Firelinx Inc

2.4GHz DSSS RF Modem: Model ASY-00006

OEM Installation Manual

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1 Overview

This document is intended as a guide for the installation of the 2.4GHz DSSS RF Modem (Model ASY-00006) into a user's end product. Proper usage of the module requires consideration of the following:

- Understanding of the module electrical specifications
- Mechanical layout for mother-board that correctly matches that indicated in this manual
- Power supply voltage and current requirements are addressed
- Electrical interface guidelines for I/O pin usage are correctly followed
- Programming interface connections are to be brought out to a connector if in-system programming of the module firmware is to be accommodated at production time.

2 Module Specifications

2.1 Physical

Dimensions: 1.265" x 1.85" x 0.618"
Manufacturing: RoHS compliant assembly

2.2 Electrical

Voltage: 3.0 to 3.3VDC (regulated)
Current (Receive): 30mA
Current (Transmit): 125mA

2.3 Radio

RF Band: 2.4 GHZ ISM
Channels 15
RF Frequency Range: 2405 MHz (channel 11) to 2475 MHz (channel 25)
Data-rate: 250 Kbps
Modulation Format: O-QPSK (Offset Quadrature Phase Shift Keying)
Transmit Power: +19.5 dBm (nominal at antenna port)
Antenna Type: +3.2dBi (max) ¼ wave dipole whip with RP-SMA connector

NOTE: This module is approved for use with any of the following antenna models:

Manufacturer	Model	Type	Peak Gain
Pulse Engineering	W1027	Dipole	+3.2dBi
Pulse Engineering	W1037	Dipole	+3.2dBi
Nearson Inc	S131AH-2450S	Dipole	+2.0dBi
Nearson Inc	T145AH-2.4/4.9/5.X-S	Dipole	+2.0dBi
Nearson Inc	S145FL-4-AH-2450S	Dipole	+2.0dBi

DO NOT SUBSTITUTE WITH NON-APPROVED ANTENNA

3 Environmental

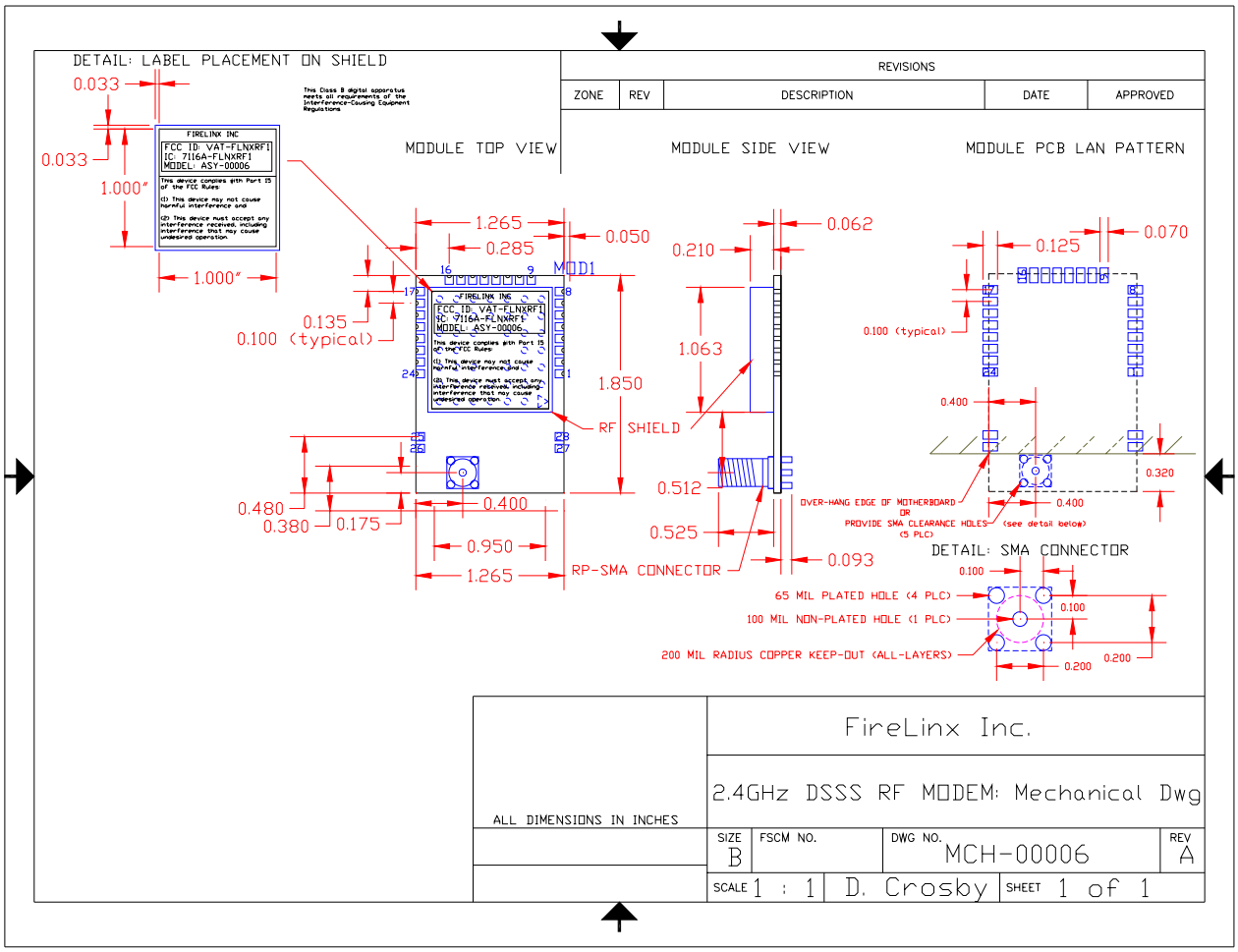
Temperature: -25C to +75C (operational)
-40C to +125C (non-operational)
Humidity: 5 – 95% (non-condensing)

3.1 Module Certifications

FCC (pending)
Industry Canada (pending)

4 Module Mechanical

Use the following dimensions to properly lay out the motherboard LAN pattern for the module.



The module pin numbers are shown in the above drawing. The function of each pin is as follows:

Pin #	Name	Function
1	VCC	Module power (3.0 to 3.3 VDC)
2	GND	Module Ground
3	RESET_N	Active low reset pin
4	P2_4	Digital I/O
5	P2_3	Digital I/O
6	P1_6	Digital I/O
7	P1_7	Digital I/O
8	P1_5	Digital I/O
9	P2_0	Digital I/O
10	P1_4	Digital I/O
11	P1_3	Digital I/O
12	P1_2	Digital I/O
13	P0_0	Digital I/O
14	P0_4	Digital I/O
15	P0_3	Digital I/O
16	P0_2	Digital I/O or serial RX line
17	P0_1	Digital I/O or serial TX line
18	P2_1/DD	Digital I/O or module programming Data line
19	P2_2/DC	Digital I/O or module programming Clock line
20	P0_5	Digital I/O
21	P0_6	Digital I/O
22	P0_7	Digital I/O
23	P1_1	Digital I/O
24	P1_0	Digital I/O
25	GND	Module Ground
26	GND	Module Ground
27	GND	Module Ground
28	GND	Module Ground

4.1 PCB Layout Considerations

When mounting the module on a mother-board, provision must be made for the 4 ground legs of the SMA connector and the center conductor which protrude from the bottom of the module by 0.1” as shown. This can be accommodated in one of two ways:

1. The bottom edge of the module can be mounted so that it over-hangs off the edge of the mother-board by 0.32”

2. Clearance holes can be made in the mother-board to allow these 5 mounting legs to protrude through the mother-board. If the latter technique is used an unplated hole should be used for the center conductor, and a minimum clearance of 0.2" should be provided around this conductor on all layers of the mother-board. The 4 ground legs of this connector may use plated or unplated clearance holes in the mother-board and may optionally be connected to the mother-board ground.

The PCB LAN pattern used on the mother-board should provide one SMT pad for each of the 28 pads on the module. The extra ground pads (pin 25,26,27, and 28) may optionally be left unconnected. SMT pad size is 0.070" x 0.125".

Avoid routing of traces on layer 1 under module where possible. Tent all vias/testpoints on layer1 that are located beneath the module. Put a block of silkscreen on the mother-board beneath the module to avoid any possibility of electrical contact with vias or other traces under module.

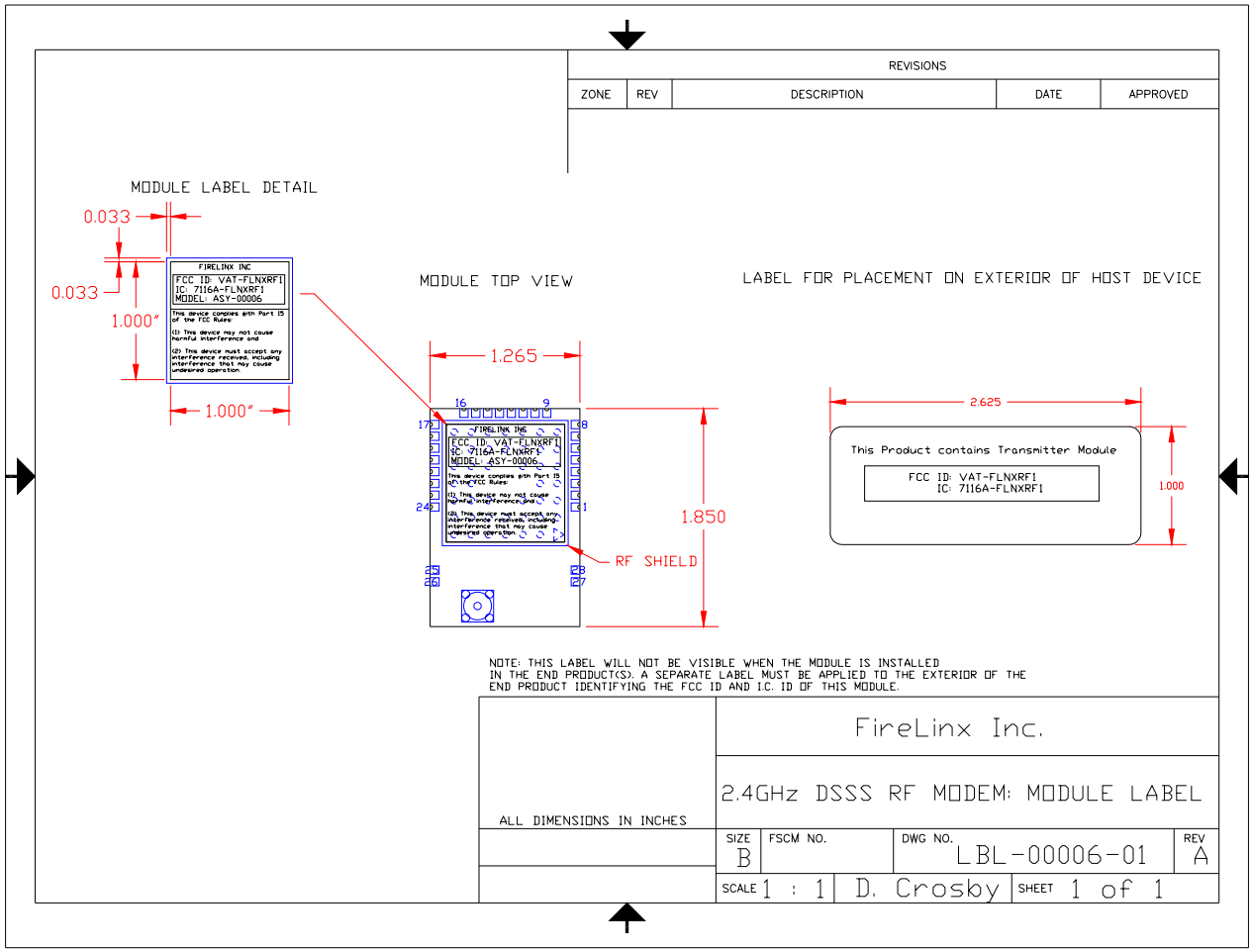
4.2 Mounting Instructions

The RF Modem may be hand soldered or reflow soldered as part of a normal SMT process flow. When using SMT reflow processing, the maximum reflow time/temperatures should be controlled according to the lead-free reflow standards of IPC/JEDEC J-STD-020C.

NOTE: This module has been manufactured as a RoHS compliant (lead-free) assembly. If RoHS compliance is desired in the end product, then lead-free solder should be used when assembling this module to the mother-board.

4.3 Product Labeling Requirements

The RF Modem module is supplied with a label identifying the FCC ID and Industry Canada certifications (see mechanical diagram of module). If this label will not visible to the end user in the final product configuration, another label must be affixed to the exterior of the final product identifying the presence of the radio module inside and the FCC ID and Industry Canada code. Use the following template for this labeling requirement.



5 Module Communications

Communications with the ASY-00006 RF Modem is via the serial port RX and TX pins. These pins interface at CMOS voltage levels (based upon voltage supplied to module) to a UART configured for operation as follows:

Baud rate: 115.2K
Data bits: 8
Parity: none

5.1 Message Format

This section describes the elemental components of message structure common to all devices that must communicate with other processors and/or products in the Firelinx product family. The RF and 2-Wire protocol starts with this structure and adds a 16 bit network identifier code.

Byte #	Value	Description
1	0x5A	SOM = Start of Message
2	{byte count}	Message length byte up to and including the checksum at the end of packet (does not include this length byte)
3	Service Type	Bit1,0: 00 => UNACKD (no response expected) 01 => ACKD (application level) 10 => REQUEST/RESPONSE (RESPONSE msg expected) 11 => ACK/RESPONSE (this is an ACK or RESPONSE message) Bit2: Application Level Security 0 => no encryption 1 => message data is encrypted
4	Source/Destination	Message source/destination specifiers (allows recipient to determine msg source and destination for any response if necessary) Bit2,1,0: Message Source Device/Link 000 => 8051 (default device level source) 001 => RFMDM (ASY-00006) 010 => Neuron PL3120 011 => not used 100 => not used 101 => PC (IrDA) 110 => PC (USB link) 111 => PC (RS232 link) Bit5,4,3: Message Destination Device/Link 000 => 8051 (default device level source) 001 => RFMDM (ASY-00006)

		010 => Neuron PL3120 011 => not used 100 => not used 101 => PC (IrDA Link) 110 => PC (USB link) 111 => PC (RS232 link) Bit7,6: unused
5,6	MSBYTE src addr LSBYTE src addr	Network device source address- ignore if message source and destination are within the same device
7,8	MSBYTE dest. addr LSBYTE dest. addr	Network device destination address- ignore if message source and destination are within the same device
9	Message ID	8 bit message identifier (see MsgID enumeration below)
10..N	Message Data	1..N bytes of message data (max length is 54 bytes)
N+1	Checksum	8 bit 2's complement checksum

5.2 NI Configuration/Status Message Types

The following message types are associated with initial network interface configuration and status reporting.

Msg ID	Msg Data Format	Description
0x00		**MSGID_NI_CONFIG** ***Network interface configuration msg***
	{coord/router/end dev}	0 = > start network as coordinator 1 => join network as a router 2 => join network as an end device (non-router)
	{network PAN ID}	16 bit PAN identifier to use for network
	{network 16 bit addr}	16 bit network address, 0 => none assigned
	{channel}	Default channel to use 0 => scan for channel to use 11 – 25 are the only valid channel selections
	{channel mask}	3 byte channel mask with bits set in positions of channels that should be included during scanning.
0x01		**MSGID_NI_STATUS** ***Network interface status*** Will be sent by radio on change in status. This msg is sent periodically after any reset until the MSGID_NI_CONFIG msg is received, then only on change in status or if requested thereafter

	{niState}	(0) NIS_RESET => device in reset state (1) NIS_FORM_NET => attempting network formation (2) NIS_NET_FORMED (2)=> network formed (3) NIS_JOIN_NET => attempting to join network (4) NIS_NET_JOINED => network joined
0x02	{DevType} {8 bit h/w version} {16 bit device address}	**MSGID_ADR_ASSIGN** ***Address assignment message (from coordinator)*** Device type- must match receiving device type as defined in the DevType enumeration Must match this devices hardware version 2 byte assigned network addr (msbyte first)

Other message IDs may be assigned/used for application level messages.

5.3 Message Handshake Timing

A message transaction always starts with the "Sender" sending the Start of Message byte (SOM= 0x5A) followed by the length byte. The Sender must then wait up to 10 msec for a single byte response from the "Receiver". This response byte will be either an "ACK" (0x06) or a NAK (0x16) indicating whether the Sender should proceed with sending the rest of its message. If at the end of 10msec, no response has been received, then the Sender is obliged to wait some random amount of time before attempting to re-initiate the transaction, starting with the SOM and length bytes again.

6 Regulatory Statements, Precautions and Warnings

This module generates RF energy. DO NOT use this module in any application where in normal operation, the antenna will be located within 20 cm of the head or body of the operator.

This device must not be co-located or operating in conjunction with any other antenna or transmitter.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of 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. If not installed and used in accordance with the instructions, it 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 tuning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

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