

# FCC SAR TEST REPORT

Report No: STS1706022H01

Issued for

GL Technologies (Hong Kong) Limited

Unit 210D, 2/F, Enterprise Place Hong Kong Science Park,  
Shatin, N.T, Hong Kong

|                              |                                |
|------------------------------|--------------------------------|
| <b>Product Name:</b>         | Microuter                      |
| <b>Brand Name:</b>           | GL·iNet                        |
| <b>Model Name:</b>           | GL-USB150                      |
| <b>Series Model:</b>         | N/A                            |
| <b>FCC ID:</b>               | 2AFIW-USB150                   |
| <b>Test Standard:</b>        | OET Bulletin 65(Edition 97-01) |
|                              | ANSI/IEEE Std. C95.1           |
|                              | FCC 47 CFR Part 2 ( 2.1093)    |
|                              | IEEE 1528: 2013                |
| <b>Max. Report SAR (1g):</b> | Body: 0.543 W/kg               |

Any reproduction of this document must be done in full. No single part of this document may be reproduced without permission from BZT, All Test Data Presented in this report is only applicable to presented Test sample.

BZT Testing Technology Co., Ltd

Add. : Buliding 17, Xinghua Road Xingwei industrial Park Fuyong,  
Baoan District, Shenzhen, Guangdong, China

TEL: +86-755 3307 1680 FAX: +86-755 27341758 E-mail:bruce@bzt.cn

## Test Report Certification

**Applicant's name** .....: GL Technologies (Hong Kong) Limited  
**Address** .....: Unit 210D, 2/F, Enterprise Place Hong Kong Science Park,  
Shatin, N.T, Hong Kong  
**Manufacture's Name** .....: GL Technologies (Hong Kong) Limited  
**Address** .....: Unit 210D, 2/F, Enterprise Place Hong Kong Science Park,  
Shatin, N.T, Hong Kong

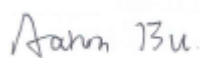
### Product description

**Product name** .....: Microuter  
**Trademark** .....: GL-iNet  
**Model and/or type reference** : GL-USB150  
**Series Model**.....: N/A  
**Standards** .....: OET Bulletin 65(Edition 97-01)  
ANSI/IEEE Std. C95.1-1992  
FCC 47 CFR Part 2 ( 2.1093)  
IEEE 1528: 2013

The device was tested by Shenzhen BZT Test Services Co., Ltd. in accordance with the measurement methods and procedures specified in KDB 865664 The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

**Date of Test** .....:  
**Date (s) of performance of tests** .....: 09 Jun. 2017  
**Date of Issue** .....: 12 Jun. 2017  
**Test Result**.....: **Pass**

Testing Engineer :



( Aaron Bu)

Technical Manager :



(John Zou)

Authorized Signatory :



(Vita Li)

## Table of Contents

|                                                                    |           |
|--------------------------------------------------------------------|-----------|
| <b>1.General Information</b>                                       | <b>4</b>  |
| 1.1 EUT Description                                                | 4         |
| 1.2 Test Environment                                               | 4         |
| 1.3 Test Factory                                                   | 4         |
| <b>2.Test Standards And Limits</b>                                 | <b>5</b>  |
| <b>3. SAR Measurement System</b>                                   | <b>6</b>  |
| 3.1 Definition Of Specific Absorption Rate (SAR)                   | 6         |
| 3.2 SAR System                                                     | 6         |
| <b>4. Tissue Simulating Liquids</b>                                | <b>9</b>  |
| 4.1 Simulating Liquids Parameter Check                             | 9         |
| <b>5. SAR System Validation</b>                                    | <b>10</b> |
| 5.1 Validation System                                              | 10        |
| 5.2 Validation Result                                              | 10        |
| <b>6. SAR Evaluation Procedures</b>                                | <b>11</b> |
| <b>7. EUT Antenna Location Sketch</b>                              | <b>12</b> |
| 7.1 SAR TEST EXCLUSION CONSIDER TABLE                              | 12        |
| <b>8. EUT Test Position</b>                                        | <b>13</b> |
| 8.1 Hotspot mode exposure position condition                       | 13        |
| 8.2 USB connector Orientations Implemented on Laptop Computers     | 13        |
| 8.3 Simple Dongle Test Procedures                                  | 14        |
| 8.4 Dongles with Swivel or Rotating Connectors                     | 14        |
| <b>9. Uncertainty</b>                                              | <b>15</b> |
| 9.1 Measurement Uncertainty                                        | 15        |
| 9.2 System validation Uncertainty                                  | 17        |
| <b>10. Conducted Power Measurement</b>                             | <b>19</b> |
| 10.1 Test Result                                                   | 19        |
| 10.2 Tune-up Power                                                 | 19        |
| 10.3 SAR Test Exclusions Applied                                   | 20        |
| <b>11. EUT And Test Setup Photo</b>                                | <b>21</b> |
| 11.1 EUT Photo                                                     | 21        |
| 11.2 Setup Photo                                                   | 25        |
| <b>12. SAR Result Summary</b>                                      | <b>28</b> |
| <b>13. Equipment List</b>                                          | <b>29</b> |
| <b>Appendix A. System Validation Plots</b>                         | <b>30</b> |
| <b>Appendix B. SAR Test Plots</b>                                  | <b>32</b> |
| <b>Appendix C. Probe Calibration And Dipole Calibration Report</b> | <b>33</b> |

## 1. General Information

Environmental evaluation measurements of specific absorption rate (SAR) distributions in emulated human head and body tissues exposed to radio frequency (RF) radiation from wireless portable devices for compliance with the rules and regulations of the U.S. Federal Communications Commission (FCC).

### 1.1 EUT Description

|                         |                                        |      |                    |
|-------------------------|----------------------------------------|------|--------------------|
| Equipment               | Microuter                              |      |                    |
| Brand Name              | GL·iNet                                |      |                    |
| Model No.               | GL-USB150                              |      |                    |
| Series Model            | N/A                                    |      |                    |
| FCC ID                  | 2AFIW-USB150                           |      |                    |
| Model Difference        | N/A                                    |      |                    |
| Power rating            | DC 5V                                  |      |                    |
| Device Category         | Portable                               |      |                    |
| Product stage           | Production unit                        |      |                    |
| RF Exposure Environment | General Population / Uncontrolled      |      |                    |
| Hardware Version        | N/A                                    |      |                    |
| Software Version        | N/A                                    |      |                    |
| Frequency Range         | WLAN 802.11b/g/n(HT20/40):2412~2462MHz |      |                    |
| Max. Reported SAR(1g):  | Band                                   | Mode | Body Hotspot(W/kg) |
|                         | DTS                                    | WIFI | 0.543              |
| FCC Equipment Class     | Digital Transmission System (DTS)      |      |                    |
| Operating Mode:         | WLAN: 802.11 b/g/n(HT20/40);           |      |                    |
| Antenna Specification:  | WIFI: PCB Antenna                      |      |                    |
| Hotspot Mode:           | Support                                |      |                    |
| DTM Mode:               | Not Support                            |      |                    |

### 1.2 Test Environment

Ambient conditions in the SAR laboratory:

| Items            | Required |
|------------------|----------|
| Temperature (°C) | 18-25    |
| Humidity (%RH)   | 30-70    |

### 1.3 Test Factory

BZT Testing Technology Co., Ltd  
 Add. : Buliding 17, Xinghua Road Xingwei industrial Park Fuyong, Baoan District,  
 Shenzhen, Guangdong, China  
 FCC Registration No.: 701733

## 2. Test Standards And Limits

| No. | Identity                            | Document Title                                                                                                                                                              |
|-----|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | OET Bulletin 65(Edition 97-01)      | Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields                                                                       |
| 2   | 47 CFR Part 2                       | Frequency Allocations and Radio Treaty Matters; General Rules and Regulations                                                                                               |
| 3   | ANSI/IEEE Std. C95.1-1992           | IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz                                                  |
| 4   | IEEE Std. 1528-2013                 | Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques |
| 5   | FCC KDB 447498 D01 v06              | Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies                                                                                      |
| 6   | FCC KDB 447498 D02 v02r01           | SAR Measurement Procedures for USB dongle transmitters                                                                                                                      |
| 7   | FCC KDB 865664 D01 v01r04           | SAR Measurement 100 MHz to 6 GHz                                                                                                                                            |
| 8   | FCC KDB 865664 D02 v01r02           | RF Exposure Reporting                                                                                                                                                       |
| 9   | FCC KDB 248227 D01 Wi-Fi SAR v02r02 | SAR Considerations for 802.11 Devices                                                                                                                                       |

### (A). Limits for Occupational/Controlled Exposure (W/kg)

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|------------|--------------|--------------------------------|
| 0.4        | 8.0          | 20.0                           |

### (B). Limits for General Population/Uncontrolled Exposure (W/kg)

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|------------|--------------|--------------------------------|
| 0.08       | 1.6          | 4.0                            |

NOTE: Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

#### **Population/Uncontrolled Environments:**

are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

#### **Occupational/Controlled Environments:**

are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

#### **NOTE**

#### **GENERAL POPULATION/UNCONTROLLED EXPOSURE**

#### **PARTIAL BODY LIMIT**

**1.6 W/kg**

### 3. SAR Measurement System

#### 3.1 Definition Of Specific Absorption Rate (SAR)

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

The SAR definition is the time derivative (rate) of the incremental energy ( $dW$ ) absorbed by (dissipated in) an incremental mass ( $dm$ ) contained in a volume element ( $dv$ ) of a given density ( $\rho$ ). The equation description is as below:

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

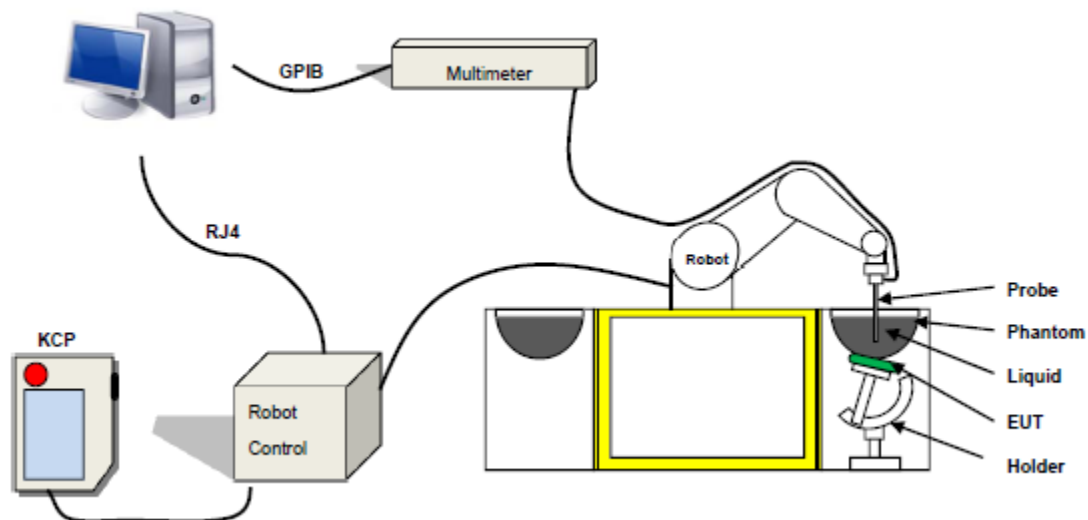
SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

$$SAR = \frac{\sigma E^2}{\rho}$$

Where:  $\sigma$  is the conductivity of the tissue,  
 $\rho$  is the mass density of the tissue and  $E$  is the RMS electrical field strength.

#### 3.2 SAR System

SATIMO SAR System Diagram:



Comosar is a system that is able to determine the SAR distribution inside a phantom of human being according to different standards. The Comosar system consists of the following items:

- Main computer to control all the system
- 6 axis robot
- Data acquisition system
- Miniature E-field probe
- Phone holder
- Head simulating tissue

The following figure shows the system.



The EUT under test operating at the maximum power level is placed in the phone holder, under the phantom, which is filled with head simulating liquid. The E-Field probe measures the electric field inside the phantom. The OpenSAR software computes the results to give a SAR value in a 1g or 10g mass.

### 3.2.1 Probe

For the measurements the Specific Dosimetric E-Field Probe SN 14/16 EP309 with following specifications is used

- Dynamic range: 0.01-100 W/kg
- Tip Diameter: 5 mm
- Length of Individual Dipoles: 4.5 mm
- Maximum external diameter: 8 mm
- Distance between dipole/probe extremity: 8 mm (repeatability better than +/- 2.7mm)
- Probe linearity:  $0 \pm 2.27\%$  ( $\pm 0.10\text{dB}$ )
- Axial Isotropy:  $< 0.10\text{ dB}$
- Spherical Isotropy:  $< 0.10\text{ dB}$
- Calibration range: 400 MHz to 3 GHz for head & body simulating liquid.
- Angle between probe axis (evaluation axis) and surface normal line: less than  $30^\circ$



Figure 1-MVG COMOSAR Dosimetric E field Dipole

### 3.2.2 Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.

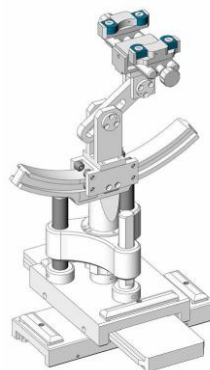


Figure-SN 32/14 SAM115



Figure-SN 32/14 SAM116

### 3.2.3 Device Holder



The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of  $\pm 0.5$  mm would produce a SAR uncertainty of  $\pm 20$  %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

## 4. Tissue Simulating Liquids

### 4.1 Simulating Liquids Parameter Check

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

| Frequency (MHz) | Bactericide | DGBE  | HEC | NaCl | Sucrose | 1,2-Propanediol | X100  | Water | Conductivity | Permittivity |
|-----------------|-------------|-------|-----|------|---------|-----------------|-------|-------|--------------|--------------|
|                 | %           | %     | %   | %    | %       | %               | %     | %     | $\sigma$     | $\epsilon_r$ |
| 750             | /           | /     | /   | 0.79 | /       | 64.81           | /     | 34.40 | 0.97         | 41.8         |
| 835             | /           | /     | /   | 0.79 | /       | 64.81           | /     | 34.40 | 0.97         | 41.8         |
| 900             | /           | /     | /   | 0.79 | /       | 64.81           | /     | 34.40 | 0.97         | 41.8         |
| 1800            | /           | 13.84 | /   | 0.35 | /       | /               | 30.45 | 55.36 | 1.38         | 41.0         |
| 1900            | /           | 13.84 | /   | 0.35 | /       | /               | 30.45 | 55.36 | 1.38         | 41.0         |
| 2000            | /           | 7.99  | /   | 0.16 | /       | /               | 19.97 | 71.88 | 1.55         | 41.1         |
| 2450            | /           | 7.99  | /   | 0.16 | /       | /               | 19.97 | 71.88 | 1.88         | 40.3         |
| 2600            | /           | 7.99  | /   | 0.16 | /       | /               | 19.97 | 71.88 | 1.88         | 40.3         |

| Tissue dielectric parameters for head and body phantoms |              |      |                 |      |
|---------------------------------------------------------|--------------|------|-----------------|------|
| Frequency                                               | $\epsilon_r$ |      | $\sigma$<br>S/m |      |
|                                                         | Head         | Body | Head            | Body |
| 300                                                     | 45.3         | 58.2 | 0.87            | 0.92 |
| 450                                                     | 43.5         | 58.7 | 0.87            | 0.94 |
| 900                                                     | 41.5         | 55.0 | 0.97            | 1.05 |
| 1450                                                    | 40.5         | 54.0 | 1.20            | 1.30 |
| 1800                                                    | 40.0         | 53.3 | 1.40            | 1.52 |
| 2450                                                    | 39.2         | 52.7 | 1.80            | 1.95 |
| 3000                                                    | 38.5         | 52.0 | 2.40            | 2.73 |
| 5800                                                    | 35.3         | 48.2 | 5.27            | 6.00 |

### LIQUID MEASUREMENT RESULTS

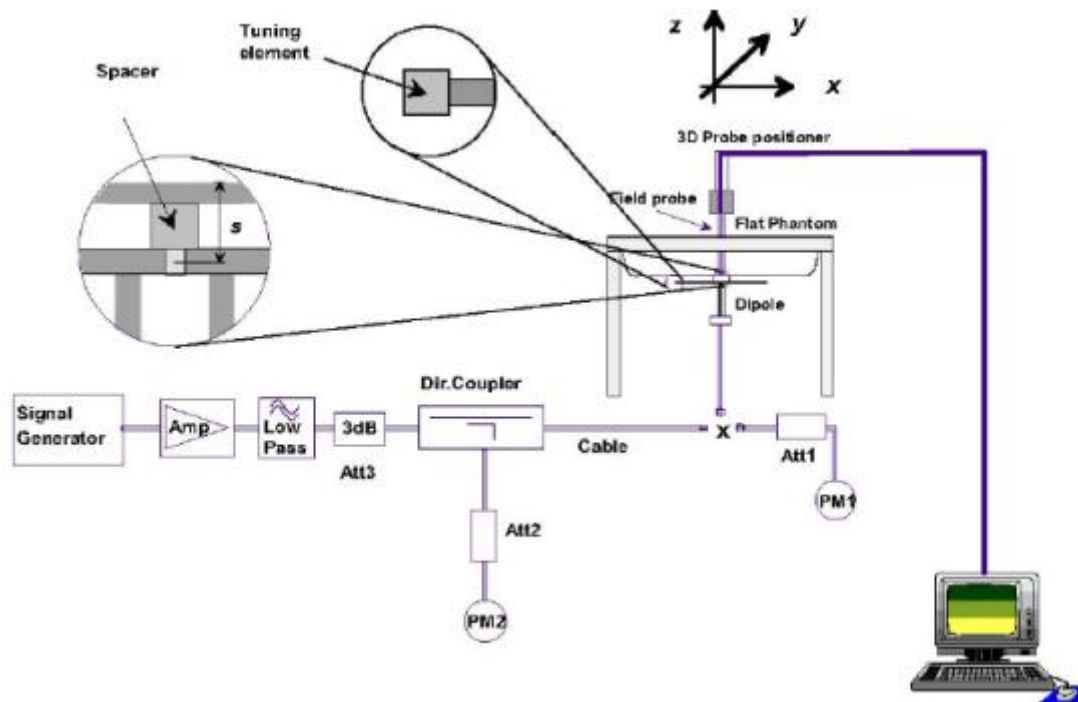
| Date       | Ambient condition |              | Body Simulating Liquid |            | Parameters    | Target | Measured | Deviation [%] | Limited [%] |
|------------|-------------------|--------------|------------------------|------------|---------------|--------|----------|---------------|-------------|
|            | Temp. [°C]        | Humidity [%] | Frequency              | Temp. [°C] |               |        |          |               |             |
| 2017-06-07 | 23.1              | 61           | 2450 MHz               | 22.8       | Permittivity: | 52.70  | 50.95    | -3.33         | ± 5         |
|            |                   |              |                        |            | Conductivity  | 1.95   | 1.92     | -1.67         | ± 5         |

## 5. SAR System Validation

### 5.1 Validation System

Each SATIMO system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the SATIMO software, enable the user to conduct the system performance check and system validation. System kit includes a dipole, and dipole device holder.

The system check verifies that the system operates within its specifications. It's performed daily or before every SAR measurement. The system check uses normal SAR measurement in the flat section of the phantom with a matched dipole at a specified distance. The system validation setup is shown as below.



### 5.2 Validation Result

Comparing to the original SAR value provided by SATIMO, the validation data should be within its specification of 10 %.

| Freq.(MHz) | Power(mW) | Tested Value (W/Kg) | Normalized SAR (W/kg) | Target(W/Kg) | Tolerance(%) | Date       |
|------------|-----------|---------------------|-----------------------|--------------|--------------|------------|
| 2450 Body  | 100       | 5.508               | 55.079                | 52.4         | 5.11         | 2017-03-13 |

Note: The tolerance limit of System validation  $\pm 10\%$ .

## 6. SAR Evaluation Procedures

The procedure for assessing the average SAR value consists of the following steps:

The following steps are used for each test position

- Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface
- Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.
- Measurement of the SAR distribution with a grid of 8 to 16mm \* 8 to 16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.
- Around this point, a cube of 30 \* 30 \* 30 mm or 32 \* 32 \* 32 mm is assessed by measuring 5 or 8 \* 5 or 8\*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

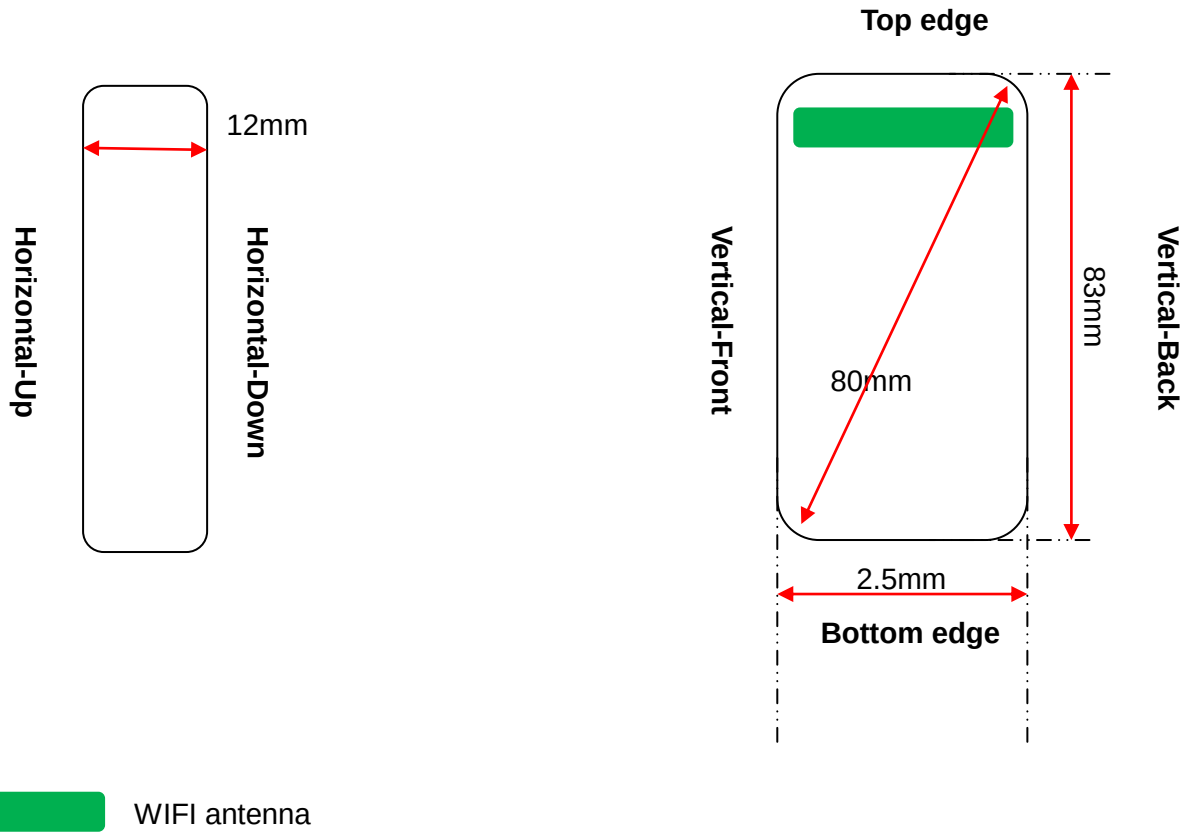
Area Scan& Zoom Scan:

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR -distribution over 10 g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r01 quoted below.

When the 1-g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

## 7. EUT Antenna Location Sketch

It is a Microuter , support WIFI mode.



### 7.1 SAR TEST EXCLUSION CONSIDER TABLE

According with FCC KDB 447498 D01, appendix A, <SAR test exclusion thresholds for 100MHz~6GHz and≤50mm> table, this device SAR test configurations consider as following:

| Band | Test position configurations |                |                |                  |          |
|------|------------------------------|----------------|----------------|------------------|----------|
|      | Vertical- Front              | Vertical- Back | Horizontal- Up | Horizontal- Down | Top edge |
| WLAN | <5mm                         | <5mm           | <5mm           | <5mm             | <5mm     |
|      | Yes                          | Yes            | Yes            | Yes              | Yes      |

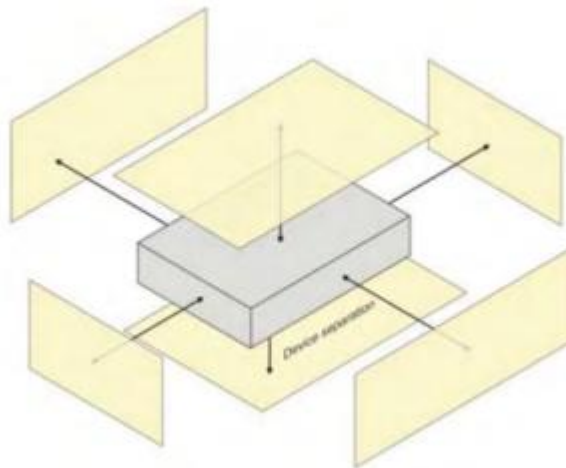
## 8. EUT Test Position

According to KDB 447498 D02, USB connector orientations on laptop computers, which is tested for SAR compliance in body-worn accessory and other use configurations described in the following subsections.

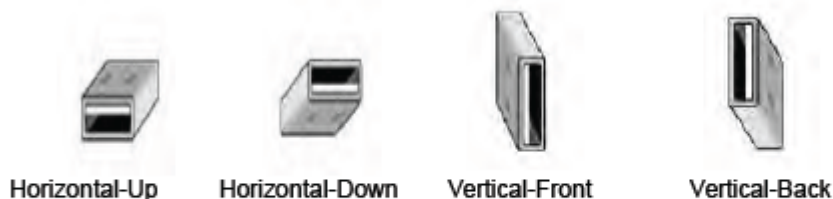
### 8.1 Hotspot mode exposure position condition

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing function, the relevant hand and body exposure condition are tested according to the hotspot SAR procedures in KDB 941225. A test separation distance of 10 mm is required between the phantom and all surface and edges with a transmitting antenna located within 25 mm from that surface or edge.

When form factor of a handset is smaller than 9cm x 5cm, a test separation distance of 5mm (instead of 10mm) is required for testing hotspot mode. When the separate distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration(surface).



### 8.2 USB connector Orientations Implemented on Laptop Computers



**Note:** These are USB connector orientations on laptop computers; USB dongles have the reverse configuration for plugging into the corresponding laptop computers.

### 8.3 Simple Dongle Test Procedures

Test all USB orientations [see figure below: (A) Horizontal-Up, (B) Horizontal-Down, (C) Vertical-Front, and (D) Vertical-Back] with a device-to-phantom separation distance of 5 mm or less, according to KDB Publication 447498 D01 requirements. These test orientations are intended for the exposure conditions found in typical laptop/notebook/netbook or tablet computers with either horizontal or vertical USB connector configurations at various locations in the keyboard section of the computer. Current generation portable host computers should be used to establish the required SAR measurement separation distance. The same test separation distance must be used to test all frequency bands and modes in each USB orientation. The typical Horizontal-Up USB connection (A), found in the majority of host computers, must be tested using an appropriate host computer. A host computer with either Vertical-Front (C) or Vertical-Back (D) USB connection should be used to test one of the vertical USB orientations. If a suitable host computer is not available for testing the Horizontal-Down (B) or the remaining Vertical USB orientation, a high quality USB cable, 12 inches or less, may be used for testing these other orientations. It must be documented that the USB cable does not influence the radiating characteristics and output power of the transmitter.

### 8.4 Dongles with Swivel or Rotating Connectors

A swivel or rotating USB connector may enable the dongle to connect in different orientations to host computers. When the antenna is built-in within the housing of a dongle, a swivel or rotating connector may allow the antenna to assume different positions. The combination of these possible configurations must be considered to determine the SAR test requirements. When the antenna is located near the tip of a dongle, it may operate at closer proximity to users in certain connector orientations where dongle tip testing may be required.

The 5 mm test separation distance used for testing simple dongles has been established based on the overall host platform (laptop/notebook/netbook) and device variations, and varying user operating configurations and exposure conditions expected for a peripheral device. The same test distance should generally apply to dongles with swivel or rotating connectors. The procedures described for simple dongles should be used to position the four surfaces of the dongle at 5 mm from the phantom to evaluate SAR. At least one of the horizontal and one of the vertical positions should be tested using an applicable host computer. If the antenna is within 1 cm from the tip of the dongle (the end without the USB connector), the tip of the dongle should also be tested at 5 mm perpendicular to the phantom. For antennas located within 2.5 cm from the USB connector and if the dongle can be positioned at 45° to 90° from the horizontal position [(A) or (B)], testing in one or more of these configurations may need to be considered. A KDB inquiry should be submitted to determine the applicable test configurations.

## 9. Uncertainty

### 9.1 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in IEEE 1528: 2013. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

| NO                  | Source                                          | Tol(%) | Prob. Dist. | Div. k     | ci (1g)         | ci (10g)        | 1gUi | 10gUi | Veff     |
|---------------------|-------------------------------------------------|--------|-------------|------------|-----------------|-----------------|------|-------|----------|
| Measurement System  |                                                 |        |             |            |                 |                 |      |       |          |
| 1                   | Probe calibration                               | 5.8    | N           | 1          | 1               | 1               | 5.8  | 5.8   | $\infty$ |
| 2                   | Axial isotropy                                  | 3.5    | R           | $\sqrt{3}$ | $(1-c_p)^{1/2}$ | $(1-c_p)^{1/2}$ | 1.43 | 1.43  | $\infty$ |
| 3                   | Hemispherical isotropy                          | 5.9    | R           | $\sqrt{3}$ | $\sqrt{C_p}$    | $\sqrt{C_p}$    | 2.41 | 2.41  | $\infty$ |
| 4                   | Boundary effect                                 | 1.0    | R           | $\sqrt{3}$ | 1               | 1               | 0.58 | 0.58  | $\infty$ |
| 5                   | Linearity                                       | 4.7    | R           | $\sqrt{3}$ | 1               | 1               | 2.71 | 2.71  | $\infty$ |
| 6                   | System Detection limits                         | 1.0    | R           | $\sqrt{3}$ | 1               | 1               | 0.58 | 0.58  | $\infty$ |
| 7                   | Readout electronics                             | 0.5    | N           | 1          | 1               | 1               | 0.50 | 0.50  | $\infty$ |
| 8                   | Response time                                   | 0      | R           | $\sqrt{3}$ | 1               | 1               | 0    | 0     | $\infty$ |
| 9                   | Integration time                                | 1.4    | R           | $\sqrt{3}$ | 1               | 1               | 0.81 | 0.81  | $\infty$ |
| 10                  | Ambient noise                                   | 3.0    | R           | $\sqrt{3}$ | 1               | 1               | 1.73 | 1.73  | $\infty$ |
| 11                  | Ambient reflections                             | 3.0    | R           | $\sqrt{3}$ | 1               | 1               | 1.73 | 1.73  | $\infty$ |
| 12                  | Probe positioner mech. restrictions             | 1.4    | R           | $\sqrt{3}$ | 1               | 1               | 0.81 | 0.81  | $\infty$ |
| 13                  | Probe positioning with respect to phantom shell | 1.4    | R           | $\sqrt{3}$ | 1               | 1               | 0.81 | 0.81  | $\infty$ |
| 14                  | Max.SAR evaluation                              | 1.0    | R           | $\sqrt{3}$ | 1               | 1               | 0.6  | 0.6   | $\infty$ |
| Test sample related |                                                 |        |             |            |                 |                 |      |       |          |
| 15                  | Device positioning                              | 2.6    | N           | 1          | 1               | 1               | 2.6  | 2.6   | 11       |

|                              |                              |                  |     |                                         |      |      |        |        |   |
|------------------------------|------------------------------|------------------|-----|-----------------------------------------|------|------|--------|--------|---|
| 16                           | Device holder                | 3                | N   | 1                                       | 1    | 1    | 3.0    | 3.0    | 7 |
| 17                           | Drift of output power        | 5.0              | R   | √3                                      | 1    | 1    | 2.89   | 2.89   | ∞ |
| Phantom and set-up           |                              |                  |     |                                         |      |      |        |        |   |
| 18                           | Phantom uncertainty          | 4.0              | R   | √3                                      | 1    | 1    | 2.31   | 2.31   | ∞ |
| 19                           | Liquid conductivity (target) | 2.5              | N   | 1                                       | 0.78 | 0.71 | 1.95   | 1.78   | 5 |
| 20                           | Liquid conductivity (meas)   | 4                | N   | 1                                       | 0.23 | 0.26 | 0.92   | 1.04   | 5 |
| 21                           | Liquid Permittivity (target) | 2.5              | N   | 1                                       | 0.78 | 0.71 | 1.95   | 1.78   | ∞ |
| 22                           | Liquid Permittivity (meas)   | 5.0              | N   | 1                                       | 0.23 | 0.26 | 1.15   | 1.30   | ∞ |
| Combined standard            |                              |                  | RSS | $U_c = \sqrt{\sum_{i=1}^n C_i^2 U_i^2}$ |      |      | 10.63% | 10.54% |   |
| Expanded uncertainty (P=95%) |                              | $U = k U_c, k=2$ |     |                                         |      |      | 21.26% | 21.08% |   |

## 9.2 System validation Uncertainty

| NO                                          | Source                                          | Tol(%) | Prob. Dist. | Div. k     | ci (1g)         | ci (10g)        | 1gUi | 10gUi | Veff     |
|---------------------------------------------|-------------------------------------------------|--------|-------------|------------|-----------------|-----------------|------|-------|----------|
| Measurement System <input type="checkbox"/> |                                                 |        |             |            |                 |                 |      |       |          |
| 1                                           | Probe calibration                               | 5.8    | N           | 1          | 1               | 1               | 5.8  | 5.8   | $\infty$ |
| 2                                           | Axial isotropy                                  | 3.5    | R           | $\sqrt{3}$ | $(1-c_p)^{1/2}$ | $(1-c_p)^{1/2}$ | 1.43 | 1.43  | $\infty$ |
| 3                                           | Hemispherical isotropy                          | 5.9    | R           | $\sqrt{3}$ | $\sqrt{C_p}$    | $\sqrt{C_p}$    | 2.41 | 2.41  | $\infty$ |
| 4                                           | Boundary effect                                 | 1.0    | R           | $\sqrt{3}$ | 1               | 1               | 0.58 | 0.58  | $\infty$ |
| 5                                           | Linearity                                       | 4.7    | R           | $\sqrt{3}$ | 1               | 1               | 2.71 | 2.71  | $\infty$ |
| 6                                           | System Detection limits                         | 1.0    | R           | $\sqrt{3}$ | 1               | 1               | 0.58 | 0.58  | $\infty$ |
| 7                                           | Modulation response                             | 0      | N           | 1          | 1               | 1               | 0    | 0     | $\infty$ |
| 8                                           | Readout electronics                             | 0.5    | N           | 1          | 1               | 1               | 0.50 | 0.50  | $\infty$ |
| 9                                           | Response time                                   | 0      | R           | $\sqrt{3}$ | 1               | 1               | 0    | 0     | $\infty$ |
| 10                                          | Integration time                                | 1.4    | R           | $\sqrt{3}$ | 1               | 1               | 0.81 | 0.81  | $\infty$ |
| 11                                          | Ambient noise                                   | 3.0    | R           | $\sqrt{3}$ | 1               | 1               | 1.73 | 1.73  | $\infty$ |
| 12                                          | Ambient reflections                             | 3.0    | R           | $\sqrt{3}$ | 1               | 1               | 1.73 | 1.73  | $\infty$ |
| 13                                          | Probe positioner mech. restrictions             | 1.4    | R           | $\sqrt{3}$ | 1               | 1               | 0.81 | 0.81  | $\infty$ |
| 14                                          | Probe positioning with respect to phantom shell | 1.4    | R           | $\sqrt{3}$ | 1               | 1               | 0.81 | 0.81  | $\infty$ |
| 15                                          | Max.SAR evaluation                              | 1.0    | R           | $\sqrt{3}$ | 1               | 1               | 0.6  | 0.6   | $\infty$ |
| Dipole                                      |                                                 |        |             |            |                 |                 |      |       |          |
| 16                                          | Deviation of experimental source from           | 4      | N           | 1          | 1               | 1               | 4.00 | 4.00  | $\infty$ |

|                              |                                                |                  |     |                                         |      |      |        |        |   |
|------------------------------|------------------------------------------------|------------------|-----|-----------------------------------------|------|------|--------|--------|---|
| 17                           | Input power and SAR drif measurement           | 5                | R   | √3                                      | 1    | 1    | 2.89   | 2.89   | ∞ |
| 18                           | Dipole Axis to liquid Distance                 | 2                | R   | √3                                      | 1    | 1    |        |        | ∞ |
| Phantom and set-up           |                                                |                  |     |                                         |      |      |        |        |   |
| 19                           | Phantom uncertainty                            | 4.0              | R   | √3                                      | 1    | 1    | 2.31   | 2.31   | ∞ |
| 20                           | Uncertainty in SAR correction for deviation(in | 2.0              | N   | 1                                       | 1    | 0.84 | 2      | 1.68   | ∞ |
| 21                           | Liquid conductivity (target)                   | 2                | N   | 1                                       | 1    | 0.84 | 2.00   | 1.68   | ∞ |
| 22                           | Liquid conductivity (temperature uncertainty)  | 2.5              | N   | 1                                       | 0.78 | 0.71 | 1.95   | 1.78   | 5 |
| 23                           | Liquid conductivity (meas)                     | 4                | N   | 1                                       | 0.23 | 0.26 | 0.92   | 1.04   | 5 |
| 24                           | Liquid Permittivity (target)                   | 2.5              | N   | 1                                       | 0.78 | 0.71 | 1.95   | 1.78   | ∞ |
| 25                           | Liquid Permittivity (temperature uncertainty)  | 2.5              | N   | 1                                       | 0.78 | 0.71 | 1.95   | 1.78   | 5 |
| 26                           | Liquid Permittivity (meas)                     | 5.0              | N   | 1                                       | 0.23 | 0.26 | 1.15   | 1.30   | ∞ |
| Combined standard            |                                                |                  | RSS | $U_C = \sqrt{\sum_{i=1}^n C_i^2 U_i^2}$ |      |      | 10.15% | 10.05% |   |
| Expanded uncertainty (P=95%) |                                                | $U = k U_C$ ,k=2 |     |                                         |      |      | 20.29% | 20.10% |   |

## 10. Conducted Power Measurement

### 10.1 Test Result

#### WIFI

| Mode           | Channel Number | Frequency (MHz) | Average Power (dBm) |
|----------------|----------------|-----------------|---------------------|
| 802.11b        | 1              | 2412            | 19.60               |
|                | 6              | 2437            | 13.71               |
|                | 11             | 2462            | 12.23               |
| 802.11g        | 1              | 2412            | 12.12               |
|                | 6              | 2437            | 13.21               |
|                | 11             | 2462            | 14.22               |
| 802.11n(HT 20) | 1              | 2412            | 15.01               |
|                | 6              | 2437            | 16.23               |
|                | 11             | 2462            | 16.24               |
| 802.11n(HT 40) | 3              | 2422            | 12.55               |
|                | 6              | 2437            | 12.45               |
|                | 9              | 2452            | 13.35               |

### 10.2 Tune-up Power

| Mode                | Channel Number | WIFI(AVG) |
|---------------------|----------------|-----------|
| IEEE 802.11b        | 1              | 19±1dBm   |
|                     | 6              | 13±1dBm   |
|                     | 11             | 12±1dBm   |
| IEEE 802.11g        | 1              | 12±1dBm   |
|                     | 6              | 13±1dBm   |
|                     | 11             | 14±1dBm   |
| IEEE 802.11n(HT 20) | 1              | 15±1dBm   |
|                     | 6              | 16±1dBm   |
|                     | 11             | 16±1dBm   |
| IEEE 802.11n(HT 40) | 3              | 12±1dBm   |
|                     | 6              | 12±1dBm   |
|                     | 9              | 13±1dBm   |

### 10.3 SAR Test Exclusions Applied

Per FCC KDB 447498D01, the 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where:

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

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

$$\frac{\text{Max Power of Channel (mW)}}{\text{Test Separation Dist (mm)}} * \sqrt{\text{Frequency (GHz)}} \leq 3.0$$

Based on the maximum conducted power of **2.4 GHz WIFI Body** (rounded to the nearest mW) and the antenna to user separation distance,

**2.4 GHz WIFI SAR was required;**  $[(100.00/5) * \sqrt{2.462}] = 31.38 > 3.0$ .

## 11. EUT And Test Setup Photo

### 11.1 EUT Photo

Photo 1

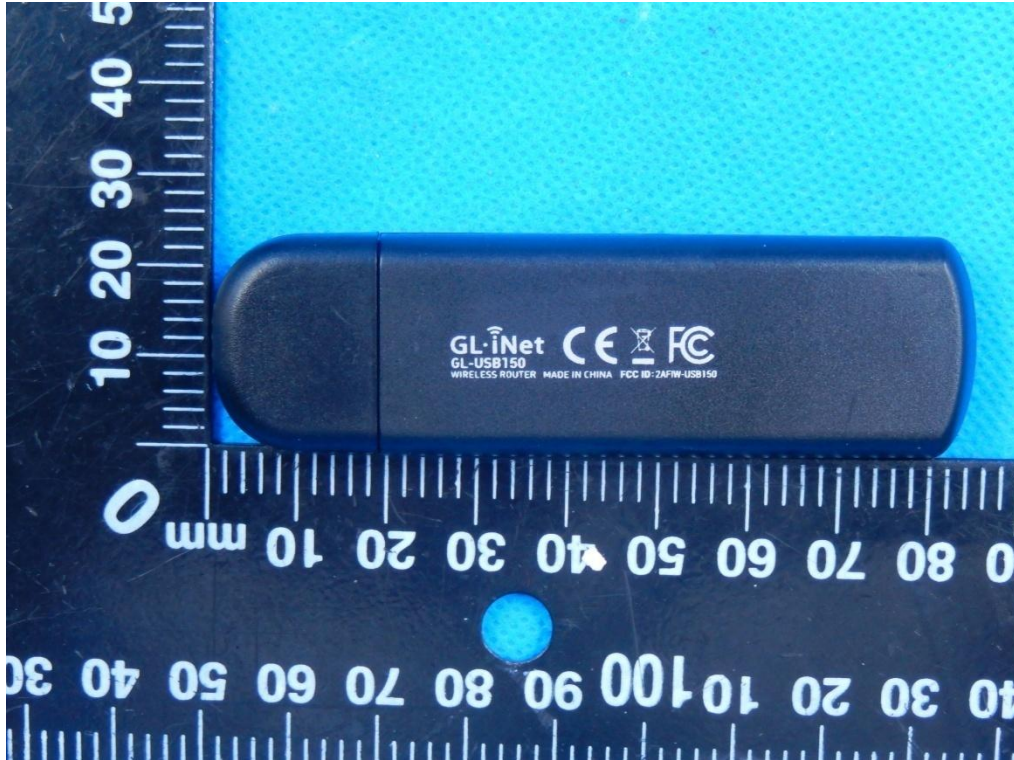


Photo 2

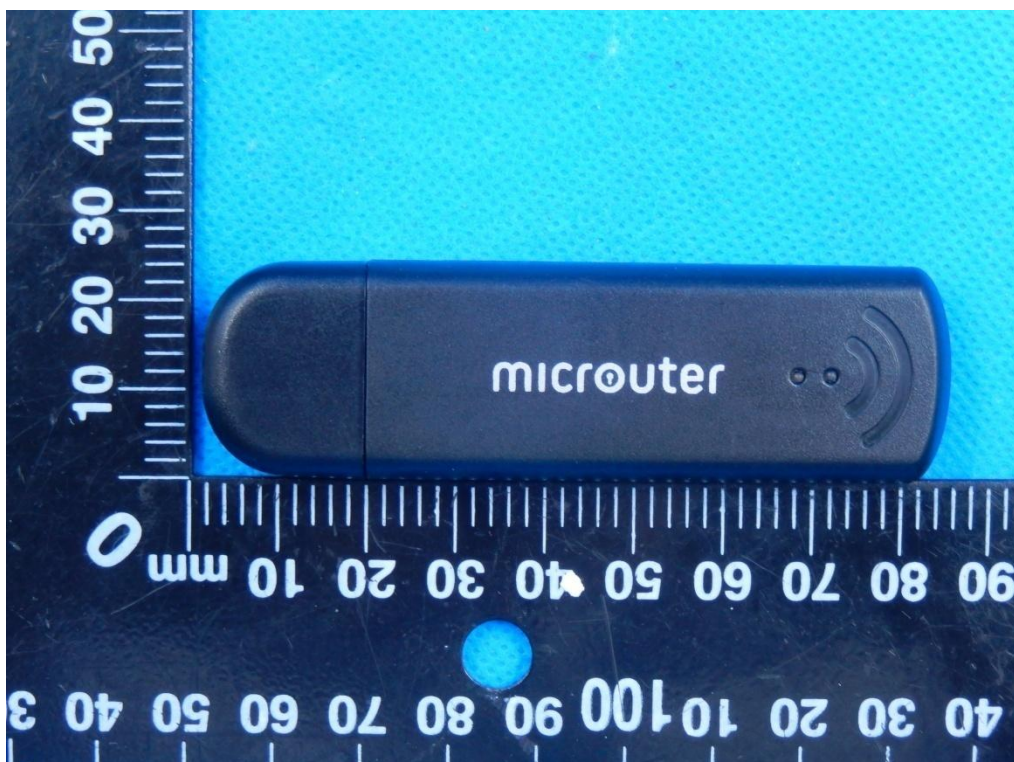


Photo 3

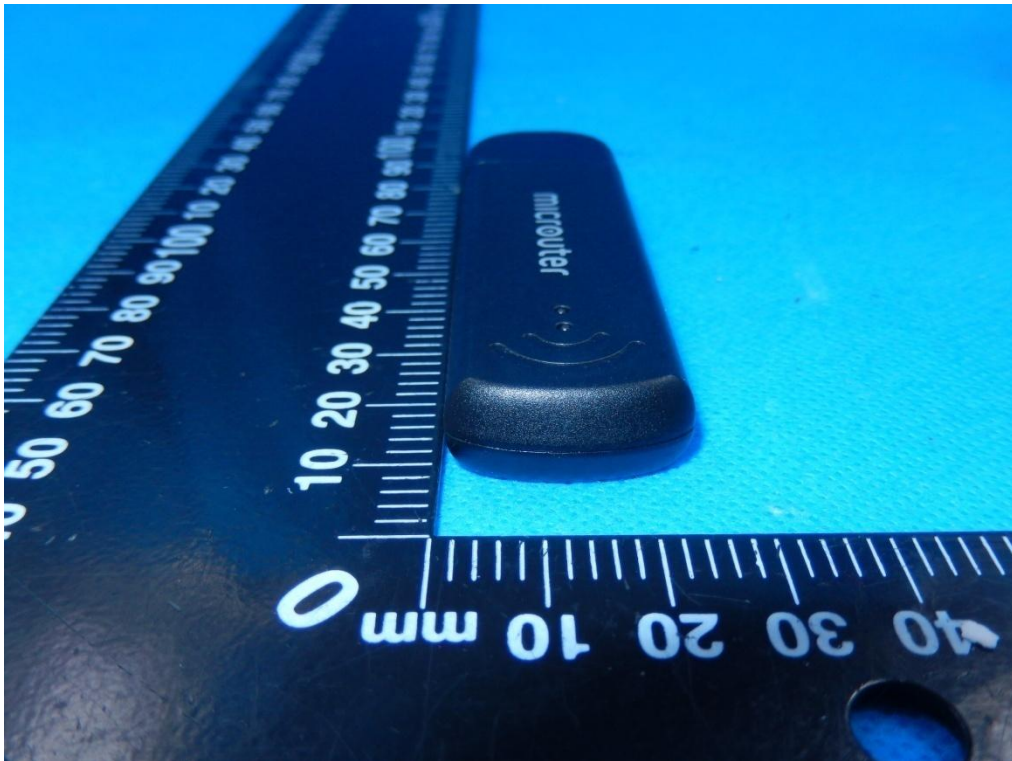


Photo 4

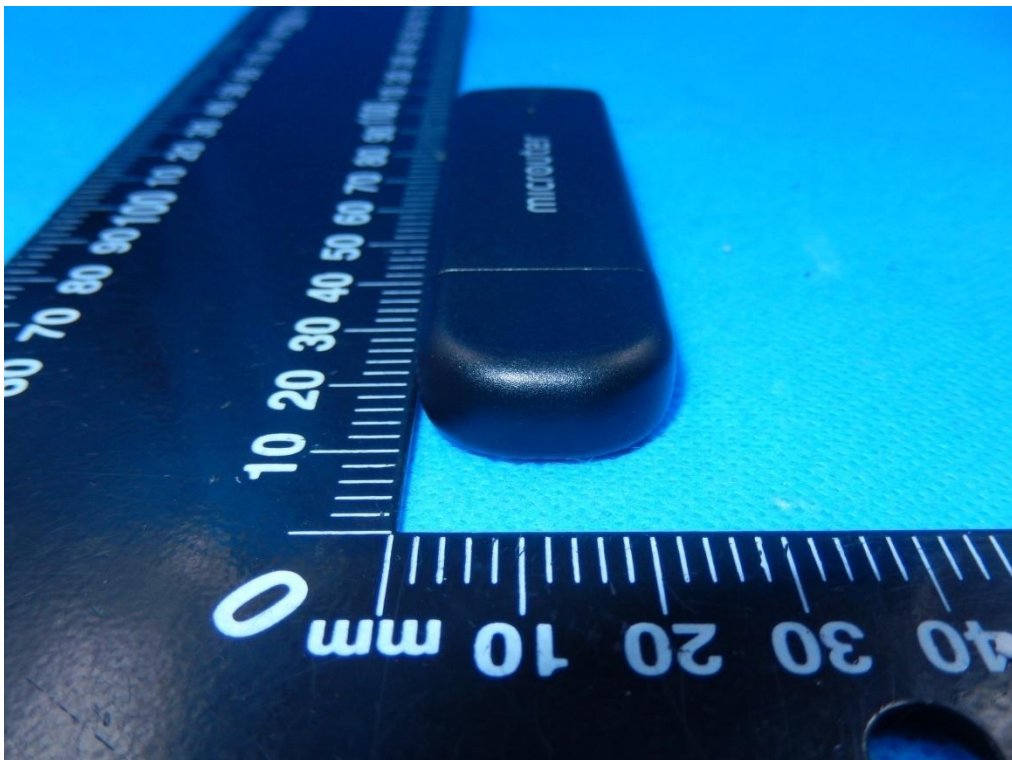


Photo 5

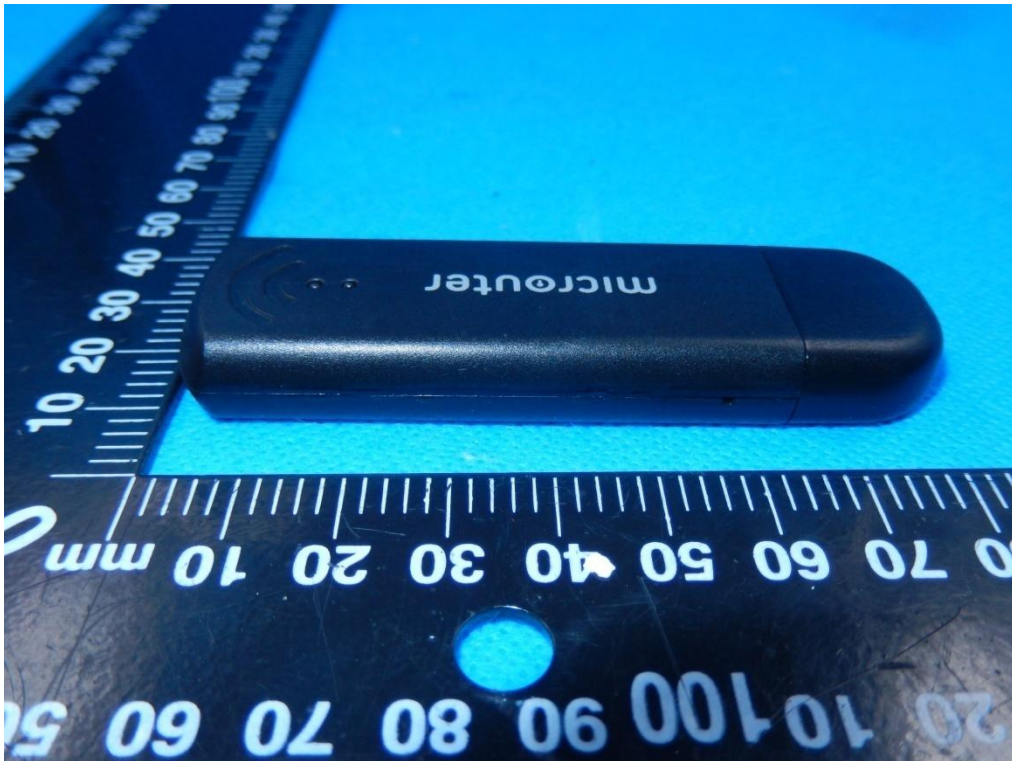
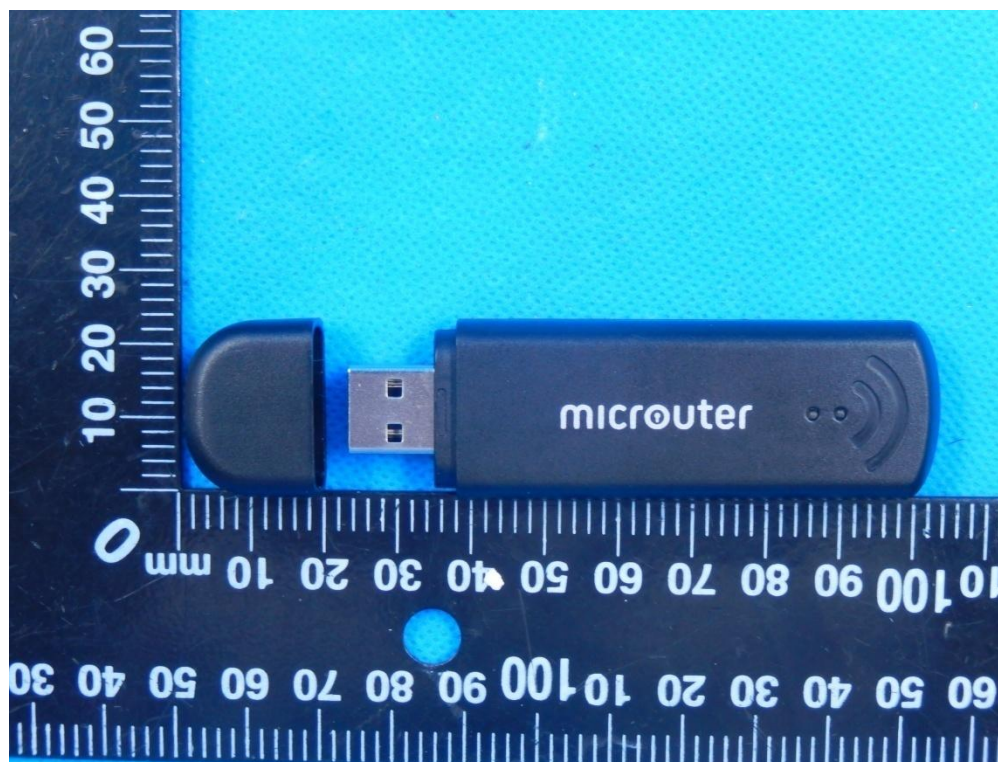


Photo 6

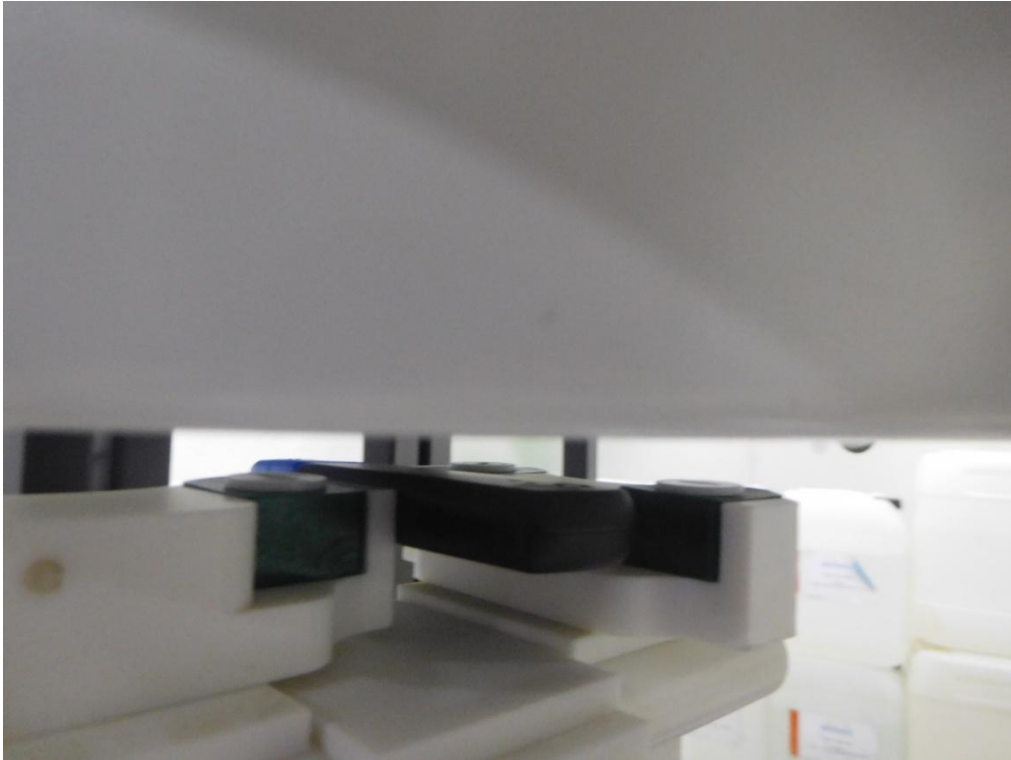


Photo 7

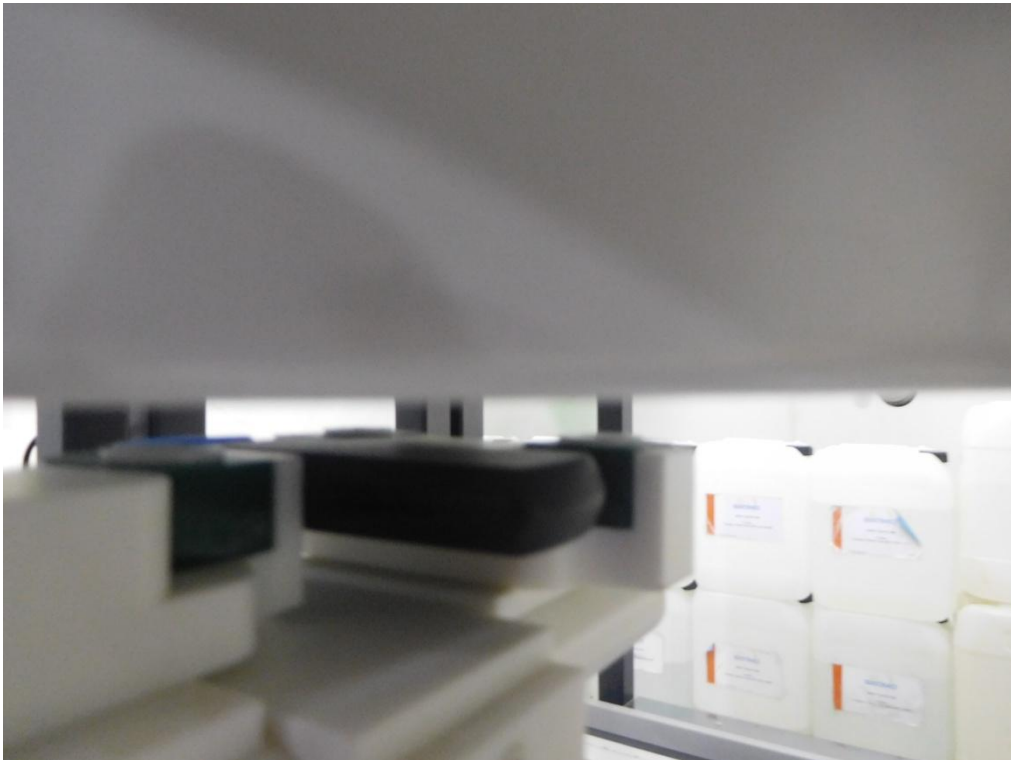


## 11.2 Setup Photo

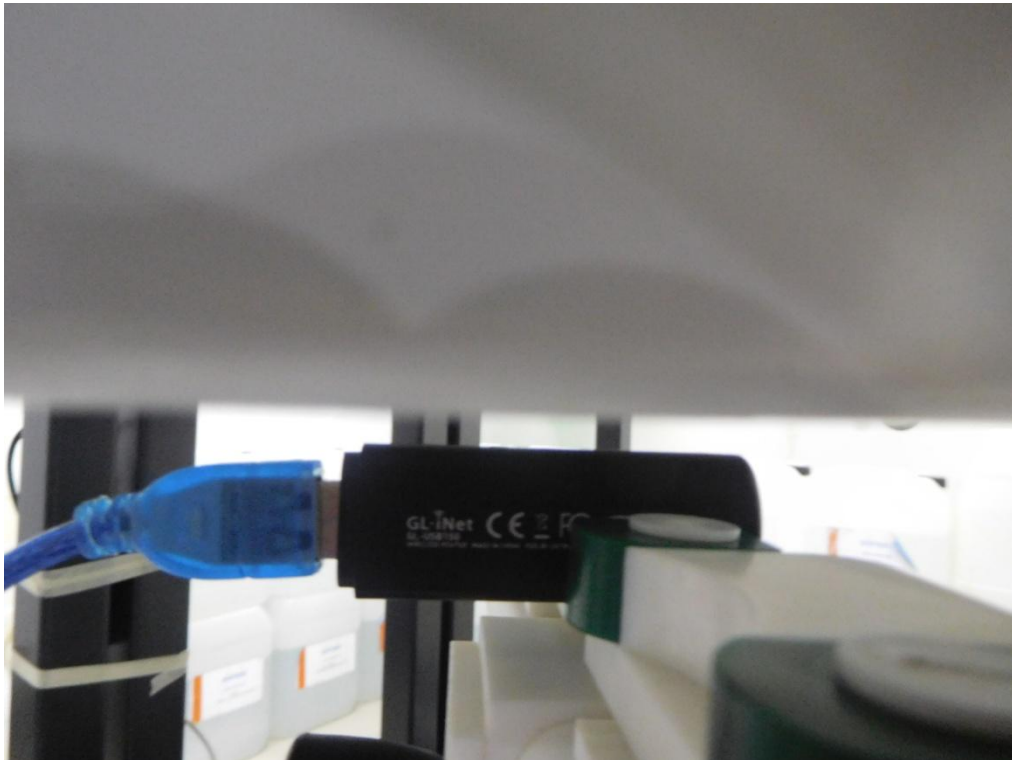
.Horizontal- Up side (separation distance is 5mm)



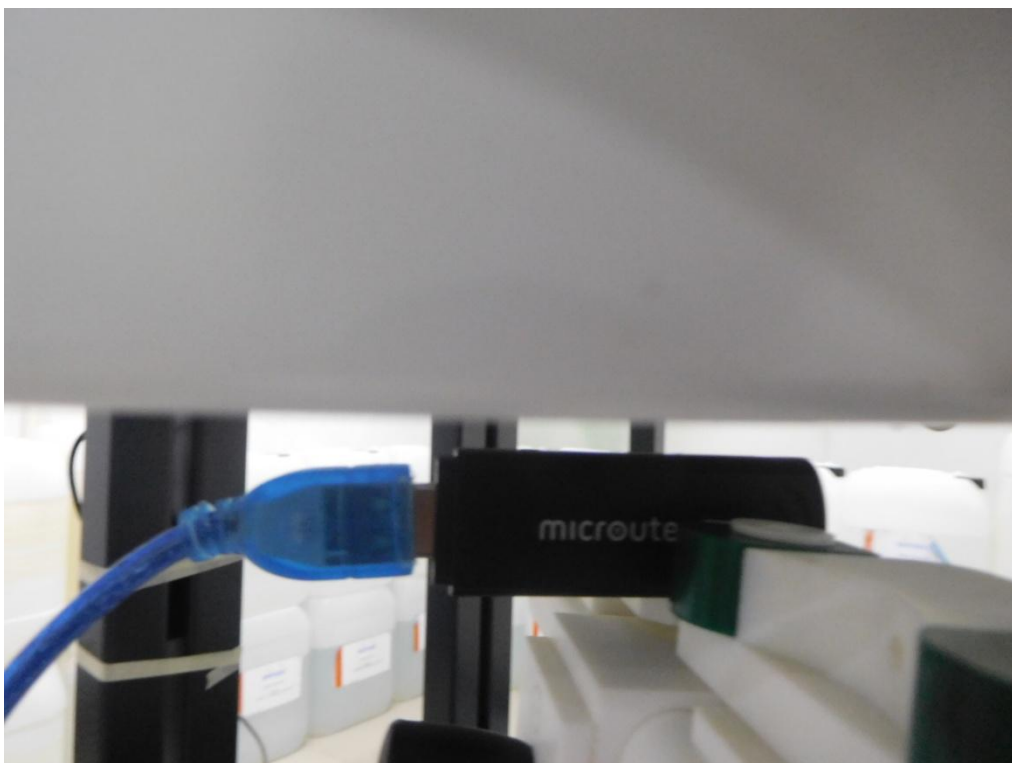
.Horizontal- Up side (separation distance is 5mm)



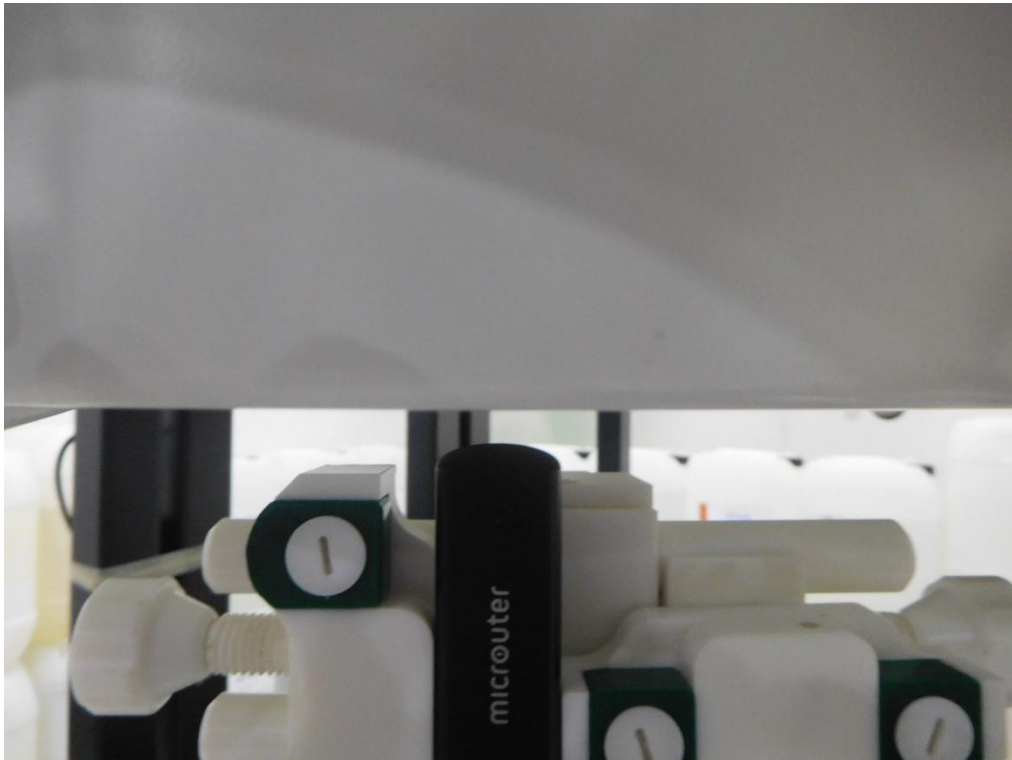
Vertical-Front side(separation distance is 5mm)



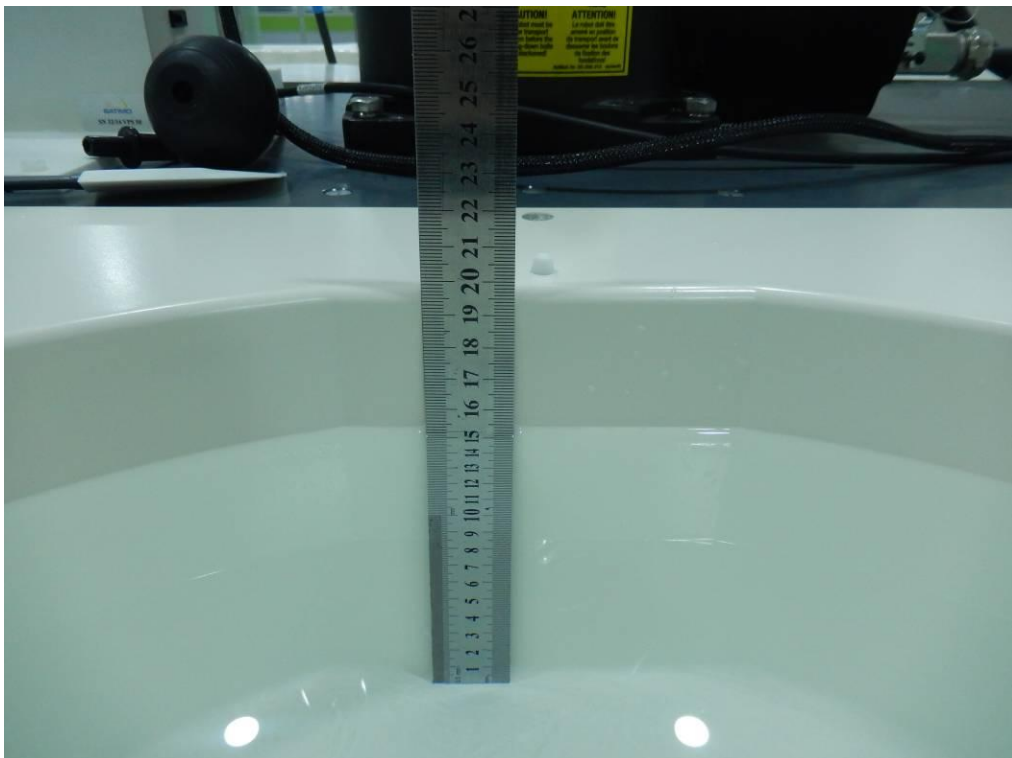
Vertical-Back side(separation distance is 5mm)



Top side(separation distance is 5mm)



Liquid depth (15 cm)



## 12. SAR Result Summary

| Band | Mode    | Test Position     | Ch. | Result 1g (W/Kg) | Power Drift(%) | Max.Turn-up Power(dBm) | Meas.Output Power(dBm) | Duty cycle(%) | Scaled SAR (W/Kg) | Meas. No. |
|------|---------|-------------------|-----|------------------|----------------|------------------------|------------------------|---------------|-------------------|-----------|
| WIFI | 802.11b | Horizontal - Up   | 1   | 0.391            | -1.69          | 20                     | 19.60                  | 100%          | 0.429             | /         |
|      |         | Horizontal - Down | 1   | 0.495            | 2.12           | 20                     | 19.60                  | 100%          | <b>0.543</b>      | 1         |
|      |         | Vertical - Front  | 1   | 0.226            | -2.49          | 20                     | 19.60                  | 100%          | 0.248             | /         |
|      |         | Vertical - Back   | 1   | 0.252            | -2.74          | 20                     | 19.60                  | 100%          | 0.276             | /         |
|      |         | Top side          | 1   | 0.114            | 1.33           | 20                     | 19.60                  | 100%          | 0.125             | /         |

Note:

1. The test separation of all above table is 5mm.
2. Per KDB 248227- When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg. (The highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power was **0.157** W/Kg for Body)
3. When the user enables the personal Wireless router functions for the handsets, actual operations include simultaneous transmission of both the Wi-Fi transmitting frequency and thus cannot be evaluated for SAR under actual use conditions. The "Portable Hotspot" feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.

### 13. Equipment List

| Kind of Equipment           | Manufacturer | Type No.                                   | Serial No.               | Last Calibration | Calibrated Until |
|-----------------------------|--------------|--------------------------------------------|--------------------------|------------------|------------------|
| 2450MHzDipole               | SATIMO       | SID2450                                    | SN 30/14<br>DIP2G450-335 | 2014.09.01       | 2017.08.31       |
| Antenna                     | SATIMO       | ANTA3                                      | SN 07/13<br>ZNTA52       | 2014.09.01       | 2017.08.31       |
| Waveguide                   | SATIMO       | SWG5500                                    | SN 13/14<br>WGA32        | 2014.09.01       | 2017.08.31       |
| E-Field Probe               | MVG          | SSE5                                       | SN 14/16<br>EP309        | 2016.12.05       | 2017.12.04       |
| Phantom1                    | SATIMO       | SAM                                        | SN 32/14<br>SAM115       | N/A              | N/A              |
| Phantom2                    | SATIMO       | SAM                                        | SN 32/14<br>SAM116       | N/A              | N/A              |
| SAR TEST BENCH              | SATIMO       | MOBILE<br>PHONE<br>POSITIONNIN<br>G SYSTEM | SN 32/14<br>MSH97        | N/A              | N/A              |
| SAR TEST BENCH              | SATIMO       | LAPTOP<br>POSITIONNIN<br>G SYSTEM          | SN 32/14<br>LSH29        | N/A              | N/A              |
| Dielectric Probe Kit        | SATIMO       | SCLMP                                      | SN 32/14<br>OCPG52       | 2016.08.30       | 2017.08.29       |
| Multi Meter                 | Keithley     | Multi Meter<br>2000                        | 4050073                  | 2016.10.23       | 2017.10.22       |
| Signal Generator            | Agilent      | N5182A                                     | MY50140530               | 2016.10.23       | 2017.10.22       |
| Power Meter                 | R&S          | NRP                                        | 100510                   | 2016.10.23       | 2017.10.22       |
| Power Meter                 | HP           | EPM-442A                                   | GB37170267               | 2016.10.23       | 2017.10.22       |
| Power Sensor                | R&S          | NRP-Z11                                    | 101919                   | 2016.10.23       | 2017.10.22       |
| Power Sensor                | HP           | 8481A                                      | 2702A65976               | 2016.10.23       | 2017.10.22       |
| Power Sensor                | R&S          | NRP-Z21                                    | 103971                   | 2016.10.23       | 2017.10.22       |
| Network Analyzer            | Agilent      | 8753ES                                     | US38432810               | 2017.03.16       | 2018.03.15       |
| Attenuator 1                | PE           | PE7005-10                                  | N/A                      | 2016.10.23       | 2017.10.22       |
| Attenuator 2                | PE           | PE7005-3                                   | N/A                      | 2016.10.23       | 2017.10.22       |
| Attenuator 3                | Woken        | WK0602-XX                                  | N/A                      | 2016.10.23       | 2017.10.22       |
| Dual Directional<br>Coupler | Agilent      | 778D                                       | 50422                    | 2016.10.23       | 2017.10.22       |

## Appendix A. System Validation Plots

### System Performance Check Data (2450MHz Body)

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

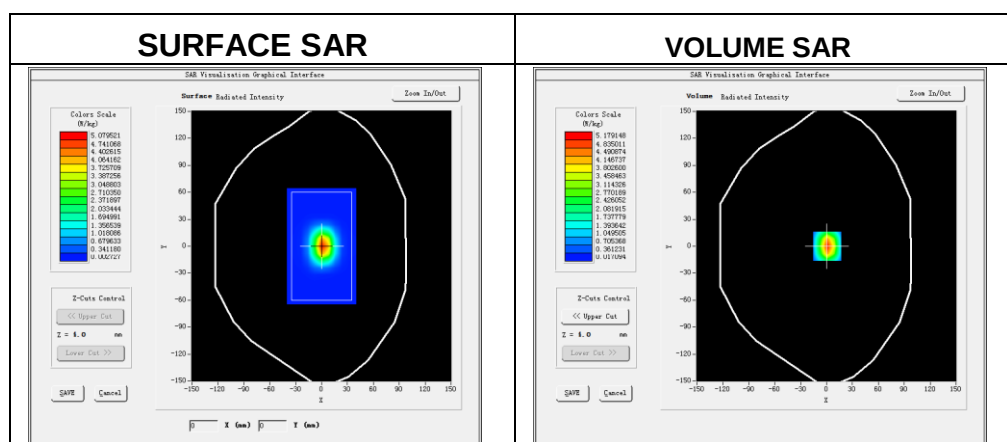
Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017-06-07

Measurement duration: 14 minutes 23 seconds

### Experimental conditions.

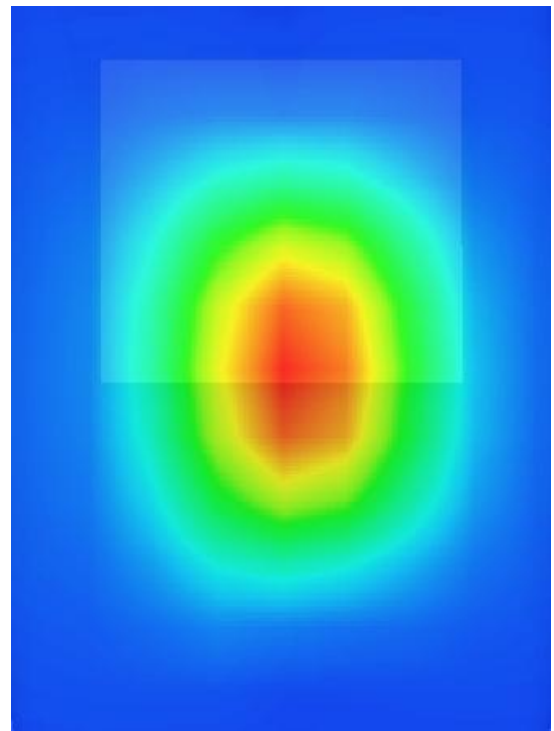
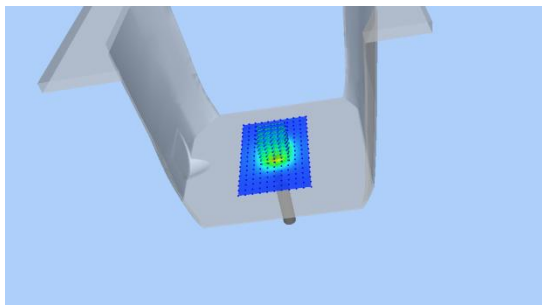
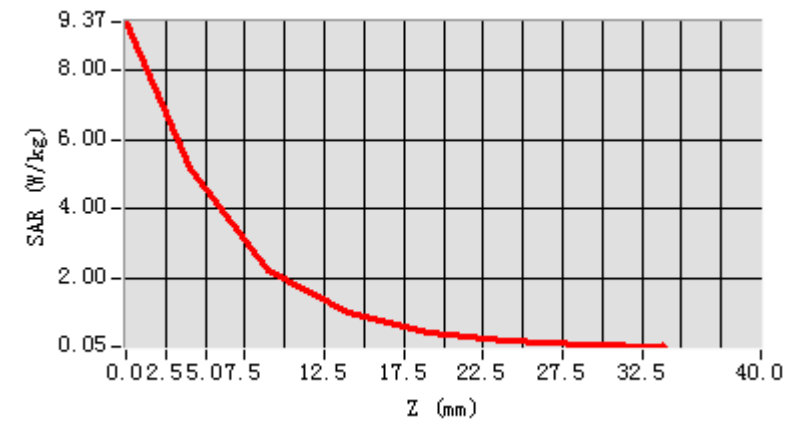
|                       |                  |
|-----------------------|------------------|
| Device Position       | Validation plane |
| Band                  | 2450 MHz         |
| Channels              | -                |
| Signal                | CW               |
| Frequency (MHz)       | 2450             |
| Relative permittivity | 50.95            |
| Conductivity (S/m)    | 1.92             |
| Power drift (%)       | 0.33             |
| Probe                 | SN 14/16 EP309   |
| ConvF                 | 5.24             |
| Crest factor:         | 1:1              |



Maximum location: X=1.00, Y=0.00

|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 2.485269 |
| SAR 1g (W/Kg)  | 5.507886 |

## Z Axis Scan



## Appendix B. SAR Test Plots

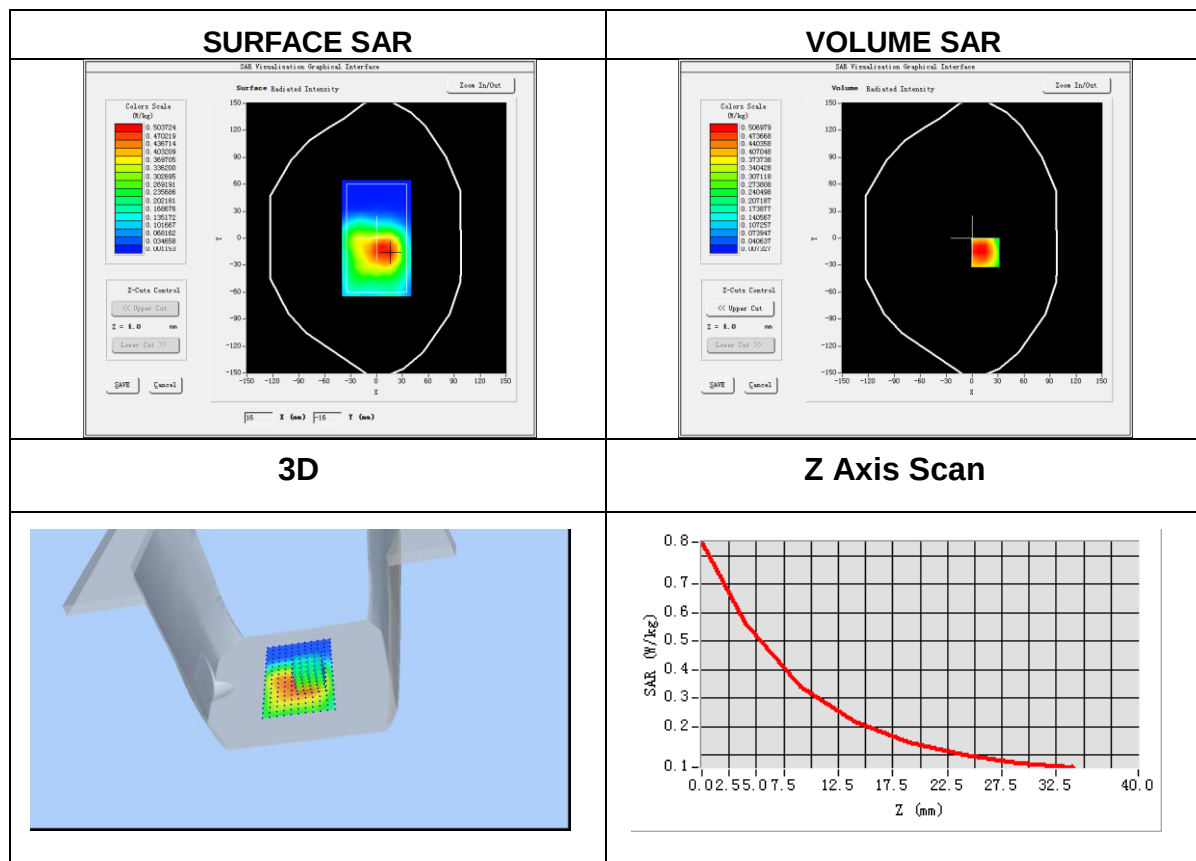
### Plot 1: DUT: Microuter ; EUT Model: GL-USB150

|                                   |                                                                     |
|-----------------------------------|---------------------------------------------------------------------|
| Test Date                         | 2016-06-07                                                          |
| Probe                             | SN 14/16 EP309                                                      |
| ConvF                             | 5.24                                                                |
| Area Scan                         | dx=8mm dy=8mm, h= 5.00 mm                                           |
| ZoomScan                          | 5x5x7, dx=8mm dy=8mm dz=5mm,<br>Complete/ndx=8mm dy=8mm, h= 5.00 mm |
| Phantom                           | Validation plane                                                    |
| Device Position                   | Horizontal - Down                                                   |
| Band                              | IEEE 802.11b ISM                                                    |
| Channels                          | Low                                                                 |
| Signal                            | IEEE802.b (Crest factor: 1.0)                                       |
| Frequency (MHz)                   | 2412                                                                |
| Relative permittivity (real part) | 52.40                                                               |
| Conductivity (S/m)                | 1.94                                                                |
| Variation (%)                     | 2.12                                                                |

Maximum location: X=15.00, Y=-16.00

SAR Peak: 0.74 W/kg

|                |          |
|----------------|----------|
| SAR 10g (W/Kg) | 0.307874 |
| SAR 1g (W/Kg)  | 0.495316 |



## Appendix C. Probe Calibration And Dipole Calibration Report

Refer the appendix Calibration Report.

※※※※※END OF THE REPORT※※※※※