# SAR TEST REPORT (15.247)

**REPORT NO.:** SA980105L17

**MODEL NO.:** TEW-664UB

**RECEIVED:** Jan. 05, 2009

**TESTED:** Jan. 20 ~ Jan. 21, 2009

**ISSUED:** Feb. 16, 2009

**APPLICANT:** TRENDware International Inc

**ADDRESS:** 20675 Manhattan Place, Torrance, CA 90501, USA

**ISSUED BY:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

**LAB ADDRESS:** No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang, Taipei Hsien 244, Taiwan, R.O.C.

**TEST LOCATION:** No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

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Testing Laboratory
2021

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# 1. CERTIFICATION

**PRODUCT:** 802.11n dual band USB adapter

**MODEL:** TEW-664UB

**BRAND:** TRENDnet

**APPLICANT:** TRENDware International Inc

**TESTED:** Jan. 20 ~ Jan. 21, 2009

**TEST SAMPLE:** ENGINEERING SAMPLE

**STANDARDS:** **FCC Part 2 (Section 2.1093)**
**FCC OET Bulletin 65, Supplement C (01-01)**
**RSS-102**

The above equipment (model: TEW-664UB) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**PREPARED BY** : Polly Chien , **DATE :** Feb. 16, 2009
Polly Chien / Specialist

**TECHNICAL ACCEPTANCE** : James Fan , **DATE :** Feb. 16, 2009
Responsible for RF
James Fan / Engineer

**APPROVED BY** : Gary Chang , **DATE :** Feb. 16, 2009
Gary Chang / Assistant Manager

# 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF EUT

| | |
|---|---|
| **PRODUCT** | 802.11n dual band USB adapter |
| **MODEL NO.** | TEW-664UB |
| **FCC ID** | S9ZTEW664UB |
| **POWER SUPPLY** | 5.0Vdc from host equipment |
| **MODULATION TYPE** | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM |
| **MODULATION TECHNOLOGY** | DSSS, OFDM |
| **TRANSFER RATE** | 802.11b:11.0/ 5.5/ 2.0/ 1.0Mbps<br>802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps<br>802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps<br>Draft 802.11n: up to 300.0Mbps |
| **FREQUENCY RANGE** | **2.4GHz:** 2400MHz ~ 2483.5MHz<br>**5.0GHz:** 5150 ~ 5250MHz & 5725 ~ 5850MHz |
| **NUMBER OF CHANNEL** | **2.4GHz:**<br>11 for 802.11b, 802.11g, draft 802.11n (20MHz)<br>7 for draft 802.11n (40MHz)<br>**5.0GHz:**<br>5150 ~ 5250MHz:<br>4 for 802.11a, draft 802.11n (20MHz)<br>2 for draft 802.11n (40MHz)<br>5725 ~ 5850MHz:<br>5 for 802.11a, draft 802.11n (20MHz)<br>2 for draft 802.11n (40MHz) |
| **CHANNEL FREQUENCIES UNDER TEST AND ITS CONDUCTED OUTPUT POWER (FOR 2.4GHz)** | **802.11b:**<br>180.315mW / Ch6: 2437MHz<br>**802.11g:**<br>387.681mW / Ch6: 2437MHz<br>**DRAFT 802.11n (20MHz):**<br>387.900mW / Ch6: 2437MHz<br>**DRAFT 802.11n (40MHz):**<br>385.899mW / Ch4: 2437MHz |

| | |
|---|---|
| **CHANNEL FREQUENCIES UNDER TEST AND ITS CONDUCTED OUTPUT POWER (FOR 5.0GHz)** | **802.11a:**<br>202.083mW / Ch165: 5825MHz<br>**DRAFT 802.11n (20MHz):**<br>226.220mW / Ch165: 5825MHz<br>**DRAFT 802.11n (40MHz):**<br>256.766mW / Ch159: 5795MHz |
| **AVERAGE SAR (1g)** | 0.424W/kg for 2.4GHz<br>0.669W/kg for 5.0GHz |
| **ANTENNA TYPE** | 2.4GHz: Printed antenna with -0.07dBi gain<br>5.0GHz: Printed antenna with 3.07dBi gain |
| **DATA CABLE** | NA |
| **I/O PORTS** | USB |
| **ACCESSORY DEVICES** | NA |

**NOTE:**

1. The EUT is a 802.11n dual band USB adapter. The functions of EUT listed as below:

| | REFERENCE REPORT |
|---|---|
| WLAN 802.11b/g, draft 802.11n | SA980105L17 |
| WLAN 802.11a, draft 802.11n (5725~5825 MHz) | |
| WLAN 802.11a, draft 802.11n (5150~ 5250MHz) | SA980105L17-1 |

2. The frequency bands used in this EUT are listed as follows:

| Frequency Band (MHz) | 2400~2483.5 | 5150~5250 | 5725~5825 |
|---|---|---|---|
| 802.11b | √ | | |
| 802.11g | √ | | |
| 802.11a | | √ | √ |
| Draft 802.11n (20MHz) | √ | √ | √ |
| Draft 802.11n (40MHz) | √ | √ | √ |

3. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

| MODULATION MODE | TX FUNCTION |
|---|---|
| 802.11b | 2TX |
| 802.11g | 2TX |
| 802.11a | 2TX |
| Draft 802.11n (20MHz) | 2TX |
| Draft 802.11n (40MHz) | 2TX |

4. The above EUT information was declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.

## 2.2 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to the specifications of the manufacturer, this product must comply with the requirements of the following standards:

**FCC Part 2 (2.1093)**
**FCC OET Bulletin 65, Supplement C (01- 01)**
**RSS-102**
**IEEE 1528-2003**

All test items have been performed and recorded as per the above standards.

## 2.3 GENERAL INOFRMATION OF THE SAR SYSTEM

DASY4 **(software 4.7 Build 53)** consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY4 software defined. The DASY4 software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

**For 2.4GHz:**

**EX3DV3 ISOTROPIC E-FIELD PROBE**

| | |
|---|---|
| **CONSTRUCTION** | Symmetrical design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| **FREQUENCY** | 10 MHz to > 6 GHz<br>Linearity: ± 0.2 dB (30 MHz to 6 GHz) |
| **DIRECTIVITY** | ± 0.3 dB in HSL (rotation around probe axis)<br>± 0.5 dB in tissue material (rotation normal to probe axis) |
| **DYNAMIC RANGE** | 10 $\mu$W/g to > 100 mW/g<br>Linearity: ± 0.2 dB (noise: typically < 1 $\mu$W/g) |
| **DIMENSIONS** | Overall length: 330 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm |
| **APPLICATION** | High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%. |

**NOTE**

1. The Probe parameters have been calibrated by the SPEAG. Please reference “APPENDIX D” for the Calibration Certification Report.
2. For frequencies above 800MHz, calibration in a rectangular wave-guide is used, because wave-guide size is manageable.
3. For frequencies below 800MHz, temperature transfer calibration is used because the wave-guide size becomes relatively large.

## For 5GHz:

### EX3DV3 ISOTROPIC E-FIELD PROBE (FREQUENCY BAND 5 ~ 6GHz)

| | |
|---|---|
| **DIMENSIONS** | Overall length: 330 mm (Tip Length: 20 mm)<br>Tip diameter: 2.5 mm (Body diameter: 12 mm)<br>Distance from probe tip to dipole centers: 1.0 mm |
| **APPLICATION** | General dosimetric measurements range 5 ~ 6 GHz.<br>Fast automatic scanning in arbitrary phantoms (EX3DV3) |

**NOTE:** The Probe parameters have been calibrated by the SPEAG. Please reference "APPENDIX D" for the Calibration Certification Report.

### TWIN SAM V4.0

| | |
|---|---|
| **CONSTRUCTION** | The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, EN 62209-1 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot. |
| **SHELL THICKNESS** | 2 ± 0.2mm |
| **FILLING VOLUME** | Approx. 25liters |
| **DIMENSIONS** | Height: 810mm; Length: 1000mm; Width: 500mm |

## SYSTEM VALIDATION KITS:

| | |
|---|---|
| **CONSTRUCTION** | Symmetrical dipole with l/4 balun enables measurement of feedpoint impedance with NWA matched for use near flat phantoms filled with brain simulating solutions. Includes distance holder and tripod adaptor |
| **CALIBRATION** | Calibrated SAR value for specified position and input power at the flat phantom in brain simulating solutions |
| **FREQUENCY** | 2450MHz, 5800MHz |
| **RETURN LOSS** | > 20dB at specified validation position |
| **POWER CAPABILITY** | > 100W (f < 1GHz); > 40W (f > 1GHz) |
| **OPTIONS** | Dipoles for other frequencies or solutions and other calibration conditions upon request |

## DEVICE HOLDER FOR SAM TWIN PHANTOM

| | |
|---|---|
| **CONSTRUCTION** | The device holder for the mobile phone device is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles. The holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity $\varepsilon$ =3 and loss tangent $\delta$ =0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered. The device holder for the portable device makes up of the polyethylene foam. The dielectric parameters of material close to the dielectric parameters of the air. |

## DATA ACQUISITION ELECTRONICS

**CONSTRUCTION**

The data acquisition electronics (DAE3) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplex, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe is mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

## 2.4 GENERAL DESCRIPTION OF THE SPATIAL PEAK SAR EVALUATION

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

| | | |
|---|---|---|
| Probe parameters: | - Sensitivity | $Norm_i$, $a_{i0}$, $a_{i1}$, $a_{i2}$ |
| | - Conversion factor | $ConvF_i$ |
| | - Diode compression point | $dcp_i$ |
| Device parameters: | - Frequency | F |
| | - Crest factor | Cf |
| Media parameters: | - Conductivity | $\sigma$ |
| | - Density | $\rho$ |

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

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

| | | |
|---|---|---|
| $V_i$ | =compensated signal of channel i | (i = x, y, z) |
| $U_i$ | =input signal of channel I | (i = x, y, z) |
| Cf | =crest factor of exciting field | (DASY parameter) |
| $dcp_i$ | =diode compression point | (DASY parameter) |

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

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

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

| | | |
|---|---|---|
| $V_i$ | =compensated signal of channel I | (i = x, y, z) |
| $Norm_i$ | =sensor sensitivity of channel i µV/(V/m)2 for E-field Probes | (i = x, y, z) |
| ConvF | = sensitivity enhancement in solution | |
| $a_{ij}$ | = sensor sensitivity factors for H-field probes | |
| F | = carrier frequency [GHz] | |
| $E_i$ | = electric field strength of channel i in V/m | |
| $H_i$ | = magnetic field strength of channel i in A/m | |

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

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

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

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

| | |
|---|---|
| SAR | = local specific absorption rate in mW/g |
| $E_{tot}$ | = total field strength in V/m |
| $\sigma$ | = conductivity in [mho/m] or [Siemens/m] |
| $\rho$ | = equivalent tissue density in g/cm3 |

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid. The entire evaluation of the spatial peak values is performed within the Post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. The extraction of the measured data (grid and values) from the Zoom Scan
2. The calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. The generation of a high-resolution mesh within the measured volume
4. The interpolation of all measured values from the measurement grid to the high-resolution grid
5. The extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. The calculation of the averaged SAR within masses of 1g and 10g.

The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated. The angle between the probe axis and the surface normal line is less than 30 degree.

The maximum search is automatically performed after each area scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the area scanning measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations. The 1g and 10g peak evaluations are only available for the predefined cube 7 x 7 x 7 scans. The routines are verified and optimized for the grid dimensions used in these cube measurements. The measured volume of 30 x 30 x 30mm contains about 30g of tissue. The first procedure is an extrapolation (incl. boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume in a 1mm grid (42875 points). In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

# 3. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

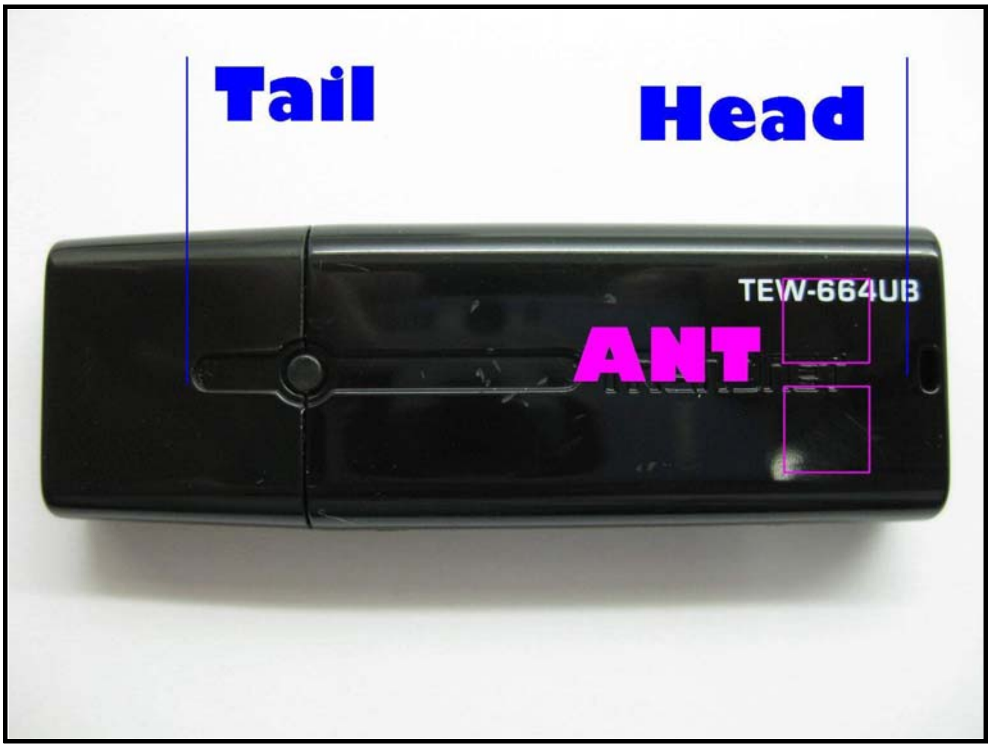
| NO. | PRODUCT | BRAND | MODEL NO. | SERIAL NO. | FCC ID |
|---|---|---|---|---|---|
| 1 | NOTEBOOK | DELL | PP18L | 29144041120 | CXSMM01BRD02D330 |

| NO. | SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS |
|---|---|
| 1 | NA |

**NOTE:** The length of USB cable is 11.6 inch. USB cable does not affect device radiating characteristics and output power

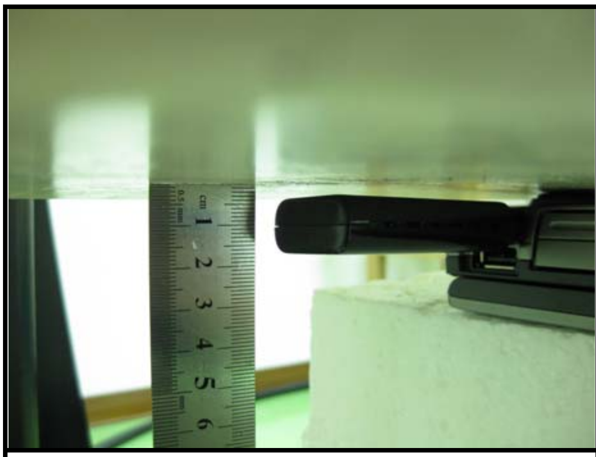
# 4. DESCRIPTION OF TEST MODES AND CONFIGURATIONS

## 4.1. DESCRIPTION OF ANTENNA LOCATION



## 4.2. DESCRIPTION OF ASSESSMENT POSITION

The following test configurations have been applied in this test report:



**A**

The bottom of the EUT faces to the phantom with 5mm-separation distance.

**B**

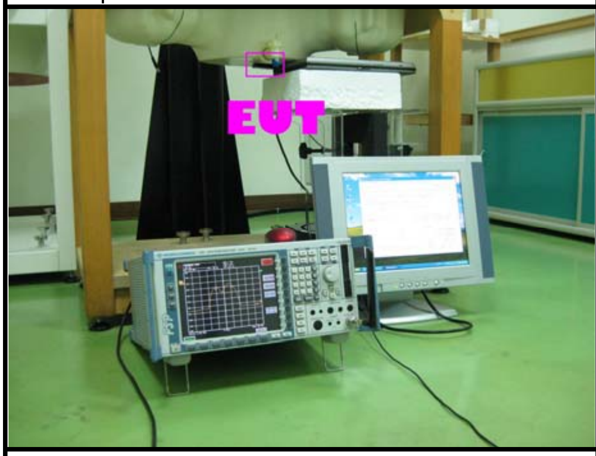
The right edge of the EUT faces to the phantom with 5mm-separation distance.

**C**

The front of the EUT faces to the phantom with 5mm-separation distance.

**D**

The left edge of the EUT faces to the phantom with 5mm-separation distance.




**SETUP PHOTO**

## 4.3. DESCRIPTION OF TEST MODE

Test tool is Ralink QAtest tool provided by client. It can control EUT to transmit continuously at specific channel, output power level, data rates and 100 % duty signal. The EUT only supports 2 tx transmitting. Therefore, the EUT will set under 2 tx transmitting mode to test.

"Per KDB 248277, for each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than ¼ dB higher than those measured at the lowest data rate."

Comparing output power of all modulations and data rates of each mode can find the lowest data rates has max output power. Therefore, EUT will set under lowest data rates to test.

"Per KDB 447498, when the SAR procedures require multiple channels to be tested and the 1-g SAR for the highest output channel is less than 0.8 W/kg and peak SAR is less than 1.6W/kg, where the transmission band corresponding to all channels is ≤ 100 MHz, testing for the other channels is not required."

According to test data from table of section 4.4, SAR value of highest output power channel is less than 0.8 W/ kg and peak SAR is less than 1.6W/kg. Therefore, testing for other channels is not required.

| ITEM | TEST MODE | MODULATION | ASSESSMENT POSTITION | TESTED CHANNEL |
|---|---|---|---|---|
| FOR 2.4GHz | | | | |
| 1 | 802.11b | DBPSK | A | 6 |
| 2 | 802.11g | BPSK | | 6 |
| 3 | Draft 802.11n (20MHz) | BPSK | | 6 |
| 4 | Draft 802.11n (40MHz) | BPSK | | 4 |
| 5 | 802.11b | DBPSK | B | 6 |
| 6 | 802.11g | BPSK | | 6 |
| 7 | Draft 802.11n (20MHz) | BPSK | | 6 |
| 8 | Draft 802.11n (40MHz) | BPSK | | 4 |
| 9 | 802.11b | DBPSK | C | 6 |
| 10 | 802.11g | BPSK | | 6 |
| 11 | Draft 802.11n (20MHz) | BPSK | | 6 |
| 12 | Draft 802.11n (40MHz) | BPSK | | 4 |
| 13 | 802.11b | DBPSK | D | 6 |
| 14 | 802.11g | BPSK | | 6 |
| 15 | Draft 802.11n (20MHz) | BPSK | | 6 |
| 16 | Draft 802.11n (40MHz) | BPSK | | 4 |

| ITEM | TEST MODE | MODULATION | ASSESSMENT POSTITION | TESTED CHANNEL |
|---|---|---|---|---|
| FOR 5.0GHz | | | | |
| 17 | 802.11a | BPSK | A | 165 |
| 18 | Draft 802.11n (20MHz) | BPSK | | 165 |
| 19 | Draft 802.11n (40MHz) | BPSK | | 159 |
| 20 | 802.11a | BPSK | B | 165 |
| 21 | Draft 802.11n (20MHz) | BPSK | | 165 |
| 22 | Draft 802.11n (40MHz) | BPSK | | 159 |
| 23 | 802.11a | BPSK | C | 165 |
| 24 | Draft 802.11n (20MHz) | BPSK | | 165 |
| 25 | Draft 802.11n (40MHz) | BPSK | | 159 |
| 26 | 802.11a | BPSK | D | 165 |
| 27 | Draft 802.11n (20MHz) | BPSK | | 165 |
| 28 | Draft 802.11n (40MHz) | BPSK | | 159 |

## 4.4. SUMMARY OF TEST RESULTS

### FOR 2.4GHz

| ITEM | | 1 | 2 | 3 | ITEM | | 4 |
|---|---|---|---|---|---|---|---|
| TEST MODE | | 802.11b | 802.11g | DRAFT 802.11n (20MHz) | TEST MODE | | DRAFT 802.11n (40MHz) |
| CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) | | | CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) |
| 1 | 2412 (Low) | - | - | - | 1 | 2422 (Low) | - |
| 6 | 2437 (Mid.) | **0.424** | 0.237 | 0.241 | 4 | 2437 (Mid.) | 0.257 |
| 11 | 2462 (High) | - | - | - | 7 | 2452 (High) | - |

| ITEM | | 5 | 6 | 7 | ITEM | | 8 |
|---|---|---|---|---|---|---|---|
| TEST MODE | | 802.11b | 802.11g | DRAFT 802.11n (20MHz) | TEST MODE | | DRAFT 802.11n (40MHz) |
| CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) | | | CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) |
| 1 | 2412 (Low) | - | - | - | 1 | 2422 (Low) | - |
| 6 | 2437 (Mid.) | 0.158 | 0.092 | 0.098 | 4 | 2437 (Mid.) | 0.089 |
| 11 | 2462 (High) | - | - | - | 7 | 2452 (High) | - |

| ITEM | | 9 | 10 | 11 | ITEM | | 12 |
|---|---|---|---|---|---|---|---|
| TEST MODE | | 802.11b | 802.11g | DRAFT 802.11n (20MHz) | TEST MODE | | DRAFT 802.11n (40MHz) |
| CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) | | | CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) |
| 1 | 2412 (Low) | - | - | - | 1 | 2422 (Low) | - |
| 6 | 2437 (Mid.) | 0.255 | 0.107 | 0.107 | 4 | 2437 (Mid.) | 0.096 |
| 11 | 2462 (High) | - | - | - | 7 | 2452 (High) | - |

| ITEM | | 13 | 14 | 15 | ITEM | | 16 |
|---|---|---|---|---|---|---|---|
| TEST MODE | | 802.11b | 802.11g | DRAFT 802.11n (20MHz) | TEST MODE | | DRAFT 802.11n (40MHz) |
| CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) | | | CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) |
| 1 | 2412 (Low) | - | - | - | 1 | 2422 (Low) | - |
| 6 | 2437 (Mid.) | 0.131 | 0.064 | 0.061 | 4 | 2437 (Mid.) | 0.059 |
| 11 | 2462 (High) | - | - | - | 7 | 2452 (High) | - |

**NOTE:** The worst value has been marked by boldface.

## FOR 5.0GHz

| ITEM | | 17 | 18 | ITEM | | 19 |
|---|---|---|---|---|---|---|
| TEST MODE | | 802.11a | DRAFT 802.11n (20MHz) | TEST MODE | | DRAFT 802.11n (40MHz) |
| CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) | | CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) |
| 149 | 5745 (Low) | - | - | 151 | 5755 (Low) | - |
| 157 | 5785 (Mid.) | - | - | 159 | 5795 (High) | **0.669** |
| 165 | 5825 (High) | 0.568 | 0.560 | | | |

| ITEM | | 20 | 21 | ITEM | | 22 |
|---|---|---|---|---|---|---|
| TEST MODE | | 802.11a | DRAFT 802.11n (20MHz) | TEST MODE | | DRAFT 802.11n (40MHz) |
| CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) | | CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) |
| 149 | 5745 (Low) | - | - | 151 | 5755 (Low) | - |
| 157 | 5785 (Mid.) | - | - | 159 | 5795 (High) | 0.581 |
| 165 | 5825 (High) | 0.509 | 0.461 | | | |

| ITEM | | 23 | 24 | ITEM | | 25 |
|---|---|---|---|---|---|---|
| TEST MODE | | 802.11a | DRAFT 802.11n (20MHz) | TEST MODE | | DRAFT 802.11n (40MHz) |
| CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) | | CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) |
| 149 | 5745 (Low) | - | - | 151 | 5755 (Low) | - |
| 157 | 5785 (Mid.) | - | - | 159 | 5795 (High) | 0.095 |
| 165 | 5825 (High) | 0.162 | 0.171 | | | |

| ITEM | | 26 | 27 | ITEM | | 28 |
|---|---|---|---|---|---|---|
| TEST MODE | | 802.11a | DRAFT 802.11n (20MHz) | TEST MODE | | DRAFT 802.11n (40MHz) |
| CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) | | CHAN. | FREQ. (MHz) | MEASURED VALUE OF 1g SAR ( W/kg) |
| 149 | 5745 (Low) | - | - | 151 | 5755 (Low) | - |
| 157 | 5785 (Mid.) | - | - | 159 | 5795 (High) | 0.546 |
| 165 | 5825 (High) | 0.479 | 0.422 | | | |

**NOTE:** The worst value has been marked by boldface.

## 4.5. CHECK FOR SCAN RESOLUTION

### COMPARE WITH DIFFERENT SCAN RESOLUTION

With EUT hold on the worst case configuration (high channel in test mode 19) with no any change in position or setting, 2 scans with different resolutions are preformed to evaluate the impact on the SAR value.

Test data as below:

| SCAN RESOLUTION (mm) | SAR VALUE (W/kg) |
|---|---|
| 4.30 | 0.669 |
| 2.15 | 0.645 |

**CONCLUSION:** No meaningful change detected.

## 4.6. ENHANCED ENERGY COUPLING AT INCREASED SEPARATION DISTANCES

**INITIAL POSITION:**

The probe tip is positioned at the peak SAR location of in test mode 1, 5, 9, 13, 19, 22, 24, 28, at a distance of one half the probe tip diameter from the phantom surface. Under this condition to get a single sar value.

**5mm INCREMENTS FROM INITIAL POSITION:**

With the probe fixed at this location, the device is moved away from the phantom in 5 mm increments from the initial touching or minimum separation position. A single point SAR is measured for each of these device positions until the SAR is less than 50% of that measured at the initial position.

| CHAN. | FREQ. (MHz) | DEVICE TEST POSITION MODE | INITIAL POSITION MEASURED 1g SAR (W/kg) | 5mm INCREMENTS FROM INITIAL POSITION MEASURED 1g SAR (W/kg) |
|---|---|---|---|---|
| 6 | 2437 | 11b Front | 0.508 | 0.212 |
| 6 | 2437 | 11b Left Edge | 0.317 | 0.108 |
| 6 | 2437 | 11b Bottom | 0.977 | 0.385 |
| 6 | 2437 | 11b Right Edge | 0.354 | 0.122 |
| CHAN. | FREQ. (MHz) | DEVICE TEST POSITION MODE | INITIAL POSITION MEASURED 1g SAR (W/kg) | 5mm INCREMENTS FROM INITIAL POSITION MEASURED 1g SAR (W/kg) |
| 165 | 5825 | 11a 20 Front | 0.448 | 0.179 |
| 159 | 5795 | 11a 40 Left Edge | 1.410 | 0.506 |
| 159 | 5795 | 11a 40 Bottom | 1.830 | 0.599 |
| 159 | 5795 | 11a 40 Right Edge | 1.470 | 0.517 |

**RESULT:** No Enhancement Energy Coupling observed.

# 5. TEST RESULTS

## 5.1 TEST PROCEDURES

Use the software to control the EUT channel and transmission power. Then record the conducted power before the testing. Place the EUT to the specific test location. After the testing, must writing down the conducted power of the EUT into the report. The SAR value was calculated via the 3D spline interpolation algorithm that has been implemented in the software of DASY4 SAR measurement system manufactured and calibrated by SPEAG. According to the IEEE 1528 standards, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

• Power reference measurement

• Verification of the power reference measurement

• Area scan

• Zoom scan

• Power reference measurement

The area scan was performed for the highest spatial SAR location. The zoom scan with 30mm x 30mm x 30mm volume was performed for SAR value averaged over 1g and 10g spatial volumes.

In the zoom scan, the distance between the measurement point at the probe sensor location (geometric center behind the probe tip) and the phantom surface is 3mm and maintained at a constant distance of ±0.5mm during a zoom scan to determine peak SAR locations. The distance is 3mm between the first measurement point and the bottom surface of the phantom. The secondary measurement point to the bottom surface of the phantom is with 8mm separation distance. The cube size is 7 x 7 x 7 points consists of 343 points and the grid space is 5mm.

The measurement time is 0.5s at each point of the zoom scan. The probe boundary effect compensation shall be applied during the SAR test. Because of the tip of the probe to the Phantom surface separated distances are longer than half a tip probe diameter.

In the area scan, the separation distance is 3mm between the each measurement point and the phantom surface. The scan size shall be included the transmission portion of the EUT. The measurement time is the same as the zoom scan. At last the reference power drift shall be less than ±5%.

## 5.2 MEASURED SAR RESULTS

| ENVIRONMENTAL CONDITION | Air Temperature：23.1°C, Liquid Temperature：22.0°C<br>Humidity：58%RH | | |
|---|---|---|---|
| TESTED BY | Sam Onn | DATE | Jan. 20, 2009 |

| CHAN. | FREQ. (MHz) | TEST MODE | CONDUCTED POWER (mW) | | POWER DRIFT (%) | DEVICE TEST POSITION MODE | MEASURED 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| | | | BEGIN TEST | AFTER TEST | | | |
| 6 | 2437 (Mid.) | 802.11b | 180.315 | 178.277 | -1.13 | 1 | 0.424 |
| 6 | 2437 (Mid.) | 802.11g | 387.681 | 383.025 | -1.20 | 2 | 0.237 |
| 6 | 2437 (Mid.) | DRAFT 802.11n (20MHz) | 387.900 | 382.896 | -1.29 | 3 | 0.241 |
| 4 | 2437 (Mid.) | DRAFT 802.11n (40MHz) | 385.899 | 380.651 | -1.36 | 4 | 0.257 |
| 6 | 2437 (Mid.) | 802.11b | 180.315 | 177.755 | -1.42 | 5 | 0.158 |
| 6 | 2437 (Mid.) | 802.11g | 387.681 | 381.711 | -1.54 | 6 | 0.092 |
| 6 | 2437 (Mid.) | DRAFT 802.11n (20MHz) | 387.900 | 381.616 | -1.62 | 7 | 0.098 |
| 4 | 2437 (Mid.) | DRAFT 802.11n (40MHz) | 385.899 | 379.300 | -1.71 | 8 | 0.089 |

**NOTE:**

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over 1g, **1.6 W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

| ENVIRONMENTAL CONDITION | Air Temperature：23.1°C, Liquid Temperature：22.0°C<br>Humidity：58%RH | | |
|---|---|---|---|
| TESTED BY | Sam Onn | DATE | Jan. 20, 2009 |

| CHAN. | FREQ. (MHz) | TEST MODE | CONDUCTED POWER (mW) | | POWER DRIFT (%) | DEVICE TEST POSITION MODE | MEASURED 1g SAR (W/kg) |
|---|---|---|---|---|---|---|---|
| | | | BEGIN TEST | AFTER TEST | | | |
| **6** | **2437 (Mid.)** | **802.11b** | 180.315 | 177.051 | -1.81 | 9 | 0.255 |
| **6** | **2437 (Mid.)** | **802.11g** | 387.681 | 380.315 | -1.90 | 10 | 0.107 |
| **6** | **2437 (Mid.)** | **DRAFT 802.11n (20MHz)** | 387.900 | 379.948 | -2.05 | 11 | 0.107 |
| **4** | **2437 (Mid.)** | **DRAFT 802.11n (40MHz)** | 385.899 | 377.679 | -2.13 | 12 | 0.096 |
| **6** | **2437 (Mid.)** | **802.11b** | 180.315 | 176.330 | -2.21 | 13 | 0.131 |
| **6** | **2437 (Mid.)** | **802.11g** | 387.681 | 378.570 | -2.35 | 14 | 0.064 |
| **6** | **2437 (Mid.)** | **DRAFT 802.11n (20MHz)** | 387.900 | 378.358 | -2.46 | 15 | 0.061 |
| **4** | **2437 (Mid.)** | **DRAFT 802.11n (40MHz)** | 385.899 | 376.059 | -2.55 | 16 | 0.059 |

**NOTE:**

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over 1g, **1.6 W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

| ENVIRONMENTAL CONDITION | Air Temperature：22.5°C, Liquid Temperature：21.7°C<br>Humidity：61%RH | | | | | | |
|---|---|---|---|---|---|---|---|
| TESTED BY | Sam Onn | | | DATE | Jan. 21, 2009 | | |
| CHAN. | FREQ. (MHz) | TEST MODE | CONDUCTED POWER (mW) | | POWER DRIFT (%) | DEVICE TEST POSITION MODE | MEASURED 1g SAR (W/kg) |
| | | | BEGIN TEST | AFTER TEST | | | |
| **165** | **5825 (High)** | **802.11a** | 202.083 | 197.738 | -2.15 | 17 | 0.568 |
| **165** | **5825 (High)** | **DRAFT 802.11n (20MHz)** | 226.220 | 221.085 | -2.27 | 18 | 0.560 |
| **159** | **5795 (High)** | **DRAFT 802.11n (40MHz)** | 256.766 | 250.629 | -2.39 | 19 | **0.669** |
| **165** | **5825 (High)** | **802.11a** | 202.083 | 197.112 | -2.46 | 20 | 0.509 |
| **165** | **5825 (High)** | **DRAFT 802.11n (20MHz)** | 226.220 | 220.497 | -2.53 | 21 | 0.461 |
| **159** | **5795 (High)** | **DRAFT 802.11n (40MHz)** | 256.766 | 250.064 | -2.61 | 22 | 0.581 |
| **165** | **5825 (High)** | **802.11a** | 202.083 | 196.506 | -2.76 | 23 | 0.162 |
| **165** | **5825 (High)** | **DRAFT 802.11n (20MHz)** | 226.220 | 219.750 | -2.86 | 24 | 0.171 |
| **159** | **5795 (High)** | **DRAFT 802.11n (40MHz)** | 256.766 | 249.268 | -2.92 | 25 | 0.095 |
| **165** | **5825 (High)** | **802.11a** | 202.083 | 195.940 | -3.04 | 26 | 0.479 |
| **165** | **5825 (High)** | **DRAFT 802.11n (20MHz)** | 226.220 | 219.162 | -3.12 | 27 | 0.422 |
| **159** | **5795 (High)** | **DRAFT 802.11n (40MHz)** | 256.766 | 248.370 | -3.27 | 28 | 0.546 |

**NOTE:**

1. Test configuration of each mode is described in section 3.
2. In this testing, the limit for General Population Spatial Peak averaged over 1g, **1.6 W/kg**, is applied.
3. Please see the Appendix A for the data.
4. The variation of the EUT conducted power measured before and after SAR testing should not over 5%.

## 5.3 SAR LIMITS

| HUMAN EXPOSURE | SAR (W/kg) | |
|---|---|---|
| | (GENERAL POPULATION / UNCONTROLLED EXPOSURE ENVIRONMENT) | (OCCUPATIONAL / CONTROLLED EXPOSURE ENVIRONMENT) |
| Spatial Average (whole body) | 0.08 | 0.4 |
| Spatial Peak (averaged over 1 g) | **1.6** | 8.0 |
| Spatial Peak (hands / wrists / feet / ankles averaged over 10 g) | 4.0 | 20.0 |

**NOTE:**

1. This limits accord to 47 CFR 2.1093 – Safety Limit.
2. The EUT property been complied with the partial body exposure limit under the general population environment.

## 5.4 RECIPES FOR TISSUE SIMULATING LIQUIDS

For the measurement of the field distribution inside the SAM phantom, the phantom must be filled with 25 litters of tissue simulation liquid.

The following ingredients are used：

- **WATER-** Deionized water (pure H20), resistivity _16 M - as basis for the liquid
- **SUGAR-** Refined sugar in crystals, as available in food shops - to reduce relative permittivity
- **SALT-** Pure NaCl - to increase conductivity
- **CELLULOSE-** Hydroxyethyl-cellulose, medium viscosity (75-125mPa.s, 2% in water, 20_C),
  CAS # 54290 - to increase viscosity and to keep sugar in solution
- **PRESERVATIVE-** Preventol D-7 Bayer AG, D-51368 Leverkusen, CAS # 55965-84-9 - to prevent the spread of bacteria and molds
- **DGMBE-** Diethylenglycol-monobuthyl ether (DGMBE), Fluka Chemie GmbH, CAS # 112-34-5 - to reduce relative permittivity

## THE RECIPES FOR 2450MHz SIMULATING LIQUID TABLE

| INGREDIENT | HEAD SIMULATING LIQUID 2450MHz (HSL-2450) | MUSCLE SIMULATING LIQUID 2450MHz (MSL-2450) |
|---|---|---|
| Water | 45% | 69.83% |
| DGMBE | 55% | 30.17% |
| Salt | NA | NA |
| Dielectric Parameters at 22℃ | f= 2450MHz<br>ε= 39.2 ± 5%<br>σ= 1.80 ± 5% S/m | f= 2450MHz<br>ε= 52.7 ± 5%<br>σ= 1.95 ± 5% S/m |

## THE INFORMATION FOR 5GHz SIMULATING LIQUID

**The 5GHz liquids was purchased from SPEAG.**

**Body liquid model:** HSL 5800, P/N: SL AAH 5800 AA

**Head liquid model:** M 5800, P/N: SL AAM 580 AD

**5GHz liquids contain the following ingredients:**

Water 64 - 78%

Mineral Oil 11 - 18%

Emulsifiers 9 - 15%

Additives and Salt 2 - 3%

Testing the liquids using the Agilent Network Analyzer E8358A and Agilent Dielectric Probe Kit 85070D.The testing procedure is following as

1. Turn Network Analyzer on and allow at least 30min. warm up.
2. Mount dielectric probe kit so that interconnecting cable to Network Analyzer will not be moved during measurements or calibration.
3. Pour de-ionized water and measure water temperature (±1°).
4. Set water temperature in Agilent-Software (Calibration Setup).
5. Perform calibration.
6. Validate calibration with dielectric material of known properties (e.g. polished ceramic slab with >8mm thickness ε'=10.0, ε''=0.0). If measured parameters do not fit within tolerance, repeat calibration (±0.2 for ε': ±0.1 for ε'').
7. Conductivity can be calculated from ε'' by $\sigma = \omega \varepsilon_0 \varepsilon'' = \varepsilon'' f$ [GHz] / 18.
8. Measure liquid shortly after calibration. Repeat calibration every hour.
9. Stir the liquid to be measured. Take a sample (~ 50ml) with a syringe from the center of the liquid container.
10. Pour the liquid into a small glass flask. Hold the syringe at the bottom of the flask to avoid air bubbles.
11. Put the dielectric probe in the glass flask. Check that there are no air bubbles in front of the opening in the dielectric probe kit.
12. Perform measurements.
13. Adjust medium parameters in DASY4 for the frequencies necessary for the measurements (‘Setup Config’, select medium (e.g. Brain 900MHz) and press ‘Option’-button.
14. Select the current medium for the frequency of the validation (e.g. Setup Medium Brain 900MHz).

## FOR 2.4GHz BAND SIMULATING LIQUID

| LIQUID TYPE | MSL-2450 | | | |
|---|---|---|---|---|
| SIMULATING LIQUID TEMP. | 22.0 | | | |
| TEST DATE | Jan. 20, 2009 | | | |
| TESTED BY | Sam Onn | | | |
| FREQ. (MHz) | LIQUID PARAMETER | STANDARD VALUE | MEASUREMENT VALUE | ERROR PERCENTAGE (%) |
| 2437.0 | Permitivity (ε) | 52.70 | 54.30 | 3.04 |
| 2437.0 | | 52.70 | 54.20 | 2.85 |
| 2450.0 | Conductivity (σ) S/m | 1.94 | 1.97 | 1.55 |
| 2450.0 | | 1.95 | 1.98 | 1.54 |
| Dielectric Parameters Required at 22℃ | f= 2450MHz<br>ε= 52.7 ± 5%<br>σ= 1.95 ± 5% S/m | | | |

## FOR WLAN 5GHz BAND SIMULATING LIQUID

| LIQUID TYPE | MSL-5800 | | | |
|---|---|---|---|---|
| SIMULATING LIQUID TEMP. | 21.7 | | | |
| TEST DATE | Jan. 21, 2009 | | | |
| TESTED BY | Sam Onn | | | |
| FREQ. (MHz) | LIQUID PARAMETER | STANDARD VALUE | MEASUREMENT VALUE | ERROR PERCENTAGE (%) |
| 5795.0 | Permitivity (ε) | 48.20 | 49.60 | 2.90 |
| 5800.0 | | 48.20 | 49.50 | 2.70 |
| 5825.0 | | 48.20 | 49.50 | 2.70 |
| 5795.0 | Conductivity (σ) S/m | 5.99 | 6.16 | 2.84 |
| 5800.0 | | 6.00 | 6.17 | 2.83 |
| 5825.0 | | 6.03 | 6.21 | 2.99 |
| Dielectric Parameters Required at 22℃ | f= 2450MHz<br>ε= 52.7 ± 5%<br>σ= 1.95 ± 5% S/m | | | |

## 5.5 TEST EQUIPMENT FOR TISSUE PROPERTY

| ITEM | NAME | BRAND | TYPE | SERIES NO. | DATE OF CALIBRATION | DUE DATE OF CALIBRATION |
|---|---|---|---|---|---|---|
| 1 | Network Analyzer | Agilent | E5071C | MY46104190 | Apr. 11, 2008 | Apr. 10, 2009 |
| 2 | Dielectric Probe | Agilent | 85070D | US01440176 | NA | NA |

**NOTE:**

1. Before starting, all test equipment shall be warmed up for 30min.
2. The tolerance (k=1) specified by Agilent for general dielectric measurements, deriving from inaccuracies in the calibration data, analyzer drift, and random errors, are usually ±2.5% and ±5% for measured permittivity and conductivity, respectively. However, the tolerances for the conductivity is smaller for material with large loss tangents, i.e., less than ±2.5% (k=1). It can be substantially smaller if more accurate methods are applied.

## 6. SYSTEM VALIDATION

The system validation was performed in the flat phantom with equipment listed in the following table. Since the SAR value is calculated from the measured electric field, dielectric constant and conductivity of the body tissue and the SAR is proportional to the square of the electric field. So, the SAR value will be also proportional to the RF power input to the system validation dipole under the same test environment. In our system validation test, 250mW RF input power was used.

### 6.1 TEST EQUIPMENT

| ITEM | NAME | BRAND | TYPE | SERIES NO. | DATE OF CALIBRATION | DUE DATE OF CALIBRATION |
|---|---|---|---|---|---|---|
| 1 | SAM Phantom | S & P | QD000 P40 CA | TP-1150 | NA | NA |
| 2 | Signal Generator | Anritsu | 68247B | 984703 | May 27, 2008 | May 26, 2009 |
| 3 | E-Field Probe | S & P | EX3DV3 | 3506 | Sep. 30, 2008 | Sep. 29, 2009 |
| 4 | DAE | S & P | DAE | 579 | Mar. 13, 2008 | Mar. 12, 2009 |
| 5 | Robot Positioner | Staubli Unimation | NA | NA | NA | NA |
| 6 | Validation Dipole | S & P | D2450V2 | 737 | Apr. 22, 2008 | Apr. 21, 2009 |
| 7 | Validation Dipole | S & P | D5GHzV2 | 1018 | Apr. 22, 2008 | Apr. 21, 2009 |
| 8 | Power Meter | Agilent | E4416A | GB41291763 | Sep. 28, 2008 | Sep. 29, 2009 |
| 9 | Power Sensor | Agilent | E9327A | US40441181 | Sep. 28, 2008 | Sep. 29, 2009 |

**NOTE:** Before starting the measurement, all test equipment shall be warmed up for 30min.

## 6.2 TEST PROCEDURE

Before the system performance check, we need only to tell the system which components (probe, medium, and device) are used for the system performance check; the system will take care of all parameters. The dipole must be placed beneath the flat section of the SAM Twin Phantom with the correct distance holder in place. The distance holder should touch the phantom surface with a light pressure at the reference marking (little cross) and be oriented parallel to the long side of the phantom. Accurate positioning is not necessary, since the system will search for the peak SAR location, except that the dipole arms should be parallel to the surface. The device holder for mobile phones can be left in place but should be rotated away from the dipole.

1. The ”Power Reference Measurement” and ”Power Drift Measurement” jobs are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the amplifier output power. If it is too high (above ±0.1 dB), the system performance check should be repeated; some amplifiers have very high drift during warm-up. A stable amplifier gives drift results in the DASY system below ±0.02dB.

2. The ”Surface Check” job tests the optical surface detection system of the DASY system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above ±0.1mm). In that case it is better to abort the system performance check and stir the liquid. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within $\pm 30^{O}$.) However, varying breaking indices of different liquid compositions might also influence the distance. If the indicated difference varies from the actual setting, the probe parameter ”optical surface

3. The "Area Scan" job measures the SAR above the dipole on a plane parallel to the surface. It is used to locate the approximate location of the peak SAR. The proposed scan uses large grid spacing for faster measurement; due to the symmetric field, the peak detection is reliable. If a finer graphic is desired, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result.

4. The "Zoom Scan" job measures the field in a volume around the peak SAR value assessed in the previous "Area Scan" job (for more information see the application note on SAR evaluation).

About the validation dipole positioning uncertainty, the constant and low loss dielectric spacer is used to establish the correct distance between the top surface of the dipole and the bottom surface of the phantom, the error component introduced by the uncertainty of the distance between the liquid (i.e., phantom shell) and the validation dipole in the DASY4 system is less than ±0.1mm.

$$SAR_{tolerance}[\%] = 100 \times (\frac{(a+d)^2}{a^2} - 1)$$

As the closest distance is 10mm, the resulting tolerance $SAR_{tolerance}[\%]$ is <2%.

## 6.3 VALIDATION RESULTS

| SYSTEM VALIDATION TEST OF SIMULATING LIQUID | | | | | |
|---|---|---|---|---|---|
| FREQUENCY (MHz) | REQUIRED SAR (mW/g) | MEASURED SAR (mW/g) | DEVIATION (%) | SEPARATION DISTANCE | TESTED DATE |
| MSL2450 | 12.80 (1g) | 13.30 | 3.91 | 10mm | Jan. 20, 2009 |
| MSL5800 | 7.37 (1g) | 7.23 | -1.90 | 10mm | Jan. 21, 2009 |
| TESTED BY | Sam Onn | | | | |

**NOTE:** Please see Appendix for the photo of system validation test.

## 6.4 SYSTEM VALIDATION UNCERTAINTIES (FOR 2.4GHz)

In the table below, the system validation uncertainty with respect to the analytically assessed SAR value of a dipole source as given in the IEEE 1528 standard is given. This uncertainty is smaller than the expected uncertainty for mobile phone measurements due to the simplified setup and the symmetric field distribution.

| Error Description | Tolerance (±%) | Probability Distribution | Divisor | ($C_i$) | | Standard Uncertainty (±%) | | ($v_i$) |
|---|---|---|---|---|---|---|---|---|
| | | | | (1g) | (10g) | (1g) | (10g) | |
| **Measurement System** | | | | | | | | |
| Probe Calibration | 5.50 | Normal | 1 | 1 | 1 | 5.50 | 5.50 | ∞ |
| Axial Isotropy | 4.70 | Rectangular | $\sqrt{3}$ | 0.7 | 0.7 | 1.90 | 1.90 | ∞ |
| Hemispherical Isotropy | 9.60 | Rectangular | $\sqrt{3}$ | 0.7 | 0.7 | 3.88 | 3.88 | ∞ |
| Boundary effects | 1.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.58 | 0.58 | ∞ |
| Linearity | 4.70 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.71 | 2.71 | ∞ |
| System Detection Limits | 1.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.58 | 0.58 | ∞ |
| Readout Electronics | 0.30 | Normal | 1 | 1 | 1 | 0.30 | 0.30 | ∞ |
| Response Time | 0.80 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.46 | 0.46 | ∞ |
| Integration Time | 2.60 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.50 | 1.50 | ∞ |
| RF Ambient Noise | 3.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.73 | 1.73 | ∞ |
| RF Ambient Reflections | 3.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.73 | 1.73 | ∞ |
| Probe Positioner | 0.40 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.23 | 0.23 | ∞ |
| Probe Positioning | 2.90 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.67 | 1.67 | ∞ |
| Max. SAR Eval. | 1.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.58 | 0.58 | ∞ |
| **Dipole Related** | | | | | | | | |
| Dipole Axis to Liquid Distance | 2.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.15 | 1.15 | 145 |
| Input Power Drift | 5.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.89 | 2.89 | ∞ |
| **Phantom and Tissue parameters** | | | | | | | | |
| Phantom Uncertainty | 4.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.31 | 2.31 | ∞ |
| Liquid Conductivity (target) | 5.00 | Rectangular | $\sqrt{3}$ | 0.64 | 0.43 | 1.85 | 1.24 | ∞ |
| Liquid Conductivity (measurement) | 2.55 | Normal | 1 | 0.64 | 0.43 | 1.63 | 1.10 | ∞ |
| Liquid Permittivity (target) | 5.00 | Rectangular | $\sqrt{3}$ | 0.6 | 0.49 | 1.73 | 1.41 | ∞ |
| Liquid Permittivity (measurement) | 3.65 | Normal | 1 | 0.6 | 0.49 | 2.19 | 1.79 | ∞ |
| **Combined Standard Uncertainty** | | | | | | **9.88** | **9.57** | |
| **Coverage Factor for 95%** | | | | | | **Kp=2** | | |
| **Expanded Uncertainty (K=2)** | | | | | | **19.75** | **19.14** | |

**NOTE:** About the system validation uncertainty assessment, please reference the section 7.

## 6.5 SYSTEM VALIDATION UNCERTAINTIES (FOR 5.0GHz)

| Error Description | Tolerance (±%) | Probability Distribution | Divisor | ($C_i$) | | Standard Uncertainty (±%) | | ($v_i$) |
|---|---|---|---|---|---|---|---|---|
| | | | | (1g) | (10g) | (1g) | (10g) | |
| **Measurement System** | | | | | | | | |
| **Probe Calibration** | 6.55 | Normal | 1 | 1 | 1 | 6.55 | 6.55 | ∞ |
| **Axial Isotropy** | 4.70 | Rectangular | $\sqrt{3}$ | 0.7 | 0.7 | 1.90 | 1.90 | ∞ |
| **Hemispherical Isotropy** | 9.60 | Rectangular | $\sqrt{3}$ | 0.7 | 0.7 | 3.88 | 3.88 | ∞ |
| **Boundary effect** | 2.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.15 | 1.15 | ∞ |
| **Linearity** | 4.70 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.71 | 2.71 | ∞ |
| **System Detection Limit** | 1.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.58 | 0.58 | ∞ |
| **Readout Electronics** | 0.30 | Normal | 1 | 1 | 1 | 0.30 | 0.30 | ∞ |
| **Response Time** | 0.80 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.46 | 0.46 | ∞ |
| **Integration Time** | 2.60 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.50 | 1.50 | ∞ |
| **RF Ambient Conditions** | 3.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.73 | 1.73 | ∞ |
| **Probe Positioner** | 3.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.73 | 1.73 | ∞ |
| **Probe positioning** | 0.80 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.46 | 0.46 | ∞ |
| **Algorithms for Max. SAR Evaluation** | 9.90 | Rectangular | $\sqrt{3}$ | 1 | 1 | 5.72 | 5.72 | ∞ |
| **Dipole** | | | | | | | | |
| **Dipole Axis to Liquid Distance** | 2.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.15 | 1.15 | 145 |
| **Input power and SAR drift measurement** | 5.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.89 | 2.89 | ∞ |
| **Phantom and Tissue Parameters** | | | | | | | | |
| **Phantom Uncertainty** | 4.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.31 | 2.31 | ∞ |
| **Liquid Conductivity (target)** | 5.00 | Rectangular | $\sqrt{3}$ | 0.64 | 0.43 | 1.85 | 1.24 | ∞ |
| **Liquid Conductivity (measurement)** | 2.16 | Normal | 1 | 0.64 | 0.43 | 1.38 | 0.93 | ∞ |
| **Liquid Permittivity (target)** | 5.00 | Rectangular | $\sqrt{3}$ | 0.6 | 0.49 | 1.73 | 1.41 | ∞ |
| **Liquid Permittivity (measurement)** | 2.09 | Normal | 1 | 0.6 | 0.49 | 1.25 | 1.02 | ∞ |
| **Combined Standard Uncertainty** | | | | | | **11.93** | **11.74** | |
| **Coverage Factor for 95%** | | | | | | kp=2 | | |
| **Expanded Uncertainty (K=2)** | | | | | | **23.85** | **23.48** | |

**Table 6.1**

**NOTE: 1.** Table 6.1 Uncertainty of the system performance check in the 5-6GHz range. Probe calibration error reflects uncertainty of the EX3DV3 probe conversion factor at Calibration Frequency.

**2.** About the system validation uncertainty assessment, please reference the section 7.

# 7. MEASUREMENT SAR PROCEDURE UNCERTAINTIES

The assessment of spatial peak SAR of the hand handheld devices is according to IEEE 1528 / EN 62209-1. All testing situation shall be met below these requirements.

- The system is used by an experienced engineer who follows the manual and the guidelines taught during the training provided by SPEAG.
- The probe has been calibrated within the requested period and the stated uncertainty for the relevant frequency bands does not exceed 4.8% (k=1).
- The validation dipole has been calibrated within the requested period and the system performance check has been successful.
- The DAE unit has been calibrated within the within the requested period.
- The minimum distance between the probe sensor and inner phantom shell is selected to be between 4 and 5mm.
- The operational mode of the DUT is CW, CDMA, FDMA or TDMA (GSM, DCS, PCS, IS136 and PDC) and the measurement/integration time per point is >500 ms.
- The dielectric parameters of the liquid have been assessed using Agilent 85070D dielectric probe kit or a more accurate method.
- The dielectric parameters are within 5% of the target values.
- The DUT has been positioned as described in section 3.

## 7.1. PROBE CALIBRATION UNCERTAINTY

SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528, EN 62209-1, IEC 62209, etc.) under ISO17025. The uncertainties are stated on the calibration certificate. For the most relevant frequency bands, these values do not exceed 4.8% (k=1). If evaluations of other bands are performed for which the uncertainty exceeds these values, the uncertainty tables given in the summary have to be revised accordingly.

## 7.2. ISOTROPY UNCERTAINTY

The axial isotropy tolerance accounts for probe rotation around its axis while the hemispherical isotropy error includes all probe orientations and field polarizations. These parameters are assessed by SPEAG during initial calibration. In 2001, SPEAG further tightened its quality controls and warrants that the maximal deviation from axial isotropy is ±0.20dB, while the maximum deviation of hemispherical isotropy is ±0.40dB, corresponding to ±4.7% and ±9.6%, respectively. A weighting factor of cp equal to 0.5 can be applied, since the axis of the probe deviates less than 30 degrees from the normal surface orientation.

## 7.3. BOUNDARY EFFECT UNCERTAINTY

The effect can be estimated according to the following error approximation formula

$$SAR_{tolerance}[\%] = SAR_{be}[\%] \times \frac{(d_{be} + d_{step})^2}{2d_{step}} \frac{e^{-\frac{d_{be}}{\delta/2}}}{\delta/2}$$

$$d_{be} + d_{step} < 10mm$$

The parameter $d_{be}$ is the distance in mm between the surface and the closest measurement point used in the averaging process; $d_{step}$ is the separation distance in mm between the first and second measurement points; δ is the minimum penetration depth in mm within the head tissue equivalent liquids (i.e., δ= 13.95mm at 3GHz); $SAR_{be}$ is the deviation between the measured SAR value at the distance $d_{be}$ from the boundary and the wave-guide analytical value $SAR_{ref}$.DASY4 applies a boundary effect compensation algorithm according to IEEE 1528, which is possible since the axis of the probe never deviates more than 30 degrees from the normal surface orientation. $SAR_{be}$[%] is assessed during the calibration process and SPEAG warrants that the uncertainty at distances larger than 4mm is always less than 1%.In summary, the worst case boundary effect SAR tolerance[%] for scanning distances larger than 4mm is < ± 0.8%.

## 7.4. PROBE LINEARITY UNCERTAINTY

Field probe linearity uncertainty includes errors from the assessment and compensation of the diode compression effects for CW and pulsed signals with known duty cycles. This error is assessed using the procedure described in IEEE 1528 / EN 62209-1. For SPEAG field probes, the measured difference between CW and pulsed signals, with pulse frequencies between 10Hz and 1kHz and duty cycles between 1 and 100, is < ±0.20dB (< ±4.7%).

## 7.5. READOUT ELECTRONICS UNCERTAINTY

All uncertainties related to the probe readout electronics (DAE unit), including the gain and linearity of the instrumentation amplifier, its loading effect on the probe, and accuracy of the signal conversion algorithm, have been assessed accordingly to IEEE 1528 / EN 62209-1.The combination (root-sum-square RSS method) of these components results in an overall maximum error of ±1.0%.

## 7.6. RESPONSE TIME UNCERTAINTY

The time response of the field probes is assessed by exposing the probe to a well-controlled electric field producing SAR larger than 2.0W/kg at the tissue medium surface. The signal response time is evaluated as the time required by the system to reach 90% of the expected final value after an on/of switch of the power source. Analytically, it can be expressed as:

$$SAR_{tolerance}[\%] = 100 \times \left(\frac{T_m}{T_m + \tau e^{-T_m/\tau} - \tau} - 1\right)$$

where Tm is 500 ms, i.e., the time between measurement samples, and $\tau$ the time constant. The response time $\tau$ of SPEAG's probes is <5ms. In the current implementation, DASY4 waits longer than 100 ms after having reached the grid point before starting a measurement, i.e., the response time uncertainty is negligible.

## 7.7. INTEGRATION TIME UNCERTAINTY

If the device under test does not emit a CW signal, the integration time applied to measure the electric field at a specific point may introduce additional uncertainties due to the discretization and can be assessed as follows

$$SAR_{tolerance}[\%] = 100 \times \sum_{allsub-frames} \frac{t_{frame}}{t_{integration}} \frac{slot_{idle}}{slot_{total}}$$

The tolerances for the different systems are given in Table 7.1, whereby the worst-case $SAR_{tolerance}$ is 2.6%.

| System | $SAR_{tolerance}$ % |
|---|---|
| CW | 0 |
| CDMA* | 0 |
| WCDMA* | 0 |
| FDMA | 0 |
| IS-136 | 2.6 |
| PDC | 2.6 |
| GSM/DCS/PCS | 1.7 |
| DECT | 1.9 |
| Worst-Case | 2.6 |

**TABLE 7.1**

## 7.8. PROBE POSITIONER MECHANICAL TOLERANCE

The mechanical tolerance of the field probe positioner can introduce probe positioning uncertainties. The resulting SAR uncertainty is assessed by comparing the SAR obtained according to the specifications of the probe positioner with respect to the actual position defined by the geometric enter of the probe sensors. The tolerance is determined as:

$$SAR_{tolerance}[\%] = 100 \times \frac{d_{ph}}{\delta/2}$$

The specified repeatability of the RX robot family used in DASY4 systems is ±25μm. The absolute accuracy for short distance movements is better than ±0.1mm, i.e., the $SAR_{tolerance}$[%] is better than 1.5% (rectangular).

## 7.9. PROBE POSITIONING

The probe positioning procedures affect the tolerance of the separation distance between the probe tip and the phantom surface as:

$$SAR_{tolerance}[\%] = 100 \times \frac{d_{ph}}{\delta/2}$$

where $d_{ph}$ is the maximum deviation of the distance between the probe tip and the phantom surface. The optical surface detection has a precision of better than 0.2mm, resulting in an $SAR_{tolerance}$[%] of <2.9% (rectangular distribution). Since the mechanical detection provides better accuracy, 2.9% is a worst-case figure for DASY4 system.

## 7.10. PHANTOM UNCERTAINTY

The SAR measurement uncertainty due to SPEAG phantom shell production tolerances has been evaluated using

$$SAR_{tolerance}[\%] \cong 100 \times \frac{2d}{a}, \qquad d << a$$

For a maximum deviation d of the inner and outer shell of the phantom from that specified in the CAD file of ±0.2mm, and a 10mm spacing a between source and tissue liquid, the calculated phantom uncertainty is ±4.0%.

## 7.11. DASY4 UNCERTAINTY BUDGET (FOR 2.4GHz)

| Error Description | Tolerance (±%) | Probability Distribution | Divisor | ($C_i$) | | Standard Uncertainty (±%) | | ($v_i$) |
|---|---|---|---|---|---|---|---|---|
| | | | | (1g) | (10g) | (1g) | (10g) | |
| **Measurement Equipment** | | | | | | | | |
| Probe Calibration | 5.50 | Normal | 1 | 1 | 1 | 5.50 | 5.50 | ∞ |
| Axial Isotropy | 4.70 | Rectangular | $\sqrt{3}$ | 0.7 | 0.7 | 1.90 | 1.90 | ∞ |
| Hemispherical Isotropy | 9.60 | Rectangular | $\sqrt{3}$ | 0.7 | 0.7 | 3.88 | 3.88 | ∞ |
| Boundary effects | 1.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.58 | 0.58 | ∞ |
| Linearity | 4.70 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.71 | 2.71 | ∞ |
| System Detection Limits | 1.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.58 | 0.58 | ∞ |
| Readout Electronics | 0.30 | Normal | 1 | 1 | 1 | 0.30 | 0.30 | ∞ |
| Response Time | 0.80 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.46 | 0.46 | ∞ |
| Integration Time | 2.60 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.50 | 1.50 | ∞ |
| RF Ambient Noise | 3.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.73 | 1.73 | ∞ |
| RF Ambient Reflections | 3.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.73 | 1.73 | ∞ |
| Probe Positioner | 0.40 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.23 | 0.23 | ∞ |
| Probe Positioning | 2.90 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.67 | 1.67 | ∞ |
| Max. SAR Eval. | 1.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.58 | 0.58 | ∞ |
| **Test Sample Related** | | | | | | | | |
| Device Positioning | 0.69 | Normal | 1 | 1 | 1 | 0.69 | 0.69 | 10 |
| Device Holder | 3.60 | Normal | 1 | 1 | 1 | 3.60 | 3.60 | 5 |
| Power Drift | 5.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.89 | 2.89 | ∞ |
| **Phantom and Tissue parameters** | | | | | | | | |
| Phantom Uncertainty | 4.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.31 | 2.31 | ∞ |
| Liquid Conductivity (target) | 5.00 | Rectangular | $\sqrt{3}$ | 0.64 | 0.43 | 1.85 | 1.24 | ∞ |
| Liquid Conductivity (measurement) | 2.55 | Normal | 1 | 0.64 | 0.43 | 1.63 | 1.10 | ∞ |
| Liquid Permittivity (target) | 5.00 | Rectangular | $\sqrt{3}$ | 0.6 | 0.49 | 1.73 | 1.41 | ∞ |
| Liquid Permittivity (measurement) | 3.65 | Normal | 1 | 0.6 | 0.49 | 2.19 | 1.79 | ∞ |
| **Combined Standard Uncertainty** | | | | | | **10.47** | **10.18** | |
| **Coverage Factor for 95%** | | | | | | **kp=2** | | |
| **Expanded Uncertainty (K=2)** | | | | | | **20.94** | **20.37** | |

**TABLE 7.2**

The table 7.2: Worst-Case uncertainty budget for DASY4 assessed according to IEEE 1528. The budget is valid for the frequency range 300MHz ~ 3GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerable smaller.

## 7.12.DASY4 UNCERTAINTY BUDGET (FOR 5 ~ 6GHz)

| Error Description | Tolerance (±%) | Probability Distribution | Divisor | ($C_i$) | | Standard Uncertainty (±%) | | ($v_i$) |
|---|---|---|---|---|---|---|---|---|
| | | | | (1g) | (10g) | (1g) | (10g) | |
| **Measurement System** | | | | | | | | |
| **Probe Calibration** | 6.55 | Normal | 1 | 1 | 1 | 6.55 | 6.55 | ∞ |
| **Axial Isotropy** | 4.70 | Rectangular | $\sqrt{3}$ | 0.7 | 0.7 | 1.90 | 1.90 | ∞ |
| **Hemispherical Isotropy** | 9.60 | Rectangular | $\sqrt{3}$ | 0.7 | 0.7 | 3.88 | 3.88 | ∞ |
| **Boundary effects** | 2.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.15 | 1.15 | ∞ |
| **Linearity** | 4.70 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.71 | 2.71 | ∞ |
| **System Detection Limits** | 1.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.58 | 0.58 | ∞ |
| **Readout Electronics** | 0.30 | Normal | 1 | 1 | 1 | 0.30 | 0.30 | ∞ |
| **Response Time** | 0.80 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.46 | 0.46 | ∞ |
| **Integration Time** | 2.60 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.50 | 1.50 | ∞ |
| **RF Ambient Noise** | 3.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.73 | 1.73 | ∞ |
| **RF Ambient Reflections** | 3.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 1.73 | 1.73 | ∞ |
| **Probe Positioner** | 0.80 | Rectangular | $\sqrt{3}$ | 1 | 1 | 0.46 | 0.46 | ∞ |
| **Probe Positioning** | 9.90 | Rectangular | $\sqrt{3}$ | 1 | 1 | 5.72 | 5.72 | ∞ |
| **Max. SAR Eval.** | 4.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.31 | 2.31 | ∞ |
| **Test EUT Related** | | | | | | | | |
| **Device Positioning** | 0.79 | Normal | 1 | 1 | 1 | 0.79 | 0.79 | 10 |
| **Device Holder** | 3.60 | Normal | 1 | 1 | 1 | 3.60 | 3.60 | 5 |
| **Power Drift** | 5.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.89 | 2.89 | ∞ |
| **Phantom and Tissue Parameters** | | | | | | | | |
| **Phantom Uncertainty** | 4.00 | Rectangular | $\sqrt{3}$ | 1 | 1 | 2.31 | 2.31 | ∞ |
| **Liquid Conductivity (target)** | 5.00 | Rectangular | $\sqrt{3}$ | 0.64 | 0.43 | 1.85 | 1.24 | ∞ |
| **Liquid Conductivity (measurement)** | 3.61 | Normal | 1 | 0.64 | 0.43 | 2.31 | 1.55 | ∞ |
| **Liquid Permittivity (target)** | 5.00 | Rectangular | $\sqrt{3}$ | 0.6 | 0.49 | 1.73 | 1.41 | ∞ |
| **Liquid Permittivity (measurement)** | 3.53 | Normal | 1 | 0.6 | 0.49 | 2.12 | 1.73 | ∞ |
| **Combined Standard Uncertainty** | | | | | | **12.68** | **12.39** | |
| **Coverage Factor for 95%** | | | | | | **Kp=2** | | |
| **Expanded STD Uncertainty** | | | | | | **25.37** | **24.78** | |

**TABLE 7.3**

The table 7.3: Worst-Case uncertainty budget for DASY4 valid for the frequency range 5 ~ 6 GHz. Probe calibration error reflects uncertainty of the narrow-bandwidth EX3DV3 probe conversion factor (±50 MHz).

## 8. INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

| | |
|---|---|
| **USA** | FCC, NVLAP |
| **GERMANY** | TUV Rheinland |
| **JAPAN** | VCCI |
| **NORWAY** | NEMKO |
| **CANADA** | INDUSTRY CANADA, CSA |
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| **RUSSIA** | CERTIS (MOU) |

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5/phtml. If you have any comments, please feel free to contact us at the following:

**Linko EMC/RF Lab**:
Tel: 886-2-26052180
Fax: 886-2-26051924

**Hsin Chu EMC/RF Lab**:
Tel: 886-3-5935343
Fax: 886-3-5935342

**Hwa Ya EMC/RF/Safety/Telecom Lab**:
Tel: 886-3-3183232
Fax: 886-3-3185050

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The address and road map of all our labs can be found in our web site also.

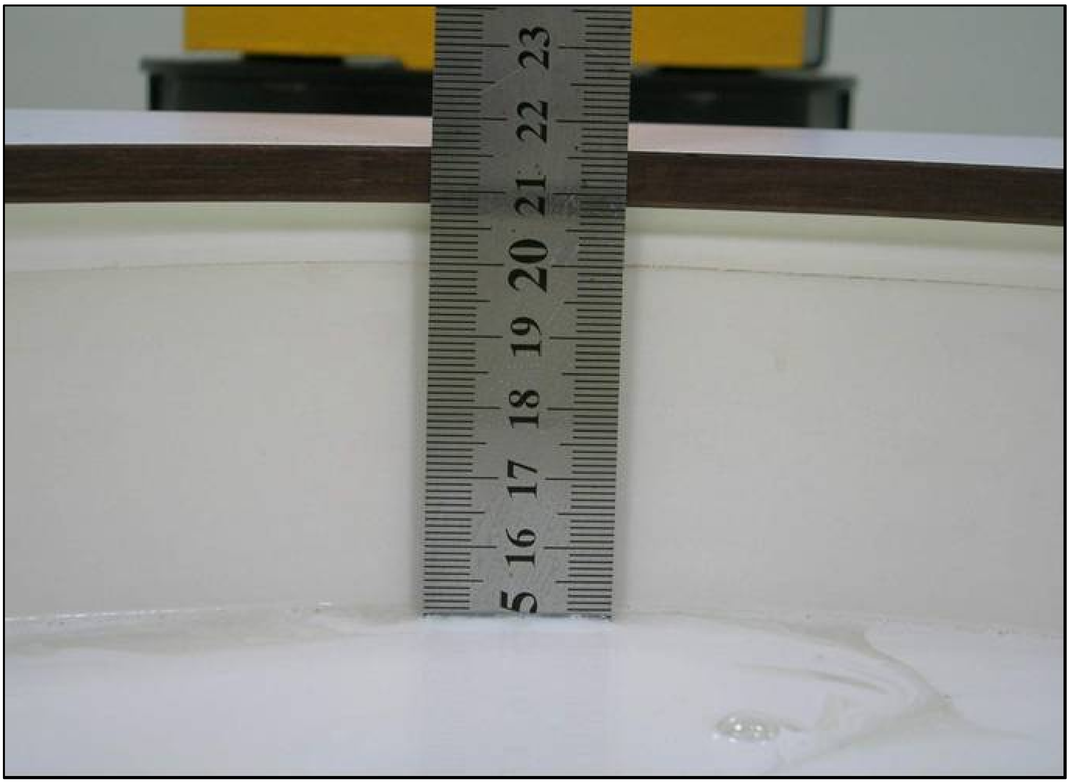
**---END---**

## APPENDIX A: TEST DATA

# Liquid Level Photo

**MSL 2450MHz D=152mm**

**MSL 5800MHz D=150mm**



Date/Time: 2009/1/20 16:06:12

Test Laboratory: Bureau Veritas ADT

## M01-11b-Ch6

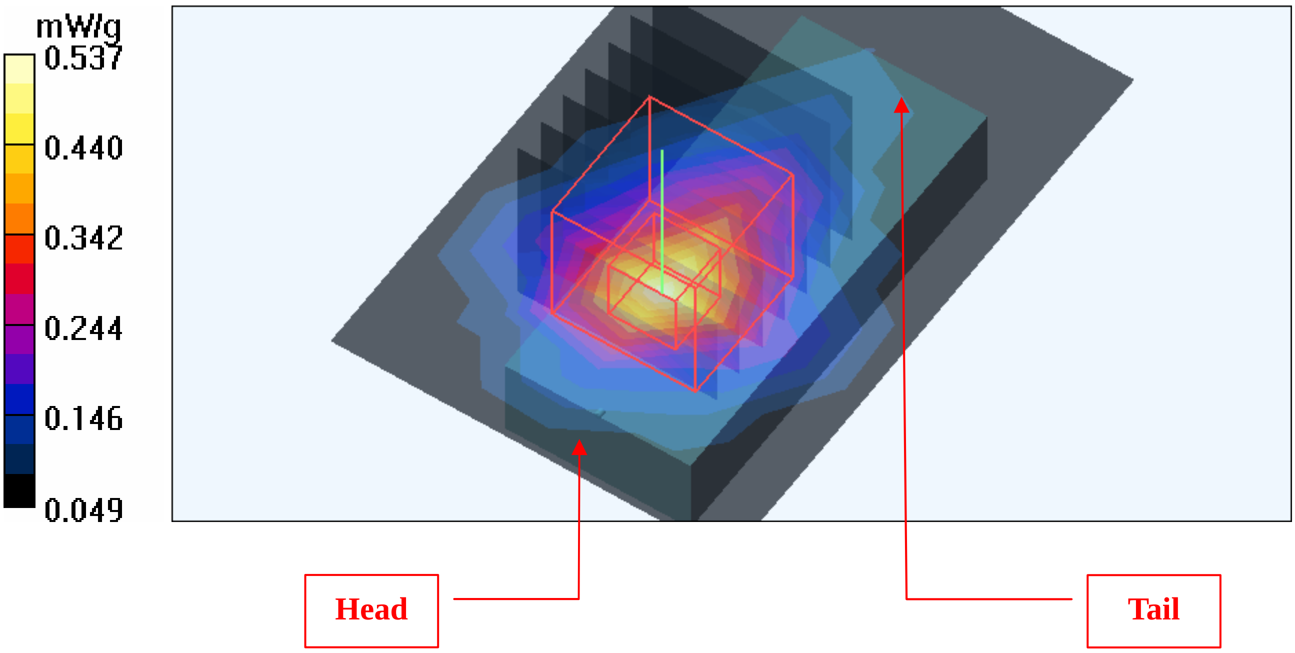
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/$m^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.529 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.61 V/m
Peak SAR (extrapolated) = 0.736 W/kg
**SAR(1 g) = 0.424 mW/g; SAR(10 g) = 0.224 mW/g**
Maximum value of SAR (measured) = 0.537 mW/g



Date/Time: 2009/1/20 16:25:48

Test Laboratory: Bureau Veritas ADT

## M02-11g-Ch6

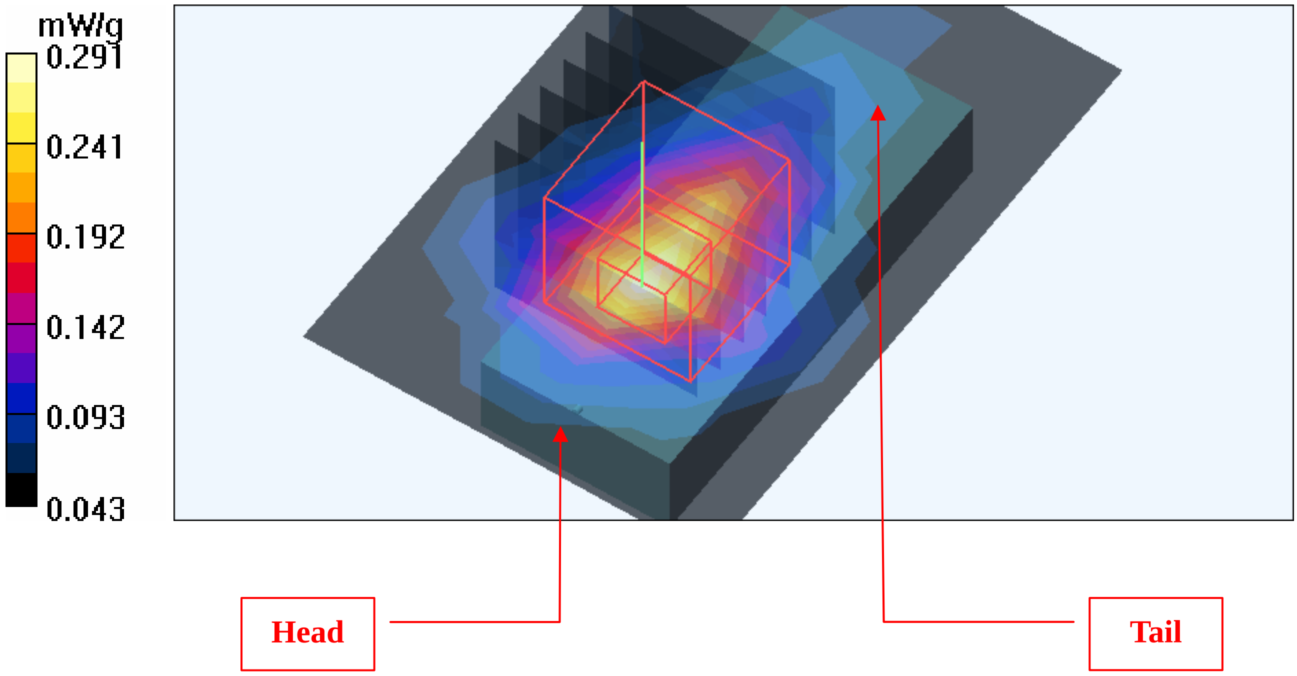
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma = 1.97$ mho/m; $\varepsilon_r = 54.3$; $\rho = 1000$ kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.293 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.70 V/m
Peak SAR (extrapolated) = 0.395 W/kg
**SAR(1 g) = 0.237 mW/g; SAR(10 g) = 0.136 mW/g**
Maximum value of SAR (measured) = 0.291 mW/g



Date/Time: 2009/1/20 16:42:12

Test Laboratory: Bureau Veritas ADT

## M03-11n 20M-Ch6

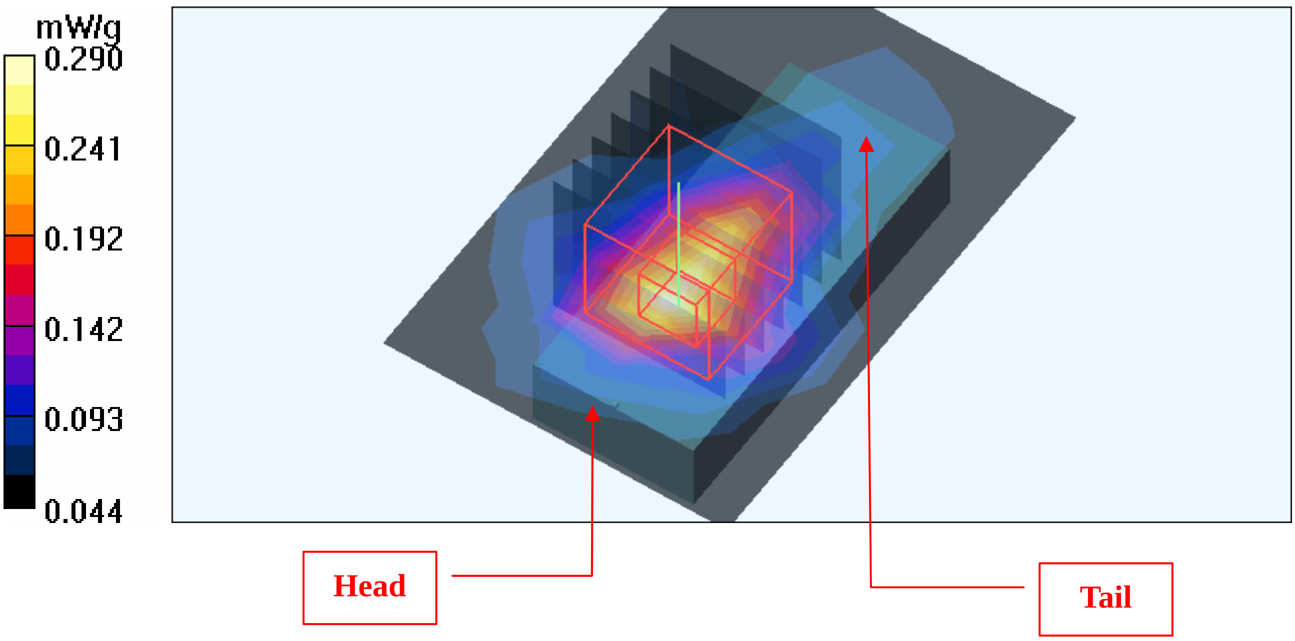
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 2.4G 11n span20 ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/$m^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.294 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.46 V/m
Peak SAR (extrapolated) = 0.399 W/kg
**SAR(1 g) = 0.241 mW/g; SAR(10 g) = 0.139 mW/g**
Maximum value of SAR (measured) = 0.290 mW/g



Date/Time: 2009/1/20 16:58:21

Test Laboratory: Bureau Veritas ADT

## M04-11n 40M-Ch4

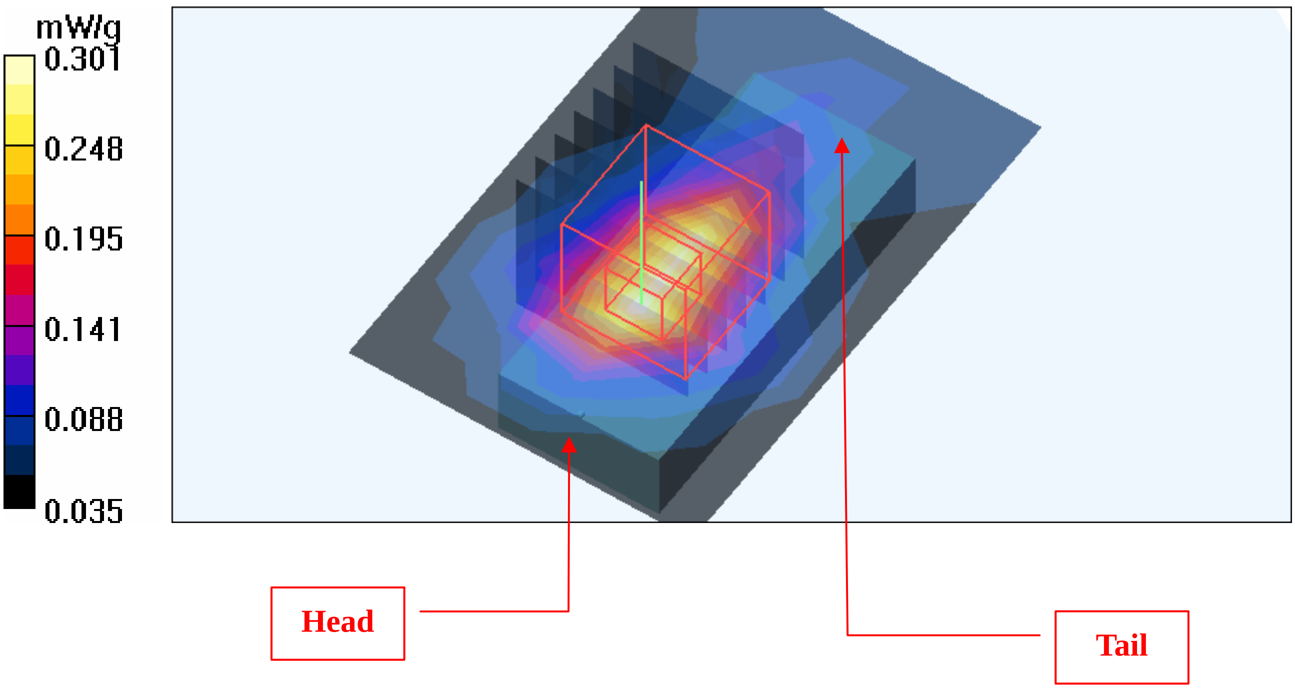
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11n 40MHz ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 4/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.301 mW/g

**Mid Channel 4/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.66 V/m
Peak SAR (extrapolated) = 0.409 W/kg
**SAR(1 g) = 0.257 mW/g; SAR(10 g) = 0.148 mW/g**
Maximum value of SAR (measured) = 0.313 mW/g



Date/Time: 2009/1/20 17:19:02

Test Laboratory: Bureau Veritas ADT

## M05-11b-Ch6

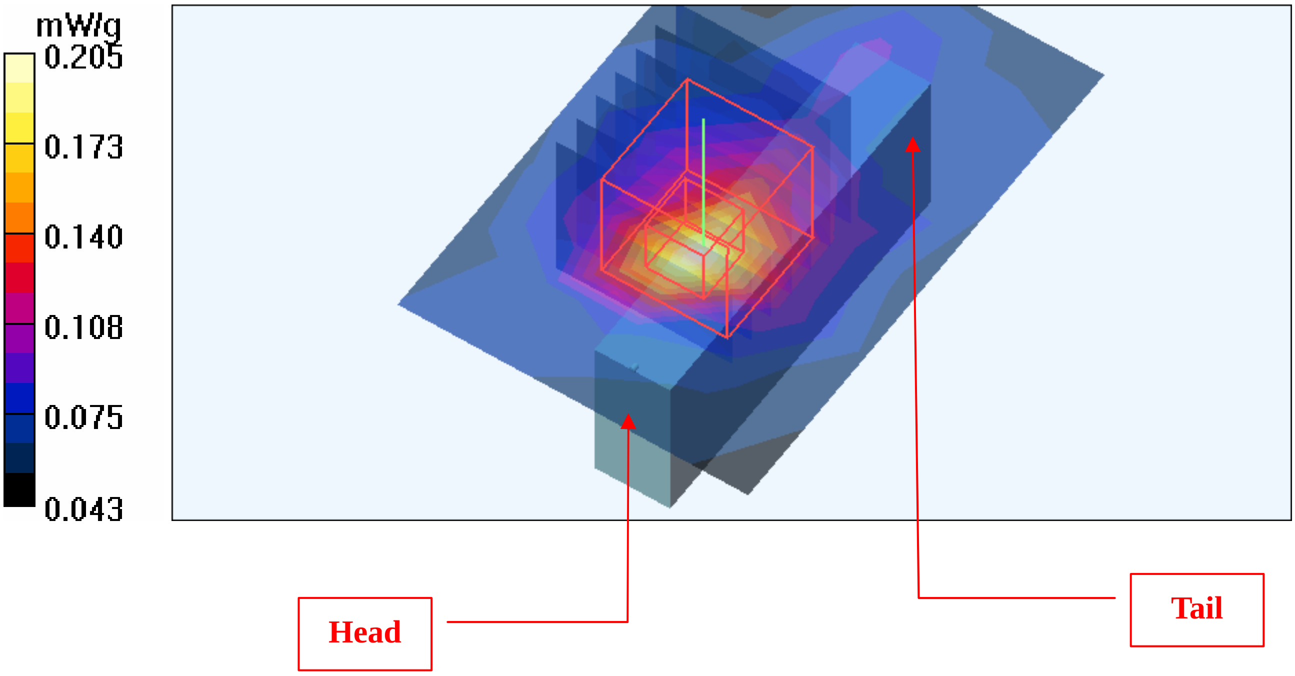
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/$m^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.205 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.75 V/m
Peak SAR (extrapolated) = 0.288 W/kg
**SAR(1 g) = 0.158 mW/g; SAR(10 g) = 0.097 mW/g**
Maximum value of SAR (measured) = 0.198 mW/g



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Test Laboratory: Bureau Veritas ADT

## M06-11g-Ch6

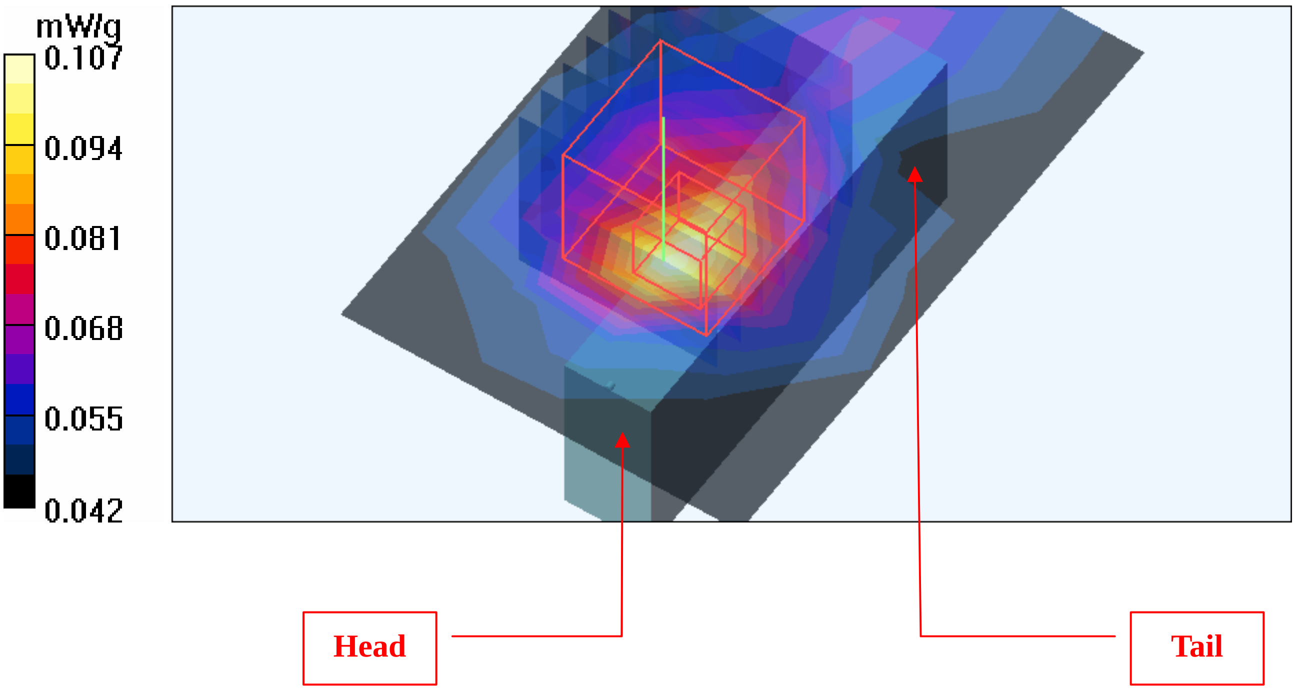
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.107 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.23 V/m
Peak SAR (extrapolated) = 0.168 W/kg
**SAR(1 g) = 0.092 mW/g; SAR(10 g) = 0.066 mW/g**



Date/Time: 2009/1/20 17:53:01

Test Laboratory: Bureau Veritas ADT

## M07-11n 20M-Ch6

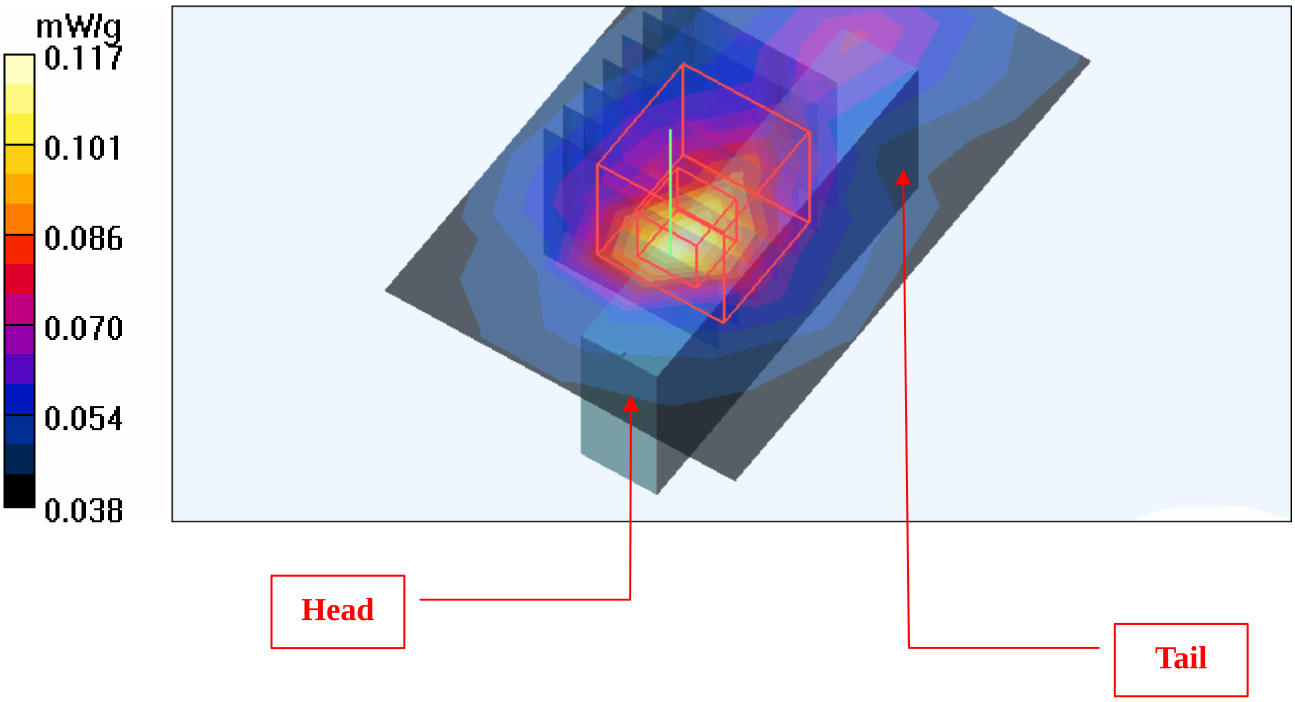
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 2.4G 11n span20 ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma = 1.97$ mho/m; $\varepsilon_r = 54.3$; $\rho = 1000$ kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.117 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.24 V/m
Peak SAR (extrapolated) = 0.177 W/kg
**SAR(1 g) = 0.098 mW/g; SAR(10 g) = 0.067 mW/g**



Date/Time: 2009/1/20 18:15:00

Test Laboratory: Bureau Veritas ADT

## M08-11n 40M-Ch4

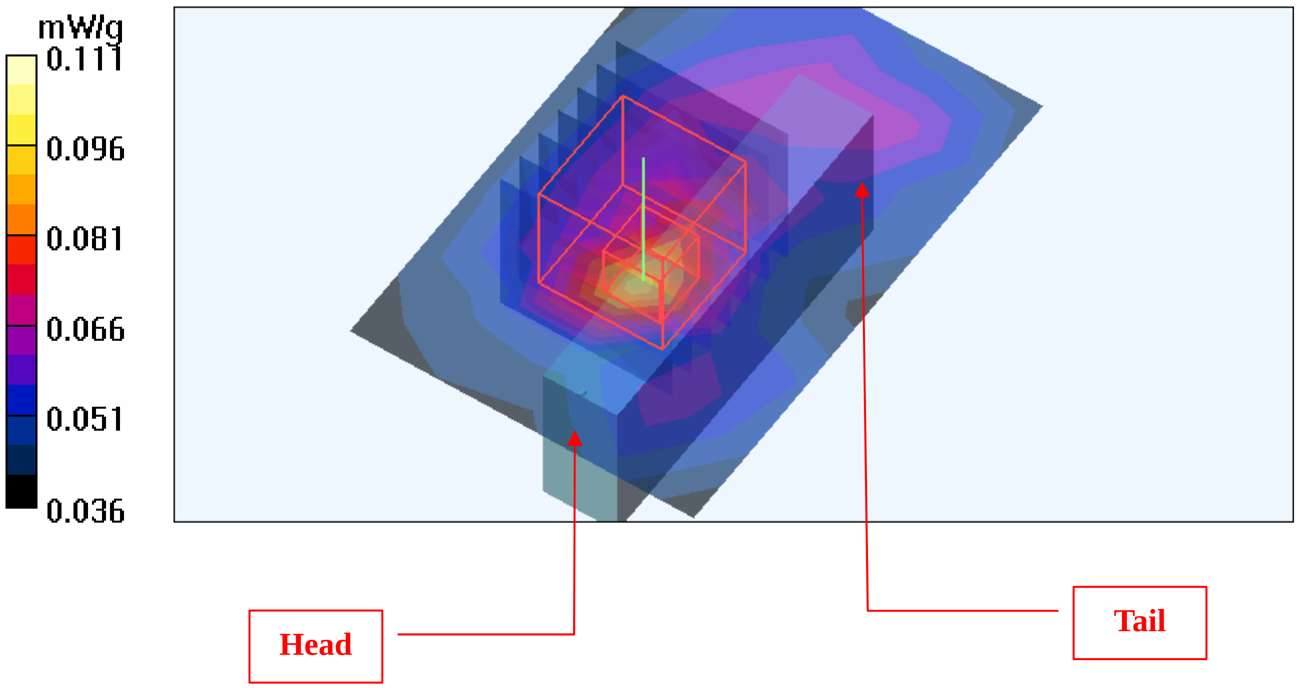
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11n 40MHz ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 4/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.111 mW/g

**Mid Channel 4/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.16 V/m
Peak SAR (extrapolated) = 0.165 W/kg
**SAR(1 g) = 0.089 mW/g; SAR(10 g) = 0.059 mW/g**
Maximum value of SAR (measured) = 0.103 mW/g



Date/Time: 2009/1/20 18:36:13

Test Laboratory: Bureau Veritas ADT

## M09-11b-Ch6

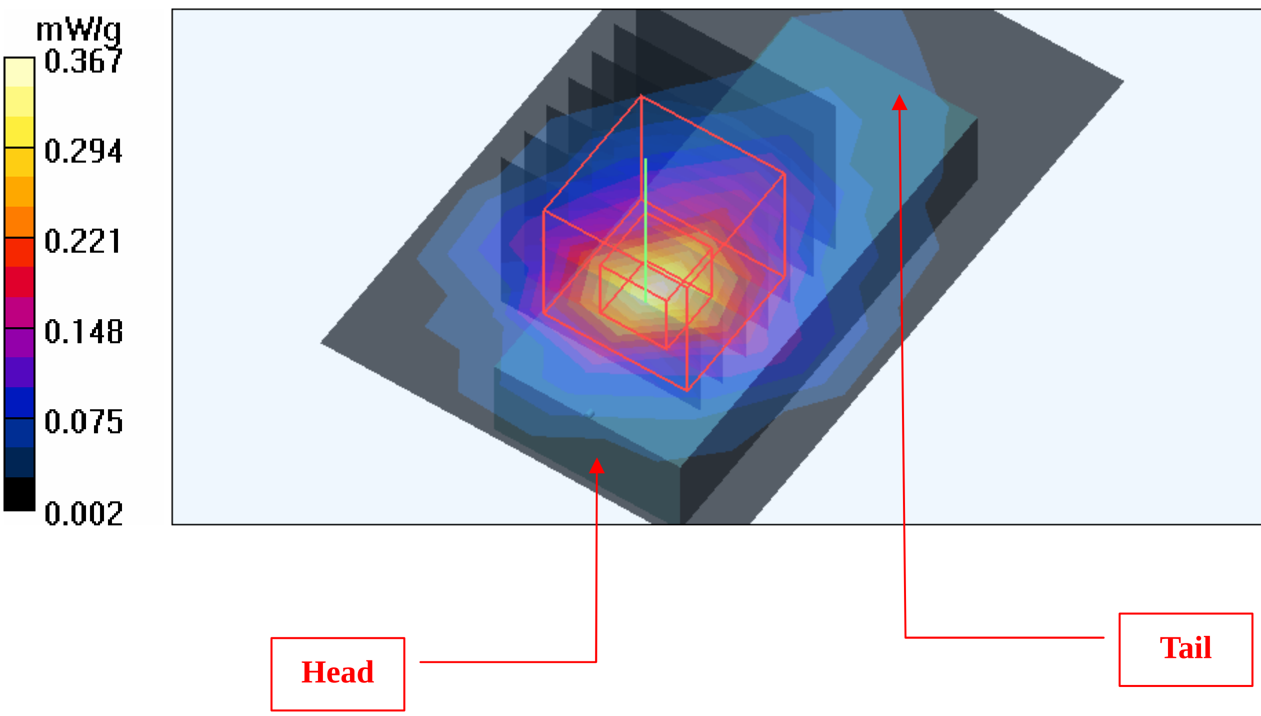
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma = 1.97$ mho/m; $\varepsilon_r = 54.3$; $\rho = 1000$ kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The front side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.367 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.05 V/m
Peak SAR (extrapolated) = 0.486 W/kg
**SAR(1 g) = 0.255 mW/g; SAR(10 g) = 0.124 mW/g**
Maximum value of SAR (measured) = 0.323 mW/g



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Test Laboratory: Bureau Veritas ADT

## M10-11g-Ch6

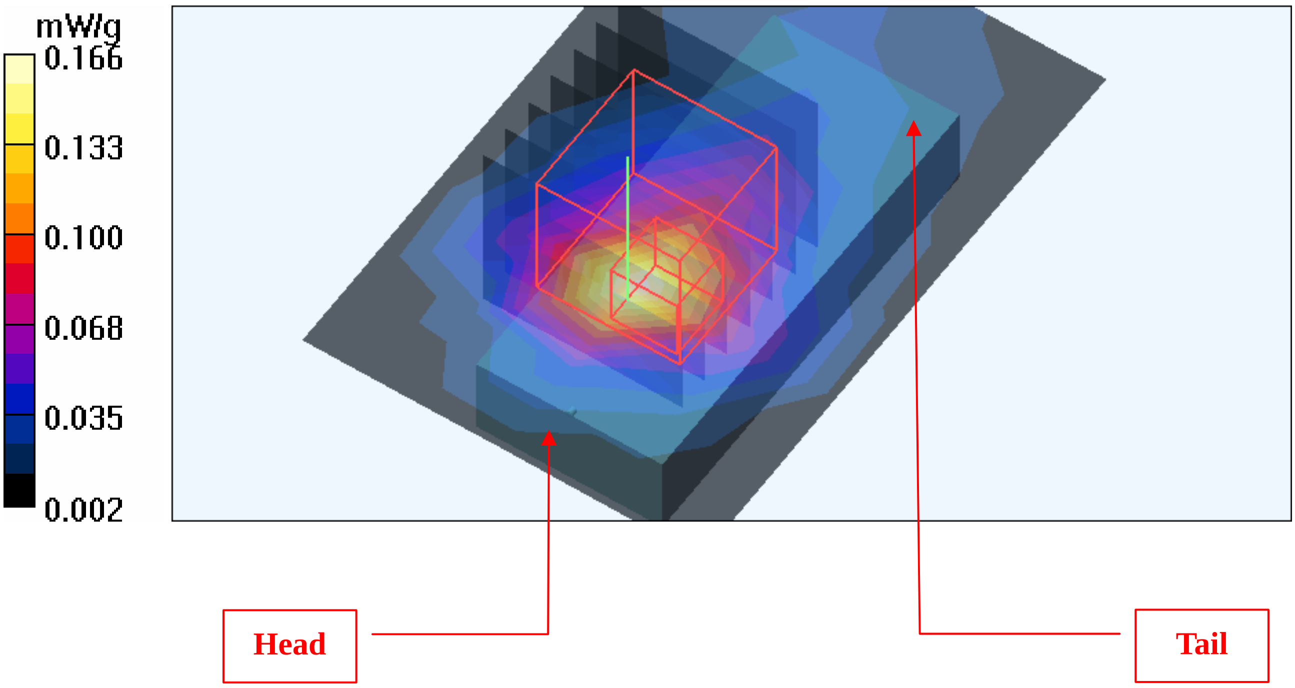
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The front side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.166 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.69 V/m
Peak SAR (extrapolated) = 0.296 W/kg
**SAR(1 g) = 0.107 mW/g; SAR(10 g) = 0.050 mW/g**
Maximum value of SAR (measured) = 0.144 mW/g



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Test Laboratory: Bureau Veritas ADT

## M11-11n 20M-Ch6

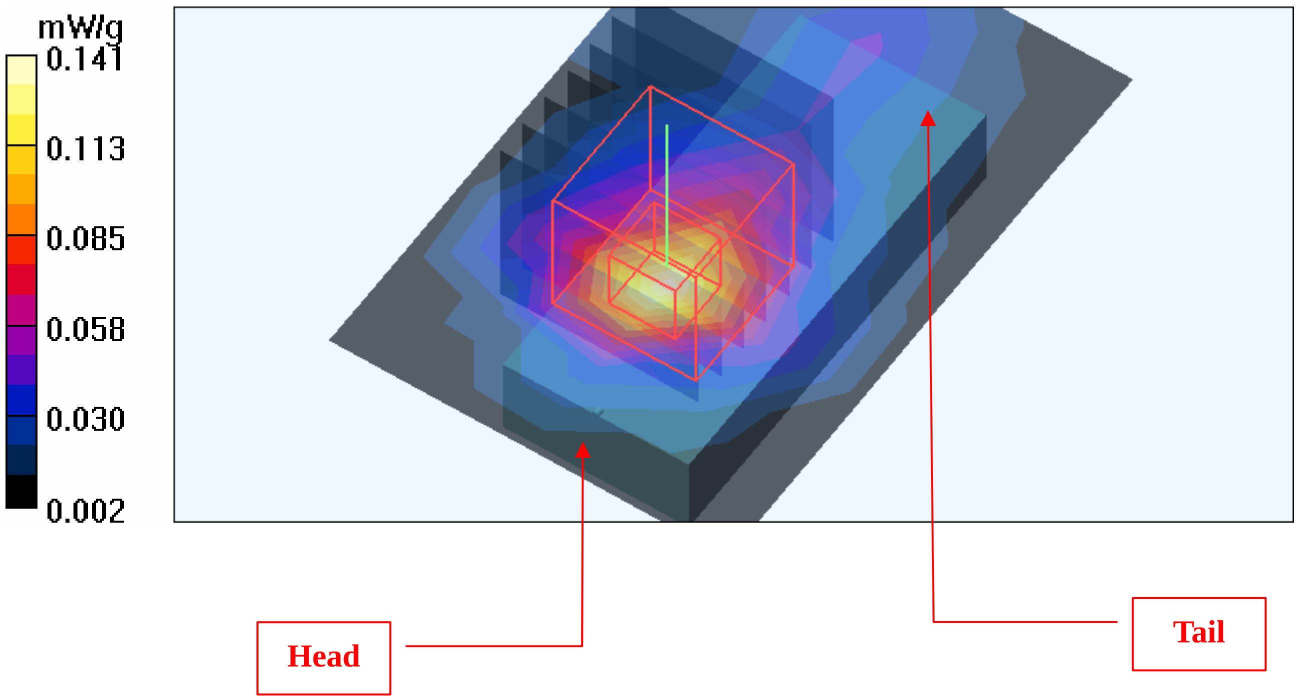
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 2.4G 11n span20 ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma = 1.97$ mho/m; $\varepsilon_r = 54.3$; $\rho = 1000$ kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The front side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.141 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.47 V/m
Peak SAR (extrapolated) = 0.199 W/kg
**SAR(1 g) = 0.107 mW/g; SAR(10 g) = 0.053 mW/g**
Maximum value of SAR (measured) = 0.133 mW/g



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Test Laboratory: Bureau Veritas ADT

## M12-11n 40M-Ch4

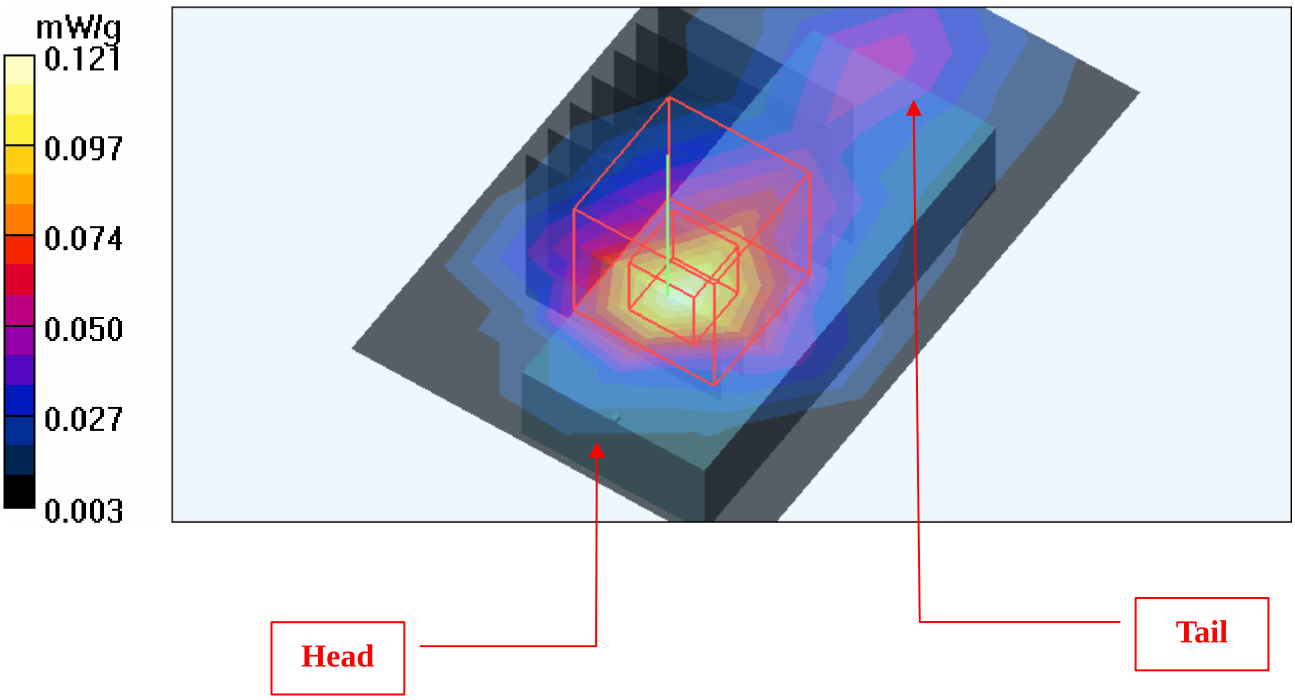
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11n 40MHz ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The front side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 4/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.121 mW/g

**Mid Channel 4/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.14 V/m
Peak SAR (extrapolated) = 0.177 W/kg
**SAR(1 g) = 0.096 mW/g; SAR(10 g) = 0.048 mW/g**
Maximum value of SAR (measured) = 0.119 mW/g



Date/Time: 2009/1/20 19:51:50

Test Laboratory: Bureau Veritas ADT

## M13-11b-Ch6

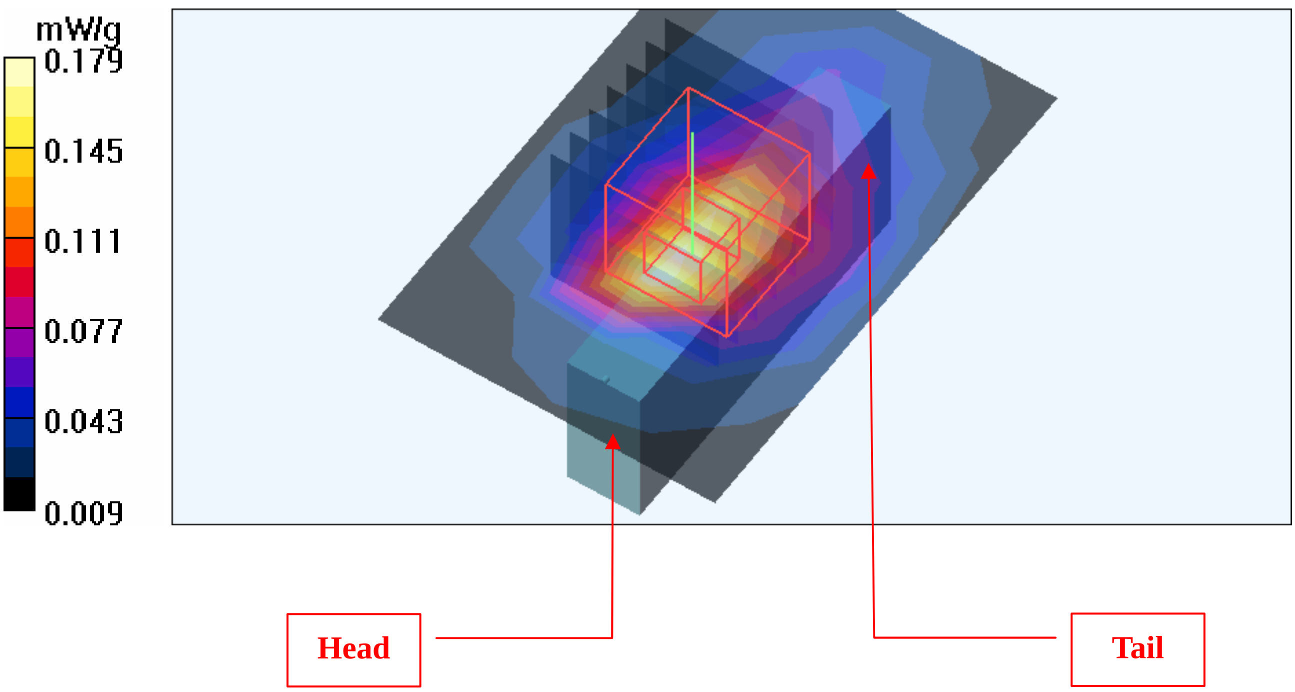
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11b ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: DBPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.179 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.55 V/m
Peak SAR (extrapolated) = 0.261 W/kg
**SAR(1 g) = 0.131 mW/g; SAR(10 g) = 0.066 mW/g**
Maximum value of SAR (measured) = 0.170 mW/g



Date/Time: 2009/1/20 20:09:41

Test Laboratory: Bureau Veritas ADT

# M14-11g-Ch6

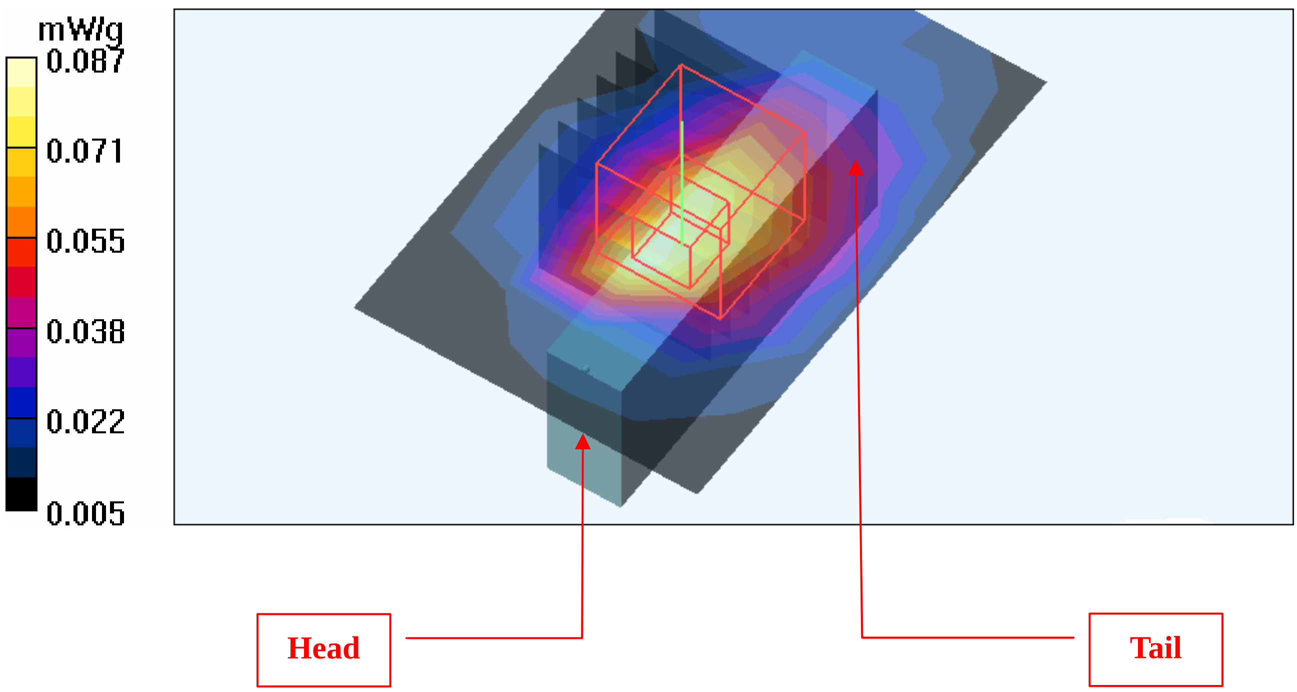
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11g ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.087 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.16 V/m
Peak SAR (extrapolated) = 0.124 W/kg
**SAR(1 g) = 0.064 mW/g; SAR(10 g) = 0.034 mW/g**
Maximum value of SAR (measured) = 0.080 mW/g



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Test Laboratory: Bureau Veritas ADT

## M15-11n 20M-Ch6

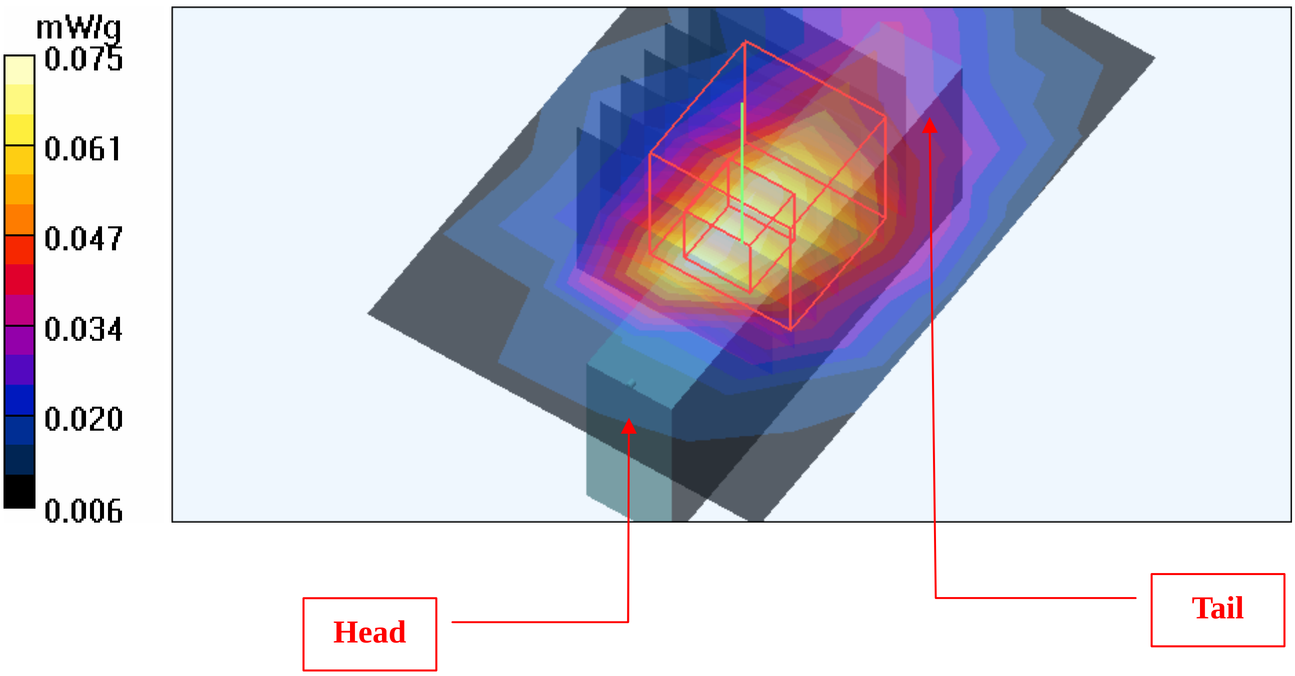
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 2.4G 11n span20 ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 6/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.075 mW/g

**Mid Channel 6/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.91 V/m
Peak SAR (extrapolated) = 0.118 W/kg
**SAR(1 g) = 0.061 mW/g; SAR(10 g) = 0.034 mW/g**
Maximum value of SAR (measured) = 0.076 mW/g



Date/Time: 2009/1/20 20:41:45

Test Laboratory: Bureau Veritas ADT

## M16-11n 40M-Ch4

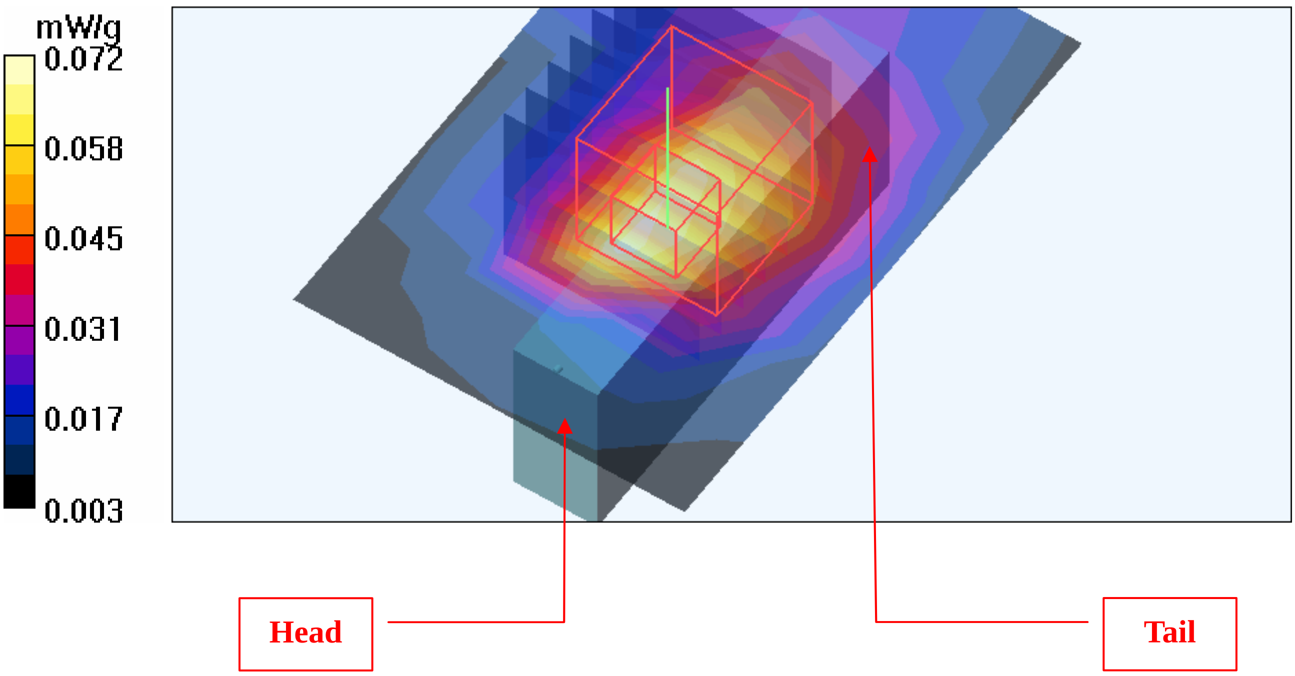
**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11n 40MHz ; Frequency: 2437 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL2450 Medium parameters used: f = 2437 MHz; $\sigma$ = 1.97 mho/m; $\varepsilon_r$ = 54.3; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**Mid Channel 4/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.071 mW/g

**Mid Channel 4/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.77 V/m
Peak SAR (extrapolated) = 0.116 W/kg
**SAR(1 g) = 0.059 mW/g; SAR(10 g) = 0.033 mW/g**
Maximum value of SAR (measured) = 0.072 mW/g



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Test Laboratory: Bureau Veritas ADT

## M17-11a-Ch165

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11a ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5825 MHz; $\sigma$ = 6.21 mho/m; $\varepsilon_r$ = 49.5; $\rho$ = 1000 kg/m$^3$

Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 165/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.626 mW/g

**High Channel 165/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 8.65 V/m

Peak SAR (extrapolated) = 1.43 W/kg

**SAR(1 g) = 0.568 mW/g; SAR(10 g) = 0.385 mW/g**

Maximum value of SAR (measured) = 1.07 mW/g

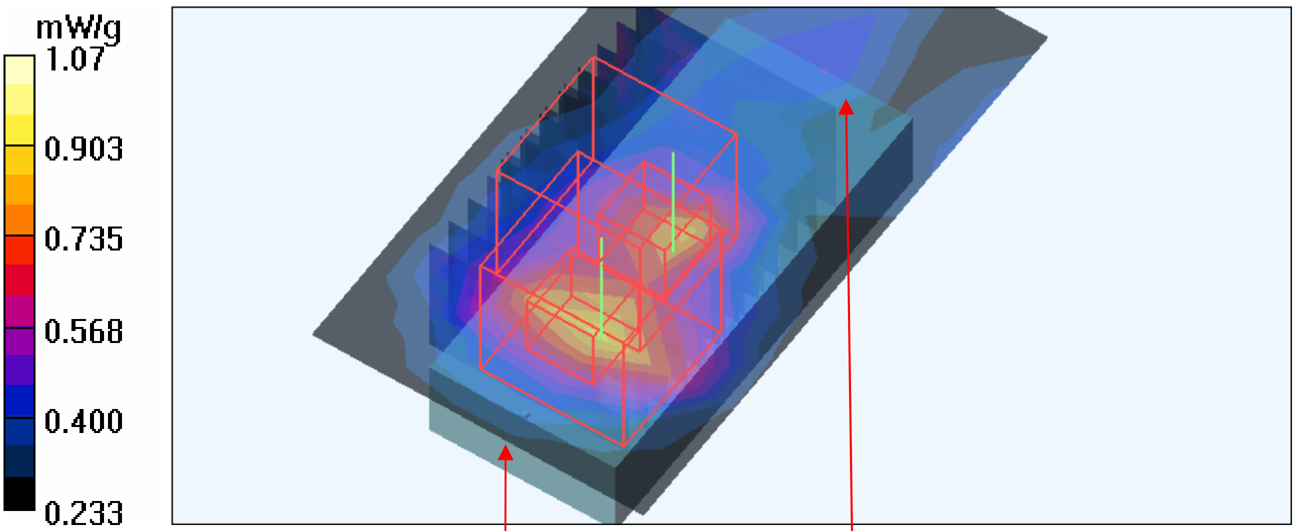
**High Channel 165/Zoom Scan (8x8x8)/Cube 1:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 8.65 V/m

Peak SAR (extrapolated) = 1.27 W/kg

**SAR(1 g) = 0.485 mW/g; SAR(10 g) = 0.366 mW/g**

Maximum value of SAR (measured) = 0.703 mW/g



Date/Time: 2009/1/21 04:49:56

Test Laboratory: Bureau Veritas ADT

## M18-11aN 20M-Ch165

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 11n 5G span20 ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5825 MHz; $\sigma$ = 6.21 mho/m; $\varepsilon_r$ = 49.5; $\rho$ = 1000 kg/$m^3$

Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

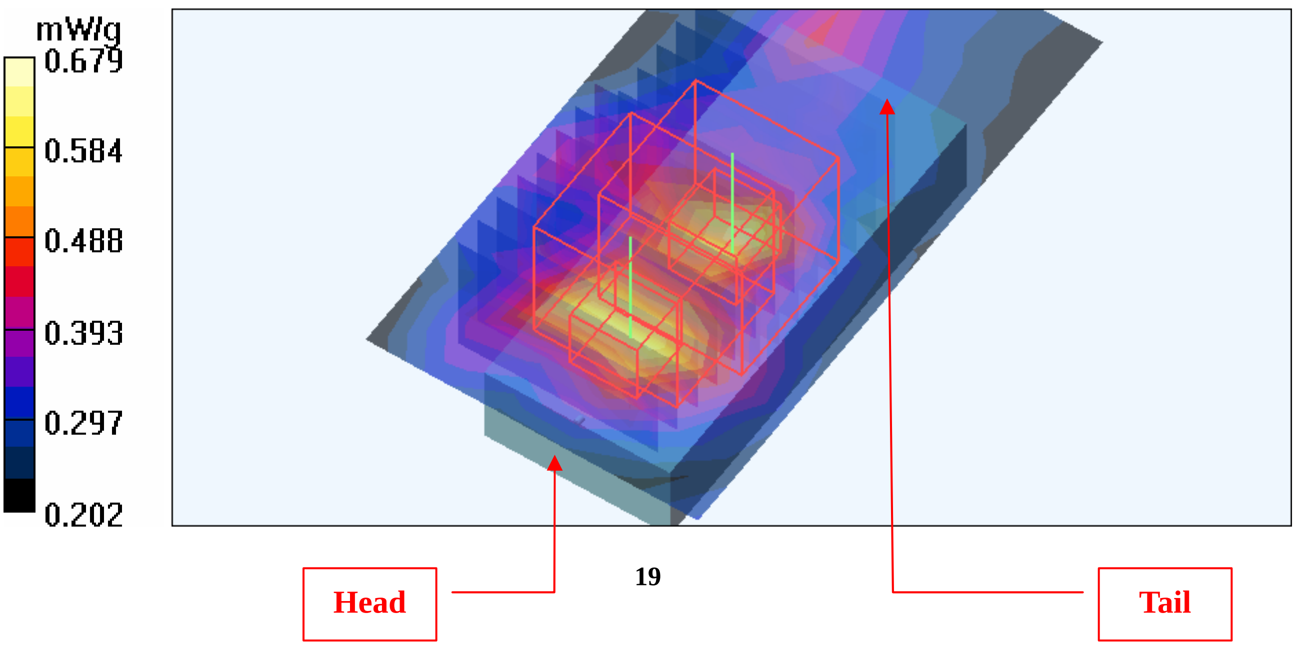
DASY4 Configuration:

- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 165/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.617 mW/g

**High Channel 165/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 9.01 V/m
Peak SAR (extrapolated) = 1.66 W/kg
**SAR(1 g) = 0.560 mW/g; SAR(10 g) = 0.374 mW/g**
Maximum value of SAR (measured) = 0.679 mW/g

**High Channel 165/Zoom Scan (8x8x8)/Cube 1:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 9.01 V/m
Peak SAR (extrapolated) = 1.54 W/kg
**SAR(1 g) = 0.492 mW/g; SAR(10 g) = 0.370 mW/g**
Maximum value of SAR (measured) = 0.668 mW/g



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Test Laboratory: Bureau Veritas ADT

## M19-11aN 40M-Ch159

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 11n 5G span40 ; Frequency: 5795 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5795 MHz; $\sigma$ = 6.16 mho/m; $\varepsilon_r$ = 49.6; $\rho$ = 1000 kg/m$^3$

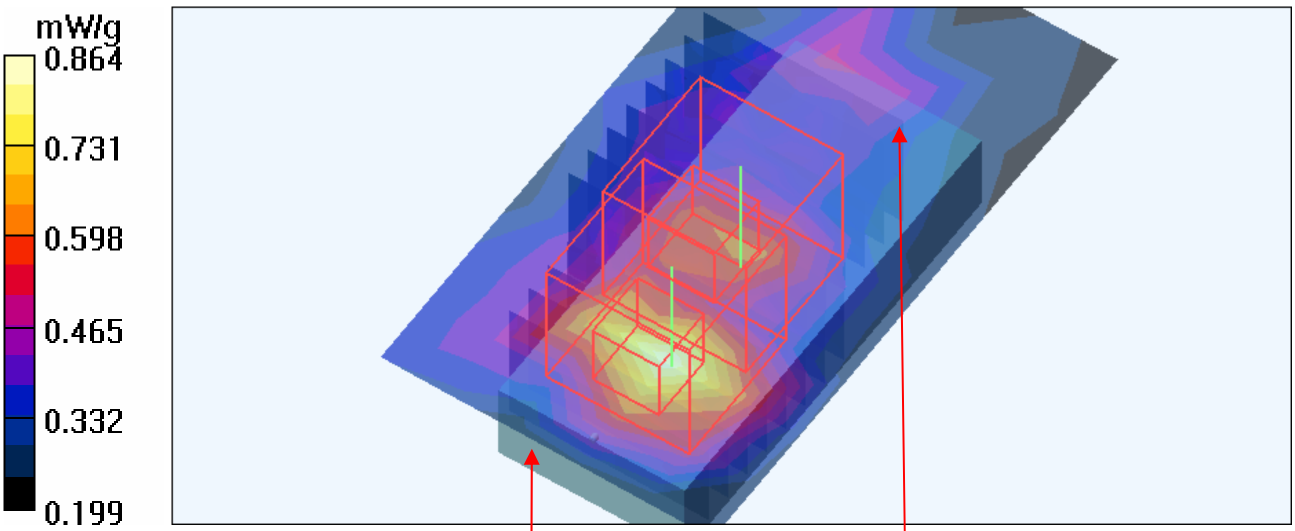
Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

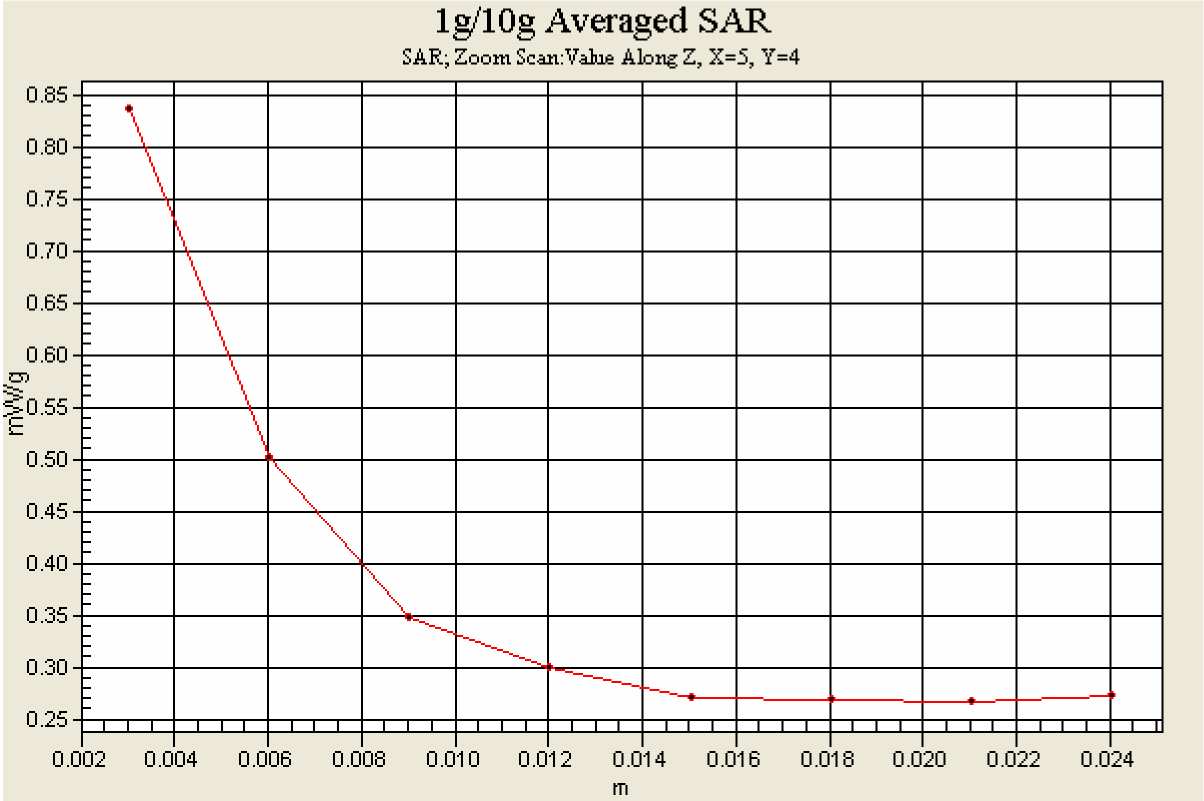
**High Channel 159/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.864 mW/g

**High Channel 159/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 9.50 V/m
Peak SAR (extrapolated) = 1.42 W/kg
**SAR(1 g) = 0.669 mW/g; SAR(10 g) = 0.422 mW/g**
Maximum value of SAR (measured) = 0.835 mW/g

**High Channel 159/Zoom Scan (8x8x8)/Cube 1:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 9.50 V/m
Peak SAR (extrapolated) = 1.39 W/kg
**SAR(1 g) = 0.559 mW/g; SAR(10 g) = 0.397 mW/g**
Maximum value of SAR (measured) = 0.710 mW/g




**Head** **Tail**


1g/10g Averaged SAR
SAR; Zoom Scan:Value Along Z, X=5, Y=4
mW/g
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.002
0.004
0.006
0.008
0.010
0.012
0.014
0.016
0.018
0.020
0.022
0.024
m

Date/Time: 2009/1/21 07:45:08

Test Laboratory: Bureau Veritas ADT

## M20-11a-Ch165

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

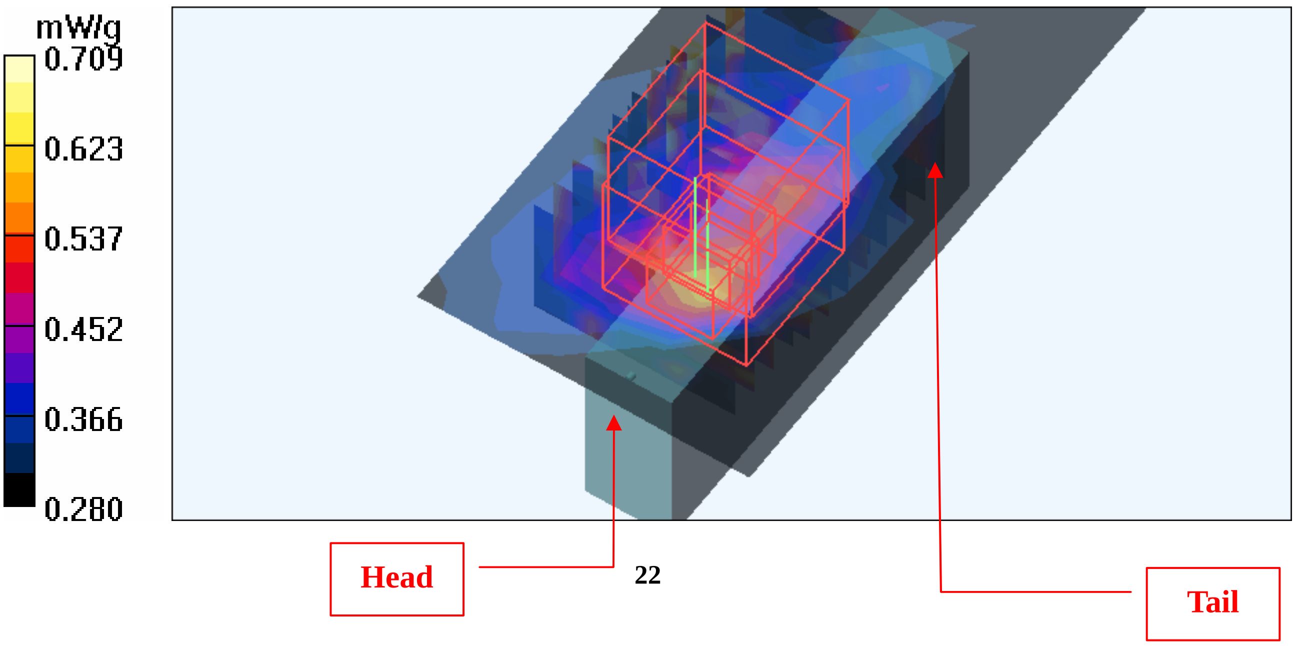
Communication System: 802.11a ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK
Medium: MSL5800 Medium parameters used: f = 5825 MHz; $\sigma$ = 6.21 mho/m; $\varepsilon_r$ = 49.5; $\rho$ = 1000 kg/m$^3$
Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 165/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.495 mW/g

**High Channel 165/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 7.38 V/m
Peak SAR (extrapolated) = 0.913 W/kg
**SAR(1 g) = 0.503 mW/g; SAR(10 g) = 0.391 mW/g**
Maximum value of SAR (measured) = 0.646 mW/g

**High Channel 165/Zoom Scan (8x8x8)/Cube 1:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 7.38 V/m
Peak SAR (extrapolated) = 1.07 W/kg
**SAR(1 g) = 0.509 mW/g; SAR(10 g) = 0.402 mW/g**
Maximum value of SAR (measured) = 0.709 mW/g



Date/Time: 2009/1/21 09:20:22

Test Laboratory: Bureau Veritas ADT

## M21-11aN 20M-Ch165

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 11n 5G span20 ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5825 MHz; $\sigma = 6.21$ mho/m; $\varepsilon_r = 49.5$; $\rho = 1000$ kg/m$^3$

Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 165/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.467 mW/g

**High Channel 165/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 7.33 V/m

Peak SAR (extrapolated) = 0.792 W/kg

**SAR(1 g) = 0.441 mW/g; SAR(10 g) = 0.324 mW/g**

Maximum value of SAR (measured) = 0.605 mW/g

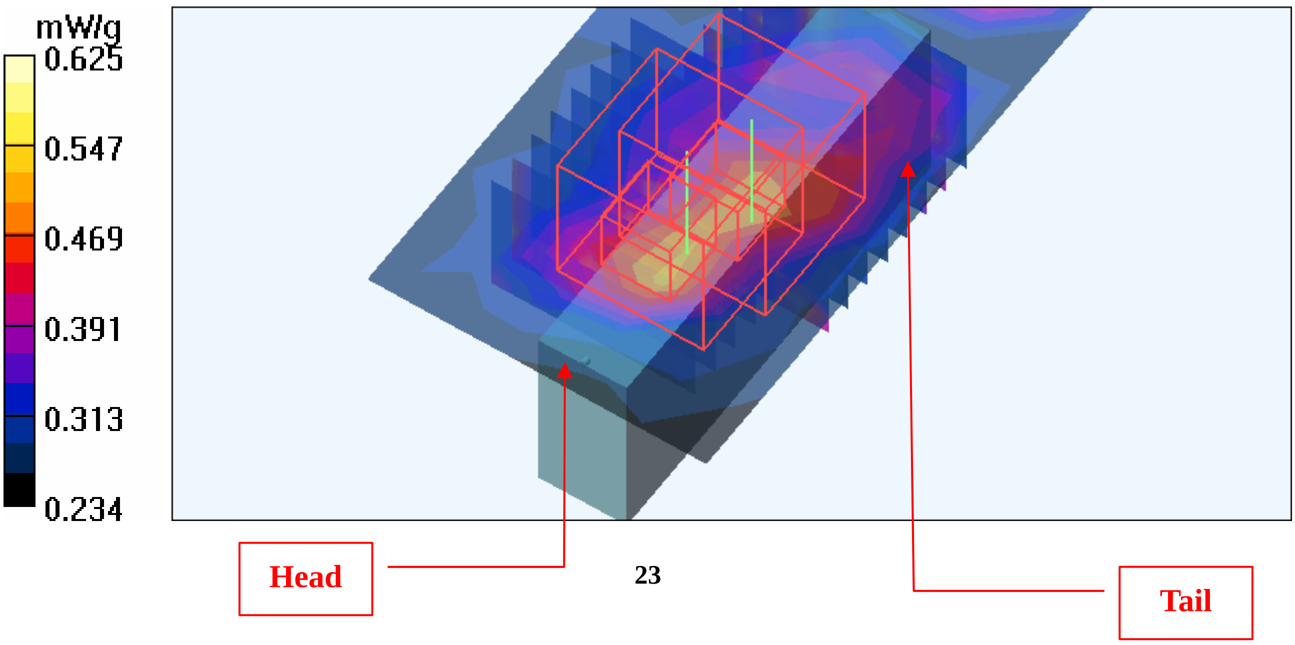
**High Channel 165/Zoom Scan (8x8x8)/Cube 1:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 7.33 V/m

Peak SAR (extrapolated) = 0.822 W/kg

**SAR(1 g) = 0.461 mW/g; SAR(10 g) = 0.364 mW/g**

Maximum value of SAR (measured) = 0.625 mW/g



Date/Time: 2009/1/21 10:51:06

Test Laboratory: Bureau Veritas ADT

## M22-11aN 40M-Ch159

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 11n 5G span40 ; Frequency: 5795 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5795 MHz; $\sigma$ = 6.16 mho/m; $\varepsilon_r$ = 49.6; $\rho$ = 1000 kg/m$^3$

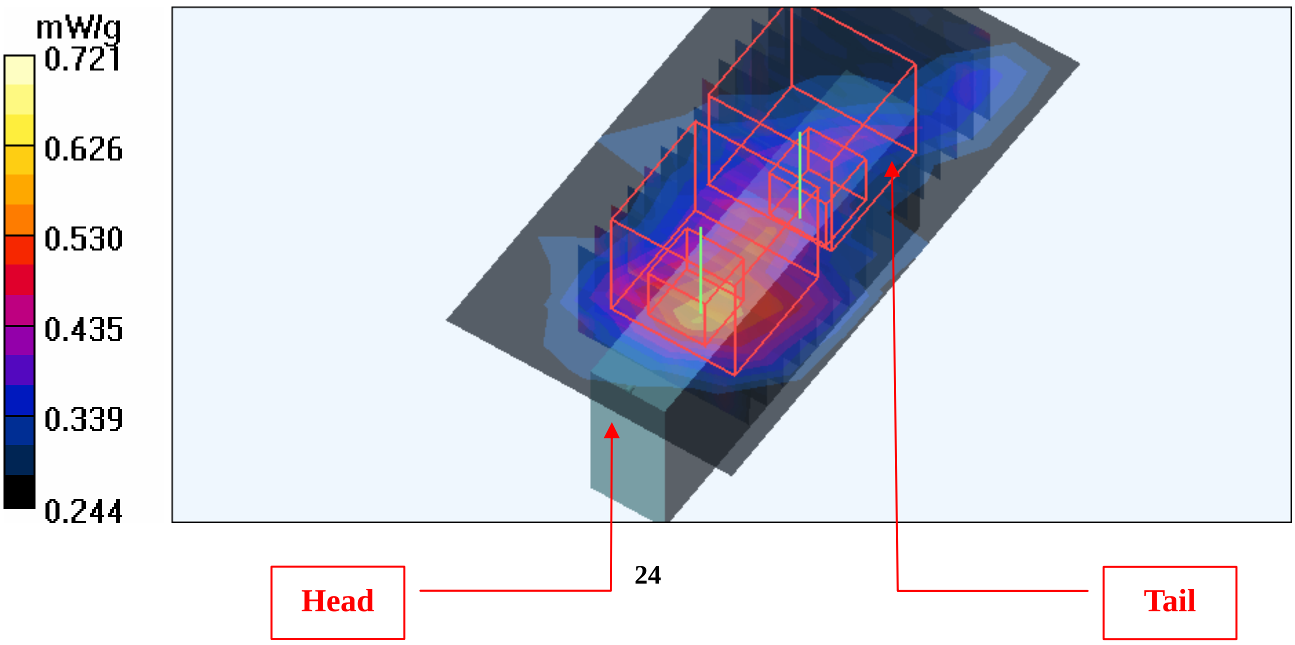
Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 159/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.569 mW/g

**High Channel 159/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 9.35 V/m
Peak SAR (extrapolated) = 0.859 W/kg
**SAR(1 g) = 0.581 mW/g; SAR(10 g) = 0.405 mW/g**
Maximum value of SAR (measured) = 0.721 mW/g

**High Channel 159/Zoom Scan (8x8x8)/Cube 1:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 9.35 V/m
Peak SAR (extrapolated) = 0.789 W/kg
**SAR(1 g) = 0.408 mW/g; SAR(10 g) = 0.348 mW/g**
Maximum value of SAR (measured) = 0.527 mW/g



Date/Time: 2009/1/21 12:10:46

Test Laboratory: Bureau Veritas ADT

## M23-11a-Ch165

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11a ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5825 MHz; $\sigma$ = 6.21 mho/m; $\varepsilon_r$ = 49.5; $\rho$ = 1000 $kg/m^3$

Phantom section: Flat Section ; Separation distance : 5 mm (The front side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 165/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.194 mW/g

**High Channel 165/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 3.32 V/m

Peak SAR (extrapolated) = 0.769 W/kg

**SAR(1 g) = 0.117 mW/g; SAR(10 g) = 0.052 mW/g**

Maximum value of SAR (measured) = 0.203 mW/g

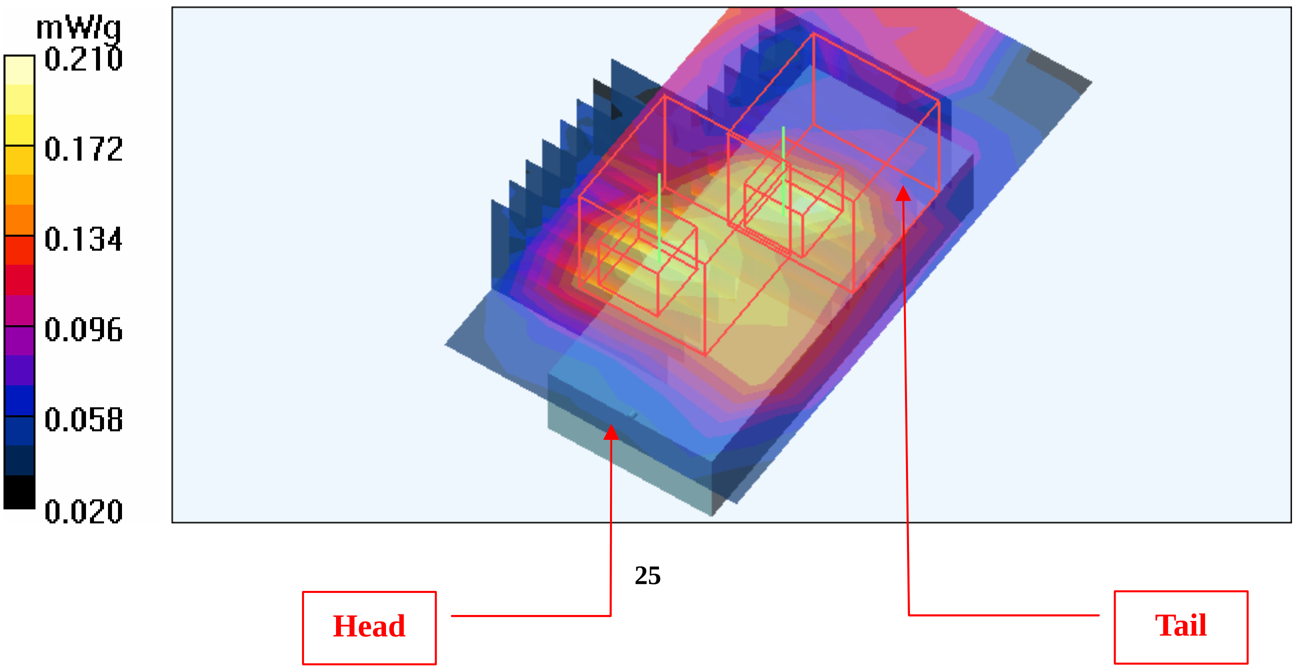
**High Channel 165/Zoom Scan (8x8x8)/Cube 1:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 3.32 V/m

Peak SAR (extrapolated) = 0.827 W/kg

**SAR(1 g) = 0.162 mW/g; SAR(10 g) = 0.083 mW/g**

Maximum value of SAR (measured) = 0.210 mW/g



Date/Time: 2009/1/21 13:27:26

Test Laboratory: Bureau Veritas ADT

## M24-11aN 20M-Ch165

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 11n 5G span20 ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5825 MHz; $\sigma$ = 6.21 mho/m; $\varepsilon_r$ = 49.5; $\rho$ = 1000 kg/m$^3$

Phantom section: Flat Section ; Separation distance : 5 mm (The front side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 165/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.246 mW/g

**High Channel 165/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 4.61 V/m

Peak SAR (extrapolated) = 0.335 W/kg

**SAR(1 g) = 0.171 mW/g; SAR(10 g) = 0.132 mW/g**

Maximum value of SAR (measured) = 0.250 mW/g

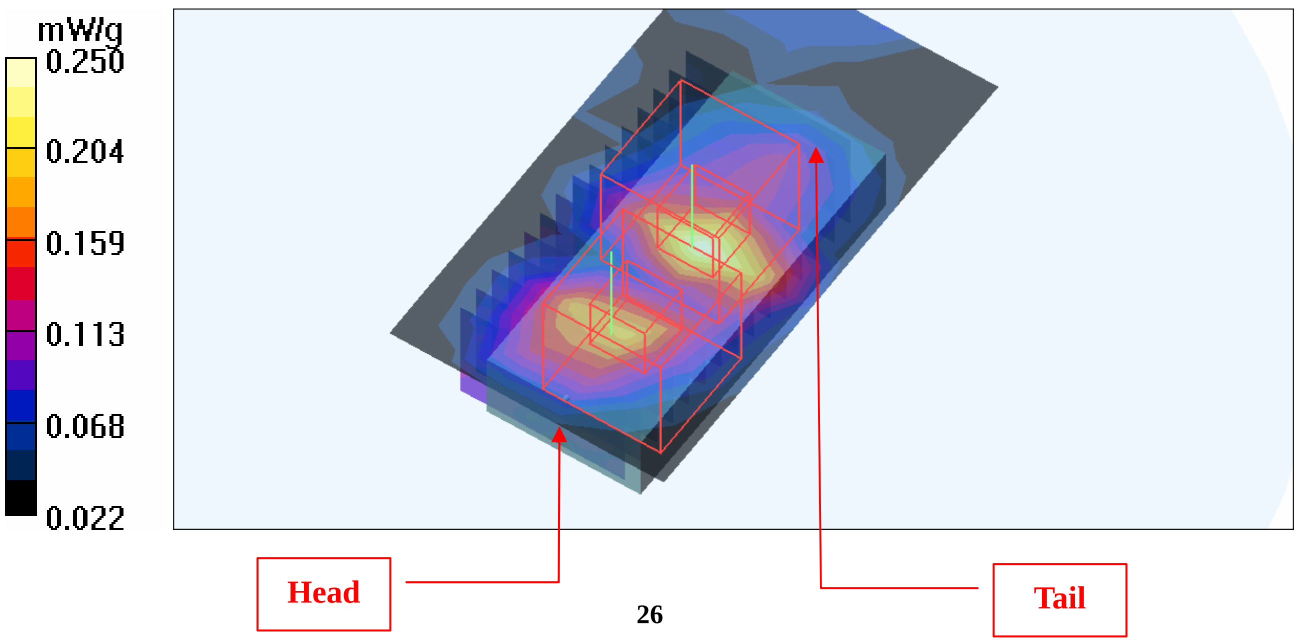
**High Channel 165/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 4.61 V/m

Peak SAR (extrapolated) = 0.302 W/kg

**SAR(1 g) = 0.156 mW/g; SAR(10 g) = 0.123 mW/g**

Maximum value of SAR (measured) = 0.224 mW/g



Date/Time: 2009/1/21 15:18:39

Test Laboratory: Bureau Veritas ADT

## M25-11aN 40M-Ch159

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 11n 5G span40 ; Frequency: 5795 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5795 MHz; $\sigma$ = 6.16 mho/m; $\varepsilon_r$ = 49.6; $\rho$ = 1000 kg/m$^3$

Phantom section: Flat Section ; Separation distance : 5 mm (The front side of the EUT to the Phantom)

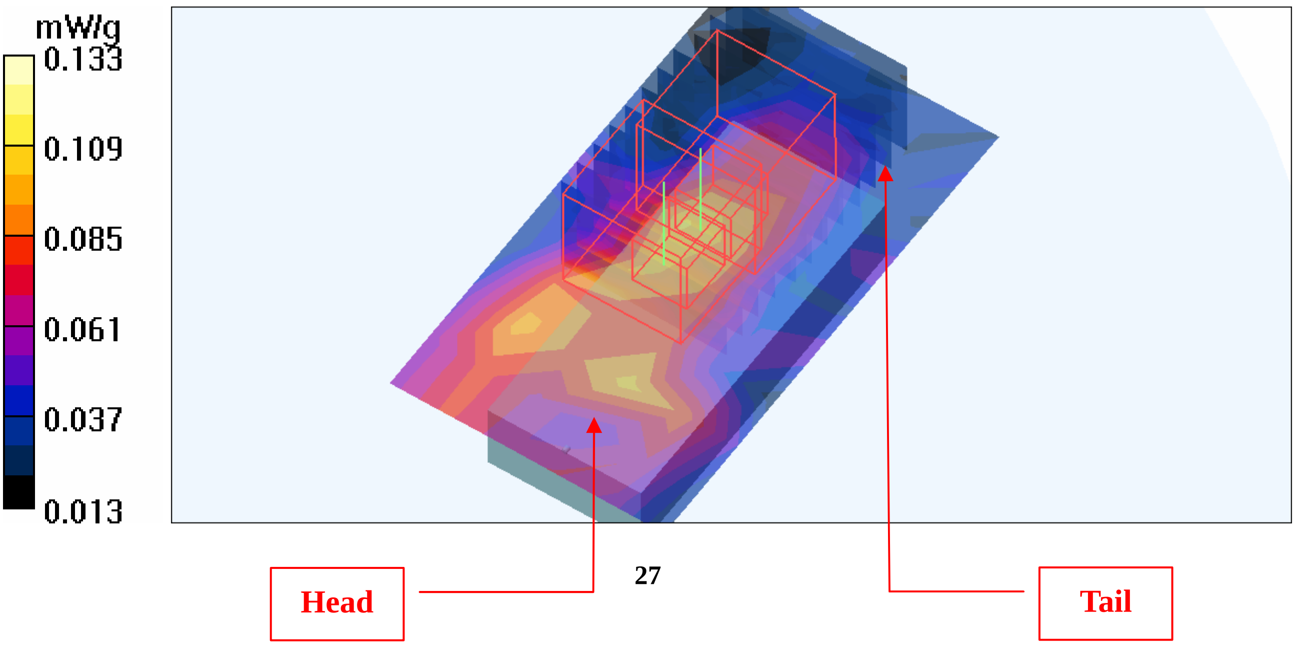
DASY4 Configuration:

- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 159/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.115 mW/g

**High Channel 159/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 3.55 V/m
Peak SAR (extrapolated) = 0.255 W/kg
**SAR(1 g) = 0.095 mW/g; SAR(10 g) = 0.054 mW/g**
Maximum value of SAR (measured) = 0.133 mW/g

**High Channel 159/Zoom Scan (8x8x8)/Cube 1:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 3.55 V/m
Peak SAR (extrapolated) = 0.235 W/kg
**SAR(1 g) = 0.057 mW/g; SAR(10 g) = 0.036 mW/g**
Maximum value of SAR (measured) = 0.123 mW/g



Date/Time: 2009/1/21 16:42:59

Test Laboratory: Bureau Veritas ADT

## M26-11a-Ch165

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 802.11a ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5825 MHz; $\sigma$ = 6.21 mho/m; $\varepsilon_r$ = 49.5; $\rho$ = 1000 kg/m$^3$

Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 165/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.468 mW/g

**High Channel 165/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 7.13 V/m

Peak SAR (extrapolated) = 0.886 W/kg

**SAR(1 g) = 0.479 mW/g; SAR(10 g) = 0.342 mW/g**

Maximum value of SAR (measured) = 0.675 mW/g

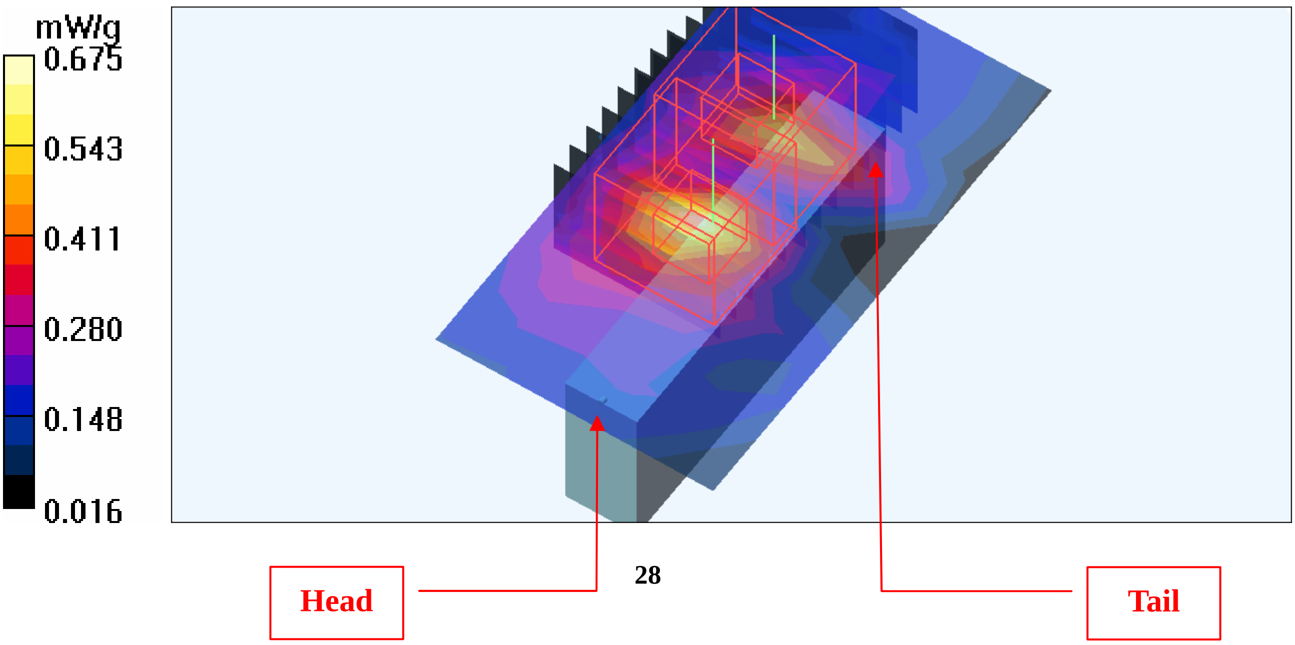
**High Channel 165/Zoom Scan (8x8x8)/Cube 1:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 7.13 V/m

Peak SAR (extrapolated) = 0.839 W/kg

**SAR(1 g) = 0.441 mW/g; SAR(10 g) = 0.328 mW/g**

Maximum value of SAR (measured) = 0.638 mW/g



Date/Time: 2009/1/21 18:05:10

Test Laboratory: Bureau Veritas ADT

## M27-11aN 20M-Ch165

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 11n 5G span20 ; Frequency: 5825 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5825 MHz; $\sigma$ = 6.21 mho/m; $\varepsilon_r$ = 49.5; $\rho$ = 1000 kg/m$^3$

Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 165/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.424 mW/g

**High Channel 165/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 7.44 V/m

Peak SAR (extrapolated) = 0.781 W/kg

**SAR(1 g) = 0.422 mW/g; SAR(10 g) = 0.298 mW/g**

Maximum value of SAR (measured) = 0.586 mW/g

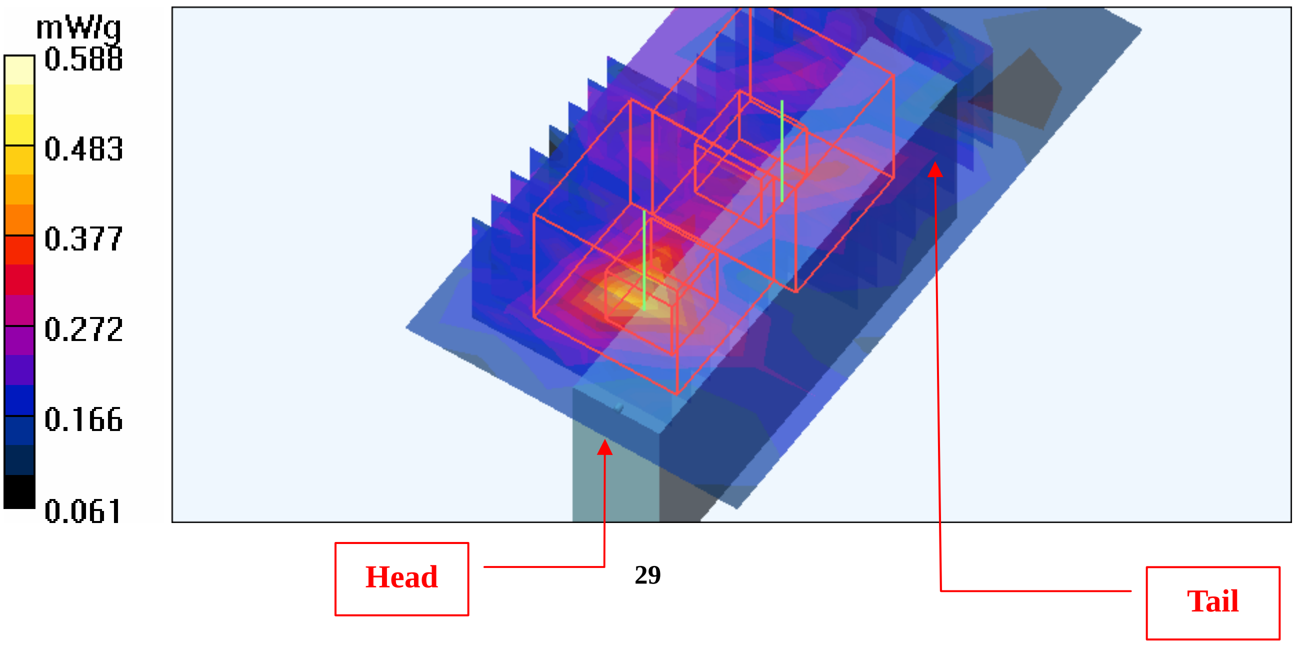
**High Channel 165/Zoom Scan (8x8x8)/Cube 1:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 7.44 V/m

Peak SAR (extrapolated) = 0.724 W/kg

**SAR(1 g) = 0.407 mW/g; SAR(10 g) = 0.271 mW/g**

Maximum value of SAR (measured) = 0.543 mW/g



Date/Time: 2009/1/21 19:36:22

Test Laboratory: Bureau Veritas ADT

## M28-11aN 40M-Ch159

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 11n 5G span40 ; Frequency: 5795 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5795 MHz; $\sigma$ = 6.16 mho/m; $\varepsilon_r$ = 49.6; $\rho$ = 1000 kg/m$^3$

Phantom section: Flat Section ; Separation distance : 5 mm (The edge side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 159/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.526 mW/g

**High Channel 159/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 8.85 V/m

Peak SAR (extrapolated) = 0.962 W/kg

**SAR(1 g) = 0.546 mW/g; SAR(10 g) = 0.363 mW/g**

Maximum value of SAR (measured) = 0.705 mW/g

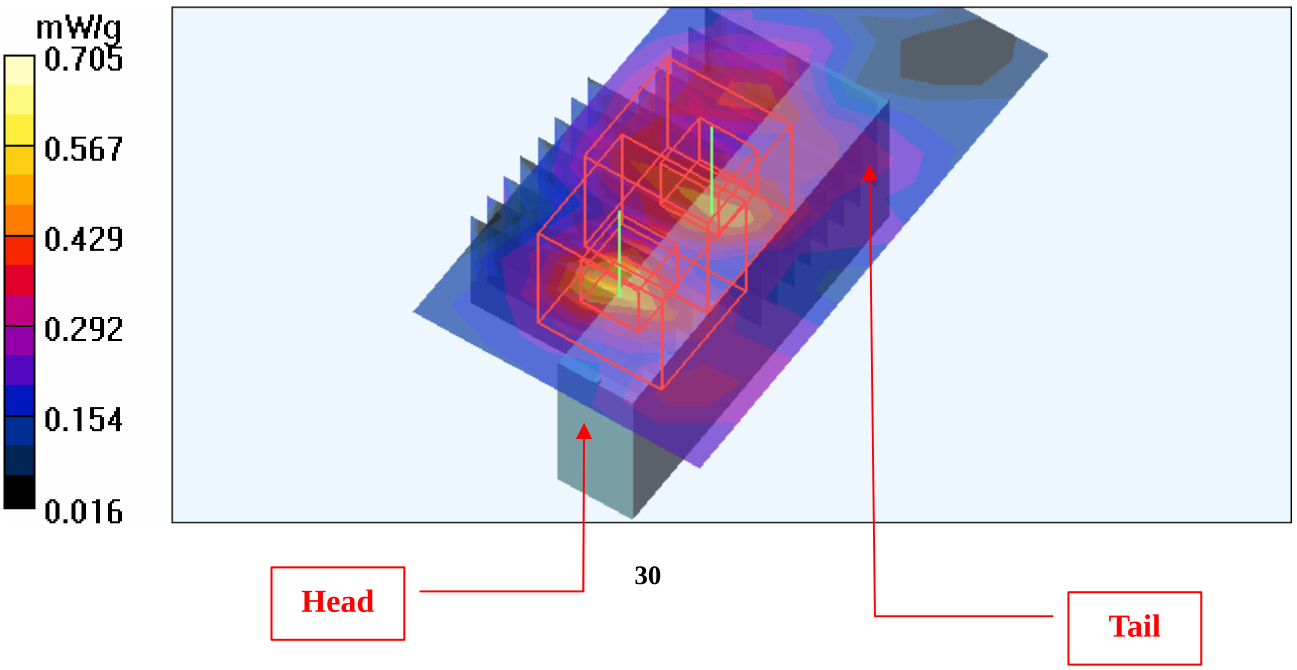
**High Channel 159/Zoom Scan (8x8x8)/Cube 1:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm

Reference Value = 8.85 V/m

Peak SAR (extrapolated) = 0.914 W/kg

**SAR(1 g) = 0.527 mW/g; SAR(10 g) = 0.339 mW/g**

Maximum value of SAR (measured) = 0.676 mW/g



Date/Time: 2009/1/21 22:47:03

Test Laboratory: Bureau Veritas ADT

## Bottom-D630-11aN 40M-Ch159 (Step Size Set Min)

**DUT: 802.11n dual band USB Adapter ; Type: TEW-644UB**

Communication System: 11n 5G span40 ; Frequency: 5795 MHz ; Duty Cycle: 1:1 ; Modulation type: BPSK

Medium: MSL5800 Medium parameters used: f = 5795 MHz; $\sigma$ = 6.16 mho/m; $\varepsilon_r$ = 49.6; $\rho$ = 1000 kg/m$^3$

Phantom section: Flat Section ; Separation distance : 5 mm (The bottom side of the EUT to the Phantom)

DASY4 Configuration:

- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579 ; Calibrated: 2008/3/13
- Phantom: SAM 12 ; Type: SAM V4.0 ; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53 ; Postprocessing SW: SEMCAD, V1.8 Build 172

**High Channel 159/Area Scan (6x10x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.895 mW/g

**High Channel 159/Zoom Scan (15x15x11)/Cube 0:** Measurement grid: dx=2.15mm, dy=2.15mm, dz=2mm

Reference Value = 10.8 V/m

Peak SAR (extrapolated) = 0.844 W/kg

**SAR(1 g) = 0.645 mW/g; SAR(10 g) = 0.418 mW/g**

Maximum value of SAR (measured) = 0.910 mW/g

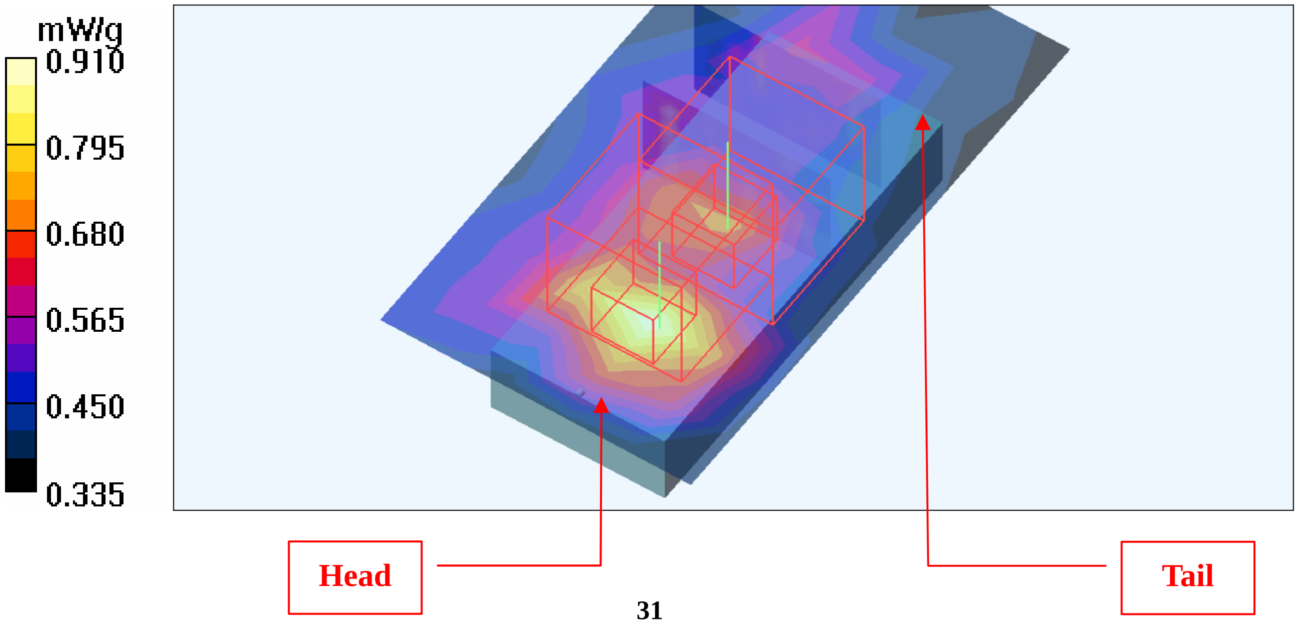
**High Channel 159/Zoom Scan (15x15x11)/Cube 1:** Measurement grid: dx=2.15mm, dy=2.15mm, dz=2mm

Reference Value = 10.8 V/m

Peak SAR (extrapolated) = 0.785 W/kg

**SAR(1 g) = 0.531 mW/g; SAR(10 g) = 0.390 mW/g**

Maximum value of SAR (measured) = 0.799 mW/g



Date/Time: 2009/1/20 11:27:11

Test Laboratory: Bureau Veritas ADT

## System Validation Check-MSL 2450MHz

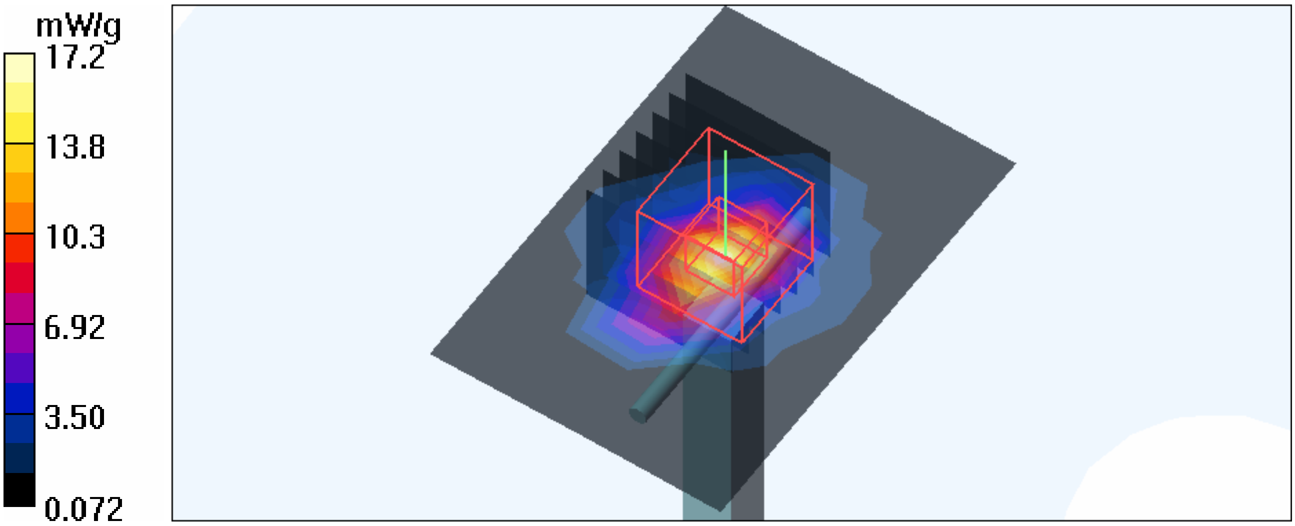
**DUT: Dipole 2450 MHz ; Type: D2450V2 ; Serial: 737 ; Test Frequency: 2450 MHz**

Communication System: CW ; Frequency: 2450 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: MSL2450;Medium parameters used: f = 2450 MHz; $\sigma$ = 1.98 mho/m; $\varepsilon_r$ = 54.2; $\rho$ = 1000 $kg/m^3$ ; Liquid level : 152 mm
Phantom section: Flat Section ; Separation distance : 10 mm (The feetpoint of the dipole to the Phantom)Air temp. : 23.1 degrees ; Liquid temp. : 22.0 degrees

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(7.52, 7.52, 7.52) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2008/3/13
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**d=10mm, Pin=250mW/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 17.3 mW/g

**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.6 V/m; Power Drift = -0.072 dB
Peak SAR (extrapolated) = 29.3 W/kg
**SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.01 mW/g**
Maximum value of SAR (measured) = 17.2 mW/g



Date/Time: 2009/1/21 01:31:09

Test Laboratory: Bureau Veritas ADT

## System Validation Check-MSL 5GHz

**DUT: Dipole 5 GHz ; Type: D5GHzV2 ; Serial: 1018 ; Test Frequency: 5800 MHz**

Communication System: CW ; Frequency: 5800 MHz; Duty Cycle: 1:1; Modulation type: CW
Medium: MSL5800;Medium parameters used: f = 5800 MHz; $\sigma$ = 6.17 mho/m; $\varepsilon_r$ = 49.5; $\rho$ = 1000 kg/m$^3$ ; Liquid level : 150 mm
Phantom section: Flat Section ; Separation distance : 10 mm (The feetpoint of the dipole to the Phantom)Air temp. : 22.5 degrees ; Liquid temp. : 21.7 degrees

DASY4 Configuration:
- Probe: EX3DV3 - SN3506 ; ConvF(3.87, 3.87, 3.87) ; Calibrated: 2008/9/30
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn579; Calibrated: 2008/3/13
- Phantom: SAM 12; Type: SAM V4.0; Serial: TP 1202
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**f=5800, d=10mm, Pin=100mW/Area Scan (6x6x1):** Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 7.29 mW/g

**f=5800, d=10mm, Pin=100mW/Zoom Scan (8x8x8)/Cube 0:** Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 48.8 V/m; Power Drift = -0.090 dB
Peak SAR (extrapolated) = 28.7 W/kg
**SAR(1 g) = 7.23 mW/g; SAR(10 g) = 1.98 mW/g**
Maximum value of SAR (measured) = 11.9 mW/g