2600 MHz Dipole Calibration Certificate

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

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Accreditation No.: SCS 0108

Client CTTL (Auden) **Certificate No: D2600V2-1012_Jul21**

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 26, 2021

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	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: BH9394 (20k)	09-Apr-21 (No. 217-03343)	Apr-22
Type-N mismatch combination	SN: 310982 / 06327	09-Apr-21 (No. 217-03344)	Apr-22
Reference Probe EX3DV4	SN: 7349	28-Dec-20 (No. EX3-7349_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 26, 2021

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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:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.3 ± 6 %	2.05 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**57.1 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.48 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.5 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.8 Ω - 5.7 jΩ
Return Loss	- 24.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 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

DASY5 Validation Report for Head TSL

Date: 26.07.2021

Test Laboratory: SPEAG, Zurich, Switzerland

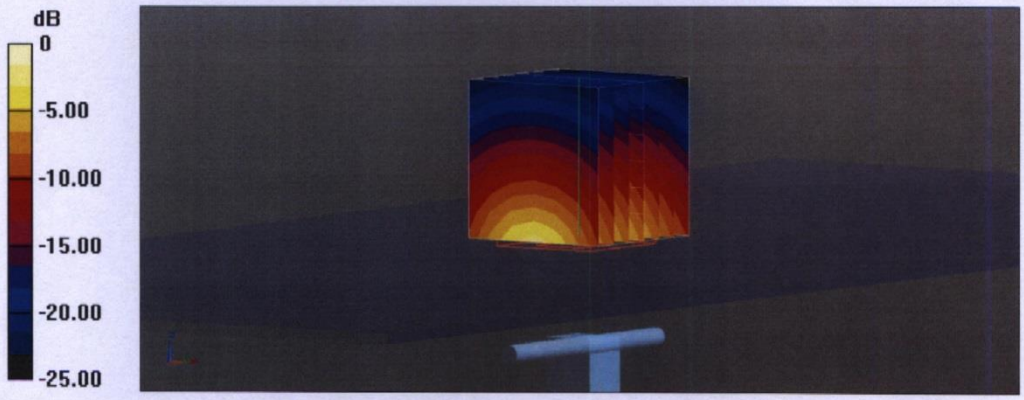
DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1012

Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.05 S/m; ε_r = 37.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

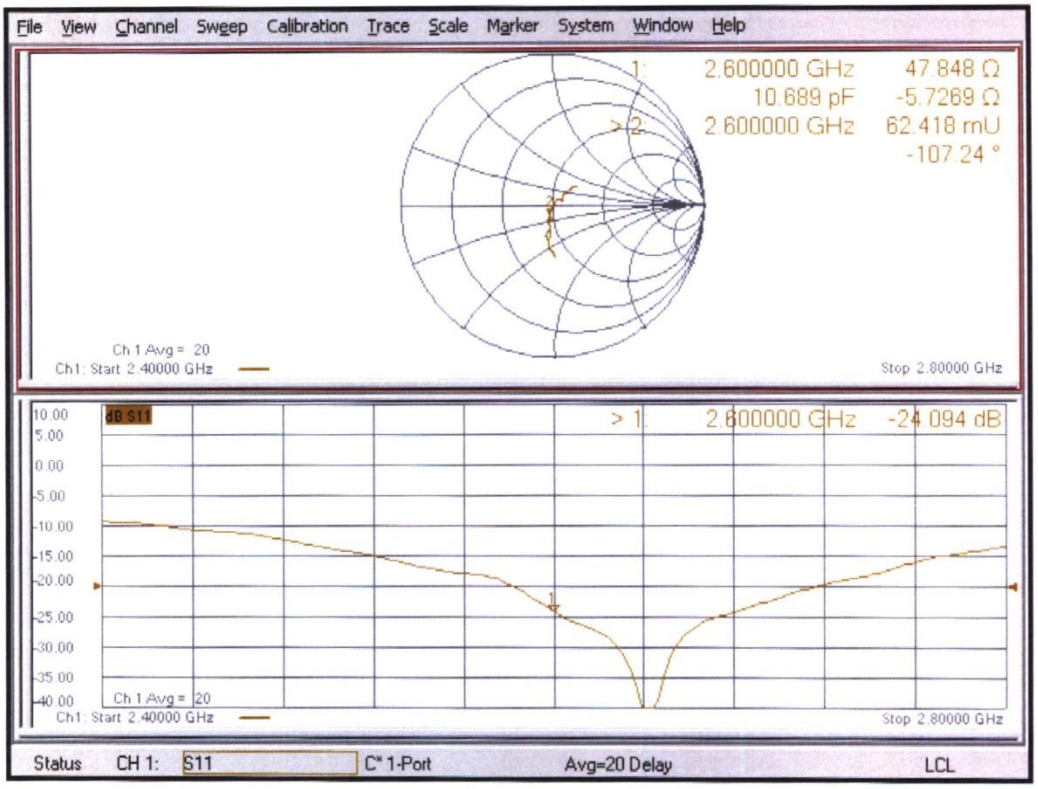
- Probe: EX3DV4 - SN7349; ConvF(7.84, 7.84, 7.84) @ 2600 MHz; Calibrated: 28.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 118.6 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 29.5 W/kg
SAR(1 g) = 14.7 W/kg; SAR(10 g) = 6.48 W/kg
Smallest distance from peaks to all points 3 dB below = 8.9 mm
Ratio of SAR at M2 to SAR at M1 = 49.6%
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



5 GHz Dipole Calibration Certificate

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Accreditation No.: SCS 0108

Client CTTL
Beijing

Certificate No. D5GHzV2-1060_Jun23

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN:1060
Calibration procedure(s)	QA CAL-22.v7 Calibration Procedure for SAR Validation Sources between 3-10 GHz
Calibration date:	June 19, 2023

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 NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 3503	07-Mar-23 (No. EX3-3503_Mar23)	Mar-24
DAE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	i.A.

Issued: June 20, 2023

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

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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:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The source is mounted in a touch configuration below the center marking of the flat phantom.
- *Return Loss:* This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5250 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	4.53 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.92 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	4.60 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.98 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.5 ± 6 %	4.67 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.4 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**85.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.42 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.3 ± 6 %	4.97 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ± 6 %	5.08 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.7 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.0 ± 6 %	5.11 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	48.6 Ω - 5.3 jΩ
Return Loss	- 25.1 dB

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	47.7 Ω - 4.1 jΩ
Return Loss	- 26.2 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	46.9 Ω - 2.2 jΩ
Return Loss	- 28.0 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	50.6 Ω - 4.0 jΩ
Return Loss	- 28.0 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.6 Ω + 1.2 jΩ
Return Loss	- 28.6 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	51.4 Ω - 0.3 jΩ
Return Loss	- 37.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	51.2 Ω - 2.2 jΩ
Return Loss	- 32.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 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

DASY5 Validation Report for Head TSL

Date: 19.06.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1060

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5250 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.53 S/m; ε_r = 35.5; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5250 MHz; σ = 4.60 S/m; ε_r = 35.5; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5300 MHz; σ = 4.67 S/m; ε_r = 35.5; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5500 MHz; σ = 4.89 S/m; ε_r = 35.4; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 4.97 S/m; ε_r = 35.3; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5750 MHz; σ = 5.08 S/m; ε_r = 35.1; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5800 MHz; σ = 5.11 S/m; ε_r = 35.0; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.8, 5.8, 5.8) @ 5200 MHz, ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.49, 5.49, 5.49) @ 5300 MHz, ConvF(5.25, 5.25, 5.25) @ 5500 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz, ConvF(5.01, 5.01, 5.01) @ 5800 MHz; Calibrated: 07.03.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 76.08 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 27.3 W/kg
SAR(1 g) = 7.92 W/kg; SAR(10 g) = 2.27 W/kg
Smallest distance from peaks to all points 3 dB below = 6.9 mm
Ratio of SAR at M2 to SAR at M1 = 70.9%
Maximum value of SAR (measured) = 18.0 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 75.90 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 26.7 W/kg
SAR(1 g) = 7.98 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 71.8%
Maximum value of SAR (measured) = 18.0 W/kg

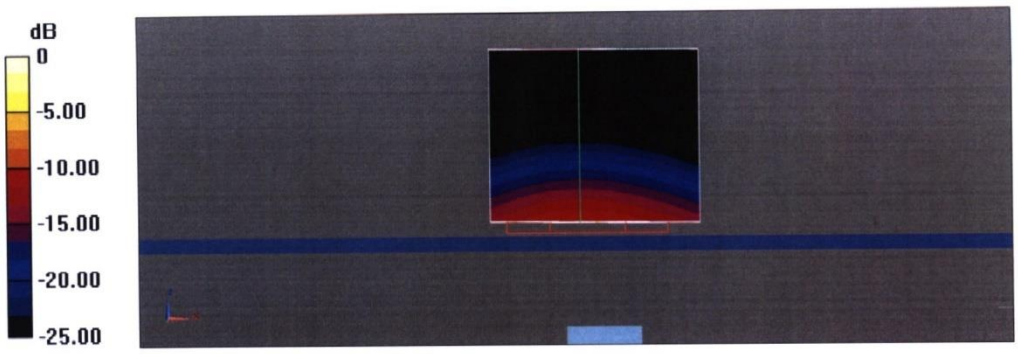
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 76.02 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 28.5 W/kg
SAR(1 g) = 8.24 W/kg; SAR(10 g) = 2.35 W/kg
Smallest distance from peaks to all points 3 dB below = 6.8 mm
Ratio of SAR at M2 to SAR at M1 = 70.8%
Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 75.86 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 32.2 W/kg
SAR(1 g) = 8.56 W/kg; SAR(10 g) = 2.42 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 67.3%
Maximum value of SAR (measured) = 20.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 76.37 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 30.3 W/kg
SAR(1 g) = 8.38 W/kg; SAR(10 g) = 2.38 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 68.5%
Maximum value of SAR (measured) = 19.6 W/kg

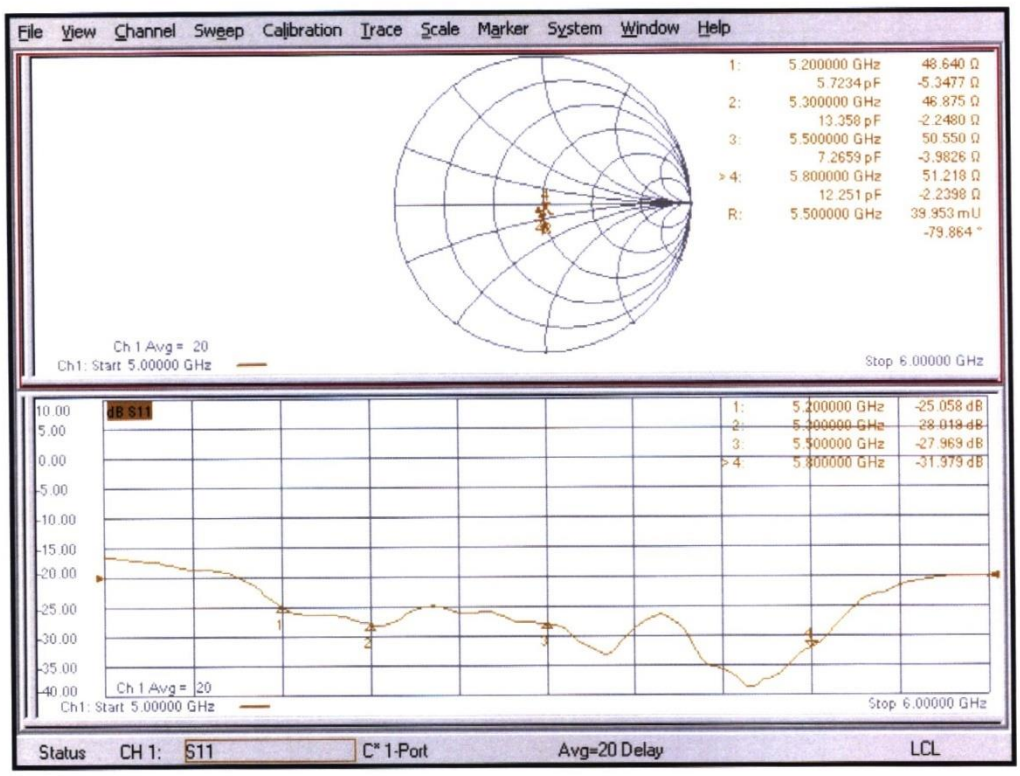
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.46 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 30.9 W/kg
SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.28 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 66.6%
Maximum value of SAR (measured) = 19.3 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 74.09 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 31.5 W/kg
SAR(1 g) = 8.22 W/kg; SAR(10 g) = 2.32 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 66.5%
Maximum value of SAR (measured) = 19.6 W/kg

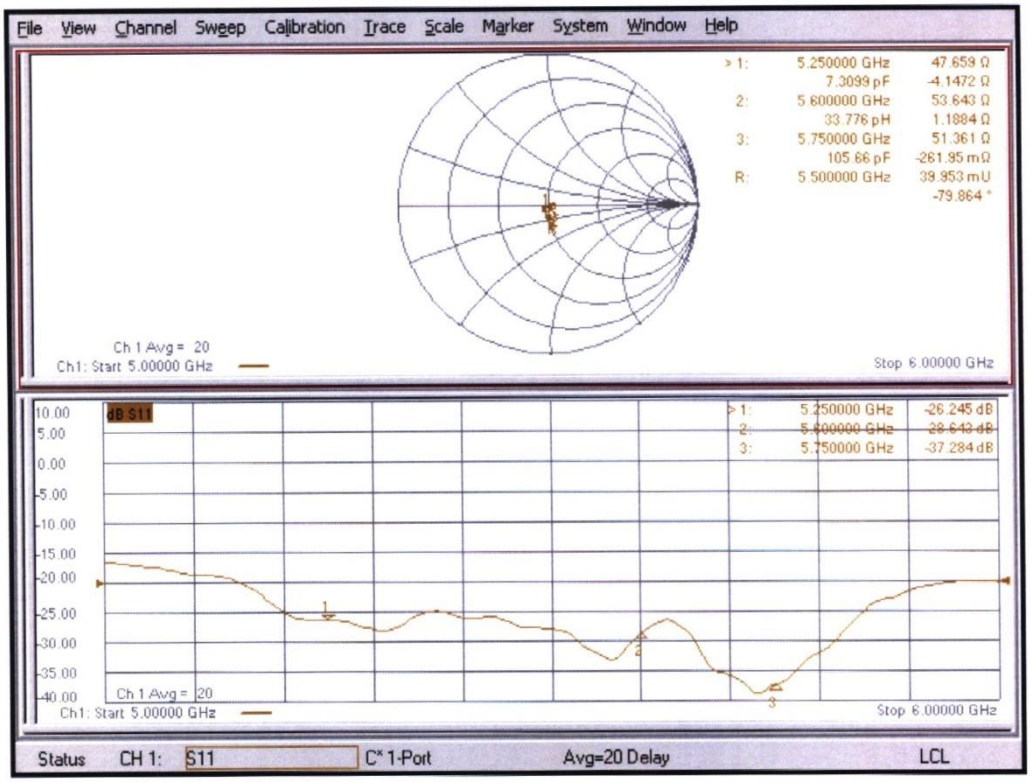


0 dB = 20.1 W/kg = 13.03 dBW/kg

Impedance Measurement Plot for Head TSL (5200, 5300, 5500, 5800 MHz)



Impedance Measurement Plot for Head TSL (5250, 5600, 5750 MHz)



ANNEX H New band of LTE B26

H.1 Dielectric Performance and System Validation

Table H.1-1: Dielectric Performance of Tissue Simulating Liquid

Measurement Date (yyyy-mm-dd)	Type	Frequency	Permittivity ε	Drift (%)	Conductivity σ (S/m)	Drift (%)
2023/11/28	Head	835 MHz	43.45	4.70%	0.923	2.56%

Table H.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
2023/11/28	835 MHz	6.25	9.62	6.28	9.84	0.48%	2.29%

H.2 Measurement result

H.2.1 Conducted Output Power

BANDWIDTH	Number of RBs	Frequency	QPSK	16QAM	64QAM
1.4MHz	1RB-High (5)	848.3 (27033)	24.01	22.98	21.97
		831.5 (26865)	23.64	22.80	21.70
		814.7 (26697)	23.77	22.98	21.91
	1RB-Middle (3)	848.3 (27033)	24.04	23.11	22.02
		831.5 (26865)	23.75	22.94	21.82
		814.7 (26697)	23.89	23.20	22.01
	1RB-Low (0)	848.3 (27033)	23.90	22.99	22.02
		831.5 (26865)	23.64	22.86	21.81
		814.7 (26697)	23.78	23.03	21.93
	3RB-High (3)	848.3 (27033)	24.10	22.83	21.93
		831.5 (26865)	23.73	22.59	21.77
		814.7 (26697)	23.85	22.83	21.88
	3RB-Middle (1)	848.3 (27033)	24.11	22.87	22.04
		831.5 (26865)	23.78	22.65	21.79
		814.7 (26697)	23.94	22.84	21.94
	3RB-Low (0)	848.3 (27033)	24.05	22.89	21.95
		831.5 (26865)	23.73	22.63	21.78
		814.7 (26697)	23.87	22.80	21.96
	6RB (0)	848.3 (27033)	23.13	22.05	20.97
		831.5 (26865)	22.76	21.80	20.77
		814.7 (26697)	22.91	21.91	20.88
3MHz	1RB-High (14)	847.5 (27025)	24.09	23.07	22.09
		831.5 (26865)	23.71	22.91	21.86
		815.5 (26705)	23.78	22.91	21.93
	1RB-Middle (7)	847.5 (27025)	24.13	23.27	22.23
		831.5 (26865)	23.87	23.03	21.98
		815.5 (26705)	23.84	23.05	21.95
	1RB-Low (0)	847.5 (27025)	23.90	23.09	22.00
		831.5 (26865)	23.73	22.86	21.91
		815.5 (26705)	23.75	22.96	21.86
	8RB-High (7)	847.5 (27025)	23.07	22.04	21.03
		831.5 (26865)	22.77	21.81	20.85
		815.5 (26705)	22.80	21.79	20.84
	8RB-Middle (4)	847.5 (27025)	23.06	22.02	21.00
		831.5 (26865)	22.80	21.83	20.86
		815.5 (26705)	22.84	21.81	20.88
	8RB-Low (0)	847.5 (27025)	22.96	21.98	20.96
		831.5 (26865)	22.76	21.79	20.84
		815.5 (26705)	22.75	21.79	20.85
	15RB (0)	847.5 (27025)	23.03	21.95	20.99
		831.5 (26865)	22.78	21.76	20.79
		815.5 (26705)	22.80	21.79	20.81
5MHz	1RB-High (24)	846.5 (27015)	23.99	22.97	21.90
		831.5 (26865)	23.66	22.94	21.80
		816.5 (26715)	23.78	22.94	21.91
	1RB-Middle (12)	846.5 (27015)	24.11	23.24	22.07
		831.5 (26865)	23.88	23.03	22.03
		816.5 (26715)	24.01	23.19	22.17
	1RB-Low (0)	846.5 (27015)	23.79	23.02	21.91
		831.5 (26865)	23.69	22.81	21.84
		816.5 (26715)	23.82	23.03	21.90
	12RB-High (13)	846.5 (27015)	23.04	21.96	20.98
		831.5 (26865)	22.79	21.76	20.81
		816.5 (26715)	22.91	21.87	20.93
	12RB-Middle (6)	846.5 (27015)	23.03	21.96	20.96
		831.5 (26865)	22.86	21.77	20.88
		816.5 (26715)	22.97	21.93	21.00
	12RB-Low (0)	846.5 (27015)	22.97	21.92	20.93
		831.5 (26865)	22.85	21.79	20.87
		816.5 (26715)	22.95	21.88	20.96
	25RB (0)	846.5 (27015)	23.05	22.00	21.00
		831.5 (26865)	22.83	21.79	20.84
		816.5 (26715)	22.95	21.94	20.95
10MHz	1RB-High (49)	844 (26990)	24.09	23.11	22.03
		831.5 (26865)	23.85	23.14	21.98
		820 (26750)	23.82	22.84	21.82
	1RB-Middle (24)	844 (26990)	24.01	23.18	22.15
		831.5 (26865)	23.91	23.13	21.97
		820 (26750)	24.02	23.11	22.13
	1RB-Low (0)	844 (26990)	23.88	23.12	21.96
		831.5 (26865)	23.86	22.94	21.86
		820 (26750)	23.92	23.11	22.06
	25RB-High (25)	844 (26990)	23.08	22.01	20.99
		831.5 (26865)	22.92	21.85	20.86
		820 (26750)	22.97	21.91	20.96
	25RB-Middle (12)	844 (26990)	23.05	21.96	21.04
		831.5 (26865)	22.93	21.86	20.93
		820 (26750)	23.00	21.94	21.02
	25RB-Low (0)	844 (26990)	23.10	22.04	21.06
		831.5 (26865)	22.97	21.89	20.94
		820 (26750)	23.01	21.94	21.02
	50RB (0)	844 (26990)	23.07	22.04	21.04
		831.5 (26865)	22.95	21.92	20.92
		820 (26750)	23.01	21.94	21.00
15MHz	1RB-High (74)	841.5 (26965)	23.82	23.15	22.00
		831.5 (26865)	23.85	23.03	21.98
		822.5 (26775)	23.81	22.96	21.87
	1RB-Middle (37)	841.5 (26965)	23.98	23.12	21.99
		831.5 (26865)	23.99	22.97	21.91
		822.5 (26775)	23.95	22.98	21.96
	1RB-Low (0)	841.5 (26965)	23.90	23.16	22.01
		831.5 (26865)	23.87	22.94	21.92
		822.5 (26775)	23.94	23.09	22.03
	36RB-High (38)	841.5 (26965)	23.04	21.93	20.92
		831.5 (26865)	22.95	21.89	20.91
		822.5 (26775)	23.00	21.88	20.94
	36RB-Middle (19)	841.5 (26965)	23.05	21.97	21.02
		831.5 (26865)	23.06	21.89	20.94
		822.5 (26775)	22.99	21.91	20.97
	36RB-Low (0)	841.5 (26965)	23.04	21.97	21.03
		831.5 (26865)	23.05	21.88	20.97
		822.5 (26775)	23.02	21.93	20.97
	75RB (0)	841.5 (26965)	23.05	21.99	21.01
		831.5 (26865)	22.98	21.90	20.93
		822.5 (26775)	23.01	21.93	20.95

H.2.2 SAR result

RF Exposure Conditions	Frequency Band	Channel Number	Frequency (MHz)	Mode/RB	Test Position	Distance	EUT Measured Power (dBm)	Tune up (dBm)	Measured SAR 1g (W/kg)	Reported SAR 1g (W/kg)	Measured SAR 10g (W/kg)	Reported SAR 10g (W/kg)	Power Drift
Head	LTE Band26	26865	831.5	1RB-Mid	Cheek Left	0mm	23.99	24.5	0.68	**0.76**	0.485	**0.55**	0.02
Head	LTE Band26	26865	831.5	1RB-Mid	Tilt Left	0mm	23.99	24.5	0.7	**0.79**	0.497	**0.56**	-0.10
Head	LTE Band26	26965	841.5	1RB-Mid	Cheek Right	0mm	23.98	24.5	0.687	**0.77**	0.492	**0.55**	-0.02
Head	LTE Band26	26865	831.5	1RB-Mid	Cheek Right	0mm	23.99	24.5	0.751	**0.84**	0.536	**0.60**	0.05
Head	LTE Band26	26775	822.5	1RB-Mid	Cheek Right	0mm	23.95	24.5	0.713	**0.81**	0.501	**0.57**	-0.17
Head	LTE Band26	26865	831.5	1RB-Mid	Tilt Right	0mm	23.99	24.5	0.674	**0.76**	0.353	**0.40**	-0.03
Head	LTE Band26	26865	831.5	36RB-Mid	Cheek Left	0mm	23.06	23.5	0.568	**0.63**	0.41	**0.45**	-0.08
Head	LTE Band26	26865	831.5	36RB-Mid	Tilt Left	0mm	23.06	23.5	0.601	**0.67**	0.388	**0.43**	0.14
Head	LTE Band26	26865	831.5	36RB-Mid	Cheek Right	0mm	23.06	23.5	0.577	**0.64**	0.412	**0.46**	0.12
Head	LTE Band26	26865	831.5	36RB-Mid	Tilt Right	0mm	23.06	23.5	0.656	**0.73**	0.393	**0.43**	0.07
Body	LTE Band26	26865	831.5	1RB-Mid	Front	10mm	23.99	24.5	0.392	**0.44**	0.218	**0.25**	0.03
Body	LTE Band26	26865	831.5	1RB-Mid	Rear	10mm	23.99	24.5	0.521	**0.59**	0.288	**0.32**	-0.14
Body	LTE Band26	26865	831.5	1RB-Mid	Left	10mm	23.99	24.5	0.313	**0.35**	0.159	**0.18**	0.09
Body	LTE Band26	26865	831.5	1RB-Mid	Right	10mm	23.99	24.5	0.211	**0.24**	0.107	**0.12**	-0.18
Body	LTE Band26	26865	831.5	1RB-Mid	Bottom	10mm	23.99	24.5	<0.01	**<0.01**	<0.01	**<0.01**	\
Body	LTE Band26	26865	831.5	36RB-Mid	Front	10mm	23.06	23.5	0.315	**0.35**	0.176	**0.19**	-0.13
Body	LTE Band26	26865	831.5	36RB-Mid	Rear	10mm	23.06	23.5	0.389	**0.43**	0.214	**0.24**	-0.09
Body	LTE Band26	26865	831.5	36RB-Mid	Left	10mm	23.06	23.5	0.279	**0.31**	0.141	**0.16**	0.04
Body	LTE Band26	26865	831.5	36RB-Mid	Right	10mm	23.06	23.5	0.179	**0.20**	0.091	**0.10**	0.01
Body	LTE Band26	26865	831.5	36RB-Mid	Bottom	10mm	23.06	23.5	<0.01	**<0.01**	<0.01	**<0.01**	\

H.3 Main Test Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	E5071C	MY46110673	January 10, 2023	One year
02	Power sensor	NRP110T	101139	January 13, 2023	One year
03	Power sensor	NRP110T	101159	January 13, 2023	One year
04	Signal Generator	E4438C	MY49071430	January 19, 2023	One year
05	Amplifier	60S1G4	0331848	No Calibration Requested	
06	BTS	CMW500	159890	January 12, 2023	One year
07	E-field Probe	SPEAG EX3DV4	7673	July 24, 2023	One year
08	DAE	SPEAG DAE4	1525	September 14, 2023	One year
09	Dipole Validation Kit	SPEAG D835V2	4d069	July 14, 2023	One year

H.4 Graph Results

LTE B26 Head

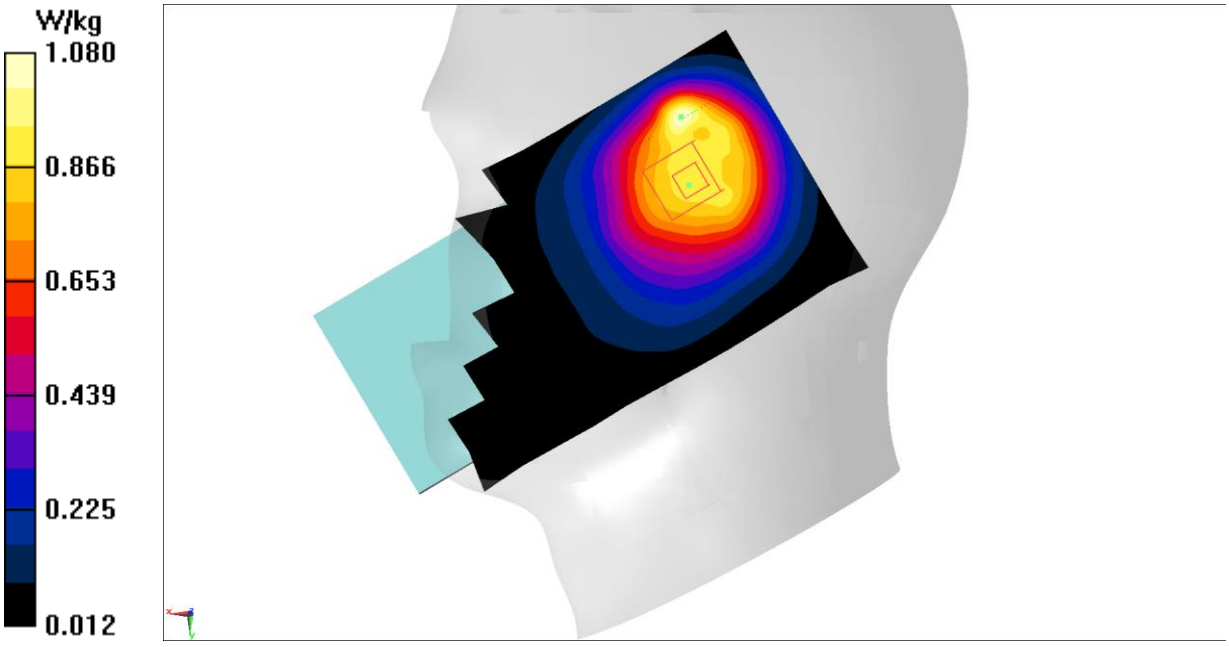
Date: 11/28/2023
Electronics: DAE4 Sn1525
Medium: H700-6000M
Medium parameters used (interpolated): f = 831.5 MHz; σ = 0.923 S/m; ε_r = 43.438; ρ = 1000 kg/m^3
Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC
Communication System: UID 0, LTE Band26 (0) Frequency: 831.5 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN7673 ConvF(10.5, 10.5, 10.5)

Area Scan (71x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.09 W/kg

Zoom Scan (9x8x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.08 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.43 W/kg
SAR(1 g) = 0.751 W/kg; SAR(10 g) = 0.536 W/kg

Maximum value of SAR (measured) = 1.08 W/kg



LTE B26 Body

Date: 11/28/2023

Electronics: DAE4 Sn1525

Medium: H700-6000M

Medium parameters used (interpolated): f = 831.5 MHz; σ = 0.923 S/m; ε_r = 43.438; ρ = 1000 kg/m^3

Ambient Temperature:23.3ºC Liquid Temperature: 22.5ºC

Communication System: UID 0, LTE Band26 (0) Frequency: 831.5 MHz Duty Cycle: 1:1

Probe: EX3DV4 - SN7673 ConvF(10.5, 10.5, 10.5)

Area Scan (81x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.805 W/kg

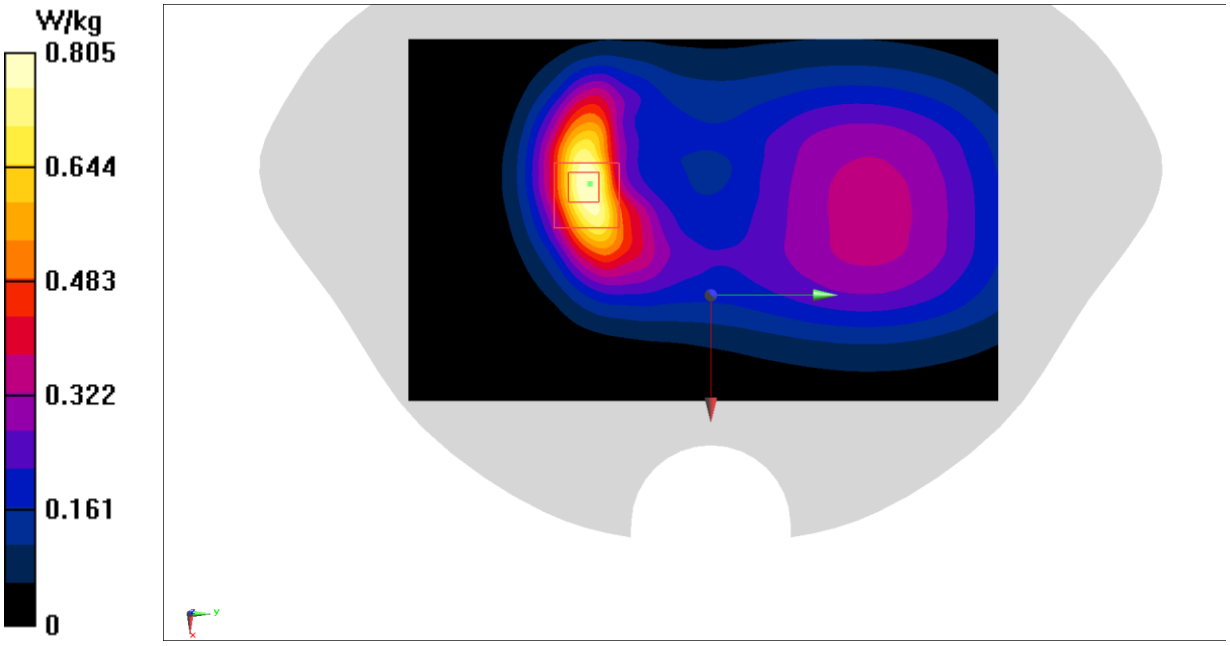
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.89 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 1.04 W/kg

SAR(1 g) = 0.521 W/kg; SAR(10 g) = 0.288 W/kg

Maximum value of SAR (measured) = 0.780 W/kg



H.5 System Validation Results

835 MHz

Date: 2023/11/28

Electronics: DAE4 Sn1525

Medium: H700-6000M

Medium parameters used: f = 835 MHz; σ =0.923 mho/m; εr = 43.45; ρ = 1000 kg/m3

Ambient Temperature: 22.5oC Liquid Temperature: 22.3oC

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

Probe: EX3DV4 – SN7673 ConvF(10.5,10.5,10.5)

Area Scan (81x191x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 3.25 W/kg

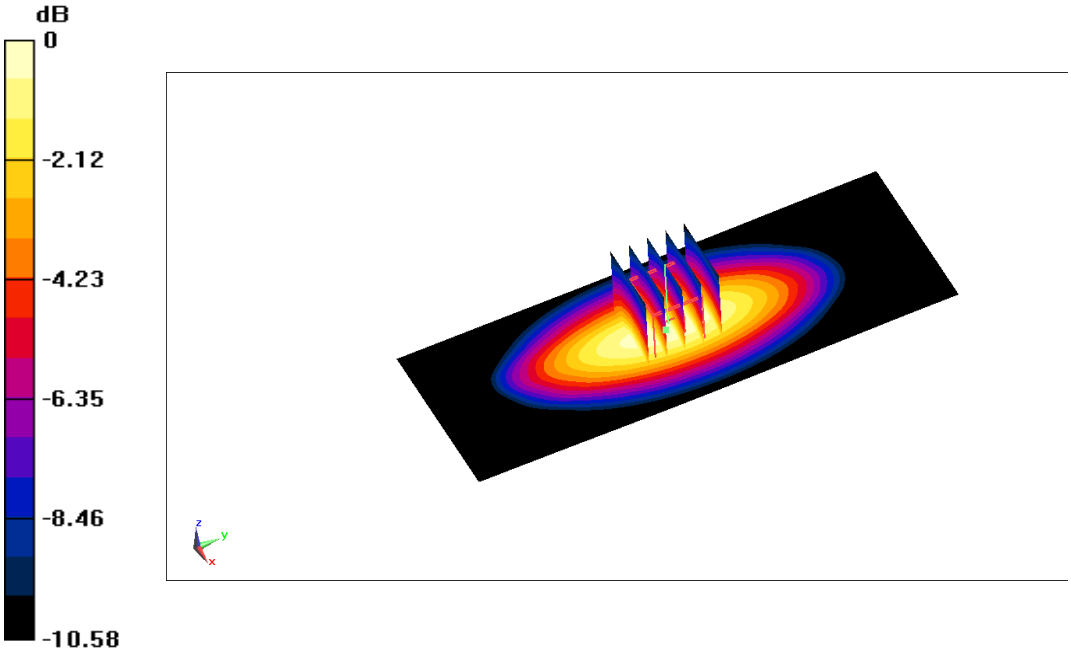
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value =63.92 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 3.48 W/kg

SAR(1 g) = 2.46 W/kg; SAR(10 g) = 1.57 W/kg

Maximum value of SAR (measured) = 3.38 W/kg



0 dB = 3.38 W/kg = 5.29 dB W/kg

H.6 Probe Calibration Certificate

Probe 7673 Calibration Certificate

In Collaboration with
CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: emf@caict.ac.cn http://www.caict.ac.cn

CALIBRATION
CNAS L0570

Client CTTL Certificate No: J23Z60316

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN : 7673
Calibration Procedure(s)	FF-Z11-004-02 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	July 24, 2023

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)℃ 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	12-Jun-23(CTTL, No.J23X05435)	Jun-24
Power sensor NRP-Z91	101547	12-Jun-23(CTTL, No.J23X05435)	Jun-24
Power sensor NRP-Z91	101548	12-Jun-23(CTTL, No.J23X05435)	Jun-24
Reference 10dBAttenuator	18N50W-10dB	19-Jan-23(CTTL, No.J23X00212)	Jan-25
Reference 20dBAttenuator	18N50W-20dB	19-Jan-23(CTTL, No.J23X00211)	Jan-25
Reference Probe EX3DV4	SN 3846	31-May-23(SPEAG, No.EX-3846_May23)	May-24
Reference Probe EX3DV4	SN 7517	27-Jan-23(SPEAG, No.EX-7517_Jan23)	Jan-24
DAE4	SN 1555	25-Aug-22(SPEAG, No.DAE4-1555_Aug22)	Aug-23
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
SignalGenerator MG3700A	6201052605	12-Jun-23(CTTL, No.J23X05434)	Jun-24
Network Analyzer E5071C	MY46110673	10-Jan-23(CTTL, No.J23X00104)	Jan-24
Reference 10dBAttenuator	BT0520	11-May-23(CTTL, No.J23X04061)	May-25
Reference 20dBAttenuator	BT0267	11-May-23(CTTL, No.J23X04062)	May-25
OCP DAK-3.5	SN 1040	18-Jan-23(SPEAG, No.OCP-DAK3.5-1040_Jan23)	Jan-24

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: July 31, 2023

