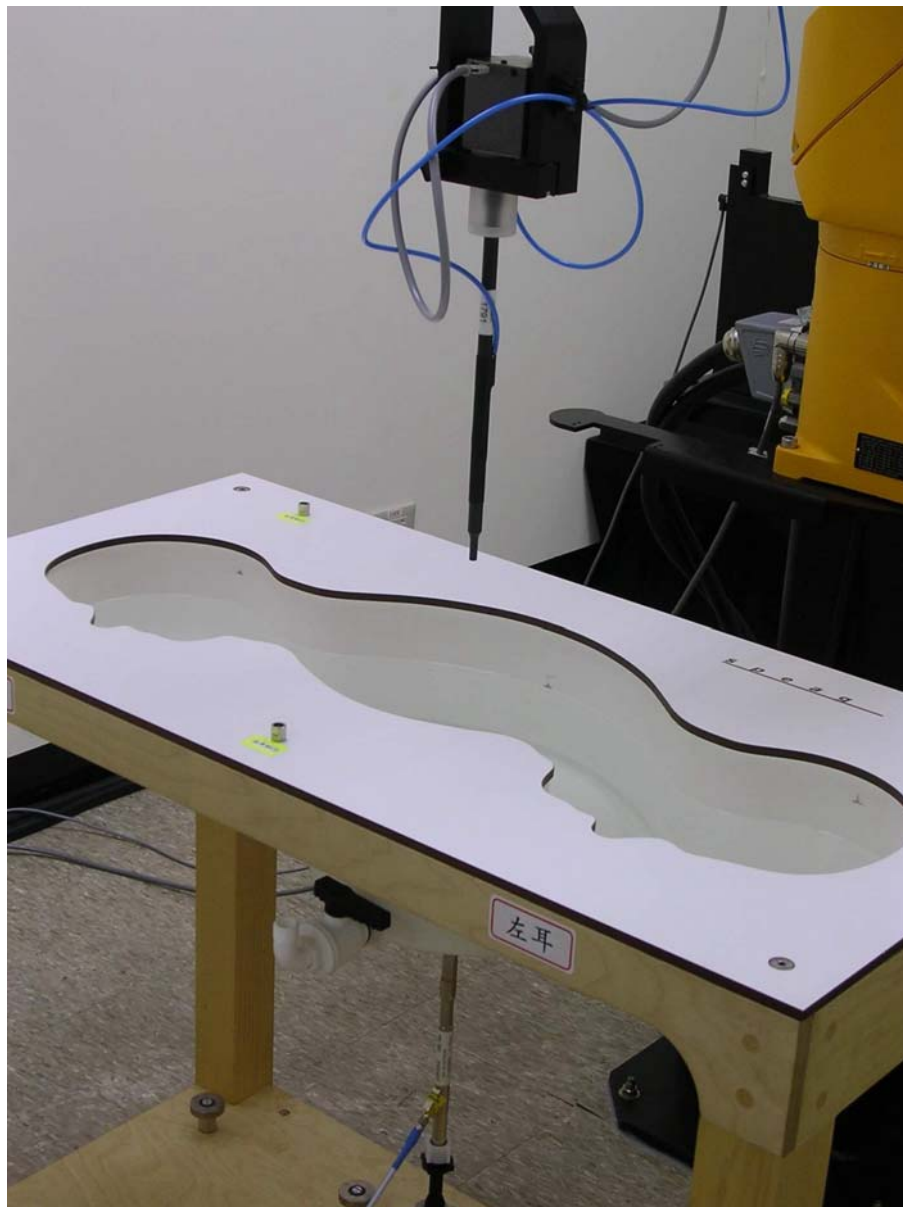


ANNEX B: SAR RESULTS

System Performance Check

Head



Date/Time: 6/23/2009 8:45:44 AM

Test Laboratory: Electronics Testing Center, Taiwan

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:xxx

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 1900$ MHz; $\sigma = 1.4$ mho/m; $\epsilon_r = 38.2$; $\rho = 1000$ kg/m³
Air temperature: 24 degC; Liquid temperature: 22.2 degC;
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3555; ConvF(6.68, 6.68, 6.68); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn871; Calibrated: 9/24/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

SPC/Area Scan (31x71x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 13.9 mW/g

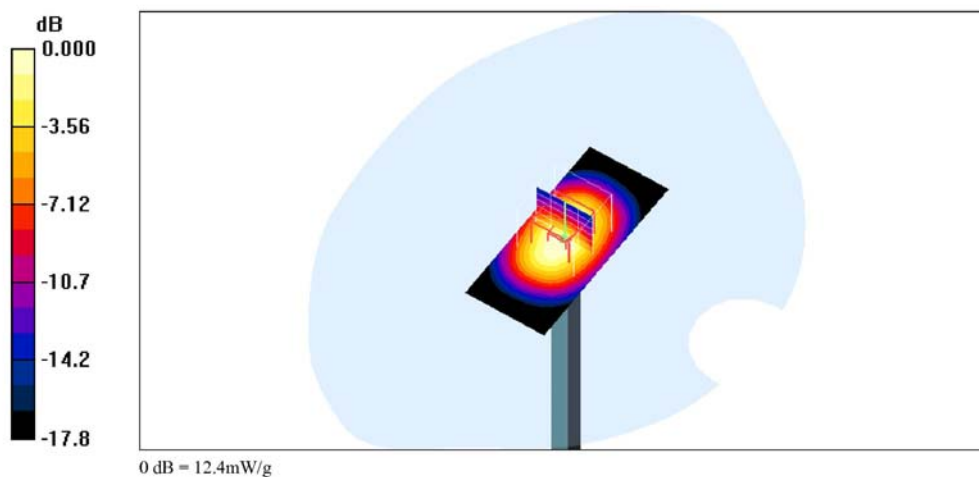
SPC/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

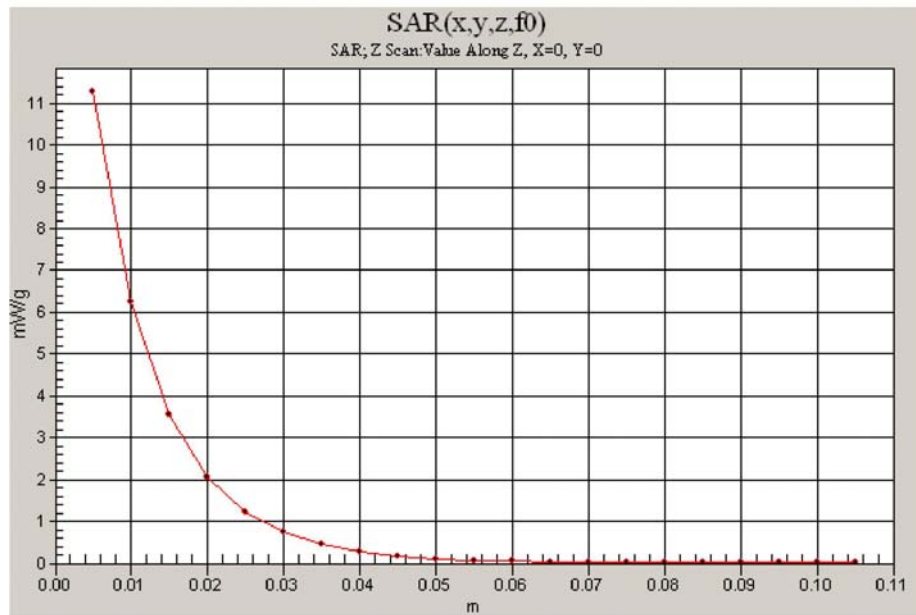
Reference Value = 93.3 V/m; Power Drift = -0.074 dB

Peak SAR (extrapolated) = 20.7 W/kg

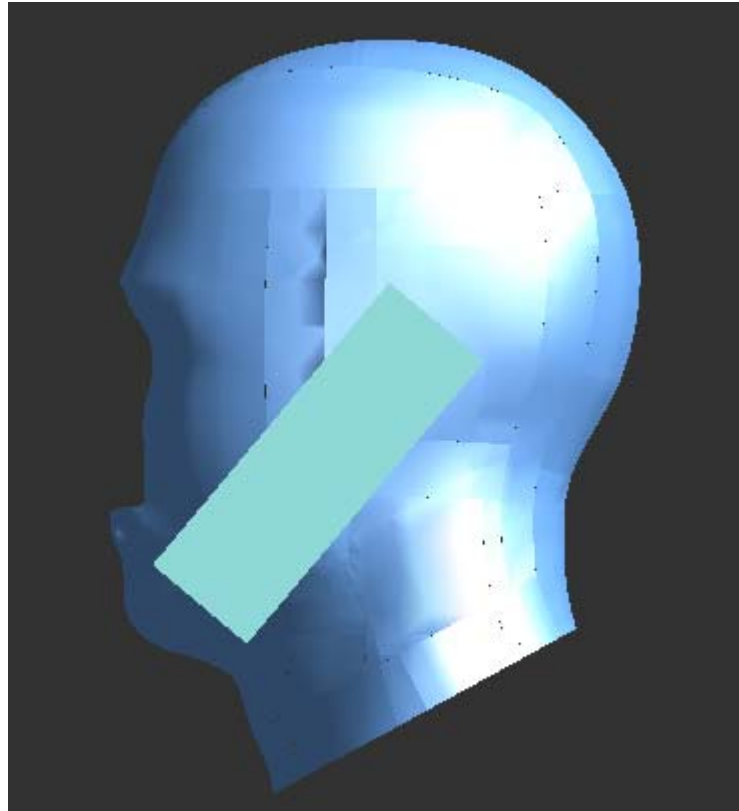
SAR(1 g) = 11.1 mW/g; SAR(10 g) = 5.79 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 12.4 mW/g





Left Head



Left Cheek

Date/Time: 6/23/2009 9:54:25 AM

Test Laboratory: Electronics Testing Center, Taiwan

DUT: DECT Phone; Type: PP; Serial: ID965

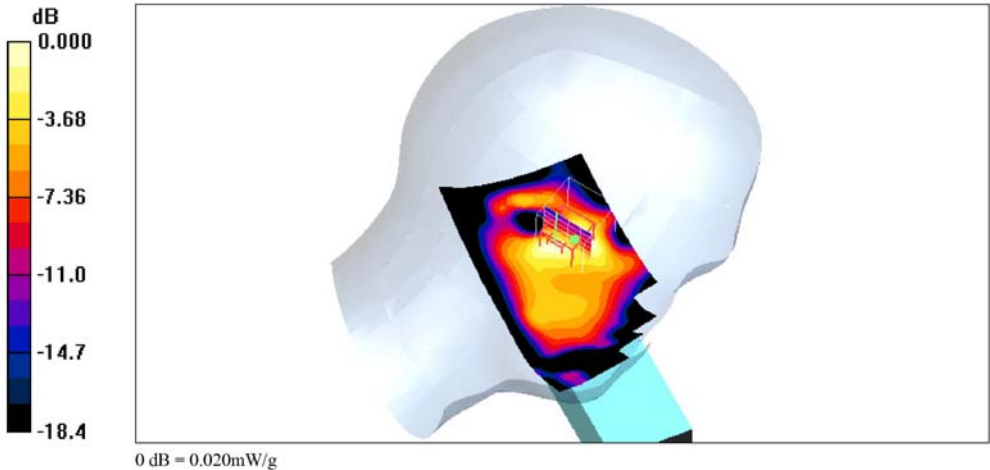
Communication System: US DECT-1900; Frequency: 1925 MHz; Duty Cycle: 1:24
Medium parameters used: $f = 1925.05 \text{ MHz}$; $\sigma = 1.43 \text{ mho/m}$; $\epsilon_r = 38.1$; $\rho = 1000 \text{ kg/m}^3$
Air temperature: 24 degC; Liquid temperature: 22.2 degC;
Phantom section: Left Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3555; ConvF(6.68, 6.68, 6.68); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn871; Calibrated: 9/24/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

LC-MID/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.44 V/m; Power Drift = -0.165 dB
Peak SAR (extrapolated) = 0.028 W/kg
SAR(1 g) = 0.0167 mW/g; SAR(10 g) = 0.00879 mW/g

Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement.
Maximum value of SAR (measured) = 0.020 mW/g

LC-MID/Area Scan (61x141x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.023 mW/g



Left Tilted

Date/Time: 6/23/2009 10:08:09 AM

Test Laboratory: Electronics Testing Center, Taiwan

DUT: DECT Phone; Type: PP; Serial: ID965

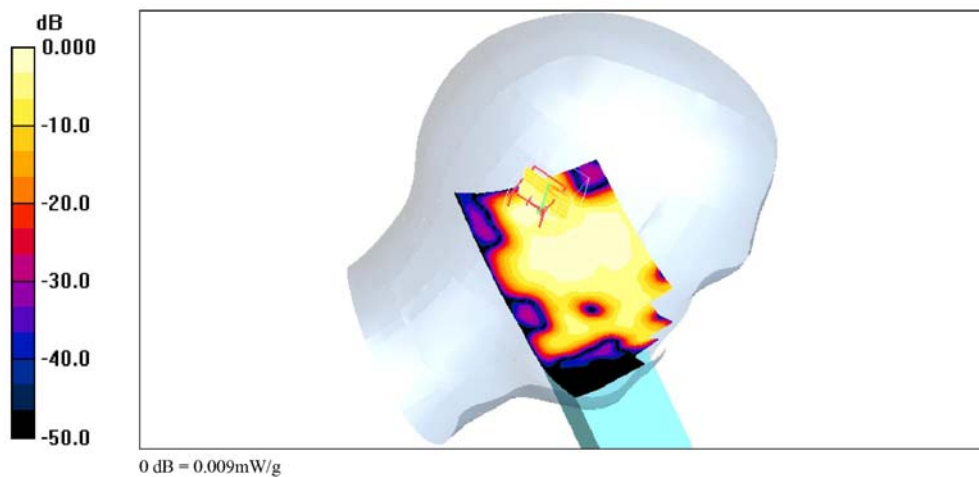
Communication System: US DECT-1900; Frequency: 1925 MHz; Duty Cycle: 1:24
Medium parameters used: $f = 1925.05$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³
Air temperature: 24 degC; Liquid temperature: 22.2 degC;
Phantom section: Left Section

DASY4 Configuration:

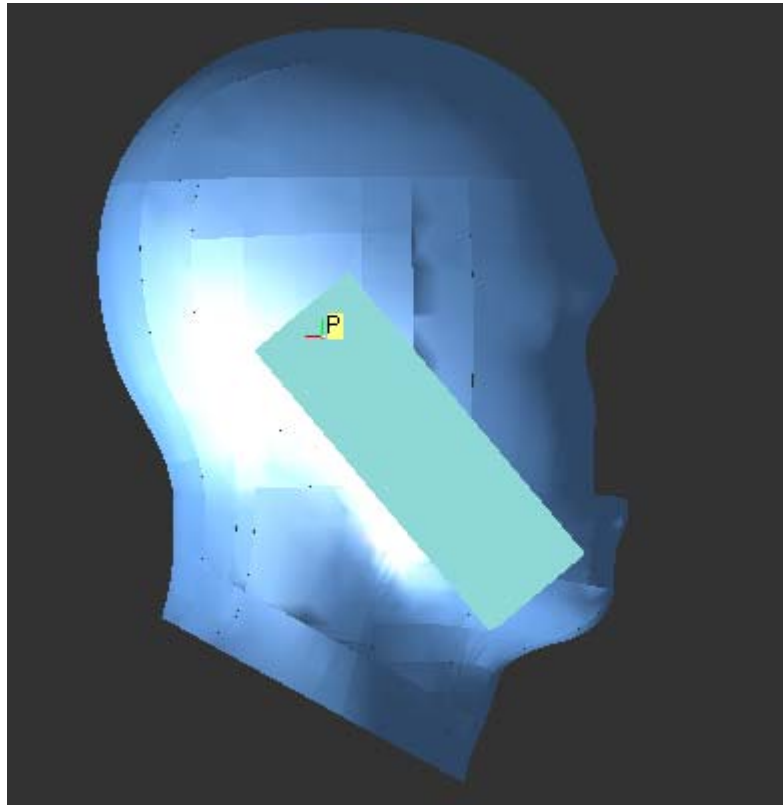
- Probe: EX3DV4 - SN3555; ConvF(6.68, 6.68, 6.68); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn871; Calibrated: 9/24/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

LT-MID/Area Scan (61x141x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.014 mW/g

LT-MID/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.06 V/m; Power Drift = 0.142dB
Peak SAR (extrapolated) = 0.017 W/kg
SAR(1 g) = 0.0077 mW/g; SAR(10 g) = 0.00323 mW/g
Maximum value of SAR (measured) = 0.009 mW/g



Right Head



Right Cheek

Date/Time: 6/23/2009 11:02:56 AM

Test Laboratory: Electronics Testing Center, Taiwan

DUT: DECT Phone; Type: PP; Serial: ID965

Communication System: US DECT-1900; Frequency: 1925 MHz; Duty Cycle: 1:24
Medium parameters used: $f = 1925.05$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³
Air temperature: 24 degC; Liquid temperature: 22.2 degC;
Phantom section: Right Section

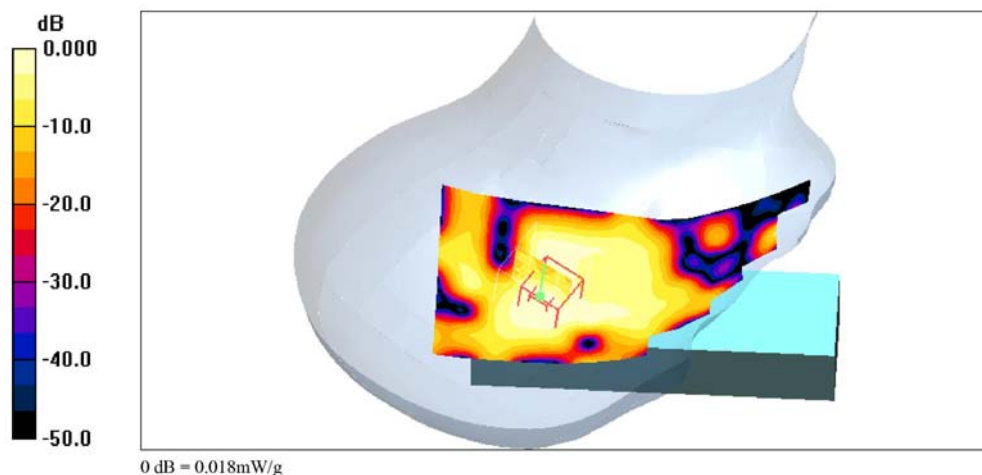
DASY4 Configuration:

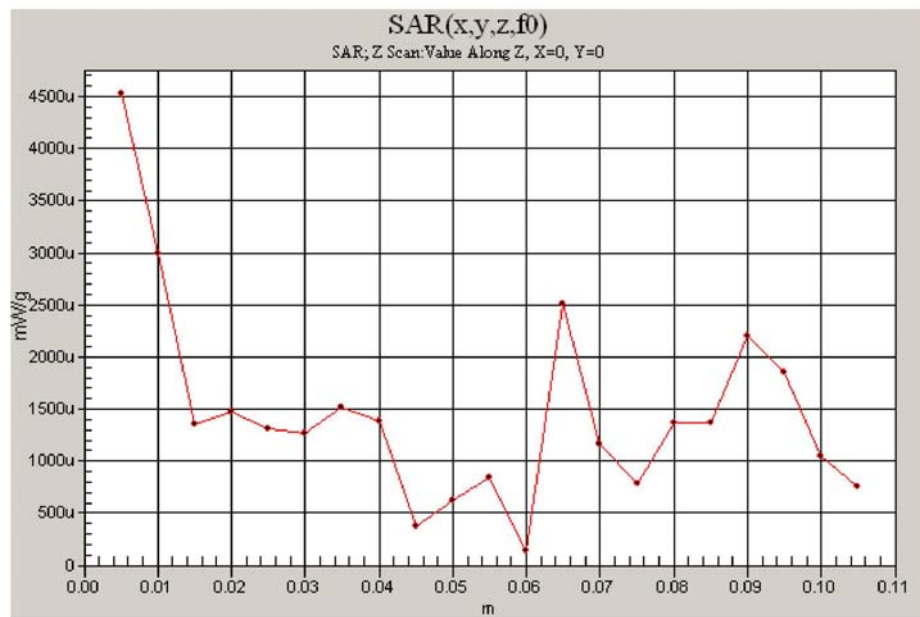
- Probe: EX3DV4 - SN3555; ConvF(6.68, 6.68, 6.68); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn871; Calibrated: 9/24/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

RC-MID/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.85 V/m; Power Drift = -0.178 dB
Peak SAR (extrapolated) = 0.030 W/kg
SAR(1 g) = 0.0168 mW/g; SAR(10 g) = 0.00895 mW/g

Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement.
Maximum value of SAR (measured) = 0.018 mW/g

RC-MID/Area Scan (61x141x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.019 mW/g





Right Tilted

Date/Time: 6/23/2009 11:14:38 AM

Test Laboratory: Electronics Testing Center, Taiwan

DUT: DECT Phone; Type: PP; Serial: ID965

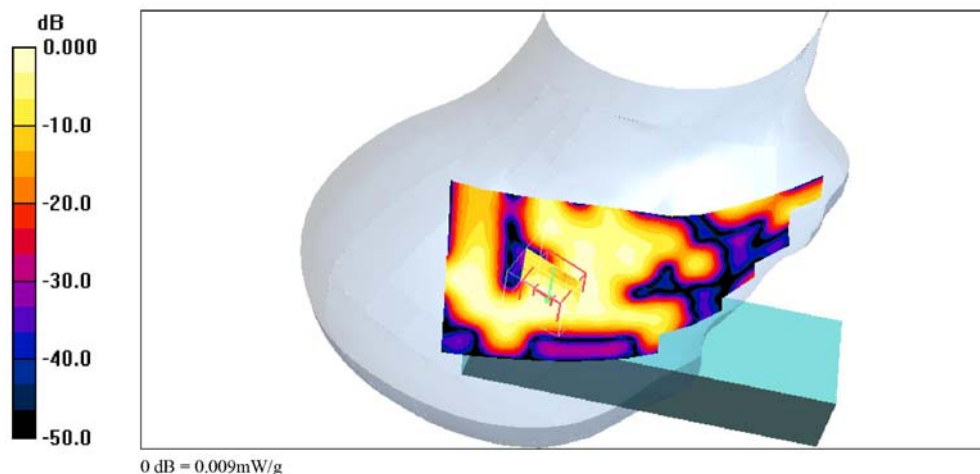
Communication System: US DECT-1900; Frequency: 1925 MHz; Duty Cycle: 1:24
Medium parameters used: $f = 1925.05$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³
Air temperature: 24 degC; Liquid temperature: 22.2 degC;
Phantom section: Right Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3555; ConvF(6.68, 6.68, 6.68); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn871; Calibrated: 9/24/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

RT-MID/Area Scan (61x141x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.023 mW/g

RT-MID/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.85 V/m; Power Drift = 0.147 dB
Peak SAR (extrapolated) = 0.015 W/kg
SAR(1 g) = 0.0083 mW/g; SAR(10 g) = 0.00444 mW/g
Maximum value of SAR (measured) = 0.009 mW/g



Right Cheek

Date/Time: 6/23/2009 11:51:14 AM

Test Laboratory: Electronics Testing Center, Taiwan

DUT: DECT Phone; Type: PP; Serial: ID965

Communication System: US DECT-1900; Frequency: 1928.5 MHz; Duty Cycle: 1:24
Medium parameters used: $f = 1928.65$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³
Air temperature: 24 degC; Liquid temperature: 22.2 degC;
Phantom section: Right Section

DASY4 Configuration:

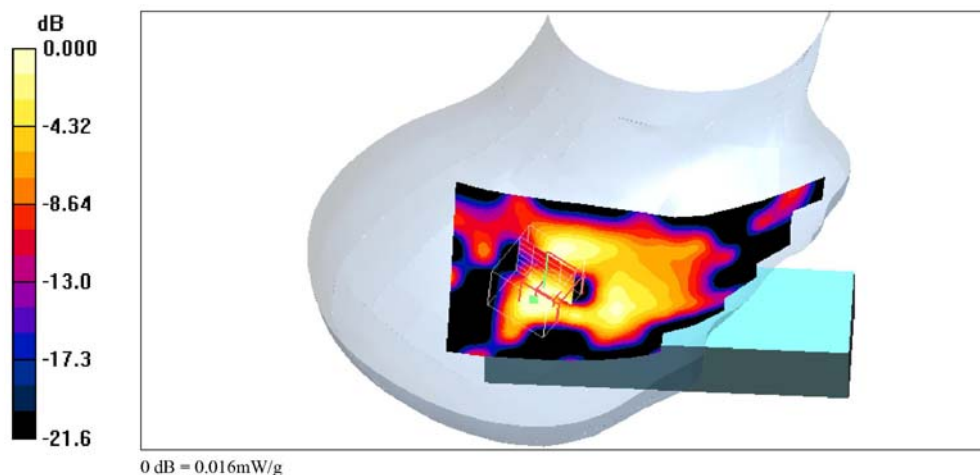
- Probe: EX3DV4 - SN3555; ConvF(6.68, 6.68, 6.68); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn871; Calibrated: 9/24/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

RC-HIGH/Area Scan (61x141x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.025 mW/g

RC-HIGH/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.19 V/m; Power Drift = 0.114 dB
Peak SAR (extrapolated) = 0.024 W/kg
SAR(1 g) = 0.0144 mW/g; SAR(10 g) = 0.00771 mW/g

Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement.

Maximum value of SAR (measured) = 0.016 mW/g



Right Cheek

Date/Time: 6/23/2009 12:11:49 PM

Test Laboratory: Electronics Testing Center, Taiwan

DUT: DECT Phone; Type: PP; Serial: ID965

Communication System: US DECT-1900; Frequency: 1921.5 MHz; Duty Cycle: 1:24
Medium parameters used (interpolated): $f = 1921.5$ MHz; $\sigma = 1.42$ mho/m; $\epsilon_r = 38.1$; $\rho = 1000$ kg/m³
Air temperature: 24 degC; Liquid temperature: 22.2 degC;
Phantom section: Right Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3555; ConvF(6.68, 6.68, 6.68); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn871; Calibrated: 9/24/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

RC-LOW/Area Scan (61x141x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.019 mW/g

RC-LOW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.84 V/m; Power Drift = 0.132 dB

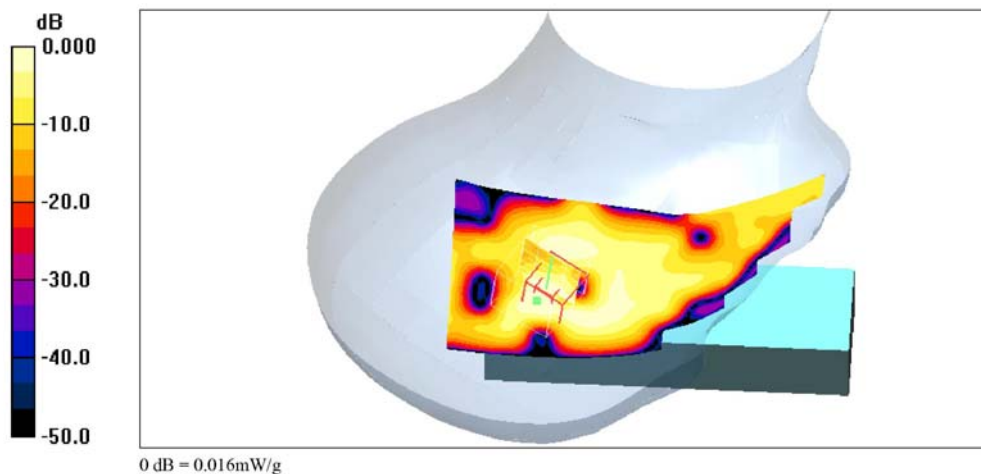
Peak SAR (extrapolated) = 0.021 W/kg

SAR(1 g) = 0.0135 mW/g; SAR(10 g) = 0.00704 mW/g

Info: Interpolated medium parameters used for SAR evaluation.

Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement.

Maximum value of SAR (measured) = 0.016 mW/g



ANNEX C: DIPOLE CERTIFICATE

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



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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 **ETC (Auden)**

Certificate No: **D1900V2-5d054-Sep08**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d054**

Calibration procedure(s) **QA CAL-05.v7**
Calibration procedure for dipole validation kits

Calibration date: **September 23, 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	04-Oct-07 (No. 217-00736)	Oct-08
Power sensor HP 8481A	US37292783	04-Oct-07 (No. 217-00736)	Oct-08
Reference 20 dB Attenuator	SN: 5086 (20g)	01-Jul-08 (No. 217-00864)	Jul-09
Type-N mismatch combination	SN: 5047.2 / 06327	01-Jul-08 (No. 217-00867)	Jul-09
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
DAE4	SN: 601	14-Mar-08 (No. DAE4-601_Mar08)	Mar-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 25, 2008

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

Certificate No: D1900V2-5d054_Sep08

Page 1 of 9

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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
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
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
- 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:

- DASY4/5 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.

Measurement Conditions

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

DASY Version	DASY5	V5.0
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	40.7 $\pm$ 6 %	1.47 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.5 $\pm$ 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	10.4 mW / g
SAR normalized	normalized to 1W	41.6 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	41.0 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.41 mW / g
SAR normalized	normalized to 1W	21.6 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	21.6 mW / g $\pm$ 16.5 % (k=2)

¹ 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	52.1 ± 6 %	1.6 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	—	—

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.3 mW / g
SAR normalized	normalized to 1W	41.2 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	39.5 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.32 mW / g
SAR normalized	normalized to 1W	21.3 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	20.8 mW / g ± 16.5 % (k=2)

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

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$53.9 \Omega + 4.6 j\Omega$
Return Loss	- 24.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$49.9 \Omega + 6.7 j\Omega$
Return Loss	- 23.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 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	March 19, 2004

DASY5 Validation Report for Head TSL

Date/Time: 23.09.2008 15:38:20

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d054

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

Medium: HSL U10 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.47$ mho/m; $\epsilon_r = 40.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.9, 4.9, 4.9); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 119; SEMCAD X Version 13.2 Build 87

Pin = 250 mW; dip = 10 mm, scan at 3.4mm/Zoom Scan (dist=3.4mm, probe 0deg)

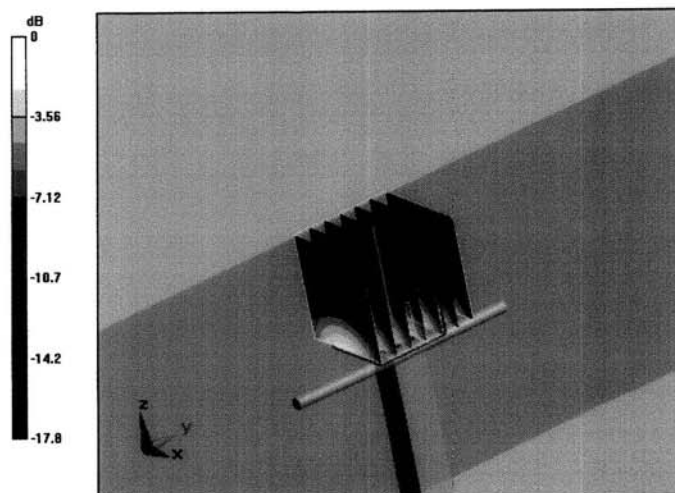
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.3 V/m; Power Drift = 0.010 dB

Peak SAR (extrapolated) = 19.3 W/kg

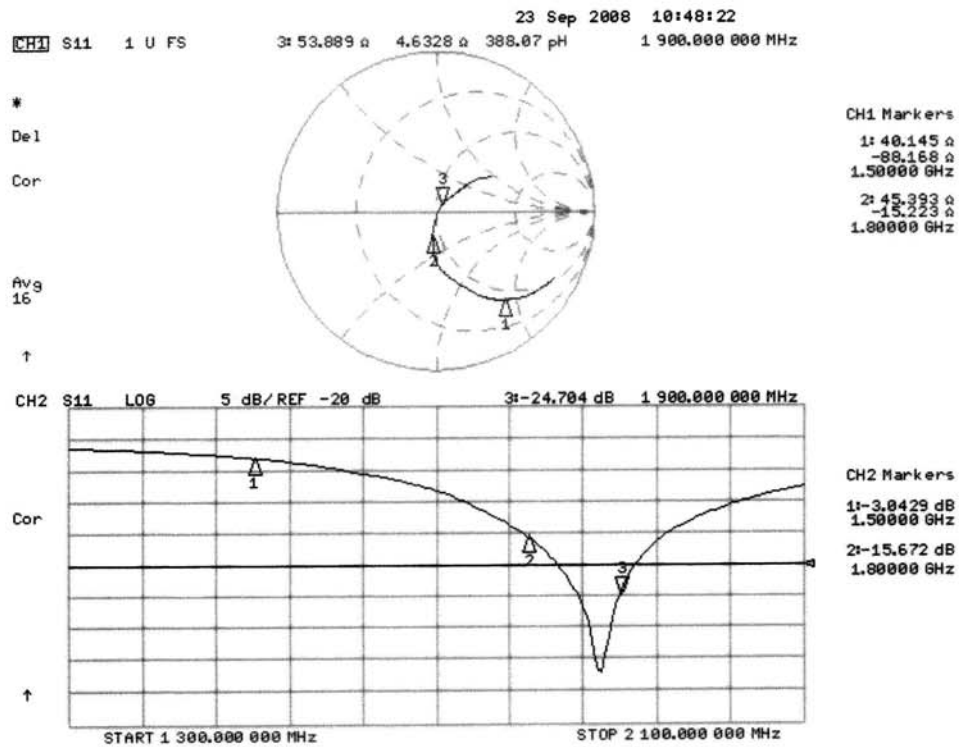
SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.41 mW/g

Maximum value of SAR (measured) = 12.5 mW/g



0 dB = 12.5mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 15.09.2008 14:34:09

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d054

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

Medium: MSL U10 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.6$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.5, 4.5, 4.5); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.0 Build 119; SEMCAD X Version 13.2 Build 87

Pin = 250 mW; dip = 10 mm, scan at 3.4mm/Zoom Scan (dist=3.4mm, probe 0deg)

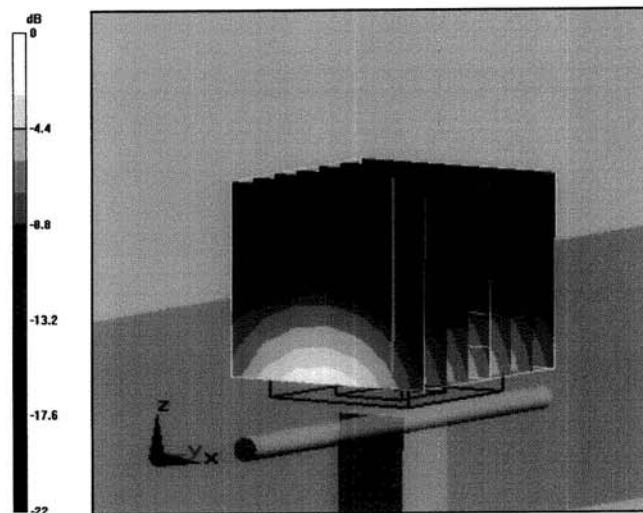
(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.1 V/m; Power Drift = 0.017 dB

Peak SAR (extrapolated) = 18.6 W/kg

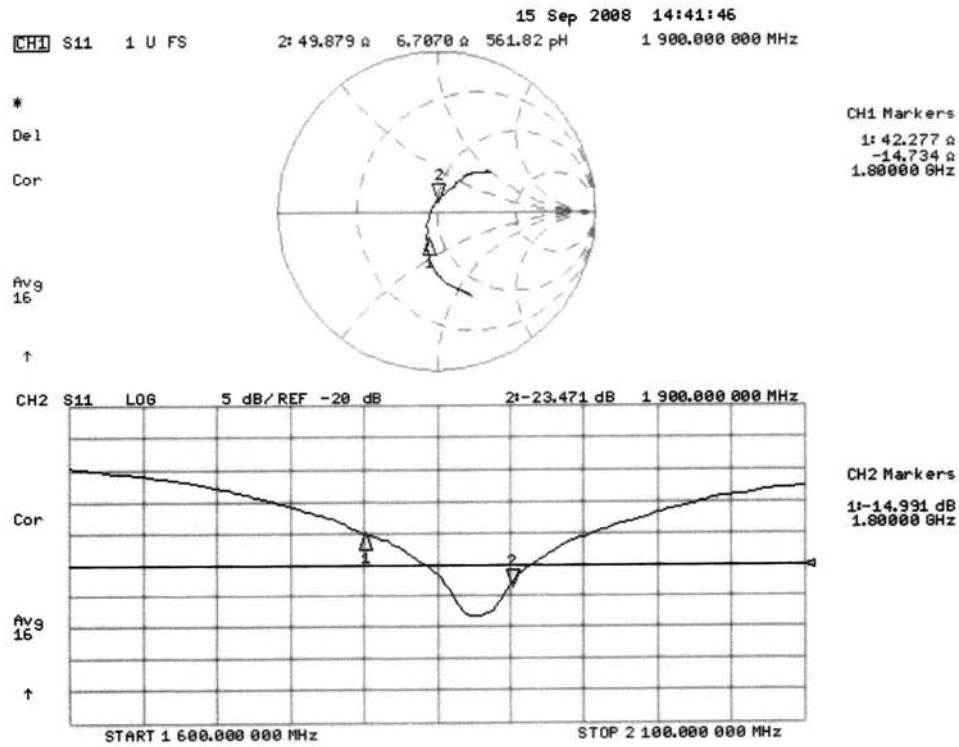
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.32 mW/g

Maximum value of SAR (measured) = 12.4 mW/g



0 dB = 12.4mW/g

Impedance Measurement Plot for Body TSL



ANNEX D: PROBE CERTIFICATE

Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **ETC (Auden)**

Certificate No: **EX3-3555_Sep08**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3555**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-14.v3 and QA CAL-23.v3
Calibration procedure for dosimetric E-field probes**

Calibration date: **September 19, 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
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-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: September 20, 2008

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

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



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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., $\vartheta = 0$ is normal to probe axis

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,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.
- DCP_{x,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 NORM_{x,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.

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Probe EX3DV4

SN:3555

Manufactured:	July 13, 2004
Last calibrated:	September 27, 2007
Recalibrated:	September 19, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

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DASY - Parameters of Probe: EX3DV4 SN:3555

Sensitivity in Free Space^A

Diode Compression^B

NormX	0.40 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	95 mV
NormY	0.41 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	103 mV
NormZ	0.40 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	93 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	2.0 mm	3.0 mm
SAR _{be} [%] Without Correction Algorithm	10.4	6.0
SAR _{be} [%] With Correction Algorithm	0.8	0.5

TSL 1750 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance	2.0 mm	3.0 mm
SAR _{be} [%] Without Correction Algorithm	8.6	4.6
SAR _{be} [%] With Correction Algorithm	0.6	0.1

Sensor Offset

Probe Tip to Sensor Center 1.0 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).

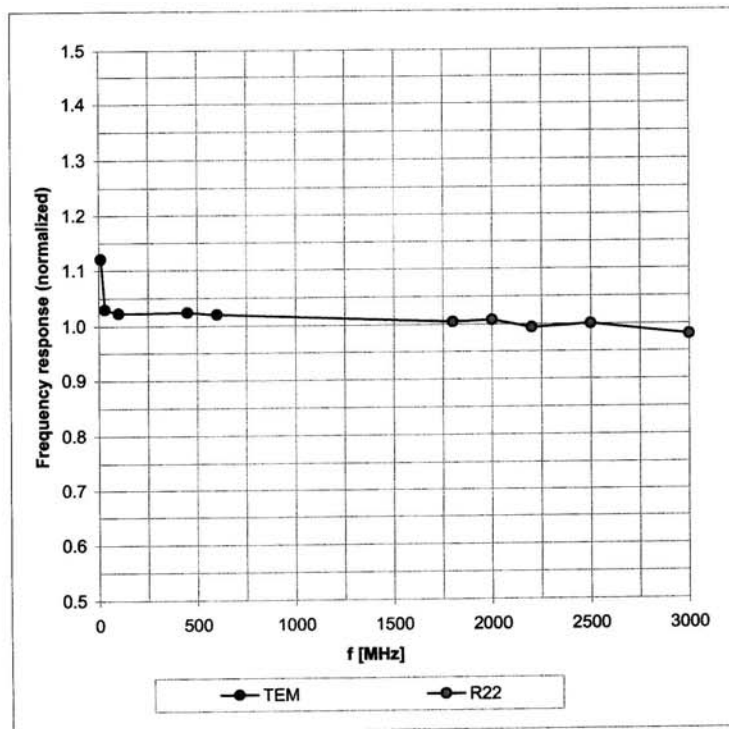
^B Numerical linearization parameter: uncertainty not required.

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Frequency Response of E-Field

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

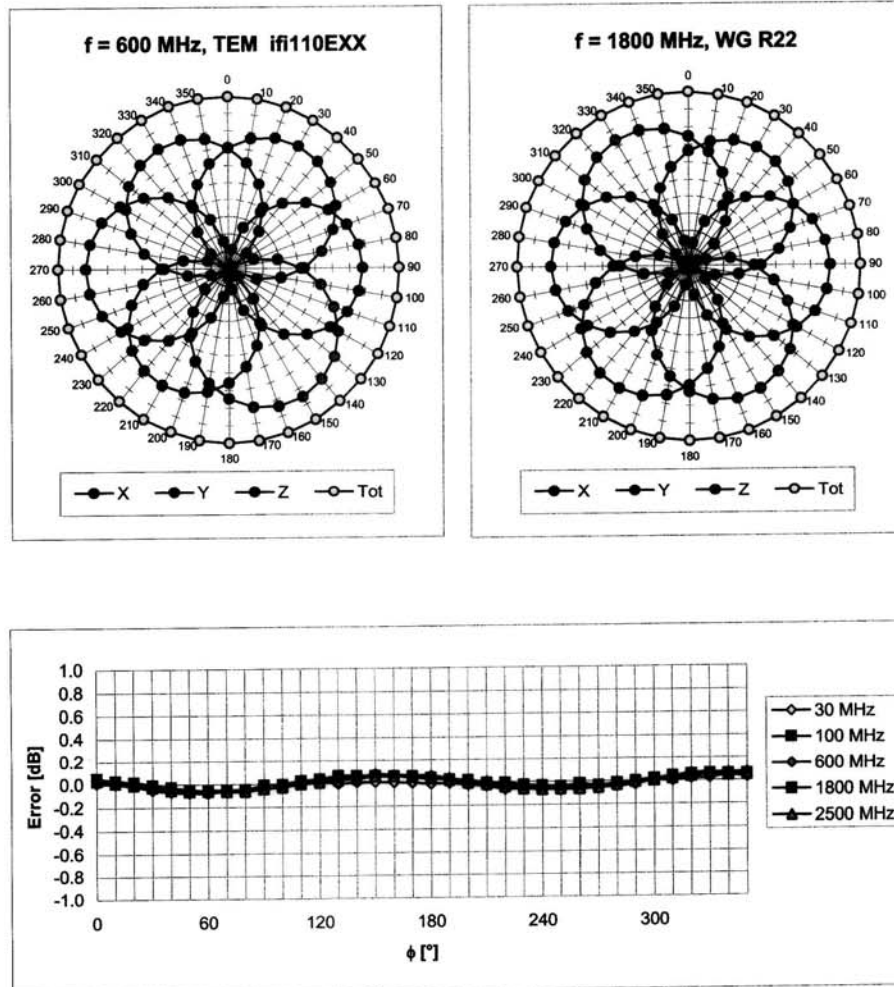


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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



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

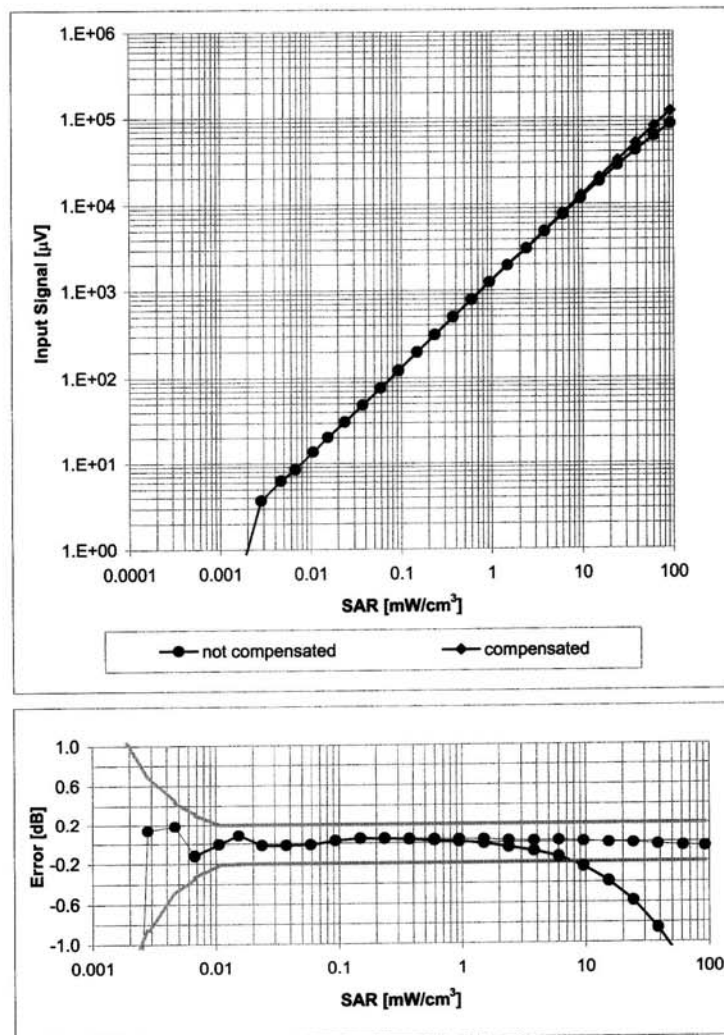
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Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800 \text{ MHz}$)

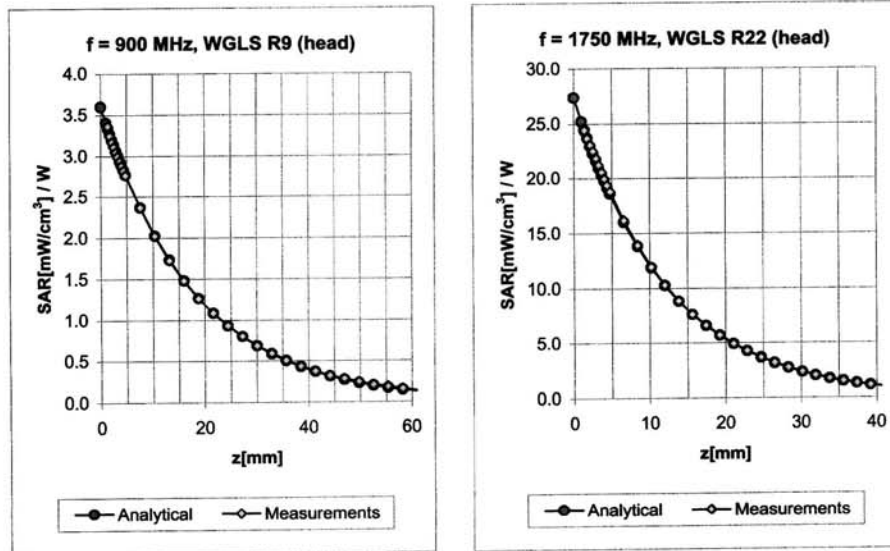


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

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Conversion Factor Assessment



f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.29	1.13	8.03 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.39	0.79	7.03 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.66	0.62	6.68 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.47	0.72	6.40 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.30	1.17	8.01 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.38	0.85	6.87 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.32	0.92	6.70 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.34	1.00	6.17 ± 11.0% (k=2)
5200	± 50 / ± 100	Body	49.0 ± 5%	5.30 ± 5%	0.48	1.70	4.08 ± 13.1% (k=2)
5500	± 50 / ± 100	Body	48.6 ± 5%	5.65 ± 5%	0.48	1.70	3.86 ± 13.1% (k=2)
5800	± 50 / ± 100	Body	48.2 ± 5%	6.00 ± 5%	0.48	1.70	3.82 ± 13.1% (k=2)

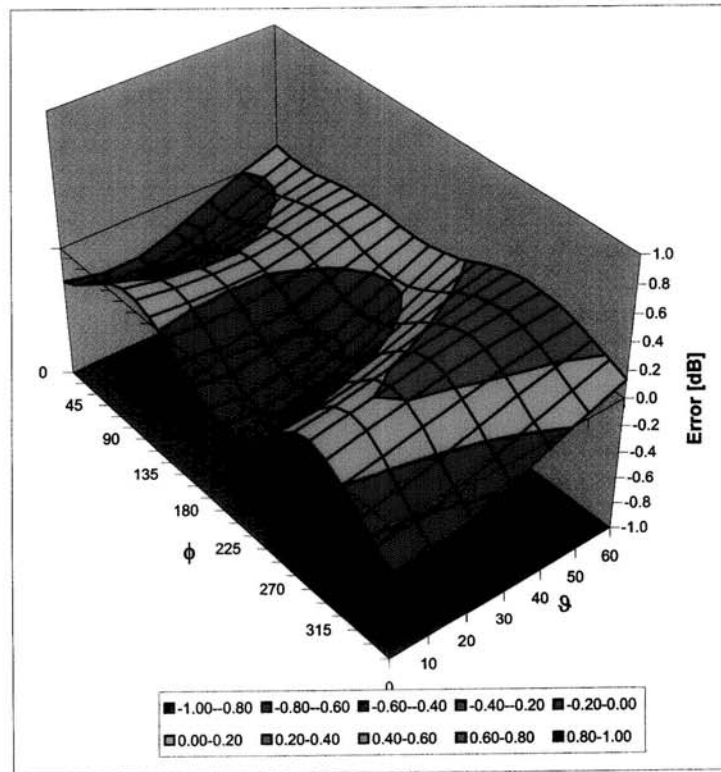
^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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Deviation from Isotropy in HSL

Error (ϕ , θ), $f = 900$ MHz



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