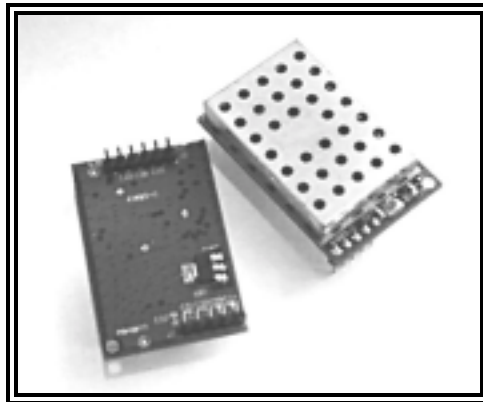




USER MANUAL

Preliminary (Dec. 2007) Version 1.1
2.4 GHz Transceiver Module
Model # 924-41484



Overview

The SwiftComm Radio Transceiver Module is designed for integration into OEM systems operating under FCC part 15.247 regulations for the 2.4 GHz ISM band.

The SwiftComm Radio Transceiver Module is a 2.4 GHz frequency hopping spread spectrum transceiver. It provides a synchronous TTL level interface for OEM Host communications. Communications include both system and configuration data. The Host supplies system data for transmission to another Host. All frequency hopping, synchronization, and RF system data checking is performed by the transceiver module.

SwiftComm transceivers operate in a Server-Client configuration. One transceiver is configured as a Server and there can be one or many Clients. To establish synchronization between transceivers, the Server emits a beacon. Upon detecting a beacon, a Client transceiver informs its Server of its presence and a RF link is established. SwiftComm transceivers manage all data

transmission overhead, including 40 bit encryption and manchester encoding, assuring secure and reliable data delivery.

The SwiftComm Radio Transceiver Module has two unique features. First, the antenna ground is DC isolated from circuit ground. With this feature, the internal circuitry of the users equipment can be electrically isolated from its enclosure. This contributes significantly to electrical noise reduction and ground loops. The second feature is the robust Transient Voltage Protection on the antenna port. This allows the SwiftComm radio to operate in outdoor environments subject to lightning strikes. Although not able to withstand a direct lightning strike, the SwiftComm radio will readily survive a near strike.

The OEM is responsible for ensuring the final product meets all FCC and/or appropriate regulatory agency requirements listed herein before selling any product incorporating the SwiftComm Radio Transceiver Module. Information furnished by BEI Industrial Encoders in this specification is believed to be accurate. BEI Industrial Encoders makes no warranty, express, statutory, and implied or by description, regarding the information set forth herein. BEI Industrial Encoders reserves the right to change specifications at any time and without notice.

Specifications

GENERAL

| | |
|-----------------------------|---|
| Interface | 11 pin Header |
| Power Voltage | 5V nominal $\pm 2\%$, $\pm 50\text{mV}$ ripple |
| Power Consumption (typical) | |
| Sleep Mode | 30 mA |
| Receive Mode | 45 mA |
| Packet Transmit Mode | 85 mA |
| CW Mode | 160 mA |

TRANSMITTER / RECEIVER

| | |
|---------------------------|--|
| RF Power Output | 50 mW (17 dBm) |
| Antenna Impedance | 50 ohm |
| Radio Type | Frequency Hopping Spread Spectrum |
| Modulation | GFSK |
| Over Air Packet Data Rate | 2 Mbps |
| Data Encryption | 40 bit |
| Frequency Band | US/Canada: 2.402 – 2.479 GHz |
| Receiver Sensitivity | -80 dBm typical |
| Channels | 77 |
| Channel Spacing | 1.0 MHz |
| Hopping Sequence | Adaptive, based on interference detected |

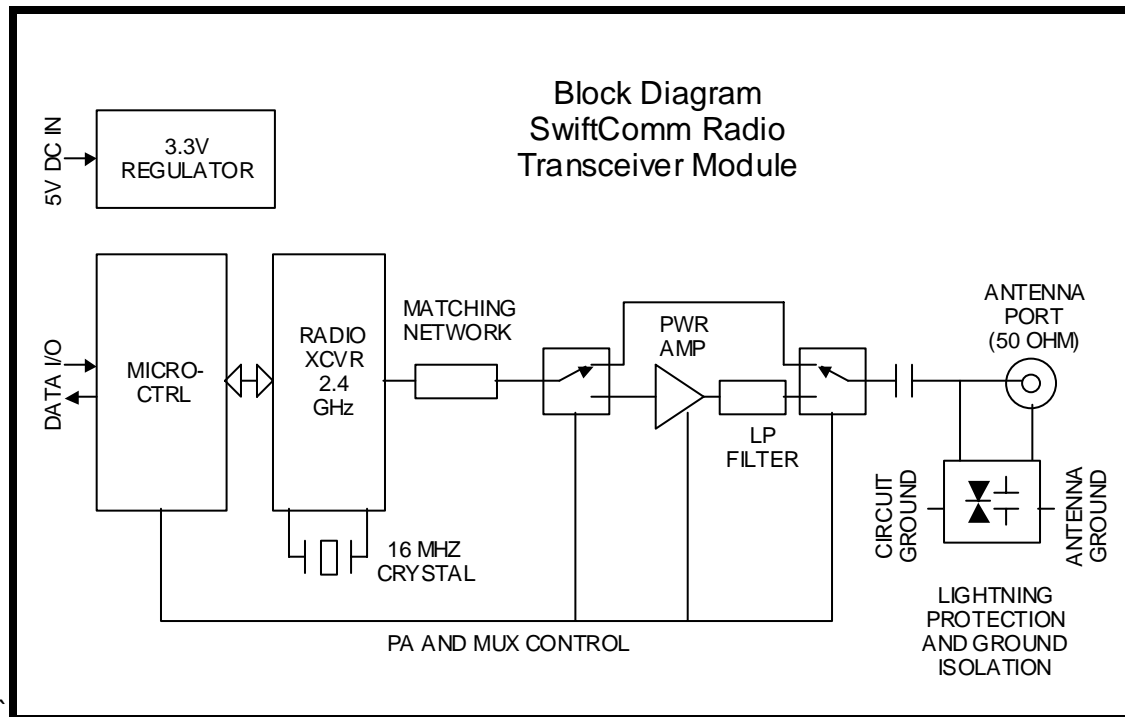
ENVIRONMENTAL

| | |
|-------------------------------------|-----------------|
| Temperature (Operating) Industrial: | -40°C to 85°C |
| Temperature (Storage) | -50°C to +120°C |
| Humidity (non-condensing) | 10% to 90% |

PHYSICAL

| | |
|-------------------|--|
| Dimensions | 2.85 W 4.46 L 0.77 H (cm) |
| Weight | 10 grams |
| Antenna Connector | U.FL PCB Jack SMT (Amphenol A-1JA or equivalent) |

Block Diagram



I/O Pin Definitions

All signal levels are 0 to 3.3 volts (TTL 5V Tolerant)

| Pin Name | Micro-Ctrl Port | Description | Data Direction |
|----------|-----------------|-------------------------------------|----------------|
| J2-1 | - | Power Supply Common | - |
| J2-2 | - | Power Supply Input (+5.0 VDC) | - |
| J2-3 | P2.0 | Data Packet Ready / C2D Pgm Port | Out |
| J2-4 | RST | Reset / C2CK Pgm Port (10K Pull-up) | not used |
| J2-5 | P0.4 | Data Clock | In |
| J2-6 | P0.5 | Data Bus Direction | In |
| J3-1 | P1.7 | Data Bus Bit 3 | In/Out |
| J3-2 | P1.6 | Data Bus Bit 2 | In/Out |
| J3-3 | P1.5 | Data Bus Bit 1 | In/Out |
| J3-4 | P1.4 | Data Bus Bit 0 | In/Out |
| J3-5 | P1.4 | Busy / Ready | Out |

Command Protocol

Communication with the SwiftCOMM Radio Transceiver module is via a 4 bit synchronous parallel bus. The Data Bus Direction line selects the data direction, and data is clocked in or out of the module four bits at a time on the falling edge of a pulse on the Data Clock line. The Busy/Ready line indicated whether the module is ready for the next four bits of data to be clocked in or out of the module. Each byte of data is transferred to or from the module upper four bits first, meaning the first read or write is the upper nibble, and the next read or write will be the lower nibble. After each read or write, the Busy/Ready line will toggle low until the module is ready for the next transaction. No action should ever be taken if the Busy/Ready line is low.

I/O:

Data Packet Ready (J2-3)
Data Clock (J2-5)
Data Bus Direction (J2-6)
Data Bus Bits 0 to 3
Busy / Ready (J3-5)

Note:

High = New Packet Ready; Low = No New Packet Ready
Normally high, data clocked on falling edge.
Low = Input Data; High = Output Data;
J3-4 to J3-1
Low = Busy; High = Ready

Input Mode (Data Bus Direction = Low):

When in input mode, commands can be sent to the RF module for processing. The command will be processed when the Data Bus Direction line is cycled from low to high. There are currently three supported commands in Input Mode:

1. Null Command: Takes no action.
Byte 0: 00h
2. Configure Radio: Configures the RF module mode of operation
Byte 0: 01h
Byte 1: 00h = Receiver Mode; 01 = Transmitter Mode
Bytes 2-6: Five byte communication address. Transmitter and receiver address must match to communicate with each other.
Byte 7: Packet data length. This specifies how many bytes of data the payload will consist of.
3. Send Data Packet: Only supported if configured in Transmitter Mode
Byte 0: 02h
Byte 1: Packet Length. This specifies how many bytes are being transmitted.
Bytes 2-x: Data Payload. The length of this field is specified by the Packet Length above.

Output Mode (Data Bus Direction = High):

When in output mode, data packets can be read from the RF module. The read command is reset when the Data Bus Direction line is cycled from high to low. There is only one supported read function at this time.

1. Read data:
Byte 0: Status Register.
Bit 0: 1 = Link Active; 0 = No Link
Bit 1: 1 = Last Packet Unsuccessful; 0 = Last Packet Successful
Bit 2: 1 = First packet since link established; 0 = Not first packet
Bit 3-7 Reserved
Byte 1: Reserved
Bytes 2-x: Data Payload. The length of this field is determined by how many bytes were sent. This field is only valid when the Data Packet Ready line is high.

Test Mode

For testing and calibration purposes, the SwiftComm Radio Transceiver Module can be placed in a test mode. This is accomplished by holding the J2-3 pin low during power up. This allows one of four modes to be selected depending on the state of J2-5 and J2-6. The unit must have the power cycled each time to select a new mode. The Channel Mode and Channel Select, however, may be changed at any time during the test, and the change will be reflected immediately.

Program Select/Power Amp.

During power up, this switch selects whether to run the test program or the normal program. After power up, this switch turns the radio power amplifier on or off.

| | | |
|------|---|------------------------|
| J2-3 | | |
| Low | = | Test Program/Amp ON |
| High | = | Normal Program/Amp OFF |

Mode Select

| | | | |
|------|------|---|---|
| J2-5 | J2-6 | | |
| Low | Low | = | Sleep Mode (radio is powered up, but deactivated) |
| Low | High | = | Receive Mode (Local Oscillator On) |
| High | Low | = | Packet Transmit Mode |
| High | High | = | Constant Wave Transmit Mode |

Channel Mode

J3-5 has a dual function capability. On power-up it selects the dBm RF output level of the internal transceiver. Once the power-up cycle is over, the selected power level will remain constant, regardless of the state of this pin. After the power-up cycle is over, this pin then selects Constant or Scanning frequency output mode.

| | | | |
|------|---|-------------|---|
| J3-5 | | On Power-Up | After Power-up |
| Low | = | -6 dBm | Scanning (unit will scan from channel 0 to 79 cyclically) |
| High | = | 0 dBm | Constant (unit will stay on the channel selected below) |

Channel Select

When Channel Mode is Constant, the following pins select which channel the radio transmits on. The SwiftComm Radio Transceiver Module only operates from channel 2 (2.402 GHz) to channel 79 (2.478 GHz) in its frequency hopping sequence.

| J3-4 | J3-3 | J3-2 | J3-1 | | Channel # | Freq (GHz) |
|------|------|------|------|---|-----------|-------------------|
| Low | Low | Low | Low | = | 0 | 2.400 Not Allowed |
| Low | Low | Low | High | = | 1 | 2.401 Not Used |
| Low | Low | High | Low | = | 2 | 2.402 |
| Low | Low | High | High | = | 3 | 2.403 |
| Low | High | Low | Low | = | 4 | 2.404 |
| Low | High | Low | High | = | 37 | 2.437 |
| Low | High | High | Low | = | 38 | 2.438 |
| Low | High | High | High | = | 39 | 2.439 |
| High | Low | Low | Low | = | 40 | 2.440 |
| High | Low | Low | High | = | 41 | 2.441 |
| High | Low | High | Low | = | 42 | 2.442 |
| High | Low | High | High | = | 75 | 2.475 |
| High | High | Low | Low | = | 76 | 2.476 |
| High | High | Low | High | = | 77 | 2.477 |
| High | High | High | Low | = | 78 | 2.478 |
| High | High | High | High | = | 79 | 2.479 |

Regulatory Agency Identification Numbers and Information

United States / FCC

FCC ID: VSR-SWIFTCOMM07

Canadian / IC

IC ID: 7445A-SWIFTCOMM07

FCC Requirements

The user is responsible for all labeling and ensuring the module complies with FCC regulations (see 47CFR2 for exact regulations).

- The FCC identifier preceded by "FCC ID:" and the FCC Notice found below must be clearly visible on the outside of the equipment.
- The RF Exposure Warning also must be printed inside the equipment's user manual.

The FCC/IC approval was granted with the module classified as mobile (i.e. the antenna is >20 cm from the human body with the exception of hands, wrists, feet, and ankles). The end user needs to ensure that the antenna location complies with this or retest for portable classification (less than 20 cm with the same exceptions as mobile) at their own expense. Re-certification will be required under a different FCC/IC number if the end user wishes to get a portable certification.

FCC regulations allow the use of any antenna of the same type and of equal or less gain. However the antenna is still required to have a unique antenna connector such as a reverse-polarity TNC. Following is a list of antennas available through BEI Industrial Encoders. Any different antenna type or antenna with gain greater than those listed must be tested to comply with FCC Section 15.203 for unique antenna connectors and Section 15.247 for emissions at user's expense.

Caution: Any changes or modifications not expressly approved by BEI Industrial Encoders could void the FCC compliancy of the SwiftComm module.

FCC and Canadian Notices

FCC Labeling Requirements

The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate Swiftcomm FCC identifier for this product as well as the following FCC Notice.

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.

FCC RF Exposure Statement

The Following statement must be included as a caution statement in manuals for OEM products to alert users on FCC RF Exposure compliance. User manuals shall also contain the following or equivalent statements in a conspicuous position:

To satisfy RF exposure requirements, this device and its antenna must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.”

Information for Canadian Users (IC NOTICE)

The Original Equipment Manufacturer (OEM) must ensure that Industry Canada labeling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate Swiftcomm IC identifier for this product as well as the following Industry Canada Notice statement in a conspicuous location in the users manual.

This device has been designed to operate with an antenna having a maximum gain of 5.5 dBi. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than the required for successful communication.

Canadian Labeling Requirements

The Original Equipment Manufacturer (OEM) must ensure that IC labeling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate Swiftcomm IC identifier for this product and must include the following wording: “Contains IC ID: 7445A-SWIFTCOMM07.

Example SwiftComm Label for FCC and Industry Canada certification compliance

This device contains a SwiftComm Radio Transceiver Module certified to operate in the United States and Canada under the following ID numbers:

FCC ID: VSR-SWIFTCOMM07 IC ID: 7445A-SWIFTCOMM07

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.

Approved Antenna and Optional Coaxial Extension Cable List

The SwiftComm Radio Transceiver Module has been designed to operate with the antenna and optional coaxial extension cable listed below. The antenna has a maximum gain of 5.5 dBi. Antennas not included in this list or having a gain greater than 5.5 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Approved Antenna: BEI Part # 924-37101

2.4 GHz 5.5 dBi Reverse Polarity-TNC "Rubber Duck" Antenna
Model # HG2405RD-RTP
HyperLink Technologies, Inc.
1201 Clint Moore Road, Boca Raton FL 33487 USA
Phone: 800-921-2256 Fax: 561-995-2432

Approved Coaxial Extension Cable (10 ft length) BEI Part # 924-37100-010

Pasternack Enterprises, Inc.
P.O. Box 16759
Irvine, CA 92623
949-261-1920
RP-TNC Male to RP-TNC Female (Bulkhead)
RG-59 U/C Coax 10 Ft Long
With Ground Plane and Mounting Bracket.

Sales, Repair and Technical Assistance

BEI Industrial Encoders
7230 Hollister Ave.
Goleta CA 93117 USA
800-357-2727 FAX 805-968-3154
WWW.BEIIED.COM