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EMI TEST REPORT
for
CERTIFICATION to
FCC PART 15.247 & RSS-210

FCC ID:	**EJE-WL0003**
Industry Canada ID:	**337J-WL0003**
Test Sample:	Mini PCI Wireless LAN Module
Wireless Module:	Calexico
Model Number:	WM3B2100-Ocampa
Tested for:	Fujitsu Australia Ltd
Issue Date:	20th October 2003

NATA Accredited Laboratory
Number: 5292

EMI TEST REPORT FOR CERTIFICATION
to
FCC Part 15.247 & RSS-210

EMC Technologies Report No. M030949_Certification_Ocampa_Calexico

Issue Date: 20th October 2003

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EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15.247 & RSS-210

Report Number:	M030949_Certification_Ocampa_Calexico
Test Sample:	Mini-PCI Wireless LAN Module
Model Number:	WM3B2100-Ocampa
Manufacturer:	Intel Corportation
Manufacturer (Host PC):	Fujitsu Limited
Address:	1405 Ohamaru, Inagi-shi, Tokyo 206-8503, Japan
Contact:	Mr. Kanbe Katsuhito
FCC ID:	EJE-WL0003
Industry Canada ID:	337J-WL0003
Tested for:	Fujitsu Australia Ltd
Address:	5 Lakeside Drive, Burwood East, VIC 3151 Australia
Phone:	+613 9845 4300
Fax:	+613 9845 4600
Responsible Party:	Mr Praveen Rao - Senior Compliance Engineer
Equipment Type:	Intentional Radiator (Transceiver)
Test Standards:	FCC Part 15, Subpart C - Intentional Radiators FCC Part 15.247 2400 - 2483.5 MHz Operation Band FCC Part 15.205 Operation in Restricted Bands FCC Part 15.207 Conducted Emissions FCC Part 15.209 Radiated Emissions ANSI C63.4-1992 OET Bulletin No. 63 RSS-210 Issue 5 Low Power Licence-Exempt RadioCommunication Devices 6.2.2 (o) 2400 – 2483.5 MHz Spread Spectrum 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:	3rd – 13th October 2003
Test Officers:	**Chied Huynh B. Eng (Hons) Electronics** **Janath Gunasekera BscEng., MtelcomEng, MIEEE**
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 Signature:	**Chris Zombolas** **Technical Director** **EMC Technologies Pty Ltd**

EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15.247 & RSS-210

1.0 INTRODUCTION

This report details the results of EMI tests and measurements performed on the Mini-PCI Wireless LAN Module (Calexico), Model WM3B2100-Ocampa in accordance with the Federal Communications Commission (FCC) regulations as detailed in Title 47 CFR, Part 15 Subpart C Rules for intentional radiators, particularly Section 15.247 (Operation in the frequency band 2400 - 2483.5 MHz).

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 C - Radio Frequency Devices (intentional radiators), Section 15.247.

The test sample also complies with the Industry Canada RSS-210 issue 5 (Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)) clauses 6.2.2(o) requirements and the RF exposure requirements of RSS-102.

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	**Not Applicable**
15.205	6.3	Operation in Restricted Bandwidth	**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 (b)(5)		Radio Frequency Hazard	***Complies with SAR requirements**
15.247 (c)	6.2.2(o)(e1)	Out of Band Emissions	**Complies**
15.247 (d)	6.2.2(o)(iv)	Peak Power Spectral Density	**Complies**

*Refer to EMC Technologies' report M030949_Ocampa_Calexico SAR Report

The measurement procedure used was in accordance with ANSI C63.4-1992 and OET Bulletin No. 96-43. The instrumentation conformed to the requirements of ANSI C63.2-1987.

1.2 Modifications by EMC Technologies

No modifications were required.

2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 Product Details

Test Sample:	Mini-PCI Wireless LAN Module (Transceiver)
Wireless Module:	Calexico
Model Number:	WM3B2100-Ocampa
Interface Type:	Mini-PCI Module
FCC ID:	EJE-WL0003
Industy Canada ID:	337J-WL0003
Equipment Type:	Intentional Radiator (Transceiver)

2.2 Test Sample Operational Description

The EUT is a Mini-PCI Wireless LAN (WLAN) Module (Calexico WM3B2100) used in Fujitsu PCs (notebooks, pentablets, etc). The Calexico module is an OEM product from Intel Corp., which has been FCC certified under modular approval (FCC ID: PD9WM3B2100) (Report Number: INTEL-021001F)

The Calexico module has been re-certified by Fujitsu for other notebooks.

The intention of this application is to certify the Calexico WLAN module for STYLISTIC ST series – model ST5010, ST5010D (Ocampa). The Ocampa is a notebook/Pentablet PC.

The highest CPU speed, Banias ULV 1.0GHz model was chosen for the tests and all other Ocampa models identical to the tested model except with lower CPU speed shall be declared compliant based on this test report.

Refer to Appendix B, Test Sample Photographs for details of WLAN and Antenna locations.

2.3 Technical Specifications

Wireless Module:	Calexico
Model Number:	WM3B2100-Ocampa
Manufacturer:	Intel Corporation
Interface Type:	Mini-PCI Module
Network Standards:	IEEE 802.11b
Modulation Type:	Direct Sequence Spread Spectrum (DSSS)
802.11b	DBPSK - 1 Mbps DQPSK - 2 Mbps CCK - 5.5 Mbps, 11Mbps
Maximum Data Rate:	11Mbps max
Frequency Range:	2400 MHz to 2483.5 MHz (Operational range 2412 to 2462 MHz)
Number of Channels:	11 maximum
Antenna Type:	Monopole Ceramic Chip Antenna YCE-5008
Output Power:	16.5 dBm max
Power Supply:	3.3 VDC from PCI bus.

Frequency allocation for 802.11b:

Channel	Frequency (MHz)
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462

EUT Host Details:

Test Sample:	STYLISTIC ST Series
Model Name:	ST5010, ST5010D
Codename:	Ocampa
Serial Number:	Not Supplied
CPU Speed:	Banias ULV 1.0GHz
Manufacturer:	Fujitsu Ltd.
SDRAM:	256MB
LCD Screen:	12.1"XGA
Hard Disk Drive:	40GB
LAN:	Giga-LAN/10/100Base-T
Wireless LAN Module:	Calexico with Monopole Ceramic Chip Antenna
Port Replicator Model:	FPCPR39 or FPCPR39AP
Docking Station Model:	FPCPR43xx (x: A-Z or blank) FPCPR44xx (x: A-Z or blank)
AC Adapter:	Tests performed with CA01007-0850 adapter

AC Adapter Model Number	Alternate Model Number	Adapter Spec		
		Volts	Amps	Watts
SEC80N2-16.0	CP171180-01	16	3.75	60

2.4 Test sample configuration

The INTEL Calexico utility software was used to set-up the WLAN module to continuously transmit during the tests. The LCD screen was observed for the transmitter status shown by the Calexico software.

Antenna

The Calexico WLAN (WM3B2100-Ocampa) is configured with a Monopole Ceramic Chip antenna (refer to Appendix K for Antenna specifications). The installation of the OEM WLAN module and the Antenna in Fujitsu STYLISTIC pentablet PC is in a controlled environment. The installation is performed during the production/assembly process at the Fujitsu factory.

AC Adapter

The AC adapter CA01007-0850 was used for all the tests. This adapter is also identified as CP171180-01. The manufacturer has stated that these adapters are identical electrically and mechanically**.**

Refer to Appendix B - Test Setup Photographs.

2.5 Test Sample Block Diagram

Refer to Appendix C.

2.6 Test Sample Support Equipment

External Monitor/s:	
Conducted EMI	Viewmaster, P/N CA64 150DL, S/N CN7610276
Radiated EMI	Hewlett Packard 15" Color monitor, Model D2827A, FCC ID: C5F7NFCMC1515X
IR Keyboard:	P/N N860-7628-T152
IR Mouse:	M2W883Z013-02, S/N 0806256M01A
USB Scanner:	Rapidscan Mobile Colour scanner, M/N FPCSCN01, S/N DF1700100
USB Floppy Drive/s:	Fujitsu Model: FPCFDD11, P/N CP032173-01 Fujitsu Model: FPCFDD12, P/N CP078720-01 USB OMNI Floppy Drive Model # USB F3501 SN W316000096
Headphones:	Verbatim Multimedia Stereo headset
LAN Hub:	Kingston SOHO Hub Model: KNE8TB/H (FCC ID: JICKNE8TP-HO)
PCMCIA Slot:	6 MB Compact flash card with Adapter, Apacer P/N 88.10200030
Memory Card:	Secure Digital- 32 MB
AC Adapter:	SEC80N2-16.0

2.7 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI C63.4-1992. Radiated emissions tests were performed at a distance of 3 and 10 metres from the EUT. OET Bulletin 63 dated October 1993 was used for reference.

2.8 Test Facility

2.8.1 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 emission measurements were performed at EMC Technologies' laboratory in Tullamarine, Victoria Australia.

The above sites have been fully described in a report submitted to the FCC office, and accepted in a letter dated June 14, 2002, **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,** (Registration Date - November 5th 2001).

2.8.2 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).

2.9 Units of Measurements

2.9.1 Conducted Emissions

Measurements are reported in units of dB relative to one microvolt. (dBμV).

2.9.2 Radiated Emissions

Measurements are reported in units of dB relative to one microvolt per metre (dBμV/m).

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 of this report.

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.

3.0 CONDUCTED EMISSION MEASUREMENTS

Testing was carried out in accordance with the requirements of FCC Part 15.207

3.1 Test Procedure

The arrangement specified in ANSI C63.4-1992 was adhered to for the conducted EMI measurements. The EUT was placed in the RF screened enclosure and a CISPR EMI Receiver as defined in ANSI C63.2-1987 was used to perform the measurements.

The EMI Receiver was operated under program control using the Max-Hold function and automatic frequency scanning, measurement and data logging techniques. The specified 0.15 MHz to 30 MHz frequency range was sub-divided into sub-ranges to ensure that all short duration peaks were captured.

3.2 Peak Maximising Procedure

The various operating modes of the system were investigated. For each of the sub-ranges, the EMI receiver was set to continuous scan with the Peak detector set to Max-Hold mode. The Quasi-Peak detector and the Average detector were then invoked to measure the actual Quasi-Peak and Average level of the most significant peaks, which were detected.

3.3 Calculation of Voltage Levels

The voltage levels were automatically measured in software and compared to the test limit. The method of calculation was as follows:

VEMI = VRx + LBPF

Where: **VEMI =** the Measured EMI voltage in dBµV to be compared to the limit.
VRx = the Voltage in dBµV read directly at the EMI receiver.
LBPF = the insertion loss in dB of the cables and the Limiter and Pass Filter.

3.4 Plotting of Conducted Emission Measurement Data

The measurement data pertaining to each frequency sub-range were then concatenated to form a single graph of (peak) amplitude versus frequency. This was performed for both Active and Neutral lines and the composite graph was subsequently plotted. A list of the highest relevant peaks and the respective Quasi-Peak and Average values were also plotted on the graph.

3.5 Results of Conducted Emission Measurements (AC Mains Ports)

Frequency MHz	Line	Measured QP Level dBµV	QP Limit dBµV	ΔQP ±dB	Measured AV Level dBµV	AV Limit dBµV	ΔAV ±dB
0.202	Active	49.2	63.5	-14.3	30.5	53.5	-23.0
0.198	Neutral	49.3	63.7	-14.4	31.6	53.7	-22.1
0.154	Neutral	49.8	65.8	-16.0	23.7	55.8	-32.1
0.153	Active	49.8	65.8	-16.0	22.5	55.8	-33.3
16.01	Active	35.6	60.0	-24.4	29.2	50.0	-20.8
16.62	Neutral	33.5	60.0	-26.5	27.0	50.0	-23.0

All emissions complied with the Class B quasi peak and average limits by margins of greater than 10 dB. The measurement uncertainty was ±2.0 dB. Refer to Appendix G for plots of the conducted EMI measurements.

4.0 RADIATED EMISSION MEASUREMENTS

4.1 Test Procedure

Testing was carried out in accordance with the requirements of FCC Part 15.247(c).

Radiated emission measurements were performed to the limits as per section 15.209.

Testing was performed while the transmitter continuously transmitted on a low, middle and high frequency channel. 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. A calibrated Biconical antenna was used for measurements between 30 MHz to 232 MHz and a calibrated Logperiodic antenna used for measurements between 230 MHz to 1000 MHz. Calibrated EMCO 3115 and EMCO 3116 Horn antennas were used for measurements between 1 to 25 GHz.

The measurement of emissions between 30 - 1000 MHz was measured with the resolution bandwidth of 120 kHz and the video bandwidth of 300 kHz.

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 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 insertion 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
(30 MHz – 1,000 MHz) ± 3.7 dB

4.3 Results - Out of Band Emissions (Spurious and Harmonics)

4.3.1 Frequency Band: 1 – 25 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 are located in the restricted bands.

The field strength at 2483.5 MHz when the EUT was operating at its highest channel (2462 MHz), was 42.5 dBμV/m peak (noise floor) and was > 20 dB below the maximum field strength of the in-band carrier.

The field strength at 2400 MHz when the EUT was operating at its lowest channel (2412 MHz), was 42.1 dBμV/m peak (noise floor) and was > 20 dB below the maximum field strength of the in-band carrier.

Measurements were made on a low (channel 1, 2412 MHz), middle (channel 6, 2437 MHz) and high (Channel 11, 2462 MHz) frequency channel.

Configuration 802.11b

Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). No significant differences in emissions were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 11 Mbps (CCK).

Channel 1 - 2412 MHz

Frequency MHz	Level dBuV/m		Antenna Polarization	Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector				
2412	Transmitter	Fundamental				
4824	48.9	37.2	Vert/Hort	74.0	54.0	Pass
7236	53.5	44.4	Vert/Hort	-	-	Pass
9648	49.0	39.5	Vert/Hort	-	-	Pass
12060	52.4	40.7	Vert/Hort	74.0	54.0	Pass
14472	54.0	43.9	Vert/Hort	74.0	54.0	Pass
16884	54.1	44.2	Vert/Hort	-	-	Pass
19296	57.3	46.9	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
21708	61.1	50.7	Vert/Hort	-	-	Pass
24120	60.0	49.3	Vert/Hort	-	-	Pass

Channel 6 - 2437 MHz

Frequency MHz	Level dBuV/m		Antenna Polarization	Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector				
2437	Transmitter	Fundamental				
4874	49.3	36.7	Vert/Hort	74.0	54.0	Pass
7311	53.4	43.1	Vert/Hort	74.0	54.0	Pass
9748	49.6	39.9	Vert/Hort	-	-	Pass
12185	51.9	41.2	Vert/Hort	74.0	54.0	Pass
14622	54.4	42.8	Vert/Hort	-	-	Pass
17059	54.5	45.0	Vert/Hort	-	-	Pass
19496	56.8	47.3	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
21933	61.5	51.4	Vert/Hort	-	-	Pass
24370	61.1	49.2	Vert/Hort	-	-	Pass

Channel 11 - 2462 MHz

Frequency MHz	Level dBuV/m		Antenna Polarization	Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector				
2462	Transmitter	Fundamental				
4924	49.2	36.9	Vert/Hort	74.0	54.0	Pass
7386	52.9	43.6	Vert/Hort	74.0	54.0	Pass
9848	49.7	40.1	Vert/Hort	-	-	Pass
12310	52.2	40.8	Vert/Hort	74.0	54.0	Pass
14772	55.0	43.5	Vert/Hort	-	-	Pass
17234	54.6	44.7	Vert/Hort	-	-	Pass
19696	58.1	46.7	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
22158	60.9	50.8	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
24620	60.8	50.2	Vert/Hort	-	-	Pass

*Measurement was performed at 1 metre distance and the limits were corrected accordingly.

Harmonics were recorded within the restricted bands of up to 25 GHz and complied with the FCC Class B average limit by a margin of greater than 10 dB. Harmonics were below the limit in section 15.209. The measurement uncertainty for radiated emissions in this band was ±4.1 dB.

Result: Complies

4.3.2 Frequency Band: 30 - 1000 MHz

Testing was performed at a distance of 10 metres.

Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). No significant differences in emissions were observed. Final testing was performed while the transmitter continuously operating on the low (Channel 1, 2412 MHz) frequency channel with the modulation rate of 11 Mbps (CCK).

The reported frequencies in the tables were mainly concerned with the notebook (Host PC) emissions and not directly related to the Calexico WLAN module emissions.

Vertical Polarity

Frequency MHz	Polarisation	QP Measured dBμV/m	QP Limit dBμV/m	ΔQP ± dB
197.61	Vertical	30.1	33.5	-3.4
197.72	Vertical	30.1	33.5	-3.4
199.99	Vertical	29.3	33.5	-4.2
202.92	Vertical	28.6	33.5	-4.9
195.58	Vertical	28.2	33.5	-5.3
237.30	Vertical	30.6	36.0	-5.4
198.91	Vertical	27.3	33.5	-6.2
130.95	Vertical	25.8	33.5	-7.7
132.92	Vertical	25.5	33.5	-8.0
128.55	Vertical	25.2	33.5	-8.3
266.45	Vertical	27.4	36.0	-8.6
666.35	Vertical	26.9	36.0	-9.1
262.32	Vertical	26.6	36.0	-9.4
122.47	Vertical	21.9	33.5	-11.6
74.79	Vertical	15.1	30.0	-14.9
295.37	Vertical	20.9	36.0	-15.1

Horizontal Polarity

Frequency MHz	Polarisation	QP Measured dBμV/m	QP Limit dBμV/m	ΔQP ± dB
266.46	Horizontal	34.3	36.0	-1.7
197.23	Horizontal	26.5	33.5	-7.0
696.19	Horizontal	27.2	36.0	-8.8
199.00	Horizontal	24.3	33.5	-9.2
202.89	Horizontal	23.4	33.5	-10.1
199.57	Horizontal	23.2	33.5	-10.3
275.05	Horizontal	24.4	36.0	-11.6
663.20	Horizontal	23.9	36.0	-12.1
115.00	Horizontal	20.8	33.5	-12.7
288.01	Horizontal	21.2	36.0	-14.8
263.49	Horizontal	19.6	36.0	-16.4
250.18	Horizontal	17.9	36.0	-18.1
82.11	Horizontal	10.4	30.0	-19.6
91.49	Horizontal	12.2	33.5	-21.3

The highest radiated emission peak occurred at 266.46 MHz (Horizontal polarity) and complied with FCC quasi peak limit by a margin of 1.7 dB. The measurement uncertainty in this band was ± 3.7 dB. Refer to tables above for results.

Result: Complies.

4.3.3 Band Edge Measurements

The highest emission level that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the operating band.

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

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

The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were utilised.

Refer to Appendix I for Band Edge plots
NB: D1 line indicates the highest level of the transmitter
D2 line indicates 20 dB limit below D1.

The field strength at 2483.5 MHz when the EUT was operating at its highest channel (2462 MHz), was 42.5 dBμV/m peak (noise floor) and was > 20 dB below the maximum field strength of the in-band carrier.

The field strength at 2400 MHz when the EUT was operating at its lowest channel (2412 MHz), was 42.1 dBμV/m peak (noise floor) and was > 20 dB below the maximum field strength of the in-band carrier.

Result: Complies.

5.0 Peak Output Power - Section 15.247 (b)(1) & (3)

Testing was performed in accordance with the requirements of FCC Part 15.247(b)(3).

Both radiated and conducted measurements were performed and both results are reported.

5.1 Radiated Measurements

Testing was performed while the transmitter continuously transmitted on a low, middle and high frequency channel. The measurements were made at the open area test site.

The device was placed on the test table, being 80 cm above the ground plane, with the computer screen display facing the test antenna located 3 metre away.

Measurements were made with the spectrum analyser operating in peak hold mode with a resolution bandwidth of 3 MHz. The power envelope of the device was determined with the antenna using vertical and horizontal polarisations. The power envelope was maximised by rotating the device using a turntable and by height scanning between 1 – 4 metres using the automated antenna tower.

As the bandwidth of the emission exceeded the resolution bandwidth of the spectrum analyser power measurements were made in 3 MHz steps across the frequency band occupied by the emission that were then summed using a spreadsheet.

Each of these emissions was recorded in dBuV and then converted to dBm and subsequently into an absolute power level (mW). Each of these individual power levels was then summed to give a total envelope power for the emission. The total envelope power in mW was then converted to dBm.

The radiated power was then determined by adding factors for the cable losses, antenna gains, path loss and the preamplifier gain.

Measurements were made on a low (channel 1, 2412 MHz), middle (channel 6, 2437 MHz) and high (Channel 11, 2462 MHz) frequency channel.

Example calculation - Low Channel – 2412 MHz

Freq MHz	Level dBuV	Level dBm	Level uW	Total Power mW	Total Power dBm	Ant Gain dB	Coax Loss dB	Preamp Gain dB	Path Loss dB	Power dBm	Power mW
2403	99.44	-7.6	175								
2406	98.83	-8.2	152								
2409	99.85	-7.2	193								
2412	99.32	-7.7	171	1.06	0.26	9.8	9.5	35	49.6	14.6	29.0
2415	99.24	-7.8	167								
2418	98.5	-8.5	141								
2421	94.59	-12.4	57								

The specification limit is 30 dBm (1.0W).

Configuration 802.11b
Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). No significant differences in emissions were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 11 Mbps (CCK).

Frequency MHz	Level mW	Limit mW	Result
2412.0	34.8	1000	Complies
2437.0	38.7	1000	Complies
2462.0	35.1	1000	Complies

The specification limit is 1W (30 dBm).

Variation by +/- 15% of the supply voltage, in accordance with section 15.31(e), to the computer power supply power did not vary the output power. This device has no external antenna port with the antenna being located internally.

Result: Complies.

5.2 Conducted Measurements

The average output power (A in dBm) of the transmitter was measured with a calibrated RF power meter and a power sensor.

The e.i.r.p (P) was calculated as follows:

P = A + G + C where G is the antenna gain in dBi & C is the cable loss

Testing was performed while the transmitter continuously transmitted on a low (channel 1, 2412 MHz), middle (channel 6, 2437 MHz) and high (Channel 11, 2462 MHz) frequency channel.

Configuration 802.11b
Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). No significant differences in power were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 11 Mbps (CCK).

Frequency MHz	A dBm	Coax Loss dB	G dBi	P dBm	Limit dBm	P mW	Limit mW
2412	11.8	0.5	0.69	13.0	30	20.0	1000
2437	12.3	0.5	0.69	13.5	30	22.4	1000
2462	11.5	0.5	0.69	12.7	30	18.6	1000

The specification limit is 1W (30 dBm).

Variation by +/- 15% of the supply voltage, in accordance with section 15.31(e), to the computer power supply power did not vary the output power.

Result: Complies.

6.0 Channel Bandwidth

Testing was carried out in accordance with the requirements of FCC Part 15.247(a)(2)

In the band 2400 - 2483.5 MHz the minimum 6 dB bandwidth was at least 500 kHz. The 6 dB bandwidth was measured while the transmitter continuously transmitted on a low, middle and high frequency channel.

The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.

The resolution bandwidth of 100 kHz and the video bandwidth of 300 kHz were utilised

Measurements were made on a low (channel 1, 2412 MHz), middle (channel 6, 2437 MHz) and high (Channel 11, 2462 MHz) frequency channel.

Configuration 802.11b

Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). No significant differences in bandwidth were observed. Final testing was performed while the transmitter continuously operating with the modulation rate of 11 Mbps (CCK).

Frequency MHz	Bandwidth MHz	Result	6 dB Bandwidth Plots
2412.0	10.42	Complies	Appendix H
2437.0	10.26	Complies	Appendix H
2462.0	10.90	Complies	Appendix H

The minimum 6 dB bandwidth is at least 500 kHz

Result: Complies.

7.0 Radio Frequency Exposure (Hazard) Information

Testing was performed in accordance with the requirements of FCC Part 15.247(b)(5)

Spread spectrum transmitters operating in the 2400 - 2483.5 MHz band 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).

In accordance with this section and also section 2.1091 this device has been defined as a portable device whereby a distance of 20 cm normally cannot be maintained between the user and the device.

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.

The maximum distance from the antenna at which the MPE is met or exceeded has been calculated from the equation relating field strength in V/m, transmit power in watts, transmit antenna gain and separation distance in metres:

E, V/m = ($\sqrt{}$ (30 * P *G)) / d
Power density, mW/cm^2 = E^2/3770
E for MPE: = E^2/3770
E = $\sqrt{}$1*3770
E = 61.4 V/m

The max Antenna (Monopole Ceramic Chip) gain = 0.69 dBi

Conducted Power
Highest output power was calculated. The result was extracted from section 5.0 of this report.

Frequency MHz	Modulation	Maximum Conducted Output Power Measured
2437	DSSS	13.5 dBm (22.4 mW)

The total power (P*G) measured at the Antenna of WLAN Module (Calexico, WM3B2100-Ocampa)

The maximum transmitter power measured = 13.5 dBm or 22.4 milliwatts.

d = √ (30 * P *G) / E
= √ (30 * 0.0224) / 61.4
= 0.0133 metres or 1.33cm

Radiated Power
Highest output power was calculated. The result was extracted from section 5.0 of this report.

Frequency MHz	Modulation	Maximum Radiated Output Power Measured
2437	DSSS	15.9 dBm (38.7mW)

The total power (P*G) measured at the Antenna of WLAN Module (Calexico, WM3B2100-Ocampa)

The maximum transmitter power measured = 15.9 dBm or 38.7 milliwatts.

d = √ (30 * P *G) / E
= √ (30 * 0.0387) / 61.4
= 0.0175 metres or 1.75cm

Conclusion:
Calculations show that this device with described antenna does not meet the MPE requirements for portable devices falling below the 20 cm clearance required, however the SAR value of 0.36 mW/g complies with the FCC human exposure requirements of 47 CFR 2.1093 (d).
Refer to EMC Technologies' report - **M030949_Ocampa_Calexico SAR Report** for details of SAR compliance.

8.0 Peak Power Spectral Density - Section 15.247(d)

Testing was carried out in accordance with the requirements of FCC Part 15.247(d)

The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.

The resolution bandwidth of 3 kHz and the video bandwidth of 30 kHz were utilised

Testing was performed while the transmitter continuously transmitted on a low (channel 1, 2412 MHz), middle (channel 6, 2437 MHz) and high (Channel 11, 2462 MHz) frequency channel.

Configuration 802.11b

Initial investigations were performed with three modulation types: (DBPSK, DQPSK and CCK). No significant differences in peak power spectral density were observed. Final testing was performed while the transmitter continuously operating with the modulation rate of 11 Mbps (CCK).

Frequency MHz	Level dBm	Limit dBm	Result	Spectral Density plots
2412.0	-9.68	8.0	Complies	Appendix J
2437.0	-10.47	8.0	Complies	Appendix J
2462.0	-12.04	8.0	Complies	Appendix J

The specification limit is 8 dBm in any 3 kHz band during a continuous transmission.

Result: Complies

9.0 Antenna Requirement

Testing to the requirements of FCC Part 15.203 was not applicable as this intentional radiator was designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

10.0 COMPLIANCE STATEMENT

The Mini-PCI Wireless LAN Module (Calexico), Model WM3B2100-Ocampa, tested on behalf of Fujitsu Australia Ltd, **complies** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.247 -Operation in the frequency band 2400 - 2483.5 MHz.

It also complies with the requirements of Industry Canada RSS-210 Issue 5 section 6.2.2 (o).

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 Bandwidth	**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 (b)(5)		Radio Frequency Hazard	***Complies with SAR requirements**
15.247 (c)	6.2.2(o)(e1)	Out of Band Emissions	**Complies**
15.247 (d)	6.2.2(o)(iv)	Peak Power Spectral Density	**Complies**

*Refer to EMC Technologies' report M030949_Ocampa_Calexico SAR Report

APPENDIX A
MEASUREMENT INSTRUMENTATION DETAILS

EQUIPMENT TYPE	MAKE/MODEL SERIAL NUMBER	LAST CAL. DD/MM/YY	DUE DATE DD/MM/YY	CAL. INTERVAL
EMI RECEIVER	HP 8546A Sn.3549A00290 EMI Receiver	13/03/03	13/03/04	1 YEAR *2
EMI RECEIVER	HP 8574B System Components	12/02/03	12/02/04	1 YEAR *2
EMI RECEIVER	HP8593EM, SN3146A-01297 9 kHz – 26 GHz	13/06/03	13/06/04	1 YEAR *2
EMI RECEIVER	Rohde & Schwarz, Model ESIB40 SN 1088 7490, 20 Hz – 40 GHz	09/07/03	09/07/04	1 YEAR *3
ANTENNAS	EMCO 93110B BICONICAL	20/08/03	20/08/04	1 YEAR *1
	20 - 300 MHz Sn. 9804-3092			
	EMCO 93146A LOG PERIODIC	11/07/03	11/07/04	1 YEAR *1
	200 -1000MHz Sn. 5033			
	EMCO 3115 DOUBLE RIDGED HORN 1 - 18 GHz Sn: 8908-3282	29/01/03	29/01/04	1 YEAR *1
	EMCO 3116 Double Ridged Guide Horn	--------	--------	*4
	18 – 40 GHz Sn 2276			
LISN	EMCO 3825/2 50ohm / 50 microH	10/02/03	10/02/04	1 YEAR *1
	0.009 – 30MHz Sn.9607-2567			
POWER METER	HP 437B	24/05/03	24/05/04	1 YEAR *2
POWER SENSOR	HP8481H	04/06/03	04/06/04	1 YEAR *2

Note *1. In-house calibration. Refer to Quality Manual.
Note *2. NATA calibration by Agilent Technologies (Aust) Pty Ltd
Note *3. NATA calibration by Rohde & Schwarz
Note *4. Manufacturer's calibration

TEST SITES

Shielded Room Test Laboratory	**Melbourne** 11m x 8m x 4m Chamber-semi-anechoic 8.8m x 5.8m x 3.1m Test Chamber 3.4m x 6.1m x 2.5m Test Chamber 3.4m x 7.3m x 7.5m Test Chamber	Feb 03 N/A N/A N/A	Feb 04 N/A N/A N/A	1 Year *1 N/A N/A N/A
Open Area Test Site	**Melbourne** 3/10 Metre site. 1-4 metre antenna mast. 1.2 metre/400 kg Turntable. (Situated at Lerderderg Gorge, near Bacchus Marsh, Victoria)	21/01/03	21/01/04	1 Year *1

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

TEST REPORT APPENDICES

(Submitted as attachments)

APPENDIX A: MEASUREMENT INSTRUMENT DETAILS

APPENDIX B: REPORT PHOTOGRAPHS

- **B1: Test Sample**
- **B2: Test Setup**
- **B3: EUT Host Photographs**
- **B4: EUT & Antenna Location**

APPENDIX C: BLOCK DIAGRAM

APPENDIX D: FCC ID LABELLING

APPENDIX E: TEST SAMPLE SCHEMATICS

APPENDIX F: PCB LAYOUTS

APPENDIX G: GRAPHS of EMI MEASUREMENTS

APPENDIX H: CHANNEL BANDWIDTH PLOTS

APPENDIX I: BANDEDGE PLOTS

APPENDIX J: PEAK POWER SPECTRAL DENSITY PLOTS

APPENDIX K: ANTENNA INFORMATION (MONOPOLE CERAMIC CHIP ANTENNA)

APPENDIX L: EUT USER GUIDE

APPENDIX M: EUT THEORY OF OPERATION

APPENDIX N: USER MANUAL