CERTIFICATE OF COMPLIANCE FCC PART 22 MEASUREMENTS

Test Lab:

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Testing and Engineering Services

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Applicant Information:

SIERRA WIRELESS INC.

13575 Commerce Parkway, Suite 150 Richmond, B.C. Canada V6V 2L1 Attn: Trent McKeen, Senior RF Engineer

FCC Classification: Licensed Non-Broadcast Station Transmitter (TNB)

 FCC Rule Part(s):
 §22.901(d), §2

 FCC ID:
 N7NACRD2

 Model(s):
 AirCard 300/350

Equipment Type: PCMCIA CDPD Modem Card installed in Itronix FeX21

Rugged Laptop PC with Itronix Dipole Antenna

Tx Frequency Range: 824-849 MHz
Rx Frequency Range: 869-894 MHz
Max. RF Output Power: 0.518 Watts (ERP)

Frequency Tolerance: 2.5 PPM Emission Designator: 31K5FXW

Class II Change(s): Add Itronix FeX21 Laptop PC & Itronix Dipole Antenna

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Celltech Research Inc. certifies that no party to this application has been denied FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

Shawn McMillen General Manager

Celltech Research Inc.





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MEASUREMENT REPORT - FCC PART 22

1.1 SCOPE

Measurement and determination of electromagnetic emissions (EME) from radio frequency devices for compliance with the technical rules and regulations of the Federal Communications Commission.

§2.1033(a) General Information

APPLICANT:

SIERRA WIRELESS INC. 13575 Commerce Parkway, Suite 150 Richmond, B.C. Canada V6V 2LI Attn: Trent McKeen, Senior RF Engineer

| FCC ID | N7NACRD2 |
|----------------------|---|
| Model(s) | AirCard 300/350 |
| EUT Type | PCMCIA CDPD Modem Card installed in Itronix FeX21 Laptop PC with Itronix Dipole Antenna |
| Classification | Licensed Non-Broadcast Station Transmitter (TNB) |
| Rule Part(s) | §22.901(d), §2 |
| Max. RF Output Power | 0.518 Watts (ERP) |
| Tx Freq. Range | 824-849 MHz |
| Rx Freq. Range | 869-894 MHz |
| Emission Designator | 31K5FXW |
| Signal Modulation | GMSK |
| Mode(s) Tested | Unmodulated Carrier |
| Class II Change(s) | Add Itronix FeX21 Laptop PC with Dipole Antenna |

2.1 MEASUREMENT PROCEDURES

2.2 SPURIOUS EMISSIONS AT ANTENNA TERMINAL - §2.1051

The level of the carrier and the various conducted spurious and harmonic frequencies were measured by means of a calibrated spectrum analyzer. The spectrum was scanned from 10MHz to 20GHz. The antenna output terminal of the EUT was connected to the input of a 50Ω spectrum analyzer through a matched 40dB attenuator and coaxial cable. The transmitter was operating at maximum power with internal data modulation.

2.3 RADIATED SPURIOUS AND HARMONIC EMISSIONS - §2.1053

Radiated and harmonic emissions above 1 GHz were measured at our 3-meter outdoor site. The EUT was placed on the turntable with the transmitter transmitting into a non-radiating load. A receiving antenna located 3 meters from the turntable received any signal radiated from the transmitter and its operating accessories. The receiving antenna was varied from 1 to 4 meters and the polarization was varied (horizontal and vertical) to determine the worst-case emission level.

3.1 TEST DATA

3.2 EFFECTIVE RADIATED POWER OUTPUT - §2.1046

| Freq. Tuned | EUT Conducted Power | Max. Field Strength of EUT (dBm) | Dipole Gain | Dipole Forward Conducted Power | ERP o Dipole H Dipole F Conducte | e Gain - Forward |
|-------------|---------------------------|---|----------------|---|--|------------------------|
| (MHz) | (dBm) | Vertical Pol. | (dBd) | (dBm) | (dBm) | (Watts) |
| 824.04 | 24.45 | - 10.45 | - 1.44 | 28.58 | 27.14 | 0.518 |
| 836.49 | 25.10 | - 10.81 | - 1.34 | 27.57 | 26.23 | 0.420 |
| 848.97 | 24.46 | - 13.60 | - 1.24 | 25.21 | 23.97 | 0.249 |

Notes:

ERP Measurements by Substitution Method:

The EUT was placed on a turntable 3-meters from the receive antenna. The field of maximum intensity was found by rotating the EUT approximately 360 degrees and changing the height of the receive antenna from 1 to 4 meters. The field strength was recorded from a calibrated spectrum analyzer for each channel being tested. A half-wave dipole was substituted in place of the EUT. The dipole was fed through a directional coupler and the power at the coupler port was monitored. A signal generator and power amplifier controlled the dipole, and the input level of the dipole was adjusted to the same field strength level as the EUT. The feed point for the dipole was then connected to a calibrated power meter and the power adjusted to read the same as the coupler port previously recorded, this is to account for any mismatch in impedance, which may occur at the dipole antenna. The conducted power at the antenna feed point was recorded. The forward power for the dipole was then determined and the ERP level was determined by adding the forward dipole power and the dipole gain in dB. For readings above 1GHz the above method is repeated using standard gain horn antennas.

3.3 FIELD STRENGTH OF SPURIOUS RADIATION - 2.1053

Operating Frequency (MHz): 824.04

Channel: 991 (Low)

Measured Cond. Pwr. (dBm): 24.45 Measured ERP (dBm): 27.14

Modulation: Unmodulated Carrier

Distance: 3 Meters

Limit: $43 + 10 \log (W) = 40.31 \text{ dBc}$

| Frequency | Field Strength of Spurious Radiation | Horn Forward Cond. Pwr. | Standard Gain Horn Antenna Gain | POL (H/V) | EIRP (dBm) | ERP (dBm) | dBc |
|-----------|--|----------------------------|---------------------------------------|-----------|---------------|--------------|-------|
| (MHz) | (dBm) | (dBm) | (dBi) | | | | |
| 1648.08 | -57.91 | -32.73 | 6.6 | V | -26.13 | -28.27 | 55.41 |
| 2472.12 | -73.45 | -46.25 | 7.8 | > | -38.45 | -40.59 | 67.73 |
| 3296.16 | -73.92 | -38.76 | 7.8 | > | -31.01 | -33.15 | 60.29 |
| 4120.20 | -78.80 | -49.78 | 7.6 | > | -42.18 | -44.32 | 71.46 |
| 4944.24 | -85.22 | -58.86 | 8.5 | > | -50.36 | -52.50 | 79.64 |
| 5768.28 | -85.02 | -58.14 | 8.8 | ٧ | -49.34 | -51.48 | 78.62 |
| 6592.32 | -79.12 | -64.04 | 9.6 | V | -54.44 | -56.58 | 83.72 |
| 7416.36 | -95.57 | -70.04 | 9.0 | V | -61.04 | -63.18 | 90.32 |
| 8240.40 | < -104 | | | | | | |

Notes:

Radiated Measurements by Substitution Method:

The EUT was placed on a turntable 3-meters from the receive antenna. The field of maximum intensity was found by rotating the EUT approximately 360 degrees and changing the height of the receive antenna from 1 to 4 meters. The field strength was recorded from a calibrated spectrum analyzer for each channel being tested. A standard gain horn antenna was substituted in place of the EUT. The antenna was fed through a directional coupler and the power at the coupler port was monitored. A signal generator and power amplifier controlled the antenna, and the input level of the antenna was adjusted to the same field strength level as the EUT. The feed point for the antenna was then connected to a calibrated power meter and the power adjusted to read the same as the coupler port previously recorded, this is to account for any mismatch in impedance, which may occur at the hom antenna. The conducted power at the antenna feed point was recorded. The forward power for the antenna was then determined and the EIRP level was determined by adding the forward power and the antenna gain in dB.

FIELD STRENGTH OF SPURIOUS RADIATION - 2.1053

Operating Frequency (MHz): 836.49

Channel: 383 (Mid)

Measured Cond. Pwr. (dBm): 25.10

Measured ERP (dBm): 26.23

Modulation: Unmodulated Carrier

Distance: 3 Meters

Limit: $43 + 10 \log (W) = 40.31 \text{ dBc}$

| Frequency | Field Strength of Spurious Radiation | Horn Forward Cond. Pwr. | Standard Gain Horn Antenna Gain | POL (H/V) | EIRP (dBm) | ERP (dBm) | dBc |
|-----------|--|----------------------------|---------------------------------------|-----------|---------------|-----------|-------|
| (MHz) | (dBm) | (dBm) | (dBi) | | | | |
| 1672.98 | -61.26 | -38.37 | 6.6 | V | -31.77 | -33.91 | 60.14 |
| 2509.47 | -66.32 | -41.26 | 7.8 | > | -33.46 | -35.60 | 61.83 |
| 3345.96 | -77.98 | -51.40 | 7.8 | > | -43.65 | -45.79 | 72.02 |
| 4182.45 | -89.40 | -61.38 | 7.6 | V | -53.78 | -55.92 | 82.15 |
| 5018.94 | -84.51 | -58.15 | 8.5 | > | -49.65 | -51.79 | 78.02 |
| 5855.43 | -86.78 | -65.90 | 8.8 | > | -57.10 | -59.24 | 85.47 |
| 6691.92 | -91.27 | -70.39 | 9.6 | V | -60.79 | -62.93 | 89.16 |
| 7528.41 | < -104 | | | | | | |
| 8364.90 | < -104 | | | | | | |

Notes:

Radiated Measurements by Substitution Method:

The EUT was placed on a turntable 3-meters from the receive antenna. The field of maximum intensity was found by rotating the EUT approximately 360 degrees and changing the height of the receive antenna from 1 to 4 meters. The field strength was recorded from a calibrated spectrum analyzer for each channel being tested. A standard gain horn antenna was substituted in place of the EUT. The antenna was fed through a directional coupler and the power at the coupler port was monitored. A signal generator and power amplifier controlled the antenna, and the input level of the antenna was adjusted to the same field strength level as the EUT. The feed point for the antenna was then connected to a calibrated power meter and the power adjusted to read the same as the coupler port previously recorded, this is to account for any mismatch in impedance, which may occur at the horn antenna. The conducted power at the antenna feed point was recorded. The forward power for the antenna was then determined and the EIRP level was determined by adding the forward power and the antenna gain in dB.

FIELD STRENGTH OF SPURIOUS RADIATION - 2.1053

Operating Frequency (MHz): 848.97

Channel: 799 (High)

Measured Cond. Pwr. (dBm): 24.46 Measured ERP (dBm): 23.97

Modulation: Unmodulated Carrier

Distance: 3 Meters

Limit: $43 + 10 \log (W) = 40.31 \text{ dBc}$

| Frequency | Field Strength of Spurious Radiation | Horn Forward Cond. Pwr. | Standard Gain Horn Antenna Gain | POL (H/V) | EIRP (dBm) | ERP (dBm) | dBc |
|-----------|--|----------------------------|---------------------------------------|-----------|---------------|-----------|-------|
| (MHz) | (dBm) | (dBm) | (dBi) | | | | |
| 1697.94 | -63.56 | -37.98 | 6.6 | V | -31.38 | -33.52 | 57.49 |
| 2546.91 | -67.03 | -39.43 | 7.8 | ٧ | -31.63 | -33.77 | 57.74 |
| 3395.88 | -75.17 | -37.28 | 7.8 | ٧ | -29.53 | -31.67 | 55.64 |
| 4244.85 | -87.36 | -58.34 | 7.6 | V | -50.74 | -52.88 | 76.85 |
| 5093.82 | -89.68 | -63.22 | 8.5 | > | -54.72 | -56.86 | 80.83 |
| 5942.79 | -89.94 | -69.06 | 8.8 | ٧ | -60.26 | -62.40 | 86.37 |
| 6791.76 | -76.31 | -57.03 | 9.6 | V | -47.43 | -49.57 | 73.54 |
| 7640.73 | -93.99 | -74.71 | 9.0 | V | -65.71 | -67.85 | 91.82 |
| 8489.70 | < -104 | | | | | | |

Notes:

Radiated Measurements by Substitution Method:

The EUT was placed on a turntable 3-meters from the receive antenna. The field of maximum intensity was found by rotating the EUT approximately 360 degrees and changing the height of the receive antenna from 1 to 4 meters. The field strength was recorded from a calibrated spectrum analyzer for each channel being tested. A standard gain horn antenna was substituted in place of the EUT. The antenna was fed through a directional coupler and the power at the coupler port was monitored. A signal generator and power amplifier controlled the antenna, and the input level of the antenna was adjusted to the same field strength level as the EUT. The feed point for the antenna was then connected to a calibrated power meter and the power adjusted to read the same as the coupler port previously recorded, this is to account for any mismatch in impedance, which may occur at the hom antenna. The conducted power at the antenna feed point was recorded. The forward power for the antenna was then determined and the EIRP level was determined by adding the forward power and the antenna gain in dB.

4.1 TEST EQUIPMENT

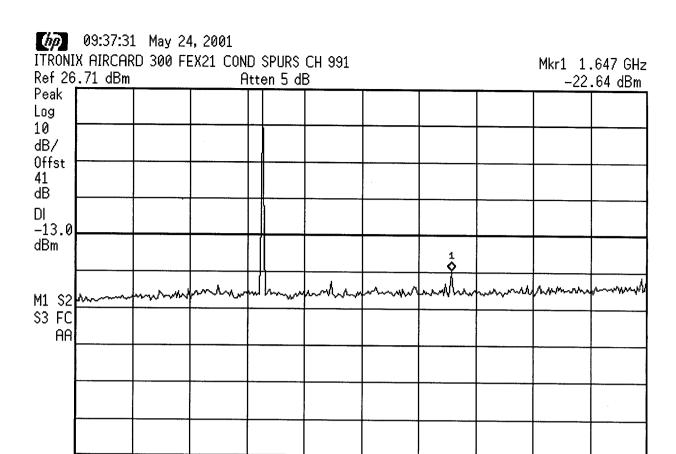
| Type | Model | Calib. Date | Serial No. |
|-------------------------------|------------------------------------|-------------|------------------|
| Signal Generator | HP 8648D (9kHz-4.0GHz) | Nov 1999 | 3847A00611 |
| Gigatronics Power Meter | 8652A | Oct 1999 | 1835272 |
| Gigatronics Power Sensor (2) | 80701A (0.05-18GHz) | Oct 1999 | 1833535, 1833542 |
| Amplifier Research Power Amp. | 5S1G4 (5W, 800MHz-4.2GHz) | N/A | 26235 |
| Microwave System Amplifier | HP 83017A (0.5-26.5GHz) | N/A | 3123A00587 |
| Network Analyzer | HP 8753E (30kHz-3GHz) | Nov 1999 | US38433013 |
| Audio Analyzer | HP 8903B | March 1999 | 3729A18691 |
| Modulation Analyzer | HP 8901A | March 1999 | 3749A07154 |
| Frequency Counter | HP 53181A (3GHz) | May 1999 | 3736A05175 |
| CDMA Base Station Test Set | Agilent E8285A | N/A | US40332926 |
| DC Power Supply | HP E3611A | N/A | KR83015294 |
| Multi-Device Controller | EMCO 2090 | N/A | 9912-1484 |
| Mini Mast | EMCO 2075 | N/A | 0001-2277 |
| Turntable | EMCO 2080-1.2/1.5 | N/A | 0002-1002 |
| Double Ridged Horn Antenna | ETS 3115 (1-18GHz) | Oct. 2000 | 6267 |
| Double Ridged Horn Antenna | ETS 3115 (1-18GHz) | Oct. 2000 | 6276 |
| Horn Antenna | Chase BBHA 9120-A (0.7-4.8GHz) | Sept 1998 | 9120A-239 |
| Horn Antenna | Chase BBHA 9120-A (0.7-4.8GHz) | Sept 1998 | 9120A-240 |
| Roberts Dipoles | Compliance Design (2 sets) 3121C | June 2000 | |
| Spectrum Analyzer | HP 8594E | March 2000 | 3543A02721 |
| Spectrum Analyzer | HP E4408B | Nov 1999 | US39240170 |
| Shielded Screen Room | Lindgren R.F. 18W-2/2-0 | N/A | 16297 |
| Environmental Chamber | ESPEC ECT-2 (Temperature/Humidity) | Feb 2000 | 0510154-B |

Test Report S/N: 052301-114N7N Dates of Tests: May 23-24, 2001 FCC Part 22 Class II Change

5.1 CONCLUSION

The data collected shows that the SIERRA WIRELESS PCMCIA CDPD Modem Card FCC ID: N7NACRD2 (installed in ITRONIX FeX21 Rugged Laptop PC with ITRONIX dipole antenna) complies with all the requirements of Parts 2 and 22.901(d) of the FCC rules.

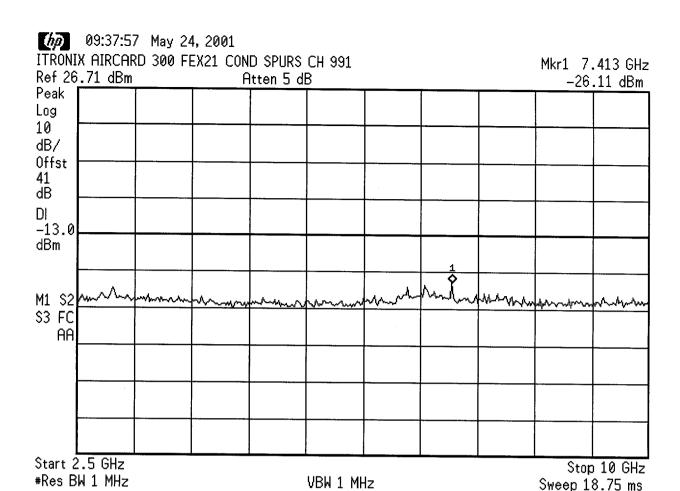
ATTACHMENT A – TEST PLOTS



Start 10 MHz #Res BW 1 MHz

VBW 1 MHz

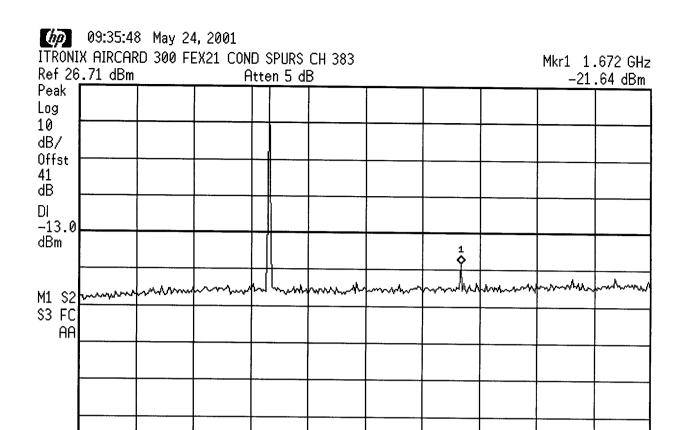
Stop 2.5 GHz Sweep 6.225 ms



Start 10 GHz *Res BW 1 MHz

VBW 1 MHz

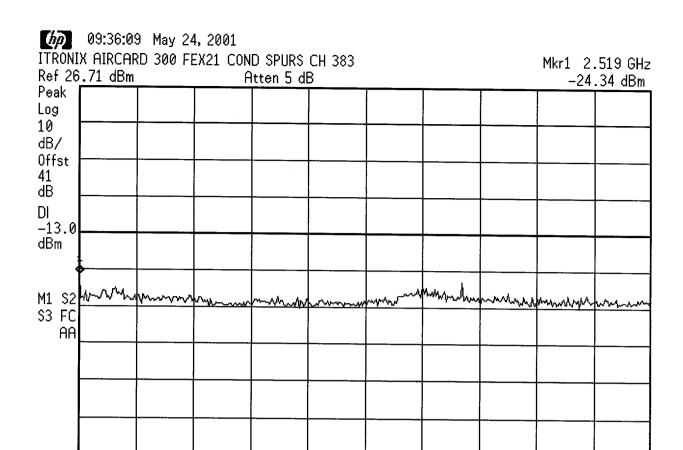
Stop 20 GHz Sweep 100 ms



Start 10 MHz #Res BW 1 MHz

VBW 1 MHz

Stop 2.5 GHz Sweep 6.225 ms



VBW 1 MHz

Stop 10 GHz

Sweep 18.75 ms

Start 2.5 GHz

*Res BW 1 MHz

(hp) 09:36:27 May 24, 2001 ITRONIX AIRCARD 300 FEX21 COND SPURS CH 383 Mkr1 13.50 GHz Ref 26.71 dBm Atten 5 dB -25.5 dBmPeak Log 10 dB/ Offst 41 ďΒ DI -13.0 dBmM1 S2 S3 FC AA

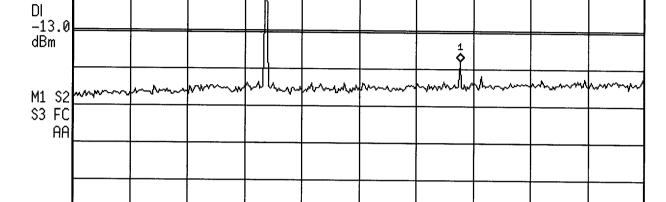
VBW 1 MHz

Stop 20 GHz

Sweep 100 ms

Start 10 GHz

#Res BW 1 MHz



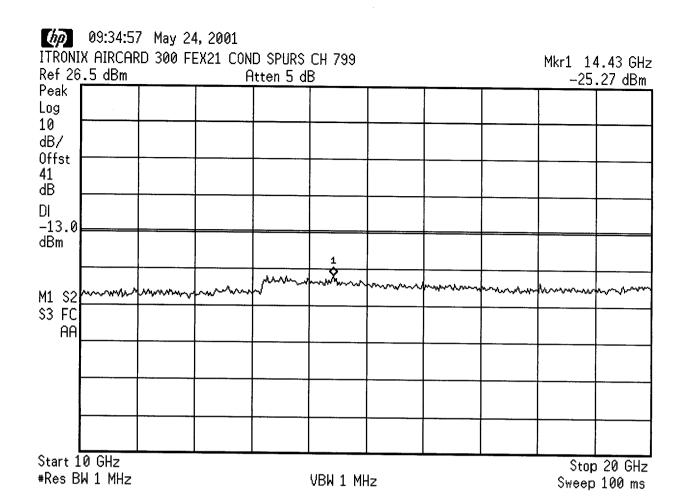
Start 10 MHz #Res BW 1 MHz

VBW 1 MHz

Stop 2.5 GHz Sweep 6.225 ms Start 2.5 GHz #Res BW 1 MHz

VBW 1 MHz

Stop 10 GHz Sweep 18.75 ms



ATTACHMENT B – TEST SETUP PHOTOGRAPHS

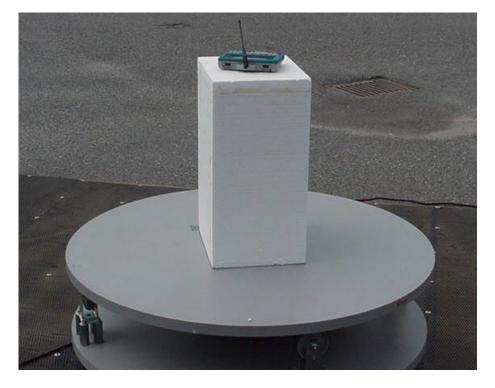
RADIATED TEST SETUP PHOTOGRAPHS





RADIATED TEST SETUP PHOTOGRAPHS





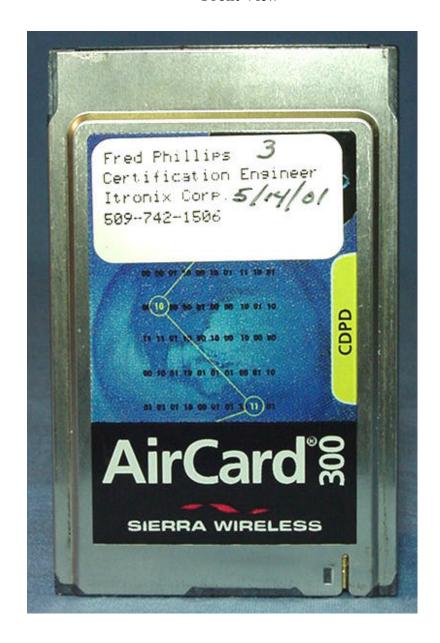
RADIATED TEST SETUP PHOTOGRAPHS





ATTACHMENT C – EUT PHOTOGRAPHS

EUT PHOTOGRAPHS PCMCIA CDPD Modem Card Front View



EUT PHOTOGRAPHS PCMCIA CDPD Modem Card Rear View



EUT PHOTOGRAPHS Itronix FeX21 Laptop PC & Itronix Dipole Antenna





EUT PHOTOGRAPHS Itronix FeX21 Laptop PC



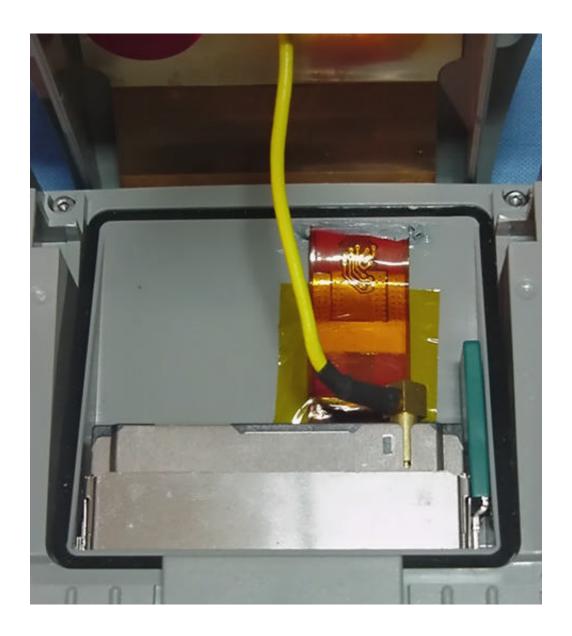




EUT PHOTOGRAPHS Itronix FeX21 Laptop PC & Itronix Dipole Antenna



EUT PHOTOGRAPHS CDPD Card installed in PC



ATTACHMENT D – ANTENNA SPECIFICATIONS

| REV | REF. | DESCRIPTION | INPT BY | APP | DATE |
|-----|------|--|---------|-----|---------|
| 1 | | Prototype Release | SLL | SLL | 5/6/98 |
| 2 | | Modify Antenna Gain to 0 dBd minimum (Section 4.2) | JD | SLL | 6/2/98 |
| 3 | 1673 | Add material requirement and Figure 1. | JLD | SLL | 6/9/99 |
| 4 | 1728 | Correct Section 3.5 and 3.6. Correct Figure 1 | CAC | SLL | 8/9/99 |
| A | 1926 | Release | BAB | | 3/20/00 |

ITRONIX

DOCUMENT

4PR 18 2000

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"ONTHOL

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| | OVALS | Unless otherwise specified dimensions are in inches. NOT TO SCALE DRAWING | ITRONIX CORPORATION S 801 STEVENS AVE P.O. BOX 0179 SPOKANE, WA 99210-0179 |
|-------------|-----------------|---|--|
| ORIG. | DATE | | TITLE: |
| S. Loranger | 4/23/98 | | |
| СНК. | DATE | | DWG, ANTENNA, |
| Levelon | 4-12-00 | 1 | T5200, CDPD |
| ENG. | DATE 4-11-00 | | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |
| MIX | DATE | | Drawing Number |
| Holm | 4/14/00 | | 46-0044-000 |
| F.S. | DATE | | PAGE 1 OF 5 |

CHANGE RECORD

| REV | SECTION | CHANGE DESCRIPTION | DATE |
|--------------|--------------------|---|---------|
| I | All | Prototype Release | 5/6/98 |
| 2 | 4.2 | Modify Antenna Gain to 0 dBd minimum | 6/2/98 |
| 3 | All | Add material requirement and Figure 1. | 6/9/99 |
| 4 | 3.5. 3.6. Figure 1 | Correct 3.5 and 3.6. Add dimensions to Figure 1 | 8/9/99 |
| A | All | Release, add color coded O'Ring | 3/14/00 |
| | | (Ref. P/N 32-0059-002) | 3,11700 |
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1.0 **DESCRIPTION**:

CDPD Antenna, T5200.

2.0 APPLICABLE DOCUMENTS AND REFERENCES:

- 2.1 EIA/IEEE STANDARDS: 149-1979 for definitions of test sites and test methods.
- 2.2 ITRONIX DOCUMENTS:

Procedure, Reliability Design Guidelines....920-0806-001

- 2.3 MANUFACTURER'S SPECIFICATION:
- 2.4 O'Ring Specification: 32-0059-000

3.0 MECHANICAL REQUIREMENTS:

3.1 Dimensions: See Figure 1. (For Reference Only).

3.2 Material: FR-4 substrate matching network driving a length of 1/16" diameter speedometer cable.

- 3.3 Construction: End-Fed, ½ wave resonant dipole.
- 3.4 Connectors: MMCX Jack
- 3.5 Overmold Material: Polyurethane 245, 92 Durometer Shore A
- 3.6 Overmold Color: To match Lexan 70809 or RTP 300HF FRA S-87654 Dark Grey

3.7 Frequency identifier: Red (See Figure 1).

4.0 ELECTRICAL REQUIREMENTS:

4.1 Antenna Return Loss

| | Operating Frequency | Minimum Return Loss |
|----------|---------------------|---------------------|
| Transmit | 824 MHz to 851 MHz | 10dB (2:1VSWR) |
| Receive | 869 MHz to 894 MHz | 5dB |

4.2 Antenna Power Gain (Directivity)

These tests are performed with the antenna connected to the T5200.

Gain Standard: The reference antenna for the gain comparison method of measurement is a thin dipole, with length adjusted to half-wavelength resonance.

Test Site: Anachoic chamber (see IEEE 149-1979 paragraph 4.5.4).

Polarization: Linear (vertical orientation).

Display Orientation: These tests are performed on the T5200. Measurements should be taken with the display enclosure in a closed position (0° from horizontal) and an open position (135° from horizontal).

Method of Measurement: The elevation of the antenna being tested is at the horizon (0° elevation from horizontal). Twelve measurements (separated by 30° rotation) are taken at each frequency.

Performance Specification:

| Test Frequency | Peak antenna gain in any direction | Average of the 12 data points |
|----------------|------------------------------------|-------------------------------|
| 824 MHz | +4 dBd | -1.2 dBd minimum |
| 837.5 MHz | +4 dBd | -1.2 dBd minimum |
| 851 MHz | +4 dBd | -1.2 dBd minimum |
| 869 MH2 | +4 dBd | -2 dBd minimum |
| 881.5 MHz | +4 dBd | -2 dBd minimum |
| 894 MHz | +4 dBd | -2 dBd minimum |

5.0 ENVIRONMENTAL REQUIREMENTS:

5.1 Temperature

Operating:

-30°C to +75°C

Non-Operating:

-40°C to +85C

5.2 Humidity

5% to 95% Relative Humidity, Non-Condensing

Antenna to have rugged mechanical construction to withstand the Itronix 1 meter drop test when coupled to the Itronix unit.

N/A

6.0 SAFETY REQUIREMENTS:

7.0 MARKING REQUIREMENTS:

The bulk shipping container must bear the Manufacturer's name and part number.

8.0 PACKAGING REQUIREMENTS:

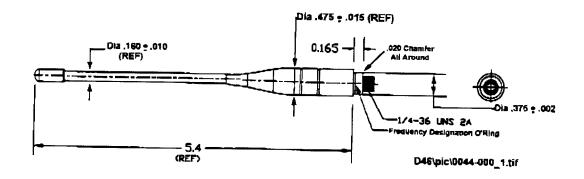
Packaging of components shall be such that no damage will occur to the component during shipment. Refer to EIA STD RS-383-A.

9.0 ACCEPTABILITY REQUIREMENTS:

These units must meet inspection requirements.

10.0 MANUFACTURER AND MANUFACTURER'S PART NUMBER:

| ITRONIX P/N | MANUFACTURER | MANUFACTURER'S P/N |
|-------------|----------------|--------------------|
| 46-0044-001 | Larsen Antenna | 46-0044-001 |
| | | |



Color Code: Black
Units are inches
TGURE 1: Antenna dimensions and Freque

FIGURE 1: Antenna dimensions and Frequency identifier location (For Reference Only)

ATTACHMENT E – SAR MEASUREMENT REPORT