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

FCC ID: EJE-WB0045
Industry Canada ID: 337J-WB0045

Test Sample: LifeBook P Series
Model: P7230

Radio Modules: AR5BXB6 XB62 Atheros Mini-PCI WLAN Module
& EYTF3CSFT Bluetooth Module

Report Number: M061025_Cert_AR5BXB6_DTS_BT

Tested for: Fujitsu Australia Ltd.

Issue Date: 24th October 2006

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NATA Accredited Laboratory Number:
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EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247) & RSS-210
EMC Technologies Report No. M061025_Cert_AR5BXB6_DTS_BT
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EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247) & RSS-210

Report Number: M061025_Cert_AR5BXB6_DTS_BT

Test Sample: LifeBook P Series
Model: P7230
Radio Modules: XB62 Mini-PCI WLAN Module, Model: AR5BXB6 (Atheros)
Bluetooth Module, Model: EYTF3CSFT (TAIYO YUDEN)

FCC ID: EJE-WB0045
Industry Canada ID: 337J-WB0045
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

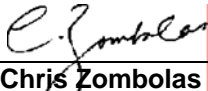
RSS-210 Issue 6 Low Power Licence-Exempt RadioCommunication Devices:
6.2.2 (o) 2400 – 2483.5 MHz & 5725 – 5850 MHz Spread Spectrum

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: 13th to 23rd October 2006

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

1.0 INTRODUCTION

EMI testing was performed on the Fujitsu LifeBook P Series, Model: P7230 with Atheros Mini-PCI Wireless LAN Module (XB62 11a+b/g), Model: AR5BXB6 & TAIYO YUDEN Bluetooth Module, Model: EYTF3CSFT.

The Atheros WLAN module was originally certified by Atheros as a modular approval under FCC ID: PPD-AR5BXB6-M (Canada ID: 4104A-AR5BXB6). 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 Atheros WLAN supports IEEE 802.11b, IEEE 802.11g and IEEE 802.11a (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 IEEE 802.11a (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 reports: M061025_Cert_AR5BXB6_NII_BT (U-NII) and M061025_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.

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.



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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)	Annex A9.2	Peak Transmit Power	Complies
15.407 (a)(5)	Annex A9.2	Peak Power Spectral Density	Complies
15.407 (a)(6)		Peak Excursion	Complies
15.407 (b)	Annex A9.3	Undesirable Emission	Complies
15.407 (f)		Radio Frequency Hazard	**Complies with SAR requirements
15.407 (g)	Annex A9.5(e)	Frequency Stability	Complies
15.407 (h)	Annex A9.4	Dynamic Frequency Selection	Complies

Refer to EMC Technologies Report No: M061025_Cert_AR5BxB6_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: M061025_Cert_EYTF3CSFT_WLAN

*Refer to EMC Technologies' report M061026_Cert_AR5BxB6_SAR_DTS_2.4G_5.8G and

**Refer to EMC Technologies' report M061026_Cert_AR5BxB6_SAR_NII_5.2G

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

Transmitter:	Mini-Card Wireless LAN Module
Wireless Module:	XB62 (11a+b/g)
Model Number:	AR5BXB6
Manufacturer:	Atheros
Modulation Type:	Direct Sequence Spread Spectrum (DSSS for 802.11b) Orthogonal Frequency Division Multiplexing (OFDM for 802.11g) Orthogonal Frequency Division Multiplexing (OFDM for 802.11a)
802.11a and 802.11g	BPSK – 6Mbps, 9Mbps QPSK – 12Mbps, 18Mbps 16QAM – 24Mbps, 36Mbps 64QAM – 48Mbps, 54Mbps Turbo mode: 12 Mbps - 108 Mbps
802.11b	DBPSK – 1Mbps DQPSK – 2Mbps CCK – 5.5Mbps, 11Mbps
Frequency Range:	2.4 –2483.5 GHz for 11b/g 5.15 - 5.35 GHz, 5.47 – 5.725 GHz and 5.725 - 5.850 GHz for 11a
Antenna Types:	Nissei Electric Inverted F Antenna Model: CP313544 (Main: Right), CP313545 (Aux: Left) Location: Top edge of LCD screen
Antenna gain:	Refer antenna data provided separately
Power Supply:	3.3 VDC from PCI bus

Frequency Allocation Table:

Band	Channel	Lower Freq.	Upper Freq.	WWF1	WWF2	JPF4	KRF1
802.11b/g	1-11	2.412GHz	2.462GHz	X	X	X	X
802.11b/g	12-13	2.467GHz	2.472GHz		X	X	X
802.11a	36-48	5.150GHz	5.250GHz	X	X	X(Notel)	X
802.11a	52-64	5.250GHz	5.350GHz	X	X	X	X
802.11a	100-140	5.470GHz	5.725GHz	X	X		X
802.11a	149-165	5.725GHz	5.850GHz	X	X		X

Note 1: Odd channel support

Channels Tested and Output power setting:

Channel and Mode:	Output Power setting (average, dBm)
802.11b mode	
*Channel 1, 6 and 11	17 (1 Mbps to 11 Mbps)
802.11g mode	
*Channel 1, 6 and 11	16 (6 Mbps to 48 Mbps)
*Channel 1, 6 and 11	15 (54 Mbps)
802.11a mode	
**Channel 36, 42, 50, 52, 58, 64, 100, 120 and 140	16 (6 Mbps to 36 Mbps)
**Channel 36, 42, 50, 52, 58, 64, 100, 120 and 140	14 (48 Mbps)
**Channel 36, 42, 50, 52, 58, 64, 100, 120 and 140	13 (54 Mbps)
*Channels 149, 152, 157, 160 and 165	16 (6 Mbps to 36 Mbps)
*Channels 149, 152, 157, 160 and 165	14 (48 Mbps)
*Channels 149, 152, 157, 160 and 165	11 (54 Mbps)

*Channels tested and reported in this report

**Channels tested and reported in the U-NII submission (M061025_Cert_AR5BXB6_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: Nissei Electric Inverted F Antenna, Model: CP115428
 Location: Right palm rest area
Antenna gain: Refer antenna data provided separately
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 (M061025_Cert_EYTF3CSFT_WLAN)

2.3 EUT (Notebook PC) Details

EUT: LifeBook P series
Model Name: P7230
Serial Number: Pre-production Sample
Manufacturer: FUJITSU LIMITED

CPU Type and Speed: Core Duo U2500 1.2GHz
LCD: 10.6" WXGA
Wired LAN: Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T
Modem: Agere MDC1.5 modem Model: D40
Port Replicator Model: FPCPR72

AC Adapter Model: 60W:SEC80N2-16.0(Sanken)
Voltage: 16 V
Current Specs: 3.75A
Watts: 60W



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2.4 Operational Description

The Atheros 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: FG06-134EFC)

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
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 (A²LA).

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 – AR5BxB6 (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: FG06-134EFC)

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: FG06-134EFC).

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 μ V/m.

V = EMI Receiver Voltage in dB μ V. (measured value)

AF = Antenna Factor in dB(m⁻¹). (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 μ 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 μ V/m limit at 3 metres has been converted to 64 dB μ 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 and 5.47 – 5.725 GHz), refer to M061025_Cert_AR5BXB6_NII_BT. Harmonics related to the Bluetooth transmitter refer to M061025_Cert_EYTF3CSFT_WLAN.

4.3.1.1 Configuration 802.11b

Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). Emissions (peak) 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).

Channel 1 - 2412 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2412	110.6	101.7	-	-	-
4824	60.5	45.4	74.0	54.0	Pass
7236	51.8	41.5	-	-	-
9648	47	35	-	-	-
12060	50	38	74.0	54.0	Pass
14472	52	42	74.0	54.0	Pass
16884	52	42	-	-	-
19296	63	50	84.0*	64.0*	Pass
21708	67	54	-	-	-
24120	68	55	-	-	-
2386	58.8	48.3	74.0	54.0	Pass
3216	52.4	41.3	-	-	-

*Limits were corrected for 1 metre measurement.



Channel 6 - 2437 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2437	110.4	101.6	-	-	-
4874	60.1	46.2	74.0	54.0	Pass
7311	51.1	40.7	74.0	54.0	Pass
9748	47	35	-	-	-
12185	50	38	74.0	54.0	Pass
14622	52	42	-	-	-
17059	52	42	-	-	-
19496	63	50	84.0*	64.0*	Pass
21933	67	54	-	-	-
24370	68	55	-	-	-
3249.4	52.6	40.8	-	-	-

*Limits were corrected for 1 metre measurement.

Channel 11 - 2462 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2462	110.9	102.3	-	-	-
4924	60.4	46.6	74.0	54.0	Pass
7386	51.4	41.3	74.0	54.0	Pass
9848	47	35	-	-	-
12310	50	38	74.0	54.0	Pass
14772	52	42	-	-	-
17234	52	42	-	-	-
19696	63	50	84.0*	64.0*	Pass
22158	67	54	84.0*	64.0*	Pass
24620	68	55	-	-	-
2488	63.9	53.5	74.0	54.0	Pass
3282.7	53.7	42.2	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 0.5 dB. The measurement uncertainty for radiated emissions in this band was ± 4.1 dB.

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 (normal mode) and 12 Mbps (turbo mode).

Channel 1 - 2412 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2412	108.7	98.5	-	-	-
4824	55.8	43.1	74.0	54.0	Pass
7236	50.3	39.1	-	-	-
9648	47	35	-	-	-
12060	50	38	74.0	54.0	Pass
14472	52	42	74.0	54.0	Pass
16884	52	42	-	-	-
19296	63	50	84.0*	64.0*	Pass
21708	67	54	-	-	-
24120	68	55	-	-	-
3216	52.5	40.2	-	-	-

*Limits were corrected for 1 metre measurement.

Channel 6 - 2437 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2437	109.0	98.9	-	-	-
4874	55.5	44.3	74.0	54.0	Pass
7311	50.7	40.8	74.0	54.0	Pass
9748	47	35	-	-	-
12185	50	38	74.0	54.0	Pass
14622	52	42	-	-	-
17059	52	42	-	-	-
19496	63	50	84.0*	64.0*	Pass
21933	67	54	-	-	-
24370	68	55	-	-	-
3249.4	51.6	40.0	-	-	-

*Limits were corrected for 1 metre measurement.



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Channel 11 - 2462 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2462	109.7	99.3	-	-	-
4924	56.8	44.7	74.0	54.0	Pass
7386	50.5	40.2	74.0	54.0	Pass
9848	47	35	-	-	-
12310	50	38	74.0	54.0	Pass
14772	52	42	-	-	-
17234	52	42	-	-	-
19696	63	50	84.0*	64.0*	Pass
22158	67	54	84.0*	64.0*	Pass
24620	68	55	-	-	-
3282.7	52.5	40.2	74.0	54.0	Pass

*Limits were corrected for 1 metre measurement

Channel 6 - 2437 MHz – Turbo Mode

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2437	105.9	96.3	-	-	-
4874	55.5	43.4	74.0	54.0	Pass
7311	50.8	39.1	74.0	54.0	Pass
9748	47	35	-	-	-
12185	50	38	74.0	54.0	Pass
14622	52	42	-	-	-
17059	52	42	-	-	-
19496	63	50	84.0*	64.0*	Pass
21933	67	54	-	-	-
24370	68	55	-	-	-
3249.4	52.0	38.8	-	-	-

*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 9.3 dB. The measurement uncertainty for radiated emissions in this band was ± 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). No significant differences in emissions were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 6 Mbps (normal mode) and 12 Mbps (turbo mode).

Channel 149 - 5745 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
5745	108.7	98.9	-	-	-
11490	59.9	47.0	74.0	54.0	Pass
17235	57	46	-	-	-
22980	67	54	84.0*	64.0*	Pass
28725	77	65	-	-	-
34470	78	66	-	-	-
3830	50.3	39.3	74.0	54.0	Pass

*Limits were corrected for 1 metre measurement.

Channel 157 - 5785 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
5785	108.4	98.1	-	-	-
11570	61.2	49.3	74.0	54.0	Pass
17355	57	46	-	-	-
23140	67	54	-	-	-
28925	77	65	-	-	-
34710	78	66	-	-	-
3856.8	50.6	39.7	74.0	54.0	Pass

Channel 165 - 5825 MHz

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
5825	108.2	98.4	-	-	-
11650	62.3	51.3	74.0	54.0	Pass
17475	57	46	-	-	-
23300	67	54	-	-	-
29125	77	65	-	-	-
34950	78	66	-	-	-
3883.3	51.5	41.0	74.0	54.0	Pass



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Channel 152 - 5760 MHz - Turbo Mode

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
5760	106.4	96.3	-	-	-
11520	55.9	45.3	74.0	54.0	Pass
17280	57	46	-	-	-
23040	67	54	84.0*	64.0*	Pass
28800	77	65	-	-	-
34560	78	66	-	-	-
3840	50.2	39.2	74.0	54.0	Pass

*Limits were corrected for 1 metre measurement.

Channel 160 - 5800 MHz - Turbo Mode

Frequency MHz	Peak Detector dBuV/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
5800	106.0	95.7	-	-	-
11600	56.4	45.9	74.0	54.0	Pass
17400	57	46	-	-	-
23200	67	54	-	-	-
29000	77	65	-	-	-
34800	78	66	-	-	-
3866.7	51.2	40.1	74.0	54.0	Pass

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 2.7 dB. The measurement uncertainty for radiated emissions in this band was ± 4.1 dB.

4.3.1.4 Both WLAN and Bluetooth Transmitters Transmitting

Result: IM spurious emissions were recorded within the restricted bands of up to 40 GHz. Emissions were complied with the FCC limits in section 15.209 and 15.247. The measurement uncertainty for radiated emissions in this band was ± 4.1 dB.

4.3.2 Frequency Band: 30 - 1000 MHz

Refer to Attachment 3 – FCC Part 15B Test Report (Report: FG06-134EFC).



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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 300 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/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2390	58.7	47.2	74.0	54.0	Pass
2483.5	60.8	50.9	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/m	Average Detector dBuV/m	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2390	62.7	50.6	74.0	54.0	Pass
2483.5	65.3	51.5	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 an integration method as per test method # 3 of DA 02-2138. The resolution bandwidth of 1 MHz was used. The video bandwidth (VBW) of 30 kHz was used.

VBW $\geq 1/T$, where T (worst case) = 180 μ S at 108 Mbps for 802.11a and 802.11g.
 = 360 μ S at 54 Mbps for 802.11a and 802.11g.
 = 1890 μ S at 11 Mbps for 802.11b.

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). Peak output power with 16QAM modulation was observed to be slightly worst. Final testing was performed while the transmitter continuously operated with the modulation rate of 24 Mbps (normal mode) and 48 Mbps (turbo mode).

Frequency MHz	Operating Mode	Power dBm	Limit dBm	Power mW	Limit mW	Result
5745	Normal	16.9	30	49.0	1000	Complies
5760	Turbo	16.2	30	41.7	1000	Complies
5785	Normal	16.6	30	45.7	1000	Complies
5800	Turbo	16.6	30	45.7	1000	Complies
5825	Normal	17.0	30	50.0	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	Operating Mode	Power dBm	Limit dBm	Power mW	Limit mW	Result
2412	Normal	17.2	30	52.5	1000	Complies
2437	Normal	17.3	30	53.7	1000	Complies
2462	Normal	16.9	30	49.0	1000	Complies

5.3 Configuration 802.11g

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). Peak output power with 16QAM modulation was observed to be slightly worst. Final testing was performed while the transmitter continuously operated with the modulation rate of 24 Mbps (normal mode) and 48 Mbps (turbo mode).

Frequency MHz	Operating Mode	Power dBm	Limit dBm	Power mW	Limit mW	Result
2412	Normal	16.6	30	45.7	1000	Complies
2437	Normal	16.5	30	44.7	1000	Complies
2437	Turbo	16.8	30	47.9	1000	Complies
2462	Normal	17.0	30	50.0	1000	Complies



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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 (normal mode) and 108 Mbps (turbo mode).

Frequency MHz	Operating Mode	Bandwidth MHz	Result	6 dB Bandwidth Plots
5745	Normal	16.6	Complies	Appendix J1
5760	Turbo	33.1	Complies	Appendix J1
5785	Normal	16.6	Complies	Appendix J1
5800	Turbo	33.1	Complies	Appendix J1
5825	Normal	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	Operating Mode	Bandwidth MHz	Result	6 dB Bandwidth Plots
2412.0	Normal	11.5	Complies	Appendix J2
2437.0	Normal	11.3	Complies	Appendix J2
2462.0	Normal	11.2	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 (normal mode) and 108 Mbps (turbo mode).

Frequency MHz	Operating Mode	Bandwidth MHz	Result	6 dB Bandwidth Plots
2412	Normal	16.6	Complies	Appendix J3
2437	Normal	16.6	Complies	Appendix J3
2437	Turbo	33.0	Complies	Appendix J3
2462	Normal	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 was observed to be slightly worst. Final testing was performed while the transmitter continuously operated with the modulation rate of 6 Mbps (normal mode) and 12 Mbps (turbo mode).

Frequency MHz	Operating Mode	Level dBm	Limit dBm	Result	Spectral Density plots
5745	Normal	-8.5	8.0	Complies	Appendix M1
5760	Turbo	-11.5	8.0	Complies	Appendix M1
5785	Normal	-8.2	8.0	Complies	Appendix M1
5800	Turbo	-8.1	8.0	Complies	Appendix M1
5825	Normal	-8.6	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	Operating Mode	Level dBm	Limit dBm	Result	Spectral Density plots
2412.0	Normal	-3.2	8.0	Complies	Appendix M2
2437.0	Normal	-4.5	8.0	Complies	Appendix M2
2462.0	Normal	-2.6	8.0	Complies	Appendix M2

7.3 Configuration 802.11g

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in peak power spectral density were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 54 Mbps (normal mode) and 108 Mbps (turbo mode).

Frequency MHz	Operating Mode	Level dBm	Limit dBm	Result	Spectral Density plots
2412.0	Normal	-5.0	8.0	Complies	Appendix M3
2437.0	Normal	-1.6	8.0	Complies	Appendix M3
2437.0	Turbo	-6.3	8.0	Complies	Appendix M3
2462.0	Normal	-1.1	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 location: Top edge of LCD screen and projected distance of less than 20cm from user.

Transmitter # 2 (Bluetooth): The antenna location: Right palm rest area and 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 M061026_Cert_AR5BXB6_SAR_DTS_2.4G_5.8G and M061026_Cert_AR5BXB6_SAR_NII_5.2G. The highest SAR value is 0.212 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 LifeBook P Series, Model: P7230 with Atheros Mini-PCI Wireless LAN Module (XB62 11a+b/g), Model: AR5BXB6 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	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

*Refer to EMC Technologies' report M061026_Cert_AR5BXB6_SAR_DTS_2.4G_5.8G

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

Refer to EMC Technologies' test report: M061025_Cert_AR5BXB6_NII_BT (U-NII) and M061025_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 P Series

Attachment 3: FCC Part 15B Test Report (Report: FG06-134EFC)



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