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**EMI TEST REPORT FOR CERTIFICATION  
to  
FCC PART 15 Subpart C (Section 15.247) & RSS-210**

FCC ID: EJE-WB0038  
Industry Canada ID: 337J-WB0038

Test Sample: LifeBook T Series  
Model: T4210

Radio Modules: WM3945ABG GOLAN INTEL Mini-PCI WLAN Module  
& EYTF3CSFT Bluetooth Module

Report Number: M060244\_Cert\_WM3945ABG\_DTS\_BT

Tested for: Fujitsu Australia Ltd.

Issue Date: 18<sup>th</sup> March 2006

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**EMI TEST REPORT FOR CERTIFICATION**  
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**FCC PART 15 Subpart C (Section 15.247) & RSS-210**  
**EMC Technologies Report No. M060244\_Cert\_WM3945ABG\_DTS\_BT**  
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**Refer to Report No: M060244\_Cert\_WM3945ABG\_NII\_BT**

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**Refer to Report No: M060244\_Cert\_EYTF3CSFT\_WLAN**

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**FCC PART 15 Subpart C (Section 15.247) & RSS-210**

**Report Number:** M060244\_Cert\_WM3945ABG\_DTS\_BT

**Test Sample:** LifeBook T Series  
**Model:** T4210  
**Radio Modules:** GOLAN INTEL Mini-PCI WLAN Module, Model: WM3945ABG (Intel Corp.)  
Bluetooth Module, Model: EYTF3CSFT (TAIYO YUDEN)

**FCC ID:** EJE-WB0038  
**Industry Canada ID:** 337J-WB0038  
**Equipment Type:** Intentional Radiator (Transceiver)

**Manufacturer (LifeBook):** Fujitsu Ltd - Mobile Computing Division  
**Address:** 1-1 Kamikodanaka 4-Chome, Nakahara-Ku, Kawasaki, Japan  
**Contact:** Mr. Tsuyoshi Uchihara

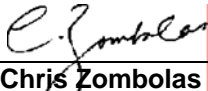
**Tested for:** Fujitsu Australia Ltd

**Test Standards:** FCC Part 15, Subpart C – Intentional Radiators  
FCC Part 15.247: 2400 – 2483.5 MHz & 5725 – 5850 MHz Operation Band  
ANSI C63.4 – 2003  
OET Bulletin No. 65  
  
RSS-210 Issue 6 Low Power Licence-Exempt RadioCommunication Devices:  
6.2.2 (o) 2400 – 2483.5 MHz & 5725 – 5850 MHz Spread Spectrum  
  
RSS-102 Issue 1 (Provisional), Evaluation Procedure for Mobile and Portable  
Radio Transmitters with respect to Health Canada's Safety Code 6 for  
Exposure of Humans to Radio Frequency Fields

**Test Dates:** 27<sup>th</sup> February to 8<sup>th</sup> March 2006

**Test Officer:**   
**Chieu Huynh - B.Eng (Hons) Electronics**

**Attestation:** *I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.*

**Authorised Signatory:**   
**Chris Zombolas**  
**Technical Director**  
**EMC Technologies Pty Ltd**



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**FCC PART 15 Subpart C (Section 15.247) & RSS-210**

## 1.0 INTRODUCTION

EMI testing was performed on the Fujitsu notebook PC, Model: T4210 with INTEL Mini-PCI Wireless LAN Module (GOLAN 11a+b/g), Model: WM3945ABG & TAIYO YUDEN Bluetooth Module, Model: EYTF3CSFT.

The GOLAN WLAN module was originally certified by INTEL as a modular approval under FCC ID: PD9WM3945ABG (Canada ID: 1000M-WM3945ABG). The Radio modules are installed in a controlled environment at the Fujitsu notebook production/assembly factory.

The Bluetooth module was originally certified by TAIYO YUDEN as a modular approval under FCC ID: RYYEYTF3CSFT (Canada ID: 4389AEYTF3CSFT). The Radio modules are installed in a controlled environment at the Fujitsu notebook production/assembly factory.

The GOLAN WLAN supports IEEE 802.11b, IEEE 802.11g and IEEE802.11a (DTS & U-NII) configurations. Tests were performed in all three configurations and also on the Bluetooth.

The results for configurations IEEE 802.11b, IEEE 802.11g and IEEE802.11a (DTS: 5725 – 5850 MHz) are reported in this test report.

The results for IEEE 802.11a (U-NII) and Bluetooth are reported separately.

Refer to EMC Technologies' test report: M060244\_Cert\_WM3945ABG\_NII\_BT (U-NII) and M060244\_Cert\_EYTF3CSFT\_WLAN (Bluetooth).

Test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations:

47 CFR, Part 15, Subpart C:	Rules for intentional radiators (particularly section 15.247)
Section 15.203:	Antenna requirements
Section 15.205:	Restricted bands of operation
Section 15.207:	Conducted Emission Limits
Section 15.209:	Radiated Emission Limits (General requirements)
Section 15.247:	Operation in the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz

The test sample **complied** with the requirements of 47 CFR, Part 15 Subpart C - Section 15.247.

The test sample also complied with the Industry Canada RSS-210 issue 6 (Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)) clause 6.2.2(o) and the RF exposure requirements of RSS-102.



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## 1.1 Summary of Results

### 1.1.1 FCC Subpart C, Section 15.247 - WLAN (802.11b, 802.11g and 802.11a)

FCC Part 15, Subpart C Clauses	Industry Canada RSS-210 Clauses	Test Performed	Result
15.203	5.5	Antenna Requirement	Not Applicable
15.205	6.3	Operation in Restricted Band	Complies
15.207	6.6	Conducted Emissions	Complies
15.209	6.3	Radiated Emissions	Complies
15.247 (a)(2)	6.2.2(o)(iv)	Channel Bandwidth	Complies
15.247 (b)(3)	6.2.2(o)(b)	Peak Output Power	Complies
15.247 (i)		Radio Frequency Hazard	*Complies with SAR requirements
15.247 (d)	6.2.2(o)(e1)	Out of Band Emissions	Complies
15.247 (e)	6.2.2(o)(iv)	Peak Power Spectral Density	Complies

### 1.1.2 FCC Subpart E, Section 15.407 - WLAN (802.11a)

FCC Part 15, Subpart E Clauses	Industry Canada RSS-210 Clauses	Test Performed	Result
15.203	5.5	Antenna Requirement	Not Applicable
15.205	6.3	Operation in Restricted Band	Complies
15.207	6.6	Conducted Emissions	Complies
15.209	6.3	Radiated Emissions	Complies
15.407 (a)(1) (a)(2)	6.2.2(q1)	Peak Transmit Power	Complies
15.407 (a)(5)	6.2.2(q1)	Peak Power Spectral Density	Complies
15.407 (a)(6)		Peak Excursion	Complies
15.407 (b)	6.2.2(q1)	Undesirable Emission	Complies
15.407 (f)		Radio Frequency Hazard	**Complies with SAR requirements
15.407 (g)	6.4	Frequency Stability	Complies

Refer to EMC Technologies Report No: M060244\_Cert\_WM3945ABG\_NII\_BT

### 1.1.3 FCC Subpart C, Section 15.247 - Bluetooth

FCC Part 15, Subpart C Clauses	Industry Canada RSS-210 Clauses	Test Performed	Result
15.203	5.5	Antenna Requirement	Not Applicable
15.205	6.3	Operation in Restricted Band	Complies
15.207	6.6	Conducted Emissions	Complies
15.209	6.3	Radiated Emissions	Complies
15.247 (a)(1)	6.2.2(o)(ii)	Channel Occupancy/Bandwidth	Complies
15.247 (b)(1)	6.2.2(o)(b)	Peak Output Power	Complies
15.247 (i)		Radio Frequency Hazard	*Complies with SAR requirements
15.247 (d)	6.2.2(o)(e1)	Out of Band Emissions	Complies

Refer to EMC Technologies Report No: M060244\_Cert\_EYTF3CSFT\_WLAN

\*Refer to EMC Technologies' report M060245\_Cert\_WM3945ABG\_SAR\_2.4

\*\*Refer to EMC Technologies' report M060245\_Cert\_WM3945ABG\_SAR\_5.2

The measurement procedure used was in accordance with ANSI C63.4-2003 and OET Bulletin No. 65. The instrumentation conformed to the requirements of ANSI C63.2-1996.

## 1.2 Modifications by EMC Technologies

No modifications were required.



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## 2.0 GENERAL INFORMATION

(Information supplied by the Client)

### 2.1 EUT (WLAN) Details

<b>Transmitter:</b>	Mini-PCI Wireless LAN Module
<b>Wireless Module:</b>	GOLAN (11a+b/g)
<b>Model Number:</b>	WM3945ABG
<b>Manufacturer:</b>	Intel Corporation
<b>Modulation Type:</b>	Direct Sequence Spread Spectrum (DSSS for 802.11b) Orthogonal Frequency Division Multiplexing (OFDM for 802.11g) Orthogonal Frequency Division Multiplexing (OFDM for 802.11a)
<b>802.11a and 802.11g</b>	BPSK – 6Mbps, 9Mbps QPSK – 12Mbps, 18Mbps 16QAM – 24Mbps, 36Mbps 64QAM – 48Mbps, 54Mbps
<b>802.11b</b>	DBPSK – 1Mbps DQPSK – 2Mbps CCK – 5.5Mbps, 11Mbps
<b>Frequency Range:</b>	2.4 – 2483.5 GHz for 11b/g 5.15 - 5.35 GHz and 5.725 - 5.850 GHz for 11a
<b>Number of Channels:</b>	11 channels for 11b or 11g 13 channels for 11a
<b>Antenna Types:</b>	Monopole Antenna - Model: DA120D-2454M-FJ01 Located on top edge of LCD screen
<b>Antenna gain:</b>	Refer antenna data provided separately
<b>Power Supply:</b>	3.3 VDC from PCI bus

**Frequency Allocation Table:**

Band	Channel	Lower Frequency	Upper Frequency	Americas SKU #1 MOW1	Europe SKU #2 MOW2	Japan SKU #3 Japan	High Band SKU #4 ROW
802.11b/g	1-11	2.401 GHz	2.473 GHz	X	X	X	X
802.11b/g	12-13	2.467 GHz	2.483 GHz		X	X	X
802.11a	34-46	5.08 GHz	5.22 GHz		X	X	
802.11a	36-48	5.150 GHz	5.250 GHz	X	X		
802.11a	52-64	5.250 GHz	5.350 GHz	X	X		
802.11a	100-140	5.470 GHz	5.725 GHz		X		
802.11a	149-161	5.725 GHz	5.825 GHz	X			X
802.11a	165	5.815 GHz	5.835 GHz	X			X

**Channels Tested and Output power setting:**

Channel and Mode:	Output Power setting (average, dBm)
802.11b mode	
*Channels 1	16
*Channel 6 and 11	18
802.11g mode	
*Channel 1	16
*Channel 6	17
*Channel 11	15
802.11a mode	
**Channel 36	16
**Channels 52 and 64	17
*Channels 149, 157 and 165	17

\*Channels tested and reported in this report

\*\*Channels tested and reported in the U-NII submission (M060244\_Cert\_WM3945ABG\_NII\_BT)



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## 2.2 EUT (Bluetooth) Details

**Transmitter:** Bluetooth Module  
**Model Number:** EYTF3CSFT  
**Manufacturer:** TAIYO YUDEN  
**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  
**Interface Type:** USB  
**Antenna Types:** Monopole Antenna - Model: DA120D-2454M-FJ01  
 Located at the middle of top edge of LCD screen  
 Refer antenna data provided separately  
**Antenna gain:**  
**Max. Output Power:** 4 dBm  
**Reference Oscillator:** 16 MHz (Built-in)  
**Power Supply:** 3.3 VDC from host.

### Frequency allocation:

Channel Number	Frequency (MHz)	Bluetooth Utility power setting
1*	2402	Power (Ext, Int) = 0, 96
2	2403	
3	2404	
.	.	
.	.	
.	.	
39	2440	
40*	2441	
41	2442	
.	.	
.	.	
.	.	
77	2478	
78	2479	
79*	2480	

\*Channels tested and reported in the Bluetooth submission (M060244\_Cert\_EYTF3CSFT\_WLAN)

## 2.3 EUT (Notebook PC) Details

**EUT:** LifeBook T series  
**Model Name:** T4210  
**Serial Number:** Pre-production Sample  
**Manufacturer:** FUJITSU LIMITED

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**CPU Type and Speed:** Yonah-DC 2.16GHz  
**LCD:** 12" SXGA+ / 12" XGA  
**Wired LAN:** Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T  
**Modem:** Agere MDC1.5 modem Model: D40  
**Port Replicator Model:** FPCPR61

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**AC Adapter Model:** 80W: SEC100P2-19.0(Sanken)  
**Voltage:** 19 V  
**Current Specs:** 4.22A  
**Watts:** 80W



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## **2.4 Operational Description**

The Intel WLAN test software "CRTU" was used to transmit continuously during the tests. For Spurious and Harmonics tests both radio modules (WLAN and Bluetooth) were simultaneously transmitting.

## **2.5 Test Configuration**

Conducted tests were performed at the WLAN Antenna ports.

Radiated tests were performed for measuring the harmonics and spurious from the transmitters.

## **2.6 Technical Specifications**

Refer to Appendix G for details

## **2.7 Block Diagram**

Refer to Appendix D - Block Diagram

## **2.8 Support Equipment**

Refer to Attachment 3 – FCC Part 15B Test Report (Report: FG06-027EFC)

## **2.9 Test Procedure**

Emissions measurements were performed in accordance with the procedures of ANSI C63.4-2003. Radiated emissions tests were performed at a distance of 1 and 3 metres from the EUT. OET Bulletin 65 dated June 2001 was used for reference.



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## 2.10 Test Facility

### 2.10.1 General

Radiated Emission measurements were performed at EMC Technologies open area test site (OATS) situated at Lerderderg Gorge, near the township of Bacchus Marsh in Victoria, Australia. Conducted measurements at antenna ports were performed at EMC Technologies' laboratory in Tullamarine, Victoria Australia.

The above test sites have been accepted for testing by the Federal Communications Commission (FCC) - **FCC Registration Number 90560**.

EMC Technologies open area test site (OATS) has also been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS 212, Issue 1 (Provisional).

**Industry Canada File Number IC 4161.**

### 2.10.2 NATA Accreditation

EMC Technologies is accredited in Australia to test to the following standards by the National Association of Testing Authorities (NATA).

***"FCC Part 15 unintentional and intentional emitters in the frequency range 9kHz to 18 GHz excluding TV receivers (15.117 and 15.119), TV interface devices (15.115), cable ready consumer electronic equipment (15.118), cable locating equipment (15.213) and unlicensed national information infrastructure devices (Sub part E)."***

The current full scope of accreditation can be found on the NATA website: [www.nata.asn.au](http://www.nata.asn.au)  
It also includes a large number of emission, immunity, SAR, EMR and Safety standards.

NATA is the Australian national laboratory accreditation body and has accredited EMC Technologies to operate to the IEC/ISO17025 requirements. A major requirement for accreditation is the assessment of the company and its personnel as being technically competent in testing to the standards. This requires fully documented test procedures, continued calibration of all equipment to the National Standard at the National Measurements Laboratory (NML) and an internal quality system to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A<sup>2</sup>LA).

## 2.11 Test Equipment Calibration

All measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Agilent Technologies (Australia) Pty Ltd or the National Measurement Laboratory (NML). All equipment calibration is traceable to Australia national standards at the National Measurements Laboratory. The reference antenna calibration was performed by NML and the working antennas (biconical and log-periodic) calibrated by the NATA approved procedures. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in Appendix A

## 2.12 Ambients at OATS

The Open Area Test Site (OATS) is an area of low background ambient signals. No significant broadband ambients are present however commercial radio and TV signals exceed the limit in the FM radio, VHF and UHF television bands. Radiated prescan measurements were performed in the shielded enclosure to check for possible radiated emissions at the frequencies where the OATS ambient signals exceeded the test limit.



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## RESULTS

### WLAN Module – WM3945ABG (802.11b, 802.11g and 802.11a (DTS))

#### 3.0 CONDUCTED EMISSION MEASUREMENTS

Testing was performed in accordance with the requirements of FCC Part 15.207  
Refer to Attachment 3 – FCC Part 15B Test Report (Report: FG06-027EFC)

#### 4.0 SPURIOUS EMISSION MEASUREMENTS

##### 4.1 Test Procedure

Testing was performed in accordance with the requirements of FCC Part 15.247(d).

Radiated emission measurements were performed to the limits as per section 15.209. The measurements were made at the open area test site.

The EUT was set up on the table top (placed on turntable) of total height 80 cm above the ground plane, and operated as described in section 2 of this report. The EMI Receiver was operated under software control via the PC Controller through the IEEE.488 Interface Bus Card Adaptor. The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. Calibrated EMCO 3115, EMCO 3116 and ETS standard gain horn antennas were used for measurements between 1 to 40 GHz.

The measurement of emissions between 30 - 1000 MHz, refer to Attachment 3 – FCC Part 15B Test Report (Report: FG06-027EFC).

The measurement of emissions above 1000 MHz, appearing in the restricted bands, was made using an average detector with a bandwidth of 1.0 MHz.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. When an emission was located, it was positively identified and its maximum level found by rotating the automated turntable, and by varying the antenna height. Each significant peak was investigated with the Quasi-Peak/Average Detectors. The software for cable losses automatically corrected the measurement data for each frequency range, antenna factors and preamplifier gain and all data was then stored on disk in sequential data files. This process was performed for both horizontal and vertical antenna polarisations.

##### 4.2 Calculation of field strength

The field strength was calculated automatically by the software using all the pre-stored calibration data. The method of calculation is shown below:

**E = V + AF - G + L** Where:

**E** = Radiated Field Strength in dB $\mu$ V/m.

**V** = EMI Receiver Voltage in dB $\mu$ V. (measured value)

**AF** = Antenna Factor in dB(m<sup>-1</sup>). (stored as a data array)

**G** = Preamplifier Gain in dB. (stored as a data array)

**L** = Cable loss in dB. (stored as a data array of Insertion Loss versus frequency)

##### • Example Field Strength Calculation

Assuming a receiver reading of 34.0 dB $\mu$ V is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB. The cable loss is 1.9 dB while the preamplifier gain is 20 dB. The resulting Field Strength is therefore as follows:

$$34.0 + 9.2 + 1.9 - 20 = 25.1 \text{ dB}\mu\text{V/m}$$

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (1000 MHz – 18,000 MHz)  $\pm$  4.1 dB



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### 4.3 Radiated Emissions (Spurious and Harmonics)

#### 4.3.1 Frequency Band: 1 – 40 GHz

All measurements above 1 GHz were initially made over a distance of 3 metres. This was decreased to 1.0 metre as the emission levels from the device were very low.

The 54 dB $\mu$ V/m limit at 3 metres has been converted to 64 dB $\mu$ V/m at 1 metre using a factor of 20 dB per decade where emissions were located in the restricted bands.

Testing was performed while both the WLAN transmitter and Bluetooth transmitter continuously operated. Harmonics related to the WLAN transmitter (2.4 – 2.4835 GHz and 5.725 – 5.850 GHz) is reported below. Harmonics in the frequency band (5.15 – 5.35 GHz), refer to M060244\_Cert\_WM3945ABG\_NII\_BT. Harmonics related to the Bluetooth transmitter refer to M060244\_Cert\_EYTF3CSFT\_WLAN.

##### 4.3.1.1 Configuration 802.11b

Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). Emissions with CCK modulation (11 Mbps) were observed to be slightly worst. Final testing was performed while the transmitter continuously operated with the modulation rate of 11 Mbps (CCK).

The EUT was operating at its highest channel (2462 MHz), the field strength at 2483.5 MHz was: 51.1 dB $\mu$ V/m peak and 40.3 dB $\mu$ V/m average

The levels were > 20 dB below the maximum field strength of the in-band carrier.

The EUT was operating at its lowest channel (2412 MHz), the field strength at 2400 MHz was: 63.5 dB $\mu$ V/m peak and 51.6 dB $\mu$ V/m average

The levels were > 20 dB below the maximum field strength of the in-band carrier.

##### Channel 1 - 2412 MHz

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2412	109.1	97.4	-	-	-
4824	52.0	40.3	74.0	54.0	Pass
7236	50.7	39.6	-	-	-
9648	51.3	41.9	-	-	-
12060	53	41	74.0	54.0	Pass
14472	57	45	74.0	54.0	Pass
16884	56	45	-	-	-
19296	65	52	84.0*	64.0*	Pass
21708	69	56	-	-	-
24120	69	56	-	-	-
2425.7	57.5	45.2	-	-	-
2397.9	54.2	41.9	-	-	-
2312	48.7	41.4	74.0	54.0	Pass
2512	47.1	38.0	-	-	-

\*Limits were corrected for 1 metre measurement.



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**Channel 6 - 2437 MHz**

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
<b>2437</b>	<b>108.4</b>	<b>96.0</b>	-	-	-
<b>4874</b>	<b>51.1</b>	<b>40.1</b>	74.0	54.0	Pass
<b>7311</b>	<b>51.6</b>	<b>40.9</b>	74.0	54.0	Pass
<b>9748</b>	<b>51.8</b>	<b>43.2</b>	-	-	-
12185	53	41	74.0	54.0	Pass
14622	57	45	-	-	-
17059	56	45	-	-	-
19496	65	52	84.0*	64.0*	Pass
21933	69	56	-	-	-
24370	69	56	-	-	-
<b>2451.3</b>	<b>57.0</b>	<b>45.1</b>	-	-	-
<b>2422.3</b>	<b>54.7</b>	<b>41.7</b>	-	-	-
<b>2337</b>	<b>49.3</b>	<b>41.2</b>	74.0	54.0	Pass
<b>2537</b>	<b>46.6</b>	<b>37.5</b>	-	-	-

\*Limits were corrected for 1 metre measurement.

**Channel 11 - 2462 MHz**

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
<b>2462</b>	<b>108.9</b>	<b>98.5</b>	-	-	-
<b>4924</b>	<b>53.0</b>	<b>40.8</b>	74.0	54.0	Pass
<b>7386</b>	<b>52.2</b>	<b>41.5</b>	74.0	54.0	Pass
<b>9848</b>	<b>51.2</b>	<b>43.3</b>	-	-	-
12310	53	41	74.0	54.0	Pass
14772	57	45	-	-	-
17234	56	45	-	-	-
19696	65	52	84.0*	64.0*	Pass
22158	69	56	84.0*	64.0*	Pass
24620	69	56	-	-	-
<b>2476.3</b>	<b>55.5</b>	<b>44.1</b>	-	-	-
<b>2447</b>	<b>52.8</b>	<b>40.0</b>	-	-	-
<b>2360</b>	<b>48.4</b>	<b>39.7</b>	74.0	54.0	Pass

\*Limits were corrected for 1 metre measurement

**Result:** Harmonic and spurious emissions were recorded within the restricted bands of up to 25 GHz. Other harmonics were confirmed low with both RBW and VBW reduced (the peak and average levels listed in the above tables were noise floor readings). The worst case emissions were complied with the FCC limits in sections 15.209 and 15.247 by a margin of 12.5 dB. The measurement uncertainty for radiated emissions in this band was  $\pm 4.1$  dB.



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**4.3.1.2 Configuration 802.11g**

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in emissions were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 6 Mbps (BPSK).

The EUT was operating at its highest channel (2462 MHz), the field strength at 2483.5 MHz was: 72.1 dB $\mu$ V/m peak and 53.6 dB $\mu$ V/m average

The levels were > 20 dB below the maximum field strength of the in-band carrier.

The EUT was operating at its lowest channel (2412 MHz), the field strength at 2400 MHz was: 83.8 dB $\mu$ V/m peak and 65.2 dB $\mu$ V/m average

The levels were > 20 dB below the maximum field strength of the in-band carrier.

**Channel 1 - 2412 MHz**

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
<b>2412</b>	<b>108.5</b>	<b>93.2</b>	-	-	-
4824	46	34	74.0	54.0	Pass
<b>7236</b>	<b>51.3</b>	<b>39.8</b>	-	-	-
9648	49	38	-	-	-
12060	53	41	74.0	54.0	Pass
14472	57	45	74.0	54.0	Pass
16884	56	45	-	-	-
19296	65	52	84.0*	64.0*	Pass
21708	69	56	-	-	-
24120	69	56	-	-	-
<b>2397</b>	<b>77.9</b>	<b>56.3</b>	-	-	-
<b>2429</b>	<b>77.2</b>	<b>56.1</b>	-	-	-
<b>2312</b>	<b>54.7</b>	<b>46.9</b>	74.0	54.0	Pass
<b>2512</b>	<b>51.3</b>	<b>41.4</b>	-	-	-

\*Limits were corrected for 1 metre measurement.

**Channel 6 - 2437 MHz**

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
<b>2437</b>	<b>109.8</b>	<b>93.0</b>	-	-	-
<b>4874</b>	<b>46</b>	<b>34</b>	74.0	54.0	Pass
<b>7311</b>	<b>51.4</b>	<b>40.5</b>	74.0	54.0	Pass
9748	49	38	-	-	-
12185	53	41	74.0	54.0	Pass
14622	57	45	-	-	-
17059	56	45	-	-	-
19496	65	52	84.0*	64.0*	Pass
21933	69	56	-	-	-
24370	69	56	-	-	-
<b>2422</b>	<b>78.2</b>	<b>56.5</b>	-	-	-
<b>2454</b>	<b>77.0</b>	<b>55.3</b>	-	-	-
<b>2337</b>	<b>54.9</b>	<b>46.7</b>	74.0	54.0	Pass
<b>2537</b>	<b>51.4</b>	<b>41.2</b>	-	-	-

\*Limits were corrected for 1 metre measurement.



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**Channel 11 - 2462 MHz**

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
<b>2462</b>	<b>109.2</b>	<b>94.1</b>	-	-	-
4924	46	34	74.0	54.0	Pass
<b>7386</b>	<b>51.5</b>	<b>40.0</b>	74.0	54.0	Pass
9848	49	38	-	-	-
12310	53	41	74.0	54.0	Pass
14772	57	45	-	-	-
17234	56	45	-	-	-
19696	65	52	84.0*	64.0*	Pass
22158	69	56	84.0*	64.0*	Pass
24620	69	56	-	-	-
<b>2480</b>	<b>76.1</b>	<b>55.3</b>			
<b>2446</b>	<b>75.9</b>	<b>55.0</b>			
<b>2360</b>	<b>52.2</b>	<b>44.7</b>	74.0	54.0	Pass

\*Limits were corrected for 1 metre measurement

**Result:** 3<sup>rd</sup> harmonic and spurious emissions were recorded within the restricted bands of up to 25 GHz. Other harmonics were confirmed low with both RBW and VBW reduced (the peak and average levels listed in the above tables were noise floor readings). The worst case emissions were complied with the FCC limits in sections 15.209 and 15.247 by a margin of 7.1 dB. The measurement uncertainty for radiated emissions in this band was  $\pm 4.1$  dB.

**4.3.1.3 Configuration 802.11a (5.725 – 5.850 MHz)**

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). Emissions with 64QAM modulation (54 Mbps) were observed to be slightly worst. Final testing was performed while the transmitter continuously operated with the modulation rate of 54 Mbps (64QAM).

The EUT was operating at its highest channel (5825 MHz), the field strength at 5850 MHz was: 71.6 dB $\mu$ V/m peak and 54.2 dB $\mu$ V/m average  
The levels were > 20 dB below the maximum field strength of the in-band carrier.

The EUT was operating at its lowest channel (5745 MHz), the field strength at 5725 MHz was: 75.4 dB $\mu$ V/m peak and 56.7 dB $\mu$ V/m average  
The levels were > 20 dB below the maximum field strength of the in-band carrier.

**Channel 149 - 5745 MHz**

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
<b>5745</b>	<b>108.1</b>	<b>81.2</b>	-	-	-
<b>11490</b>	<b>55.3</b>	<b>42.5</b>	74.0	54.0	Pass
<b>17235</b>	<b>62.2</b>	<b>49.8</b>	-	-	-
22980	69	56	84.0*	64.0*	Pass
28725	79	67	-	-	-
34470	80	68	-	-	-
<b>5640</b>	<b>51.4</b>	<b>40.7</b>	-	-	-
<b>4701</b>	<b>50.7</b>	<b>40.5</b>	74.0	54.0	Pass

\*Limits were corrected for 1 metre measurement.



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**Channel 157 - 5785 MHz**

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
5785	107.8	81.9	-	-	-
11570	54.3	42.0	74.0	54.0	Pass
17355	60.1	48.5	-	-	-
23140	69	56	-	-	-
28925	79	67	-	-	-
34710	80	68	-	-	-
4821	54.8	44.2	74.0	54.0	Pass
5720	52.2	42.9	-	-	-

\*Limits were corrected for 1 metre measurement.

**Channel 165 - 5825 MHz**

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
5825	110.1	83.0	-	-	-
11650	54.9	42.4	74.0	54.0	Pass
17475	58.1	46.5	-	-	-
23300	69	56	-	-	-
29125	79	67	-	-	-
34950	80	68	-	-	-
4856	55.3	44.3	74.0	54.0	Pass
5720	52.2	42.9	-	-	-

\*Limits were corrected for 1 metre measurement.

**Result:** Harmonic and spurious emissions were recorded within the restricted bands of up to 40 GHz. Harmonics were low and confirmed with both RBW and VBW reduced (the peak and average levels listed in the above tables were noise floor readings). Emissions were complied with the FCC limits in section 15.209 and 15.247 by a margin of 9.7 dB. The measurement uncertainty for radiated emissions in this band was  $\pm 4.1$  dB.

**4.3.1.4 Both WLAN and Bluetooth Transmitters Transmitting**

802.11b and BT	Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2437 MHz & 2402 MHz	2472	54.5	40.8	-	-	-
2437 MHz & 2402 MHz	2367	51.3	38.1	74.0	54.0	Pass
2462 MHz & 2402 MHz	2521	53.6	39.3	-	-	-
2412 MHz & 2441 MHz	2383	58.7	45.0	74.0	54.0	Pass
2412 MHz & 2441 MHz	2471	53.0	41.2	-	-	-
2462 MHz & 2441 MHz	2421	53.8	41.9	-	-	-
2412 MHz & 2480 MHz	2344	55.2	41.1	74.0	54.0	Pass
2412 MHz & 2480 MHz	2547	52.5	40.1	-	-	-
2437 MHz & 2480 MHz	2393	54.6	42.4	-	-	-
2437 MHz & 2480 MHz	2525	53.4	41.6	-	-	-
2462 MHz & 2480 MHz	2498	54.1	42.3	74.0	54.0	Pass



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802.11g and BT	Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2437 MHz & 2402 MHz	2367	50.3	38.1	74.0	54.0	Pass
2462 MHz & 2402 MHz	2342	51.6	38.8	74.0	54.0	Pass
2412 MHz & 2441 MHz	2471	53.0	42.2	-	-	-
2462 MHz & 2441 MHz	2421	55.8	43.9	-	-	-
2412 MHz & 2480 MHz	2547	53.5	42.1	-	-	-
2437 MHz & 2480 MHz	2525	54.4	42.2	-	-	-
2462 MHz & 2480 MHz	2498	53.9	41.8	74.0	54.0	Pass

802.11a and BT	Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
5745 MHz & 2402 MHz	3344	46.7	30.4	-	-	-
5785 MHz & 2402 MHz	3385	46.9	31.5	-	-	-
5825 MHz & 2402 MHz	3424	45.2	30.0	-	-	-
5745 MHz & 2441 MHz	3304	49.1	32.9	-	-	-
5785 MHz & 2441 MHz	3344	50.6	34.3	-	-	-
5825 MHz & 2441 MHz	3385	49.2	33.8	-	-	-
5745 MHz & 2480 MHz	3266	49.0	33.7	74.0	54.0	Pass
5785 MHz & 2480 MHz	3305	47.1	32.0	-	-	-
5825 MHz & 2480 MHz	3345	46.5	31.5	74.0	54.0	Pass

#### 4.3.2 Frequency Band: 30 - 1000 MHz

Refer to Attachment 3 – FCC Part 15B Test Report (Report: FG06-027EFC).



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**4.3.3 RF Conducted Measurements at the Antenna Terminal**

In the 100 kHz bandwidth within the operating band, the highest emissions (spurious/harmonics) level that is produced by the intentional radiator shall be at least 20 dB below.

The transmitter output was connected to the spectrum analyser in peak hold mode.

The resolution bandwidth of 100 kHz and the video bandwidth of 300 kHz were utilised.

D1 line indicates the 20 dB limit below the highest level of the transmitter

**Configuration 802.11a (5.725 – 5.850 GHz)**

Refer to Appendix K1 for Harmonics plots

**Configuration 802.11b**

Refer to Appendix K2 for Harmonics plots

**Configuration 802.11g**

Refer to Appendix K3 for Harmonics plots

**Results:** Complies.

**4.3.4 Band Edge Measurements**

In the 100 kHz bandwidth within the operating band, the highest emissions (spurious/harmonics) level that is produced by the intentional radiator shall be at least 20 dB below.

The transmitter output was connected to the spectrum analyser in peak hold mode.

The resolution bandwidth of 100 kHz and the video bandwidth of 300 kHz were utilised.

**Configuration 802.11a (5.725 – 5.850 GHz)**

Refer to Appendix L1 for Band Edge plots

**Configuration 802.11b**

BE Frequency (MHz) within the restricted band	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2390	54.4	47.6	74.0	54.0	Pass
2483.5	50.5	48.3	74.0	54.0	Pass

Refer to Appendix L2 for Band Edge plots

**Configuration 802.11g**

BE Frequency (MHz) within the restricted band	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2390	69.4	53.2	74.0	54.0	Pass
2483.5	68.6	53.3	74.0	54.0	Pass

Refer to Appendix L3 for Band Edge plots

**Results:** Complies.



## 5.0 PEAK OUTPUT POWER - Section 15.247 (b)(3)

Testing was performed in accordance with the requirements of FCC Part 15.247(b)(3).

Measurements were performed while the WLAN transmitter continuously transmitted.

The peak output power measurement was performed using the integration method as per test method # 3 of DA 02-2138. The resolution bandwidth of 1 MHz was used. The video bandwidth of 30 kHz was used ( $VBW \geq 1/T$ , where T (worst case) = 230  $\mu$ S).

Variation by +/- 15% of the supply voltage, in accordance with Section 15.31(e), to the computer power supply did not vary the output power observed.

### 5.1 Configuration 802.11a

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in peak power were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 54Mbps (64QAM).

Frequency MHz	P dBm	Limit dBm	P mW	Limit mW	Result
5745	17.3	30	53.7	1000	Complies
5785	17.9	30	61.7	1000	Complies
5825	17.5	30	56.2	1000	Complies

### 5.2 Configuration 802.11b

Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). Power with CCK modulation (rate = 11 Mbps) was observed to be slightly worst. Final testing was performed while the transmitter continuously operating with the modulation rate of 11 Mbps (CCK).

Frequency MHz	P dBm	Limit dBm	P mW	Limit mW	Result
2412	14.1	30	25.7	1000	Complies
2437	15.3	30	33.9	1000	Complies
2462	15.6	30	36.3	1000	Complies

### 5.3 Configuration 802.11g

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in peak power were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 54Mbps (64QAM).

Frequency MHz	P dBm	Limit dBm	P mW	Limit mW	Result
2412	16.4	30	43.7	1000	Complies
2437	17.1	30	51.3	1000	Complies
2462	16.0	30	39.8	1000	Complies



## 6.0 CHANNEL BANDWIDTH

Testing was performed in accordance with the requirements of FCC Part 15.247(a)(2)

In the bands 2400 - 2483.5 MHz and 5725 - 5850 MHz, the minimum 6 dB bandwidth was at least 500 kHz. The 6 dB bandwidth was measured while the transmitter continuously transmitted.

The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.

The resolution bandwidth of 100 kHz and the video bandwidth of 300 kHz were utilised

The minimum 6 dB bandwidth is at least 500 kHz

### 6.1 Configuration 802.11a

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in bandwidth were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 54 Mbps (64QAM).

Frequency MHz	Bandwidth MHz	Result	6 dB Bandwidth Plots
5745	16.6	Complies	Appendix J1
5785	16.6	Complies	Appendix J1
5825	16.6	Complies	Appendix J1

### 6.2 Configuration 802.11b

Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). No significant differences in bandwidth were observed. Final testing was performed while the transmitter continuously operating with the modulation rate of 11 Mbps (CCK).

Frequency MHz	Bandwidth MHz	Result	6 dB Bandwidth Plots
2412.0	9.0	Complies	Appendix J2
2437.0	9.0	Complies	Appendix J2
2462.0	9.0	Complies	Appendix J2

### 6.3 Configuration 802.11g

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in bandwidth were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 54 Mbps (64QAM).

Frequency MHz	Bandwidth MHz	Result	6 dB Bandwidth Plots
2412.0	16.6	Complies	Appendix J3
2437.0	16.6	Complies	Appendix J3
2462.0	16.6	Complies	Appendix J3

## 7.0 PEAK POWER SPECTRAL DENSITY - Section 15.247(e)

Testing was performed accordance with the requirements of FCC Part 15.247(e)

The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.

The resolution bandwidth of 3 kHz and the video bandwidth of 30 kHz were utilised

The specification limit is 8 dBm in any 3 kHz band during a continuous transmission.

### 7.1 Configuration 802.11a

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). Peak power spectral density with BPSK modulation (rate = 6 Mbps) was observed to be slightly worst. Final testing was performed while the transmitter continuously operated with the modulation rate of 6 Mbps (BPSK).

Frequency MHz	Level dBm	Limit dBm	Result	Spectral Density plots
5745	-9.3	8.0	Complies	Appendix M1
5785	-7.8	8.0	Complies	Appendix M1
5825	-8.5	8.0	Complies	Appendix M1

### 7.2 Configuration 802.11b

Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). Peak power spectral density with CCK modulation (rate = 11 Mbps) was observed to be slightly worst. Final testing was performed while the transmitter continuously operating with the modulation rate of 11 Mbps (CCK).

Frequency MHz	Level dBm	Limit dBm	Result	Spectral Density plots
2412.0	-6.6	8.0	Complies	Appendix M2
2437.0	-6.5	8.0	Complies	Appendix M2
2462.0	-6.4	8.0	Complies	Appendix M2

### 7.3 Configuration 802.11g

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). Peak power spectral density with 64QAM modulation (rate = 54 Mbps) was observed to be slightly worst. Final testing was performed while the transmitter continuously operated with the modulation rate of 54 Mbps (64QAM).

Frequency MHz	Level dBm	Limit dBm	Result	Spectral Density plots
2412.0	-7.2	8.0	Complies	Appendix M3
2437.0	-7.9	8.0	Complies	Appendix M3
2462.0	-10.1	8.0	Complies	Appendix M3



## 8.0 RADIO FREQUENCY EXPOSURE (HAZARD) INFORMATION

Testing was performed in accordance with the requirements of FCC Part 15.247(i)

Spread spectrum transmitters operating in the 2400 - 2483.5 MHz and 5725 – 5850 MHz bands are required to be operated in a manner that ensures that the public is not exposed to RF energy levels in accordance with CFR 47, Section 1.1307(b)(1).

Transmitter # 1 (WLAN): The antennas are located on the top edge of LCD screen (left and right hand side) and projected distance of less than 20cm from user.

Transmitter # 2 (Bluetooth): The antenna is located at the middle of top edge of LCD screen projected distance of less than 20cm from user.

The separation distance between the WLAN and BT antennas is less than 20cm. Therefore, they are co-located transmitters. Testing was performed with both WLAN and BT transmitters transmitting continuously.

In accordance with this section and also section 2.1093 this device has been defined as a portable device.

SAR testing was performed in accordance with OET Bulletin 65 and reported under EMC Technologies reports M060245\_Cert\_WM3945ABG\_SAR\_2.4 and M060245\_Cert\_WM3945ABG\_SAR\_5.2. The highest SAR value is 1.51 mW/g which complies with the FCC human exposure requirements of 47 CFR 2.1093 (d).



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## 9.0 ANTENNA REQUIREMENT

Testing to the requirements of FCC Part 15.203 was not applicable as this intentional radiator was designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

## 10.0 COMPLIANCE STATEMENT

The Fujitsu notebook PC, Model: T4210 with INTEL Mini-PCI Wireless LAN Module (GOLAN 11a+b/g), Model: WM3945ABG and Bluetooth Module, Model: EYTF3CSFT, tested on behalf of Fujitsu Australia Ltd, **comply** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.247 - Operation in the frequency band 2400 - 2483.5 MHz and 5725 – 5850 MHz.

The test sample also complies with the Industry Canada RSS-210 issue 6 (Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)) clause 6.2.2(o) 2400 – 2483.5 MHz Spread Spectrum requirements and the RF exposure requirements of RSS-102.

Results were as follows:

### FCC Subpart C, Section 15.247 - WLAN (802.11b, 802.11g and 802.11a)

FCC Part 15, Subpart C Clauses	Industry Canada RSS-210 Clauses	Test Performed	Result
15.203	5.5	Antenna Requirement	<b>Not Applicable</b>
15.205	6.3	Operation in Restricted Band	<b>Complies</b>
15.207	6.6	Conducted Emissions	<b>Complies</b>
15.209	6.3	Radiated Emissions	<b>Complies</b>
15.247 (a)(2)	6.2.2(o)(iv)	Channel Bandwidth	<b>Complies</b>
15.247 (b)(3)	6.2.2(o)(b)	Peak Output Power	<b>Complies</b>
15.247 (i)		Radio Frequency Hazard	<b>*Complies with SAR requirements</b>
15.247 (d)	6.2.2(o)(e1)	Out of Band Emissions	<b>Complies</b>
15.247 (e)	6.2.2(o)(iv)	Peak Power Spectral Density	<b>Complies</b>

\*Refer to EMC Technologies' report M060245\_Cert\_WM3495ABG\_SAR\_2.4 and M060245\_Cert\_WM3945ABG\_SAR\_5.2

**The results for IEEE 802.11a (U-NII) and Bluetooth are reported separately.**

Refer to EMC Technologies' test report: M060244\_Cert\_WM3945ABG\_NII\_BT (U-NII) and M060244\_Cert\_EYTF3CSFT\_WLAN (Bluetooth).



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## TEST REPORT APPENDICES

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**Attachment 1: RF Exposure Information**

**Attachment 2: FCC DOC for LifeBook T Series**

**Attachment 3: FCC Part 15B Test Report (Report: FG06-027EFC)**



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