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-12139-01-00.

Dosimetric Assessment of the Trex Device Communicator from R. Stahl HMI Systems GmbH

(FCC ID 2AIM6-GC667032 / IC: 21553-20122901X)

Test Report for SAR Evaluation According to the FCC and IC Requirements

August 17, 2016

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Executive Summary

The Trex Device Communicator is a multifunctional handheld device from R. Stahl HMI Systems GmbH operating in the 2.4 GHz frequency range. The device has an integrated antenna (1 x WLAN/BT) and supports Bluetooth and IEEE 802.11 b/g/n standards. The overall diagonal dimension of the display section is > 20 cm.

The objective of the measurements done by IMST was the dosimetric assessment of one device in body worn and extremity exposure conditions according to the applicable FCC and IC requirements. For SAR assessment of Bluetooth and IEEE 802.11 b/g/n, special test software was used to set the device to a specific frequency and maximum output power with a specific data rate.

The examinations have been carried out with the dosimetric assessment system „DASY4“.

Measurements are performed according to the 47 CFR § 2.1093 [47CFR] for evaluating compliance of portable devices with FCC limits for human exposure (general population) to radiofrequency emissions, IEEE 1528-2013 [IEEE1528-2013] and measurement techniques of RSS-102 Issue 5 [RSS-102].

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

- SAR Measurement Requirements for 100 MHz to 6 GHz
  [KDB 865664 D01 v01r04]
- RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices
  [KDB 447498 D01 v06]
- SAR Evaluation Considerations for Laptop, Netbook, Netbook and Tablet Computers
  [KDB 616217 D04 v01r02]
- SAR Guidance for IEEE 802.11 (WiFi) Transmitters
  [KDB 248227 D01 v02r02]

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

Compliance Statement

The assessed SAR values for Trex Device Communicator from R. Stahl HMI Systems GmbH (FCC ID 2AIM6-GC667032; IC: 21553-20122901X) are in compliance with the SAR limits according to:

- 47 CFR § 2.1093 [47CFR]
- ANSI / IEEE C95.1-1999 [IEEE C95.1-1999]
- IEEE 1528-2013 [IEEE1528-2013]
- Safety Code 6 [HCSC 6] / RSS-102 Issue 5 [RSS-102]

SAR assessment was conducted with a closest distance of 0 mm between the flat part of the phantom and the housing of the device.

All measured SAR results are shown in Chapter 5, Table 6. The highest result of SAR for the Trex Device Communicator is as follows:

Highest MeasuredSAR$_{1g}$ [W/kg]									
Test Configuration	Band	Freq. [MHz]	CH	Position	Gap [mm]	Fig No.	SAR$_{1g}$ Reported	SAR$_{1g}$ Limit	
Body Worn	IEEE 802.11 b	2437	6	Front	0	9	1.172	1.6	PASS

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Subject of Investigation

The Trex Device Communicator is a multifunctional handheld device from R. Stahl HMI Systems GmbH operating in the 2.4 GHz frequency range. The device has an integrated antenna (1 x WLAN/BT) and supports Bluetooth and IEEE 802.11 b/g/n standards. The overall diagonal dimension of the display section is > 20 cm.

Fig. 1: Picture of the front and back side of the device under test.

The objective of the measurements done by IMST was the dosimetric assessment of one device in body worn and extremity exposure conditions according to the applicable FCC and IC requirements. For SAR assessment of Bluetooth and IEEE 802.11 b/g/n, special test software was used to set the device to a specific frequency and maximum output power with a specific data rate.

1 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].

In this report the comparison between the FCC 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.

Rule	SAR Limit [W/kg]	
	Body (SAR 1g)	Extremity (SAR 10g)
47 CFR § 2.1093 (d)(2)	1.6	4.0

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

1.1 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.

1.2 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 The FCC Measurement Procedure

2.1 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. All tests have been conducted according the latest version of all relevant KDBs.

2.2 SAR Testing for Tablet Computers according KDB 616217 D04

Due to its size, according KDB 616217 D04 this device is a full sized tablet computer. Accordingly the back surface and edges of the tablet should be tested for SAR compliance ith the tablet touching the phantom. The SAR exclusion threshold in KDB 447498 D01 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge position against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

2.3 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.

2.4 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.

2.5 Additional Information for IEEE 802.11 (WiFi) Transmitters

For both DSSS and OFDM wireless modes an Initial Test Position must be established for each applicable exposure configuration using either:

- Design implementation defined by the manufacturer, or
- Investigative results by the test lab based on:
  - Exclusions based on the distance from the antenna to the surface, or
  - Highest measured SAR from the area-scan-only measurements on all applicable test positions at the Initial Test Configuration, if found to require SAR tests.

Then, the initial test position procedure defines the required complete SAR scan measurements on each exposure configuration as following:

- When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurements is not required for the remaining test positions in that configuration as well as 802.11 transmission mode combinations within the frequency or aggregated band.
- When the reported SAR of the initial test position is > 0.4 W/kg, further SAR measurements is required in the initial test position or next closest/smallest test separation distance based on manufacturer justification, on the following highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.
- When the reported SAR for all initial and subsequent test positions is > 0.8 W/kg, further SAR measurements is required on these positions on the subsequent next highest measured output power channels, until the reported SAR is ≤ 1.2 W/kg or all required channels have been tested.

For OFDM transmission configurations in 2.4 GHz and 5 GHz bands, it is important to determine SAR Initial Test Configuration for each stand alone and aggregated frequency band according to the maximum output power and tune-up tolerance specified for production units. The procedure is as following:

- Highest output power channel is chosen; if there are channels with same maximum output power then the closest to the mid-band frequency is preferred. If there are more than one channel with same maximum output power and same distance to the mid-band frequency, then the channel with the higher frequency is preferred.
- When SAR measurement is required for a subsequent test configuration and the channel bandwidth is smaller than that in the initial test configuration, all channels in the subsequent test configuration that overlap with the larger bandwidth channel tested in the initial test configuration should be used to determine the highest maximum output power channel in the subsequent test configuration.

Along with the initial test position reduction guidelines, the following procedures are also applied to SAR measurement requirements when multiple OFDM configurations are supported:

- When the reported SAR of the initial test configuration with the highest output power channel is > 0.8 W/kg, further SAR measurements is required for next highest output power channel in the initial test configuration, until the reported SAR is ≤ 1.2 W/kg or all required channels have been tested.
- When the reported SAR of the subsequent test configuration with the highest output power channel is > 1.2 W/kg, further SAR measurements is required for next highest output power channel in this test configuration, until the reported SAR is ≤ 1.2 W/kg or all required channels have been tested.
- When the reported SAR of the subsequent test configuration is > 1.2 W/kg, further SAR measurements for the following subsequent test configurations are required.

2.6 Measurement Variability

According KDB 865664 repeated measurements are required only when the measured SAR is ≥ 0.80 W/kg. If the measured SAR value of the initial repeated measurement is < 1.45 W/kg with ≤ 20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. A second repeated measurement is required only if the measured result for the initial repeated measurement is within 10% of the SAR limit and vary by more than 20%, which are often related to device and measurement setup difficulties. The following procedures are applied to determine if repeated measurements are required.

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

For 10g extremity SAR, the values have to be scaled by a factor of 2.5. For 10g extremity SAR, repeated measurements are not required when the original highest measured SAR is < 2.0 W/kg.

3 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 show the equipment, similar to the installations in other laboratories.

- Fully compliant with all current measurement standards as stated in Fig. 5
- 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

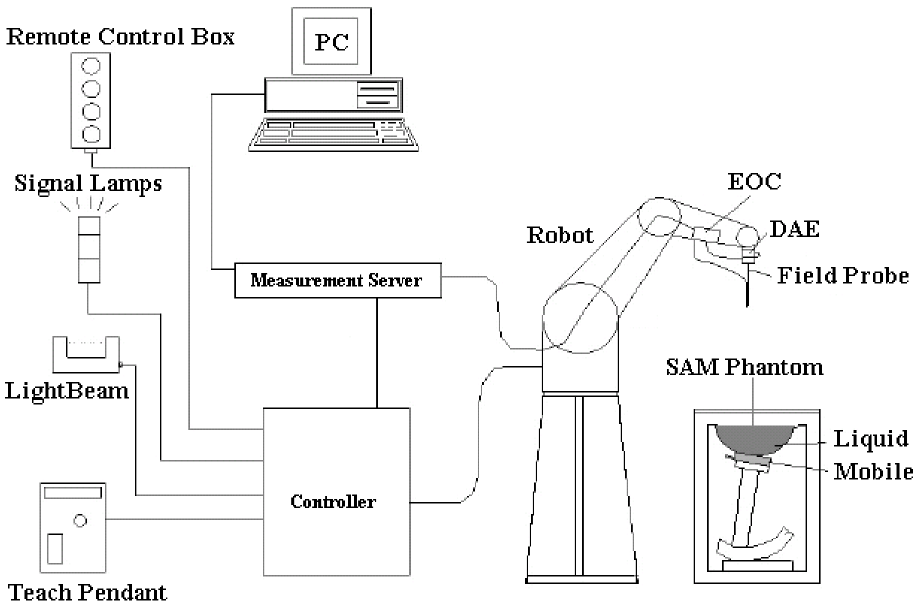


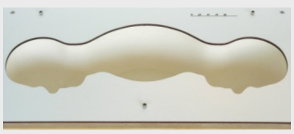
Fig. 2: The DASY4 measurement system.

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

The mobile phone 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.

3.1 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. 6.
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

3.2 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 KDB 865664 and IEEE [IEEE 1528-2013] 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

3.3 Measurement Procedure

The following steps are used for each test position:

- Establish a call with the maximum output power with a base station simulator or by software. 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 2.
- 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">≤ 1.5· $\Delta Z_{Zoom}(n-1)$</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 2: Parameters for SAR scan procedures.

3.4 Uncertainty Assessment

Table 3 includes the worst case uncertainty budget suggested by KDB 865664 and determined by Schmid & Partner Engineering AG. The expanded uncertainty (K=2) is assessed to be ± 21.7%. The requirements for the validity and the Certificate of conformity can be found in Fig. 5

Uncertainty Budget of DASY4						
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 3: Uncertainty budget of DASY4.

4 Output Power Values

4.1 Output Power Values and Tune-Up Information for IEEE 802.11 b/g/n

Measurements for IEEE 802.11 b/g/n has been performed with maximum power level settings (PWL) supported by the device and provided by the manufacturer.

<table>
<tr><th colspan="12">Max. Averaged Output Power (RMS) [dBm]</th></tr>
<tr><th rowspan="2">Mode</th><th rowspan="2">Frequency [MHz]</th><th rowspan="2">CH</th><th colspan="8">Data Rate [Mbit/s]</th><th rowspan="3">Tune-Up Limit</th></tr>
<tr><th colspan="2">1</th><th colspan="2">2</th><th colspan="2">5.5</th><th colspan="2">11</th></tr>
<tr><th colspan="3">2.4 GHz Range</th><th colspan="8">PWL 18</th></tr>
<tr><td rowspan="3">b</td><td>2412</td><td>1</td><td colspan="2">17.9</td><td colspan="2">18.4</td><td colspan="2">18.4</td><td colspan="2">17.9</td><td rowspan="3">19.0</td></tr>
<tr><td>2437</td><td>6</td><td colspan="2">17.2</td><td colspan="2">17.7</td><td colspan="2">18.0</td><td colspan="2">17.5</td></tr>
<tr><td>2462</td><td>11</td><td colspan="2">17.6</td><td colspan="2">18.0</td><td colspan="2">18.0</td><td colspan="2">17.8</td></tr>
<tr><th rowspan="2">Mode</th><th rowspan="2">Frequency [MHz]</th><th rowspan="2">CH</th><th colspan="8">Data Rate [Mbit/s]</th><th rowspan="3">Tune-Up Limit</th></tr>
<tr><th>6.0</th><th>9</th><th>12</th><th>18</th><th>24</th><th>36</th><th>48</th><th>54</th></tr>
<tr><th colspan="3">2.4 GHz Range</th><th colspan="8">PWL 15</th></tr>
<tr><td rowspan="3">g</td><td>2412</td><td>1</td><td>14.0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td rowspan="3">16.0</td></tr>
<tr><td>2437</td><td>6</td><td>14.1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2462</td><td>11</td><td>14.8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><th rowspan="2">Mode</th><th rowspan="2">Frequency [MHz]</th><th rowspan="2">CH</th><th colspan="8">MCS Index No.</th><th rowspan="3">Tune-Up Limit</th></tr>
<tr><th>MCS0</th><th>MCS1</th><th>MCS2</th><th>MCS3</th><th>MCS4</th><th>MCS5</th><th>MCS6</th><th>MCS7</th></tr>
<tr><th colspan="3">2.4 GHz Range</th><th colspan="8">PWL 15</th></tr>
<tr><td rowspan="3">n HT20</td><td>2412</td><td>1</td><td>14.3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td rowspan="4">16.0</td></tr>
<tr><td>2437</td><td>6</td><td>14.2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2462</td><td>11</td><td>14.5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>n HT40</td><td>2437</td><td>6</td><td>14.0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Table 4: Measured output power for b/g/n-mode for Trex Device Communicator from R. Stahl HMI Systems GmbH.

4.2 SAR Test Consideration according KDB 447498

Trex Device Communicator from R. Stahl HMI Systems GmbH is a device which is intended to be used in the hand. A leather hand strap is available as an optional accessory. Additionally, the manufacturer provides a shoulder strap, for carrying the device in close proximity to the user's body. Therefore, front and back sides of the device have been considered for the body worn exposure assessment. Both accessories are without any metallic parts and optional, thus SAR measurements are performed without them as worst case condition.

The table below shows the SAR test exclusion consideration for the applicable modes against the different device edges with the relevant distances.

The 1g and 10g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50mm are determined by:

*[(max power of channel. incl. tune-up tolerance. mW) / (min test separation distance. mm)] * [√f(GHz)]*

≤ 3.0 for 1g SAR and ≤ 7.5 for 10g extremity SAR

When the minimum test separation distance is < 5mm a distance of 5mm is applied to determine SAR test exclusion.

At 100 MHz to 6GHz and a test separation distance of > 50 mm, the SAR test exclusion threshold is determined according to the following and illustrated in Appendix B of KDB 447498 D01:

- *[(Power allowed at numeric threshold for 50 mm) + (test separation distance – 50mm) * (f(MHz)/150] mW at 100 MHz to 1500 MHz*
- *[(Power allowed at numeric threshold for 50 mm) + (test separation distance – 50mm)* 10] mW at 1500 MHz to 6 GHz*

Transmission Scenario for Test Exclusion Considerations

Exposure Position	Antenna	Body		Extremity	
		Bluetooth	WLAN	Bluetooth	WLAN
	Mode	BDR / GFSK	IEEE 802.11b/g/n	BDR / GFSK	IEEE 802.11b/g/n
	Frequency [GHz]	2.402	2.412	2.402	2.412
	Max. Avg. Power [dBm]	7.0	19.0	7.0	19.0
	Max. Avg. Power [mW]	5.0	79.4	5.0	79.4
Back	Antenna to user [mm]	40.0	40.0	40.0	40.0
	SAR exclusion threshold	0.2	3.1	0.2	3.1
	SAR testing required?	no	yes	no	no
	Estimated SAR [W/kg]	0.03	measured	0.01	0.16
Front	Antenna to user [mm]	5.0	5.0	5.0	5.0
	SAR exclusion threshold	1.6	24.7	1.6	24.7
	SAR testing required?	no	yes	no	yes
	Estimated SAR [W/kg]	0.21	measured	0.08	measured
Left	Antenna to user [mm]	42.0	42.0	42.0	42.0
	SAR exclusion threshold	0.2	2.9	0.2	2.9
	SAR testing required?	no	no	no	no
	Estimated SAR [W/kg]	0.02	0.39	0.01	0.16
Right	Antenna to user [mm]	65.0	65.0	65.0	65.0
	SAR exclusion threshold	246.8 mW	246.6 mW	392.0 mW	391.5 mW
	SAR testing required?	no	no	no	no
	Estimated SAR [W/kg]	0.40	0.40	1.00	1.00
Bottom	Antenna to user [mm]	195.0	195.0	195.0	195.0
	SAR exclusion threshold	1546.8 mW	1546.6 mW	1692.0 mW	1691.5 mW
	SAR testing required?	no	no	no	no
	Estimated SAR [W/kg]	0.40	0.40	1.00	1.00

Table 5: SAR test exclusion consideration for the applicable modes against different device edges.
Notes: Max. avg. power values according to the information provided by the manufacture.

When the standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas the standalone SAR must be estimated according to KDB 447498 in order to determine simultaneous transmission SAR test exclusion:

- *(max. power of channel. including tune-up tolerance. mW)/(min. test separation distance. mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;*

  where x = 7.5 for 1-g SAR.

When the minimum test separation distance is < 5 mm. a distance of 5 mm is applied to determine SAR test exclusion.

- *0.4 W/kg for 1g SAR and 1.0 W/kg for 10g SAR. when the test separation distance is > 50 mm*

5 SAR Results

Since the overall diagonal dimension of the display section is > 20 cm, SAR was evaluated according to KDB 616217 D04 with the highest output power values according to Table 4.

Following KDB 447498 D01, 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.

SAR Results for Body Worn Configuration												
Band	**Freq. [MHz]**	**Channel**	**Test Position**	**Spacing [mm]**	**Fig. No.**	**Measured SAR1g [W/kg]**	**EUT Output Power [dBm]**	**Tune Up Limit [dBm]**	**Power Drift [dBm]**	**Scaling Factor**	**Reported SAR1g [W/kg]**	**Plot No.**
IEEE 802.11b (5.5 Mbit/s)	2437	6	Front	0	9	0.898	18.0	19.0	-0.022	1.259	1.131	1
			back	0	10	0.106	18.0	19.0	0.049	1.259	0.133	2
			front**	0	9	0.931	18.0	19.0	-0.122	1.259	1.172	3
	2412	1	front	0	9	0.774	18.4	19.0	-0.042	1.148	0.889	4
	2462	11	front	0	9	0.874	18.0	19.0	0.042	1.259	1.100	5
	SAR Results for Extremity Exposure											
	Freq. [MHz]	**Channel**	**Test Position**	**Spacing [mm]**	**Fig. No.**	**Measured SAR10g [W/kg]**	**EUT Output Power [dBm]**	**Tune Up Limit [dBm]**	**Power Drift [dBm]**	**Scaling Factor**	**Reported SAR10g [W/kg]**	**Plot No.**
	2437	6	front**	0	9	0.417	18.0	19.0	-0.122	1.259	0.525	3
			left	0	-	excluded*						
			right	0	-	excluded*						

Table 6: SAR results for IEEE 802.11 b for body worn and extremity exposure configuration.

*Notes: * Sides excluded according to Table*

*** Measurement variability according to KDB 865664*

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%.

6 Simultaneous Transmission Consideration

According KDB 447498, the following table gives an overview about the ∑SAR for simultaneous transmitting modes. When ∑SAR > 1.6 W/kg. a SAR test exclusion is determined by the SAR to peak location separation ratio.

The ratio is determined by $(SAR1 + SAR2)^{1.5}/Ri$ rounded to two decimal digits and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion. Where Ri is the separation distance between the peak SAR locations for the antenna pair in mm. When SAR is measured for both antennas in a pair the peak location separation distance is computed by the square root of $[(x1-x2)^2 + (y1-y2)^2 + (z1-z2)^2]$ where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the area scans or extrapolated peak SAR locations in the zoom scans as appropriate.

Simultaneous Transmission Scenario SAR [W/kg]				
Exposure Position	Highest Reported SAR Values		ΣSAR	SPLSR Analysis
	Bluetooth	WLAN 2.4 GHz		
Front	0.210	1.172	1.382	NO
Back	0.030	0.133	0.163	NO
Note:	Estimated SAR values marked in blue			

Table 7: Simultaneous transmission consideration for the applicable modes against different device edges, for BT and IEEE 802.11 transmissions.

7 Appendix

7.1 Administrative Data

Date of System Check:	June 6, 2016
Date of Measurement:	June 6, 2016 - June 7, 2016
Data Stored:	R.Stahl_60120_6160088
Contact:	IMST GmbH
	Carl-Friedrich-Gauß-Str. 2 - 4
	47475 Kamp-Lintfort Germany
	email: SAR@imst.de

7.2 Device under Test and Test Conditions

MTE:	Trex Device Communicator
Date of Receipt:	May 13, 2016
IMEI:	01452529
FCC ID:	2AIM6-GC667032
IC:	21553-20122901X
Transmitter:	u-blox ELLA-W131 (WLAN/BT)
Antenna:	integrated (1 x WLAN/BT)
Equipment Class:	Portable device
RF Exposure Environment:	General Population/ Uncontrolled
Power Supply:	Internal battery (Li-Ion 8.4 V)
Accessories:	hand and shoulder straps (without metallic parts)
Power Class:	WLAN (802.11 b): tested with max. power level 18
	WLAN (802.11 g/n):tested with max. power level 15

Standard	TX Range [MHz]	RX Range [MHz]	Used Channels	Crest Factor	Phantom
IEEE 802.11 b/g/n	2412.0 – 2462.0	2412.0 – 2462.0	1, 6, 11	1	SAM Twin Phantom V4.0

Table 8: Used channels and crest factors during the test.

7.3 Tissue Recipes

The following recipes are provided in percentage by weight.

2450 MHz Body:	31.40 %	Diethylenglykol-monobutylether
	68.60 %	De-IonizedWater

7.4 Material Parameters

For the measurement of the following parameters the Speag DAK-3.5 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.

Tissue Simulating Liquids					
Frequency		ε_r	**Delta [%]**	**σ [S/m]**	**Delta [%]**
2450 MHz Body	Recommended Value	52.7	+/- 5	1.95	+/- 5
IEEE 802.11 b/g/n	Measured Value (System Check)	51.5	-2.3	1.98	1.5
	Measured Value (Ch. 1)	51.6	-2.1	1.93	-1.0
	Measured Value (Ch. 6)	51.5	-2.3	1.97	1.0
	Measured Value (Ch. 11)	51.4	-2.5	1.99	2.1

Table 9: Parameters of the tissue simulating liquids.

7.5 Simplified Performance Checking

The simplified performance check was realized using the dipole validation kits. The input power of the dipole antennas were 250 mW (cw signal) and they were placed under the flat part of the SAM phantom. The target and measured results are listed in the Table 10 and shown in Figure 4. The target values were adopted from the calibration certificates which are attached in the appendix. Table 11 includes the uncertainty assessment for the system performance checking which was suggested by the IEEE 1528-2013.

Measured and Target System Check Results			
Available Dipoles		**SAR_{1g} [W/kg]**	**Delta [%]**
D2450V2, SN #709	Target Values Body	13.08	+/- 10
	Measured Values	13.50	3.25

Table 10: Measured and target system check results as given by the calibration certificates.

Test Laboratory: IMST GmbH, DASY Blue (I); File Name: 060716_b_3860_631.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 = 51.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3860; ConvF(7.52, 7.52, 7.52); Calibrated: 18.09.2015
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn631; Calibrated: 16.09.2015
- Phantom: SAM Glycol 1176; Type: Speag; Serial: 1176
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=10mm, Pin=250mW/Area Scan (7x8x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 14.7 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.0 V/m; Power Drift = 0.008 dB
Peak SAR (extrapolated) = 29.3 W/kg
SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.07 mW/g
Maximum value of SAR (measured) = 15.5 mW/g

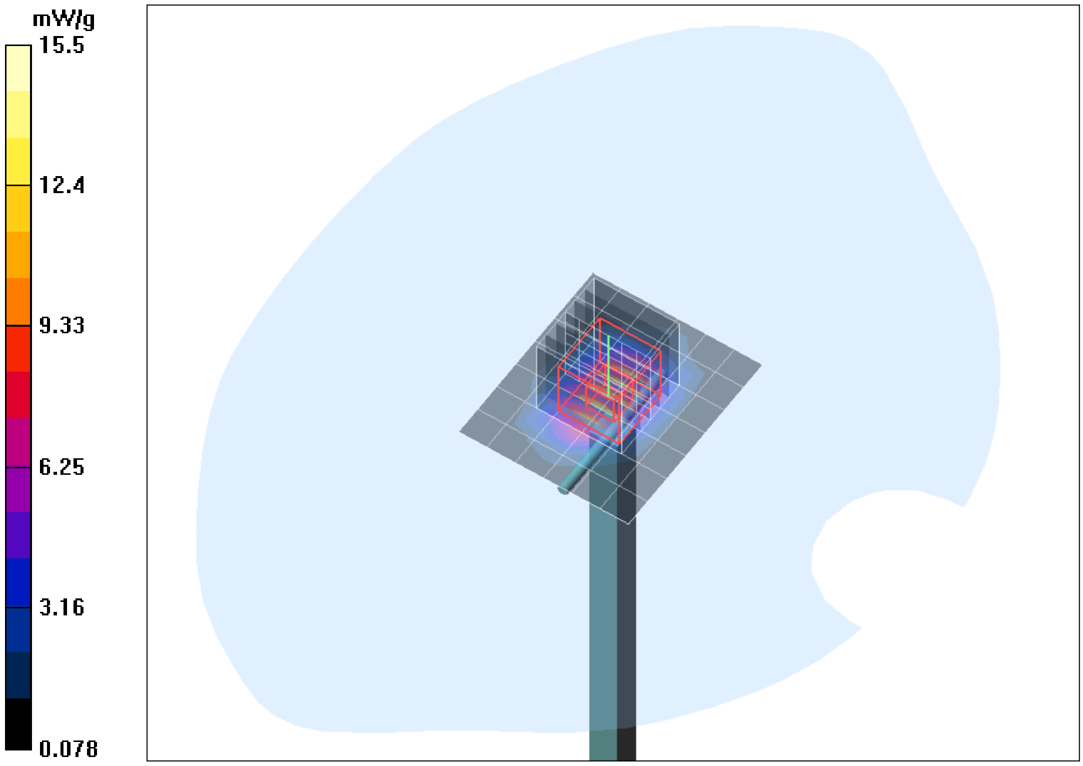


Fig. 4: System Check for 2450 MHz Body (June 6, 2016), coarse grid.

Uncertainty Budget for SAR System Validation according to IEEE 1528-2013 (300 MHz - 6 GHz)								
Error Sources	**Uncertainty Value [± %]**	**Probability Distribution**	**Divisor**	**c_i**	**c_i**	**Standard Uncertainty [± %]**		**v_i^2 or v_{eff}**
Measurement System				1g	10g	1g	10g	
Probe calibration	6.7	Normal	1	1	1	6.7	6.7	∞
Axial isotropy	0.3	Rectangular	√3	1	1	0.1	0.1	∞
Hemispherical isotropy	1.3	Rectangular	√3	0	0	0.0	0.0	∞
Boundary effects	1.0	Rectangular	√3	1	1	0.6	0.6	∞
Linearity	0.3	Rectangular	√3	1	1	0.2	0.2	∞
System detection limit	1.0	Rectangular	√3	1	1	0.6	0.6	∞
Modulation response	0.0	Rectangular	√3	0	0	0.0	0.0	∞
Readout electronics	0.3	Normal	1	1	1	0.3	0.3	∞
Response time	0.0	Rectangular	√3	0	0	0.0	0.0	∞
Integration time	0.0	Rectangular	√3	0	0	0.0	0.0	∞
RF ambient conditions - noise	1.0	Rectangular	√3	1	1	0.6	0.6	∞
RF ambient conditions - refl.	1.0	Rectangular	√3	1	1	0.6	0.6	∞
Probe positioner mech. tol.	0.4	Rectangular	√3	1	1	0.2	0.2	∞
Probe positioning	2.9	Rectangular	√3	1	1	1.7	1.7	∞
Algorithms for max SAR eval.	2.0	Rectangular	√3	1	1	1.2	1.2	∞
Validation Dipole								
Dev. of exp. dipole from num.	5.0	Normal	1	1	1	5.0	5.0	∞
Input power and SAR drift	4.7	Rectangular	√3	1	1	2.7	2.7	∞
Dipole axis to liquid distance	2.0	Rectangular	√3	1	1	1.2	1.2	∞
Phantom and Set-up								
Phantom uncertainty	4.0	Rectangular	√3	1	1	2.3	2.3	∞
SAR correction for perm./cond.	1.9	Normal	1	1	0.84	1.9	1.6	∞
Liquid conductivity (meas.)	5.0	Normal	1	0.78	0.71	3.9	3.6	∞
Liquid permittivity (meas.)	5.0	Normal	1	0.23	0.26	1.2	1.3	∞
Liquid conductivity temp. unc.	1.7	Rectangular	√3	0.78	0.71	0.8	0.7	∞
Liquid permittivity temp. unc.	2.7	Rectangular	√3	0.23	0.26	0.4	0.4	∞
Combined Standard Uncertainty						10.5	10.4	
Coverage Factor for 95%						kp=2		
Expanded Standard Uncertainty						21.0	20.7	

Table 11: Uncertainty budget for system validation.

Note: Worst case probe calibration uncertainty has been applied for all available probes and frequencies.

7.6 Environment

To comply with the required noise level (less than 12 mW/kg) periodically measurements without a DUT were conducted.

Humidity: 40% ± 5 %

7.7 Test Equipment

SAR 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	09/2015	09/2016
Data Acquisition Electronics	DAE 4	631	09/2015	09/2016
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	11/2015	11/2017
Material Measurement				
Network Analyzer	E5071C	MY46103220	07/2015	07/2017
Dielectric Probe Kit	DAK-3.5	1234	01/2016	01/2018
Test Equipment				
Power Meters				
Power Meter. Agilent	E4416A	GB41050414	02/2015	02/2017
Power Meter. Agilent	E4417A	GB41050441	02/2015	02/2017
Power Sensors				
Power Sensor. Agilent	E9301H	US40010212	03/2015	03/2017
Power Sensor. Agilent	E9301A	MY41495584	03/2015	03/2017
RF Sources				
Network Analyzer	E5071C	MY46103220	07/2015	07/2017
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	6200576536	04/2016	04/2018

Table 12: SAR and Test equipment.

7.8 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. 5: 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

Doc No 881 – QD 000 P40 BA – B Page 1 (1)

Fig. 6: Certificate of conformity for the used SAM phantom.

7.9 Pictures of the Device under Test

Fig. 7 - 8 show the device under test, antenna locations and device dimensions.

Fig. 7: Front and back views of the Trex Device Communicator from R. Stahl HMI Systems GmbH, with optional available hand strap attached.

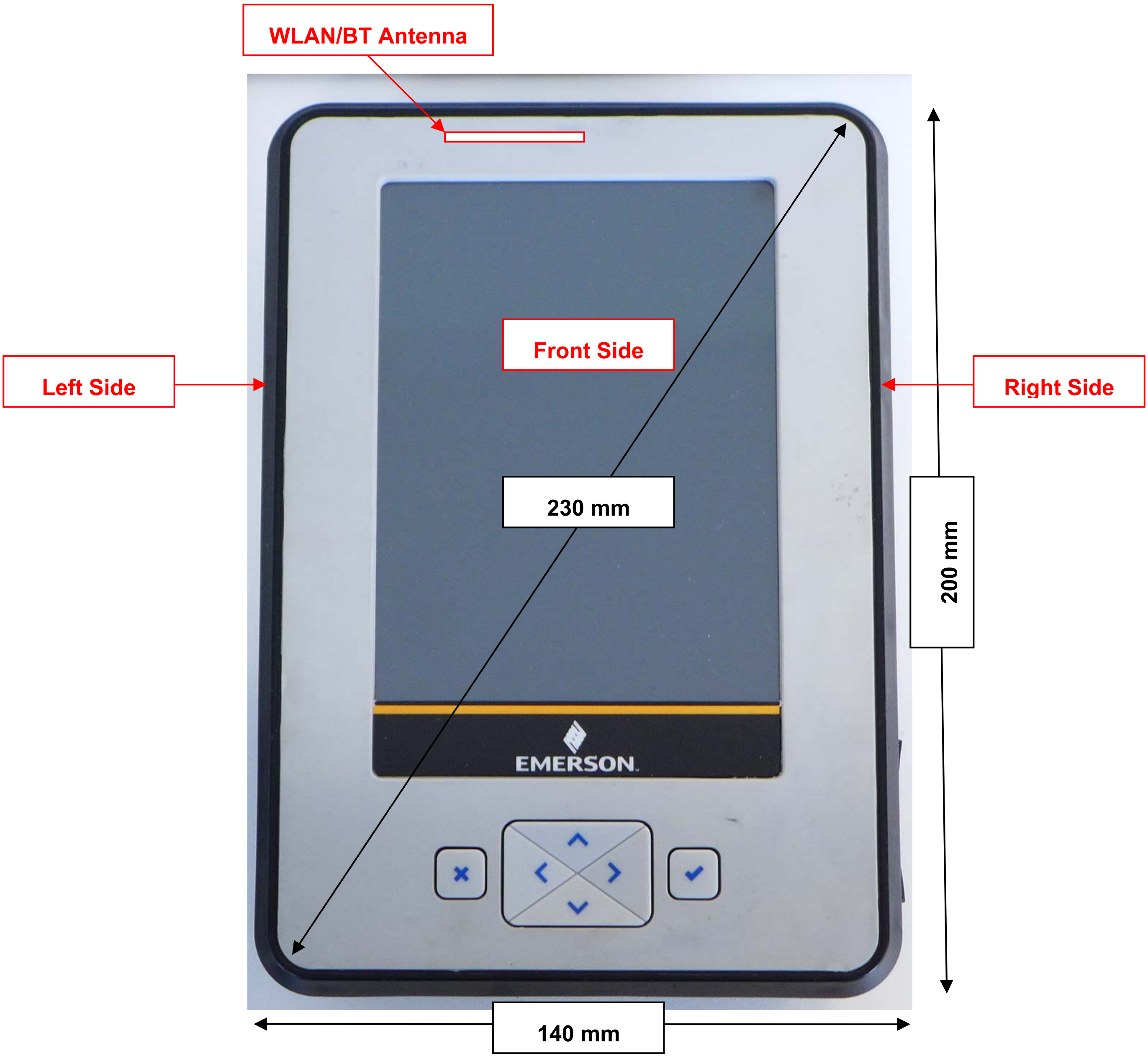


Fig. 8: Antenna location and device dimensions of Trex Device Communicator.

7.10 Test Positions for the Device under Test

Figure 9 - 10 show the test positions for the SAR measurements for WWAN antenna.

Fig. 9: Front of the device side towards the phantom, 0 mm distance.

Fig. 10: Back side of the device towards the phantom, 0 mm distance.

7.11 Pictures to Demonstrate the Required Liquid Depth

Figure 11 shows the liquid depth in the used SAM phantom.

Fig. 11: Liquid depth for 2.4 GHz WLAN.

8 Revision History

Revision History of Test Report				
Revision	**Name of Test Report**	**Date**	**Revised Page**	**Comments**
Original	R.Stahl_60120_6160088_FCC_Trex	07/15/2016	-	-
1	R.Stahl_60120_6160088_FCC_Trex_v2	08/01/2016	14	uncertainty assessment
2	R.Stahl_60120_6160088_FCC_Trex_v3	08/17/2016	22	uncertainty assessment for system validation included

9 References

[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 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.

[IEEE 1528-2013] IEEE Std 1528-2013: IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques. 1528-2013, June 14, 2013, The Institute of Electrical and Electronics Engineers.

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

[47 CFR] Code of Federal Regulations; Title 47. Telecommunications

[KDB 865664] 865664 D01 v01r04 SAR measurement 100 MHz to 6 GHz August 07, 2015

[KDB 447498] 447498 D01 v01r06 General RF Exposure Guidance v05, October 23, 2015

[KDB 616217] 616217 D04 SAR for laptop and tablets v01r02, Oct. 23, 2015

[KDB 248227] 248227 D01 802.11 Wi-Fi SAR v02r02, Oct. Oct. 23, 2015

10 Appendices

Refer to separated files for the following appendices:

- SAR Distribution Plots: SAR_Report_R.Stahl_60120_6160088_FCC_Trex_Plots
- Calibration Data: SAR_Report_R.Stahl_60120_6160088_FCC_Trex_CalData