RS9113 WiseConnect™

ZigBee Software Programming Reference Manual

Version 1.7.8

October 2019

About this Document

This document describes the commands to operate the RS9113-WiSeConnect Module Family for ZigBee. Host layers use RS9113-WiSeConnect module to communicate with other ZigBee devices using various profiles. Various Command requests along with the expected responses from the modules and the parameters in the commands are also described.RS9113-WiSeConnect Module Family can be operated in either End Device or Router or Co-ordinator mode at a time. This document should be referred by the developer to write software on Host to control and operate the module.

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1 ZigBee Overview

The ZigBee protocol was developed to provide low-power, wireless connectivity for a wide range of network applications concerned with monitoring and control. ZigBee is a worldwide open standard controlled by the ZigBee Alliance. ZigBee PRO is an enhancement of the original ZigBee protocol, providing a number of extra features that are particularly useful for very large networks (that may include hundreds or even thousands of nodes).

The ZigBee standard builds on the established IEEE 802.15.4 standard for packet based wireless transport. ZigBee enhances the functionality of IEEE 802.15.4 by providing flexible, extendable network topologies with integrated set-up and routing intelligence to facilitate easy installation and high resilience to failure. ZigBee networks also incorporate listen-before-talk and rigorous security measures that enable them to co-exist with other wireless technologies (such as Bluetooth and Wi-Fi) in the same operating environment.

ZigBee's wireless connectivity means that it can be installed easily and cheaply, and its built-in intelligence and flexibility allow networks to be easily adapted to changing needs by adding, removing or moving network nodes. The protocol is designed such that nodes can appear in and disappear from the network, allowing some devices to be put into a power-saving mode when not active. This means that many devices in a ZigBee network can be battery-powered, making them self-contained and, again, reducing installation costs.

The following are the basic things of ZigBee protocol.

1.1.1 ZigBee Network Nodes (Modes)

A wireless network comprises of a set of nodes that can communicate with each other by means of radio transmissions, according to a set of routing rules (for passing messages between nodes). A ZigBee wireless network includes three types of node:

1. Co-ordinator: This is the first node to be started and is responsible for forming the network by allowing other nodes to join the network through it. Once the network is established, the Co-ordinator has a routing role (is able to relay messages from one node to another) and is also able to send/receive data. Every network must have one and only one Co-ordinator.
2. Router: This is a node with a routing capability, and is also able to send/receive data. It also allows other nodes to join the network through it, so plays a role in extending the network. A network may have many Routers.
3. End Device: This is a node which is only capable of sending and receiving data (it has no routing capability). A network may have many End Devices.

1.1.2 Profiles

For the purpose of interoperability, the ZigBee Alliance has introduced the concept of a device ‘profile’, which contains the essential properties of a device for a particular application or market.

1.1.3 ZigBee Cluster Library (ZCL)

The ZigBee Alliance has defined the ZigBee Cluster Library (ZCL), comprising a number of standard clusters that can be applied to different functional areas. For example, all ZigBee application profiles use the Basic cluster from the ZCL.

The ZCL provides a common means for applications to communicate. It also defines attribute types (such as ints, strings, etc), common commands (e.g. for reading attributes) and default responses for indicating success or failure.

2 ZigBee Software Architecture

This section describesZigBee software architecture and commands to operate and configure the RS9113 modules in ZigBee.

The ZigBee host mode APIs create a virtual layer of API functions, which are actually available in RS9113 ZigBee stack. The high-level architecture is shown in the following diagram.

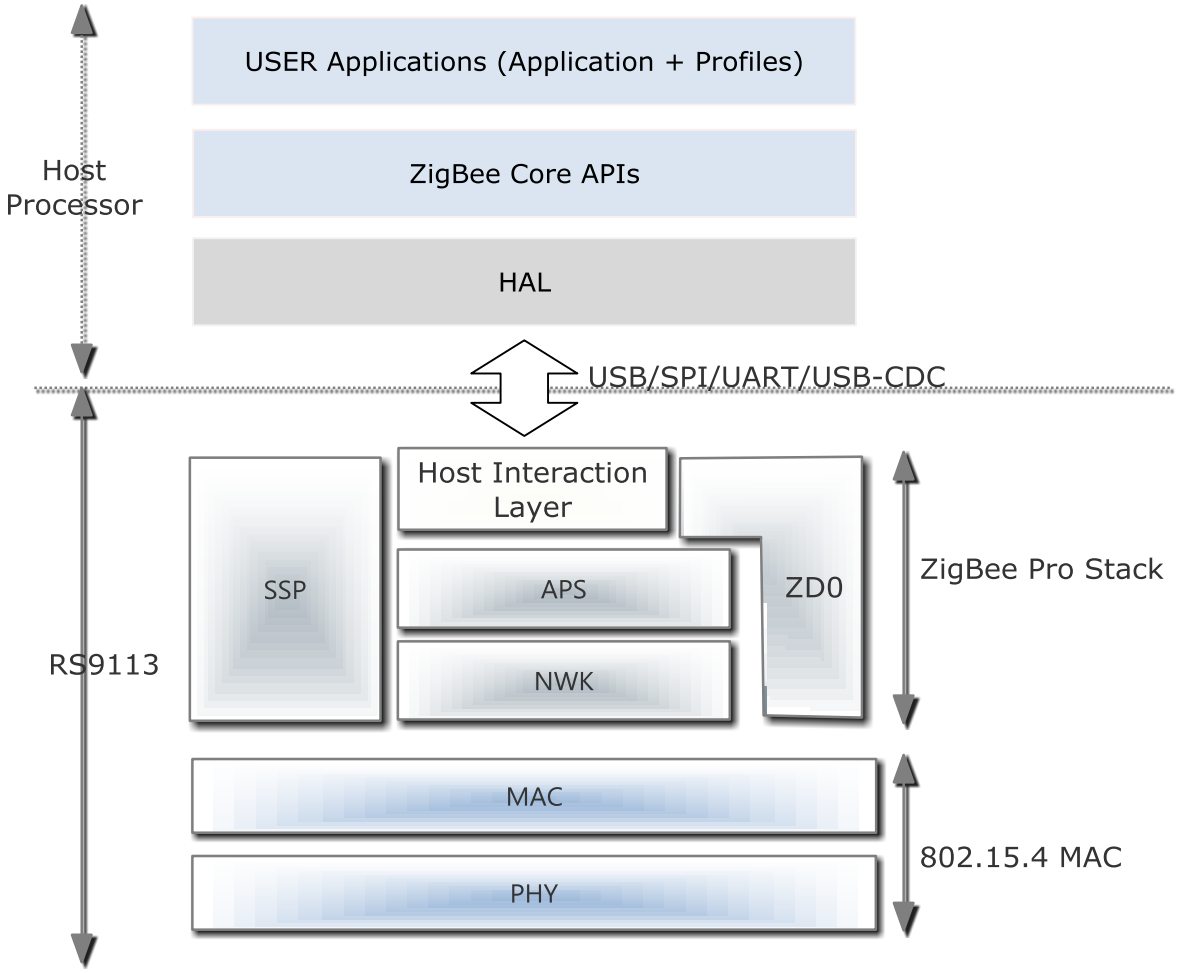

Figure 1: ZigBee Software Architecture

When the user connects the RS9113 ZigBee device to the host machine, 9113 exposes itself as USB/SDIO device. The command parser application which is running in RS9113 accepts the packets from the host and identifies the appropriate command based on the respective argument values. After identification of command and argument values, parser calls the respective API in the stack.

2.1 ZigBeeCommandFormat

This section explains the general command format and its details. Commands should be sent to the Module in the specified format only. The commands are sent to the module and the responses are read from the module using frame write/frame read (as mentioned in the preceeding sections).These commands are called as command frames.

The format of the command frame is divided into two parts:

4. Frame descriptor
5. Frame Body(Frame body is often called as Payload)

Frame Descriptor (16 bytes)	Frame Body (multiples of 4 bytes)

Command frame format is shown below. This description is for a Little Endian System.

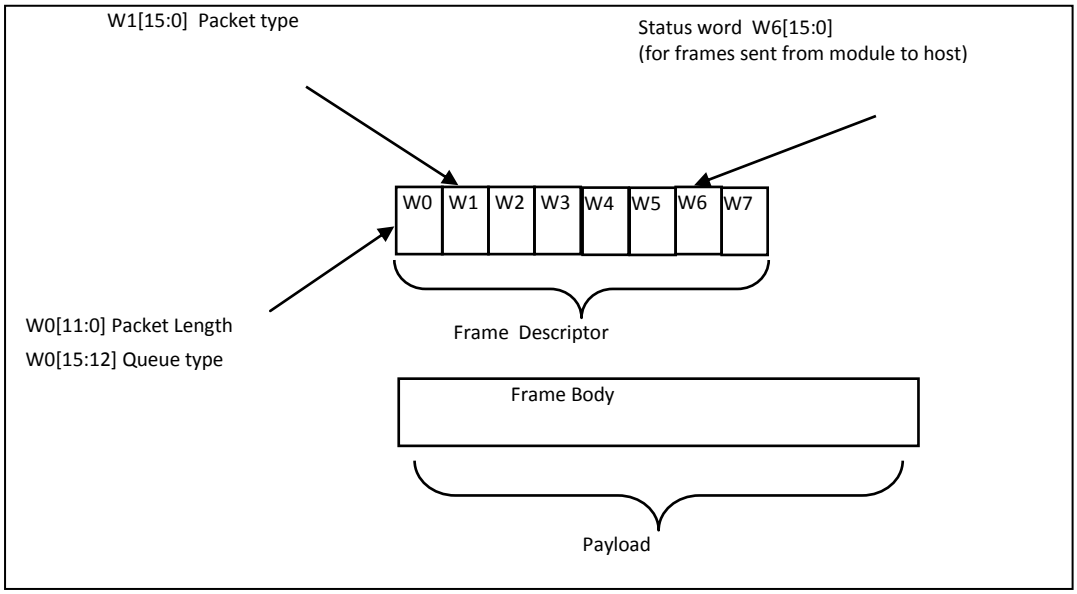

Figure 2: Command frame format

2.1.1 Frame Descriptor:

The following table provides the general description of the frame descriptor.

Word	Frame Descriptor
Word0 W0[15:0]	Bits [11:0] – Length of the frame Bits [15:12] – 1 (indicatesZigBee packet).
Word1 W1[15:0]	Reserved
Word2 W2[15:0]	Reserved
Word3 W3[15:0]	Reserved
Word4 W4[15:0]	Reserved
Word5 W5 [15:0]	Reserved
Word6 W6 [15:0]	Bits [7:0] - Reserved Bits [15:8] –Direction 1 – Host to Device 2 –Device to Host
Word7 W7 [15:0]	Bits [7:0] - Interface type Bits [15:8] - Command type

Table1 Frame Descriptor

Three types of frames will get exchanged between the module and the host.

1. Request/Command frames - These are sent from Host to Device. Each Request/ Command has an asscociated response with it.
2. Repsonse frames – These are sent from Device to Host. These are given in response to the previous Request/Command from the Host. Each command has a single reponse.
3. Callback frames – These are sent from Module to Host. These frames are sent when
   - There are multiple reponses for a particular Request/ Command frame
   - There is Asynchonous message to be sent to host.

2.1.1.1 Direction

Direction is used to identify the packet directed towards to host or device. The below shown table indicates whether the packet is sent from host to device or from device to host.

Direction	Direction type
0x01	Host to Device
0x02	Device to Host

Table 2 Direction Type

2.1.1.2 Interface Type

It is used to identify the type of interface to which the frame is being redirected to in ZigBee stack.

Interface Type	Interface Id
MANAGEMENT_INTERFACE	0x01
DATA_INTERFACE	0x02
SECURITY_INTERFACE	0x03
BINDING_INTERFACE	0x04
PACKET_DATA	0x05
INTERFACE_CALLBACK(CALLBACK)	0x06

Table 3 Interface Types

2.1.1.3 Command Type

The following are the types of frame requests and responses used in ZigBee to establish communication between host and device.Command IDs for the corresponding command types are also listed in the table. Thebelow tableliststhe Command, Response andCallbackframes for all mode.

Interface type	Command	Cmd Id
Management	ZIGBEEFORMNETWORK	0x01
Management	ZIGBEEJOINNETWORK	0x02
Management	ZIGBEEPERMITJOIN	0x03
Management	ZIGBEELEAVENETWORK	0x04
Management	ZIGBEEFINDNETWORKANDPERFORMREJOI	0x05

	N	
Management	ZIGBEEREJOINNETWORK	0x06
Management	ZIGBEENETWORKRESTORE	0x07
Management	ZIGBEEINITIATESCAN	0x08
Management	ZIGBEESTOPSCAN	0x09
Management	ZIGBEENETWORKSTATE	0x0A
Management	ZIGBEESTACKISUP	0x0B
Management	ZIGBEEGETSELFIEEEADDRESS	0x0C
Management	ZIGBEEISITSELFIEEEADDRESS	0x0D
Management	ZIGBEEGETSELFSHORTADDRESS	0x0E
Management	ZIGBEESETMANUFACTURERCODEFORNODEDESC	0x0F
Management	ZIGBEESETPOWERDESCRIPTOR	0x10
Management	ZIGBEESETMAXMINCOMINGTXFRSIZE	0x11
Management	ZIGBEESETMAXMOUTGOINGTXFRSIZE	0x12
Management	ZIGBEESETOPERATINGCHANNEL	0x13
Management	ZIGBEEGETDEVICETYPE	0x14
Management	ZIGBEEGETOPERATINGCHANNEL	0x15
Management	ZIGBEEGETSHORTPANID	0x16
Management	ZIGBEEGETEXTENDEDPANID	0x17
Management	ZIGBEEGETENDPOINTID	0x18
Management	ZIGBEEGETSIMPLEDDESCRIPTOR	0x19
Management	ZIGBEEGETENDPOINTCLUSTOR	0x1A
Management	ZIGBEEGETSHORTADDRFORSPECIFIEDIEEEADDR	0x1B
Management	ZIGBEESTACKPROFILE	0x1C
Management	ZIGBEEGETIEEEADDRFORSPECIFIEDSHORTADDR	0x1D
Management	ZIGBEEREADNEIGHBOURTABLEENTRY	0x1E
Management	ZIGBEEGETROUTETABLEENTRY	0x1F
Management	ZIGBEEGETREEDEPTH	0x20
Management	ZIGBEEGETNEIGHBOURTABLEENTRYCOUNT	0x21
Management	ZIGBEEGETCHILDSHORTADDRESSFORTHEINDEX	0x22

Management	ZIGBEEGETCHILDINDEXFORSPECIFIEDSHORTADDR	0x23
Management	ZIGBEEGETCHILDDETAILS	0x24
Management	ZIGBEEENDDEVICEPOLLFORDATA	0x25
Management	ZIGBEEREADCOUNTOFCHILDDEVICES	0x26
Management	ZIGBEEREADCOUNTOFROUTERCHILDDEVICE	0x27
Management	ZIGBEEGETPARENTSHORTADDRESS	0x29
Management	ZIGBEEGETPAREANTIEEEADDRESS	0x2A
Management	ZIGBEEBROADCASTNWKMANAGERREQUEST	0x2C
Management	ZDPSENDNWKADDRREQUEST	0x2D
Management	ZDPSENDIEEEADDRREQUEST	0x2E
Management	ZDPSENDDEVICEANNOUNCEMENT	0x2F
Management	ZDPSENDMATCHDESCRIPTORSREQUEST	0x30
Management	ZIGBEEACTIVEENDPOINTSREQUEST	0x31
Management	ZDPSENDPOWERDESCRIPTORREQUEST	0x32
Management	ZDPSENDNODEDESCRIPTORREQUEST	0x33
Management	ZIGBEESIMPLEDESCRIPTORREQUEST	0x34
Data	ZIGBEESENDUNICASTDATA	0x36
Data	ZIGBEESENDGROUPDATA	0x37
Data	ZIGBEEGETMAXAPSPAYLOADLENTH	0x39
Binding	ZIGBEESETBINDINGENTRY	0x3A
Binding	ZIGBEEDELETEBINDING	0x3B
Binding	ZIGBEEISBINDINGENTRYACTIVE	0x3C
Binding	ZIGBEECLEARBINDINGTABLE	0x3D
Binding	ZIGBEEBINDREQUEST	0x3E
Binding	ZIGBEEENDDEVICEBINDREQUEST	0x3F
Binding	ZIGBEEUNBINDREQUEST	0x40
Security	ZIGBEEGETKEY	0x41
Security	ZIGBEEHAVELINKKEY	0x42
Security	ZIGBEESWITCHNETWORKKEYHANDLER	0x43
Security	ZIGBEEREQUESTLINKKEY	0x44

Security	ZIGBEEGETKEYTABLEENTRY	0x45
Security	ZIGBEESETKEYTABLEENTRY	0x46
Security	ZIGBEEADDORUPDATEKEYTABLEENTRY	0x47
Security	ZIGBEEFINDKEYTABLEENTRY	0x48
Security	ZIGBEEERASEKEYTABLEENTRY	0x49
Management	ZIGBEESETSIMPLEDESCRIPTOR	0x4A
Binding	ZIGBEEGETBINDINGINDICES	0x60
Management	ZIGBEESTACKINIT	0x61
Management	ZIGBEESTACKRESET	0x62
Security	ZIGBEEUPDATESAS	0x65
Security	ZIGBEEUPDATEZDO	0x66

Table4Command types in ZigBee

2.1.2 EventCallbacks

These interface/event specific callbacks are sent asynchronously by device to host to indicate status of Stack, Network, Data confirmation, Data Indication, Scan etc..

Interface type	Command	Cmd Id
Callback	APPSCANCOMPLETEHANDLER	0x4B
Callback	APPENERGYSCANRESULTHANDLER	0x4C
Callback	APPNETWORKFOUNDHANDLER	0x4D
Callback	APPZIGBEESTACKSTATUSHANDLER	0x4E
Callback	ZIGBEECHILDJOINHANDLER	0x4F
Callback	APPINCOMINGMANYTOONEROUTERREQUESTHANDLER	0x50
Callback	APPHANDLEDATAINDICATION	0x51
Callback	APPHANDLEDATACONFIRMATION	0x52

Table5Interface Callbacks

2.2 Operations through Host interface

This section explains the procedure that host needs to follow to send ZigBeecommands frames to module and to receive responses from the module.

2.2.1 Tx Operation

Host needs to send Command frame in two parts using frame write:

1. First it is required to send 16 byte Frame descriptor
2. Optional Frame body

First frame descriptor is prepared and then frame body is appended (only if frame body is exists) at the end of frame descriptor and sent to module in a single frame write as shown below:

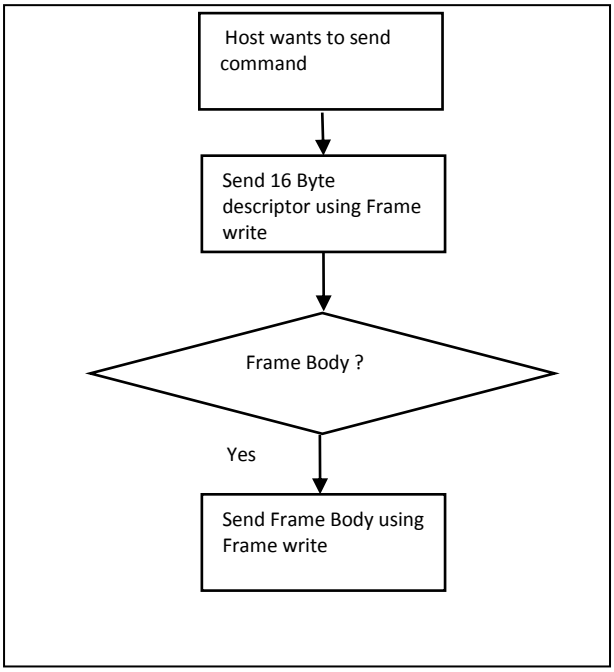

Figure 3: Tx Operation From Host to Module

2.2.2 Rx Operation

The Host uses this operation:

a. To receive module's responses,for the commands issued to the module.

b. To read data received by the module from the remote terminal.

Module sends the response/received data to Host in a format as shown below:

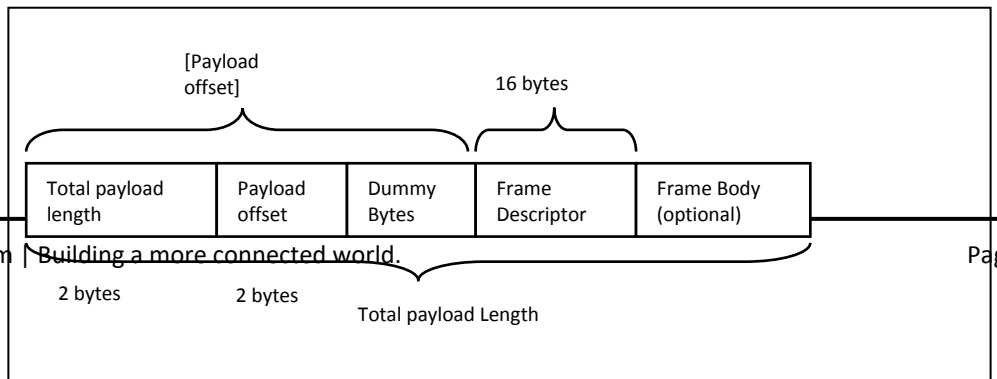

Figure 4: Rx operation descriptor and payload information

Host should follow the steps below to read the frame from the Module:

1. If any packet is pending from module, module raises an interrupt to HOST.
2. Host needs to check the reason for interrupt by reading interrupt status register using register read.
3. If data pending bit is set in interrupt status register, follow the steps below:
    a. Read 4 bytes using Frame read.
    b. Decode Total payload length and payload offset.
    c. Read remaining payload by sending Frame read with (total payload length-4) and decode Frame descriptor and Frame Body by discarding Dummy Bytes.

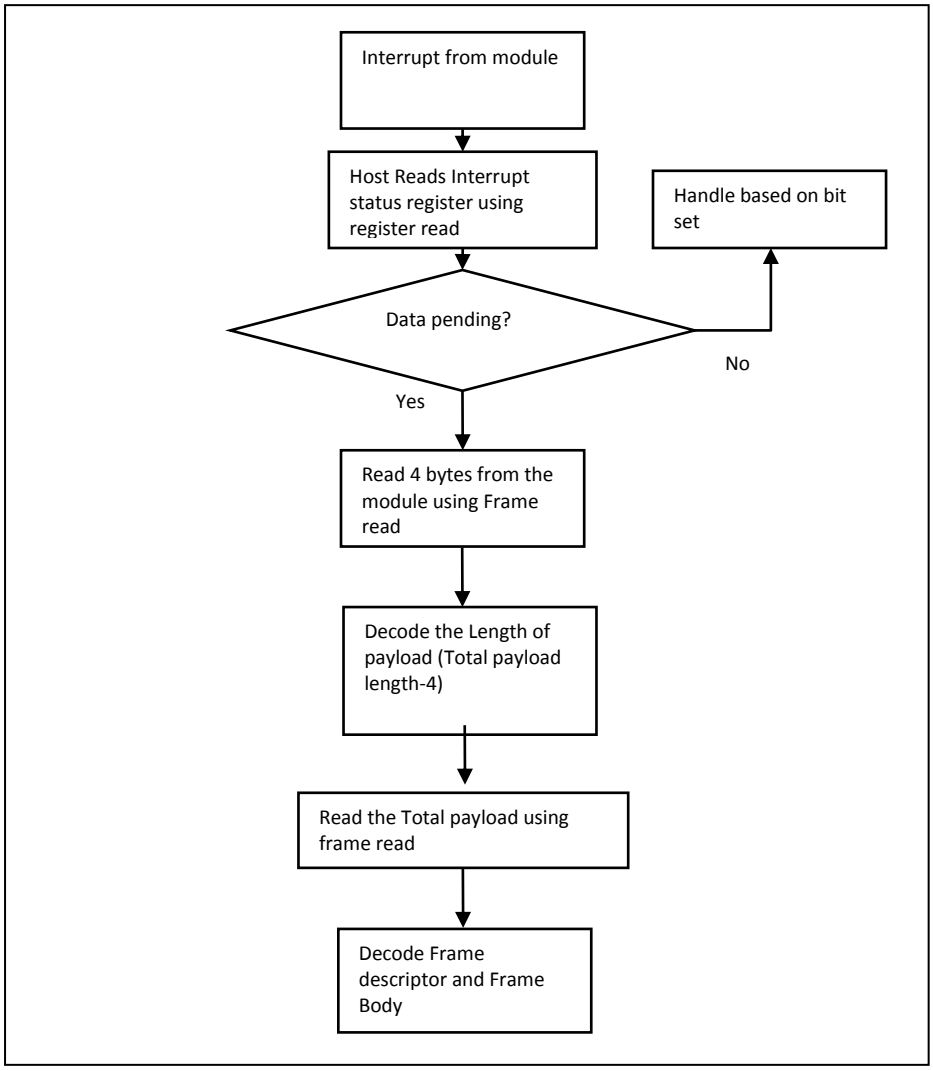

Figure 5: Rx Operation From Moduleto Host

3 ZigBeeAPI Library

3.1 API File Organization

ZigBee APIs are organized into following directory structure

	Path(Within *RS9113.xxZ.WC.GENR.x.x.x* folder)
ZIGBEE APIs	host/binary/apis/zb/core/
Interface Specific APIs	host/binary/apis/intf/
HAL APIs	host/binary/apis/hal/
ZIGBEE Reference Applications	host/binary/apis/zb/ref_apps/
ZIGBEE Linux Application	host/binary/reference_projects/LINUX/Application/zb/src
Linux USB Driver	host/binary/reference_projects/LINUX/Driver/usb/src
Linux SPI Driver	host/binary/reference_projects/LINUX/Driver/spi/src
Linux UART & USB-CDC Driver	host/binary/reference_projects/LINUX/Driver/uart/src
ZigBee alone UART App	host/binary/reference_projects/LINUX_WINDOWS/Application/src

4 Commandframes

All the command frames that are sent from host to devicefollow a specific format as specified in ZigBee Command Format. The 16-byte descriptor will be similar for all the tx frames and it needs to be sent for command frames. The fields that differ for each command descriptor are length of payload, Interface type and Command type.In the descriptor direction would be from host to device.

Note:

1. All the command frames expect a response frame from device to confirm that the frame is sent to device.
2. The return value for all the command frame is int16_t value. This is Success(0x1) or Failure(0x0), when a user call these APIs this return is expected.

4.1 Management frames

4.1.1 ZigBeeStackInit

Description:

When this frame is sent to device from application, then device will initialize the ZigBee Pro stack.

SupportedModes: End-device, Router and Coordinator

Prerequisites: Card ready must be received in order to issue this frame.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESTACKINIT (0x61)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only descriptor is sent but payload is not required

Payload Parameters: None

Expected Response Frames:

For this command frame ZigBeeCommandResp response frame is expected

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.2 ZigBeeDeInitStack

Description:

When this frame is sent to device from application, then device willde-init the ZigBee Pro stack and hardware initializations .

SupportedModes: End-device, Router and Coordinator

Prerequisites: none.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEDEINITSTACK (0xFF)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only descriptor is sent but payload is not required

Payload Parameters: None

Expected Response Frames:

For this command frame Card readyframe is expected.

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.3 ZigBeeStackReset

Description:

This frame allows the device to reset the ZigBee Pro stack.This frame is sent from application to device to reset all the states and reinitialize stack.

SupportedModes: End_device, Router and Coordinator

Prerequisites: The ZigBee stack must be initialized before sending this frame.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESTACKRESET (0x62)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only descriptor is sent but payload is not required

Paylaod Parameters: None

Expected Response Frames:

For this command frame ZigBeeCommandResp response frame is expected

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.4 ZigBeeUpdateSAS

Description:

This frame allows the Application to update startup attribute set required to perform internal operations in device**.**

SupportedModes: End_device, Router and Coordinator

Prerequisites: : The ZigBee stack must be initialized.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEUPDATESAS (0x65)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
        uint8_t     a_extended_pan_id[8];
        uint32_t    channel_mask;
        uint8_t     startup_control;
        uint8_t     use_insecure_join;
        uint8_t     scan_attempts;
        uint8_t     parent_retry_threshold;
        uint8_t     a_trust_center_address[8];
        uint8_t     a_network_key[16];
        uint16_t    time_between_scans;
        uint16_t    rejoin_interval;
        uint16_t    max_rejoin_interval;
        uint16_t    indirect_poll_rate;
        uint16_t    a_pan_id;
        uint16_t    network_manager_address;
        uint8_t     a_trustcenter_master_key[16];
        uint8_t     a_preconfigured_link_key[16];
        uint8_t     end_device_bind_timeout;
}Startup_Attribute_Set_t
```

Paylaod Parameters:

Name	Type	Valid Range	Description
a_extended_pan_id	Integer	0x0000000000000001 – 0xfffffffffffffffe	This field holds the extended PAN ID of the network. In which the device needs to be a member . If the device doesn't know the specific network, then update this 8-byte field with zeros

			otherwise specify the specific 8 bytes extended pan id.
channel_mask	Bitmap	32-bit field	The bits (b11, b12,... b26) indicate which channels are to be scanned (1=scan, 0=do not scan) for each of the 16 valid channels.
startup_control	Integer	0x00 – 0x03	This field indicates how the device needs to respond or start depending on the startup control value. **0x00** - Indicates that the device considers itself as a part of the network. indicated by the extended PAN ID attribute. In this case device does not perform any explicit join or rejoin operation. **0x01** - Indicates that the device forms a network with extended PAN ID given by the extended PAN ID attribute. The AIB's attribute APS Designated Coordinator is set to TRUE in this case. **0x02** - Indicates that the device rejoins network with extended PAN ID given by the extended PAN ID attribute. **0x03** - Indicates that the device starts "from scratch" and join the network using association. The default value for an un-commissioned device is 0x03.
use_insecure_ join	Integer	00 = TRUE 01 = FLASE	A flag controlling the use of insecure join at startup.
scan_attempts	Integer	1 - 255	Integer value representing the number of scan attempts to make before the NWK layer decides which ZigBee coordinator or router to associate with. This attribute has default value of

			5
parent_retry_ threshold	Integer	3-10	The number of failed attempts to contact a parent that will cause a “find new parent” procedure to be initiated
a_trust_center_ address	Integer	0x0000-0xFFFF	Address of the network manager.
a_network_key	Set of 16 octets	Variable	The network key.
time_between_ scans	Integer	1 – 0xFFFF	Time between scans in milliseconds
rejoin_interval	Integer	Max value:60	Rejoin interval in seconds
max_rejoin_ interval	Integer	Max value:3600	Max Rejoin interval in seconds
indirect_poll_rate	integer	In msec	The rate, in milliseconds, to poll the parent
a_pan_id	Integer	0x0000000000000001 – 0xfffffffffffffffe	This field indicates the PAN ID of the device.
network_ manager_address	Integer	0x0000-0xFFFF	Address of the network manager.
a_trustcenter_ master_key	Set of 16 octets	Variable	The Trust Center master key
a_preconfigured_link _key	Set of 16 octets	Variable	The Link key
end_device_bind_tim eout	Integer	1-60	The time the coordinator will wait (in seconds) for a second end device bind request to arrive. The default value is 10.

Table 6 Update SAS Parameters

Expected Response Frames:

For this command frame ZigBeeCommandResp response frame is expected

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.5 ZigBeeUpdateZDO

Description:

This frame allows the Application to update the default ZDO configuration.

SupportedModes: End_device, Router and Coordinator

Prerequisites: The ZigBee stack must be initialized before calling this API.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEUPDATEZDO (0x66)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {_Tag
      uint8_t     config_permit_join_duration;
      uint8_t     config_NWK_secure_all_frames;
      uint8_t     config_formation_attempts;
      uint8_t     config_scan_duration;
      uint8_t     config_join_attempts;
      uint8_t     config_preconfigured_key;
      uint16_t    a_config_trust_center_short_address;
      uint8_t     automatic_poll_allowed;
      uint8_t     config_authentication_poll_rate;
      uint16_t    config_switch_key_time;
      uint8_t     config_security_level;
      uint8_t     config_aps_ack_poll_time_out;
Node_Descriptor_Information_t node_desc_info;
}ZDO_Configuration_Table_t;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
config_permit_ join_duration	Integer	00-0xFF 0x00 Indicates that no devices can join 0xFF Indicates that devices are always allowed to join 0x01 - 0xFE Indicates the time in seconds for which the device allows	defines the time for which a coordinator or router device allows other devices to join to itself.

		other devices to join	
config_NWK_ secure_all_frames	Integer	0-Enable 1-Disabled	defines whether security is applied for incoming and outgoing network data frames or not
config_formation_attempts	Integer	1	the number of times the devices attempts for formation failure.
config_scan _duration	Integer	00-0xFE	The field indicates the duration of active scan while performing startup, join or rejoin the network.
config_join_ attempts	Integer	Default = 02	This field indicates the number of times join is retried once the join fails
config_preconfigured_key	Integer	Set to 0x01 if supporting only preconfigured nwk key, or else to be set with 0x02 if we hight security value = 0x01 value = 0x02	This field indicates whether a preconfigured key is already available in the device or not
a_config_trust_center_short_address	Integer	Default 0x0000	This field holds the short address of the TC
automatic_poll_allowed	Integer	Enable- 0x01 Disable- 0x00(default)	This field indicates whether an end device does an auto poll or not.
config_authentication_poll_rate	Integer	Default 0x64(100 msec)	The poll rate of end device while waiting for authentication.
config_switch_key_time	Integer	Default 0x06	The time after which active key sequence number is changed, once the device receives

			Switch Key request
config_security_level	Integer	0x05	The security level for outgoing and incoming network frames.
config_aps_ack_poll_time_out	Integer	0xFA(250 msec)	The maximum number of seconds to wait for an acknowledgement to a transmitted frame.
node_desc_info	-		

Table 7 Update ZDO Parameters

Expected Response Frames:

For this command frame ZigBeeCommandResp response frame is expected.

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.6 ZigBeeInitiaiteScan

Description:

This frame allows the Application to initiate Scan of specified type in the provided channel mask for a specific duration. The Scan procedure is an asynchronous call.

SupportedModes: End_device, Router and Coordinator

Prerequisites:The zigBee stack must be initialized

Descriptor:16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type-ZIGBEEINITIATESCAN (0x08)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint32_t    Channel_Mask;
      uint8_t     ScanType;
      uint8_t     Duration;
  }initScanFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Channel Mask	Bitmap	32-bit field	The five most significant bits (b27,..., b31) are reserved. The 27 least significant bits (b0, b1,... b26) indicate which channels are to be scanned (1=scan, 0=do not scan) for each of the 27 valid channels.
ScanType	Integer	0x00 –0x01	00 = g_MAC_ED_SCAN_TYPE_c 01 = g_MAC_ACTIVE_SCAN_TYPE _c
Duration	Integer	0x00-0x0e	A value used to calculate the length of time to spend scanning each channel. Thetime spent scanning each channel is (*aBaseSuperframeDuration* * (2*n* + 1)) symbols, where *n* is the value of the ScanDuration parameter .

Table 8Initiate Scan parameters

No .of Symbols = (aBaseSuperframeDuration * ($2^{Duration}$ + 1))

Where,

aBaseSuperframeDuration = (**aBaseSlotDuration * aNumSuperframeSlots)**

aBaseSuperframeDuration: The number of symbols forming a superframe when the superframe order is equal to 0.

aBaseSlotDuration = 60 symbols

aNumSuperframeSlots = 16

Expected Response Frames:

For this commandframe following response framesare expected:

1. Default Command response ZigBeeInitiaiteScan
2. If ScanType is **g_MAC_ACTIVE_SCAN_TYPE_c,** then following frames are expected as response frames

   • Network found information event callback(AppNetworkFoundHandler) is received each and every time a new network is found. This will not be sent if there are no network during scan.

   • Scan complete event callback frame(AppScanCompleteHandler) is receivedas response after scanning is done in each channel of the provided channel mask.

3. If ScanType is **g_MAC_ED_SCAN_TYPE_c**then energy scan complete event callback frame (AppEnergyCompleteHandler) is received as response.

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

Flow Diagram

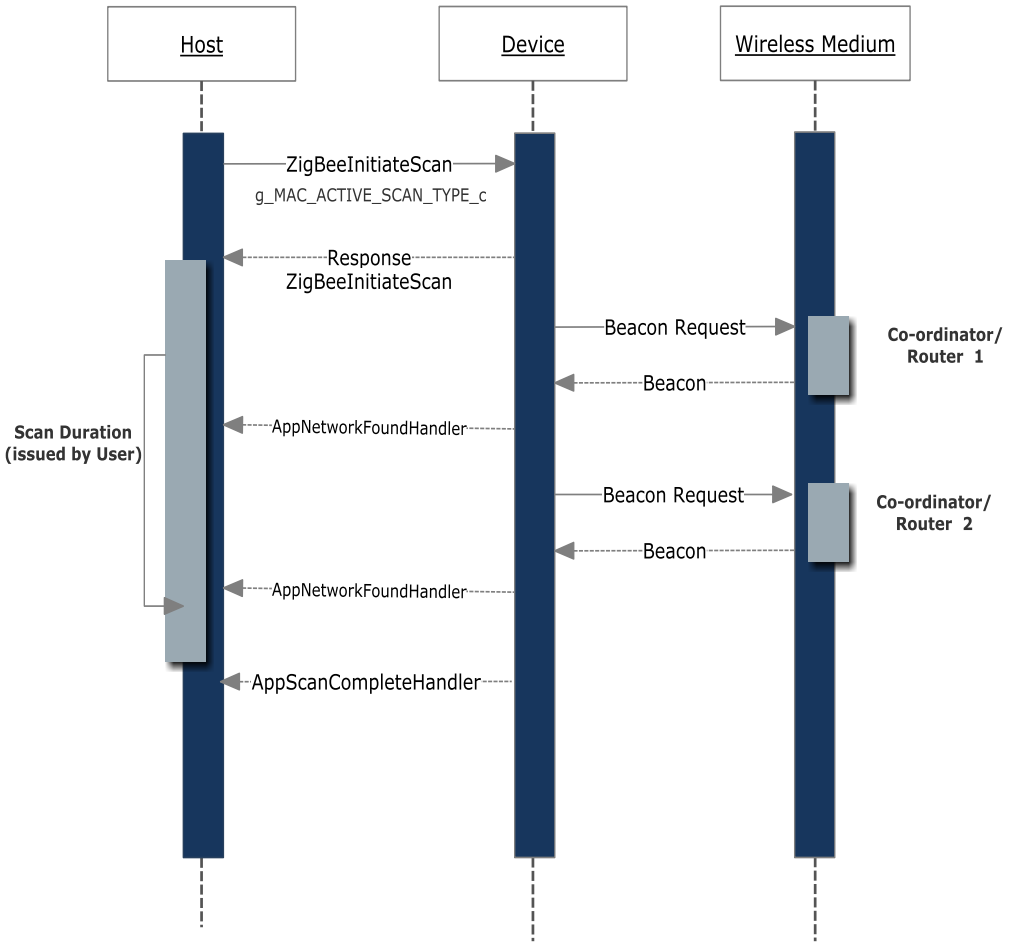

Figure 6: Scan Sequence diagram

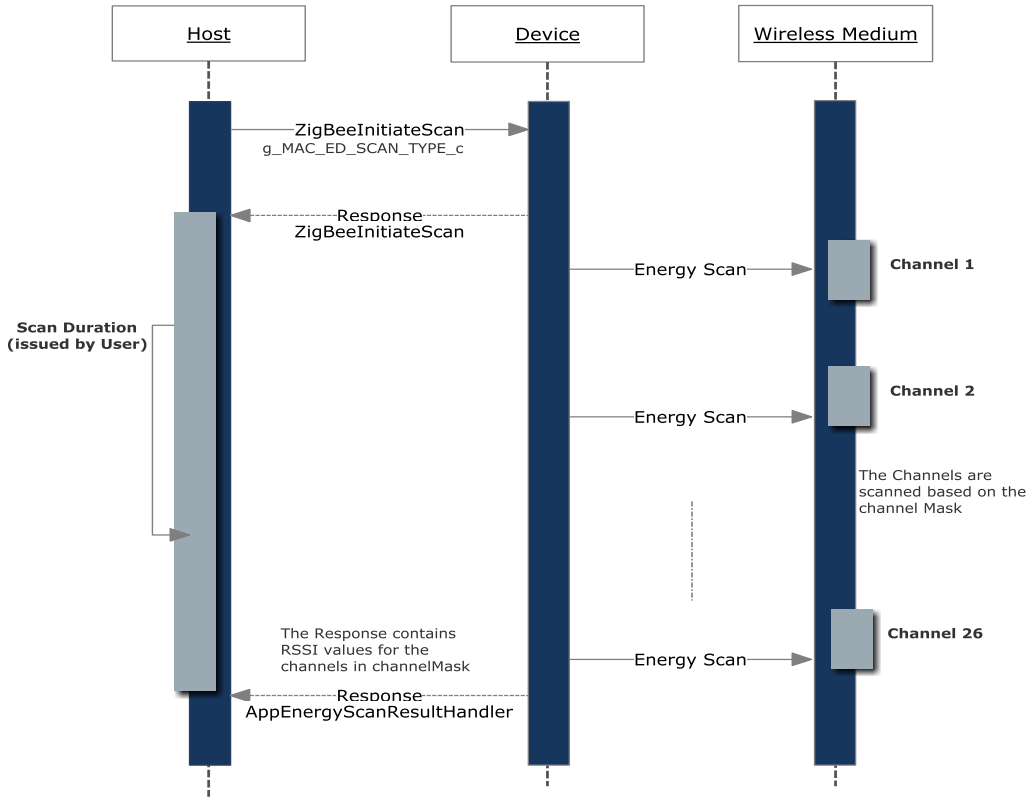

Figure 7: Energy Scan Sequence diagram

4.1.7 ZigBeeFormNetwork

Description:

This frame allowstheApplication toestablish theNetwork intheprovidedchannel with thespecifiedExtended PANId. The formationprocedureisan asynchronous call.Thestackshalltrigger AppZigBeeStackStatusHandlerResp toindicate thestatusof network formation totheApplication.

SupportedModes: Co-ordinator.

Prerequisites: The ZigBee stack must be initialized.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEFORMNETWORK (0x01)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
    uint8_t          RadioChannel;
    uint8_t          power;
    uint8_t          ExtPanId[8];
}formNetworkFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
RadioChannel	Bitmap	32-bit field	The five most significant bits (b27,..., b31) are reserved. The 27 least significant bits (b0, b1,... b26) indicate which channels are to be scanned (1=scan, 0=do not scan) for each of the 27 valid channels.
power	Integer	0 – 18 dBm	Power setting in dBm
ExtendedPANId	Integer	0x0000000000000001 – 0xfffffffffffe	The 64-bit PAN identifier of the network to join.

Table 9 Form Network Parameters

Expected Response Frames:

For this commandframe following response framesare expected:

1. For this command frame ZigBeeCommandResp response frame is expected
2. Scan complete event callback frameAppScanCompleteHandlerResp is received as response after scanning is done in each channel of the provided channel mask

3. upon establishing the network, AppZigBeeStackStatusHandlerRespshall be called by the device stack to indicate status of ZigBee Network

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.8 ZigBeeJoinNetwork

Description:

This frame allowstheApplication tojointhe Network in theprovidedchannel withthespecified Extended PANId.TheJoin procedureisanasynchronous call.The stackshallcallAppZigBeeStackStatusHandlerResptoindicatethestatus of devicejoining thenetwork to theApplication

SupportedModes: End_device, Router.

Prerequisites: ZigBee stack must be initialized

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEJOINNETWORK (0x02)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
        uint8_t              DeviceType;
        uint8_t              RadioChannel;
        uint8_t              power;
        uint8_t             ExtPanId[8];
} joinNetworkFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
DeviceType	Integer	0x00 – 0x02	Type ofdeviceattemptingto join the network.The device type canbe either Router or end device 0x01 = Router 0x 02 =end device
RadioChannel	Bitmap	32-bit field	The five most significant bits (b27,..., b31) are reserved. The 27 least significant bits (b0, b1,... b26) indicate which channels are to be scanned (1=scan, 0=do not scan) for each of the 27 valid channels.
power	Integer		Power setting in dBm

ExtendedPANId	Integer	0x0000000000000001 – 0xfffffffffffffffe	The 64-bit PAN identifier of the network to join.

Table 10 Join Network Parametres

ExpectedResponse Frames:

For this commandframe following response framesare expected:

1. For this commandframe ZigBeeCommandResp response frame is expected
2. Upon establishingthe network,AppZigBeeStackStatusHandlerResp shall be called by the stack toindicatestatusZigBeeNetworkIsUp.

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.9 ZigBeePermitJoin

Description:
This frame allowstheApplication toenablejoinpermit on thedevice forthe specifiedduration in seconds.

SupportedModes: Coordinator.

Prerequisites:Device must have formed network before sending this frame

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEPERMITJOIN(0x03)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint8_t          PermitDuration;
}permitJoinFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Permit Duration	Integer	0x00 – 0xff	The length of time in seconds during which the ZigBee coordinator or router will allow associations. The value 0x00 and 0xff indicate that permission is disabled or enabled, respectively, without a specified time limit.

Table 11 permit Join Parameters

ExpectedResponse Frames:

For this commandframe ZigBeeCommandRespresponse frame is expected

.

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.10 ZigBeeLeaveNetwork

Description:
Thisframewillperformself leavefrom thenetwork. Theleavingprocedureisan asynchronous call, but it should be part of a network to issue this frame.Thestackshall triggerAppZigBeeStackStatusHandlerResp toindicate thestatusof deviceleavingthenetwork to theApplication.
SupportedModes: End_device and Router.

Prerequisites:Device must have joined a network

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEELEAVENETWORK(0x04)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only descriptor is to be sent but payload is not required

Paylaod Parameters: None

ExpectedResponse Frames:

For this commandframe ZigBeeCommandResp response frame is expected

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.11 ZigBeeFindNetworkAndPerformRejoin

Description:
The application may use this frame, when contact with the network has been lost. The most common usage case is when an end device can no longer communicate with its parent and wishes to find a new one or rejoin. Another case is when a device has missed a Network Key update and no longer has the current Network Key.

SupportedModes: End device and Router.

Prerequisites: Device must have joined a network

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEFINDNETWORKANDPERFORMREJOIN(0x5)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
    uint32_t            ChannelMask;
    uint8_t             Secured;
} findNWKRejoinFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
ChannelMask	Bitmap	32-bit field	The five most significant bits (b27,..., b31) are reserved. The 27 least significant bits (b0, b1,... b26) indicate which channels are to be scanned (1=scan, 0=do not scan) for each of the 27 valid channels.
Secured	Integer	0x00 – 0x01	This parameter will be TRUE (0x00) if the rejoin was performed in a secure manner. Otherwise, this parameter will be FALSE (0x01).

Table 12 Network And Perform Rejoin parameters

ExpectedResponse Frames:

For this commandframe following response framesare expected:

1. For this commandframe ZigBeeCommandResp response frame is expected.
2. Upon establishingthe network,AppZigBeeStackStatusHandlerRespshall be called by the stack toindicatestatusof ZigBeeNetwork.

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.12 ZigBeeRejoinNetwork

Description:
Theapplicationmaycallthisframe,whencontactwiththenetworkhasbeen lost. Themostcommonusagecaseiswhen an enddevicecan nolonger communicatewithits parent andit wishestoa rejoin the same network.

SupportedModes: End deviceand Router.

Prerequisites:Device must have joined a network

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEREJOINNETWORK (0x06).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Payload Structure:

```
    struct {
        uint8_t            Secured;
}rejoinNWKFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Secured	Integer	0x00 – 0x01	This parameter will be TRUE (0x00) if the rejoin was performed in a secure manner. Otherwise, this parameter will be FALSE (0x01).

Table 13 Rejoin Network parameters

Example:#defineSECURED_NETWORK TRUE

ExpectedResponse Frames:

For this commandframe following response framesare expected:

1. For this commandframe ZigBeeCommandResp response frame is expected
2. Upon establishingthe network,AppZigBeeStackStatusHandlerResp shall be called by the stack toindicatestatusof ZigBeeNetwork

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.13 ZigBeeNetworkRestore

Description:
This frame allowsthe Application toretrieveitsnetworkinformationifitwas already partofthenetwork,afterretrievingnetworkinformation device silently comesupinthenetworkordoesassociation basedonthestartup Control attributeinStartUpAttribute(SAS)Set.

SupportedModes: End_device, Router and Coordinator.

Prerequisites:The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEENETWORKRESTORE(0x07)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

ExpectedResponse Frames:

For this commandframe following response framesare expected:

1. For this command frame ZigBeeCommandResp response frame is expected
2. Upon establishing the network, AppZigBeeStackStatusHandlerResp shall be called by the stack to indicate status of ZigBee Network

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.14 ZigBeeStopScan

Description:

This frame allowstheApplication tostopthescanthat wasinitiated earlier.

SupportedModes: End_device, Router and co-ordinator.

Prerequisites: The device must be in scanning state.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESTOPSCAN(0x09)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

ExpectedResponse Frames:

For this command frame ZigBeeCommandResp response frame is expected

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.15 ZigBeeNetworkState

Description:

This frame allowstheApplicationtoknowifthedeviceisintheprocessof Joining,oralready Joinedorleavingthenetwork.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEENETWORKSTATE(0x0A)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None.

ExpectedResponse Frames:

For this commandframe following response framesare expected:

1. For this command frame ZigBeeCommandResp response frame is expected

4. Upon establishing the network, AppZigBeeStackStatusHandlerResp shall be called by the stack to indicate status of ZigBee Network

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.16 ZigBeeStackIsUp

Description:
This frame is sent to know if the stack is up or not. Returnstrueif thestackis joinedtoa network andready tosendandreceive messages. Thisreflects only thestateofthelocalnode;itdoesnot indicate whether other nodesare abletocommunicatewith thisnode.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: Stack must be initialized

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESTACKISUP(0x0B)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

ExpectedResponse Frames:

For this command frame ZigBeeCommandResp response frame is expected

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.17 ZigBeeGetSelfIEEEAddress

Description:

This frame allowstheApplication to know thedevice'sself extended address.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: Stack must be initialized.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETSELFIEEEADDRESS(0x0C)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters:

Only descriptor is sent payload is not required

ExpectedResponse Frames:

For this commandframe following response frame is expected:

1. Default Command response is ZigBeeGetSelfIEEEAddressResp

API : For more information about frame usage refer corresponding API
In sample application. Refer Appendix for Command type and API Name.

4.1.18 ZigBeeIsItSelfIEEEAddress

Description:
This frame allowstheApplication to compare thespecifiedIEEEaddresswith theself IEEEaddress. This functionisimplementedby stackandisinvoked by Application.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: Stack must be initialized.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEISITSELFIEEEADDRESS(0x0D)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
    uint8_t                ieee_Addr[8];
}isitSelfIEEEFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Ieee_Addr 0r DeviceAddress	64-bit IEEE address(Integer)	Any 64-bit IEEE address	The 64-bit IEEE address of an entity that has been added to the network.

Table 14 Self IEEE Address Parameters

ExpectedResponse Frames:

For this command frame ZigBeeCommandResp response frame is expected

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.19 ZigBeeGetSelfShortAddress

Description:
This frame is sent to device to getthe16-bitshortaddressofour device.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETSELFSHORTADDRESS(0x0E)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

ExpectedResponse Frames:

For this commandframe following response frameis expected:

1. Default Command response ZigBeeGetSelfShortAddressResp

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.20 ZigBeeSetManufacturerCodeForNodeDesc

Description:
This frame allowstheApplication tospecify themanufacturercodetobesetin theNodedescriptor.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESETMANUFACTURERCODEFORNODEDESC(0xF)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint16_t          ManufacturerCode;
  }setManufFrameSnd;
```

Paylaod Parameters:

1. **ManufacturerCode:** Itindicatesthe 16-bitmanufacturer c o d e f o r thelocalnode.

ExpectedResponse Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.21 ZigBeeSetPowerDescriptor

Descriptor:

This frame allowstheApplication tospecify the powerdescriptor forthe device.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: Stack must be initialized

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESETPOWERDESCRIPTOR (0x10).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
   setPowerDescFrameSnd  power_Desc;
}nodePowerDesc;


typsdef struct {
    uint8_t            PowerSources;
    uint8_t            CurPowerLevel;
}setPowerDescFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
PowerSources	Integer	8-bit	the first 4 bits of LSB gives the current sleep/ power saving mode of the node and MSB 4 bits gives the power sources available in this node
CurPowerLevel	Integer	8-bit	the first 4 bit of LSB gives the current power source and 4 bits of MSB gives the current power source level.

Table 15 Power Descriptor Parameters.

Current Power Mode Value (b3b2b1b0)	Description
0000	Receiver synchronized with the receiver on when idle subfield of the node descriptor.
0001	Receiver comes on periodically as defined by the node power descriptor.

0010	Receiver comes on when stimulated, e.g. by a user pressing abutton.
0011-1111	Reserved.

Table 16 Current Power Mode Parameters

Current Power Source Level Field (b3b2b1b0)	Charge Level
0000	Critical
0100	33%
1000	66%
1100	100%
All other values	Reserved

Table 17 Current Power Level Parameters

ExpectedResponse Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.22 ZigBeeSetMaxmIncomingTxfrSize

Descriptor:

This frame allowstheApplication tospecify themaximumincomingtransfer sizeforthe local node in uint16_t format.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: Stack must be initialized.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESETMAXMINCOMINGTXFRSIZE (0x11).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint16_t        MaxIncomingTxfrSize;
  }setMaxIncomingTxfrFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
MaxIncomingTxfrSize	Integer	0x0000-0x7fff	This field specifies the maximum size, in octets, of the application sub-layer data unit (ASDU) that can be transferred to this node in one single message transfer.

Table 18 Incoming TXFR Size parameters

ExpectedResponse Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.23 ZigBeeSetMaxmOutgoingTxfrSize

Descriptor:

This frame allowstheApplication tospecify themaximumoutgoingtransfer sizefor the local node.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: Stack must be initialized

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESETMAXMOUTGOINGTXFRSIZE (0x12).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint16_t       MaxOutgoingTxfrSize;
  }setMaxOutTxfrFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
MaxOutgoingTxfrSize	Integer	0x0000-0x7fff	This field specifies the maximum size, inoctets, of the application sub-layer data unit (ASDU) that can be transferred from this node in one single message transfer.

Table 19 Outgoing TXFR Size Parameters

ExpectedResponse Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.24 ZigBeeSetOperatingChannel

Descriptor:

This frame allowstheApplication toset thecurrent channel.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: Stack must be initialized

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESETOPERATINGCHANNEL (0x13).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint8_t              Channel;
  } setOperChanFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Channel	Bitmap	32-bit field	The five most significant bits (b27,..., b31) are reserved. The 27 least significant bits (b0, b1,... b26) indicate which channels are to be scanned (1=scan, 0=do not scan) for each of the 27 valid channels.

Table 20 Operating Channel parameters

ExpectedResponse Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.25 ZigBeeGetDeviceType

Descriptor:

This frame allowstheApplication toget thecurrent device type.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: Stack must be initialized.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETDEVICETYPE (0x14).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None.

ExpectedResponse Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.26 ZigBeeGetOperatingChannel

Descriptor:

When this frameis sent to device, then device returns the current operatingchannel.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: Stack must be initialized.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETOPERATINGCHANNEL (0x15).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None.

ExpectedResponse Frames:

For this command frame channel number is expected as response and that response frame isZigBeeGetOperatingChannelResp.

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.27 ZigBeeGetShortPANId

Descriptor:

When this frame is send to device, then device returnstheshortPANIdof theoperatingNetwork

SupportedModes: End_device, Router and Coordinator.

Prerequisites: The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETSHORTPANID (0x16).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None.

ExpectedResponse Frames:

For this commandframe following response frame is expected:

1. Default Command response ZigBeeGetShortPANIdResp

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.28 ZigBeeGetExtendedPanId

Descriptor:

This frame allowstheApplication toget the64-bit Extended PANid of the operatingNetwork from device.

SupportedModes: End-device, Router and Coordinator.

Prerequisites: The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETEXTENDEDPANID (0x17).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

ExpectedResponse Frames:

For this commandframe following response frame is expected:

1. Default Command response ZigBeeGetExtendedPanIdResp

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.29 ZigBeeGetEndpointId

Descriptor:

When this frame is sent to device from application, then devicewillsendtheEndpoint id locatedinthespecifiedindex. Theindexvalue shouldbelessthan theNumberof Endpoints supportedonthedevice.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: Endpoint point information should be set earlier in device.

Endpoint info must have been set using Set Simple descriptor frame (ZigBeeSetSimpleDescriptor).

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETENDPOINTID (0x18).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint8_t                Index;
} getEndPointIdFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Index	Integer	0x00-0xff	Index within the Active Endpoint list in the response.

Table 21Get End Point Id Parameters

ExpectedResponse Frames:

For this commandframe following response frame is expected:

1. Default Command response ZigBeeGetEndpointIdResp

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.30 ZigBeeGetSimpleDescriptor

Descriptor:

This frame allowstheApplicationtogettheSimple descriptor for thespecified endpointid from device.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: Simple descriptor must be set earlier.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETSIMPLEDESCRIPTOR (0x19).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
   uint8_t              EndPointId;
}getSimpleDescFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
EndPointId	Integer	1-254	The 8-bit endpoint id whose simple descriptorneeds tobe retrieved.

Table 22 Get Simple Descriptor Parameters

ExpectedResponse Frames:

For this commandframe following response frame is expected:

1. Default Command response is ZigBeeGetSimpleDescriptorResp

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.31 ZigBeeGetEndpointCluster

Descriptor:

This frame allowstheApplication toread theendpoint's clusterID fromthe specified index. When this frame is received by device it sends the cluster ID of that endpoint.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETENDPOINTCLUSTER (0x1A).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
    uint8_t                 EndPointId;
    uint8_t                 ClusterType;
    uint8_t                 ClusterIndex;
}getEPClusterFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
EndPointId	Integer	1 – 254	The 8 – bit endpoint id whose cluster id needs to be

			retrieved.
ClusterType	Integer	0x00 – 0x01	Indicatesiftheinclusterlist should be read or out cluster listto beread. 0 = indicates inclusterlist1= indicates outcluster list.
ClusterIndex	Integer	0x 00 – 0xff	Indicatestheindexofthelist ofwhichclusteridis to be read.

Table 23 Get End Point Cluster Parameters

ExpectedResponse Frames:

For this commandframe following response frame is expected:

1. Default Command response ZigBeeGetEndpointClusterResp

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.32 ZigBeeGetShortAddrForSpecifiedIEEEAddr

Descriptor:

This frame allowstheApplication toget the16-bit short address of thedevice forthegiven 64-bitIEEEaddress. The device will respond with short address of the specified IEEE address.

SupportedModes: End_device,Router and End devicce .

Prerequisites: The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETSHORTADDRFORSPECIFIEDIEEEADDR(0x1B)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint8_t           ieee_Addr[8];
   } getShortAddrForIeeeAddrFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
IEEE Addr	Integer (IEEE Address)	A valid 64-bit IEEE Address	Pointing to IEEE address whose 16 bit short address is to be determined.

Table 24AddrForSpecifiedIEEEAddr Params

ExpectedResponse Frames:

For this commandframe following response frame is expected:

1. Default Command response ZigBeeGetShortAddrForSpecifiedIEEEAddrResp

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.33 ZigBeeStackProfile

Descriptor:

This frame allowstheApplication toretrieve thestackprofileinformationofdevice. The device will respond with stack profile information

SupportedModes: End_device,Router and End devicce .

Prerequisites: Stack must be initialized

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESTACKPROFILE (0x1C).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

ExpectedResponse Frames:

For this commandframe ZigBeeStackProfileResp response frame is expected

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.34 ZigBeeGetIEEEAddrForSpecifiedShortAddr

Descriptor:

This frame allowstheApplication toget the64-bit IEEEaddress of the device forthegiven 16-bitShort address.

SupportedModes: End_device,Router and End devicce .

Prerequisites: The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type–ZIGBEEGETIEEEADDRFORSPECIFIEDSHORTADDR(0x1D)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
        uint16_t      ShortAddr;
}getIeeeAddrForShortAddrFrameSnd;
```

PaylaodParameters:

Name	Type	Valid Range	Description
ShortAddr	Integer (Device Address List)	0x0000 - 0xffff	Provide the 16-bit short address of device whose64-bit IEEE address needto be determined.

Table 25IEEEAddrForSpecifiedShortAddr Params

ExpectedResponse Frames:

For this commandframe ZigBeeGetIEEEAddrForSpecifiedShortAddrResp response frame is expected

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.35 ZigBeeReadNeighborTableEntry

Descriptor:

This frame allowstheApplicationtogetthe Neighbortableentry ofspecifiedindex from device.

SupportedModes: End_device, Router and Co-ordinator.

Prerequisites: The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEREADNEIGHBORTABLEENTRY (0x1E)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint8_t              Index;
  } readNeighborTableFrameSnd;
```

PaylaodParameters:

Name	Type	Valid Range	Description
Index	Integer	0x00 – 0xff	Indicates indexfrom where theroutingtableentryisto beretrieved.

Table 26ReadNeighborTableEntry Parameters

ExpectedResponse Frames:

For this commandframe ZigBeeReadNeighborTableEntryResp response frame is expected

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.36 ZigBeeGetRouteTableEntry

Descriptor:

This frame allowstheApplication toreadtheRoutingtableentry of specifiedindex from device.

SupportedModes: Router and Coordinator.

Prerequisites: The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETROUTETABLEENTRY(0x1F)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint8_t              Index;
  } getRouteTableFrameSnd;
```

PaylaodParameters:

Name	Type	Valid Range	Description
Index	Integer	0x 00 – 0xff	Indicates indexfrom where theroutingtableentryisto beretrieved.

Table 27GetRouteTableEntry Parameters

ExpectedResponse Frames:

For this commandframe ZigBeeGetRouterTableEntryResp response frame is expected

API : For more information about frame usage refer corresponding API In sample application. Refer Appendix for Command type and API name.

4.1.37 ZigBeeTreeDepth

Descriptor:

This frame allowstheApplication toretrieve thecurrent tree depth wherethe device hasjoined.

SupportedModes: End-Device , Router& Coordinator .

Prerequisites: The device must be a part of network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEETREEDEPTH(0x20).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Payload Structure:

Only Descriptor is sent, payload is not required for this frame.

Paylaod Parameters: None.

ExpectedResponse Frames:

For this commandframe ZigBeeTreeDepthResp response frame is expected

API : For more information about frame usage refer corresponding API In sample application. Refer Appendix for Command type and API name.

4.1.38 ZigBeeGetNeighborTableEntryCount

Description:

This frame allows the Application to read count of active neighbor table entries from our device.

SupportedModes: End_device, Router and Coordinator.

Prerequisites: The ZigBee stack must be initialized.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETNEIGHBORTABLEENTRYCOUNT (0x21)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint8_t            index;
}getRouteTableFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
Index	Integer	0x00 – 0xff	Total number of Neighbor Table entries within the Remote Device.

Table 28GetNeighborTableEntryCount Params

Expected Response Frames:

Command response for this request frame is ZigBeeTreeDepthResp.

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.39 ZigBeeGetChildShortAddressForTheIndex

Description:

This frameallows the Application to read the 16-bit short address of the child from the specified index.

SupportedModes: Router and Coordinator.

Prerequisites: The zigBee stack must be initialized and a child must have joined the device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETCHILDSHORTADDRESSFORTHEINDEX(0x22)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
typedef struct {
      uint8_t              ChildIndex;
  }getChildShortAddrFrameSnd;
```

Payload Parameters:

Name	Type	Valid	Description

		Range	
Child Index	Integer	0x00 – 0xff	Index of the child device.

Table 29GetChildShortAddressForTheIndex

Expected Response Frames:

Default Command response is ZigBeeGetChildShortAddressForTheIndexResp.

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.40 ZigBeeGetChildIndexForSpecifiedShortAddr

Description:

This frameallows the Application to get child index for the specified 16-bit child address.

SupportedModes: Router and Coordinator.

Prerequisites: The ZigBee stack must be initialized and a child must have joined the device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEEGETCHILDINDEXFORSPECIFIEDSHORTADDR(0x23)

Interface Type - MANAGEMENT_INTERFACE (0x1).

Payload Structure:

```
struct {
        uint8_t                 ShortAddr;
    }getChildIndexForShortAddrFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
ShortAddr	Integer (Device Address List)	0x0000 - 0xffff	16-bit Short address of the child device whose index is to be determined.

Table 30GetChildIndexForSpecifiedShortAddr

Expected Response Frames:

Default Command responseZigBeeGetChildIndexForSpecifiedShortAddrResp.

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.41 ZigBeeGetChildDetails

Description:

This frameallows the Application to get the child details from the specified child index.

SupportedModes: Router and Coordinator.

Prerequisites: The zigBee stack must be initialized and a child must have joined the device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEEGETCHILDDETAILS (0x24)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
Struct{
      uint8_t            Index,
}getChildDetailsFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
Child Index	Integer	0x00 – 0xff	Index of the child device.

Table 31GetChildDetails Parameters

Expected Response Frames:
For this command frame ZigBeeGetChildDetailsResp response frame is expected

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.42 ZigBeeEndDevicePollForData

Description:

This frameallows the End device application to poll the parent for data.

SupportedModes: End-Device.

Prerequisites: The zigBee stack must be initialized and the device must have joined a network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEEENDDEVICEPOLLFORDATA (0x25)

Interface Type - MANAGEMENT_INTERFACE (0x1).

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

Expected Response Frames:
For this command frame default ZigBeeCommandResp response frame is expected for indicating status

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.43 ZigBeeReadCountOfChildDevices

Description:

This frameallows the application to read the number of child devices on the node.

SupportedModes: Router and Coordinator.

Prerequisites: The zigBee stack must be initialized and a child should have joined the device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEEREADCOUNTOFCHILDDEVICES (0x26)

Interface Type - MANAGEMENT_INTERFACE (0x1).

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

Expected Response Frames:
Default Command response ZigBeeReadCountOfChildDevicesResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.44 ZigBeeReadCountOfRouterChildDevices

Description:

This frameallows the application to read the number of child devices on the node.

SupportedModes: Router and Coordinaor.

Prerequisites: The zigBee stack must be initialized and a child should have joined the device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEEREADCOUNTOFROUTERCHILDDEVICES (0x27)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

Expected Response Frames:
Default Command response ZigBeeReadCountOfRouterChildDevicesResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.45 ZigBeeGetParentShortAddress

Description:

This frameallows the application to read the 16-bit short address of the parent.

SupportedModes: Router and End-Device.

Prerequisites: The ZigBee stack must be initialized and the device must have joined the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEEGETPARENTSHORTADDRESS(0x29)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

Expected Response Frames:
Default Command response ZigBeeGetParentShortAddressResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.46 ZigBeeGetParentIEEEAddress:

Description:

This frameallows the application to read the 64-bit ieee address of the parent.

SupportedModes: Router and End-Device.

Prerequisites: The zigBee stack must be initialized and the device must have joined the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEEGETPARENTIEEEADDRESS(0x2A)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

Expected Response Frames:
Default Command response ZigBeeGetParentIEEEAddressResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.47 ZigBeeBroadcastNWKManagerRequest

Description:

This frameallows the application tobroadcasts a request to set the identity of the network manager and the active channel mask. The mask is used when scanning for the network after missing a channel update. This request may only be sent by the current Network manager.

SupportedModes: Coordinator.

Prerequisites: The zigBee stack must be initialized and the device must have formed the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEEBROADCASTNWKMANAGERREQUEST (0x2C)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
Struct{
      uint32_t          ActiveChannels,
      uint8_t           ShortAddr,
}bcastNWKManagerFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
Active Channels	Integer	32 bit field	The new active channel mask
ShortAddr	Integer	0x0000 - 0xffff	The 16-bit short address of the network manager

Table 32BroadcastNWKManagerRequest Params

Expected Response Frames:
Default Command response is ZigBeeCommandResp.

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.48 ZDPSendNWKAddrRequest

Description:

This frameallows the application tosend ZDP network address request to determine the 16-bit short address of the device whose IEEE address is known.

SupportedModes: End-Device, Router and Coordinator.

Prerequisites: The zigBee stack must be initialized and the device must be in the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZDPSENDNWKADDRREQUEST (0x2D)

Interface Type - MANAGEMENT_INTERFACE (0x1).

Payload Structure:

```
Struct{
        uint8_t     ieee_Addr[8],
        uint8_t     RequestType,
        uint8_t     StartIndex
}getZDPNWKShortAddrFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
IEEE_Addr	IEEE Address(Integer)	A valid 64-bit IEEE address	The IEEE address whose short address is to be determined.
RequestType	Integer	0x00-0xff	Request type for this command: 0x00 – Single device response 0x01 – Extended response 0x02-0xFF – reserved
StartIndex	Integer	0x00-0xff	If the Request type for this command is Extended response, the StartIndex provides the starting index for the requested elements of the associated devices list

Table 33 Network Address Request Parameters

Expected Response Frames:
The following command frames are expected:

1. For this command frame default ZigBeeCommandResp response frame is expected for indicating status and
2. AppHandleDataIndicationResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

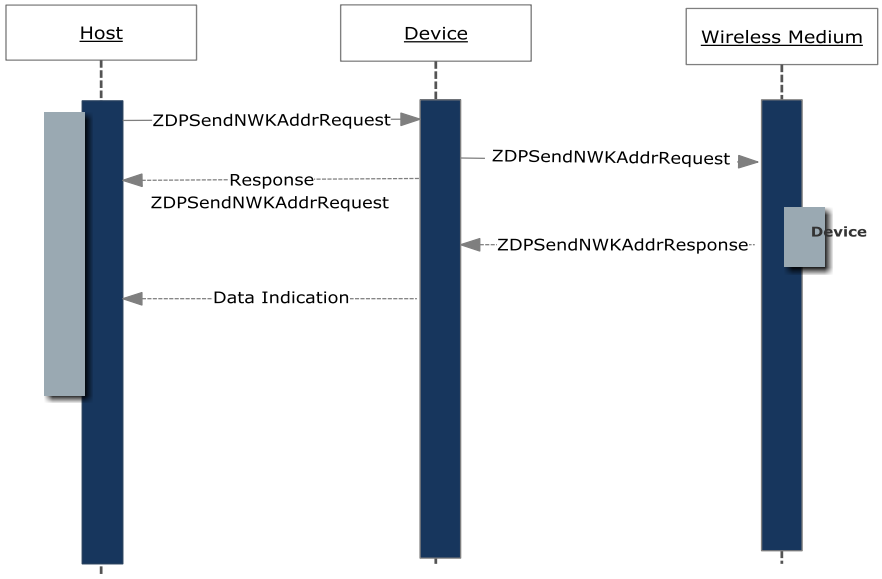

Figure 8: Network Address Request

4.1.49 ZDPSendIEEEAddrRequest

Description:

This frameallows the application tosend ZDP ieee address request to determine the 64-bit IEEEaddress of the device whose short address is known.

SupportedModes: End-Device, Router and Coordinator.

Prerequisites: The ZigBee stack must be initialized and the device must be in the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZDPSENDIEEEADDRREQUEST (0x2E)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
Struct{
      Uint16_t    ShortAddr,
      uint8_t     RequestType,
      uint8_t     StartIndex,
      uint8_t     APSAckRequired
}getZDPIEEEAddrFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
ShortAddr	Device Address(Integer)	0x0000 - 0xffff	The short address whose IEEE address is to be determined.

RequestType	Integer	0x00-0xff	Request type for this command: 0x00 – Single device response 0x01 – Extended response 0x02-0xFF – reserved
StartIndex	Integer	0x00-0xff	If the Request type for this command is Extended response, the StartIndex provides the starting index for the requested elements of the associated devices list
APSAckRequired	Integer	0x00 – 0x01	TRUE (0x00) indicates APS ack is required.

Table 34 IEEE address Request Parameters

Expected Response Frames:
The following command frames are expected:

1. For this command frame default ZigBeeCommandResp response frame is expected for indicating status and
2. AppHandleDataIndicationResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

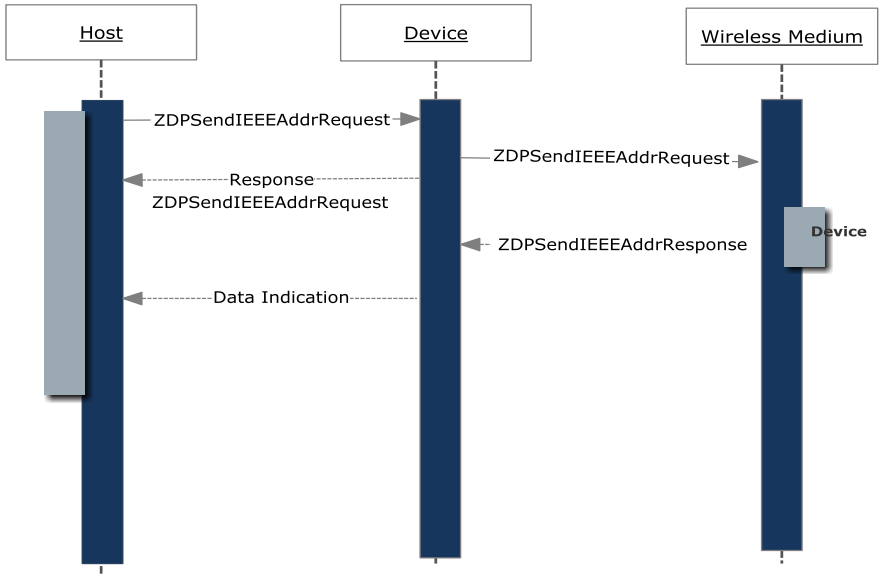

Figure 9: IEEE Address Request

4.1.50 ZDPSendDeviceAnnouncement

Description:

This frameallows the application tosend a broadcast for a ZDO Device announcement. Normally, it is NOT required to send this as the stack automatically sends a device

announcement during joining or rejoining, as per the spec. However, if the device wishes to broadcast device announcement it can do through this frame.

SupportedModes: End-Device, Router.

Prerequisites: The ZigBee stack must be initialized and the device must be in the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZDPSENDDEVICEANNOUNCEMENT (0x2F)

Interface Type - MANAGEMENT_INTERFACE (0x1).

Payload Structure:

Only Descriptor is sent, payload is not required for this frame.

Paylaod Parameters: None

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.51 ZigBeeSetSimpleDescriptor

Description:

This frameallows the application toset simple descriptor request, which contains information about profile, In and Out Clusters of a specific endpoint.

SupportedModes: End_Device, Router and Coordinator.

Prerequisites: The ZigBee stack must be initialized.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEESETSIMPLEDESCRIPTOR(0x4A)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint16_t   ProfileId;
      uint16_t    DevId;
      uint8_t     EndPointId;
      uint8_t     DevVersion;
      uint8_t     InClusterCnt;
      uint8_t     OutClusterCnt;
      uint8_t     ClusterInfo[40];
}setSimpleDescFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
ProfileId	Integer	0x0000 – 0xffff	The Endpoint on which these clusters are defined
DevId	Integer	0x0000 - 0xfff7	The address of the designated network channel manager function
EndPointId	Integer	1-254	The endpoint on the destination.
DevVersion	Integer	0x00 – 0x0f	The version of the ZigBee protocol in use in the discovered network.
InClusterCnt	Integer	0x00-0xff	The number of Input Clusters
OutClusterCnt	Integer	0x00-0xff	The number of Output Clusters
ClusterInfo	Integer	-	Buffer for input and output cluster, supports 20 in and 20 out clusters per endpoint

Table 35 Set Simple Descriptor Parameters

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.1.52 ZDPSendMatchDescriptorsRequest

Description:

This frameallows the application to send Match Descriptor request on air to know which other devices are supported to start data communication.

SupportedModes: End-Device, Router and Coordinator.

Prerequisites: The ZigBeestack must be initialized.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZDPSENDMATCHDISCRIPTORREQUEST(0x30)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint16_t    ShortAddr;
      uint16_t   ProfileId;
      uint16_t    DestAddress;
```

```
        uint8_t     InClusterCnt;
        uint8_t     OutClusterCnt;
        uint8_t     APSAckRequired;
        uint8_t     ClusterInfo[40];
    }sendMatchDescFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
ShortAddr	Device Address(Integer)	0x0000 - 0xffff	The device short address whose matching end-points are desired.
ProfileId	Integer	0x0000 – 0xffff	The application profile id
DestAddress	Integer	0x0000 - 0xffff	Destination device address
InClusterCnt	Integer	0x00 – 0x0f	The number of Input Clusters
OutClusterCnt	Integer	0x00-0xff	The number of output Clusters
APSAckRequired	Integer	0x00 – 0x01	TRUE (0x00) indicates APS ack is required.
ClusterInfo	Integer	-	Buffer for input and output cluster, supports 20 in and 20 out clusters per endpoint

Table 36 Match Descriptor Request Parameters

Expected Response Frames:
The following command frames are expected:

1. For this command frame default ZigBeeCommandResp response frame is expected for indicating status and
2. AppHandleDataIndicationResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

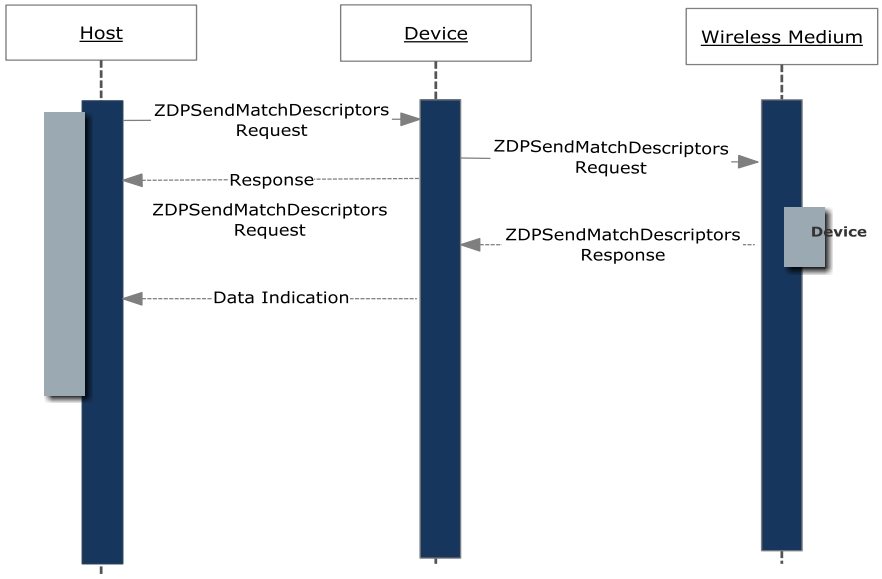

Figure 10: Match Descriptor Request

4.1.53 ZigBeeActiveEndpointsRequest

Description:

This frameallows the application tosendZDP Active Endpoint request to specified short address.

SupportedModes: End-Device, Router and Coordinator.

Prerequisites: The ZigBee stack must be initialized and the device must be in the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEEACTIVEENDPOINTSREQUEST (0x31)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint16_t    ShortAddr;
      uint8_t     APSAckRequired;
}activeEPOfShortAddrFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
ShortAddr	Integer	0x0000 - 0xffff	The device short address whose matching end-points are desired.
APSAckRequired	Integer	0x00 – 0x01	TRUE (0x00) indicates

			APS ack is required.

Table 37 Active End Point Request Parameters

Expected Response Frames:
The following command frames are expected:

1. For this command frame default ZigBeeCommandResp response frame is expected for indicating status
2. AppHandleDataIndicationResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

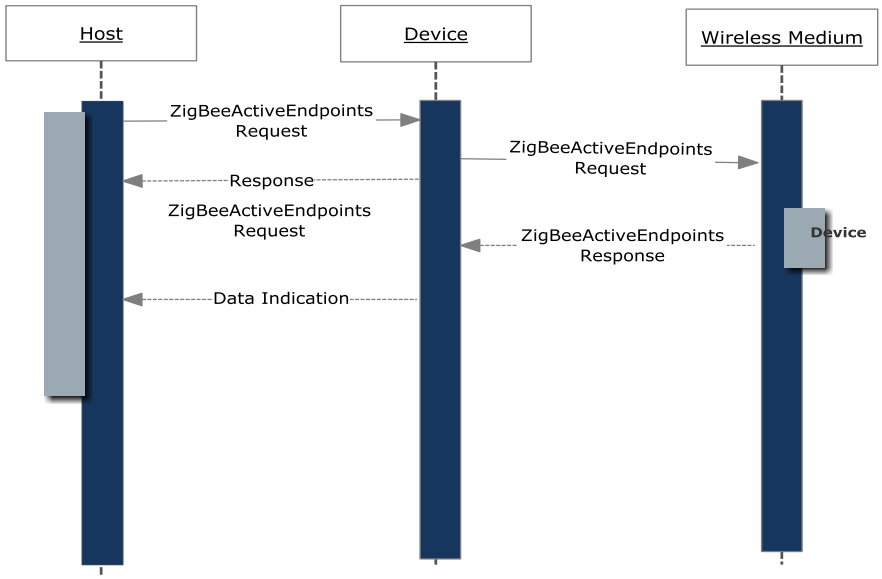

Figure 11: Active Endpoint Request

4.1.54 ZDPSendPowerDescriptorRequest

Description:

This frameallows the application tosendZDPpower descriptor request to the specified short address.

SupportedModes: End-Device, Router and Coordinator.

Prerequisites: The ZigBee stack must be initialized and the device must be in the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZDPSENDPOWERDESCRIPTORREQUEST (0x32)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
```

```
        uint16_t    ShortAddr;
        uint8_t     APSAckRequired;
}powerDescFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
ShortAddr	Integer	0x0000 - 0xffff	The device short address whose power descriptor is to be obtained..
APSAckRequired	Integer	0x00 – 0x01	TRUE (0x00) indicates APS ack is required.

Table 38 Power Descriptor Request Parameters

Expected Response Frames:
The following command frames are expected:

1. For this command frame default ZigBeeCommandResp response frame is expected for indicating status and
2. AppHandleDataIndicationResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

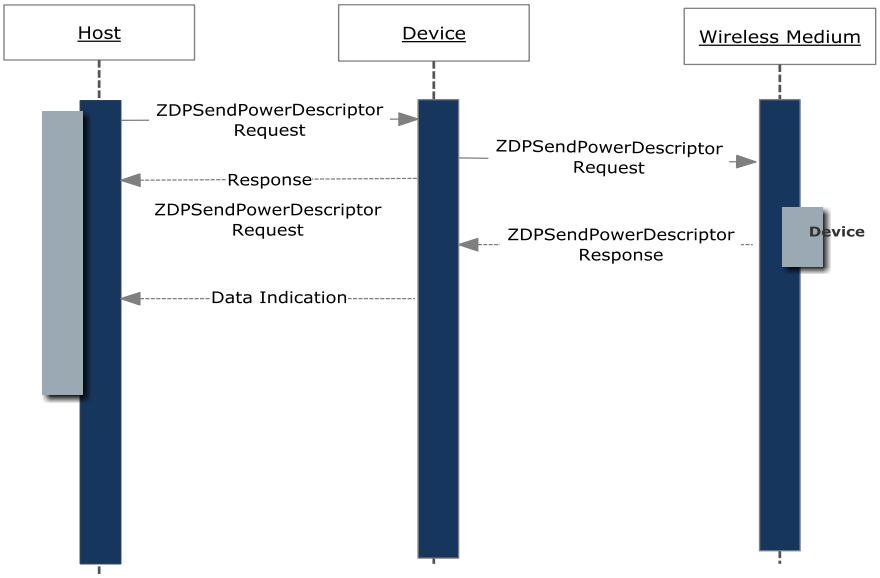

Figure 12: Power Descriptor Request

4.1.55 ZDPSendNodeDescriptorRequest

Description:

This frameallows the application tosendZDPnode descriptor request.

SupportedModes: End-Device, Router and Coordinator.

Prerequisites: The zigBee stack must be initialized and the device must be in the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZDPSENDNODEDESCRIPTORREQUEST (0x33)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
        uint16_t            ShortAddr;
        uint8_t             APSAckRequired;
}nodeDescFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
ShortAddr	Integer	0x0000 - 0xffff	The device short address whose node descriptor is to be obtained.
APSAckRequired	Integer	0x00 – 0x01	TRUE (0x00) indicates APS ack is required.

Table 39Node Descriptor Request Parameters

Expected Response Frames:
The following command frames are expected:

1. For this command frame default ZigBeeCommandResp response frame is expected for indicating status and
2. AppHandleDataIndicationResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

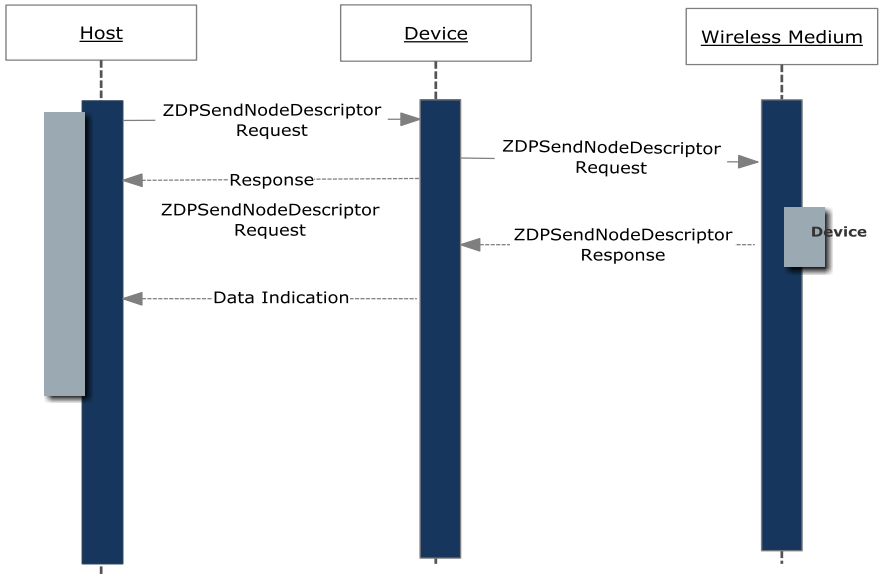

Figure 13: Node Descriptor Request

4.1.56 ZigBeeSimpleDescriptorRequest

Description:

This frameallows the application request to get the simple descriptor of target device..

SupportedModes: End-Device, Router and Coordinator.

Prerequisites: The zigBee stack must be initialized and the device must be in the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEESIMPLEDESCRIPTORREQUEST (0x34)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint16_t    ShortAddr;
      uint8_t     EndPointId;
}getSimpleDescOfShortAddrFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
ShortAddr	Interger	0x0000 - 0xffff	The device short address whose matching end-points are desired.
EndPointId	Integer	1-254	The endpoint on the destination.

Table 40 Simple Descriptor Request Parameters

Expected Response Frames:
The following command frames are expected:

1. For this command frame default ZigBeeCommandResp response frame is expected for indicating status and
2. AppHandleDataIndicationResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

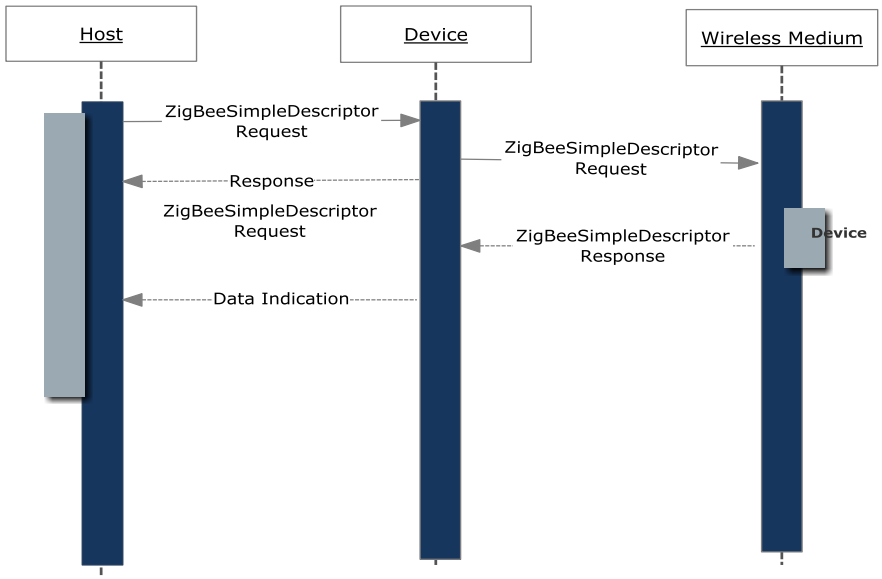

Figure 14: Simple Descriptor Request

4.1.57 ZigBeeGetRSSI:

Description:
The frame allows the application to get the rssi value from the inputs of baseband register.

Supported Modes: End-Device, Router and Coordinator**.**

Prerequisites: Stack must be initialized.

Descriptor: 16 bytes Frame Descriptor should be sent first then payload **should be followed by descriptor.**

Command Type - ZIGBEEGETRSSI (0xF6)

Interface Type -MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
typedef struct {
uint8_t   pkt;
}getrssiFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
Packet	Integer	0x00	Zero for Zigbee packet.

Expected Response Frames:

For this command frame defaultZigBeeCommandResp response frame is expected for indicating status.

4.1.58 ZigBeeInitPS:

Description:

This frame allows the application to read the number of child devices on the node.

SupportedModes: EndDevice.

Prerequisites: The device must be End Device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEEINITPS (0x68)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint8_t     ps_en;
      uint8_t     deep_sleep_wkp_period;
      uint8_t     slp_mode;
}pwrModeFrameSnd;
```

Payload Parameters:

1. **ps_en**: Power save Enable/Disable.
   - **ENABLE** : 0x1
   - **DISABLE** : 0x0
2. **Deep_sleep_wkp_period** : the deep sleep wake up period in seconds .
3. **Slp_mode**: **The device sleep mode,**
   - **LP_MODE**: 0x1
   - **ULP_MODE**: 0x2

Expected Response Frames:
For this command frame default ZigBeeCommandResp response frame is expected for indicating status

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.2 Data Frames

4.2.1 ZigBeeSendUnicastData

Description:

This frameallows the application toinitiate APSDE data request to the specified destination address.

SupportedModes: End-Device, Router and Coordinator.

Prerequisites: The zigBee stack must be initialized and the device must be in the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEESENDUNICASTDATA (0x36)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
        uint16_t    ProfileId;
        uint16_t    ClusterId;
        uint8_t     msgType;
        uint8_t     ieee_Addr[8];
        uint8_t     DestEndpoint;
        uint8_t     SrcEndpoint;
        uint8_t     AsduLength;
        uint8_t     TxOptions;
        uint8_t     Radius;
        uint8_t     Data[120];
    } unicastDataFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description
ProfileId	Integer	0x0000 – 0xffff	The identifier of the profile for which this frame is intended.
ClusterId	Integer	0x0000 – 0xffff	The identifier of the object for which this frame is intended
msgType	Integer	0x00– 0x04	ZigBee_Outgoing_Direct (0x00) ZigBee_Via_Address_Map (0x01) ZigBee_Via_Binding_Table(0x02) ZigBee_Via_Multicast (0x03) ZigBee_Broadcast (0x04)
IEEE_Addr	IEEE Address(Integer)	A valid 64-bit IEEE address	Address of the destination device

DestEndpoint	Integer	0x00 –0xff	This parameter shall be present if, and onlyif, the DstAddrMode parameter has a value of 0x02 or 0x03 and, if present, shall be either the number of the individual endpoint of the entity to which the ASDU is being transferred or the broadcast endpoint (0xff).
SrcEndpoint	Integer	0x00 – 0xfe	The individual endpoint of the entity from which the ASDU is being transferred.
AsduLength	Integer	0x00 - 256*(NsduLength - apscMinHeader Overhead)	The number of octets comprising the ASDU to be transferred. The maximum length of an individual APS frame payload is given as NsduLength - *apscMinHeaderOverhead*. Assuming fragmentation is used, there can be 256 such blocks comprising a single maximum sized ASDU.
TxOptions	Bitmap	0000 0000 – 00011111	The transmission options for the ASDU to be transferred. These are a bitwise OR of one or more of the following: 0x01 = Security enabled transmission 0x02 = Use NWK key 0x04 = Acknowledged transmission 0x08 = Fragmentation permitted 0x10 = Include extended nonce in APSsecurity frame
Radius	Unsigned integer	0x00-0xff	The distance, in hops, that a transmitted frame will be allowed to travel through the network.
Data	Unsigned integer	0 - 120	The payload

Table 41 Send Uni-cast Data Parameters

Expected Response Frames:
The following command frames are expected:

1. For this command frame default ZigBeeCommandResp response frame is expected for indicating status and
2. AppHandleDataConfirmationResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

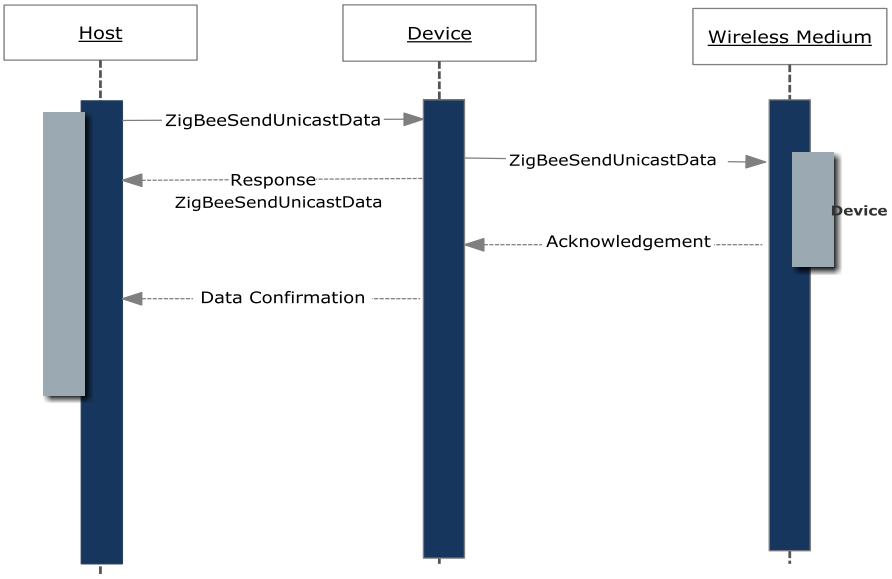

Figure 15: Send Data

4.2.2 ZigBeeSendGroupData

Description:

This frameallows the application toinitiate APSDE data request to the specified group address.

SupportedModes: End-Device, Router and Coordinator.

Prerequisites: The zigBee stack must be initialized and the device must be in the network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEESENDGROUPDATA (0x37)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

```
struct {
      uint16_t    ProfileId;
      uint16_t    ClusterId;
      uint16_t    group_addr;
      uint8_t     DestEndpoint;
      uint8_t     SrcEndpoint;
      uint8_t     AsduLength;
      uint8_t     TxOptions;
      uint8_t     Radius;
      uint8_t     Data[120];
  } groupDataFrameSnd;
```

Payload Parameters:

Name	Type	Valid Range	Description

ProfileId	Integer	0x0000 – 0xffff	The identifier of the profile for which this frame is intended.
ClusterId	Integer	0x0000 – 0xffff	The identifier of the object for which this frame is intended
group_addr	16-bit group address	0x0000 - 0xffff	The 16-bit address of the group being added.
DestEndpoinst	Integer	0x00 –0xff	This parameter shall be present if, and onlyif, the DstAddrMode parameter has a value of 0x02 or 0x03 and, if present, shall be either the number of the individual endpoint of the entity to which the ASDU is being transferred or the broadcast endpoint (0xff).
SrcEndpoint	Integer	0x00 – 0xfe	The individual endpoint of the entity from which the ASDU is being transferred.
AsduLength	Integer	0x00 - 256*(NsduLength - apscMinHeader Overhead)	The number of octets comprising the ASDU to be transferred. The maximum length of an individual APS frame payload is given as NsduLength - *apscMinHeaderOverhead*. Assuming fragmentation is used, there can be 256 such blocks comprising a single maximum sized ASDU.
TxOptions	Bitmap	0000 0000 – 00011111	The transmission options for the ASDU to be transferred. These are a bitwise OR of one or more of the following: 0x01 = Security enabled transmission 0x02 = Use NWK key 0x04 = Acknowledged transmission 0x08 = Fragmentation permitted 0x10 = Include extended nonce in APSsecurity frame
Radius	Unsigned integer	0x00-0xff	The distance, in hops, that a transmitted frame will be allowed to travel through the network.
Data	Unsigned integer	0 - 120	The payload

Table 42 Send Group Data Parameters

Expected Response Frames:
The following command frames are expected:

1. For this command frame default ZigBeeCommandResp response frame is expected for indicating status and
2. AppHandleDataConfirmationResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.2.3 ZigBeeGetMaxAPSPayloadLength

Description:

This frameallows the application to read the maximum size of the payload that the Application Support sub-layer will accept. The size depends on the security level in use. The value is the same as that found in the node descriptor.

SupportedModes: End-Device, Router and Coordinator.

Prerequisites: The zigBee stack must be initialized.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type - ZIGBEEGETMAXAPSPAYLOADLENGTH (0x39)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Payload Structure:

Only Descriptor is sent payload is not required for this frame.

Paylaod Parameters: None

Expected Response Frames:
Command responses for this request are ZigBeeGetMaxAPSPayloadLengthResponse and AppHandleDataIndicationResp

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

4.3 Security Frames

4.3.1 ZigBeeGetKey

Description:

This frame allows the Application to get specified key and its associated data. Using this frame user can retrieve Link key, Current Network Key, or Next Network Key.

SupportedModes: End_device, Router and Coordinator

Prerequisites: The zigBee stack must be initialized

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETKEY (0x41)

Interface Type - SECURITY_INTERFACE (0x3)

Payload Structure:

```
struct {
      Security_Key_TypesKeyType;
  }getKeyFrameSnd;

typedef enum Security_Key_Types_Tag {
      g_Trust_Center_Master_Key_c,
      g_Network_Key_c,
      g_Application_Master_Key_c,
      g_Link_Key_c,
      g_Trust_Center_Link_Key_c,
      g_Next_Network_Key_c
} Security_Key_Types
```

Paylaod Parameters:

1. **KeyType** : Indicates the typeofkeysent and waits for the associated response frame. Possible values for KeyType are:
   - **g_Trust_Center_Master_Key_c:**Get trust center master key
   - **g_Network_Key_c:**Get network key
   - **g_Application_Master_Key_c:**Get application master key
   - **g_Link_Key_c:**Get link key
   - **g_Trust_Center_Link_Key_c:**Get trust center(co-ordinator) link key
   - **g_Next_Network_Key_c**:Get next network link key

KeyType	Value

2. g_Trust_Center_Master_Key_c (Reserved) **0x0**
3. g_Network_Key_c **0x1**
   g_Application_Master_Key_c (Reserved) **0x2**
   g_Link_Key_c (Reserved) **0x3**
   g_Trust_Center_Link_Key_c **0x4**

Table 43 **Key Types Expected**

Response Frames:

For this commandframe ZigBeeGetKeyResp response frame is expected

Note:

Presently only Current Network Key, Next Network Key and Trust Center Link key are supported and other key types are not supported. So when any other key type other than the above specified type is sent then g_Invalid_Request_c will be sent as response.

4.3.2 ZigBeeHaveLinkKey

Description:

This frame allows the Application to get information about trust center linkkey from our device so that we are securing our messages sent to the partner joined.

SupportedModes: End_device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEHAVELINKKEY (0x42)

Interface Type - SECURITY_INTERFACE (0x3)

Payload Structure:

```
struct {
      uint8_tieee_Addr[8];
  }haveLinkKeyFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
IEEE_Addr	IEEE Address(Integer)	A valid 64-bit IEEE address	It is the IEEE Addr of the partner connected to.

Table 44 Have Link Key Parameters

Expected Response Frames:

For this commandframe ZigBeeGetKeyResp response frame is expected

4.3.3 ZigBeeSwitchNetworkKeyHandler

Description:

This frame allows the Application to switch network key. This frame will be sent to device and it request every body to switch current key.

This frame is reserved.

4.3.4 ZigBeeRequestLinkKey

Description:

This frame allows the Application to get trust center link key for the child joined.

SupportedModes: Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEREQUESTLINKKEY (0x44)

Interface Type - SECURITY_INTERFACE (0x3)

Payload Structure:

```
struct {
        uint8_t     TrustCenterIEEEAddr[8];
        uint8_t     PartnerIEEEAddr[8];
}reqLinkKeyFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
TrustCenter IEEEAddr	Device address(Integer)	Any valid 64-bit address	Identifies the address of the device's Trust Center.
Partner IEEEAddr	Device address(Integer)	Any valid 64-bit address	If the KeyType parameter indicates an application key, this parameter shall indicate an extended 64-bit address of a device that shall receive the same key as the device requesting the key.

Table 45 Request Link Key Parameters

Expected Response Frames:

For this commandframe ZigBeeCommandResp response frame is expected

4.3.5 ZigBeeGetKeyTableEntry

Description:

This frame allows the Application to get the key configuration for the given index.

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETKEYTABLEENTRY(0x45)

Interface Type - SECURITY_INTERFACE (0x3)

Payload Structure:

```
struct {
	uint8_t	Index;
}getKeyTableFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Index	Integer	0x00 – 0xff	Index From Where Key structure information is gathered.

Table 46 Get Key Table Entry Parameters

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

4.3.6 ZigBeeSetKeyTableEntry

Description:

This frame allows the Application to set the key configuration for the given index.

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESETKEYTABLEENTRY (0x46)

Interface Type - SECURITY_INTERFACE (0x3)

Payload Structure:

```
struct {
	uint8_t	Index;
	uint8_t	ieee_Addr[8];
	uint8_t	LinkKey;
```

```
        uint8_t     KeyData[16];
}setKeyTableFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Index	Integer	0x00-0xff	Index entry where key table information is set.
IEEE_Addr	IEEE Address(Integer)	A valid 64-bit IEEE address	It is the IEEE Addr of the partner connected to.
LinkKey	Set of 16 octets	Variable	The actual value of the link key.if link key type is : 0x00 = Unique Link Key 0x01 = Global Link Key.
KeyData	Integer	Variable	Key to update

Table 47 Set Key Table Entry Parameters

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

4.3.7 ZigBeeAddOrUpdateKeyTableEntry

Description:

This frame allows the Application to add a new entry in the key table or update an existing entry with a new key. It first searches the key table for an entry that has a matching IEEE Address. If it does not find one, it searches for the first free entry. If it is successful in either case, it sets the entry with the IEEE address, key data, and flag that indicates if it is a Link or Master Key. The Incoming Frame Counter for that key is also reset to 0. If no existing entry is found, and there is no free entry in the table, then the call will fail.

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEADDORUPDATEKEYTABLEENTRY (0x47)

Interface Type - SECURITY_INTERFACE (0x3)

Payload Structure:

```
struct {
      uint8_t     ieee_Addr[8];
      uint8_t     LinkKey;
      uint8_t     KeyData[16];
  } addKeyTableFrameSnd
```

Paylaod Parameters:

Name	Type	Valid Range	Description
IEEE_Addr	IEEE Address(Integer)	A valid 64-bit IEEE address	It is the IEEE Addr of the partner connected to.
LinkKey	Set of 16 octets	Variable	The actual value of the link key.if link key type is : 0x00 = Unique Link Key 0x01 = Global Link Key.
KeyData	Integer	Variable	Key to update

Table 48 Update Key Table Entry Parameters

Expected Response Frames:

The expected response for this frame would be the index number from the entry table where it is updated. For this commandframe ZigBeeAddOrUpdateKeyTableEntryResp response frame is expected

4.3.8 ZigBeeFindKeyTableEntry

Description:

This frame allows the Application tofind the table entry using the 64-bit extended address(IEEE Address).

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEFINDKEYTABLEENTRY (0x48)

Interface Type - SECURITY_INTERFACE (0x3)

Payload Structure:

```
struct {
        uint8_t      ieee_Addr[8];
        uint8_t      LinkKey;
} findKeyTableFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
IEEE_Addr	IEEE Address(Integer)	A valid 64-bit IEEE address	It is the IEEE Addr of the partner connected to.
LinkKey	Set of 16 octets	Variable	The actual value of the link key.if link key type

			is : 0x00 = Unique Link Key 0x01 = Global Link Key.

Table 49 Find Key Table Entry Parameters

Expected Response Frames:

The expected response for this frame would be the index number from the entry table where it is found. For this commandframe ZigBeeFindKeyTableEntryResp response frame is expected.

4.3.9 ZigBeeEraseKeyTableEntry

Description:

This frame allows the Application toerase the key table entry based on Index provided

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEERASEKEYTABLEENTRY (0x49)

Interface Type - SECURITY_INTERFACE (0x3)

Payload Structure:

```
struct {
      uint8_t     Index;
} eraseKeyTableFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Index	Integer	0x00-0xff	Index of key table from which key entry has to be erased

Table 50 Earse Key Table Entry Parameters

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

4.4 Binding Frames

4.4.1 ZigBeeSetBindingEntry

Description:

This frame allows the Application toset binding entry in ZigBee stack. With this frame the source End point and destination End point info will be stored in the binding table.

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEESETBINDINGENTRY (0x3A)

Interface Type - BINDING_INTERFACE (0x4)

Payload Structure:

```
struct {
        uint8_t     SrcIEEEAddr[8];
        uint8_t     SrcEndpoint;
        uint16_t    ClusterId;
        uint8_t     DestAddrMode;
        uint8_t     DestAddress;/*8 bytes are reserved*/
        uint8_t     DestEndpoint;
} setBindEntryFrameSnd;

union Address {
        uint16_t short_address;
        uint8_t IEEE_address[8];
};
```

Paylaod Parameters:

Name	Type	Valid Range	Description
SrcIEEEAddr	IEEE Address	A valid 64-bit IEEE address	The IEEE address for the source.
SrcEndpoint	Integer	0x01-0xfe	The source endpoint for the binding entry.
ClusterId	Integer	0x0000-0xffff	The identifier of the cluster on the source device that is bound to the destination.
DestAddrMode	Integer	0x00-0xff	The addressing mode for the destination address used in this command. This field can take one of the non-reserved values from the following list: 0x00 = reserved 0x01 = 16-bit group address for DstAddress and DstEndp not present 0x02 = reserved 0x03 = 64-bit extended address for DstAddress and DstEndp present

			0x04 – 0xff = reserved
DestAddress	Address	As specified by the DstAddrMode field	The destination address for the binding entry.
DestEndpoint	Integer	0x01-0xfe	This field shall be present only if the DstAddrMode field has a value of 0x03 and, if present, shall be the destination endpoint for the binding entry.

Table 51 Set Binding Entry Parameters

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

4.4.2 ZigBeeGetBindingIndices

Description:

This frame allows the Application toget the active binding indices from ZigBee stack.

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEGETBINDINGINDICES (0x60)

Interface Type - BINDING_INTERFACE (0x4)

Payload Structure: None.
Paylaod Parameters: None.

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

4.4.3 ZigBeeDeleteBinding

Description:

This frame allows the Application todelete the binding entry of specified index from binding table.

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEDELETEBINDING (0x3B)

Interface Type - BINDING_INTERFACE (0x4)

Payload Structure:

```
struct {
      uint8_t     BindIndex;
} delBindEntryFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Index	Integer	0x00-0xff	Binding entry of binding table which is to be removed.

Table 52 Delete Binding Parameters

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

4.4.4 ZigBeeIsBindingEntryActive

Description:

This frame allows the Application toverify if the binding entry is active or not.

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEISBINDINGENTRYACTIVE (0x3C)

Interface Type - BINDING_INTERFACE (0x4)

Payload Structure:

```
struct {
      uint8_t     BindIndex;
} isBindEntryActiveFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Index	Integer	0x00-0xff	Binding entry of binding table which is to be verified.

Table 53 Binding Entry Active Parameters

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

4.4.5 ZigBeeClearBindingTable

Description:

This frame allows the Application toclear the formed binding table.

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEECLEARBINDINGTABLE (0x3D)

Interface Type - BINDING_INTERFACE (0x4)

Payload Structure:

Only Descriptor is sent and payload is not required for this frame.

Paylaod Parameters:

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

4.4.6 ZigBeeBindRequest

Description:

This frame allows the Application to bindsource and destination endpoints. With this frame the source End point and destination End point will be linked logically which can be later used for data communication.

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEBINDREQUEST (0x3E)

Interface Type - BINDING_INTERFACE (0x4)

Payload Structure:

```
struct {
      uint16_t    SrcShortAddr;
      uint16_t    ClusterId;
      uint8_t     SrcIEEEAddr[8];
      uint8_t     SrcEndpoint;
      uint8_t     DestAddrMode;
      Address     DestAddress;/*8 bytes are reserved*/
      uint8_t     DestEndpoint;
      uint8_t     APSAckRequired;
} bindReqFrameSnd;

union Address{
```

```
        uint16_t short_address;
        uint8_t IEEE_address[8];
    };
```

Paylaod Parameters:

Table 54 Bnd Request Parameters

Name	Type	Valid Range	Description
SrcShortAddr	Interger	0x0000 - 0xffff	The device short address .
ClusterId	Integer	0x0000-0xffff	The identifier of the cluster on the source device that is bound to the destination.
SrcIEEEAddr	IEEE Address	A valid 64-bit IEEE address	The IEEE address for the source.
SrcEndpoint	Integer	0x01-0xfe	The source endpoint for the binding entry.
DestAddrMode	Integer	0x00-0xff	The addressing mode for the destination address used in this command. This field can take one of the non-reserved values from the following list: 0x00 = reserved 0x01 = 16-bit group address for DstAddress and DstEndp not present 0x02 = reserved 0x03 = 64-bit extended address for DstAddress and DstEndp present 0x04 – 0xff = reserved
DestAddress	Address	As specified by the DstAddrMode field	The destination address for the binding entry.
DestEndpoint	Integer	0x01-0xfe	This field shall be present only if the DstAddrMode field has a value of 0x03 and, if present, shall be the destination endpoint for the binding entry.
APSAckRequired	Interger	0x00 – 0x01	TRUE (0x00) indicates APS ack is required.

Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

4.4.7 ZigBeeUnBindRequest

Description:

This frame allows the Application to unbindsource and destination endpoints. With this frame logical link between Source End point and Destination End point will be terminated.

SupportedModes: End_Device, Router and Coordinator

Prerequisites: The device must be part of a network or a network is formed by device.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEUNBINDREQUEST (0x40)

Interface Type - BINDING_INTERFACE (0x4)

Payload Structure:

```
struct {
        uint16_t    SrcShortAddr;
        uint16_t    ClusterId;
        uint8_t     SrcIEEEAddr[8];
        uint8_t     SrcEndpoint;
        uint8_t     DestAddrMode;
        Address     DestAddress;/*8 bytes are reserved*/
        uint8_t     DestEndpoint;
        uint8_t     APSAckRequired;
} unbindReqFrameSnd;

union Address {
        uint16_t short_address;
        uint8_t IEEE_address[8];
};
```

Paylaod Parameters:

Name	Type	Valid Range	Description
SrcShortAddr	Interger	0x0000 - 0xffff	The device short address .
ClusterId	Integer	0x0000-0xffff	The identifier of the cluster on the source device that is bound to the destination.
SrcIEEEAddr	IEEE Address	A valid 64-bit IEEE address	The IEEE address for the source.
SrcEndpoint	Integer	0x01-0xfe	The source endpoint for the binding entry.
DestAddrMode	Integer	0x00-0xff	The addressing mode for the destination address used in this command. This field can take one of the non-reserved values from the following list: 0x00 = reserved 0x01 = 16-bit group address for DstAddress and DstEndp not present 0x02 = reserved 0x03 = 64-bit extended address for DstAddress and DstEndp present 0x04 – 0xff = reserved
DestAddress	Address	As specified by the DstAddrMode field	The destination address for the binding entry.
DestEndpoint	Integer	0x01-0xfe	This field shall be present only if the DstAddrMode field has a value of 0x03 and, if present, shall be the

			destination endpoint for the binding entry.
APSAckRequired	Interger	0x00 – 0x01	TRUE (0x00) indicates APS ack is required.

Expected Response F

Table 55 Unbind Request Parameters

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status

4.4.8 ZigBeeEndDeviceBindRequest

Description:

To bind two end devices of same network then this frameshould be used from host application. Both the end devices should send bind request simultaneously to Co-ordinator, if Co-ordinator receives end device bind request first then it will wait for timeout duration to receive other bind request from other end device. Later these to end devices will be binded logically by Co-ordinator.

By default the EndDevice Binding request timeout is configured to 10 seconds.

SupportedModes: End_Device

Prerequisites: The device must be part of a network.

Descriptor: 16 bytesFrame Descriptor should be sent first then payload should be followed by descriptor.

Command Type- ZIGBEEENDDEVICEBINDREQUEST (0x3F)

Interface Type - BINDING_INTERFACE (0x4)

Payload Structure:

```
struct {
      uint8_t     EndPointId;
      uint8_t     APSAckRequired;
} endDevBindFrameSnd;
```

Paylaod Parameters:

Name	Type	Valid Range	Description
Endpoint Id	8 bits	1-254	The endpoint on the device generating the request
APSAckRequired	Interger	0x00 – 0x01	TRUE (0x00) indicates APS ack is required.

Table 56 End device Bind Request Parameters

Expected Response Frames:

For this command frame default ZigBeeCommandResp response frame is expected for indicating status.

5 Response frames

This section contains description of various response frames received from device. All the response frames contains 4-byte length descriptor, reserved dummy bytes, 16-byte descriptor and payload as described in Rx Operation. The 16-byte descriptor will be similar for all the received command frames. The fields which differ for each command descriptor are length of payload, Interface type and Command type. In the descriptor direction would be from device to host.

5.1 Default Status Frame

5.1.1 ZigBeeCommandResp

Description:

Once device receives command request, it validates the input parameters and sends the common response frame to host for most of the command requests with status success or failure or invalid etc.,. Based on the type of command additional payload may be expected for few frames, but for this response frame status is only expected.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This generic response is expected when a command is sent to device from host.

Payload Structure:

```
struct {
    uint8_tstatus;
}rsi_StatusResp;
```

Payload Parameters:

The response payload structure may contain one of the status as specified in the table Zigbee status Codes (Error Codes).

5.2 Event Callbacks

5.2.1 ZigBeeCardReady

Description:

This is the first packet received from device, intimating that the device is ready to accept commands. This will also come as a response for de-init command.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

The command type is ZIGBEE_CARD_READY(0xFF) for card ready and interface type is 0x6(EVENTCALLBACKS).

5.2.2 AppNetworkFoundHandler

Description:

This event callback is triggered from the stack(device) to inform about the networks found in the current channel. The network information is beacon content.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This frame is expected when ZigBeeInitiaiteScan command frameis sent to device from host and if the device detects any new networks in the channels specified in Channel Mask**Payload Structure:**

```
Struct{
      uint16_t    shortPanId,
      uint8_t     channel,
      uint8_t extendedPanId[8],
      uint8_tstackProfile,
      uint8_t nwkUpdateId
      bool allowingJoining,
}ZigBeeNetworkDetails;
```

Payload Parameters:

1. **channel:** The 802.15.4channel associated with the network.
1. **ShortPanId** : The network's PAN identifier.
2. **extendedPanId**[8] : The network's extended PAN identifier.
3. **allowingJoining** : Whether the network is allowing MAC associations.
4. **stackProfile** :The StackProfile associated with the network.
5. **nwkUpdateId** : The instance of the Network.

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

5.2.3 AppScanCompleteHandler

Description:

This event callback is triggered from the stack(device) to inform the status of the current channel scan to the application.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This is expected when ZigBeeInitiaiteScan command frame is sent to device from host and when the scan for the specified duration is completed.

Payload Structure:

```
Struct {
      uint32_t    channel,
      uint32_t    scan_status,
}rsi_ScanDoneResp;
```

Payload Parameters:

1. **Channel:** Thechannelon whichthescanoccurred
2. **Scan_status:** Mac status obtained would be one of the below specified status

MAC Scan Status	Value
g_MAC_Success_c	0x0
g_PAN_At_Capacity_c	0x1
g_PAN_Access_denied_c	0x2
g_MAC_Scan_In_Progress_c	0xAA
g_MAC_Beacon_Loss_c	0xE0
g_MAC_Channel_Access_Failure_c	0xE1
g_MAC_Denied_c	0xE2
g_MAC_Disable_TRX_Failure_c	0xE3
g_MAC_Failed_Security_Check_c	0xE4
g_MAC_Frame_Too_Long_c	0xE5
g_MAC_Invalid_GTS_c	0xE6
g_MAC_Invalid_Handle_c	0xE7
g_MAC_Invalid_Parameter_c	0xE8
g_MAC_No_ACK_c	0xE9
g_MAC_No_Beacon_c	0xEA
g_MAC_No_Data_c	0xEB
g_MAC_No_Short_Address_c	0xEC
g_MAC_Out_Of_CAP_c	0xED
g_MAC_PAN_ID_Conflict_c	0xEE
g_MAC_Realignment_c	0xEF
g_MAC_Transaction_Expired_c	0xF0
g_MAC_Transaction_Overflow_c	0xF1
g_MAC_TX_Active_c	0xF2
g_MAC_Unavailable_Key_c	0xF3
g_MAC_Unsupported_Attribute_c	0xF4
g_MAC_Missing_Address_c	0xF5
g_MAC_Past_Time_c	0xF6

Table 57 MAC Scan status Types

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

5.2.4 AppEnergyCompleteHandler

Description:

This event callback is triggered from the stack(device) toreport RSSI value measured in the required channel.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This is expected when ZigBeeInitiaiteScan command frame is sent to device from host and when the energy scan for the specified duration is completed.

Payload Structure:

```
Struct{

      uint32_t    channel,
      uint8_t     PEnergyValues[16],
}rsi_EnergyScanDoneResp;
```

Payload Parameters:

1. **Channel:** The channel on which the scan occurred.
2. **pEnergyValues[16] :**This array holds the RSSI values for the channels from 11 to 26.

API: For more information about frame usage, refer corresponding API in sample application. Refer Appendix for Command type and API name.

5.2.5 AppHandleDataConfirmationResp

Description:

This event callback is data confirmation response for the data, which is sent to device from host. This event callback is triggered for every data packet sent over the air.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This response is expected when data is transmitted from the device over the air.
Payload Structure:

```
struct{
    Address dest_address;
    uint8_t dest_addr_mode;
    uint8_t dest_endpoint;
    uint8_t src_endpoint;
    uint8_t status;
}APSDE_Data_Confirmation_t;

Union Address{
      uint16_t short_address;
      uint8_t IEEE_address[8];
};
```

Payload Parameters:

1. **dest_address:** This field indicates the individual device address or group address of the transmitted message.
   - **short_address** : The short address of the device .
   - **IEEE_address** : The IEEE address of the device .

2. **dest_addr_mode :**
   This field indicates the destination address mode. This field takes one of the following values:
   - 0x00 - Indirect data transmission (destination address and destination endpoint are not present)
   - 0x01 - 16-bit group address
   - 0x02 - 16-bit address of destination device
   - 0x03 - 64-bit extended address of destination device
   - 0x04 - 0xff - Reserved
3. **dest_endpoint :** This field indicates the destination endpoint to which the data frame was sent.
4. **src_endpoint :** This field indicates the source endpoint from which the data frame was originated.
5. **Status :** This field indicates the status of data confirmation. For details of the various status values refer Zigbee status Codes.

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

5.2.6 AppHandleDataIndicationResp

Description:

This event callback is triggered from the stack (device) toinform that datais pending for reading. This is a data indication frame sent to inform that data is received by device for the data request sent.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This frame is expected when data request is transmitted from the device on air.
Payload Structure:

```
struct {
    Address     dest_address;
    uint8_t     dest_addr_mode;
    uint8_t     dest_endpoint;
    uint8_t     src_addr_mode;
    Address     src_address;
    uint8_t     src_endpoint;
    profile_id_t profile_id;
    cluster_id_t cluster_id;
    uint8_t     asdulength;
    uint8_t     was_broadcast;
    uint8_t     security_status;
    uint8_t     link_quality;
    uint8_t     a_asdu[1];
} APSDE_Data_Indication_t;

Union Address {
      uint16_t short_address;
```

```
        uint8_t IEEE_address[8];
    };
```

Payload Parameters:

1. **dest_address**: This field the destination address in the received message.
   - **short_address** : The short address of the device .
   - **IEEE_address** : The IEEE address of the device .
2. **dest_addr_mode :**This field indicates the destination address mode in the receivedmessage. This field takes one of the following values:
   - 0x00 - Indirect data transmission (destination address and destination endpoint are not present)
   - 0x01 - 16-bit group address
   - 0x02 - 16-bit address of destination device
   - 0x03 - 64-bit extended address of destination device
   - 0x04 - 0xff - Reserved
3. **dest_endpoint :** This field indicates the destination endpoint in the received message.
4. **src_addr_mode :** This field indicates the source address mode in the received message. This field can have one of the following values:
   - 0x00 - Indirect data transmission (destination address and destination endpoint are not present)
   - 0x01 - 16-bit group address
   - 0x02 - 16-bit address of destination device
   - 0x03 - 64-bit extended address of destination device
   - 0x04 - 0xff - Reserved
5. **src_address:** This field indicates the source address from which the message is originated. This field can have one of the following values:
   - If the source address mode is 0x01, this field will have 16-bit address.
   - If source address mode is 0x03, this field will have 64-bit extended address.
6. **profile_id:**This fieldindicates the 16-bit profile ID**.**
7. **cluster_id -** This field indicates the cluster ID**.**
8. **Asdulength-** This field indicates the length of the data received.
9. **was_broadcast**- This field indicates whether the data frame is received throughbroadcast.
10. **security_status :** This field indicates whether the received message was secured or not and type of the security applied. The enum values are as follows:

- g_APS_UNSECURED_c - ASDU is received without any security.
- g_Recieved_Nwk_Key_Secured_Asdu_c - ASDU is received

  security using the Network Key.
- g_Recieved_Link_Key_Secured_Asdu_c - ASDU is received with security using the link Key.

11. **link_quality**: This field indicates the LQI of the received message.
12. **a_asdu[1]**: This field points to the actual message received.

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

5.2.7 ZigBeeChildJoinHandler

Description:

This event callback is triggered from the stack(device) tointimate about child device joining or leaving the network.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This is expected when a child joins/leaves the device.
Payload Structure:

```
Struct{
      uint16_t          short_addr,
      uint8_t           joined,
  }rsi_EnergyScanDoneResp;
```

Payload Parameters:

1. **short_**addr**:** The child's short address.
2. **joined :**
   - TRUE : Child joined the device.
   - FALSE : Child left the network.

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

5.2.8 AppIncomingManyToOneRouteHandler

Description:

Thisevent callback is triggered from the stack(device) to handle many to One Route Request.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This is expected when many to one route request is initiated.

Payload Structure:

```
Struct{
        uint16_t          source_addr,
        uint8_t     source_ieee[8],
        uint8_t     Cost;
  }rsi_EnergyScanDoneResp;
```

Payload Parameters:

1. **source_addr:** The short address of the concentrator which initiated the many to one request.
2. **source_ieee:** The concentrator's ieee address.
3. **Cost:**Thepath cost of the concentrator.

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

5.2.9 AppZigBeeStackStatusHandler

Description:

Thisevent callback is triggered from the stack(device) to indicate any kind of Network status. For example: Upon establishing the network, this function shall be called by the stack to indicate status ZigBeeNetworkIsUp. If the device leaves the network, a status of ZigBeeNWkisDown status is indicated via this event callback.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This is expected when ZigBeeJoinNetwork or ZigBeeFormNetwork command frame is sent to device from host or when the device leaves/joins the network or when network is demolished, this event callback will be triggered

Payload Structure:

```
enum {
    ZigBeeNWKIsUp,
    ZigBeeNWKIsDown,
    ZigBeeJoinFailed,
    ZigBeeCannotJoinAsRouter,
    ZigBeeChangedNodeID,
    ZigBeeChangedPANID,
    ZigBeeChangedChannel,
    ZigBeeNoBeacons,
    ZigBeeReceivedKeyInClear,
    ZigBeeNoNWKKeyReceived,
    ZigBeeNoLinkKeyReceived,
    ZigBeePreconfiguredKeyRequired,
    ZigBeeChangedManagerAddress
}ZigBeeNWKStatusInfo;
```

Payload Parameters:

1. **ZigBeeNWKIsUp** indicates that Network is formed or joined successfully.

2. **ZigBeeNWKIsDown**indicates that NWK formation failed or the deviceleft the network.
3. **ZigBeeJoinFailed**indicates that network join failed.
4. **ZigBeeCannotJoinAsRouter** indicates that network was unableto start as Router.
5. **ZigBeeChangedNodeID**indicates that PANID is changed after resolvingPAN ID conflict.
6. **ZigBeeChangedChannel** indicates that the channel is changed due tofrequency agility mechanism
7. **ZigBeeReceivedKeyInClear** indicates the Network Key is received is inclear.
8. **ZigBeeNoNWKKeyReceived** indicates no Network key is received.
9. **ZigBeeNoLinkKeyReceived** indicates no Link key is received.
10. **ZigBeePreconfiguredKeyRequired** indicates Preconfigured link key is required.
11. **ZigBeeChangedManagerAddress**indicates network manager changed.

API: For more information about frame usage refer corresponding API in sample application. Refer Appendix for Command type and API name.

5.3 Other Responses

5.3.1 ZigBeeGetNeighborTableEntryCountResp

Description:

Once device receives a neighbor tableEntry count request, it validates the input parameters and sends the response frame, which contains the status of the request and the neighbor table entry.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEREADNEIGHBORTABLEENTRY (0x1E)

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected whenZigBeeGetNeighborTableEntryCount command is sent to device from host.

Payload Structure:

```
struct {
      uint8_t  status;
      ZigBeeNeighborTableEntry_t  Neighbor_table_entry;
}rsi_GetNeighborTableEntryResp;

struct {
      uint16_t          shortId;
      uint8_t           averageLqi;
      uint8_t           incomingCost;
      uint8_t           outgoingCost;
      uint8_t           age;
      uint8_t           aIEEEAddress[8];
}ZigBeeNeighborTableEntry_t;
```

Payload Parameters:

1. **status**can have two values

- **g_SUCCESS_c**: indicating scan begun successfully.
- **ZigBee_Invalid_Argument**: indicates invalid arguments being passed to the transmit frame.

2. **Neighbor_table_entry**

- **shorted** : The neighbor's two byte short address.
- **averageLqi** : An exponentially weighted moving average of the link quality values of incoming packets from this neighbor as reported by the PHY.
- **incomingCost** :The incoming cost for this neighbor, computed from the average LQI. Values range from 1 for a good link to 7 for a bad link.
- **outgoingCost**: The outgoing cost for this neighbor, obtained from the most recently received neighbor exchange message from the neighbor.
- **Age** : The number of aging periods elapsed since a neighbor exchange message was last received from this neighbor. An entry with an age greater than 3 is considered stale and may be reclaimed. The aging period is 16 seconds.
- **aIEEEAddress** : The 8 byte IEEE address of the neighbor.

5.3.2 ZigBeeGetChildShortAddressForTheIndexResp

Description:

On device receivesZigBeeGetChildShortAddressForTheIndex frame, then the device sends 16-bit short address of the child in the specified index if found else INVALID_ADDRESS.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type - ZIGBEEGETCHILDINDEXFORSPECIFIEDSHORTADDR(0x22)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeGetChildShortAddressForTheIndex command is sent to device from host.

Payload Structure:

```
struct {
      uint16_tshort_addr;
}rsi_ShortAddrResp;
```

Payload Parameters:

1. **short_addr**

- 16-bit short address of the child on success,otherwise
- INVALID_ADDRESS = 0xFFFF.

5.3.3 ZigBeeInitiaiteScanResp

Description:

Once device receives scan request, it validates the input parameters and sends the response frame, which contains the status of the scan request.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This is expected when corresponding command is sent to device from host.

Payload Structure:

```
struct {
      uint8_tstatus;
  }rsi_StatusResp;
```

Payload Parameters:

The response payload structure may contain one of the status as specified in the table Error Codes.

5.3.4 ZigBeeNetworkStateResp

Once device receives ZigBeeNetworkState request, it verifies networkstate and sends the status of network.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEENETWORKSTATE(0x0A)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeNetworkStatecommand is sent to device from host.

Payload Structure:

```
enum {
      g_ZigBeeNotPartOfNWK_c,
      g_ZigBeeInTheProcessOfJoiningNWK_c,
      g_ZigBeeJoinedNWK_c,
      g_ZigBeeJoinedNWKNoParent_c,
      g_ZigBeePerformingLeaveFromNWK_c
} ZigBeeJoinStatus;
```

Payload Parameters:

1. **g_ZigBeeNotPartOfNWK_c** : indicates the device is not part of anynetwork
2. **g_ZigBeeInTheProcessOfJoiningNWK_c** - indicates the device is in the process of Joining the network
3. **g_ZigBeeJoinedNWK_c** - indicates the device has joined the Network
4. **g_ZigBeeJoinedNWKNoParent_c** - indicates the device has joined the Network, but parent communication has failed
5. **g_ZigBeePerformingLeaveFromNWK_c** - indicates the device is in the process of leaving the Network

5.3.5 ZigBeeGetSelfIEEEAddressResp

Description:

Once device receives ZigBeeGetSelfIEEEAddress request, it sends the IEEE address of device

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEGETSELFIEEEADDRESS(0x0C).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected whenZigBeeGetSelfIEEEAddress command is sent to device from host.

Payload Structure:

```
struct {
    uint8_t    Self_ieee[8];
} rsi_getSelfIEEEAddrResp;
```

Payload Parameters:

1. **Self_ieee**: it holds the 64 bit IEEE address.

5.3.6 ZigBeeGetSelfShortAddressResp

Once device receives ZigBeeGetSelfShortAddress request, it sends short address of deviceafter it has joined/formed network.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEGETSELFSHORTADDRESS(0x0E).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected whenZigBeeGetSelfShortAddresscommand is sent to device from host.

Payload Structure:

```
struct {
    uint16_t    short_addr;
} rsi_getSelfShortAddrResp;
```

Payload Parameters:

1. **short_addr** : It indicates the 16-bit short address of the device.

   - If Short addr is **(0xFF),** then it represents thatstatus is failure while retrieving short address

5.3.7 ZigBeeGetDeviceTypeResp

Once device receives ZigBeeGetDeviceTyperequest, it gathers information about the device being used and sends the device type as response to the command.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEGETDEVICETYPE (0x14).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeGetDeviceType command is sent to device from host.

Payload Structure:

```
struct {
```

```
    uint8_t      status;
    uint8_t      type;
} rsi_DevTypeResp;
```

Payload Parameters:

1. The status can have four values
   - **g_SUCCESS_c:**indicating GetDeviceType successfully.
   - **g_FAILURE_c:**indicating GetDeviceType successfully.
2. The type can have three values
   - "0" for Coordinator
   - "1" for Router
   - "2" for End device

5.3.8 ZigBeeGetOperatingChannelResp

Once device receives ZigBeeGetOperatingChannelrequest, it sends the current operating channel number as response.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEGETOPERATINGCHANNEL (0x15).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected whenZigBeeGetOperatingChannel command is sent to device from host.

Payload Structure:

```
struct {
      uint8_t     channel;
}rsi_ChannelResp;
```

Payload Parameters:

1. **channel**: ItindicatesCurrent radio channel.

5.3.9 ZigBeeGetShortPANIdResp

Once device receives ZigBeeGetShortPANIdrequest, it sends the response frame which contains pan id of network.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEGETSHORTPANID (0x16).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected whenZigBeeGetShortPANId command is sent to device from host.

Payload Structure:

```
struct {
    uint16_t     pan_id;
```

```
}rsi_PanIdResp;
```

Payload Parameters:

1. **pan_id:**ItindicatesShort PANID of the network
   - If the network is not formed **0xFFFF** is the value returned

5.3.10 ZigBeeGetExtendedPanIdResp

Once device receives ZigBeeGetExtendedPanIdrequest, it sends the response frame which contains Extended Pan Id of device.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEGETEXTENDEDPANID (0x17).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected whenZigBeeGetExtendedPanId command is sent to device from host.

Payload Structure:

```
struct {
    uint8_t    ExtPanId[8];
}rsi_ExtPanIdResp;
```

Payload Parameters:

1. **Ext_PanId:** it indicatesnetworks extended PANID.

5.3.11 ZigBeeGetEndpointIdResp

Once device receives ZigBeeGetEndpointIdrequest, it validates the input parameters and sends the response frame, which contains the status of the scan request.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEGETENDPOINTID (0x18).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected when corresponding command is sent to device from host.

Payload Structure:

```
struct {
    uint16_tEndPointId;
}rsi_EndPointId;
```

Payload Parameters:

1. **EndPointId:** ThevalidEndpointIDlocatedin thespecified index.
   - If EndPointId value is (0xF1) it indicates Endpoint value is not valid

5.3.12 ZigBeeGetSimpleDescriptorResp

Once device receives form nerwork request, it validates the input parameters and sends the response frame, which contains the status of the scan request.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEGETSIMPLEDESCRIPTOR (0x19).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected when corresponding command is sent to device from host.

Payload Structure:

```
struct {
      uint8_t     EndPointId;
      uint16_t    ProfileId;
      uint16_t    DevId;
      uint8_t     DevVersion;
      uint8_t     InClusterCnt;
      uint8_t     *InClusterInfo; //Pointer
      uint8_t     OutClusterCnt;
      uint8_t     *OutClusterInfo; //Pointer
}rsi_GetSimpleDescResp;
```

Payload Parameters:

1. **EndPointId:** The Endpoint on which these clusters are defined
2. **ProfileId** : The application profile id
3. **DevId**: Device ID
4. **Device Version**: Device version info
5. **InClusterCnt**: Number of input clusters.
6. **InCluserInfo**: Input Cluster information buffer indicating various supported input clusters
7. **OutClusterCnt**:Number of output clusters
8. **OutCluserInfo**: Output Cluster information buffer indicating various supported output clusters
9. **ClusterInfo**: Buffer for input and output cluster, supports 20 in and 20 out clusters per endpoint

5.3.13 ZigBeeGetEndpointClusterResp

Once device receives ZigBeeGetEndpointClusterrequest, it validates the input parameters and sends the response frame, which contains Cluster Id.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEGETENDPOINTCLUSTER (0x1A).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected when corresponding command is sent to device from host.

Payload Structure:

```
        struct {
            uint16_t     ClusterId;
}rsi_ClusterResp;
```

Payload Parameters:

1. **ClusterId:** Cluster id of the endpoint'ssimple descriptor locatedat thespecified index.
   - If Cluster Id is **0xFFFF** then it represents that it has received invalid parameters

5.3.14 ZigBeeGetShortAddrForSpecifiedIEEEAddrResp

Once device receives ZigBeeGetShortAddrForSpecifiedIEEEAddrrequest, it validates the input parameters and sends the response frame, which contains Short Address of device.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type–ZIGBEEGETSHORTADDRFORSPECIFIEDIEEEADDR(0x1B)

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected whenZigBeeGetShortAddrForSpecifiedIEEEAddr command is sent to device from host.

Payload Structure:

```
      struct {
            uint16_t     short_addr;
      }rsi_ShortAddrResp;
```

Payload Parameters:

1. **short_addr :** 16-bit short address of the corresponding 64-bit IEEE address if the address is known. INVALID_SHORT_ADDR**(0xFFFF)**is sent if it is not valid or Short address is not assigned or IEEE address is in correct.

5.3.15 ZigBeeStackProfileResp

Once device receives ZigBeeStackProfilerequest, it validates the input parameters and sends the response frame, which contains stack profile info

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEESTACKPROFILE (0x1C).

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeStackProfile command is sent to device from host.

Payload Structure:

```
struct {
      uint16_t    status;
  }rsi_StatusResp;
```

Payload Parameters:

The status can have two values

1. If **Status is 0x01,** stack follows Zigbeestandard Profile.
2. If **Status is 0x02,** stack follows Zigbee-Pro standard Profile.

5.3.16 ZigBeeGetIEEEAddrForSpecifiedShortAddrResp

Once device receives ZigBeeGetIEEEAddrForSpecifiedShortAddrrequest, it validates the input parameters and sends the response frame, which contains the status and ieee address of the device.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type– ZIGBEEGETIEEEADDRFORSPECIFIEDSHORTADDR(0x1D)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeGetIEEEAddrForSpecifiedShortAddr command is sent to device from host.

Payload Structure:

```
struct {
      uint8_t     status;
      uint8_t     IEEE_Addr[8];
}rsi_GetIEEEAddrForShrtAddr;
```

Payload Parameters:

1. **Status:** The status can be of one of the following .
   - **ZigBee_Success(0x00)** on success,else
   - **ZigBee_Failure**
2. **IEEE_Addr[8]:** The IEEE address corresponding to the short address.

5.3.17 ZigBeeReadNeighborTableEntryResp

Once device receives ZigBeeReadNeighborTableEntryrequest, it validates the input parameters and sends the response frame, which contains the status of the scan request.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEREADNEIGHBORTABLEENTRY (0x1E)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeReadNeighborTableEntry command is sent to device from host.

Payload Structure:

```
struct {
      uint8_t  status;
      ZigBeeNeighborTableEntry_t  Neighbor_table_entry;
}rsi_StatusResp;

struct {
      uint16_t          shortId;
      uint8_t           averageLqi;
      uint8_t           incomingCost;
      uint8_t           outgoingCost;
      uint8_t           age;
      uint8_t           aIEEEAddress[8];
}ZigBeeNeighborTableEntry_t;
```

Payload Parameters:

1. statuscan have two values

   - **g_SUCCESS_c:** indicating scan begun successfully.
   - ZigBee_Invalid_Argument: indicates invalid arguments being passed to the transmit frame.

2. **Neighbor_table_entry**

   - **shorted:** The neighbor's two byte short address.
   - **averageLqi**: An exponentially weighted moving average of the link quality values of incoming packets from this neighbor as reported by the PHY.
   - **incomingCost**:The incoming cost for this neighbor, computed from the average LQI. Values range from 1 for a good link to 7 for a bad link.
   - **outgoingCost**: The outgoing cost for this neighbor, obtained from the most recently received neighbor exchange message from the neighbor.
   - **Age**: The number of aging periods elapsed since a neighbor exchange message was last received from this neighbor. An entry with an age greater than 3 is considered stale and may be reclaimed. The aging period is 16 seconds.
   - **aIEEEAddress**: The 8 byte IEEE address of the neighbor.

5.3.18 ZigBeeGetRouteTableEntryResp

Once device receives ZigBeeGetRouteTableEntryrequest, it validates the input parameters and sends the response frame, which contains the status of request and the route table entry.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEEGETROUTETABLEENTRY(0x1F)

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected whenZigBeeGetRouteTableEntry command is sent to device from host.

Payload Structure:

```
struct {
        uint8_t     status;
        uint8_tdestAddr;
        uint8_tnextHop;
       uint8_t entry_status;
        uint8_t age;
        uint8_t    concentratorType;
        uint8_t    routeRecordState;
       }ZigBeeRoutingTableEntry_t;
```

Payload Parameters:

1) The status can have three values.
   - **ZigBee_Success(**0x00**) :** No error occured while parsing the required API parameters .
   - **ZigBee_Index_Out_Of_Range(**0x12**) :** Accessing entry is out of range in the table.
   - **ZigBee_Invalid_Argument(**0x06**) :** Argument passed for API is invalid .
2) **destAddr:** The short id of the destination.
3) **nextHop :** The short address of the next hop to this destination.
4) **entry_status :** Indicates whether this entry is active (0), being discovered (1), or unused (0x3)
5) **age :** The number of seconds since this route entry was last used to send a packet.
6) **concentratorType :** Indicates whether this destination is a High RAM Concentrator (2), a Low RAM Concentrator (1), or not a concentrator (0).
7) **routeRecordState :** For a High RAM Concentrator, indicates whether a route record isneeded (2), has been sent (1), or is no long needed (0) because a source routed message from the concentrator has been received.

5.3.19 ZigBeeTreeDepthResp

Once device receivesZigBeeTreeDepthrequest, it validates the input parameters and sends the response frame, which contains the status of the scan request.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type- ZIGBEETREEDEPTH(0x20).

Interface Type - MANAGEMENT_INTERFACE (0x1).

Expected: This is expected whenZigBeeTreeDepth command is sent to device from host.

Payload Structure:

```
struct {
        uint16_t    tree_depth;
}rsi_TreeDepthResp;
```

Payload Parameters:

1. **tree_depth**: The current tree depth where the device has joined .

5.3.20 ZigBeeGetChildIndexForSpecifiedShortAddrResp

Description:

On reception ofZigBeeGetChildIndexForSpecifiedShortAddr by device,the device sendsthe index of the child address else the status received is INVALID short address.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type - ZIGBEEGETCHILDINDEXFORSPECIFIEDSHORTADDR(0x22)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeGetChildIndexForSpecifiedShortAddr command is sent to device from host.

Payload Structure:

```
struct {
      uint8_t            Index;
}getChildDetailsFrameSnd;
```

Payload Parameters:

1. **Index**
   - index of the child-address on success,otherwise
   - INVALID_Index = 0xFF.

5.3.21 ZigBeeGetChildDetailsResp

Description:

Once device receives request for child details, the device sends child details.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type - ZIGBEEGETCHILDDETAILS (0x24)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeGetChildDetails command is sent to device from host.

Payload Structure:

```
struct {
      uint8_t                 status;
      uint8_t                 Ieee_Addr[8];
      uint8_t                 device_type;
  } rsi_ChildDetailsResp;
```

Payload Parameters:

1. **status** : The status can have the following values: Refer Zigbee status Codes for values.
   - ZigBee_Success : If the index is valid.
   - ZigBee_Invalid_Argument : If the paramters are wrong.
   - ZigBee_No_Entry : Child is not connected.

2. **Ieee_Addr :** The Ieee address of the child.
3. **device_type :** The device type of child.

5.3.22 ZigBeeReadCountOfChildDevicesResp

Description:

Once device receives read count device request, it sends the response frame, which contains the number of child devices joined.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type - ZIGBEEREADCOUNTOFCHILDDEVICES (0x26)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeReadCountOfChildDevices command is sent to device from host.

Payload Structure:

```
struct {
    uint8_t     child_count;
}rsi_CountOfChildResp;
```

Payload Parameters:

1. **child_count** : Number of child devices joined.

5.3.23 ZigBeeReadCountOfRouterChildDevicesResp

Description:

Once device receives read count device request, it sends the response frame, which contains the number of child devices joined.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type - ZIGBEEREADCOUNTOFROUTERCHILDDEVICES (0x27)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeReadCountOfRouterChildDevices command is sent to device from host.

Payload Structure:

```
struct {
    uint8_t     child_count;
}rsi_CountOfRouterChildResp;
```

Payload Parameters:

1. **child_count** : Number of child devices joined.

5.3.24 ZigBeeGetParentShortAddressResp

Description:

Once device receives parent short address request, it sends the response frame, which contains the 16-bit short address of the parent.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type - ZIGBEEGETPARENTSHORTADDRESS(0x29)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeGetParentShortAddress command is sent to device from host.

Payload Structure:

```
struct {
    uint16_t          short_addr;
}rsi_ShortAddrResp;
```

Payload Parameters:

1. **short_addr** :
   - short address of the parent ,
   - Invalid Address : 0xFFFF,

5.3.25 ZigBeeGetParentIEEEAddressResp

Description:

Once device receives parent ieee address request, it sends the response frame, which contains the 64-bit ieee address of the parent.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type - ZIGBEEGETPARENTIEEEADDRESS(0x2A)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeGetParentIEEEAddress. command is sent to device from host.

Payload Structure:

```
struct {
    uint8_t           Self_ieee[8];
}rsi_SelfIEEEAddrResp;
```

Payload Parameters:

1. Self_ieee :
   - Ieee Address of the parent.

5.3.26 ZigBeeGetMaxAPSPayloadLengthResp

Description:

Once device receives request to read the maximum APS payload length, it sends the response frame, which contains the length of the maximum payload supported by APS layer.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Command Type - ZIGBEEGETMAXAPSPAYLOADLENGTH (0x39)

Interface Type - MANAGEMENT_INTERFACE (0x1)

Expected: This is expected whenZigBeeGetMaxAPSPayloadLength.

Payload Structure:

```
struct {
    uint8_t           aps_payload_len;
}rsi_MaxApsPayloadLenResp;
```

Payload Parameters:

The **status** can have two values

1. **aps_payload_len:** Maximum aps payload length.

5.3.27 ZigBeeGetKeyResp

Description:

Once device receives ZigBeeGetKey/ZigBeeGetKeyTableEntry request, it validates the input parameters and sends the response frame. If command request was ZigBeeGetKey, then based on the type of Key sent response key information for that corresponding KeyType is expected.If command request was ZigBeeGetKeyTableEntry, then based on the Index sent response key information for that corresponding Index is retrived.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This is expected whenZigBeeGetKey/ZigBeeGetKeyTableEntry command is sent to device from host.

Payload Structure:

```
struct {
    uint8_tstatus;
    ZigBeeKeyStructBitmask_tbitmask;
    Security_Key_Typestype;
    uint8_tkey[16];
    uint32_t outgoingFrameCounter;
    uint32_t incomingFrameCounter;
    uint8_t sequenceNumber;
    uint8_t apartnerIEEEAddress[8];
}ZigBeeKeyStructure_t;


typedef enum ZigBeeKeyStructBitmask_Tag {
      g_Key_Has_Sequence_Number_c = 0x01,
      g_Key_Has_Outgoing_Frame_Counter_c = 0x02,
      g_Key_Has_Incoming_Frame_Counter_c = 0x04,
      g_Key_Has_Partner_IEEE_Addr_c = 0x08,
      g_Key_Is_Authorized_c = 0x10
} ZigBeeKeyStructBitmask_t


typedef enum Security_Key_Types_Tag {
```

```
        g_Trust_Center_Master_Key_c,
        g_Network_Key_c,
        g_Application_Master_Key_c,
        g_Link_Key_c,
        g_Trust_Center_Link_Key_c,
        g_Next_Network_Key_c
} Security_Key_Types
```

Payload Parameters:

The response payload structure information is given below:

1. **status:** For various status refer
2. **bitmask:**This bitmask indicates the presence of information about that particular field present in bitmask. For e.g., if g_Key_Has_Sequence_Number_c is set then sequence number is present in this payload. The information about each bitfield is provided as:

   - **g_Key_Has_Sequence_Number_c:** This indicates that the key has a sequence number associated with Network Key
   - **g_Key_Has_Outgoing_Frame_Counter_c:**This indicates that the key has an outgoing frame counter
   - **g_Key_Has_Incoming_Frame_Counter_c:**This indicates that the key has an incoming frame counter
   - **g_Key_Has_Partner_IEEE_Addr_c**: This indicates that the key has an associated Partner IEEE addressand the corresponding value within the ZigBeeKeyStructure_t has been populated with the data
   - **g_Key_Is_Authorized_c:**This indicates the key is authorized for use in APS data messages. If the key is not authorized for use in APS data messages it has not yet gone through a key agreement protocol, such as CBKE (i.e. ECC)

3. **keytype**: Type of key sent from host. It is one of key from the defined structure Security_Key_Types.
4. **key**: The actual value of the key to be used for Encryption and Decryption.
5. **outgoingFrameCounter**: This is the outgoing frame counter associated with the key. It will contain valid data based on the ZigBeeKeyStructBitmask_t.
6. **incomingFrameCounter**: This is the incoming frame counter associated with the key. It will contain valid data based on the ZigBeeKeyStructBitmask_t
7. **sequenceNumber**: This is the sequence number associated with the key. It will contain valid data based on the ZigBeeKeyStructBitmask_t
8. **apartnerIEEEAddress**: This is the Partner IEEE Address associated with the key (Link Key). It will contain valid data based on the ZigBeeKeyStructBitmask_t

5.3.28 ZigBeeAddOrUpdateKeyTableEntryResp

Description:

When device receives ZigBeeAddOrUpdateKeyTableEntrycommand request, it updates or adds the entry in the key table and sends this response frame to host.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This frame is expected when ZigBeeAddOrUpdateKeyTableEntry command frame is sent to device from host.

Payload Structure:

```
struct {
      uint8_tstatus;
      uint8_tIndex;
  }rsi_StatusResp;
```

Payload Parameters:

1. **Status:** The status would be one of the response value from the table Error Codes.
2. **Index :**Index of the key table where the entry is updated.

5.3.29 ZigBeeFindKeyTableEntryResp

Description:

When device receives ZigBeeFindKeyTableEntrycommand request, it traverses for the partner's IEEE address in the table entry and returns the key Index if it succeeds in finding IEEE address .

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This frame is expected when ZigBeeAddOrUpdateKeyTableEntry command frame is sent to device from host.

Payload Structure:

```
struct {
      uint8_tstatus;
      uint8_tIndex;
  }rsi_FindKeyTableResp;
```

Payload Parameters:

1. **Status:** The status would be one of the response value from the table Error Codes.
2. **Index:**Index of the key table where the entry is updated.

5.3.30 ZigBeeGetBindingIndicesResp

Description:

When device receives ZigBeeGetBindingIndicescommand request, it checks for total number of active indices in binding table and then returns those indices.

Descriptor: The 4-byte and 16-byte descriptors (Rx Operation) are received first, then follows the payload.

Expected: This frame is expected when ZigBeeGetBindingIndices command frame is sent to device from host.

Payload Structure:

```
struct {
      uint8_tnum_of_indices;
      uint8_tIndex[num_of_indices];
  }rsi_StatusResp;
```

Payload Parameters:

1. **num_of_indices:** Total number of active indices
2. **Index:**Index numbers of all the active indices

6 Appendix:

6.1 Commands and corresponding API names

The command frames specified above are represented using unique API names which are used in source code.One can findthe APIsin the provided sample project. The following table provides us API name representing the corresponding command:

Command type	API name	Cmd Id
ZIGBEEFORMNETWORK	rsi_zigb_form_network	0x01
ZIGBEEJOINNETWORK	rsi_zigb_join_network	0x02
ZIGBEEPERMITJOIN	rsi_zigb_permit_join	0x03
ZIGBEELEAVENETWORK	rsi_zigb_leave_network	0x04
ZIGBEEFINDNETWORKANDPERFORMREJOIN	rsi_zigb_find_network_and_perform_rejoin	0x05
ZIGBEEREJOINNETWORK	rsi_zigb_rejoin_network	0x06
ZIGBEENETWORKRESTORE	rsi_zigb_network_restore	0x07
ZIGBEEINITIATESCAN	rsi_zigb_initiate_scan	0x08
ZIGBEESTOPSCAN	rsi_zigb_stop_scan	0x09
ZIGBEENETWORKSTATE	rsi_zigb_network_state	0x0A
ZIGBEESTACKISUP	rsi_zigb_stack_is_up	0x0B
ZIGBEEGETSELFIEEEADDRESS	rsi_zigb_get_self_ieee_address	0x0C
ZIGBEEISITSELFIEEEADDRESS	rsi_zigb_is_it_self_ieee_address	0x0D
ZIGBEEGETSELFSHORTADDRESS	rsi_zigb_get_self_short_address	0x0E
ZIGBEESETMANUFACTURERCODEFORNODEDESC	rsi_zigb_set_manufacturer_code_for_node_desc	0x0F
ZIGBEESETPOWERDESCRIPTOR	rsi_zigb_set_power_descriptor	0x10
ZIGBEESETMAXMINCOMINGTXFRSIZE	rsi_zigb_set_maxm_incoming_txfr_size	0x11
ZIGBEESETMAXMOUTGOINGTXFRSIZE	rsi_zigb_set_maxm_outgoing_txfr_size	0x12
ZIGBEESETOPERATINGCHANNEL	rsi_zigb_set_operating_channel	0x13
ZIGBEEGETDEVICETYPE	rsi_zigb_get_device_type	0x14
ZIGBEEGETOPERATINGCHANNEL	rsi_zigb_get_operating_channel	0x15
ZIGBEEGETSHORTPANID	rsi_zigb_get_short_panid	0x16
ZIGBEEGETEXTENDEDPANID	rsi_zigb_get_extended_panid	0x17

ZIGBEEGETENDPOINTID	rsi_zigb_get_endpoint_id	0x18
ZIGBEEGETSIMPLEDDESCRIPTOR	rsi_zigb_get_simple_descriptor	0x19
ZIGBEEGETENDPOINTCLUSTOR	rsi_zigb_get_endpoint_cluster	0x1A
ZIGBEEGETSHORTADDRFORSPECIFIEDIEEEADDR	rsi_zigb_get_short_addr_for_specified_ieee_addr	0x1B
ZIGBEESTACKPROFILE	rsi_zigb_stack_profile	0x1C
ZIGBEEGETIEEEADDRFORSPECIFIEDSHORTADDR	rsi_zigb_get_ieee_addr_for_specified_short_addr	0x1D
ZIGBEEREADNEIGHBOURTABLEENTRY	rsi_zigb_read_neighbor_table_entry	0x1E
ZIGBEEGETROUTETABLEENTRY	rsi_zigb_get_route_table_entry	0x1F
ZIGBEEGETREEDEPTH	rsi_zigb_tree_depth	0x20
ZIGBEEGETNEIGHBOURTABLEENTRYCOUNT	rsi_zigb_get_neighbor_table_entry_count	0x21
ZIGBEEGETCHILDSHORTADDRESSFORTHEINDEX	rsi_zigb_get_child_short_address_for_the_index	0x22
ZIGBEEGETCHILDINDEXFORSPECIFIEDSHORTADDR	rsi_zigb_get_child_index_for_specified_short_addr	0x23
ZIGBEEGETCHILDDETAILS	rsi_zigb_get_child_details	0x24
ZIGBEEENDDEVICEPOLLFORDATA	rsi_zigb_end_device_poll_for_data	0x25
ZIGBEEREADCOUNTOFCHILDDEVICES	rsi_zigb_read_count_of_child_devices	0x26
ZIGBEEREADCOUNTOFROUTERCHILDDEVICE	rsi_zigb_read_count_of_router_child_devices	0x27
ZIGBEEGETPARENTSHORTADDRESS	rsi_zigb_get_parent_short_address	0x29
ZIGBEEGETPAREANTIEEEADDRESS	rsi_zigb_get_parent_ieee_address	0x2A
ZIGBEEBROADCASTNWKMANAGERREQUEST	rsi_zigb_broadcast_nwk_manager_request	0x2C
ZDPSENDNWKADDRREQUEST	rsi_zigb_zdp_send_nwk_addr_request	0x2D
ZDPSENDIEEEADDRREQUEST	rsi_zigb_zdp_send_ieee_addr_request	0x2E
ZDPSENDDEVICEANNOUNCEMENT	rsi_zigb_zdp_send_device_announcement	0x2F
ZDPSENDMATCHDESCRIPTORSREQUEST	rsi_zigb_send_match_descriptors_request	0x30
ZIGBEEACTIVEENDPOINTSREQU	rsi_zigb_active_endpoints_request	0x31

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ZDPSENDPOWERDESCRIPTORREQUEST	rsi_zigb_zdp_send_power_descriptor_request	0x32
ZDPSENDNODEDESCRIPTORREQUEST	rsi_zigb_zdp_send_node_descriptor_request	0x33
ZIGBEESIMPLEDESCRIPTORREQUEST	rsi_zigb_simple_descriptor_request	0x34
ZIGBEESENDUNICASTDATA	rsi_zigb_send_unicast_data	0x36
ZIGBEESENDGROUPDATA	rsi_zigb_send_group_data	0x37
ZIGBEEGETMAXAPSPAYLOADLENTH	rsi_zigb_get_max_aps_payload_length	0x39
ZIGBEESETBINDINGENTRY	rsi_zigb_set_binding_entry	0x3A
ZIGBEEDELETEBINDING	rsi_zigb_delete_binding	0x3B
ZIGBEEISBINDINGENTRYACTIVE	rsi_zigb_is_binding_entry_active	0x3C
ZIGBEECLEARBINDINGTABLE	rsi_zigb_clear_binding_table	0x3D
ZIGBEEBINDREQUEST	rsi_zigb_bind_request	0x3E
ZIGBEEENDDEVICEBINDREQUEST	rsi_zigb_enddevice_bind_request	0x3F
ZIGBEEUNBINDREQUEST	rsi_zigb_unbind_request	0x40
ZIGBEEGETKEY	rsi_zigb_get_key	0x41
ZIGBEEHAVELINKKEY	rsi_zigb_have_link_key	0x42
ZIGBEESWITCHNETWORKKEY	rsi_zigb_switch_network_key_handler	0x43
ZIGBEEREQUESTLINKKEY	rsi_zigb_request_link_key	0x44
ZIGBEEGETKEYTABLEENTRY	rsi_zigb_get_key_table_entry	0x45
ZIGBEESETKEYTABLEENTRY	rsi_zigb_set_key_table_entry	0x46
ZIGBEEADDORUPDATEKEYTABLEENTRY	rsi_zigb_add_or_update_key_table_entry	0x47
ZIGBEEFINDKEYTABLEENTRY	rsi_zigb_find_key_table_entry	0x48
ZIGBEEERASEKEYTABLEENTRY	rsi_zigb_erase_key_table_entry	0x49
ZIGBEESETSIMPLEDESCRIPTOR	rsi_zigb_set_simple_descriptor	0x4A
ZIGBEEGETBINDINGINDICES	rsi_zigb_get_binding_indices	0x60
ZIGBEEINITSTACK	rsi_zigb_init_stack	0x61
ZIGBEESTACKRESET	rsi_zigb_reset_stack	0x62

ZIGBEEUPDATESAS	rsi_zigb_set_tc_master_key	0x65
ZIGBEEUPDATEZDO	rsi_zigb_set_preconfigured_link_key	0x66
ZIGBEEDEINITSTACK	rsi_zigb_deinit_stack	0xFF

Table 58 Commands and API name

6.2 ZigBee status Codes

Below table shows status information ofcommand request frames.

Status	Description	Value
ZigBee_Success	No error occured while parsing the required API parameters	0x00
ZigBee_Failure	Error occured while parsing the required API parameters	0x01
ZigBee_Address_Table_ Entry_Is_Active	Requested address table entry is active	0x02
ZigBee_Table_Full	requested Stack table is full	0x03
ZigBee_No_Buffer	Out of buffers	0x04
ZigBee_Error_Fatal	Error occured in stack	0x05
ZigBee_Invalid_Argument	Argument passed for API is invalid	0x06
ZigBee_Fragment_Tx_Aborted	Transmission stopped inbetween in Fragmentation process	0x07
ZigBee_Fragment_Tx_Complete	Transmission Complete in Fragmentation process	0x08
ZigBee_Fragment_Rx_Aborted	Receivingstoppedinbetweeninfragmentationprocess	0x09
ZigBee_Fragment_Reception_ Completed	Receiving Complete in Fragmentation process	0x0a
ZigBee_Fragment_Message_Too_Long	Message Too Long	0x0b

ZigBee_Invalid_Call	Request might be not valid for the flashed device type or it is not in a state to receive call	0x0c
ZigBee_Device_Down	Device is not in network	0x0d
ZigBee_Unsupported	Feature not supported	0x0e
ZigBee_Unknown_Device_Type	Device type is unknown	0x0f
ZigBee_No_Key	No Requested Key	0x10
ZigBee_No_Entry	Entry in the table is empty	0x11
ZigBee_Index_Out_Of_Range	Accessing entry is out of range in the table	0x12
ZigBee_MAC_No_Data	No data pending	0x13
ZigBee_MAC_No_ACK	No ACK received	0x14
ZigBee_Channel_Access_Failure	MAC Channel Access Failure	0x15
ZigBee_MAC_Unavailable_Key	MAC key unavailable	0x06
ZigBee_Failed_Security_Check	MAC Failed Security Check	0x07
ZigBee_MAC_Invalid_Parameter	MAC Invalid Parameter	0x08

Table 59 ZigBee Status Codes

Revision History

Revision No.	Version No.	Date	Changes
1	1.0.10	Sep 2014	Initial Version
2	1.0.10fi	Oct 2014	Updated Commands
3	1.0.10gi	Oct 2014	1. Added information about ZigBee Architecture 2. Reorganized and Updated Command frames 3. Added Appendix for API names 4. Added stored configuration APIs 5. Updated API library paths
4	1.0.10i	Nov 2014	Added information about register command and card ready
5	1.1.0	Mar 2015	Update the structure members
6	1.3.0	June 2015	1.Corrections in Documentation 2.Added Ranges information for Command variables.

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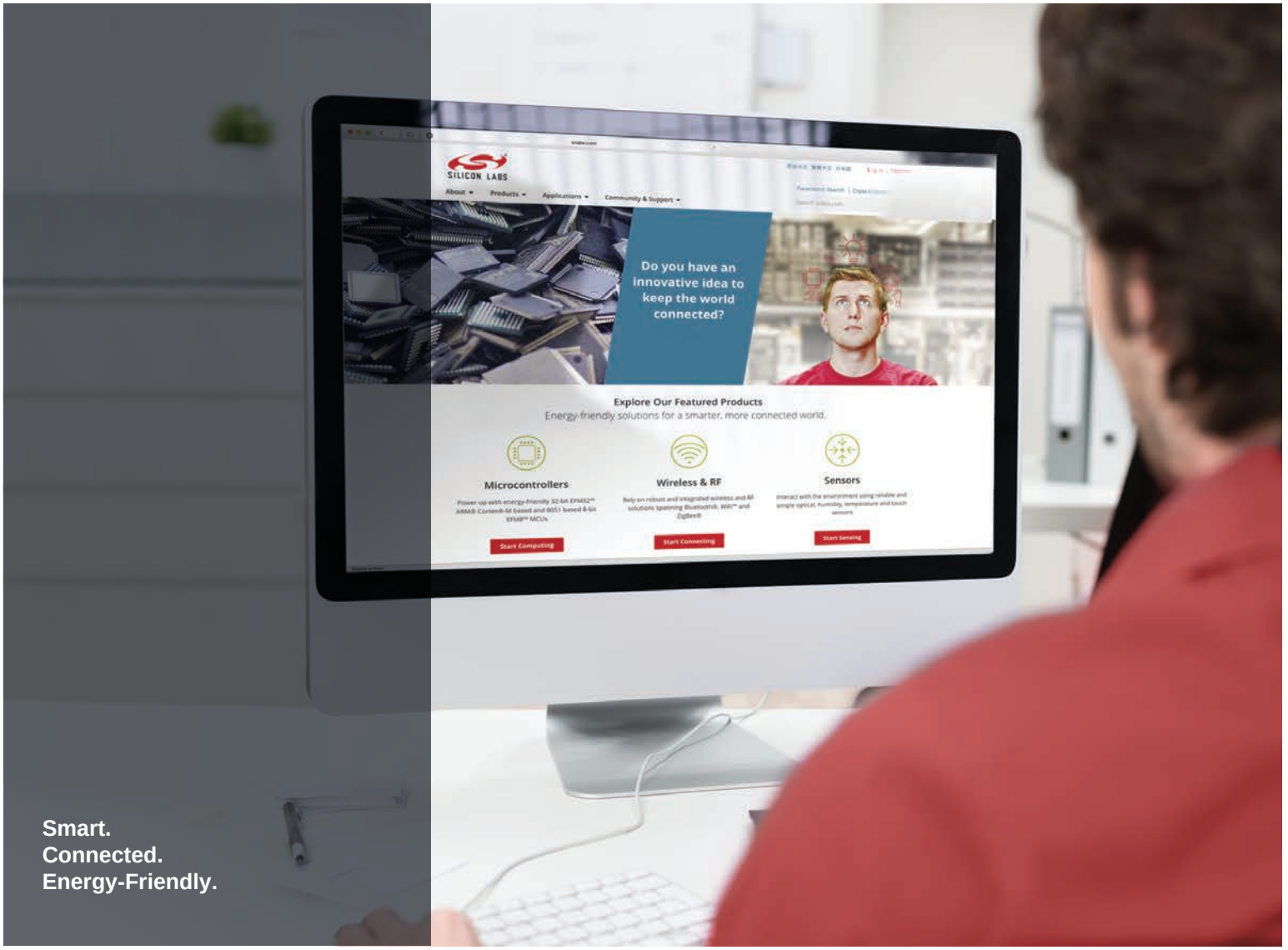

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