GPS Location

Pinnacle™ 100

Application Note *v1.0*

1 Introduction

This application note shows how to bring up the GPS/GNSS interface of the Laird Connectivity Pinnacle 100 Cellular modem and how to output location data in a terminal window.

2 Requirements

The following are needed for retrieving location information from the Pinnacle 100 cellular modem:

- Pinnacle 100 DVK with micro-USB cable – https://www.lairdconnect.com/wireless-modules/cellular-solutions/pinnacle-100-cellular-modem
- PC running Laird Connectivity's UwTerminalX – https://github.com/LairdCP/UwTerminalX/releases
- U.FL to U.FL cable to connect Pinnacle 100 to the on-board GPS antenna – e.g. https://www.rsonline-privat.de/Products/ProductDetail/Molex-50-Koaxialkabel-konfektioniert-Stecker-U-FL-7031345

3 Preparation

To prepare for this function, follow these steps:

1. With the development board powered off, connect a U.FL to U.FL cable between the GPS antenna of the Pinnacle 100 module (middle connector) to the connector near the GPS antenna on the development board.

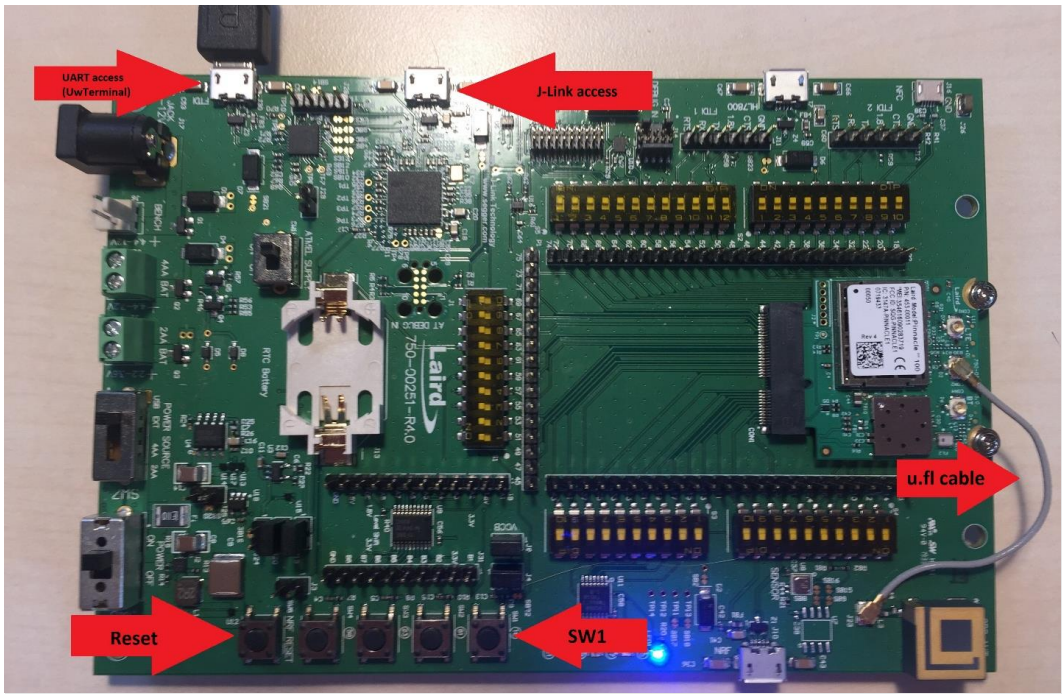

Figure 1: Location of the relevant USB ports as well as RESET and SW1 push buttons

Note: You must attach the U.FL cable from the module to the board as shown before applying power.

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2. Connect your Pinnacle 100 DVK with your PC using the micro-USB cable. Connect to the UART access port as shown in Figure 1.
3. Open UwTerminalX. Select Pinnacle 100 in the *Device* dropdown. Select the proper COM port in the *Port* dropdown.

Note: If *Pinnacle 100* is not available in the dropdown, select *BL65x* instead.

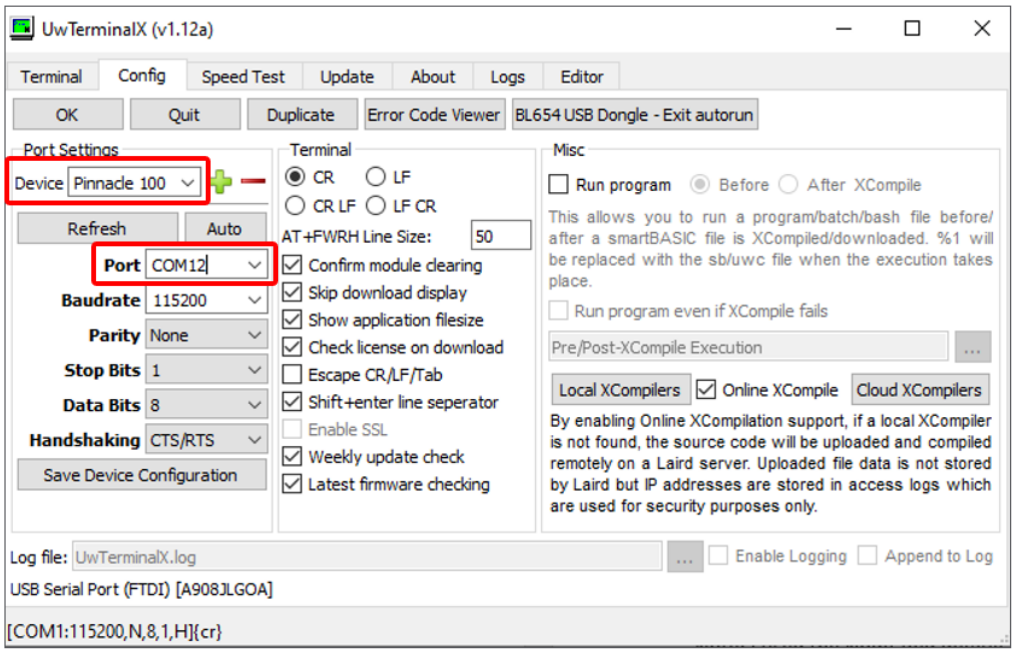
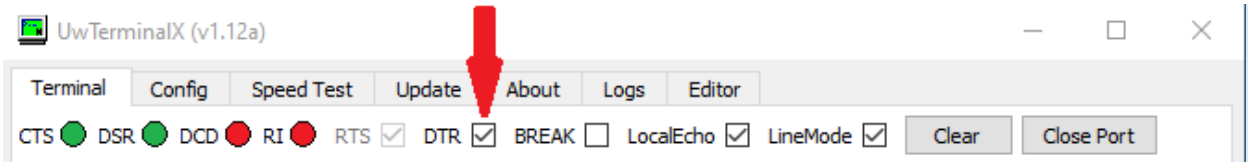


Figure 2: UwTerminalX setup

4. If you have not already, load the Hosted Mode – AT Command firmware to your Pinnacle 100. Instructions for loading this firmware are provided in the by following the necessary steps in this user guide: https://connectivity-staging.s3.us-east-2.amazonaws.com/2020-04/CS-GUIDE-Converting-Pinnacle-100-AT%20v1_0.pdf
5. Apply power to the Pinnacle 100 development board. Click **OK** in the top-left of UwTerminalX.
6. Click on the **Terminal** tab. In the terminal tab, you can communicate either with the *smart*BASIC command interface or the Sierra Wireless HL7800 AT Command interface. To switch, toggle off and then toggle back on the DTR checkbox at the top of the terminal.



7. To determine whether you're connected to the *smart*BASIC command interface or the Sierra Wireless HL7800 AT command interface, issue the following command:

```
ati3
```

If connected to the HL7800 AT command interface, the terminal echoes a response beginning with HL7800.

If connected to the *smart*BASIC command interface, the terminal echoes the current firmware version (no HL7800 prefix).

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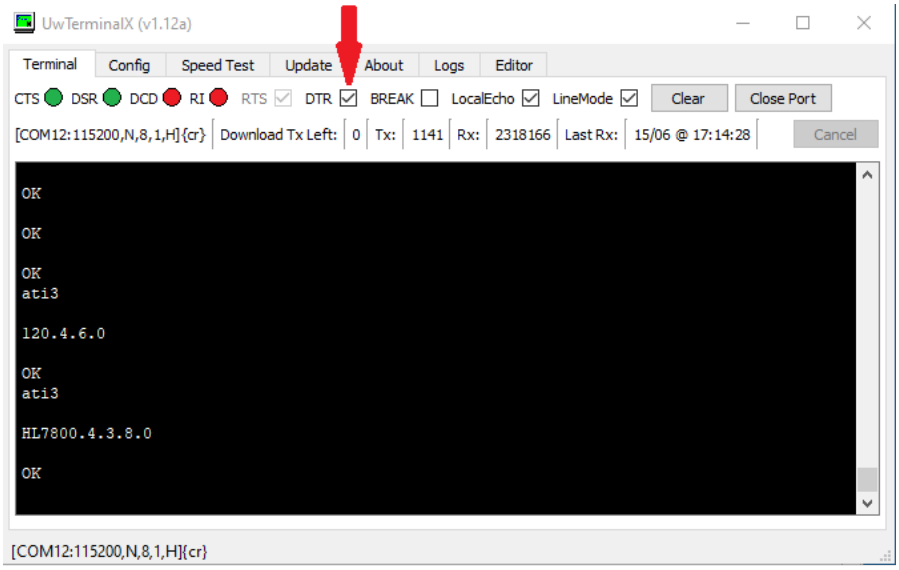

Figure 3: Enable HL7800 AT command set

8. To proceed, ensure you're connected to the HL7800 AT command set (ati3 returns response with HL7800 prefix).
9. In the Pinnacle 100, the GPS radio hardware is shared with LTE radio hardware. That means you need to disable LTE functionality in order to enable the GPS functionality. This can be done by issuing the following command to enable airplane mode:

```
at+cfun=4,0
```

Note: To disable airplane mode, issue the following command:
`at+cfun=1,0`

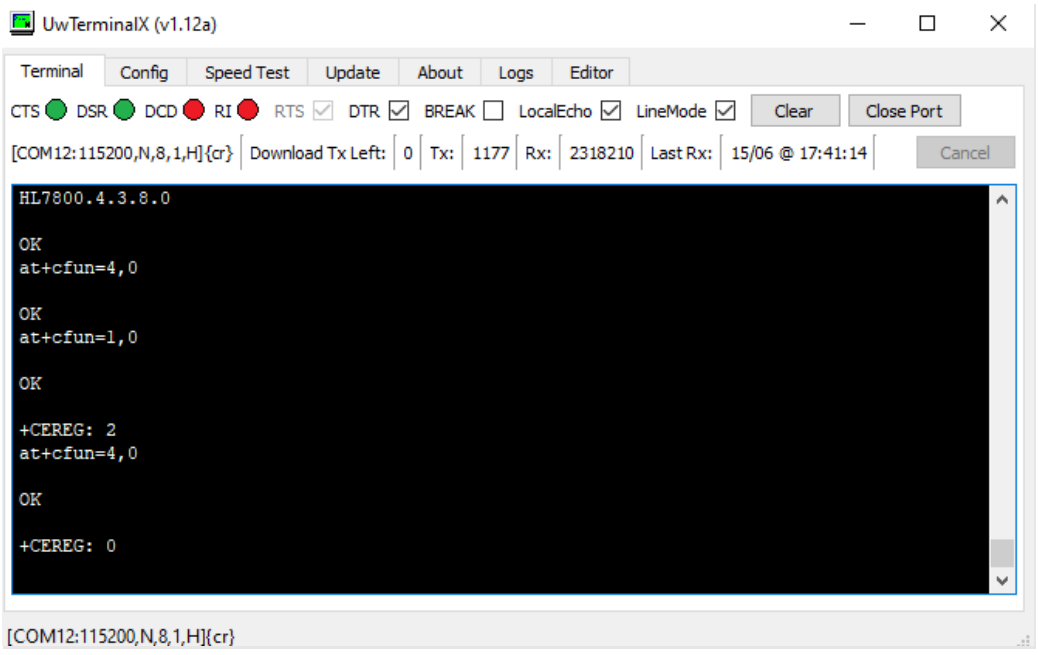

Figure 4: Enable / disable airplane mode

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4 Retrieving GPS Location from the Pinnacle 100 Modem

For configuring GPS on the Pinnacle 100 and displaying location information, you only need the following two commands:

`at+gnssstart=0`	Starts the GPS engine of the HL7800
`at+gnssloc?`	Displays the location information

After issuing these two commands, your terminal output should resemble the following:

```
at+gnssstart=0

OK

+GNSSEV: 1,1

+GNSSEV: 3,3
at+gnssloc?


+GNSSLOC:
Latitude: 50 Deg 2 Min 25.63 Sec N
Longitude: 8 Deg 52 Min 26.87 Sec E
GpsTime: 2020 6 16 08:39:25
FixType: 3D
HEPE: 0.23 m
Altitude: 112.100 m
AltUnc: 0.0 m
Direction:
HorSpeed:
VerSpeed:
```

Figure 5: Retrieve location information

Note: The unsolicited event notification "+GNSSEV: 3,3" indicates a 3-dimensional position is available.

To retrieve constant location output via the UART, issue the following command:

```
at+gnssnmea=4
```

Your terminal output should resemble the following:

```
AT+GNSSNMEA=4

CONNECT
$GPGGA,084133.00,5002.4177,N,00852.4426,E,1,06,2.3,120.9,M,47.8,M,,*6E
$GPGSV,2,1,08,12,33,095,29,14,22,254,18,18,09,177,,25,64,092,32*77
$GPGSV,2,2,08,26,15,287,32,29,79,210,20,31,50,293,30,32,11,234,12*72
$GPGNS,084133.00,5002.4177,N,00852.4426,E,AN,06,2.3,120.9,M,47.8,M,,*4B
$GPRMC,084133.00,A,5002.4177,N,00852.4426,E,3.6,192.7,160620,,,A,7.80e-08*2C
$GPGST,084133.00,,2.2,0.7,5.7,2.2,0.7,1.8*7F
$GPGGA,084134.00,5002.4184,N,00852.4432,E,1,06,2.3,120.6,M,47.8,M,,*6F
$GPGSV,2,1,08,12,33,095,29,14,22,254,17,18,09,177,,25,64,092,33*79
$GPGSV,2,2,08,26,15,287,32,29,79,210,21,31,50,293,30,32,11,233,07*70
$GPGNS,084134.00,5002.4184,N,00852.4432,E,AN,06,2.3,120.6,M,47.8,M,,*4A
$GPRMC,084134.00,A,5002.4184,N,00852.4432,E,3.6,192.7,160620,,,A,6.79e-08*25
$GPGST,084134.00,,2.2,0.7,5.7,2.2,0.7,1.8*78
$GPGGA,084135.00,5002.4188,N,00852.4434,E,1,06,2.3,120.5,M,47.8,M,,*67
```

Figure 6: Enable constant location output via UART

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There is a series of additional commands that can be used to control the GPS interface of the Pinnacle 100. This complete list is taken from the *AirPrime HL7800 AT Commands Interface Guide*:

Command	Description
+GNSSSTART	Start or Restart the GNSS Session
+GNSSSTOP	Stop the GNSS Session
+GNSSNMEA	Configure NMEA Frames Flow
+GNSSCONF	Configure the Location Service and GNSS Receiver
+GNSSTTFF	Report Calculated TTFF of the Last Run
+GNSSLOC	Report Latest Known Position Fix
+GNSSEV	Location Service Events Notification

Note: You can also reference the AirPrime HL7800 AT Commands Interface Guide for a more detailed description of each AT command used in these examples. It can be found at the following address: https://source.sierrawireless.com/resources/airprime/software/airprime_hl78xx_at_commands_interface_guide/#sthash.sdZh7ZBk.dpbs

5 Troubleshooting

In a failure case, in response to `at+gnssloc?` you may receive the following message:

```
+GNSSLOC:
FIX NOT AVAILABLE
```

If this error occurs, consider the following:

1. Wait a few minutes for a FIX to occur, and then run `at+gnssloc?` again.
2. Ensure that your GPS antenna is connected to the Pinnacle 100 with the U.FL to U.FL cable as shown in Figure 1.
3. Be sure that you enabled airplane mode by running the command `at+cfun=4,0` as shown in Figure 4.
4. Make sure your GPS antenna has clear view to the sky for optimal connection.

6 Revision History

Version	Date	Notes	Approver
1.0	16 June 2020	Initial Release	Jonathan Kaye

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