

Calibration Laboratory ofSchmid & 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)

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Multilateral Agreement for the recognition of calibration certificates**Accreditation No.: **SCS 0108**

Client

Element

Yongin, Republic of Korea

Certificate No.

D2450V2-945_Jun25**CALIBRATION CERTIFICATE**

Object

D2450V2 - SN: 945

Calibration procedure(s)

QA CAL-05.v12

Calibration Procedure for SAR Validation Sources between 0.7 - 3 GHz

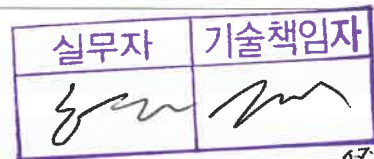
Calibration date

June 3, 2025

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)



67-18-2025

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-33T	SN: 100967	26-Mar-25 (No. 217-04290)	Mar-26
Power Sensor R&S NRP18A	SN: 101859	06-Feb-25 (No. 4030A315009541)	Feb-26
Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
OCP DAK-12	SN: 1016	24-Sept-24 (No. OCP-DAK12-1016_Sep24)	Sep-25
OCP DAK-3.5	SN: 1249	23-Sept-24 (No. OCP-DAK3.5-1249_Sep24)	Sep-25
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4ip	SN: 1836	17-Apr-25 (No. DAE4ip-1836_Apr25)	Apr-26

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Setup 1	SN: 1000	27-May-25 (No. 675-ACAD_Source_Box-250527)	May-26
Signal Generator R&S SMB100A	SN: 182081	27-May-25 (No. 675-CAL16-S4588-250527)	May-26
Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26

	Name	Function
Calibrated by	Claudio Leubler	Laboratory Technician
Approved by	Sven Kühn	Technical Manager

Signature

Issued: June 4, 2025

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Accreditation No.: **SCS 0108**

Glossary

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

Calibration is Performed According to the Following Standards

- 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.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation

- 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.
- *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%.

Measurement Conditions

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

DASY Version	DASY8 Module SAR	16.4.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 5mm, dz = 1.5mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	2450MHz $\pm$ 1MHz	

HSL parameters at 2450 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	39.2	1.80 mho/m
Measured HSL parameters	(22.0 $\pm$ 0.2)°C	37.9 $\pm$ 6%	1.85 mho/m $\pm$ 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 2450 MHz

SAR averaged over 1 cm ³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	13.3 W/kg
SAR for nominal HSL parameters	normalized to 1W	52.9 W/kg $\pm$ 17.0% (k = 2)

SAR averaged over 10 cm ³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	6.29 W/kg
SAR for nominal HSL parameters	normalized to 1W	25.0 W/kg $\pm$ 16.5% (k = 2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with HSL at 2450 MHz**

Impedance	$54.7 \Omega \pm 1.5 j\Omega$
Return Loss	-26.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.159 ns
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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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System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D2450V2 - SN945	2450	HSL	24

Exposure Conditions

Phantom Section, TSL	Test Distance (mm)	Band	Group, UID	Frequency (MHz), Channel Number	Conversion Factor	TSL Conductivity (S/m)	TSL Permittivity
Flat	10		CW, 0--	2450, 0	7.06	1.85	37.9

Hardware Setup

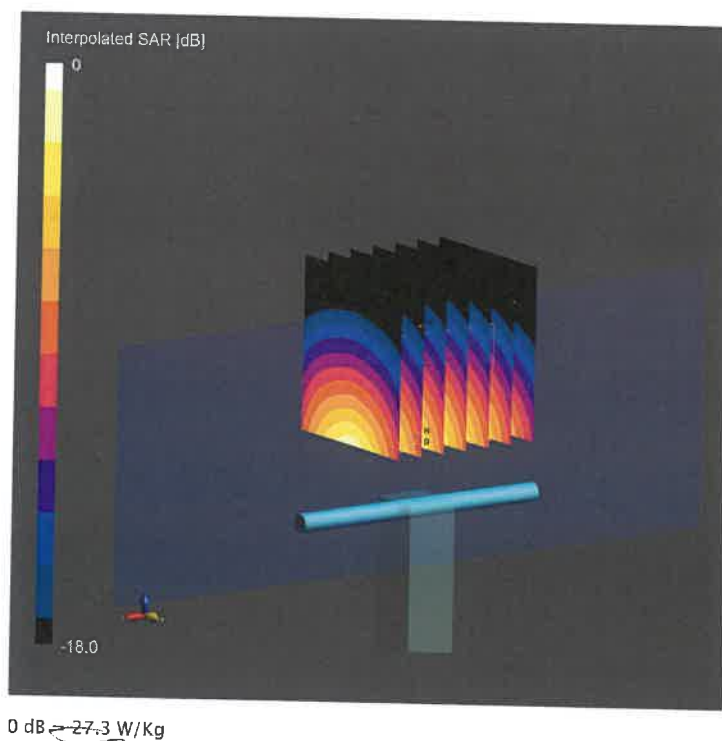
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-06-03	EX3DV4 - SN7349, 2025-01-10	DAE4ip Sn1836, 2025-04-17

Scans Setup

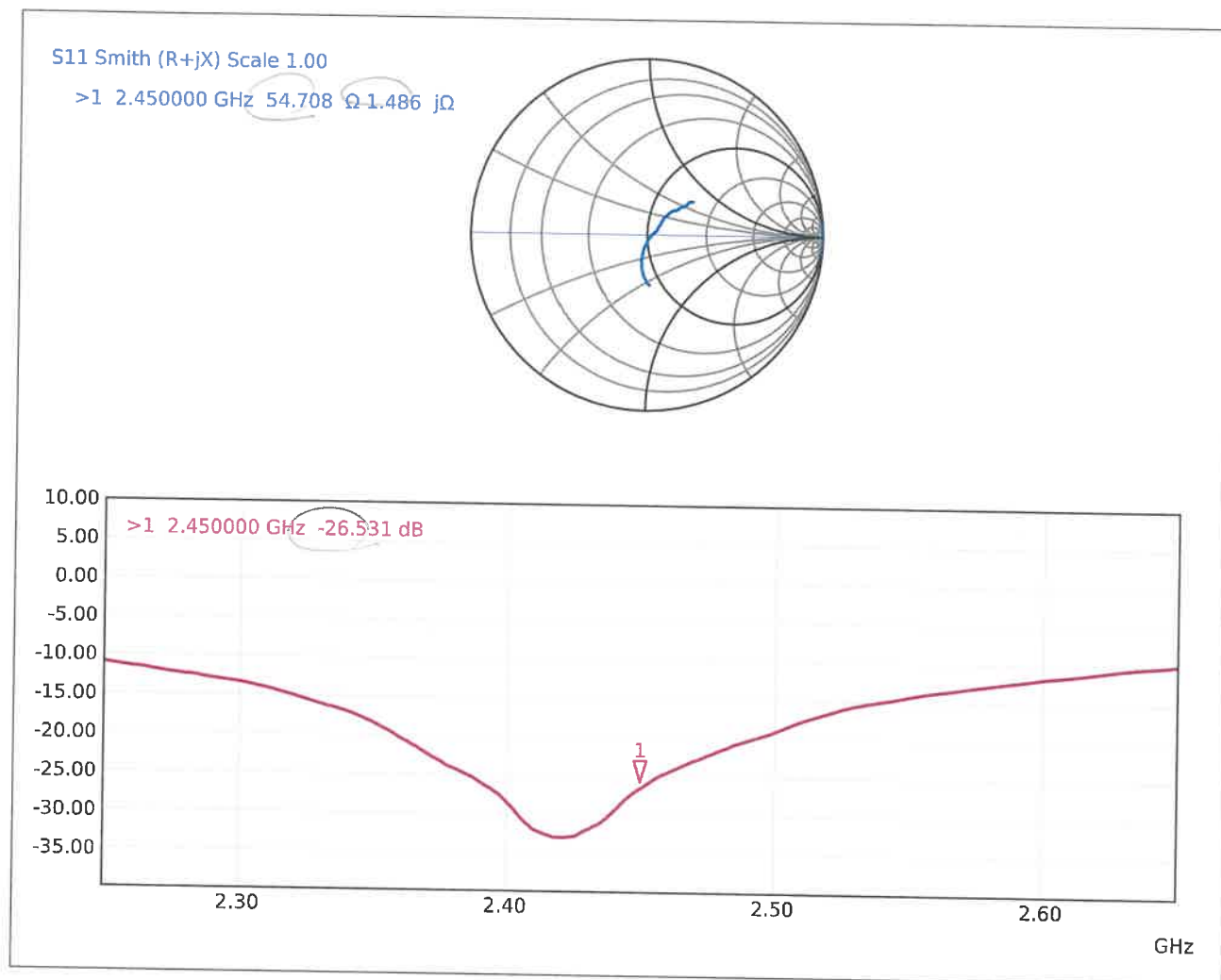
	Zoom Scan
Grid Extents [mm]	30 x 30 x 30
Grid Steps [mm]	5.0 x 5.0 x 1.5
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

Measurement Results

	Zoom Scan
Date	2025-06-03
psSAR1g [W/Kg]	13.3
psSAR10g [W/Kg]	6.29
Power Drift [dB]	0.01
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



Impedance Measurement Plot for HSL





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Accreditation No.: **SCS 0108**

Client

Element
 Yongin, Republic of Korea

Certificate No.

D2600V2-1126_Aug25

CALIBRATION CERTIFICATE

Object

D2600V2 - SN: 1126

실무자	기술책임자

Calibration procedure(s)

QA CAL-05.v12

Calibration Procedure for SAR Validation Sources between 0.7 - 3 GHz

Calibration date

August 11, 2025

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-33T	SN: 100967	30-Apr-25 (No. 1020-300791789)	Apr-26
Power Sensor R&S NRP18A	SN: 101859	06-Feb-25 (No. 4030A315009541)	Feb-26
Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
OCP DAK-12	SN: 1016	24-Sept-24 (No. OCP-DAK12-1016_Sep24)	Sep-25
OCP DAK-3.5	SN: 1249	23-Sept-24 (No. OCP-DAK3.5-1249_Sep24)	Sep-25
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4ip	SN: 1836	17-Apr-25 (No. DAE4ip-1836_Apr25)	Apr-26

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Setup 1	SN: 1000	27-May-25 (No. 675-ACAD_Source_Box-250527)	May-26
Signal Generator R&S SMB100A	SN: 182081	27-May-25 (No. 675-CAL16-S4588-250527)	May-26
Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26
OCP DAK-12	SN: 1029	27-Feb-25 (No. OCP-DAK12-1029_Feb25)	Feb-26
OCP DAK-3.5	SN: 1336	09-Dec-24 (No. OCP-DAK3.5-1336_Dec24)	Dec-25

	Name	Function	Signature
Calibrated by	Paulo Pina	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	

Issued: August 11, 2025

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Accreditation No.: **SCS 0108**

Glossary

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

Calibration is Performed According to the Following Standards

- 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.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation

- 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.
- *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%.

Measurement Conditions

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

DASY Version	DASY8 Module SAR	16.4.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 5mm, dz = 1.5mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	2600MHz $\pm$ 1MHz	

HSL parameters at 2600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	39.0	1.96 mho/m
Measured HSL parameters	(22.0 $\pm$ 0.2)°C	38.2 $\pm$ 6%	1.99 mho/m $\pm$ 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 2600 MHz

SAR averaged over 1 cm ³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	13.9 W/kg
SAR for nominal HSL parameters	normalized to 1W	55.3 W/kg $\pm$ 17.0% (k = 2)

SAR averaged over 10 cm ³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	6.24 W/kg
SAR for nominal HSL parameters	normalized to 1W	24.8 W/kg $\pm$ 16.5% (k = 2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with HSL at 2600 MHz**

Impedance	48.6 Ω - 7.0 j Ω
Return Loss	-22.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 ns
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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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System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D2600V2 - SN1126	2600	HSL	24

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10	CW, 0---		2600, 0	7.26	1.99	38.2

Hardware Setup

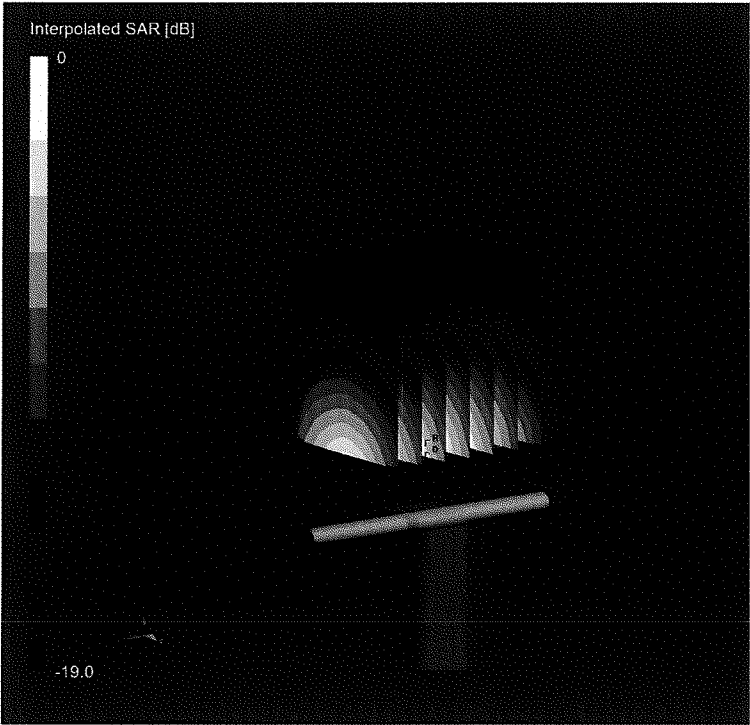
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-08-11	EX3DV4 - SN7349, 2025-01-10	DAE4ip Sn1836, 2025-04-17

Scans Setup

	Zoom Scan
Grid Extents [mm]	30 x 30 x 30
Grid Steps [mm]	5.0 x 5.0 x 1.5
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

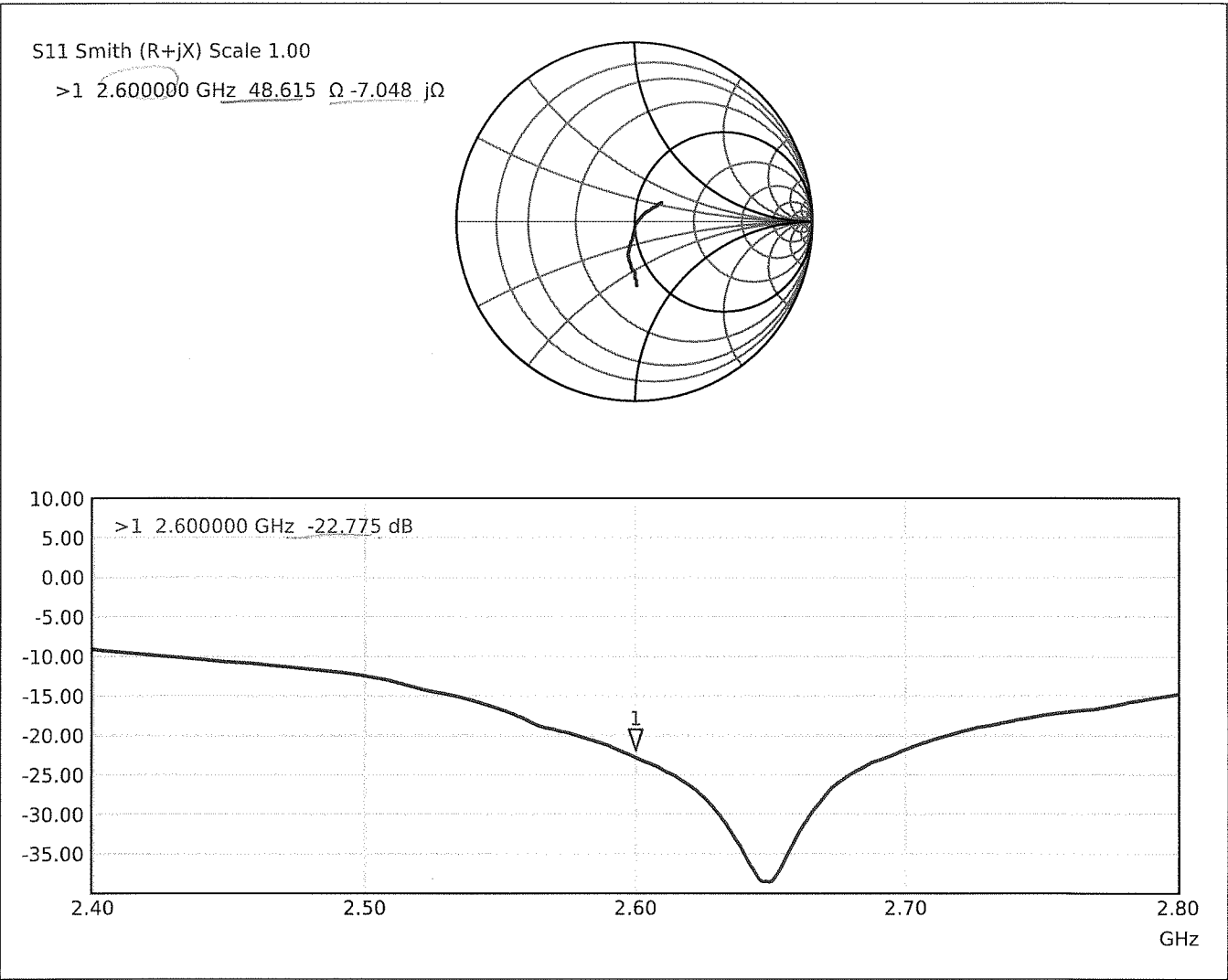
Measurement Results

	Zoom Scan
Date	2025-08-11
psSAR1g [W/Kg]	13.9
psSAR10g [W/Kg]	6.24
Power Drift [dB]	0.00
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



0 dB = 29.4 W/Kg

Impedance Measurement Plot for HSL





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Accreditation No.: **SCS 0108**

Client

Element
 Yongin, Republic of Korea

Certificate No.

D2600V2-1009_Jun25

CALIBRATION CERTIFICATE

Object

D2600V2 - SN: 1009

Calibration procedure(s)

QA CAL-05.v12

Calibration Procedure for SAR Validation Sources between 0.7 - 3 GHz

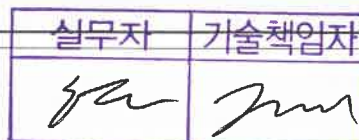
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Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
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Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26

	Name	Function	Signature
Calibrated by	Claudio Leubler	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	

Issued: June 4, 2025

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Glossary

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

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- *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.
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Measurement Conditions

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

DASY Version	DASY8 Module SAR	16.4.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 5mm, dz = 1.5mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	2600MHz $\pm$ 1MHz	

HSL parameters at 2600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	39.0	1.96 mho/m
Measured HSL parameters	(22.0 $\pm$ 0.2) °C	37.3 $\pm$ 6%	2.01 mho/m $\pm$ 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 2600 MHz

SAR averaged over 1 cm ³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	14.2 W/kg
SAR for nominal HSL parameters	normalized to 1W	56.5 W/kg $\pm$ 17.0% (k = 2)

SAR averaged over 10 cm ³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	6.38 W/kg
SAR for nominal HSL parameters	normalized to 1W	25.4 W/kg $\pm$ 16.5% (k = 2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with HSL at 2600 MHz**

Impedance	48.8 Ω - 4.9 j Ω
Return Loss	-25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.154 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D2600V2 - SN1009	2600	HSL	24

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10	CW, 0--		2600, 0	7.26	2.01	37.3

Hardware Setup

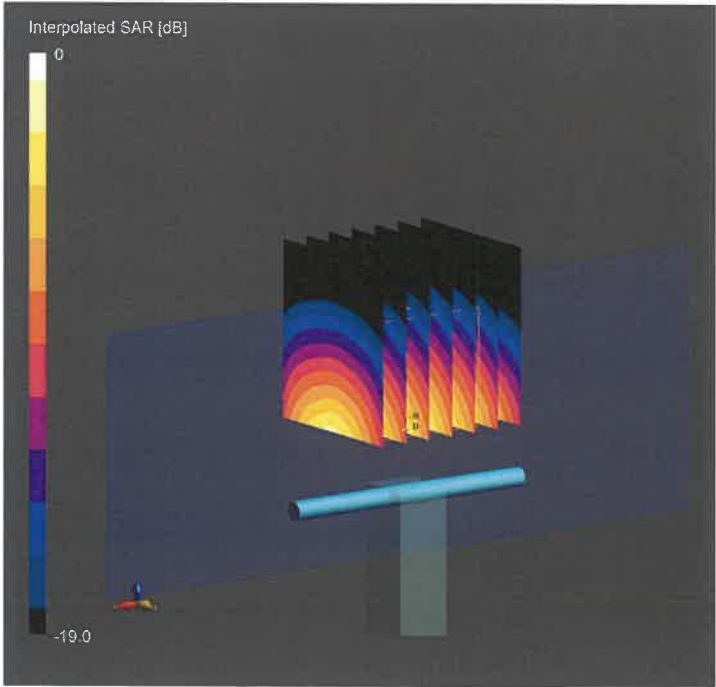
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-06-03	EX3DV4 - SN7349, 2025-01-10	DAE4ip Sn1836, 2025-04-17

Scans Setup

	Zoom Scan
Grid Extents [mm]	30 x 30 x 30
Grid Steps [mm]	5.0 x 5.0 x 1.5
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

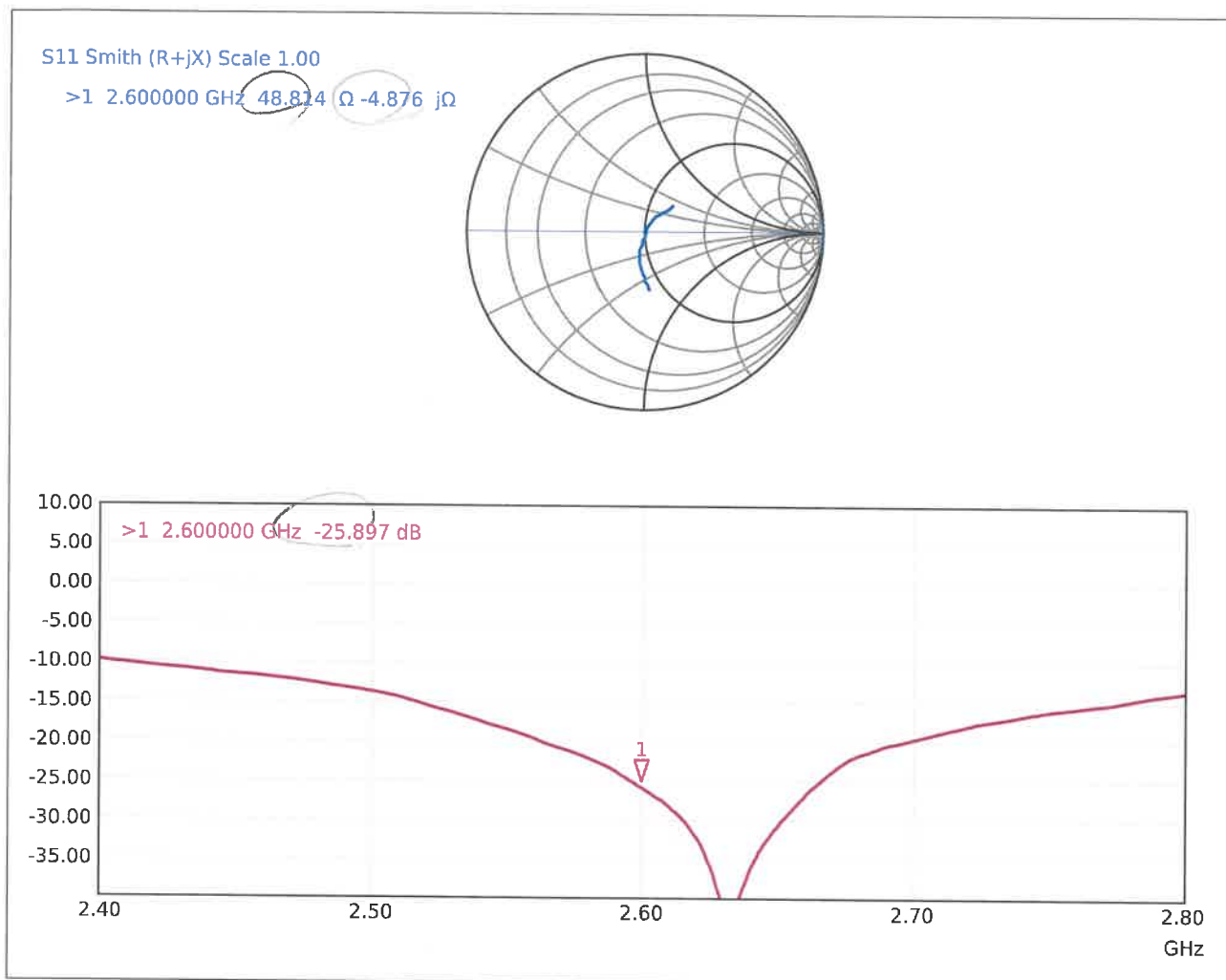
Measurement Results

	Zoom Scan
Date	2025-06-03
psSAR1g [W/Kg]	14.2
psSAR10g [W/Kg]	6.38
Power Drift [dB]	0.00
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



0 dB = 30.4 W/Kg

Impedance Measurement Plot for HSL





Accredited by the Swiss Accreditation Service (SAS)
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Accreditation No.: **SCS 0108**

Client

Element
 Columbia, USA

Certificate No.

D2600V2-1071_Nov25

CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1071**

Calibration procedure(s) **QA CAL-05.v13**
Calibration Procedure for SAR Validation Sources between 0.7 - 3 GHz

Calibration date **November 10, 2025**

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

HA 11/20/25

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-33T	SN: 100967	29-Oct-25 (No. Part of L1407)	Oct-26
Power Sensor R&S NRP18A	SN: 101859	06-Feb-25 (No. 4030A315009541)	Feb-26
Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
OCP DAK-12	SN: 1016	16-Sept-25 (No. OCP-DAK12-1016_Sep25)	Sep-26
OCP DAK-3.5	SN: 1249	16-Sept-25 (No. OCP-DAK3.5-1249_Sep25)	Sep-26
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4ip	SN: 1836	04-Sept-25 (No. DAE4ip-1836_Sep25)	Sep-26

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Setup 1	SN: 1000	27-May-25 (No. 675-ACAD_Source_Box-250527)	May-26
Signal Generator R&S SMB100A	SN: 182081	27-May-25 (No. 675-CAL16-S4588-250527)	May-26
Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26
OCP DAK-12	SN: 1029	27-Feb-25 (No. OCP-DAK12-1029_Feb25)	Feb-26
OCP DAK-3.5	SN: 1336	09-Dec-24 (No. OCP-DAK3.5-1336_Dec24)	Dec-25

	Name	Function	Signature
Calibrated by	Paulo Pina	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	
			Issued: November 10, 2025
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



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

Accreditation No.: **SCS 0108**

Glossary

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

Calibration is Performed According to the Following Standards

- 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.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation

- 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.
- *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%.

Measurement Conditions

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

DASY Version	DASY8 Module SAR	17.0.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 5mm, dz = 1.5mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	2600MHz $\pm$ 1MHz	

HSL parameters at 2600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	39.0	1.96 mho/m
Measured HSL parameters	(22.0 $\pm$ 0.2)°C	37.7 $\pm$ 6%	2.03 mho/m $\pm$ 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 2600 MHz

SAR averaged over 1 cm ³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	14.2 W/kg
SAR for nominal HSL parameters	normalized to 1W	56.5 W/kg $\pm$ 17.0% (k = 2)

SAR averaged over 10 cm ³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	6.38 W/kg
SAR for nominal HSL parameters	normalized to 1W	25.4 W/kg $\pm$ 16.5% (k = 2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with HSL at 2600 MHz**

Impedance	48.9 Ω – 5.7 j Ω
Return Loss	-24.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 ns
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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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System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [d8m]
D2600V2 - SN1071	2600	HSL	24

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10	CW, 0---		2600, 0	7.26	2.03	37.7

Hardware Setup

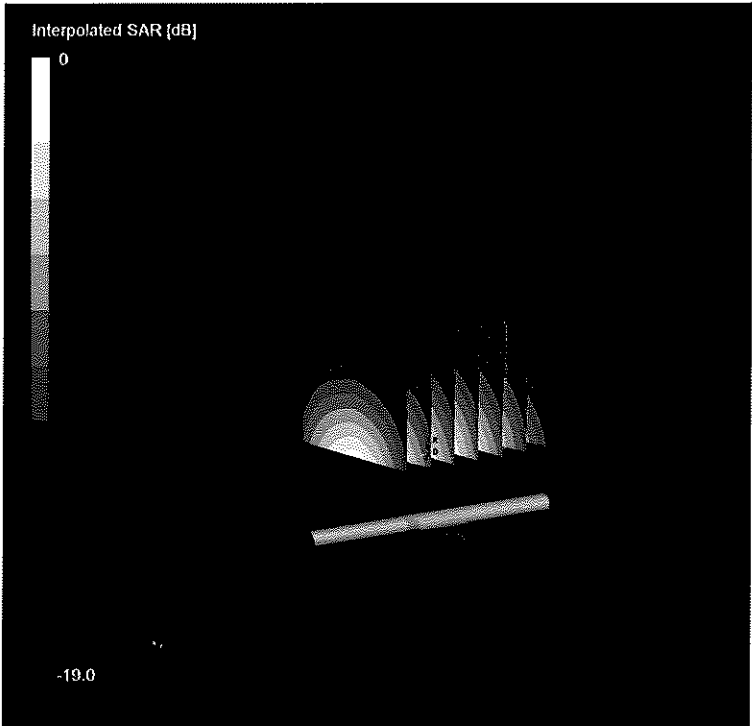
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-11-10	EX3DV4 - SN7349, 2025-01-10	DAE4lp Sn1836, 2025-09-04

Scans Setup

	Zoom Scan
Grid Extents [mm]	30 x 30 x 30
Grid Steps [mm]	5.0 x 5.0 x 1.5
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

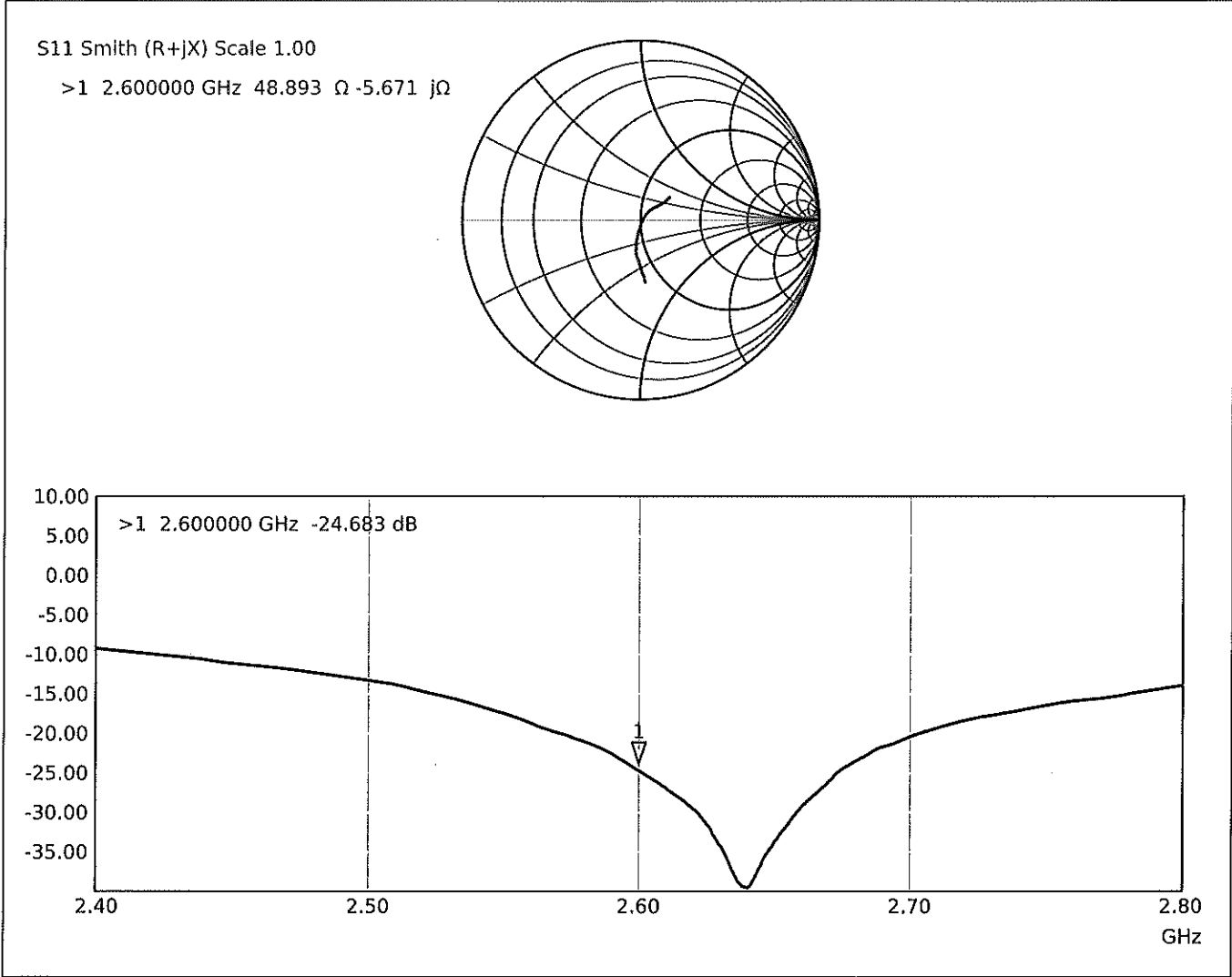
Measurement Results

	Zoom Scan
Date	2025-11-10
psSAR1g [W/Kg]	14.2
psSAR10g [W/Kg]	6.38
Power Drift [dB]	-0.01
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



0 dB = 30.6 W/Kg

Impedance Measurement Plot for HSL





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client

Element
Columbia, USA

Certificate No.

D2600V2-1064_Jun25

CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1064**

Calibration procedure(s) **QA CAL-05.v12**
Calibration Procedure for SAR Validation Sources between 0.7 - 3 GHz

Calibration date **June 6, 2025**

SPS 07/02/25

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-33T	SN: 100967	26-Mar-25 (No. 217-04290)	Mar-26
Power Sensor R&S NRP18A	SN: 101859	06-Feb-25 (No. 4030A315009541)	Feb-26
Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
OCP DAK-12	SN: 1016	24-Sept-24 (No. OCP-DAK12-1016_Sep24)	Sep-25
OCP DAK-3.5	SN: 1249	23-Sept-24 (No. OCP-DAK3.5-1249_Sep24)	Sep-25
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4ip	SN: 1836	17-Apr-25 (No. DAE4ip-1836_Apr25)	Apr-26

Secondary Standards	ID	Check Date (In house)	Scheduled Check
ACAD Setup 1	SN: 1000	27-May-25 (No. 675-ACAD_Source_Box-250527)	May-26
Signal Generator R&S SMB100A	SN: 182081	27-May-25 (No. 675-CAL16-S4588-250527)	May-26
Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26
OCP DAK-12	SN: 1029	27-Feb-25 (No. OCP-DAK12-1029_Feb25)	Feb-26
OCP DAK-3.5	SN: 1336	09-Dec-24 (No. OCP-DAK3.5-1336_Dec24)	Dec-25

	Name	Function	Signature
Calibrated by	Leif Klysner	Laboratory Technician	<i>Leif Klysner</i>
Approved by	Sven Kühn	Technical Manager	<i>Sven Kühn</i>
			Issued: June 6, 2025
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



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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

- 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.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation

- 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.
- *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%.

Measurement Conditions

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

DASY Version	DASY8 Module SAR	16.4.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 5mm, dz = 1.5mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	2600MHz $\pm$ 1MHz	

HSL parameters at 2600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	39.0	1.96 mho/m
Measured HSL parameters	(22.0 $\pm$ 0.2)°C	37.3 $\pm$ 6%	2.01 mho/m $\pm$ 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 2600 MHz

SAR averaged over 1 cm ³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	14.1 W/kg
SAR for nominal HSL parameters	normalized to 1W	56.1 W/kg $\pm$ 17.0% (k = 2)

SAR averaged over 10 cm ³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	24 dBm input power	6.34 W/kg
SAR for nominal HSL parameters	normalized to 1W	25.2 W/kg $\pm$ 16.5% (k = 2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with HSL at 2600 MHz

Impedance	49.6 Ω – 6.0 j Ω
Return Loss	-24.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.151 ns
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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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System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D2600V2 – SN1064	2600	HSL	24

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10		CW, 0---	2600, 0	7.26	2.01	37.3

Hardware Setup

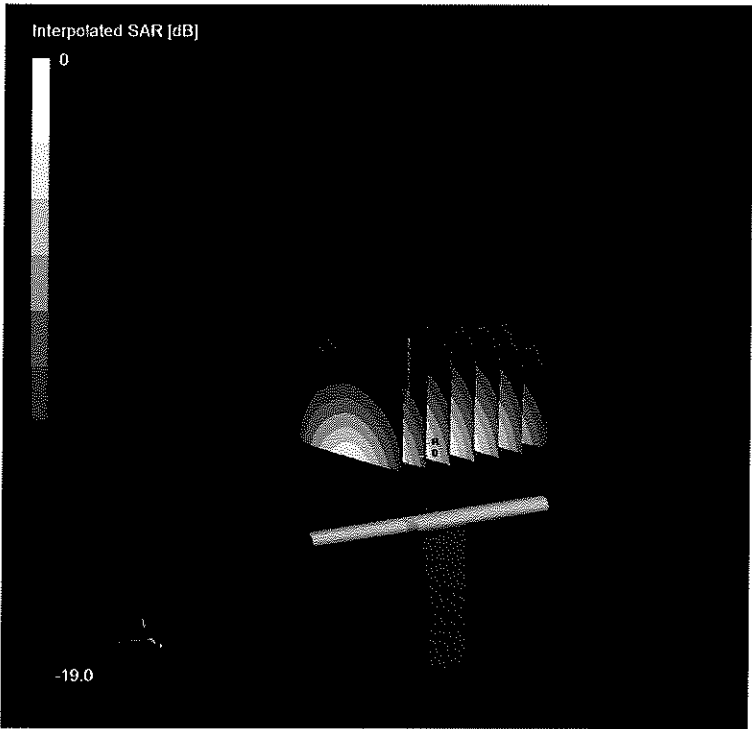
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-06-06	EX3DV4 – SN7349, 2025-01-10	DAE4ip Sn1836, 2025-04-17

Scans Setup

	Zoom Scan
Grid Extents [mm]	30 x 30 x 30
Grid Steps [mm]	5.0 x 5.0 x 1.5
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

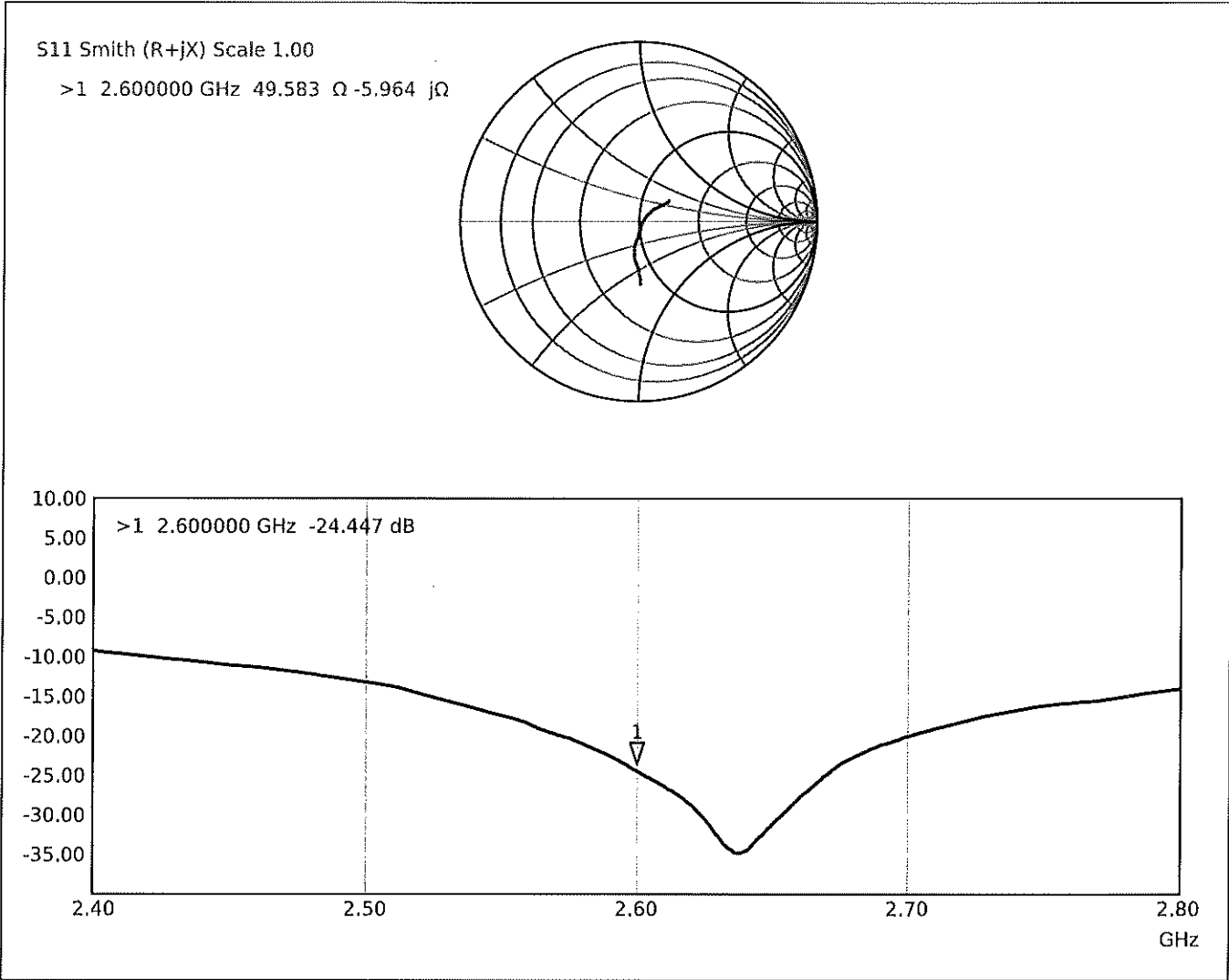
Measurement Results

	Zoom Scan
Date	2025-06-06
psSAR1g [W/Kg]	14.1
psSAR10g [W/Kg]	6.34
Power Drift [dB]	0.00
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



0 dB = 30.1 W/Kg

Impedance Measurement Plot for HSL





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client

Element

YongIn, Republic of Korea

Certificate No.

D3500V2-1068_Dec25

44A 12/17/2025

CALIBRATION CERTIFICATE

Object D3500V2 - SN: 1068

Calibration procedure(s) QA CAL-22.v8
Calibration Procedure for SAR Validation Sources between 3 - 10 GHz

Calibration date December 8, 2025

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP40T	SN: 101861	29-Apr-25 (No. 2025-001450)	Apr-26
Power Sensor R&S NRP18A	SN: 101859	06-Feb-25 (No. 4030A315009541)	Feb-26
Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
OCP DAK-12	SN: 1016	16-Sept-25 (No. OCP-DAK12-1016_Sep25)	Sep-26
OCP DAK-3.5	SN: 1249	16-Sept-25 (No. OCP-DAK3.5-1249_Sep25)	Sep-26
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4ip	SN: 1836	26-Nov-25 (No. DAE4ip-1836_Nov25)	Nov-26

Secondary Standards	ID	Check Date (In house)	Scheduled Check
ACAD Setup 1	SN: 1000	27-May-25 (No. 675-ACAD_Source_Box-250527)	May-26
Signal Generator R&S SMB100A	SN: 182081	27-May-25 (No. 675-CAL16-S4588-250527)	May-26
Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26
OCP DAK-12	SN: 1029	27-Feb-25 (No. OCP-DAK12-1029_Feb25)	Feb-26
OCP DAK-3.5	SN: 1336	09-Dec-24 (No. OCP-DAK3.5-1336_Dec24)	Dec-25

	Name	Function	Signature
Calibrated by	Krešimir Franjić	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	
Issued: December 8, 2025			
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Accreditation No.: SCS 0108

Glossary

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

Calibration is Performed According to the Following Standards

- 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.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation

- 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.
- *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%.

Measurement Conditions

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

DASY Version	DASY8 Module SAR	17.0.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Frequency	3500MHz $\pm$ 1MHz	

HSL parameters at 3500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	37.9	2.91 mho/m
Measured HSL parameters	(22.0 $\pm$ 0.2)°C	39.1 $\pm$ 6%	2.94 mho/m $\pm$ 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 3500 MHz

SAR averaged over 1 cm ³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	6.37 W/kg
SAR for nominal HSL parameters	normalized to 1W	63.7 W/kg $\pm$ 19.9% (k = 2)

SAR averaged over 10 cm ³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	2.42 W/kg
SAR for nominal HSL parameters	normalized to 1W	24.2 W/kg $\pm$ 19.5% (k = 2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with HSL at 3500 MHz**

Impedance	51.5 Ω – 6.2 j Ω
Return Loss	-24.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.13 ns
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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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System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D3500V2 – SN1068	3500	HSL	20

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10		CW, 0--	3500, 0	6.63	2.94	39.1

Hardware Setup

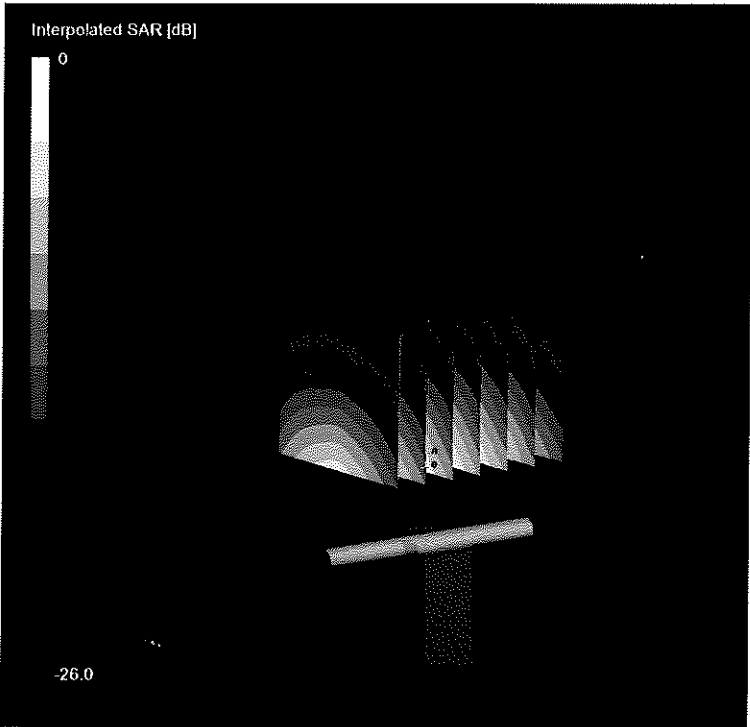
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-12-08	EX3DV4 – SN7349, 2025-01-10	DAE4lp Sn1836, 2025-11-26

Scans Setup

	Zoom Scan
Grid Extents [mm]	28 x 28 x 28
Grid Steps [mm]	5.0 x 5.0 x 1.4
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

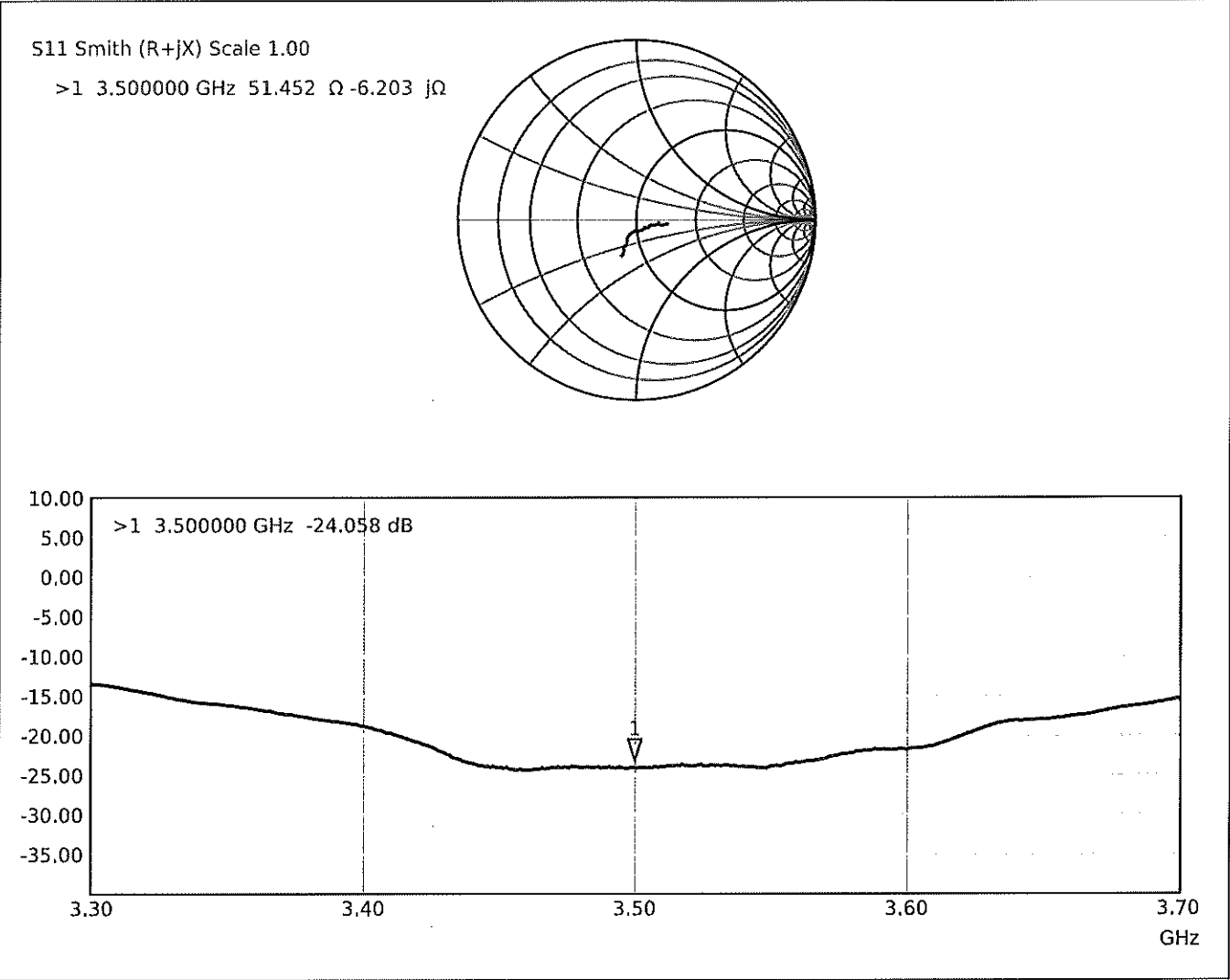
Measurement Results

	Zoom Scan
Date	2025-12-08
psSAR1g [W/Kg]	6.37
psSAR10g [W/Kg]	2.42
Power Drift [dB]	-0.01
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



0 dB = 16.2 W/Kg

Impedance Measurement Plot for HSL





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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client

Element

Yongin, Republic of Korea

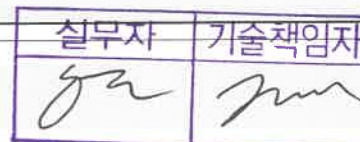
Certificate No.

D3500V2-1127_Jun25

CALIBRATION CERTIFICATE

Object

D3500V2 - SN: 1127



07-18-2025

Calibration procedure(s)

QA CAL-22.v7

Calibration Procedure for SAR Validation Sources between 3 - 10 GHz

Calibration date

June 2, 2025

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-33T	SN: 100967	26-Mar-25 (No. 217-04290)	Mar-26
Power Sensor R&S NRP18A	SN: 101859	06-Feb-25 (No. 4030A315009541)	Feb-26
Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
OCP DAK-12	SN: 1016	24-Sept-24 (No. OCP-DAK12-1016_Sep24)	Sep-25
OCP DAK-3.5	SN: 1249	23-Sept-24 (No. OCP-DAK3.5-1249_Sep24)	Sep-25
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4ip	SN: 1836	17-Apr-25 (No. DAE4ip-1836_Apr25)	Apr-26

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Setup 1	SN: 1000	27-May-25 (No. 675-ACAD_Source_Box-250527)	May-26
Signal Generator R&S SMB100A	SN: 182081	27-May-25 (No. 675-CAL16-S4588-250527)	May-26
Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26

	Name	Function	Signature
Calibrated by	Paulo Pina	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	
Issued: June 3, 2025			
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Calibration Laboratory of

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Zeughausstrasse 43, 8004 Zurich, Switzerland



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S Servizio svizzero di taratura
S Swiss Calibration Service

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Accreditation No.: **SCS 0108**

Glossary

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

Calibration is Performed According to the Following Standards

- 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.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation

- 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.
- *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%.

Measurement Conditions

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

DASY Version	DASY8 Module SAR	16.4.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 5mm, dz = 1.4mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	3500MHz $\pm$ 1MHz	

HSL parameters at 3500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	37.9	2.91 mho/m
Measured HSL parameters	(22.0 $\pm$ 0.2)°C	39.0 $\pm$ 6%	2.94 mho/m $\pm$ 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 3500 MHz

SAR averaged over 1 cm³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	6.49 W/kg
SAR for nominal HSL parameters	normalized to 1W	64.9 W/kg $\pm$ 19.9% (k = 2)

SAR averaged over 10 cm³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	2.47 W/kg
SAR for nominal HSL parameters	normalized to 1W	24.7 W/kg $\pm$ 19.5% (k = 2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with HSL at 3500 MHz**

Impedance	$48.5 \Omega + 3.8 j\Omega$
Return Loss	-27.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.127 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D3500V2 - SN1127	3500	HSL	20

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10		CW, 0--	3500, 0	6.63	2.94	39.0

Hardware Setup

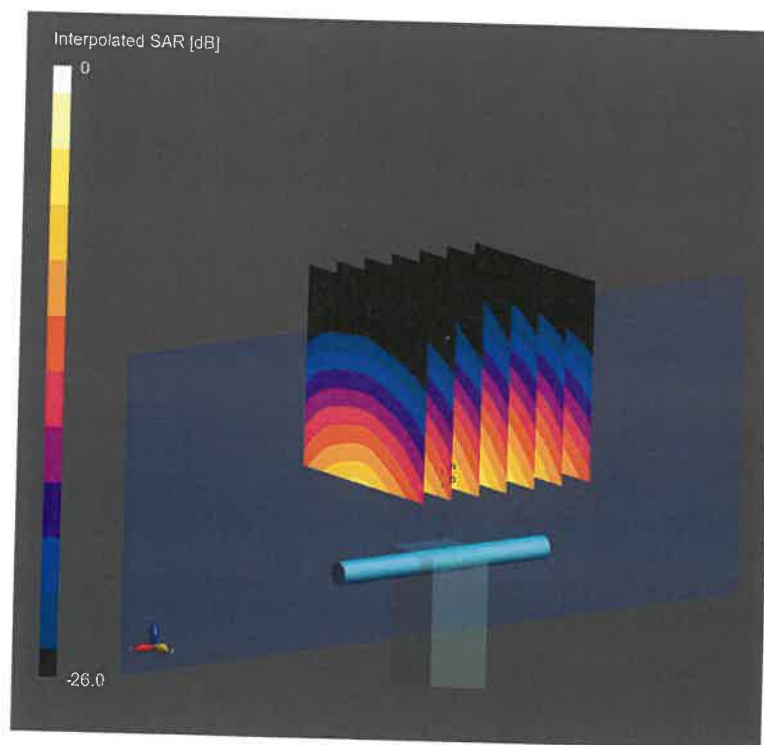
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-06-02	EX3DV4 - SN7349, 2025-01-10	DAE4ip Sn1836, 2025-04-17

Scans Setup

	Zoom Scan
Grid Extents [mm]	28 x 28 x 28
Grid Steps [mm]	5.0 x 5.0 x 1.4
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

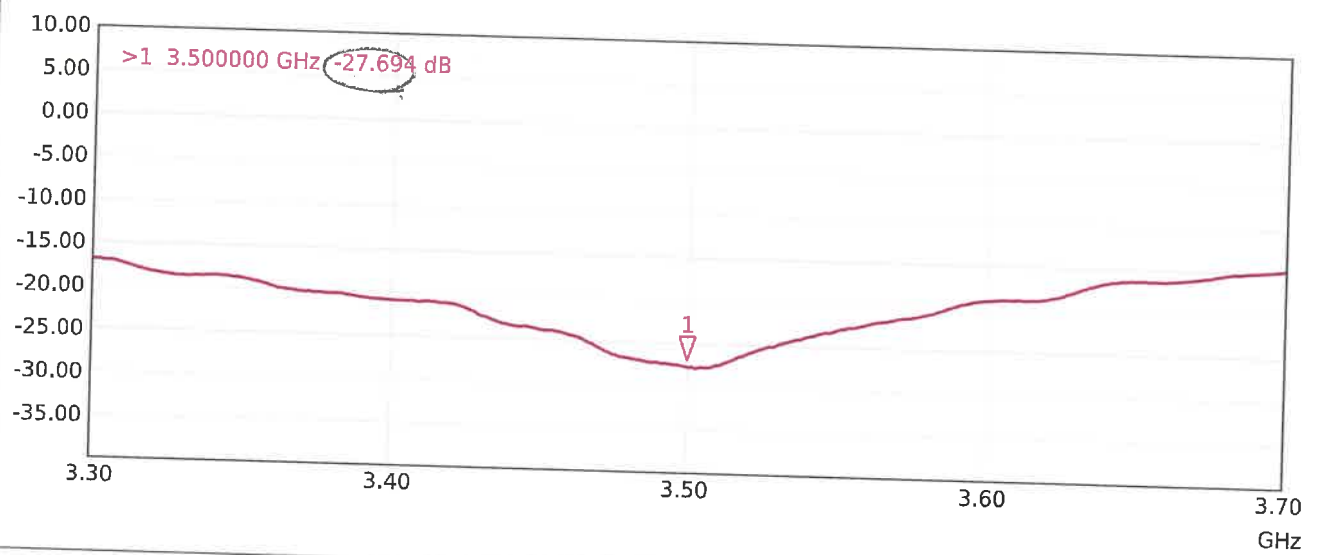
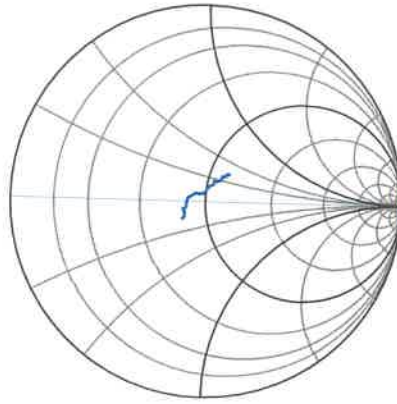
Measurement Results

	Zoom Scan
Date	2025-06-02
psSAR1g [W/Kg]	6.49
psSAR10g [W/Kg]	2.47
Power Drift [dB]	-0.01
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



Impedance Measurement Plot for HSL

S11 Smith (R+jX) Scale 1.00

>1 3.500000 GHz 48.541 Ω 3.796 $j\Omega$ 



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Accreditation No.: **SCS 0108**

Client **Element**
 Yongin, Republic of Korea

Certificate No. **D3700V2-1029_Dec25**

HA 12/17/2025

CALIBRATION CERTIFICATE

Object **D3700V2 - SN: 1029**

Calibration procedure(s) **QA CAL-22.v8**
Calibration Procedure for SAR Validation Sources between 3 - 10 GHz

Calibration date **December 8, 2025**

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP40T	SN: 101861	29-Apr-25 (No. 2025-001450)	Apr-26
Power Sensor R&S NRP18A	SN: 101859	06-Feb-25 (No. 4030A315009541)	Feb-26
Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
OCP DAK-12	SN: 1016	16-Sept-25 (No. OCP-DAK12-1016_Sep25)	Sep-26
OCP DAK-3.5	SN: 1249	16-Sept-25 (No. OCP-DAK3.5-1249_Sep25)	Sep-26
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4ip	SN: 1836	26-Nov-25 (No. DAE4ip-1836_Nov25)	Nov-26

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Setup 1	SN: 1000	27-May-25 (No. 675-ACAD_Source_Box-250527)	May-26
Signal Generator R&S SMB100A	SN: 182081	27-May-25 (No. 675-CAL16-S4588-250527)	May-26
Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26
OCP DAK-12	SN: 1029	27-Feb-25 (No. OCP-DAK12-1029_Feb25)	Feb-26
OCP DAK-3.5	SN: 1336	09-Dec-24 (No. OCP-DAK3.5-1336_Dec24)	Dec-25

	Name	Function	Signature
Calibrated by	Krešimir Franjić	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	

Issued: December 8, 2025

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Accreditation No.: **SCS 0108**

Glossary

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

Calibration is Performed According to the Following Standards

- 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.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation

- 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.
- *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%.

Measurement Conditions

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

DASY Version	DASY8 Module SAR	17.0.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Frequency	3700MHz $\pm$ 1MHz	

HSL parameters at 3700 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	37.7	3.12 mho/m
Measured HSL parameters	(22.0 $\pm$ 0.2)°C	38.9 $\pm$ 6%	3.11 mho/m $\pm$ 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 3700 MHz

SAR averaged over 1 cm ³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	6.66 W/kg
SAR for nominal HSL parameters	normalized to 1W	66.6 W/kg $\pm$ 19.9% (k = 2)

SAR averaged over 10 cm ³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	2.45 W/kg
SAR for nominal HSL parameters	normalized to 1W	24.5 W/kg $\pm$ 19.5% (k = 2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with HSL at 3700 MHz**

Impedance	45.0 Ω + 1.2 j Ω
Return Loss	-25.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.138 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D3700V2 - SN1029	3700	HSL	20

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10		CW, 0---	3700, 0	6.45	3.11	38.9

Hardware Setup

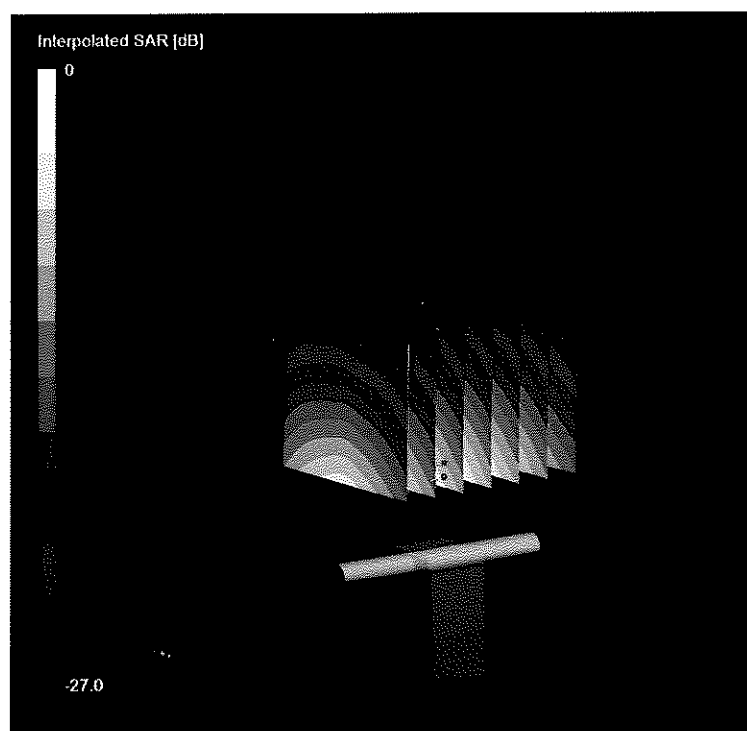
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-12-08	EX3DV4 - SN7349, 2025-01-10	DAE4lp Sn1836, 2025-11-26

Scans Setup

	Zoom Scan
Grid Extents [mm]	28 x 28 x 28
Grid Steps [mm]	5.0 x 5.0 x 1.4
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

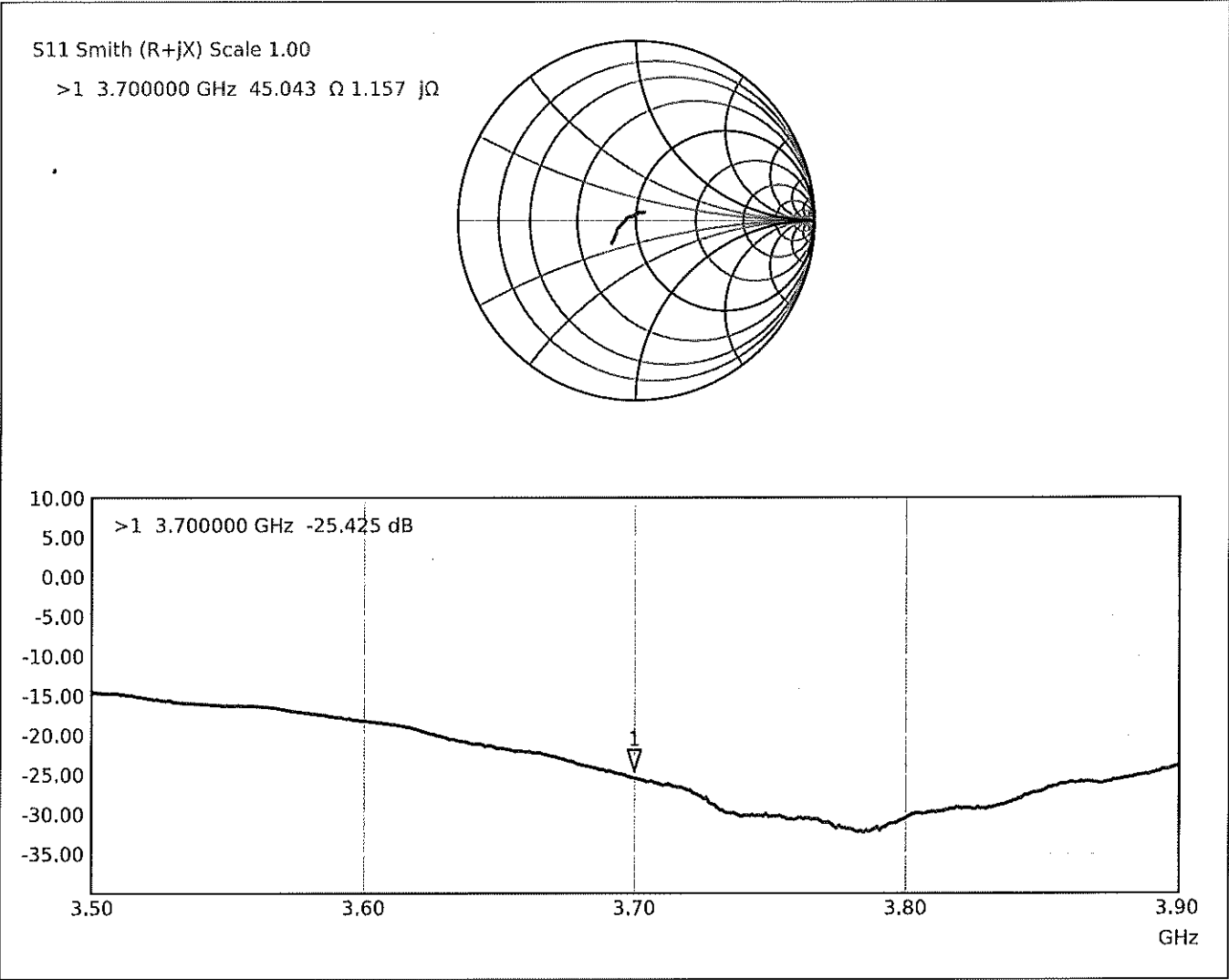
Measurement Results

	Zoom Scan
Date	2025-12-08
psSAR1g [W/Kg]	6.66
psSAR10g [W/Kg]	2.45
Power Drift [dB]	-0.02
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



0 dB = 17.5 W/Kg

Impedance Measurement Plot for HSL





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Accreditation No.: **SCS 0108**

Client

Element

Yongin, Republic of Korea

Certificate No.

D3700V2-1096 Jun25

CALIBRATION CERTIFICATE

Object

D3700V2 - SN: 1096

실무자

기술책임자

[Signature]

[Signature]

07-18-2025

Calibration procedure(s)

QA CAL-22.v7

Calibration Procedure for SAR Validation Sources between 3 - 10 GHz

Calibration date

June 2, 2025

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-33T	SN: 100967	26-Mar-25 (No. 217-04290)	Mar-26
Power Sensor R&S NRP18A	SN: 101859	06-Feb-25 (No. 4030A315009541)	Feb-26
Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
OCP DAK-12	SN: 1016	24-Sept-24 (No. OCP-DAK12-1016_Sep24)	Sep-25
OCP DAK-3.5	SN: 1249	23-Sept-24 (No. OCP-DAK3.5-1249_Sep24)	Sep-25
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4ip	SN: 1836	17-Apr-25 (No. DAE4ip-1836_Apr25)	Apr-26

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Setup 1	SN: 1000	27-May-25 (No. 675-ACAD_Source_Box-250527)	May-26
Signal Generator R&S SMB100A	SN: 182081	27-May-25 (No. 675-CAL16-S4588-250527)	May-26
Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26

	Name	Function	Signature
Calibrated by	Paulo Pina	Laboratory Technician	<i>[Signature]</i>
Approved by	Sven Kühn	Technical Manager	<i>[Signature]</i>

Issued: June 3, 2025

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Calibration Laboratory of

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S Swiss Calibration Service

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Accreditation No.: **SCS 0108**

Glossary

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

Calibration is Performed According to the Following Standards

- 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.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation

- 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.
- *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%.

Measurement Conditions

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

DASY Version	DASY8 Module SAR	16.4.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 5mm, dz = 1.4mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	3700MHz $\pm$ 1MHz	

HSL parameters at 3700 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	37.7	3.12 mho/m
Measured HSL parameters	(22.0 $\pm$ 0.2) °C	38.8 $\pm$ 6%	3.11 mho/m $\pm$ 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 3700 MHz

SAR averaged over 1 cm³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	6.96 W/kg
SAR for nominal HSL parameters	normalized to 1W	69.6 W/kg $\pm$ 19.9% (k = 2)

SAR averaged over 10 cm³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	2.56 W/kg
SAR for nominal HSL parameters	normalized to 1W	25.6 W/kg $\pm$ 19.5% (k = 2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with HSL at 3700 MHz**

Impedance	$47.3 \Omega + 3.4 j\Omega$
Return Loss	-27.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.131 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D3700V2 - SN1096	3700	HSL	20

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10	CW, 0--		3700, 0	6.45	3.11	38.8

Hardware Setup

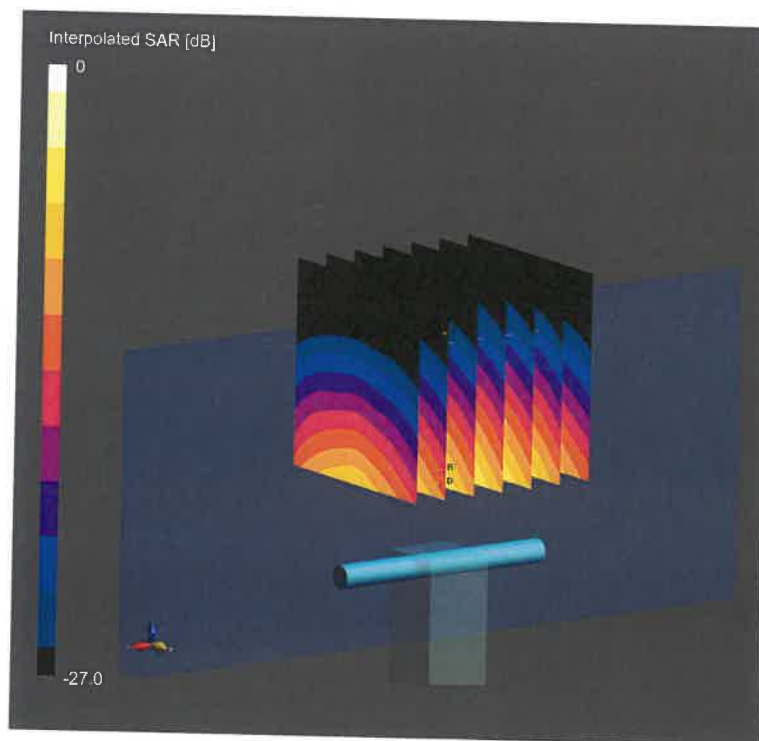
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-06-02	EX3DV4 - SN7349, 2025-01-10	DAE4ip Sn1836, 2025-04-17

Scans Setup

	Zoom Scan
Grid Extents [mm]	28 x 28 x 28
Grid Steps [mm]	5.0 x 5.0 x 1.4
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

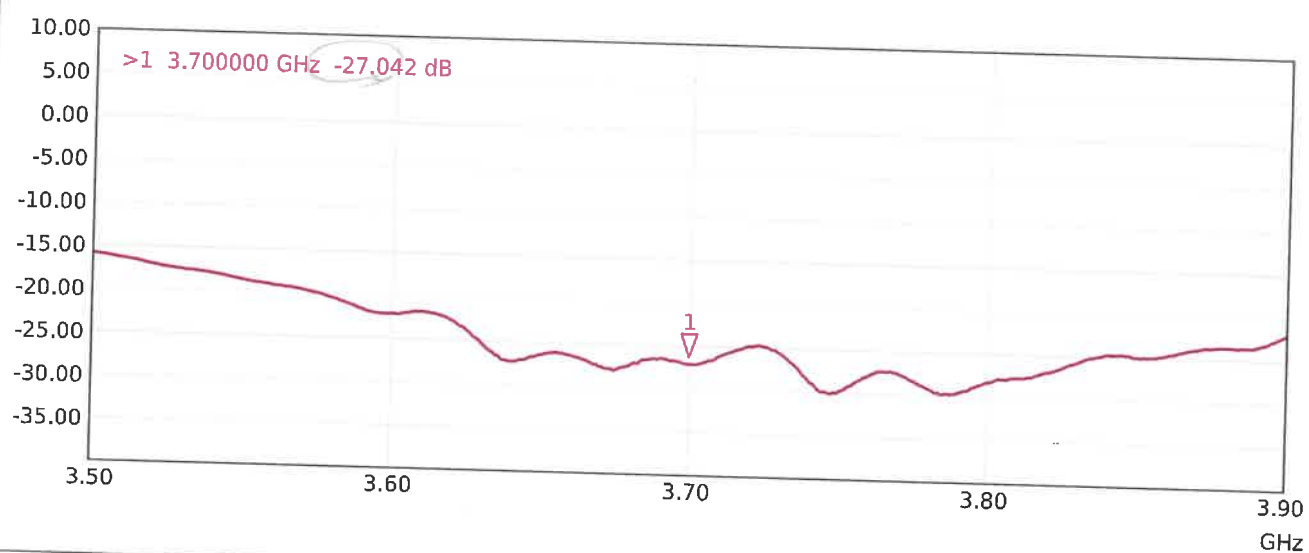
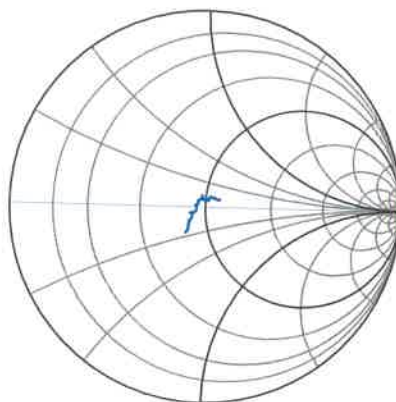
Measurement Results

	Zoom Scan
Date	2025-06-02
psSAR1g [W/Kg]	6.96
psSAR10g [W/Kg]	2.56
Power Drift [dB]	-0.01
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



Impedance Measurement Plot for HSL

S11 Smith (R+jX) Scale 1.00

>1 3.700000 GHz 47.284 Ω 3.368 $j\Omega$ 



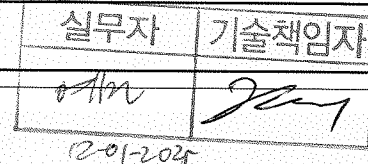
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Accreditation No.: **SCS 0108**

Client **Element**
 Yongin, Republic of Korea

Certificate No. **D3900V2-1113 Nov25**

CALIBRATION CERTIFICATE



Object **D3900V2 - SN: 1113**

Calibration procedure(s) **QA CAL-22.v8**
Calibration Procedure for SAR Validation Sources between 3 - 10 GHz

Calibration date **November 3, 2025**

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-33T	SN: 100967	29-Oct-25 (No. Part of L1407)	Oct-26
Power Sensor R&S NRP18A	SN: 101859	06-Feb-25 (No. 4030A315009541)	Feb-26
Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
OCP DAK-12	SN: 1016	16-Sept-25 (No. OCP-DAK12-1016_Sep25)	Sep-26
OCP DAK-3.5	SN: 1249	16-Sept-25 (No. OCP-DAK3.5-1249_Sep25)	Sep-26
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4ip	SN: 1836	04-Sept-25 (No. DAE4ip-1836_Sep25)	Sep-26

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Setup 1	SN: 1000	27-May-25 (No. 675-ACAD_Source_Box-250527)	May-26
Signal Generator R&S SMB100A	SN: 182081	27-May-25 (No. 675-CAL16-S4588-250527)	May-26
Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26
OCP DAK-12	SN: 1029	27-Feb-25 (No. OCP-DAK12-1029_Feb25)	Feb-26
OCP DAK-3.5	SN: 1336	09-Dec-24 (No. OCP-DAK3.5-1336_Dec24)	Dec-25

	Name	Function
Calibrated by	Krešimir Franjić	Laboratory Technician
Approved by	Sven Kühn	Technical Manager

Signature

Issued: November 19, 2025

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Accreditation No.: **SCS 0108**

Glossary

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

Calibration is Performed According to the Following Standards

- 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.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation

- 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.
- *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%.

Measurement Conditions

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

DASY Version	DASY8 Module SAR	17.0.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 5mm, dz = 1.4mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	3900MHz $\pm$ 1MHz 4100MHz $\pm$ 1MHz	

HSL parameters at 3900 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	37.5	3.32 mho/m
Measured HSL parameters	(22.0 $\pm$ 0.2)°C	38.5 $\pm$ 6%	3.28 mho/m $\pm$ 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 3900 MHz

SAR averaged over 1 cm ³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	6.90 W/kg
SAR for nominal HSL parameters	normalized to 1W	69.0 W/kg $\pm$ 19.9% (k = 2)

SAR averaged over 10 cm ³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	2.41 W/kg
SAR for nominal HSL parameters	normalized to 1W	24.1 W/kg $\pm$ 19.5% (k = 2)

HSL parameters at 4100 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	37.2	3.53 mho/m
Measured HSL parameters	(22.0 ± 0.2) °C	38.3 ± 6%	3.46 mho/m ± 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 4100 MHz

SAR averaged over 1 cm ³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	6.70 W/kg
SAR for nominal HSL parameters	normalized to 1W	67.0 W/kg ± 19.9% (k = 2)

SAR averaged over 10 cm ³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	2.32 W/kg
SAR for nominal HSL parameters	normalized to 1W	23.2 W/kg ± 19.5% (k = 2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with HSL at 3900 MHz**

Impedance	$48.1 \Omega - 6.5 j\Omega$
Return Loss	-23.2 dB

Antenna Parameters with HSL at 4100 MHz

Impedance	$57.0 \Omega - 0.1 j\Omega$
Return Loss	-23.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.105 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D3900V2 - SN1113	3900	HSL	20

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10	CW, 0--		3900, 0	6.37	3.28	38.5

Hardware Setup

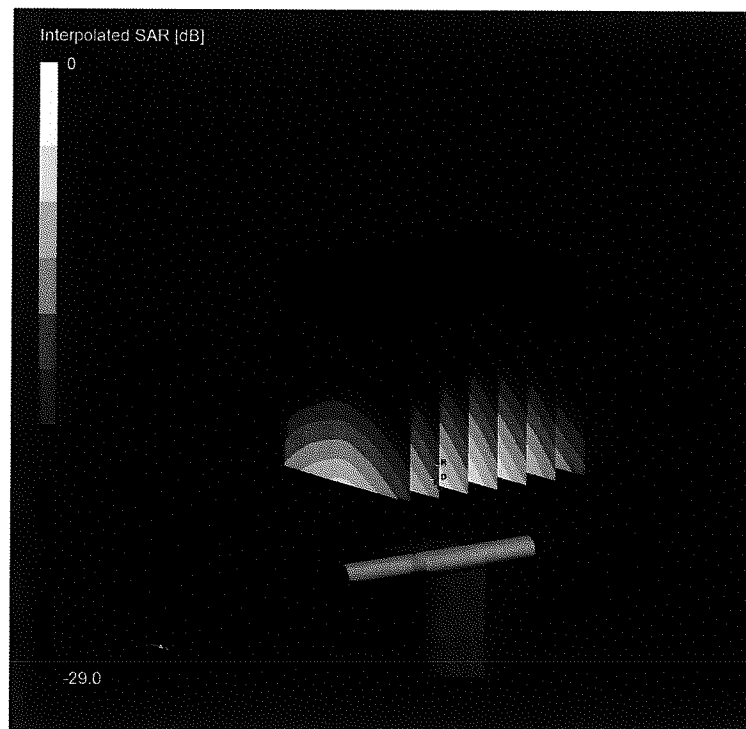
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-11-03	EX3DV4 - SN7349, 2025-01-10	DAE4ip Sn1836, 2025-09-04

Scans Setup

	Zoom Scan
Grid Extents [mm]	28 x 28 x 28
Grid Steps [mm]	5.0 x 5.0 x 1.4
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

Measurement Results

	Zoom Scan
Date	2025-11-03
psSAR1g [W/Kg]	6.90
psSAR10g [W/Kg]	2.41
Power Drift [dB]	-0.03
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



0 dB = 19.4 W/Kg

System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D3900V2 - SN1113	4100	HSL	20

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10	CW, 0--		4100, 0	6.39	3.46	38.3

Hardware Setup

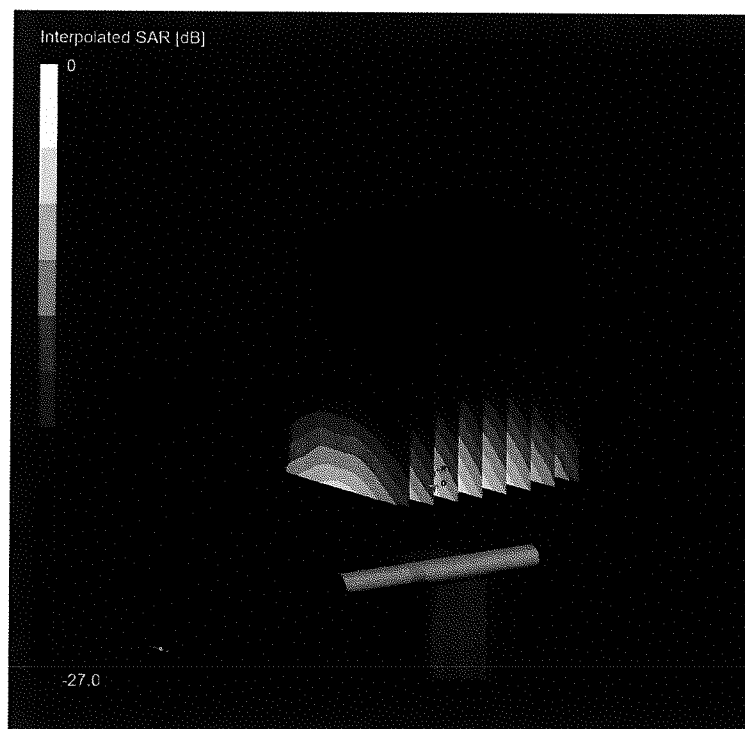
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-11-03	EX3DV4 - SN7349, 2025-01-10	DAE4ip Sn1836, 2025-09-04

Scans Setup

	Zoom Scan
Grid Extents [mm]	25 x 25 x 25
Grid Steps [mm]	4.0 x 4.0 x 1.4
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.4
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

Measurement Results

	Zoom Scan
Date	2025-11-03
psSAR1g [W/Kg]	-6.70
psSAR10g [W/Kg]	2.32
Power Drift [dB]	-0.01
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative

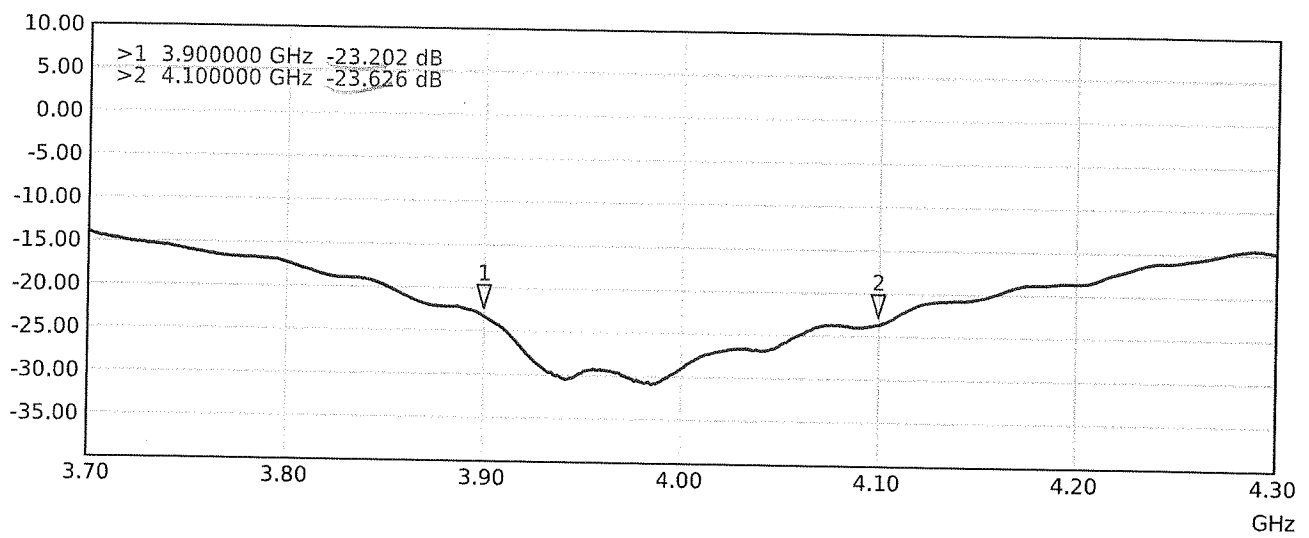
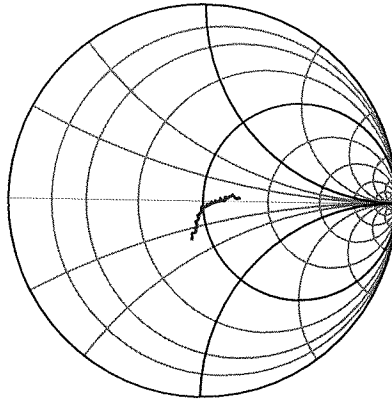


0 dB = 19.2 W/Kg

Impedance Measurement Plot for HSL

S11 Smith (R+jX) Scale 1.00

>1 3.900000 GHz 48.111 Ω -6.534 j Ω
>2 4.100000 GHz 57.050 Ω -0.123 j Ω





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Accreditation No.: **SCS 0108**

Client

Element

Yongin, Republic of Korea

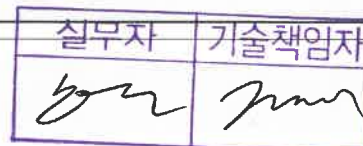
Certificate No.

D3900V2-1074 Jun25

CALIBRATION CERTIFICATE

Object

D3900V2 - SN: 1074



Calibration procedure(s)

QA CAL-22.v7

Calibration Procedure for SAR Validation Sources between 3 - 10 GHz

Calibration date

June 2, 2025

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-33T	SN: 100967	26-Mar-25 (No. 217-04290)	Mar-26
Power Sensor R&S NRP18A	SN: 101859	06-Feb-25 (No. 4030A315009541)	Feb-26
Spectrum Analyzer R&S FSV40	SN: 101832	29-Jan-25 (No. 4030A315009658)	Jan-26
3.5mm mismatch combination	SN: 1152	24-Mar-25 (No. 217-04293)	Mar-26
OCP DAK-12	SN: 1016	24-Sept-24 (No. OCP-DAK12-1016_Sep24)	Sep-25
OCP DAK-3.5	SN: 1249	23-Sept-24 (No. OCP-DAK3.5-1249_Sep24)	Sep-25
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4ip	SN: 1836	17-Apr-25 (No. DAE4ip-1836_Apr25)	Apr-26

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Setup 1	SN: 1000	27-May-25 (No. 675-ACAD_Source_Box-250527)	May-26
Signal Generator R&S SMB100A	SN: 182081	27-May-25 (No. 675-CAL16-S4588-250527)	May-26
Mismatch; SMA	SN: 1102	24-Apr-25 (No. 675-Mismatch_SMA-250424)	Apr-26

	Name	Function
Calibrated by	Paulo Pina	Laboratory Technician
Approved by	Sven Kühn	Technical Manager

Signature

Issued: June 5, 2025

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Accreditation No.: SCS 0108

Glossary

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

Calibration is Performed According to the Following Standards

- 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.
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation

- 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.
- *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%.

Measurement Conditions

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

DASY Version	DASY8 Module SAR	16.4.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with spacer
Zoom Scan Resolution	dx, dy = 5mm, dz = 1.4mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	3900MHz $\pm$ 1MHz	

HSL parameters at 3900 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal HSL parameters	22.0 °C	37.5	3.32 mho/m
Measured HSL parameters	(22.0 $\pm$ 0.2)°C	38.6 $\pm$ 6%	3.28 mho/m $\pm$ 6%
HSL temperature change during test	< 0.5 °C		

SAR result with HSL at 3900 MHz

SAR averaged over 1 cm ³ (1 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	7.08 W/kg
SAR for nominal HSL parameters	normalized to 1W	70.8 W/kg $\pm$ 19.9% (k = 2)

SAR averaged over 10 cm ³ (10 g) of HSL	Condition	
SAR for nominal HSL parameters	20 dBm input power	2.48 W/kg
SAR for nominal HSL parameters	normalized to 1W	24.8 W/kg $\pm$ 19.5% (k = 2)

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with HSL at 3900 MHz**

Impedance	$45.5 \Omega - 4.0 j \Omega$
Return Loss	-24.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.101 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured. The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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System Performance Check Report

Summary

Dipole	Frequency [MHz]	TSL	Power [dBm]
D3900V2 - SN1074	3900	HSL	20

Exposure Conditions

Phantom Section, TSL	Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity
Flat	10		CW, 0--	3900, 0	6.37	3.28	38.6

Hardware Setup

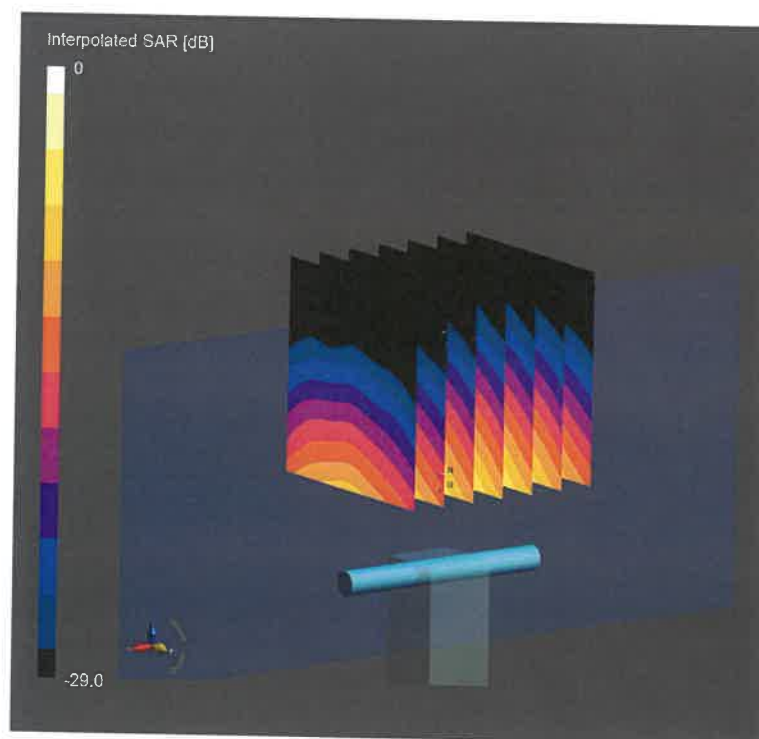
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
MFP V8.0 Center	HSL, 2025-06-02	EX3DV4 - SN7349, 2025-01-10	DAE4ip Sn1836, 2025-04-17

Scans Setup

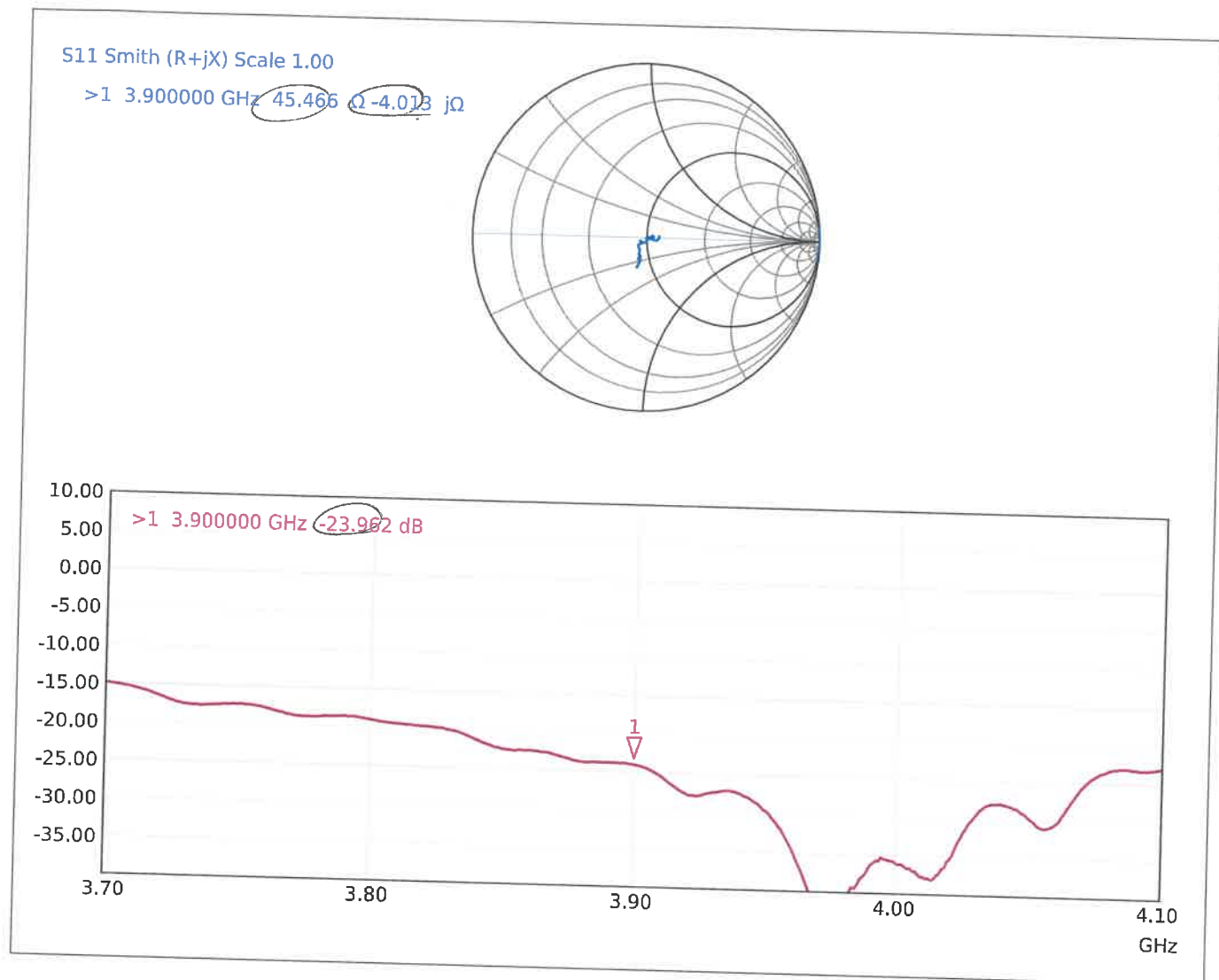
	Zoom Scan
Grid Extents [mm]	28 x 28 x 28
Grid Steps [mm]	5.0 x 5.0 x 1.4
Sensor Surface [mm]	1.4
Graded Grid	Yes
Grading Ratio	1.5
MAIA	N/A
Surface Detection	VMS + 6p
Scan Method	Measured

Measurement Results

	Zoom Scan
Date	2025-06-02
psSAR1g [W/Kg]	7.08
psSAR10g [W/Kg]	2.48
Power Drift [dB]	-0.01
Power Scaling	Disabled
Scaling Factor [dB]	
TSL Correction	Positive / Negative



Impedance Measurement Plot for HSL





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Accreditation No.: **SCS 0108**

Client **Element**
Columbia, USA

Certificate No. **D5GHzV2-1057_Feb24**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1057**

SRS
0311124

Calibration procedure(s) **QA CAL-22.v7**
Calibration Procedure for SAR Validation Sources between 3-10 GHz

SRS 03/04/25

Calibration date: **February 21, 2024**

BB 03/05/26

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

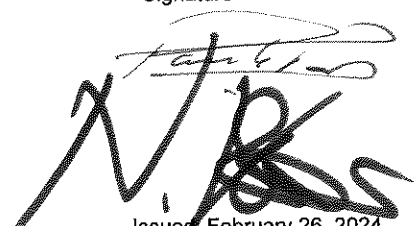
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (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	30-Jan-24 (No. DAE4-601_Jan24)	Jan-25

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

Calibrated by: **Paulo Pina**  **Laboratory Technician**

Approved by: **Niels Kuster**  **Quality Manager**

Signature


Issued: February 26, 2024

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Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- c) DASY System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz $\pm$ 1 MHz 5600 MHz $\pm$ 1 MHz 5750 MHz $\pm$ 1 MHz 5850 MHz $\pm$ 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 $\pm$ 0.2) °C	36.2 $\pm$ 6 %	4.61 mho/m $\pm$ 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	7.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.4 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm ³ (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	22.7 W/kg $\pm$ 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 $\pm$ 0.2) °C	35.6 $\pm$ 6 %	5.00 mho/m $\pm$ 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	8.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	82.8 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.6 W/kg $\pm$ 19.5 % (k=2)

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	35.3 ± 6 %	5.16 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	7.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.7 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5850 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.2	5.32 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	5.25 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5850 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.5 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.0 W/kg ± 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	48.7 Ω - 3.4 j Ω
Return Loss	- 28.6 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	55.9 Ω - 0.3 j Ω
Return Loss	- 25.0 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	53.5 Ω + 4.0 j Ω
Return Loss	- 25.8 dB

Antenna Parameters with Head TSL at 5850 MHz

Impedance, transformed to feed point	52.2 Ω - 2.2 j Ω
Return Loss	- 30.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 21.02.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1057

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Frequency: 5850 MHz

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.61$ S/m; $\epsilon_r = 36.2$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5600$ MHz; $\sigma = 5.00$ S/m; $\epsilon_r = 35.6$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5750$ MHz; $\sigma = 5.16$ S/m; $\epsilon_r = 35.3$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5850$ MHz; $\sigma = 5.25$ S/m; $\epsilon_r = 35.2$; $\rho = 1000$ 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, ConvF(4.99, 4.99, 4.99) @ 5850 MHz; Calibrated: 07.03.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 71.92 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 26.9 W/kg

SAR(1 g) = 7.93 W/kg; SAR(10 g) = 2.27 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 70.5%

Maximum value of SAR (measured) = 18.1 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 = 71.29 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 30.4 W/kg

SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.36 W/kg

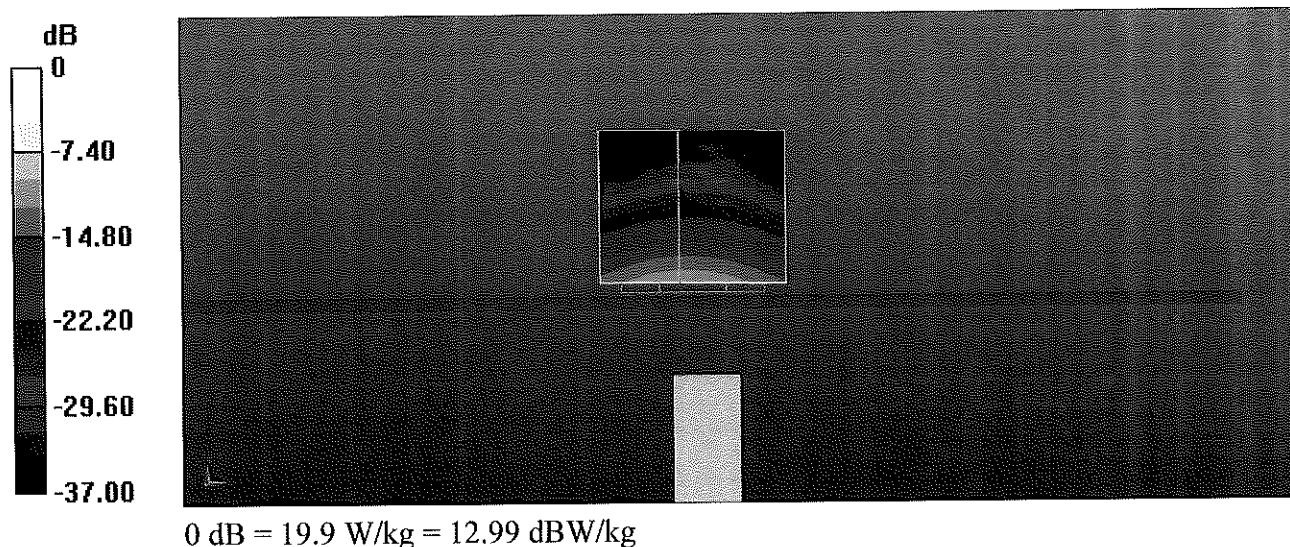
Smallest distance from peaks to all points 3 dB below = 7.5 mm

Ratio of SAR at M2 to SAR at M1 = 67.7%

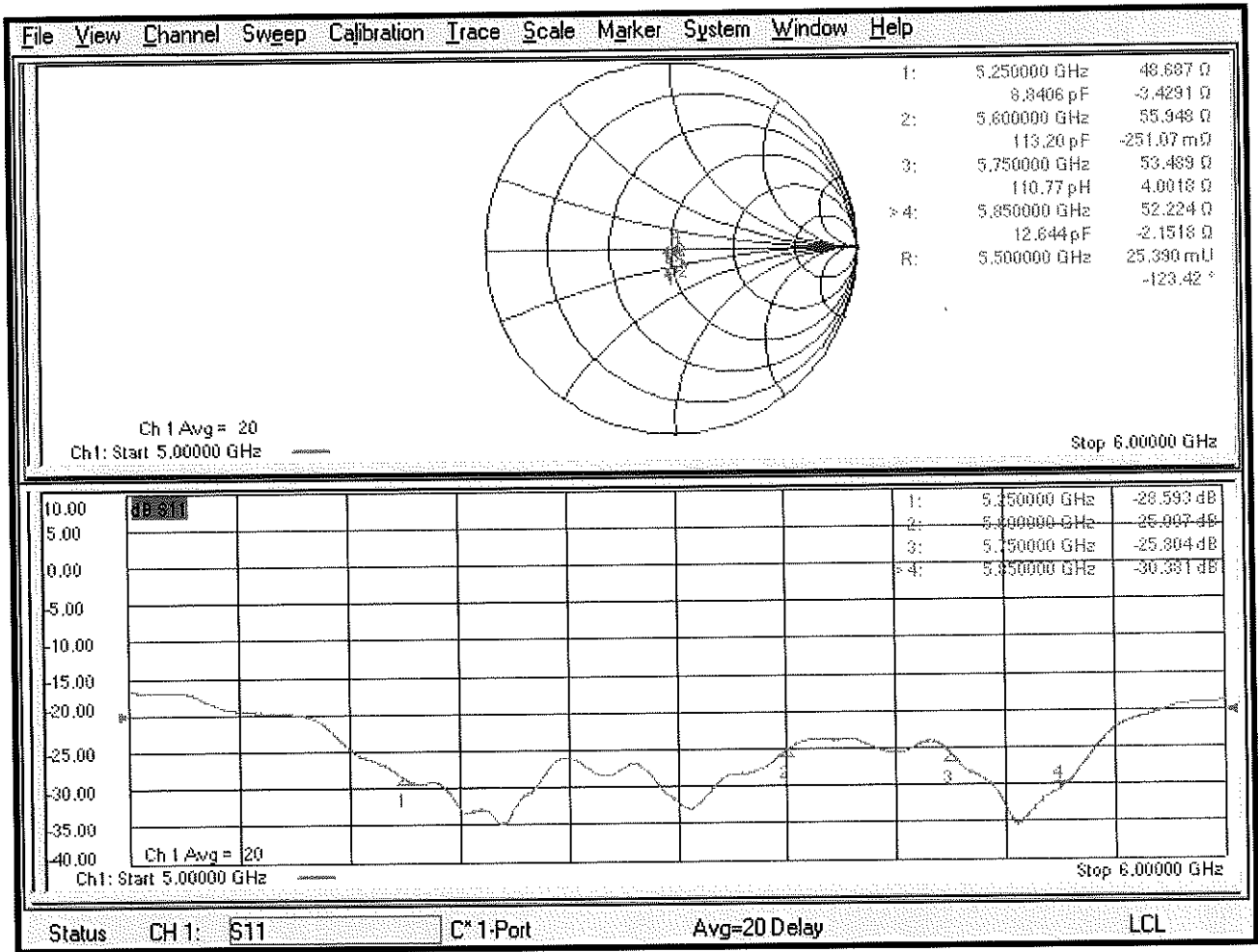
Maximum value of SAR (measured) = 19.4 W/kg

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 = 69.35 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 31.1 W/kg
SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.27 W/kg
Smallest distance from peaks to all points 3 dB below = 7.5 mm
Ratio of SAR at M2 to SAR at M1 = 66%
Maximum value of SAR (measured) = 19.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5850 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.94 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 32.6 W/kg
SAR(1 g) = 8.15 W/kg; SAR(10 g) = 2.31 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 65.2%
Maximum value of SAR (measured) = 19.9 W/kg



Impedance Measurement Plot for Head TSL



Certification of Calibration

Object: D5GHzV2 – SN: 1057

Calibration procedure(s): Procedure for Calibration Extension for SAR Dipoles.

Extension Calibration date: 02/20/2025

Description: SAR Validation Dipole at 5250,5600,5750,5850 MHz.

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	N5182A	MXG Vector Signal Generator	3/7/2024	Annual	3/7/2025	MY47420603
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	343971
Anritsu	MA24106A	USB Power Sensor	3/14/2024	Annual	3/14/2025	1349513
Control Company	4040	Digital Thermometer	3/27/2023	Biennial	3/27/2025	230208311
Control Company	4052	Long Stem Thermometer	2/27/2024	Annual	2/27/2025	240171059
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Huber + Suhner	74Z-0-0-21	Torque Wrench	10/17/2023	Biennial	10/17/2025	16476
Mini-Circuits	ZHDC-16-63-S+	Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	ZNLE6	Vector Network Analyzer	3/8/2024	Annual	3/8/2025	1204153
SPEAG	DAK-3.5	Dielectric Assessment Kit	10/15/2024	Annual	10/15/2025	1091
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	2/1/2024	Triennial	2/1/2027	MY53401181
SPEAG	EX3DV4	SAR Probe	6/28/2024	Annual	6/28/2025	7803
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/8/2024	Annual	7/8/2025	1583

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	Tho Tong	Test Engineer	<i>Tho Tong</i>
Approved By:	Greg Snyder	Executive VP of Operations, Regulatory	<i>Greg Snyder</i>

DIPOLE CALIBRATION EXTENSION

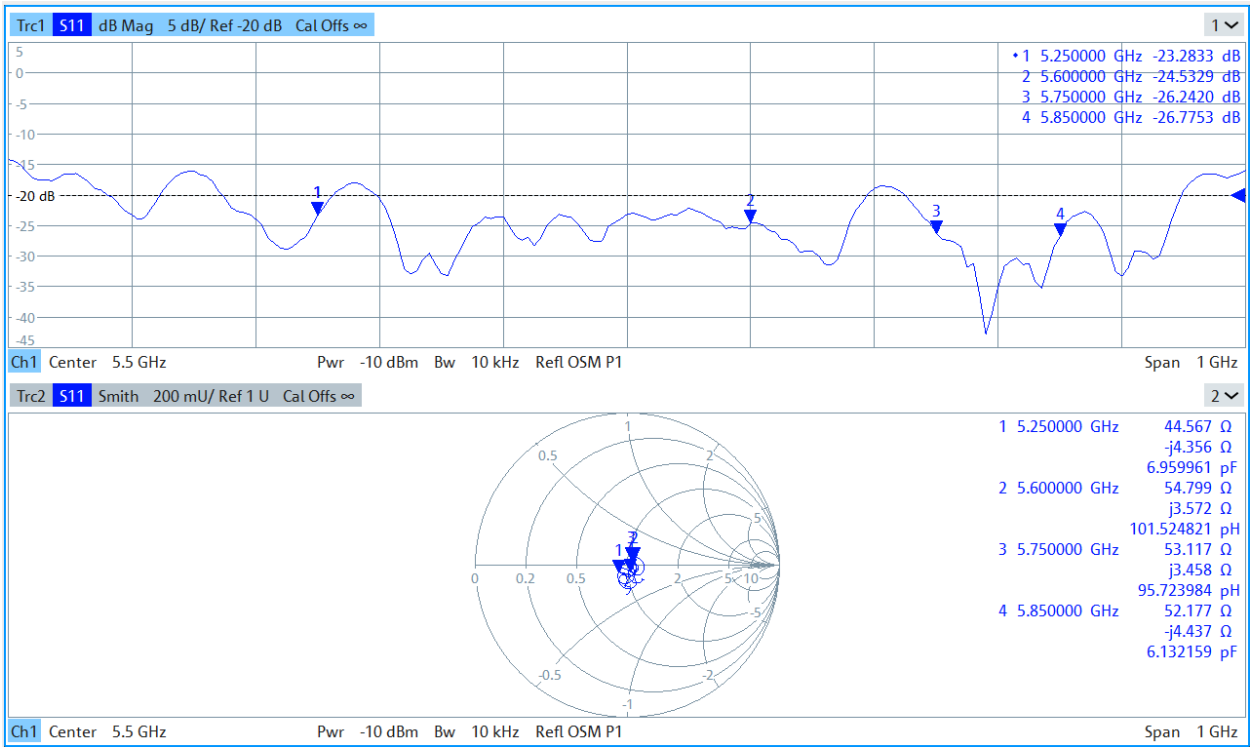
Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return-loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 2-year calibration period from the calibration date:

Frequency (MHz)	Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 17.0 dBm	Measured Head SAR (1g) W/kg @ 17.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 17.0 dBm	Measured Head SAR (10g) W/kg @ 17.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
5250	2/21/2024	2/20/2025	1.202	3.97	3.67	-7.56%	1.14	1.05	-7.49%	48.7	44.6	-4.1	-3.4	-4.4	1.0	-28.6	-23.3	18.60%	PASS
5600	2/21/2024	2/20/2025	1.202	4.14	3.87	-6.52%	1.18	1.11	-5.93%	55.9	54.8	-1.1	-0.3	-3.6	3.9	-25.0	-24.5	1.90%	PASS
5750	2/21/2024	2/20/2025	1.202	3.99	3.68	-7.77%	1.14	1.05	-7.49%	53.5	53.1	-0.4	4	3.5	0.5	-25.8	-26.2	-1.70%	PASS
5850	2/21/2024	2/20/2025	1.202	4.08	3.74	-8.22%	1.15	1.06	-7.83%	52.2	52.2	0	-2.2	-4.4	2.2	-30.4	-26.8	11.80%	PASS

Impedance & Return-Loss Measurement Plot for Head TSL



Certification of Calibration

Object: D5GHzV2 – SN: 1057

Calibration procedure(s): Procedure for Calibration Extension for SAR Dipoles.

Extension Calibration date: 02/21/2026

Description: SAR Validation Dipole at 5250,5600,5750,5850 MHz

Calibration Equipment used:

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	N5182A	MXG Vector Signal Generator	8/1/2025	Annual	8/1/2026	MY47420651
Amplifier Research	1551G6	Amplifier	CBT	N/A	CBT	0343971
Anritsu	ML2496A	Power Meter	8/21/2025	Annual	8/21/2026	1138001
Anritsu	MA24106A	USB Power Sensor	5/29/2025	Annual	5/29/2026	1344545
TERMOPRODUKT	DT-1	Digital Thermometer	10/16/2025	Annual	10/16/2026	740621
Traceable	4052 90225-15	Long Stem Thermometer	9/3/2025	Annual	9/3/2026	250209401
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	VL6-6000+	Low Pass Filter DC to 6000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Keysight	8710-1765	Torque Wrench	4/2/2024	Biennial	4/2/2026	0821000633
Mini-Circuits	ZHDC-16-63-S+	Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	ZND	Vector Network Analyzer	4/29/2025	Biennial	4/29/2027	100465
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/12/2025	Annual	5/12/2026	1070
Keysight Technologies	85033E	Standard Mechanical Calibration Kit (DC to 9GHz, 3.5mm)	2/1/2024	Triennial	2/1/2027	MY53401181
SPEAG	EX3DV4	SAR Probe	6/11/2025	Annual	6/11/2026	7661
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/5/2025	Annual	6/5/2026	1558

Measurement Uncertainty = $\pm 23\%$ (k=2)

	Name	Function	Signature
Calibrated By:	ThuyTram Pham	Test Engineer	<i>ThuyTram Pham</i>
Approved By:	Greg Snyder	Executive VP of Operations, Regulatory	<i>Greg Snyder</i>

Object: D5GHzV2 – SN: 1057	Date Issued: 02/21/2026	Page 1 of 3
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DIPOLE CALIBRATION EXTENSION

Per KDB 865664 D01, calibration intervals of up to three years may be considered for reference dipoles when it is demonstrated that the SAR target, impedance and return loss of a dipole have remained stable according to the following requirements:

1. The measured SAR does not deviate more than 10% from the target on the calibration certificate.
2. The return-loss does not deviate more than 20% from the previous measurement and meets the required 20dB minimum return loss requirement.
3. The measurement of real or imaginary parts of impedance does not deviate more than 5Ω from the previous measurement.

The following dipole was checked to pass the above 3 requirements to have 3-year calibration period from the calibration date:

Frequency (MHz)	Calibration Date	Extension Date	Certificate Electrical Delay (ns)	Certificate SAR Target Head (1g) W/kg @ 17.0 dBm	Measured Head SAR (1g) W/kg @ 17.0 dBm	Deviation 1g (%)	Certificate SAR Target Head (10g) W/kg @ 17.0 dBm	Measured Head SAR (10g) W/kg @ 17.0 dBm	Deviation 10g (%)	Certificate Impedance Head (Ohm) Real	Measured Impedance Head (Ohm) Real	Difference (Ohm) Real	Certificate Impedance Head (Ohm) Imaginary	Measured Impedance Head (Ohm) Imaginary	Difference (Ohm) Imaginary	Certificate Return Loss Head (dB)	Measured Return Loss Head (dB)	Deviation (%)	PASS/FAIL
5250	2/21/2024	2/21/2026	1.202	3.97	3.71	-6.55%	1.14	1.08	-4.85%	48.7	49.4	0.7	-3.4	-1.5	1.9	-28.6	-31.1	-8.60%	PASS
5600	2/21/2024	2/21/2026	1.202	4.14	4.0	-3.38%	1.18	1.15	-2.54%	55.9	52.3	3.6	-0.3	-2.6	2.3	-25.0	-29.2	-16.80%	PASS
5750	2/21/2024	2/21/2026	1.202	3.99	3.72	-6.77%	1.14	1.07	-5.73%	53.5	52.4	1.1	4.0	1.2	2.8	-25.8	-24.3	5.90%	PASS
6850	2/21/2024	2/21/2026	1.202	4.08	3.93	-3.56%	1.15	1.12	-2.61%	52.2	48.6	3.6	-2.2	-4.8	2.6	-30.4	-25.6	15.70%	PASS

Object: D5GHzV2 – SN: 1057	Date Issued: 02/21/2026	Page 2 of 3
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Impedance & Return-Loss Measurement Plot for Head TSL:

