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# **Appendix C**

# **Phantom Description**

Schmid & Partner Engineering All

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Zeughausstlasse 43, 8004 Zurich, Switzerland Prione +41 44 245 9700, Fax +41 44 245 9779 Info@spiag.com, Mrp.(Vvvvv spiag.com

# Certificate of Conformity / First Article Inspection

Item	Oval Flat Phantom ELI 5.0	
Type No	QD OVA 002 A	
Series No.	1108 and higher	
Manufacturer	Untersee Composites Knebelstrasse 8, CH-8268 Mannenbach, Switzerland	

#### Tests

Complete tests were made on the prototype units QD OVA 001 A, pre-series units QD OVA 001 B as well as on some series units QD OVA 001 B. Some tests are made on all series units QD OVA 002 A.

Test	Requirement	Details	Units tested
Shape	Internal dimensions, depth and sagging are compatible with standards	Bottom elliptical 600 x 400 mm, Depth 190 mm, dimension compliant with [1] for t > 375 MHz	Prototypes
Material thickness	Bottom: 2 0mm +/- 0 2mm	dimension compliant with [3] for f > 800 MHz	all
Material parameters	rel. permittivity 2 - 5, loss tangent ≤ 0.05, at f ≤ 6 GHz	rel. permittivity 3,5 +/- 0,5 loss tangent ≤ 0,05	Material samples
Material resistivity	Compatibility with tissue simulating liquids	Compatible with SPEAG liquids. **	Phantoms, Material sample
Sagging	Sagging of the flat section in tolerance when filled with tissue simulating liquid.	within tolerance for filling height up to 155 mm	Prototypes, samples

Note: Compatibility restrictions apply certain liquid components mentioned in the standard, containing e.g. DGBE, DGMHE or Triton X-100. Observe technical note on material compatibility.

## Standards

- OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 01-01
   IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific.
- [2] IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices, Measurement Techniques, December 2003
- [3] IEC 62209-1 ed1.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", 2005-02-18.
- proximity to the ear (frequency range of 300 MHz to 3 GHz)\*, 2005-02-18.

  IEC 62209-2 ed1.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices. Human models, instrumentation, and procedures. Part 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)\*, 2010-03-30.

## Conformit

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of body-worn SAR measurements and system performance checks as specified in [1 – 4] and further standards.

Date 25.7.201

Signature / Stamp

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Doc No | 881 - QD OVA 002 A - A

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# **System Validation from Original Equipment Supplier**

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





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

Accreditation No.: SCS 0108

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

SGS-TW (Auden)

Certificate No: D2450V2-727\_Apr21

**CALIBRATION CERTIFICATE** 

Object D2450V2 - SN:727

QA CAL-05.v11 Calibration procedure(s)

Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date April 14, 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:	Jeffrey Katzman	Laboratory Technician	S. Kytura
Approved by:	Katja Pokovic	Technical Manager	das

Certificate No: D2450V2-727\_Apr21

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





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Glossary:

TSL

tissue simulating liquid

ConvF N/A

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010 d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

# **Additional Documentation:**

e) DASY4/5 System Handbook

# Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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

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# **Measurement Conditions**

DASY 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 ± 1 MHz	

# **Head TSL parameters**

ing parameters and calculations were appli-

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.0 ± 6 %	1.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.9 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.1 W/kg ± 16.5 % (k=2)

# **Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.4 ± 6 %	2.04 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C		Employee Company

# 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	13.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	51.4 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.15 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	24.2 W/kg ± 16.5 % (k=2)

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

# Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.4 Ω + 2.9 jΩ	
Return Loss	- 23.6 dB	

## Antenna Parameters with Body TSL

Impedance, transformed to feed point	$51.9 \Omega + 4.8 j\Omega$
Return Loss	- 25.9 dB

# General Antenna Parameters and Design

Electrical Delay (one direction)	1.148 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: 14.04.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:727

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

Medium parameters used: f = 2450 MHz;  $\sigma = 1.87$  S/m;  $\epsilon_r = 38.0$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

# DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 28.12.2020

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

Electronics: DAE4 Sn601; Calibrated: 02.11.2020

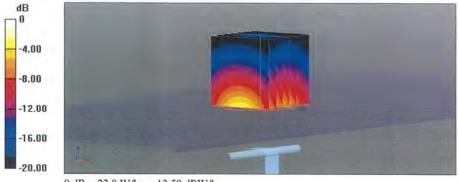
Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001

DASY52 52.10.4(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 = 118.9 V/m; Power Drift = 0.07 dB Peak SAR (extrapolated) = 27.6 W/kg SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.36 W/kg Smallest distance from Peak to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 49.9% Maximum value of SAR (measured) = 22.8 W/kg



0 dB = 22.8 W/kg = 13.59 dBW/kg

Certificate No: D2450V2-727\_Apr21

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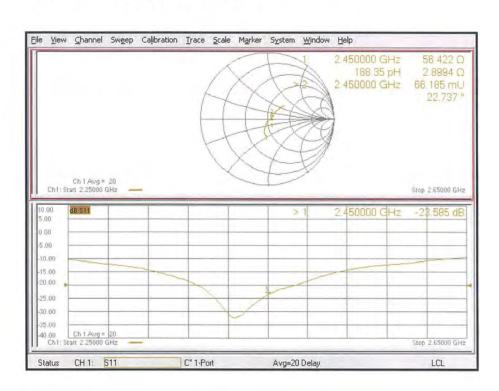
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# Impedance Measurement Plot for Head TSL



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# **DASY5 Validation Report for Body TSL**

Date: 14.04.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:727

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

Medium parameters used: f = 2450 MHz;  $\sigma = 2.04 \text{ S/m}$ ;  $\varepsilon_t = 51.4$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

## DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(8.12, 8.12, 8.12) @ 2450 MHz; Calibrated: 28.12.2020

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 02.11.2020

Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002

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

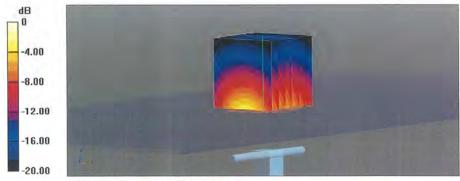
# Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 111.4 V/m; Power Drift = -0.00 dB Peak SAR (extrapolated) = 25.2 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.15 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm Ratio of SAR at M2 to SAR at M1 = 53.1%

Maximum value of SAR (measured) = 21.5 W/kg



0 dB = 21.5 W/kg = 13.32 dBW/kg

Certificate No: D2450V2-727\_Apr21

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# Impedance Measurement Plot for Body TSL

Yiew Channel Sweep Calibration Irace Scale Marker System Window Help 2 450000 GHz 51.874 O 313.31 pH 4.8230 Ω 2.450000 GHz 50.734 mU 66.055 ° Ch 1 Avg = 20 Ch1: Start 2.25000 GHz Ston 2 65000 RHz 450000 GHz 00 0,00 5.00 10.00 15.00 20.00 25.00 30.00 35.00 40.00 Ch1 Stop 2.65000 GHz CH 1: S11 C\* 1-Port Avg=20 Delay

Certificate No: D2450V2-727\_Apr21

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SGS (Auden)

Accreditation No.: SCS 0108

Certificate No: D5GHzV2-1023 Jan22 **CALIBRATION CERTIFICATE** Object D5GHzV2 - SN:1023 Calibration procedure(s) QA CAL-22.v6 Calibration Procedure for SAR Validation Sources between 3-10 GHz January 27, 2022 Calibration date: 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 09-Apr-21 (No. 217-03291/03292) 09-Apr-21 (No. 217-03291) Power meter NRP SN: 104778 Apr-22 Power sensor NRP-Z91 SN: 103244 Apr-22 09-Apr-21 (No. 217-03292) 09-Apr-21 (No. 217-03343) Power sensor NRP-Z91 SN: 103245 Apr-22 Reference 20 dB Attenuator SN: BH9394 (20k) Apr-22 Type-N mismatch combination SN: 310982 / 06327 09-Apr-21 (No. 217-03344) Apr-22 Dec-22 SN: 3503 SN: 601 Reference Probe EX3DV4 31-Dec-21 (No. EX3-3503\_Dec21) 01-Nov-21 (No. DAE4-601 Nov21) Nov-22 Secondary Standards Check Date (in house) Scheduled Check Power meter E4419B Power sensor HP 8481A SN: GB39512475 30-Oct-14 (in house check Oct-20) 07-Oct-15 (in house check Oct-20) In house check: Oct-22 SN: US37292783 in house check: Oct-22 07-Oct-15 (in house check Oct-20) 15-Jun-15 (in house check Oct-20) Power sensor HP 8481A SN: MY41093315 In house check: Oct-22 RF generator R&S SMT-06 SN: 100972 In house check: Oct-22 Network Analyzer Agilent E8358A SN: US41080477 31-Mar-14 (in house check Oct-20) In house check: Oct-22 Name Signature Aldonia Georgiadou Laboratory Technician Approved by: Sven Köhn Deputy Manager Issued: January 27, 2022 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

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Schweizerischer Kalibrierdiens S C Service suisse d'étalonnage Servizio svizzero di taratura

Accreditation No.: SCS 0108

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Glossary:

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

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## Measurement Conditions

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	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

### Head TSL parameters at 5250 MHz

	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	34.9 ± 6 %	4.52 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-m-	(man)

#### SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.0 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 W/kg ± 19.5 % (k=2)

# Head TSL parameters at 5600 MHz

	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	34.4 ± 6 %	4.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	T

# 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	8.51 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.4 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	23.8 W/kg ± 19.5 % (k=2)

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# 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	34.2 ± 6 %	5.02 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	12024	and a

## SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.0 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.9 W/kg ± 19.5 % (k=2)

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

## Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	52.0 Ω - 5.2 jΩ
Return Loss	- 25.3 dB

# Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	$54.7 \Omega + 0.2 j\Omega$
Return Loss	- 27.0 dB

#### Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	57.2 Ω + 2.1 jΩ
Return Loss	- 23,1 dB

## General Antenna Parameters and Design

Electrical Delay (one direction)	1 107 mg
Liectifical Delay (offe direction)	1.197 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	OPELO
Manufactured by	SPEAG

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## DASY5 Validation Report for Head TSL

Date: 27.01.2022

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1023

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz,

Frequency: 5750 MHz

Medium parameters used: f = 5250 MHz;  $\sigma = 4.52$  S/m;  $\epsilon_r = 34.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Medium parameters used: f = 5600 MHz;  $\sigma = 4.87 \text{ S/m}$ ;  $\epsilon_r = 34.4$ ;  $\rho = 1000 \text{ kg/m}^3$ . Medium parameters used: f = 5750 MHz;  $\sigma = 5.02 \text{ S/m}$ ;  $\epsilon_r = 34.2$ ;  $\rho = 1000 \text{ kg/m}^3$ .

Phantom section: Flat Section

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

#### DASY52 Configuration:

- $Probe: EX3DV4 SN3503; ConvF(5.5, 5.5, 5.5) @ 5250 \ MHz, ConvF(5.1, 5.1, 5.1) @ 5600 \ MHz, ConvF(5.1, 5.1, 5.1) \\$ ConvF(5.08, 5.08, 5.08) @ 5750 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- 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=5250 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 76.83 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 28.0 W/kg SAR(1 g) = 8.16 W/kg; SAR(10 g) = 2.34 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mmRatio of SAR at M2 to SAR at M1 = 70.7%

Maximum value of SAR (measured) = 18.6 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 = 77.04 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 31.5 W/kg
SAR(1 g) = 8.51 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 = 68%

Maximum value of SAR (measured) = 20.1 W/kg

Certificate No: D5GHzV2-1023 Jan22

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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 = 74.27 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 31.8 W/kg SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.31 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 66.3%

Maximum value of SAR (measured) = 19.8 W/kg



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

Certificate No: D5GHzV2-1023\_Jan22

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Impedance Measurement Plot for Head TSL

File View Channel Sweep Calibration Trace Scale Marker System Window 0.00 5.00 10.00 15.00 20.00 35 00 CH 1: C\* 1-Port Avg=20 Delay LCL

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Client SGS (Auden)

. . . . . . . . . . . .

Certificate No: D6.5GHzV2-1006\_Aug21

Accreditation No.: SCS 0108

# CALIBRATION CERTIFICATE

Object D6.5GHzV2 - SN:1006

Calibration procedure(s) QA CAL-22.v6

Calibration Procedure for SAR Validation Sources between 3-10 GHz

Calibration date: August 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
Power sensor R&S NRP33T	SN: 100967	08-Apr-21 (No. 217-03293)	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: 7405	30-Dec-20 (No. EX3-7405_Dec20)	Dec-21
DAE4	SN: 908	24-Jun-21 (No. DAE4-908_Jun21)	Jun-22
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
RF generator Anapico APSIN20G	SN: 669	28-Mar-17 (in house check Dec-18)	In house check: Dec-21
Network Analyzer R&S ZVL13	SN: 101093	10-May-12 (in house check Dec-18)	In house check: Dec-21
	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	HILA
			1 / 10

Katja Pokovic Technical Manager

Issued: August 27, 2021

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Certificate No: D6.5GHzV2-1006\_Aug21

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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.

# Additional Documentation:

b) 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 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
- 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 absorbed power density (APD): The absorbed power density is evaluated according to Samaras T, Christ A, Kuster N, "Compliance assessment of the epithelial or absorbed power density above 6 GHz using SAR measurement systems", Bioelectromagnetics, 2021 (submitted). The additional evaluation uncertainty of 0.55 dB (rectangular distribution) is considered.

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

Certificate No: D6.5GHzV2-1006\_Aug21

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## Measurement Conditions

DASY Version	DASY6	V16.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	5 mm	with Spacer
Zoom Scan Resolution	dx, $dy = 3.4$ mm, $dz = 1.4$ mm	Graded Ratio = 1.4 (Z direction)
Frequency	6500 MHz ± 1 MHz	

# Head TSL parameters

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	34.5	6.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.6 ± 6 %	6.11 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		****

# SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	29.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	291 W/kg ± 24.7 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	5.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	53.5 W/kg ± 24.4 % (k=2)

Certificate No: D6.5GHzV2-1006\_Aug21

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## Appendix

## Antenna Parameters with Head TSL

Impedance, transformed to feed point	45.7 Ω - 6.6 jΩ
Return Loss	- 21.7 dB

# APD (Absorbed Power Density)

APD averaged over 1 cm <sup>2</sup>	Condition	
APD measured	100 mW input power	291 W/m <sup>2</sup>
APD measured	normalized to 1W	2910 W/m <sup>2</sup> ± 29.2 % (k=2)

APD averaged over 4 cm <sup>2</sup>	condition	
APD measured	100 mW input power	132 W/m <sup>2</sup>
APD measured	normalized to 1W	1320 W/m <sup>2</sup> ± 28.9 % (k=2)

# General Antenna Parameters and Design

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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Measurement Report for D6.5GHz-1006, UID 0 -, Channel 6500 (6500.0MHz)

**Device under Test Properties** 

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
D6.5GHz	16.0 x 6.0 x 300.0	SN: 1006	

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz]	Conversion Factor	TSL Cond. [S/m]	TSL Permittivity
Flat, HSL	5.00	Band	CW.	6500	5.75	6.11	33.6

Hardware Setup

Phantom	TSL	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center - 1182	HBBL600-10000V6	EX3DV4 - SN7405, 2020-12-30	DAE4 Sn908, 2021-06-24

Scan Setup		Measurement Results	
	Zoom Scan		Zoom Scan
Grid Extents [mm]	22.0 x 22.0 x 22.0	Date	2021-08-26, 10:54
Grid Steps [mm]	3.4 x 3.4 x 1.4	psSAR1g [W/Kg]	29.3
Sensor Surface [mm]	1.4	psSAR10g [W/Kg]	5.39
Graded Grid	Yes	Power Drift [dB]	0.03
Grading Ratio	1.4	Power Scaling	Disabled
MAIA	N/A	Scaling Factor [dB]	
Surface Detection	VMS + 6p	TSL Correction	No correction
Scan Method	Measured	M2/M1 [%]	50.3
		Dist 3dB Peak [mm]	4.8



Certificate No: D6.5GHzV2-1006\_Aug21

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# Impedance Measurement Plot for Head TSL

FIFE 511 Smith (R+jX) Scale 1.000 U [F1] >1 6.5000000 GHz 45.696 Ω -6.5992 Ω 3.7103 pF (b)



Certificate No: D6.5GHzV2-1006\_Aug21

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SGS (Auden)

Certificate No: D7GHzV2-1007\_Aug21

Accreditation No.: SCS 0108

# **CALIBRATION CERTIFICATE**

Object D7GHzV2 - SN:1007

QA CAL-22.v6 Calibration procedure(s)

Calibration Procedure for SAR Validation Sources between 3-10 GHz

Calibration date:

August 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

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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
Power sensor R&S NRP33T	SN: 100967	08-Apr-21 (No. 217-03293)	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: 7405	30-Dec-20 (No. EX3-7405_Dec20)	Dec-21
DAE4	SN: 908	24-Jun-21 (No. DAE4-908_Jun21)	Jun-22
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
RF generator Anapico APSIN20G	SN: 669	28-Mar-17 (in house check Dec-18)	In house check: Dec-21
Network Analyzer R&S ZVL13	SN: 101093	10-May-12 (in house check Dec-18)	In house check: Dec-21
	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	1011
Approved by:	Katia Pokovic	Toolseigal Managar	110

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Issued: August 27, 2021

Certificate No: D7GHzV2-1007\_Aug21

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## Glossary:

TSL ConvF

N/A

tissue simulating liquid

sensitivity in TSL / NORM x,y,z 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.

# Additional Documentation:

b) 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 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
- 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 absorbed power density (APD): The absorbed power density is evaluated according to Samaras T, Christ A, Kuster N, "Compliance assessment of the epithelial or absorbed power density above 6 GHz using SAR measurement systems", Bioelectromagnetics, 2021 (submitted). The additional evaluation uncertainty of 0.55 dB (rectangular distribution) is considered.

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

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# **Measurement Conditions**

DASY Version	DASY6	V16.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	5 mm	with Spacer
Zoom Scan Resolution	dx, dy = 3.4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	7000 MHz ± 1 MHz	

# **Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	33.9	6.65 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	32.7 ± 6 %	6.71 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	27.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	275 W/kg ± 24.7 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	4.78 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	47.4 W/kg ± 24.4 % (k=2)

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# Appendix

# Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.9 Ω - 3.8 jΩ
Return Loss	- 26.6 dB

# APD (Absorbed Power Density)

APD averaged over 1 cm <sup>2</sup>	Condition	
APD measured	100 mW input power	274 W/m²
APD measured	normalized to 1W	2740 W/m <sup>2</sup> ± 29.2 % (k=2)

APD averaged over 4 cm <sup>2</sup>	condition	
APD measured	100 mW input power	119 W/m <sup>2</sup>
APD measured	normalized to 1W	1190 W/m <sup>2</sup> ± 28.9 % (k=2)

## General Antenna Parameters and Design

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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Measurement Report for D7GHz-1007, UID 0 -, Channel 7000 (7000.0MHz)

Device u	under T	est Pr	operties
----------	---------	--------	----------

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
D7GHz	14.0 x 6.0 x 297.0	SN: 1007	1.4.1

Exposure Cond	ditions						
Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz]	Conversion Factor	TSL Cond. [S/m]	TSL Permittivity
Flat, HSL	5.00	Band	CW,	7000	6.09	6.71	32.7

Hardware Setup

Phantom	TSL	Probe, Calibration Date	DAE, Calibration Date	
MFP V8.0 Center - 1182	HBBL600-10000V6	EX3DV4 - SN7405, 2020-12-30	DAE4 Sn908, 2021-06-24	

Scan Setup		Measurement Results	
	Zoom Scan		Zoom Scan
Grid Extents [mm]	22.0 x 22.0 x 22.0	Date	2021-08-26, 14:14
Grid Steps [mm]	3.0 x 3.0 x 1.4	psSAR1g [W/Kg]	27.7
Sensor Surface [mm]	1.4	psSAR10g [W/Kg]	4.78
Graded Grid	Yes	Power Drift [dB]	0.05
Grading Ratio	1.4	Power Scaling	Disabled
MAIA	N/A	Scaling Factor [dB]	
Surface Detection	VMS + 6p	TSL Correction	No correction
Scan Method	Measured	M2/M1 [%]	46.9
		Dist 3dB Peak [mm]	4.6



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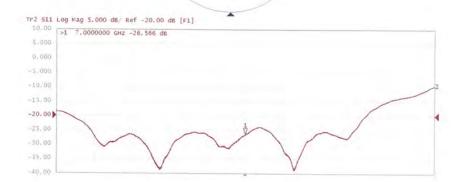


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## Impedance Measurement Plot for Head TSL

FIT 511 Smith (R+jx) Scale 1.000 U [F1] >1 7.0000000 GHz 52.936 Ω -3.8442 Ω 5.9145-pF



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Accreditation No.: SCS 0108

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# **CALIBRATION CERTIFICATE** 5G Verification Source 10 GHz - SN: 1021 QA CAL-45.v3 Calibration procedure(s) Calibration procedure for sources in air above 6 GHz January 24, 2022 Calibration date: 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 2021-12-21(No. EUmmWV3-9374\_Dec21) 2021-06-25 (No. DAE4ip-1602\_Jun21) Reference Probe EUmmWV3 SN: 9374 DAE4ip SN: 1602 Jun-22 Secondary Standards ID# Check Date (in house) Scheduled Check Function Calibrated by Leif Klysne Laboratory Technician Approved by: Sven Kühn Deputy Manager Issued: January 26, 2022 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

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#### Glossary

CW

Continuous wave

## Calibration is Performed According to the Following Standards

Internal procedure QA CAL-45-5Gsources

 IEC TR 63170 ED1, "Measurement procedure for the evaluation of power density related to human exposure to radio frequency fields from wireless communication devices operating between 6 GHz and 100 GHz", January 2018

# Methods Applied and Interpretation of Parameters

- Coordinate System: z-axis in the waveguide horn boresight, x-axis is in the direction of the E-field, y-axis normal to the others in the field scanning plane parallel to the horn flare and horn flange.
- Measurement Conditions: (1) 10 GHz: The radiated power is the forward power to the horn
  antenna minus ohmic and mismatch loss. The forward power is measured prior and after
  the measurement with a power sensor. During the measurements, the horn is directly
  connected to the cable and the antenna ohmic and mismatch losses are determined by farfield measurements. (2) 30, 45, 60 and 90 GHz: The verification sources are switched on for
  at least 30 minutes. Absorbers are used around the probe cub and at the ceiling to minimize
  reflections.
- Horn Positioning: The waveguide horn is mounted vertically on the flange of the waveguide source to allow vertical positioning of the EUmmW probe during the scan. The plane is parallel to the phantom surface. Probe distance is verified using mechanical gauges positioned on the flare of the horn.
- E- field distribution: E field is measured in two x-y-plane (10mm, 10mm + \(\lambda\)) with a
  vectorial E-field probe. The E-field value stated as calibration value represents the E-fieldmaxima and the averaged (1cm² and 4cm²) power density values at 10mm in front of the
  horn.
- Field polarization: Above the open horn, linear polarization of the field is expected. This is verified graphically in the field representation.

# Calibrated Quantity

 Local peak E-field (V/m) and average of peak spatial components of the poynting vector (W/m²) averaged over the surface area of 1 cm² and 4cm² at the nominal operational frequency of the verification 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%.

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# **Measurement Conditions**

DASY Version	cDASY6 Module mmWave	V2.4
Phantom	5G Phantom	
Distance Horn Aperture - plane	10 mm	
XY Scan Resolution	dx, dy = 7.5 mm	
Number of measured planes	2 (10mm, 10mm + λ/4)	
Frequency	10 GHz ± 10 MHz	

# Calibration Parameters, 10 GHz

Circular Averaging

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg (psPD psPD	er Density n+, psPDIot+, mod+) /m <sup>2</sup> )	Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	86.1	148	1.27 dB	55.2	51.7	1.28 dB

Causes Averaging

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg (psPD psPD	er Density n+, psPDtot+, mod+) /m²)	Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	86.1	148	1.27 dB	55.2	51.5	1.28 dB

<sup>1</sup> Assessed ohmic and mismatch loss plus numerical offset: 0.55 dB

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\*\*SCST Stawan Ltd.\*\* No 134 Wit King Road New Taipoi Industrial Park Withu District New Taipoi City, Taipon City, Taipon

No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號 t (886-2) 2299-3279

台灣檢驗科技股份有限公司

f (886-2) 2298-0488



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## **DASY Report**

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Device under Test Properties

Dimensions [mm] Name, Manufacturer 5G Verification Source 10 GHz

IME 100.0 x 100.0 x 172.0 SN: 1021

**DUT Type** 

**Exposure Conditions** 

Position, Test Distance 10.0 mm

Validation band CW Frequency [MHz], Channel Number

10000.0, 10000

Hardware Setup

mmWave Phantom - 1002

Probe, Calibration Date EUmmWV3 - SN9374\_F1-55GHz, 2021-12-21

Measurement Results

DAE, Calibration Date DAE4ip Sn1602, 2021-06-25

1.0

Scan Setup

Grid Extents [mm] Grid Steps [lambda] Sensor Surface [mm] MAIA

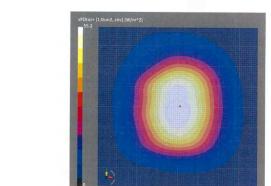
5G Scar 120.0 x 120.0 0.25 x 0.25 10.0

MAIA not used

Avg. Area [cm²] psPDn+ [W/m²] psPDtot+ [W/m²

psPDmod+ [W/m²] E<sub>max</sub> [V/m] Power Drift [dB]

5G Scan 2022-01-24, 11:01 1.00 55.0 55.2 55.4 148 0.01



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1.0

10000

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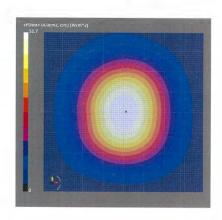
#### **DASY Report**

wiedsurement keput	t ioi 3d verilication	Source 10 GHz, C	old u -, Channel .	10000 (10000.0IVIHZ)
Device under Test Pr	roperties			
Name, Manufacturer	Dimensions [n	nm]	IMEI	DUT Type
5G Verification Source 10	GHz 100.0 x 100.0	x 172.0	SN: 1021	10
Exposure Conditions				
Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number
5G -	10.0 mm	Validation band	CW	10000.0,

Hardware Setup

Probe, Calibration Date EUmmWV3 - SN9374\_F1-55GHz, 2021-12-21 Mediun mmWave Phantom - 1002 DAE4ip Sn1602, 2021-06-25

Measurement Results 5G Scan Grid Extents [mm] Grid Steps [lambda] Sensor Surface [mm] MAIA 120.0 x 120.0 0.25 x 0.25 2022-01-24, 11:01 Avg. Area (cm²) psPDn+ [W/m²] psPDtot+ [W/m²] psPDmod+ [W/m²] 4.00 51.5 51.7 51.8 148 0.01 10.0 MAIA not used E<sub>max</sub> [V/m] Power Drift [dB]



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Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

**Device under Test Properties** 

Name, Manufacturer 5G Verification Source 10 GHz

Dimensions [mm] 100.0 x 100.0 x 172.0 SN: 1021

DUT Type

**Exposure Conditions** 

10.0 mm

Validation band CW

Frequency [MHz], Channel Number 10000.0.

10000

Hardware Setup

mmWave Phantom - 1002

Probe, Calibration Date EUmmWV3 - SN9374\_F1-55GHz, 2021-12-21

Measurement Results

DAE, Calibration Date DAE4ip Sn1602, 2021-06-25

10

Scan Setup

Grid Extents [mm] Grid Steps [lambda] Sensor Surface [mm] MAIA

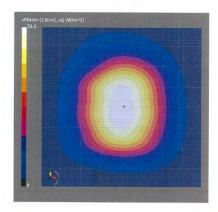
5G Scan 120.0 x 120.0 0.25 x 0.25

10.0 MAIA not used

Avg. Area [cm²] psPDn+ [W/m²] psPDtot+ [W/m²] psPDmod+ [W/m²] E<sub>max</sub> [V/m] Power Drift [dB)

56 Scan 2022-01-24, 11:01 1.00 55.0 55.2 55.4 148 0.01





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## **DASY Report**

Measurement Report for 5G Verification Source 10 GHz, UID 0 -, Channel 10000 (10000.0MHz)

Device under Test Properties Name, Manufacturer 5G Verification Source 10 GHz Dimensions [mm] 100.0 x 100.0 x 172.0

**DUT Type** 

**Exposure Conditions** 

Position, Test Distance **Phantom Section** 10.0 mm

10000.0, 10000

1.0

Hardware Setup

Phantom mmWave Phantom - 1002

Probe, Calibration Date EUmmWV3 - SN9374\_F1-55GHz, 2021-12-21

Measurement Results

DAE, Calibration Date DAE4ip Sn1602, 2021-06-25

Scan Setup

Grid Extents [mm] Grid Steps [lambda] Sensor Surface [mm] MAIA

5G Scan 120.0 x 120.0 0.25 x 0.25 10.0

Avg. Area [cm²] psPDn+ [W/m²] psPDtot+ [W/m²] psPDmod+ [W/m²]

56 Scan 2022-01-24, 11:01 4.00 51.3 51.5 51.7 148 0.01

MAIA not used E<sub>max</sub> [V/m] Power Drift [dB]



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- End of report -

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