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SAR Test Report

Report Number: M141024_FCC_7265NGW_SAR_2.4

Test Sample:	Portable NOTEBOOK Computer
Host PC Model Number:	T725
Radio Modules:	WLAN & Bluetooth Intel StonePeak 7265NGW
FCC ID:	EJE-WB0091
Date of Issue:	18th November 2014

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SAR TEST REPORT

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1.0 GENERAL INFORMATION

Test Sample:	Portable NOTEBOOK Computer
Model Name:	T725
Radio Modules:	WLAN & Bluetooth 7265NGW
Interface Type:	M.2 Wireless LAN Module
Device Category:	Portable Transmitter
Test Device:	Pre-Production Unit
FCC ID:	EJE-WB0091
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 NOTEBOOK Computer T725 with Wireless LAN and Bluetooth model 7265NGW 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 - 0.246 mW/g
Test Dates:	27th October 2014

Test Officer:

Peter Jakubiec **Mahan Ghassempouri**

Authorised Signature:

Chris Zombolas
Technical Director

SAR TEST REPORT
Portable NOTEBOOK Computer Model: T725
Report Number: M141024_FCC_7265NGW_SAR_2.4

2.0 INTRODUCTION

Testing was performed on the Fujitsu NOTEBOOK PC, Model: T725 with INTEL M.2 integrated Wireless LAN & Bluetooth Module (INTEL STONEPEAK 802.11a/b/g/n/ac), Model: 7265NGW. The 7265HMW WLAN module was originally certified by INTEL Corporation as a modular approval under FCC ID: PD97265NG. The INTEL STONEPEAK module is an OEM product was tested in the dedicated host – LIFEBOOK T SERIES, Model T725 . 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 B (2), the Bluetooth maximum power was 6dBm (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 - [(3.98)/(8mm)] ·[√f(2.45GHz)]=0.78

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 - [(3.98)/(8mm)] ·[√f(GHz)/7.5]=0.1W/kg.

The highest SAR for the antenna A (1) was 0.098 mW/g so the sum of the simultaneously transmitting Bluetooth and WLAN (Ant. B) was 0.198 mW/g which was below the SAR limit of 1.6mW/g.

The measurement test results mentioned hereon only apply to the 2450MHz frequency band; an additional report titled “M141024_FCC_7265NGW_SAR_5.6” applies to the 5GHz range.

3.0 TEST SAMPLE TECHNICAL INFORMATION

(Information supplied by the client)

3.1 DUT (WLAN) Details

Table 1

Transmitter:	M.2 Wireless LAN Module (WLAN parts)
FCC ID	PD97265NG
Wireless Module:	Intel Dual Band Wireless-AC 7265 (Stone Peak) (11ac/abgn)
Model Number:	7265NGW
Manufacturer:	Intel Corporation
Wi-Fi standard	802.11ac 2x2
Wi-Fi TX/RX chains	2x2 chains
Supported Bands	2.4GHz, 5GHz
Antenna Allocation	Main: Wi-Fi only, Aux: Shared Wi-Fi, BT
Wi-Fi TX/RX Throughput	867Mbps
Bluetooth Core	Bluetooth 4.0
Antenna Types:	Nissei Inverted F antenna BT: Antenna B (2)
Power Supply:	3.3 VDC from PCI bus

Table 2 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) Ch A	Average Power Target (dBm) Ch B	Gain Control Tx A	Gain Control Tx B	Average Power Measured (dBm) Tx A	Average Power Measured (dBm) Tx B
802.11b 2.4 GHz	1	2412	1	-	14.5	14.5	11.5	16.0	14.66	14.54
	6	2437					11.5	16.0	14.78	14.51
	11	2462					11.0	16.5	14.52	14.83
	13	2472					-	-	-	-
802.11g 2.4 GHz	1	2412	6	-	12.5	13.0	-	-	-	-
	2	2417			14.0	14.0	-	-	-	-
	6	2437			15.0	15.0	17.0	22.0	15.03	15.02
	10	2457			14.0	14.0	-	-	-	-
	11	2462			11.0	11.0	-	-	-	-
	13	2472			15.0	15.0	17.0	22.5	15.29	15.32
802.11n 2.4 GHz	1	2412	HT0	20	12.5	13.0	-	-	-	-
	2	2417			14.0	14.0	-	-	-	-
	6	2437			15.0	15.0	17.5	22.5	15.12	15.19
	10	2457			14.0	14.0	-	-	-	-
	11	2462			11.0	11.0	-	-	-	-
	13	2472			15.0	15.0	-	-	-	-
	3F	2422	HT0	40	12.0	12.0	14.0	19.0	12.01	12.02
	4F	2427			13.0	13.0	-	-	-	-
	5F	2432			14.0	14.0	-	-	-	-
	6F	2437			15.0	15.0	17.5	22.5	15.15	15.21
	7F	2442					-	-	-	-
	8F	2447			14.5	12.0	-	-	-	-
	9F	2452			11.0	10.0	-	-	-	-
	10F	2457			15.0	15.0	-	-	-	-
	11F	2462					17.5	22.5	15.31	15.16

5 GHz (802.11a)

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Tx BW (MHz)	Average Power Target (dBm)			Gain Control		Average Power Measured (dBm)	
					Ch A		Ch B	Gain Control Tx A	Gain Control Tx B	Tx A	Tx B
	5.2 GHz										
	36	5180			**12.5**		**12.5**	**-**	**-**	-	-
	40	5200						**24.5**	**24.5**	13.54	13.62
	44	5220			**13.5**		**13.5**	**-**	**-**	-	-
	48	5240						**24.5**	**24.5**	13.68	13.55
	5.3 GHz										
	52	5260						**24.5**	**25.0**	13.83	13.88
	56	5280			**13.5**		**13.5**	**-**	**-**	-	-
	60	5300						**24.0**	**25.0**	13.54	13.57
	64	5320			**12.0**		**12.0**	**-**	**-**	-	-
	5.6 GHz										
	100	5500			**12.0**		**12.0**	**-**	**-**	-	-
	104	5520						**24.0**	**26.0**	13.82	13.51
802.11a	108	5540	6	-				**-**	**-**	-	-
	112	5560						**-**	**-**	-	-
	116	5580						**24.0**	**26.5**	13.76	13.77
	120	5600			**13.5**		**13.5**	**24.0**	**26.5**	13.73	13.59
	124	5620						**-**	**-**	-	-
	128	5640						**-**	**-**	-	-
	132	5660						**-**	**-**	-	-
	136	5680						**24.5**	**27.5**	13.74	13.73
	140	5700			**11.5**		**11.5**	**-**	**-**	-	-
	5.8 GHz										
	149	5745						**24.5**	**27.5**	13.57	13.68
	153	5765						**-**	**-**	-	-
	157	5785			**13.5**		**13.5**	**24.5**	**27.5**	13.51	13.56
	161	5805						**-**	**-**	-	-
	165	5825						**-**	**-**	-	-

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	Gain Control Tx A	Gain Control Tx B	Average Power Measured (dBm) Tx A	Average Power Measured (dBm) Tx B
	5.2 GHz									
	36	5180			12.5	12.5	-	-	-	-
	40	5200					25.0	25.0	13.50	13.65
	44	5220			13.5	13.5	-	-	-	-
	48	5240					25.0	25.0	13.80	13.64
	5.3 GHz									
	52	5260					24.5	25.0	13.55	13.53
	56	5280			13.5	13.5	-	-	-	-
	60	5300					24.5	25.5	13.77	13.76
	64	5320			12.0	12.0	-	-	-	-
	5.6 GHz									
	100	5500			12.0	12.0	-	-	-	-
	104	5520		20			24.0	26.5	13.58	13.71
	108	5540					-	-	-	-
	112	5560					-	-	-	-
	116	5580					24.0	26.5	13.54	13.53
	120	5600			13.5	13.5	-	-	-	-
	124	5620					-	-	-	-
	128	5640					-	-	-	-
	132	5660					-	-	-	-
	136	5680					24.5	27.5	13.54	13.55
802.11n	140	5700	HT0		11.5	11.5	-	-	-	-
	5.8 GHz									
	149	5745					25.0	27.5	13.85	13.52
	153	5765					-	-	-	-
	157	5785			13.5	13.5	25.0	28.0	13.76	13.82
	161	5805					-	-	-	-
	165	5825					25.0	28.0	13.51	13.54
	5.2 GHz									
	38	5190			10.5	12.0	-	-	-	-
	46	5230			13.5	13.5	-	-	-	-
	5.3 GHz									
	54	5270			13.5	13.5	-	-	-	-
	62	5310			12.0	12.0	-	-	-	-
	5.6 GHz									
	102	5510		40 Wide	12.0	12.5	-	-	-	-
	110	5550					-	-	-	-
	118	5590					-	-	-	-
	126	5630			13.5	13.5	-	-	-	-
	134	5670					-	-	-	-
	142	5710			13.5	13.5	-	-	-	-
	5.8 GHz									
	151	5755			13.5	13.5	-	-	-	-
	159	5795					-	-	-	-

5 GHz (802.11ac)

Mode	Channel	Frequency (MHz)	Data Rate (Mbps)	Tx BW (MHz)	Average Power Target (dBm)			Gain Control		Average Power Measured (dBm)	
					Ch A		Ch B	Gain Control Tx A	Gain Control Tx B	Tx A	Tx B
802.11ac	**5.2 GHz**		HT0	80 Wide							
	42	5210			12.0		12.0	-	-	-	-
	5.3 GHz										
	58	5290			12.0		12.0	-	-	-	-
	5.6 GHz										
	106	5530			12.0		12.0	-	-	-	-
	122	5610			13.5		13.5	-	-	-	-
	138	5690			13.5		13.5	-	-	-	-
	5.8 GHz										
	155	5775			13.5		13.5	-	-	-	-

NOTE: For 5GHz SAR results refer to report titled "M141024_FCC_7265NGW_SAR_5.6".

3.2 DUT (Bluetooth) Details

Table 3

Transmitter:	WLAN / BT Combo Module
Network Standard:	Bluetooth™ 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: Antenna B (2)
Max. Output Power:	6 dBm
Reference Oscillator:	16 MHz (Built-in)
Power Supply:	3.3 VDC from host.

Table 4 Frequency allocation

Channel Number	Frequency (MHz)	Bluetooth Utility power setting
1	**2402**	6 dBm
2	2403	
-	-	
39	2440	
40	**2441**	
41	2442	
-	-	
78	2479	
79	**2480**	

3.3 DUT (Notebook PC) Details

Host notebook :	LIFEBOOK T series
Model Name:	T725
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Core i7 2.6GHz
LCD	12.5”HD+(1366x768) : LP125WH2
Graphics chip	Non
Wired LAN:	Intel 218LM : 10 Base-T/100 Base-TX/1000Base-T
Modem:	Non
Port Replicator Model:	FPCPR213
AC Adapter Model:	90W: A13-090P1A(Chicony), A13-090P2A (Chicony) ADP-90BE D(Delta), ADP-90BE C(Delta) 80W: ADP-80SB A(Delta), ADP-80SB B(Delta) 65W: ADP-65MD B(Delta), ADP-65MD C(Delta) A13-065N2A(Chicony), A13-065N3A(Chicony)
Voltage:	19 V
Current Specs:	4.74A / 4.22A / 3.42A
Watts:	90W / 80W / 65W

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	FPCBP446
V/mAh	11.25V/6400mAh

4.0 TEST SIGNAL, FREQUENCY AND OUTPUT POWER

INTEL's CRTU 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 device operates in OFDM mode only. For the SAR measurements the device 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 3.98 mW), 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 "M141024_FCC_7265NGW_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

EMC Technologies Pty Ltd
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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:

AS/NZS 2772.2 2011:	RF and microwave radiation hazard measurement
ACMA:	Radio communications (Electromagnetic Radiation - Human Exposure) Standard 2003 + Amdt (No. 1):2007
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 53%. 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 6

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 7 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
27th Oct. 2014	2450	51.2	1.95	13.5	6.11	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 8 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	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.

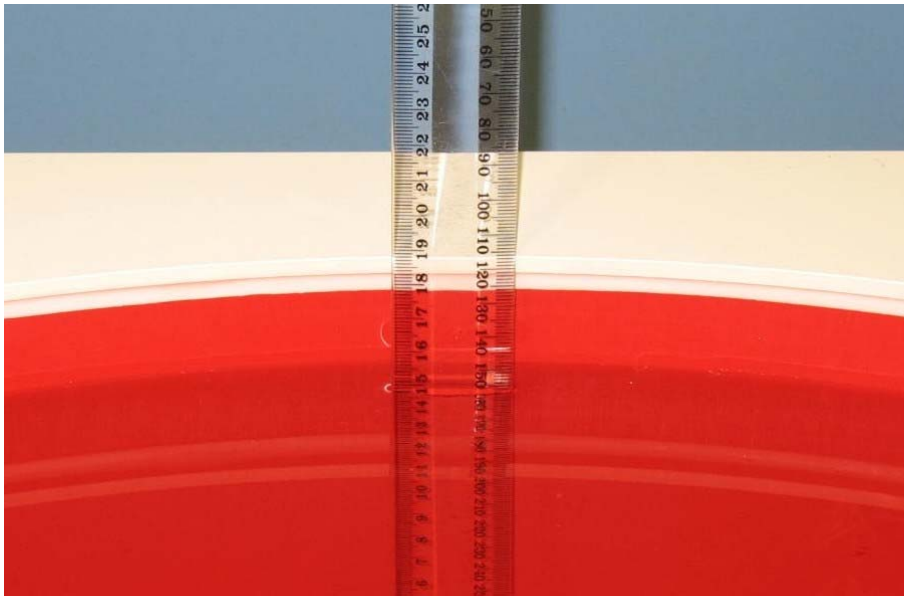

Photo of liquid Depth in Flat Phantom

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 9 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 10 Target Body Simulating Liquid Dielectric Values

Frequency Band	$\in r$ (target)	σ (target)	ρ kg/m^3
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 11 Temperature and Humidity recorded for each day

Date	Ambient Temperature (°C)	Liquid Temperature (°C)	Humidity (%)
27th October 2014	19.9	19.7	53

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 12 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 12 mm x 12 mm. The actual Area Scan has dimensions of 96mm x 120mm 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 13 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	4.50	R	1.73	1	1	2.60	2.60	∞
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)						12.19	12.12	
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=	2		24.38	24.25	

Estimated total measurement uncertainty for the DASY5 measurement system was ±12.19%. The extended uncertainty (K = 2) was assessed to be ±24.38% based on 95% confidence level. The uncertainty is not added to the measurement result.

Table 14 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		19.52	19.41	

Estimated total measurement uncertainty for the DASY5 measurement system was ±9.76%. The extended uncertainty (K = 2) was assessed to be ±19.52% based on 95% confidence level. The uncertainty is not added to the System verification measurement result.

9.0 EQUIPMENT LIST AND CALIBRATION DETAILS

Table 15 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

Notebooks 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 laptop can be operated in. The “LIFEBOOK T SERIES ” can be used in either a conventional laptop position (see Appendix A) or a Tablet configuration. The antenna location in the “LIFEBOOK T SERIES ” is closest to the top of the.

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 Antennas 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 a 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 16 Testing configurations

Phantom Configuration	*Device Mode	Antenna	Test Configurations		
			Channel (Low)	Channel (Middle)	Channel (High)
Lap Held	DSSS 2.4 GHz	A		X	
	OFDM 2.4 GHz	B		X	
Edge On	DSSS 2.4 GHz	A		X	
	OFDM 2.4 GHz	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 and B refer to Tx1 and Tx2 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 17 SAR MEASUREMENT RESULTS

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)
Edge 1 2450 MHz Antenna B (2) 27-10-14	1.	OFDM 2450 MHz 6 Mbs	6	2437	**0.246**	-0.18	51.2	1.93	0.246
Edge 1 2450 MHz Antenna B (2) DSSS 27-10-14	2.	DSSS 2450 MHz 1Mbs	1	2412	0.241	0.04	51.3	1.889	0.241
Edge 1 2450 MHz Antenna B (2) DSSS 27-10-14	3.	DSSS 2450 MHz 1Mbs	6	2437	0.232	-0.02	51.2	1.93	0.232
Edge 1 2450 MHz Antenna B (2) DSSS 27-10-14	4.	DSSS 2450 MHz 1Mbs	1	2412	0.232	-0.05	51.3	1.889	0.232
Edge 1 2450 MHz Antenna A (1) 27-10-14	5.	OFDM 2450 MHz 6 Mbs	6	2437	0.023	-0.10	51.2	1.93	0.023
Edge 3 2450 MHz Antenna A (1) 27-10-14	-	OFDM 2450 MHz 6 Mbs	6	2437	Noise floor	N/A	51.2	1.93	Noise floor
Edge 2 2450 MHz Antenna A (1) 27-10-14	6.	OFDM 2450 MHz 6 Mbs	6	2437	0.098	0.00	51.2	1.93	0.098
Edge 2 2450 MHz Antenna A (1) DSSS 27-10-14	7.	DSSS 2450 MHz 1Mbs	1	2412	0.083	-0.05	51.3	1.889	0.083
Edge 2 2450 MHz Antenna A (1) DSSS 27-10-14	8.	DSSS 2450 MHz 1Mbs	6	2437	0.091	-0.15	51.2	1.93	0.091
Edge 2 2450 MHz Antenna A (1) DSSS 27-10-14	9.	DSSS 2450 MHz 1Mbs	11	2462	0.084	-0.07	51.1	1.967	0.084
Edge 2 2450 MHz Antenna B (2) 27-10-14	10.	OFDM 2450 MHz 6 Mbs	6	2437	0.057	-0.20	51.2	1.93	0.057
Edge 2 2450 MHz Antenna B (2) DSSS 27-10-14	11.	DSSS 2450 MHz 1Mbs	1	2412	0.047	-0.04	51.3	1.889	0.047
Edge 2 2450 MHz Antenna B (2) DSSS 27-10-14	12.	DSSS 2450 MHz 1Mbs	6	2437	0.050	-0.16	51.24	1.93	0.050
Edge 2 2450 MHz Antenna B (2) DSSS 27-10-14	13.	DSSS 2450 MHz 1Mbs	11	2462	0.053	-0.08	51.1	1.967	0.053
Lap Held 2450 MHz Antenna A (1) 27-10-14	14.	OFDM 2450 MHz 6 Mbs	6	2437	0.068	-0.08	51.2	1.93	0.068
Lap Held 2450 MHz Antenna B (2) 27-10-14	15.	OFDM 2450 MHz 6 Mbs	6	2437	0.084	-0.08	51.2	1.93	0.084
System Check 27-10-14	16.	CW	1	2450	13.5	-0.02	51.2	1.95	-

NOTE: The measurement uncertainty of 24.38% for 2.45GHz was not added to the result.

The highest SAR level recorded in the 2450MHz band was 0.246 mW/g as evaluated in a 1g cube of averaging mass. This value was obtained in Edge 1 position in OFDM mode, utilizing channel 6 (2437 MHz) and antenna 2.

12.0 COMPLIANCE STATEMENT

The Fujitsu NOTEBOOK PC, Model: T725 with INTEL Wireless LAN & Bluetooth Module (802.11a/b/g/n/ac), Model: 7265NGW, was found to comply with the FCC SAR requirements.

The highest Reported SAR level was 0.246 mW/g for a 1g cube of averaging mass. The manufacturer's tune up power is stated to be 15 dBm. Scaling the SAR value was not required because the RF power during testing was 15 dBm or higher. This value was obtained in Edge 1 position in OFDM mode, utilizing channel 6(2437 MHz) and antenna 2. . This was below the limit of 1.6 mW/g for uncontrolled exposure, even taking into account the measurement uncertainty of 24.38 %.

13.0 MULTIBAND EVALUATION CONSIDERATIONS

According to the FCC SAR evaluation procedures mentioned in KDB447498, when the sum of 1-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit (∑ SAR <1.6), SAR test exclusion applies to that simultaneous transmission configuration.

The shortest distance between the BT antenna (Antenna 2) and the user is 8mm. The closest distance between WLAN 1 and WLAN2 antennas was 94 mm.

According to the section 4.3.2 of the KDB 447498 the estimated SAR of the Bluetooth is given by the formula:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(2.45GHz)/x] W/kg
Result - [(3.98 mW)/(5mm)] ·[√f(GHz)/7.5]=0.1 W/kg.

The highest SAR for the antenna B (2) was 0.246 mW/g the highest SAR for antenna A(1) was 0.098 mW/g, the sum of the 1-g SAR (0.246+0.098=0.344 mW/g) is less than SAR limit (1.6 mW/g). So SAR test exclusion applies to the simultaneous transmission configuration.

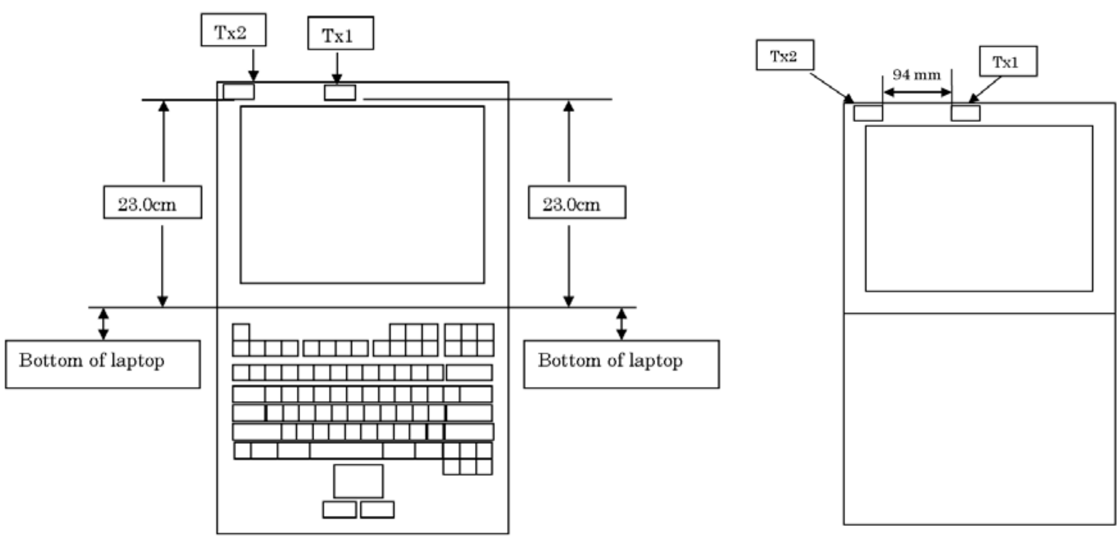

Diagram Showing Antenna Positions

NOTE: Throughout this report, Antenna A and B refer to Tx1, Tx2 in the host.