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

FCC ID: QK3-WB0001

Industry Canada ID: IC-337H-WB0001

**Test Sample: LIFEBOOK Ginger with Callexico WLAN
& Bluetooth device**

Model Number: S6120,S6120D

Tested for: Fujitsu Australia Ltd

**Report Number: M030507R_Certification_Ginger_CalWB
(Replacement for Report Number M030507_Certification_Ginger_CalWB)**

Issue Date: 23rd May 2003

EMC Technologies Pty Ltd reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. EMC Technologies Pty Ltd shall have no liability for any deductions, inferences or generalisations drawn by the client or others from EMC Technologies Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Technologies Pty Ltd.



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**NATA Accredited Laboratory
Number: 5292**

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

EMC Technologies Report No. M030507R_Certification_Ginger_CalWB

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FCC PART 15.247 & RSS-210

Report Number: M030507R_Certification_Ginger_CalWB
Test Sample: LIFEBOOK Ginger with Calxico WLAN & Bluetooth device
Model Number: S6120, S6120D

FCC ID: QK3-WB0001
Industry Canada ID: IC-337H-WB0001

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 (Transmitter)

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: 5th - 14th May 2003

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 Signature: 
Chris Zombolas
Technical Director
EMC Technologies Pty Ltd



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

1. INTRODUCTION

This report details the results of EMI tests and measurements performed on LIFEBOOK Ginger, model S6120, S6120D with Callexico WLAN & Bluetooth Device, 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

Callexico WLAN - Direct Sequence Spread Spectrum (DSSS)

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
15.247 (c)	6.2.2(o)(e1)	Out of Band Transmissions	Complies
15.247 (d)	6.2.2(o)(iv)	Peak Power Spectral Density	Complies

Bluetooth Device - Frequency Hopping Spread Spectrum (FHSS)

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)(1)&(3)	6.2.2(o)(ii)	Channel Occupancy/Bandwidth	Complies
15.247 (b)(1)	6.2.2(o)(b)	Peak Output Power	Complies
15.247 (b)(5)		Radio Frequency Hazard	Complies
15.247 (c)	6.2.2(o)(e1)	Out of Band Transmissions	Complies

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.



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2. GENERAL INFORMATION

(Information supplied by the Client)

2.1 Product Details

Test Sample:	LIFEBOOK Ginger with Calexico WLAN & Bluetooth device
Model Number:	S6120, S6120D
FCC ID:	QK3-WB0001
Industry Canada ID:	IC-337H-WB0001
Equipment Type:	Intentional Radiator (Transceiver)

2.2 Test Sample Operational Description

The EUT (Equipment Under Test) is a notebook PC, model: Ginger S6120, S6120D with two radio devices. Mini-PCI Wireless LAN (WLAN) Module (Calexico WM3B2100) and ALPS Bluetooth device that are factory configured during production of Fujitsu Notebook PCs (LifeBooks).

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)

Curtis-Straus TCB has individually certified the ALPS Bluetooth device used in Ginger S6120, S6120D (FCC ID: QK3-BT0001) (Report Number: EMC Technologies-M030235_FCC_Ginger_BT)

The intention of this test and report is to verify compliance of the dual transmitters configured in LifeBook model: Ginger S6120, S6120D. The dual transmitters are Calexico module with monopole ceramic chip Antenna and the ALPS Bluetooth device with monopole ceramic chip Antenna.

NB: Dual transmitters are OFF when lid of LifeBook is in the closed position (System in standby mode).

2.3 Technical Specifications

Transmitter#1:

Wireless Module:	Calexico
Model Number:	WM3B2100
Manufacturer:	Intel Corporation
Interface Type:	Mini-PCI Module
Network Standards:	IEEE 802.11b
Modulation Type:	Direct Sequence Spread Spectrum (DSSS)
Maximum Data Rate:	11Mbps max
Frequency Range:	2400 MHz to 2483.5 MHz (Operational range 2402 to 2462 MHz)
Number of Channels:	14 (Operational channels = 11)
Antenna Type:	Monopole Ceramic chip Antenna
Output Power:	16 dBm typical
Power Supply:	3.3 VDC from PCI bus.

Transmitter#2:

Module:	ALPS Bluetooth Module
Manufacturer:	ALPS
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:	Monopole Ceramic Chip Antenna
Reference Oscillator:	16 MHz (Built-in)
Power Supply:	3.3 VDC from host.



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EUT Host Details:

Test Sample	LIFEBOOK S Series
Model Number:	S6120, S6120D
Codename:	Ginger
CPU Speed:	1.6 GHz
Manufacturer:	Fujitsu Ltd.
AC Adapter Model:	CA01007-850 16VDC, 3.75A, 60W

2.4 Test sample configuration

The Callexico utility software and the BlueSuiteCasira software were used to set-up the WLAN module and Bluetooth device respectively to continuously transmit during the tests. Refer to Appendix B2 - Test Setup Photographs

2.5 Test Sample Block Diagram

Refer to Appendices C1 & C2.

2.6 Test Sample Support Equipment**Printer/s:**

Conducted EMI	HP Deskjet 850c Model: C2145A, FCC ID: B94C2145X
Radiated EMI	Diconix, Model 150, FCC ID E759WG-RBCN150

External Monitor/s:

Conducted EMI	IPEX, Model: H566, FCC ID: GKR567
Radiated EMI	Tatung, Model No. CMITMC5, S/N 23490103, FCC ID: BJMCM15MC

Keyboards:

Conducted EMI	Diamond Touch Model: 6511-B
Radiated EMI	Genius Model: KWD-805, S/N 9B17800073

USB Floppy Drives:

Fujitsu Model: FPCFDD11, P/N CP032173-01
Fujitsu Model: FPCFDD12, P/N CP078720-01

Headphones:

Verbatim Multimedia Stereo headset

Modem:

Maestro Companion Series 3

PS2 Mouse:

Microsoft Intellimouse, S/N 00723014, FCC ID: C3KKS9
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USB Mouse:

Microsoft Intellimouse, P/N X05-48976, S/N 3220403
--

LAN Hub:

Kingston SOHO Hub Model: KNE8TP/H (FCC ID: JICKNE8TP-HO)
--

PCMCIA Slot:

8 MB flash card, kingmax ATA008M

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).



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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 (A²LA).

2.9 Units of Measurements

2.9.1 Conducted Emissions

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

2.9.2 Radiated Emissions

Measurements are reported in units of dB relative to one microvolt per metre (dB μ V/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.



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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 dB μ V to be compared to the limit.

VRx = the Voltage in dB μ V 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)

LIFEBOOK Ginger, model S6120, S6120D - WLAN Module (Calexico, WM3B2100) & Bluetooth Device

Frequency MHz	Line	Measured QP Level dB μ V	QP Limit dB μ V	Δ QP \pm dB	Measured AV Level dB μ V	AV Limit dB μ V	Δ AV \pm dB
0.559	Neutral	43.4	56.0	-12.6	39.0	46.0	-7.0
0.492	Active	42.8	56.1	-13.3	38.6	46.1	-7.5
0.630	Active	42.6	56.0	-13.4	38.2	46.0	-7.8
0.559	Active	42.3	56.0	-13.7	37.6	46.0	-8.4
0.492	Neutral	41.8	56.1	-14.3	37.3	46.1	-8.8
0.631	Neutral	41.4	56.0	-14.6	37.0	46.0	-9.0

The worst case conducted EMI occurred at 0.559 MHz and complied with the quasi peak and average limits by margins of 12.6 dB and 7.0 dB respectively. The measurement uncertainty was ± 2.0 dB. Refer to Appendix G for plots of the conducted EMI measurements.



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4.0 RADIATED EMISSION MEASUREMENTS

4.1 Test Procedure

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 and HP8449B preamplifier were used for measurements between 1 to 25 GHz.

Testing was performed at a distance of 10 metres for the frequency ranges 30 to 1000 MHz and 3 metres for the frequency range 1 to 25 GHz.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. Each significant peak was then investigated and maximised with the Quasi-Peak detector. 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 dB μ V/m.
- V** = EMI Receiver Voltage in dB μ V. (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 dB μ V is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB. The cable loss is 1.9 dB while the preamplifier gain is 20 dB. The resulting Field Strength is therefore as follows:

$$34.0 + 9.2 + 1.9 - 20 = 25.1 \text{ dB}\mu\text{V/m}$$



4.3 Section: 15.247 (c) Out of Band Emissions (Spurious and Harmonics)

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

As the transmitter has no external connections measurements were made at the open area test site. Testing was carried while transmitter continuously on a low, middle and high frequency channel.

The device was placed on the test table, being 0.8 m above the ground plane, with the front display facing the test antenna.

Measurements were made using a resolution bandwidth of 100 kHz where an emission fell outside of a restricted band. When an emission fell within a restricted band an average detector with a resolution bandwidth of 1 MHz was utilised.

All measurements were initially made over a distance of 3 metres which was decreased to 1.0 metres as the emission levels from the device were very low. All measurements have been made in absolute field strength $\mu\text{V/m}$ which has been converted to $\text{dB}\mu\text{V/m}$.

The 54 $\text{dB}\mu\text{V/m}$ limit at 3 metres has been converted to 64 $\text{dB}\mu\text{V/m}$ at 1 metre using a factor of 20 dB per decade where emissions are located in the restricted bands.

In the unrestricted bands measurements were made to determine if the field strength of the emissions observed were more than 20 dB down on the fundamental.

Radiated emission measurements are required to be carried out with the limits as per section 15.209 applied.

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, that appear in the restricted bands, was made using an average detector with a bandwidth of 1.0 MHz.

When an emission is located, it is positively identified and its maximum level is found by rotating the automated turntable, and by varying the antenna height.

The emission is measured in both vertical and horizontal antenna polarisations.

The emission level is determined in field strength by taking the following into consideration:

$$\text{Level (dB}\mu\text{V/m)} = \text{Receiver Reading (dB}\mu\text{V)} + \text{Antenna Factor (dB)} + \text{Coax Loss (dB)}$$

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

4.3.1 Frequency Band: 1 – 25 GHz

LIFEBOOK Ginger, model S6120, S6120D - WLAN Module (Calexico, WM3B2100)

All recorded emissions complied with the FCC Class B average limit by a margin of greater than 10 dB. No harmonics were recorded within the restricted bands of up to 25 GHz. Harmonics were below the limit in section 15.209. The measurement uncertainty for radiated emissions in this band was ± 4.1 dB.

The field strength at 2483.5 MHz when the EUT is operating at its highest channel (2462 MHz), is < 38 $\text{dB}\mu\text{V/m}$ (noise floor) and is > 20 dB below the maximum field strength of the in-band carrier.



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Frequency MHz	Level dBuV/m		Antenna Polarization	Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector				
2412	94.7	-	Vert	-	-	Pass
4824	45.5	34.7	Vert/Hort	74.0	54.0	Pass
7236	49.6	36.9	Vert/Hort	-	-	Pass
9648	52.8	39.6	Vert/Hort	-	-	Pass
12060	55.2	41.6	Vert/Hort	74.0	54.0	Pass
14472	58.7	45.2	Vert/Hort	74.0	54.0	Pass
16884	62.1	47.5	Vert/Hort	-	-	Pass
19296	64.2	51.2	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
21708	68.5	55.9	Vert/Hort	-	-	Pass
24120	68.7	56.0	Vert/Hort	-	-	Pass

Frequency MHz	Level dBuV/m		Antenna Polarization	Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector				
2437	94.2	-	Vert	-	-	Pass
4874	45.2	32.7	Vert/Hort	74.0	54.0	Pass
7311	48.6	37.0	Vert/Hort	74.0	54.0	Pass
9748	54.0	39.8	Vert/Hort	-	-	Pass
12185	55.2	42.0	Vert/Hort	74.0	54.0	Pass
14622	58.7	45.0	Vert/Hort	-	-	Pass
17059	62.1	48.8	Vert/Hort	-	-	Pass
19496	66.5	52.8	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
21933	67.7	55.5	Vert/Hort	-	-	Pass
24370	68.7	55.8	Vert/Hort	-	-	Pass

Frequency MHz	Level dBuV/m		Antenna Polarization	Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector				
2462	94.0	-	Vert	-	-	Pass
4924	45.0	32.5	Vert/Hort	74.0	54.0	Pass
7386	49.5	37.1	Vert/Hort	74.0	54.0	Pass
9848	53.3	39.5	Vert/Hort	-	-	Pass
12310	55.5	42.0	Vert/Hort	74.0	54.0	Pass
14772	58.5	44.4	Vert/Hort	-	-	Pass
17234	62.3	50.0	Vert/Hort	-	-	Pass
19696	65.8	52.9	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
22158	67.7	55.0	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
24620	68.7	55.9	Vert/Hort	-	-	Pass

*Measurement was performed at 1 metre distance and the limits were corrected accordingly.
No further emissions detected.

Result: Complies



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4.3.2 Frequency Band: 1 – 25 GHz

LIFEBOOK Ginger, model S6120, S6120D - Bluetooth Device

All recorded emissions complied with the FCC average limit by a margin of greater than 20 dB. No harmonics were recorded within the restricted bands of up to 25 GHz. Harmonics were below the limit in section 15.209. The measurement uncertainty for radiated emissions in this band was ± 4.1 dB.

The field strength at 2483.5 MHz when the EUT is operating at its highest channel (2480 MHz), is <38 dBuV/m (noise floor) and is > 20 dB below the maximum field strength of the in-band carrier.

Frequency MHz	Level dBuV/m		Antenna Polarization	Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector				
2402	88.8	-	Vert	-	-	Pass
4804	45.5	34.7	Vert/Hort	74.0	54.0	Pass
7206	49.6	36.9	Vert/Hort	-	-	Pass
9608	52.8	39.6	Vert/Hort	-	-	Pass
12010	55.2	41.6	Vert/Hort	74.0	54.0	Pass
14412	58.7	45.2	Vert/Hort	-	-	Pass
16814	62.1	47.5	Vert/Hort	-	-	Pass
19216	64.2	51.2	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
21618	68.5	55.9	Vert/Hort	-	-	Pass
24020	68.7	56.0	Vert/Hort	-	-	Pass

Frequency MHz	Level dBuV/m		Antenna Polarization	Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector				
2441	89.2	-	Vert	-	-	Pass
4882	45.2	32.7	Vert/Hort	74.0	54.0	Pass
7323	48.6	37.0	Vert/Hort	74.0	54.0	Pass
9764	54.0	39.8	Vert/Hort	-	-	Pass
12205	55.2	42.0	Vert/Hort	74.0	54.0	Pass
14646	58.7	45.0	Vert/Hort	-	-	Pass
17087	62.1	48.8	Vert/Hort	-	-	Pass
19258	66.5	52.8	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
21969	67.7	55.5	Vert/Hort	-	-	Pass
24410	68.7	55.8	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass



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Frequency MHz	Level dBuV/m		Antenna Polarization	Peak Limit dBuV/m	Average Limit dBuV/m	Result
	Peak Detector	Average Detector				
2480	88.8	-	Vert	-	-	Pass
4960	45.0	32.5	Vert/Hort	74.0	54.0	Pass
7440	49.5	37.1	Vert/Hort	74.0	54.0	Pass
9920	53.3	39.5	Vert/Hort	-	-	Pass
12400	55.5	42.0	Vert/Hort	74.0	54.0	Pass
14880	58.5	44.4	Vert/Hort	-	-	Pass
17360	62.3	50.0	Vert/Hort	-	-	Pass
19840	65.8	52.9	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
22320	67.7	55.0	Vert/Hort	84.0* (1m)	64.0* (1m)	Pass
24800	68.7	55.9	Vert/Hort	-	-	Pass

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

No further emissions detected.

Result: Complies

4.3.3 Frequency Band: 30 - 1000 MHz

LIFEBLOCK Ginger, model S6120, S6120D - WLAN Module (Calexico, WM3B2100) & Bluetooth Device

The highest radiated emission peak occurred at 668.96 MHz (Horizontal polarity) and complied with FCC quasi peak limit by a margin of 1.3 dB. The measurement uncertainty in this band was ± 3.7 dB.

Refer to tables below for results.

Vertical Polarity

Frequency MHz	Polarisation	QP Measured dB μ V/m	QP Limit dB μ V/m	Δ QP \pm dB
666.65	Vertical	34.2	36.0	-1.8
637.72	Vertical	32.0	36.0	-4.0
749.72	Vertical	31.2	36.0	-4.8
625.41	Vertical	31.1	36.0	-4.9
323.73	Vertical	30.5	36.0	-5.5
400.02	Vertical	30.2	36.0	-5.8
215.32	Vertical	27.5	33.5	-6.0
318.84	Vertical	28.1	36.0	-7.9
211.50	Vertical	25.6	33.5	-7.9
209.91	Vertical	25.3	33.5	-8.2
209.06	Vertical	25.0	33.5	-8.5
410.00	Vertical	27.3	36.0	-8.7
120.00	Vertical	23.7	33.5	-9.8
213.85	Vertical	23.7	33.5	-9.8
116.07	Vertical	23.6	33.5	-9.9
117.51	Vertical	22.7	33.5	-10.8



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Horizontal Polarity

Frequency MHz	Polarisation	QP Measured dB μ V/m	QP Limit dB μ V/m	Δ QP \pm dB
668.96	Horizontal	34.7	36.0	-1.3
624.92	Horizontal	33.7	36.0	-2.3
648.91	Horizontal	33.0	36.0	-3.0
215.93	Horizontal	25.0	33.5	-8.5
215.73	Horizontal	24.8	33.5	-8.7
574.73	Horizontal	27.1	36.0	-8.9
587.58	Horizontal	26.9	36.0	-9.1
398.15	Horizontal	26.9	36.0	-9.1
323.41	Horizontal	26.8	36.0	-9.2
750.45	Horizontal	26.7	36.0	-9.3
144.53	Horizontal	22.6	33.5	-10.9
210.27	Horizontal	21.5	33.5	-12.0
208.72	Horizontal	21.4	33.5	-12.1
196.85	Horizontal	21.3	33.5	-12.2
184.11	Horizontal	21.2	33.5	-12.3
213.86	Horizontal	20.7	33.5	-12.8

Result: Complies.

4.4 Channel Bandwidth & Occupancy Bandwidth

4.4.1 LIFEBOOK Ginger, model S6120, S6120D - WLAN Module (Calexico, WM3B2100)

4.4.1.1 Channel Bandwidth

Testing was carried out in accordance with the requirements of FCC Part 15.247(a)(2). The EUT was a Direct Sequence Spread Spectrum transmitter using digital modulation techniques and operated as described in section 2 of this report.

In the band 2400 - 2483.5 MHz the minimum 6 dB bandwidth was at least 500 kHz. The -6 dB bandwidth was measured at 2412, 2437 and 2462 MHz which equated to low, middle and top frequencies using a spectrum analyser in peak hold mode and a horn antenna. A resolution bandwidth of 300 kHz was utilised.

The 6 dB bandwidth for these 3 frequencies was determined to be:

Frequency MHz	Bandwidth MHz	Result
2412.0	11.6	Complies
2437.0	11.9	Complies
2462.0	11.9	Complies

Result: Complies.

Refer to Appendix H for Channel Bandwidth plots.



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4.4.2 LIFEBOOK Ginger, model S6120, S6120D - Bluetooth Device

Testing was carried out in accordance with the requirements of FCC Part 15.247(a)(1)(i)&(iii). The EUT was a Frequency Hopping Spread Spectrum transmitter and operated as described in section 2 of this report.

4.4.2.1 Channel Bandwidth

In the band 2400 - 2483.5 MHz the hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

A resolution bandwidth of 300 kHz was utilised.

The channel separation of 1 MHz was recorded.

The 20 dB bandwidth was measured at 2402, 2441 and 2480 MHz which equated to low, middle and top frequencies using a spectrum analyser in peak hold mode and a horn antenna.

The 20 dB bandwidth for these 3 frequencies was determined to be:

Frequency MHz	Bandwidth kHz	Result
2402	850	Complies
2441	875	Complies
2480	888	Complies

Refer to Appendix H for Channel Bandwidth plots.

4.4.2.2 Channel Occupancy

This measurement was made on a channel using a spectrum analyser with a 0 Hz span and a sweep speed of 5 mS.

79 channels were observed operating between 2400 – 2483.5 MHz

The specification allows for a dwell time not exceeding 400 mS.

The maximum period is 79 channels x 0.4 seconds = 31.6 seconds

The device was observed to have a dwell time of 625 uS.

During the test the transmitter was observed to activate on average 90 times in 31.6 seconds.

The transmitter therefore occupies in one channel for $90 \times 625\mu\text{S} = 0.05625$ seconds

Result: Complies.



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

4.5.1 LIFEBOOK Ginger, model S6120, S6120D - WLAN Module (Calexico, WM3B2100)

Testing was carried out in accordance with the requirements of FCC Part 15.247(b)(3)

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 were recorded in dBuV and were 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, middle and high 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).

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.

Frequency MHz	Level mW	Limit mW	Result
2412.0	24.2	1000	Complies
2437.0	22.5	1000	Complies
2462.0	19.7	1000	Complies

The specification limit is 1W (30 dBm).

Result: Complies.



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4.5.2 LIFEBOOK Ginger, model S6120, S6120D - Bluetooth Device

Testing was carried out in accordance with the requirements of FCC Part 15.247(b)(1)

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.

The emissions were recorded in dBuV and were then converted to dBm and subsequently into an absolute power level (mW).

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

Example calculation - Middle Channel – 2441 MHz

Freq MHz	Level dBuV	Level dBm	Level μ W	Ant Gain dB	Coax Loss dB	Preamp Gain dB	Path Loss dB	Power dBm	Power mW
2441	106.67	-0.33	93	9.8	9.5	35	49.6	14.0	24.9

The specification limit is 30 dBm (1.0W).

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

This device has no external antenna port with the antenna being located internally.

Measurements were made on a low (channel 1), middle (channel 39) and high (Channel 79) frequency channel.

Frequency MHz	Level mW	Limit mW	Result
2402.0	22.8	1000	Complies
2441.0	24.9	1000	Complies
2480.0	23.0	1000	Complies

The specification limit is 1W (30 dBm).

Result: Complies.



4.6 Radio Frequency Exposure (Hazard) Information

Testing was carried out 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 the test sample has been defined as a mobile device whereby a distance of 20 cm can normally 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/cm².

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:

$$E, \text{ V/m} = (\sqrt{30 * P * G}) / d$$

$$\text{Power density, mW/m}^2 = E^2/3770$$

$$\begin{aligned} E \text{ for MPE: } &= E^2/3770 \\ E &= \sqrt{1*3770} \\ E &= 61.4 \text{ V/m} \end{aligned}$$

The maximum transmitter power was calculated by adding the power measured from WLAN Module (Calexico, WM3B2100) and the power measured from the Bluetooth Device.

The max Antenna gain for Bluetooth = 0.67 dBi

The max Antenna gain for WLAN = 0.67 dBi

The total power (P*G) measured at the Antenna of transmitter# 1:
WLAN Module (Calexico, WM3B2100) = 24.2 mW

The total power (P*G) measured at the Antenna of transmitter# 2:
Bluetooth Device = 24.9 mW

The combined power of both transmitters (24.2 mW + 24.9 mW) = 0.0491W

$$\begin{aligned} d &= \sqrt{(30 * P * G) / E} \\ &= \sqrt{(30 * 0.0491) / 61.4} \\ &= 0.024 \text{ metres or } 2.4 \text{ cm} \end{aligned}$$

Calculations show that the test sample (LIFEBOOK Ginger, model S6120, S6120D with WLAN Module (Calexico, WM3B2100) and Bluetooth Device), with described antennae meet the MPE requirements for mobile devices falling below the 20 cm clearance required.

Conclusion: Complies.



4.7 Section 15.247(d) - Peak Power Spectral Density

4.7.1 LIFEBOOK Ginger, model S6120, S6120D - WLAN Module (Calexico, WM3B2100)

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

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 metres away.

Measurements were made with the spectrum analyser operating in peak hold mode with a resolution bandwidth of 3 kHz

The maximum peak power spectral density was determined with the antenna using vertical and horizontal polarisations and when the device was rotated by using a turntable and it was height scanned between 1 – 4 metres using an automated antenna tower.

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

Measurements were made on a low, middle and high frequency channel

Example Calculation

Freq MHz	Level dBuV	Level dBm	Ant Gain dB	Coax Loss dB	Preamp Gain dB	Path Loss dB	Power dBm	Antenna Polarisation
2408.23	76.15	-30.9	9.8	10.7	35	49.6	-15.4	Vertical
2407.94	73.45	-33.6	9.8	10.7	35	49.6	-18.1	Horizontal

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

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.

This device has no external antenna port with the antenna being located internally.

Frequency MHz	Level dBm	Limit dBm	Result
2412.0	-10.8	8.0	Complies
2437.0	-12.9	8.0	Complies
2462.0	-13.3	8.0	Complies

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

Result: Complies.

4.7.2 LIFEBOOK Ginger, model S6120, S6120D - Bluetooth Device

Not applicable as EUT is not a digital modulation system.



5.0 COMPLIANCE STATEMENT

The LIFEBOOK Ginger, model S6120, S6120D with Callexico WLAN & Bluetooth Device, tested on behalf of Fujitsu Australia Ltd, **complied** 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.

The EUT also complied with the requirements of Industry Canada RSS 210 Issue 5 section 6.2.2 (o) and the RF exposure requirements of RSS-102.

Results were as follows:

Callexico WLAN - Direct Sequence Spread Spectrum (DSSS)

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
15.247 (c)	6.2.2(o)(e1)	Out of Band Transmissions	Complies
15.247 (d)	6.2.2(o)(iv)	Peak Power Spectral Density	Complies

Bluetooth Device - Frequency Hopping Spread Spectrum (FHSS)

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)(1)&(3)	6.2.2(o)(ii)	Channel Occupancy/Bandwidth	Complies
15.247 (b)(1)	6.2.2(o)(b)	Peak Output Power	Complies
15.247 (b)(5)		Radio Frequency Hazard	Complies
15.247 (c)	6.2.2(o)(e1)	Out of Band Transmissions	Complies



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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	13/01/03	13/03/04	1 YEAR *2
EMI RECEIVER	HP 8574B System Components	12/02/03	12/02/04	1 YEAR *2
SPECTRUM ANALYSER	HP8593EM Sn. 3146A-01297 9 kHz –26 GHz	23/05/02	23/05/03	1 YEAR *2
ANTENNAS	EMCO 93110B BICONICAL 20 - 300 MHz Sn. 9804-3092	07/08/02	07/08/03	1 YEAR *3
	EMCO 93146A LOG PERIODIC 300 -1000MHz Sn. 5033	26/07/02	26/07/03	1 YEAR *3
	EMCO 3115 DOUBLE RIDGED HORN 1 - 18 GHz Sn: 8908-3282	29/01/03	29/01/04	1 YEAR *3
	EMCO 3116 Double Ridged Guide Horn 18 – 40 GHz Sn 2276	22/08/02	22/01/04	2 YEARS *1
PREAMPLIFIER	HP 8449B PREAMPLIFIER 1 - 26.5 GHz (30 dB Gain) Sn: 3008A01113	29/05/02	29/05/03	1 YEAR *3
LISN	EMCO 3825/2 50ohm / 50 microH 0.009 – 30MHz Sn.9607-2567	10/02/03	10/02/04	1 YEAR *3

Note *1. National Measurements Laboratory calibration.

Note *2. NATA calibration by Agilent Technologies (Aust) Pty Ltd

Note *3. In-house calibration. Refer to Quality Manual.

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 Lerderberg Gorge, near Bacchus Marsh, Victoria)	21/01/03	21/01/04	1 Year *1

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



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TEST REPORT APPENDICES

(Submitted as attachments)

APPENDIX A: MEASUREMENT INSTRUMENT DETAILS

APPENDIX B: TEST SAMPLE PHOTOGRAPHS

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: ANTENNA INFORMATION

APPENDIX J: USER MANUALS (SUPPLIED TO END USER)

APPENDIX K: LIFEBOOK GINGER BLUETOOTH SPECIFICATIONS

APPENDIX L: LIFEBOOK GINGER BLUETOOTH RADIO SPECIFICATIONS

**ANNEX 1: LIFEBOOK GINGER BLUETOOTH THEORY OF OPERATION
BLUETOOTH QUALIFICATION BOARD CERTIFICATION**

ANNEX 2: MINI-PCI WIRELESS LAN (CALEXICO) THEORY OF OPERATION

