AT Command Set Firmware

Lyra Series

Quick Start Guide *v1.1*

1 INTRODUCTION

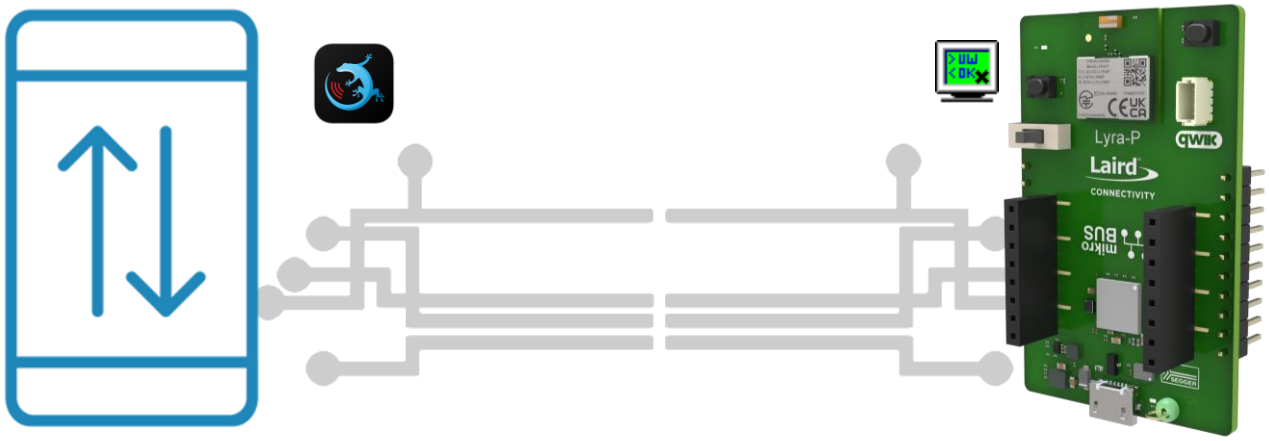
Laird Connectivity's Lyra modules running with the AT Command Set firmware provide a very robust, intuitive, and easy-to-use application for any user regardless of their Bluetooth LE expertise or host MCU. It is a great fit for developers who wish to operate the Lyra modules from their own host system using AT commands, rather than developing a C code application or using the existing Wireless Xpress feature set from Silicon Labs which is frozen at its current software release.

Our AT Command Set firmware implements a wide range of AT command functions (e.g. cable replacement) that can be used to control most of the standard Bluetooth tasks which are supported by the underlying Bluetooth Stack – without having to learn a new programming language. It also removes the complexity of Bluetooth from the design engineer and allows the Bluetooth Stack to be managed by the means of AT commands, which are well-established in the industrial standard and have been used for many years.

The purpose of this quick start guide is to explain how to create a GATT Database structure using EFR Connect App on an Android or iOS smartphone. We'll demonstrate how to make a simple non-VSP BLE connection between one of our Lyra Series development kits (client) and a smartphone (server) where the client retrieves the GATT Database structure, reads data, and disconnects from it.

It is highly recommended that users refer to the User Guide – Lyra Series AT Interface Application, available on the Product Page of the Lyra Series, which will provide more information about all AT commands, events, return values and error codes.

Note: Please note that this document does not cover how to implement / utilize the Wireless Xpress and AT Command Set functions – or any C code development guidance. For more information, refer to the induvial User Guide documents available under http://www.lairdconnect.com/lyra-series.



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2 REQUIREMENTS

This quick start guide document is applicable to the following part number(s) using Laird's AT Command Set firmware:

Development Kits

- (453-00090-K1) Lyra Series – PCB Development Kit with integrated antenna option,
- (453-00091-K1) Lyra Series – SIP Development Kit with various antenna options.

Software and Tools

1. (Recommended) The latest AT Commend Set Firmware for the Lyra Series, available at: https://www.lairdconnect.com/lyra-series
2. (Recommended) UwTerminalX v1.13a or later: https://github.com/LairdCP/UwTerminalX/releases
3. Android or iOS Smartphone with Bluetooth Low Energy support running latest OS version installed.
4. Silicon Labs EFR Connect mobile app for Android / iOS v2.4.3 or later: https://www.silabs.com/developers/efr-connect-mobile-app

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Note: All Lyra Series – Development Kits are using the **JLink CDC UART Port (SEGGER)**. If the driver is not installed automatically when the DVK is plugged into a Windows PC, please make sure that Simplicity Studio 5 is installed. For more information, please refer to the Silicon Labs AN0822: Simplicity Studio™ User's Guide.

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3 FIRMWARE SETUP

By default, all Lyra modules ship without any installed firmware. First you must flash and run the AT Command Set firmware.

This quick start guide document assumes that you are familiar with programming all firmware options which are available / supported by our Lyra module respectively how to change / swap between those firmware versions if required. Further information and instructions can be found in our Lyra Series Firmware Options and Upgrading User Guide.

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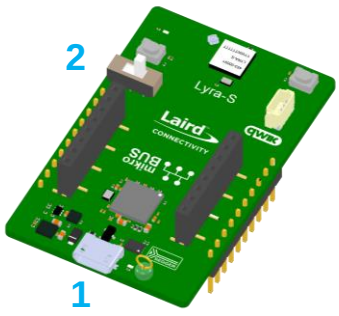
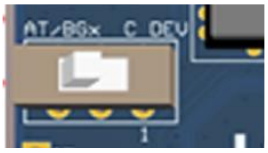
4 Hardware and Terminal Setup

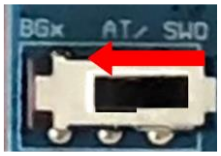
To begin, physically connect the Lyra Series development kit to your PC and UwTerminalX to run AT commands as follows:

1. Connect your Lyra Series – Development Kit to your PC via the included USB micro cable.
2. Make sure that your Lyra Series – Development Kit is powered, and **Switch (SW1)** is in the left-hand **AT/BGx** position.



Note: Versions of the development board silkscreen prior to v2.3 may list SW1 options as *BGx or AT/SWO.* On these boards, *BGx* should be understood to be *AT/BGx* and *AT/SWO* should be understood to be *C-DEV.*





3. Launch **UwTerminalX.exe** on your development PC. From the Config tab in the Device drop-down menu, select **Lyra** under **Port Settings**. This will auto-populate connection settings for the Lyra development board.

Note: The Lyra option may not appear in the drop-down menu in older versions of UwTerminalX. In this case, please make sure to update UwTerminalX from the **Update** tab in UwTerminalX. Click **Check for Updates** to ensure you're using the latest version of UwTerminalX with support for the Lyra Series and AT Command Set firmware.

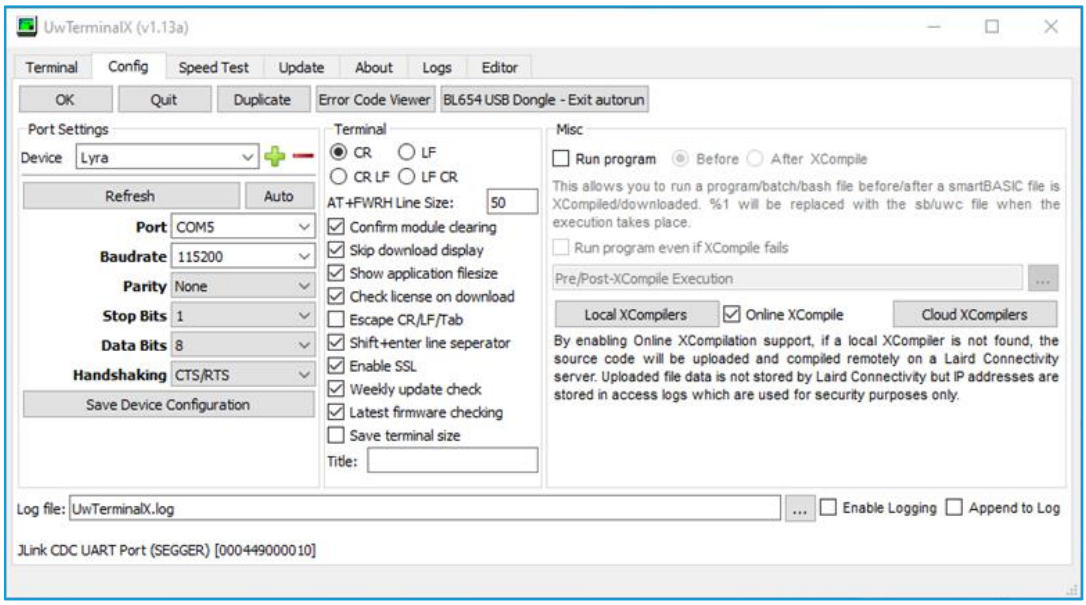


Figure 1: UwTerminalX Config window

4. Next press **Refresh** and select the correct **Port** to which your Lyra Series development kit is connected. In the bottom left corner of your UwTerminalX window you should see *JLink CDC UART Port (SEGGER).*
5. Keep all other Settings as configured and click **Save Device Configuration.**

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6. Click **OK** to advance to the Terminal tab.
7. Type **AT** into the terminal and press **Enter**. If you see the return value *OK*, you are successfully connected over UART.

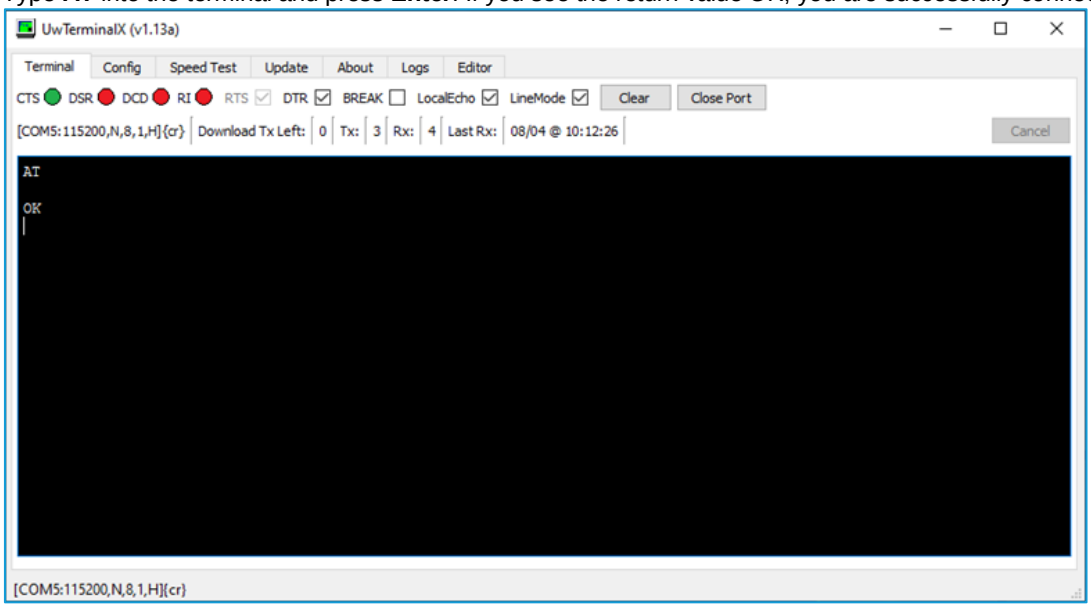

Figure 2: UwTerminalX Terminal window showing AT command usage

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5 GATT DATABASE / SERVER ON YOUR SMARTPHONE USING EFR CONNECT APP

We will use our smartphone as a BLE Peripheral (Server), so that our Lyra Series – Development Kit which acts as a BLE Central (Client) can connect to it. Let's start by manually creating a GATT Database structure based off the following:

- **User Data Service** (*0x18C1*)
- **Battery Level Characteristic** (*0x2A19*)
- **Characteristic User Descriptor** (*0x2901*)

This GATT Database structure allows us to store the value of an underscore "_" in ASCII for later readouts and demonstration purposes. Further information about the used **Assigned Numbers** (16-bit UUIDs) can be found in the official Bluetooth SIG documentation and specification: https://www.bluetooth.com/specifications/assigned-numbers/.

Note: The following screenshots were taken on iOS. Android will vary in appearance but follow the same approach. Also, it is worth mentioning that smartphones are using so called private resolvable random addresses to protect the privacy of the user. So please keep in mind that it is very likely that your MAC address of your smartphone will occasionally change, so it's not always the same.

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1. Start EFR Connect mobile app after it is downloaded and installed on your smartphone.

2. Go to **GATT Configurator** and press the three dots (⋮) icon in the top right corner to create a **New GATT Server**.

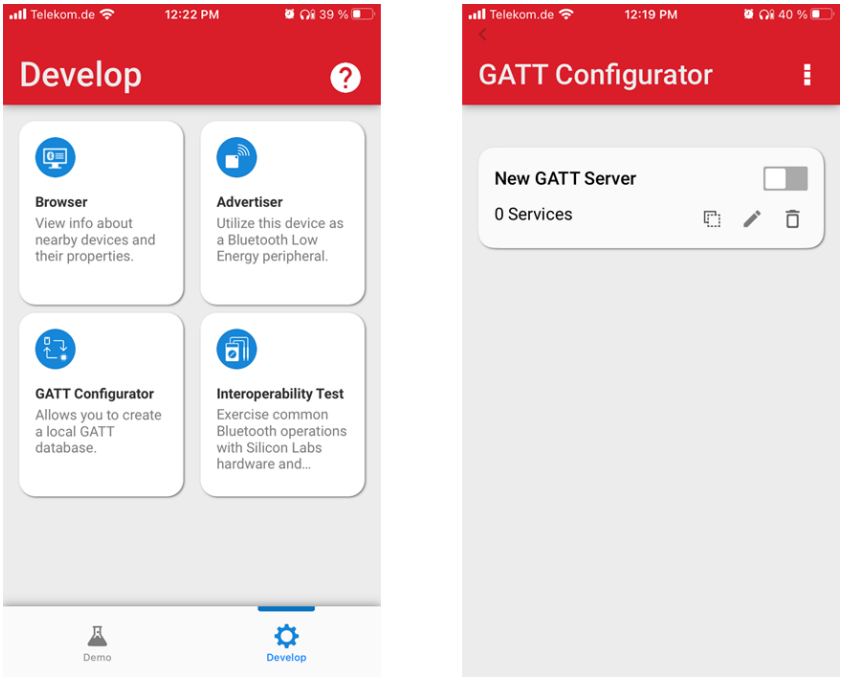

Figure 3: Getting started with the EFR Connect mobile app

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3. Now choose a **GATT Server Name** which is easy to remember and find. In our case we will call it **Anna's Smartphone** as shown.

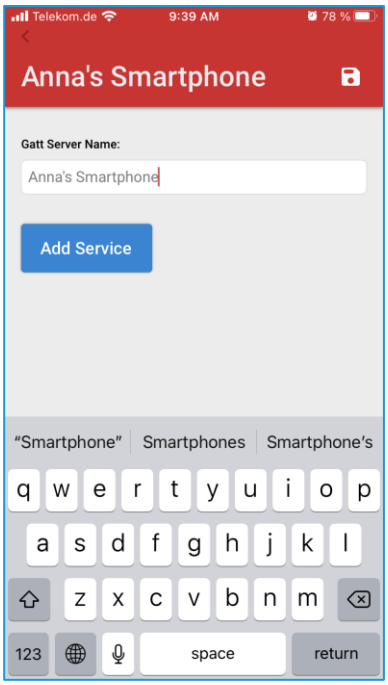

Figure 4: GATT Server Name in EFR Connect mobile app

4. Define GATT Service:
   Click the pencil (✎) icon and **Add Service** button. Now add **Service Name** *User Data* with *0x181C* for the **16/128-bit UUID** value.

   Please double-check that "*Add mandatory service requirements*" box is NOT ticked. Keep all other parameters unchanged and hit **Save** button.

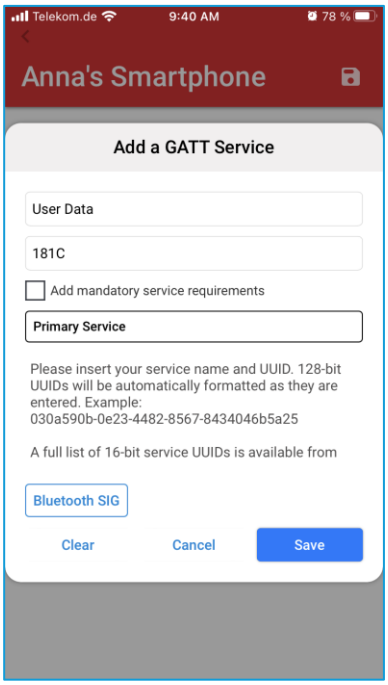

Figure 5: Define GATT Service in EFR Connect mobile app

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5. Define GATT Characteristic:
   Press **Add Characteristic** button and add **Characteristic Name** *Battery Level* with *0x2A19* used for the **16/128-bit UUID**.

   Check that **Read** is set and everything else is unchecked. Hit the **Save** button.

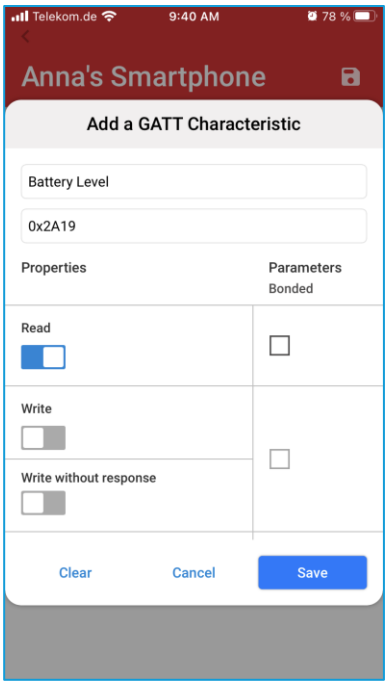

Figure 6: Define GATT Characteristic in EFR Connect mobile app

6. GATT Descriptor:
   Now press on *More info* text, **Add Descriptor** button and add **Descriptor Name** *Characteristic User Description* with *0x2901* value for the **16/128-bit UUID**.

   Insert one underscore character "_" into the **Insert text** field using Text (ASCII) format and press **Save**.

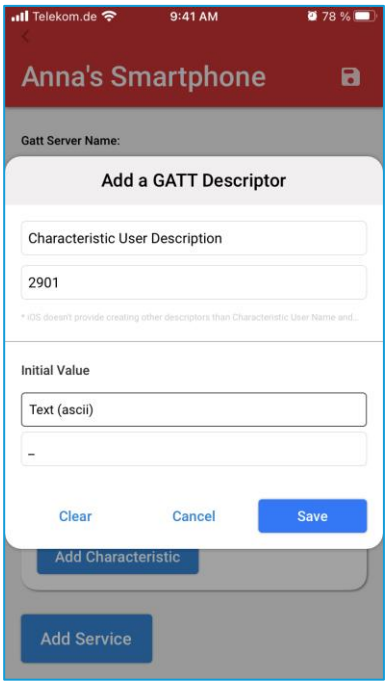

Figure 7: Define GATT Descriptor in EFR Connect mobile app

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7. Save your current GATT Server structure and database by pressing the floppy disk icon which is located in the top right corner.

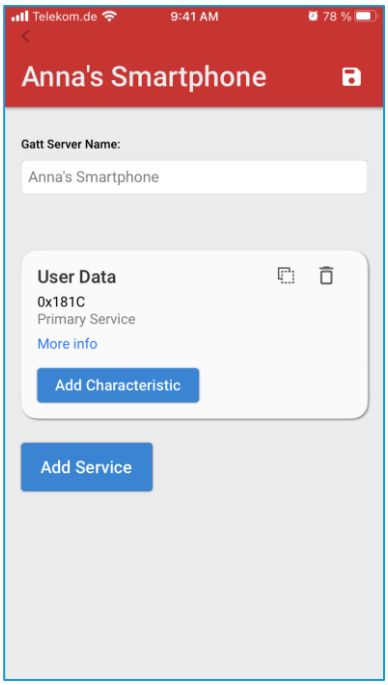

Figure 8: Save your GATT structure and database in EFR Connect mobile app

8. By default, the new GATT Configuration is not enabled / active.

   Click the on/off slider to activate when finished and ready.

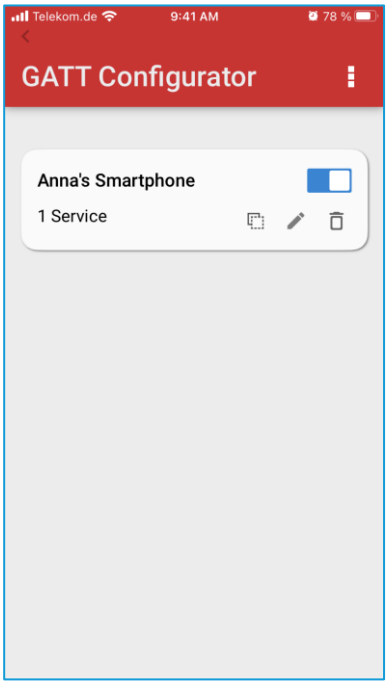

Figure 9: Enable GATT Configurator in EFR Connect mobile app

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6 GETTING STARTED WITH THE AT COMMAND SET FIRMWARE

1. In UwTerminalX, we will first request for our Lyra development board the module name, firmware version and MAC address by using the **ATI** command.

```
ATI 0
  LYRA

ATI 3
  125.3.0.27

ATI 4
  0018C293000019
```

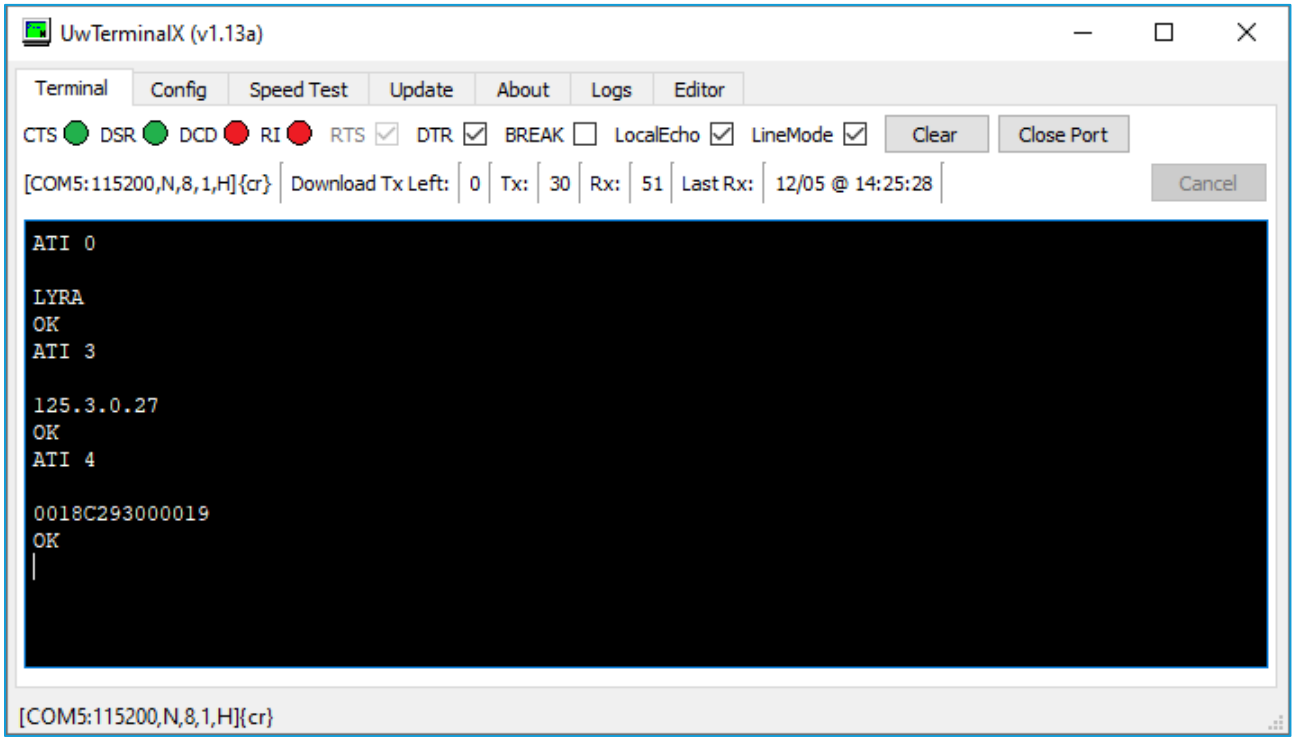

Figure 10: UwTerminalX Terminal window showing ATI command usage

2. Next, it's time to search for our smartphone using the **AT+LSCN** command. This command will scan for all available BLE devices. Once completed, look for the GATT server name you specified (*Anna's Smartphone*, in our example) and note the associated Bluetooth MAC address (in the following example, the MAC address is *0244608760214F*):

```
AT+LSCN

  [...]

  AD0:0 01FCCF69712D6C -58 "BT510"
  AD0:0 0244608760214F -35 "Anna's Smartphone"
  AD0:0 027624E0252547 -20 "Unknown"
  AD0:0 01E8761E568086 -63 ""


  [...]

  scanned
```


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You may also see other nearby BLE devices in this list. **0244608760214F** and **Anna's Smartphone** are specific to this example and your values will differ here. If you are not seeing your smartphone, please make sure that Bluetooth is enabled, EFR Connect mobile app is running in foreground and that your GATT Configuration is active.

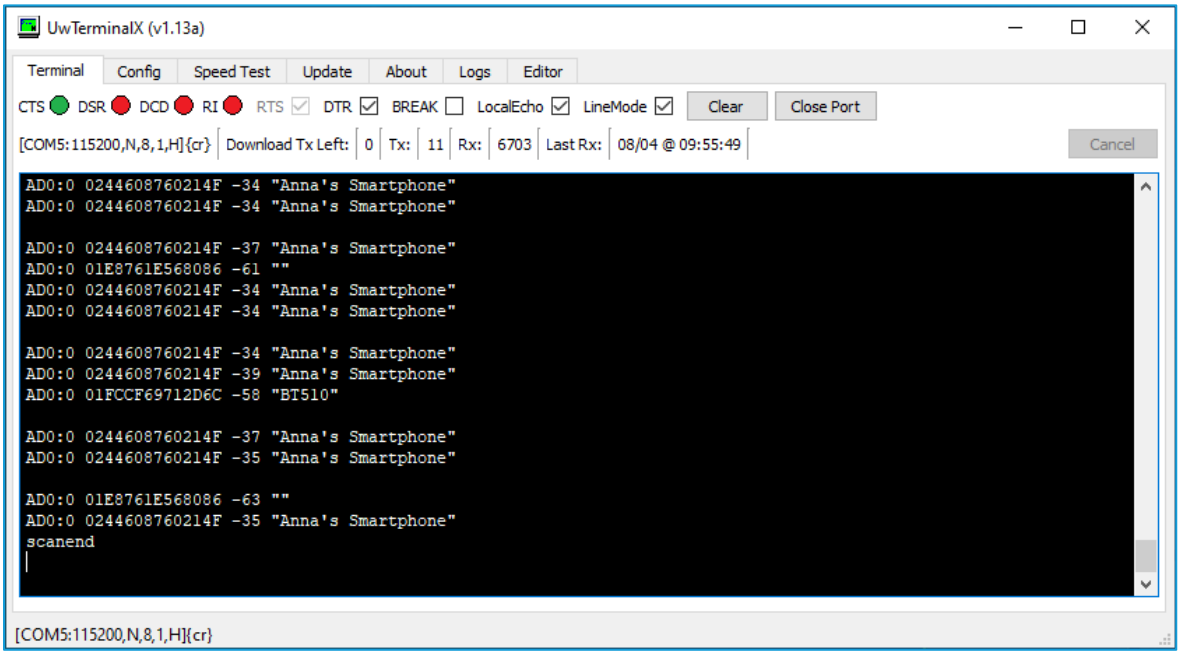

Figure 11: UwTerminalX Terminal window showing AT+LSCN usage

3. Since we now know the Bluetooth MAC address (**0244608760214F**) for our smartphone (**Anna's Smartphone**), we will initiate and establish a BLE connection from our Lyra Series – Development Kit to it using the **AT+LCON** command.

```
AT+LCON 0244608760214F
  connect 1,0244608760214F,15000,6000000,0
```

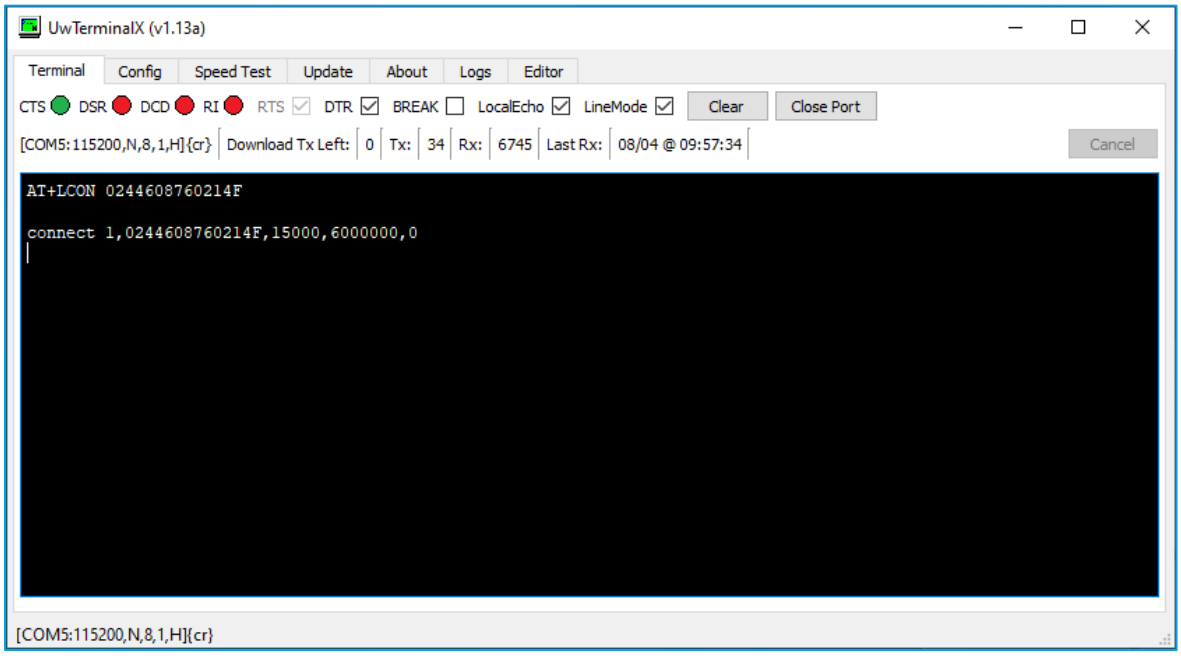

Figure 12: UwTerminalX Terminal window showing AT+LCON usage

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4. Our Lyra development board is now connected via BLE to our smartphone. We use the **AT+GCTM** command to fetch and read the GATT database structure, which we defined and added via the EFR Connect mobile app previously. For the sake of simplicity in this quick start guide, we will only focus on the latest returned GATT Service / Characteristic that is highlighted:

```
AT+GCTM 1

  TM:S:1 ,(5) ,FE011800
  TM: C:3 ,00000002 ,FE012A00 ,0
  TM: C:5 ,00000002 ,FE012A01 ,0

  TM:S:6 ,(9) ,FE011801
  TM: C:8 ,00000020 ,FE012A05 ,0
  TM:  D:9 ,FE012902

  TM:S:10 ,(14) ,FC031E78
  TM: C:12 ,00008018 ,FB04556C ,0
  TM:  D:13 ,FE012900
  TM:  D:14 ,FE012902

  TM:S:15 ,(19) ,FA0580E0
  TM: C:17 ,00008018 ,F906ADB1 ,0
  TM:  D:18 ,FE012900
  TM:  D:19 ,FE012902

  TM:S:23 ,(26) ,FE01180F
  TM: C:25 ,00000012 ,FE012A19 ,0
  TM:  D:26 ,FE012902

  TM:S:27 ,(32) ,FE011805
  TM: C:29 ,00000012 ,FE012A2B ,0
  TM:  D:30 ,FE012902
  TM: C:32 ,00000002 ,FE012A0F ,0

  TM:S:33 ,(37) ,FE01180A
  TM: C:35 ,00000002 ,FE012A29 ,0
  TM: C:37 ,00000002 ,FE012A24 ,0

  TM:S:38 ,(47) ,F807F431
  TM: C:40 ,00008008 ,F708D8F3 ,0
  TM:  D:41 ,FE012900

  TM: C:43 ,00000010 ,F609120D ,0
  TM:  D:44 ,FE012902
  TM: C:46 ,00000010 ,F50AC6E9 ,0
  TM:  D:47 ,FE012902

  TM:S:48 ,(59) ,F40B502B
  TM: C:50 ,00008018 ,FF000000 ,0
  TM:  D:51 ,FE012900
  TM:  D:52 ,FE012902

  TM: C:54 ,00008018 ,FF000000 ,0
  TM:  D:55 ,FE012900
  TM:  D:56 ,FE012902
  TM: C:58 ,0000800A ,FF000000 ,0
  TM:  D:59 ,FE012900

  TM:S:60 ,(63) ,FE01181C
  TM: C:62 ,00000002 ,FE012A19 ,0
  TM:  D:63 ,FE012901

  OK
```


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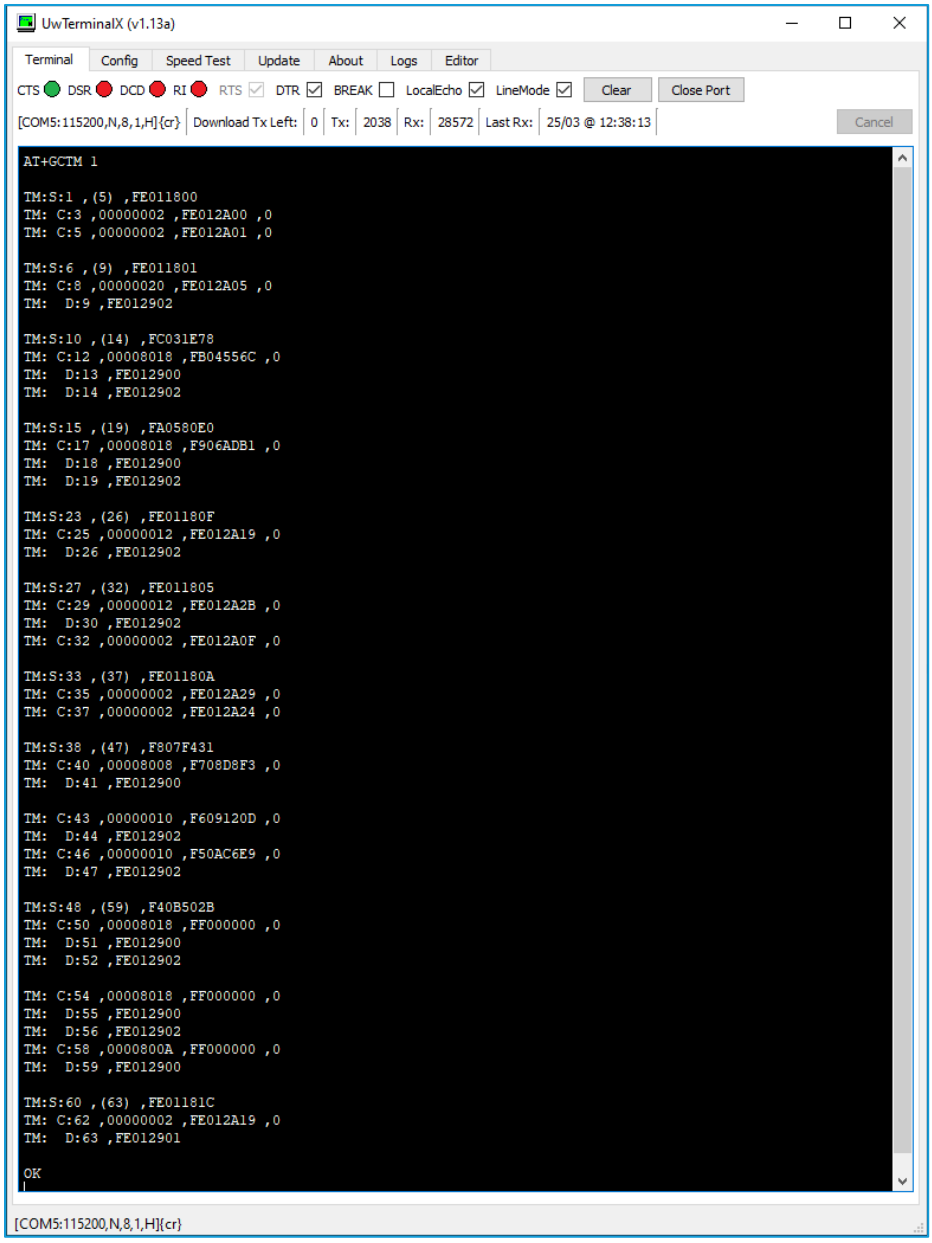

Figure 13: UwTerminalX Terminal window showing AT+GCTM usage ...

Note: By default, most smartphones terminate the BLE connection automatically after a short period of time due to power consumption and/or connection inactivity timeout reasons.

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5. Finally, we can read the value from the **Battery Level Characteristic** which is part of the **User Data Service** using the **AT+GCRD** command. In this case the returned value is *0x5F00* in hex (little-endian), *0x005F* in hex (big-endian) or 95 in decimal which represents our underscore character "_" in ASCII.

```
AT+GCRD 1,63,0

  OK
  AR:1,0,5F00
```

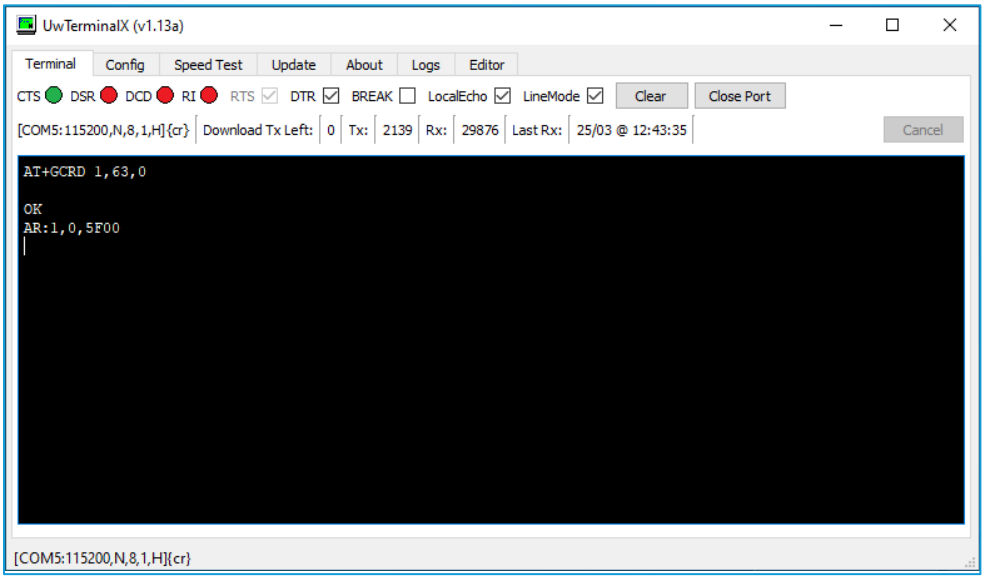

Figure 14: UwTerminalX Terminal window showing AT+GCRD usage

6. At the end we can safely disconnect from our smartphone with the **AT+LDSC** command.

```
AT+LDSC 1

  OK
  discon 1,22
```

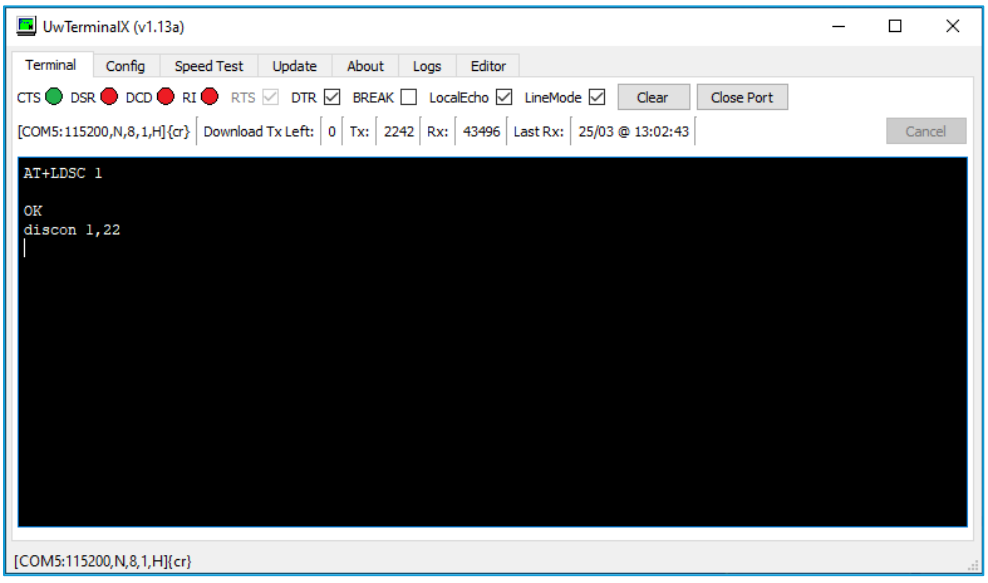

Figure 15: UwTerminalX Terminal window showing AT+LDSC usage

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7 Conclusion

Laird Connectivity's AT Command Set firmware is available for use in your design and exposes an industry standard AT command / response protocol. It's a perfect fit for developers who wish to operate the Lyra modules from their host system using AT commands. This can accelerate and simplify your development of wireless applications drastically.

In this quick start guide, we've seen and learned how to structure a simple GATT database using our smartphone with EFR Connect mobile app and how to read data from it with the Lyra Series – Development Kit running the AT Command Set firmware in non-VSP mode.

There are many more useful AT commands to explore which can be found in our User Guide – Lyra Series AT Interface Application allowing you to extend your host application individually.

8 Further Information

Further information and resources (i*ncluding Firmware, Certificates, Reports, Software, Application Notes, User Guide and more*) relating to the Lyra Series module is available on our Lyra Series product page:
https://www.lairdconnect.com/lyra-series

9 Revision History

Version	Date	Notes	Contributor(s)	Approver
1.0	22 July 2022	Initial Release	Florian Baumgartl	Jonathan Kaye
1.1	19 Aug 2022	Added note about silkscreen labelling on board revisions 2.2 and previous for SW1 in Hardware and Terminal Setup	Dave Drogowski	Jonathan Kaye

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