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

FCC ID: EJE-WB0007
Industry Canada ID: 337J-WB0007

Test Sample: Stylistic ST Series Pentablet PC
Model: ST5021D / ST5020D / ST5022D (Ocamp3)

Radio Modules: Mini-PCI WLAN (Atheros 11a+b/g), Model: WLL4030 &
Bluetooth Model: UGXZ5-102A

Report Number M040603_Cert_Ocamp3_Atheros_5.2_BT

Tested for: Fujitsu Australia Ltd.

Issue Date: 2nd July 2004

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NATA Accredited Laboratory
Number: 5292

EMI TEST REPORT FOR CERTIFICATION
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EMC Technologies Report No. M040603_Cert_Ocampa3_Atheros_5.2_BT
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EMI TEST REPORT FOR CERTIFICATION to FCC PART 15 Subpart E (Section 15.407) & RSS-210

Report Number: M040603_Cert_Ocampa3_Atheros_5.2_BT

Test Sample: Stylistic ST Series Pentablet PC
Model: ST5021D / ST5020D / ST5022D (Ocampa3)

Radio Modules: Mini-PCI WLAN, Model: WLL4030 (Askey Computer Corp.)
Bluetooth, Model: UGXZ5-102A (Fujitsu Ltd)

FCC ID: EJE-WB0007
Industry Canada ID: 337J-WB0007
Equipment Type: Intentional Radiator (Transceiver)

Manufacturer (Tablet): Fujitsu Ltd
Address: 1405, Ohamaru, Inagi-shi, Tokyo 206-8503, Japan
Contact: Mr. Hirotaka Yakame

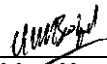
Tested for: Fujitsu Australia Ltd
Address: 5 Lakeside Drive,
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Test Standards: FCC Part 15, Subpart E – Unlicensed National Information,
Infrastructure Devices
FCC Part 15.407, General Technical Requirements
ANSI C63.4 – 1992
OET Bulletin No. 63

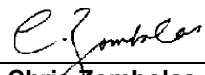
RSS-210 Issue 5 Low Power Licence-Exempt RadioCommunication
Devices: 6.2.2 (q1) 5150 - 5350 MHz & 5725-5825 MHz Local Area
Network Devices

RSS-102 Issue 1 (Provisional), Evaluation Procedure for Mobile and
Portable Radio Transmitters with respect to Health Canada's Safety
Code 6 for Exposure of Humans to Radio Frequency Fields

Test Dates: 7th February to 21st June 2004

Test Officers: 
Chieu Huynh **B.Eng (Hons) Electronics**
Janath Gunakesera **BScEng., MTelcomEng, MIEEE**
Jorge Lara

Attestation: *I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.*

Authorised Signatory: 
Chris Zombolas
Technical Director
EMC Technologies Pty Ltd



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

1.0 INTRODUCTION

EMI testing was performed on test sample Stylistic ST Series Pentablet PC, Model: ST5021D / ST5020D / ST5022D (Ocampa3) with Mini-PCI Wireless LAN Module (Atheros 11a+b/g), Model WLL4030 & Bluetooth, Model UGXZ5-102A.

The Atheros WLAN supports IEEE 802.11a, IEEE 802.11b and IEEE 802.11g configurations. Tests were performed in all three configurations and also on the Bluetooth.

The results for configurations IEEE 802.11a are reported in this test report.

The results for IEEE 802.11b/g and Bluetooth are reported separately.
Refer to EMC Technologies' test report: M040603_Cert_Ocampa3_Atheros_2.4_BT (802.11b/g) and M040603_Cert_Ocampa3_BT_Atheros (Bluetooth).

Test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations:

| | |
|-----------------------------|---|
| 47 CFR, Part 15, Subpart E: | Unlicensed National Information Infrastructure Devices (U-NII) operating in the 5.15-5.35 GHz and 5.725-5.825 GHz frequency bands |
| Section 15.203: | Antenna requirements |
| Section 15.205: | Restricted bands of operation |
| Section 15.207: | Conducted Emission Limits |
| Section 15.209: | Radiated Emission Limits (General requirements) |
| Section 15.407: | General Technical Requirements |

The results and technical details of the test sample are detailed in this report. The test sample **complies** with the requirements of 47 CFR, Part 15 Subpart E - Section 15.407.

The test sample also complies with the Industry Canada RSS-210 issue 5 (Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)) clause 6.2.2(q1) requirements and the RF exposure requirements of RSS-102.

1.1 Summary of Results

1.1.1 WLAN, Atheros 802.11a - FCC PART 15 Subpart E (Section 15.407)

| FCC Part 15, Subpart E Clauses | Industry Canada RSS-210 Clauses | Test Performed | Result |
|--------------------------------|---------------------------------|-----------------------------------|---------------------------------|
| 15.203 | 5.5 | Antenna Requirement | Not Applicable |
| 15.205 | 6.3 | Operation in Restricted Bandwidth | Complies |
| 15.207 | 6.6 | Conducted Emissions | Complies |
| 15.209 | 6.3 | Radiated Emissions | Complies |
| 15.407 (a)(4) | 6.2.2(q1) | Peak Transmit Power | Complies |
| 15.407 (a)(5) | 6.2.2(q1) | Peak Power Spectral Density | Complies |
| 15.407 (a)(6) | | Peak Excursion | Complies |
| 15.407 (b) | 6.2.2(q1) | Undesirable Emission | Complies |
| 15.407 (f) | | Radio Frequency Hazard | *Complies with SAR requirements |
| 15.407 (g) | 6.4 | Frequency Stability | Complies |

*Refer to EMC Technologies Report No: M040630_Ocampa3_Atheros_5.2_SAR



1.1.2 WLAN, Atheros 802.11b/g - FCC PART 15 Subpart C (Section 15.247)

| FCC Part 15, Subpart C Clauses | Industry Canada RSS-210 Clauses | Test Performed | Result |
|--------------------------------|---------------------------------|-----------------------------------|---|
| 15.203 | 5.5 | Antenna Requirement | Not Applicable |
| 15.205 | 6.3 | Operation in Restricted 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 No: **M040603_Cert_Ocampa3_Atheros_2.4_BT**

1.1.3 Bluetooth - FCC PART 15 Subpart C (Section 15.247)

| FCC Part 15, Subpart C Clauses | Industry Canada RSS-210 Clauses | Test Performed | Result |
|--------------------------------|---------------------------------|-----------------------------------|---|
| 15.203 | 5.5 | Antenna Requirement | Not Applicable |
| 15.205 | 6.3 | Operation in Restricted 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 with SAR requirements |
| 15.247 (c) | 6.2.2(o)(e1) | Out of Band Emissions | Complies |

Refer to EMC Technologies Report No: **M040603_Cert_Ocampa3_BT_Atheros**

**Refer to EMC Technologies' report M040630_Ocampa3_Atheros_SAR_2.4

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 (Host PC): | Stylistic ST Series Pentablet PC |
| Model Number: | ST5021D / ST5020D / ST5022D |
| Code Name: | Ocampa3 |
| Serial Number: | Pre-production Sample |
| Manufacturer: | Fujitsu Ltd |
| CPU Type and Speed: | Banias 1.1 GHz ULV |
| SDRAM: | 256 |
| LCD Screen: | 10.4"XGA (ST5021D) / 12.1"XGA (ST5020D / ST5022D) |
| Hard Disk Drive: | 40GB |
| Wired LAN: | Giga-LAN/10/100Base-T |
| Modem: | MBH7MD33 / MBH7MD35 |
| Wireless LAN (WLAN) Module: | Atheros 11a+b/g (WLL4030) |
| Bluetooth: | ALPS Bluetooth |
| Bluetooth Model Number: | UGXZ5-102A |
| Port Replicator Model: | FPCPR43xx and FPCPR44xx |
| AC Adapter Model: | SEC80N2-16.0 |
| Alternate Models: | CP171180-01 |
| Voltage: | 16 V |
| Current Specs: | 3.75 A |
| Watts: | 60 W |
| Radio Modules: | WLAN (Atheros 11a+b/g) and Bluetooth |
| WLAN Model Number: | WLL4030 |
| WLAN Manufacturer: | Askey Computer Corp. |
| Interface Type: | Mini-PCI Wireless LAN Module |
| Bluetooth Model Number: | UGXZ5-102A |
| Bluetooth Manufacturer: | Fujitsu Ltd |
| FCC ID: | EJE-WB0007 |
| Industry Canada ID: | 337J-WB0007 |
| Equipment Type: | Intentional Radiator (Transceiver) |



2.2 Technical Specifications

2.2.1 WLAN Transmitter Specifications

| | |
|----------------------------|--|
| Transmitter #1: | Mini-PCI Wireless LAN Module |
| Wireless Module: | Atheros |
| Model Number: | WLL4030 (11a+b/g module) |
| Manufacturer: | Askey Computer Corp. |
| Modulation Type: | Direct Sequence Spread Spectrum (DSSS for 802.11b) Orthogonal Frequency Division Multiplexing (OFDM for 802.11g) Orthogonal Frequency Division Multiplexing (OFDM for 802.11a) |
| 802.11a | BPSK – 6Mbps, 9Mbps QPSK – 12Mbps, 18Mbps 16QAM – 24Mbps, 36Mbps 64QAM – 48Mbps, 54Mbps |
| 802.11g | BPSK – 6Mbps, 9Mbps QPSK – 12Mbps, 18Mbps 16QAM – 24Mbps, 36Mbps 64QAM – 48Mbps, 54Mbps |
| 802.11b | DBPSK – 1Mbps DQPSK – 2Mbps CCK – 5.5Mbps, 11Mbps |
| Maximum Data Rate: | 802.11b = 11Mbps, 802.11g and 802.11a = 54Mbps |
| Frequency Range: | 2.4 – 2483.5 GHz for 11b/g 5.15 - 5.35 GHz and 5.725 - 5.825 GHz for 11a |
| Number of Channels: | 11 maximum (for 11b/11g) 12 maximum (for 11a) *Passive Scan only |
| Antenna Types: | Monopole Ceramic Chip Antenna (YCE-5008) |
| Max. Output Power: | 802.11b = 15 dBm 802.11g = 14.5 dBm 802.11a Band 1 (5.15 to 5.25 GHz) = 13.5 dBm 802.11a Band 2 (5.25 to 5.35 GHz) = 14 dBm 802.11a Band 3 (5.725 to 5.825 GHz) = 14.5 dBm |
| Power Supply: | 3.3 VDC from PCI bus |
| Chipset Used: | Atheros AR5212, AR5112 |
| Turbo Mode: | For 802.11g & 802.11a only |
| Data rate (Turbo): | 12 Mbps to 108 Mbps |

Frequency allocation for 802.11b/g:

| Channel Number | Frequency (MHz) | Turbo mode Frequency (MHz) FOR 802.11g ONLY |
|----------------|-----------------|--|
| 1 | 2412 | -- |
| 2 | 2417 | -- |
| 3 | 2422 | -- |
| 4 | 2427 | -- |
| 5 | 2432 | -- |
| 6 | 2437 | 2437 |
| 7 | 2442 | -- |
| 8 | 2447 | -- |
| 9 | 2452 | -- |
| 10 | 2457 | -- |
| 11 | 2462 | -- |



Frequency allocation for 802.11a:

| Channel Number | Frequency (MHz) | Turbo mode Frequency (MHz) |
|----------------|-----------------|----------------------------|
| 36 | 5180 | 5210 |
| 40 | 5200 | -- |
| 44 | 5220 | -- |
| 48 | 5240 | 5250 |
| 52 | 5260 | -- |
| 56 | 5280 | 5290 |
| 60 | 5300 | |
| 64 | 5320 | |
| 149 | 5745 | |
| 153 | 5765 | 5760 |
| 157 | 5785 | -- |
| 161 | 5805 | 5800 |

2.2.2 Bluetooth Transmitter Specifications

Transmitter#2: Bluetooth
Model Number: UGXZ5-102A
Manufacturer: Fujitsu Ltd
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 (YCE-5008)
Max. Output Power: 12 dBm
Reference Oscillator: 16 MHz (Built-in)
Power Supply: 3.3 VDC from host.

Frequency allocation:

| Channel Number | Frequency (MHz) |
|----------------|-----------------|
| 1 | 2402 |
| 2 | 2403 |
| 3 | 2404 |
| . | . |
| . | . |
| . | . |
| 39 | 2440 |
| 40 | 2441 |
| 41 | 2442 |
| . | . |
| . | . |
| . | . |
| 77 | 2478 |
| 78 | 2479 |
| 79 | 2480 |



2.3 Operational Description

The EUT is a Stylistic ST Series Pentablet PC, Model: ST5021D / ST5020D / ST5022D (Ocampa3) installed with a Mini-PCI Wireless LAN (WLAN) Module (Atheros 11a+b/g, Model WLL4030) & Bluetooth, Model UGXZ5-102A.

The WLAN module is an OEM product from Askey Computer Corp., which is already certified by the manufacturer FCC ID: H8NWLL4030 and IC: 1353A-WLL4030. The same WLAN radio module and antenna has been previously certified by Fujitsu for the same series host tablet PC (FCC ID: EJE-WL0004 and IC: 337J-WL0004). The radiating elements environment also is identical. The host CPU speed has been upgraded from 1.0GHz to 1.1GHz.

The same ALPS Bluetooth also has been previously certified by the manufacturer, Fujitsu Ltd under FCC ID: EJE-WB0002 and IC: 337J-WB0002 for a different host.

The intention of re-certifying is due to the addition of a Bluetooth transmitter module to this host and the host CPU upgrade.

The measurements reported in this test report are for (Atheros 11a+b/g, Model WLL4030) WLAN and Bluetooth (UGXZ5-102A) with Monopole Ceramic Chip antenna in Host PC, Stylistic ST Series Pentablet PC. The WLAN test results are same as the testing performed for FCC ID: EJE-WL0004 and IC: 337J-WL0004 certification.

The model ST5021D is with 10.4" LCD screen and models ST5020D / ST5022D is with a 12.1" LCD screen. All models are identical except the screen size as indicated above. The transmitters / antenna locations, structure, operation, etc are identical on all models.

2.4 Test Configuration

The Askey software and the BlueSuiteCasira software were used to set-up the WLAN module and Bluetooth devices respectively to continuously transmit during the tests. The LCD screen was observed for the transmitter status shown for the respective software.

Data Transmission is always initiated by software, which is then passed down through the MAC, through the digital and analog baseband, finally to the RF chip. Several special packets (ACKs, CTS, PSpoll, etc) are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which then turns off at the end of the packet. Therefore, the transmitter will be ON only while one of the four mentioned packets is being transmitted.

Antenna

The Atheros (11a+b/g) WLAN, Model WLL4030 and ALPS Bluetooth device, Model UGXZ5-102A are configured with Monopole Ceramic Chip Antenna – YCE 5008. The installation of the OEM WLAN module, Bluetooth Device and the Antenna in Fujitsu Stylistic ST Series Pentablet PC, (Ocampa3) is in a controlled environment. The installation is performed during the production/assembly process at the Fujitsu factory.

Refer to Appendix F – Antenna Information.

AC Adapter

The AC adapter SEC80N2-16.0 was used for all the tests. This adapter is also identified as CP171180-01. Details of the AC adapters are supplied in section 2.1 of this report. The manufacturer has stated that the alternate model number: CP171180-01 of this adapter is identical electrically and mechanically.

2.5 Block Diagram

Refer to Appendix D - Block Diagram



2.6 Support Equipment

External Monitor/s:

Conducted EMI IPEX, Model H566, FCC ID: GKR567
Radiated EMI TATUNG Monitor, Model: CM15VDE
Serial: 11470186

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

USB Scanner:

Rapidscan Mobile Colour scanner, M/N FPCSCN01, S/N DF1700100

Headphones:

Verbatim Multimedia Stereo headset

PCMCIA Slot:

6 MB Compact flash card with Adapter, Apacer P/N 88.10200030

Memory Card:

Secure Digital- 32 MB

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 (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.

2.11 Ambients at OATS

The Open Area Test Site (OATS) is an area of low background ambient signals. No significant broadband ambients are present however commercial radio and TV signals exceed the limit in the FM radio, VHF and UHF television bands. Radiated prescan measurements were performed in the shielded enclosure to check for possible radiated emissions at the frequencies where the OATS ambient signals exceeded the test limit.



RESULTS

WLAN Module - WLL4030 (802.11a of Atheros 11a+b/g)

1.0 CONDUCTED EMISSION MEASUREMENTS

Testing was performed in accordance with the requirements of FCC Part 15.207

1.1 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.

1.2 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.

1.3 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.

1.4 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.

1.5 Results of Conducted Emission Measurements (AC Mains Ports)

Conducted Emission Measurements were performed on the Stylistic ST Series Pentablet PC, (Ocampa3) with WLAN module (Atheros 11a+b/g, WLL4030) and Bluetooth (UGXZ5-102A).

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in emissions were observed. Final testing was performed while the WLAN transmitter continuously operated with the modulation rate of 6 Mbps (BPSK) and the Bluetooth transmitter continuously operated.

Result: The worst case conducted EMI complied with the quasi peak and average limits by margins of >10 dB. The measurement uncertainty was ± 2.0 dB. Refer to Appendix I for plots of the conducted EMI measurements.



2.0 RADIATED EMISSION MEASUREMENTS

2.1 Test Procedure

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

Radiated emission measurements were performed to the limits as per section 15.209 and 15.407. The measurements were made at the open area test site.

The EUT was set up on the table top (placed on turntable) of total height 80 cm above the ground plane, and operated as described in section 2 of this report. The EMI Receiver was operated under software control via the PC Controller through the IEEE.488 Interface Bus Card Adaptor. The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. 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 40 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.

2.2 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:

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

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



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

2.3.1 Frequency Band: 1 – 40 GHz

All measurements above 1 GHz were initially made over a distance of 3 metres. This was decreased to 1.0 metre as the emission levels from the device were very low.

The 54 dB μ V/m limit at 3 metres has been converted to 64 dB μ V/m at 1 metre using a factor of 20 dB per decade where emissions were located in the restricted bands.

The peak limits for undesirable emission outside of the restricted bands are –27 dBm (68.3 dB μ V/m @ 3m), except emissions within 10MHz of operating frequency range of 5.725 – 5825 GHz are –17 dBm (78.3 dB μ V/m @ 3m).

Measurements were performed on two frequency bands (5.15 - 5.35 GHz and 5.725 - 5.825 GHz)

Testing was performed while both the WLAN transmitter and Bluetooth transmitter continuously operated. Harmonics related to the WLAN transmitter are reported below. For harmonics related to the Bluetooth transmitter, refer to M040603_Cert_Ocampa3_BT_Atheros.

The field strength at 5825 MHz when the EUT was operating at its highest channel (5805 MHz), was 52.3 dB μ V/m peak (noise floor) and was > 20 dB below the maximum field strength of the in-band carrier.

The field strength at 5150 MHz when the EUT was operating at its lowest channel (5180 MHz), was 50.8 dB μ V/m peak (noise floor) and was > 20 dB below the maximum field strength of the in-band carrier.

2.3.1.1 Configuration 802.11a - Normal Operating Mode

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in emissions were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 54 Mbps (64QAM).

Channel 36 – 5180 MHz

| Frequency MHz | Level dB μ V/m | | Antenna Polarization | Peak Limit dB μ V/m | Average Limit dB μ V/m | Result |
|------------------|-----------------------|---------------------|-------------------------|-------------------------------|----------------------------------|--------|
| | Peak Detector | Average Detector | | | | |
| 5180 | Transmitter | Fundamental | | | | |
| 10360 | 60.4 | 46.9 | Vert/Hort | 68.3 | - | Pass |
| 15540 | 62.1 | 47.6 | Vert/Hort | 74.0 | 54.0 | Pass |
| 20720 | 64.5 | 49.5 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 25900 | 68.8 | 54.2 | Vert/Hort | 78.3* (1m) | - | Pass |
| 31080 | 65.3 | 52.1 | Vert/Hort | 78.3* (1m) | - | Pass |
| 36260 | 70.1 | 55.4 | Vert/Hort | 78.3* (1m) | - | Pass |

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



Channel 52 – 5260 MHz

| Frequency MHz | Level dBuV/m | | Antenna Polarization | Peak Limit dBuV/m | Average Limit dBuV/m | Result |
|---------------|---------------|------------------|----------------------|-------------------|----------------------|--------|
| | Peak Detector | Average Detector | | | | |
| 5260 | Transmitter | Fundamental | | | | |
| 10520 | 59.7 | 46.6 | Vert/Hort | 68.3 | - | Pass |
| 15780 | 61.0 | 47.5 | Vert/Hort | 74.0 | 54.0 | Pass |
| 21040 | 64.6 | 49.3 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 26300 | 68.3 | 54.4 | Vert/Hort | 78.3* (1m) | - | Pass |
| 31560 | 65.8 | 52.0 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 36820 | 70.2 | 55.4 | Vert/Hort | 78.3* (1m) | - | Pass |

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

Channel 64 – 5320 MHz

| Frequency MHz | Level dBuV/m | | Antenna Polarization | Peak Limit dBuV/m | Average Limit dBuV/m | Result |
|---------------|---------------|------------------|----------------------|-------------------|----------------------|--------|
| | Peak Detector | Average Detector | | | | |
| 5320 | Transmitter | Fundamental | | | | |
| 10640 | 60.4 | 47.3 | Vert/Hort | 74.0 | 54.0 | Pass |
| 15960 | 61.8 | 47.9 | Vert/Hort | 74.0 | 54.0 | Pass |
| 21280 | 65.7 | 50.6 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 26600 | 61.1 | 46.2 | Vert/Hort | 78.3* (1m) | - | Pass |
| 31920 | 66.6 | 52.5 | Vert/Hort | 78.3* (1m) | - | Pass |
| 37240 | 69.8 | 54.7 | Vert/Hort | 78.3* (1m) | - | Pass |

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

Channel 149 – 5745 MHz

| Frequency MHz | Level dBuV/m | | Antenna Polarization | Peak Limit dBuV/m | Average Limit dBuV/m | Result |
|---------------|---------------|------------------|----------------------|-------------------|----------------------|--------|
| | Peak Detector | Average Detector | | | | |
| 5745 | Transmitter | Fundamental | | | | |
| 11490 | 62.5 | 48.2 | Vert/Hort | 74.0 | 54.0 | Pass |
| 17235 | 64.1 | 47.7 | Vert/Hort | 68.3 | - | Pass |
| 22980 | 66.9 | 48.5 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 28725 | 61.4 | 51.3 | Vert/Hort | 78.3* (1m) | - | Pass |
| 34470 | 68.7 | 54.9 | Vert/Hort | 78.3* (1m) | - | Pass |

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

Channel 157 – 5785 MHz

| Frequency MHz | Level dBuV/m | | Antenna Polarization | Peak Limit dBuV/m | Average Limit dBuV/m | Result |
|---------------|---------------|------------------|----------------------|-------------------|----------------------|--------|
| | Peak Detector | Average Detector | | | | |
| 5785 | Transmitter | Fundamental | | | | |
| 11570 | 61.0 | 47.8 | Vert/Hort | 74.0 | 54.0 | Pass |
| 17355 | 63.1 | 47.4 | Vert/Hort | 68.3 | - | Pass |
| 23140 | 66.7 | 48.2 | Vert/Hort | 78.3* (1m) | - | Pass |
| 28925 | 61.3 | 46.5 | Vert/Hort | 78.3* (1m) | - | Pass |
| 34710 | 68.8 | 53.9 | Vert/Hort | 78.3* (1m) | - | Pass |

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

Channel 161 – 5805 MHz

| Frequency MHz | Level dBuV/m | | Antenna Polarization | Peak Limit dBuV/m | Average Limit dBuV/m | Result |
|---------------|---------------|------------------|----------------------|-------------------|----------------------|--------|
| | Peak Detector | Average Detector | | | | |
| 5805 | Transmitter | Fundamental | | | | |
| 11610 | 61.2 | 47.5 | Vert/Hort | 74.0 | 54.0 | Pass |
| 17415 | 63.6 | 47.6 | Vert/Hort | 68.3 | - | Pass |
| 23220 | 66.0 | 48.8 | Vert/Hort | 78.3* (1m) | - | Pass |
| 29025 | 62.4 | 47.1 | Vert/Hort | 78.3* (1m) | - | Pass |
| 34830 | 68.5 | 54.0 | Vert/Hort | 78.3* (1m) | - | Pass |

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

Result: Harmonics were recorded within the restricted bands of up to 40 GHz and complied with the FCC Class B limits by a margin of 5.8 dB. Harmonics were below the limit in section 15.209 and 15.407. The measurement uncertainty for radiated emissions in this band was ± 4.1 dB.

2.3.1.2 Configuration 802.11a – Turbo Operating Mode

Testing was performed while the transmitter continuously operated with the modulation rate of 108 Mbps (Turbo).

Channel 36 – 5210 MHz

| Frequency MHz | Level dBuV/m | | Antenna Polarization | Peak Limit dBuV/m | Average Limit dBuV/m | Result |
|---------------|---------------|------------------|----------------------|-------------------|----------------------|--------|
| | Peak Detector | Average Detector | | | | |
| 5210 | Transmitter | Fundamental | | | | |
| 10420 | 63.1 | 48.3 | Vert/Hort | 68.3 | - | Pass |
| 15630 | 62.4 | 47.0 | Vert/Hort | 74.0 | 54.0 | Pass |
| 20840 | 65.6 | 50.1 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 26050 | 68.9 | 54.7 | Vert/Hort | 78.3* (1m) | - | Pass |
| 31260 | 65.5 | 52.2 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 36470 | 70.1 | 55.8 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |

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



Channel 48 – 5250 MHz

| Frequency MHz | Level dBuV/m | | Antenna Polarization | Peak Limit dBuV/m | Average Limit dBuV/m | Result |
|---------------|---------------|------------------|----------------------|-------------------|----------------------|--------|
| | Peak Detector | Average Detector | | | | |
| 5250 | Transmitter | Fundamental | | | | |
| 10500 | 62.6 | 48.0 | Vert/Hort | 68.3 | - | Pass |
| 15750 | 62.5 | 46.8 | Vert/Hort | 74.0 | 54.0 | Pass |
| 21000 | 65.9 | 50.3 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 26250 | 68.2 | 54.7 | Vert/Hort | 78.3* (1m) | - | Pass |
| 31500 | 65.7 | 52.1 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 36750 | 70.3 | 56.5 | Vert/Hort | 78.3* (1m) | - | Pass |

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

Channel 56 – 5290 MHz

| Frequency MHz | Level dBuV/m | | Antenna Polarization | Peak Limit dBuV/m | Average Limit dBuV/m | Result |
|---------------|---------------|------------------|----------------------|-------------------|----------------------|--------|
| | Peak Detector | Average Detector | | | | |
| 5290 | Transmitter | Fundamental | | | | |
| 10580 | 62.2 | 48.1 | Vert/Hort | 68.3 | - | Pass |
| 15870 | 62.2 | 47.1 | Vert/Hort | 74.0 | 54.0 | Pass |
| 21160 | 66.5 | 51.4 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 26450 | 68.7 | 54.8 | Vert/Hort | 78.3* (1m) | - | Pass |
| 31740 | 65.5 | 52.3 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 37030 | 70.0 | 56.5 | Vert/Hort | 78.3* (1m) | - | Pass |

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

Channel 153 – 5760 MHz

| Frequency MHz | Level dBuV/m | | Antenna Polarization | Peak Limit dBuV/m | Average Limit dBuV/m | Result |
|---------------|---------------|------------------|----------------------|-------------------|----------------------|--------|
| | Peak Detector | Average Detector | | | | |
| 5760 | Transmitter | Fundamental | | | | |
| 11520 | 64.8 | 49.8 | Vert/Hort | 74.0 | 54.0 | Pass |
| 17280 | 64.3 | 48.1 | Vert/Hort | 68.3 | - | Pass |
| 23040 | 66.0 | 48.7 | Vert/Hort | 84.0* (1m) | 64.0* (1m) | Pass |
| 28800 | 61.6 | 46.4 | Vert/Hort | 78.3* (1m) | - | Pass |
| 34560 | 69.5 | 54.7 | Vert/Hort | 78.3* (1m) | - | Pass |

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



Channel 161 – 5800 MHz

| Frequency MHz | Level dBuV/m | | Antenna Polarization | Peak Limit dBuV/m | Average Limit dBuV/m | Result |
|------------------|------------------|---------------------|-------------------------|-------------------------|----------------------------|--------|
| | Peak Detector | Average Detector | | | | |
| 5800 | Transmitter | Fundamental | | | | |
| 11600 | 63.7 | 49.0 | Vert/Hort | 74.0 | 54.0 | Pass |
| 17400 | 64.1 | 48.2 | Vert/Hort | 78.3* (1m) | - | Pass |
| 23200 | 66.4 | 48.9 | Vert/Hort | 78.3* (1m) | - | Pass |
| 29000 | 62.5 | 46.7 | Vert/Hort | 78.3* (1m) | - | Pass |
| 34800 | 69.3 | 54.1 | Vert/Hort | 78.3* (1m) | - | Pass |

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

Result: Harmonics were recorded within the restricted bands of up to 40 GHz and complied with the FCC Class B limits by a margin of 4.2 dB. Harmonics were below the limit in section 15.209 and 15.407. The measurement uncertainty for radiated emissions in this band was ± 4.1 dB.



2.3.2 Frequency Band: 30 - 1000 MHz

Testing was performed at a distance of 10 metres.

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in emissions were observed. Final testing was performed while the transmitter continuously operated on channel 36 (5180 MHz - normal operating mode) with the modulation rate of 54 Mbps (64QAM) and the Bluetooth transmitter continuously operated on the low (Channel 1, 2402 MHz) frequency channel.

The reported frequencies in the tables below are mainly concerned with the Host PC emissions and not directly related to the Atheros WLAN module & Bluetooth emissions.

Vertical Polarity

| Frequency MHz | Polarisation | QP Measured dB μ V/m | QP Limit dB μ V/m | Δ QP \pm dB |
|---------------|--------------|--------------------------|-----------------------|----------------------|
| 400.00 | Vertical | 29.4 | 36.0 | -6.6 |
| 57.29 | Vertical | 23.3 | 30.0 | -6.7 |
| 107.11 | Vertical | 24.7 | 33.5 | -8.8 |
| 333.50 | Vertical | 26.6 | 36.0 | -9.4 |
| 452.33 | Vertical | 25.4 | 36.0 | -10.6 |
| 108.40 | Vertical | 22.9 | 33.5 | -10.6 |
| 79.08 | Vertical | 18.8 | 30.0 | -11.2 |
| 110.84 | Vertical | 22.0 | 33.5 | -11.5 |
| 123.11 | Vertical | 20.9 | 33.5 | -12.6 |
| 57.63 | Vertical | 16.7 | 30.0 | -13.3 |
| 156.50 | Vertical | 19.2 | 33.5 | -14.3 |

Horizontal Polarity

| Frequency MHz | Polarisation | QP Measured dB μ V/m | QP Limit dB μ V/m | Δ QP \pm dB |
|---------------|--------------|--------------------------|-----------------------|----------------------|
| 334.43 | Horizontal | 34.4 | 36.0 | -1.7 |
| 601.39 | Horizontal | 31.2 | 36.0 | -4.8 |
| 788.85 | Horizontal | 30.2 | 36.0 | -5.8 |
| 787.12 | Horizontal | 29.9 | 36.0 | -6.1 |
| 386.24 | Horizontal | 25.1 | 36.0 | -11.0 |
| 108.02 | Horizontal | 17.8 | 33.5 | -15.7 |
| 48.72 | Horizontal | 11.3 | 30.0 | -18.7 |
| 111.34 | Horizontal | 14.6 | 33.5 | -18.9 |

Result: The highest radiated emission peak occurred at 334.43 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

2.3.3 RF Conducted Measurements at the antenna terminal

In the 100 kHz bandwidth within the operating band, the highest emissions (spurious/harmonics) level that is produced by the intentional radiator shall be at least 20 dB below.

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

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

Refer to Appendix N for Harmonics plots

Result: Complies.

2.3.4 Band Edge Measurements

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

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

Testing was performed while transmitter continuously transmitted on a low and high frequency channel of two frequency bands (5.150 – 5.350 GHz and 5.725 – 5.825 GHz)

2.3.3.1 Configuration 802.11a - Normal Operating Mode

Band1: 5.150 – 5.350 GHz

Refer to Appendix K for Band Edge plots

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

Band2: 5.725 – 5.825 GHz

Refer to Appendix K for Band Edge plots

NB: D1 indicates the limit line for undesirable emission frequencies within 10 MHz above or below the band edge of the operation frequency band.

D2 indicates the limit line for undesirable emission frequencies 10 MHz or greater above or below the band edge of the operation frequency band.

2.3.3.2 Configuration 802.11a - Turbo Operating Mode

Band1: 5.150 – 5.350 GHz

Refer to Appendix K for Band Edge plots

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

Band2: 5.725 – 5.825 GHz

Refer to Appendix K for Band Edge plots

NB: D1 indicates the limit line for undesirable emission frequencies within 10 MHz above or below the band edge of the operation frequency band.

D2 indicates the limit line for undesirable emission frequencies 10 MHz or greater above or below the band edge of the operation frequency band.

Result: Complies.



3.0 PEAK OUTPUT POWER - Section 15.407 (a)

Testing was performed in accordance with the requirements of FCC Part 15.407(a)(4)

Measurements were performed while the WLAN transmitter continuously transmitted.

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

The resolution bandwidth of 1 MHz and the video bandwidth of 10 MHz were utilised.

The Peak Output Power (P) was calculated as follows:

$$P = R + G + C \quad \text{where} \quad \begin{array}{l} R \text{ is the recorded peak power} \\ G \text{ is the antenna gain in dBi \& } \\ C \text{ is the cable loss} \end{array}$$

Measurements were performed on two frequency bands (5.150 – 5.350 GHz and 5.725 – 5.825 GHz)

3.1 Configuration 802.11a – Normal Operating Mode

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in peak transmit power were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 54 Mbps (64QAM).

| Frequency MHz | A dBm | Cable Loss dB | G dBi | P dBm | Limit dBm | P mW | Limit mW |
|---------------|-------|---------------|-------|-------|-----------|-------|----------|
| 5180 | 13.4 | -1.0 | 1.51 | 13.91 | 17 | 24.60 | 50 |
| 5260 | 15.5 | -1.0 | 1.51 | 16.01 | 24 | 39.90 | 250 |
| 5320 | 15.8 | -1.0 | 1.51 | 16.31 | 24 | 42.76 | 250 |
| 5745 | 15.0 | -1.0 | 4.91 | 18.91 | 30 | 77.80 | 1000 |
| 5785 | 15.7 | -1.0 | 4.91 | 19.61 | 30 | 91.41 | 1000 |
| 5805 | 15.6 | -1.0 | 4.91 | 19.51 | 30 | 89.33 | 1000 |

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.

Result: Complies.

3.2 Configuration 802.11a – Turbo Operating Mode

Testing was performed while the transmitter continuously operated with the modulation rate of 108 Mbps (Turbo).

| Frequency MHz | A dBm | Cable Loss dB | G dBi | P dBm | Limit dBm | P mW | Limit mW |
|---------------|-------|---------------|-------|-------|-----------|-------|----------|
| 5210 | 12.8 | -1.0 | 1.51 | 13.31 | 17 | 21.43 | 50 |
| 5250 | 12.9 | -1.0 | 1.51 | 13.41 | 17 | 21.93 | 250 |
| 5290 | 13.3 | -1.0 | 1.51 | 13.81 | 24 | 24.04 | 250 |
| 5760 | 13.6 | -1.0 | 4.91 | 17.51 | 30 | 56.36 | 1000 |
| 5800 | 13.8 | -1.0 | 4.91 | 17.71 | 30 | 59.02 | 1000 |

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.

Result: Complies.



4.0 CHANNEL BANDWIDTH

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

The 26 dB bandwidth was measured while the transmitter continuously transmitted.

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

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

Measurements were performed on two frequency bands (5.150 – 5.350 GHz and 5.725 – 5.825 GHz)

4.1 Configuration 802.11a – Normal Operating Mode

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in bandwidth were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 54 Mbps (64QAM).

| Channel | Frequency MHz | Bandwidth MHz | 26 dB Bandwidth Plots |
|---------|---------------|---------------|-----------------------|
| 36 | 5180 | 26.05 | Appendix J |
| 52 | 5260 | 24.45 | Appendix J |
| 64 | 5320 | 24.05 | Appendix J |
| 149 | 5745 | 24.75 | Appendix J |
| 157 | 5785 | 26.05 | Appendix J |
| 161 | 5805 | 25.35 | Appendix J |

4.2 Configuration 802.11a – Turbo Operating Mode

Testing was performed while the transmitter continuously operated with the modulation rate of 108 Mbps (Turbo).

| Channel | Frequency MHz | Bandwidth MHz | 26 dB Bandwidth Plots |
|---------|---------------|---------------|-----------------------|
| 36 | 5210 | 42.18 | Appendix J |
| 48 | 5250 | 42.59 | Appendix J |
| 56 | 5290 | 42.08 | Appendix J |
| 153 | 5760 | 42.69 | Appendix J |
| 161 | 5800 | 41.78 | Appendix J |

5.0 RADIO FREQUENCY EXPOSURE (HAZARD) INFORMATION

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

Spread spectrum transmitters operating in the 5.150 – 5.350 GHz and 5.725 – 5.825 GHz 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).

In accordance with this section and also section 2.1091 this device has been defined as a mobile 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.

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

where: P_d = power density (mW/cm²)

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 3.0 of this report. (WLAN Module):

Maximum peak output power = 19.61dBm = 91.41mW

Antenna (Inverted-F) gain (typical) = 4.91 dBi = 3.097 numeric

Prediction distance = 4.87 cm

Prediction frequency = 5785 MHz

MPE limit for uncontrolled exposure at prediction frequency = 1 mW/cm²

Therefore, the power density at prediction frequency (P_d) = 0.950 mW/cm²

The result was extracted from section 3.0 of EMC Technologies Report No: M040603_Cert_Ocampa3_BT_Atheros (Bluetooth):

Maximum peak output power = 10.75dBm = 12.0mW

Antenna (Inverted-F) gain (typical) = 0.12 dBi = 1.03 numeric

Prediction distance = 4.87 cm

Prediction frequency = 2441 MHz

MPE limit for uncontrolled exposure at prediction frequency = 1 mW/cm²

Therefore, the power density at prediction frequency (P_d) = 0.041 mW/cm²

The total power density (TPd) for WLAN and Bluetooth transmitters continuously operated:

$TP_d = 0.950 \text{ (WLAN)} + 0.041 \text{ (Bluetooth)} = 0.991 \text{ mW/cm}^2$

Calculations show that this portable device with described antenna must have a minimum of 4.87 cm clearance between the user and the device.

SAR testing was performed in accordance with OET Bulletin 65 and reported under EMC Technologies M040630_Ocampa3_Atheros_SAR_5.2. The highest SAR value was 1.29 mW/g which complies with the FCC human exposure requirements of 47 CFR 2.1093 (d).

Refer to EMC Technologies' report - M040630_Ocampa3_Atheros_SAR_5.2 for details of SAR compliance.

Results: Complies



6.0 PEAK POWER SPECTRAL DENSITY - Section 15.407 (a)

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

The peak transmit power was measured over an interval of continuous transmission using a calibrated spectrum analyser with the resolution bandwidth of 1 MHz and the video bandwidth of 3 MHz.

The transmitter output was connected to the spectrum analyser with a span setting to capture the entire emission bandwidth of the signal. The peak transmit power was recorded in dBm.

Measurements were performed on two frequency bands (5.150 – 5.350 GHz and 5.725 – 5.825 GHz)

6.1 Configuration 802.11a – Normal Operating Mode

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in peak power spectral density were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 54 Mbps (64QAM).

| Channel | Frequency MHz | Peak Power Spectral Density (dBm) | Limit (dBm) | Result | Spectral Density plots |
|---------|---------------|-----------------------------------|-------------|----------|------------------------|
| 36 | 5180 | 0.71 | 4.0 | Complies | Appendix L |
| 52 | 5260 | 0.65 | 11.0 | Complies | Appendix L |
| 64 | 5320 | 0.69 | 11.0 | Complies | Appendix L |
| 149 | 5745 | 1.59 | 17.0 | Complies | Appendix L |
| 157 | 5785 | 1.77 | 17.0 | Complies | Appendix L |
| 161 | 5805 | 1.39 | 17.0 | Complies | Appendix L |

Result: Complies.

6.2 Configuration 802.11a – Turbo Operating Mode

Testing was performed while the transmitter continuously operated with the modulation rate of 108 Mbps (Turbo).

| Channel | Frequency MHz | Peak Power Spectral Density (dBm) | Limit (dBm) | Result | Spectral Density plots |
|---------|---------------|-----------------------------------|-------------|----------|------------------------|
| 36 | 5210 | -1.34 | 4.0 | Complies | Appendix L |
| 48 | 5250 | -0.94 | 4.0 | Complies | Appendix L |
| 56 | 5290 | -1.15 | 11.0 | Complies | Appendix L |
| 153 | 5760 | -0.48 | 17.0 | Complies | Appendix L |
| 161 | 5800 | 0.41 | 17.0 | Complies | Appendix L |

Result: Complies.



7.0 PEAK EXCURSION - Section 15.407 (a)

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

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

The peak transmit power was measured over an interval of continuous transmission using a calibrated spectrum analyser with the resolution bandwidth of 1 MHz and the video bandwidth of 3 MHz for Trace 1 and video bandwidth of 300 kHz for Trace 2. The difference between Trace 1 and Trace 2 was recorded.

Measurements were performed on two frequency bands (5.150 – 5.350 GHz and 5.725 – 5.825 GHz)

7.1 Configuration 802.11a – Normal Operating Mode

Initial investigations were performed with four modulation types: (BPSK, QPSK, 16QAM and 64QAM). No significant differences in peak excursion were observed. Final testing was performed while the transmitter continuously operated with the modulation rate of 54 Mbps (64QAM).

| Channel | Frequency MHz | Peak Power Excursion (dB) | Limit (dB) | Result | Spectral Density plots |
|---------|---------------|---------------------------|------------|----------|------------------------|
| 36 | 5180 | 3.55 | 13.0 | Complies | Appendix M |
| 52 | 5260 | 3.25 | 13.0 | Complies | Appendix M |
| 64 | 5320 | 3.39 | 13.0 | Complies | Appendix M |
| 149 | 5745 | 3.39 | 13.0 | Complies | Appendix M |
| 157 | 5785 | 3.34 | 13.0 | Complies | Appendix M |
| 161 | 5805 | 3.41 | 13.0 | Complies | Appendix M |

Result: Complies.

7.2 Configuration 802.11a – Turbo Operating Mode

Testing was performed while the transmitter continuously operated with the modulation rate of 108 Mbps (Turbo).

| Channel | Frequency MHz | Peak Power Excursion (dB) | Limit (dB) | Result | Spectral Density plots |
|---------|---------------|---------------------------|------------|----------|------------------------|
| 36 | 5210 | 3.52 | 13.0 | Complies | Appendix M |
| 48 | 5250 | 2.94 | 13.0 | Complies | Appendix M |
| 56 | 5290 | 3.97 | 13.0 | Complies | Appendix M |
| 153 | 5760 | 2.90 | 13.0 | Complies | Appendix M |
| 161 | 5800 | 3.32 | 13.0 | Complies | Appendix M |

Result: Complies.

8.0 FREQUENCY STABILITY

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

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

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

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

Measurements were performed on two frequency bands (5.150 – 5.350 GHz and 5.725 – 5.825 GHz)

8.1 Configuration 802.11a – Normal Operating Mode

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

| Channel | Frequency MHz | Maximum Frequency Deviation kHz | Maximum Deviation % | $\pm 0.02\%$ Limit kHz | Result |
|---------|---------------|---------------------------------|---------------------|------------------------|----------|
| 36 | 5180 | 355 | 0.007 | 1036 | Complies |
| 52 | 5260 | 357 | 0.007 | 1052 | Complies |
| 64 | 5320 | 391 | 0.007 | 1064 | Complies |
| 149 | 5745 | 496 | 0.009 | 1149 | Complies |
| 157 | 5785 | 520 | 0.009 | 1157 | Complies |
| 161 | 5805 | 539 | 0.009 | 1161 | Complies |

Result: Complies.

8.2 Configuration 802.11a – Turbo Operating Mode

Testing was performed while the transmitter continuously operated with the modulation rate of 108 Mbps (Turbo).

| Channel | Frequency MHz | Maximum Frequency Deviation kHz | Maximum Deviation % | $\pm 0.02\%$ Limit kHz | Result |
|---------|---------------|---------------------------------|---------------------|------------------------|----------|
| 36 | 5210 | 388 | 0.007 | 1042 | Complies |
| 48 | 5250 | 412 | 0.008 | 1050 | Complies |
| 56 | 5290 | 421 | 0.008 | 1058 | Complies |
| 153 | 5760 | 575 | 0.010 | 1152 | Complies |
| 161 | 5800 | 604 | 0.010 | 1160 | Complies |

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 Stylistic ST Series Pentablet PC, Model: ST5021D / ST5020D / ST5022D (Ocampa3) with Mini-PCI Wireless LAN Module (Atheros 11a+b/g), Model WLL4030 & Bluetooth, Model UGXZ5-102A, tested on behalf of Fujitsu Australia Ltd, **comply** with the requirements of 47 CFR, Part 15 Subpart E -Section 15.407 (5.15-5.35 GHz and 5.725-5.825 GHz bands).

The test sample also complies with the Industry Canada RSS-210 issue 5 (Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands)) clause 6.2.2(q1) 5150-5350 MHz and 5725-5825 MHz Local Area Network Devices requirements and the RF exposure requirements of RSS-102.

Results were as follows:

WLAN, Atheros 802.11a - FCC PART 15 Subpart E (Section 15.407)

| FCC Part 15, Subpart E Clauses | Industry Canada RSS-210 Clauses | Test Performed | Result |
|--------------------------------|---------------------------------|-----------------------------------|---------------------------------|
| 15.203 | 5.5 | Antenna Requirement | Not Applicable |
| 15.205 | 6.3 | Operation in Restricted Bandwidth | Complies |
| 15.207 | 6.6 | Conducted Emissions | Complies |
| 15.209 | 6.3 | Radiated Emissions | Complies |
| 15.407 (a)(4) | 6.2.2(q1) | Peak Transmit Power | Complies |
| 15.407 (a)(5) | 6.2.2(q1) | Peak Power Spectral Density | Complies |
| 15.407 (a)(6) | | Peak Excursion | Complies |
| 15.407 (b) | 6.2.2(q1) | Undesirable Emission | Complies |
| 15.407 (f) | | Radio Frequency Hazard | *Complies with SAR requirements |
| 15.407 (g) | 6.4 | Frequency Stability | Complies |

*Refer to EMC Technologies Report No: M040630_Ocampa3_Atheros_5.2

The results for Atheros 802.11b/g and Bluetooth are reported separately.

Refer to EMC Technologies' test report: M040603_Cert_Ocampa3_Atheros_2.4_BT (802.11b/g) and M040603_Cert_Ocampa3_BT_Atheros (Bluetooth).



TEST REPORT APPENDICES

APPENDIX A: MEASUREMENT INSTRUMENTATION DETAILS
APPENDIX B: REPORT PHOTOGRAPHS
APPENDIX C: FUNCTIONAL DESCRIPTION
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APPENDIX E: SCHEMATICS
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APPENDIX O: USER MANUAL

Attachment 1: RF Exposure Information

Attachment 2: FCC DOC for Stylistic ST Series Pentablet PC (Ocampa3).

