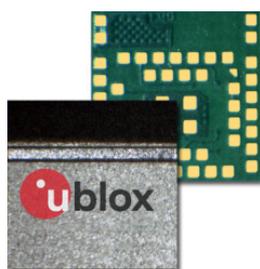


ANNA-B112

Stand-alone Bluetooth 5 low energy module

Getting Started



Abstract

This document describes how to set up and use the ANNA-B112 Bluetooth 5 low energy module with the u-blox connectivity software. It also provides a technical overview of ANNA-B112.

Document Information

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1 Introduction

The ANNA-B112 is a highly integrated Bluetooth® low energy module developed by u-blox for integration in demanding, reliable devices, such as those needed for industrial and medical applications. The module is built around a Bluetooth low energy chip. This document describes how to set up and use the modules.

1.1 Key features

One of the key features of ANNA-B112 is the Wireless serial cable replacement functionality. The basic functionality is to transfer data between the serial port and a wireless link. It is possible to configure the ANNA-B112 module to automatically setup a connection and/or accept an incoming connection using AT commands.

For a host, this means that an existing serial cable can be replaced by a wireless solution; in many cases without the need to modify the host.



Figure 1: ANNA-B112 Bluetooth setup

1.2 Modes of operation

The ANNA-B112 module can operate in the following three different modes:

- Command mode
- Data mode
- Extended Data mode

In command mode, the module is configured using AT commands. For information regarding the available AT commands, see u-blox Short Range Modules AT Commands Manual [1].

In data mode, the module transmits data transparently between the serial UART and wireless connection(s).

The extended data mode (EDM) allows individual control of each active link. While sending and/or receiving data, AT commands can simultaneously be sent to the module from the host. For more information about EDM, see section 2.6 and u-blox Extended Data Mode Protocol Specification [7]).

1.3 u-blox Low Energy Serial Port Service (SPS)

In Bluetooth BR/EDR, there is a Serial Port Profile (SPP) that emulates a serial port over air. For Bluetooth low energy, there is no such profile and thereby no standardized way of transferring generic data over the air.

The u-blox Low Energy Serial Port Service is a non-standard profile developed for the u-blox serial port adapter concept. The specification is open and may be implemented in any Bluetooth Low Energy device to enable generic data transmission.

The serial port service is implemented on top of the Generic Attribute Profile (GATT). It contains the following characteristics:

- FIFO for reading and writing data
- Credits to simulate the Bluetooth BR/EDR credit-based flow control

To connect, the central/client side sets up the ACL (Asynchronous Connection-Less) link and enables indications for both the FIFO and credits characteristics. Then the server side sends the number of credits to the client using the credit indication, and the client writes the number of credits to the server. The credits correspond to the number of packets the remote side may write before receiving new credits. The received credits are added to the remaining ones (if any).

When the connection has been established and credits have been received, data transmission starts. The client writes to the FIFO and the server sends indications or notifications with the FIFO data. Connections without credits are also supported. Connections without credits are faster to establish and ideal for scenarios where a small amount of data shall be transferred.

For more information, see the u-blox Low Energy Serial Port Service Protocol Specification [10].

1.4 NFC



ANNA-B112 includes NFC (Near Field Communication), which can be used to “touch” ANNA-B112 to an NFC reader device to perform actions. NFC can simplify the connection process to a module and reduce the number of steps when provisioning an ANNA-B112 module. NFC can also be used to launch apps on smartphones and store a web link or a text.

An NFC antenna is included in the ANNA-B112 evaluation kit.

2 Configuration

You can configure the ANNA-B112 module according to your specific requirements by means of AT commands (see u-blox Short Range Modules AT Commands Manual [1]). The easiest way to get started is to use the u-blox s-center, which is a graphical user interface for sending the AT-commands (see s-center Product Summary [4]). The u-blox s-center enables easy configuration for the most common AT commands.

2.1 Basic settings

There are some basic commands for controlling the general Bluetooth behavior of the module as listed below.

- Connection Mode - AT+UBTCM: Configures the module for incoming connections.
- Discover Mode - AT+UBTDM: Configures the visibility for remote devices making inquiries.
- Pairing Mode - AT+UBTPM: Configures the ability to pair (authenticate) to remote devices.
- Bluetooth name - AT+UBTLN: Sets the name presented to remote devices making inquiries or name requests.

Once pairing has been done with a remote device, it is recommended to disable both discover and pairing mode for security reasons and performance.

2.2 Peers

A connection consists of a sender and a receiver of data. Every sender and receiver in a setup is referred to as a peer. Thus, a peer is capable of either receiving or sending data.

There are two kinds of peer classes in the serial port adapter:

- Local peer
- Remote peer

The local peer is synonymous with the UART. In contrast to the local peer, the remote peer is another device. Several remote peers can be defined if a multidrop scenario is needed.

A remote peer is addressed using a Uniform Resource Locator, URL. These locators are strings representing the nodes on internet or on a local net. This is the same addressing technology used in case of a web browser. For more information about URLs, see <http://www.rfc-base.org/txt/rfc-1738.txt>.

In general, URLs are written as follows: *<scheme>:<scheme-specific-part>*

Where *<scheme>* is the scheme or protocol used when communicating and *<scheme-specific-part>* is normally the address and port number of the remote node. For example, a web server on the internet can have the following address:

<http://www.u-blox.com/>

This tells the browser to use the HTTP protocol and connect to the node at address <http://www.u-blox.com/>. A similar addressing scheme is used by ANNA-B112 to pinpoint the remote peer. The scheme is not "http", but the node addressing is identical.

Available schemes:

- sps: Bluetooth low energy u-blox Serial Port Service

Syntax:

- sps: *<scheme>://bluetooth_address/*

Example

- `sps://0012f3000001`

A peer can be set up using either the default remote peer command **AT+UDDRP** or dynamically created using the connect peer command **AT+UDCP**. A connection is closed using **AT+UDCPC**.

 The Bluetooth low energy SPS service is enabled by default in ANNA-B112 and it accepts incoming connections by default.

2.3 Client and server

A client will initiate a connection and the server will accept an incoming connection.

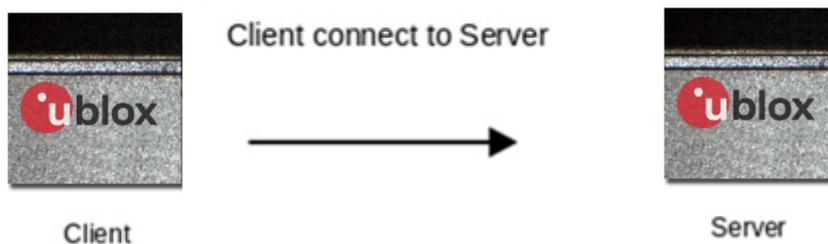


Figure 2: ANNA-B112 as a client connecting to the ANNA-B112 server

To configure a client to automatically set up a connection to a server, configure the correct Bluetooth service and the remote peer. The Bluetooth service controls the type of connection that is requested (see section 2.4) and the preferred server to connect is defined by the remote peer.

- **Default Remote Peer AT+UDDRP** Configures server (profile and address) to connect and when to initiate the connection. Peer is enumerated starting with id 0.
- **Server Configuration AT+UDSC:** Will only accept incoming connection attempts for the configured server profile. ANNA-B112 will have the SPS enabled by default.

2.4 2 Mbps physical layer (PHY)

In Bluetooth 5, a new physical layer has been introduced. This physical layer doubles the modulation rate as compared to Bluetooth 4.2. The change from 1 Mbps to 2 Mbps is done by doubling the symbol rate; because of this, the bandwidth becomes twice as wide. The Bluetooth low energy already has 2 MHz channel centers so the increased bandwidth does not reduce the number of channels.

- **Preferred Transmitter/Receiver PHY AT+UBTLECFG=27/28:** Set the preferred PHYs to be used as response for peer-initiated PHY update requests.
- **Low Energy PHY Request AT+UBTLEPHYR:** Request a change of PHY for the specified connection.

2.5 Bluetooth services

The Generic Attributes (GATT) is used when Bluetooth LE devices exchange data. There are two roles defined in GATT - the client and server. For more information about GATT, see [8].

The GATT server stores data received from the GATT client. The GATT server sends responses to requests and sends indications and notifications to the GATT client when specified events occur on the GATT server.

Official as well as user-defined GATT Services can be set up with AT commands. The Serial Port Service (SPS) is a u-blox proprietary serial cable emulation service, which is enabled by default.

2.6 Command mode, data mode, and extended data mode

By default, ANNA-B112 will enter command mode and has to be reconfigured to start up in data mode or extended data mode. From the data mode or extended data mode, it is possible to enter the command mode by transmitting escape sequence to the module. By default, the escape sequence is:

1. Silence 1 second
2. +++
3. Silence 1 second

 The +++ must be sent within 200 ms, which means that it is difficult or impossible to enter the escape sequence manually using a terminal window though the characters can also be typically pasted instead. The module leaves the command mode and enters data mode using the **ATO1/ATO2** command. It is also possible to toggle the UART DTR pin from High to Low to enter the command mode.

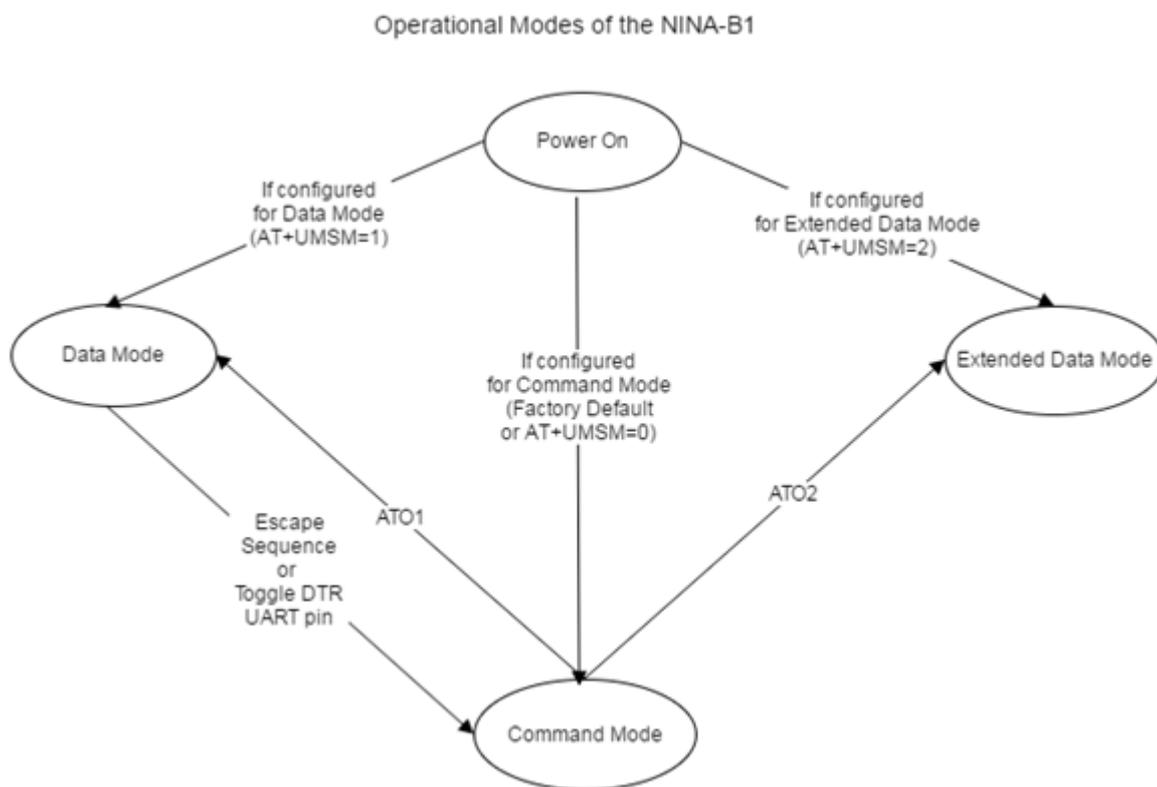
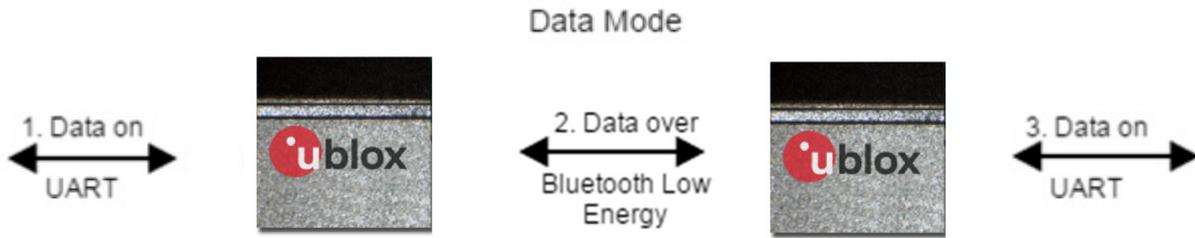
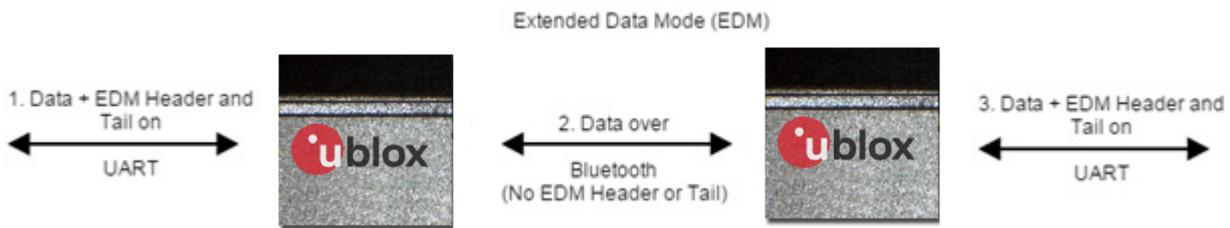


Figure 3: Operational modes

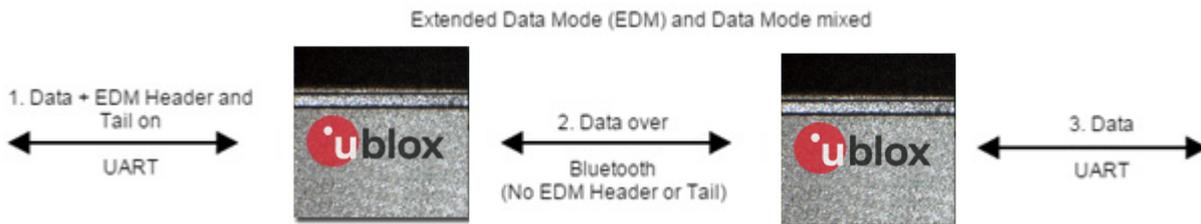
In data mode, the data transmitted on the UART to the module will be transmitted (and broadcast for all connections) over the air to all wireless connections. Data received from the wireless connections may be interleaved upon reception and it may be difficult or impossible to figure out from which remote device the data is received. This "multipoint strategy" is known as Wireless Multidrop. It is suitable mainly for master/slave polled protocols such as Modbus and point-to-point communication.


Figure 4: Data mode

The extended data mode is a simple protocol for the UART, which enables transmission of data to one specific remote device and also informs the remote device from where the data originated. It is also possible to execute AT commands as part of the extended data mode protocol. Hence, it is not necessary to enter the command mode from the extended data mode.


Figure 5: Extended data mode

No extended data mode protocol data is available over the air. Only "raw" data is transmitted in the same way as in the data mode over air. Hence, it is possible for one side to be configured for extended data mode and the other side for the standard data mode.


Figure 6: Data mode and extended data mode

2.7 Multipoint

It is possible to configure a module to support up to 8 parallel Bluetooth connections. These connections can be to 1 central and 7 peripherals in a multirole configuration. The `AT+UBTCFG` command is used to set the maximum number of Bluetooth connections.

In data mode, data is transmitted over air to all the connected devices and the data received from remote devices is interleaved.

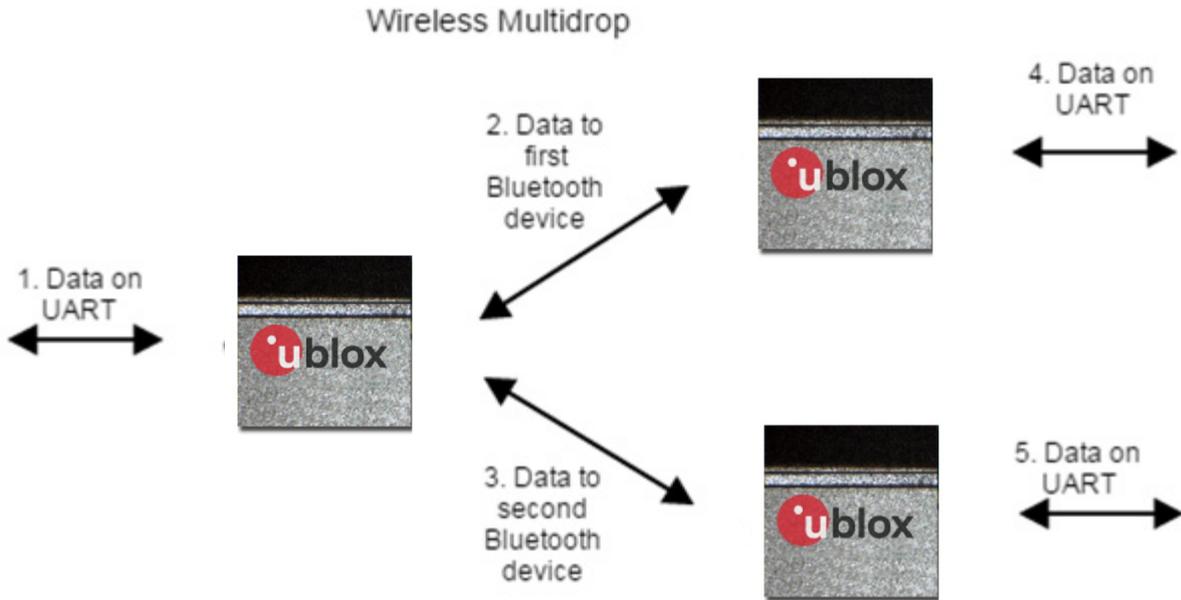


Figure 7: Wireless Multidrop

In extended data mode, it is possible to transmit data to a specific remote device and to know from which remote device data is received (see *u-blox Extended Data Mode Protocol Specification [7]*).

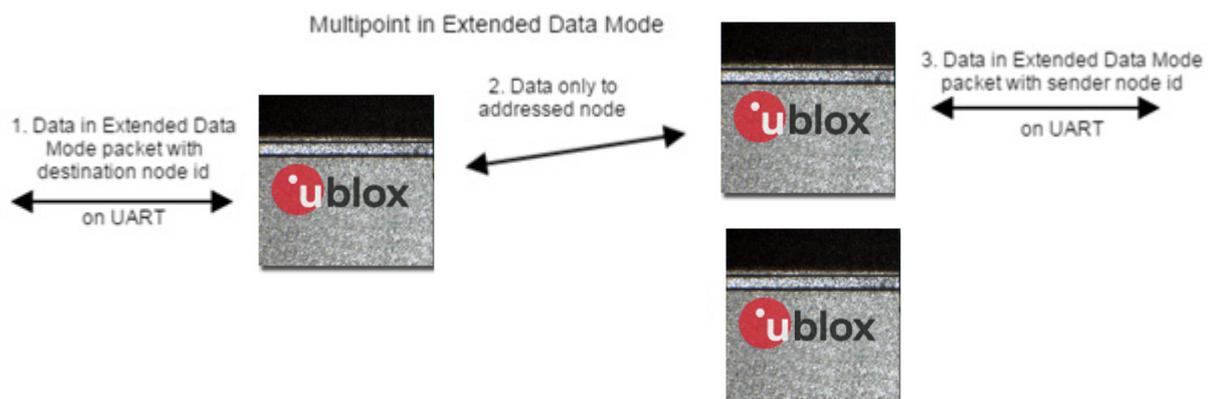


Figure 8: Multidrop in extended data mode

2.8 Bluetooth security

There are six different security modes that support all kinds of use cases regarding the pairing procedure.

All security modes use encryption. The encryption algorithm is a 128-bit cipher called E0.

Security mode 1 and 2 are implemented to keep the same or similar behavior as for previous versions of u-blox Bluetooth products.

Secure Simple Pairing (SSP) was introduced in Bluetooth 2.1 to improve security and simplify the pairing process. SSP uses a form of public key cryptography and the just works, numeric comparison, passkey entry, and out of band authentication mechanisms.

- Just works: No user interaction is needed, except that the user may need to confirm the pairing process. The method is typically used by devices with very limited IO capabilities.
- Numeric comparison: A 6-digit numeric code is displayed on each device where the user compares the numbers to ensure they are identical.
- Passkey entry: Either a 6-digit numeric code is displayed on one device that the user enters on the other device, or the same 6-digit numbers are entered on both devices.
- Out of band: This security mode is used to connect to a remote device when the temporary key has been exchanged out of band.

Use the security mode 1 (Bluetooth 2.1 auto accept security) **AT+UBTSM=1** to start with. It is highly recommended to analyze the security and if appropriate, use a more secured solution, for example security mode 2 (Bluetooth 2.1 Just Works) **AT+UBTSM=2**.

2.9 Low power modes

The Standby mode is one of the power saving modes in the ANNA-B112 module that essentially powers down the module but keeps the system RAM and allows incoming connection to the module. The Sleep mode is the deepest power saving mode of ANNA-B112 modules, and does not allow any connection to wake up the module. The low power modes in ANNA-B112 are set using the AT&D command.

2.9.1 Standby mode

The standby mode in ANNA-B112, enabled with **AT&D3**, is used to disable the UART. The radio is still active and the UART can be activated again either on a logical 0 to logical 1 signal transition on the DTR line, or by an incoming Bluetooth connection establishment.

For more information about Standby mode, see ANNA-B112 Data Sheet [2].

2.9.2 Sleep mode

The sleep mode in ANNA-B112 module is enabled with the command **AT&D4**, which causes a logical 0 to logical 1 signal transition of the DTR line to completely shut off the module. Upon a logical 1 to logical 0 signal transition on the DTR line, the module is started again. This is the lowest power mode, and ANNA-B112 will not be able to keep or make any connection in this mode.

For more information about Sleep mode, see the ANNA-B112 Data Sheet [2].

3 Evaluation board

The evaluation board for ANNA-B112 module is EVK-ANNA-B112.

3.1 LED indications and buttons

There are two operational buttons (SW1 and SW2) and one multi LED (DS9), as shown in Figure 9.

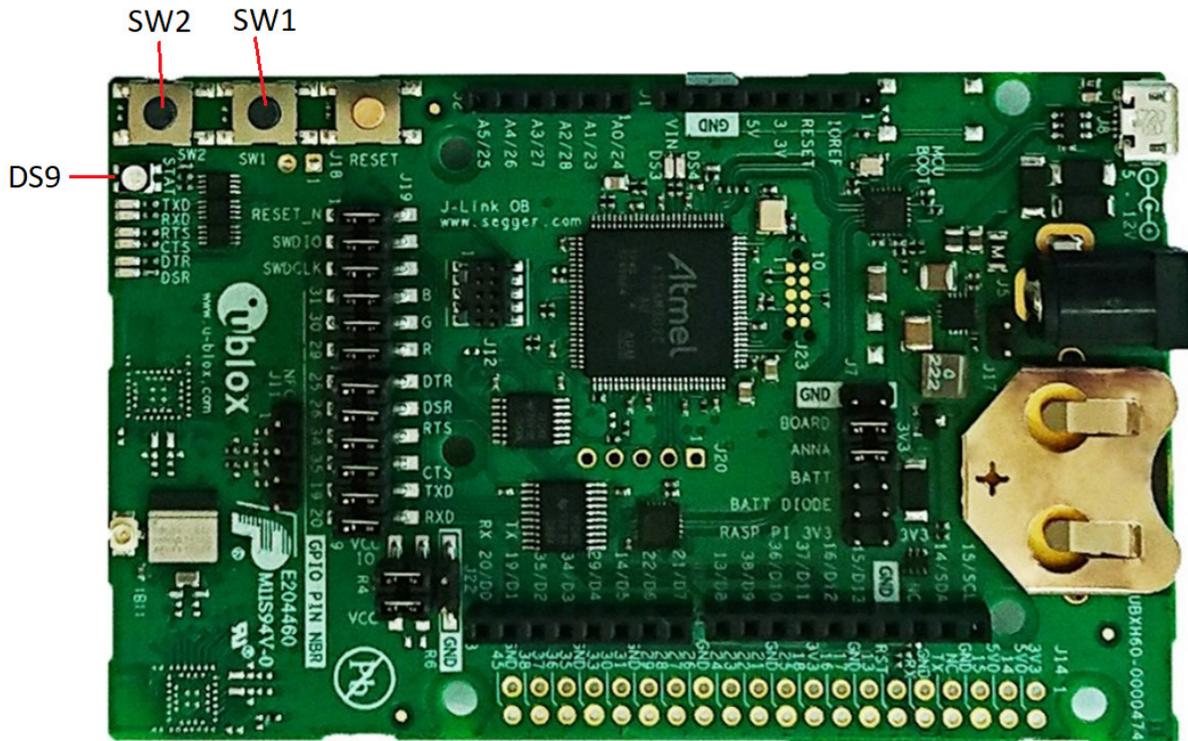


Figure 9: EVK-ANNA-B112 Evaluation board

The LED indicates what mode is currently active and what activity is currently in progress. The following color indications are used. See EVK-ANNA-B112 User Guide [3] for more information about the EVK-ANNA-B112.

- Green: The current mode is data mode and no connection attempts are in progress.
- Orange: The current mode is command mode.
- Purple: A connection attempt is in progress.
- Blue: A connection is currently active.
- Blue Blinking: A connection is active and data is transmitted or received over air.
- Red Blinking: Error detected. Typically, this means buffer overflow, parity or framing error detected on the UART.

 The LED on the evaluation board is a 3-colour LED, which means that, on the module, it corresponds to three IO pins.

3.2 Restore default serial settings

If the SW2 button is pressed during power on, the module resets the serial settings and escape sequence to the default values.

- Default serial settings are 115.2 kbps, 8N1 and HW flow control enabled
- Default escape sequence is +++
- Default escape sequence timing is 1s silence before and after the escape sequence

3.3 Restore factory settings

If both the SW1 and SW2 buttons are pressed for 10 seconds during power up, the factory settings are restored. You can also restore to the factory settings using the **AT+UFACTORY** command followed by power off/on.

3.4 Enter the bootloader

To enter the bootloader, press the SW1 and SW2 buttons during a reset; this will start the module in the u-blox bootloader. You can also enter the bootloader using the **AT+UFWUPD** command. The bootloader will time out and resume the application after 10 seconds.

3.5 Flashing the module

The PC tool s-center can be used to flash ANNA-B112. Instructions on flashing the ANNA-B112 can be found in the *Software section* of the ANNA-B112 System Integration Manual [11].

Go to the u-blox support webpage to obtain the latest available software.

4 Use case examples

4.1 Connect two ANNA-B112 using Bluetooth low energy

Connect two ANNA-B112 modules using Bluetooth low energy Serial Port Service (SPS), which connects automatically.

Set up first ANNA-B112 as a Central (Device A)

- Enable Central Role

```
AT+UBTLE=1
```

- Default peer to Serial Port Service and always connected (use the address of Device B)

```
AT+UDDRP=0,sps://112233445566,2
```

- Startup ANNA-B112 in data mode

```
AT+UMSM=1
```

- Store configuration

```
AT&W
```

- Restart ANNA-B112

```
AT+CPWROFF
```

Set up second ANNA-B112 as a Peripheral (Device B)

ANNA-B112 has the u-blox Serial Port Service enabled by default:

- Startup in data mode

```
AT+UMSM=1
```

- Store configuration

```
AT&W
```

- Restart

```
AT+CPWROFF
```

4.2 Set up iBeacon on ANNA-B112

Set up ANNA-B112 to advertise Apple iBeacon packets:

 This is only an example use case. Apple requires iBeacon license agreement if it is used in a product.

iBeacon is a Manufacturer-specific event, and contains an 128 bit UUID such as D9B9EC1F-3925-43D0-80A9-1E39D4CEA95C. Note that the byte order for the AT command use the reverse byte order. Together with the Major (2 bytes), Minor (2 bytes) and the Tx power (1 byte), it builds up the iBeacon advertise packet.

Apple recommends the Local Name in the Scan Response packet. See [5] for more information about iBeacon.

- To change advertise packet on ANNA-B112 to include iBeacon:

```
AT+UBTAD=1AFF4C000215EBEFD08370A247C89837E7B5634DF52400010001C5
```

- To change Local Name to "Bluetooth Device":

```
AT+UBTSD=1109426C7565746F6F746820446576696365
```

4.3 Set up Eddystone on ANNA-B112

Setup ANNA-B112 to advertise Google Eddystone packets:

 This example will show how to send an URL inside the advertisement packet; by nature, the advertisement packet is limited in size and the information is also limited.

The payload contains a short version of an URL, for example `https://goo.gl/Aq18zF`. The link is encoded to save space, but most smartphones can use this information to navigate to the advertised URL. See [6] for more information about Eddystone.

- To change advertise packet on ANNA-B112 to include the Eddystone URL:

```
AT+UBTAD=0303AAFE0D16AAFE10F801752D626C6F7807
```

- To change Local Name to "Bluetooth Device":

```
AT+UBTSD=1109426C7565746F6F746820446576696365
```

4.4 Change the ANNA-B112 name

ANNA-B112 (Device A) is a Peripheral

- Set Local Name on ANNA-B1 to

```
AT+UBTLN="u-blox ANNA-B1"
```

ANNA-B112 (Device B) as a Central

- Set Central Role on ANNA-B112

```
AT+UBTLE=1
```

- Store configuration

```
AT&W
```

- Restart ANNA-B112

```
AT+CPWROFF
```

- Make a Device Discover to find Device A

```
AT+UBTD
+UBTD:112233445566p,-70,"u-blox ANNA-B1",1,0F09752D626C6F78204E494E412D...
```

4.5 Set up GATT Server on ANNA-B112

The following example shows how to set up a GATT Server on ANNA-B112. The GATT Server value can be read by a remote device see the use case in section 4.6.

Set up a GATT Server with a pre-defined service on ANNA-B112

- Define a Heart Rate service - A list of all available pre-defined services and its characteristics can be found at [8] and [9]

```
AT+UBTGSER=180D
+UBTGSER:30
```

- Add a Heart Rate measurement characteristic with notification support

```
AT+UBTGCHA=2A37,10,1,1
+UBTGCHA:32,33
```

4.6 Set up GATT Server / Client on ANNA-B112

The following example shows how to set up a GATT Server on one ANNA-B112 and receive notifications of updated values at a GATT Client on a second ANNA-B112.

Set up a GATT Server with a pre-defined service on ANNA-B112 (Device A)

- Define a Heart Rate service - A list of all available pre-defined services and its characteristics can be found at [8] and [9]

```
AT+UBTGSER=180D
+UBTGSER:30
```

- Add a Heart Rate measurement characteristic with notification support

```
AT+UBTGCHA=2A37,10,1,1
+UBTGCHA:32,33
```

Use the GATT Client on ANNA-B112 (Device B) to receive Heart rate measurement values:

- Enable Central Role

```
AT+UBTLE=1
```

- Store configuration

```
AT&W
```

- Restart

```
AT+CPWROFF
```

- Find the other device

```
AT+UBTD=4,1
+UBTD:112233445566p,-59,"ANNA-B1 GATT Server",1,1109426C756574...
```

- Create an ACL connection

```
AT+UBTACLIC=112233445566
+UUBTACLIC:0,0,112233445566p
```

- Use the connection handle 0 from the +UUBTACLIC and Discover Services

```
AT+UBTGDP=0
+UBTGDP:0,1,9,1800
+UBTGDP:0,10,13,1801
+UBTGDP:0,14,22,180A
+UBTGDP:0,23,29,01D7E9014FF344E7838FE226B9E15624
+UBTGDP:0,30,65535,180D
OK
```

- After finding the “Heart Rate service” (180 D), use the start handle 30 and end handle 65535 from the +UBTGDP, and Discover all characteristics of service

```
AT+UBTGDCS=0,30,65535
+UBTGDCS:0,31,10,32,2A37
OK
```

- After finding the “Heart Rate Measurement characteristics” (2A37), use the value handle 32 from the +UBTGDCS and end handle 65535 from the +UBTGDP, and Discover all characteristic descriptors

```
AT+UBTGDCD=0,32,65535
+UBTGDCD:0,32,33,2902
OK
```

- After finding the “Client Characteristic Configuration descriptor” (2902), use the descriptor handle 33 from the +UBTGDCD and subscribe to notifications of Heart Rate measurement value changes

```
AT+UBTGWC=0,33,1
```

OK

Update and notify new value of Heart Rate measurement (Device A):

- We can now set a new value (50) and send a notification from Device A (the GATT Server)

```
AT+UBTGSN=0,32,50
```

New value is notified to Device B:

- An event is received when the remote side (Device A) sends a notification

```
+UUBTGN:0,32,50
```

4.7 Configure ANNA-B112 over air

Set up ANNA-B1 (Device A) that should be configured over air

- Enable remote configuration through the SPS server

```
AT+UDSF=0,1
```

- Enter data mode

```
ATO1
```

Set up ANNA-B112 (Device B)

- Enable Central Role

```
AT+UBTLE=1
```

- Store configuration

```
AT&W
```

- Restart

```
AT+CPWROFF
```

- Change escape character from default '+' (ASCII 43) to '-' (ASCII 45) to make the escape sequence pass through Device A without getting detected as an escape sequence at Device B

```
ATS2=45
```

- Find the other device (Device A)

```
AT+UBTD=4,1
```

```
+UBTD:112233445566p,-59,"ANNA-B1 Device A",1,1109426C756574...
```

- Create an SPS connection to Device A

```
AT+UDCP="sps://112233445566"
```

- Enter data mode

```
ATO1
```

- Enter configuration mode by sending escape sequence of Device A. By default, the ANNA-B112 escape sequence is:

1. Silence 1 second
2. +++
3. Silence 1 second

- Device B can now send AT-commands to Device A, for example, reading the local Bluetooth address of Device A:

```
AT+UMLA=1
```

```
+UMLA:112233445566
```

4.8 NFC web link

Store a web link to the NFC tag; this web link will be opened in the browser of your NFC enabled smart phone when you touch the NFC antenna of ANNA-B112 with your smart phone.

- Set URI to NFC tag

```
AT+UNFCURI=1,https://www.u-blox.com
```

- Enable NFC URI

```
AT+UNFCEN=2
```

- Touch the NFC antenna of ANNA-B112 with the smart phone to go to the u-blox website.

4.9 NFC launch app

Store an Android application's package name to the NFC tag; this application will be opened on your NFC enabled smart phone when you touch the NFC antenna of ANNA-B112 with your smart phone.

The Android package name is the unique identifier of an application. It can be found by searching for the app and finding the Google Play web page for the app. For example, the web page for Google Calendar is: <https://play.google.com/store/apps/details?id=com.google.android.calendar>

- Set URI to NFC tag

```
AT+UNFCURI=2,com.google.android.calendar
```

- Enable NFC URI

```
AT+UNFCEN=2
```

- Touch the NFC antenna of ANNA-B112 with the smart phone to open the Google Calendar app

4.10 Pair ANNA-B112 to a smart phone using NFC

Use NFC to initiate the pairing between ANNA-B112 and an NFC enabled smart phone.

- Enable NFC OOB pairing

```
AT+UNFCEN=1
```

- Touch the NFC antenna of ANNA-B112 with the smart phone to initiate the pairing

4.11 Pair two ANNA-B112 using Out-of-Band security mode

Generate an OOB Temporary Key in ANNA-B1. Another ANNA-B112 can then use this OOB Temporary Key to authenticate during the pairing procedure.

Set up ANNA-B112 (Device A) as a Peripheral

- Set OOB security mode

```
AT+UBTSM=6,0
```

- Store configuration

```
AT&W
```

- Restart

```
AT+CPWROFF
```

- Generate a random OOB Temporary Key

```
AT+UBTOTK=0
```

- Read the random OOB Temporary Key

```
AT+UBTOTK?  
+UBTOTK:239FBA31E3A435B10AF28B5FEF47DDC1
```

Set up ANNA-B112 (Device B) that should initiate the pairing

- Set Central role
`AT+UBTLE=1`
- Set OOB security mode
`AT+UBTSM=6,0`
- Store configuration
`AT&W`
- Restart
`AT+CPWROFF`
- Input the OOB Temporary Key generated in Device A
`AT+UBTOTK=1,239FBA31E3A435B10AF28B5FEF47DDC1`
- Pair to Device A (Bluetooth address D4CA6EB00613)
`AT+UBTB=D4CA6EB00613p,1`

4.12 Connect two ANNA-B112 using 2 Mbps PHY

The default physical layer (PHY) is used when connecting two ANNA-B112 modules

Set preferred PHY on ANNA-B112 (Device A)

- Set 1 Mbps and 2 Mbps as preferred PHYs for Tx
`AT+UBTLECFG=27,3`
- and for Rx
`AT+UBTLECFG=28,3`

Connect two ANNA-B112 according to the use case in section 4.1.

When the connection is established, request a new PHY configuration for the connection (Device B)

- Go to AT mode by sending the escape sequence:
 1. Silence 1 second
 2. +++
 3. Silence 1 second
- Request 2 Mbps PHY for both Tx and Rx on connection with handle 0
`AT+UBTLEPHYR=0,2,2`
- If the remote device (Device A) accepts the request, a successful event will be received
`+UUBTLEPHYU:0,0,2,2`
- Go to data mode
`AT01`

4.13 Change Device Information values of ANNA-B112

Change the characteristics values of the Device Information service (UUID 0x180A) to the values of your choice.

- Read the current values of the Device Information service
`AT+UBTLEDIS?`
`+UBTLEDIS:"u-blox","ANNA-B1","4.0.0","4.0.0"`
- Set the Manufacturer, Model, Firmware version and Software version to "Company", "Model A", "fw1.0" and "sw1.1" respectively.

```
AT+UBTLEDIS="Company","Model A","fw1.0","sw1.1"
```

- Store configuration

```
AT&W
```

- Restart

```
AT+CPWROFF
```

- Connect to ANNA-B112 with for example, a smart phone using the nRF Connect app and verify the characteristics values of the Device Information service.

4.14 Write ANNA-B112 GPIO pin and read ANNA-B112 GPIO pin

Configure, write, and read GPIO pin using AT command. See ANNA-B112 System Integration Manual [11] for GPIO pin id mapping.

Preconditions

- Connect GPIO pin 2 on ANNA-B112 (Device A) to GPIO pin 25 on ANNA-B112 (Device B)

Set up ANNA-B112 (Device A) GPIO pin

- Check current configuration status of available GPIOs (result shows that all GPIOs are disabled)

```
AT+UGPIOC?
+UGPIOC:2,255
+UGPIOC:3,255
+UGPIOC:4,255
+UGPIOC:5,255
+UGPIOC:24,255
+UGPIOC:25,255
+UGPIOC:27,255
OK
```

- Set pin 2 as an input, no resistor activated

```
AT+UGPIOC=2,1,0
```

- Read the current value of pin 2 current value is 0 (zero)

```
AT+UGPIOR=2
+UGPIOR:2,0
```

Set up ANNA-B112 (Device B) GPIO pin

- Check current configuration status of available GPIOs (result shows that all GPIOs are disabled)

```
AT+UGPIOC?
+UGPIOC:2,255
+UGPIOC:3,255
+UGPIOC:4,255
+UGPIOC:5,255
+UGPIOC:24,255
+UGPIOC:25,255
+UGPIOC:27,255
OK
```

- Set pin 25 as an output with initial value set to 0 (zero)

```
AT+UGPIOC=25,0,0
```

- Set pin 25 to 1 (one)

```
AT+UGPIOW=25,1
```

Read the value of Device A's pin 2

- Read pin 2 (Device A), the read value is 1 (one)

```
AT+UGPIOR=2
+UGPIOR:2,1
```

Appendix

A Glossary

Abbreviation	Definition
ACL	Asynchronous Connection-Less
BR	Basic Rate
DSR	Data Set Ready
DTR	Data Terminal Ready
EDM	Extended Data Mode
EDR	Enhanced Data Rate
GATT	Generic Attributes
GPIO	General Purpose Input/Output
HTTP	Hypertext Transfer Protocol
LED	Light-Emitting Diode
NFC	Near Field Communication
OOB	Out Of Band
PHY	Physical Layer
SPS	Serial Port Service
URL	Uniform Resource Locator

Table 1: Explanation of the abbreviations and terms used

Related documents

- [1] u-blox Short Range Modules AT Commands Manual, Document No. UBX-14044127
- [2] ANNA-B112 series Data Sheet, Document No. UBX-18011707
- [3] EVK- ANNA-B112 User Guide, Document No. UBX-18018539
- [4] s-center Product Summary, Document No. UBX-15020022
- [5] <https://developer.apple.com/ibeacon/>
- [6] <https://developers.google.com/beacons/eddystone>
- [7] u-blox Extended Data Mode Protocol Specification, Document No. UBX-14044126
- [8] <https://www.bluetooth.com/specifications/gatt/services>
- [9] <https://www.bluetooth.com/specifications/gatt/characteristics>
- [10] u-blox Low Energy Serial Port Service Protocol Specification, Document No. UBX-16011192
- [11] ANNA-B112 System Integration Manual, Document No. UBX-18009821

 For regular updates to u-blox documentation and to receive product change notifications, register on our homepage (www.u-blox.com).

Revision history

Revision	Date	Name	Comments
R01	5-Jun-2018	cmag, fbro, kgom	Initial release.

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