



ANSI/IEEE Std. C95.1-1992

in accordance with the requirements of
FCC Report and Order: ET Docket 93-62, and OET Bulletin 65 Supplement C



FCC TEST REPORT

For

PCIE 802.11A/B/G/N 2.4GHZ/5GHZ+USB BT 4.0 CARD

Trade Name: Qualcomm Atheros, Inc.

Model: AR5B22

Issued to

**Qualcomm Atheros, Inc.
1700 Technology Dr San Jose California
United States 95110**

Issued by

**Compliance Certification Services Inc.
No. 11, Wugong 6th Rd., Wugu Industrial Park,
Taipei Hsien 248, Taiwan.
<http://www.ccsrf.com>
service@ccsrf.com
Issued Date: 2012/11/28**



***Note:** This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc. This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document.*



Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	2012/11/28	Initial Issue	ALL	Anson Lu
01	2012/11/30	Revised the WiFi 5.5G HT20 Conducted Power Removed the Chain Power on 1Tx mode	24	Anson Lu
02	2012/12/05	Revised the Tissue Liquid parameter	18	Anson Lu
03	2012/12/06	Section 2; Section9 ;Section10; Section11		Alex Wu
04	2012/12/07	Add 802.11n HT20 and 802.11n HT40 test data	4,5,15,21 23,28,30,32	Anson Lu
05	2012/12/13	Revise 802.11n HT40_5GHz Frequency Range	5	Anson Lu
06	2012/12/14	Removed, frequency range from 5600-5650MHz	27	Anson Lu



Table of contents

1.	Certificate of Compliance (SAR Evaluation)	4
2.	EUT Description	5
3.	Requirements for Compliance Testing Defined	6
	3.1 Requirements for Compliance Testing Defined by the FCC	6
4.	Dosimetric Assessment System	6
	4.1 Measurement System Diagram	7
	4.2 System Components	8
5.	Evaluation Procedures	11
6.	Measurement Uncertainty	15
7.	Exposure Limit	16
8.	Typical Composition of Ingredients for Liquid Tissue Phantoms	17
9.	Device Under Test	18
	9.1 Exposure Positions Consideration	18
	9.2 Simultaneous Transmission	18
10.	SAR Test configurations	19
	10.1 Body Test Conditions for WiFi (Main Antenna)	19
	10.2 Body Test Conditions for WiFi (Aux Antenna)	19
11.	Measurement Results	20
	11.1 Test Liquid Confirmation	20
	11.2 System Performance Check	22
	11.3 RF Output Power Measurement	24
	11.4 SAR Measurements Results	28
12.	Antenna Locations & Separation Distances	29
13.	Equipment List & Calibration Status	30
14.	Facilities	31
15.	Reference	31
16.	Attachments	32



1. Certificate of Compliance (SAR Evaluation)

Applicant Qualcomm Atheros, Inc.
1-781-400-1491 / 1700 Technology Dr San Jose California
United States 95110

Equipment Under Test: Tablet PC

Trade Name: Qualcomm Atheros

Model Number: AR5B22

Date of Test: November 26 ~ December 07, 2012

Device Category: PORTABLE DEVICES

Exposure Category: GENERAL POPULATION/UNCONTROLLED EXPOSURE

APPLICABLE STANDARDS	
STANDARD	
FCC	<ul style="list-style-type: none">● FCC OET 65 Supplement C● IEEE 1528 2003● KDB 447498 D01 Mobile Portable RF Exposure V04 ,Published● KDB 248227 D01 SAR meas for 802 11 a b g v01r02● KDB 616217 D01 SAR for Laptop with Screen Ant v01r01
Deviation from Applicable Standard	
1.6 W/Kg	
TEST RESULT	
PASS	

The device was tested by Compliance Certification Services Inc. in accordance with the measurement methods and procedures specified in OET Bulletin 65 Supplement C (Edition 01-01). 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:

Tested by:

Alex Wu
Section Manager
Compliance Certification Services Inc.

Anson Lu
Test Engineer
Compliance Certification Services Inc.



2. EUT Description

Product	Tablet PC
Trade Name	Qualcomm Atheros
Model Number	AR5B22
Model Discrepancy	All the above models are identical except the model designation.
Received Date	October 03, 2012
Frequency Range	802.11b: 2412 ~ 2462 MHz 802.11g: 2412 ~ 2462 MHz 802.11n HT20: 2412 ~ 2462 MHz 802.11n HT40: 2422 ~ 2452 MHz 802.11a: 5180 ~ 5240 MHz / 5260 ~ 5320 MHz / 5500 ~ 5700 MHz / 5745 ~ 5825 MHz 802.11n HT20: 5180 ~ 5240 MHz / 5260 ~ 5320 MHz / 5500 ~ 5700 MHz / 5745 ~ 5825 MHz 802.11n HT40: 5190 ~ 5230MHz / 5270 ~ 5310 MHz / 5510 ~ 5670 MHz / 5755 ~ 5795 MHz Bluetooth: 2402 ~ 2480 MHz
Maximum Output Power(Avg)	802.11b: 19.9 dBm 802.11g: 20.0 dBm 802.11n HT20 (2x2) : 19.9 dBm 802.11n HT40(2x2) : 17.0 dBm 802.11a 5.2GHz: 16.6 dBm 802.11a 5.3GHz: 20.1 dBm 802.11a 5.5GHz: 18.7 dBm 802.11a 5.8GHz: 17.3 dBm Above power in WiF only(Chain1 or Chain0+1) , Bluetooth OFF Bluetooth: 4.3 dBm
Maximum SAR (1g)	802.11b: 0.272 W/kg (Body position) 802.11g: 0.224 W/kg (Body position) 802.11a 5.2GHz: 0.156 W/kg (Body position) 802.11a 5.3GHz: 0.716 W/kg (Body position) 802.11a 5.5GHz: 0.419 W/kg (Body position) 802.11a 5.8GHz: 0.219 W/kg (Body position) Bluetooth: SAR test is not required, please refer to page 27
Modulation Technique	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) Bluetooth4.0: GFSK for 1Mbps; $\pi/4$ -DQPSK for 2Mbps; 8DPSK for 3Mbps; GFSK(LE mode) for 24Mbps
Antenna Specification	Antenna. Type: WLAN Chain 0: PIFA antenna WLAN Chain 1: PIFA antenna
Rechargeable Li-polymer Battery–alternate	Brand: Pegatron Corporation Model: GS4150-02 Rating: 7.4v, 4150mAh, 30Wh

Remark: The sample selected for test was prototype that approximated to production product and was provided by manufacturer.



3. Requirements for Compliance Testing Defined

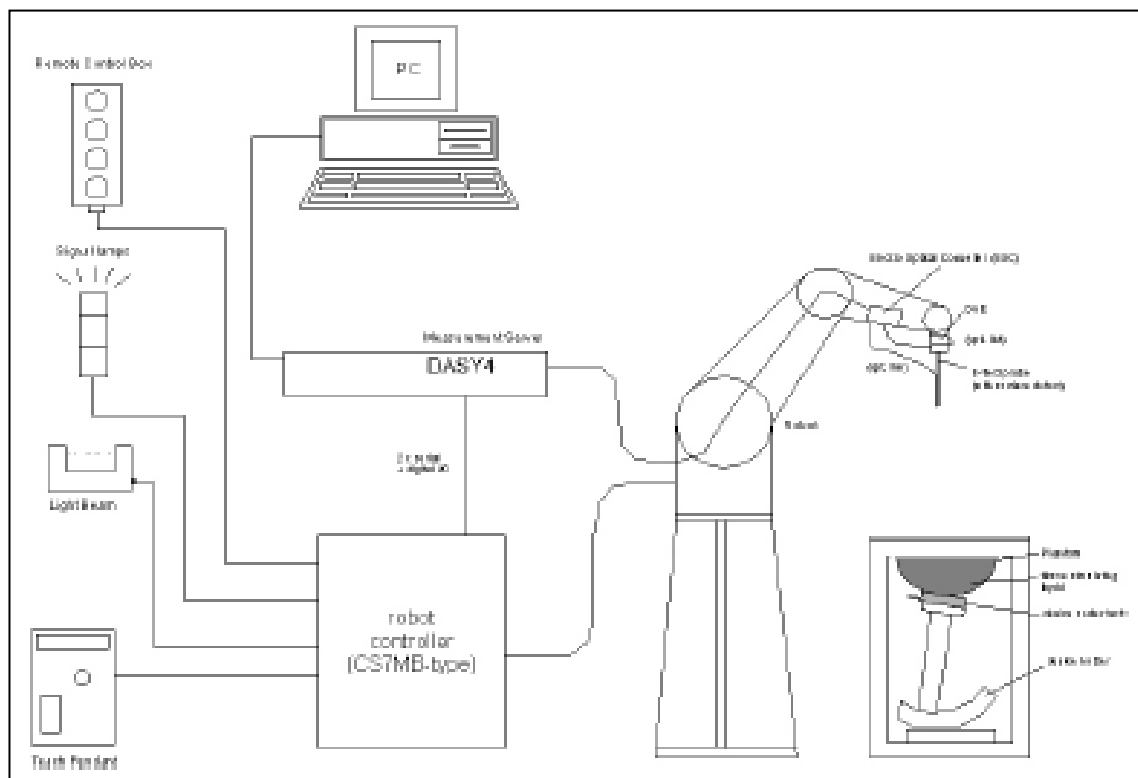
3.1 Requirements for Compliance Testing Defined by the FCC

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 mW/g 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]. According to the Supplement C of OET Bulletin 65 "Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

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: 3554 (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 $\pm 10\%$. 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 (Stäubli 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/DAST5 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 (DAE3) 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 DAE3 box is 200M Ω ; 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 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB
(noise: typically < 1 μ W/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





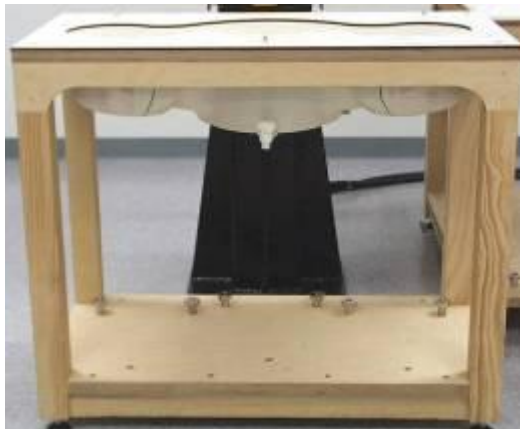
SAM Phantom (V4.0)

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 1/4 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, 5800 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W ($f < 1\text{GHz}$); > 40 W ($f > 1\text{GHz}$)

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 1/4 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, 5800 MHz

Return loss: > 20 dB at specified validation position

Power capability: > 100 W ($f < 1\text{GHz}$); > 40 W ($f > 1\text{GHz}$)

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:
$$E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

H-field probes:
$$H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

with	V_i	= Compensated signal of channel i	(i = x, y, z)
	$Norm_i$	= Sensor sensitivity of channel i	(i = x, y, z)
		$\mu V/(V/m)^2$ for E0field Probes	
	$ConvF$	= Sensitivity enhancement in solution	
	a_{ij}	= 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):

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

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 mW/g
 E_{tot} = total field strength in V/m
 σ = conductivity in [mho/m] or [Siemens/m]
 ρ = equivalent tissue density in g/cm³

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.

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

- with P_{pwe} = Equivalent power density of a plane wave in mW/cm²
 E_{tot} = total electric field strength in V/m
 H_{tot} = total magnetic field strength in A/m



SAR Measurement Procedures

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

- **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, grid was at to **12 mm by 12 mm (10mm by 10mm for 5GHz)** and can be edited by a user.

- **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 **7x7x7 (7x7x12 for 5GHz)** 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 than one maximum, the number of Zoom Scans has to be enlarged accordingly (The default number inserted is 1).

- **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.



Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the IEEE1528 2003 standard. It can be conducted for 1 g and 10 g.

The DASY4/DASY5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maximum searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.

Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Cube Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 7x7x7(7x7x12 for 5GHz) measurement points with 5mm resolution amounting to 343(588 for 5GHz) measurement points, the uncertainty of the extrapolation routines is less than 1% for 1 g and 10 g cubes.

Boundary Effect

For measurements in the immediate vicinity of a phantom surface, the field coupling effects between the probe and the boundary influence the probe characteristics. Boundary effect errors of different dosimetric probe types have been analyzed by measurements and using a numerical probe model. As expected, both methods showed an enhanced sensitivity in the immediate vicinity of the boundary. The effect strongly depends on the probe dimensions and disappears with increasing distance from the boundary. The sensitivity can be approximately given as:

$$S \approx S_o + S_b \exp\left(-\frac{z}{a}\right) \cos\left(\pi \frac{z}{\lambda}\right)$$

Since the decay of the boundary effect dominates for small probes ($a \ll \lambda$), the cos-term can be omitted. Factors S_b (parameter Alpha in the DASY4/DASY5 software) and a (parameter Delta in the DASY4/DASY5 software) are assessed during probe calibration and used for numerical compensation of the boundary effect. Several simulations and measurements have confirmed that the compensation is valid for different field and boundary configurations.

This simple compensation procedure can largely reduce the probe uncertainty near boundaries. It works well as long as:

- the boundary curvature is small
- the probe axis is angled less than 30° to the boundary normal
- the distance between probe and boundary is larger than 25% of the probe diameter
- the probe is symmetric (all sensors have the same offset from the probe tip)

Since all of these requirements are fulfilled in a DASY4/DASY5 system, the correction of the probe boundary effect in the vicinity of the phantom surface is performed in a fully automated manner via the measurement data extraction during post processing.



6. 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	∞
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	3.09	Normal	1	0.64	1.98	39
Liquid Permittivity - deviation from target values	3.92	Rectangular	$\sqrt{3}$	0.6	1.36	∞
Liquid Permittivity - measurement uncertainty	-3.85	Normal	1	0.6	-2.31	39
		RSS			11.48	611
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =		$k=2$				22.96%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =		$k=2$				1.80dB

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	∞
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	4.47	Normal	1	0.64	2.86	39
Liquid Permittivity - deviation from target values	5.00	Rectangular	$\sqrt{3}$	0.6	1.73	∞
Liquid Permittivity - measurement uncertainty	2.63	Normal	1	0.6	1.58	39
		RSS			12.72	611
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =		$k=2$				25.45%
Expanded Uncertainty U, Coverage Factor = 2, > 95 % Confidence =		$k=2$				1.97dB



7. Exposure Limit

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

<u>Whole-Body</u>	<u>Partial-Body</u>	<u>Hands, Wrists, Feet and Ankles</u>
0.4	8.0	2.0

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

<u>Whole-Body</u>	<u>Partial-Body</u>	<u>Hands, Wrists, Feet and Ankles</u>
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



8. 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 MΩ⁺ 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

Simulating Liquids for 5 GHz, Manufactured by SPEAG:

Ingredients	(% by weight)
Water	50-65
Mineral oil	10-30
Emulsifiers	8-25
Sodium and Salt	0-1.5



9. Device Under Test

9.1 Exposure Positions Consideration

Antenna Band	Ant 0	Ant 1	Ant 0+1
Bluetooth	Yes	No	No
2.4GHz 802.11b/g	No	Yes	Yes
2.4GHz 802.11n	No	Yes	Yes
5GHz 802.11a	No	Yes	Yes
5GHz 802.11n	No	No	Yes

Note(s):

Ant.0 represents the BT/WLAN Main Antenna transmission only;Ant.1 represents the WLAN Aux Antenna transmission only;Ant.0+1 represents BT/WLAN Main and WLAN Aux antennas simultaneous transmission.

9.2 Simultaneous Transmission

No.	Conditions	Head	Body	Hotspot
1	WiFi 2.4GHz Bands+ BT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	WiFi 5GHz Bands+ BT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Note(s):

1. As the tablet has been assessed in accordance with KDB 447498, which has more conservative measurement distances than KDB 941225, further assessment in accordance with KDB 941225 is judged unnecessary. This is also in accordance with FCC training provided in October 2012 (TCBC Workshop) which indicates that hotspot mode KDB procedures are not intended for larger tablets.
2. WiFi 2.4GHz band and BT cannot simultaneous transmit.
3. Only WiFi 2.4 GHz Band supports hotspot function.



10. SAR Test configurations

The following test configurations are based on KDB 447498 4) b) Tablet Mode

10.1 Body Test Conditions for WiFi (Main Antenna)

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear/Bottom	16 mm	Yes	
Edge 1	2 mm	No	The Edge1 has been disabled via software, therefore WLAN Antenna Edge 1 SAR testing is not required.
Edge 2	60 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)
Edge 3	180 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)
Edge 4	156 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)

10.2 Body Test Conditions for WiFi (Aux Antenna)

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear/Bottom	16 mm	Yes	
Edge 1	2 mm	No	The Edge1 has been disabled via software, therefore WLAN Antenna Edge 1 SAR testing is not required.
Edge 2	60 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)
Edge 3	180 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)
Edge 4	156 mm	No	This is not the most conservative antenna-to-user distance at edge mode as per KDB 447498 4) b) ii) (2)



11. Measurement Results

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 if the dielectric parameters are within the tolerances of the specified target values

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

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



Simulating Liquids Parameter Check Results

Ambient condition: Temperature 24.0 °C; Relative humidity: 55 %

Band	Freq(MHz)	Measured			Standard		Δ		Limit
		e' (ϵ_r)	e''	σ	e' (ϵ_r)	σ	e' (ϵ_r)	σ	± 5
Body 2450	2412	50.89	14.68	1.97	52.75	1.91	-3.53%	2.81%	± 5
	2437	50.82	14.75	2.00	52.72	1.94	-3.59%	3.05%	± 5
	2442	50.81	14.76	2.00	52.71	1.94	-3.61%	3.07%	± 5
	2462	50.70	14.83	2.03	52.68	1.97	-3.77%	3.09%	± 5
	2472	50.64	14.87	2.04	52.67	1.98	-3.85%	3.08%	± 5

Ambient condition: Temperature 25.0 °C; Relative humidity: 55 %

Date	Band	Freq(MHz)	Measured			Standard		Δ		Limit
			e' (ϵ_r)	e''	σ	e' (ϵ_r)	σ	e' (ϵ_r)	σ	± 5
2012/11/28	Body 5GHz	5180	50.36	18.61	5.35	49.07	5.25	2.63%	1.93%	± 5
		5200	50.31	18.64	5.39	49.04	5.28	2.60%	2.06%	± 5
		5500	49.79	18.98	5.80	48.64	5.62	2.37%	3.13%	± 5
		5800	49.24	19.33	6.23	48.23	5.97	2.08%	4.33%	± 5
		5825	49.21	19.37	6.27	48.20	6.00	2.10%	4.47%	± 5

Ambient condition: Temperature 25.0 °C; Relative humidity: 55 %

Date	Band	Freq(MHz)	Measured			Standard		Δ		Limit
			e' (ϵ_r)	e''	σ	e' (ϵ_r)	σ	e' (ϵ_r)	σ	± 5
2012/12/5	Body 5GHz	5180	50.06	17.72	5.10	49.07	5.25	2.03%	-2.91%	± 5
		5200	49.97	17.75	5.13	49.04	5.28	1.90%	-2.80%	± 5
		5500	49.60	18.09	5.53	48.64	5.62	1.99%	-1.70%	± 5
		5800	49.08	18.30	5.90	48.23	5.97	1.76%	-1.24%	± 5
		5825	49.06	18.35	5.94	48.20	6.00	1.79%	-1.05%	± 5

Ambient condition: Temperature 25.0 °C; Relative humidity: 55 %

Date	Band	Freq(MHz)	Measured			Standard		Δ		Limit
			e' (ϵ_r)	e''	σ	e' (ϵ_r)	σ	e' (ϵ_r)	σ	± 5
2012/12/6	Body 5GHz	5180	49.66	18.35	5.28	49.07	5.25	1.21%	0.53%	± 5
		5200	49.62	18.38	5.31	49.04	5.28	1.17%	0.62%	± 5
		5500	49.09	18.66	5.70	48.64	5.62	0.93%	1.39%	± 5
		5800	48.57	18.94	6.10	48.23	5.97	0.69%	2.18%	± 5
		5825	48.54	18.97	6.14	48.20	6.00	0.70%	2.33%	± 5

Ambient condition: Temperature 25.0 °C; Relative humidity: 55 %

Date	Band	Freq(MHz)	Measured			Standard		Δ		Limit
			e' (ϵ_r)	e''	σ	e' (ϵ_r)	σ	e' (ϵ_r)	σ	± 5
2012/12/7	Body 5GHz	5180	49.76	18.29	5.26	49.07	5.25	1.42%	0.18%	± 5
		5200	49.70	18.33	5.30	49.04	5.28	1.34%	0.36%	± 5
		5500	49.23	18.63	5.69	48.64	5.62	1.22%	1.20%	± 5
		5800	48.70	18.88	6.08	48.23	5.97	0.96%	1.86%	± 5
		5825	48.64	18.91	6.12	48.20	6.00	0.92%	1.97%	± 5



11.2 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: 3554 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 ($dx=dy=5\text{ mm}$, $dz=5\text{ mm}$).
- Distance between probe sensors and phantom surface was set to 3.0 mm.
- The dipole input power (forward power) was $250\text{ mW} \pm 3\%$.
- 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 (mW/g)		
				1g/10g	Head	Body
D2450V2	869	06/15/2012	2450	1g	54.3	51
				10g	25.4	24

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (mW/g)		
				1g/10g	Head	Body
D5GHzV2	1040	06/19/2012	5200	1g	81.5	73.1
				10g	23.4	20.5
D5GHzV2	1040	06/19/2012	5500	1g	87.5	78.1
				10g	25	21.7
D5GHzV2	1040	06/19/2012	5800	1g	81.6	73.8
				10g	23.3	20.4
D5GHzV2	1004	11/16/2012	5200	1g	77.8	71.8
				10g	22.1	20.1
D5GHzV2	1004	11/16/2012	5300	1g	83.9	75.4
				10g	24	21.2
D5GHzV2	1004	11/16/2012	5600	1g	83.3	78.8
				10g	23.6	21.8
D5GHzV2	1004	11/16/2012	5800	1g	79.8	73.5
				10g	22.7	20.4



System Performance Check Results

Date	System Dipole			Parameters	Target	Measured	Deviation[%]	Limited[%]
	Type	Serial No.	Liquid					
2012/11/27	D2450V2	869	Body	1g SAR:	51.00	52.00	1.96	± 5
				10g SAR:	24.00	24.16	0.67	± 5
2012/11/28	D5GHzV2 (5200MHz)	1040	Body	1g SAR:	73.1	76.40	4.51	± 5
				10g SAR:	20.5	21.20	3.41	± 5
2012/11/28	D5GHzV2 (5500MHz)	1040	Body	1g SAR:	78.1	79.90	2.30	± 5
				10g SAR:	21.7	22.50	3.69	± 5
2012/11/28	D5GHzV2 (5800MHz)	1040	Body	1g SAR:	73.8	76.60	3.79	± 5
				10g SAR:	20.4	21.20	3.92	± 5
2012/12/5	D5GHzV2 (5200MHz)	1004	Body	1g SAR:	71.80	68.90	-4.04	± 5
				10g SAR:	20.10	19.40	-3.48	± 5
2012/12/6	D5GHzV2 (5600MHz)	1004	Body	1g SAR:	78.80	80.00	1.52	± 5
				10g SAR:	21.80	22.40	2.75	± 5
2012/12/6	D5GHzV2 (5800MHz)	1004	Body	1g SAR:	73.50	74.00	0.68	± 5
				10g SAR:	20.40	20.70	1.47	± 5
2012/12/7	D5GHzV2 (5800MHz)	1004	Body	1g SAR:	73.50	73.70	0.27	± 5
				10g SAR:	20.40	20.60	0.98	± 5
2012/12/7	D5GHzV2 (5300MHz)	1004	Body	1g SAR:	75.40	77.30	2.52	± 5
				10g SAR:	21.20	21.80	2.83	± 5

**11.3RF Output Power Measurement****2.4GHz Band:**

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Target Pwr (dBm)		Avg. Pwr (dBm)		Total Pwr (dBm)
					Chain 0	Chain 1	Chain 0	Chain 1	
2.4	802.11b	1	1	2412		17.8		18.0	
			6	2437		19.8		19.9	
			11	2462		18.9		19.0	
		2	1	2412	17.2	16.3	17.2	16.1	19.7
			6	2437	17.2	16.3	17.3	16.2	19.8
			11	2462	17.2	16.3	17.0	16.3	19.7
	802.11g	6	1	2412		16.1		16.5	
			6	2437		19.9		20.0	
			11	2462		15.9		16.2	
		12	1	2412	13.2	12.3	13.2	12.4	15.8
			6	2437	17.1	16.3	17.0	16.4	19.7
			11	2462	12.5	12.2	12.7	12.5	15.6
	802.11n (HT20) 2x2	13	1	2412	13.0	12.6	13.0	12.7	15.8
			6	2437	17.1	16.5	17.2	16.7	19.9
			11	2462	12.0	11.4	12.2	11.5	14.9
	802.11n (HT40) 2x2	27	3	2422	9.5	9.0	9.8	9.2	12.5
			6	2737	14.4	13.6	14.5	13.5	17.0
			9	2452	11.3	10.6	11.5	10.7	14.1

**WiFi 5.2GHz Band:**

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Target Pwr (dBm)		Avg Pwr (dBm)		Total Pwr (dBm)
					Chain 0	Chain 1	Chain 0	Chain 1	
5.2	802.11a	6	36	5180		14.8		14.9	
			40	5200		14.7		15.0	
			44	5220		14.6		14.9	
			48	5240		14.8		15.0	
		12	36	5180	11.5	11.4	11.6	11.5	14.5
			40	5200	11.4	11.3	11.6	11.5	14.6
			44	5220	11.4	11.2	11.6	11.5	14.5
			48	5240	11.7	11.3	11.9	11.3	14.6
	802.11n (HT20) 2x2	13	36	5180	11.2	11.1	11.3	11.1	14.2
			40	5200	11.3	11.0	11.5	11.1	14.3
			44	5220	11.4	11.2	11.3	11.2	14.3
			48	5240	11.0	10.9	11.4	11.1	14.2
	802.11n 2x2 (HT40)	27	38	5190	9.6	9.4	10.1	9.5	12.8
			46	5230	13.8	13.2	13.8	13.3	16.6

WiFi 5.3GHz Band:

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Target Pwr (dBm)		Avg Pwr (dBm)		Total Pwr (dBm)
					Chain 0	Chain 1	Chain 0	Chain 1	
5.3	802.11a	6	52	5260		19.9		19.9	
			56	5280		19.7		19.9	
			60	5300		20.0		20.1	
			64	5320		17.6		17.7	
		12	52	5260	17.0	15.8	17.1	15.9	19.5
			56	5280	17.0	16.1	17.1	16.2	19.7
			60	5300	17.0	16.7	17.1	17.1	20.1
			64	5320	14.5	14.2	14.8	14.0	17.4
	802.11n (HT20) 2x2	13	52	5260	15.0	14.3	15.2	14.4	17.8
			56	5280	14.7	14.3	14.8	14.5	17.6
			60	5300	14.5	14.2	14.6	14.4	17.5
			64	5320	14.2	14.1	14.3	14.2	17.2
	802.11n 2x2 (HT40)	27	54	5270	15.3	14.6	15.4	14.9	18.1
			62	5310	9.7	9.5	9.9	9.7	12.8



WiFi 5.5GHz Band:

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Target Pwr (dBm)		Avg Pwr (dBm)		Total Pwr (dBm)
					Chain 0	Chain 1	Chain 0	Chain 1	
5.5	802.11a	6	100	5500		14.6		14.8	
			104	5520		17.3		17.2	
			108	5540		17.3		17.2	
			112	5560		17.4		17.4	
			116	5580		17.5		17.7	
			132	5660		16.8		17.0	
			136	5680		16.8		17.0	
			140	5700		13.7		13.8	
		12	100	5500	11.1	11.9	10.9	12.0	14.5
			104	5520	14.2	14.5	14.2	14.6	17.4
			108	5540	14.2	14.5	14.2	14.6	17.4
			112	5560	14.2	14.5	14.2	14.7	17.5
			116	5580	14.2	14.8	14.3	14.7	17.5
			132	5660	13.5	14.1	13.5	14.0	16.8
			136	5680	13.6	14.2	13.3	14.5	17.0
			140	5700	10.2	11.1	10.1	11.4	13.8
	802.11n (HT20) 2x2	13	100	5500	12.1	13.1	11.9	13.0	15.5
			104	5520			14.2	16.3	18.4
			108	5540			14.2	16.3	18.4
			112	5560			14.3	16.5	18.5
			116	5580	14.4	16.5	14.5	16.7	18.7
			132	5660	14.5	15.1	14.7	15.2	18.0
			136	5680	14.5	14.8	14.5	14.8	17.7
			140	5700	11.6	12.8	11.8	13.0	15.5
	802.11n 2x2 (HT40)	27	102	5510	8.5	8.9	8.5	9.2	11.9
			118	5550	14.2	15.6	14.1	15.4	17.8
			134	5670	11.3	12.8	11.5	12.8	15.2

**WiFi 5.8GHz Band:**

Band (GHz)	Mode	Data rate (Mbps)	Ch #	Freq. (MHz)	Target Pwr (dBm)		Avg Pwr (dBm)		Total Pwr (dBm)
					Chain 0	Chain 1	Chain 0	Chain 1	
5.8	802.11a	6	149	5745		14.3		14.3	
			153	5765		14.2		14.3	
			157	5785		14.7		14.8	
			161	5805		15.1		14.9	
			165	5825		15.2		15.4	
		12	149	5745	12.0	12.5	12.1	12.7	15.4
			153	5765	12.1	12.6	12.2	12.8	15.5
			157	5785	12.1	12.6	12.3	12.5	15.4
			161	5805	12.3	12.7	12.0	12.7	15.4
			165	5825	12.5	12.8	12.5	13.2	15.9
	802.11n (HT20) 2x2	13	149	5745	13.2	13.7	13.6	13.3	16.5
			153	5765	13.5	13.9	13.7	14.2	17.0
			157	5785	13.8	14.0	13.9	13.9	16.9
			161	5805	13.9	13.7	14.1	13.7	16.9
			165	5825	14.1	13.8	14.0	13.8	16.9
	802.11n 2x2 (HT40)	27	151	5755	14.2	14.3	14.3	14.3	17.3
			159	5795	14.1	14.0	14.0	14.0	17.0

Bluetooth

Mode	Channel	Frequency (MHz)	Conducted Power	
			(dBm)	(mw)
Bluetooth	0	2402	3.8	5.75
	39	2441	4.3	6.31
	78	2480	4.1	6.11

Note(s):

Bluetooth maximum output power 4.3dBm (6.31mW) is less than 24.580mW (60/f), so SAR isn't required.

**11.4 SAR Measurements Results**

Wi-Fi (2.4GHz Band):

Test Position	Band	Antenna	Channel	Dist. (mm)	1g SAR (mW/g)	10g SAR (mW/g)	Power (dBm)
							Measured
Rear Side	802.11b	Chain 1	6	0	0.272	0.135	19.9
Rear Side	802.11g	Chain 1	6	0	0.224	0.109	20.0

Wi-Fi (5.2GHz Band):

Test Position	Band	Antenna	Channel	Dist. (mm)	1g SAR (mW/g)	10g SAR (mW/g)	Power (dBm)
							Measured
Rear Side	802.11a	Chain 1	40	0	0.156	0.040	15.0
Rear Side	802.11a	Chain 1	48	0	0.124	0.047	15.0
Rear Side	802.11n HT40	Chain 0+1	46	0	0.113	0.039	16.6

Wi-Fi (5.3GHz Band):

Test Position	Band	Antenna	Channel	Dist. (mm)	1g SAR (mW/g)	10g SAR (mW/g)	Power (dBm)
							Measured
Rear Side	802.11a	Chain 1	52	0	0.644	0.247	19.9
Rear Side	802.11a	Chain 1	60	0	0.716	0.028	20.1
Rear Side	802.11a	Chain 1	64	0	0.667	0.215	17.7

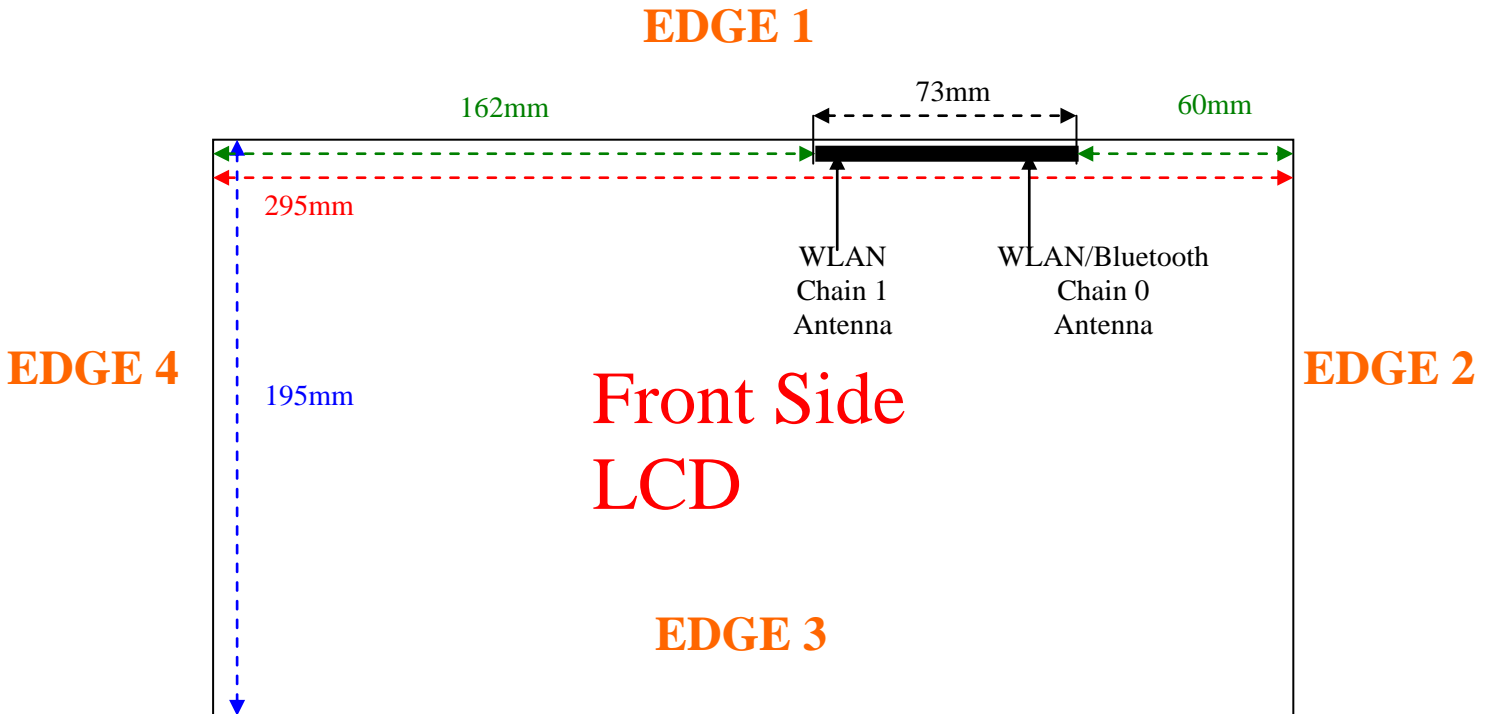
Wi-Fi (5.5GHz Band):

Test Position	Band	Antenna	Channel	Dist. (mm)	1g SAR (mW/g)	10g SAR (mW/g)	Power (dBm)
							Measured
Rear Side	802.11a	Chain 1	104	0	0.137	0.047	17.2
Rear Side	802.11a	Chain 1	116	0	0.296	0.096	17.7
Rear Side	802.11a	Chain 1	132	0	0.318	0.097	17.0
Rear Side	802.11n HT20	Chain 0+1	104	0	0.133	0.045	18.4
Rear Side	802.11n HT20	Chain 0+1	108	0	0.156	0.055	18.4
Rear Side	802.11n HT20	Chain 0+1	112	0	0.257	0.086	18.5
Rear Side	802.11n HT20	Chain 0+1	116	0	0.418	0.133	18.7
Rear Side	802.11n HT20	Chain 0+1	132	0	0.353	0.108	18.0

Wi-Fi (5.8GHz Band):

Test Position	Band	Antenna	Channel	Dist. (mm)	1g SAR (mW/g)	10g SAR (mW/g)	Power (dBm)
							Measured
Rear Side	802.11a	Chain 1	153	0	0.153	0.048	14.3
Rear Side	802.11a	Chain 1	161	0	0.201	0.066	14.9
Rear Side	802.11a	Chain 1	165	0	0.215	0.061	15.4
Rear Side	802.11a	Chain 0+1	165	0	0.112	0.033	15.9
Rear Side	802.11n HT20	Chain 0+1	149	0	0.193	0.069	16.5
Rear Side	802.11n HT20	Chain 0+1	153	0	0.127	0.043	17.0
Rear Side	802.11n HT20	Chain 0+1	157	0	0.180	0.058	16.9
Rear Side	802.11n HT20	Chain 0+1	161	0	0.184	0.056	16.9
Rear Side	802.11n HT20	Chain 0+1	165	0	0.219	0.074	16.9
Rear Side	802.11n HT40	Chain 0+1	151	0	0.180	0.060	17.3
Rear Side	802.11n HT40	Chain 0+1	159	0	0.153	0.048	17.0

12. Antenna Locations & Separation Distances



Thickness: 22mm

WLAN Antenna to Rear Side: 16mm

WLAN Antenna to Edge 1 is 2mm, but The Edge1 has disabled via software, therefore WLAN Antenna Edge 1 SAR testing is not required.

The separation distance from Edge 2 to WLAN Antenna is 60mm(>25mm), therefore WLAN Antenna Edge 2 SAR testing is not required.

The separation distance from Edge 3 to WLAN Antenna is 180mm(>25mm), therefore WLAN Antenna Edge 3 SAR testing is not required.

The separation distance from Edge 4 to WLAN Antenna is 156mm(>25mm), therefore WLAN Antenna Edge 4 SAR testing is not required.



13. Equipment List & Calibration Status

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Cycle(days)	Calibration Due
S-Parameter Network Analyzer	Agilent	E8358A	US40260243	365	07/03/2013
Electronic Probe kit	Hewlett Packard	85070D	N/A	N/A	N/A
Power Meter	Anritsu	ML2495A	1012009	365	04/26/2013
Power Sensor	Anritsu	MA2411B	917072	365	04/26/2013
Spectrum Analyzer	Agilent	E4446A	US42510252	365	12/09/2013
Wireless Communication Test Set	Agilent	E5515C 8960	MY48363204	365	09/12/2013
Data Acquisition Electronics (DAE)	SPEAG	DAE4	558	365	07/18/2013
Dosimetric E-Field Probe	SPEAG	EX3DV4	3554	365	9/26/2013
2450 MHz System Validation Dipole	SPEAG	D2450V2	869	365	06/14/2013
5GHz System Validation Dipole	SPEAG	D5GHzV2	1040	365	06/18/2013
5GHz System Validation Dipole	SPEAG	D5GHzV2	1004	365	11/15/2013
Robot	Staubli	RX90L	F02/5T69A1/A/0	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
DC Power generator	ABM	8301HD	N/A	N/A	N/A
Probe Alignment Unit	SPEAG	LB (V2)	348	N/A	N/A
SAM Twin Phantom V4.0	SPEAG	N/A	N/A	N/A	N/A
Devices Holder	SPEAG	N/A	N/A	N/A	N/A
Muscle 2450 MHz	CCS	M 2450A	N/A	N/A	N/A
Muscle 5GHz	SPEAG	M5GHzA	N/A	N/A	N/A



14. 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, Wu-Gong 6th Rd., Wugu Industrial Park, New Taipei City 248, Taiwan (R.O.C.)
- ☐ No. 199, Chungshen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

15. Reference

- [1] Federal Communications Commission, \Report and order: Guidelines for evaluating the environmental effects of radiofrequency radiation", Tech. Rep. FCC 96-326, FCC, Washington, D.C. 20554, 1996.
- [2] David L. Means Kwok Chan, Robert F. Cleveland, \Evaluating compliance with FCC guidelines for human exposure to radiofrequency electromagnetic fields", Tech. Rep., Federal Communication Commission, Office of Engineering & Technology, Washington, DC, 1997.
- [3] Thomas Schmid, Oliver Egger, and Niels Kuster, \Automated E-field scanning system for dosimetric assessments", IEEE Transactions on Microwave Theory and Techniques, vol. 44, pp. 105{113, Jan. 1996.
- [4] Niels Kuster, Ralph Kastle, and Thomas Schmid, \Dosimetric evaluation of mobile communications equipment with known precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp. 645{652, May 1997.
- [5] CENELEC, \Considerations for evaluating of human exposure to electromagnetic fields (EMFs) from mobile telecommunication equipment (MTE) in the frequency range 30MHz - 6GHz", Tech. Rep., CENELEC, European Committee for Electrotechnical Standardization, Brussels, 1997.
- [6] ANSI, ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.
- [7] Katja Pokovic, Thomas Schmid, and Niels Kuster, \Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies", in ICECOM '97, Dubrovnik, October 15{17, 1997, pp. 120{124.
- [8] Katja Pokovic, Thomas Schmid, and Niels Kuster, \E-field probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23{25 June, 1996, pp. 172{175.
- [9] Volker Hombach, Klaus Meier, Michael Burkhardt, Eberhard Kuhn, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 900 MHz", IEEE Transactions on Microwave Theory and Techniques, vol. 44, no. 10, pp. 1865{1873, Oct. 1996.
- [10] Klaus Meier, Ralf Kastle, Volker Hombach, Roger Tay, and Niels Kuster, \The dependence of EM energy absorption upon human head modeling at 1800 MHz", IEEE Transactions on Microwave Theory and Techniques, Oct. 1997, in press.
- [11] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.
- [12] W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992..Dosimetric Evaluation of Sample device, month 1998 9
- [13] NIS81 NAMAS, \The treatment of uncertainty in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, England, 1994.
- [14] Barry N. Taylor and Christ E. Kuyatt, \Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology, 1994. Dosimetric Evaluation of Sample device, month 1998 10



16. Attachments

Exhibit	Content
1	System performance check plots
2	SAR test plots for 2.4GHz
3	SAR test plots for 5.2GHz
4	SAR test plots for 5.3GHz
5	SAR test plots for 5.5GHz
6	SAR test plots for 5.8GHz
7	SAR_Probe_EX3DV4_sn3554_20120927
8	SAR_Dipole_D2450v2_sn869_20120615
9	SAR_Dipole_D5GHz_sn1040_20120619
10	SAR_Dipole_D5GHz_sn1004_20121116
11	T120927W01-SF PHOTOS
12	Thermometer

End of Report