SAR Compliance Test Report

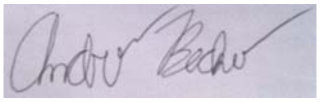
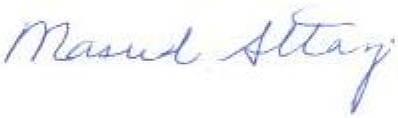
Testing Lab: RIM Testing Services
440 Phillip Street
Waterloo, Ontario
Canada N2L 5R9
Phone: 519-888-7465
Fax: 519-746-0189

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. C95.1-2005, 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. C95.3-2002, 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 SAR & HAC Compliance Specialist		30-January-2012
Tested and reviewed by: Daoud Attayi Team Lead: Safety, SAR & HAC Compliance		02-Feburary-2012
Approved by: Masud S. Attayi 2012 Manager, Regulatory Compliance		02-Feburary-

> **Note: SAR test results in this report are Mobile Hot Spot Mode. When mobile hot spot mode is enabled certain bands will operate at a reduced power. Refer to report RTS-5955-1110-23 to see REQ71UW SAR values normal mode with mobile hot spot mode disabled.**

CONTENTS

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	REQ71UW			
FCC ID	L6AREQ70UW			
PIN	Radiated: 2868B77A Conducted: 2842F698			
Hardware Rev	Rev 5			
Software Version	7.1.0.649/749			
Prototype or Production Unit	Production			
Mode(s) of Operation	1-slot GSM 850 GSM 1900	2-slots EDGE/GPRS 850/1900	3-slots EDGE/GPRS 850/1900	4-slots EDGE/GPRS 850/1900
Nominal Maximum conducted RF Output Power (dBm) in Mobile Hot Spot Mode	28.5 26.5	26.5 26.0	25.5 23.5	23.0 23.0
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	± 0.5
Duty Cycle	1:8	2:8	3:8	4:8
Transmitting Frequency Range (MHz)	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8
Mode(s) of Operation	802.11b	802.11g	802.11n	Bluetooth
Nominal Maximum conducted RF Output Power (dBm) in Mobile Hot Spot Mode	17.0	15.5	15.5	9.80
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	N/A
Duty Cycle	1:1	1:1	1:1	N/A

Transmitting Frequency Range (MHz)	2412-2462	2412-2462	2412-2462	2402-2483
Mode(s) of Operation	WCDMA / UMTS FDD V (850)	WCDMA / UMTS FDD II (1900)		
Nominal Maximum conducted RF Output Power (dBm) in Mobile Hot Spot Mode	24.5	22.5		
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5		
Duty Cycle	1:1	1:1		
Transmitting Frequency Range (MHz)	824.6 – 846.6	1852.4 – 1907.6		

Table 1.3.1. Test device description

The REQ71UW 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 holster below. The holster has been designed with the intended device orientation being with the LCD facing the belt clip only. Proper positioning is vital for protection of the LCD display, and to help maximize the battery life of the device. By design, device cannot be placed in the holster with the backside facing the belt clip/body

Number	Holster Type	Part Number	Separation distance (mm)
1	Leather Holster	HDW-42720-001	21

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-30615-006

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.

1.8 Highlights of the FCC OET SAR Measurement Requirements

1.8.1 SAR Measurement Procedures for 802.11 b/g/n Transmitter

• Maintained dielectric parameter uncertainty to ± 5.0% of the target value.
• Liquid depth from SAM ERP or flat phantom was kept at 15 cm.
• Probe Requirement: Used SPEAG probe model ET3DV6/ ES3DV3 for 2.45 GHz SAR testing specs are outlined below:

Probe tip to sensor center	2.7 mm / 2.0mm
Probe tip diameter is	6.8 mm / 4.0mm
Probe calibration uncertainty	< 15 % for f = 2.45 GHz
Probe calibration range	± 100 MHz

Table 1.8.1. Probe specification requirements

• System accuracy validation was conducted within ± 100 MHz of device mid-band frequency and results were within ± 10 % of the manufacturers target value for each band.
• Zoom Scan: The following settings were used for the validation and measurement.

Closet Measurement Point to Phantom	4.0 mm / 3mm
Zoom Scan (x,y) Resolution	7.5 mm
Zoom Scan (z) Resolution	5.0 mm
Zoom Scan Volume	Minimum 30 x 30 x 30 mm*

Table 1.8.2. Zoom Scan requirement

***Note: "Auto-extend zoom scan when maxima on boundry" is enabled, which can result in the zoom scan dimensions varying between 30x30x30 to 60x60x30.**

• 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/n 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 and highest duty cycle.

• Conducted power measurements:

802.11b @ 1Mbps		**802.11g @ 6Mbps**		**802.11n @ 6.5 Mbps**	
Chan	**Cond. Power (dBm)**	**Chan**	**Cond. Power (dBm)**	**Chan**	**Cond. Power (dBm)**
1	16.52	1	12.70	1	12.50
6	17.18	6	15.64	6	15.57

11	16.94	11	13.20	11	13.10

802.11g			**802.11b**		
Data Rate (Mbps)	**Mod.**	**Channel 6 Cond. Power (dBm)**	**Data Rate (Mbps)**	**Mod.**	**Channel 6 Cond. Power (dBm)**
6	BPSK	15.64	1	BPSK	17.18
9	BPSK	15.11	2	DQPSK	16.90
12	QPSK	13.32	5.5	CCK	16.32
18	QPSK	12.75	11	CCK	15.75
24	16-QAM	10.05	22	CCK	17.10
36	16-QAM	9.16			
48	64-QAM	8.14			
54	64-QAM	8.00			

802.11 n		
Data Rate (Mbps)	**Mod.**	**Channel 6 Cond. Power (dBm)**
6.5	MCS0	15.57
13	MCS1	13.31
19.5	MCS2	12.65
26	MCS3	10.18
39	MCS4	9.38
52	MCS5	8.40
58.5	MCS6	8.32
65	MCS7	7.30

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

1.8.2 SAR Measurement Requirements for Bluetooth

Channel	Freq (MHz)	Mode	Conducted Transmit Power (dBm)
0	2402	DH5	9.83
39	2441	DH5	9.33
78	2480	DH5	8.83

Table 1.8.3. Bluetooth peak conducted power measurements

1.8.3 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/HSPA or applying the required inner loop.
- For Release 6 HSPA, output power is measured according to requirements for HS-DPCCH Sub-test 1-4/1-5

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 HSPA

Body SAR is not required for handsets with HSPA capabilities, when the maximum average output of each RF channel with HSPA active is less than ¼ dB higher than that measured in 12.2 kbps RMC without HSPA Otherwise, SAR for HSPA 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 V (850)**			**FDD II (1900)**		
	Channel	4132	4182	4233	9262	9400	9538
	Freq (MHz)	826.4	836.4	846.6	1852.4	1880.0	1907.6
Mode	**Subtest**	**Max burst averaged conducted power (dBm)**			**Max burst averaged conducted power (dBm)**		
Rel99	12.2 kbps RMC	24.4	24.5	24.4	22.5	22.6	22.5
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	24.4	24.5	24.4	22.5	22.6	22.5
Rel5 HSDPA	1	24.4	24.4	24.2	22.4	22.2	22.2
Rel5 HSDPA	2	24.4	24.4	24.2	22.4	22.3	22.4
Rel5 HSDPA	3	24.3	24.4	24.2	22.3	22.2	22.3
Rel5 HSDPA	4	24.4	24.3	24.1	22.1	22.3	22.4
Rel6 HSUPA	1	24.3	24.3	24.3	22.5	22.4	22.3
Rel6 HSUPA	2	24.3	24.3	24.3	22.5	22.4	22.4
Rel6 HSUPA	3	24.3	24.3	24.3	22.4	22.3	22.2
Rel6 HSUPA	4	24.3	24.4	24.3	22.3	22.5	22.3
Rel6 HSUPA	5	24.3	24.4	24.2	22.4	22.4	22.3

Table 1.8.6. WCDMA (Rel99) / HSPA conducted power measurements

1.8.4 SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

Standalone personal wireless routers and handsets with hotspot mode capabilities must address hand-held and other near-body exposure conditions to show SAR compliance. The following procedures are applicable when the overall device length and width are ≥ 9 cm x 5 cm respectively. A test separation of 10 mm is required. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25 mm from that surface or edge, for the data modes, wireless technologies and frequency bands supporting hotspot mode. The standalone SAR results in each device test orientation must be analyzed for the applicable hotspot mode simultaneous transmission configurations to determine SAR test exclusion and volume scan requirements

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.

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

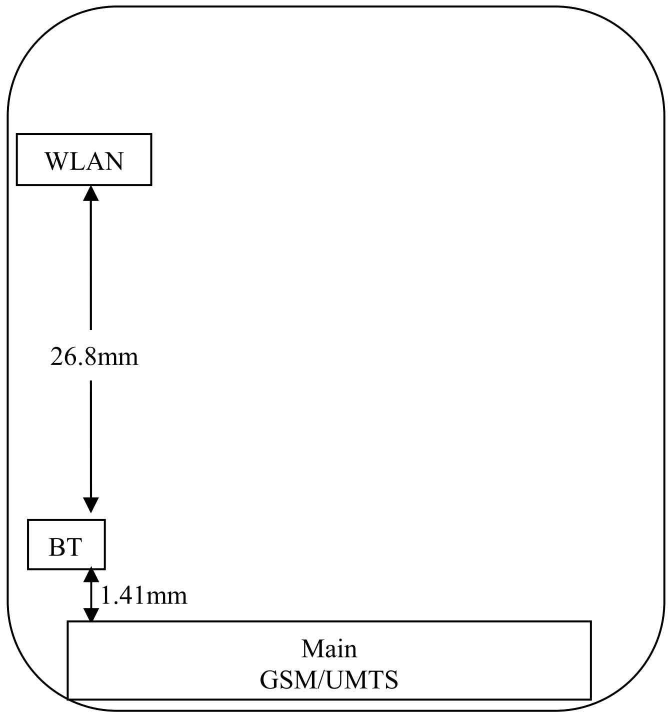


Figure 1.9.1. Back view of device showing closest distance between antenna pairs

Antenna	Position	SAR Zoom 1g	X [mm]	Y [mm]	Z [mm]	
Antenna 1 (**802.11 b)**	MHS SAR, 10 mm distance, back	0.71	-18.5	-35.0	-207.7	
Antenna 2 UMTS band II	MHS SAR, 10 mm distance, back	1.36	-12.5	50.5	-208.0	
	SAR Sum	2.07				
	Delta [cm]		-0.6	-8.5	0.0	
	closest Distance [cm]					**8.57**
	Ratio	0.24				
Antenna	**Position**	**SAR Zoom 1g**	**X [mm]**	**Y [mm]**	**Z [mm]**	
Antenna 1 (**802.11 b)**	MHS SAR, 10 mm distance, back	0.71	-18.5	-35.0	-207.7	
Antenna 2 GPRS 1900	MHS SAR, 10 mm distance, back	0.99	-9.5	51.0	-208.1	
	SAR Sum	1.70				
	Delta [cm]		-0.9	-8.6	0.0	
	closest Distance [cm]					**8.65**
	Ratio	0.20				

Table 1.9.2. Highest SAR values & Peak Coordiates distance

BT & WiFi:

- BT Stand-alone SAR is not required because the BT output power ≤ PRef and the antenna is > 2.5 cm from the WiFi antenna.
- BT Simultaneous Transmission SAR is not required because the sum of the 1-g SAR between the WiFi antenna and BT antenna is < 1.6 W/kg

BT & GSM/WCDMA:

- BT Stand-alone SAR is required because the main antenna, which is < 2.5 cm away, has an output ≥ PRef AND max 1g SAR > 1.2 W/kg
- BT Simultaneous Transmission SAR is not required because the sum of the 1-g SAR between the main antenna and BT antenna is < 1.6 W/kg

GSM & WiFi:

- Simultaneous Transmission is not required as ratio of SAR to peak SAR separation distance of simultaneous transmitting antenna pair is < 0.3.
.

WCDMA & WiFi:

- Simultaneous Transmission is not required as ratio of SAR to peak SAR separation distance of simultaneous transmitting antenna pair is < 0.3.
.

- The device supports DTM, GPRS Category Class A/B, Multi-Slot Class 11/12 with maximum 5-slots (2/3/4-slots uplink and 3/2/1-slot downlink).
- For mobile hot ppot SAR configurations, 2/3/4-slots GPRS (PD) mode were tested.
- In GPRS mode, GMSK Modulation was used using CS1-CS4 or MCSI-MCS4.
- 8-PSK modulation or MCS5-MCS9 code scheme were avoided since maximum burst avg power was measured lower on those modulation schemes.
- Each slot is set to maximum power, but there is software power reduction of ~ 2 dB in multislot modes.

- Please refer to the conducted power measurements table below:

Mode	Freq. (MHz)	Max burst averaged conducted power (dBm) CS1	Max burst averaged conducted power (dBm) MCS1	Max burst averaged conducted power (dBm) MCS5
2-slots GPRS 850 MHz	824.2	26.6	N/A	N/A
	836.8	26.6	N/A	N/A
	848.8	26.7	N/A	N/A
3-slots GPRS 850 MHz	824.2	25.2	N/A	N/A
	836.8	25.3	N/A	N/A
	848.8	25.4	N/A	N/A
4-slots GPRS 850 MHz	824.2	23.1	N/A	N/A
	836.8	23.2	N/A	N/A
	848.8	23.3	N/A	N/A
2-slots DTM 850 MHz	824.2	26.5	26.5	26.5 / 22.8
	836.8	26.6	26.7	26.6 / 22.8
	848.8	26.6	26.7	26.6 / 22.8
2-slots EDGE 850 MHz	824.2	26.5	26.5	22.8
	836.8	26.6	26.7	22.8
	848.8	26.6	26.7	22.8
2-slots GPRS 1900 MHz	1850.2	25.8	N/A	N/A
	1880.0	25.9	N/A	N/A
	1909.8	25.8	N/A	N/A
3-slots GPRS 1900 MHz	1850.2	23.5	N/A	N/A
	1880.0	23.4	N/A	N/A
	1909.8	23.4	N/A	N/A
4-slots GPRS 1900 MHz	1850.2	22.9	N/A	N/A
	1880.0	22.9	N/A	N/A
	1909.8	22.7	N/A	N/A
2-slots EDGE 1900MHz	1850.2	25.6	25.6	22.4
	1880.0	25.6	25.6	22.4
	1909.8	25.6	25.6	22.4

Mode	Freq. (MHz)	Max burst averaged conducted power (dBm)
1-slot GSM (CS) 850 MHz	824.2	28.3
	836.8	28.3
	848.8	28.3
1-slot GSM (CS) 1900 MHz	1850.2	26.6
	1880.0	26.4
	1909.8	26.6

Table 1.9.3. GSM/EDGE/GPRS channel vs. conducted power

2.0 DESCRIPTION OF THE TEST EQUIPMENT

2.1 SAR measurement system

SAR measurements were performed using a Dosimetric Assessment System (DASY52), an automated SAR measurement system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich, Switzerland.

The DASY 52 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.
· DASY52 software version 52.6(2).
· 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.

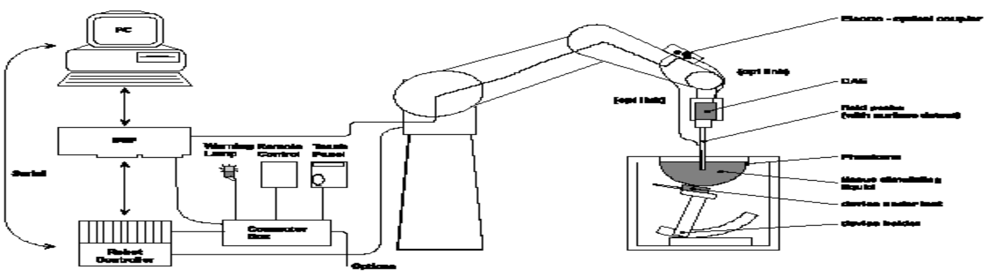


Figure 2.1.1. System Description

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	ES3DV3	3225	01/11/2013
SCHMID & Partner Engineering AG	E-field probe	ET3DV6	1644	11/15/2012
SCHMID & Partner Engineering AG	E-field probe	ET3DV6	1643	03/09/2012
SCHMID & Partner Engineering AG	Data Acquisition Electronics (DAE3)	DAE3 V1	472	03/07/2012
SCHMID & Partner Engineering AG	Dipole Validation Kit	D835V2	446	01/21/2013
SCHMID & Partner Engineering AG	Dipole Validation Kit	D1900V2	545	01/13/2013
SCHMID & Partner Engineering AG	Dipole Validation Kit	D2450V2	747	11/09/2013
Agilent Technologies	Signal generator	8648C	4037U03155	09/23/2013
Agilent Technologies	Power meter	E4419B	GB40202821	09/23/2013
Agilent Technologies	Power sensor	8481A	MY41095417	09/27/2012
Amplifier Research	Amplifier	5S1G4M3	300986	CNR
Agilent Technologies	Power meter	N1911A	MY45100905	05/17/2013
Agilent Technologies	Power sensor	N1921A	SG45240281	05/16/2012
Weinschel Corp	20dB Attenuator	33-20-34	BMO697	CNR
Agilent Technologies	Network analyzer	8753ES	US39174857	09/20/2012
Rohde & Schwarz	Base Station Simulator	CMU 200	109747	11/21/2012
Rohde & Schwarz	Bluetooth Tester	CBT	100368	11/30/2012

Table 2.1.1. 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.
- Start the DASY 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 probes ES3DV3/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
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 had been calibrated with an accuracy better than ±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) C	Relative Permittivity F	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.42	6.42	6.42	0.27	2.04	± 12.0 %
900	41.5	0.97	6.06	6.06	6.06	0.35	1.74	± 12.0 %
1810	40.0	1.40	5.23	5.23	5.23	0.73	1.21	± 12.0 %
1950	40.0	1.40	4.98	4.98	4.98	0.58	1.41	± 12.0 %
2450	39.2	1.80	4.50	4.50	4.50	0.79	1.26	± 12.0 %
2600	39.0	1.96	4.32	4.32	4.32	0.77	1.32	± 12.0 %

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) C	Relative Permittivity F	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.27	6.27	6.27	0.36	1.74	± 12.0 %
900	55.0	1.05	6.07	6.07	6.07	0.29	2.02	± 12.0 %
1810	53.3	1.52	4.92	4.92	4.92	0.50	1.57	± 12.0 %
1950	53.3	1.52	4.87	4.87	4.87	0.59	1.49	± 12.0 %
2450	52.7	1.95	4.30	4.30	4.30	0.68	1.16	± 12.0 %
2600	52.5	2.16	4.12	4.12	4.12	0.80	0.99	± 12.0 %

Table 3.2.1. Probe ES3DV3 SN: 3225

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) C	Relative Permittivity F	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.28	6.28	6.28	0.67	1.99	± 12.0 %
900	41.5	0.97	5.96	5.96	5.96	0.72	1.88	± 12.0 %
1810	40.0	1.40	5.10	5.10	5.10	0.63	2.36	± 12.0 %
2450	39.2	1.80	4.34	4.34	4.34	0.89	1.73	± 12.0 %

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) C	Relative Permittivity F	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.18	6.18	6.18	0.79	1.86	± 12.0 %
900	55.0	1.05	5.92	5.92	5.92	0.61	2.26	± 12.0 %
1810	53.3	1.52	4.69	4.69	4.69	0.65	2.60	± 12.0 %
2450	52.7	1.95	4.14	4.14	4.14	1.00	1.37	± 12.0 %

Table 3.2.2. Probe ET3DV6 SN: 1644

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.59	6.59	6.59	0.81	1.77	± 12.0 %
900	41.5	0.97	6.21	6.21	6.21	0.74	1.88	± 12.0 %
1810	40.0	1.40	5.15	5.15	5.15	0.56	2.39	± 12.0 %
1950	40.0	1.40	4.96	4.96	4.96	0.57	2.35	± 12.0 %

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.29	6.29	6.29	0.78	1.83	± 12.0 %
900	55.0	1.05	6.13	6.13	6.13	0.72	1.98	± 12.0 %
1810	53.3	1.52	4.72	4.72	4.72	0.65	2.59	± 12.0 %
1950	53.3	1.52	4.72	4.72	4.72	0.65	2.39	± 12.0 %

Table 3.2.3. Probe ET3DV6 SN: 1643

The validity of ± 100 MHz only applies for DASY v4.4 and higher.
DASY 52 has been used for measurements, therefore ± 100 MHz tolerance is valid.

Measured dielectric parameters are within +/- 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 measurememts are limited to approximately +/- 100 MHz of the probe/dipole calibration frequency.

4.1 System accuracy verification for head adjacent use

f (MHz)	Limits / Measured (MM/DD/YYYY)	SAR 1 g/10 g (W/kg)	Dielectric Parameters		Liquid Temp. (°C)
			ε_r	σ [S/m]	
835	Measured (01/09/2012)	9.18/6.05	41.7	0.89	22.4
	Recommended Limits	9.50/6.27	41.5	0.90	N/A
1900	Measured (01/12/2012)	37.4/19.8	40.7	1.40	22.0
	Measured (01/23/2012)	37.8/19.8	40.0	1.43	20.1
	Recommended Limits	39.5/20.8	40.0	1.40	N/A
2450	Measured (12/05/2011)	54.7/25.2	38.6	1.86	22.5
	Measured (12/07/2011)	53.3/24.6	37.7	1.80	22.0
	Measured (01/25/2012)	59.1/26.9	40.7	1.89	21.2
	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 are shown in the table below.

INGREDIENT	MIXTURE 800–900MHz		MIXTURE 1800–1900MHz		MIXTURE 2450 MHz		MIXTURE 5 – 6 GHz	
	Brain %	Muscle %	Brain %	Muscle %	Brain %	Muscle %	Brain %	Muscle %
Water	40.29	65.45	55.24	69.91	55.0	68.75	64	64-78
Sugar	57.90	34.31	0	0	0	0	0	0
Salt	1.38	0.62	0.31	0.13	0	0	0	0
HEC	0.24	0	0	0	0	0	0	0
Bactericide	0.18	0.10	0	0	0	0	0	0
DGBE	0	0	44.45	29.96	40.0	31.25	0	0
Triton X-100	0	0	0	0	5.0	0	0	0
Additives and Salt	0	0	0	0	0	0	3	2-3
Emulsifiers	0	0	0	0	0	0	15	9-15
Mineral Oil	0	0	0	0	0	0	18	11-18

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
IKA Works Inc.	Hot Plate	RC Basic	3.107433	N/A
Dell	PC using GPIB card	GX110	347	N/A
Agilent Technologies	Dielectric probe kit	HP 85070C	US9936135	CNR
Agilent Technologies	Network Analyzer	8753ES	US39174857	09/20/2012
Control Company	Digital Thermometer	15-077-21	51129471	05/17/2012

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 manual and from FCC Tissue Dielectric Properties web page at http://www.fcc.gov/fcc-bin/dielec.sh

Band (MHz)	Tissue Type	Limits / Measured (MM/DD/YYYY)	f (MHz)	Dielectric Parameters		Liquid Temp (°C)
				ε_r	σ [S/m]	
835	Head	Measured (01/09/2012)	825	41.8	0.87	22.4
			835	41.7	0.89	22.4
			850	41.5	0.90	22.4
		Recommended Limits	835	41.5	0.90	N/A
	Muscle	Measured (01/09/2012)	825	56.5	0.96	22.4
			835	56.4	0.97	22.4
			850	56.3	0.98	22.4
		Recommended Limits	835	55.2	0.97	N/A
1900	Head	Measured (01/12/2012)	1850	40.8	1.35	22.0
			1900	40.7	1.40	22.0
			1910	40.7	1.41	22.0
			1980	40.2	1.48	22.0
		Measured (01/23/2012)	1850	40.2	1.38	20.1
			1900	40.0	1.43	20.1
			1910	40.0	1.44	20.1
			1980	39.7	1.51	20.1
		Recommended Limits	1900	40.0	1.40	N/A

	Muscle	Measured (01/12/2012)	1850	51.3	1.48	22.0
			1900	51.2	1.54	22.0
			1910	50.8	1.57	22.0
		Measured (01/23/2012)	1850	51.2	1.53	20.3
			1900	51.0	1.58	20.3
			1910	51.0	1.59	20.3
		Recommended Limits	1900	53.3	1.52	N/A
2450	Head	Measured (12/05/2011)	2412	38.7	1.82	22.5
			2450	38.6	1.87	22.5
			2462	38.6	1.88	22.5
		Measured (12/07/2011)	2412	37.9	1.77	22.0
			2450	37.7	1.80	22.0
			2462	37.6	1.82	22.0
		Measured (01/25/2012)	2400	40.88	1.83	21.2
			2450	40.72	1.89	21.2
			2480	40.62	1.93	21.2
		Recommended Limits	2450	39.2	1.80	N/A
	Muscle	Measured (12/05/2011)	2412	50.2	1.97	22.5
			2450	50.1	2.02	22.5
			2462	50.1	2.04	22.5
		Measured (12/07/2011)	2412	50.4	1.96	21.1
			2450	50.2	1.99	21.1
			2462	50.2	2.01	21.1
		Measured (01/25/2012)	2400	50.6	1.91	21.2
			2450	50.5	1.97	21.2
			2480	50.4	2.02	21.2
		Recommended Limits	2450	52.7	1.95	N/A

Table 6.2.1. Electrical parameters of tissue simulating liquid

6.2.2 Test Configuration

Dielectric Probe Kit

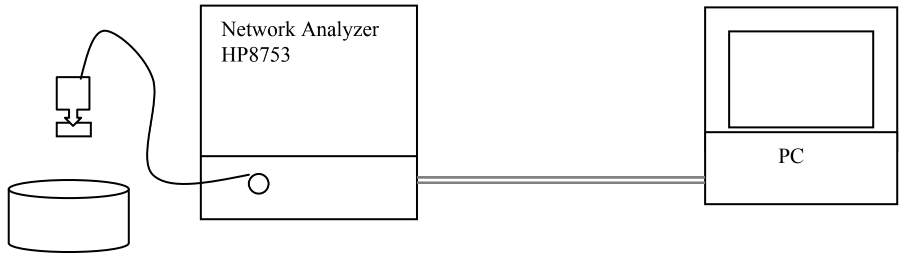


Figure 6.2.1. Test configuration

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 DASY software 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).

7.0 SAR SAFETY LIMITS

Standards/Guideline	Localized SAR Limit (W/kg) General public (uncontrolled)	Localized SAR Limits (W/kg) Workers (controlled)
ICNIRP Standard	2.0 (10g)	10.0 (10g)
IEEE C95.1 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 Standard	Localized SAR Limits (W/kg) 1g, IEEE C95.1 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 DASY5 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).

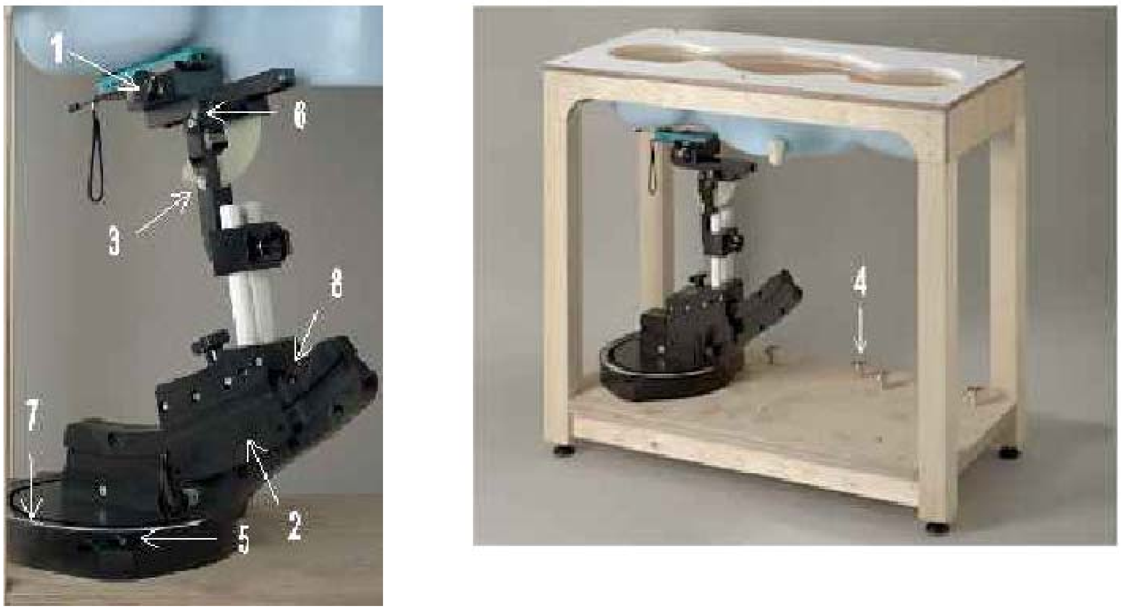


Figure 8.1.1. Device Holder

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.

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".

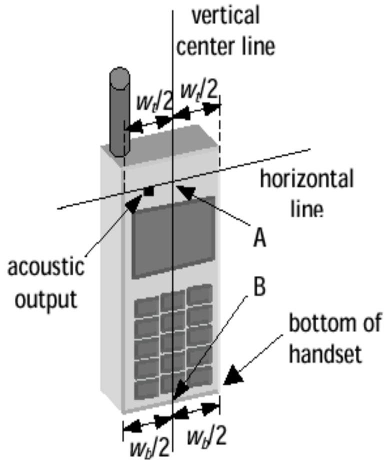


Figure 8.2.1a. Handset vertical and horizontal reference lines – fixed case

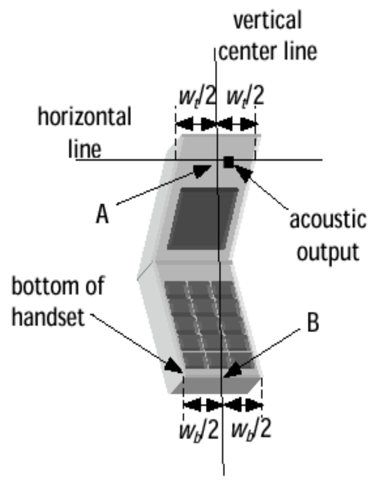


Figure 8.2.1b. Handset vertical and horizontal reference lines – "clam-shell"

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).

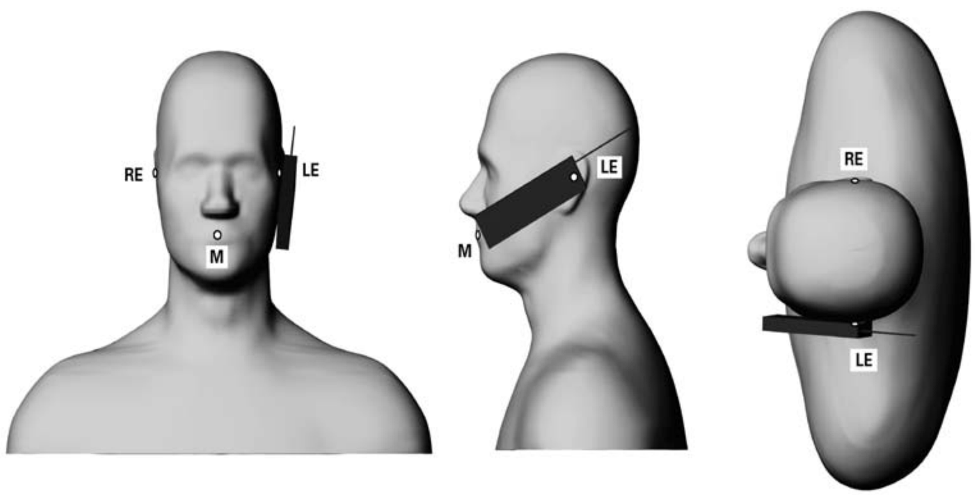


Figure 8.2.2. Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

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**.**

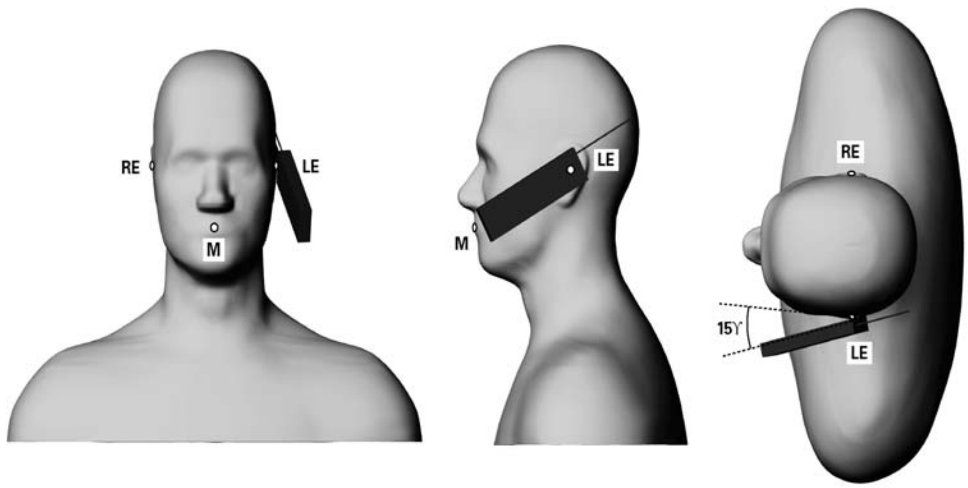


Figure 8.2.3. Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

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

DASY5 Uncertainty Budget
According to IEEE 1528/2003 [1]

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±5.5 %	N	1	1	1	±5.5 %	±5.5 %	∞
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	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
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 Noise	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±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						±10.7 %	±10.5 %	387
Expanded STD Uncertainty						**±21.4 %**	**±21.0 %**	

Table 10.0.1. Worst-Case uncertainty budget for DASY52 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.

DASY5 Uncertainty Budget
for the 3 - 6 GHz range

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±6.55 %	N	1	1	1	±6.55 %	±6.55 %	∞
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	±2.0 %	R	$\sqrt{3}$	1	1	±1.2 %	±1.2 %	∞
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	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
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 Noise	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Probe Positioning	±9.9 %	R	$\sqrt{3}$	1	1	±5.7 %	±5.7 %	∞
Max. SAR Eval.	±4.0 %	R	$\sqrt{3}$	1	1	±2.3 %	±2.3 %	∞
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						±12.8 %	±12.6 %	330
Expanded STD Uncertainty						**±25.6 %**	**±25.2 %**	

Table 10.0.2. Worst-Case uncertainty budget for DASY52 assessed according to IEEE P1528.
Source: Schmid & Partner Engineering AG.

11.0 TEST RESULTS

11.1 SAR Measurement results at highest power measured in mobile hot spot 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)
2-slots GPRS 850 MHz	836.8	26.6	Back side 10 mm away	21.1	0.53	0.27	0.53
	836.8	26.6	Front side 10 mm away	20.9	0.31	0.03	0.31
	836.8	26.6	Right side 10 mm away	20.7	0.23	-0.43	0.25
	836.8	26.6	Left side 10 mm away	21.0	0.25	2.55	0.25
	836.8	26.6	Bottom side 10 mm away	20.8	0.05	-0.08	0.05
3-slots GPRS 850 MHz	836.8	25.3	Back side 10 mm away	21.9	0.59	-0.03	0.59
4-slots GPRS 850 MHz	836.8	23.2	Back side 10 mm away	21.7	0.49	0.07	0.49

Table 11.1.1. SAR results for GSM/EDGE 850 MHS configurations

Note 1: 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)

Note 2: Only Middle channel was tested when 1g Average SAR <0.8 W/Kg or 3dB lower than the limit.

Note 3: Any side of the phone that is further than 2.5 cm away from the transmitting antenna can be exempted from testing.

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 V 850 MHz	826.4	24.5	Back side 10 mm away	21.4	0.75	-0.08	0.75
	836.4	24.5	Back side 10 mm away	21.6	0.80	-0.01	0.80
	846.6	24.5	Back side 10 mm away	21.5	0.76	-0.04	0.76
	836.4	24.5	Front side 10 mm away	21.4	0.75	-0.04	0.75
	836.4	24.5	Right side 10 mm away	21.5	0.32	-0.01	0.32
	836.4	24.5	Left side 10 mm away	21.4	0.32	0.07	0.32
	836.4	24.5	Bottom side 10 mm away	21.4	0.05	0.00	0.05

Table 11.1.2. SAR results for WCDMA FDD V MHS configurations

Mode	Freq. (MHz)	Cond. Power (dBm)	Device Configuration	Liquid Temp. (°C)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
2-slots GPRS 1900MHz	1850.2	25.8	Back side 10 mm away	20.1	0.94	0.35	0.94
	1880.0	25.9	Back side 10 mm away	20.1	0.91	0.15	0.91
	1909.8	25.8	Back side 10 mm away	20.2	0.99	0.14	0.99
	1880.0	25.9	Front side 10 mm away	20.2	0.62	-0.19	0.62
	1880.0	25.9	Right side 10 mm away	20.3	0.11	-0.05	0.11
	1880.0	25.9	Left side 10 mm away	20.3	0.19	0.08	0.19
	1850.2	25.8	Bottom side 10 mm away	20.3	1.14	-0.05	1.14
	1880.0	25.9	Bottom side 10 mm away	20.3	1.18	-0.03	1.18
	1909.8	25.8	Bottom side 10 mm away	20.3	1.15	-0.01	1.15
3-slots GPRS 1900MHz	1909.8	23.4	Back side 10 mm away	20.2	0.84	0.01	0.84
	1880.0	23.4	Bottom side 10 mm away	20.3	1.04	-0.07	1.04
4-slots GPRS 1900MHz	1909.8	22.7	Back side 10 mm away	20.2	1.02	-0.05	1.02
	1880.0	22.9	Bottom side 10 mm away	20.3	1.16	0.09	1.16

Table 11.1.3. SAR results for GSM/EDGE 1900 MHS configurations

Mode	Freq. (MHz)	Cond. Power (dBm)	Device Configuration	Liquid Temp. (°C)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
WCDMA FDD II 1900 MHz	1852.4	22.5	Back side 10 mm away	20.9	1.22	0.04	1.22
	1880.0	22.6	Back side 10 mm away	20.9	1.29	0.16	1.29
	1907.6	22.5	Back side 10 mm away	20.9	1.36	-0.01	**1.36**
	1880.0	22.6	Front side 10 mm away	21.0	0.46	0.06	0.46
	1880.0	22.6	Right side 10 mm away	20.9	0.08	0.05	0.08
	1880.0	22.6	Left side 10 mm away	20.9	0.13	0.07	0.13
	1852.4	22.5	Bottom side 10 mm away	20.7	0.81	0.03	0.81
	1880.0	22.6	Bottom side 10 mm away	20.8	0.87	-0.04	0.87
	1907.6	22.5	Bottom side 10 mm away	20.7	0.88	-0.01	0.88

Table 11.1.4. SAR results for WCDMA FDD II MHS configurations

Mode	Freq. (MHz)	Cond. Power (dBm)	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	16.5	Back side 10 mm away	21.1	0.63	-0.14	0.63
	2437	17.2	Back side 10 mm away	21.1	0.68	0.06	0.68
	2462	16.9	Back side 10 mm away	21.1	0.71	0.10	0.71
	2437	17.2	Front side 10 mm away	22.4	0.00	1.58	0.00
	2437	17.2	Right side 10 mm away	22.4	0.01	0.43	0.01
	2437	17.2	Top side 10 mm away	22.1	0.06	0.32	0.06

Table 11.1.5. SAR results for WiFi/WLAN/802.11b MHS configurations

Mode	Freq. (MHz)	Cond. Power (dBm)	Device Configuration	Liquid Temp. (°C)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Bluetooth 2450 MHz	2480	8.8	Back side 10 mm away	20.2	0.00	-0.36	0.00
	2480	8.8	Front side 10 mm away	20.2	0.00	2.77	0.00
	2480	8.8	Right side 10 mm away	20.2	0.00	0.15	0.00
	2480	8.8	Bottom side 10 mm away	20.2	0.00	0.69	0.00

Table 11.1.6. SAR results for Bluetooth MHS configurations

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