Itron Riva™ Modular LE

User Guide

Technical Communications

knowledge to shape your future

Identification
Itron Riva™Modular LE User Guide
31January 2019
Itron Riva™ Modular LE

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Chapter 1: Important Safety and Compliance Information

This section provides important information for your safety and product compliance.

USA FCC PART 15 SPECTRUM COMPLIANCE

This device complies with Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference that may cause undesirable operation.

This device must be installed to provide a separation distance of at least 20 centimeters (7.9 inches) from all persons to be compliant with regulatory RF exposure.

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 or TV technician for help.

To ensure system performance, this device and antenna shall not be changed or modified without the express approval of Itron. Per FCC rules, unapproved modifications or operation beyond or in conflict with these instructions for use could void the user's authority to operate the equipment.

OEM INTEGRATION INSTRUCTIONS

This device is intended only for OEM integrators under the following conditions:

The module must be installed in the host equipment such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with antennas that have been originally tested and certified with this module. As long as the condition above is met, further transmitter test will not be required.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.). The end-product may need Verification testing, Declaration of Conformity testing, a Permissive Class II Change or new Certification. Please involve an FCC certification specialist in order to determine what will be exactly applicable for the end-product.

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization. In such cases, please involve an FCC certification specialist in order to determine if a Permissive Class II Change or new Certification is required.

Upgrade Firmware:

The software provided for firmware upgrade will not be capable to affect any RF parameters as certified for the FCC for this module, in order to prevent compliance issues.

End product labeling:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following:

For FCC: Contains FCC ID: 2ANHYMODLE

For ISED: Contains IC:23664-MODLE

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

CANADA, ISED SPECTRUM COMPLIANCE

Compliance Statement Canada / Déclaration de Conformité

This device complies with Innovation, Science and Economic Development Canada (ISED) license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Under Innovation, Science and Economic Development Canada (ISED) regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. 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 necessary for successful communication.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Please see the approved antennas in Chapter 5: Approved Antennas for the Modular LE.

RF Exposure (FCC/ISED)

This equipment complies with radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 21 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement do it être installé et utilisé à distance minimum de 21 cm entre le radiateur et votre corps. Cet émetteur ne doit pas être co-localisées ou opérant en conjonction avec tout autre antenne ou transmetteur

LITHIUM BATTERY SAFETY

Warning: Follow these procedures to avoid injury to avoid injury to yourself or others:

- The lithium battery may cause a fire or chemical burn if it is not disposed of properly.
- Do not recharge, disassemble, heat above 100° Celsius (212° Fahrenheit), crush, expose to water, or incinerate the lithium battery.
- Keep the lithium battery away from children.
- Fire, explosion, and severe burn hazard.

MODIFICATIONS AND REPAIRS

Warning: This unit cannot be modified and is not repairable. Attempts to modify or repair this module will void the warranty.

ELECTROMAGNETIC COMPATIBILITY

Warning: Use only approved accessories with this equipment. Unapproved modifications or operation beyond or in conflict with these instructions for use may void authorization by the authorities to operate the equipment.

ELECTROSTATIC DISCHARGE

Warning: Internal circuit components can be sensitive to electrostatic discharge.

Before installation, discharge electrostatic buildup by touching a metal pipe or other earth-grounded metal object prior to touching the meter body, register housing, or Itron device.

DO NOT DROP

Warning: While Itron modules are designed to withstand a drop, dropping the module may damage the device and void the warranty

LABELING

The following requirements apply to any products that use this module.

The end product or host label includes the following text:

- **Model: MOD-LE**
- **FCC ID: 2ANHYMODLE**
- **IC: 23664-MODLE**
- **HVIN: MOD-LE**

The user's manual for any product that contains this module must contain the following text. If the device is large enough, then this must also be placed on the label.

"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."

RECYCLING INFORMATION

The product you have purchased may contain a battery (or batteries), circuit boards, and switches. At the end of the product's useful life, under various state and local laws, it may be illegal to dispose of certain components into the municipal waste system. Check with your local solid waste officials for details about recycling options or proper disposal.

Chapter 2: Overview

This document provides information on the design, construction, and operation of the Itron Riva Modular LE device (module).

The module is a fully shielded communications device which can be integrated into a host device where it provides communications capability for joining the Itron OpenWay Riva network. The module is used with an external antenna.

The module housing is a lead free, non-vented, surface mount shield that provides protection for the internal components. Power may be supplied from a host supply ranging from 5VDC to 9VDC or by batteries.

This module contains the cutting-edge communication technology featuring IPv6 RF to route messages and data between the host device and the head-end system on an Itron OpenWay Riva network.

Intelligence in the module chooses the communication link quality and modulation scheme that support the best possible data rate. This is done automatically in real-time by the module without any need for pre-programming or path hard-coding. The communication modules create their own multi-hop environment using the best available physical path for communication where the routing is managed by standardized IETF routing protocols that are independent of the physical link. Itron's technology offers a unique way to deploy the same communication module anywhere, regardless of traditional network design considerations, such as geography, density, or structural environment.

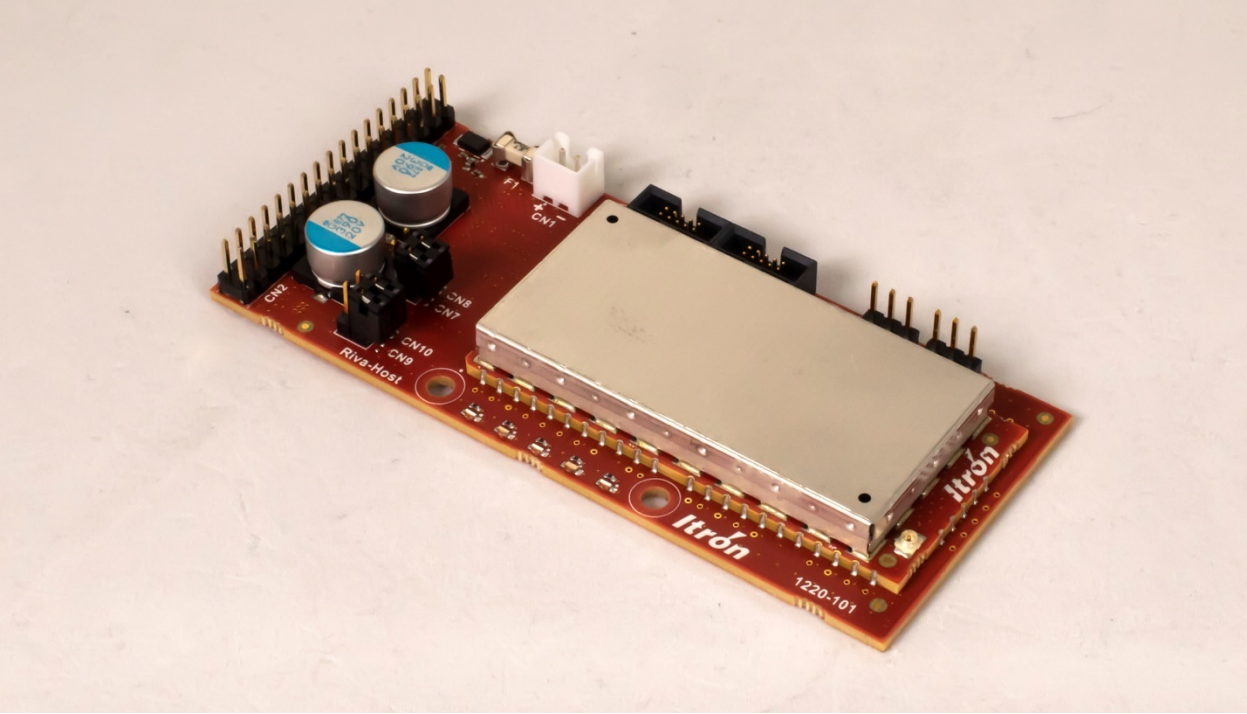

Figure 1: Shielded Itron Riva Modular LE on Itron host board

The module was certified for operation in multiple configurations of the FSK, GFSK, and OOK modes within the 902=928 mHz frequency range. The module employs channel hopping and channel separation, The low, mid, and high channel frequency was recorded for each configuration.

Operational Mode	Data Rate with Highest Power kbps	Channel Frequency (MHZ)		
		Low	Mid	High
Mode 1 GFSK	10	902.2	915.2	927.75
Mode 2 FSK	50	902.2	915.2	927.6
Mode 3 OOK	16.384	903	915	926.8
Mode 4 FSK	100	902.3	914.9	926.9
Mode 5 GFSK	150	902.4	915.2	927.6

Chapter 3: Module Description

The Itron Riva Modular LE (module) is a single full modular low energy radio communications device. The module is designed for integration into 3rd party host devices wanting to communicate by radio frequency (RF) on an Itron Riva network. As shown in Figure 2, the module is contained inside the silver rectangular perimeter and is fully shielded (shield is removed in this image). The module and can reside on an Itron host board or be integrated with any host as a standalone module.

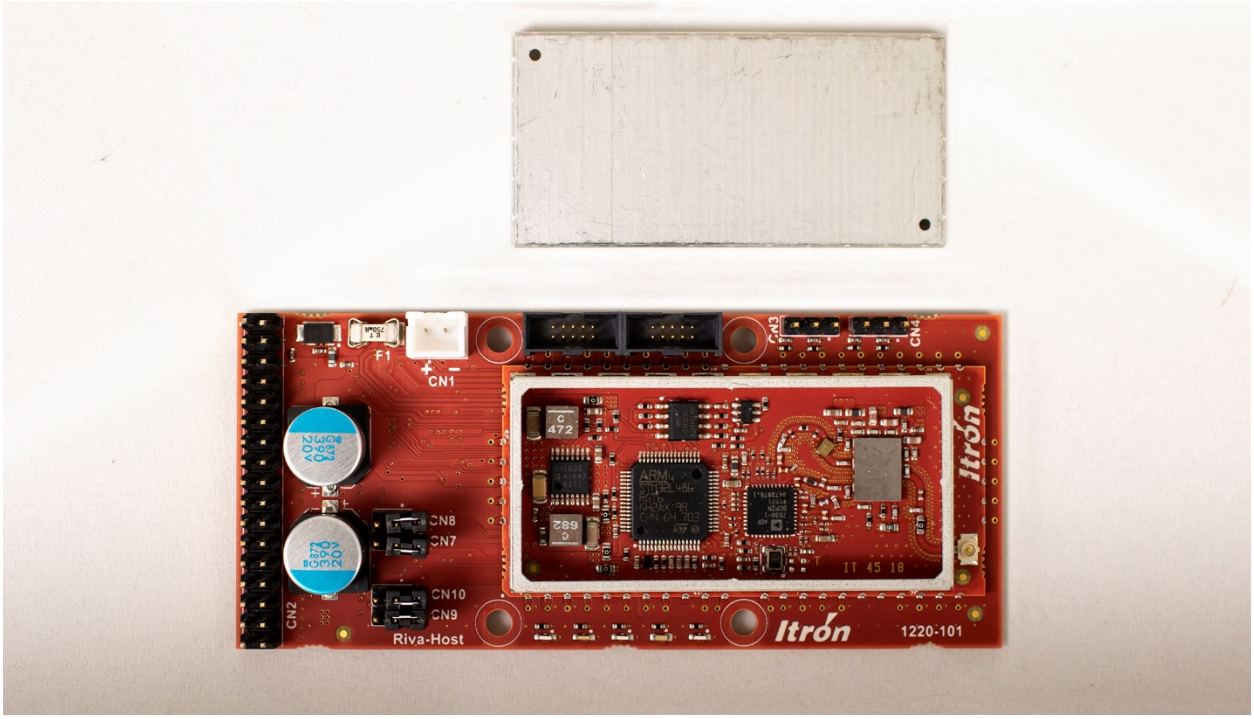

Figure 2: Itron Riva Modular LE mounted on host board and with shield removed

The module is designed for low energy applications (including battery powered). The module includes a communications processor that sleeps whenever possible to conserve power. The microprocessor uses an external 32.768 kHz mems oscillator and an internal resistor-capacitor (RC) oscillator at up to 40 MHz when awake and processing/sending/receiving data. The module has modulations ranging from 150 kbps GFSK down to 10 kbps GFSK at maximal ranges and can operate in other modes including 100 kbps FSK, 50 kbps FSK and 16384 bps OOK.

ITRON RIVA MODULAR LE HIGH-LEVEL ARCHITECTURE

The Itron Riva Modular LE has a dedicated communication processor for handling RF connection to Itron developer boards and devices, Cisco CGRs, and other compatible hardware, via Itron's Riva network. The module can be integrated with a dedicated application processor for interfacing with sensors, actuators and custom devices.

The diagram shown in Figure 3 depicts the layers and communication protocols for the Itron Riva Modular LE and a sample host with application processor (which is any host board that can be integrated with the module).

The host will provide the power supply and antenna connectors.

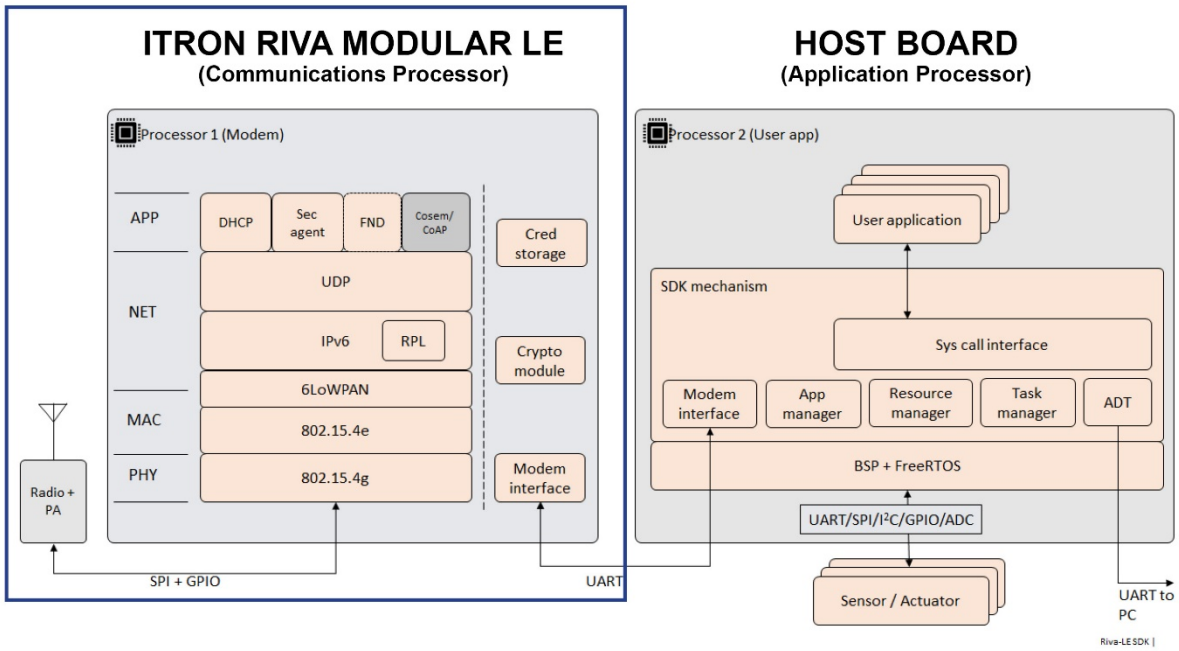

Figure 3: Layers and communication protocols for Itron Riva Modular LE and host board

The paths within and out of the module are shown in Figure 4.

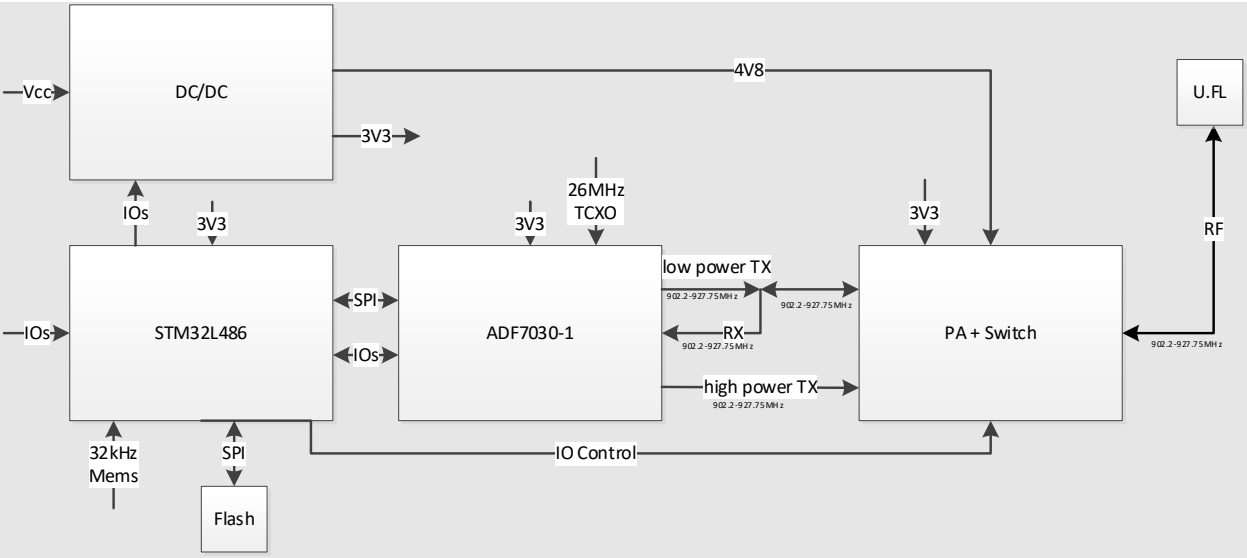

Figure 4: Module RF Paths

Chapter 4: Connecting, Initializing and Programming the Module

CONNECTING THE MODULE TO A HOST BOARD OR HOST DEVICE

The Itron Riva Modular LE is designed with castellations (pads) which are mapped to specific functions. The mapping begins in the lower leftmost corner of the module and moves counter clockwise around the module with pads numbered from 1 to 54.

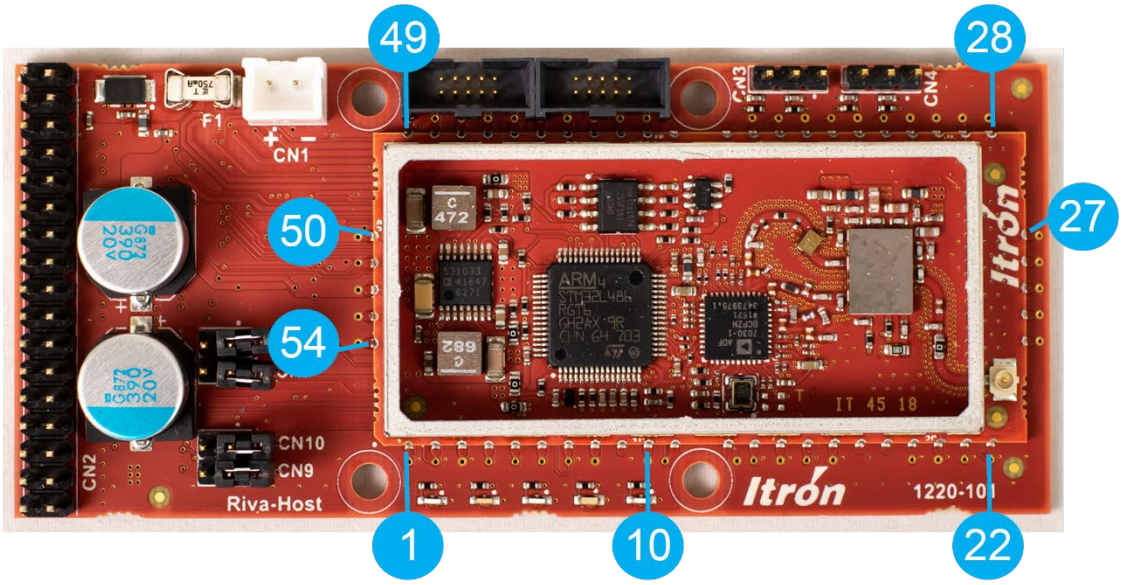

Figure 5: Module pad numbering

When the module is paired with a host, the following mapping will facilitate integration.

Pin Number	Castellation	PURPOSE	Maps to	FUNCTIONALITY
3	CST1	GND		POWER SUPPLY
8	CST2	GND		POWER SUPPLY
53	CST3	Vin		POWER SUPPLY
54	CST4	Vin		POWER SUPPLY
5	CST5	3V3Out		POWER SUPPLY
6	CST6	3V3Out		POWER SUPPLY
13	CST7	COMM USART2 CTS	PA0	
15	CST8	COMM USART2 RTS	PA1	
17	CST9	COMM USART2 TX	PA2	
22	CST10	COMM USART2 RX	PA3	
34	CST11	COMM USB SOF	PA8	

Pin Number	Castellation	PURPOSE	Maps to	FUNCTIONALITY
36	CST12	COMM USB VBUS/USART1 TX	PA9	
32	CST13	COMM USB ID/USART1 RX	PA10	
38	CST14	COMM USB DM	PA11	
39	CST15	COMM USB DP	PA12	
41	CST16	COMM USB OE#JTMS1	PA13	
1	CST17	COMM WAKE OUT	PB5	
2	CST18	COMM I2C1 SCL	PB6	
4	CST19	COMM I2C1 SDA	PB7	
9	CST20	COMM SP13 SS#	PB8	
47	CST21	COMM SPI3 SCK	PC10	
48	CST22	COMM SPI3 MISO	PC11	
51	CST23	COMM SP1I3 MOSI	PC12	
11	CST24	COMM_WAKE_IN	PC13	
7	CST25	32.768khZ MEMS OSC OUTPUT	PC14/OSC32IN	
10	CST26	GND		
12	CST27	GND		
14	CST28	GND		
18	CST29	COMMS PROCESSOR RESET	NRST	ACTIVE LOW RESET
16	CST30	GND		
20	CST31	GND		
23	CST32	GND		
24	CST33	GND		
25	CST34	GND		
26	CST35	GND		
27	CST37	GND		
28	CST38	GND		
19	CST39	COMM USART3 TX	PC4	
21	CST40	COMM USART3 RX	PC5	
44	CST41	JTCK1	PA14	
45	CST42	JTDI1	PA15	
42	CST43	JTDO1	PB3	
49	CST44	LED1	PD2	
29	CST45	GND		
30	CST46	GND		
31	CST48	GND		
33	CST49	GND		
35	CST50	GND		
37	CST51	GND		

Pin Number	Castellation	PURPOSE	Maps to	FUNCTIONALITY
40	CST52	GND		
43	CST54	GND		
46	CST55	GND		
50	CST57	GND		
52	CST58	GND		

INITIALIZING AND LOADING FIRMWARE ON THE ITRON RIVA MODULAR LE

To load firmware on the communications processor within the module, you can follow these steps using the tools described, or other tools you may have available.

You will need the following:

- host board with connectors for
  - power supply
  - 9 pin JTAG connector (for connecting to a JLINK debugger)
  - Serial
  - antenna
  - Power supply
- JLINK with USB
- Serial to USB cable
- Laptop with
  - software for terminal display
  - J-Flashlite or other software for setting the baud rate, selecting the COM port, and specifying the firmware file to upload

Using the tools listed above, follow these steps to load firmware.

1. Connect the module to a host. In the photos shown here, the module is connected to a host board provided by Itron.
2. Connect the power supply to the host as shown in Figure 6 and then plug in to the power source.

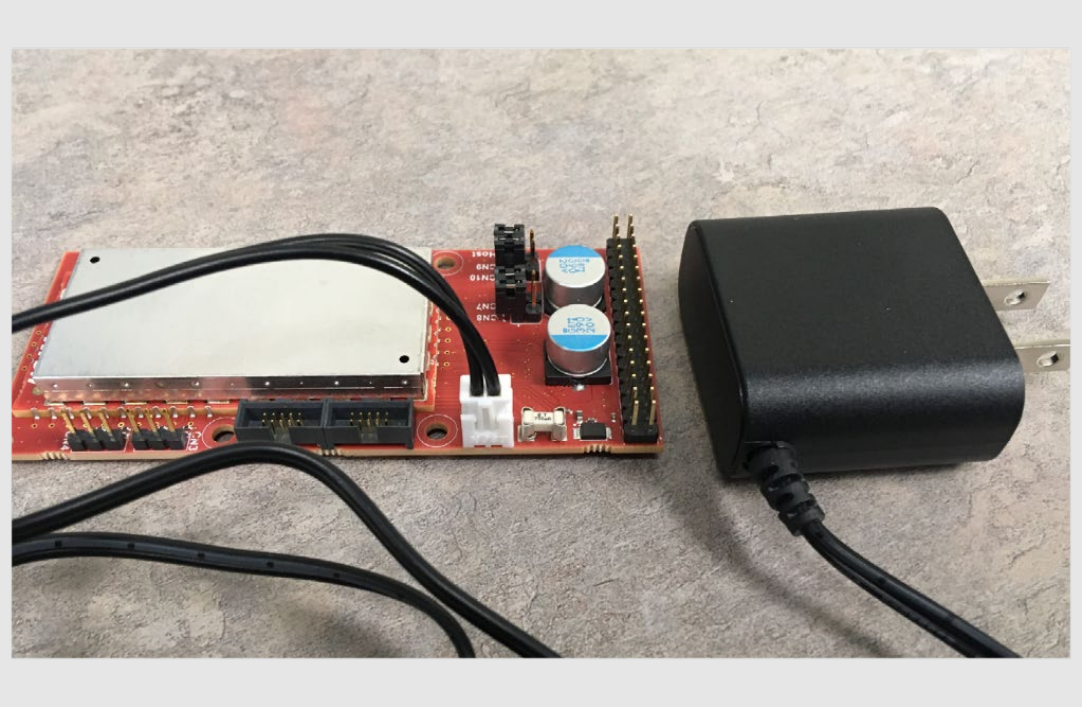

Figure 6: Module, host board, and connected power supply

3. Connect the JLINK to the JTAG connector on the host as shown in Figure 7 and connect the JLINK USB to the laptop.

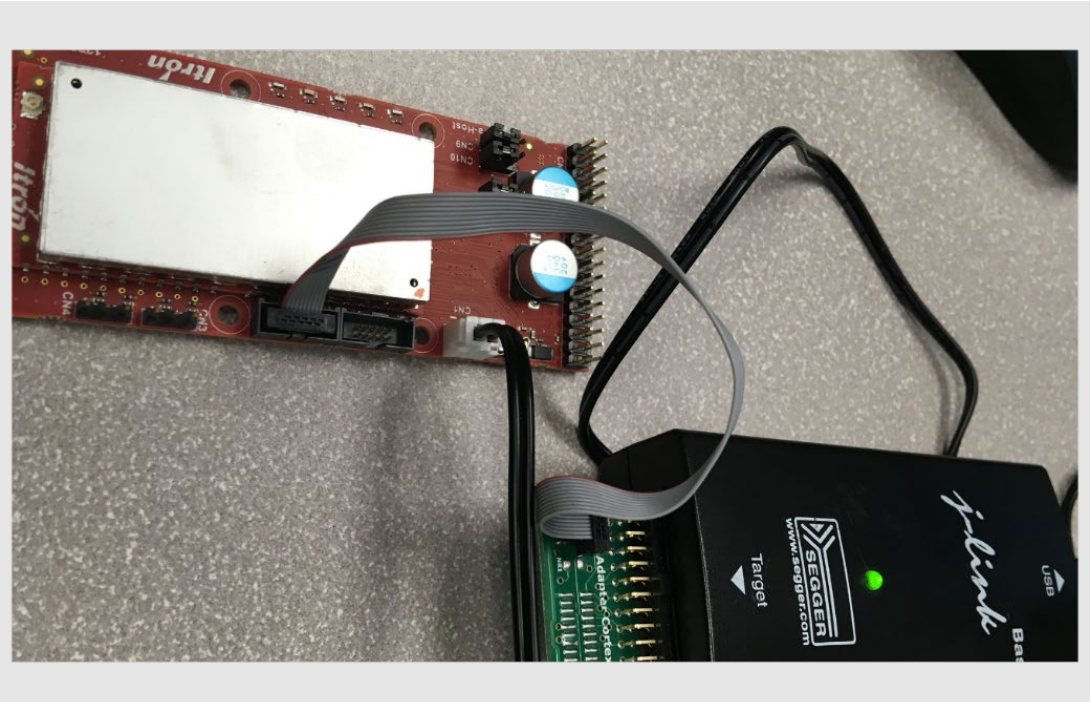

Figure 7: Module on host board and connected to J-Link

4. Connect the serial to USB cable with the three pin connector on the far left of the image shown in Figure 8. The yellow in the middle and the black (ground) in the position closest to the end of the board. Plug the USB end of the cable you're your laptop.

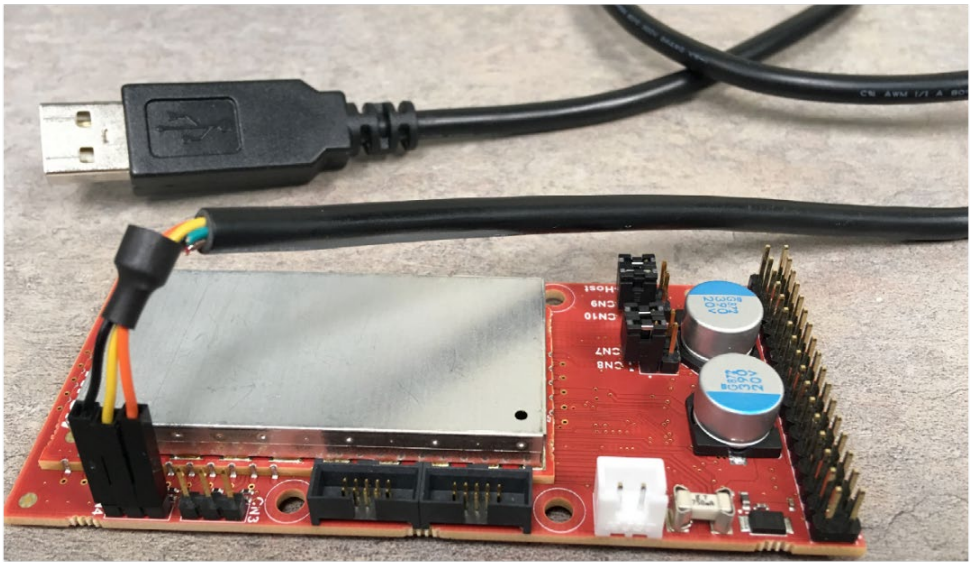

Figure 8: Module on host board and connected to Serial to USB cable

Once all the connections are in place, your board should be connected as shown in Figure 9 and you are ready to load firmware on your module.

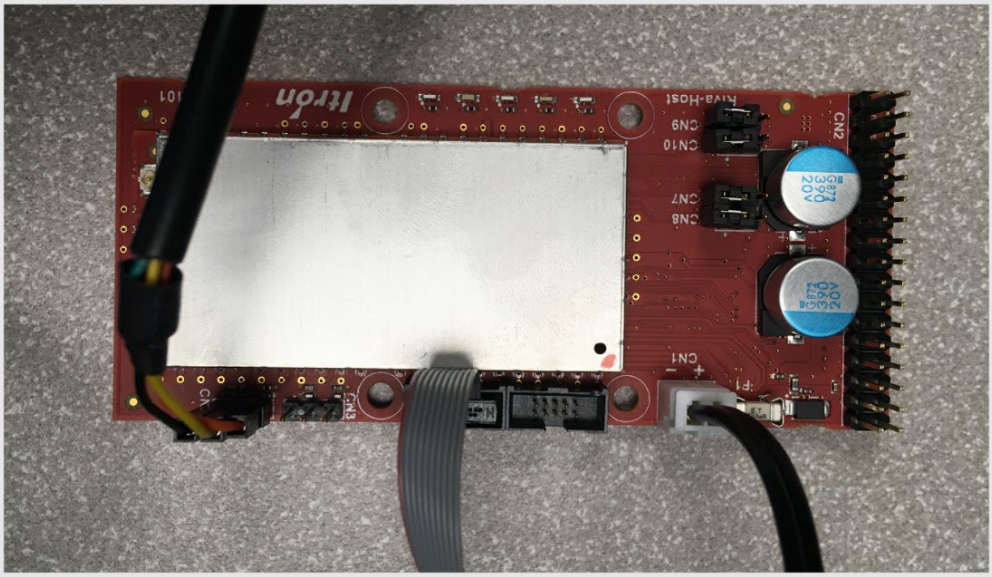

Figure 9: Module on fully connected host board

Chapter 5: Approved Antennas for the Modular LE

The Modular LE can be operated with an external antenna. The required antenna impedance is 50Ω. The host device will determine what type of antenna connector is available. The module was tested with the Itron host board which contains an external uFL antenna connector as shown in Figure 10.

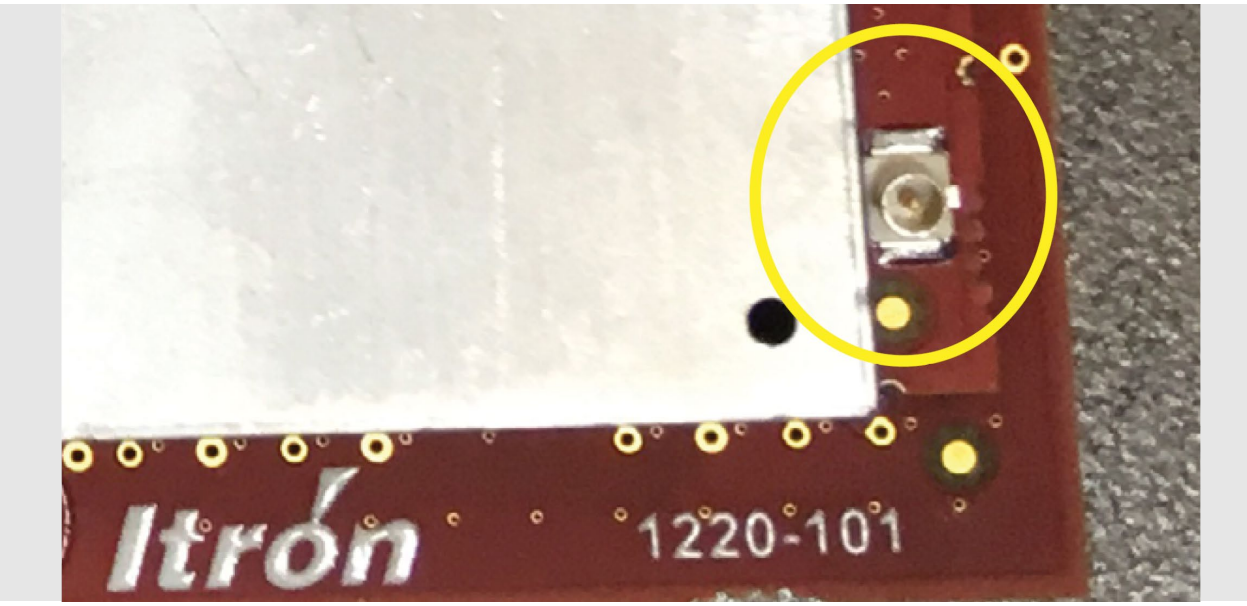

Figure 10: uFL antenna connector on Itron host board

An antenna or antenna extension cable can be attached to the uFL connector as shown here.

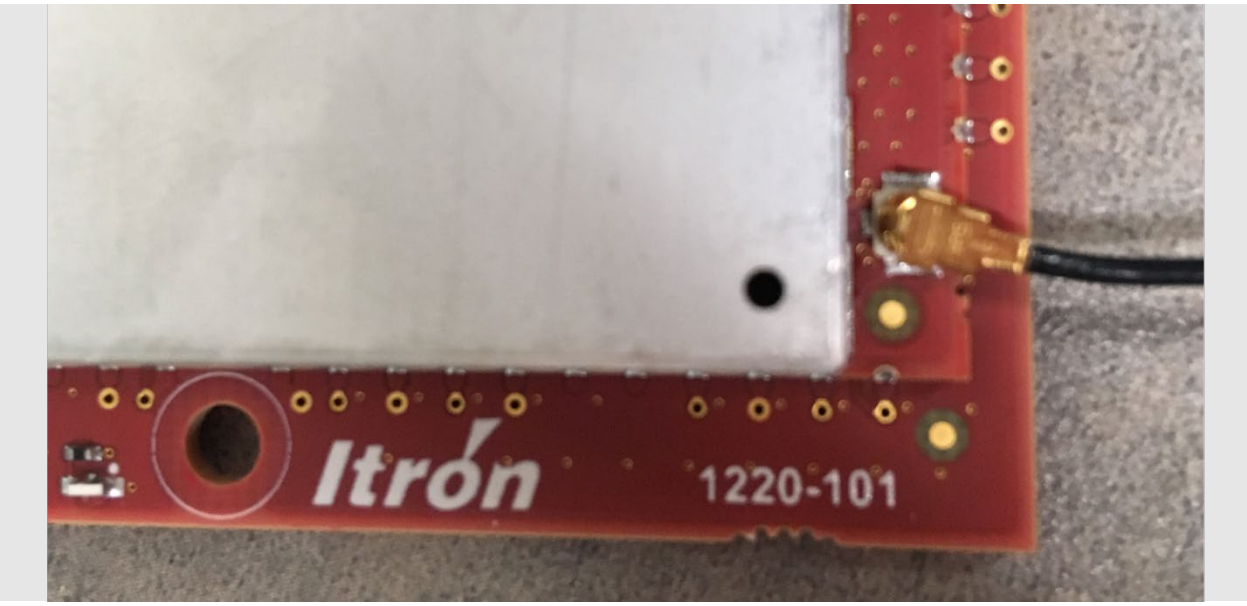

Figure 11: Antenna cable attached to uFL connector

Two antennas were tested and approved during the FCC testing and certification process. The Modular LE has been designed and approved per FCC and ISED rules to operate with the two antennas which are described here.

LAIRD MODEL 0600-00048

The Laird model 0600-00048 omni directional antenna with 2.0 dBi gain was successfully tested for transmission in the 902-928 mHz frequency band.

WORLD PRODUCTS MODEL WPANT30088-S1A

The World Products model WPANT30088-S1A omni directional antenna with 2.5 dBi gain was successfully tested for transmission in the 902-928 mHz frequency band.

ADDITIONAL ANTENNA OPTIONS

Antennas not included in this list are strictly prohibited for use with this device unless additional certification testing is performed. Should you plan to integrate a host with the Modular LE that requires a different antenna than those listed above, and additional certification will be required.

Industry Canada Compliance

This radio transmitter complies with the Innovation, Science and Economic Development Canada (ISED) to operate with the antenna types listed above and having the maximum allowable gain and the required antenna impedance for each antenna type indicated. Antenna types not included in the list or whose gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio est conforme aux normes Innovation, Science et Développement économique Canada (ISED) pour fonctionner avec les types d'antenne énumérés ci-dessus et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.