# FCC SAR Test Report

## FCC ID: IR5DK13

| | | |
|---|---|---|
| **Project No.** | : | 2004T174 |
| **Equipment** | : | Tablet Computer |
| **Model Name** | : | DK13 |
| **Applicant** | : | MilDef Crete Inc. |
| **Address** | : | 7F, No. 250, Sec.3, Peishen Rd., Shenkeng District, New Taipei City, Taiwan |
| **Date of Receipt** | : | May, 07. 2020 |
| **Date of Test** | : | May, 08. 2020~ May, 11. 2020 |
| **Issued Date** | : | Jun, 11. 2020 |
| **Tested by** | : | BTL Inc. |

**PREPARED BY** : (Louis Luo)

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Testing Laboratory
0659

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**BTL** is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

## Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.

## Table of Contents Page


1 GENERAL SUMMARY 6

2 RF EMISSIONS MEASUREMENT 7

2.1 TEST FACILITY 7

2.2 MEASUREMENT UNCERTAINTY 7

3 GENERAL INFORMATION 8

3.1 STATEMENT OF COMPLIANCE 8

3.2 GENERAL DESCRIPTION OF EUT 9

3.3 LABORATORY ENVIRONMENT 10

3.4 MAIN TEST INSTRUMENTS 11

4 SAR MEASUREMENTS SYSTEM CONFIGURATION 12

4.1 SAR MEASUREMENT SET-UP 12

4.1.1 TEST SETUP LAYOUT 12

4.2 DASY5 E-FIELD PROBE SYSTEM 13

4.2.1 EX3DV4 PROBE SPECIFICATION 13

4.2.2 E-FIELD PROBE CALIBRATION 14

4.2.3 OTHER TEST EQUIPMENT 15

4.2.4 SCANNING PROCEDURE 16

4.2.5 SPATIAL PEAK SAR EVALUATION 17

4.2.6 DATA STORAGE AND EVALUATION 18

4.2.7 DATA EVALUATION BY SEMCAD 19

5 SYSTEM VERIFICATION PROCEDURE 21

5.1 TISSUE VERIFICATION 21

5.2 SYSTEM CHECK 22

5.3 SYSTEM CHECK PROCEDURE 22

6 SAR MEASUREMENT VARIABILITY AND UNCERTAINTY 23

6.1 SAR MEASUREMENT VARIABILITY 23

7 OPERATIONAL CONDITIONS DURING TEST 24

7.1 SAR TEST CONFIGURATION 24

7.1.1 WIFI TEST CONFIGURATION 24

7.2 TEST POSITION 27

7.2.1 BODY 27

8 TEST RESULT 31

8.1 CONDUCTED POWER RESULTS 31

8.1.1 CONDUCTED POWER MEASUREMENTS OF BT 31

8.1.2 CONDUCTED POWER MEASUREMENTS OF WIFI 2.4G 32

8.1.3 CONDUCTED POWER MEASUREMENTS OF WIFI 5G 35

Table of Contents Page


8.2 SAR TEST RESULTS 37
8.2.1 SAR MEASUREMENT RESULT 38
9. MULTIPLE TRANSMITTER EVALUATION 39
9.1 SAR SUMMATION SCENARIO 39
APPENDIX 40
1. TEST LAYOUT 40
Appendix A. SAR Plots of System Verification
Appendix B. SAR Plots of SAR Measurement
Appendix C. Calibration Certificate
Appendix D. Photographs of the Test Set-Up

## REPORT ISSUED HISTORY

| Report Version | Description | Issued Date |
| --- | --- | --- |
| R00 | Original Issue | Jun.11. 2020 |

## 1. GENERAL SUMMARY

| | |
|---|---|
| Equipment | Tablet Computer |
| Model Name | DK13 |
| Brand Name | MilDef Crete Inc. |
| Manufacturer | MilDef Crete Inc. |
| Address | 7F, No. 250, Sec.3, Peishen Rd., Shenkeng District, New Taipei City, Taiwan |
| Standard(s) | **ANSI Std C95.1-1992** Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz - 300 GHz.(IEEE Std C95.1-1991)<br>**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<br><br>**KDB447498 D01** General RF Exposure Guidance v06<br>**KDB248227 D01** 802. 11 Wi-Fi SAR v02r02<br>**KDB865664 D01** SAR measurement 100 MHz to 6 GHz v01r04<br>**KDB865664 D02** SAR Reporting v01r02<br>**KDB690783 D01** SAR Listings on Grants v01r03<br>**KDB616217 D04** SAR for laptop and tablets v01r02<br>**KDB941225 D01** 3G SAR Procedures v03r01<br>**KDB941225 D05** SAR for LTE Devices v02r05 |

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.
The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCC SAR-1-2004T174) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO/IEC 17025 quality assessment standard and technical standard(s).

# 2. RF EMISSIONS MEASUREMENT

## 2.1. TEST FACILITY

The test facilities used to collect the test data in this report is **SAR room** at the location of No. 68-1, Ln. 169, Sec.2, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan.

## 2.2. MEASUREMENT UNCERTAINTY

Note: Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

# 3. GENERAL INFORMATION

## 3.1. STATEMENT OF COMPLIANCE

| Equipment Class | Mode | Highest Body SAR-1g (W/kg) |
|---|---|---|
| DTS | 2.4G WLAN | 0.827 |
| U_NII | 5.2G WLAN | 1.470 |

Note:

1) The device is in compliance with Specific Absorption Rate(SAR)for general population uncontrolled exposure limits according to the FCC rule §2.1093, the ANSI C95.1:1992/IEEE C95.1:1991, the NCRP Report Number 86 for uncontrolled environment and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013 .

## 3.2. GENERAL DESCRIPTION OF EUT

| | | | |
|---|---|---|---|
| Equipment | Tablet Computer | | |
| Model Name | DK13 | | |
| Modulation | WiFi(DSSS/OFDM),BT(GFSK/π/4-DQPSK/8-DPSK) | | |
| Operation Frequency Range(s) | Band | TX (MHz) | RX (MHz) |
| | Bluetooth | 2402-2480 | |
| | 2.4G WIFI | 2412-2462 | |
| | 5G U-NII-1 | 5150-5250 | |
| Test Channels (low-mid-high): | Band | Channel | |
| | 2.4G WIFI | 1-6-11 | |
| | 5G U-NII-1 | 36-40-44-48 | |
| | BT | 0-39-78 | |
| | BLE | 0-19-39 | |

| Antenna Information | | | | | |
|---|---|---|---|---|---|
| Ant. | Brand | Model | Type | Band | Peak Gain (dBi) |
| Main | U-blox | NEO-M8N-0 | PIFA | 2.4G | 2.90 |
| | | | | 5G | 4.41 |
| Aux | | | | 2.4G | 3.01 |
| | | | | 5G | 4.81 |

## 3.3. LABORATORY ENVIRONMENT

| | |
|---|---|
| Temperature | Min. = 18ºC, Max. = 25ºC |
| Relative humidity | Min. = 30%, Max. = 70% |
| Ground system resistance | < 0.5Ω |
| Ambient noise is checked and found very low and in compliance with requirement of standards.<br>Reflection of surrounding objects is minimized and in compliance with requirement of standards. | |

## 3.4. MAIN TEST INSTRUMENTS

| Item | Equipment | Manufacturer | Model | Serial No. | Cal. Date | Cal. Interval |
|---|---|---|---|---|---|---|
| 1 | Data Acquisition Electronics | Speag | DAE4 | 1486 | Jun 13, 2019 | 1 Year |
| 2 | E-field Probe | Speag | EX3DV4 | 7369 | Jun. 19, 2019 | 1 Year |
| 3 | System Validation Dipole | Speag | D2450V2 | 937 | Sep. 21, 2018 | 3 Years |
| 4 | System Validation Dipole | Speag | D5GHzV2 | 1160 | Jun. 20, 2018 | 3 Years |
| 5 | ELI4 Phantom | Speag | ELI4 Phantom V5.0 | 1222 | N/A | N/A |
| 6 | Power Amplifier | Mini-Circuits | ZHL-42W+ | QA1333003 | Nov. 25, 2019 | 1 Year |
| 7 | Power Amplifier | Mini-Circuits | ZVE-8G+ | 520701341 | Nov. 25, 2019 | 1 Year |
| 8 | DC Source | Iteck | OT6154 | M00157 | Aug. 03, 2019 | 1 Year |
| 9 | ENA Network Analyzer | Agilent | E5071C | MY46102965 | July. 10, 2019 | 1 Year |
| 10 | MXG Analog Signal Generator | Agilent | N5181A | MY49060710 | Aug. 03, 2019 | 1 Year |
| 11 | Signal Generator | Agilent | E4438C | MY4907131 | July. 10, 2019 | 1 Year |
| 12 | P-series power meter | Agilent | N1911A | MY45100473 | Sep. 23, 2019 | 1 Year |
| 13 | Wideband power sensor | Agilent | N1921A | MY51100041 | Sep. 23, 2019 | 1 Year |
| 14 | Smart Power Sensor | R&S | NRP-Z21 | 102209 | July. 01, 2019 | 1 Year |
| 15 | Dielectric Assessment Kit | Speag | DAK-3.5 | 1226 | N/A | N/A |
| 16 | Dual directional coupler | Woken | TS-PCC0M-05 | 107090019 | Apr. 10, 2019 | 1 Year |
| 17 | Coupler | Woken | 0110A05601O-10 | COM5BNW1A2 | Sep. 10, 2019 | 1 Year |
| 18 | Digital Themometer | LKM | DTM3000 | 3519 | Jul. 08, 2019 | 1 Year |

Remark:
1. “N/A” denotes no model name, serial No. or calibration specified.
2. * The test equipment recalibrated between different test periods were within the valid period when the tests were performed.

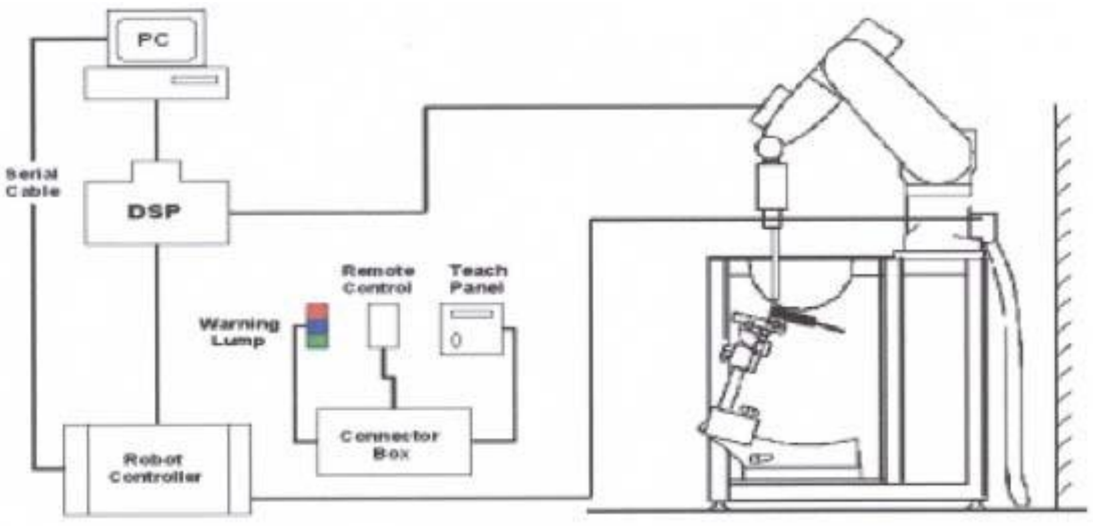
# 4. SAR MEASUREMENTS SYSTEM CONFIGURATION

## 4.1. SAR MEASUREMENT SET-UP

The DASY5 system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
4. A unit to operate the optical surface detector which is connected to the EOC.
5. The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
6. TheDASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows.
7. DASY5 software and SEMCAD data evaluation software.
8. Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling the testing of left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. System validation dipoles allowing to validate the proper functioning of the system.

### 4.1.1. TEST SETUP LAYOUT

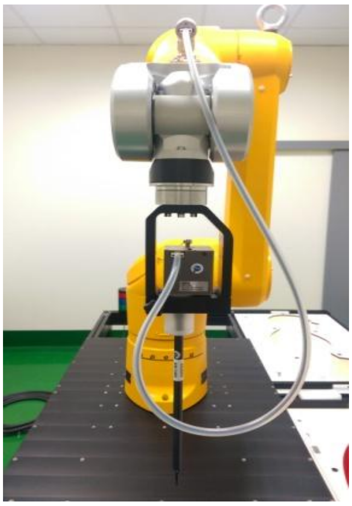


## 4.2. DASY5 E-FIELD PROBE SYSTEM

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

### 4.2.1. EX3DV4 PROBE SPECIFICATION

| | |
|---|---|
| Construction | Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |
| Calibration | ISO/IEC 17025 calibration service available |
| 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:± 0.2dB |
| Dimensions | Overall length: 330 mm (Tip: 20 mm)<br>Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.0 mm |



**EX3DV4 E-field Probe**

#### 4.2.2. E-FIELD PROBE CALIBRATION

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than ±10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C\frac{\Delta T}{\Delta t}$$

Where: $\Delta t$ = Exposure time (30 seconds),
C = Heat capacity of tissue (brain or muscle),
$\Delta T$ = Temperature increase due to RF exposure.

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

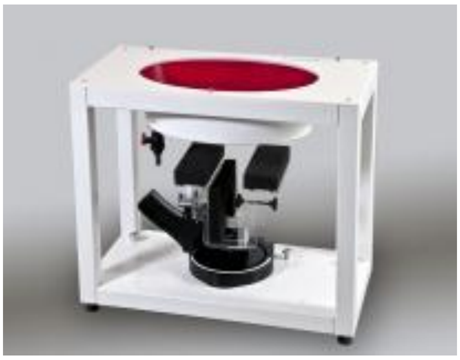
Where: σ = Simulated tissue conductivity,
ρ = Tissue density (kg/m3).

### 4.2.3. OTHER TEST EQUIPMENT

#### 4.2.3.1. Device Holder for Transmitters

**Construction:** Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices (e.g., laptops, cameras, etc.) It is light weight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI4and SAM v6.0Phantoms.
**Material:** POM, Acrylic glass, Foam

#### 4.2.3.2 Phantom

| | | |
|---|---|---|
| Model | ELI4 Phantom |  |
| Construction | Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles. | |
| Shell Thickness | 2±0.1 mm | |
| Filling Volume | Approx. 30 liters | |
| Dimensions | Length: 600 mm ; Width: 190mm<br>Height: adjustable feet | |
| Aailable | Special | |

| | | |
|---|---|---|
| Model | Twin SAM |  |
| Construction | The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot. | |
| Shell Thickness | 2 ± 0.2 mm | |
| Filling Volume | Approx. 25 liters | |
| Dimensions | Length:1000mm; Width: 500mm<br>Height: adjustable feet | |
| Aailable | Special | |

### 4.2.4. SCANNING PROCEDURE

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements 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 DUT’s output power and should vary max. ± 5 %.

The “surface check” measurement 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). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within ± 30°.)

- Area Scan

The “area scan” measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The standard scan uses large grid spacing for faster measurement. Standard grid spacing for head measurements is 15 mm in x- and y- dimension(≤2GHz)，12 mm in x- and y- dimension(2-4 GHz) and 10mm in x- and y- dimension(4-6GHz). If a finer resolution is needed, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation.

- Zoom Scan

A “zoom scan” measures the field in a volume around the 2D peak SAR value acquired in the previous “coarse” scan. This is a fine grid with maximum scan spatial resolution: $\Delta x_{zoom}$, $\Delta y_{zoom} \leq$ 2GHz -≤8mm, 2-4GHz -≤5 mm and 4-6 GHz-≤4mm; $\Delta z_{zoom} \leq$3GHz -≤5 mm, 3-4 GHz-≤4mm and 4-6GHz-≤2mm where the robot additionally moves the probe along the z-axis away from the bottom of the Phantom. DASY is also able to perform repeated zoom scans if more than 1 peak is found during area scan. In this document, the evaluated peak 1g and 10g averaged SAR values are shown in the 2D-graphics in Appendix B. Test results relevant for the specified standard (see chapter 1.4.)are shown in table form form in chapter 7.2.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 2 mm steps. This measurement shows the continuity of the liquid and can - depending in the field strength – also show the liquid depth.

The following table summarizes the area scan and zoom scan resolutions per FCC KDB 865664D01:

| Frequency | Maximun Area Scan resolution ($\Delta x_{area}$, $\Delta y_{area}$) | Maximun Zoom Scan spatial resolution ($\Delta x_{Zoom}$, $\Delta y_{Zoom}$) | Maximun Zoom Scan spatial resolution | | | Minimum zoom scan volume (x,y,z) |
|---|---|---|---|---|---|---|
| | | | Uniform Grid | Graded Grad | | |
| | | | $\Delta z_{Zoom}(n)$ | $\Delta z_{Zoom}(1)$* | $\Delta z_{Zoom}(n>1)$* | |
| ≤2GHz | ≤15mm | ≤8mm | ≤5mm | ≤4mm | ≤1.5*$\Delta z_{Zoom}(n-1)$ | ≥30mm |
| 2-3GHz | ≤12mm | ≤5mm | ≤5mm | ≤4mm | ≤1.5*$\Delta z_{Zoom}(n-1)$ | ≥30mm |
| 3-4GHz | ≤12mm | ≤5mm | ≤4mm | ≤3mm | ≤1.5*$\Delta z_{Zoom}(n-1)$ | ≥28mm |
| 4-5GHz | ≤10mm | ≤4mm | ≤3mm | ≤2.5mm | ≤1.5*$\Delta z_{Zoom}(n-1)$ | ≥25mm |
| 5-6GHz | ≤10mm | ≤4mm | ≤2mm | ≤2mm | ≤1.5*$\Delta z_{Zoom}(n-1)$ | ≥22mm |

### 4.2.5. SPATIAL PEAK SAR EVALUATION

The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The basis of the evaluation are the SAR values measured at the points of the fine cube grid consisting of 5 x 5 x 7 points( with 8mm horizontal resolution) or 7 x 7 x 7 points( with 5mm horizontal resolution) or 8 x 8 x 7 points( with 4mm horizontal resolution). The algorithm that finds the maximal averaged volume is separated into three different stages.

- The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting “Graph Evaluated”.
- The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.
- All neighboring volumes are evaluated until no neighboring volume with a higher average value is found.

**Extrapolation**

The extrapolation is based on a least square algorithm [W. Gander, Computer mathematic, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

**Interpolation**

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computer mathematic, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff ].

**Volume Averaging**

At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000 points (20x20x20) are interpolated to calculate the average.

**Advanced Extrapolation**

DASY5 uses the advanced extrapolation option which is able to compensate boundary effects on E-field probes.

## 4.2.6. DATA STORAGE AND EVALUATION

### 4.2.6.1 Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “DAE4”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm$^2$], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

### 4.2.7. DATA EVALUATION BY SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

| | | |
|---|---|---|
| Probe parameters: | Sensitivity | Normi, $a_{i0}$, $a_{i1}$, $a_{i2}$ |
| | Conversion factor | $ConvF_i$ |
| | Diode compression point | $Dcp_i$ |
| Device parameters: | Frequency | f |
| | Crest factor | cf |
| Media parameters: | Conductivity | |
| | Density | |

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multi meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

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

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

E-field probes: $E_i = ( V_i / Norm_i \cdot ConvF )^{1/2}$

H-field probes: $H_i = ( V_i )^{1/2} \cdot ( a_{i0} + a_{i1} f + a_{i2} f^2 ) / f$

With $V_i$ = compensated signal of channel i ( i = x, y, z )

$Norm_i$ = sensor sensitivity of channel i ( i = x, y, z )
[mV/(V/m)$^2$] for E-field Probes

ConvF = sensitivity enhancement in solution

aij = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

$E_i$ = electric field strength of channel i in V/m

$H_i$ = magnetic field strength of channel i in A/m

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

$$E_{tot} = (E_X^2 + E_Y^2 + E_Z^2)^{1/2}$$

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

$$SAR = (E_{tot})^2 \cdot \sigma / (\rho \cdot 1000)$$

With SAR = local specific absorption rate in mW/g

$E_{tot}$ = total field strength in V/m

= conductivity in [mho/m] or [Siemens/m]

= equivalent tissue density in g/cm$^3$

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \text{ or } P_{pwe} = H_{tot}^2 \cdot 37.7$$

With $P_{pwe}$ = equivalent power density of a plane wave in mW/cm$^2$

$E_{tot}$ = total field strength in V/m

$H_{tot}$ = total magnetic field strength in A/m

# 5. SYSTEM VERIFICATION PROCEDURE

## 5.1. TISSUE VERIFICATION

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectic parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ± 5% of the target values.

The following materials are used for producing the tissue-equivalent materials.

| Tissue Type | Bactericide | DGBE | HEC | NaCl | Sucrose | Triton X-100 | Water | Diethylene Glycol Mono-hexylether |
|---|---|---|---|---|---|---|---|---|
| Head2450 | - | 31.4 | - | 0.1 | - | - | 68.5 | - |
| Head 5G | - | - | - | - | - | 10.7 | 78.6 | 10.7 |

Salt: 99+% Pure Sodium Chloride; Sugar: 98+% Pure Sucrose; Water: De-ionized, 16M + resistivity
HEC: Hydroxyethyl Cellulose; DGBE: 99+% Di(ethylene glycol) butyl ether,[2-(2-butoxyethoxy)ethanol]
Triton X-100(ultra pure): Polyethylene glycol mono [4-(1,1,3,3-tetramethylbutyl)phenyl]ether

| Tissue Verification | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Tissue Type | Frequency (MHz) | Liquid Temp. (℃) | Conductivity (σ) | Permittivity (εr) | Targeted Conductivity (σ) | Targeted Permittivity (εr) | Deviation Conductivity (σ) (%) | Deviation Permittivity (εr) (%) | Date |
| Head | 2450 | 21.5 | 1.800 | 39.200 | 1.80 | 39.2 | 0.00 | 0.00 | May. 08,2020 |
| Head | 5200 | 21.3 | 4.672 | 35.096 | 4.66 | 36.0 | 0.26 | -2.51 | May. 11,2020 |

Note:
1) The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.
2) KDB 865664 was ensured to be applied for probe calibration frequencies greater than or equal to 50MHz of the EUT frequencies.
3) The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies. The SAR test plots may slightly differ from the table above since the DASY rounds to three significant digits.

## 5.2. SYSTEM CHECK

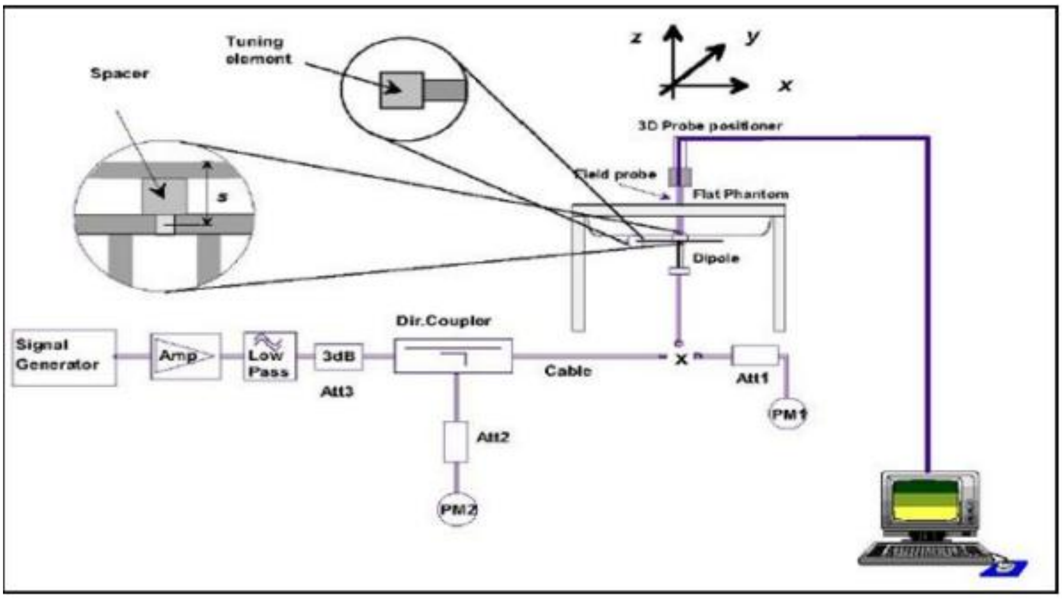
The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands and tissue liquids used during the tests.

| System Check | Date | Frequency (MHz) | Targeted SAR-1g (W/kg) | Measured SAR-1g (W/kg) | normalized SAR-1g (W/kg) | Deviation (%) | Dipole S/N |
|---|---|---|---|---|---|---|---|
| Head | May. 08,2020 | 2450 | 24.60 | 6.24 | 24.96 | 1.46 | 919 |
| Head | May. 11,2020 | 5200 | 21.70 | 2.30 | 23.00 | 5.99 | 1160 |

## 5.3. SYSTEM CHECK PROCEDURE

The system check is performed by using a system check dipole which is positioned parallel to the planar part of the SAM phantom at the reference point. The distance of the dipole to the SAM phantom is determined by a plexiglass spacer. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 250 mW(below 3GHz) or 100mW(3-6GHz). To adjust this power a power meter is used. The power sensor is connected to the cable before the system check to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the system check to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test.

System check results have to be equal or near the values determined during dipole calibration (target SAR in table above) with the relevant liquids and test system (±10 %).



# 6. SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

## 6.1. SAR MEASUREMENT VARIABILITY

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

The detailed repeated measurement results are shown in Section 8.2.

# 7. OPERATIONAL CONDITIONS DURING TEST

## 7.1. SAR TEST CONFIGURATION

### 7.1.1. WIFI TEST CONFIGURATION

For WLAN SAR testing, WLAN engineering testing software installed on the DUT can provide continuous transmitting RF signal.

2.4G

| Mode | 802.11b | 802.11g | 802.11n HT20 | 802.11n HT40 |
|---|---|---|---|---|
| Duty cycle | 100% | | | |
| Crest factor | 1 | | | |

5G

| Mode | 802.11a | 802.11n HT20/HT40 | 802.11ac HT20 | 802.11ac HT40 | 802.11ac VH80 | 802.11ac VH160 |
|---|---|---|---|---|---|---|
| Duty cycle | 100% | | | | | |
| Crest factor | 1 | | | | | |

For WiFi SAR testing, a communication link is set up with the test mode software for WiFi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. The RF signal utilized in SAR measurement has 100% duty cycle and its crest factor is 1. The test procedures in KDB 248227 D01 are applied.

#### 7.1.1.1 2.4G SAR Test Requirements

**802.11b DSSS SAR Test Requirements**

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
2) When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

**2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements**

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied. SAR is not required for the following 2.4 GHz OFDM conditions.

1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
2) 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 ≤ 1.2 W/kg.

**SAR Test Requirements for OFDM configurations**

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, each standalone And frequency aggregated band is considered separately for SAR test reduction. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

### 7.1.1.2 5G SAR Test Requirements

- **U-NII-1 and U-NII-2A Band**

For devices that operate in both U-NII-1 and U-NII-2A bands, when the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, both bands are tested independently for SAR. When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, both bands are tested independently for SAR.

- **U-NII-2C, U-NII-3 Bands**

The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. When Terminal Doppler Weather Radar (TDWR) restriction applies, the channels at 5.60 – 5.65 GHz in U-NII-2C band must be disabled with acceptable mechanisms and documented in the equipment certification.
Unless band gap channels are permanently disabled, they must be considered for SAR testing. To maintain SAR measurement accuracy and to facilitate test reduction, the channels in U-NII-2C band above 5.65 GHz may be grouped with the 5.8 GHz channels in U-NII-3 or §15.247 band to enable two SAR probe calibration frequency points to cover the bands, including the band gap channels.11 When band gap channels are supported and the bands are not aggregated for SAR testing, band gap channels must be considered independently in each band according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

### 7.1.1.3 OFDM transmission mode and SAR test channel selection

For the 2.4GHz and 5GHz bands, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations(for example 802.11a,802.11n and 802.11ac,or 802.11g and 802.11n,with the same channel bandwidth, modulation, and data rate, etc.),the lower order 802.11 mode(i.e.802.11a then 802.11n and 802.11ac,or 802.11g then 802.11n) is used for SAR measurement. When the maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

#### 7.1.1.4 Initial test configuration procedure

For OFDM, in both 2.4G and 5GHz bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, and lowest data rate. If the average RF output powers of the highest identical transmission modes are within 0.25 dB of each other, mid channel of the transmission mode with highest average RF output powers is the initial test channel. Otherwise, the channel of the transmission mode with the highest average RF output power will be the initial test configuration.
When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤1.2 W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurement.

## 7.2 TEST POSITION

### 7.2.1 BODY

The overall diagonal dimension of the display section of a tablet is 21.1cm>20cm, per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the Tablet touching the phantom. SAR evaluation for the front surface of tablet display screens is generally not necessary. The SAR Exclusion Threshold in KDB 447498 D01 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned adjacent the phantom and the edge containing the antenna positioned perpendicular to the phantom.

**SAR test reduction and exclusion guidance**

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

$$\frac{\text{(max. power of channel, including tune-up tolerance, mW)}}{\text{(min. test separation distance, mm)}} \cdot \sqrt{\text{Frequency (GHz)}} \leq 3.0$$

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

(2)The SAR exclusion threshold for distances>50mm is defined by the following equation, as illustrated in KDB 447498 D01 Appendix B:

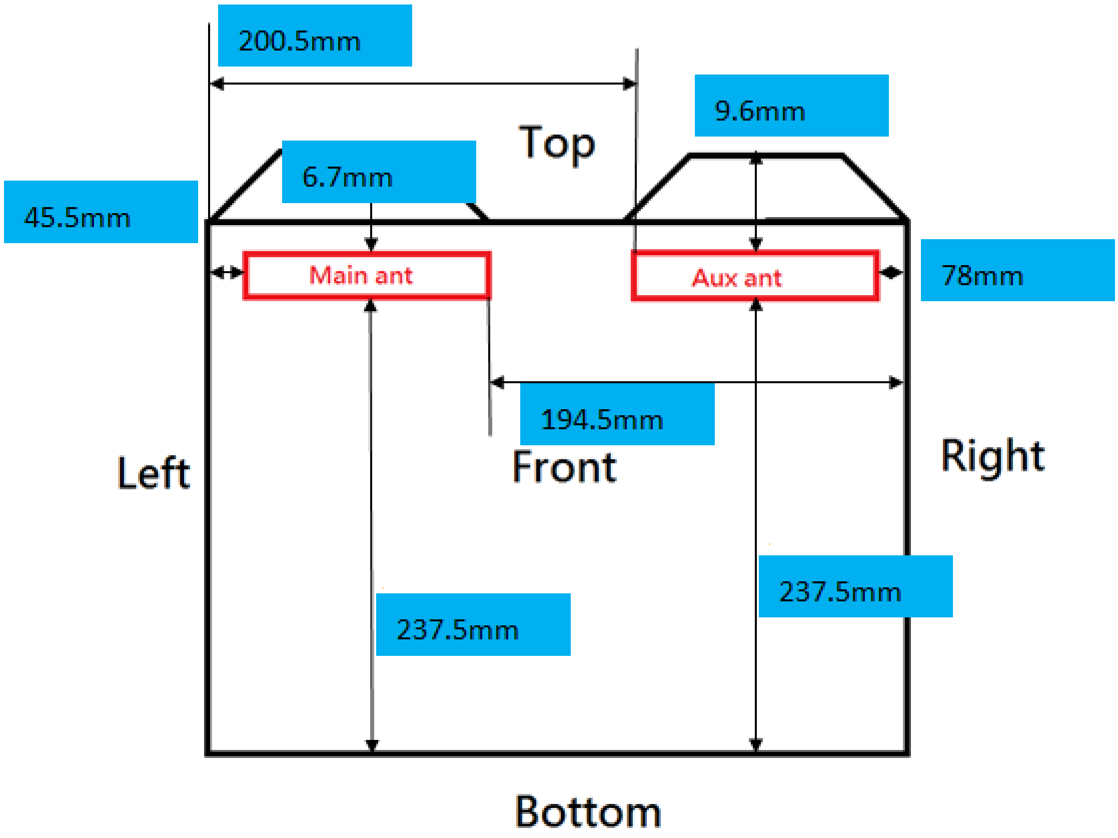
a) at 100 MHz to1500 MHz

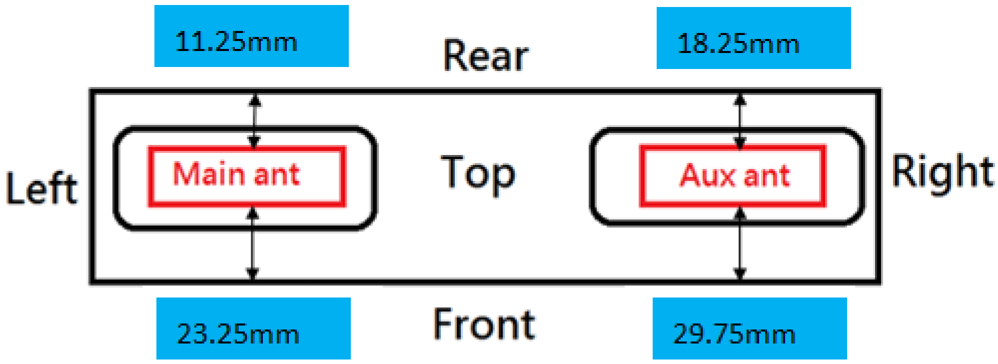
$$\text{[Power allowed at numeric Threshold at 50 mm in step 1)} + \text{(test separation distance} - 50\text{ mm)} \cdot (f_{(MHz)}/150)]\text{ mW}$$

b) at >1500MHz and ≤6GHz

$$\text{[Power allowed at numeric Threshold at 50 mm in step 1)} + \text{(test separation distance} - 50\text{ mm)} \cdot 10]\text{ mW}$$

The location of the antenna inside EUT is as below.




| Antenna | Rear Face | Right Side | Left Side | Top Side | Bottom Side |
|---|---|---|---|---|---|
| WLAN Main | 11.25mm | 194.5mm | 45.5mm | 6.7mm | 237.5mm |
| WLAN Aux | 18.25mm | 78mm | 200.5mm | 9.6mm | 237.5mm |
| WLAN/BT Aux | 18.25mm | 78mm | 200.5mm | 9.6mm | 237.5mm |

**The distance <50mm_Main**

| Mode | Position | Pmax (dBm)* | Pmax (mW) | Distance (mm) | f (GHz) | Calculation Result | SAR Exclusion threshold | Test Requirement (Yes/No) |
|---|---|---|---|---|---|---|---|---|
| 2.4G WiFi | Top | 21.00 | 125.89 | 6.70 | 2.437 | 29.33 | 3 | Yes |
| | Rear | 21.00 | 125.89 | 11.25 | 2.437 | 17.47 | 3 | Yes |
| | Left | 21.00 | 125.89 | 45.50 | 2.437 | 4.32 | 3 | Yes |
| 5G WiFi | Top | 21.00 | 125.89 | 6.70 | 5.240 | 43.01 | 3 | Yes |
| | Rear | 21.00 | 125.89 | 11.25 | 5.240 | 25.62 | 3 | Yes |
| | Left | 21.00 | 125.89 | 45.50 | 5.240 | 6.33 | 3 | Yes |

**The distance <50mm_Aux**

| Mode | Position | Pmax (dBm)* | Pmax (mW) | Distance (mm) | f (GHz) | Calculation Result | SAR Exclusion threshold | Test Requirement (Yes/No) |
|---|---|---|---|---|---|---|---|---|
| BT | Top | 11 | 12.59 | 9.6 | 2.480 | 2.07 | 3 | No |
| | Rear | 11 | 12.59 | 18.25 | 2.480 | 1.09 | 3 | No |
| 2.4G WiFi | Top | 21 | 125.89 | 9.60 | 2.437 | 20.47 | 3 | Yes |
| | Rear | 21 | 125.89 | 18.25 | 2.437 | 10.77 | 3 | Yes |
| 5G WiFi | Top | 21 | 125.89 | 9.60 | 5.240 | 30.02 | 3 | Yes |
| | Rear | 21 | 125.89 | 18.25 | 5.240 | 15.79 | 3 | Yes |

**The distance >50mm_Main**

| Mode | Position | f (GHz) | Power allowed at numeric Threshold at 50mm | Distance (mm) | Pmax (dBm)* | Pmax (mW) | SAR Exclusion Result | Test Requirement (Yes/No) |
|---|---|---|---|---|---|---|---|---|
| 2.4GWiFi | Right | 2.437 | 96.09 | 194.5 | 21 | 125.89 | 1541.09 | No |
| | Bottom | 2.437 | 96.09 | 237.5 | 21 | 125.89 | 1971.09 | No |
| 5GWiFi | Right | 5.240 | 65.53 | 194.5 | 21 | 125.89 | 1510.53 | No |
| | Bottom | 5.240 | 65.53 | 237.5 | 21 | 125.89 | 1940.53 | No |

**The distance >50mm_Aux**

| Mode | Position | f (GHz) | Power allowed at numeric Threshold at 50mm | Distance (mm) | Pmax (dBm)* | Pmax (mW) | SAR Exclusion Result | Test Requirement (Yes/No) |
|---|---|---|---|---|---|---|---|---|
| BT | Left | 2.480 | 95.25 | 200.5 | 11 | 12.59 | 1600.25 | No |
| | Right | 2.480 | 95.25 | 78.0 | 11 | 12.59 | 375.25 | No |
| | Bottom | 2.480 | 95.25 | 237.5 | 11 | 12.59 | 1970.25 | No |
| 2.4GWiFi | Left | 2.437 | 96.09 | 200.5 | 21 | 125.89 | 1601.09 | No |
| | Right | 2.437 | 96.09 | 78.0 | 21 | 125.89 | 376.09 | No |
| | Bottom | 2.437 | 96.09 | 237.5 | 21 | 125.89 | 1971.09 | No |
| 5GWiFi | Left | 5.240 | 65.53 | 200.5 | 21 | 125.89 | 1570.53 | No |
| | Right | 5.240 | 65.53 | 78.0 | 21 | 125.89 | 345.53 | No |
| | Bottom | 5.240 | 65.53 | 237.5 | 21 | 125.89 | 1940.53 | No |

# 8. TEST RESULT

## 8.1. CONDUCTED POWER RESULTS

### 8.1.1. CONDUCTED POWER MEASUREMENTS OF BT

| BT | Max. Tune up | Average Conducted Power (dBm) | | |
|---|---|---|---|---|
| | | CH0 | CH39 | CH78 |
| DH5 | 11 | 9.13 | 10.03 | 10.71 |
| 2DH5 | 11 | 7.73 | 8.39 | 8.88 |
| 3DH5 | 11 | 7.73 | 8.40 | 8.89 |

| BT | Max. Tune up | Average Conducted Power (dBm) | | |
|---|---|---|---|---|
| | | CH0 | CH19 | CH39 |
| BLE1M | 10 | 9.84 | 9.92 | 10.45 |
| BLE2M | 10 | 10.00 | 9.93 | 9.88 |

Note:
1) The conducted power of BT is measured with RMS detector.

### 8.1.2. CONDUCTED POWER MEASUREMENTS OF WIFI 2.4G

1) Conducted power measurement results of WiFi 2.4G_Main

| Mode | Channel | Frequency (MHz) | Data Rate (Mbps) | Tune-up | Average Power (dBm) | Yes |
|---|---|---|---|---|---|---|
| 802.11b | 1 | 2412 | 1 | 19.5 | 19.45 | Yes |
| | 6 | 2437 | | 21.0 | 20.90 | Yes |
| | 11 | 2462 | | 20.0 | 19.90 | No |
| | 12 | 2467 | | 17.5 | 17.46 | No |
| | 13 | 2472 | | 15.0 | 14.48 | Yes |
| 802.11g | 1 | 2412 | 6 | 16.5 | 16.48 | Yes |
| | 6 | 2437 | | 21.0 | 20.98 | Yes |
| | 11 | 2462 | | 17.0 | 16.97 | No |
| | 12 | 2467 | | 13.5 | 13.34 | No |
| | 13 | 2472 | | -5.0 | -4.92 | No |
| 802.11n HT20 | 1 | 2412 | HT0 | 16.0 | 15.92 | No |
| | 6 | 2437 | | 20.5 | 20.43 | No |
| | 11 | 2462 | | 16.0 | 15.91 | No |
| | 12 | 2467 | | 13.5 | 13.46 | No |
| | 13 | 2472 | | -6.0 | -5.56 | No |
| 802.11n HT40 | 3 | 2422 | HT0 | 14.0 | 13.94 | No |
| | 6 | 2437 | | 16.0 | 15.96 | No |
| | 9 | 2452 | | 14.5 | 14.42 | No |
| | 10 | 2457 | | 11.0 | 10.89 | No |
| | 11 | 2462 | | 3.0 | 2.93 | Yes |

2) Conducted power measurement results of WiFi 2.4G_Aux

| Mode | Channel | Frequency (MHz) | Data Rate (Mbps) | Tune-up | Average Power (dBm) | SAR Test (Yes/No) |
|---|---|---|---|---|---|---|
| 802.11b | 1 | 2412 | 1 | 20.0 | 19.95 | Yes |
| | 6 | 2437 | | 21.0 | 20.95 | Yes |
| | 11 | 2462 | | 21.0 | 21.00 | Yes |
| | 12 | 2467 | | 18.0 | 17.80 | No |
| | 13 | 2472 | | 14.5 | 16.67 | No |
| 802.11g | 1 | 2412 | 6 | 17.0 | 20.97 | Yes |
| | 6 | 2437 | | 21.0 | 16.48 | Yes |
| | 11 | 2462 | | 16.5 | 13.47 | Yes |
| | 12 | 2467 | | 13.5 | -5.53 | No |
| | 13 | 2472 | | -5.5 | 16.67 | No |
| 802.11n HT20 | 1 | 2412 | HT0 | 16.5 | 16.47 | No |
| | 6 | 2437 | | 21.0 | 20.89 | No |
| | 11 | 2462 | | 16.5 | 16.43 | No |
| | 12 | 2467 | | 13.5 | 13.48 | No |
| | 13 | 2472 | | -6.0 | -5.98 | No |
| 802.11n HT40 | 3 | 2422 | HT0 | 13.5 | 13.47 | No |
| | 6 | 2437 | | 16.0 | 15.98 | No |
| | 9 | 2452 | | 14.5 | 14.45 | No |
| | 10 | 2457 | | 11.0 | 10.97 | No |
| | 11 | 2462 | | 3.5 | 3.46 | No |

3) Conducted power measurement results of WiFi 2.4G_MIMO_Main+Aux

| Mode | Channel | Frequency (MHz) | Data Rate (Mbps) | Tune-up | Main Average Power(dBm) | Aux Average Power(dBm) | Total Average Power(dBm | SAR Test (Yes/No) |
|---|---|---|---|---|---|---|---|---|
| 802.11n HT20 | 1 | 2412 | HT8 | 17.5 | 14.33 | 14.12 | 17.24 | No |
| | 6 | 2437 | | 20.5 | 17.56 | 17.22 | 20.40 | No |
| | 11 | 2462 | | 17.5 | 14.28 | 14.24 | 17.27 | No |
| | 12 | 2467 | | 15.0 | 11.56 | 12.41 | 14.99 | No |
| | 13 | 2472 | | -5.5 | -9.12 | -8.44 | -5.76 | No |
| 802.11n HT40 | 3 | 2422 | HT8 | 14.5 | 13.34 | 13.46 | 16.41 | No |
| | 6 | 2437 | | 17.5 | 10.32 | 10.54 | 13.44 | No |
| | 9 | 2452 | | 16.5 | 2.61 | 2.33 | 5.48 | No |
| | 10 | 2457 | | 13.5 | 10.17 | 10.65 | 13.43 | No |
| | 11 | 2462 | | 5.5 | 2.18 | 2.68 | 5.45 | No |

Note:

1. The Average conducted power of WiFi is measured with RMS detector.
2. Per KDB248227 D01, for WiFi 2.4GHz Ant0, the highest measured maximum output power Channel for DSSS modes(802.11b)was selected for SAR measurement. SAR for OFDM modes(2.4GHz 802.11g/n) was not required When the highest reported SAR for DSSS is adjusted by the ratio of OFDM modes(802.11g/n)to DSSS modes(802.11b)specified maximum output power and the adjusted SAR is > 1.2 W/kg.

### 8.1.3. CONDUCTED POWER MEASUREMENTS OF WIFI 5G

4) Conducted power measurement results of WiFi 5G_Main

| Band | Mode | Channel | Frequency (MHz) | Data Rate (Mbps) | Tune-up | Average Power (dBm) | SAR Test (Yes/No) |
|---|---|---|---|---|---|---|---|
| 5.2G | 802.11a | 36 | 5180 | 6 | 11.5 | 11.5 | Yes |
| | | 40 | 5200 | | 11.5 | 11.4 | Yes |
| | | 48 | 5240 | | 11.5 | 11.4 | Yes |
| | 802.11n HT20 | 36 | 5180 | HT0 | 11.5 | 11.3 | No |
| | | 40 | 5200 | | 11.5 | 11.4 | No |
| | | 48 | 5240 | | 11.5 | 11.4 | No |
| | 802.11n HT40 | 38 | 5190 | HT0 | 11.5 | 11.5 | No |
| | | 46 | 5230 | | 11.5 | 11.3 | No |
| | 802.11ac HT80 | 42 | 5210 | VHT0 | 11.5 | 11.4 | No |
| | 802.11ac HT160 | 50 | 5250 | VHT0 | 11.5 | 11.4 | No |

5) Conducted power measurement results of WiFi 5G_Aux

| Band | Mode | Channel | Frequency (MHz) | Data Rate (Mbps) | Tune-up | Average Power (dBm) | SAR Test (Yes/No) |
|---|---|---|---|---|---|---|---|
| 5.2G | 802.11a | 36 | 5180 | 6 | 19.0 | 18.60 | Yes |
| | | 40 | 5200 | | 19.0 | 18.60 | Yes |
| | | 48 | 5240 | | 19.0 | 18.50 | Yes |
| | 802.11n HT20 | 36 | 5180 | HT0 | 17.0 | 16.96 | No |
| | | 40 | 5200 | | 19.0 | 18.72 | No |
| | | 48 | 5240 | | 19.0 | 18.54 | No |
| | 802.11n HT40 | 38 | 5190 | HT0 | 18.0 | 17.99 | No |
| | | 46 | 5230 | | 19.5 | 18.89 | No |
| | 802.11ac HT80 | 42 | 5210 | VHT0 | 18.0 | 17.89 | No |
| | 802.11ac HT160 | 50 | 5250 | VHT0 | 13.0 | 12.94 | No |

5) Conducted power measurement results of WiFi 5G MIMO_ Main+Aux

| Band | Mode | Channel | Frequency (MHz) | Data Rate (Mbps) | Tune-up | Main Average Power(dBm) | Aux Average Power(dBm) | Total Average Power(dBm |
|---|---|---|---|---|---|---|---|---|
| 5.2G | 802.11n HT20 | 36 | 5180 | HT8 | 11.5 | 8.40 | 8.40 | 11.40 |
| | | 40 | 5200 | | 11.5 | 8.50 | 8.30 | 11.40 |
| | | 48 | 5240 | | 11.5 | 8.30 | 8.40 | 11.40 |
| | 802.11n HT40 | 38 | 5190 | HT8 | 11.5 | 8.30 | 8.30 | 11.30 |
| | | 46 | 5230 | | 11.5 | 8.20 | 8.40 | 11.30 |
| | 802.11ac HT80 | 42 | 5210 | VHT8 | 11.5 | 8.40 | 8.30 | 11.40 |
| | 802.11ac HT160 | 50 | 5250 | VHT8 | 11.5 | 8.40 | 8.40 | 11.40 |

Note:

The Average conducted power of WiFi is measured with RMS detector.

## 8.2. SAR TEST RESULTS

**General Notes:**

1) Per KDB447498 D01, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demonstrate compliant.
2) Per KDB447498 D01, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:⩽0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is⩽100 MHz. When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.
3) Per KDB865664 D01,for each frequency band, repeated SAR measurement is required only when the measured SAR is ⩾0.8W/kg; if the deviation among the repeated measurement is ⩽ 20%,and the measured SAR <1.45W/kg, only one repeated measurement is required.
4) Per KDB865664 D02, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing.

**WLAN Notes:**

1. For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all positions in an exposure condition. The test position with the highest extrapolated (peak)SAR is used as the initial test position. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other (remaining) test positions. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 for 2.4GHZ WIFI single transmission chain operations, the highest measured maximum output power Channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section7.1.4 for more information.
3. Justification for test configurations for WLAN per KDB Publication 248227 for 5GHZ WIFI single transmission chain operations, the initial test configuration was selected according to the transmission mode with the highest maximum allowed power.

### 8.2.1. SAR MEASUREMENT RESULT

SAR test results of Wifi 2.4G/BT_ separation distance=0cm

| Test No. | Band | Channel | Test Position | Ant | Data Rate | Maximum Tune-up (dBm) | Conducted Power (dBm) | SAR 1g | Reported 1g SAR |
|---|---|---|---|---|---|---|---|---|---|
| T01 | 802.11b | 6 | Top | Main | 1M | 21.00 | 20.95 | 0.507 | 0.513 |
| T02 | 802.11b | 6 | Left | Main | 1M | 21.00 | 20.95 | 0.001 | 0.001 |
| T03 | 802.11b | 6 | Rear | Main | 1M | 21.00 | 20.95 | 0.664 | 0.672 |
| T04 | 802.11b | 1 | Rear | Main | 1M | 20.00 | 19.95 | 0.31 | 0.314 |
| T05 | 802.11b | 11 | Rear | Main | 1M | 21.00 | 21.00 | 0.627 | 0.627 |
| T06 | 802.11g | 6 | Rear | Main | 6M | 21.00 | 20.95 | 0.664 | 0.672 |
| T07 | 802.11g | 11 | Rear | Main | 6M | 21.00 | 21.00 | 0.827 | **0.827** |
| T08 | 802.11g | 1 | Rear | Main | 6M | 21.00 | 21.00 | 0.352 | 0.352 |
| T09 Repeatec | 802.11g | 11 | Rear | Main | 6M | 21.00 | 21.00 | 0.364 | 0.364 |
| T10 | 802.11b | 6 | Top | Aux | 1M | 21.00 | 20.90 | 0.445 | 0.455 |
| T11 | 802.11b | 6 | Rear | Aux | 1M | 21.00 | 20.90 | 0.548 | 0.561 |
| T12 | 802.11b | 1 | Rear | Aux | 1M | 19.50 | 19.45 | 0.176 | 0.178 |
| T13 | 802.11b | 11 | Rear | Aux | 1M | 20.00 | 19.90 | 0.187 | 0.191 |
| T14 | 802.11g | 6 | Rear | Aux | 6M | 21.00 | 20.90 | 0.591 | **0.605** |
| T15 | 802.11g | 11 | Rear | Aux | 6M | 20.00 | 19.90 | 0.281 | 0.288 |

Note: The value with boldface is the maximum SAR Value of each test band.

SAR test results of Wifi 5G_ separation distance=0cm

| Test No. | Band | Channel | Test Position | Ant | Data Rate | Maximum Tune-up (dBm) | Conducted Power (dBm) | SAR 1g | Reported 1g SAR |
|---|---|---|---|---|---|---|---|---|---|
| T16 | 802.11a | 48 | Top | Main | 6M | 11.50 | 11.40 | 1.280 | **1.310** |
| T17 | 802.11a | 48 | Left | Main | 6M | 11.50 | 11.30 | 0.001 | 0.001 |
| T18 | 802.11a | 48 | Rear | Main | 6M | 11.50 | 11.40 | 0.389 | 0.398 |
| T19 | 802.11a | 40 | Top | Main | 6M | 11.50 | 11.40 | 1.220 | 1.248 |
| T20 | 802.11a | 36 | Top | Main | 6M | 11.50 | 11.50 | 1.200 | 1.200 |
| T21 Repeatec | 802.11a | 40 | Top | Main | 6M | 11.50 | 11.40 | 1.260 | 1.289 |
| T22 | 802.11a | 48 | Top | Aux | 6M | 19.00 | 18.60 | 1.280 | **1.403** |
| T23 | 802.11a | 48 | Rear | Aux | 6M | 19.00 | 18.60 | 0.693 | 0.693 |
| T24 | 802.11a | 40 | Top | Aux | 6M | 19.00 | 18.50 | 0.553 | 0.606 |
| T25 | 802.11a | 36 | Top | Aux | 6M | 19.00 | 18.53 | 0.570 | 0.625 |
| T26 | 802.11n_HT20 | 48 | Top | Main+Aux | HT8 | 11.00 | 10.49 | 0.897 | **1.009** |
| T27 | 802.11n_HT20 | 48 | Rear | Main+Aux | HT8 | 11.00 | 10.49 | 0.254 | 0.286 |
| T28 | 802.11n_HT20 | 40 | Top | Main+Aux | HT8 | 11.00 | 10.71 | 0.799 | 0.854 |
| T29 | 802.11n_HT20 | 36 | Top | Main+Aux | HT8 | 11.00 | 10.68 | 0.703 | 0.757 |
| T30 Repeatec | 802.11n_HT20 | 48 | Top | Main+Aux | HT8 | 11.00 | 10.49 | 0.775 | 0.872 |

Note: The value with boldface is the maximum SAR Value of each test band.

# 9. MULTIPLE TRANSMITTER EVALUATION

The following tables list information which is relevant for the decision if a simultaneous transmit evaluation is necessary according to FCC KDB 447498D01 General RF Exposure Guidance v06.

| No. | Configuration | Body |
|---|---|---|
| 1 | WLAN 2.4G + BT | Yes |
| 2 | WLAN 5G + BT | Yes |

Note:

1.BT antenna only supports the aux antenna.

## 9.1 SAR SUMMATION SCENARIO

| SAR1g(W/kg) \ Test Position | Rear Face | Top Side | Left Side |
|---|---|---|---|
| WiFi 2.4G | 0.827 | 0.513 | 0.001 |
| BT | | | |
| MAX $\sum SAR_{1g}$ | 0.827 | 0.513 | 0.001 |

Note:

MAX. $\sum SAR_{1g}$=0.827W/Kg<1.6 W/Kg, so simultaneous SAR are not required.

| SAR1g(W/kg) \ Test Position | Rear Face | Top Side | Left Side |
|---|---|---|---|
| WiFi 5.2G | 0.693 | 1.403 | 0.001 |
| BT | | | |
| MAX $\sum SAR_{1g}$ | 0.693 | 1.403 | 0.001 |

Note:

MAX. $\sum SAR_{1g}$=1.422W/Kg<1.6 W/Kg, so simultaneous SAR are not required.

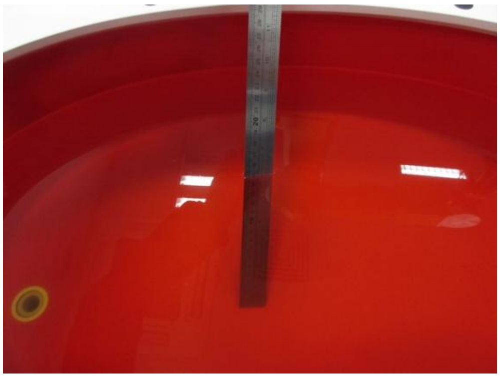
# APPENDIX

## 1. Test Layout

**Specific Absorption Rate Test Layout**

**Liquid depth in the flat Phantom (≥15cm depth)**

HSL(2450MHz) HSL(5GHz)



# Appendix A. SAR Plots of System Verification

**(Pls See BTL-FCC SAR-1-2004T174_Appendix A.)**

# Appendix B. SAR Plots of SAR Measurement

**(Pls See BTL-FCC SAR-1-2004T174_Appendix B.)**

# Appendix C. Calibration Certificate

**(Pls See BTL-FCC SAR-1-2004T174_Appendix C.)**

# Appendix D. Photographs of the Test Set-Up

**(Pls See BTL-FCC SAR-1-2004T174_Appendix D.)**

**End of Test Report**