HA Switch-Light-HCU Demo User Guide

1vv0301025 Rev.1 – 2012-10-03

APPLICABILITY TABLE

PRODUCT
ZE51-2.4
ZE61-2.4

SW Version
P8x.02.00
Z1x.02.00

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Contents

1. Introduction

1.1. Scope

The goal of this document is:

- to describe the system's architecture (Chapter 2).
- to describe how to setup a secure/unsecure network (Chapter 3).
- to provide the functional description of some use cases of the OnOff cluster (Chapter 4).
- to describe how to flash Telit modules (Chapter 5).

Please refer to [3] par. IV.2.1 for the Telit serial protocol definition.

1.2. Audience

This document is intended for customers who want to evaluate the Home Automation Demo based on ZEx1 platform.

1.3. Contact Information, Support

For general contact, technical support, to report documentation errors and to order manuals, contact Telit Technical Support Center (TTSC) at:

TS-SRD@telit.com
TS-NORTHAMERICA@telit.com
TS-LATINAMERICA@telit.com
TS-APAC@telit.com

Alternatively, use:

http://www.telit.com/en/products/technical-support-center/contact.php

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

To register for product news and announcements or for product questions contact Telit Technical Support Center (TTSC).

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

1.4. Document Organization

This document contains the following chapters:

"Chapter 1: Introduction" provides a scope for this document, target audience, contact and support information, and text conventions.

"Chapter 2: Demo Architecture" gives an overview of the features of the product.

"Chapter 3: Steps to Setup a Secure Network" describes in details how to setup a secure/unsecure ZigBee network.

"Chapter 4: On Off Cluster Usage" describes some use cases of the OnOff cluster usage.

1.5. Text Conventions

Danger – This information MUST be followed or catastrophic equipment failure or bodily injury may occur.

Caution or Warning – Alerts the user to important points about integrating the module, if these points are not followed, the module and end user equipment may fail or malfunction.

Tip or Information – Provides advice and suggestions that may be useful when integrating the module.

All dates are in ISO 8601 format, i.e. YYYY-MM-DD.

1.6. Related Documents

[1]	ZE51/61-2.4 RF module User Guide	1vv0300868
[2]	SR Manager Tool User Guide	1vv0300899
[3]	ZigBee PRO Democase User Guide	1vv0300900

2. Demo Architecture

The final aim of this demo is to set up an operative network where there are Home Automation devices that allow to a customized combo device, acting as Coordinator, to manage their ON Off states. Refer to the combo device residing in the Coordinator as Switch device.

The Switch device is able to control a remote OnOff Light end device through its OnOffLightSwitch component, and two HeatingCoolingUnit (HCU) end devices through the OnOffSwitch component.

The devices involved in the demo are shown in the following figure.

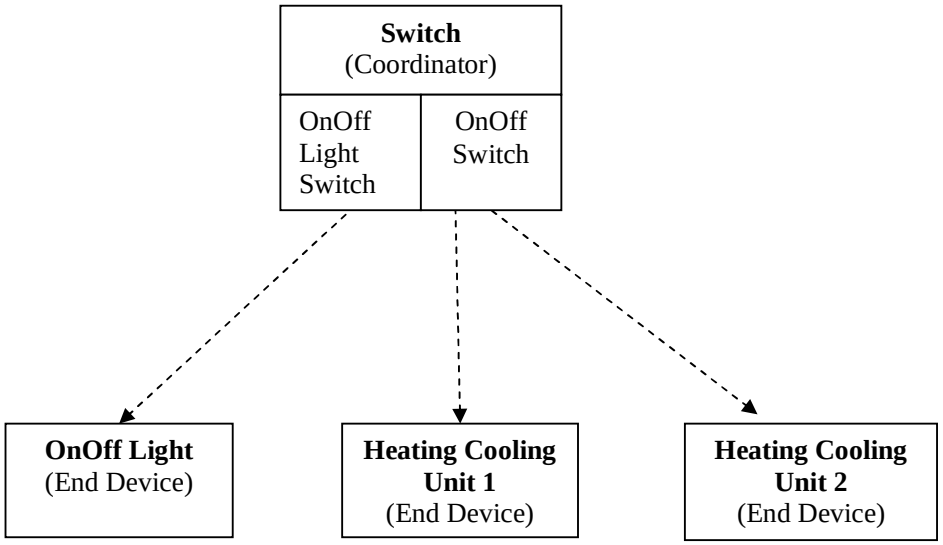


Figure 1. Device Architecture

The remote control is achieved by communicating on the HA OnOff Cluster supported by both coordinator and end device sides. The running demo applications using this cluster will run above the endpoints depicted in the figure below:

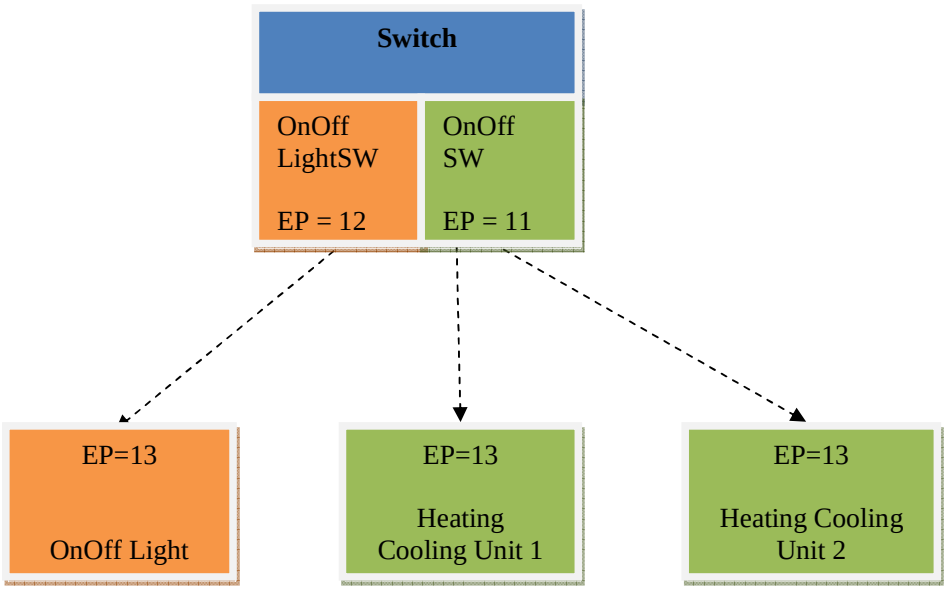


Figure 2. EndPoints Architecture

3. Steps to Setup a Secure Network

3.1. Network Formation

The Network shall be formed by the device Switch acting as Coordinator.
The Serial Requests and the expected Confirms are listed below:

1. Reset the Switch:

	Packet Length	Command ID	Reset Type
Number of Bytes	1	1	1
Value	0x02	0x10	0x00

Expected Confirm:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x11	0x00 (SUCCESS)

2. Set a channel mask (for example enable channel 16 -> channel mask = 0x0020)

	Packet Length	Command ID	Attribute ID	Attribute Length	Attribute
Number of Bytes	1	1	1	1	2
Value	0x05	0x12	0x01	0x02	0x00,0x20

Expected Confirm:

	Packet Length	Command ID	Status	Attribute ID
Number of Bytes	1	1	1	1
Value	0x03	0x13	0x00 (SUCCESS)	0x01

3. Set an Extended PAN ID (for example 0x00,0x00,0x00,0x00,0x00,0x00,0xAB,0xCD)

	Packet Length	Command ID	Attribute ID	Attribute Length	Attribute
Number of Bytes	1	1	1	1	8
Value	0x0B	0x12	0xC4	0x08	0x00,0x00,0x00,0x00, 0x00,0x00,0xAB,0xCD

Expected Confirm:

	Packet Length	Command ID	Status	Attribute ID
Number of Bytes	1	1	1	1
Value	0x03	0x13	0x00 (SUCCESS)	0xC4

The underlying Telit Stack Pro can support both security and no security modes. If security is a requirement, perform the following steps, otherwise skip to point 7:

4. Enable Network security (Attribute Id = 0xA3).

	Packet Length	Command ID	Attribute ID	Attribute Length	Attribute
Number of Bytes	1	1	1	1	1
Value	0x04	0x12	0xA3	0x01	0x01

Expected Confirm:

	Packet Length	Command ID	Status	Attribute ID
Number of Bytes	1	1	1	1
Value	0x03	0x13	0x00 (SUCCESS)	0xA3

5. Enable Trust Center Link Key management (Attribute Id = 0xE5).

	Packet Length	Command ID	Attribute ID	Attribute Length	Attribute
Number of Bytes	1	1	1	1	1
Value	0x04	0x12	0xE5	0x01	0x01

Expected Confirm:

	Packet Length	Command ID	Status	Attribute ID
Number of Bytes	1	1	1	1
Value	0x03	0x13	0x00 (SUCCESS)	0xE5

6. Set TC LINK KEY

	Packet Length	Command ID	Attribute ID	Attribute Length	Attribute	
					TC Link Key	IEEE Address
Number of Bytes	1	1	1	1	16	8
Value	0x1B	0x12	0xA5	0x18	0xXX,0xXX,0xXX,0xXX, 0xXX,0xXX,0xXX,0xXX, 0xXX,0xXX,0xXX,0xXX, 0xXX,0xXX,0xXX,0xXX	0xXX,0xXX,0xXX,0xXX, 0xXX,0xXX,0xXX,0xXX

IEEE address should be set with different values depending on the device type:

- 0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x,00: the TC link key is valid for every device.
- Otherwise the TC link key is valid for the specific device.

NOTE:

The TC link key is used only during the network joining to exchange the Network Key.

Expected Confirm:

	Packet Length	Command ID	Status	Attribute ID
Number of Bytes	1	1	1	1
Value	0x03	0x13	0x00 (SUCCESS)	0xA5

7. Form the network sending a start request to the Switch.

	Packet Length	Command ID
Number of Bytes	1	1
Value	0x01	0x16

Expected Confirm:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x17	0x00 (SUCCESS)

8. Enable Permit Joining to the Switch.

	Packet Length	Command ID	Nwk Address	Permit Join	TC Significance
Number of Bytes	1	1	2	1	1
Value	0x05	0xEA	0x00,0x00	0xFF	0x00

Expected Confirm:

NOTE:

If the Permit Join field is set to 0xFF the joining is allowed forever so you need to do it only one time.

NOTE:

This command can be managed by the Switch only if it has already formed a network. By default the joining is not allowed

The expected confirm is:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0xEB	0x00 (SUCCESS)

3.2. Network Join – On Off Light Device

The OnOff Light shall join the network formed by the Switch to be able to communicate with it.
The Serial Requests and the expected Confirms are listed below:

1. Reset the OnOffLight:

	Packet Length	Command ID	Reset Type
Number of Bytes	1	1	1
Value	0x02	0x10	0x00

Expected Confirm:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x11	0x00 (SUCCESS)

2. Set a channel mask (for example enable channel 16 -> channel mask = 0x0020)

	Packet Length	Command ID	Attribute ID	Attribute Length	Attribute
Number of Bytes	1	1	1	1	2
Value	0x05	0x12	0x01	0x02	0x00,0x20

Expected Confirm:

	Packet Length	Command ID	Status	Attribute ID
Number of Bytes	1	1	1	1
Value	0x03	0x13	0x00 (SUCCESS)	0x01

3. Set an Extended PAN ID (for example 0x00,0x00,0x00,0x00,0x00,0x00,0xAB,0xCD)

	Packet Length	Command ID	Attribute ID	Attribute Length	Attribute
Number of Bytes	1	1	1	1	8
Value	0x0B	0x12	0xC4	0x08	0x00,0x00,0x00,0x00, 0x00,0x00,0xAB,0xCD

Expected Confirm:

	Packet Length	Command ID	Status	Attribute ID
Number of Bytes	1	1	1	1
Value	0x03	0x13	0x00 (SUCCESS)	0xC4

The underlying Telit Stack Pro can support both security and no security modes. If security is a requirement, perform the following steps, otherwise skip to point 7:

4. Enable Network security (Attribute Id = 0xA3).

	Packet Length	Command ID	Attribute ID	Attribute Length	Attribute
Number of Bytes	1	1	1	1	1
Value	0x04	0x12	0xA3	0x01	0x01

Expected Confirm:

	Packet Length	Command ID	Status	Attribute ID
Number of Bytes	1	1	1	1
Value	0x03	0x13	0x00 (SUCCESS)	0xA3

5. Enable Trust Center Link Key management (Attribute Id = 0xE5).

	Packet Length	Command ID	Attribute ID	Attribute Length	Attribute
Number of Bytes	1	1	1	1	1
Value	0x04	0x12	0xE5	0x01	0x01

Expected Confirm:

	Packet Length	Command ID	Status	Attribute ID
Number of Bytes	1	1	1	1
Value	0x03	0x13	0x00 (SUCCESS)	0xE5

6. Set TC LINK KEY

	Packet Length	Command ID	Attribute ID	Attribute Length	Attribute	
					TC Link Key	IEEE Address
Number of Bytes	1	1	1	1	16	8
Value	0x1B	0x12	0xA5	0x18	0xXX,0xXX,0xXX,0xXX, 0xXX,0xXX,0xXX,0xXX, 0xXX,0xXX,0xXX,0xXX, 0xXX,0xXX,0xXX,0xXX	0x00,0x00,0x00,0x00, 0x00,0x00,0x00,0x00

NOTE:

The TC Link Key shall be the same set on the Switch.

NOTE:

The "IEEE Address" field is ignored so can be set to 0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00..

NOTE:

The TC link key is used only during the network joining to exchange the Network Key.

Expected Confirm:

	Packet Length	Command ID	Status	Attribute ID
Number of Bytes	1	1	1	1
Value	0x03	0x13	0x00 (SUCCESS)	0xA5

7. Join the network sending a start request to the Switch.

	Packet Length	Command ID
Number of Bytes	1	1
Value	0x01	0x16

During association and authentication phases the OnOff Light receives the serial messages listed below.

- Association Confirm:

	Packet Length	Command ID	Short Address	Pan ID	HasNwkKey	Status
Number of Bytes	1	1	2	2	1	1
Value	0x02	0x77	0x21,0x78	0xEB,0x25	0x00	0x00 (SUCCESS)

NOTE:

The short address and the Pan ID can be different because they are generated randomly.

- Join Confirm

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x17	0x00 (SUCCESS)

NOTE:

During association and the authentication the Switch receives the serial message listed below.

Message	Message Type	Message Description
0x0C,0xD5,0x21,0x78,0x02,0x00,0x50, 0x00,0x00,0x4F,0x15,0x00,0x8C	End Device Announce	A device with short address 0x21,0x78 (Little endian) and extended address 0x02,0x00,0x50,0x00,0x00,0x4F,0x15,0x00 (Little endian) joined the network

3.3. Network Join – Heating Cooling Unit Devices

The HeatCoolingUnit_1 and HeatCoolingUnit_2 shall join the network formed by the Switch to be able to communicate with it. Please follow steps of paragraph 3.2 to perform joining.

NOTE:

During association and authentication phases the HeatCoolingUnit_1 receives the serial messages listed below.

Message	Message Type	Message Description
0x07,0x77,0x39,0x12,0xEB,0x25,0x00,0x00	Join Confirm	Indicates the HeatCoolingUnit_1 joined the network and has short address 0x39 0x12 (Little endian)
0x02,0x17,0x00	Start Confirm	Start succeeded

NOTE:

During association and authentication phases the HeatCoolingUnit_2 receives the serial messages listed below.

Message	Message Type	Message Description
0x07,0x77,0xA2,0x79,0xEB,0x25,0x00,0x00	Join Confirm	Indicates the HeatCoolingUnit_2 joined the network and has short address 0xA2 0x79 (Little endian)
0x02,0x17,0x00	Start Confirm	Start succeeded

NOTE:

During association and authentication phases the Switch receives the serial messages listed below.

Message	Message Type	Message Description
0x0C,0xD5,0x39,0x12,0x03,0x00,0x50, 0x00, 0x00,0x4F,0x15,0x00,0x8C	End Device Announce	A device with short address 0x39,0x12 (Little endian) and extended address 0x03,0x00,0x50,0x00,0x00,0x4F,0x15,0x00 (Little endian) joined the network
0x0C,0xD5,0xA2,0x79,0x04,0x00,0x50, 0x00, 0x00,0x4F,0x15,0x00,0x8C	End Device Announce	A device with short address 0xA2,0x79 (Little endian) and extended address 0x04,0x00,0x50,0x00,0x00,0x4F,0x15,0x00 (Little endian) joined the network

3.4. End Device Bindings

Once the network is formed the device can be bound using the end device binding feature.

3.4.1. OnOff Light Switch ↔ OnOff Light Devices

End Device bind between OnOff Light Switch device (Enpdoint 12 on the Switch), and the OnOff Light Device (Endpoint 13).

1. On the OnOff Light End Device

Offset	Name	Value
0	Packet Length	0x08
1	Command ID	0xD6
2	Source EP	0x0D
3	Profile ID (Little endian)	0x04,0x01
5	NumInClusters	0x01
6	InClusterList (Little endian)	0x06,0x00
8	NumOutClusters	0x00

Within one minute issue the next command.

2. On the Coordinator Switch – Device OnOffLightSwitch:

Offset	Name	Value
0	Packet Length	0x08
1	Command ID	0xD6
2	Source EP	0x0C
3	Profile ID (Little endian)	0x04,0x01
5	NumInClusters	0x00
6	NumOutClusters	0x01
7	OutClusterList (Little endian)	0x06,0x00

3. Expected Confirms:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0xD7	0x00 (SUCCESS)

3.4.2. OnOff Switch ↔ HeatCoolingDeviceUnit_1 and 2 Devices

End Device bind between OnOff Switch device (Enpdoint 11 on the Switch), and the Heat Cooling Device Units 1 and 2 (Endpoint 13).

1. On the HeatingCoolingDevice_Unit1 End Device

Offset	Name	Value
0	Packet Length	0x08
1	Command ID	0xD6
2	Source EP	0x0D
3	Profile ID (Little endian)	0x04,0x01
5	NumInClusters	0x01
6	InClusterList (Little endian)	0x06,0x00
8	NumOutClusters	0x00

Within one minute issue the next command.

2. On the Coordinator Switch – Device OnOffSwitch:

Offset	Name	Value
0	Packet Length	0x08
1	Command ID	0xD6
2	Source EP	0x0B
3	Profile ID (Little endian)	0x04,0x01
5	NumInClusters	0x00
6	NumOutClusters	0x01
7	OutClusterList (Little endian)	0x06,0x00

Please repeat steps 1 and 2 for the HeatingCoolingDevice_Unit 2 binding.

3. Expected Confirms:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0xD7	0x00 (SUCCESS)

The confirmation message is expected to be received on the serial terminal of both devices after few seconds that the procedure has successfully ended.

4. On Off Cluster Usage

This section describes how to manage OnOff Cluster.

The main goal is to check if the cluster commands work correctly by switching On and Off the corresponding attributes of the remote devices. The Read Remote Attribute command will be used to verify this.

Having previously setup the End Device binding (3.4), we should be able to use indirect addressing on the remote requests.

NOTE:

Values such Source/Destination Nwk Address and Packet Sequence Number will be different for each built network.

1. From Switch: Remote Read (using indirect addressing) of Attribute OnOff (0x0000) on OnOffLight device, Cluster OnOff (0x0006).

Offset	Name	Value	Description
0	Packet Length	0x0B	
1	Command ID	0x55	Read Remote Attr
2	Address Mode	0x00	0x00: indirect addressing, the destination address length is two bytes and is not used
3	Destination Address	0x00,0x00	Don't care
5	DstEP	0x0D	DstEndPoint(OnOffLightEP)
6	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Number Of Attributes	0x01	One Attribute
10	List Of Attributes	0x00,0x00	OnOff Attrib ID (Little Endian)

Expected Confirms:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x56	0x00 (SUCCESS)

2. Check ReadResponse with Attribute's value = 0x00

Offset	Name		Value	Description
0	Packet Length		0x0D	
1	Command ID		0x5A	Read Remote Attr Response
2	Src Nwk Address		0x21,0x78	Source Addr (Little Endian)
4	SrcEP		0x0D	SrcEndpoint.
5	DstEP		0x0C	DstEndPoint)
6	Cluster ID		0x06,0x00	OnOff ClusterId (Little Endian)
8	Number Of Attributes		0x01	One Attribute
9	Attributes	AttrID	0x00,0x00	Attrib ID - little endian
11		Status	0x00	Success
12		Data Type	0x20	UINT8
13		Data	**0x00**	**OFF**

3. From Switch: Remote Read (using indirect addressing) of Attribute OnOff (0x0000) on HeatingCoolingUnit_1 and 2 device, Cluster OnOff (0x0006):

NOTE:

Just send one command for both devices, while both have a binding on the same endpoint and cluster.

Offset	Name	Value	Description
0	Packet Length	0x0B	
1	Command ID	0x55	Read Remote Attr
2	Address Mode	0x00	0x00: indirect addressing, the destination address length is two bytes and is not used
3	Destination Address	0x00,0x00	Don't care
5	DstEP	0x0D	DstEndPoint(HeatCoolEP)
6	SrcEP	0x0B	SrcEndPoint(OnOffSwitchEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Number Of Attributes	0x01	One Attribute
10	List Of Attributes	0x00,0x00	OnOff Attrib ID (Little Endian)

Expected Confirms:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x56	0x00 (SUCCESS)

4. Check ReadResponse sent by Unit_1 with Attribute value = **0x00**

Offset	Name		Value	Description
0	Packet Length		0x0D	
1	Command ID		0x5A	Read Remote Attr Response
2	Src Nwk Address		0x39,0x12	Source Addr (Little Endian)
4	SrcEP		0x0D	SrcEndpoint.
5	DstEP		0x0B	DstEndPoint)
6	Cluster ID		0x06,0x00	OnOff ClusterId (Little Endian)
8	Number Of Attributes		0x01	One Attribute
9	Attributes	AttrID	0x00,0x00	Attrib ID - little endian
11		Status	0x00	Success
12		Data Type	0x20	UINT8
13		Data	**0x00**	**OFF**

5. Check ReadResponse sent by Unit_2 with Attribute value = 0x00

Offset	Name	Value	Description
0	Packet Length	0x0D	
1	Command ID	0x5A	Read Remote Attr Response
2	Src Nwk Address	0xA2,0x79	Source Addr (Little Endian)
4	SrcEP	0x0D	SrcEndpoint.
5	DstEP	0x0B	DstEndPoint)

6	Cluster ID		0x06-0x00	OnOff ClusterId (Little Endian)
8	Number Of Attributes		0x01	One Attribute
9	Attributes	AttrID	0x00-0x00	Attrib ID - little endian
11		Status	0x00	Success
12		Data Type	0x20	UINT8
13		Data	**0x00**	**OFF**

6. From Switch: Send command **ON (0x01)** to OnOffLight device using indirect addressing, Cluster OnOff (0x0006).

Offset	Name	Value	Description
0	Packet Length	0x0A	
1	Command ID	0x43	ZCL Message From Client to Server Request
2	Address Mode	0x00	0x00: indirect addressing, the destination address length is two bytes and is not used
3	Destination Address	0x00,0x00	Don't care
5	DstEP	0x0D	DstEndPoint(OnOffLightEP)
6	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Cluster Command ID	**0x01**	**ON**
10	Cluster Command Length	0x00	Has only the Cluster command ID

Expected Confirm:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x44	0x00 (SUCCESS)

7. Check Indication on the serial terminal connected to the OnOffLight device.

Offset	Name	Value	Description
0	Packet Length	0x0A	
1	Command ID	0x45	ZCL Message From Client to Server Indication
2	Src Address	0x00,0x00	Switch Address
4	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
5	Seq Num	0x00	
6	DstEP	0x0D	DstEndPoint(OnOffLightEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Cluster Command ID	**0x01**	**ON**
10	Cluster Command Length	0x00	Has only the Cluster command ID

8. From Switch: Remote Read (using indirect addressing) of Attribute OnOff (0x0000) on OnOffLight device, Cluster OnOff (0x0006).

Offset	Name	Value	Description
0	Packet Length	0x0B	
1	Command ID	0x55	Read Remote Attr
2	Address Mode	0x00	0x00: indirect addressing, the destination address length is two bytes and is not used
3	Destination Address	0x00,0x00	Don't care
5	DstEP	0x0D	DstEndPoint(OnOffLightEP)
6	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Number Of Attributes	0x01	One Attribute
10	List Of Attributes	0x00,0x00	OnOff Attrib ID (Little Endian)

Expected Confirm:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x56	0x00 (SUCCESS)

9. Check ReadResponse with Attribute value = 0x01

Offset	Name		Value	Description
0	Packet Length		0x0D	
1	Command ID		0x5A	Read Remote Attr Response
2	Src Nwk Address		0x21,0x78	Source Addr (Little Endian)
4	SrcEP		0x0D	SrcEndpoint.
5	DstEP		0x0C	DstEndPoint)
6	Cluster ID		0x06,0x00	OnOff ClusterId (Little Endian)
8	Number Of Attributes		0x01	One Attribute
9	Attributes	AttrID	0x00,0x00	Attrib ID - little endian
11		Status	0x00	Success
12		Data Type	0x20	UINT8
13		Data	**0x01**	**ON**

10. From Switch: Send command OFF (0x00) to OnOffLight device using indirect addressing, Cluster OnOff (0x0006).

Offset	Name	Value	Description
0	Packet Length	0x0A	
1	Command ID	0x43	ZCL Message From Client to Server Request
2	Address Mode	0x00	0x00: indirect addressing, the destination address length is two bytes and is not used
3	Destination Address	0x00,0x00	Don't care
5	DstEP	0x0D	DstEndPoint(OnOffLightEP)
6	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Cluster Command ID	**0x00**	**OFF**
10	Cluster Command Length	0x00	Has only the Cluster command ID

Expected Confirm:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x44	0x00 (SUCCESS)

11. Check Indication on the serial terminal connected to OnOffLight device.

Offset	Name	Value	Description
0	Packet Length	0x0A	
1	Command ID	0x45	ZCL Message From Client to Server Indication
2	Src Address	0x00,0x00	Switch Address
4	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
5	Seq Num	0x01	
6	DstEP	0x0D	DstEndPoint(OnOffLightEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Cluster Command ID	**0x00**	**OFF**
10	Cluster Command Length	0x00	Has only the Cluster command ID

12. From Switch: Remote Read (using indirect addressing) of Attribute OnOff (0x0000) on OnOffLight device, Cluster OnOff (0x0006).

Offset	Name	Value	Description
0	Packet Length	0x0B	
1	Command ID	0x55	Read Remote Attr
2	Address Mode	0x00	0x00: indirect addressing, the destination address length is two bytes and is not used
3	Destination Address	0x00,0x00	Don't care
5	DstEP	0x0D	DstEndPoint(OnOffLightEP)
6	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Number Of Attributes	0x01	One Attribute
10	List Of Attributes	0x00,0x00	OnOff Attrib ID (Little Endian)

Expected Confirm:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x56	0x00 (SUCCESS)

13. Check ReadResponse with Attribute's value = 0x00

Offset	Name		Value	Description
0	Packet Length		0x0D	
1	Command ID		0x5A	Read Remote Attr Response
2	Src Nwk Address		0x21,0x78	Source Addr (Little Endian)
4	SrcEP		0x0D	SrcEndpoint.
5	DstEP		0x0C	DstEndPoint)
6	Cluster ID		0x06,0x00	OnOff ClusterId (Little Endian)
8	Number Of Attributes		0x01	One Attribute
9	Attributes	AttrID	0x00,0x00	Attrib ID - little endian
11		Status	0x00	Success
12		Data Type	0x20	UINT8
13		Data	**0x00**	**OFF**

14. From Switch: Send command TOGGLE (0x02) to OnOffLight device using indirect addressing, Cluster OnOff (0x0006).

Offset	Name	Value	Description
0	Packet Length	0x0A	
1	Command ID	0x43	ZCL Message From Client to Server Request
2	Address Mode	0x00	0x00: indirect addressing, the destination address length is two bytes and is not used

3	Destination Address	0x00,0x00	Don't care
5	DstEP	0x0D	DstEndPoint(OnOffLightEP)
6	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Cluster Command ID	**0x02**	**TOGGLE**
10	Cluster Command Length	0x00	Has only the Cluster command ID

Expected Confirm:

	Packet Length	**Command ID**	**Status**
Number of Bytes	1	1	1
Value	0x02	0x44	0x00 (SUCCESS)

15. Check Indication on the serial terminal connected to OnOffLight device.

Offset	Name	Value	Description
0	Packet Length	0x0A	
1	Command ID	0x45	ZCL Message From Client to Server Indication
2	Src Address	0x00,0x00	Switch Address
4	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
5	Seq Num	0x02	
6	DstEP	0x0D	DstEndPoint(OnOffLightEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Cluster Command ID	**0x02**	**TOGGLE**
10	Cluster Command Length	0x00	Has only the Cluster command ID

16. From Switch: Remote Read (using indirect addressing) of Attribute OnOff (0x0000) on OnOffLight device, Cluster OnOff (0x0006).

Offset	Name	Value	Description
0	Packet Length	0x0B	
1	Command ID	0x55	Read Remote Attr
2	Address Mode	0x00	0x00: indirect addressing, the destination address length is two bytes and is not used
3	Destination Address	0x00,0x00	Don't care
5	DstEP	0x0D	DstEndPoint(OnOffLightEP)
6	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Number Of Attributes	0x01	One Attribute
10	List Of Attributes	0x00,0x00	OnOff Attrib ID (Little Endian)

Expected Confirm:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x56	0x00 (SUCCESS)

17. Check ReadResponse with Attribute value = 0x01

Offset	Name		Value	Description
0	Packet Length		0x0D	
1	Command ID		0x5A	Read Remote Attr Response
2	Src Nwk Address		0x21,0x78	Source Addr (Little Endian)
4	SrcEP		0x0D	SrcEndpoint.
5	DstEP		0x0C	DstEndPoint)
6	Cluster ID		0x06,0x00	OnOff ClusterId (Little Endian)
8	Number Of Attributes		0x01	One Attribute
9	Attributes	AttrID	0x00,0x00	Attrib ID - little endian
11		Status	0x00	Success
12		Data Type	0x20	UINT8
13		Data	**0x01**	**ON**

18. From Switch: Send command TOGGLE (0x02) to OnOffLight device using indirect addressing, Cluster OnOff (0x0006).

Offset	Name	Value	Description
0	Packet Length	0x0A	
1	Command ID	0x43	ZCL Message From Client to Server Request
2	Address Mode	0x00	0x00: indirect addressing, the destination address length is two bytes and is not used

3	Destination Address	0x00,0x00	Don't care
5	DstEP	0x0D	DstEndPoint(OnOffLightEP)
6	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Cluster Command ID	**0x02**	**TOGGLE**
10	Cluster Command Length	0x00	Has only the Cluster command ID

Expected Confirm:

	Packet Length	**Command ID**	**Status**
Number of Bytes	1	1	1
Value	0x02	0x44	0x00 (SUCCESS)

19. Check Indication on the serial terminal connected to OnOffLight device.

Offset	Name	Value	Description
0	Packet Length	0x0A	
1	Command ID	0x45	ZCL Message From Client to Server Indication
2	Src Address	0x00,0x00	Switch Address
4	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
5	Seq Num	0x03	
6	DstEP	0x0D	DstEndPoint(OnOffLightEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Cluster Command ID	**0x02**	**TOGGLE**
10	Cluster Command Length	0x00	Has only the Cluster command ID

20. From Switch: Remote Read (using indirect addressing) of Attribute OnOff (0x0000) on OnOffLight device, Cluster OnOff (0x0006).

Offset	Name	Value	Description
0	Packet Length	0x0B	
1	Command ID	0x55	Read Remote Attr
2	Address Mode	0x00	0x00: indirect addressing, the destination address length is two bytes and is not used
3	Destination Address	0x00,0x00	Don't care
5	DstEP	0x0D	DstEndPoint(OnOffLightEP)

6	SrcEP	0x0C	SrcEndPoint(OnOffLightSwitchEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Number Of Attributes	0x01	One Attribute
10	List Of Attributes	0x00,0x00	OnOff Attrib ID (Little Endian)

Expected Confirm:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x56	0x00 (SUCCESS)

21. Check ReadResponse with Attribute value = 0x00.

Offset	Name		Value	Description
0	Packet Length		0x0D	
1	Command ID		0x5A	Read Remote Attr Response
2	Src Nwk Address		0x21,0x78	Source Addr (Little Endian)
4	SrcEP		0x0D	SrcEndpoint.
5	DstEP		0x0C	DstEndPoint)
6	Cluster ID		0x06,0x00	OnOff ClusterId (Little Endian)
8	Number Of Attributes		0x01	One Attribute
9	Attributes	AttrID	0x00,0x00	Attrib ID - little endian
11		Status	0x00	Success
12		Data Type	0x20	UINT8
13		Data	**0x00**	**OFF**

Now repeat steps 6-21 for HeatingCoolingUnit_1 and HeatingCoolingUnit_2 just replacing the SrcEndPoint with 0x0B.

NOTE:

Just send one command at each step for both devices as explained in steps 22-24, while both have a binding on the same endpoint and cluster.

22. From Switch: Send command ON (0x01) to HeatCoolingUnit_1 and HeatCoolingUnit_2 devices using indirect addressing, Cluster OnOff (0x0006).

Offset	Name	Value	Description
0	Packet Length	0x0A	
1	Command ID	0x43	ZCL Message From Client to Server Request
2	Address Mode	0x00	0x00: indirect addressing, the destination address length is two bytes and is not used
3	Destination Address	0x00,0x00	Don't care
5	DstEP	0x0D	DstEndPoint(HeatCoolEP)
6	SrcEP	0x0B	SrcEndPoint(OnOffSwitchEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Cluster Command ID	**0x01**	**ON**
10	Cluster Command Length	0x00	Has only the Cluster command ID

Expected Confirm:

	Packet Length	Command ID	Status
Number of Bytes	1	1	1
Value	0x02	0x44	0x00 (SUCCESS)

23. Check Indications on the serial terminal connected of both devices:

Unit_1

Offset	Name	Value	Description
0	Packet Length	0x0A	
1	Command ID	0x45	ZCL Message From Client to Server Indication
2	Src Address	0x00,0x00	Switch Address
4	SrcEP	0x0B	SrcEndPoint(OnOffSwitchEP)
5	Seq Num	0x04	
6	DstEP	0x0D	DstEndPoint(HeatCoolEP)
7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Cluster Command ID	**0x01**	**ON**
10	Cluster Command Length	0x00	Has only the Cluster command ID

Unit_2

Offset	Name	Value	Description
0	Packet Length	0x0A	
1	Command ID	0x45	ZCL Message From Client to Server Indication
2	Src Address	0x00,0x00	Switch Address
4	SrcEP	0x0B	SrcEndPoint(OnOffSwitchEP)
5	Seq Num	0x04	
6	DstEP	0x0D	DstEndPoint(HeatCoolEP)

7	Cluster ID	0x06,0x00	OnOff ClusterId (Little Endian)
9	Cluster Command ID	**0x01**	**ON**
10	Cluster Command Length	0x00	Has only the Cluster command ID

Now check that OnOff attributes of both devices assume value=0x01 through the Read Remote Request, by simply using 0x0B as Source Endpoint, then continue switching the values by sending OFF and TOGGLE commands, and checking them again.

5. APPENDIX

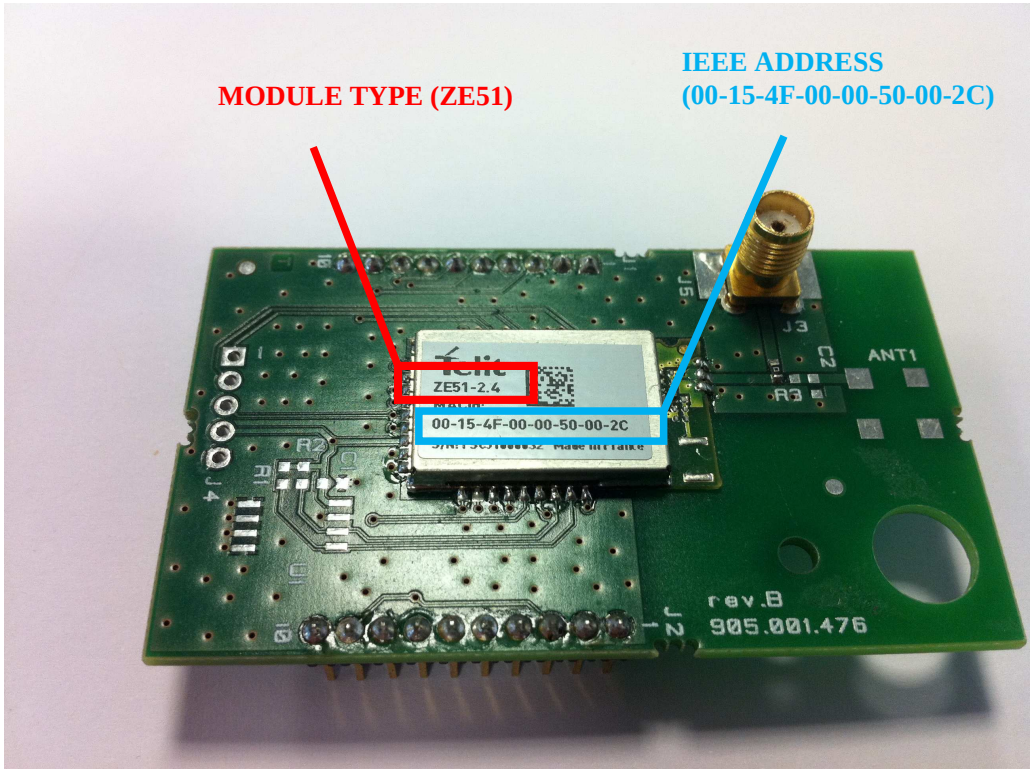
5.1. APPENDIX A: HOW TO FLASH TELIT MODULES

This annex is a quick start guide to explain how to flash Telit modules with the Home Automation Demo firmware. For more info refer to [2].

To flash Telit short range modules the SR Manager Tool is needed. SR Manager Tool is a software developed and provided by Telit to manage its short range modules.

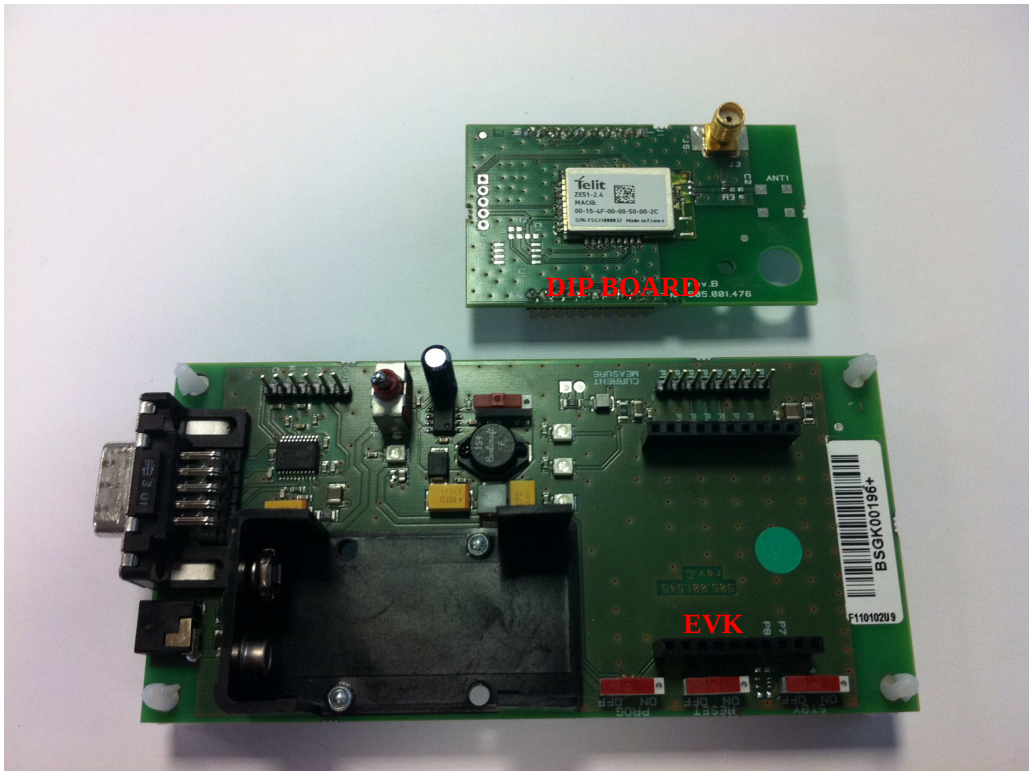
The firmware of interest is:

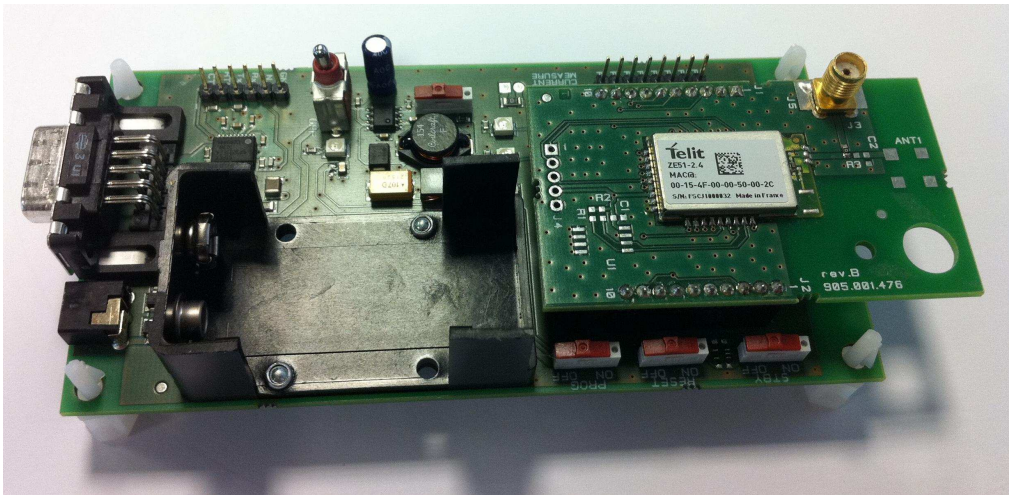
- ZEx1_PRO_SWITCH_R0.s28: Switch Coordinator for ZEx1 module
- ZEx1_PRO_ONOFFLIGHT_R0.s28: On Off Light for ZEx1 module
- ZEx1_PRO_HEATCOOLUNIT_R0.s28: Heat Cool Units 1 and 2 for ZEx1 modules



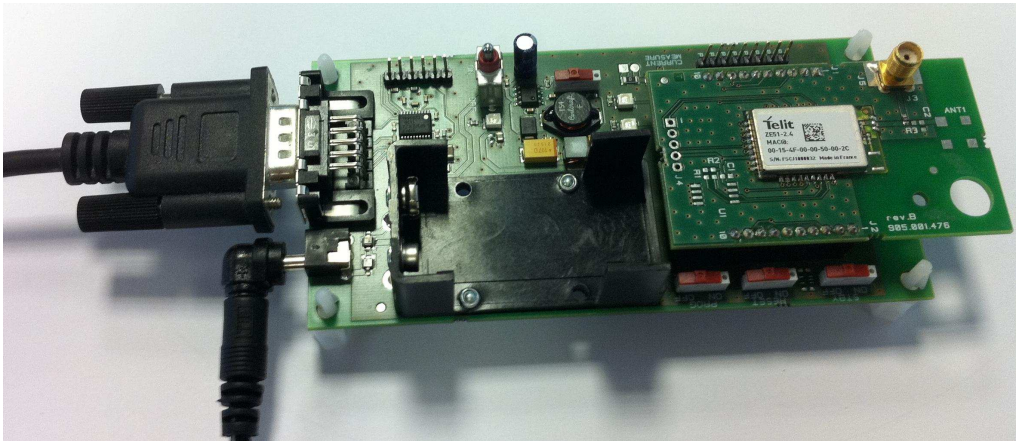
Steps to flash a new firmware on the module are described below:

Step 1: Plug the dip board to the EVK

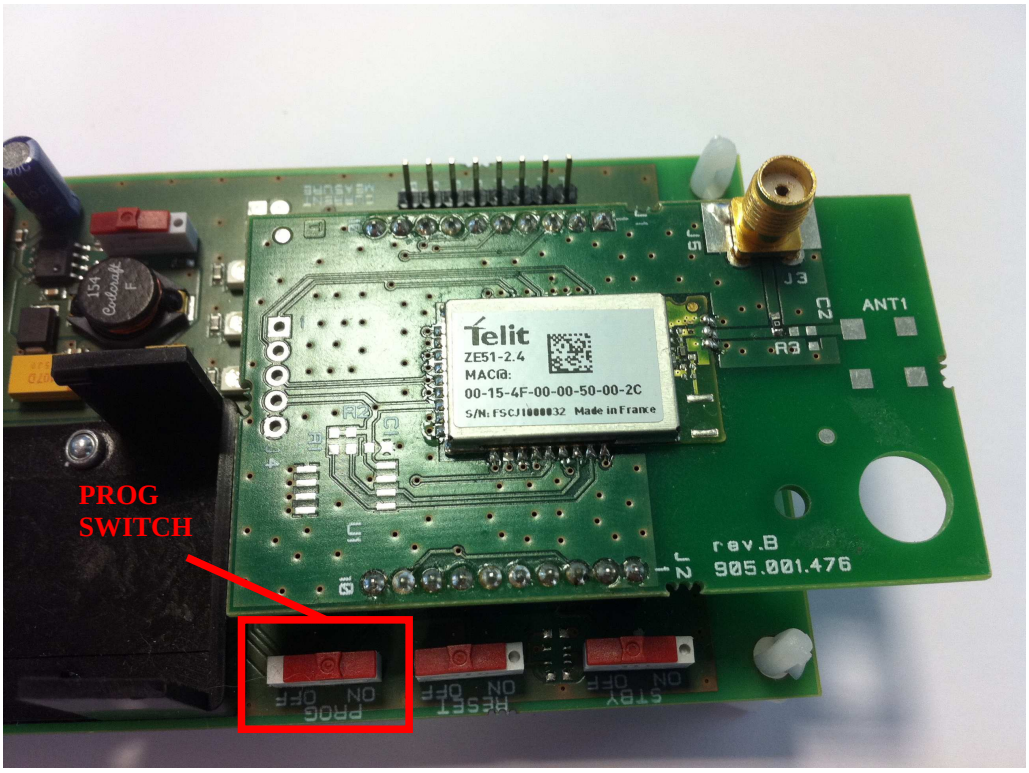

DIP BOARD
EVK



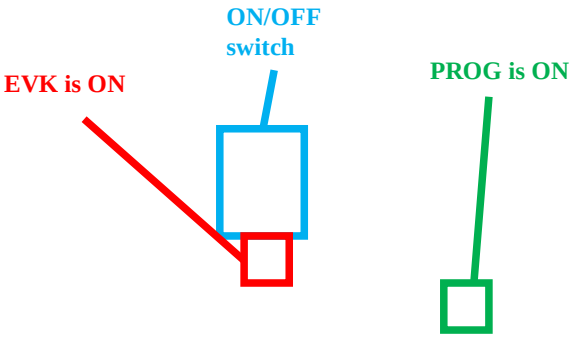
Step 2: Plug the power supply and serial cable to the EVK.

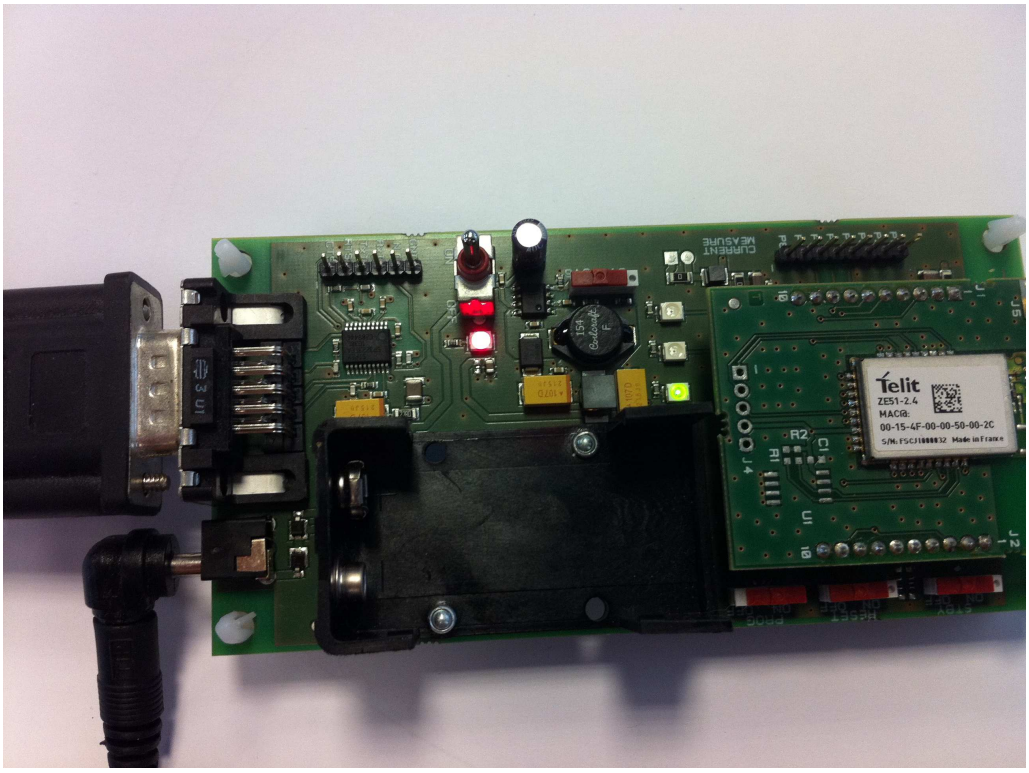


Step 3: Before switch on the EVK put PROG switch in ON position.

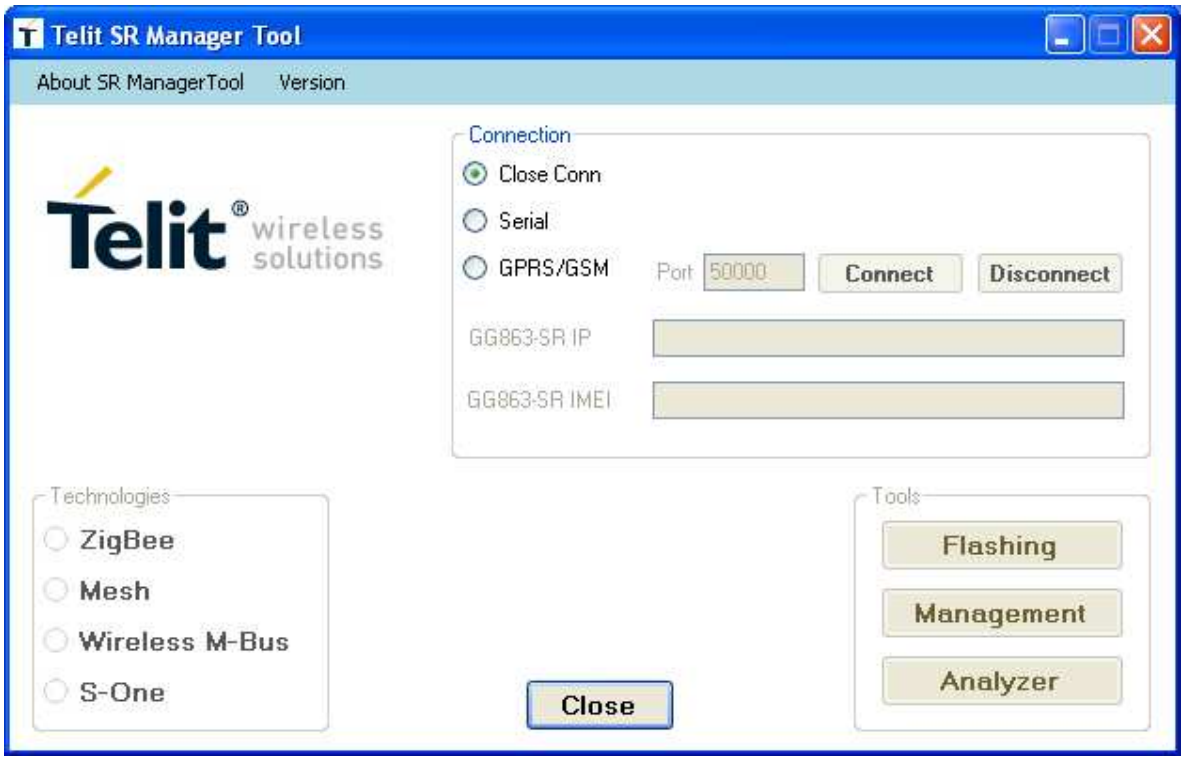


Step 4: Switch on the EVK, two led should be on (one red and one green).

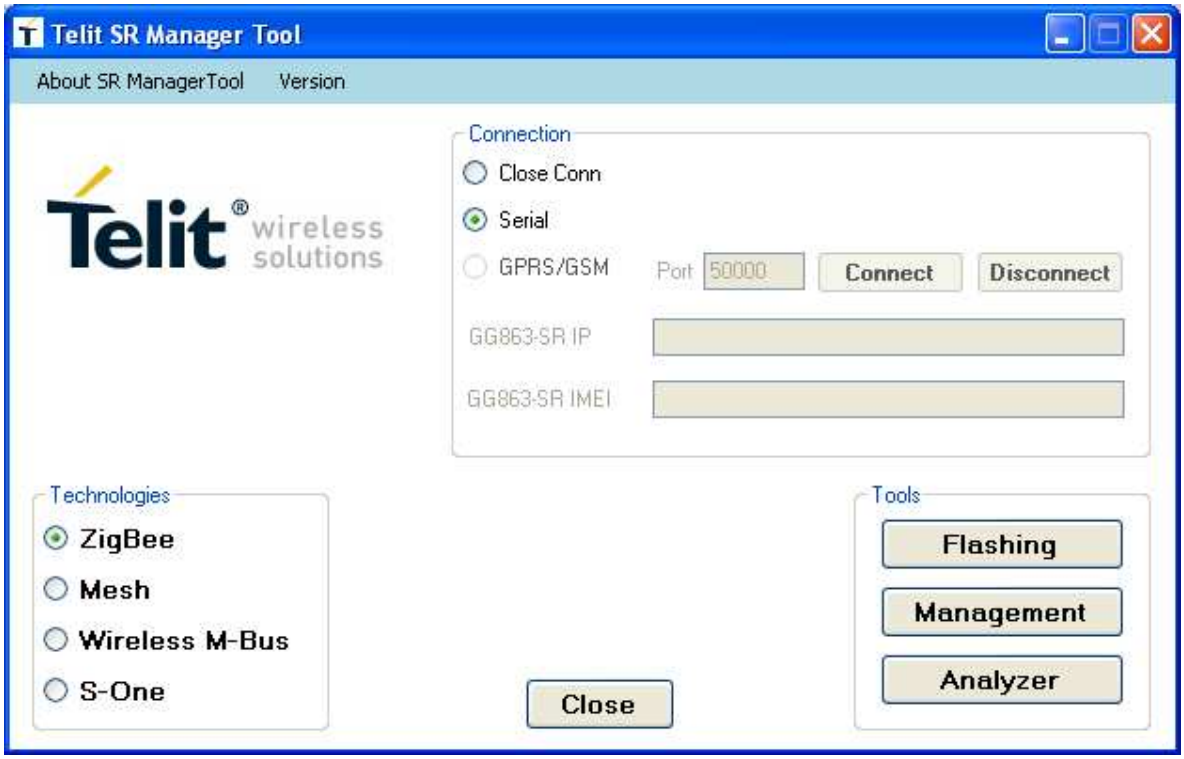




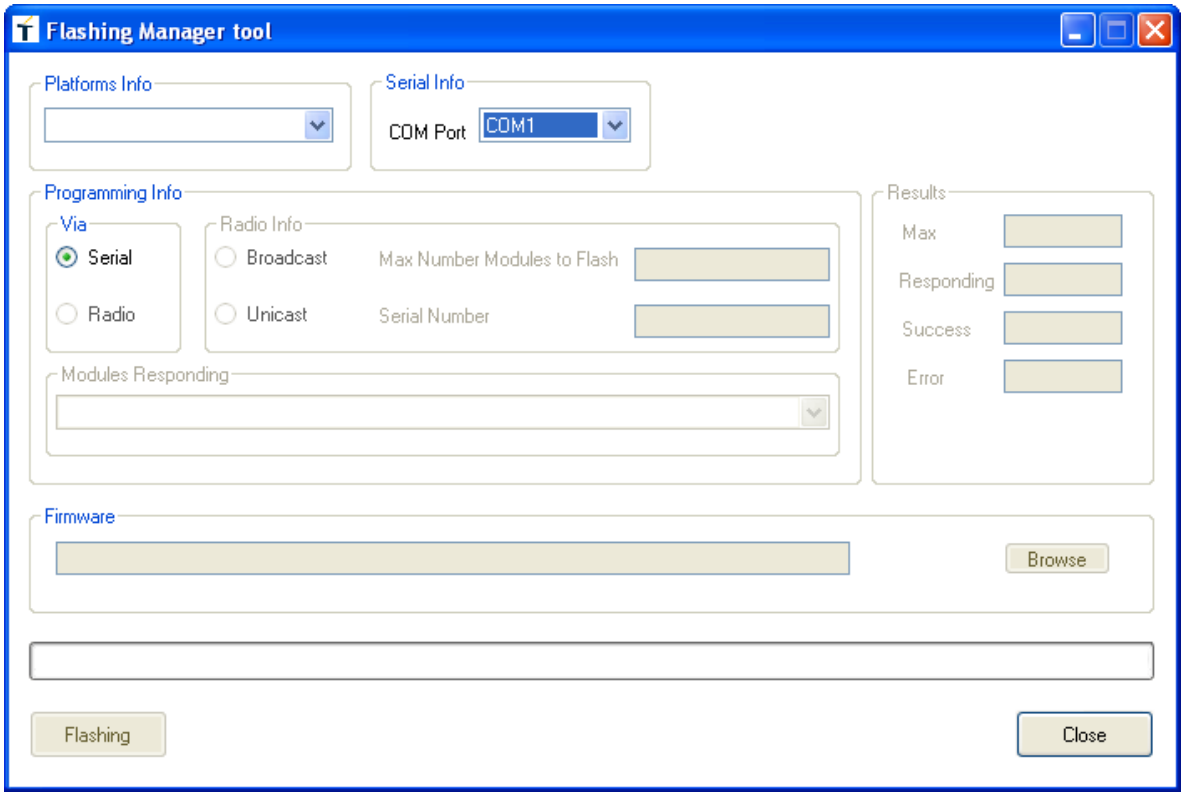
Step 5: Run SR Manager Tool.



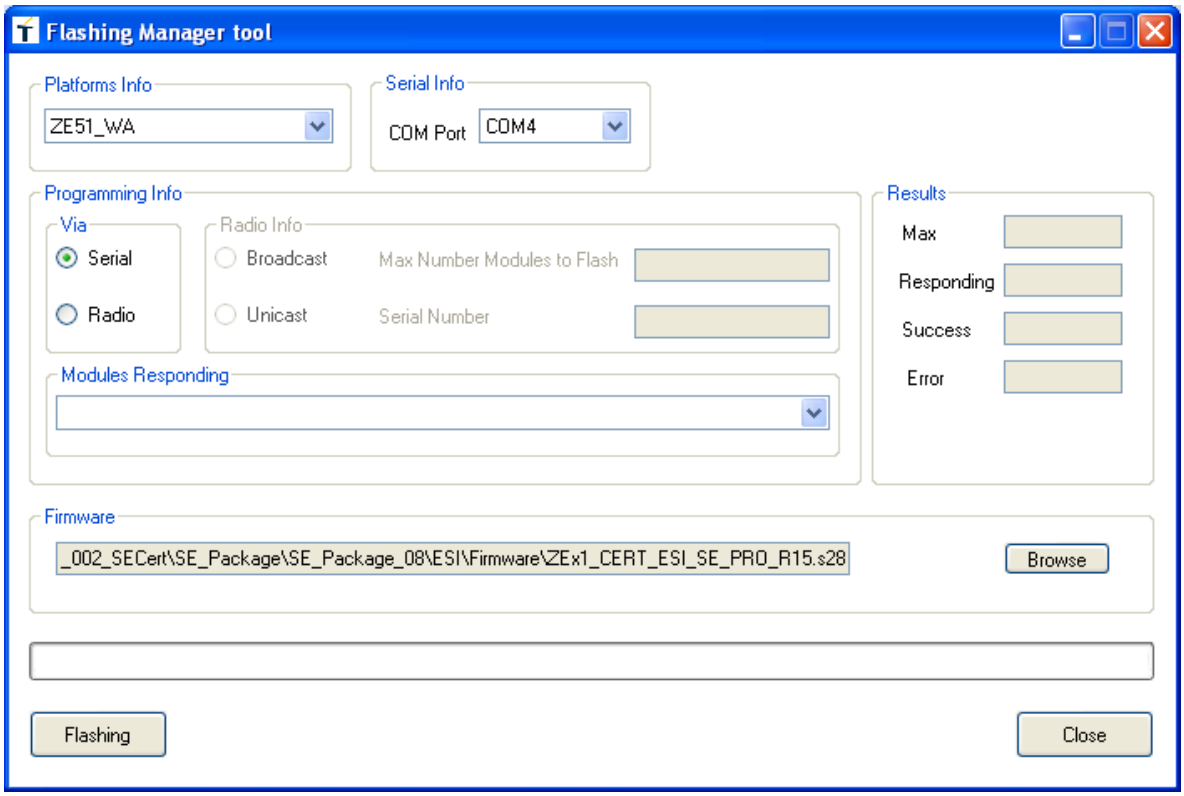
Step 6: Select Serial in Connection section.



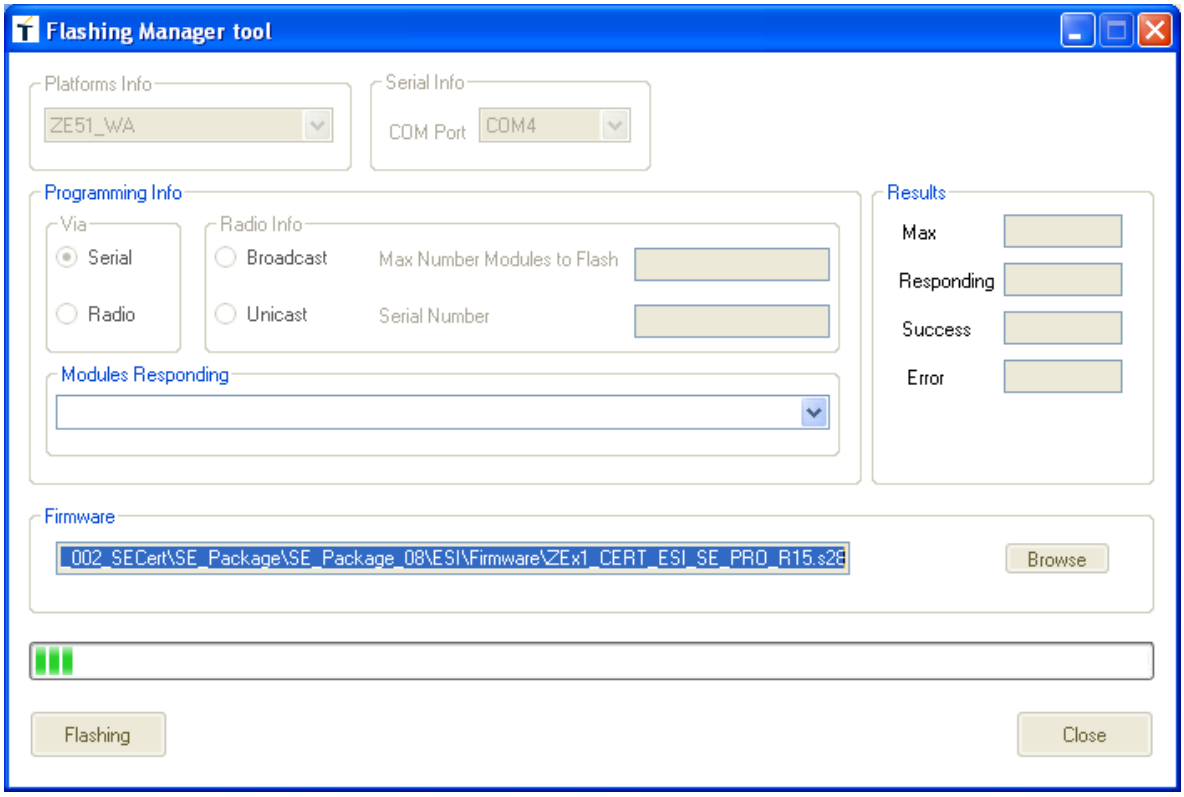
Step 7: Click on Flashing button in Tools section, the Flashing Manager Tool window will appear.



Step 8: In Platform Info section set ZE51_WA, in COM Port set that plugged to the EVK, through the browse function select the path where the firmware (ZEx1_CERT_ESI_SE_PRO_R15.s28 or ZEx1_CERT_IHD_SE_PRO_R18.s28) is.



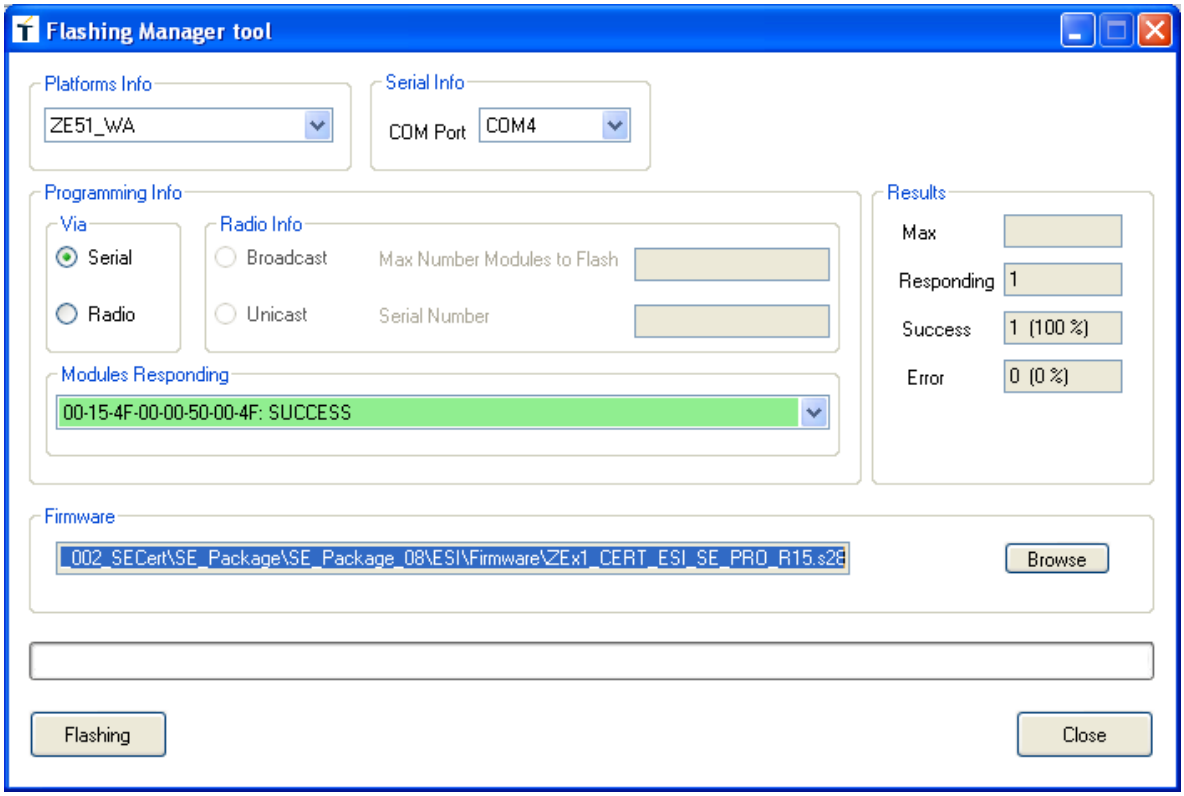
Step 9: Click on Flashing button.



NOTE: if an error is returned:

- close the Tool application
- verify if the COM is the correct one
- verify if there are other tools using it,
- switch off the module,
- try again from step 3.

Step 10:when the flashing ends a message is provided.



Step 11:To run the firmware switch off the module, put the PROG switch to off position and switch on the module again.

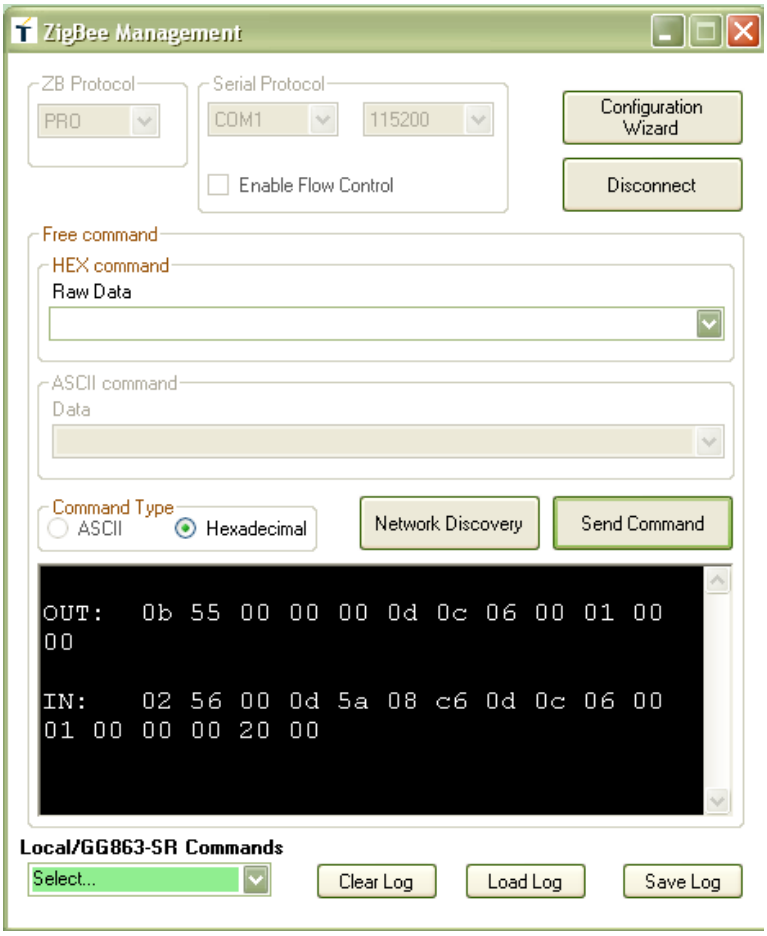
5.2. APPENDIX B: TELIT SERIAL MANAGEMENT TOOL

This section gives a brief example of the the Telit ZigBee Management serial Tool that can be used to communicate with the ZEx1 modules of this demo.

See [2] par.2.1 and 3.3.4 for more details.

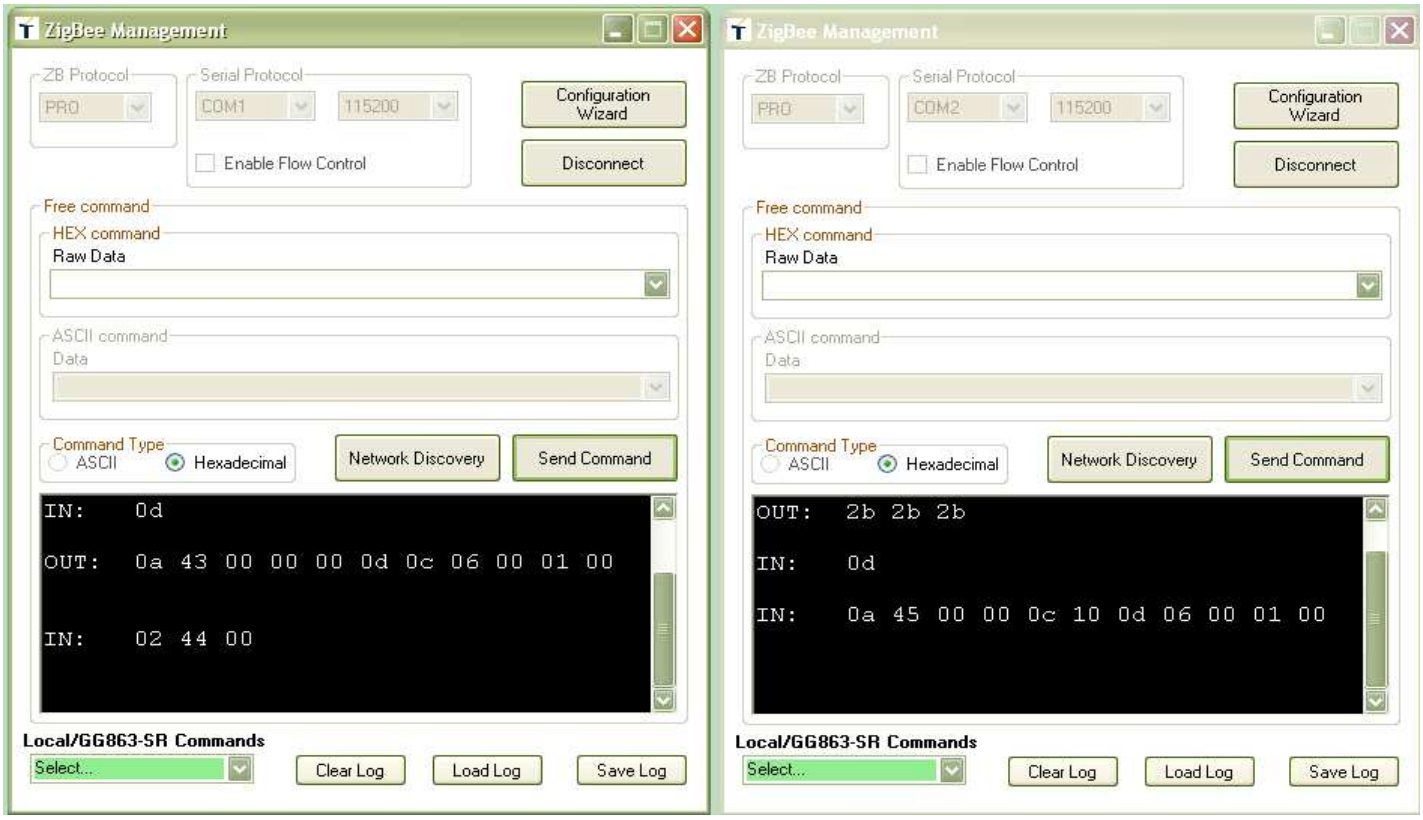
- **Example 1**: Verify from Switch the OnOff Attribute Id stored on the remote OnOffLightDevice server.

  The tool is connected to the Switch. It shows the Read Remote command (0x55) and after the received Read Confirmation (0x56) and the Read Response command (0x5A) with the value of the OnOff AttributeID (**0x00=OFF**).



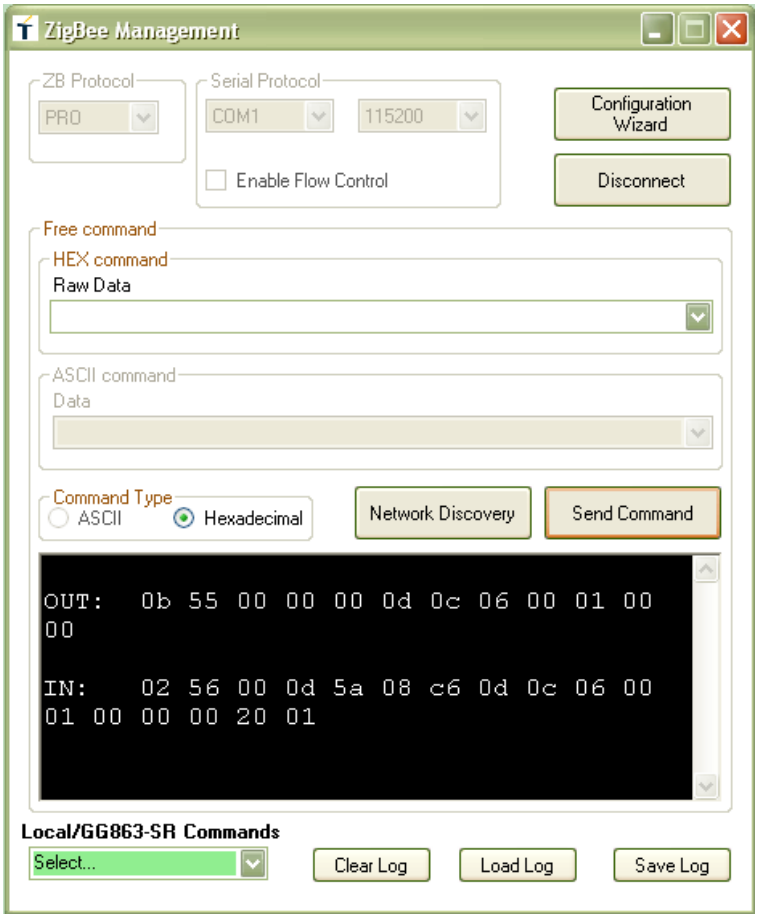
- **Example 2**: Send ON command from Switch to OnOff Light Device

  On the left side the tool is connected to the Switch and shows the Send Remote command (0x43) "**ON**". On the right side the tool is connected to the end device running the OnOffLight device, and shows the indication (0x45) of the received command.



- **Example 3**: Verify from Switch the OnOff Attribute Id stored on the remote OnOffLightDevice server.

  The tool is connected to the Switch. It shows the Read Remote command (0x55) and after the received Read Confirmation (0x56) and the Read Response command (0x5A) with the value of the OnOff AttributeID (**ON=0x01**).



6. ACRONYMS AND ABBREVIATIONS

ARIB	Association of Radio Industries and Businesses
BER	Bit Error Rate
Bits/s	Bits per second (1000 bits/s = 1Kbps = 1Kbaud)
CER	Character Error Rate
CEPT	European Conference of Postal and Telecommunications Administrations
CFR	Code of Federal Regulations
Chips	Chip or chip sequence refers to a spreading-code used to transform the original data to DSSS
dBm	Power level in decibel milliwatt (10 log (P/1mW))
DRLC	Demand Response Load Control
DSSS	Direct Sequence Spread Spectrum
EPROM	Electrical Programmable Read Only Memory
ERC	European Radiocommunications Committee
ESI	Energy Service Interface
ESR	Equivalent Series Resistance
ETR	ETSI Technical Report
ETSI	European Telecommunication Standard Institute
FCC	Federal Communications Commission
HA	Home Automation
HCU	Heating Cooling Unit
IEEE	Institute of Electrical and Electronics Engineers
ISM	Industrial, Scientific and Medical
KB	1024 bytes (1 byte = 8 bits)
kbps	kilobits/s
LBT	Listen Before Talk
LNA	Low Noise Amplifier
MAC	Medium Access Control
MHz	Mega Hertz (1 MHz = 1000 kHz)
Mchip/s	Mega chips per second (A measure of the speed with which chips are generated in DSSS)
PCB	Printed Circuit Board
PROM	Programmable Read Only Memory
PER	Packet Error Rate
PHY	Physical Layer
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
RSSI	Receive Strength Signal Indicator
Rx	Reception
SE	Smart Energy
SRD	Short Range Device
SMD	Surface Mounted Device
Tx	Transmission
Via	Metal Hole on a printed circuit board
WPANs	Wireless Personal Area Networks

7. Document History

Revision	Date	Changes
0	2012-09-11	First issue
1	2012-10-03	Replaced Word Model