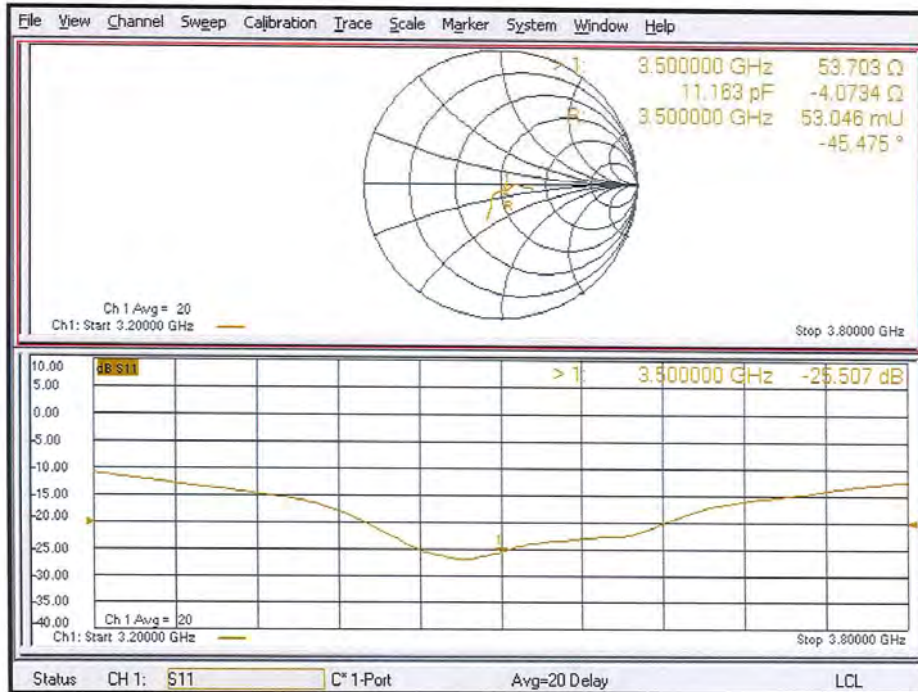


Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.12.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1052

Communication System: UID 0 - CW; Frequency: 3500 MHz

Medium parameters used: $f = 3500$ MHz; $\sigma = 3.33$ S/m; $\epsilon_r = 51$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(7.46, 7.46, 7.46) @ 3500 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 31.08.2022
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Body Tissue/Pin=100 mW, d=10mm, f=3500MHz/Zoom Scan ,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 63.71 V/m; Power Drift = -0.09 dB

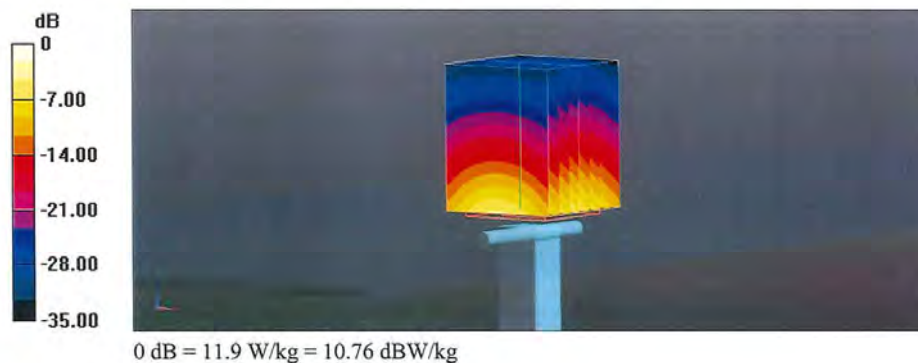
Peak SAR (extrapolated) = 16.9 W/kg

SAR(1 g) = 6.46 W/kg; SAR(10 g) = 2.42 W/kg

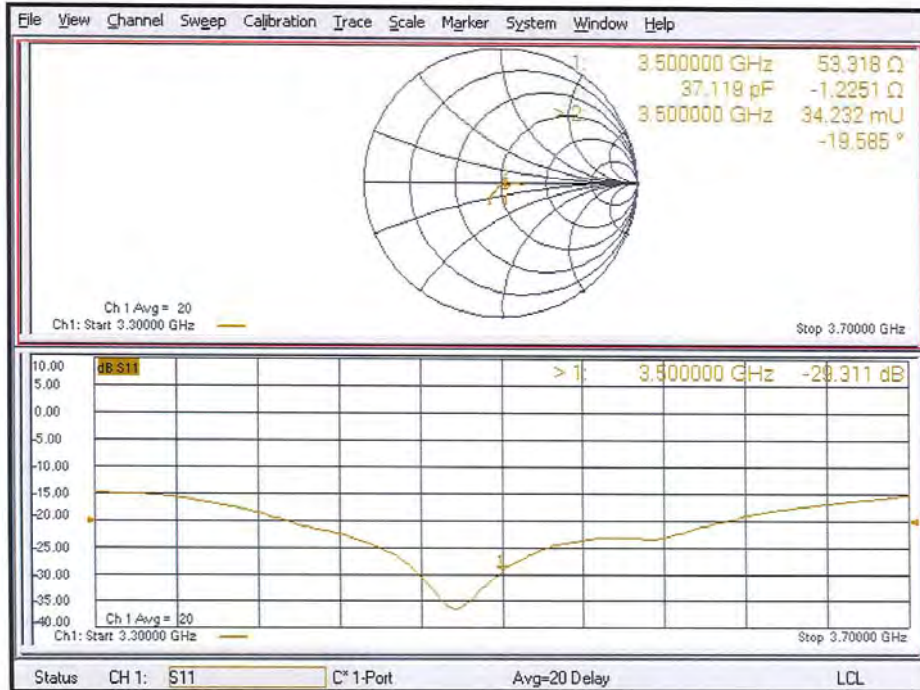
Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 76.1%

Maximum value of SAR (measured) = 11.9 W/kg



Impedance Measurement Plot for Body TSL



Calibration for Impedance and Return-loss

Equipment	Dipole Antenna	Model	D3500V2
Manufacture	Schmid & Partner Engineering AG	Serial	1052
Tested by	Hisayoshi Sato		

1. Test environment

Date	December 22, 2023		
Ambient Temperature	23.0 deg.C	Relative humidity	40 %RH

2. Equipment used

LIMS ID	Description	Manufacturer	Model	Serial	Last Cal Date	Interval
88581	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/7/18	12
142056	2mm Oval Flat Phantom	Schmid & Partner Engineering AG	QDOVA001BB	1045	2023/5/10	12
176484	Head Simulating Liquid	Schmid & Partner Engineering AG	HBBL600-10000V6	SL AAH U16 BC	-	-
150815	Network Analyzer	Keysight Technologies Inc	E5071C	MY46523746	2023/08/11	12
141991	2.4mm Calibration Kit	Keysight Technologies Inc	85056A	MY44300225	2023/8/29	12
142060	SAM Phantom	Schmid & Partner Engineering AG	QD000P40CB	1333	2023/5/10	12
176483	Body Simulating Liquid	Schmid & Partner Engineering AG	MBBL600-6000	SL AAM U16 BC	-	-

3. Test Result

Impedance, Transformed to feed point	cal day	Head (real part) [Ω]	Head (img part) [jΩ]	Deviation (real part) [Ω]	Deviation (img part) [jΩ]	Tolerance	Result
Calibration (SPEAG)	2022/12/14	53.70	-4.07	-	-	-	-
Calibration(ULJ)	2023/12/22	54.29	-1.96	0.58	2.11	+/- 5 Ω +/- 5 jΩ	Complied

Return loss	cal day	Head [dB]	Deviation [%]	Deviation [dB]	Tolerance [%]	Tolerance [± dB]	Result
Calibration (SPEAG)	2022/12/14	-25.51	-	-	-	-	-
Calibration(ULJ)	2023/12/22	-26.83	-5.18	-1.32	+/- 20.00	5.10	Complied

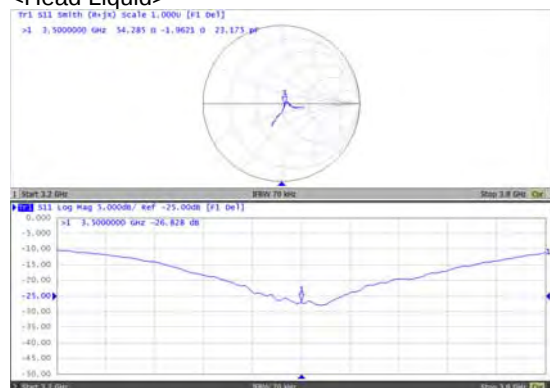
Impedance, Transformed to feed point	cal day	Body (real part) [Ω]	Body (img part) [jΩ]	Deviation (real part) [Ω]	Deviation (img part) [jΩ]	Tolerance	Result
Calibration (SPEAG)	2022/12/14	53.32	-1.23	-	-	-	-
Calibration(ULJ)	2023/12/22	52.58	0.11	-0.74	1.34	+/- 5 Ω +/- 5 jΩ	Complied

Return loss	cal day	Body [dB]	Deviation [%]	Deviation [dB]	Tolerance [%]	Tolerance [± dB]	Result
Calibration (SPEAG)	2022/12/14	-29.31	-	-	-	-	-
Calibration(ULJ)	2023/12/22	-32.02	-9.24	-2.71	+/- 20.00	5.86	Complied

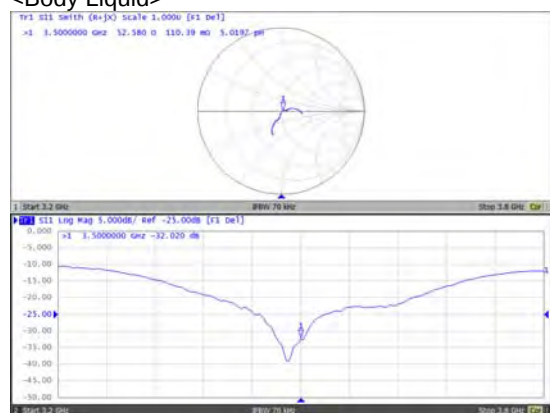
Tolerance: According to the KDB 865664 D1

Measurement Plots

<Head Liquid>



<Body Liquid>



D3700V2 – SN:1078

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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client: **UL Japan Head Office (RCC)**

Certificate No: **D3700V2-1078_Jul22**

CALIBRATION CERTIFICATE

Object: **D3700V2 - SN:1078**

Calibration procedure(s): **QA CAL-22.v6
Calibration Procedure for SAR Validation Sources between 3-10 GHz**

Calibration date: **July 14, 2022**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)	Apr-23
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
Power sensor NRP-Z91	SN: 103246	04-Apr-22 (No. 217-03525)	Apr-23
Reference 20 dB Attenuator	SN: BH8394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
Type-N mismatch combination	SN: 310862 / 06327	04-Apr-22 (No. 217-03528)	Apr-23
Reference Probe EX3DV4	SN: 3503	08-Mar-22 (No. EX3-3503_Mar22)	Mar-23
DAE4	SN: 601	02-May-22 (No. DAE4-601_May22)	May-23
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8366A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22

Calibrated by:	Name Jeffrey Kahrman	Function Laboratory Technician	Signature
Approved by:	Name Nils Kuster	Function Quality Manager	Signature

Issued: July 19, 2022

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

Certificate No: D3700V2-1078_Jul22

Page 1 of 8

**Calibration Laboratory of
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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 source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss:** This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3700 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.7	3.12 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	36.9 $\pm$ 6 %	3.10 mho/m $\pm$ 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	6.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	65.7 W/kg $\pm$ 18.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.9 W/kg $\pm$ 19.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	51.0	3.55 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	51.3 $\pm$ 6 %	3.47 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	6.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	62.4 W/kg $\pm$ 19.9 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.5 W/kg $\pm$ 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$44.5 \Omega + 0.5 j\Omega$
Return Loss	-24.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$43.9 \Omega + 1.1 j\Omega$
Return Loss	-23.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.135 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: 12.07.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1078

Communication System: UID 0 - CW; Frequency: 3700 MHz

Medium parameters used: $f = 3700$ MHz; $\sigma = 3.1$ S/m; $\epsilon_r = 36.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(7.73, 7.73, 7.73) @ 3700 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3700MHz/Zoom Scan,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 70.27 V/m; Power Drift = 0.00 dB

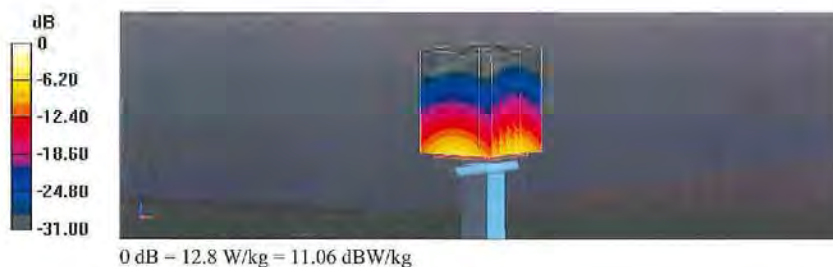
Peak SAR (extrapolated) = 18.6 W/kg

SAR(1 g) = 6.59 W/kg; SAR(10 g) = 2.40 W/kg

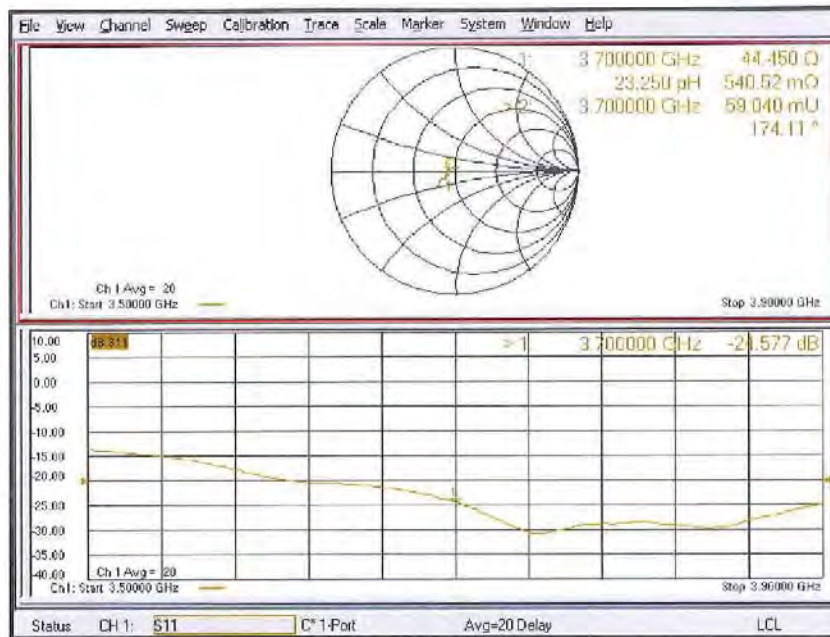
Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 74%

Maximum value of SAR (measured) = 12.8 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.07.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1078

Communication System: UID 0 - CW; Frequency: 3700 MHz

Medium parameters used: $f = 3700$ MHz; $\sigma = 3.47$ S/m; $\epsilon_r = 51.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(7.31, 7.31, 7.31) @ 3700 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.05.2022
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Body Tissue/Pin=100 mW, d=10mm, f=3700MHz/Zoom Scan ,

dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 62.63 V/m; Power Drift = -0.08 dB

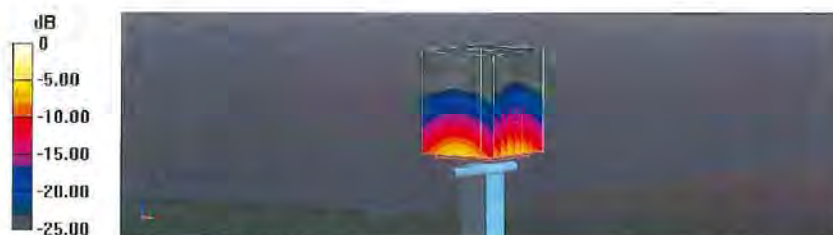
Peak SAR (extrapolated) = 16.6 W/kg

SAR(1 g) = 6.20 W/kg; SAR(10 g) = 2.25 W/kg

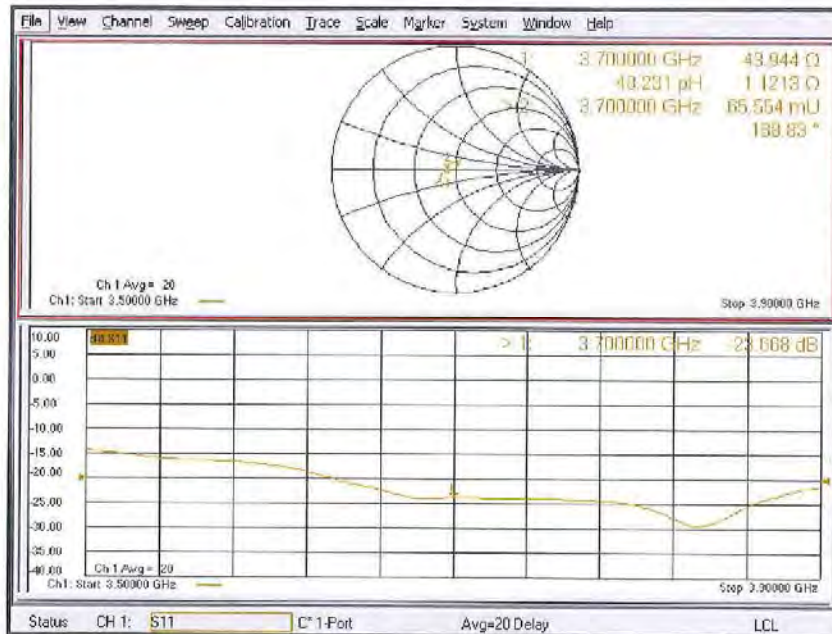
Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 76%

Maximum value of SAR (measured) = 11.8 W/kg



Impedance Measurement Plot for Body TSL



Calibration for Impedance and Return-loss

Equipment	Dipole Antenna	Model	D3700V2
Manufacture	Schmid & Partner Engineering AG	Serial	1078
Tested by	Hisayoshi Sato	Tested by	Tomohisa Nakagawa

1. Test environment

Date	July 31, 2023	Tested by	Hisayoshi Sato
Ambient Temperature	22.5 deg.C	Relative humidity	40 %RH
Date	July 16, 2024	Tested by	Tomohisa Nakagawa
Ambient Temperature	20.5 deg.C	Relative humidity	52 %RH

2. Equipment used

2023

LIMS ID	Description	Manufacturer	Model	Serial	Last Cal Date	Interval
88581	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/07/18	12
142060	SAM Phantom	Schmid & Partner Engineering AG	QD000P40CB	1333	2023/05/10	12
142056	2mm Oval Flat Phantom	Schmid & Partner Engineering AG	QDOVA001BB	1045	2023/05/10	12
176484	Head Simulating Liquid	Schmid & Partner Engineering AG	HBBL600-10000V6	SL AAH U16 BC	-	-
150815	Network Analyzer	Keysight Technologies Inc	E5071C	MY46523746	2022/08/23	12
141991	2.4mm Calibration Kit	Keysight Technologies Inc	85056A	MY44300225	2022/08/18	12

2024

LIMS ID	Description	Manufacturer	Model	Serial	Last Cal Date	Interval
176484	Head Simulating Liquid	Schmid & Partner Engineering AG	HBBL600-10000V6	SL AAH U16 BC	-	-
141573	Digital thermometer	HANNA INSTRUMENTS	Checktemp 4	-	2023/07/18	12
142057	2mm Oval Flat Phantom	Schmid&Partner Engineering AG	QDOVA001BB	1203	2024/05/31	12
141991	2.4mm Calibration Kit	Keysight Technologies Inc	85056A	MY44300225	2023/08/29	12
239339	Network Analyzer	Keysight Technologies Inc	N5244A	MY52441964	2023/09/07	12

3. Test Result

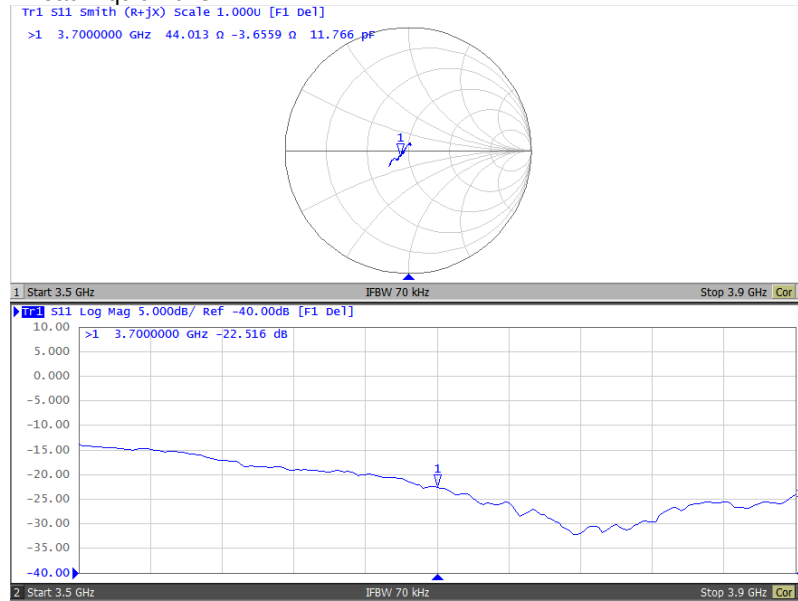
Impedance, Transformed to feed point	cal day	Head (real part) [Ω]	Head (img part) [jΩ]	Deviation (real part) [Ω]	Deviation (img part) [jΩ]	Tolerance	Result
Calibration (SPEAG)	2022/7/14	44.45	0.54	-	-	-	-
Calibration(ULJ)	2023/7/31	44.01	-3.66	-0.44	-4.20	+/- 5 Ω +/- 5 jΩ	Complied
Calibration(ULJ)	2024/7/16	44.51	1.21	0.06	0.67	+/- 5 Ω +/- 5 jΩ	Complied

Return loss	cal day	Head [dB]	Deviation [%]	Deviation [dB]	Tolerance [%]	Tolerance [+/- dB]	Result
Calibration (SPEAG)	2022/7/14	-24.58	-	-	-	-	-
Calibration(ULJ)	2023/7/31	-22.52	8.39	2.061	+/- 20.00	4.92	Complied
Calibration(ULJ)	2024/7/16	-24.51	0.27	0.07	+/- 20.00	4.92	Complied

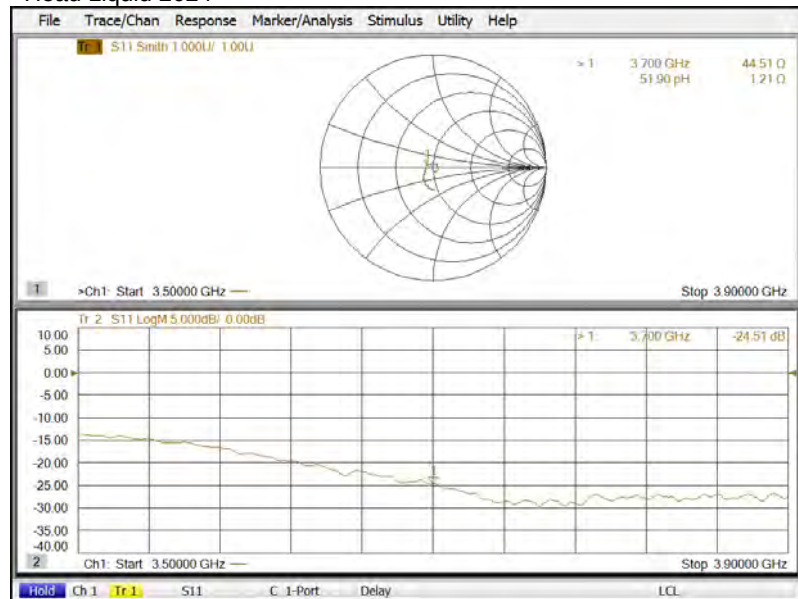
Tolerance: According to the KDB 865664 D1

Measurement Plots

<Head Liquid 2023>



<Head Liquid 2024>



D3900V2 - S/N:1006

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **UL Japan (RCC)**

Certificate No: D3900V2-1006_Apr22

CALIBRATION CERTIFICATE

Object	D3900V2 - SN:1006		
Calibration procedure(s)	QA CAL-22.v6 Calibration Procedure for SAR Validation Sources between 3-10 GHz		
Calibration date:	April 19, 2022		
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration)			
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)	Apr-23
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
Power sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23
Reference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
Type-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)	Apr-23
Reference Probe EX3DV4	SN: 3503	08-Mar-22 (No. EX3-3503_Mar22)	Mar-23
DAE4	SN: 601	01-Nov-21 (No. DAE4-601_Nov21)	Nov-22
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22
Calibrated by:	Name Michael Weber	Function Laboratory Technician	Signature
Approved by:	Sven Kühn	Deputy Manager	
			Issued: April 21, 2022

Certificate No: D3900V2-1006_Apr22

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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 source is mounted in a touch configuration below the center marking of the flat phantom.
- Return Loss:** This parameter is measured with the source positioned under the liquid filled phantom (as described in the measurement condition clause). The Return Loss ensures low reflected power. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.5	3.32 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	36.5 $\pm$ 6 %	3.25 mho/m $\pm$ 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	7.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	71.0 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	2.46 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg $\pm$ 19.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	50.8	3.78 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	50.2 $\pm$ 6 %	3.80 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	6.55 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	65.3 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.2 W/kg $\pm$ 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.0 Ω - 8.0 j Ω
Return Loss	- 21.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.3 Ω - 5.6 j Ω
Return Loss	- 25.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.101 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: 13.04.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3900 MHz; Type: D3900V2; Serial: D3900V2 - SN:1006

Communication System: UID 0 - CW; Frequency: 3900 MHz

Medium parameters used: $f = 3900$ MHz; $\sigma = 3.25$ S/m; $\epsilon_r = 36.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(7.39, 7.39, 7.39) @ 3900 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3900MHz/Zoom Scan, dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 73.80 V/m; Power Drift = -0.08 dB

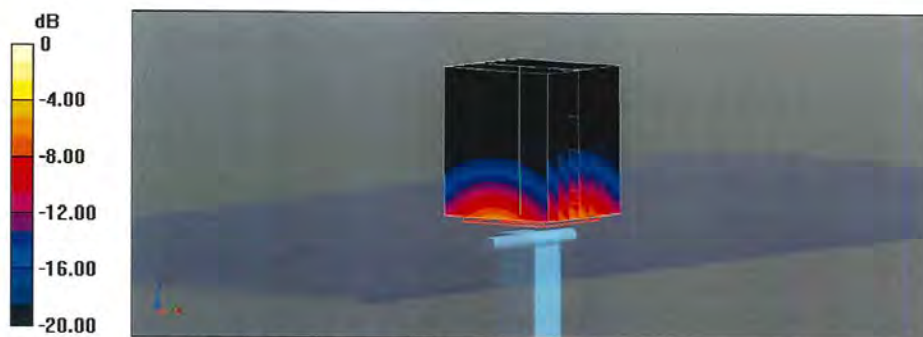
Peak SAR (extrapolated) = 20.5 W/kg

SAR(1 g) = 7.11 W/kg; SAR(10 g) = 2.46 W/kg

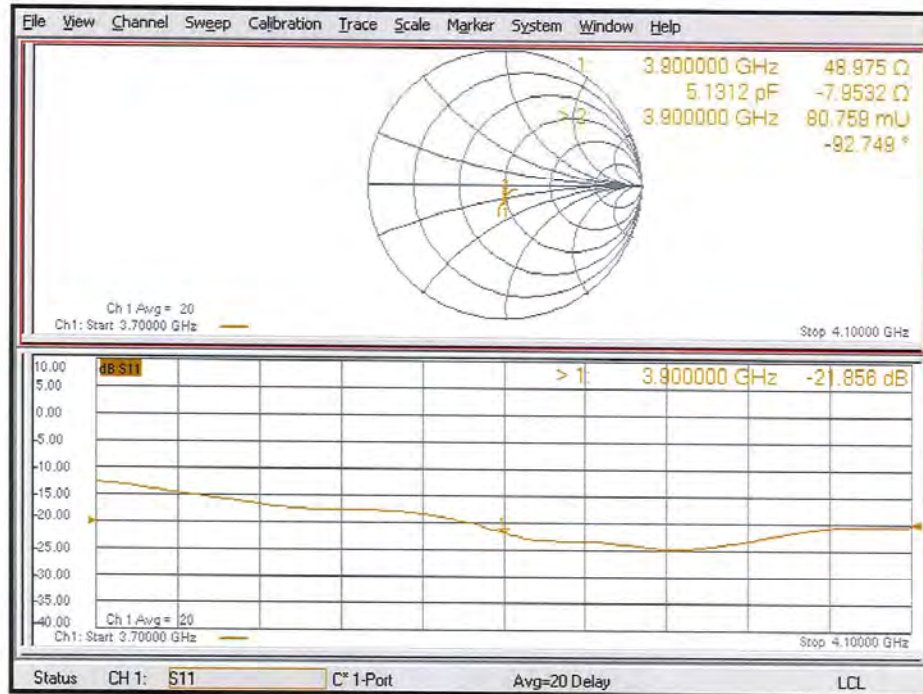
Smallest distance from peaks to all points 3 dB below = 7.9 mm

Ratio of SAR at M2 to SAR at M1 = 73.5%

Maximum value of SAR (measured) = 14.1 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.04.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3900 MHz; Type: D3900V2; Serial: D3900V2 - SN: 1006

Communication System: UID 0 - CW; Frequency: 3900 MHz

Medium parameters used: $f = 3900$ MHz; $\sigma = 3.8$ S/m; $\epsilon_r = 50.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(7.18, 7.18, 7.18) @ 3900 MHz; Calibrated: 08.03.2022
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 01.11.2021
- Phantom: Flat Phantom 5.0 (back); Type: QD 000 P50 AA; Serial: 1002
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Body Tissue/Pin=100 mW, d=10mm, f=3900MHz/Zoom Scan , dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.76 V/m; Power Drift = -0.09 dB

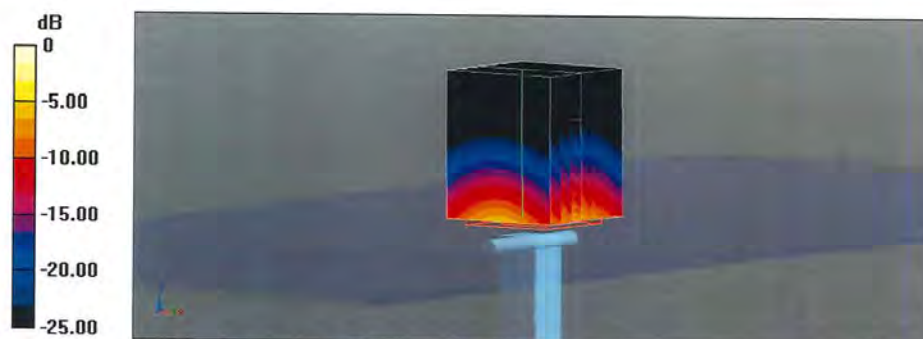
Peak SAR (extrapolated) = 19.8 W/kg

SAR(1 g) = 6.55 W/kg; SAR(10 g) = 2.22 W/kg

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

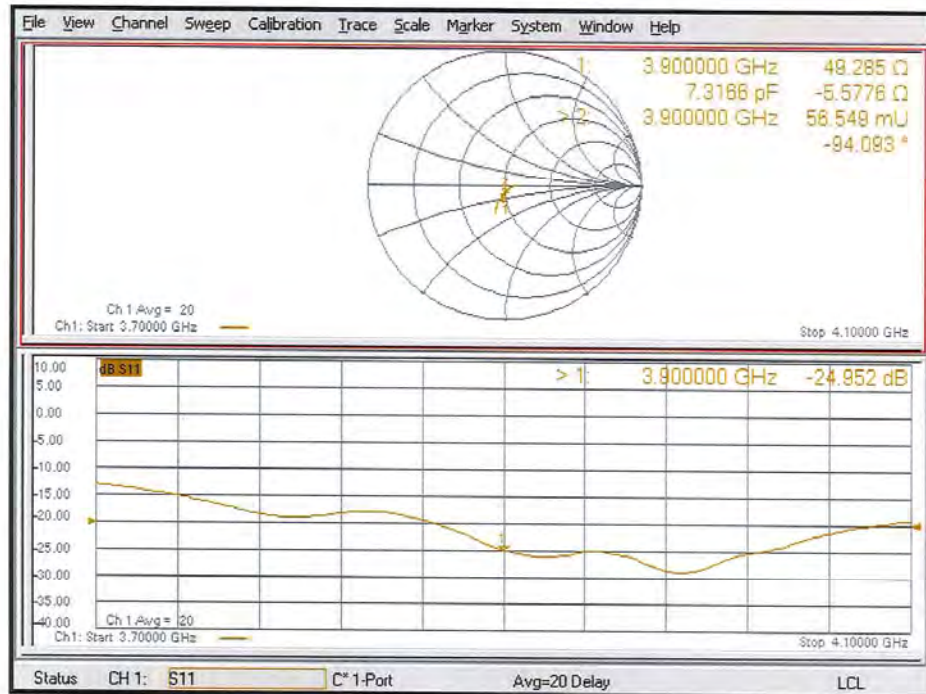
Ratio of SAR at M2 to SAR at M1 = 73.5%

Maximum value of SAR (measured) = 13.0 W/kg



0 dB = 13.0 W/kg = 11.14 dBW/kg

Impedance Measurement Plot for Body TSL



Calibration for Impedance and Return-loss

Equipment	Dipole Antenna	Model	D3900V2
Manufacture	Schmid & Partner Engineering AG	Serial	1006
Tested by	Hisayoshi Sato (2023)	Tested by	Tomohisa Nakagawa (2024)

1. Test environment

Date	April 25, 2023	Relative humidity	40 %RH
Ambient Temperature	24.0 deg.C		
Date	April 12, 2023	Relative humidity	35 %RH
Ambient Temperature	22.0 deg.C		

2. Equipment used

2023

LIMS ID	Description	Manufacturer	Model	Serial	Last Cal Date	Interval
88581	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2022/07/03	12
142056	2mm Oval Flat Phantom	Schmid & Partner Engineering AG	QDOVA001BB	1045	2022/05/23	12
176484	Head Simulating Liquid	Schmid & Partner Engineering AG	HBBL600-10000V6	SL AAH U16 BC	-	-
150815	Network Analyzer	Keysight Technologies Inc	E5071C	MY46523746	2022/08/23	12
141991	2.4mm Calibration Kit	Keysight Technologies Inc	85056A	MY44300225	2022/08/18	12
142060	SAM Phantom	Schmid & Partner Engineering AG	QD000P40CB	1333	2022/05/23	12
176483	Body Simulating Liquid	Schmid & Partner Engineering AG	MBBL600-6000	SL AAM U16 BC	-	-

2024

LIMS ID	Description	Manufacturer	Model	Serial	Last Cal Date	Interval
150815	Network Analyzer	Keysight Technologies Inc	E5071C	MY46523746	2023/08/11	12
150816	Calibration Kit	Keysight Technologies Inc	85032F	MY53200995	2023/08/17	12
176484	Head Simulating Liquid	Schmid & Partner Engineering AG	HBBL600-10000V6	SL AAH U16 BC	-	-
142056	2mm Oval Flat Phantom	Schmid & Partner Engineering AG	QDOVA001BB	1045	2023/05/10	12
176484	Head Simulating Liquid	Schmid & Partner Engineering AG	HBBL600-10000V6	SL AAH U16 BC	-	-
88581	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	-	2023/07/18	12

3. Test Result

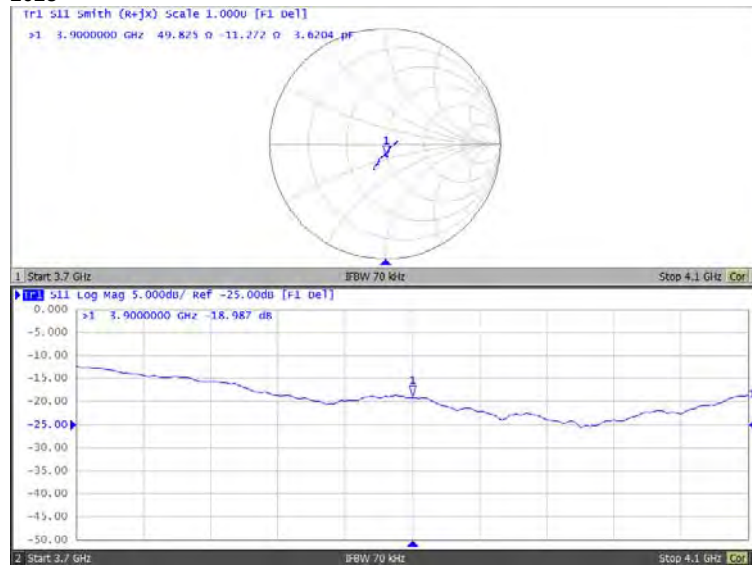
Impedance, Transformed to feed point	cal day	Head (real part) [Ω]	Head (img part) [jΩ]	Deviation (real part) [Ω]	Deviation (img part) [jΩ]	Tolerance	Result
Calibration (SPEAG)	2022/4/19	48.98	-7.95	-	-	-	-
Calibration(ULJ)	2023/4/25	49.83	-11.27	0.85	-3.32	+/- 5 Ω +/- 5 jΩ	Complied
Calibration(ULJ)	2024/4/12	50.67	-10.46	1.69	-2.51	+/- 5 Ω +/- 5 jΩ	Complied

Return loss	cal day	Head [dB]	Deviation [%]	Deviation [dB]	Tolerance [%]	Tolerance [dB]	Result
Calibration (SPEAG)	2022/4/19	-21.86	-	-	-	-	-
Calibration(ULJ)	2023/4/25	-18.99	13.13	2.87	+/- 20.00	4.37	Complied
Calibration(ULJ)	2024/4/12	-20.62	5.64	1.23	+/- 20.00	4.37	Complied

Tolerance: According to the KDB865664 D01

Measurement Plots

2023



2024

