MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*

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Dosimetric Assessment
Test Report

for the

Nielsen Audio

Tested and Evaluated In Accordance With
IEEE 1528:2013 & IEC62209-2

Prepared for

Nielsen Audio
9705 Patuxent Woods Drive
Columbia, MD 21046

Engineering Statement: The measurements shown in this report were made in accordance with the procedures specified in the Federal Communications Commission (FCC) Guidelines and Industry Canada RSS-102 for uncontrolled exposure. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment evaluated is capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1999.

SAR Evaluation
Certificate of Compliance

APPLICANT: Nielsen Audio

Applicant Name and Address: Nielsen Audio
9705 Patuxent Woods Drive
Columbia, MD 21046

Test Location: MET Laboratories, Inc.
3162 Belick Street
Santa Clara, CA 95054
USA

EUT:	PPM 360 Meter (Model DA120)
Test Dates:	January 8^{th} -11^{th} , 2015
RF exposure environment:	Uncontrolled Exposure/General Population
RF exposure category:	Portable
Power supply:	Internal battery
Antenna:	Fixed Internal Antenna
Production/prototype:	Production
Modulations Tested:	**GPRS/EDGE:** GMSK/8PSK **WCDMA:** QPSK
Multislot Class:	GPRS: Class **12** EDGE: Class **12**
TX Frequency Range:	GPRS/EGPRS 850: 824.2-848.8 MHz GPRS/EDGE 1900: 1850.2-1909.8 WCDMA Band II: 826.4-846.6 WCDMA Band V: 1852.4-1907.6
Max SAR Measured:	1.339 W/kg (1-g SAR)

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

INTRODUCTION

This measurement report demonstrates that Nielsen Audio PPM 360 Meter as described within this report complies with the Specific Absorption Rate (SAR) RF exposure requirements specified in ANSI/IEEE Std. C95.1-1999 and FCC 47 CFR §2.1093 for the Uncontrolled Exposure/General population environment. The test procedures described in and IEEE 1528-2013 and IEC 62209-2 were employed.

A description of the device under test, device operating configuration and test conditions, measurement and site description, methodology and procedures used in the evaluation, equipment used, detailed summary of the test results and the various provisions of the rules are included in this dosimetric assessment test report.

SAR DEFINITION

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (*dU*) absorbed by (dissipated in) an incremental mass (*dm*) contained in a volume element (*dV*) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Fig. 1.1).

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho dv}\right)$$

Figure 1.1
SAR Mathematical Equation

SAR is expressed in units of Watts per Kilogram (W/kg).

$$\mathrm{SAR} = \sigma E^2 / \rho$$

where:

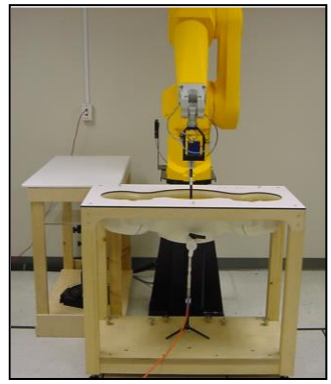
σ - conductivity of the tissue - simulant material (S/m)
ρ - mass density of the tissue - simulant material (kg/m3)
E - Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.

DESCRIPTION OF DEVICE UNDER TEST (EUT)

Applicant:	Nielsen Audio
Description of Test Item:	PPM 360 Meter (Model DA120)
Supply Voltage:	Internal Battery
Antenna Type(s) Tested:	Integral
Accessories:	Belt Clip
Duty Cycle Tested:	GPRS/EDGE: 1:2 WCDMA: 1
Application Type:	Class II PC/Reassessment
Exposure Category:	Uncontrolled Exposure/General population
FCC and IC Rule Part(s):	FCC 47 CFR §2.1093 & RSS-102
Standards:	IEEE Std. 1528-2013, IEC 62209-2

SAR MEASUREMENT SYSTEM



MET Laboratories, Inc SAR measurement facility utilizes the DASY4 Professional Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland for performing SAR compliance tests. The DASY4 measurement system is comprised of the measurement server, robot controller, computer, near-field probe, probe alignment sensor, specific anthropomorphic mannequin (SAM) phantom, and various planar phantoms for brain and/or body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). The Cell controller system contain the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the DASY4 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit.

Transmission to the DASY4 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

MEASUREMENT SUMMARY

Freq (MHz)	Channel	Test Mode	Cond. Peak Pwr (dBm)	Battery Type	Phantom Section	EUT Position and separation distance	Measured SAR 1g (mW/g)
824	Low	GPRS	31.22	Li-ion	Planar	Back side (10mm)	0.636
836	Mid	GPRS	30.87	Li-ion	Planar	Back side (10mm)	0.566
848.8	High	GPRS	30.52	Li-ion	Planar	Back side (10mm)	0.509
824	Low	EGPRS	28.84	Li-ion	Planar	Back side (10mm)	0.677
836	Mid	EGPRS	28.85	Li-ion	Planar	Back side (10mm)	0.599
848.8	High	EGPRS	28.83	Li-ion	Planar	Back side (10mm)	0.59
824	Low	WCDMA	25.32	Li-ion	Planar	Back side (10mm)	0.764
836	Mid	WCDMA	24.88	Li-ion	Planar	Back side (10mm)	0.549
848.8	High	WCDMA	25.04	Li-ion	Planar	Back side (10mm)	0.926
1850	Low	GPRS	28.69	Li-ion	Planar	Back side (10mm)	0.794
1880	Mid	GPRS	28.92	Li-ion	Planar	Back side (10mm)	0.781
1909	High	GPRS	28.74	Li-ion	Planar	Back side (10mm)	0.512
1850	Low	EGPRS	27.92	Li-ion	Planar	Back side (10mm)	0.53
1880	Mid	EGPRS	27.52	Li-ion	Planar	Back side (10mm)	0.756
1909	High	EGPRS	27.39	Li-ion	Planar	Back side (10mm)	0.681
1850	Low	WCDMA	25.62	Li-ion	Planar	Back side (10mm)	1.3
1880	Mid	WCDMA	25.47	Li-ion	Planar	Back side (10mm)	1.17
1909	High	WCDMA	25.58	Li-ion	Planar	Back side (10mm)	1.04

SCALED SAR PER MAXIMUM TUNE-UP TOLERANCE

Frequency (MHz)	Mode	Measured SAR 1g (mW/g)	Maximum tune-up tolerance	Tune up tolerance scaling Factor	Scaled SAR Value 1g (mW/g)
824	GPRS	0.636	31 ±0.5	1.06	0.674
836	GPRS	0.566	31 ±0.5	1.15	0.65
848.8	GPRS	0.509	31 ±0.5	1.25	0.636
824	EGPRS	0.677	28.8 ±0.5	1.11	0.751
836	EGPRS	0.599	28.8 ±0.5	1.11	0.664
848.8	EGPRS	0.59	28.8 ±0.5	1.11	0.654
824	WCDMA	0.764	25.25 ±0.5	1.08	0.825
836	WCDMA	0.549	25.25 ±0.5	1.2	0.658
848.8	WCDMA	0.926	25.25 ±0.5	1.19	1.101
1850	GPRS	0.794	28.8 ±0.5	1.15	0.913
1880	GPRS	0.781	28.8 ±0.5	1.08	0.843
1909	GPRS	0.512	28.8 ±0.5	1.13	0.578
1850	EGPRS	0.53	27.4 ±0.5	1.15	0.609
1880	EGPRS	0.756	27.4 ±0.5	1.08	0.816
1909	EGPRS	0.681	27.4 ±0.5	1.1	0.749
1850	WCDMA	1.3	25.25 ±0.5	1.03	**1.339**
1880	WCDMA	1.17	25.25 ±0.5	1.05	1.22
1909	WCDMA	1.04	25.25 ±0.5	1.02	1.06

DIELECTRIC PERFORMANCE OF TISSUE SIMULATING LIQUID

Measured Mixture Type	M 900-B Body			M 1800-B Body		
Dielectric Constant **εr**	**IEEE Target**	**Measured**		**IEEE Target 1800-2000 MHz**	**Measured**	
	55.242	54.39	824 MHz	53.3	52.56	1850 MHz
	55.2	54.36	836 MHz		52.38	1880 MHz
	55.158	54.16	848.8 MHz		53.32	1909 MHz
Conductivity **σ (mho/m)**	**IEEE Target**	**Measured**		**IEEE Target**	**Measured**	
	0.971	0.98	824 MHz	1.52	1.49	1850 MHz
	0.97	0.99	836 MHz		1.51	1880 MHz
	0.986	1	848.8 MHz		1.54	1909 MHz
Test Dates	1/8/2015-1/11/2015					
Duty Cycle	100%					
Ambient Temperature (C)	23					
Fluid Temperature (C)	22					
Fluid Depth	≥15cm					

Note: GPRS test scenarios (worst case)

Band	Time slots Consignation	Duty Cycle	Power Class
GPRS 850	4Up1Down	1:2	4
GPRS 1900	4Up1Down	1:2	4

REPEATED SAR MEASUREMENTS

Repeated measurements are required only when the measured SAR is ≥ 0.80 W/kg. If the measured SAR value of the initial repeated measurement is < 1.45 W/kg with ≤ 20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations. A second repeated measurement is required only if the measured result for the initial repeated measurement is within 10% of the SAR limit and vary by more than 20%, which are often related to device and measurement setup difficulties. The following procedures are applied to determine if repeated measurements are required.

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.20
2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

Band	Test Position	Measured SAR (W/kg)			Largest to smallest SAR Ratio
		Initial	1st Repeat	2nd Repeat	
WCDMA850	Body	0.926	0.824	NA	1.12
WCDMA1900	Body	1.3	0.979	0.98	1.32

MULTIPLE TRANSMITTER EVALUATION

Test Distance: 10mm with belt clip installed.		
Mode	**SAR Test Exclusion Threshold(mW) Per KDB 447498 D01v05r01**	**Highest Power(mW)**
EGPRS 850	16	851.1
GPRS 850	16	1412.5
WCDMA 850	16	375.8
EGPRS 1900	11	616.5
GPRS 1900	11	851.1
WCDMA 1900	11	375.8

Note: Radio does not support simultaneous transmission.

Per table above the Stand-alone SAR evaluation is required for GPRS/EDGE 850, WCDMA 850, GPRS/EDGE1900 and WCDMA1900 but, the BT is not.

DETAILS OF SAR EVALUATION

The Nielsen Audio PPM 360 Meter (Model DA118) was determined to be compliant for localized Specific Absorption Rate based on the test provisions and conditions described below.

1. A Call box was used for placing the EUT in different coding schemes and channels.

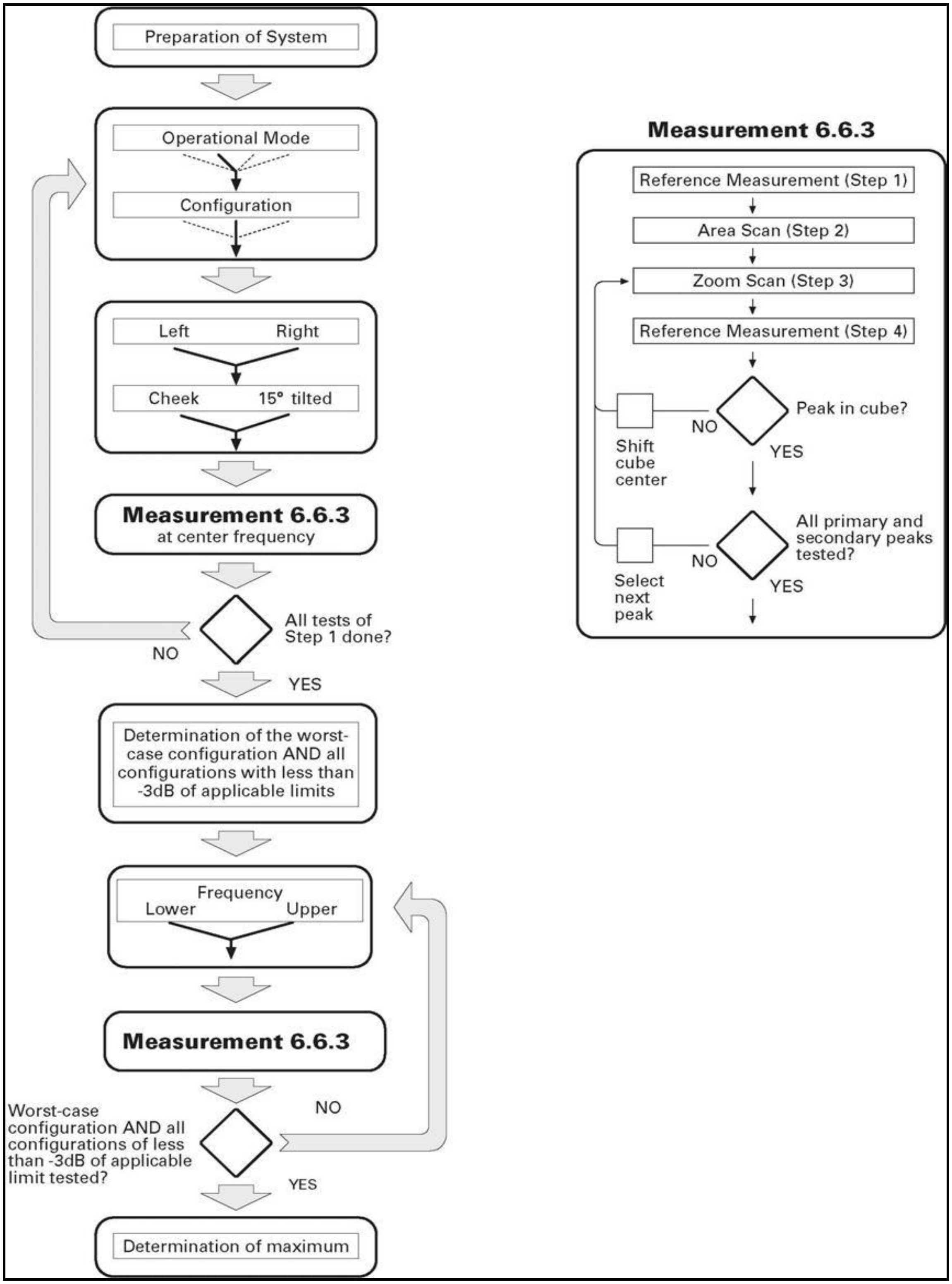
2. The EUT was tested for SAR against the planar section of the phantom in one orientation. The back side of the unit while wearing a belt clip was placed at 0.0cm separation from the phantom surface.

3. All SAR evaluations were performed with a fully charged battery.

4. The dielectric parameters of the simulated body fluid were measured prior to the evaluation using an 85070D Dielectric Probe Kit and an 8722D Network Analyzer.

5. The fluid and air temperature was measured prior to and after each SAR evaluation to ensure the temperature remained within ±2 deg C of the temperature of the fluid when the dielectric properties were measured.

FLOW CHART OF THE RECOMMENDED PRACTICES AND PROCEDURES



EAR Reference Point

Figure 12.1 shows the front, back and side views of the SAM Twin Phantom. The point M is the reference point for the center of the mouth, LE is the left ear reference point (ERP), and RE is the right ERP. The ERPs are 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 12.2. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting. Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning.

Figure 12.1
Front, back and side view of SAM Twin Phantom

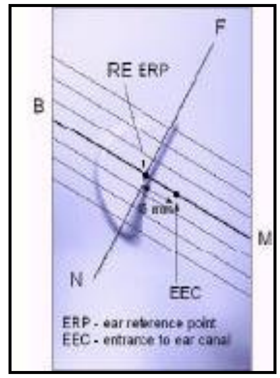


Figure 12.2
Side view of ERPs

HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the test device reference point located along the vertical centerline on the front of the device aligned to the ear reference point (See Fig. 12.3). The test device reference point was than located at the same level as the center of the ear reference point. The test device was positioned so that the vertical centerline was bisecting the front surface of the handset at it s top and bottom edges, positioning the ear reference point on the outer surface of the both the left and right head phantoms on the ear reference point.

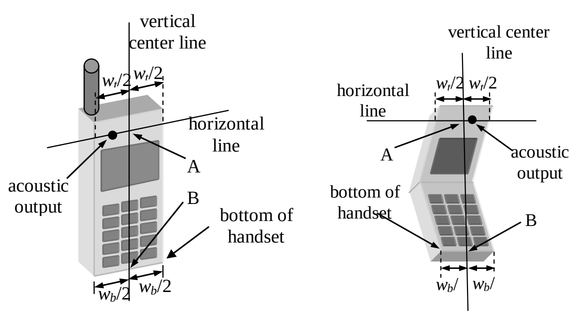


Figure 12.3
Handset Vertical Center & Horizontal Line Reference Points

POSITIONING FOR CHEEK/TOUCH

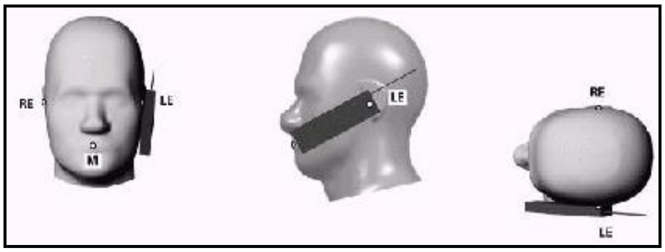
1. The test device was positioned with the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom, such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.

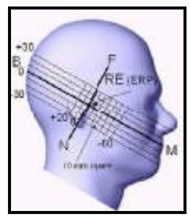
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).

4. The phone was hen rotated around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.

5. 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, the handset was rotated about the line NF until any point on the handset made contact with a phantom point below the ear (cheek). See Figure 12.5)



Front, Side and Top View of Cheek/Touch Position



Side view with relevant markings

POSITIONING FOR EAR/15 DEGREE TILE

With the test device aligned in the Cheek/Touch Position:

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degree.

2. The phone was then rotated around the horizontal line by 15 degree.

3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the phone touches the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. The tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head.

Front, Side and Top View of Ear/15 Tilt Position

Body Worn Configurations

The body-worn configurations shall be tested with the supplied accessories (belt-clips, holsters, etc.) attached to the device in normal use configuration.

For body-worn and other configurations a flat phantom shall be used which is comprised of material with electrical properties similar to the corresponding tissues.

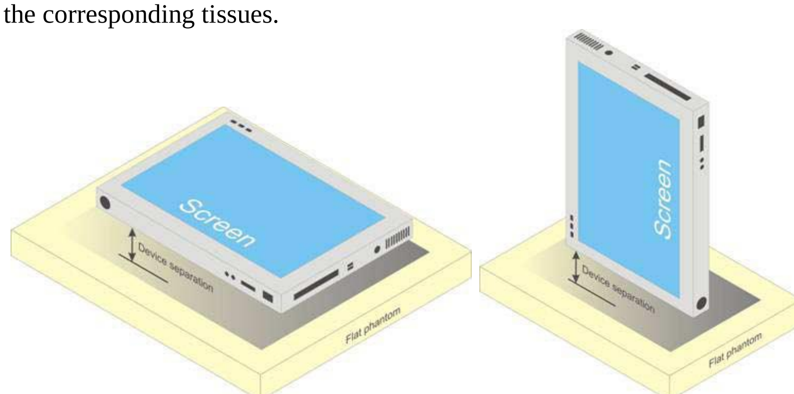


Illustration for Body Worn Positions

EVALUATION PROCEDURES

The evaluation was performed in the applicable area of the phantom depending on the type of device being tested.

(i) For devices held to the ear during normal operation, both the left and right ear positions were evaluated using the SAM phantom.
(ii) For body-worn and face-held devices a planar phantom was used.

The SAR was determined by a pre-defined procedure within the DASY4 software. Upon completion of a reference check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 15mm x 15mm.

An area scan was determined as follows:

Based on the defined area scan grid, a more detailed grid is created to increase the points by a factor of 10. The interpolation function then evaluates all field values between corresponding measurement points.

A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.

A 1g and 10g spatial peak SAR was determined as follows:

For frequencies ≤4.5GHz a 32mm x 32mm x 34mm (7x7x7 data points) zoom scan was assessed at the position where the greatest V/m was detected. For frequencies ≥4.5GHz a 28mm x 28mm x 24mm (7x7x9 data points) zoom scan was assessed at the position where the greatest V/m was detected. The data at the surface was extrapolated since the distance from the probes sensors to the surface is 3.9cm. A least squares fourth-order polynomial was used to generate points between the probe detector and the inner surface of the phantom.

Interpolated data is used to calculate the average SAR over 1g and 10g cubes by spatially discretizing the entire measured cube. The volume used to determine the averaged SAR is a 1mm grid (42875 interpolated points).

Z-Scan was determined as follows:

The Z-scan measures points along a vertical straight line. The line runs along a line normal to the inner surface of the phantom surface.

DATA EVALUATION PROCEDURES

The DASY4 post processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe Parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion Factor	$ConvF_i$
	- Dipole Compression Point	dcp_i
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used. The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC – transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with V_i = Compensated signal of channel i (i = x, y, z)
U_i = Input signal of channel i (i = x, y, z)
cf = Crest factor of exciting field (DASY parameter)
dcp_i = Diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\text{E}-\text{fieldprobes}: \qquad E_i = \sqrt{\frac{V_1}{Norm_i \cdot ConvF}}$$

$$\text{H}-\text{fieldprobes}: \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

with V_i = Compensated signal of channel i (i = x, y, z)
$Norm_i$ = Sensor sensitivity of channel i (i = x, y, z)
$\mu V/(V/m)^2$ for E-field probes
$ConvF$ = Sensitivity enhancement in solution
a_{ij} = Sensor sensitivity factors for H-field probes
f = Carrier frequency (GHz)
E_i = Electric field strength of channel i in V/m
H_i = Magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

with SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

The power flow density is calculated assuming the excitation field as a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \qquad \text{or} \qquad P_{pwe} = H_{tot}^2 \cdot 37.7$$

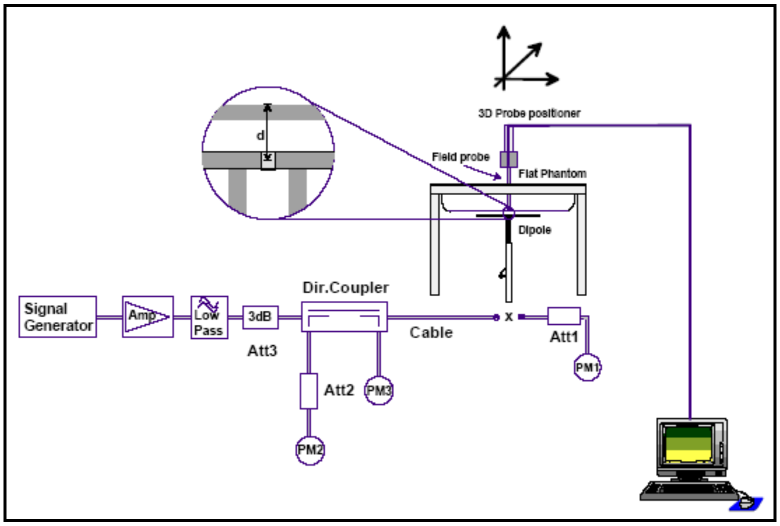
with P_{pwe} = Equivalent power density of a plane wave in mW/cm2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed in the planar section of the SAM phantom with an 2450MHz dipole. The dielectric parameters of the simulated brain fluid were measured prior to the system performance check using an 85070D Dielectric Probe Kit and an 8722D Network Analyzer. A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of +10%. All results were normalized to 1W.

Test Date	Fluid Type (MHz)	SAR 1g (W/kg)		Permittivity Constant εr		Conductivity σ (mho/m)		Ambient Temp. I	Fluid Temp. I	Fluid Depth (cm)
		Calibrated Target	Measured	IEEE Target	Measured	IEEE Target	Measured			
1/9/2015	M 900- B 835 MHz	2.45 ±5%	2.47	55.2 ±5%	54.36	0.97 ±5%	0.99	23.0	22.0	≥15
1/9/2015	M 1800-B 1800 MHz	9.52 ±5%	9.96	53.3 ±5%	52.65	1.52 ±5%	1.45	23.0	22.0	≥15

Note: The ambient and fluid temperatures were measured prior to the fluid parameter check and the system performance check. The temperatures listed in the table above were consistent for all measurement periods.



SIMULATED EQUIVALENT TISSUES

Simulated Tissue Mixture	
Ingredient	**900-B Body (EUT testing)**
Water	50.75%
Sugar	48.21%
Salt	0.94%

Simulated Tissue Mixture	
Ingredient	**1800-B Body (EUT testing)**
Water	70.17%
DGBE	29.44%
Salt	0.39%

SAR SAFETY LIMITS

EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	**(Occupational / Controlled Exposure Environment)**
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10g)	4.0	20.0

Notes:

1. Uncontrolled exposure environments are locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled exposure environments are locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

ROBOT SYSTEM SPECIFICATIONS

1.1. SPECIFICATIONS

Positioner:

Robot:	Staubli Unimation Corp. Robot Model: RX90
Repeatability:	0.02 mm
No. of axis:	6

1.2. DATA ACQUISITION ELECTRONIC (DAE) SYSTEM:

Cell Controller

Processor:	Compaq Evo Clock Speed:2.4 GHz Operating System: Windows XP Professional

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converter, and control logic
Software:	DASY4 software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock

Dasy4 Measurement Server

Function:	Real-time data evaluation for field measurements and surface detection
Hardware:	PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM
Connections:	COM1, COM2, DAE, Robot, Ethernet, Service Interface

E-Field Probe

Model:	ET3DV6
Serial No.:	1793
Construction:	Triangular core fiber optic detection system
Frequency:	10 MHz to 6 GHz
Linearity:	± 0.2 dB (30 MHz to 3 GHz)

EX-Probe

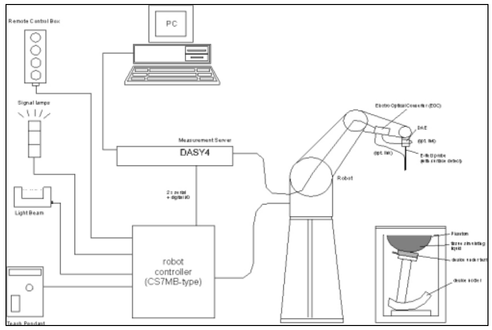
Model:	EX3DV4
Serial No.	3511
Construction:	Triangular core
Frequency:	10 MHz to > 6 GHz
Linearity:	± 0.2 dB (30 MHz to 3 GHz)

1.3. PHANTOM(S):

Validation & Evaluation Phantom

Type:	SAM V4.0C
Shell Material:	Fiberglass
Thickness:	2.0 ±0.1 mm
Volume:	Approx. 20 liters

SAR Measurement System



Measurement System Diagram

1.4. RX90BL ROBOT

The Stäubli RX90BL Robot is a standard high precision 6-axis robot with an arm extension for accommodating the data acquisition electronics (DAE).

1.5. ROBOT CONTROLLER

The CS7MB Robot Controller system drives the robot motors. The system consists of a power supply, robot controller, and remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.

1.6. LIGHT BEAM SWITCH

The Light Beam Switch (Probe alignment tool) allows automatic ”tooling” of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured as well as the probe length and the horizontal probe offset. The software then corrects all movements, so that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

1.7. DATA ACQUISITION ELECTRONICS

The Data Acquisition Electronics consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain switching multiplexer, a fast 16-bit A/D converter and a command decoder and control logic unit. Some of the task the DAE performs is signal amplification, signal multiplexing, A/D conversion, and offset measurements. The DAE also contains the mechanical probe-mounting device, which contains two different sensor systems for frontal and sideways probe contacts used for probe collision detection and mechanical surface detection for controlling the distance between the probe and the inner surface of the phantom shell. Transmission from the DAE to the measurement server, via the EOC, is through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

1.8. ELECTO-OPTICAL CONVERTER (EOC)

The Electro-Optical Converter performs the conversion between the optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC connects to, and transfers data to, the DASY4 measurement server. The EOC also contains the fiber optical surface detection system for controlling the distance between the probe and the inner surface of the phantom shell.

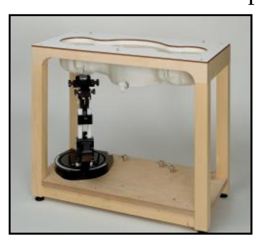
1.9. MEASUREMENT SERVER

The Measurement Server performs time critical tasks such as signal filtering, all real-time data evaluation for field measurements and surface detection, controls robot movements, and handles safety operation. The PC-operating system cannot interfere with these time critical processes. A watchdog supervises all connections, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements.

1.10. DOSIMETRIC PROBE

Dosimetric Probe is a symmetrical design with triangular core that incorporates three 3 mm long dipoles arranged so that the overall response is close to isotropic. The probe sensors are covered by an outer protective shell, which is resistant to organic solvents i.e. glycol. The probe is equipped with an optical multi-fiber line, ending at the front of the probe tip, for optical surface detection. This line connects to the EOC box on the robot arm and provides automatic detection of the phantom surface. The optical surface detection works in transparent liquids and on diffuse reflecting surfaces with a repeatability of better than ±0.1mm.

1.11. SAM PHANTOM

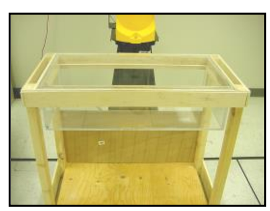


The SAM (Specific Anthropomorphic Mannequin) twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm) integrated into a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left hand, right hand phone usage as well as body mounted usage at the flat phantom region. The flat section is also used for system validation and the length and width of the flat section are at least 0.75 λO and 0.6 λO respectively at frequencies of 824 MHz and above (λO = wavelength in air).

Reference markings on the phantom top allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. A white cover is provided to cover the phantom during off-periods preventing water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible. The phantom is filled with a tissue simulating liquid to a depth of at least 15 cm at each ear reference point. The bottom plate of the wooden table contains three pair of bolts for locking the device holder.

1.12. PLANAR PHANTOM

The planar phantom is constructed of Plexiglas material with a 2.0 mm shell thickness for face-held and body-worn SAR evaluations of handheld radio transceivers. The planar phantom is mounted on the wooden table of the DASY4 system.



1.13. VALIDATION PLANAR PHANTOM

The validation planar phantom is constructed of Plexiglas material with a 6.0 mm shell thickness for system validations at 450MHz and below. The validation planar phantom is mounted on the wooden table of the DASY4 system.

1.14. DEVICE HOLDER

The device holder is designed to cope with the different measurement positions in the three sections of the SAM phantom given in the standard. It has two scales, one for device rotation (with respect to the body axis) and one for device inclination (with respect to the line between the ear openings). The rotation center for both scales is the ear opening, thus the device needs no repositioning when changing the angles. The plane between the ear openings and the mouth tip has a rotation angle of 65°.

The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

The dielectric properties of the liquid conform to all the tabulated values [2-5]. Liquids are prepared according to Annex A and dielectric properties are measured according to Annex B.

1.15. SYSTEM VALIDATION KITS

Power Capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Construction: Symmetrical dipole with l/4 balun Enables measurement of feed point impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 300, 450, 835, 1900, 2450 MHz, 5-6GHz

Return loss: >20 dB at specified validation position

Dimensions: 300 MHz Dipole: Length: 396mm; Overall Height:430 mm; Diameter: 6 mm
450 MHz Dipole: Length: 270 mm; Overall Height: 347 mm; Diameter: 6 mm
835 MHz Dipole: Length: 161 mm; Overall Height: 270 mm; Diameter: 3.6 mm
1900 MHz Dipole: Length: 68 mm; Overall Height: 219 mm; Diameter: 3.6 mm
2450 MHz Dipole: Length: 51.5 mm; Overall Height: 300 mm; Diameter: 3.6 mm
5-6GHz Dipole: Length: 26.0 mm; Overall Height: 170 mm; Diameter: 3.6 mm

TEST EQUIPMENT LIST

Test Equipment	Serial Number	Calibration Date
DASY4 System Robot RX90	FO3/SX19A1/A/01	N/A
EX3DV4	3722	October 17. 2014
DAE	584	October 14, 2014
835MHz Dipole	4d110	July 22, 2013
1800Mhz Dipole	1S2572	July 18,2013
SAM Phantom V4.0C	N/A	N/A
Agilent Tech/Hewlett Packard Signal Generator	1S2269	11/15/2013
EMCO Horn Antenna	1S2208	1/23/2013
Agilent E4407B Spectrum Analyzer	1S2460	2/27/2014
Agilent 8722D Network Analyzer	1S2272	2/25/2014
Extech Power Supply (30 VDC)	4S3771	Functional Verification
Mini-Circuits power amplifier	1S2447	Functional Verification
Agilent power meter	1S2276	04/22/2014
Mini-Circuits USB power sensor	1S3838	10/25/2013
Krytar Directional Coupler (1-20Ghz)	1S2034	Functional Verification
AR dual Directional Coupler (9Khz-1Ghz)	1S2542	Functional Verification
HP High Temperature Dielectric Probe Kit 85070D Opt 1	1T4366	Functional Verification

MEASUREMENT UNCERTANTIES

UNCERTAINTY ASSESSMENT 300MHz-3GHz

Error Description	Tol. ±%	Prob. Dist.	Div.	c_i 1g	c_i 10g	Std Unc ±% (1g)	Std Unc ±% (10g)	v_i or v_{eff}
Measurement System								
Probe calibration	4.8	N	1	1	1	4.8	4.8	N/A
Axial isotropy of the probe	4.7	R	√3	0.7	0.7	1.9	1.9	N/A
Spherical isotropy of the probe	9.6	R	√3	0.7	0.7	3.9	3.9	N/A
Boundary effects	1.0	R	√3	1	1	4.8	4.8	N/A
Probe linearity	4.7	R	√3	1	1	2.7	2.7	N/A
Modulation response	2.4	R	√3	1	1	1.4	1.4	NA
Detection limit	1.0	R	√3	1	1	0.6	0.6	N/A
Readout electronics	1.0	N	1	1	1	1.0	1.0	N/A
Response time	0.8	R	√3	1	1	0.5	0.5	N/A
Integration time	2.6	R	√3	1	1	0.8	0.8	N/A
RF ambient conditions	3.0	R	√3	1	1	0.43	0.43	N/A
Mech. Constraints of robot	0.4	R	√3	1	1	0.2	0.2	N/A
Probe positioning	2.9	R	√3	1	1	1.7	1.7	N/A
Extrapolation & integration	1.0	R	√3	1	1	2.3	2.3	N/A
Test Sample Related								
Device positioning	2.9	N	1	1	1	2.23	2.23	145
Device holder uncertainty	3.6	N	1	1	1	5.0	5.0	5
Power drift	5.0	R	√3	1	1	2.9	2.9	N/A
Phantom and Setup								
Phantom uncertainty	4.0	R	√3	1	1	2.3	2.3	N/A
Liquid conductivity (target)	5.0	R	√3	0.64	0.43	1.8	1.2	N/A
Liquid conductivity (measured)	2.5	N	1	0.64	0.43	1.6	1.1	N/A
Liquid permittivity (target)	5.0	R	√3	0.6	0.5	1.7	1.4	N/A
Liquid permittivity (measured)	2.5	N	1	0.6	0.5	1.5	1.2	N/A
Deviations in Complex permittivity	5	R	√3	1	1	1.2	0.97	N/A
Temperature uncertainty – conductivity	3.4	R	√3	0.78	0.71	5.2	5.2	N/A
Temperature uncertainty – permittivity	0.4	R	√3	1	1	1	1	N/A
Combined Standard Uncertainty (k=1)		RSS				12.9	12.7	
Expanded Uncertainty (k=2) 95% Confidence Level						25.8	25.4	

Table 1. Worst-case uncertainty for DASY4 assessed according to IEEE P1528.

The budget is valid for the frequency range 300MHz to 3GHz and represents a worst-case analysis.

UNCERTAINTY FOR SYSTEM PERFORMANCE CHECK

Error Description	Tol. ±%	Prob. Dist.	Div.	c_i 1g	c_i 10g	Std Unc ±% (1g)	Std Unc ±% (10g)	v_i or v_{eff}
Measurement System								
Probe calibration	5.9	N	1	1	1	5.9	5.9	∞
Axial Isotropy	4.7	R	√3	1	1	2.7	2.7	∞
Hemispherical Isotropy	9.6	R	√3	0	0	0	0	∞
Boundary effects	1.0	R	√3	1	1	0.6	0.6	∞
Linearity	4.7	R	√3	1	1	2.7	2.7	∞
Modulation response	2.4	R	√3	1	1	1.4	1.4	∞
System Detection limit	1.0	R	√3	1	1	0.6	0.6	∞
Readout electronics	0.3	N	1	1	1	0.3	0.3	∞
Response time	0	R	√3	1	1	0	0	∞
Integration time	0	R	√3	1	1	0	0	∞
RF Ambient Noise	3.0	R	√3	1	1	1.7	1.7	∞
RF Ambient Reflections	3.0	R	√3	1	1	1.7	1.7	∞
Probe Positioner	0.4	R	√3	1	1	0.2	0.2	∞
Probe positioning	2.9	R	√3	1	1	1.7	1.7	∞
Algorithms for Max. SAR Eval.	1.0	R	√3	1	1	0.6	0.6	∞
Dipole								
Dipole Axis to Liquid Distance	2.0	R	√3	1	1	1.2	1.2	∞
Input power and SAR drift meas.	4.7	R	√3	1	1	2.7	2.7	∞
Phantom and Tissue Parameters								
Phantom uncertainty	4.0	R	√3	1	1	2.3	2.3	∞
Liquid conductivity (target)	5.0	R	√3	0.64	0.43	1.8	1.2	∞
Liquid conductivity (measured)	2.5	N	1	0.64	0.43	1.6	1.1	∞
Liquid permittivity (target)	5.0	R	√3	0.6	0.5	1.7	1.4	∞
Liquid permittivity (measured)	2.5	N	1	0.6	0.5	1.5	1.2	∞
Deviations in Complex permittivity	5	R	√3	1	1	1.2	0.97	∞
Temperature uncertainty – conductivity	3.4	R	√3	0.78	0.71	5.2	5.2	∞
Temperature uncertainty – permittivity	0.4	R	√3	1	1	1	1	∞
Combined Standard Uncertainty						10.7	10.5	
Coverage Factor for 95%		kp=2						
Expanded Uncertainty						21.4	21.0	

Table 2. Uncertainty of a system performance check with DASY4 system.

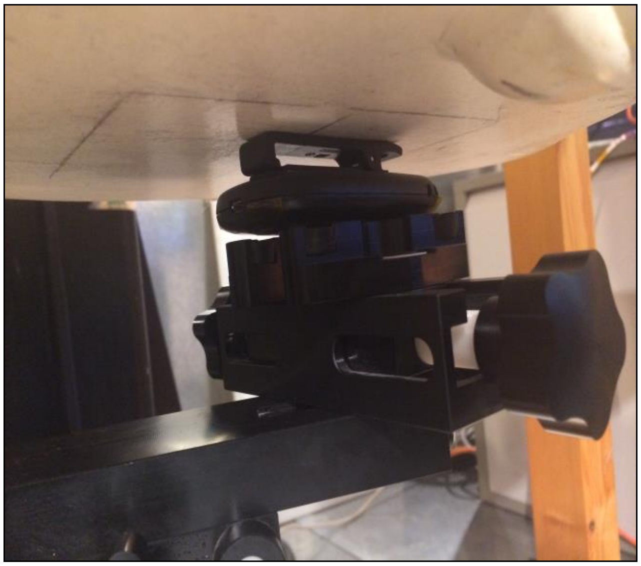
The budget is valid for the frequency range 300MHz to 3GHz and represents a worst-case analysis.

REFERENCES

No	Reference	Document Title
1	47 CFR 2.1093	
2	IEEE 1528: 2013	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques.
3	IEC 62209-2: 2010	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)
4	KDB 447498 D01v05r02	General RF Exposure Guidance
5	KDB 941225 D03v01	SAR Test Reduction GSM GPRS
6	KDB 941225 D01v02	SAR test for 3G devices
6	KDB 865664 D01v01r02	SAR Measurement 100 MHz to 6 GHz
7	KDB 865664 D02v01r01	SAR Reporting
8	RSS-102	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Updated December 2010

EUT TEST SETUP PHOTOS

Photograph 1. Back side of the EUT against phantom



Photograph 2. Back side of the EUT against phantom

Photograph 3. Fluid Depth

APPENDIX A - SAR MEASUREMENT DATA

GPRS back side low ch,824Mhz

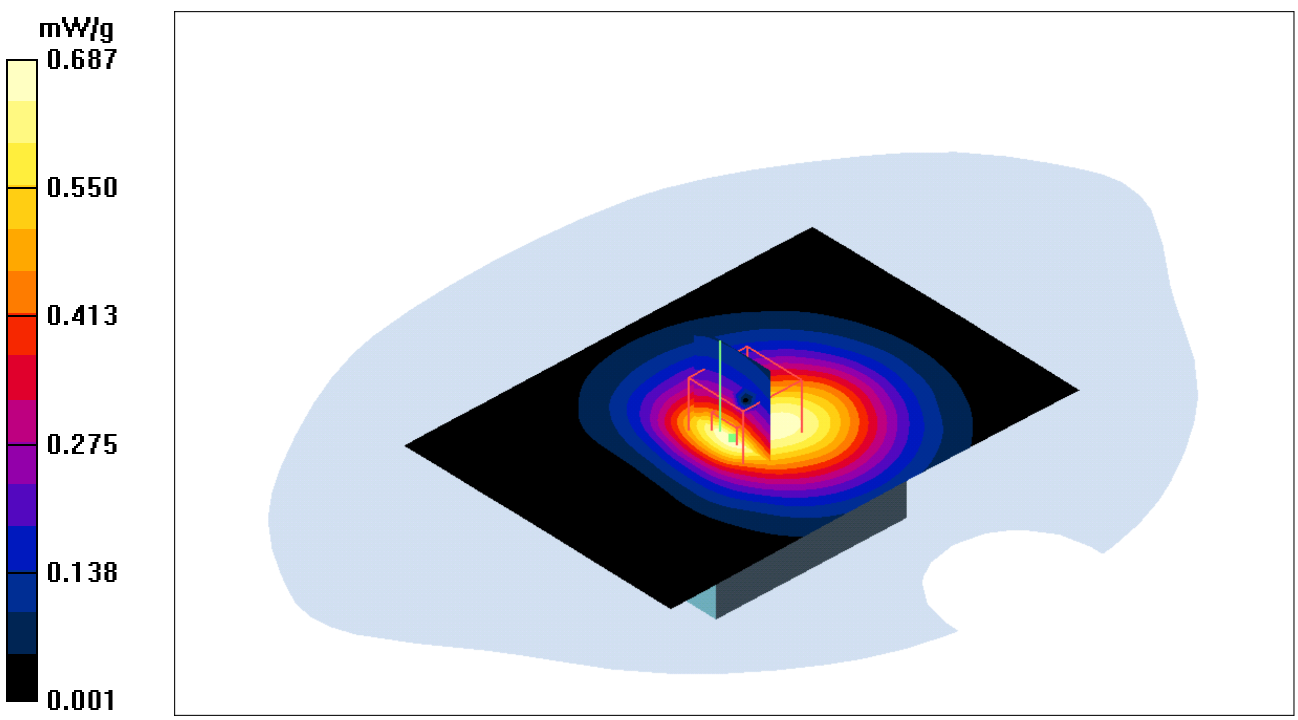
DUT: Nielson;

Communication System: 850 MHz GPRS; ; Frequency: 824 MHz;Duty Cycle: 1:2.12
Medium: M 900-B Medium parameters used: f = 824 MHz; σ = 0.98 mho/m; ε_r = 54.39; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(8.72, 8.72, 8.72); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.687 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.0 V/m; Power Drift = -0.057 dB
Peak SAR (extrapolated) = 1.13 W/kg
SAR(1 g) = 0.636 mW/g; SAR(10 g) = 0.435 mW/g
Maximum value of SAR (measured) = 0.679 mW/g



GPRS back side mid ch,836Mhz

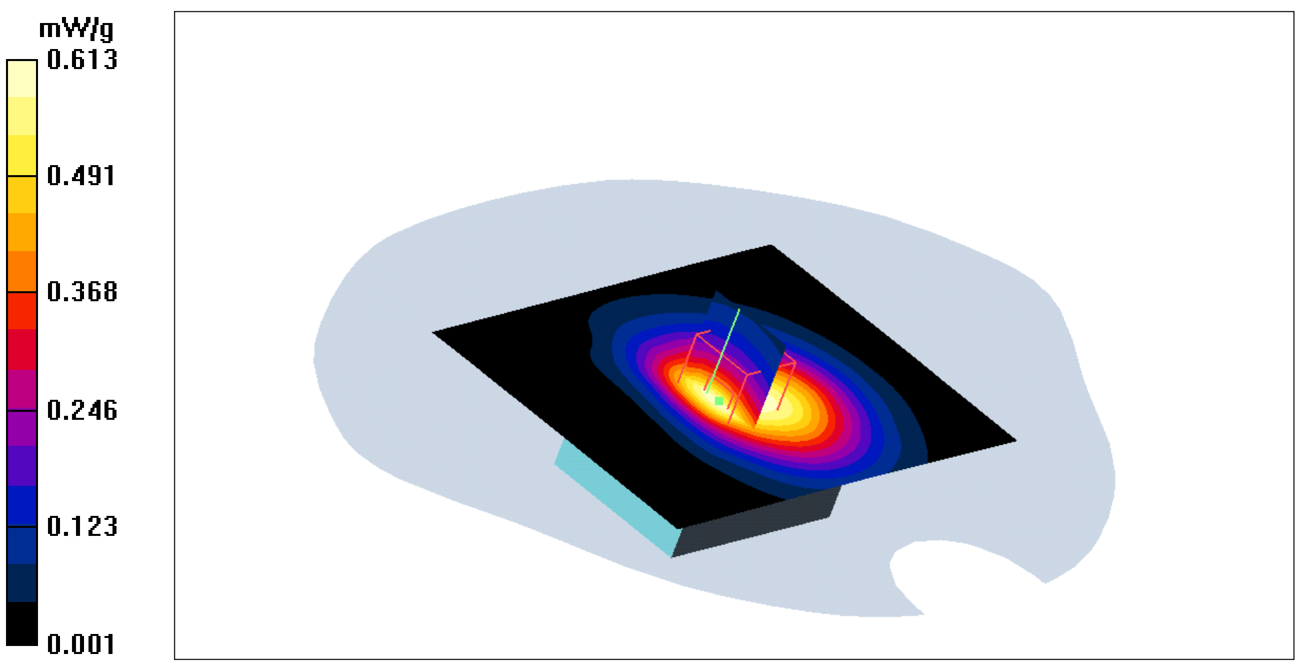
DUT: Nielson;

Communication System: 850 MHz GPRS; ; Frequency: 836 MHz;Duty Cycle: 1:2.12
Medium: M 900-B Medium parameters used: f = 836 MHz; σ = 0.99 mho/m; ε_r = 54.36; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(8.72, 8.72, 8.72); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.613 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.5 V/m; Power Drift = -0.096 dB
Peak SAR (extrapolated) = 0.861 W/kg
SAR(1 g) = 0.566 mW/g; SAR(10 g) = 0.383 mW/g
Maximum value of SAR (measured) = 0.601 mW/g



GPRS back side High ch,848.8Mhz

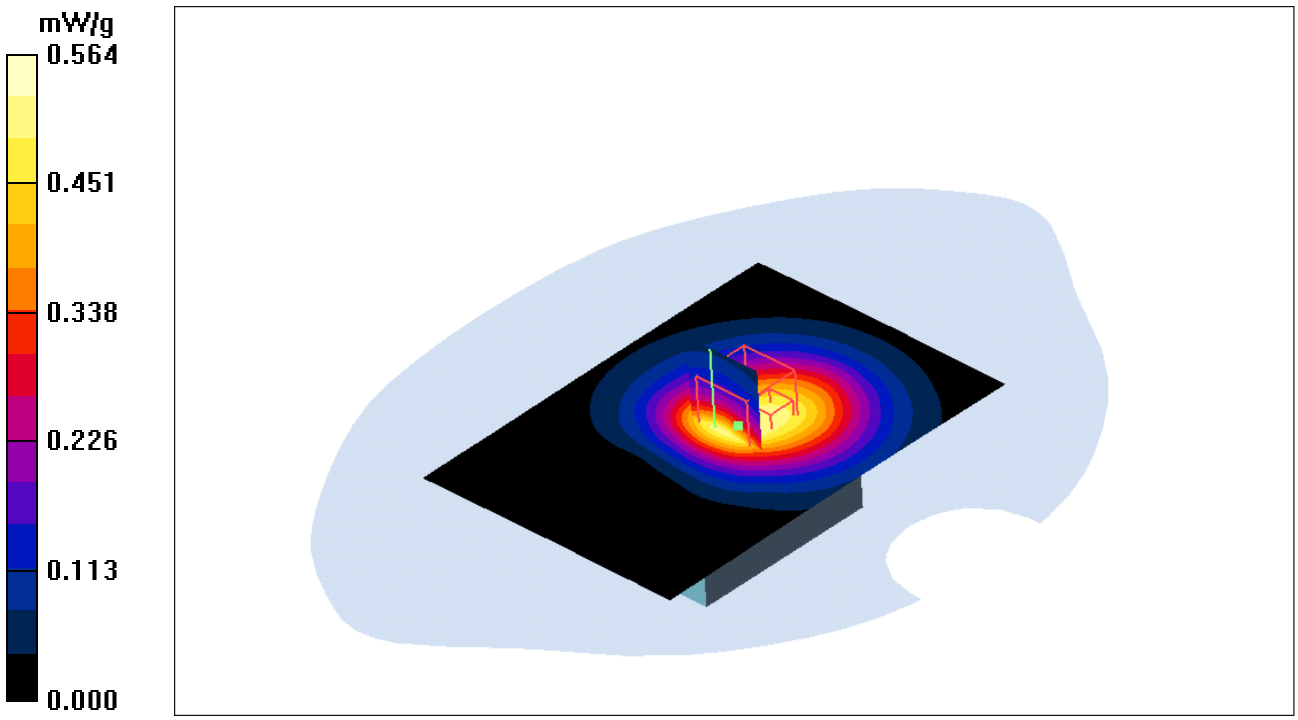
DUT: Nielson;

Communication System: 850MHz GPRS; ; Frequency: 848.8 MHz;Duty Cycle: 1:2.12
Medium: M900-B Medium parameters used: f = 848.8 MHz; σ = 1 mho/m; ε_r = 54.16; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(8.72, 8.72, 8.72); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.564 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 23.7 V/m; Power Drift = 0.002 dB
Peak SAR (extrapolated) = 0.779 W/kg
SAR(1 g) = 0.509 mW/g; SAR(10 g) = 0.350 mW/g
Maximum value of SAR (measured) = 0.535 mW/g



EGPRS back side low ch,824Mhz

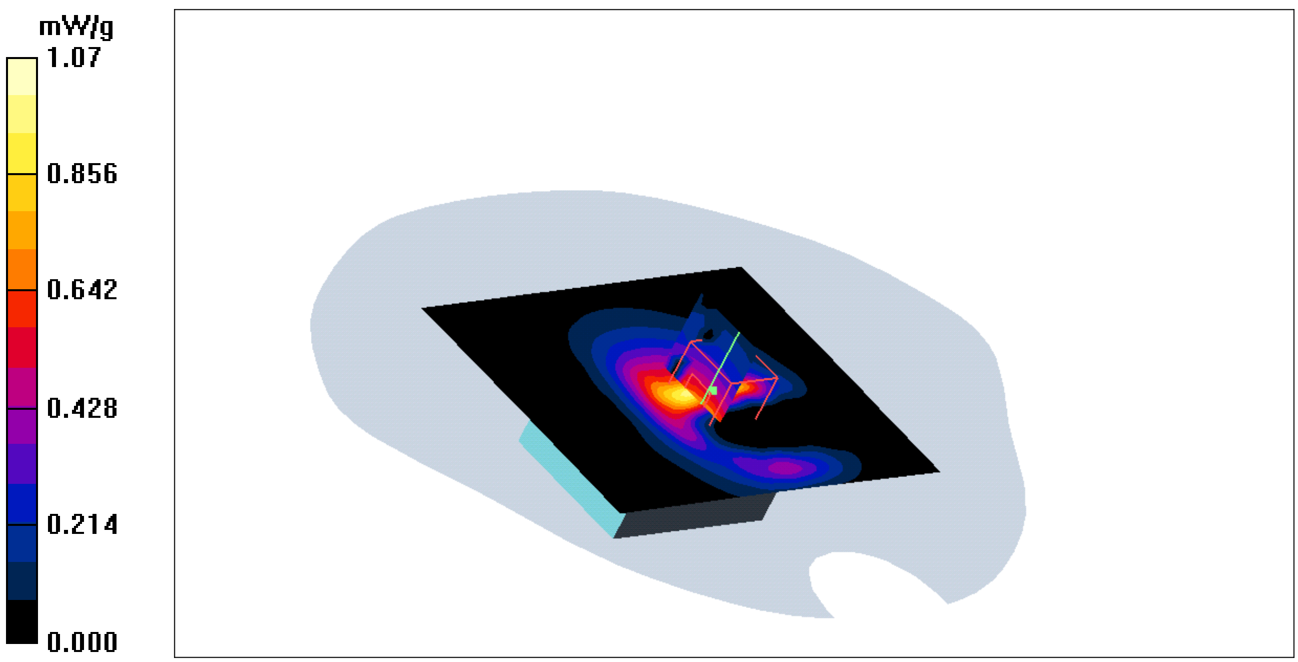
DUT: Nielson;

Communication System: 850 MHz EGPRS; ; Frequency: 824 MHz;Duty Cycle: 1:2.12
Medium: M 900-B Medium parameters used: f = 824 MHz; σ = 0.99 mho/m; ε_r = 54.36; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(8.72, 8.72, 8.72); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.07 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 27.1 V/m; Power Drift = -0.162 dB
Peak SAR (extrapolated) = 0.994 W/kg
SAR(1 g) = 0.677 mW/g; SAR(10 g) = 0.440 mW/g
Maximum value of SAR (measured) = 0.715 mW/g



EGPRS back side mid ch,836Mhz

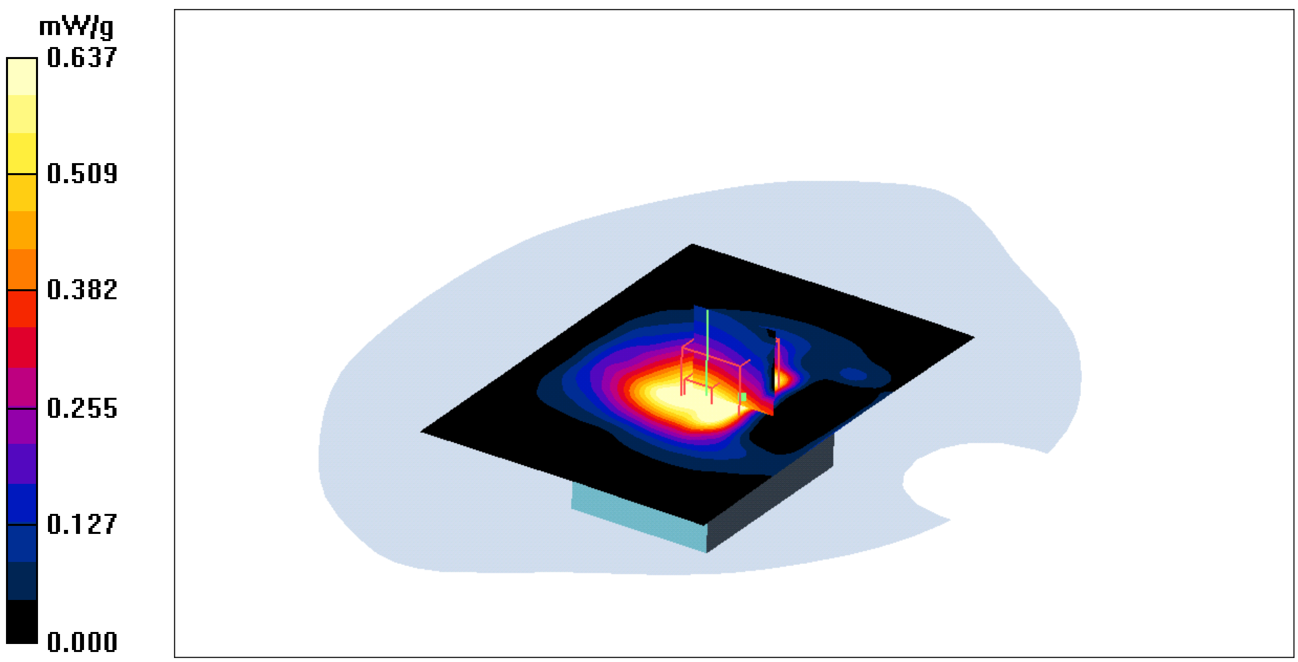
DUT: Nielson;

Communication System: 850MHz EGPRS; ; Frequency: 836 MHz;Duty Cycle: 1:2.12
Medium: M 900-B Medium parameters used: f = 836 MHz; σ = 0.99 mho/m; ε_r = 54.36; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(8.72, 8.72, 8.72); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 1.16 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.8 V/m; Power Drift = 0.009 dB
Peak SAR (extrapolated) = 1.11 W/kg
SAR(1 g) = 0.599 mW/g; SAR(10 g) = 0.407 mW/g
Maximum value of SAR (measured) = 0.637 mW/g



EGPRS back side High ch,848.8Mhz

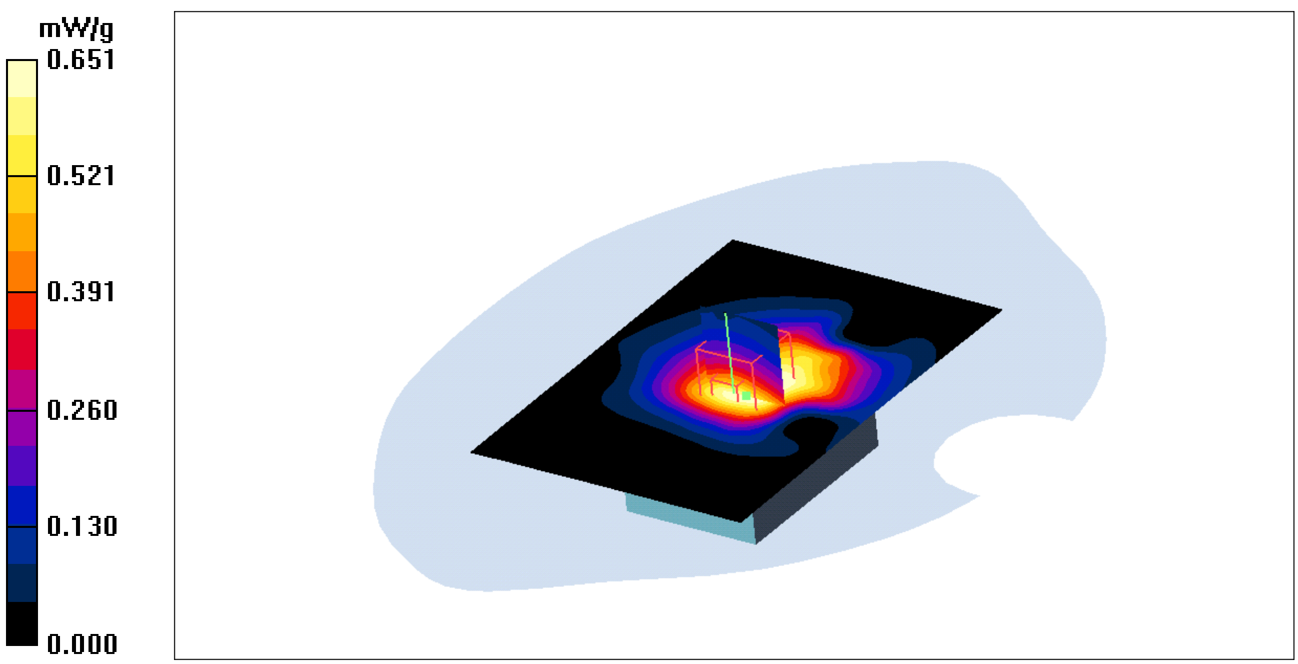
DUT: Nielson;

Communication System: 850 MHz EGPRS; ; Frequency: 848.8 MHz;Duty Cycle: 1:2.12
Medium: M 900-B Medium parameters used: f = 848.8 MHz; σ = 1 mho/m; ε_r = 54.16; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(8.72, 8.72, 8.72); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.651 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.8 V/m; Power Drift = -0.110 dB
Peak SAR (extrapolated) = 0.892 W/kg
SAR(1 g) = 0.590 mW/g; SAR(10 g) = 0.396 mW/g
Maximum value of SAR (measured) = 0.639 mW/g



WCDMA back side Low ch,824Mhz

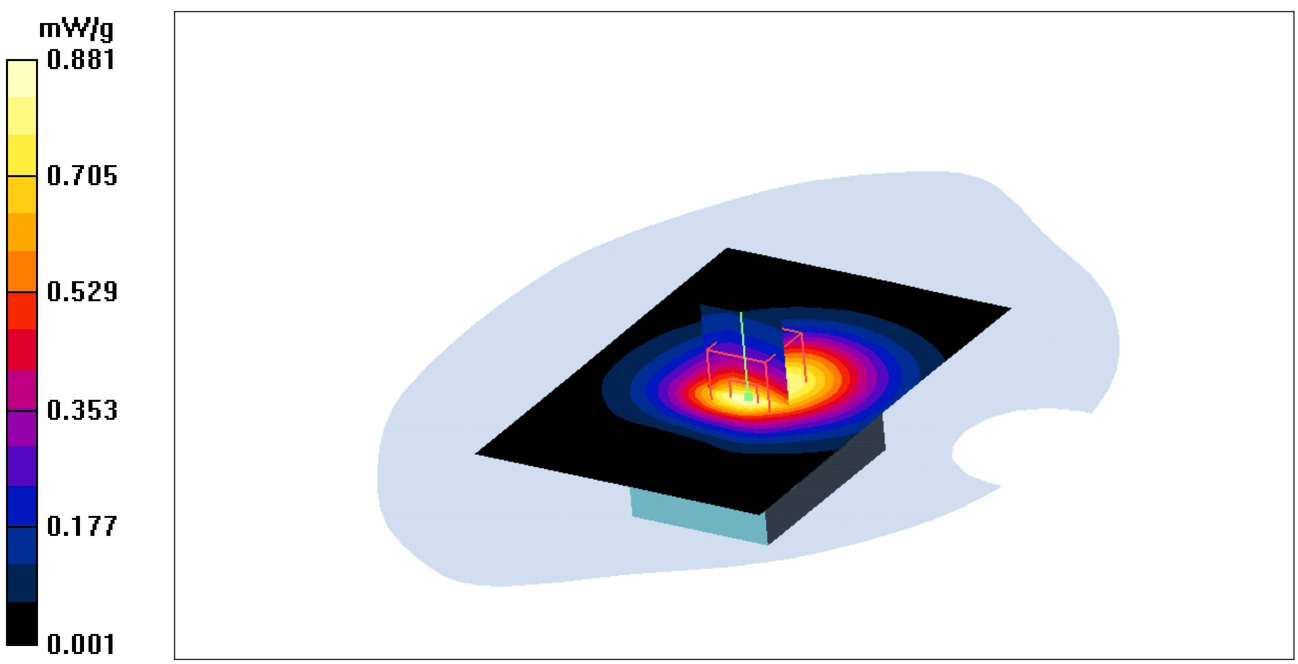
DUT: Nielson;

Communication System: 850MHz WCDMA; ; Frequency: 824 MHz;Duty Cycle: 1:1
Medium: M900-B Medium parameters used: f = 824 MHz; σ = 0.98 mho/m; ε_r = 54.39; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(8.72, 8.72, 8.72); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.881 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 28.2 V/m; Power Drift = -0.268 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.764 mW/g; SAR(10 g) = 0.529 mW/g
Maximum value of SAR (measured) = 0.823 mW/g



WCDMA back side Mid ch,836Mhz

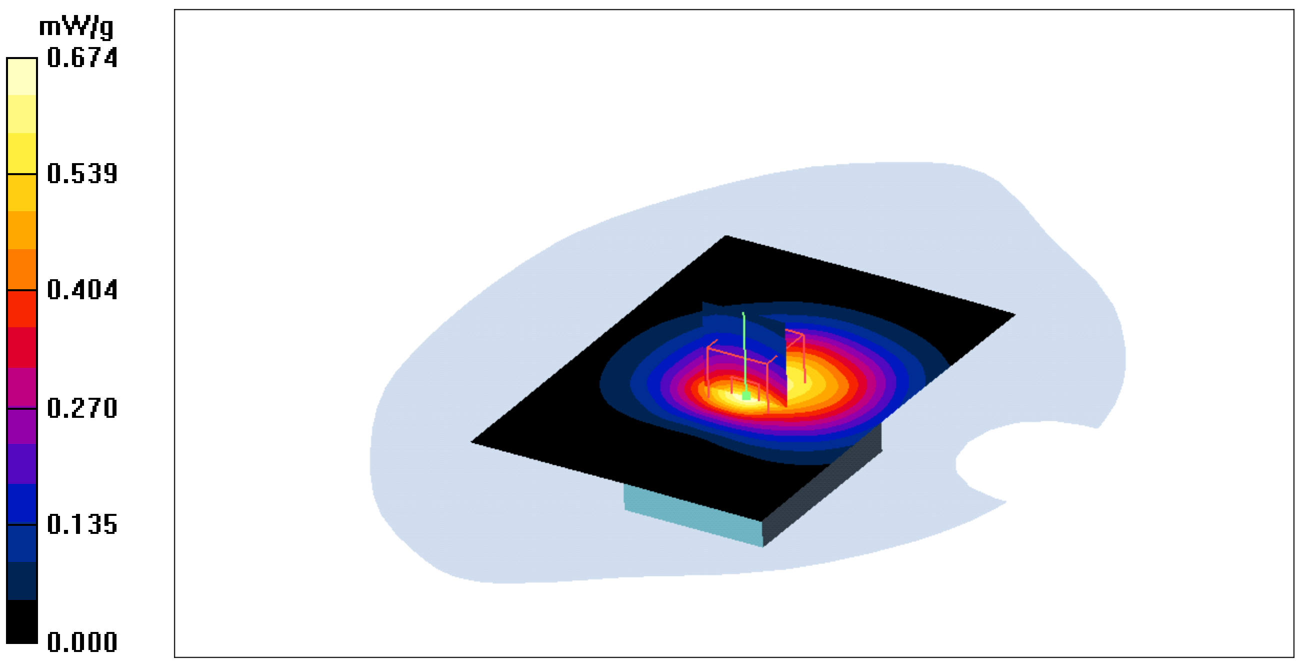
DUT: Nielson;

Communication System: 850 MHz WCDMA; ; Frequency: 836 MHz;Duty Cycle: 1:1
Medium: M 900-B Medium parameters used: f = 836 MHz; σ = 0.99 mho/m; ε_r = 54.36; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(8.72, 8.72, 8.72); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.674 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 26.6 V/m; Power Drift = -0.956 dB
Peak SAR (extrapolated) = 0.801 W/kg
SAR(1 g) = 0.549 mW/g; SAR(10 g) = 0.378 mW/g
Maximum value of SAR (measured) = 0.590 mW/g



WCDMA back side High ch,848.8Mhz

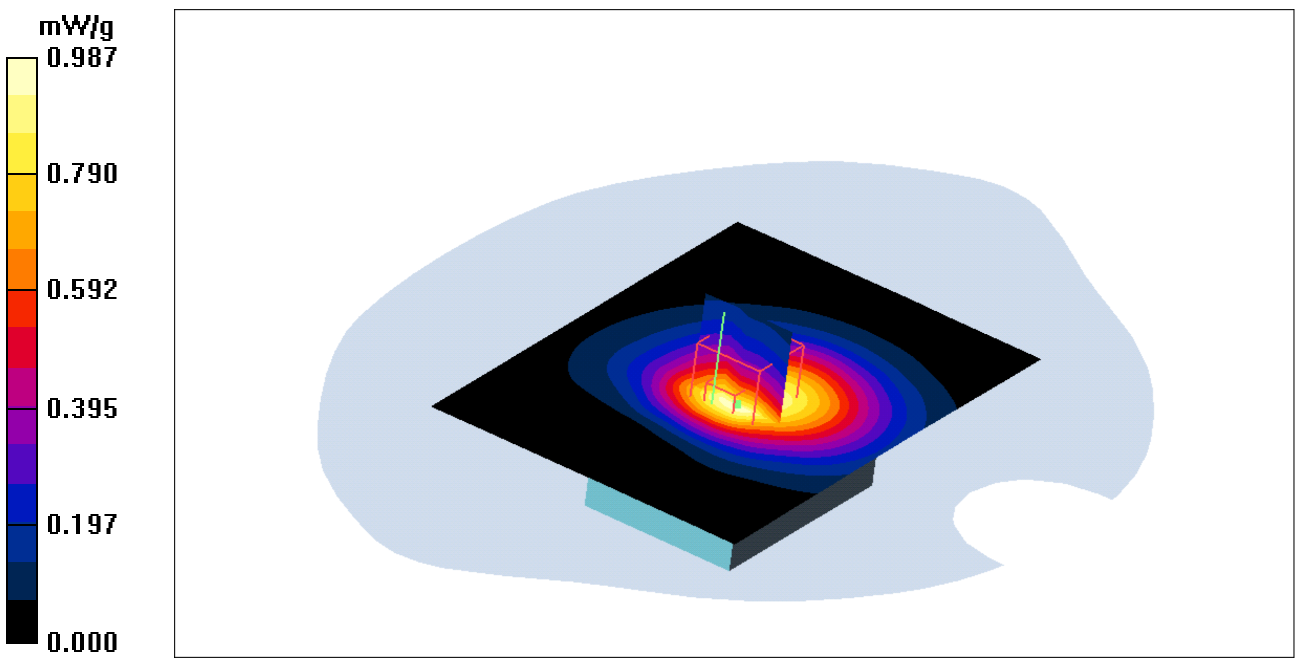
DUT: Nielson;

Communication System: 850MHz WCDMA; ; Frequency: 848.8 MHz;Duty Cycle: 1:1
Medium: M900-B Medium parameters used: f = 848.8 MHz; σ = 1 mho/m; ε_r = 54.16; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(8.72, 8.72, 8.72); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.987 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 29.1 V/m; Power Drift = 0.062 dB
Peak SAR (extrapolated) = 1.66 W/kg
SAR(1 g) = 0.926 mW/g; SAR(10 g) = 0.615 mW/g
Maximum value of SAR (measured) = 0.982 mW/g



GPRS back side low ch,1850Mhz

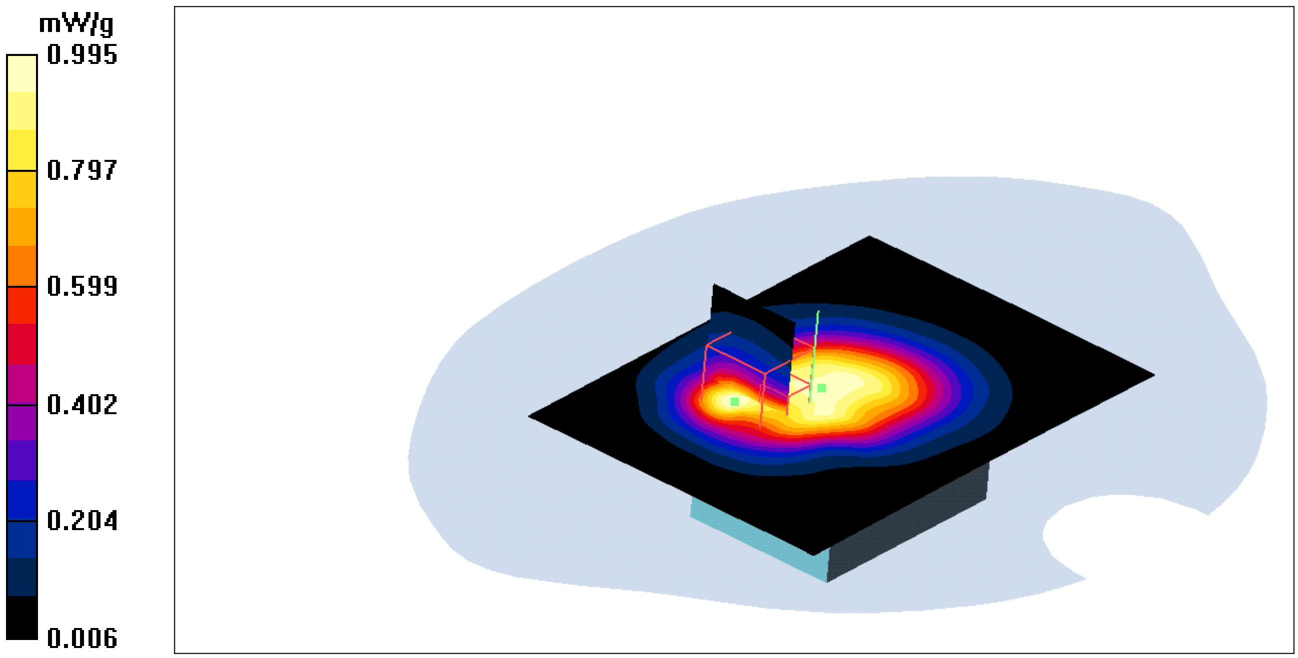
DUT: Nielson;

Communication System: 1900MHz GPRS; ; Frequency: 1850 MHz;Duty Cycle: 1:2.12
Medium: M1800-B Medium parameters used: f = 1850 MHz; σ = 1.49 mho/m; ε_r = 52.56; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(7.1, 7.1, 7.1); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.995 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 24.7 V/m; Power Drift = -0.097 dB
Peak SAR (extrapolated) = 1.45 W/kg
SAR(1 g) = 0.794 mW/g; SAR(10 g) = 0.469 mW/g
Maximum value of SAR (measured) = 0.932 mW/g



GPRS back side mid ch,1880Mhz

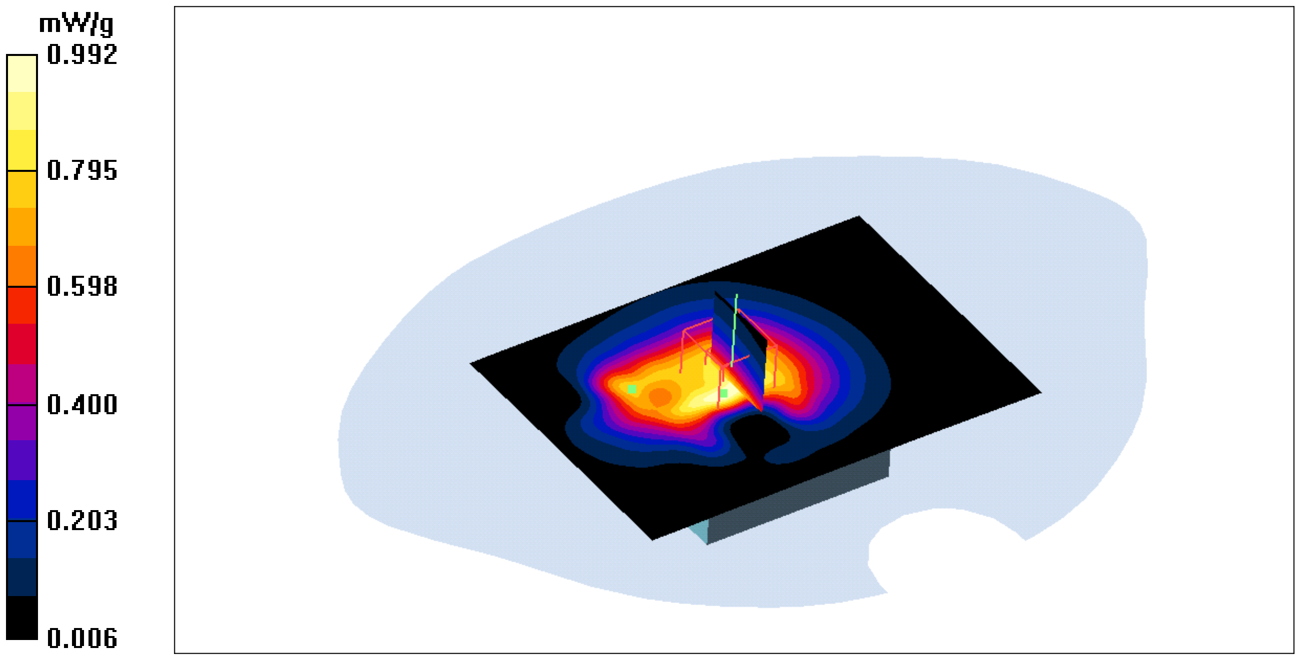
DUT: Nielson;

Communication System: 1900MHz GPRS; ; Frequency: 1880 MHz;Duty Cycle: 1:2.12
Medium: M1800-B Medium parameters used: f = 1880 MHz; $\sigma = 1.51$ mho/m; $\varepsilon_r = 52.38$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(7.1, 7.1, 7.1); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.992 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 22.5 V/m; Power Drift = -0.030 dB
Peak SAR (extrapolated) = 1.18 W/kg
SAR(1 g) = 0.781 mW/g; SAR(10 g) = 0.496 mW/g
Maximum value of SAR (measured) = 0.832 mW/g



GPRS back side Highh ch,1909Mhz

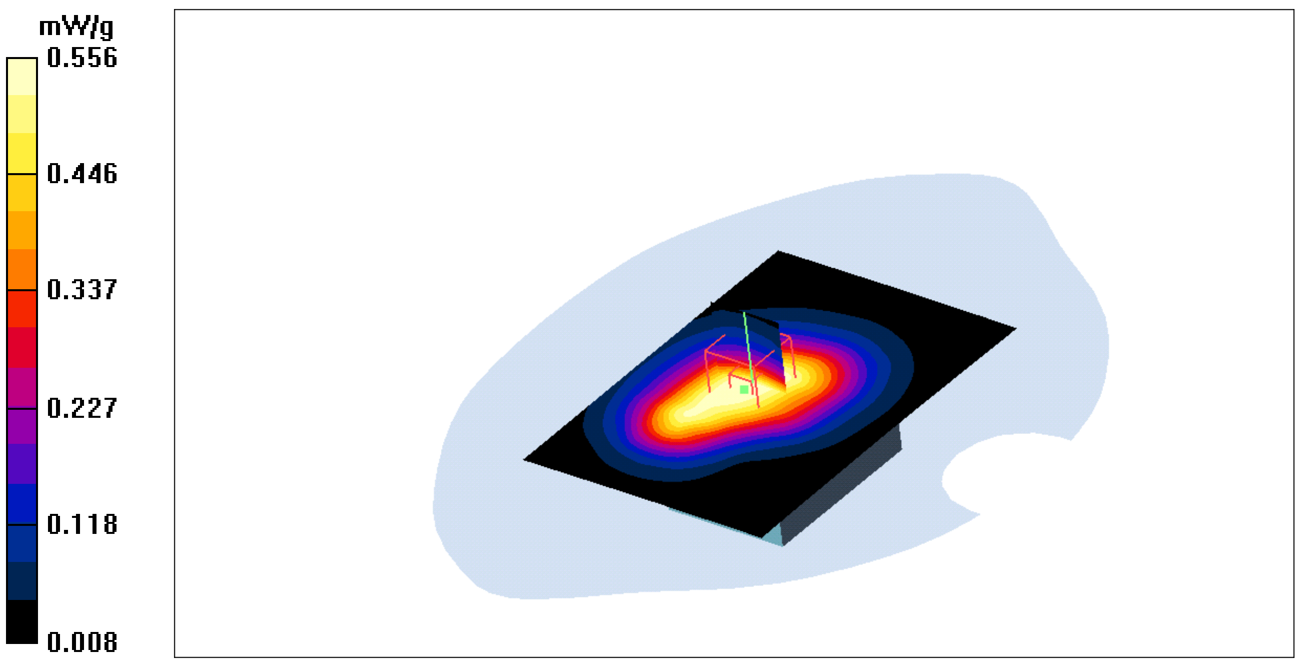
DUT: Nielson;

Communication System: 1900MHz GPRS; ; Frequency: 1909 MHz;Duty Cycle: 1:2.12
Medium: M1800-B Medium parameters used: f = 1909 MHz; $\sigma = 1.54$ mho/m; $\varepsilon_r = 53.32$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(7.1, 7.1, 7.1); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.556 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.3 V/m; Power Drift = -0.172 dB
Peak SAR (extrapolated) = 0.787 W/kg
SAR(1 g) = 0.512 mW/g; SAR(10 g) = 0.332 mW/g
Maximum value of SAR (measured) = 0.546 mW/g



EGPRS back side low ch,1850Mhz

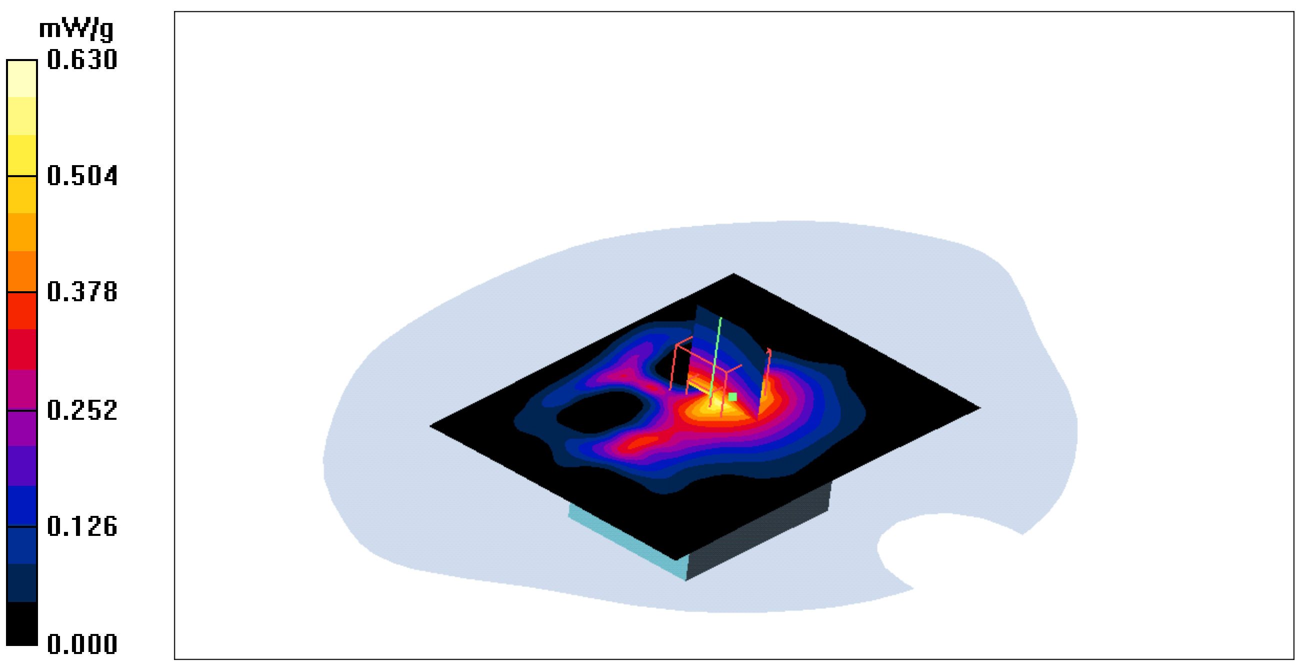
DUT: Nielson;

Communication System: 1900MHz GPRS; ; Frequency: 1850 MHz;Duty Cycle: 1:2.12
Medium: M1800-B Medium parameters used: f = 1850 MHz; σ = 1.49 mho/m; ε_r = 52.56; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(7.1, 7.1, 7.1); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.630 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.0 V/m; Power Drift = -0.062 dB
Peak SAR (extrapolated) = 1.23 W/kg
SAR(1 g) = 0.530 mW/g; SAR(10 g) = 0.334 mW/g
Maximum value of SAR (measured) = 0.560 mW/g



EGPRS back side mid ch,1880Mhz

DUT: Nielson;

Communication System: 1900MHz GPRS; ; Frequency: 1880 MHz;Duty Cycle: 1:2.12
Medium: M1800-B Medium parameters used: f = 1880 MHz; σ = 1.51 mho/m; ε_r = 52.38; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV4 - SN3722; ConvF(7.1, 7.1, 7.1); Calibrated: 10/17/2014
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 10/14/2014
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (71x101x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.838 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 23.1 V/m; Power Drift = -0.400 dB
Peak SAR (extrapolated) = 1.34 W/kg
SAR(1 g) = 0.756 mW/g; SAR(10 g) = 0.492 mW/g
Maximum value of SAR (measured) = 0.804 mW/g