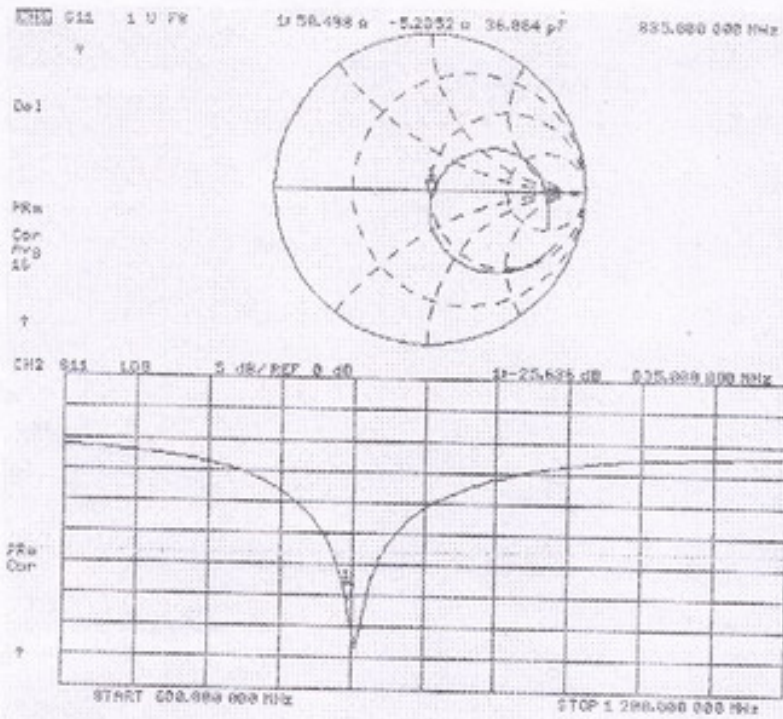


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Impedance measurement Plot for Head TSL



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**ANNEX G: D1900V2 DIPOLE CALIBRATION CERTIFICATE**

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



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

Accredited by the Swiss Federal Office of Metrology and Accreditation  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client: **Auden**

Certificate No: **D1900V2-5d018\_Mar08**

**CALIBRATION CERTIFICATE**

Object: **D1900V2 - SN: 5d018**

Calibration procedure(s): **QA CAL-05.v6  
Calibration procedure for dipole validation kits**

Calibration date: **March 21, 2008**

Condition of the calibrated item: **In Tolerance**

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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	23-Sep-07 (METAS, No. 217-00608)	Sep-08
Power sensor HP 8481A	US37292783	23-Sep-07 (METAS, No. 217-00608)	Sep-08
Reference 20 dB Attenuator	SN: 5086 (20g)	21-Jun-07 (METAS, No 217-00581)	Jun-08
Reference 10 dB Attenuator	SN: 5047.2 (10r)	21-Jun-07 (METAS, No 217-00591)	Jun-08
Reference Probe ET3DV6	SN: 1507	11-Sep-07 (SPEAG, No. ET3-1507_Sep07)	Sep-08
Reference Probe ES3DV3	SN: 3025	11-Sep-07 (SPEAG, No. ES3-3025_Sep07)	Sep-08
DAE4	SN 601	15-Jan-06 (SPEAG, No. DAE4-601_Jan06)	Jan-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-07)	In house check: Oct-09
RF generator Agilent E4421B	MY41000875	11-May-05 (SPEAG, in house check Nov-07)	In house check: Nov-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Oct-07)	In house check: Oct-08

Calibrated by: **Claudio Leubler** (Name), **Laboratory Technician** (Function), *[Signature]* (Signature)

Approved by: **Katja Pokovic** (Name), **Technical Manager** (Function), *[Signature]* (Signature)

Issued: **March 22, 2008**

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

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



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

Accredited by the Swiss Federal Office of Metrology and Accreditation  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

**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:**

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- 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 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

**Additional Documentation:**

- DASY4 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.

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## Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 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 $\pm$ 0.2) °C	39.6 $\pm$ 6 %	1.43 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.3 $\pm$ 0.2) °C	—	—

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	condition	
SAR measured	250 mW input power	9.45 mW / g
SAR normalized	normalized to 1W	37.8 mW / g
SAR for nominal Head TSL parameters. <sup>1</sup>	normalized to 1W	36.4 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.98 mW / g
SAR normalized	normalized to 1W	19.9 mW / g
SAR for nominal Head TSL parameters. <sup>1</sup>	normalized to 1W	19.5 mW / g $\pm$ 16.5 % (k=2)

<sup>1</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

**Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.0 ± 6 %	1.55 mho/m ± 6 %
Body TSL temperature during test	(21.3 ± 0.2) °C	---	---

**SAR result with Body TSL**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.63 mW / g
SAR normalized	normalized to 1W	38.5 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	36.8 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.21 mW / g
SAR normalized	normalized to 1W	20.8 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	20.2 mW / g ± 16.5 % (k=2)

<sup>2</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

**Appendix**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	52.5 $\Omega$ + 3.3 j $\Omega$
Return Loss	-27.9 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	48.5 $\Omega$ + 2.9 j $\Omega$
Return Loss	-29.6 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.203 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. 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
Manufactured on	June 4, 2002

4

### DASY4 Validation Report for Head TSL

Date/Time: 21.03.2008 15:30:20

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d018**

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.43$  mho/m;  $\epsilon_r = 39.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

#### DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(4.97, 4.97, 4.97); Calibrated: 11.09.2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.01.2008
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:**

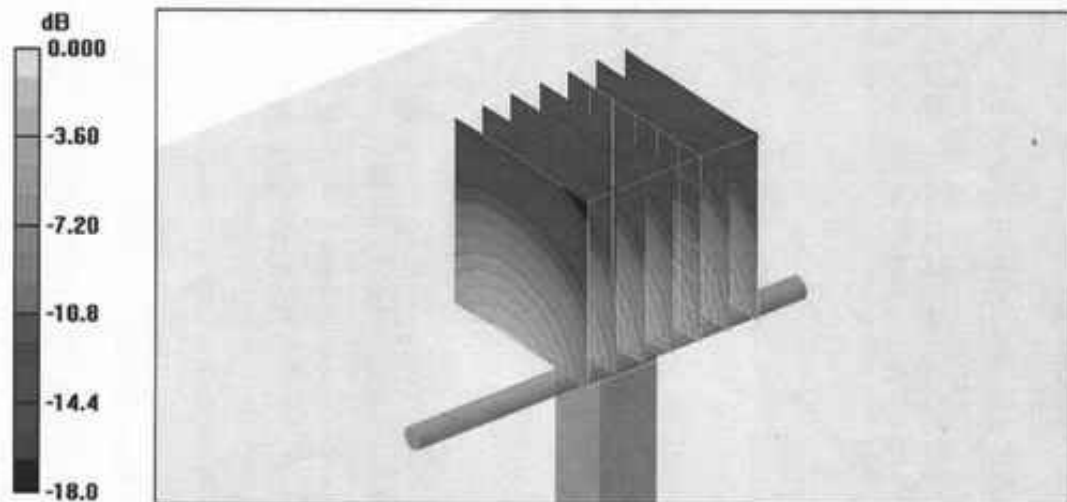
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 87.8 V/m; Power Drift = 0.057 dB

Peak SAR (extrapolated) = 16.2 W/kg

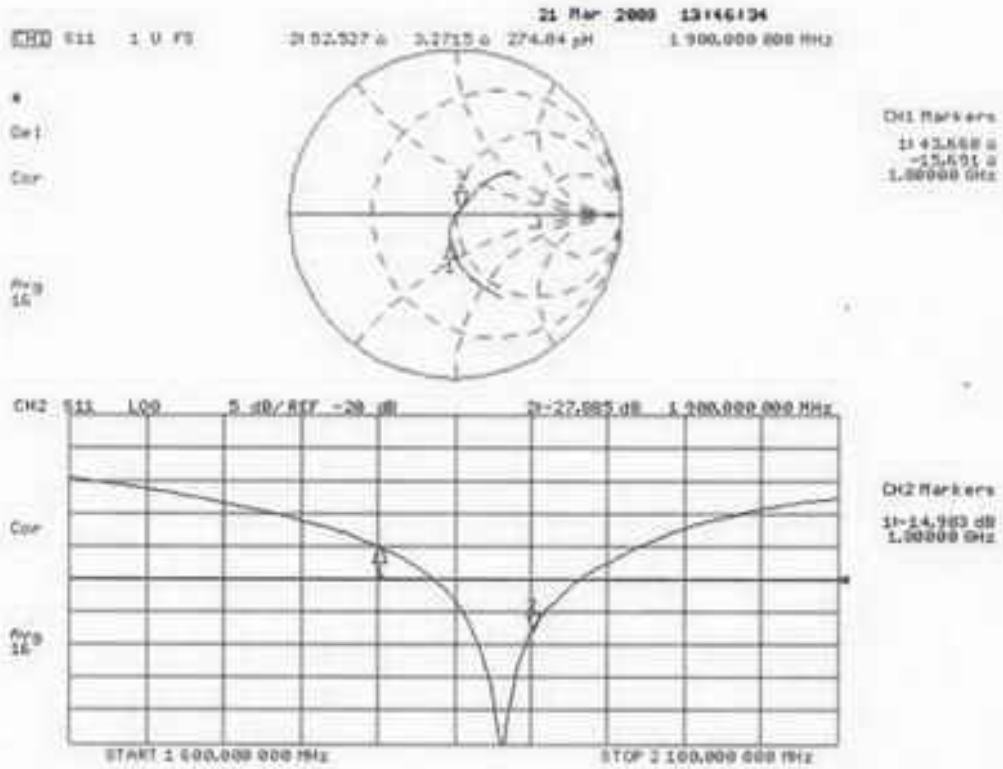
**SAR(1 g) = 9.45 mW/g; SAR(10 g) = 4.98 mW/g**

Maximum value of SAR (measured) = 10.7 mW/g



0 dB = 10.7mW/g

Impedance Measurement Plot for Head TSL





**DASY4 Validation Report for Body TSL**

Date/Time: 21.03.2008 16:41:02

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d018**

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL U10 BB;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.55$  mho/m;  $\epsilon_r = 52$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

**DASY4 Configuration:**

- Probe: ET3DV6 - SN1507 (HF); ConvF(4.43, 4.43, 4.43); Calibrated: 11.09.2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.01.2008
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:**

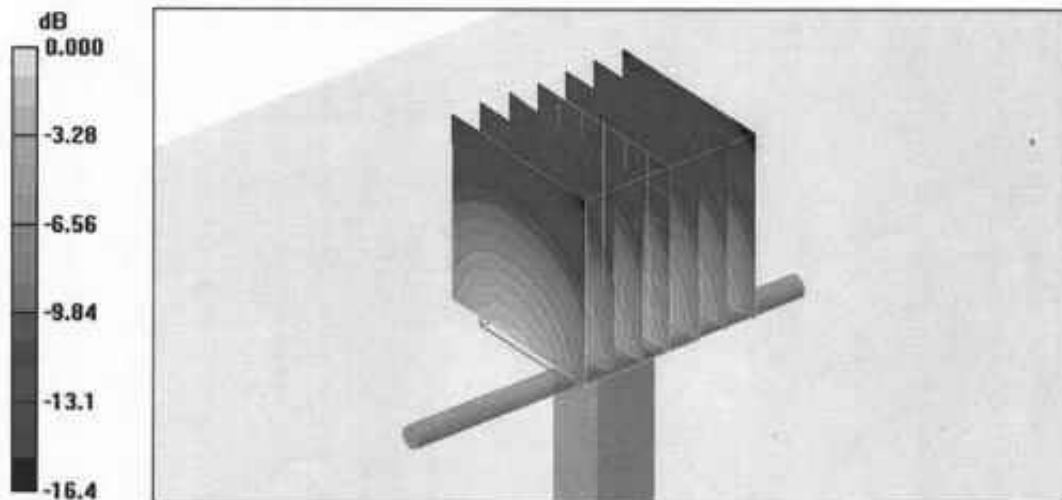
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.2 V/m; Power Drift = 0.021 dB

Peak SAR (extrapolated) = 16.1 W/kg

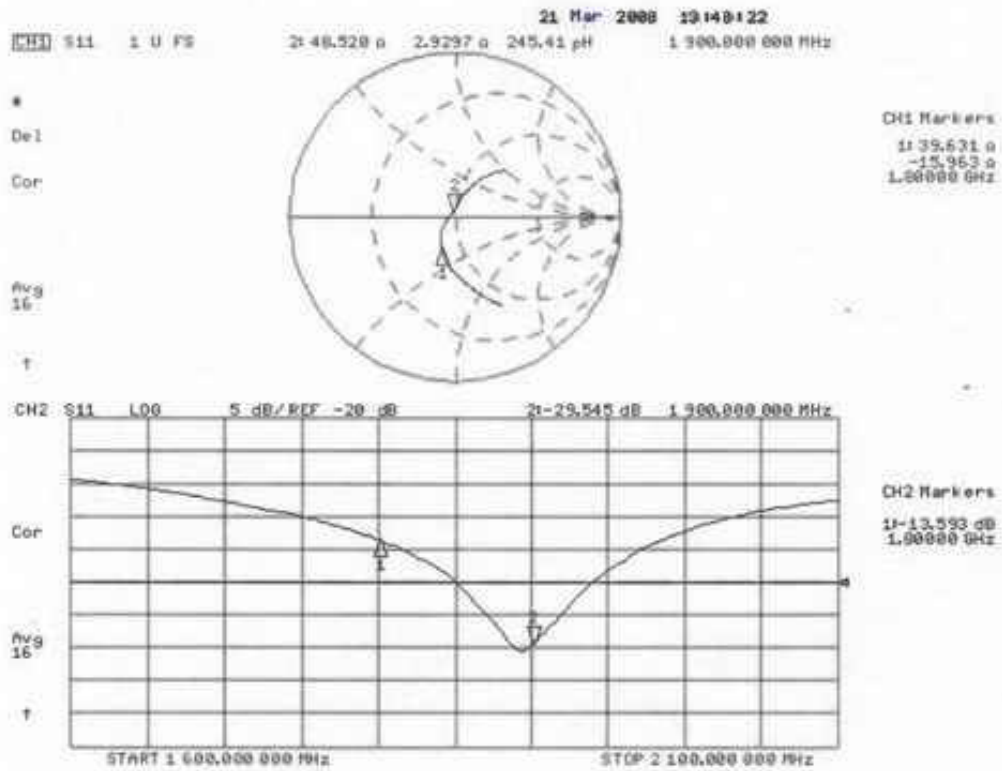
**SAR(1 g) = 9.63 mW/g; SAR(10 g) = 5.21 mW/g**

Maximum value of SAR (measured) = 11.3 mW/g



0 dB = 11.3mW/g

Impedance Measurement Plot for Body TSL



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## ANNEX H: DAE4 CALIBRATION CERTIFICATE

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



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

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

Accreditation No.: **SCS 108**

Client **TA (Auden)**

Certificate No: **DAE4-452\_Jul08**

### CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BA - SN: 452**

Calibration procedure(s) **QA CAL-06.v12  
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **July 21, 2008**

Condition of the calibrated item **In Tolerance**

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
Fluke Process Calibrator Type 702	SN: 6295803	04-Oct-07 (No: 6467)	Oct-08
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-07 (No: 6465)	Oct-08
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	06-Jun-08 (in house check)	In house check: Jun-09

Calibrated by:	Name Andrea Guntli	Function Technician	Signature 
Approved by:	Fin Bornholt	R&D Director	

Issued: July 21, 2008

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



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

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

Accreditation No.: **SCS 108**

### Glossary

**DAE** data acquisition electronics  
**Connector angle** 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:** 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.

**TA Technology (Shanghai) Co., Ltd.**  
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**DC Voltage Measurement**

A/D - Converter Resolution nominal

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

Calibration Factors	X	Y	Z
High Range	404.675 $\pm$ 0.1% (k=2)	404.426 $\pm$ 0.1% (k=2)	404.582 $\pm$ 0.1% (k=2)
Low Range	3.97902 $\pm$ 0.7% (k=2)	3.97676 $\pm$ 0.7% (k=2)	3.97703 $\pm$ 0.7% (k=2)

**Connector Angle**

Connector Angle to be used in DASY system	57 $^{\circ}$ $\pm$ 1 $^{\circ}$
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### Appendix

#### 1. DC Voltage Linearity

High Range	Input ( $\mu\text{V}$ )	Reading ( $\mu\text{V}$ )	Error (%)
Channel X + Input	200000	199999.6	0.00
Channel X + Input	20000	20010.85	0.05
Channel X - Input	20000	-20007.22	0.04
Channel Y + Input	200000	199999.7	0.00
Channel Y + Input	20000	20004.64	0.02
Channel Y - Input	20000	-20007.87	0.04
Channel Z + Input	200000	199999.9	0.00
Channel Z + Input	20000	20006.37	0.03
Channel Z - Input	20000	-20004.56	0.02

Low Range	Input ( $\mu\text{V}$ )	Reading ( $\mu\text{V}$ )	Error (%)
Channel X + Input	2000	2000.1	0.00
Channel X + Input	200	200.31	0.16
Channel X - Input	200	-200.05	0.03
Channel Y + Input	2000	2000.1	0.00
Channel Y + Input	200	200.32	0.16
Channel Y - Input	200	-201.77	0.89
Channel Z + Input	2000	1999.9	0.00
Channel Z + Input	200	199.01	-0.50
Channel Z - Input	200	-201.29	0.64

#### 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 ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	4.04	3.25
	- 200	-2.86	-3.04
Channel Y	200	-8.82	-8.52
	- 200	6.51	7.21
Channel Z	200	10.37	10.27
	- 200	-12.69	-12.80

#### 3. Channel separation

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

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	2.55	-0.94
Channel Y	200	0.77	-	2.38
Channel Z	200	-1.41	-0.39	-

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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	16118	16294
Channel Y	15879	15841
Channel Z	16155	16260

#### 5. Input Offset Measurement

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

Input 10M $\Omega$

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	0.35	-1.09	1.93	0.35
Channel Y	-1.29	-2.07	-0.24	0.35
Channel Z	-0.68	-1.73	0.45	0.36

#### 6. Input Offset Current

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

#### 7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2000	198.4
Channel Y	0.2000	200.1
Channel Z	0.2001	199.5

#### 8. Low Battery Alarm Voltage (verified during pre test)

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

#### 9. Power Consumption (verified during pre test)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	-0.01	-8	-9

**ANNEX I: THE EUT APPEARANCES AND TEST CONFIGURATION**



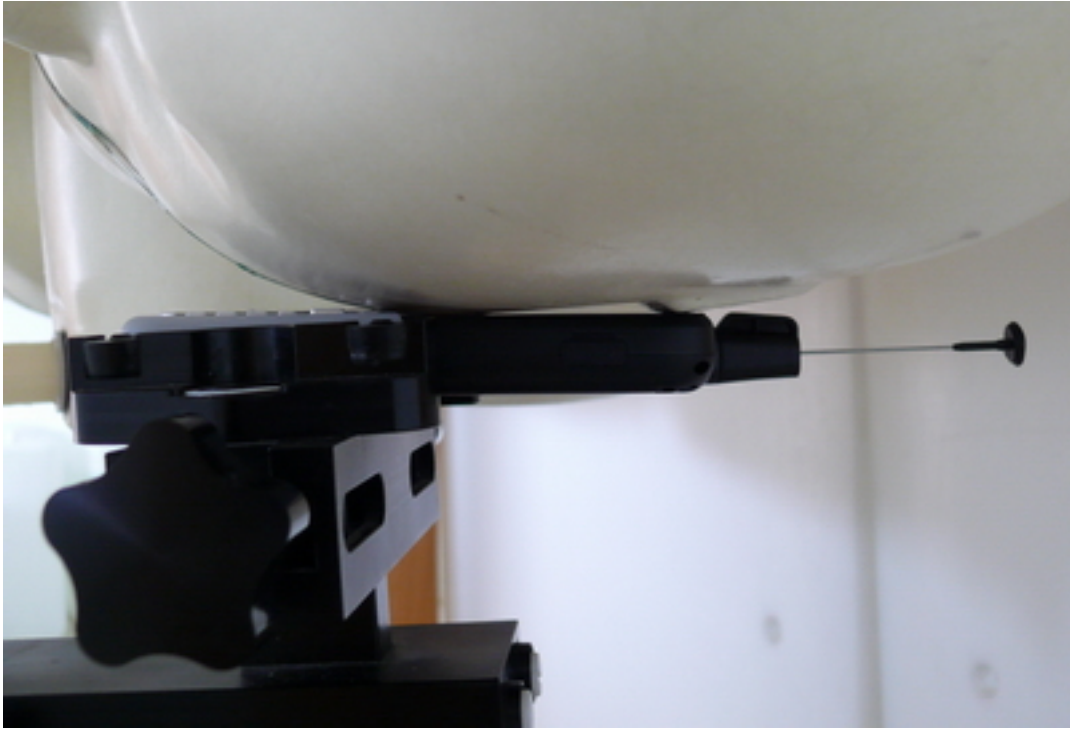
6-a: DUT front view



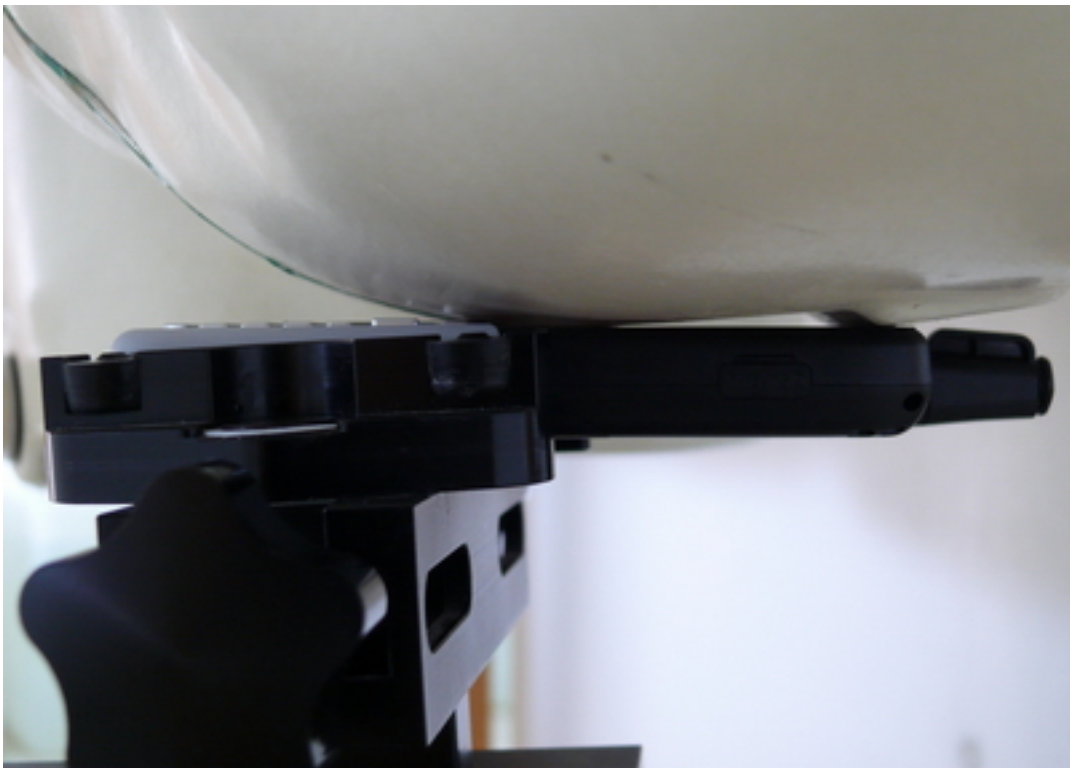
6-b: Battery - front view

Picture 6: Constituents of the sample



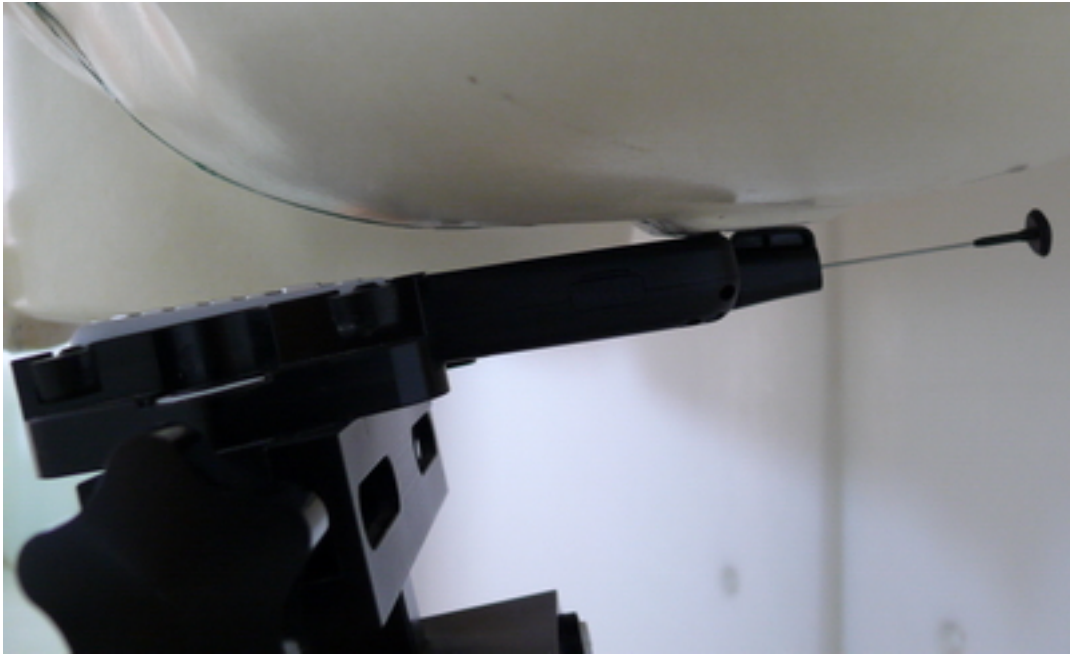


7-a: Antenna extend

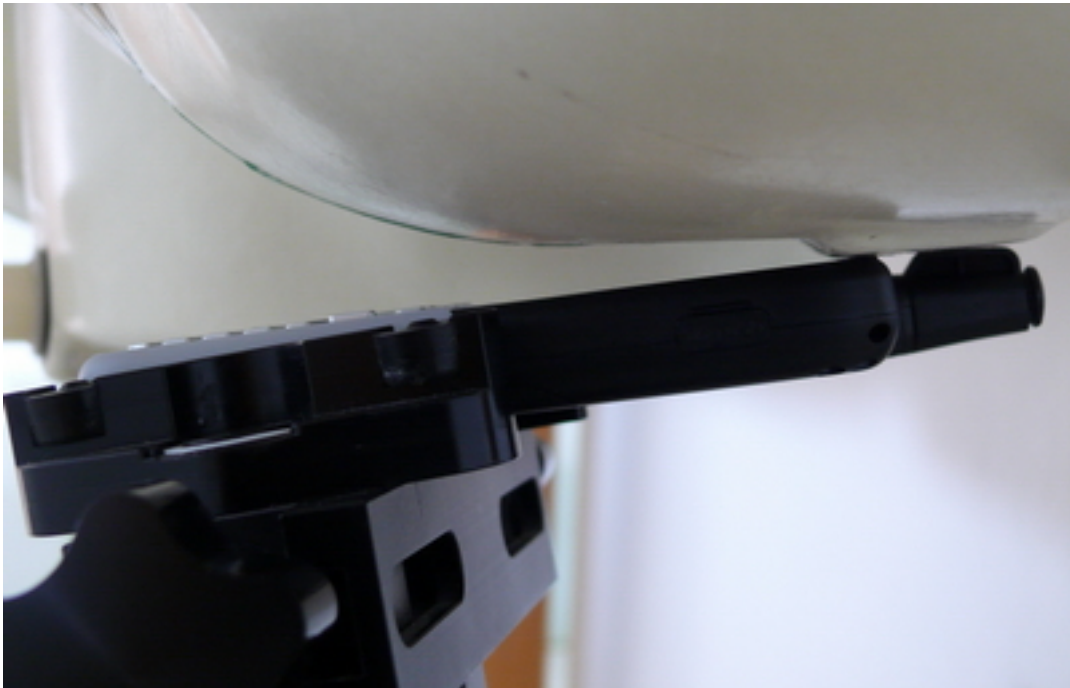


7-b: Antenna retract

Picture 7: Left Hand Touch Cheek Position

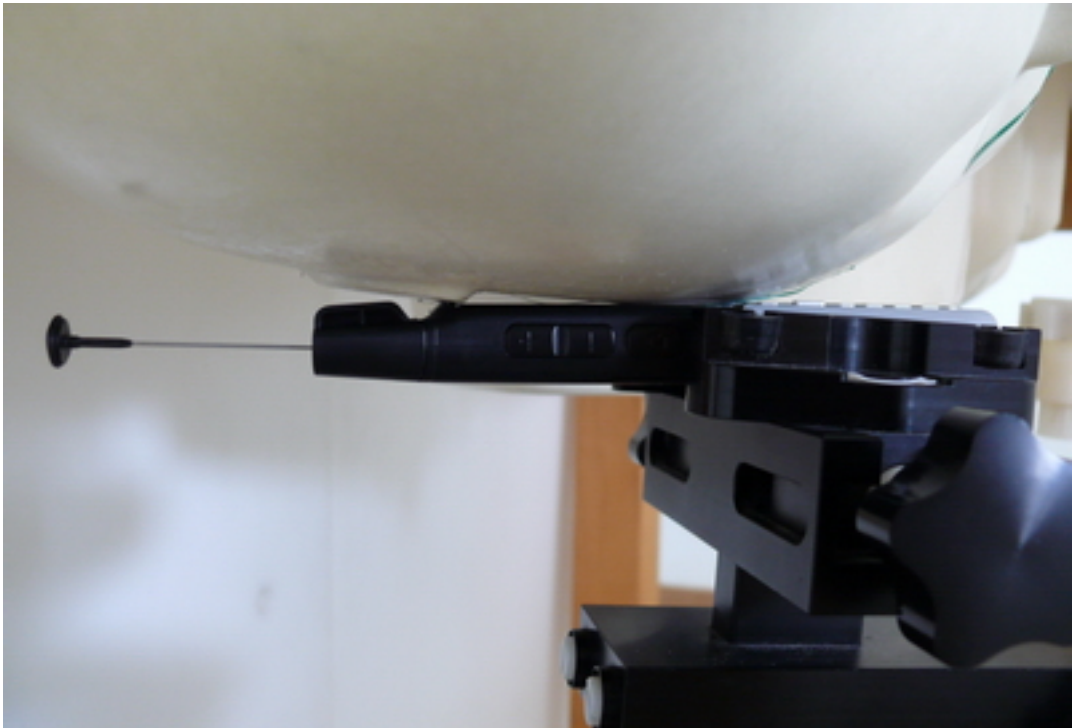


8-a: Antenna extend

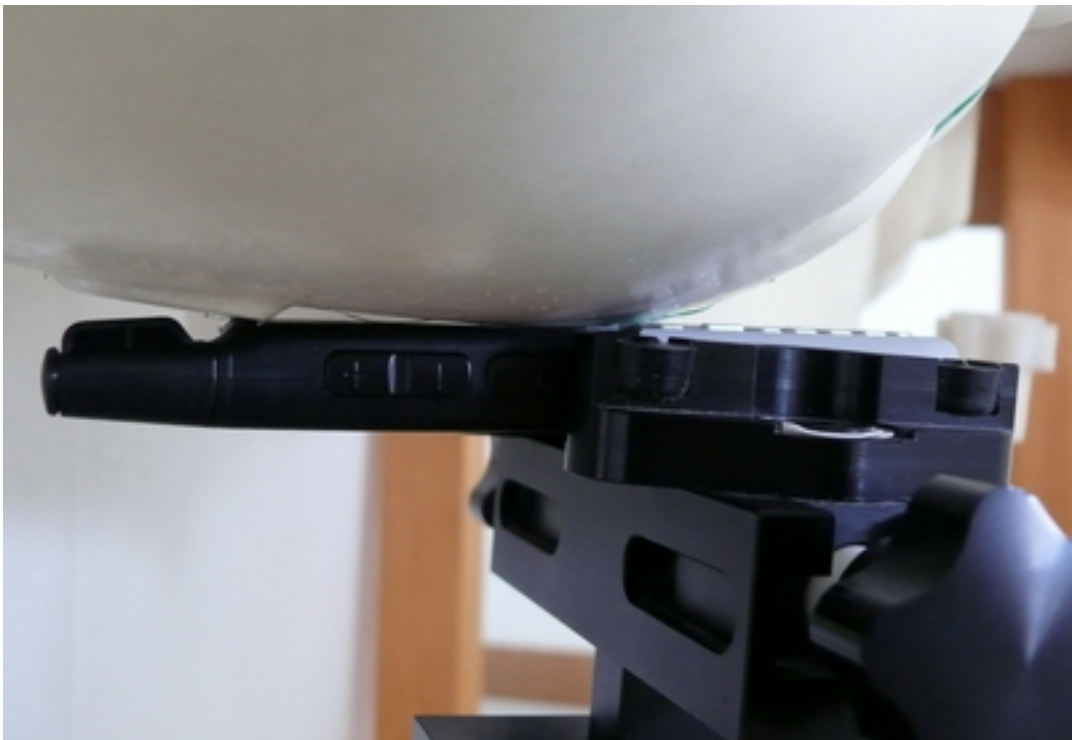


8-b: Antenna retract

Picture 8: Left Hand Tilt 15° Position



9-a: Antenna extend

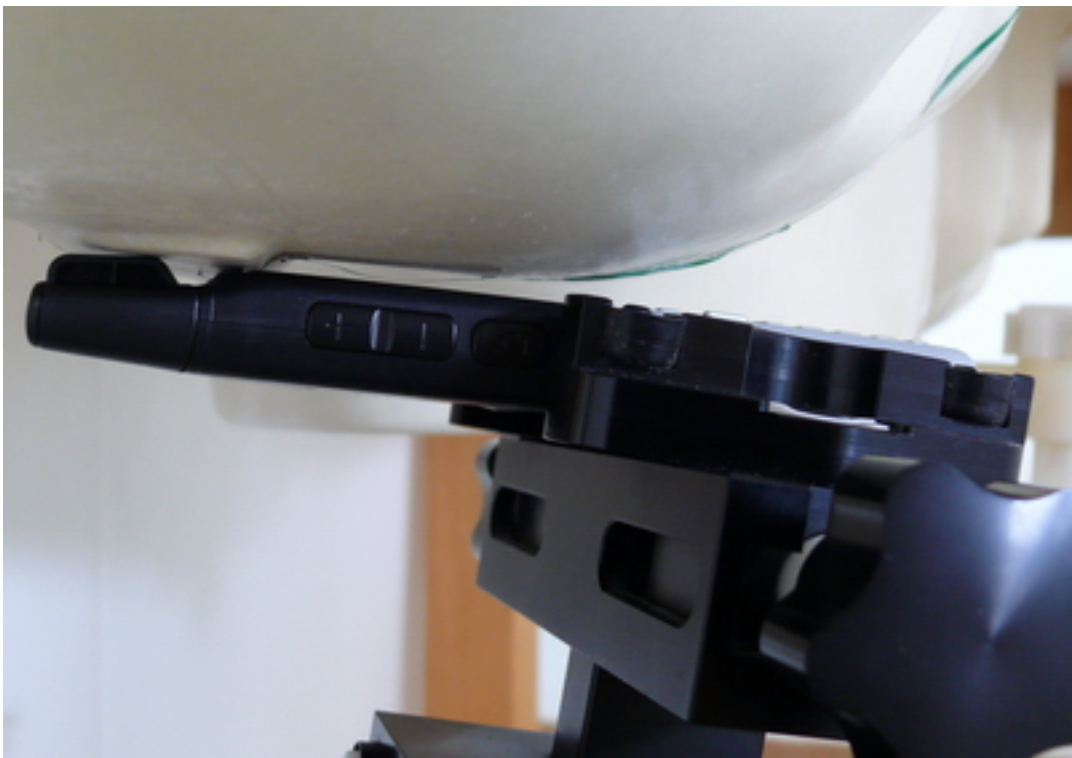


9-b: Antenna retract

Picture 9: Right Hand Touch Cheek Position

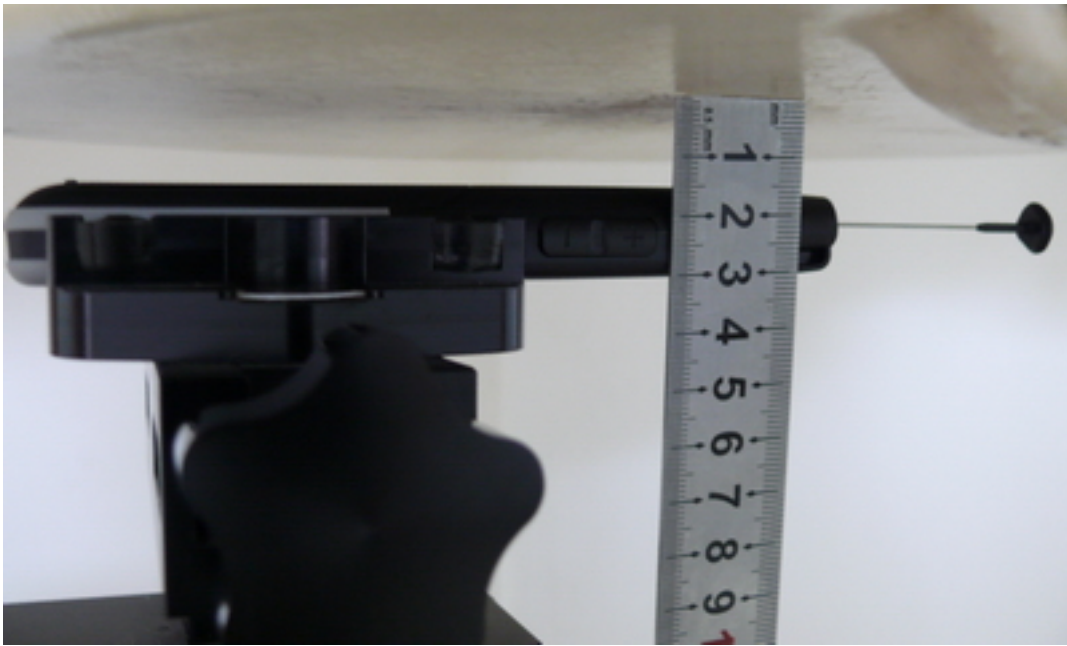


10-a: Antenna extend



10-b: Antenna retract

Picture 10: Right Hand Tilt 15° Position



11-a: Antenna extend



11-b: Antenna retract

Picture 11: Body, The EUT display towards ground, the distance from handset to the bottom of the Phantom is 15mm)

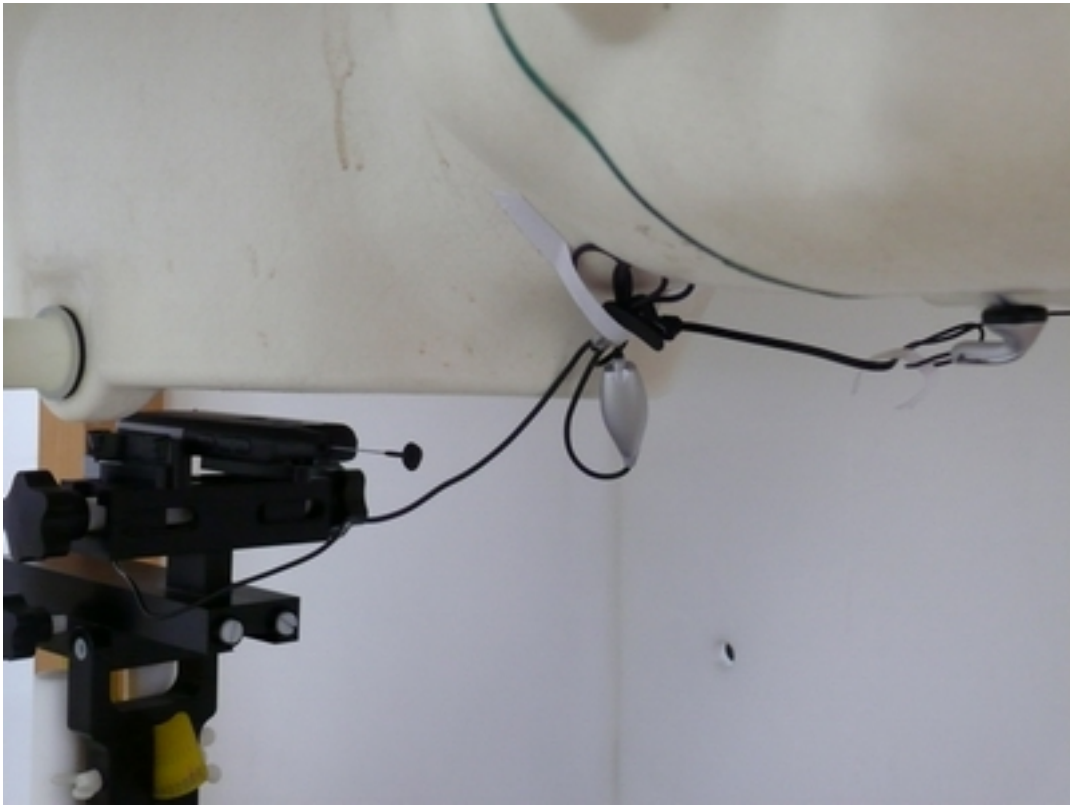


12-a: Antenna extend



12-b: Antenna retract

Picture 12: Body, The EUT display towards phantom, the distance from handset to the bottom of the Phantom is 15mm)



13-a: Antenna extend



13-b: Antenna retract

Picture 13: Body with the Earphone, towards ground, the distance from handset to the bottom of the Phantom is 15mm)



14-a: Antenna retract

Picture 14: Body with the Earphone, towards phantom, the distance from handset to the bottom of the Phantom is 15mm)