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## EMI TEST REPORT FOR CERTIFICATION to FCC PART 15 Subpart C (Section 15.247)

FCC ID: W8I-ADPC2400R9

**Radio Module:** BTMM3C1XX Bluetooth

Test Sample: XSports 2400  
Model: ADPC2400

Report Number: M090227\_Cert\_XSports\_2400

Issue Date: 25<sup>th</sup> March 2009

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**EMI TEST REPORT FOR CERTIFICATION  
to  
FCC PART 15 Subpart C (Section 15.247)**

**EMC Technologies Report No. M090227\_Cert\_XSports\_2400**

**Issue Date: 25<sup>th</sup> March 2009**

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Accreditation No. 5292

**EMI TEST REPORT FOR CERTIFICATION  
to  
FCC PART 15 Subpart C (Section 15.247)**

**Report No. M090227\_Cert\_XSports\_2400**

**Test Sample:** XSports 2400  
**Model:** ADPC2400

**Radio Module:** BTMM3C1XX Bluetooth from Windigo Systems

**FCC ID:** W8I-ADPC2400R9  
**Equipment Type:** Intentional Radiator

**Tested For:** Phicom Pty Ltd  
**Address:** 83 Wood Street  
Eaglehawk VIC 3556  
**Contact:** Peter Crowhurst  
**Email:** Peter.crowhurst@phicom.com.au

**Test Standards:** FCC Part 15 – Radio Frequency Devices (July 2008)  
FCC Part 15 Subpart C - Intentional Radiators  
Section 15.247: 2400 – 2483.5 MHz Operation Bands  
ANSI C63.4 – 2003  
OET Bulletin No. 65

**Test Date:** 23<sup>rd</sup> February to 13<sup>th</sup> March 2009

**Senior Test Engineer:** Chieu Huynh  
B.Eng (Hons) Electronics

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

**Authorised Signatory:**   
Chieu Huynh  
Senior EMC Engineer  
EMC Technologies Pty Ltd

**EMI TEST REPORT FOR CERTIFICATION**  
**to**  
**FCC PART 15 Subpart C (Section 15.247)**

## 1.0 INTRODUCTION

EMI testing was performed on the XSports 2400, Model: ADPC2400 with Windigo Systems BTMM3C1XX Bluetooth.

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

47 CFR, Part 15, Subpart C:	Rules for intentional radiators (particularly section 15.247)
Section 15.203:	Antenna requirements
Section 15.205:	Restricted bands of operation
Section 15.207:	Conducted Emission Limits
Section 15.209:	Radiated Emission Limits (General requirements)
Section 15.247:	Operation in the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz

The test sample **complied** with the requirements of 47 CFR, Part 15 Subpart C - Section 15.247.

The measurement procedure used was in accordance with ANSI C63.4-2003 and OET Bulletin No. 65. The instrumentation conformed to the requirements of ANSI C63.2-1996.

## 1.1 Summary of Results

### FCC Subpart C, Section 15.247 - Bluetooth

FCC Part 15 Subpart C Clauses	Test Performed	Results
15.203	Antenna Requirement	<b>Complies</b>
15.205	Operation in Restricted Band	<b>Complies</b>
15.207	Conducted Emissions	<b>Not Applicable</b> Device is battery powered
15.209	Radiated Emissions	<b>Complies</b>
15.247 (a)(1)	Channel Occupancy/Bandwidth	<b>Complies</b>
15.247 (b)(1)	Peak Output Power	<b>Complies</b>
15.247 (c)	Antenna Gain > 6 dBi	<b>Not Applicable.</b> Antenna gain < 6 dBi
15.247 (d)	Out of Band Emissions	<b>Complies</b>
15.247 (e)	Peak Power Spectral Density	<b>Not Applicable.</b> Device is not digital modulated system
15.247 (f)	Hybrid Systems (Note 1)	<b>Not Applicable.</b> Device does not employ a hybrid system
15.247 (g)	Frequency Hopping	<b>Complies</b>
15.247 (h)	Frequency Hopping	<b>Complies</b>
15.247 (i)	Radio Frequency Hazard	<b>Complies</b>

**Note 1:** Hybrid systems are those that employ a combination of both frequency hopping and digital modulations technique.

## 1.2 Modifications

No modifications were required.



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## 2.0 GENERAL INFORMATION

(Information supplied by the Client)

### 2.1 Bluetooth Transmitter Details

<b>Transmitter:</b>	Bluetooth
<b>Model Number:</b>	BTMM3C1XX
<b>Manufacturer:</b>	Windigo Systems
<b>Modulation Type:</b>	Frequency Hopping Spread Spectrum (FHSS)
<b>Frequency Range:</b>	2402 MHz to 2480 MHz
<b>Number of Channels:</b>	79
<b>Carrier Spacing:</b>	1.0 MHz
<b>Antenna Type:</b>	Printed circuit board
<b>Antenna gain:</b>	Max antenna gain is -3 dBi.
<b>Output Power:</b>	20 dBm (Class 1)

**Frequency allocation:**

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

Power (Ext, Int) = 170, 42

\*Channels tested and reported.

### 2.2 XSports 2400 Details

<b>Name:</b>	XSports 2400
<b>Model Number:</b>	ADPC2400
<b>Serial Number:</b>	ADPC2400Rx
<b>Manufacturer:</b>	Phicom Pty Ltd
<b>Microprocessor Type:</b>	TMS320VC5501
<b>Crystal Frequency:</b>	10 MHz
<b>Real Time Clock:</b>	75 MHz
<b>Input Supply:</b>	Internal Battery

### 2.3 Test Configuration

The Bluetooth test software "BlueTest" was used to transmit continuously during the tests.

Measurements were performed while the transmitter transmits continuously.

### 2.4 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI C63.4-2003. Radiated emissions tests were performed at a distance of 1 and 3 metres from the EUT. OET Bulletin 65 dated June 2001 was used for reference.



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## 2.5 Test Facility

### 2.5.1 General

Radiated Emission measurements were performed at EMC Technologies open area test site (OATS) situated at Lerderderg Gorge, near the township of Bacchus Marsh in Victoria, Australia. Conducted measurements at an antenna ports were performed at EMC Technologies' laboratory in Tullamarine, Victoria Australia.

The above test sites have been accepted for testing by the Federal Communications Commission (FCC) - **FCC Registration Number 90560**.

EMC Technologies open area test site (OATS) has also been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS 212, Issue 1 (Provisional). **Industry Canada File Number IC 3569B-1**.

### 2.5.2 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) and cable locating equipment (15.213).***

The current full scope of accreditation can be found on the NATA website: [www.nata.asn.au](http://www.nata.asn.au). It also includes a large number of emissions, 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 Institute (NMI) and an internal quality system to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A<sup>2</sup>LA).

## 2.6 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 Institute (NMI). All equipment calibration is traceable to Australia national standards at the National Measurements Institute. The reference antenna calibration was performed by NMI 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

## 2.7 Ambients at OATS

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



## FCC 15.247 (DSS) RESULTS

### 3.0 CONDUCTED EMISSION MEASUREMENTS

Not applicable as device is battery powered.

### 4.0 RADIATED SPURIOUS EMISSION MEASUREMENTS

#### 4.1 Test Procedure

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

Radiated emission measurements were performed to the limits as per section 15.209 and 15.247. The measurements were made at the open area test site. Measurements were made over a distance of 3 and 1 metres.

A calibrated Biconical antenna was used for measurements between 30 MHz and 232 MHz, a calibrated Logperiodic antenna used for measurements between 230 MHz and 1000 MHz. Calibrated EMCO 3115 and ETS standard gain horn antennas were used for measurements between 1 to 25 GHz.

The measurement of emissions below 1000 MHz was measured using a following setting: RBW = 120 kHz and VBW = 300 kHz.

The measurement of emissions above 1000 MHz was measured using following settings:

Peak measurements setting: RBW = VBW = 1 MHz

Average measurements setting: RBW = 1 MHz and VBW = 100 Hz

The receiver bandwidth was set to 6 dB.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. When an emission was located, it was positively identified and its maximum level found by rotating the automated turntable, and by varying the antenna height. Each significant peak was investigated with the Quasi-Peak/Average Detectors. The software for cable losses automatically corrected the measurement data for each frequency range, antenna factors and preamplifier gain and all data was then stored on disk in sequential data files. This process was performed for both horizontal and vertical antenna polarisations.

#### 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 $\mu$ V/m.

**V** = EMI Receiver Voltage in dB $\mu$ 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 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 $\mu$ 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 Radiated Emissions (Spurious and Harmonics)

### 4.3.1 Frequency Band: 1 – 40 GHz

The 74 dB $\mu$ V/m @ 3m and 54 dB $\mu$ V/m @ 3m limits are applied for emissions fall in the restricted bands. The limits for emission outside the restricted band (FCC 15.205) are 20 dB below the fundamental field strength.

Frequency MHz	Peak Detector dB $\mu$ V/m	Average Detector dB $\mu$ V/m	Peak Limit dB $\mu$ V/m	Average Limit dB $\mu$ V/m	Result
2402	115.2	73.3	Refer to 5.0 - Peak Output Power		
4804	68.8	45.7	74.0	54.0	Complies
7206	68.9	45.0	74.0	54.0	Complies
9608	64.5	43.8	85.2	54.0	Complies
12010	61.2	43.1	74.0	54.0	Complies
14412	60.6	43.4	85.2	54.0	Complies
16814	55.6	42.3	85.2	54.0	Complies
2390	48.4	34.0	74.0	54.0	Complies
2385.8	62.4	47.9	74.0	54.0	Complies
1601	53.8	51.2	74.0	54.0	Complies
3202	63.2	44.0	86.5	54.0	Complies

Frequency MHz	Peak Detector dB $\mu$ V/m	Average Detector dB $\mu$ V/m	Peak Limit dB $\mu$ V/m	Average Limit dB $\mu$ V/m	Result
2441	114.4	72.9	Refer to 5.0 - Peak Output Power		
4882	65.3	44.1	74.0	54.0	Complies
7323	68.5	45.2	74.0	54.0	Complies
9764	63.1	43.1	84.4	54.0	Complies
12205	58.6	41.8	74.0	54.0	Complies
14646	57.2	42.7	84.4	54.0	Complies
17087	55.0	42.2	84.4	54.0	Complies
1627.1	53.4	50.9	84.4	54.0	Complies
3254.3	60.7	44.6	84.4	54.0	Complies

Frequency MHz	Peak Detector dB $\mu$ V/m	Average Detector dB $\mu$ V/m	Peak Limit dB $\mu$ V/m	Average Limit dB $\mu$ V/m	Result
2480	116.5	73.7	Refer to 5.0 - Peak Output Power		
4960	65.0	43.4	74.0	54.0	Complies
7440	68.7	45.3	74.0	54.0	Complies
9920	65.4	45.1	86.5	54.0	Complies
12400	60.2	43.0	74.0	54.0	Complies
14880	57.3	42.2	86.5	54.0	Complies
17360	55.1	42.4	86.5	54.0	Complies
2483.5	63.5	45.8	74.0	54.0	Complies
2496	67.1	50.2	74.0	54.0	Complies
1653	50.9	46.9	86.5	54.0	Complies
3307	58.8	43.6	86.5	54.0	Complies



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**Result:** Harmonic emissions were recorded up to 25 GHz. Other harmonics were confirmed low with both RBW and VBW reduced. Emissions complied with the FCC limits of sections 15.209 and 15.247 by a margin of 2.8 dB.

#### 4.3.2 Frequency Band: 30 - 1000 MHz

The worst case radiated EMI complied with the FCC 15.209 Class B, limit by a margin of greater than 10 dB. Refer to Appendix J, Graphs 1 & 2.

#### 4.3.3 RF Conducted Measurements at the antenna terminal

Not applicable as device has no antenna port.

#### 4.3.4 Band Edge Measurements

Complied (refer to section 4.3.1).

### 5.0 PEAK OUTPUT POWER - Section 15.247 (b)(1)

Testing was performed in accordance with the requirements of FCC Part 15.247(b)(1).

Measurements were performed while the Bluetooth transmitter continuously transmitted.

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

Measurements were performed at an Open Area Test Site (OATS). The fundamental level is recorded in dBuV and is then converted to dBm and subsequently into an absolute power level (mW).

The radiated power is determined by adding factors for the cable loss, antenna gain and path loss.

Frequency MHz	Power dBm	Limit dBm	Power mW	Limit mW	Result
2402	19.0	30	79.4	1000	Complies
2441	18.2	30	66.1	1000	Complies
2480	20.3	30	107.2	1000	Complies



## 6.0 CHANNEL BANDWIDTH & CHANNEL OCCUPANCY

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

The EUT was a Frequency Hopping Spread Spectrum transmitter and operated as described in section 2 of this report.

### 6.1 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 30 kHz and the video bandwidth of 100 kHz were utilised.

Frequency MHz	Bandwidth kHz	Result	20 dB Bandwidth Plots
2402	823.6	Complies	Appendix H
2441	841.7	Complies	Appendix H
2480	841.7	Complies	Appendix H

### 6.2 Channel Occupancy

79 channels were observed operating between 2400 to 2483.5 MHz. Refer to Appendix I for number of channel plot.

The channel separation of 1 MHz was recorded. Refer to Appendix I for channel separation plot.

The device was observed to have a dwell time of 410.8 uS. Refer to Appendix I for dwell time plot.

The specification allows for a dwell time not exceeding 0.4 seconds.

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

During the test the transmitter was observed to activate on average 316 times in 31.6 seconds.

The transmitter therefore occupies in one channel for  $316 \times 410.8 \mu\text{s} = 0.130$  seconds.

**Result:** Complies.

## 7.0 RADIO FREQUENCY EXPOSURE (HAZARD) INFORMATION

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

Spread spectrum transmitters operating in the 2400 - 2483.5 MHz band is 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 2.1093 this device has been defined as a portable device.

SAR testing was performed in accordance with OET Bulletin 65 and reported under EMC Technologies report: M090333. SAR values of 0.058 mW/g was measured which complied with the FCC human exposure requirements of 47 CFR 2.1093 (d).

## 8.0 ANTENNA REQUIREMENT

This intentional radiator was designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.



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## 9.0 COMPLIANCE STATEMENT

The XSports 2400, Model: ADPC2400 with Windigo Systems BTMM3C1XX Bluetooth, **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.

### FCC Subpart C, Section 15.247 - Bluetooth

FCC Part 15 Subpart C Clauses	Test Performed	Results
15.203	Antenna Requirement	<b>Complies</b>
15.205	Operation in Restricted Band	<b>Complies</b>
15.207	Conducted Emissions	<b>Not Applicable</b> Device is battery powered
15.209	Radiated Emissions	<b>Complies</b>
15.247 (a)(1)	Channel Occupancy/Bandwidth	<b>Complies</b>
15.247 (b)(1)	Peak Output Power	<b>Complies</b>
15.247 (c)	Antenna Gain > 6 dBi	<b>Not Applicable.</b> Antenna gain < 6 dBi
15.247 (d)	Out of Band Emissions	<b>Complies</b>
15.247 (e)	Peak Power Spectral Density	<b>Not Applicable.</b> Device is not digital modulated system
15.247 (f)	Hybrid Systems (Note 1)	<b>Not Applicable.</b> Device does not employ a hybrid system
15.247 (g)	Frequency Hopping	<b>Complies</b>
15.247 (h)	Frequency Hopping	<b>Complies</b>
15.247 (i)	Radio Frequency Hazard	<b>Complies</b>

**Note 1:** Hybrid systems are those that employ a combination of both frequency hopping and digital modulations technique.

## 10.0 MEASUREMENT UNCERTAINTIES

EMC Technologies has evaluated the equipment and the methods used to perform the emissions testing. The estimated measurement uncertainties for emissions tests shown within this report are as follows:

<b>Radiated Emissions:</b>	30 MHz to 300 MHz	$\pm 5.1$ dB
	300 MHz to 1000 MHz	$\pm 4.7$ dB
	1 GHz to 18 GHz	$\pm 4.6$ dB

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

## 11.0 TEST REPORT APPENDICES

### APPENDIX A: MEASUREMENT INSTRUMENT DETAILS

### APPENDIX B: REPORT PHOTOGRAPHS

### APPENDIX C: OPERATIONAL DESCRIPTION

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### Attachment 1: RF Exposure Information



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