The Testcenter facility ‘Dosimetric Test Lab’ within IMST GmbH is accredited by the German National ‘Deutsche Akkreditierungsstelle GmbH (DAkkS)’ for testing according to the scope as listed in the accreditation certificate: D-PL-12139-01-01.

Appendix to SAR Report

(SAR_Report_Nemko_60320_6130012_FCC_Body_2.4GHz_VictorReader_V2)

Dosimetric Assessment of the Victor Reader Stream from HumanWare (FCC ID: XT5503VRC) (IC: 8670A-503VRC)

According to the FCC Requirements

November 19, 2013

IMST GmbH

Carl-Friedrich-Gauß-Str. 2

D-47475 Kamp-Lintfort

Customer

HumanWare

445, Rue Du Parc-Industriel

Longueuil, (Quebec)

Canada J4H 3V7

Executive Summary

The device Victor Reader Stream is a new handheld media player from HumanWare operating in the 2450 MHz frequency range. The device has an integrated antenna and the system concepts used are the IEEE 802.11 b/g/n standards. There is no simultaneous transmission mode available.

The objective of the measurements done by IMST was the dosimetric assessment of one device in body worn configuration in the IEEE 802.11 b/g/n standards. Since there was a special test software available, SAR tests in IEEE 802.11 b/g/n are conducted with a specific channel, bandwidth and maximum output power. The device was tested in two positions. Position one with the housing of the handheld (with headphones and microphone) in direct contact against the flat phantom and position two in PTT configuration (with attached headphones). The examinations have been carried out with the dosimetric assessment system „DASY4“.

The measurements were made according to the 47 CFR § 2.1093 [47CFR] for evaluating compliance of mobile and portable devices with FCC limits for human exposure (general population) to radiofrequency emissions, IEEE 1528-2003 [IEEE1528-2003] and IC RSS 102 Issue 4.

Additional information and guidelines given by the following FCC documents were used:

- SAR Measurement Requirements for 100 MHz to 6 GHz [KDB 865664 D01 v01r01]
- Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies [KDB 447498 D01 v05r01]
- SAR Measurement Procedures for 802.11 a/b/g Transmitters [KDB 248227]

All measurements have been performed in accordance to the recommendations given by SPEAG.

Compliance Statement

The portable device Victor Reader Stream from HumanWare (FCC ID: XT5503VRC, IC: 8670A-503VRC) is in compliance with the following standards for uncontrolled exposure:

- **47 CFR § 2.1093 [47CFR]**
- **IC RSS 102 Issue 4 [RSS 102],**
- **IEEE Std. C95.1 - 1999 [C95.1-1999],**
- **IEEE Std. C95.3 - 2002 [C95.3-2002],**
- **IEEE 1528-2003 [IEEE 1528-2003],**
- **The latest version of all relevant FCC OET KDB Procedures**

In addition to the original SAR report:

“SAR_Report_Nemko_60320_6130012_FCC_Body_2.4GHz_VictorReader_V2”

IMST has conducted SAR assessment for the following configurations:

- **Body worn (worst case channel) with attached headphones and microphone**
- **PTT configuration with attached headphones, 25 mm distance**

The maximum results of SAR for the above mentioned configurations for the Victor Reader Stream are as follows:

Test Position	Frequency Band	Channel	Accessory	Position	Highest Reported SAR_{1g} [W/kg]
Body Worn	IEEE 802.11 b	1	Headphones + Microphone	1 (Fig. 12)	0.671

prepared by: .... reviewed by: ....

Alexander Rahn
test engineer

André van den Bosch
quality assurance engineer

Table of Contents

1 Subject of Investigation

The device Victor Reader Stream is a new handheld media player from HumanWare operating in the 2450 MHz frequency range. The device has an integrated antenna and the system concepts used are the IEEE 802.11 b/g/n standards. There is no simultaneous transmission mode available.

Fig. 1: Pictures of the device under test.

The objective of the measurements done by IMST was the dosimetric assessment of one device in body worn configuration in the IEEE 802.11 b/g/n standards. Since there was a special test software available, SAR tests in IEEE 802.11 b/g/n are conducted with a specific channel, bandwidth and maximum output power. The device was tested in two positions. Position one with the housing of the handheld (with headphones and microphone) in direct contact against the flat phantom and position two in PTT configuration (with attached headphones). The examinations have been carried out with the dosimetric assessment system „DASY4“.

2 The IEEE Standard C95.1 and the FCC Exposure Criteria

In the USA the FCC exposure criteria [KDB 865664] are based on the withdrawn IEEE Standard C95.1-1999 [IEEE C95.1-1999]. This version was replaced by the IEEE Standard C95.1-2005 [IEEE C95.1-2005] in October, 2005.

Both IEEE standards sets limits for human exposure to radio frequency electromagnetic fields in the frequency range 3 kHz to 300 GHz. One of the major differences in the newly revised C95.1-2005 is the change in the basic restrictions for localized exposure, from 1.6 W/kg averaged over 1 g tissue to 2.0 W/kg averaged over 10 g tissue, which is now identical to the ICNIRP guidelines [ICNIRP 1998].

2.1 Distinction Between Exposed Population, Duration of Exposure and Frequencies

The American Standard [IEEE C95.1-1999] distinguishes between controlled and uncontrolled environment. Controlled environments are locations where there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment or by other cognizant persons. Uncontrolled environments are locations where there is the exposure of individuals who have no knowledge or control of their exposure. The exposures may occur in living quarters or workplaces. For exposure in controlled environments higher field strengths are admissible. In addition the duration of exposure is considered.

Due to the influence of frequency on important parameters, as the penetration depth of the electromagnetic fields into the human body and the absorption capability of different tissues, the limits in general vary with frequency.

2.2 Distinction between Maximum Permissible Exposure and SAR Limits

The biological relevant parameter describing the effects of electromagnetic fields in the frequency range of interest is the specific absorption rate SAR (dimension: power/mass). It is a measure of the power absorbed per unit mass. The SAR may be spatially averaged over the total mass of an exposed body or its parts. The SAR is calculated from the r.m.s. electric field strength *E* inside the human body, the conductivity σ and the mass density ρ of the biological tissue:

$$SAR = \sigma \frac{E^2}{\rho} = c \left. \frac{\partial T}{\partial t} \right|_{t \to 0+} . \qquad (1)$$

The specific absorption rate describes the initial rate of temperature rise $\partial T / \partial t$ as a function of the specific heat capacity *c* of the tissue. A limitation of the specific absorption rate prevents an excessive heating of the human body by electromagnetic energy.

As it is sometimes difficult to determine the SAR directly by measurement (e.g. whole body averaged SAR), the standard specifies more readily measurable maximum permissible exposures in terms of external electric *E* and magnetic field strength *H* and power density *S*, derived from the SAR limits. The limits for *E*, *H* and *S* have been fixed so that even under worst case conditions, the limits for the specific absorption rate SAR are not exceeded.

For the relevant frequency range the maximum permissible exposure may be exceeded if the exposure can be shown by appropriate techniques to produce SAR values below the corresponding limits.

2.3 General SAR Limit

In this report the comparison between the American exposure limits and the measured data is made using the spatial peak SAR; the power level of the device under test guarantees that the whole body averaged SAR is not exceeded.

Having in mind a worst case consideration, the SAR limit is valid for uncontrolled environment and mobile respectively portable transmitters. According to Table 1 the SAR values have to be averaged over a mass of 1 g (SAR_{1g}) with the shape of a cube.

Standard	Status	SAR limit [W/kg]
IEEE C95.1-1999	Replaced	1.6

Table 1: Relevant spatial peak SAR limit averaged over a mass of 1 g.

3 The FCC Measurement Procedure

The Federal Communications Commission (FCC) has published a report and order on the 1st of August 1996 [FCC 96-326], which requires routine dosimetric assessment of mobile telecommunications devices, either by laboratory measurement techniques or by computational modeling, prior to equipment authorization or use. In 2001 the Commission's Office of Engineering and Technology has released Edition 01-01 of Supplement C to OET Bulletin 65. This revised edition, which replaces Edition 97-01, provides additional guidance and information for evaluating compliance of mobile and portable devices with FCC limits for human exposure to radiofrequency emissions [OET 65]. In 2013 the FCC has published a Notice of Proposed Rule Making [FCC 03-137] that discontinued the Supplement C to OET Bulletin 65 and reference will be made to KDB publications in 2.1093 (d)(3) of 47 CFR [47 CFR].

3.1 General Requirements

The test shall be performed in a laboratory with an environment which avoids influence on SAR measurements by ambient EM sources and any reflection from the environment itself. The ambient temperature shall be in the range of 20°C to 26°C and 30-70% humidity.

4 Body-worn Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. Per FCC KDB 648474 [KDB 648474], Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB 447498 [KDB 447498] should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body worn accessory, measured without headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body worn accessory with a headset attached to the handset.

For purpose of determining test requirements, accessories may be divided into two categories: those that do not contain metallic components and those that do. For multiple accessories that do not contain metallic components, the device may be tested only with that accessory which provides the closest spacing to the body.

For multiple accessories that contain metallic components, the device must be tested with each accessory that contains a unique metallic component. If multiple accessories share an identical metallic component, only the accessory that provides the closest spacing to the body must be tested.

Devices that are designed to operate on the body of users using lanyards and straps, or without requiring additional body worn accessories, must be tested for SAR compliance using a conservative minimum test separation distance ≤ 5 mm to support compliance. Nevertheless, all accessories that contain metallic components must be tested for compliance additionally.

Other separation distances may be used, but they shall not exceed 2.5 cm.

4.1 PoC (PTT) Position

The PoC (PTT) configurations shall be tested with the front of the device positioned at 25 mm from a flat phantom (display towards the phantom).

4.2 Phantom Requirements

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.

4.3 Test to be Performed

For devices with retractable antenna the SAR test shall be performed with the antenna fully extended and fully retracted. Other factors that may affect the exposure shall also be tested. For example, optional antennas or optional battery packs which may significantly change the volume, lengths, flip open/closed, etc. of the device, or any other accessories which might have the potential to considerably increase the peak spatial-average SAR value.

The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at the middle channel resp. that channel with the highest output power for each test configuration is < 0.4 W/kg, testing at the high and low channels is optional.

4.3.1 Measurement Variability

According to KDB 865664 SAR measurement variability was assessed for each frequency band which was determined by the SAR probe calibration point and tissue equivalent medium, used for the device measurement. When both head and body tissue equivalent media were required for SAR measurements in a frequency band, the variability measurement procedure were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue equivalent medium in a frequency band. The test device was returned to ambient conditions with the battery fully charged before it was remounted on the device holder for the repeated measurements to minimize any unexpected variations in the repeated results. Repeated measurement is not required when the original measured highest SAR is < 0.8 W/kg.

4.4 Additional Information for 802.11 a/b/g Transmitters according KDB 248227

In May 2007 the FCC published the revised issue of the SAR Measurement Procedures for 802 a/b/g transmitters to support the SAR measurements for demonstrating compliance with the FCC RF exposure guidelines. Additional information were required to establish specific device operating configurations to use during the measurements since the specific signal modulations, data rates, network conditions and other parameters were not considered within the current SAR measurement procedures (FCC, IEEE-1528).

Following the most important differences compared to the common SAR measurements of e.g. mobile phones working in the GSM or PCS standards were listed:

- Using of chipset based test mode software to ensure consistent and reliable results
- The SAR is measured for the “default test channels” listed below as given by the FCC
- SAR measurements for 802.11g channels when the maximum avg output power is less than ≥ 0.25 dB higher than the values for the corresponding 802.11b channels
- The avg. output power for 802.11a should be measured on all channels in each frequency band
- If the channel with the maximum avg. output power is not included in the default test channels, this channel should be tested instead of an adjacent default test channel
- For multiple channel bandwidth configurations, the configuration with the highest output power limit should be tested.
- Each channel should be tested at the lowest data rate in each a/b/g mode
- Each channel should be tested at the lowest data rate in each b/g/n mode.

Mode 802.11	Frequency [MHz]	Channel	Turbo Channel	Default Test Channels			
				§ 15.247		UNII	
				802.11b	802.11g		
b / g	2412	1°		x	^		
	2437	6	6	x	^		
	2462	11°		x	^		

Table 2: Default Test channels given by the FCC

X: default test channels

*****: possible 802.11a channels with maximum avg output > the default test channels

^: possible 802.11g channels with maximum avg output ¼ dB ≥ the default test channels

°: when output power is reduced for channel 1 and / or 11 to meet restricted band requirements the highest output channels closet to each of these channels should be tested

5 The Measurement System

DASY is an abbreviation of „Dosimetric Assessment System“ and describes a system that is able to determine the SAR distribution inside a phantom of a human being according to different standards. The DASY4 system consists of the following items as shown in Fig: 2. Additional Fig: 3 shows the equipment, similar to the installations in other laboratories.

- High precision robot with controller
- Measurement server (for surveillance of the robot operation and signal filtering)
- Data acquisition electronics DAE (for signal amplification and filtering)
- Field probes calibrated for use in liquids
- Electro-optical converter EOC (conversion from the optical into a digital signal)
- Light beam (improving of the absolute probe positioning accuracy)
- Two SAM phantoms filled with tissue simulating liquid
- DASY4 software
- SEMCAD

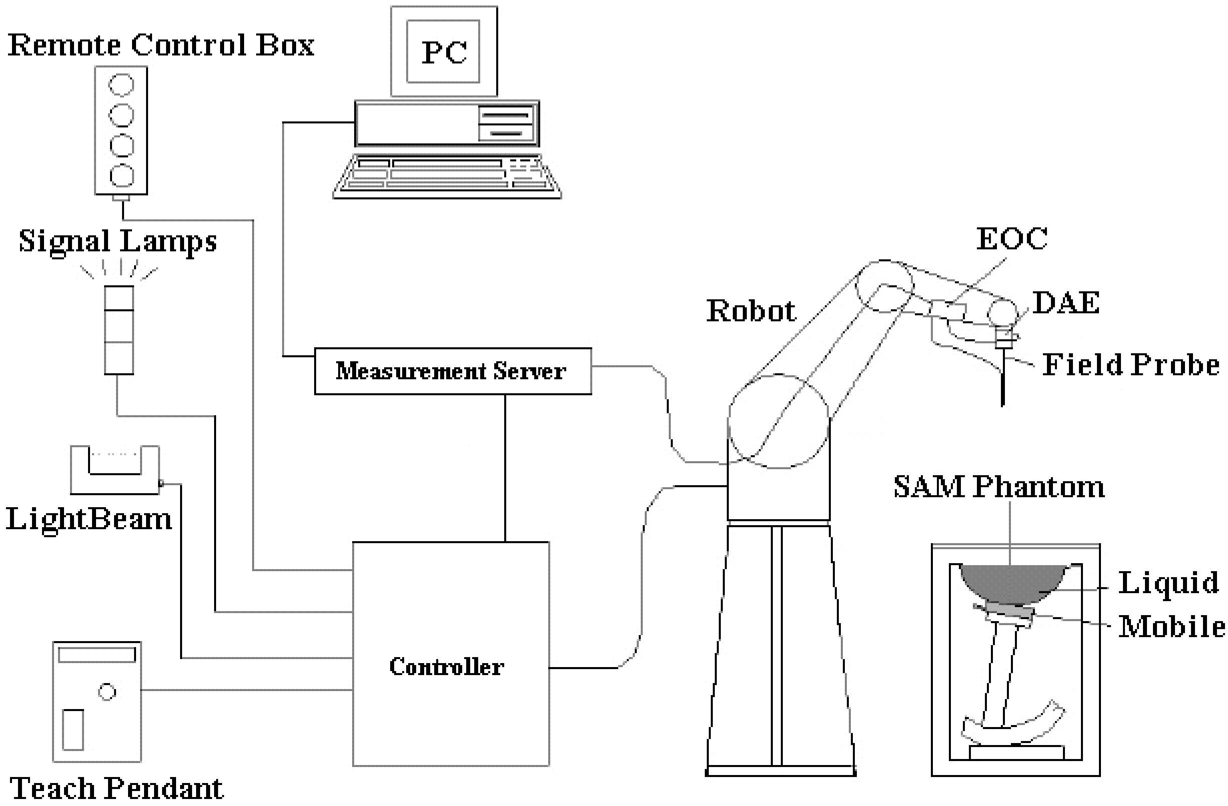


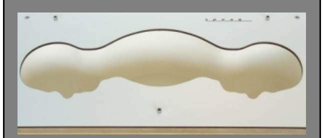
Fig. 2: The DASY4 measurement system.

Fig. 3: The measurement set-up with two SAM phantoms containing tissue simulating liquid.

The device operating at the maximum power level is placed by a non metallic device holder (delivered from Schmid & Partner) in the above described positions at a shell phantom of a human being. The distribution of the electric field strength *E* is measured in the tissue simulating liquid within the shell phantom. For this miniaturised field probes with high sensitivity and low field disturbance are used. Afterwards the corresponding SAR values are calculated with the known electrical conductivity σ and the mass density ρ of the tissue in the SEMCAD FDTD software. The software is able to determine the averaged SAR values (averaging region 1 g or 10 g) for compliance testing.

The measurements are done by two scans: first a coarse scan determines the region of the maximum SAR, afterwards the averaged SAR is measured in a second scan within the shape of a cube. The measurement time takes about 20 minutes.

5.1 Phantoms

Twin SAM Phantom V4.0	
	Specific Anthropomorphic Mannequin defined in IEEE 1528 and IEC 62209-1 and delivered by Schmid & Partner Engineering AG. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. The details and the Certificate of conformity can be found in Fig. 8.
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)
Dimensions	Length: 1000 mm; Width: 500 mm Height: adjustable feet
Filling Volume	approx. 25 liters

5.2 E-Field-Probes

For the measurements the Dosimetric E-Field Probes ET3DV6R or EX3DV4 with following specifications are used. They are manufactured and calibrated in accordance with FCC [OET 65] and IEEE [IEEE 1528-2003] recommendations annually by Schmid & Partner Engineering AG.

ET3DV6R	
Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system (ET3DV6 only) Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Dimensions	Overall length: 337 mm (Tip: 16 mm) Tip diameter: 6.8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.7 mm
Frequency	10 MHz to 2.3 GHz Linearity: ± 0.2 dB (30 MHz to 2.3 GHz)
Directivity	Axial isotropy: ± 0.2 dB in TSL (rotation around probe axis) Spherical isotropy: ± 0.4 dB in TSL (rotation normal to probe axis)
Dynamic Range	5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
Calibration Range	450 MHz / 750 MHz / 900 MHz / 1750 MHz / 1900 MHz / 1950 MHz for head and body simulating liquid

EX3DV4	
Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Frequency	10 MHz to > 6 GHz Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	Axial isotropy: ± 0.3 dB in TSL (rotation around probe axis) Spherical isotropy: ± 0.5 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Calibration Range	1950 MHz / 2450 MHz / 2600 MHz / 3500 MHz / 5200 MHz / 5300 MHz / 5600 MHz / 5800 MHz for head and body simulating liquid

5.3 Measurement Procedure

The following steps are used for each test position:

- Establish a call with the maximum output power with a base station simulator. The connection between the mobile phone and the base station simulator is established via air interface.
- Measurement of the local E-field value at a fixed location (P1). This value serves as a reference value for calculating a possible power drift.
- Measurement of the SAR distribution with resolution settings for area scan and zoom scan according KDB 865664 D01 as shown in Table 3.
- The used extrapolation and interpolation routines are all based on the modified Quadratic Shepard´s method [DASY4].
- Repetition of the E-field measurement at the fixed location (P1) and repetition of the whole procedure if the two results differ by more than ± 0.21dB.

<table>
<tr><th colspan="3"></th><th>≤ 3 GHz</th><th>≥ 3 GHz</th></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 - 3 GHz: ≤ 12 mm</td><td>3 - 4 GHz: ≤ 12 mm
4 - 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: ΔX_{Zoom}, ΔY_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 - 3 GHz: ≤ 5 mm*</td><td>3 - 4 GHz: ≤ 5 mm*
4 - 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">Uniform grid: $\Delta Z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 - 4 GHz: ≤ 4 mm
4 - 5 GHz: ≤ 3 mm
5 - 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta Z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 - 4 GHz: ≤ 3 mm
4 - 5 GHz: ≤ 2.5 mm
5 - 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta Z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta Z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 - 4 GHz: ≥ 28 mm
4 - 5 GHz: ≥ 25 mm
5 - 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium: see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz</td></tr>
</table>

Table 3: Parameters for SAR scan procedures.

5.4 Uncertainty Assessment

Table 4 includes the worst case uncertainty budget suggested by the [IEEE 1528-2003] and determined by Schmid & Partner Engineering AG. The expanded uncertainty (K=2) is assessed to be ± 21.7% and is valid up to 3.0 GHz.

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i	Standard Uncertainty	v_i^2 or v_{eff}
Measurement System						
Probe calibration	± 5.9 %	Normal	1	1	± 5.9 %	∞
Axial isotropy	± 4.7 %	Rectangular	√3	0.7	± 1.9 %	∞
Hemispherical isotropy	± 9.6 %	Rectangular	√3	0.7	± 3.9 %	∞
Boundary effects	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Linearity	± 4.7 %	Rectangular	√3	1	± 2.7 %	∞
System detection limit	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Readout electronics	± 1.0 %	Normal	1	1	± 1.0 %	∞
Response time	± 0.8 %	Rectangular	√3	1	± 0.5 %	∞
Integration time	± 2.6%	Rectangular	√3	1	± 1.5 %	∞
RF ambient conditions	± 3.0 %	Rectangular	√3	1	± 1.7 %	∞
Probe positioner	± 0.4 %	Rectangular	√3	1	± 0.2 %	∞
Probe positioning	± 2.9 %	Rectangular	√3	1	± 1.7 %	∞
Algorithm for max SAR eval.	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Test Sample Related						
Device positioning	± 2.9 %	Normal	1	1	± 2.9 %	145
Device holder	± 3.6 %	Normal	1	1	± 3.6 %	5
Power drift	± 5.0 %	Rectangular	√3	1	± 2.9 %	∞
Phantom and Set-up						
Phantom uncertainty	± 4.0 %	Rectangular	√3	1	± 2.3 %	∞
Liquid conductivity (target)	± 5.0 %	Rectangular	√3	0.64	± 1.8 %	∞
Liquid conductivity (meas.)	± 2.5 %	Normal	1	0.64	± 1.6 %	∞
Liquid permittivity (target)	± 5.0 %	Rectangular	√3	0.6	± 1.7 %	∞
Liquid permittivity (meas.)	± 2.5 %	Normal	1	0.6	± 1.5 %	∞
Combined Uncertainty					± 10.8 %	

Table 4: Uncertainty budget of DASY4.

6 Output Power Values

AVARAGE OUTPUT POWER FOR IEEE 802.11 b [dBm]						
Mode	Freq. [MHz]	CH	Data Rate [Mbit/s]			
			1	2	5.5	11
b	2412	1	15.2	15.8	15.5	15.2
	2437	6	15.6	15.8	15.3	15.4
	2462	11	15.8	15.8	15.5	15.3

Table 5: Conducted output power values for b-mode for HumanWare Victor Reader Stream.

AVARAGE OUTPUT POWER FOR IEEE 802.11 g [dBm]										
Mode	Frequency [MHz]	CH	Data Rate [Mbit/s]							
			6	9	12	18	24	36	48	54
g	2412	1	14.5	14.5	14.4	14.5	14.6	14.6	14.8	14.7
	2437	6	14.5	14.5	14.5	14.6	14.6	14.8	14.8	15.1
	2462	11	14.4	14.4	14.5	14.3	14.5	14.4	14.7	14.7

Table 6: Conducted output power values for g-mode for HumanWare Victor Reader Stream.

AVARAGE OUTPUT POWER FOR IEEE 802.11 n [dBm]										
Mode	Frequency [MHz]	CH	Data Rate [Mbit/s]							
			MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
n (800ns)	2412	1	14.3	14.4	14.4	14.8	14.9	14.4	14.7	14.7
	2437	6	14.5	14.4	14.6	15.0	14.9	14.7	14.8	14.9
	2462	11	14.3	14.4	14.3	14.7	14.7	14.4	14.4	14.7
n (400ns)	2412	1	14.1	14.4	14.3	14.6	14.4	14.3	14.6	14.8
	2437	6	14.6	14.6	14.5	14.8	14.6	14.6	14.2	14.7
	2462	11	14.3	14.3	14.2	14.7	14.4	14.3	14.4	14.7

Table 7: Conducted output power values for n-mode (800 nsGI and 400 ns GI) for HumanWare Victor Reader Stream.

6.1 Tune-Up Information

Maximum transmit output power [dBm]			
Band	2.45 GHz range		
	b-mode	g-mode	n-mode
IEEE 802.11	17.0	16.1	16.0

Table 8: Maximum transmit output power values for HumanWare Victor Reader Stream.

7 SAR Test Results

The tables below contain the measured SAR values for IEEE 802.11b averaged over a mass of 1 g. SAR assessment was conducted in the worst case configuration with output power values according Table 5 - Table 7. The maximum output power is based on the linear average of the output power listed in Table 5 - Table 7 +1.5 dB and calculated in Table 8.

According KDB 248227 Rev. 1.2, SAR is not required for 802.11g/n channels when the maximum average output power is less than ¼ dB higher than that measured on the corresponding 802.11b channels.

According KDB 447498 D01 V05, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.

Scaling Factor = tune-up limit power (mW) / RF power (mW)
Reported SAR = measured SAR * scaling factor

Furthermore, testing of other required channels within the operating mode of frequency band is not required when the reported SAR for the mid-band or highest output power channel is ≤ 0.4 W/kg for transmission band ≥ 200 MHz.

These additional SAR assessments are based on the results shown in SAR report:

“SAR_Report_Nemko_60320_6130012_FCC_Body_2.4GHz_VictorReader_V2”

Therefore the additional SAR assessment was conducted only for the worst case configuration.

Band	Mode	Freq [MHz]	Channel	Test Position	Figure No.	Tune-Up Limtt [dBm]	Output Power [dBm	Measured SAR_{1g} [W/kg]	Power Drift [dBm]	Scaling Factor	Reported SAR	Plot No.
2.4 GHz	b	2412	1	1	12	17.0	15.2	0.443	0.179	1.514	0.671	1
				2	13		15.2	0.019	-0.194	1.514	0.029	2

Table 9: Measurement results for IEEE 802.11b for the HumanWare Victor Reader Stream.

To control the output power stability during the SAR test the used DASY4 system calculates the power drift by measuring the e-field at the same location at the beginning and at the end of the measurement for each test position. These drift values can be found in the above tables labeled as: (Drift[dB]). This ensures that the power drift during one measurement is within 5%. Please note that we add the measured “power drift” values from the DASY4 system.

8 Evaluation

In Figure 4 the flat phantom SAR results for IEEE 802.11 b given in Table 9 are summarized and compared to the limit.

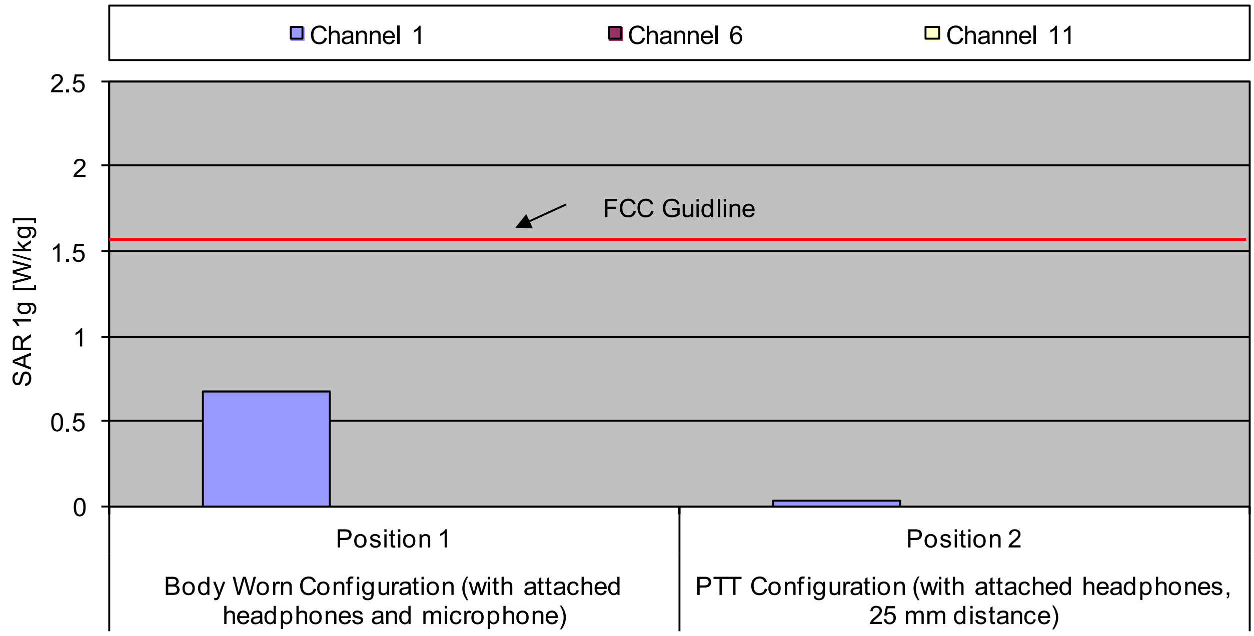


Fig. 4: The reported SAR values for the HumanWare Victor Reader Stream in comparison to the FCC exposure limit.

9 Appendix

9.1 Administrative Data

Date of Validation:	November 11, 2013
Date of Measurement:	November 11, 2013
Data Stored:	Nemko_60320_6130377
Contact:	IMST GmbH Carl-Friedrich-Gauß-Str. 2 D-47475 Kamp-Lintfort. Germany Tel.: +49- 2842-981 378. Fax: +49- 2842-981 399 email: vandenbosch@imst.de

9.2 Device under Test and Test Conditions

MTE:	HumanWare Victor Reader Stream, identical prototype
Date of Receipt:	January 23, 2013
IMEI:	Item No. 5
FCC ID:	XT5503VRC
IC:	8670A-503VRC
Used Accessroy:	universal headphones, Sony ECM-CS3 microphone
Equipment Class:	Portable device
Power Class:	max output power
RF Exposure Environment:	General Population/ Uncontrolled
Power Supply:	Internal battery
Antenna Type:	integrated
Measured Standards:	IEEE 802.11 b: data rate: 1 Mbps IEEE 802.11 g: data rate: 6 Mbps IEEE 802.11 n: data rate: 6.5 Mbps
Method to establish a call:	IEEE 802.11 b/g/n: Test software
Modulation:	IEEE 802.11 b: DPSK IEEE 802.11 g: BPSK IEEE 802.11 n: MCS
Used Phantom:	SAM Twin Phantom V4.0. as defined by the IEEE SCC-34/SC2 group and delivered by Schmid & Partner Engineering AG

HumanWare Victor Reader Stream	TX Range [MHz]	RX Range [MHz]	Used Channels [low. middle. high]	Used Crest Factor
IEEE 802.11 b/g/n	2412.0 – 2462.0	2412.0 – 2462.0	1	1

Table 10: Used channels and crest factors during the test.

9.3 Tissue Recipes

The following recipes are provided in percentage by weight.

2450 MHz, Head: 45.65% Diethylenglykol-monobutylether
54.00% De-Ionized Water

2450 MHz, Body: 31.40% Diethylenglykol-monobutylether
68.60% De-Ionized Water

9.4 Material Parameters

For the measurement of the following parameters the HP 85070B dielectric probe kit is used representing the open-ended coaxial probe measurement procedure. The measured values should be within ± 5% of the recommended values given by the FCC.

Frequency		ε_r	σ [S/m]
2450 MHz Head (IEEE 802.11 b/g/n)	Recommended Value	39.20 ± 2.00	1.80 ± 0.09
	Measured Value (Ch. 1)	39.40	1.74
2450 MHz Body (IEEE 802.11 b/g/n)	Recommended Value	52.70 ± 2.63	1.95 ± 0.09
	Measured Value (Ch. 1)	51.40	1.87

Table 11: Parameters of the tissue simulating liquid.

9.5 Simplified Performance Checking

The simplified performance check was realized using the dipole validation kits. The input power of the dipole antennas were 250 mW and they were placed under the flat part of the SAM phantoms. The target and measured results are listed in the Table 12 - 13 and shown in Fig. 6. The target values were adopted from the calibration certificates.

Available Dipoles		SAR_{1g} [W/kg]	ε_r	σ [S/m]
D2450V2, SN #709	Target Values Head	13.80	39.70	1.81
D2450V2, SN #709	Target Values Body	13.90	50.90	1.96

Table 12: Dipole target results.

Used Dipoles		SAR_{1g} [W/kg]	ε_r	σ [S/m]
D2450V2, SN: 709	Measured Values Body	13.60	39.20	1.83
D2450V2, SN: 709	Measured Values Body	13.80	51.30	1.98

Table 13: Measured dipole validation results.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 111113_y_3860_2450.da4

DUT: Dipole 2450 MHz SN: 709; Type: D2450V2; Serial: D2450V2 - SN:709
Program Name: System Performance Check at 2450 MHz

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.83 mho/m; ε_r = 39.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3860; ConvF(7.38, 7.38, 7.38); Calibrated: 29.07.2013
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 23.09.2013
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 14.9 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.5 V/m; Power Drift = -0.012 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 13.6 mW/g; SAR(10 g) = 6.04 mW/g
Maximum value of SAR (measured) = 15.2 mW/g

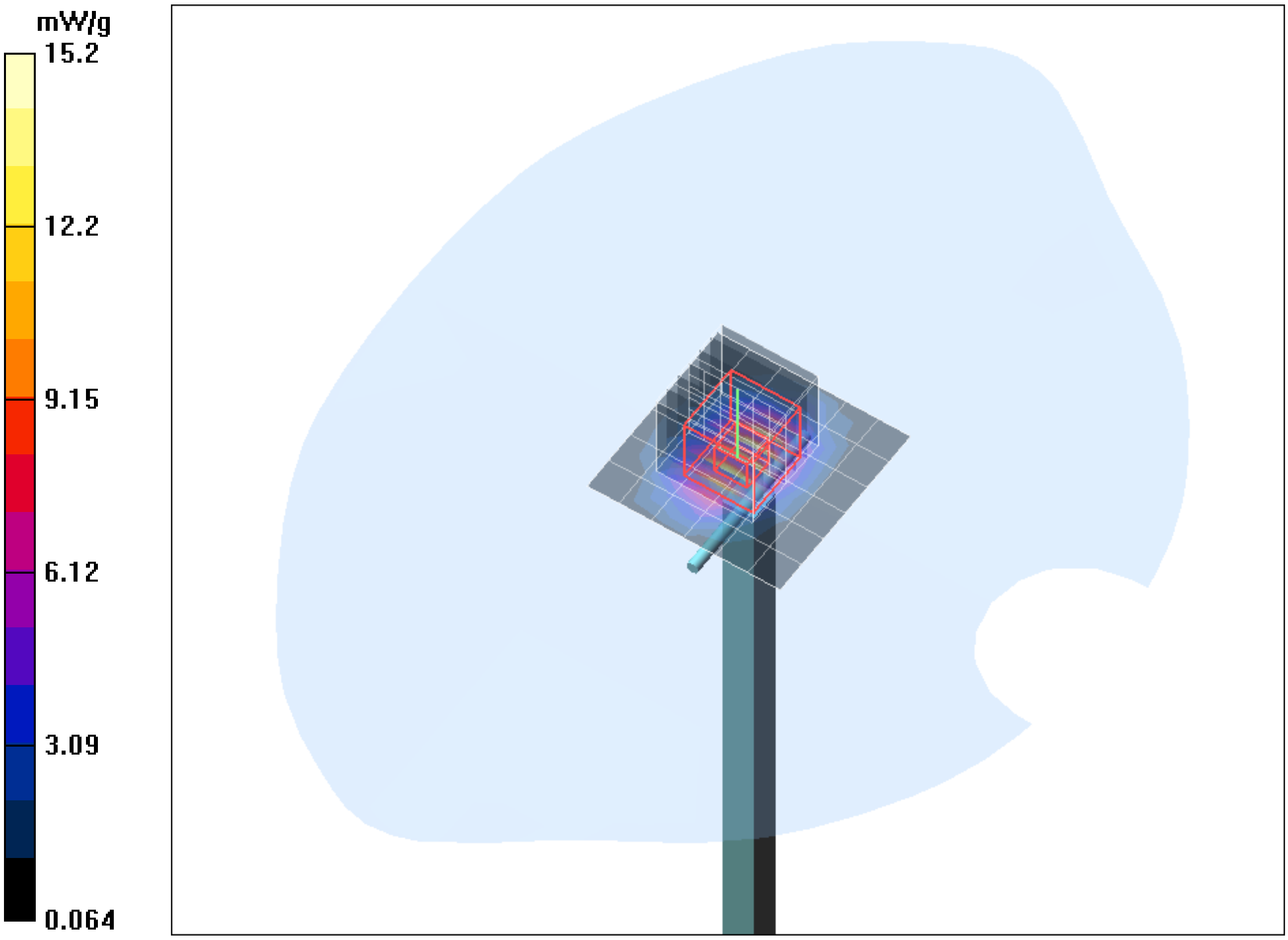


Fig. 5: Validation measurement 2450 MHz Head (November 11, 2013), coarse grid. Ambient Temperature: 20.9°C. Liquid Temperature: 20.2°C.

Test Laboratory: Imst GmbH, DASY Yellow (II); File Name: 111113_y_3860_2450.da4

DUT: Dipole 2450 MHz SN: 709; Type: D2450V2; Serial: D2450V2 - SN:709
Program Name: System Performance Check at 2450 MHz

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.98 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3860; ConvF(7.47, 7.47, 7.47); Calibrated: 29.07.2013
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 23.09.2013
- Phantom: SAM Glycol 1340; Type: QD 000 P40 CB; Serial: TP-1340
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 15.2 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 87.6 V/m; Power Drift = 0.067 dB
Peak SAR (extrapolated) = 30.3 W/kg
SAR(1 g) = 13.8 mW/g; SAR(10 g) = 6.18 mW/g
Maximum value of SAR (measured) = 15.6 mW/g

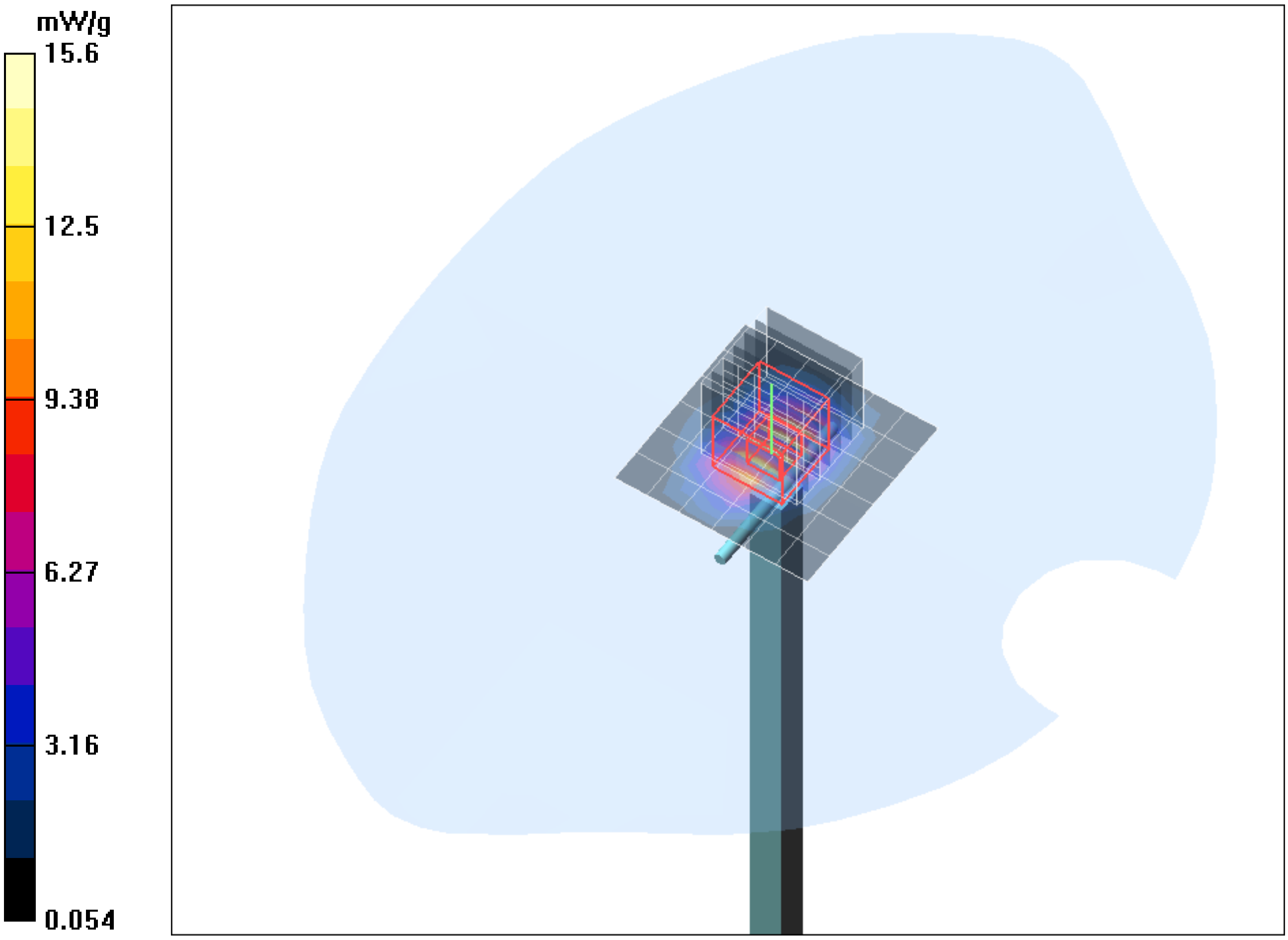


Fig. 6: Validation measurement 2450 MHz Body (November 11, 2013), coarse grid. Ambient Temperature: 20.4°C. Liquid Temperature: 20.1°C.

Error Sources	Uncertainty Value	Probability Distribution	Divisor	c_i	Standard Uncertainty	v_i^2 or v_{eff}
Measurement System						
Probe calibration	± 4.8 %	Normal	1	1	± 4.8 %	∞
Axial isotropy	± 4.7 %	Rectangular	√3	1	± 2.7 %	∞
Hemispherical isotropy	± 0 %	Rectangular	√3	1	± 0 %	∞
Boundary effects	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Linearity	± 4.7 %	Rectangular	√3	1	± 2.7 %	∞
System detection limit	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Readout electronics	± 1.0 %	Normal	1	1	± 1.0 %	∞
Response time	± 0 %	Rectangular	√3	1	± 0 %	∞
Integration time	± 0%	Rectangular	√3	1	± 0 %	∞
RF ambient conditions	± 3.0 %	Rectangular	√3	1	± 1.7 %	∞
Probe positioner	± 0.4 %	Rectangular	√3	1	± 0.2 %	∞
Probe positioning	± 2.9 %	Rectangular	√3	1	± 1.7 %	∞
Algorithms for max SAR eval.	± 1.0 %	Rectangular	√3	1	± 0.6 %	∞
Dipole						
Dipole Axis to Liquid Distance	± 2.0 %	Rectangular	1	1	± 1.2 %	∞
Input power and SAR drift meas.	± 4.7 %	Rectangular	√3	1	± 2.7 %	∞
Phantom and Set-up						
Phantom uncertainty	± 4.0 %	Rectangular	√3	1	± 2.3 %	∞
Liquid conductivity (target)	± 5.0 %	Rectangular	√3	0.64	± 1.8 %	∞
Liquid conductivity (meas.)	± 2.5 %	Normal	1	0.64	± 1.6 %	∞
Liquid permittivity (target)	± 5.0 %	Rectangular	√3	0.6	± 1.7 %	∞
Liquid permittivity (meas.)	± 2.5 %	Normal	1	0.6	± 1.5 %	∞
Combined Uncertainty					± 8.4 %	

Table 14: Uncertainty budget for the system performance check.

9.6 Environment

To comply with the required noise level (less than 12 mW/kg) periodically measurements without a DUT were conducted. Humidity: 37% ± 5 %

9.7 Test Equipment

Test Equipment	Model	Serial Number	Last Calibration	Next Calibration
DASY4 Systems				
Software Versions DASY4	V4.7	N/A	N/A	N/A
Software Versions SEMCAD	V1.8	N/A	N/A	N/A
Dosimetric E-Field Probe	EX3DV4	3860	07/2013	07/2014
Data Acquisition Electronics	DAE 4	631	09/2013	09/2014
Phantom	SAM	1059	N/A	N/A
Phantom	SAM	1176	N/A	N/A
Phantom	SAM	1340	N/A	N/A
Phantom	SAM	1341	N/A	N/A
Dipoles				
Validation Dipole	D2450V2	709	09/2013	09/2015
Material Measurement				
Network Analyzer	E5071C	MY46103220	08/2013	08/2015
Dielectric Probe Kit	HP85070B	US33020263	N/A	N/A

Table 15: SAR equipment.

Test Equipment	Model	Serial Number	Last Calibration	Next Calibration
Power Meters				
Power Meter. Agilent	E4416A	GB41050414	12/2012	12/2014
Power Meter. Agilent	E4417A	GB41050441	12/2012	12/2014
Power Meter. Anritsu	ML2487A	6K00002319	12/2011	12/2013
Power Meter. Anritsu	ML2488A	6K00002078	12/2011	12/2013
Power Sensors				
Power Sensor. Agilent	E9301H	US40010212	12/2012	12/2014
Power Sensor. Agilent	E9301A	MY41495584	12/2012	12/2014
Power Sensor. Anritsu	MA2481B	031600	12/2011	12/2013
Power Sensor. Anritsu	MA2490A	031565	12/2011	12/2013
RF Sources				
Network Analyzer	E5071C	MY46103220	08/2013	08/2015
Rohde & Schwarz	SME300	100142	N/A	N/A
Amplifiers				
Mini Circuits	ZHL-42	D012296	N/A	N/A
Mini Circuits	ZHL-42	D031104#01	N/A	N/A
Mini Circuits	ZVE-8G	D031004	N/A	N/A
Radio Tester				
Anritsu	MT8815B	6200586536	N/A	N/A

Table 16: Test equipment. General.

9.8 Certificates of Conformity

Schmid & Partner Engineering AG **s p e a g**

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

Certificate of conformity

Item	Dosimetric Assessment System DASY4
Type No	SD 000 401A, SD 000 402A
Software Version No	DASY 4.7
Manufacturer / Origin	Schmid & Partner Engineering AG Zeughausstrasse 43, CH-8004 Zürich, Switzerland

References

[1] IEEE 1528-2003, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques, December 2003

[2] EN 50361:2001, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz – 3 GHz)", July 2001

[3] IEC 62209 – 1, "Specific Absorption Rate (SAR) in the frequency range of 300 MHz to 3 GHz – Measurement Procedure, Part 1: Hand-held mobile wireless communication devices", February 2005

[4] IEC 62209 – 2, Draft Version 0.9, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation and Procedures
Part 2: Procedure to determine the Specific Absorption Rate (SAR) for ... including accessories and multiple transmitters", December 2004

[5] OET Bulletin 65, Supplement C, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", Edition 01-01

[6] ANSI-C63.19-2006, "American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids", June 2006

[7] ANSI-C63.19-2007, "American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids", June 2007

Conformity

We certify that this **system is designed to be fully compliant** with the standards [1 – 7] for RF emission tests of wireless devices.

Uncertainty

The uncertainty of the measurements with this system was evaluated according to the above standards and is documented in the applicable chapters of the DASY4 system handbook.
The uncertainty values represent current state of methodology and are subject to changes. They are applicable to all laboratories using DASY4 provided the following requirements are met (responsibility of the system end user):

1) the system is used by an experienced engineer who follows the manual and the guidelines taught during the training provided by SPEAG,
2) the probe and validation dipoles have been calibrated for the relevant frequency bands and media within the requested period,
3) the DAE has been calibrated within the requested period,
4) the "minimum distance" between probe sensor and inner phantom shell and the radiation source is selected properly,
5) the system performance check has been successful,
6) the operational mode of the DUT is CW, CDMA, FDMA or TDMA (GSM, DCS, PCS, IS136, PDC) and the measurement/integration time per point is ≥ 500 ms,
7) if applicable, the probe modulation factor is evaluated and applied according to field level, modulation and frequency,
8) the dielectric parameters of the liquid are conformant with the standard requirement,
9) the DUT has been positioned as described in the manual.
10) the uncertainty values from the calibration certificates, and the laboratory and measurement equipment dependent uncertainties, are updated by end user accordingly.

Date 24.4.2008 **Signature / Stamp**

Doc No 880 – SD00040XA-Standards_0804 – F KP/FB Page 1 (1)

Fig. 7: Certificate of conformity for the used DASY4 system

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 BA
Series No	TP-1002 and higher
Manufacturer / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

Tests

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards	Liquid type HSL 1800 and others according to the standard.	Pre-series, First article

Standards

[1] CENELEC EN 50361
[2] IEEE P1528-200x draft 6.5
[3] IEC PT 62209 draft 0.9
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 18.11.2001

Signature / Stamp

Schmid & Partner
Engineering AG
Zeughausstrasse 43, CH-8004 Zurich
Tel. +41 1 245 97 00, Fax +41 1 245 97 79

Fig. 8: Certificate of conformity for the used SAM phantom.

9.9 Pictures of the Device under Test

Fig. 9 - 11 show the device under test and the used accessory.

Fig. 9: Front view of the HumanWare Victor Reader Stream.

Fig. 10: Back view of the HumanWare Victor Reader Stream.

Fig. 11: Used headphones and microphone.

9.10 Test Positions for the Device under Test

Fig. 12 - 13 show the test positions for the SAR measurements.

Fig. 12: Body worn configuration, position 1, front towards the phantom, with attached headphones and microphone.

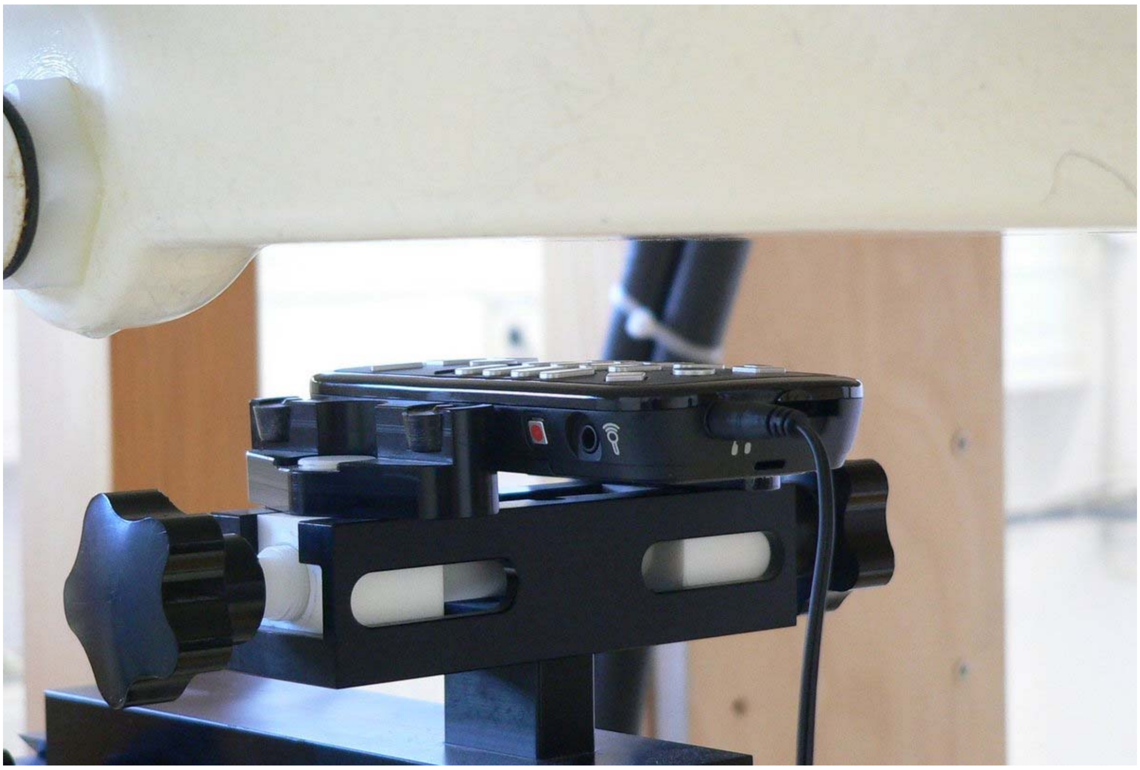


Fig. 13: PTT configuration, position 2, 25 mm distance, front towards the phantom, with attached headphones .

9.11 Pictures to demonstrate the required Liquid Depth

Fig. 14 - Fig. 15 show the liquid depth in the used SAM phantom.

Fig. 14: Liquid depth for IEEE 802.11 head measurements.

Fig. 15: Liquid depth for IEEE 802.11 body worn measurements.

10 References

[OET 65] Federal Communications Commission: Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01). FCC. 2001.

[IEEE C95.1-1999] IEEE Std C95.1-1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields. 3 kHz to 300 GHz. Inst. of Electrical and Electronics Engineers. Inc.. 1999.

[IEEE C95.1-2005] IEEE Std C95.1-2005: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields. 3 kHz to 300 GHz. Inst. of Electrical and Electronics Engineers. Inc.. 2005.

[ICNIRP 1998] ICNIRP: Guidelines for Limiting Exposure to Time-varying Electric. Magnetic. and Electromagnetic Fields (up to 300 GHz). In: Health Physics. Vol. 74. No. 4. 494-522. 1998.

[IEEE 1528-2003] IEEE Std 1528-2003: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques. 1528-2003. December 19. 2003. The Institute of Electrical and Electronics Engineers.

[NIST 1994] NIST: Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results. Technical Note 1297 (TN1297). United States Department of Commerce Technology Administration. National Institute of Standards and Technology. 1994.

[DASY4] Schmid & Partner Engineering AG: DASY4 Manual. April 2008

[FCC 96-326] FCC 96-326. ET Docket No. 93-62. Report and Order. August 1. 1996

[3GPP 34.121] ETSI TS 134 121-1 V7.4.0. Universal Mobile Telecomunications System (UMTS) ; User Equipment (UE) conformance specification; Radio transmission and reception (FDD)

[KDB 447498] 447498 D01 v05r01 General RF Exposure Guidance v05, May 28, 2013

[KDB 865664] 865664 D01 v01r01 SAR measurement 100 MHz to 6 GHz, May 28, 2013

[KDB 248227] 248227 Rev. 1.2 SAR Measurement Procedures for 802.11 a/b/g Transmitters. May 2007

[IC RSS 102] Industry Canada, Radio Standards Specification, Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands); RSS-102 Issue 4 March 2010