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| Andrew Becker | June 10– June 24 & July 15, 2010 | RTS-1689-1007-38 | L6ARCN70UW | 2503A-RCN70UW |


SAR Compliance Test Report

| | | | |
|---------------------|---|-------------------|--|
| Testing Lab: | RIM Testing Services 440 Phillip Street Waterloo, Ontario Canada N2L 5R9 Phone: 519-888-7465 Fax: 519-746-0189 | Applicant: | Research In Motion Limited 295 Phillip Street Waterloo, Ontario Canada N2L 3W8 Phone: 519-888-7465 Fax: 519-888-6906 Web site: www.rim.com |
|---------------------|---|-------------------|--|

Statement of Compliance: RIM Testing Services declares under its sole responsibility that the product to which this declaration relates, is in conformity with the appropriate RF exposure standards, recommendations and guidelines. It also declares that the product was tested in accordance with the appropriate measurement standards, guidelines and recommended practices.

Device Category: This BlackBerry® Smartphone is a portable device, designed to be used in direct contact with the user’s head, hand and to be carried in approved accessories when carried on the user’s body.

RF exposure environment: This device has been shown to be in compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in OET Bulletin 65 Supplement C (Edition 01-01), FCC 96-326, IEEE Std. C95.1-1999, Health Canada’s Safety Code 6, as reproduced in RSS-102 issue 4-2010 and has been tested in accordance with the measurement procedures specified in FCC OET Procedures, OET Bulletin 65 Supplement C (Edition 01-01), ANSI/IEEE Std. C95.3-1991, IEEE 1528-2003, IEC 62209-1-2005, IEC 62209 - 2-2010 and Health Canada’s Safety Code 6.

| Tested and documented by: | Signatures | Date |
|--|--|--------------|
| Andrew Becker Compliance Specialist |  | 16-July-2010 |
| Tested and reviewed by: Daoud Attayi Team Lead: Safety, SAR & HAC Compliance |  | 19-July-2010 |
| Approved by: Masud S. Attayi Manager, Regulatory Compliance |  | 21-July-2010 |



| | | | | |
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APPENDIX A: SAR DISTRIBUTION COMPARISON FOR ACCURACY VERIFICATION

APPENDIX B: SAR DISTRIBUTION PLOTS - HEAD CONFIGURATION

APPENDIX C: SAR DISTRIBUTION PLOTS - BODY-WORN CONFIGURATION

APPENDIX D: PROBE & DIPOLE CALIBRATION DATA

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1.0 OPERATING CONFIGURATIONS AND TEST CONDITIONS

1.1 Picture of Device

Please refer to Appendix E.
Figure 1.1.1. BlackBerry Smartphone

1.2 Antenna description

| | |
|----------------------|---|
| Type | Internal fixed antenna |
| Location | Back bottom centre (main licensed transmitters) |
| Configuration | Internal fixed antenna |


Table 1.2.1. Antenna description

1.3 Device description

| | | | | |
|--|--|----------------------------------|----------------------------------|--|
| Device Model | RCN72UW | | | |
| FCC ID | L6ARCN70UW | | | |
| IC ID | 2503A-RCN70UW | | | |
| PIN | 226DC9FE (Radiated Rev1), 228EB762 (Radiated Rev2), 226DCB8B (Conducted Rev1), 228EB762 (Conducted Rev2) | | | |
| Hardware Version | Rev1, Rev2 | | | |
| Software Version | 6.0.0.142 | | | |
| Prototype or Production Unit | Production | | | |
| Mode(s) of Operation in North America | 1-slot GSM 850 GSM 1900 | 2-slots EDGE/GPRS 850/1900 | WCDMA / UMTS FDD IV (1700) | |
| Maximum nominal conducted RF Output Power (dBm) | 32.0 30.5 | 30.0 28.0 | 22.5 | |
| Tolerance in Power Setting on centre channel (dB) | ± 0.50 | ± 0.50 | ± 0.50 | |
| Duty Cycle | 1:8 | 2:8 | 1:1 | |
| Tx Frequency Range (MHz) | 824.2 – 848.8 1850.2 – 1909.8 | 824.2 – 848.8 1850.2 – 1909.8 | 824.6 – 846.6 | |
| Mode(s) of Operation in North America | Bluetooth | 802.11b | 802.11g | |
| Maximum nominal conducted RF Output Power (dBm) | 7.67 | 17.5 | 16.0 | |
| Tolerance in Power Setting on centre channel (dB) | N/A | ± 0.50 | ± 0.50 | |
| Duty Cycle | N/A | 1:1 | 1:1 | |
| Tx Frequency Range (MHz) | 2402 - 2483 | 2412-2462 | 2412-2462 | |

Table 1.2.2. Test device description

The device supports GSM/GPRS/EDGE 900/1800 MHz bands and UMTS band I and VIII that are not operational in North America, therefore no data is presented in this report for those bands.

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1.4 Body worn accessories (holsters)

The device has been tested with the first holster listed below. All other holsters contain identical belt-clip/metal components, different outside leather material has been used and the separation distance between the device and the user’s body is listed in the table below. The holsters are designed with the intended device orientation being with the LCD facing the belt clip. Proper positioning is vital for protection of the LCD display, and to help maximize the battery life of the device. The device can also be placed in the holster with the backside facing the belt clip. Body SAR measurements were carried out with the worst-case configuration front LCD side and backside towards the belt clip.

| Number | Holster Type | Part Number | Separation distance (mm) |
|--------|--|---------------|--------------------------|
| 1 | Leather Holster | HDW-31350-001 | 20 |
| 2 | PU Holster | HDW-31347-001 | 20 |
| 3 | Leather Vertical Swivel Holster (Alt. 1) | HDW-18969-001 | 20 |
| 4 | Leather Horizontal Holster (Alt. 2) | HDW-18965-001 | 21 |
| 5 | Vertical Swivel Holster (Alt. 3) | HDW-24208-001 | 22 |
| 6 | Vertical Swivel Holster (Alt. 4) | HDW-24210-001 | 22 |
| 7 | Vertical Swivel Holster (Alt. 5) | HDW-23466-001 | 21 |
| 8 | Leather Vertical Swivel Holster (Alt. 6) | HDW-18960-001 | 20 |
| 9 | Leather Vertical Swivel Holster (Alt. 7) | HDW-16001-001 | 23 |
| 10 | Leather Vertical Swivel Holster (Alt. 8) | HDW-28111-001 | 20 |
| 11 | Horizontal Swivel Holster (Alt. 9) | HDW-23468-001 | 22 |

Table 1.4.1. Body worn holster

Please refer to Appendix E.

Figure 1.4.1. Body-worn holster

1.5 Headset


The device was tested with and without the following headset model numbers.

- 1) HDW-14322-003
- 2) HDW-15766-005
- 3) HDW-24529-001

1.6 Battery

The device was tested with the following Lithium Ion Battery pack.

- 1) BAT-14392-001

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1.7 Procedure used to establish test signal

The device was put into test mode for SAR measurements by placing a voice call from a Rohde & Schwarz CMU 200 Communications Test Instrument. The power control level was set to command the device to transmit at full power at the specified frequency. Other parameters include: Channel type = full rate, discontinuous transmission off, frequency hopping off. A Rohde & Schwarz CBT Bluetooth Tester was used to establish a connection with the EUT’s Bluetooth radio. Worst case SAR was evaluated with Bluetooth on.

1.8 Highlights of the FCC OET SAR Measurement Requirements


1.8.1 SAR Measurement Requirements for 3-6 GHz and Measurement Procedures for 802.11 a/b/g Transmitter

- Maintained dielectric parameter uncertainty as close to $\pm 5.0\%$ of the target value as possible.
- Liquid depth from SAM ERP or flat phantom was kept at 15 cm.
- Probe Requirement: Used SPEAG probe model ES3DV3 for 10 MHz to 4 GHz; Linearity: ± 0.2 dB (30 MHz to 4 GHz):

| | |
|-------------------------------|----------------------|
| Probe tip to sensor center | 2.0 mm |
| Probe tip diameter | 3.9 mm (Body: 12 mm) |
| Probe calibration uncertainty | $\leq 12\%$ |
| Probe calibration range | ± 100 MHz |

Table 1.8.1. Probe specification requirements

- Frequency Channel Configuration: 802.11 b/g modes are tested on “default test channels” 1, 6 and 11.
- For each frequency band, testing at higher rates and higher modulations is not required when the maximum average output power for each of these configurations is less than $\frac{1}{4}$ dB higher than those measured at the lowest data rate.
- SAR is not required for 802.11g channels when the maximum average output power is less than $\frac{1}{4}$ dB higher than that measured on the corresponding 802.11b channels.
- SAR test was conducted on each “default test channel” and each band with the worst case modulation that resulted in maximum duty cycle of 99.5 %.

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- Conducted power measurements:

| 802.11b @ 1Mbps | | 802.11g @ 6Mbps | |
|-----------------|-------------------|-----------------|-------------------|
| Chan | Cond. Power (dBm) | Chan | Cond. Power (dBm) |
| 1 | 17.00 | 1 | 12.60 |
| 6 | 17.60 | 6 | 16.30 |
| 11 | 17.60 | 11 | 13.10 |

Table 1.8.2. 802.11 b/g channel vs. conducted power

| Data Rate (Mbps) | Mod. | 802.11g | | 802.11b | | |
|------------------|--------|-----------|-------------------|------------------|-------|-----------|
| | | Channel 6 | Cond. Power (dBm) | Data Rate (Mbps) | Mod. | Channel 6 |
| 6 | BPSK | 16.30 | 17.60 | 1 | BPSK | 17.60 |
| 9 | BPSK | 16.35 | 17.65 | 2 | DQPSK | 17.65 |
| 12 | QPSK | 14.70 | 17.55 | 5.5 | CCK | 17.55 |
| 18 | QPSK | 14.55 | 17.40 | 11 | CCK | 17.40 |
| 24 | 16-QAM | 13.10 | | | | |
| 36 | 16-QAM | 12.70 | | | | |
| 48 | 64-QAM | 11.00 | | | | |
| 54 | 64-QAM | 10.90 | | | | |

Table 1.8.3. 802.11 b/g modulation type/data rate vs. conducted power

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1.8.2 SAR Measurement Procedures for 3G Devices

WCDMA Handsets

Output Power Verification


- Maximum output power is verified on the High, Middle and Low channels using 12.2 kbps RMC, 12.2 kbps AMR with a 3.4 kbps SRB (signal radio bearer) with TPC (transmit power control) set to all “1’s” for WCDMA/HSDPA or applying the required inner loop.
- For Release 5 HSDPA, output power is measured according to requirements for HS-DPCCH Sub-test 1-4

Head SAR Measurements

SAR for head exposure configurations is measured using the 12.2 kbps RMC with TPC bits configured to all “1s”. SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2 kbps AMR is less than ¼ dB higher than that measured in 12.2 kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2 AMR with a 3.4 kbps SRB (signalling radio bearer) using the exposure configuration that results in the highest SAR for that RF channel in 12.2 RMC.

Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits configured to all “1s”. SAR for other spreading codes and multiple DPDCH_n, when supported by the DUT, are not required when the maximum average outputs of each RF channel, for each spreading code and DPDCH_n configuration, are less than ¼ dB higher than those measured in 12.2 RMC. Otherwise, SAR is measured on the maximum output channel with an applicable RMC configuration for the corresponding spreading code or DPDCH_n using the exposure configuration that results in the highest SAR with 12.2 RMC.

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Handsets with HSDPA

Body SAR is not required for handsets with HSDPA capabilities, when the maximum average output of each RF channel with HSDPA active is less than ¼ dB higher than that measured in 12.2 kbps RMC without HSDPA. Otherwise, SAR for HSDPA is measured using FRC (fixed reference channel) in the body exposure configuration that results in the highest SAR for that RF channel in 12.2kbps RMC.

| | Band | FDD IV (1700) | | |
|-------------|-----------------------------|---------------------------------------|--------|--------|
| | Channel | 1312 | 1413 | 1513 |
| | Freq (MHz) | 1712.4 | 1732.6 | 1752.6 |
| Mode | Subtest | Conducted Transmit Power (dBm) | | |
| Rel99 | 12.2 kbps RMC | 22.72 | 22.45 | 22.63 |
| Rel99 | 12.2 kbps AMR, SRB 3.4 kbps | 22.67 | 22.43 | 22.52 |
| Rel5 HSDPA | 1 | 22.41 | 22.32 | 22.36 |
| Rel5 HSDPA | 2 | 22.40 | 22.17 | 22.32 |
| Rel5 HSDPA | 3 | 22.41 | 22.19 | 22.33 |
| Rel5 HSDPA | 4 | 22.42 | 22.20 | 22.34 |

Table 1.8.4. WCDMA (Rel99) / HSDPA (Rel5) conducted power measurements

1.9 Highlights of the FCC OET SAR Evaluation Considerations for Handsets with Multiple Transmitters/ Antennas & GSM/GPRS/EDGE Procedure

Unlicensed Transmitters

When there is simultaneous transmission –

Stand-alone SAR not required when

- output $\leq 2 \cdot P_{Ref}$ and antenna is > 5.0 cm from other antennas
- output $\leq P_{Ref}$ and antenna is > 2.5 cm from other antennas
- the other antenna(s), which are < 2.5 cm away, has an output $\leq P_{Ref}$ OR max 1g SAR < 1.2 W/kg

Otherwise stand-alone SAR is required

- test SAR on highest output channel for each wireless mode and exposure condition
- if SAR for highest output channel is $> 50\%$ of SAR limit, evaluate all channels according to normal procedure

Simultaneous Transmission SAR not required:

Unlicensed only

- when stand-alone 1-g SAR is not required and antenna is > 5 cm from other antennas
- when the other antenna(s), which are < 2.5 cm away, has an output $\leq P_{Ref}$ OR max 1g SAR < 1.2 W/kg

Licensed & Unlicensed

- when the sum of the 1-g SAR is < 1.6 W/kg for each pair of simultaneous transmitting antennas.
- or
- when the ratio of SAR to peak SAR separation distance of simultaneous transmitting antenna pair is < 0.3

Simultaneous Transmission SAR required:

Licensed & Unlicensed

- antenna pairs with SAR to antenna separation ratio ≥ 0.3 ; test is only required for the configuration that results in the highest SAR in standalone configuration for each wireless mode and exposure condition.

| | 2.45 | 5.15 - 5.35 | 5.47 - 5.85 | GHz |
|---|------|-------------|-------------|-----|
| P_{Ref} | 12 | 6 | 5 | mW |
| Device output power should be rounded to the nearest mW to compare with values specified in this table. | | | | |

Table 1.9.1. – Output Power Thresholds for Unlicensed Transmitters

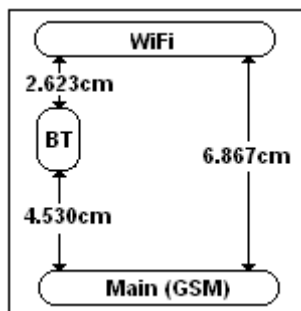



Figure 1.9.1. Back view of device showing closet distance between antenna pairs


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| Mode | Configuration | Highest 1 g SAR (W/kg) |
|---------------------|----------------------------------|------------------------|
| GSM/GPRS/EDGE/WCDMA | Head-Left-Touch | 1.34 |
| | Body-Vertical Holster Back | 0.78 |
| 802.11b/g/n | Head-Left-Touch | 0.14 |
| | Body- Vertical Holster HS#2 Back | 0.08 |

Table 1.9.2. Highest SAR values for the same setup

- In EDGE/GPRS mode, GMSK Modulation was used using CSI or MCS1
- The device supports GPRS Multi-Class 10, EDGE/GSM 2– slots for uplink were evaluated.

Simultaneous Transmission SAR is not required for head/body configuration based on the sum of 1-g SAR values for each pair of simultaneous transmitting antennas being < 1.6W/kg.

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2.0 DESCRIPTION OF THE TEST EQUIPMENT

2.1 SAR measurement system

SAR measurements were performed using a Dosimetric Assessment System (DASY4), an automated SAR measurement system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich, Switzerland.

The DASY 4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
- An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A DAE module that performs the signal amplification, signal multiplexing, A/D conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the Electro-optical coupler (EOC).
- A unit to operate the optical surface detector that is connected to the EOC.
- The EOC performs the conversion from an optical signal into the digital electric signal of the DAE. The EOC is connected to the PC plug-in card.
- The functions of the PC plug-in card based on a DSP is to perform the time critical tasks such as signal filtering, surveillance of the robot operation fast movement interrupts.
- A computer operating Windows NT.
- DASY 4 software version 4.7.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM Twin Phantom enabling testing left-hand and right-hand usage.
- The device holder for mobile phones.
- Tissue simulating liquid mixed according to the given recipes (see section 6.1).
- System validation dipoles allowing for the validation of proper functioning of the system.

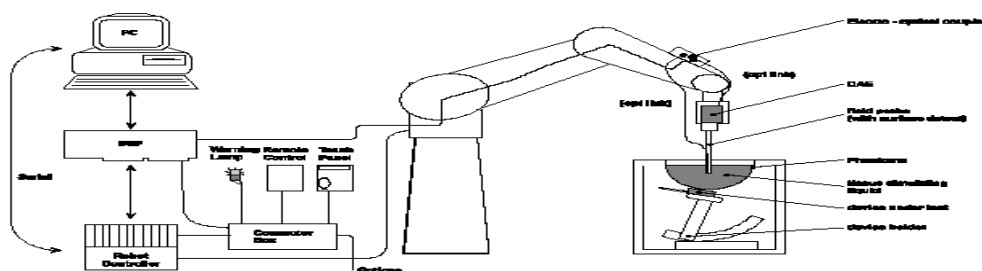




Figure 2.1.1. System Description

| | | | | |
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2.1.1 Equipment List

| Manufacturer | Test Equipment | Model Number | Serial Number | Cal. Due Date (MM/DD/YY) |
|---------------------------------|-------------------------------------|---------------------|----------------------|---------------------------------|
| SCHMID & Partner Engineering AG | E-field probe | ES3DV3 | 3225 | 12/11/2010 |
| SCHMID & Partner Engineering AG | Data Acquisition Electronics (DAE3) | DAE3 V1 | 473 | 01/04/2011 |
| SCHMID & Partner Engineering AG | Dipole Validation Kit | D835V2 | 446 | 01/05/2011 |
| SCHMID & Partner Engineering AG | Dipole Validation Kit | D1900V2 | 545 | 01/06/2011 |
| SCHMID & Partner Engineering AG | Dipole Validation Kit | D2450V2 | 747 | 11/11/2011 |
| Agilent Technologies | Signal generator | 8648C | 4037U03155 | 09/24/2011 |
| Agilent Technologies | Power meter | E4419B | GB40202821 | 09/15/2011 |
| Agilent Technologies | Power sensor | 8481A | MY41095417 | 10/07/2010 |
| Agilent Technologies | Power sensor | N1921A | SG45240281 | 05/22/2011 |
| Agilent Technologies | Power meter | N1911A | MY45100905 | 05/01/2011 |
| Amplifier Research | Amplifier | 5S1G4M3 | 300986 | CNR |
| Agilent Technologies | Network analyzer | 8753ES | US39174857 | 10/02/2010 |
| Rohde & Schwarz | Base Station Simulator | CMU 200 | 109747 | 11/25/2010 |

Table 2.1.2. Equipment list

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2.2 Description of the test setup

Before SAR measurements are conducted, the device and the DASY equipment are setup as follows:

2.2.1 Device and base station simulator setup

- Power up the device.
- Turn on the base station simulator and set the radio channel and power to the appropriate values.
- Connect an antenna to the RF IN/OUT of the communication test set and place it close to the device.

2.2.2 DASY setup

- Turn the computer on and log on to Windows
- Start the DASY4 software by clicking on the icon located on the Windows desktop.
- Mount the DAE unit and the probe. Turn on the DAE unit.
- Turn the Robot Controller on by turning the main power switch to the horizontal position
- Align the probe by clicking the ‘Align probe in light beam’ button.
- Open a file and configure the proper parameters - probe, medium, communications system etc.
- Establish a connection between the Device and the communications test instrument. Place the Device on the stand and adjust it under the phantom.
- Start SAR measurements.


3.0 ELECTRIC FIELD PROBE CALIBRATION

3.1 Probe Specifications

SAR measurements were conducted using the dosimetric probe ES3DV3, designed by Schmid & Partner Engineering AG for the measurement of SAR. The probe is constructed using the thin film technique, with printed resistive lines on ceramic substrates. It has a symmetrical design with triangular core, built-in optical fibre for the surface detection system and built-in shielding against static discharge. The probe is sensitive to E-fields and thus incorporates three small dipoles arranged so that the overall response is close to isotropic. The table below summarizes the technical data for the probe.

| Property | Data |
|---------------------------------|---|
| Probe model ES3DV3 | |
| Frequency range | 10 MHz to 4 GHz |
| Linearity | ± 0.2 dB (30 MHz to 4 GHz) |
| Directivity | ± 0.2 dB in HSL (rotation around probe axis) |
| Directivity | ± 0.3 dB in tissue material (rotation normal to probe axis) |
| Dynamic Range | 5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB |
| Probe positioning repeatability | ±0.2 mm |
| Spatial resolution | < 0.125 mm ³ |

Table 3.1.1. Probe specifications

| | | | | |
|---|---|-------------------------|-------------------|----------------------|
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3.2 Probe calibration and measurement uncertainty

The probe had been calibrated with an accuracy better than $\pm 12\%$. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe were tested. The probe calibration parameters are shown on Appendix D and below:

Calibration Parameter Determined in Head Tissue Simulating Media

| f [MHz] | Validity [MHz] ^c | Permittivity | Conductivity | ConvF X | ConvF Y | ConvF Z | Alpha | Depth Unc (k=2) |
|---------|-----------------------------|----------------|----------------|---------|---------|---------|-------|-------------------|
| 900 | $\pm 50 / \pm 100$ | $41.5 \pm 5\%$ | $0.97 \pm 5\%$ | 6.12 | 6.12 | 6.12 | 0.99 | $1.07 \pm 11.0\%$ |
| 1810 | $\pm 50 / \pm 100$ | $40.0 \pm 5\%$ | $1.40 \pm 5\%$ | 5.14 | 5.14 | 5.14 | 0.46 | $1.60 \pm 11.0\%$ |
| 1950 | $\pm 50 / \pm 100$ | $40.0 \pm 5\%$ | $1.40 \pm 5\%$ | 4.96 | 4.96 | 4.96 | 0.47 | $1.57 \pm 11.0\%$ |
| 2450 | $\pm 50 / \pm 100$ | $39.2 \pm 5\%$ | $1.80 \pm 5\%$ | 4.53 | 4.53 | 4.53 | 0.41 | $1.89 \pm 11.0\%$ |

Calibration Parameter Determined in Body Tissue Simulating Media

| f [MHz] | Validity [MHz] ^c | Permittivity | Conductivity | ConvF X | ConvF Y | ConvF Z | Alpha | Depth Unc (k=2) |
|---------|-----------------------------|----------------|----------------|---------|---------|---------|-------|-------------------|
| 900 | $\pm 50 / \pm 100$ | $55.0 \pm 5\%$ | $1.05 \pm 5\%$ | 5.97 | 5.97 | 5.97 | 0.98 | $1.12 \pm 11.0\%$ |
| 1810 | $\pm 50 / \pm 100$ | $53.3 \pm 5\%$ | $1.52 \pm 5\%$ | 4.90 | 4.90 | 4.90 | 0.35 | $2.07 \pm 11.0\%$ |
| 1950 | $\pm 50 / \pm 100$ | $53.3 \pm 5\%$ | $1.52 \pm 5\%$ | 4.83 | 4.83 | 4.83 | 0.32 | $2.45 \pm 11.0\%$ |
| 2450 | $\pm 50 / \pm 100$ | $52.7 \pm 5\%$ | $1.95 \pm 5\%$ | 4.32 | 4.32 | 4.32 | 0.74 | $1.27 \pm 11.0\%$ |


^c The validity of ± 100 MHz only applies for DASY v4.4 and higher. DASY v4.7 has been used for measurements, therefore ± 100 MHz tolerance is valid.

Measured dielectric parameters are within $\pm 5\%$ of the probe calibration values and target values. Expanded probe calibration uncertainty (k=2) is $< 15\%$

4.0 SAR MEASUREMENT SYSTEM VERIFICATION

Prior to conducting SAR measurements, the system was validated using the dipole validation kit and the flat section of the SAM phantom. A power level of 1.0W was applied to the dipole antenna. The verification results are in the table below with a comparison to reference values. Printouts are shown in Appendix A. All the measured parameters are within the allowed tolerances.

At above 1.5 – 2 GHz, dipoles maintain good return loss of -15 dB to -20 dB, therefore SAR measurements are limited to approximately ± 100 MHz of the probe/dipole calibration frequency.

| | | | | |
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4.1 System accuracy verification for head adjacent use

| f (MHz) | Limits / Measured (MM/DD/YY) | SAR (W/kg) 1 g/ 10 g | Dielectric Parameters | | Liquid Temp (°C) |
|------------|---------------------------------|-------------------------|-----------------------|----------------|---------------------|
| | | | ϵ_r | σ [S/m] | |
| 835 | Measured (06/21/2010) | 9.63/6.32 | 42.6 | 0.89 | 22.0 |
| | Measured (06/22/2010) | 8.83/5.77 | 41.0 | 0.86 | 22.5 |
| | Recommended Limits | 9.50/6.27 | 41.5 | 0.90 | N/A |
| 1710 | Measured (07/15/2010) | 33.3/18.0 | 41.8 | 1.30 | 22.2 |
| 1800 | Measured (06/14/2010) | 36.2/19.2 | 41.5 | 1.37 | 22.0 |
| | Recommended Limits | 38.2/20.1 | 40.0 | 1.40 | N/A |
| 1900 | Measured (06/14/2010) | 40.5/21.0 | 40.2 | 1.41 | 22.0 |
| | Recommended Limits | 39.5/20.8 | 40.0 | 1.40 | N/A |
| 2450 | Measured (06/16/2010) | 54.0/24.8 | 40.7 | 1.86 | 22.6 |
| | Recommended Limits | 53.2/24.8 | 39.2 | 1.80 | N/A |

Table 4.1.1. System accuracy (validation for head adjacent use)

5.0 PHANTOM DESCRIPTION

The SAM Twin Phantom, manufactured by SPEAG, was used during the SAR measurements. The phantom is made of a fibreglass shell integrated with a wooden table.

The SAM Twin Phantom is a fibreglass shell phantom with 2 mm shell thickness. It has three measurement areas:

- Left side head
- Right side head
- Flat phantom

The phantom table dimensions are: 100x50x85 cm (LxWxH). The table is intended for use with freestanding robots.

The bottom shelf contains three pair of bolts for locking the device holder in place. The device holder positions are adjusted to the standard measurement positions in the three sections. Only one device holder is necessary if two phantoms are used (e.g., for different solutions).

A white cover is provided to top the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible; however the optical surface detector does not work properly at the cover surface. Place a sheet of white paper on the cover when using optical surface detection.

Liquid depth of ≥ 15 cm is maintained in the phantom for all the measurements.



Figure 5.0.1. SAM Twin Phantom


6.0 TISSUE DIELECTRIC PROPERTIES

6.1 Composition of tissue simulant

The composition of the brain and muscle simulating liquids for 800-900 MHz and 1800-1900 MHz are shown in the table below.

| INGREDIENT | MIXTURE 800–900MHz | | MIXTURE 1800–1900MHz | | MIXTURE 2450 MHz | |
|-------------------|---------------------------|-----------------|-----------------------------|-----------------|-------------------------|-----------------|
| | Brain % | Muscle % | Brain % | Muscle % | Brain % | Muscle % |
| Water | 40.29 | 65.45 | 55.24 | 69.91 | 55.0 | 68.75 |
| Sugar | 57.90 | 34.31 | 0 | 0 | 0 | 0 |
| Salt | 1.38 | 0.62 | 0.31 | 0.13 | 0 | 0 |
| HEC | 0.24 | 0 | 0 | 0 | 0 | 0 |
| Bactericide | 0.18 | 0.10 | 0 | 0 | 0 | 0 |
| DGBE | 0 | 0 | 44.45 | 29.96 | 40.0 | 31.25 |
| Triton X-100 | 0 | 0 | 0 | 0 | 5.0 | 0 |

Table 6.1.1. Tissue simulant recipe

| | | | | |
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6.1.1 Equipment

| Manufacturer | Test Equipment | Model Number | Serial Number | Cal. Due Date (MM/DD/YY) |
|-----------------|---------------------|--------------|---------------|--------------------------|
| Pyrex, England | Graduated Cylinder | N/A | N/A | N/A |
| Pyrex, USA | Beaker | N/A | N/A | N/A |
| Acculab | Weight Scale | V1-1200 | 018WB2003 | N/A |
| Control Company | Digital Thermometer | 1870 | 230355192 | 01/08/2011 |
| IKA Works Inc. | Hot Plate | RC Basic | 3.107433 | N/A |

Table 6.1.2. Tissue simulant preparation equipment

6.1.2 Preparation procedure

800-900 MHz liquids

- Fill the container with **water**. Begin heating and stirring.
- Add the **Cellulose**, the **preservative substance** and the **salt**. After several hours, the liquid will become more transparent again. The container must be covered to prevent evaporation.
- Add **Sugar**. Stir it well until the sugar is sufficiently dissolved.
- Keep the liquid hot but below the boiling point for at least an hour. The container must be covered to prevent evaporation.
- Remove the container from, and turn the hotplate off and allow the liquid to cool off to room temperature prior to performing dielectric measurements.

1800-2450 MHz liquid

- Fill the container with water and place it on hotplate. Begin heating and stirring.
- Add the salt, Glycol/Triton X-100. The container must be covered to prevent evaporation.
- Keep the liquid hot enough to dissolve sugar for at least an hour. The container must be covered to prevent evaporation.
- Remove the container from, and turn the hotplate off and allow the liquid to cool off to room temperature prior to performing dielectric measurements.

6.2 Electrical parameters of the tissue simulating liquid

The tissue dielectric parameters shall be measured before a batch can be used for SAR measurements to ensure that the simulated tissue was properly made and will simulate the desired human characteristic. Limits and measured electrical parameters are shown in the table below.

Recommended limits are adopted from IEEE P1528-2003:

“Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, DAS4 manual and from FCC Tissue Dielectric Properties web page at <http://www.fcc.gov/fcc-bin/dielec.sh>

| f (MHz) | Tissue Type | Limits / Measured | Dielectric Parameters | | Liquid Temp (°C) |
|---------|-------------|-----------------------|-----------------------|----------------|------------------|
| | | | ϵ_r | σ [S/m] | |
| 835 | Head | Measured (06/21/2010) | 42.6 | 0.89 | 22.0 |
| | | Measured (06/22/2010) | 41.0 | 0.86 | 22.5 |
| | | Recommended Limits | 41.5 | 0.90 | N/A |
| | Muscle | Measured (06/21/2010) | 57.3 | 0.96 | 22.4 |
| | | Recommended Limits | 55.2 | 0.97 | N/A |
| 1800 | Head | Measured (06/14/2010) | 41.5 | 1.37 | 22.0 |
| | | Measured (07/15/2010) | 41.5 | 1.42 | 22.2 |
| | | Recommended Limits | 40.0 | 1.40 | N/A |
| | Muscle | Measured (06/14/2010) | 52.1 | 1.46 | 21.9 |
| | | Measured (07/15/2010) | 51.8 | 1.48 | 22.4 |
| 1900 | Head | Measured (06/14/2010) | 40.2 | 1.41 | 22.0 |
| | | Recommended Limits | 40.0 | 1.40 | N/A |
| | Muscle | Measured (06/14/2010) | 52.0 | 1.50 | 22.0 |
| | | Recommended Limits | 53.3 | 1.52 | N/A |
| 2450 | Head | Measured (06/16/2010) | 40.7 | 1.86 | 22.6 |
| | | Recommended Limits | 39.2 | 1.80 | N/A |
| | Muscle | Measured (06/16/2010) | 50.9 | 1.97 | 22.4 |
| | | Recommended Limits | 52.7 | 1.95 | N/A |

Table 6.2.1. Electrical parameters of tissue simulating liquid

6.2.1 Equipment

| Manufacturer | Test Equipment | Model Number | Serial Number | Cal. Due Date (MM/DD/YY) |
|----------------------|----------------------|--------------|---------------|--------------------------|
| Agilent Technologies | Network Analyzer | 8753ES | US39174857 | 10/02/2010 |
| Agilent Technologies | Dielectric probe kit | HP 85070C | US9936135 | CNR |
| Dell | PC using GPIB card | GX110 | 347 | N/A |
| Control Company | Digital Thermometer | 15-077-21 | 51129471 | 04/29/2011 |

Table 6.2.2. Equipment required for electrical parameter measurements

6.2.2 Test Configuration

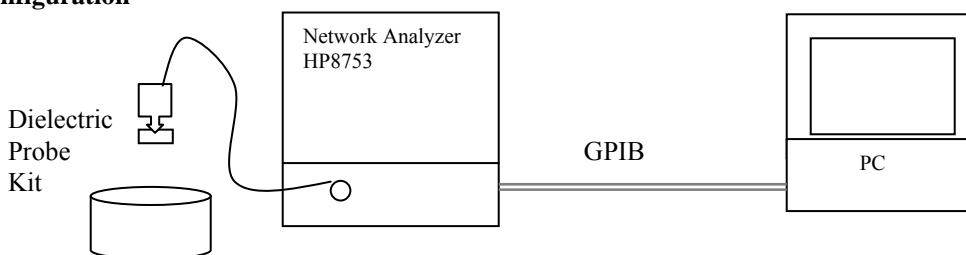



Figure 6.2.1. Test configuration

6.2.3 Procedure

1. Turn NWA on and allow at least 30 minutes for warm up.
2. Mount dielectric probe kit so that interconnecting cable to NWA will not be moved during measurements or calibration.
3. Pour de-ionized water and measure water temperature ($\pm 1^\circ$).
4. Set water temperature in HP-Software (Calibration Setup).
5. Perform calibration.
6. Relative permittivity $\epsilon_r = \epsilon'$ and conductivity can be calculated from ϵ''

$$\sigma = \omega \epsilon_0 \epsilon''$$
7. Measure liquid shortly after calibration.
8. Stir the liquid to be measured. Take a sample (~50ml) with a syringe from the center of the liquid container.
9. Pour the liquid into a small glass flask. Hold the syringe at the bottom of the flask to avoid air bubbles.
10. Put the dielectric probe in the glass flask. Check that there are no air bubbles in front of the opening in the dielectric probe kit.
11. Perform measurements.
12. Adjust medium parameters in DASY4 for the frequencies necessary for the measurements ('Setup Config', select medium (e.g. Head 835 MHz) and press 'Option'-button.
13. Select the current medium for the frequency of the validation (e.g. Setup Medium Brain 835 MHz).

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7.0 SAR SAFETY LIMITS

| Standards/Guideline | Localized SAR Limit (W/kg) General public (uncontrolled) | Localized SAR Limits (W/kg) Workers (controlled) |
|----------------------------|--|--|
| ICNIRP (1998) Standard | 2.0 (10g) | 10.0 (10g) |
| IEEE C95.1 (1999) Standard | 1.6 (1g) | 8.0 (1g) |

Table 7.0.1. SAR safety limits for Controlled / Uncontrolled environment

| Human Exposure | Localized SAR Limits (W/kg) 10g, ICNIRP (1998) Standard | Localized SAR Limits (W/kg) 1g, IEEE C95.1 (1999) Standard |
|--|---|--|
| Spatial Average (averaged over the whole body) | 0.08 | 0.08 |
| Spatial Peak (averaged over any X g of tissue) | 2.00 | 1.60 |
| Spatial Peak (hands/wrists/feet/ankles averaged over 10 g) | 4.00 | 4.00 (10g) |

Table 7.0.2. SAR safety limits

Uncontrolled Environments are defined as locations where there is exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

8.0 DEVICE POSITIONING

8.1 Device holder for SAM Twin Phantom

The Device was positioned for all test configurations using the DASY4 holder. The device holder facilitates the rotation of the mounted transmitter in spherical coordinates whereby the rotation point is the ear opening. The devices can be easily, accurately and with repeatability positioned according to FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

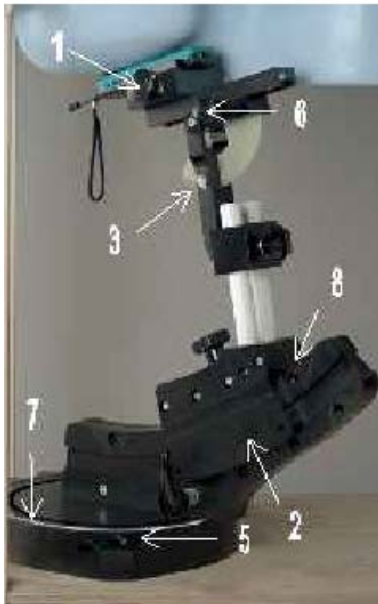


Figure 8.1.1. Device Holder

1. Put the phone in the clamp mechanism (1) and hold it straight while tightening. (Curved phones or phones with asymmetrical ear pieces should be positioned so that the earpiece is in the symmetry plane of the clamp).
2. Adjust the sliding carriage (2) to 90°. Then adjust the phone holder angle (3) until the reference line of the phone is horizontal (parallel to the flat phantom bottom). The phone reference line is defined as the front tangential line between the earpiece and the center of the device bottom (or the center of the flip hinge). For devices with parallel front and backsides, the phone holder angle (3) is 0°.
3. Place the device holder at the desired phantom section and move it securely against the positioning pins (4). The screw in front of the turning plate can be applied for correct positioning (5). (Do not tighten it too strongly).
4. Shift the phone clamp (6) so that the earpiece is exactly below the ear marking of the phantom. The phone is now correctly positioned in the holder for all standard phantom measurements, even after changing the phantom or phantom section.
5. Adjust the device position angles to the desired measurement position.

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6. After fixing the device angles, move the phone fixture up until the phone touches the ear marking. (The point of contact depends on the design of the device and the positioning angle).

8.2 Description of the test positioning

8.2.1 Test Positions of Device Relative to Head

The handset was tested in two test positions against the head phantom, the “cheek” position and the “tilted” position, on both left and right sides of the phantom.

The handset was tested in the above positions according to IEEE 1528- 2003 “Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”.

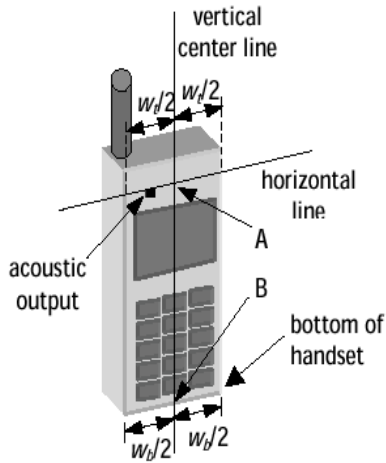


Figure 8.2.1a. Handset vertical and horizontal reference lines – fixed case

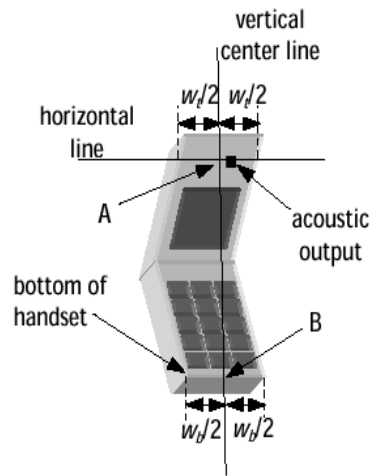



Figure 8.2.1b. Handset vertical and horizontal reference lines – “clam-shell”

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8.2.1.1 Definition of the “cheek” position

- 1) Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece, open the cover.
- 2) Define two imaginary lines on the handset: the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset: the midpoint of the width w_t of the handset at the level of the acoustic output (point A on Figures 8.2.1a and 8.2.1b), and the midpoint of the width w_b of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 8.2.1a). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 8.2.1b), especially for clamshell handsets, handsets with flip pieces, and other irregularly shaped handsets.
- 3) Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 8.2.1), such that the plane defined by the vertical center line and the horizontal center line is in a plane approximately parallel to the sagittal plane of the phantom.
- 4) Translate the handset towards the phantom along the line passing through RE and LE until the handset touches the ear.
- 5) While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is the plane normal to MB (“mouth-back”) - NF (“neck-front”) including the line MB (reference plane).
- 6) Rotate the phone around the vertical centerline until the phone (horizontal line) is symmetrical with respect to the line NF.
- 7) While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, rotate the handset about the line NF until any point on the handset is in contact with a phantom point below the ear (cheek).

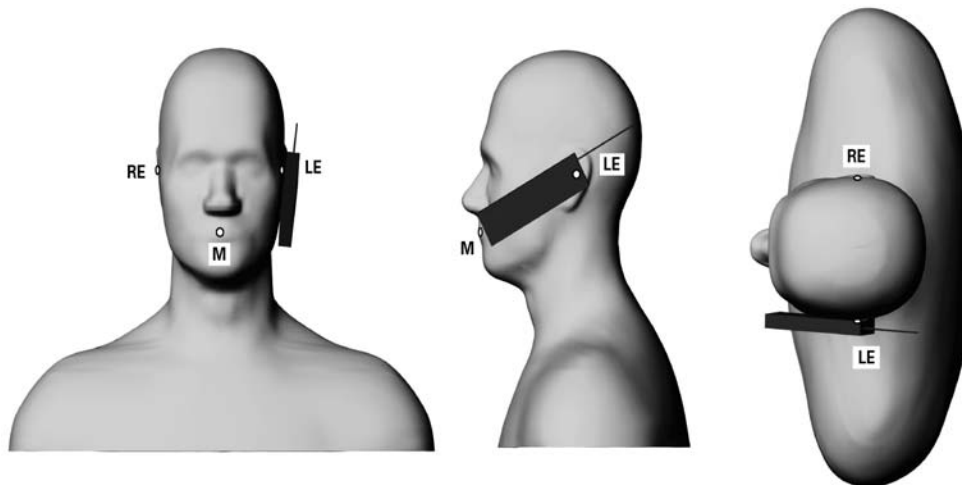



Figure 8.2.2. Phone position 1, “cheek” or “touch” position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

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8.2.1.2 Definition of the “Tilted” Position

- 1) Repeat steps 1 to 7 of 5.4.1 (in this report 8.2.1.1) to replace the device in the “cheek position.”
- 2) While maintaining the device in the reference plane (described above) and pivoting against the ear, move the device outward away from the mouth by an angle of 15 degrees, or until the antenna touches the phantom.

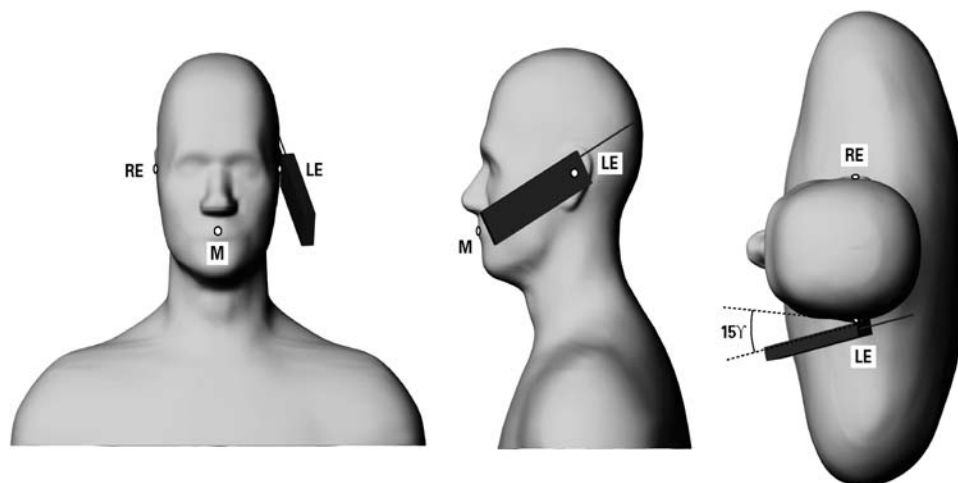



Figure 8.2.3. Phone position 2, “tilted position.” The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

8.2.2 Body Holster Configuration

Body worn holsters, as shown on Figure 1.4.1, have been test with the device for FCC RF exposure compliance. The EUT was positioned in each holster case and the belt clip was placed against the flat section of the phantom. A headset was then connected to the device to simulate hands-free operation in a body worn holster configuration.

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9.0 HIGH LEVEL EVALUATION

9.1 Maximum search

The maximum search is automatically performed after each coarse scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations.

9.2 Extrapolation

The extrapolation can be used in z-axis scans with automatic surface detection. The SAR values can be extrapolated to the inner phantom surface. The extrapolation distance is the sum of the probe sensor offset, the surface detection distance and the grid offset. The extrapolation is based on fourth order polynomial functions. The extrapolation is only available for SAR values.

9.3 Boundary correction

The correction of the probe boundary effect in the vicinity of the phantom surface is done in the standard (worst case) evaluation; the boundary effect is reduced by different weights for the lowest measured points in the extrapolation routine. The result is a slight overestimation of the extrapolated SAR values (2% to 8%) depending on the SAR distribution and gradient. The advanced evaluation makes a full compensation of the boundary effect before doing the extrapolation. This is only possible for probes with specifications on the boundary effect.

9.4 Peak search for 1g and 10g cube averaged SAR

The 1g and 10g peak evaluations are only available for the predefined cube 5x5x7 scan. The routines are verified and optimized for the grid dimensions used in these cube measurements.

The measured volume of 30x30x30mm with 7.5mm resolution in (x,y) and 5mm resolution in z axis amounts to 175 measurement points. The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume in a 1mm grid. In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is then moved around until the highest averaged SAR is found. This last procedure is repeated for a 10 g cube. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.


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10.0 MEASUREMENT UNCERTAINTY

| DASY4 Uncertainty Budget According to IEEE P1528 [1] | | | | | | | | |
|--|-------------------|-------------|------|--------------|---------------|----------------|-----------------|---------------------|
| Error Description | Uncertainty value | Prob. Dist. | Div. | (c_i) 1g | (c_i) 10g | Std. Unc. (1g) | Std. Unc. (10g) | (v_i) v_{eff} |
| Measurement System | | | | | | | | |
| Probe Calibration | ±4.8% | N | 1 | 1 | 1 | ±4.8% | ±4.8% | ∞ |
| Axial Isotropy | ±4.7% | R | √3 | 0.7 | 0.7 | ±1.9% | ±1.9% | ∞ |
| Hemispherical Isotropy | ±9.6% | R | √3 | 0.7 | 0.7 | ±3.9% | ±3.9% | ∞ |
| Boundary Effects | ±1.0% | R | √3 | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Linearity | ±4.7% | R | √3 | 1 | 1 | ±2.7% | ±2.7% | ∞ |
| System Detection Limits | ±1.0% | R | √3 | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Readout Electronics | ±1.0% | N | 1 | 1 | 1 | ±1.0% | ±1.0% | ∞ |
| Response Time | ±0.8% | R | √3 | 1 | 1 | ±0.5% | ±0.5% | ∞ |
| Integration Time | ±2.6% | R | √3 | 1 | 1 | ±1.5% | ±1.5% | ∞ |
| RF Ambient Conditions | ±3.0% | R | √3 | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| Probe Positioner | ±0.4% | R | √3 | 1 | 1 | ±0.2% | ±0.2% | ∞ |
| Probe Positioning | ±2.9% | R | √3 | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| Max. SAR Eval. | ±1.0% | R | √3 | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Test Sample Related | | | | | | | | |
| Device Positioning | ±2.9% | N | 1 | 1 | 1 | ±2.9% | ±2.9% | 145 |
| Device Holder | ±3.6% | N | 1 | 1 | 1 | ±3.6% | ±3.6% | 5 |
| Power Drift | ±5.0% | R | √3 | 1 | 1 | ±2.9% | ±2.9% | ∞ |
| Phantom and Setup | | | | | | | | |
| Phantom Uncertainty | ±4.0% | R | √3 | 1 | 1 | ±2.3% | ±2.3% | ∞ |
| Liquid Conductivity (target) | ±5.0% | R | √3 | 0.64 | 0.43 | ±1.8% | ±1.2% | ∞ |
| Liquid Conductivity (meas.) | ±2.5% | N | 1 | 0.64 | 0.43 | ±1.6% | ±1.1% | ∞ |
| Liquid Permittivity (target) | ±5.0% | R | √3 | 0.6 | 0.49 | ±1.7% | ±1.4% | ∞ |
| Liquid Permittivity (meas.) | ±2.5% | N | 1 | 0.6 | 0.49 | ±1.5% | ±1.2% | ∞ |
| Combined Std. Uncertainty | | | | | | ±10.3% | ±10.0% | 330 |
| Expanded STD Uncertainty | | | | | | ±20.6% | ±20.1% | |

Table 10.0.1. Worst-Case uncertainty budget for DASY4 assessed according to IEEE P1528.
Source: Schmid & Partner Engineering AG.

[1] The budget is valid for the frequency range 300MHz - 3 GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerably smaller.

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11.0 TEST RESULTS

11.1 SAR Measurement results at highest power measured against the head

| Test Position | Mode | f (MHz) | Cond. Output Power (dBm) | Liquid Temp. (°C) | SAR, averaged over 1 g | | |
|---------------------|--------------------------|---------|--------------------------|-------------------|------------------------|------------------|----------------------|
| | | | | | Measured (W/kg) | Power Drift (dB) | *Extrapolated (W/kg) |
| Right Head Cheek | 2-slots GSM/EDGE 850 MHz | 824.2 | 29.6 | 22.3 | 0.90 | 0.03 | 0.90 |
| | | 836.8 | 29.7 | 22.5 | 0.97 | 0.08 | 0.97 |
| | | 848.8 | 29.9 | 22.2 | 1.10 | 0.06 | 1.10 |
| Right Head 15° Tilt | 2-slots GSM/EDGE 850 MHz | 824.2 | | | | | |
| | | 836.8 | | | | | |
| | | 848.8 | 29.9 | 22.0 | 0.58 | 0.10 | 0.58 |
| Right Head Cheek | 1-slot GSM 850 MHz | 824.2 | | | | | |
| | | 836.8 | | | | | |
| | | 848.8 | 31.7 | 22.1 | 0.89 | 0.05 | 0.89 |
| Left Head Cheek | 2-slots GSM/EDGE 850 MHz | 824.2 | 29.6 | 21.8 | 0.83 | 0.14 | 0.83 |
| | | 836.8 | 29.7 | 22.0 | 0.88 | 0.05 | 0.88 |
| | | 848.8 | 29.9 | 22.2 | 1.01 | 0.00 | 1.01 |
| Left Head 15° Tilt | 2-slots GSM/EDGE 850 MHz | 824.2 | | | | | |
| | | 836.8 | | | | | |
| | | 848.8 | 29.9 | 22.1 | 0.63 | 0.11 | 0.63 |

Table 11.1.1. SAR results for GSM/EDGE 850 head configuration

* Note: If the power drift is ≤ -0.200 dB, the extrapolated SAR is calculated using the formula:

$$\text{Extrapolated SAR} = (\text{Measured SAR}) * 10^{(|\text{Power Drift (dB)}| / 10)}$$

| Test Position | Mode | f (MHz) | Cond. Output Power (dBm) | Liquid Temp. (°C) | SAR, averaged over 1 g | | |
|---------------------|-----------------------|---------|--------------------------|-------------------|------------------------|------------------|----------------------|
| | | | | | Measured (W/kg) | Power Drift (dB) | *Extrapolated (W/kg) |
| Right Head Cheek | WCDMA FDD IV 1700 MHz | 1712.4 | 22.0 | 21.9 | 0.71 | -0.06 | 0.71 |
| | | 1732.6 | 22.2 | 22.1 | 0.80 | 0.01 | 0.80 |
| | | 1752.6 | 22.3 | 22.2 | 0.88 | 0.05 | 0.88 |
| Right Head 15° Tilt | WCDMA FDD IV 1700 MHz | 1712.4 | | | | | |
| | | 1732.6 | | | | | |
| | | 1752.6 | 22.3 | 22.1 | 0.34 | 0.03 | 0.34 |
| Left Head Cheek | WCDMA FDD IV 1700 MHz | 1712.4 | 22.0 | 21.4 | 0.95 | 0.04 | 0.95 |
| | | 1732.6 | 22.2 | 21.5 | 1.14 | 0.00 | 1.14 |
| | | 1752.6 | 22.3 | 21.7 | 1.19 | 0.08 | 1.19 |
| Left Head 15° Tilt | WCDMA FDD IV 1700 MHz | 1712.4 | | | | | |
| | | 1732.6 | | | | | |
| | | 1752.6 | 22.3 | 21.6 | 0.33 | 0.01 | 0.33 |

Table 11.1.2. SAR results for WCDMA FDD IV head configuration for Rev1

| Test Position | Mode | f (MHz) | Cond. Output Power (dBm) | Liquid Temp. (°C) | SAR, averaged over 1 g | | |
|------------------|-----------------------|---------|--------------------------|-------------------|------------------------|------------------|----------------------|
| | | | | | Measured (W/kg) | Power Drift (dB) | *Extrapolated (W/kg) |
| Right Head Cheek | WCDMA FDD IV 1700 MHz | 1712.4 | 22.7 | | | | |
| | | 1732.6 | 22.4 | | | | |
| | | 1752.6 | 22.6 | 22.0 | 0.85 | -0.07 | 0.85 |
| Left Head Cheek | WCDMA FDD IV 1700 MHz | 1712.4 | 22.7 | | | | |
| | | 1732.6 | 22.4 | | | | |
| | | 1752.6 | 22.6 | 22.0 | 1.34 | -0.05 | 1.34 |

Table 11.1.3. SAR results for WCDMA FDD IV head configuration for Rev2


| | | | | |
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| Test Position | Mode | f (MHz) | Cond. Output Power (dBm) | Liquid Temp. (°C) | SAR, averaged over 1 g | | |
|---------------------|---------------------------|---------|--------------------------|-------------------|------------------------|------------------|----------------------|
| | | | | | Measured (W/kg) | Power Drift (dB) | *Extrapolated (W/kg) |
| Right Head Cheek | 2-slots GSM/EDGE 1900 MHz | 1850.2 | | | | | |
| | | 1880.0 | 28.0 | 22.0 | 0.47 | -0.15 | 0.47 |
| | | 1909.8 | | | | | |
| Right Head 15° Tilt | 2-slots GSM/EDGE 1900 MHz | 1850.2 | | | | | |
| | | 1880.0 | 28.0 | 21.8 | 0.27 | 0.00 | 0.27 |
| | | 1909.8 | | | | | |
| Left Head Cheek | 2-slots GSM/EDGE 1900 MHz | 1850.2 | 28.0 | 22.2 | 0.89 | 0.07 | 0.89 |
| | | 1880.0 | 28.0 | 21.6 | 0.85 | -0.08 | 0.85 |
| | | 1909.8 | 27.7 | 21.8 | 0.73 | 0.07 | 0.73 |
| Left Head 15° Tilt | 2-slots GSM/EDGE 1900 MHz | 1850.2 | 28.0 | 21.5 | 0.28 | -0.04 | 0.28 |
| | | 1880.0 | | | | | |
| | | 1909.8 | | | | | |
| Left Head Cheek | 1-slot GSM 1900 MHz | 1850.2 | 30.5 | 21.4 | 0.76 | 0.10 | 0.76 |
| | | 1880.0 | | | | | |
| | | 1909.8 | | | | | |

Table 11.1.4. SAR results for GSM/EDGE 1900 for head configuration

| Test Position | Mode | f (MHz) | Cond. Output Power (dBm) | Liquid Temp. (°C) | SAR, averaged over 1 g | | |
|---------------------|-------------------|---------|--------------------------|-------------------|------------------------|------------------|----------------------|
| | | | | | Measure d (W/kg) | Power Drift (dB) | *Extrapolated (W/kg) |
| Right Head Cheek | 802.11 b 2450 MHz | 2412 | 17.0 | 22.0 | 0.09 | -0.10 | 0.09 |
| | | 2437 | 17.6 | 21.8 | 0.10 | -0.04 | 0.10 |
| | | 2462 | 17.6 | 22.1 | 0.10 | 0.07 | 0.10 |
| Right Head 15° Tilt | 802.11 b 2450 MHz | 2412 | | | | | |
| | | 2437 | | | | | |
| | | 2462 | 17.6 | 22.7 | 0.11 | -0.02 | 0.11 |
| Left Head Cheek | 802.11 b 2450 MHz | 2412 | | | | | |
| | | 2437 | | | | | |
| | | 2462 | 17.6 | 22.3 | 0.14 | 0.22 | 0.14 |
| Left Head 15° Tilt | 802.11 b 2450 MHz | 2412 | | | | | |
| | | 2437 | | | | | |
| | | 2462 | 17.6 | 22.0 | 0.13 | 0.12 | 0.13 |

Table 11.1.5. Head SAR results for WiFi/WLAN/802.11b

| | | | | | |
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11.2 SAR measurement results at highest power measured against the body using accessories

| Mode | Freq. (MHz) | Cond. Power (dBm) | Holster type / device configuration | Liquid Temp. (°C) | SAR, averaged over 1 g | | |
|----------------------|-------------|-------------------|---|-------------------|------------------------|------------------|----------------------|
| | | | | | Measured (W/kg) | Power Drift (dB) | *Extrapolated (W/kg) |
| 2-slots GPRS 850 MHz | 836.8 | 29.8 | Vertical Holster, back side facing | 22.2 | 0.78 | -0.02 | 0.78 |
| | 836.8 | 29.8 | Vertical Holster, front side facing | 22.0 | 0.60 | 0.00 | 0.60 |
| | 836.8 | 29.8 | Vertical Holster, headset 2, back side facing | 22.1 | 0.68 | 0.12 | 0.68 |
| | 836.8 | 29.8 | No Holster, back side 25 mm away | 22.3 | 0.56 | 0.07 | 0.56 |

Table 11.2.1. SAR results for GPRS850 body-worn configurations

* Note: If the power drift is ≤ -0.200 dB, the extrapolated SAR is calculated using the formula:

$$\text{Extrapolated SAR} = (\text{Measured SAR}) * 10^{(|\text{Power Drift (dB)}| / 10)}$$

| | | | | |
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| Mode | Freq. (MHz) | Cond. Power (dBm) | Holster type / device configuration | Liquid Temp. (°C) | SAR, averaged over 1 g | | |
|-----------------------|-------------|-------------------|---|-------------------|------------------------|------------------|----------------------|
| | | | | | Measured (W/kg) | Power Drift (dB) | *Extrapolated (W/kg) |
| WCDMA FDD IV 1700 MHz | 1732.6 | 22.2 | Vertical Holster, back side facing | 22.5 | 0.44 | 0.03 | 0.44 |
| | 1732.6 | 22.2 | Vertical Holster, front side facing | 22.4 | 0.26 | -0.07 | 0.26 |
| | 1732.6 | 22.2 | Vertical Holster, headset 1, back side facing | 22.5 | 0.49 | -0.02 | 0.49 |
| | 1732.6 | 22.2 | Vertical Holster, headset 2, back side facing | 22.3 | 0.48 | 0.00 | 0.48 |
| | 1732.6 | 22.2 | Vertical Holster, headset 3, back side facing | 22.3 | 0.49 | -0.03 | 0.49 |
| | 1732.6 | 22.2 | No Holster, back side 25 mm away | 22.2 | 0.24 | 0.06 | 0.24 |

Table 11.2.2. SAR results for WCDMA FDD IV body-worn configurations for Rev1

| Mode | Freq. (MHz) | Cond. Power (dBm) | Holster type / device configuration | Liquid Temp. (°C) | SAR, averaged over 1 g | | |
|-----------------------|-------------|-------------------|---|-------------------|------------------------|------------------|----------------------|
| | | | | | Measured (W/kg) | Power Drift (dB) | *Extrapolated (W/kg) |
| WCDMA FDD IV 1700 MHz | 1732.6 | 22.4 | Vertical Holster, back side facing | 22.2 | 0.40 | 0.05 | 0.40 |
| | 1732.6 | 22.4 | Vertical Holster, headset 1, back side facing | 21.9 | 0.44 | 0.07 | 0.44 |
| | 1732.6 | 22.4 | Vertical Holster, headset 3, back side facing | 22.1 | 0.44 | -0.06 | 0.44 |

Table 11.2.3. SAR results for WCDMA FDD IV body-worn configurations for Rev2


| | | | | |
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| Mode | Freq. (MHz) | Cond. Power (dBm) | Holster type / device configuration | Liquid Temp. (°C) | SAR, averaged over 1 g | | |
|-----------------------|-------------|-------------------|--|-------------------|------------------------|------------------|-----------------------|
| | | | | | Measured (W/kg) | Power Drift (dB) | *Extrapolate d (W/kg) |
| 2-slots GPRS 1900 MHz | 1880.0 | 28.0 | Vertical Holster, back side facing | 21.4 | 0.25 | -0.08 | 0.25 |
| | 1880.0 | 28.0 | Vertical Holster, front side facing | 22.5 | 0.19 | -0.03 | 0.19 |
| | 1880.0 | 28.0 | Vertical Holster, headset #1, back side facing | 21.9 | 0.32 | -0.03 | 0.32 |
| | 1880.0 | 28.0 | Vertical Holster, headset #2, back side facing | 22.3 | 0.34 | -0.14 | 0.34 |
| | 1880.0 | 28.0 | Vertical Holster, headset #3, back side facing | 22.2 | 0.28 | 0.03 | 0.28 |
| | 1880.0 | 28.0 | No Holster, back side 25 mm away | 22.2 | 0.18 | 0.12 | 0.18 |

Table 11.2.4. SAR results for GPRS1900 body-worn configurations


| Mode | Freq. (MHz) | Cond. Power (dBm) | Holster type / device configuration | Liquid Temp. (°C) | SAR, averaged over 1 g | | |
|-----------------------|-------------|-------------------|---|-------------------|------------------------|------------------|----------------------|
| | | | | | Measured (W/kg) | Power Drift (dB) | *Extrapolated (W/kg) |
| 802.11b/WLAN 2450 MHz | 2412 | 17.0 | Vertical Holster, back side facing | 22.4 | 0.07 | 0.06 | 0.07 |
| | 2437 | 17.6 | Vertical Holster, back side facing | 22.5 | 0.08 | 0.06 | 0.08 |
| | 2462 | 17.6 | Vertical Holster, back side facing | 22.5 | 0.07 | -0.06 | 0.07 |
| | 2437 | 17.6 | Vertical Holster, front side facing | 22.6 | 0.03 | -0.05 | 0.03 |
| | 2437 | 17.6 | Vertical Holster, headset 1, back side facing | 22.6 | 0.08 | -0.18 | 0.08 |
| | 2437 | 17.6 | Vertical Holster, headset 2, back side facing | 22.7 | 0.12 | -0.04 | 0.12 |
| | 2437 | 17.6 | Vertical Holster, headset 3, back side facing | 22.6 | 0.08 | 0.08 | 0.08 |
| | 2437 | 17.6 | No Holster, back side 25 mm away | 22.5 | 0.04 | 0.37 | 0.04 |

Table 11.2.5. SAR results for WiFi/WLAN/802.11b body-worn configurations

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