

Z-Stack Monitor and Test API

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1.2	Add MT_AF command and MT_ZDO callback for source routing	06/25/2009
	Add MT_AF commands to support inter-pan Add MT_ZDO commands to support link key configuration	
1.3	Add MT_ZDO commands to MSG callback register/remove/indicate	01/17/2010

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1. Introduction

1.1 Scope

This document describes the Monitor and Test (MT) interface that is used for communication between the host tester and a ZigBee device through RS-232 serial port. Tester can issue MT commands to the ZigBee target through a PC application called Z-Tool. The target must be programmed with the latest Texas Instruments Z-StackTM.

1.2 Overview

MT interfaces are divided into categories, shown in the table below. Most interfaces can be disabled or enabled by a compile flag. Depending on the desired interfaces, certain flags need to be enabled during compilation. For a list of supported compile flags, check the "**Z-Stack Compile Option**" document.

Interface	Description	Compile flags
MT_AF	This interface allows tester to interact with AF layer of the target.	MT_AF_FUNC MT_AF_CB_FUNC
MT_APP	This interface allows tester to interact with APP layer of the target to control custom tests such as test profile or user-defined test.	MT_APP_FUNC
MT_DEBUG	This interface allows tester to control the debug- messaging mechanism such as debug threshold, debug messagesetc	MT_DEBUG_FUNC
MT_NWK	This interface allows tester to interact with NWK layer of the target.	MT_NWK_FUNC MT_NWK_CB_FUNC
MT_SAPI	This interface allows tester to interact with simple API interface.	MT_SAPI_FUNC MT_SAPI_CB_FUNC
MT_SYS	This interface allows the tester to interact with the target at system level such as reset, read/write memory, read/write extended addressetc.	MT_SYS_FUNC
MT_TASK	This interface handles communication between the Monitor Test interface and Z-Stack. Tester has no control direct over this interface.	MT_TASK
MT_UART	This interface handles communication between the target and Z-Tool. Tester has no direct control over this interface.	N/A
MT_UTIL	This interface provides tester supporting functionalities such as setting PanId, getting device info, getting NV info, subscribing callbacksetc.	MT_UTIL_FUNC
MT_VERSION	This interface contains information about the release version of the software.	N/A
MT_ZDO	This interface allows tester to interact with the ZDO layer of the target.	MT_ZDO_FUNC MT_ZDO_CB_FUNC

1.3 Requirements

There are several requirements for a tester to interact with the ZigBee target through the MT interface:

- ZigBee target is programmed with Texas Instruments Z-Stack™ (ZStack-2.1.0 or newer).
- Z-Tool 2.0 or newer installed on the tester PC.
- PC is connected to ZigBee target though RS-232 serial port.

1.4 Acronyms

MT	Monitor and Test
Z-Stack	Texas Instruments ZigBee protocol stack
Z-Tool	Texas Instruments ZigBee PC-based test tool
RPC	Remote Procedure Call
FCS	Frame Check Sequence
SOF	Start of Frame
SAPI	Simple API
AF	Application Framework
SREQ	Synchronous Request
AREQ	Asynchronous Request
SRSP	Synchronous Response
ADC	Analog to Digital Conversion

1.5 Reference Documents

- [1] Z-Stack Compile Options (SWRA188).
- [2] Z-Stack User's Guides (SWRA161, SWRA162, SWRA163, SWRA164, SWRA165)
- [3] Z-Stack Developer's Guide (SWRA176)
- [4] Z-Stack Application Programming Interface (SWRA195)

2. Monitor and Test Transport Protocol

- A transport protocol is necessary so that messages can be exchanged between the tester
 and target over an RS-232 serial link. The purpose of the transport protocol is to frame
 the messages in packets for proper transmission and reception and to ensure message
 integrity.
- The physical transmission uses: no Parity; 8 data bits and 1 stop bits for each byte.
- The transmission rate will be 38.4 kbps, 57.6kbps and 115.2kbps
- The Z-Tool program must send one message at a time and wait for either the expected response message to a timeout before sending the next message or resending the current message.
- Fields that are multi-byte fields are transmitted Least Significant byte first (LSB). There is no provision for retransmission of lost packets

2.1 Format

2.1.1 General Serial Packet

- Serial packets are sent between the Z-Tool PC application and the target ZigBee device. They contain an SOF (Start of Frame), followed by a variable-length MT packet, and terminated by an FCS (Frame Check Sequence).
- Building of the serial packets is handled by MT_TransportSend() where the SOF is
 inserted at the beginning of the packet and FCS is computed and appended to the end of
 the packet.

SOF	MT CMD	FCS
Byte: 1	3-256	1

SOF (Start of Frame): This is a one byte field with value equal to **0xFE** that defines the start of each general serial packet.

MT CMD (Monitor Test Command): This contains 1 byte for the length of the actual data, 2 bytes for the MT command ID, and the data ranging from 0-253 bytes. Check 2.1.2 for more details.

FCS (Frame Check Sequence): This is a one byte field that is used to ensure packet integrity. This field is computed as an XOR of all the bytes in the message starting with LEN field and through the last byte of data. The receiver XORs all the received data bytes as indicated above and then XORs the received FCS field. If the sum is not equal to zero, the received packet is in error.

2.1.2 MT CMD

- MT CMD is the actually Monitor and Test command. It contains information that Z-Tool and Z-Stack need to control the target.
- It contains 1 byte for the length of the actual data, 2 bytes for the command, and data ranging from 0-253 bytes.

LEN	CMD	DATA
Byte: 1	2	0-253

LEN (Length): This one byte field is the number of bytes in the **DATA** field. If the **DATA** field contains no information this LEN field has a value of 0 and the total length of the **MT CMD** is 3 bytes (0 data message).

CMD (Command ID): This is a two byte field with a value denoting the Command Identification (ID) for this message. This field is described in detail below.

	CMD0	CMD1
Bit: 7-5	4-0	7-0
Type	Subsystem	ID

Type: Type for the command is described by bit 5, 6, 7 of CMD0 byte. The command type has one of the following values:

Type	CMD0Value
POLL	0x00
SREQ	0x20
AREQ	0x40
SRSP	0x60

- 0: POLL. A POLL command is used to retrieve queued data. This command is only applicable to SPI transport. For a POLL command the subsystem and ID are set to zero and data length is zero.
- 1: SREQ: A synchronous request that requires an immediate response. For example, a function call with a return value would use an SREQ command.
- 2: AREQ: An asynchronous request. For example, a callback event or a function call with no return value would use an AREQ command.
- 3: SRSP: A synchronous response. This type of command is only sent in response to a SREQ command. For an SRSP command the subsystem and ID are set to the same values as the corresponding SREQ. The length of an

SRSP is generally nonzero, so an SRSP with length=0 can be used to indicate an error.

• 4-7: Reserved.

Subsystem: The subsystem of the command is described by bit 0, 1, 2, 3, 4 of CMD0. The command subsystem has one of the following values:

Subsystem	Subsystem Value
Reserved	0x00
SYS interface	0x01
MAC interface	0x02
NWK interface	0x03
AF interface	0x04
ZDO interface	0x05
SAPI interface	0x06
UTIL interface	0x07
DEBUG interface	0x08
APP interface	0x09

ID: The command ID. The ID maps to a particular interface message. Range: 0-255.

DATA: This field contains the actual data to be transmitted. This is a field which varies in size according to the command. It can be 0 to 253.

2.2 Example

SYS_PING command will look like 0xFE 0x00 0x21 0x01 0x20

SOF	LEN	CMD0	CMD1	DATA	FCS
Byte: 1	1	1	1	0	1
0xFE	0x00	0x21	0x01	N/A	0x20

SYS_PING response will look like 0xFE 0x02 0x61 0x01 0x11 0x00 0x73

SOF	LEN	CMD0	CMD1	DATA0	DATA1	FCS
Byte: 1	1	1	1	1	1	1
0xFE	0x02	0x61	0x01	0x11	0x00	0x73

3. Monitor and Test Commands

3.1 Introduction

Monitor and Test commands (MT commands) exchanged between the target and the tester via a supported H/W medium (i.e.RS-232 or USB.) The tester controls the target using Z-Tool 2.0. In order for the target to communicate with Z-Tool 2.0, Z-Stack must be compiled with MT_SYS_FUNC. This enables the MT_SYS interface so Z-Tool 2.0 can communicate to establish the connection. Some MT interfaces support callbacks. This requires MT_UTIL_FUNC to be compiled with Z-Stack in order for the tester to subscribe callback. The corresponding MT interface must also be complied with the

correct flag in order for the callbacks to be received and processed correctly by Z-Stack and Z-Tool 2.0. For the complete details on MT flags, check section 1.2 or "Z-Stack Compile Option" document (SWRA188).

Summary:

- Z-Tool 2.0 installed and connected to target using the supported H/W interface.
- Z-Stack must be compiled with MT_SYS_FUNC and MT_UTIL_FUNC.
- Z-Stack must be compiled with MT interface what tester will use.
- Z-Stack and Z-Tool must be set at the same baud rate, no Parity, 8 data-bits and 1 stop-bit for each byte.
- If the target supports flow control, this must be set correctly as well in Z-Tool 2.0

3.2 MT_AF

This interface allows the tester to interact with the Application Framework layer (AF).

3.2.1 MT_AF Commands

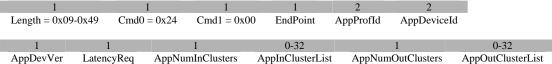
3.2.1.1 AF_REGISTER

Description:

This command enables the tester to register an application's endpoint description.

Usage:





Attributes:

Attribute	Length (byte)	Description
EndPoint	1	Specifies the endpoint of the device
AppProfId	2	Specifies the profile id of the application
AppDeviceId	2	Specifies the device description id for this endpoint
AddDevVer	1	Specifies the device version number
		Specifies latency.
LatencyReq	1	0x00-No latency
LatencyKeq		0x01-fast beacons
		0x02-slow beacons
AppNumInClusters	1	the number of Input cluster Ids following in the
Appivulilliciusieis	1	AppInClusterList
AppInClusterList	32	Specifies the list of Input Cluster Ids
AppNumOutClusters	1	Specifies the number of Output cluster Ids following in the
Approunoutclusters	1	AppOutClusterList
AppOutClusterList	32	Specifies the list of Output Cluster Ids

SRSP:

Byte:1	1	1	1
Length = $0x01$	Cmd0 = 0x64	Cmd1 = 0x00	Status

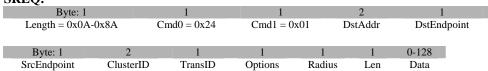
Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.2.1.2 AF_DATA_REQUEST

Description:

This command is used by the tester to build and send a message through AF layer.

Usage: SREQ:



Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Short address of the destination device
DstEndpoint	1	Endpoint of the destination device
SrcEndpoint	1	Endpoint of the source device
ClusterID	2	Specifies the cluster ID
TransID	1	Specifies the transaction sequence number of the message.
Options	1	Transmit options bit mask according to the following defines from AF.h: bit 4: turns on/off 'APS ACK'; bit 5 sets "discover route"; bit 6 sets 'APS security'; bit 7 sets 'skip routing'.
Radius	1	Specifies the number of hops allowed delivering the message (see AF_DEFAULT_RADIUS.)
Len	1	Length of the data.
Data	0-128	0-128 bytes data

SRSP:



Attributes:

Att	tribute	Length (byte)	Description
S	tatus	1	Status is either Success (0) or Failure (1)

3.2.1.3 AF_DATA_REQUEST_EXT

Description:

This extended form of the AF_DATA_REQUEST must be used to send an inter-pan message (note that the target code must be compiled with the INTER_PAN flag defined.)

Usage:

SREQ:

1	1		1	1	8		1
Length = $0x13-0x$	x93 Cmd0 =	0x24 C	Cmd1 = 0x02	DstAddrMod	e DstAdo	dr	DstEndpoint
							•
2	1	2	1	1	1	1	0-128
DstPanId	SrcEndpoint	ClusterID	TransID	Options	Radius	Len	Data

1101100000		
Attribute	Length (byte)	Description
DstAddrMode	1	A value of 3 (the enumeration value for 'afAddr64Bit') indicates 8-byte (64-bit) address mode; otherwise a value of 2 indicates 2-byte (16-bit) address mode, using only the 2 LSB's of the DstAddr field to form a 2-byte short address.
DstAddr	8	LSB to MSB for the long or short address of the destination device (upper 6 bytes are don't care when short address.)
DstEndpoint	1	Endpoint of the destination device (but a don't care if the DstPanId is non-zero, which indicates an inter-pan message.)
DstPanId	2	PanId of the destination device: 0x0000=Intra-Pan; otherwise, Inter-Pan.

SrcEndpoint	1	Endpoint of the source device.
ClusterID	2	Specifies the cluster ID
TransID	1	Specifies the transaction sequence number of the message.
Options	1	Transmit options bit mask according to the following defines from AF.h: bit 4: turns on/off 'APS ACK'; bit 5 sets "discover route"; bit 6 sets 'APS security'; bit 7 sets 'skip routing'. (This is a don't care for an inter-pan message.)
Radius	1	Specifies the number of hops allowed delivering the message (reference DEF_NWK_RADIUS.)
Len	1	Length of the data.
Data	0-128	0-128 bytes data

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x64	Cmd1 = 0x02	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.2.1.4 AF_DATA_REQUEST_SRC_RTG

Description:

This command is used by the tester to build and send a message through AF layer using source routing.

Usage:

SREQ:

Byte: 1		1	2	1				
Length $= 0$	x0B-0xFF	Cmd0 = 0	0x24	Cmd1 = 0x03	DstAddr	DstEndpoint		
Byte: 1	2	1	1	1	1	2N	1	
SrcEndpoint	ClusterID	TransID	Ontions	Radius	Relay Count (N)	RelayList	Len	

Attributes:

multipates.				
Attribute	Length (byte)	Description		
DstAddr	2	Short address of the destination device		
DstEndpoint	1	Endpoint of the destination device		
SrcEndpoint	1	Endpoint of the source device		
ClusterID	2	Specifies the cluster ID		
TransID	1	Specifies the transaction sequence number of the message.		
Options	1	Transmit options bit mask: Bit 0: turns on/off 'APS ACK'; bit 2 sets 'APS security'; bit 3 sets 'skip routing'.		
Radius	1	Specifies the number of hops allowed delivering the message (reference DEF_NWK_RADIUS.)		
Relay Count	1	Specifies the number of devices in the relay list for source routing		
Relay List	2N	List of relay devices on the source routing path. For each device, it contains 2 bytes short address for each device.		
Len	1	Length of the data.		
Data	0-128	0-128 bytes data		

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x64	Cmd1 = 0x03	Status

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Memory Failure (0x10).

3.2.1.5 AF_INTER_PAN_CTL

Description:

Inter-Pan control command and data. The data content depends upon the command and the available commands are enumerated as InterPanCtl_t.

Usage:

SREQ:

Byte: 1	1	1	1	0-3
Length = 0x01-0x04	Cmd0 = 0x24	Cmd1 = 0x10	Command	Data

Data:

Command	Data Length (byte)	Description
0: InterPanClr	0	Proxy call to StubAPS_SetIntraPanChannel() to switch channel back to the NIB-specified channel.
1: InterPanSet	1	Proxy call to StubAPS_SetInterPanChannel() with the 1-byte channel specified.
2: InterPanReg	1	If the 1-byte Endpoint specified by the data argument is found by invoking afFindEndPointDesc(), then proxy a call to StubAPS_RegisterApp() with the pointer to the endPointDesc_t found (i.e. the Endpoint must already be registered with AF).
3: InterPanChk	3	Proxy a call to StubAPS_InterPan() with the 2-byte PanId (LSB:MSB) and 1-byte EndPoint data.

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x64	Cmd1 = 0x10	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Success (0) Failure (0x10) if a channel change is in progress Invalid_Parameter (0x02). ZApsNotAllowed (0xBA) if MAC is not in an idle state.

3.2.2 MT_AF Callbacks

3.2.2.1 AF_DATA_CONFIRM

Description:

This command is sent by the device to the user after it receives a data request.

Usage:

AREO:

6.						
Byte: 1	1	1	1	1	1	
Length = $0x03$	Cmd0 = 0x44	Cmd1 = 0x80	Status	Endpoint	TransID	

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).
Endpoint	1	Endpoint of the device
TransId	1	Specified the transaction sequence number of the message

3.2.2.2 AF_INCOMING_MSG

Description:

This callback message is in response to incoming data to any of the registered endpoints on this device.

Usage:



Attributes:

Attribute	Length (byte)	Description
GroupID	2	Specifies the group ID of the device
ClusterID	2	Specifies the cluster ID (only the LSB is used in V1.0 networks.)
SrcAddr	2	Specifies the ZigBee network address of the source device sending the message.
SrcEndpoint	1	Specifies the source endpoint of the message
DstEndpoint	1	Specifies the destination endpoint of the message
WasBroadcast	1	Specifies if the message was a broadcast or not
LinkQuality	1	Indicates the link quality measured during reception
SecurityUse	1	Specifies if the security is used or not
TimeStamp	4	Specifies the timestamp of the message
TransSeqNumber	1	Specifies transaction sequence number of the message
Len	1	Specifies the length of the data.
Data	0-128	Contains 0 to 128 bytes of data.

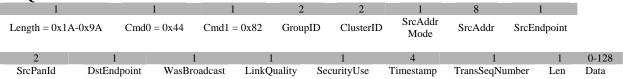
3.2.2.3 AF_INCOMING_MSG_EXT

Description:

This callback message is in response to incoming data to any of the registered endpoints on this device when the code is compiled with the INTER_PAN flag defined.

Usage:





Attribute	Length (byte)	Description
GroupID	2	Specifies the group ID of the device
ClusterID	2	Specifies the cluster ID (only the LSB is used in V1.0 networks.)
SrcAddrMode	1	A value of 3 (i.e. the enumeration value for 'afAddr64Bit') indicates 8-byte/64-bit address mode; otherwise, only the 2 LSB's of the 8 bytes are used to form a 2-byte short address.
SrcAddr	8	LSB to MSB for the long or short address of the destination device (upper 6 bytes are don't care when short address.)
SrcEndpoint	1	Specifies the source endpoint of the message
SrcPanId	2	Specifies the source PanId of the message.
DstEndpoint	1	Specifies the destination endpoint of the message
WasBroadcast	1	Specifies if the message was a broadcast or not
LinkQuality	1	Indicates the link quality measured during reception
SecurityUse	1	Specifies if the security is used or not
TimeStamp	4	Specifies the timestamp of the message
TransSeqNumber	1	Specifies transaction sequence number of the message
Len	1	Specifies the length of the data.
Data	0-128	Contains 0 to 128 bytes of data.

3.3 MT_APP

This interface allows tester to interact with APP layer of the target to control custom tests such as test profile or user-defined test.

3.3.1 MT_APP Commands

3.3.1.1 APP_MSG

Description:

This command is sent to the target in order to test the functions defined for individual applications. This command sends a raw data to an application.

Usage:

SREO:

	SKEQ:				
ı	Byte: 1	1	1	1	2
	Length = 0x07-0x87	Cmd0 = 0x29	Cmd1 = 0x00	AppEndpoint	DestAddress
ı	1	2	1	0-128	
	DestEndpoint	ClusterID	MsgLen	Message	

Attributes:

Attribute	Length (byte)	Description
AppEndpoint	1	Application endpoint of the outgoing message
DestAddress	2	Destination address of the outgoing message
DestEndpoint	1	Destination endpoint of the outgoing message
ClusterID	2	Cluster ID of the outgoing message
MsgLen	1	Length of the outgoing message
Message	0-128	Raw data packet to send to the application

SRSP:

SKSI:						
Byte: 1	1	1	1			
Length = $0x01$	Cmd0 = 0x69	Cmd1 = 0x00	Status			

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.3.1.2 APP_USER_TEST

Description:

This command is used by tester to issue user's defined commands to the application.

Usage:

SREQ:

Byte: 1	1	1	1	2	2	2
Length = $0x07$	Cmd0 = 0x29	Cmd1 = 0x01	SrcEP	CommandID	Parameter1	Parameter2

Attributes:

Attribute	Length (byte)	Description
SrcEP	1	Source Endpoint of the user-defined command
CommandID	2	Command ID of the user-defined command
Parameter1	2	Parameter #1 of the command
Parameter2	2	Parameter #2 of the command

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x69	Cmd1 = 0x01	Status

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.3.2 MT_APP Callbacks

NONE

3.4 MT_DEBUG

This interface allows tester to control the debug-messaging mechanism such as debug threshold, debug messages...etc

3.4.1 MT_DEBUG Commands

3.4.1.1 DEBUG_SET_THRESHOLD

Description:

This command allows the user to set the threshold for the debug message

Usage:

SREQ:

Byte: 1	1	1	1	1
Length = $0x03$	Cmd0 = 0x28	Cmd1 = 0x00	ComponentID	Threshold

Attributes:

Attribute	Length (byte)	Description
ComponentID	1	Uniquely identifies a particular software component on the target
Threshold	1	Specifies the threshold value for reporting debug messages by that software component

SRSP:

DIEI.					
Byte: 1	1	1	1		
Length = $0x01$	Cmd0 = 0x68	Cmd1 = 0x00	Status		

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.4.1.2 DEBUG_MSG

Description:

This command sends a debug string to Z-Tool. The content of the string is defined by the application.

Usage:

AREQ:

1	Byte: 1	1	1	1	0-254
	Length = $0x01-0xFF$	Cmd0 = 0x48	Cmd1 = 0x00	Length	String

Attributes:

Attribute	Length (byte)	Description
Length	1	Length of the string
String	0-254	String to be displayed by Z-Tool 2.0

3.4.2 MT_DEBUG Callbacks

NONE

3.5 MT_MAC

This interface allows tester to interact with the TI-MAC

3.5.1 MT_MAC Commands

3.5.1.1 MT_MAC_RESET_REQ

Description:

This command is used to send a MAC Reset command to reset MAC state machine.

Attributes:

Attribute	Length (byte)	Description
SetDefault	1	TRUE – Set the MAC pib values to default values.

SRSP:



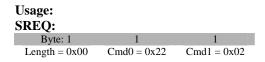
Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.5.1.2 MT_MAC_INIT

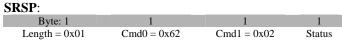
Description:

This command is used to initialize the MAC.



Attributes:

None



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.5.1.3 MT_MAC_START_REQ

Description:

This command is used to start the MAC as a coordinator or end device.

Usage: SREQ: Byte: 1 Length = 0x1CCmd0 = 0x22Cmd1 = 0x03StartTime PanID LogicalChannel ChannelPage Byte: 1 BeaconOrder SuperFrameOrder PanCoordinator BatteryLifeExt CoordRealignment RealignKeySource Byte: 1 RealignKeyIdMode RealignSecurityLevel RealignKeyIndex BeaconSecurityLevel BeaconKeySource Byte: 1 BeaconKeyIdMode BeaconKeyIndex

Attributes:

Attibutes.		
Attribute	Length (byte)	Description
StartTime	4	The time to begin transmitting beacons relative to the received beacon
PanID	2	The PAN ID to use. This parameter is ignored if Pan Coordinator is FALSE
LogicalChannel	1	The logical channel to use. This parameter is ignored if Pan Coordinator is FALSE
ChannelPage	1	The channel page to use. This parameter is ignored if Pan Coordinator is FALSE
BeaconOrder	1	The exponent used to calculate the beacon interval
SuperFrameOrder	1	The exponent used to calculate the superframe duration
PanCoordinator	1	Set to TRUE to start a network as PAN coordinator
		If this value is TRUE, the receiver is disabled after
BatteryLifeExt	1	MAC_BATT_LIFE_EXT_PERIODS full backoff periods following the
		interframe spacing period of the beacon frame
CoordRealignment	1	Coordinator Realignment
RealignKeySource	8	Key Source of this data frame

Security Level of this data frame:

		Security Level	Value
		NO_SECURITY	0x00
		MIC_32_AUTH	0x01
RealignSecurityLevel	1	MIC_64_AUTH	0x02
		MIC_128_AUTH	0x03
		AES_ENCRYPTION	0x04
		AES_ENCRYPTION_MIC_32	0x05
		AES_ENCRYPTION_MIC_64	0x06
		AES_ENCRYPTION_MIC_128	0x07
		Key Id Mode of this data frame:	

Key	Id	Mode	of	this	data	frame	:
-----	----	------	----	------	------	-------	---

		Key Id Mode	value
Daalian Van Jahra da	1	NOT_USED	0x00
RealignKeyIdMode	1	KEY_1BYTE_INDEX	0x01
		KEY_4BYTE_INDEX	0x02
		KEY_8BYTE_INDEX	0x03
RealignKeyIndex	1	Key Index of this data frame	
BeaconKeySource	8	Key Source of this data frame	

Security Level of this data frame:

		Security Level	Value
		NO_SECURITY	0x00
		MIC_32_AUTH	0x01
BeaconSecurityLevel	1	MIC_64_AUTH	0x02
		MIC_128_AUTH	0x03
		AES_ENCRYPTION	0x04
		AES_ENCRYPTION_MIC_32	0x05
		AES_ENCRYPTION_MIC_64	0x06
		AES_ENCRYPTION_MIC_128	0x07
BeaconKevIdMode	1	Key Id Mode of this data frame	

BeaconKeyIndex Key Index of this data frame

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x62	Cmd1 = 0x03	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.5.1.4 MT_MAC_SYNC_REQ

Description:

This command is used to request synchronization to the current network beacon

Usage:

SREQ:

Byte: 1	1	1	1	1	1
Length = $0x03$	Cmd0 = 0x22	Cmd1 = 0x04	LogicalChannel	ChannelPage	TrackBeacon

Attributes:

Attribute	Length (byte)	Description
LogicalChannel	1	The logical channel to use.
ChannelPage	1	The channel page to use.
TrackBeacon	1	Set to TRUE to continue tracking beacons after synchronizing with the first beacon. Set to FALSE to only synchronize with the first beacon

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

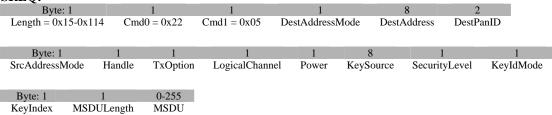
3.5.1.5 MT_MAC_DATA_REQ

Description:

This command is used to send (on behalf of the next higher layer) MAC Data Frame packet.

Usage:

SREQ:



Attribute	Length (byte)	Description
-----------	------------------	-------------

Description

Specifies the format of the destination address.

DestAddressMode 1

Mode	Value	Description
ADDRESS_NOT_PRESENT	0x00	Address Not Present
GROUP_ADDRESS	0x01	Group address
ADDRESS_16_BIT	0x02	Address 16 bit
ADDRESS_64_BIT	0x03	Address 64 bit
BROADCAST	0xFF	Broadcast

DestAddress 8

Address of the destination. PAN ID of the destination.

DestPanID 2

Specifies the format of the source address.

Option

SrcAddressMode

Mode	Value	Description
ADDRESS_NOT_PRESENT	0x00	Address Not Present
GROUP_ADDRESS	0x01	Group address
ADDRESS_16_BIT	0x02	Address 16 bit
ADDRESS_64_BIT	0x03	Address 64 bit
BROADCAST	0xFF	Broadcast

Handle

Handle of the packet.

Transmitting options:

Acknowledged transmission. The MAC will attempt to MAC_TXOPTION_ACK 0x01 retransmit the frame until it is acknowledged MAC_TXOPTION_GTS 0x02 GTS transmission (unused) Indirect transmission. The MAC will queue the data and wait for the destination MAC_TXOPTION_INDIRECT 0x04 device to poll for it. This can only be used by a coordinator device This proprietary option MAC_TXOPTION_NO_RETRANS 0x10 prevents the frame from being retransmitted This proprietary option prevents a MAC_TXOPTION_NO_CNF 0x20 MAC_MCPS_DATA_CNF event from being sent for this

frame Use PIB value

MAC_ALT_BE for the minimum backoff exponent Use the power and channel

values in macDataReq_t instead of the PIB values

0x40

0x80

Value

TxOption

LogicalChannel 1 Channel that data frame will be transmitted.

Power 1 Power level that data frame will be transmitted.

KeySource 8 Key Source of this data frame.

Security Level of this data frame:

MAC_TXOPTION_ALT_BE

MAC_TXOPTION_PWR_CHAN

SecurityLevel 1

Security Level	Value
NO_SECURITY	0x00
MIC_32_AUTH	0x01
MIC_64_AUTH	0x02
MIC_128_AUTH	0x03
AES_ENCRYPTION	0x04
AES_ENCRYPTION_MIC_32	0x05
AES_ENCRYPTION_MIC_64	0x06
AES_ENCRYPTION_MIC_128	0x07

Key Id Mode of this data frame:

KeyIdMode	1	Key Id Mode NOT_USED	Value 0x00
•		KEY_1BYTE_INDEX	0x01
		KEY_4BYTE_INDEX	0x02
		KEY_8BYTE_INDEX	0x03

KeyIndex	1	Key Index of this data frame.
MSDULength	1	Length of the data.
MSDU	0-255	Actual data that will be sent.

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x62	Cmd1 = 0x05	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.5.1.6 MT_MAC_ASSOCIATE_REQ

Description:

This command is used to request (on behalf of the next higher layer) an association with a coordinator

Usage:

SREQ:

Byte: 1	1	1	1	1	1
Length = $0x12$	Cmd0 = 0x22	Cmd1 = 0x06	LogicalChannel	ChannelPage	CoordAddressMode

Byte: 8	2	1	8	1	1	1
CoordAddress	CoordPanID	CapabilityInformation	KeySource	SecurityLevel	KeyIdMode	KeyIndex

Attributes:

CapabilityInformation

KeySource

8

Attitibutes.				
Attribute	Length (byte)	Desc	ription	
LogicalChannel	1	Channel that data frame will be transmitted.		
ChannelPage	1	The channel page to be used.		
		Specifies the format of the coordinate	nator addre	ss.
		Mode	Value	Description
CoordAddressMode	1	ADDRESS_NOT_PRESENT	0x00	Address Not Present
CoordAddressiviode	1	GROUP_ADDRESS	0x01	Group address
		ADDRESS_16_BIT	0x02	Address 16 bit
		ADDRESS_64_BIT	0x03	Address 64 bit
		BROADCAST	0xFF	Broadcast
CoordAddress	8	Address of the Coordinator.		
CoordPanID	2	PAN ID of the coordinator.		
		Bit map which specifies the opera	tional capa	bilities of the device.
		Bit: 0 – Alternate PAN Coordinat 1 – Device type: 1- ZigBee R	outer; 0 – I	End Device

2 – Power Source: 1 Main powered
3 – Receiver on when idle
4 – Reserved
5 – Reserved
6 – Security capability
7 – Reserved

Key Source of this data frame

Security Level of this data frame:

SecurityLevel 1

Security Level	Value
NO_SECURITY	0x00
MIC_32_AUTH	0x01
MIC_64_AUTH	0x02
MIC_128_AUTH	0x03
AES_ENCRYPTION	0x04
AES_ENCRYPTION_MIC_32	0x05
AES_ENCRYPTION_MIC_64	0x06
AES_ENCRYPTION_MIC_128	0x07

Key Id Mode of this data frame:

KeyIdMode

Key Id Mode	Value
NOT_USED	0x00
KEY_1BYTE_INDEX	0x01
KEY_4BYTE_INDEX	0x02
KEY_8BYTE_INDEX	0x03

KeyIndex 1 Key Index of this data frame.

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x62	Cmd1 = 0x06	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.5.1.7 MT_MAC_ASSOCIATE_RSP

Description:

This command is sent by the host to response to the MAC_ASSOCIATE_IND.

Usage:

SREQ:

Byte: 1	1	1	8	2	1
Length = $0x0B$	Cmd0 = 0x42	Cmd1 = 0x50	ExtAddr	AssocShortAddress	AssocStatus

Attributes:

Attribute	Length (byte)	Descrip	tion	
ExtAddr	8	Extended Address of the device requesting association		
AssocShortAddress	2	Short address for the associated device. Allocated by the coordinator.		
		Status of the association:	Value	
AssocStatus	1	SUCCESSFUL ASSOCIATION	0x00	
		PAN_AT_CAPACITY	0x01	
		PAN_ACCESS_DENIED	0x02	

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x62	Cmd1 = 0x50	Status

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.5.1.8 MT_MAC_DISASSOCIATE_REQ

Description:

This command is used to request (on behalf of the next higher layer) a disassociation of the device from the coordinator.

Usage:

_	~	-
S	REO):

Byte: 1	1	1	1	8	2
Length = $0x18$	Cmd0 = 0x22	Cmd1 = 0x07	DeviceAddressMode	DeviceAddress	DevicePanID

Byte: 1	1	8	1	1	1
DisassociateReason	TxIndirect	KeySource	SecurityLevel	KeyIdMode	KeyIndex

Attributes:

D

Attribute	Length (byte)	Description

Specifies the format of the device address.

		Mode	Value	Description
N A dd M d.	1	ADDRESS_NOT_PRESENT	ESS_NOT_PRESENT 0x00 Ac	Address Not Present
DeviceAddressMode	1	GROUP_ADDRESS	0x01	Group address
		ADDRESS_16_BIT	0x02	Address 16 bit
		ADDRESS_64_BIT	0x03	Address 64 bit
		BROADCAST	0xFF	Broadcast

DeviceAddress Device Address. DevicePanID 2 Network PAN ID of device.

Reason of disassociation:

DisassociateReason	4	Reason	Value
DisassociateReason	1	RESERVED	0x00
		COOR_WISHES_DEV_LEAVE	0x01
		DEV WISHES LEAVE	0x02

TxIndirect Tx indirect KeySource 8

Key Source of this data frame.

Security Level of this data frame:

		Security Level	Value
		NO_SECURITY	0x00
		MIC_32_AUTH	0x01
SecurityLevel	1	MIC_64_AUTH	0x02
		MIC_128_AUTH	0x03
		AES_ENCRYPTION	0x04
		AES_ENCRYPTION_MIC_32	0x05
		AES_ENCRYPTION_MIC_64	0x06
		AES ENCRYPTION MIC 128	0x07

Key Id Mode of this data frame:

		Key Id Mode	Value
KeyIdMode	1	NOT_USED	0x00
•		KEY_1BYTE_INDEX	0x01
		KEY_4BYTE_INDEX	0x02
		KEY_8BYTE_INDEX	0x03

1 KeyIndex Key Index of this data frame.

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x62	Cmd1 = 0x07	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.5.1.9 MT_MAC_GET_REQ

Description:

This command is used to read (on behalf of the next higher layer) a MAC PIB attribute.

Usage:

SREO:

Byte: 1 1 1 1 1 Length = 0x01 Cmd0 = 0x22 Cmd1 = 0x08 Attribute

Attributes:

Attribute Length (byte) Description

Specifies the MAC PIB Attributes:

MAC PIB Attribute Value ZMAC_ACK_WAIT_DURATION 0x40 ZMAC_ASSOCIATION_PERMIT ZMAC_AUTO_REQUEST ZMAC_BATT_LIFE_EXT 0x41 0x42 0x43 ZMAC_BATT_LEFT_EXT_PERIODS 0x44 ZMAC_BEACON_MSDU 0x45 ZMAC_BEACON_MSDU_LENGTH 0x46 ZMAC_BEACON_ORDER 0x47 ZMAC_BEACON_TX_TIME 0x48 ZMAC_BSN 0x49 ZMAC_COORD_EXTENDED_ADDRESS 0x4A ZMAC_COORD_SHORT_ADDRESS 0x4B ZMAC_DSN 0x4CZMAC_GTS_PERMIT 0x4D ZMAC_MAX_CSMA_BACKOFFS
ZMAC_MIN_BE 0x4E 0x4F ZMAC_PANID 0x50 ZMAC_PROMISCUOUS_MODE 0x51 ZMAC_RX_ON_IDLE 0x52 ZMAC_SHORT_ADDRESS 0x53 ZMAC_SUPERFRAME_ORDER
ZMAC_TRANSACTION_PERSISTENCE_TIME 0x54 0x55 ZMAC_ASSOCIATED_PAN_COORD 0x56 ZMAC_MAX_BE 0x57 ZMAC_FRAME_TOTAL_WAIT_TIME 0x58ZMAC_MAC_FRAME_RETRIES 0x59 ZMAC_RESPONSE_WAIT_TIME 0x5A ZMAC_SYNC_SYMBOL_OFFSET 0x5BZMAC_TIMESTAMP_SUPPORTED 0x5C ZMAC_SECURITY_ENABLED 0x5D ZMAC_PHY_TRANSMIT_POWER 0xE0ZMAC_LOGICAL_CHANNEL 0xE1 ZMAC_EXTENDED_ADDRESS ZMAC_ALT_BE 0xE2 0xE3

Attribute

SRSP:

Byte: 1 1 1 1 16

 $Length = 0x11 \hspace{1cm} Cmd0 = 0x62 \hspace{1cm} Cmd1 = 0x08 \hspace{1cm} Status \hspace{1cm} Data$

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).
Data	16	1-16 bytes value of the PIB attribute.

3.5.1.10 MT_MAC_SET_REQ

Description:

This command is used to request the device to write a MAC PIB value.

Usage:

SREQ:

Attributes:

Attribute

Attribute	Length (byte)	Description
-----------	------------------	-------------

Specified the MAC PIB Attribute:

MAC PIB Attribute	Value
ZMAC_ACK_WAIT_DURATION	0x40
ZMAC_ASSOCIATION_PERMIT	0x41
ZMAC_AUTO_REQUEST	0x42
ZMAC_BATT_LIFE_EXT	0x43
ZMAC_BATT_LEFT_EXT_PERIODS	0x44
ZMAC_BEACON_MSDU	0x45
ZMAC_BEACON_MSDU_LENGTH	0x46
ZMAC_BEACON_ORDER	0x47
ZMAC_BEACON_TX_TIME	0x48
ZMAC_BSN	0x49
ZMAC_COORD_EXTENDED_ADDRESS	0x4A
ZMAC_COORD_SHORT_ADDRESS	0x4B
ZMAC_DSN	0x4C
ZMAC_GTS_PERMIT	0x4D
ZMAC_MAX_CSMA_BACKOFFS	0x4E
ZMAC_MIN_BE	0x4F
ZMAC_PANID	0x50
ZMAC_PROMISCUOUS_MODE	0x51
ZMAC_RX_ON_IDLE	0x52
ZMAC_SHORT_ADDRESS	0x53
ZMAC_SUPERFRAME_ORDER	0x54
ZMAC_TRANSACTION_PERSISTENCE_TIME	0x55
ZMAC_ASSOCIATED_PAN_COORD	0x56
ZMAC_MAX_BE	0x57
ZMAC_FRAME_TOTAL_WAIT_TIME	0x58
ZMAC_MAC_FRAME_RETRIES	0x59
ZMAC_RESPONSE_WAIT_TIME	0x5A
ZMAC_SYNC_SYMBOL_OFFSET	0x5B
ZMAC_TIMESTAMP_SUPPORTED	0x5C
ZMAC_SECURITY_ENABLED	0x5D
ZMAC_PHY_TRANSMIT_POWER	0xE0
ZMAC_LOGICAL_CHANNEL	0xE1
ZMAC_EXTENDED_ADDRESS	0xE2
ZMAC_ALT_BE	0xE3

 $Attribute Value \qquad 16 \qquad 1 \hbox{-} 16 \ bytes \ of the PIB \ attribute \ value.}$

SRSP:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x62	Cmd1 = 0x09	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.5.1.11 MT_MAC_SCAN_REQ

Description:

This command is used to send a request to the device to perform a network scan.

Usage:

SREQ:



Attributes:

Attribute Length (byte) Description

This represents a bit-mask of channels to be scanned when starting the device:

Channel	Value
NONE	0x00000000
ALL_CHANNELS	0x07FFF800
CHANNEL 11	0x00000800
CHANNEL 12	0x00001000
CHANNEL 13	0x00002000
CHANNEL 14	0x00004000
CHANNEL 15	0x00008000
CHANNEL 16	0x00010000
CHANNEL 17	0x00020000
CHANNEL 18	0x00040000
CHANNEL 19	0x00080000
CHANNEL 20	0x00100000
CHANNEL 21	0x00200000
CHANNEL 22	0x00400000
CHANNEL 23	0x00800000
CHANNEL 24	0x01000000
CHANNEL 25	0x02000000
CHANNEL 26	0x04000000

ScanChannels 4

Specifies the scan type:

ScanType 1

Scan Type	Value
ENERGY_DETECT	0x00
ACTIVE	0x01
PASSIVE	0x02
ORPHAN	0x03

ScanDuration 1 ChannelPage 1 Duration of the scan - The exponent used in the scan duration calculation.

The channel page on which to perform the scan.

KeySource 8 Key Source of this data frame.

Security Level of this data frame:

SecurityLevel 1

Security Level	Value
NO_SECURITY	0x00
MIC_32_AUTH	0x01
MIC_64_AUTH	0x02
MIC_128_AUTH	0x03
AES_ENCRYPTION	0x04
AES_ENCRYPTION_MIC_32	0x05
AES_ENCRYPTION_MIC_64	0x06
AES_ENCRYPTION_MIC_128	0x07

Key Id Mode of this data frame:

KeyIdMode

Key Id Mode	Value
NOT_USED	0x00
KEY_1BYTE_INDEX	0x01
KEY_4BYTE_INDEX	0x02
KEY_8BYTE_INDEX	0x03

KeyIndex 1 Key Index of this data frame.

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x62	Cmd1 = 0x0C	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1)

3.5.1.12 MT_MAC_ORPHAN_RSP

Description:

This command is sent by the host to response to the ORPHAN_IND.

Usage:

SREQ:

~ ~ .						
Byte: 1	1	1	8	2	1	
Length = 0x0B	Cmd0 = 0x42	Cmd1 = 0x51	ExtAddr	AssocShortAddress	AssociatedMember	

Attributes:

Attribute	Length (byte)	Description
ExtAddr	8	Extended Address of the device sending the orphan notification
AssocShortAddress	2	Short address of the orphan device
AssociatedMember	1	TRUE if the orphan is a associated member. FALSE otherwise.

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x62	Cmd1 = 0x51	Status

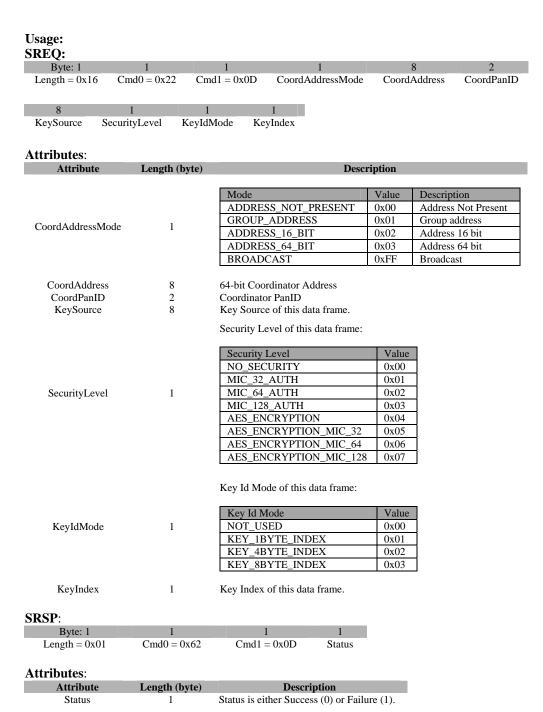
Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.5.1.13 MT_MAC_POLL_REQ

Description:

This command is used to send a MAC data request poll.



3.5.1.14 MT_MAC_PURGE_REQ

Description:

This command is used to send a request to the device to purge a data frame

Usage: SREQ: Byte: 1 1 1 1

AttributeLength (byte)DescriptionMsduHandle1Msdu Handle

SRSP:

 Byte: 1
 1
 1
 1

 Length = 0x01 Cmd0 = 0x62 Cmd1 = 0x0E Status

Attributes:

 Attribute
 Length (byte)
 Description

 Status
 1
 Status is either Success (0) or Failure (1).

3.5.1.15 MT_MAC_SET_RX_GAIN_REQ

Description:

This command is used to send a request to the device to set Rx gain.

Usage:

SREQ:

Byte: 1 1 1 1 1 Length = 0x01 Cmd0 = 0x22 Cmd1 = 0x0F Mode

Attributes:

Attribute	Length (byte)	Description
Mode	1	PA/PNA mode – TRUE/FALSE

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1)

3.5.1.16 MT_MAC_SRC_MATCH_ENABLE

Description:

This command is used to enable AUTOPEND and source address matching.

Usage:

SREQ:

Byte: 1 1 1 1 1 1 Length = 0x02 Cmd0 = 0x22 Cmd1 = 0x10 AddrType NumEntries

Attribute	Length (byte)	Description		
		Address types used in AutoPend		
AddrType	1	Auto Pend Address Type	Value	
• • • • • • • • • • • • • • • • • • • •		SHORT_ADDRESS	0x02	
		EXTENDED_ADDRESS	0x03	
NumEntries	1	Numbers of source address table	entries to be used.	

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x62	Cmd1 = 0x10	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

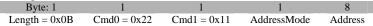
3.5.1.17 MT_MAC_SRC_MATCH_ADD_ENTRY

Description:

This command is used to add a short or extended address to source address table.

Usage:

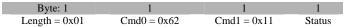
SREQ:



Attributes:

Attribute	Length (byte)	Description			
		Mode	Value	Description	
AddressMode 1	1	ADDRESS_16_BIT	0x02	Address 16 bit	
		ADDRESS_64_BIT	0x03	Address 64 bit	
Address	8	Address of the device that wi			
PanID	2	the address mode. PAN ID of the device. Only to	ise when the ad	ldress is a short address.	

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.5.1.18 MT_MAC_SRC_MATCH_DEL_ENTRY

Description:

This command is used to delete a short or extended address to source address table.

Usage:

SREQ:

Byte: 1	1	1	1	8	2
Length = 0x0B	Cmd0 = 0x22	Cmd1 = 0x12	AddressMode	Address	PanID

Attribute	Length (byte)		Descrip	tion
		Mode	Value	Description
AddressMode	1	ADDRESS_16_BIT	0x02	Address 16 bit
		ADDRESS_64_BIT	0x03	Address 64 bit
Address PanID	8 2	Address of the device that wi address mode. PAN ID of the device. Only		

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x62	Cmd1 = 0x12	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

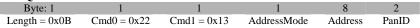
3.5.1.19 MT_MAC_SRC_MATCH_CHECK_SRC_ADDR

Description:

This command is used to check if a short or extended address is in the source address table.

Usage:

SREQ:



Attributes:

Attribute	(byte)	Description			
		Mode	Value	Description	
AddressMode	1	ADDRESS_16_BIT	0x02	Address 16 bit	
		ADDRESS_64_BIT	0x03	Address 64 bit	

Address 8 Address of the device that will be checked - Can be short or extended depends on the address mode.

PanID 2 PAN ID of the device. Only use when the address is a short address.

Tamb 2 TAN 15 of the device. Only use when the address is a short address

SRSP:

Attributes:

Attribute	Length (byte)	Description	
Status	1	Status is either Success (0) or Failure (1).	

3.5.1.20 MT_MAC_SRC_MATCH_ACK_ALL_PENDING

Description:

This command is used to enabled/disable acknowledging all packets with pending bit set.

Usage:

SREQ:



Attributes:

Attribute	Length (byte)	Description
Option	1	TRUE - acknowledging all packets with pending field set. FALSE - Otherwise

SRSP:



Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.5.1.21 MT_MAC_SRC_MATCH_CHECK_ALL_PENDING

Description:

This command is used to check if acknowledging all packets with pending bit set is enabled.

Usage:



Cmd0 = 0x15

Attributes:

Length = 0x00

None

SRSP:



Cmd1 = 0x09

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).
Value	1	TRUE - acknowledging all packets with pending bit set is enabled. FALSE – otherwise.

3.5.2 MT_MAC Callbacks

3.5.2.1 MT_MAC_SYNC_LOSS_IND

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) an indication of the synchronization loss.

Usage:



8	1	1	1
KeySource	SecurityLevel	KeyIdMode	KeyIndex

Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).
PanId	2	PAN ID of the device
LogicalChannel	1	Logical Channel of the device where the synchronization is lost
ChannelPage	1	Channel Page of the device where the synchronization is lost
KeySource	8	Key Source of this data frame.

Security Level of this data frame:

SecurityLevel 1

Security Level	Value
NO_SECURITY	0x00
MIC_32_AUTH	0x01
MIC_64_AUTH	0x02
MIC_128_AUTH	0x03
AES_ENCRYPTION	0x04
AES_ENCRYPTION_MIC_32	0x05
AES_ENCRYPTION_MIC_64	0x06
AES_ENCRYPTION_MIC_128	0x07

Key Id Mode of this data frame:

KeyIdMode

Value
0x00
0x01
0x02
0x03

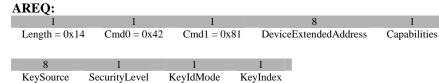
KeyIndex 1 Key Index of this data frame.

3.5.2.2 MT_MAC_ASSOCIATE_IND

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) an association indication message.

Usage:



Atti ibutes.		
Attribute	Length (byte)	Description
DeviceExtendedAddress	8	Extended address of the device
Capabilities	1	Specifies the operating capabilities of the device being directly joined. Bit weighted values follow: Bit: 0 – Alternate PAN Coordinator 1 – Device type: 1- ZigBee Router; 0 – End Device 2 – Power Source: 1 Main powered 3 – Receiver on when idle 4 – Reserved 5 – Reserved 6 – Security capability 7 – Reserved
KeySource	8	Key Source of this data frame.

Security Level of this data frame:

SecurityLevel 1

Security Level	Value
NO_SECURITY	0x00
MIC_32_AUTH	0x01
MIC_64_AUTH	0x02
MIC_128_AUTH	0x03
AES_ENCRYPTION	0x04
AES_ENCRYPTION_MIC_32	0x05
AES_ENCRYPTION_MIC_64	0x06
AES_ENCRYPTION_MIC_128	0x07

Key Id Mode of this data frame:

KeyIdMode 1

Key Id Mode	Value
NOT_USED	0x00
KEY_1BYTE_INDEX	0x01
KEY_4BYTE_INDEX	0x02
KEY_8BYTE_INDEX	0x03

KeyIndex 1 Key Index of this data frame.

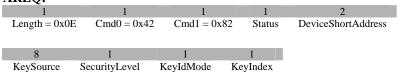
3.5.2.3 MT_MAC_ASSOCIATE_CNF

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) an association confirmation message.

Usage:





Length (byte)	Description		
1	This field indicates either SUCCESS (0) or FAILURE (1).		
2	Short address of the device		
8	Key Source of this data frame.		
	Security Level of this data frame:		
	Security Level	Value	
	NO_SECURITY	0x00	
	MIC_32_AUTH	0x01	
1	MIC_64_AUTH	0x02	
	MIC_128_AUTH	0x03	
	AES_ENCRYPTION	0x04	
	AES_ENCRYPTION_MIC_32	0x05	
	AES_ENCRYPTION_MIC_64	0x06	
	AES_ENCRYPTION_MIC_128	0x07	
	1 2	1 This field indicates either SUCCESS 2 Short address of the device 8 Key Source of this data frame. Security Level of this data frame: Security Level NO_SECURITY MIC_32_AUTH 1 MIC_64_AUTH MIC_128_AUTH AES_ENCRYPTION AES_ENCRYPTION_MIC_32 AES_ENCRYPTION_MIC_64	1 This field indicates either SUCCESS (0) or FAI 2 Short address of the device 8 Key Source of this data frame. Security Level of this data frame: Security Level Value

Key Id Mode of this data frame:

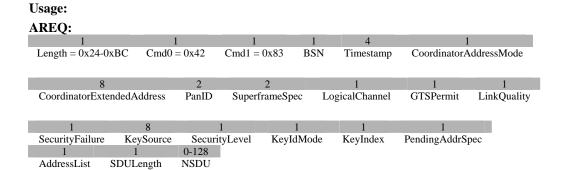
		Key Id Mode	Value
KeyIdMode	1	NOT_USED	0x00
		KEY_1BYTE_INDEX	0x01
		KEY_4BYTE_INDEX	0x02
		KEY_8BYTE_INDEX	0x03

KeyIndex 1 Key Index of this data frame.

3.5.2.4 MT_MAC_BEACON_NOTIFY_IND

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC beacon notify indication.



Attribute	Length (byte)	Description			
BSN	1	BSN			
Timestamp	4	Timestamp of the message			
		Address mode of the coordinator			
		Mode	Value	Description	
	1	ADDRESS_NOT_PRESENT	0x00	Address Not Present	
CoordinatorAddressMode		GROUP_ADDRESS	0x01	Group address	
		ADDRESS_16_BIT	0x02	Address 16 bit	
		ADDRESS_64_BIT	0x03	Address 64 bit	
		BROADCAST	0xFF	Broadcast	
CoordinatorExtendedAddress	8	Extended address of the coordinat	or		
PanID	2	Pan ID of the device			
SuperframeSpec	2				
LogicalChannel	1	Current logical channel			
GTSPermit	1	TRUE/FALSE - Permit/Not permit GTS			
LinkQuality	1	Link quality of the message			
SecurityFailure	1				
KeySource	8	Key Source of this data frame.			

Security Level of this data frame:

SecurityLevel 1

Security Level	Value
NO_SECURITY	0x00
MIC_32_AUTH	0x01
MIC_64_AUTH	0x02
MIC_128_AUTH	0x03
AES_ENCRYPTION	0x04
AES_ENCRYPTION_MIC_32	0x05
AES_ENCRYPTION_MIC_64	0x06
AES_ENCRYPTION_MIC_128	0x07

Key Id Mode of this data frame:

KeyIdMode	1
Regiunioue	1

Key Id Mode	Value
NOT_USED	0x00
KEY_1BYTE_INDEX	0x01
KEY_4BYTE_INDEX	0x02
KEY_8BYTE_INDEX	0x03

KeyIndex	1
PendingAddrSpec	1
AddressList	1
SDULength	1
NSDU	0-128

I jet of address associate with the device

Key Index of this data frame.

List of address associate with the device Beacon Length Beacon payload

3.5.2.5 MT_MAC_DATA_CNF

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC data confirmation.

Usage:





Attributes:

TICLIDATES.				
Attribute Length (byte)		Description		
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).		
Handle	1	Handle of the message		
Timestamp	4	64bit timestamp of the message		
Timestamp2	2	16bit timestamp of the message		

3.5.2.6 MT_MAC_DATA_IND

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC data indication.

Usage:





1	8	1	1	1	1	0-128
DSN	KeySource	SecurityLevel	KeyIdMode	KeyIndex	Length	Data

A

Attributes:						
Attribute	Length (byte)	e) Description				
		Source address mode				
		Mode Mode	Value	Description		
		ADDRESS_NOT_PRESENT	0x00	Address Not Present		
SrcAddrMode	1	GROUP ADDRESS	0x01	Group address		
Brer iddiviode	•	ADDRESS 16 BIT	0x02	Address 16 bit		
		ADDRESS_64_BIT	0x03	Address 64 bit		
		BROADCAST	0xFF	Broadcast		
SrcAddr	8	Source address				
DstAddrMode	1	Destination address mode				
DstAddr	8	Destination address				
Timestamp	4	32bit timestamp of the message				
Timestamp2	2	16bit timestamp of the message				
SrcPanID	2	Pan ID of the source address				
DstPanID	2	Pan ID of the destination address				
LinkQuality	1	Link quality				
Correlation	1	Correlation				
RSSI	1	RSSI				
DSN	1	DSN				
KeySource	8	Key Source of this data frame.				
		Security Level of this data frame:				
		Security Level	Value			
		NO_SECURITY	0x00			
		MIC_32_AUTH	0x01			
SecurityLevel	1	MIC_64_AUTH	0x02			
		MIC_128_AUTH	0x03			
		AES_ENCRYPTION	0x04			
		AES_ENCRYPTION_MIC_32	0x05			
		AES_ENCRYPTION_MIC_64	0x06			
		AES_ENCRYPTION_MIC_128	0x07			
		Key Id Mode of this data frame:				
		Key Id Mode	Value			
KeyIdMode	1	NOT_USED	0x00			
		KEY_1BYTE_INDEX	0x01			
		KEY_4BYTE_INDEX	0x02]		
		KEY_8BYTE_INDEX	0x03			
KeyIndex	1	Key Index of this data frame.				
Length	1	Data length				
Data	0-128	Data				

3.5.2.7 MT_MAC_DISASSOCIATE_IND

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC disassociation indication.

Usage:

AREQ:

1	1	1	8	1	8
Length = $0x14$	Cmd0 = 0x42	Cmd1 = 0x86	ExtendedAddress	DisassociateReason	KevSource

Ì	1	1	1	
	SecurityLevel	KeyIdMode	KeyIndex	

Attributes:

Attributes:					
Attribute	Length (byte)	Desc	ription		
ExtendedAddress	8	Extended address of the device leavi	Extended address of the device leaving the networ		
		Reason of the disassociation:			
DisassociateReason	1	Reason		Value	
		Coordinator wishes the device to o	lisassociate	0x01	
		Device itself wishes to disassociat	e	0x02	
KeySource	8	Key Source of this data frame.			
		Security Level of this data frame:			
		Security Level	Value		
		NO_SECURITY	0x00		
		MIC_32_AUTH	0x01		
SecurityLevel	1	MIC_64_AUTH	0x02		
		MIC_128_AUTH	0x03		
		AES_ENCRYPTION	0x04		
		AES_ENCRYPTION_MIC_32	0x05		
		AES_ENCRYPTION_MIC_64	0x06		
		AES_ENCRYPTION_MIC_128	0x07		
		Key Id Mode of this data frame:			
		Key Id Mode	Value		
KeyIdMode	1	NOT_USED	0x00		
		KEY_1BYTE_INDEX	0x01		
		KEY_4BYTE_INDEX	0x02		
		KEY_8BYTE_INDEX	0x03		
KeyIndex	1	Key Index of this data frame.			

3.5.2.8 MT_MAC_DISASSOCIATE_CNF

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC disassociate confirm.

Usage:



1	1	1	1	1	8	2
Length = $0x0C$	Cmd0 = 0x42	Cmd1 = 0x87	Status	DeviceAddrMode	DeviceAddr	DevicePanID

Attribute	Length (byte)	Description			
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).			
		Address mode of the device Mode ADDRESS NOT PRESENT	Value 0x00	Description Address Not Present	
DeviceAddrMode	1	GROUP ADDRESS	0x00	Group address	
Devices radiiviode	•	ADDRESS_16_BIT	0x02	Address 16 bit	
		ADDRESS_64_BIT	0x03	Address 64 bit	
		BROADCAST	0xFF	Broadcast	
DeviceAddr	8	Address of the device			
DevicePanID	2	Pan ID of the device			

3.5.2.9 MT_MAC_ORPHAN_IND

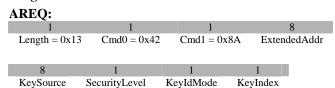
Length (byte)

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC orphan indication.

Description

Usage:



Attributes: Attribute

	Zengen (Sjee)		
ExtendedAddr	8	Extended address of the orphan devi	ce
KeySource	8	Key Source of this data frame.	
		Security Level of this data frame:	
		Security Level	Value
		NO_SECURITY	0x00
		MIC_32_AUTH	0x01
SecurityLevel	1	MIC_64_AUTH	0x02
·		MIC_128_AUTH	0x03
		AES_ENCRYPTION	0x04
		AES_ENCRYPTION_MIC_32	0x05
		AES_ENCRYPTION_MIC_64	0x06
		AES_ENCRYPTION_MIC_128	0x07

Key Id Mode of this data frame:

		Key Id Mode	Value
KeyIdMode	1	NOT_USED	0x00
		KEY_1BYTE_INDEX	0x01
		KEY_4BYTE_INDEX	0x02
		KEY_8BYTE_INDEX	0x03

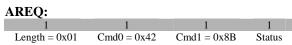
KeyIndex Key Index of this data frame.

3.5.2.10 MT_MAC_POLL_CNF

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC poll confirmation.

Usage:



Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.5.2.11 MT_MAC_SCAN_CNF

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC scan confirmation.

Usage:

AREQ:



Attributes:

Attribute	Length (byte)	D	escription
Status	1	This field indicates either	SUCCESS (0) or FAILURE (1).
ED	1	ED max energy.	
		Specifies the scan type:	
		Scan Type	Value
ScanType	1	ENERGY_DETECT	0x00
31		ACTIVE	0x01
		PASSIVE	0x02
		ORPHAN	0x03
ChannelPage	1	Channel Page	
UnscannedChannelList	4	List of un-scanned chann	els
ResultListCount	1	Number of item in the res	sult list
ResultListMaxLength	1	Max length of the result l	ist in bytes
ResultList	0-128	Result list	

3.5.2.12 MT_MAC_COMM_STATUS_IND

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC communication indicator.

Usage:

AREQ:



Attribute	Length (byte)	Desc	ription	
Status	1	This field indicates either SUCCE	SS (0) or I	FAILURE (1).
		Destination address mode		
		Mode	Value	Description
		ADDRESS_NOT_PRESENT	0x00	Address Not Present
DstAddrMode	1	GROUP_ADDRESS	0x01	Group address
		ADDRESS_16_BIT	0x02	Address 16 bit
		ADDRESS_64_BIT	0x03	Address 64 bit
		BROADCAST	0xFF	Broadcast
SrcAddr	8	Source address		
DstAddr	8	Destination address		

Timestamp	4	Timestamp of the message
DevicePanID	2	Pan ID of the device that generate the indication
Reason	1	Reason for this communication indication.
KeySource	8	Key Source of this data frame.

Security Level of this data frame:

SecurityLevel	1	

Security Level	Value
NO_SECURITY	0x00
MIC_32_AUTH	0x01
MIC_64_AUTH	0x02
MIC_128_AUTH	0x03
AES_ENCRYPTION	0x04
AES_ENCRYPTION_MIC_32	0x05
AES_ENCRYPTION_MIC_64	0x06
AES_ENCRYPTION_MIC_128	0x07

Key Id Mode of this data frame:

KeyIdMode 1

Key Id Mode	Value
NOT_USED	0x00
KEY_1BYTE_INDEX	0x01
KEY_4BYTE_INDEX	0x02
KEY_8BYTE_INDEX	0x03

KeyIndex 1 Key Index of this data frame.

3.5.2.13 MT_MAC_START_CNF

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC start confirmation.

Usage:

AREQ:



Attributes:

Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.5.2.14 MT_MAC_RX_ENABLE_CNF

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC Rx enable confirmation.

Usage:

AREQ:



Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.5.2.15 MT_MAC_PURGE_CNF

Description:

This callback is called by the MAC to send (on behalf of the next higher layer) a MAC purge confirmation.

Usage:





Attributes:

Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).
Handle	1	Handle of this message

3.6 MT NWK

Not supported.

3.7 MT SAPI

This interface allows tester to interact with the simple API interface.

3.7.1 MT_SAPI Commands

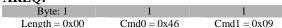
3.7.1.1 ZB_SYSTEM_RESET

Description:

This command will reset the device.

Usage:

AREQ:



Attributes:

None

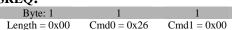
3.7.1.2 ZB_START_REQUEST

Description:

This command starts the ZigBee stack. When the ZigBee stack starts, the device reads configuration parameters from nonvolatile memory and the device joins its network. The ZigBee stack calls the zb_StartConfirm callback function when the startup process completes. After the start request process completes, the device is ready to send, receive, and route network traffic.

Usage:

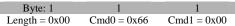
SREQ:



Attributes:

None

SRSP:



Attributes:

None

3.7.1.3 ZB_PERMIT_JOINING_REQUEST

Description:

This command is used to control the joining permissions and thus allows or disallows new devices from joining the network.

Usage:

SREQ:



Attributes:

multipates.		
Attribute	Length (byte)	Description
Destination	2	The destination parameter indicates the address of the device for which the joining permissions should be set. This is usually the local device address or the special broadcast address that denotes all routers and coordinator (0xFFFC). This way the joining permissions of a single device or the whole network can be controlled.
Timeout	1	Indicates the amount of time in seconds for which the joining permissions should be turned on. If timeout is set to 0x00, the device will turn off the joining permissions indefinitely. If it is set to 0xFF, the joining permissions will be turned on indefinitely.

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.7.1.4 ZB_BIND_DEVICE

Description:

This command establishes or removes a 'binding' between two devices. Once bound, an application can send messages to a device by referencing the commandId for the binding.

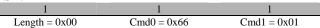
Usage:

SREQ:

SKEQ.					
1	1	1	1	2	8
Length = $0x0B$	Cmd0 = 0x26	Cmd1 = 0x01	Create	CommandId	Destination

rittibutes.		
Attribute	Length (byte)	Description
Create	1	TRUE to create a binding, FALSE to remove a binding.
CommandId	2	The identifier of the binding
Destination	8	Specifies the 64-bit IEEE address of the device to bind to.

SRSP:



Attributes:

None

3.7.1.5 ZB_ALLOW_BIND

Description:

This command puts the device into the Allow Binding Mode for a given period of time. A peer device can establish a binding to a device in the Allow Binding Mode by calling zb_BindDevice with a destination address of NULL.

Usage:

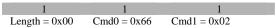
SREQ:



Attributes:

I I I I I I I I I I I I I I I I I I I				
Attribute	Length (byte)	Description		
		The number of seconds to remain in the allow binding mode. Valid values range from 1		
Timeout	1	through 65. If 0, the Allow Bind mode will be set false without timeout. If greater than 64, the Allow Bind mode will be true.		

SRSP:



Attributes:

None

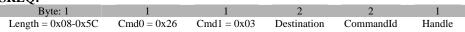
3.7.1.6 ZB_SEND_DATA_REQUEST

Description:

This command initiates transmission of data to a peer device.

Usage:

SREQ:



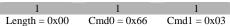


multiputes.			
Attribute	Attribute Length (byte) Description		
	2	The destination of the data. The destination can be one of the following:	
Destination		- 16-Bit short address of device [0-0xfffD]	
Destination		- ZB_BROADCAST_ADDR sends the data to all devices in the network.	
		- ZB_BINDING_ADDR sends the data to a previously bound device.	
C11.1	Id 2	The command ID to send with the message. If the ZB_BINDING_ADDR destination is	
CommandId		used, this parameter also indicates the binding to use.	
Handle	1	A handle used to identify the send data request.	
Ack	1	TRUE if requesting acknowledgement from the destination.	
Radius	1	The max number of hops the packet can travel through before it is dropped.	

Len 1 Specifies the size of the Data buffer in bytes.

Data 0-84 Data

SRSP:



Attributes:

None

3.7.1.7 ZB_READ_CONFIGURATION

Description:

This command is used to get a configuration property from nonvolatile memory.

Usage:

SREQ:



Attributes:

Attribute	Length (byte)	Description
ConfigId	1	Specifies the identifier for the configuration property.

SRSP:

Byte: 1	1	1	1	1	1	0-128
Length = 0x03-0x83	Cmd0 = 0x66	Cmd1 = 0x04	Status	ConfigId	Len	Value

Attributes:

Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).
ConfigId	1	Specifies the identifier for the configuration property.
Len	1	Specifies the size of the Value buffer in bytes.
Value	0-128	buffer to hold the configuration property.

3.7.1.8 ZB_WRITE_CONFIGURATION

Description:

This command is used to write a Configuration Property to nonvolatile memory.

Usage:

SREQ:

Byte: 1	1	1	1	1	1-128
Length = 0x03-0x83	Cmd0 = 0x26	Cmd1 = 0x05	ConfigId	Len	Value

Attributes:

Attribute Length (byte)		Description
ConfigId	1	The identifier for the configuration property
Len	1	Specifies the size of the Value buffer in bytes.
Value	1-128	The buffer containing the new value of the configuration property.

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x66	Cmd1 = 0x05	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.7.1.9 ZB_GET_DEVICE_INFO

Description:

This command retrieves a Device Information Property.

Usage:

SREQ:

Byte: 1	1	1	1	
Length = $0x01$	Cmd0 = 0x26	Cmd1 = 0x06	Param	

Attributes:

Attribute	Length (byte)	Description
Param	1	The identifier for the device information.

SRSP:

1	1	1	1	8
Length = $0x09$	Cmd0 = 0x66	Cmd1 = 0x06	Param	Value

Attributes:

Attribute	Length (byte)	Description
Param	1	The identifier for the device information.
Value	2	A buffer to hold the device information

3.7.1.10 ZB_FIND_DEVICE_REQUEST

Description:

This command is used to determine the short address for a device in the network. The device initiating a call to zb_FindDeviceRequest and the device being discovered must both be a member of the same network. When the search is complete, the zv_FindDeviceConfirm callback function is called.

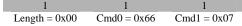
SREQ:



Attributes:

Attribute	Length (byte)	Description
SearchKey	8	Specifies the value to search on.

SRSP:



Attributes:

None

3.7.2 MT_SAPI Callbacks

3.7.2.1 ZB_START_CONFIRM

Description:

This callback is called by the ZigBee stack after a start request operation completes.

Usage:

AREQ:



Attributes:

Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.7.2.2 ZB_BIND_CONFIRM

Description:

This callback is called by the ZigBee stack after a bind operation completes.

Usage:

AREO:

1	1	1	2	1
Length = $0x03$	Cmd0 = 0x46	Cmd1 = 0x81	CommandId	Status

Attributes:

Attribute	Length (byte)	Description
CommandId	2	The command ID of the binding being confirmed.
Status	1	Specifies the status of the bind operation.

3.7.2.3 ZB_ALLOW_BIND_CONFIRM

Description:

This callback indicates another device attempted to bind to this device.

Usage:

AREQ:

1	1	1	2
Length = $0x02$	Cmd0 = 0x46	Cmd1 = 0x82	Source

Attributes:

Attribute	Length (byte)	Description
Source	2	Contains the address of the device attempted to bind to this device.

3.7.2.4 ZB_SEND_DATA_CONFIRM

Description:

This callback indicates the data has been sent.

Usage:

AREQ:



Attributes:

Attribute	Length (byte)	Description
Handle	1	Specifies the handle.
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.7.2.5 ZB_RECEIVE_DATA_INDICATION

Description:

This callback is called asynchronously by the ZigBee stack to notify the application when data is received from a peer device.

Usage:

AREQ:

1	1	1	2	2	2	0-84
Length = $0x06-5A$	Cmd0 = 0x46	Cmd1 = 0x87	Source	Command	Len	Data

Attributes:

Attribute	Length (byte)	Description
Source	2	Specifies the short address of the peer device that sent the data.
Command	2	The command ID associated with the data.
Len	2	Specifies the number of bytes in the Data parameter.
Data	0-84	The data sent by the peer device.

3.7.2.6 ZB_FIND_DEVICE_CONFIRM

Description:

This callback is called by the ZigBee stack when a find device operation completes.

Usage:

AREQ:



Attributes:

Attribute	Length (byte)	Description
SearchType	1	The type of search that was performed.
SearchKey	2	Value that the search was executed on.
Result	8	The result of the search.

3.8 MT_SYS

This interface allows the tester to interact with the target at system level such as reset, read/write memory, read/write extended address...etc.

3.8.1 MT_SYS Commands

3.8.1.1 SYS_RESET_REQ

Description:

This command is sent by the tester to reset the target device

Usage:

AREQ:

1 1		1	1	
	Length = $0x01$	Cmd0 = 0x41	Cmd1 = 0x00	Type

Attributes:

Attribute	Length (byte)	Description
		Rrequests a target device reset (0) or serial bootloader reset (1). If the target device
Type	1	does not support serial bootloading, bootloader reset commands are ignored and no
		response is sent from the target.

3.8.1.2 SYS_PING

Description:

This command issues PING requests to verify if a device is active and check the capability of the device.

Usage:

SREQ:

1	1	1
Length = $0x00$	Cmd0 = 0x21	Cmd1 = 0x01

Attributes:

None

SRSP:

1 1		1	2	
Length = $0x02$	Cmd0 = 0x61	Cmd1 = 0x01	Capabilities	

Attributes:

atti ibutes.		
Attribute	Length (byte)	Description

This field represents the interfaces that this device can handle (compiled into the device). Bit weighted and defined as:

Capabilities

Capability	Value
MT_CAP_SYS	0x0001
MT_CAP_MAC	0x0002
MT_CAP_NWK	0x0004
MT_CAP_AF	0x0008
MT_CAP_ZDO	0x0010
MT_CAP_SAPI	0x0020
MT_CAP_UTIL	0x0040
MT_CAP_DEBUG	0x0080
MT_CAP_APP	0x0100
MT_CAP_ZOAD	0x1000

3.8.1.3 SYS_VERSION

Description:

This command is used to request for the device's version string.

Usage:

SREQ:

1	1	1
Length = $0x00$	Cmd0 = 0x21	Cmd1 = 0x02

Attributes:

Attribute	Length (byte)	Description
Type	1	Requests a target device reset (0) or serial bootloader reset (1). If the target device does not support serial bootloading, bootloader reset commands are ignored and no response is sent from the target.

SRSP:

1	1	1	1	1	1	1	1
Length = $0x05$	Cmd0 = 0x61	Cmd1 = 0x02	TransportRev	Product	MajorRel	MinorRel	HwRev

Attributes:

Attribute	Length (byte)) Description	
TransportRev	1	Transport protocol revision	
Product	1	Product ID	
MajorRel	1	Software major release number	
MinorRel	1	Software minor release number	
HwRev	1	Chip hardware revision	

3.8.1.4 SYS_SET_EXTADDR

Description:

This command is used to set the extended address of the device.

Usage:

SREQ:

1	1	1	8
Length = $0x08$	Cmd0 = 0x21	Cmd1 = 0x03	ExtAddress

Attributes:

Attribute	Length (byte)	Description
ExtAddress	8	The device's extended address.

SRSP:

SIGI.					
1	1	1	1		
Length = $0x01$	Cmd0 = 0x61	Cmd1 = 0x03	Status		

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (1) or Failure (0)

3.8.1.5 SYS_GET_EXTADDR

Description:

This command is used to get the extended address of the device.

Usage:

SREQ:

oite Q.					
1	1	1			
Length = $0x00$	Cmd0 = 0x21	Cmd1 = 0x04			

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (1) or Failure (0)

SRSP:

1	1	1	8	
Length = $0x08$ Cmd0 = $0x61$		Cmd1 = 0x04	ExtAddress	

Attributes:

Attribute	Length (byte)	Description
ExtAddress	8	The device's extended address.

3.8.1.6 SYS_RAM_READ

Description:

This command is used by the tester to read a single memory location in the target RAM. The command accepts an address value and returns the memory value present in the target RAM at that address.

Usage:

SREQ:

1	1	1	2	1	
Length = $0x03$	Cmd0 = 0x21	Cmd1 = 0x05	Address	Len	

Attributes:

1100110000		
Attribute	Length (byte)	Description
Address	2	Address of the memory that will be read.
Len	1	The number of bytes that will be read from the target RAM.

SRSP:

	2-2-7					
ĺ	1	1	1	1	1	0-128
ſ	Length = $0x02-0x82$	Cmd0 = 0x61	Cmd1 = 0x05	Status	Len	Value

Attributes:

ricci in acco.		
Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).
Len	1	The number of bytes that will be read from the target RAM.
Value	0-128	The value read from the target RAM.

3.8.1.7 SYS_RAM_WRITE

Description:

This command is used by the tester to write to a particular location in the target RAM. The command accepts an address location and a memory value. The memory value is written to the address location in the target RAM.

Usage:

SREQ:

1	1	1	2	1	1-128
Length = 0x04-0x84	Cmd0 = 0x21	Cmd1 = 0x06	Address	Len	Value

Attributes:

Attribute	Length (byte)	Description
Address	2	Address of the memory that will be read.
Len	1	The number of bytes that will be read from the target RAM.
Value	1-128	The value written to the target RAMS.

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x61	Cmd1 = 0x06	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.8.1.8 SYS_OSAL_NV_READ

Description:

This command is used by the tester to read a single memory item in the target non-volatile memory. The command accepts an attribute ID value and returns the memory value present in the target for the specified attribute ID.

Usage:

SREQ:

1	1	1	2	1
Length = $0x03$	Cmd0 = 0x21	Cmd1 = 0x08	Id	Offset

Attributes:

Attribute	Length (byte)	Description
Id	2	The id of the NV item.
Offset	1	Number of bytes offset from the beginning or the NV value.

SRSP:

1	1	1	1	1	0-128
Length = 0x02-0x82	Cmd0 = 0x61	Cmd1 = 0x08	Status	Len	Value

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).
Len	1	Length of the NV value.
Value	0-128	Value of the NV item.

3.8.1.9 SYS_OSAL_NV_WRITE

Description:

This command is used by the tester to write to a particular item in non-volatile memory. The command accepts an attribute ID and an attribute value. The attribute value is written to the location specified for the attribute ID in the target.

Usage:

SREQ:

1	1	1	2	1	1	1-128
Length = 0x04-0x84	Cmd0 = 0x21	Cmd1 = 0x09	Id	Offset	Len	Value

Attributes:

Attribute	Length (byte)	Description
Id	2	The id of the NV item.
Offset	1	Number of bytes offset from the beginning or the NV value.
Len	1	Length of the NV value.
Value	0-128	Value of the NV item.

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x61	Cmd1 = 0x09	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.8.1.10 SYS_OSAL_START_TIMER

Description

This command is used by the tester to start a timer event. The event will expired after the indicated amount of time and a notification will be sent back to the tester.

Usage

SREO:

~ · ·				
1	1	1	1	2
Length = $0x03$	Cmd0 = 0x21	Cmd1 = 0x0A	Id	Timeout

Attributes:

Attribute	Length (byte)	Description
Id	1	The id of the timer event (0-3)
Timeout	2	Amount of time it will take before the event expired in milliseconds.

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x61	Cmd1 = 0x0A	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.8.1.11 SYS_OSAL_STOP_TIMER

Description:

This command is used by the tester to stop a timer event.

Usage:

SREQ:

~ ~ ·			
1	1	1	1
Length = $0x01$	Cmd0 = 0x21	Cmd1 = 0x0B	Id

Attribute	Length (byte)	Description
Id	1	The id of the timer event (0-3).

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x61	Cmd1 = 0x0B	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.8.1.12 SYS_RANDOM

Description:

This command is used by the tester to get a random 16-bit number.

Usage:

SREQ:

1	1	1
Length = $0x00$	Cmd0 = 0x21	Cmd1 = 0x0C

Attributes:

None

SRSP:

~			
1	1	1	2
Length = $0x02$	Cmd0 = 0x61	Cmd1 = 0x0C	Value

Attributes:

Attribute	Length (byte)	Description
Value	2	The random value

3.8.1.13 **SYS_ADC_READ**

Description

This command is used by the tester to read a value from the ADC based on specified channel and resolution.

Usage

SREO:

<u></u>					
	1	1	1	1	1
	Length = $0x02$	Cmd0 = 0x21	Cmd1 = 0x0D	Channel	Resolution

Attributes:

Attribute Length (byte) Description

The channel of the ADC that will be used.

Channel

Temperature Sensor 0x0E

Voltage Reading 0x0F

Value

0x00

0x01

0x02

0x03

0x04

0x05

0x06

0x07

Resolution of the reading. This can be 8-bit, 10-bit, 12-bit or 14-bit.

Resolution 1

Resolution	Value
8-bit	0x00
10-bit	0x01
12-bit	0x02
14-bit	0x03

SRSP:

1	1	1	2
Length = $0x02$	Cmd0 = 0x61	Cmd1 = 0x0D	Value

Attributes:

Attribute	Length (byte)	Description
Value	2	Value of the ADC reading based on the specified information.

3.8.1.14 SYS_GPIO

Description

This command is used by the tester to control the 4 GPIO pins on the CC2530-ZNP build.

Usage

SREQ:

1	1	1	1	1
Length = $0x02$	Cmd0 = 0x21	Cmd1 = 0x0E	Operation	Value

Operation -1 byte - specifies the type of operation to perform on the GPIO pins. It can take the values, shown in the table below, with effects dictated by the bit values of the value parameter:

Operation	Description
Set direction (0x00)	Configure the direction of the GPIO pins. A value of 0 in a bit position configures
	the corresponding GPIO pin as an Input while a value of 1 configures it as Output.
Set Input mode (0x01)	Configure the Input mode of the GPIO pins. A value of 0 in a bit position
	configures it as pull-up mode while a 1 configures it in tri-state Input mode. (Note:
	P1_0 and P1_1 of the CC2530 can only be set in tri-state input mode).
Set (0x02)	A value of 1 in a bit position will set the corresponding GPIO pin (writes a 1).
Clear (0x03)	A value of 0 in a bit position will clear the corresponding GPIO pin (writes a 0).
Toggle (0x04)	A value of 1 in a bit position will toggle the corresponding GPIO pin.
Read (0x05)	Reads the GPIO pins.

SRSP:

1	1	1	2
Length = $0x01$	Cmd0 = 0x61	Cmd1 = 0x0E	Value

Attributes:

Attribute	Length (byte)	Description
Value	1	The value read from the GPIO pins.

3.8.1.15 SYS_STACK_TUNE

Description

This command is used by the tester to tune intricate or arcane settings at runtime.

Usage

SREQ:

1	1	1	1	1
Length = $0x02$	Cmd0 = 0x21	Cmd1 = 0x0F	Operation	Value

Attributes:

The tuning operation to be executed according to the STK_Tune_t enumeration:

Operation	Value
Set the transmitter power level according to the value of the Value parameter	0x00
which should correspond to the valid values specified by the	
ZMacTransmitPower_t enumeration (0xFD – 0x16)	
Set RxOnWhenIdle off/on if the value of Value is 0/1; otherwise return the	0x01
current setting of RxOnWhenIdle.	

SRSP:

1	1	1	2
Length = $0x01$	Cmd0 = 0x61	Cmd1 = 0x0F	Value

Attributes:

Attribute	Length (byte)	Description
Value 1		Applicable status of the tuning operation.

3.8.2 MT_SYS Callbacks

3.8.2.1 SYS_RESET_IND

Description

This command is sent by the device to indicate the reset

Usage

AREQ:

1	1	1	1	1	1	
Length = $0x06$	Cmd0 = 0x41	Cmd1 = 0x80	Reason	TransportRev	ProductId	

1	1	1
MajorRel	MinorRel	HwRev

muttoutes.			
Attribute	Length (byte)	Description	

Reason for the reset.

Daggan	1	Resolution	0x00 0x01
Reason	1	Power-up	0x00
		External	0x01
		Watch-dog	0x02

TransportRev 1 Transport protocol revision.

Product 1 Major release number.

MinorRel 1 Minor release number.

HwRev 1 Hardware revision number.

3.8.2.2 SYS_OSAL_TIMER_EXPIRED

Description:

This command is sent by the device to indicate a specific time has been expired.

Usage:

AREQ:

1	1	1	1
Length = $0x01$	Cmd0 = 0x41	Cmd1 = 0x81	Id

Attributes:

Attribute	Length (byte)	Description
Id	1	The id of the timer event (0-3)

3.9 MT_UART

This interface handles communication between the target and Z-Tool. Tester has no direct control over this interface. There is no direct command for the tester to interact with this interface.

3.10 MT_UTIL

This interface provides tester supporting functionalities such as setting PanId, getting device info, getting NV info, subscribing callbacks...etc.

3.10.1 MT_UTIL Commands

3.10.1.1 UTIL_GET_DEVICE_INFO

Description:

This command is sent by the tester to retrieve the device info.

Usage:

SREO:

~ • •		
1	1	1
Length = $0x00$	Cmd0 = 0x27	Cmd1 = 0x00

Attributes:

None

SRSP:

1	1	1	1	8	2	1
Length = $0x02$	Cmd0 = 0x67	Cmd1 = 0x00	Status	IEEEAddr	ShortAddr	DeviceType

1	1	0-128
DeviceState	NumAssocDevices	AssocDeviceList

Attributes:

Attributes:		
Attribute	Length (byte)	Description
Status	1	Status is a one byte field and is either success(0) or fail(1). The fail status is returned if the address value in the command message was not within the valid range.
IEEEAddr	8	IEEE address of the device
ShortAddr	2	Short address of the device
DeviceType	1	Indicates device type, where bits 0 to 2 indicate the capability for the device to operate as a coordinator, router, or end device, respectively.
		Indicates the state of the device with different possible states as shown below:
DeviceState	1	0x00: Initialized - not started automatically 0x01: Initialized - not connected to anything 0x02: Discovering PAN's to join 0x03: Joining a PAN 0x04: Rejoining a PAN, only for end devices 0x05: Joined but not yet authenticated by trust center 0x06: Started as device after authentication 0x07: Device joined, authenticated and is a router
NumAssocDevices AssocDevicesList	1 Array	0x08: Starting as ZigBee Coordinator 0x09: Started as ZigBee Coordinator 0x0A: Device has lost information about its parent Specifies the number of devices being associated to the target device. Array of 16-bits specifies the network address associated with the device.

3.10.1.2 UTIL_GET_NV_INFO

Description:

This command is used by the tester to read a block of parameters from Non-Volatile storage of the target device.

Usage:

SREQ:

<u> </u>		
1	1	1
Length = $0x00$	Cmd0 = 0x27	Cmd1 = 0x01

Attributes:

None

SRSP:

DIGI:							
1	1	1	1	8	4	2	
Length = $0x20$	Cmd0 = 0x67	Cmd1 = 0x01	Status	IEEEAddr	ScanChannels	PanID	

1	16
SecurityLevel	PreConfigKey

Atti ibutes.			
Attribute	Length (byte)	Description	
Status	1	A value of zero indicates success. Failure is indicated by a non-zero value, representaing a bit mask of each item that failed to be retrieved from NV memory.	

IEEEAddr

PanID

ScanChannels

SecurityLevel

PreConfigKey

(ScanChannels), and so forth. Data values for failed items are returned as one or more bytes of 0xFF, the typical value read from erased NV memory. IEEE address of the device

This represents a bit-mask of channels to be scanned when starting the device. Specifies the Pan ID to start or join. Set to 0xFFFF to select a PAN after scanning. This specifies the network messaging security level, zero disables security.

3.10.1.3 UTIL_SET_PANID

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Description:

Store a PanID value into Non-Volatile memory to be used the next time the target device resets.

This specifies the pre-configured security key.

Usage:

SREQ:

	1	1	1	2
	Length = $0x02$	Cmd0 = 0x27	Cmd1 = 0x02	PanID

Attributes:

Attribute	Length (byte)	Description
PanID	2	PanID that will be set

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x67	Cmd1 = 0x02	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.10.1.4 UTIL_SET_CHANNELS

Description:

This command is used to store a channel select bit-mask into Non-Volatile memory to be used the next time the target device resets.

Usage:

SREO:

1 1		1	4	
	Length = $0x04$	Cmd0 = 0x27	Cmd1 = 0x03	Channels

Attributes:

Attribute	Length (byte)	Description
Channels	4	A bit-mask representing the channel(s) to scan the next time the target device resets.

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x67	Cmd1 = 0x03	Status

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1)

3.10.1.5 UTIL_SET_SECLEVEL

Description:

This command is used to store a security level value into Non-Volatile memory to be used the next time the target device resets.

Usage:

SREQ:

1 1		1	1	
	Length = $0x01$	Cmd0 = 0x27	Cmd1 = 0x04	SecLevel

Attributes:

Attribute	Length (byte)	Description	
SecLevel	1	Security level to use the next time the target device resets. Zero is used to disable security.	

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x67	Cmd1 = 0x04	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.10.1.6 UTIL_SET_PRECFGKEY

Description:

This command is used to store a pre-configured key array into Non-Volatile memory to be used the next time the target device resets.

Usage:

SREQ:

1	1	1	16
Length = $0x10$	Cmd0 = 0x27	Cmd1 = 0x05	PreCfgKey

Attributes:

Attibutes.		
Attribute	Length (byte)	Description
PreCfgKey	16	An array representing the pre-configured key to use the next time the target device resets.

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x67	Cmd1 = 0x05	Status

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.10.1.7 UTIL_CALLBACK_SUB_CMD

Description:

This command subscribes/unsubscribes to layer callbacks. For particular subsystem callbacks to work, the software must be compiled with a special flag that is unique to that subsystem to enable the callback mechanism. For example to enable ZDO callbacks, MT_ZDO_CB_FUNC flag must be compiled when the software is built. For complete list of callback compile flags, check section 1.2 or "**Z-Stack Compile Options**" document.

Usage:

SREQ:

1	1	1	2	1
Length = $0x03$	Cmd0 = 0x27	Cmd1 = 0x06	SubsystemID	Action

Attributes:

inibutes.			
Attribute	Length (byte)	Description	

Subsystem ID of the expected layer

SubsystemID 2

Subsystem	ID
MT_SYS	0x0100
MT_MAC	0x0200
MT_NWK	0x0300
MT_AF	0x0400
MT_ZDO	0x0500
MT_SAPI	0x0600
MT_UTIL	0x0700
MT_DEBUG	0x0800
MT_APP	0x0900
ALL SUBSYSTEM	0xFFFF

Action 1 0: Disable, 1: Enable

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x67	Cmd1 = 0x06	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.10.1.8 UTIL_KEY_EVENT

Description:

Sends a key event to the device registered application. The device register application means that the application registered for key events with OnBoard. Not all application support all keys, so you must know what keys the application supports

Usage:

SREQ:

1	1	1	1	1
Length = $0x02$	Cmd0 = 0x27	Cmd1 = 0x07	Shift	Key

Attribute	Length (byte)	Description
Shift	1	0: No shift 1: Shift

Key 1 Value of the key

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x67	Cmd1 = 0x06	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.10.1.9 UTIL_TIME_ALIVE

Description:

This command is used by the tester to get the board's time alive.

Usage:

SREQ:

1	1	1
Length = $0x00$	Cmd0 = 0x27	Cmd1 = 0x09

Attributes:

None

SRSP:

DIEDI U			
1	1	1	4
Length = $0x04$	Cmd0 = 0x67	Cmd1 = 0x09	Seconds

Attributes:

Attribute	Length (byte)	Description
Seconds	4	The time of the board's live in seconds

3.10.1.10 UTIL_LED_CONTROL

Description:

This command is used by the tester to control the LEDs on the board.

Usage:

SREO:

· · · · · · · · · · · · · · · · · · ·				
1	1	1	1	1
Length = $0x02$	Cmd0 = 0x27	Cmd1 = 0x0A	LedID	Mode

Attributes:

Attribute	Length (byte)	Description
LedID	1	The LED number
Mode	1	0: OFF, 1: ON

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x67	Cmd1 = 0x0A	Status

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.10.2 MT_UTIL Callbacks

None

3.11 MT VERSION

This interface contains information about the release version of the software. There is no direct command for tester to interact with this interface.

3.12 MT_ZDO

This interface allows the tester to issue commands to the ZDO layer in the target and receive responses. Each of these messages has a corresponding message that is returned by the target. The response message only indicates that the command message was received and executed. The result of the command execution will be conveyed to the tester via a callback message interface.

3.12.1 MT_ZDO Commands

3.12.1.1 ZDO_NWK_ADDR_REQ

Description:

This message will request the device to send a "Network Address Request". This message sends a broadcast message looking for a 16 bit address with a known 64 bit IEEE address. You must subscribe to "ZDO Network Address Response" to receive the response to this message. Check section 3.0.1.7 for more details on callback subscription. The response message listed below only indicates whether or not the message was received properly.

Usage:



DILL Q.					
Byte: 1	1	1	8	1	1
Length = $0x0A$	Cmd0 = 0x25	Cmd1 = 0x00	IEEEAddress	ReqType	StartIndex

Attributes:

rici in accs.				
Attribute	Length (byte)	Description		
IEEEAddress	8	64 bit IEEE address of the device.		
		Value that the search was executed on.		
ReqType	1	Туре	Value	
		Single Device response	0x00	
		Extended, include associated devices	0x01	
StartIndex	1	Starting index into the list of children. The too large for one message.	nis is used to get more of the list if the list is	

SRSP:



Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1)

3.12.1.2 ZDO_IEEE_ADDR_REQ

Description:

This command will request a device's IEEE 64-bit address. You must subscribe to "ZDO IEEE Address Response" to receive the data response to this message. The response message listed below only indicates whether or not the message was received properly.

Usage:

SREQ:

Byte: 1	1	1	2	1	1	
Length = $0x04$	Cmd0 = 0x25	Cmd1 = 0x01	ShortAddr	ReqType	StartIndex	

Attributes:

Attribute	Length (byte)	Description		
ShortAddr	2	Specifies the short address of the device.		
		Value that the search was executed on.		
ReqType	1	Туре	Value	
		Single Device response	0x00	
		Extended, include associated devices	0x01	
StartIndex	1	Starting index into the list of children. The too large for one message.	nis is used	to get more of the list if the list is

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

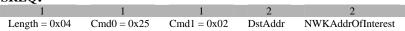
3.12.1.3 ZDO_NODE_DESC_REQ

Description:

This command is generated to inquire about the Node Descriptor information of the destination device

Usage

SREQ:



Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies NWK address of the device generating the inquiry.
NWKAddrOfInterest	2	Specifies NWK address of the destination device being queried.

SRSP:



Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1)

3.12.1.4 ZDO_POWER_DESC_REQ

Description:

This command is generated to inquire about the Power Descriptor information of the destination device.

Usage:

SREQ:

Byte: 1	1	1	2	2
Length = $0x04$	Cmd0 = 0x25	Cmd1 = 0x03	DstAddr	NWKAddrOfInterest

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies NWK address of the device generating the inquiry.
NWKAddrOfInterest	2	Specifies NWK address of the destination device being queried.

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.5 ZDO_SIMPLE_DESC_REQ

Description:

This command is generated to inquire as to the Simple Descriptor of the destination device's Endpoint.

Usage:

SREQ:

•					
Byte: 1	1	1	2	2	1
Length = $0x05$	Cmd0 = 0x25	Cmd1 = 0x04	DstAddr	NWKAddrOfInterest	Endpoint

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies NWK address of the device generating the inquiry.
NWKAddrOfInterest	2	Specifies NWK address of the destination device being queried.
Endpoint	1	Specifies the application endpoint the data is from.

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x65	Cmd1 = 0x04	Status

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.6 ZDO_ACTIVE_EP_REQ

Description:

This command is generated to request a list of active endpoint from the destination device.

Usage:

SREQ:

Byte: 1	1	1	2	2
Length = $0x04$	Cmd0 = 0x25	Cmd1 = 0x05	DstAddr	NWKAddrOfInterest

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies NWK address of the device generating the inquiry.
NWKAddrOfInterest	2	Specifies NWK address of the destination device being queried.

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

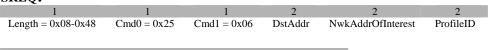
3.12.1.7 ZDO_MATCH_DESC_REQ

Description:

This command is generated to request the device match descriptor.

Usage:

SREQ:



1	0-32	1	0-32
NumInClusters	InClusterList	NumOutClusters	OutClusterList

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies NWK address of the device generating the inquiry.
NWKAddrOfInterest	2	Specifies NWK address of the destination device being queried.
ProfileID	2	Specifies the profile ID of the device
NumInClusters	1	Specifies the number of IDs in the InClusterList.
InClusterList	0-32	Contains the input cluster IDs.
NumOutClusters	1	Specifies the number of IDs in the OutClusterList.
OutClusterList	0-32	Contains the output cluster IDs.

SRSP:



Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.8 ZDO_COMPLEX_DESC_REQ

Description:

This command is generated to request for the destination device's complex descriptor.

Usage:

SREQ:

Byte: 1	1	1	2	2
Length = $0x04$	Cmd0 = 0x25	Cmd1 = 0x07	DstAddr	NWKAddrOfInterest

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies NWK address of the device generating the inquiry.
NWKAddrOfInterest	2	Specifies NWK address of the destination device being queried.

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

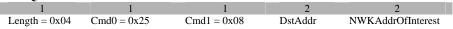
3.12.1.9 ZDO_USER_DESC_REQ

Description:

This command is generated to request for the destination device's user descriptor.

Usage:

SREQ:



Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies NWK address of the device generating the inquiry.
NWKAddrOfInterest	2	Specifies NWK address of the destination device being queried.

SRSP:



11tt11bates.			
Attribute	Length (byte)	Description	
Status	1	Status is either Success (0) or Failure (1).	

3.12.1.10 ZDO_END_DEVICE_ANNCE

Description:

This command will cause the CC2480 device to issue an "End device announce" broadcast packet to the network. This is typically used by an end-device to announce itself to the network.

Usage:

SREQ:

1	1	1	2	8	1
Length = 0x0B	Cmd0 = 0x25	Cmd1 = 0x0A	NwkAddr	IEEEAddr	Capabilites

Attributes:

rici ibuccs.		
Attribute	Length (byte)	Description
NwkAddr	2	Specifies network address of the device generating the request.
IEEEAddr	8	Specifies the 64 bit IEEE Address of the device being announced.
		Specifies MAC capabilities
		Bit: 0 – Alternate PAN Coordinator
		1 – Device type: 1- ZigBee Router; 0 – End Device
		2 – Power Source: 1 Main powered
Capabilites	1	3 – Receiver on when idle
		4 – Reserved
		5 – Reserved
		6 – Security capability
		7 – Reserved

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x65	Cmd1 = 0x0A	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.11 ZDO_USER_DESC_SET

Description:

This command is generated to write a User Descriptor value to the targeted device

Usage:

SREQ:



Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies network address of the device generating the set request.
NWKAddrOfInterest	2	Specifies NWK address of the destination device being queried.
Len	1	Specifies the length of the user descriptor.
UserDescriptor	0-16	User descriptor array (can be up to 16 bytes).

SRSP:



Attribute	Length (byte)	Description	
Status	1	Status is either Success (0) or Failure (1).	

3.12.1.12 ZDO_SERVER_DISC_REQ

Description:

The command is used for local device to discover the location of a particular system server or servers as indicated by the ServerMask parameter. The destination addressing on this request is 'broadcast to all RxOnWhenIdle devices'.

Usage:





Attributes:

Attribute	Length (byte)	Description
ServerMask	2	Specifies the system server capabilities of the device.

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

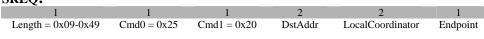
3.12.1.13 ZDO_END_DEVICE_BIND_REQ

Description:

This command is generated to request an End Device Bind with the destination device.

Usage:

SREQ:



2	1	0-32	1	0-32
ProfileID	NumInClusters	InClusterList	NumOutClusters	OutClusterList

Attribute	Length (byte)	Description
DstAddr	2	Specifies NWK address of the device generating the inquiry.
LocalCoordinator	2	Specifies Specifies local coordinator's short address. In the case of source binding, it's the short address of the source address
IEEE	8	Local coordinator's IEEE address
Endpoint	1	Device's endpoint.
ProfileID	2	Specifies the profile ID of the device.
NumInClusters	1	Specifies the number of IDs in the InClusterList.
InClusterList	0-32	Contains the input cluster IDs.
NumOutClusters	1	Specifies the number of IDs in the OutClusterList.
OutClusterList	0-32	Contains the output cluster IDs.

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.14 ZDO_BIND_REQ

Description:

This command is generated to request a Bind.

Usage:

SREQ:

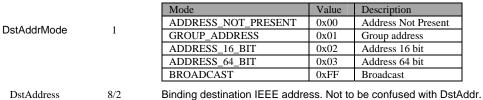


1	2/8	0/1
DstAddrMode	DstAddress	DstEndpoint

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies the destination address of the device generating the bind request
SrcAddress	8	64 bit Binding source IEEE address
SrcEndpoint	1	Specifies the binding source endpoint.
ClusterID	2	Specifies the cluster ID to match in messages.

Specifies destination address mode



DstAddress 8/2 Binding destination IEEE address. Not to be confused with DstAddr.

Specifies the binding destination endpoint. It is used only when DstAddrMode is 64 bits extended address

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.15 ZDO_UNBIND_REQ

Description:

This command is generated to request an UnBind

Usage:

SREQ:



1 2/8 0/1
DstAddrMode DstAddress DstEndpoint

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies destination address of the device generating the bind request.
SrcAddress	8	Specifies 64 bit Binding source IEEE address.
SrcEndpoint	1	Specifies the binding source endpoint.
ClusterID	2	Specifies cluster ID to match in messages.

Specifies 64 bit Binding destination address mode:

		Mode	Value	Description
DatA dalaMa da	1	ADDRESS_NOT_PRESENT	0x00	Address Not Present
DstAddrMode	1	GROUP_ADDRESS	0x01	Group address
		ADDRESS_16_BIT	0x02	Address 16 bit
		ADDRESS_64_BIT	0x03	Address 64 bit
		BROADCAST	0xFF	Broadcast

DstAddress 8 Specifies 64 bit Binding destination IEEE address. Not to be confused with DstAddr.

DstEndpoint 1 Specifies the binding destination endpoint

SRSP:

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.16 ZDO_MGMT_NWK_DISC_REQ

Description:

This command is generated to request the destination device to perform a network discovery.

Usage:

SREQ:



Attribute	Length (byte)	Description
DstAddr	2	Specifies the network address of the device performing the discovery.

Specifies the Bit Mask for channels to scan:

ScanChannels

Channel	Value
NONE	0x00000000
ALL_CHANNELS	0x07FFF800
CHANNEL 11	0x00000800
CHANNEL 12	0x00001000
CHANNEL 13	0x00002000
CHANNEL 14	0x00004000
CHANNEL 15	0x00008000
CHANNEL 16	0x00010000
CHANNEL 17	0x00020000
CHANNEL 18	0x00040000
CHANNEL 19	0x00080000
CHANNEL 20	0x00100000
CHANNEL 21	0x00200000
CHANNEL 22	0x00400000
CHANNEL 23	0x00800000
CHANNEL 24	0x01000000
CHANNEL 25	0x02000000
CHANNEL 26	0x04000000

ScanDuration Specifies the scanning time. 1

Specifies where to start in the response array list. The result may contain more entries than can be reported, so this field allows the user to retrieve the responses StartIndex 1

anywhere in the array list.

SRSP:

Length = 0x01Cmd0 = 0x65Cmd1=0x30Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.17 ZDO_MGMT_LQI_REQ

Description:

This command is generated to request the destination device to perform a LQI query of other devices in the network.

Usage:

SREQ:

Byte: 1	1	1	2	1
Length = $0x03$	Cmd0 = 0x25	Cmd1 = 0x31	DstAddr	StartIndex

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies the network address of the device generating the query.
StartIndex	1	Specifies where to start in the response array list. The result may contain more entries than can be reported, so this field allows the user to retrieve the responses anywhere in the array list.

SRSP:



Attributes.			
Attribute	Length (byte)	Description	

Status 1 Status is either Success (0) or Failure (1).

3.12.1.18 ZDO_MGMT_RTG_REQ

Description:

This command is generated to request the Routing Table of the destination device

Usage:

SREQ:

Byte: 1	1	1	2	1	1
Length = $0x03$	Cmd0 = 0x25	Cmd1 = 0x32	DstAddr	StartIndex	

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies the network address of the device generating the query.
StartIndex	1	Specifies where to start in the response array list. The result may contain more entries than can be reported, so this field allows the user to retrieve the responses anywhere in the array list.

SRSP:

Byte: 1	1	1	1
Length = $0x01$	Cmd0 = 0x65	Cmd1 = 0x32	Status

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.19 ZDO_MGMT_BIND_REQ

Description

This command is generated to request the Binding Table of the destination device.

Usage

SREQ:



Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies the network address of the device being queried.
		Specifies where to start in the response array list. The result may contain more entries
StartIndex	1	than can be reported, so this field allows the user to retrieve the responses anywhere in
		the array list.

SRSP:



Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.20 ZDO_MGMT_LEAVE_REQ

Description:

This command is generated to request a Management Leave Request for the target device

Usage:

SREQ:

1	1	1	2	8	1	
Length = 0x0B	Cmd0 = 0x25	Cmd1 = 0x34	DstAddr	DeviceAddr	RemoveChildren/Rejoin	

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies the network address of the device generating the request.
DeviceAddress	8	Specifies the 64 bit IEEE Address of the target device you want to leave.
RemoveChildren/Rejoin	1	This field has a value of 1 if the device being asked to leave the network is also being asked to remove its child devices, if any. Otherwise it has a value of 0. Currently, the stack profile of Home Control specifies that this field should always be set to 0.

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.21 ZDO_MGMT_DIRECT_JOIN_REQ

Description:

This command is generated to request the Management Direct Join Request of a designated device.

Usage:

SREQ:

Byte: 1	1	1	2	8	1
Length = $0x0B$	Cmd0 = 0x25	Cmd1 = 0x35	DstAddr	DeviceAddr	CapInfo

Attribute	Length (byte)	Description
DstAddr	2	Network address of the device to which the device specified in DeviceAddress is to join.
DeviceAddress	8	The 64 bit IEEE Address of the device you want to be joined to the device at DstAddr.
CapInfo	1	Specifies the operating capabilities of the device being directly joined. Bit weighted values follow: Bit: 0 – Alternate PAN Coordinator 1 – Device type: 1- ZigBee Router; 0 – End Device 2 – Power Source: 1 Main powered 3 – Receiver on when idle 4 – Reserved 5 – Reserved 6 – Security capability 7 – Reserved

SRSP:

Byte: 1	1	1	1	
Length = $0x01$	Cmd0 = 0x65	Cmd1 = 0x35	Status	

Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.22 ZDO_MGMT_PERMIT_JOIN_REQ

Description:

This command is generated to set the Permit Join for the destination device

Usage:

SREQ:



Attributes:

Attibutes.		
Attribute	Length (byte)	Description
DstAddr	2	Specifies the network address of the destination device whose Permit Join
DstAddi	2	information is to be modified.
Duration	1	Specifies the duration to permit joining. $0 = \text{join disabled}$. $0 \times \text{ff} = \text{join enabled}$.
Duration	1	0x01-0xfe = number of seconds to permit joining.
TCSignificance	1	Trust Center Significance.

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1).

3.12.1.23 ZDO_MGMT_NWK_UPDATE_REQ

Description:

This command is provided to allow updating of network configuration parameters or to request information from devices on network conditions in the local operating environment.

Usage:

SREQ:



Attribute	Length (byte)	Description
DstAddr	2	Short address of the destination device(s). The destination addressing on this primitive can be unicast or broadcast to all devices for which

macRxOnWhenIdle=TRUE (i.e., 0xFFFD)

Destination address mode:

DstAddrMode 1

Mode	Value	Description
ADDRESS_NOT_PRESENT	0x00	Address Not Present
GROUP_ADDRESS	0x01	Group address
ADDRESS_16_BIT	0x02	Address 16 bit
ADDRESS_64_BIT	0x03	Address 64 bit
BROADCAST	0xFF	Broadcast

A bitmap indicating which channels are to be scanned:

annel	Value
NONE	0x00000000
ALL_CHANNELS	0x07FFF800
CHANNEL 11	0x00000800
CHANNEL 12	0x00001000
CHANNEL 13	0x00002000
CHANNEL 14	0x00004000
CHANNEL 15	0x00008000
CHANNEL 16	0x00010000
CHANNEL 17	0x00020000
CHANNEL 18	0x00040000
CHANNEL 19	0x00080000
CHANNEL 20	0x00100000
CHANNEL 21	0x00200000
CHANNEL 22	0x00400000
CHANNEL 23	0x00800000
CHANNEL 24	0x01000000
CHANNEL 25	0x02000000
CHANNEL 26	0x04000000

ChannelMask 4

ScanDuration 1 A value used to calculate the length of time to spend scanning each channel
ScanCount 1 This field represents the number of energy scans to be conducted and reported
Indicates the NWK address for the device with the Network Manager bit set in its
Node Descriptor

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Status is either Success (0) or Failure (1)

3.12.1.24 ZDO_MSG_CB_REGISTER

Description:

This command registers for a ZDO callback (see Reference[3], "6. ZDO Message Requests" for example usage).

Usage:

SREQ:



110110 40000				
Attribute	Length (byte)	Description		
ClusterID	2	Specifies the ZDO Cluster Id for which to		

SRSP:



Attributes:

th (byte)	Description
1	Return value of the call to ZDO_RegisterForZDOMsg().
	1

3.12.1.25 ZDO_MSG_CB_REMOVE

Description:

This command removes a registration for a ZDO callback (see Reference[3], "6. ZDO Message Requests" for example usage).

Usage:

SREQ:



Attributes:

Attribute	Length (byte)	Description
ClusterID	2	Specifies the ZDO Cluster Id for which to receive a ZDO callback.

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	Return value of the call to ZDO_RemoveRegisteredCB ().

3.12.1.26 ZDO_STARTUP_FROM_APP

Description:

This command starts the device in the network.

Usage:

SREQ:



Attributes:

Attribute	Length (byte)	Description
StartDelay	2	Specifies the time delay before the device starts.

SRSP:



Attributes:

Attribute	Length (byte)	Description	
		0x00 - Restored network state	
Status	1	0x01 – New network state	
		0x02 – Leave and not Started	

3.12.1.27 ZDO_AUTO_FIND_DESTINATION

Description:

This function will issue a Match Description Request for the requested endpoint outputs. This message will generate a broadcast message.

Usage:

AREQ:



Attributes:

Attribute	Length (byte)	Description		
Endpoint	1	Specifies which endpoint to issue the End Device Bind request for.		

3.12.1.28 ZDO_SET_LINK_KEY

Description:

This Command sets the application link key for a given device.

Usage:

SREQ:

1	1	1	2	0	16
1	1	1	2	0	10
Length = $0x1A$	Cmd0 = 0x45	Cmd1 = 0x23	ShortAddr	IEEEaddr	LinkKeyData

Attributes:

Attribute	Length (byte)	Description
ShortAddr	2	Specifies the short address of the pair device of the link key.
IEEEaddr	8	Specifies the IEEE address of the pair device of the link key
LinkKeyData	16	128 bit link key data of the device.

SRSP:

1	1	1	1
Length = $0x01$	Cmd0 = 0x65	Cmd1 = 0x23	Status

Attribute	Length (byte)	Description
		0x00 – Success
Status	1	0x01 – Fail to add to address manager.
		0x11 – Security manager key table full

3.12.1.29 ZDO_REMOVE_LINK_KEY

Description:

This command removes the application link key of a given device.

Usage:

SREQ:

1 1		1	8
Length = $0x08$	Cmd0 = 0x45	Cmd1 = 0x24	IEEEaddr

Attributes:

Attribute	Length (byte)	Description
IEEEaddr	8	Specifies the IEEE address of the pair device of the link key

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	0x00 – Success 0xC8 – Unknown device.

3.12.1.30 ZDO_GET_LINK_KEY

Description:

This command removes the application link key of a given device.

Usage:

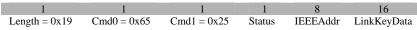
SREO:

1	1	1	8
Length = $0x08$	Cmd0 = 0x45	Cmd1 = 0x25	IEEEaddr

Attributes:

Attribute	Length (byte)	Description
IEEEaddr	8	Specifies the IEEE address of the pair device of the link key

SRSP:



Attributes:

Attribute	Length (byte)	Description
Status	1	0x00 – Success 0xC8 – Unknown device.
IEEEAddr	8	IEEE address of the device
LinkKeyData	16	Link key data of the device.

3.12.2 MT_ZDO Callbacks

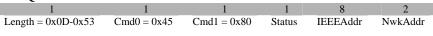
3.12.2.1 ZDO_NWK_ADDR_RSP

Description:

This command is issued by the tester to return the results from a ZDO_NWK_ADDR_REQ.

Usage





1 1 0-70 StartIndex NumAssocDev AssocDevList

Attributes:

Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS or FAILURE.
IEEEAddr	8	64 bit IEEE address of source device.
NwkAddr	2	Specifies the short network address of responding device.
StartIndex	1	Specifies the starting index into the list of associated devices for this report.
NumAssocDev	1	Specifies the number of associated devices.
AssocDevList	0-70	Contains the list of network address for associated devices. This list can be a partial list if the entire list doesn't fit into a packet. If it is a partial list, the starting index is StartIndex.

3.12.2.2 ZDO_IEEE_ADDR_RSP

Description:

This callback message is in response to the ZDO IEEE Address Request.

Usage:

AREQ:



Attributes:

Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS or FAILURE.
IEEEAddr	8	64 bit IEEE address of source device.
NwkAddr	2	Specifies the short network address of responding device.
StartIndex	1	Specifies the starting index into the list of associated devices for this report.
NumAssocDev	1	Specifies the number of associated devices.
AssocDevList	0-70	Contains the list of network address for associated devices. This list can be a partial list if the entire list doesn't fit into a packet. If it is a partial list, the starting index is StartIndex.

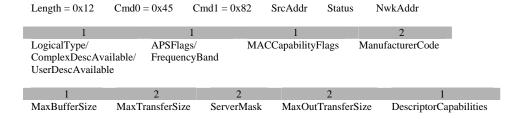
3.12.2.3 ZDO_NODE_DESC_RSP

Description:

This callback message is in response to the ZDO Node Descriptor Request.

Usage:





Attributes:

Attributes:			
Attribute	Length (byte)	Description	
SrcAddr	2	The message's source network address.	
Status	1	This field indicates either SUCCESS or FAIL	
NWKAddrOfInterest	2	Device's short address of this Node descriptor	
LogicalType/ ComplexDescriptorAvailable/ UserDescriptorAvailable	1	Logical Type: Bit 0-2 Description Value ZigBee Coordinator 0 ZigBee Router 1 ZigBee End Device 2 ComplexDescriptorAvailable: Bit 4- Indicates complex descriptor is available for the node NodeFrequencyBand - Bit 5-7 - Identifies no frequency band capabilities	
APSFlags/FrequencyBand	1	 APSFlags – Bit 0-4 – Node Flags assigned for V1.0 all bits are reserved. NodeFrequencyBand – Bit 5-7 – Identifies n frequency band capabilities 	
		Capability flags stored for the MAC	T
		Description CAPINFO DEVICETYPE RFD	Value
MacCapabilitiesFlags	1	CAPINFO_DEVICET TPE_RFD CAPINFO_ALTPANCOORD	0x00 0x01
		CALINIO_ALTI ANCOORD	UAUI
MacCapabilitiesFlags	1	CAPINEO DEVICETYPE FED	0v 0 2
MacCapabilitiesFlags	1	CAPINFO_DEVICETYPE_FFD CAPINFO_POWER_AC	0x02
MacCapabilitiesFlags	1	CAPINFO_POWER_AC	0x04
MacCapabilitiesFlags	1	CAPINFO_POWER_AC CAPINFO_RCVR_ON_IDLE	0x04 0x08
MacCapabilitiesFlags	1	CAPINFO_POWER_AC CAPINFO_RCVR_ON_IDLE CAPINFO_SECURITY_CAPABLE	0x04 0x08 0x40
		CAPINFO_POWER_AC CAPINFO_RCVR_ON_IDLE CAPINFO_SECURITY_CAPABLE CAPINFO_ALLOC_ADDR Specifies a manufacturer code that is allocated	0x04 0x08 0x40 0x80
MacCapabilitiesFlags ManufacturerCode	2	CAPINFO_POWER_AC CAPINFO_RCVR_ON_IDLE CAPINFO_SECURITY_CAPABLE CAPINFO_ALLOC_ADDR Specifies a manufacturer code that is allocated ZigBee Alliance, relating to the manufacturer	0x04 0x08 0x40 0x80
, ,		CAPINFO_POWER_AC CAPINFO_RCVR_ON_IDLE CAPINFO_SECURITY_CAPABLE CAPINFO_ALLOC_ADDR Specifies a manufacturer code that is allocated	0x04 0x08 0x40 0x80 1 by the to the
ManufacturerCode	2	CAPINFO_POWER_AC CAPINFO_RCVR_ON_IDLE CAPINFO_SECURITY_CAPABLE CAPINFO_ALLOC_ADDR Specifies a manufacturer code that is allocated ZigBee Alliance, relating to the manufacturer device. Indicates size of maximum NPDU. This field a high level indication for management. Indicates maximum size of Transfer up to 0x7 field is reserved in version 1.0 and shall be set	0x04 0x08 0x40 0x80 1 by the to the is used as
ManufacturerCode MaxBufferSize	2	CAPINFO_POWER_AC CAPINFO_RCVR_ON_IDLE CAPINFO_SECURITY_CAPABLE CAPINFO_ALLOC_ADDR Specifies a manufacturer code that is allocated ZigBee Alliance, relating to the manufacturer device. Indicates size of maximum NPDU. This field a high level indication for management. Indicates maximum size of Transfer up to 0x7 field is reserved in version 1.0 and shall be set Bit 0 - Primary Trust Center 1 - Backup Trust Center 2 - Primary Binding Table Cache 3 - Backup Binding Table Cache 4 - Primary Discovery Cache	0x04 0x08 0x40 0x80 1 by the to the is used as
ManufacturerCode MaxBufferSize MaxInTransferSize	2 1 2	CAPINFO_POWER_AC CAPINFO_RCVR_ON_IDLE CAPINFO_SECURITY_CAPABLE CAPINFO_ALLOC_ADDR Specifies a manufacturer code that is allocated ZigBee Alliance, relating to the manufacturer device. Indicates size of maximum NPDU. This field a high level indication for management. Indicates maximum size of Transfer up to 0x7 field is reserved in version 1.0 and shall be set Bit 0 - Primary Trust Center 1 - Backup Trust Center 2 - Primary Binding Table Cache 3 - Backup Binding Table Cache	0x04 0x08 0x40 0x80 1 by the to the is used as fiff (This it to zero).

DescriptorCapabilities

Specifies the Descriptor capabilities

3.12.2.4 ZDO_POWER_DESC_RSP

Description:

This callback message is in response to the ZDO Power Descriptor Request.

Usage:



Attributes:

Attiibutes.		
Attribute	Length (byte)	Description
SrcAddr	2	Specifies the message's source network address.
Status	1	This field indicates either SUCCESS or FAILURE.
NWKAddr	2	Specifies Device's short address that this response describes.
CurrentPowerMode/AvailablePowerSources	1	- CurrentPowerMode: bits 3-0- AvailablePowerSources: bits 7-4
CurrentPowerSource/CurrentPowerSourceLevel	1	- CurrentPowerSource: bits 3-0- CurrentPowerSourceLevel: bits 7-4

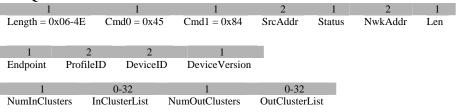
3.12.2.5 ZDO_SIMPLE_DESC_RSP

Description:

This callback message is in response to the ZDO Simple Descriptor Request

Usage:





Attribute	Length (byte)	Description
SrcAddr	2	Specifies the message's source network address.
Status	1	This field indicates either SUCCESS or FAILURE.
NWKAddr	2	Specifies Device's short address that this response describes.
Len	1	Specifies the length of the simple descriptor
Endpoint	1	Specifies Endpoint of the device
ProfileId	2	The profile ID for this endpoint.
DeviceID	2	The Device Description ID for this endpoint.
		Defined as the following format
DeviceVersion	1	0 – Version 1.00
		0x01-0x0F – Reserved.
NumInClusters	1	The number of input clusters in the InClusterList.
InClusterList	0-32	List of input cluster IDs supported.
NumOutClusters	1	The number of output clusters in the OutClusterList.
OutClusterList	0-32	List of output cluster IDs supported.

3.12.2.6 ZDO_ACTIVE_EP_RSP

Description:

This callback message is in response to the ZDO Active Endpoint Request.

Usage:





0-77 ActiveEPList

Attributes:

1100110000		
Attribute	Length (byte)	Description
SrcAddr	2	The message's source network address.
Status	1	This field indicates either SUCCESS or FAILURE.
NWKAddr	2	Device's short address that this response describes.
ActiveEPCount	1	Number of active endpoint in the list
ActiveEPList	0-77	Array of active endpoints on this device.

3.12.2.7 ZDO_MATCH_DESC_RSP

Description:

This callback message is in response to the ZDO Match Descriptor Request

Usage:

AREQ:



0-77 MatchList

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	The message's source network address.
Status	1	This field indicates either SUCCESS or FAILURE.
NWKAddr	2	Device's short address that this response describes.
MatchLength	1	The count of endpoints on the remote device that match the request criteria
MatchList	0-77	List of bytes, each represents an 8 bit endpoint

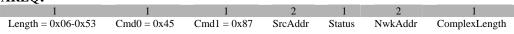
3.12.2.8 ZDO_COMPLEX_DESC_RSP

Description:

This callback message is in response to the ZDO Complex Descriptor Request

Usage:

AREQ:



0-77 ComplexList

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	The message's source network address.
Status	1	This field indicates either SUCCESS or FAILURE.
NWKAddr	2	Device's short address that this response describes.
ComplexLength	1	Length of the complex descriptor.
ComplexDescriptor	0-77	Array of bytes contains the complex descriptor.

3.12.2.9 ZDO_USER_DESC_RSP

Description:

This callback message is in response to the ZDO User Descriptor Request

Usage:

AREQ:

1	1	1	2	1	2	1	0-77
Length = 0x06-0x16	Cmd0 = 0x45	Cmd1 = 0x88	SrcAddr	Status	NwkAddr	Len	UserDescriptor

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	The message's source network address.
Status	1	This field indicates either SUCCESS or FAILURE.
NWKAddr	2	Device's short address that this response describes.
UserLength	1	Length of the complex descriptor.
UserDescriptor	0-77	Array of bytes contains user descriptor.

3.12.2.10 ZDO_USER_DESC_CONF

Description:

This confirmation notifies the user when the device receives a user descriptor.

Usage:

AREQ:

1	1	1	2	1	2
Length = $0x05$	Cmd0 = 0x45	Cmd1 = 0x89	SrcAddr	Status	NwkAddr

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	The message's source network address.
Status	1	This field indicates either SUCCESS or FAILURE.
NWKAddr	2	Device's short address that this response describes.

3.12.2.11 ZDO_SERVER_DISC_RSP

Description:

This callback message is in response to the ZDO System Service Discovery Request. Upon receiving the request, remote devices shall compare the ServerMask parameter to the Server Mask field in their own Node descriptor. If no bits are found to match, no action is taken.

Usage:

AREQ:

1	1	1	2	1	2
Length = $0x05$	Cmd0 = 0x45	Cmd1 = 0x8A	SrcAddr	Status	ServerMask

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	The message's source network address.
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).
		Each bit signifies one system server capability of the node. The bit
		setting is defined in the following table:

		Bit Number	Assignment
		0	Primary Trust Center
		1	Backup Trust Center
Server Mask	Server Mask 2	2	Primary Binding Table Cache
		3	Backup Binding Table Cache
		4	Primary Discovery Cache
		5	Backup Discovery Cache
		6– 15	Reserved

3.12.2.12 ZDO_END_DEVICE_BIND_RSP

Description:

This callback message is in response to the ZDO End Device Bind Request

Usage:

AREQ:



Attributes:

multiputes.		
Attribute	Length (byte)	Description
SrcAddr	2	The message's source network address.
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.12.2.13 ZDO_BIND_RSP

Description:

This callback message is in response to the ZDO Bind Request.

Usage:

AREQ:



Attribute	Length (byte)	Description
SrcAddr	2	The message's source network address.
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.12.2.14 ZDO_UNBIND_RSP

Description:

This callback message is in response to the ZDO Unbind Request.

Usage:

AREQ:

Byte: 1	1	1	2	1
Length = $0x03$	Cmd0 = 0x45	Cmd1 = 0xA2	SrcAddr	Status

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	The message's source network address.
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.12.2.15 ZDO_MGMT_NWK_DISC_RSP

Description:

This callback message is in response to the ZDO Management Network Discovery Request

Usage:

AREQ:



1 0-72
NetworkListCount NetworkList Records

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	Source address of the message.
Status	1	This field indicates either SUCCESS or FAILURE.
NetworkCount	1	Total number of entries available in the device.
StartIndex	1	Where in the total number of entries this response starts.
NetworkListCount	1	Number of entries in this response.

 $An \ array \ of \ Network List \ items. \ Network List Count \ contains \ the \ number \ of \ items \ in \ this \ table$

NetworkList List

Name	Size	Description
PAN ID/Extended PAN	2 bytes	PAN ID of the neighbor device
ID		
Logical Channel	1 byte	The current logical channel occupied by the
		network.
Stack Profile / ZigBee	1 byte	StackProfile: bits 3-0
Version		ZigBeeVersion: bits 7-4
		A ZigBee stack profile identifier indicating the
		stack profile in use in the discovered network.
		The version of the ZigBee protocol in use in
		the discovered network.
Beacon Order / Super	1 byte	BeaconOrder: bits 3-0
frame Order		SuperframeOrder: bits 7-4
Permit Joining	1 byte	Permit joining flag

3.12.2.16 ZDO_MGMT_LQI_RSP

Description:

This callback message is in response to the ZDO Management LQI Request

Usage:

AREQ:



1 0-66
NeighborTableListCount NeighborTableListRecords

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	Source address of the message.
Status	1	This field indicates either SUCCESS or FAILURE.
NeighborTableEntries	1	Total number of entries available in the device.
StartIndex	1	Where in the total number of entries this response starts.
NeighborLqiListCount	1	Number of entries in this response.

An array of NeighborLqiList items. NeighborLQICount contains the number of items in this table.

NeighborLqiList 0-66

Name	Size	Description
ExtendedPanID	8	Extended PAN ID of the
	bytes	neighbor device
ExtendedAddress	8 bytes	Network extended address
NetworkAddress	2 bytes	Device short address
DeviceType/	1 byte	DeviceType: bits 1-0
RxOnWhenIdle/		RxOnWhenIdle: bits 3-2
Relationship		Relationship: bits 6-4
PermitJoining	1 byte	PermitJoining: bits 1-0
Depth	1 byte	
LQI	1 byte	

3.12.2.17 ZDO_MGMT_RTG_RSP

Description:

This callback message is in response to the ZDO Management Routing Table Request.

Usage:

AREQ:



1 0-75
RoutingTableListCount RoutingTableListRecords

Tittibutes.			
Attribute	Length (byte)		Description
SrcAddr	2	Source address of the message.	

This field indicates either SUCCESS or FAILURE. Status Routing Table EntriesTotal number of entries available in the device. 1 StartIndex 1 Where in the total number of entries this response starts.

Routing Table List CountNumber of entries in this response. 1

An array of RtgList items. RtgListCount contains the number of items in this table.

Name	Size	Description
Destination	2 bytes	Network destination
Address		address
Status	1 byte	Route status: bits 2-0
		0x00 Active 0x01 Discovery Underway 0x02 Discovery Failed 0x03 Inactive 0x04 – 0x07 Reserved
Next Hop	2 bytes	Next hop network address

RoutingTableList 0-75

3.12.2.18 ZDO_MGMT_BIND_RSP

Description:

This callback message is in response to the ZDO Management Binding Table Request

Usage:

AREO:

~ .						
Byte: 1	1	1	2	1	1	1
Length = 0x06-0x51	Cmd0 = 0x45	Cmd1 = 0xB3	SrcAddr	Status	BindingTableEntries	StartIndex

BindingTableListCount BindingTableListRecords

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	Source address of the message
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).
BindTableEntries	1	Total number of entries available in the device.
StartIndex	1	Where in the total number of entries this response starts.
BindTableListCount	1	Number of entries in this response.

An array of BindList items. BindListCount contains the number of items in this table.

Name	Size	Description
SrcAddr	8 bytes	Binding Entry's source IEEE address
SrcEndpoint	1 byte	Binding Entry's source endpoint
ClusterID	1 byte	Message ID in binding table
DstAddrMode	1 byte	Address mode for binding entry's destination address
DstAddr	8 bytes	Binding Entry's destination IEEE address
DstEndpoint	1 byte	Binding Entry's destination endpoint. For V1.1, this field is only present when the DestAddrMode is 64-bits extended address.

BindTableList List

3.12.2.19 ZDO_MGMT_LEAVE_RSP

Description:

This callback message is in response to the ZDO Management Leave Request

Usage:

AREO:

THE Q.					
Byte: 1	1	1	2	1	ı
Length = $0x03$	Cmd0 = 0x45	Cmd1 = 0xB4	SrcAddr	Status	

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	Source address of the message
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.12.2.20 ZDO_MGMT_DIRECT_JOIN_RSP

Description:

This callback message is in response to the ZDO Management Direct Join Request

Usage:

AREQ:



Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	Source address of the message
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

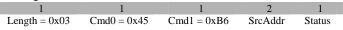
3.12.2.21 ZDO_MGMT_PERMIT_JOIN_RSP

Description:

This callback message is in response to the ZDO Management Permit Join Request

Usage:

AREQ:



Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	Source address of the message.
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.12.2.22 ZDO_NEW_DSTADDR_IND

Description:

This callback message indicates there is a new destination address.

Usage:

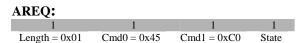
AREQ: TBD

3.12.2.23 ZDO_STATE_CHANGE_IND

Description:

This callback message indicates the ZDO state change.

Usage:



Attributes:

Attribute	Length (byte)	Description
State	1	Specifies the changed ZDO state.

3.12.2.24 ZDO_END_DEVICE_ANNCE_IND

Description:

This callback indicates the ZDO End Device Announce.

Usage:



AKEQ.						
Byte: 1	1	1	2	2	8	1
Length = $0x0D$	Cmd0 = 0x45	Cmd1 = 0xC1	SrcAddr	NwkAddr	IEEEAddr	Capabilites

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	Source address of the message.
NwkAddr	2	Specifies the device's short address.
IEEEAddr	8	Specifies the 64 bit IEEE address of source device.
		Specifies the MAC capabilities of the device. Bit: 0 – Alternate PAN Coordinator 1 – Device type: 1- ZigBee Router; 0 – End Device 2 – Power Source: 1 Main powered
Capabilites	1	 3 – Receiver on when idle 4 – Reserved 5 – Reserved 6 – Security capability 7 – Reserved

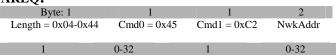
3.12.2.25 ZDO_MATCH_DESC_RSP_SENT

Description:

This callback indicates that Match Descriptor Response has been sent.

Usage:

AREQ:



NumInClusters InClusterList NumOutClusters OutClusterList

Attributes:

Attribute	Length (byte)	Description
NwkAddr	2	Specifies the device's short address
NumInClusters	1	The number of input clusters in the InClusterList.
InClusterList	0-32	List of input cluster IDs supported.
NumOutClusters	1	The number of output clusters in the OutClusterList.
OutClusterList	0-32	List of output cluster IDs supported.

3.12.2.26 ZDO_STATUS_ERROR_RSP

Description:

This message is the default message for error status.

Usage:

AREQ:

•				
Byte: 1	1	1	2	1
Length = 0x04-0x44	Cmd0 = 0x45	Cmd1 = 0xC3	SrcAddr	Status

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	Source address of the message
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

3.12.2.27 ZDO_SRC_RTG_IND

Description:

This message is an indication to inform host device the receipt of a source route to a given device.

Usage:

AREQ:

Byte: 1	1	1	2	1	2N
Length = 0x04-0x44	Cmd0 = 0x45	Cmd1 = 0xC4	dstAddr	Relay Count (N)	Relay List

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Short address of the destination of the source route
Relay Count	1	This field indicates number of devices in the relay list of the source route.
Relay List	2N	This field contains the list of devices in the relay list of the source route. It includes a two bytes short address for each device.

3.12.2.28 ZDO_MSG_CB_INCOMING

Description:

This message is a ZDO callback for a Cluster Id that the host requested to receive with a ZDO_MSG_CB_REGISTER request.

Usage:

AREQ:



Attitutes.		
Attribute	Length (byte)	Description
SrcAddr	2	Short address (LSB-MSB) of the source of the ZDO message.
WasBroadcast	1	This field indicates whether or not this ZDO message was broadcast.
ClusterID	2	The ZDO Cluster Id of this message.
SecurityUse	1	N/A – not used.
SeqNum	1	The sequence number of this ZDO message.
MacDstAddr	2	The MAC destination short address (LSB-MSB) of the ZDO message.
Data	0-Max MTU length.	The data that corresponds to the Cluster Id of the message (see Reference[4], "ZDO Parsing Functions" for information on parsing the data that corresponds to each ZDO Cluster Id).