Global Product Certification
EMC-EMF-Safety Approvals

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SAR Test Report

Report Number: M140913_FCC_DWM-W095A_SAR_2.4

Test Sample:	Portable TABLET Computer
Host PC Model Number:	Q555
Radio Modules:	WLAN & Bluetooth MITSUMI DWM-W095A
FCC ID:	EW4DWMW095A
Date of Issue:	2nd October 2014

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SAR TEST REPORT

Report Number: M140913_FCC_DWM-W095A_SAR_2.4

FCC ID: EW4DWMW095A,

1.0 GENERAL INFORMATION

Test Sample:	Portable TABLET Computer
Model Name:	Q555
Radio Modules:	WLAN & Bluetooth DWM-W095A
Interface Type:	SDIO / UART
Device Category:	Portable Transmitter
Test Device:	Pre-Production Unit
FCC ID:	EW4DWMW095A
RF exposure Category:	General Population/Uncontrolled
Manufacturer:	Fujitsu Limited
Test Standard/s:	**1.** KDB 248227 D01 SAR meas for 802 11 a b g v01r02 KDB 447498 D01 General RF Exposure Guidance v05r02 KDB 616217 D04 SAR for laptop and tablets v01r01 KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r03 KDB 865664 D02 RF Exposure Reporting v01r01 **2.** **IEEE 1528: 2013** Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Measurement Techniques.
Statement Of Compliance:	The Fujitsu TABLET Computer Q555 with Wireless LAN and Bluetooth model DWM-W095A module complied with the FCC General public/uncontrolled RF exposure limits of 1.6mW/g per requirements of 47CFR2.1093(d).
Highest Reported SAR:	2450 MHz WLAN Band – 1.52 mW/g
Test Dates:	11th – 12th September 2014

Test Officer:

Peter Jakubiec

Authorised Signature:

Chris Zombolas
Technical Director

SAR TEST REPORT
Portable TABLET Computer Model: Q555
Report Number: M140913_FCC_DWM-W095A_SAR_2.4

2.0 INTRODUCTION

Testing was performed on the Fujitsu TABLET PC, Model: Q555 with Mitsumi SDIO/UART integrated Wireless LAN & Bluetooth Module (802.11a/b/g/n), Model: DWM-W095A. The MITSUMI module is an OEM product. The WLAN was tested in the dedicated host – STYLISTIC Q SERIES, Model Q555. The system tested will be referred to as the DUT throughout this report.

The Wireless LAN Module incorporates Bluetooth Transmitter which can only transmit via Antenna A (0), the Bluetooth maximum power was **9**dBm (including tune-up) therefore it did not require SAR testing as a stand-alone transmitter. This is in accordance with KDB 447498 section 4.3.1 exemption formula:

[(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for 1-g SAR Result - [(**8mW**)/(**5**mm)] ·[√f(2.45GHz)]= **2.5**

and also for the simultaneous transmission according to the section 4.3.2 the estimated SAR is given by formula:

(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[√f(2.45GHz)/*x*] W/kg

Result - [(**8 mW**)/(**5**mm)] ·[√f(GHz)/7.5]=**0.33**W/kg.

The highest SAR for the antenna B (1) was 0.768 mW/g so the sum of the simultaneously transmitting Bluetooth and WLAN (Ant. B) was 1.098 mW/g which was below the SAR limit of 1.6mW/g.

The measurement test results mentioned herein only apply to the 2450MHz frequency band. An additional report titled "M140913_FCC_DWM-W095A_SAR_5.6" applies to the 5GHz range.

3.0 TEST SAMPLE TECHNICAL INFORMATION

(Information supplied by the client)

3.1 DUT (WLAN) Details

Transmitter:	WLAN / BT Combo Module
FCC ID:	EW4DWMW095A
Wireless Module:	Mitsumi WLAN (11a/b/g/n)
Model Number:	DMW-W095A
Manufacturer:	Mitsumi Electric Co., LTD.
Modulation Type:	DSSS for 802.11b OFDM for 802.11g OFDM for 802.11a OFDM for 802.11n
5GHz (802.11a/n)	BPSK, QPSK, 16QAM, 64QAM
2.4GHz (802.11b/g/n)	CCK, DQPSK, DBPSK, 16QAM, 64QAM
Maximum Data Rate:	802.11b = 11 Mbps, 802.11g and 802.11a = 54 Mbps 802.11n = 270 Mbps
Frequency Range:	2.412–2.462 GHz for 11b/g/n 5.18-5.32 GHz and 5.745-5.825 GHz for 11a/n
Number of Channels:	13 channels for 11b/g/n 23 channels for 11a/n with 20MHz Bandwidth 18 channels for 11n with 40MHz Bandwidth
Antenna Types:	Nissei Inverted F antenna BT: ANT 0
Power Supply:	3.3 VDC from mother baord

Table 1 Channels and Output power setting

2.4 GHz (802.11b, 802.11g and 802.11n)

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Tx BW (MHz)	Average Power Target (dBm)			Average Power Measured (dBm)	
					Ch A		Ch B	Tx A	Tx B
802.11b 2.4 GHz	1	2412	1	-	**16.0**		**16.0**	16.02	16.07
	6	2437						16.14	16.01
	11	2462						16.09	16.04
	13	2472						16.08	16.08
802.11g 2.4 GHz	1	2412	6	-	**16.0**		**16.0**	-	-
	2	2417						-	-
	6	2437						-	-
	10	2457						-	-
	11	2462						-	-
	13	2472						-	-
802.11n 2.4 GHz	1	2412	HT0	20	**16.0**		**16.0**	16.07	16.01
	2	2417						-	-
	6	2437						16.05	16.05
	10	2457						-	-
	11	2462						16.03	16.09
	13	2472							
	3F	2422	HT0	40	**N/A**		**N/A**	-	-
	4F	2427			**N/A**		**N/A**	-	-
	5F				**N/A**		**N/A**	-	-
	6F	2437			**N/A**		**N/A**	-	-
	7F				**N/A**		**N/A**	-	-
	8F	2447			**N/A**		**N/A**	-	-
	9F	2452			**N/A**		**N/A**	-	-
	10F	2457			**N/A**		**N/A**	-	-
	11F	2462			**N/A**		**N/A**	-	-

5 GHz (802.11a)

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Tx BW (MHz)	Average Power Target (dBm)			Average Power Measured (dBm)	
					Ch A		Ch B	Tx A	Tx B
802.11a	5.2 GHz		6	-					
	36	5180			12.0		12.0	12.09	12.01
	40	5200						-	-
	44	5220						-	-
	48	5240						12.20	12.03
	5.3 GHz								
	52	5260			12.0		12.0	12.21	12.05
	56	5280						-	-
	60	5300						-	-
	64	5320						12.09	12.06
	5.6 GHz								
	100	5500			12.0		12.0	12.12	12.06
	104	5520						12.13	12.17
	108	5540						-	-
	112	5560						-	-
	116	5580						12.20	12.05
	120	5600						12.05	12.11
	124	5620						-	-
	128	5640						-	-
	132	5660						-	-
	136	5680						12.10	12.29
	140	5700						12.12	12.02
	5.8 GHz								
	149	5745			12.0		12.0	12.04	12.10
	153	5765						-	-
	157	5785						12.04	12.00
	161	5805						-	-
	165	5825						12.20	12.00

5 GHz (802.11n)

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Tx BW (MHz)	Average Power Target (dBm) Ch A		Average Power Target (dBm) Ch B	Average Power Measured (dBm) Tx A	Average Power Measured (dBm) Tx B
802.11n	**5.2 GHz**		HT0	20					
	36	5180			**12.0**		**12.0**	-	-
	40	5200						-	-
	44	5220						-	-
	48	5240						-	-
	5.3 GHz								
	52	5260			**12.0**		**12.0**	-	-
	56	5280						-	-
	60	5300						-	-
	64	5320						-	-
	5.6 GHz								
	100	5500			**12.0**		**12.0**	-	-
	104	5520						-	-
	108	5540						-	-
	112	5560						-	-
	116	5580						-	-
	120	5600						-	-
	124	5620						-	-
	128	5640						-	-
	132	5660						-	-
	136	5680						-	-
	140	5700						-	-
	5.8 GHz								
	149	5745			**12.0**		**12.0**	-	-
	153	5765						-	-
	157	5785						-	-
	161	5805						-	-
	165	5825						-	-
	5.2 GHz			40 Wide					
	38	5190			**12.0**		**12.0**	-	-
	46	5230						12.00	12.05
	5.3 GHz								
	54	5270			**12.0**		**12.0**	12.22	12.21
	62	5310						-	-
	5.6 GHz								
	102	5510			**12.0**		**12.0**	-	-
	110	5550						12.17	12.15
	118	5590						-	-
	126	5630						-	-
	134	5670						-	-
	5.8 GHz								
	151	5755			**12.0**		**12.0**	-	-
	159	5795						12.09	12.00

NOTE: For 5GHz SAR results refer to report titled “M140913_FCC_DWM-W095A_SAR_5.6”.

3.2 DUT (Bluetooth) Details

Table 2

Transmitter:	WLAN / BT Combo Module
Network Standard:	Bluetooth^{TM} RF Test Specification
Modulation Type:	Frequency Hopping Spread Spectrum (FHSS)
Frequency Range:	2402 MHz to 2480 MHz
Number of Channels:	79
Carrier Spacing:	1.0 MHz
Antenna Types:	Nissei Inverted F antenna BT: ANT 0
Max. Output Power:	9 dBm
Reference Oscillator:	16 MHz (Built-in)
Power Supply:	3.3 VDC from host.

Table 3 Frequency allocation

Channel Number	Frequency (MHz)	Bluetooth Utility power setting
1	**2402**	9 dBm
2	2403	
-	-	
39	2440	
40	**2441**	
41	2442	
-	-	
78	2479	
79	**2480**	

3.3 DUT (Notebook PC) Details

Table 4

Host notebook :	STYLISTIC Q series
Model Name:	Q555
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Intel Atom Z3795 1.6GHz
LCD	10.1"WQXGA(2560x1600) : VVX10F046J0
Port Replicator Model:	Cradle: FPCPR291xx Charging only Cradle: FPCPR294

3.4 Test Sample Accessories

3.4.1 Battery Types

One type of Fujitsu Lithium Ion battery is used to power the DUT.

Table 5 Battery Details

Model	FPCBP415
V/mAh	3.8V/9600mAh

4.0 TEST SIGNAL, FREQUENCY AND OUTPUT POWER

Mitsumi test tool was used to configure the WLAN for testing. The DUT Wireless LAN had a total of 11 channels within the 2412 to 2462 MHz frequency band and 12 channels within the frequency range 5180 to 5825 MHz. In The frequency range 2412 MHz to 2462 MHz the DUT operates in 2 modes, OFDM and DSSS. Within the 5180 to 5825 MHz frequency range, the DUT operates in OFDM mode only. For the SAR measurements the DUT was operating in continuous transmit mode using programming codes supplied by Fujitsu.

The Bluetooth module operates over 79 channels within the frequency range 2402 to 2480 MHz. It is possible for the Bluetooth module to operate simultaneously with the WLAN module (co-transmission). However, due to low output power of Bluetooth module (less than 8mW), standalone SAR measurement for Bluetooth module was not conducted (as per **KDB 616217**).

The test results mentioned in this report only apply to the 2450MHz frequency range. An additional report titled *"M140913_FCC_DWM-W095A_SAR_5.6"* is specific to the 5GHz range.

The WLAN modules can be configured in a number of different data rates. It was found that the highest source based time averaged power was measured when using the lowest data rates available in each mode. This lowest data rate corresponds to 6Mbps in OFDM mode and 1Mbps in DSSS mode.

The frequency span of the 2450 MHz range Band was more than 10MHz consequently; the SAR levels of the test sample were measured for lowest, centre and highest channels in the applicable modes. There were no wires or other connections to the DUT during the SAR measurements.

At the beginning of the SAR tests, the conducted power of the device was measured after temporary modification of antenna connector inside the device's TX RX compartment. Measurements were performed with a calibrated Power Meter. The Transmitter power was set to be equal or higher than power specified by the manufacturer.

4.1 Battery Status

The device battery was fully charged prior to commencement of measurement. Each SAR test was completed within 30 minutes. The battery condition was monitored by measuring the RF field at a defined position inside the phantom before the commencement of each test and again after the completion of the test. It was not possible to perform conducted power measurements at the output of the device, at the beginning and end of each scan due to lack of a suitable antenna port. The uncertainty associated with the power drift was less than 5% and was assessed in the uncertainty budget.

5.0 DETAILS OF TEST LABORATORY

5.1 Location

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5.2 Accreditations

EMC Technologies Pty. Ltd. is accredited by the National Association of Testing Authorities, Australia (NATA).
NATA Accredited Laboratory Number: 5292

EMC Technologies Pty Ltd is NATA accredited for the following standards:

Table 6

AS/NZS 2772.2 2011:	RF and microwave radiation hazard measurement
ACMA:	Radio communications (Electromagnetic Radiation - Human Exposure) Standard 2003 as amended.
EN 50360: 2001	Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)
EN 62209-1:2006	Human Exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models instrumentation and procedures. **Part 1:** Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (300 MHz to 3 GHz)
EN 62209-2:2010	Human Exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models instrumentation and procedures **Part 2**: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz
IEEE 1528: 2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Measurement Techniques.

Refer to NATA website www.nata.asn.au for the full scope of accreditation.

5.3 Environmental Factors

The measurements were performed in a shielded room with no background RF signals. The temperature in the laboratory was controlled to within 20±1°C, the humidity was in the range 41% to 43%. The liquid parameters are measured daily prior to the commencement of each test. Tests were performed to check that reflections within the environment did not influence the SAR measurements. The noise floor of the DASY5 SAR measurement system using the SN1380 probe was less than 5μV in both air and liquid mediums.

6.0 DESCRIPTION OF SAR MEASUREMENT SYSTEM

Table 7

Applicable Head Configurations Applicable Body Configurations	: None : Lap Held Position : Edge On Position

6.1 Probe Positioning System

The measurements were performed with the state-of-the-art automated near-field scanning system **DASY5 Version 52** from Schmid & Partner Engineering AG (SPEAG). The DASY5 fully complies with the IEEE 1528, EN62209-1 and EN62209-2 SAR measurement requirements.

6.2 E-Field Probe Type and Performance

The SAR measurements were conducted with SPEAG dosimetric probe ET3DV6 Serial: 1380. Please refer to appendix C for detailed information.

6.3 System verification

6.3.1 System verification Results @ 2450MHz

The following tables lists the dielectric properties of the tissue simulating liquid measured prior to SAR system verification. The results of the system verification are listed in columns 4 and 5. The forward power into the reference dipole for SAR system verification was adjusted to 250 mW.

Table 8 System verification Results (Dipole: SPEAG D2450V2 SN: 724)

1. System Verification Date	2. Frequency (MHz)	3. ∈r (measured)	4. σ (mho/m) (measured)	5. Measured SAR 1g	6. Measured SAR 10g	7. Last Validation Date
11th Sept. 2014	2450	52.3	1.94	14.1	6.42	14th Apr.2014
12th Sept. 2014	2450	52.3	1.94	13.5	6.17	14th Apr.2014

6.3.2 Deviation from reference system verification values

Currently no IEEE Std 1528-2013 or EN 62209-2 SAR reference values are available in 2.4 GHz band, as a consequence all system verification results were compared against the SPEAG calibration reference SAR values.

The SPEAG calibration reference SAR value is the SAR system verification result obtained in a specific dielectric liquid using the validation dipole (D2450V2) during calibration. The measured one-gram SAR should be within 10% of the expected target reference values shown in table below (2450MHz) below.

Table 9 Deviation from reference system verification values @ 2450MHz

Frequency and Date	Measured SAR 1g (mW/g)	Measured SAR 1g (Normalized to 1W)	SPEAG Calibration reference SAR Value 1g (mW/g)	Deviation From SPEAG Reference 1g (%)
2450MHz 11th Sept. 2014	14.1	56.40	51.5	9.51
2450MHz 12th Sept. 2014	13.5	54.00	51.5	4.85

NOTE: All reference system verification values are referenced to 1W input power.

6.3.3 Liquid Depth 15cm

During the SAR measurement process the liquid level was maintained to a level of 15cm with a tolerance of 0.5cm.

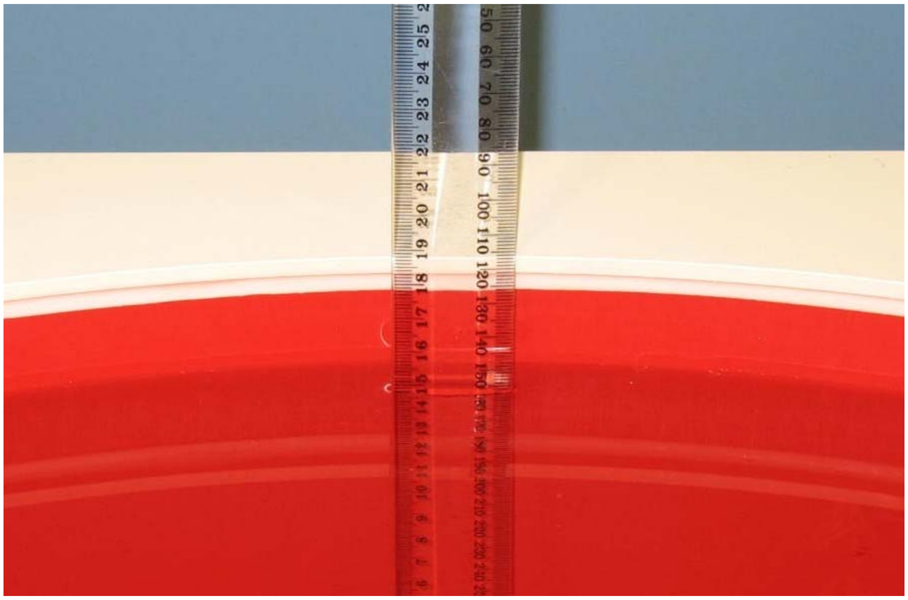

Photo of liquid Depth in Flat Phantom

6.4 Phantom Properties

The phantoms used during the testing comply with the IEEE 1528 and EN62209-1 and EN62209-2 SAR measurement requirements.

Table 10 Phantom Properties

Phantom Properties	
Depth of Phantom	19 cm
Width of flat section	40 cm
Length of flat section	60 cm
Thickness of flat section	2.0mm +/-0.2mm (flat section)
Dielectric Constant	<5.0
Loss Tangent	<0.05

6.5 Tissue Material Properties

The dielectric parameters of the human tissue simulating liquid were measured prior to SAR assessment using the HP85070A dielectric probe kit and HP8753ES Network Analyser. The actual dielectric parameters are shown in the following table.

Table 11 Target Body Simulating Liquid Dielectric Values

Frequency Band	∈r (target)	σ (target)	ρ kg/m³
2412 MHz Muscle	52.7 ±5% (50.1 to 55.3)	1.95 ±5% (1.85 to 2.05)	1000
2437 MHz Muscle	52.7 ±5% (50.1 to 55.3)	1.95 ±5% (1.85 to 2.05)	1000
2462 MHz Muscle	52.7 ±5% (50.1 to 55.3)	1.95 ±5% (1.85 to 2.05)	1000

NOTE: The muscle liquid parameters were within the required tolerances of ±5%.

6.5.1 Liquid Temperature and Humidity

The humidity and dielectric/ambient temperatures were recorded during the assessment of the tissue material dielectric parameters. The difference between the ambient temperature of the liquid during the dielectric measurement and the temperature during tests was less than |2|°C.

Table 12 Temperature and Humidity recorded for each day

Date	Ambient Temperature (°C)	Liquid Temperature (°C)	Humidity (%)
11th Sept. 2014	20.5	20.3	43
12th Sept. 2014	20.6	20.4	41

6.6 Simulated Tissue Composition Used for SAR Test

The tissue simulating liquids are created prior to the SAR evaluation and often require slight modification each day to obtain the correct dielectric parameters.

Table 13 Tissue Type: Muscle @ 2450MHz

Volume of Liquid: 60 Litres

Approximate Composition	% By Weight
Distilled Water	73.2
Salt	0.04
DGBE	26.7

6.7 Device Holder for Laptops and ELI 4.0 Phantom

A low loss clamp was used to position the DUT underneath the phantom surface.

Refer to Appendix A for photographs of device positioning

7.0 SAR MEASUREMENT PROCEDURE USING DASY5

The SAR evaluation was performed with the SPEAG DASY5 system. A summary of the procedure follows:

a) A measurement of the SAR value at a fixed location is used as a reference value for assessing the power drop of the DUT. The SAR at this point is measured at the start of the test, and then again at the end of the test.

b) The SAR distribution at the exposed flat section of the flat phantom is measured at a distance of 4 mm from the inner surface of the shell. The area covers the entire dimension of the DUT and the horizontal grid spacing is 15 mm x 15 mm. The actual Area Scan has dimensions of 90mm x 75mm surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation.

c) Around this point, a volume of 30 mm x 30 mm x 30 mm is assessed by measuring 7 x 7 x 7 points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:

  (i) The data at the surface are extrapolated, since the centre of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 4 mm. The extrapolation is based on a least square algorithm. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.

  (ii) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot”- condition (in x, y and z-direction). The volume is integrated with the trapezoidal – algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.

  (iii) All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.

  (iv) The SAR value at the same location as in Step (a) is again measured to evaluate the actual power drift.

8.0 MEASUREMENT UNCERTAINTY

The uncertainty analysis is based on the template listed in the IEEE Std 1528-2013 for both device SAR tests and System verification uncertainty. The measurement uncertainty of a specific device is evaluated independently and the total uncertainty for both evaluations (95% confidence level) must be less than 30%.

Table 14 Uncertainty Budget for DASY5 Version 52 – DUT SAR test 2450MHz

Error Description	Uncert. Value	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i	10g u_i	v_i
Measurement System								
Probe Calibration	6	N	1.00	1	1	6.00	6.00	∞
Axial Isotropy	4.7	R	1.73	0.7	0.7	1.90	1.90	∞
Hemispherical Isotropy	9.6	R	1.73	0.7	0.7	3.88	3.88	∞
Boundary Effects	2	R	1.73	1	1	1.15	1.15	∞
Linearity	4.7	R	1.73	1	1	2.71	2.71	∞
System Detection Limits	1	R	1.73	1	1	0.58	0.58	∞
Modulation response	2.4	R	1.73	1	1	1.39	1.39	∞
Readout Electronics	0.3	N	1.00	1	1	0.30	0.30	∞
Response Time	0.8	R	1.73	1	1	0.46	0.46	∞
Integration Time	2.6	R	1.73	1	1	1.50	1.50	∞
RF Ambient Noise	3	R	1.73	1	1	1.73	1.73	∞
RF Ambient Reflections	3	R	1.73	1	1	1.73	1.73	∞
Probe Positioner	0.8	R	1.73	1	1	0.46	0.46	∞
Probe Positioning	6.7	R	1.73	1	1	3.87	3.87	∞
Post Processing	4	R	1.73	1	1	2.31	2.31	∞
Test Sample Related								
Power Scaling	0	R	1.73	1	1	0.00	0.00	∞
Test Sample Positioning	2.9	N	1.00	1	1	2.90	2.90	145
Device Holder Uncertainty	3.6	N	1.00	1	1	3.60	3.60	5
Output Power Variation – SAR Drift Measurement	4.71	R	1.73	1	1	2.72	2.72	∞
Phantom and Setup								
Phantom Uncertainty	7.6	R	1.73	1	1	4.39	4.39	∞
SAR Correction	1.9	R	1.73	1	0.84	1.10	0.92	∞
Liquid Conductivity – Measurement uncertainty	2.5	N	1.00	0.64	0.71	1.60	1.78	∞
Liquid Permittivity – Measurement uncertainty	2.5	N	1.00	0.6	0.26	1.50	0.65	∞
Temp.unc. - Conductivity	3.4	R	1.73	0.78	0.71	0.77	0.70	∞
Temp. unc. - Permittivity	0.4	R	1.73	0.23	0.26	0.04	0.05	∞
Combined standard Uncertainty (u_c)						12.2	12.1	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=	2		24.4	24.3	

Estimated total measurement uncertainty for the DASY5 measurement system was ±12.2%. The extended uncertainty (K = 2) was assessed to be ±24.4% based on 95% confidence level. The uncertainty is not added to the measurement result.

Table 15 Uncertainty Budget for DASY5 Version 52 – System verification 2450MHz

Error Description	Uncert. Value	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i	10g u_i	v_i
Measurement System								
Probe Calibration	6	N	1.00	1	1	6.00	6.00	∞
Axial Isotropy	4.7	R	1.73	1	1	2.71	2.71	∞
Hemispherical Isotropy	9.6	R	1.73	0	0	0.00	0.00	∞
Boundary Effects	1	R	1.73	1	1	0.58	0.58	∞
Linearity	4.7	R	1.73	1	1	2.71	2.71	∞
System Detection Limits	1	R	1.73	1	1	0.58	0.58	∞
Modulation response	0	R	1.73	1	1	0.00	0.00	∞
Readout Electronics	0.3	N	1.00	1	1	0.30	0.30	∞
Response Time	0	R	1.73	1	1	0.00	0.00	∞
Integration Time	0	R	1.73	1	1	0.00	0.00	∞
RF Ambient Noise	1	R	1.73	1	1	0.58	0.58	∞
RF Ambient Reflections	1	R	1.73	1	1	0.58	0.58	∞
Probe Positioner	0.8	R	1.73	1	1	0.46	0.46	∞
Probe Positioning	6.7	R	1.73	1	1	3.87	3.87	∞
Post Processing	2	R	1.73	1	1	1.15	1.15	∞
Dipole Related								
Deviation of exp. dipole	5.5	R	1.73	1	1	3.18	3.18	##
Dipole Axis to Liquid Dist.	2	R	1.73	1	1	1.15	1.15	##
Input power & SAR drift	3.40	R	1.73	1	1	1.96	1.96	∞
Phantom and Setup								
Phantom Uncertainty	4	R	1.73	1	1	2.31	2.31	∞
SAR Correction	1.9	R	1.73	1	0.84	1.10	0.92	∞
Liquid Conductivity – Measurement uncertainty	2.5	N	1.00	0.78	0.71	1.95	1.78	∞
Liquid Permittivity – Measurement uncertainty	2.5	N	1.00	0.26	0.26	0.65	0.65	∞
Temp.unc. - Conductivity	3.4	R	1.73	0.78	0.71	0.77	0.70	∞
Temp. unc. - Permittivity	0.4	R	1.73	0.23	0.26	0.04	0.05	∞
Combined standard Uncertainty (u_c)						9.76	9.70	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k= 2			19.5	19.4	

Estimated total measurement uncertainty for the DASY5 measurement system was ±9.76%. The extended uncertainty (K = 2) was assessed to be ±19.5% based on 95% confidence level. The uncertainty is not added to the System verification measurement result.

9.0 EQUIPMENT LIST AND CALIBRATION DETAILS

Table 16 SPEAG DASY5 Version 52

Equipment Type	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test?
Robot - Six Axes	Staubli	RX90BL	N/A	Not applicable	✓
Robot Remote Control	SPEAG	CS7MB	RX90B	Not applicable	✓
SAM Phantom	SPEAG	N/A	1260	Not applicable	
SAM Phantom	SPEAG	N/A	1060	Not applicable	
Flat Phantom	AndreT	10.1	P 10.1	Not Applicable	
Flat Phantom	AndreT	9.1	P 9.1	Not Applicable	
Flat Phantom	SPEAG	ELI 4.0	1101	Not Applicable	✓
Data Acquisition Electronics	SPEAG	DAE3 V1	359	06-June-2015	
Data Acquisition Electronics	SPEAG	DAE3 V1	442	10-Dec-2014	✓
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	
Probe E-Field	SPEAG	ET3DV6	1380	13-Dec-2014	✓
Probe E-Field	SPEAG	ET3DV6	1377	10-June-2015	
Probe E-Field	SPEAG	ES3DV6	3029	Not Used	
Probe E-Field	SPEAG	EX3DV4	3956	13-June-2015	
Probe E-Field	SPEAG	EX3DV4	3657	17-Dec-2014	
Antenna Dipole 450 MHz	SPEAG	D450V3	1074	11-Dec-2015	
Antenna Dipole 750 MHz	SPEAG	D750V2	1051	13-Dec-2016	
Antenna Dipole 900 MHz	SPEAG	D900V2	047	22-June-2015	
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	20-June-2015	
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	20-June-2015	
Antenna Dipole 1950 MHz	SPEAG	D1950V3	1113	6-Dec -2015	
Antenna Dipole 2300 MHz	SPEAG	D2300V2	1032	22-Aug-2016	
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	04-Dec-2015	✓
Antenna Dipole 2600 MHz	SPEAG	D2600V2	1044	13-Dec-2016	
Antenna Dipole 3500 MHz	SPEAG	D3500V2	1002	13-July-2013	
Antenna Dipole 5600 MHz	SPEAG	D5GHzV2	1008	16-Dec-2014	
RF Amplifier	EIN	603L	N/A	*In test	
RF Amplifier	Mini-Circuits	ZHL-42	N/A	*In test	✓
RF Amplifier	Mini-Circuits	ZVE-8G	N/A	*In test	
Synthesized signal generator	Hewlett Packard	ESG-D3000A	GB37420238	*In test	
RF Power Meter	Hewlett Packard	437B	3125012786	28-Aug-2014	✓
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	29-Aug-2014	✓
RF Power Meter	Rohde & Schwarz	NRP	101415	18-Sept-2014	
RF Power Sensor	Rohde & Schwarz	NRP - Z81	100174	18-Sept-2014	
RF Power Meter Dual	Hewlett Packard	435A	1733A05847	*In test	✓
RF Power Sensor	Hewlett Packard	8482A	2349A10114	*In test	✓
Network Analyser	Hewlett Packard	8714B	GB3510035	25-Sept-2014	
Network Analyser	Hewlett Packard	8753ES	JP39240130	6-Nov-2014	✓
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	*In test	
Dual Directional Coupler	NARDA	3022	75453	*In test	✓
Radio Communication Test Set	Rohde & Schwarz	CMU200	101573	Not Applicable	
Radio Communication Test Set	Anritsu	MT8820A	6200240559	Not Applicable	
Radio Communication Test Set	Agilent	PXT E6621A	MY51100168	Not Applicable	

* Calibrated during the test for the relevant parameters.

10.0 TEST METHODOLOGY

Tablets should be evaluated in normal use positions, typical for lap-held bottom-face only. However the number of positions will depend on the number of configurations the tablet can be operated in. The “Q555” PC can be used on the lap (see Appendix A) or hand held as a Tablet PC. One WLAN antenna location in the “Q555” is closest to the bottom of the tablet and the other antenna location is closest to the top of the tablet.

10.1 Positions

10.1.1 “Lap Held” Position Definition (0mm spacing)

The DUT was tested in the 2.00 mm flat section of the ELI4 Flat phantom for the “Lap Held” position. The Transceiver was placed at the bottom of the phantom and suspended in such way that the back of the DUT was touching the phantom. This device orientation simulates the PC’s normal use – being held on the lap of the user. A spacing of 0mm ensures that the SAR results are conservative and represent a worst-case position.

10.1.2 “Edge On” Position (Portrait or Landscape)

The DUT was tested in the (2.00 mm) flat section of the ELI4 Flat phantom for the “Edge On” position. The Antenna edge of the Transceiver was placed underneath the flat section of the phantom and suspended until the edge touched the phantom. *Refer to Appendix A for photos of measurement positions.*

10.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes)

The DUT has fixed antennas. Depending on the measured SAR level up to three test channels with the test sample operating at maximum power were recorded. The following table represents the matrix used to determine what testing was required. All relevant provisions of KDB 447498 are applied for SAR measurements of the host system.

Table 17 Testing configurations

Phantom Configuration	*Device Mode	Antenna	Test Configurations		
			Channel (Low)	Channel (Middle)	Channel (High)
Lap Held	2.4 GHz DSSS	A		X	
		B		X	
Edge On	2.4 GHz DSSS	A		X	
		B		X	

Legend

X (blue)	Testing Required in this configuration
(green)	Testing required in this configuration only if SAR of middle channel is more than 3dB below the SAR limit or it is the worst case.

NOTE: Throughout this report, Antenna A, B refer to Tx0, Tx1 in the host respectively.

11.0 SAR MEASUREMENT RESULTS

The SAR values averaged over 1g tissue masses were determined for the sample DUT for all test configurations listed in section 10.2.

11.1 2450MHz SAR Results

There are two modes of operation within the 2450MHz band, they include OFDM and DSSS modulations. Refer to section 10.2 for selection of all device test configurations. Table below displays the SAR results.

Table 18 SAR MEASUREMENT RESULTS – DSSS Mode

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (1g) mW/g	Drift (dB)	∈r (target 52.7 ±5% 50.1 to 55.3)	σ (target 1.95 ±5% 1.85 to 2.05)	Tune – Up SAR (mW/g)
Body Worn Lap Held Antenna 1 11-09-14	1.	DSSS 2450 MHz 1Mbs	1	2412	0.758	-0.05	52.58	1.86	0.758
Body Worn Lap Held Antenna 1 11-09-14	2.	DSSS 2450 MHz 1Mbs	6	2437	0.768	-0.03	52.52	1.909	0.768
Body Worn Lap Held Antenna 1 11-09-14	3.	DSSS 2450 MHz 1Mbs	11	2462	0.69	-0.2	52.32	1.964	0.69
Body Worn Lap Held Antenna 1 11-09-14	4.	DSSS 2450 MHz 1Mbs	6	2437	0.592	0.01	52.52	1.909	0.592
Body Worn Lap Held Antenna 1 11-09-14	5.	DSSS 2450 MHz 1Mbs	6	2437	0.673	-0.03	52.52	1.909	0.673
Body Worn Lap Held Antenna 0 11-09-14	6.	DSSS 2450 MHz 1Mbs	1	2412	1.48	0	52.58	1.86	1.48
Body Worn Lap Held Antenna 0 11-09-14	7.	DSSS 2450 MHz 1Mbs	6	2437	1.35	-0.13	52.52	1.909	1.35
Body Worn Lap Held Antenna 0 11-09-14	8.	DSSS 2450 MHz 1Mbs	11	2462	1.34	0.2	52.32	1.964	1.34
Body Worn Lap Held Antenna 0 11-09-14	9.	DSSS 2450 MHz 1Mbs	1	2412	1.32	-0.05	52.58	1.86	1.32
Body Worn Lap Held Antenna 0 11-09-14	10.	DSSS 2450 MHz 1Mbs	1	2412	**1.52**	0.01	52.58	1.86	**1.52**
Body Worn Secondary Landscape Antenna 0 12-09-14	11.	DSSS 2450 MHz 1Mbs	6	2437	0.13	0.07	52.39	1.915	0.13
Body Worn Primary Landscape Antenna 1 12-09-14	12.	DSSS 2450 MHz 1Mbs	6	2437	0.0852	0.01	52.39	1.915	0.0852
Body Worn Secondary Portrait Antenna 0 12-09-14	13.	DSSS 2450 MHz 1Mbs	6	2437	0.632	-0.03	52.39	1.915	0.632
Body Worn Primary Portrait Antenna 1 12-09-14	14.	DSSS 2450 MHz 1Mbs	6	2437	0.547	0	52.39	1.915	0.547
System Check 11-09-14	15.	CW	1	2450	14.1	-0.07	52.43	1.944	14.1
System Check 12-09-14	16.	CW	1	2450	13.5	-0.09	52.3	1.937	13.5

NOTE: The measurement uncertainty of 24.4% for 2.45GHz was not added to the result.

The highest SAR level recorded in the 2450MHz band was 1.52 mW/g as evaluated in a 1g cube of averaging mass. The manufacturer's tune up power is stated to be 16 dBm. Scaling the SAR value was not required because the RF power during testing was 16.0 dBm or higher This value was obtained in Body Worn Lap Held position in DSSS mode, utilizing channel 1 (2412 MHz) and antenna 0

12.0 COMPLIANCE STATEMENT

The Fujitsu TABLET PC, Model: Q555 with MITSUMI Wireless LAN & Bluetooth Module (802.11a/b/g/n), Model: DWM-W095A was found to comply with the FCC SAR requirements.

The highest Reported SAR level was 1.52 mW/g for a 1g cube. The manufacturer's tune up power is stated to be 16 dBm. Scaling the SAR value was not required because the RF power during testing was 16.0 dBm or higher. This value was obtained in Body Worn Lap Held position in DSSS mode, utilizing channel 1 (2412 MHz) and antenna 0. This was below the limit of 1.6 mW/g for uncontrolled exposure, but was within the band of measurement uncertainty around the limit.

The SAR test Variability checks were conducted and the repeated results are included in the SAR results tables.

13.0 MULTIBAND EVALUATION CONSIDERATIONS

According to the FCC SAR evaluation procedures mentioned in KDB447498, when the sum of SAR results (simultaneously transmitting antennas WLAN and WWAN) is > 1.6mW/g, and "the aggregate 1-g SAR is scaled by the sum of the differences between maximum tune-up and tested power of each transmitter - [(SAR1 +SAR2) * (Pdiff1 + Pdiff2)]", or the ratio of above sum raised to the power of 1.5 to the distance between peak SAR locations is ≥ 0.04, $(SAR1 + SAR2)^{1.5}/Ri$ (rounded to two decimal digits), simultaneous transmission SAR evaluation is required.

The shortest distance between the BT antenna (Antenna 0) and the user is 5mm. The closest distance between WLAN 0 and WLAN1 antennas was 235mm.

In regards to the simultaneous transmission: according to the section 4.3.2 of the KDB 447498 the estimated SAR of the simultaneously transmitting Bluetooth is given by formula:

(*max. power of channel*, *including tune-up tolerance*, *mW*)/(*min. test separation distance*, *mm*)]·[√f(2.45GHz)/*x*] W/kg
Result - [(**8 mW**)/(**5**mm)] ·[√f(GHz)/7.5]=**0.33**W/kg.

The highest SAR for the antenna A (0) was 1.52 mW/g and the highest SAR for antenna B(1) was 0.768 mW/g the ratio of above sum raised to the power of 1.5 to the distance between peak SAR locations is

As $(1.52 + 0.768)^{1.5}/235=0.015 < 0.04$ so simultaneous transmission is not required

Diagram Showing Antenna Positions