



1900 MHz Dipole Calibration Certificate

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e Swis	d by the Swiss Accredi s Accreditation Servi ral Agreement for the	ce is one of the	ne signatories		Accreditation N	Io.: SCS 0108
ient	CTTL Beijing	970 		Certificate No.	D1900V2-5	d101_Jul24
CAL	IBRATION CE	RTIFICA	ſE			
Object		D1900V	2 - SN: 5d1	01		
Calibra	tion procedure(s)	QA CAL Calibrati		re for SAR Validation Sou	irces between (0.7 - 3 GHz
Calibra	tion date	July 8, 2	024			
All calib	prations have been cond tion Equipment used (M			facility: environment temperature	$(22\pm3)^\circ C$ and hum	idity < 70%.
All calib Calibrat	tion Equipment used (N		calibration)		(22±3)°C and hum	
All calib Calibrat	tion Equipment used (N Standards		calibration)	Cal Date (Certificate No.)	(22±3)°C and hum	Scheduled Cal
All calib Calibrat rimary	tion Equipment used (N Standards Sensor R&S NRP-33T		ID SN: 100967	Cal Date (Certificate No.) 28-Mar-24 (No. 217-04038)		Scheduled Cal Mar-25
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Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland S Schweizerischer Kalibrierdienst

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

Accreditation No.: SCS 0108

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

Glossary

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x v 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%.

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July 8, 2024

D1900V2 - SN: 5d101

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 = 6mm, dz = 1.5mm	Graded Ratio = 1.5 mm (Z direction)
Frequency	1900MHz ±1MHz	

Head TSL parameters at 1900 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ±0.2)°C	41.3 ±6%	1.38 mho/m ±6%
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 1900 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition		
SAR for nominal Head TSL parameters	24 dBm input power	9.83 W/kg	
SAR for nominal Head TSL parameters	normalized to 1W	39.1 W/kg ±17.0% (k = 2)	

SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	24 dBm input power	5.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.6 W/kg ±16.5% (k = 2)

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July 8, 2024

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 1900 MHz

Impedance	49.4 Ω + 4.2 jΩ	
Return Loss	-27.3 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.203 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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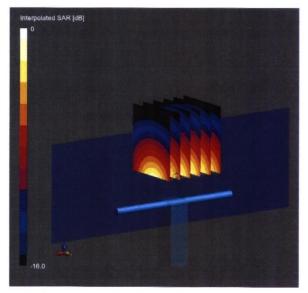


D1900V2 - SN: 5d101

July 8, 2024

System Performance Check Report

Dipole		Frequency [MHz]	TSL	Power (dBm)			
D1900V2 - SN5d101		1900	HSL	24			
Exposure Condition	15						
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 1900, 0		7.73	1.38	41.3	
Hardware Setup		6					
Phantom	TSL, Measured Date	Probe, Calibration Da	te	DAE,	Calibration Date		
MFP V8.0 Right	HSL, 2024-07-08	EX3DV4 - SN7349, 20	EX3DV4 - SN7349, 2024-06-03		DAE4ip Sn1836, 2024-01-10		
Scans Setup			Measuremen	t Results			
		Zoom Scan				Zoom Scan	
		30 x 30 x 30	Date			2024-07-08	
Grid Extents [mm]							
Grid Extents [mm] Grid Steps [mm]		6.0 x 6.0 x 1.5	psSAR1g [W/K	g]		9.83	
		6.0 x 6.0 x 1.5	psSAR1g [W/K psSAR10g [W/			9.83	
Grid Steps [mm]				Kg]			
Crid Steps [mm] Sensor Surface [mm]		1.4	psSAR10g [W/	Kg]		5.18	
Grid Steps [mm] Sensor Surface [mm] Graded Grid		1.4 Yes	psSAR10g [W/ Power Drift [dl	кg] B]		5.18	
Crid Steps [mm] Sensor Surface [mm] Graded Grid Grading Ratio		1.4 Yes 1.5	psSAR10g [W/ Power Drift (dl Power Scaling	Kg] 8) (dB)		5.18	



 $0 \, dB = 17.3 \, W/Kg$

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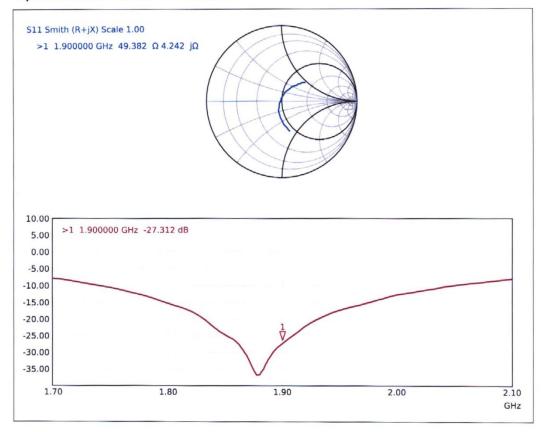




D1900V2 - SN: 5d101

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2450 MHz Dipole Calibration Certificate

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



S Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servicio svizzero di taratura

Servizio svizzero di taratura Sussi Calibration Service

Accreditation No.: SCS 0108

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

Client CTTL Beijing Certificate No. D

D2450V2-853_Jul24

Object	D2450V2 - SN: 853
Calibration procedure(s)	QA CAL-05.v12 Calibration Procedure for SAR Validation Sources between 0.7 - 3 GHz
Calibration date	July 10, 2024

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Cal
Power Sensor R&S NRP-33T	SN: 100967	28-Mar-24 (No. 217-04038)	Mar-25
Power Sensor R&S NRP18A	SN: 101859	21-Mar-24 (No. 4030A315007801)	Mar-25
Spectrum Analyzer R&S FSV40	SN: 101832	25-Jan-24 (No. 4030-315007551)	Jan-25
Mismatch; Short [S4188] Attenuator [S4423]	SN: 1152	28-Mar-24 (No. 217-04050)	Mar-25
OCP DAK-12	SN: 1016	05-Oct-23 (No. OCP-DAK12-1016_Oct23)	Oct-24
OCP DAK-3.5	SN: 1249	05-Oct-23 (No. OCP-DAK3.5-1249_Oct23)	Oct-24
Reference Probe EX3DV4	SN: 7349	03-Jun-24 (No. EX3-7349_Jun24)	Jun-25
DAE4ip	SN: 1836	10-Jan-24 (No. DAE4ip-1836_Jan24)	Jan-25

Secondary Standards	ID	Check Date (in house)	Scheduled Check
ACAD Source Box	SN: 1000	28-May-24 (No. 675-ACAD_Source_Box-240528)	May-25
Signal Generator R&S SMB100A	SN: 182081	28-May-24 (No. 0001-300719404)	May-25
Mismatch; SMA	SN: 1102	22-May-24 (No. 675-Mismatch_SMA-240522)	May-25

	Name	Function	Signature
Calibrated by	Paulo Pina	Laboratory Technician	tasthe
Approved by	Sven Kühn	Technical Manager	Sin
			Issued: July 10, 2024
This calibration certifica	te shall not be reproduced except	in full without written approval of the lat	oratory

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



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Swiss Calibration Service

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Accreditation No.: SCS 0108

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

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%.

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D2450V2 - SN: 853

July 10, 2024

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 ±1MHz	

Head TSL parameters at 2450 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ±0.2)°C	38.0 ±6%	1.83 mho/m ±6%
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 2450 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	24 dBm input power	13.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.2 W/kg ±17.0% (k = 2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	24 dBm input power	6.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg ±16.5% (k = 2)

Certificate No: D2450V2-853_Jul24

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D2450V2 - SN: 853

July 10, 2024

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 2450 MHz

Impedance	52.4 Ω + 2.6 jΩ
Return Loss	-29.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.163 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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Certificate No: D2450V2-853_Jul24

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MAIA

Surface Detection Scan Method

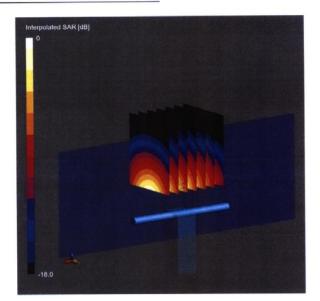


D2450V2 - SN: 853

July 10, 2024

System Performance Check Report

Summary					1000			
Dipole		Fre	quency [MHz]		TSL	Power [dBm]		
D2450V2 - SN853	2450			HSL	24			
Exposure Condition	5							
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		7.24	1.83	38.0
Hardware Setup								
Phantom	TSL, Measured	Date		Probe, Calibration D	late	DAE	Calibration Date	
MFP V8.0 Center	HSL, 2024-07-	-10		EX3DV4 - SN7349,	2024-06-03	DAE	4ip Sn1836, 2024-01-10	
Scans Setup					Measureme	nt Results		
				Zoom Scan				Zoom Scan
Grid Extents [mm]				30 x 30 x 30	Date			2024-07-10
Grid Steps [mm]			5	.0 x 5.0 x 1.5	psSAR1g [W/I	(g]		13.1
Sensor Surface [mm]		1.4		1.4	psSAR10g [W	/Kg]		6.16
Graded Grid				Yes	Power Drift (o	IB]		0.00
Grading Ratio				1.5	Power Scaling			Disabled



N/A

VMS + 6p

Measured

Scaling Factor [dB]

TSL Correction

 $0 \, dB = 26.6 \, W/Kg$

Certificate No: D2450V2-853_Jul24

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Positive / Negative

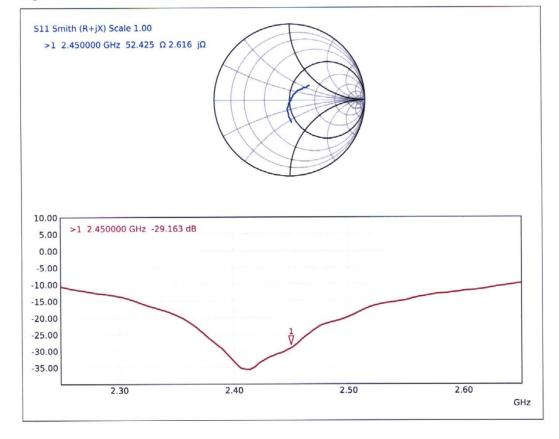




D2450V2 - SN: 853

July 10, 2024

Impedance Measurement Plot for Head TSL



Certificate No: D2450V2-853_Jul24

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2600 MHz Dipole Calibration Certificate

ugnau	eering AG usstrasse 43, 8004 Zuri	ich, Switzerland	and the second se	Sundalation State	S Swiss Calib	ration Service
e Swi	ed by the Swiss Accre iss Accreditation Ser eral Agreement for th	vice is one of th	e signatories t		Accreditation No	b.: SCS 0108
ent	CTTL Beijing			Certificate No.	D2600V2-10)12_Jul24
CAI	LIBRATION C	ERTIFICAT	E			
Object	t	D2600V2	2 - SN: 1012	2		
Calibra	ration procedure(s)	QA CAL Calibrati		re for SAR Validation Sou	rces between 0).7 - 3 GHz
Calibr	ration date	July 10,	2024			
The m All cal	neasurements and the	uncertainties with onducted in the clo	confidence pro	nal standards, which realize the ph bability are given on the following facility: environment temperature	pages and are part	of the certificate.
The m All cal Calibr	neasurements and the librations have been co ration Equipment used	uncertainties with onducted in the clo	confidence pro	bability are given on the following	pages and are part	of the certificate.
The m All cal Calibr Prima	neasurements and the librations have been co	uncertainties with onducted in the clo (M&TE critical for	confidence pro osed laboratory calibration)	bability are given on the following facility: environment temperature	pages and are part	of the certificate. idity < 70%.
The m All cal Calibr Prima	neasurements and the librations have been co ration Equipment used rry Standards	uncertainties with onducted in the clo (M&TE critical for	confidence pro osed laboratory calibration) ID SN: 100967 SN: 101859	Cal Date (Certificate No.) 28-Mar-24 (No. 217-04038) 21-Mar-24 (No. 4030A3150078	pages and are part (22±3)°C and humi	of the certificate. idity < 70%. Scheduled Cal Mar-25 Mar-25
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Certificate No: D2600V2-1012_Jul24

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

DC MRA



S Schweizerischer Kalibrierdienst C Service sulsse d'étalonnage

Servizio svizzero di taratura

S Swiss Calibration Service

Accreditation No.: SCS 0108

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

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%.

Certificate No: D2600V2-1012_Jul24

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D2600V2 - SN: 1012

July 10, 2024

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 ±1MHz	

Head TSL parameters at 2600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ±0.2)°C	37.4 ±6%	1.99 mho/m ±6%
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 2600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR for nominal Head TSL parameters	24 dBm input power	13.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	54.9 W/kg ±17.0% (k = 2)

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

Certificate No: D2600V2-1012_Jul24

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D2600V2 - SN: 1012

July 10, 2024

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 2600 MHz

Impedance	47.3 Ω – 6.6 jΩ	
Return Loss	-22.7 dB	

General Antenna Parameters and Design

1.153 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
Manual actives by	

Certificate No: D2600V2-1012_Jul24

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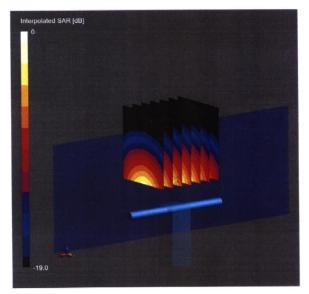


D2600V2 - SN: 1012

July 10, 2024

System Performance Check Report

Dipole		1	Frequency [MH	iz]	TSL	Power [dBm]		
D2600V2 - SN1012		3	2600		HSL	24		
Exposure Condition	5							
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		7.29	1.99	37.4
Hardware Setup								
Phantom	TSL, Measured	TSL, Measured Date Probe, Calibration Date		DAE, Calibration Date				
MFP V8.0 Center	HSL, 2024-07-	10	I	EX3DV4 - SN7349,	2024-06-03	DAE	4ip Sn1836, 2024-01-10	
Scans Setup					Measureme	nt Results		
				Zoom Scan	-			Zoom Scan
Grid Extents (mm)				30 x 30 x 30	Date			2024-07-10
Grid Steps [mm]			5	.0 x 5.0 x 1.5	psSAR1g (W/	Kg]		13.8
Sensor Surface [mm]				1.4	psSAR10g [W	/Kg]		6.24
Graded Grid				Yes	Power Drift [c	IB]		0.00
Grading Ratio		-	3	1.5	Power Scaling	1		Disabled
MAIA				N/A	Scaling Facto	r (dB)		
Surface Detection				VMS + 6p	TSL Correctio	n		Positive / Negative
Scan Method				Measured				



0 dB = 29.3 W/Kg

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July 10, 2024 D2600V2 - SN: 1012 Impedance Measurement Plot for Head TSL S11 Smith (R+jX) Scale 1.00 >1 2.600000 GHz 47.308 Ω -6.609 jΩ 10.00 >1 2.600000 GHz -22.714 dB 5.00 0.00 -5.00 -10.00 -15.00 -20.00 -25.00 -30.00 -35.00 2.70 2.80 2.40 2.50 2.60 GHz

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5 GHz Dipole Calibration Certificate





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



C S

Schweizerischer Kalibrierdienst

- Service suisse d'étalonnage
- Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

Accredited by the Swiss Accreditation Service (SAS)

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

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 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%.

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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	5200 MHz ± 1 MHz 5250 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.4 ± 6 %	4.55 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.64 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	76.5 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.8 W/kg ± 19.5 % (k=2)

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Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.3 ± 6 %	4.60 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	78.3 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.23 W/kg

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.2 ± 6 %	4.64 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.94 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.5 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.8 W/kg ± 19.5 % (k=2)

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Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.8 ± 6 %	4.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	83.4 W/kg ± 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR averaged over 10 cm ³ (10 g) of Head TSL SAR measured	condition 100 mW input power	2.37 W/kg

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.6 ± 6 %	4.97 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.7 W/kg ± 19.9 % (k=2)
		,
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.2 W/kg ± 19.5 % (k=2)

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