Appendix D - Calibration Certificates

Calibration Laboratory of

Schmid & Partner **Engineering AG**

Zeughausstrasse 43, 8004 Zurich, Switzerland





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

Client

Eurofins E&E Wireless

Taoyuan City

Certificate No. D2450V2-712 Jul23

CALIBRATION CERTIFICATE

Object

D2450V2 - SN:712

Calibration procedure(s)

QA CAL-05.v12

Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date:

July 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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

8 4 5 94 (20k) 2 / 06327	30-Mar-23 (No. 217-03804/03805) 30-Mar-23 (No. 217-03804) 30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22)	Mar-24 Mar-24 Mar-24 Mar-24 Mar-24 Jan-24 Dec-23 Scheduled Check
5 94 (20k) 2 / 06327	30-Mar-23 (No. 217-03805) 30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22)	Mar-24 Mar-24 Mar-24 Jan-24 Dec-23
94 (20k) 2 / 06327	30-Mar-23 (No. 217-03809) 30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22)	Mar-24 Mar-24 Jan-24 Dec-23
2 / 06327	30-Mar-23 (No. 217-03810) 10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22)	Mar-24 Jan-24 Dec-23
	10-Jan-23 (No. EX3-7349_Jan23) 19-Dec-22 (No. DAE4-601_Dec22)	Jan-24 Dec-23
	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23
-10175		
540475	Check Date (in house)	Scheduled Check
-40475		
512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
2	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24
	Function	Signature
	Laboratory Technician	fante
	Technical Manager	
	093315 2 080477	292783 07-Oct-15 (in house check Oct-22) 293315 07-Oct-15 (in house check Oct-22) 2 15-Jun-15 (in house check Oct-22) 280477 31-Mar-14 (in house check Oct-22) Function Laboratory Technician

Issued: July 13, 2023

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

Certificate No: D2450V2-712_Jul23

Page 1 of 6

Calibration Laboratory of

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





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:

TSL

tissue simulating liquid

ConvF

sensitivity in TSL / NORM x,y,z

N/A

not applicable or not measured

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	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	37.8 ± 6 %	1.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	51.7 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg ± 16.5 % (k=2)

Certificate No: D2450V2-712_Jul23

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7 Ω + 4.4 jΩ
Return Loss	- 25.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.157 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
-	

Certificate No: D2450V2-712_Jul23 Page 4 of 6

DASY5 Validation Report for Head TSL

Date: 11.07.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:712

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

Medium parameters used: f = 2450 MHz; $\sigma = 1.85$ S/m; $\epsilon_r = 37.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

Probe: EX3DV4 - SN7349; ConvF(7.9, 7.9, 7.9) @ 2450 MHz; Calibrated: 10.01.2023

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 19.12.2022

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

DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 114.2 V/m; Power Drift = 0.03 dB

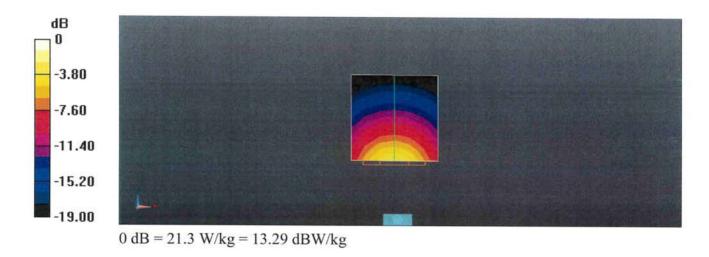
Peak SAR (extrapolated) = 25.4 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.21 W/kg

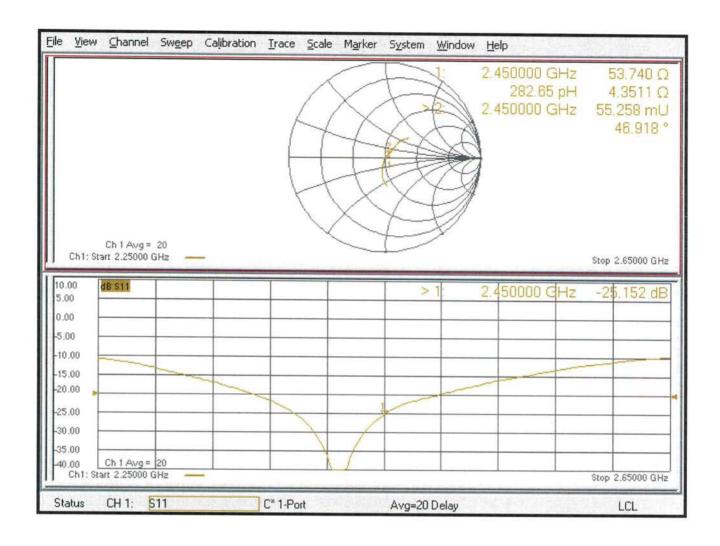
Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 52.1%

Maximum value of SAR (measured) = 21.3 W/kg



Impedance Measurement Plot for Head TSL



Calibration Laboratory of

Schmid & Partner Engineering AG 57-007-23-291

Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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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

Client Eurofins E&E Wireless

Taoyuan City

Certificate No. D5GHzV2-1021_Jul23

CALIBRATION CERTIFICATE

Object

D5GHzV2 - SN:1021

Calibration procedure(s)

QA CAL-22.v7

Calibration Procedure for SAR Validation Sources between 3-10 GHz

Calibration date:

July 18, 2023

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 3503	07-Mar-23 (No. EX3-3503_Mar23)	Mar-24
DAE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24
	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	A) last
Approved by:	Sven Kühn	Technical Manager	3.12

Issued: July 19, 2023

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Certificate No: D5GHzV2-1021_Jul23

Page 1 of 8

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





Schweizerischer Kalibrierdienst
Service suisse d'étalonnage
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Swiss Calibration Service

Accreditation No.: SCS 0108

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

Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL

tissue simulating liquid

ConvF

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

N/A no

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.60 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.01 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.8 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	4.98 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.3 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	23.2 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1021_Jul23

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	34.6 ± 6 %	5.08 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.00 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.5 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.5 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1021_Jul23

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	52.2 Ω - 6.1 jΩ
Return Loss	- 23.9 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	57.4 Ω - 1.8 jΩ
Return Loss	- 23.0 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	58.7 Ω + 1.6 jΩ
Return Loss	- 21.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.200 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 18.07.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1021

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750

MHz

Medium parameters used: f = 5250 MHz; $\sigma = 4.6$ S/m; $\epsilon_r = 34.9$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5600 MHz; $\sigma = 4.98$ S/m; $\epsilon_r = 34.7$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5750 MHz; $\sigma = 5.08$ S/m; $\epsilon_r = 34.6$; $\rho = 1000$ kg/m³

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(5.08, 5.08, 5.08) @ 5750 MHz; Calibrated: 07.03.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan,

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

Reference Value = 75.52 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 26.7 W/kg

SAR(1 g) = 8.01 W/kg; SAR(10 g) = 2.3 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 71.7%

Maximum value of SAR (measured) = 17.8 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 = 75.45 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 29.5 W/kg

SAR(1 g) = 8.18 W/kg; SAR(10 g) = 2.34 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 69%

Maximum value of SAR (measured) = 18.9 W/kg

Certificate No: D5GHzV2-1021_Jul23

Page 6 of 8

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 = 72.83 V/m; Power Drift = 0.04 dB

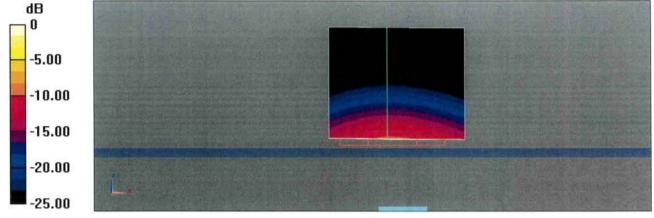
Peak SAR (extrapolated) = 30.5 W/kg

SAR(1 g) = 8 W/kg; SAR(10 g) = 2.27 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

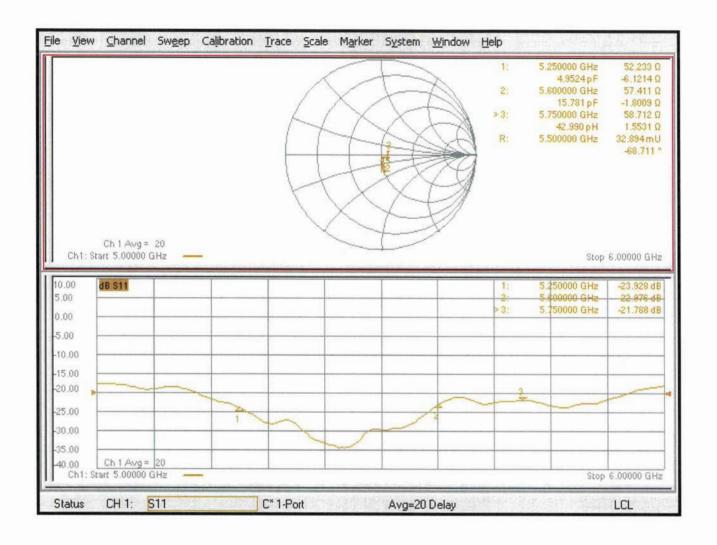
Ratio of SAR at M2 to SAR at M1 = 67.2%

Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 18.9 W/kg = 12.77 dBW/kg

Impedance Measurement Plot for Head TSL









Add: No.52 Hua Yuan Bei Road, Haidian District, Beijing, 100191

Tel: +86-10-62304633-2117

E-mail: emf@caict.ac.cn

http://www.caic.ac.cn

Client Eurofins E&E Wireless Taiwan

Certificate No: Z22-60561

CALIBRATION CERTIFICATE

Object D5GHzV2 - SN: 1021

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

Reviewed by:

December 22, 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±3)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	10-May-22 (CTTL, No.J22X03103)	May-23
Power sensor NRP6A	101369	10-May-22 (CTTL, No.J22X03103)	May-23
Reference Probe EX3DV4	SN 7464	26-Jan-22(SPEAG,No.EX3-7464_Jan22)	Jan-23
DAE4	SN 1556	12-Jan-22(CTTL-SPEAG,No.Z22-60007)	Jan-23
Secondary Standards	ID#	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL, No. J22X00409)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL, No.J22X00406)	Jan-23

Name Function Signature

Calibrated by: Zhao Jing SAR Test Engineer

Lin Hao SAR Test Engineer

Approved by: Qi Dianyuan SAR Project Leader

Issued: December 30, 2022

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Certificate No: Z22-60561 Page 1 of 6





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

Glossary:

TSL tissue simulating liquid

ConvF sensitivity in TSL / NORMx,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-mounted 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) 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 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%.

Certificate No: Z22-60561 Page 2 of 6





Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China

Tel: +86-10-62304633-2117

E-mail: emf@caict.ac.cn

http://www.caic.ac.cn

Measurement Conditions

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5800 MHz ± 1 MHz	

Head TSL parameters at 5800MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.7 ± 6 %	5.24 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL at 5800MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.86 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.7 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.3 W/kg ± 24.2 % (k=2)

Certificate No: Z22-60561 Page 3 of 6





Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China

Tel: +86-10-62304633-2117

E-mail: emf@caict.ac.cn

http://www.caic.ac.cn

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5800MHz

Impedance, transformed to feed point	57.7Ω+ 0.74jΩ	
Return Loss	- 22.9dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.106 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG

Certificate No: Z22-60561 Page 4 of 6





Date: 2022-12-22

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China

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http://www.caic.ac.cn

DASY5 Validation Report for Head TSL

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1021

Communication System: CW; Frequency: 5800 MHz

Medium parameters used: f = 5800 MHz; $\sigma = 5.241 \text{ S/m}$; $\varepsilon_r = 35.68$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 SN7464; ConvF(5, 5, 5) @ 5800 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan,

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

Reference Value = 63.40 V/m; Power Drift = -0.09 dB

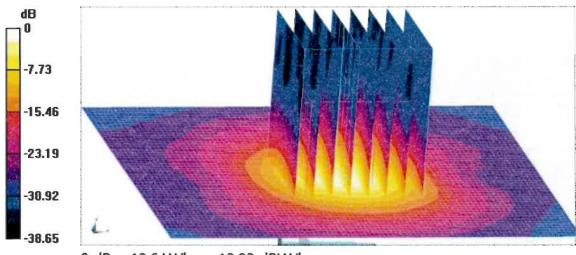
Peak SAR (extrapolated) = 35.8 W/kg

SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.22 W/kg

Smallest distance from peaks to all points 3 dB below = 7.5 mm

Ratio of SAR at M2 to SAR at M1 = 61.3%

Maximum value of SAR (measured) = 19.6 W/kg



0 dB = 19.6 W/kg = 12.92 dBW/kg

Certificate No: Z22-60561 Page 5 of 6



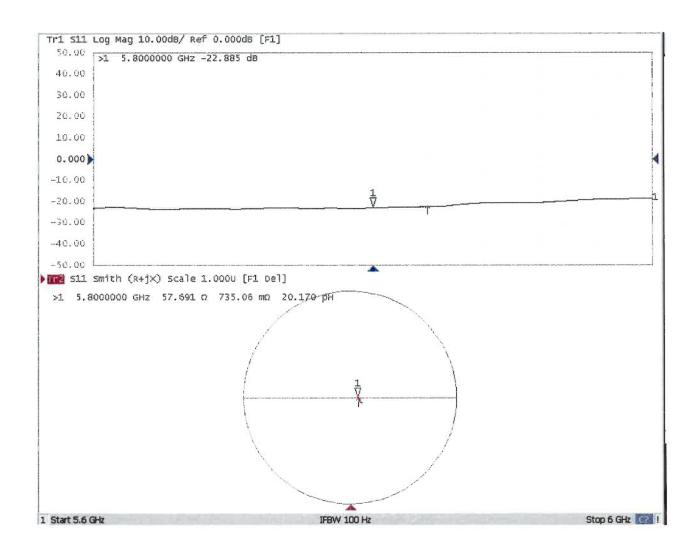
Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China

Tel: +86-10-62304633-2117

E-mail: emf@caict.ac.cn

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Impedance Measurement Plot for Head TSL



Calibration Laboratory of

Schmid & Partner
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Zeughausstrasse 43, 8004 Zurich, Switzerland





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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

Client Eurofins E&E Wireless

New Taipei City

Certificate No. D5GHzV2-1358_Aug23

CALIBRATION CERTIFICATE

Object

D5GHzV2 - SN:1358

Calibration procedure(s)

QA CAL-22.v7

Calibration Procedure for SAR Validation Sources between 3-10 GHz

Calibration date:

August 22, 2023

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 3503	07-Mar-23 (No. EX3-3503_Mar23)	Mar-24
DAE4	SN: 601	19-Dec-22 (No. DAE4-601_Dec22)	Dec-23
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-22)	In house check: Oct-24
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-22)	In house check: Oct-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24
	Name	Function	Signature
Calibrated by:	Krešimir Franjić	Laboratory Technician	II)
Approved by:	Sven Kühn	Technical Manager	
and The second s			5.6

Issued: August 23, 2023

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

Calibration Laboratory of

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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland





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Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: SCS 0108

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

Glossary:

TSL tissue simulating liquid

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

Multilateral Agreement for the recognition of calibration certificates

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:

Certificate No: D5GHzV2-1358_Aug23

c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	4.67 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.03 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.7 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (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)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	5.05 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.6 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1358_Aug23 Page 3 of 8

Head TSL parameters at 5800 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.3 ± 6 %	5.19 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.5 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (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	23.2 W/kg ± 19.5 % (k=2)

Certificate No: D5GHzV2-1358_Aug23 Page 4 of 8

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	48.8 Ω - 2.2 jΩ
Return Loss	- 32.0 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.4 Ω + 0.5 jΩ
Return Loss	- 27.4 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	$52.8 \Omega + 4.5 j\Omega$
Return Loss	- 25.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

Certificate No: D5GHzV2-1358_Aug23 Page 5 of 8

DASY5 Validation Report for Head TSL

Date: 22.08.2023

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1358

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5800

MHz

Medium parameters used: f = 5250 MHz; $\sigma = 4.67$ S/m; $\epsilon_r = 34.8$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5600 MHz; $\sigma = 5.05$ S/m; $\epsilon_r = 34.6$; $\rho = 1000$ kg/m³, Medium parameters used: f = 5800 MHz; $\sigma = 5.19$ S/m; $\epsilon_r = 34.3$; $\rho = 1000$ kg/m³

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(5.01, 5.01, 5.01) @ 5800 MHz; Calibrated: 07.03.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 19.12.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan,

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

Reference Value = 76.16 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 26.7 W/kg

SAR(1 g) = 8.03 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 = 72.1%

Maximum value of SAR (measured) = 17.9 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 = 74.73 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 29.6 W/kg

SAR(1 g) = 8.22 W/kg; SAR(10 g) = 2.37 W/kg

Smallest distance from peaks to all points 3 dB below = 7.4 mm

Ratio of SAR at M2 to SAR at M1 = 69.5%

Maximum value of SAR (measured) = 18.7 W/kg

Certificate No: D5GHzV2-1358_Aug23 Page 6 of 8

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan,

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

Reference Value = 73.83 V/m; Power Drift = 0.02 dB

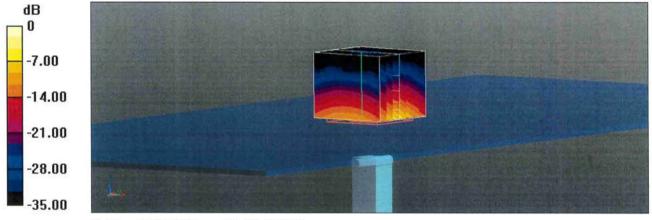
Peak SAR (extrapolated) = 31.3 W/kg

SAR(1 g) = 8.20 W/kg; SAR(10 g) = 2.34 W/kg

Smallest distance from peaks to all points 3 dB below = 7.4 mm

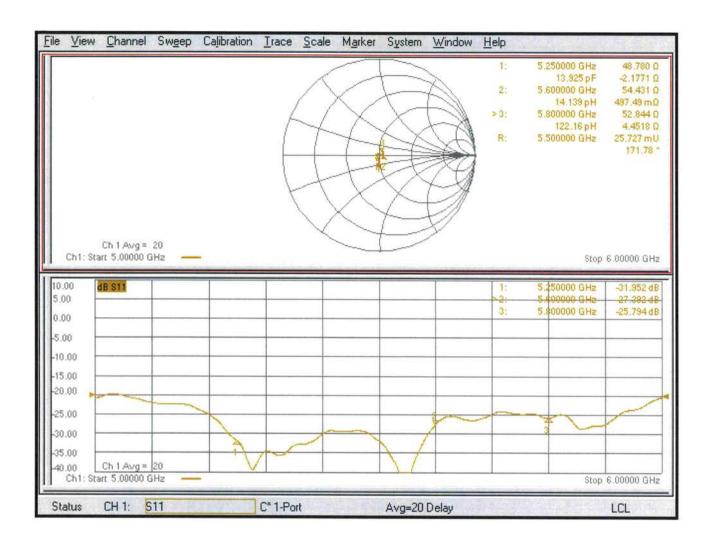
Ratio of SAR at M2 to SAR at M1 = 67.2%

Maximum value of SAR (measured) = 19.2 W/kg



0 dB = 19.2 W/kg = 12.83 dBW/kg

Impedance Measurement Plot for Head TSL



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





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Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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Client

Eurofins E&E Wireless

Taoyuan City

Certificate No. D6.5GHzV2-1016_Aug23

CALIBRATION CERTIFICATE

Object

D6.5GHzV2 - SN:1016

Calibration procedure(s)

QA CAL-22.v7

Calibration Procedure for SAR Validation Sources between 3-10 GHz

Calibration date:

August 16, 2023

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power sensor R&S NRP33T	SN: 100967	03-Apr-23 (No. 217-03806)	Apr-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Mismatch combination	SN: 84224 / 360D	03-Apr-23 (No. 217-03812)	Apr-24
Reference Probe EX3DV4	SN: 7405	12-Jun-23 (No. EX3-7405_Jun23)	Jun-24
DAFA	navan anner		1.104
DAE4 Secondary Standards	SN: 908	03-Jul-23 (No. DAE4-908_Jul23) Check Date (in house)	Jul-24 Scheduled Check
	Lacons		
Secondary Standards RF generator Anapico APSIN20G	ID # SN: 827	O3-Jul-23 (No. DAE4-908_Jul23) Check Date (in house) 18-Dec-18 (in house check Dec-21)	Scheduled Check In house check: Dec-23
Secondary Standards RF generator Anapico APSIN20G	ID#	Check Date (in house)	Scheduled Check
Secondary Standards	ID # SN: 827	Check Date (in house) 18-Dec-18 (in house check Dec-21)	Scheduled Check In house check: Dec-23

Calibrated by:

Name Jeton Kastrati Function

Laboratory Technician

Approved by:

Sven Kühn

Technical Manager

Issued: August 18, 2023

Signature

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

Certificate No: D6.5GHzV2-1016_Aug23

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

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:

TSL

N/A

tissue simulating liquid

ConvF

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 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: D6.5GHzV2-1016_Aug23

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 = 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	33.9 ± 6 %	6.03 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	29.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	294 W/kg ± 24.7 % (k=2)

SAR averaged over 8 cm ³ (8 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.64 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	66.1 W/kg ± 24.4 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	5.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	54.2 W/kg ± 24.4 % (k=2)

Certificate No: D6.5GHzV2-1016_Aug23

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.2 Ω - 7.1 jΩ
Return Loss	- 22.1 dB

APD (Absorbed Power Density)

APD averaged over 1 cm ²	Condition	
APD measured	100 mW input power	293 W/m ²
APD measured	normalized to 1W	2930 W/m ² ± 29.2 % (k=2)

APD averaged over 4 cm ²	condition	
APD measured	100 mW input power	133 W/m²
APD measured	normalized to 1W	1330 W/m ² ± 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

Certificate No: D6.5GHzV2-1016_Aug23 Page 4 of 6

DASY6 Validation Report for Head TSL

Measurement Report for D6.5GHz-1016, 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: 1016	-

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	6.03	33.9

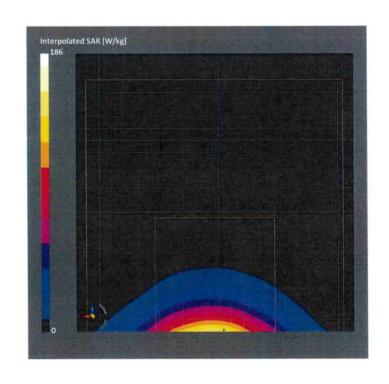
Hardware Setup

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	

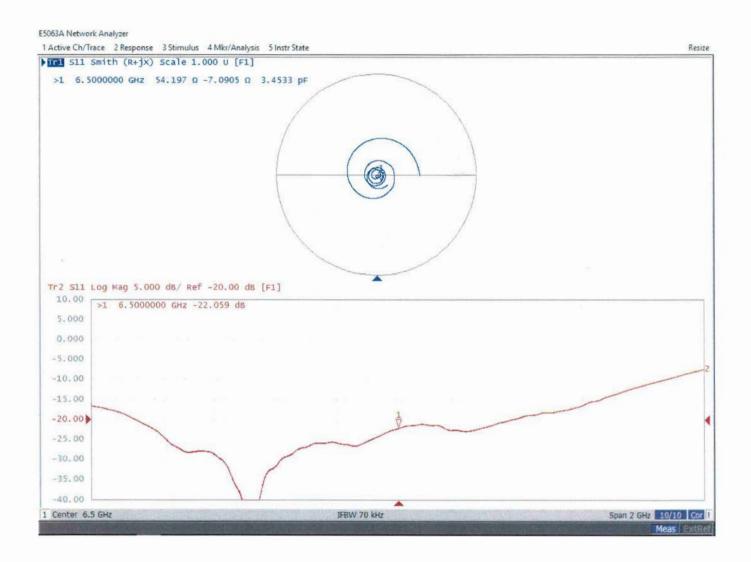
Measurement Results

Scan Setup

Colonia (Andrea representa de Antre)	Zoom Scan		Zoom Scan
Grid Extents [mm]	22.0 x 22.0 x 22.0	Date	2023-08-16, 12:05
Grid Steps [mm]	$3.4 \times 3.4 \times 1.4$	psSAR1g [W/Kg]	29.5
Sensor Surface [mm]	1.4	psSAR8g [W/Kg]	6.64
Graded Grid	Yes	psSAR10g [W/Kg]	5.44
Grading Ratio	1.4	Power Drift [dB]	0.01
MAIA	N/A	Power Scaling	Disabled
Surface Detection	VMS + 6p	Scaling Factor [dB]	
Scan Method	Measured	TSL Correction	No correction
		M2/M1 [%]	51.2
		Dist 3dB Peak [mm]	4.8



Impedance Measurement Plot for Head TSL



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





Schweizerischer Kalibrierdienst 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

Client

Eurofins E&E Wireless New Taipei City

Certificate No. 5G-Veri10-1060_Aug23

CALIBRATION CERTIFICATE

Object

5G Verification Source 10 GHz - SN: 1060

Calibration procedure(s)

QA CAL-45.v4

Calibration procedure for sources in air above 6 GHz

Calibration date:

August 21, 2023

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

ID#

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	
	ID # SN: 100184	Check Date (in house) 19-May-22 (in house check Nov-22)	Scheduled Check In house check: Nov-23	
Secondary Standards RF generator R&S SMF100A Power sensor R&S NRP18S-10	A CONTRACTOR OF THE CONTRACTOR		10 Fy 200 At 200 200	

Calibrated by:

Name

Function

Joanna Lleshaj

Laboratory Technician

Approved by:

Sven Kühn

Technical Manager

Signature

Issued: August 22, 2023

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

Certificate No: 5G-Veri10-1060_Aug23

Page 1 of 8

Calibration Laboratory of

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





S Schweizerischer Kalibrierdienst
Service suisse d'étalonnage
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Swiss Calibration Service

Accreditation No.: SCS 0108

Glossary

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Multilateral Agreement for the recognition of calibration certificates

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 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-Veri10-1060_Aug23 Page 2 of 8

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	Prad1	Max E-field	Uncertainty	Avg Powe	Uncertainty	
Aperture to	(mW)	(V/m)	(k = 2)	Avg (psPDn+, psPDtot+, psPDmod+)		(k = 2)
Measured Plane				(W/m²)		
				1 cm ²	4 cm ²	
10 mm	93.3	154	1.27 dB	61.1	56.7	1.28 dB

Distance Horn	Prad1	Max E-field	Uncertainty	Power Density		Uncertainty
Aperture to	(mW)	(V/m)	(k = 2)	psPDn+, psPDtot+, psPDmod+		(k = 2)
Measured Plane				(W	/m²)	
				1 cm ²	4 cm ²	
10 mm	93.3	154	1.27 dB	60.8, 61.0, 61.5	56.3, 56.7, 57.0	1.28 dB

Square Averaging

Distance Horn	Prad1	Max E-field	Uncertainty	Avg Power Density		Uncertainty
Aperture to	(mW)	(V/m)	(k = 2)	Avg (psPDn+, psPDtot+, psPDmod+)		(k = 2)
Measured Plane				(W/m²)		
				1 cm ²	4 cm ²	
10 mm	93.3	154	1.27 dB	61.1	56.6	1.28 dB

Distance Horn	Prad1	Max E-field	Uncertainty	Power Density		Uncertainty
Aperture to	(mW)	(V/m)	(k = 2)	psPDn+, psPDtot+, psPDmod+		(k = 2)
Measured Plane				(W	/m²)	
				1 cm ²	4 cm ²	
10 mm	93.3	154	1.27 dB	60.9, 61.0, 61.5	56.3, 56.6, 56.9	1.28 dB

Max Power Density

Distance Horn	Prad1	Max E-field	Uncertainty	Max Power Density	Uncertainty
Aperture to	(mW)	`(V/m)	(k = 2)	Sn, Stot, Stot	(k = 2)
Measured Plane				(W/m²)	
10 mm	93.3	154	1.27 dB	62.6, 62.6, 63.2	1.28 dB

Certificate No: 5G-Veri10-1060_Aug23

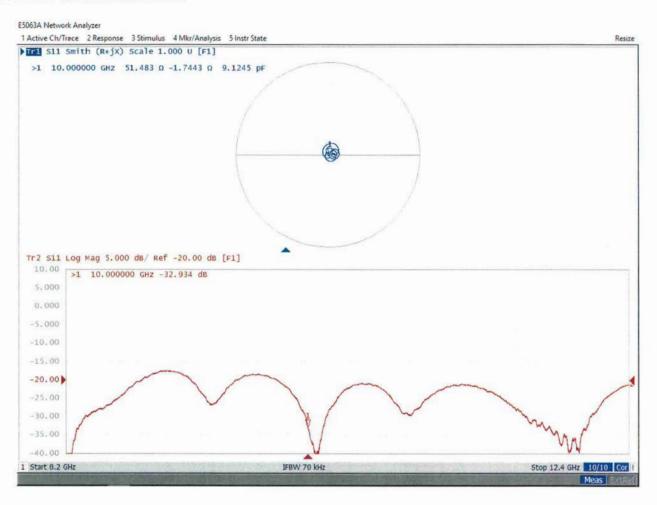
 $^{^{\}rm 1}$ Assessed ohmic and mismatch loss plus numerical offset: 0.30 dB

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

Impedance, transformed to feed point	51.5 Ω - 1.7 jΩ	
Return Loss	- 32.9 dB	

Impedance Measurement Plot



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: 1060 **DUT Type**

Exposure Conditions

Phantom Section

Position, Test Distance

Band

Group,

Frequency [MHz],

Channel Number

Conversion Factor

5G Scan

1.00

60.8

61.0

61.5

62.6

62.6

63.2

154

-0.04

[mm]

5G -

10.0 mm

Validation band

CW

10000.0.

1.0

10000

Hardware Setup

Phantom

mmWave Phantom - 1002

Medium

Probe, Calibration Date

EUmmWV3 - SN9374_F1-55GHz,

2023-05-22

DAE, Calibration Date

DAE4ip Sn1602, 2023-07-05

Scan Setup

Sensor Surface [mm]

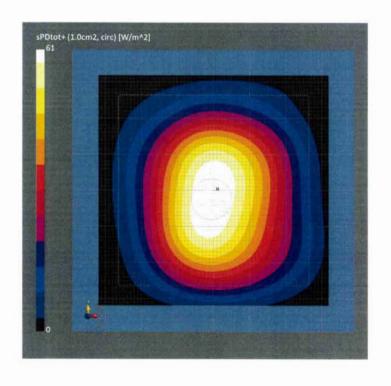
MAIA

5G Scan 10.0

MAIA not used

Measurement Results

Date 2023-08-21, 12:51 Avg. Area [cm²] Circular Averaging Avg. Type psPDn+ [W/m²] psPDtot+ [W/m²] psPDmod+ [W/m²] Max(Sn) [W/m2] Max(Stot) [W/m²] Max(|Stot|) [W/m²] $E_{max}[V/m]$ Power Drift [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: 1060 **DUT Type**

Exposure Conditions

Phantom Section

Position, Test Distance

Band

Group,

Frequency [MHz], Channel Number

Conversion Factor

[mm]

Validation band

10000.0,

5G -

10.0 mm

CW

10000

1.0

Hardware Setup

Phantom

mmWave Phantom - 1002

Medium

Air

Probe, Calibration Date

EUmmWV3 - SN9374_F1-55GHz,

2023-05-22

DAE, Calibration Date DAE4ip Sn1602,

2023-07-05

Scan Setup

Sensor Surface [mm]

MAIA

5G Scan

10.0 MAIA not used

Measurement Results

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_{max} [V/m]

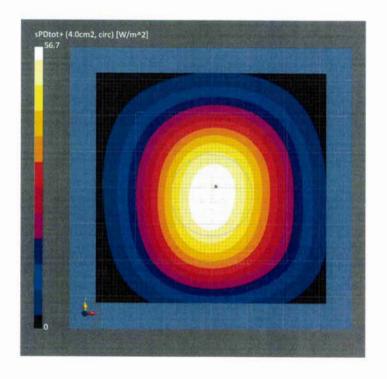
Power Drift [dB]

2023-08-21, 12:51 4.00 Circular Averaging 56.3 56.7 57.0 62.6 62.6

5G Scan

154 -0.04

63.2



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: 1060

Exposure Conditions

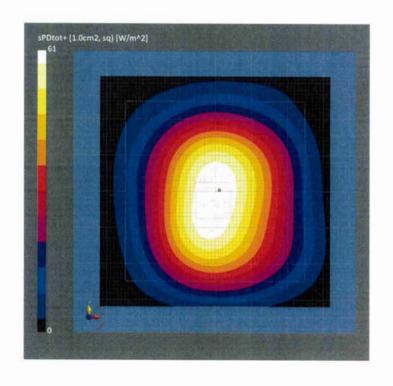
Phantom Section Position, Test Distance Band Group, Frequency [MHz], Conversion Factor Channel Number

5G - 10.0 mm Validation band CW 10000.0, 1.0

Hardware Setup

PhantomMediumProbe, Calibration DateDAE, Calibration DatemmWave Phantom - 1002AirEUmmWV3 - SN9374_F1-55GHz,
2023-05-22DAE4ip Sn1602,
2023-07-05

Scan Setup Measurement Results 5G Scan 5G Scan Sensor Surface [mm] 10.0 Date 2023-08-21, 12:51 MAIA MAIA not used Avg. Area [cm²] 1.00 Avg. Type Square Averaging psPDn+ [W/m²] 60.9 psPDtot+ [W/m²] 61.0 psPDmod+ [W/m²] 61.5 Max(Sn) [W/m²] 62.6 Max(Stot) [W/m²] 62.6 Max(|Stot|) [W/m²] 63.2 E_{max} [V/m] 154 Power Drift [dB] -0.04



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: 1060 **DUT Type**

Exposure Conditions

Phantom Section

Position, Test Distance

Band

Group,

Frequency [MHz], **Channel Number**

Conversion Factor

[mm]

10.0 mm

Validation band

CW

10000.0.

10000

Hardware Setup

Phantom

5G -

mmWave Phantom - 1002

Medium

Air

Probe, Calibration Date

EUmmWV3 - SN9374_F1-55GHz,

2023-05-22

DAE, Calibration Date

1.0

DAE4ip Sn1602, 2023-07-05

Scan Setup

Sensor Surface [mm]

MAIA

Measurement Results

5G Scan 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_{max} [V/m] Power Drift [dB]

2023-08-21, 12:51 4.00 Square Averaging 56.3 56.6 56.9 62.6 62.6 63.2 154 -0.04

5G Scan

