

# Technical Solutions Inc.

## ZCO01

### ZPoint Co-Ordinate Unit

### EMC Directive Compliance Test Report

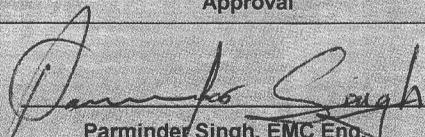
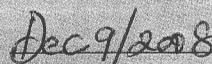
FCC ID #: WYEZCO01

Model #: ZCO01

### FCC PT 15.249 Low Power Device Test Report

Revision 1.0

December 9, 2008

| Approval    |  |   |
|-------------|--|---|
| Checked By: | Signature  | Date  |
|             | <br>Parminder Singh, EMC Eng. |  |

Protocol Data Systems Inc, EMC Lab, Abbotsford BC, Canada. SCC ISO/17025 (CAN-P-4E) Accredited Laboratory No. 612  
FCC O.A.T.S. Registration Number 96437 Industry Canada O.A.T.S. Registration Number IC3384

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## **Section I: Report of Measurements Testing Information**

### **General Information**

|                           |   |
|---------------------------|---|
| Applicant Company Name    | Technical Solutions Inc.  |
| Address                   | 7787 Progress Way<br>Delta, BC V4G 1A3  |
|                           | Phone: 604-946-8324   |
|                           | Fax 604-946-6445  |
|                           | Contact Person: Howard Davis  |
|                           | Email: <a href="mailto:howard@techsol.ca">howard@techsol.ca</a>   |
| Product Name              | zPoint Co-ordination Unit   |
| FCC ID#                   | WYEZCO01  |
| Applicable Standard       | FCC Part 15.249, ANSI C63.4:2003; Part 15.207, 15.209   |
| Test Results              | Pass  |
| Related Report/s Approval | Technical Solutions 03344 Rev 0.0   |
| Statement of Compliance   | This equipment has been tested in accordance with the standards indentified in the referenced test report. To the best of our knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment complies with the appropriate standards. – Signature on Front Cover Page. |

### **Equipment Under Test Specification**

|                     |                           |
|---------------------|---------------------------|
| Manufacturer        | Technical Solutions Inc.  |
| Product Description | zPoint Co-Ordination Unit |
| FCC ID              | WYEZCO01                  |
| Model Number        | zCO01                     |
| Name                | zPoint Co-Ordination Unit |
| Operating Frequency | 2400-2483.5MHz            |
| Emission Designator | DXX                       |
| EUT Power Source    | 120Vac 60Hz               |
| Test Item           | Production Unit           |
| Type of Equipment   | Mobile                    |
| Antennas            | Internal PCB              |
| Antenna Connector   | permanently attached      |
| Test Voltage        | 120Vac 60Hz               |

### **Test Environment**

|                    |   |
|--------------------|---|
| Test Facility      | Protocol Data Systems Inc.<br>28945 McTavish Road<br>Abbotsford, BC V4X 2E7<br>Phone: 604-607-0012<br>Fax: 604-607-0019<br>Email: <a href="mailto:info@protocol-emc.com">info@protocol-emc.com</a><br>Website: <a href="http://www.protocol-emc.com">www.protocol-emc.com</a> |
| Test Facility ID's | SCC ISO/17025 (CAN-P-4E) Accredited Laboratory No. 612<br>FCC O.A.T.S. Registration Number 96437<br>Industry Canada O.A.T.S. Registration Number IC3384   |
| Date Tested        | 10July08  |
| Tested By          | David Johanson  |

## Test Setup

|   |  |
|---|--|
| Test Supporting Equipment                                     | None required  |
| Test Conditions   | Temperature and Humidity: 20.7°C, 49%  |
| Test Exercise<br>e.g. software description, test signal, etc. | The EUT was set for continuous transmit mode of operation. It was programmable to transmit on a fixed frequency as selected. |
| Deviation from Standard/s                                     | No deviation from Standard   |
| Modification to the EUT                                       | No modifications was made.   |

## Test Equipment List

| EMISSION     |               |                              |            |          |
|--------------|---------------|------------------------------|------------|----------|
| Manufacturer | Model         | Equipment Description        | Serial No. | Next Cal |
| HPs          | 85650A        | CDN Quasi-Peak Adapter       | 2043A00240 | 18/09/09 |
| HP           | 85662A        | Spectrum Analyzer Display    | 2318A05184 | 18/09/09 |
| HP           | 8566B         | Spectrum Analyzer RF Section | 2241A02102 | 18/09/09 |
| HP           | 85685A        | RF-Preselector               | 3107A01222 | 18/09/09 |
| Solar        | 8012-50-R-24  | LISN                         | 863092     | 28/09/08 |
| EMCO         | CPA-30        | Ant Log Periodic 200-1000MHZ | 563        | 05/12/08 |
| EMCO         | 3110B         | Ant Biconical 20-300MHz      | 9401-1850  | 05/12/08 |
| EMCO         | 3115          | DGR Horn At. 1-18GHzMHz      | 3429       | 15/12/08 |
| AH Systems   | SAS-200/550-1 | Active Monopole Antenna      | 631        | 08/05/09 |
| EMCO         | 6502          | Active Loop Antenna          | 9002-2489  | 28/02/09 |
| Rhientech    | Custom        | Antenna Mast                 | N/A        | N/A      |
| Protocol EMC | Custom        | Turntable                    | N/A        | N/A      |

## Measurement Uncertainty

| Parameter                     | Uncertainty |
|-------------------------------|-------------|
| Radio Frequency               | ±1 x 10-5   |
| Total RF power, conducted     | ±1,5 dB     |
| RF power density, conducted   | ±3 dB       |
| Spurious emissions, conducted | ±3 dB       |
| All emissions, radiated       | ±3 dB       |
| Temperature                   | ±1°C        |
| Humidity                      | ±5 %        |
| DC and low frequency voltages | ±3 %        |

## **Section II: Report of Measurements Test Procedure**

### **Radiation Interference:**

The measurement was made per ANSI C63.4-2003 using an Agilent model 8566B spectrum analyzer, a model 85685A Preselector, a model 85650A quasi-peak adapter, and the appropriate antenna. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100kHz with an appropriate sweep speed and the video bandwidth was 300kHz up to 1GHz and 1MHz with a VBW greater than or equal to the RBW above 1GHz. When an emission was found, the table was rotated to produce the maximum, signal strength. The antenna was placed in both the horizontal and vertical planes and the worse case emissions were reported. The EUT was re-positioned to produce the highest emission level. The spectrum was searched to at least the tenth (10) harmonic of the fundamental.

### **Formula of Conversion Factors:**

The field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dB $\mu$ V) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the spectrum analyzer meter reading.

Example:

$$\begin{array}{lllll} \text{Freq (MHz)} & \text{Meter Reading} & +\text{ACF} & +\text{CL} & = \text{FS} \\ 330 & 20 \text{ dB}\mu\text{V} & +10.36 \text{ dB} & +0.5 & = 30.86 \text{ dB}\mu\text{V/m} @ 3\text{m} \end{array}$$

Where the field strength was too low to get an accurate reading at the required distance of 3meters, the Antenna was moved closer to 1 meter. The resulting measurement was distance corrected for 3 meters by using the formula:

$$(1 \text{ meter result}) - (20\text{Log}(\text{measured distance}/\text{required distance})) = (3 \text{ meter result})$$

Example:

$$\begin{array}{l} 1 \text{ meter result} + \text{distance correction} = 3 \text{ meter result} \\ 54.5 \text{ dB}\mu\text{V} + -9.54\text{dB} = 45 \text{ dB}\mu\text{V} \end{array}$$

### **Power Line Conducted Interference:**

The procedure used was ANSI C63.4-2003 using a 50 $\mu$ H LISN. Both lines were observed. The bandwidth of the spectrum analyzer was 10kHz with an appropriate sweep speed. The spectrum was scanned from 0.15 to 30MHz. The measurement was performed on an Open Air Test Site at 0.8meters above the horizontal groundplane.

### **Occupied Bandwidth:**

A sample of the transmitter output detected by an antenna was fed into the spectrum analyzer and the attached plot was printed. The vertical scale is set to 10dB per division.

### **ANSI C63.4-2003 Measurement Procedures:**

The EUT was placed in a horizontal orientation, laying flat, on top of a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.m side). The table used for radiated measurements is capable of continuous rotation.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

Due to the construction of the EUT, the EUT was also placed in a vertical orientation and rotated on its axis and the emissions were maximized again to identify the highest emission level.

Frequencies less than 1GHz were measured using the Quasi-Peak receiver. Frequencies equal to and greater than 1GHz were measured using the Average receiver.

## Section III: Report of Measurements to Radiation Interference

### Rules Part No.:

Pt 15.249, Pt 15.209

| Frequency                  | Limits                              |
|----------------------------|-------------------------------------|
| <b>Part 15.209</b>         |                                     |
| 9 to 490 kHz               | 2400/F (kHz) $\mu$ V/m @ 300 meters |
| 490 to 1705 kHz            | 24000/F (kHz) $\mu$ V/m @ 30 meters |
| 1705 to 30 MHz             | 29.54 dB $\mu$ V/m @ 30 meters      |
| 30 – 88                    | 40.0 dB $\mu$ V/m @ 3 meters        |
| 80 – 216                   | 43.5 dB $\mu$ V/m @ 3 meters        |
| 216 – 960                  | 46.0 dB $\mu$ V/m @ 3 meters        |
| Above 960                  | 54.0 dB $\mu$ V/m @ 3 meters        |
| <b>Part 15.249</b>         |                                     |
| Fundamental 902-928 MHz    | 94.0 dB $\mu$ V/m @ 3 meters        |
| Fundamental 2.4-2.4835 MHz | 94.0 dB $\mu$ V/m @ 3 meters        |
| Harmonics                  | 54.0 dB $\mu$ V/m @ 3 meters        |

### Test Data: Fundamental as per Part 15.249

| Tuned Frequency MHz | Emission Frequency MHz | Meter Reading dB $\mu$ V at 3m | Antenna Polarity V/H | Coax Loss and Antenna Correction Factor dB/m | Field Strength Peak dB $\mu$ V/m | Field Strength Avg dB $\mu$ V/m | Limit dB $\mu$ V/m | Margin dB |
|---------------------|------------------------|--------------------------------|----------------------|--|----------------------------------|---------------------------------|--------------------|-----------|
| 2404                | 2404.91014             | 48.9                           | H                    | 39.14  | 88.04                            | 80.35                           | 94.0               | 13.7      |
| 2440                | 2439.70798             | 48.7                           | H                    | 39.25  | 87.95                            | 80.71                           | 94.0               | 13.3      |
| 2480                | 2479.88609             | 49.8                           | H                    | 39.38  | 89.18                            | 81.98                           | 94.0               | 12.0      |

### Test Data: Unintentional Radiated Emissions as per Part 15.209

| Frequency (MHz) | Pol  | Hgt (m) | Ang (deg) | Uncor-Pk (dB $\mu$ V) | Tot Corr (dB) | Peak (dB $\mu$ V/m) | QP Lmt (dB $\mu$ V/m) | DeLLim-Pk (dB) | QP (dB $\mu$ V/m) | DeLLim-QP (dB) |
|-----------------|------|---------|-----------|-----------------------|---------------|---------------------|-----------------------|----------------|-------------------|----------------|
| 31.99689        | Vert | 1       | 350       | 23.30                 | 14.76         | 38.06               | 40.00                 | -1.94          | 27.62             | -12.38         |
| 63.99402        | Vert | 1       | 270       | 23.90                 | 10.41         | 34.31               | 40.00                 | -5.69          | 29.88             | -10.12         |
| 79.99295        | Vert | 1       | 190       | 18.30                 | 10.84         | 29.14               | 40.00                 | -10.86         | 20.40             | -19.60         |
| 95.99149        | Vert | 1       | 200       | 26.80                 | 11.87         | 38.67               | 43.50                 | -4.83          | 26.92             | -16.58         |
| 191.98424       | Horz | 1       | 260       | 7.70                  | 15.94         | 23.64               | 43.50                 | -19.86         | 18.29             | -25.21         |
| 223.98020       | Horz | 2       | 80        | 13.30                 | 13.25         | 26.55               | 46.00                 | -19.45         | 22.81             | -23.19         |

No other emissions or Harmonics were detected. The spectrum was checked to the tenth harmonic.

## Section IV: Report of Maximum Permissible Exposure

**Rules Part No.:** Pt 1.1310 and 2.1091

**Requirements:** General Population/Uncontrolled Exposure : 1mW/cm<sup>2</sup>

**Calculation:**

$$S = \frac{PG}{4\pi r^2} = \frac{EIRP}{4\pi r^2}$$

S = Power Density

P = Power at Antenna Terminal

G = Gain of the Transmit Antenna

EIRP = Effective Isotropic Radiated power

r = Measurement Distance

EIRP Measurement at 3m at 1MHz RBW (peak) = 89.19 dBuV

Conversion to dBm (dBuV – 107) = -17.81 dBm at 300 cm

Conversion to 20cm (-17.81 + (20log (300/20)) = +5.71 dBm at 20 cm

Conversion to mW EIRP ( $10^{\frac{5.71}{10}}$ ) = 3.71mW EIRP at 20cm

$$\text{Power Density} = \frac{3.71}{4\pi(20)^2} = 0.000739 \text{ mW/cm}^2 \text{ at 20cm}$$

**Recommendations:**

Based on these worst case calculations the EUT is well below the maximum permissible exposure limit of 1mW/cm<sup>2</sup> at 20cm.

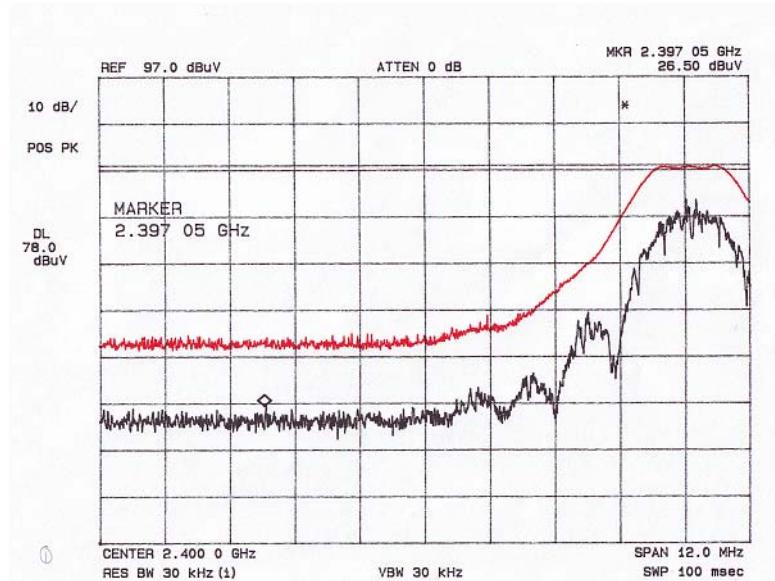
## Section V: Report of Measurements to Occupied Bandwidth

**Rules Part No.:** Pt 15.249. (d)

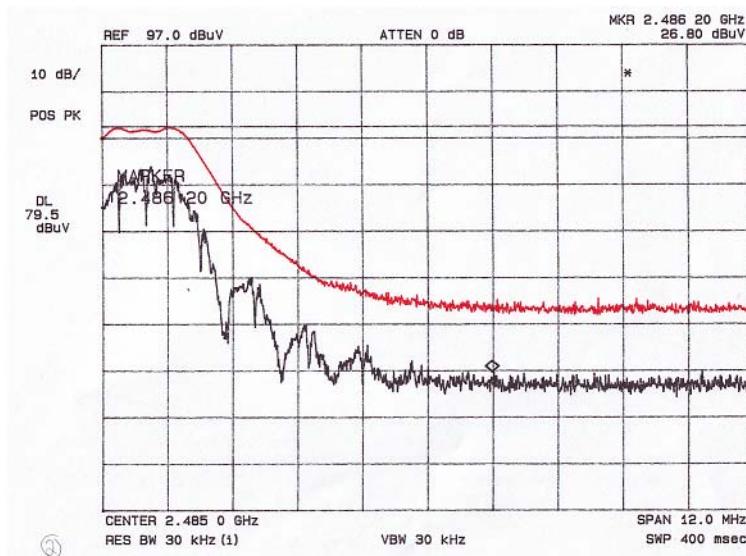
**Requirements:** The field strength of any emissions appearing outside the bandedges and up to 10kHz and below the band edges shall be attenuated at least 50dB below the Level of the carrier or to the general limits of 15.209. Which ever is the lesser

**Test Data:**

All emissions at the band edges are below the 15.209 limit line.



**Figure1: Low Frequency Band Edge.**



**Figure 2: High Frequency Band Edge.**

## Section VI: Report of Measurements to Power Line Conducted Interference

Rules Part No.:

Pt 15.207

Requirements:

| Frequency<br>MHz | Quasi Peak Limits<br>dB $\mu$ V | Average Limits<br>dB $\mu$ V |
|------------------|---------------------------------|------------------------------|
| 0.15 – 0.5       | 66 – 56                         | 56 -46                       |
| 0.5 – 5.0        | 56                              | 46                           |
| 5.0 – 30         | 60                              | 50                           |

Test Data:

Table 1: Line 1- 120Vac, 60Hz Peak

| Frequency<br>(MHz) | Peak<br>(dB $\mu$ V) | DeLLim-Pk<br>(dB) |
|--------------------|----------------------|-------------------|
| 1.003              | 55.5                 | +9.5              |
| 1.041              | 54.9                 | +8.9              |
| 0.9071             | 52.1                 | +6.1              |
| 1.328              | 51.7                 | +5.7              |
| 1.253              | 51.4                 | +5.4              |
| 1.913              | 51.4                 | +5.4              |
| AVERAGE            |                      |                   |
| 1.008              | 44.6                 | -1.4              |
| 1.069              | 44.5                 | -1.5              |
| 0.9413             | 42.2                 | -3.8              |
| 1.873              | 40.6                 | -5.4              |
| 2.728              | 40.0                 | -6.0              |
| 3.48               | 39.7                 | -6.3              |

Table 2: Line 2- 120Vac, 60Hz Peak

| Frequency<br>(MHz) | Peak<br>(dB $\mu$ V) | DeLLim-Pk<br>(dB) |
|--------------------|----------------------|-------------------|
| 1.086              | 54.7                 | +8.7              |
| 1.233              | 52.8                 | +6.8              |
| 1.307              | 51.6                 | +5.6              |
| 0.5457             | 61.3                 | +5.3              |
| 0.4935             | 51.2                 | +5.1              |
| 0.4731             | 51.4                 | +5.0              |
| AVERAGE            |                      |                   |
| 1.069              | 44.6                 | -1.4              |
| 1.035              | 43.8                 | -2.2              |
| 1.139              | 43.6                 | -2.4              |
| 1.176              | 43.6                 | -2.4              |
| 1.014              | 43.5                 | -2.5              |
| 1.027              | 43.5                 | -2.5              |

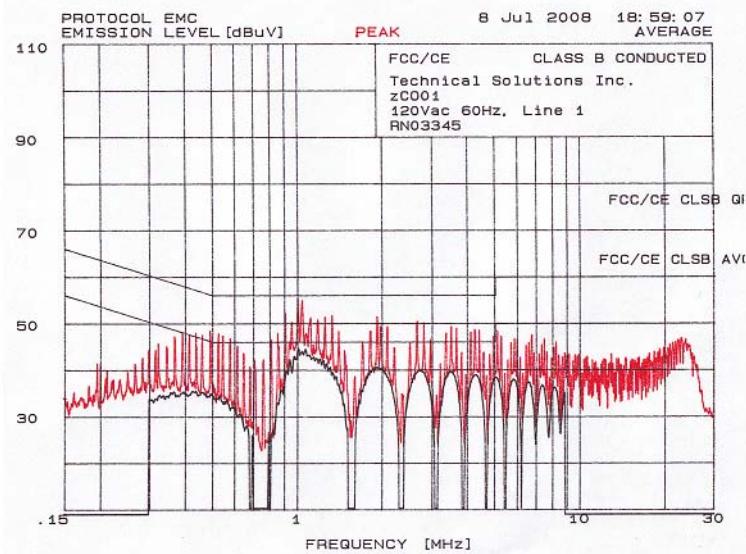


Figure1: Conducted Emissions Line 1 – 120Vac, 60Hz

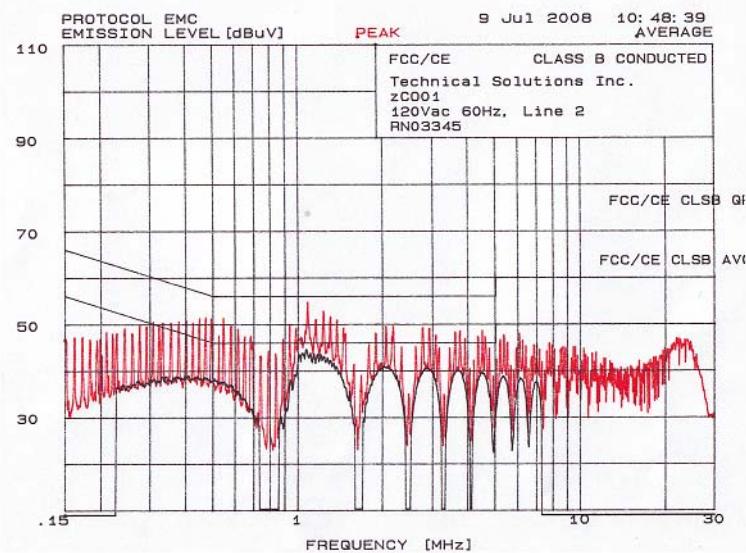


Figure2: Conducted Emissions Line 2 – 120Vac, 60Hz

## Section VII: Measurements EUT Photos



Test Setup of EUT Front View



Test Setup of EUT for AC Mains Conducted Emissions