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Dosimetric Assessment
Test Report

for the

Vuzix Corporation
M300 Smart Glasses

FCC ID: 2AA9D-446

Tested and Evaluated In Accordance With
IEEE 1528:2013, KDB 248227 and KDB 594280

Prepared for

Vuzix Corporation
Devrin Talen
25 Hendrix Road
West Henrietta, NY 14586

Engineering Statement: The measurements shown in this report were made in accordance with the procedures specified in IEEE1528:2013, KDB 248227 and KDB 594280 for RF 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.

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SAR Evaluation
Certificate of Compliance

APPLICANT: Vuzix Corporation

Applicant Name and Address: Devrin Talen
25 Hendrix Road
West Henrietta, NY 14586

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

EUT:	M300	
Test Dates:	November 28th- November 30th	
RF exposure environment:	Uncontrolled Exposure/General Population	
RF exposure category:	Portable	
Power supply:	Internal battery	
Antenna:	Internal	
Production/prototype:	Production	
Modes of operation tested:	2.4 GHz (802.11b) 5.0 GHz (802.11a, n) BT	
Modulation tested:	DSSS, OFDM	
Duty Cycle tested:	2.4 GHz 802.11b → 99% 5.0 GHz 802.11n → 98%	
TX Range:	2400MHz-2483MHz; 5150MHz-5850MHz	
Max SAR Measured	**SAR 1g (W/kg)**	
	Phantom Head Section (0cm)	1.0687

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Asad Bajwa
Director, EMC

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1 INTRODUCTION

This measurement report demonstrates that Vuzix M300 unit as described within this report complies with the Specific Absorption Rate (SAR) RF exposure requirements specified in ANSI/IEEE Std. C95.1-1999, FCC 47 CFR §2.1093 for the Uncontrolled Exposure/General population environment. The test procedures described in IEEE 1528:2013, KDB 248227 and KDB 594280 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.

1.1 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).

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

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.

1.2 DESCRIPTION OF DEVICE UNDER TEST (EUT)

Applicant:	Vuzix Corporation
Description of Test Item:	The Vuzix M300 is a smart glasses device that is worn on the head. The device includes a display, processor, camera, speaker, and wireless connectivity, and runs the Android operating system. The user runs applications on the device that assist them in their job or provide environmental information. The M300 must always be connected to an external battery pack. The connection is a custom 8-pin cable designed by Vuzix that connects the M300 to custom battery packs. The default battery pack is an 860 mAh cell with onboard electronics to monitor state of charge and provide battery charging over USB.
Supply Voltage:	860 mAh internal Battery
Antenna Type(s) Tested:	Integral
Accessories:	None
Modes of Operation:	802.11a, ac, b, g, n 2.4 GHz b, g (20MHz) 2.4 GHz n (20MHz, 40MHz) 5.0 GHz n (20MHz, 40MHz) 5.0 GHz a (20MHz) 5.0 GHz ac (20MHz, 40MHz, 80MHz) Bluetooth
Duty Cycles:	98%, 99%
Application Type:	Evaluation for aggregated SAR levels
Exposure Category:	Uncontrolled Exposure/General Population
FCC and IC Rule Part(s):	FCC 47 CFR §2.1093
Standards:	IEEE 1528:2013, KDB 248227 and KDB 594280

Table 1: Description of device under test.

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1.3 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.

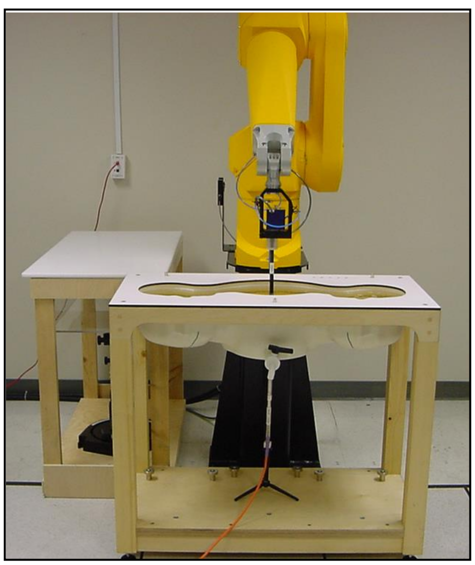

Figure 1: Staubli Robotic Arm

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2 Vuzix M300 Antenna Analysis

Vuzix M300 comprises of two antennas which are placed about 17.4 mm apart. The reported gain of the antennas is 0 dBi.

3 SAR MEASUREMENT SUMMARY – FCC

SAR HEAD MEASUREMENT RESULTS							
Channel #	Frequency (MHz)	mode	Position	Antenna	Power Drift %	Measured SAR 1g (W/kg)	Worst case tune-up corrected SAR 1g (W/kg)
11	2462	802.11b	Left	A	4.0	0.0066	0.0083
11	2462	802.11b	Right	A	0.8	0.0056	0.0070
6	2437	802.11b	Left	B	4.0	0.1110	0.1397
6	2437	802.11b	Right	B	2.5	0.1130	0.1422

Table 2: 2.4GHz SAR head measurement results

SAR HEAD MEASUREMENT RESULTS							
Channel #	Frequency (MHz)	mode	Position	Antenna	Power Drift %	Measured SAR 1g (W/kg)	Worst case tune-up corrected SAR 1g (W/kg)
38	5190	802.11n	Left	A	4.4	0.0130	0.0163
38	5190	802.11n	Right	A	4.5	0.0180	0.0220
58	5290	802.11n	Left	A	4.2	0.0160	0.0201
58	5290	802.11n	Right	A	3.2	0.0022	0.0028
106	5530	802.11n	Left	A	3.8	0.0340	0.0428
106	5530	802.11n	Right	A	4.0	0.0330	0.0415
151	5755	802.11n	Left	A	3.7	0.0570	0.0717
151	5755	802.11n	Right	A	3.4	0.0340	0.0428
46	5230	802.11a	Left	B	1.0	0.7920	0.9970
46	5230	802.11a	Right	B	1.0	0.5710	0.7188
52	5260	802.11n	Left	B	4.5	0.5920	0.7452
52	5260	802.11n	Right	B	4.2	0.5830	0.7339
110	5550	802.11n	Left	B	3.6	0.2920	0.3676
110	5550	802.11n	Right	B	3.0	0.1730	0.2177
159	5795	802.11a	Left	B	3.0	0.1170	0.1472
159	5795	802.11a	Right	B	1.8	0.0640	0.0805

Table 3: 5GHz SAR head measurement results

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SAR HEAD MEASUREMENT RESULTS						
Channel #	Frequency (MHz)	mode	Position	Power Drift %	Measured SAR 1g (W/kg)	Worst case tune-up corrected SAR 1g (W/kg)
39	2444	BLE	Left	2.5	0.0068	0.0075
39	2444	BLE	Right	4.9	0.0069	0.0076

Table 4: Bluetooth SAR head measurement results (Antenna B)

Note 1: Duty cycle correction is not required for both 2.4 GHz, and 5GHz channels because their duty cycles are 99%, and 98% respectively
Note 2: Power drift correction is only applicable if it is more than 5%
Note 3: Worst case tune up tolerance corrected SAR
= [(Target Power + 1dBm) in mW / (Measured Power in mW)] x DC corrected SAR

COMBINED MAXIMUM SAR HEAD MEASUREMENT				
Antenna A		Antenna B		① + ②
Technology	**SAR 1**	**Technology**	**SAR 2**	**Combined SAR**
2.4 GHz	0.0083	2.4 GHz	0.1422	0.1505
2.4 GHz	0.0083	5.0 GHz	0.9970	1.0053
5.0 GHz	0.0717	2.4 GHz	0.1422	0.2139
5.0 GHz	0.0717	5.0 GHz	0.9970	1.0687
2.4 GHz	0.0083	BT	0.0076	0.0159
5.0 GHz	0.0717	BT	0.0076	0.7246

Table 5: Worse case is the summation of maximum SAR value caused by Wi-Fi signal of each antenna and Bluetooth

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2462 MHz Left (Antenna A)

Measured Power = 21.02 dBm = 126.47 mW
Target = 21.02 dBm + 1dBm = 22.02 dBm = 159.22 mW
Worst case tune up tolerance corrected SAR = [159.22 mW / (126.47 mW)] x 0.0066 = 0.0083

2462 MHz Right (Antenna A)

Measured Power = 21.02 dBm = 126.47 mW
Target = 21.02 dBm + 1dBm = 22.02 dBm = 159.22 mW
Worst case tune up tolerance corrected SAR = [159.22 mW / (126.47 mW)] x 0.0056 = 0.0070

2437 MHz Left (Antenna B)

Measured Power = 22.38dBm = 172.98 mW
Target = 22.38 dBm + 1dBm = 23.38 dBm = 217.77 mW
Worst case tune up tolerance corrected SAR = [217.77 mW / (172.98 mW)] x 0.1110 = 0.1397

2437 MHz Right (Antenna B)

Measured Power = 22.38dBm = 172.98 mW
Target = 22.38 dBm + 1dBm = 23.38 dBm = 217.77 mW
Worst case tune up tolerance corrected SAR = [217.77 mW / (172.98 mW)] x 0.1130 = 0.1422

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5190 MHz Left (Antenna A)

Measured Power = 22.2 dBm = 165.95 mW
Target = 22.2 dBm + 1dBm = 23.2 dBm = 208.92 mW
Worst case tune up tolerance corrected SAR = [208.92 mW / (165.95 mW)] x 0.013 = 0.0163

5190 MHz Right (Antenna A)

Measured Power = 22.2 dBm = 165.95 mW
Target = 22.2 dBm + 1dBm = 23.2 dBm = 208.92 mW
Worst case tune up tolerance corrected SAR = [208.92 mW / (165.95 mW)] x 0.018 = 0.0226

5290 MHz Left (Antenna A)

Measured Power = 22.03dBm = 159.58 mW
Target = 22.03 dBm + 1dBm = 23.03 dBm = 200.90 mW
Worst case tune up tolerance corrected SAR = [200.90 mW / (159.58 mW)] x 0.016 = 0.0201

5290 MHz Right (Antenna A)

Measured Power = 22.03dBm = 159.58 mW
Target = 22.03 dBm + 1dBm = 23.03 dBm = 200.90 mW
Worst case tune up tolerance corrected SAR = [200.90 mW / (159.58 mW)] x 0.0022 = 0.0028

5530 MHz Left (Antenna A)

Measured Power = 21.18 dBm = 131.21 mW
Target = 21.18 dBm + 1dBm = 22.18 dBm = 165.19 mW
Worst case tune up tolerance corrected SAR = [165.19 mW / (131.21 mW)] x 0.034 = 0.0428

5530 MHz Right (Antenna A)

Measured Power = 21.18 dBm = 131.21 mW
Target = 21.18 dBm + 1dBm = 22.18 dBm = 165.19 mW
Worst case tune up tolerance corrected SAR = [165.19 mW / (131.21 mW)] x 0.033 = 0.0415

5755 MHz Left (Antenna A)

Measured Power = 22.61 dBm = 182.38 mW
Target = 22.61 dBm + 1dBm = 23.61 dBm = 229.61 mW
Worst case tune up tolerance corrected SAR = [229.61 mW / (182.38 mW)] x 0.057 = 0.0717

5755 MHz Right (Antenna A)

Measured Power = 22.61 dBm = 182.38 mW
Target = 22.61 dBm + 1dBm = 23.61 dBm = 229.61 mW
Worst case tune up tolerance corrected SAR = [229.61 mW / (182.38 mW)] x 0.034 = 0.0428

<u>5230 MHz Left (Antenna B)</u>

Measured Power = 21.65 dBm = 146.21 mW
Target = 21.65 dBm + 1dBm = 22.65 dBm = 184.07 mW
Worst case tune up tolerance corrected SAR = [184.07 mW / (146.21mW)] x 0.792 = 0.9970

<u>5230 MHz Right (Antenna B)</u>

Measured Power = 21.65 dBm = 146.21 mW
Target = 21.65 dBm + 1dBm = 22.65 dBm = 184.07 mW
Worst case tune up tolerance corrected SAR = [184.07 mW / (146.21mW)] x 0.571 = 0.7188

<u>5260 MHz Left (Antenna B)</u>

Measured Power = 23.06 = 202.30 mW
Target = 23.06 dBm + 1dBm = 24.06 dBm = 254.68 mW
Worst case tune up tolerance corrected SAR = [254.68 mW / (202.30 mW)] x 0.592 = 0.7452

<u>5260 MHz Right (Antenna B)</u>

Measured Power = 23.06 = 202.30 mW
Target = 23.06 dBm + 1dBm = 24.06 dBm = 254.68 mW
Worst case tune up tolerance corrected SAR = [254.68 mW / (202.30 mW)] x 0.583 = 0.7339

5550 MHz Left (Antenna B)

Measured Power = 22.67 dBm = 184.92 mW
Target = 22.67 dBm + 1dBm = 23.67 dBm = 232.80 mW
Worst case tune up tolerance corrected SAR = [232.80 mW / (184.92 mW)] x 0.292 = 0.3676

5550 MHz Right (Antenna B)

Measured Power = 22.67 dBm = 184.92 mW
Target = 22.67 dBm + 1dBm = 23.67 dBm = 232.80 mW
Worst case tune up tolerance corrected SAR = [232.80 mW / (184.92 mW)] x 0.173 = 0.2177

5795 MHz Left (Antenna B)

Measured Power = 22.47 dBm = 176.60 mW
Target = 22.47 dBm + 1dBm = 23.47 dBm = 222.33 mW
Worst case tune up tolerance corrected SAR = [222.33 mW / (176.6 mW)] x 0.117 = 0.1472

5795 MHz Right (Antenna B)

Measured Power = 22.47 dBm = 176.60 mW
Target = 22.47 dBm + 1dBm = 23.47 dBm = 222.33 mW
Worst case tune up tolerance corrected SAR = [222.33 mW / (176.6 mW)] x 0.064 = 0.0805

2444 MHz Left (Antenna B)

Measured Power = 8.68 dBm = mW
Target = 8.68 dBm + 1dBm = 9.68 dBm = mW
Worst case tune up tolerance corrected SAR = [9.68 mW / (8.68 mW)] x 0.0068 = 0.0075

2444 MHz Right (Antenna B)

Measured Power = 8.68 dBm = mW
Target = 8.68 dBm + 1dBm = 9.68 dBm = mW
Worst case tune up tolerance corrected SAR = [9.68 mW / (8.68 mW)] x 0.0069 = 0.0076

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4 CONDUCTED POWER MEASUREMENT SUMMARY

Since the EUT is capable of communicating via a large number of channels in various 802.11 modes, SAR testing for all the configurations is not desirable. KDB 248227 which is the SAR guidance for IEEE 802.11 WiFi transmitters was consulted to reduce the number of SAR tests without compromising the validity of the tested channel's applicability to the whole range of EUT supported channels.

So according to the KDB 248227, channels with the highest output conducted power were tested for SAR first. If the SAR number was greater than 1.2 W/kg then the next highest power channel was test for SAR. Below are the measured conducted output powers from the EUT for the 2.4 GHz channels.

As highlighted below, channels were selected. Since the SAR value was less than 1.2 W/kg, further testing for other modes was not necessary.

The main goal of SAR test reduction method as prescribed in KDB 248227 is to save time and not test unnecessarily for a very large number of channels.

SAR test reduction method was also applied to 5GHz channels. Since their SAR value was less than 0.8 W/kg, no further modes were tested for SAR.

802.11 b (DSSS) - 20MHz Bandwidth	
Channels	**1/6/11**
Power (dBm)	17.95/20.62/21.02

Table 6: 802.11b 2.4 GHz conducted power measurements, Port A

802.11 b (DSSS) - 20MHz Bandwidth	
Channels	**1/6/11**
Power (dBm)	18.41/22.38/22.2

Table 7: 802.11b 2.4 GHz conducted power measurements, Port B

Note 1: Reported antenna gain is zero.

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Note 2: Cable loss and duty cycle correction factors are negligible.

802.11 OFDM Modes	g	n (HT)	
Bandwidth (MHz)	20	20	40
Channels	1/6/11	1/6/11	3/6/11
Power (dBm)	16.59/20.26/19.73	15.04/19.84/20.05	16.3/17.18/16.46

Table 8: 802.11g, n 2.4 GHz conducted power measurements, Port A

802.11 OFDM Modes	g	n (HT)	
Bandwidth (MHz)	20	20	40
Channels	1/6/11	1/6/11	3/6/11
Power (dBm)	16.98/21.47/21.16	16.21/21.1/17.1	12.9/18.38/6.28

Table 9: 802.11g, n 2.4 GHz conducted power measurements, Port B

Bluetooth	Channels	Power (dBm)
DH1	0/39/78	7.85/8.26/6.3
BLE	0/19/39	7.68/8.68/5.69

Table 10: Bluetooth conducted power measurements.

Note 1: Reported antenna gain is zero.
Note 2: Cable loss and duty cycle correction factors are negligible.

Maximum output power measured at the port A							
802.11 Modes		**a**	**n**		**ac**		
CH BW(MHz)		**20**	**20**	**40**	**20**	**40**	**80**
U-NII-1	CH#	**36/44/48**	**44/48**	**38/46**	**44/48**	**46**	**42**
	Power (dBm)	21.69/19.65/22.44	21.05/20.26	22.2/19.82	20.78/20.2	20.58	18.44
U-NII-2A	CH#	**52/56/64**	**52/56/64**	**54/62**	**52/56/64**	**54/62**	**58**
	Power (dBm)	20.53/19.67/20.21	20.7/19.85/20.08	20.94/21.47	20.46/20.36/19.99	20.76/20.79	22.03
U-NII-2C	CH#	**100/112/140**	**100/112/140**	**102/110/134**	**100/112/140**	**102/110/134**	**106**
	Power (dBm)	19.79/19.61/20.16	19.52/19.0/20.53	20.87/20.98/20.75	19.63/20.41/20.32	20.57/20.54/21.01	21.18
U-NII-3	CH#	**149/157/165**	**149/157/165**	**151/159**	**149/157**	**151**	**155**
	Power (dBm)	20.75/20.36/20.55	20.81/20.5/20.62	22.61/21.00	21.02/20.85	20.93	20.74

Table 11: 802.11a, n, ac 5 GHz conducted power measurements, Port A

Maximum output power measured at the port B							
802.11 Modes		**a**	**n**		**ac**		
CH BW(MHz)		**20**	**20**	**40**	**20**	**40**	**80**
U-NII-1	CH#	**36/44/48**	**44/48**	**38/46**	**44/48**	**46**	**42**
	Power (dBm)	19.22/19.65/20.68	20.58/20.69	21.04/21.65	19.15/21.21	19.98	20.39
U-NII-2A	CH#	**52/56/64**	**52/56/64**	**54/62**	**52/56/64**	**54/62**	**58**
	Power (dBm)	23.06/22.92/23.03	22.71/23.02/22.74	21.52/22.84	21.09/23.02/22.79	21.63/21.02	20.87
U-NII-2C	CH#	**100/112/140**	**100/112/140**	**102/110/134**	**100/112/140**	**102/110/134**	**106**
	Power (dBm)	22.52/22.13/21.26	21.63/22.3/21.56	21.72/22.67/22.16	21.5/21.37/21.44	21.08/22.48/21.79	21.78
U-NII-3	CH#	**149/157/165**	**149/157/165**	**151/159**	**149/157**	**151**	**155**
	Power (dBm)	21.63/20.57/21.04	21.78/21.65/21.09	20.9/22.47	20.94/21.56	22.37	21.81

Table 12: 802.11a, n, ac 5 GHz conducted power measurements, Port B

Note 1: Reported antenna gain is zero.
Note 2: Cable loss and duty cycle correction factors are negligible.

5 DETAILS OF SAR EVALUATION

The Vuzix M300 was determined to be compliant for localized Specific Absorption Rate based on the test provisions and conditions described below.

1. The EUT was tested for SAR on the head section of the phantom at 0 cm separation distance.

2. DSSS and OFDM signals were supplied to the antennas of each module at a power lever equal to that of normal operation.

3. Spectrum analyzer was used to measure the conducted output power before the SAR tests. The power drift measurement routine of the SAR system was used to determine if the power of the EUT stayed within the allowable limits.

4. The dielectric parameters of the simulated head 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^{o}C of the temperature of the fluid when the dielectric properties were measured.

6. During the SAR evaluations if a distribution produced several hotspots over the course of the area scan, each hotspot was evaluated separately.

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5.1 FLOWCHART OF THE RECOMMENDED PRACTICES AND PROCEDURES

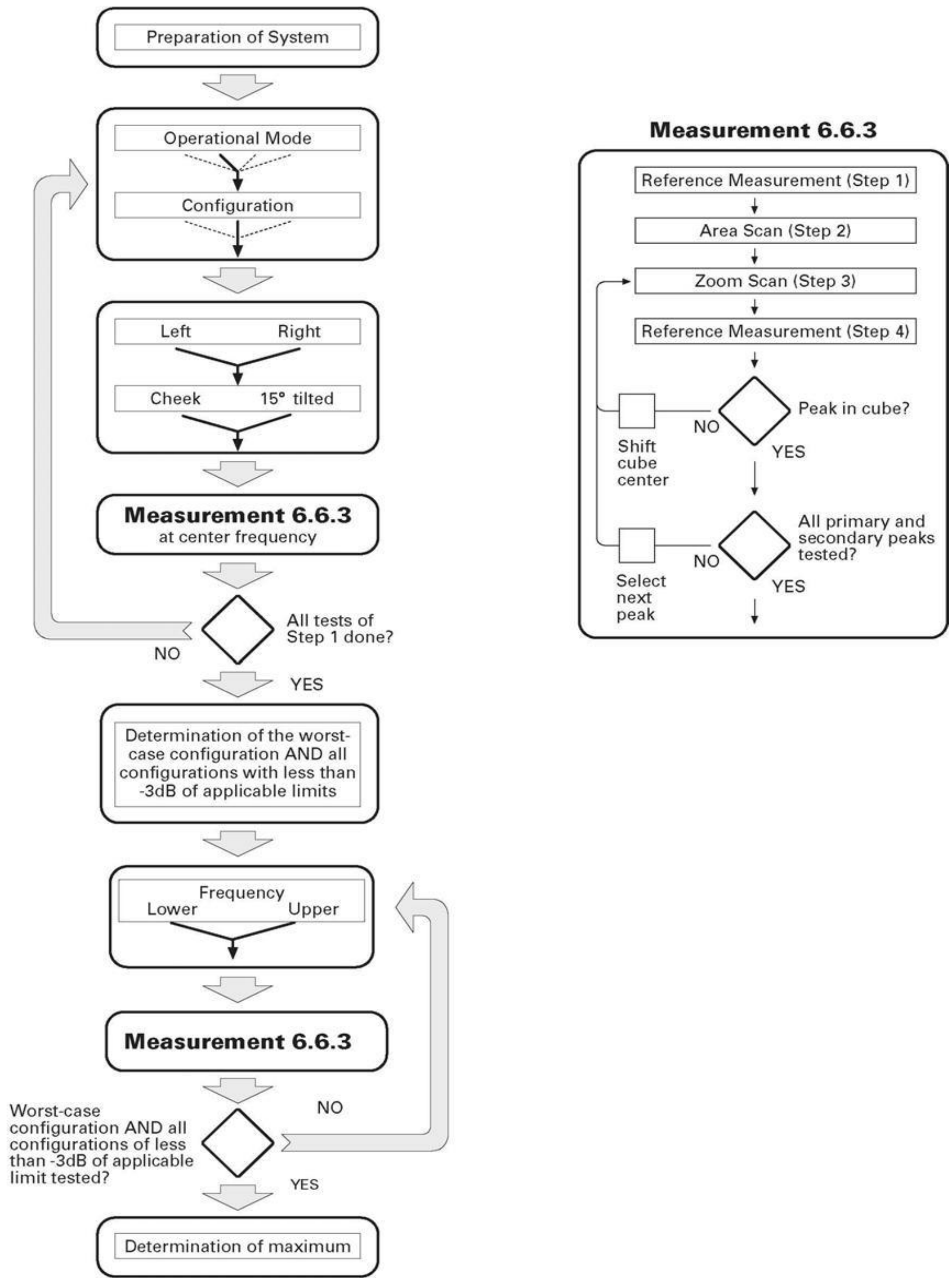

Figure 2: Flowchart of the recommended practices and procedures

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5.2 EAR REFERENCE POINTS

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 3: Front, back and side view of SAM Twin Phantom

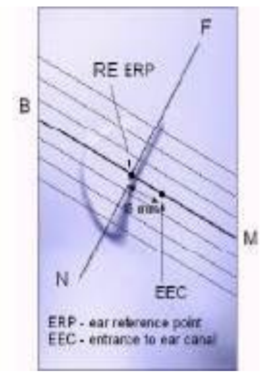

Figure 4: Side view of ERPs

5.3 EVALUATION PROCEDURES

The evaluation was performed in the head area of the phantom in both left and right sides. 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 10mm x 10mm.

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.

5.4 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:

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

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

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.

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

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

5.5 SAR SAFETY LIMITS

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

Table 13: SAR safety limits for FCC.

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.

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6 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed in the planar section of the SAM phantom with a 2450MHz dipole and 5000MHz dipole. The dielectric parameters of the simulated brain fluid and body were measured prior to the system performance check using an 85070D Dielectric Probe Kit and an 8722D Network Analyzer. A forward power of 250 mW for 2.4 GHz and 100 mW for 5GHz was applied to the dipole and the system was verified to a tolerance of ±10%.

Test Date	Fluid Type (MHz)	SAR 1g (W/kg)		Permittivity Constant εr		Conductivity σ (mho/m)	
		Calibrated Target	Measured	IEEE Target	Measured	IEEE Target	Measured
11/28/2016	2450 head	13.3 ±10%	13.9	39.2 ±10%	38.51	1.80 ±10%	1.89
11/29/2016	5200 head	7.8 ±10%	7.96	36.0 ±10%	34.79	4.66 ±10%	4.54
11/29/2016	5500 head	8.38 ±10%	8.50	35.6 ±10%	34.55	4.96 ±10%	5.01
11/29/2016	5800 head	8.05 ±10%	8.19	35.3 ±10%	34.20	5.27 ±10%	5.34

Table 14: System performance and head simulating fluid parameter check results

Note1: The ambient temperature, 23^{o}C, and the fluid temperatures, 22^{o}C were measured prior to the fluid parameter check and the system performance check and kept consistent during the measurement periods.
Note2: Fluid Depth was ≥15 cm.

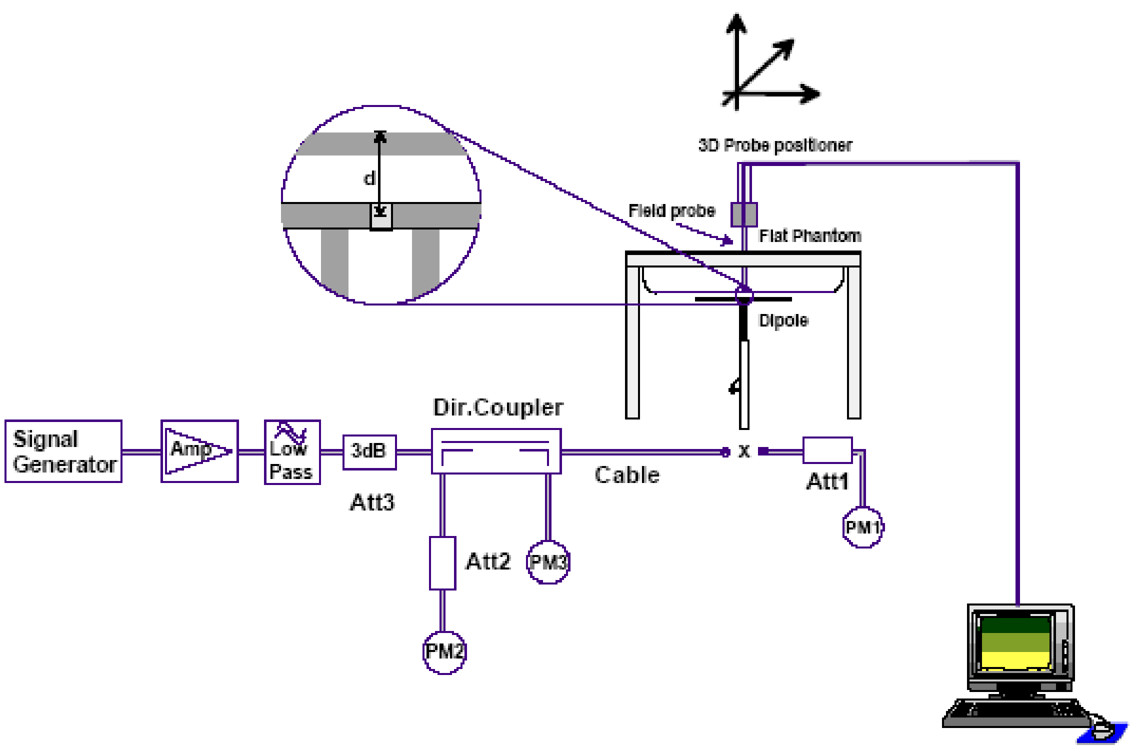

Figure 5: System performance check components

7 SIMULATED EQUIVALENT TISSUE

For the measurement of the field distribution inside the SAM phantom with DASY4, the phantom must be filled with 25 liters of homogeneous head simulating liquid. Target dielectric parameters for the head simulating liquid at 2450 MHz are defined in the standards for compliance testing (e.g CENELEC EN50361, IEEE P1528)

Liquid Type	**HSL 2450-B**	
Ingredient	Weight (g)	Weight (%)
Water	550.00	55.00
DGBE	450.00	45.00
Salt	0.00	0.00
Total amount	1000.00	100.00
Goal Dielectric Parameters		
Frequency (MHz)	2450	
Relative Permittivity	39.20	
Conductivity (S/m)	1.80	

Table 15: Recipe for head tissue simulating fluid for 2450 MHz.

The 2.4 GHz fluids for head tissue simulation were prepared in-house. For 5 GHz range head tissue simulating fluids were obtained directly from SPEAG.

8 ROBOT SYSTEM SPECIFICATIONS

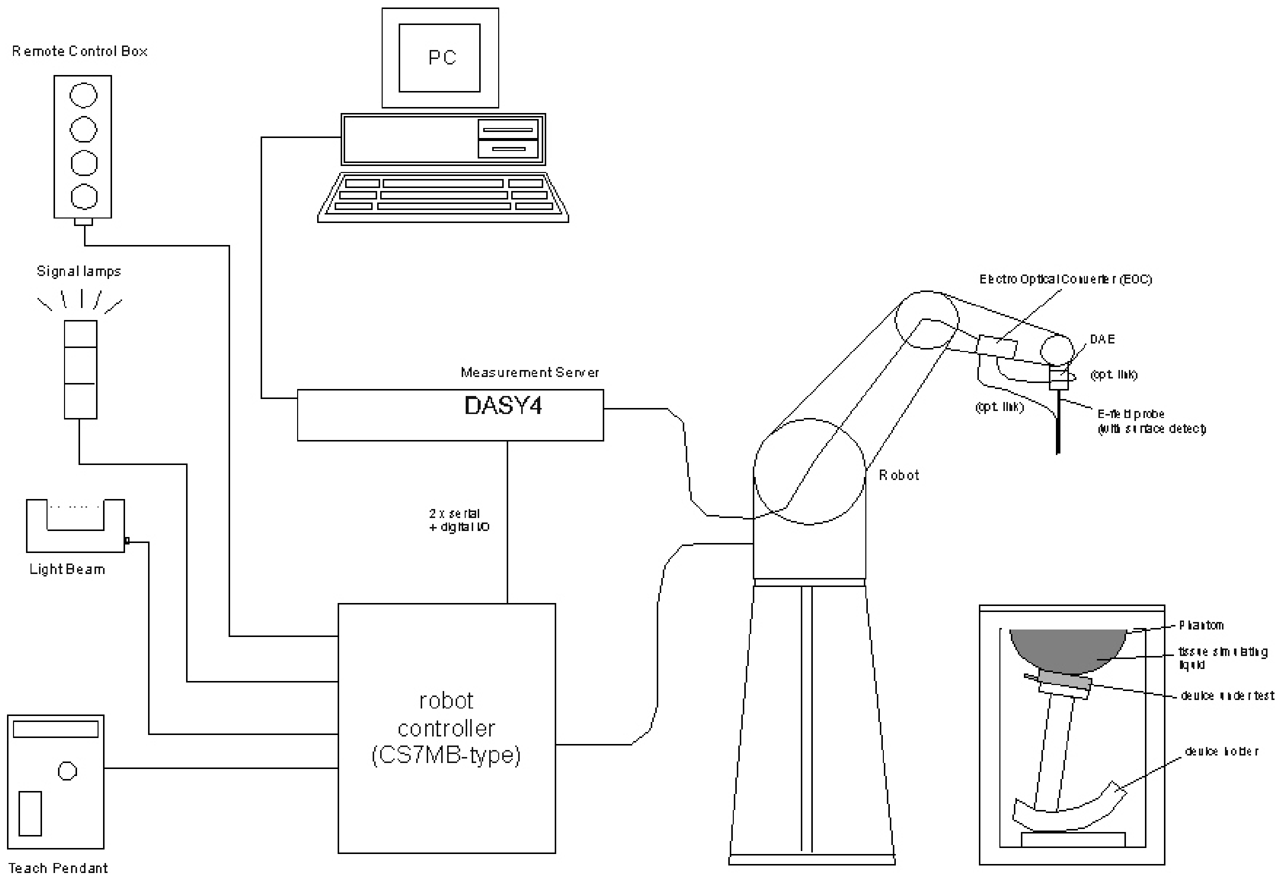

Figure 6: SAR Measurement System

8.1 Specifications

Positioner:

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

8.2 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)

8.3 Phantom(s):

Validation & Evaluation Phantom

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

8.4 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).

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8.5 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.

8.6 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.

Figure 7: Light beam switch

8.7 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.

Figure 8: Data acquisition electronics

8.8 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.

Figure 9: Electro optical converter

8.9 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.

Figure 10: DASY4 measurement server

8.10 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.

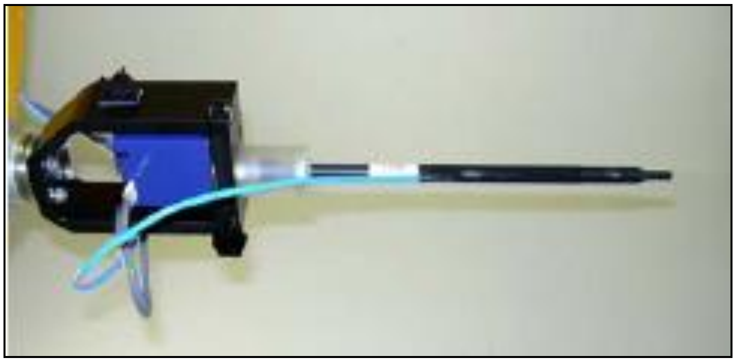

Figure 11: Electric field probe

8.11 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).

Figure 12: Specific anthropomorphic mannequin twin phantom

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.

8.12 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.

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Figure 13: Planner phantom

8.13 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.

8.14 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 $\varepsilon = 3$ and loss tangent $\delta = 0.02$. 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.

Figure 14: Device holder

8.15 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

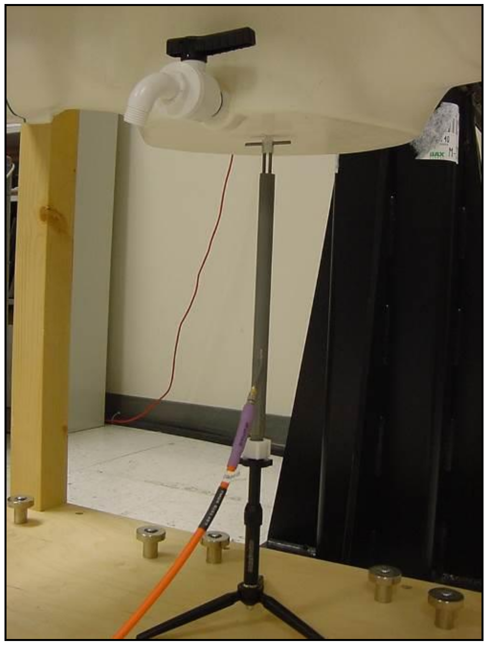

Figure 15: System validation using dipole antenna

9 TEST EQUIPMENT LIST

Test Equipment	Serial Number	Calibration Date	Calibration Due
DASY4 System Robot RX90	FO3/SX19A1/A/01	N/A	NA
EX3DV4	3722	9/23/2016	9/23/2017
DAE	584	9/21/2016	9/21/2017
2450MHz Dipole	857	9/23/2016	9/23/2017
5000Mhz Dipole	1S2571	9/20/2016	9/20/2017
SAM Phantom V4.0C	N/A	N/A	NA
Keysight Vector Signal Generator	1S3905	3/30/2015	3/30/2017
EMCO Horn Antenna	1S2208	Functional Verification	
Agilent E4407B Spectrum Analyzer	1S2607	3/23/2016	3/23/2017
Agilent 8722D Network Analyzer	1S2272	9/3/2015	3/3/2017
Extech Power Supply (30 VDC)	4S3771	Functional Verification	
Mini-Circuits power amplifier	1S2447	Functional Verification	
Agilent power meter	1S2276	10/22/2015	4/22/2017
Mini-Circuits USB power sensor	1S3838	06/29/2015	12/29/2016
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 (stand)	1T4366	04/30/2015	12/29/2016

Table 16: Test equipment list details.

9.1 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
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			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
Combined Standard Uncertainty (k=1)		RSS				10.3	10.0	
Expanded Uncertainty (k=2) 95% Confidence Level						20.6	20.1	

Table 17: 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.

9.2 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	∞
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	∞
Combined Standard Uncertainty						9.2	8.9	
Coverage Factor for 95%		kp=2						
Expanded Uncertainty						18.4	17.8	

Table 18: 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.

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11 EUT TEST SETUP PHOTOS

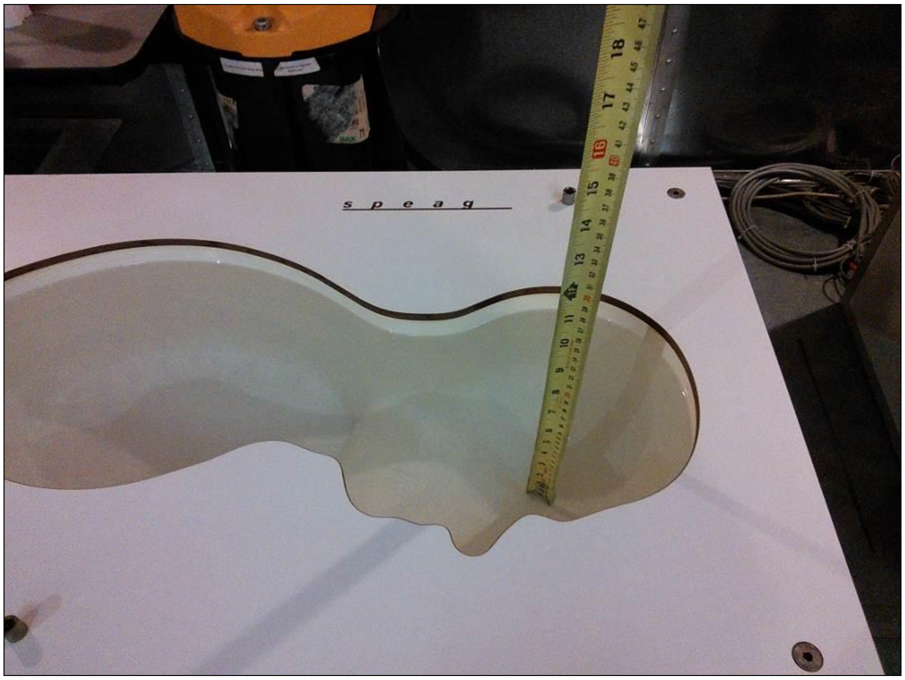


Figure 16: 2.4GHz head tissue simulating fluid

Figure 17: 5GHz head tissue simulating fluid

ANNEX A 2.4 GHz SAR MEASUREMENT DATA

802.11b-20MHz Ch11 Left Head Port A

Date/Time: 11/28/2016 12:26:40 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: DSSS; ; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used: f = 2462 MHz; σ = 1.9 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Left Section

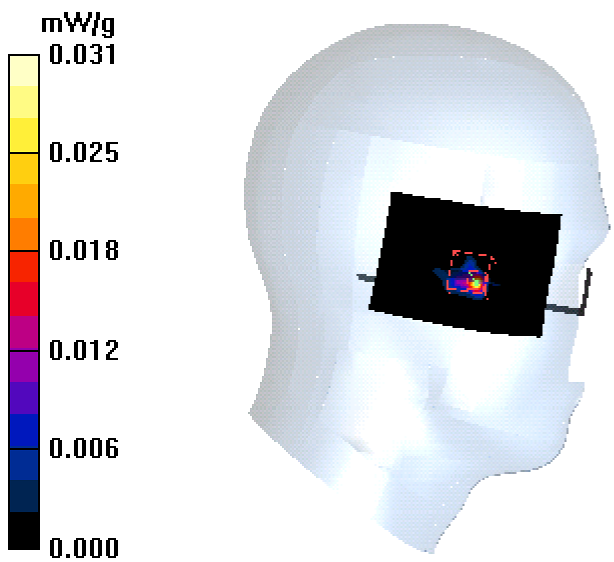
- Probe: EX3DV4 - SN3722; ConvF(6.9, 6.9, 6.9); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.031 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.714 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 0.017 W/kg
SAR(1 g) = 0.00664 mW/g
Maximum value of SAR (measured) = 0.011 mW/g



802.11b-20MHz Ch11 Right Head Port A

Date/Time: 11/28/2016 9:49:22 AM

DUT: M300 Vuzix Smart Glasses;

Communication System: DSSS; ; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used: f = 2462 MHz; σ = 1.9 mho/m; ε_r = 38.4; ρ = 1000 kg/m^3
Phantom section: Right Section

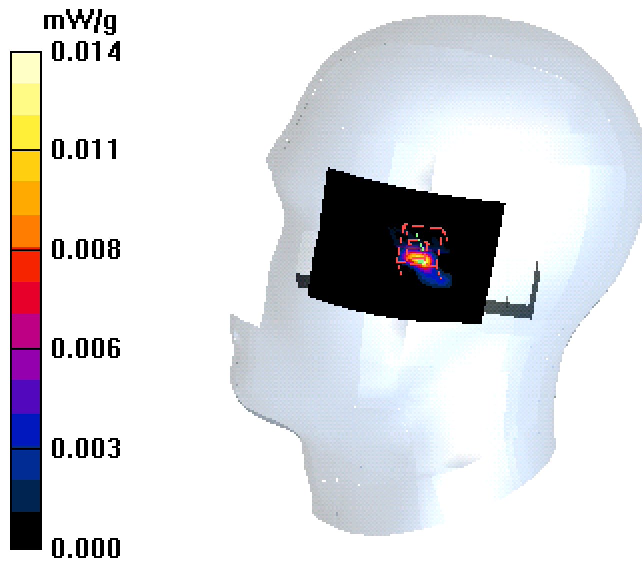
- Probe: EX3DV4 - SN3722; ConvF(6.9, 6.9, 6.9); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (81x61x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.014 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.795 V/m; Power Drift = 0.035 dB
Peak SAR (extrapolated) = 0.016 W/kg
SAR(1 g) = 0.0056 mW/g
Maximum value of SAR (measured) = 0.010 mW/g



802.11b-20MHz Ch6 Left Head Port B

Date/Time: 11/28/2016 11:03:28 AM

DUT: M300 Vuzix Smart Glasses;

Communication System: DSSS; ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used: f = 2437 MHz; σ = 1.88 mho/m; ε_r = 38.5; ρ = 1000 kg/m^3
Phantom section: Left Section

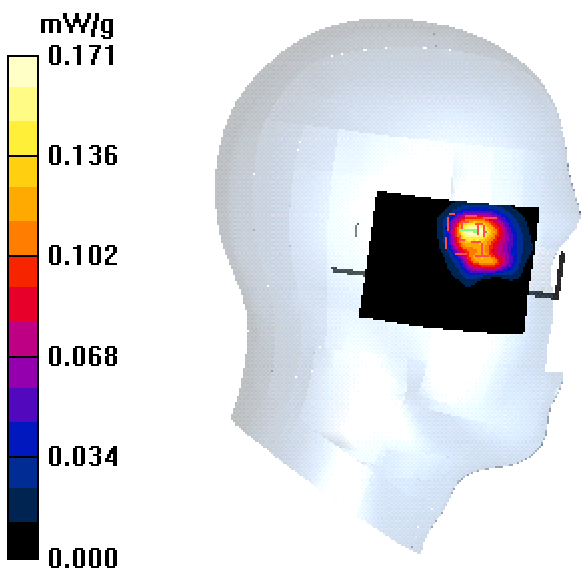
- Probe: EX3DV4 - SN3722; ConvF(6.9, 6.9, 6.9); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (81x61x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.171 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.29 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 0.248 W/kg
SAR(1 g) = 0.111 mW/g
Maximum value of SAR (measured) = 0.183 mW/g



802.11b-20MHz Ch6 Right Head Port B

Date/Time: 11/28/2016 10:34:08 AM

DUT: M300 Vuzix Smart Glasses;

Communication System: DSSS; ; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used: f = 2437 MHz; σ = 1.88 mho/m; ε_r = 38.5; ρ = 1000 kg/m^3
Phantom section: Right Section

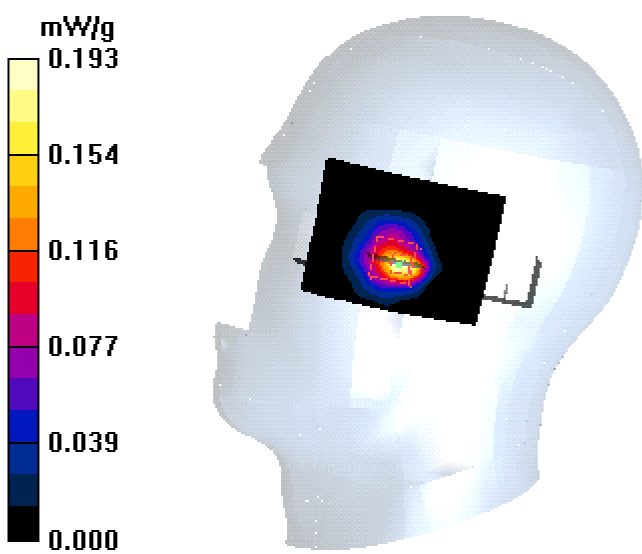
- Probe: EX3DV4 - SN3722; ConvF(6.9, 6.9, 6.9); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (81x61x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.193 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.01 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 0.277 W/kg
SAR(1 g) = 0.113 mW/g
Maximum value of SAR (measured) = 0.181 mW/g



ANNEX B 5.0 GHz SAR MEASUREMENT DATA

802.11n 40MHz Ch-38 Left Head A

Date/Time: 11/29/2016 1:33:08 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5190 MHz;Duty Cycle: 1:1
Medium: HSL5190 Medium parameters used: f = 5190 MHz; $\sigma = 4.53$ mho/m; $\varepsilon_r = 34.7$; $\rho = 1000$ kg/m^3
Phantom section: Left Section

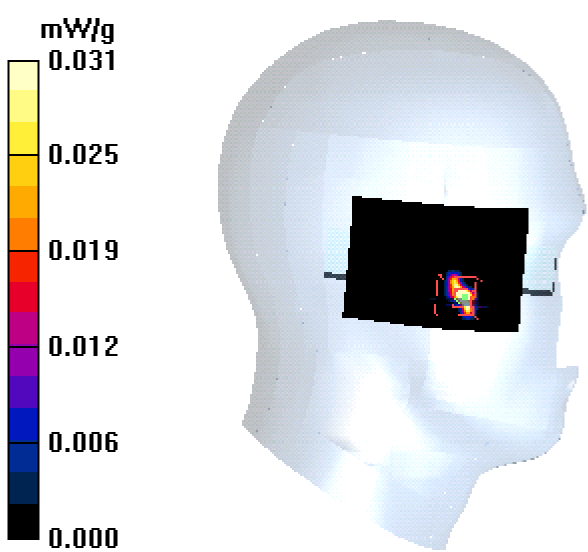
- Probe: EX3DV4 - SN3722; ConvF(5.08, 5.08, 5.08); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.062 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.59 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 0.089 W/kg
SAR(1 g) = 0.013 mW/g
Maximum value of SAR (measured) = 0.031 mW/g



802.11n 40MHz Ch-38 Right Head A

Date/Time: 11/29/2016 5:10:28 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5190 MHz;Duty Cycle: 1:1
Medium: HSL5190 Medium parameters used: f = 5190 MHz; σ = 4.53 mho/m; ε_r = 34.7; ρ = 1000 kg/m^3
Phantom section: Right Section

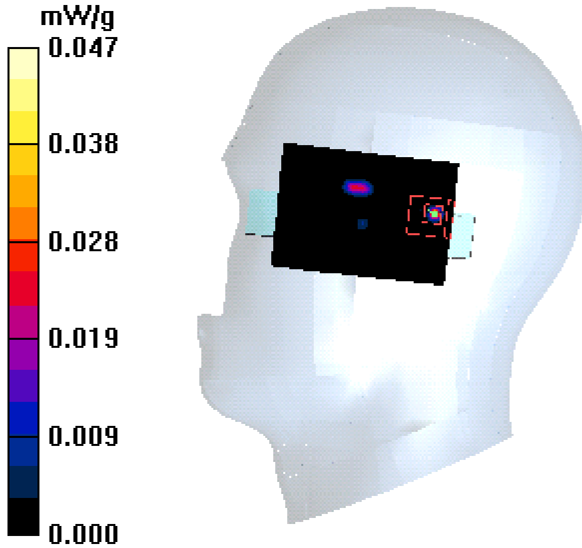
- Probe: EX3DV4 - SN3722; ConvF(5.08, 5.08, 5.08); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.047 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.580 V/m; Power Drift = 0.20 dB
Peak SAR (extrapolated) = 0.118 W/kg
SAR(1 g) = 0.018 mW/g
Maximum value of SAR (measured) = 0.047 mW/g



802.11n 40MHz Ch-58 Left Head A

Date/Time: 11/30/2016 12:08:01 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5290 MHz;Duty Cycle: 1:1
Medium: HSL5270 Medium parameters used: f = 5290 MHz; σ = 4.64 mho/m; ε_r = 34.5; ρ = 1000 kg/m^3
Phantom section: Left Section

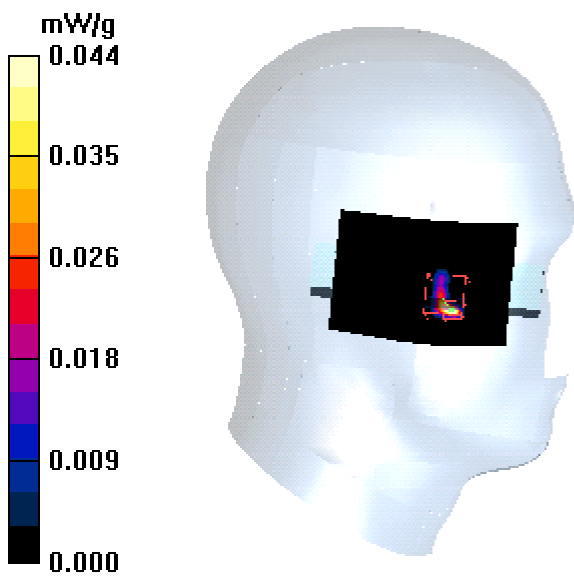
- Probe: EX3DV4 - SN3722; ConvF(4.78, 4.78, 4.78); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.061 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.33 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.120 W/kg
SAR(1 g) = 0.016 mW/g
Maximum value of SAR (measured) = 0.044 mW/g



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802.11n 40MHz Ch-58 Right Head A

Date/Time: 11/30/2016 1:17:46 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5290 MHz;Duty Cycle: 1:1
Medium: HSL5270 Medium parameters used: f = 5290 MHz; σ = 4.64 mho/m; ε_r = 34.5; ρ = 1000 kg/m^3
Phantom section: Right Section

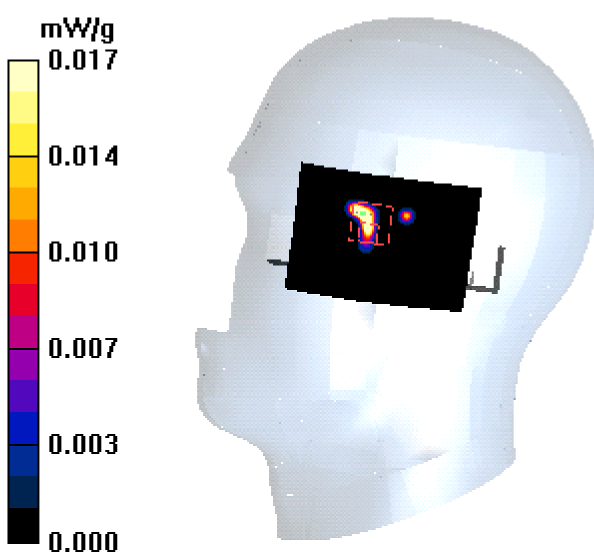
- Probe: EX3DV4 - SN3722; ConvF(4.78, 4.78, 4.78); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.035 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.52 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 0.026 W/kg
SAR(1 g) = 0.00228 mW/g
Maximum value of SAR (measured) = 0.017 mW/g



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802.11n 40MHz Ch-106 Left Head A

Date/Time: 11/29/2016 2:05:58 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5530 MHz;Duty Cycle: 1:1
Medium: HSL5510 Medium parameters used: f = 5530 MHz; σ = 5.05 mho/m; ε_r = 34.5; ρ = 1000 kg/m^3
Phantom section: Left Section

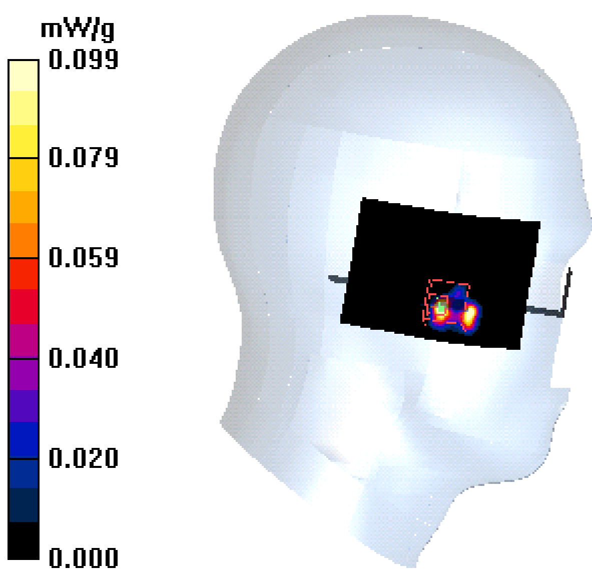
- Probe: EX3DV4 - SN3722; ConvF(4.62, 4.62, 4.62); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.171 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.34 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 0.253 W/kg
SAR(1 g) = 0.034 mW/g
Maximum value of SAR (measured) = 0.099 mW/g



802.11n 40MHz Ch-106 Right Head A

Date/Time: 11/29/2016 4:41:24 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5530 MHz;Duty Cycle: 1:1
Medium: HSL5510 Medium parameters used: f = 5530 MHz; σ = 5.05 mho/m; ε_r = 34.5; ρ = 1000 kg/m^3
Phantom section: Right Section

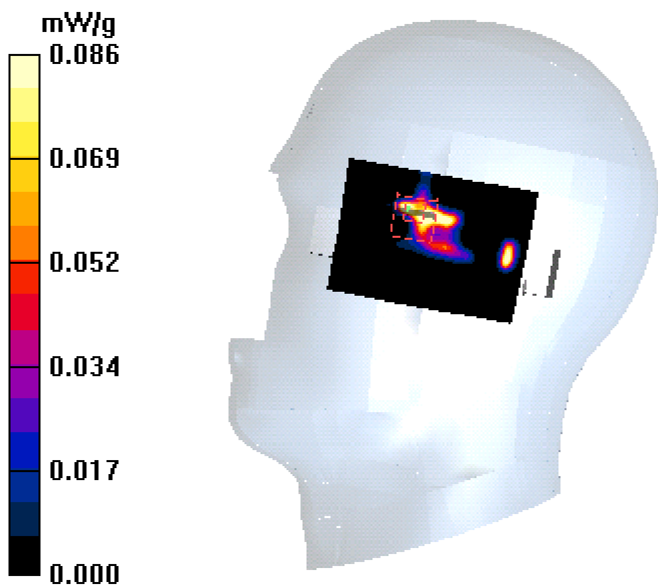
- Probe: EX3DV4 - SN3722; ConvF(4.62, 4.62, 4.62); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.128 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.631 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 0.221 W/kg
SAR(1 g) = 0.033 mW/g
Maximum value of SAR (measured) = 0.086 mW/g



802.11n 40MHz Ch-151 Left Head A

Date/Time: 11/30/2016 11:36:58 AM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5755 MHz;Duty Cycle: 1:1
Medium: HSL5755 Medium parameters used: f = 5755 MHz; σ = 5.3 mho/m; ε_r = 34.2; ρ = 1000 kg/m^3
Phantom section: Left Section

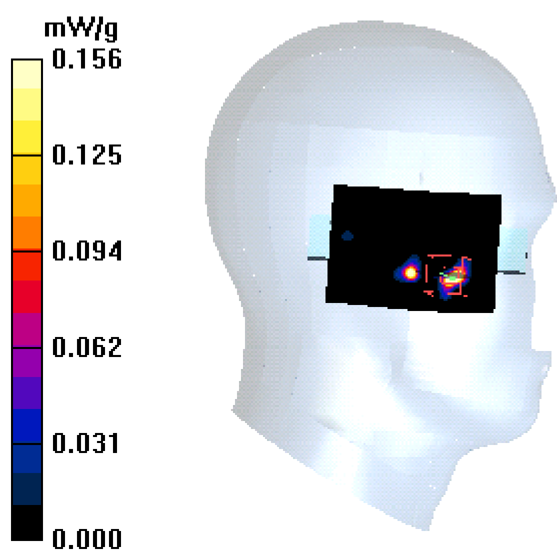
- Probe: EX3DV4 - SN3722; ConvF(4.34, 4.34, 4.34); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.275 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.05 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.390 W/kg
SAR(1 g) = 0.057 mW/g
Maximum value of SAR (measured) = 0.156 mW/g



802.11n 40MHz Ch-151 Right Head A

Date/Time: 11/30/2016 9:47:01 AM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5755 MHz;Duty Cycle: 1:1
Medium: HSL5755 Medium parameters used: f = 5755 MHz; $\sigma = 5.3$ mho/m; $\varepsilon_r = 34.2$; $\rho = 1000$ kg/m^3
Phantom section: Right Section

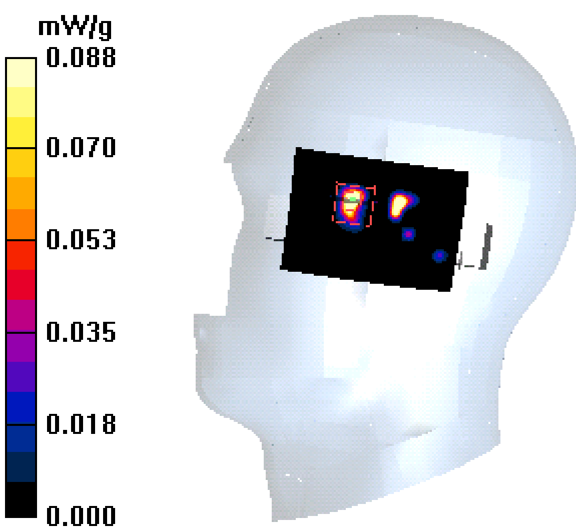
- Probe: EX3DV4 - SN3722; ConvF(4.34, 4.34, 4.34); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.232 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.27 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.230 W/kg
SAR(1 g) = 0.034 mW/g
Maximum value of SAR (measured) = 0.088 mW/g



802.11a 20MHz Ch-46 Left Head B

Date/Time: 11/29/2016 2:55:34 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5230 MHz;Duty Cycle: 1:1
Medium: HSL5180 Medium parameters used: f = 5230 MHz; $\sigma = 4.53$ mho/m; $\varepsilon_r = 34.7$; $\rho = 1000$ kg/m^3
Phantom section: Left Section

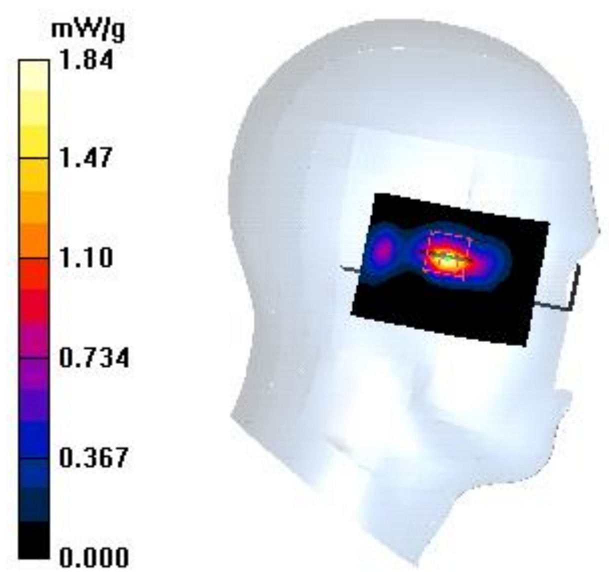
- Probe: EX3DV4 - SN3722; ConvF(5.08, 5.08, 5.08); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.84 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.5 V/m; Power Drift = 0.002 dB
Peak SAR (extrapolated) = 3.16 W/kg
SAR(1 g) = 0.792 mW/g
Maximum value of SAR (measured) = 1.64 mW/g



802.11a 20MHz Ch-46 Right Head B

Date/Time: 11/29/2016 3:27:36 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5230 MHz;Duty Cycle: 1:1
Medium: HSL5180 Medium parameters used: f = 5230 MHz; σ = 4.53 mho/m; ε_r = 34.7; ρ = 1000 kg/m^3
Phantom section: Right Section

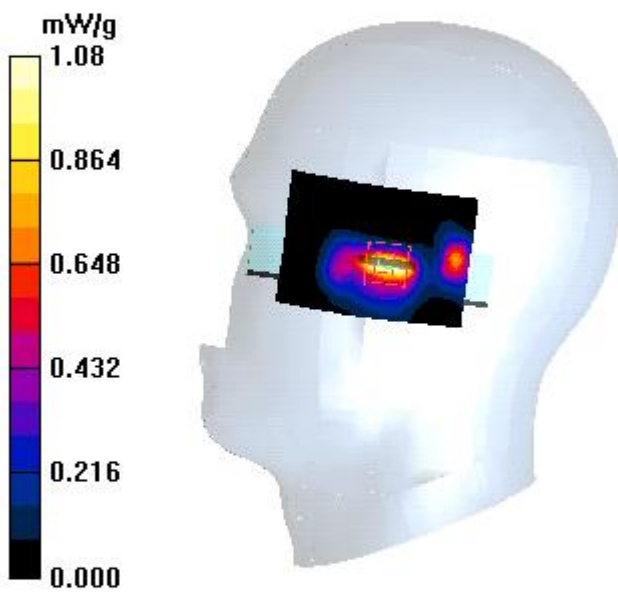
- Probe: EX3DV4 - SN3722; ConvF(5.08, 5.08, 5.08); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.17 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.51 V/m; Power Drift = 0.044 dB
Peak SAR (extrapolated) = 2.17 W/kg
SAR(1 g) = 0.571 mW/g
Maximum value of SAR (measured) = 1.08 mW/g



802.11n 40MHz Ch-52 Left Head B

Date/Time: 11/30/2016 12:30:40 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5260 MHz;Duty Cycle: 1:1
Medium: HSL5270 Medium parameters used: f = 5260 MHz; $\sigma = 4.53$ mho/m; $\varepsilon_r = 34.6$; $\rho = 1000$ kg/m^3
Phantom section: Left Section

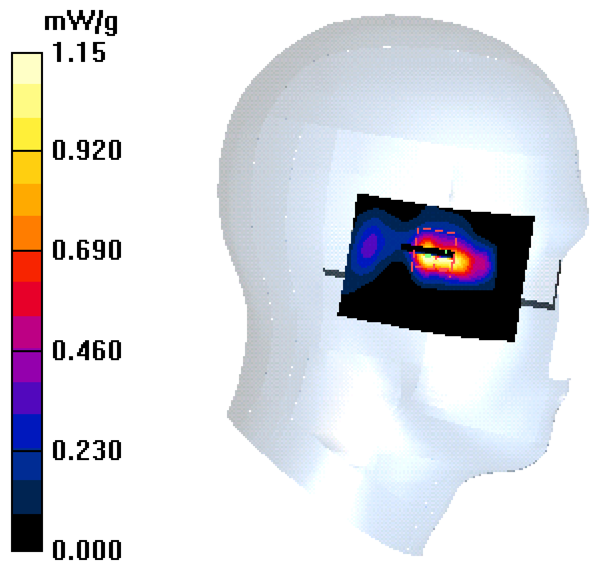
- Probe: EX3DV4 - SN3722; ConvF(4.78, 4.78, 4.78); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.27 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.61 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 2.24 W/kg
SAR(1 g) = 0.592 mW/g
Maximum value of SAR (measured) = 1.15 mW/g



802.11n 40MHz Ch-52 Right Head B

Date/Time: 11/30/2016 12:55:47 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5260 MHz;Duty Cycle: 1:1
Medium: HSL5270 Medium parameters used: f = 5260 MHz; $\sigma = 4.53$ mho/m; $\varepsilon_r = 34.6$; $\rho = 1000$ kg/m^3
Phantom section: Right Section

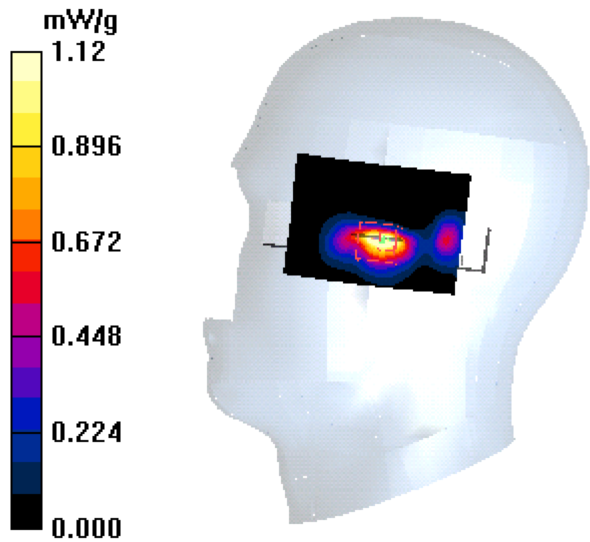
- Probe: EX3DV4 - SN3722; ConvF(4.78, 4.78, 4.78); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.46 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.41 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 2.26 W/kg
SAR(1 g) = 0.583 mW/g
Maximum value of SAR (measured) = 1.12 mW/g



802.11n 40MHz Ch-110 Left Head B

Date/Time: 11/29/2016 2:28:54 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5550 MHz;Duty Cycle: 1:1
Medium: HSL5510 Medium parameters used: f = 5550 MHz; σ = 5.05 mho/m; ε_r = 34.5; ρ = 1000 kg/m^3
Phantom section: Left Section

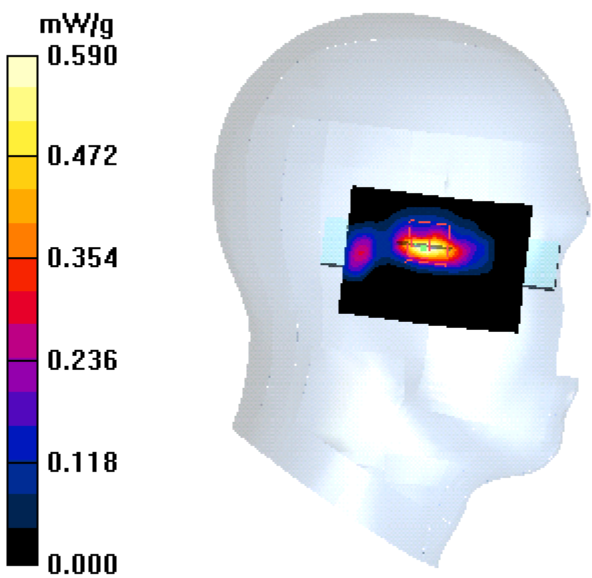
- Probe: EX3DV4 - SN3722; ConvF(4.62, 4.62, 4.62); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.630 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.32 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 0.932 W/kg
SAR(1 g) = 0.292 mW/g
Maximum value of SAR (measured) = 0.590 mW/g



802.11n 40MHz Ch-110 Right Head B

Date/Time: 11/29/2016 4:09:59 PM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5550 MHz;Duty Cycle: 1:1
Medium: HSL5510 Medium parameters used: f = 5550 MHz; σ = 5.02 mho/m; ε_r = 34.5; ρ = 1000 kg/m^3
Phantom section: Right Section

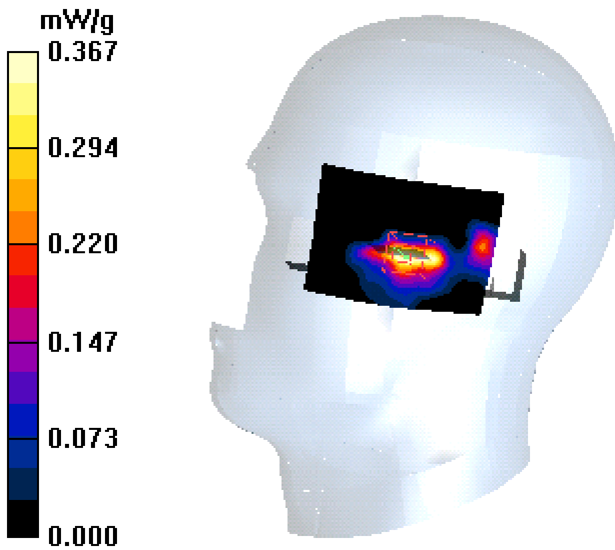
- Probe: EX3DV4 - SN3722; ConvF(4.62, 4.62, 4.62); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.415 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.36 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.598 W/kg
SAR(1 g) = 0.173 mW/g
Maximum value of SAR (measured) = 0.367 mW/g



802.11a 20MHz Ch-159 Left Head B

Date/Time: 11/30/2016 11:09:07 AM

DUT: M300 Vuzix Smart Glasses;

Communication System: OFDM; ; Frequency: 5795 MHz;Duty Cycle: 1:1
Medium: HSL5805 Medium parameters used: f = 5795 MHz; $\sigma = 5.35$ mho/m; $\varepsilon_r = 34.2$; $\rho = 1000$ kg/m^3
Phantom section: Left Section

- Probe: EX3DV4 - SN3722; ConvF(4.34, 4.34, 4.34); Calibrated: 9/23/2016
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/21/2016
- 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 (101x71x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.316 mW/g

Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.21 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.657 W/kg
SAR(1 g) = 0.117 mW/g
Maximum value of SAR (measured) = 0.269 mW/g