9Xtream

Frequency Hopping Data Radio

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FCC Compliance Warning:
Changes or modifications to the 9Xtreme Data Radio not expressly approved by CDH Communications, Inc. 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, uses, 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.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1)   This device may not cause harmful interference, and
(2)   This device must accept any interference received, including interference that may cause undesired operation.

Introduction

The 9XTREAM-192/96 radio is a 100-milliwatt frequency hopping wireless modem that communicates with other equipment using a standard 19200 or 9600 baud asynchronous serial data stream. The radio is half-duplex and can sustain close to a continuous data stream at the specified data rate. The 9XTREAM operates within the 900 MHz ISM Band under Part 15 of the FCC Rules and Regulations.

Caution: If this radio is integrated into another product, the system integrator must make sure that the FCC label is visible from the outside of the final product, or that the external label provided with this device is placed on the outside of the final product. The system integrator may only use antennas that have been tested and approved with this radio to maintain the FCC approval. If a system integrator uses a non-approved antenna they are responsible for obtaining their own FCC certification. The radio also requires +5V source voltage. Any voltage higher than 5.5V will damage the radio.

Approved Antennas

Mfr	Model	Freq	Gain	Type	Connector	Dimensions
Astron	AXQ900 PTL	902-928	2dBi	Omni	MMCX	3"
Astron	AXH900 RP SMA R	902-928	2dBi	Omni	Reverse Polarity SMA	6.5"
CDH	900CDAN	902-928	2dBi	Omni	Integrated	3"

Caution: The 9XTREAM has been certified as a mobile device as per FCC Section 2.1091. In order to comply with the FCC RF exposure requirements the 9XTREAM must be installed with the antennas listed above and a minimum separation distance of 20 cm must be maintained from the antenna to any near by persons. If the OEM integrates the 9XTREAM into their final product, where the final product is classified as a portable device per FCC Section 2.1093 (less than 20 cm separation distance between the antenna to any near by persons). The OEM is responsible for obtaining a separate authorization on the final product.

The Radio uses an asynchronous serial interface with a start bit, stop bit and eight (8) data bits at TTL levels for communicating with the host system. Using an RS232 driver chip (such as a Maxim MAX232) the Radio can communicate directly to a standard Serial Communications Port on a PC. See the section titled Demo Kit Instructions for a tutorial to help get started using the 9Xtreme Radio.

9Xtreme Features:

- Frequency Hopping Spread Spectrum (FHSS) technology
- Secure over the air data encryption
- Resistant to noise and interference.
- 100mW transmit power
- Up to 25 mile (40 Kilometer) effective range (line of sight, 9600 baud)
- Broadcast (promiscuous) networking protocol – data sent to the RX pin on one radio will be presented out of the TX pin of the serial port on all other radios that are within range and have the same network identifier code.

Connections

The Data Radio is connected to a host device using the 11 pin and the 4 pin berg headers. These connections provide the radio with the required DC power source (+5V) and allow the Data Radio to be configured and provide the I/O lines for the asynchronous line level (TTL) RS-232 connection.

J1 PIN DESCRIPTIONS

J1-1	CTS	Clear to send flow control (output)
J1-2	INT1	Interrupt line to radio processor (input, not currently implemented)
J1-3	TX	Asynchronous data output (data going from radio to user)
J1-4	RX	Asynchronous data input (data going from user to radio)
J1-5	RTS	Ready to send flow control (input, not currently implemented)
J1-6	*RESET	Reset line to radio processor (assert low to reset radio processor)
J1-7	MOSI	SPI data in (input, not currently implemented)
J1-8	MISO	SPI data out (output, not currently implemented)
J1-9	SCK	SPI data clock (input/output, not currently implemented)
J1-10	Power	+5 volts DC. (55mA in RX mode, 200mA in TX mode)
J1-11	Ground	

J2 PIN DESCRIPTIONS

J2-1	Ground
J2-2	Ground
J2-3	Ground
J2-4	Ground

Antenna Connection
Female MMCX
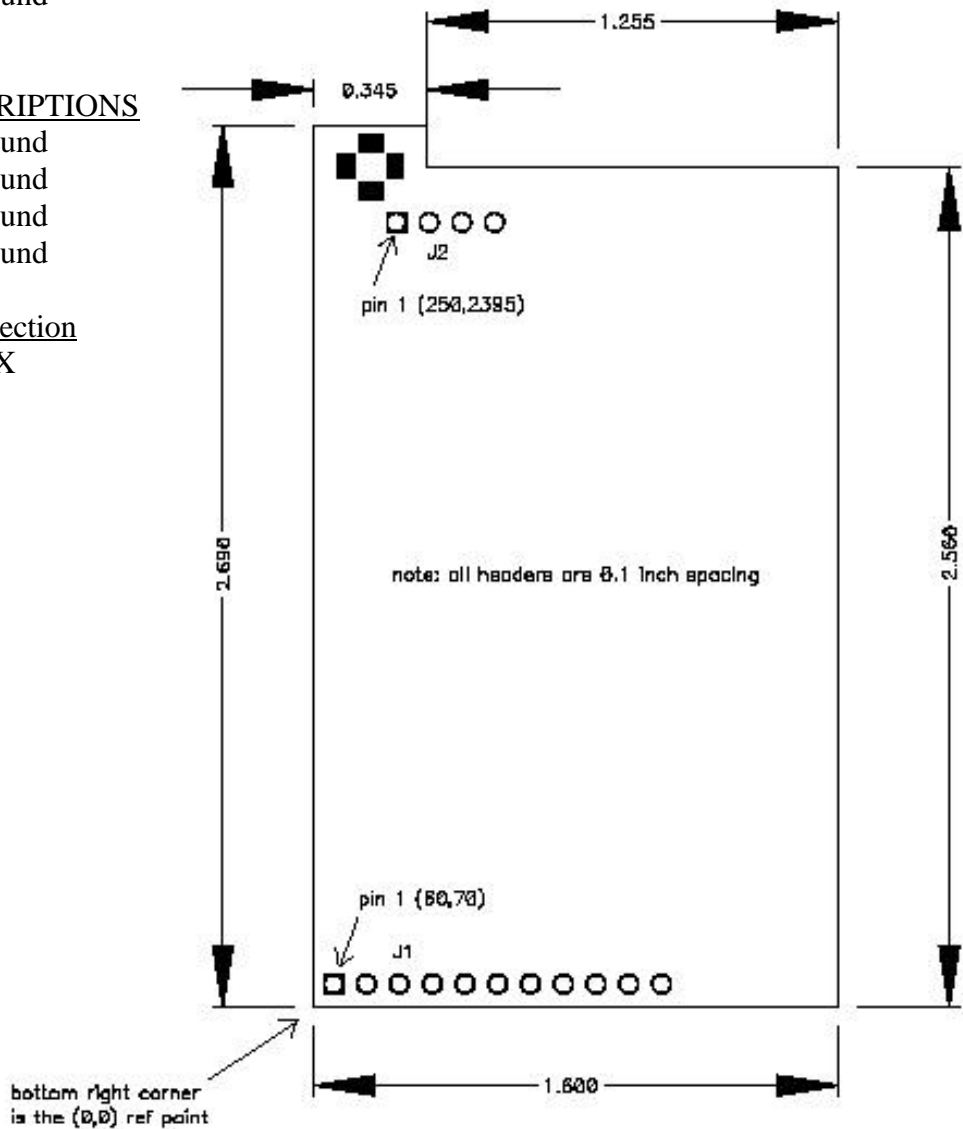
Operating States

Scanning

When the radio is neither transmitting nor receiving, it is continually scanning for valid transmissions. From the Scanning state the radio can either transmit, if data is presented on the serial port; or receive, if data is presented over the air. The radio will return to scanning when data is no longer present either on the air or on the serial port, or if a receive error is detected.

Transmitting

When data is presented to the serial port, the radio must first initialize the RF link; it will then send the incoming data over the air. Initialization of the link takes approximately 50 milliseconds (ms), this is the latency between the transmitter receiving data through the serial port, and the receiver transmitting data out the serial port. During this time, all receivers within range will sync up with the transmitter. While the RF channel is being initialized, the radio can buffer up to 48 characters before it must stop receiving characters. The radio will assert the CTS control line when approximately 32 characters have been received to notify the sending device to stop sending data. This assertion point was chosen to accommodate PC's with FIFO serial ports that can buffer up to 16 characters and sends these characters even after CTS assertion.

After initialization, the radio will start to send any buffered data. Data is sent in packets up to 32 bytes long. As soon as the radio starts sending a packet the CTS line is de-asserted and more data can be sent to the radio. At this point as long as data is continuously sent to the radio there should be very little if any assertion of CTS and data can be continuously sent to the radio.

Data is sent in what could be considered raw mode. Meaning no CRC or check sum is appended to the data packet. Also no attempt is made to verify whether the packet was received (no acknowledgement). Checks that are made on a packet to verify it is a good include: 1) a 16-bit network identifier that is used so that multiple networks or radios can operate in the same vicinity, 2) a byte count of the packet length, 3) extensive checking of bits to make sure they are valid.

Due to this raw mode it is suggested that the data sender use a check sum or CRC and acknowledgement from the receiving radio to verify data transmission.

Receiving

When a scanning radio detects a valid transmission, the radio is locked in receive mode until no more data is detected or a receive error occurs. This means that this radio will not be able to transmit any incoming data until it returns to scanning mode. It is important to note that all radios within range of a transmitter and with the same network address will receive the transmission and send it out their serial ports. Any networking or addressing will be handled outside of the radio, this is called a Broadcast, or Transparent protocol.

After the radio is in receive mode it will receive a packet and transmit it out the serial port. A packet will be rejected if: 1) the network identifier is incorrect, 2) the byte count is incorrect or 3) there is a bit error in the data packet. A packet that is rejected is discarded and is not sent to the serial port.

If there are gaps in receiving data the receiver automatically returns to scanning mode. If the receiver has buffered data coming in the serial port this data will be sent after the radio returns to scanning mode.

Specifications

Frequency Range:	902 to 928 MHz ISM Band
Radio Power Source:	5 VDC 200mA
Demo Kit Power Source:	6-15 VDC 200mA
Antenna Impedance:	50 Ohms unbalanced
Antenna Connection:	MMCX female
Operation Mode:	Frequency Hopping Spread Spectrum
Sensitivity:	-109 dBm
Selectivity:	70 dB at pager and cellular frequencies
FCC Compliance:	Part 15
Transport Protocol:	Transparent
Data Interface:	Asynchronous Serial TTL
RF Data Rate:	10,000 bps or 20,000 bps
Data Interface Rates:	9600 or 19,200 bps
Data Protocol:	8 data bits, no parity, 1 stop bit, hardware handshaking, transparent networking.
Operating Temperatures:	-40°C to 70°C, (-40°F to 185°F)
Size:	1.6 in. x 2.7 in. x .35 in.

IMPORTANT: This device operates with a modular transmitter that must satisfy FCC RF exposure compliance requirements for mobile transmitting devices. The antenna of this device (modular transmitter) must be installed and operated with a separation distance of 20 cm or more from persons to satisfy the RF exposure requirements. Operations that do not meet these requirements must be avoided.

Warranty

The 9XTREAM radio from CDH Communications is warranted against defects in materials and manufacturing for a period of 90 days from the date of purchase. In the event of a product failure due to materials or workmanship, CDH Communications will repair or replace the defective product. For warranty service, return the defective product to CDH for prompt repair or replacement.

CDH Communications, its suppliers, and its licensors shall in no event be liable for any damages arising from the use of or inability to use this product. This includes business interruption, loss of business information, or other losses that may arise from the use of this product.

Using the 9Xtream Demo Kit

Introduction:

Use this demo kit to experience the power and sensitivity of the CDH 9XTREAM radio. This radio transmits data at 19200 bits per second in the license-free 900MHz ISM band. See how simple it is to communicate with the radio using asynchronous serial communications by following the instructions below.

Contents:

2	9XTREAM Frequency Hopping radios
2	Demo Boards
2	9VDC adapters
2	DB-9 connecting cables
1	Null modem adapter
1	3.5" floppy disk containing file RAT.TXT

Requirements:

2 computers with an available comm port and Windows 95/98 or NT.

Instructions:

1. Assemble and Connect Demo Boards to computers.
    a. Connect the radios to the Demo Boards by fitting the 4 and 11-pin connectors into their respective female headers.
    b. Attach the male sides of one of the DB-9 Connecting Cables to the female DB-9 jacks on the Demo Boards.
    c. Attach the female side of a DB-9 connecting cable to an available comm port on the back of Computer 1. Connect Radio 2 to Computer 2 in the same fashion.
    d. Plug Battery clips into the Demo Boards. The green LEDs on the Demo Boards will illuminate to show the boards are powered.
    e. Refer to figure 1 for completed assembly.

2. Run and configure HyperTrm.exe on both computers
    a. Open the folder on the Start Menu found under Programs -> Accessories -> Communications -> HyperTerminal.
    b. Double-click on the application HyperTrm.exe and choose a name and an icon for the new connection in the **Connection Description** dialogue box.
    c. In the **Connect To** dialogue box on each computer, select *Connect using: Direct to Com1* or *Direct to Com2* to correspond with the comm port used on the respective computers (see figure 2) . Click *OK*.
    d. In the **COM Properties** dialogue box, set the following: *Bits per second: 19200; Data bits: 8; Parity: None; Stop Bits: 1* and *Flow Control: Hardware* (See figure 3). Click *OK*.
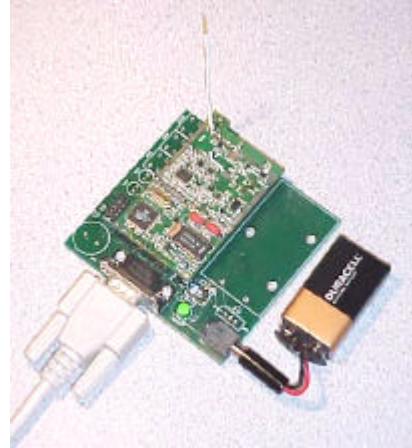   e. Both computers are now set up and ready to communicate.

Figure 1– Demo Kit

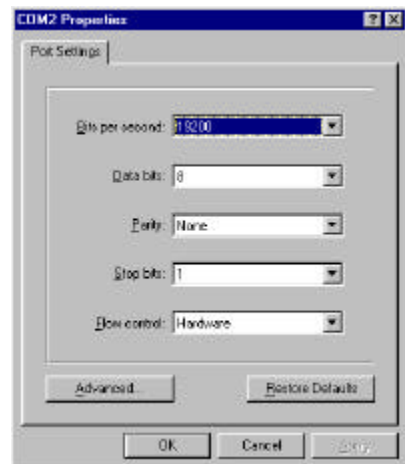**Figure 2 –Connect To** Dialogue Box

Figure 3 – COM Properties Dialogue Box

3. Test Connection
    a. Place cursor in HyperTerminal window of Computer 1 and type a message. Notice that text appears only in the window of Computer 2 and text typed on Computer 2 appears only on Computer 1. This text is being transferred over the air by the CDH 9Xtream radios.
    b. Transfer the file RAT.TXT
        i. On Computer 1: Select *Transfer* menu -> *Send File*(or try right-clicking in the HyperTerminal window). Insert the disk into the A: drive and enter *Filename: A:\RAT.TXT* Select *Protocol: Ymodem* (See figure 4). Press *Send*.
        ii. On Computer 2: Select *Transfer* menu -> *Receive File.* Select a folder in which to place the file and select *Protocol: Ymodem* (see figure 5). Press *Receive*.

Figure 4 – Send File Dialogue Box

        iii. The file will begin to transfer and any errors or retries will be accounted for. Touch the antennas and move the radios around to notice that errors or retries do occur under certain circumstances.
        iv. When the transfer completes, open RAT.TXT on Computer 2 and observe the pattern of text, it will be easy to see if any characters were lost or corrupted.
        v. Any file can be transferred this way. Use either Xmodem or Ymodem protocol. Both computers must have the same settings.

Figure 5 – Receive File Dialogue Box

    c. Try range testing by distancing the two computers from each other. The radios can send and receive data over 20 miles line of sight.

4. Problems (Trouble Shooting)
    a. Can't find the HyperTerminal on your computer?
        i. Search your hard drive for HyperTrm.exe
        ii. Download a free version from http://www.hilgraeve.com
    b. Power LED doesn't illuminate when battery clip is attached?
        i. Replace the battery.
    c. Cannot connect to the comm port or communication not working?
        i. Try selecting another comm port by selecting *Properties* under the *File* menu.
        ii. If necessary test the comm ports with a null modem cable (cross RX and TX) between the two computers to verify operation of comm ports.
    d. Some characters come through but not all?
        i. Verify that both comm ports are set to 19200 bits per second.