SAR Compliance Test Report

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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 3-2009 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, DASY4 manual which follows draft IEC 62209 – Part 2 and Health Canada's Safety Code 6.

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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 transmitter)
Configuration	Internal fixed antenna

Table 1.2.1. Antenna description

1.3 Device description

Device Model	RCN71UW		
FCC ID	L6ARCN70UW		
PIN	21088684 (Rev2), 211AA31 (Rev3)		
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	29.5 28.0	22.0
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	1712.4-1752.6
Mode(s) of Operation in North America	802.11b	802.11g	Bluetooth
Maximum nominal conducted RF Output Power (dBm)	17.5	16.0	7.67
Tolerance in Power Setting on centre channel (dB)	± 0.50	± 0.50	N/A
Duty Cycle	1:1	1:1	N/A
Tx Frequency Range (MHz)	2412-2462	2412-2462	2402-2483

Table 1.2.2. Test device description

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

1.4 Body worn accessories (holsters)

The device has been tested with the first two holsters listed below. All other holsters contain indentical 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 Vertical Swivel Holster	HDW-18969-001	20
2	Leather Horizontal Holster	HDW-18965-001	21
3	Vertical Swivel Holster (Alt. 1)	HDW-24208-001	22
4	Vertical Swivel Holster (Alt. 2)	HDW-24210-001	22
5	Vertical Swivel Holster (Alt. 3)	HDW-23466-001	21
6	Leather Vertical Swivel Holster (Alt. 4)	HDW-18960-001	20
7	Leather Vertical Swivel Holster (Alt. 5)	HDW-16001-001	23
8	Leather Vertical Swivel Holster (Alt. 6)	HDW-28111-001	20
9	Horizontal Swivel Holster (Alt. 7)	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

1.6 Battery

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

1) BAT-14392-001

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 ± 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 EX3DV4 for 2.4 – 6 GHz SAR testing specs are outlined below:

Probe tip to sensor center	1.0 mm
Probe tip diameter is	2.5 mm
Probe calibration uncertainty	< 15 % for f = 2.45 to < 6.0 GHz
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 ¼ 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 ¼ 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 %.

• 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

		802.11g			**802.11b**
Data Rate (Mbps)	**Mod.**	**Channel 6**	**Data Rate (Mbps)**	**Mod.**	**Channel 6**
		Cond. Power (dBm)			**Cond. Power (dBm)**
6	BPSK	16.30	1	BPSK	17.60
9	BPSK	16.35	2	DQPSK	17.65
12	QPSK	14.70	5.5	CCK	17.55
18	QPSK	14.55	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

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.

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	1312	1312
	Freq (MHz)	1712.4	1712.4	1712.4
Mode	**Subtest**	**Conducted Transmit Power (dBm)**		
Rel99	12.2 kbps RMC	22.00	22.00	22.00
Rel99	12.2 kbps AMR, SRB 3.4 kbps	21.95	21.95	21.95
Rel5 HSDPA	1	21.90	21.90	21.90
Rel5 HSDPA	2	21.95	21.95	21.95
Rel5 HSDPA	3	21.89	21.89	21.89
Rel5 HSDPA	4	21.90	21.90	21.90

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 ≤ 2·PRef and antenna is > 5.0 cm from other antennas
- output ≤ PRef and antenna is > 2.5 cm from other antennas
- the other antenna(s), which are < 2.5 cm away, has an output ≤ PRef 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 ≤ PRef 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.
- when SAR to peak separation ratio 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

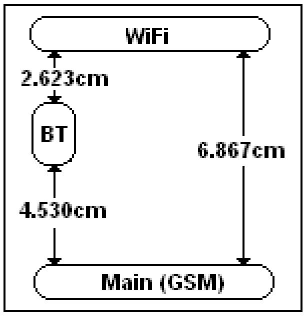

Figure 1.9.1. Back view of device showing closet distance between antenna pairs

Mode	Configuration	Highest 1 g SAR (W/kg)
GSM/GPRS/EDGE/WCDMA	Head-Left-Touch	1.39
	Body-Vertical Holster Back	0.67
802.11 b/g	Head-Left-Touch	0.12
	Body- Vertical Holster Back	0.09

Table 1.9.2. Highest SAR values for the same setup

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

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

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 2000.
· 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.

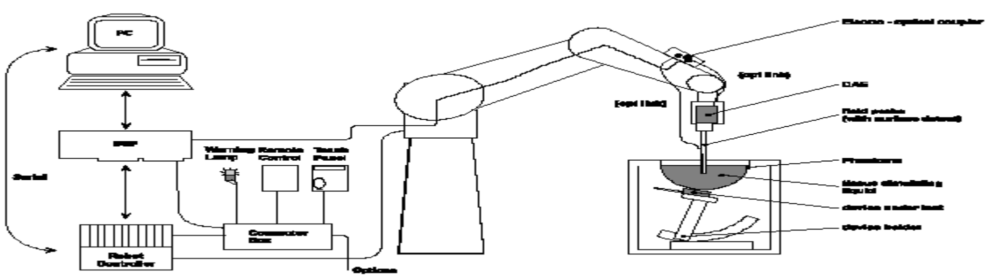

Figure 2.1.1. System Description

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	ET3DV6	1642	01/12/2010
SCHMID & Partner Engineering AG	Data Acquisition Electronics (DAE3)	DAE3 V1	472	03/03/2010
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	11/06/2009
Agilent Technologies	Signal generator	8648C	4037U03155	09/20/2009
Agilent Technologies	Power meter	E4419B	GB40202821	09/19/2009
Agilent Technologies	Power sensor	8481A	MY41095417	10/30/2009
Agilent Technologies	Power sensor	N1921A	SG45240281	05/01/2011
Agilent Technologies	Power meter	N1911A	MY45100905	05/08/2010
Amplifier Research	Amplifier	5S1G4M3	300986	CNR
Agilent Technologies	Network analyzer	8753ES	US39174857	10/29/2009
Rohde & Schwarz	Base Station Simulator	CMU 200	109747	12/07/2009

Table 2.1.2. Equipment list

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 2000.
- 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 ET3DV6, 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 ET3DV6	
Frequency range	30 MHz – 3 GHz
Linearity	±0.1 dB
Directivity (rotation around probe axis)	≤ ±0.2 dB
Directivity (rotation normal to probe axis)	±0.4 dB
Dynamic Range	5 mW/kg – 100 W/kg
Probe positioning repeatability	±0.2 mm
Spatial resolution	< 0.125 mm^3

Table 3.1.1. Probe specifications

3.2 Probe calibration and measurement uncertainty

The probe ET3DV6 was calibrated with an accuracy better than ±10% . 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.

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.

4.1 System accuracy verification for head adjacent use

f (MHz)	Limits / Measured	SAR (W/kg) 1 g/ 10 g	Dielectric Parameters		Liquid Temp (°C)
			ε_r	σ [S/m]	
835	Measured (08/18/2009)	9.10 / 6.01	42.5	0.90	22.6
	Recommended Limits	9.50 / 6.27	41.5	0.90	N/A
1800	Measured (07/13/2009)	36.4 / 19.6	38.57	1.35	22.3
	Measured (07/20/2009)	35.3 / 19.0	38.4	1.38	22.6
	Recommended Limits	38.2 / 20.1	40.0	1.40	N/A
1900	Measured (08/12/2009)	41.3 / 21.9	38.1	1.46	22.8
	Recommended Limits	39.5 / 20.8	40.0	1.40	N/A
2450	Measured (07/30/2009)	57.8 / 26.8	37.7	1.87	22.8
	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

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	15-077-21	51129471	05/01/2010
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", DASY 4 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 (08/18/2009)	42.5	0.90	22.6
		Recommended Limits	41.5	0.90	N/A
	Muscle	Measured (08/19/2009)	53.3	0.94	23.1
		Recommended Limits	55.2	0.97	N/A
1800	Head	Measured (07/13/2009)	38.57	1.35	22.2
		Measured (07/20/2009)	38.4	1.38	22.6
		Recommended Limits	40.0	1.40	N/A
	Muscle	Measured (07/20/2009)	53.5	1.54	22.5
		Recommended Limits	53.3	1.52	N/A
1900	Head	Measured (08/12/2009)	38.0	1.46	22.8
		Recommended Limits	40.0	1.40	N/A
	Muscle	Measured (08/11/2009)	51.5	1.45	22.9
		Recommended Limits	53.3	1.52	N/A
2450	Head	Measured (07/30/2009)	37.7	1.87	22.8
		Recommended Limits	39.2	1.80	N/A
	Muscle	Measured (07/31/2009)	50.2	2.04	21.7
		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	10/29/2009
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	05/01/2010

Table 6.2.2. Equipment required for electrical parameter measurements

6.2.2 Test Configuration

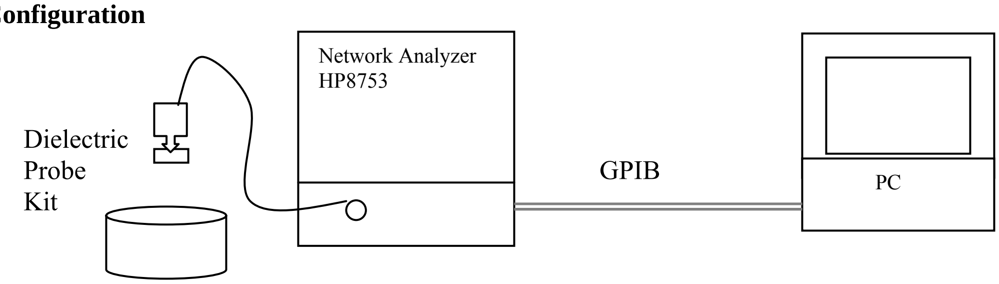

Figure 6.2.1 Test configuration

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 (±1°).
4. Set water temperature in HP-Software (Calibration Setup).
5. Perform calibration.
6. Relative permittivity $\varepsilon r = \varepsilon'$ and conductivity can be calculated from ε''
   $\sigma = \omega\, \varepsilon_0\, \varepsilon''$
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).

Sample calculation for 835 MHz head tissue dielectric parameters using data from Table 6.2.3.
Relative permittivity $\varepsilon r = \varepsilon' = 42.50$
Conductivity $\sigma = \omega\, \varepsilon_0\, \varepsilon'' = (2\pi \times 835 \times 10^6)(8.854 \times 10^{-12})(19.43) = 0.90$ S/m

Title

SubTitle

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Frequency	e'	e"
800.000000 MHz	42.9529	19.5291
805.000000 MHz	42.9042	19.5094
810.000000 MHz	42.7984	19.4951
815.000000 MHz	42.7183	19.4903
820.000000 MHz	42.7075	19.4609
825.000000 MHz	42.6358	19.4596
830.000000 MHz	42.5674	19.4469
835.000000 MHz	42.5000	19.4343
840.000000 MHz	42.4282	19.4023
845.000000 MHz	42.3850	19.3939
850.000000 MHz	42.3043	19.3965
855.000000 MHz	42.2288	19.3772
860.000000 MHz	42.1910	19.3421
865.000000 MHz	42.1000	19.3332
870.000000 MHz	42.0182	19.3170
875.000000 MHz	41.9684	19.3018
880.000000 MHz	41.9232	19.2654
885.000000 MHz	41.8527	19.2771
890.000000 MHz	41.7963	19.2647
895.000000 MHz	41.7626	19.2258
900.000000 MHz	41.7132	19.2318
905.000000 MHz	41.6678	19.2316
910.000000 MHz	41.6087	19.2161
915.000000 MHz	41.5564	19.2037
920.000000 MHz	41.5048	19.1912
925.000000 MHz	41.4575	19.1583
930.000000 MHz	41.3721	19.1570
935.000000 MHz	41.3055	19.1501
940.000000 MHz	41.2660	19.1350
945.000000 MHz	41.2158	19.1140
950.000000 MHz	41.1316	19.1039

Head

Title

SubTitle

August 19, 2009 02:02 AM

Frequency	e'	e"
800.000000 MHz	53.5462	20.2067
805.000000 MHz	53.4795	20.2007
810.000000 MHz	53.4609	20.2003
815.000000 MHz	53.4148	20.1983
820.000000 MHz	53.3891	20.1725
825.000000 MHz	53.3163	20.2134
830.000000 MHz	53.3269	20.1911
835.000000 MHz	53.2763	20.1798
840.000000 MHz	53.1970	20.1465
845.000000 MHz	53.1529	20.1767
850.000000 MHz	53.1235	20.1257
855.000000 MHz	53.0192	20.1028
860.000000 MHz	52.9966	20.1090
865.000000 MHz	52.9293	20.0785
870.000000 MHz	52.8346	20.0428
875.000000 MHz	52.7864	20.0430
880.000000 MHz	52.7541	20.0268
885.000000 MHz	52.6698	20.0095
890.000000 MHz	52.6325	20.0165
895.000000 MHz	52.5795	19.9931
900.000000 MHz	52.5544	19.9592
905.000000 MHz	52.5017	19.9722
910.000000 MHz	52.4501	19.9849
915.000000 MHz	52.4260	19.9869
920.000000 MHz	52.3826	19.9760
925.000000 MHz	52.3258	19.9806
930.000000 MHz	52.2823	19.9902
935.000000 MHz	52.2709	19.9769
940.000000 MHz	52.2152	20.0015
945.000000 MHz	52.1776	19.9686
950.000000 MHz	52.1295	19.9453

Muscle

Table 6.2.3. 835 MHz head and muscle tissue dielectric parameters

Title

SubTitle

July 13, 2009 06:43 PM

Frequency	e'	e"
1.700000000 GHz	39.0155	13.3575
1.710000000 GHz	38.9898	13.3888
1.720000000 GHz	38.9560	13.4091
1.730000000 GHz	38.9321	13.4391
1.740000000 GHz	38.8970	13.4418
1.750000000 GHz	38.8630	13.4500
1.760000000 GHz	38.7991	13.4572
1.770000000 GHz	38.7359	13.4583
1.780000000 GHz	38.6758	13.4731
1.790000000 GHz	38.6123	13.4902
1.800000000 GHz	38.5726	13.5148
1.810000000 GHz	38.5041	13.5293
1.820000000 GHz	38.4737	13.5756
1.830000000 GHz	38.4459	13.6292
1.840000000 GHz	38.4359	13.6603
1.850000000 GHz	38.4196	13.6889
1.860000000 GHz	38.3814	13.7187
1.870000000 GHz	38.3576	13.7310
1.880000000 GHz	38.3089	13.7348
1.890000000 GHz	38.2637	13.7427
1.900000000 GHz	38.1970	13.7522

Head

Title

SubTitle

July 20, 2009 07:34 PM

Frequency	e'	e"
1.700000000 GHz	55.1511	15.1942
1.705000000 GHz	55.0609	15.2083
1.710000000 GHz	54.9750	15.2039
1.715000000 GHz	54.8879	15.2200
1.720000000 GHz	54.8055	15.2363
1.725000000 GHz	54.7407	15.2457
1.730000000 GHz	54.6675	15.2400
1.735000000 GHz	54.5390	15.2664
1.740000000 GHz	54.4876	15.2806
1.745000000 GHz	54.4134	15.3071
1.750000000 GHz	54.3411	15.3172
1.755000000 GHz	54.2718	15.2951
1.760000000 GHz	54.1912	15.3206
1.765000000 GHz	54.1112	15.3197
1.770000000 GHz	54.0440	15.3419
1.775000000 GHz	53.9814	15.3643
1.780000000 GHz	53.8968	15.3648
1.785000000 GHz	53.8083	15.3729
1.790000000 GHz	53.7153	15.3667
1.795000000 GHz	53.6368	15.3893
1.800000000 GHz	53.5420	15.3967

Muscle

Table 6.2.4 1800 MHz head and muscle tissue dielectric parameters

Title
SubTitle
August 12, 2009 10:42 PM

Frequency	e'	e''
1.850000000 GHz	38.1581	13.6190
1.855000000 GHz	38.0997	13.6225
1.860000000 GHz	38.0802	13.6412
1.865000000 GHz	38.0641	13.6551
1.870000000 GHz	38.0608	13.6849
1.875000000 GHz	38.0776	13.7084
1.880000000 GHz	38.0660	13.7283
1.885000000 GHz	38.0689	13.7570
1.890000000 GHz	38.0676	13.7735
1.895000000 GHz	38.0639	13.8002
1.900000000 GHz	38.0552	13.8181
1.905000000 GHz	38.0643	13.8310
1.910000000 GHz	38.0781	13.8321
1.915000000 GHz	38.0763	13.8457
1.920000000 GHz	38.0674	13.8519
1.925000000 GHz	38.0280	13.8653
1.930000000 GHz	37.9963	13.8623
1.935000000 GHz	37.9590	13.8687
1.940000000 GHz	37.9268	13.8546
1.945000000 GHz	37.8958	13.8515
1.950000000 GHz	37.8484	13.8356
1.955000000 GHz	37.7960	13.8346
1.960000000 GHz	37.7629	13.8361
1.965000000 GHz	37.7340	13.8439
1.970000000 GHz	37.6931	13.8506
1.975000000 GHz	37.6517	13.8606
1.980000000 GHz	37.6399	13.8895

Head

Title
SubTitle
August 11, 2009 02:52 PM

Frequency	e'	e''
1.700000000 GHz	51.3908	14.2373
1.710000000 GHz	51.3653	14.2515
1.720000000 GHz	51.3583	14.2871
1.730000000 GHz	51.3610	14.3005
1.740000000 GHz	51.3449	14.3287
1.750000000 GHz	51.3229	14.3471
1.760000000 GHz	51.2985	14.3603
1.770000000 GHz	51.2607	14.3987
1.780000000 GHz	51.2324	14.4510
1.790000000 GHz	51.2071	14.4866
1.800000000 GHz	51.1487	14.5317
1.810000000 GHz	51.1059	14.5715
1.820000000 GHz	51.0788	14.6234
1.830000000 GHz	51.0627	14.6733
1.840000000 GHz	51.0124	14.7307
1.850000000 GHz	50.9795	14.7809
1.860000000 GHz	50.9542	14.8000
1.870000000 GHz	50.9113	14.8379
1.880000000 GHz	50.8714	14.8523
1.890000000 GHz	50.8220	14.8823
1.900000000 GHz	50.7600	14.9202
1.910000000 GHz	50.7038	14.9219
1.920000000 GHz	50.6532	14.9403

Muscle

Table 6.2.5 1900 MHz head and muscle tissue dielectric parameters

Title

SubTitle

July 30, 2009 06:56 PM

Frequency	e'	e''
2.400000000 GHz	37.9551	13.6160
2.405000000 GHz	37.9594	13.6232
2.410000000 GHz	37.9425	13.6585
2.415000000 GHz	37.9190	13.6442
2.420000000 GHz	37.8704	13.6393
2.425000000 GHz	37.8334	13.6553
2.430000000 GHz	37.8025	13.6583
2.435000000 GHz	37.7749	13.6752
2.440000000 GHz	37.7720	13.7022
2.445000000 GHz	37.7397	13.7230
2.450000000 GHz	37.7103	13.7470
2.455000000 GHz	37.7011	13.7820
2.460000000 GHz	37.6787	13.8140
2.465000000 GHz	37.6694	13.8383
2.470000000 GHz	37.6459	13.8714
2.475000000 GHz	37.6228	13.9015
2.480000000 GHz	37.5946	13.9250
2.485000000 GHz	37.5691	13.9682
2.490000000 GHz	37.5470	14.0085
2.495000000 GHz	37.5398	14.0367
2.500000000 GHz	37.5219	14.0847

Head

Title

SubTitle

July 31, 2009 12:59 AM

Frequency	e'	e''
2.400000000 GHz	50.1909	14.7462
2.405000000 GHz	50.1820	14.7723
2.410000000 GHz	50.1693	14.8101
2.415000000 GHz	50.1715	14.8449
2.420000000 GHz	50.1834	14.8722
2.425000000 GHz	50.1957	14.9025
2.430000000 GHz	50.2161	14.9089
2.435000000 GHz	50.2349	14.9317
2.440000000 GHz	50.2581	14.9457
2.445000000 GHz	50.2436	14.9794
2.450000000 GHz	50.2507	14.9944
2.455000000 GHz	50.2500	14.9935
2.460000000 GHz	50.2219	14.9786
2.465000000 GHz	50.1877	14.9856
2.470000000 GHz	50.1620	14.9754
2.475000000 GHz	50.1277	14.9758
2.480000000 GHz	50.1012	14.9524
2.485000000 GHz	50.0561	14.9555
2.490000000 GHz	50.0001	14.9613
2.495000000 GHz	49.9603	14.9801
2.500000000 GHz	49.9126	14.9981

Muscle

Table 6.2.6 2450 MHz head and muscle tissue dielectric parameters

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).

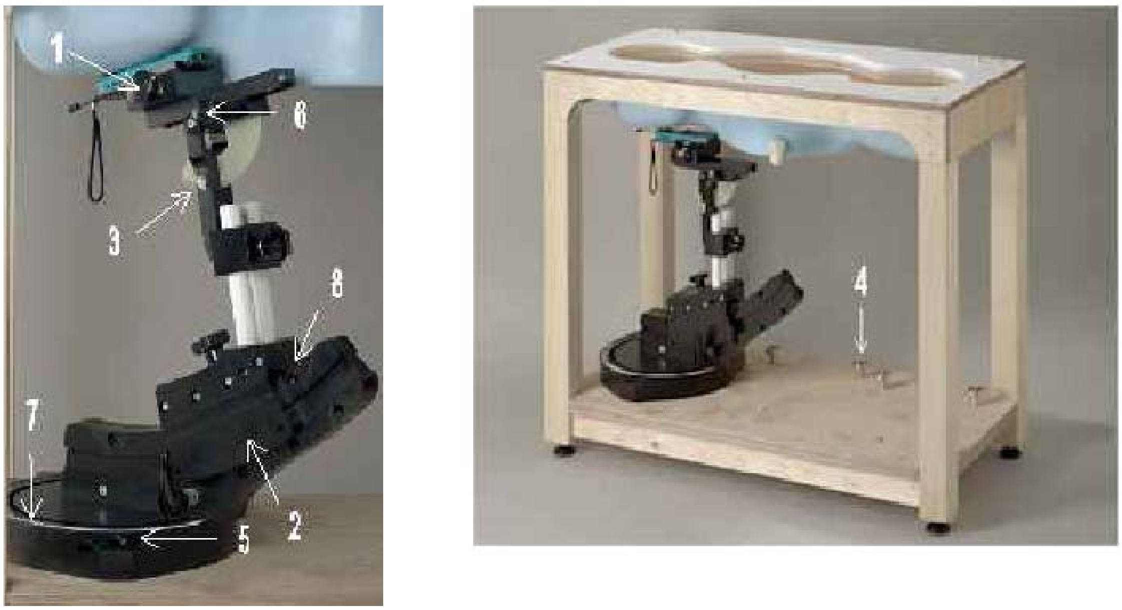

Figure 7. Device Holder

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.

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".

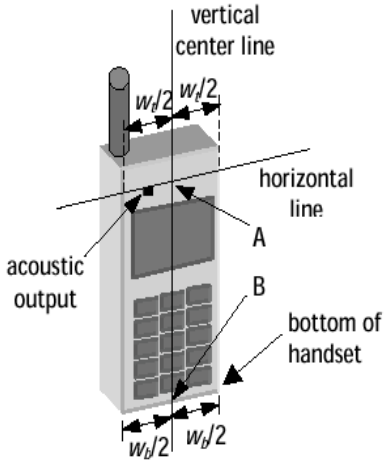

Figure 8.2.1a. Handset vertical and horizontal reference lines – fixed case

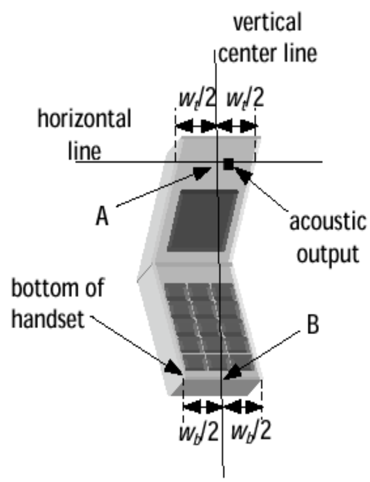

Figure 8.2.1b. Handset vertical and horizontal reference lines – "clam-shell"

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 *wt* 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 *wb* 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).

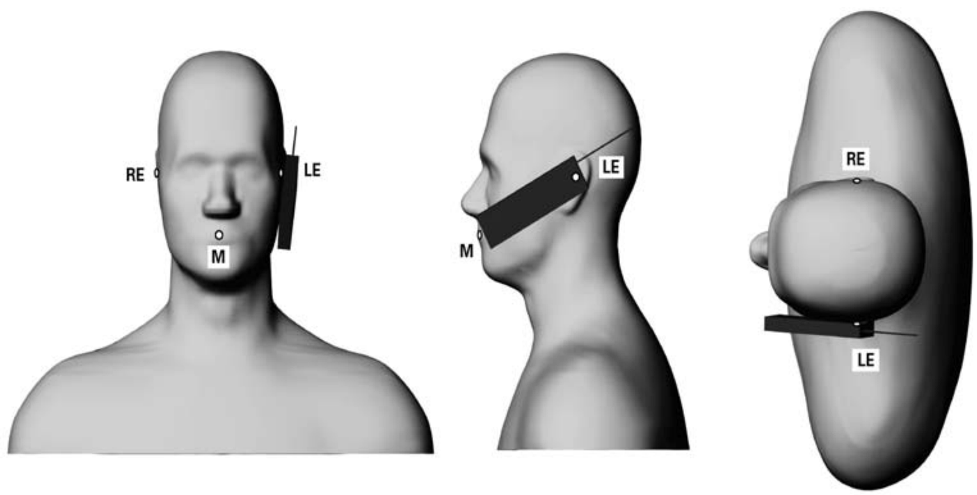

Figure 8.2.2. Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

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**.**

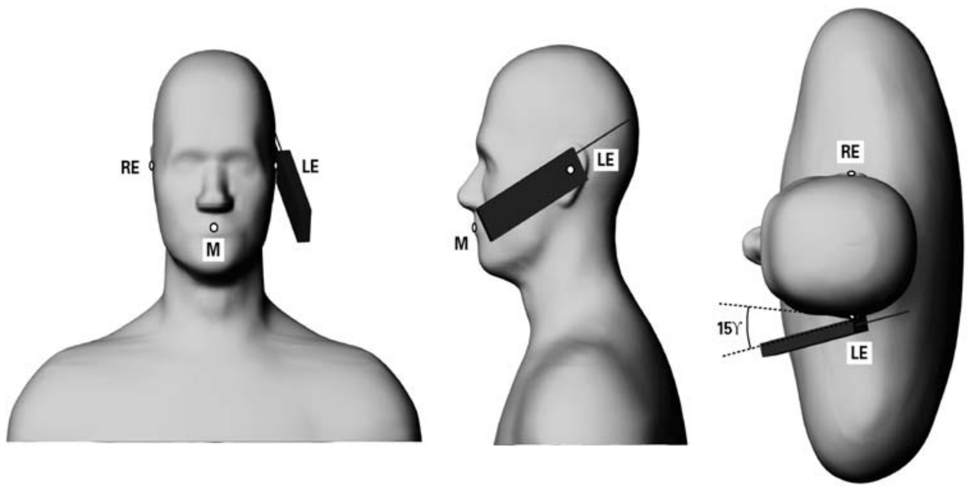

Figure 8.2.3. Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

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.

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.

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	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Readout Electronics	±1.0%	N	1	1	1	±1.0%	±1.0%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Conditions	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Max. SAR Eval.	±1.0%	R	$\sqrt{3}$	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	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Setup								
Phantom Uncertainty	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
Liquid Conductivity (target)	±5.0%	R	$\sqrt{3}$	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	$\sqrt{3}$	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.

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)
Left Head Cheek	2-slots GSM/EDGE 850 MHz	824.2	29.7	22.2	1.00	-0.14	1.00
		836.8	29.8	22.0	1.07	-0.08	1.07
		848.8	30.1	22.2	1.20	-0.09	1.20
Left Head Cheek	1-slot GSM 850 MHz	824.2	31.7				
		836.8	31.9				
		848.8	32.1	22.1	1.01	-0.04	1.01
Left Head 15° Tilt	2-slots GSM/EDGE 850 MHz	824.2	29.7				
		836.8	29.8				
		848.8	30.1	22.2	0.65	-0.02	0.65
Right Head Cheek	2-slots GSM/EDGE 850 MHz	824.2	29.7	22.3	0.97	0.09	0.97
		836.8	29.8	22.3	1.04	-0.02	1.04
		848.8	30.1	22.4	1.19	-0.04	1.19
Right Head Cheek	1-slot GSM 850 MHz	824.2	31.7				
		836.8	31.9				
		848.8	32.1	22.3	1.01	-0.19	1.01
Right Head 15° Tilt	2-slots GSM/EDGE 850 MHz	824.2	29.7				
		836.8	29.8				
		848.8	30.1	22.4	0.58	0.03	0.58

Table 11.1.1. SAR results for GSM/EDGE 850 head configuration for Rev3

***** Note: If the power drift is ≤ – 0.200 dB, the extrapolated SAR is calculated using the formula:
Extrapolated SAR = (Measured SAR) * 10^(|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)
Left Head Cheek	WCDMA FDD IV 1700 MHz	1712.4	22.0	22.0	1.09	0.06	1.09
		1732.6	22.2	22.0	1.13	-0.03	1.13
		1752.6	22.3	22.1	1.39	0.01	**1.39**
Left Head 15° Tilt	WCDMA FDD IV 1700 MHz	1712.4	22.0				
		1732.6	22.2				
		1752.6	22.3	22.3	0.37	-0.02	0.37
Right Head Cheek	WCDMA FDD IV 1700 MHz	1712.4	22.0	22.3	0.75	-0.15	0.75
		1732.6	22.2	22.2	0.75	-0.08	0.75
		1752.6	22.3	22.2	0.85	0.04	0.85
Right Head 15° Tilt	WCDMA FDD IV 1700 MHz	1712.4	22.0				
		1732.6	22.2				
		1752.6	22.3	22.3	0.32	-0.03	0.32

Table 11.1.2. SAR results for WCDMA FDD IV head configuration for Rev2

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)
Left Head Cheek	2-slots GSM/EDGE 1900 MHz	1850.2	28.1	22.1	0.98	-0.15	0.98
		1880.0	28.0	22.1	1.09	-0.07	1.09
		1909.8	27.8	22.1	1.10	-0.05	1.10
Left Head Cheek	1-slot GSM 1900 MHz	1850.2	30.7				
		1880.0	30.6				
		1909.8	30.3	22.2	1.01	0.00	1.01
Left Head 15° Tilt	2-slots GSM/EDGE 1900 MHz	1850.2	28.1				
		1880.0	28.0				
		1909.8	27.8	22.0	0.35	0.00	0.35
Right Head Cheek	2-slots GSM/EDGE 1900 MHz	1850.2	28.1	22.4	0.59	-0.03	0.59
		1880.0	28.0	22.2	0.66	-0.03	0.66
		1909.8	27.8				
Right Head 15° Tilt	2-slots GSM/EDGE 1900 MHz	1850.2	28.1				
		1880.0	28.0	22.0	0.34	0.00	0.34
		1909.8	27.8				

Table 11.1.3. SAR results for GSM/EDGE 1900 for head configuration gor Rev3

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)
Left Head Cheek	802.11 b 2450 MHz	2412	17.00				
		2437	17.60				
		2462	17.60	22.2	0.12	0.11	0.12
Left Head 15° Tilt	802.11 b 2450 MHz	2412	17.00				
		2437	17.60				
		2462	17.60	22.0	0.11	-0.19	0.11
Right Head Cheek	802.11 b 2450 MHz	2412	17.00	22.2	0.07	0.13	0.07
		2437	17.60	22.1	0.07	-0.07	0.07
		2462	17.60	22.3	0.08	-0.01	0.08
Right Head 15° Tilt	802.11 b 2450 MHz	2412	17.00				
		2437	17.60				
		2462	17.60	22.4	0.09	-0.19	0.09

Table 11.1.4 Head SAR results for WiFi/WLAN/802.11b for Rev2

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	31.9	Vertical Holster, back side facing	22.5	0.67	-0.12	**0.67**
	836.8	31.9	Horizontal Holster, back side facing	22.4	0.60	-0.22	0.63
	836.8	31.9	Vertical Holster, front side facing	22.4	0.61	-0.02	0.61
	836.8	31.9	Vertical Holster, back side facing, Headset #1	22.4	0.51	-0.14	0.51
	836.8	31.9	Vertical Holster, back side facing, Headset #2	22.3	0.52	-0.03	0.52
	836.8	31.9	No Holster, back side 25 mm away	22.3	0.50	-0.03	0.50

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:
Extrapolated SAR = (Measured SAR) * 10^(|Power Drift (dB)| / 10)

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	1712.4	22.0	Vertical Holster, back side facing	21.7	0.35	-0.04	0.35
	1732.6	22.2	Vertical Holster, back side facing	21.7	0.35	-0.10	0.35
	1752.6	22.3	Vertical Holster, back side facing	21.8	0.44	-0.03	0.44
	1752.6	22.3	Horizontal Holster, back side facing	21.7	0.43	-0.10	0.43
	1752.6	22.3	Vertical Holster, front side facing	21.8	0.40	-0.03	0.40
	1752.6	22.3	Vertical Holster, back side facing, Headset #1	21.6	0.55	0.00	0.55
	1752.6	22.3	Vertical Holster, back side facing, Headset #2	21.7	0.53	-0.09	0.53
	1752.6	22.3	No Holster, back side 25 mm away	21.9	0.33	0.00	0.33

Table 11.2.2. SAR results for WCDMA FDD IV body-worn configurations for Rev2

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 1900 MHz	1850.2	28.1	Vertical Holster, back side facing	21.6	0.43	-0.05	0.43
	1880.0	28.0	Vertical Holster, back side facing	21.7	0.47	-0.02	0.47
	1909.8	27.8	Vertical Holster, back side facing	21.7	0.44	-0.08	0.44
	1909.8	27.8	Horizontal Holster, back side facing	21.7	0.42	0.11	0.42
	1909.8	27.8	Vertical Holster, front side facing	21.7	0.23	-0.11	0.23
	1909.8	27.8	Vertical Holster, back side facing, Headset #1	21.7	0.44	-0.08	0.44
	1909.8	27.8	Vertical Holster, back side facing, Headset #2	21.7	0.46	0.06	0.46
	1909.8	27.8	No Holster, back side 25 mm away	21.6	0.25	0.27	0.25

Table 11.2.3. SAR results for GPRS1900 body-worn configurations for Rev3

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	2462	17.60	Vertical Holster, back side facing	21.8	0.08	-0.54	0.09
	2462	17.60	Horizontal Holster, back side facing	21.7	0.06	-0.45	0.06
	2462	17.60	Vertical Holster, front side facing	21.8	0.04	-0.14	0.04
	2462	17.60	Vertical Holster, back side facing, Headset #1	22.0	0.08	0.01	0.08
	2462	17.60	No Holster, back side 25 mm away	22.1	0.04	-0.03	0.04

Table 11.2.4: SAR results for WiFi/WLAN/802.11b body-worn configurations for Rev2

12.0 REFERENCES

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