

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 86of

ANNEX D: Probe 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 Shanghai (Auden)

Certificate No: ET3-1737_Nov08

CALIBRATION CERTIFICATE

Object ET3DV6 - SN:1737

Calibration procedure(s)
QA CAL-01.v6, QA CAL-12.v5 and QA CAL-23.v3
Calibration procedure for dosimetric E-field probes

Calibration date: November 25, 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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ES3DV2	SN: 3013	2-Jan-08 (No. ES3-3013_Jan08)	Jan-09
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

Calibrated by:	Name	Function	Signature
	Katja Pokovic	Technical Manager	

Approved by:	Name	Function	Signature
	Niels Kuster	Quality Manager	

Issued: November 25, 2008

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

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 87 of

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:

TSL	tissue simulating liquid
NORM x,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORM x,y,z
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- a) 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
- 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 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- $NORMx,y,z$: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). $NORMx,y,z$ are only intermediate values, i.e., the uncertainties of $NORMx,y,z$ does not effect the E^2 -field uncertainty inside TSL (see below ConvF).
- $NORM(f)x,y,z = NORMx,y,z * frequency_response$ (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- $DCPx,y,z$: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- *ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to $NORMx,y,z * ConvF$ whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical Isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

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

Report No. RZA2009-1265FCC

Page 88of

ET3DV6 SN:1737

November 25, 2008

Probe ET3DV6

SN:1737

Manufactured:	September 27, 2002
Last calibrated:	February 19, 2007
Repaired:	November 18, 2008
Recalibrated:	November 25, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 89of

ET3DV6 SN:1737

November 25, 2008

DASY - Parameters of Probe: ET3DV6 SN:1737

Sensitivity in Free Space^A

NormX	1.42 ± 10.1%	µV/(V/m) ²
NormY	1.68 ± 10.1%	µV/(V/m) ²
NormZ	1.63 ± 10.1%	µV/(V/m) ²

Diode Compression^B

DCP X	93 mV
DCP Y	94 mV
DCP Z	85 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL 900 MHz Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance	3.7 mm	4.7 mm
SAR _{be} [%] Without Correction Algorithm	10.7	6.9
SAR _{be} [%] With Correction Algorithm	0.3	0.4

TSL 1750 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance	3.7 mm	4.7 mm
SAR _{be} [%] Without Correction Algorithm	12.5	8.4
SAR _{be} [%] With Correction Algorithm	0.8	0.5

Sensor Offset

Probe Tip to Sensor Center **2.7** mm

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%.

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).

^B Numerical linearization parameter: uncertainty not required.

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

Report No. RZA2009-1265FCC

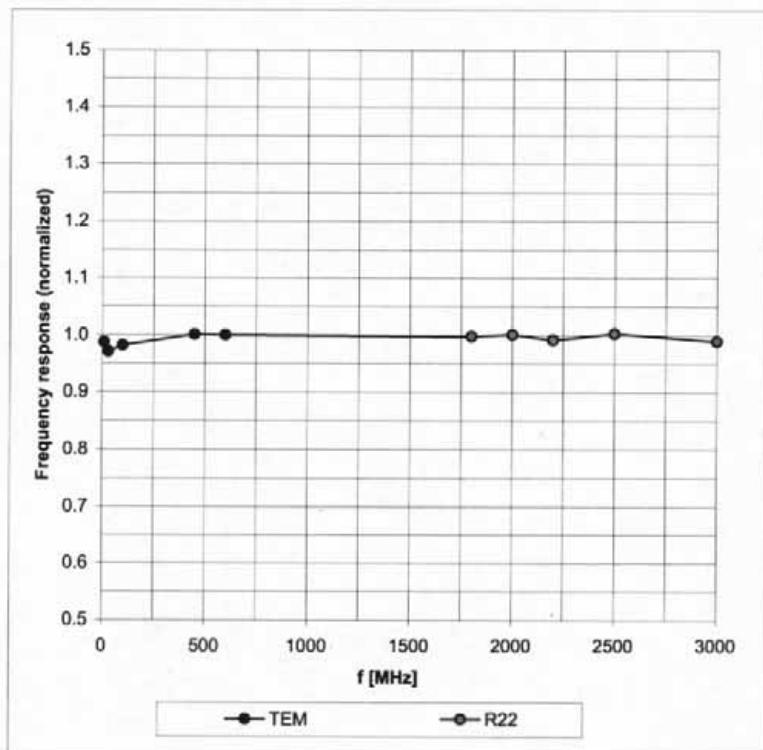
Page 9 of

ET3DV6 SN:1737

November 25, 2008

Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

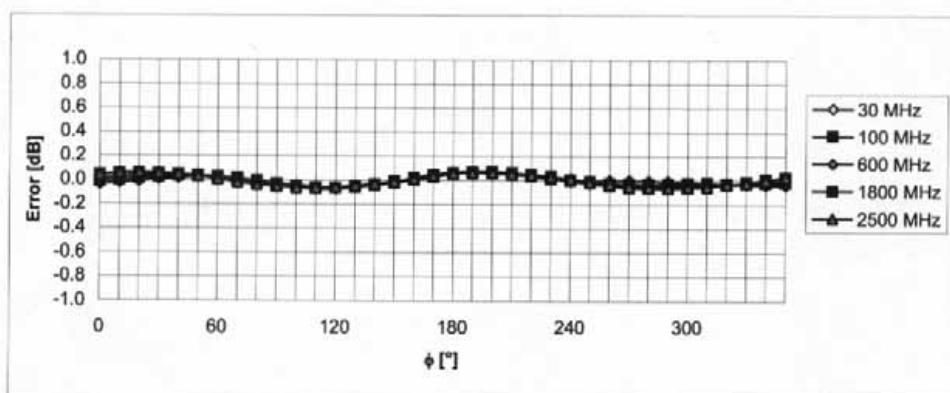
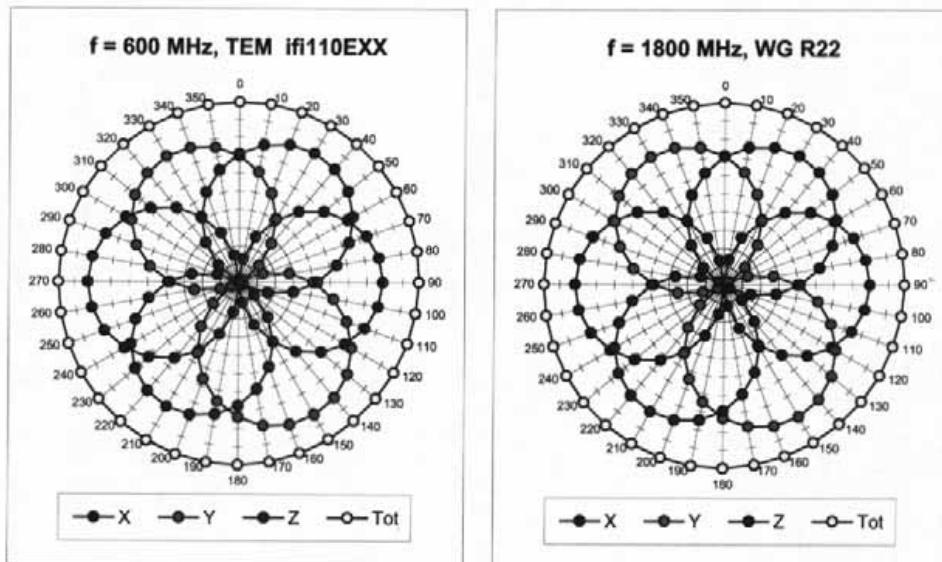
Report No. RZA2009-1265FCC

Page 91 of

ET3DV6 SN:1737

November 25, 2008

Receiving Pattern (ϕ), $\theta = 0^\circ$



Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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

Report No. RZA2009-1265FCC

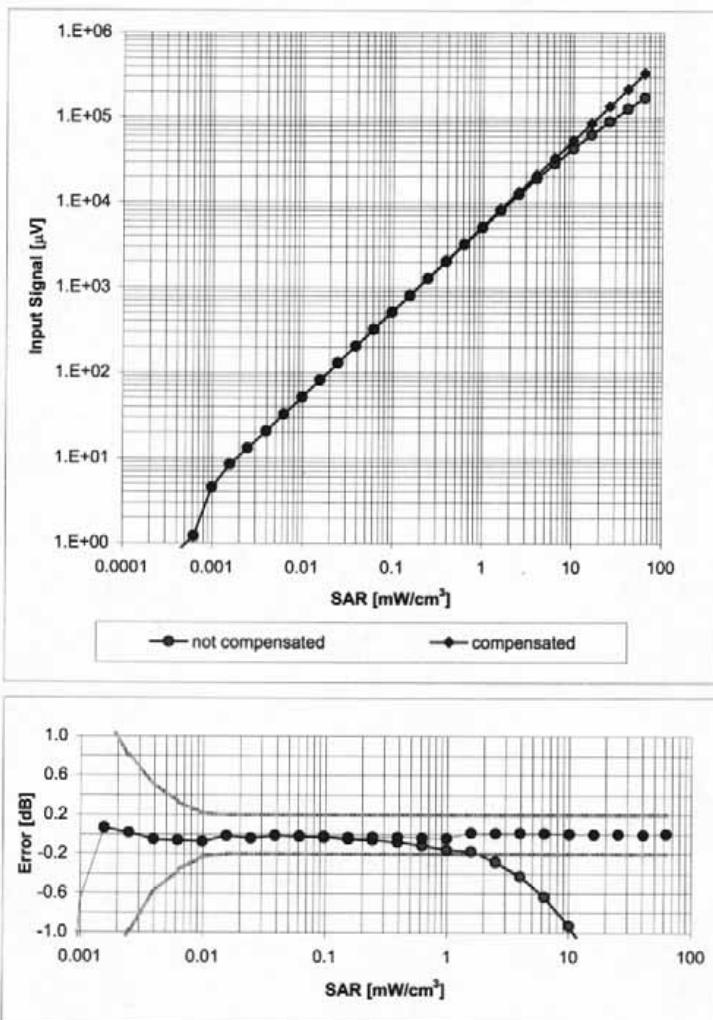
Page 92of

ET3DV6 SN:1737

November 25, 2008

Dynamic Range $f(\text{SAR}_{\text{head}})$

(Waveguide R22, $f = 1800 \text{ MHz}$)



Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

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

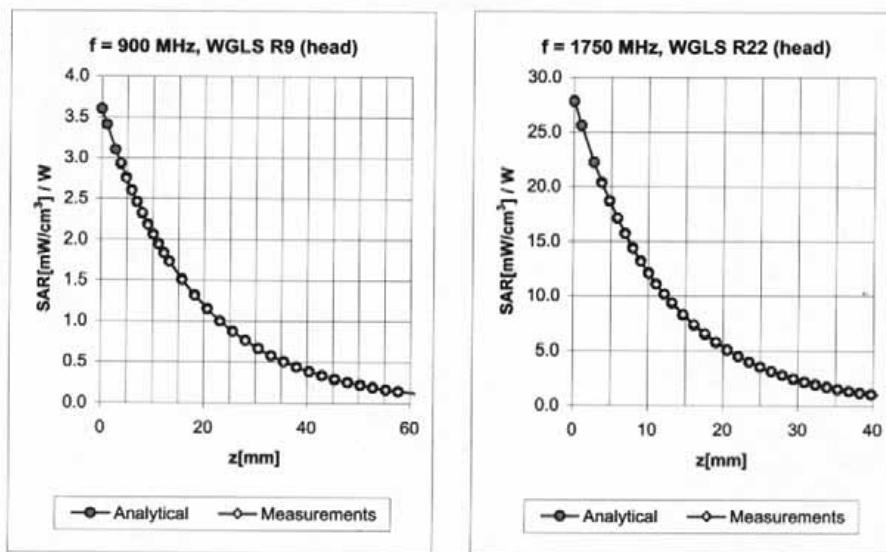
Report No. RZA2009-1265FCC

Page 93of

ET3DV6 SN:1737

November 25, 2008

Conversion Factor Assessment



f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.36	1.84	7.20	± 13.3% (k=2)
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.25	3.53	6.33	± 11.0% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.27	3.53	6.14	± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.56	2.77	5.35	± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.57	2.72	4.89	± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.51	1.60	4.39	± 11.0% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.27	1.80	7.52	± 13.3% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.36	2.75	6.14	± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.43	2.51	5.98	± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.99	1.74	4.84	± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.99	1.50	4.60	± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.98	1.42	3.91	± 11.0% (k=2)

^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

Report No. RZA2009-1265FCC

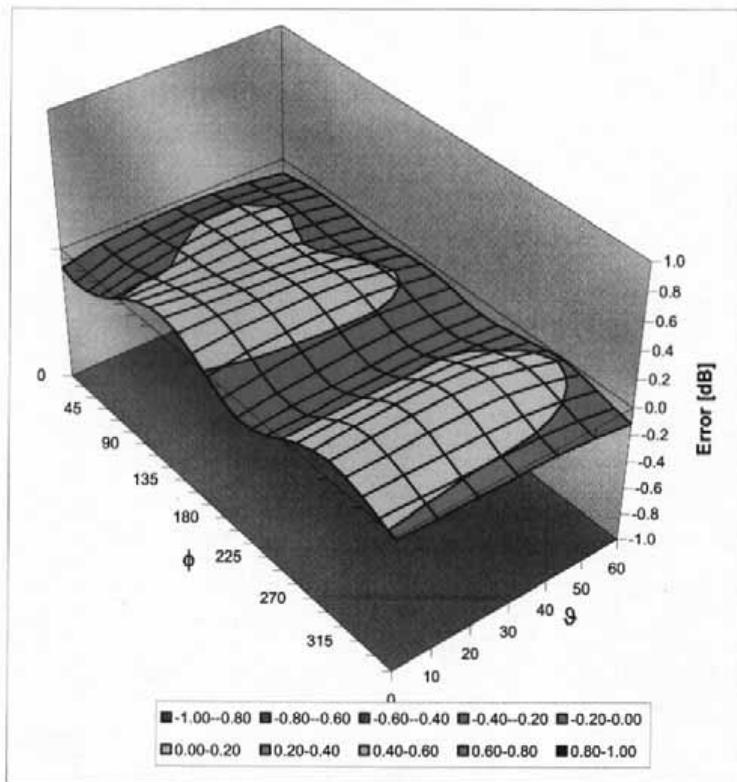
Page 94of

ET3DV6 SN:1737

November 25, 2008

Deviation from Isotropy in HSL

Error (ϕ, θ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ (k=2)

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 95of

ANNEX E: D835V2 Dipole Calibration Certificate

信息产业部通信计量中心
Telecommunication Metrology Center of MII



检 测
CNAS L0442

Client

TA

Certificate No: D835V2-4d020_Jul09

CALIBRATION CERTIFICATE

Object D835V2 - SN: 4d020

Calibration Procedure(s)
TMC-XZ-01-027
Calibration procedure for dipole validation kits

Calibration date: July 15, 2009

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 NRVD	101253	19-Jun-09 (TMC, No.JZ09-248)	Jun-10
Power sensor NRV-Z5	100333	19-Jun-09 (TMC, No. JZ09-248)	Jun-10
Reference Probe ES3DV3	SN 3149	08-Dec-08(SPEAG, No.ES3-3149_Dec08)	Dec-09
DAE4	SN 771	21-Nov-08(SPEAG, No.DAE4-771_Nov08)	Nov-09
RF generator E4438C	MY45092879	18-Jun-09(TMC, No.JZ09-302)	Jun-10
Network Analyzer 8753E	US38433212	03-Aug-08(TMC, No.JZ08-056)	Aug-09

	Name	Function	Signature
Calibrated by:	Lin Hao	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: July 15, 2009

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

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 96 of

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) 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
- 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) 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:

- d) 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 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.

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 97 of

Measurement Conditions

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

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	2mm Oval Phantom ELI4	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	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	41.2 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature during test	(21.7 ± 0.2) °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.40 mW / g
SAR normalized	normalized to 1W	9.60 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	9.2 mW /g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.55 mW / g
SAR normalized	normalized to 1W	6.20 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	6.07 mW /g ± 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 98 of

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.6 ± 6%	0.99mho/m ± 6 %
Body TSL temperature during test	(21.9 ± 0.2) °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.41 mW / g
SAR normalized	normalized to 1W	9.64 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	9.28 mW /g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.58 mW / g
SAR normalized	normalized to 1W	6.32 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	6.19 mW /g ± 16.5 % (k=2)

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 99of

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7Ω -3.7 jΩ
Return Loss	- 25.9dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.4Ω - 5.1 jΩ
Return Loss	-25.6dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.387 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	April 22, 2004

DASY5 Validation Report for Head TSL

Certificate No: D835V2-4d020_Jul09

Page 5 of 9

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

Report No. RZA2009-1265FCC

Page 100 of

Date/Time: 2009-7-15 14:54:13

Test Laboratory: TMC, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: SN: 4d020

Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1

Medium: Head 835MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.91 \text{ mho/m}$; $\epsilon_r = 41.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: ES3DV3 - SN3149; ConvF(6.34, 6.34, 6.34); Calibrated: 08.12.08
- Electronics: DAE4 Sn771; Calibration: 21.11.08
- Phantom: 2mm Oval Phantom ELI4; Type: QDOVA001BB
- Measurement SW: DASY5, V5.0 Build 119.9; Postprocessing SW: SEMCAD, V13.2 Build 87

Pin=250mW; d=15mm/Zoom Scan (7x7x7)/Cube 0:

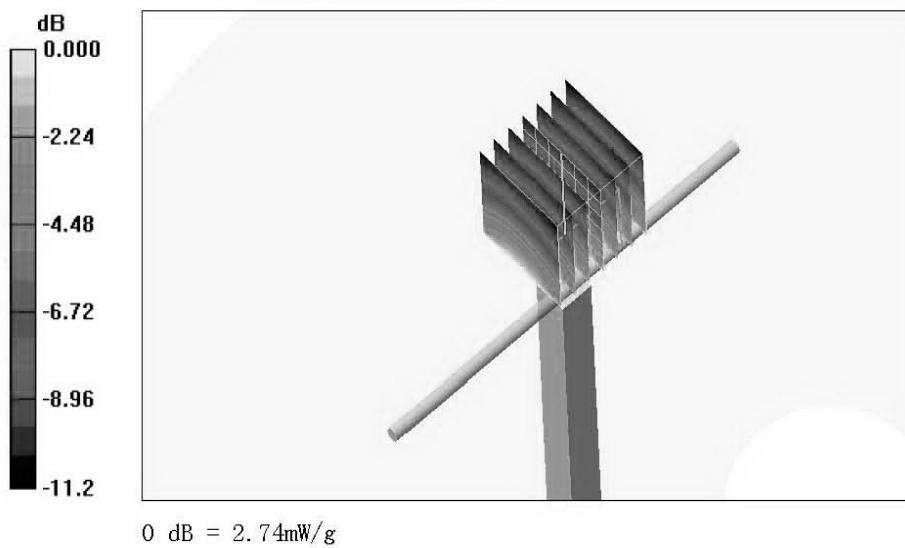
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 55.2 V/m; Power Drift = -0.019 dB

Peak SAR (extrapolated) = 3.16 W/kg

SAR(1 g) = 2.4 mW/g; SAR(10 g) = 1.55 mW/g

Maximum value of SAR (measured) = 2.74 mW/g

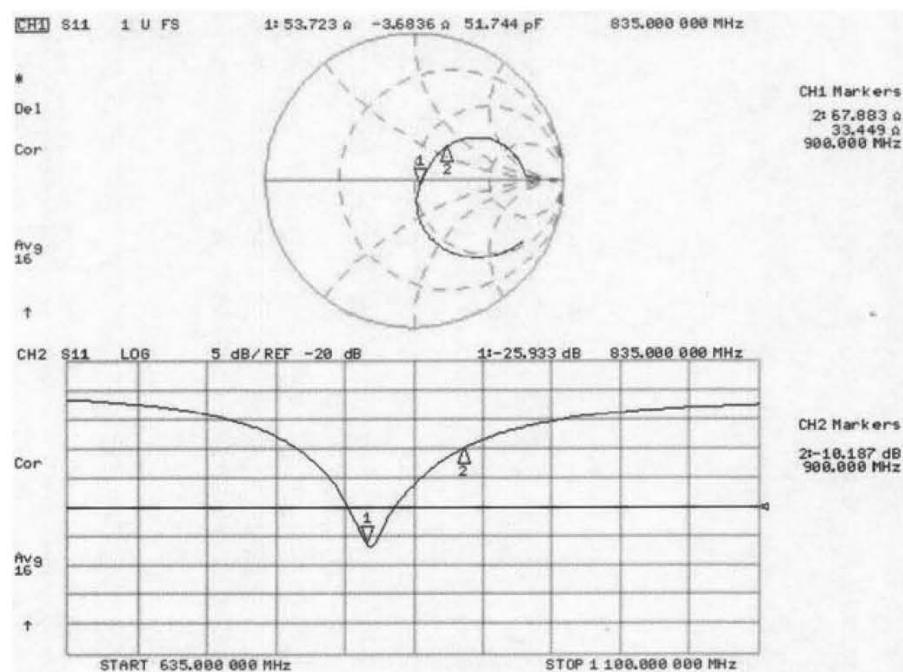


TA Technology (Shanghai) Co., Ltd.
Test Report

Report No. RZA2009-1265FCC

Page 101 of

Impedance Measurement Plot for Head TSL



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

Report No. RZA2009-1265FCC

Page 102 of

DASY5 Validation Report for Body TSL

Date/Time: 2009-7-15 11:27:23

Test Laboratory: TMC, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: SN: 4d020

Communication System: CW Frequency: 835 MHz Duty Cycle: 1:1

Medium: Body 835MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.99 \text{ mho/m}$; $\epsilon_r = 54.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: ES3DV3 - SN3149; ConvF(6.02, 6.02, 6.02); Calibrated: 08.12.08
- Electronics: DAE4 Sn771; Calibration: 21.11.08
- Phantom: 2mm Oval Phantom ELI4; Type: QDOVA001BB
- Measurement SW: DASY5, V5.0 Build 119.9; Postprocessing SW: SEMCAD, V13.2 Build 87

Pin=250mW; d=15mm/Zoom Scan (7x7x7)/Cube 0:

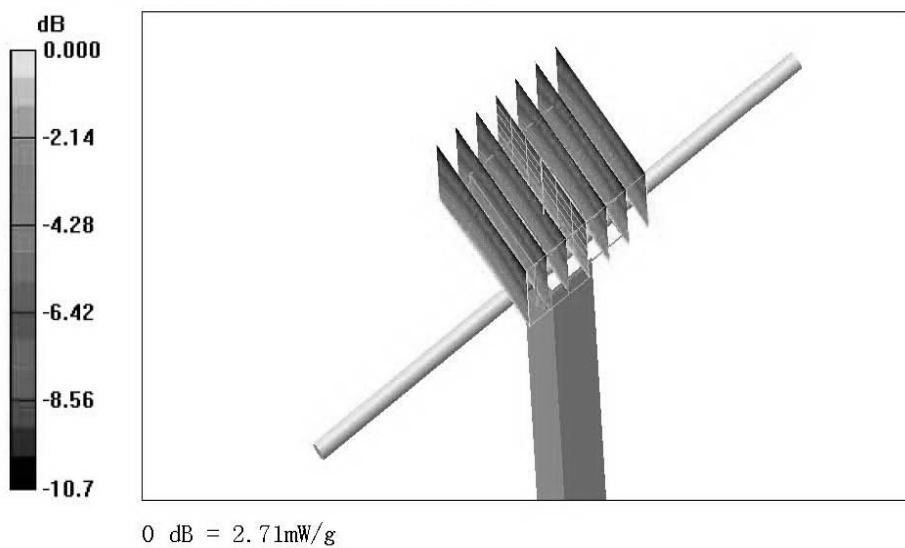
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 54.1 V/m; Power Drift = -0.004 dB

Peak SAR (extrapolated) = 3.81 W/kg

SAR(1 g) = 2.41 mW/g; SAR(10 g) = 1.58 mW/g

Maximum value of SAR (measured) = 2.71 mW/g

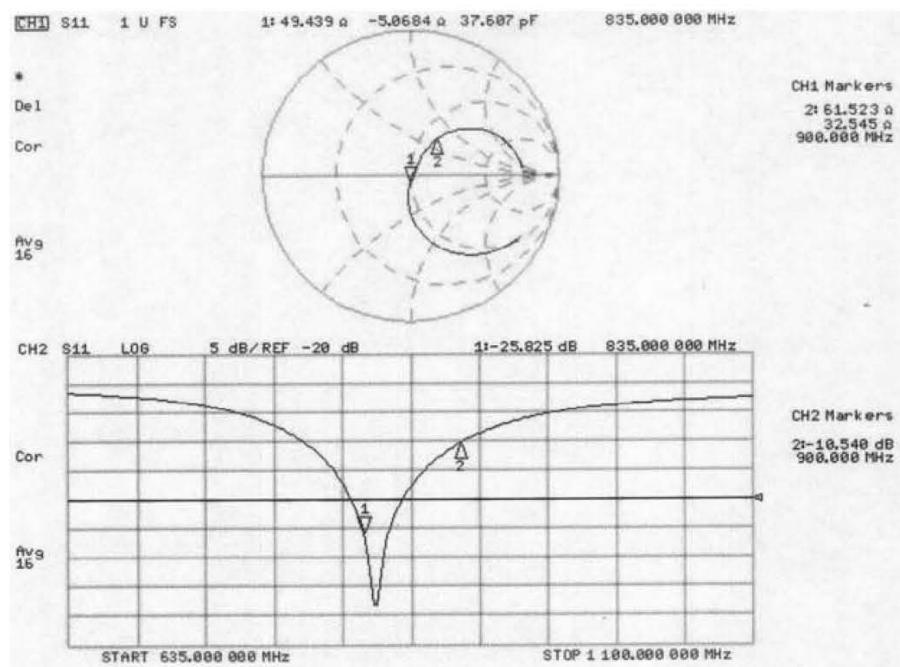


TA Technology (Shanghai) Co., Ltd.
Test Report

Report No. RZA2009-1265FCC

Page 103 of

Impedance Measurement Plot for Body TSL



TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 104 of

ANNEX F: D1900V2 Dipole Calibration Certificate

信息产业部通信计量中心
Telecommunication Metrology Center of MIIT



Client

TA

Certificate No: D1900V2-5d060_Jul09

CALIBRATION CERTIFICATE

Object D1900V2 - SN: 5d060

Calibration Procedure(s)
TMC-XZ-01-027
Calibration procedure for dipole validation kits

Calibration date: July 15, 2009

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 NRVD	101253	19-Jun-09 (TMC, No. JZ09-248)	Jun-10
Power sensor NRV-Z5	100333	19-Jun-09 (TMC, No. JZ09-248)	Jun-10
Reference Probe ES3DV3	SN 3149	08-Dec-08(SPEAG, No.ES3-3149_Dec08)	Dec-09
DAE4	SN 771	21-Nov-08(SPEAG, No.DAE4-771_Nov08)	Nov-09
RF generator E4438C	MY45092879	18-Jun-09(TMC, No.JZ09-302)	Jun-10
Network Analyzer 8753E	US38433212	03-Aug-08(TMC, No.JZ08-056)	Aug-09

	Name	Function	Signature
Calibrated by:	Lin Hao	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: July 15, 2009

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

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 105 of

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) 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
- 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) 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:

- d) 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 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.

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 106 of

Measurement Conditions

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

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	2mm Oval Phantom ELI4	
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	39.6 ± 6 %	1.40mho/m ± 6 %
Head TSL temperature during test	(21.9 ± 0.2) °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.88 mW / g
SAR normalized	normalized to 1W	39.5 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	37.8 mW /g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.0 mW / g
SAR normalized	normalized to 1W	20.0 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	19.8 mW /g ± 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 107 of

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	52.9 ± 6%	1.55 mho/m ± 6 %
Body TSL temperature during test	(21.8 ± 0.2) °C	---	---

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.2 mW / g
SAR normalized	normalized to 1W	40.8 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	39.4 mW /g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.18 mW / g
SAR normalized	normalized to 1W	20.72 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	21.0 mW /g ± 16.5 % (k=2)

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 108 of

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$54.8\Omega + 4.0 \text{ j}\Omega$
Return Loss	- 23.7dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$47.9\Omega + 7.1 \text{ j}\Omega$
Return Loss	- 22.6dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 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	December 10, 2004

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

Report No. RZA2009-1265FCC

Page 109 of

DASY5 Validation Report for Head TSL

Date/Time: 2009-7-15 14:15:30

Test Laboratory: TMC, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: SN: 5d060

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

Medium: Head 1900MHz

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.40 \text{ mho/m}$; $\epsilon_r = 39.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: ES3DV3 - SN3149; ConvF(5.18, 5.18, 5.18); Calibrated: 08.12.08
- Electronics: DAE4 Sn771; Calibration: 21.11.08
- Phantom: 2mm Oval Phantom ELI4; Type: QDOVA001BB
- Measurement SW: DASY5, V5.0 Build 119.9; Postprocessing SW: SEMCAD, V13.2 Build 87

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

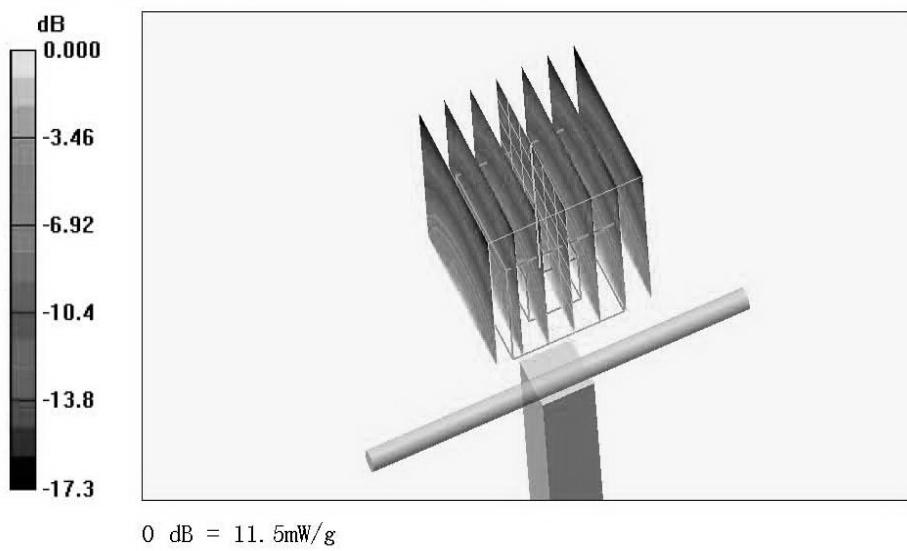
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 85.1 V/m; Power Drift = -0.057 dB

Peak SAR (extrapolated) = 18.8 W/kg

SAR(1 g) = 9.88 mW/g; SAR(10 g) = 5.0 mW/g

Maximum value of SAR (measured) = 11.5 mW/g

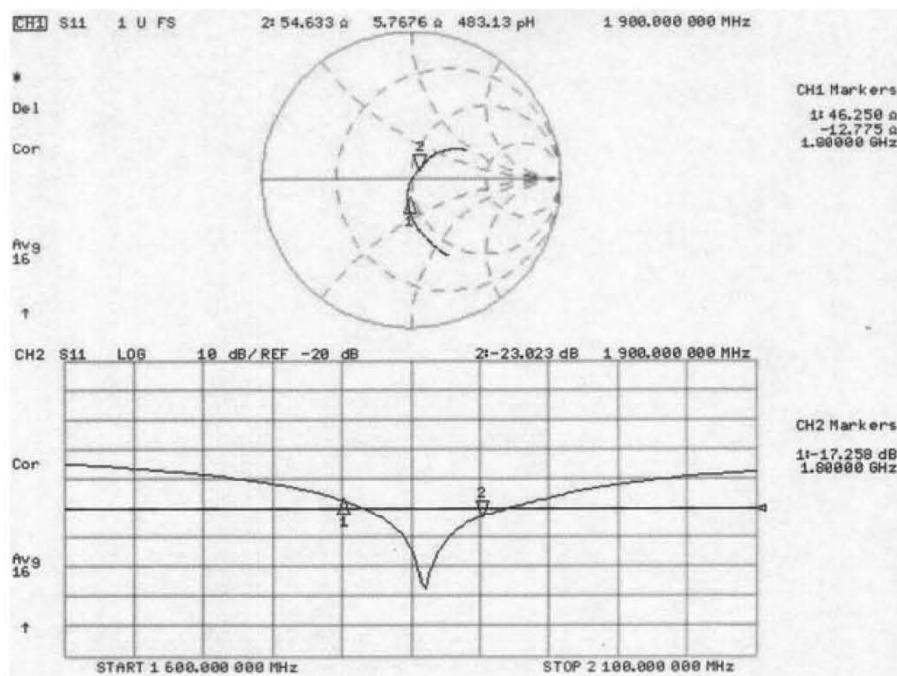


TA Technology (Shanghai) Co., Ltd.
Test Report

Report No. RZA2009-1265FCC

Page 110 of

Impedance Measurement Plot for Head TSL



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

Report No. RZA2009-1265FCC

Page 11 of 11

DASY5 Validation Report for Body TSL

Date/Time: 2009-7-15 15:37:31

Test Laboratory: TMC, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: SN: 5d060

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

Medium: Body 1900MHz

Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.55 \text{ mho/m}$; $\epsilon_r = 52.9$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: ES3DV3 - SNS149, ConvP(4.97, 4.97, 4.97), Calibrated: 08.12.08
- Electronics: DAE4 Sn771; Calibration: 21.11.08
- Phantom: 2mm Oval Phantom EL14; Type: QDOVA00IBB
- Measurement SW: DASY5, V5.0 Build 119.9; Postprocessing SW: SEMCAD, V13.2 Build 87

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

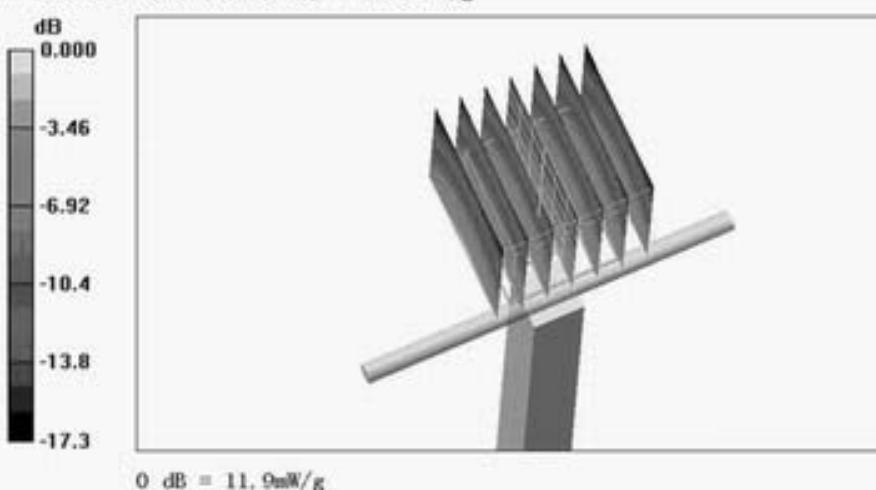
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 79.6 V/m; Power Drift = -0.009 dB

Peak SAR (extrapolated) = 19.1 W/kg

SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.18 mW/g

Maximum value of SAR (measured) = 11.9 mW/g

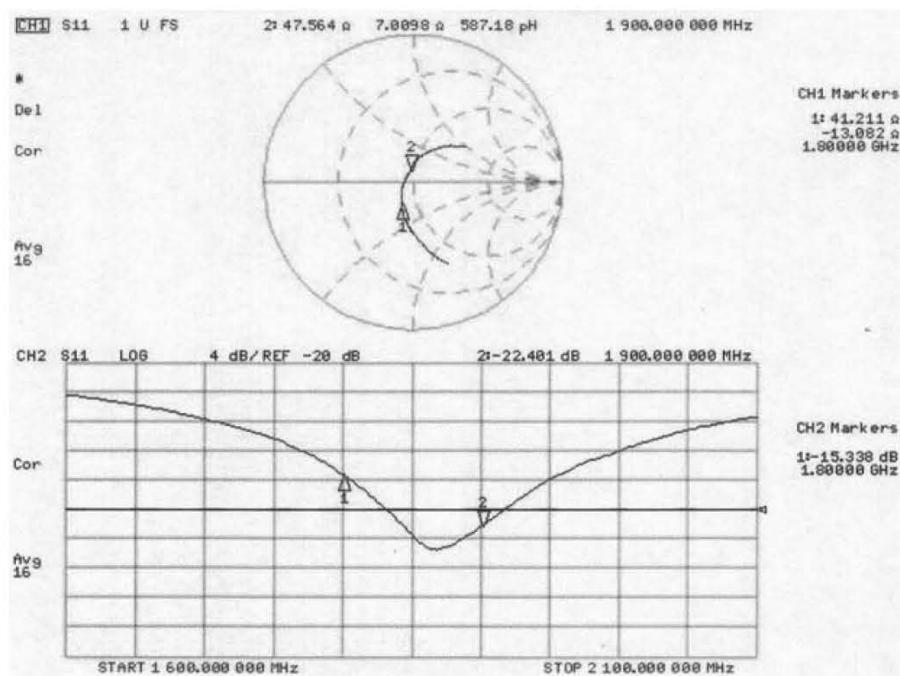


TA Technology (Shanghai) Co., Ltd.
Test Report

Report No. RZA2009-1265FCC

Page 112 of

Impedance Measurement Plot for Body TSL



TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 113 of

ANNEX G: 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 Auden

Certificate No: DAE4-452_Nov08

CALIBRATION CERTIFICATE

Object DAE4 - SD 000 D04 BJ - SN: 452

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

Calibration date: November 18, 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	30-Sep-08 (No: 7673)	Sep-09
Keithley Multimeter Type 2001	SN: 0810278	30-Sep-08 (No: 7670)	Sep-09
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 Function Signature
 Dominique Steffen Technician

Approved by: Name Function Signature
 Fin Bomholt R&D Director

Issued: November 18, 2008

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

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 114 of

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.

Test Report

Report No. RZA2009-1265FCC

Page 115 of

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	$404.585 \pm 0.1\% (k=2)$	$404.416 \pm 0.1\% (k=2)$	$404.565 \pm 0.1\% (k=2)$
Low Range	$3.97854 \pm 0.7\% (k=2)$	$3.95135 \pm 0.7\% (k=2)$	$3.98063 \pm 0.7\% (k=2)$

Connector Angle

Connector Angle to be used in DASY system	$148^\circ \pm 1^\circ$
---	-------------------------

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

Report No. RZA2009-1265FCC

Page 116 of

Appendix

1. DC Voltage Linearity

High Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	200000	200000	0.00
Channel X	+ Input	20000	20006.89	0.03
Channel X	- Input	20000	-20003.71	0.02
Channel Y	+ Input	200000	200000.5	0.00
Channel Y	+ Input	20000	20008.05	0.04
Channel Y	- Input	20000	-20006.61	0.03
Channel Z	+ Input	200000	199999.6	0.00
Channel Z	+ Input	20000	20006.84	0.03
Channel Z	- Input	20000	-20004.66	0.02

Low Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	2000	2000	0.00
Channel X	+ Input	200	200.19	0.09
Channel X	- Input	200	-199.99	0.00
Channel Y	+ Input	2000	2000	0.00
Channel Y	+ Input	200	199.38	-0.31
Channel Y	- Input	200	-200.73	0.36
Channel Z	+ Input	2000	2000.1	0.00
Channel Z	+ Input	200	199.25	-0.38
Channel Z	- Input	200	-201.52	0.76

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	2.99	1.90
	-200	-1.54	-1.85
Channel Y	200	-8.82	-8.73
	-200	6.90	6.96
Channel Z	200	9.94	10.21
	-200	-13.53	-13.21

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Charinel Y (μV)	Channel Z (μV)
Channel X	200	-	1.31	-0.98
Channel Y	200	1.52	-	2.97
Channel Z	200	-1.16	0.18	-

TA Technology (Shanghai) Co., Ltd.

Test Report

Report No. RZA2009-1265FCC

Page 117 of

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	16123	16646
Channel Y	15886	16452
Channel Z	16175	16346

5. Input Offset Measurement

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

Input 10MΩ

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	0.53	-0.80	1.64	0.33
Channel Y	-1.51	-2.67	-0.89	0.35
Channel Z	-1.99	-3.07	-1.43	0.29

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.1999	198.3
Channel Y	0.1999	200.1
Channel Z	0.1999	199.3

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

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

Report No. RZA2009-1265FCC

Page 118 of

ANNEX H: The EUT Appearances and Test Configuration



Picture 6: Constituents of EUT

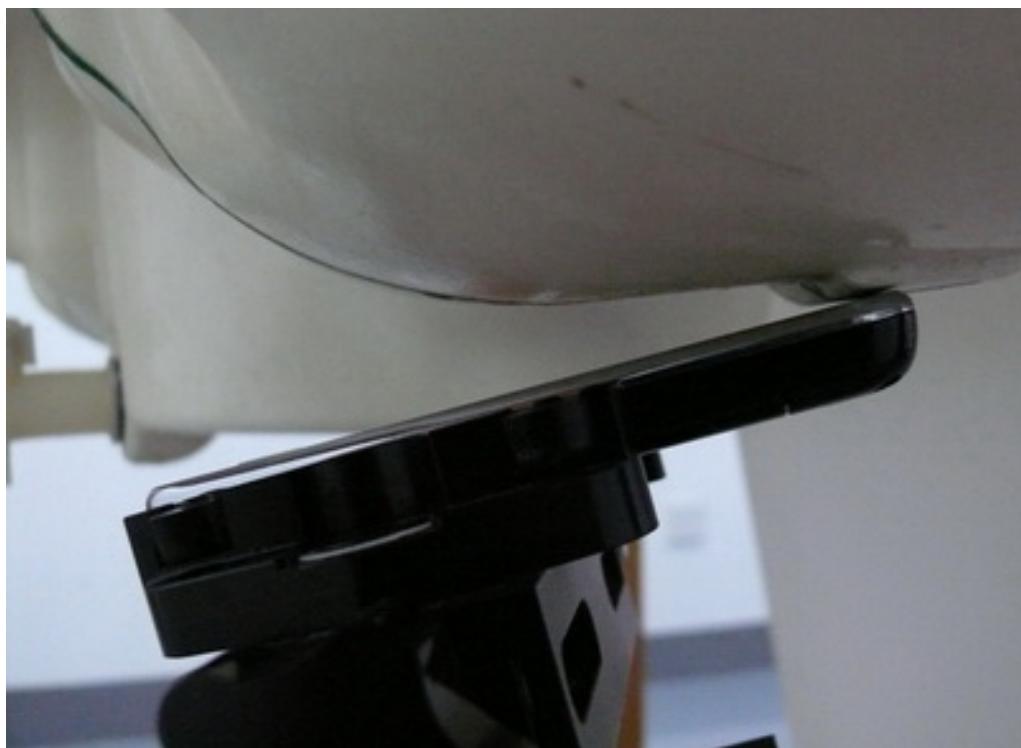


Picture 7: Left Hand Touch Cheek Position

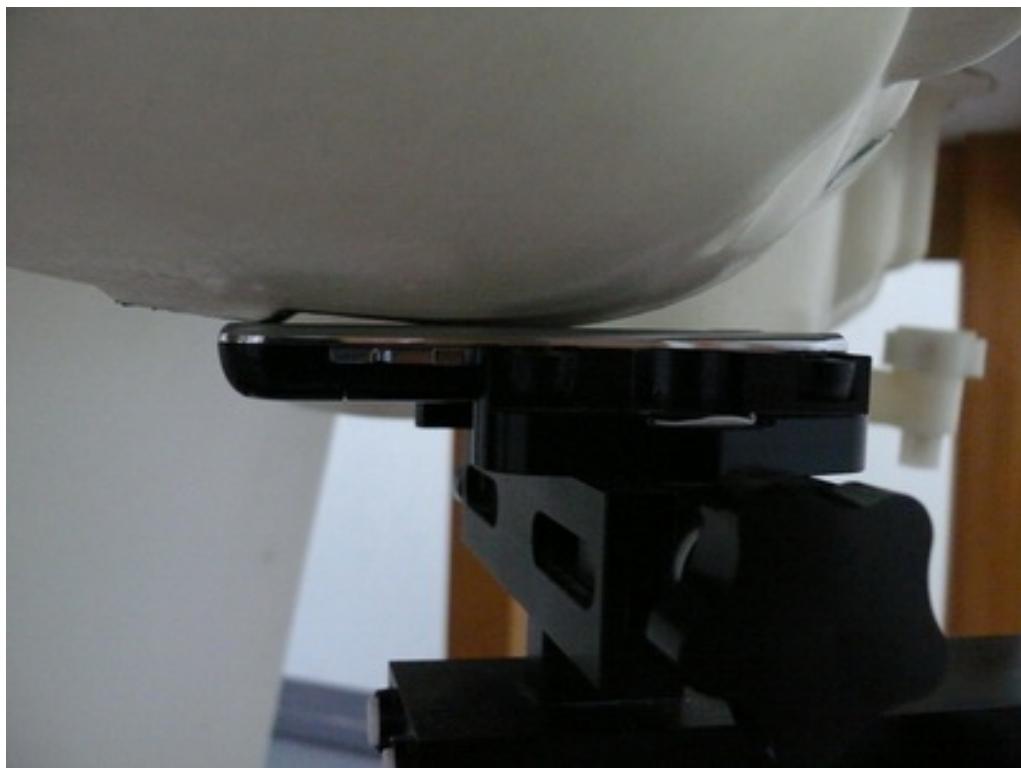
**TA Technology (Shanghai) Co., Ltd.
Test Report**

Report No. RZA2009-1265FCC

Page 119 of



Picture 8: Left Hand Tilt 15 Degree Position

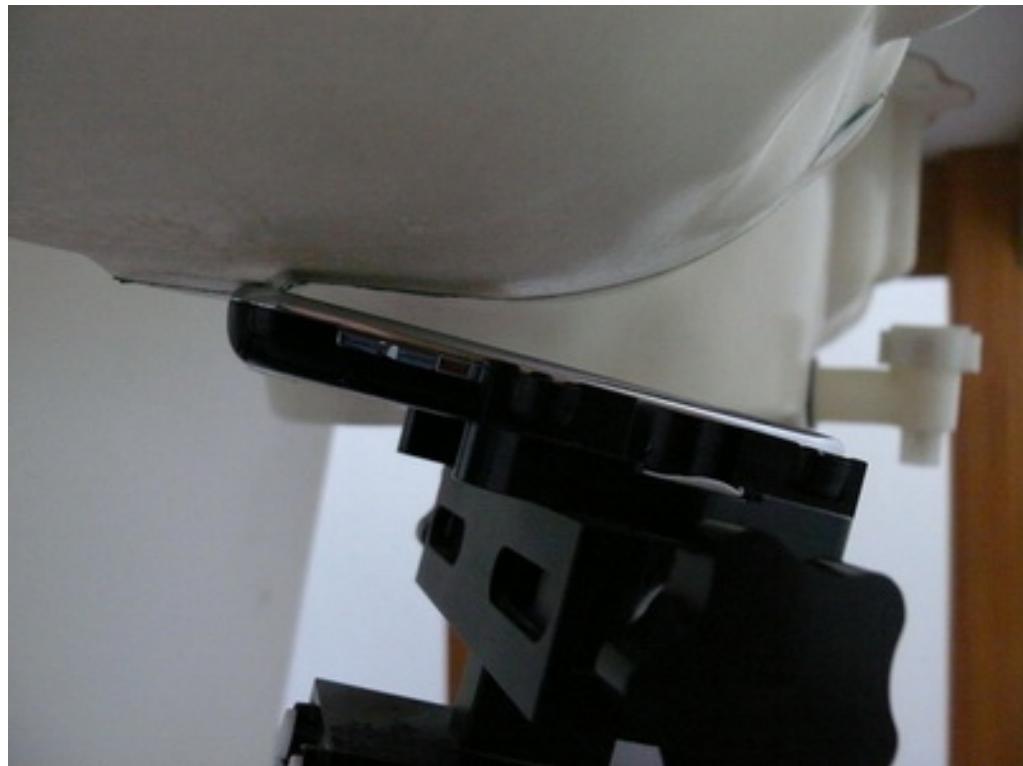


Picture 9: Right Hand Touch Cheek Position

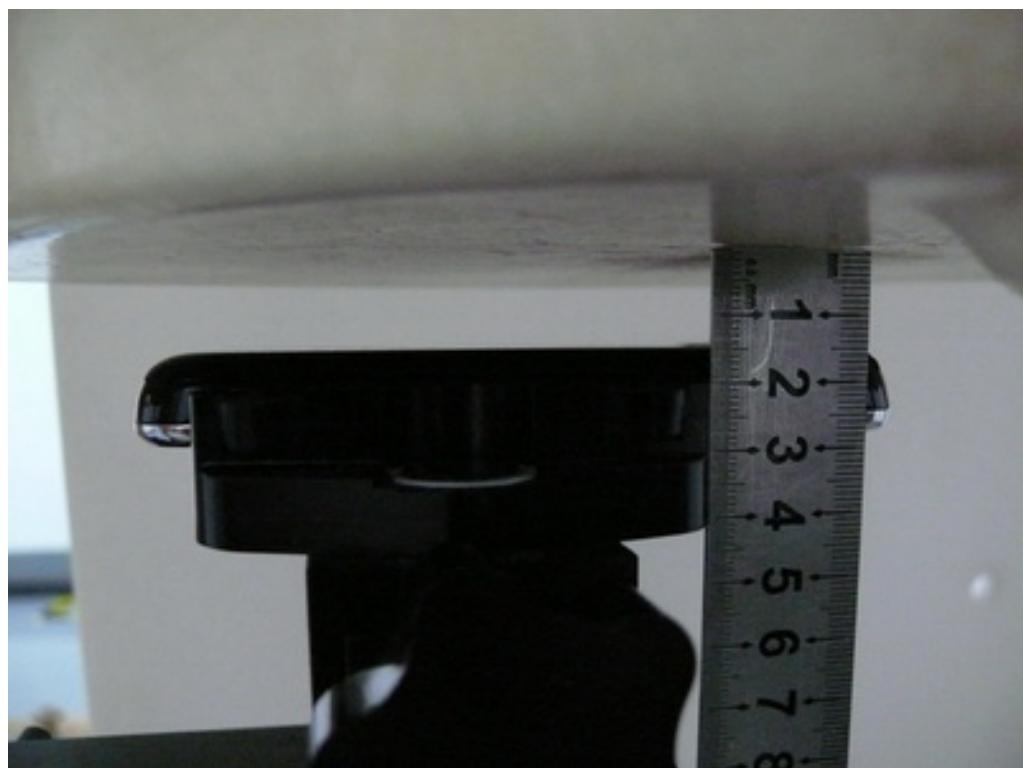
**TA Technology (Shanghai) Co., Ltd.
Test Report**

Report No. RZA2009-1265FCC

Page 120 of



Picture 10: Right Hand Tilt 15 Degree Position

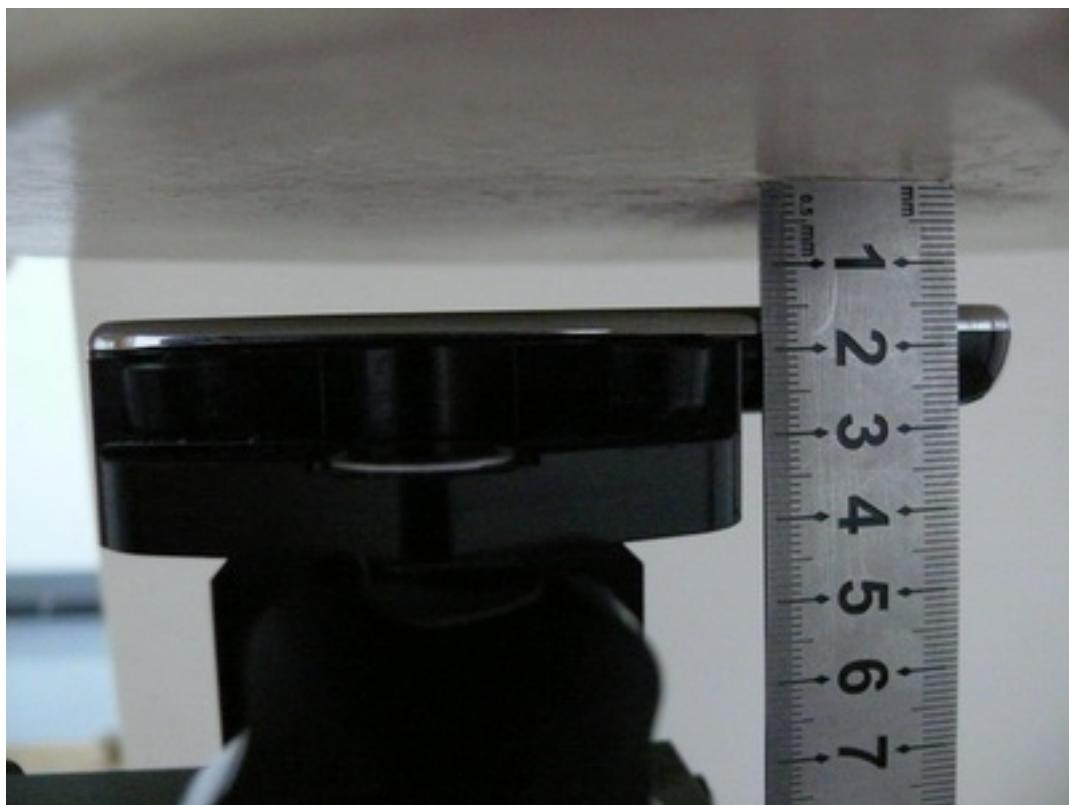


Picture 11: Body, The EUT display towards ground, the distance from handset to the bottom of the Phantom is 15mm)

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

Report No. RZA2009-1265FCC

Page 121 of



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