# FCC SAR Report

| | | |
|---|---|---|
| **Report No.** | **:** | **SESF1501029** |
| **Client** | **:** | **Intracom Asia Co., Ltd** |
| **Address** | **:** | **4F., No.77, Sec.1, Xintai 5th Rd., Xizhi Dist., New Taipei City 221, Taiwan** |
| **Manufacture** | **:** | **Intracom Asia Co., Ltd** |
| **Address** | **:** | **4F., No.77, Sec.1, Xintai 5th Rd., Xizhi Dist., New Taipei City 221, Taiwan** |
| **Product** | **:** | **Micro 150N Wireless Adapter** |
| **Brand** | **:** | **Manhattan** |
| **Model** | **:** | **525503** |
| **FCC ID** | **:** | **2ADQY503** |
| **Standards** | **:** | **FCC 47 CFR Part 2 (2.1093) / IEEE C95.1:1992 / IEEE 1528-2013 / IEEE 1528a-2005 / KDB 865664 D01 v01r03 / KDB 248227 D01 v01r02 / KDB 447498 D01 v05r02 / KDB 447498 D02 v02** |
| **Test Date** | **:** | **January 12th, 2015** |

Statement of Compliance:

The SAR values measured for the test sample are below the maximum recommended level of 1.6W/kg averaged over any 1g tissue according to FCC Acknowledge Data Base / FCC 47CFR Part 2 (2.1093) / IEEE Std.1528-2013.

**The test result only corresponds to the tested sample. It is not permitted to copy this report, in part or in full, without the permission of the test laboratory.**

The testing described in this report has been carried out to the best of our knowledge and ability, and our responsibility is limited to the exercise of reasonable care. This certification is not intended to believe the sellers from their legal and/or contractual obligations.

Prepared By: ______________
Leo Chen

Approved By: ______________
Miro Chueh

ilac-MRA

TAF Testing Laboratory 2877

# Release Version

| Report No. | Issue Date | Description |
|---|---|---|
| SESF1501029 | 2015-01-14 | Initial release |
| | | |
| | | |

## Contents

# 1. Summary of Maximum SAR Value

| Equipment Class | Mode | Highest Reported $SAR_{1\text{-}g}$(W/kg) |
|---|---|---|
| DTS | 2.4GHz WIFI | 0.617 |
| Highest Simultaneous Transmission SAR | | Body |
| | | Highest Simultaneous $SAR_{1\text{-}g}$(W/kg) |
| N/A | | N/A |

## 2. Description of Equipment under Test

| | |
|---|---|
| **Product Name** | Micro 150N Wireless Adapter |
| **Model No.** | 525503 |
| **Brand Name** | Manhattan |
| **EUT Configuration** | Wi-Fi |
| **Antenna Type** | Internal |
| **Antenna Peak Gain** | 2400- 2500MHz: 1.5dBi |
| **Device Category** | Portable |
| **RF Exposure Environment** | Uncontrolled |
| **Wi-Fi** | |
| **Modulation technology** | 802.11b: CCK, DQPSK, DBPSK<br>802.11g: 64 QAM, 16 QAM, QPSK, BPSK<br>802.11n: BPSK, QPSK,16QAM, 64QAM |
| **Frequency Range** | 802.11b/g/n(20MHz): 2412-2462MHz<br>802.11n(40MHz): 2422-2452MHz |
| **Number of Channels** | 802.11b/g/n (20MHz):11<br>802.11n (40MHz): 7 |
| **Data Rate** | 802.11b: 1, 2, 5.5, 11Mbps<br>802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps<br>802.11n: MCS0~MCS7 |

# 3. General Information

**Our Lab,**

| | |
|---|---|
| Test Site | Cerpass Technology (Suzhou) Co.,Ltd |
| Test Site Location | No.66,Tangzhuang Road, Suzhou Industrial Park, Jiangsu 215006, China |

# 4. Basic restrictions and Standards

## 4.1. Test Standards

1. IEEE 1528-2013
2. FCC KDB Publication 447498 D01 General RF Exposure Guidance v05r02
3. FCC KDB Publication 447498 D02 SAR Procedures for Dongle Xmtr v02
4. FCC KDB Publication 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03
5. FCC KDB Publication 248227 D01 SAR measurement for 802 11 a b g v01r02

## 4.2. Environment Condition

| Item | Target | Measured |
|---|---|---|
| Ambient Temperature(℃) | 18~25 | 21.5 ± 2 |
| Temperature of Simulant(℃) | 20~22 | 21 ± 2 |
| Relative Humidity(%RH) | 30~70 | 52 |

## 4.3. RF Exposure Limits

| Human Exposure | Basic restrictions for electric, magnetic and electromagnetic fields. (Unit in mW/g or W/kg) |
|---|---|
| Spatial Peak SAR[1](Head and Body) | 1.60 |
| Spatial Average SAR[2](Whole Body) | 0.08 |
| Spatial Peak SAR[3](Arms and Legs) | 4.00 |

**Notes:**

1. The Spatial Peak value of the SAR averaged over any 1gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over appropriate averaging time.

# 5. DASY5 Measurement System

**DASY5 Measurement System**

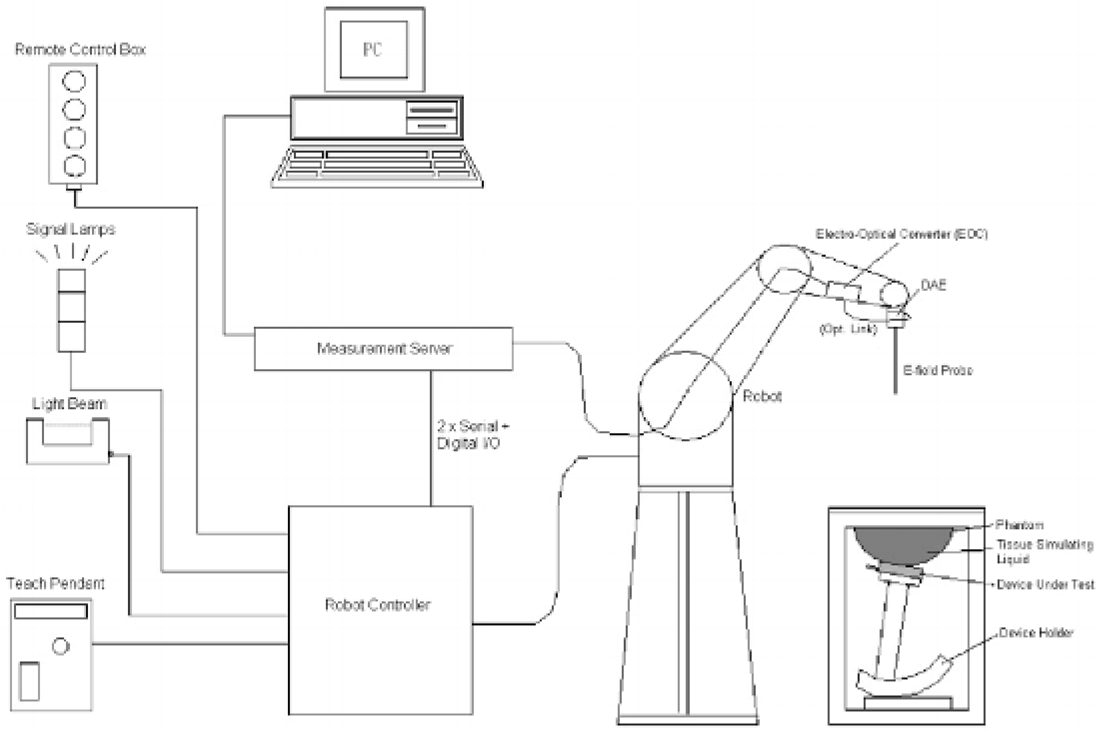



**Figure 2.1 SPEAG DASY5 System Configurations**

The DASY5 system for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic(DAE)attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter(ECO)performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows 7
- DASY5 software
- Remove control with teach pendant additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

### 5.1. Uncertainty of Inter-/Extrapolation and Averaging

In order to evaluate the uncertainty of the interpolation, extrapolation and averaged SAR calculation algorithms of the Postprocessor, DASY5 allows the generation of measurement grids which are artificially predefined by analytically based test functions. Therefore, the grids of area scans and zoom scans can be filled with uncertainty test data, according to the SAR benchmark functions of IEEE 1528.The three analytical functions shown in equations as below are used to describe the possible range of the expected SAR distributions for the tested handsets. The field gradients are covered by the spatially flat distribution f1, the spatially steep distribution f3 and f2 accounts for H-field cancellation on the phantom/tissue surface.

$$f_1(x,y,z) = Ae^{-\frac{z}{2a}} \cos^2\left(\frac{\pi}{2}\frac{\sqrt{x'^2+y'^2}}{5a}\right)$$

$$f_2(x,y,z) = Ae^{-\frac{z}{a}} \frac{a^2}{a^2+x'^2}\left(3-e^{-\frac{2z}{a}}\right)\cos^2\left(\frac{\pi}{2}\frac{y'}{3a}\right)$$

$$f_3(x,y,z) = A\frac{a^2}{\frac{a^2}{4}+x'^2+y'^2}\left(e^{-\frac{2z}{a}}+\frac{a^2}{2(a+2z)^2}\right)$$

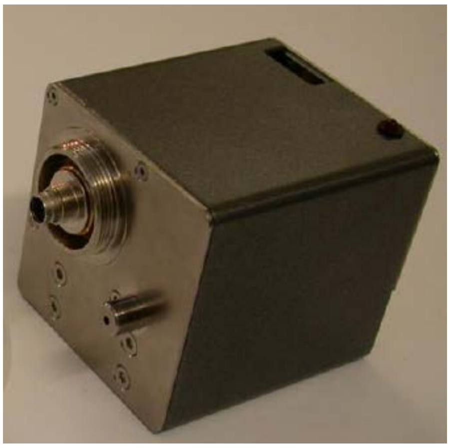
### 5.2. DASY5 E-Field Probe

The SAR measurement is conducted with the dosimetric probe manufactured by SPEAG. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.
SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528, EN 62209-1, IEC 62209, etc.) under ISO 17025. The calibration data are in Appendix D.

| **Model** | EX3DV4 | |
|---|---|---|
| **Construction** | Symmetrical design with triangular core 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 µW/g to 100 mW/g<br>Linearity: ± 0.2 dB (noise: typically < 1 µW/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%. | |

## 5.3. Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit.
Transmission to the 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 input impedance of the DAE4 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.



## 5.4. Robot

The DASY5 system uses the high precision robots TX90 XL type out of the newer series from Stäubli SA (France). For the 6-axis controller DASY5 system, the CS8C robot controller version from Stäubli is used.
The XL robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

## 5.5. Light Beam Unit

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

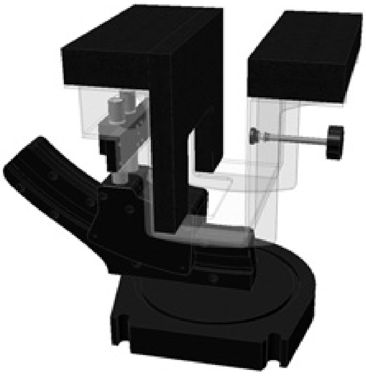
## 5.6. Measurement Server

| | |
|---|---|
| The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chipdisk and 128MB RAM. The necessary circuits for communication with the DAE electronics box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY5 I/O board, which is directly connected to the PC/104 bus of the CPU board. |  |

## 5.7. SAM Phantom

| | |
|---|---|
| The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:<br>■ Left head<br>■ Right head<br>■ Flat phantom |  |
| The ELI4 Phantom also is a fiberglass shell phantom with 2mm shell thickness. It has 30 liters filling volume, and with a dimension of 600mm for major ellipse axis, 400mm for minor axis. It is intended for compliance testing of handheld and body-mounted wireless devices in frequency range of 30 MHz to 6GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids. |  |
| The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot. | |

## 5.8. Device Holder

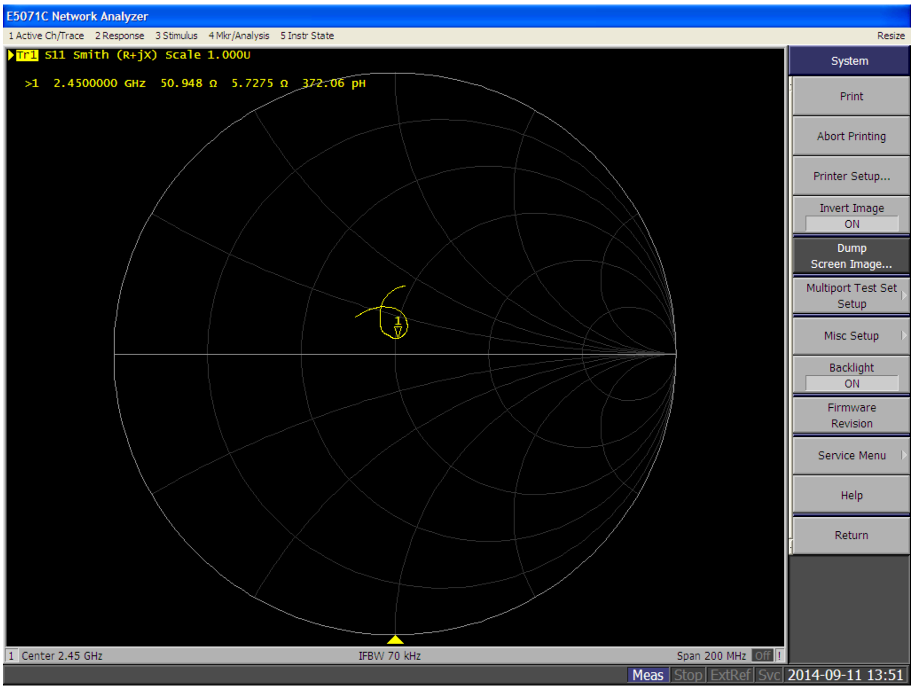
| | |
|---|---|
| The DASY5 device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR).Thus the device needs no repositioning when changing the angles. The DASY5 device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity εr =3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered. |  |
| The laptop extension is lightweight and made of POM, acrylic glass and foam. It fits easily on upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms. |  |

## 5.9. Test Equipment List

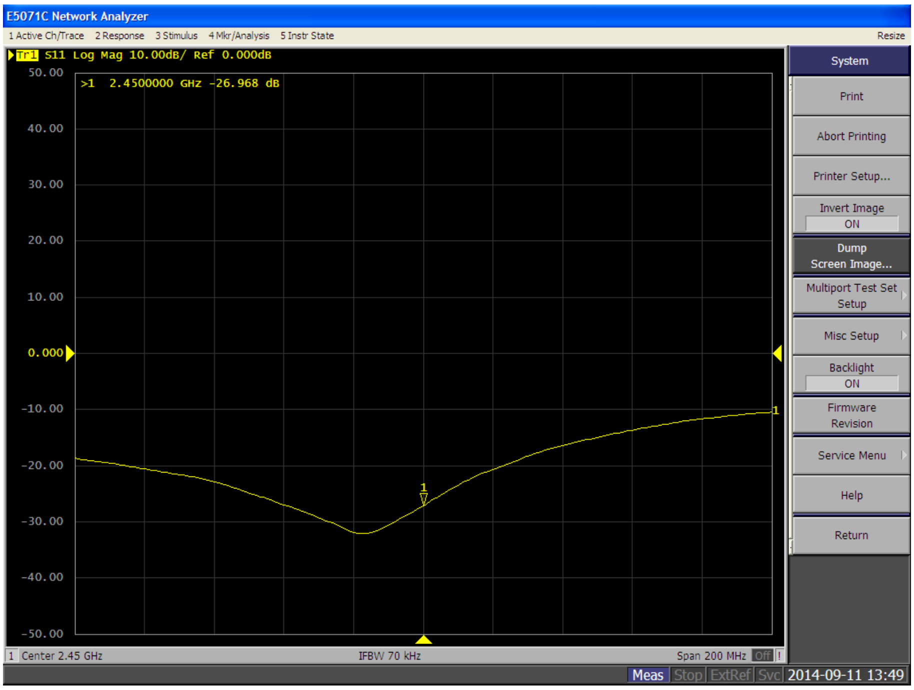
| Instrument | Manufacturer | Model No. | Serial No. | Cali. Due Date |
|---|---|---|---|---|
| Stäubli Robot TX60L | Stäubli | TX60L | 5P6VA1/A/01 | only once |
| Robot Controller | Stäubli | CS8C | 5P6VA1/C/01 | only once |
| Dipole Validation Kits | Speag | D2450V2 | 914 | 2015.06.06 |
| SAM ELI Phantom | Speag | SAM | 1211 | N/A |
| Laptop Holder | Speag | SM LH1 001CD | N/A | N/A |
| Data Acquisition Electronic | Speag | DAE4 | 1379 | 2015.05.18 |
| E-Field Probe | Speag | EX3DV4 | 3927 | 2015.05.22 |
| SAR Software | Speag | DASY5 | V5.2 Build 162 | N/A |
| Power Amplifier | Mini-Circuit | ZVA-183W-S+ | MN136701248 | 2015.09.03 |
| Directional Coupler | Agilent | 772D | MY52180104 | 2015.09.03 |
| Spectrum Analyzer | R&S | FSP40 | 100324 | 2015.03.23 |
| Vector Network | Agilent | E5071C | MY4631693 | 2015.01.15 |
| Signal Generator | R&S | SML | 103287 | 2015.03.09 |
| Power Meter | BONN | BLWA0830-160/100/40D | 76659 | 2015.11.10 |
| AUG Power Sensor | R&S | NRP-Z91 | 100384 | 2015.03.09 |

## 5.10. Annul Internal Check of Impedance and Return Loss

2450MHz Body calibrated impedance 52.051Ω; measured impedance: 50.948Ω (within 5Ω)




2450MHz Body calibrated return loss: -28.024 dB; Measured return loss: -26.968dB (within 20%)



# 6. The SAR Measurement Procedure

## 6.1. System Performance Check

### 6.1.1 Purpose

1. To verify the simulating liquids are valid for testing.
2. To verify the performance of testing system is valid for testing.

### 6.1.2 Tissue Dielectric Parameters for Head and Body Phantoms

| Target Frequency | Head | | Body | |
|---|---|---|---|---|
| (MHz) | $\varepsilon_r$ | σ (S/m) | $\varepsilon_r$ | σ (S/m) |
| 150 | 52.3 | 0.76 | 61.9 | 0.80 |
| 300 | 45.3 | 0.87 | 58.2 | 0.92 |
| 450 | 43.5 | 0.87 | 56.7 | 0.94 |
| 835 | 41.5 | 0.90 | 55.2 | 0.97 |
| 850 | 41.5 | 0.92 | 55.2 | 0.99 |
| 900 | 41.5 | 0.97 | 55.0 | 1.05 |
| 915 | 41.5 | 0.98 | 55.0 | 1.06 |
| 1450 | 40.5 | 1.20 | 54.0 | 1.30 |
| 1610 | 40.3 | 1.29 | 53.8 | 1.40 |
| 1800 – 2000 | 40.0 | 1.40 | 53.3 | 1.52 |
| **2450** | 39.2 | 1.80 | **52.7** | **1.95** |
| 3000 | 38.5 | 2.40 | 52.0 | 2.73 |
| 5200 | 36.0 | 4.66 | 49.0 | 5.30 |
| 5600 | 35.5 | 5.07 | 48.5 | 5.77 |
| 5800 | 35.3 | 5.27 | 48.2 | 6.00 |

($\varepsilon_r$ = relative permittivity, σ = conductivity and ρ = 1000 kg/$m^3$)

### 6.1.3 Tissue Calibration Result

■ The dielectric parameters of the liquids were verified prior to the SAR evaluation using DASY5 Dielectric Assessment Kit and Agilent Vector Network Analyzer E5071C.

| Tissue parameter for body(2015-01-12) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Fre. <MHz> | Ch. | Permittivity | Conductivity | Target Permittivity | Target Conductivity | Delta Permittivity % | Delta Conductivity % | Tissue Temperature℃ |
| 2450 | N/A | 52.67 | 1.95 | 52.70 | 1.95 | 0.00 | 0.00 | 21.0 |

Note: The delta permittivity and delta conductivity are within ±5%, and delta SAR value was not calculated in this report.

■ Refer to KDB 865664 D01 v01r03, The depth of body tissue-equivalent liquid in a phantom must be ≥ 15.0 cm with ≤ ± 0.5 cm variation for SAR measurements ≤ 3 GHz and ≥ 10.0 cm with ≤ ± 0.5 cm variation for measurements > 3 GHz.

### 6.1.4 System Performance Check Procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and the system performance check. They are read-only document files and destined as fully defined but unmeasured masks, so the finished system performance check must be saved under a different name. The system performance check document requires the SAM Twin Phantom or ELI4 Phantom, so the phantom must be properly installed in your system. (User defined measurement procedures can be created by opening a new document or editing an existing document file). Before you start the system performance check, you need only to tell the system with which components (probe, medium, and device) you are performing the system performance check; the system will take care of all parameters.

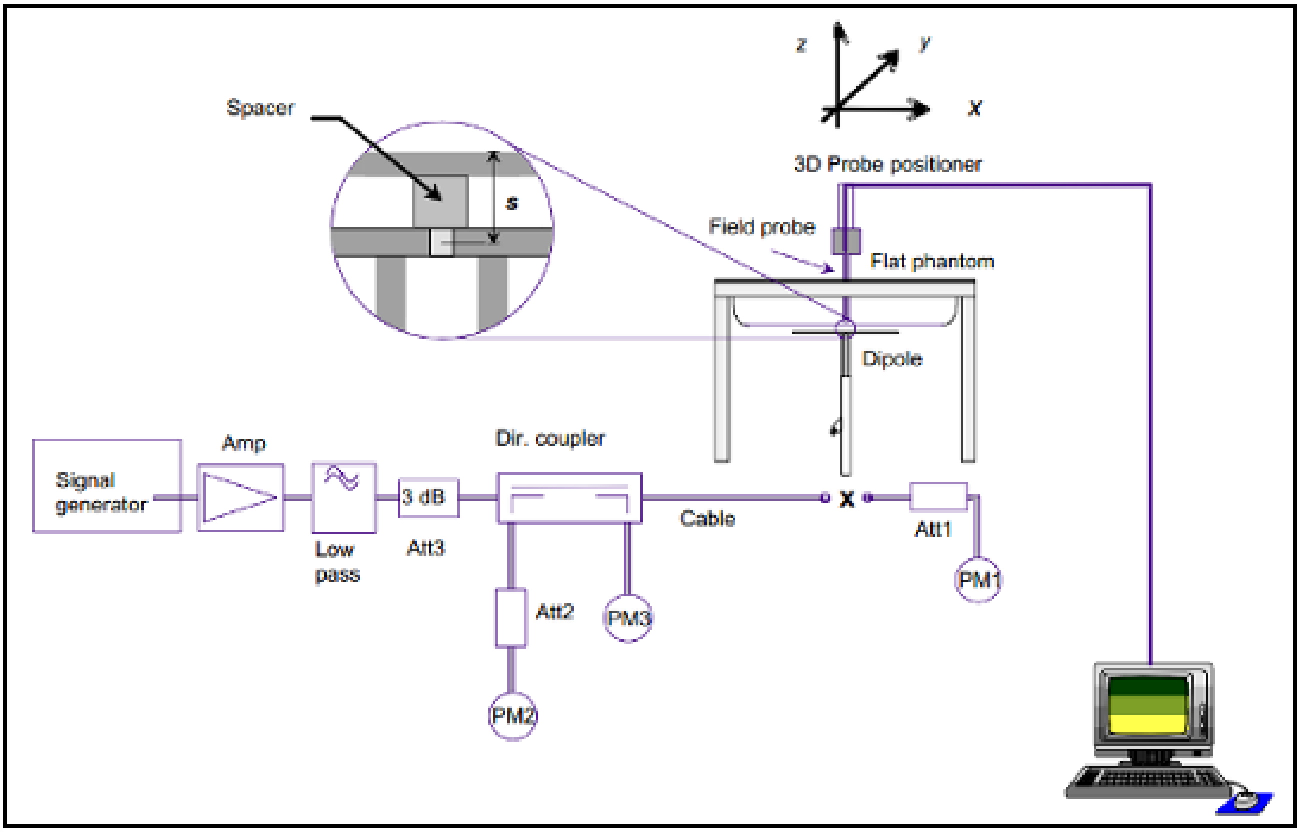
■ **The Power Reference Measurement and Power Drift Measurement** jobs are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the Dipole output power. If it is too high (above ±0.2 dB), the system performance check should be repeated;

■ **The Surface Check** job tests the optical surface detection system of the DASY5 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 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;

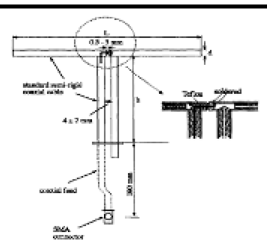
■ **The Zoom Scan** job measures the field in a volume around the peak SAR value assessed in the previous Area Scan job (for more information see the application note on SAR evaluation). If the system performance check gives reasonable results. The dipole input power(forward power) was 250mW, 1 g and 10 g spatial average SAR values normalized to 1W dipole input power give reference data for comparisons and it's equal to 10x(dipole forward power). The next sections analyze the expected uncertainties of these values, as well as additional checks for further information or troubleshooting.

### 6.1.5 System Performance Check Setup




### 6.1.6 Validation Dipoles

The dipoles use is based on the IEEE Std.1528-2013 and FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03standard, and is complied with mechanical and electrical specifications in line with the requirements of both EN62209-1 and EN62209-2. The table below provides details for the mechanical and electrical specifications for the dipoles.



### 6.1.7 Results of System Performance Check

**System Performance Check at 2450MHz for Body.**

**Validation Dipole: D2450V2- Type: SA AAD 245 BB- SN 914**

| Frequency [MHz] | Description | SAR [w/kg] 1g | SAR [w/kg] 10g | Tissue Temp. [°C] |
|---|---|---|---|---|
| 2450 MHz | Reference result ± 10% window | 51.5<br>46.35 to 56.65 | 23.9<br>21.51 to 26.29 | 21.0 |
| | 12-01-2015 | 51.2 | 23.4 | |

Note: All SAR values are normalized to 1W forward power.

## 6.2. Test Requirements

### 6.2.1 Test Procedures

**Step 1 Setup a Connection**

First, engineer should record the conducted power before the test. Then establish a call in handset at the maximum power level with a base station simulator via air interface, or make the EUT estimate by itself in testing band. Place the EUT to the specific test location. After the testing, must export SAR test data by SEMCAD. Then writing down the conducted power of the EUT into the report, also the SAR values tested.

**Step 2 Power Reference Measurements**

To measure the local E-field value at a fixed location which value will be taken as a reference value for calculating a possible power drift.

**Step 3 Area Scan**

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

**Area Scan Parameters extracted from KDB 865664 D01v01r01**

| | ≤ 3 GHz | > 3 GHz |
|---|---|---|
| Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface | 5 ± 1 mm | ½·δ·ln(2) ± 0.5 mm |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location | 30° ± 1° | 20° ± 1° |
| Maximum area scan spatial resolution: $\Delta x_{Area}$, $\Delta y_{Area}$ | ≤ 2 GHz: ≤ 15 mm<br>2 – 3 GHz: ≤ 12 mm | 3 – 4 GHz: ≤ 12 mm<br>4 – 6 GHz: ≤ 10 mm |
| | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device. | |

**Step 4 Zoom Scan**

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the Zoom Scan evaluates the averaged SAR for 1 g and 10 g and displays these values next to the job's label.

**Zoom Scan Parameters extracted from KDB 865664 D01 v01r03**

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$</td><td>≤ 2 GHz: ≤ 8 mm<br>2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*<br>4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm<br>4 – 5 GHz: ≤ 3 mm<br>5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm<br>4 – 5 GHz: ≤ 2.5 mm<br>5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm<br>4 – 5 GHz: ≥ 25 mm<br>5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.<br>* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

**Step 5 Power Drift Measurements**

Repetition of the E-field measurement at the fixed location mentioned in Step 1 to make sure the two results differ by less than ± 0.2 dB.

### 6.2.2 Test Channel

| Mode | GHz | Channel | Turbo Channel | "Default Test Channels" | | | |
|---|---|---|---|---|---|---|---|
| | | | | §15.247 | | UNII | |
| | | | | 802.11b | 802.11g | | |
| 802.11 b/g | 2.412 | 1# | | √ | ∇ | | |
| | 2.437 | 6 | 6 | √ | ∇ | | |
| | 2.462 | 11# | | √ | ∇ | | |

1. Per KDB 248227 D01v01r02, SAR is not required for 802.11g/HT20 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11b channels.

2. SAR is not required for Channels 12 and 13, if the tune-up limit and the measured output power for these two channels are no greater than those for the default test channels.

# 7. Wi-Fi/Bluetooth SAR Exclusion and Results

## 7.1. Maximum Tune-up Conducted Average Power

**< WIFI> (Unite: dBm)**

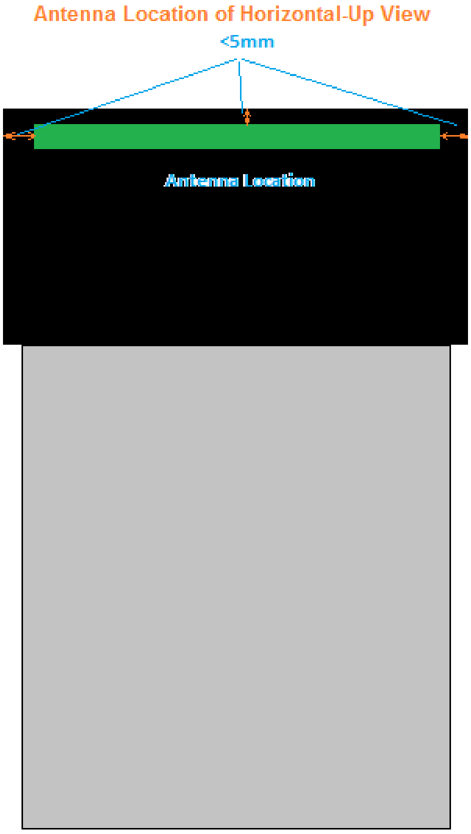
| Ch. | Freq(MHz) | 11b | 11g | HT20 | HT40 |
|---|---|---|---|---|---|
| 1 | 2412 | 12.5 | 15.7 | 16 | -- |
| 3 | 2422 | -- | -- | -- | 15.5 |
| 6 | 2437 | 14 | 16 | 16.7 | 15.7 |
| 9 | 2452 | -- | -- | -- | 16 |
| 11 | 2462 | 14.5 | 16.5 | 17.6 | -- |

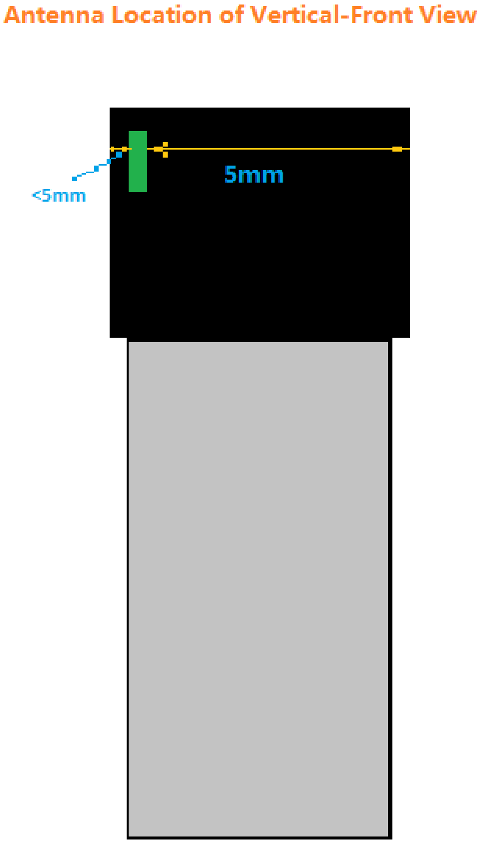
## 7.2. Measured Conducted Average Power

**< WIFI> (Unite: dBm)**

| Configurations | Mode | | |
|---|---|---|---|
| | Channel / Frequency (MHz) | | |
| 2.4GHz WLAN Average Power (Tx1) | 802.11b | | |
| | 1/2412 | 6/2437 | 11/2462 |
| | 12.43 | 13.92 | 14.34 |
| | 802.11g | | |
| | 1/2412 | 6/2437 | 11/2462 |
| | 15.57 | 15.85 | 16.31 |
| | 802.11n(HT20) | | |
| | 1/2412 | 6/2437 | 11/2462 |
| | 15.95 | 16.54 | 17.46 |
| | 802.11n(HT40) | | |
| | 3/2422 | 6/2437 | 9/2452 |
| | 15.35 | 15.51 | 15.93 |

## 7.3. Antenna Location




| Antenna | Distance to Edges(mm) | | | |
|---|---|---|---|---|
| | Horizontal-Up | Horizontal-Down | Vertical-Front | Vertical-Back |
| | 5 | <5 | <5 | <5 |

## 7.4. SAR exclusion

Per FCC KDB 447498 D01v05r02 for 100MHz~6GHz:

1) The SAR exclusion threshold for distances<50mm is defined by the following equation:

$$\frac{Max\ Power\ of\ \ Channel(mW)}{Test\ Separation\ Distance(mm)} \times \sqrt{Frequency(GHz)} \leq 3.0\ ,\ for\ 1\text{-}g\ SAR$$

Based on the maximum conducted power and the antenna to use separation distance, Max. average output power Wi-Fi is Higher the $P_{re}$, therefore Wi-Fi SAR is required:

*[(57.54mW/15)* √2.441] = 5.99>3.0, for Body.*

| Test Mode | Test Separation (mm) | Thresholds (mW) | Max. Tune-up power(dBm) | Max. Tune-up power(mW) | SAR Test (Y/N) |
|---|---|---|---|---|---|
| 2.45GHz WIFI | 5 | 10 | 17.6 | 57.54 | Y |

2) At test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following:

a. [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50mm)·( f (MHz)/150)] mW, at 100 MHz to 1500 MHz

b. [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

**Note:**

No test separation distances > 50 mm conditions.

## 7.5. Required Edges for SAR Testing

| Test Mode | Horizontal-Up | Horizontal-Down | Vertical-Front | Vertical-Back |
|---|---|---|---|---|
| 2.45GHz WIFI | Yes | Yes | Yes | Yes |

## 7.6. Estimated SAR

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05r02, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is≤1.6W/kg. When standalone SAR is not required to be measured, per FCC KDB 447498 D01v05r02 4.3.2 2, the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

$$Estimated\ SAR = \frac{\sqrt{f(GHz)}}{7.5} * \frac{(Max\ Power\ of\ channel, mW)}{Min.\ Separation, mm}$$

N/A

## 7.7. SAR Test Results Summary

■ **WLAN 2.4GHz**

| Plot No. | Band | Test Position | Dist. mm | Ch. | Fre. | Max. Tune-up Power(dBm) | Measured Conducted Power (dBm) | Scaling Factor | Power Drift(dB) | Measured SAR-1g (W/kg) | Scaled SAR-1g (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 802.11n HT20 | Vertical-Front | 5 | 1 | 2412 | 16.0 | 15.95 | 1.00 | -0.20 | 0.567 | 0.569 |
| | 802.11n HT20 | Vertical-Front | 5 | 6 | 2437 | 16.7 | 16.54 | 1.01 | -0.11 | 0.583 | 0.589 |
| 01 | 802.11n HT20 | Vertical-Front | 5 | 11 | 2462 | 17.6 | 17.46 | 1.01 | -0.05 | 0.612 | 0.617 |
| | 802.11n HT20 | Vertical-Back | 5 | 11 | 2462 | 17.6 | 17.46 | 1.01 | 0.13 | 0.432 | 0.435 |
| | 802.11n HT20 | Horizontal-Up | 5 | 11 | 2462 | 17.6 | 17.46 | 1.01 | 0.10 | 0.354 | 0.357 |
| | 802.11n HT20 | Horizontal-Down | 5 | 11 | 2462 | 17.6 | 17.46 | 1.01 | -0.08 | 0.344 | 0.347 |
| | 802.11n HT20 | Top | 5 | 11 | 2462 | 17.6 | 17.46 | 1.01 | 0.04 | 0.387 | 0.390 |
| | 802.11b | Vertical-Front | 5 | 11 | 2462 | 14.5 | 14.34 | 1.01 | -0.20 | 0.538 | 0.544 |
| | 802.11g | Vertical-Front | 5 | 11 | 2462 | 16.5 | 16.31 | 1.01 | 0.18 | 0.598 | 0.605 |
| | 802.11n HT40 | Vertical-Front | 5 | 9 | 2452 | 16.0 | 15.93 | 1.00 | -0.06 | 0.562 | 0.564 |

**Note:** Per KDB447498 D02 v02, USB dongle transmitters must show compliance at a test separation distance of 5 mm.

# 8. Simultaneous Transmission Analysis

## 8.1. Max. Simultaneous SAR

N/A

## 8.2. Simultaneous Transmission Conclusion

N/A

# 9. Measurement Uncertainty

| Error Description | Uncert. value | Prob. Dist. | Div. | (ci) 1g | (ci) 10g | Std.Unc. (1g) | Std. nc. (10g) | (vi) veff |
|---|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | | |
| Probe Calibration | ±6.0% | N | 1 | 1 | 1 | ±6.0% | ±6.0% | ∞ |
| Axial Isotropy | ±4.7% | R | $\sqrt{3}$ | 0.7 | 0.7 | ±1.9% | ±1.9% | ∞ |
| Hemispherical Isotropy | ±9.6% | R | $\sqrt{3}$ | 0.7 | 0.7 | ±3.9% | ±3.9% | ∞ |
| Boundary Effects | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Linearity | ±4.7% | R | $\sqrt{3}$ | 1 | 1 | ±2.7% | ±2.7% | ∞ |
| System Detection Limits | ±1.0% | R | $\sqrt{3}$ | 1 | 1 | ±0.6% | ±0.6% | ∞ |
| Modulation Response | ±2.4% | R | $\sqrt{3}$ | 1 | 1 | ±1.4% | ±1.4% | ∞ |
| Readout Electronics | ±0.3% | N | 1 | 1 | 1 | ±0.3% | ±0.3% | ∞ |
| Response Time | ±0.8% | R | $\sqrt{3}$ | 1 | 1 | ±0.5% | ±0.5% | ∞ |
| Integration Time | ±2.6% | R | $\sqrt{3}$ | 1 | 1 | ±1.5% | ±1.5% | ∞ |
| RF Ambient Noise | ±3.0% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| RF Ambient Reflections | ±3.0% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| Probe Positioner | ±0.4% | R | $\sqrt{3}$ | 1 | 1 | ±0.2% | ±0.2% | ∞ |
| Probe Positioning | ±2.9% | R | $\sqrt{3}$ | 1 | 1 | ±1.7% | ±1.7% | ∞ |
| Max.SAR Eval. | ±2.0% | R | $\sqrt{3}$ | 1 | 1 | ±1.2% | ±1.2% | ∞ |
| **Test Sample Related** | | | | | | | | |
| Device Positioning | ±2.9% | N | 1 | 1 | 1 | ±2.9% | ±2.9% | 145 |
| Device Holder | ±3.6% | N | 1 | 1 | 1 | ±3.6% | ±3.6% | 5 |
| Power Drift | ±5.0% | R | $\sqrt{3}$ | 1 | 1 | ±2.9% | ±2.9% | ∞ |
| Power Scalingp | ±0% | R | $\sqrt{3}$ | 0 | 0 | ±0% | ±0% | ∞ |
| **Phantom and Setup** | | | | | | | | |
| Phantom Uncertainty | ±6.1% | R | $\sqrt{3}$ | 1 | 1 | ±3.5% | ±3.5% | ∞ |
| SAR correction | ±1.9% | R | $\sqrt{3}$ | 1 | 0.84 | ±1.1% | ±0.9% | ∞ |
| Liquid Conductivity (mea.)DAK | ±2.5% | R | $\sqrt{3}$ | 0.78 | 0.71 | ±1.1% | ±1.0% | ∞ |
| Liquid Permittivity (mea.)DAK | ±2.5% | R | $\sqrt{3}$ | 0.26 | 0.26 | ±0.3% | ±0.4% | ∞ |
| Temp. unc. –ConductivityBB | ±3.4% | R | $\sqrt{3}$ | 0.78 | 0.71 | ±1.5% | ±1.4% | ∞ |
| Temp. unc. – PermittivityBB | ±0.4% | R | $\sqrt{3}$ | 0.23 | 0.26 | ±0.1% | ±0.1% | ∞ |
| **Combined Std. Uncertainty** | | | | | | ±11.2% | ±11.1% | 361 |
| **Expanded STD Uncertainty(k=2)** | | | | | | **±22.3%** | **±22.2%** | |

**DASY5 Uncertainty Budget, according to IEEE 1528/2011 and IEC 62209-1/2011(0.3-3GHz)**

--END--

# APPENDIX A. SAR System Verification Data

The plots for system verification with largest deviation for each SAR system combination are shown as follows.

**Date/Time: 12/01/2015**

Test Laboratory: Cerpass Lab

Dipole Calibration for Body Tissue Pin=250mW, dist=10mm, f=2450 MHz

**DUT: Dipole 2450 MHz D2450V2; Type: SA AAD 245 BB**

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: f = 2450 MHz; σ = 1.95 S/m; εr = 52.67; ρ = 1000 kg/m3

Phantom section: Flat Section; Meas. Ambient Temp (celsius) -22℃; Input power-250mW

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

- Probe: EX3DV4 - SN3927; ConvF(7.63, 7.63, 7.63); Calibrated: 2014/5/23;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1379; Calibrated: 2014/5/19
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Configuration/Dipole Calibration for Body Tissue/ Pin=250mW, dist=10mm, f=2450MHz/Area Scan (4x6x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 10.4 W/kg

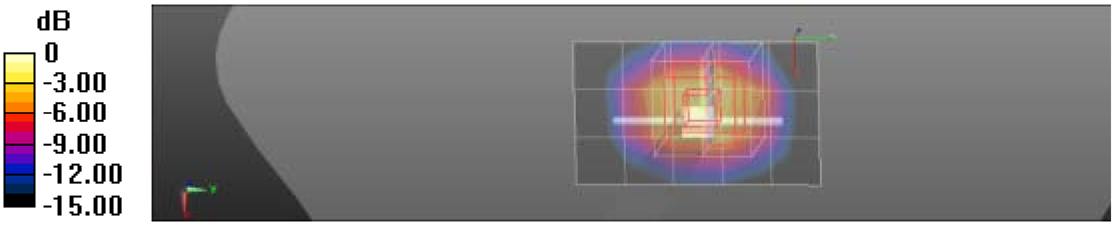
**Configuration/Dipole Calibration for Body Tissue/ Pin=250mW, dist=10mm, f=2450MHz/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.29 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 27.5 W/kg

**SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.85 W/kg**

Maximum value of SAR (measured) = 14.7 W/kg




0 dB = 14.7 W/kg = 11.67 dBW/kg

# APPENDIX B. SAR measurement Data

The SAR plots for highest measured SAR in each exposure configuration, wireless mode and frequency band combination, and measured SAR > 1.5 W/kg are shown as follows.

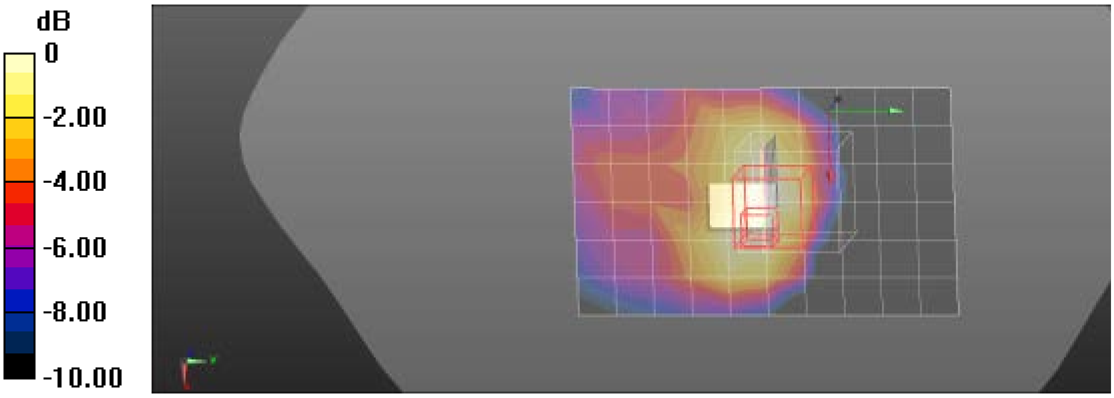
**Date/Time: 12/01/2015**

Test Laboratory: Cerpass Lab
DUT: Micro 150N Wireless Adapter; Type: 525503
**Procedure Name: 802.11n(20MHz) 2462MHz High Vertical-Front**
Communication System Band: 802.11n(20MHz); Frequency: 2462 MHz; Duty Cycle: 1:1
Medium parameters used: f = 2462 MHz; σ = 1.97 S/m; εr = 52.65; ρ = 1000 kg/m3
Phantom section: Flat Section; Tissue Temp(celsius) - 21℃
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY5 Configuration:

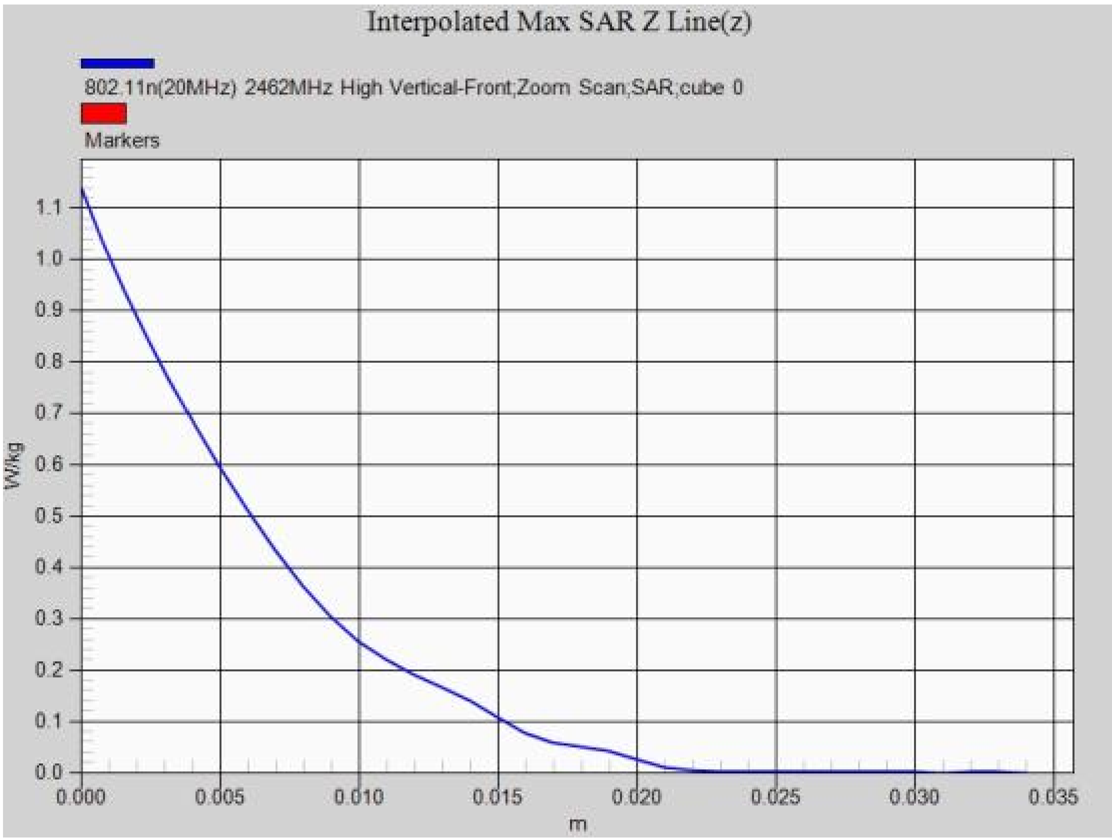
- Probe: EX3DV4 - SN3927; ConvF(7.63, 7.63, 7.63); Calibrated: 2014/5/23;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1379; Calibrated: 2014/5/19
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD
- Measurement SW: DASY52, Version 52.8 (8);

**Configuration/802.11n(20MHz) 2462MHz High Vertical-Front/Area Scan (7x11x1):**
Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.733 W/kg

**Configuration/802.11n(20MHz) 2462MHz High Vertical-Front/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 2.875 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 1.14 W/kg
**SAR(1 g) = 0.612 W/kg; SAR(10 g) = 0.278 W/kg**
Maximum value of SAR (measured) = 0.697 W/kg




0 dB = 0.697 W/kg = -1.57 dBW/kg


Interpolated Max SAR Z Line(z)
802.11n(20MHz) 2462MHz High Vertical-Front;Zoom Scan;SAR;cube 0
Markers
W/kg
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0.035
m

## APPENDIX C. Calibration Data for Probe, Dipole and DAE

Please refer to attached files.

## APPENDIX D. Photographs of EUT and Setup

Please refer to attached files.