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EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart E (Section 15.407) & RSS-210

FCC ID:	EJE-WL0010
Industry Canada ID:	337J-WL0010
Test Sample:	GOLAN INTEL Mini-PCI WLAN Module
Model:	WM3945ABG
Report Number	M060108_Cert_WM3945ABG_NII
Tested for:	Fujitsu Australia Ltd.
Issue Date:	8th February 2006

NATA Accredited Laboratory Number:
5292

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Report Number: M060108_Cert_WM3945ABG_NII

Test Sample: GOLAN INTEL Mini-PCI WLAN Module
Model: WM3945ABG
Manufacturer: INTEL Corp

FCC ID: EJE-WL0010
Industry Canada ID: 337J-WL0010
Equipment Type: Intentional Radiator (Transceiver)

Host Notebook Manufacturer: 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 E – Unlicensed National Information, Infrastructure Devices
FCC Part 15.407, General Technical Requirements
ANSI C63.4 – 2003
OET Bulletin No. 65

RSS-210 Issue 6 Low Power Licence-Exempt RadioCommunication Devices: 6.2.2 (q1) 5150 - 5350 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: 10th January to 8th February 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

EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart E (Section 15.407) & RSS-210

1.0 INTRODUCTION

Testing was performed on the INTEL Mini-PCI Wireless LAN Module (GOLAN 11a+b/g), Model: WM3945ABG installed in Fujitsu notebook PC.

The GOLAN WLAN module was originally certified by INTEL as a modular approval under FCC ID: PD9WM3945ABG (Canada ID: 1000M-WM3945ABG). 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 GOLAN 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: M060108_Cert_WM3945ABG_DTS (DTS).

The second transmitter in the notebook is a Bluetooth module, model: EYTF3CSFT. This Bluetooth transmitter is tested and certified under EMC Technologies report No: M060108_Cert_EYTF3CSFT with FCC ID: EJE-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 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 6 (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	**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**
15.407 (g)	6.4	Frequency Stability	**Complies**

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	**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**
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 No: M010608_Cert_WM3945ABG_DTS

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

Transmitter:	Mini-PCI Wireless LAN Module
Wireless Module:	GOLAN (11a+b/g)
Model Number:	WM3945ABG
Manufacturer:	Intel Corporation
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
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 and 5.725 - 5.850 GHz for 11a
Number of Channels:	11 channels for 11b or 11g
	13 channels for 11a
Power Supply:	3.3 VDC from PCI bus

Frequency Allocation Table:

				Americas	Europe	Japan	High Band
Band	Channel	Lower Frequency	Upper Frequency	SKU #1 MOW1	SKU #2 MOW2	SKU #3 Japan	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 DTS submission (M060108_Cert_WM3945ABG_DTS)

2.2 Operational Description

The GOLAN WLAN Module was individual tested in 3 Fujitsu host notebooks E8110, E8210 and S7110 to cover two antenna types

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.

2.3 Technical Specifications

Refer to Appendix G for details

2.4 Test Configuration

Conducted tests were performed at the WLAN Antenna ports.
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	Comments
E8110	GOLAN WM3945ABG	2 x Inverted F antenna	All results are reported
E8210		2 x Inverted F antenna	
S7110		2 x Monopole Antenna	

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	2.47	-0.44	0.38	0.38
S7110	Monopole	2.08	1.66	0.59	1.79

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.

2.5 Host PC Details

2.5.1 S7110 Model Notebook

Host notebook :	LifeBook S series
Model Name:	S7110 / S7110D
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Yonah-DC 2.16GHz
LCD	14"SXGA+ / 14"XGA
Wired LAN:	Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T
Modem:	Agere MDC1.5 modem Model: AM3(New)
Port Replicator Model:	FPCPR63
AC Adapter Model:	80W: SEB100P2-19.0(Sanken) / SQ2N80W19P-01(Nagano) 64W: SED80N2-19.0(Sanken)
Voltage:	19 V
Current Specs:	4.22A, 3.37A
Watts:	80W, 64W

RADIO MODULES	
Module # 1	WLAN (Golan IEEE802.11a+b/g)
WLAN Model No.:	WM3945ABG
WLAN Manufacturer:	Intel Corp.
Interface Type:	Mini-Card Wireless LAN Module
Antenna Type:	Monopole Antenna - Model: YCE-5008 Located on top edge of LCD screen (Left and Right)
Antenna gain:	Refer to antenna data provided separately (Appendix F)
Module # 2:	Bluetooth Module
Model Number:	EYTF3CSFT
Manufacturer:	TAIYO YUDEN
Interface Type:	USB
Antenna Types:	Yokowo Inverted F Antenna, Model: YCE-5250 Location: Under Left side of the Shift key, above the air vent
Antenna gain:	2.78 dBi
Max. Output Power:	4 dBm

2.5.2 E8110 Model Notebook

Host notebook :	LifeBook E series
Model Name:	E8110 / E8110D
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Yonah-DC 2.16GHz
LCD	15”SXGA+ / 15”XGA
Wired LAN:	Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T
Modem:	Agere MDC1.5 modem Model: AM3(New)
Port Replicator Model:	FPCPR63
AC Adapter Model:	SEB100P2-19.0(Sanken) / SQ2N80W19P-01(Nagano JRC)
Voltage:	19 V
Current Specs:	4.22A
Watts:	80W

RADIO MODULES	
Module # 1:	WLAN (Golan IEEE802.11a+b/g)
WLAN Model Number:	WM3945ABG
WLAN Manufacturer:	Intel Corp.
Interface Type:	Mini-Card Wireless LAN Module
Antenna Types:	Nissei Electric Inverted F Antenna Model: CP115429(Left), CP115429(Right) Located on top edge of LCD screen (Left and Right)
Antenna gain:	Refer to antenna data provided separately (Appendix F)
Module # 2:	Bluetooth Module
Model Number:	EYTF3CSFT
Manufacturer:	TAIYO YUDEN
Interface Type:	USB
Antenna Types:	Yokowo Inverted F Antenna, Model: YCE-5250 Location: Under Left side of the Shift key, above the air vent
Antenna gain:	-0.22 dBi
Max. Output Power:	4 dBm

2.5.3 E8210 Model Notebook

Host notebook :	LifeBook E series
Model Name:	E8210 / E8210D
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Yonah-DC 2.16GHz
LCD	15”WUXGA / 15”WSXGA+ / 15”WXGA
Wired LAN:	Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T
Modem:	Agere MDC1.5 modem Model: AM3(New)
Port Replicator Model:	FPCPR63
AC Adapter Model:	SEB100P2-19.0(Sanken) / SQ2N80W19P-01(Nagano JRC)
Voltage:	19 V
Current Specs:	4.22A
Watts:	80W
RADIO MODULES	
Module # 1:	WLAN (Golan IEEE802.11a+b/g)
WLAN Model Number:	WM3945ABG
WLAN Manufacturer:	Intel Corp.
Interface Type:	Mini-Card Wireless LAN Module
Antenna Types:	Nissei Electric Inverted F Antenna Model: CP115431(Left), CP115431(Right) Located on top edge of LCD screen
Antenna gain:	Refer antenna data provided separately (Appendix F)
Module # 2:	Bluetooth Module
Model Number:	EYTF3CS FT
Manufacturer:	TAIYO YUDEN
Interface Type:	USB
Antenna Types:	Yokowo Inverted F Antenna, Model: YCE-5250 Location: Under Left side of the Shift key, above the air vent
Antenna gain:	-0.22 dBi
Max. Output Power:	4 dBm

2.6 Block Diagram

Refer to Appendix D - Block Diagram

2.7 Support Equipment

Refer to Attachment 3 – FCC Part 15B Test Report (Report: FG06-016EAL)

2.8 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.

2.9 Test Facility

2.9.1 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.

2.9.2 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 (A^2LA).

2.10 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.

2.11 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 – WM3945ABG (802.11a (NII))

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: FG06-016EAL)

4.0 RADIATED EMISSION MEASUREMENTS

4.1 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 Attachment 3 – FCC Part 15B Test Report (Report: FG06-016EAL).

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.

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 dBµV/m.
V = EMI Receiver Voltage in dBµV. (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 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 dBµV/m

Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (1000 MHz – 18,000 MHz) ± 4.1 dB

4.3 Results - Out of Band 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 dBμV/m limit at 3 metres has been converted to 64 dBμV/m at 1 metre using a factor of 20 dB per decade where emissions were located in the restricted bands.

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

Measurements were performed on 3 Fujitsu host notebooks E8110, E8210 and S7110 and all test results are reported.

Testing was performed while both the WLAN transmitter and Bluetooth transmitter continuously operated. Harmonics related to the WLAN transmitter (5.15 – 5.35 GHz) are reported below. Harmonics in the frequency band 2.4 – 2.4835 GHz and 5.725 – 5.850 GHz, refer to M060108_Cert_WM3945ABG_DTS. Harmonics related to the Bluetooth transmitter refer to M060108_Cert_EYTF3CSFT.

Measurements were performed on frequency band (5.15 - 5.35 GHz)

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 54 Mbps (64QAM).

The EUT was operating at its highest channel (5320 MHz), the field strength at 5350 MHz was:
64.3 dBμV/m peak and 51.2 dBμV/m average (E8110 LifeBook).
62.4 dBμV/m peak and 45.4 dBμV/m average (S7110 LifeBook)
61.9 dBμV/m peak and 48.7 dBμV/m average (E8210 LifeBook)
The levels were > 20 dB below the maximum field strength of the in-band carrier.

The EUT was operating at its lowest channel (5180 MHz), the field strength at 5150 MHz was:
61.1 dBμV/m peak and 48.5 dBμV/m average (E8110 LifeBook).
63.7 dBμV/m peak and 45.9 dBμV/m average (S7110 LifeBook)
64.4 dBμV/m peak and 50.2 dBμV/m average (E8210 LifeBook)
The levels were > 20 dB below the maximum field strength of the in-band carrier.

Channel 36 - 5180 MHz

Frequency MHz	E8110 LifeBook Level (dBuV/m)		S7110 LifeBook Level (dBuV/m)		E8210 LifeBook Level (dBuV/m)		Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector	Peak Detector	Average Detector	Peak Detector	Average Detector			
5180	**Transmitter Fundamental**								
10360	51	39	51	39	51	39	68.3	-	Pass
15540	57	44	57	44	57	44	74.0	54.0	Pass
20720	65	52	65	52	65	52	84.0*	64.0*	Pass
25900	69	56	69	56	69	56	78.3*	-	Pass
31080	80**	68	80**	68	80**	68	78.3*	-	Pass
36260	82**	71	82**	71	82**	71	78.3*	-	Pass

*Limits were corrected for 1 metre measurement.
**Refer to results

Channel 52 - 5260 MHz

Frequency MHz	E8110 LifeBook Level (dBuV/m)		S7110 LifeBook Level (dBuV/m)		E8210 LifeBook Level (dBuV/m)		Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector	Peak Detector	Average Detector	Peak Detector	Average Detector			
5260	**Transmitter Fundamental**								
10520	51	39	51	39	51	39	68.3	-	Pass
15780	57	44	57	44	57	44	74.0	54.0	Pass
21040	65	52	65	52	65	52	84.0*	64.0*	Pass
26300	69	56	69	56	69	56	78.3*	-	Pass
31560	80	68**	80	68**	80**	68	84.0*	64.0*	Pass
36820	82**	71	82**	71	82**	71	78.3*	-	Pass

*Limits were corrected for 1 metre measurement.
**Refer to results

Channel 64 - 5320 MHz

Frequency MHz	E8110 LifeBook Level (dBuV/m)		S7110 LifeBook Level (dBuV/m)		E8210 LifeBook Level (dBuV/m)		Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector	Peak Detector	Average Detector	Peak Detector	Average Detector			
5320	**Transmitter Fundamental**								
10640	51	39	51	39	51	39	74.0	54.0	Pass
15960	57	44	57	44	57	44	74.0	54.0	Pass
21280	65	52	65	52	65	52	84.0*	64.0*	Pass
26600	69	56	69	56	69	56	78.3*	-	Pass
31920	80**	68	80**	68	80**	68	78.3*	-	Pass
37240	82**	71	82**	71	82**	71	78.3*	-	Pass

*Limits were corrected for 1 metre measurement.
**Refer to results

Result: No harmonics or spurious emissions were recorded 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). Harmonics/ spurious emissions were complied with the FCC limits in section 15.209 and 15.407. 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: FG06-016EAL).

4.3.3 RF Conducted Measurements at the antenna terminal

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

The resolution bandwidth of 300 kHz and the video bandwidth of 1000 kHz were utilised.

Refer to Appendix K for Harmonics plots

D1 indicates the limit line for undesirable emission outside the operation frequency band.

Result: Complies.

4.3.4 Band Edge Measurements

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

The resolution bandwidth of 1000 kHz and the video bandwidth of 1000 kHz were utilised.

Testing was performed while transmitter continuously transmitted on a low and high frequency channel.

Refer to Appendix L for Band Edge plots

D1 indicates the limit line for undesirable emission outside the operation frequency band.

Result: Complies.

5.0 PEAK OUTPUT POWER - Section 15.407(a)

Testing was performed in accordance with the requirements of FCC Part 15.407(a)(1)(2)

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 μS.

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).

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.

Frequency MHz	P dBm	Limit dBm	P mW	Limit mW	Result
5180	16.7	17	46.8	50	Complies
5260	17.2	24	52.5	250	Complies
5320	17.8	24	60.3	250	Complies

6.0 CHANNEL BANDWIDTH

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

The 26 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 300 kHz and the video bandwidth of 1000 kHz were utilised

Measurements were performed on frequency band (5.150 – 5.350 GHz)

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).

Channel	Frequency MHz	Bandwidth MHz	26 dB Bandwidth Plots
36	5180	22.3	Appendix J
52	5260	22.6	Appendix J
64	5320	23.3	Appendix J

7.0 PEAK POWER SPECTRAL DENSITY - Section 15.407 (a)

Testing was performed in accordance with the requirements of FCC Part 15.407(a)(5)

The peak power spectral density measurement was performed as per test method #2 of DA 02-2138. The resolution bandwidth of 1 MHz and the video bandwidth of 3 MHz were utilised.

Measurements were performed on frequency bands (5.15 – 5.35 GHz)

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	Peak Power Spectral Density (dBm)	Limit (dBm)	Result	Spectral Density plots
5180	0.9	4.0	Complies	Appendix M
5260	1.7	11.0	Complies	Appendix M
5320	2.3	11.0	Complies	Appendix M

8.0 PEAK EXCURSION - Section 15.407 (a)

Testing was performed in accordance with the requirements of FCC Part 15.407(a)(6)

The transmitter output was connected to the spectrum analyser with a span setting to capture the entire emission bandwidth of the signal.

The peak transmit power was measured over an interval of continuous transmission using a calibrated spectrum analyser with the resolution bandwidth of 1 MHz and the video bandwidth of 3 MHz for Trace 1 and video bandwidth of 30 kHz for Trace 2. The difference between Trace 1 and Trace 2 was recorded.

Measurements were performed on frequency bands (5.15 – 5.35 GHz)

Frequency MHz	Peak Power Excursion (dB)	Limit (dB)	Result	Peak Excursion plots
5180	7.8	13.0	Complies	Appendix N
5260	8.3	13.0	Complies	Appendix N
5320	6.6	13.0	Complies	Appendix N

9.0 FREQUENCY STABILITY

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

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

The measurements were made at ambient room temperature and extreme (-20 to +55 ˚C) test conditions.

The AC supply voltage to the computer was varied by ±15%. This was observed to have no effect on the results obtained.

Measurements were performed on frequency bands (5.150 – 5.350 GHz)

Testing was performed while the transmitter continuously operated with the modulation rate of 54 Mbps (64QAM).

Channel	Frequency MHz	Maximum Frequency Deviation kHz	Maximum Deviation %	± 0.02 % Limit kHz	Result
36	5180	98	0.002	1036	Complies
52	5260	115	0.003	1052	Complies
64	5320	90	0.002	1064	Complies

10.0 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 under the LHS of keyboard (near Caps lock area) 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 the aggregate of WLAN and BT 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^2.

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

where: Pd = power density (mW/cm^2)
P = power input to the antenna (mW)
G = antenna gain (numeric)
r = distance to the center of radiation of the antenna (cm)

The result was extracted from section 5.0 of this report (WLAN Module):
Prediction frequency = **5320 MHz**
Maximum peak output power = 17.8 dBm = 60.3 mW
Antenna (Monopole) gain (max) = 1.66 dBi = 1.47 numeric
The power density calculated = 0.02 mW/cm^2

The result was extracted from section 5.0 of M060108_Cert_EYTF3CSFT (BT Module):
Prediction frequency = 2480 MHz
Maximum peak output power = 3.3 dBm = 2.1 mW
Antenna (Inverted F) gain (max) = 2.78 dBi = 1.9 numeric
The power density calculated = 0.001 mW/cm^2

Therefore, the power density (WLAN + BT) = 0.021 mW/cm^2
MPE limit for uncontrolled exposure at prediction frequency = 1 mW/cm^2

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

11.0 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.

12.0 COMPLIANCE STATEMENT

The INTEL Mini-PCI Wireless LAN Module (GOLAN 11a+b/g), Model: WM3945ABG installed in Fujitsu notebook PCs tested on behalf of Fujitsu Australia Ltd, **comply** with the requirements of 47 CFR, Part 15 Subpart E -Section 15.407 (5.15-5.35 GHz and 5.725-5.825 GHz bands).

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(q1) 5150-5350 MHz and 5725-5825 MHz Local Area Network Devices 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	**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**
15.407 (g)	6.4	Frequency Stability	**Complies**

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: M060108_Cert_WM3945ABG_DTS (DTS)

TEST REPORT APPENDICES

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APPENDIX B: REPORT PHOTOGRAPHS
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Attachment 1: RF Exposure Information
Attachment 2: FCC DOC for Fujitsu Notebooks
Attachment 3: FCC Part 15B Test Report (Report: FG06-016EAL)