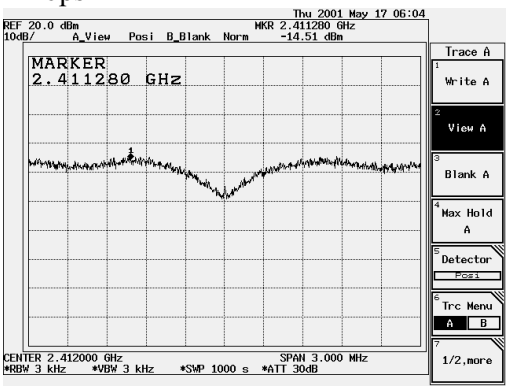
## 6.5. Test Result of Transmitter Power Density

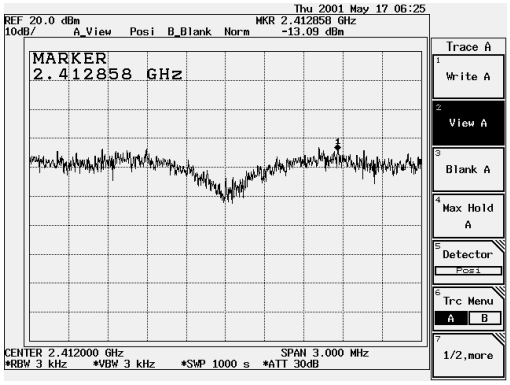
Product : Mozart
Test Item : Transmitter Power Density Data
Test Site : No.1 OATS
Test Mode : Normal Operation

| Channel No. | Frequency (MHz) | Measurement Level (dBm) | Required Limit (dBm) | Result |
|---|---|---|---|---|
| 1 (1Mbps) | 2411.991 | -14.51dBm | < 8dBm | Pass |
| 1 (2Mbps) | 2411.991 | -13.09dBm | < 8dBm | Pass |
| 1 (5.5Mbps) | 2411.991 | -13.69dBm | < 8dBm | Pass |
| 1 (11Mbps) | 2411.991 | -11.56dBm | < 8dBm | Pass |

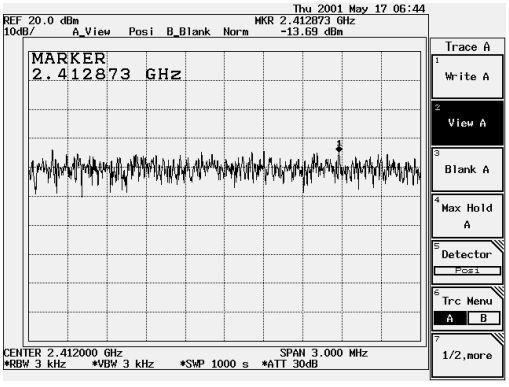
1Mbps



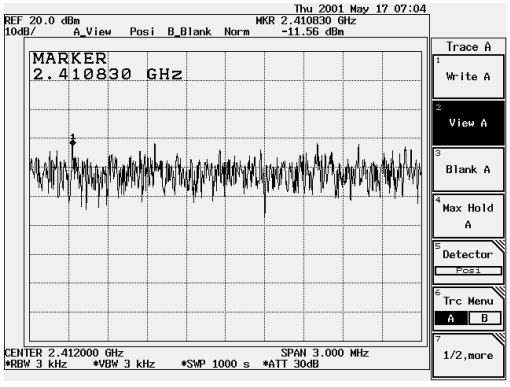

2Mbps




5.5Mbps



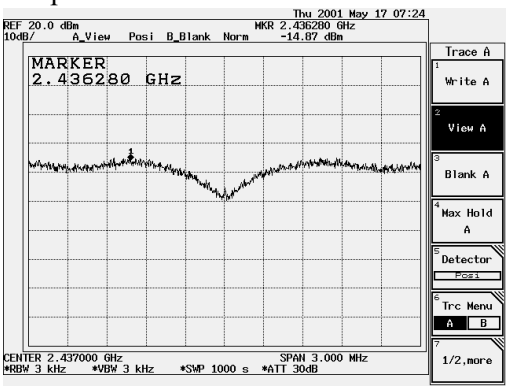

11Mbps



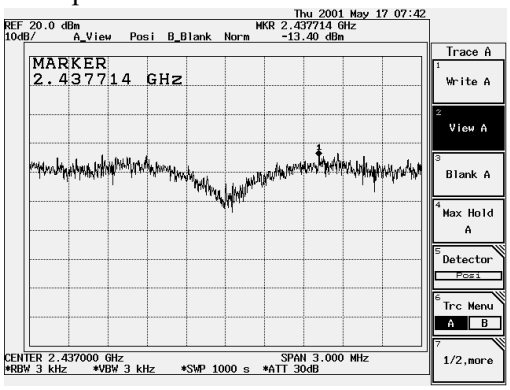
Product : Mozart
Test Item : Transmitter Power Density Data
Test Site : No.1 OATS
Test Mode : Normal Operation

| Channel No. | Frequency (MHz) | Measurement Level (dBm) | Required Limit (dBm) | Result |
|---|---|---|---|---|
| 6 (1Mbps) | 2441.991 | -14.87dBm | < 8dBm | Pass |
| 6 (2Mbps) | 2441.991 | -13.40dBm | < 8dBm | Pass |
| 6(5.5Mbps) | 2441.991 | -13.95dBm | < 8dBm | Pass |
| 6 (11Mbps) | 2441.991 | -11.95dBm | < 8dBm | Pass |

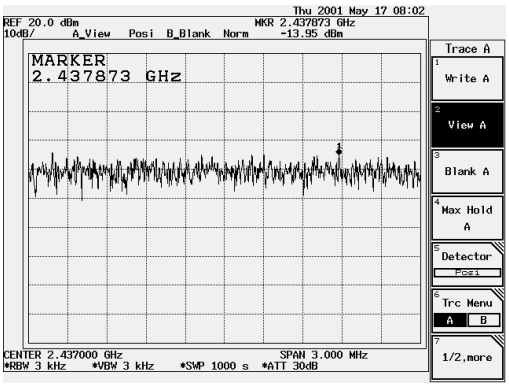
1Mbps



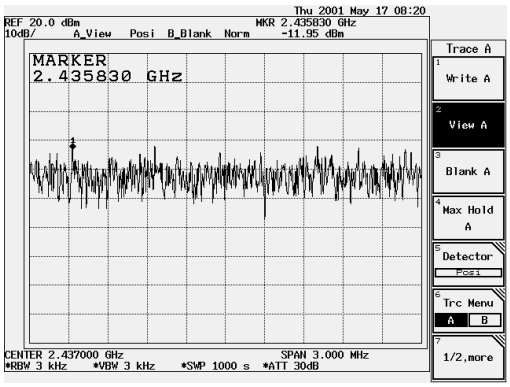

2Mbps




5.5Mbps



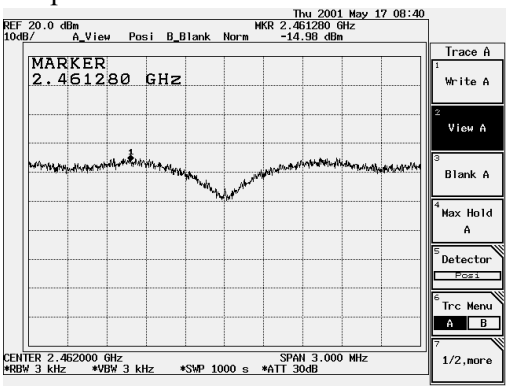

11Mbps



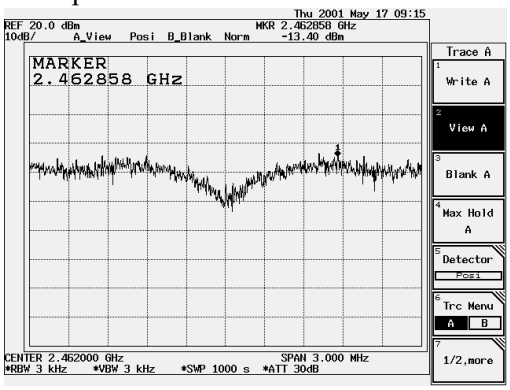
Product : Mozart
Test Item : Transmitter Power Density Data
Test Site : No.1 OATS
Test Mode : Normal Operation

| Channel No. | Frequency (MHz) | Measurement Level (dBm) | Required Limit (dBm) | Result |
|---|---|---|---|---|
| 11 (1Mbps) | 2471.991 | -14.98dBm | < 8dBm | Pass |
| 11 (2Mbps) | 2471.991 | -13.40dBm | < 8dBm | Pass |
| 11 (5.5Mbps) | 2471.991 | -13.99dBm | < 8dBm | Pass |
| 11 (11Mbps) | 2471.991 | -11.95dBm | < 8dBm | Pass |

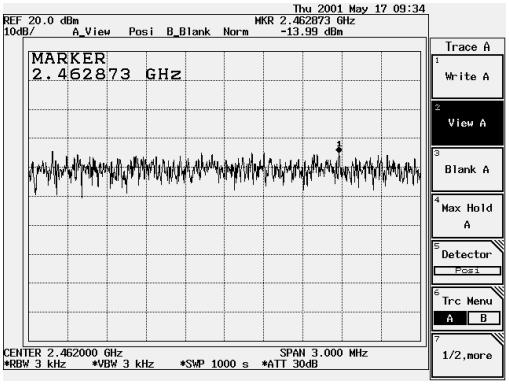
1Mbps



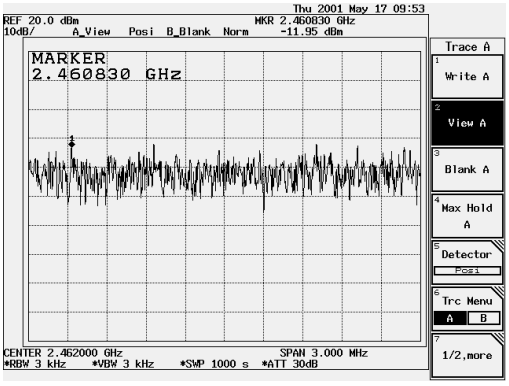

2Mbps




5.5Mbps




11Mbps



# 7. Processing Gain

## 7.1. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

## 7.2. Minimum Standard

The processing gain shall be at least 10 dB.

## 7.3. Method of Measurement

The processing gain of this spread spectrum was measured the CW jamming method. The Section9.1 illustrates the measurement setup. The output power of the spread spectrum transmitter is fixed and the output power of jammed is adjustable. The frequency of iammer was stopped through the pass band of nominal channel in 50kHz steps. In each frequency step of the jammed, the output power of rammed is adjusted to cause the Bit Error Rate (BER) to be 1.0*10e-6. The power levels are recorded to calculate the J/S as shown in Table 1.

## 7.4. Calculation of Processing Gain:

The processing gain was determined by measuring the jamming margin of the EUT and using the following formula:

Gp = (S/N)o + Mj + Lsys

Where (S/N)o is the required signal to noise ratio at the receiver output
Mj is the jammer to signal ratio (J/S)
Lsys is the system loss

The (S/N)o is calculated from:

Pe = 1/2exp(-1/2(S/N)o) ; Pe = probability of error (BER)

For the Pe(BER) = 1.0*10e-6, the required (S/N)o is 14.2dB

From Measurement, the minimum J/S(Mj) is –3.4dB
We assume the system loss is 1dB.
Therefore the processing gain is calculated below:

Gp = (S/N)o + Mj + Lsys = 14.2 + (-3.4) + 1 = 11.8 (dB)

## 7.5. Test Result of Processing Gain

## 8. EMI Reduction Method During Compliance Testing

No modification was made during testing.

## 9. Attachment

| | | |
|---|---|---|
| Attachment 1: EUT Test Photographs | Number of Pages : | 3 |
| Attachment 2: EUT Detailed Photographs | Number of Pages : | 11 |
| Attachment 3: Processing Gain Test Report | Number of Pages : | 30 |

Attachment 1 : EUT Test Photographs

Attachment 2 : EUT Detailed Photographs

# Attachment 3 : Processing Gain Test Report

# PROCESSING GAIN TEST REPORT

**REPORT NO.:** RF90022613
**MODEL NO.:** WarpLink 2411
**RECEIVED:** February 26, 2001
**TESTED:** March 6, 2001

**APPLICANT:** Acer NeWeb Corporation

**ADDRESS:** 6F, No.110, Sec. 2, Tung Ta Road,
Hsinchu, Taiwan, R.O.C.

**ISSUED BY:** Advance Data Technology Corporation

**LAB LOCATION:** 13-1, Lane 19, Wen Shan 3rd St., Kweishan,
Taoyuan Hsien, Taiwan, R.O.C.



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# Table of Contents

# 1 CERTIFICATION

| | |
|---|---|
| **PRODUCT :** | 11Mbps Wireless LAN PCMCIA Card |
| **BRAND NAME :** | Acer |
| **MODEL NO. :** | WarpLink 2411 |
| **APPLICANT :** | Acer NeWeb Corporation |
| **STANDARDS :** | 47 CFR Part 15, Subpart C (Section 15.247 e2), |
| **SITE REGISTERATION NO :** | 90422 (FCC)<br>IC 3789-5 (Canada IC) |

We, **Advance Data Technology Corporation**, hereby certify that one sample WA3001A of the designation has been tested in our facility on March 6, 2001.
The test record, data evaluation and Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions herein specified.

Tested by : Steven Lu , Date: March 6, 2001
Steven Lu

Prepared by : Demi Chen , Date: March 6, 2001
Demi Chen

Approved by : Alan Lane , Date: Mar. 6, 2001
Dr. Alan Lane, Manager

## 2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

| APPLIED STANDARD: 47 CFR Part 15, Subpart C | | | |
|---|---|---|---|
| **STANDARD PARAGRAPH** | **TEST REQUIREMENTS** | **RESULT** | **REMARK** |
| 15.247(e) | Processing Gain of Direct Sequence Spread Spectrum System<br>Spec.: min. 10 dB | PASS | 20% points lower than 10dB is allowed |

# 3 GENERAL INFORMATION

## 3.1 GENERAL DESCRIPTION OF EUT

| | |
|---|---|
| **PRODUCT** | 11Mbps Wireless LAN PCMCIA Card |
| **MODEL NO.** | WarpLink 2411 |
| **POWER SUPPLY** | 3.3VDC |
| **DATA CABLE** | |
| **I/O PORTS** | NA |
| **MODULATION TYPE** | DSSS BPSK/QPSK/CCK |
| **TRANSFER RATE** | 11/5.5/2/1Mbps |
| **FREQUENCY RANGE** | 2412 ~ 2462MHz |
| **NUMBER OF CHANNEL** | 11 |
| **ANTENNA TYPE** | |
| **ASSOCIATED DEVICES** | NA |
| **DESCRIPTION BETWEEN MODELS** | NA |

## 3.2 DESCRIPTION OF TEST MODES

Eleven channels are provided in this EUT.

| Channel | Frequency | Channel | Frequency |
|---|---|---|---|
| 1 | 2412 MHz | 7 | 2442 MHz |
| 2 | 2417 MHz | 8 | 2447 MHz |
| 3 | 2422 MHz | 9 | 2452 MHz |
| 4 | 2427 MHz | 10 | 2457 MHz |
| 5 | 2432 MHz | 11 | 2462 MHz |
| 6 | 2437 MHz | | |

Note: Since the processing gain of data rate 11Mbps is lower than that of the other data rates, so only 11Mbps is shown in this test report.

## 3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a 11Mbps Wireless LAN PCMCIA Card, according to the specifications of the manufacturers, it must comply with the requirements of the following standards:

**FCC CFR 47 Part 15, Subpart C. (15.247 e2)**

All tests have been performed and recorded as per the above standards.

## 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| No | Product | Brand | Model No. | Serial No. | I/O Cable |
|---|---|---|---|---|---|
| 1 | NOTEBOOK | DELL | Insprion 5000e | TW-012JXN-12961-0139-2192 | Nonshielded Power (1.8m) |
| 2 | NOTEBOOK | DELL | PPX | 99125 | Nonshielded Power (1.8m) |

# 4 TEST PROCEDURES AND RESULTS

## 4.1 LIMITS OF PROCESSING GAIN OF A DIRECT SEQUENCE SPREAD SPECTRUM MEASUREMENT

Discard the worst 20%, the limit is 10dB.

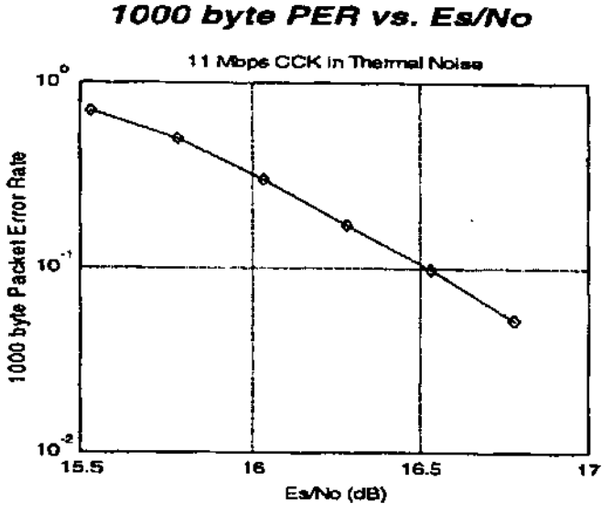
## 4.2 TEST INSTRUMENTS & SUPPORT UNIT

| Description & Manufacturer | Model No. | Serial No. |
|---|---|---|
| Anritsu Spectrum Analyzer, 9kHz to 30GHz | MS2667C | M10281 |
| Anritsu Signal Generator, 10kHz to 20GHz | 68247B | 984703 |
| Hewlett Packard Power Meter, | HP438A | 2743A04416 |
| Hewlett Packard Power Sensor, -30 to 20dBm | 8485A | 2942A08387 |
| Hewlett Packard Step Attenuator, 10dB steps | HP8496B | 3247A18505 |
| Mini-Circuits Power Splitter | ZN2PD-9G | NA |
| DELL Laptop Computer | Inspiron 5000e | TW-012JXN-12961-0139-2192 |
| DELL Laptop Computer | PPX | 99125 |

## 4.3 METHOD OF MEASUREMENT

The processing gain may be measured using the CW jamming margin method. Section 4.4 shows the test configuration. The test consists of stepping a signal generator in 50 kHz increments across the passband of the system. At each point, the generator level required to produce the recommended Bit Error Rate (BER) is recorded. This level is jammer level. The output power of the transmitting unit is measured at the same point. The jammer to Signal (J/S) ratio is then calculated. Discard the worst 20% of the J/S data points. The lowest remaining J/S ratio is used when calculating the Process Gain.

The reference PER is specified as 8%. The corresponding Es/No (signal to noise ratio per symbol) is 16.4 dB. The curve is attached as below.




This value and the measured J/S ratio are used in the following equation to calculate the Process Gain (Gp) of the system.

$$Gp = (S/N)_o + Mj + Lsys$$

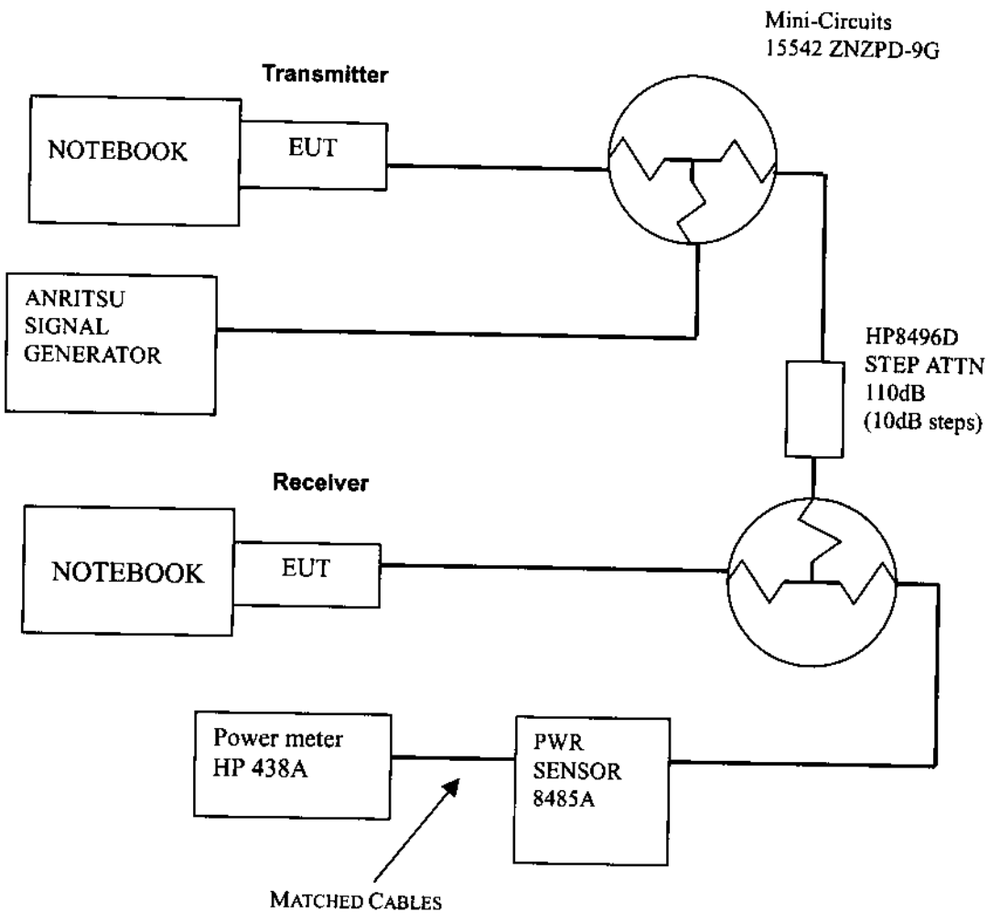
Where:

$(S/N)_o$: Signal to noise ratio for the chosen BER.

Mj : Maximum jammer to Signal Ratio recorded at the detected BER.

Lsys : System losses . We assume 1dB as the system Loss (maximum 2dB is allowed).

## 4.4 TEST SETUP



## 4.5 TEST PROCEDURES

Obtain the simplex link shown. Perform all independent instrumentation calibrations prior to this procedure. Set operating power levels using fixed and variable attenuators in system to meet the following objectives:

Signal Power at receiver approximately –55dBm (above thermal sensitivity such that thermal noise does not cause bit errors.

Signal Power at power meter between –20 and –30dBm for optimal linearity.

Use spectrum analyzer to monitor test.

Ensure that CW Jammer generator RF output is disabled and measure the power at the power meter port using the power meter. This is the relative signal power, Sr.

Disable Transmitter, and set CW Jammer generator RF output frequency equal to the carrier frequency and enable generator output. Set reference CW Jammer power level at power meter port 8.4dB below Sr (minimum J/S, or 10dB processing gain reference level). Note the power level setting on the generator, this is the reference CW Jammer power setting, Jr.

Disable CW Jammer, re-establish link. PER test should be operating essentially error -free.

Enable CW Jammer at the reference power level and verify that the PER test indicates a PER of less than 8%.

Alternatively, adjust the CW Jammer level to that which causes 8% PER and verify that the S/J is less than 8.4dB.

Repeat step 7 for uniform steps in frequency increments of 50 kHz across the receiver passband with the CW Jammer. In this case the receiver passband is +/- 8.5 MHz over carrier frequency.

The numerical data associated with the following radio channel is tabulated and presented for Channel 1,6, and 11.

## 4.6 EUT OPERATING CONDITION

The software provided by client to set the EUT to transmit at lowest, middle and highest channel.