ANSI/IEEE Std. C95.1-1992

in accordance with the requirements of
FCC Report and Order: ET Docket 93-62

FCC TEST REPORT

For

Notebook Computer

Trade Name: TOSHIBA

Model: Satellite S5*******-C******;**
Satellite E5*******-C******; Satellite L5*********-C******;**
Satellite P5*******-C******; Satellite Radius L5*********-C******;**
Satellite Radius P5*******-C******;Satellite Fusion L5*********-C********
(* means 0-9; a-z; A-Z; / ; - ; no symbol, or blank for marketing purpose)

Issued to

Pegatron Corporation
5F, NO. 76, LIGONG ST., BEITOU DISTRICT, TAIPEI CITY 112, TAIWAN (R.O.C.)

Issued by

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Testing Laboratory 1309

Issued Date: 2015/02/09

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	2015/02/09	Initial Issue	ALL	Tony Liao
01	2015/03/20	1. Add note for simultaneous transmission. 2. Revise Bluetooth power. 3. Revise note to explanation Spot check.	18, 34, 35	Tony Liao
02	2015/03/28	1. Add channel 12 and 13 average Power of 2.4GHz band	30	Tony Liao
03	2015/03/31	1. Revise frequency range of 2.4GHz	17	Tony Liao

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1 Certificate of Compliance (SAR Evaluation)

Applicant:	Pegatron Corporation 5F, NO. 76, LIGONG ST., BEITOU DISTRICT, TAIPEI CITY 112, TAIWAN (R.O.C.)
Equipment Under Test:	Notebook Computer
Trade Name:	TOSHIBA
Model Number:	Satellite S5*********-C******; Satellite E5*********-C******; Satellite L5*********-C******; Satellite P5*********-C******; Satellite Radius L5*********-C******; Satellite Radius P5*********-C******;Satellite Fusion L5*********-C****** (* means 0-9; a-z; A-Z; / ; - ; no symbol, or blank for marketing purpose)
Date of Test:	February 04, 2015
Device Category:	PORTABLE DEVICES
Exposure Category:	GENERAL POPULATION/UNCONTROLLED EXPOSURE

Applicable Standards	
FCC	● KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03 ● KDB 447498 D01 General RF Exposure Guidance v05r02 ● KDB 616217 D04 SAR for laptop and tablets v01r01 ● KDB 248227 D01 SAR measurement for 802 11 a b g v01r02
Limit	
1.6W/kg	
Test Result	
Pass	

The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Alex Wu
Section Manager
Compliance Certification Services Inc.

Tested by:

Tony Liao
SAR Engineer
Compliance Certification Services Inc.

2 Description of Equipment Under Test

Product	Notebook Computer		
Trade Name	TOSHIBA		
Model Number	Satellite S5*********-C******; Satellite E5*********-C******; Satellite L5*********-C******; Satellite P5*********-C******; Satellite Radius L5*********-C******; Satellite Radius P5*********-C******; Satellite Fusion L5*********-C****** (* means 0-9; a-z; A-Z; / ; - ; no symbol, or blank for marketing purpose)		
RF Module	Intel	Model:	3160NGW
Transmitters	Wi-Fi & Bluetooth		
Modulation Technique	Bluetooth:GFSK for 1Mbps;π/4-DQPSK for 2Mbps;8DPSK for 3Mbps		
	802.11a: Orthogonal Frequency Division Multiplexing (OFDM)		
	802.11b: Direct Sequence Spread Spectrum(DSSS)		
	802.11g: Orthogonal Frequency Division Multiplexing (OFDM)		
	802.11n: Orthogonal Frequency Division Multiplexing (OFDM)		
	802.11ac: Orthogonal Frequency Division Multiplexing (OFDM)		
Antenna Specification	Ant 1	Brand name	Yageo
		Parts Number	ANTA0TP09551WLAN4
			ANTA0TP09551WLAN3
		Type	PIFA
	Ant 2	Brand name	ACON
		Parts Number	APP6Y-700301
			APP6Y-700302
		Type	PIFA
Rechargeable Li-polymer Battery–alternate	Brand :TOSHIBA Model: PA5208U-1BRS Rating 10.8Vdc, 45Wh, 3860mAh		

Remark:

1. The sample selected for test was prototype that approximated to production product and was provided by manufacturer
2. The platform have Notebook mode, Stand mode, Tablet mode and Tent mode. But antennas are upper in the displays section of a laptop computer, we Performed SAR test in tablet mode, because the EUT can fold 360 degrees.

3 Requirements for Compliance Testing Defined

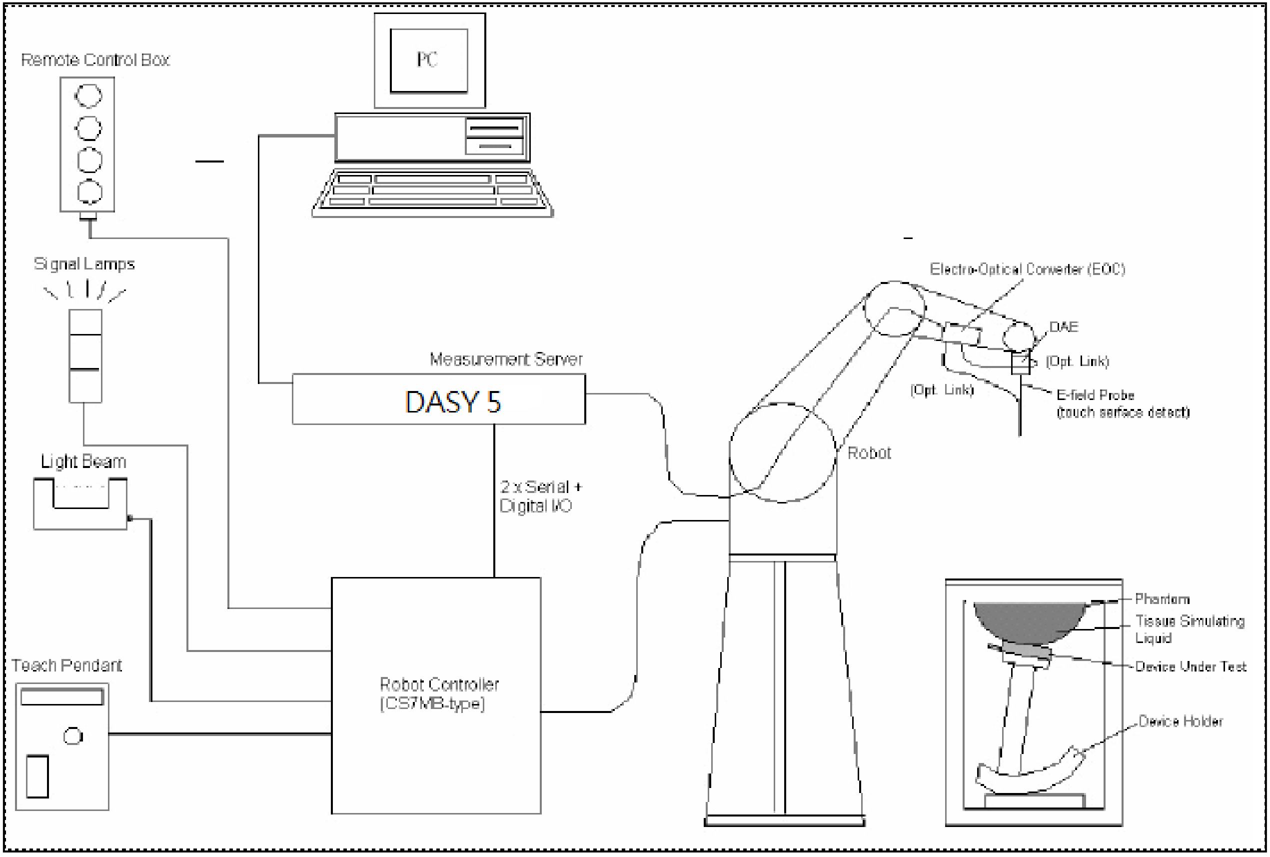
3.1 Requirements for Compliance Testing Defined by the FCC

The US Federal Communications Commission has released the report and order “Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996 [1]. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 W/kg for an uncontrolled environment and 8.0 mW/g for an occupational/controlled environment as recommended by the ANSI/IEEE standard C95.1-1992 [6].

4 Dosimetric Assessment System

These measurements were performed with the automated near-field scanning system DASY4/DAST5 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9 m) which positions the probes with a positional repeatability of better than ± 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the dosimetric probe EX3DV4-SN: 3665 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure with accuracy of better than ±10%. The spherical isotropy was evaluated with the procedure and found to be better than ±0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEEE 1528 2003.

4.1 Measurement System Diagram



The DASY4/DASY5 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (St¨aubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- 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.
- A data acquisition electronics (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.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY4/DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

4.2 System Components

DASY4/DASY5 Measurement Server

The DASY4/DASY5 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE3 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4/DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.

The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE4) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE4 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements

Construction: Symmetrical design with triangular core
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration: Basic Broad Band Calibration in air: 10-3000 MHz.
Conversion Factors (CF) for HSL 900 and HSL 1800
CF-Calibration for other liquids and frequencies upon request.

Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity: ± 0.3 dB in HSL (rotation around probe axis)
± 0.5 dB in HSL (rotation normal to probe axis)

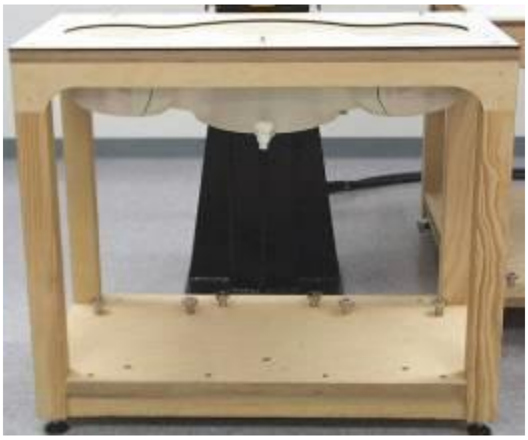
Dynamic Range: 10 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
(noise: typically < 1 µW/g)

Dimensions: Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 2.5 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 1 mm

Application: High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.

Interior of probe

SAM Phantom (V4.0)



Construction: The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-2003, CENELEC 50361 and IEC 62209. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.

Shell Thickness: 2 ±0.2 mm

Filling Volume: Approx. 25 liters

Dimensions: Height: 810mm; Length: 1000mm; Width: 500mm

SAM Phantom (ELI4)

Construction: Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 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 supported by software version DASY4/DASY5 and higher and is compatible with all SPEAG dosimetric probes and dipoles

Shell Thickness: 2.0 ± 0.2 mm (sagging: <1%)

Filling Volume: Approx. 25 liters

Dimensions: Major ellipse axis: 600 mm

Minor axis: 400 mm 500mm

Device Holder for SAM Twin Phantom

Construction: In combination with the Twin SAM Phantom V4.0 or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom).

System Validation Kits for SAM Phantom (V4.0)

Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 2450, 5200, 5300, 5600, 5800 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions: D2450V2: dipole length: 51.5 mm; overall height: 290 mm
D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm

System Validation Kits for ELI4 phantom

Construction: Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 2450, 5200, 5300, 5600, 5800 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Dimensions: D2450V2: dipole length: 51.5 mm; overall height: 290 mm
D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm

5 Evaluation Procedures

Data Evaluation

The DASY4/DASY5 post processing software (SEMCAD) 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	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or be imported into the software from the configuration files issued for the DASY 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:

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

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:

$$E_i = \sqrt{\frac{V_i}{Norm_i \bullet ConvF}}$$

H-field probes:

$$H_i = \sqrt{Vi} \cdot \frac{a_{i10} + a_{i11} f + a_{i12} f^2}{f}$$

with	V_i	= Compensated signal of channel i	(i = x, y, z)
	$Norm_i$	= Sensor sensitivity of channel i	(i = x, y, z)

$\mu V/(V/m)^2$ for E0field Probes

ConvF	= Sensitivity enhancement in solution
aij	= Sensor sensitivity factors for H-field probes
f	= Carrier frequency (GHz)
Ei	= Electric field strength of channel i in V/m
Hi	= Magnetic field strength of channel i in A/m

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

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

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

with *SAR* = local specific absorption rate in W/kg

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

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

ρ = 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 as a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{377} \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with P_{pwe} = Equivalent power density of a plane wave in mW/cm^2

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

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

6 SAR Measurement Procedures

6.1 Normal SAR Test Procedure

- **Power Reference Measurement**

The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

- **Area Scan**

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a finer measurement around the hot spot. The sophisticated interpolation routines implemented in DASY4/DASY5 software can find the maximum locations even in relatively coarse grids. The scan area is defined by an editable grid. This grid is anchored at the grid reference point of the selected section in the phantom. When the area scan's property sheet is brought-up, the grid resolution has to less than 15 mm by 15 mm at frequency ≤2GHz; the grid resolution has to less than 12mm by 12 mm at frequency between 2GHz to 4GHz; grid resolution has to less than 10 mm by 10 mm at frequency between 4GHz to 6GHz.

According to KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01

<table>
<tr><th></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td>Maximum probe abgle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.</td></tr>
</table>

- **Zoom Scan**

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default zoom scan measures points in accordance with the frequency can be divided into three parts. (1)The zoom scan volume was set to 5x5x7 points at frequency ≤ 2GHz. (2) The zoom scan volume was set to 7x7x7 points at frequency between 2GHz to 4GHz (3) The zoom scan volume was set to 7x7x12 points at frequency between 4GHz to 6GHz. The measures points within a cube whose base faces are centered around the maximum found in a preceding area scan job within the same procedure. If the preceding Area Scan job indicates more then one maximum, the number of Zoom Scans has to be enlarged accordingly.

According to KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm</td><td>3 – 4 GHz: ≤ 5 mm
4 – 6 GHz: ≤ 4 mm</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">Uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$:between 1st two points losest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Maximum zoom scan volume</td><td>x, y, z</td><td>≥ 30 mm</td><td colspan="2">3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
</table>

- **Power Drift Measurement**

The drift job measures the field at the same location as the most recent reference job within the same procedure, and with the same settings. The drift measurement gives the field difference in dB from the reading conducted within the last reference measurement. Several drift measurements are possible for one reference measurement. This allows a user to monitor the power drift of the device under test within a batch process. In the properties of the Drift job, the user can specify a limit for the drift and have DASY4/DASY5 software stop the measurements if this limit is exceeded.

- **Z-Scan**

The Z Scan job measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. A user can anchor the grid to the current probe location. As with any other grids, the local Z-axis of the anchor location establishes the Z-axis of the grid.

7 Device Under Test

7.1 Band Interface

Tx Frequency Bands	• 802.11 a/b/g/n/ac: 2412 - 2472 MHz 5180 - 5825 MHz • Bluetooth: 2402 - 2480 MHz
Mode	• 802.11 a/b/g/n HT20/HT40/ac • Bluetooth 2.1 • Bluetooth 4.0 LE

7.2 Simultaneous Transmission

No.	Conditions	Body SAR	Hotspot
1	Wi-Fi 2.4GHz_Main Ant + Bluetooth	☑	☒
2	Wi-Fi 5GHz_ Main Ant + Bluetooth	☑	☒

☑: The Product can simultaneously transmit

☒: The Product can’t simultaneously transmit

Note: WLAN operates on the Main Antenna and Bluetooth operates on Aux Antenna.

8 Summary of SAR Test Exclusion Configurations

8.1 Standalone SAR Test Exclusion Calculations

Since the Dedicated Host Approach is applied, the standalone SAR test exclusion procedure in KDB 447498 section4.3.1 is applied in conjunction with KDB 616217 section 4.3 to determine the minimum test separation distance:

1. According to KDB 447498 Section 4.1 5) if the antenna is at close proximity to user then the outer surface of the DUT should be treated as the radiating surface. The test separation distance is then determined by the smallest distance between the outer surface of the device and the user. For the purposes of this report close proximity has been defined as closer than 50 mm. For antennas <50 mm from the rear or edge the separation distance used for the estimated SAR calculations is 0 mm.
2. When the minimum test separation distance is < 5mm, a distance of 5mm is applied to determine SAR test exclusion.
3. When the separation distance from the antenna to an adjacent edge is > 5 mm, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion.
4. If the antenna to DUT adjacent edge or bottom separation distance >50mm the actual antenna to user separation distance is used to determine SAR exclusion and estimated SAR value.

Refer to Appendix for the specific details on the antenna-to-antenna and antenna-to-edge distances used for test exclusion calculations.

8.1.1 SAR Exclusion Calculations for Wi-Fi Antenna < 50mm from the User

According to KDB 447498 v05 r02 in section 4.3.1, if the calculated threshold value is > 3 then SAR testing is required.

Tablet Mode

Antenna	Band	Mode	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
				dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
Wi-Fi Main	2.4GHz	802.11b	2412	15	32	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.0	>50mm
	2.4GHz	802.11g	2412	15	32	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.0	>50mm
	2.4GHz	802.11n HT20	2412	15	32	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.0	>50mm
	2.4GHz	802.11n HT40	2442	15	32	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.1	>50mm
	5.2GHz	802.11a	5180	13.5	22	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.1	>50mm
	5.3GHz		5260	13.5	22	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.2	>50mm
	5.5GHz		5500	13.5	22	19.15	233.3	190.3	5.5	163.7	2.7	>200mm	>50mm	9.4	>50mm
	5.8GHz		5745	13.5	22	19.15	233.3	190.3	5.5	163.7	2.8	>200mm	>50mm	9.6	>50mm
	5.2GHz	802.11n HT20	5180	13.5	22	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.1	>50mm
	5.3GHz		5260	13.5	22	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.2	>50mm
	5.5GHz		5500	13.5	22	19.15	233.3	190.3	5.5	163.7	2.7	>200mm	>50mm	9.4	>50mm
	5.8GHz		5745	13.5	22	19.15	233.3	190.3	5.5	163.7	2.8	>200mm	>50mm	9.6	>50mm
	5.2GHz	802.11n HT40	5190	13.5	22	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.1	>50mm
	5.3GHz		5270	13.5	22	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.2	>50mm
	5.5GHz		5510	13.5	22	19.15	233.3	190.3	5.5	163.7	2.7	>200mm	>50mm	9.4	>50mm
	5.8GHz		5755	13.5	22	19.15	233.3	190.3	5.5	163.7	2.8	>200mm	>50mm	9.6	>50mm
	5.2GHz	802.11 ac	5210	13.5	22	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.1	>50mm
	5.3GHz		5290	13.5	22	19.15	233.3	190.3	5.5	163.7	2.6	>200mm	>50mm	9.2	>50mm
	5.5GHz		5530	13.5	22	19.15	233.3	190.3	5.5	163.7	2.7	>200mm	>50mm	9.4	>50mm
	5.8GHz		5775	13.5	22	19.15	233.3	190.3	5.5	163.7	2.8	>200mm	>50mm	9.6	>50mm
Wi-Fi Aux	Bluetooth	DH5	2402	5	3	19.15	233.3	72.5	5.5	282.5	0.2	>200mm	>50mm	0.8	>50mm

8.1.2 SAR Exclusion Calculations for Wi-Fi Antenna > 50mm from the User

Tablet Mode

Antenna	Band	Mode	Frequency (MHz)	Output Power		Separation Distances(mm)					Calculated Threshold Value				
				dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
Wi-Fi Main	2.4GHz	802.11b	2412	15	32	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1499.6	<50mm	1233.6
	2.4GHz	802.11g	2412	15	32	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1499.6	<50mm	1233.6
	2.4GHz	802.11n HT20	2412	15	32	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1499.6	<50mm	1233.6
	2.4GHz	802.11n HT40	2442	15	32	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1499.0	<50mm	1233.0
	5.2GHz	802.11a	5180	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1468.9	<50mm	1202.9
	5.3GHz		5260	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1468.4	<50mm	1202.4
	5.5GHz		5500	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1467.0	<50mm	1201.0
	5.8GHz		5745	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1465.6	<50mm	1199.6
	5.2GHz	802.11n HT20	5180	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1468.9	<50mm	1202.9
	5.3GHz		5260	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1468.4	<50mm	1202.4
	5.5GHz		5500	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1467.0	<50mm	1201.0
	5.8GHz		5745	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1465.6	<50mm	1199.6
	5.2GHz	802.11n HT40	5190	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1468.8	<50mm	1202.8
	5.3GHz		5270	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1468.3	<50mm	1202.3
	5.5GHz		5510	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1466.9	<50mm	1200.9
	5.8GHz		5755	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1465.5	<50mm	1199.5
	5.2GHz	802.11 ac	5210	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1468.7	<50mm	1202.7
	5.3GHz		5290	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1468.2	<50mm	1202.2
	5.5GHz		5530	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1466.8	<50mm	1200.8
	5.8GHz		5775	13.5	22	19.15	233.3	190.3	5.5	163.7	<50mm	>200mm	1465.4	<50mm	1199.4
Wi-Fi Aux	Bluetooth	DH5	2402	5.0	3	19.15	233.3	72.5	5.5	282.5	<50mm	>200mm	321.8	<50mm	>200mm

Note(s):

1. According to KDB 447498 v05 r02, if the calculated Power threshold is less than the output power of DUT, the SAR testing is required.

8.1.3 For Wi-Fi & Bluetooth

Test Configurations	Rear	Edge1	Edge2	Edge3	Edge4
Wi-Fi Main 802.11 b	No	No	No	YES	No
Wi-Fi Main 802.11 g	No	No	No	YES	No
Wi-Fi Main 802.11 n HT20	No	No	No	YES	No
Wi-Fi Main 802.11 n HT40	No	No	No	YES	No
Wi-Fi Main 802.11 a_5.2GHz	No	No	No	YES	No
Wi-Fi Main 802.11 a_5.3GHz	No	No	No	YES	No
Wi-Fi Main 802.11 a_5.5GHz	No	No	No	YES	No
Wi-Fi Main 802.11 a_5.8GHz	No	No	No	YES	No
Wi-Fi Main 802.11 n HT20_5.2GHz	No	No	No	YES	No
Wi-Fi Main 802.11 n HT20_5.3GHz	No	No	No	YES	No
Wi-Fi Main 802.11 n HT20_5.5GHz	No	No	No	YES	No
Wi-Fi Main 802.11 n HT20_5.8GHz	No	No	No	YES	No
Wi-Fi Main 802.11 n HT40_5.2GHz	No	No	No	YES	No
Wi-Fi Main 802.11 n HT40_5.3GHz	No	No	No	YES	No
Wi-Fi Main 802.11 n HT40_5.5GHz	No	No	No	YES	No
Wi-Fi Main 802.11 n HT40_5.8GHz	No	No	No	YES	No
Wi-Fi Main 802.11 ac_5.2GHz	No	No	No	YES	No
Wi-Fi Main 802.11 ac_5.3GHz	No	No	No	YES	No
Wi-Fi Main 802.11 ac_5.5GHz	No	No	No	YES	No
Wi-Fi Main 802.11 ac_5.8GHz	No	No	No	YES	No
Bluetooth Aux	No	No	No	No	No

Note(s):

1. Yes = SAR is required.
2. No = SAR is not required.

9 Measurement uncertainty

Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram

Uncertainty Component	Uncertainty	Prob.	Div.	$c_{i\ (10g)}$	Std. Unc.(1-g)	v_i or V_{eff}
Measurement System						
Probe Calibration (k=1)	6.00	Normal	1	1	6.00	∞
Probe Isotropy	7.60	Rectangular	$\sqrt{3}$	0.7	3.07	∞
Boundary Effect	0.65	Rectangular	$\sqrt{3}$	1	0.38	∞
Linearity	4.70	Rectangular	$\sqrt{3}$	1	2.71	∞
Modulation Response	2.40	Rectangular	$\sqrt{3}$	1	1.40	∞
System Detection Limit	1.00	Rectangular	$\sqrt{3}$	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	$\sqrt{3}$	1	0.46	∞
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1.50	∞
RF Ambient Conditions	3.00	Rectangular	$\sqrt{3}$	1	1.73	∞
RF Ambient Reflections	3.00	Rectangular	$\sqrt{3}$	1	1.73	∞
Probe Positioner Mechanical Tolerance	0.40	Rectangular	$\sqrt{3}$	1	0.23	∞
Probe Positioning with respect to Phantom Shell	2.90	Rectangular	$\sqrt{3}$	1	1.67	∞
Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	2.00	Rectangular	$\sqrt{3}$	1	1.15	∞
Test sample Related						
Test sample Positioning	3.70	Normal	1	1	3.7	89
Device Holder Uncertainty	3.40	Normal	1	1	3.4	5
Output Power Variation - SAR drift measurement	5.00	Rectangular	$\sqrt{3}$	1	2.89	∞
Phantom and Tissue Parameters						
Phantom Uncertainty (shape and thickness tolerances)	7.50	Rectangular	$\sqrt{3}$	1	4.33	∞
Liquid Conductivity - deviation from target values	4.14	Rectangular	$\sqrt{3}$	0.64	1.53	∞
Liquid Conductivity - measurement uncertainty	0.92	Normal	1	0.64	0.59	39
Liquid Permittivity - deviation from target values	3.92	Rectangular	$\sqrt{3}$	0.6	1.36	∞
Liquid Permittivity - measurement uncertainty	1.60	Normal	1	0.6	0.96	39
Temp. Unc. - Conductivity	1.70	Rectangular	$\sqrt{3}$	0.78	0.77	∞
Temp. Unc. - Permittivity	0.30	Rectangular	$\sqrt{3}$	0.23	0.04	∞
		RSS			11.24	611
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =		k=2			22.48%	
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =		k=2			1.76dB	

Measurement uncertainty for 3 to 6 GHz averaged over 1 gram

Uncertainty Component	Uncertainty	Prob.	Div.	$c_{i\ (10g)}$	Std. Unc.(1-g)	v_i or V_{eff}
Measurement System						
Probe Calibration (k=1)	6.55	Normal	1	1	6.55	∞
Probe Isotropy	7.60	Rectangular	$\sqrt{3}$	0.7	3.07	∞
Boundary Effect	2.00	Rectangular	$\sqrt{3}$	1	1.15	∞
Linearity	4.70	Rectangular	$\sqrt{3}$	1	2.71	∞
Modulation Response	2.40	Rectangular	$\sqrt{3}$	1	1.40	∞
System Detection Limit	1.00	Rectangular	$\sqrt{3}$	1	0.58	∞
Readout Electronics	0.30	Normal	1	1	0.30	∞
Response Time	0.80	Rectangular	$\sqrt{3}$	1	0.46	∞
Integration Time	2.60	Rectangular	$\sqrt{3}$	1	1.50	∞
RF Ambient Conditions	3.00	Rectangular	$\sqrt{3}$	1	1.73	∞
RF Ambient Reflections	3.00	Rectangular	$\sqrt{3}$	1	1.73	∞
Probe Positioner Mechanical Tolerance	0.80	Rectangular	$\sqrt{3}$	1	0.46	∞
Probe Positioning with respect to Phantom Shell	6.70	Rectangular	$\sqrt{3}$	1	3.87	∞
Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	4.00	Rectangular	$\sqrt{3}$	1	2.31	∞
Test sample Related						
Test sample Positioning	3.70	Normal	1	1	3.7	89
Device Holder Uncertainty	3.40	Normal	1	1	3.4	5
Output Power Variation - SAR drift measurement	5.00	Rectangular	$\sqrt{3}$	1	2.89	∞
Phantom and Tissue Parameters						
Phantom Uncertainty (shape and thickness tolerances)	7.90	Rectangular	$\sqrt{3}$	1	4.56	∞
Liquid Conductivity - deviation from target values	5.00	Rectangular	$\sqrt{3}$	0.64	1.85	∞
Liquid Conductivity - measurement uncertainty	-0.80	Normal	1	0.64	-0.51	39
Liquid Permittivity - deviation from target values	5.00	Rectangular	$\sqrt{3}$	0.6	1.73	∞
Liquid Permittivity - measurement uncertainty	-1.16	Normal	1	0.6	-0.70	39
Temp. Unc. - Conductivity	1.70	Rectangular	$\sqrt{3}$	0.78	0.77	∞
Temp. Unc. - Permittivity	0.30	Rectangular	$\sqrt{3}$	0.23	0.04	∞
		RSS			12.43	611
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =		k=2			24.86%	
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =		k=2			1.93dB	

10 Exposure Limit

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

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	2.0

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

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

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

Population/Uncontrolled Environments:

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

Occupational/Controlled Environments:

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

NOTE GENERAL POPULATION/UNCONTROLLED EXPOSURE PARTIAL BODY LIMIT 1.6 W/kg

11 Tissue Dielectric Properties

11.1 Test Liquid Confirmation

Simulating Liquids Parameter Check

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameters are within the tolerances of the specified target values

The relative permittivity and conductivity of the tissue material should be within ± 5% of the values given in the table below 5% may not be easily achieved at certain frequencies.

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in IEEE 1528 2003 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in IEEE 1528 2003 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in IEEE 1528 2003

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

11.2 Typical Composition of Ingredients for Liquid Tissue Phantoms

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

alt: 99^{+}% Pure Sodium Chloride   Sugar: 98^{+}% Pure Sucrose
Water: De-ionized, 16 $M\Omega^{+}$ resistivity   HEC: Hydroxy thyl 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

Simulating Liquids for 5 GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	78
Mineral oil	11
Emulsifiers	9
Additives and Salt	2

11.3 Simulating Liquids Parameter Check Results

Date	Band	Freq(MHz)	Measured			Standard		Δ		Limit
			e' (εr)	e''	σ	e' (εr)	σ	e' (εr)	σ	±5
2015/2/4	Body 5000	5180	48.63	18.19	5.23	49.02	5.28	-0.79%	-0.80%	±5
		5200	48.58	18.21	5.26	49.00	5.30	-0.85%	-0.75%	±5
		5220	48.56	18.23	5.29	48.98	5.32	-0.85%	-0.71%	±5
		5240	48.53	18.23	5.31	48.96	5.35	-0.87%	-0.75%	±5
		5260	48.49	18.25	5.33	48.94	5.37	-0.91%	-0.71%	±5
		5280	48.46	18.27	5.36	48.92	5.40	-0.93%	-0.66%	±5
		5300	48.43	18.27	5.38	48.90	5.42	-0.97%	-0.76%	±5
		5320	48.39	18.30	5.41	48.86	5.44	-0.96%	-0.62%	±5
		5500	48.12	18.43	5.63	48.60	5.65	-0.99%	-0.31%	±5
		5520	48.07	18.43	5.65	48.58	5.67	-1.04%	-0.40%	±5
		5540	48.04	18.46	5.68	48.56	5.70	-1.07%	-0.28%	±5
		5560	48.02	18.46	5.70	48.54	5.72	-1.07%	-0.33%	±5
		5580	47.98	18.49	5.73	48.52	5.75	-1.12%	-0.26%	±5
		5600	47.95	18.51	5.76	48.50	5.77	-1.14%	-0.19%	±5
		5620	47.93	18.51	5.78	48.46	5.79	-1.10%	-0.24%	±5
		5640	47.88	18.53	5.81	48.42	5.81	-1.12%	-0.14%	±5
		5660	47.86	18.54	5.83	48.38	5.84	-1.07%	-0.08%	±5
		5680	47.83	18.55	5.85	48.34	5.86	-1.06%	-0.05%	±5
		5700	47.79	18.59	5.89	48.30	5.88	-1.05%	0.10%	±5
		5745	47.72	18.60	5.94	48.26	5.93	-1.10%	0.07%	±5
		5765	47.70	18.62	5.96	48.24	5.96	-1.11%	0.11%	±5
		5785	47.67	18.63	5.99	48.22	5.98	-1.14%	0.10%	±5
		5805	47.63	18.66	6.02	48.19	6.01	-1.16%	0.21%	±5
		5825	47.62	18.68	6.04	48.15	6.03	-1.11%	0.23%	±5
2015/2/4	Body 2450	2412	53.60	14.31	1.92	52.75	1.91	1.60%	0.17%	±5
		2437	53.52	14.41	1.95	52.72	1.94	1.52%	0.71%	±5
		2442	53.51	14.43	1.96	52.71	1.94	1.51%	0.77%	±5
		2462	53.45	14.51	1.99	52.68	1.97	1.46%	0.92%	±5
		2472	53.42	14.55	2.00	52.67	1.98	1.42%	0.89%	±5

12 System Performance Check

The system performance check is performed prior to any usage of the system in order to guarantee reproducible results. The system performance check verifies that the system operates within its specifications. The system performance check results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the SAM twin phantom filled with Body simulating liquid of the following parameters.
- The DASY4/DASY5 system with an E-field probe EX3DV4 SN:3665 was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15 mm (below 1 GHz) and 10 mm (above 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 10mm was aligned with the dipole.
- Special 7x7x7 fine cube was chosen for cube integration (dx=dy= 5 mm, dz= 5 mm).
- Distance between probe sensors and phantom surface was set to 3.0 mm.
- The dipole input power (forward power) was 100 mW±3%.
- The results are normalized to 1 W input power.

Reference SAR Values for System Performance Check

The reference SAR values can be obtained from the calibration certificate of system validation dipoles

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (W/kg)		
				1g/10g	Head	Body
D2450V2	728	2014/5/20	2450	1g	52.6	50.2
				10g	24.5	23.4
D5GHzV2	1004	2014/11/20	5200	1g	80.5	74.7
				10g	22.9	20.7
D5GHzV2	1004	2014/11/20	5300	1g	85.7	77.7
				10g	24.4	21.6
D5GHzV2	1004	2014/11/20	5600	1g	84.1	81.2
				10g	23.9	22.4
D5GHzV2	1004	2014/11/20	5800	1g	80.3	74.2
				10g	22.8	20.3

12.1 System Performance Check Results

Date	System Dipole			Parameters	Target	Measured	Deviation[%]	Limited[%]
	Type	Serial No.	Liquid					
2015/2/4	D2450V2	728	Body	1g SAR:	50.2	48.2	-3.98	± 5
				10g SAR:	23.4	22.4	-4.27	± 5
2015/2/4	D5GHzV2 (5.2GHz)	1004	Body	1g SAR:	74.7	74.6	-0.13	± 5
				10g SAR:	20.7	21.5	3.86	± 5
2015/2/4	D5GHzV2 (5.3GHz)	1004	Body	1g SAR:	77.7	76.8	-1.16	± 5
				10g SAR:	21.6	22.4	3.70	± 5
2015/2/4	D5GHzV2 (5.6GHz)	1004	Body	1g SAR:	81.2	79.0	-2.71	± 5
				10g SAR:	22.4	22.7	1.34	± 5
2015/2/4	D5GHzV2 (5.8GHz)	1004	Body	1g SAR:	74.2	74.1	-0.13	± 5
				10g SAR:	20.3	21.1	3.94	± 5

13 RF Output Power Measurement

13.1 Wi-Fi (2.4 GHz Band)

Required Test Channels per KDB 248227 D01

Mode	Band (GHz)	Freq. (MHz)	Ch #	Default Test Channels	
				802.11b	802.11g
802.11 b/g	2.4	2412	1#	✓	∇
		2437	6	✓	∇
		2462	11#	✓	∇

Notes
✓ = "default test channels"
∇ = possible 802.11g channels with maximum average output ¼ dB the "default test channels"
= when output power is reduced for channel 1 and /or 11 to meet restricted band requirements the highest output channels closest to each of these channels should be tested.

The indicated Wi-Fi target powers in the following table are absolute maximums.

Output power table

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Target Pwr (dBm)	Tune-up Tolerance (dB)	Maximum Tune-up Pwr (dBm)	Avg. Pwr (dBm)
2.4	802.11b	1	1	2412	13.5	±1.5	15.0	14.8
			6	2437	13.5	±1.5	15.0	15.0
			11	2462	13.5	±1.5	15.0	14.9
			12	2467	13.5	±1.5	15.0	14.5
			13	2472	9.5	±1.5	11.0	10.8
	802.11g	6	1	2412	13.5	±1.5	15.0	14.8
			6	2437	13.5	±1.5	15.0	15.0
			11	2462	13.5	±1.5	15.0	14.9
			12	2467	12.5	±1.5	14.0	13.7
			13	2472	1.5	±1.5	3.0	1.7
	802.11n HT20	MCS0	1	2412	13.5	±1.5	15.0	14.9
			6	2437	13.5	±1.5	15.0	14.9
			11	2462	13.5	±1.5	15.0	14.8
			12	2467	12.5	±1.5	14.0	13.3
			13	2472	1.5	±1.5	3.0	1.3
	802.11n HT40	MCS0	3	2422	13.5	±1.5	15.0	14.9
			6	2437	13.5	±1.5	15.0	14.8
			9	2452	13.5	±1.5	15.0	14.8
			10	2457	12.5	±1.5	14.0	13.9
			11	2462	1.5	±1.5	3.0	1.6

13.2 Wi-Fi (5 GHz Band)

Wi-Fi 5.2GHz Band:

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Target Pwr (dBm)	Tune-up Tolerance (dB)	Maximum Tune-up Pwr (dBm)	Avg. Pwr (dBm)
5.2	802.11a	6	36	5180	12.0	±1.5	13.5	13.3
			40	5200	12.0	±1.5	13.5	13.4
			44	5220	12.0	±1.5	13.5	13.5
			48	5240	12.0	±1.5	13.5	13.5
	802.11n (HT20)	MCS0	36	5180	12.0	±1.5	13.5	13.4
			40	5200	12.0	±1.5	13.5	13.4
			44	5220	12.0	±1.5	13.5	13.3
			48	5240	12.0	±1.5	13.5	13.5
	802.11n (HT40)	MCS0	38	5190	12.0	±1.5	13.5	13.4
			46	5230	12.0	±1.5	13.5	13.4
	802.11ac	VHT80	42	5210	12.0	±1.5	13.5	13.5

Wi-Fi 5.3GHz Band:

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Target Pwr (dBm)	Tune-up Tolerance (dB)	Maximum Tune-up Pwr (dBm)	Avg. Pwr (dBm)
5.3	802.11a	6	52	5260	12.0	±1.5	13.5	13.4
			56	5280	12.0	±1.5	13.5	13.3
			60	5300	12.0	±1.5	13.5	13.5
			64	5320	12.0	±1.5	13.5	13.3
	802.11n (HT20)	MCS0	52	5260	12.0	±1.5	13.5	13.5
			56	5280	12.0	±1.5	13.5	13.4
			60	5300	12.0	±1.5	13.5	13.5
			64	5320	12.0	±1.5	13.5	13.4
	802.11n (HT40)	MCS0	54	5270	12.0	±1.5	13.5	13.4
			62	5310	12.0	±1.5	13.5	13.4
	802.11ac	VHT80	58	5290	12.0	±1.5	13.5	13.5

Wi-Fi 5.5GHz Band:

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Target Pwr (dBm)	Tune-up Tolerance (dB)	Maximum Tune-up Pwr (dBm)	Avg. Pwr (dBm)
5.5	802.11a	6	100	5500	12.0	±1.5	13.5	13.3
			104	5520	12.0	±1.5	13.5	13.2
			108	5540	12.0	±1.5	13.5	13.3
			112	5560	12.0	±1.5	13.5	13.5
			116	5580	12.0	±1.5	13.5	13.3
			120	5600	12.0	±1.5	13.5	13.2
			124	562	12.0	±1.5	13.5	13.2
			128	5640	12.0	±1.5	13.5	13.3
			132	5660	12.0	±1.5	13.5	13.4
			136	5680	12.0	±1.5	13.5	13.4
			140	5700	12.0	±1.5	13.5	13.4
	802.11n (HT20)	MCS0	100	5500	12.0	±1.5	13.5	13.3
			104	5520	12.0	±1.5	13.5	13.3
			108	5540	12.0	±1.5	13.5	13.4
			112	5560	12.0	±1.5	13.5	13.5
			116	5580	12.0	±1.5	13.5	13.5
			120	5600	12.0	±1.5	13.5	13.4
			124	5620	12.0	±1.5	13.5	13.3
			128	5640	12.0	±1.5	13.5	13.2
			132	5660	12.0	±1.5	13.5	13.3
			136	5680	12.0	±1.5	13.5	13.3
			140	5700	12.0	±1.5	13.5	13.3
	802.11n (HT40)	MCS0	102	5510	12.0	±1.5	13.5	13.3
			110	5550	12.0	±1.5	13.5	13.4
			118	5590	12.0	±1.5	13.5	13.3
			126	5630	12.0	±1.5	13.5	13.5
			134	5670	12.0	±1.5	13.5	13.4
			142	5710	12.0	±1.5	13.5	13.4
	802.11ac	VHT80	106	5530	12.0	±1.5	13.5	13.3
			122	5610	12.0	±1.5	13.5	13.4
			138	5690	12.0	±1.5	13.5	13.5

Wi-Fi 5.8GHz Band:

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Target Pwr (dBm)	Tune-up Tolerance (dB)	Maximum Tune-up Pwr (dBm)	Avg. Pwr (dBm)
5.8	802.11a	6	149	5745	12.0	±1.5	13.5	13.4
			153	5765	12.0	±1.5	13.5	13.3
			157	5785	12.0	±1.5	13.5	13.5
			161	5805	12.0	±1.5	13.5	13.3
			165	5825	12.0	±1.5	13.5	13.4
	802.11n (HT20)	MCS0	149	5745	12.0	±1.5	13.5	13.3
			153	5765	12.0	±1.5	13.5	13.4
			157	5785	12.0	±1.5	13.5	13.5
			161	5805	12.0	±1.5	13.5	13.3
			165	5825	12.0	±1.5	13.5	13.4
	802.11n (HT40)	MCS0	151	5755	12.0	±1.5	13.5	13.4
			159	5795	12.0	±1.5	13.5	13.5
	802.11ac	VHT80	155	5775	12.0	±1.5	13.5	13.5

13.3 Bluetooth

Output power table

Mode	Ch #	Freq. (MHz)	Target Pwr (dBm)	Tune-up Tolerance (dB)	Maximum Tune-up Pwr (dBm)	Avg. Pwr (dBm)
DH5	0	2402	4.0	± 1.0	5.0	4.4
	39	2441	4.0	± 1.0	5.0	4.5
	78	2480	4.0	± 1.0	5.0	4.7
3DH5	0	2402	-2.5	± 1.0	-1.5	-3.4
	39	2441	-2.5	± 1.0	-1.5	-3.2
	78	2480	-2.5	± 1.0	-1.5	-3.0
BLE	0	2402	0.5	± 1.0	1.5	0.5
	19	2440	0.5	± 1.0	1.5	0.8
	39	2480	0.5	± 1.0	1.5	1.0

14 SAR Measurements Results

Wi-Fi (2.4GHz Band):

Test Mode	Test Position	Mode	Channel	Freq. (MHz)	Chain	Dist. (mm)	Power (dBm)		Measured 1g SAR (W/kg)	Reported SAR(W/kg)	Note
							Tune up limit	Measured			
Tablet	Edge3	802.11b	6	2437	0	0	15	15	0.727	0.727	
			6	2437	0	0	15	15	0.416	0.416	Ant 2

Note(s):

1. The Ant 1 & Ant 2 are the same type and antenna location. So we choose the Ant 1 to perform the all SAR test. The Ant 2 was performed the SAR test of the worst channel of Ant 1. The reported SAR don't have over the limit value ,so SAR test of the Ant 2 performed spot check can cover test result.

Wi-Fi (5GHz Band):

Test Mode	Test Position	Mode	Channel	Freq. (MHz)	Chain	Dist. (mm)	Power (dBm)		Measured 1g SAR (W/kg)	Reported SAR(W/kg)	Note
							Tune up limit	Measured			
Tablet	Edge3	802.11a	44	5220	0	0	13.5	13.5	1.060	1.060	
			48	5240	0	0	13.5	13.5	0.971	0.971	
			60	5300	0	0	13.5	13.5	1.060	1.060	
			52	5260	0	0	13.5	13.4	1.090	1.115	
			112	5560	0	0	13.5	13.5	0.905	0.905	
			132	5660	0	0	13.5	13.4	0.522	0.534	
			157	5785	0	0	13.5	13.5	0.997	0.997	
			149	5745	0	0	13.5	13.4	0.861	0.881	
		802.11ac	42	5210	0	0	13.5	13.5	0.923	0.923	
			58	5290	0	0	13.5	13.5	1.190	1.190	
			138	5690	0	0	13.5	13.5	0.574	0.574	
			155	5775	0	0	13.5	13.5	1.030	1.030	
			58	5290	0	0	13.5	13.5	1.210	1.210	2
			58	5290	0	0	13.5	13.5	0.998	0.998	Ant 2

Note(s):

1. Testing of other required channels within the operating mode of a frequency band is required when the reported 1-g SAR for the mid-band or highest output power channel. ≥ 0.8 W/kg and transmission band ≤ 100 MHz (Per KDB 447498 D01 v05r01 section 4.3.3)
2. Repeated measurements are required only when the measured SAR is ≥0.80 W/kg. If the measured SAR values are < 1.45 W/kg with ≤20% variation, only one repeated measurement is required to reaffirm that the results are not expected to have substantial variations, which may introduce significant compliance concerns. (Per KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r01)
   - 2.1 Original SAR = 1.190 W/kg, therefore two times repeat SAR is required.
   - 2.2 Repeat SAR = 1.210 W/kg < 1.45W/kg
   - 2.3 SAR variation= 1.6 % < 20%
3. The Ant 1 & Ant 2 are the same type and antenna location. So we choose the Ant 1 to perform the all SAR test. The Ant 2 was performed the SAR test of the worst channel of Ant 1. The reported SAR don't have over the limit value ,so SAR test of the Ant 2 performed spot check can cover test result.

14.1 Summary of Highest SAR Values

Results for highest reported SAR values for each frequency band and mode

Technology/Band	Test configuration	Mode	Highest Reported 1g-SAR (W/kg)
Wi-Fi 2.4 GHz	Edge3	802.11b	0.727
Wi-Fi 5.2 GHz	Edge3	802.11a	1.060
Wi-Fi 5.3 GHz	Edge3	802.11ac	1.210
Wi-Fi 5.5 GHz	Edge3	802.11a	0.905
Wi-Fi 5.8 GHz	Edge3	802.11ac	1.030

15 Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance v05, introduces a new formula for calculating the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$SPLSR = (SAR_1 + SAR_2)^{1.5} / R_i$$

Where:

SAR_1 is the highest Reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR_2 is the highest Reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

R_i is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$

A new threshold of 0.04 is also introduced in the draft KDB. Thus, in order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(SAR_1 + SAR_2)^{1.5} / R_i < 0.04$$

15.1 Estimated SAR for Simultaneous Transmission SAR Analysis

Considerations for SAR estimation

1. When standalone SAR test exclusion applies, standalone SAR must also be estimated to determine simultaneous transmission SAR test exclusion.
2. Dedicated Host Approach criteria for SAR test exclusion is likewise applied to SAR estimation, with certain distinctions between test exclusion and SAR estimation:

- When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied for SAR estimation; this is the same between test exclusion and SAR estimation calculations.
- When the separation distance from the antenna to an adjacent edge is > 5 mm but ≤ 50 mm, the actual antenna-to-edge separation distance is applied for SAR estimation.
- When the minimum test separation distance is > 50 mm, the estimated SAR value is 0.4 W/kg

15.1.1 Estimated SAR

Tablet Mode

Antenna	Band	Frequency (MHz)	Output Power		Separation Distances(mm)					Estimated 1-g SAR (W/Kg)				
			dBm	mW	Rear	Edge1	Edge2	Edge3	Edge4	Rear	Edge1	Edge2	Edge3	Edge4
Wi-Fi Main	2.4GHz	2412	15	32	19.15	233.3	190.3	5.5	163.7	0.346	0.400	0.400	Measure	0.400
Wi-Fi Main	5.2GHz	5180	13.5	22	19.15	233.3	190.3	5.5	163.7	0.349	0.400	0.400	Measure	0.400
Wi-Fi Main	5.3GHz	5260	13.5	22	19.15	233.3	190.3	5.5	163.7	0.351	0.400	0.400	Measure	0.400
Wi-Fi Main	5.5GHz	5500	13.5	22	19.15	233.3	190.3	5.5	163.7	0.359	0.400	0.400	Measure	0.400
Wi-Fi Main	5.8GHz	5745	13.5	22	19.15	233.3	190.3	5.5	163.7	0.367	0.400	0.400	Measure	0.400
Wi-Fi Aux	Bluetooth	2402	5.5	4	19.15	233.3	72.5	5.5	282.5	0.043	0.400	0.400	0.150	0.400

15.2 Sum of the SAR for Simultaneous Transmission Analysis

15.2.1 Sum of the SAR for Wi-Fi Main & Bluetooth

Band	Test Position	Simulataneous Transmission Scenario		∑ 1-g SAR (W/kg)	SPLSR (Yes/No)
		Wi-Fi Main	Bluetooth		
2.4GHz	Edge 3	0.727	0.150	0.877	No
5.2GHz	Edge 3	1.060	0.150	1.210	No
5.3GHz	Edge 3	1.210	0.150	1.360	No
5.5GHz	Edge 3	0.905	0.150	1.055	No
5.8GHz	Edge 3	1.030	0.150	1.180	No

Note(s):

1. As the Sum of the SAR is not greater than 1.6W/Kg, so SPLSR is not required.

16 Equipment List & Calibration Status

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Cycle(year)	Calibration Due
S-Parameter Network Analyzer	Agilent	E5071C	MY46213916	1	2015/6/25
Electronic Probe kit	Hewlett Packard	85070D	N/A	N/A	N/A
Power Meter	Agilent	4416	GB41291611	1	2015/9/4
Power Sensor	Agilent	8481H	MY41091956	1	2015/9/4
Data Acquisition Electronics (DAE)	SPEAG	DAE4	877	1	2015/3/25
Dosimetric E-Field Probe	SPEAG	EX3DV4	3665	1	2015/5/21
2450 MHz System Validation Dipole	SPEAG	D2450V2	728	1	2015/5/19
5GHz System Validation Dipole	SPEAG	D5GHzV2	1004	1	2015/11/19
Robot	Staubli	RX90L	F02/5T69A1/A/01	N/A	N/A
Amplifier	Mini-Circuit	ZVE-8G	665500309	N/A	N/A
Amplifier	Mini-Circuit	ZHL-1724HLN	D072602#2	N/A	N/A

17 Facilities

All measurement facilities used to collect the measurement data are located at

☐ No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang, Taoyuan Hsien, Taiwan, R.O.C.

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

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19 Attachments

Exhibit	Content
1	System Performance Check Plots
2	SAR test plots for Wi-Fi 2.4GHz Band
3	SAR test plots for Wi-Fi 5GHz Band
4	SAR_Probe_EX3DV4_sn3665
5	SAR_DAE4_sn877
6	SAR_Dipole_D2450v2_sn728
7	SAR_Dipole_D5GHzv2_sn1004
8	T150123W04-SF PHOTOs

END OF REPORT