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**EMI TEST REPORT FOR CERTIFICATION  
to  
FCC PART 15 Subpart E (Section 15.407) & RSS-210  
Class II Permissive Change**

FCC ID: EJE-WL0011  
Industry Canada ID: 337J-WL0011

Test Sample: XB62 Atheros Mini-PCI WLAN Module  
Model: AR5BXB6

Report Number M060703\_Cert\_AR5BXB6\_NII\_Class\_2

Tested for: Fujitsu Australia Ltd.

Issue Date: 15<sup>th</sup> July 2006

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**CONTENTS**

- 1.0 INTRODUCTION**
- 2.0 GENERAL INFORMATION**

**RESULTS – WLAN, AR5BXB6 (802.11a of 11a+b/g)\***

- 3.0 SPURIOUS EMI MEASUREMENTS**
- 4.0 RADIO FREQUENCY EXPOSURE**
- 5.0 COMPLIANCE STATEMENT**
- 6.0 MEASUREMENT INSTRUMENTATION DETAILS**
- 7.0 TEST REPORT APPENDICES**
  - APPENDIX A: ANTENNA INFORMATION**
  - APPENDIX B: WLAN, BT and ANTENNA LOCATIONS PHOTOS**
  - Attachment 1: RF Exposure Information**

**\*RESULTS of 802.11b/g and 802.11a (5725 – 5850 MHz):**  
**Refer to Report No: M060703\_Cert\_AR5BXB6\_DTS\_Class\_2**



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**FCC PART 15 Subpart E (Section 15.407) & RSS-210**  
**Class II Permissive Change**

**Report Number:** M060703\_Cert\_AR5BXB6\_NII\_Class\_2

**Test Sample:** XB62 Mini-PCI WLAN Module  
**Model:** AR5BXB6  
**Manufacturer:** Atheros Communications

**FCC ID:** EJE-WL0011  
**Industry Canada ID:** 337J-WL0011  
**Equipment Type:** Intentional Radiator (Transceiver)

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

**Tested for:** Fujitsu Australia Ltd

**Test Standards:** FCC Part 15, Subpart E – Unlicensed National Information, Infrastructure Devices  
FCC Part 15.407, General Technical Requirements  
ANSI C63.4 – 2003  
OET Bulletin No. 65  
  
RSS-210 Issue 5 and Issue 6 Low Power Licence-Exempt  
RadioCommunication Devices: 6.2.2 (q1) 5150 - 5350 MHz, 5470 – 5725 MHz  
& 5725-5825 MHz Local Area Network Devices  
  
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:** 6<sup>th</sup> to 14<sup>th</sup> July 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 E (Section 15.407) & RSS-210**  
**Class II Permissive Change**

## 1.0 INTRODUCTION

Testing was performed on the Atheros Mini-PCI Wireless LAN Module (XB62 11a+b/g), Model: AR5BXB6 installed in Fujitsu notebook PC.

The AR5BXB6 WLAN module has been recently certified by Fujitsu Australia Ltd under the FCC ID: EJE-WL0011 (IC: 337J-WL0011). The intention of this application is to add host models (Fujitsu Notebooks) and re-certify the AR5BXB6 WLAN module installed in, models: C1410, A3110/A3190 and A6010/A6090 as a **Class II Permissive Change**.

The Atheros WLAN module was originally certified by Atheros as a modular approval under FCC ID: PPD-AR5BXB6-M (Canada ID: 4104A-AR5BXB6). The intention of this application is to get a Limited Modular approval for this WLAN module for use in Fujitsu notebook PCs. 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 IEEE802.11a (DTS & U-NII) configurations. Tests were performed in all three configurations.

The results for configuration IEEE 802.11a (U-NII: 5150 – 5350 MHz) are reported in this test report.

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

Refer to EMC Technologies' test report: M060703\_Cert\_AR5BXB6\_DTS\_Class\_2 (DTS).

The second transmitter in the notebook is a Bluetooth module, model: EYTF3CSFT. This Bluetooth module has been recently certified by Fujitsu Australia Ltd under the FCC ID: EJE-BT0001 (IC: 337J-BT0001).

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

47 CFR, Part 15, Subpart E:	Unlicensed National Information Infrastructure Devices (U-NII) operating in the 5.15-5.35 GHz, 5.47-5.725 GHz and 5.725-5.825 GHz frequency bands
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 15.407:	General Technical Requirements

The results and technical details of the test sample are detailed in this report. The test sample **complies** with the requirements of 47 CFR, Part 15 Subpart E - Section 15.407.

The test sample also complies with the Industry Canada RSS-210 Issue 5 for frequency band 5250 to 5350 MHz and Issue 6 for frequency band 5150 to 5250 MHz (Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)) clause 6.2.2(q1) requirements and the RF exposure requirements of RSS-102.



## 1.1 Summary of Results

### 1.1.1 FCC Subpart E, Section 15.407

FCC Part 15, Subpart E Clauses	Industry Canada RSS-210 Clauses	Test Performed	Result
15.203	5.5	Antenna Requirement	Note 1
15.205	6.3	Operation in Restricted Band	Complies
15.207	6.6	Conducted Emissions	Note 1
15.209	6.3	Radiated Emissions	Complies
15.407 (a)(1) (a)(2)	6.2.2(q1)	Peak Transmit Power	Note 1
15.407 (a)(5)	6.2.2(q1)	Peak Power Spectral Density	Note 1
15.407 (a)(6)		Peak Excursion	Note 1
15.407 (b)	6.2.2(q1)	Undesirable Emission	Complies
15.407 (f)		Radio Frequency Hazard	Note 1
15.407 (g)	6.4	Frequency Stability	Note 1

**Note 1:** Refer to EMC test report M060223\_Cert\_AR5BXB6\_NII with FCC ID: EJE-WL0011 (IC ID: 337J-WL0011)

### 1.1.2 FCC Subpart C, Section 15.247

FCC Part 15, Subpart C Clauses	Industry Canada RSS-210 Clauses	Test Performed	Result
15.203	5.5	Antenna Requirement	Note 1
15.205	6.3	Operation in Restricted Band	Complies
15.207	6.6	Conducted Emissions	Note 1
15.209	6.3	Radiated Emissions	Complies
15.247 (a)(2)	6.2.2(o)(iv)	Channel Bandwidth	Note 1
15.247 (b)(3)	6.2.2(o)(b)	Peak Output Power	Note 1
15.247 (i)		Radio Frequency Hazard	Complies
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	Note 1

**Refer to EMC Technologies Report No: M060703\_Cert\_AR5BXB6\_DTS\_Class\_2**

**Note 1:** Refer to EMC test report M060223\_Cert\_AR5BXB6\_DTS with FCC ID: EJE-WL0011 (IC ID: 337J-WL0011)

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.



## 2.0 GENERAL INFORMATION

(Information supplied by the Client)

### 2.1 EUT (WLAN) Details

<b>Transmitter:</b>	Mini-Card Wireless LAN Module
<b>Wireless Module:</b>	XB62 (11a+b/g)
<b>Model Number:</b>	AR5BXB6
<b>Manufacturer:</b>	Atheros
<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>	Turbo mode: 12 Mbps - 108 Mbps DBPSK – 1Mbps DQPSK – 2Mbps CCK – 5.5Mbps, 11Mbps
<b>Frequency Range:</b>	2.4 – 2.4835 GHz for 11b/g 5.15 - 5.35 GHz and 5.725 - 5.850 GHz for 11a
<b>Antenna Types:</b>	Refer antenna data provided separately
<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 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
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 and 64	16 (6 Mbps to 36 Mbps)
*Channel 36, 42, 50, 52, 58 and 64	14 (48 Mbps)
*Channel 36, 42, 50, 52, 58 and 64	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 DTS submission (M060703\_Cert\_AR5BXB6\_DTS\_Class\_2)



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## 2.2 Operational Description

The Atheros WLAN Module was tested in Fujitsu host notebook C1410 and A3110/A3190.

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.

## 2.3 Test Configuration

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

Limited Modular Approval (LMA) details to cover the following Fujitsu notebook configurations:

Fujitsu Notebook Model	WLAN Module	WLAN Antenna	FCC/IC CERTIFICATION STATUS
E8210	Atheros XB62	2 x Inverted F antenna	GRANT Issued FCC ID: EJE-WL0011
Q2010		2 x Inverted F antenna	
S7110		2 x Monopole Antenna	
E8110		2 x Inverted F antenna	
S6310		2 x Inverted F antenna	
B6210		2 x Monopole Antenna	
Following NEW Model to be added			
C1410	Atheros XB62	2 x Inverted F antenna	Tested model in this application
A3110/A3190		2 x Inverted F antenna	
A6010/A6090		2 x Inverted F antenna	Same as A3110/A3190

Fujitsu Notebook Model	WLAN antenna type	WLAN antenna Peak gain [dBi]			
		2.4GHz band	5GHz low band	5GHz Mid band*	5GHz High band
E8110	Inverted F	-0.99	-1.12	-0.56	-0.56
E8210	Inverted F	<b>2.47</b>	-0.44	0.38	0.38
S7110	Monopole	2.08	1.66	0.59	1.79
Q2010	Inverted F	2.32	<b>3.23</b>	<b>3.36</b>	1.48
S6310	Inverted F	-0.38	1.09	0.64	0.90
B6210	Monopole	-1.3	-0.8	-0.8	-0.8
<b>C1410</b>	Inverted F	2.42	2.72	2.42	<b>3.08</b>
<b>A3110/A3190</b>	Inverted F	1.66	3.19	2.60	2.03
<b>A6010/A6090</b>	Inverted F	1.66	3.19	2.60	2.03

\*5 GHz Mid band (5470 to 5725 MHz) is not applicable for this application.

To qualify for a class 2 permissive change, the output power was re-measured on host C1410. The highest output powers are report below.

**The highest output powers were granted:**

Frequency MHz	Output Power Granted dBm
5200	17.0
5300	17.1
2400	18.0

**The highest new output powers are measured:**

Frequency MHz	New Output Power Measured dBm
5200	16.8
5300	16.7
2400	17.7

The location of the WLAN antennas and the design of the WLAN antennas (Inverted F) in host C1410, A3110/A3190 and A6010/A6090 notebook (new models added) are identical to the antenna in other host notebooks (had been certified).

Only the highest band of the 5 GHz WLAN (5725 – 5850 MHz) was tested for host C1410 notebook as the antenna gain for this band is higher than in other host notebooks (refer to the table above). The result for this band is reported under section 3.0. For harmonics and spurious emissions of the WLAN installed in other host notebooks were reported under EMC Technologies report number: M060223\_Cert\_AR5BXB6\_NII (original filing).

IM spurious emissions was tested for host C1410 and A3110/A3190 when both radio modules (WLAN and Bluetooth) simultaneously transmitting. No testing was required for host A6010/A6090 as it was identical to host A3110/A3190 (only product code name was different). Refer to section 3.0 of this report for IM statements.

Refer to Appendix\_A1\_C1410 for antenna details.

Refer to Appendix\_A2\_ A3110/A3190 and A6010/A6090 for antenna details.

Data Transmission is always initiated by software, which is then passed down through the MAC, through the digital and analog baseband, finally to the RF chip. Several special packets (ACKs, CTS, PSpoll, etc) are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which then turns off at the end of the packet. Therefore, the transmitter will be ON only while one of the four mentioned packets is being transmitted.

## 2.4 Host PC Details

### 2.4.1 C1410 Model NoteBook

<b>Host notebook :</b>	LifeBook C series
<b>Model Name:</b>	C1410
<b>Serial Number:</b>	Pre-production Sample
<b>Manufacturer:</b>	FUJITSU LIMITED
<b>CPU Type and Speed:</b>	Yonah-DC 2.16GHz
<b>LCD</b>	15" WXGA / 15" XGA
<b>Wired LAN:</b>	Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T
<b>Modem:</b>	Agere MDC1.5 modem Model: D40
<b>Port Replicator Model:</b>	FPCPR63
<b>AC Adapter Model:</b>	SEC100P2-19.0(Sanken) / SQ2N80W19P-01(Nagano JRC)
<b>Voltage:</b>	19 V
<b>Current Specs:</b>	4.22A
<b>Watts:</b>	80W
<b>RADIO MODULES</b>	
<b>Module # 1:</b>	WLAN (XB62 IEEE802.11a+b/g)
<b>WLAN Model Number:</b>	AR5BxB6
<b>WLAN Manufacturer:</b>	Atheros
<b>Interface Type:</b>	Mini-Card Wireless LAN Module
<b>Antenna Types:</b>	Nissei Electric Inverted F Antenna Model: CP250925 Located on top edge of LCD screen
<b>Antenna gain:</b>	Refer antenna data provided separately (Appendix A)
<b>Module # 2:</b>	Bluetooth Module
<b>Model Number:</b>	EYTF3CS FT
<b>Manufacturer:</b>	TAIYO YUDEN
<b>Interface Type:</b>	USB
<b>Antenna Types:</b>	Yokowo Inverted F Antenna, Model: YCE-5250 Location: right hinge of LCD
<b>Antenna gain:</b>	3.20 dBi
<b>Max. Output Power:</b>	4 dBm



**2.4.2 A3110/A3190 Model Notebook**

<b>Host notebook :</b>	LifeBook A series
<b>Model Name:</b>	A3110 / A3190
<b>Serial Number:</b>	Pre-production Sample
<b>Manufacturer:</b>	FUJITSU LIMITED
<b>CPU Type and Speed:</b>	Turion64x2 TL60 2.2GHz / Sempron3500+ 2.00GHz
<b>LCD</b>	15.4" WXGA
<b>Wired LAN:</b>	Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T
<b>Modem:</b>	Agere MDC1.5 modem Model: D40
<b>Port Replicator Model:</b>	Non

<b>AC Adapter Model:</b>	80W: SEC100P2-19.0(Sanken), ADP-80NB A(Delta) 60W: ADP-60ZH A(Delta)
<b>Voltage:</b>	19 V
<b>Current Specs:</b>	4.22A / 3.16A
<b>Watts:</b>	80W / 60W

**RADIO MODULES**

<b>Module # 1:</b>	WLAN (XB62 IEEE802.11a+b/g)
<b>WLAN Model Number:</b>	AR5BxB6
<b>WLAN Manufacturer:</b>	Atheros
<b>Interface Type:</b>	Mini-Card Wireless LAN Module
<b>Antenna Types:</b>	Nissei Electric Inverted F Antenna Model: CP115445 Located on top edge of LCD screen
<b>Antenna gain:</b>	Refer antenna data provided separately (Appendix A)
<b>Module # 2:</b>	Bluetooth Module
<b>Model Number:</b>	EYTF3CS FT
<b>Manufacturer:</b>	TAIYO YUDEN
<b>Interface Type:</b>	USB
<b>Antenna Types:</b>	Nissei Electric Inverted F Antenna, Model: YCE-5250 Location: edge of right palm rest
<b>Antenna gain:</b>	0.97 dBi
<b>Max. Output Power:</b>	4 dBm

**2.4.3 A6010/A6090 Model Notebook**

<b>Host notebook :</b>	LifeBook A series
<b>Model Name:</b>	A6010 / A6090
<b>Serial Number:</b>	Pre-production Sample
<b>Manufacturer:</b>	FUJITSU LIMITED
<b>CPU Type and Speed:</b>	Core2 Duo T7600 2.33GHz / Celeron M 1.6GHz
<b>LCD</b>	15.4" WXGA
<b>Wired LAN:</b>	Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T
<b>Modem:</b>	Agere MDC1.5 modem Model: D40
<b>Port Replicator Model:</b>	Non

<b>AC Adapter Model:</b>	80W: SEC100P2-19.0(Sanken), ADP-80NB A(Delta) 60W: ADP-60ZH A(Delta)
<b>Voltage:</b>	19V
<b>Current Specs:</b>	4.22A / 3.16A
<b>Watts:</b>	80W / 60W

**RADIO MODULES**

<b>Module # 1:</b>	WLAN (XB62 IEEE802.11a+b/g)
<b>WLAN Model Number:</b>	AR5BxB6
<b>WLAN Manufacturer:</b>	Atheros
<b>Interface Type:</b>	Mini-Card Wireless LAN Module
<b>Antenna Types:</b>	Nissei Electric Inverted F Antenna Model: CP115445 Located on top edge of LCD screen
<b>Antenna gain:</b>	Refer antenna data provided separately (Appendix A)
<b>Module # 2:</b>	Bluetooth Module
<b>Model Number:</b>	EYTF3CS FT
<b>Manufacturer:</b>	TAIYO YUDEN
<b>Interface Type:</b>	USB
<b>Antenna Types:</b>	Nissei Electric Inverted F Antenna, Model: YCE-5250 Location: edge of right palm rest
<b>Antenna gain:</b>	0.97 dBi
<b>Max. Output Power:</b>	4 dBm

## 2.5 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.

## 2.6 Test Facility

### 2.6.1 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 an 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**.

### 2.6.2 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).

## 2.7 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 calibrated by the NATA approved procedures.

## 2.8 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.



## RESULTS

### WLAN Module – AR5BXB6 (802.11a (NII))

### 3.0 RADIATED EMISSION MEASUREMENTS

#### 3.1 Test Procedure

Testing was performed in accordance with the requirements of FCC Part 15.407(b).

Radiated emission measurements were performed to the limits as per section 15.209 and 15.407. 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 EMC test report M060223\_Cert\_AR5BXB6\_NII with FCC ID: EJE-WL0011 (IC ID: 337J-WL0011).

The measurement of emissions above 1000 MHz, appearing in the restricted bands, was made using an average detector with a resolution 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 measurement data for each frequency range was automatically corrected by the software for cable losses, 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.

#### 3.2 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 dBμV/m.

**V** = EMI Receiver Voltage in dBμV. (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 dBμV 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) ± 4.1 dB



### 3.3 Results - Out of Band Emissions (Spurious and Harmonics)

#### 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 peak limits for undesirable emission outside of the restricted bands are  $-27$  dBm (68.3 dBuV/m @ 3m).

Measurements were performed on Fujitsu host notebook C1410 and A3110/A3190.

Testing was performed while both the WLAN transmitter and Bluetooth transmitter continuously operated. IM spurious emissions (5.15 – 5.35 GHz) are reported below. IM spurious emissions in the frequency band (2.4 – 2.4835 GHz and 5.725 – 5.850 GHz), refer to M060703\_Cert\_AR5BxB6\_DTS\_Class\_2.

The harmonics and spurious emissions of the WLAN transmitter were reported under EMC Technologies report number: M060223\_Cert\_AR5BxB6\_NII.

**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  $\pm 4.1$  dB.

#### 4.0 RADIO FREQUENCY EXPOSURE (HAZARD) INFORMATION

Testing was performed in accordance with the requirements of FCC Part 15.407(f)

Spread spectrum transmitters operating in the 2400 - 2483.5 MHz and 5.150 – 5.350 GHz 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: The WLAN antennas are located on the top edge of LCD screen (2 antennas left and right) and projected distance of greater than 20cm from user.

Transmitter # 2: The Bluetooth antenna is located at right hinge of LCD screen and projected distance of less than 20cm from user.

SAR is not required as the WLAN transmitter is mobile device and the power for the Bluetooth transmitter is below the low threshold.

The separation distance between the WLAN and BT antennas is greater than 20cm. Therefore, they are not co-located transmitters.

The MPE calculation shown below is for the WLAN power densities.

In accordance with Section 1.1310, the Maximum Permissible Exposure (MPE) limit for the General Population/Uncontrolled Exposure of 1.0 has been applied, i.e 1mW/cm<sup>2</sup>.

Friis transmission formula:  $P_d = (P \cdot G) / (4 \cdot \pi \cdot r^2)$

where:  $P_d$  = power density (mW/cm<sup>2</sup>)

$P$  = power input to the antenna (mW)

$G$  = antenna gain (numeric)

$r$  = distance to the center of radiation of the antenna (cm)

Prediction frequency = **5260 MHz**

\*Maximum peak output power = 17.1 dBm = 51.3 mW

Antenna (Inverted F) gain (max) = 3.23 dBi = 2.014 numeric

The power density calculated = 0.022 mW/cm<sup>2</sup>

\*Refer to EMC report: M060223\_Cert\_AR5BXB6\_DTS (WLAN)

MPE limit for uncontrolled exposure at prediction frequency = 1 mW/cm<sup>2</sup>

**Results:** Calculations show that the Radio devices with described antennas complied with Maximum Permissible Exposure (MPE) limit for the General Population/Uncontrolled Exposure.

## 5.0 COMPLIANCE STATEMENT

The Atheros Mini-PCI Wireless LAN Module (XB62 11a+b/g), Model: AR5BXB6 installed in Fujitsu notebook PCs tested on behalf of Fujitsu Australia Ltd, **comply** with the **Class II Permissive Change** requirements of 47 CFR, Part 15 Subpart E -Section 15.407 (5.15-5.35 GHz band).

The test sample also complies with the Industry Canada RSS-210 Issue 5 for frequency band 5250 to 5350 MHz and Issue 6 for frequency band 5150 to 5250 MHz (Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)) clause 6.2.2(q1) requirements and the RF exposure requirements of RSS-102.

**Results were as follows:**

### FCC Subpart E, Section 15.407

FCC Part 15, Subpart E Clauses	Industry Canada RSS-210 Clauses	Test Performed	Result
15.203	5.5	Antenna Requirement	<b>Note 1</b>
15.205	6.3	Operation in Restricted Band	<b>Complies</b>
15.207	6.6	Conducted Emissions	<b>Note 1</b>
15.209	6.3	Radiated Emissions	<b>Complies</b>
15.407 (a)(1) (a)(2)	6.2.2(q1)	Peak Transmit Power	<b>Note 1</b>
15.407 (a)(5)	6.2.2(q1)	Peak Power Spectral Density	<b>Note 1</b>
15.407 (a)(6)		Peak Excursion	<b>Note 1</b>
15.407 (b)	6.2.2(q1)	Undesirable Emission	<b>Complies</b>
15.407 (f)		Radio Frequency Hazard	<b>Note 1</b>
15.407 (g)	6.4	Frequency Stability	<b>Note 1</b>

**Note 1:** Refer to EMC test report M060223\_Cert\_AR5BXB6\_NII with FCC ID: EJE-WL0011 (IC ID: 337J-WL0011)

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

Refer to EMC Technologies' test report: M060703\_Cert\_AR5BXB6\_DTS\_Class\_2 (DTS)

## 6.0 MEASUREMENT INSTRUMENTATION DETAILS

EQUIPMENT TYPE	MAKE/MODEL SERIAL NUMBER	CAL. DATE DD/MM/YY	DUE DATE DD/MM/YY	CAL. INTERVAL
EMI RECEIVER	Rohde & Schwarz, Model ESIB40 SN 1088 7490, 20 Hz – 40 GHz	23/06/06	23/06/07	1 YEAR *2
ANTENNAS	EMCO 3115 DOUBLE RIDGED HORN 1 - 18 GHz Sn: 8908-3282	24/02/06	24/02/09	3 YEAR *1
	EMCO 3116 Double Ridged Guide Horn 18 - 40 GHz Sn: 2276	-----	-----	*3
	ETS Standard Gain Horn, M/N: 3160-02	21/11/03	21/11/06	3 YEAR *1
	ETS Standard Gain Horn, M/N: 3160-03	25/06/04	25/06/07	3 YEAR *1
	Narda Standard Gain Horn, M/N: 644	28/10/03	28/10/06	3 YEAR *1
	ETS Standard Gain Horn, M/N: 3160-05	25/06/04	25/06/07	3 YEAR *1
	ETS Standard Gain Horn, M/N: 3160-06	25/06/04	25/06/07	3 YEAR *1
	ETS Standard Gain Horn, M/N: 3160-07	25/06/04	25/06/07	3 YEAR *1
	ETS Standard Gain Horn, M/N: 3160-08	25/06/04	25/06/07	3 YEAR *1
ENVIRONMENTAL CHAMBER	Heraeus votsch, Type: HT 4033 Order number: 60884376 Temperature range: -40 to +180 degrees			

Note \*1. In-house calibration. Refer to Quality Manual.

Note \*2. NATA calibration by Vicom

Note \*3. Manufacturer's Calibration

## 7.0 TEST REPORT APPENDICES

### APPENDIX A: ANTENNA INFORMATION

### APPENDIX B: WLAN, BT and ANTENNA LOCATIONS PHOTOS

### Attachment 1: RF Exposure Information



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