

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



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

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

Accreditation No.: **SCS 0108****Glossary:**

TS	tissue simulating liquid
ConvF	sensitivity in TS / 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 TS:* 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 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 TS parameters:* The measured TS 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%.

### Measurement Conditions

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

<b>DASY Version</b>	DASY6	V16.2
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom	
<b>Distance Dipole Center - TSL</b>	5 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy = 3.4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
<b>Frequency</b>	6500 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	34.5	6.07 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	33.5 ± 6 %	5.88 mho/m ± 6 %
<b>Head TSL temperature change during test</b>	< 0.5 °C	----	----

### SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	29.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>294 W/kg ± 24.7 % (k=2)</b>
<b>SAR averaged over 8 cm<sup>3</sup> (8 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	6.70 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>66.5 W/kg ± 24.4 % (k=2)</b>
<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	Condition	
SAR measured	100 mW input power	5.49 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	<b>54.5 W/kg ± 24.4 % (k=2)</b>

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

Impedance, transformed to feed point	46.6 $\Omega$ + 0.7 $j\Omega$
Return Loss	- 29.0 dB

**APD (Absorbed Power Density)**

APD averaged over 1 cm <sup>2</sup>	Condition	
APD measured	100 mW input power	294 W/m <sup>2</sup>
APD measured	normalized to 1W	2940 W/m <sup>2</sup> ± 29.2 % (k=2)

APD averaged over 4 cm <sup>2</sup>	Condition	
APD measured	100 mW input power	134 W/m <sup>2</sup>
APD measured	normalized to 1W	1340 W/m <sup>2</sup> ± 28.9 % (k=2)

\*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
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**DASY6 Validation Report for Head TSL**

Measurement Report for D6.5GHz-1101, UID 0 -, Channel 6500 (6500.0MHz)

**Device under Test Properties**

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
D6.5GHz	10.0 x 10.0 x 10.0	SN: 1101	-

**Exposure Conditions**

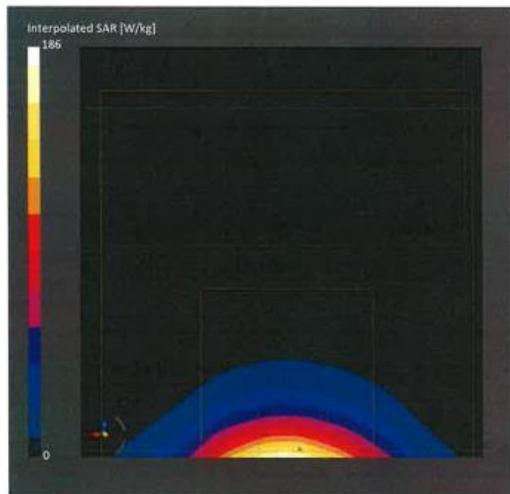
Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz]	Conversion Factor	TSL Cond. [S/m]	TSL Permittivity
Flat, HSL	5.00	Band	CW,	6500	5.50	5.88	33.5

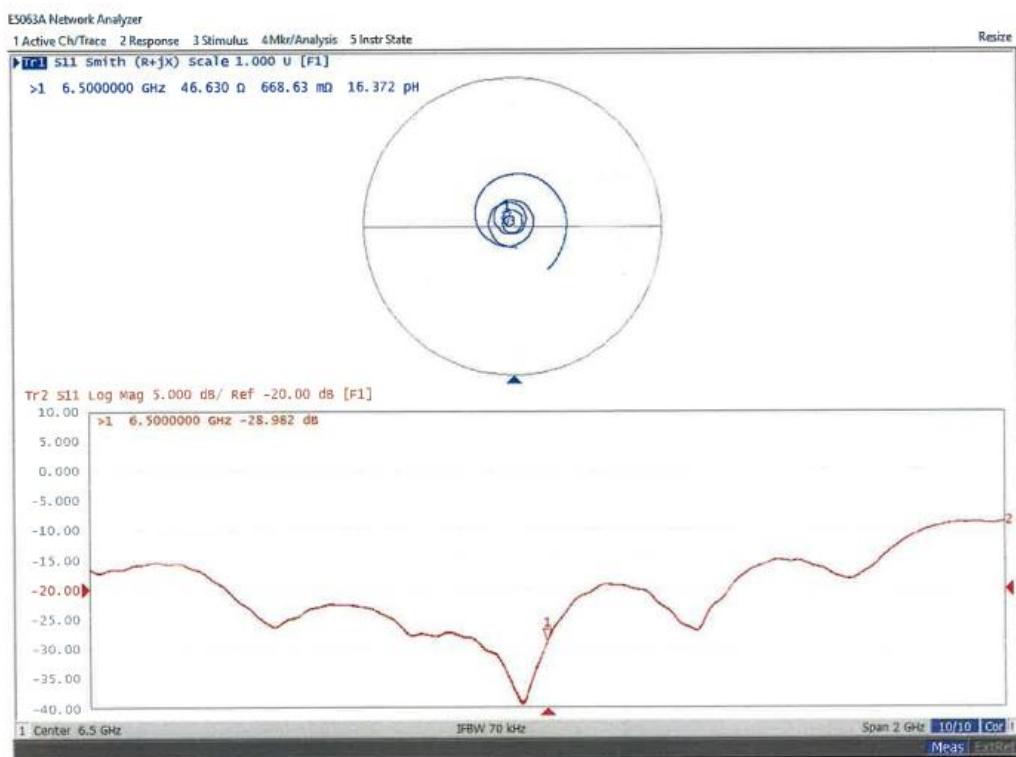
**Hardware Setup**

Phantom	TSL	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center - 1182	HBBL600-10000V6	EX3DV4 - SN7405, 2023-06-12	DAE4 Sn908, 2023-07-03

**Scan Setup**

	Zoom Scan		Zoom Scan
Grid Extents [mm]	22.0 x 22.0 x 22.0	Date	2023-08-10, 15:32
Grid Steps [mm]	2.9 x 2.9 x 1.2	psSAR1g [W/Kg]	29.6
Sensor Surface [mm]	1.4	psSAR8g [W/Kg]	6.70
Graded Grid	Yes	psSAR10g [W/Kg]	5.49
Grading Ratio	1.4	Power Drift [dB]	0.02
MAIA	N/A	Power Scaling	Disabled
Surface Detection	VMS + 6p	Scaling Factor [dB]	No correction
Scan Method	Measured	TSL Correction	
		M2/M1 [%]	55.8
		Dist 3dB Peak [mm]	4.7



**Impedance Measurement Plot for Head TSL**

**10GHz**

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Accreditation No.: SCS 0108

Client **SAICT**  
Shenzhen

Certificate No. 5G-Veri10-1071\_Aug23

## **CALIBRATION CERTIFICATE**

Object 5G Verification Source 10 GHz - SN: 1071

Calibration procedure(s) QA CAL-45.v4  
Calibration procedure for sources in air above 6 GHz

Calibration date: **August 11, 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)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Reference Probe EUmmWV3	SN: 9374	22-May-23 (No. EUmm-9374_May23)	May-24
DAE4ip	SN: 1602	05-Jul-23 (No. DAE4ip-1602_Jul23)	Jul-24

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

Calibrated by: **Joanna Llesha** Name **Laboratory Technician** Function

**Signature**

Issued: August 15, 2023

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

Certificate No: 5G-Veri10-1071\_Aug23

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Accreditation No.: **SCS 0108**

### 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. 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 far-field 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 +  $\lambda/4$ ) with a vectorial E-field probe. The E-field value stated as calibration value represents the E-field-maxima and the averaged (1cm<sup>2</sup> and 4cm<sup>2</sup>) 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/m<sup>2</sup>) averaged over the surface area of 1 cm<sup>2</sup> and 4cm<sup>2</sup> 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%.

### 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 + $\lambda/4$ )		
Frequency	10 GHz $\pm$ 10 MHz		

### Calibration Parameters, 10 GHz

#### Circular Averaging

Distance Horn Aperture to Measured Plane	<i>Prad</i> <sup>1</sup> (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m <sup>2</sup> )	Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>
10 mm	93.3	152	1.27 dB	59.9	55.6

Distance Horn Aperture to Measured Plane	<i>Prad</i> <sup>1</sup> (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m <sup>2</sup> )	Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>
10 mm	93.3	152	1.27 dB	59.7, 59.9, 60.1	55.4, 55.6, 55.9

#### Square Averaging

Distance Horn Aperture to Measured Plane	<i>Prad</i> <sup>1</sup> (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density Avg (psPDn+, psPDtot+, psPDmod+) (W/m <sup>2</sup> )	Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>
10 mm	93.3	152	1.27 dB	59.9	55.5

Distance Horn Aperture to Measured Plane	<i>Prad</i> <sup>1</sup> (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Power Density psPDn+, psPDtot+, psPDmod+ (W/m <sup>2</sup> )	Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>
10 mm	93.3	152	1.27 dB	59.7, 59.9, 60.0	55.2, 55.5, 55.8

#### Max Power Density

Distance Horn Aperture to Measured Plane	<i>Prad</i> <sup>1</sup> (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Max Power Density Sn, Stot,  Stot  (W/m <sup>2</sup> )	Uncertainty (k = 2)
10 mm	93.3	152	1.27 dB	61.3, 61.4, 61.5	1.28 dB

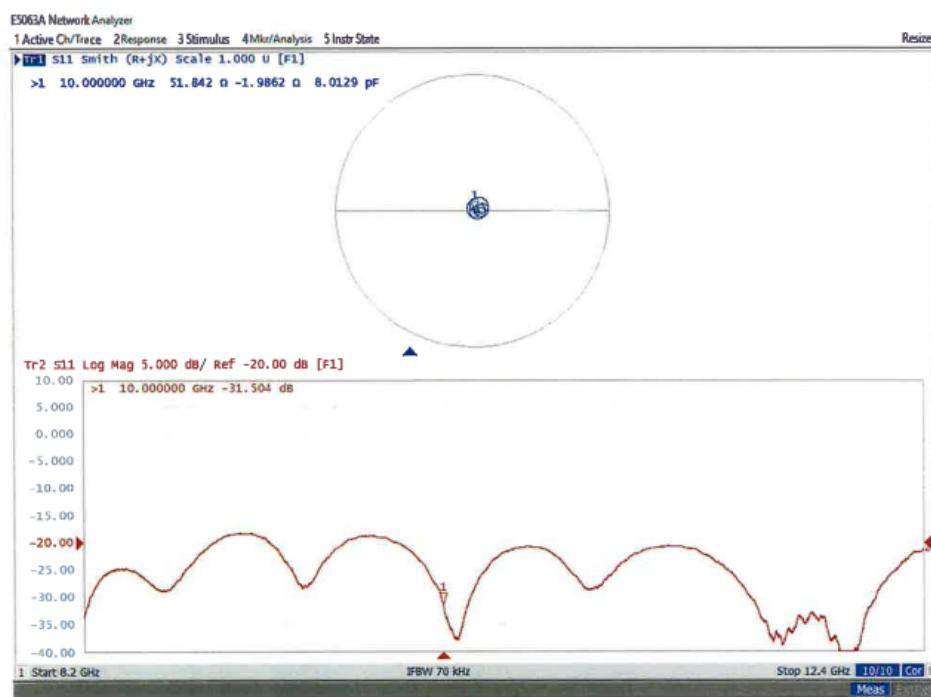
<sup>1</sup> Assessed ohmic and mismatch loss plus numerical offset: 0.30 dB

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

**Antenna Parameters**

Impedance, transformed to feed point	51.8 $\Omega$ - 2.0 $j\Omega$
Return Loss	- 31.5 dB

**Impedance Measurement Plot**



## DASY Report

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: 1071	-

### 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, 2023-05-22	DAE4ip Sn1602, 2023-07-05

### Scan Setup

Sensor Surface [mm]	5G Scan	Measurement Results	5G Scan
MAIA	10.0	Date	2023-08-11, 13:11
	MAIA not used	Avg. Area [cm <sup>2</sup> ]	1.00
		Avg. Type	Circular Averaging
		psPDn+ [W/m <sup>2</sup> ]	59.7
		psPDbt+ [W/m <sup>2</sup> ]	59.9
		psPDmod+ [W/m <sup>2</sup> ]	60.1
		Max(Sn) [W/m <sup>2</sup> ]	61.3
		Max(Stot) [W/m <sup>2</sup> ]	61.4
		Max( Stot ) [W/m <sup>2</sup> ]	61.5
		E <sub>max</sub> [V/m]	152
		Power Drift [dB]	-0.00



## DASY Report

### 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: 1071	-

#### 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, 2023-05-22	DAE4ip Sn1602, 2023-07-05

#### Scan Setup

Sensor Surface [mm]	5G Scan	Measurement Results	5G Scan
MAIA	10.0 MAIA not used	Date 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/m <sup>2</sup> ] E <sub>max</sub> [V/m] Power Drift [dB]	2023-08-11, 13:11 4.00 Circular Averaging 55.4 55.6 55.9 61.3 61.4 61.5 152 -0.00



## DASY Report

### 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: 1071	-

#### Exposure Conditions

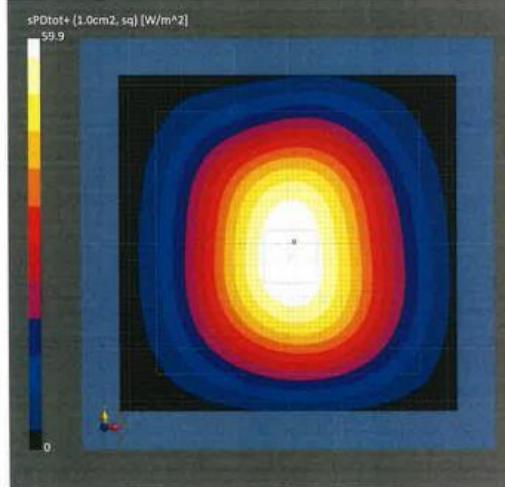
Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	CW	10000.0, 10000	1.0

#### Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWV3 - SN9374_F1-55GHz, 2023-05-22	DAE4ip Sn1602, 2023-07-05

#### Scan Setup

Sensor Surface [mm]	5G Scan	Measurement Results	5G Scan
MAIA	10.0 MAIA not used	Date 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> ] E <sub>max</sub> [V/m] Power Drift [dB]	2023-08-11, 13:11 1.00 Square Averaging 59.7 59.9 60.0 61.3 61.4 61.5 152 -0.00



## DASY Report

### 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: 1071	-

#### Exposure Conditions

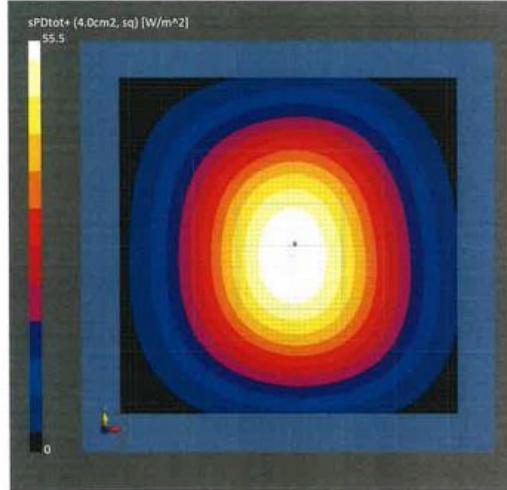
Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	10.0 mm	Validation band	CW	10000.0, 10000	1.0

#### Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWV3 - SN9374_F1-55GHz, 2023-05-22	DAE4ip Sn1602, 2023-07-05

#### Scan Setup

Sensor Surface [mm]	SG Scan	Measurement Results	SG Scan
MAIA	10.0	Date	2023-08-11, 13:11
	MAIA not used	Avg. Area [cm <sup>2</sup> ]	4.00
		Avg. Type	Square Averaging
		psPDn+ [W/m <sup>2</sup> ]	55.2
		psPDtot+ [W/m <sup>2</sup> ]	55.5
		psPDmod+ [W/m <sup>2</sup> ]	55.8
		Max(Sn) [W/m <sup>2</sup> ]	61.3
		Max(Stot) [W/m <sup>2</sup> ]	61.4
		Max( Stot ) [W/m <sup>2</sup> ]	61.5
		E <sub>max</sub> [V/m]	152
		Power Drift [dB]	-0.00



## ANNEX J: Extended Calibration SAR Dipole

Referring to KDB865664 D01, if dipoles are verified in return loss (<-20dBm, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

Justification of Extended Calibration SAR Dipole D6.5GHzV2 - SN:1101

Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)
2023/8/10	-29.0	/	46.6	/	0.70	/
2024/8/10	-28.4	2.1	48.5	1.9	0.86	0.16

Justification of Extended Calibration SAR Dipole 5G Verification Source 10 GHz - SN:1071

Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)
2023/8/11	-31.5	/	51.8	/	-2.00	/
2024/8/11	-30.4	3.5	50.5	-1.3	-1.89	0.11

The Return-Loss is <-20dB, and within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the value result should support extended calibration.

## ANNEX K: Accreditation Certificate



### Accredited Laboratory

A2LA has accredited

**TELECOMMUNICATION TECHNOLOGY LABS, CAICT**

*Beijing, People's Republic of China*

for technical competence in the field of

#### Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-LAC-IAF Communiqué dated April 2017).



Presented this 23<sup>rd</sup> day of July 2024.



Mr. Trace McInturff, Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 7049.01  
Valid to July 31, 2026

*For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.*