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Modules

Development Kit Guide

HL78xx Series, HL7900

January 2026

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Revision History

Revision Number	Release Date	Changes
1	March 2022	Creation
2	July 2022	Modify the content
3	June 2024	Removed List of Figures and List of Tables TOCs Minor formatting updates Added description after Table 3-16 Added Interface for Arduino® and Interface for STMod+ Updated Snap-In Connector Changed to Semtech template
3.1	August 2024	Added HL7900 information Minor edits and updates from internal review Used high resolution images for the development kit
4	November 2024	Added 3.5.2 SPI / UART3 Interface
5	February 2025	Updated note under Introduction
6	January 2026	Added an important note to help prevent USB enumeration issues in the following sections: ▪ 3.3 USB (Main) ▪ 3.5.1 USB-UART0/3 ▪ 3.6.1 USB-UART1

Contents

1: Introduction

This document describes the Development Kit and how it integrates with the HL78xx series of embedded modules (via specific snap-in connector) and the HL7900 module. The Development Kit may be used to develop both software and hardware applications based on embedded modules from the HL78xx series and the HL7900.

It also briefly describes the different interfaces and peripheral connections supported by the Development Kit and provides schematics to facilitate the user's understanding and configuration of the Development Kit board for their own application use.

The following table enumerates the different HL module variants that can be used with the Development Kit.

Table 1-1: Supported Module Variants

Variant Name	Description
HL78xx	2G, LTE Cat-M1 NB1/2 with GPS and GLONASS
HL7900	LTE Cat-M1 NB1/2 with GPS and GLONASS

Note: The HL78xx series development kit only supports Ring C pins. Functions on the HL7900 Ring B pins are not supported.

For more information about the HL78xx series modules and the HL7900, refer to their corresponding Product Technical Specification document.

2: General Description

This section gives a brief overview of the Development Kit and describes the interfaces and special jumpers used to control or set the unit's behavior. It also lists all available test points on the Development Kit board.

2.1 Development Kit

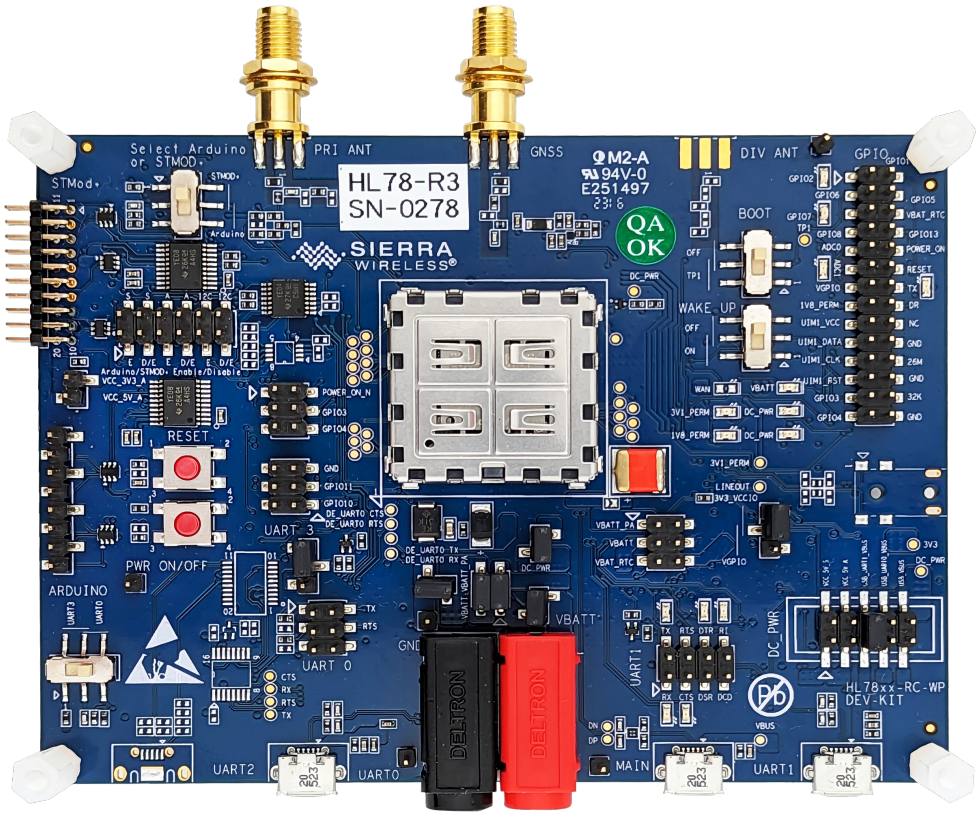


Figure 2-1: Development Kit—Top View

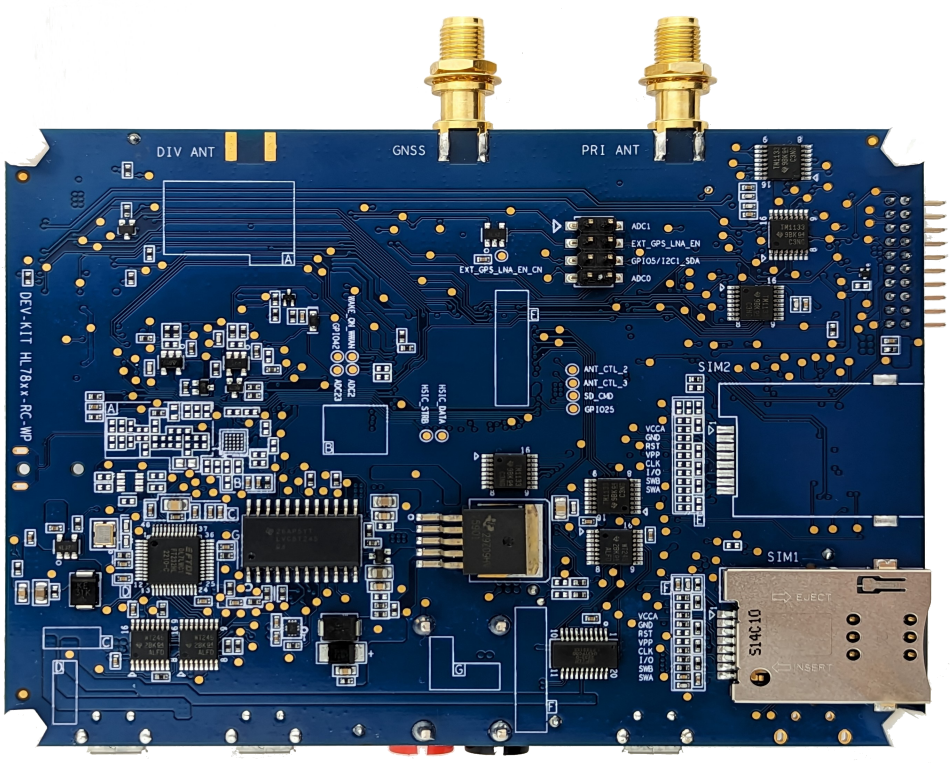


Figure 2-2: Development Kit—Bottom View

2.1.1 Features

Interfaces available on the Development Kit board include:

- Flexible power supply options:
  - Native USB connector
  - UART to USB connector
  - Banana jacks
- ON/OFF push button
- BOOT Switch
- Tests points (TP) to access all signals of the embedded module
- Main serial link (UART1), interfaced through USB connector and USB to serial converter, for modem port with full signals
- Auxiliary serial link, interfaced through USB connector and USB to serial converter, for UART1 function with 8 wire UART signals
- Auxiliary serial link, interfaced through USB connector and USB to serial converter, for UART0/3 function with 4 wire UART signals (Debug Log)
- Full speed main USB connector
- SIM 3V / 1.8V (with SIM presence management)
- GPIOs
- ADCs
- TX-ON (RF transmit signal)
- System 19.2Mhz clock out
- VGPIO reference voltage out
- LEDs for several indications

- RF connector and detection circuit antenna
- GNSS connector and detection circuit antenna
- LNA enable by GNSS
- Snap-in connector (for plugging in the HL78xx series modules)
- STMod+ connector for easy connection to STM32 development boards.
- IO Header with access to most module IOs.
- Arduino Header with access to they key signals needed to interface to an Arduino board.

Refer to Interfaces for detailed information about these interfaces.

2.1.2 Connectors and Component Placement

Refer to the following figure for the location of connectors and other components on the Development Kit.

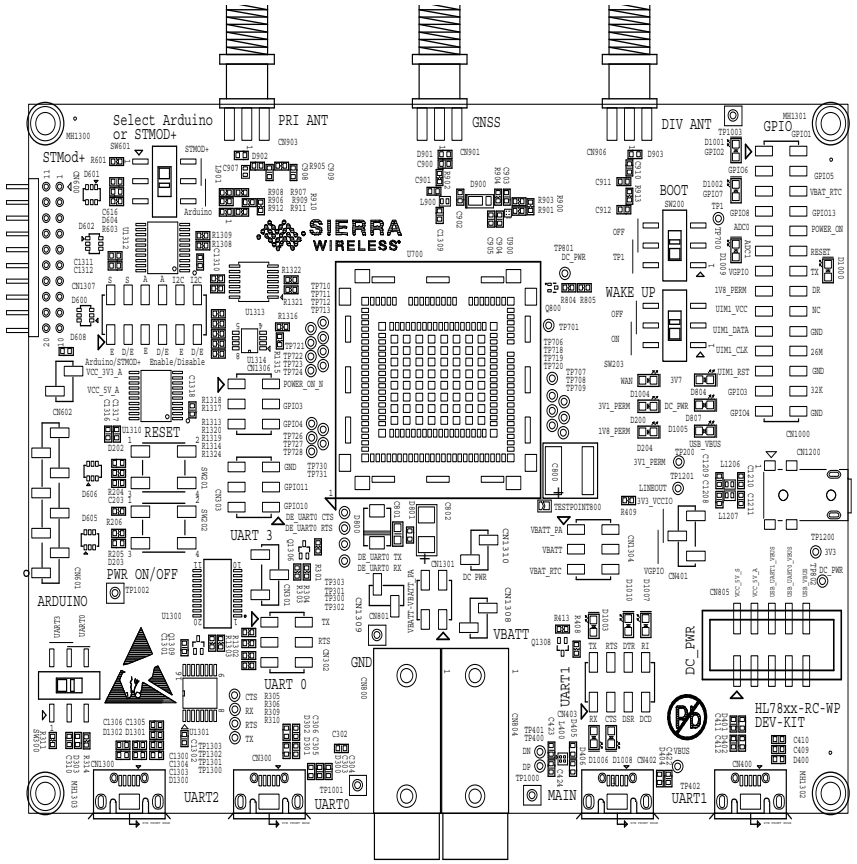


Figure 2-3: Available Connectors and Components – Top

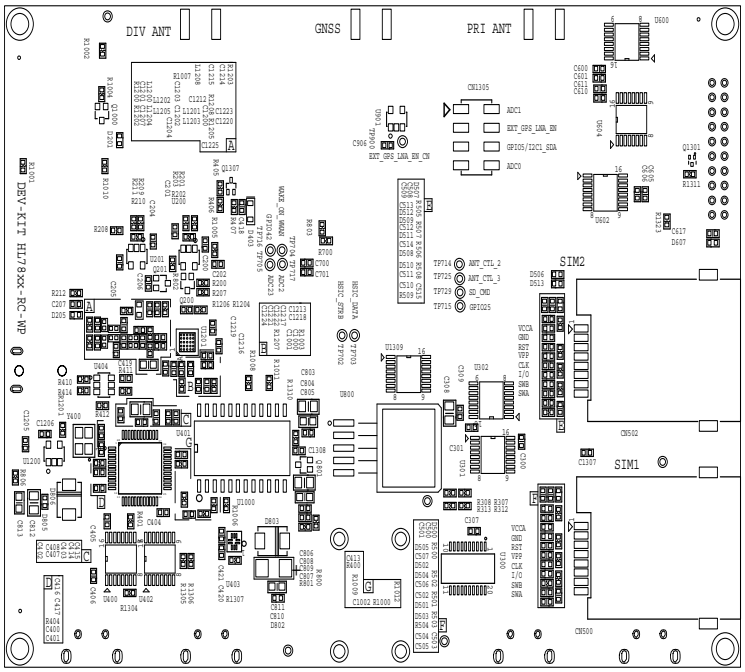


Figure 2-4: Available Connectors and Components – Bottom

The following table describes the connectors and switches available on the Development Kit and the table after describes the different connections available.

Table 2-1: Connector and Switch Description

Connector / Switch	Description	HL78xx	HL7900
SW200	BOOT	✓	✓
SW201	RESET pushbutton	✓	✓
SW202	POWER_ON_N switch	x	x
SW203	WAKE-UP switch	✓	✓
SW300	UART0 or UART3 selector	✓	✓
CN300	USB-UART0 (dwl and debug port)	✓	✓
CN301	DEBUG UART0 to USB Enable	✓	✓
CN302	UART0 test pin	✓	✓
CN303	UART3 test pin	✓	✓
CN400	USB-UART 1	✓	✓
CN401	UART1 to USB converters	✓	✓
CN402	Main USB	✓	x

Table 2-1: Connector and Switch Description (Continued)

Connector / Switch	Description	HL78xx	HL7900
CN403	UART1 test pin	✓	✓
CN500	SIM1	✓	✓
CN502	SIM2	x	x
CN600	STMod+ header	✓	✓
CN601	Arduino IO header	✓	✓
CN602	Arduino 3V / 5V input select	✓	✓
SW601	Arduino / STMod+ selector	✓	✓
U700	Snap-in connector	✓	✓
CN800	GND banana jack	✓	✓
CN801	4V, 3.75A power (VBATT_PA)	✓	✓
CN804	VBAT banana jack	✓	✓
CN805	Power supply selector	✓	✓
CN901	GNSS connector	✓	✓
CN903	RF main connector	✓	✓
CN1000	GPIO test pin	✓	✓
CN1306	UIM1_DET/GPIO3 GPIO4	✓	✓
CN1307	Arduino / STMod+ enable and disable	✓	✓
CN1301	VBATT VBATT_PA	✓	✓
CN1305	Antenna detection circuit enable for GNSS/ EXT_GPS_LNA_EN, RF/GPIO5, RF/ADC0	✓	✓
CN1304	VBAT_RTC	x	x
CN1308	VBATT power jumper	✓	✓
CN1309	VBATT_PA power jumper	✓	✓
CN1310	DC_PWR power jumper	✓	✓

Table 2-2: Available Connector, Switch and Jumper Solder Pads

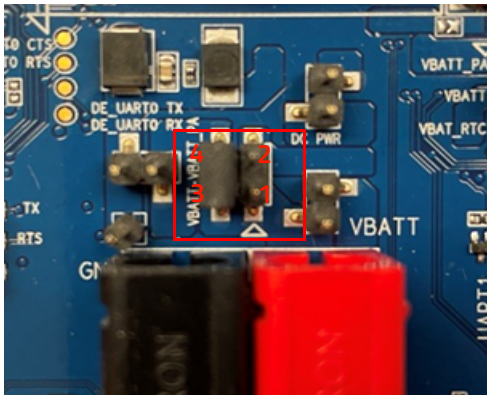
Connector, Switch and Jumper Solder Pads	Connection
SW200	Switch “OFF” the module to force it to go into Download mode
SW201	▪ push button (level ‘0’) to enable RESET ▪ No push button (level ‘1’) to disable RESET
SW202	▪ push button (level ‘0’) to enable POWER_ON_N on the module ▪ No push button (level ‘1’) to disable POWER_ON_N on the module
SW203	▪ Switch to "ON" (level '1') to enable WAKE_UP ▪ Switch to "OFF" (level '0') to disable WAKE_UP
SW300	▪ Switch to "3V1_PERM" to enable UART0 ▪ Switch to "GND" to enable UART3
CN301	Short with a jumper to enable UART0
CN401	Short with a jumper to enable UART1
CN1307	Short with a jumper to enable the STMod+ or Arduino
SW601	▪ Switch to “3V1_PERM” to enable STMod+ ▪ Switch to “GND” to enable Arduino
CN801	This connector is shorted by default via a jumper: ▪ Jumper connected = VBATT connection with VBATT_PA ▪ Jumper disconnected = VBATT disconnection with VBATT_PA
CN1301 	▪ Jumper installed on 3 and 4 = VBATT connection with VBATT_PA ▪ Jumper removed from 3 and 4 = VBATT and VBATT_PA are separated ▪ Jumper installed on 1 and 2 = DC_PWR is connected to VBATT and/or VBATT_PA ▪ Jumper removed from 1 and 2 = DC_PWR is not connected to VBATT and/or VBATT_PA

Table 2-2: Available Connector, Switch and Jumper Solder Pads (Continued)

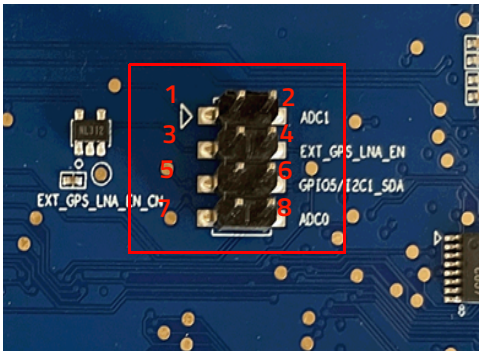
Connector, Switch and Jumper Solder Pads	Connection
CN805	▪ Jumper installed on 1 and 2: Power from STMOD+ 5V ▪ Jumper installed on 3 and 4: Power from ARDUINO 5V. ▪ Jumper installed on 5 and 6: Power from USB_UART1 5V ▪ Jumper installed on 7 and 8: Power from USB_UART0 5V ▪ Jumper installed on 9 and 10: Power from Main USB 5V
CN1305 	*Note: This is located on the back of the board.* ▪ Jumper installed on 1 and 2 = antenna detection circuit enable for GNSS antenna ▪ Jumper removed from 1 and 2 = ADC1 application ▪ Jumper installed on 3 and 4 = GPS LNA Enable ▪ Jumper removed from 3 and 4 = GPS LNA Disable ▪ Jumper installed on 5 and 6 = antenna detection circuit enable for RF antenna ▪ Jumper removed from 5 and 6= GPIO5 application ▪ Jumper installed on 7 and 8 = antenna detection circuit enable for RF antenna ▪ Jumper removed from 7 and 8 = ADC0 application

Table 2-3: Available Test Points

Test Points	Description
TP200	3V1_PERM
TP300	DEBUG_UART_TX
TP301	DEBUG_UART_RTS
TP302	DEBUG_UART_RX
TP303	DEBUG_UART_CTS
TP400	USB_DP
TP401	USB_DN
TP402	USB_VBUS
CN403	UART1_RX UART1_TX UART1_CTS UART1_RTS UART1_DSR UART1_DTR UART1_DCD UART1_RI
CN602	VCC_3V3_A VCC_5V_A

Table 2-3: Available Test Points (Continued)

Test Points	Description
TP700	TP1
TP701	GND
TP702	HSIC_STRB
TP703	HSIC_DATA
TP704	WAKE_ON_WWAN
TP705	ADC3
TP706	WWAN_LED_N
TP707	GPIO32
TP708	GPIO36
TP709	GPIO34
TP710	GPIO21
TP711	GPIO23
TP712	W_DISABLE_N
TP713	ANT_CTL_0
TP714	ANT_CTL_2
TP715	GPIO25
TP716	GPIO42
TP717	ADC2
TP718	GPIO33
TP719	GPIO37
TP720	GPIO35
TP721	GPIO22
TP722	GPIO24
TP723	SAFE_PWR_REMOVE
TP724	ANT_CTL_1
TP725	ANT_CTL_3
TP726	SD_CLK
TP727	SD_D2
TP728	SD_D0
TP729	SD_CMD
TP730	SD_D3

Table 2-3: Available Test Points (Continued)

Test Points	Description
TP731	SD_D1
TP801	LDO_1V8_PERM LDO_3V1_PERM enable
TP802	DC_PWR
TP900	EXT_GPS_LNA_EN
CN1000	GPIO testing header
TP1000	GND
TP1001	GND
TP1002	GND
TP1200	VCC_3V3
TP1201	WM8944 LINEOUT
TP1300	UART2_TX
TP1301	UART2_RTS
TP1302	UART2_RX
TP1303	UART2_CTS

2.1.3 Snap-In Connector

The snap-in connector houses the embedded module and allows easy switching between any of the supported HL78xx series embedded modules.

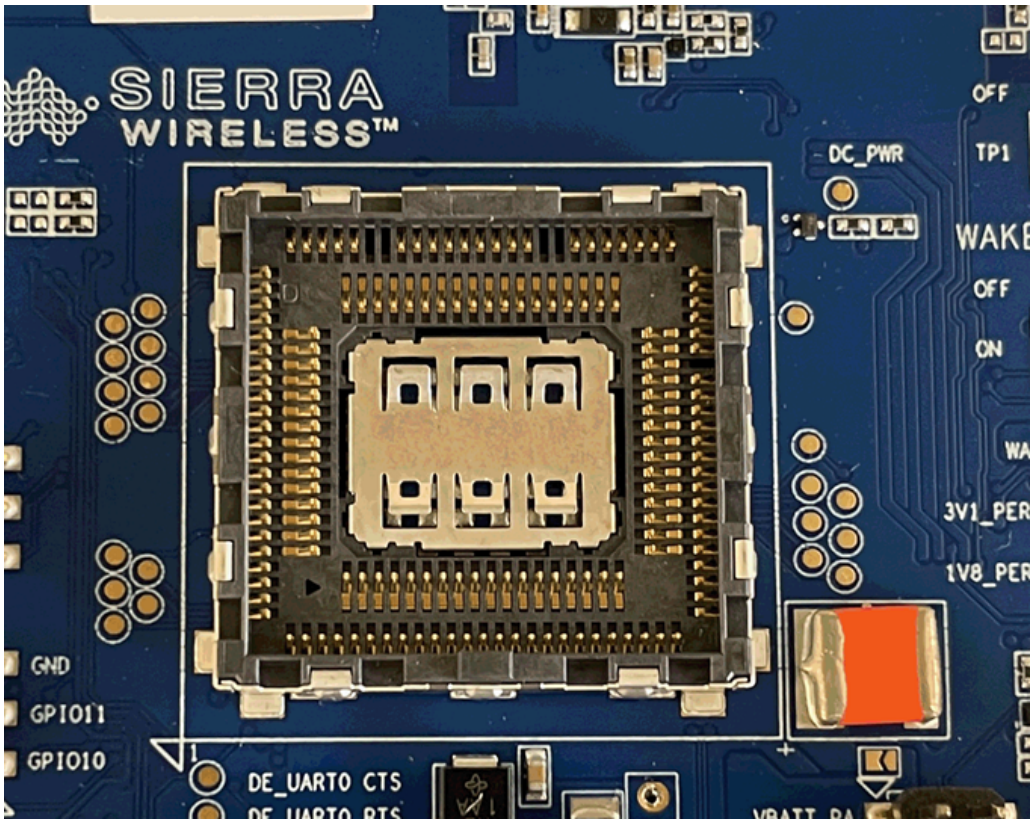


Figure 2-5: Snap-In Connector

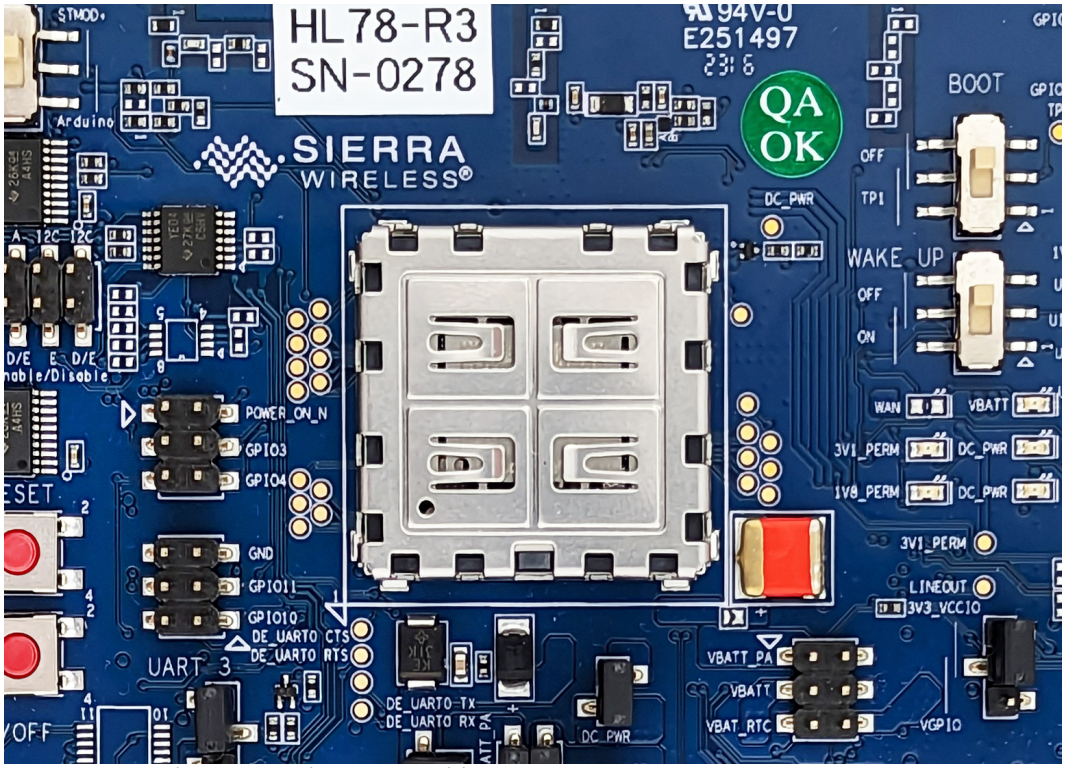


Figure 2-6: Snap-In Connector with Interposer and an HL78xx Module

Note: The HL78xx module needs to be placed in the snap-in socket in the correct orientation. This is determined by lining up the dot on the unit itself, the lid, and the arrow on the snap-in socket base itself (refer to Figure 2-5).

The HL7900 and HL78xx modules share the same PIN defined in RING-C, excluding the USB function. Therefore, the development kit can accommodate HL7900 RING-C features such as GPIOs, RF, GPS, UART, ADC, etc. For support regarding the HL7900 RING-B function (JTAG, PSRAM, Dual-FLASH, etc.), contact Semtech.

The plastic interposer included in the kit must be used for the HL78xx modules. After plugging an HL78xx module in the snap-in connector, attach the snap-in cover as show in the following figure.

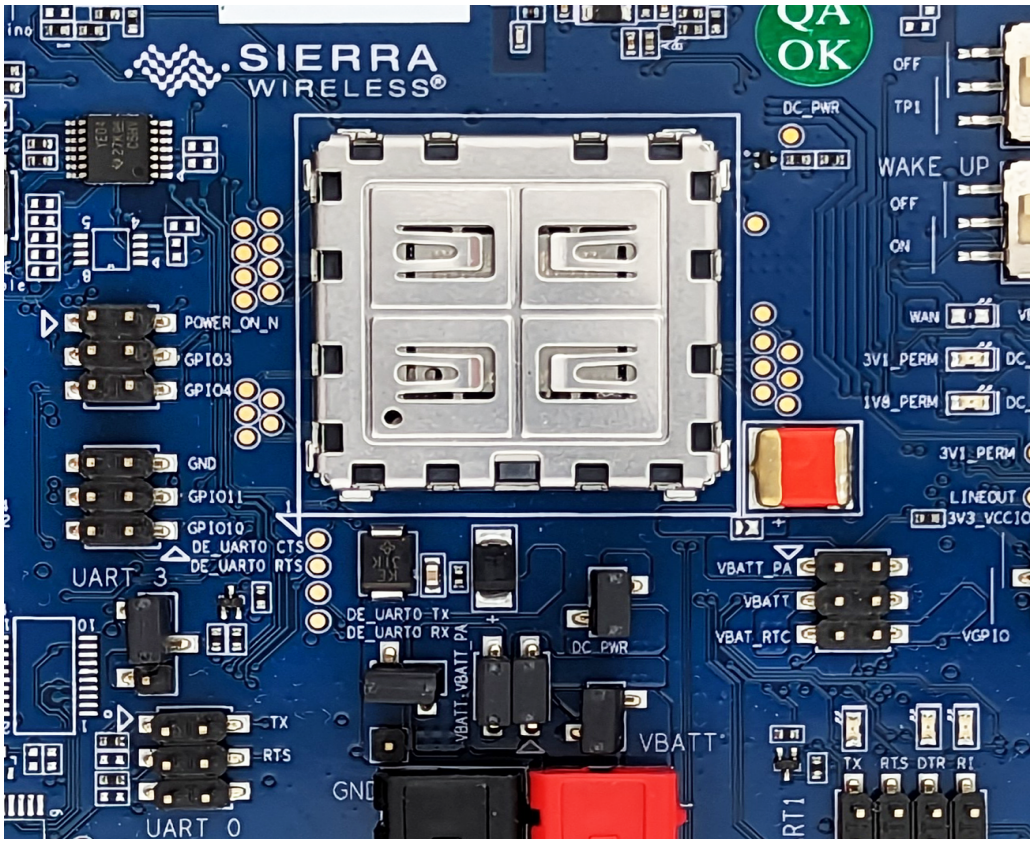


Figure 2-7: Snap-In Connector with HL78xx Module and Cover

2.1.4 Module Pins

There are a total of 66 module pins available on the Development Kit. The following table lists the test point label and the corresponding signal names of the applicable HL78xx module.

For more information about these signals, refer to the Product Technical Specification document.

Table 2-4: HL78xx Series Development Kit Module Pins

Module Pin	Serigraphy	Test Points	Connector	HL78xx Pin Out Signal Name
C1	GPIO1/ I2C1_CLK		CN1000_2	I2C1_CLK
C2	UART1_RI		CN403_8	UART1_RI
C3	UART1_RTS		CN403_4	UART1_RTS
C4	UART1_CTS		CN403_3	UART1_CTS
C5	UART1_TX		CN403_2	UART1_TX
C6	UART1_RX		CN403_1	UART1_RX
C7	UART1_DTR		CN403_6	UART1_DTR

Module Pin	Serigraphy	Test Points	Connector	HL78xx Pin Out Signal Name
C8	UART1_DCD		CN403_7	UART1_DCD
C9	UART1_DSR		CN403_5	UART1_DSR
C10	GPIO2		CN1000_1	GPIO2
C11	RESET_IN_N		CN1000_12	RESET_IN_N
C12	USB_DN	TP401		USB_DN
C13	USB_DP	TP400		USB_DP
C14	NC			NC
C15	NC			NC
C17	NC			NC
C18	NC			NC
C19	NC			NC
C20	NC			NC
C21	VBAT_RTC		CN1000_6	NC
C22	26MHZ		CN1000_22	SYS_CLK
C23	32KHZ		CN1000_26	SLEEP_CLK
C24	ADC1		CN1000_11	ADC1
C25	ADC0		CN1000_9	ADC0
C26	UIM1_VCC		CN1000_17	UIM1_VCC
C27	UIM1_CLK		CN1000_21	UIM1_CLK
C28	UIM1_DATA		CN1000_19	UIM1_DATA
C29	UIM1_RST		CN1000_23	UIM1_RST
C30	GND			GND
C31	RF_DIV		CN906	RF_DIV
C32	GND			GND
C33	PCM_OUT			PCM_OUT/ I2S_OUT
C34	PCM_IN			PCM_IN / I2S_IN
C35	PCM_SYNC			PCM_SYNC / I2S_WS
C36	PCM_CLK			PCM_CLK / I2S_CLK
C37	GND			GND
C38	GNSS		CN901	GNSS_ANT
C39	GND			GND
C40	GPIO07		CN1000_5	GPIO7

Module Pin	Serigraphy	Test Points	Connector	HL78xx Pin Out Signal Name
C41	GPIO08		CN1000_7	GPIO8
C42	DR_SYNC		CN1000_16	DR_SYNC
C43	EXT_LNA_GPS_EN	TP900		EXT_LNA_GPS_EN
C44	WAKEUP / GPIO13		CN1000_8	GPIO13
C45	VGPIO		CN1000_13	VGPIO
C46	GPIO06		CN1000_3	GPIO6
C47	TP1	TP700		TP1
C48	GND			GND
C49	PRI_ANT		CN903	PRI_ANT
C50	GND			GND
C51	GPIO14 / UART3_CTS /SPI_CS		CN303_3	SPI1_MRDY
C52	GPIO10 / UART3_TX / SPI_MISO		CN303_2	SPI1_MISO
C53	GPIO11 / UART3_RTS / SPI_CLK		CN303_4	SPI1_CLK
C54	GPIO15 / UART3_RX / SPI_MOSI		CN303_1	SPI1_MOSI
C55	UART0_RX / UIM2_VCC		CN302_1	UIM2_VCC
C56	UART0_TX / UIM_DATA		CN302_2	UIM2_DATA
C57	UART0_CTS / UIM2_RST		CN302_3	UIM2_RESET
C58	UART0_RTS / UIM2_CLK		CN302_4	UIM2_CLK
C59	POWER_ON		CN1000_10	POWER_ON_N
C60	TX_ON		CN1000_14	TX_ON
C61	VBATT_PA		CN801	VBATT_PA
C62	VBATT_PA		CN801	VBATT_PA
C63	VBATT		CN804	VBATT
C64	UIM1_DET / GPIO03		CN1000_25	UIM1_DET / GPIO3
C65	FAST_SHUTDOWN / GPIO4 / UIM2_DET		CN1000_27	GPIO4
CG1	GND			GND
CG2	GND			GND
CG3	GND			GND
CG4	GND			GND

3: Interfaces

3.1 Power

3.1.1 Power Supply

The following supply sources are available on the Development Kit. To use these supply sources, CN805 must install the jumper connector via the following options:

Table 3-1: Connector and Jump Configuration for Power Supply Sources

Connector	Jump
CN400 (UART1)	CN805_5 and CN805_6
CN402 (Main USB)	CN805_9 and CN805_10
CN600 (STMod+ interface)	CN805_1 and CN805_2
CN602 (Arduino/STMod+ Extra PWR)	CN805_3 and CN805_4
CN300 (UART0)	CN805_7 and CN805_8

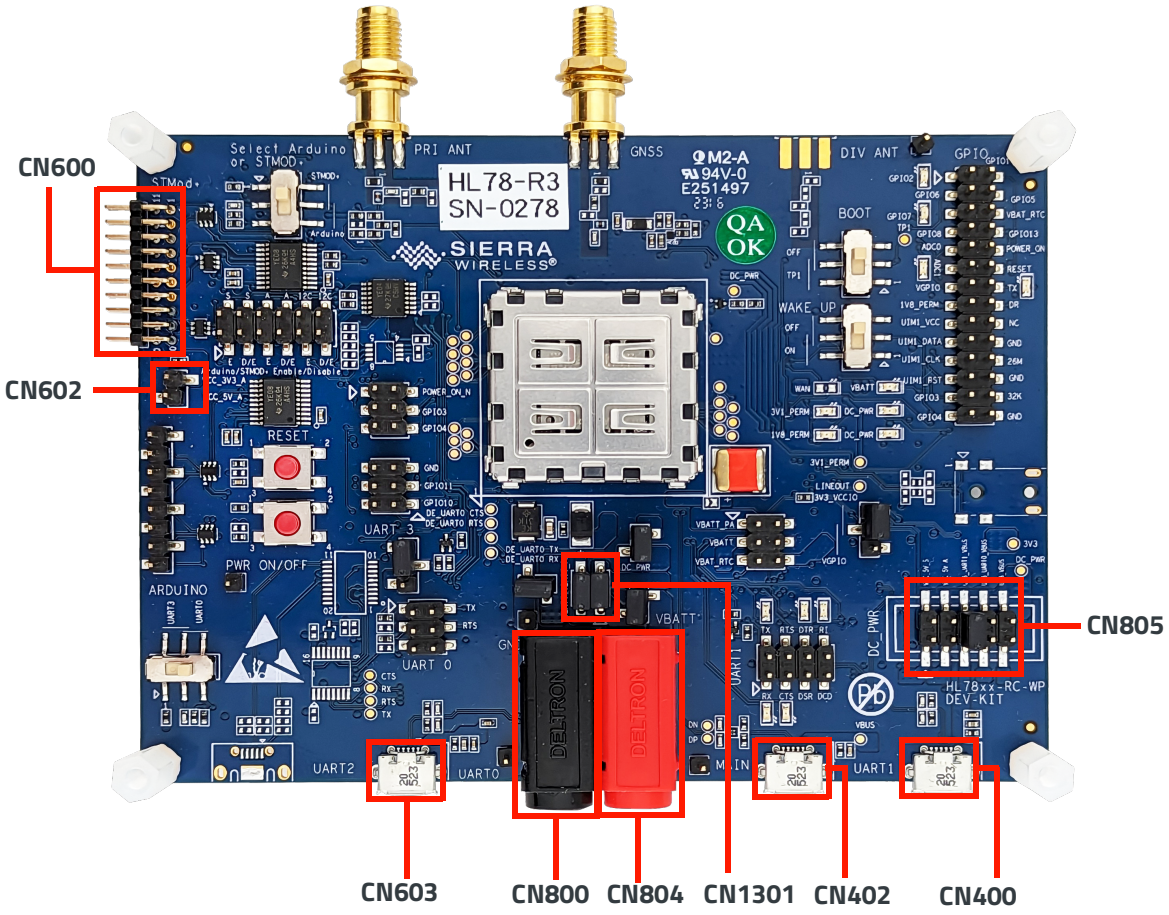


Figure 3-1: DC_PWR Connector (on the top side of the Development Kit)

Three power supplies can be used to supply the Development Kit and the HL78xx module. They can be used to supply power to DC_PWR, VBATT and VBATT_PA separately or they can supply power collectively depending on CN1301 jumper configurations.

VBATT and VBATT_PA of the embedded module can be measured separately or as a total current drain depending on the following configurations.

Table 3-2: C1301 Jumper Configuration

	CN1310	CN1301_1 and CN1301_2	CN1301_3 and CN1301_4	Current measurement
Current for VBATT_PA and VBATT are measured together	Disconnected	Disconnected	Connected	CN804 and CN800
Current for VBATT_PA and VBATT are measured separately	Disconnected	Disconnected	Disconnected	VBATT: CN804 and CN800 VBATT_PA: CN1301_4 and CN800

The state of DC_PWR is indicated by a green LED and can be controlled by a test point. VBATT and VBATT_PA can be controlled by two test points.

Note: The green LED, D807, is always activated regardless of the connection of jumpers CN1301.

Table 3-3: Power Supply Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	LED	Test Point / Jumper	Development Kit Signal Name
DC_PWR		I	D807	TP802 / CN1301_2	DC_PWR
VBATT	C63	I	N/A	CN1301_1 / CN1301_3	VBATT
VBATT_PA	C61 C62	I	N/A	CN1301_4	VBATT_PA

Refer to the following table for the electrical characteristics of the power supplies.

Table 3-4: Power Supply Electrical Characteristics

Power Supply	Vmin.	Vnom.	Vmax.
DC_PWR (V)	3.6	4	4.35
VBATT (V)	3.2[a]	3.7	4.35
VBATT_PA (V) Full Specification	3.2[a]	3.7	4.35
VBATT_PA (V) Extended Range	2.8[b]	3.7	4.35

a. This value must be guaranteed during the burst.
b. No guarantee of 3GPP performances over extended range.

For more information, refer to the Product Technical Specification document.

3.1.2 Internal Power Supply

The Development Kit includes two internal power supplies that are permanently activated. These two power supplies are powered by the DC_PWR power supply.

Figure 3-2: Internal Power Supply

Table 3-5: Internal Power Supply Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LEDs	Test Point / Jumper	Development Kit Signal Name
		O	1V8 / 200mA	D204	CN1000_15	LDO_1V8_PERM
		O	3V1 / 300mA	D200	TP200	LDO_3V1_PERM

3.1.3 POWER_ON_N

The HL78xx module automatically turns on when power is provided to the Development Kit.

The module can be powered off by disconnecting the Development Kit from the power source or by issuing the appropriate AT command. For more information about AT commands, refer to the HL78xx Series AT Commands Interface Guide.

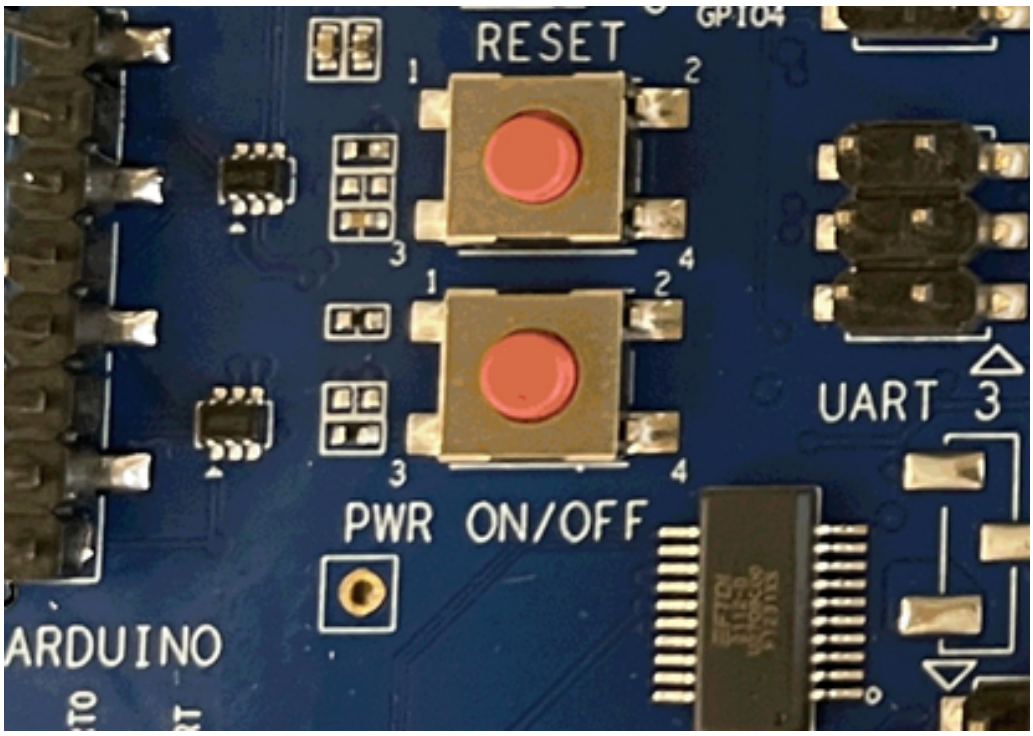


Figure 3-3: POWER_ON_N pushbutton

Table 3-6: POWER_ON_N Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LEDs	Test Point / Jumper	Development Kit Signal Name
POWER_ON_N	C59	I	1.8v		CN1000_10	POWER_ON_N

3.2 Control Functions

3.2.1 RESET_IN_N

The Development Kit includes a RESET_IN_N pushbutton to reset the HL78xx module.

The SW201 pushbutton starts a general reset when it is pushed. Reset can only be executed after the module has been switched ON.

Note: A controlled reset via software, using at+cfun=1,1 is the recommended reset mechanism. A hard reset should only be used when the unit is non responsive.

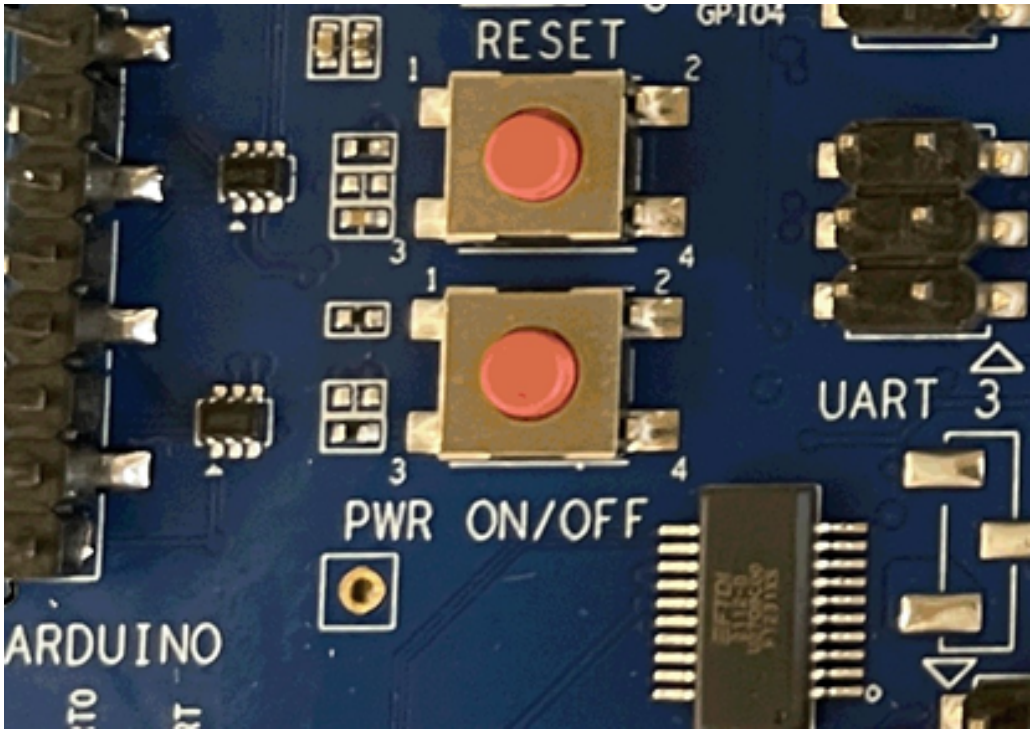


Figure 3-4: RESET_IN_N pushbutton

Table 3-7: RESET_IN_N Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LEDs	Test Point / Jumper	Development Kit Signal Name
RESET_IN_N	C11	I	1.8v		CN1000_12	RESET_IN_N

3.3 USB (Main)

The main USB connection on the Development Kit is available from CN402 and can be used to communicate with the HL78xx module directly via a PC.

CN402 is a receptacle USB Micro-AB connector.

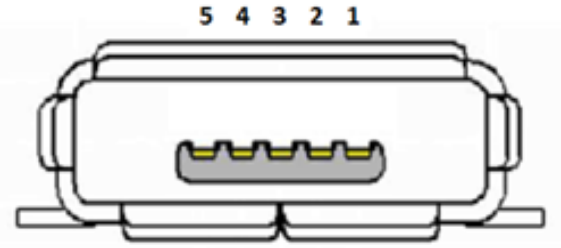


Figure 3-5: Micro-AB USB Connector

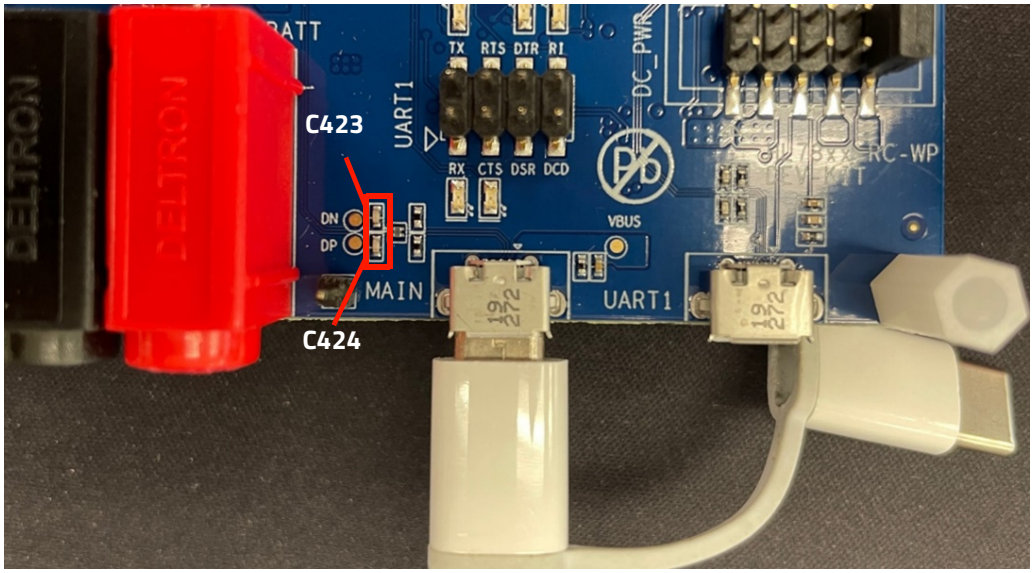


Figure 3-6: Main USB Interface

Important: *If a USB enumeration issue is encountered, capacitors C423 and C424 may be de-soldered.*

Table 3-8: Main USB Connector Pin Description

Pin #	Signal Name	I/O	I/O Type	Description
1	USB_VBUS	I	USB	+5 VDC
2	USB_DN	I/O	USB	Data -
3	USB_DP	I/O	USB	Data +

Table 3-8: Main USB Connector Pin Description (Continued)

Pin #	Signal Name	I/O	I/O Type	Description
4	NC	I	USB	USB OTG ID
5	GND			Ground

A Green LED, D1005, indicates the USB_VBUS state. When this LED is lit, it indicates that the USB cable is plugged into the receptacle USB Micro-AB connector and is available for use.

One test point is available to control the state of USB_VBUS.

Table 3-9: Main USB Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point / PCB Pad	Development Kit Signal Name
USB_VBUS	C16	I	5V	D1005	TP402	VBUS
USB_DP	C13	I/O	3.3V		TP400 (pads)	
USB_DN	C12	I/O	3.3V		TP401 (pads)	

3.4 UIM / SIM1

The Development Kit has one SIM connector, SIM1, CN500.

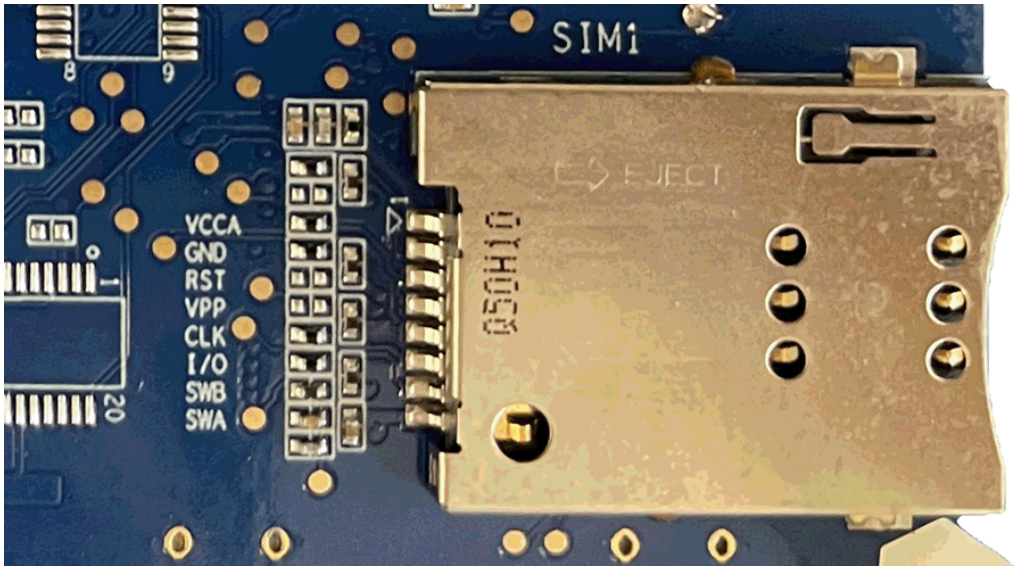


Figure 3-7: SIM1 Interface—Bottom Side

Note: ESD protection is available on all SIM1 signals.

Refer to the following table for the SIM1 connector pin description.

Table 3-10: SIM1 Connector Pin Description

Pin #	Signal Name	I/O	I/O Type	Description
1	UIM1_VCC	O	1.8V/2.85V	SIM Power Supply
2	UIM1_RESET	O	1.8V/2.85V	SIM Reset
3	UIM1_CLK	O	1.8V/2.85V	SIM Clock
4	CC4	Not used		
5	GND			Ground
6	VPP	Not used		
7	UIM1_DATA	I/O	1.8V/2.85V	SIM Data
8	CC8	Not used		
9	1V8_PERM	I	VIO[a]	VIO supply from the Development Kit
10	UIM1_DET / GPIO3	I	VIO[a]	SIM Card Detect
11 12 13 14	GND			Ground casing

a. VIO = 1.8V (1V8_PERM) from the Development Kit.

Four test points are available to control the state of the four SIM1 signals of the HL78xx module, and one jumper is available to control the status of the SIM1 detection signal of the module.

Refer to the following table for the SIM1 pin description.

Table 3-11: SIM1 Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point / Jumper	Development Kit Signal Name
UIM1_VCC	C26	O	1.8V/2.85V		CN1000_17	UIM1_VCC
UIM1_DATA	C28	I/O	1.8V/2.85V		CN1000_19	UIM1_DATA
UIM1_RST	C29	O	1.8V/2.85V		CN1000_23	UIM1_RST
UIM1_CLK	C27	O	1.8V/2.85V		CN1000_21	UIM1_CLK
UIM1_DET / GPIO3	C64	I	1.8V		CN1000_25	UIM1_DET, GPIO3

3.5 UART0/3

3.5.1 USB-UART0/3

The USB-UART0/3 connection on the Development Kit is available from CN300, which is a receptacle USB Micro-AB connector via a USB-UART transceiver and voltage level translator at level 1.8V. Refer to Figure 3-5 for connector reference. Select UART0 or UART3 by SW300.

This interface is used to communicate between the module and a PC or host processor.

Important: *If a USB enumeration issue is encountered, capacitors C305 and C306 may be de-soldered.*

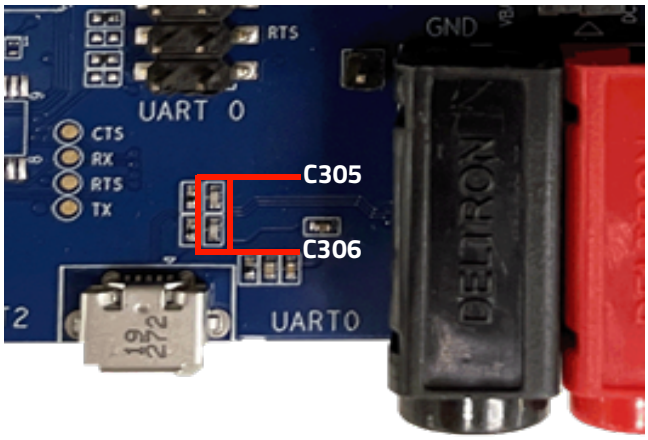


Figure 3-8: USB-UART0/3 Interface

Table 3-12: USB-UART0/3 Interface

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point	Development Kit Signal Name
UART0_TX	C56	I	1.8V		TP300	UART0_TX
UART0_RX	C55	O	1.8V		TP302	UART0_RX
UART0_RTS	C58	I	1.8V		TP301	UART0_RTS
UART0_CTS	C57	O	1.8V		TP303	UART0_CTS
UART3_TX	C52	I	1.8V		CN303.2	UART3_TX
UART3_RX	C54	O	1.8V		CN303.1	UART3_RX
UART3_RTS	C53	I	1.8V		CN303.4	UART3_RTS
UART3_CTS	C51	O	1.8V		CN303.3	UART3_CTS

Table 3-13: USB-UART0 Connector Pin Description

Pin #	Signal Name	I/O	I/O Type	Description
1	USB_UART1_VBUS	I	USB	+5 VDC
2	USB_DN	I/O	USB	Data -
3	USB_DP	I/O	USB	Data +
4	NC	I	USB	NC
5	GND			Ground

3.5.2 SPI /UART3 Interface

In the HL78xx and HL7900 modules, pins C51, C52, C53 and C54 support UART3, SPI interface, and GPIO functionalities.

To switch between these functions enable SW300 and use relevant AT Commands. For details see the HL7900 AT Command Reference Guide or the HL78xx AT Command Reference Guide.

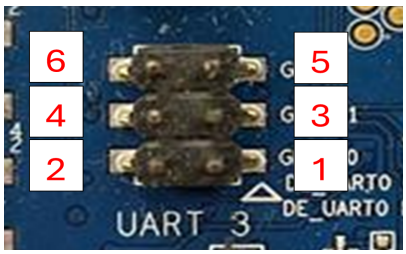


Figure 3-9: SPI /UART 3 pins

CN303 can enable SPI, UART3, and GPIOs as shown in Table 3-14.

Table 3-14: CN303 Connector Pin Description

Pin	HL78xx SPI Pin Definition	HL7900 SPI Pin Definition	HL78xx / HL7900 Host UART Connection	HL78xx / HL7900 GPIOs Pin Definition
1	GPIO15/SPI_MOSI	MCU_SPIM_CLK	Host RxD	GPIO15
2	GPIO10/SPI_MISO	MCU_SPIM_MOSI	Host TxD	GPIO10
3	GPIO14/SPI_CS	MCU_SPIM_MISO	Host RTS	GPIO14
4	GPIO11/SPI_CLK	MCU_SPIM_EN0	Host CTS	GPIO11
5	GND			
6	GND			

Note: To enable the SPI interface, switch SW300 to UART0.

3.6 UART1

3.6.1 USB-UART1

The USB-UART1 connection on the Development Kit is available from CN400, which is a receptacle USB Micro-AB connector via a USB-UART transceiver and voltage level translator at level 1.8V. Refer to Figure 3-5 for connector reference.

This interface is used to communicate between the module and a PC or host processor.

Important: *If a USB enumeration issue is encountered, capacitors C411 and C412 may be de-soldered.*

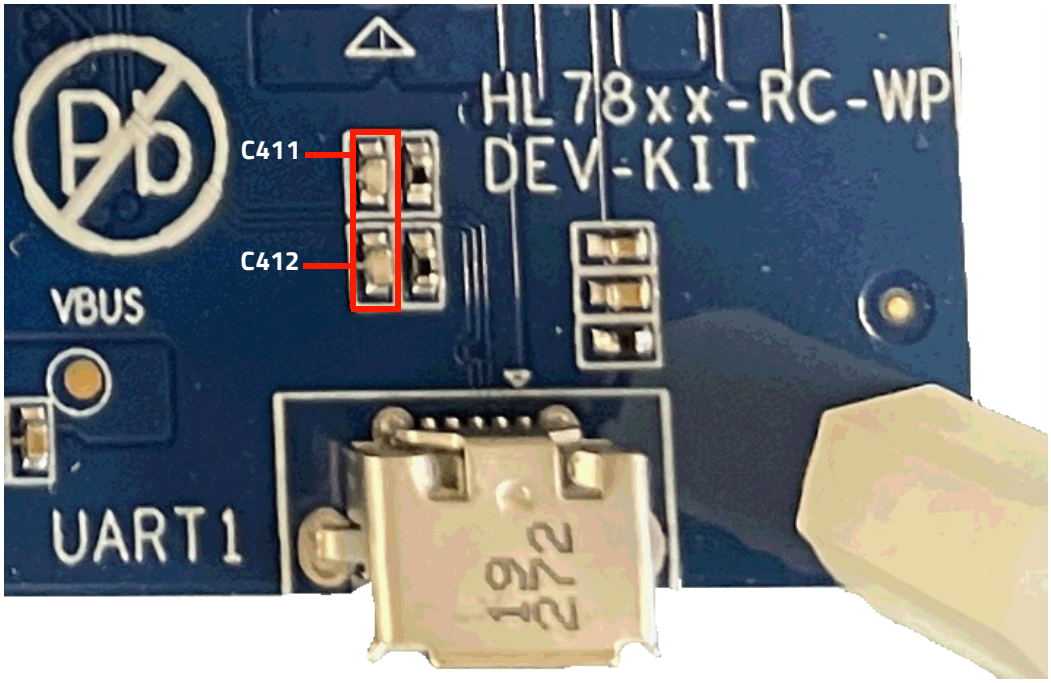


Figure 3-10: USB-UART1 Interface

Table 3-15: UART1 Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point	Development Kit Signal Name
UART1_TX	C5	I	1.8V	D1003	CN403_2	UART1_TX
UART1_RX	C6	O	1.8V	D1006	CN403_1	UART1_RX
UART1_RTS	C3	I	1.8V		CN403_4	UART1_RTS
UART1_CTS	C4	O	1.8V	D1008	CN403_3	UART1_CTS
UART1_DSR	C9	O	1.8V		CN403_5	UART1_DSR
UART1_DTR	C7	I	1.8V	D1010	CN403_6	UART1_DTR

Table 3-15: UART1 Pin Description (Continued)

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point	Development Kit Signal Name
UART1_DCD	C8	O	1.8V		CN403_7	UART1_DCD
UART1_RI	C2	O	1.8V		CN403_8	UART1_RI

Table 3-16: USB-UART1 Connector Pin Description

Pin #	Signal Name	I/O	I/O Type	Description
1	USB_UART1_VBUS	I	USB	+5 VDC
2	USB_DN	I/O	USB	Data -
3	USB_DP	I/O	USB	Data +
4	NC	I	USB	NC
5	GND			Ground

The power for UART to USB IC is provided by external power. When module is off, the RXD and CTS pin are no longer controlled by the module. The signal level will change from low to high due to the external power provided from UART to USB IC. If the user tries to input keys, a voltage drop happening on RXD and CTS pins causes the appearance of certain characters.

3.7 GPIO

The Development Kit provides all GPIO signals from the HL78xx module.

Figure 3-11: GPIO Signals

The state of GPIOs can be controlled by eight test points.

Table 3-17: GPIO Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point / Jumper	Development Kit Signal Name
GPIO1/ I2C1_CLK	C1	I/O	1.8V		CN1000_2	GPIO1/ I2C1_CLK
GPIO2	C10	I/O	1.8V		CN1000_1	GPIO02
GPIO3/UIM1_DET	C64	I/O	1.8V		CN1000_25	GPIO3/UIM1_DET
GPIO4/UIM2_DET	C65	I/O	1.8V		CN1000_27	GPIO4/UIM2_DET
GPIO5/I2C1_SDA	C66	I/O	1.8V		CN1000_4	GPIO5/I2C1_SDA
GPIO6	C46	I/O	1.8V		CN1000_3	GPIO06
GPIO7	C40	I/O	1.8V		CN1000_5	GPIO07
GPIO8	C41	I/O	1.8V		CN1000_7	GPIO08

Note: Ensure that CN1000 is set to position "OUT" when testing GPIOs set as output signals.

3.8 ADC

Two ADC signals are available on the Development Kit.

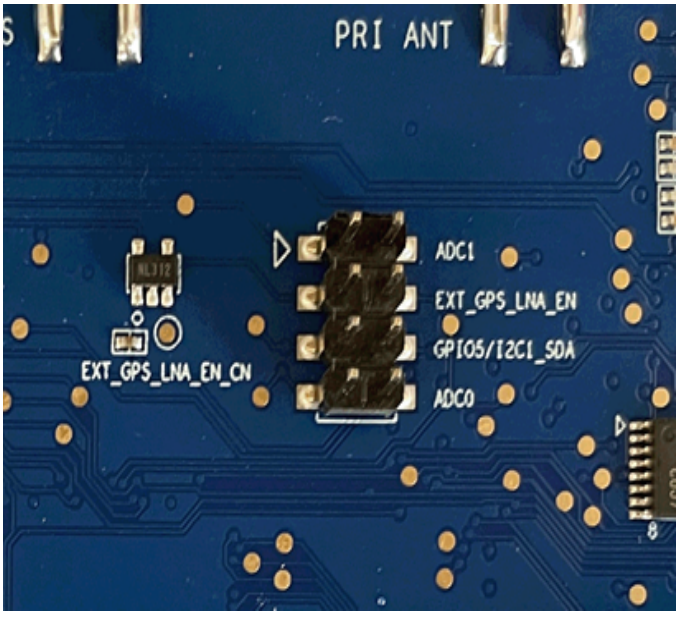


Figure 3-12: ADC Signals

Two test points are available to control the state of the two ADC signals.

Table 3-18: GPIO Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level[a]	LED	Test Point / Jumper	Development Kit Signal Name
ADC0	C25	O	1.8V		CN1000_9	ADC0
ADC1	C24	O	1.8V		CN1000_11	ADC1

a. ADCx voltage = 0.0V to 1.8V.

3.9 EXT_GPS_LNA_EN

Note: Although this hardware is included on the module board, its corresponding feature is currently unsupported in the modules.

The Development Kit provides an EXT_GPS_LNA_EN signal from the HL78xx module. The EXT_GPS_LNA_EN signal indicates whether the GNSS receiver is active and can be used to enable an external LNA (for active antenna).

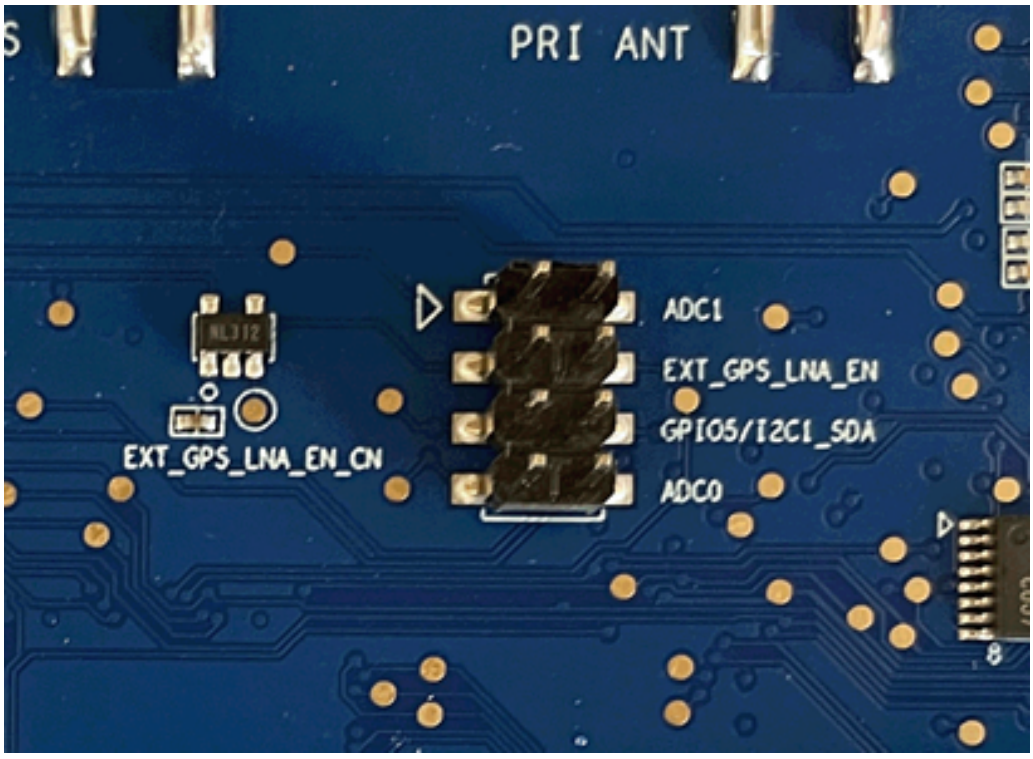


Figure 3-13: EXT_GPS_LNA_EN Signal

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Table 3-19: GPIO Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point / Jumper	Development Kit Signal Name
EXT_GPS_LNA_EN	C43	O	1.8V		TP900 / CN1305	EXT_GPS_LNA_EN

3.10 Antenna Detection Circuit

The Development Kit provides two antenna detection circuits for the RF and GNSS connectors, and a GNSS antenna bias circuit (for active antenna).

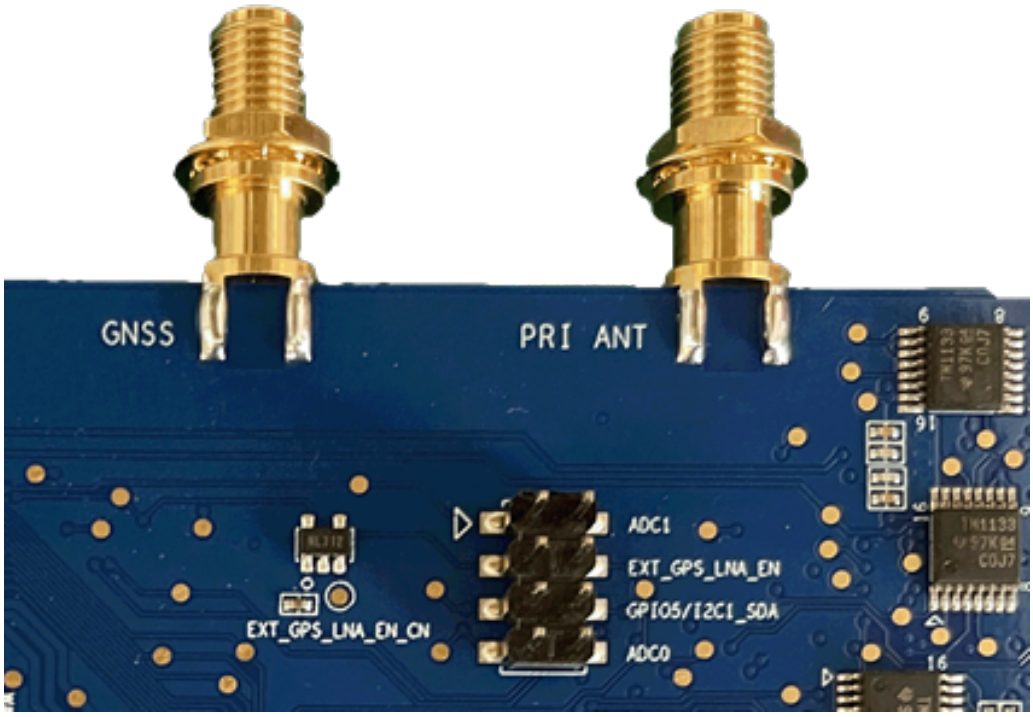

Figure 3-14: RF and GNSS Antenna Detection

Table 3-20: RF Antenna Detection Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point	Development Kit Signal Name
ADC0	C25	O	1.8V		CN1305_7_8 / CN1000_9	ADC0
GPIO5	C66	I/O	1.8V		CN1305_5_6 / CN1000_4	GPIO05

Table 3-21: GNSS Antenna Detection Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point	Development Kit Signal Name
ADC1	C24	O	1.8V		CN1305_1_2/ CN1000_11	ADC1
EXT_GPS_LNA_EN[a]	C43	O	1.8V	D1112	CN1305_3_4/ TP900	EXT_GPS_LNA_EN[a]

a. Although this hardware is included on the module board, its corresponding feature is currently unsupported in the modules.

3.11 Clock Out

Two clocks out signals are available on the Development Kit from the HL78xx module.

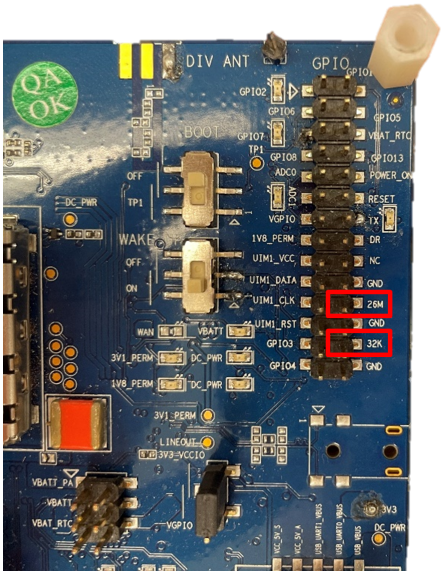

Figure 3-15: Clock Out Signals

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Table 3-22: Clock Out Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point / Jumper	Development Kit Signal Name
32K_CLKOUT[a]	C23	O	1.8V		CN1000_26	32KHZ
26M_CLKOUT[b]	C22	O	1.8V		CN1000_22	26MHZ

a. 32K_CLKOUT = 32.768 KHz
b. 26M_CLKOUT = 19.2 MHz in HL78xx

3.12 TX-ON

The Development Kit provides a TX-ON signal from the HL78xx module. The TX-ON indication status signal depends on the module's transmitter state.

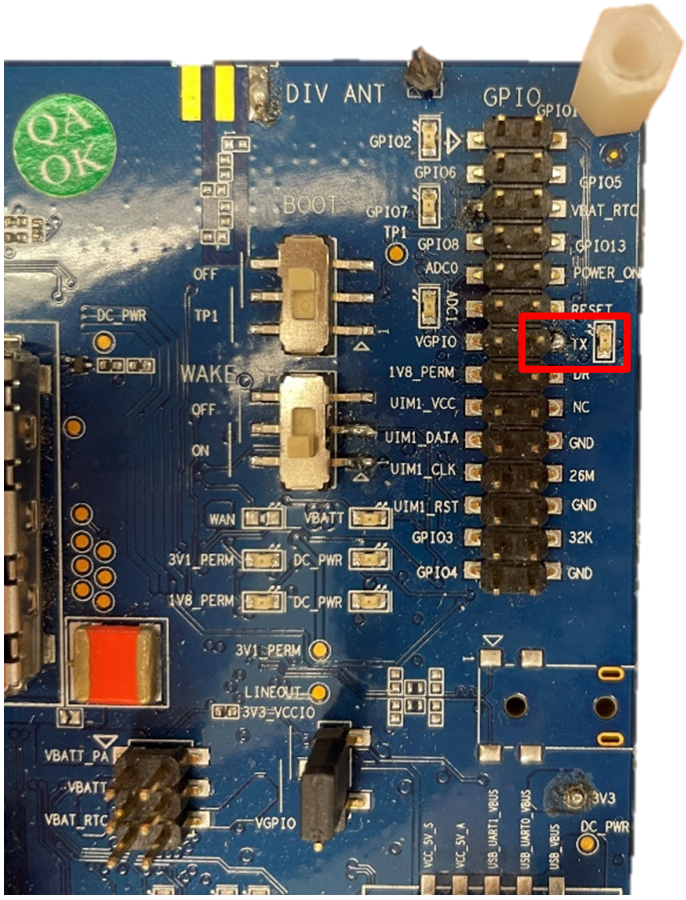

Figure 3-16: TX-ON Signal

The state of TX-ON is indicated by a green LED and can be controlled by a test point.

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Table 3-23: Clock Out Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point / Jumper	Development Kit Signal Name
TX-ON	C60	O	1.8V	D1000	CN1000_14	TX-ON

3.13 VGPIO

One VGPIO power supply signal is available on the Development Kit from the HL78xx module.

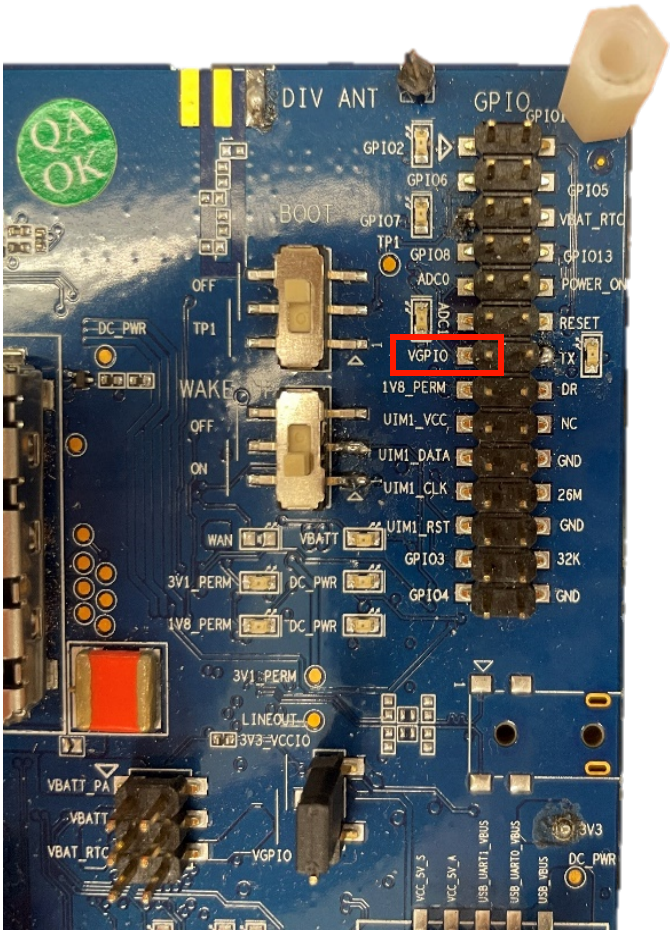


Figure 3-17: VGPIO Signal

One test point is available to control the state of VGPIO.

Table 3-24: VGPIO Pin Description

HL78xx Signal Name	HL78xx Pin Out	I/O	Voltage Level	LED	Test Point / Jumper	Development Kit Signal Name
VGPIO	C45	O	1.8V		CN1000_13	VGPIO

3.14 RF and GNSS Antenna

Two SMA connectors are available on the Development Kit for RF and GNSS antenna connections:

- RF antenna via CN903 (PRI_ANT)
- GNSS antenna via CN901

Figure 3-18: RF and GNSS Antenna Connectors

3.15 Interface for Arduino®

The Development Kit provides an Arduino IO interface which can boot up and control the HL78xx module using Arduino.

Make sure VCC_5V_A and DC_PWR are short together on CN805 and Arduino should be input 5V and 3V3 to CN602.

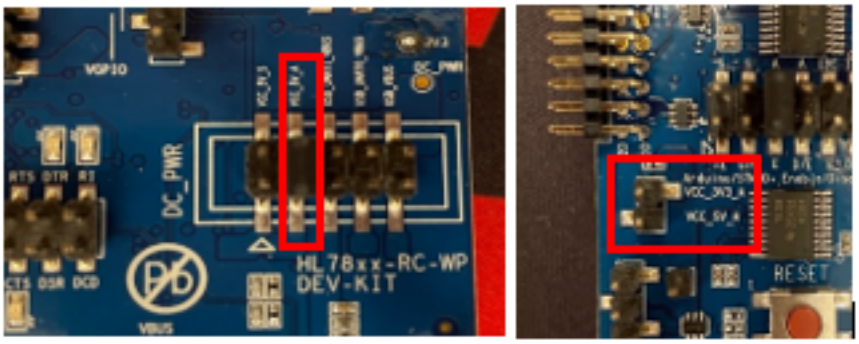


Figure 3-19: Jumpers for Power Supply

The SW601 should be changed to Arduino mode. To ensure the correct booting sequence, CN1307 must remain in the **Arduino disable** state when the HL78xx is still booting. After the module has boot-up, CN1307 can be returned to its **Arduino enable** state.

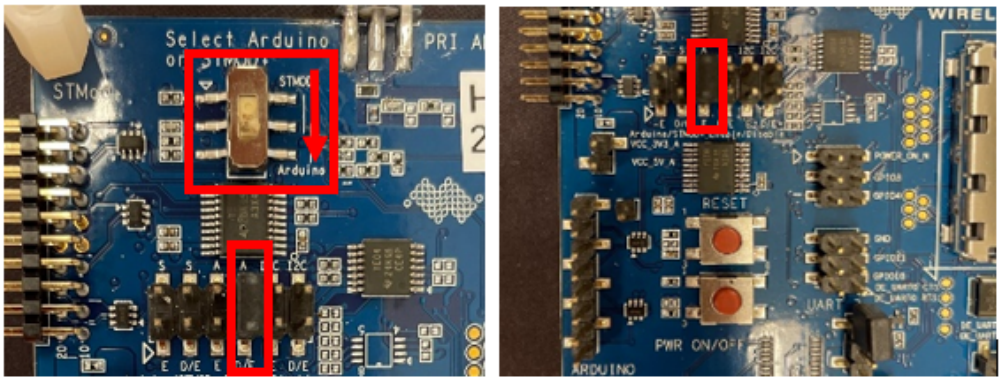


Figure 3-20: Boot-up

Make sure your configuration of UART can connect to Rx, Tx, CTS, and RTS. CN401 must be removed.

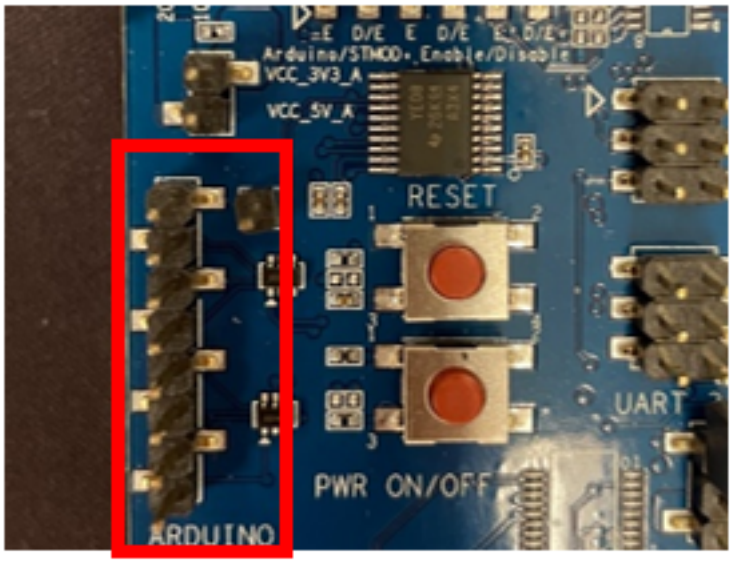


Figure 3-21: Interface for Arduino

You may refer to the following IO list:

Table 3-25: Connector Pin Description for Arduino

Pin #	Signal Name	I/O	Description
1	VGPIO	O	+1.8 VDC
2	ARDUINO_RESET_IN_N	I	Module reset
3	ARDUINO_WAKEUP / GPIO13	I/O	HL78xx: WAKEUP, WP76xx: GPIO13
4	ARDUINO_GPIO2	I/O	GPIO2
5	ARDUINO_UART1_CTS	O	UART1_CTS
6	ARDUINO_UART1_RTS	I	UART1_RTS
7	ARDUINO_UART1_Rx	O	UART1_Rx
8	ARDUINO_UART1_Tx	I	UART1_Tx

3.16 Interface for STMod+

The Development Kit provides an STMod+ IO interface, It can boot up and control the HL78xx module through STMod+.

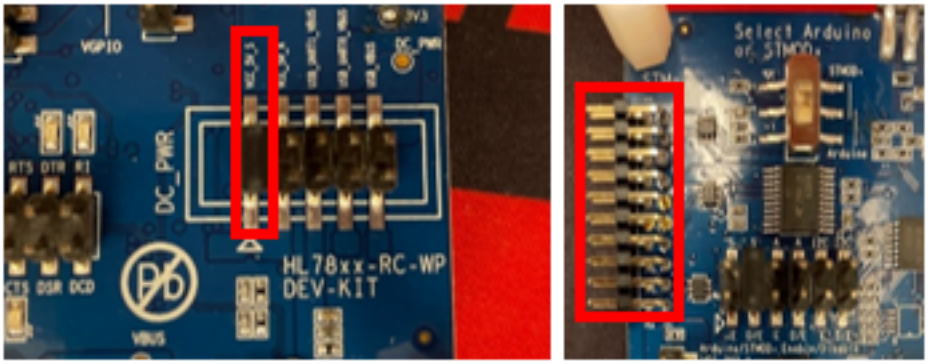


Figure 3-22: Internal Power Supply

The SW601 should be changed to STMod+ mode. To ensure the correct booting sequence, CN1307 must remain in the **STMod+ disable** state when the HL78xx is still booting. After the module has boot-up, CN1307 can be returned to an **STMod+ enable** state.

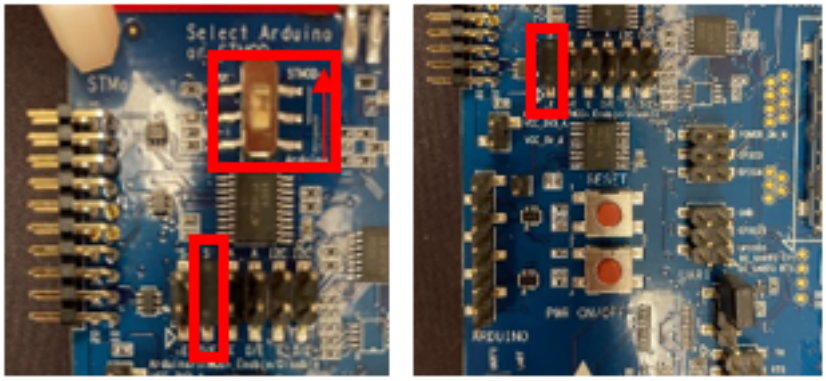


Figure 3-23: Boot Up

Make sure your configuration of UART can connect to Rx, Tx, CTS, and RTS. CN401 must be removed.

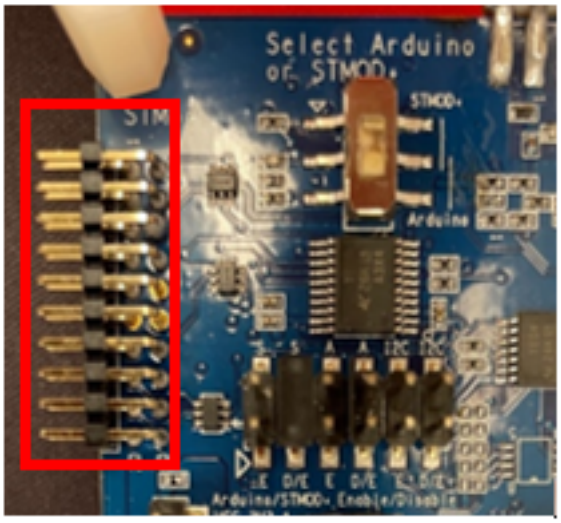


Figure 3-24: Interface for STMod+

You may refer to the following IO list:

Table 3-26: Connector Pin Description for Arduino

Pin #	Signal Name	I/O	Description
1	STMOD_UART1_CTS	O	UART1_CTS
2	STMOD_UART1_Tx	I	UART1_Tx
3	STMOD_UART1_Rx	O	UART1_Rx
4	STMOD_UART1_RTS	I	UART1_RTS
5	GND	Power	GND
6	VCC_5V_S	Power	+5V VDC
7	S_GPIO1/I2C1_SCL	I/O	GPIO1/I2C1_SCL
8	NC	-	-
9	STMOD_POWER_ON_N	I	Module Power ON key
10	S_GPIO5/I2C1_SDA	I/O	GPIO5/I2C1_SDA
11	STMOD_UART1_RI	I/O	UART1_RI
12	STMOD_RESET_IN_N	I	Module reset
13	NC	-	-
14	STMOD_UART1_DTR	I	UART1_DTR
15	VCC_5V_S	Power	+5V VDC
16	GND	Power	

Table 3-26: Connector Pin Description for Arduino (Continued)

Pin #	Signal Name	I/O	Description
17	VGPIO	O	+1.8 VDC
18	STMOD_GPIO2	I/O	GPIO2
19	STMOD_WAKEUP/GPIO13	I/O	HL78xx: WAKEUP, WP76xx: GPIO13
20	NC	-	-

4: Getting Started

This section describes how the Development Kit is set up and how communications testing and debugging is done with an embedded module.

4.1 Setting Up

Do the following steps before powering on the Development Kit:

1. Ensure that switches and connectors are configured as required. By default, the Development Kit board is configured from the factory before shipment to allow the module to power up normally.
2. Connect the HL78xx module to the snap-in connector with an interposer, and attach the snap-in cover as shown in Snap-In Connector.
3. Insert a SIM or USIM card in the SIM slot, CN500, if communications are required.
4. Connect the HL78xx module to a PC using CN400 (AT Port) and CN300 (CLI port for HL78xx and EMUX port for HL7900). By default, HL78xx/HL7900 AT port and HL78xx CLI port baud rate = 115.2Kbps, data bits = 8, parity = N, and stop bits = 1.
5. Connect an RF antenna to the CN903 of the Development Kit.
6. Connect a GNSS antenna to the CN901 of the Development Kit.
7. Connect a power cable to the CN400 and check if jumpers are plugged to the CN1301, CN1308, CN1309, CN1310, and CN805.

Note that the Development Kit may be supplied with power depending on jumper configurations and power supplies CN805. Refer to Power Supply for more information on supplying power to the Development Kit.

4.2 RF Communications

4.2.1 Configure the COM Port

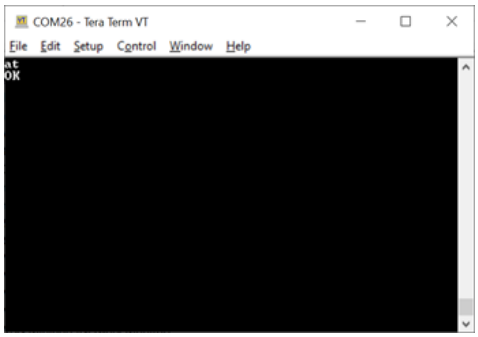
4.2.1.1 USB Port

The HL78xx module is automatically detected when the USB cable from the Development Kit is connected to the PC (UART to USB).

- UART1_AT Port:

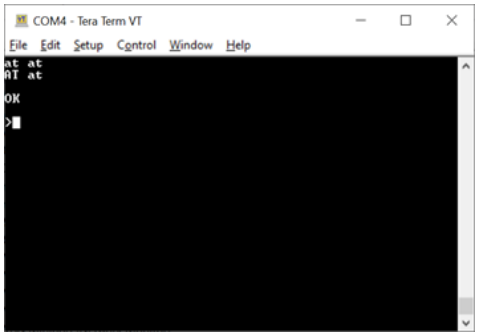
  Enable the UART1 (CN400), please check CN401 has been plugged to pin1 and pin2.

Test communications using a PC terminal emulator (HyperTerminal or Tera Term, for example) by entering **AT**. The module should answer with OK.



- UART0_CLI Port:
  Enable the UART0(CN300), please check CN301 has been plugged to pin1 and pin2.

Test communications using a PC terminal emulator (HyperTerminal or Tera Term, for example) by entering **at**. The module should answer with OK.

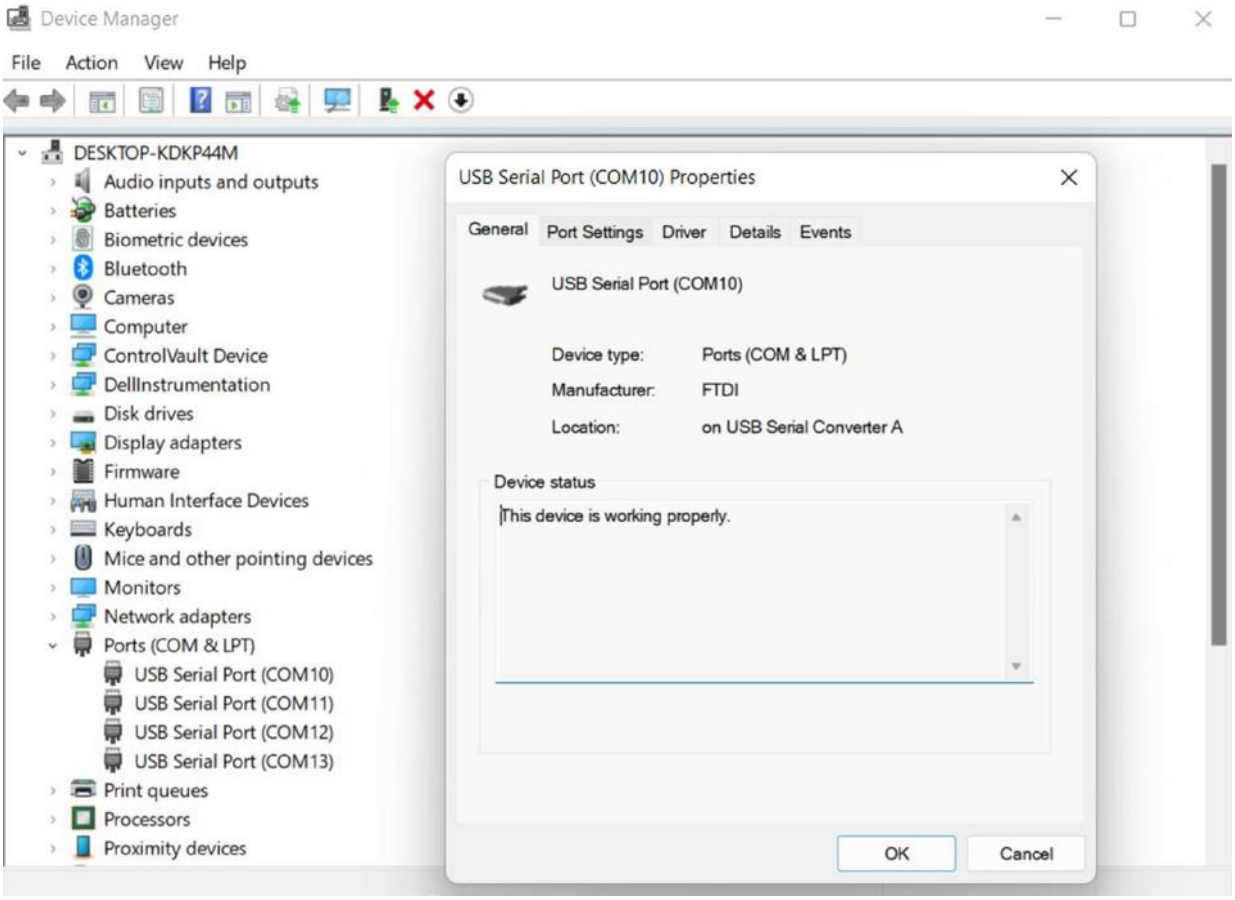


4.2.1.2 USB to UART Converter Settings for the HL7900 Module

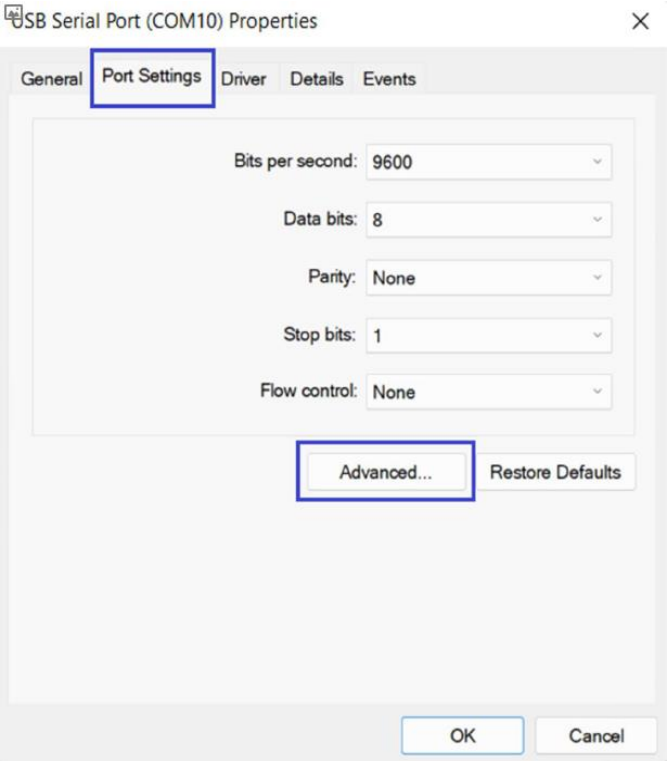
The default configuration of the driver uses a latency configuration which results in slow response time, long image burning, and EMUX communication synchronization loss for the HL7900 module.

Refer to the following steps on how to configure the port used by u-boot/EMUX COM for the HL7900:

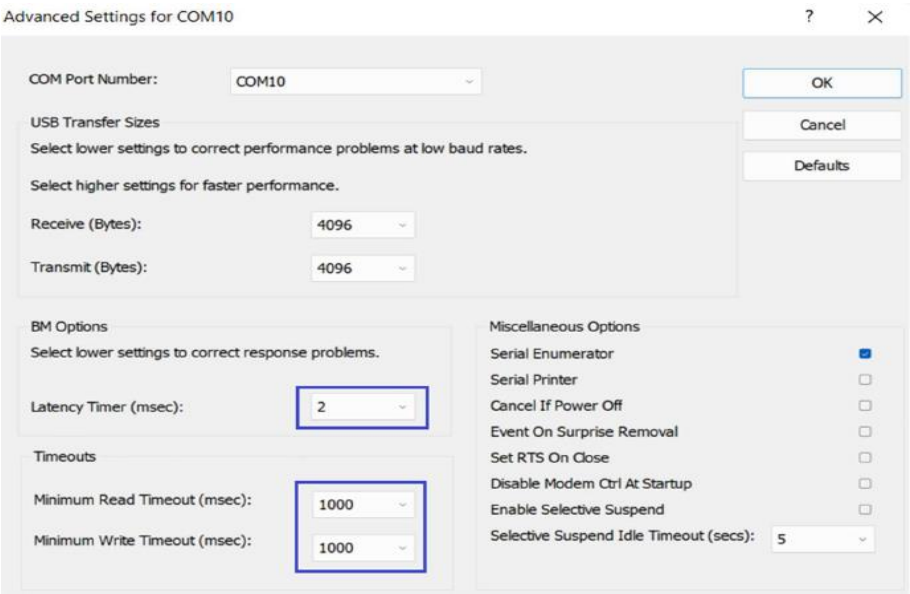
1. Open COM port **Properties** from **Device Manager**:



2. Select **Port Settings Tab** and press **Advanced**:



3. Modify the following default settings:
   - BM Options: Latency Timer (msec): Value from "16" to "2".
   - Timeouts: Minimum Read Timeout (msec): Value from "0" to "1000".
   - Timeouts: Minimum Write Timeout (msec): Value from "0" to "1000".
4. Click **OK**. Do a reboot to activate these settings.



Contact Semtech support team on how to debug through EMUX.

4.3 GNSS Communications

To get GNSS output, ensure that:

- Power is on.
- Module is ON
- COM port is connected by main USB CN402
- SIM card is inserted in SIM holder, CN500.
- RF antenna is connected to CN901
- Jumper CN902 is shorted if using GNSS antenna bias circuit (for active antenna), or jumper CN902 is not shorted if using GNSS antenna (for passive antenna).

4.4 Low Power Consumption Measurement

Put the HL78xx module inside the snap-in connector in the correct position; refer to Snap-In Connector for details.

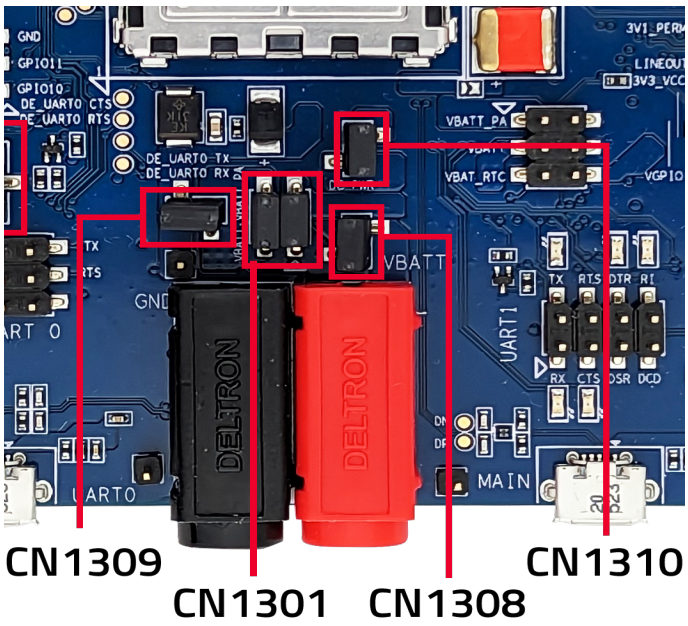


Figure 4-1: Low Power Consumption Measurement Jumper

Note: When entering low-power mode, the module should be powered by banana jacks CN804 and CN800.

5: ESD Protection

External ESD protection is available on the Development Kit for the following connectors:

- UIM/SIM1 connector
- USB main connector
- USB-UART0 connector
- USB-UART1 connector
- RF connector
- GNSS connector

Caution: *As the test points on the Development Kit are not protected against ESD discharge and they are directly connected to the signal pins of the embedded module, users must be careful when using these TP signals.*