

# Percomm Technologies Inc.

## e80/1100

### Report of Measurements

per

### CFR47, FCC Part 15, Subpart B and FCC Part 24 Subpart D

Revision 1.1

March 6, 2003

| Approval    |                               |            |
|-------------|-------------------------------|------------|
| Checked By: | <hr/> Robert Stirling, P.Eng. | <hr/> Date |

Protocol Labs, Abbotsford BC, Canada  
FCC Registration Number 96437  
Industry Canada Registration Number IC3384

# Index

|                                                  |    |
|--------------------------------------------------|----|
| Index                                            | 2  |
| FCC CFR47 Part 15/B Report of Measurements ..... | 3  |
| Equipment Under Test:.....                       | 4  |
| Part 1- Conducted Emission Testing .....         | 6  |
| Part 2- Radiated Emission Testing .....          | 7  |
| Part 4- Spurious Emission Testing .....          | 8  |
| Appendix B: Photos .....                         | 10 |
| Appendix C: Measurement Data and Plots .....     | 13 |
| Measurement Data .....                           | 13 |
| Plot Radiated Spurious (901.5 MHz) .....         | 14 |
| Emissions Plots .....                            | 15 |

## **FCC CFR47 Part 15/B Report of Measurements**

### **Testing Details:**

TESTED BY: Bruce Balston  
 WRITTEN BY: Craig Long  
 TEST CONDITIONS: Temperature and Humidity: 16°C, 60%  
 TEST VOLTAGE: Internal Battery and external power supply at 120 Vac, 60 Hz

### **Test Facilities:**

Protocol Labs  
 28945 McTavish Rd.  
 Abbotsford BC, Canada, V4X 2E7  
  
 FCC Registration Number 96437  
 Industry Canada Registration Number IC3384

### **Test Equipment List:**

EMISSIONS:

| Device             | Model Number                 | Serial No. | Last Cal. | Next Cal |
|--------------------|------------------------------|------------|-----------|----------|
| Antenna            | EMCO 3141 Bilog              | 1127       | 09/26/02  | 09/26/03 |
| Antenna            | EMCO 3105 Horn               | 2024       | 10/30/02  | 10/30/02 |
| Antenna            | EMCO 3115 Horn               | 9005-3429  | 10/31/02  | 10/31/02 |
| Antenna            | Electro-metrics LPA-30       | 563        | 01/07/03  | 01/07/04 |
| Signal Gernerator  | Hewlett Packard 8652A        | 2913A00373 | 09/05/02  | 09/05/03 |
| Signal Generator   | Wavetek 2002A                | 9362081    | 01/05/03  | 01/05/04 |
| Amplifier          | Amplifier Research 30W1000M7 | 22606      | N/A       | N/A      |
| Amplifier          | Hewlett Packard              | 2512A00824 | 09/13/02  | 09/13/03 |
| Signal Generator   | Hewlett Packard 8672A        | 1930A00890 | 01/14/03  | 01/14/04 |
| Spectrum Analyzer  | Hewlett Packard 8566B        | 2241A02102 | 01/13/03  | 01/13/04 |
| RF-Preselector     | Hewlett Packard 85685A       | 3107A01222 | 01/10/03  | 01/10/04 |
| Quasi-Peak Adapter | Hewlett Packard 85650A       | 2043A00240 | 01/13/03  | 01/13/04 |
| Tower              | Rhientech Labs               | Custom     | N/A       | N/A      |
| Turntable          | Protocol                     | Custom     | N/A       | N/A      |

**Testing Details**

COMPANY TESTING: Percomm Technologies Inc.

CONTACT PERSON: Radu I. Oprea

PHONE NUMBER: 604-293-5217

ADDRESS:

**Equipment Under Test:**THE TEST SYSTEM: EUT: Two Way Pager

Manufacturer: Percomm Technologies Inc.  
Model Name: E80 Two Way Pager  
Model Number: 1100  
Serial Number: XAAB3B223K

Antenna Type: Internal

Auxiliary Equipment: AC Power Adapter

Manufacturer: Merry King Enterprises Co.  
Part Number: MKD-350500500

Auxiliary Equipment: Serial Cable

Manufacturer: Weison  
Part Number: Percomm Custom cable

Test Software: Hermes\_Jan21

TEST SETUP: The EUT was setup in its normal operating mode for the duration of the FCC part 15 testing. The EUT was placed in full transmit mode for the duration of FCC part 24 testing.

EUT Description: The EUT is a two-way pager and has an internal permanently attached antenna. The serial cable can only be attached when the AC Adapter is not connected and vice versa.

CABLING:

| Cable        | Name                   | Ferrite | Shielded |
|--------------|------------------------|---------|----------|
| Power Cable  | AC Adapter Power cable | No      | No       |
| Serial Cable | Serial Interface Cable | No      | No       |

## TEST SUMMARY:

| Test                                   | Standard                         | Description                                                                                             | Result   |
|----------------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------|----------|
| Conducted Emissions                    | FCC15.107<br>Class B<br>Limits   | The Conducted Emissions are measured on the phase and Neutral Power lines in the 0.15 - 30.0 MHz range. | Complies |
| Radiated Emissions                     | FCC15.109<br>Class B<br>Limits   | The Radiated Emissions are measured above 30 MHz.                                                       | Complies |
| Radiated Spurious                      | FCC 2.103/<br>2.1053/<br>24.133  | The radiated emissions are measured up to the 10 <sup>th</sup> Harmonic                                 | Complies |
| Spurious Emissions at Antenna Terminal | FCC 2.1035/<br>2.1051/<br>24.132 | The radiated emissions are measured in the 30-1000Mhz range                                             | Complies |

## MODIFICATIONS:

This unit requires no modifications for it to pass.

## CONCLUSION:

e80/1100 tested complies with the requirements of FCC CFR47 part 15/B and FCC Part 24 subpart D.

**Part 1- Conducted Emission Testing**

DATE: February 18, 2003

TEST STANDARD: FCC CFR47, Part 15, Subpart B

DEVICE DESCRIPTIONS: As described in the Equipment Under Test Section, above.

TEST SETUP: The EUT was connected to the conducted emissions LISN apparatus.

METHOD OF MEASUREMENT: Measurements were made using a spectrum analyzer, Peak detector. Any emissions that are close to the limit are measured using a test receiver and CISPR Quasi-Peak detector.

CABLING DETAILS: The EUT was set up using the manufacturer's specified normal cabling configuration.

CABLING:

| Cable        | Name                   | Ferrite | Shielded |
|--------------|------------------------|---------|----------|
| Power Cable  | AC Adapter Power cable | No      | No       |
| Serial Cable | Serial Interface Cable | No      | No       |

MINIMUM STANDARD: Class B Limits:

| Frequency (MHz) | Maximum Level (dB $\mu$ V) | Maximum Level (dB $\mu$ V) |
|-----------------|----------------------------|----------------------------|
|                 | Quasi-Peak                 | Average                    |
| 0.15 - 0.50     | 66-56 (Log Delta)          | 56-46 (Log Delta)          |
| 0.50 - 5.00     | 56                         | 46                         |
| 5.00 - 30.0     | 60                         | 50                         |

MODIFICATIONS: No modifications were required for the devices to pass the test.

MEASUREMENT DATA: See Appendix B for Plots,

EMISSIONS DATA: See Tables 1 and 2 in Appendix B for corresponding frequencies.

PERFORMANCE: Complies.

The tests were performed at 120 Vac, 60 Hz

**Part 2- Radiated Emission Testing**

DATE: February 19, 2003

TEST STANDARD: FCC CFR47, Part 15, Subpart B section 15.109 Class B  
FCC Part 24 Subpart D

DEVICE DESCRIPTIONS: Refer to the Equipment Under Test Section, above, for EUT Descriptions.

TEST SETUP: The equipment was set up in a 3-meter open field test site. Emissions in both horizontal and vertical polarizations were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots.

CABLING DETAILS: The EUT was set up using the manufacturer's specified normal cabling configuration.

CABLE DESCRIPTIONS:

| Cable        | Name                   | Ferrite | Shielded |
|--------------|------------------------|---------|----------|
| Power Cable  | AC Adapter Power cable | No      | No       |
| Serial Cable | Serial Interface Cable | No      | No       |

MINIMUM STANDARD: Class B Limits:

| Frequency (MHz) | Maximum Field Strength dBuV/m at 3m |
|-----------------|-------------------------------------|
| 30 - 88         | 39.0                                |
| 88 - 216        | 43.5                                |
| 216 - 960       | 46.5                                |
| 960 - up        | 49.5                                |

MEASUREMENT DATA: See Appendix B for Plots, The blue trace represents all emissions, including ambient noise. 'All Suspects' are marked in purple. FCC Class B limits are marked in solid purple.

EMISSIONS DATA: See Table 3,4 and 5 in Appendix B for corresponding frequencies.

PERFORMANCE: Complies.

## **Part 4- Spurious Emission Testing**

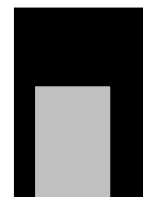
|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DATE:                | February 19 and 20, 2002                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TEST STANDARD:       | FCC CFR47, Part 2, 103, and 1053, and Part 24, Subpart D 133                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| DEVICE DESCRIPTIONS: | Refer to the Equipment Under Test Section, above, for EUT Descriptions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| TEST SETUP:          | The equipment was set up at a 3 m measurement distance, and. Spurious emissions we measured in both horizontal and vertical polarization's with signal strength and the results recorded on the attached graph and tables.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| CABLING DETAILS:     | The EUT was set up using the manufacturer's specified normal cabling configuration.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| MINIMUM STANDARD:    | 1 Watts ERP is the maximum limit. Spurious Attenuation = $43 + 10\log(\text{Power})\text{dB}$ .Power is specified in Watts.(363 mW) The Spurious limit is 38.59 dBc.<br><br>$\text{ERP} = (\text{S/G} - \text{loss}) + (\text{G}_{\text{SUB}} - \text{G}_d)$ $\text{ERP} = (\text{S/G} - \text{loss}) + [(20\log F - \text{AF}_S - 31.94) - (20\log F - \text{AF}_D - 31.94)]$<br>ERP = Effective Radiated Power<br>S/G = Signal Generator Reading<br>Loss = Cable Loss to Substitution Antenna<br>$\text{G}_{\text{SUB}}$ = Substitution Antenna Gain<br>$\text{G}_d$ = Ideal Dipole Gain<br>$\text{AF}_{\text{SUB}}$ = Antenna Factor for Substitution Antenna<br>$\text{AF}_D$ = Antenna Factor for Ideal Dipole |
| MEASUREMENT DATA:    | See Appendix B for Graphs and Data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| EMISSIONS DATA:      | See Table 2 Spurious Emissions in Appendix B, for corresponding frequencies.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| EUT ORIENTATION:     | The EUT was tested in three orientation's to represent how the EUT can be oriented by the end user. Harmonic 9 is the maximun at position A, Harmonic 1,2,6,7,10 are at there maximun values at position B, harmonic 3,4,5,8 are at there maximun values at position C.                                                                                                                                                                                                                                                                                                                                                                                                                                             |



Bottom of the Pager  
Facing the Antenna (A)



LCD Display  
Facing Antenna  
(B)



LCD Display  
Facing Antenna  
(C)

**MEASUREMENT PROCEDURE:** The radiated emissions test was performed according to TIA/EIA-603-A. The substitution method in section 2.1.1.2 was used. A bilog and horn antenna located 3 meters away from the transmitter picks up any signal radiated from the transmitter. A spectrum analyzer covering the necessary frequency range is used to detect and measure any radiation picked up by the antenna. The testing procedure is repeated for both horizontal and vertical polarizations of the receiving antenna. Relative signal strength is indicated on the spectrum analyzer connected to this antenna. And the cable losses, amplifier gains and antenna correction factor are added to calculate the signal strength. Actual measurements are recorded on the attached graphs.

**PERFORMANCE:** Complies.

## **Appendix B: Photos**



Emissions Test Setup Front View (Pager only)



Emissions Test Setup front View (Pager with Serial Cable)



Emissions Test Setup front View (Pager with Power Supply)

## **Appendix C: Measurement Data and Plots**

### **Measurement Data**

#### **Conducted Emissions:**

**Table 1: Line 1 CISPR FCC Class A**

| Frequency (MHz) | Peak (dBμV) | DelLim-Pk (dB) |
|-----------------|-------------|----------------|
| 0.1864          | 44.4        | -9.7           |
| 0.1934          | 43.2        | -10.6          |
| 0.1721          | 43.7        | -11.1          |
| 0.6533          | 34.9        | -11.1          |
| 0.1659          | 43.9        | -11.2          |

**Table 2: Line 2 CISPR FCC Class A**

| Frequency (MHz) | Peak (dBμV) | DelLim-Pk (dB) |
|-----------------|-------------|----------------|
| 0.1557          | 50.0        | -5.6           |
| 0.1685          | 48.8        | -6.2           |
| 0.1615          | 48.0        | -7.3           |
| 0.1825          | 45.6        | -8.7           |
| 0.1844          | 43.7        | -10.5          |

**Table 3: Total Radiated Emissions for the Pager with Serial cable.**

| Frequency (MHz) | Pol  | Height (cm) | Angle (deg) | Un Corr Pk (dB) | Tot Corr (dB) | Peak (dBμV/m) | DelLim-Pk (dB) |
|-----------------|------|-------------|-------------|-----------------|---------------|---------------|----------------|
| 985.038002      | Vert | 150         | 240         | 7.90            | 28.83         | 36.74         | -17.26         |
| 414.680951      | Vert | 170         | 270         | 7.10            | 19.16         | 26.26         | -19.74         |
| 322.558436      | Vert | 150         | 295         | 6.10            | 17.11         | 23.21         | -22.79         |
| 138.206232      | Vert | 180         | 270         | 10.50           | 10.12         | 20.62         | -22.88         |
| 230.424850      | Vert | 180         | 260         | 6.50            | 13.62         | 20.12         | -25.88         |

**Table 4: Total Radiated Emissions for the Pager with AC adapter.**

| Frequency (MHz) | Pol  | Height (cm) | Angle (deg) | Un Corr Pk (dB) | Tot Corr (dB) | Peak (dBμV/m) | DelLim-Pk (dB) |
|-----------------|------|-------------|-------------|-----------------|---------------|---------------|----------------|
| 414.731057      | Vert | 200         | 235         | 11.00           | 19.16         | 30.16         | -15.84         |
| 984.971524      | Vert | 250         | 270         | 6.60            | 28.83         | 35.43         | -18.57         |

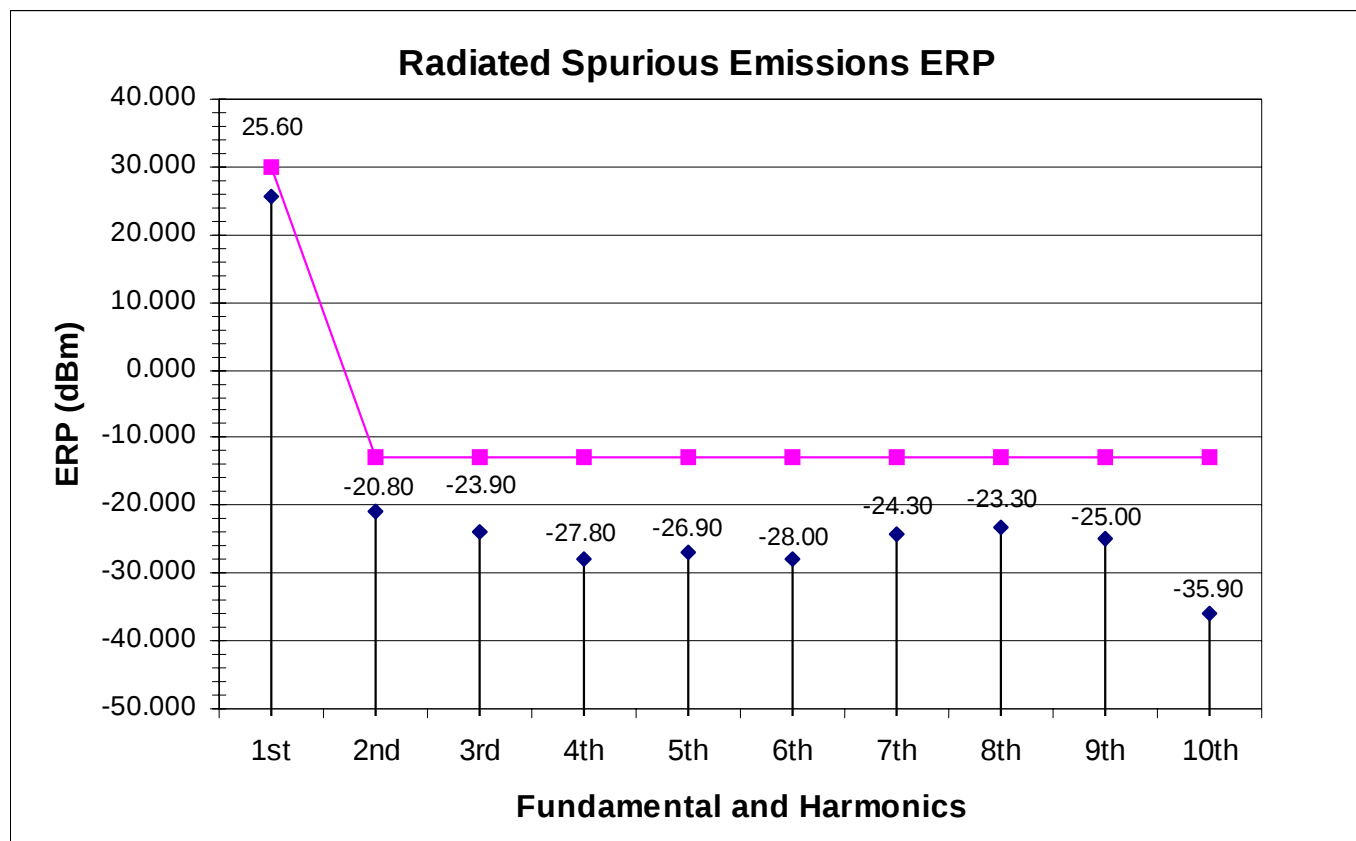
**Table 5: Total Radiated Emissions for the Pager**

| Frequency (MHz) | Pol  | Height (cm) | Angle (deg) | Un Corr Pk (dB) | Tot Corr (dB) | Peak (dBμV/m) | DelLim-Pk (dB) |
|-----------------|------|-------------|-------------|-----------------|---------------|---------------|----------------|
| 984.996746      | Vert | 120         | 65          | 7.60            | 28.84         | 36.44         | -17.56         |
| 414.742090      | Vert | 190         | 45          | 7.60            | 19.16         | 26.76         | -19.24         |

**Table 6: Radiated Spurious Emissions 901.5 MHz**

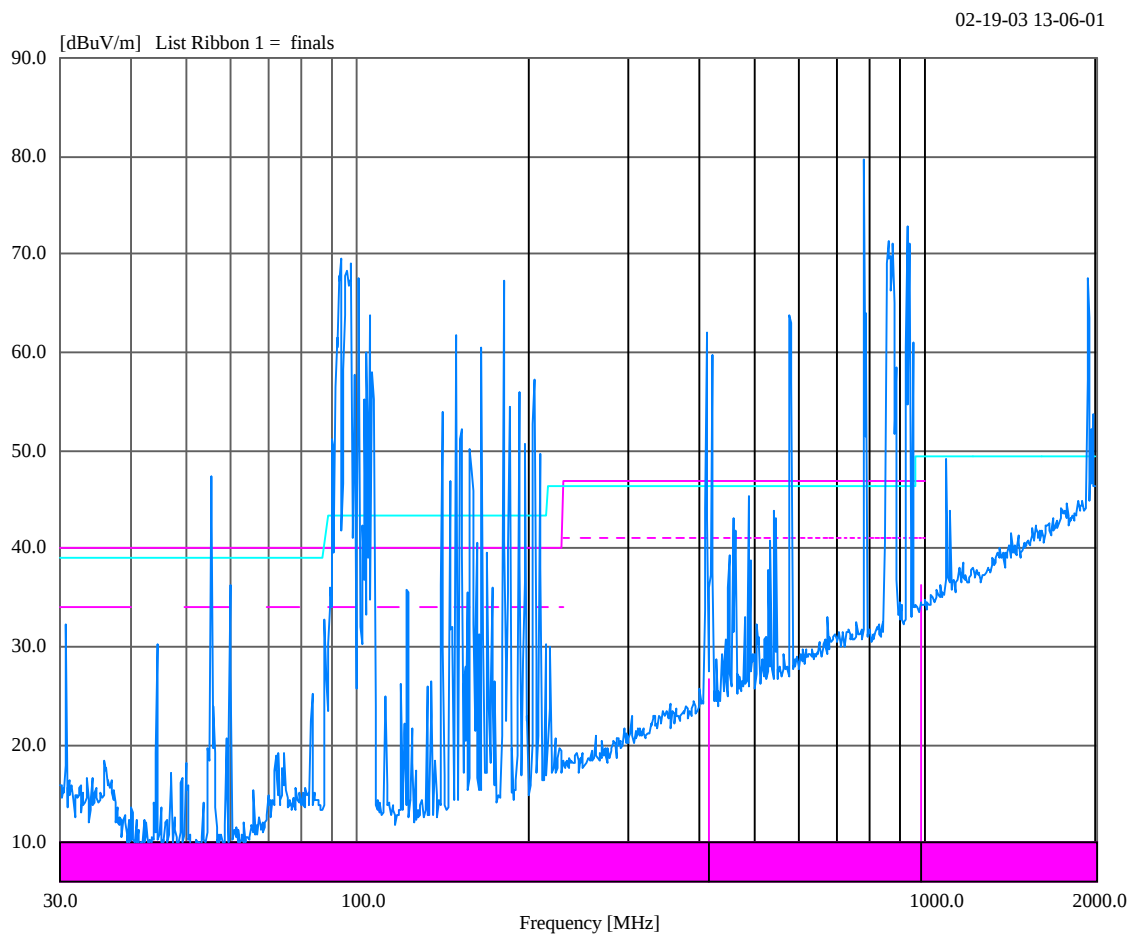
|    | Frequency (MHz) | Polarity | Uncor Pk (dBμV) | Tot Corr (dB) | Peak (dBμV/m) | S/G dBm | Loss dBm | Subs AF dBm | Dipole AF dBm | ERP dBm | dBc   |
|----|-----------------|----------|-----------------|---------------|---------------|---------|----------|-------------|---------------|---------|-------|
| 1  | 901.5           | V        | 97.2            | 27.8          | 125           | 19.4    | 0.0      | 22.8        | 29.3          | 25.6    | -     |
| 2  | 1803.0          | V        | 41.3            | 35.93         | 77.23         | -27.3   | 0.0      | 28.6        | 35.3          | -20.8   | -46.4 |
| 3  | 2704.5          | H        | 62.7            | 7.28          | 69.98         | -30.0   | 1.7      | 31.2        | 38.8          | -23.9   | -49.5 |
| 4  | 3606.0          | H        | 51.5            | 14.63         | 66.13         | -33.0   | 2.1      | 33.5        | 41.4          | -27.8   | -53.4 |
| 5  | 4507.5          | H        | 47              | 18.81         | 65.81         | -33.0   | 2.6      | 34.6        | 43.3          | -26.9   | -52.5 |
| 6  | 5409.0          | H        | 36.5            | 28.69         | 65.19         | -33.0   | 2.8      | 36.5        | 44.8          | -28.0   | -53.6 |
| 7  | 6310.5          | V        | 44.4            | 29.98         | 74.38         | -31.0   | 3.0      | 37.1        | 46.2          | -24.3   | -49.9 |
| 8  | 7212.0          | H        | 43.3            | 30.15         | 73.45         | -30.0   | 3.1      | 38.4        | 47.4          | -23.3   | -48.9 |
| 9  | 8113.5          | H        | 36.8            | 35.81         | 72.61         | -30.0   | 4.0      | 39.2        | 48.4          | -25.0   | -50.6 |
| 10 | 9015.0          | H        | 21.5            | 38.69         | 60.19         | -38.0   | 4.8      | 40.1        | 49.3          | -35.9   | -61.5 |

(No other measurable spurious emissions)



Plot Radiated Spurious (901.5 MHz)

## Emissions Plots



- FCC Limit
- - - 10 dB below FCC Limit
- CISPR Limit
- - - 10 dB below CISPR Limit



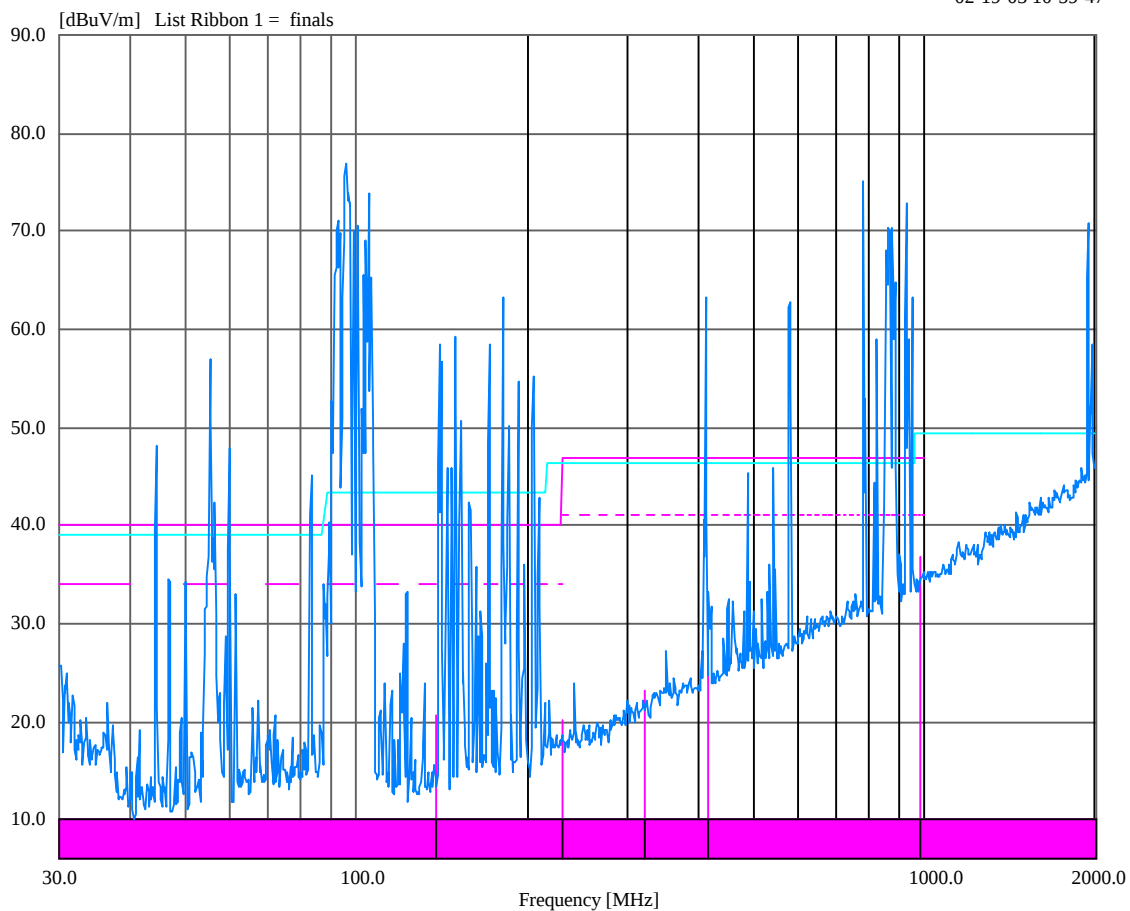
(Dark Blue Traces) All Emissions including ambient noise.



(Vertical Pink Line) – Markings of each Suspect Frequency  
("X") – indicates Quasi-Peak

Radiated Emission E80/1100 Only

02-19-03 10-59-47



— FCC Limit

- - - 10 dB below FCC Limit

— CISPR Limit

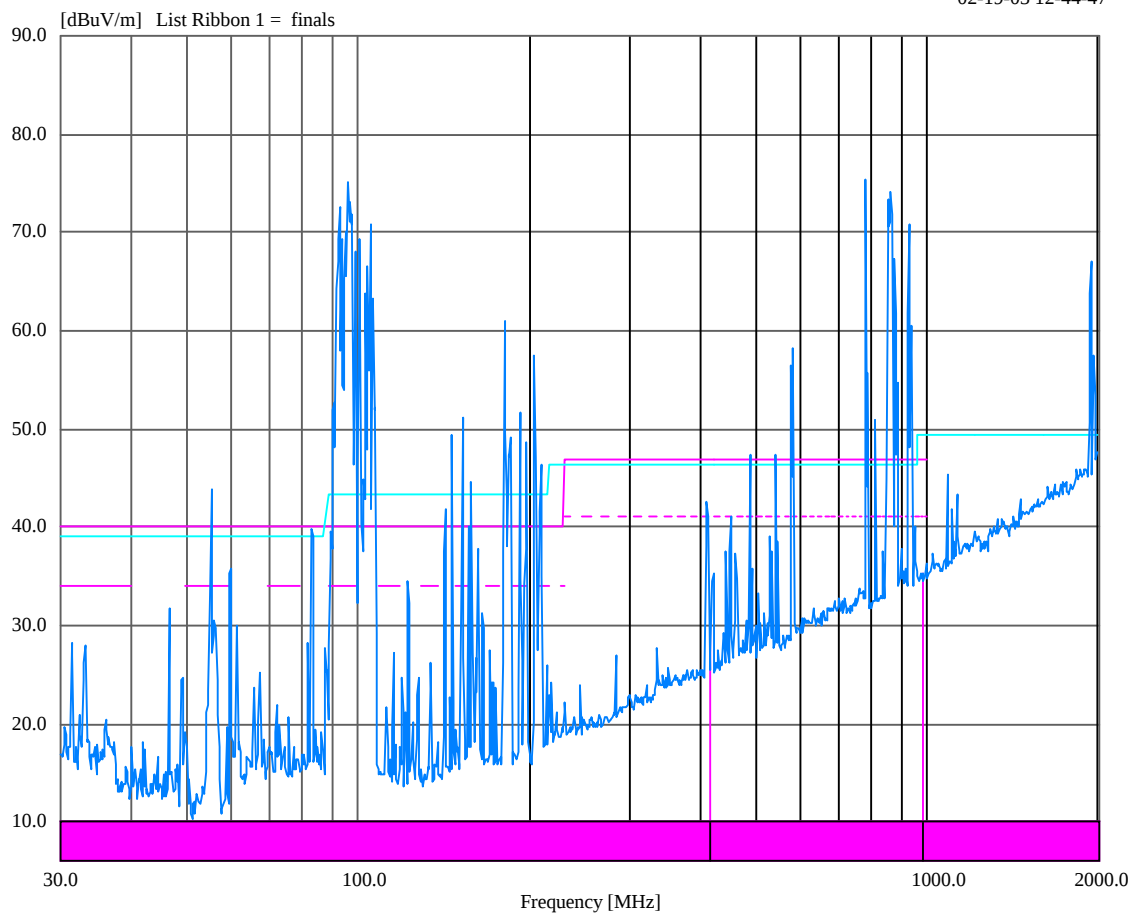
- - - 10 dB below CISPR Limit

(Dark Blue Traces) All  
Emissions including  
ambient noise.

(Vertical Pink Line) –  
Markings of each Suspect  
Frequency  
("X") – indicates Quasi-  
Peak

Radiated Emission E80/1100 with AC Adapter

02-19-03 12-44-47



— FCC Limit

--- 10 dB below FCC Limit

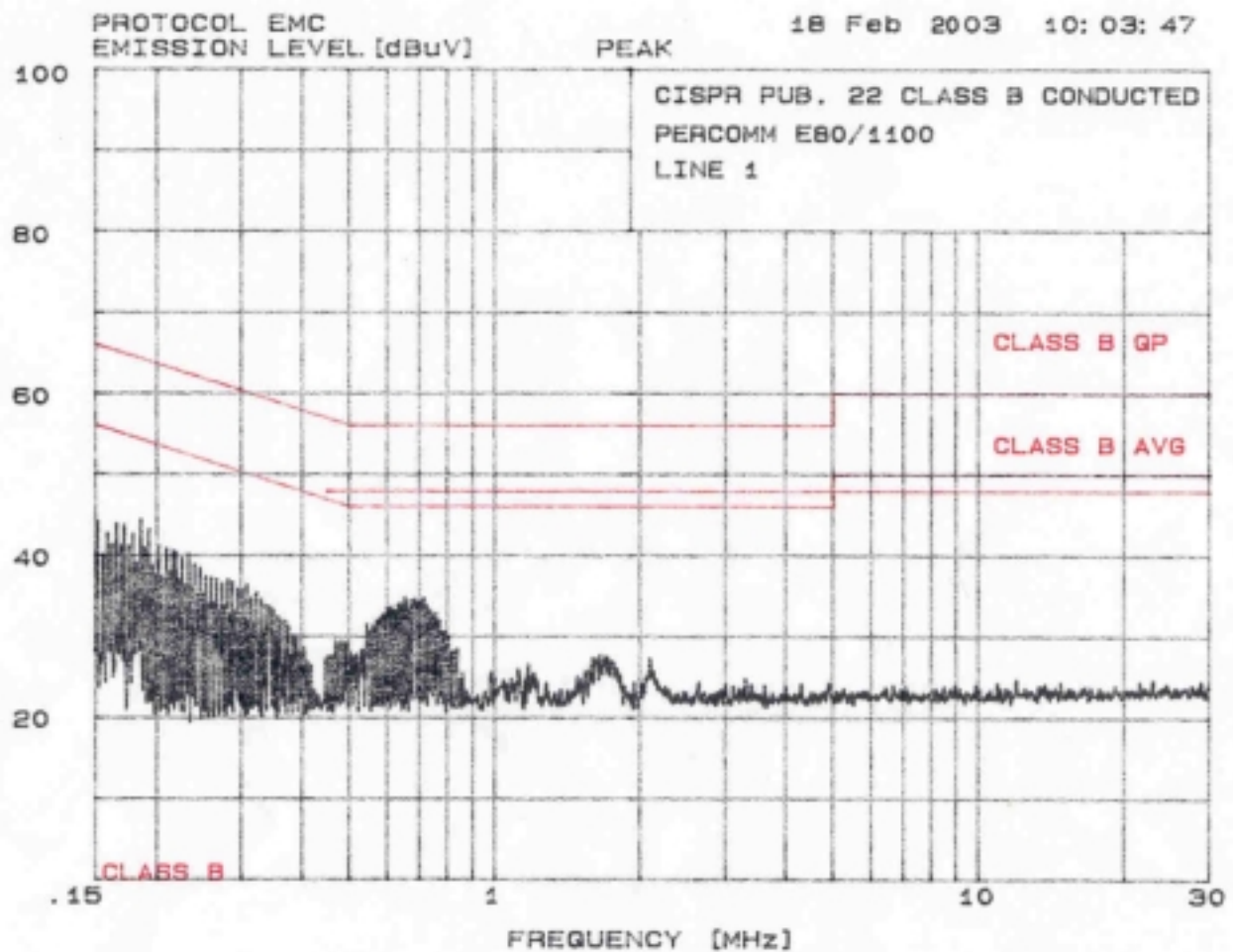
— CISPR Limit

--- 10 dB below CISPR Limit

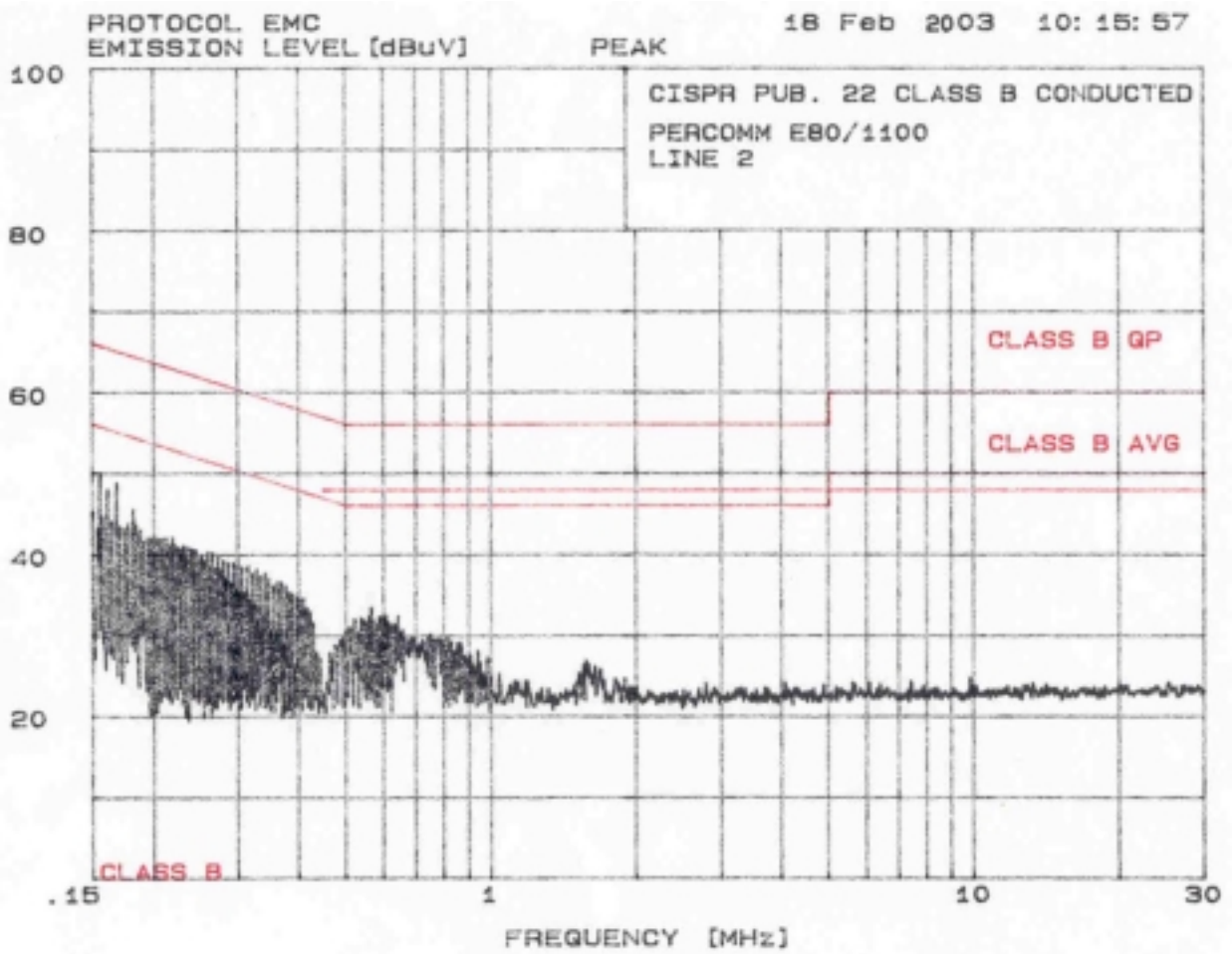
(Dark Blue Traces) All  
Emissions including  
ambient noise.

(Vertical Pink Line) –  
Markings of each Suspect  
Frequency  
("X") – indicates Quasi-  
Peak

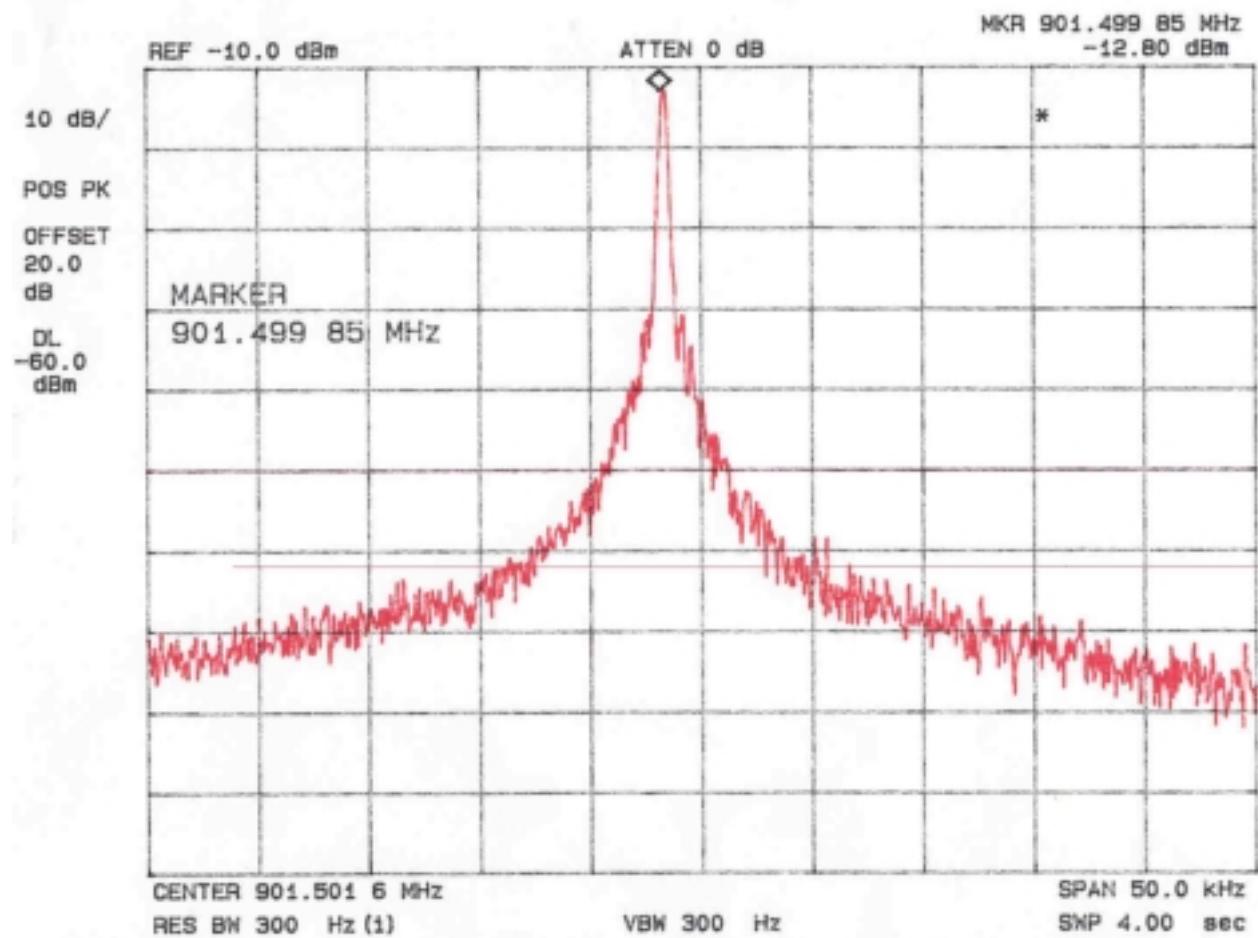
Radiated Emission E80/1100 with Serial Cable



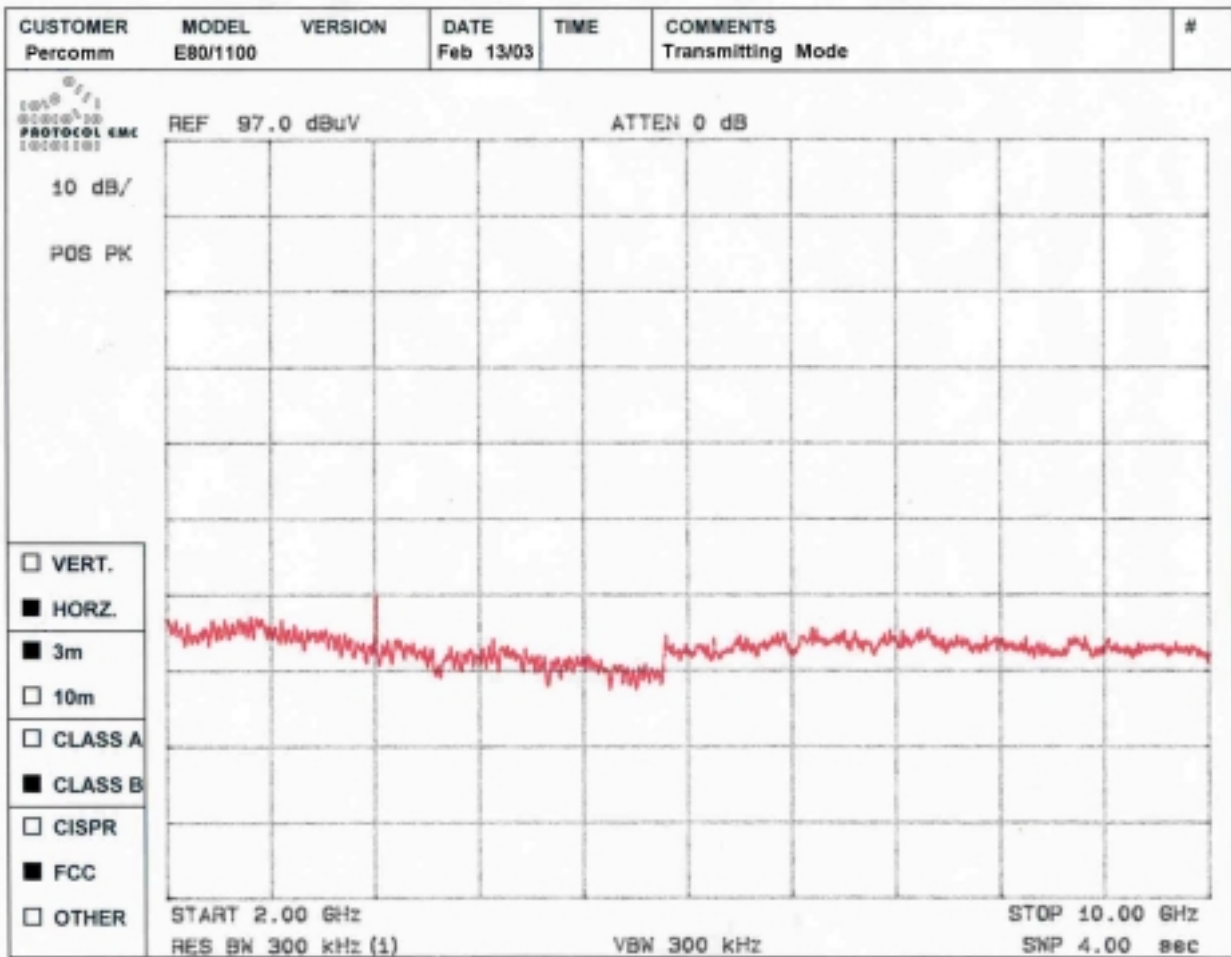
Line 1 Conducted



Line 1 Conducted

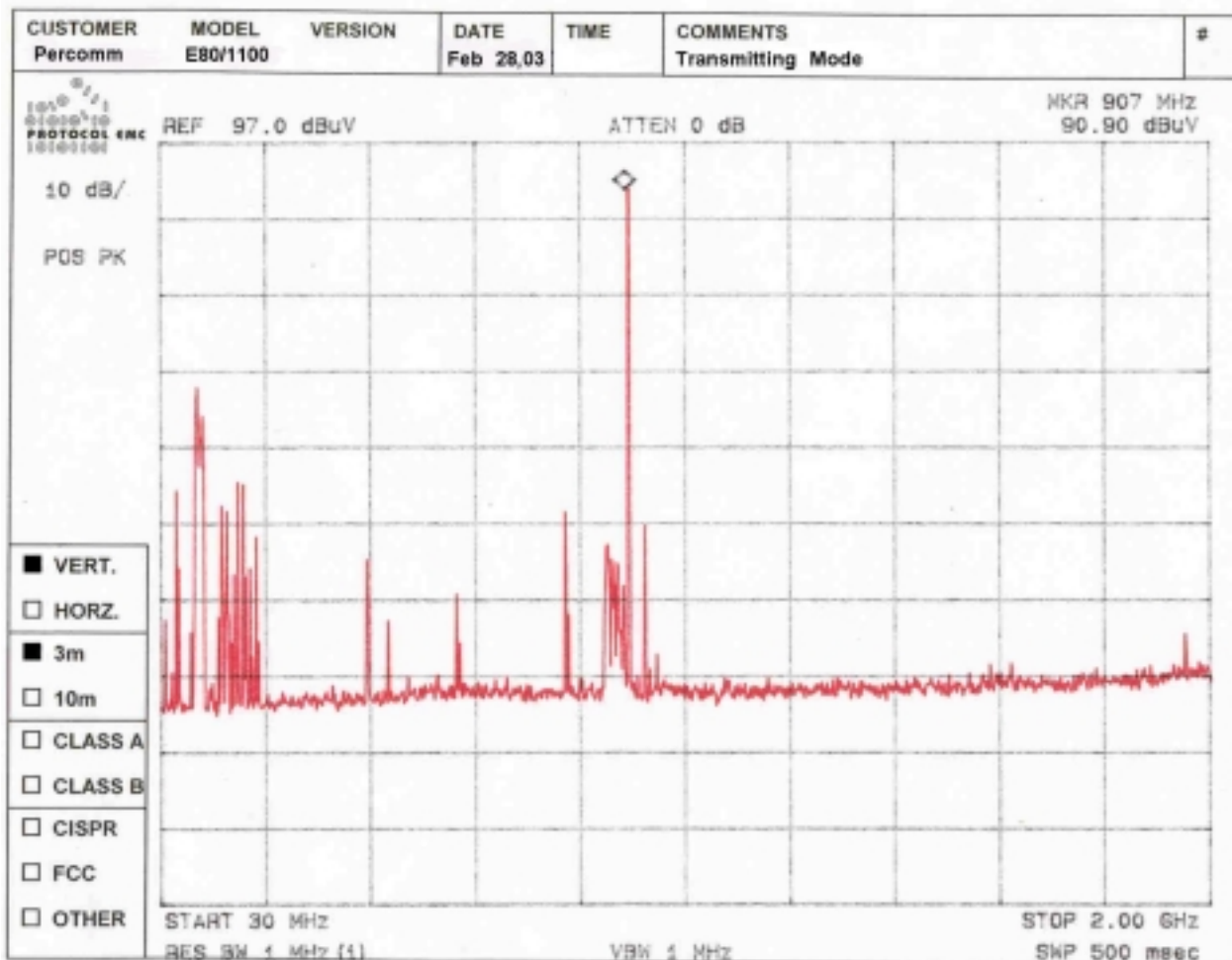


901.5 Bandedge



28945 McTavish Rd. Abbotsford BC, Canada. Protocollabs@earthlink.net Ph 604 218 1762 Fax: 604 607 0019

901.5 High Band Spurious



## 901.5 Low Band Spurious