;  $\epsilon_r = 41.35$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 23.30C

Liquid Temperature: 22.50C

Communication System: Frequency: 1750 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7548 ConvF(8.24, 8.24, 8.24)

Area Scan (51x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 102.0 V/m; Power Drift = -0.06 dB

Fast SAR: SAR(1 g) = 9.25 W/kg; SAR(10 g) = 4.89 W/kg

Maximum value of SAR (interpolated) = 13.8 W/kg

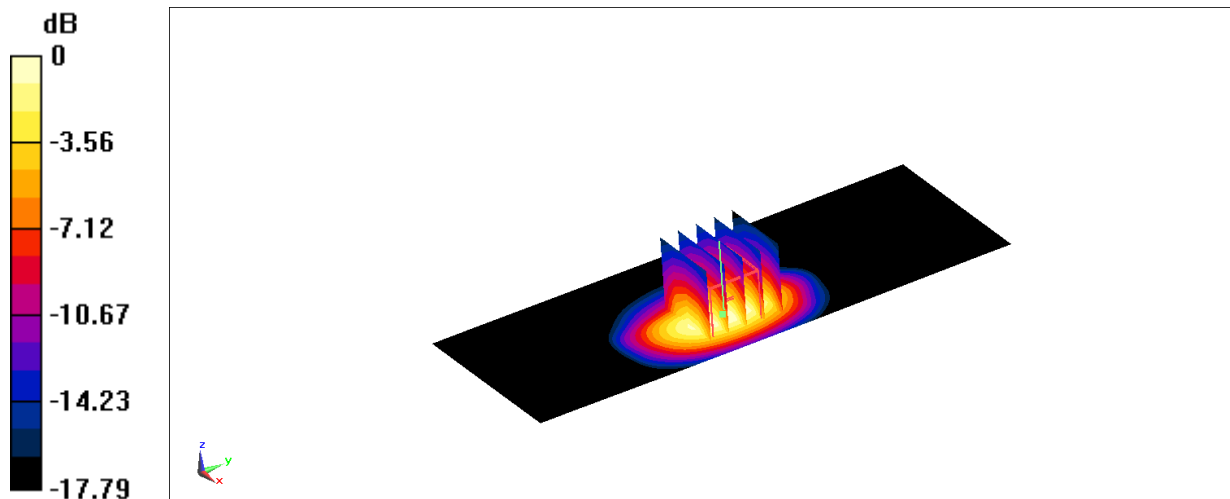
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 102.0 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 16.5 W/kg

SAR(1 g) = 9.04 W/kg; SAR(10 g) = 4.81 W/kg

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



0 dB = 13.0 W/kg = 11.14 dBW/kg



No.I21Z60782-SEM03

### I.7 Probe Calibration Certificate

#### Probe 7600 Calibration Certificate



中国认可  
国际互认  
校准  
CALIBRATION  
CNAS L0570

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China  
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504  
E-mail: cttl@chinattl.com <http://www.chinattl.cn>

Client **CTTL** Certificate No: **Z20-60421**

CALIBRATION CERTIFICATE			
Object	EX3DV4 - SN : 7600		
Calibration Procedure(s)	FF-Z11-004-02 Calibration Procedures for Dosimetric E-field Probes		
Calibration date:	November 30, 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(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Power sensor NRP-Z91	101547	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Power sensor NRP-Z91	101548	16-Jun-20(CTTL, No.J20X04344)	Jun-21
Reference 10dBAttenuator	18N50W-10dB	10-Feb-20(CTTL, No.J20X00525)	Feb-22
Reference 20dBAttenuator	18N50W-20dB	10-Feb-20(CTTL, No.J20X00526)	Feb-22
Reference Probe EX3DV4	SN 7307	29-May-20(SPEAG, No.EX3-7307_May20)	May-21
DAE4	SN 1556	4-Feb-20(SPEAG, No.DAE4-1556_Feb20)	Feb-21
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGenerator MG3700A	6201052605	23-Jun-20(CTTL, No.J20X04343)	Jun-21
Network Analyzer E5071C	MY46110673	10-Feb-20(CTTL, No.J20X00515)	Feb-21
Calibrated by:	Name Yu Zongying	Function SAR Test Engineer	Signature 
Reviewed by:	Name Lin Hao	Function SAR Test Engineer	Signature 
Approved by:	Name Qi Dianyuan	Function SAR Project Leader	Signature 
Issued: December 02, 2020			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

Certificate No: Z20-60421

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