

Appendix (Additional assessments outside the scope of SCS 0108)**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	56.1 Ω - 5.9 $j\Omega$
Return Loss	- 22.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	53.2 Ω - 9.7 $j\Omega$
Return Loss	- 20.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.347 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: 17.11.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1096

Communication System: UID 0 - CW; Frequency: 450 MHz
Medium parameters used: $f = 450$ MHz; $\sigma = 0.88$ S/m; $\epsilon_r = 43.4$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(10.64, 10.64, 10.64) @ 450 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 26.01.2022
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Head Tissue/d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:

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

Reference Value = 38.89 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 1.79 W/kg

 $SAR(1\text{ g}) = 1.15\text{ W/kg}; SAR(10\text{ g}) = 0.766\text{ W/kg}$

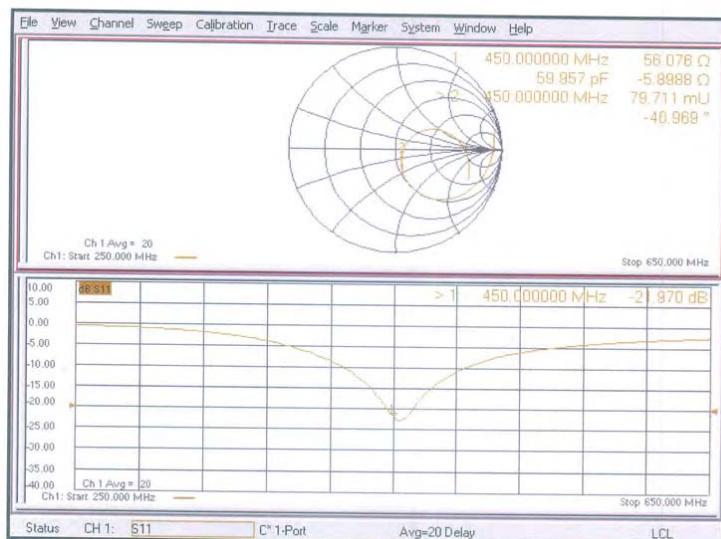
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 15 mm)

Ratio of SAR at M2 to SAR at M1 = 64.3%

Maximum value of SAR (measured) = 1.56 W/kg



Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 17.11.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V3; Serial: D450V3 - SN:1096

Communication System: UID 0 - CW; Frequency: 450 MHz
Medium parameters used: $f = 450$ MHz; $\sigma = 0.93$ S/m; $\epsilon_r = 56.2$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3877; ConvF(10.64, 10.64, 10.64) @ 450 MHz; Calibrated: 31.12.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn654; Calibrated: 26.01.2022
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1003
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration for Body Tissue/d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:

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

Reference Value = 42.04 V/m; Power Drift = -0.04 dB

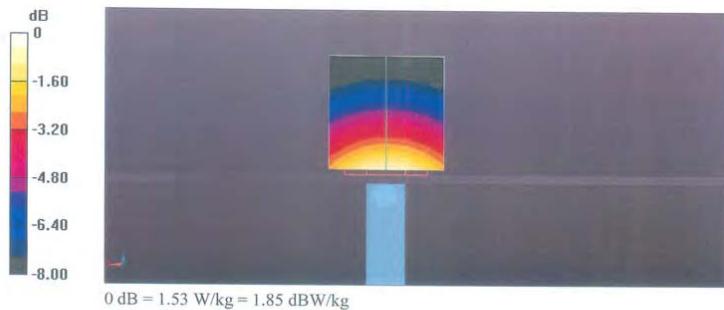
Peak SAR (extrapolated) = 1.74 W/kg

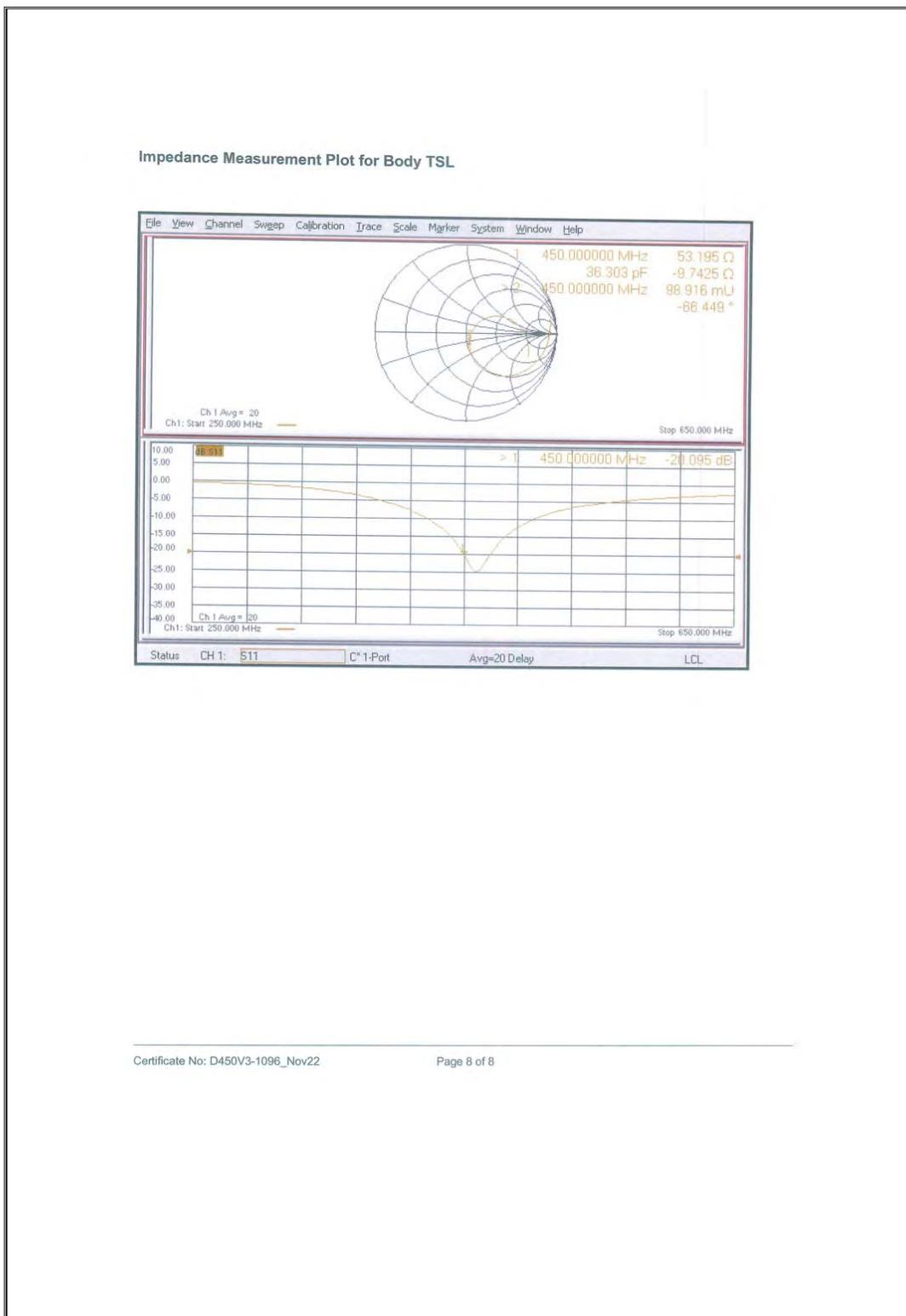
SAR(1 g) = 1.14 W/kg; SAR(10 g) = 0.768 W/kg

Smallest distance from peaks to all points 3 dB below: Larger than measurement grid (> 15 mm)

Ratio of SAR at M2 to SAR at M1 = 65.8%

Maximum value of SAR (measured) = 1.53 W/kg





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APPENDIX E - RETURN LOSS AND IMPEDANCE MEASUREMENT

D450V3 - SN:1096 Extended Dipole Calibrations

Referring to KDB 865664 D01, if dipoles are verified in return loss(< -20dB, within 20% of prior calibration), and in impedance(within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

Test Equipment Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Simulated Tissue 450 MHz Head	TS-450H	2409045001	Each Time	/
Oval Flat Phantom	ELI V8.0	2051	NCR	NCR
Network Analyzer	E5071C	MY46519680	2023/07/16	2024/07/15
Network Analyzer Calibration Kit	50 Ω	51026	NCR	NCR

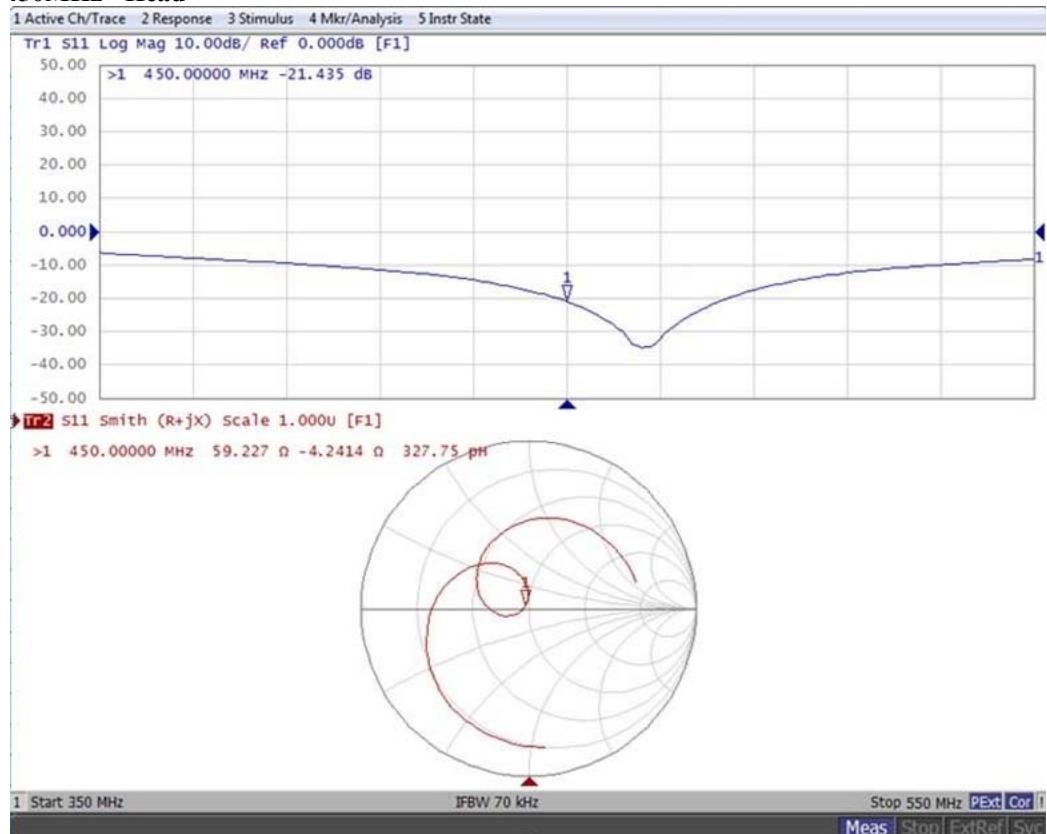
Justification of the extended calibration

D450V3 - SN:1096						
450MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2022/11/17 (Cal. Report)	-21.97	/	56.076	/	-5.8988	/
2023/11/15 (Extended)	-21.435	2.44	59.227	-3.151	-4.2414	-1.6574

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data > D450V3 - SN:1096 (Date of Measurement: 2023/11/15)

450MHz - Head



	Name	Title	Signature
Measure By:	Mark Dong	SAR Engineer	<i>Mark Dong</i>

D450V3 - SN:1096 Extended Dipole Calibrations

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Test Equipment Information:

Equipment	Model	S/N	Calibration Date	Calibration Due Date
Simulated Tissue 450 MHz Head	TS-450H	2409045001	Each Time	/
Oval Flat Phantom	ELI V8.0	2051	NCR	NCR
Network Analyzer	E5071C	MY46519680	2024/07/11	2025/07/10
Network Analyzer Calibration Kit	50 Ω	51026	NCR	NCR

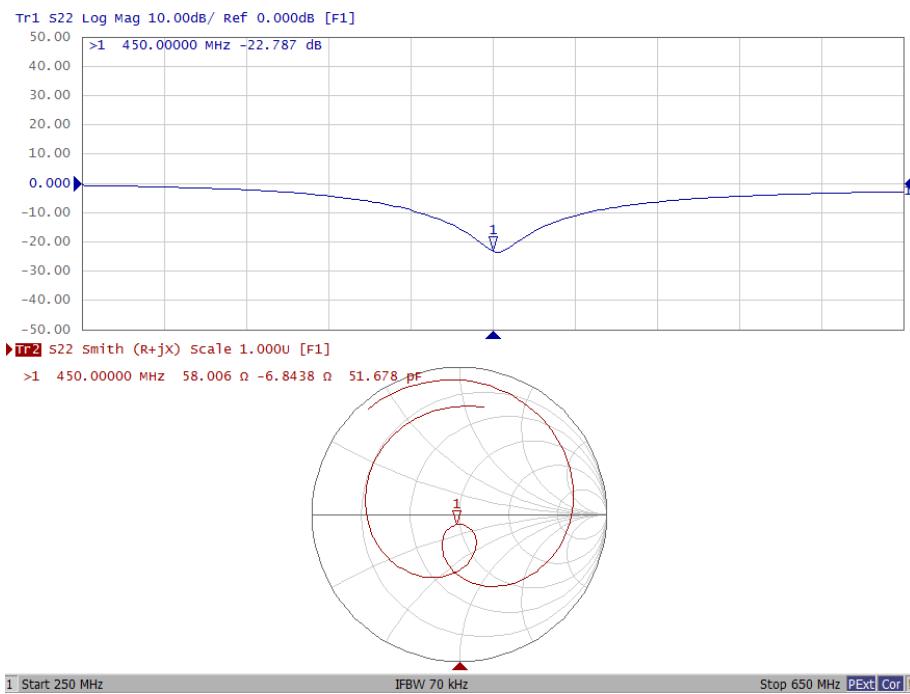
Justification of the extended calibration

D450V3 - SN:1096						
450MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2022/11/17 (Cal. Report)	-21.97	/	56.076	/	-5.8988	/
2024/11/15 (Extended)	-22.787	-3.72	58.006	-1.93	-6.8438	0.945

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data > D450V3 - SN:1096 (Date of Measurement: 2024/11/15)

450MHz - Head



	Name	Title	Signature
Measure By:	Mark Dong	SAR Engineer	<i>Mark Dong</i>

***** END OF REPORT *****