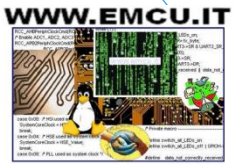
BlueNRG MS Hands-on

AMS

Application team EMEA

life.augmented



AVNET Silica

Agenda

- Demo / Hands On prerequisites
- What I can easily demonstrate
- Evaluate BlueNRG MS over IDB05A1:GUI Hands On
- Lab 1 : BlueNRG MS advertising
- Lab 2 : BlueNRG MS communication with smartphone
- Lab 3 : Scripts & Multiple connections
- How to start coding my ideas

Demo and Hands prerequisites

BlueNRG MS Hands On - HW compatibility

- X-NUCLEO-IDB05A1: Bluetooth Low Energy expansion board based on SPBTLE-RF module

+

- STM32 NUCLEO-F401RE / L053R8 or L476RG

- STEVAL-IDB005V1: Bluetooth low energy board based on the BlueNRG-MS network processor

Smartphone prerequisites

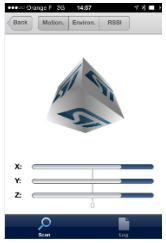
Smartphone requirement

Android
KitKat OS phone

IOS device
(**starting 4S**)

App for Sensor Demo

https://play.**google**.com/store/apps/details?id=com.st.bluenrg&hl=fr_FR



https://itunes.**apple**.com/fr/app/bluenrg/id705873549?mt=8

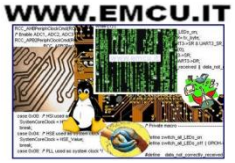
App for Hands On

Android - BLE scanner

https://play.google.com/store/apps/details?id=com.macdom.ble.blescanner

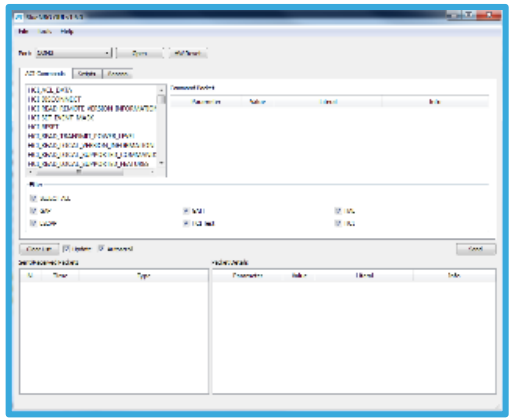
Ios - Light Blue

https://itunes.apple.com/fr/app/lightblue-bluetooth-low-energy/id557428110?mt=8



SW prerequisites for Nucleo setup

- ST-Link driver
  - http://www.st.com/web/catalog/tools/FM147/SC1887/PF260218
- ST-Link Upgrade utility
  - http://www.st.com/web/en/catalog/tools/PF260217
- X-CUBE-BLE1 – 2.5.2
  - http://www.st.com/web/catalog/tools/FM147/SC1870/PF261442
  - copy the zip file content into: “c:\Program Files (x86)\STMicroelectronics\” folder on your PC
- SDK BlueNRG – 1.9.0 : STSW-BLUENRG-DK
  - http://www.st.com/web/catalog/tools/FM147/SC1870/PF261967
  - package will contain the BlueNRG **GUI**



BlueNRG MS / SPBTLE-RF SW Evaluation and prototyping – Key Links

SBPTLE-RF evaluation DK = BlueNRG MS DK

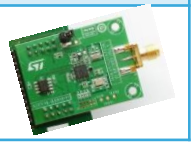
PM0237 powerful BlueNRG MS programming guide

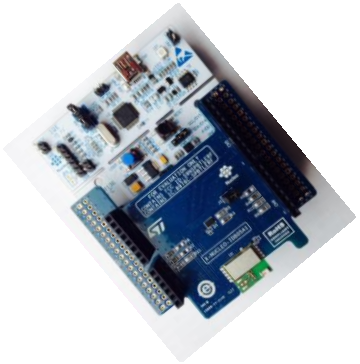
- comprehensive understanding of BLE concepts
- Associated BlueNRG MS API usage

X-CUBE-BLE1

SPBTLE-RF (BlueNRG MS) code examples

STM32 based : L0 & L4 & F4

PM0237 powerful guideline BlueNRG-MS stacks programming guidelines	http://www.st.com/st-web-ui/static/active/en/resource/technical/document/programming_manual/DM00141271.pdf
X-CUBE-BLE1 BlueNRG MS code examples **OSXSmartConnPS** BLE profiles on top of X-CUBE-BLE1	http://www.st.com/web/en/catalog/tools/PF261442  http://www.st.com/web/catalog/tools/FM147/CL2116/SC2023/PF261620
STSW-BLUENRG-DK more BlueNRG MS source code examples	http://www.st.com/web/en/catalog/tools/PF261967 

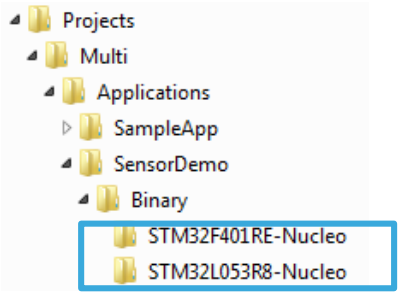


what I can easily demonstrate

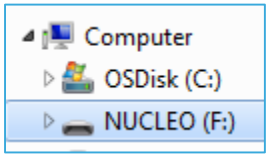
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Demo1 -what I can easily demonstrate (1/2)

1



From X-CUBE-BLE1
SW ressource package
drag and drop
SensorDemoProject.bin
on Nucleo drive



2 load ST BlueNRG MS application on your smarpthone from Google Play or App Store

https://play.google.com/store/apps/details?id=com.st.bluenrg&hl=fr_FR

https://itunes.apple.com/fr/app/bluenrg/id705873549?mt=8

WWW.EMCU.IT

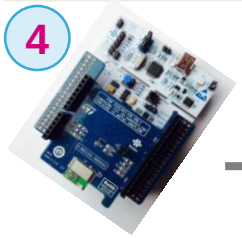
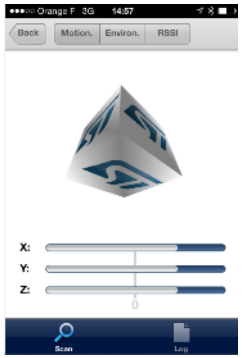

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Demo1 -what I can easily demonstrate (2/2)

3 connect your smartphone application to the BlueNRG MS device and control the cube on the smartphone app


Press the user button on Nucleo board to rotate the cube on the smartphone app

4

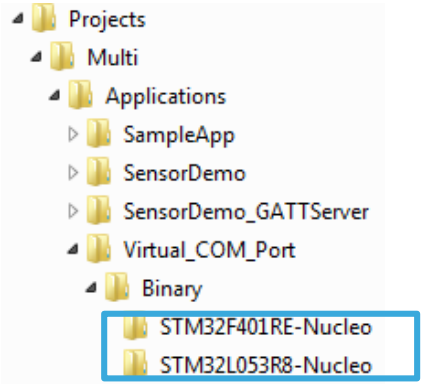



How to evaluate BlueNRG MS GUI Hands On

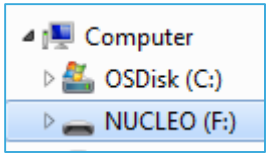
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

evaluate BlueNRG MS product thanks to GUI

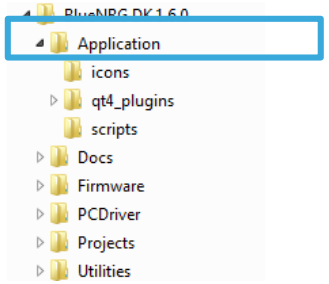
1



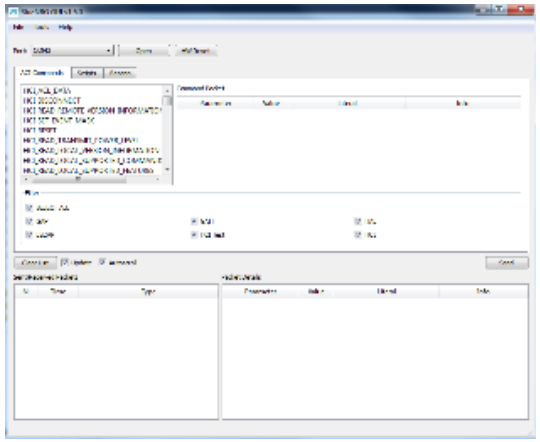
From X-CUBE-BLE1
SW ressource package
drag and drop
Virtual_COM_Port.bin
on Nucleo drive



2



From BlueNRG SDK
launch GUI application
BLUENRG_GUI.exe

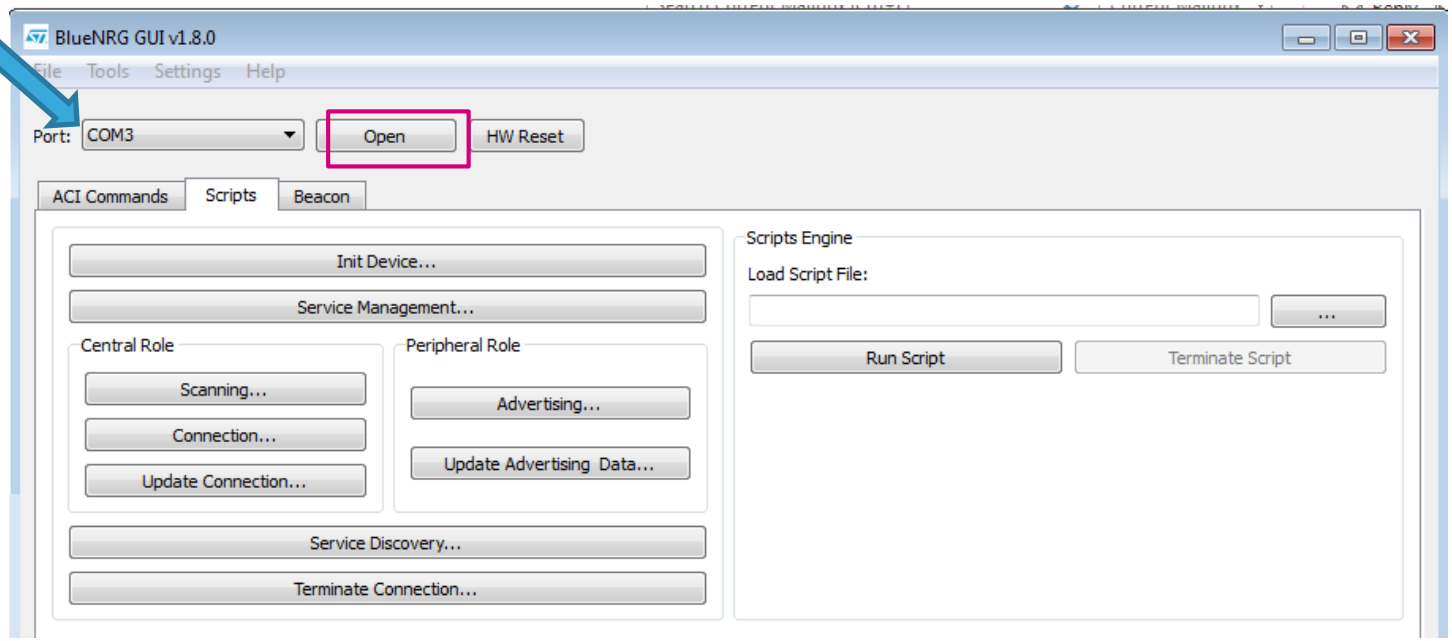


X-NUCLEO-IDB05A1 & X-CUBE-BLE1

evaluate BlueNRG MS product thanks to GUI

select port com associated to VCOM

3



From this step, the GUI is connected to BlueNRG MS and BLE commands can be transmitted (GUI acting as host µC)

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Ios Light Blue Apps constrains & behaviour

Notes (when master is an Ios device & associated Light Blue App)

- Light Blue Apps is storing device name (part of the GAP service created after slave initialization) only after the 1st connection.
- Light Blue Apps is memorizing MAC/BT address and associates it with device name

- when Lab is executed in same time over several boards, to avoid any connection and discover issue , the slave (BlueNRG MS) BT MAC address and device name need to be modified. Please refer to back up slide (*this is valid especially if Ios & Light Blue apps used*)

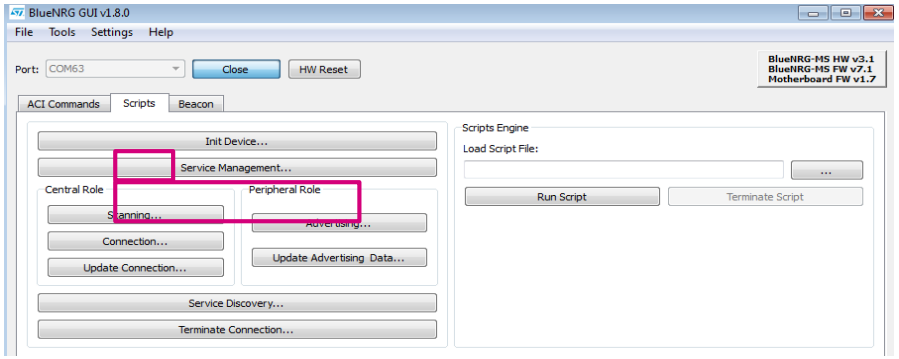
Agenda

- Demo / Hands On prerequisites
- What I can easily demonstrate
- Evaluate BlueNRG MS over IDB05A1:GUI Hands On
- Lab 1 : BlueNRG MS advertising
- Lab 2 : BlueNRG MS communication with smartphone
- Lab 3 : Scripts & Multiple connections
- How to start coding my ideas

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

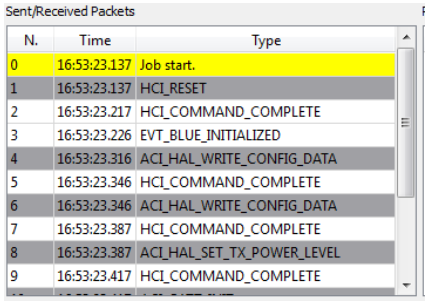
Lab 1 : BlueNRG MS advertising

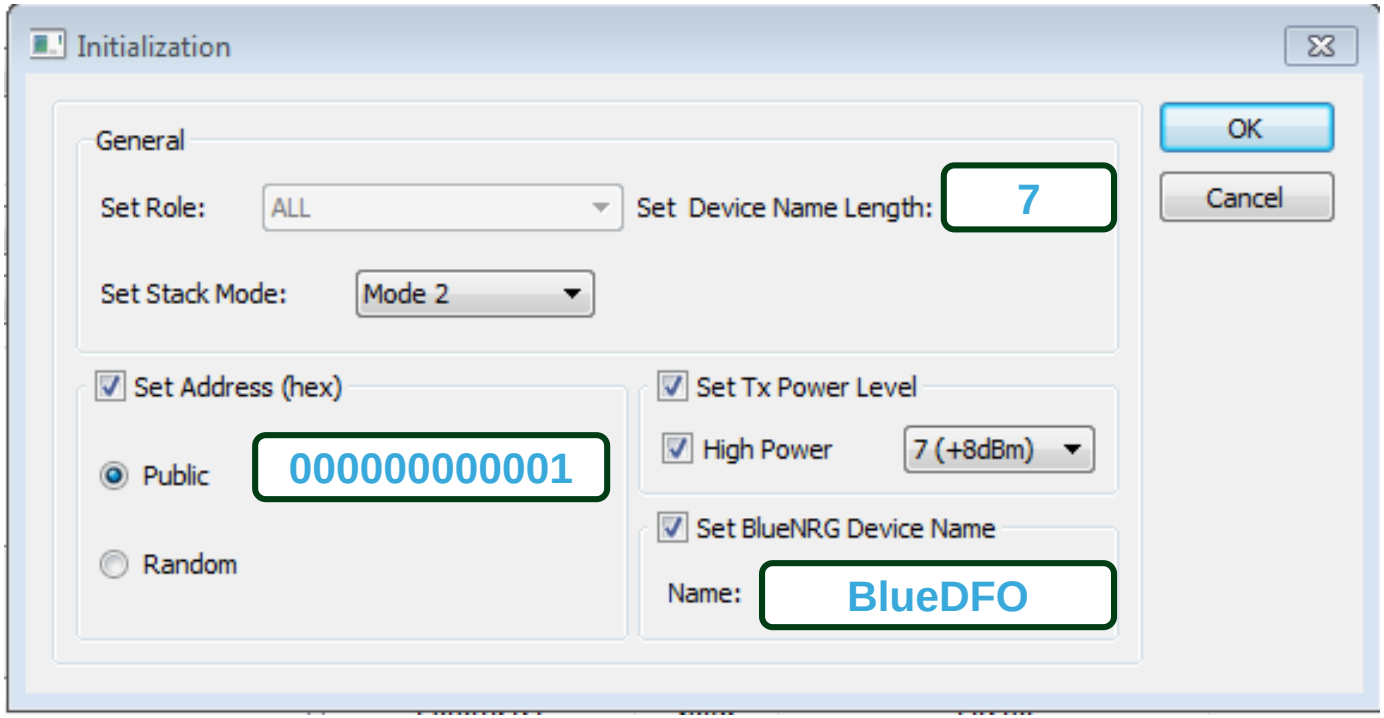
1



- **BlueNRG initialization**

Tx power, mac @, stack mode, stack init

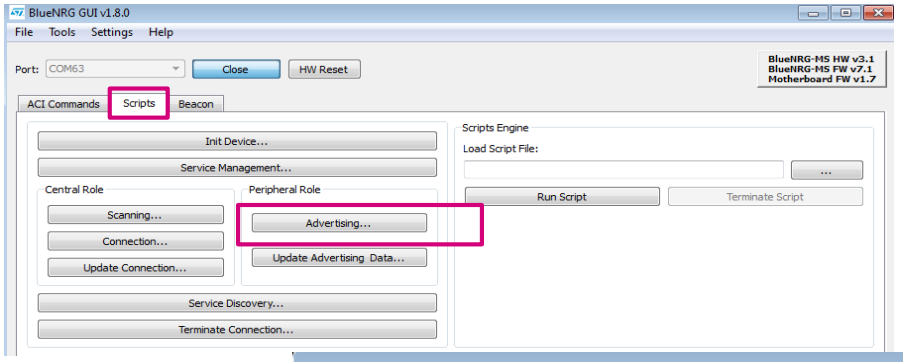




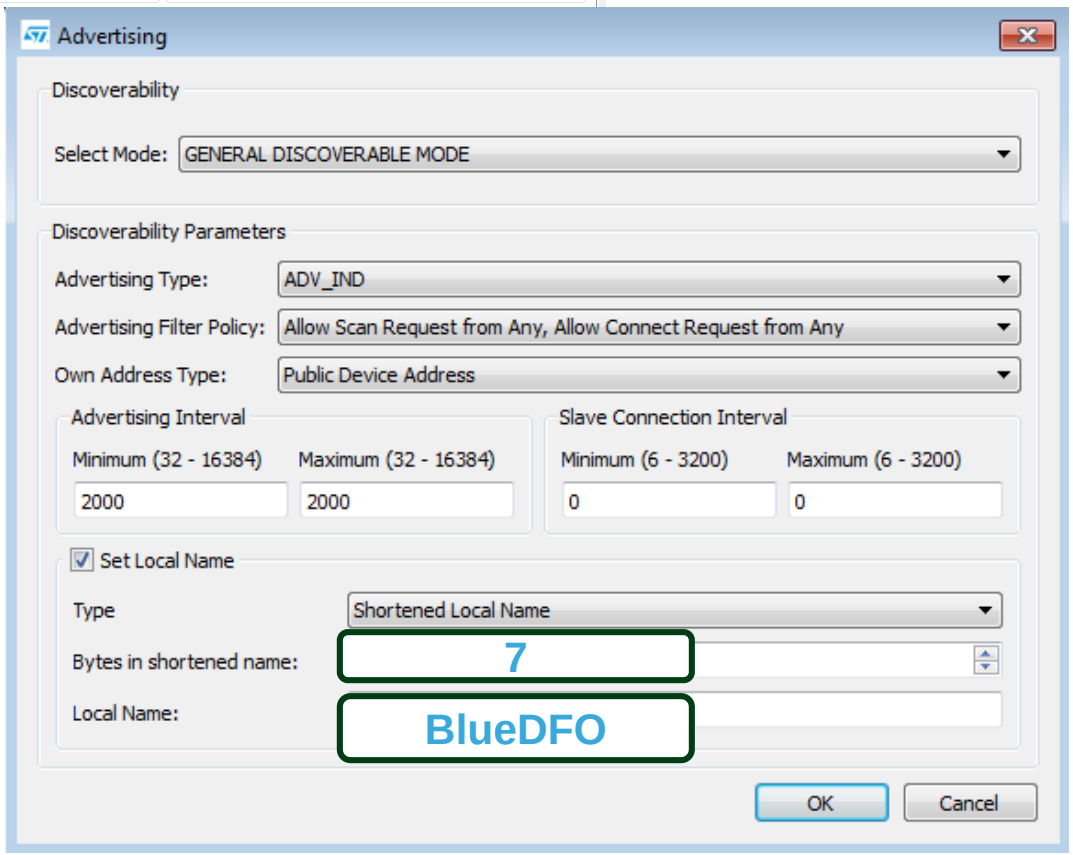
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 1 : BlueNRG MS advertising

7



- **BlueNRG set in discoverable mode**



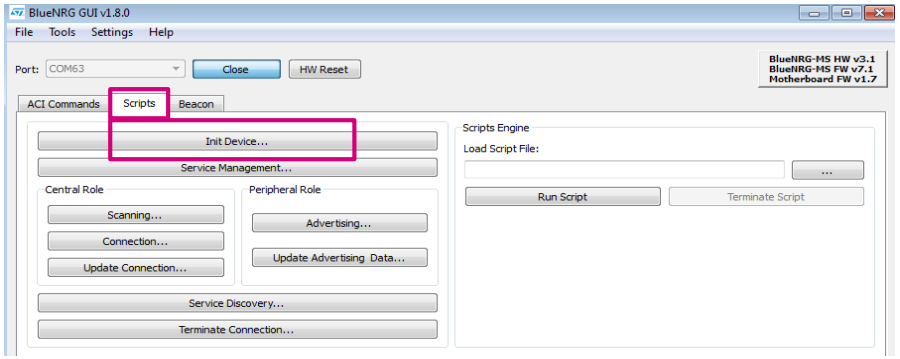
Agenda

- Demo / Hands On prerequisites
- What I can easily demonstrate
- Evaluate BlueNRG MS over IDB05A1:GUI Hands On
- Lab 1 : BlueNRG MS advertising
- Lab 2 : BlueNRG MS communication with smartphone
- Lab 3 : Scripts & Multiple connections
- How to start coding my ideas

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

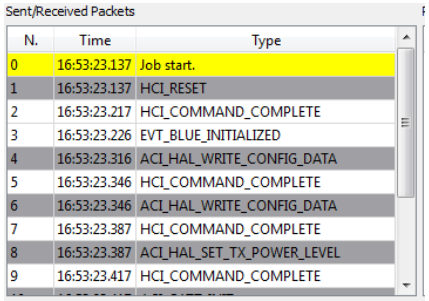
Lab 2 : BlueNRG MS communication with smartphone

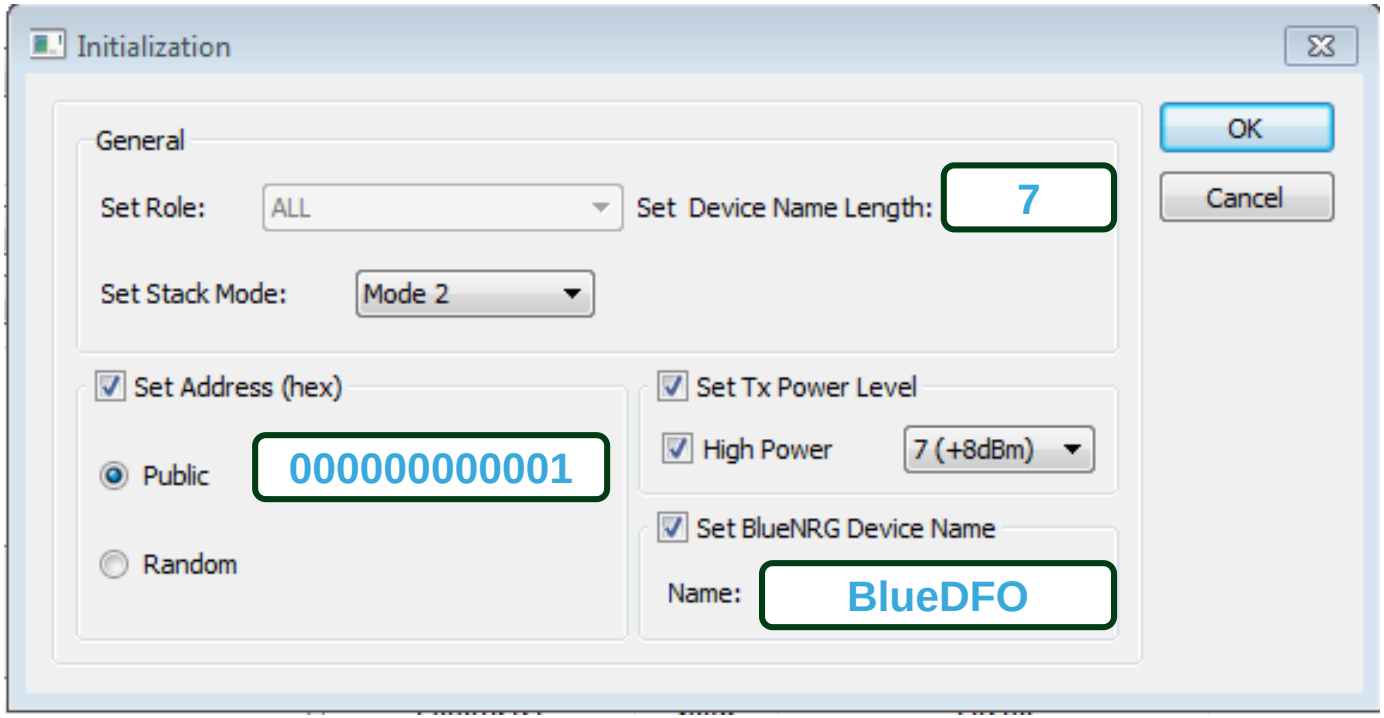
1



- **BlueNRG initialization**

Tx power, mac @, stack mode, stack init

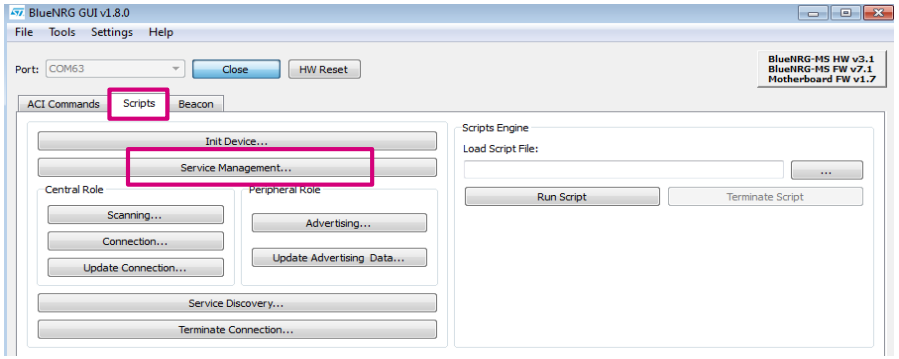




X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG MS communication with smartphone

2



- **create a service and associated characteristic** (read|write|notify properties) into BlueNRG

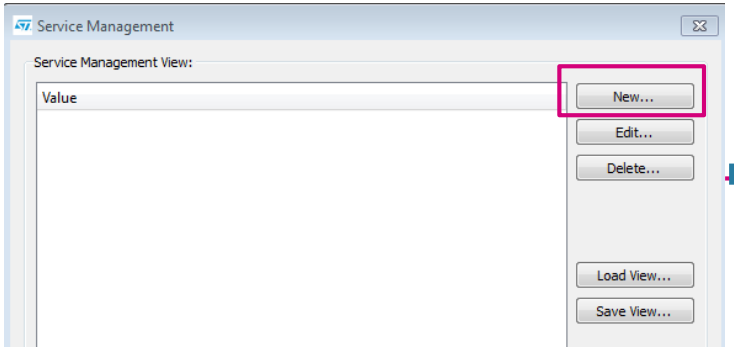
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG MS communication with smartphone

AVNET Silica

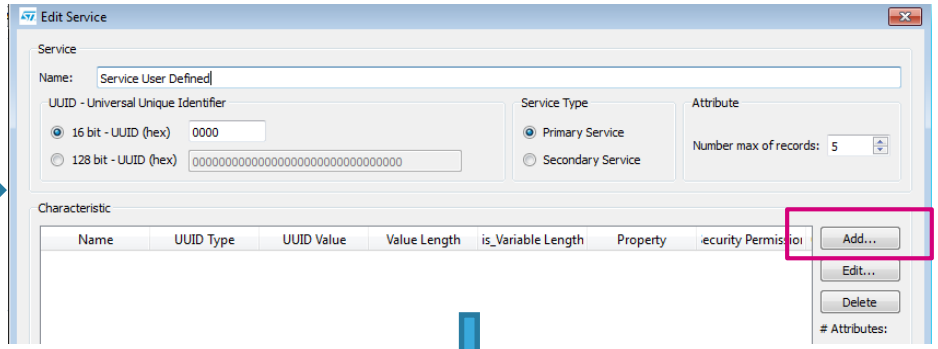
- **create a service**

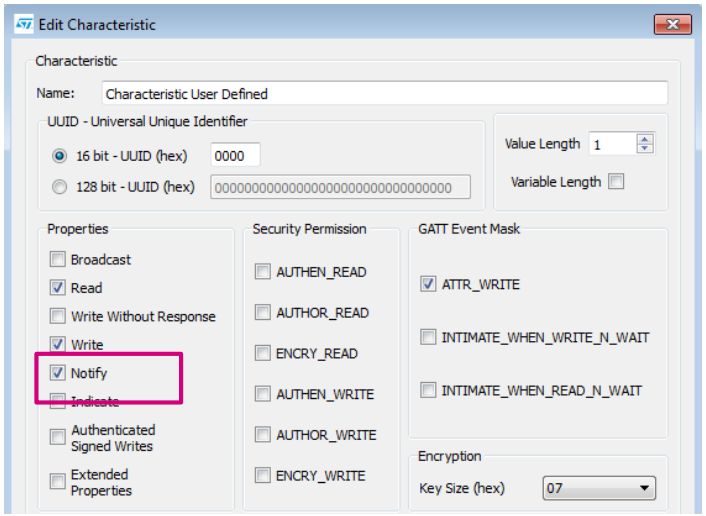
3



4

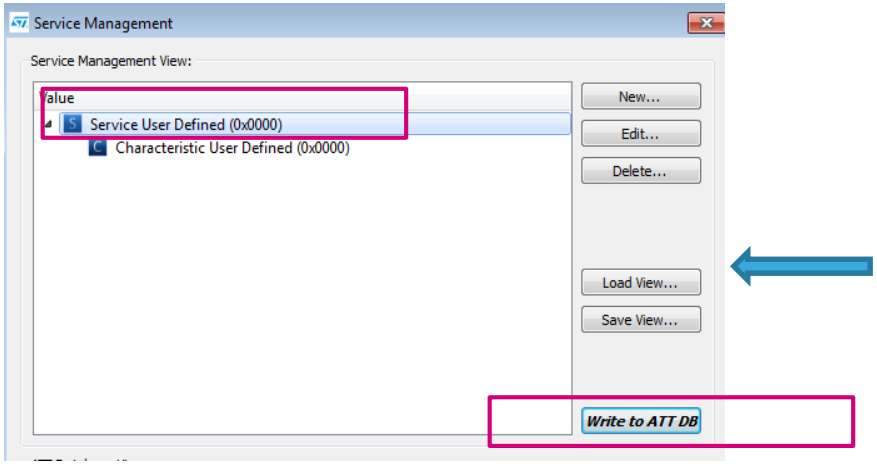
- **add associated characteristic**





5

- **associated characteristic** (read|write|notify properties) into BlueNRG



6

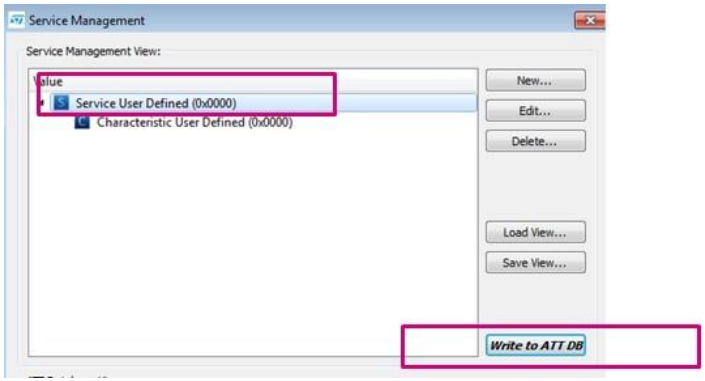
- **Write this new service to data base**

life.augmented

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG MS communication with smartphone

- As soon as service and characteristic have been created , BlueNRG MS is notifying associated handles
- Handles will be used by smartphone to access to the characteristic value (user data)



N.	Time	Type
23	16:37:44.345	ACI_GATT_READ_HANDLE_VAL
24	16:37:45.351	Job terminated.
25	16:37:45.361	Job finished.
26	17:04:29.798	Job start.
27	17:04:29.798	ACI_GATT_ADD_SERVICE
28	17:04:29.828	HCI_COMMAND_COMPLETE
29	17:04:29.838	HCI_COMMAND_COMPLETE
30	17:04:29.838	ACI_GATT_ADD_CHAR
31	17:04:29.858	HCI_COMMAND_COMPLETE
32	17:04:29.858	Job finished.

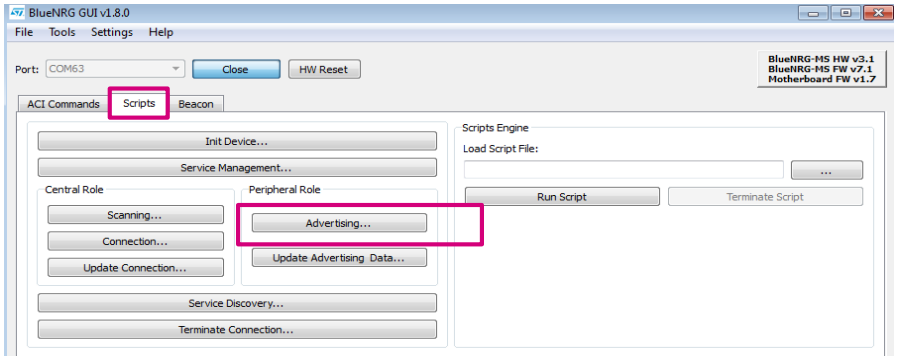
Parameter	Value	Literal	Info
Event Code	0x0E	HCI_COMMAND_COMPLETE	
Parameter Total Length	0x06		
Num_HCI_Comman...	0x01		The Number of HCI com...
Command_Opcode	0xFD02	ACI_GATT_ADD_SERVICE	Opcode of the command...
Status	0x00	Success	
Service_Handle	0x000C		

Parameter	Value	Literal	Info
Event Code	0x0E	HCI_COMMAND_COMPLETE	
Parameter Total Length	0x06		
Num_HCI_Comman...	0x01		The Number of HCI com...
Command_Opcode	0xFD04	ACI_GATT_ADD_CHAR	Opcode of the command...
Status	0x00	Success	
Char_Handle	0x000D		

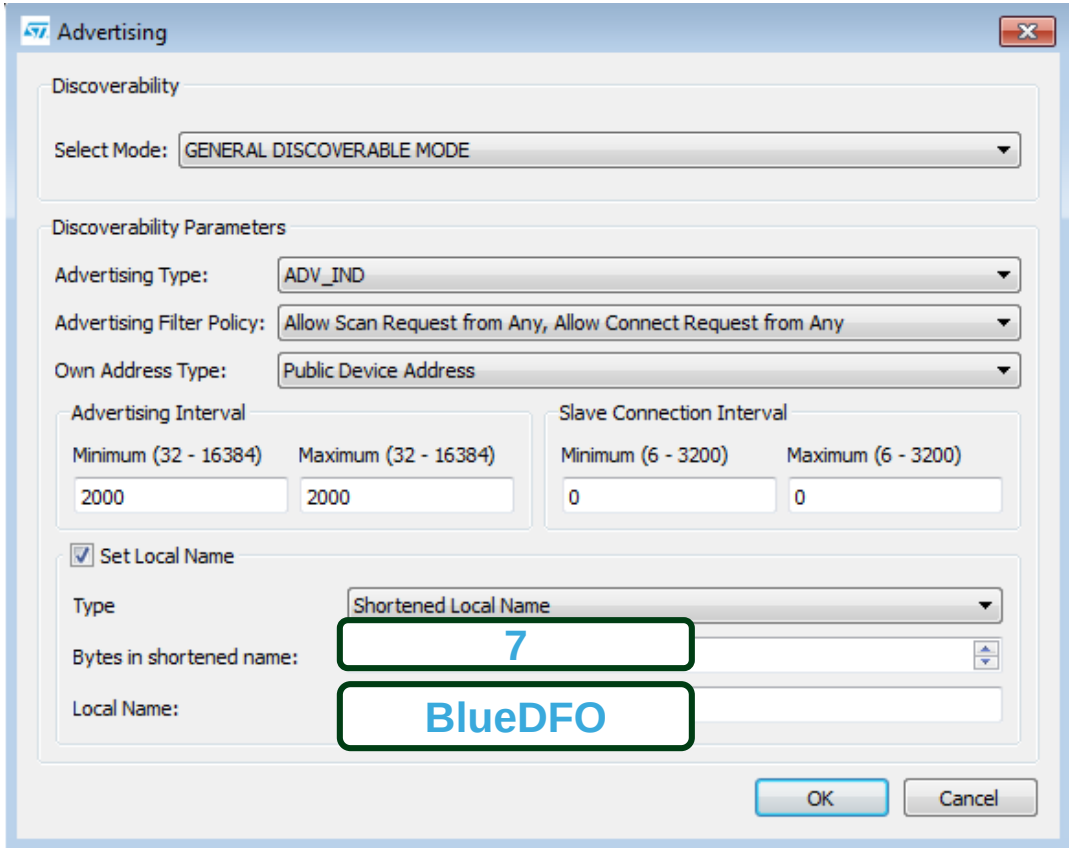
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG communication with smartphone

7



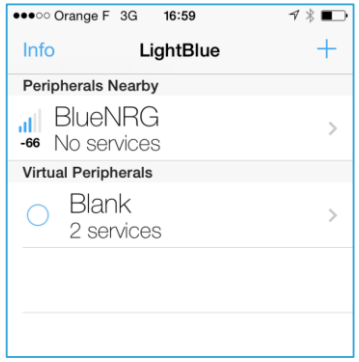
- **BlueNRG set in discoverable mode**



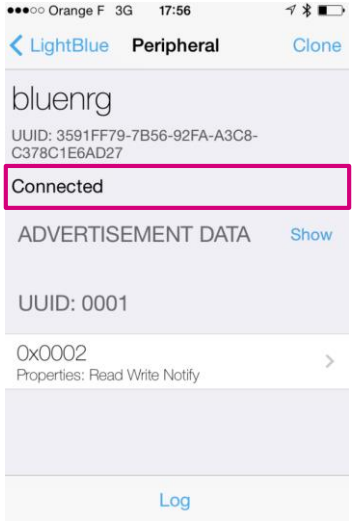
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG communication with smartphone

8



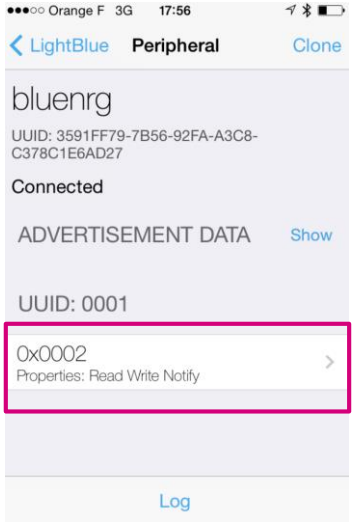
- once clicking on peripheral device, connection is established



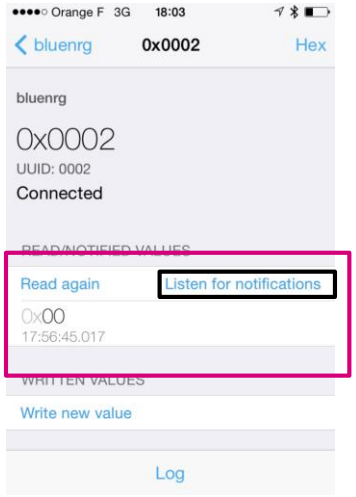
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG communication with smartphone

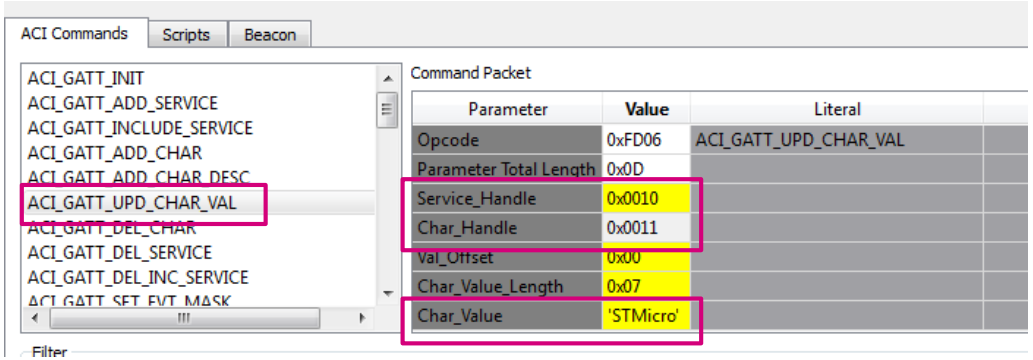
9



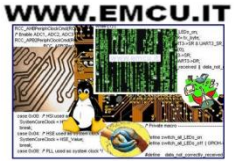
- **Read characteristic value from your smartphone and enable listen to notifications**



10



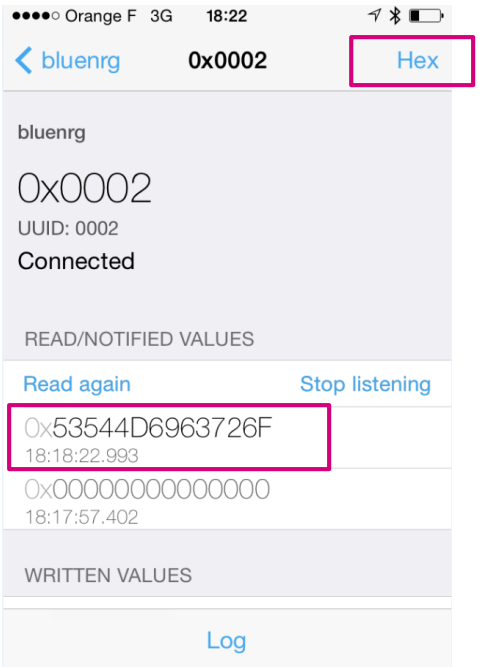
- **Update the value characteristic thanks to ACI interface (UM1755) and the right service and characteristic handles**



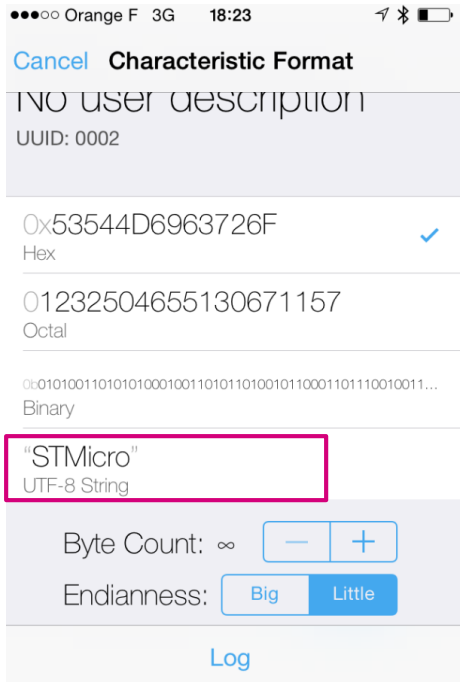
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG communication with smartphone

11



- As notification has been enable, as soon as GUI/Host µC will update a characteristic value, smartphone will be automatically notify of the new value



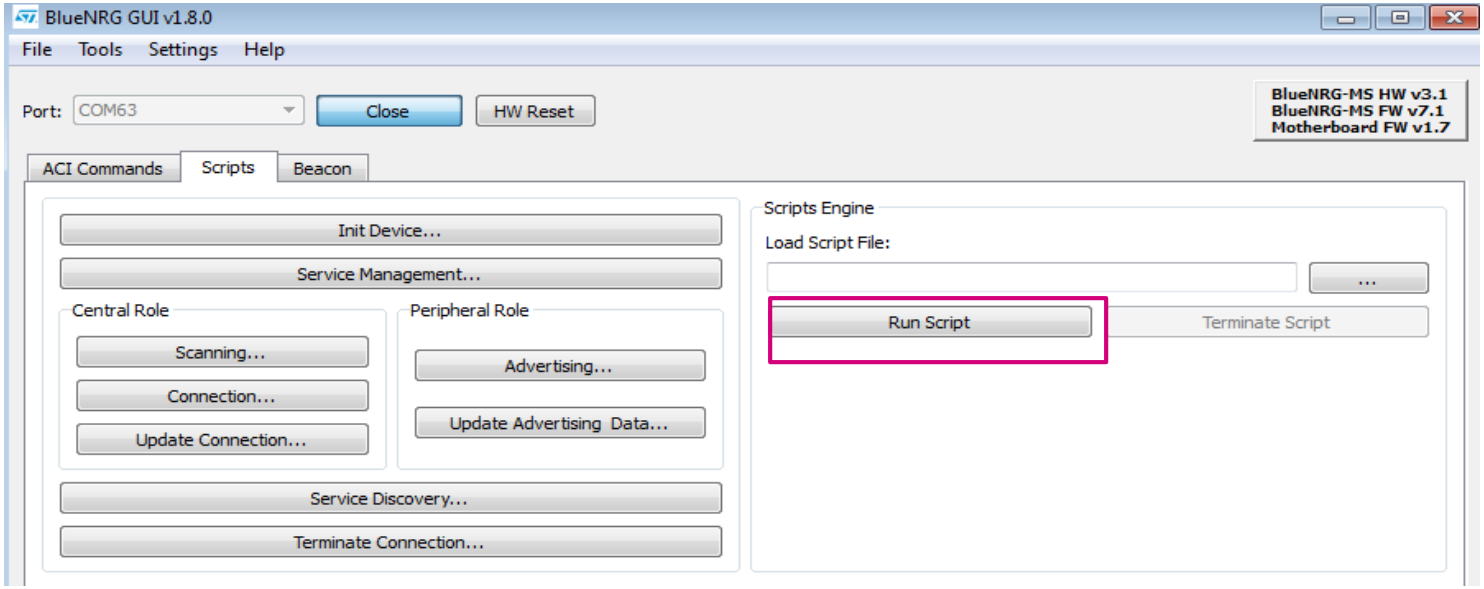
You succeed to enable a “point to point link” between smartphone and BlueNRG device

Agenda

- Demo / Hands On prerequisites
- What I can easily demonstrate
- Evaluate BlueNRG MS over IDB05A1:GUI Hands On
- Lab 1 : BlueNRG MS advertising
- Lab 2 : BlueNRG MS communication with smartphone
- Lab 3 : Scripts & Multiple connections
- How to start coding my ideas

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 3 : Lab 2 using scripts



BlueNRG_and_BlueNRG_MS_scripts

See also

- BLE_Beacon.py for documentation.
- SensorDemo_Central.py for documentation.
- Multiple_Connection_Master_Role.py for documentation.
- Multiple_Connection_Slave_Role.py for documentation.
- Security_PassKeyEntry_Master_Role.py for documentation.
- Security_PassKeyEntry_Slave_Role.py for documentation.

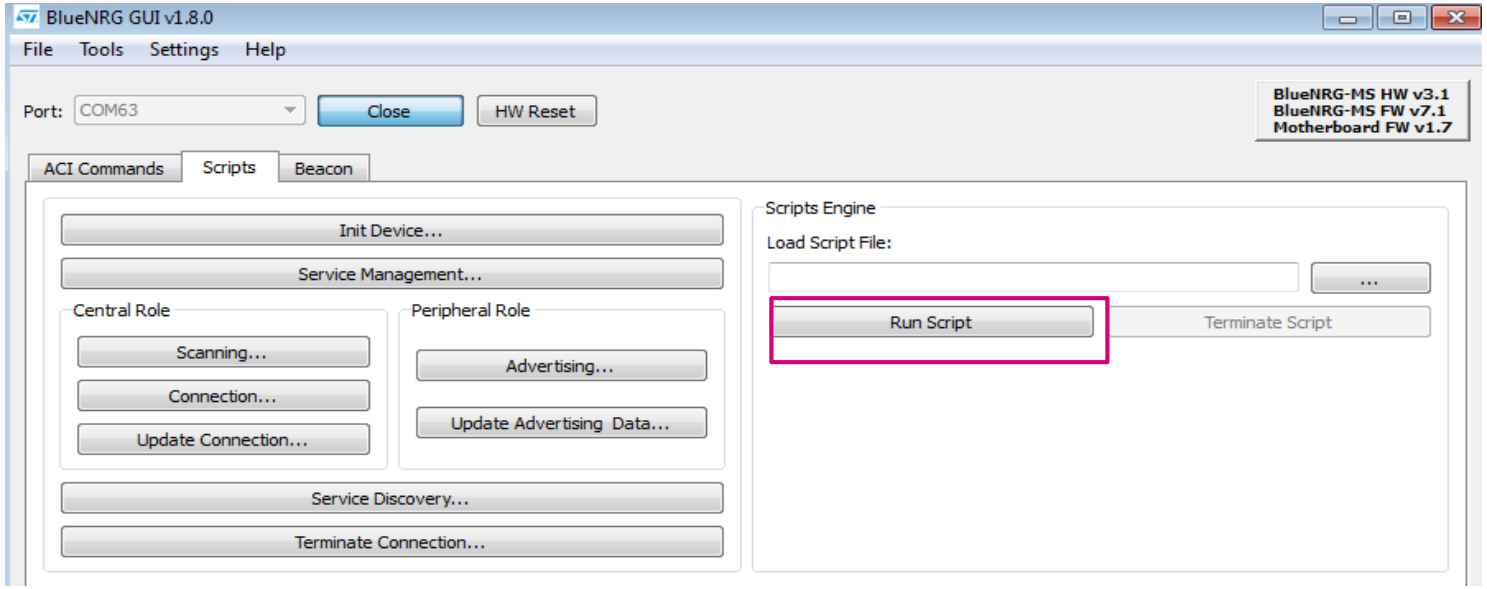
BlueNRG_MS_scripts

See also

- BlueNRG-MS_Master_Slave.py for documentation.
- BlueNRG-MS_Master.py for documentation.
- BlueNRG-MS_Slave.py for documentation.
- BlueNRG-MS_firmware_update.py for documentation.
- OTA_Central_BlueNRG-MS.py for documentation.

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

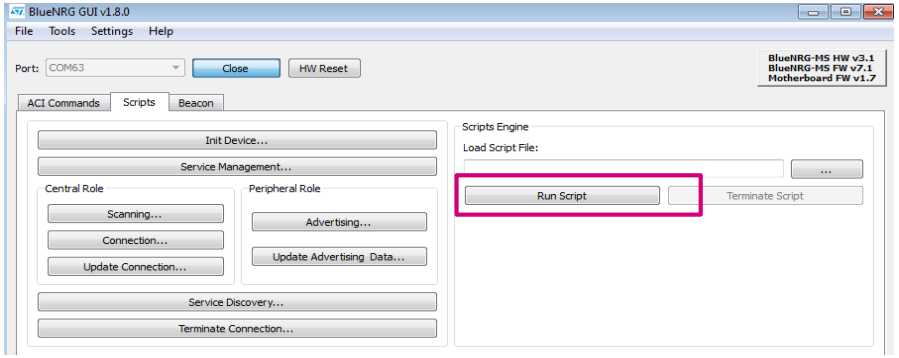
Lab 3 : Lab 2 using scripts



script implementation
Starting from BlueNRG-MS_Slave.py

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 3 : Multiple connections



Multiple connections are possible thanks to
- **GUI scripting capabitlies (Python)**
- **scripts part of STSW-BLUENRG-DK**

C:\Program Files (x86)\STMicroelectronics\BlueNRG standard DK\BlueNRG DK 1.8.0ALPHA\Docs\scripts_html\modules.html

Here is a list of all modules:

- **BlueNRG_and_BlueNRG_MS_scripts**
- **BlueNRG_MS_scripts**
- **BlueNRG_scripts**

See also:

BlueNRG-MS_Master_Slave.py for documentation.
BlueNRG-MS_Master.py for documentation.
BlueNRG-MS_Slave.py for documentation.
BlueNRG-MS_firmware_update.py for documentation.

C:\Program Files (x86)\STMicroelectronics\BlueNRG standard DK\BlueNRG DK 1.8.0ALPHA\Docs\scripts_html_blue_n_r_g-_m_s___master___slave_8py.html

Detailed Description

One BlueNRG-MS device (Master&Slave) is configured as Central & Peripheral, with a service and one characteristic and it performs two connections procedures (as Central) for connecting, respectively, to two BlueNRG-MS Peripheral devices (Slave_A, Slave_B) which have defined the same service and characteristic. Then BlueNRG-MS Master&Slave device enables the characteristics notification on both of them. At this stage, BlueNRG-MS Master&Slave device enters in discovery mode (acting as Peripheral) and it waits for connection request coming from another BlueNRG-MS device configured as Central (Master). Once this connection is performed, BlueNRG-MS Master&Slave device receives characteristics notifications from both BlueNRG-MS Slave_A, Slave_B devices and it notifies these characteristics (as Peripheral) to the BlueNRG-MS Master device which displays the related values.

Documentation extract

Agenda

- Demo / Hands On prerequisites
- What I can easily demonstrate
- Evaluate BlueNRG MS over IDB05A1:GUI Hands On
- Lab 1 : BlueNRG MS advertising
- Lab 2 : BlueNRG MS communication with smartphone
- Lab 3 : Scripts & Multiple connections
- How to start coding my ideas

How to start coding my ideas

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

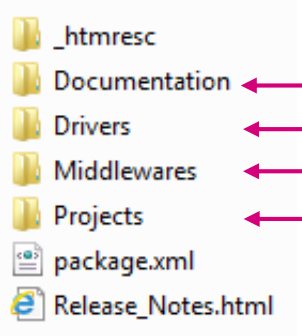
Start coding your ideas in just a few minutes

1 www.st.com/X-NUCLEO

2 Select X-NUCLEO-IDB05A1

3 Download & unpack

X-CUBE-BLE1 package



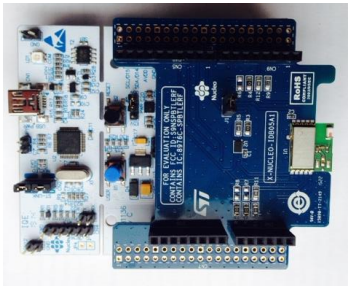
Generic Nucleo docs & BLE porting

BlueNRG SPI driver

Bluetooth LE HCI stack

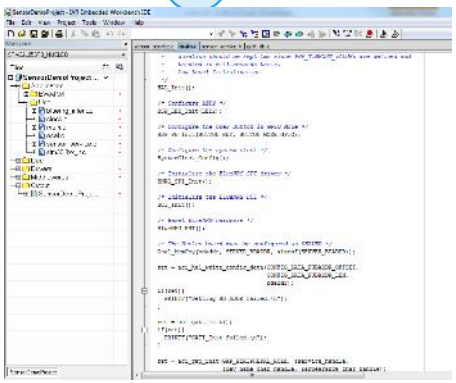
Application examples

4 Download & install STM32 Nucleo ST-LINK/V2-1 USB driver



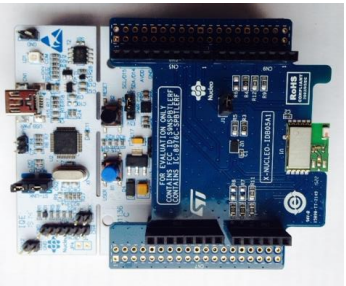
5 Open project example **Sensor Demo**

6 modify, build application



X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Start coding your ideas in just a few minutes



Using a unique characteristic

1. Push data to smartphone on press button action
2. Toggle LED on data reception

Code based on sensor Demo
STM32CubeExpansion_BLE1_V2.5.2\
Projects\Multi\Applications

+

Modifications in
Main.c
sensor_service.c
sensor_service.h