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Appendix C

Phantom Description

C/NIG

id & Partner Engineering 40	S	D	e	a	a	
	-		-			_

Zeughausstiesse 43, 8004 Zurich, Switzerland Ptione +41 44 245 9700, Fan +41 44 245 9779 info@spead.com. Mito /Weirw spead.do/

Certificate of Conformity / First Article Inspection

item	Oval Flat Phantom ELI 5.0
Type No	QD OVA 002 A
Series No	1108 and higher
Manufacturer	Untersee Composites Knebelstrasse 8, CH-6268 Mannenbach, Switzerland

Tests

Complete tests were made on the prototype units QD OVA 001 A, pre-series units QD OVA 001 B as well as on some series units QD OVA 001 B. Some tests are made on all series units QD OVA 002 A

Test	Requirement	Details	Units tested
Shape	Internal dimensions, depth and sagging are compatible with standards	Bottom elliptical 600 × 400 mm, Depth 190 mm, dimension compliant with [1] for t > 375 MHz	Prototypes
Material thickness	Bottom: 2.0mm +/- 0.2mm	dimension compliant with [3] for f > 800 MHz	al
Material parameters	rel. permittivity $2 = 5$, loss tangent ≤ 0.05 , at $f \leq 6$. GHz	rel. permittivity 3.5 +/- 0.5 loss tangent < 0.05	Material samples
Material resistivity	Compatibility with tissue simulating liquids .	Compatible with SPEAG liquids, **	Phantoms, Material sample
Sagging	Sagging of the flat section in folerance when filled with tissue simulating liquid.	within tolerance for filling height up to 155 mm	Prototypes, samples

Note: Compatibility restrictions apply certain liquid components mentioned in the standard, containing e.g. DGBE, DGMHE or Triton %-100. Observe technical note on material compatibility.

Standards

- OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 01-01
 IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific: Absorption Rate (SAR) In the Human Head from Wireless Communications Devices. Measurement
- Techniques, December 2003 [3] IEC 62209–1 ed1.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices Human models, instrumentation, and procedures Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in class proximity to the ear (frequency range of 300 MHz to 3 GHz)², 2005-02-18
 [4] IEC 62209–2 ed1.0, "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 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)", 2010-03-30

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of body-worn SAR measurements and system performance checks as specified in [1 - 4] and further standards

25.7.2011 Date

Signature / Stamp

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Doc No SS1-QD OVA 002 A - A

1102 Page

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System Validation from Original Equipment Supplier

E-mail: cttl@china Clicent SGS			1-60367
Client SGS	a hard sold and		1-60367
CALIBRATION	ENTIFICAT	E	
Object	D750V	3 - SN: 1015	
Calibration Procedure(s)	FF-Z11	-003-01	
	Calibra	tion Procedures for dipole validation kits	
Calibration date:	Octobe	er 14, 2021	
measurements (SI). The me	easurements and	the uncertainties with confidence probability a	are given on the following
pages and are part of the cr All calibrations have been humidity<70%.	conducted in t	the closed laboratory facility: environment to or calibration)	emperature (22±3)°C and
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Glossary: TSL

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

Calibration is Performed According to the Following Standards:

- Calibration is renormed According to the Pollowing Standards:
 a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
 b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to eCHIEM")
- communication devices F and T. Device used next to the ear (requercy range of source) (SGH2), July 2016
 c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6 GH2)", March 2010
 d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 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 space 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 Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	42.0	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.5 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.51 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.59 W/kg ± 18.7 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

mpedance, transformed to feed point	53.7Ω+ 0.24jΩ
Return Loss	- 29.0dB

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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Date: 10.14.2021

Test Laboratory: CTTL, Beijing, China DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1015

DASY5 Validation Report for Head TSL

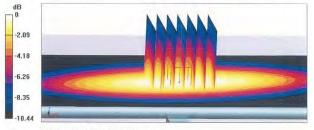
Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1 Medium parameters used: f=750 MHz; $\sigma=0.9$ S/m; $\epsilon_r=41.52;$ $\rho=1000$ kg/m³

Phantom section: Right Section DASY5 Configuration:

- Probe: EX3DV4 SN7517; ConvF(9.81, 9.81, 9.81) @ 750 MHz; Calibrated:
- 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) · Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7501)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 55.71 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.34 W/kg SAR(1 g) = 2.15 W/kg; SAR(10 g) = 1.41 W/kg Smallest distance from peaks to all points 3 dB below = 21.2 mm Ratio of SAR at M2 to SAR at M1 = 64.6%Maximum value of SAR (measured) = 2.91 W/kg



0 dB = 2.91 W/kg = 4.64 dBW/kg

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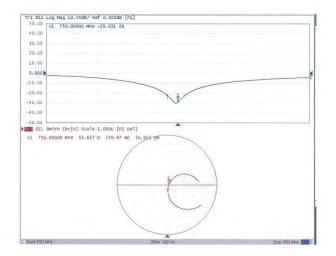
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Impedance Measurement Plot for Head TSL



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Client SGS	and a state		1-60368
CALIBRATION CI	EDTIEICAT	E	
GALIBITATION	LINITIOAT	te.	
Object	D835V	2 - SN: 4d063	
Calibration Procedure(s)	FF-711	-003-01	
		tion Procedures for dipole validation kits	
Calibration date:	Octobe	or 18, 2021	
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pages and are part of the ce All calibrations have been humidity<70%. Calibration Equipment used Primary Standards Power Meter NRP2	I (M&TE critical fr I (D # 106277	he closed laboratory facility: environment to or calibration) Cal Date (Calibrated by, Certificate No.) 24-Sep-21 (CTTL, No.J21X08326)	emperature (22±3)°C an Scheduled Calibration Sep-22
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Certificate No: Z21-60368 Page 1 of 6

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N/A

Glossary: TSL ConvF

tissue simulating liquid sensitivity in TSL / NORMx,y,z not applicable or not measured

- Calibration is Performed According to the Following Standards: a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013 D) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless
- communication devices Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016 c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless
- communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010 d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation: e) DASY4/5 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 Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.9 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.64 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.29 W/kg ± 18.7 % (k=2)

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.1Ω- 3.03jΩ
Return Loss	- 29.9dB

Electrical Delay (one direction) 1.299 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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Date: 10.18.2021

DASY5 Validation Report for Head TSL Test Laboratory: CTTL, Beijing, China DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d063

 $\begin{array}{l} \mbox{Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1 \\ \mbox{Medium parameters used: } f = 835 MHz; \sigma = 0.886 \ S/m; \epsilon_r = 40.9; \rho = 1000 \ kg/m^3 \end{array}$

Phantom section: Right Section DASY5 Configuration:

- Probe: EX3DV4 SN7517; ConvF(9.81, 9.81, 9.81) @ 835 MHz; Calibrated:
- 2021-02-03 .
- Sensor-Surface: 1.4mm (Mechanical Surface Detection) Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- . .
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7501)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.22 V/m; Power Drift = -0.01 dB Peak SAR (extrapolated) = 3.68 W/kg SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.56 W/kg Smallest distance from peaks to all points 3 dB below = 20.6 mm Ratio of SAR at M2 to SAR at M1 = 64.8%

Maximum value of SAR (measured) = 3.24 W/kg



0 dB = 3.24 W/kg = 5.11 dBW/kg

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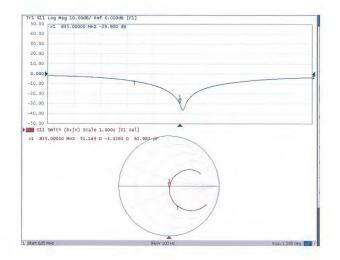
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Impedance Measurement Plot for Head TSL



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Client SGS			-60369
CALIBRATION CI	ERTIFICAT	E	
Object	D1750	/2 - SN: 1008	
Calibration Procedure(s)		-003-01 tion Procedures for dipole validation kits	
Calibration date:	Octobe	r 19, 2021	
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Glossary: TSL ConvF N/A

tissue simulating liquid sensitivity in TSL / NORMx,y,z not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak
- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013 b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to concerning).
- communication devices rait 1. Device used next to the ear (Frequency range of source)
 c) IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6 GHz)", March 2010
 d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 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: Z21-60369

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Measurement Conditions

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C		

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	36.6 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.83 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	19.2 W/kg ± 18.7 % (k=2)

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Page 3 of 6

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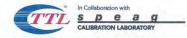
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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

	51.1Ω+ 0.76jΩ
Return Loss	- 37.6 dB

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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Date: 10.19.2021

DASY5 Validation Report for Head TSL

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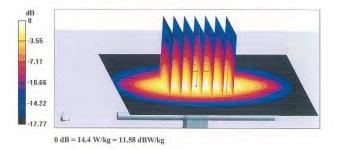
Phantom section: Right Section

- DASY5 Configuration:
 - Probe: EX3DV4 SN7517; ConvF(8.22, 8.22, 8.22) @ 1750 MHz; Calibrated:
 - 2021-02-03
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection)
 - . Electronics: DAE4 Sn1556; Calibrated: 2021-01-15 .
 - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062 Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7501)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mr

Reference Value = 98.81 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 17.5 W/kgSAR(1 g) = 9.23 W/kg; SAR(10 g) = 4.83 W/kgSmallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 53% Maximum value of SAR (measured) = 14.4 W/kg



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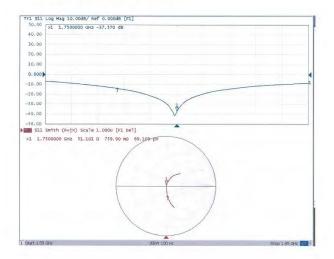
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Impedance Measurement Plot for Head TSL



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Page 1 of 6

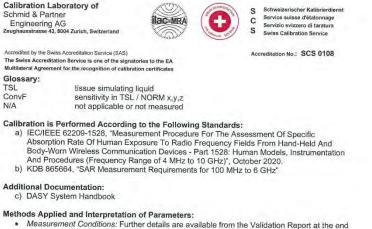
Certificate No: D1900V2-5d173_Apr22

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- 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%.

Certificate No: D1900V2-5d173 Apr22

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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	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

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	39.1 ± 6 %	1.41 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	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.6 W/kg ± 17.0 % (k=2)
	1	
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 250 mW input power	5.22 W/kg

Certificate No: D1900V2-5d173_Apr22

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω + 5.0 jΩ
Return Loss	- 25.7 dB

1.198 ns

General Antenna Parameters and Design

Electrical Delay (one direction)

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. 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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f (886-2) 2298-0488



Date: 28.04.2022

DASY5 Validation Report for Head TSL

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d173

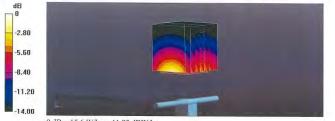
Communication System: UID 0 - CW; Frequency: 1900 MHz Medium parameters used: f = 1900 MHz; σ = 1.41 S/m; ϵ_r = 39.1; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration

- Probe: EX3DV4 SN7349; ConvF(8.43, 8.43, 8.43) @ 1900 MHz; Calibrated: 31.12.2021
- 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=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 110.1 V/m; Power Drift = -0.01 dB Noticine value = 110.1 V/m, rower D/m1 = 0.01 dB Peak SAR (cutrapolated) = 18.6 W/kg SAR(1 g) = 10 W/kg; SAR(10 g) = 5.22 W/kg Smallest distance from peaks to all points 3 dB below = 10 mm Ratio of SAR at M2 to SAR at M1 = 54.3% Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

Certificate No: D1900V2-5d173 Apr22

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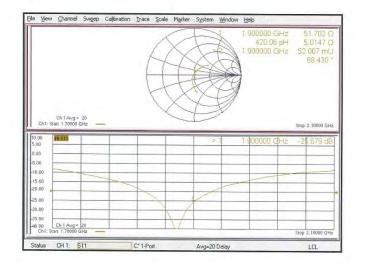
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Impedance Measurement Plot for Head TSL



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Client SGS-TW (Aud	en)	Certificate M	lo: D2450V2-727_Apr22
CALIBRATION	CERTIFICATI		
Object	D2450V2 - SN:7	27	
Calibration procedure(s)	QA CAL-05.v11 Calibration Proce	edure for SAR Validation Source	s between 0.7-3 GHz
Calibration date:	April 25, 2022		
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Certificate No: D2450V2-727_Apr22

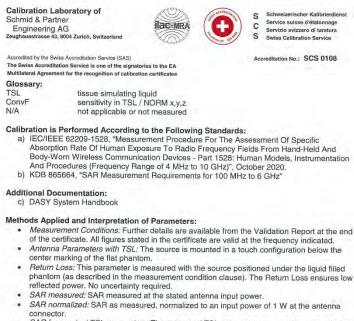
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SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result. .

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 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, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters 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	37.8 ± 6 %	1.87 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	250 mW input power	13.6 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.8 W/kg ± 17.0 % (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 250 mW input power	6.34 W/kg

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Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.7 Ω + 3.0 jΩ
Return Loss	- 24.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction) 1.149 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 according to the Standard. No excessive force must b sive 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

Test Laboratory: SPEAG, Zurich, Switzerland

Date: 25.04.2022

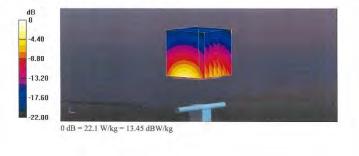
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 727 Communication System: UID 0 - CW; Frequency: 2450 MHz Medium parameters used: f = 2450 MHz; σ = 1.87 S/m; ϵ_r = 37.8; ρ = 1000 kg/m³ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 SN7349; ConvF(7.96, 7.96, 7.96) @ 2450 MHz; Calibrated: 31.12.2021
- 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=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 115.6 V/m; Power Drift = 0.09 dB

Reference value = 11.5.0 v/m, rower D/m = 0.09 uB Peak SAR (extrapolated) = 26.5 W/kg SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.34 W/kg Smallest distance from peaks to all points 3 dB below = 9 mm Ratio of SAR at M2 to SAR at M1 = 51% Maximum value of SAR (measured) = 22.1 W/kg



Certificate No: D2450V2-727 Apr22

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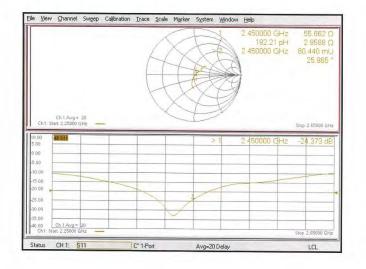
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Impedance Measurement Plot for Head TSI



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lient SGS (Auden)			o: D5GHzV2-1023_Jan2
CALIBRATION C	ERTIFICATI	E	
Dbject	D5GHzV2 - SN:1	1023	
Calibration procedure(s)	QA CAL-22.v6 Calibration Proce	edure for SAR Validation Sources	s between 3-10 GHz
Calibration date:	January 27, 2022	2	
All calibrations have been conduct	ed in the closed laborator	robability are given on the following pages ar ry facility: environment temperature $(22 \pm 3)^{\circ}$	
All calibrations have been conduct	ed in the closed laborator		
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Calibration Laboratory of Schmid & Partner **Engineering AG** Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst Service suisse d'étalonnage C

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:

- 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%

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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	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	4.52 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	8.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.0 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	2.34 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	34.4 ± 6 %	4.87 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	8.51 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.4 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	2.40 W/kg

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Head TSL parameters at 5750 MHz The following parameters and calculations were applied

the second of the second se	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	5.02 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

SAR result with Head TSL at 5750 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	81.0 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	2.31 W/kg

Certificate No: D5GHzV2-1023 Jan22

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f (886-2) 2298-0488



Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	52.0 Ω - 5.2 jΩ
Return Loss	- 25.3 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.7 Ω + 0.2 jΩ
Return Loss	- 27.0 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	57.2 Ω + 2.1 jΩ
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 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	00510
Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL

Date: 27.01.2022

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1023

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz Medium parameters used: f = 5250 MHz; $\sigma = 4.52 \text{ S/m}$; $\epsilon_r = 34.9$; $\rho = 1000 \text{ kg/m}^3$, Medium parameters used: f = 5600 MHz; $\sigma = 4.87 \text{ S/m}$; $\varepsilon_r = 34.4$; $\rho = 1000 \text{ kg/m}^3$, Medium parameters used: f = 5750 MHz; σ = 5.02 S/m; ϵ_r = 34.2; ρ = 1000 kg/m³ Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz; Calibrated: 31.12.2021
- 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=100mW, dist=10mm, f=5250 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 76.83 V/m; Power Drift = 0.05 dB Peak SAR (extrapolated) = 28.0 W/kg SAR(1 g) = 8.16 W/kg; SAR(10 g) = 2.34 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 70.7% Maximum value of SAR (measured) = 18.6 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 = 77.04 V/m; Power Drift = 0.06 dB Peak SAR (extrapolated) = 31.5 W/kg SAR(1 g) = 8.51 W/kg; SAR(10 g) = 2.40 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 68% Maximum value of SAR (measured) = 20.1 W/kg

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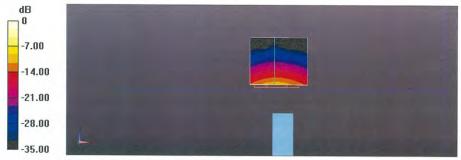
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Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm Reference Value = 74.27 V/m; Power Drift = 0.09 dB Peak SAR (extrapolated) = 31.8 W/kg SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.31 W/kg Smallest distance from peaks to all points 3 dB below = 7.2 mm Ratio of SAR at M2 to SAR at M1 = 66.3% Maximum value of SAR (measured) = 19.8 W/kg



0 dB = 20.1 W/kg = 13.03 dBW/kg



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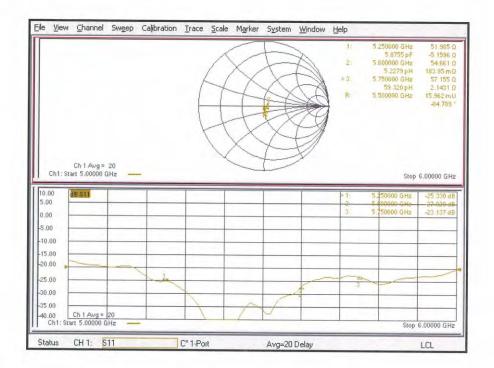
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Impedance Measurement Plot for Head TSL



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- End of report -

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