



Sept. 23, 2002

**FEDERAL COMMUNICATIONS COMMISSION**

7435 Oakland Mills Road  
Columbia, MD 21046  
USA

**Subject:** FCC Certification Authorization Application - Class II Permissive Change under FCC Docket No.: 99-231:2002 (Amendment of Part 15), Part 15, Subpart C, Sec. 15.247 - Digital Modulation Transmitters operating in the frequency band 2400 - 2483.5 MHz.

**Product:** NETPAD + TRX7431 (DSSS Modular Transceiver)  
**Model No.:** NETPAD RLAN  
**FCC ID:** GM3WLPC24HN

Dear Sir/Madam

As appointed agent for Psion Teklogix Inc., we would like to submit the application to the Federal Communications Commission for Class II Permissive Change Certification of the above product. Please review all necessary files uploaded to FCC OET site for detailed information.

**Modification:** The Model Netpad RLAN will be market with a new optional Microstrip 1/4 Wave Antenna, gain = 0 dBi, this antenna is permanently attached to transmitter RF port and located inside the enclosure.

- Compliance with RF Exposure Requirements: The transmitter complies with FCC 2.1093 and FCCOET Bulletin 65 (August 1997) with maximum 0.338 W/Kg (measured at 100% duty cycle, even though the actual maximum duty cycle is 19%) with body tissue, and the EUT touches the phantom. Please refer to attached SAR test report.

If you have any queries, please do not hesitate to contact us.

Yours truly,



Tri Minh Luu, P. Eng.,  
V.P., Engineering

Encl



31040/SIT



C-1376



46390-2049



200093-0



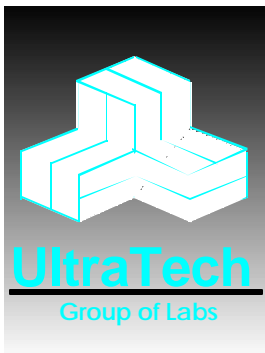
00-034



3000 Bristol Circle,  
Oakville, Ontario,  
Canada L6H 6G4

Tel.: (905) 829-1570  
Fax: (905) 829-8050

Website: [www.ultratech-labs.com](http://www.ultratech-labs.com)  
Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com)



31040/SIT



C-1376



46390-2049



200093-0



00-034



3000 Bristol Circle,  
Oakville, Ontario,  
Canada L6H 6G4

Tel.: (905) 829-1570  
Fax: (905) 829-8050

Website: [www.ultratech-labs.com](http://www.ultratech-labs.com)  
Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com)

Sept. 23, 2002

**Psion Teklogix Inc.**  
2100 Meadowvale Blvd.  
Mississauga, Ontario  
Canada, L5N 7J9

**Attn.: Mr. Sada Dhawarkar**

**Subject: FCC Certification Authorization Application - Class II Permissive Change under FCC Docket No.: 99-231:2002 (Amendment of Part 15), Part 15, Subpart C, Sec. 15.247 - Digital Modulation Transmitters operating in the frequency band 2400 - 2483.5 MHz.**

**Product: NETPAD + TRX7431 (DSSS Modular Transceiver)**  
**Model No.: NETPAD RLAN**  
**FCC ID: GM3WLPC24HN**

Dear Mr. Dhawarkar,

The product sample, as provided by you, has been tested and found to comply with **FCC Docket No.: 99-231:2002 (Amendment of Part 15), Part 15, Subpart C, Sec. 15.247 - Digital Modulation Transmitters operating in the frequency band 2400 - 2483.5 MHz.**

**Modification:** The Model Netpad RLAN will be market with a new optional Microstrip 1/4 Wave Antenna, gain = 0 dBi, this antenna is permanently attached to transmitter RF port and located inside the enclosure.

- Compliance with RF Exposure Requirements: The transmitter complies with FCC 2.1093 and FCCOET Bulletin 65 (August 1997) with maximum 0.338 W/Kg (measured at 100% duty cycle, even though the actual maximum duty cycle is 19%) with body tissue and the EUT touches the phantom. Please refer to attached SAR test report.

Enclosed you will find copies of the engineering report. If you have any queries, please do not hesitate to contact us.

Yours truly,

Tri Minh Luu, P. Eng., V.P., Engineering

Encl.

# ENGINEERING TEST REPORT



## NETPAD + TRX7431 (DSSS Modular Transceiver) Model No.: NETPAD RLAN

**FCC ID: GM3WLPC24HN**

*Applicant:* **Psion Teklogix Inc.**  
2100 Meadowvale Blvd.  
Mississauga, Ontario  
Canada, L5N 7J9

*In Accordance With*

**FEDERAL COMMUNICATIONS COMMISSION (FCC)  
PART 15, SUBPART C, SEC. 15.247  
Digital Modulation Transmitters operating in the frequency  
band 2400 - 2483.5 MHz  
(Class II Permissive Change)**

**UltraTech's File No.: TEK-393FCCTX**

This Test report is Issued under the Authority of  
Tri M. Luu, Professional Engineer,  
Vice President of Engineering  
UltraTech Group of Labs



Date: Sept. 23, 2002

Report Prepared by: Tri M. Luu, P.Eng.

Tested by: Hung Trinh, RFI Technician

Issued Date: Sept. 23, 2002

Test Dates: Sept. 19, 2002

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

## UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4

Tel.: (905) 829-1570 Fax.: (905) 829-8050

Website: [www.ultratech-labs.com](http://www.ultratech-labs.com) Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Email: [tri.luu@sympatico.ca](mailto:tri.luu@sympatico.ca)



31040/SIT



C-1376



46390-2049



200093-0



00-034



## TABLE OF CONTENTS

<b>EXHIBIT 1.</b>	<b>SUBMITTAL CHECK LIST.....</b>	<b>4</b>
<b>EXHIBIT 1.</b>	<b>INTRODUCTION .....</b>	<b>5</b>
1.1.	SCOPE.....	5
1.2.	RELATED SUBMITAL(S)/GRANT(S).....	5
1.3.	NORMATIVE REFERENCES .....	5
<b>EXHIBIT 2.</b>	<b>PERFORMANCE ASSESSMENT .....</b>	<b>6</b>
2.1.	CLIENT INFORMATION.....	6
2.2.	EQUIPMENT UNDER TEST (EUT) INFORMATION .....	6
2.3.	MANUFACTURER'S EUT'S TECHNICAL SPECIFICATIONS .....	8
	BLOCK DIAGRAM OF TEST SETUP .....	10
2.5.	ANCILLARY EQUIPMENT .....	10
<b>EXHIBIT 3.</b>	<b>EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS .....</b>	<b>11</b>
3.1.	CLIMATE TEST CONDITIONS.....	11
3.2.	OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST S.....	11
<b>EXHIBIT 4.</b>	<b>SUMMARY OF TEST RESULTS.....</b>	<b>12</b>
4.1.	LOCATION OF TESTS .....	12
4.2.	APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS.....	12
4.3.	MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES.....	12
<b>EXHIBIT 5.</b>	<b>MEASUREMENTS, EXAMINATIONS &amp; TEST DATA FOR EMC EMISSIONS .....</b>	<b>13</b>
5.1.	TEST PROCEDURES.....	13
5.2.	MEASUREMENT UNCERTAINTIES.....	13
5.3.	MEASUREMENT EQUIPMENT USED:.....	13
5.4.	ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER:.....	13
5.5.	COMPLIANCE WITH FCC PART 15 – GENERAL TECHNICAL REQUIREMENTS.....	14
5.6.	PEAK OUTPUT POWER (CONDUCTED) @ FCC 15.247(B).....	15
5.6.1.	<i>Limits .....</i>	<i>15</i>
5.6.2.	<i>Method of Measurements &amp; Test Arrangement .....</i>	<i>15</i>
5.6.3.	<i>Test Equipment List .....</i>	<i>15</i>
5.6.4.	<i>Test Data.....</i>	<i>15</i>
5.7.	RF EXPOSURE REQUIRMENTS @ FCC 15.247(B)(4), 1.1310 & 2.1091.....	16
5.8.	SPURIOUS EMISSIONS (RADIATED @ 3 METERS), FCC CFR 47, PARA. 15.247(C), 15.209 & 15.205 .....	17
5.8.1.	<i>Limits .....</i>	<i>17</i>
5.8.2.	<i>Method of Measurements.....</i>	<i>18</i>
5.8.3.	<i>Test Equipment List .....</i>	<i>18</i>
5.8.4.	<i>Photographs of Test Setup .....</i>	<i>18</i>
5.8.5.	<i>Test Data.....</i>	<i>19</i>
<b>EXHIBIT 6.</b>	<b>MEASUREMENT UNCERTAINTY.....</b>	<b>26</b>
6.1.	RADIATED EMISSION MEASUREMENT UNCERTAINTY.....	26
<b>EXHIBIT 7.</b>	<b>MEASUREMENT METHODS.....</b>	<b>27</b>
7.1.	GENERAL TEST CONDITIONS .....	27
7.1.1.	<i>Normal temperature and humidity .....</i>	<i>27</i>
7.1.2.	<i>Normal power source .....</i>	<i>27</i>

---

7.1.3.	<i>Operating Condition of Equipment under Test</i> .....	27
7.2.	PEAK CONDUCTED POWER & PEAK EIRP .....	28
7.2.1.	<i>Measurements of Transmitter Parameters (Duty Cycle &amp; Peak Power)</i> .....	28
7.3.	SPURIOUS EMISSIONS (RADIATED).....	29
7.3.1.	<i>Spurious Emissions (Radiated)</i> .....	29

## EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
	Test Report	<ul style="list-style-type: none"> <li>Exhibit 1: Submittal check lists</li> <li>Exhibit 2: Introduction</li> <li>Exhibit 3: Performance Assessment</li> <li>Exhibit 4: EUT Operation and Configuration during Tests</li> <li>Exhibit 5: Summary of test Results</li> <li>Exhibit 6: Measurement Data</li> <li>Exhibit 7: Measurement Uncertainty</li> <li>Exhibit 8: Measurement Methods</li> </ul>	OK
1	Test Setup Photos	Photos # 1 to 3	OK
2	External Photos of EUT	Same as original submission	N/A
3	Internal Photos of EUT	Same as original submission	N/A
4	Cover Letters	<ul style="list-style-type: none"> <li>Letter from Ultratech for Certification Request</li> </ul>	OK
5	Attestation Statements	<ul style="list-style-type: none"> <li>Letter from the Applicant to appoint Ultratech to act as an agent</li> <li>Letter from the Applicant to request for Confidentiality Filing</li> </ul>	OK N/A
6	ID Label/Location Info	Same as original submission	N/A
7	Block Diagrams	Same as original submission	N/A
8	Schematic Diagrams	Same as original submission	N/A
	Parts List/Tune Up Info	Same as original submission	N/A
9	Operational Description	Same as original submission	N/A
10	RF Exposure Info	SAR Test Report	OK
11	Users Manual	Same as original submission	N/A

### ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: TEK-393FC

Sept. 23, 2

• All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

## EXHIBIT 1. INTRODUCTION

### 1.1. SCOPE

<b>Reference:</b>	FCC Docket No.: 99-231:2002 (Amendment to FCC Part 15 of the Commission's Rules Regarding to Spread Spectrum Devices), Part 15, Subpart C, Section 15.247
<b>Title</b>	Telecommunication - Code of Federal Regulations, CFR 47, Part 15
<b>Purpose of Test:</b>	To gain FCC Certification Authorization - Class II Permissive Change for Digital Modulation Transmitters operating in the Frequency Band 2400 - 2483.5 MHz .
<b>Test Procedures</b>	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
<b>Environmental Classification:</b>	<ul style="list-style-type: none"> <li>• Light-industry, Commercial</li> <li>• Industry</li> </ul>
<b>FCC Class II Permissive Change</b>	The Model Netpad RLAN will be market with a new optional Microstrip 1/4 Wave Antenna, gain = 0 dBi, this antenna is permanently attached to transmitter RF port and located inside the enclosure.

### 1.2. RELATED SUBMITAL(S)/GRANT(S)

The Psion Teklogix Model NETPAD RLAN employs an Agere 2.4 GHz DSSS 11 Mb PCMCIA Card, FCC ID Number: IMRWLPCE24H and Psion Teklogix Model TRX7431 DSSS Module, FCC ID: GM3WLPC24H. Since our peak power measurements was found higher than that is listed in FCC Grant, FCC ID: IMRWLPCE24H, and the EUT is a portable device, the new FCC Grant is required for compliance with FCC 15.247 and RF Exposure Requirements.

### 1.3. NORMATIVE REFERENCES

Publication	YEAR	Title
FCC CFR Parts 0-19	2001	Code of Federal Regulations – Telecommunication
ANSI C63.4	1992	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 22 & EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1		Specification for Radio Disturbance and Immunity measuring apparatus and methods
FCC Public Notice DA 00-705	2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
FCC Public Notice DA 00-1407	2000	Part 15 Unlicensed Modular Transmitter Approval
FCC ET Docket No. 99-231	2002	Amendment to FCC Part 15 of the Commission's Rules Regarding to Spread Spectrum Devices

## EXHIBIT 2. PERFORMANCE ASSESSMENT

### 2.1. CLIENT INFORMATION

<b>APPLICANT:</b>	
<b>Name:</b>	Psion Teklogix Inc.
<b>Address:</b>	2100 Meadowvale Blvd. Mississauga, Ontario Canada, L5N 7J9
<b>Contact Person:</b>	Mr. Sada Dhawarkar Phone #: 905-812-6200 Fax #: 905-812-6301 Email Address: <a href="mailto:sdharwar@teklogix.com">sdharwar@teklogix.com</a>

<b>MANUFACTURER:</b>	
<b>Name:</b>	Psion Teklogix Inc.
<b>Address:</b>	2100 Meadowvale Blvd. Mississauga, Ontario Canada, L5N 7J9
<b>Contact Person:</b>	Mr. Sada Dhawarkar Phone #: 905-812-6200 Fax #: 905-812-6301 Email Address: <a href="mailto:sdharwar@teklogix.com">sdharwar@teklogix.com</a>

### 2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

<b>Brand Name</b>	Psion Teklogix Inc.
<b>Product Name</b>	NETPAD + TRX7431 (DSSS Modular Transceiver)
<b>Model Name or Number</b>	NETPAD RLAN
<b>Serial Number</b>	Eng 001
<b>Type of Equipment</b>	Digital Modulation Transmitters
<b>Input Power Supply Type</b>	Internal rechargeable Lithium Ion Battery Pack, P/N: A2202-0001-0000, 7.2 V, 1400 mAh
<b>Primary User Functions of EUT:</b>	Provide data communication link through air



<b>NETPAD'S TRANSMITTER</b>	
<b>Equipment Type:</b>	▪ Portable
<b>Intended Operating Environment:</b>	▪ Commercial, light industry & heavy industry
<b>Power Supply Requirement:</b>	Internal rechargeable Lithium Ion Battery Pack, P/N: A2202-0001-0000, 7.2 V, 1400 mAh
<b>RF Output Power Rating:</b>	58.88 mWatts peak
<b>Operating Frequency Range:</b>	2412 - 24632 MHz
<b>RF Output Impedance:</b>	50 Ohms
<b>Channel Spacing:</b>	1 MHz
<b>Duty Cycle:</b>	19% in 100 mS
<b>6 dB Bandwidth:</b>	10 MHz maximum
<b>Modulation Type:</b>	<ul style="list-style-type: none"> <li>• DBPSK for 1Mb/s Data Rate</li> <li>• DQPSK for 2 Mb/s Data Rate</li> <li>• CCK for 5.5 Mb/s Data Rate</li> <li>• CCK for 11 Mb/s Data Rate</li> </ul>
<b>Emission Designation:</b>	Direct Sequence Spread Spectrum
<b>Spectral Density</b>	5.888 mW/MHz (Power output at the antenna / bandwidth of the RF output spectrum)
<b>Antenna Connector Type:</b>	<ul style="list-style-type: none"> <li>• Non-integral, special coupling (reversed thrust SMA connector without a center pin)</li> </ul>
<b>Antenna Description:</b>	Microstrip 1/4 Wave Antenna Gain: 0 dBi max. Operating frequency: 2400 - 2500 MHz In/Out Impedance: 50 Ohms Method of coupling: permanently attached and located inside the enclosure.

### Duty Cycle Calculation for PSION Teklogix equipment

"The access point sends out a beacon every 100ms.

A client terminal can only transmit once (if at all) during each of these intervals.

The maximum fragmentation limit of a client terminal is 2312 bytes. This translate to 18496 bits.

There is a 192 bit preamble for each packet sent.

Thus a client terminal can transmit a maximum of ~19kbits/100ms. At 1Mbps data rate, this will take 19ms every 100ms, translating to a max duty cycle of 19%. Duty cycle will be reduced when a higher data rate is used or when there are less data being transmitted."

### 2.3. MANUFACTURER'S EUT'S TECHNICAL SPECIFICATIONS

Title:	Author:	File Name:	Date:
Product Configuration, FCC & IC Test	Sada Dharwarkar	RA Product Configuration.doc	June 21, 2002

#### TITLE: NETPAD + TRX7431 AGERE SYSTEMS NEDERLAND B.V. 802.11 2.4 GHZ RADIO

PRODUCT UNDER TEST	netpad + TRX7431
DESTINATION COUNTRY	NA
APPLICABLE STANDARD	FCC Part 15.247, FCC Part 15 B Unintentional & RSS-210 & SAR
EQUIPMENT CLASS	Class B
EQUIPMENT TYPE	Radio Equipment
TESTER	Sada Dharwarkar
DATE	June 21, 2002

Revision	Date	Change Description	by	Comments
Draft 1	2002-06-07	Initial Draft	Sada Dharwarkar	

<b>HARDWARE</b>	
MANUFACTURER	Psion Teklogix Inc.
PRODUCT	netpad
MODEL NUMBER	netpad RLAN
SERIAL NUMBER	Eng 001
MLB PART NUMBER	A220100140003
PCMCIA EXPANSION BOARD	A220100430001
<b>MISCELLANEOUS HARDWARE</b>	
MANUFACTURER	Symbol Technology
PRODUCT	Scanner Module
MODEL NUMBER	SE923-1000A
SERIAL NUMBER	N/A
TEKLOGIX PART NUMBER	A220200290001
<b>HARDWARE</b>	
MANUFACTURER	Hitachi
PRODUCT	LCD Display (Transmissive)
SERIAL NUMBER	N/A
TEKLOGIX PART NUMBER	A220400060003

#### ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: TEK-393FC  
 Sept. 23, 2

- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

SOFTWARE	
OPERATING SYSTEM	WinCE
SOFTWARE VERSION (netpad)	1000420p1
BOOT CODE VERSION (netpad5)	1000378A
Pic	12c7
CLOCK SPEED (netpad)	206 MHz
OSCILLATOR FREQUENCIES (netpad)	3.686MHz; 1MHz RC Oscillator, 32KHz; 8MHz/40MHz to FPGA;24MHz Coodec; 100MHz SDLK
IP ADDRESS	10.1.0.4
ESSID	N/A

ADD ON CARDS	
LOCATION	MMC port
MANUFACTURER	Hitachi
PRODUCT	Multi-Media Card (MMC)
MODEL NUMBER	16Mb Hitachi HB288016 MMI
TEKLOGIX PART NUMBER	A220100190001

**Remarks:** The Psion Teklogix Model NETPAD RLAN employs an Agere 2.4 GHz DSSS 11 Mb PCMCIA Card, FCC ID Number: IMRWLPCE24H, FCC Certified for mobile and base application without SAR Tests. Since our peak power measurements was found higher than that is listed in FCC Grant, FCC ID: IMRWLPCE24H, and the EUT is a portable device, the new FCC Grant is required to be submitted to FCC.

RADIO	
MANUFACTURER:	Agere Systems Nederland B.V.
PRODUCT	2.4 GHz DSSS 11MB PCMCIA Card
MODEL NUMBER	PC24-H-FC
PSION TEKLOGIX MODEL NUMBER	TRX7431
PSION TEKLOGIX PART NUMBER	30589-211
FCC ID	IMRWLPCE24H
POWER	32 mW
FREQUENCY RANGE	2.412 to 2.462 GHz
Duty Cycle	19% in 100 mS
DATA RATES	11 MBps
CHANNELS	11 (FCC)
L.O. FREQUENCIES	352 MHz
REF. OSC. FREQUENCIES	22 MHz
INTERNAL/EXTRENAL ANTENNA	INTERNAL TO NETPAD
RF CABLE TYPE	N/A
TEKLOGIX PART NUMBER	N/A
ANTENNA TYPE + GAIN	Microstrip 1/4 Wave Antenna, Gain = 0 dBi
PSION TEKLOGIX PART NUMBER	

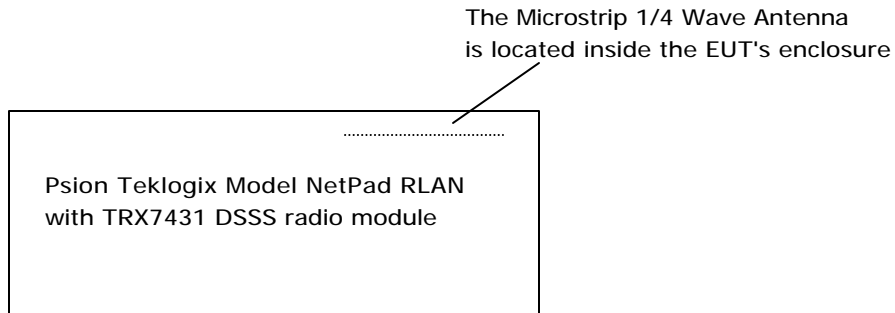
**ULTRATECH GROUP OF LABS**

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: http://www.ultratech-labs.com

File #: TEK-393FC  
 Sept. 23, 2

- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

## 2.4. BLOCK DIAGRAM OF TEST SETUP



## 2.5. ANCILLARY EQUIPMENT

None

## EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

### 3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	7.2 V, 1400 mAh Rechargeable Lithium Ion Battery

### 3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

<b>Operating Modes:</b>	<ul style="list-style-type: none"> <li>▪ Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements.</li> </ul>
<b>Special Test Software:</b>	<ul style="list-style-type: none"> <li>▪ None</li> </ul>
<b>Special Hardware Used:</b>	<ul style="list-style-type: none"> <li>▪ None</li> </ul>
<b>Transmitter Test Antenna:</b>	The Model Netpad RLAN is installed with a new optional Microstrip 1/4 Wave antenna, gain = 0 dBi, this antenna is permanently attached to transmitter RF port and located inside the enclosure as intended.

<b>Transmitter Test Signals:</b>	
<b>Frequencies:</b>	Lowest, middle and highest channel frequencies tested:
<ul style="list-style-type: none"> <li>▪ 2400 - 2483.5 MHz band:</li> </ul>	2412, 2437 and 2462 MHz
<b>Transmitter Wanted Output Test Signals:</b>	
<ul style="list-style-type: none"> <li>▪ RF Power Output (measured maximum output power):</li> <li>▪ Normal Test Modulation</li> <li>▪ Modulating signal source:</li> </ul>	<ul style="list-style-type: none"> <li>▪ 58.88 mWatts peak (conducted)</li> <li>▪ DBPSK (1Mbps), DQPSK (2Mbps), CCK (5.5 Mbps), CCK (11 Mbps)</li> <li>▪ Internal</li> </ul>

## EXHIBIT 4. SUMMARY OF TEST RESULTS

### 4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).
- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Aug. 08, 2001.

### 4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
15.107(a) & 207	AC Power Conducted Emissions	N/A for battery operated device
15.247(a)(2)	6dB Bandwidth of a Digital Modulation System	N/A. Note 1
15.247(b) & 1.1310	Maximum Peak Power (Conducted)	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
15.247(c)	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	N/A. Note 1
15.247(d)	Transmitted Power Density of a Digital Modulation System	N/A. Note 1
15.247(c), 15.209 & 15.205	Transmitter Radiated Emissions	Yes
FCC Part 15, Sub. B, Sec. 15.109	Class B Radiated Emissions	N/A. Note 2

**Notes:**

- (1) This test is not required to be repeated since the change of the antenna will not affect it.
- (2) A separate engineering test report for compliance with FCC Part 15, Subpart B - Class B Unintentional Radiators will be provided upon request.

### 4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

---

#### ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: TEK-393FC  
 Sept. 23, 2

- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

## **EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS**

### **5.1. TEST PROCEDURES**

This section contains test results only. Details of test methods and procedures can be found in Exhibit 8 of this report and ANSI C63-4:1992

### **5.2. MEASUREMENT UNCERTAINTIES**

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

### **5.3. MEASUREMENT EQUIPMENT USED:**

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C64-3:1992, FCC 15.247 and CISPR 16-1.

### **5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER:**

The essential function of the EUT is to correctly communicate data to and from radios over RF link.

## 5.5. COMPLIANCE WITH FCC PART 15 – GENERAL TECHNICAL REQUIREMENTS

FCC Section	FCC Rules	
15.203	<p>Described how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.</p> <p>The exception is in those cases where EUT must be professionally installed. In order to demonstrate that professional installation is required, the following 3 points must be addressed:</p> <ul style="list-style-type: none"> <li>• The application (or intended use) of the EUT</li> <li>• The installation requirements of the EUT</li> <li>• The method by which the EUT will be marketed</li> </ul>	<p>Permanently attached and located inside the enclosure.</p> <p>N/A</p>
15.204	<p>Provided the information for every antenna proposed for use with the EUT:</p> <p>(a) type (e.g. Yagi, patch, grid, dish, etc...),                      (b) manufacturer and model number                      (c) gain with reference to an isotropic radiator</p>	<p>Microstrip 1/4 Wave Antenna                      Antenna Gain: 0 dBi max.                      Operating frequency: 2400 - 2500 MHz                      In/Out Impedance: 50 Ohms</p>



## 5.6. PEAK OUTPUT POWER (CONDUCTED) @ FCC 15.247(B)

### 5.6.1. Limits

- **FCC 15.247(b)(3):** Maximum peak output power of the transmitter shall not exceed 1 Watt.
- **FCC 15.247(b)(4)(i):** If the device is not for fixed point to point radio, the antenna of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 5.6.2. Method of Measurements & Test Arrangement

Refer to Exhibit 7, Sec. 8.2 of this test report, FCC 15.247(b)(1)&(3), ANSI C63-4:1992 & ETSI 300 328

**Note:** The conducted peak power measurement method was performed in accordance with ETSI 300 328 since it was proven to be independent with the peak power meter characteristics.

### 5.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8546A	...	9 kHz to 5.6 GHz with built-in 30 dB Gain Pre-selector, QP, Average & Peak Detectors.
RF Signal Generator	Hewlett Packard	HP 83752B	3610A00457	0.01 – 20 GHz
67297 RF Detector (Diode Detector)	Herotex	DZ122-553	63400	..
Storage Oscilloscope	Philips	PM3320A	ST9907959	--

### 5.6.4. Test Data

Transmitter Channel	Modulation & Data Rate	Frequency (MHz)	(full bandwidth) Peak Power at Antenna Terminals (dBm)	Limit (dBm)
Lowest	DBPSK (1 Mbps)	2412	17.7	30.0
Middle	DBPSK (1 Mbps)	2437	17.7	30.0
Highest	DBPSK (1 Mbps)	2462	17.7	30.0
Lowest	DQPSK (2 Mbps)	2412	17.7	30.0
Middle	DQPSK (2 Mbps)	2437	17.7	30.0
Highest	DQPSK (2 Mbps)	2462	17.7	30.0
Lowest	CCK (5.5 Mbps)	2412	17.7	30.0
Middle	CCK (5.5 Mbps)	2437	17.7	30.0
Highest	CCK (5.5 Mbps)	2462	17.7	30.0
Lowest	CCK (11 Mbps)	2412	17.7	30.0
Middle	CCK (11 Mbps)	2437	17.7	30.0
Highest	CCK (11 Mbps)	2462	17.7	30.0

## ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Website: <http://www.ultratech-labs.com>

File #: TEK-393FC

Sept. 23, 2

### 5.7. RF EXPOSURE REQUIRMENTS @ FCC 15.247(B)(4), 1.1310 & 2.1091

Please refer to the SAR Test report for Psion Teklogix Model NETPAD RLAN.

- Compliance with RF Exposure Requirements: The transmitter complies with FCC 2.1093 and FCCOET Bulletin 65 (August 1997) with maximum 0.338 W/Kg (measured at 100% duty cycle, even though the actual maximum duty cycle is 19%) with body tissue and the EUT touches the phantom. Please refer to attached SAR test report.

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	Compliance with FCC Rules
SAR Tests for Portable Transmitters <ul style="list-style-type: none"> <li>• Body Tissue</li> </ul>	<ul style="list-style-type: none"> <li>• Comply with SAR limits with body tissue, please refer to SAR test report with maximum SAR level of 0.338 W/Kg measured at 100% duty cycle (actual maximum duty cycle is 19%) and the EUT touches the phantom.</li> </ul>

- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

**5.8. SPURIOUS EMISSIONS (RADIATED @ 3 METERS), FCC CFR 47, PARA. 15.247(C), 15.209 & 15.205**

**5.8.1. Limits**

In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in @ 15.209(a), which lesser attenuation.

All other emissions inside restricted bands specified in @ 15.205(a) shall not exceed the general radiated emission limits specified in @ 15.209(a)

**Remarks:**

- Applies to harmonics/spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- @ **FCC CFR 47, Para. 15.237(c)** - The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in @ **15.35** for limiting peak emissions apply.

**FCC CFR 47, Part 15, Subpart C, Para. 15.205(a) - Restricted Frequency Bands**

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 - 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 - 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 - 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 - 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 - 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 - 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 - 156.9	2200 - 2300	9000 - 9200	

**FCC CFR 47, Part 15, Subpart C, Para. 15.209(a)  
 -- Field Strength Limits within Restricted Frequency Bands --**

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	DISTANCE (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

**5.8.2. Method of Measurements**

Refer to Exhibit 7, Sec. 7.3 of this test report and ANSI 63.4-1992, Para. 8 for detailed radiated emissions measurement procedures.

The following measurement procedures were also applied:

- Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.
- For measurement below 1 GHz, set RBW = 100 KHz, VBW ≥ 100 KHz, SWEEP=AUTO.
- For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz (Peak) & VBW = 10 Hz (Average), SWEEP=AUTO.
- If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

**5.8.3. Test Equipment List**

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz to 32 GHz with external mixer for frequency above 32 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Highpass Filter	K&L	11SH10-1500-T8000	--	Cut-off at 1500 MHz used for 902-928 MHz Radio
Highpass Filter	Michael Lab	XD40N	--	Cut-off at 4 GHz used for 2.4-2.4835 GHz

**5.8.4. Photographs of Test Setup**

Refer to the Photographs #1, 2 & 3 in Annex 1 for setup and arrangement of equipment under tests and its ancillary equipment.

### 5.8.5. Test Data

#### Duty Cycle:

"The access point sends out a beacon every 100ms.

A client terminal can only transmit once (if at all) during each of these intervals.

The maximum fragmentation limit of a client terminal is 2312 bytes. This translate to 18496 bits.

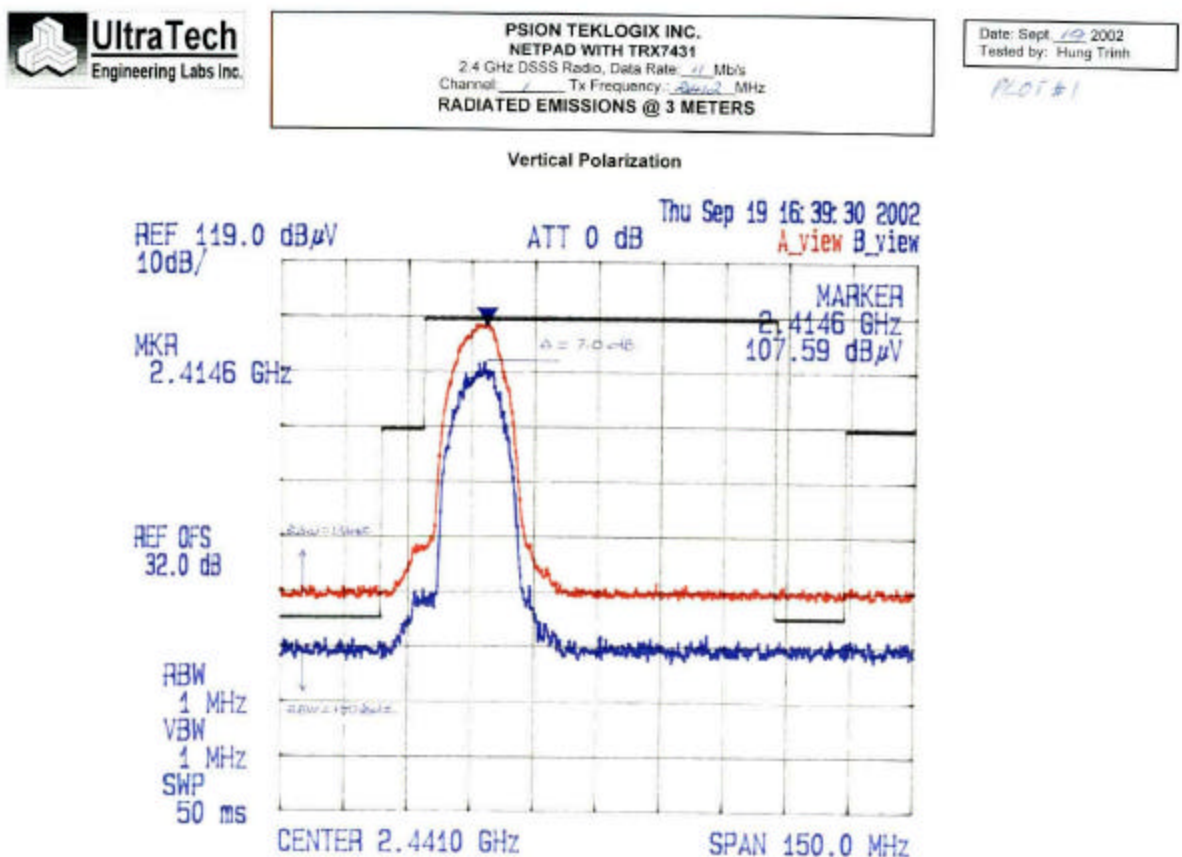
There is a 192 bit preamble for each packet sent.

Thus a client terminal can transmit a maximum of ~19kbits/100ms. At 1Mbps data rate, this will take 19ms every 100ms, translating to a max duty cycle of 19%. Duty cycle will be reduced when a higher data rate is used or when there are less data being transmitted."

Peak-Average Conversion Factor =  $20 \cdot \log(0.19) = -14.4 \text{ dB}$

#### 5.8.5.1. RADIATED EMISSIONS AT THE BAND-EDGES OF THE FCC PERMITTED BAND

- Plots # 1 to 6 show the Radiated Emissions at the Band-edges of the FCC Permitted Band 2.4-2.4835 GHz of LOWEST, MIDDLE and HIGHEST channel frequencies with modulation & data of CCK & 11 Mbps. These results shall also represent other modulations and data rate since the rf output characteristics are identical according to the transmitter conducted tests in the previous sections of this test report..



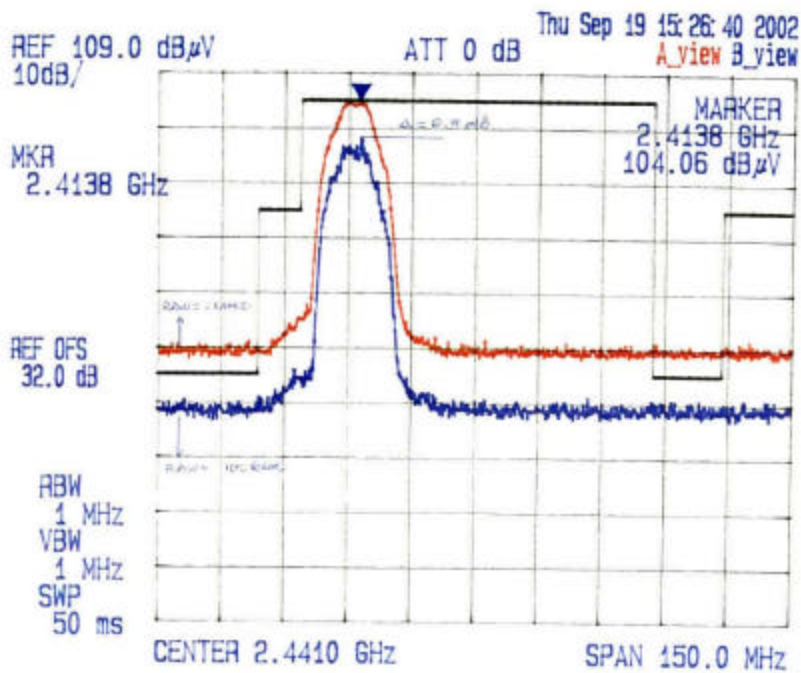


PSION TEKLOGIX INC.  
NETPAD WITH TRX7431  
2.4 GHz DSSS Radio, Data Rate: 11 Mb/s  
Channel: 1 Tx Frequency: 2.412 MHz  
RADIATED EMISSIONS @ 3 METERS

Date: Sept. 19, 2002  
Tested by: Hung Trinh

PLOT # 2

Horizontal Polarization



ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: http://www.ultratech-labs.com

File #: TEK-393FC

Sept. 23, 2

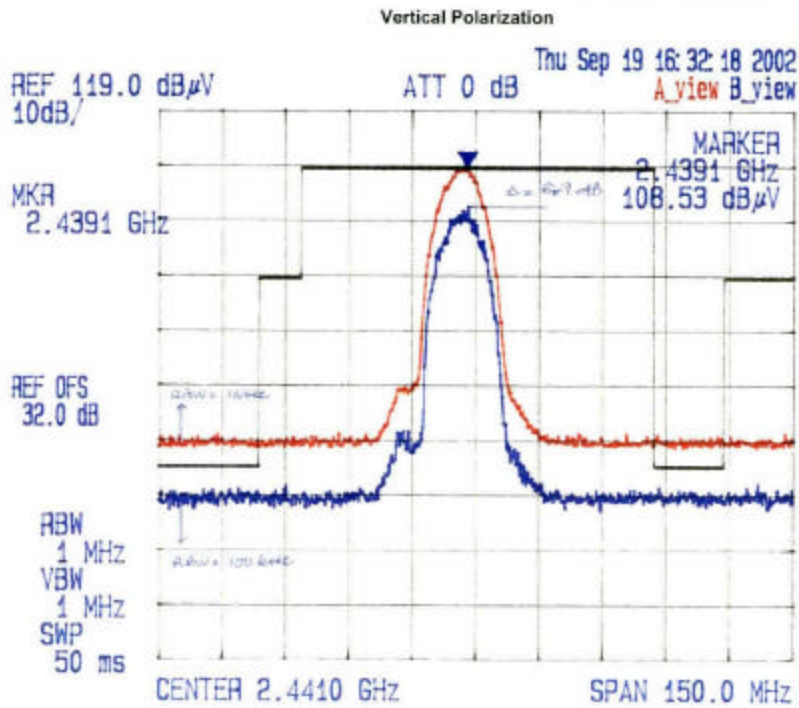
- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)



PSION TEKLOGIX INC.  
NETPAD WITH TRX7431  
2.4 GHz DSSS Radio, Data Rate: 11 Mbit/s  
Channel: 6 Tx Frequency: 2.437 MHz  
RADIATED EMISSIONS @ 3 METERS

Date: Sept 19 2002  
Tested by: Hung Trinh

PLOT #3

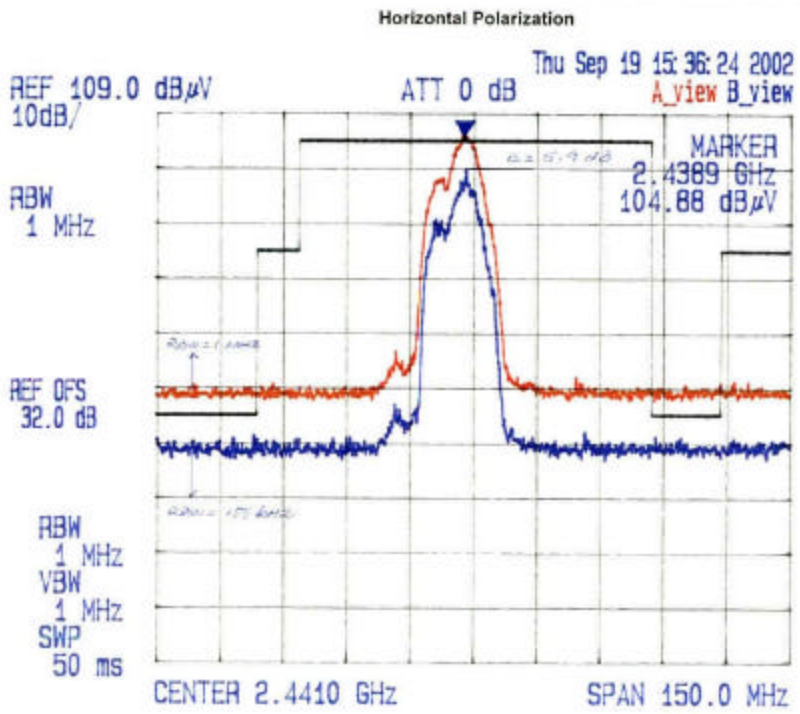




PSION TEKLOGIX INC.  
NETPAD WITH TRX7431  
2.4 GHz DSSS Radio, Data Rate: 11 Mb/s  
Channel: 2 Tx Frequency: 2.437 MHz  
RADIATED EMISSIONS @ 3 METERS

Date: Sept. 19, 2002  
Tested by: Hung Trinh

PLOT #4



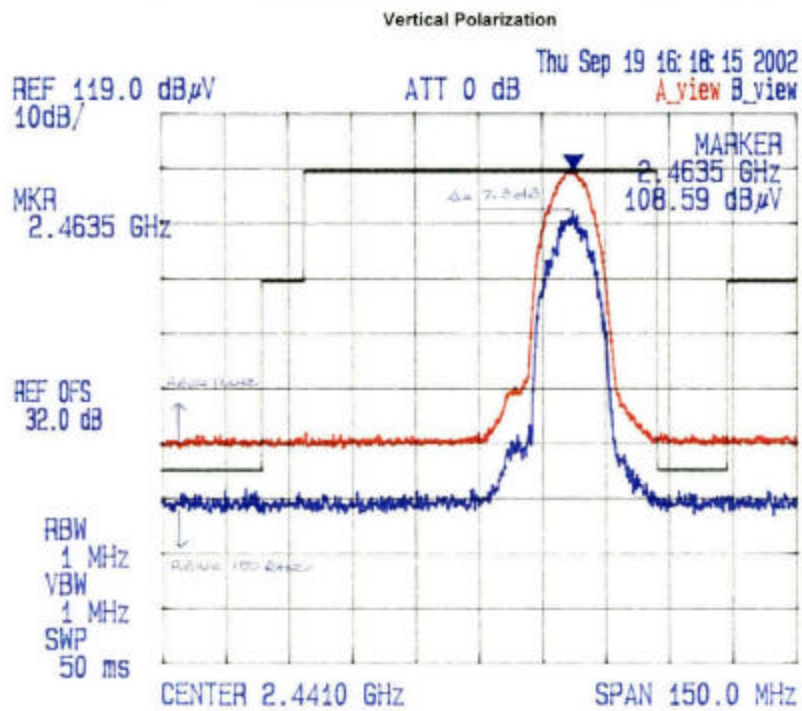




PSION TEKLOGIX INC.  
NETPAD WITH TRX7431  
2.4 GHz DSSS Radio, Data Rate: 11 Mb/s  
Channel: 11 Tx Frequency: 2433 MHz  
RADIATED EMISSIONS @ 3 METERS

Date: Sept. 19 2002  
Tested by: Hung Trinh

PL07# 5

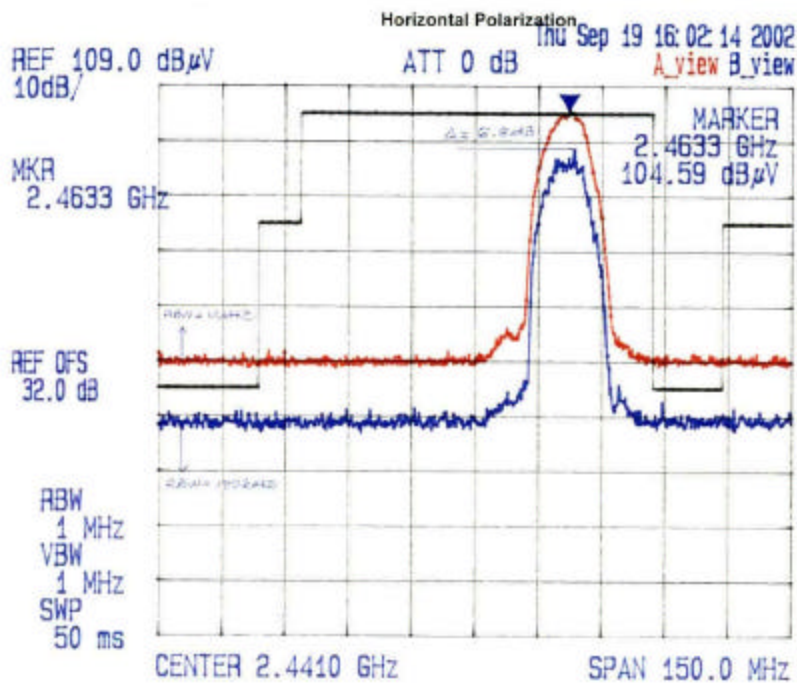




PSION TEKLOGIX INC.  
NETPAD WITH TRX7431  
2.4 GHz DSSS Radio, Data Rate: 11 Mb/s  
Channel: 11 Tx Frequency: 2.4633 MHz  
RADIATED EMISSIONS @ 3 METERS

Date: Sept. 19, 2002  
Tested by: Hung Trinh

PLT #6



5.8.5.1.1. Tx Radiated Emissions at Lowest Frequency (2412 MHz Modulation: CCK @ 11 Mbps)

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)/MHz	RF AVG LEVEL @ 3m (dBuV/m)/MHz	ANTENNA PLANE (H/V)	LIMIT @3m 15.209 (dBuV/m)	LIMIT @3m 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2412.00	107.6	93.2	V	--	--	--	--
2412.00	104.1	89.7	H	--	--	--	--
10 - 25,000	<<	<<	V	54.0	73.2	<<	PASS

- The emissions were scanned from 10 MHz to 25 GHz and no significant RF spurious/harmonic emissions from the transmitter were found in this band.
- The EUT was placed in 3 different orthogonal positions and full maximization (rotating turn-table and moving measuring antenna up & down from 1 to 4 meters) was performed to find the maximum RF level at 3 meters.

5.8.5.1.2. Tx Radiated Emissions at Middle Frequency (2437 MHz, Modulation: CCK @ 11 Mbps)

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)/MHz	RF AVG LEVEL @ 3m (dBuV/m)/MHz	ANTENNA PLANE (H/V)	LIMIT @3m 15.209 (dBuV/m)	LIMIT @3m 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2437.00	108.5	94.1	V	--	--	--	--
2437.00	104.9	90.5	H	--	--	--	--
10 - 25,000	<<	<<	V	54.0	74.1	<<	PASS

- The emissions were scanned from 10 MHz to 25 GHz and no significant RF spurious/harmonic emissions from the transmitter were found in this band.
- The EUT was placed in 3 different orthogonal positions and full maximization (rotating turn-table and moving measuring antenna up & down from 1 to 4 meters) was performed to find the maximum RF level at 3 meters.

5.8.5.1.3. Tx Radiated Emissions at Highest Frequency (2462 MHz, Modulation: CCK @ 11 Mbps)

FREQUENCY (MHz)	RF PEAK LEVEL @ 3m (dBuV/m)/MHz	RF AVG LEVEL @ 3m (dBuV/m)/MHz	ANTENNA PLANE (H/V)	LIMIT @3m 15.209 (dBuV/m)	LIMIT @3m 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
2462	108.6	94.2	V	--	--	--	--
2462	104.6	90.2	H	--	--	--	--
10 - 25,000	<<	<<	V	54.0	74.2	<<	PASS

- The emissions were scanned from 10 MHz to 25 GHz and no significant RF spurious/harmonic emissions from the transmitter were found in this band.
- The EUT was placed in 3 different orthogonal positions and full maximization (rotating turn-table and moving measuring antenna up & down from 1 to 4 meters) was performed to find the maximum RF level at 3 meters.

## EXHIBIT 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

### 6.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY ( $\pm$ dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	$\pm 1.0$	$\pm 1.0$
Cable Loss Calibration	Normal (k=2)	$\pm 0.3$	$\pm 0.5$
EMI Receiver specification	Rectangular	$\pm 1.5$	$\pm 1.5$
Antenna Directivity	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	$\pm 2.0$	$\pm 0.5$
Antenna phase center variation	Rectangular	0.0	$\pm 0.2$
Antenna factor frequency interpolation	Rectangular	$\pm 0.25$	$\pm 0.25$
Measurement distance variation	Rectangular	$\pm 0.6$	$\pm 0.4$
Site imperfections	Rectangular	$\pm 2.0$	$\pm 2.0$
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67(\text{Bi}) 0.3 (\text{Lp})$ Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	+1.1 -1.25	$\pm 0.5$
System repeatability	Std. Deviation	$\pm 0.5$	$\pm 0.5$
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$

## EXHIBIT 7. MEASUREMENT METHODS

### 7.1. GENERAL TEST CONDITIONS

The following test conditions shall be applied throughout the tests covered in this report.

#### 7.1.1. Normal temperature and humidity

- Normal temperature: +15°C to +35°C
- Relative Humidity: +20% to 75%

The actual values during tests shall be recorded in the test report.

#### 7.1.2. Normal power source

##### 7.1.2.1. MAINS VOLTAGE

The nominal test voltage of the equipment to be connected to mains shall be the nominal mains voltage which is the declared voltage or any of the declared voltages for which the equipment was designed.

The frequency of test power source corresponding to the AC mains shall be between 59 Hz and 61 Hz.

##### 7.1.2.2. BATTERY POWER SOURCE.

For operation from battery power sources, the nominal test voltage shall be as declared by the equipment manufacturer. This shall be recorded in the test report.

#### 7.1.3. Operating Condition of Equipment under Test

- All tests were carried out while the equipment operated at the following frequencies:
  - The lowest operating frequency,
  - The middle operating frequency and
  - The highest operating frequency
- Modulation were applied using the Test Data sequence
- The transmitter was operated at the highest output power, or in the case the equipment able to operate at more than one power level, at the lowest and highest output powers

## 7.2. PEAK CONDUCTED POWER & PEAK EIRP

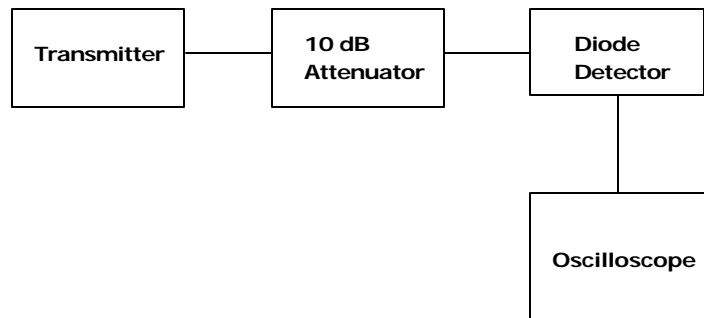
### 7.2.1. Measurements of Transmitter Parameters (Duty Cycle & Peak Power)

- The following shall be applied to the combination(s) of the radio device and its intended antenna(e).
- If the RF level is user adjustable, all measurements shall be made with the highest power level available to the user for that combination.
- The following method of measurement shall apply to both conducted and radiated measurements.
- The radiated measurements are performed at the Ultratech Calibrated Open Field Test Site.
- The measurement shall be performed using normal operation of the equipment with modulation.

Test procedure shall be as follows:

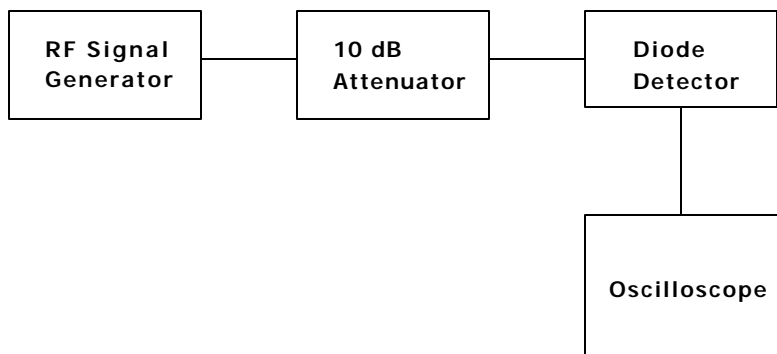
**Step 1:** Duty Cycle (x) and Peak Power (y) parameters measurements

- Connect the transmitter output to a diode detector through an attenuator
- Connect the diode detector to the vertical channel of an oscilloscope.
- The observed duty cycle of the transmitter,  $x = \text{Tx on} / (\text{Tx on} + \text{Tx off})$  with  $0 < x < 1$ , is measure and recorded in the test report. For the purpose of testing, the equipment shall be operated with a duty cycle that is equal or more than 0.1.
- Observe and record the y parameter of the DC level on the oscilloscope.



**Step 2:** Peak Power Measurements

- Replace the transmitter by a RF signal generator
- Set the signal generator frequency be the same as the transmitter frequency
- Adjust the rf output level of the RF signal generator until the DC level on the oscilloscope is same as that (y) recorded in step 1.
- Measure the RF signal generator output level using a power meter
- Calculate the total peak power (Pp) by adding the signal generator level with the attenuator value and the cable loss.



### 7.3. SPURIOUS EMISSIONS (RADIATED)

For both conducted and radiated measurements, the spurious emissions were scanned from the lowest frequency generated by the EUT or 10 MHz whichever is lower to 10<sup>th</sup> harmonic of the highest frequency generated by the EUT.

#### 7.3.1. Spurious Emissions (Radiated)

- The radiated emission measurements were performed at the UltraTech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC, Industry Canada, ACA/Austel, NVLap and ITI.
- Radiated emissions measurements were made using the following test instruments:
  1. Calibrated EMCO BiconiLog antenna in the frequency range from 30 MHz to 2000 MHz.
  2. Calibrated Emco Horn antennas in the frequency range above 1000 MHz (1GHz - 40 GHz).
  3. The test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:
    - RBW = 100 kHz for  $f < 1\text{GHz}$  and  $\text{RBW} = 1\text{ MHz}$  for  $f \geq 1\text{ GHz}$
    - VBW = RBW
    - Sweep = auto
    - Detector function = peak
    - Trace = max hold
    - Follows the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc.. A pre-amp and highpass filter are required for this test, in order to provide the measuring system with sufficient sensitivity.
    - Allow the trace to stabilize.

- The peak reading of the emission, after being corrected by the antenna correction factor, cable loss, pre-amp gain, etc.... is the peak field strength which comply with the limit specified in Section 15.35(b)

**Calculation of Field Strength:**

The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$FS = RA + AF + CF - AG$
--------------------------

Where FS = Field Strength  
 RA = Receiver/Analyzer Reading  
 AF = Antenna Factor  
 CF = Cable Attenuation Factor  
 AG = Amplifier Gain

Example: If a receiver reading of 60.0 dBuV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:

Field Level =  $60 + 7.0 + 1.0 - 30 = 38.0$  dBuV/m.  
 Field Level =  $10^{(38/20)} = 79.43$  uV/m.

- Submit this test data
- Now set the VBW to 10Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time of the each channel is less than 100ms, then the reading obtained may be further adjusted by a “duty cycle correction factor”, derived from  $10\log(\text{dwell time}/100\text{mS})$  in an effort to demonstrate compliance with the 15.209.
- Submit test data

**Maximizing The Radiated Emissions :**

- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.
- During this process, cables and peripheral devices were manipulated within the range of likely configuration.
- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement were explored to produce the highest amplitude signal relative to the limit.

The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

- Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.
- Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.
- Step3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.



- Step4: Move the antenna over its full allowable range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.
- Step5: Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.
- Step6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.
- Step7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.