Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.1 Ω + 2.3 jΩ
Return Loss	- 27.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.156 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 19.02.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:973

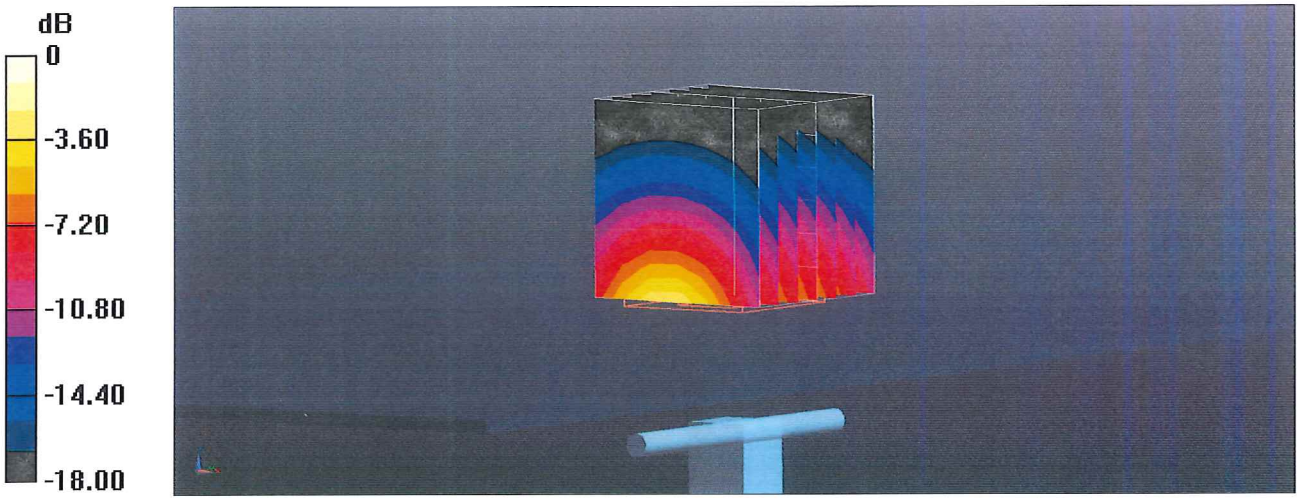
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.87 S/m; ε_r = 38.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 03.11.2023
- 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)

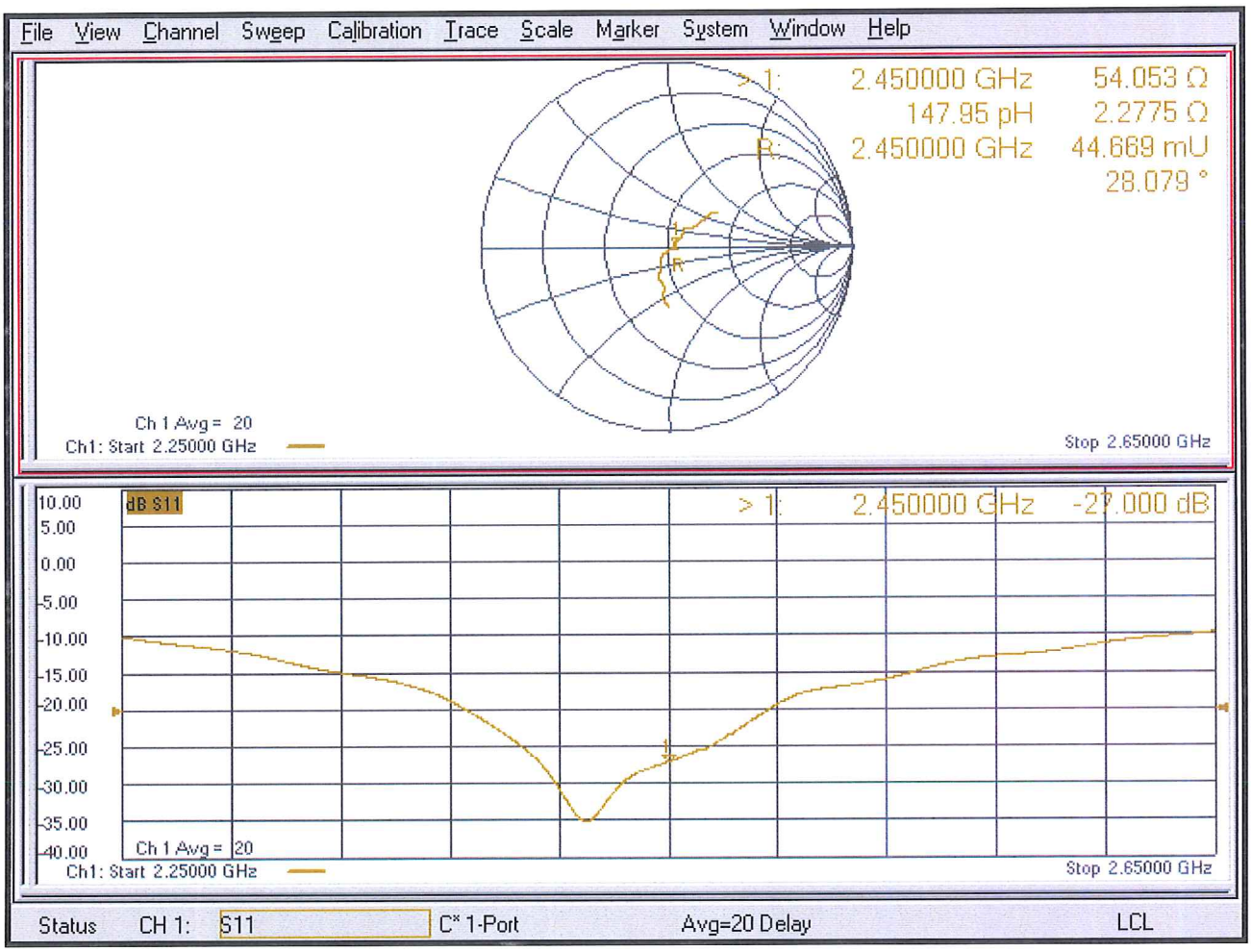
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 117.1 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.0 W/kg
SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.29 W/kg
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 50.8%
Maximum value of SAR (measured) = 21.7 W/kg



0 dB = 21.7 W/kg = 13.36 dBW/kg

Impedance Measurement Plot for Head TSL



Dipole Internal Calibration Record

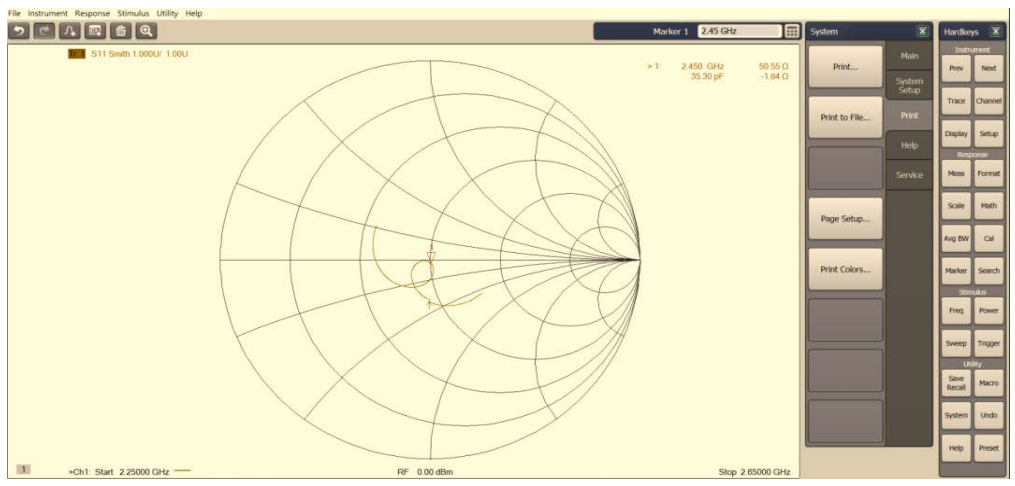
Asset No. :	E-537	Model No. :	D2450MHzV2	Serial No. :	973
Environmental	23.5℃, 48 %	Original Cal. Date :	February 19, 2024	Next Cal. Date :	February 19, 2027

Standard List		
1	IEEE Std 1528-2013	IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorpiton Rate(SAR) in the Human Head from Wireless Communication Devices: Measurement Texhniques, June 2013
2	IEC 62209-2	Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body(frequency range of 30 MHz to 6 GHz), March 2010
3	KDB865664	SAR Measurement Requirements for 100 MHz to 6 GHz

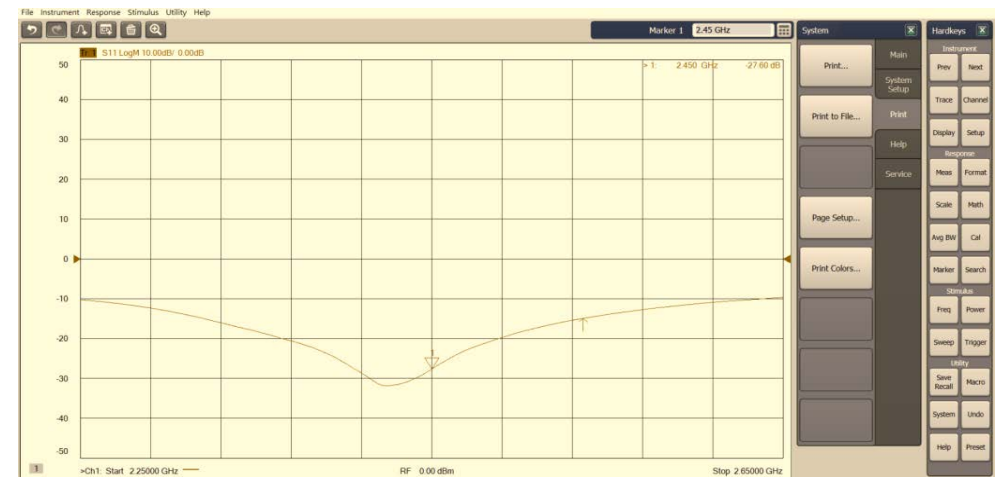
Equipment Information					
Equipment :	Manufacturer :	Model No. :	Serial No. :	Cal.Organization :	Cal. Date :
Power Amplifier	EMCI	EMC053035	980869	N/A	N/A
Power Meter	Anritsu	ML2495A	1128008	N/A	May 11, 2024
Power Sensor	Anritsu	MA2411B	1126001	N/A	May 11, 2024
Directional Coupler	Woken	TS-PCC0M-05	107090019	N/A	N/A
Signal Generator	R & S	SMB100A	113244	N/A	June 18, 2024
Vector network analyzer	Keysight	P5002A	MY58301034	N/A	March 6, 2024

Model No	For Head Tissue				
D2450V2	Item	Original Cal. Result	Verified on 2025/02/18	Deviation	Result
	Impedance, transformed to feed point	54.1Ω+2.3jΩ	50.6Ω-1.8jΩ	<5Ω	Pass
	Return Loss(dB)	-27.0	-27.6	-2.2%	Pass
	SAR Value for 1g(mW/g)	13.5	13.0	-3.7%	Pass
	SAR Value for 10g(mW/g)	6.29	6.02	-4.3%	Pass

Impedance Test-Head



Return Loss-Head



Validation Report for Head TSL

Test Laboratory: BTL Date: 2025/2/18

System Check_H2450

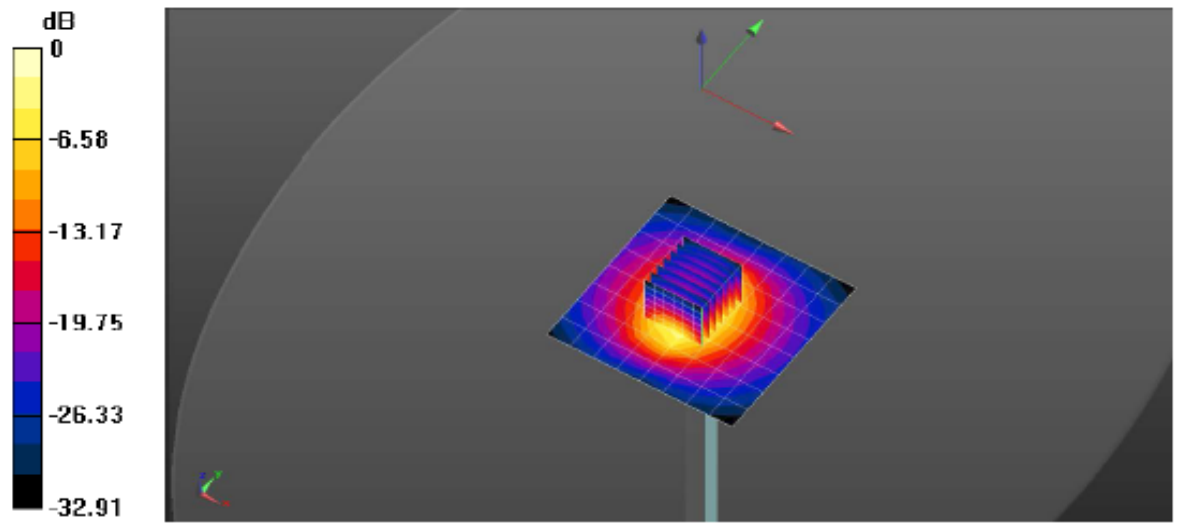
Frequency: 2450 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 23.0°C; Liquid Temperature: 22.0°C
Medium parameters used: f = 2450 MHz; σ = 1.789 S/m; ε_r = 38.049; ρ = 1000 kg/m^3
DASY5 Configuration:
- Area Scan Setting: Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1486; Calibrated: 2024/5/16
- Probe: EX3DV4 - SN7369; ConvF(7.6, 7.66, 7.12) @ 2450 MHz; Calibrated: 2024/6/3
- Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1240

System Performance Check at Frequencies above 1 GHz/Pin=250mW/Area Scan (9x9x1):

Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 19.1 W/kg

System Performance Check at Frequencies above 1 GHz/Pin=250mW/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 108.9 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 25.8 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 6.02 W/kg
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 50.8%
Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 19.1 W/kg = 12.80 dBW/kg

Calibrator: Jerry Chuang Approver: Peter Chen

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

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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

Client BTL
New Taipei City

Certificate No. D5GHzV2-1221_Feb24

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN:1221

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

Calibration date: February 13, 2024

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-Z91	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
Power sensor NRP-Z91	SN: 103245	30-Mar-23 (No. 217-03805)	Mar-24
Reference 20 dB Attenuator	SN: BH9394 (20k)	30-Mar-23 (No. 217-03809)	Mar-24
Type-N mismatch combination	SN: 310982 / 06327	30-Mar-23 (No. 217-03810)	Mar-24
Reference Probe EX3DV4	SN: 3503	07-Mar-23 (No. EX3-3503_Mar23)	Mar-24
DAE4	SN: 601	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

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

Issued: February 16, 2024

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

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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	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5600 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	36.1 ± 6 %	4.49 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.81 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.3 W/kg ± 19.5 % (k=2)**

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	35.9 ± 6 %	4.58 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.2 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.3 ± 6 %	4.89 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	8.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.5 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ± 6 %	5.12 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.8 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	47.6 Ω - 6.0 jΩ
Return Loss	- 23.6 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	49.9 Ω - 0.9 jΩ
Return Loss	- 40.4 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	51.0 Ω - 0.5 jΩ
Return Loss	- 39.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	56.6 Ω + 3.2 jΩ
Return Loss	- 23.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.189 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 13.02.2024

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1221

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.49 S/m; ε_r = 36.1; ρ = 1000 kg/m^3
Medium parameters used: f = 5300 MHz; σ = 4.58 S/m; ε_r = 35.9; ρ = 1000 kg/m^3
Medium parameters used: f = 5600 MHz; σ = 4.89 S/m; ε_r = 35.3; ρ = 1000 kg/m^3
Medium parameters used: f = 5800 MHz; σ = 5.12 S/m; ε_r = 35.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

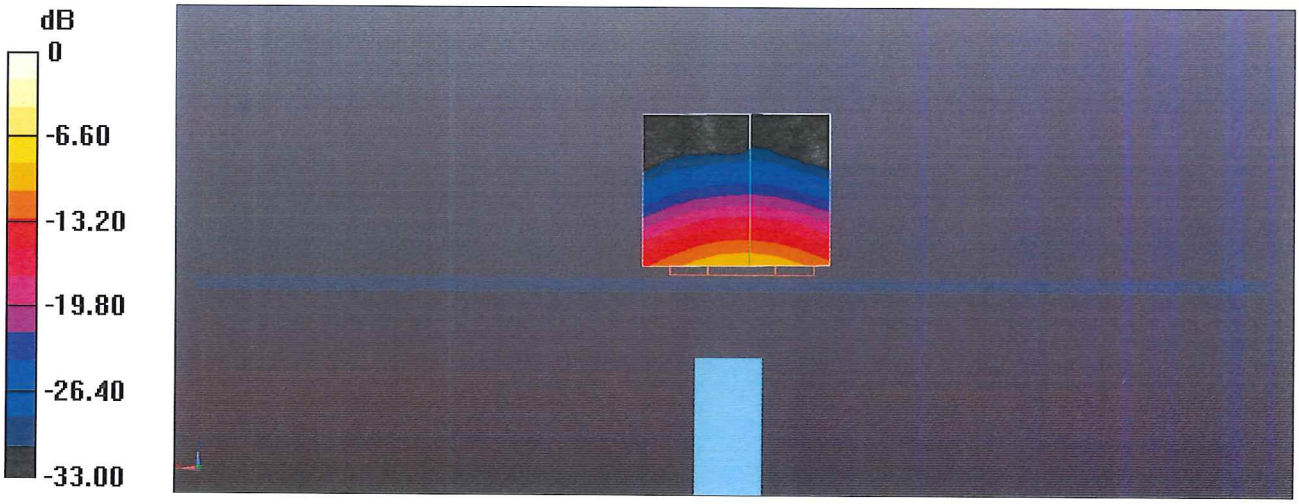
- Probe: EX3DV4 - SN3503; ConvF(5.8, 5.8, 5.8) @ 5200 MHz, ConvF(5.49, 5.49, 5.49) @ 5300 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.01, 5.01, 5.01) @ 5800 MHz; Calibrated: 07.03.2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2024
- Phantom: 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=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.76 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 7.81 W/kg; SAR(10 g) = 2.24 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 69.5%
Maximum value of SAR (measured) = 18.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.58 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 28.2 W/kg
SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.33 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 69.3%
Maximum value of SAR (measured) = 18.8 W/kg

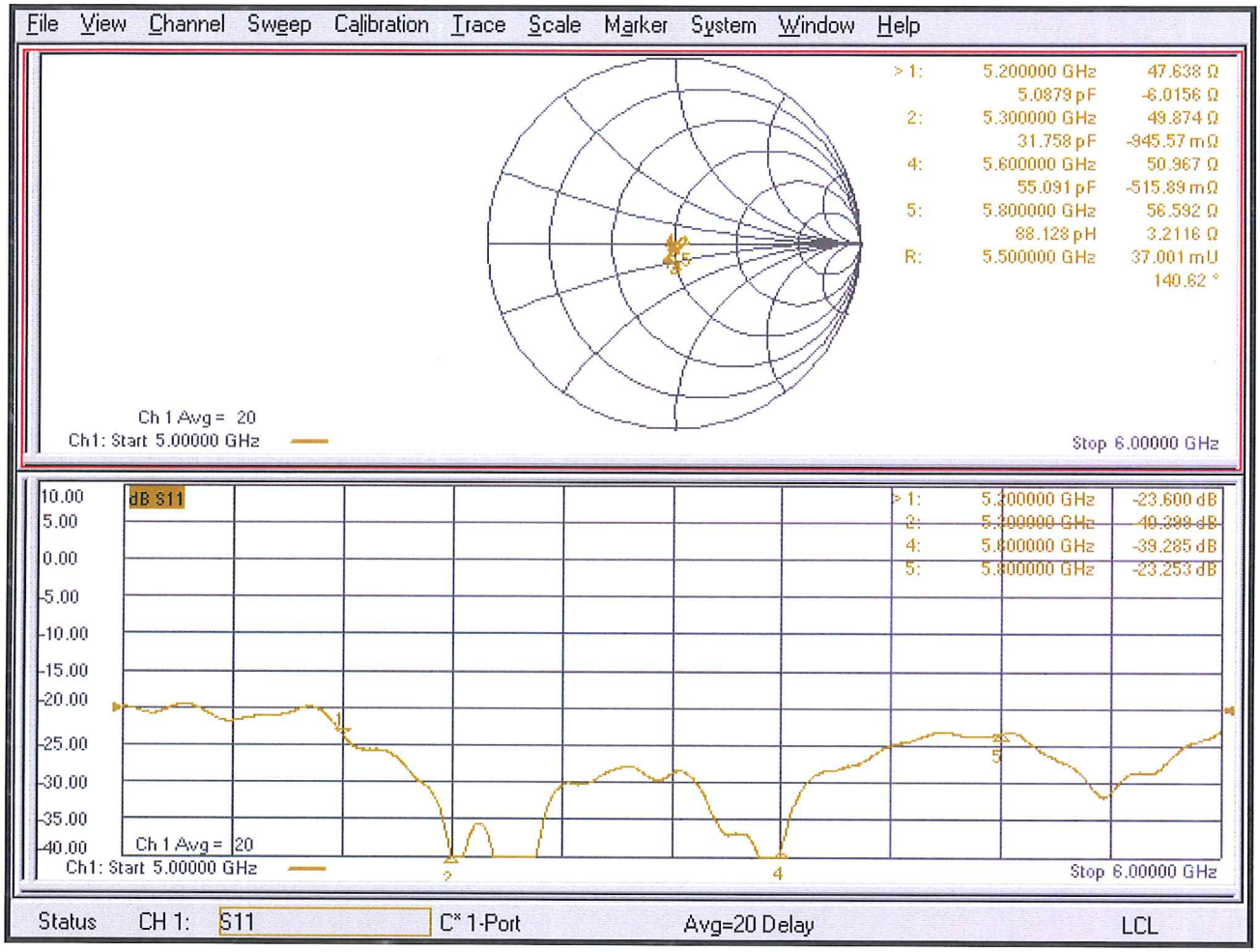
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 73.16 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 8.30 W/kg; SAR(10 g) = 2.36 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 67.4%
Maximum value of SAR (measured) = 20.0 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 70.45 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 31.8 W/kg
SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 65.3%
Maximum value of SAR (measured) = 20.0 W/kg



0 dB = 20.0 W/kg = 13.00 dBW/kg

Impedance Measurement Plot for Head TSL



Dipole Internal Calibration Record

Asset No. :	E-529	Model No. :	D5GHzV2	Cal. Date :	February 13, 2024
Serial No. :		1221		Next Cal. Date :	February 13, 2027
Environmental condition :		Temp :	23.3℃	R.H. :	44%

Standard List

1	IEEE Std 1528-2013	IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorpiton Rate(SAR) in the Human Head from Wireless Communication Devices: Measurement Texhniques, June 2013
2	IEC 62209-2	Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body(frequency range of 30 MHz to 6 GHz), March 2010
3	KDB865664	SAR Measurement Requirements for 100 MHz to 6 GHz

Equipment Information

Equipment :	Manufacturer :	Model No. :	Serial No. :	Cal.Organization :	Cal. Date :
Power Amplifier	EMCI	EMC053035	980869	N/A	N/A
Power Meter	Anritsu	ML2495A	1128008	N/A	May 11, 2024
Power Sensor	Anritsu	MA2411B	1126001	N/A	May 11, 2024
Directional Coupler	Woken	TS-PCC0M-05	107090019	N/A	N/A
Signal Generator	R & S	SMB100A	113244	N/A	June 18, 2024
Vector network analyzer	Keysight	P5002A	MY58301034	N/A	March 6, 2024

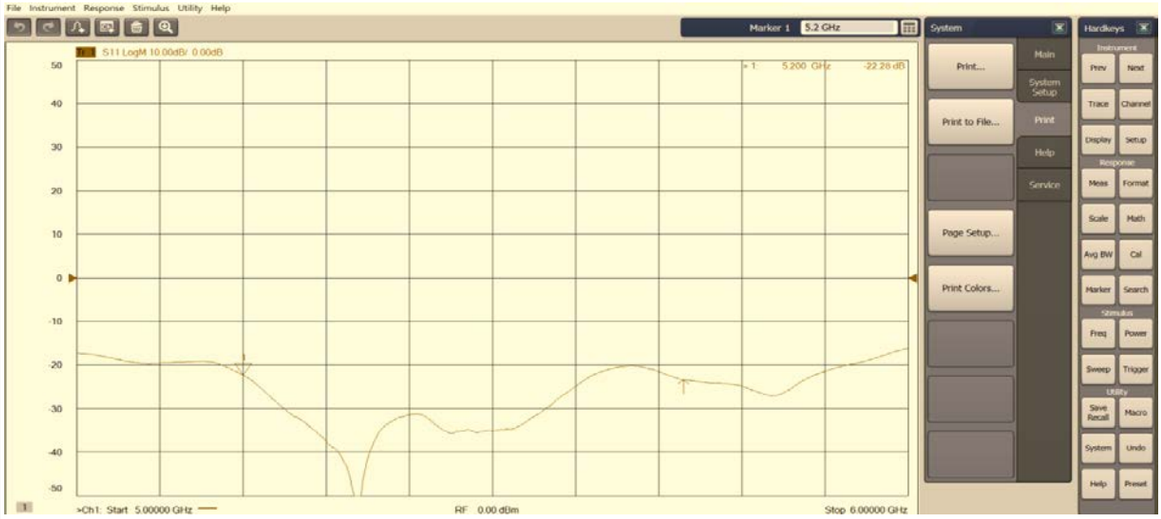
For Head Tissue

Frequency	Item	Originak Cal. Result	Verified on 2025/2/11	Deviation	Result
5.2G	Impedance, transformed to feed point(Ω)	47.6Ω-6.0jΩ	43.8Ω-2.4jΩ	<5Ω	Pass
	Return Loss(dB)	-23.6	-22.28	5.6%	Pass
	SAR Value for 1g(mW/g)	7.81	8.29	-6%	Pass
	SAR Value for 10g(mW/g)	2.24	2.36	-5.4%	Pass
5.3G	Impedance, transformed to feed point	49.9Ω-0.9jΩ	51.8Ω-1.0jΩ	<5Ω	Pass
	Return Loss(dB)	-40.4	-39.05	3.3%	Pass
	SAR Value for 1g(mW/g)	8.11	8.60	-6.0%	Pass
	SAR Value for 10g(mW/g)	2.33	2.44	-4.7%	Pass
5.6G	Impedance, transformed to feed point	51.0Ω-0.5jΩ	47.9Ω+1.5jΩ	<5Ω	Pass
	Return Loss(dB)	-39.3	-38.92	1.0%	Pass
	SAR Value for 1g(mW/g)	8.30	8.26	0.5%	Pass
	SAR Value for 10g(mW/g)	2.36	2.33	1.3%	Pass
5.8G	Impedance, transformed to feed point	56.6Ω+3.2jΩ	52.3Ω+4.4jΩ	<5Ω	Pass
	Return Loss(dB)	-23.3	-22.45	3.6%	Pass
	SAR Value for 1g(mW/g)	8.07	8.63	-6.9%	Pass
	SAR Value for 10g(mW/g)	2.29	2.40	-4.8%	Pass
Note :	SAR System Uncertainty : % , (95% CONFIDENCE LEVEL , Expanded uncertainty K=2)				

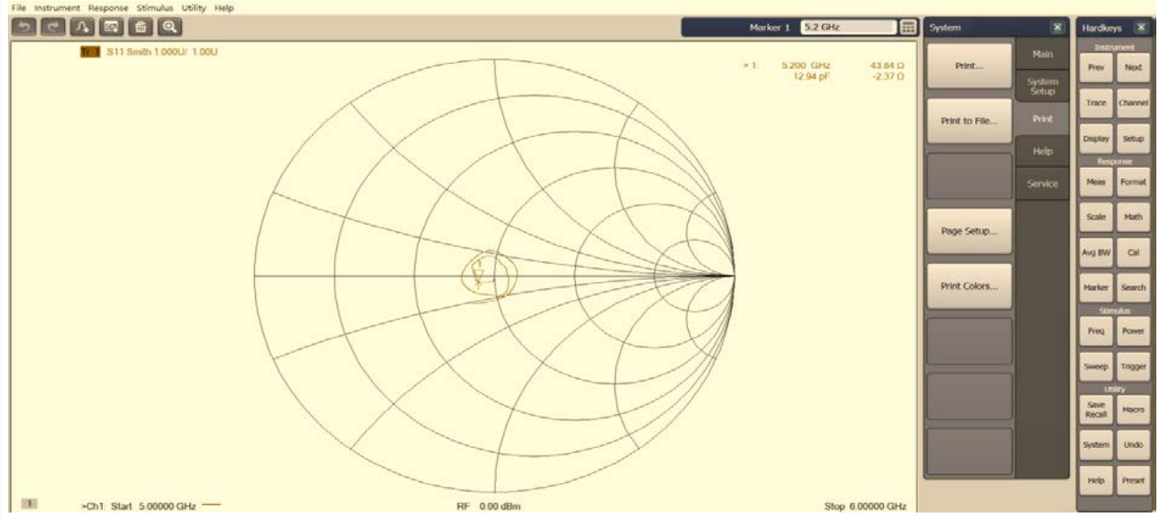
Tester : Jerry Chang

Technical Director : Peter Chen

Return Loss For Head



Impedance, transformed to feed point For Head



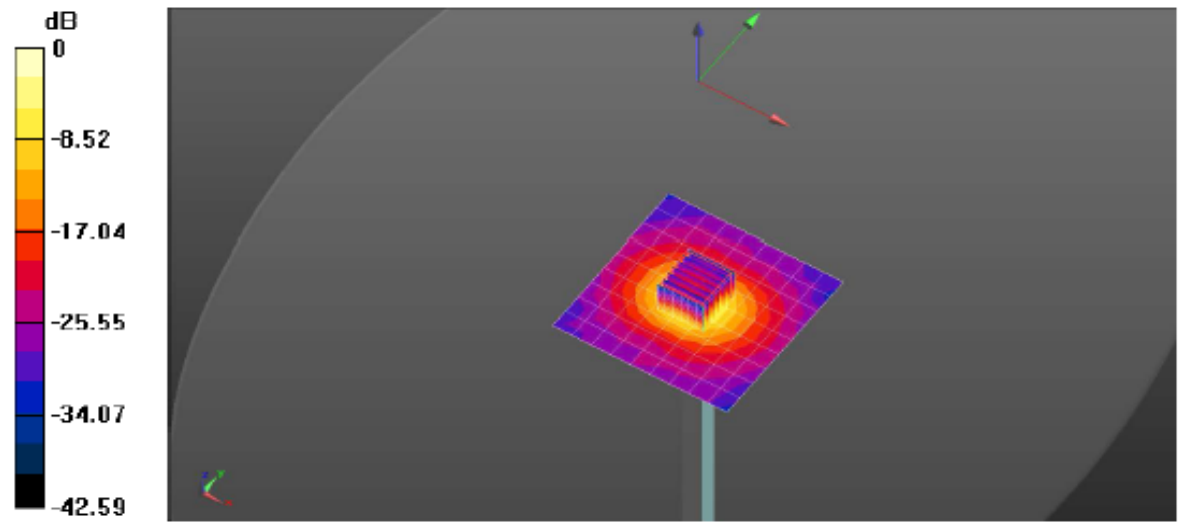
Test Laboratory: BTL Date: 2025/2/11

System Check_H5G

Frequency: 5200 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 23.0°C; Liquid Temperature: 22.0°C
Medium parameters used: f = 5200 MHz; σ = 4.747 S/m; ε_r = 35.789; ρ = 1000 kg/m^3
DASY5 Configuration:
- Area Scan Setting: Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1486; Calibrated: 2024/5/16
- Probe: EX3DV4 - SN7369; ConvF(5.36, 5.44, 4.91) @ 5200 MHz; Calibrated: 2024/6/3
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1240

Configuration/Pin=100mW/Area Scan (10x10x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.4 W/kg

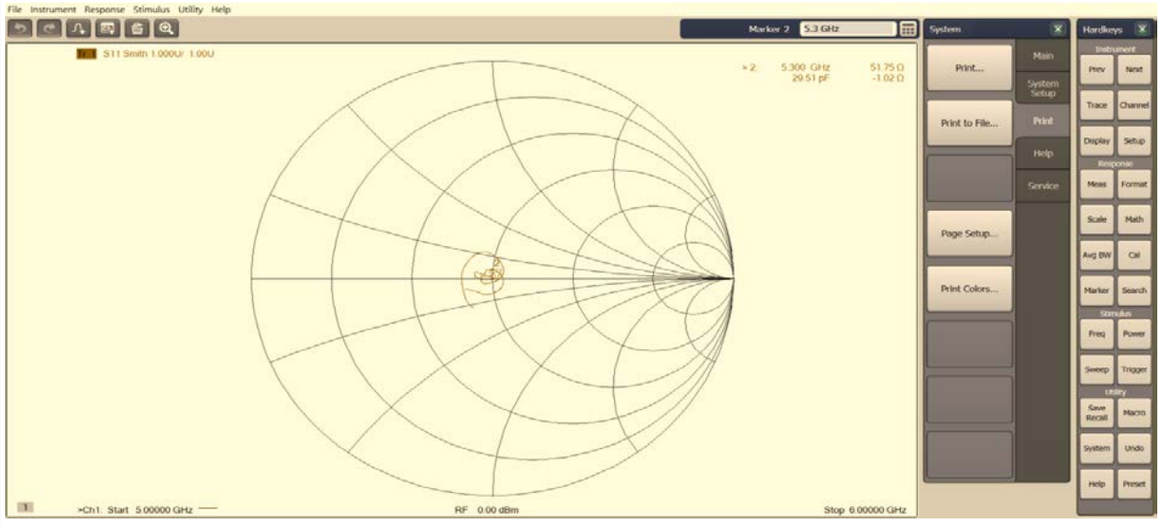
Configuration/Pin=100mW/Zoom Scan (7x7x11)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 71.73 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 35.2 W/kg
SAR(1 g) = 8.29 W/kg; SAR(10 g) = 2.36 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 52.6%
Maximum value of SAR (measured) = 21.5 W/kg



0 dB = 21.5 W/kg = 13.32 dBW/kg

Calibrator: Jerry Chuang Approver: Peter Chen

Return Loss For Head


Impedance, transformed to feed point For Head


Validation Report for Head TSL

Test Laboratory: BTL Date: 2025/2/11

System Check_H5G

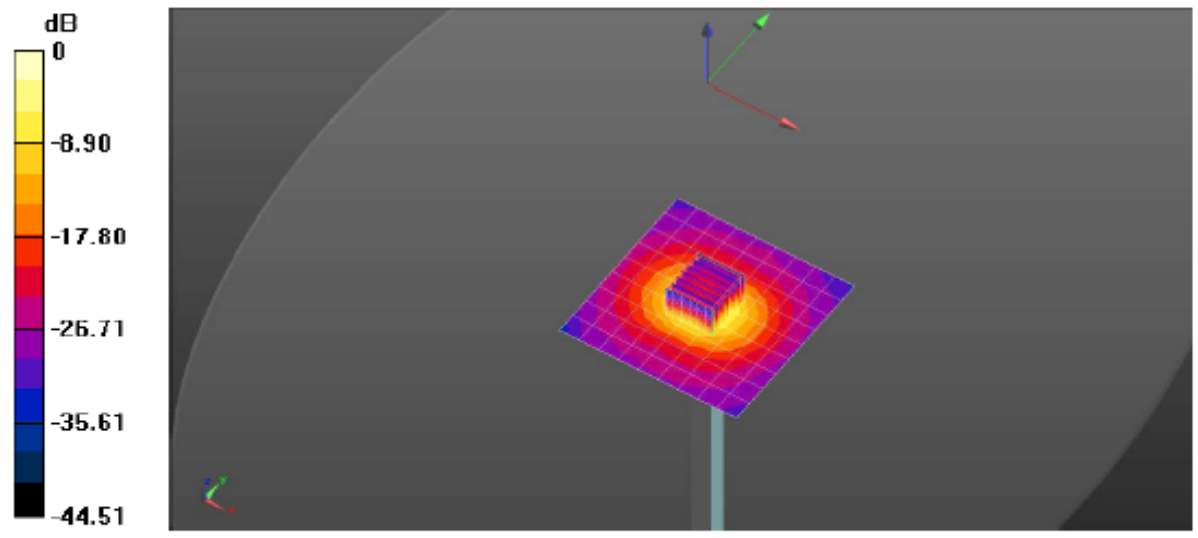
Frequency: 5300 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 23.0°C; Liquid Temperature: 22.0°C
Medium parameters used: f = 5300 MHz; σ = 4.866 S/m; ε_r = 35.536; ρ = 1000 kg/m^3
DASY5 Configuration:
- Area Scan Setting: Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1486; Calibrated: 2024/5/16
- Probe: EX3DV4 - SN7369; ConvF(5.17, 5.24, 4.78) @ 5300 MHz; Calibrated: 2024/6/3
- Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1240

Configuration/Pin=100mW/Area Scan (10x10x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 14.0 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x11)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 72.88 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 37.0 W/kg
SAR(1 g) = 8.6 W/kg; SAR(10 g) = 2.44 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 52.2%
Maximum value of SAR (measured) = 22.3 W/kg

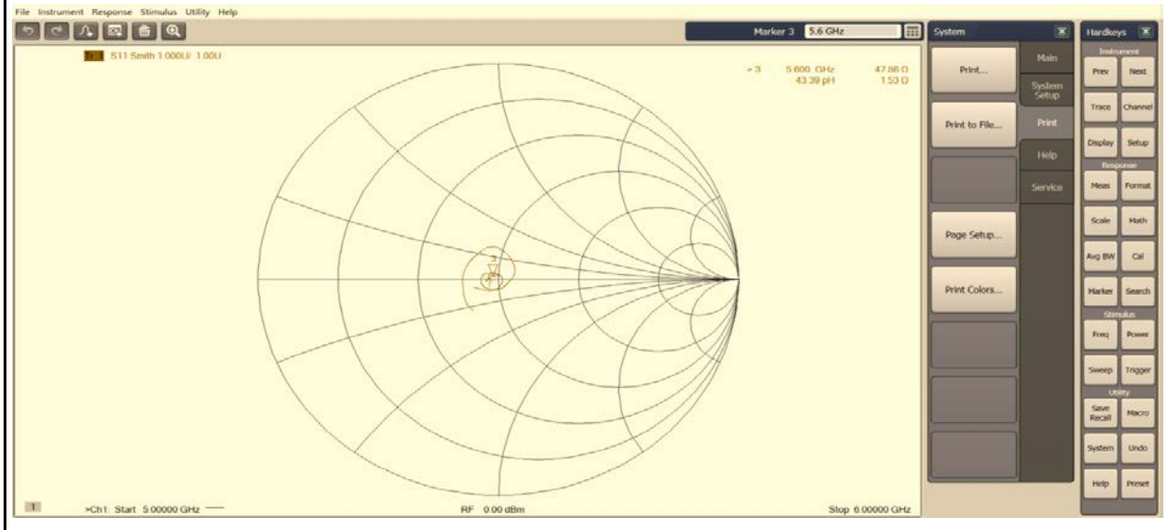


0 dB = 22.3 W/kg = 13.48 dBW/kg

Calibrator: Jerry Chuang Approver: Peter Chen

Return Loss For Head

Impedance, transformed to feed point For Head



Validation Report for Head TSL

Test Laboratory: BTL Date: 2025/2/11

System Check_H5G

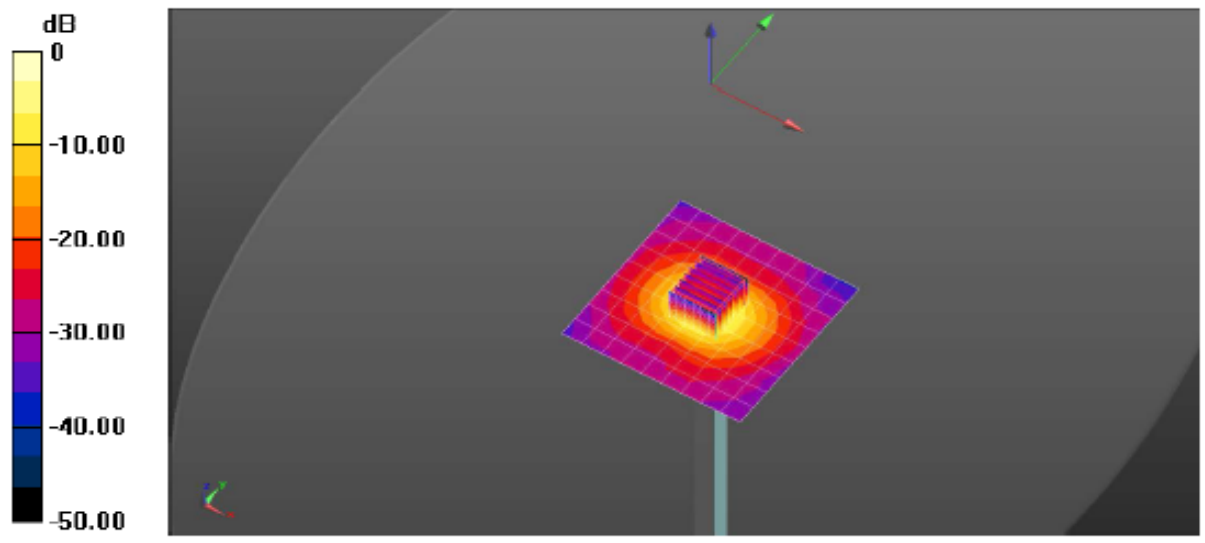
Frequency: 5600 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 23.0°C; Liquid Temperature: 22.0°C
Medium parameters used: f = 5600 MHz; σ = 5.219 S/m; ε_r = 34.798; ρ = 1000 kg/m^3
DASY5 Configuration:
- Area Scan Setting: Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1486; Calibrated: 2024/5/16
- Probe: EX3DV4 - SN7369; ConvF(4.57, 4.65, 4.21) @ 5600 MHz; Calibrated: 2024/6/3
- Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1240

Configuration/Pin=100mW/Area Scan (10x10x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 14.0 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x11)/Cube 0:

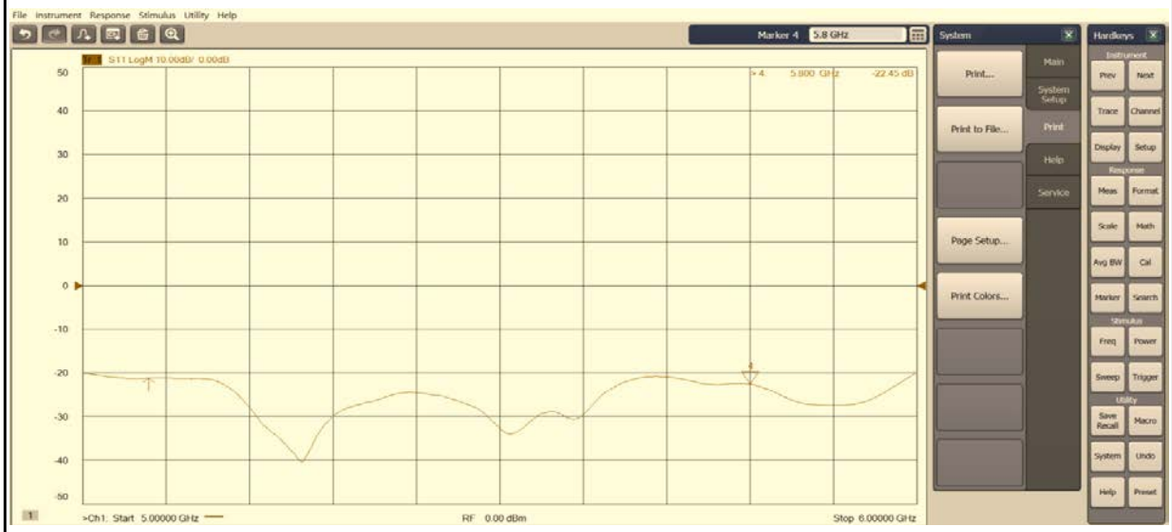
Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 70.24 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 38.4 W/kg
SAR(1 g) = 8.26 W/kg; SAR(10 g) = 2.33 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 49.5%
Maximum value of SAR (measured) = 22.0 W/kg



0 dB = 22.0 W/kg = 13.42 dBW/kg

Calibrator: Jerry Chuang Approver: Peter Chen

Return Loss For Head



Impedance, transformed to feed point For Head

Test Laboratory: BTL Date: 2025/2/11

System Check_H5G

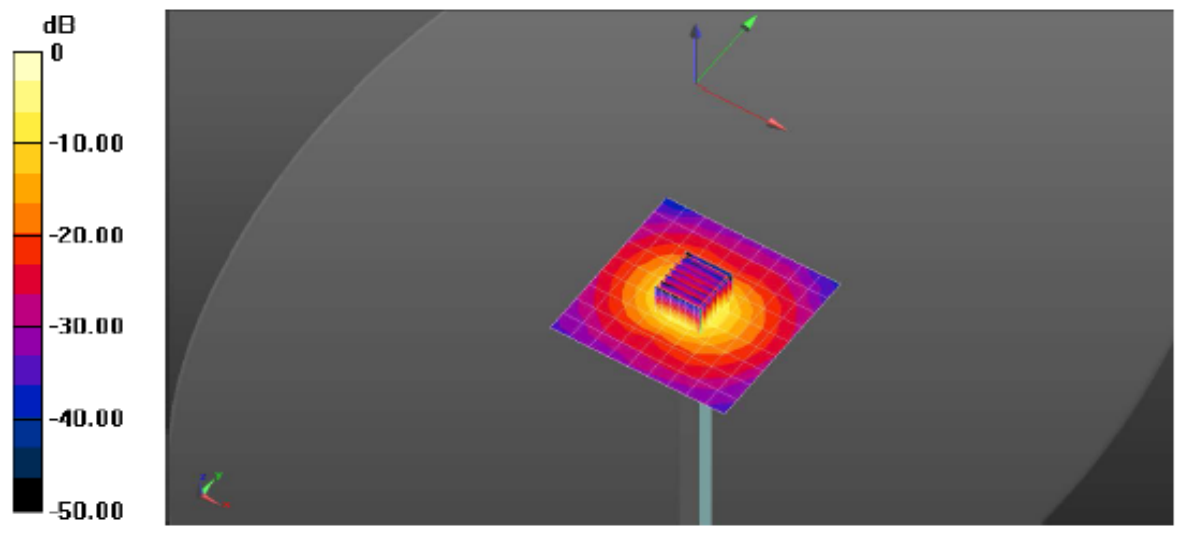
Frequency: 5800 MHz; Duty Cycle: 1:1; Room Ambient Temperature: 23.0°C; Liquid Temperature: 22.0°C
Medium parameters used: f = 5800 MHz; σ = 5.464 S/m; ε_r = 34.327; ρ = 1000 kg/m^3
DASY5 Configuration:
- Area Scan Setting: Find Secondary Maximum Within: 2.0 dB and with a peak SAR value greater than 0.0012W/kg
- Electronics: DAE4 Sn1486; Calibrated: 2024/5/16
- Probe: EX3DV4 - SN7369; ConvF(4.67, 4.76, 4.28) @ 5800 MHz; Calibrated: 2024/6/3
- Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Phantom: ELI V5.0 (20deg probe tilt); Type: QD OVA 002 AA; Serial: 1240

Configuration/Pin=100mW/Area Scan (10x10x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 14.7 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x11)/Cube 0:

Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 70.17 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 42.8 W/kg
SAR(1 g) = 8.63 W/kg; SAR(10 g) = 2.4 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 47.7%
Maximum value of SAR (measured) = 23.5 W/kg



0 dB = 23.5 W/kg = 13.71 dBW/kg

Calibrator: Jerry Chang Approver: Peter Chen

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

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

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

Accreditation No.: SCS 0108

Client **BTL**
New Taipei City

Certificate No. **D6.5GHzV2-1041_Sep24**

CALIBRATION CERTIFICATE

Object D6.5GHzV2 - SN:1041

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

Calibration date: September 09, 2024

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power sensor R&S NRP33T	SN: 100967	28-Mar-24 (No. 217-04038)	Mar-25
Reference 20 dB Attenuator	SN: BH9394 (20k)	26-Mar-24 (No. 217-04046)	Mar-25
Mismatch combination	SN: 84224 / 360D	28-Mar-24 (No. 217-04050)	Mar-25
Reference Probe EX3DV4	SN: 7405	01-Jul-24 (No. EX3-7405_Jul24)	Jul-25
DAE4	SN: 908	27-Mar-24 (No. DAE4-908_Mar24)	Mar-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator Anapico APSIN20G	SN: 827	18-Dec-18 (in house check Jan-24)	In house check: Jan-25
Power sensor NRP-Z23	SN: 100169	10-Jan-19 (in house check Jan-24)	In house check: Jan-25
Power sensor NRP-18T	SN: 100950	28-Sep-22 (in house check Jan-24)	In house check: Jan-25
Network Analyzer Keysight E5063A	SN:MY54504221	31-Oct-19 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: September 17, 2024

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

b) DASY System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The Return Loss ensures low reflected power. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.
- *The absorbed power density (APD):* The absorbed power density is evaluated according to Samaras T, Christ A, Kuster N, "*Compliance assessment of the epithelial or absorbed power density above 6 GHz using SAR measurement systems",* Bioelectromagnetics, 2021 (submitted). The additional evaluation uncertainty of 0.55 dB (rectangular distribution) is considered.

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	34.5	6.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ± 6 %	6.34 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	30.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**303 W/kg ± 24.7 % (k=2)**

SAR averaged over 8 cm^3 (8 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.77 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**68.0 W/kg ± 24.4 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	5.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**55.7 W/kg ± 24.4 % (k=2)**