

Microhard Systems Inc.

MHX-2400 Operational Description

The MHX-2400 is a high-performance embedded spread spectrum data transceiver. Users communicate with this module via an asynchronous RS-232 interface. All data that users send to the module is buffered in banks of SRAM memory, packetized with the appropriate header information, and sent over the air at a fixed bit rate. The microprocessor inside the module precisely controls the bit-width, packet size, and hopping algorithm, to ensure that the RF occupied bandwidth and channel dwell-times remain constant. Users have no ability to modify the occupied bandwidth of the transmitted data. Users power the module from a 5 - 5.5V source. This is linearly regulated down to 4.5V for the radio circuitry. This ensures that any changes in input voltage will not have any effect on the radiated power, which is limited to 1W, or in the case that the module is sold with high gain antennas, the radiated power is factory-limited to 100mW. The MHX-2400 modem can be configured for a wide range of applications. The module is designed such that all communication is through one serial port (Pins 21 to 28 on the module). This port has two functions:

1. It provides the asynchronous interface with the host equipment for data that is sent/received on the RF channel. When operating in this fashion, the module is said to be in **data mode**.
2. It is also used for configuring and programming the module. When operating in this fashion, the module is said to be in **command mode**.

The functionality of any particular MHX-2400 can be configured as follows:

- **Master Point-to-Point:** The modem is configured to communicate with a single *Slave*, either directly, or through one or more *Repeaters*.
- **Master Point-to-Multipoint:** The modem is configured to communicate with one or more *Slaves* and/or *Repeaters*.
- **Slave:** The modem is configured to communicate with one *Master* either directly or through one or more *Repeaters*..
- **Repeater:** The modem is configured to pass information from either a *Master* or another *Repeater* onto subsequent *Repeaters* and/or *Slaves* and vice versa. The *Repeater* also acts as a *Slave* in the sense that, like a *Slave*, it passes information to/from its serial port.

The MHX-2400 hops according to a pseudorandom pattern of 76 different channels. Each of the 76 channels is used once in the pseudorandom pattern, and the dwell time is equal among channels. Here is a list of a sample Hop pattern:

Table01

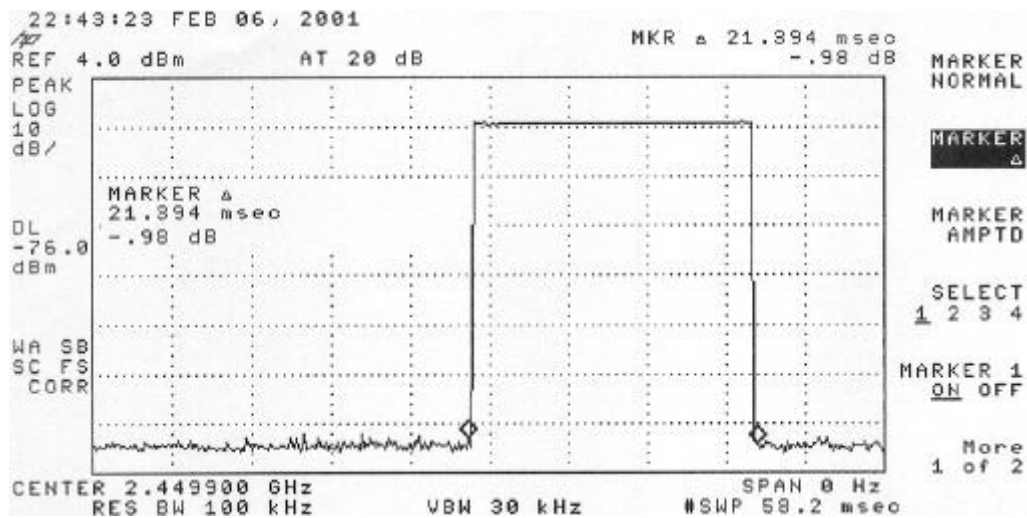
```

db 122,121,145,103,39,178,34,158
db 78,106,165,73,167,97,71,86
db 154,51,75,166,141,198,197,32
db 150,15,45,131,177,124,44,91
db 67,02,07,54,18,115,99,176
db 85,56,64,96,116,28,170,125
db 193,47,200,110,21,136,195,146
db 147,82,180,128,01,41,133,185
db 117,120,20,134,148,31,186,48
db 88,190,140,55,

```

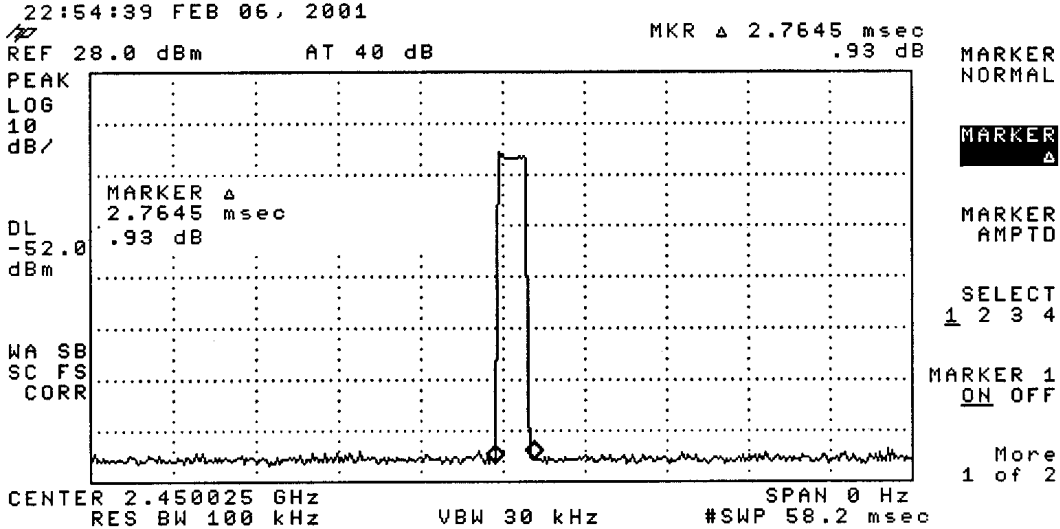
There are 202 available channels with spacing of 400 kHz starting at 2.4016 GHz and going up to 2.4820 GHz. The system receiver input bandwidth is 350 kHz. The RF connector on the module is a proprietary connector reverse thread SMA or MCX straight PC mount (Johnson # 133-3701-211). Furthermore, the received shall hop in synchronization with the master when the network address and the hopping patterns of the master and the slave are set to the same. The hopping patterns are stored in an onboard EEPROM and programmed in the factory.

The MHX-2400 is a frequency hopping transceiver, meaning that it “hops” to a new frequency after a predetermined time interval. This time interval is a fixed time set by the user, and can range from 8ms to 120ms. The master’s transmit time is less than the 120ms and varies depending on the size of the packet. See plots 1 and 2.



Plot 1. Master Transmit Time on a Given Channel in the Pseudorandom Hop Sequence for Continuous Data on RS-232 port

In plot 2, there is no data transmitted over the RS-232 port and hence the master only transmits a beacon, which is 2.76ms in duration. The maximum time for the system to be on a single channel is 120ms as stated in the MHX-2400 User's Manual.



Plot 2. Master Transmit Time on a Given Channel in the Pseudorandom Hop Sequence for No Data on RS-232 port