Test Laboratory:            HCT CO., LTD

EUT Type:                   GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Liquid Temperature:         21.3 ℃

Ambient Temperature:        21.5 ℃

Test Date:                  Apr . 02, 2013

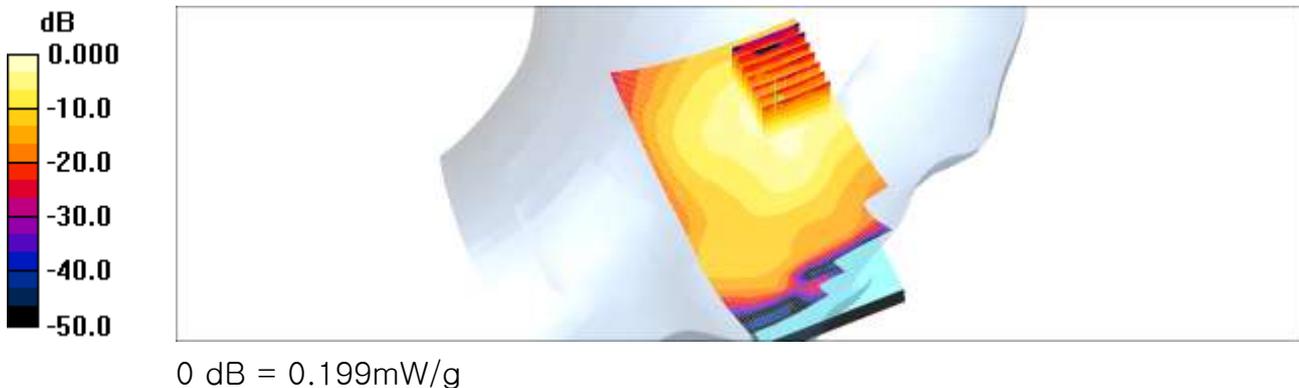Plot NO.                    21


**DUT: LG-E440f; Type: Bar; Serial: #1**


Communication System: 2450MHz FCC; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.85 mho/m; $\varepsilon_r$ = 38.9; ρ = 1000 kg/m$^3$

Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184


DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: 1800/1900 Phantom; Type: SAM


**Left touch 6ch 1Mbps/Area Scan (71x121x1):** Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.187 mW/g


**Left touch 6ch 1Mbps/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.97 V/m; Power Drift = 0.101 dB

Peak SAR (extrapolated) = 0.399 W/kg

**SAR(1 g) = 0.175 mW/g; SAR(10 g) = 0.083 mW/g**

Maximum value of SAR (measured) = 0.199 mW/g



0 dB = 0.199mW/g

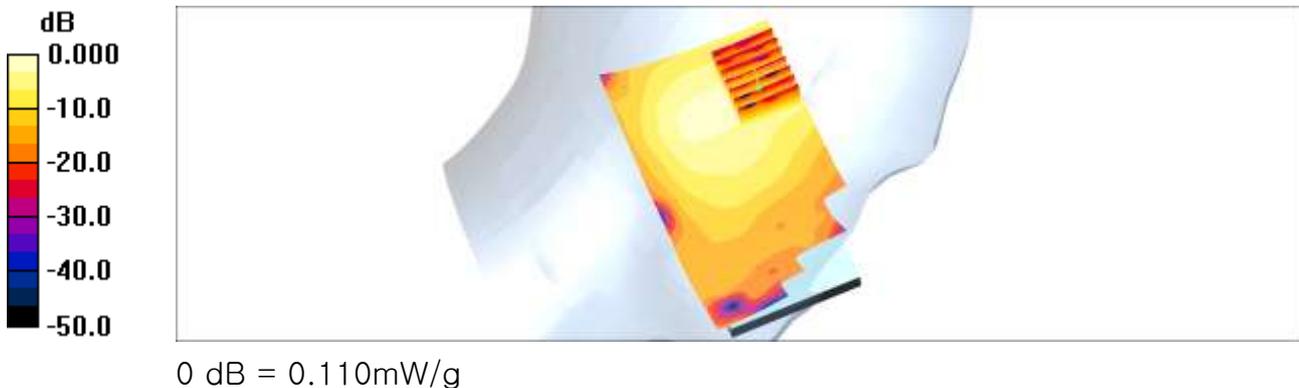| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.3 ℃ |
| Ambient Temperature: | 21.5 ℃ |
| Test Date: | Apr . 02, 2013 |
| Plot NO. | 22 |

**DUT: LG-E440f; Type: Bar; Serial: #1**

Communication System: 2450MHz FCC; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.85 mho/m; $\varepsilon_r$ = 38.9; ρ = 1000 kg/m$^3$
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: 1800/1900 Phantom; Type: SAM

**Left tilt 6ch 1Mbps/Area Scan (71x121x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.111 mW/g

**Left tilt 6ch 1Mbps/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.39 V/m; Power Drift = -0.107 dB
Peak SAR (extrapolated) = 0.224 W/kg
**SAR(1 g) = 0.101 mW/g; SAR(10 g) = 0.046 mW/g**
Maximum value of SAR (measured) = 0.110 mW/g



0 dB = 0.110mW/g

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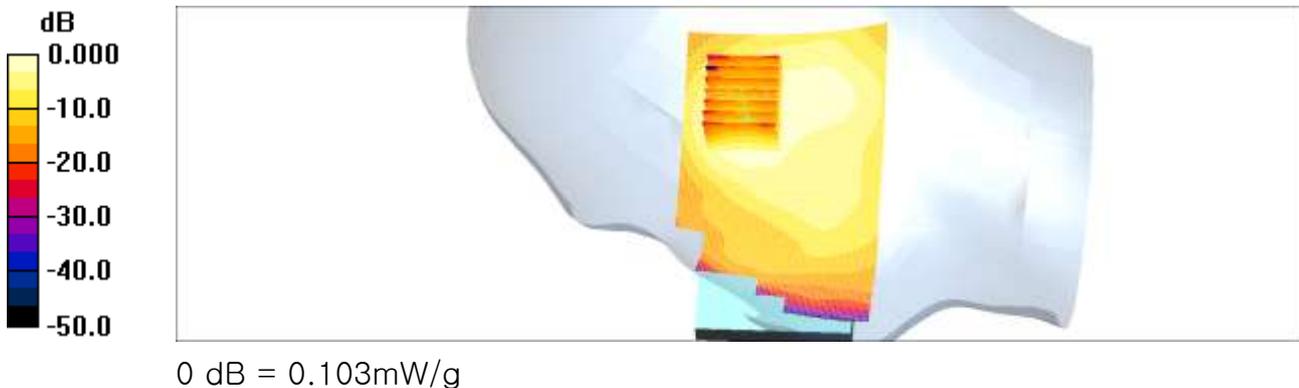| Test Laboratory: | HCT CO., LTD |
| --- | --- |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.3 ℃ |
| Ambient Temperature: | 21.5 ℃ |
| Test Date: | Apr . 02, 2013 |
| Plot NO. | 23 |

### DUT: LG-E440f; Type: Bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.85 mho/m; $\varepsilon_r$ = 38.9; ρ = 1000 kg/m$^3$
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: 1800/1900 Phantom; Type: SAM

**Right touch 6ch 1Mbps/Area Scan (71x121x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.109 mW/g

**Right touch 6ch 1Mbps/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.30 V/m; Power Drift = 0.133 dB
Peak SAR (extrapolated) = 0.174 W/kg
**SAR(1 g) = 0.095 mW/g; SAR(10 g) = 0.052 mW/g**
Maximum value of SAR (measured) = 0.103 mW/g



0 dB = 0.103mW/g

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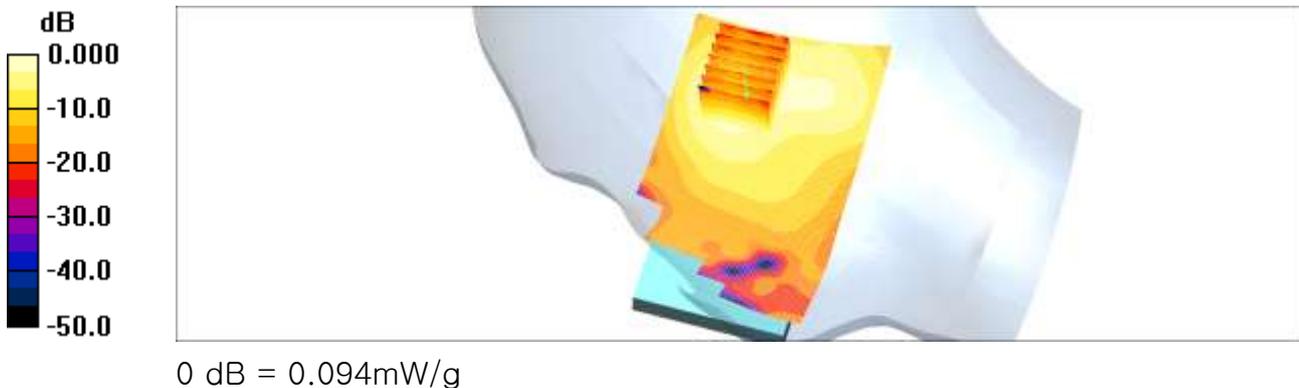| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.3 ℃ |
| Ambient Temperature: | 21.5 ℃ |
| Test Date: | Apr . 02, 2013 |
| Plot NO. | 24 |

**DUT: LG-E440f; Type: Bar; Serial: #1**

Communication System: 2450MHz FCC; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.85 mho/m; $\varepsilon_r$ = 38.9; ρ = 1000 kg/m$^3$
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: 1800/1900 Phantom; Type: SAM

**Right tilt 6ch 1Mbps/Area Scan (71x121x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.096 mW/g

**Right tilt 6ch 1Mbps/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.27 V/m; Power Drift = -0.102 dB
Peak SAR (extrapolated) = 0.171 W/kg
**SAR(1 g) = 0.083 mW/g; SAR(10 g) = 0.044 mW/g**
Maximum value of SAR (measured) = 0.094 mW/g



0 dB = 0.094mW/g

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Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 21.2 ℃
Ambient Temperature: 21.4 ℃
Test Date: Mar . 30, 2013
Plot NO. 25

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 824.2 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 825 MHz; σ = 0.979 mho/m; $\varepsilon_r$ = 56.9; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184
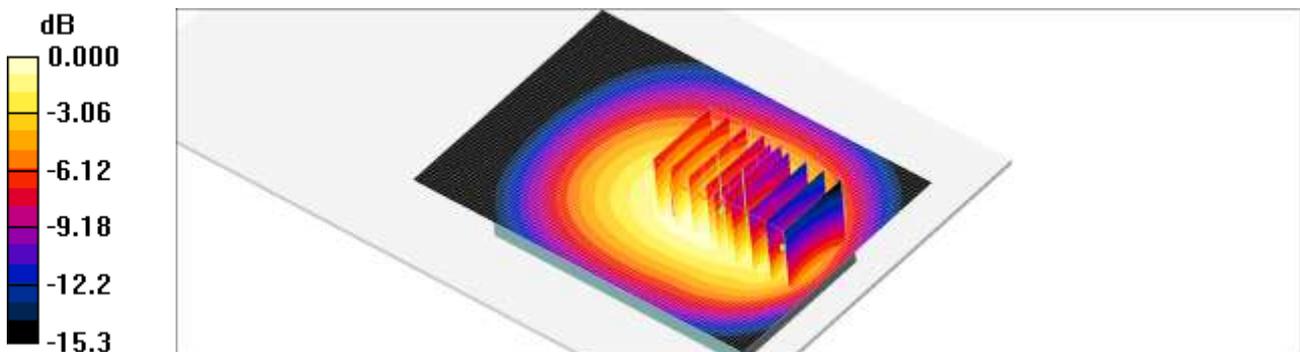
DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body rear 128 4tx low/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.04 mW/g

**Body rear 128 4tx low/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.91 V/m; Power Drift = -0.124 dB
Peak SAR (extrapolated) = 1.32 W/kg
**SAR(1 g) = 0.977 mW/g; SAR(10 g) = 0.702 mW/g**
Maximum value of SAR (measured) = 1.03 mW/g

**Body rear 128 4tx low/Zoom Scan (5x5x7)/Cube 1:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.91 V/m; Power Drift = -0.124 dB
Peak SAR (extrapolated) = 1.24 W/kg
**SAR(1 g) = 0.755 mW/g; SAR(10 g) = 0.474 mW/g**
Maximum value of SAR (measured) = 0.925 mW/g



0 dB = 0.925mW/g

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| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.2 ℃ |
| Ambient Temperature: | 21.4 ℃ |
| Test Date: | Mar . 30, 2013 |
| Plot NO. | 26 |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; $\varepsilon_r$ = 56.8; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184
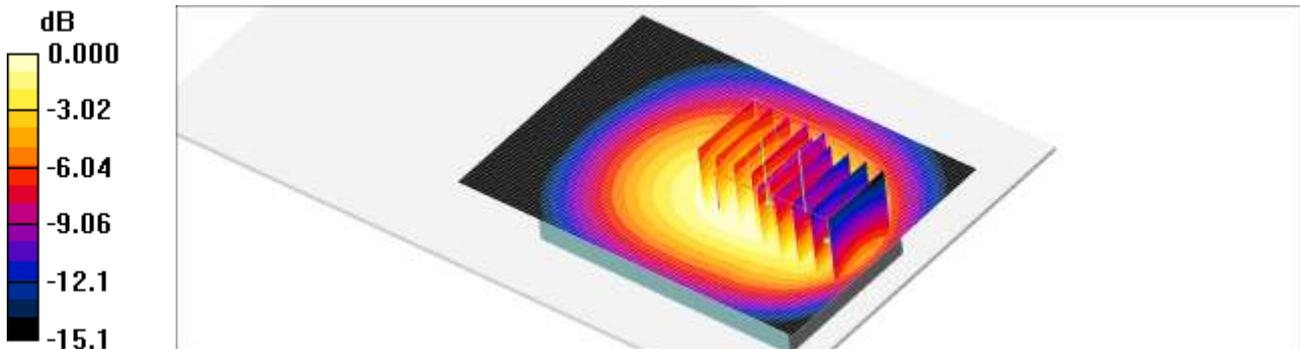
DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body rear 190 4tx/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.03 mW/g

**Body rear 190 4tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.64 V/m; Power Drift = -0.136 dB
Peak SAR (extrapolated) = 1.29 W/kg
**SAR(1 g) = 0.957 mW/g; SAR(10 g) = 0.686 mW/g**
Maximum value of SAR (measured) = 1.01 mW/g

**Body rear 190 4tx/Zoom Scan (5x5x7)/Cube 1:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.64 V/m; Power Drift = -0.136 dB
Peak SAR (extrapolated) = 1.17 W/kg
**SAR(1 g) = 0.702 mW/g; SAR(10 g) = 0.448 mW/g**
Maximum value of SAR (measured) = 0.869 mW/g



0 dB = 0.869mW/g

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| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.2 ℃ |
| Ambient Temperature: | 21.4 ℃ |
| Test Date: | Mar . 30, 2013 |
| Plot NO. | 27 |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 848.8 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 850 MHz; σ = 0.999 mho/m; $\varepsilon_r$ = 56.7; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184
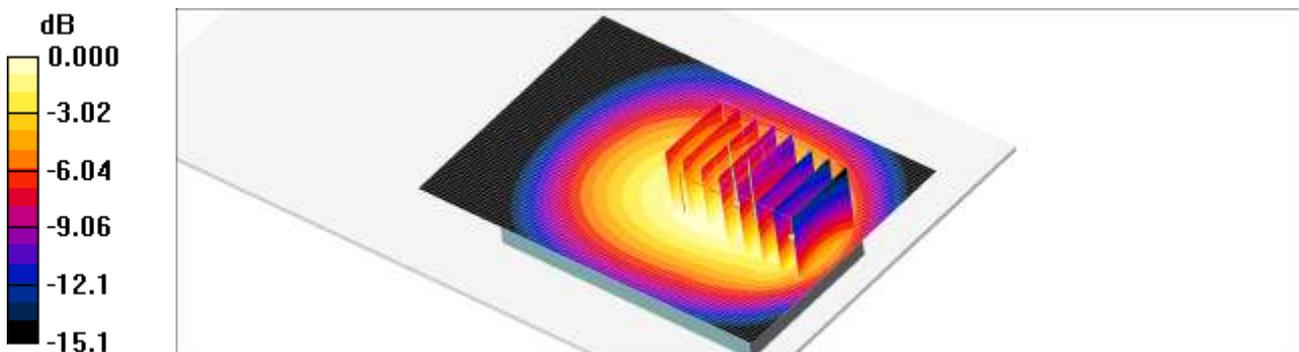
DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body rear 251 4tx/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.15 mW/g

**Body rear 251 4tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.58 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 1.48 W/kg
**SAR(1 g) = 1.09 mW/g; SAR(10 g) = 0.776 mW/g**
Maximum value of SAR (measured) = 1.15 mW/g

**Body rear 251 4tx/Zoom Scan (5x5x7)/Cube 1:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.58 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 1.37 W/kg
**SAR(1 g) = 0.845 mW/g; SAR(10 g) = 0.534 mW/g**
Maximum value of SAR (measured) = 1.03 mW/g



0 dB = 1.03mW/g

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| Test Laboratory: | HCT CO., LTD |
| --- | --- |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.2 ℃ |
| Ambient Temperature: | 21.4 ℃ |
| Test Date: | Mar . 30, 2013 |
| Plot NO. | 28 |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; $\sigma$ = 0.987 mho/m; $\varepsilon_r$ = 56.8; $\rho$ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body front 190 4tx/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.632 mW/g

**Body front 190 4tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.49 V/m; Power Drift = -0.074 dB
Peak SAR (extrapolated) = 0.761 W/kg
**SAR(1 g) = 0.594 mW/g; SAR(10 g) = 0.441 mW/g**
Maximum value of SAR (measured) = 0.626 mW/g



0 dB = 0.626mW/g

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Test Laboratory: HCT CO., LTD
EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature: 21.2 ℃
Ambient Temperature: 21.4 ℃
Test Date: Mar . 30, 2013
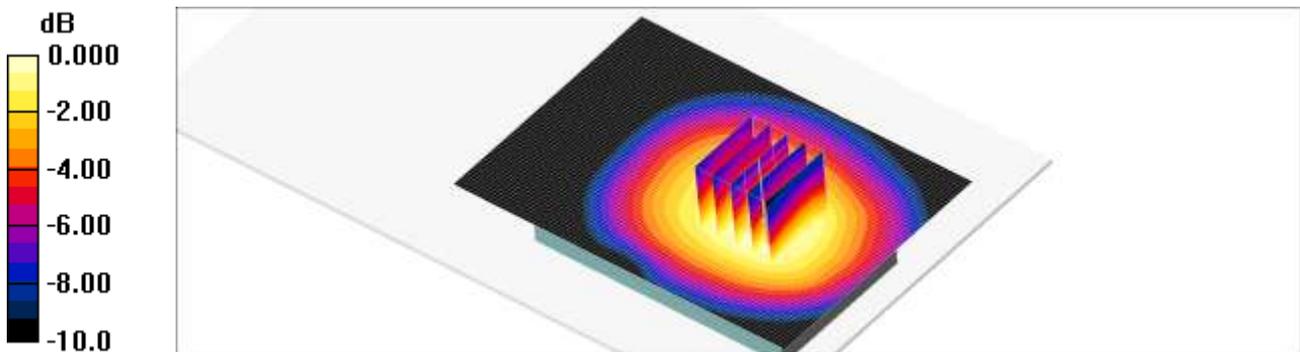Plot NO. 29

**DUT: LG-E440F; Type: Bar; Serial: #1**
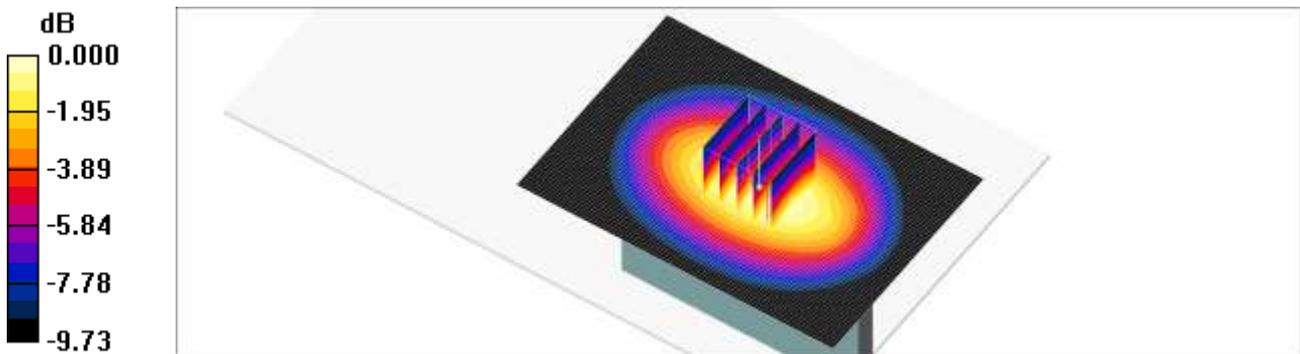
Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; $\sigma$ = 0.987 mho/m; $\varepsilon_r$ = 56.8; $\rho$ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8
Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body Left 190 4tx/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.417 mW/g

**Body Left 190 4tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.80 V/m; Power Drift = -0.100 dB
Peak SAR (extrapolated) = 0.546 W/kg
**SAR(1 g) = 0.386 mW/g; SAR(10 g) = 0.263 mW/g**
Maximum value of SAR (measured) = 0.413 mW/g



0 dB = 0.413mW/g

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| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.2 ℃ |
| Ambient Temperature: | 21.4 ℃ |
| Test Date: | Mar . 30, 2013 |
| Plot NO. | 30 |

### DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; $\varepsilon_r$ = 56.8; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body Right 190/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.666 mW/g

**Body Right 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.2 V/m; Power Drift = -0.164 dB
Peak SAR (extrapolated) = 0.992 W/kg
**SAR(1 g) = 0.650 mW/g; SAR(10 g) = 0.443 mW/g**
Maximum value of SAR (measured) = 0.690 mW/g



0 dB = 0.690mW/g

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| Test Laboratory: | HCT CO., LTD |
| Liquid Temperature: | 21.2 ℃ |
| Ambient Temperature: | 21.4 ℃ |

EUT Type:　　　　　　　　GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Test Date:　　　　　　　　Mar . 30, 2013
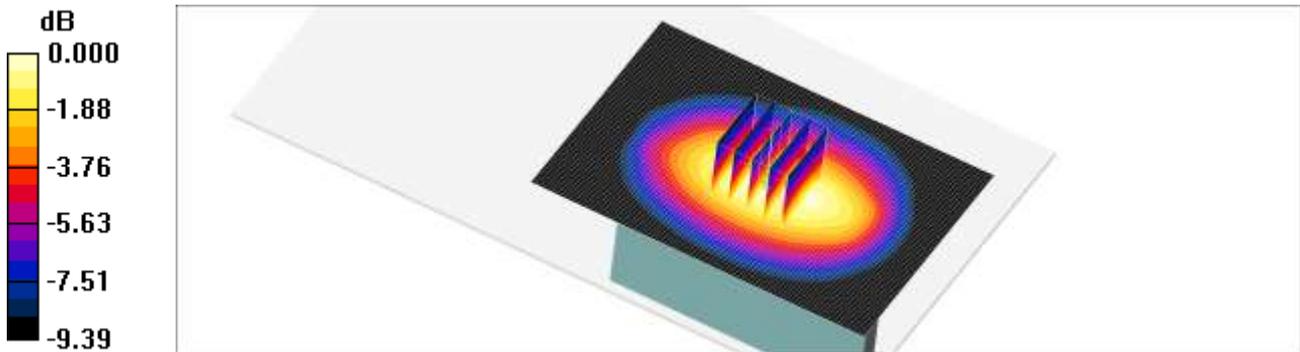
Plot NO.　　　　　　　　　31

### DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; $\varepsilon_r$ = 56.8; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body Bottom 190 4tx/Area Scan (71x41x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.118 mW/g

**Body Bottom 190 4tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.8 V/m; Power Drift = 0.001 dB
Peak SAR (extrapolated) = 0.179 W/kg
**SAR(1 g) = 0.110 mW/g; SAR(10 g) = 0.066 mW/g**
Maximum value of SAR (measured) = 0.120 mW/g



0 dB = 0.120mW/g

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| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 20.7 ℃ |
| Ambient Temperature: | 20.9 ℃ |
| Test Date: | Apr . 01, 2013 |
| Plot NO. | 32 |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 1880 MHz; σ = 1.54 mho/m; $\varepsilon_r$ = 52.3; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body rear 661 4Tx/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.598 mW/g

**Body rear 661 4Tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.20 V/m; Power Drift = -0.011 dB
Peak SAR (extrapolated) = 0.874 W/kg
**SAR(1 g) = 0.541 mW/g; SAR(10 g) = 0.326 mW/g**
Maximum value of SAR (measured) = 0.587 mW/g



0 dB = 0.587mW/g

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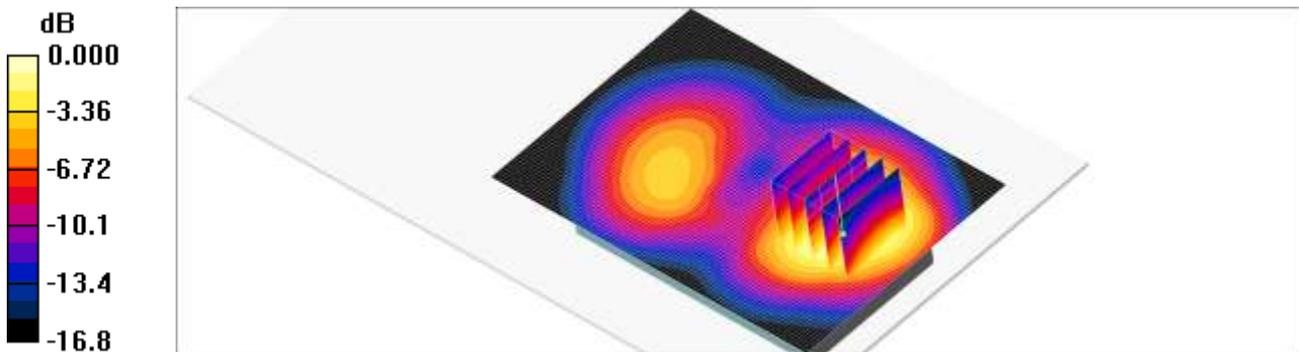| Test Laboratory: | HCT CO., LTD |
| --- | --- |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 20.7 ℃ |
| Ambient Temperature: | 20.9 ℃ |
| Test Date: | Apr . 01, 2013 |
| Plot NO. | 33 |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 1880 MHz; $\sigma$ = 1.54 mho/m; $\varepsilon_r$ = 52.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body front 661 4Tx/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.545 mW/g

**Body front 661 4Tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.73 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 0.795 W/kg
**SAR(1 g) = 0.491 mW/g; SAR(10 g) = 0.294 mW/g**
Maximum value of SAR (measured) = 0.541 mW/g



0 dB = 0.541mW/g

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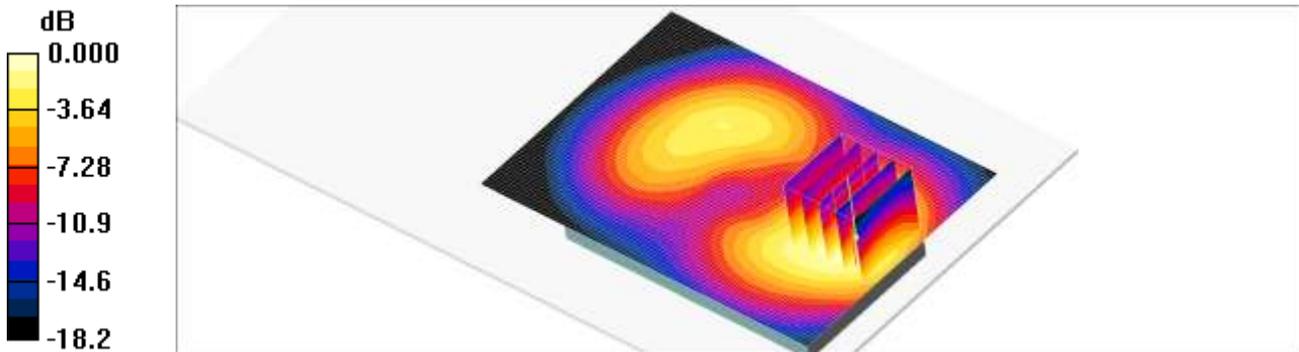| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 20.7 ℃ |
| Ambient Temperature: | 20.9 ℃ |
| Test Date: | Apr . 01, 2013 |
| Plot NO. | 34 |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 1880 MHz; σ = 1.54 mho/m; $\varepsilon_r$ = 52.3; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body left side 661 4Tx/Area Scan (51x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.122 mW/g

**Body left side 661 4Tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.66 V/m; Power Drift = -0.053 dB
Peak SAR (extrapolated) = 0.176 W/kg
**SAR(1 g) = 0.105 mW/g; SAR(10 g) = 0.063 mW/g**
Maximum value of SAR (measured) = 0.114 mW/g



0 dB = 0.114mW/g

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| Test Laboratory: | HCT CO., LTD |
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 20.7 ℃ |
| Ambient Temperature: | 20.9 ℃ |
| Test Date: | Apr . 01, 2013 |
| Plot NO. | 35 |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 1880 MHz; σ = 1.54 mho/m; $\varepsilon_r$ = 52.3; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body right side 661 4Tx/Area Scan (51x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.129 mW/g

**Body right side 661 4Tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 3.32 V/m; Power Drift = -0.059 dB
Peak SAR (extrapolated) = 0.190 W/kg
**SAR(1 g) = 0.117 mW/g; SAR(10 g) = 0.068 mW/g**
Maximum value of SAR (measured) = 0.129 mW/g



0 dB = 0.129mW/g

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Test Laboratory:          HCT CO., LTD

EUT Type:                 GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Liquid Temperature:       20.7 ℃

Ambient Temperature:      20.9 ℃

Test Date:                Apr . 01, 2013

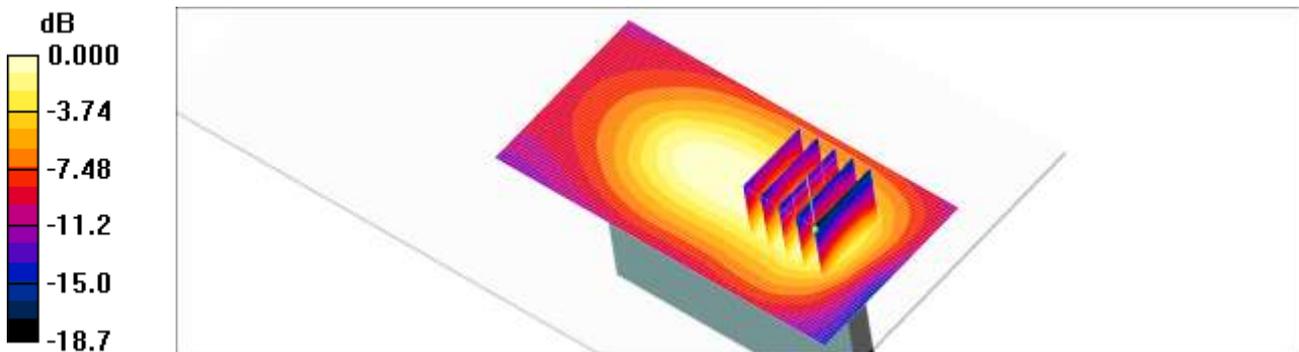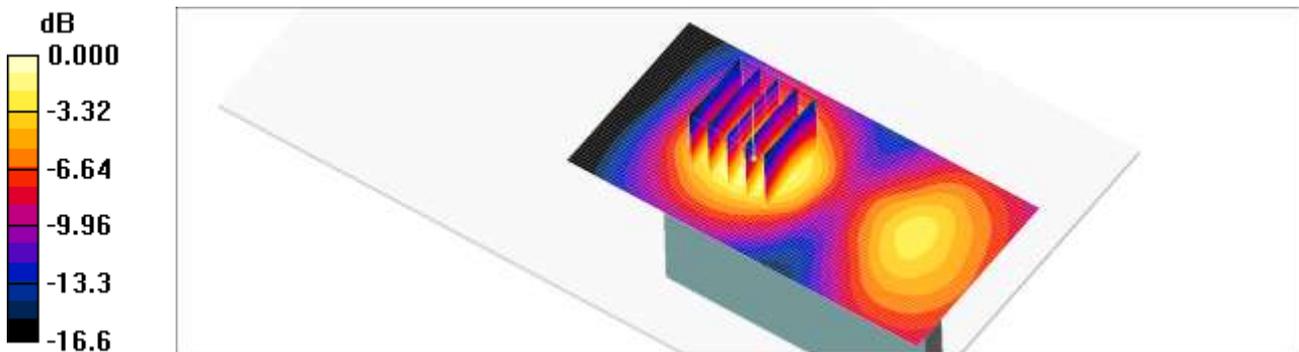Plot NO.                  36

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 1880 MHz; σ = 1.54 mho/m; $\varepsilon_r$ = 52.3; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8
Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body Bottom 661 4Tx/Area Scan (51x71x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.453 mW/g

**Body Bottom 661 4Tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.5 V/m; Power Drift = 0.041 dB
Peak SAR (extrapolated) = 0.661 W/kg
**SAR(1 g) = 0.382 mW/g; SAR(10 g) = 0.215 mW/g**
Maximum value of SAR (measured) = 0.419 mW/g



0 dB = 0.419mW/g

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Test Laboratory:          HCT CO., LTD
EUT Type:                 GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature:       21.2 ℃
Ambient Temperature:      21.4 ℃
Test Date:                Mar . 30, 2013
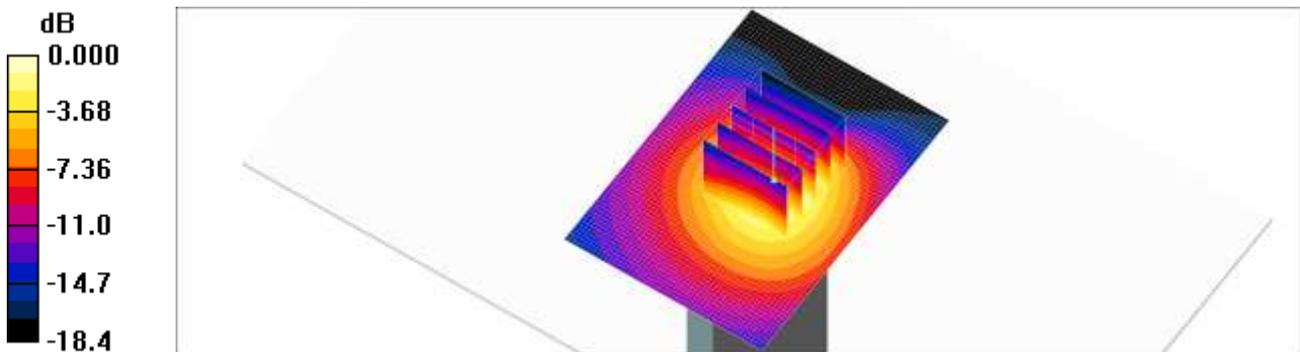Plot NO.                  37

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; $\varepsilon_r$ = 56.8; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body rear 4183/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.695 mW/g

**Body rear 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.38 V/m; Power Drift = -0.122 dB
Peak SAR (extrapolated) = 0.870 W/kg
**SAR(1 g) = 0.653 mW/g; SAR(10 g) = 0.470 mW/g**
Maximum value of SAR (measured) = 0.691 mW/g



0 dB = 0.691mW/g

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Test Laboratory:      HCT CO., LTD

EUT Type:      GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Liquid Temperature:      21.2 ℃

Ambient Temperature:      21.4 ℃

Test Date:      Mar . 30, 2013

Plot NO.      38

### DUT: LG-E440F; Type: Bar; Serial: #1
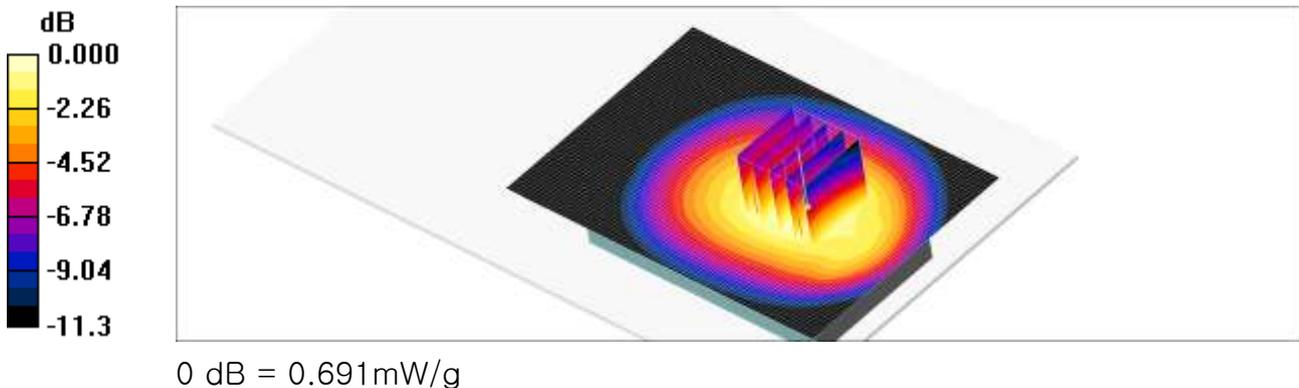
Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; $\varepsilon_r$ = 56.8; ρ = 1000 kg/m$^3$

Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body front 4183/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.402 mW/g

**Body front 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.97 V/m; Power Drift = 0.122 dB

Peak SAR (extrapolated) = 0.486 W/kg

**SAR(1 g) = 0.379 mW/g; SAR(10 g) = 0.280 mW/g**

Maximum value of SAR (measured) = 0.400 mW/g



0 dB = 0.400mW/g

Test Laboratory:              HCT CO., LTD

EUT Type:                     GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Liquid Temperature:           21.2 ℃

Ambient Temperature:          21.4 ℃

Test Date:                    Mar . 30, 2013

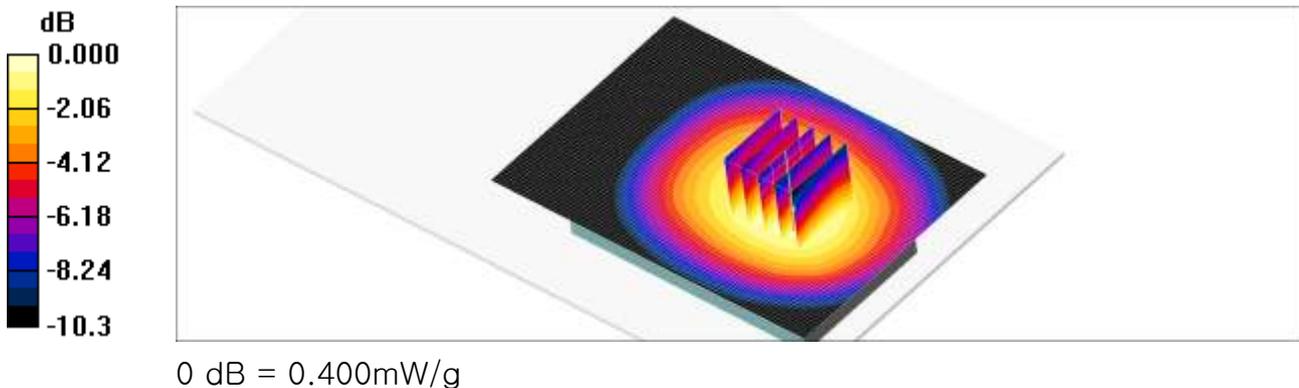Plot NO.                      39

## DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 836.6 MHz; $\sigma$ = 0.987 mho/m; $\varepsilon_r$ = 56.8; $\rho$ = 1000 kg/m$^3$

Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body Left 4183/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.276 mW/g

**Body Left 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 7.92 V/m; Power Drift = -0.021 dB

Peak SAR (extrapolated) = 0.367 W/kg

**SAR(1 g) = 0.261 mW/g; SAR(10 g) = 0.178 mW/g**

Maximum value of SAR (measured) = 0.279 mW/g



0 dB = 0.279mW/g

Test Laboratory:            HCT CO., LTD

EUT Type:            GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Liquid Temperature:            21.2 ℃

Ambient Temperature:            21.4 ℃

Test Date:            Mar . 30, 2013

Plot NO.            40


## DUT: LG-E440F; Type: Bar; Serial: #1


Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; $\varepsilon_r$ = 56.8; ρ = 1000 kg/m$^3$

Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184


DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA


**Body right 4183/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.408 mW/g


**Body right 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.9 V/m; Power Drift = -0.040 dB

Peak SAR (extrapolated) = 0.533 W/kg

**SAR(1 g) = 0.382 mW/g; SAR(10 g) = 0.264 mW/g**

Maximum value of SAR (measured) = 0.409 mW/g



0 dB = 0.409mW/g

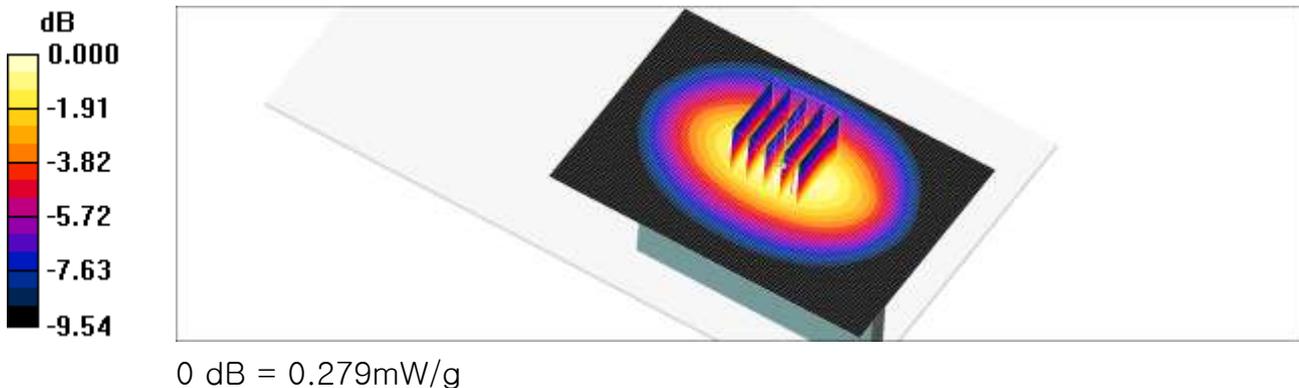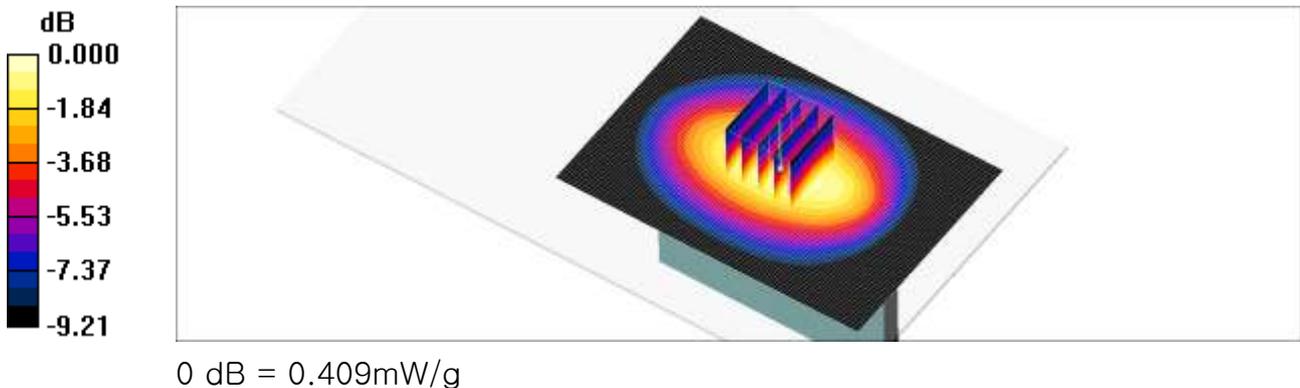| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.2 ℃ |
| Ambient Temperature: | 21.4 ℃ |
| Test Date: | Mar . 30, 2013 |
| Plot NO. | 41 |

### DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; $\varepsilon_r$ = 56.8; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body Bottom 4183/Area Scan (71x41x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.075 mW/g

**Body Bottom 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.52 V/m; Power Drift = -0.164 dB
Peak SAR (extrapolated) = 0.106 W/kg
**SAR(1 g) = 0.067 mW/g; SAR(10 g) = 0.040 mW/g**
Maximum value of SAR (measured) = 0.073 mW/g



0 dB = 0.073mW/g

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| Test Laboratory: | HCT CO., LTD |
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.3 ℃ |
| Ambient Temperature: | 21.5 ℃ |
| Test Date: | Apr . 02, 2013 |
| Plot NO. | 42 |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: 2450MHz FCC; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.97 mho/m; $\varepsilon_r$ = 53.6; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body rear ch6/Area Scan (81x121x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.042 mW/g

**Body rear ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.33 V/m; Power Drift = 0.134 dB
Peak SAR (extrapolated) = 0.081 W/kg
**SAR(1 g) = 0.039 mW/g; SAR(10 g) = 0.021 mW/g**
Maximum value of SAR (measured) = 0.043 mW/g



0 dB = 0.043mW/g

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Test Laboratory:　　　　　　HCT CO., LTD

EUT Type:　　　　　　　　　GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Liquid Temperature:　　　　21.3 ℃

Ambient Temperature:　　　 21.5 ℃

Test Date:　　　　　　　　 Apr . 02, 2013

Plot NO.　　　　　　　　　 43

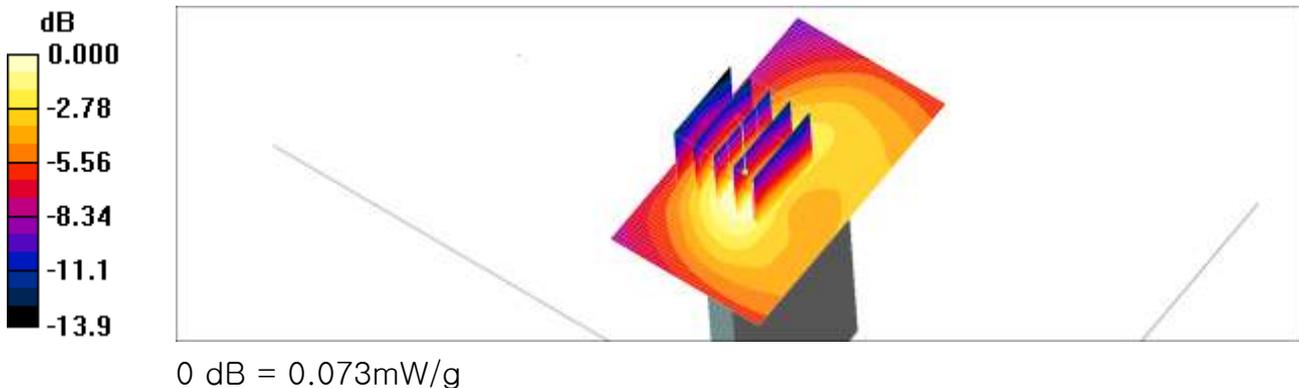### DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 53.6; $\rho$ = 1000 kg/m$^3$

Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body front ch6/Area Scan (81x121x1):** Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.023 mW/g

**Body front ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.83 V/m; Power Drift = 0.113 dB

Peak SAR (extrapolated) = 0.040 W/kg

**SAR(1 g) = 0.020 mW/g; SAR(10 g) = 0.010 mW/g**

Maximum value of SAR (measured) = 0.022 mW/g



0 dB = 0.022mW/g

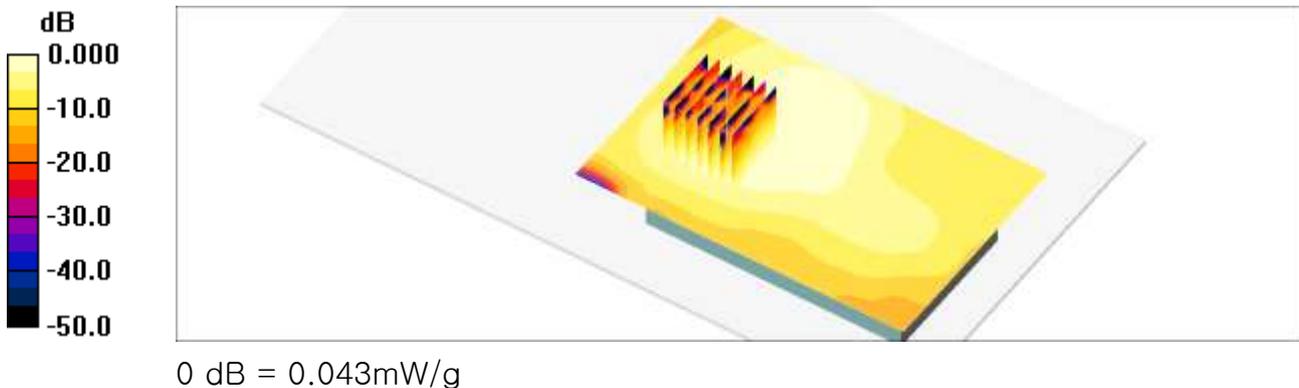| Test Laboratory: | HCT CO., LTD |
| --- | --- |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.3 ℃ |
| Ambient Temperature: | 21.5 ℃ |
| Test Date: | Apr . 02, 2013 |
| Plot NO. | 44 |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: 2450MHz FCC; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.97 mho/m; $\varepsilon_r$ = 53.6; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body Left ch6/Area Scan (81x121x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.013 mW/g

**Body Left ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.31 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 0.024 W/kg
**SAR(1 g) = 0.012 mW/g; SAR(10 g) = 0.00592 mW/g**
Maximum value of SAR (measured) = 0.014 mW/g



0 dB = 0.014mW/g

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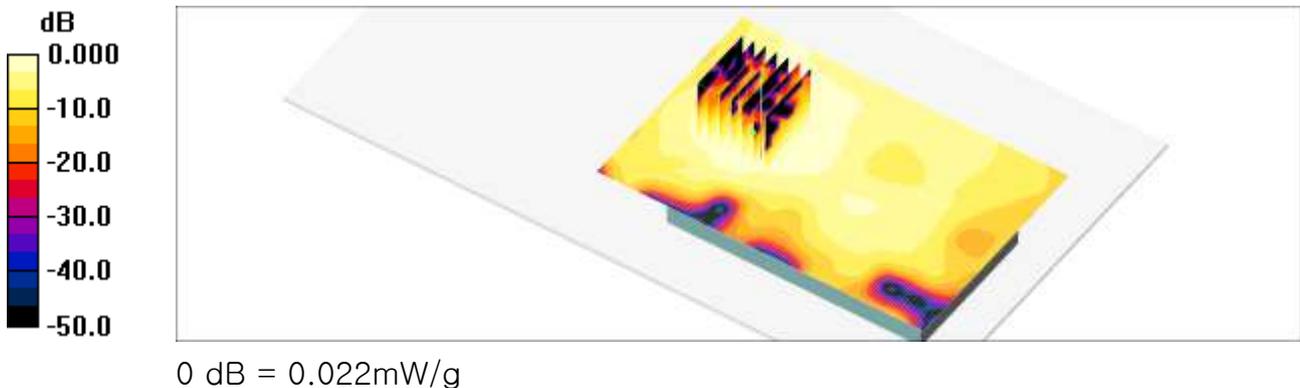| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.3 ℃ |
| Ambient Temperature: | 21.5 ℃ |
| Test Date: | Apr . 02, 2013 |
| Plot NO. | 45 |

### DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.97 mho/m; $\varepsilon_r$ = 53.6; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body Top ch6/Area Scan (81x61x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.035 mW/g

**Body Top ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.42 V/m; Power Drift = 0.179 dB
Peak SAR (extrapolated) = 0.061 W/kg
**SAR(1 g) = 0.030 mW/g; SAR(10 g) = 0.015 mW/g**
Maximum value of SAR (measured) = 0.032 mW/g
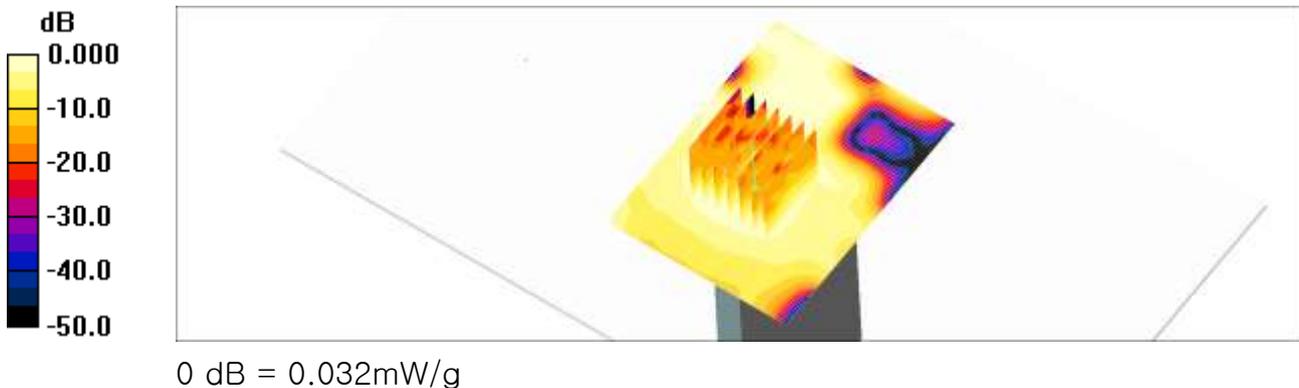


0 dB = 0.032mW/g

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| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.2 ℃ |
| Ambient Temperature: | 21.4 ℃ |
| Test Date: | Mar . 30, 2013 |
| Plot NO. | 46 |

### DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; $\varepsilon_r$ = 56.8; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body-worn rear 190/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.595 mW/g

**Body-worn rear 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.57 V/m; Power Drift = -0.096 dB
Peak SAR (extrapolated) = 0.701 W/kg
**SAR(1 g) = 0.574 mW/g; SAR(10 g) = 0.455 mW/g**
Maximum value of SAR (measured) = 0.598 mW/g



0 dB = 0.598mW/g

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| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.2 ℃ |
| Ambient Temperature: | 21.4 ℃ |
| Test Date: | Mar . 30, 2013 |
| Plot NO. | 47 |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.987 mho/m; $\varepsilon_r$ = 56.8; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body-worn front 190/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.401 mW/g

**Body-worn front 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.39 V/m; Power Drift = -0.084 dB
Peak SAR (extrapolated) = 0.451 W/kg
**SAR(1 g) = 0.384 mW/g; SAR(10 g) = 0.313 mW/g**
Maximum value of SAR (measured) = 0.398 mW/g



0 dB = 0.398mW/g

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| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 20.7 ℃ |
| Ambient Temperature: | 20.9 ℃ |
| Test Date: | Apr . 01, 2013 |
| Plot NO. | 48 |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; $\sigma$ = 1.54 mho/m; $\varepsilon_r$ = 52.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**Body-worn Rear 661/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.441 mW/g

**Body-worn Rear 661/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.87 V/m; Power Drift = -0.141 dB
Peak SAR (extrapolated) = 0.638 W/kg
**SAR(1 g) = 0.403 mW/g; SAR(10 g) = 0.247 mW/g**
Maximum value of SAR (measured) = 0.436 mW/g



| dB |
|---|
| 0.000 |
| -3.34 |
| -6.68 |
| -10.0 |
| -13.4 |
| -16.7 |

0 dB = 0.436mW/g

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Test Laboratory: HCT CO., LTD

EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Liquid Temperature: 20.7 ℃

Ambient Temperature: 20.9 ℃

Test Date: Apr . 01, 2013

Plot NO. 49
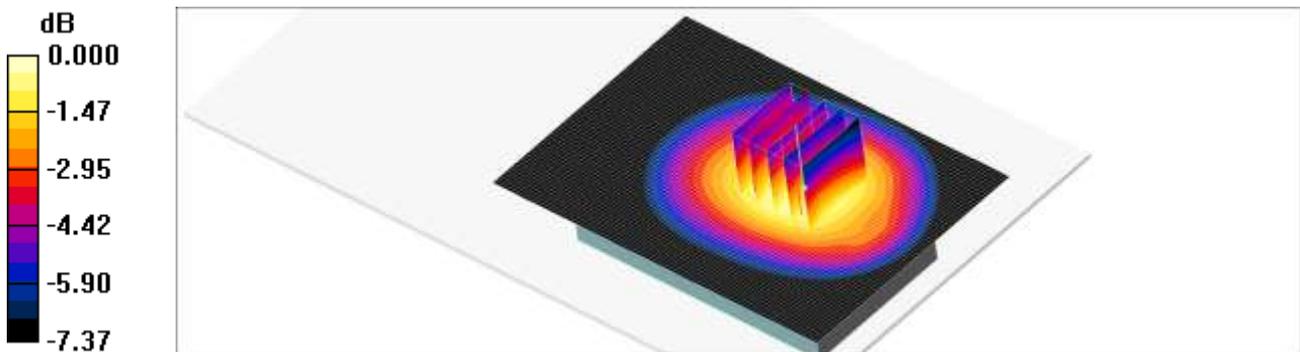

### DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium parameters used: f = 1880 MHz; $\sigma$ = 1.54 mho/m; $\varepsilon_r$ = 52.3; $\rho$ = 1000 kg/m$^3$

Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184


DASY4 Configuration:

- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA


### Body-worn Front 661/Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.421 mW/g


### Body-worn Front 661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.61 V/m; Power Drift = -0.154 dB

Peak SAR (extrapolated) = 0.607 W/kg

### SAR(1 g) = 0.380 mW/g; SAR(10 g) = 0.231 mW/g

Maximum value of SAR (measured) = 0.413 mW/g



0 dB = 0.413mW/g

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Test Laboratory:          HCT CO., LTD
EUT Type:                 GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n
Liquid Temperature:       21.2 ℃
Ambient Temperature:      21.4 ℃
Test Date:                Mar . 30, 2013
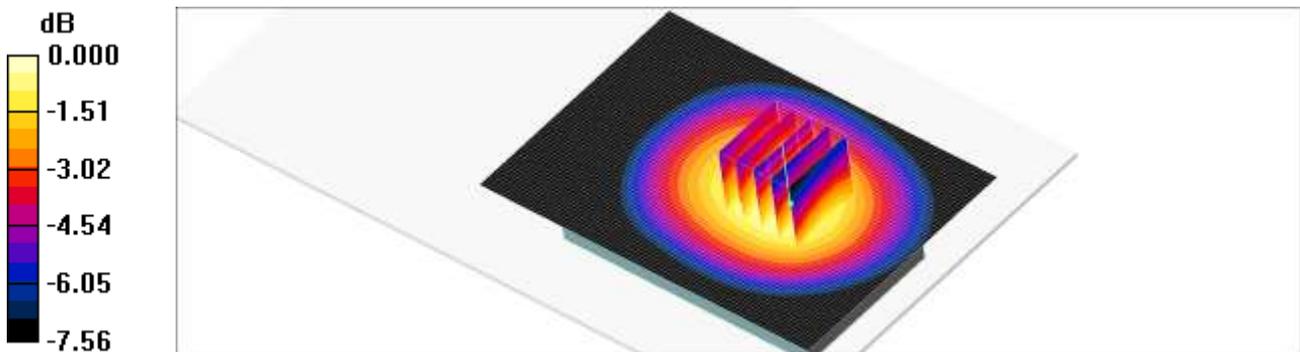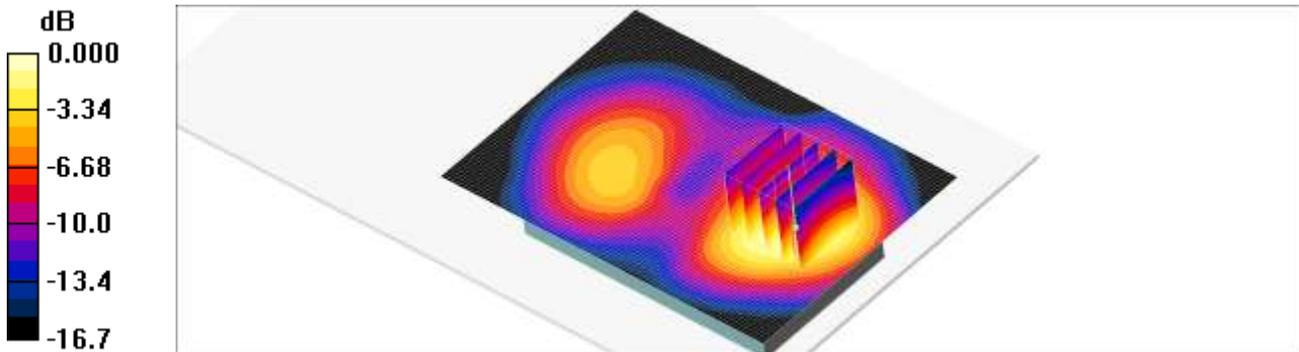Plot NO.                  50

DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: GSM 850; Frequency: 848.8 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 850 MHz; σ = 0.999 mho/m; $\varepsilon_r$ = 56.7; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body rear 251 4tx/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.15 mW/g

**Body rear 251 4tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.78 V/m; Power Drift = -0.073 dB
Peak SAR (extrapolated) = 1.44 W/kg
**SAR(1 g) = 1.07 mW/g; SAR(10 g) = 0.768 mW/g**
Maximum value of SAR (measured) = 1.14 mW/g

**Body rear 251 4tx/Zoom Scan (5x5x7)/Cube 1:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.78 V/m; Power Drift = -0.073 dB
Peak SAR (extrapolated) = 1.31 W/kg
**SAR(1 g) = 0.778 mW/g; SAR(10 g) = 0.496 mW/g**
Maximum value of SAR (measured) = 0.963 mW/g



0 dB = 0.963mW/g

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Test Laboratory:              HCT CO., LTD

EUT Type:                     GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Liquid Temperature:           21.1 ℃

Ambient Temperature:          21.3 ℃

Test Date:                    Mar . 29, 2013

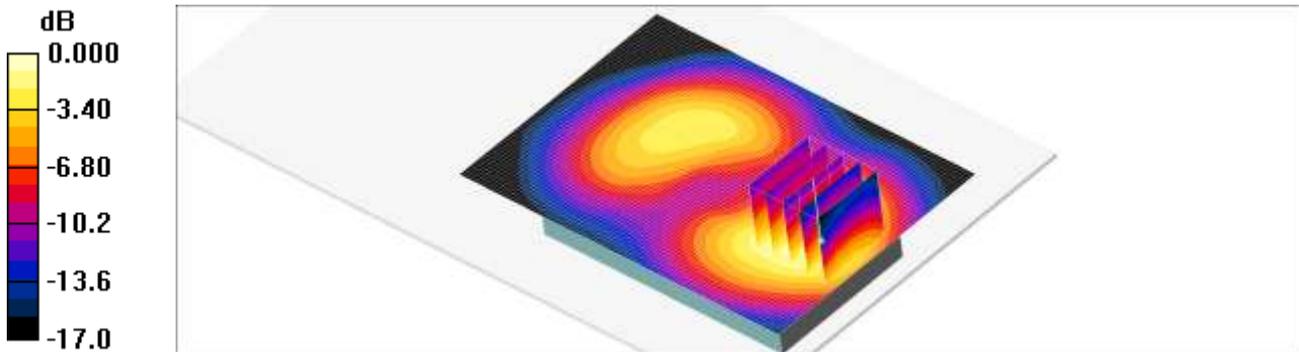Plot NO.                      7

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 836.6 MHz;Duty Cycle: 1:2.075
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.921 mho/m; $\varepsilon_r$ = 40.4; ρ = 1000 kg/m$^3$
Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Right touch 190/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.616 mW/g

**Right touch 190/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.82 V/m; Power Drift = 0.167 dB
Peak SAR (extrapolated) = 0.693 W/kg
**SAR(1 g) = 0.581 mW/g; SAR(10 g) = 0.442 mW/g**
Maximum value of SAR (measured) = 0.614 mW/g

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| | |
|---|---|
| Test Laboratory: | HCT CO., LTD |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 20.7 ℃ |
| Ambient Temperature: | 20.9 ℃ |
| Test Date: | Apr . 01, 2013 |
| Plot NO. | 13 |

DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 1880 MHz; σ = 1.35 mho/m; $ε_r$ = 40.9; ρ = 1000 kg/m$^3$
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184
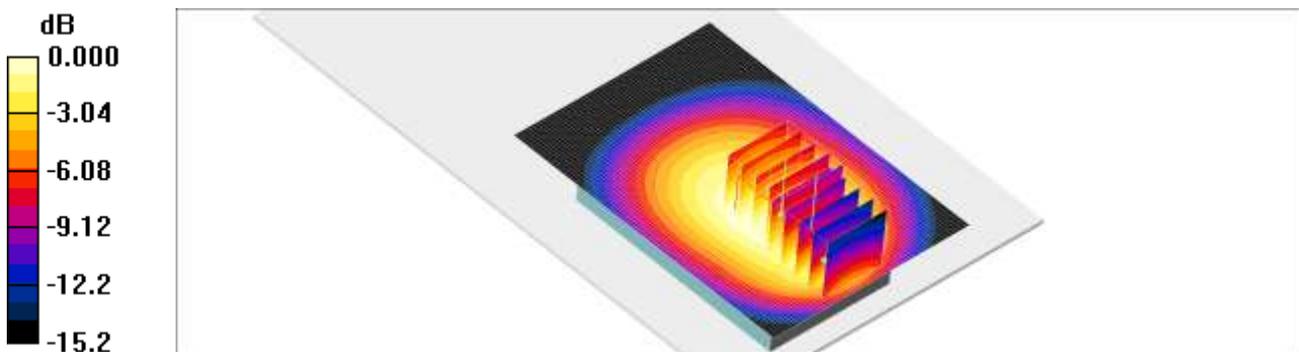
DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 1800/1900 MHz; Type: SAM

**Left Touch 661 GPRS 4Tx/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.499 mW/g

**Left Touch 661 GPRS 4Tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.41 V/m; Power Drift = -0.082 dB
Peak SAR (extrapolated) = 0.774 W/kg
**SAR(1 g) = 0.477 mW/g; SAR(10 g) = 0.283 mW/g**
Maximum value of SAR (measured) = 0.512 mW/g

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| | | |
|---|---|---|
| Test Laboratory: | HCT CO., LTD | |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n | |
| Liquid Temperature: | 21.1 ℃ | |
| Ambient Temperature: | 21.3 ℃ | |
| Test Date: | Mar . 29, 2013 | |
| Plot NO. | 19 | |

**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.921 mho/m; $\varepsilon_r$ = 40.4; ρ = 1000 kg/m$^3$
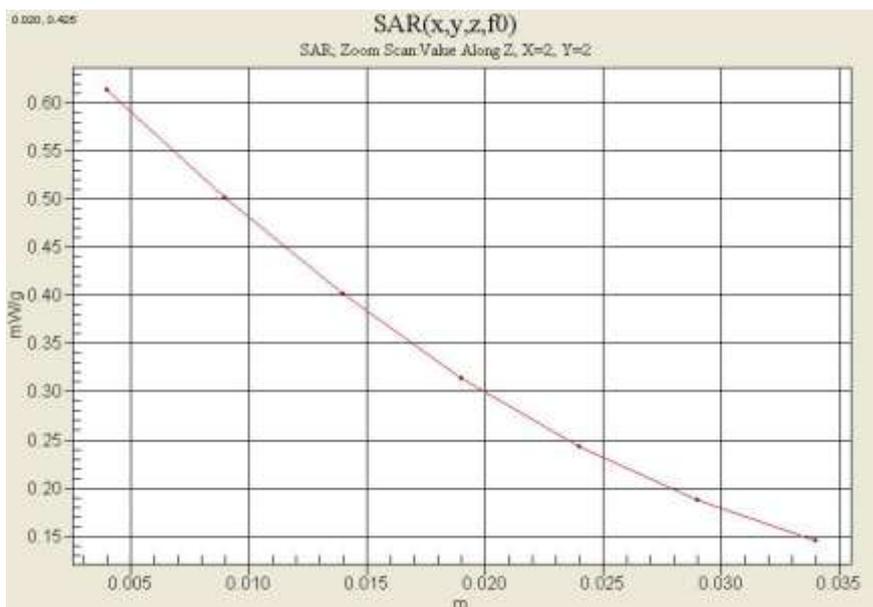Phantom section: Right Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: SAM 835/900 MHz; Type: SAM

**Right touch 4183/Area Scan (61x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.461 mW/g

**Right touch 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.34 V/m; Power Drift = -0.116 dB
Peak SAR (extrapolated) = 0.538 W/kg
**SAR(1 g) = 0.438 mW/g; SAR(10 g) = 0.327 mW/g**
Maximum value of SAR (measured) = 0.461 mW/g

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Test Laboratory: HCT CO., LTD

EUT Type: GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Liquid Temperature: 21.3 ℃

Ambient Temperature: 21.5 ℃

Test Date: Apr . 02, 2013

Plot NO. 21

### DUT: LG-E440f; Type: Bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.85 mho/m; $\varepsilon_r$ = 38.9; ρ = 1000 kg/m$^3$
Phantom section: Left Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: 1800/1900 Phantom; Type: SAM

**Left touch 6ch 1Mbps/Area Scan (71x121x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.187 mW/g

**Left touch 6ch 1Mbps/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.97 V/m; Power Drift = 0.101 dB
Peak SAR (extrapolated) = 0.399 W/kg
**SAR(1 g) = 0.175 mW/g; SAR(10 g) = 0.083 mW/g**
Maximum value of SAR (measured) = 0.199 mW/g

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| Test Laboratory: | HCT CO., LTD |
| --- | --- |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 21.2 ℃ |
| Ambient Temperature: | 21.4 ℃ |
| Test Date: | Mar . 30, 2013 |
| Plot NO. | 27 |

### DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: GSM 850; Frequency: 848.8 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 850 MHz; σ = 0.999 mho/m; $\varepsilon_r$ = 56.7; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body rear 251 4tx/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.15 mW/g

**Body rear 251 4tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.58 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 1.48 W/kg
**SAR(1 g) = 1.09 mW/g; SAR(10 g) = 0.776 mW/g**
Maximum value of SAR (measured) = 1.15 mW/g

**Body rear 251 4tx/Zoom Scan (5x5x7)/Cube 1:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.58 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 1.37 W/kg
**SAR(1 g) = 0.845 mW/g; SAR(10 g) = 0.534 mW/g**
Maximum value of SAR (measured) = 1.03 mW/g

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| Test Laboratory: | HCT CO., LTD |
| --- | --- |
| EUT Type: | GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n |
| Liquid Temperature: | 20.7 ℃ |
| Ambient Temperature: | 20.9 ℃ |
| Test Date: | Apr . 01, 2013 |
| Plot NO. | 32 |

### DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:2.075
Medium parameters used: f = 1880 MHz; σ = 1.54 mho/m; $\varepsilon_r$ = 52.3; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body rear 661 4Tx/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.598 mW/g

**Body rear 661 4Tx/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.20 V/m; Power Drift = -0.011 dB
Peak SAR (extrapolated) = 0.874 W/kg
**SAR(1 g) = 0.541 mW/g; SAR(10 g) = 0.326 mW/g**
Maximum value of SAR (measured) = 0.587 mW/g

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Test Laboratory:          HCT CO., LTD

EUT Type:                 GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Liquid Temperature:       21.2 ℃

Ambient Temperature:      21.4 ℃

Test Date:                Mar . 30, 2013

Plot NO.                  37
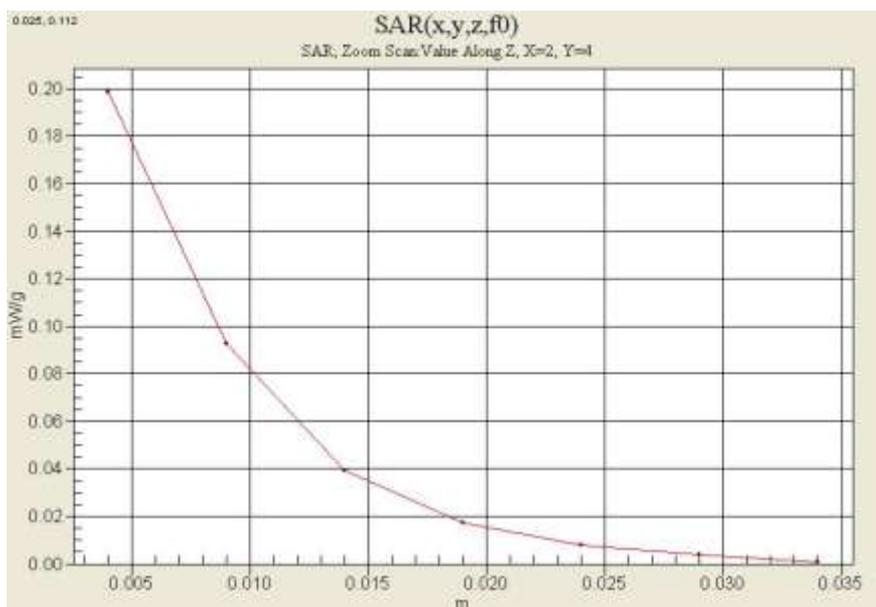
**DUT: LG-E440F; Type: Bar; Serial: #1**

Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 836.6 MHz; $\sigma$ = 0.987 mho/m; $\varepsilon_r$ = 56.8; $\rho$ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body rear 4183/Area Scan (71x101x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.695 mW/g

**Body rear 4183/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.38 V/m; Power Drift = -0.122 dB
Peak SAR (extrapolated) = 0.870 W/kg
**SAR(1 g) = 0.653 mW/g; SAR(10 g) = 0.470 mW/g**
Maximum value of SAR (measured) = 0.691 mW/g

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Test Laboratory:　　　　　　　HCT CO., LTD

EUT Type:　　　　　　　　　　GSM/WCDMA Phone with Bluetooth3.0, WIFI802.11 b/g/n

Liquid Temperature:　　　　　21.3 ℃

Ambient Temperature:　　　　21.5 ℃

Test Date:　　　　　　　　　Apr . 02, 2013

Plot NO.　　　　　　　　　　42

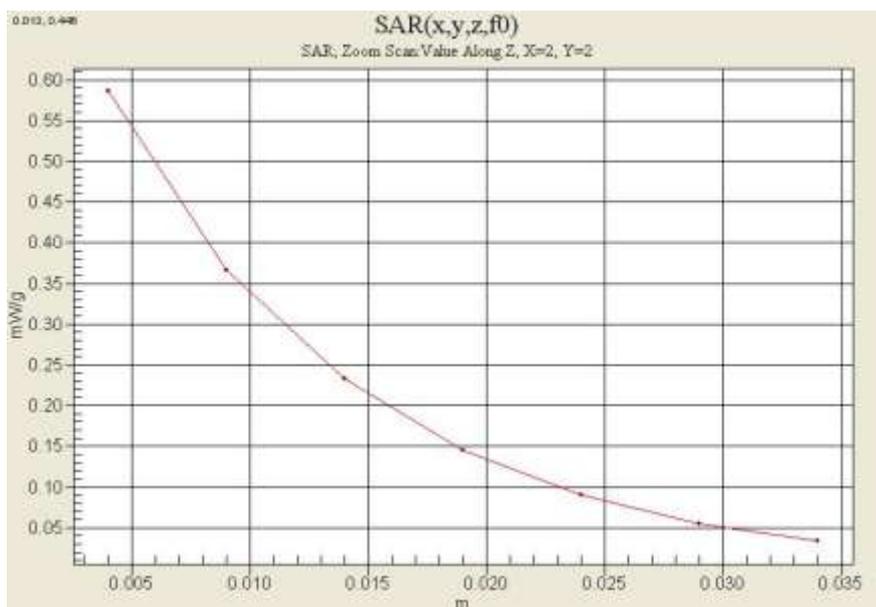### DUT: LG-E440F; Type: Bar; Serial: #1

Communication System: 2450MHz FCC; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.97 mho/m; $\varepsilon_r$ = 53.6; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C_20120905; Type: QD 000 P51 CA

**Body rear ch6/Area Scan (81x121x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 0.042 mW/g

**Body rear ch6/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.33 V/m; Power Drift = 0.134 dB
Peak SAR (extrapolated) = 0.081 W/kg
**SAR(1 g) = 0.039 mW/g; SAR(10 g) = 0.021 mW/g**
Maximum value of SAR (measured) = 0.043 mW/g

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# Attachment 2. – Dipole Verification Plots

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## ■ Verification Data (835 MHz Head)

Test Laboratory: HCT CO., LTD

Input Power 100 mW (20 dBm)

Liquid Temp: 21.1 ℃

Test Date: Mar. 29, 2013

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 – SN:441**

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.919 mho/m; $\varepsilon_r$ = 40.5; ρ = 1000 kg/m$^3$
Phantom section: Flat Section ; Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 – SN3797; ConvF(8.94, 8.94, 8.94); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: 1800/1900 Phantom; Type: SAM

**Validation 835MHz/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.04 mW/g

**Validation 835MHz/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.8 V/m; Power Drift = 0.003 dB
Peak SAR (extrapolated) = 1.57 W/kg
**SAR(1 g) = 0.953 mW/g; SAR(10 g) = 0.580 mW/g**
Maximum value of SAR (measured) = 1.05 mW/g



0 dB = 1.05mW/g

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## ■ Verification Data (835 MHz Body)

Test Laboratory: HCT CO., LTD

Input Power 100 mW (20 dBm)

Liquid Temp: 21.2 ℃

Test Date: Mar. 30, 2013

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:441**

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.985 mho/m; $\varepsilon_r$ = 56.8; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(8.98, 8.98, 8.98); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**Validation 835 MHz/Area Scan (111x61x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.04 mW/g

**Validation 835 MHz/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 32.4 V/m; Power Drift = -0.008 dB
Peak SAR (extrapolated) = 1.45 W/kg
**SAR(1 g) = 0.962 mW/g; SAR(10 g) = 0.624 mW/g**
Maximum value of SAR (measured) = 1.04 mW/g



0 dB = 1.04mW/g

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# ■ Verification Data (1 900 MHz Head)

Test Laboratory:　　　HCT CO., LTD

Input Power　　　　100 mW (20 dBm)

Liquid Temp:　　　　20.7 ℃

Test Date:　　　　　Apr. 01, 2013

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d032**

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.37 mho/m; $\varepsilon_r$ = 40.8; ρ = 1000 kg/m$^3$
Phantom section: Flat Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(7.47, 7.47, 7.47); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: 1800/1900 Phantom; Type: SAM

**Dipole 1900MHz Validation/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 4.45 mW/g

**Dipole 1900MHz Validation/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 55.2 V/m; Power Drift = 0.002 dB
Peak SAR (extrapolated) = 7.33 W/kg
**SAR(1 g) = 3.78 mW/g; SAR(10 g) = 1.93 mW/g**
Maximum value of SAR (measured) = 4.16 mW/g



0 dB = 4.16mW/g

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## ■ Verification Data (1 900 MHz Body)

Test Laboratory:        HCT CO., LTD

Input Power             100 mW (20 dBm)

Liquid Temp:            20.7 ℃

Test Date:              Apr. 01, 2013

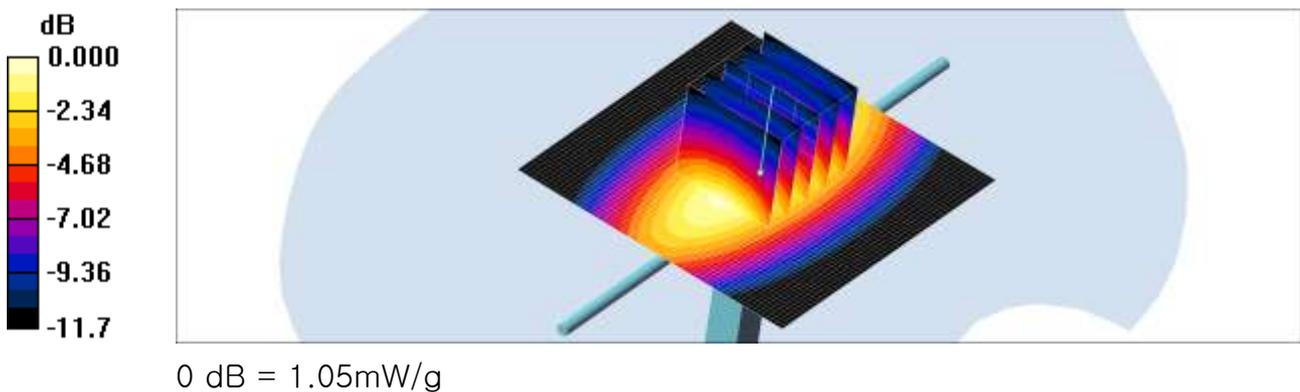**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 – SN:5d032**

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.56 mho/m; $\varepsilon_r$ = 52.3; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 – SN3797; ConvF(7.28, 7.28, 7.28); Calibrated: 2012-11-22
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**Validation1900 MHz/Area Scan (61x61x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 4.85 mW/g

**Validation1900 MHz/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 52.8 V/m; Power Drift = -0.010 dB
Peak SAR (extrapolated) = 7.25 W/kg
**SAR(1 g) = 4 mW/g; SAR(10 g) = 2.1 mW/g**
Maximum value of SAR (measured) = 4.39 mW/g



0 dB = 4.39mW/g

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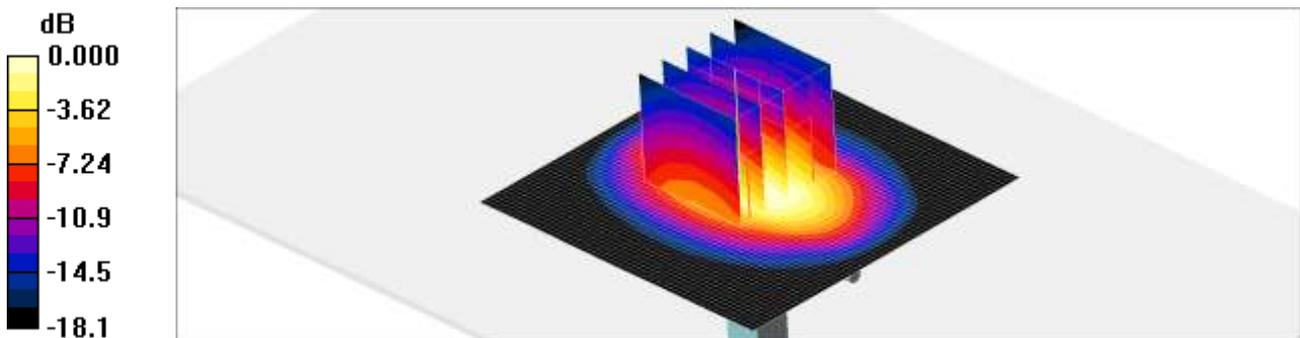
## ■ Verification Data (2 450 MHz Head)

Test Laboratory:　　　HCT CO., LTD

Input Power　　　　　100 mW (20 dBm)

Liquid Temp:　　　　 21.3 ℃

Test Date:　　　　　 Apr. 02, 2013

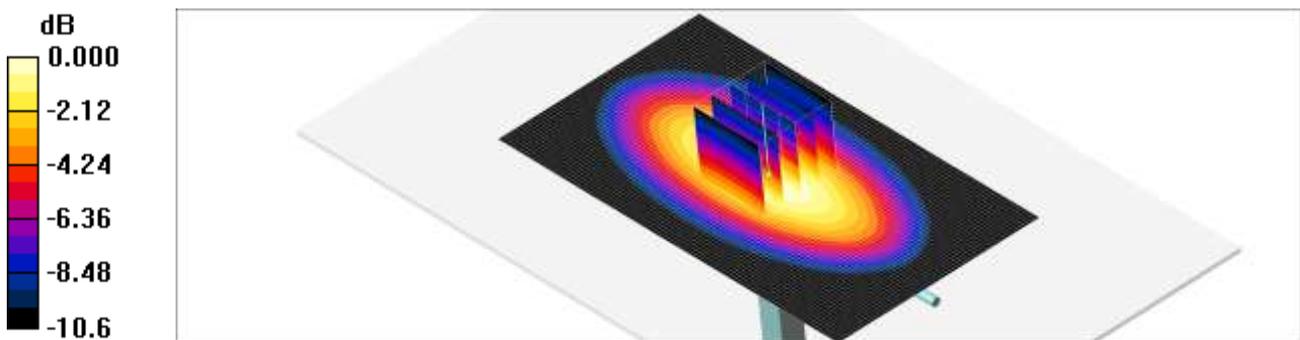DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:743

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.86 mho/m; $ε_r$ = 38.9; ρ = 1000 kg/m$^3$
Phantom section: Flat Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 - SN3797; ConvF(6.76, 6.76, 6.76); Calibrated: 2012-11-22
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: 835/900 Phamtom ; Type: SAM

**Validation 2450MHz/Area Scan (81x81x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 8.65 mW/g

**Validation 2450MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.9 V/m; Power Drift = -0.013 dB
Peak SAR (extrapolated) = 12.2 W/kg
**SAR(1 g) = 5.48 mW/g; SAR(10 g) = 2.43 mW/g**
Maximum value of SAR (measured) = 8.64 mW/g



0 dB = 8.64mW/g

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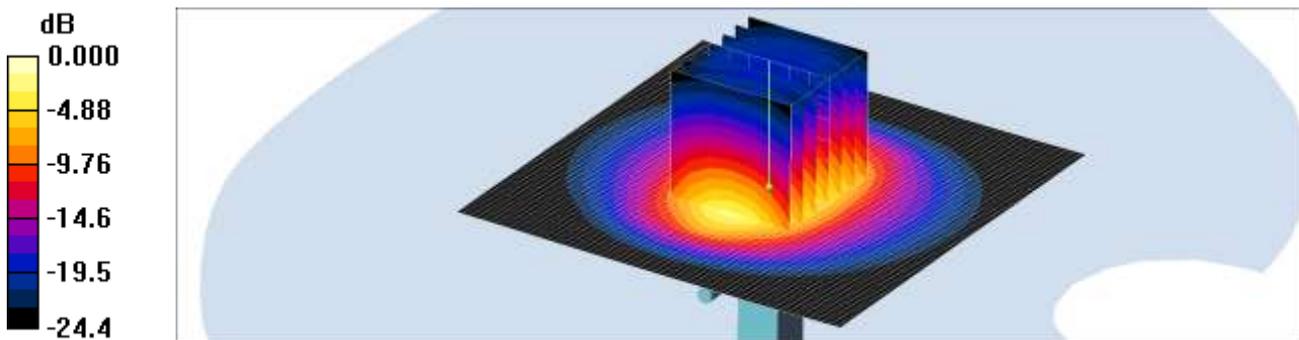
## ■ **Verification Data (2 450 MHz Body)**

Test Laboratory:        HCT CO., LTD

Input Power             100 mW (20 dBm)

Liquid Temp:            21.3 ℃

Test Date:              Apr. 02, 2013

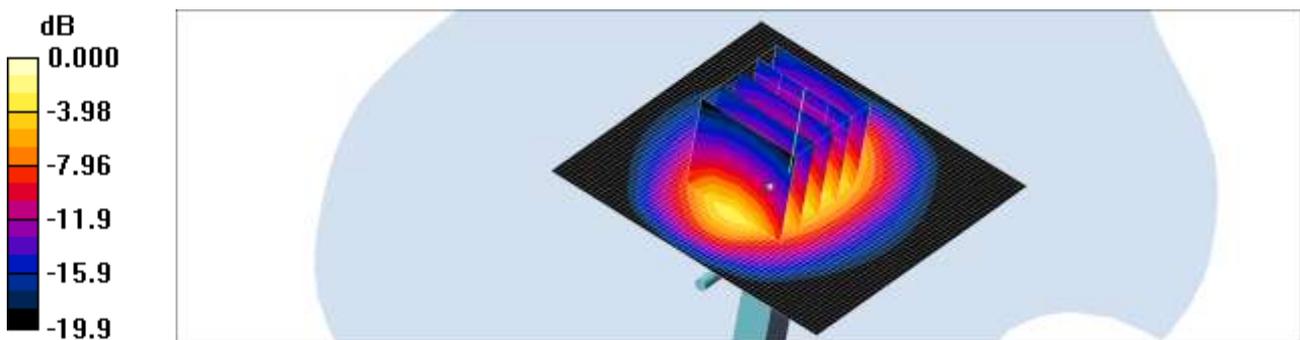**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 – SN:743**

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.99 mho/m; $\varepsilon_r$ = 53.6; ρ = 1000 kg/m$^3$
Phantom section: Center Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:
- Probe: EX3DV4 – SN3797; ConvF(6.98, 6.98, 6.98); Calibrated: 2012-11-22
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn446; Calibrated: 2013-01-16
- Phantom: Triple Flat Phantom 5.1C; Type: QD 000 P51 CA

**Validation 2450MHz/Area Scan (81x81x1):** Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 8.19 mW/g

**Validation 2450MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 48.8 V/m; Power Drift = 0.139 dB
Peak SAR (extrapolated) = 12.2 W/kg
**SAR(1 g) = 5.22 mW/g; SAR(10 g) = 2.25 mW/g**
Maximum value of SAR (measured) = 8.47 mW/g



0 dB = 8.47mW/g

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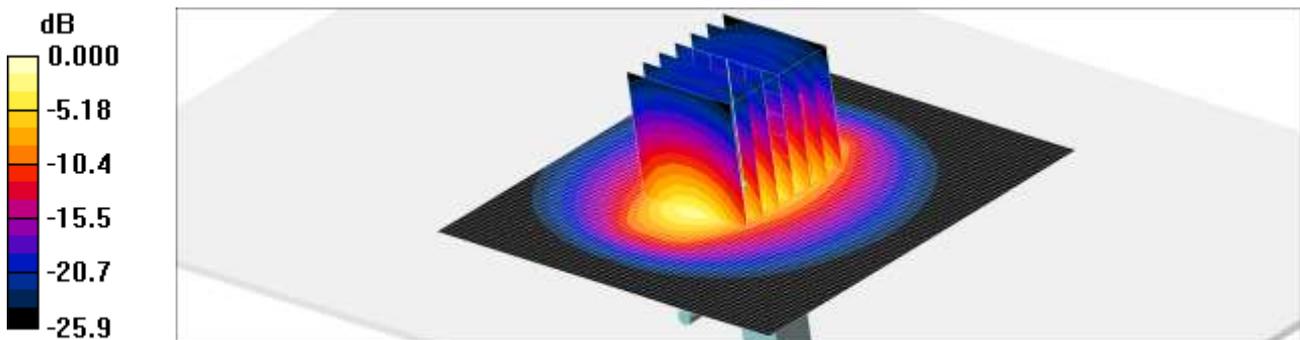
# Attachment 3. – Probe Calibration Data

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

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   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    **HCT (Dymstec)**                     Certificate No: **EX3-3797_Nov12**

## CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | EX3DV4 - SN:3797 |
| Calibration procedure(s) | QA CAL-01.v8, QA CAL-12.v7, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4<br>Calibration procedure for dosimetric E-field probes |
| Calibration date: | November 22, 2012 |

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 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Power sensor E4412A | MY41498087 | 29-Mar-12 (No. 217-01508) | Apr-13 |
| Reference 3 dB Attenuator | SN: S5054 (3c) | 27-Mar-12 (No. 217-01531) | Apr-13 |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 27-Mar-12 (No. 217-01529) | Apr-13 |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 27-Mar-12 (No. 217-01532) | Apr-13 |
| Reference Probe ES3DV2 | SN: 3013 | 29-Dec-11 (No. ES3-3013_Dec11) | Dec-12 |
| DAE4 | SN: 660 | 20-Jun-12 (No. DAE4-660_Jun12) | Jun-13 |
| | | | |
| Secondary Standards | ID | Check Date (in house) | Scheduled Check |
| RF generator HP 8648C | US3642U01790 | 4-Aug-99 (in house check Apr-11) | In house check: Apr-13 |
| Network Analyzer HP 8753E | US37390585 | 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: November 22, 2012

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

Certificate No: EX3-3797_Nov12          Page 1 of 11

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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

## Glossary:

| | |
|---|---|
| TSL | tissue simulating liquid |
| NORMx,y,z | sensitivity in free space |
| ConvF | sensitivity in TSL / NORMx,y,z |
| DCP | diode compression point |
| CF | crest factor (1/duty_cycle) of the RF signal |
| A, B, C | modulation dependent linearization parameters |
| 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., ϑ = 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 ϑ = 0 (f ≤ 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 affect 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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.

- *PAR*: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics

- *Ax,y,z; Bx,y,z; Cx,y,z; VRx,y,z*: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.

- *ConvF and Boundary Effect Parameters*: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 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.

Certificate No: EX3-3797_Nov12　　　　　　Page 2 of 11

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EX3DV4 – SN:3797

November 22, 2012

# Probe  EX3DV4

# SN:3797

Manufactured:     April 5, 2011
Calibrated:        November 22, 2012

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

Certificate No: EX3-3797_Nov12                    Page 3 of 11

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EX3DV4– SN:3797                                                November 22, 2012

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3797

### Basic Calibration Parameters

|  | Sensor X | Sensor Y | Sensor Z | Unc (k=2) |
|---|---|---|---|---|
| Norm ($\mu V/(V/m)^2$)[A] | 0.63 | 0.59 | 0.57 | ± 10.1 % |
| DCP (mV)[B] | 97.5 | 94.8 | 93.7 | |

### Modulation Calibration Parameters

| UID | Communication System Name | PAR | | A dB | B dB | C dB | VR mV | Unc[E] (k=2) |
|---|---|---|---|---|---|---|---|---|
| 0 | CW | 0.00 | X | 0.0 | 0.0 | 1.0 | 134.7 | ±3.0 % |
| | | | Y | 0.0 | 0.0 | 1.0 | 130.7 | |
| | | | Z | 0.0 | 0.0 | 1.0 | 130.3 | |

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 $E^2$-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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EX3DV4– SN:3797

November 22, 2012

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:3797

## Calibration Parameter Determined in Head Tissue Simulating Media

| f (MHz) [C] | Relative Permittivity [ε] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|---|---|---|---|---|---|---|---|---|
| 450 | 43.5 | 0.87 | 9.30 | 9.30 | 9.30 | 0.15 | 3.00 | ± 13.4 % |
| 835 | 41.5 | 0.90 | 8.94 | 8.94 | 8.94 | 0.44 | 0.78 | ± 12.0 % |
| 900 | 41.5 | 0.97 | 8.83 | 8.83 | 8.83 | 0.37 | 0.88 | ± 12.0 % |
| 1450 | 40.5 | 1.20 | 7.89 | 7.89 | 7.89 | 0.24 | 1.28 | ± 12.0 % |
| 1750 | 40.1 | 1.37 | 7.77 | 7.77 | 7.77 | 0.75 | 0.60 | ± 12.0 % |
| 1900 | 40.0 | 1.40 | 7.47 | 7.47 | 7.47 | 0.44 | 0.82 | ± 12.0 % |
| 1950 | 40.0 | 1.40 | 7.27 | 7.27 | 7.27 | 0.80 | 0.59 | ± 12.0 % |
| 2450 | 39.2 | 1.80 | 6.76 | 6.76 | 6.76 | 0.41 | 0.83 | ± 12.0 % |
| 2600 | 39.0 | 1.96 | 6.68 | 6.68 | 6.68 | 0.46 | 0.81 | ± 12.0 % |
| 5200 | 36.0 | 4.66 | 4.84 | 4.84 | 4.84 | 0.34 | 1.80 | ± 13.1 % |
| 5300 | 35.9 | 4.76 | 4.61 | 4.61 | 4.61 | 0.34 | 1.80 | ± 13.1 % |
| 5500 | 35.6 | 4.96 | 4.58 | 4.58 | 4.58 | 0.34 | 1.80 | ± 13.1 % |
| 5600 | 35.5 | 5.07 | 4.45 | 4.45 | 4.45 | 0.31 | 1.80 | ± 13.1 % |
| 5800 | 35.3 | 5.27 | 4.50 | 4.50 | 4.50 | 0.34 | 1.80 | ± 13.1 % |

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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EX3DV4– SN:3797                                                          November 22, 2012

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3797

### Calibration Parameter Determined in Body Tissue Simulating Media

| f (MHz) [c] | Relative Permittivity [F] | Conductivity (S/m) [F] | ConvF X | ConvF Y | ConvF Z | Alpha | Depth (mm) | Unct. (k=2) |
|---|---|---|---|---|---|---|---|---|
| 450 | 56.7 | 0.94 | 10.22 | 10.22 | 10.22 | 0.07 | 3.31 | ± 13.4 % |
| 835 | 55.2 | 0.97 | 8.98 | 8.98 | 8.98 | 0.44 | 0.85 | ± 12.0 % |
| 1750 | 53.4 | 1.49 | 7.58 | 7.58 | 7.58 | 0.68 | 0.66 | ± 12.0 % |
| 1900 | 53.3 | 1.52 | 7.28 | 7.28 | 7.28 | 0.49 | 0.79 | ± 12.0 % |
| 2450 | 52.7 | 1.95 | 6.98 | 6.98 | 6.98 | 0.80 | 0.58 | ± 12.0 % |
| 2600 | 52.5 | 2.16 | 6.73 | 6.73 | 6.73 | 0.80 | 0.50 | ± 12.0 % |
| 5200 | 49.0 | 5.30 | 4.17 | 4.17 | 4.17 | 0.46 | 1.90 | ± 13.1 % |
| 5300 | 48.9 | 5.42 | 4.20 | 4.20 | 4.20 | 0.42 | 1.90 | ± 13.1 % |
| 5500 | 48.6 | 5.65 | 4.05 | 4.05 | 4.05 | 0.41 | 1.90 | ± 13.1 % |
| 5600 | 48.5 | 5.77 | 4.06 | 4.06 | 4.06 | 0.30 | 1.90 | ± 13.1 % |
| 5800 | 48.2 | 6.00 | 4.19 | 4.19 | 4.19 | 0.42 | 1.90 | ± 13.1 % |

[c] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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EX3DV4– SN:3797

November 22, 2012

## Frequency Response of E-Field
### (TEM-Cell:ifi110 EXX, Waveguide: R22)
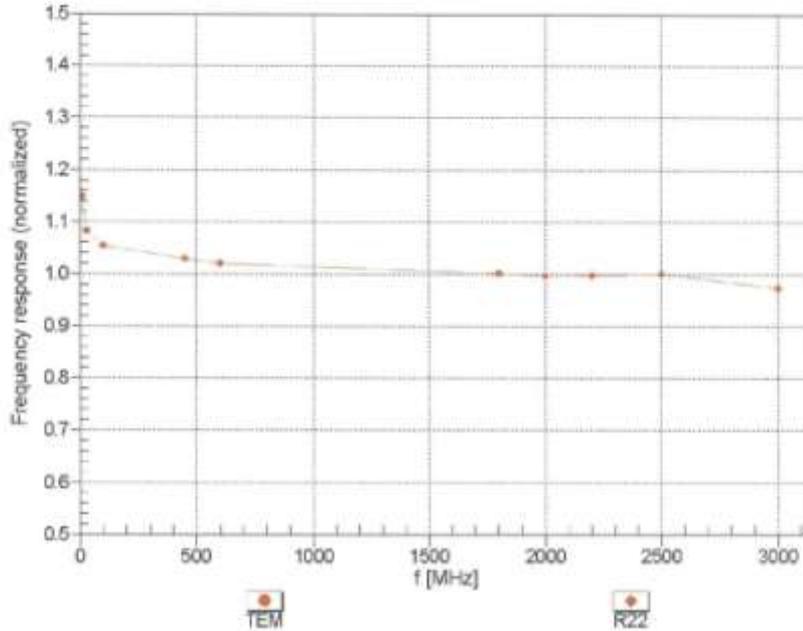


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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## Receiving Pattern (φ), ϑ = 0°

f=600 MHz,TEM

f=1800 MHz,R22
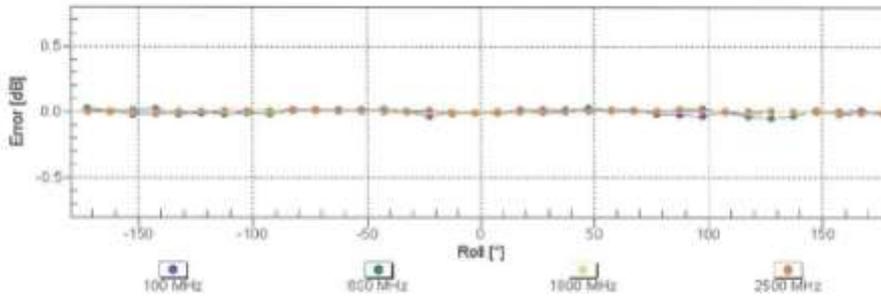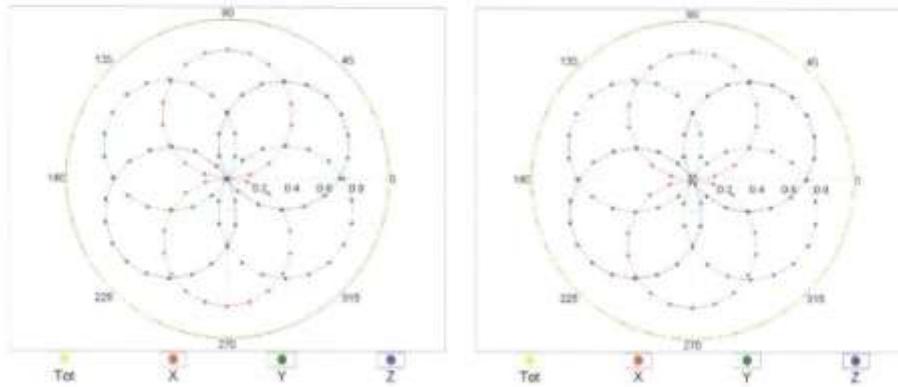


Uncertainty of Axial isotropy Assessment: ± 0.5% (k=2)

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## Dynamic Range f(SAR_head)
### (TEM cell , f = 900 MHz)



not compensated    compensated



not compensated    compensated
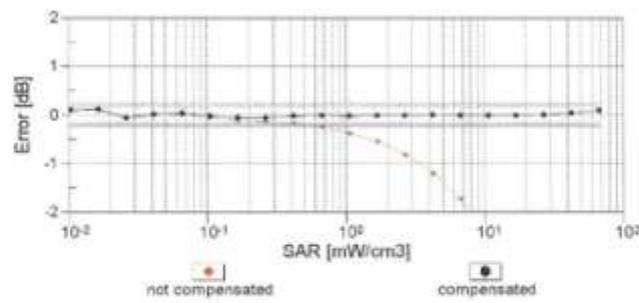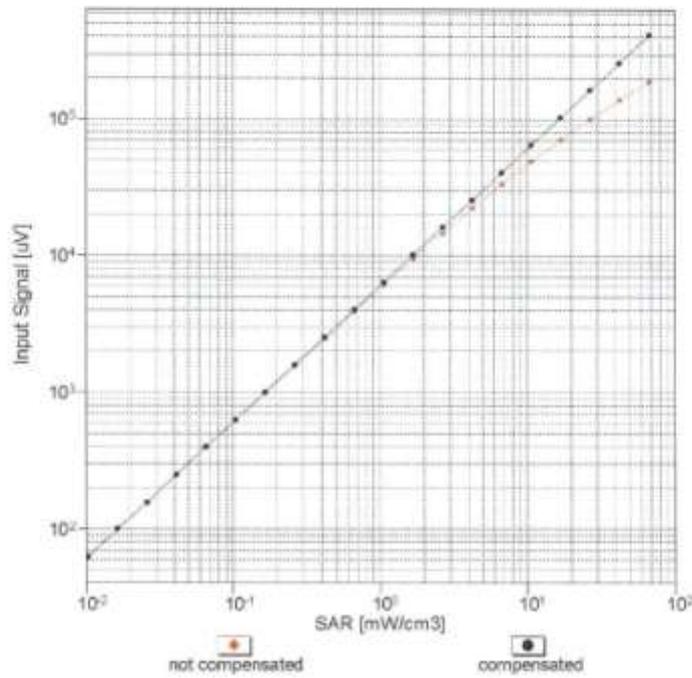
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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EX3DV4– SN:3797                                                                November 22, 2012

## Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)          f = 1900 MHz,WGLS R22 (H_convF)
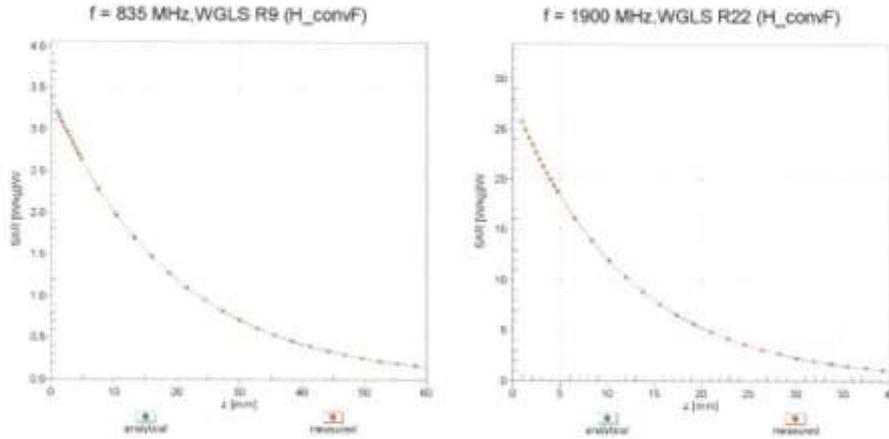
## Deviation from Isotropy in Liquid
### Error (φ, ϑ), f = 900 MHz

Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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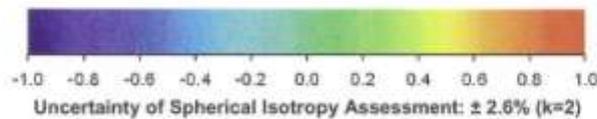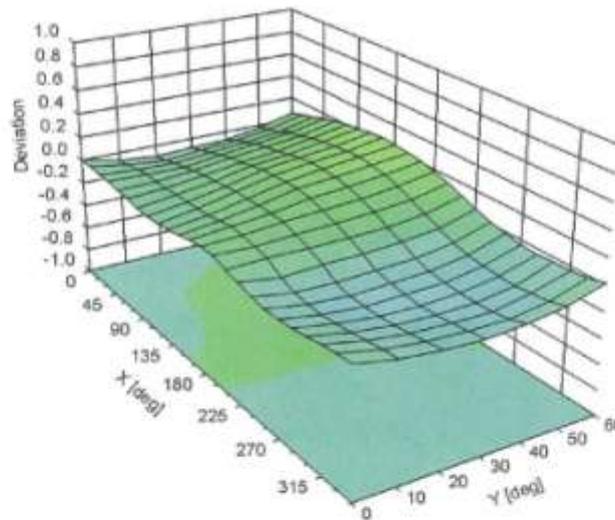
EX3DV4~ SN:3797 November 22, 2012

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3797

### Other Probe Parameters

| Sensor Arrangement | Triangular |
|---|---|
| Connector Angle (°) | 67.5 |
| Mechanical Surface Detection Mode | enabled |
| Optical Surface Detection Mode | disabled |
| Probe Overall Length | 337 mm |
| Probe Body Diameter | 10 mm |
| Tip Length | 9 mm |
| Tip Diameter | 2.5 mm |
| Probe Tip to Sensor X Calibration Point | 1 mm |
| Probe Tip to Sensor Y Calibration Point | 1 mm |
| Probe Tip to Sensor Z Calibration Point | 1 mm |
| Recommended Measurement Distance from Surface | 2 mm |

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# Attachment 4. – Dipole Calibration Data

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**Calibration Laboratory of**
**Schmid & Partner**
**Engineering AG**
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    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   **HCT (Dymstec)**                    Certificate No.: **D835V2-441_May12**

## CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D835V2 - SN: 441 |
| Calibration procedure(s) | QA CAL-05.v8<br>Calibration procedure for dipole validation kits above 700 MHz |
| Calibration date: | May 16, 2012 |

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 | 05-Oct-11 (No. 217-01451) | Oct-12 |
| Power sensor HP 8481A | US37292783 | 05-Oct-11 (No. 217-01451) | Oct-12 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 27-Mar-12 (No. 217-01530) | Apr-13 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 27-Mar-12 (No. 217-01533) | Apr-13 |
| Reference Probe ES3DV3 | SN: 3205 | 30-Dec-11 (No. ES3-3205_Dec11) | Dec-12 |
| DAE4 | SN: 601 | 04-Jul-11 (No. DAE4-601_Jul11) | Jul-12 |

| 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-11) | In house check: Oct-12 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Israe El-Naoug | Laboratory Technician | |
| Approved by: | Katja Pokovic | Technical Manager | |

Issued: May 16, 2012

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

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

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S    Servizio svizzero di taratura
S    Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)          Accreditation No.: SCS 108
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

**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%.

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## Measurement Conditions

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

| DASY Version | DASY5 | V52.8.1 |
|---|---|---|
| Extrapolation | Advanced Extrapolation | |
| Phantom | Modular Flat Phantom | |
| 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 | 40.6 ± 6 % | 0.89 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 | 2.35 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 9.43 mW /g ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 1.54 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 6.18 mW /g ± 16.5 % (k=2) |

## 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 | 54.3 ± 6 % | 1.00 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 | 2.44 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 9.50 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 1.60 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 6.27 mW / g ± 16.5 % (k=2) |

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Appendix

## Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 51.1 Ω - 5.8 jΩ |
| Return Loss | - 24.6 dB |

## Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 47.0 Ω - 8.1 jΩ |
| Return Loss | - 21.0 dB |

## General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.372 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 09, 2001 |

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**DASY5 Validation Report for Head TSL**

Date: 16.05.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 441**

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma$ = 0.89 mho/m; $\varepsilon_r$ = 40.6; $\rho$ = 1000 kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011;

- Sensor-Surface: 3mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 04.07.2011

- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001

- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

**Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.129 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.474 mW/g
**SAR(1 g) = 2.35 mW/g; SAR(10 g) = 1.54 mW/g**
Maximum value of SAR (measured) = 2.73 mW/g



0 dB = 2.73 mW/g = 8.72 dB mW/g

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Impedance Measurement Plot for Head TSL

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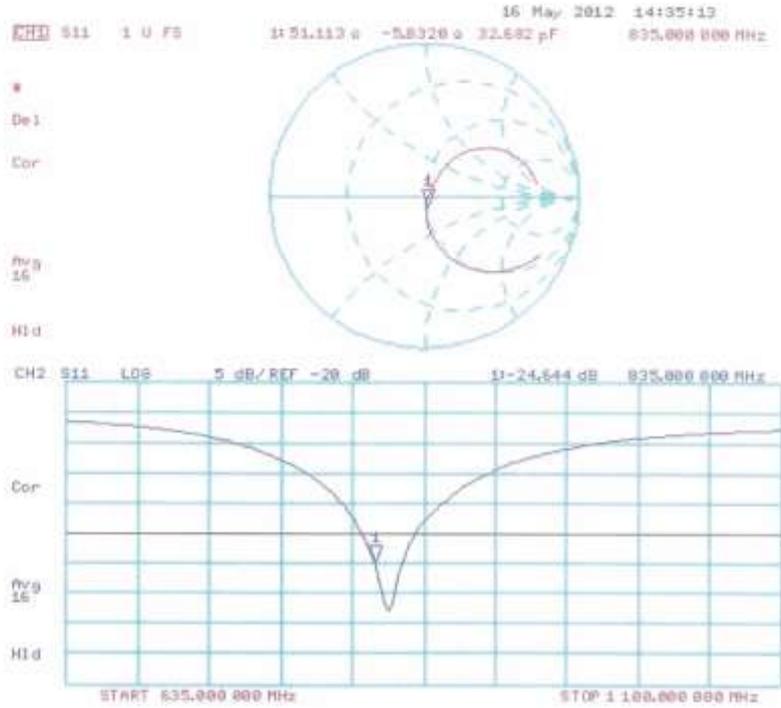
## DASY5 Validation Report for Body TSL

Date: 16.05.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 441**

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma$ = 1 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011;

- Sensor-Surface: 3mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 04.07.2011

- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001

- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

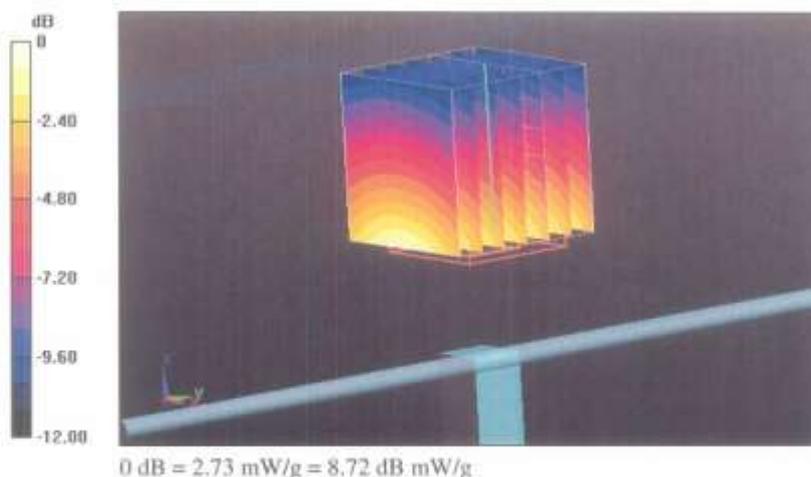**Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.054 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.533 mW/g
**SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.6 mW/g**
Maximum value of SAR (measured) = 2.82 mW/g
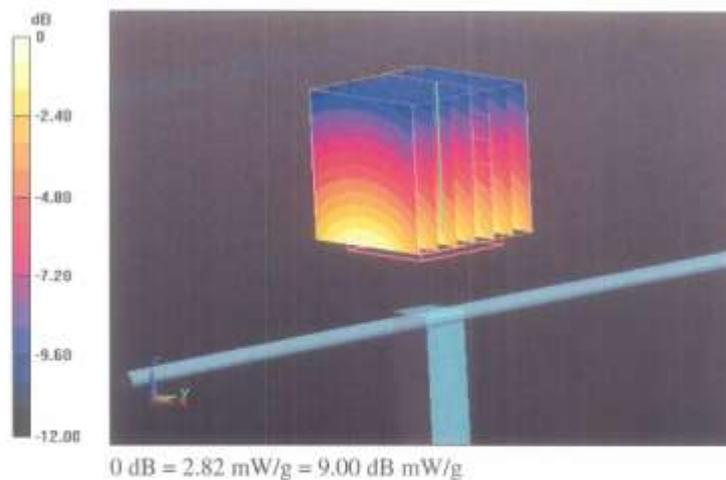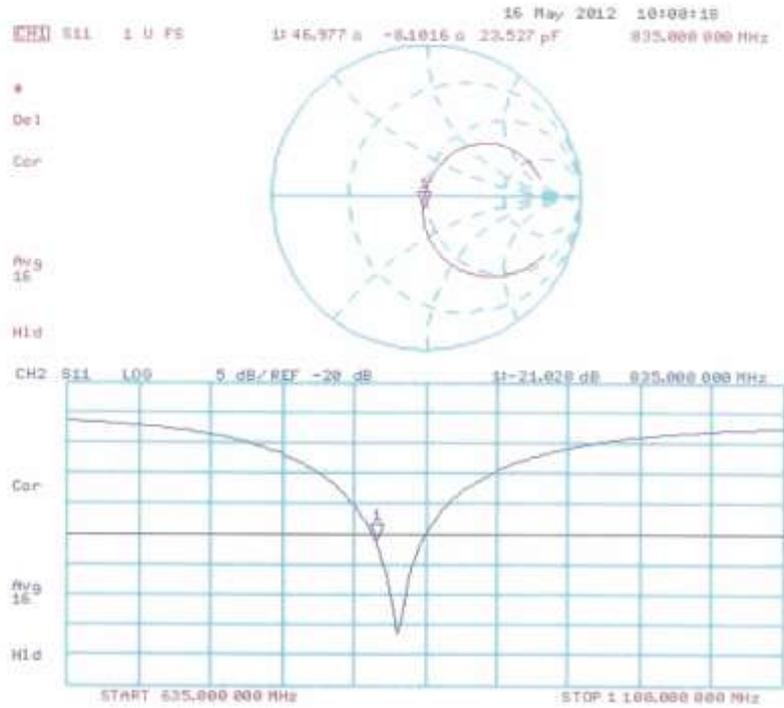


0 dB = 2.82 mW/g = 9.00 dB mW/g

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Impedance Measurement Plot for Body TSL.

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

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| C | Service suisse d'étalonnage |
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Multilateral Agreement for the recognition of calibration certificates

Client     **HCT (Dymstec)**                              Certificate No: **D1900V2-5d032_Jul12**

# CALIBRATION CERTIFICATE

| Object | D1900V2 - SN: 5d032 |
|---|---|
| Calibration procedure(s) | **QA CAL-05.v8**<br>**Calibration procedure for dipole validation kits above 700 MHz** |
| Calibration date: | **July 20, 2012** |

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 | 05-Oct-11 (No. 217-01451) | Oct-12 |
| Power sensor HP B481A | US37292783 | 05-Oct-11 (No. 217-01451) | Oct-12 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 27-Mar-12 (No. 217-01530) | Apr-13 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 27-Mar-12 (No. 217-01533) | Apr-13 |
| Reference Probe ES3DV3 | SN: 3205 | 30-Dec-11 (No. ES3-3205_Dec11) | Dec-12 |
| DAE4 | SN: 601 | 27-Jun-12 (No. DAE4-601_Jun12) | Jun-13 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power sensor HP B481A | 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-11) | in house check: Oct-12 |

|  | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Dimce Iliev | Laboratory Technician | *(signature)* |
| Approved by: | Katja Pokovic | Technical Manager | *(signature)* |

Issued: July 20, 2012

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Certificate No: D1900V2-5d032_Jul12          Page 1 of 8

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Accredited by the Swiss Accreditation Service (SAS)          Accreditation No.: SCS 108

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Multilateral Agreement for the recognition of calibration certificates

**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%.

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## Measurement Conditions

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

| DASY Version | DASY5 | V52.8.1 |
|---|---|---|
| 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 | 39.9 ± 6 % | 1.38 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 | 9.68 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 39.0 mW /g ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.11 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 20.5 mW /g ± 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 | 52.6 ± 6 % | 1.52 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 | 10.0 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 39.9 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 5.30 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 21.2 mW / g ± 16.5 % (k=2) |

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## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 50.0 Ω + 3.1 jΩ |
| Return Loss | - 30.1 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 46.2 Ω + 3.7 jΩ |
| Return Loss | - 25.2 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.194 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 17, 2003 |

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## DASY5 Validation Report for Head TSL

Date: 20.07.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d032**

Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 mho/m; $\varepsilon_r$ = 39.9; ρ = 1000 kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011;

- Sensor-Surface: 3mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 27.06.2012

- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001

- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

### 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 = 96.864 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 17.209 mW/g
**SAR(1 g) = 9.68 mW/g; SAR(10 g) = 5.11 mW/g**
Maximum value of SAR (measured) = 12.1 mW/g



0 dB = 12.1 mW/g = 21.66 dB mW/g

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Impedance Measurement Plot for Head TSL

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## DASY5 Validation Report for Body TSL

Date: 20.07.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d032**

Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.52 mho/m; $\varepsilon_r$ = 52.6; ρ = 1000 kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011;

- Sensor-Surface: 3mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 27.06.2012

- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002

- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

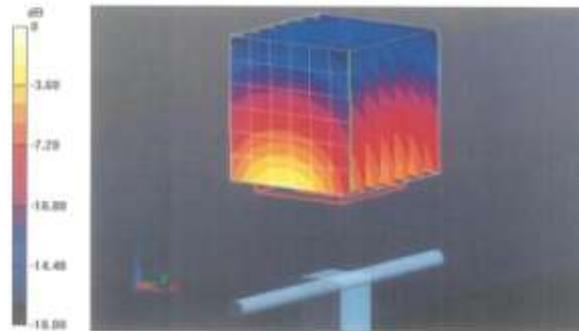**Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.470 V/m; Power Drift = -0.00 dB
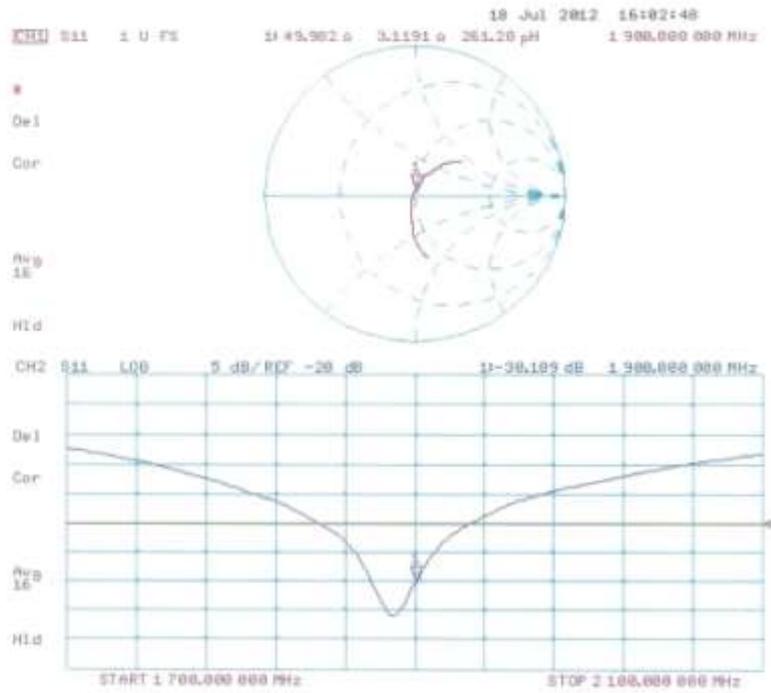Peak SAR (extrapolated) = 17.332 mW/g
**SAR(1 g) = 10 mW/g; SAR(10 g) = 5.3 mW/g**
Maximum value of SAR (measured) = 12.6 mW/g
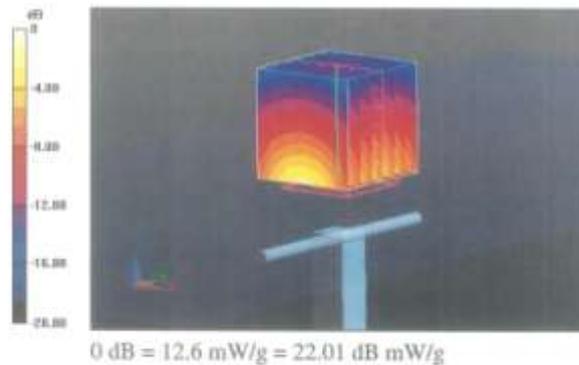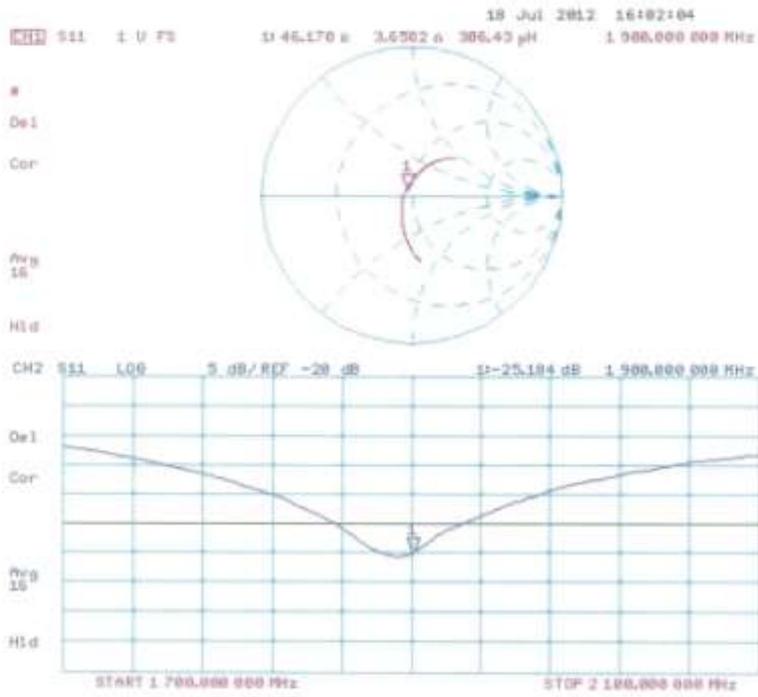


0 dB = 12.6 mW/g = 22.01 dB mW/g

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Impedance Measurement Plot for Body TSL

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Accreditation No.: SCS 108

Client   **HCT (Dymstec)**

Certificate No: **D2450V2-743_Aug12**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | D2450V2 - SN: 743 |
| Calibration procedure(s) | QA CAL-05.v8<br>Calibration procedure for dipole validation kits above 700 MHz |
| Calibration date: | August 23, 2012 |

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 | 05-Oct-11 (No. 217-01451) | Oct-12 |
| Power sensor HP 8481A | US37292783 | 05-Oct-11 (No. 217-01451) | Oct-12 |
| Reference 20 dB Attenuator | SN: 5058 (20k) | 27-Mar-12 (No. 217-01530) | Apr-13 |
| Type-N mismatch combination | SN: 5047.2 / 06327 | 27-Mar-12 (No. 217-01533) | Apr-13 |
| Reference Probe ES3DV3 | SN: 3205 | 30-Dec-11 (No. ES3-3205_Dec11) | Dec-12 |
| DAE4 | SN: 601 | 27-Jun-12 (No. DAE4-601_Jun12) | Jun-13 |

| 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-11) | In house check: Oct-12 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Israe El-Naouq | Laboratory Technician | *[signature]* |
| Approved by: | Katja Pokovic | Technical Manager | *[signature]* |

Issued: August 23, 2012

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Certificate No: D2450V2-743_Aug12          Page 1 of 8

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Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: SCS 108

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

**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%.

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## Measurement Conditions

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

| DASY Version | DASY5 | V52.8.2 |
|---|---|---|
| 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 | 39.2 ± 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 | 13.2 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 52.7 mW /g ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Head TSL | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 6.18 mW / g |
| SAR for nominal Head TSL parameters | normalized to 1W | 24.7 mW /g ± 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 | 51.3 ± 6 % | 1.99 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 | 13.0 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 51.2 mW / g ± 17.0 % (k=2) |

| SAR averaged over 10 cm³ (10 g) of Body TSL | condition | |
|---|---|---|
| SAR measured | 250 mW input power | 6.10 mW / g |
| SAR for nominal Body TSL parameters | normalized to 1W | 24.2 mW / g ± 16.5 % (k=2) |

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## Appendix

### Antenna Parameters with Head TSL

| | |
|---|---|
| Impedance, transformed to feed point | 54.0 Ω + 4.7 jΩ |
| Return Loss | - 24.6 dB |

### Antenna Parameters with Body TSL

| | |
|---|---|
| Impedance, transformed to feed point | 50.9 Ω + 6.5 jΩ |
| Return Loss | - 23.7 dB |

### General Antenna Parameters and Design

| | |
|---|---|
| Electrical Delay (one direction) | 1.158 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 | December 01, 2003 |

Certificate No: D2450V2-743_Aug12          Page 4 of 8

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**DASY5 Validation Report for Head TSL**

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 743**

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma$ = 1.81 mho/m; $\varepsilon_r$ = 39.2; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;

- Sensor-Surface: 3mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 27.06.2012

- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
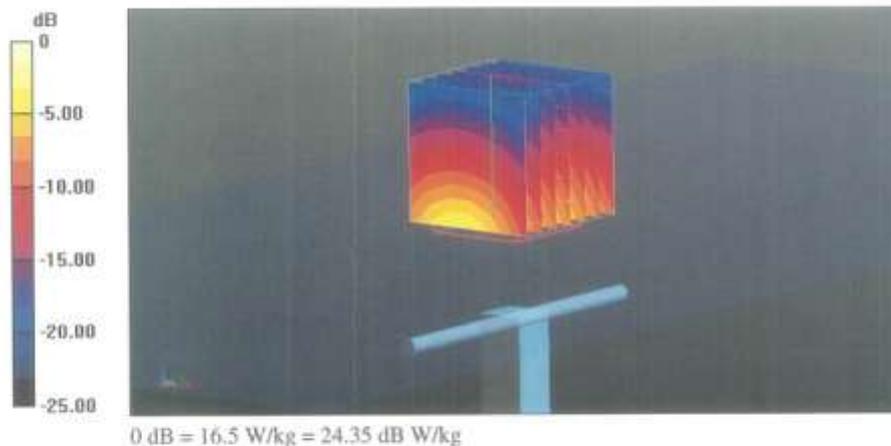
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

**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 = 98.554 V/m; Power Drift = 0.01 dB
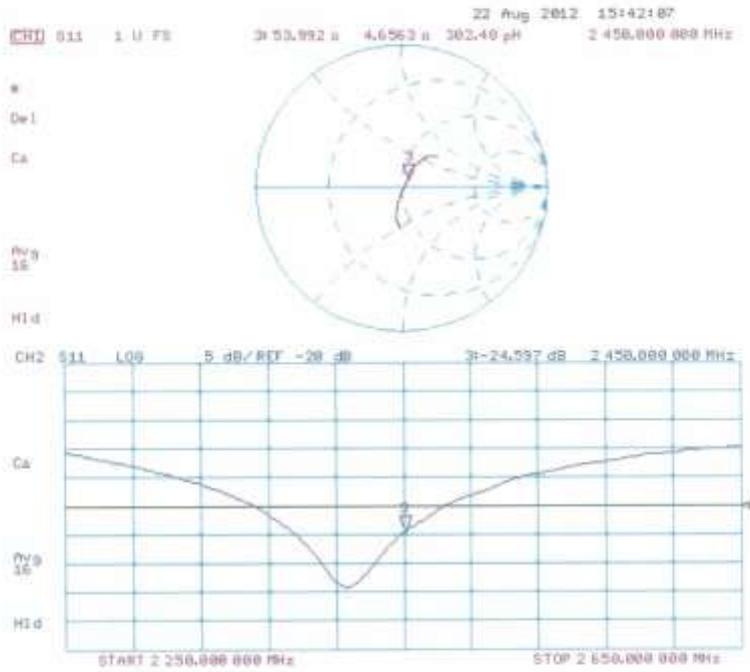Peak SAR (extrapolated) = 26.584 mW/g
**SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.18 mW/g**
Maximum value of SAR (measured) = 16.5 W/kg



0 dB = 16.5 W/kg = 24.35 dB W/kg

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Impedance Measurement Plot for Head TSL

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**DASY5 Validation Report for Body TSL**

Date: 22.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 743**

Communication System: CW; Frequency: 2450 MHz
Medium parameters used: $f = 2450$ MHz; $\sigma = 1.99$ mho/m; $r_e = 51.3$; $\rho = 1000$ kg/m$^3$
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;

- Sensor-Surface: 3mm (Mechanical Surface Detection)

- Electronics: DAE4 Sn601; Calibrated: 27.06.2012

- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002

- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

**Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**
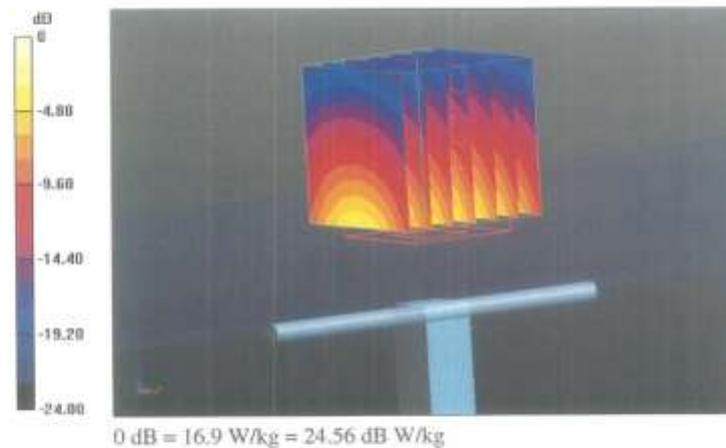Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.699 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.489 mW/g
**SAR(1 g) = 13 mW/g; SAR(10 g) = 6.1 mW/g**
Maximum value of SAR (measured) = 16.9 W/kg



0 dB = 16.9 W/kg = 24.56 dB W/kg

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Impedance Measurement Plot for Body TSL

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