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







Accredited by the Swiss Accreditation Service (SAS)

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

Client

**UL Korea (Dymstec)** 

Certificate No: D6.5GHzV2-1010\_May22

Accreditation No.: SCS 0108

### **CALIBRATION CERTIFICATE**

Object

D6.5GHzV2 - SN:1010

Calibration procedure(s)

**QA CAL-22.v6** 

Calibration Procedure for SAR Validation Sources between 3-10 GHz

Calibration date:

May 27, 2022

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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power sensor R&S NRP33T	SN: 100967	01-Apr-22 (No. 217-03526)	Apr-23
Reference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
Mismatch combination	SN: 84224 / 360D	26-Apr-21 (No. 217-03353)	Apr-24
Reference Probe EX3DV4	SN: 7405	31-Dec-21 (No. EX3-7405_Dec21)	Dec-22
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: 827	18-Dec-18 (in house check Dec-21)	In house check: Dec-23
Network Analyzer Keysight E5063A	SN:MY54504221	31-Oct-19 (in house check Oct-19)	In house check: Oct-22

Calibrated by:

Name Leif Klysner **Function** 

Signature

Approved by:

Sven Kühn

Technical Manager

Laboratory Technician

Issued: May 31, 2022

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

Certificate No: D6.5GHzV2-1010 May22

Page 1 of 6

### **Calibration Laboratory of**

Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland





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Swiss Calibration Service

Accreditation No.: SCS 0108

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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 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 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: D6.5GHzV2-1010\_May22

#### **Measurement Conditions**

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

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	33.7 ± 6 %	6.08 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	28.7 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	285 W/kg ± 24.7 % (k=2)

SAR averaged over 8 cm <sup>3</sup> (8 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.49 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	64.6 W/kg ± 24.4 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	5.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.9 W/kg ± 24.4 % (k=2)

### **Appendix**

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.9 Ω - 7.3 jΩ	
Return Loss	- 22.7 dB	

### **APD (Absorbed Power Density)**

APD averaged over 1 cm <sup>2</sup>	Condition	
APD measured	100 mW input power	285 W/m²
APD measured	normalized to 1W	2850 W/m <sup>2</sup> ± 29.2 % (k=2)

APD averaged over 4 cm <sup>2</sup>	condition	
APD measured	100 mW input power	130 W/m²
APD measured	normalized to 1W	1300 W/m <sup>2</sup> ± 28.9 % (k=2)

<sup>\*</sup>The reported APD values have been derived using psSAR8g.

### 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

Certificate No: D6.5GHzV2-1010\_May22

# **DASY6 Validation Report for Head TSL**

Measurement Report for D6.5GHz-1010, UID 0 -, Channel 6500 (6500.0MHz)

<b>Device under Test Propertie</b>	Device	under	Test	Pro	pertie
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Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
D6.5GHz	16.0 x 6.0 x 300.0	SN: 1010	

#### **Exposure Conditions**

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	6.08	33.7

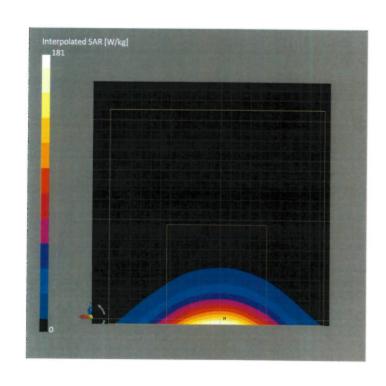
#### **Hardware Setup**

Phantom	TSL	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center - 1182	HBBL600-10000V6	EX3DV4 - SN7405, 2021-12-31	DAE4 Sn908, 2021-06-24

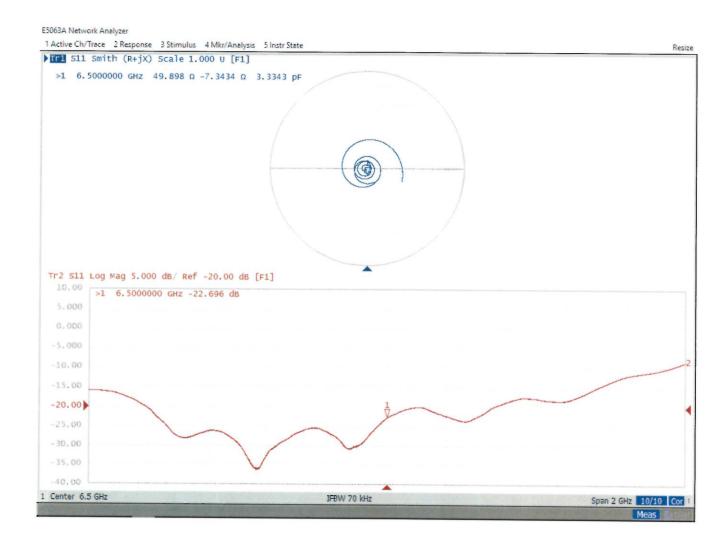
**Measurement Results** 

#### Scan Setup

	Zoom Scan		Zoom Scan
Grid Extents [mm]	22.0 x 22.0 x 22.0	Date	2022-05-27, 10:24
Grid Steps [mm]	$3.4 \times 3.4 \times 1.4$	psSAR1g [W/Kg]	28.7
Sensor Surface [mm]	1.4	psSAR8g [W/Kg]	6.49
Graded Grid	Yes	psSAR10g [W/Kg]	5.32
Grading Ratio	1.4	Power Drift [dB]	0.01
MAIA	N/A	Power Scaling	Disabled
Surface Detection	VMS + 6p	Scaling Factor [dB]	-1023.04
Scan Method	Measured	TSL Correction	No correction
		M2/M1 [%]	50.8
		Dist 3dB Peak [mm]	4.8



### Impedance Measurement Plot for Head TSL



#### **Justification for Extended SAR Dipole Calibrations**

Instead of the typical annual calibration recommended by measurement standards, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements

#### KDB 865664 D01v01r04 requirements

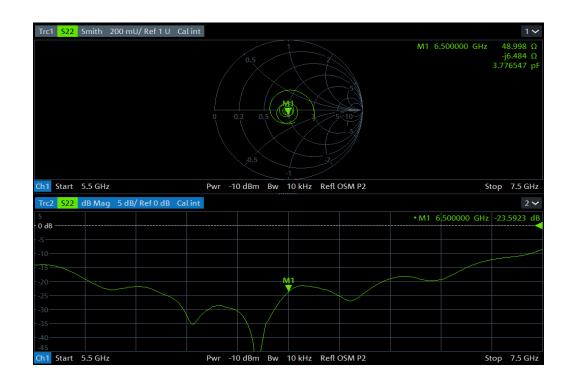
a ) return loss : < - 20 dB, within 20% of previous measurement

b ) impedance : within 5  $\boldsymbol{\Omega}$  from previous measurement

Dipole Antenna	Head/Body	Date of Measurement	Return Loss(dB)	Δ%	Impedance(Ω)	ΔΩ
D6.5GHzV2-SN:1010	Head	2022-05-27	-22.70	3.95	49.90	-0.90
D0.3GHZVZ-3IV.1010	пеац	2023-05-23	-23.59	5.95	49.00	-0.90

c ) extrapolated peak SAR : within 10% of that reported in the calibration data

Dipole Antenna	Head/Body	Date of Measurement	extrapolated peak SAR(W/kg)	Δ%
D6.5GHzV2-SN:1010	Head	2022-05-27	28.70	1.74
D6.5GHZVZ-SN.1010	пеац	2023-05-23	29.20	1.74



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Client

**UL Korea (Dymstec)** 

Certificate No: D8GHzV2-1012\_Nov22

Calibration Procedure for SAR Validation Sources between 3-10 GH Calibration date:  November 01, 2022  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 certificat 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)  Trimary Standards  ID # Cal Date (Certificate No.) Scheduled Calibration Over sensor R&S NRP33T  SN: 100967 01-Apr-22 (No. 217-03526) Apr-23 (Perence 20 dB Attenuator SN: BH9394 (20k) 04-Apr-22 (No. 217-03527) Apr-23 (Perence 20 dB Attenuator SN: BH9394 (20k) 04-Apr-22 (No. 217-03527) Apr-23 (Perence Probe EX3DV4 SN: 7405 02-Jun-22 (No. EX3-7405_Jun22) Jun-23 (Perence Probe EX3DV4 SN: 7405 02-Jun-22 (No. EX3-7405_Jun22) Jun-23 (Perence Probe EX3DV4 SN: 908 27-Jun-22 (No. DAE4-908_Jun22) Jun-23 (Perence Probe EX3DV4 SN: 827 18-Dec-18 (in house check Dec-21) In house check: Condense of the probability of the pr		ERTIFICAT	- 12	나 서 거 ㅌ 하 이
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Issued: November as calibration certificate shall not be reproduced except in full without written approval of the laboratory.	librated by:	Leif Klysner	Laboratory Technician	Signature Seef Allpur

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





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

TSL

tissue simulating liquid

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

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- 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.
- 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: D8GHzV2-1012\_Nov22

Page 2 of 6

#### **Measurement Conditions**

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

DASY Version	DASY6	V16.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	5 mm	with Spacer
Zoom Scan Resolution	dx, dy = 2.7  mm, dz = 1.2  mm	Graded Ratio = 1.2 (Z direction)
Frequency	8000 MHz ± 1 MHz	

### **Head TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	32.7	7.84 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	32.2 ± 6 %	8.16 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	26.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	267 W/kg ± 24.7 % (k=2)

SAR averaged over 1 cm <sup>3</sup> (8 g) of Head TSL	Condition	
SAR measured	100 mW input power	5.51 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	54.9 W/kg ± 24.4 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	4.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	44.8 W/kg ± 24.4 % (k=2)

### **Appendix**

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.5 Ω - 4.1 jΩ
Return Loss	- 25.6 dB

### **APD (Absorbed Power Density)**

APD averaged over 1 cm <sup>2</sup>	Condition	
APD measured	100 mW input power	266 W/m²
APD measured	normalized to 1W	2660 W/m <sup>2</sup> ± 29.2 % (k=2)

APD averaged over 4 cm <sup>2</sup>	condition		
APD measured	100 mW input power	110 W/m²	
APD measured	normalized to 1W	1100 W/m <sup>2</sup> ± 28.9 % (k=2)	

<sup>\*</sup> The reported APD values have been derived using the psSAR1g and psSAR8g.

### 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
	SPEAG

# **DASY6 Validation Report for Head TSL**

Measurement Report for D8GHz-1012, UID 0 -, Channel 8000 (8000.0MHz)

Device under To	est Properties
-----------------	----------------

Name, Manufacturer		Dimensions [mm]		IMEI	DUT Type		
D8GHz	1	6.0 x 6.0 x	300.0	SN: 1012	-		
Exposure Con	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,	8000	5.65	8.16	32.2

#### **Hardware Setup**

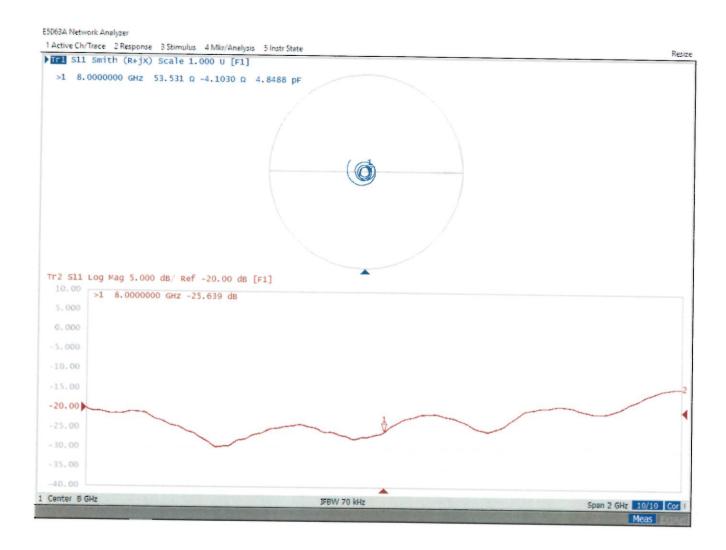
Phantom	TSL	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center - 1182	HBBL600-10000V6	EX3DV4 - SN7405, 2022-06-02	DAE4 Sn908, 2022-06-27

#### Scan Setup

Scan Setup		Measurement Results	
	Zoom Scan		Zoom Scan
Grid Extents [mm]	28.0 x 28.0 x 24.0	Date	2022-11-01, 14:55
Grid Steps [mm]	2.7 x 2.7 x 1.2	psSAR1g [W/Kg]	26.8
Sensor Surface [mm]	1.4	psSAR8g [W/Kg]	5.51
Graded Grid	Yes	psSAR10g [W/Kg]	4.50
Grading Ratio	1.2	Power Drift [dB]	0.02
MAIA	N/A	Power Scaling	Disabled
Surface Detection	VMS + 6p	Scaling Factor [dB]	Disastea
Scan Method	Measured	TSL Correction	Enabled
		M2/M1 [%]	47.6
		Dist 3dB Peak [mm]	4.2



# Impedance Measurement Plot for Head TSL



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





C

Schweizerischer Kalibrierdienst Service suisse d'étalonnage 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

Client

**UL Korea** 

Certificate No: 5G-Veri10-1022 Feb23

Accreditation No.: SCS 0108

# CALIBRATION CERTIFICATE

Object

5G Verification Source 10 GHz - SN: 1022

Calibration procedure(s)

QA CAL-45.v4

Calibration procedure for sources in air above 6 GHz

Calibration date:

Primary Standards

February 20, 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 ( $22 \pm 3$ )°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

ID#

The state of the s	1.00 11	car bate (certificate 146.)	Scrieduled Calibration
Reference Probe EUmmWV3	erence Probe EUmmWV3 SN: 9374 2023-01-03(No. EUmmV		Jan-24
DAE4ip	SN: 1602	2022-06-27 (No. DAE4ip-1602_Jun22)	Jun-23
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
	• tan A is said and	,	m medde emeent 1404 Ee

Cal Date (Certificate No.)

Calibrated by:

Name

**Function** 

Signature

Leif Klysner

Laboratory Technician

Scheduled Calibration

Approved by:

Sven Kühn

Technical Manager

Issued: February 28, 2023

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

Certificate No: 5G-Veri10-1022\_Feb23

Page 1 of 19

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





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

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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

Multilateral Agreement for the recognition of calibration certificates

#### Glossary

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 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. 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 + λ/4) 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%.

Certificate No: 5G-Veri10-1022\_Feb23 Page 2 of 19

### **Measurement Conditions**

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

DASY Version	DASY8 Module mmWave	V3.2
Phantom	5G Phantom	······································
Distance Horn Aperture - plane	10 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 Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	56.2	53.0	1.28 dB

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)		Uncertainty (k = 2)
				<b>1</b> cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	55.9, 56.2, 56.4	52.7, 53.1, 53.3	1.28 dB

**Square Averaging** 

	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	ty Avg Power Density Avg (psPDn+, psP0tot+, psP0(W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	56.2	53.0	1.28 dB

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	55.9, 56.2, 56.4	52.7, 53.0, 53.2	1.28 dB

**Max Power Density** 

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Max Power Density Sn, Stot,  Stot  (W/m²)	Uncertainty (k = 2)
10 mm	89.1	148	1.27 dB	57.0, 57.3, 57.5	1.28 dB

 $<sup>^{\</sup>mathrm{1}}$  Assessed ohmic and mismatch loss plus numerical offset: 0.40 dB

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

### **Device under Test Properties**

Name, Manufacturer Dimensions [mm] IMEI **DUT Type** 5G Verification Source 10 GHz 100.0 x 100.0 x 172.0 SN: 1022

#### **Exposure Conditions**

Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	cw	10000.0, 10000	1.0

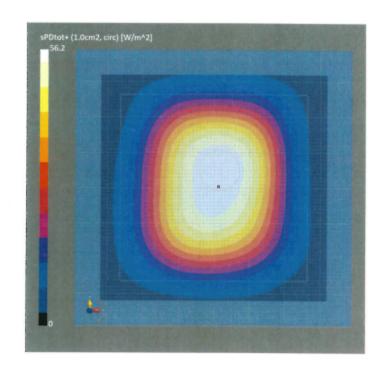
#### **Hardware Setup**

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWV3 - SN9374_F1-55GHz,	DAE4ip Sn1602,
		2023-01-03	2022-06-27

#### **Scan Setup**

Scan Setup			
	5G Scan		5G Scan
Sensor Surface [mm]	10.0	Date	2023-02-20, 11:28
MAIA	MAIA not used	Avg. Area [cm <sup>2</sup> ]	1.00
		Avg. Type	Circular Averaging
		psPDn+ [W/m <sup>2</sup> ]	55.9
		psPDtot+ [W/m <sup>2</sup> ]	56.2
		psPDmod+ [W/m <sup>2</sup> ]	56.4
		Max(Sn) [W/m <sup>2</sup> ]	57.0
		Max(Stot) [W/m <sup>2</sup> ]	57.3
		Max( Stot ) [W/m <sup>2</sup> ]	57.5
		E <sub>max</sub> [V/m]	148
		Power Drift [dB]	0.01

0.01



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

#### **Device under Test Properties**

Name, Manufacturer Dimensions [mm] IMEI **DUT Type** 5G Verification Source 10 GHz 100.0 x 100.0 x 172.0 SN: 1022

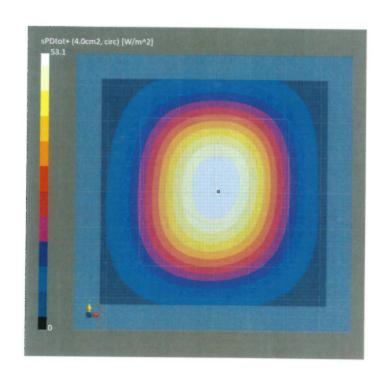
#### **Exposure Conditions**

Phantom Section Position, Test Distance Group, Frequency [MHz], **Conversion Factor** [mm] **Channel Number** 5G -10.0 mm Validation band CW 10000.0, 1.0 10000

#### **Hardware Setup**

**Phantom** Medium **Probe, Calibration Date** DAE, Calibration Date mmWave Phantom - 1002 EUmmWV3 - SN9374\_F1-55GHz, DAE4ip Sn1602, 2023-01-03 2022-06-27

Scan Setup		Measurement Results	
Sensor Surface [mm] MAIA	<b>5G Scan</b> 10.0 MAIA not used	Date Avg. Area [cm²] Avg. Type psPDn+ [W/m²] psPDtot+ [W/m²] psPDmod+ [W/m²] Max(Sn) [W/m²] Max(Stot) [W/m²] Max(Stot) [W/m²] Power Drift [dB]	5G Scan 2023-02-20, 11:28 4.00 Circular Averaging 52:7 53:1 53:3 57:0 57:3 57:5 148



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

#### **Device under Test Properties**

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
5G Verification Source 10 GHz	100.0 x 100.0 x 172.0	SN: 1022	

#### nosure Conditio

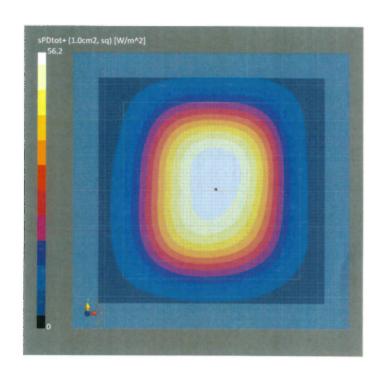
Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	CW	10000.0, 10000	1.0

#### **Hardware Setup**

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWV3 - SN9374_F1-55GHz, 2023-01-03	DAE4ip Sn1602, 2022-06-27

#### Scan Setup

Scan Setup			
	5G Scan		5G Scan
Sensor Surface [mm]	10.0	Date	2023-02-20, 11:28
MAIA	MAIA not used	Avg. Area [cm <sup>2</sup> ]	1.00
		Avg. Type	Square Averaging
		psPDn+ [W/m <sup>2</sup> ]	55.9
		psPDtot+ [W/m <sup>2</sup> ]	56.2
		psPDmod+ [W/m <sup>2</sup> ]	56.4
		Max(Sn) [W/m <sup>2</sup> ]	57.0
		Max(Stot) [W/m <sup>2</sup> ]	57.3
		Max( Stot ) [W/m <sup>2</sup> ]	57.5
		E <sub>max</sub> [V/m]	148
		Power Drift [dB]	0.01



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

#### **Device under Test Properties**

Name, Manufacturer Dimensions [mm] IMEI **DUT Type** 5G Verification Source 10 GHz 100.0 x 100.0 x 172.0 SN: 1022

#### **Exposure Conditions**

**Phantom Section Position, Test Distance** Group, Frequency [MHz], **Conversion Factor** [mm] **Channel Number** 5G -10.0 mm Validation band CW 10000.0, 1.0

10000

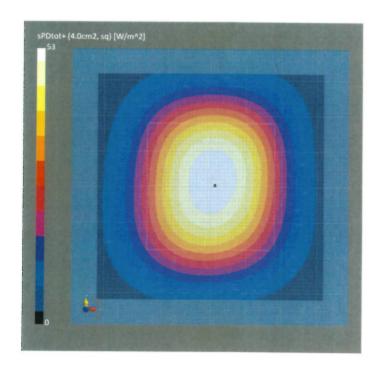
**Measurement Results** 

#### **Hardware Setup**

Phantom Medium **Probe, Calibration Date DAE, Calibration Date** mmWave Phantom - 1002 Air EUmmWV3 - SN9374\_F1-55GHz, DAE4ip Sn1602, 2023-01-03 2022-06-27

#### Scan Setup

	5G Scan		5G Scan
Sensor Surface [mm]	10.0	Date	2023-02-20, 11:28
MAIA	MAIA not used	Avg. Area [cm <sup>2</sup> ]	4.00
		Avg. Type	Square Averaging
		psPDn+ [W/m²]	52.7
		psPDtot+ [W/m <sup>2</sup> ]	53.0
		psPDmod+ [W/m²]	53.2
		Max(Sn) [W/m²]	57.0
		Max(Stot) [W/m²]	57.3
		Max( Stot ) [W/m²]	57.5
		E <sub>max</sub> [V/m]	
		Power Drift [dB]	148
		romer brint (ab)	0.01



### Appendix: Source Evaluation for Relative System Check

## **Measurement Equipment**

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

Item	ID#	Certificate No.
Probe EUmmWV4	SN: 9536	EUmm-9536_Feb23

#### **Measurement Conditions**

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

DASY Version	DASY8 Module mmWave	V3.2
Phantom	5G Phantom	
Distance Horn Aperture - plane	10 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	perture to (mW) (V/	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	59.4	54.9	1.28 dB

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	59.2, 59.4, 59.5	54.7, 54.9, 55.2	1.28 dB

**Square Averaging** 

Distance Horn Aperture to Measured Plane	(mW) (V/m)		Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	59.4	54.9	1.28 dB

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	59.2, 59.4, 59.5	54.7, 54.9, 55.2	1.28 dB

**Max Power Density** 

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Max Power Density Sn, Stot,  Stot  (W/m²)	Uncertainty (k = 2)
10 mm	89.1	148	1.27 dB	60.9, 60.9, 60.9	1.28 dB

<sup>&</sup>lt;sup>1</sup> Assessed ohmic and mismatch loss plus numerical offset: 0.40 dB

### 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

IMEI SN: 1022

**DUT Type** 

**Exposure Conditions** 

**Phantom Section** 

Position, Test Distance [mm]

Band

Group,

Frequency [MHz], **Channel Number** 

**Conversion Factor** 

5G -

10.0 mm

Validation band

CW

10000.0, 10000

1.0

**Hardware Setup** 

**Phantom** mmWave Phantom - 1002 Medium

Air

**Probe, Calibration Date** 

EUmmWV4 - SN9536 F1-55GHz.

2023-02-16

**DAE, Calibration Date** 

DAE4 Sn1215, 2022-06-27

Scan Setup

Sensor Surface [mm]

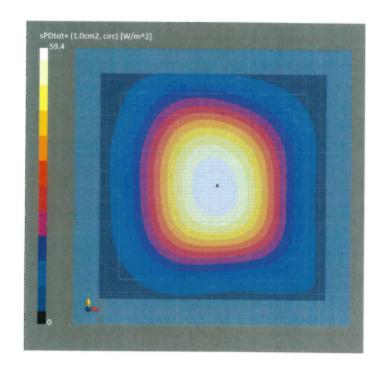
MAIA

5G Scan 10.0 MAIA not used **Measurement Results** 

Avg. Area [cm<sup>2</sup>] Avg. Type psPDn+ [W/m<sup>2</sup>] psPDtot+ [W/m<sup>2</sup>] psPDmod+ [W/m<sup>2</sup>] Max(Sn) [W/m<sup>2</sup>] Max(Stot) [W/m<sup>2</sup>] Max(|Stot|) [W/m2] E<sub>max</sub> [V/m] Power Drift [dB]

5G Scan 2023-02-20, 16:11 1.00 Circular Averaging 59.2 59.4 59.5 60.9 60.9 60.9 148

-0.02



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

### **Device under Test Properties**

Name, Manufacturer Dimensions [mm] IMEI **DUT Type** 5G Verification Source 10 GHz 100.0 x 100.0 x 172.0 SN: 1022

#### **Exposure Conditions**

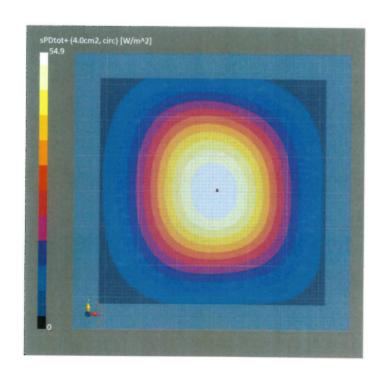
Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	CW	10000.0, 10000	1.0

#### **Hardware Setup**

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWV4 - SN9536_F1-55GHz,	DAE4 Sn1215,
		2023-02-16	2022-06-27

#### S

Scan Setup		Measurement Results	
	5G Scan		5G Scan
Sensor Surface [mm]	10.0	Date	2023-02-20, 16:11
MAIA	MAIA not used	Avg. Area [cm <sup>2</sup> ]	4.00
		Avg. Type	Circular Averaging
		psPDn+ [W/m <sup>2</sup> ]	54.7
		psPDtot+ [W/m²]	54.9
		psPDmod+ [W/m²]	55.2
		Max(Sn) [W/m <sup>2</sup> ]	60.9
		Max(Stot) [W/m <sup>2</sup> ]	60.9
		Max( Stot ) [W/m²]	60.9
		E <sub>max</sub> [V/m]	148
		Power Drift [dB]	-0.02



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

#### **Device under Test Properties**

Name, ManufacturerDimensions [mm]IMEIDUT Type5G Verification Source 10 GHz100.0 x 100.0 x 172.0SN: 1022

#### **Exposure Conditions**

Phantom Section Position, Test Distance [mm] Frequency [MHz], Channel Number

5G - 10.0 mm Validation band CW 10000.0, 10000

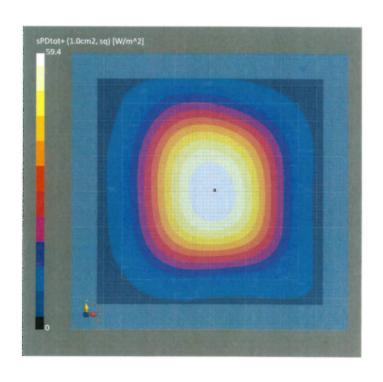
#### **Hardware Setup**

PhantomMediumProbe, Calibration DateDAF, Calibration DatemmWave Phantom - 1002AirEUmmWV4 - SN9536\_F1-55GHz,<br/>2023-02-16DAE4 Sn1215,<br/>2022-06-27

#### Scan Setup

	5G Scan		5G Scan
Sensor Surface [mm]	10.0	Date	2023-02-20, 16:11
MAIA	MAIA not used	Avg. Area [cm <sup>2</sup> ]	1.00
		Avg. Type	Square Averaging
		psPDn+ [W/m <sup>2</sup> ]	59.2
		psPDtot+ [W/m²]	59.4
		psPDmod+ [W/m <sup>2</sup> ]	59.5
		Max(Sn) [W/m <sup>2</sup> ]	60.9
		Max(Stot) [W/m <sup>2</sup> ]	60.9
		Max( Stot ) [W/m <sup>2</sup> ]	60.9
		E <sub>max</sub> [V/m]	148
		Power Drift [dB]	-0.02

**Measurement Results** 



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

#### **Device under Test Properties**

Name, Manufacturer Dimensions [mm] IMEI **DUT Type** 5G Verification Source 10 GHz 100.0 x 100.0 x 172.0 SN: 1022

#### **Exposure Conditions**

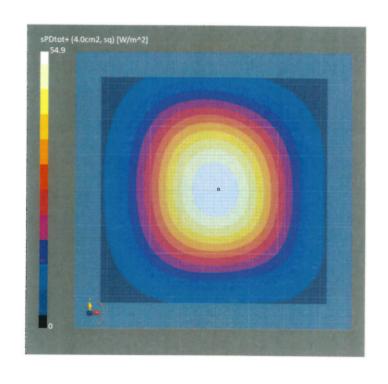
**Phantom Section Position, Test Distance** Group, Frequency [MHz], **Conversion Factor** [mm] **Channel Number** 5G -10.0 mm Validation band CW 10000.0, 1.0 10000

#### **Hardware Setup**

Phantom Medium DAE, Calibration Date **Probe, Calibration Date** mmWave Phantom - 1002 EUmmWV4 - SN9536\_F1-55GHz, Air DAE4 Sn1215, 2023-02-16 2022-06-27

#### S

Scan Setup		Measurement Results	
	5G Scan		5G Scan
Sensor Surface [mm]	10.0	Date	2023-02-20, 16:11
MAIA	MAIA not used	Avg. Area [cm <sup>2</sup> ]	4.00
		Avg. Type	Square Averaging
		psPDn+ [W/m <sup>2</sup> ]	54.7
		psPDtot+ [W/m²]	54.9
		psPDmod+ [W/m <sup>2</sup> ]	55.2
		Max(Sn) [W/m <sup>2</sup> ]	60.9
		Max(Stot) [W/m <sup>2</sup> ]	60.9
		Max( Stot ) [W/m <sup>2</sup> ]	60.9
		E <sub>max</sub> [V/m]	148
		Power Drift [dB]	-0.02



# Appendix: Source Evaluation for Relative System Check

# **Measurement Equipment**

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

Item	ID#	Certificate No.
Probe EUmmWV4	SN: 9559	EUmm-9559_Feb23

### **Measurement Conditions**

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

DASY Version	DASY8 Module mmWave	V3.2
Phantom	5G Phantom	
Distance Horn Aperture - plane	10 mm	
Number of measured planes	2 (10mm, 10mm + λ/4)	
Frequency	10 GHz ± 10 MHz	

# Calibration Parameters, 10 GHz

**Circular Averaging** 

	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	58.6	53.9	1.28 dB

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	58.5, 58.6, 58.8	53.6, 53.9, 54.2	1.28 dB

### **Square Averaging**

1	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	58.6	53.8	1.28 dB

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m²)		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	89.1	148	1.27 dB	58.5, 58.6, 58.8	53.5, 53.8, 54.1	1.28 dB

### **Max Power Density**

Distance Horn Aperture to Measured Plane	Prad¹ (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Max Power Density Sn, Stot,  Stot  (W/m²)	Uncertainty (k = 2)
10 mm	89.1	148	1.27 dB	60.3, 60.3, 60.4	1.28 dB

Certificate No: 5G-Veri10-1022\_Feb23

 $<sup>^{\</sup>rm I}$  Assessed ohmic and mismatch loss plus numerical offset: 0.40 dB

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

#### **Device under Test Properties**

Name, Manufacturer Dimensions [mm] IMEI **DUT Type** 5G Verification Source 10 GHz 100.0 x 100.0 x 172.0 SN: 1022

#### **Exposure Conditions**

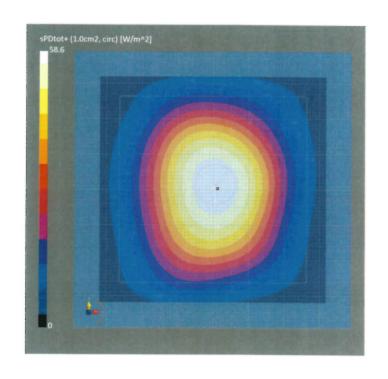
Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	CW	10000.0, 10000	1.0

#### **Hardware Setup**

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWV4 - SN9559_F1-55GHz,	DAE4 Sn1215,
		2023-02-16	2022-06-27

#### Scan Setup

Scan Setup		Measurement Results	
	5G Scan		5G Scan
Sensor Surface [mm]	10.0	Date	2023-02-20, 17:19
MAIA	MAIA not used	Avg. Area [cm <sup>2</sup> ]	1.00
		Avg. Type	Circular Averaging
		psPDn+ [W/m <sup>2</sup> ]	58.5
		psPDtot+ [W/m <sup>2</sup> ]	58.6
		psPDmod+ [W/m <sup>2</sup> ]	58.8
		Max(Sn) [W/m <sup>2</sup> ]	60.3
		Max(Stot) [W/m <sup>2</sup> ]	60.3
		Max( Stot ) [W/m²]	60.4
		E <sub>max</sub> [V/m]	148
		Power Drift [dB]	0.03



# 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 IMEI SN: 1022

**DUT Type** 

**Exposure Conditions** 

**Phantom Section** 

Position, Test Distance

Group,

Frequency [MHz], **Channel Number** 

**Conversion Factor** 

5G -

[mm] 10.0 mm

Validation band

CW

10000.0, 10000

1.0

**Hardware Setup** 

Phantom

mmWave Phantom - 1002

Medium

Air

**Probe, Calibration Date** 

EUmmWV4 - SN9559\_F1-55GHz,

2023-02-16

**DAE, Calibration Date** 

DAE4 Sn1215, 2022-06-27

**Scan Setup** 

Sensor Surface [mm]

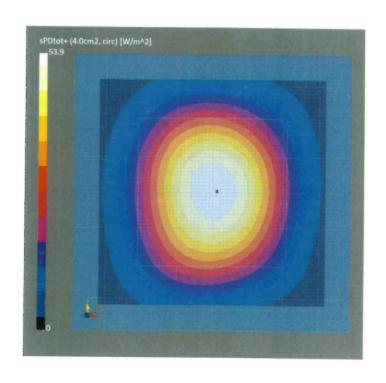
MAIA

5G Scan 10.0

MAIA not used

#### **Measurement Results**

	5G Scan
Date	2023-02-20, 17:19
Avg. Area [cm <sup>2</sup> ]	4.00
Avg. Type	Circular Averaging
psPDn+ [W/m²]	53.6
psPDtot+ [W/m²]	53.9
psPDmod+ [W/m²]	54.2
Max(Sn) [W/m²]	60.3
Max(Stot) [W/m²]	60.3
Max( Stot ) [W/m²]	60.4
E <sub>max</sub> [V/m]	148
Power Drift [dB]	0.03



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

#### **Device under Test Properties**

Name, Manufacturer Dimensions [mm] IMEI **DUT Type** 5G Verification Source 10 GHz 100.0 x 100.0 x 172.0 SN: 1022

#### **Exposure Conditions**

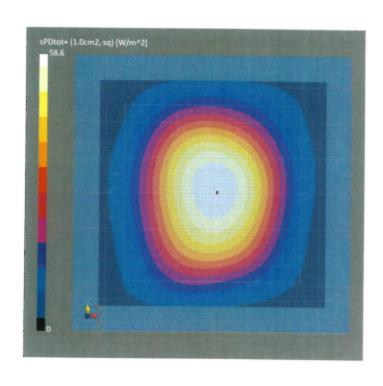
**Phantom Section** Position, Test Distance Group, Frequency [MHz], **Conversion Factor** [mm] **Channel Number** 5G -10.0 mm Validation band CW 10000.0, 1.0 10000

#### **Hardware Setup**

**Phantom** Medium **Probe, Calibration Date DAE, Calibration Date** mmWave Phantom - 1002 Air EUmmWV4 - SN9559\_F1-55GHz, DAE4 Sn1215, 2023-02-16 2022-06-27

#### S

Scan Setup		Measurement Results	
Sensor Surface [mm] MAIA	<b>5G Scan</b> 10.0 MAIA not used	Date Avg. Area [cm²] Avg. Type psPDn+ [W/m²] psPDtot+ [W/m²] psPDmod+ [W/m²] Max(Sn) [W/m²] Max(Stot) [W/m²] Max( Stot ) [W/m²] E <sub>max</sub> [V/m] Power Drift [dB]	5G Scan 2023-02-20, 17:19 1.00 Square Averaging 58.5 58.6 58.8 60.3 60.3 60.4 148



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

### **Device under Test Properties**

Name, Manufacturer Dimensions [mm] IMEI **DUT Type** 5G Verification Source 10 GHz 100.0 x 100.0 x 172.0 SN: 1022

#### **Exposure Conditions**

**Phantom Section** Position, Test Distance Band Group, Frequency [MHz], **Conversion Factor** [mm] **Channel Number** 5G -10.0 mm Validation band CW 10000.0, 1.0 10000

#### **Hardware Setup**

Phantom Medium **Probe, Calibration Date** DAE, Calibration Date mmWave Phantom - 1002 EUmmWV4 - SN9559\_F1-55GHz, Air DAE4 Sn1215, 2023-02-16 2022-06-27

#### Scan Setup

Scan Setup		Measurement Results	
	5G Scan		5G Scan
Sensor Surface [mm]	10.0	Date	2023-02-20, 17:19
MAIA	MAIA not used	Avg. Area [cm <sup>2</sup> ]	4.00
		Avg. Type	Square Averaging
		psPDn+ [W/m²]	53.5
		psPDtot+ [W/m²]	53.8
		psPDmod+ [W/m <sup>2</sup> ]	54.1
		Max(Sn) [W/m <sup>2</sup> ]	60.3
		Max(Stot) [W/m <sup>2</sup> ]	60.3
		Max( Stot ) [W/m <sup>2</sup> ]	60.4
		E <sub>max</sub> [V/m]	148
		Power Drift [dB]	0.03

