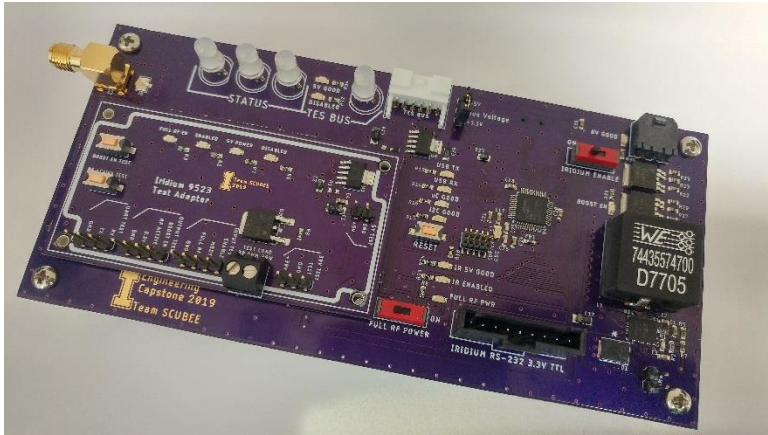


IRIDIUM 9523 CARRIER USER GUIDE

Team SCUBEE 2018-2019



Iridium Carrier Overview

A test-bench for the development of a software package to interface with the Iridium 9523, the Iridium Carrier Module is designed to make programming and configuring the 9523 as simple as possible. The carrier is modeled after the Arduino Zero and is loaded with Sparkfun Electronic's SAMD21 Arduino Bootloader. Any example Arduino code can be run as-is on the carrier module, which will be identified as a Sparkfun development board when connected to a PC via the onboard mini-USB port. The module must be powered from an external supply via the TES Bus Adapter PCB as the mini-USB port does not supply power to the module.

Programming:

The carrier is designed to be easily programmable via the Arduino IDE once [Sparkfun's SAMD21 Arduino cores](#) have been installed. The carrier emulates an Arduino Zero, complete with an LED on pin 13. All standard serial and I2C buses are used, eliminating the need to bit-bang communication protocols or to modify standard Arduino libraries, such as the SX1509 I2C expander library. Additionally, a standard ARM Cortex debug header allows for direct programming of the SAMD21 using Atmel studio and a USB debugger such as the Segger J-link. However, programming the carrier in this way will remove the Arduino bootloader from the processor. The bootloader can always be burned back onto the carrier later.

[Bootloader File](#)

[Bootloader Burning Guide](#)

Power:

The carrier must be fed from a clean 5VDC supply via the TES Bus connector capable of sourcing at least 1.5A. This supply enables complete functionality of both the carrier board and an attached Iridium 9523 **except** for data transmission from the Iridium 9523. A 6VDC to 10VDC supply capable of sourcing at least 5A must be connected to the Battery connector of the carrier board to power the boost converter that feeds the Iridium RF transmitter.

Troubleshooting:

To verify signal behavior, test points are located on the bottom side of the carrier board and are referenced to the common ground header on the top side of the board. To monitor the Iridium RS-232 bus or to directly communicate with the Iridium, a Raspberry Pi or other 3.3V device can be connected via the RS-232 breakout header. Debug information can also be sent via the mini-USB port when enabled, which is the only un-buffered serial bus that is normally connected to the processor. The 'uC GOOD', 'I2C GOOD', and WS2812B LEDs can also be used to indicate state as they are not tied to any other signal line. No red LEDs should be lit during standard operation, with the exception of the 'FULL RF POWER' LED. If the Iridium is set to full power via the 'FULL RF POWER' switch, a minimum safe distance of 1 meter must be maintained around the antenna. The full broadcast power setting is only able to be enabled or disabled manually.

PCB Connectors

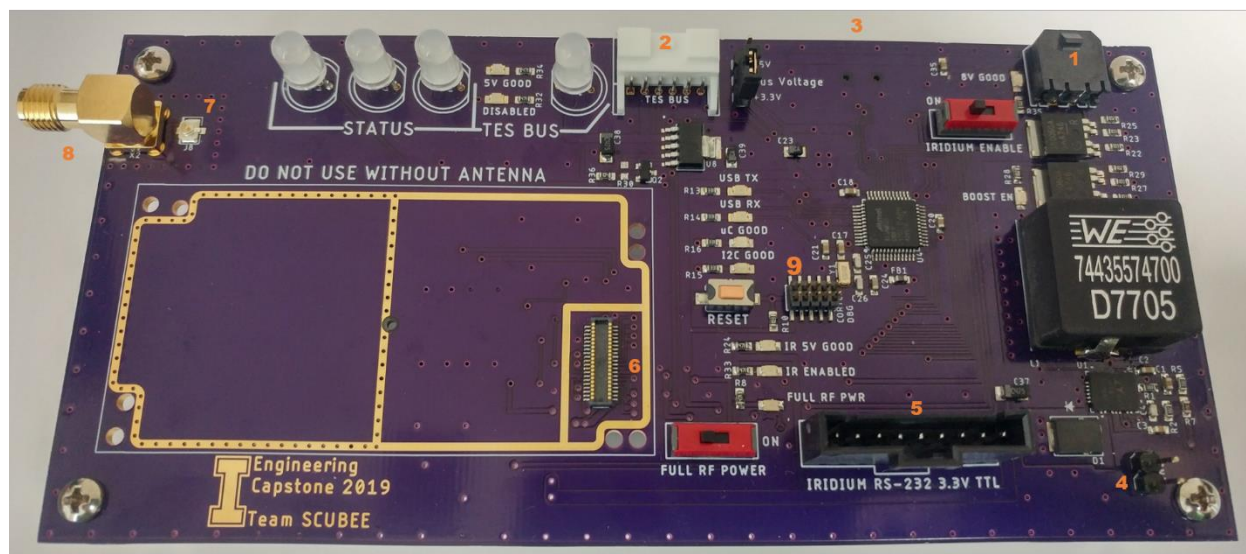


Diagram Number	PCB Name	SCH Name	MFG PN#	Function
1	BATT PWR	X1	Molex 0436500200 *Micro-Fit 3.0*	6-10VDC input to power boost converter
2	TES BUS	J7	JST S06B-PASK-2(LF)(SN) *JST PA Series*	5VDC (input), Master Enable (3.3-5V input), GPS Flag (3.3/5V output), Serial UART (3.3/5V IO)
3	SAMD21 PRG	J5	Amphenol 10033526-N3212LF *USB-B mini*	Standard USB data only for Arduino use of carrier or debug
4	GND	J6	Standard .1" male header	Common ground point for test points
5	IRIDIUM RS-232	X3	Molex 0705430043	'Direct' breakout of Iridium communication pins for offboard debugging
6	None	J1	Molex 0538850408	Iridium 9523 mating connector
7	None	X2	Hirose U.FL-R-SMT-1(10) *50-ohm U.FL*	Iridium U.FL mating connector (Iridium to carrier)
8	None	J8	Taoglas PCB.SMAFRA.HT *50-ohm SMA*	Antenna SMA connector (Antenna to carrier)
9	CORTEX DEBUG	J4	Samtec FTSH-105-01-F-DV	Standard ARM debug header – use with Segger J-Link or similar

Microcontroller Interface Signals

Signal Group	Signal Name	Signal Type	Signal Controller	IC Pin	Pin Name/Bus	Arduino IDE Reference	Notes
Boost Converter	3959_EN	O	SX1509	2	3	/	Active high enable - activates 3959
	3959_GOOD	I	SX1509	1	2	/	Feedback from 3959, active high
Iridium I/O	BOOST_EN	I	SX1509	19	12	/	Boost power request from 9523
	TX_ACTIVE	I	SX1509	15	10	/	TX warning flag from 9523 - GPS protection
	PWR_EN	O	SX1509	20	13	/	Active high enable signal – MUST ENABLE 5V SUPPLY BEFORE ENABLING 9523
Iridium RS-232 Bus	IO_RX	Serial	SAMD21	16	PA11	"Serial1"	Standard UART serial 3.3V TTL signal level
	IO_TX	Serial	SAMD21	15	PA10		
	IO_RTS	I/O	SAMD21	24	PA15	D5	See 9523 User Guide for configuration
	IO_DTR	I/O	SAMD21	29	PA20	D6	See 9523 User Guide for configuration
	IO_DSR	I/O	SAMD21	23	PA14	D2	See 9523 User Guide for configuration
	IO_RI	I/O	SAMD21	24	PA18	D10	See 9523 User Guide for configuration
	IO_CTS	I/O	SAMD21	13	PA08	D4	See 9523 User Guide for configuration
	IO_DCD	I/O	SAMD21	25	PA16	D11	See 9523 User Guide for configuration
Bus Buffers	EN_IR_BUS	O	SX1509	14	9	/	Active high enable – connects Iridium RS-232 bus to board – MUST ENABLE AFTER ENABLING PWR_EN
	EN_RS232_BUS	O	SAMD21	30	PA21	D7	Active high enable – connects Iridium RS-232 bus to breakout header
	EN_TES_BUS	O	SX1509	16	11	/	Active high enable – connects SAMD21 Serial bus to TES connector
Debug	SYS_LED	PWM	SAMD21	26	PA17	D13	Standard Arduino pin 13 LED for debug
	I2C_LED	PWM	SX1509	7	6	/	Debug LED for I2C expander
	PIXELS	'PWM'	SAMD21	28	PA19	D12	WS2812B 'NeoPixel' string of 4 – 'RGB' type NOT 'GRB' LEDs
	PWR_SW	I	SX1509	21	14	/	Physical SPDT slider switch input

PMIC	5V_EN	O	SX1509	27	0	/	Active high enable – Enables 5V supply to 9523 – MUST BE ENABLED BEFORE PWR_EN
	5V_ISENSE	Analog	SAMD21	7	PB08	A1	Analog current feedback from PMIC – see datasheet for details
	8V_EN	O	SX1509	28	1	/	Active high enable – Enables 8V supply to 3959 MUST BE ENABLED BEFORE 3959_EN
	8V_ISENSE	Analog	SAMD21	8	PB09	A2	Analog current feedback from PMIC – see datasheet for details
TES Bus UART	SYS_TX	Serial	SAMD21	37	PB22	“Serial”	Standard UART serial 3.3V TTL signal level
	SYS_RX	Serial	SAMD21	38	PB23		
I2C Bus	SDA	I2C	SAMD21	31	PA22	I2C 0	Arduino standard I2C bus (no library modification required)
	SCL	I2C	SAMD21	32	PA23		