## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 49.4 Ω - 7.6 jΩ |
| Return Loss | - 22.3 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 51.0 Ω - 9.5 jΩ |
| Return Loss | - 20.5 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.386 ns |

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

| | |
|---|---|
| Manufactured by | SPEAG |
| Manufactured on | July 26, 2001 |

## DASY5 Validation Report for Head TSL

Date: 29.08.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 443**

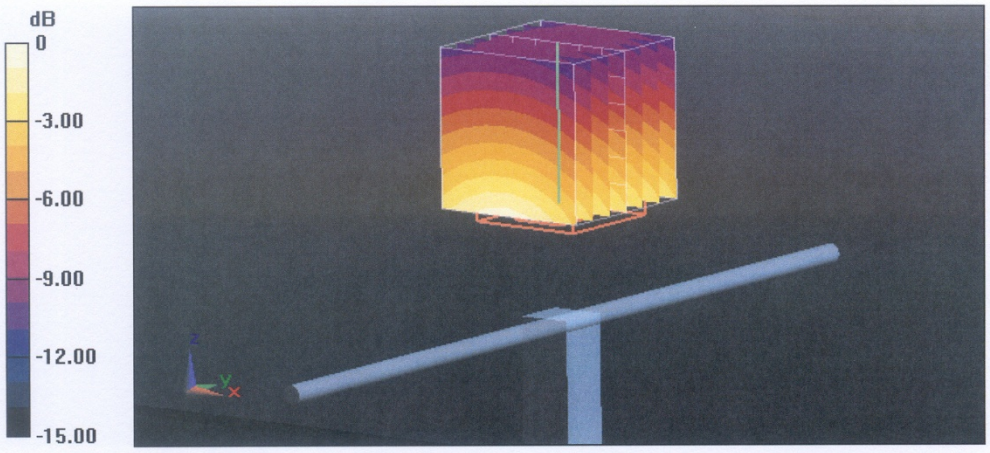
Communication System: UID 0 - CW ; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma$ = 0.92 S/m; $\varepsilon_r$ = 41.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.05, 6.05, 6.05); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

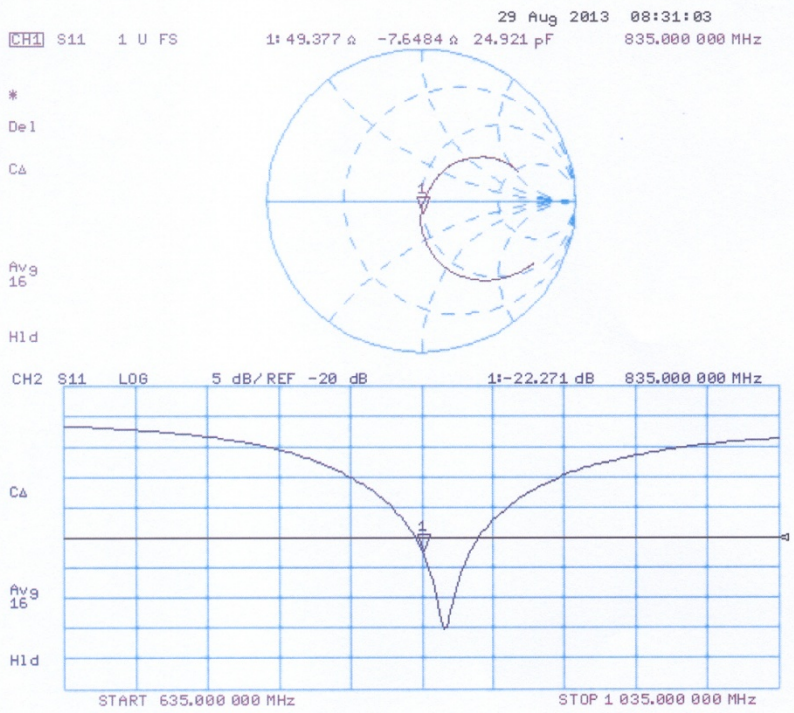
### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.828 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.63 W/kg
**SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.56 W/kg**
Maximum value of SAR (measured) = 2.81 W/kg




0 dB = 2.81 W/kg = 4.49 dBW/kg

## Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 29.08.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 443**

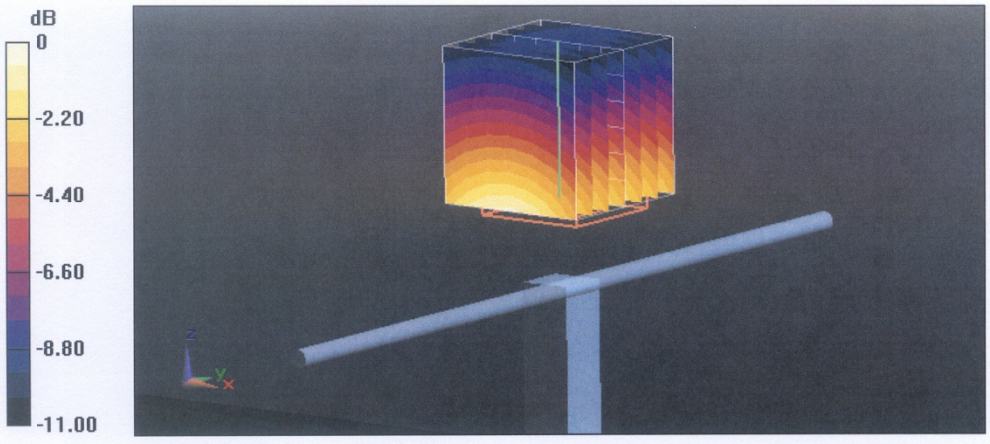
Communication System: UID 0 - CW ; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma$ = 1.01 S/m; $\varepsilon_r$ = 54.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

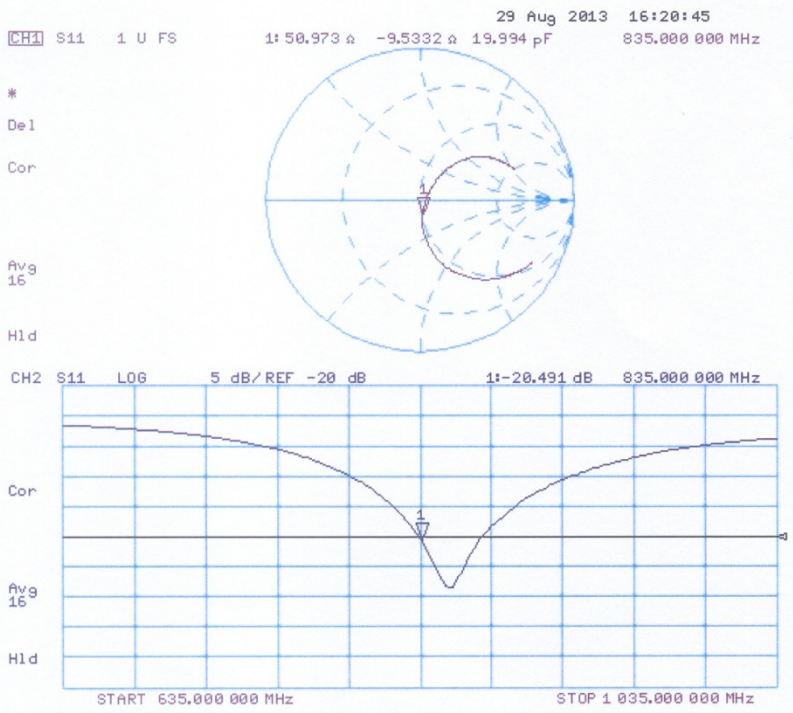
### Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.828 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.57 W/kg
**SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.59 W/kg**
Maximum value of SAR (measured) = 2.82 W/kg




0 dB = 2.82 W/kg = 4.50 dBW/kg

## Impedance Measurement Plot for Body TSL



**1900 MHz 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 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 TMC-BJ (Auden)

Certificate No: D1900V2-5d101_Jul13

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D1900V2 - SN: 5d101 |
| Calibration procedure(s) | QA CAL-05.v9<br>Calibration procedure for dipole validation kits above 700 MHz |
| Calibration date: | July 09, 2013 |

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 EPM-442A | GB37480704 | 01-Nov-12 (No. 217-01640) | Oct-13 |
| Power sensor HP 8481A | US37292783 | 01-Nov-12 (No. 217-01640) | Oct-13 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 04-Apr-13 (No. 217-01736) | Apr-14 |
| Type-N mismatch combination | SN: 5047.3 / 06327 | 04-Apr-13 (No. 217-01739) | Apr-14 |
| Reference Probe ES3DV3 | SN: 3205 | 28-Dec-12 (No. ES3-3205_Dec12) | Dec-13 |
| DAE4 | SN: 601 | 25-Apr-13 (No. DAE4-601_Apr13) | Apr-14 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06 | 100005 | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Leif Klysner | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: July 9, 2013

**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 |
| ConvF | sensitivity in TSL / NORM x,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 300 MHz to 3 GHz)", 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) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

## Measurement Conditions

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

| | | |
|---|---|---|
| **DASY Version** | DASY5 | V52.8.7 |
| **Extrapolation** | Advanced Extrapolation | |
| **Phantom** | Modular Flat Phantom | |
| **Distance Dipole Center - TSL** | 10 mm | with Spacer |
| **Zoom Scan Resolution** | dx, dy, dz = 5 mm | |
| **Frequency** | 1900 MHz ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 40.0 | 1.40 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 38.9 ± 6 % | 1.36 mho/m ± 6 % |
| **Head TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 cm³ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 10.0 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **40.4 W/kg ± 17.0 % (k=2)** |

| **SAR averaged over 10 cm³ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.28 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **21.3 W/kg ± 16.5 % (k=2)** |

## 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 | 53.4 ± 6 % | 1.49 mho/m ± 6 % |
| **Body TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 cm³ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 10.2 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | **41.3 W/kg ± 17.0 % (k=2)** |

| **SAR averaged over 10 cm³ (10 g) of Body TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.43 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | **21.9 W/kg ± 16.5 % (k=2)** |

## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 51.0 Ω + 6.0 jΩ |
| Return Loss | - 24.4 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 46.7 Ω + 6.5 jΩ |
| Return Loss | - 22.5 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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

| | |
|---|---|
| Manufactured by | SPEAG |
| Manufactured on | March 28, 2008 |

## DASY5 Validation Report for Head TSL

Date: 09.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

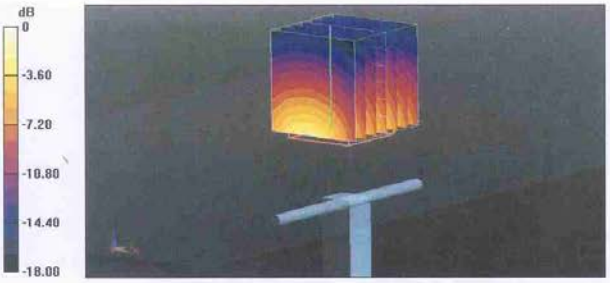
**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d101**

Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma$ = 1.36 S/m; $\varepsilon_r$ = 38.9; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

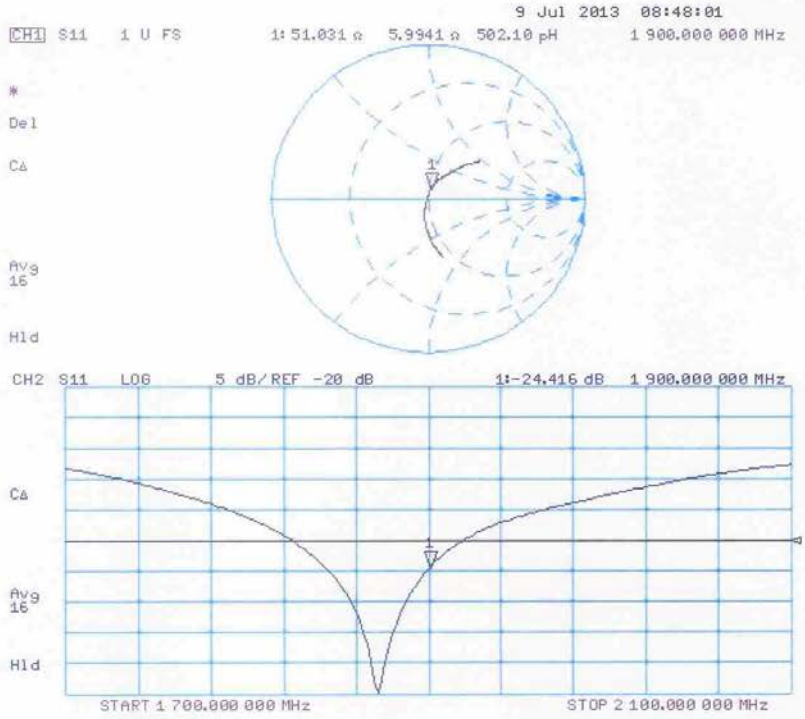
- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.435 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 18.2 W/kg
**SAR(1 g) = 10 W/kg; SAR(10 g) = 5.28 W/kg**
Maximum value of SAR (measured) = 12.2 W/kg




0 dB = 12.2 W/kg = 10.86 dBW/kg

## Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 09.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

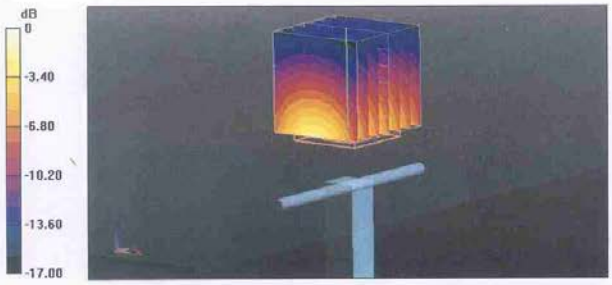
**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d101**

Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma$ = 1.49 S/m; $\varepsilon_r$ = 53.4; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

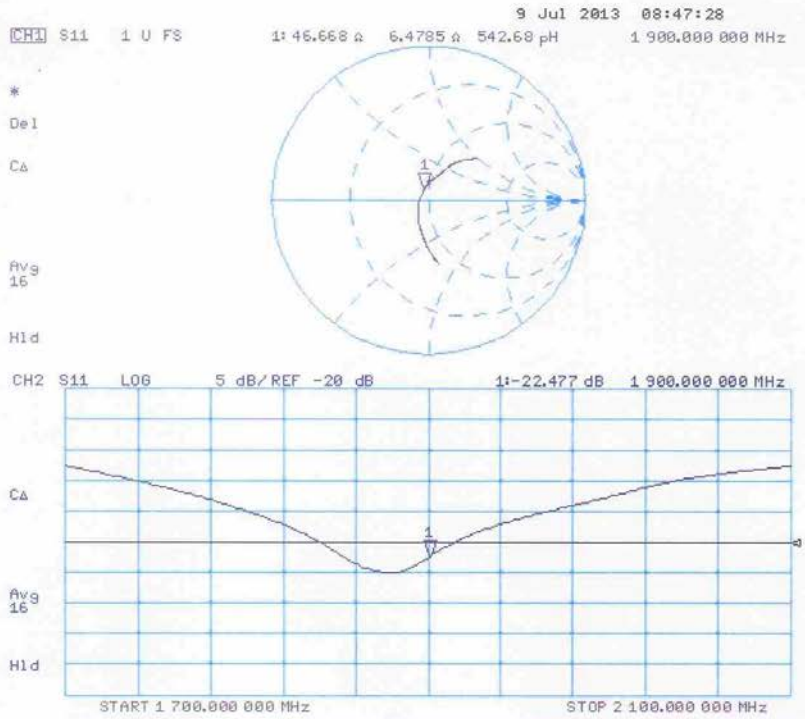
- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.435 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 17.4 W/kg
**SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.43 W/kg**
Maximum value of SAR (measured) = 12.7 W/kg




0 dB = 12.7 W/kg = 11.04 dBW/kg

## Impedance Measurement Plot for Body TSL



**2450 MHz 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 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 TMC-BJ (Auden)

Certificate No: D2450V2-853_Jul13

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D2450V2 - SN: 853 |
| Calibration procedure(s) | QA CAL-05.v9<br>Calibration procedure for dipole validation kits above 700 MHz |
| Calibration date: | July 08, 2013 |

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 EPM-442A | GB37480704 | 01-Nov-12 (No. 217-01640) | Oct-13 |
| Power sensor HP 8481A | US37292783 | 01-Nov-12 (No. 217-01640) | Oct-13 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 04-Apr-13 (No. 217-01736) | Apr-14 |
| Type-N mismatch combination | SN: 5047.3 / 06327 | 04-Apr-13 (No. 217-01739) | Apr-14 |
| Reference Probe ES3DV3 | SN: 3205 | 28-Dec-12 (No. ES3-3205_Dec12) | Dec-13 |
| DAE4 | SN: 601 | 25-Apr-13 (No. DAE4-601_Apr13) | Apr-14 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power sensor HP 8481A | MY41092317 | 18-Oct-02 (in house check Oct-11) | In house check: Oct-13 |
| RF generator R&S SMT-06 | 100005 | 04-Aug-99 (in house check Oct-11) | In house check: Oct-13 |
| Network Analyzer HP 8753E | US37390585 S4206 | 18-Oct-01 (in house check Oct-12) | In house check: Oct-13 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Jeton Kastrati | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: July 9, 2013

**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 |
| ConvF | sensitivity in TSL / NORM x,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 300 MHz to 3 GHz)", 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) DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

## Measurement Conditions

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

| | | |
|---|---|---|
| **DASY Version** | DASY5 | V52.8.7 |
| **Extrapolation** | Advanced Extrapolation | |
| **Phantom** | Modular Flat Phantom | |
| **Distance Dipole Center - TSL** | 10 mm | with Spacer |
| **Zoom Scan Resolution** | dx, dy, dz = 5 mm | |
| **Frequency** | 2450 MHz ± 1 MHz | |

## Head TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Head TSL parameters** | 22.0 °C | 39.2 | 1.80 mho/m |
| **Measured Head TSL parameters** | (22.0 ± 0.2) °C | 37.8 ± 6 % | 1.81 mho/m ± 6 % |
| **Head TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Head TSL

| **SAR averaged over 1 cm³ (1 g) of Head TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 13.5 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **53.4 W/kg ± 17.0 % (k=2)** |

| **SAR averaged over 10 cm³ (10 g) of Head TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 6.28 W/kg |
| SAR for nominal Head TSL parameters | normalized to 1W | **24.9 W/kg ± 16.5 % (k=2)** |

## Body TSL parameters

The following parameters and calculations were applied.

| | **Temperature** | **Permittivity** | **Conductivity** |
|---|---|---|---|
| **Nominal Body TSL parameters** | 22.0 °C | 52.7 | 1.95 mho/m |
| **Measured Body TSL parameters** | (22.0 ± 0.2) °C | 50.5 ± 6 % | 2.01 mho/m ± 6 % |
| **Body TSL temperature change during test** | < 0.5 °C | ---- | ---- |

## SAR result with Body TSL

| **SAR averaged over 1 cm³ (1 g) of Body TSL** | Condition | |
|---|---|---|
| SAR measured | 250 mW input power | 12.9 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | **50.4 W/kg ± 17.0 % (k=2)** |

| **SAR averaged over 10 cm³ (10 g) of Body TSL** | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.93 W/kg |
| SAR for nominal Body TSL parameters | normalized to 1W | **23.4 W/kg ± 16.5 % (k=2)** |

## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 54.8 Ω + 3.4 jΩ |
| Return Loss | - 25.0 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 50.6 Ω + 4.7 jΩ |
| Return Loss | - 26.6 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.162 ns |

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

| | |
|---|---|
| Manufactured by | SPEAG |
| Manufactured on | November 10, 2009 |

## DASY5 Validation Report for Head TSL

Date: 08.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 853**

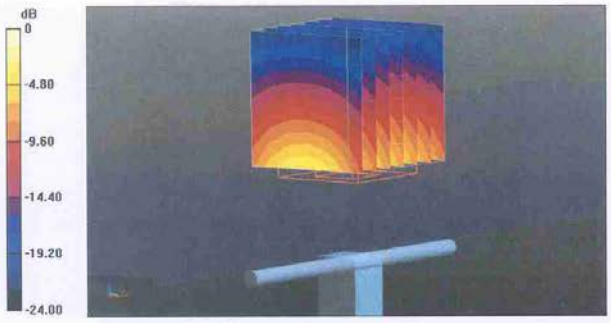
Communication System: UID 0 - CW ; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma$ = 1.81 S/m; $\varepsilon_r$ = 37.8; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

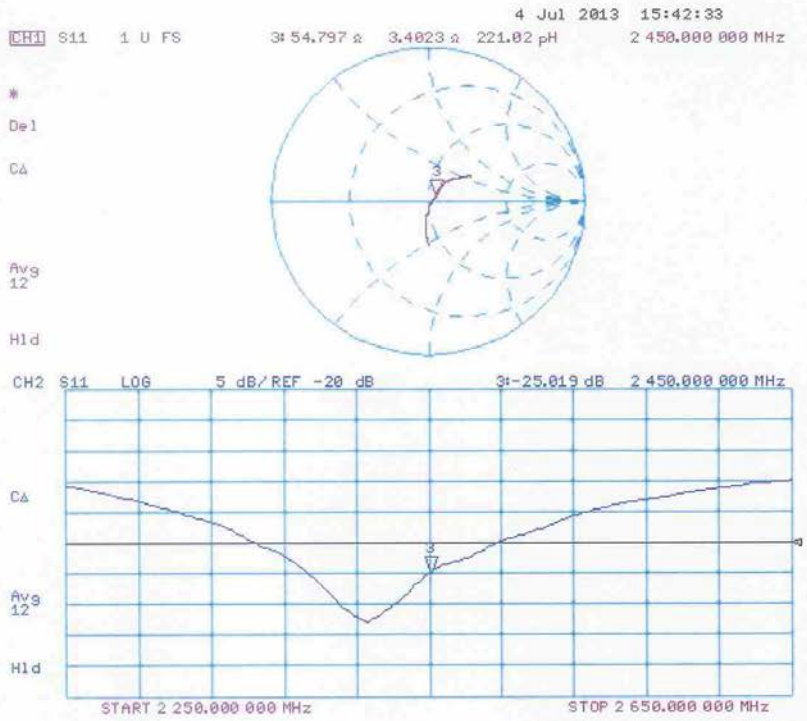
### Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.672 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 28.1 W/kg
**SAR(1 g) = 13.5 W/kg; SAR(10 g) = 6.28 W/kg**
Maximum value of SAR (measured) = 17.7 W/kg




0 dB = 17.7 W/kg = 12.48 dBW/kg

## Impedance Measurement Plot for Head TSL



## DASY5 Validation Report for Body TSL

Date: 05.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

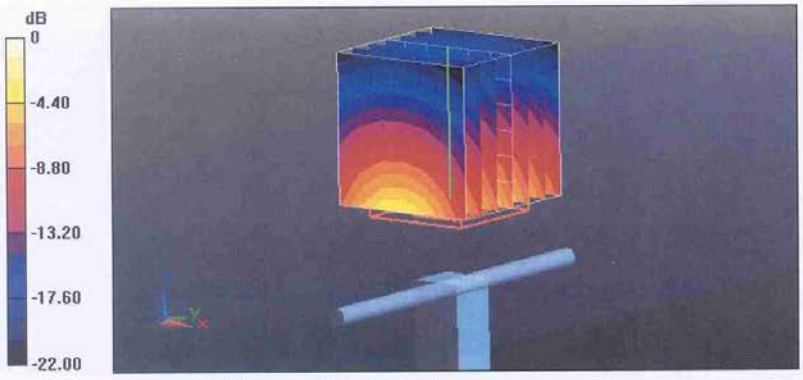
**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 853**

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma$ = 2.01 S/m; $\varepsilon_r$ = 50.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

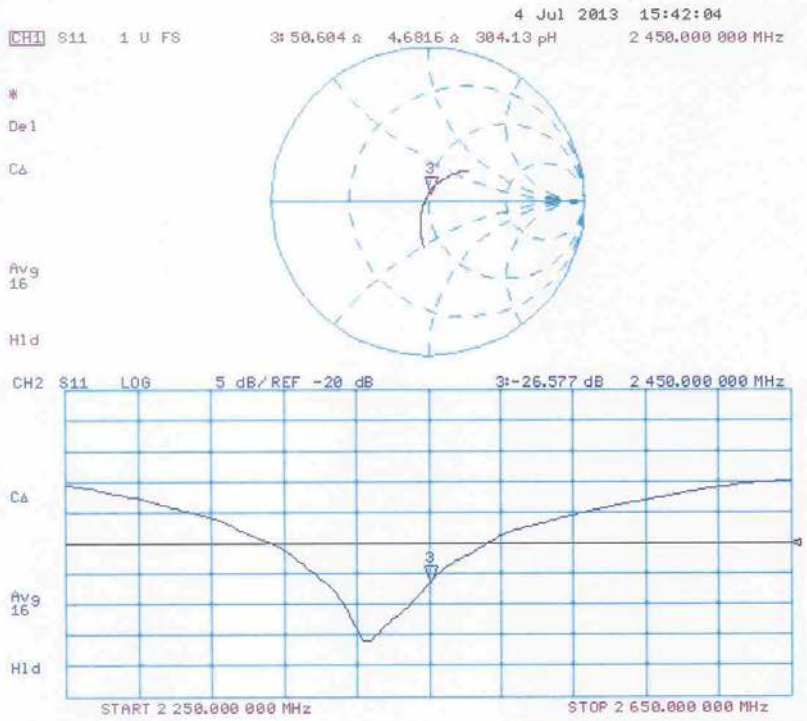
- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.672 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 27.2 W/kg
**SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.93 W/kg**
Maximum value of SAR (measured) = 16.9 W/kg




0 dB = 16.9 W/kg = 12.28 dBW/kg

## Impedance Measurement Plot for Body TSL



# ANNEX I SPOT CHECK TEST

**As the test lab for 6016E from TCT Mobile Limited, we, TMC Beijing, declare on our sole responsibility that, according to "Declaration of changes" provided by applicant, only the Spot check test should be performed. The test results are as below.**

## I.1 Internal Identification of EUT used during the spot check test

| EUT ID* | IMEI | HW Version | SW Version |
|---|---|---|---|
| EUT1 | 863829020000715 | Proto | v1AC2_US+Z3 |

*EUT ID: is used to identify the test sample in the lab internally.

## I.2 Conducted power of selected case

**Table I.1: The conducted power results for GSM850/1900**

| | | | |
|---|---|---|---|
| GSM 850MHz | Conducted Power (dBm) | | |
| | Channel 251(848.8MHz) | Channel 190(836.6MHz) | Channel 128(824.2MHz) |
| | \ | \ | 32.27 |
| GSM 1900MHz | Conducted Power (dBm) | | |
| | Channel 810(1909.8MHz) | Channel 661(1880MHz) | Channel 512(1850.2MHz) |
| | 29.20 | \ | \ |

**Table I.2: The conducted power results for GPRS**

| | | | |
|---|---|---|---|
| GSM 850 GPRS (GMSK) | Measured Power (dBm) | | |
| | **251** | **190** | **128** |
| **2 Txslots** | 30.27 | \ | \ |
| PCS1900 GPRS (GMSK) | Measured Power (dBm) | | |
| | **810** | **661** | **512** |
| **2 Txslots** | 26.93 | \ | \ |

**Table I.3: The conducted power results for WCDMA**

| | | | | |
|---|---|---|---|---|
| **Item** | **band** | **FDD V result** | | |
| | **ARFCN** | **4233 (846.6MHz)** | **4182 (836.4MHz)** | **4132 (826.4MHz)** |
| **WCDMA** | **** | 23.04 | **** | **** |
| **Item** | **band** | **FDD II result** | | |
| | **ARFCN** | **9538 (1907.6MHz)** | **9400 (1880MHz)** | **9262 (1852.4MHz)** |
| **WCDMA** | **** | 22.53 | 22.25 | **** |

## I.3 Measurement results

**SAR Values (GSM 850 MHz Band - Head)**

| Frequency | | Side | Test Position | Battery Type | SAR(1g) (W/kg) | |
|---|---|---|---|---|---|---|
| MHz | Ch. | | | | Original data | Spot check data |
| 824.2 | 128 | Left | Touch | CAB1700001C1 | 0.338 | 0.295 |

**SAR Values (GSM 850 MHz Band - Body)**

| Frequency | | Mode/Band | Test Position | Spacing (mm) | Battery Type | SAR(1g) (W/kg) | |
|---|---|---|---|---|---|---|---|
| MHz | Ch. | | | | | Original data | Spot check data |
| 848.8 | 251 | GPRS | Rear | 10 | CAB1700001C1 | 0.668 | 0.513 |

**SAR Values (PCS 1900 MHz Band - Head)**

| Frequency | | Side | Test Position | Battery Type | SAR(1g) (W/kg) | |
|---|---|---|---|---|---|---|
| MHz | Ch. | | | | Original data | Spot check data |
| 1909.8 | 810 | Right | Touch | CAB1700001C1 | 0.184 | 0.098 |

**SAR Values (PCS 1900 MHz Band - Body)**

| Frequency | | Mode/Band | Test Position | Spacing (mm) | Battery Type | SAR(1g) (W/kg) | |
|---|---|---|---|---|---|---|---|
| MHz | Ch. | | | | | Original data | Spot check data |
| 1909.8 | 810 | GPRS | Rear | 10 | CAB1700001C1 | 0.670 | 0.614 |

**SAR Values (WCDMA 850 MHz Band - Head)**

| Frequency | | Side | Test Position | Battery Type | SAR(1g) (W/kg) | |
|---|---|---|---|---|---|---|
| MHz | Ch. | | | | Original data | Spot check data |
| 846.6 | 4233 | Left | Touch | CAB1700001C1 | 0.459 | 0.293 |

**SAR Values (WCDMA 850 MHz Band - Body)**

| Frequency | | Test Position | Spacing (mm) | Battery Type | SAR(1g) (W/kg) | |
|---|---|---|---|---|---|---|
| MHz | Ch. | | | | Original data | Spot check data |
| 846.6 | 4233 | Rear | 10 | CAB1700001C1 | 0.622 | 0.421 |

**SAR Values (WCDMA 1900 MHz Band - Head)**

| Frequency | | Side | Test Position | Battery Type | SAR(1g) (W/kg) | |
|---|---|---|---|---|---|---|
| MHz | Ch. | | | | Original data | Spot check data |
| 1880 | 9400 | Right | Touch | CAB1700001C1 | 0.447 | 0.293 |

**SAR Values (WCDMA 1900 MHz Band - Body)**

| Frequency | | Test Position | Spacing (mm) | Battery Type | SAR(1g) (W/kg) | |
|---|---|---|---|---|---|---|
| MHz | Ch. | | | | Original data | Spot check data |
| 1907.6 | 9538 | Rear | 10 | CAB1700001C1 | 1 | 0.710 |

## I.4 Reported SAR Comparison

| Exposure Configuration | Technology Band | Reported SAR 1g (W/Kg): original | Reported SAR 1g (W/Kg): spot check |
|---|---|---|---|
| Head (Separation Distance 0mm) | GSM 850 | 0.38 | 0.38 |
| | PCS 1900 | 0.23 | 0.13 |
| | UMTS FDD 2 | 0.47 | 0.37 |
| | UMTS FDD 5 | 0.56 | 0.37 |
| Body-worn (Separation Distance 10mm) | GSM 850 | 0.80 | 0.68 |
| | PCS 1900 | 0.80 | 0.79 |
| | UMTS FDD 2 | 1.11 | 0.85 |
| | UMTS FDD 5 | 0.75 | 0.53 |

## I.5 Graphic results

### 850 Left Cheek Low

Date: 2014-2-15
Electronics: DAE4 Sn771
Medium: Head 850 MHz
Medium parameters used: f = 825 MHz; $\sigma$ = 0.878 S/m; $\varepsilon r$ = 40.3; $\rho$ = 1000 kg/m$^3$
Ambient Temperature: 22.1°C Liquid Temperature: 21.6°C
Communication System: GSM 850 Frequency: 824.2 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 - SN3846 ConvF(8.92, 8.92, 8.92)

**Cheek Low/Area Scan (61x111x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.302 W/kg

**Cheek Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.860 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.372 W/kg
**SAR(1 g) = 0.295 W/kg; SAR(10 g) = 0.216 W/kg**
Maximum value of SAR (measured) = 0.309 W/kg

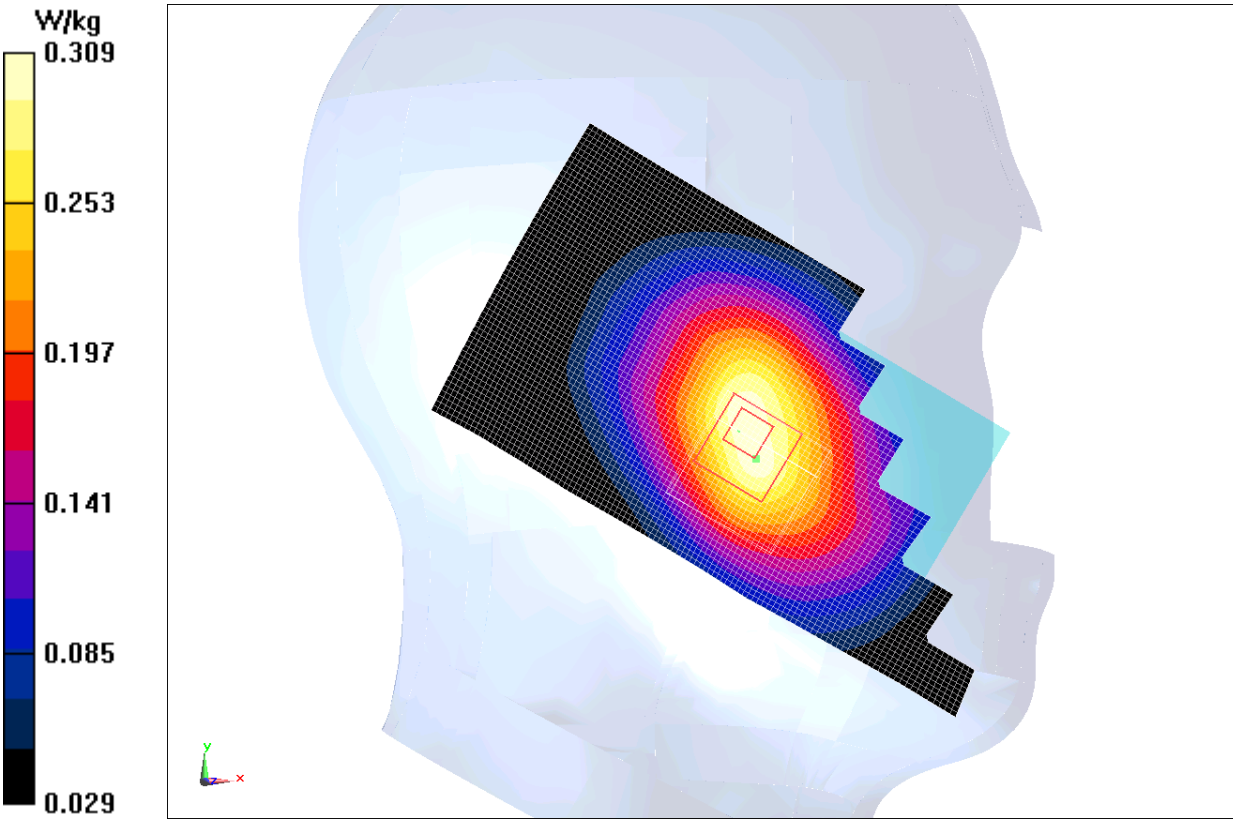



**Fig.I.1 850MHz CH128**

**850 Body Rear High**

Date: 2014-2-15
Electronics: DAE4 Sn771
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 848.8 MHz; $\sigma$ = 0.971 S/m; $\varepsilon r$ = 54.159; $\rho$ = 1000 kg/$m^3$
Ambient Temperature: 22.1°C Liquid Temperature: 21.6°C
Communication System: GSM 850 EGPRS Frequency: 848.8 MHz Duty Cycle: 1:4
Probe: EX3DV4 - SN3846 ConvF(8.73, 8.73, 8.73)

**Rear High/Area Scan (61x111x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.547 W/kg

**Rear High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.974 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 0.626 W/kg
**SAR(1 g) = 0.513 W/kg; SAR(10 g) = 0.398 W/kg**
Maximum value of SAR (measured) = 0.546 W/kg

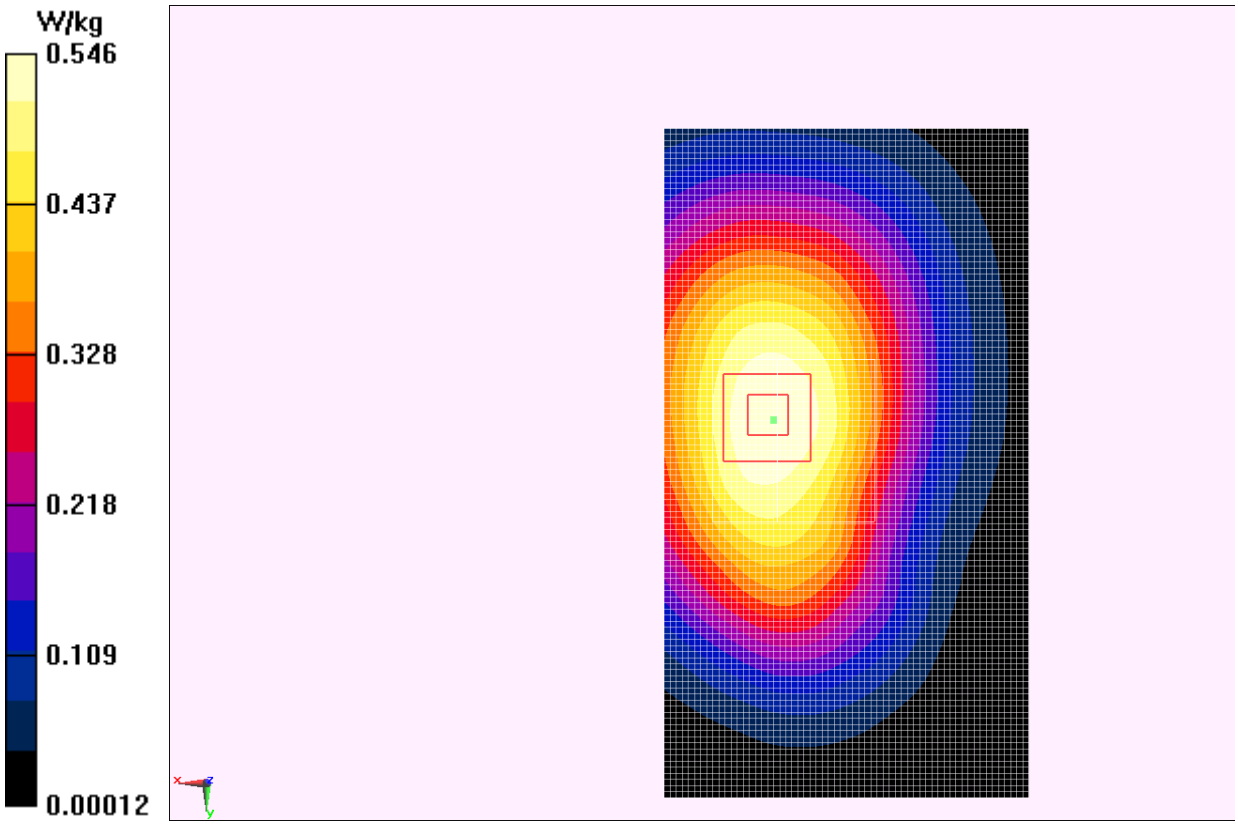



**Fig.I.2 850 MHz CH251**

**GSM1900 Right Cheek High**
Date: 2014-2-16
Electronics: DAE4 Sn771
Medium: Head 1900 MHz
Medium parameters used: f = 1910 MHz; $\sigma$ = 1.439 S/m; $\varepsilon r$ = 39.424; $\rho$ = 1000 kg/$m^3$
Ambient Temperature: 22.1°C Liquid Temperature: 21.6°C
Communication System: GSM 1900MHz Frequency: 1909.8 MHz Duty Cycle: 1:8.3
Probe: EX3DV4 - SN3846 ConvF(7.57, 7.57, 7.57)

**Cheek High/Area Scan (61x111x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.118 W/kg

**Cheek High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.898 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.134 W/kg
**SAR(1 g) = 0.098 W/kg; SAR(10 g) = 0.064 W/kg**
Maximum value of SAR (measured) = 0.116 W/kg

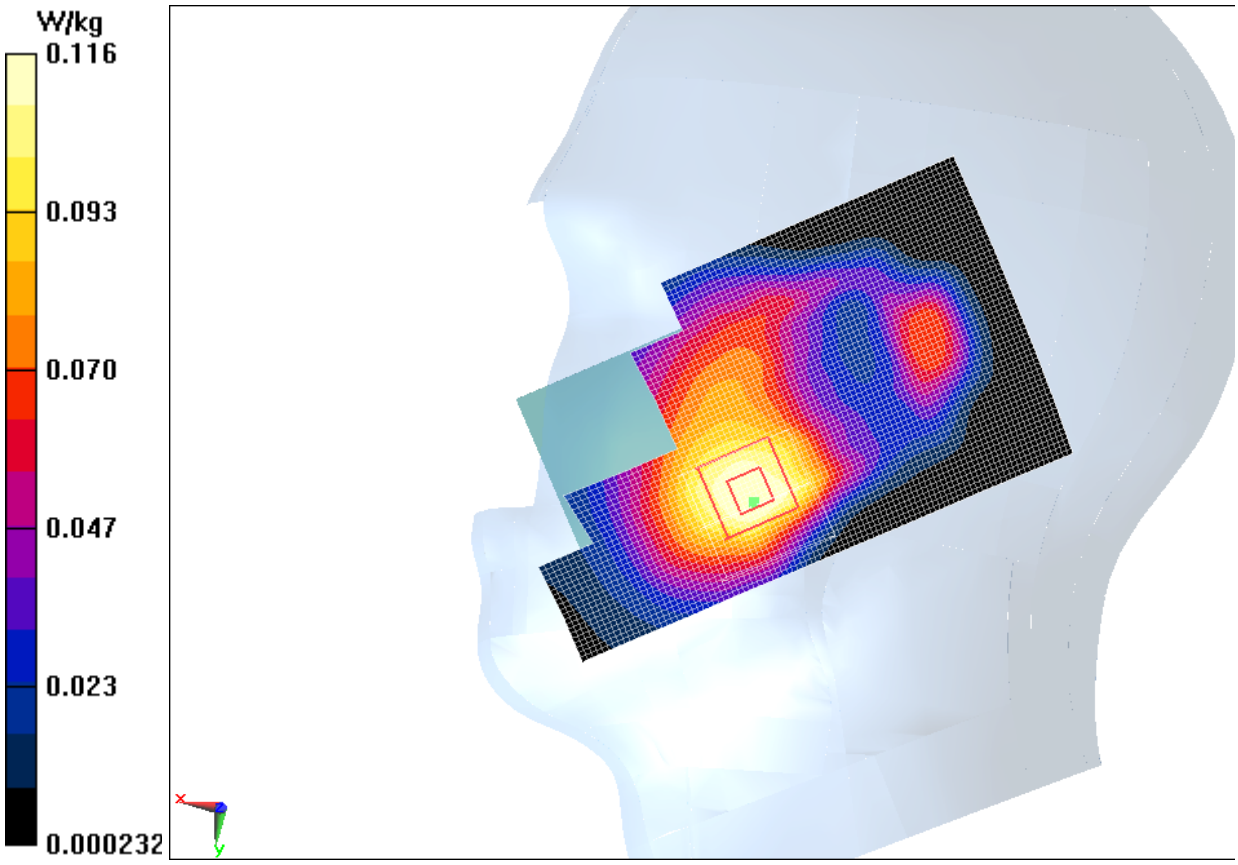



**Fig.I.3 1900 MHz CH810**

**GSM1900 Body Rear High**
Date: 2014-2-16
Electronics: DAE4 Sn771
Medium: Body 1900 MHz
Medium parameters used: f = 1910 MHz; $\sigma$ = 1.551 S/m; $\varepsilon r$ = 53.847; $\rho$ = 1000 kg/$m^3$
Ambient Temperature: 22.1°C Liquid Temperature: 21.6°C
Communication System: GSM 1900MHz GPRS Frequency: 1909.8 MHz Duty Cycle: 1:4
Probe: EX3DV4 - SN3846 ConvF(7.03, 7.03, 7.03)

**Rear High/Area Scan (61x111x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.667 W/kg

**Rear High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.168 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.964 W/kg
**SAR(1 g) = 0.614 W/kg; SAR(10 g) = 0.378 W/kg**
Maximum value of SAR (measured) = 0.693 W/kg

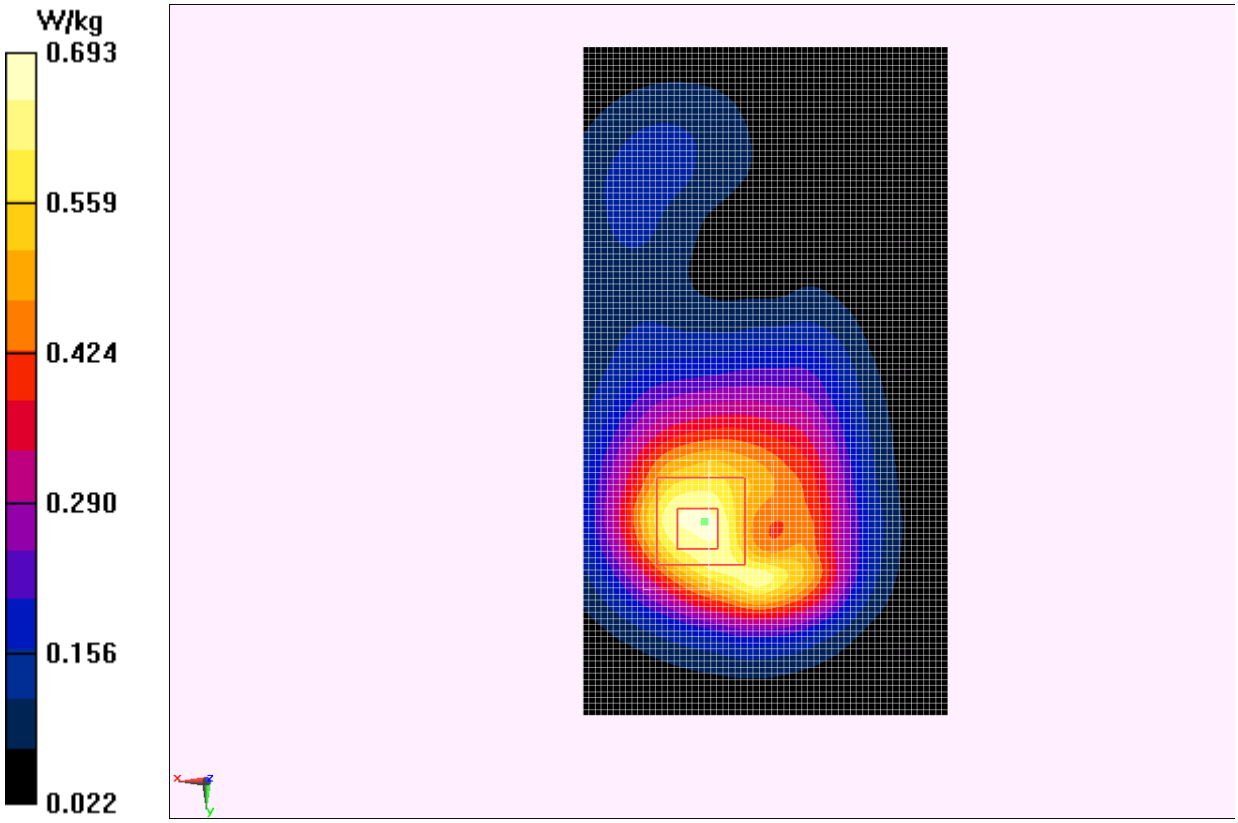



**Fig.I.4 1900 MHz CH810**

**WCDMA 850 Left Cheek High**
Date: 2014-2-15
Electronics: DAE4 Sn771
Medium: Head 850 MHz
Medium parameters used (interpolated): f = 846.6 MHz; $\sigma$ = 0.896 S/m; $\varepsilon r$ = 39.986; $\rho$ = 1000 kg/$m^3$
Ambient Temperature: 22.1°C Liquid Temperature: 21.6°C
Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(8.92, 8.92, 8.92)

**Cheek High/Area Scan (61x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.309 W/kg

**Cheek High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.959 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.362 W/kg
**SAR(1 g) = 0.293 W/kg; SAR(10 g) = 0.221 W/kg**
Maximum value of SAR (measured) = 0.305 W/kg

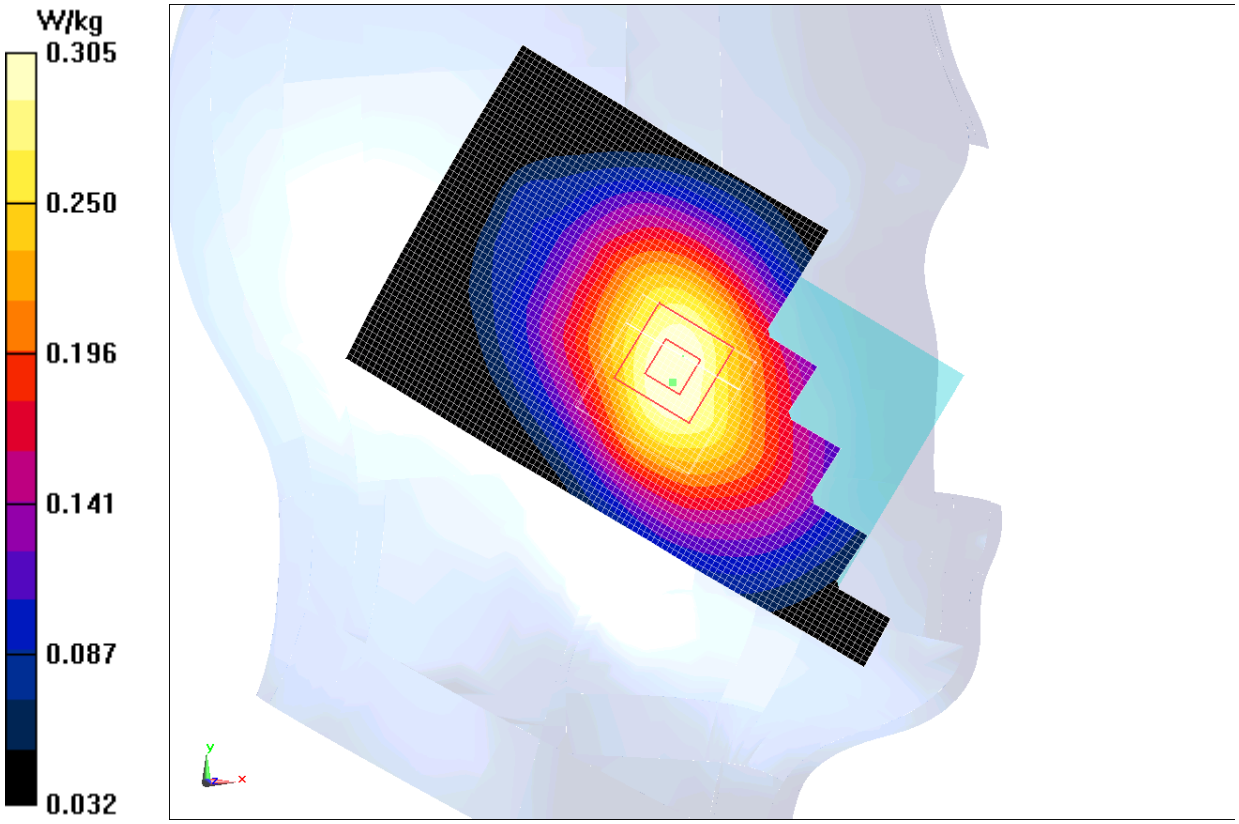



**Fig.I.5 WCDMA 850 CH4233**

**WCDMA 850 Body Rear High**
Date: 2014-2-15
Electronics: DAE4 Sn771
Medium: Body 850 MHz
Medium parameters used (interpolated): f = 846.6 MHz; $\sigma$ = 0.969 S/m; $\varepsilon r$ = 54.186; $\rho$ = 1000 kg/$m^3$
Ambient Temperature: 22.1°C Liquid Temperature: 21.6°C
Communication System: WCDMA; Frequency: 846.6 MHz; Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(8.73, 8.73, 8.73)

**Rear High/Area Scan (61x111x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.441 W/kg

**Rear High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.408 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.513 W/kg
**SAR(1 g) = 0.421 W/kg; SAR(10 g) = 0.326 W/kg**
Maximum value of SAR (measured) = 0.450 W/kg

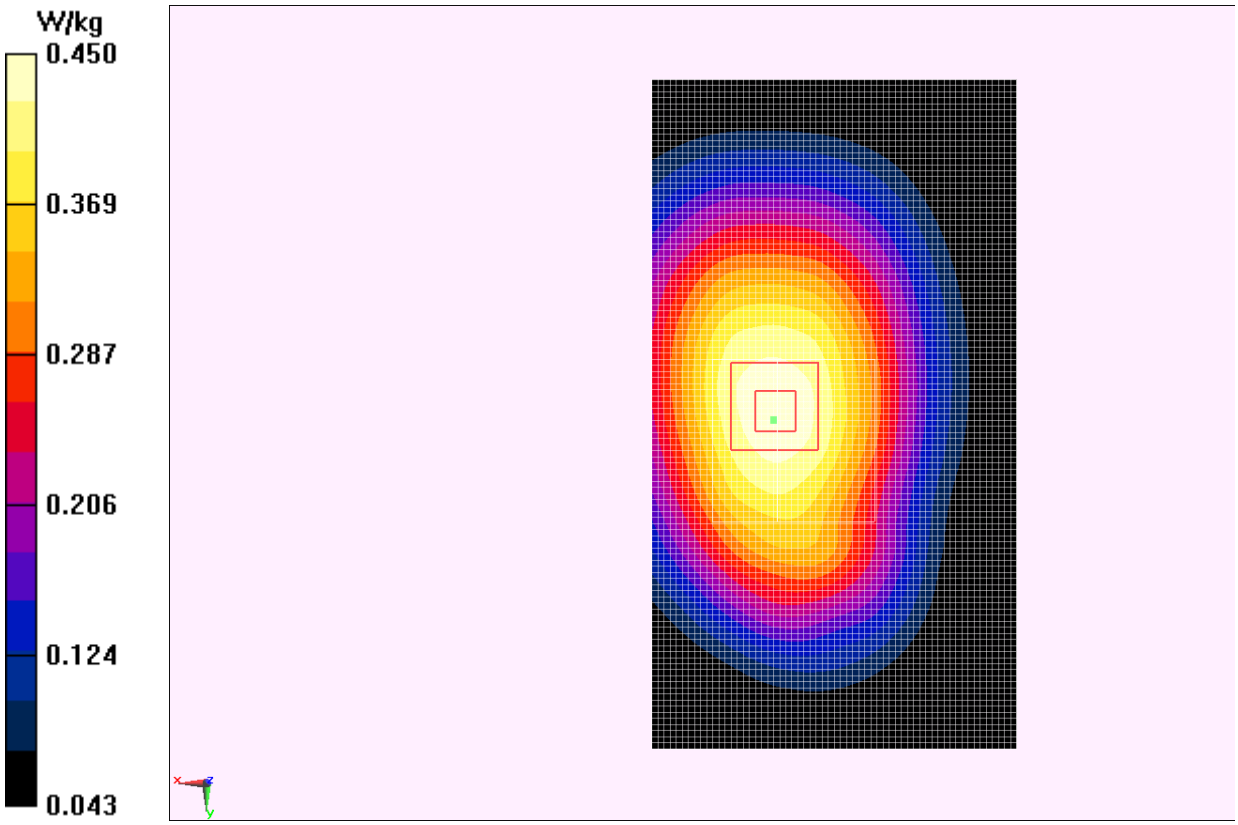



**Fig.I.6 WCDMA 850 CH4233**

**WCDMA 1900 Right Cheek Middle**
Date: 2014-2-16
Electronics: DAE4 Sn771
Medium: Head 1900 MHz
Medium parameters used: f = 1880 MHz; $\sigma$ = 1.412 S/m; $\varepsilon r$ = 39.576; $\rho$ = 1000 kg/$m^3$
Ambient Temperature: 22.1°C Liquid Temperature: 21.6°C
Communication System: WCDMA 1900 Frequency: 1880 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(7.57, 7.57, 7.57)

**Cheek Middle/Area Scan (61x111x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.561 W/kg

**Cheek Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.683 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 0.407 W/kg
**SAR(1 g) = 0.293 W/kg; SAR(10 g) = 0.191 W/kg**
Maximum value of SAR (measured) = 0.352 W/kg

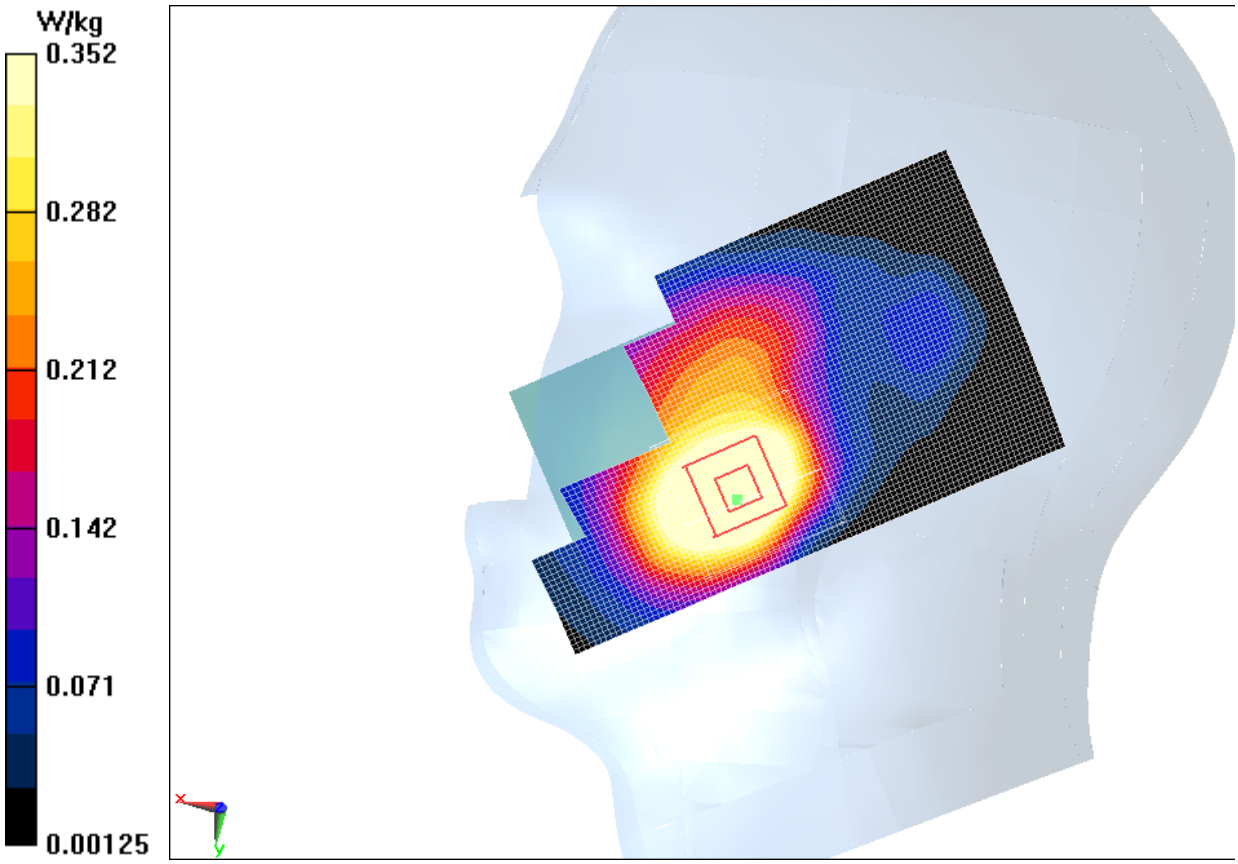



**Fig.I.7 WCDMA1900 CH9400**

**WCDMA 1900 Body Rear High**
Date: 2014-2-16
Electronics: DAE4 Sn771
Medium: Body 1900 MHz
Medium parameters used (interpolated): f = 1907.6 MHz; $\sigma$ = 1.55 S/m; $\varepsilon r$ = 53.861; $\rho$ = 1000 kg/$m^3$
Ambient Temperature: 22.1°C Liquid Temperature: 21.6°C
Communication System: WCDMA 1900 Frequency: 1907.6 MHz Duty Cycle: 1:1
Probe: EX3DV4 - SN3846 ConvF(7.03, 7.03, 7.03)

**Rear High/Area Scan (61x111x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.772 W/kg

**Rear High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.598 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.13 W/kg
**SAR(1 g) = 0.710 W/kg; SAR(10 g) = 0.435 W/kg**
Maximum value of SAR (measured) = 0.800 W/kg

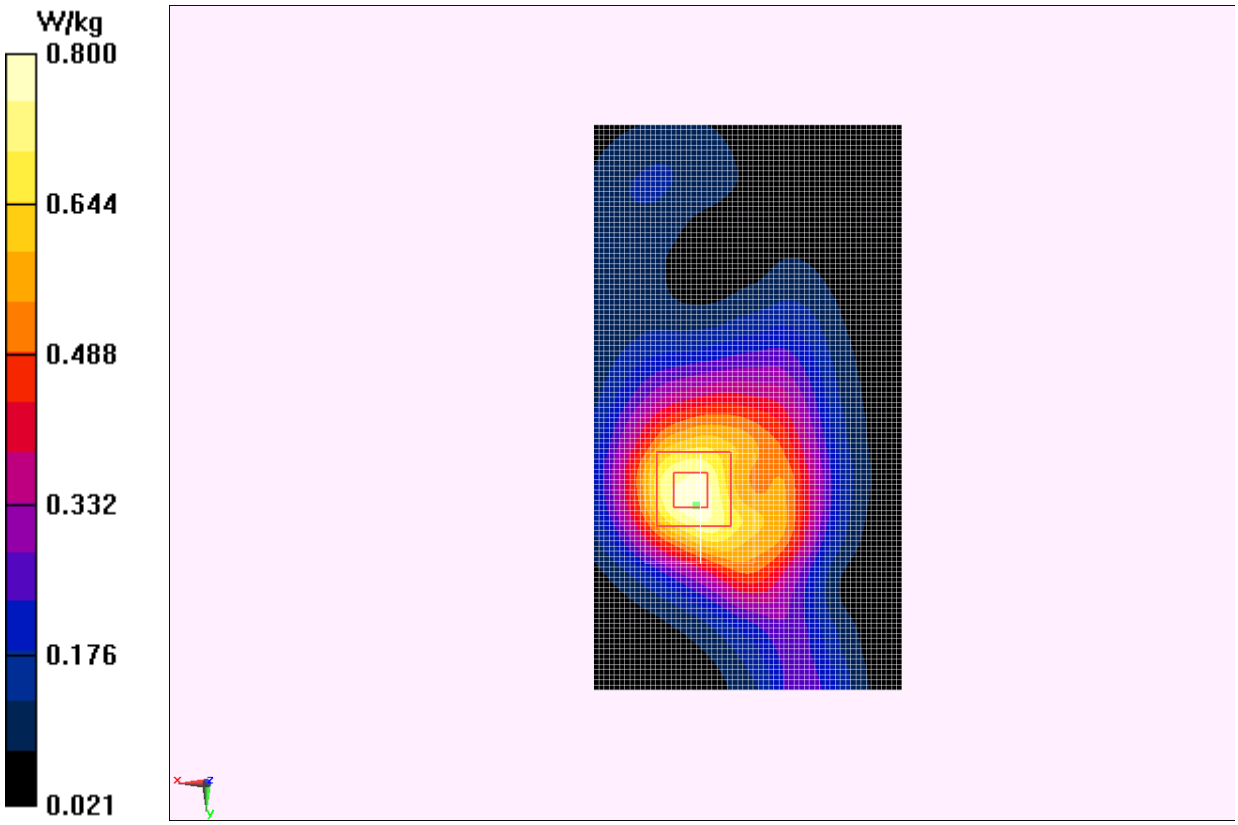



**Fig.I.8 WCDMA1900 CH9538**