FCC SAR Test Report

FCC ID: 2ADPBIDRIVEONE

Project No.	:	1602C008
Equipment	:	IDrive One
Model Name	:	IDrive.One-XTB(“X” is for the capacity of the hard drive)
Applicant	:	IDrive Inc.
Address	:	26115 Mureau Road Suite A Calabasas,CA 91302

Date of Receipt	:	Feb. 01, 2016
Date of Test	:	Feb. 26, 2016 ~ Feb. 27, 2016
Issued Date	:	Mar. 03, 2016
Tested by	:	BTL Inc.

Super Jiang

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Steven Lu

APPROVED BY : (Steven Lu / Technical Manager)

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ilac-MRA TAF Testing Laboratory 2640

Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**), or National Institute of Standards and Technology (**NIST**) .

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

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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.

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REPORT ISSUED HISTORY

Issued No.	Description	Issued Date
BTL-FCC SAR-1-1602C008	Original Issue.	Mar. 03, 2016

1. GENERAL SUMMARY

Equipment	IDrive One
Model Name	IDrive.One-XTB(“X” is for the capacity of the hard drive)
Brand Name	IDrive
Manufacturer	IDrive Inc.
Address	26115 Mureau Road Suite A Calabasas,CA 91302
Standard(s)	**FCC 47CFR §2.1093** Radio frequency Radiation Exposure Evaluation: Portable Devices **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) **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 **KDB447498 D01** General RF Exposure Guidance v06 **KDB248227 D01** 802. 11 Wi-Fi SAR v02r02 **KDB865664 D01** SAR measurement 100 MHz to 6 GHz v01r04 **KDB865664 D02** RF Exposure Reporting v01r02 **KDB690783 D01** SAR Listings on Grants v01r03

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-1-1602C008) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-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.3,Jinshagang 1st Road, ShiXia, Dalang Town,Dong Guan, China.523792

2.2 MEASUREMENT UNCERTAINTY

Note: Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04,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 (5mm) SAR-1g(W/kg)
DTS	2.4G WLAN	0.065
NII	5.2G WLAN	0.234
	5.8G WLAN	0.144

Note: 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/IEEE C95.1:1992, 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.

3.1.1 GENERAL DESCRIPTION OF EUT

<table>
<tr><td>Equipment</td><td colspan="3">IDrive One</td></tr>
<tr><td>Model Name</td><td colspan="3">IDrive.One-XTB(“X” is for the capacity of the hard drive)</td></tr>
<tr><td>S/N</td><td colspan="3">S377J9FG903636</td></tr>
<tr><td>HW Version</td><td colspan="3">PI-719-V1.1</td></tr>
<tr><td>SW Version</td><td colspan="3">2.000.010</td></tr>
<tr><td>Modulation</td><td colspan="3">WiFi(DSSS/OFDM)</td></tr>
<tr><td rowspan="4">Operation Frequency Ranges</td><td>Band</td><td>TX (MHz)</td><td>RX (MHz)</td></tr>
<tr><td>2.4G WIFI</td><td colspan="2">2412 ~2462</td></tr>
<tr><td rowspan="2">5G WIFI</td><td colspan="2">5150 ~5250</td></tr>
<tr><td colspan="2">5725 ~5850</td></tr>
<tr><td rowspan="6">Test Channels
(low-mid-high):</td><td colspan="3">1-6-11(2.4G WIFI 802.11b/g/n HT20)</td></tr>
<tr><td colspan="3">3-6 - 9(2.4G WIFI 802.11n HT40)</td></tr>
<tr><td>5G WIFI</td><td>Band 1</td><td>Band 4</td></tr>
<tr><td>a/n20/
ac20</td><td>36-40-44-48</td><td>149-153-157-161-165</td></tr>
<tr><td>n40/
ac40</td><td>38-46</td><td>151-159</td></tr>
<tr><td>ac80</td><td>42</td><td>155</td></tr>
<tr><td rowspan="2">Antenna Gain</td><td colspan="3">2.4G WIFI: Ant 1 2.5dBi Ant 2 3dBi</td></tr>
<tr><td colspan="3">5G WIFI: 3dBi</td></tr>
</table>

3.2 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. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

3.3 MAIN TEST INSTRUMENTS

Item	Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. Interval
1	Data Acquisition Electronics	Speag	DAE4	1390	Sep. 18, 2015	1 Year
2	E-field Probe	Speag	EX3DV4	3661	Apr. 24, 2015	1 Year
3	System Validation Dipole	Speag	D2450V2	919	Sep. 28, 2015	1 Year
4	System Validation Dipole	Speag	D5GHzV2	1160	Oct. 05, 2015	1 Year
5	Twin Sam Phantom	Speag	Twin Sam Phantom V5.0	1784	N/A	N/A
6	Twin Sam Phantom	Speag	Twin Sam Phantom V5.0	1896	N/A	N/A
7	Power Amplifier	Mini-Circuits	ZHL-42W+	QA1333003	Mar. 09, 2015	1 Year
8	Power Amplifier	Mini-Circuits	ZVE-8G+	520701341	Mar. 09, 2015	1 Year
9	ENA Network Analyzer	Agilent	E5071C	MY46102965	Mar. 29, 2015	1 Year
10	MXG Analog Signal Generator	Agilent	N5181A	MY49060710	Nov. 02, 2015	1 Year
11	P-series power meter	Agilent	N1911A	MY45100473	Mar. 29, 2015	1 Year
12	wideband power sensor	Agilent	N1921A	MY51100041	Mar. 29, 2015	1 Year
13	Power Meter	Anritsu	ML2487A	6K00004714	Mar. 16, 2015	1 Year
14	Power Meter Sensor	Anritsu	MA2491A	34138	Mar. 16, 2015	1 Year
15	Attenuator	MEB	300-affn-03	314	Mar. 29, 2015	1 Year
16	Dielectric Assessment Kit	Speag	DAK-3.5	1226	Aug. 04, 2015	1 Year
17	Low pass filter	Mini-Circuits	SLP-2950+	M108294	Mar. 29, 2015	1 Year
18	Attenuator	Mini-Circuits	VAT-10+	31317-1	Mar. 29, 2015	1 Year
19	Attenuator	Mini-Circuits	VAT-10+	31317-2	Mar. 29, 2015	1 Year
20	Attenuator	MEB	300-affn-03	314	Mar. 29, 2015	1 Year
21	Dual directional coupler	Agilent	777D	50208	Mar. 29, 2015	1 Year

Remark: " N/A" denotes no model name, serial No. or calibration specified.
All calibration period of equipment list is one year.

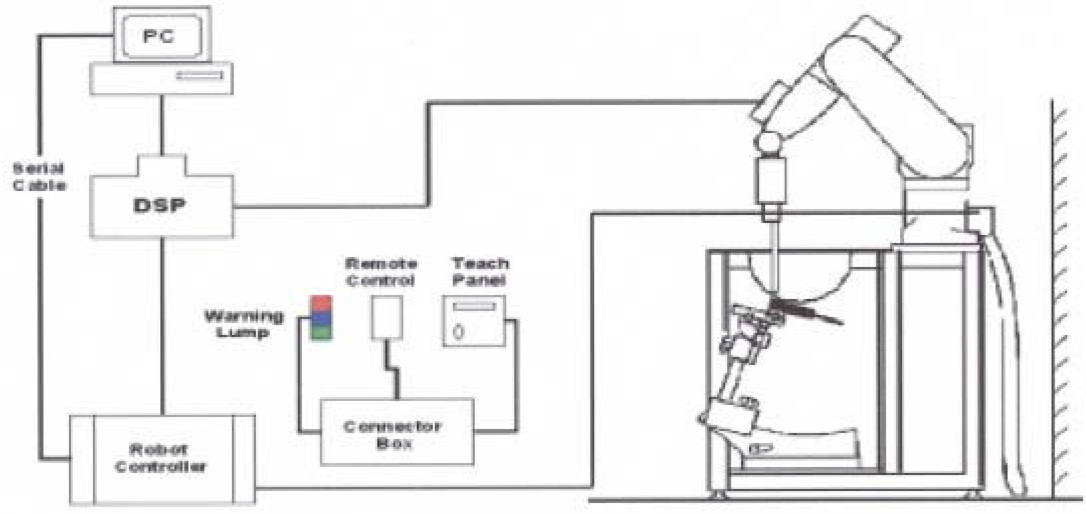
4.SAR MEASUREMENTS SYSTEM CONFIGURATION

4.1SAR 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
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.

4.1.1Test Setup Layout



4.2DASY5E-FIELDPROBESYSTEM

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

4.2.1EX3DV4 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 Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 μW/g to > 100 mW/g Linearity:± 0.2dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.0 mm

EX3DV4 E-field Probe

4.2.2E-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.

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

Where: Δt = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

ΔT = Temperature increase due to RF exposure.

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

Where: σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m3).

4.2.3OTHER 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	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 Height: adjustable feet	
Aailable	Special	

4.2.4SCANNING 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) 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: Δx_{zoom}, $\Delta y_{zoom} \leqslant$ 2GHz -⩽8mm, 2-4GHz -⩽5 mm and 4-6 GHz-⩽4mm; $\Delta z_{zoom} \leqslant$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 (Δx_{area}, Δy_{area})	Maximun Zoom Scan spatial resolution (Δx_{Zoom}, Δy_{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

4.2.5SPATIAL 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, Computermathematik, 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, Computermathematik, 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 compansate boundary effects on E-field probes.

4.2.6DATA STORAGE AND EVALUATION

4.2.6.1Data 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/cm²], [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.

4.2.6.2 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
Body 2450	-	31.4	-	0.1	-	-	68.5	-
Body 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
Body	2450	22.3	1.982	53.270	1.95	52.7	1.64	1.08	Feb. 26, 2016
Body	5200	22.4	5.419	47.810	5.30	49.0	2.25	-2.43	Feb. 27, 2016
Body	5800	22.5	6.109	46.870	6.00	48.2	1.82	-2.76	Feb. 27, 2016

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

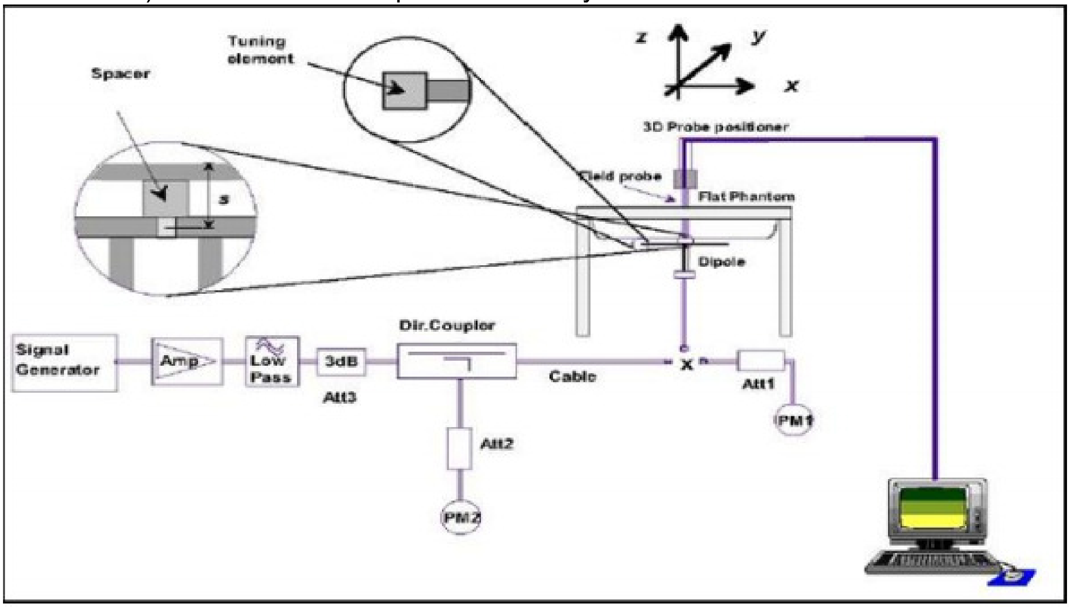
The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands 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
Body	Feb. 26, 2016	2450	51.10	12.28	49.12	-3.87	919
Body	Feb. 27, 2016	5200	77.80	8.03	80.30	3.21	1160
Body	Feb. 27, 2016	5800	78.30	7.57	75.70	-3.32	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 5GHz) or 100mW(above 5GHz). 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.



6.SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

6.1SAR MEASUREMENT VARIABILITY

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r04, 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.

6.2SAR MEASUREMENT UNCERTAINTY

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04,when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis is not required.

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.

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.

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.

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

SAR test reduction and exclusion guidance

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

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

The test exclusions are applicable only when the minimum test separation distance is ≤50mm and for transmission frequencies between 100MHz and 6GHz. When the minimum test separation distance is<5mm, a distance of 5mm according to 5) in section 4.1 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:

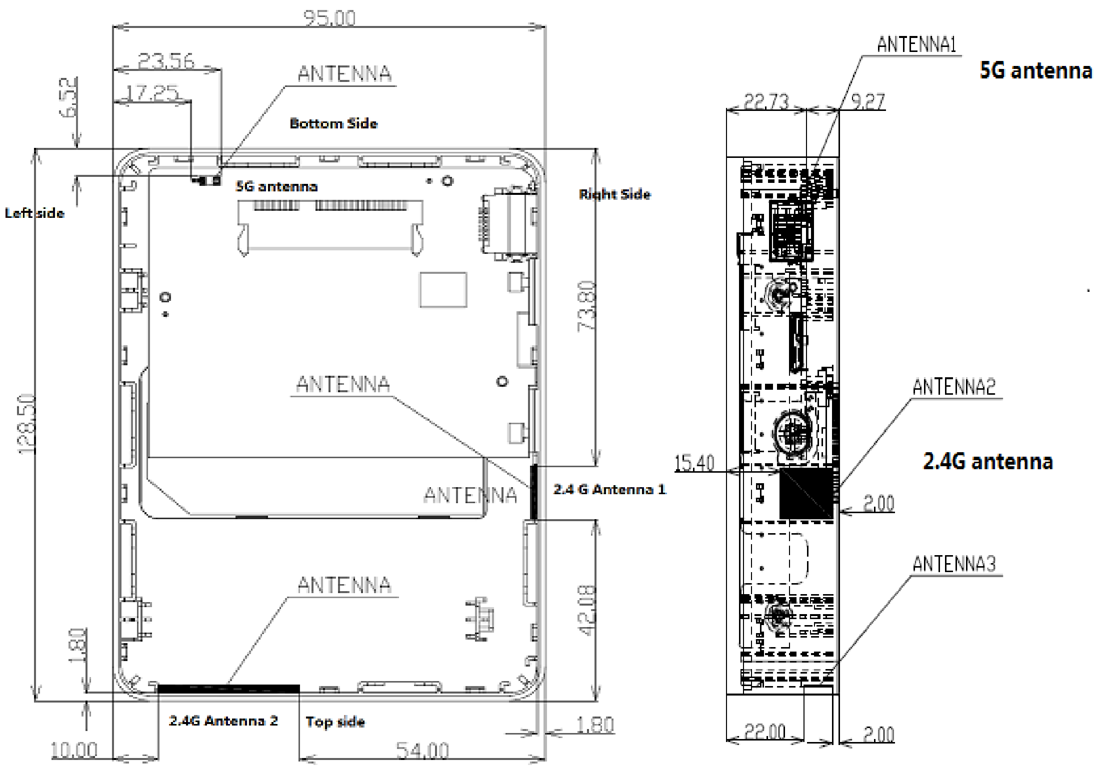
a) at 100 MHz to1500 MHz

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

b) at >1500MHz and ≤6GHz

[Power allowed at numeric Threshold at 50 mm in step 1) + (test separation distance - 50 mm) ·10] mW

The location of the antenna inside EUT is as below.



The test exclusion result of 2.4G

The distance <50mm

Band	Frequency	Turn-UP(dBm)	Turn-UP (mW)	Position	Rear Face	Front Face	Top Side	Right Side	Left Side
				Antenna -to -edge distance(mm)	22	5	5	5	10
2.4G	2462	14.5	28.18	Exclusion considerations	2.01	8.84	8.84	8.84	4.42
				Test requirements(Yes/No)	No	Yes	Yes	Yes	Yes

The distance >50mm

Band	Frequency	Turn-UP(dBm)	Turn-UP(mW)	Position	Bottom Side
				Antenna -to -edge distance(mm)	73.80
2.4G	2462	14.5	28.18	Exclusion considerations(mW)	333.60
				Test requirements(Yes/No)	No

The Test Position

Mode	Rear Side	Left Side	Right Side	Top Side	Front Side	Bottom Side
2.4G WiFi	No	Yes	Yes	Yes	Yes	No

The test exclusion result of 5.8G

The distance <50mm

Band	Frequency	Turn-UP(dBm)	Turn-UP(mW)	Position	Rear Face	Front Face	Bottom Side	Left Side
				Antenna -to -edge distance(mm)	22.73	9.27	6.52	17.25
5.8G	5825	14.5	28.18	Exclusion considerations	2.99	7.34	10.43	3.94
				Test requirements(Yes/No)	No	Yes	Yes	Yes

The distance >50mm

Band	Frequency	Turn-UP(dBm)	Turn-UP (mW)	Position	Top Side	Right Side
				Antenna -to -edge distance(mm)	121.98	71.44
5.8G	5825	14.5	28.18	Exclusion considerations(mW)	781.95	276.55
				Test requirements(Yes/No)	No	No

The Test Position

Mode	Rear Side	Left Side	Right Side	Top Side	Front Side	Bottom Side
5.8G WiFi	No	Yes	No	No	Yes	Yes

8. POWER TEST RESULT

8.1 CONDUCTED POWER MEASUREMENTS OF WiFi 2.4G

Mode	802.11b ANT1+ANT2			
Channel	Tune-up	1	6	11
Frequency		2412	2437	2462
1M	14.5	13.99	13.94	13.89
Power Setting	x	03/06	02/06	00/06

Mode	802.11g ANT1+ANT2			
Channel	Tune-up	1	6	11
Frequency		2412	2437	2462
6M	**14**	13.90	13.78	13.96
Power Setting	x	01/05	00/05	00/06

Mode	802.11n HT20 ANT1+ANT2				802.11n HT40 ANT1+ANT2			
Channel	Tune-up	1	6	11	Tune-up	3	6	9
Frequency		2412	2437	2462		2422	2437	2452
MCS8	14	13.94	13.81	13.93	14	13.86	13.74	13.96
Power Setting	x	02/06	01/06	00/07	x	05/09	04/09	04/0A

Note:

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

2) Per KDB248227, for WiFi 2.4GHz, 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

8.2 CONDUCTED POWER MEASUREMENTS OF WiFi 5G

Mode		802.11a					802.11a				
Channel	Tune-up	36	40	44	48	Tune-up	149	153	157	161	165
Frequency		5180	5260	5320	5500		5745	5765	5785	5805	5825
6M	14.50	14.23	14.14	14.16	14.18	14.50	14.28	14.13	14.03	14.05	14.24
Power Setting	X	16	18	19	0B	X	11	13	15	17	0A

Mode		802.11n HT20					802.11n HT20				
Channel	Tune-up	36	40	44	48	Tune-up	149	153	157	161	165
Frequency		5180	5260	5320	5500		5745	5765	5785	5805	5825
MC S0	14.50	14.18	14.12	14.04	14.26	14.50	13.85	13.92	13.93	14.04	14.25
Power Setting	x	11	13	14	0D	x	0A	09	09	11	0B

Mode		802.11n HT40			802.11n HT40	
Channel	Tune-up	38	46	Tune-up	151	159
Frequency		5190	5230		5755	5795
MC S0	14.50	13.69	13.46	14.50	13.70	13.28
Power Setting	x	19	15	x	0B	0F

Mode		802.11ac VH20					802.11ac VH20				
Channel	Tune-up	36	40	44	48	Tune-up	56	60	64	100	104
Frequency		5180	5260	5320	5500		5700	5300	5320	5500	5520
MC S0	14.50	14.21	14.12	14.17	14.22	14.50	14.28	14.15	14.03	13.98	13.94
Power Setting	x	16	0B	14	10	x	0E	0D	0F	09	10

Mode		802.11ac VH40			802.11ac VH40	
Channel	Tune-up	38	46	Tune-up	151	159
Frequency		5190	5230		5755	5795
MC S0	14.00	13.69	13.64	14.00	13.40	13.36
Power Setting	x	14	0C	x	0B	09

Mode		802.11ac VH80	802.11ac VH80	
Channel	Tune-up	38	Tune-up	151
Frequency		5190		5755
MC S0	13.00	12.39	13.00	12.46
Power Setting	x	10	x	0D

9. SAR TEST RESULTS

General Notes:

1) Per KDB447498 D01v06, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demonstrate compliant.
2) Per KDB447498 D01v06, 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 D01v01r04,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 D02v01r02, 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 Section 7.1 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. Other transmission modes were not investigated since the highest reported SAR for initial test configuration adjusted by the ratio of maximum output powers is less than1.2W/kg. See Section 7.1 for more information.

9.1 SAR MEASUREMENT RESULT

SAR test results of WIFI

Test No.	Band	CH	Test Position	Separation Distance(cm)	Tune up	Measured	Drift(dB)	Peak SAR of Area Scan(W/kg) 1-g	SAR Value (W/kg)1-g	Reported SAR
T01	802.11b	1	Front Face	0.5	14.5	13.99	0.04	0.046	-	-
T03	802.11b	1	Left Side	0.5	14.5	13.99	0.01	0.028	-	-
T04	802.11b	1	Right Side	0.5	14.5	13.99	0.07	0.000	-	-
T06	802.11b	1	Top Side	0.5	14.5	13.99	-0.02	0.059	**0.057**	0.065
T07	802.11a	36	Front Face	0.5	14.5	14.23	-0.01	0.242	**0.220**	0.234
T09	802.11a	36	Left Side	0.5	14.5	14.23	0.04	0.099	-	-
T12	802.11a	36	Bottom Side	0.5	14.5	14.23	-0.05	0.121	-	-
T13	802.11a	149	Front Face	0.5	14.5	14.28	0.01	0.148	**0.137**	0.144
T15	802.11a	149	Left Side	0.5	14.5	14.28	-0.02	0.089	-	-
T18	802.11a	149	Bottom Side	0.5	14.5	14.28	0.09	0.084	-	-

Note:

1) The value with boldface is the maximum SAR Value of each test band.

2) The 2.4G adjusted SAR: 0.065 x (25.12mW/28.18mW)=0.058＜1.2 W/kg, the OFDM is not to test.
The 5G adjusted SAR: 0.234 x (26.49mW/28.18mW)=0.220＜1.2 W/kg, other transmission modes are not to test.

10. SIMULTANEOUS TRANSMISSION CONDITIONS

2.4G WiFi and 5G WiFi can transmit simultaneously.

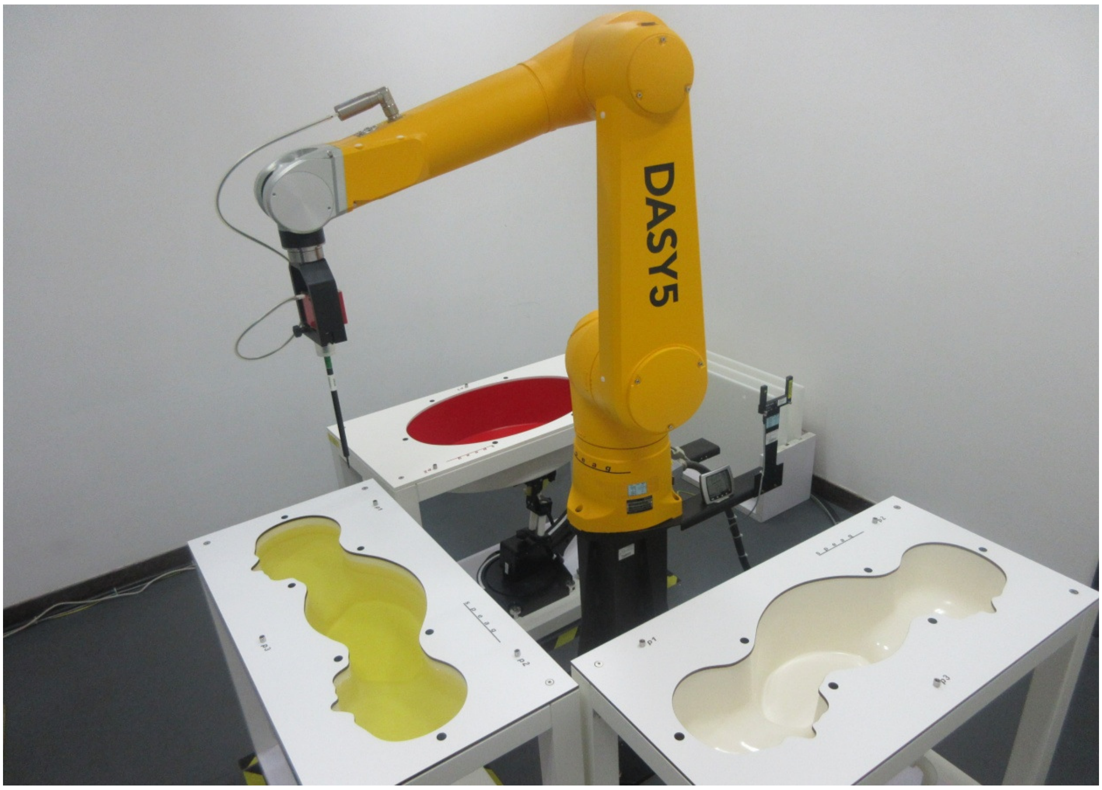
Test Position	2.4G WiFi SAR Max.(W/Kg)	5G WiFi SAR Max.(W/Kg)	∑1-gSARMAX.(W/Kg) 2.4G WiFi&5G WiFi
Body SAR	0.065	0.234	0.299

Simultaneous Transmission SAR evaluation is not required for 2.4G WiFi and 5G WiFi, because the sum of 1g SAR Max is 0.299W/Kg<1.6W/Kg for 2.4G WiFi and 5G WiFi.

APPENDIX

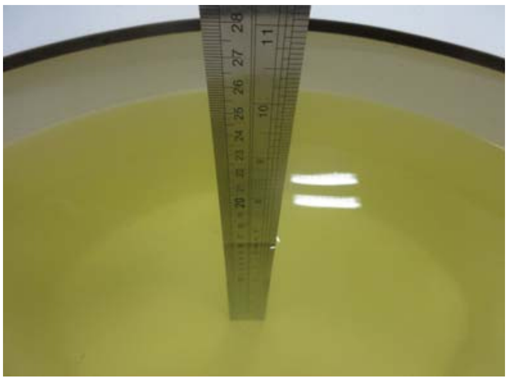
1. Test Layout

Specific Absorption Rate Test Layout

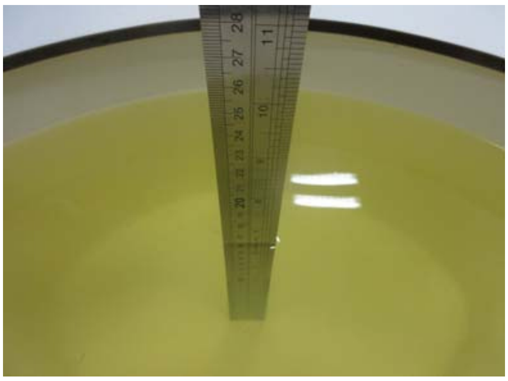


Liquid depth in the flat Phantom (≥15cm depth)

Body(24500MHz)



Body(5G-6G)



Appendix A. SAR Plots of System Verification

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

Appendix B. SAR Plots of SAR Measurement

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

Appendix C. Calibration Certificate for Probe and Dipole

The SPEAG calibration certificates are shown as follows.

Appendix D. Photographs of the Test Set-Up

Photo 1: Front Face_5mm	Photo 2: Top Side_5mm

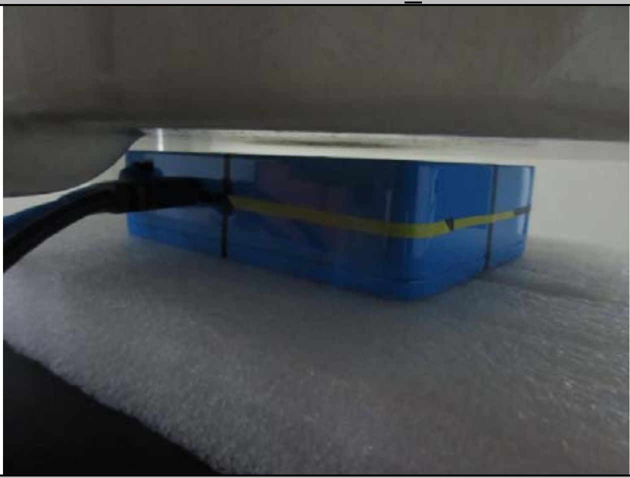
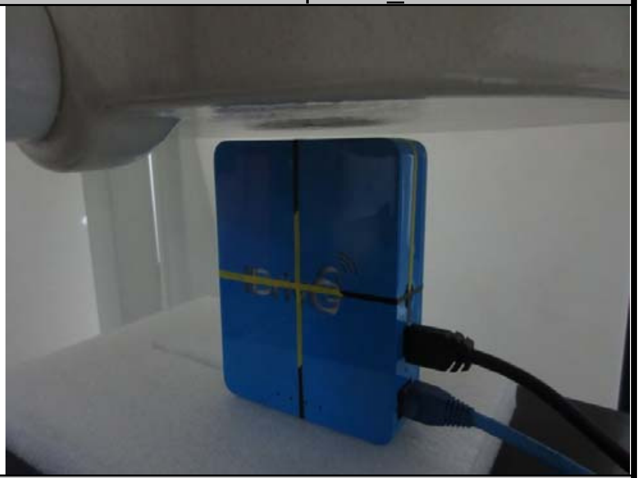

	

Photo 3: Left Side_5mm	Photo 4: Bottom Side_5mm

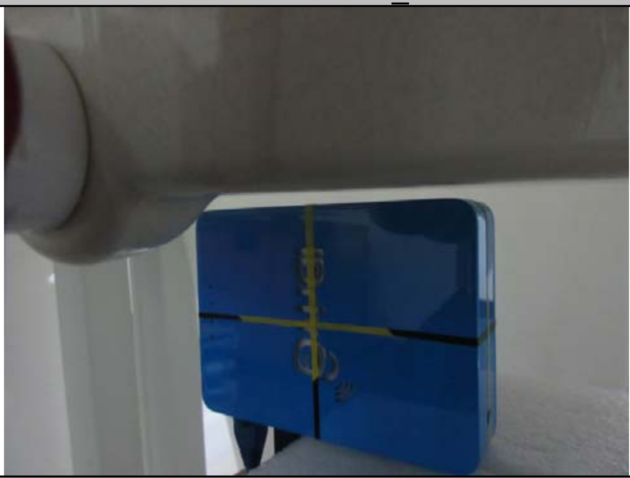
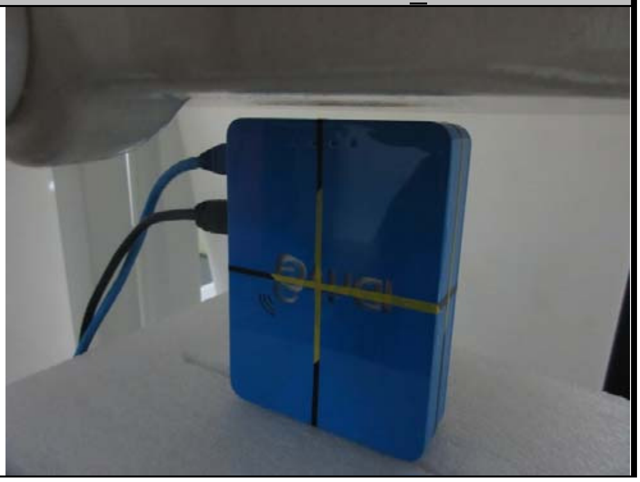

	

Photo 5: Right Side_5mm