TUV SUD Limited
Digitally signed by TUV SUD Limited
Date: 2024.10.14 14:16:20 +01'00'

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

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

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:

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 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 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	36.2 ± 6 %	4.57 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	7.88 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 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	36.1 ± 6 %	4.70 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	8.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.9 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	**23.2 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	35.8 ± 6 %	4.92 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	8.45 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**84.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 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	35.7 ± 6 %	5.02 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	8.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.7 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	35.5 ± 6 %	5.20 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	8.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.8 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.2 ± 6 %	5.44 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.31 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**73.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.1 ± 6 %	5.60 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.33 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**73.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.6 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.8 ± 6 %	5.88 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**78.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.8 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.7 ± 6 %	6.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**78.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.1 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.3 ± 6 %	6.28 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.50 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 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	47.6 Ω - 3.6 jΩ
Return Loss	- 27.0 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	47.7 Ω + 0.3 jΩ
Return Loss	- 32.3 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	46.3 Ω + 2.1 jΩ
Return Loss	- 27.1 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	51.0 Ω + 2.9 jΩ
Return Loss	- 30.5 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	52.2 Ω + 4.5 jΩ
Return Loss	- 26.2 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	48.2 Ω - 2.6 jΩ
Return Loss	- 29.7 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	47.9 Ω + 1.9 jΩ
Return Loss	- 30.6 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	46.4 Ω + 3.1 jΩ
Return Loss	- 26.2 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	52.3 Ω + 4.5 jΩ
Return Loss	- 26.2 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	52.6 Ω + 5.8 jΩ
Return Loss	- 24.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 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: 14.12.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1100

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.57 S/m; ε_r = 36.2; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5300 MHz; σ = 4.70 S/m; ε_r = 36.1; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5500 MHz; σ = 4.92 S/m; ε_r = 35.8; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 5.02 S/m; ε_r = 35.7; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5800 MHz; σ = 5.20 S/m; ε_r = 35.5; 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(5.49, 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(5.01, 5.01, 5.01) @ 5800 MHz; Calibrated: 07.03.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 03.10.2023
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

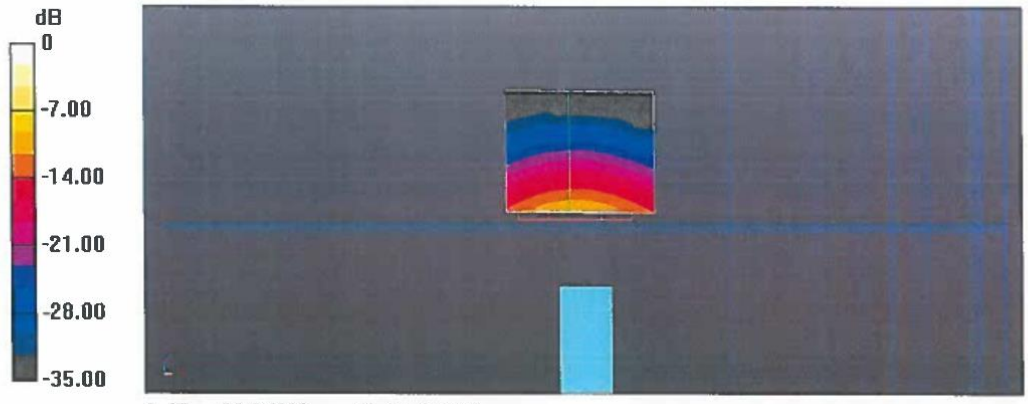
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 70.55 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.1 W/kg
SAR(1 g) = 7.88 W/kg; SAR(10 g) = 2.26 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 70%
Maximum value of SAR (measured) = 18.3 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 = 72.19 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 27.8 W/kg
SAR(1 g) = 8.09 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 = 69.9%
Maximum value of SAR (measured) = 18.9 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 = 71.15 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 31.7 W/kg
SAR(1 g) = 8.45 W/kg; SAR(10 g) = 2.40 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 67.1%
Maximum value of SAR (measured) = 20.3 W/kg

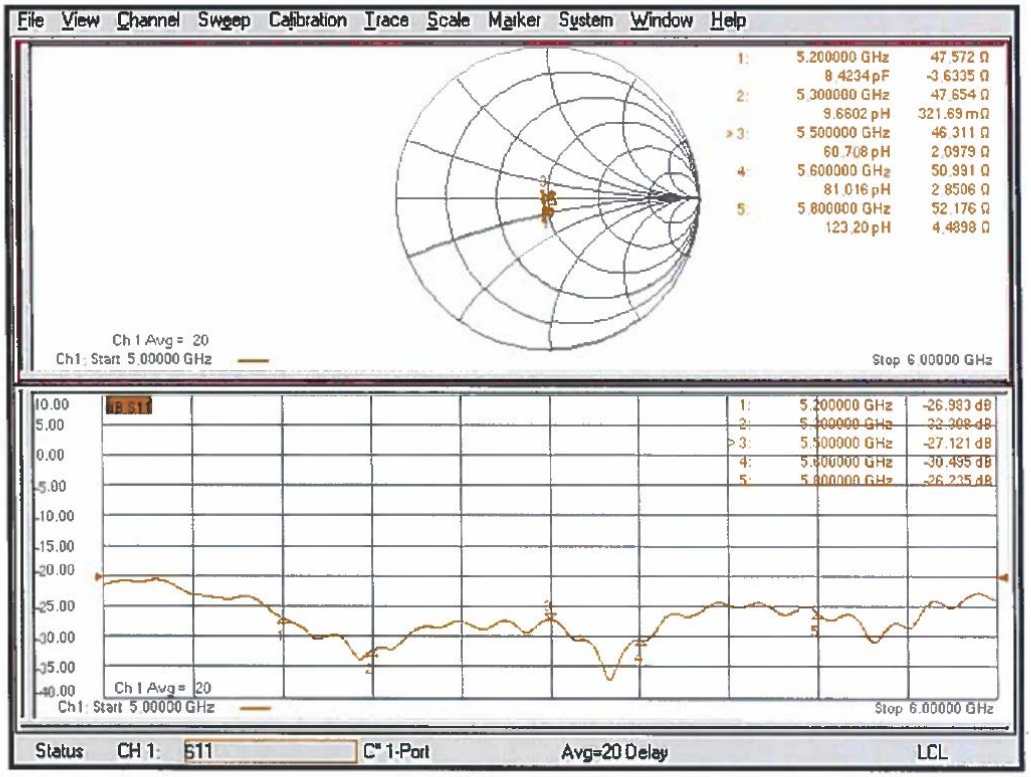
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 72.54 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 29.9 W/kg
SAR(1 g) = 8.29 W/kg; SAR(10 g) = 2.37 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 68.4%
Maximum value of SAR (measured) = 19.9 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 = 69.47 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 31.6 W/kg
SAR(1 g) = 8.11 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 = 65.6%
Maximum value of SAR (measured) = 19.8 W/kg



0 dB = 20.3 W/kg = 13.07 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.12.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1100

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.44 S/m; ε_r = 49.2; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5300 MHz; σ = 5.60 S/m; ε_r = 49.1; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5500 MHz; σ = 5.88 S/m; ε_r = 48.8; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 6.01 S/m; ε_r = 48.7; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5800 MHz; σ = 6.28 S/m; ε_r = 48.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.29, 5.29, 5.29) @ 5200 MHz, ConvF(5.23, 5.23, 5.23) @ 5300 MHz, ConvF(4.84, 4.84, 4.84) @ 5500 MHz, ConvF(4.79, 4.79, 4.79) @ 5600 MHz, ConvF(4.62, 4.62, 4.62) @ 5800 MHz; Calibrated: 07.03.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 03.10.2023
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

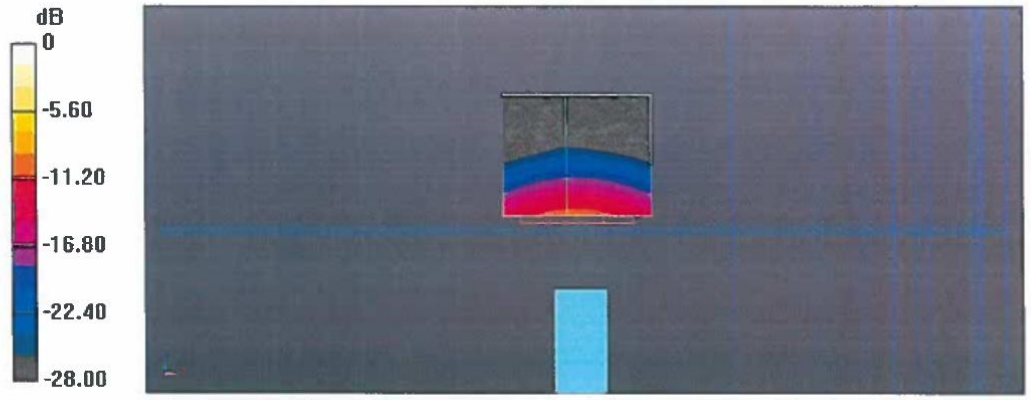
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.06 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 26.0 W/kg
SAR(1 g) = 7.31 W/kg; SAR(10 g) = 2.07 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 69.3%
Maximum value of SAR (measured) = 16.5 W/kg

Dipole Calibration for Body 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 = 64.35 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 7.33 W/kg; SAR(10 g) = 2.06 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 67.8%
Maximum value of SAR (measured) = 16.9 W/kg

Dipole Calibration for Body 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 = 66.02 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 31.2 W/kg
SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.17 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%
Maximum value of SAR (measured) = 18.5 W/kg

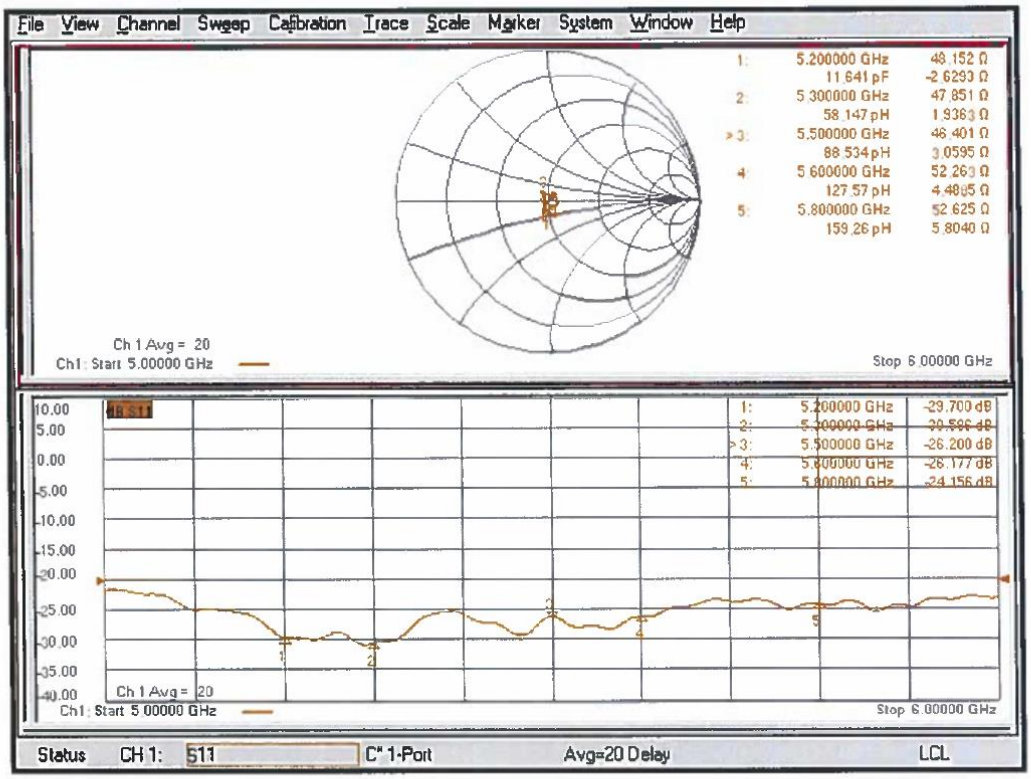
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.95 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 32.2 W/kg
SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.21 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 64.7%
Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Body 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 = 63.73 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 31.2 W/kg
SAR(1 g) = 7.50 W/kg; SAR(10 g) = 2.07 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 64.5%
Maximum value of SAR (measured) = 18.0 W/kg



0 dB = 18.8 W/kg = 12.74 dBW/kg

Impedance Measurement Plot for Body TSL



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

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

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

Client TüV SÜD
Fareham, United Kingdom

Certificate No. P6500-PD_1018_Nov23

CALIBRATION CERTIFICATE

Object	P6500V2 - SN: 1018
Calibration procedure(s)	QA CAL-45.v4 Calibration procedure for sources in air above 6 GHz
Calibration date:	November 07, 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
Reference Probe EUmmWV3	SN: 9374	2023-05-22(No. EUmm-9374_May23)	May-24
DAE4	SN: 1215	2023-06-29 (No. DAE4-1215_Jun23)	Jun-24

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMF100A	SN: 100184	19-May-22 (in house check Nov-22)	In house check: Nov-23
Power sensor R&S NRP18S-10	SN: 101258	31-May-22 (in house check Nov-22)	In house check: Nov-23
Network Analyzer Keysight E5063A	SN: MY54504221	31-Oct-19 (in house check Oct-22)	In house check: Oct-25

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: November 9, 2023

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

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

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

Glossary

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

CW Continuous wave

Calibration is Performed According to the Following Standards

- Internal procedure QA CAL-45, Calibration procedure for sources in air above 6 GHz.
- IEC/IEEE 63195-1, "Assessment of power density of human exposure to radio frequency fields from wireless devices in close proximity to the head and body (frequency range of 6 GHz to 300 GHz)", May 2022

Methods Applied and Interpretation of Parameters

- *Coordinate System:* z-axis orthogonal to the top surface of P6500, y-axis is in the direction of the SMA connector, x-axis normal to y and z.
- *Measurement Conditions:* During the measurements, the source is directly connected to the cable and measured without the spacer. Fields are measured at the stated antenna input power. Absorbers are used around the probe cup and at the ceiling to minimize reflections.
- *Positioning:* The source is placed on the phantom and measured with the EUmmW probes at the measurement planes stated. The planes are parallel to the phantom and source surfaces. The probe distance is verified using mechanical gauges positioned on the surface of the source.
- *E- field distribution:* E field is measured in two x-y-planes with an EUmmW probe. The E-field value stated as calibration value represents the E-field-maxima and the averaged (1cm^2 and 4cm^2) power density values at 2mm and 8mm from top surface of the source or 4mm and 10mm from top surface of the antenna patch.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the source radiating into air and absorbers present. The impedance stated is the impedance measured at the SMA connector.

Calibrated Quantity

- Local peak E-field (V/m) and average of peak spatial components of the Poynting vector (W/m^2) averaged over the surface area of 1 cm^2 and 4cm^2 at the nominal operational frequency of the source. Both square and circular averaging results are listed.

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	DASY8 Module mmWave	V3.2
Phantom	5G Phantom	
Distance patch - plane	4 mm	
Number of measured planes	2 (4 mm, 4 mm + λ/4)	
Frequency	6.5 GHz ± 1 MHz	

Calibration Parameters, 6.5 GHz

Circular Averaging

Distance Antenna to Measured Plane	*Pin (mW)*	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m²)		Uncertainty (k = 2)
				1 cm²	4 cm²	
4 mm	100	453	1.27 dB	232	166	1.28 dB
	1000[1]	**1433**	1.27 dB	**2317**	**1663**	1.28 dB

Distance Antenna to Measured Plane	*Pin (mW)*	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)		Uncertainty (k = 2)
				1 cm²	4 cm²	
4 mm	100	453	1.27 dB	201, 219, 275	131, 156, 212	1.28 dB
	1000[1]	**1433**	1.27 dB	**2010, 2190, 2750**	**1310, 1560, 2120**	1.28 dB

Square Averaging

Distance Antenna to Measured Plane	*Pin (mW)*	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m²)		Uncertainty (k = 2)
				1 cm²	4 cm²	
4 mm	100	453	1.27 dB	233	167	1.28 dB
	1000[1]	**1433**	1.27 dB	**2330**	**1670**	1.28 dB

Distance Antenna to Measured Plane	*Pin (mW)*	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)		Uncertainty (k = 2)
				1 cm²	4 cm²	
4 mm	100	453	1.27 dB	202, 220, 277	132, 156, 213	1.28 dB
	1000[1]	**1433**	1.27 dB	**2020, 2200, 2770**	**1320, 1560, 2130**	1.28 dB

[1] Measured result normalized to 1W input power.

Max Power Density

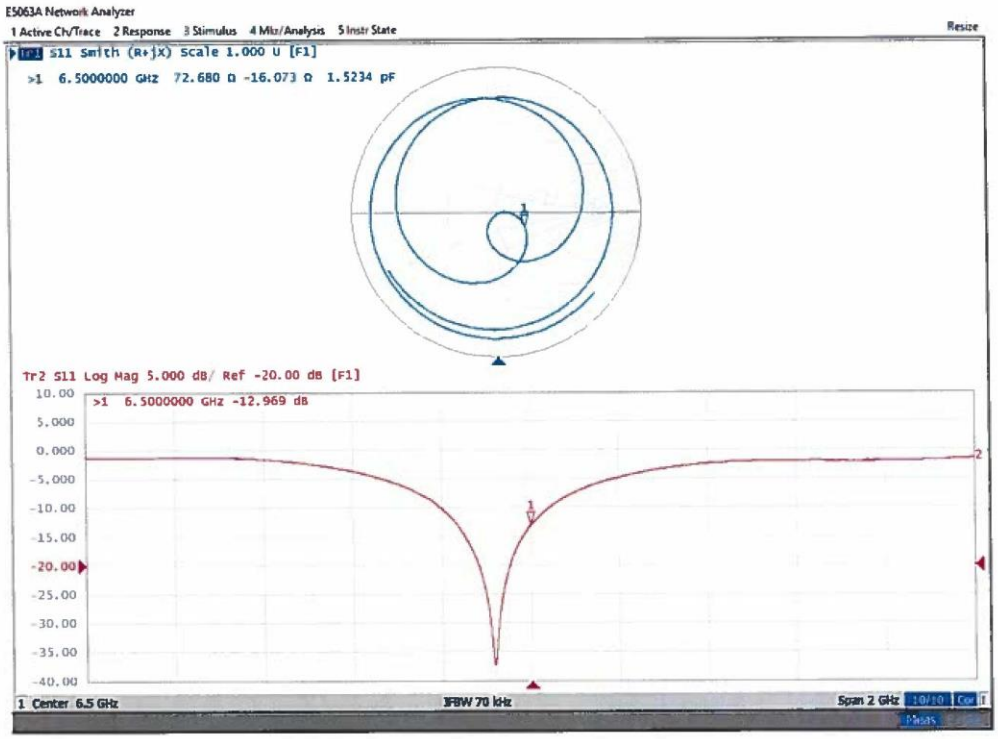
Distance Antenna to Measured Plane	*Pin (mW)*	Max E-field (V/m)	Uncertainty (k = 2)	Max Power Density Sn, Stot, |Stot| (W/m^2)	Uncertainty (k = 2)
4 mm	100	453	1.27 dB	257, 278, 348	1.28 dB
	1000[1]	**1433**	1.27 dB	**2570, 2780, 3480**	1.28 dB

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

Impedance, transformed to feed point	72.7 Ω - 16.1 jΩ
Return Loss	- 13.0 dB

Impedance Measurement Plot



DASY Report

Measurement Report for P6500V2, UID 0 -, Channel 6500 (6500.0MHz)

Device under Test Properties

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
P6500V2	100.0 x 100.0 x 100.0	SN: 1018	-

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	2.0 mm	Validation band	CW	6500.0, 6500	1.0

Hardware Setup

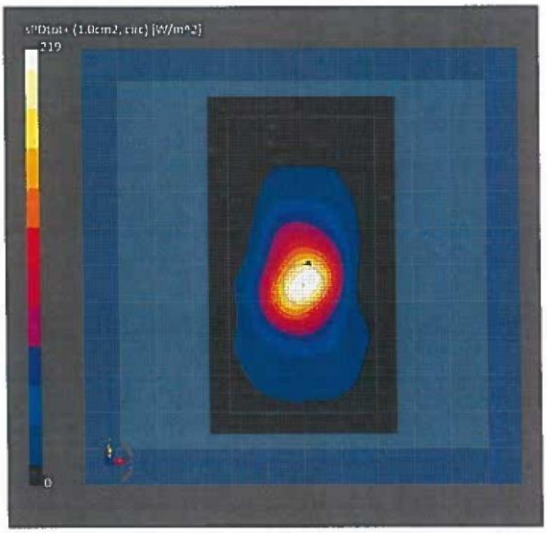
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWV4 - SN9374_F1-55GHz, 2023-05-22	DAE4 Sn1215, 2023-06-29

Scan Setup

	5G Scan
Grid Extents (auto extend) [mm]	50.0 x 90.0
Grid Steps (automatic) [lambda]	0.044 x 0.044
Sensor Surface [mm]	2.0
MAIA	MAIA not used

Measurement Results

	5G Scan
Date	2023-11-07, 11:45
Avg. Area [cm²]	1.00
Avg. Type	Circular Averaging
psPDn+ [W/m²]	201
psPDtot+ [W/m²]	219
psPDmod+ [W/m²]	275
Max(Sn) [W/m²]	257
Max(Stot) [W/m²]	278
Max(|Stot|) [W/m²]	348
E_{max} [V/m]	453
Power Drift [dB]	0.01



DASY Report

Measurement Report for P6500V2, UID 0 -, Channel 6500 (6500.0MHz)

Device under Test Properties

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
P6500V2	100.0 x 100.0 x 100.0	SN: 1018	-

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	2.0 mm	Validation band	CW	6500.0, 6500	1.0

Hardware Setup

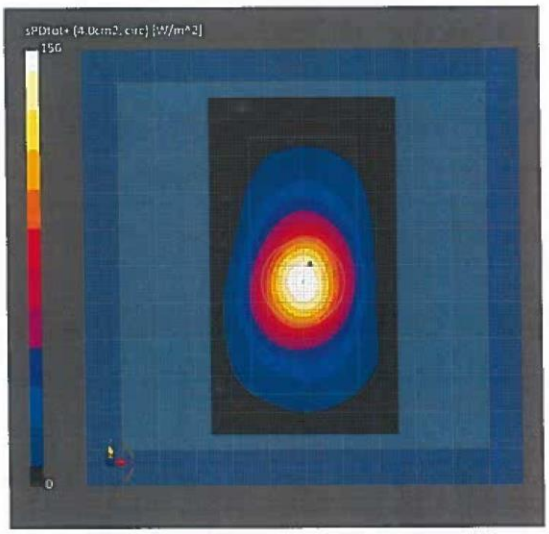
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWV4 - SN9374_F1-55GHz, 2023-05-22	DAE4 Sn1215, 2023-06-29

Scan Setup

	5G Scan
Grid Extents (auto extend) [mm]	50.0 x 90.0
Grid Steps (automatic) [lambda]	0.044 x 0.044
Sensor Surface [mm]	2.0
MAIA	MAIA not used

Measurement Results

	5G Scan
Date	2023-11-07, 11:45
Avg. Area [cm²]	4.00
Avg. Type	Circular Averaging
psPDn+ [W/m²]	131
psPDtot+ [W/m²]	156
psPDmod+ [W/m²]	212
Max(Sn) [W/m²]	257
Max(Stot) [W/m²]	278
Max(|Stot|) [W/m²]	348
E_{max} [V/m]	453
Power Drift [dB]	0.01



DASY Report

Measurement Report for P6500V2, UID 0 -, Channel 6500 (6500.0MHz)

Device under Test Properties

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
P6500V2	100.0 x 100.0 x 100.0	SN: 1018	-

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	2.0 mm	Validation band	CW	6500.0, 6500	1.0

Hardware Setup

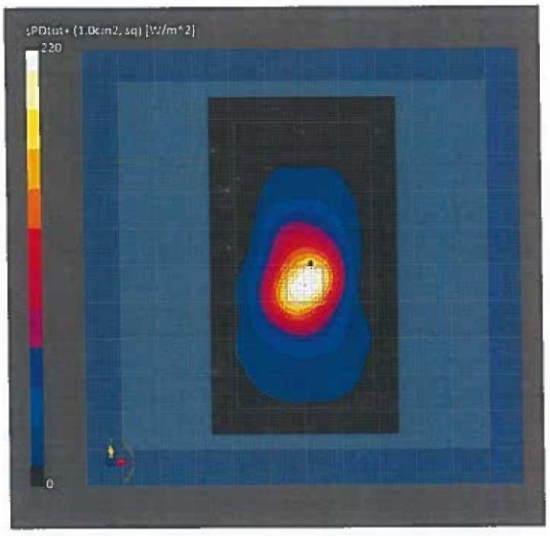
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWV4 - SN9374_F1-55GHz, 2023-05-22	DAE4 Sn1215, 2023-06-29

Scan Setup

	5G Scan
Grid Extents (auto extend) [mm]	50.0 x 90.0
Grid Steps (automatic) [lambda]	0.044 x 0.044
Sensor Surface [mm]	2.0
MAIA	MAIA not used

Measurement Results

	5G Scan
Date	2023-11-07, 11:45
Avg. Area [cm²]	1.00
Avg. Type	Square Averaging
psPDn+ [W/m²]	202
psPDtot+ [W/m²]	220
psPDmod+ [W/m²]	277
Max(Sn) [W/m²]	257
Max(Stot) [W/m²]	278
Max(|Stot|) [W/m²]	348
E_{max} [V/m]	453
Power Drift [dB]	0.01



DASY Report

Measurement Report for P6500V2, UID 0 -, Channel 6500 (6500.0MHz)

Device under Test Properties

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
P6500V2	100.0 x 100.0 x 100.0	SN: 1018	-

Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	2.0 mm	Validation band	CW	6500.0, 6500	1.0

Hardware Setup

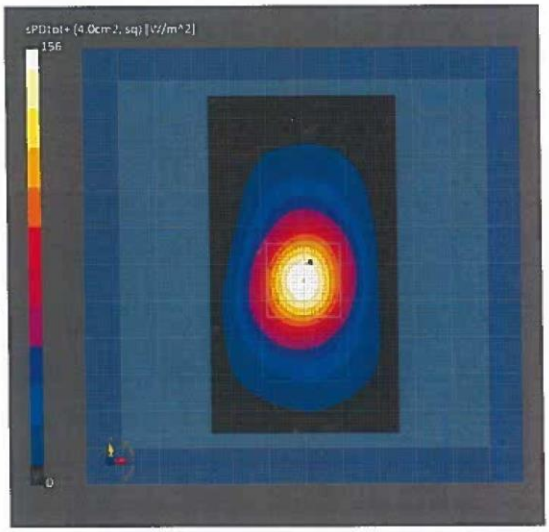
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWV4 - SN9374_F1-55GHz, 2023-05-22	DAE4 Sn1215, 2023-06-29

Scan Setup

	5G Scan
Grid Extents (auto extend) [mm]	50.0 x 90.0
Grid Steps (automatic) [lambda]	0.044 x 0.044
Sensor Surface [mm]	2.0
MAIA	MAIA not used

Measurement Results

	5G Scan
Date	2023-11-07, 11:45
Avg. Area [cm²]	4.00
Avg. Type	Square Averaging
psPDn+ [W/m²]	132
psPDtot+ [W/m²]	156
psPDmod+ [W/m²]	213
Max(Sn) [W/m²]	257
Max(Stot) [W/m²]	278
Max(|Stot|) [W/m²]	348
E_{max} [V/m]	453
Power Drift [dB]	0.01



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

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

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**

Client TüV SÜD
Fareham, United Kingdom

Certificate No. D2450V2-715_Dec23

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:715
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	December 07, 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: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24
DAE4	SN: 601	03-Oct-23 (No. DAE4-601_Oct23)	Oct-24

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:	Paulo Pina	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: December 8, 2023

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