Program: Idea Labs Itron Riva Dev Mini

Name: Itron Riva Dev Mini Hardware User Guide

Compliance Information (Certification Exhibit) – For further information see Appendix A.:

FCC ID: 2ANHYMINI1

FCC Rule Part: 15.247

Model: Itron Riva Dev Mini

Part Number: 575188r3

Manufacturer: Itron Inc

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Riva Edge Mini HW Design and User Guide

Contents

LIST OF TABLES

CHANGE LIST

Rev 0.07 –
1. Added RF cable information
2. Added Solderless Breadboard section
3. Added Test Fixture section
4. Updated revision number and table of contents

Rev 0.09 –
1. Added text to pin table

Rev 0.10 –
1. Added information about USB cables
2. Updated revision number and table of contents

Rev 0.11 –
1. Changed document name from ACT Dongle to Riva Edge Mini Dev Kit
2. Added testing section
3. Cleaned up other sections

Rev 0.12 –
1. Added DSP Programming section

Rev 0x13
1. Altered text in HV_CMP section

Rev 0x14
1. Updated pin out diagram for easier readability
2. Updated some text in Pinout description area

Rev 0.17
1. Corrected GPIO1_17 Table information
2. Added info on testing UART5

Rev 0.19
1. Switched Antenna and cables to reflect RP-SMA types

Rev 0.20
1. Enhanced Introduction section text.

Rev 0.21
1. Mentioned required pull-up resistors on I2C2_SCL_3.3 and I2C2_SDA_3.3

Rev 0.22
1. Added section on Expansion Connector J4 peripheral usage

Rev 1.0
1. APPENDIX A: FCC RELATED STATEMENTS added
2. 1st page edited with FCC related info (FCC ID, itd.)
3. Antenna info modified

Rev 1.01
1. RF Exposure statement added

INTRODUCTION

The Itron Riva Dev Mini Kit is a complete Linux system on a module that includes an Itron ACT Radio suitable for addition to an Itron ACT RF network. It contains all hardware and comes loaded with firmware which allows the user to easily bring up a product within an ACT Network.

It is intended to be used in a laboratory environment for product development or used as a professionally installed OEM module1.

The end user will be a hardware developer who will ensure a proper power supply, ESD protection, physical enclosure, and antenna are provided to suit their product needs. The end user will also provide customized firmware to suit their application.

Only specified antennas may be used for integration of the OEM module to comply with FCC emission limits! Please refer to the antenna tables in this document. Antenna and RF Cable type and purchasing information are provided later in the document.

If the product is used as an OEM device within a user's product they will be responsible for all testing, qualifications and specifications to insure the Mini DK operates within all agency certifications that apply to the product. The end user is also responsible for all design related to safety designs and testing of safety features.

Only specified antennas listed in this document may be used for integration of the OEM module to comply with FCC emission limits! Please refer to the antenna tables in this document. Antenna and RF Cable type and purchasing information are provided later in the document.

The Itron Riva Dev Mini is designed by Itron and based on an Itron iSOM module which is based on a TI AM335X ARM Cortex Microprocessor. The iSOM module contains the processor, FLASH, RAM, power supply control, clock and other features. This iSOM module is mounted to a small board which includes all ACT RF circuitry to act as a USB NIC. There is also an expansion connector to allow the board to serve as the control and communications part of assorted devices.

Figure 1: Top Side of Itron Riva Dev Mini showing iSOM[2]

Figure 2: Bottom Side of Itron Riva Dev Mini[3]

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[1] Only specified antennas may be used for integration of the OEM module to comply with emission limits! Please refer to the antenna tables in this document.

[2] Note that 40 Pin connector is not place in this picture.

[3] Note that 40 Pin connector is not place in this picture and that the shields are left off of the RF and DSP sections.

PURPOSE OF DOCUMENT

The goal of this document is to provide a hardware designer with enough information to use the Itron Riva Dev Mini board as a processing engine for assorted types of projects. It will cover the hardware necessary, at a high level, to guide a designer to the point where they can bring Linux up on the platform.

This document is intended to show the user how to interface the Itron Riva Dev Mini to a product based on the Muse platform. However, there will not be a comprehensive definition of how to use each type of GPIO to interface to assorted devices. This will have to be obtained through the A8 datasheet. Some examples will be given but most of the time only the parameters of the pin will be defined and its usage left up to the end product designer to reconfigure them as necessary. You may contact Itron for specific interface assistance.

Building Linux will also be covered in a separate document.

This document is not intended to inform the user how to use Linux or any subset of Linux commands. The coverage of Linux will only cover booting to a kernel prompt. This document is not intended to be a detailed usage guide to Linux or to the intricacies of the additions that Itron has made to Linux through its extensive IP library. These details are covered in separate documents.

This document is also will not cover Muse additions to the Linux Operating System or the Itron Over the Air protocols or how to use them. Contact Itron for specific assistance in these areas.

ESD Warning
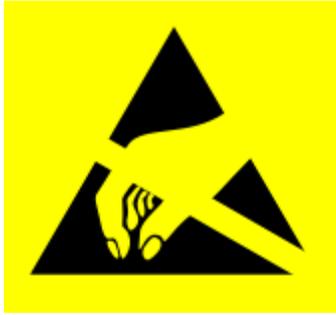
ESD Warning

This product is intended to be treated as any other solid state component that you may use in an ESD save engineering or manufacturing environment. Many exposed pins do not have any additional ESD protection beyond what is provided by the integrated circuit that is directly connected to that pin. Treat it as you would treat any other high density low voltage electronic component.

This product, like all microcontroller products, uses semiconductors that can be damaged by electrostatic discharge (ESD). When handling, care must be taken so that the devices are not damaged. Damage due to inappropriate handling is not covered by the warranty.

The following precautions must be taken:
•Do not open the protective conductive packaging until you have read the following, and are at an approved anti-static work station.
•Use a conductive wrist strap attached to a good earth ground.
•If working on a prototyping board, use a soldering iron or station that is marked as ESD-safe.
•Always disconnect the microcontroller from the prototyping board when it is being worked on.
•Always discharge yourself by touching a grounded bare metal surface or approved anti-static mat before picking up an ESD - sensitive electronic component.
•Use an approved anti-static mat to cover your work surface.

DEFINITIONS AND ACRONYMS

Term		Definition
EPF	Early Power Fail	An indication to the Linux system that the system requires a graceful shutdown.
HV_CMP	High Voltage Compare	This is the circuit name for the power fail sense input to the PMIC. It is used to create PDN_POWERFAIL to insure the rails are shutdown with proper sequencing.
IP	Intellectual Property	For example, the extensions Itron has created to extend the capabilities of the platform in our products.
MMPS	Main Motherboard Power Supply	This is the main power supply for the motherboard that the module is soldered to. At times in this document it is also referred to as +24VDC. This supply is the one that all power rails and power control signals are ultimately derived from.
PIC		A Microchip microprocessor used to control our power rails and provide other services to the A8
PLC	Power Line Carrier or Power Line Communications	A method of transmitting and receiving data through the power lines.
PMIC	Power Management IC	This chip contains multiple switching and LDO regulators and other power rail management circuitry.
FTDI	Future Technology Devices International LTD	Manufacturer of USB to Serial converter cables
Itron Riva Dev Mini	This board	Either of these two terms may be used to describe this board depending on how it is used.
ACT NIC	This board	

REFERENCE DOCUMENTS

- A8 Product Preview Document. (SPRS717B.PDF)
- A8 Technical Reference Document (SPRUH73C)
- PIC16(L)F1824/8 Datasheet (DS40001419E)
- NXP PCF85363A RTC Datasheet
- CDP 3.02 PICInCircuitProgramming.docx
- Riva ACT-RF Design and User Guide
- DS_TTL-232R_CABLES.pdf
- SMSC 9514 USB 2.0 Hub and 10/100 Ethernet Controller Chip

ITRON RIVA DEV MINI INTRODUCTION

This section describes, at a very high level, the nature of the Itron Riva Dev Mini which is based on the Itron iSOM and includes ACT RF functionality to support the 870 MHz and the 920 MHz bands used for the proprietary Openway network. The RF section connects to an antenna via a UF.L connector[4].

The Itron Riva Dev Mini has one mini-USB connector. Power can be derived from the external host when the board is operating as a USB device. Power can be provided to a device when the board is operating as a host. This is basic OTG operation but not certified as OTG by the USB group.

The Mini DK does NOT directly support Ethernet. An Ethernet port can be created by using a USB-to-Ethernet adapter.

The Itron Riva Dev Mini does NOT support EMMC or other external memory. It is possible to break-out J4 to provide a second USB port that can use USB based external memory such as a hard drive or a thumb drive.

A 40 pin expansion connector is provided to bring control and communications off the board. The pinout is shown below. This connector allows use of a standard ribbon cable to extend the signals to another board.
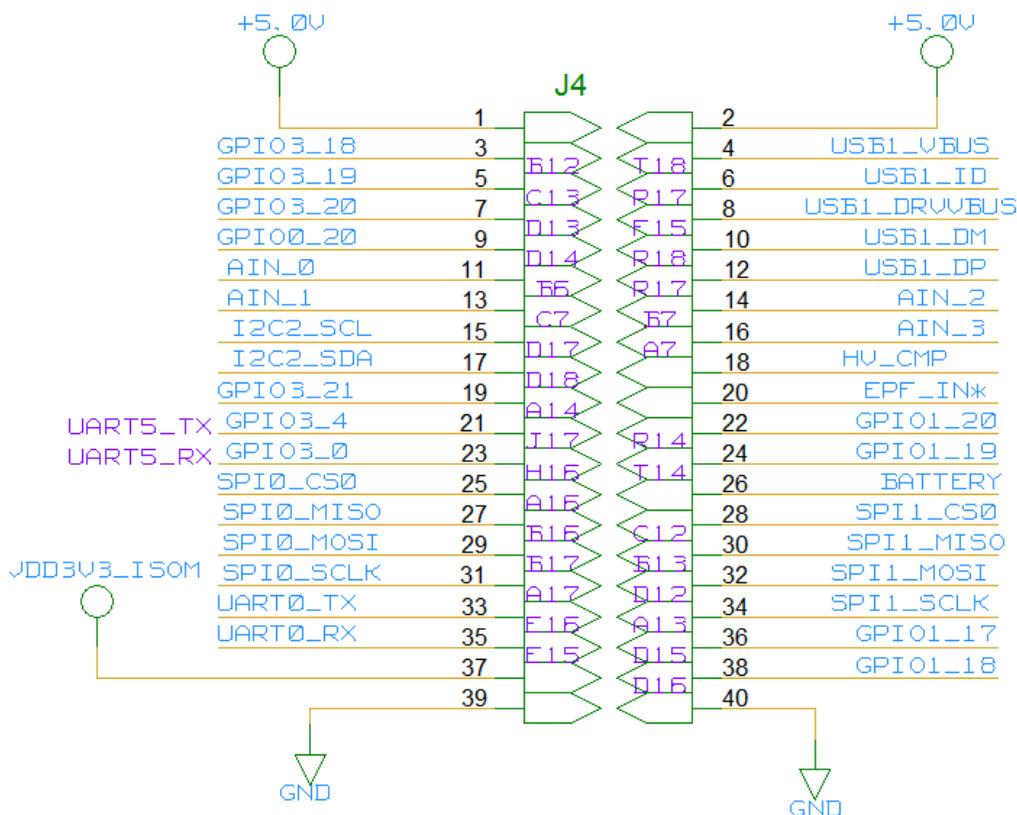
ITRON RIVA DEV MINI BOARD DESCRIPTION

The Itron Riva Dev Mini takes the Itron iSOM module, combines it with an ACT RF module and expands it into a Complete Embedded Linux Communications system through an assortment of communications and control lines on an expansion header. The board is designed to be used as a development platform for embedded product prototyping or as the core processor NIC for an embedded product.

Following is a list of the available hardware:

Item	Description	Notes
Single 5VDC supply		All other rails are generated on the module
A8 Microprocessor	ARM® Cortex™-A8 32-Bit RISC Microprocessor	32KB L1 Cache 256KB L2 Cache
Internal RAM	Dedicated to boot and security	64KB Dedicated on-chip RAM
Internal RAM	General Purpose	64KB on chip RAM
Internal ROM		176K On-Chip boot ROM
Crypto Hardware Accelerator		AES, SHA, PKA and RNB
External FLASH	2Gb as x16	Code, file system and data storage
External RAM	1Gb as x16	Data storage
EEPROM	256 Bytes	On PIC, accessible through I2C
RTC	NXP PCF85363A	Very Low Power
External Interrupts		
Early Power Fail Detection		For graceful Linux shutdown, Accessed through the Expansion Connector
Expansion Signals	SPI0, SPI1	Accessed through the Expansion Connector
	I2C2	Accessed through the Expansion Connector
	UART1, UART4	Accessed through the Expansion Connector
	Assorted GPIOs	Accessed through the Expansion Connector
	AIN_0…AIN_3	4 ADC inputs, 12 Bits, Accessed through the Expansion Connector
	UART0	Linux Console Accessed through the Expansion Connector
	USB0	Mini-USB connector
	USB1	Accessed through the Expansion Connector
	JTAG	Bottom of board Test Points marked JTAG
PIC interface	PIC Programming	Bottom of board Test Points Marked JPIC

MECHANICAL

The Mini is a compact board designed for small environments. It is available with a vertical connector, a right-angle connector or no connector. The connector can also be located on either side of the board to best suit a customer's needs.
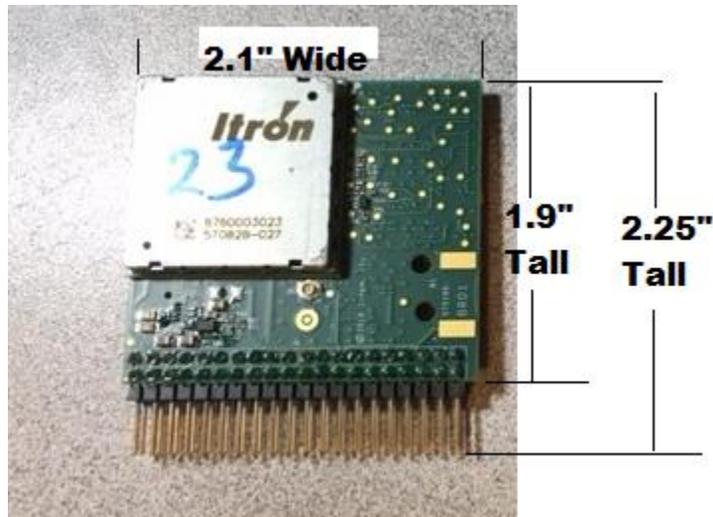

Figure 4: Mini Board Dimensions

MAJOR COMPONENTS

The following sections will list the major components on the Itron Riva Dev Mini and briefly describe them. Datasheets are available for more detailed information.

Caution!! Only specified antennas listed in this document may be used for integration of the OEM module to comply with FCC emission limits! Please refer to the antenna tables in this document. Antenna and RF Cable type and purchasing information are provided later in the document.

CPU BRIEF

The Muse Platform contains a TI AM335X ARM Cortex Microprocessor. The processor contains a number of internal peripherals such as UARTs, SPI, I2C, USB, MMC, RTC and others. It also contains an internal boot ROM and internal RAM. The ROM and RAM are mostly used during the boot-up process and during security operations.

CLOCKING

A 26MHz clock crystal is used to clock the AM335X. This is internally changed to 450 MHz using an internal PLL through Firmware. Other speeds can be selected depending on user requirements.

FLASH AND RAM BRIEF

The system contains a Micron technologies MT29C2G24MAABAHAMD-5IT chip in a 130 ball package combining both FLASH and RAM on single chip. The Itron PN is 570725-003. This is a 2Gb NAND (x16bit) + 1Gb (x16bit) LPDDR.

RTC BRIEF

The module contains a NXP PCF85363A RTC CHIP. It is a tiny Real-Time Clock/calendar with 64-byte RAM, alarm function, battery switch over and I2C-bus.

PIC BRIEF

The module contains a Microchip PIC16LF1823, or PIC16LF1823 microprocessor to serve as the power rail control and to provide some system support features.

The PIC provides

1. Power Rail control
2. PON timing
3. Reset capability for the A8
4. EEPROM and some configuration storage.

PMIC BRIEF

The TI TPS650250 PMIC provides 3.3VDC, 1.8VDC and 1.1VDC regulators to supply the requirements for the A8, RAM, FLASH and other components.

The PMIC also provides two LDO regulators. One provides 3.3VDC to the PIC and the other provides 3.3VDC to the Real Time Clock chip[5]. The two LDO enables are hard wired to a MIC826 voltage monitor chip and come on as soon as 5 VDC is applied to the module. The PIC will then sequence the power rails to the A8 and other circuitry.

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[5] As of the writing of this document the RTC chip was being changed. The original chip was an AM1805. I do not know what the new chip is at this time.

ITRON RIVA DEV MINI POWER HANDLING

POWER INPUT

The Mini requires a single +5 VDC supply. The input voltage should be within 4.75 VDC and 5.25 VDC.

+5 VDC SUPPLY

The Itron Riva Dev Mini requires an input power supply of +5 VDC. This can be supplied through the mini-USB connector or through the expansion connector. The +5.0 VDC supply derives from one of two sources: U57, the mini-USB connector or from the expansion header pins 1 and 2. In either case this board can consume a peak of about 6 watts during full power transmissions.

+5 VDC from USB

When the Itron Riva Dev Mini is powered through the mini-usb connector it will provide +5 VDC power to the expansion connector pins 1 and 2. There is a circuit to limit the inrush current to prevent the host from triggering an over-current error. Once the initial period of current limiting ends the TPS2151 will allow up to 1.6 amps to flow from the USB Host. Note it is up the system firmware to provide the configuration and protocol operations to request the maximum required current from the host port. Careful attention to this detail must be followed for adding external circuitry.

+5 VDC from Expansion Header

If the mini-USB port is not used as a power source +5 VDC may be supplied through the expansion connector pins 1 and 2. Currently, for the first prototype run, this will not provide power to the mini-USB port. It should be possible to put a diode where R21 is to allow powering the mini-usb from the expansion +5 VDC input.

POWER OUTPUT

+5 VDC to USB

When powered from the USB connector the current limited +5 VDC is routed to the Expansion header to provide power for additional circuitry.

+3.3 VDC SUPPLY TO EXPANSION CONNECTOR (3V3_EXP)

There is a 3.3 VDC regulator connected to the +5 VDC signal to create an expansion power supply for use by the user. This rail is gated by a signal from the iSOM which tells the system that the iSOM is powered on and ready. This supply rail is limited to 250ma.

USER POWER SUPPLY WARNING

When adding hardware to the interface connector it may be required to create additional power supply rails or higher current supplies. It is important to not connect any of these voltages to the Itron Riva Dev Mini before the A8 has its power rails in place and steady. Having a voltage on an I/O Pin on the A8 before it has its Vdd supply can cause permanent damage to the A8.

If you need to create your own power supplies make sure you gate them with 3V3_EXP because 3V3_EXP will not rise until the A8 supply rails are ready. This will prevent you from damaging the A8 processor or other circuitry.

SYS_BOOT CONFIGURATION JUMPERS

The board comes configured to run its preloaded Linux on delivery. It is rarely necessary to change the configuration jumper or switches.

The A8 can boot from a number of peripherals or memory units. For instance, it can boot from a UART, USB, I2C, NAND or other sources. Often first stage of booting is used to load a small bootloader which will then download the full system code. The iSOM module brings two of the system boot configuration pins out on its connector. The two signals are SYSBOOT0, on J1 pins 1 and 2, and SYSBOOT4, on J1 pins 3 and 4.

Normally both jumpers will be in the off condition. But occasionally other modes may be required. For instance, if a download was interrupted leaving bad contents in FLASH the system may appear dead or not be presenting CCCC. You can configure Sysboot0 jumpered and Sysboot4 unjumpered to not allow booting from NAND thereby forcing a boot from UART0. This will present CCCC allowing you to xmodem the SPL file and then ymodem the u-boot program to get a u-boot prompt. Once at the prompt a "nand erase.chip" will restore the flash to a blank state and a complete reload can be started.
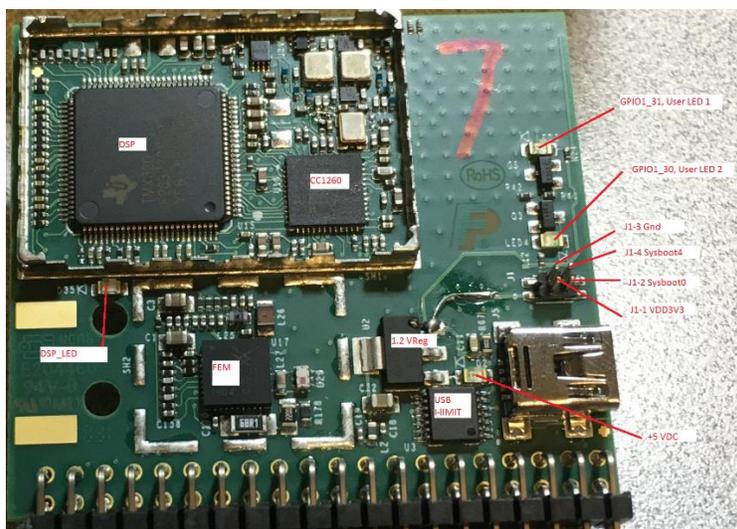
These two pins are connected to individual mini-jumpers and can be used together to determine the boot sequence the A8 will use. Typically, the both jumpers are left in the open position.

Figure 5 - Revision 2 Itron Riva Dev Mini Board jumpers

Rev. 1		Boot Order				
SYSBOOT4 J1 (3-4)	SYSBOOT0 J1 (1-2)					
On = 0	Off = 0	UART0	SPI0	NAND	NANDI2C	A8 Sends Cs
On = 0	On = 1	EMAC1	MMC0	XIP	NAND	
Off = 1	Off = 0	NAND	NANDI	USB0	UART0	DEFAULT
Off = 1	On = 1	MMC0	SPI0	UART0	USB0	Force CCC to allow xmodem of spl + mlo to get to uboot to erase nand.chip

STARTUP – RIVA ITRON RIVA DEV MINI LINUX FIRST TIME POWER ON

This section covers powering the board on and getting a prompt at the command line. The information below assumes you are starting with a fresh power-up having had your supply at 0VDC previously. This is the absolute minimal step to get an operational Linux console.

When shipped from the Itron factory the board is programmed with MLO, u-boot and a valid kernel. The PIC is also programmed. The two configuration jumpers are also placed in the basic operation configuration. So on receipt the board should boot into Linux without any changes.

The board can be powered up by using several different methods;
1. Connecting to a solderless breadboard expansion board
2. By direct wiring
3. On a Test Fixture
4. By connecting to another host board.

The following sections explain these methods in detail. Item 4 is not covered because it implies the user has developed their own host board.

DIRECT WIRING, NO SOLDERLESS BREADBOARD EXPANSION BOARD

Establishing a terminal session is a very simple process. Essentially only +5 VDC is required along with a console serial port. This is the minimal requirements to boot into a Linux system.

POWER SUPPLIES

Connect +5 VDC through the expansion connector. Leave this turned off for now.

CREATE A CONSOLE PORT

Connect a USB-To-Serial adapter to J4. Some adapters do not require 3.3 VDC so Pin 37 may be omitted based on the wiring guide provided by the USB adapter manufacturer. More information about USB-To-Serial adapters is provided later in this document.

J4 Pin 33	UART0_TX
J4 Pin 35	UART0_RX
J4 Pin 37	3.3 VDC
J4 Pin 39	Ground

SOLDERLESS BREADBOARD EXPANSION BOARD

The easiest way to connect and power the board is to use the solderless breadboard expansion board. This board breaks the pins out spaced properly to allow the device to be plugged into a solderless breadboard. Even if not being used with an actual breadboard it provides the typical +5 barrel connector and 4-pin UART0 connection used on our development kits.

Figure 6 - ACT NIC on Solderless Breadboard Expansion Board

When inserting the Itron Riva Dev Mini/NIC into the expansion board be very careful of orientation. Note that the mating connector on the expansion board has a label in each side noting which shield should be visible and power orientation. The "iSOM side" is the side with a single square shield with the large Itron logo printed on it and the 57088-027 part number. The last 3 digits of the part number may vary depending on the iSOM configuration.

Simply plug the board into the expansion board, connect a +5 VDC power supply to the barrel connector (center +) and a serial port to the 4-pin connector. The system is now ready to boot.

ITRON RIVA DEV MINI/NIC TEST FIXTURE

A test fixture has been designed to support programming and testing of the Itron Riva Dev Mini/NIC. Typically this will be an Itron factory item or an Itron development base. At this time, I do not know if it will be made available to customers.

This fixture provides the following capabilities:
1. A8 UART0 breakout and Other UARTs
   a. JM4 Breakout (40 Pin Expansion Connector) to LEDs and headers
2. A8 JTAG
3. DSP JTAG
4. USB1 Breakout and connector
5. +5 VDC Supply Connector
6. Miscellaneous test point breakout

There is a separate manual that describes this fixture in detail.
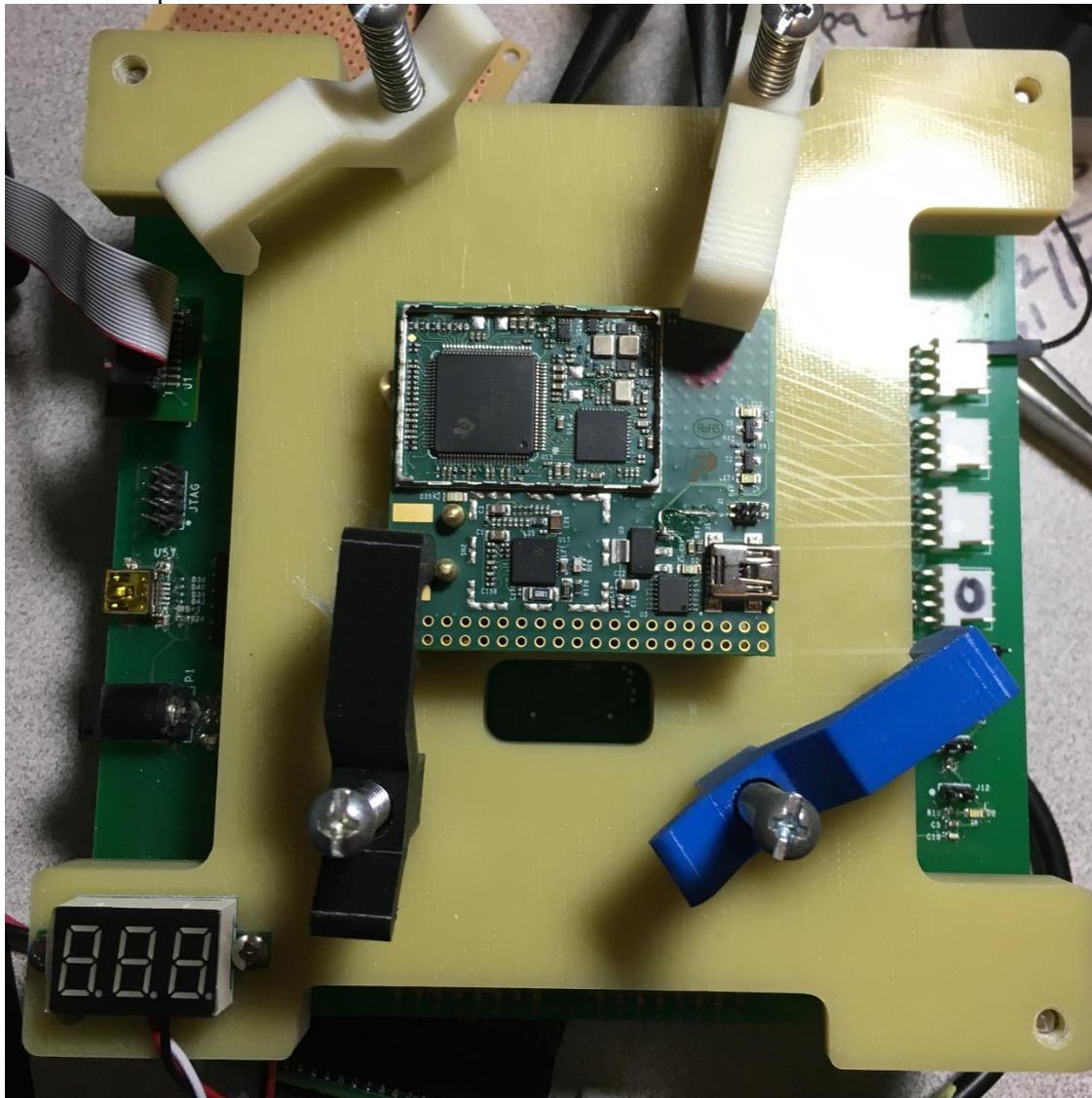
Figure 7 - Itron Riva Dev Mini/NIC Test Fixture

POGO-PIN AND SOCKET INFORMATION (SPRING TEST PINS)

Pogo-pins are used for reliable temporary connection between the fixture and the Itron Riva Dev Mini Under test.

Do not turn the fixture upside down without something to hold the pins in. By their nature the pins slide in and out of the sockets easily. If you do turn a fixture upside down many, if not all, of the pogo pins may fall out.

Note that it is nearly impossible to clamp a board onto the fixture with all pins inserted. We recommend that you only insert the pins that are required for the particular function you are performing. For instance, it is not necessary to insert all pins for DSP or A8 programming. Pin usage is shown in the
following section including a map of pins by usage group for each function.

SOCKET

Sockets are used to hold the pogo-pins into the test fixture. They are soldered in but can be replaced. Different types of pins may be inserted into the sockets as needed.

The pogo-pin socket is QA Technology Company art number 100-SDN2502 a "100 Socket, Sgl PR, WireWrap". This socket is press fit into the alignment block and then goes into a PCB hole. The pin is soldered into the PCB. Because of the way these are mounted it is very difficult to remove or replace a socket.

The best method is remove a socket is to heat the respective pin at the PCB until the solder melts. Then pull the socket from the top of the alignment board through the alignment board.

PINS

Three types of pogo-pins are used for this fixture and one type of socket. Pins just slide into and out of the sockets with no force needed.

SPEAR PIN

This spear pin type used to mate to test points on the Itron Riva Dev Mini PCB. Many useful signals are brought out on test pins for diagnostics and programming. For instance, all usable GPIO are brought out to LEDs so they can be flashed for testing. The QA Technology part number for the spear pin compatible with this fixture is "100-PRN2541L".

CHISEL TRIAD PIN

The Chisel Triad pin type used to mate to holes in the Itron Riva Dev Mini PCB. Often the fixture will be used with a Itron Riva Dev Mini that does not have the 40 pin expansion connector populated. The QA Technology part number for the chisel Triad pin compatible with this fixture is "100-PRN2518L".

CUP PIN

This Cup pin type used to mate to through hole connectors on the Itron Riva Dev Mini PCB such as an expansion connector has been soldered onto a board. Cup pins mate to the bottom of the connector that protrudes through the bottom of the board. The QA Technology part number for the spear pin compatible with this fixture is "100-PRN2522L".

ESTABLISHING A LINUX SESSION

GET INTO A TERMINAL

Establish a terminal using a terminal emulator application. This can be done from Windows with something like Hyperterm or from Linux using minicom. In either case make sure you are connected to the proper serial port (the USB-To-Serial converter) and have set your configuration to 115200bps and N81.

GETTING A PROMPT, AND WHAT TO DO WITH IT

It is now time to power-on your board. Once power is applied you should get a prompt after the board finishes booting. Typically, as shipped from the factory, the system will load u-boot then Linux and after about a minute will stop at a Linux Prompt. Depending on the state of the firmware in the module you will get one of the following:

Seen Onscreen	Description	Meaning
Linux Prompt		System is up and ready to use
u-boot prompt		Linux must be loaded
"C" character stream	Continuous "C"s about 1 second apart	The PIC is loaded but MLO, u-boot and the kernel are not
Nothing		This is an undefined state. It is possible that power is not being applied, the PIC is not loaded or the system is bad.

LINUX PROMPT

This verifies that the PIC, MLO, u-boot and a valid kernel are all loaded and have operated successfully. At this point you can operate the system as any other Linux system.

U-BOOT PROMPT

This means that the PIC, MLO, u-boot are loaded but the kernel is not loaded. This could mean a kernel is not present in the file system or the kernel image is bad. Reload a kernel image using u-boot and restart the system.

"C" STREAM (CONTINUOUS "C"S ABOUT 1 SECOND APART)

This means that PIC is loaded but MLO, u-boot and the kernel are not or have bad images. Reload the firmware starting with MLO and u-boot and verify you can boot with u-boot. Then reload the kernel.

NO PROMPT AT ALL

This is an undefined state. It is possible that power is not being applied, a signal is not tied, the PIC is not loaded, the kernel or u-boot are not loaded or corrupted. It can also mean that J1 is not placed correctly.

PIN CONFIGURATION AND USAGE

The A8 is extremely configurable including peripheral to pin assignments. Table 2-7 from TI document SPRS717B provides the list showing which peripherals can be assigned to which ball (pin) on the processor package. This table also lists other information about the signal such as its reset state, drive current, power domain and if there is an internal pull down or pull up resistor.

Most A8 GPIO pins can take the form of up to one of 7 different peripheral functions. Typically,[6], at least in Linux configuration code, the pin is referred to using the name from the PIN name column of Table 2-7 from TI document SPRS717B. The signal you wish to put onto that pin is chosen by setting the mode of the port. So to use this pin as a general purpose IO you would set the GPMC_A8 port to mode 7.

This versatility can make layout easier but it can also produce mutually exclusive situations. For instance, peripheral A may not be available if you are using peripheral B or if you require peripheral B to use a particular pin. TI provides a software application that allows you to define your pin usage and shows any conflicts. It will also export C code that can be used in u-boot or Linux to configure the pins according to what you have defined.

Typically, IO pin selection is done through u-boot or on kernel setup. At times the kernel definition may prevent certain pins from being changed from user space commands. But typically, it is possible to set the port type and direction through the console. Once set the console can be used to control the pins in some modes. For instance, you can raise and lower GPIO1_24 if GPMC_A8 is set to mode 7 as shown in the table below.

The following table is a copied section from the A8 Product Preview Document (SPRS717B.PDF). For detailed pin information and muxing information see that document.

Pin Name	Signal Name	Mode	Type
GPMC_A8	GPMC_A8	0	O
	GMII2_RXD3	1	I
	RGMII2_RD3	2	I
	MMC2_DATA6	3	IO
	GPMC_A24	4	O
	PR1_MII_RXD0	5	I
	MCASP0_ACLKX	6	IO
	GPIO1_24	7	IO

In some cases, Linux requires a pin for its usage or the pin may be used for a dedicated function based on the platform hardware design. This may make a particular pin unavailable for usage by the product motherboard designer

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[6] I say typically here because a programmer can define a new name and use that in their code. Also some names are slightly different than the default @defines for some pins.

ITRON RIVA DEV MINI PINOUT
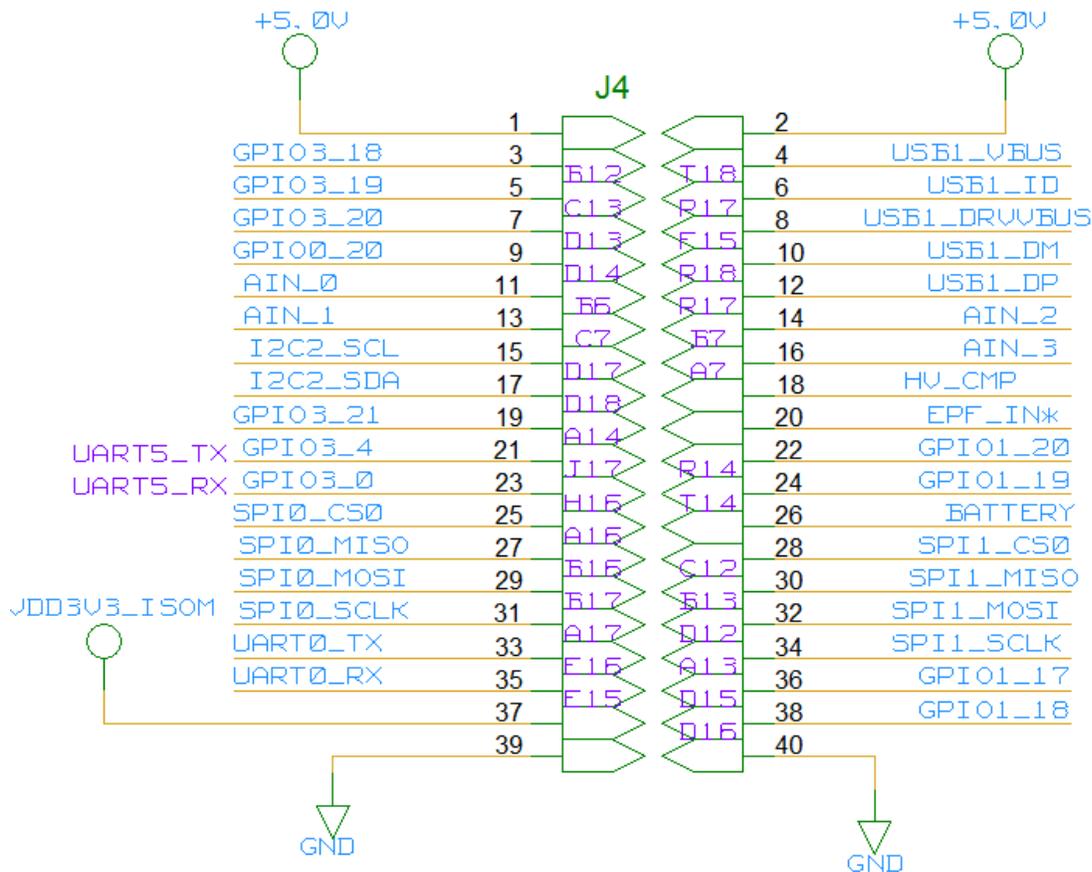
EXPANSION CONNECTOR PINOUT DESCRIPTION

The following tables show the connections to the two expansion headers.

The modes column shows the possible modes the A8 can support for that pin. The red item indicates the mode that is selected by the default bootloader and kernel.

After each table is a detailed description of each pin that is not directly connected to a processor pin on the A8. Pins that connect directly to the A8 are described in detail in the A8 Product Preview Document (SPRS717B.PDF) or A8 Technical Reference Document (SPRUH73C). These documents provide much more detail than would be possible here.

EXPANSION CONNECTOR J4 PINOUT

Expansion Connector Pinout					
J4 PIN		LGA Pin	Ball ZCZ	Rail	LGA Name	MODES
1					+5.0V	
2					+5.0V	
3		9	B12	3.3	GPIO3_18 Test with: ./gpio3_18.sh	(0) MCASP0_ACLKR (1) EQEP0A_IN (2) MCASP0_AXR2 (3) MCASP1_ACLKX

					Expansion Connector Pinout	
J4 PIN		LGA Pin	Ball ZCZ	Rail	LGA Name	MODES
						(4) MMC0_SDWP (5) PR1_PRU0_PUR_R30_4 (6) PR1_PRU0_PRU_R31_4 (7) GPIO3_18
4			T18		USB1_VBUS	
5		11	C13	3.3	GPIO3_19 Test with: ./gpio3_19.sh	(0) MCASP0_FSR (1) EQEP0B_IN (2) MCASP0_AXR3 (3) MCASP1_FSX (4) EMU2 (5) PR1_PRU0_PRU_R30_5 (6) PR1_PRU0_PRU_R31_5 (7) GPIO3_19
6			P17		USB1_ID	
7		10	D13	V6	GPIO3_20 Test with: ./gpio3_20.sh	(0) MCASP0_AXR1 (1) EQEP0_INDEX (2) (3) MCASP1_AXR0 (4) EMU3 (5) PR1_PRU0_PRU_R30_6 (6) PR1_PRU0_PRU_R32_6 (7) GPIO3_20
8			F15		USB1_DRVVBUS	
9		130	D14	V6	GPIO0_20 Test with: ./gpio3_20.sh	(0) XDMA_EVENT_INTR1 (1) (2) TCLKIN (3) CLKOUT2 (4) TIMER7 (5) PR1_PRU0_PRU_R31_16 (6) EMU3 (7) GPIO0_20
10			R18		USB1_DM	
11				1.8	AIN_0 Test with: ./ad0.sh and voltage input (Vin <1.8)	Note: 1.8 VDC MAX
12			R17		USB1_DP	
13				1.8	AIN_1 Test with: ./ad1.sh and voltage input (Vin <1.8)	Note: 1.8 VDC MAX
14				1.8	AIN_2 Test with: ./ad2.sh and voltage input (Vin <1.8)	Note: 1.8 VDC MAX
15		8	D17		I2C2_SCL Requires ~2.2k pullup to 3.3 VDC Test with i2cdetect. See test section later in this document.	(0) UART1_RTSN (1) TIMER5 (2) DCAN0_RX (3) I2C2_SCL (4) SPI1_CS1 (5) PR1_UART0_RTS_N (6) PR1_EDC_LATCH_1_IN (7) GPIO0_13
16				1.8	AIN_3 Test with:	Note: 1.8 VDC MAX

J4 PIN		LGA Pin	Ball ZCZ	Rail	LGA Name	MODES
					./ad3.sh and voltage input (Vin <1.8)	
17		7	D18	3.3	I2C2_SDA Requires ~2.2k pullup to 3.3 VDC Test with i2cdetect. See test section later in this document.	(0) UART1_CTSN (1) TIMER6 (2) DCAN0_TX (3) I2C2_SDA (4) SPI1_CS0 (5) NA (6) NA (7) GPIO0_12
18					HV_CMP See Testing Section	Input from external power fail circuitry
19		32	A14	3.3	GPIO3_21 Test with: ./gpio3_21.sh	(0) MCASP0_AHCLKX (1) EQEP0_STROBE (2) MCASP0_AXR3 (3) MCASP1_AXR1 (4) EMU4 (5) PR1_PRU0_PRU_R30_7 (6) PR1_PRU0_PRU_R31_7 (7) GPIO3_21
20					EPF_IN* See Testing Section	
21		188	J17	3.3	GPIO3_4 Test with: ./gpio3_4.sh	(0) GMII1_RXDV (1) LCD_MEMORY_CLK (2) RGMII1_RCTL (3) UART5_TXD (4) MCASP1_ACLKX (5) MMC2_DAT0 (6) MCASP0_ACLKR (7)GPIO3_4
22		182	R14	3.3	GPIO1_20 Test with: ./gpio1_20.sh	(0) GPMC_A4 (1) GMII2_TXD1 (2) RGMII2_TD1 (3) RMII2_TXD1 (4) GPMC_A20 (5) PR1_MII1_TXD0 (6) EQEP1A_IN (7) GPIO1_20
23		116	B16	3.3	GPIO3_0 Test with: ./gpio3_0.sh	(0) GMII1_COL (1) RMII2_REFCLK (2) SPI1_SCLK (3) UART5_RXD (4) MCASP1_AXR2 (5) MMC2_DAT3 (6) MCASP0_ARX2 (7) GPIO3_0
24		152	T14	3.3	GPIO1_19 Test with: ./gpio1_19.sh	(0) GPMC_A3 (1) MII2_TXD2 (2) RGMII2_TD2 (3) MMC2_DAT2 (4) GPMC_A19 (5) EHRPWM1B_MUX1 (6) (7) GPIO1_19
25		145	A16	3.3	SPIO_CS0 Test with SPITest0.exe	(0) SPI0_CS0 (1) MMC2_SDWP (2) I2C1_SCL

J4 PIN		LGA Pin	Ball ZCZ	Rail	LGA Name	MODES
					Expansion Connector Pinout	
					And Microchip SPI test board. See test section later in this document.	(3) EHRPWM0_SYNCI (4) PR1_UART0_TXD (5) PR1_EDIO_DATA_IN1 (6) PR1_EDIO_DATA_OUT1 (7) GPIO0_5
26					BATTERY	RTC Battery
27		160	B17	3.3	SPI0_MISO Test with SPITest0.exe And Microchip SPI test board. See test section later in this document.	(0) SPI0_D0 (1) UART2_TXD (2) I2C2_SCL (3) EHRPWM0B (4) EMU3_MUX1 (5) (6) (7) GPIO0_3
28		61	C12	3.3	SPI1_CS0 Test with SPITest1.exe And Microchip SPI test board. See test section later in this document.	(0) MCASP0_AHCLKR (1) EHRPWM0_SYNCI (2) MCASP0_AXR2 (3) SPI1_CS0 (4) ECAP2_IN_PWM2_OUT (5) PR1_PRU0_PRU_R30_3 (6) PR1_PRU0_PRU_R31_3 (7) GPIO3_17
29		146	B16	3.3	SPI0_MOSI Test with SPITest0.exe And Microchip SPI test board. See test section later in this document.	(0) SPI0_D1 (1) MMC1_SDWP (2) I2C1_SDA (3) EHRPWM0_TRIPZONE_INPUT (4) PR1_UART0_RXD (5) PR1_EDIO_DATA_IN0 (6) PR1_EDIO_DATA_OUT0 (7) GPIO0_4
30		60	B13	3.3	SPI1_MISO Test with SPITest1.exe And Microchip SPI test board. See test section later in this document.	(0) MCASP0_FSX (1) EHRPWM0B (2) (3) SPI1_D0 (4) MMC1_SDCD_MUX1 (5) PR1_PRU0_PRU_R30_0 (6) PR1_PRU0_PRU_R31_1 (7) GPIO3_15
31		159	A17	3.3	SPI0_SCLK Test with SPITest0.exe And Microchip SPI test board. See test section later in this document.	(0) SPI0_SCLK (1) UART2_RXD (2) I2C2_SDA (3) EHRPWM0A (4) EMU2_MUX1 (5) (6) (7) GPIO0_2
32		75	D12	3.3	SPI_MOSI Test with SPITest1.exe And Microchip SPI test board. See test section later in this document.	(0) MCASP0_AXR0 (1) EHRPWM0_TRIPZONE (2) SPI1_D1 (3) MMC2_SDCD_MUX1 (4) (5) (6) (7) GPIO3_16
33			F16	3.3	UART0_TX This is console so no other testing required.	Linux Console Access

				Expansion Connector Pinout	
J4 PIN		LGA Pin	Ball ZCZ	Rail	LGA Name	MODES
34		140	H16	3.3	SPI1_SCLK Test with SPITest1.exe And Microchip SPI test board. See test section later in this document.	(0) GMII1_COL (1) RMII2_REFCLK (2) SPI1_SCLK (3) UART5_RXD (4) MCASP1_AXR2 (5) MMC2_DAT3 (6) MCASP0_AXR2 (7) GPIO3_0
35			F15	3.3	UART0_RX This is console so no other testing required.	Linux Console Access
36		154	D16	3.3	GPIO1_17 Test with: ./gpio1_19.sh	(0) GPMC_A1 (1) GMII2_RXDV (2) RGMII2_RCTL (3) MMC2_DAT0 (4) GPMC_A17 (5) PR1_MII1_TXD3 (6) EHRPWM0_SYNCO (7) GPIO1_17
37					3V3_EXP Test with Meter or Scope	3V3_EXP
38		153	U14	3.3	GPIO1_18 Test with: ./gpio1_18.sh	(0) GPMC_A2 (1) GMII2_TXD3 (2) RGMII2_TD3 (3) MMC_DAT1 (4) GPMC_A18 (5) PR1_MII_TXD2 (6) EHRPWM1A (7) GPIO1_18
39						Ground
40						Ground

P4 Pin Descriptions

This section describes the pins on P8 that are not connected directly to the A8 processor. For those connected directly to the A8 processor please refer to the TI AM33xA8ProductPreview document for details of pin usage. Note that the Linux Device table will specify which pin peripheral is used for each pin at power up.

P4-1 and 2 +5.0 VDC

See the earlier section called "Itron Riva Dev Mini Power Supply Handling"

P4-18 HV_CMP

This pin is an input to the PMIC power supply chip on the iSOM module. Its purpose is to notify the iSOM that power is failing and that it needs to shut down all of its power supply rails as fast as possible. This is not a graceful shutdown.

A default voltage divider (100k and 28k resistors) holds this pin above 1VDC until the +5VDC supply drops below 4.6 VDC. If it goes below 1 VDC it will cause a non-graceful shutdown. This input can be driven below 1 VDC by user circuitry if a forced shutdown is required.

There is another pin called EPF_IN* that provides a way of letting the system know of an Early Power Fail condition to permit a graceful shutdown in hardware. Typically, enough capacitance would be provided on the main (+5V) power supply line to allow the system to run long enough for the power rails to be cycled down in the appropriate order with the appropriate delays before the HV_CPM signal is applied through this pin. This signal is an over-ride of the EPF process.

P4-20 EPF_IN* (THIS SECTION REQUIRES WORK)

EPF* is the Early Power Fail input and is an active low. In other words, when EPF* is high there is no presence of a power failure. EPF* is effectively an input to both the PIC and the A8. EPF* is mainly used to allow the product motherboard to alert the module that power is about to be lost. It is typically the first signal to go low when a shutdown is required.

EPF* can be provided to this pin or from circuitry on the board. The on-board circuitry will trigger EPF* when the +5 VDC rail falls to 4.4 VDC. If you require another voltage, then R45 must be removed from the board to use this pin.

EPF* is a required part of the power-on sequence and is required before the PIC will activate the power rails for the A8. Therefor EPF* must be raised after, or simultaneously, when 5VDC is initially applied. Typically, if there are hold-up capacitors on the main supply rail and EPF* is held low until they are sufficiently charged to provide enough hold-up power for the system to shut down gracefully.

If it is not high the PMIC will partially power the module (LDOs) but NOT power the A8 until it goes high.

During normal operations this pin is used as part of the Early Power Fail system. PON_WAKEUP is generated as a result of an EPF* signal and some timing delays.

EPF* (Early Power Fail) is created on the motherboard and sent to the module. It informs the A8 that it must shut down as soon as possible. EPF* also goes to the communications module telling it that it must send PON (Power Outage Notification) packets. After EPF* occurs the communications module and the A8 are operating asynchronously with the A8s only job being to get shut down to conserve power.

While the A8 is shutting down the communications module will put 3 timer values into the PIC via the I2C bus. The communications module will also then enter a low power mode waiting for the PIC.

PON_WAKEUP is generated when the first timer expires in the PIC causing a PIC internal interrupt. PON_WAKEUP is a normally low signal that is active high with a programmable high pulse. The communications module sees PON_WAKEUP as an interrupt and exits low power mode to send a message packet indicating that there has been a power loss.

Once the PIC generates PON_WAKEUP the next timer value is loaded and the process is repeated a total of three times. After the communications module has sent its three PON messages it then shuts down.

P4-26 BATTERY

This is an input to the PCF8546A RTC chip. Its purpose is to provide a method of keeping the RTC time accurate when there is no main power. The battery voltage can be between .9 and 5.0 VDC and switchover thresholds can be set by software. Please see the PCF8563A RTC chip datasheet for configuration and usage of this pin.

P4-37 3V3_EXP

See the previous section called "Itron Riva Dev Mini Power Supply Handling"

EXPANSION PERIPHERAL PORT USAGE

Multiple A8 peripherals are brought out on the Expansion Port. The following sections that help explain their usage

SPI0

A8 name	CONN	Note
SPI0_CS1	NC	Dedicated to DSP
SPI0_CS0	J4-25	Dedicated to user
SPI0_MISO	J4-27	Shared by user and DSP
SPI0_MOSI	J4-29	Shared by user and DSP
SPI0_CLK	J4-31	Shared by user and DSP

SPI1

A8 name	CONN	Note
SPI1_CS1	NC	Dedicated to DSP
SPI1_CS0	J4-28	Dedicated to user
SPI1_MISO	J4-30	Shared by user and DSP
SPI1_MOSI	J4-32	Shared by user and DSP
SPI1_CLK	J4-34	Shared by user and DSP

AIN0...AIN3

A8 name	CONN	Note
AIN0	J4-11	Dedicated to user
AIN1	J4-13	Dedicated to user
AIN2	J4-14	Dedicated to user
AIN3	J4-16	Dedicated to user

I2C2

Note that I2C2 requires a pull-up resistor to 3.3V on both SCL and SDA. The value should be around 2.2k but can vary depending on the devices you have connected.

A8 name	CONN	Note
AIN0	J4-15	Dedicated to user
AIN1	J4-17	Dedicated to user

DSP TO A8 INTERCONNECTS

This section describes the basic connection between the A8 processor and the RF DSP.

More needs to be added here.

A8 name	iSOM Pin	P8 CONN	RF Desc	DSP Name	DSP Pin	
UART4_TX	175	P8-5	UART4_TX	SCI_DSP_RXDC	97	
UART4_RX	190	P8-6	UART4_RX	SCI_DSP_TXDC	96	
UART1_TX	71	P8-33	UART1_TX	SCI_DSP_RXDA	74	
UART1_RX	57	P8-34	UART1_RX	SCI_DSP_TXDA	73	

RF CONNECTOR AND CABLE

There is a very small UF.L connector located between the DSP shield and J4 the expansion interface connector. This is the connection for the radio transceiver. This mates with A HIROSE U.FL connector.

This device must be professionally installed.
Only the following antennas are permitted or antennas of the same type but less peak gain.

Only specified antennas listed in this document may be used for integration of the OEM module to comply with FCC emission limits! Please refer to the antenna tables in this document. Antenna and RF Cable type and purchasing information are provided later in the document.

	931-1040-ND		850MHz, 900MHz, 1.8GHz, 1.9GHz, 2.1GHz CDMA, DCS, EDGE, GPRS, GSM, HSPA, PCS, UMTS, WCDMA Whip, Straight RF Antenna 824MHz ~ 960MHz, 1.71GHz ~ 2.17GHz 1.91dBi @ 900MHz, SMA Male Connector	
	931-1186-ND		Cable Assembly Coaxial SMA to U.FL Female to Female 1.13mm OD Coaxial Cable 7.874" (200.00mm) ATT@<2GHz = < 2.8dB/m ATT < 0.56 dB	

DOWNLOADING, IF NECESSARY (LINUX)

The board firmware, and Linux in general, is made up of several images broken into multiple files. Each file performs a different set of operations at different times. For details of what each file contains please see a Linux Reference.

You will need the following files:
u-boot-spl.bin
u-boot.bin
MLO
u-boot.img
uImage

For the descriptions below it is assumed that the images are in a folder named images at the root of your Linux system on your PC. It is also assumed your terminal is connected on /dev/ttyUSB0.

Enter a terminal program such as minicom. Connect to the main terminal port (UART0 by default) at 115800, N-8-1. Power on the board and it will begin outputting a continuous stream of "C" characters at about 1-2 second intervals if it is an erased board or has the jumpers set as described in an earlier section,

C:\Users\jbean\Documents\ItronProducts\CTO   Design Kit\LinuxTestApps\LinuxStuff\TestBuilds\register_hwtest_isom.config_images\bootloader

Wait until you see the "CCC" pattern and then exit the terminal. Now we put small version of u-boot in RAM that can be used to FLASH the rest of the firmware. On the Linux host command line execute the following:
sx -k /images/u-boot-spl.bin > /dev/ttyUSB0 < /dev/ttyUSB0
sx -k /images/u-boot.bin > /dev/ttyUSB0 < /dev/ttyUSB0

Once these programs complete re-enter the terminal application with the same settings as before. Now you are executing the RAM version of u-boot and we can FLASH the rest of the code.

Run loady of MLO (ymodem)
When it completes do the following two commands:
nand erase 0x0 0x20000
nand write.i 0x82000000 0x0 0x20000

Run loady of u-boot.img (ymodem)
When it completes do the following two commands:
nand erase 0x80000 0x60000
nand write.i 0x82000000 0x80000 0x60000

Run loady of uImage (note may take 10 minutes or more depending on kernel size)
When it completes do the following two commands:
nand erase 0x5A0000 0xCE0000
nand write.i 0x82000000 0x5A0000 0xCE0000

All of the code is now Flashed and ready to run. We need to reboot from the new FLASH image. Cycling power works better but corrupts the RTC when there is no battery. So you may run bootm instead as follows:
bootm ${loadaddr}

The system should now reboot from the FLASH image. Depending on the image you loaded you may be given a chance to break the boot process when u-boot completes before getting into Linux.

ERASING FLASH IMAGE

If you need to erase the chip totally killing Linux and u-boot it can be done from u-boot or Linux.

ERASING FLASH IMAGE FROM U-BOOT

From the command line type:
nand erase.chip

ERASING FLASH IMAGE FROM LINUX

From the command line type:
flash_erase /dev/mtd4 0 0
And then:
flash_erase /dev/mtd8 0 0

ITRON RIVA DEV MINI TEST PROCEDURE

This section of the document explains how to perform a basic hardware test on the Riva Edge Mini using a test fixture, a solderless breadboard adapter or point-to-point wiring.

The tests are described as single item step-by-step actions allowing testing of a single piece of hardware. For instance, if you are not sure a GPIO is working look up its test below and run its respective test.

EQUIPMENT REQUIRED:

1. Itron Riva Dev Mini
2. Test Fixture (Optional)
3. Solderless Breadboard Adapter
4. Bench Power Supply capable of 5 VDC at 1.5 AMPs or greater with Ammeter
5. USB-To-Serial adapter cable with 4-pin connector or individual pins
   a. 3.3 VDC Powered
   b. Self Powered
      i. Leave Pin 3.3 VDC pin disconnected
6. Oscilloscope or logic analyzer or at a minimum a logic probe.[7]
7. Multi-meter

MINIMAL OPERATIONAL CONNECTIONS

This section describes how to connect power for each type of fixture or adapter. It also includes connecting UART0. With these minimal connections you can operate the Linux system from a terminal as console.

Note when making these connections power should be removed from the system.

We will describe all tests as though you are using a solderless breadboard adapter. Although a little more complicated than using the test fixture is more likely that a user will have it. There is a document that describes the test fixture usage on the google drive.

MINI DK TEST FIXTURE

1. Clamp Mini DK onto Test Fixture using spring clamps
2. Ensure that proper pins are inserted in test fixture for
   a. +5 VDC to J4 Pin 1
   b. Ground to J4 Pin 40
   c. RX Pin to J4 Pin 33
   d. TX Pin to J4 Pin 35
   e. 3.3 VDC **Input** Pin to J4 Pin 37
      i. If this USB-To-Serial adapter creates an output voltage do not connect this pin

---

[7] Running the test scripts produces slow toggling signals for GPIO pins. Other pins such as I2C and SPI use much faster signals that may require a scope.

f.   Ground Pin to J4 Pin 39

MINI DK SOLDERLESS BREADBOARD ADAPTER

1.   Plug Mini DK into Solderless breadboard adapter if available
2.   Connect +5 VDC Barrel connector, +5 on center contact, collar is ground.
3.   Plug USB-To-Serial adapter into white connector

MINI DK DIRECT WIRING

This sections assumes you don't have a fixture or solderless breadboard adapter. It assumes you are using wires soldered to board or connector, push terminals on pins or mini jumper clips.

1.   Connect +5 VDC to J4 Pin 1
2.   Connect Ground to J4 Pin 40
3.   Connect USB-To-Serial adapter as follows
   a.   RX Pin to J4 Pin 33
   b.   TX Pin to J4 Pin 35
   c.   3.3 VDC **Input** Pin to J4 Pin 37
      i.   If this USB-To-Serial adapter creates an output voltage do not connect this pin
   d.   Ground Pin to J4 Pin 39

SMOKE/BOOT TEST

1. Perform a visual inspection
   a. Watch for shorts, solder blobs or other manufacturing issues
2. Make sure Power Supply is turned off
3. Connect Power Supply and UART as described above
4. Establish a terminal session at 115200, N, 8, 1
5. Prepare to monitor Ammeter
   a. If exceeds 200ma immediately remove power
6. Turn on Power[8]
   a. If exceeds 500ma immediately remove power
   b. If about 260ma the iSOM (A8) is programmed but DSP isn't.
   c. If about 460ma the iSOM (A8) and DSP are programmed.
7. Watch Terminal for data from Itron Riva Dev Mini
   a. If "cccc", repeating "c"s, then the board is minimally operational as far as hardware but requires loading of MLO and u-boot and kernel if a kernel is required.
   b. If u-boot starts but ends at a u-boot prompt without launching kernel, then the board is minimally operational as far as hardware but the board requires loading of kernel if a kernel is required.
   c. If Linux Kernel starts and ends with a prompt the board is operational as far as the Linux System.[9]
8. Proceed to specific hardware tests described below as needed. All scripts are located at on the google drive.

---

[8] Note the currents specified are for Board Revision 2 and may be different for other revisions. It is also possible that there will be variances board to board depending on software revisions.

[9] In this case you can tell if the DSP is programmed and running by looking at the total current draw on the system. But that does not tell you it is capable of transmitting or receiving.

LED TESTING

A script has been written to toggle each user LED that is located on the Mini DK board and they can be visually monitored for activity.

The scripts are toggleamberled6.sh and toggleamberled6.sh.

GPIO TESTING

All GPIO pins can be tested in a similar fashion. A script is available to toggle each pin requiring you to use an oscilloscope, logic probe or meter to monitor the pins. It will be necessary to substitute the proper GPIO name when running the test script.

This test covers the following pins:
1. J4 Pin 3 GPIO3_18 (gpio3_18.sh)
2. J4 Pin 5 GPIO3_19 (gpio3_19.sh)
3. J4 Pin 7 GPIO3_20 (gpio3_20.sh)
4. J4 Pin 9 GPIO0_20 (gpio0_20.sh)
5. J4 Pin 19 GPIO3_21 (gpio3_21.sh)
6. J4 Pin 21 GPIO3_4 (gpio3_4.sh)
7. J4 Pin 23 GPIO3_0 (gpio3_0.sh)
8. J4 Pin 36 GPIO1_17 (gpio1_17.sh)
9. J4 Pin38 GPIO1_18 (gpio1_18.sh)
10. J4 Pin 22 GPIO1_20 (gpio1_20.sh)
11. J4 Pin 24 GPIO1_19 (gpio1_19.sh)

ANALOG INPUT PINS

This test covers testing the Analog input pins. There is a script available for testing each ADC. The script will continuously read the ADC and display its value in hex on the screen. An adjustable power supply can be used to apply power on the individual pins and varied to change the value being displayed on the screen.

DO NOT EXCEED 1.8 VDC OR THE ADC WILL BE DAMAGED

This test covers the following four pins:
1. J4 Pin 11 AIN_0 (ad0.sh)
2. J4 Pin 13 AIN_1 (ad1.sh)
3. J4 Pin 14 AIN_2 (ad2.sh)
4. J4 Pin 16 AIN_3 (ad3.sh)

I2C2 TESTING

Note that requires a pull-up resistor to 3.3V on both SCL and SDA. The value should be around 2.2k but can vary depending on the devices you have connected.

This test covers testing the I2C port. We use the Linux i2ctools to do the basic test. This test covers the following two pins:
1. J4 Pin 15 I2C2_SCL
2. J4 Pin 17 I2C2_SDA

Following is the actual command sent to the I2C port and the response from the Mini DK with no I2C peripherals on I2C bus 2.

```
# /usr/sbin/i2cdetect -y -r 2
   0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:       -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
```

Now the same command with a Microchip PICKit I2C Demo board attached.

	PKSERIAL-I2C1-ND		24LC02B, MCP9800, MCP3221, TC1321, MCP23008 - Interface, I2C Devices, 5 Evaluation Board	

```
# /usr/sbin/i2cdetect -y -r 2
   0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:       -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: 20 -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- 48 49 -- -- -- 4d -- --
50: 50 51 52 53 54 55 56 57 -- -- -- -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
```

The following table shows the parts on the Demo Board and their respective device addresses. Note that the datasheet shows the left shifted address assuming a r/w bit is inserted at bit 0. I2Cdetect displays the Unshifted address without the r/w bit.

Part #	Description	Unshifted Address	Shifted Address
24LC02B	2Kbit Serial EEPROM	0xAx	0x5x

MCP3221	Low-Power 12-Bit A/D Converter	0x9A	0x4D
TC1321	10-Bit Digital-to-Analog Converter	0x90	0x48
MCP23008	8-Bit I/O Expander	0x40	0x20
MCP9801	High-Accuracy Temperature Sensor	0x92	0x49

SPI TESTING

This test covers testing the two SPI ports. All four pins are tested simultaneously by running a test application individually for each port. The test application is called spitest0.exe for SPI0 and spitest1.exe for SPI1.

A Microchip PICKit Serial SPI Demo Board is used for testing but a scope could be connected to the SPI lines to watch activity. On the SPI Demo Board JP-7 and JP-8 must be installed. The test code will change the LEDs located on the end of the board to show activity.

	PKSERIAL-SPI1-ND		PICkit™ 1 - Interface, SPI Devices, 7 Evaluation Board	

This test covers the following four pins: (spitest0.exe)
1. J4 Pin 25 SPIO0_CS0
2. J4 Pin 27 SPIO0_MISO
3. J4 Pin 29 SPIO0_MOSI
4. J4 Pin 31 SPIO0_SCLK

This test covers the following four pins: (spitest1.exe)
1. J4 Pin 28 SPI1_CSO
2. J4 Pin 30 SPI1_MISO
3. J4 Pin 32 SPI1_MOSI
4. J4 Pin 34 SPI1_SCLK

UART0 TESTING

UART0 is the default UART for the console. So no specific testing is required since this UART is the primary console.

1. J4 Pin 33 UART0_TX
2. J4 Pin 35 UART0_RX

USB1 TESTING

This test covers the testing of USB1.

1. J4 Pin 4 USB1_VBUS
2. J4 Pin 6 USB1_ID
3. J4 Pin 8 USB1_DRVVBUS
4. J4 Pin 10 USB1_DM
5. J4 Pin 12 USB1_DP

EPF* TESTING

To test this pin simply ground it for 5 seconds. When released from ground the system will restart with a reset.

1. J4 Pin 20 EPF_IN*

HV_CMP TESTING

A default voltage divider (2 100k resistors) holds this pin at about 2.5 Volts. If it goes below 1 VDC it will cause a non-graceful shutdown. To test this pin simply ground it for 5 seconds. When released from ground the system will restart with a reset.

1. J4 Pin 18 HV_CMP

BATTERY PIN TESTING

The following pins do not have tests defined at this time.

2. J4 Pin 26 BATTERY

DSP Programming (Requires Fixture)

Programming the DSP requires a programming fixture and a XDS 200 JTAG programmer and a Windows application called CCS UniFlash 3.1.0.[10]

First place the EUT on the fixture and connect the JTAG to the fixture following the instructions from the fixture user guide. Connect the JTAG USB cable to the PC also. Power on the fixture.

Note this programming can be done while the iSOM programming script is running.

Launch the CCS UniFlash application and you should see the following window.
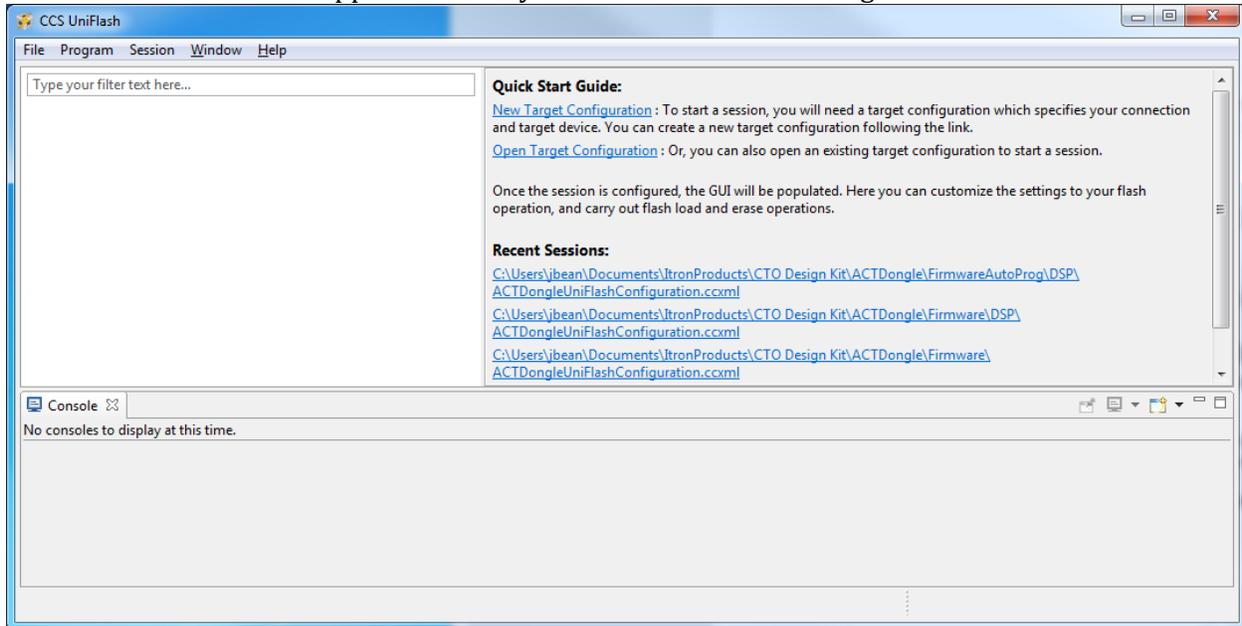
Go to File::Open Existing Target Configuration and use the dialog to browse to wherever you put the ACTDongleUniFlashConfiguration.ccxml file. You will see a "Progress Information" dialog explaining that it is starting.

After completing you should see:

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[10] There may be Linux support for this but I am not aware of it at this writing.
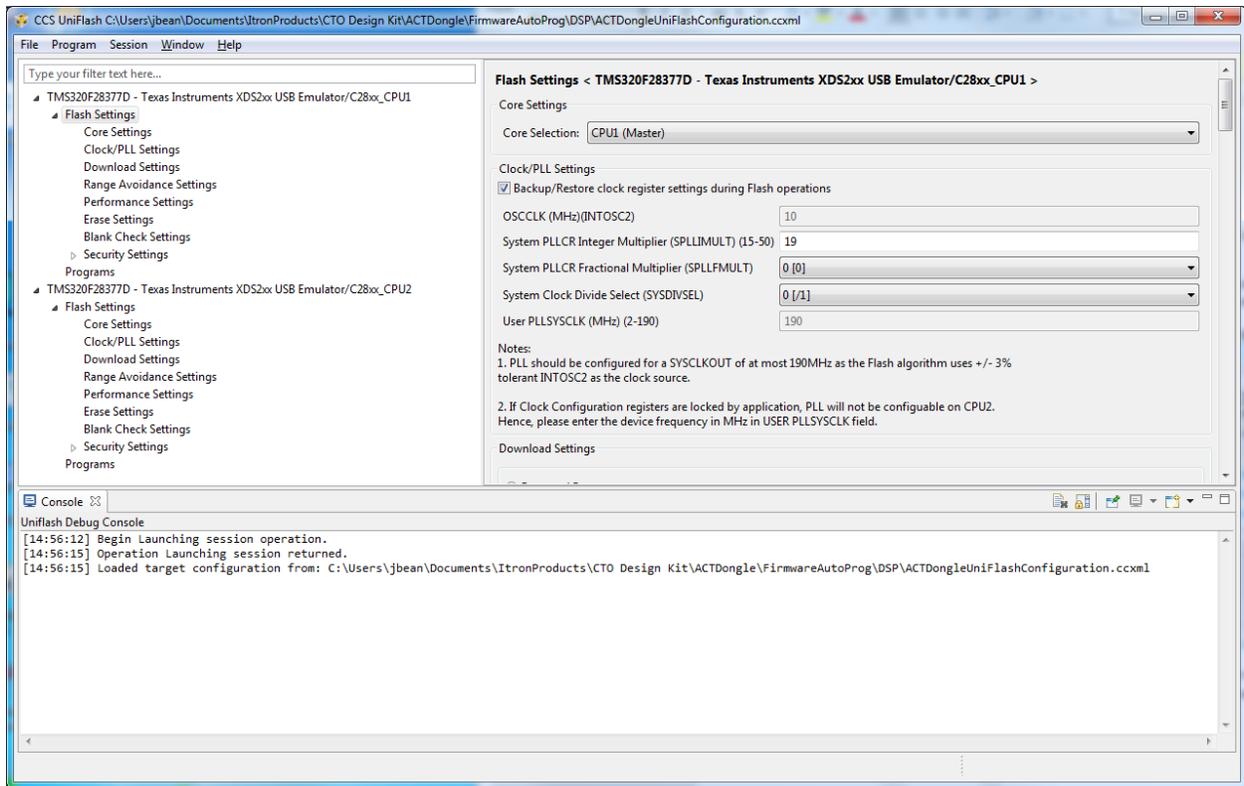
On the left you are shown a summary of both DSP cores. Click on the black triangle that is next to "Flash Settings" for each core to close that information. This step is optional.
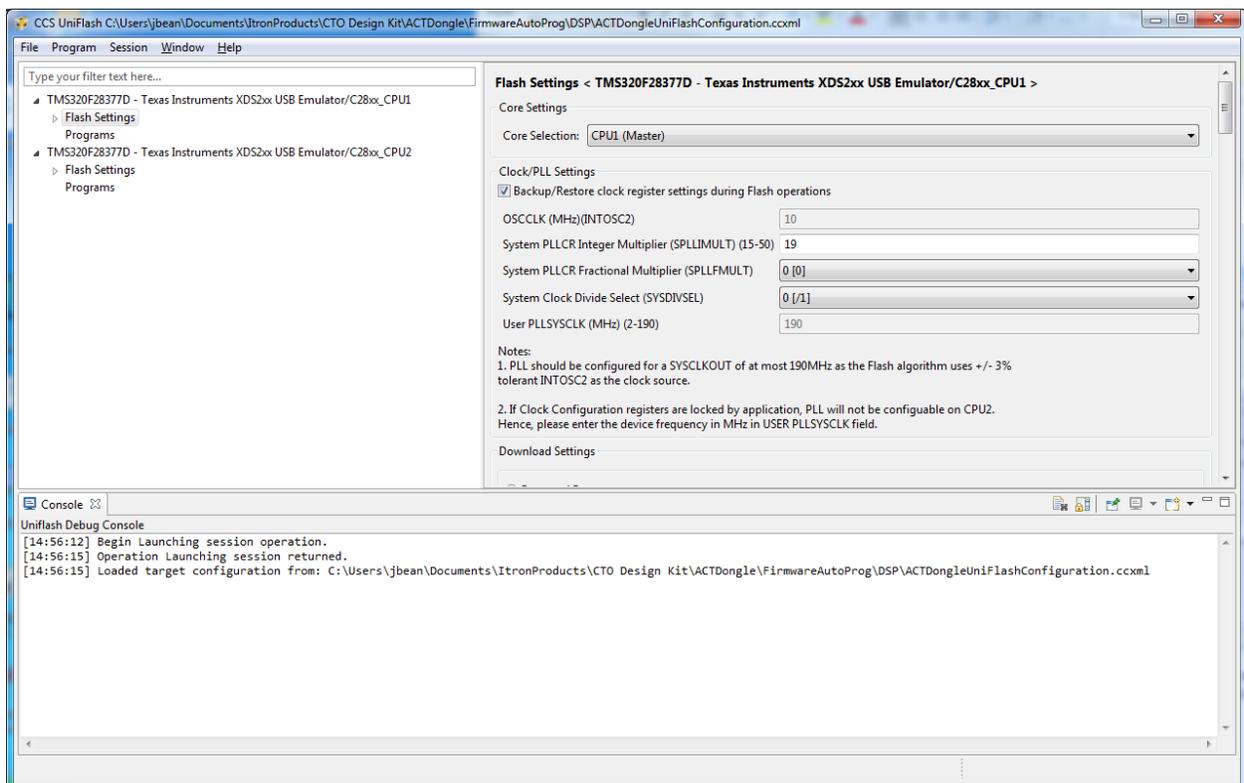
Now click on "Programs" for Core 1 (CPU1) to select the file for the first core. The ccxml file you loaded already has the proper filename in place.
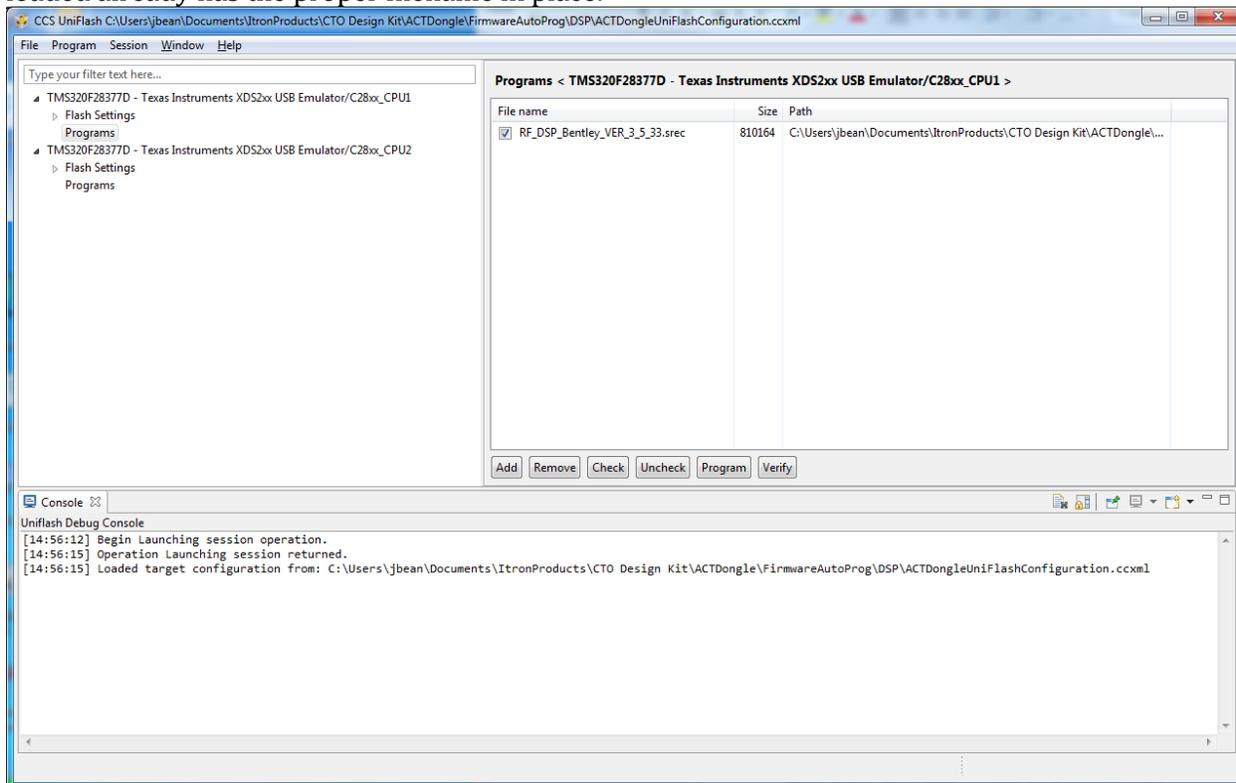
Now click on the "Program" soft-button on the right panel. You will see a "Progress Information" dialog explaining the steps as it programs.

Now click on "Programs" for Core 2 (CPU2) to select the file for the first core. The ccxml file you loaded already has the proper filename in place.

Now click on the "Program" soft-button on the right panel. You will see a "Progress Information" dialog explaining the steps as it programs.

Both Cores are now programmed.

USB-TO-SERIAL ADAPTERS

Since most PCs no longer have serial ports it is customary to use a USB-to-serial TTL converter cable. We typically use cables made by FTDI (Future Technology Devices International LTD). It is possible to use cables from other manufacturers that meet the same specifications. Use the datasheet for the particular cable you have to identify the 4 required signals (Rx, Tx, Gnd, +3.3VDC In) along with drawing below to connect your board.

We typically use a USB-to-Serial[11] converter to bring UART0 out as our terminal port. This port operates in 115kbps N81 format. The adapter is powered by 3.3VDC from the Itron Riva Dev Mini board.

One cable is the TTL-232R-RPI from FTDI sold by Digi-Key as part number 768-1024-ND. This cable has 3 wires with connectors designed to be individually placed on individual pins. Because there are only 3 pins the 3.3 VDC supplies are not connected together.

Figure 8 - FTDI TTL-232R-RPI

Another cable is the TTL-232R-3V3-WE from FTDI sold by Digi-Key as part number 768-1016-ND. This cable has 6 unterminated wires of which only 4 are used. The image below shows the two ends of this cable using a 4-pin female connector.

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[11] Note this is a serial 0VDC to 3.3VDC connection NOT RS-232.

Figure 9 - FTDI TTL232R-3V3-WE

The white housing shown is a Molex part number –22013047 or Digi-Key WM2002-ND.
Each wire requires a female pin Molex part number – 0008500114 or Digi-Key WM1114-ND.

Figure 1: Serial-To-USB Adapter cable

Figure 2: Typical 4-Pin Keyed Adapter

USB CABLES

The board can act as a USB host or a USB peripheral depending on the cable chosen. How the board acts is determined by using one of the following cables select USB Host or USB peripheral.

	AE1450-ND	Board looks like USB Device, and is powered by Host	USB 2.0 Cable A Male to Mini B Male 3.28' (1.00m) Shielded
	10-00003-ND	Board looks like Host, and Powers device	USB 2.0 Cable A Female to Mini A Male 0.33' (100.0mm) Shielded

To use the ACT board as an USB host the ACT board must be powered by the expansion connector +5 V pins. The white cable with a Mini-A to Type-A Receptacle would be used. The peripheral being hosted, for instance a thumb drive, would be plugged into Type-Receptacle and Mini-A plug into the Mini-AB Jack on the board.

To use the ACT board as a USB peripheral the board must be powered by the USB cable[12]. For this mode the black cable with a Mini-B to Type-A Plug would be used. The Mini-B would plug into the ACT board and the Type-A plug would plug into the PC or other host.

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[12] This may change. It may be possible to power the board by the expansion connector while it is serving as a peripheral to allow more power.

APPENDIX A: FCC RELATED STATEMENTS

DECLARATION OF CONFORMITY

The Itron Riva Dev Mini Module complies with Part 15 of the FCC rules and regulations. Compliance with the labeling requirements, FCC notices and antenna usage guidelines is required. To fufill FCC Certification, the OEM must comply with the following regulations:

1. The system integrator must ensure that the text on the external label provided with this device is placed on the outside of the final product.
2. Itron Riva Dev Mini Module may only be used with antennas that have been tested and approved for use with this module [refer to the antenna tables in this section].

OEM LABELING REQUIREMENTS

WARNING: The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the final product enclosure that displays the contents shown in the figure below. Required FCC Label for OEM products containing the Itron Riva Dev Mini Module.

Contains FCC ID: 2ANHYMINI1

The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i.) this device may not cause harmful interference and (ii.) this device must accept any interference received, including interference that may cause undesired operation.

FCC NOTICES

IMPORTANT: The Itron Riva Dev Mini Module has been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Modifications not expressly approved by Itron, Inc. could void the user's authority to operate the equipment.

OEMs must test final product to comply with unintentional radiators (FCC section 15.107 & 15.109) before declaring compliance of their final product to Part 15 of the FCC Rules.

The RF module has been certified for remote and base radio applications. If the module will be used for portable applications, the device must undergo SAR testing.

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: Re-orient or relocate the receiving antenna, Increase the separation between the equipment and receiver, connect equipment and receiver to outlets on different circuits, or Consult the dealer or an experienced radio/TV technician for help.

RF Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC-Approved Antennas (902-928 MHz)

The Itron Riva Dev Mini Module can be installed utilizing antennas and cables constructed with standard connectors (Type-N, SMA, TNC, etc.) if the installation is performed professionally and according to FCC guidelines. For installations not performed by a professional, non-standard connectors (RPSMA, RPTNC, etc.) must be used.

The Itron Riva Dev Mini Module have been tested and approved for use with all the antennas listed in the tables below.

Antennas not listed in the table must be tested to comply with FCC Section 15.203 (Unique Antenna Connectors) and Section 15.247 (Emissions).

OMNI-DIRECTIONAL ANTENNAS				
Manufacturer	Part Number	Type	Peak Gain @ 902-928MHz	Min. cable loss @ 902-928MHz[13]
Taoglas Limited	TG.22.0111	Monopole	1.91 dBi	0.56 dB

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[13] The cable used was for FCC certification was 200mm Taoglas CAB.718, with attenuation of 2.8 dB/m below 2 GHz.