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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:	M060108_Cert_EYTF3CSFT_Class_2
Tested for:	Fujitsu Australia Ltd.
Issue Date:	7th April 2006

NATA Accredited Laboratory
Number: 5292

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Class II Permissive Change

EMC Technologies Report No. M060108_Cert_EYTF3CSFT_Class_2

Issue Date: 7th April 2006

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EMI TEST REPORT FOR CERTIFICATION
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Class II Permissive Change

Report Number:	M060108_Cert_EYTF3CSFT_Class_2
Test Sample:	Bluetooth Module
Model:	EYTF3CSFT
Manufacturer:	TAIYO YUDEN
FCC ID:	EJE-BT0001
Industry Canada ID:	337J-BT0001
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 C – Intentional Radiators FCC Part 15.247, 2400 – 2483.5 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 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 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 C (Section 15.247) & RSS-210
Class II Permissive Change

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 recently certified by Fujitsu Australia Ltd under the FCC ID: EJE-BT0001 (IC: 337J-BT0001). The intention of this application is to add host models (Fujitsu Notebooks) and re-certify the EYTF3CSFT Bluetooth module installed in, models: Q2010 and S6310 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 **Class II Permissive Change** 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.

1.1 Summary of Results

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)(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 (i)		Radio Frequency Hazard	**Complies**
15.247 (d)	6.2.2(o)(e1)	Out of Band Emissions	**Complies**

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

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 (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
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 Q2010.

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
E8110			-0.22	
E8210			-0.22	
Following NEW Models to be added				
Q2010	EYTF3CSFT	Inverted F antenna	3.27	Tested model in this application
S6310			0.38	Low gain

The Bluetooth Module was tested in Fujitsu host notebook Q2010 as this notebook has the highest antenna gain.

2.4 Host PC Details

2.4.1 Q2010 Model Notebook

Host notebook :	LifeBook Q series
Model Name:	Q2010
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Yonah-SC(ULV) 1.2GHz
LCD	12”WXGA
Wired LAN:	Marvell 88E8055 : 10 Base-T/100 Base-TX/1000Base-T
Modem:	None
Port Replicator Model:	FPCPR64
AC Adapter Model:	SEC80N2-16.0(Sanken)
Voltage:	16 V
Current Specs:	3.75A
Watts:	60W
RADIO MODULES	
Module # 1:	Bluetooth Module
Model Number:	EYTF3CSFT
Manufacturer:	TAIYO YUDEN
Interface Type:	USB
Antenna Type:	Nissei Electric Inverted F Antenna, Model: CP115428 Location: Right side of the [Back Space] key, above the connector
Antenna gain:	3.27 dBi (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: CP115426(Left), CP115435(Right) Located on top edge of LCD screen

2.4.2 S6310 Model Notebook

Host notebook :	LifeBook S series
Model Name:	S6310
Serial Number:	Pre-production Sample
Manufacturer:	FUJITSU LIMITED
CPU Type and Speed:	Yonah-DC 2.16GHz
LCD	13.3"XGA
Wired LAN:	Marvell 88E8055 : 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) / SQ2N80W19P-01(Nagano JRC) 64W: SED80N2-19.0(Sanken)
Voltage:	19 V
Current Specs:	4.22A, 3.37A
Watts:	80W, 64W
RADIO MODULES	
Module # 1:	Bluetooth Module
Model Number:	EYTF3CSFT
Manufacturer:	TAIYO YUDEN
Interface Type:	USB
Antenna Type:	Yokowo Inverted F Antenna, Model: YCE-5250 Location: Right side of media card slot
Antenna gain:	0.38 dBi (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: CP115441(Left), CP115440(Right) Located on 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.

RESULTS
Bluetooth Module, Model EYTF3CSFT

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, 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.

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)

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.

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

The EUT was operating at its highest channel (2480 MHz), the field strength at 2483.5 MHz was:
51.1 dBμV/m peak and 37.5 dBμV/m average.
The levels were > 20 dB below the maximum field strength of the in-band carrier.

The EUT was operating at its lowest channel (2402 MHz), the field strength at 2400 MHz was:
61.7 dBμV/m peak and 45.4 dBμV/m average.
The levels were > 20 dB below the maximum field strength of the in-band carrier.

Channel 1 - 2402 MHz

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2402	**96.3**	**74.8**	-	-	-
4804	**50.5**	**38.9**	74.0	54.0	Pass
7206	46	35	-	-	-
9608	49	38	-	-	-
12010	53	41	74.0	54.0	Pass
14412	57	45	-	-	-
16814	56	45	-	-	-
19216	65	52	84.0*	64.0*	Pass
21618	69	56	-	-	-
24020	69	56	-	-	-
2129	**53.1**	**39.3**	-	-	-

*Limits were corrected for 1 metre measurement.

Channel 40 - 2441 MHz

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2441	**94.8**	**73.3**	-	-	-
4882	**52.0**	**39.7**	74.0	54.0	Pass
7323	46	35	74.0	54.0	Pass
9764	49	38	-	-	-
12205	53	41	74.0	54.0	Pass
14646	57	45	-	-	-
17087	56	45	-	-	-
19528	65	52	84.0*	64.0*	Pass
21969	69	56	-	-	-
24410	69	56	-	-	-
2129	**54.1**	**40.3**	-	-	-

*Limits were corrected for 1 metre measurement.

Channel 79 - 2480 MHz

Frequency MHz	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2480	**94.1**	**72.3**	-	-	-
4960	**55.4**	**42.2**	74.0	54.0	Pass
7440	46	35	74.0	54.0	Pass
9920	49	38	-	-	-
12400	53	41	74.0	54.0	Pass
14880	57	45	-	-	-
17360	56	45	-	-	-
19840	65	52	84.0*	64.0*	Pass
22320	69	56	-	-	-
24800	69	56	-	-	-
2484.0	**54.0**	**39.5**	74.0	54.0	Pass

*Limits were corrected for 1 metre measurement.

Result: 2nd harmonics 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). Harmonics were complied with the FCC limits in sections 15.209 and 15.247 by a margin of 11.8 dB. The measurement uncertainty for radiated emissions in this band was ±4.1 dB.

4.3.5 Band Edge Measurements

Testing was performed while the transmitter continuously transmitted on a low (2402 MHz) and high frequency (2480 MHz) channel.

BE Frequency (MHz) within the restricted band	Peak Detector dBuV	Average Detector dBuV	Peak Limit dBuV/m	Average Limit dBuV/m	Result
2390	40.9	Low	74.0	54.0	Pass
2483.5	48.2	Low	74.0	54.0	Pass

Result: Complies.

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 under the LHS of keyboard (near Caps lock area) and projected distance of less than 20cm from user.

Transmitter # 2: The Bluetooth antenna is located under the keyboard 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 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)

The result was extracted from section 4.0 of EMC report:
M060108_Cert_WM3945ABG_DTS_Class_2
Prediction frequency = **5785 MHz**
Maximum peak output power = 17.9 dBm = 61.7 mW
Antenna (Monopole) gain (max) = 1.79 dBi = 1.51 numeric
The power density calculated = 0.02 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

The result was extracted from section 4.0 of EMC report:
M060108_Cert_WM3945ABG_NII_Class_2
Prediction frequency = **5320 MHz**
Maximum peak output power = 17.8 dBm = 60.3 mW
Antenna (Monopole) gain (max) = 3.23 dBi = 2.104 numeric
The power density calculated = 0.026 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 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)(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 (i)		Radio Frequency Hazard	**Complies**
15.247 (d)	6.2.2(o)(e1)	Out of Band Emissions	**Complies**

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

TEST REPORT APPENDICES

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