



BlueNRG MS Hands-on

AMS

Application team EMEA



Agenda

 Demo / Hands On prerequisites

 What I can easily demonstrate

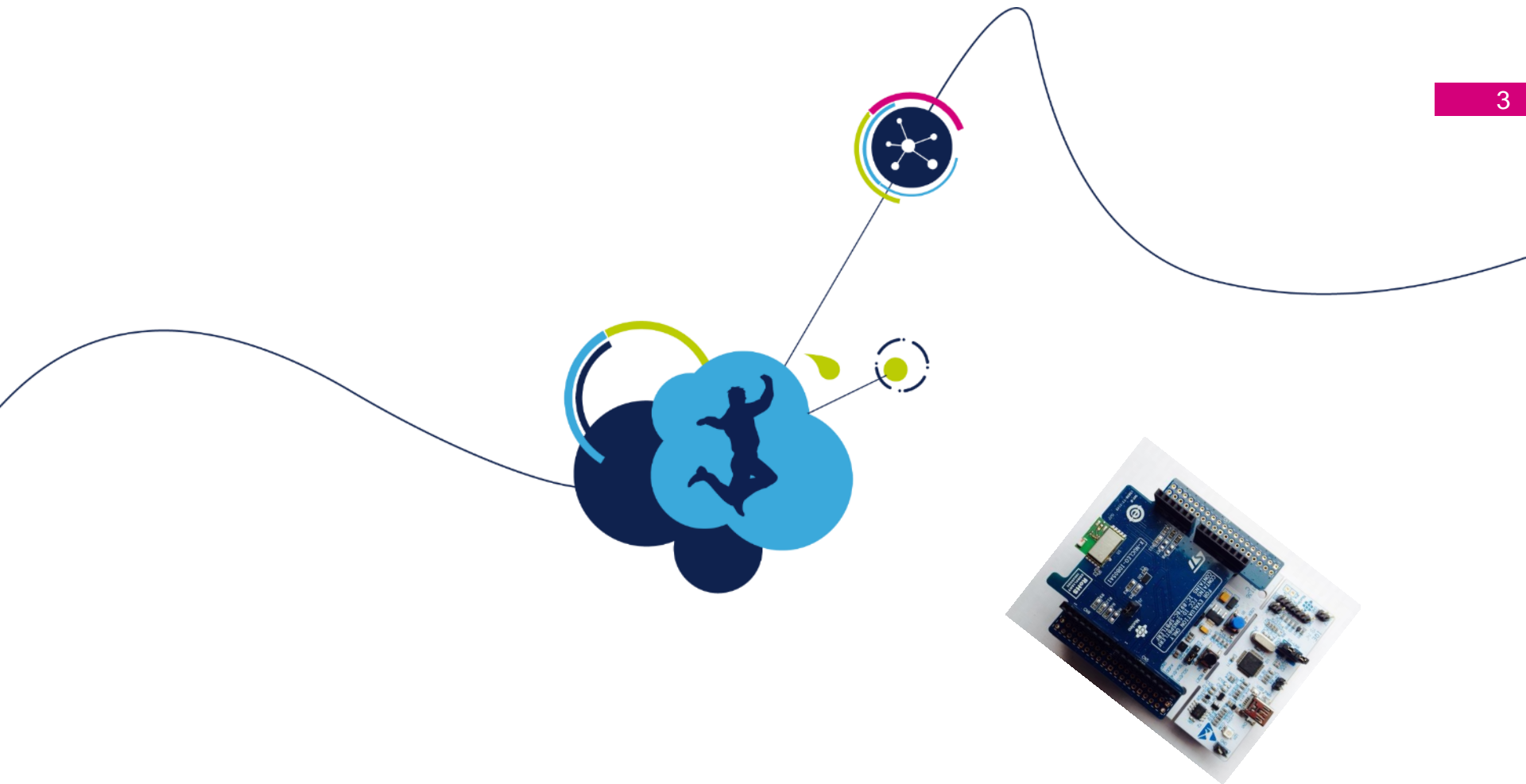
 Evaluate BlueNRG MS over IDB05A1:GUI Hands On

 Lab 1 : BlueNRG MS advertising

 Lab 2 : BlueNRG MS communication with smartphone

 Lab 3 : Scripts & Multiple connections

 How to start coding my ideas



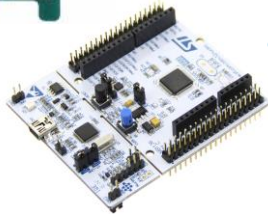
Demo and Hands prerequisites

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



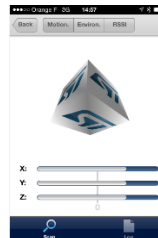
Android
KitKat OS phone



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)
 - <http://www.st.com/web/catalog/tools/FM147/SC1870/PF261967>
- **BLUENRG GUI:** http://www.st.com/content/st_com/en/products/embedded-software/wireless-connectivity-software/stsw-bnrgui.html



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

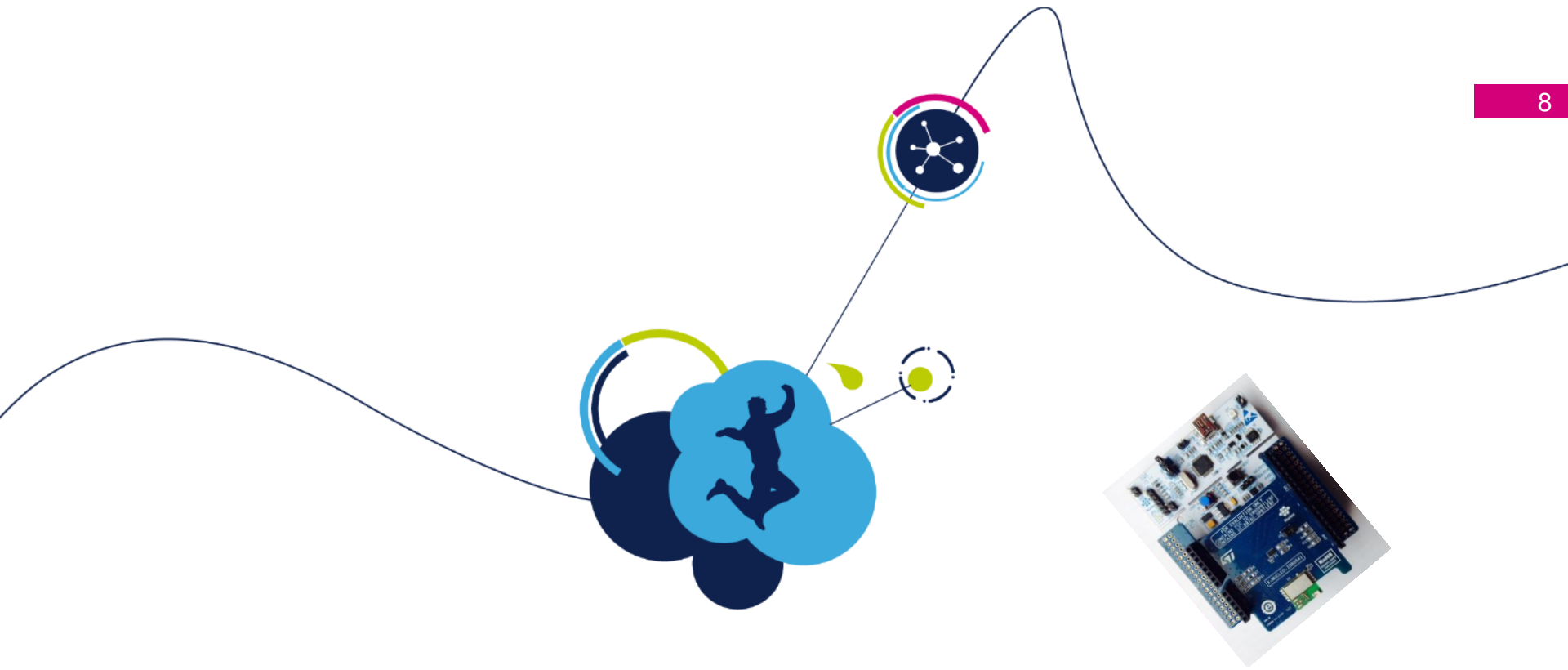


X-CUBE-BLE1
SPBTLE-RF (BlueNRG MS) code examples
STM32 based : L0 & L4 & F4



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	http://www.st.com/web/en/catalog/tools/PF261442
OSXSmartConnPS BLE profiles on top of X-CUBE-BLE1	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

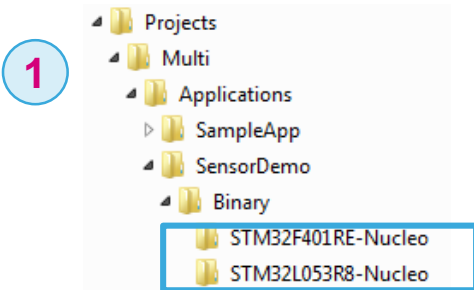




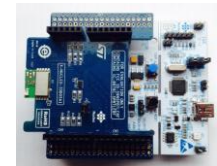
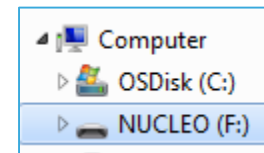
what I can easily demonstrate

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

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



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



2 load ST BlueNRG MS application on your smarphone 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/p/bluenrg/id705873549?mt=8>



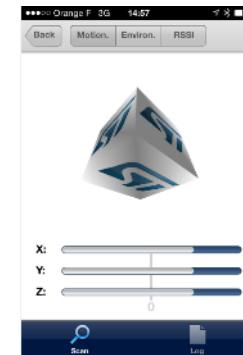
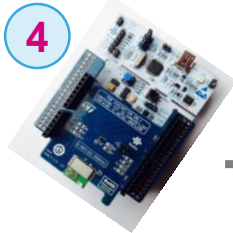
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

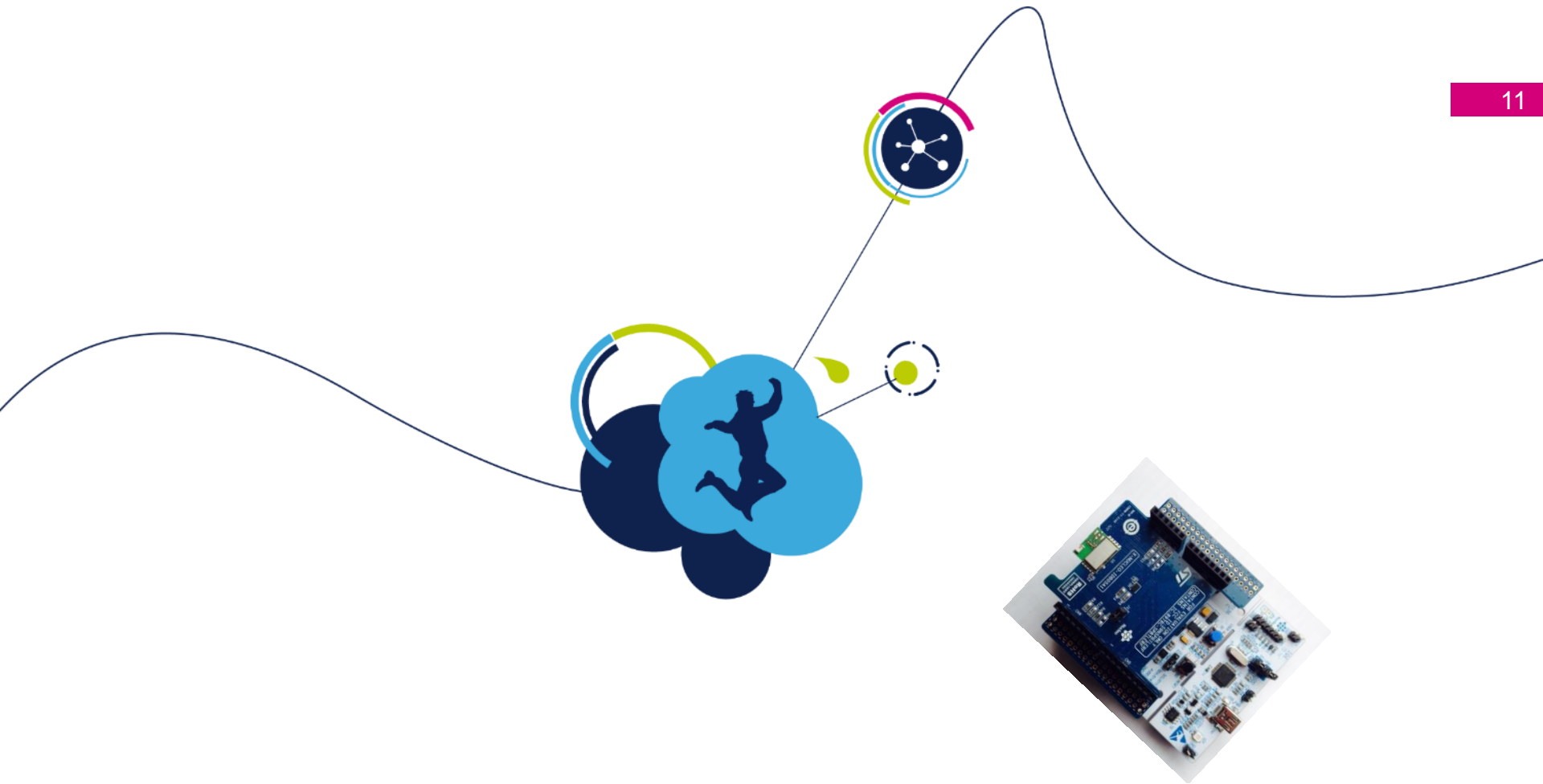
Demo1 -what I can easily demonstrate (2/2)

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



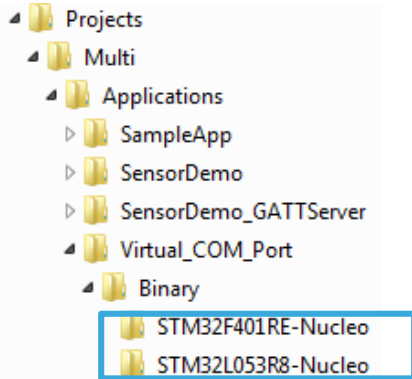


How to evaluate BlueNRG MS GUI Hands On

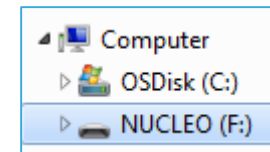
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

evaluate BlueNRG MS product thanks to GUI

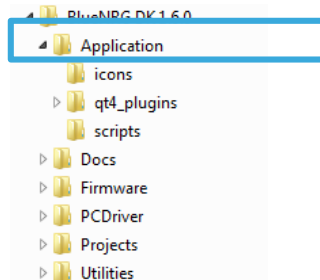
1



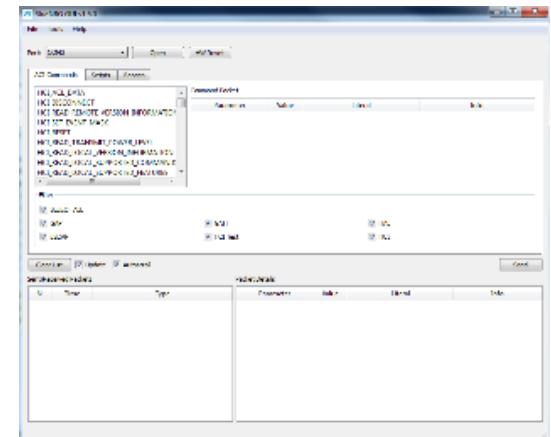
From **X-CUBE-BLE1**
SW resource package
drag and drop
Virtual_COM_Port.bin
on Nucleo drive



2



From BlueNRG SDK
launch GUI application
BLUENRG_GUI.exe

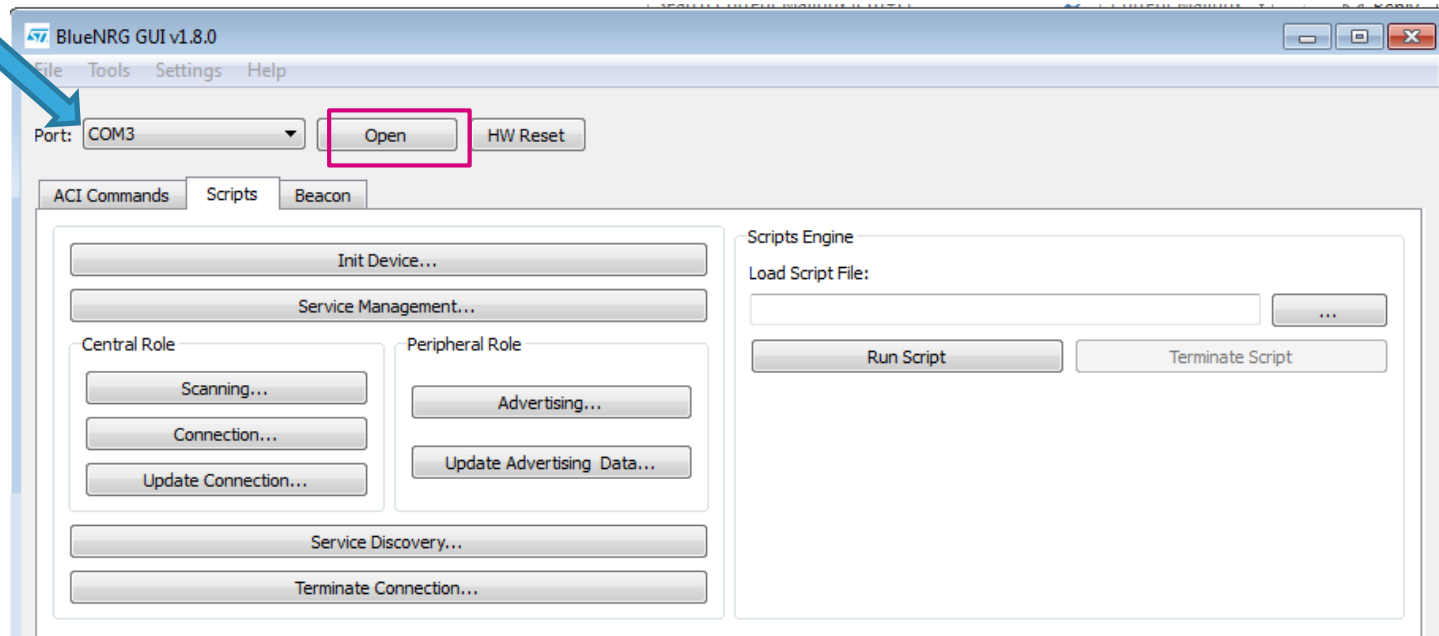


X-NUCLEO-IDB05A1 & X-CUBE-BLE1

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 μ C)

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

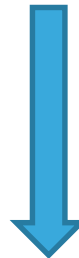
Ios Light Blue Apps constrains & behaviour

14



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*)

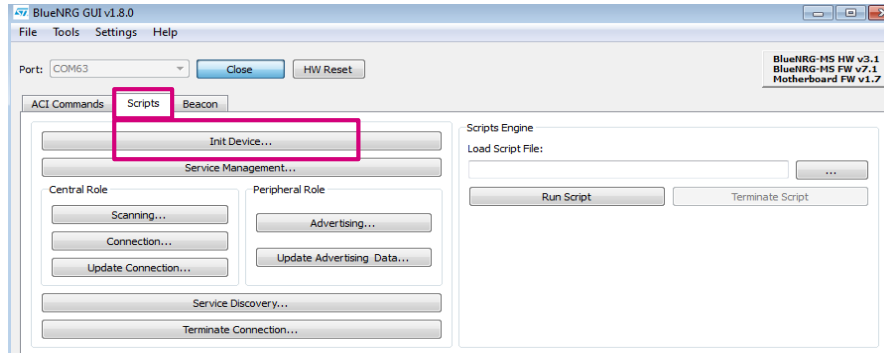
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X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 1 : BlueNRG MS advertising

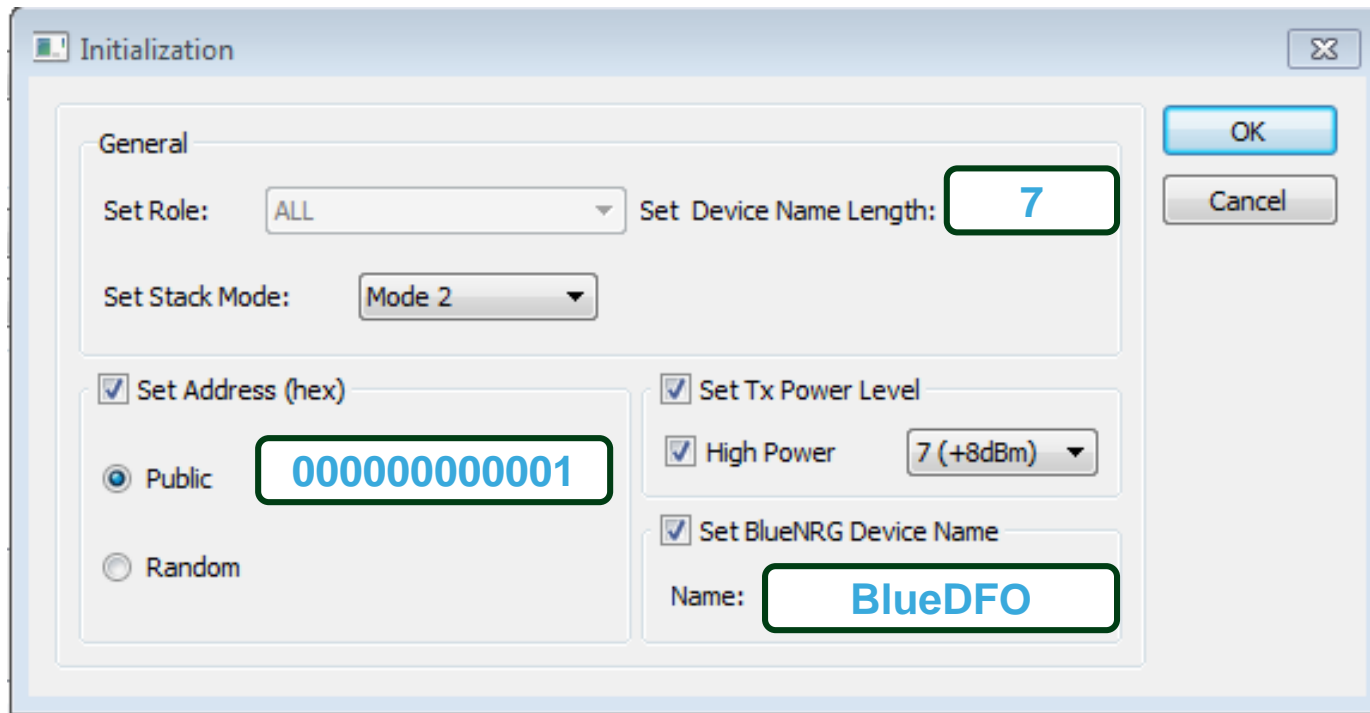
1



- **BlueNRG initialization**
Tx power, mac @, stack mode, stack init



N.	Time	Type
0	16:53:23.137	Job start.
1	16:53:23.137	HCI_RESET
2	16:53:23.217	HCI_COMMAND_COMPLETE
3	16:53:23.226	EVT_BLUE_INITIALIZED
4	16:53:23.316	ACL_HAL_WRITE_CONFIG_DATA
5	16:53:23.346	HCI_COMMAND_COMPLETE
6	16:53:23.346	ACL_HAL_WRITE_CONFIG_DATA
7	16:53:23.387	HCI_COMMAND_COMPLETE
8	16:53:23.387	ACL_HAL_SET_TX_POWER_LEVEL
9	16:53:23.417	HCI_COMMAND_COMPLETE

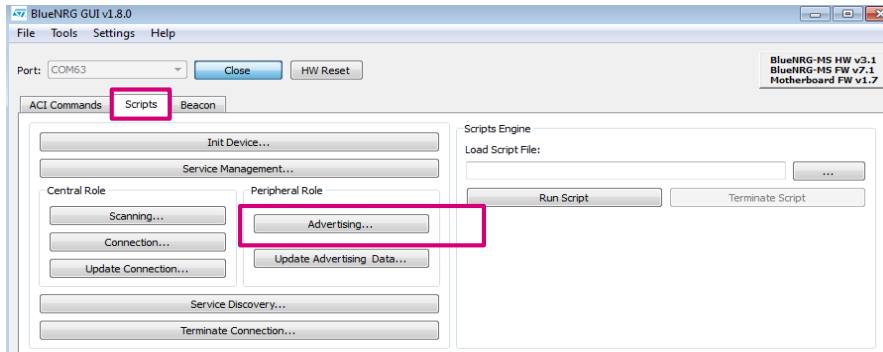


X-NUCLEO-IDB05A1 & X-CUBE-BLE1

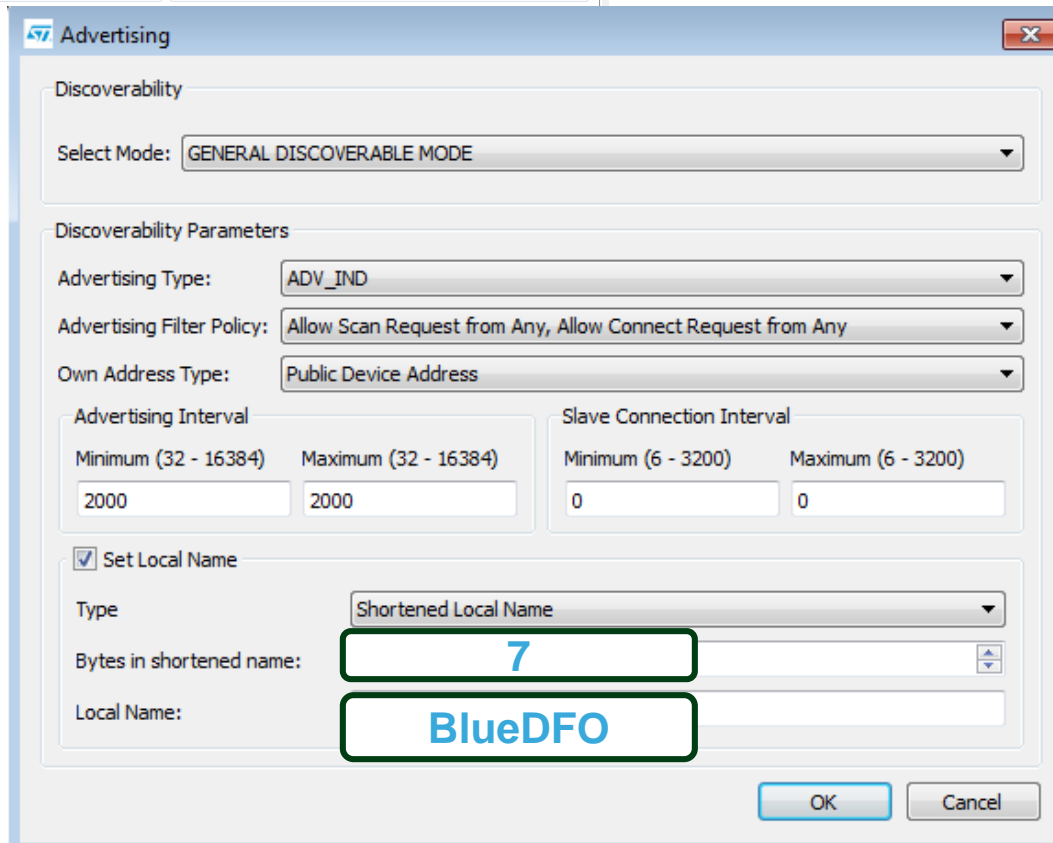
Lab 1 : BlueNRG MS advertising

17

7



- BlueNRG set in discoverable mode



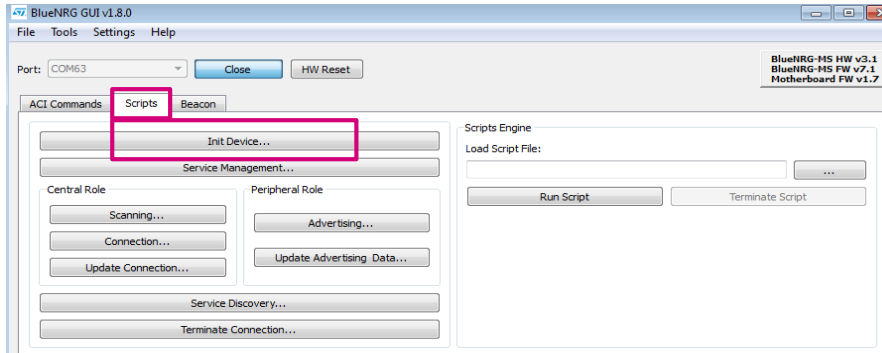
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X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG MS communication with smartphone

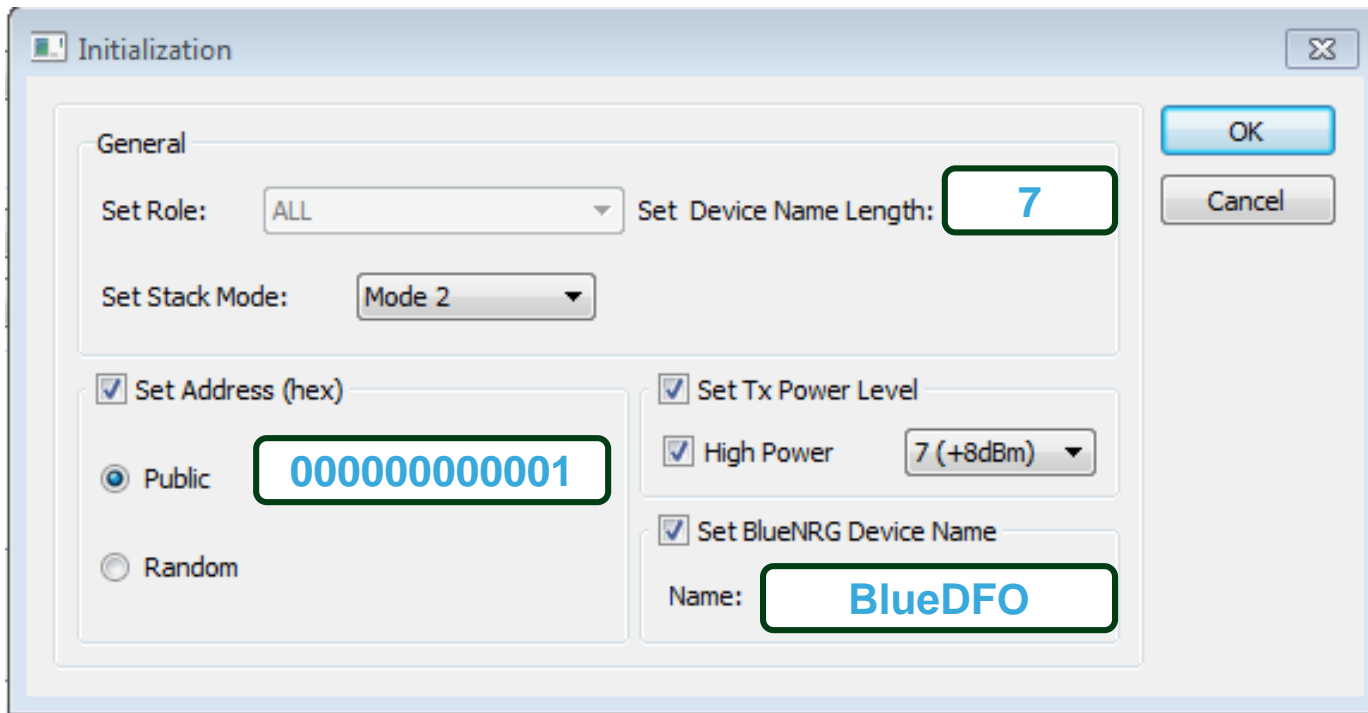
1



- **BlueNRG initialization**
Tx power, mac @, stack mode, stack init

The screenshot shows a 'Sent/Received Packets' window with a table of HCI commands. The first row is highlighted in yellow.

N.	Time	Type
0	16:53:23.137	Job start.
1	16:53:23.137	HCI_RESET
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8	16:53:23.387	ACL_HAL_SET_TX_POWER_LEVEL
9	16:53:23.417	HCI_COMMAND_COMPLETE

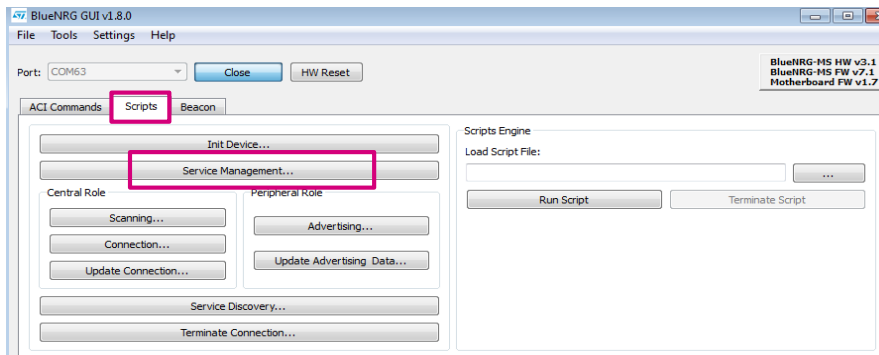


X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG MS communication with smartphone

20

2



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

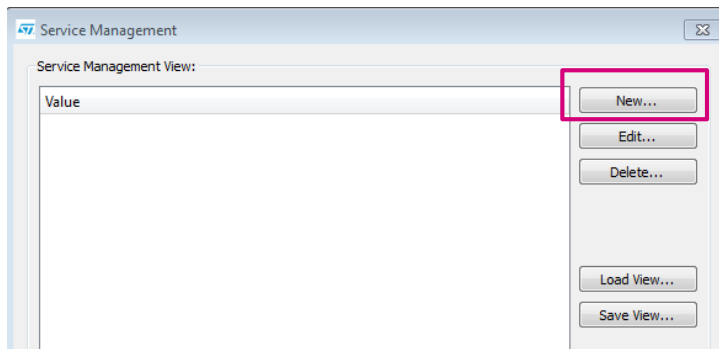
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG MS communication with smartphone

21

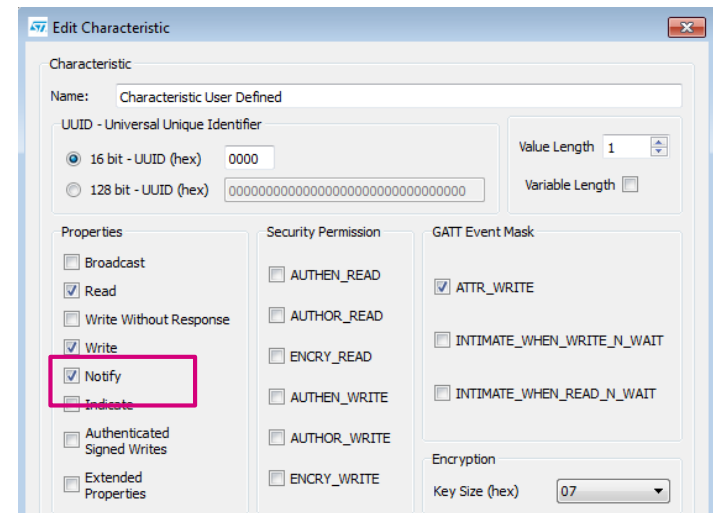
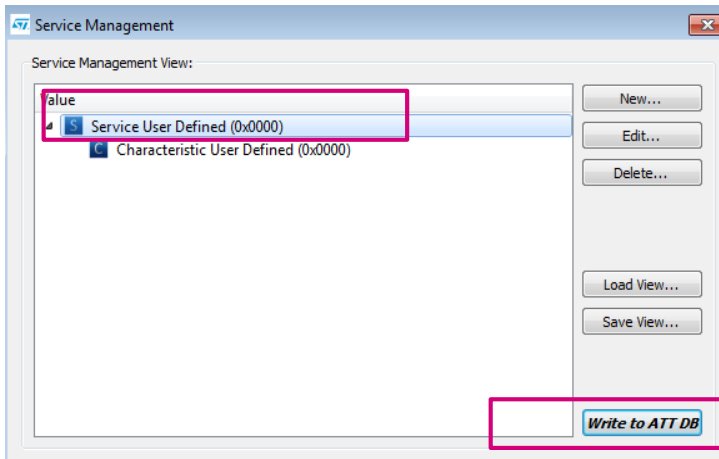
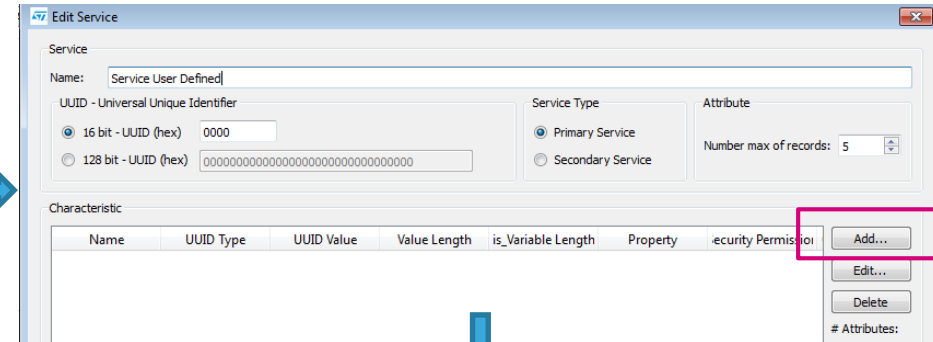
- create a service

3



4

- add associated characteristic



6

- Write this new service to data base

5

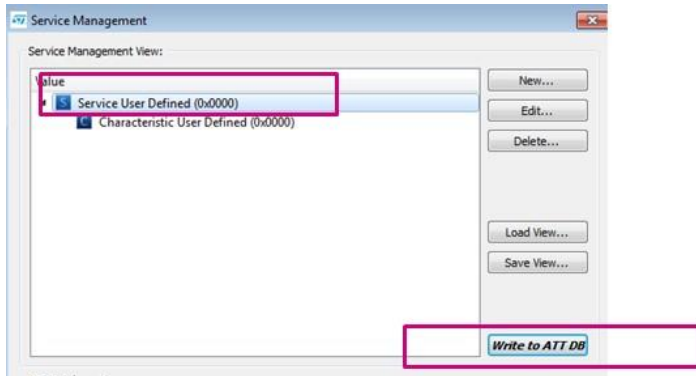
- associated characteristic (read|write|notify properties) into BlueNRG

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG MS communication with smartphone

22

- 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)



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

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.

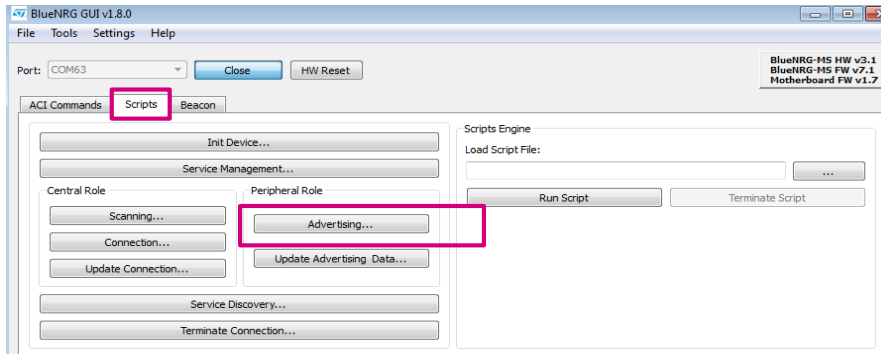
Parameter	Value	Literal	Info
Event Code	0x0E	HCI_COMMAND_COMPLETE	
Parameter Total Length	0x06		
Num_HCI_Commands	0x01		The Number of HCI commands
Command_Opcode	0xFD04	ACI_GATT_ADD_CHAR	Opcode of the command...
Status	0x00	Success	
Char_Handle	0x000D		

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

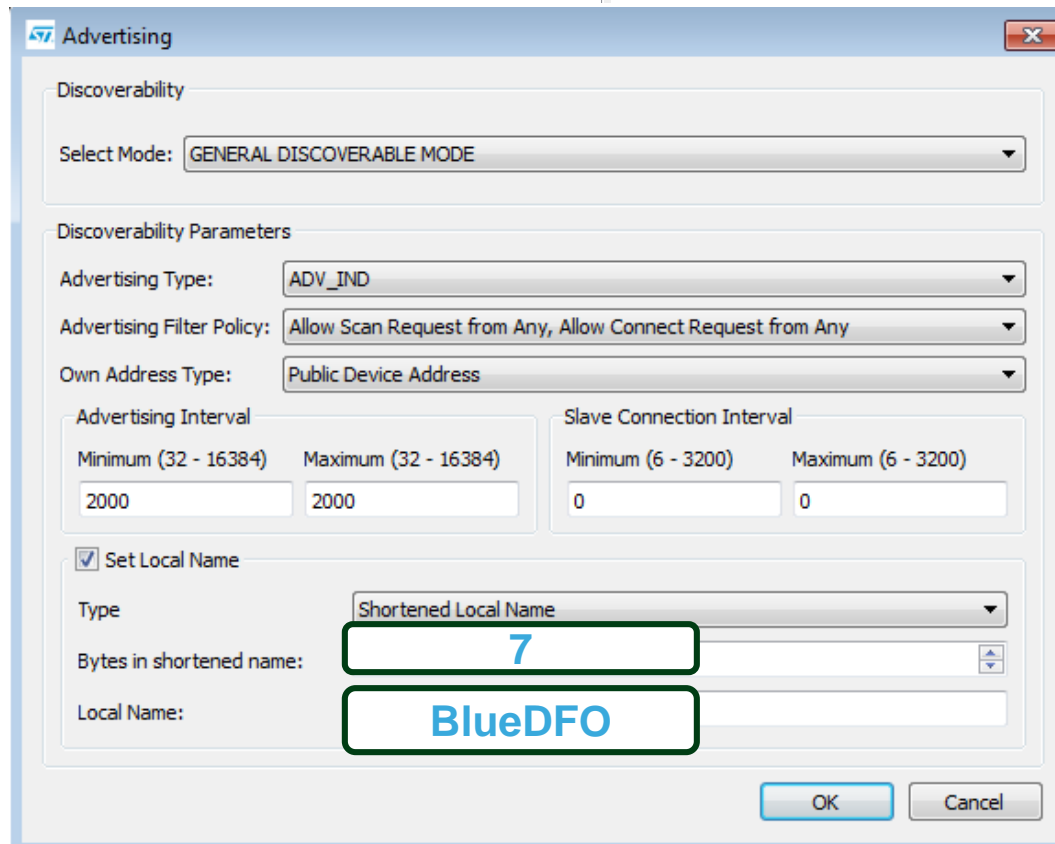
Lab 2 : BlueNRG communication with smartphone

23

7



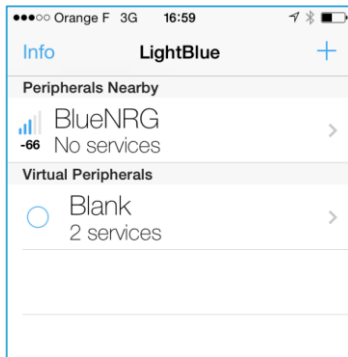
- BlueNRG set in discoverable mode



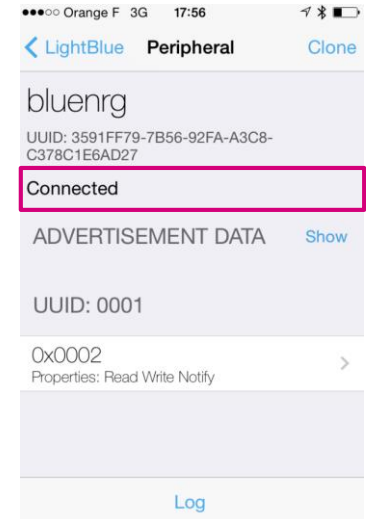
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG communication with smartphone

8



- once clicking on peripheral device, connection is established



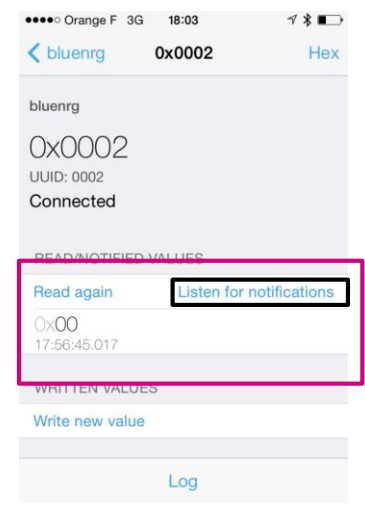
X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG communication with smartphone

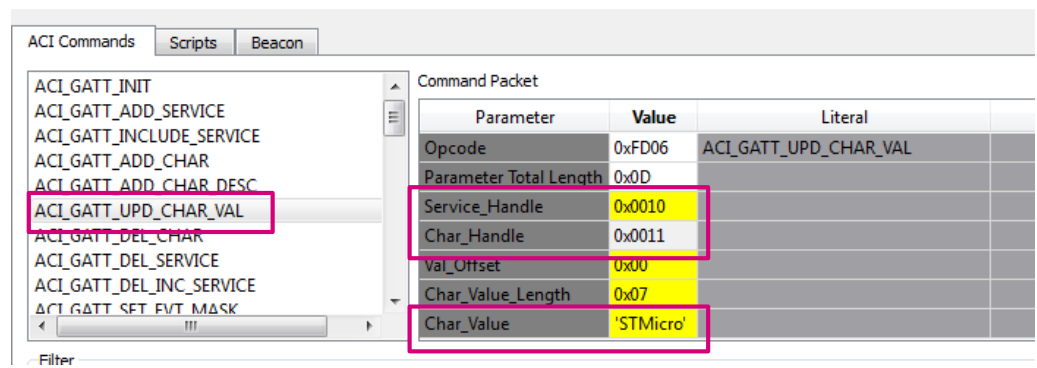
9



• Read characteristic value from your smartphone and enable listen to notifications



10



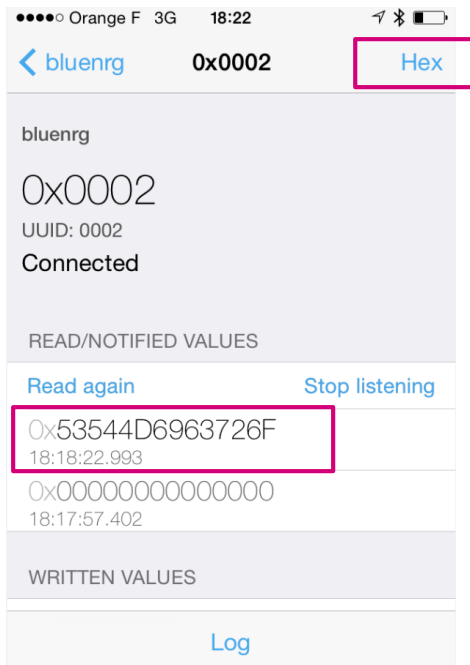
• Update the value characteristic thanks to ACI interface (UM1755) and the right service and characteristic handles

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 2 : BlueNRG communication with smartphone

26

11



- As notification has been enable, as soon as GUI/Host μ C 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

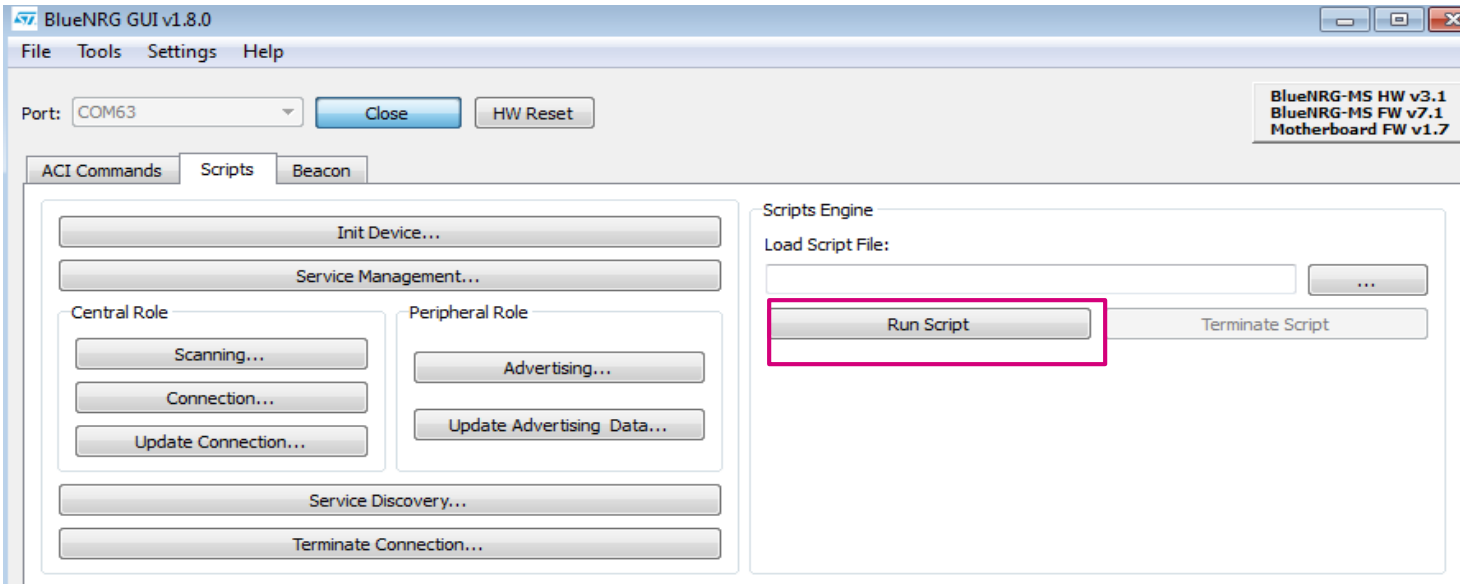
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X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 3 : Lab 2 using scripts

28



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

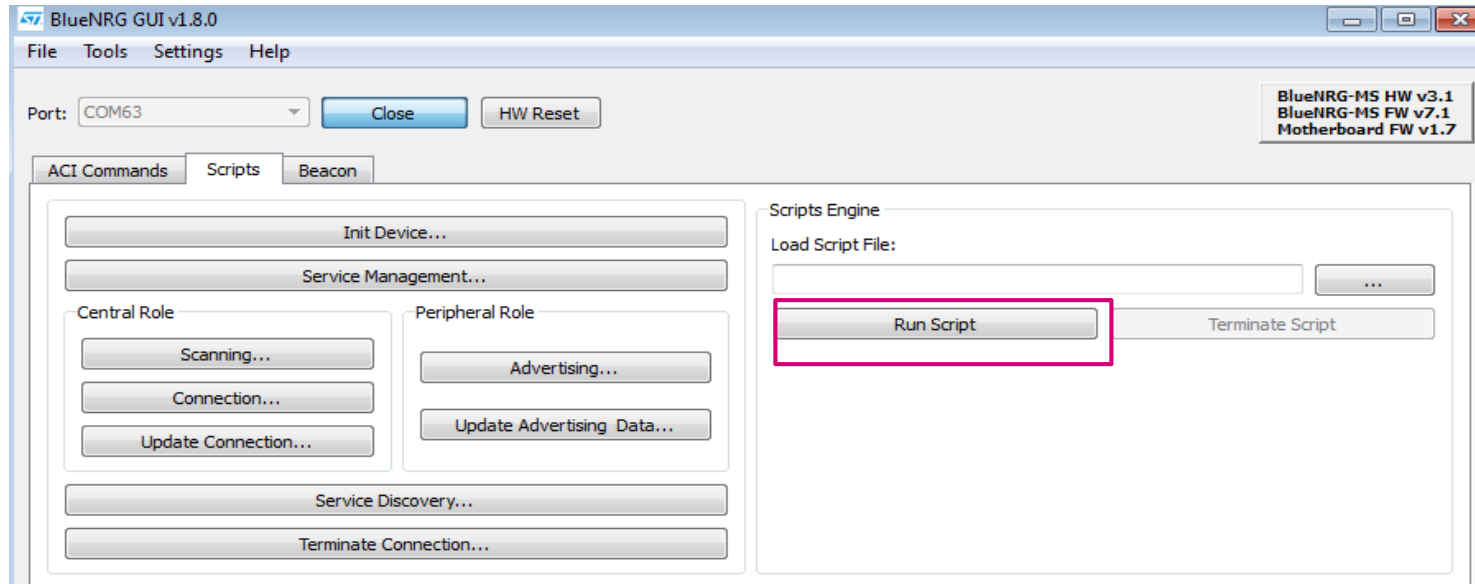
See also

- [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

29

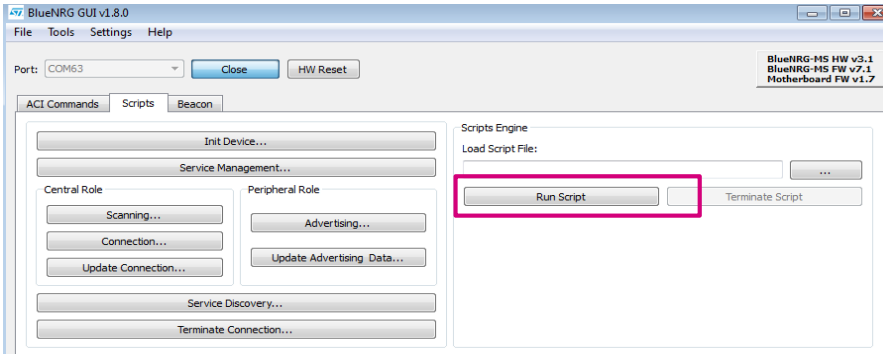


script implementation
Starting from BlueNRG-MS_Slave.py

X-NUCLEO-IDB05A1 & X-CUBE-BLE1

Lab 3 : Multiple connections

30



Multiple connections are possible thanks to

- GUI scripting capabilities (Python)
- scripts part of [STSW-BLUNRG-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.



Detailed Description

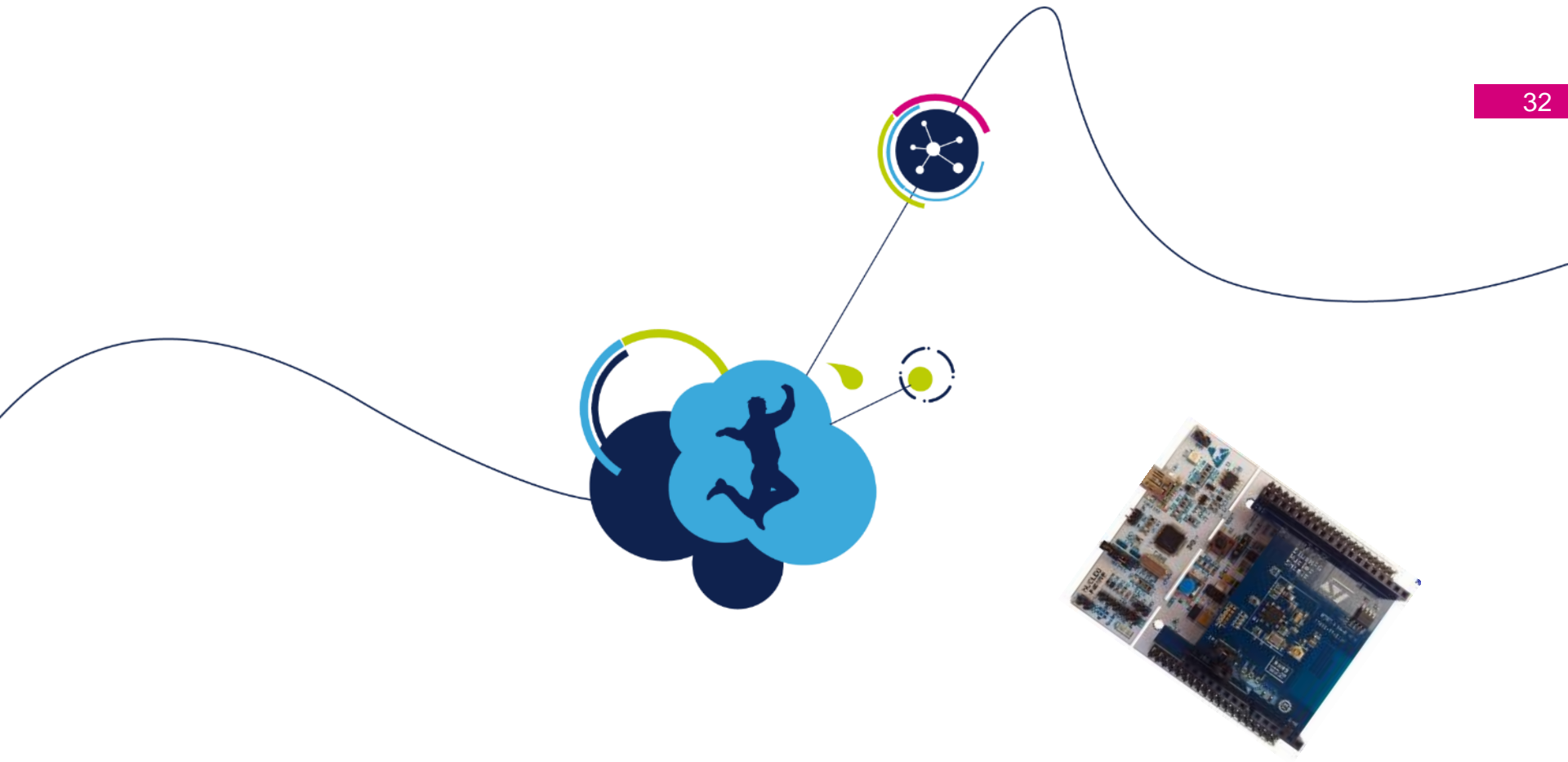
One BlueNRG-MS device (Master&Slave) is configured as Central & Peripheral, with a service and one characteristic and it performs two connections procedures (as Central) for connecting, respectively, to two BlueNRG-MS Peripheral devices (Slave_A, Slave_B) which have defined the same service and characteristic. 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

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

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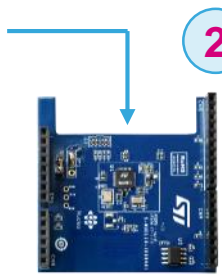


How to start coding my ideas

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

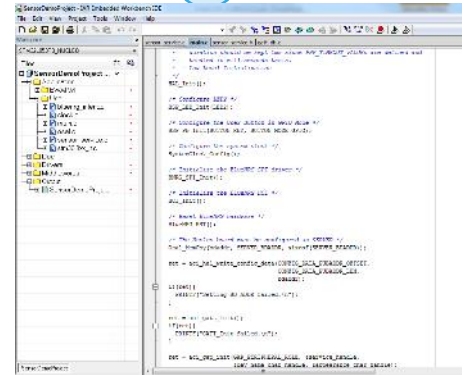
Download & unpack

X-CUBE-BLE1 package

- _htmresc
- Documentation ← Generic Nucleo docs & BLE porting
- Drivers ← BlueNRG SPI driver
- Middlewares ← Bluetooth LE HCI stack
- Projects ← Application examples
- package.xml
- Release_Notes.html

modify, build application

6

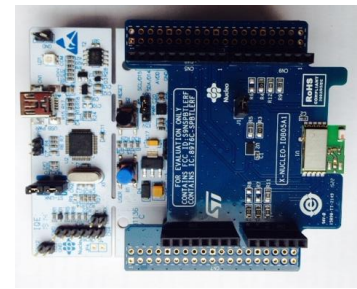


Open project example Sensor Demo

5

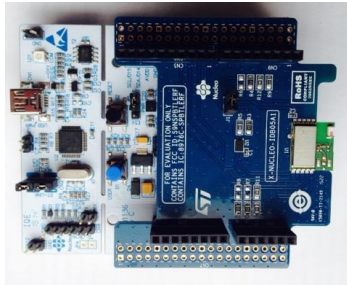
4

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



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

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Modifications in
Main.c
sensor_service.c
sensor_service.h