FCC ID: PQS-DWM0001

Exhibit 2d

Engineering Report on

Spurious Emissions at Antenna Terminal (2.1051)

Assessment of Compliance

of

Spurious Emissions at Antenna Terminal in accordance with the FCC Rules & Regulations Part 2.1051 and 90

Wireless Modem
DUALWAVE M

Wavenet Technologies Pty Ltd.

February 2002

APREL Project No.:WVTB-DFUALWAVE M -3861

51 Spectrum Way Nepean ON K2R 1E6
Tel: (613) 820-2730 Fax: (613) 820-4161
email: info@aprel.com

APREL Laboratories

Engineering Report

Subject: **Assessment of Spurious Emissions at Antenna Terminal in accordance with the FCC Rules & Regulations Part 2.1051 and 90**

FCC ID: **PQS-DWM0001**

Equipment: **Wireless Modem attachment for Palm m125/m250/m505/PDA**

Model: **DUALWAVE M**

Client: **Wavenet Technologies Pty Ltd.**
140 Burswood Rd
Burswood, Perth, WA 6100
AUSTRALIA

Project #: WVTB-Dual Wave M-3861

Prepared By: **APREL Laboratories,**
Regulatory Compliance Division
51 Spectrum Way
Nepean, Ontario
K2R 1E6

Approved by: _____ Date: March 6, 2002
Jay Sarkar
Technical Director, Standards & Certification

Submitted by: _____ Date: March 6, 200
Jay Sarkar
Technical Director, Standards & Certification

Released by: _____ Date: March 6, 2002.
Dr. Jack J. Wojcik, P.Eng.

51 SPECTRUM WAY
NEPEAN, ONTARIO
CANADA K2R 1E6

VISIT OUR WEB PAGES: WWW.APREL.COM

TEL. (613) 820-2730
FAX (613) 820-4161
E-MAIL: INFO@APREL.COM

FCC ID: **PQS-DWM0001**
Applicant: Wavenet Technologies Pty Ltd.
Equipment: Wireless Modem attachment for Palm m125/m500/m505/PDA
Model: DUALWAVE M
Standard: FCC Rules and Regulations Part 2.1051 and 90

ENGINEERING SUMMARY

This report contains the results of the Spurious Emissions at antenna terminal measurement performed on a **Wavenet Wireless Modem attachment for Palm** m125/m500/m505/ or equivalent PDA**.** The measurements were carried out in accordance with the FCC Rules and Regulations Part 2.1051 and 90. The product was evaluated for the Spurious Emissions at the Antenna Terminal when it was set at the maximum power level and appropriately modulated. **The evaluation was carried out on Wireless Modem attached to Palm m500.**

The PDA Wireless Modem is an attachment for a Palm and it can be attached to a PC.

The **Wavenet DUALWAVE M Wireless Modem** was evaluated in three configurations:
1) Wireless Modem attached to Palm m500.
2) Wireless Modem attached to Palm m500 and connected to PC.
3) Wireless Modem connected with a PC.

No differences were observed in the test data when measured for above three configurations. As such, only the data for configuration 1, Wireless Modem attached to Palm m500 is presented.

The results presented in this report relate only to the sample tested.

Summary of the Results

Test Description	Page No.	Test Set-up Figure No.	Results Summary
Spurious Emissions at the Antenna Terminal Part 2.1051 and 90	8	1	Pass

INTRODUCTION

General

This report describes the results of the Spurious Emissions at the Antenna Terminal measurement conducted on a Wavenet Technologies Wireless Modem attachment for Palm m125/m500/m505/PDA model DUALWAVE M**.**

Test Facility

The evaluation for compliance was performed for Wavenet Technologies Pty Ltd**.** by APREL Laboratories at APREL's EMI facility located in Nepean, Ontario, Canada. The laboratory operates an (3m and 10m) Open Area Test Site (OATS). The measurement facility is calibrated in accordance with ANSI C63.4-1992.

A description of the measurement facility in accordance with the radiated and AC line conducted test site criteria per ANSI C63.4-1992 is on file with the Federal Communications Commission and is in compliance with the requirements of Section 2.948 of the Commissions rules and regulations. ***APREL's registration number is: 90416***

APREL is accredited by Standard Council of Canada. APREL is also accredited by Industry Canada and recognised by the Federal Communications Commissions (FCC).

Standard

The evaluation and analysis were conducted in accordance with FCC Rules and Regulations Parts 2.1051 and the appropriate limits (90).

Personnel: The test was conducted by Roman Kuleba. Methodology developed and report was written by Jay Sarkar.

Test Equipment

The test equipment used during the evaluation is listed in Appendix A with calibration due dates.

Environmental Conditions

- Temperature: 25 °C ± 2

- Relative Humidity: 30 - 50 %
- Air Pressure: 101 kPa ± 3

FCC SUBMISSION INFORMATION

FCC ID: **PQS-DWM0001**

Equipment (Type): **Wireless Modem attachment for Palm m125/m500/m505/PDA**
As marketed

Model: **DUALWAVE M**

For: Certification

Applicant: **Wavenet Technologies Pty Ltd.**
140 Burswood Rd
Burswood, Perth, WA 6100
AUSTRALIA

Manufacturer: **Wavenet Technologies Pty Ltd.**
140 Burswood Rd
Burswood, Perth, WA 6100
AUSTRALIA

Evaluated by: **APREL Laboratories**
51 Spectrum Way
Nepean, Ontario
Canada K2R 1E6

MANUFACTURER'S DATA

FCC ID No:	**PQS-DWM0001**
Equipment Type:	Wireless Modem attachment for Palm m125/m500/m505/PDA
Model:	DUALWAVE M
Reference:	FCC Rules and Regulations Parts 2 and Part 90
Manufacturer:	Wavenet Technologies Pty Ltd
Power Source:	3.6 VDC Battery, Lithium-ion
Development Stage of Unit:	Production

GENERAL SPECIFICATIONS

1.	Frequency Range:	806.00 to 821.00 MHz (Transmitter)
2.	Measured ERP:	1.622 W (32.1 dBm)
3.	Emission Designators (See 47 CFR § 2.201 and §2.202):	20K0F1D
4.	Antenna Impedance:	50 Ohms

Measurements: Spurious Emissions at Antenna Terminal

Ref.: **FCC Part 2 paragraph 2.1051 and Part 90.210**

Criteria: *Emission Mask G.* The power of emissions must be attenuated below the power of the unmodulated carrier (P) on any frequency removed from the centre of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB. This is calculated to be –13 dBm.

Set-up: See Figure No. **1.**

Methodology:

The DUI was set-up in accordance with the set-up/block diagram Figure no.1. The set –up consisted of the DUI, Spectrum Analyser, Attenuator, and other auxiliary instrumentation necessary to perform the measurements (see Measurement Equipment Lists).

The mobile was configured to operate at maximum power and applicable modulation applied to the transmitter.

The Wireless Modem was coupled to the spectrum analyzer through a 3-dB attenuator and a cable to the spectrum analyser. The antenna of the Wireless Modem was detached (detachable antenna) from the antenna port. In place of the antenna, a SMA-F to N-F connector adapter was connected and then from the N-F connector the 3-dB attenuator was hooked up. From the other side of the attenuator the Spectrum Analyser was connected via a cable (see block diagram and set-up photograph).

The spectrum was searched from nine kHz to the 10^{th} harmonic of the operating frequency.

Measurements required: Spurious emissions at antenna terminals — The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly terminated with a 50 ohms measurement system.

Spectrum Analyser Set-up - RB: 10kHz, VB: 10kHz, Span: 1MHz.

Data Required: Curves or equivalent data showing the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in paragraph 2.1049 as appropriate.

Not Required: The amplitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, was not reported.

Frequency Spectrum to be investigated: In all of the spurious emissions measurements of spurious emissions at antenna terminals (2.991) the Spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least to the 10^{th} harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower if the equipment operates below 10 GHz.

If operates below 40 GHz: Since the DUI operated below 10 GHz, the spectrum was searched from nine kHz to the 10^{th} harmonic of the operating frequency.

Harmonics and sub-harmonics: Particular attention was paid to harmonics and sub-harmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency.

Measurements contain: Measurements shown contain spectrum analyzer reading, correction factor, and final reading. The final spurious emission levels are derived from the analyzer measurement and the correction factor (3-dB attenuator and cable loss) as shown in the following example:

Calculation of data: A sample calculation is provided showing the final data obtained from the measured value.

Sample Calculation:

A. Spectrum analyzer reading (Direct measurement)

At 1630.00 MHz a spurious level of –48.6 dBm is measured.

B. Correction factor (3 dB attenuator and 1.2 dB cable loss also included in Reading)

Total Correction Factor: 4.2 dB

C. Spurious Emission Level (Spurious Emissions at Antenna Terminal)

C = A+B = –48.6 dBm + 4.2 dB = –44.4 dBm
C= –44.4 dBm

D. The criteria level is derived from this equation:
P_{TX} is the conducted power of the unmodulated carrier: 1.932 Watts (32.86 dBm)

$D = P_{TX} – [43 + (10 \cdot \log P_{TX(W)})]$
D = 32.86 dBm – [43 + (10·log 1.932 W)]
D = 32.86 dBm – 45.86 dB
D = Criteria (reference) level = -13.0 dBm

E = Margin (spurious emission below the reference level)

E = D - C
E = (-13.0 dBm) – (–44.4 dBm)
E = 31.4 dB

Results: **PASSED.** See Tables 2, 3 and 4 and the plots (shown only for configuration 1).

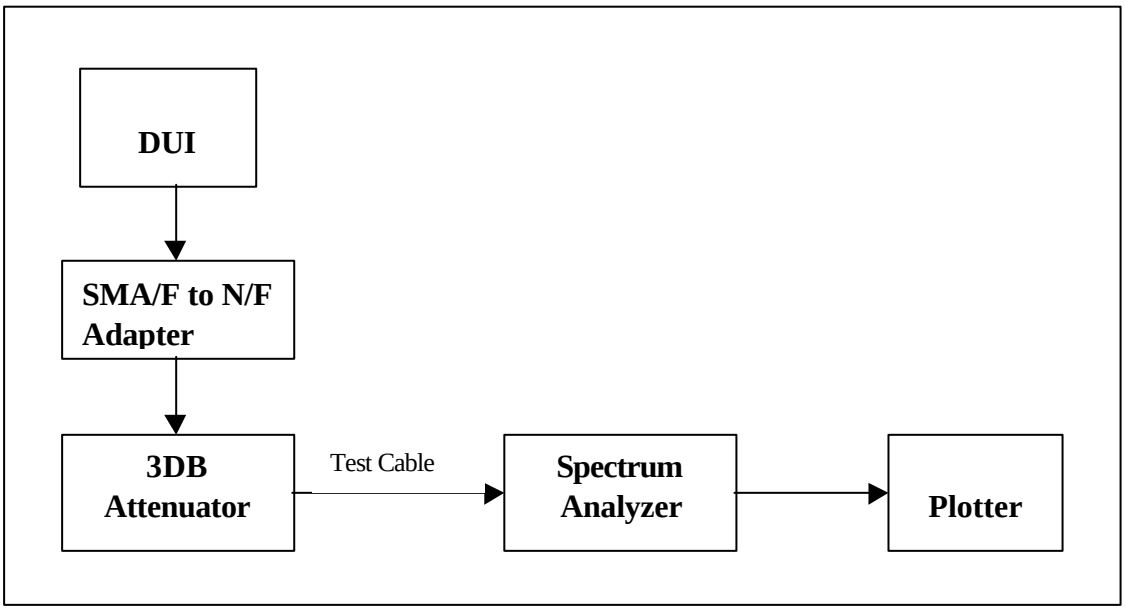


Figure 1: Set Up
Spurious Emissions at Antenna Terminal

DATA

Table 2
Spurious Emissions from Transmitter at Antenna Terminal

Configuration 1, Wireless Modem attached to Palm m500

Frequency (MHz)	Measured Level (dBm) A	Correction Factor B	Spurious Emission Level (dBm) C	Criteria Level (dBm) D	Margin (dB) E
815.00	28.7	4.2	32.9	-13.0	-
1630.00	-48.6	4.2	-44.4	-13.0	31.4
2445.00	-49.6 noise level	4.2	-45.4	-13.0	32.4
3260.00	-49.1	4.2	-44.9	-13.0	31.9
4075.00	-51.8 noise level	4.2	-47.6	-13.0	34.6
4890.00	-45.9	4.2	-41.7	-13.0	28.7
5705.00	-51.3	4.2	-47.1	-13.0	34.1
6520.00	-53.3 noise level	4.2	-49.1	-13.0	36.1
7335.00	-53.4 noise level	4.2	-49.2	-13.0	36.2
8150.00	-40.3 noise level	4.2	-36.1	-13.0	23.1

No other signals were detected.

Fundamental Transmitter Frequency: 815.00 MHz
R.B.: 10 kHz

Test performed by: Kr. Cleo Rowan **Date:** February 2002

Table 3
Spurious Emissions from Transmitter at Antenna Terminal

Configuration 2, Wireless Modem attached to Palm m500 and connected to PC

Frequency (MHz)	Measured Level (dBm) A	Correction Factor B	Spurious Emission Level (dBm) C	Criteria Level (dBm) D	Margin (dB) E
815.00	28.7	4.2	32.9	-13.0	-
1630.00	-50.5	4.2	-46.3	-13.0	33.3
2445.00	-49.8 noise level	4.2	-45.6	-13.0	32.6
3260.00	-50.9	4.2	-46.7	-13.0	33.7
4075.00	-51.6 noise level	4.2	-47.4	-13.0	34.4
4890.00	-47.6	4.2	-43.4	-13.0	30.4
5705.00	-52.9	4.2	-48.7	-13.0	35.7
6520.00	-53.6 noise level	4.2	-49.4	-13.0	36.4
7335.00	-54.4 noise level	4.2	-50.2	-13.0	37.2
8150.00	-40.0 noise level	4.2	-35.8	-13.0	22.8

No other signals were detected.

Fundamental Transmitter Frequency: 815.00 MHz
R.B.: 10 kHz

Test performed by: Ken Rosen **Date:** February 2002

Table 4
Spurious Emissions from Transmitter at Antenna Terminal

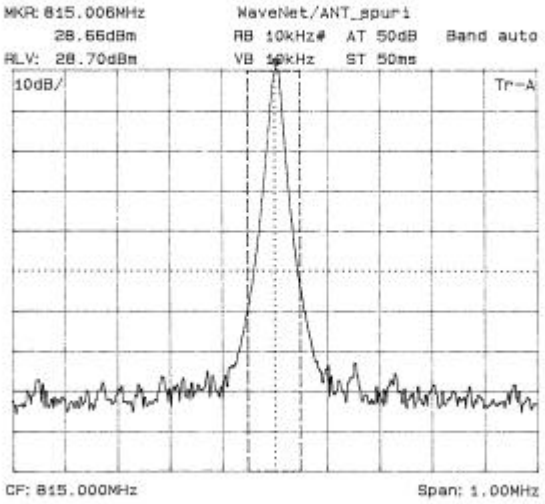
Configuration 3, Wireless Modem without palm connected to a PC

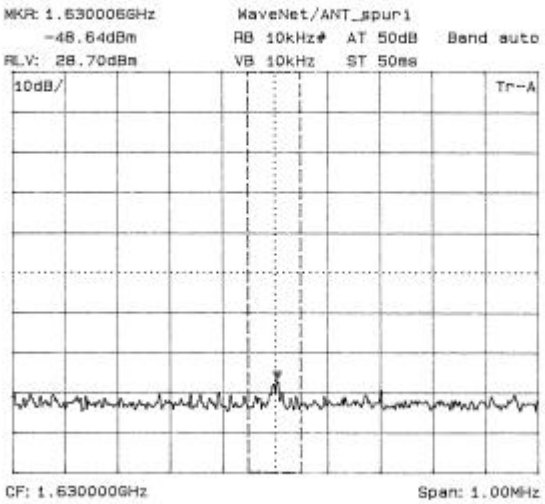
Frequency (MHz)	Measured Level (dBm) A	Correction Factor B	Spurious Emission Level (dBm) C	Criteria Level (dBm) D	Margin (dB) E
815.00	28.7	4.2	32.9	-13.0	-
1630.00	-49.6	4.2	-45.4	-13.0	32.4
2445.00	-49.7 noise level	4.2	-45.5	-13.0	32.5
3260.00	-50.9	4.2	-46.7	-13.0	33.7
4075.00	-51.5 noise level	4.2	-47.3	-13.0	34.3
4890.00	-46.8	4.2	-42.6	-13.0	29.6
5705.00	-52.9	4.2	-48.7	-13.0	35.7
6520.00	-53.5 noise level	4.2	-49.3	-13.0	36.3
7335.00	-54.0 noise level	4.2	-49.8	-13.0	36.8
8150.00	-40.3 noise level	4.2	-36.1	-13.0	23.1

No other signals were detected.

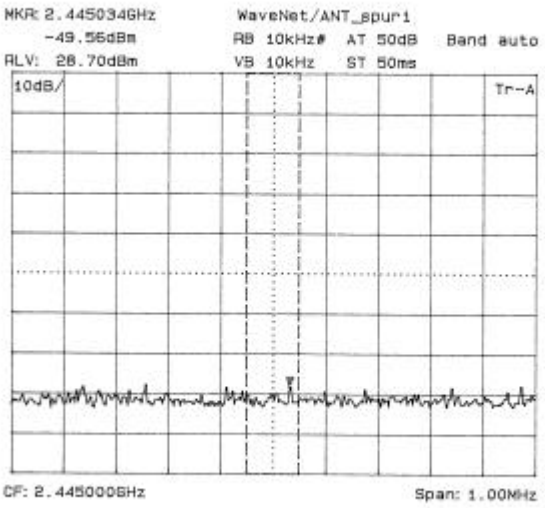
Fundamental Transmitter Frequency: 815.00 MHz
R.B.: 10 kHz

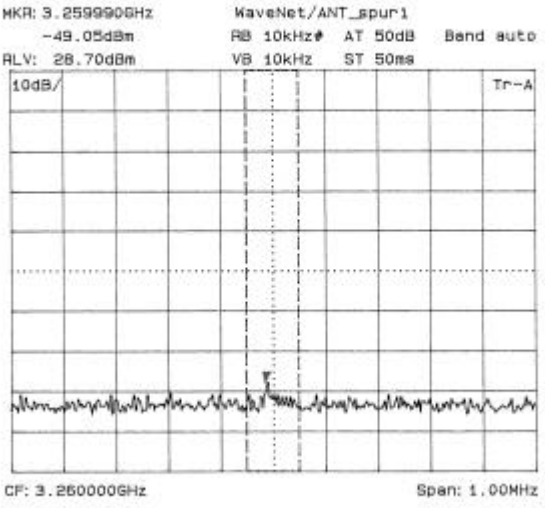
Test performed by: Ku Celso Rowan **Date:** February 2002



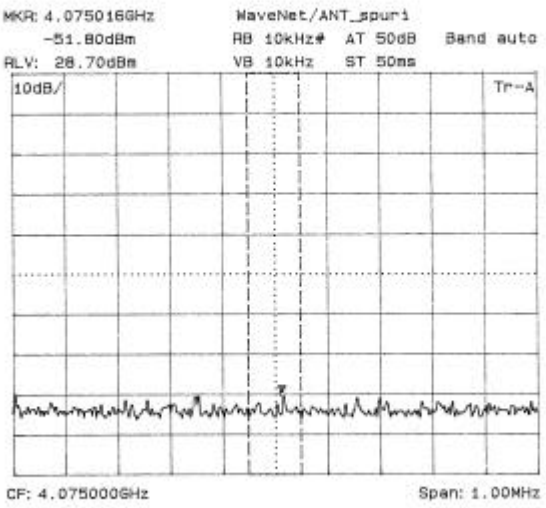


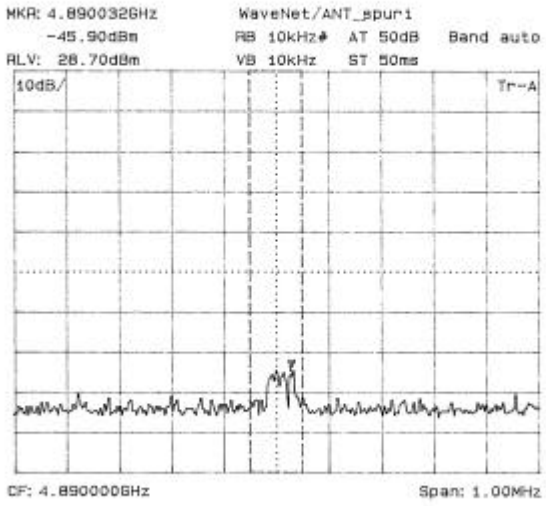
Configuration 1
Spurious Emissions from Transmitter
Fundamental frequency and 2nd harmonic



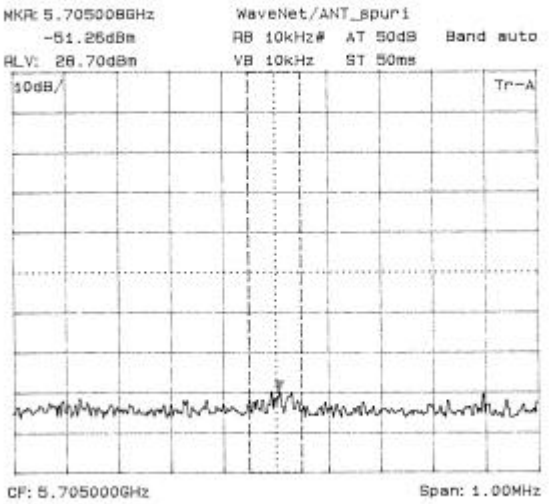


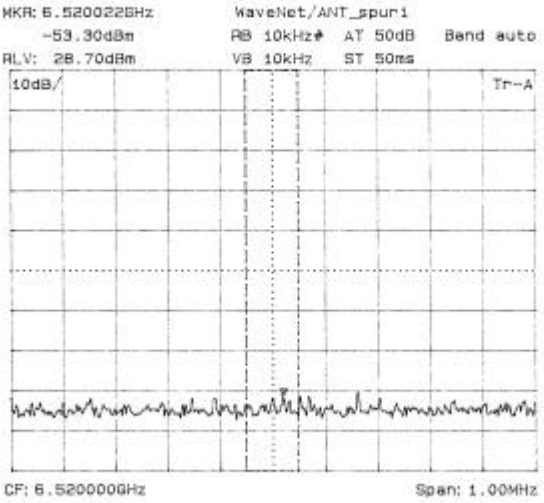
Configuration 1
Spurious Emissions from Transmitter
3rd and 4th harmonic



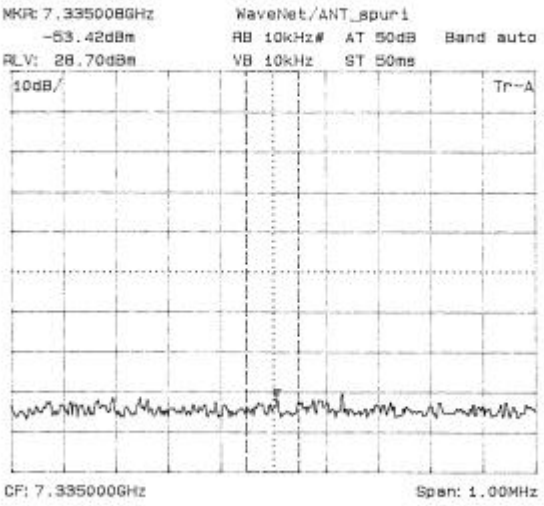


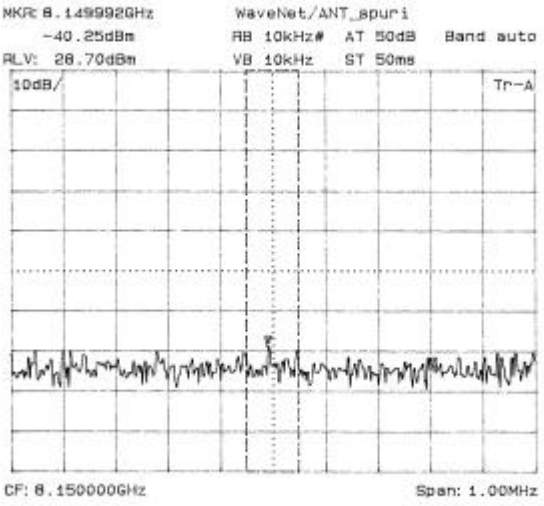
Configuration 1
Spurious Emissions from Transmitter
5th and 6th harmonic





Configuration 1
Spurious Emissions from Transmitter
7th and 8th harmonic





Configuration 1
Spurious Emissions from Transmitter
9th and 10th harmonic
No other signals were detected.

APPENDIX A
TESTING EQUIPMENT

List of Equipment used

Description	Manufacturer	Model #	Asset #	Calibration Due Data
Spectrum Analyzer	Anritsu	MS2661C	301330	Dec 10, 2002
Power Meter	Rhode & Schwarz	NRVS	100851	July 21, 2002
3 dB Attenuator	Bird	8307-030-N	100889	CBT

APPENDIX B
PHOTOGRAPHS

Palm and Wireless Modem DUALWAVE M

Testing Spurious Radiation from Transmitter at Antenna Port on DUALWAVE M Wireless Modem only connected to PC

Testing Spurious Radiation from Transmitter at Antenna Port
Palm attached to DUALWAVE M Wireless Modem

Testing Spurious Radiation from Transmitter at Antenna Port
Palm attached to DUALWAVE M Wireless Modem and connected to PC