

**Exhibit 8: User's Manual**

A copy of the user's manual is enclosed below. The compliance statement for the 900 SS Hopper is located on page 14 of the manual.

**TABLE OF CONTENTS**

Quick Start Guide.....	2-4
Contents of Developer Kit.....	2
Setting up the Radios.....	2
Installing the Software.....	3
General Information.....	5
Configuring the Data Radio.....	6
Basic Commands.....	6-8
LED Indicators.....	8
Default Settings.....	9
Specifications.....	10
Mechanical Overview/Interface Board.....	11
Mechanical Overview/Radio Hardware Interface.....	11
Pin Definitions for Connector J1.....	12
FCC Compliance Warning and Class B Statement.....	14
Correcting Interference.....	14
Glossary.....	15-16



# **WWC 900 SS Hopper Data Radio**

## **Quick Start Guide**

### **Contents**

The World Wireless Communications 900 SS Hopper Developer Kit contains the following items:

- User's Guide with technical diagrams
- 900 SS Hopper Radios with an attached RS-232 Interface Board
- 900 Megahertz Antennas
- 12-volt, 1.2 amp DC Power Adapter
- Serial Data Cables with 9-pin connectors

### **Getting Started**

#### **You will need to supply the following items:**

- An RS-232 terminal or a computer (PC) running a communication software package
- A serial COM port for connecting the terminal or computer to the radio
- A 120-volt AC power source for the radio power supply
- A standard 25-pin to 9-pin adapter if your PC or terminal does not have a 9-pin serial port available

### **Setting up the Radios**

1. Locate the antennas and install them on the antenna connectors of the Hopper radios. Set the radios with antennas aside in a safe place.
2. Remove the 9-pin serial cable from the box and attach it to an available serial COM port on your PC or terminal. If the port has a 25-pin connector, use the appropriate adapter, which is not supplied with this kit.
3. Attach the other end of the serial cable to the radios.
4. Plug the power supply into a 120-volt AC outlet. Power up the radio by plugging the cable from the power supply into the radio.

If you are using a terminal or a PC with a communications program other than the Data Radio Configuration program, set the communications parameters of your terminal to 9600 baud, 8 data bits, no parity, and one stop bit. You will also want to enable "local echo" or "half-duplex" mode so that the characters typed will appear on the screen as well as be sent to the radio.

If you are using a PC with the supplied Configuration program, the following instructions will explain how to set up your computer for use with the radio.

## Installing the Software

You are now ready to install the software.

1. Turn on your computer and start Windows.
2. Insert the first Install disk in your disk drive.
3. Click the Windows "Start" button, point to "Run".
4. In the "Open" box type "a:setup" and press Return.
5. Follow the instructions on your screen, inserting the remaining disk(s) when prompted.

You are now ready to use the Hopper Radio Configuration program.

## Performing a Quick Start Radio Test

1. Launch the Configuration program by clicking "Start" then "Programs" then "Hopper 900 Configuration". You should see the screen as shown below.
2. Select the appropriate COM port to which the radio is connected.

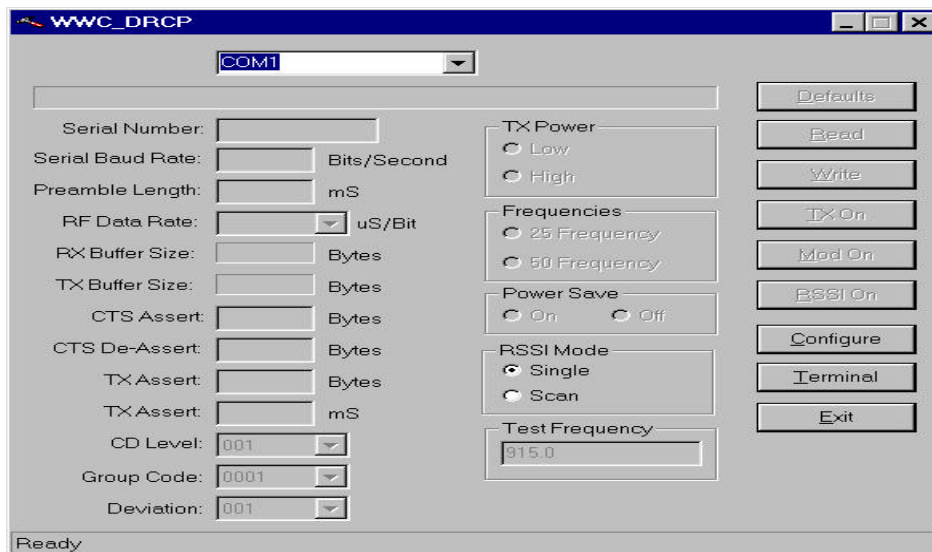
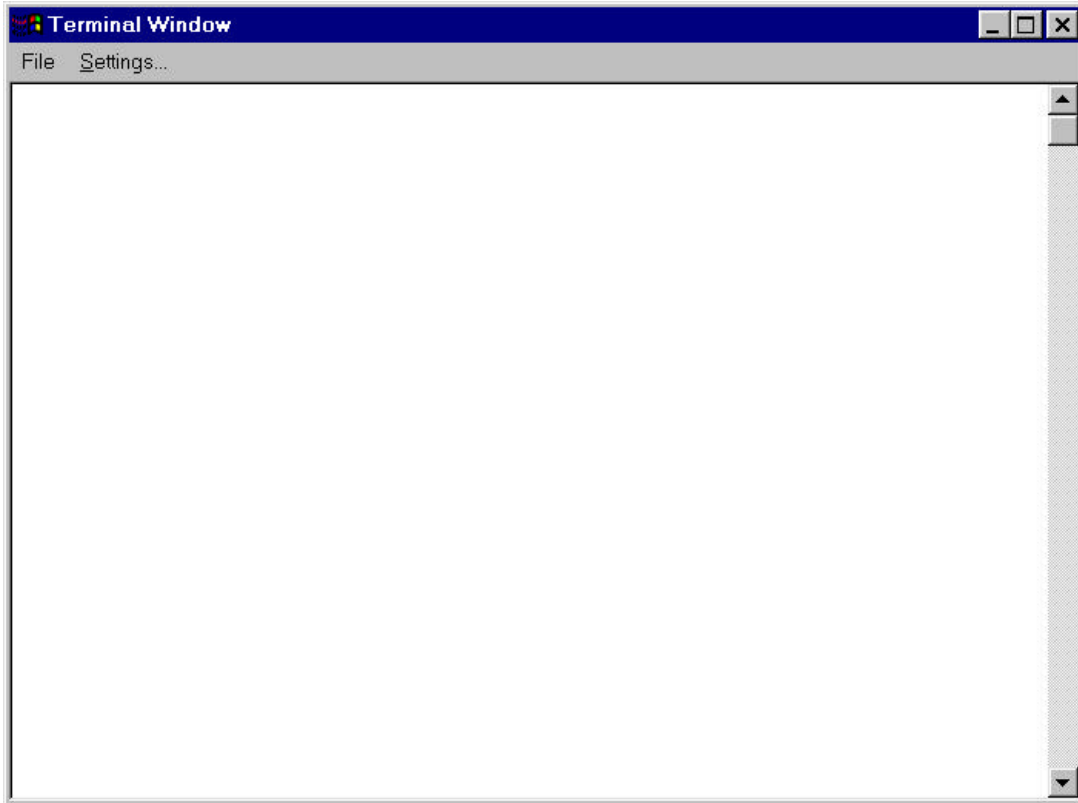


Exhibit 8



3. Click on the "Terminal" button to open the terminal test window. You should see the screen as shown below.
4. Setup the second radio in the same manner.
5. Type text to communicate between the terminals or PC's and verify proper radio operation.



## WWC 900 SS Hopper Data Radio

### General Information

The Data Radio is a frequency-hopping data transceiver operating in the 902-928 MHz ISM band. The transceiver is designed to operate under Part 15 of the FCC rules and regulations and is designed as an OEM module for professional integration into other products or field devices. When installed using a World Wireless Communications approved antenna, the user need only make sure the radio's FCC label or a copy of the FCC label is clearly visible on the outside of the integrated product.

In order to comply with FCC Section 15.203 the 900 Micro Hopper Data Radio was tested with and can only be installed with the three different types of antennas listed below:

<u>Antenna Type</u>	<u>Model</u>	<u>Antenna Gain</u>
Small Dipole		0 dBi
Large Dipole		3 dBi
Comtelco Yagi	Y2283A-66	6 dBi
Maxrad Omni	MFB9155	5 dBi

In order to comply with the FCC RF exposure requirements the Data Radio must be installed with the antennas listed above and a minimum separation distance of 20 cm (for the Dipole's and Omni antennas) and a minimum separation distance of 40 cm (for the Yagi antenna) must be maintained from the antenna to any near by persons.

**Caution:** *If this radio is integrated into another product, the user is responsible for complying with the external labeling requirements as directed in the FCC Rules and Regulations part 15.19. The user may only use antennas that have been tested and approved with this radio without obtaining their own FCC certification.*

The unit operates on 50 discrete frequencies within the ISM band, each frequency about 400kHz apart. Using a high-speed phase-locked loop synthesizer, the receiver is able to quickly acquire synchronization with the transmitter and receive the transmitted data.

The Data Radio is connected to a host device using a 20-pin dual in-line header. This connection provides the radio with the required DC power source and allows the Data Radio to be programmed, configured and provides all I/O lines for a fully compliant RS-232 port.

Data is transported across the RF channel in a transparent, promiscuous mode. In other words, data sent into the serial port on one radio will be presented out of the serial port on all other radios that are within range and have the same group code. Data verification and retries are the responsibility of the host (DTE) device.

The transceiver also provides visual indication of proper operation and valid packet reception using on-board LED indicators.



## Programming and Configuring Selections

The screenshot shows the WWC\_DRCP software interface. The window title is "WWC\_DRCP". The main area is titled "900 Hopper v1.00". The interface is divided into several sections:

- Serial Port:** A dropdown menu shows "COM1".
- Serial Number:** A text field contains "000000".
- Serial Baud Rate:** A text field contains "9600" with the unit "Bits/Second".
- Preamble Length:** A text field contains "147" with the unit "mS".
- RF Data Rate:** A dropdown menu shows "18" with the unit "uS/Bit".
- RX Buffer Size:** A text field contains "200" with the unit "Bytes".
- TX Buffer Size:** A text field contains "150" with the unit "Bytes".
- CTS Assert:** A text field contains "100" with the unit "Bytes".
- CTS De-Assert:** A text field contains "125" with the unit "Bytes".
- TX Assert:** A text field contains "120" with the unit "Bytes".
- TX Assert:** A text field contains "10" with the unit "mS".
- CD Level:** A dropdown menu shows "001".
- Group Code:** A dropdown menu shows "0001".
- Deviation:** A dropdown menu shows "001".
- TX Power:** Radio buttons for "Low" and "High", with "High" selected.
- Frequencies:** Radio buttons for "25 Frequency" and "50 Frequency", with "50 Frequency" selected.
- Power Save:** Radio buttons for "On" and "Off", with "Off" selected.
- RSSI Mode:** Radio buttons for "Single" and "Scan", with "Single" selected.
- Test Frequency:** A text field contains "915.0".

On the right side, there is a vertical stack of buttons: "Defaults", "Read", "Write", "TX On", "Mod On", "BSSI On", "Disconnect", "Terminal", and "Exit".

At the bottom of the window, a status bar displays "Device configuration written".

Exhibit 8

Commands are accepted by the radio when it is in "configure" mode. On the figure of the main menu shown above, "Configure" toggles with "Disconnect." Select "configure", make changes as desired, and select "Write." Your radio is configured. Select "TX On" to transmit.

### **Basic Commands**

#### **Serial Port on PC**

Default to COM1. The configuration program supports COM1 through COM8.

(i) Serial Number

This unique number is predetermined by the manufacturer.

(ii) Serial Baud Rate

This is the baud rate the data radio uses to talk to a PC or external device. The default is 9600 bits/second. Drop-down settings allow standard baud rates from 2400 to 57600 bps.

(iii) Preamble Length

This is the amount of time the transmitting radio sends a polling preamble to search for a receiving radio. Default is 147 mS.

(iv) RF Data Rate

This determines how fast the transmitting radio sends data. The default is 18 with drop-down settings of 35 and 50.

(v) RX buffer size

The RX (receiving) buffer size is the number of bytes stored in the receive buffer. The default predetermined by the manufacturer is 200 bytes.

(vi) TX buffer size

The TX (transmission) buffer size is the number of bytes stored in the transmit buffer. The default predetermined by the manufacturer is 150

bytes.

(vii) CTS Assert

CTS (Clear to Send) Assert, also known as "flow control on," has a default setting of 100 bytes.

(viii) CTS De-Assert

CTS De-Assert, also known as "flow control off," is defaulted to 125 bytes.

(ix) TX Assert

The volume or amount of time the transmitting radio will collect or wait before it transmits. Default is 10 mS.

(x) CD Level

Carrier Detect level. Lets the scanning radio determine if there's a valid signal to receive. This is a factory alignment setting.

(xi) Group Code

Lets you set any number of radios to the same group. There are 1600 available groups. Radios with different group codes will not receive each other. The data radio's default setting is Group 1.

(xii) Deviation

This is a factory alignment setting.

(xiii) TX Power

This setting allows the user to change the transmitter output power. This feature is not supported on all products. The default setting is "high".

(xiv) Frequencies

Number of frequencies available for the data radio to scan. Choices for this setting vary with radio model.



## (xv) Power Save

When enabled, the radio reduces power consumption where possible. The default setting is off.

## (xvi) RSSI Mode

Receive Signal Strength Indicator. Lets you know how strong a receive signal is on any given frequency. Selecting "single" will hold the radio on a specific channel while selecting "scan" will cycle through all available channels displaying the most recent and peak signal strength values. The default mode is single channel mode.

## (xvii) Test Frequency

Lets you test the sending and receiving frequency of any two radios. The default is set to 915.0. Available frequencies are 902-928 MHz.

## LED Indicators

The front panel on your radio has LED indicators that let you know the unit is operating properly and that data is being transmitted or received.

- Status LED. Flashing yellow light lets you know the radio is working properly.
- Transmitting (TX) LED. Solid red light lets you know data is being transmitted.
- Receiving (RX) LED. Solid green light lets you know the data packet is being received.



Default Settings

Serial Baud

Rate.....9600

bits/second

Preamble Length:.....147 mS  
 RF Data Rate:.....18  
 RX buffer size:.....200 bytes\*  
 TX buffer size:.....150 bytes\*  
 CTS Assert:.....100 bytes  
 CTS De-assert:.....125 bytes  
 TX Assert:.....120 bytes/10 mS  
 CD Level:.....Factory setting  
 Group Code:.....0001 – 1600  
 Deviation:.....Factory setting  
 TX Power:.....High\*  
 Frequencies:.....50 frequency\*  
 Power save:.....Off  
 RSSI mode:.....Single  
 Test Frequency:.....915.0

\*predetermined by manufacturer

## WWC 900 SS Hopper Data Radio Specifications

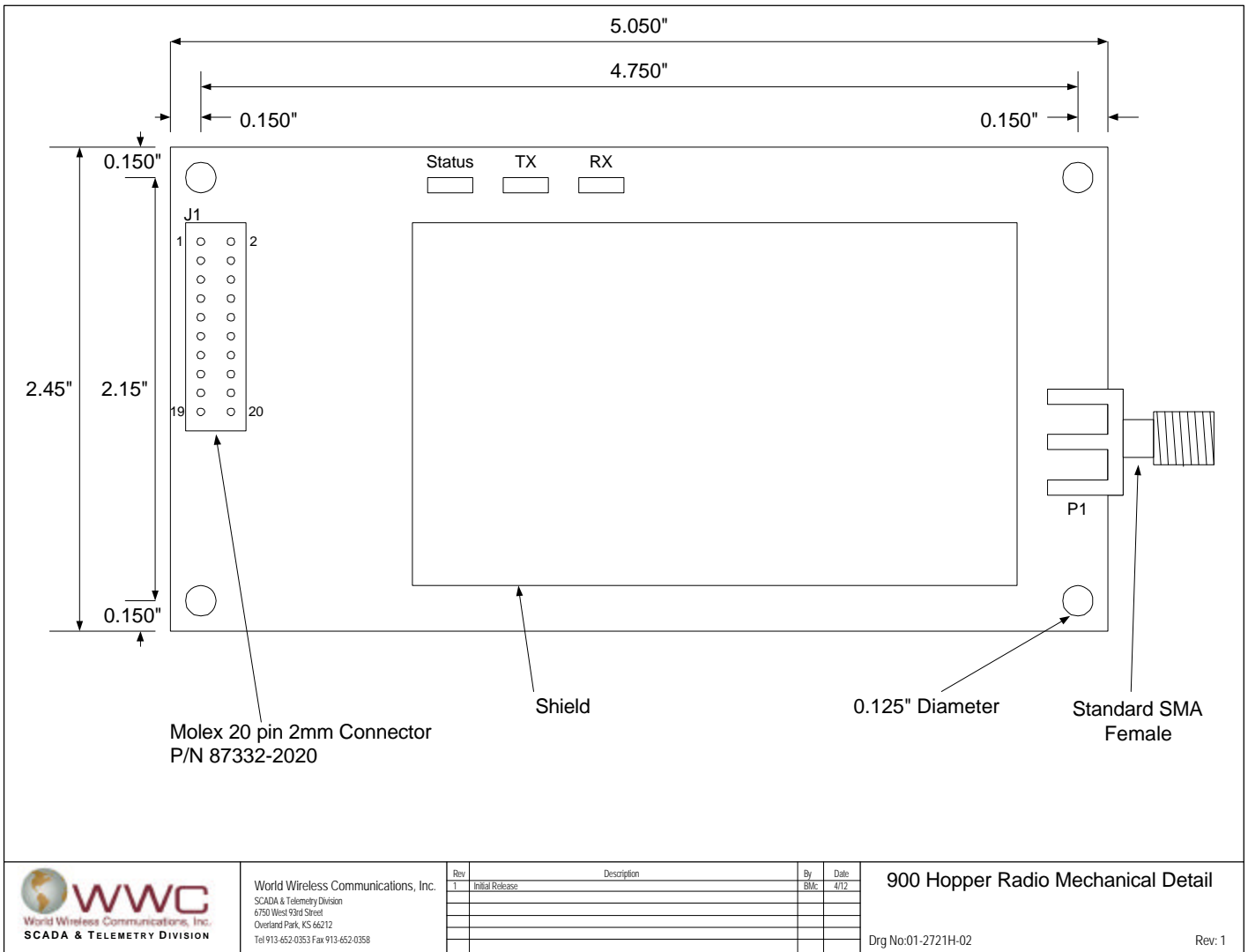
### General Specifications

Power Source .....	9-32 VDC 10 Watts
Temperature .....	-40 to +80 °C
Antenna Impedance .....	50 Ohms unbalanced
Antenna Connection .....	SMA female
Operation Mode .....	Frequency Hopping Spread Spectrum
Frequency Control .....	PLL Synthesizer, 100 kHz step size
Operating Band .....	ISM 902 MHz – 928 MHz
Channel Spacing .....	400 kHz
Modulation System .....	Direct FM
System Deviation .....	100 kHz max
Channel Capacity .....	50
Data Rate .....	56 kbps
Sensitivity .....	-104 dBm
Data Interface .....	Asynchronous Serial – RS-232 or TTL
Size .....	Approx. 2.5" x 5.1" x 1.0"
FCC Compliance .....	Part 15
Transport Protocol .....	
Transparent	



# WWC 900 SS Hopper Data Radio Radio Hardware Interface

## Mechanical Overview



## WWC 900 SS Hopper Data Radio Hardware Interface

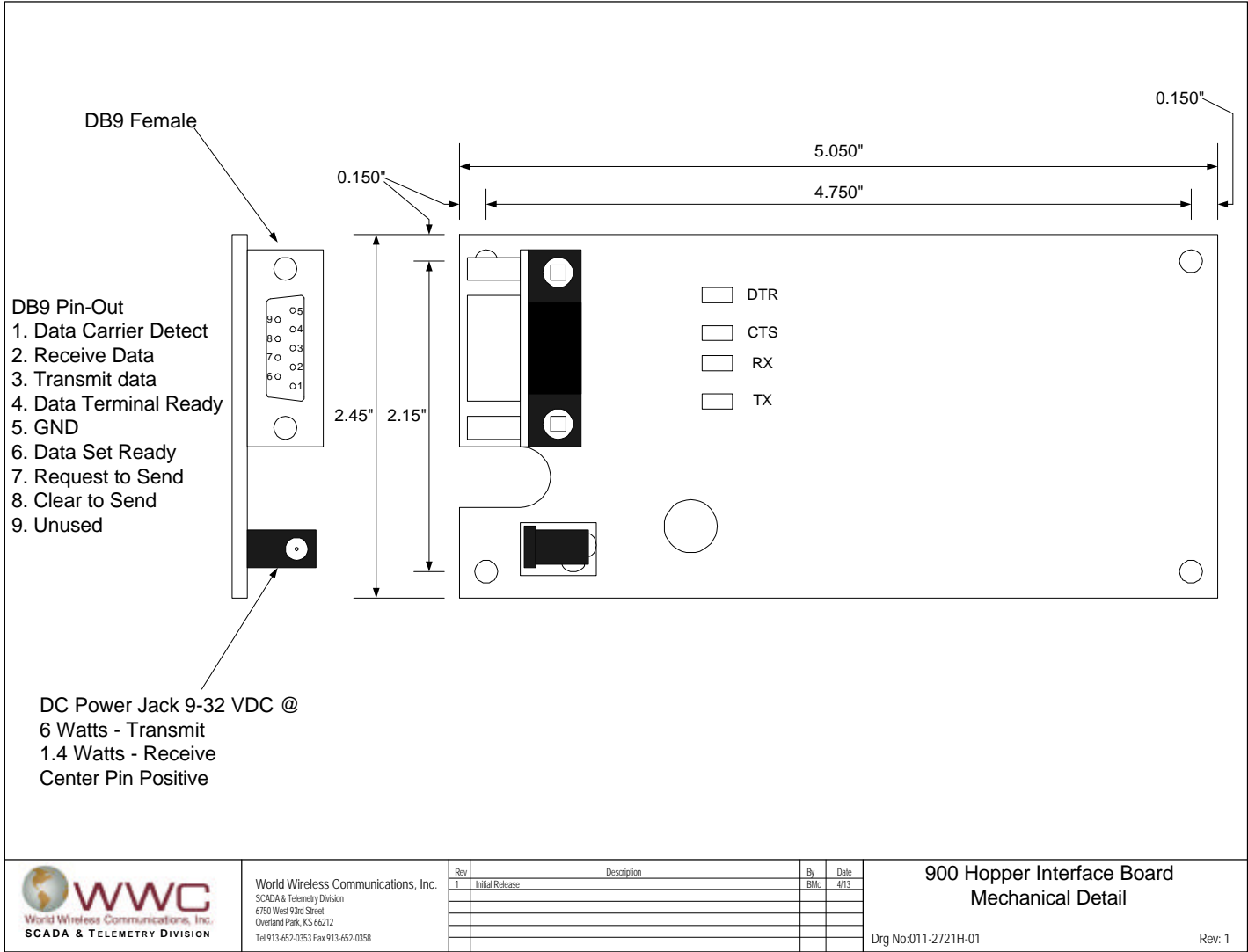
### Pin Definitions for Connector J1

The following pin out summary is achieved through a 20 pin 2mm connector J1 (Molex P/N 87332-2020).

PIN	FUNCTION
1	AT90S8515 MOSI
2	Received Data
3	AT90S8515 MISO
4	Clear to Send Out
5	AT90S8515 SCK
6	Data Terminal Rdy In
7	Reset
8	Request to Send In
9	AT90S2313 SCK
10	Transmit Data
11	AT90S2313 MISO
12	Data Carrier Detect Out
13	AT90S2313 MOSI
14	5VDC Out
15	Status LED Out
16	5VDC Out
17	9-32 VDC In
18	Ground
19	9-32 VDC In
20	Ground

# WWC 900 SS Hopper Data Radio Interface Board

## Mechanical Overview



World Wireless Communications, Inc.  
 SCADA & Telemetry Division  
 6750 West 93rd Street  
 Overland Park, KS 66212  
 Tel 913-652-0353 Fax 913-652-0358

Rev	Description	By	Date
1	Initial Release	BMc	4/13

### 900 Hopper Interface Board Mechanical Detail

Drg No:011-2721H-01

Rev: 1

## WWC 900 SS Hopper Data Radio Hardware Interface

### FCC Declaration of Conformity

Responsible Party:

World Wireless Communications, Inc.  
2441 South 385 West  
West Valley City, UT 84120  
(801) 575-6600

Changes or modifications to the 900 SS Hopper Data Radio not expressly approved by World Wireless Communications could void the user's authority to operate this product.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, users and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.



## **Glossary**

### **Baud**

Measurement of the signaling speed of a data transmission device.

### **CD**

Carrier Detect level. Used to tell the scanning radio if a receiving radio is present.

### **Communication (COM) Ports**

Designation of serial communications channels. COM port designations for this radio are COM1 through COM8.

### **Configuration Default**

Operating characteristics of this data radio. The configuration default parameters are stored in the data radio's non-volatile memory and are predetermined by the manufacturer.

### **CTS**

Clear to Send. A control signal used in conjunction with Request to Send (RTS) to perform data flow control.

### **Flow Control**

A method used to regulate the flow of data between two devices; in this instance, between the customer DTE and the data radio.

### **Group Code**

A setting to designate which group a radio will belong to. A radio will only "hear" other radios with the same group code. You may program up to 1600 different groups with unlimited radios in each group.

### **Modulation**

The shifting of transmit frequency representing the data being transmitted.

### **Preamble Length**

The length of time a transmitting radio sends a preamble to search for the receiving radio.



**RF Data Rate**

How fast the transmitting radio sends data across the RF channel.

**RSSI**

Receive Signal Strength Indicator. Indicates signal strength on any given frequency.

**RTS**

Request to Send. A control signal used in conjunction with Clear to Send (CTS) to perform data flow control.

**RX Buffer Size**

Number of bytes in the receive buffer.

**Serial Baud Rate**

Baud rate the radio uses to talk to a pc or external device.

**TX Assert**

Amount of time or volume the transmitting radio will wait before it sends data.

**TX Buffer**

Number of bytes available for the transmit buffer.

**TX Power**

Transmitting power. This radio has 4 settings for range, preset by the manufacturer.

