

# Shenznen Andotek Compliance Laboratory Limited

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# Anbotek Product Safety

Report No.: 18220WC30206104

FCC ID: 2BCZ8-CUNIT

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 Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China

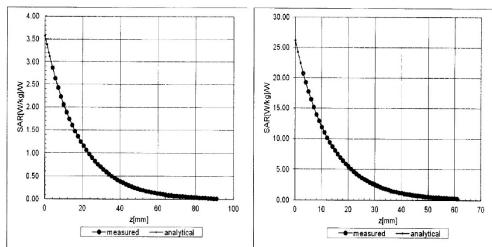
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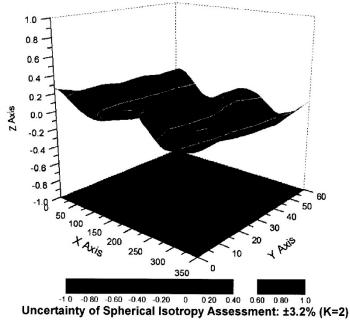
# **Conversion Factor Assessment**

f=900 MHz, WGLS R9(H\_convF)

f=1750 MHz, WGLS R22(H\_convF)



# **Deviation from Isotropy in Liquid**



Certificate No: Z23-98671

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# DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7396

# **Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	156.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

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Schmid & Partner Engineering AG S D C

Zeughausstrasse 43, 8004 Zurich, Switzerland Phone +41 44 245 9700, Fax +41 44 245 9779 info@speag.com, http://www.speag.com

# **IMPORTANT NOTICE**

#### **USAGE OF THE DAE 4**

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

#### Important Note:

Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

#### Important Note:

Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the Estop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

#### Important Note:

To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

Schmid & Partner Engineering

TN\_BR040315AD DAE4.doc

11.12.2009

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Calibration Laborato Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zuri		HAC-MRA	Schweizerischer Kalibrier Service suisse d'étalonna Servizio svizzero di taratu Swiss Calibration Service
Accredited by the Swiss Accredit The Swiss Accreditation Servio Multilateral Agreement for the	ce is one of the signatories	s to the EA	on No.: SCS 0108
Client Anbotek (Aud			No: DAE4-387_Sep10
CALIBRATION	CERTIFICATE		
Object	DAE4 - SD 000 D	04 BM - SN: 387	
Calibration procedure(s)	QA CAL-06.v29 Calibration procee	dure for the data acquisition ele	ctronics (DAE)
Calibration date: This calibration certificate docum The measurements and the unc	September 06, 20 nents the traceability to natio ertainties with confidence pro	023 onal standards, which realize the physical u obability are given on the following pages a	nits of measurements (SI). nd are part of the certificate.
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Schweizerischer Kalibrierdienst Service suisse d'étalonnage Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 0108

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

#### Glossary

DAE Connector angle data acquisition electronics information used in DASY system to align probe sensor X to the robot coordinate system.

# Methods Applied and Interpretation of Parameters

- DC Voltage Measurement: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- Connector angle: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a
  result from the performance test and require no uncertainty.
  - DC Voltage Measurement Linearity: Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - Common mode sensitivity: Influence of a positive or negative common mode voltage on the differential measurement.
  - Channel separation: Influence of a voltage on the neighbor channels not subject to an input voltage.
  - AD Converter Values with inputs shorted: Values on the internal AD converter corresponding to zero input voltage
  - Input Offset Measurement: Output voltage and statistical results over a large number of zero voltage measurements.
  - Input Offset Current: Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - Input resistance: Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - Low Battery Alarm Voltage: Typical value for information. Below this voltage, a battery alarm signal is generated.
  - Power consumption: Typical value for information. Supply currents in various operating modes.

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#### DC Voltage Measurement

#### A/D - Converter Resolution nominal High Range: 1LSB =

 High Range:
 1LSB =
  $6.1\mu$ V,
 full range =
 -100...+300 mV

 Low Range:
 1LSB =
 61nV,
 full range =
 -1....+3mV

 DASY measurement parameters:
 Auto Zero Time: 3 sec; Measuring time: 3 sec

<b>Calibration Factors</b>	X	Y	Z
High Range	404.489 ± 0.02% (k=2)	404.852 ± 0.02% (k=2)	404.862 ± 0.02% (k=2)
Low Range	3.97827 ± 1.50% (k=2)	3.95875 ± 1.50% (k=2)	3.97982 ± 1.50% (k=2)

#### **Connector Angle**

Connector Angle to be used in DASY system	53.0 ° ± 1 °
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# Appendix (Additional assessments outside the scope of SCS0108)

#### 1. DC Voltage Linearity

High Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	200032.85	-3.31	-0.00
Channel X + Input	20007.64	1.88	0.01
Channel X - Input	-20003.48	1.18	-0.01
Channel Y + Input	200034.23	-1.43	-0.00
Channel Y + Input	20006.60	0.91	0.00
Channel Y - Input	-20004.04	0.72	-0.00
Channel Z + Input	200035.38	-0.83	-0.00
Channel Z + Input	20003.69	-2.11	-0.01
Channel Z - Input	-20006.38	-1.59	0.01

Low Range	Reading (µV)	Difference (µV)	Error (%)
Channel X + Input	2001.63	0.08	0.00
Channel X + Input	202.29	0.70	0.35
Channel X - Input	-197.90	0.60	-0.30
Channel Y + Input	2001.33	-0.07	-0.00
Channel Y + Input	200.86	-0.60	-0.30
Channel Y - Input	-199.87	-1.23	0.62
Channel Z + Input	2001.61	0.27	0.01
Channel Z + Input	200.60	-0.70	-0.35
Channel Z - Input	-199.51	-0.85	0.43

#### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	13.50	11.56
	- 200	-8.64	-11.18
Channel Y	200	-0.81	-1.28
	- 200	1.05	0.09
Channel Z	200	7.17	6.91
	- 200	-9.46	-9.01

#### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

1000	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200		-1.70	0.33
Channel Y	200	10.70		-0.38
Channel Z	200	7.11	7.89	

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# 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15969	17466
Channel Y	15661	16162
Channel Z	15990	16190

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec Input 10  $M\Omega$ 

	Average (μV)	min. Offset (µV)	max. Offset (μV)	Std. Deviation (µV)
Channel X	0.73	-2.58	3.29	0.62
Channel Y	0.41	-0.49	1.23	0.40
Channel Z	-0.80	-1.88	0.30	0.42

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

#### 7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

# 8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

# 9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

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### Glossary:

TSL ConvF N/A

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

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CALIBRATION LABORATORY

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# 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
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- 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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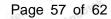
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#### **Measurement Conditions**

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

DASY Version	DASY52	52.8.8.1258
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	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	39.0 ± 6 %	1.77 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	13.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	52.4 mW /g ± 20.8 % (k=2)
SAR averaged over 10 $cm^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.06 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.3 mW /g ± 20.4 % (k=2)

#### **Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	1.97 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C		

#### SAR result with Body TSL

SAR averaged over 1 $cm^3$ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	51.8 mW /g ± 20.8 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.18 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.7 mW /g ± 20.4 % (k=2)

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#### Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.6Ω+ 2.77jΩ
Return Loss	- 25.8dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.7Ω+ 4.28jΩ	
Return Loss	- 27.3dB	

#### **General Antenna Parameters and Design**

Electrical Delay (one direction)	1.263 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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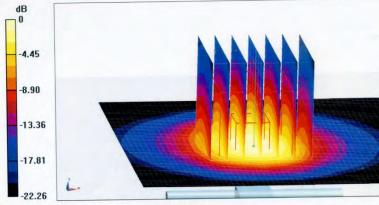
# Report No.: 18220WC30206104 FCC ID: 2BCZ8-CUNIT Page 59 of 62 Image: State of the state of t

DASY5 Validation Report for Head TSLDate: 06.15.201Test Laboratory: CTTL, Beijing, ChinaDUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 910Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1Medium parameters used: f = 2450 MHz;  $\sigma = 1.767$  S/m;  $\epsilon r = 39.01$ ;  $\rho = 1000$  kg/m3Phantom section: Right SectionMeasurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)DASY5 Configuration:

- Probe: EX3DV4 SN7307; ConvF(7.36, 7.36, 7.36); Calibrated: 2/19/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2018-02-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 106.5 V/m; Power Drift = 0.02 dB Peak SAR (extrapolated) = 26.7 W/kg SAR(1 g) = 13 W/kg; SAR(10 g) = 6.06 W/kg

Maximum value of SAR (measured) = 19.7 W/kg



0 dB = 19.7 W/kg = 12.94 dBW/kg

Certificate No: Z18-97091

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## Shenzhen Anbotek Compliance Laboratory Limited

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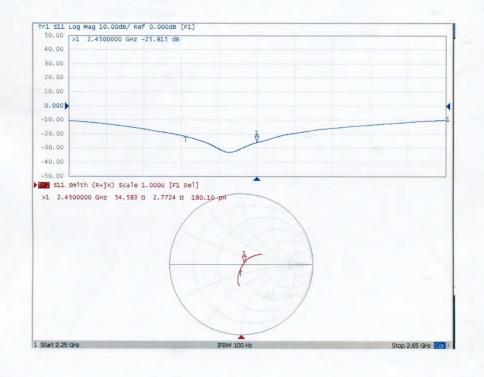


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#### Impedance Measurement Plot for Head TSL



Certificate No: Z18-97091

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#### DASY5 Validation Report for Body TSL Test Laboratory: CTTL, Beijing, China

Date: 06.15.2018

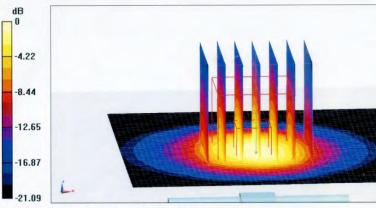
**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 910** Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium parameters used: f = 2450 MHz;  $\sigma = 1.972$  S/m;  $\varepsilon_r = 52.92$ ;  $\rho = 1000$  kg/m<sup>3</sup> Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007) DASY5 Configuration:

- Probe: EX3DV4 SN7307; ConvF(7.22, 7.22, 7.22); Calibrated: 2/19/2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2018-02-02
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA; Serial: 1161/1
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7372)

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

Reference Value = 98.89 V/m; Power Drift = 0.03 dB Peak SAR (extrapolated) = 25.6 W/kg SAR(1 g) = 13 W/kg; SAR(10 g) = 6.18 W/kg Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

Certificate No: Z18-97091

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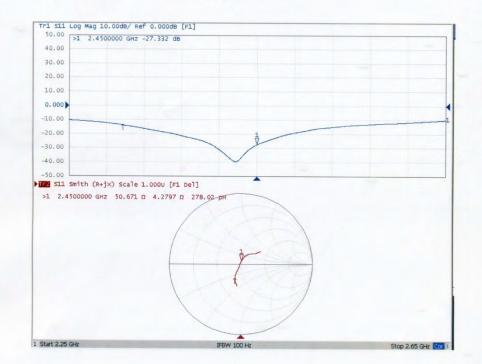
# FCC ID: 2BCZ8-CUNIT

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Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504 E-mail: cttl@chinattl.com Http://www.chinattl.cn

#### Impedance Measurement Plot for Body TSL



Certificate No: Z18-97091

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# \*\*\*\*\*END OF REPORT\*\*\*\*\*

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