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EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247) & RSS-210
Class II Permissive Change

FCC ID:	EJE-BT0001
Industry Canada ID:	337J-BT0001
Test Sample:	Bluetooth Module
Model:	EYTF3CSFT
Report Number:	M070421_Cert_EYTF3CSFT_C2PC
Tested for:	Fujitsu Australia Ltd.
Issue Date:	23rd April 2007

NATA Accredited Laboratory
Number: 5292

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Report Number:	M070421_Cert_EYTF3CSFT_C2PC
Test Sample:	Bluetooth Module
Model:	EYTF3CSFT
Manufacturer:	TAIYO YUDEN
FCC ID:	EJE-BT0001
Industry Canada ID:	337J-BT0001
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 – Radio Frequency Devices (August 2006) FCC Part 15 Subpart C - Intentional Radiators Section 15.247: 2400 – 2483.5 MHz & 5725 – 5850 MHz Operation Bands 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 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:	14th March 17th April 2007
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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1.0 INTRODUCTION

Testing was performed on the TAIYO YUDEN Bluetooth Module, Model: EYTF3CSFT installed in Fujitsu notebook PC.

The EYTF3CSFT Bluetooth module has been certified by Fujitsu Australia Ltd under the FCC ID: EJE-BT0001 (IC: 337J-BT0001). The intention of this application is to add host model (Fujitsu Notebooks) and re-certify the EYTF3CSFT Bluetooth module installed in models A6030 & E8410/E8490 as a **Class II Permissive Change.**

The EYTF3CSFT Bluetooth module was also originally certified by TAIYO YUDEN as a modular approval under FCC ID: RYYEYTF3CSFT (Canada ID: 4389AEYTF3CSFT). The intention of this application is to get a Limited Modular approval for this Bluetooth module for use in Fujitsu notebook PCs. The Radio modules are installed in a controlled environment at the Fujitsu notebook production/assembly factory.

The second transmitter in the notebook is INTEL WLAN module, model: WM3945ABG. This WLAN module has been recently certified by Fujitsu Australia Ltd under the FCC ID: EJE-WL0010 (IC: 337J-WL0010).

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.

1.1 Summary of Results

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)(1)	6.2.2(o)(ii)	Channel Occupancy/Bandwidth	**Note 1**
15.247 (b)(1)	6.2.2(o)(b)	Peak Output Power	**Note 1**
15.247 (c)		Antenna Gain > 6 dBi	**Not Applicable.** Antenna gain < 6 dBi
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	**Not Applicable.** EUT is not digital modulated system
15.247 (f)		*Hybrid Systems	**Not Applicable.** EUT does not employ a hybrid system
15.247 (g)		Frequency Hopping	**Complies**
15.247 (h)		Frequency Hopping	**Complies**
15.247 (i)		Radio Frequency Hazard	**Complies**

*Hybrid systems are those that employ a combination of both frequency hopping and digital modulations technique.

Note 1: Refer to EMC test report M060108_Cert_EYTF3CSFT with FCC ID: EJE-BT0001 (IC ID: 337J-BT0001)

1.2 Modifications by EMC Technologies

No modifications were required.

2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 EUT (Bluetooth) Details

Transmitter:	Bluetooth
Model Number:	EYTF3CS FT
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
Antenna Types:	Taiyo Yuden Monopole Antenna, Model: CP341612 Location: edge of palm rest area
Antenna gain:	Max antenna gain is less than 6 dBi.
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 this report

2.2 Operational Description

The Bluetooth Module was tested in Fujitsu host notebook A6030.

The Bluetooth Utility Software 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	Bluetooth Module	Bluetooth Antenna	Antenna Gain dBi	FCC/IC CERTIFICATION STATUS
S7110	EYTF3CSFT	Inverted F antenna	2.78	GRANT Issued FCC ID: EJE-BT0001
Q2010			3.27	
Following NEW Models to be added				
A6030	EYTF3CSFT	Monopole antenna	-0.2	Tested model in this application
E8410E8490			-2.1	Low gain

The Bluetooth Module was tested in Fujitsu host notebook A6030 as this notebook has the highest antenna gain.

The design of the antennas (Monopole) is identical in both host E8410/E8490 and A6030 notebooks. Refer to Appendix_A1_E8410/E8490 and Appendix_A2_A6030 for details.

To qualify for a class 2 permissive change, the output power was re-measured on host A6030. The highest output powers are report below.

The highest output powers were granted:

Frequency MHz	Output Power Granted dBm
2400	3.9

The highest new output powers are measured:

Frequency MHz	New Output Power Measured dBm
2400	3.5

2.4 Host PC Details

2.4.1 A6030 Model Notebook

Host notebook :	LifeBook A series
Model Name:	A6030
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Core2 Duo T7700 2.40 GHz
LCD	15.4" WXGA
Wired LAN:	Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T
Modem:	Agere MDC1.5 modem Model: D40
Port Replicator Model:	None
AC Adapter Model:	80W: SEC100P2-19.0(Sanken), ADP-80NB A(Delta)
Voltage:	19V
Current Specs:	4.22A
Watts:	80W
	RADIO MODULES
Module # 1:	Bluetooth Module
Model Number:	EYTF3CSFT
Manufacturer:	TAIYO YUDEN
Interface Type:	USB
Antenna Type:	Taiyo Yuden Monopole Antenna, Model: CP341612 Location: edge of palm rest area
Antenna gain:	Refer to antenna data provided separately
Max. Output Power:	4 dBm
Module # 2	WLAN (Golan IEEE802.11a+b/g)
WLAN Model No.:	WM3945ABG
FCC/IC ID:	EJE-WL0010 / 337J-WL0010
WLAN Manufacturer:	Intel Corp.
Interface Type:	Mini-Card Wireless LAN Module
Antenna Types:	Nissei Electric Inverted F Antenna Model: CP313551(T1:Left), CP313552(T2:Right) Location: Top edge of LCD screen

2.4.2 E8410/E8490 Model Notebook

Host notebook :	LifeBook E series
Model Number/s;	E8410(80W) / E8490(100W)
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Core2 Duo T7700 2.40GHz
LCD	15”WUXGA / 15”WSXGA+ / 15”WXGA
Wired LAN:	Intel 82566MM : 10 Base-T/100 Base-TX/1000Base-T
Modem:	Agere MDC1.5 modem Model: D40
Port Replicator Model:	FPCPR63
AC Adapter Model:	80W: SEC100P2-19.0(Sanken), ADP-80NB A(Delta), SEC100P3-19.0(Sanken, 3pin) 100W: SED110P2-19.0(Sanken)
Voltage:	19 V
Current Specs:	4.22A / 5.27
Watts:	80W / 100W
	RADIO MODULES
Module # 1:	Bluetooth Module
Model Number:	EYTF3CSFT
Manufacturer:	TAIYO YUDEN
Interface Type:	USB
Antenna Type:	Taiyo Yuden Monopole Antenna, Model: CP331590 Location: Right hinge of LCD screen
Antenna gain:	Please refer antenna data provided separately
Max. Output Power:	4 dBm
Module # 2	WLAN (Golan IEEE802.11a+b/g)
WLAN Model No.:	WM3945ABG
FCC/IC ID:	EJE-WL0010 / 337J-WL0010
WLAN Manufacturer:	Intel Corp.
Interface Type:	Mini-Card Wireless LAN Module
Antenna Types:	Nissei Electric Inverted F Antenna Model: CP313551(T1:Left), CP313552(T2:Right) Location: Top edge of LCD screen

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
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).

2.7 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 (biconical and log-periodic) 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.

FCC 15.247 (DTS) RESULTS

3.0 SPURIOUS EMISSION MEASUREMENTS

3.1 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 EMC test report M060108_Cert_EYTF3CSFT with FCC ID: EJE-BT0001 (IC ID: 337J-BT0001).

The measurement of emissions above 1000 MHz was measured using a following setting:
Peak measurements setting: RBW = VBW = 1 MHz
Average measurements setting: RBW = 1 MHz and VBW = 10 Hz

The receiver bandwidth was set to 6 dB.

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.

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^{-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

3.3 Radiated Emissions (Spurious and Harmonics)

3.3.1 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 74 dBμV/m @ 3m and 54 dBμV/m @ 3m limits are applied for emissions fall in the restricted bands.

Measurements were performed on Fujitsu host notebook E8410/E8490 and the test results are reported.

Testing was performed while both the WLAN transmitter and Bluetooth transmitter continuously operated. Harmonics related to the Bluetooth transmitter are reported below.

Channel 1 - 2402 MHz

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2402	**90.2**	**59.7**	-	-	-
4804	**53.8**	**39.4**	74.0	54.0	Pass

Channel 40 - 2441 MHz

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2441	**92.5**	**61.1**	-	-	-
4882	**54.0**	**39.8**	74.0	54.0	Pass

Channel 79 - 2480 MHz

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2480	**94.6**	**62.0**	-	-	-
4960	**53.4**	**39.2**	74.0	54.0	Pass

Result: 2nd harmonics was recorded up to 25 GHz. Other harmonics were confirmed low with both RBW and VBW reduced. Harmonics were complied with the FCC limits in sections 15.209 and 15.247 by a margin of 14.2 dB. The measurement uncertainty for radiated emissions in this band was ±4.1 dB.

3.3.2 Both WLAN and Bluetooth Transmitters Transmitting

Result: IM spurious emissions were recorded within the restricted bands of up to 40 GHz. Emissions complied with the FCC limits of section 15.209 and 15.247.

3.3.3 Band Edge Measurements

Note 1: Refer to EMC test report M060108_Cert_EYTF3CSFT with FCC ID: EJE-BT0001 (IC ID: 337J-BT0001)

4.0 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, 5150 – 5350 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: The Bluetooth antenna is located edge of palm rest area and projected distance of less than 20cm from user.

Transmitter # 2: 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.

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 density.

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)

Prediction frequency = **5785 MHz**
Maximum peak output power = 17.9 dBm = 61.7 mW
Antenna (Inverted F) gain (max) = 3.36 dBi = 2.17 numeric
The power density calculated = 0.03 mW/cm^2

Prediction frequency = **2437 MHz**
Maximum peak output power = 17.1 dBm = 51.3 mW
Antenna (Inverted F) gain (max) = 2.47 dBi = 1.77 numeric
The power density calculated = 0.02 mW/cm^2

Prediction frequency = **5320 MHz**
Maximum peak output power = 17.8 dBm = 60.3 mW
Antenna (Monopole) gain (max) = 3.96 dBi = 2.49 numeric
The power density calculated = 0.03 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

5.0 COMPLIANCE STATEMENT

The Bluetooth Module, Model: EYTF3CSFT 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 C - Rules for Radio Frequency Devices (intentional radiators), Section 15.247 - Operation in the frequency band 2400 - 2483.5 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 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)(1)	6.2.2(o)(ii)	Channel Occupancy/Bandwidth	**Note 1**
15.247 (b)(1)	6.2.2(o)(b)	Peak Output Power	**Note 1**
15.247 (c)		Antenna Gain > 6 dBi	**Not Applicable.** Antenna gain < 6 dBi
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	**Not Applicable.** EUT is not digital modulated system
15.247 (f)		*Hybrid Systems	**Not Applicable.** EUT does not employ a hybrid system
15.247 (g)		Frequency Hopping	**Complies**
15.247 (h)		Frequency Hopping	**Complies**
15.247 (i)		Radio Frequency Hazard	**Complies**

*Hybrid systems are those that employ a combination of both frequency hopping and digital modulations technique.

Note 1: Refer to EMC test report M060108_Cert_EYTF3CSFT with FCC ID: EJE-BT0001 (IC ID: 337J-BT0001)

TEST REPORT APPENDICES

APPENDIX A: ANTENNA DETAILS

APPENDIX B: BLUETOOTH AND ANTENNA LOCATION PHOTOS

Attachment 1: RF Exposure Information