TEXAS INSTRUMENTS

Z-Stack
Monitor and Test API

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Texas Instruments, Inc.
San Diego, California USA

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Table of Contents

1.   Introduction

1.1 Scope

This document describes the Monitor and Test (MT) interface that is used for communication between the 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-Stack™.

1.2 Overview

MT interfaces are divided in to the following categories. Most interfaces can be disabled or enabled by a corresponding compile flags. Depends on the interface, certain flags need to be enabled during compilation. For the complete list of compile flags, check "**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 messages…etc	**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 address…etc.	**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 callbacks…etc.	**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

In order for the tester to interact with the ZigBee target through MT interface, there are several requirements:

- ZigBee target with the latest Texas Instruments Z-Stack™ programmed (Z-Stack 2.1.0 or newer).

- Z-Tool 2.0 or newer installed on a PC.
- PC is connected to ZigBee target though RS-232 serial port.

1.4 Acronyms

MT	Monitor and Test
Z-Stack	ZigBee stack
Z-Tool	ZigBee PC test tool
RPC	Remote Procedure Calls
FCS	Freq
SOP	Start of Packet
SAPI	Simple API
AF	Application Framework
SREQ	Synchronous request
AREQ	Asynchronous request
SRSP	Synchronous response
ADC	Analog to Digital Conversion

1.5 Related Documents

- Z-Stack Compile Option (SWRA188)
- Z-Stack User's Guide (SWRA161, SWRA162, SWRA163, SWRA164, SWRA165)

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 back and forth between the Z-Tool and the target. It contains a SOF (Start of Packet), followed by MT packet and ended by FCS (Frame Check Sequence).
- Building of the serial packets is taken cared by MT_TransportSend() where SOF is inserted at the beginning of the packet and FCS is computed and inserted at the end of the packet.

SOF	MT CMD	FCS
Byte: 1	**3-256**	**1**

SOP (Start of Packet): 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 CMD 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) can be sent and received between the target and the tester through RS-232 serial interface. 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 interface 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 RS-232 serial port.
- 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 bits 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:
SREQ:

1	1	1	1	2	2
Length = 0x09-0x49	Cmd0 = 0x24	Cmd1 = 0x00	EndPoint	AppProfId	AppDeviceId

1	1	1	0-32	1	0-32
AppDevVer	LatencyReq	AppNumInClusters	AppInClusterList	AppNumOutClusters	AppOutClusterList

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
LatencyReq	1	Specifies latency. 0x00-No latency 0x01-fast beacons 0x02-slow beacons
AppNumInClusters	1	the number of Input cluster Ids following in the AppInClusterList
AppInClusterList	32	Specifies the list of Input Cluster Ids
AppNumOutClusters	1	Specifies the number of Output cluster Ids following in the AppOutClusterList
AppOutClusterList	32	Specifies the list of Output Cluster Ids

SRSP:

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

Attributes:

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:

Byte: 1	1	1	2	1
Length = 0x0A-0x8A	Cmd0 = 0x24	Cmd1 = 0x01	DstAddr	DestEndpoint

Byte: 1	2	1	1	1	1	0-128
SrcEndpoint	ClusterID	TransID	Options	Radius	Len	Data

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Short address of the destination device
DestEndpoint	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.
Radius	1	Specifies the number of hops allowed delivering the message; usually using 7.
Len	1	Length of the data.
Data	0-128	0-128 bytes data

SRSP:

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

Attributes:

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

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:
AREQ:

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:
AREQ:

1	1	1	2	2	2	1
Length = 0x11-0x91	Cmd0 = 0x44	Cmd1 = 0x81	GroupID	ClusterID	SrcAddr	SrcEndpoint

1	1	1	1	4	1	1	0-128
DestEndpoint	WasBroadcast	LinkQuality	SecurityUse	Timestamp	TransSeqNumber	Len	Data

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
DestEndpoint	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:
SREQ:

Byte: 1	1	1	1	2
Length = 0x07-0x87	Cmd0 = 0x29	Cmd1 = 0x00	AppEndpoint	DestAddress

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:

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

Attributes:

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:

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:

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.

Usage:
SREQ:

Byte: 1	1	1	1
Length = 0x02	Cmd0 = 0x22	Cmd1 = 0x01	SetDefault

Attributes:

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

SRSP:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x62	Cmd1 = 0x00	Status

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.

Usage:
SREQ:

Byte: 1	1	1
Length = 0x00	Cmd0 = 0x22	Cmd1 = 0x02

Attributes:
None
SRSP:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x62	Cmd1 = 0x02	Status

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	1	1	4	2	1	1
Length = 0x1C	Cmd0 = 0x22	Cmd1 = 0x03	StartTime	PanID	LogicalChannel	ChannelPage

Byte: 1	1	1	1	1	8
BeaconOrder	SuperFrameOrder	PanCoordinator	BatteryLifeExt	CoordRealignment	RealignKeySource

Byte: 1	1	1	8	1
RealignSecurityLevel	RealignKeyIdMode	RealignKeyIndex	BeaconKeySource	BeaconSecurityLevel

Byte: 1	1
BeaconKeyIdMode	BeaconKeyIndex

Attributes:

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
BatteryLifeExt	1	If this value is TRUE, the receiver is disabled after 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
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

RealignSecurityLevel   1

Key Id Mode of this data frame:

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

RealignKeyIdMode   1

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
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

BeaconSecurityLevel   1

BeaconKeyIdMode   1   Key Id Mode of this data frame
BeaconKeyIndex   1   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:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x62	Cmd1 = 0x04	Status

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:

Byte: 1	1	1	1	8	2
Length = 0x15-0x114	Cmd0 = 0x22	Cmd1 = 0x05	DestAddressMode	DestAddress	DestPanID

Byte: 1	1	1	1	1	8	1	1
SrcAddressMode	Handle	TxOption	LogicalChannel	Power	KeySource	SecurityLevel	KeyIdMode

Byte: 1	1	0-255
KeyIndex	MSDULength	MSDU

Attributes:

Attribute	Length (byte)	Description
DestAddressMode	1	Specifies the format of the destination address. | 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.
DestPanID	2	PAN ID of the destination.
SrcAddressMode	1	Specifies the format of the source address. | 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	1	Handle of the packet.

Transmitting options:

Option	Value	Description
MAC_TXOPTION_ACK	0x01	Acknowledged transmission. The MAC will attempt to retransmit the frame until it is acknowledged
MAC_TXOPTION_GTS	0x02	GTS transmission (unused)
MAC_TXOPTION_INDIRECT	0x04	Indirect transmission. The MAC will queue the data and wait for the destination device to poll for it. This can only be used by a coordinator device
MAC_TXOPTION_NO_RETRANS	0x10	This proprietary option prevents the frame from being retransmitted
MAC_TXOPTION_NO_CNF	0x20	This proprietary option prevents a MAC_MCPS_DATA_CNF event from being sent for this frame
MAC_TXOPTION_ALT_BE	0x40	Use PIB value MAC_ALT_BE for the minimum backoff exponent
MAC_TXOPTION_PWR_CHAN	0x80	Use the power and channel values in macDataReq_t instead of the PIB values

TxOption — 1 (spans the table above)

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:

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

SecurityLevel — 1 (spans table above)

Key Id Mode of this data frame:

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

KeyIdMode — 1 (spans table above)

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:

Attribute	Length (byte)	Description
LogicalChannel	1	Channel that data frame will be transmitted.
ChannelPage	1	The channel page to be used.
CoordAddressMode	1	Specifies the format of the coordinator address. | 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	
CoordAddress	8	Address of the Coordinator.
CoordPanID	2	PAN ID of the coordinator.

CapabilityInformation	1	Bit map which specifies the operational capabilities of the device.
		
		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
SecurityLevel	1	Security Level of this data frame: 	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	
KeyIdMode	1	Key Id Mode of this data frame: 	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)	Description
ExtAddr	8	Extended Address of the device requesting association
AssocShortAddress	2	Short address for the associated device. Allocated by the coordinator.
AssocStatus	1	Status of the association: | Status	Value
---	---
SUCCESSFUL_ASSOCIATION	0x00
PAN_AT_CAPACITY	0x01
PAN_ACCESS_DENIED	0x02	

SRSP:

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

Attributes:

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:
SREQ:

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:

Attribute	Length (byte)	Description

Specifies the format of the device address.

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

DeviceAddressMode   1

DeviceAddress   8   Device Address.
DevicePanID   2   Network PAN ID of device.

Reason of disassociation:

Reason	Value
RESERVED	0x00
COOR_WISHES_DEV_LEAVE	0x01
DEV_WISHES_LEAVE	0x02

DisassociateReason   1

TxIndirect   1   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
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

SecurityLevel   1

Key Id Mode of this data frame:

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

KeyIdMode   1

KeyIndex   1   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:
SREQ:

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

Attributes:

Attribute	Length (byte)	Description
Attribute	1	Specifies the MAC PIB Attributes:

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

SRSP:

Byte: 1	1	1	1	16
Length = 0x11	Cmd0 = 0x62	Cmd1 = 0x08	Status	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:

Byte: 1	1	1	1	16
Length = 0x11	Cmd0 = 0x22	Cmd1 = 0x09	Attribute	AttributeValue

Attributes:

Attribute	Length (byte)	Description
Attribute	1	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

AttributeValue	16	1-16 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:

Byte: 1	1	1	4	1	1
Length = 0x13	Cmd0 = 0x22	Cmd1 = 0x0C	ScanChannels	ScanType	ScanDuration

Byte: 1	1	8	1	1	1
ChannelPage	MaxResults	KeySource	SecurityLevel	KeyIdMode	KeyIndex

Attributes:

Attribute	Length (byte)	Description
ScanChannels	4	This represents a bit-mask of channels to be scanned when starting the device: table below
ScanType	1	Specifies the scan type: table below
ScanDuration	1	Duration of the scan - The exponent used in the scan duration calculation.
ChannelPage	1	The channel page on which to perform the scan.
KeySource	8	Key Source of this data frame.
SecurityLevel	1	Security Level of this data frame: table below
KeyIdMode	1	Key Id Mode of this data frame: table below
KeyIndex	1	Key Index of this data frame.

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

ScanType:

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

SecurityLevel:

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

KeyIdMode:

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

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.

Usage:
SREQ:

Byte: 1	1	1	1	8	2
Length = 0x16	Cmd0 = 0x22	Cmd1 = 0x0D	CoordAddressMode	CoordAddress	CoordPanID

8	1	1	1
KeySource	SecurityLevel	KeyIdMode	KeyIndex

Attributes:

Attribute	Length (byte)	Description		
		Mode	Value	Description
		ADDRESS_NOT_PRESENT	0x00	Address Not Present
		GROUP_ADDRESS	0x01	Group address
CoordAddressMode	1	ADDRESS_16_BIT	0x02	Address 16 bit
		ADDRESS_64_BIT	0x03	Address 64 bit
		BROADCAST	0xFF	Broadcast
CoordAddress	8	64-bit Coordinator Address		
CoordPanID	2	Coordinator PanID		
KeySource	8	Key Source of this data frame.		

Security Level of this data frame:

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

SecurityLevel   1

Key Id Mode of this data frame:

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

KeyIdMode   1

KeyIndex   1   Key Index of this data frame.

SRSP:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x62	Cmd1 = 0x0D	Status

Attributes:

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

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
Length = 0x01	Cmd0 = 0x22	Cmd1 = 0x0E	MsduHandle

Attributes:

Attribute	Length (byte)	Description
MsduHandle	1	Msdu 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
Length = 0x01	Cmd0 = 0x22	Cmd1 = 0x0F	Mode

Attributes:

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

SRSP:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x62	Cmd1 = 0x0F	Status

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
Length = 0x02	Cmd0 = 0x22	Cmd1 = 0x10	AddrType	NumEntries

Attributes:

Attribute	Length (byte)	Description
AddrType	1	Address types used in AutoPend | 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:

Byte: 1	1	1	1	8
Length = 0x0B	Cmd0 = 0x22	Cmd1 = 0x11	AddressMode	Address

Attributes:

Attribute	Length (byte)	Description		
AddressMode	1	Mode	Value	Description
		ADDRESS_16_BIT	0x02	Address 16 bit
		ADDRESS_64_BIT	0x03	Address 64 bit
Address	8	Address of the device that will be added - 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.		

SRSP:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x62	Cmd1 = 0x11	Status

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

Attributes:

Attribute	Length (byte)	Description		
AddressMode	1	Mode	Value	Description
		ADDRESS_16_BIT	0x02	Address 16 bit
		ADDRESS_64_BIT	0x03	Address 64 bit
Address	8	Address of the device that will be deleted - 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.		

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:

Byte: 1	1	1	1	8	2
Length = 0x0B	Cmd0 = 0x22	Cmd1 = 0x13	AddressMode	Address	PanID

Attributes:

Attribute	Length (byte)	Description
AddressMode	1	<table><tr><td>Mode</td><td>Value</td><td>Description</td></tr><tr><td>ADDRESS_16_BIT</td><td>0x02</td><td>Address 16 bit</td></tr><tr><td>ADDRESS_64_BIT</td><td>0x03</td><td>Address 64 bit</td></tr></table>
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.

SRSP:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x62	Cmd1 = 0x13	Status

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:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x22	Cmd1 = 0x14	Option

Attributes:

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

SRSP:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x62	Cmd1 = 0x14	Status

Attributes:

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:
SREQ:

Byte: 1	1	1
Length = 0x00	Cmd0 = 0x15	Cmd1 = 0x09

Attributes:
None

SRSP:

Byte: 1	1	1	1	1
Length = 0x01	Cmd0 = 0x62	Cmd1 = 0x15	Status	Value

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:

AREQ:

1	1	1	1	2	1	1
Length = 0x10	Cmd0 = 0x42	Cmd1 = 0x80	Status	PanId	LogicalChannel	ChannelPage

8	1	1	1
KeySource	SecurityLevel	KeyIdMode	KeyIndex

Attributes:

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.
SecurityLevel	1	Security Level of this data frame: <table><tr><td>Security Level</td><td>Value</td></tr><tr><td>NO_SECURITY</td><td>0x00</td></tr><tr><td>MIC_32_AUTH</td><td>0x01</td></tr><tr><td>MIC_64_AUTH</td><td>0x02</td></tr><tr><td>MIC_128_AUTH</td><td>0x03</td></tr><tr><td>AES_ENCRYPTION</td><td>0x04</td></tr><tr><td>AES_ENCRYPTION_MIC_32</td><td>0x05</td></tr><tr><td>AES_ENCRYPTION_MIC_64</td><td>0x06</td></tr><tr><td>AES_ENCRYPTION_MIC_128</td><td>0x07</td></tr></table>
KeyIdMode	1	Key Id Mode of this data frame: <table><tr><td>Key Id Mode</td><td>Value</td></tr><tr><td>NOT_USED</td><td>0x00</td></tr><tr><td>KEY_1BYTE_INDEX</td><td>0x01</td></tr><tr><td>KEY_4BYTE_INDEX</td><td>0x02</td></tr><tr><td>KEY_8BYTE_INDEX</td><td>0x03</td></tr></table>
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:

AREQ:

1	1	1	8	1
Length = 0x14	Cmd0 = 0x42	Cmd1 = 0x81	DeviceExtendedAddress	Capabilities

8	1	1	1
KeySource	SecurityLevel	KeyIdMode	KeyIndex

Attributes:

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.
SecurityLevel	1	Security Level of this data frame:

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:

Attribute	Length (byte)	Description
KeyIdMode	1	

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

Attribute	Length (byte)	Description
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:

AREQ:

1	1	1	1	2
Length = 0x0E	Cmd0 = 0x42	Cmd1 = 0x82	Status	DeviceShortAddress

8	1	1	1
KeySource	SecurityLevel	KeyIdMode	KeyIndex

Attributes:

Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).
DeviceShortAddress	2	Short address of the device
KeySource	8	Key Source of this data frame.
SecurityLevel	1	Security Level of this data frame:
KeyIdMode	1	Key Id Mode of this data frame:
KeyIndex	1	Key Index of this data frame.

Security Level of this data frame:

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:

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

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.

Usage:

AREQ:

1	1	1	1	4	1
Length = 0x24-0xBC	Cmd0 = 0x42	Cmd1 = 0x83	BSN	Timestamp	CoordinatorAddressMode

8	2	2	1	1	1
CoordinatorExtendedAddress	PanID	SuperframeSpec	LogicalChannel	GTSPermit	LinkQuality

1	8	1	1	1	1
SecurityFailure	KeySource	SecurityLevel	KeyIdMode	KeyIndex	PendingAddrSpec

1	1	0-128
AddressList	SDULength	NSDU

Attributes:

Attribute	Length (byte)	Description
BSN	1	BSN
Timestamp	4	Timestamp of the message

Address mode of the coordinator

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

CoordinatorAddressMode   1

CoordinatorExtendedAddress	8	Extended address of the coordinator
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:

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

SecurityLevel   1

Key Id Mode of this data frame:

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

KeyIdMode   1

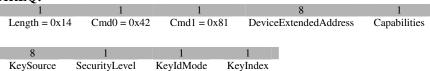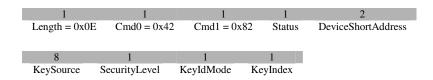| KeyIndex	1	Key Index of this data frame.
PendingAddrSpec	1	
AddressList	1	List of address associate with the device
SDULength	1	Beacon Length
NSDU	0-128	Beacon payload

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:

AREQ:

1	1	1	1	1	4	2
Length = 0x08	Cmd0 = 0x42	Cmd1 = 0x84	Status	Handle	Timestamp	Timestamp2

Attributes:

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:

AREQ:
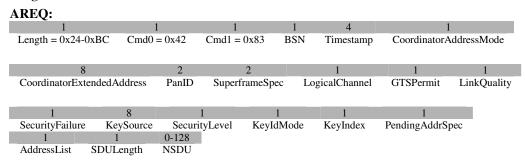
1	1	1	1	8	1	8
Length = 0x2C-0xAC	Cmd0 = 0x42	Cmd1 = 0x85	SrcAddrMode	SrcAddr	DstAddrMode	DstAddr

4	2	2	2	2	1	1	1
Timestamp	Timestamp2	SrcPanID	SrcPanID	DstPanID	LinkQuality	Correlation	RSSI

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

Attributes:

Attribute	Length (byte)	Description
SrcAddrMode	1	Source address mode <table><tr><td>Mode</td><td>Value</td><td>Description</td></tr><tr><td>ADDRESS_NOT_PRESENT</td><td>0x00</td><td>Address Not Present</td></tr><tr><td>GROUP_ADDRESS</td><td>0x01</td><td>Group address</td></tr><tr><td>ADDRESS_16_BIT</td><td>0x02</td><td>Address 16 bit</td></tr><tr><td>ADDRESS_64_BIT</td><td>0x03</td><td>Address 64 bit</td></tr><tr><td>BROADCAST</td><td>0xFF</td><td>Broadcast</td></tr></table>
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.
SecurityLevel	1	Security Level of this data frame: <table><tr><td>Security Level</td><td>Value</td></tr><tr><td>NO_SECURITY</td><td>0x00</td></tr><tr><td>MIC_32_AUTH</td><td>0x01</td></tr><tr><td>MIC_64_AUTH</td><td>0x02</td></tr><tr><td>MIC_128_AUTH</td><td>0x03</td></tr><tr><td>AES_ENCRYPTION</td><td>0x04</td></tr><tr><td>AES_ENCRYPTION_MIC_32</td><td>0x05</td></tr><tr><td>AES_ENCRYPTION_MIC_64</td><td>0x06</td></tr><tr><td>AES_ENCRYPTION_MIC_128</td><td>0x07</td></tr></table>
KeyIdMode	1	Key Id Mode of this data frame: <table><tr><td>Key Id Mode</td><td>Value</td></tr><tr><td>NOT_USED</td><td>0x00</td></tr><tr><td>KEY_1BYTE_INDEX</td><td>0x01</td></tr><tr><td>KEY_4BYTE_INDEX</td><td>0x02</td></tr><tr><td>KEY_8BYTE_INDEX</td><td>0x03</td></tr></table>
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	KeySource

1	1	1
SecurityLevel	KeyIdMode	KeyIndex

Attributes:

Attribute	Length (byte)	Description
ExtendedAddress	8	Extended address of the device leaving the network
DisassociateReason	1	Reason of the disassociation: 	Reason	Value	 |---|---| 	Coordinator wishes the device to disassociate	0x01	 	Device itself wishes to disassociate	0x02	
KeySource	8	Key Source of this data frame.
SecurityLevel	1	Security Level of this data frame:
KeyIdMode	1	Key Id Mode of this data frame:
KeyIndex	1	Key Index of this data frame.

Security Level of this data frame:

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:

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

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:

AREQ:

1	1	1	1	1	8	2

| Length = 0x0C | Cmd0 = 0x42 | Cmd1 = 0x87 | Status | DeviceAddrMode | DeviceAddr | DevicePanID |

Attributes:

Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).
DeviceAddrMode	1	Address mode of the device
DeviceAddr	8	Address of the device
DevicePanID	2	Pan ID of the device

Address mode of the device

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

3.5.2.9   MT_MAC_ORPHAN_IND

Description:

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

Usage:

AREQ:

1	1	1	8
Length = 0x13	Cmd0 = 0x42	Cmd1 = 0x8A	ExtendedAddr

8	1	1	1
KeySource	SecurityLevel	KeyIdMode	KeyIndex

Attributes:

Attribute	Length (byte)	Description
ExtendedAddr	8	Extended address of the orphan device
KeySource	8	Key Source of this data frame.
SecurityLevel	1	Security Level of this data frame:
KeyIdMode	1	Key Id Mode of this data frame:
KeyIndex	1	Key Index of this data frame.

Security Level of this data frame:

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:

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

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:

AREQ:

1	1	1	1
Length = 0x01	Cmd0 = 0x42	Cmd1 = 0x8B	Status

Attributes:

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:

1	1	1	1	1	1	1
Length = 0x0A-0x8A	Cmd0 = 0x42	Cmd1 = 0x8C	Status	ED	ScanType	ChannelPage

4	1	1	0-128
UnscannedChannelList	ResultListCount	ResultListMaxLength	ResultList

Attributes:

Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).
ED	1	ED max energy.
ScanType	1	Specifies the scan type: <table><tr><td>Scan Type</td><td>Value</td></tr><tr><td>ENERGY_DETECT</td><td>0x00</td></tr><tr><td>ACTIVE</td><td>0x01</td></tr><tr><td>PASSIVE</td><td>0x02</td></tr><tr><td>ORPHAN</td><td>0x03</td></tr></table>
ChannelPage	1	Channel Page
UnscannedChannelList	4	List of un-scanned channels
ResultListCount	1	Number of item in the result list
ResultListMaxLength	1	Max length of the result list 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:

1	1	1	1	8	1	8
Length = 0x24	Cmd0 = 0x42	Cmd1 = 0x8D	Status	SrcAddr	DstAddrMode	DstAddr

4	2	1	8	1	1	1
Timestamp	DevicePanID	Reason	KeySource	SecurityLevel	KeyIdMode	KeyIndex

Attributes:

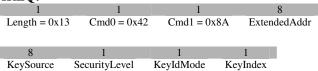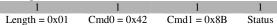| Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).
DstAddrMode	1	Destination address mode <table><tr><td>Mode</td><td>Value</td><td>Description</td></tr><tr><td>ADDRESS_NOT_PRESENT</td><td>0x00</td><td>Address Not Present</td></tr><tr><td>GROUP_ADDRESS</td><td>0x01</td><td>Group address</td></tr><tr><td>ADDRESS_16_BIT</td><td>0x02</td><td>Address 16 bit</td></tr><tr><td>ADDRESS_64_BIT</td><td>0x03</td><td>Address 64 bit</td></tr><tr><td>BROADCAST</td><td>0xFF</td><td>Broadcast</td></tr></table>
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.
SecurityLevel	1	Security Level of this data frame: <table><tr><td>Security Level</td><td>Value</td></tr><tr><td>NO_SECURITY</td><td>0x00</td></tr><tr><td>MIC_32_AUTH</td><td>0x01</td></tr><tr><td>MIC_64_AUTH</td><td>0x02</td></tr><tr><td>MIC_128_AUTH</td><td>0x03</td></tr><tr><td>AES_ENCRYPTION</td><td>0x04</td></tr><tr><td>AES_ENCRYPTION_MIC_32</td><td>0x05</td></tr><tr><td>AES_ENCRYPTION_MIC_64</td><td>0x06</td></tr><tr><td>AES_ENCRYPTION_MIC_128</td><td>0x07</td></tr></table>
KeyIdMode	1	Key Id Mode of this data frame: <table><tr><td>Key Id Mode</td><td>Value</td></tr><tr><td>NOT_USED</td><td>0x00</td></tr><tr><td>KEY_1BYTE_INDEX</td><td>0x01</td></tr><tr><td>KEY_4BYTE_INDEX</td><td>0x02</td></tr><tr><td>KEY_8BYTE_INDEX</td><td>0x03</td></tr></table>
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:

1	1	1	1
Length = 0x01	Cmd0 = 0x42	Cmd1 = 0x8E	Status

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:

1	1	1	1
Length = 0x01	Cmd0 = 0x42	Cmd1 = 0x8F	Status

Attributes:

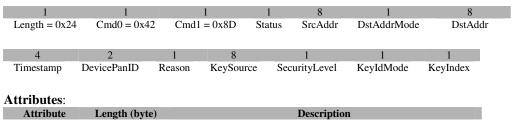| Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS (0) or FAILURE (1).

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:

AREQ:

1	1	1	1	1
Length = 0x01	Cmd0 = 0x42	Cmd1 = 0x9A	Status	Handle

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:

Byte: 1	1	1
Length = 0x00	Cmd0 = 0x46	Cmd1 = 0x09

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:

Byte: 1	1	1
Length = 0x00	Cmd0 = 0x26	Cmd1 = 0x00

Attributes:
None

SRSP:

Byte: 1	1	1
Length = 0x00	Cmd0 = 0x66	Cmd1 = 0x00

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:

Byte: 1	1	1	2	1
Length = 0x03	Cmd0 = 0x26	Cmd1 = 0x08	Destination	Timeout

Attributes:

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:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x66	Cmd1 = 0x08	Status

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:

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

Attributes:

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:

1	1	1
Length = 0x00	Cmd0 = 0x66	Cmd1 = 0x01

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:

1	1	1	1
Length = 0x01	Cmd0 = 0x26	Cmd1 = 0x02	Timeout

Attributes:

Attribute	Length (byte)	Description
Timeout	1	The number of seconds to remain in the allow binding mode. Valid values range from 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:

1	1	1
Length = 0x00	Cmd0 = 0x66	Cmd1 = 0x02

Attributes:
None

3.7.1.6   ZB_SEND_DATA_REQUEST

Description:

This command initiates transmission of data to a peer device.

Usage:

SREQ:

Byte: 1	1	1	2	2	1
Length = 0x08-0x5C	Cmd0 = 0x26	Cmd1 = 0x03	Destination	CommandId	Handle

1	1	1	0-84
Ack	Radius	Len	Data

Attributes:

Attribute	Length (byte)	Description
Destination	2	The destination of the data. The destination can be one of the following: - 16-Bit short address of device [0-0xfffD] - ZB_BROADCAST_ADDR sends the data to all devices in the network. - ZB_BINDING_ADDR sends the data to a previously bound device.
CommandId	2	The command ID to send with the message. If the ZB_BINDING_ADDR destination is 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:

1	1	1
Length = 0x00	Cmd0 = 0x66	Cmd1 = 0x03

Attributes:
None

3.7.1.7   ZB_READ_CONFIGURATION

Description:

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

Usage:

SREQ:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x26	Cmd1 = 0x04	ConfigId

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:

1	1	1	8
Length = 0x08	Cmd0 = 0x26	Cmd1 = 0x07	SearchKey

Attributes:

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

SRSP:

1	1	1
Length = 0x00	Cmd0 = 0x66	Cmd1 = 0x07

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:

1	1	1	1
Length = 0x01	Cmd0 = 0x46	Cmd1 = 0x80	Status

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:

AREQ:

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:

1	1	1	1	1
Length = 0x02	Cmd0 = 0x46	Cmd1 = 0x83	Handle	Status

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:

1	1	1	1	2	8
Length = 0x0B	Cmd0 = 0x46	Cmd1 = 0x85	SearchType = 0x01	SearchKey	Result

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
Type	1	Rrequests 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.

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:

Attribute	Length (byte)	Description
Capabilities	2	This field represents the interfaces that this device can handle (compiled into the device). Bit weighted and defined as:

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:

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:

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:

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:

1	1	1	1	1	0-128
Length = 0x02-0x82	Cmd0 = 0x61	Cmd1 = 0x05	Status	Len	Value

Attributes:

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

SREQ:

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

Attributes:

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

SREQ:

1	1	1	1	1
Length = 0x02	Cmd0 = 0x21	Cmd1 = 0x0D	Channel	Resolution

Attributes:

Attribute	Length (byte)	Description
Channel	1	The channel of the ADC that will be used. {{CHANNEL_TABLE}}
Resolution	1	Resolution of the reading. This can be 8-bit, 10-bit, 12-bit or 14-bit. {{RESOLUTION_TABLE}}

The channel of the ADC that will be used.

Channel	Value
AIN0	0x00
AIN1	0x01
AIN2	0x02
AIN3	0x03
AIN4	0x04
AIN5	0x05
AIN6	0x06
AIN7	0x07
Temperature Sensor	0x0E
Voltage Reading	0x0F

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

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.

3.8.2 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

Attributes:

Attribute	Length (byte)	Description
Reason	1	Reason for the reset. | Resolution	Value | |---|---| | 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:

SREQ:

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:

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.
DeviceState	1	Indicates the state of the device with different possible states as shown below: 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 0x08: Starting as ZigBee Coordinator 0x09: Started as ZigBee Coordinator 0x0A: Device has lost information about its parent
NumAssocDevices	1	Specifies the number of devices being associated to the target device.
AssocDevicesList	Array	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:

1	1	1
Length = 0x00	Cmd0 = 0x27	Cmd1 = 0x01

Attributes:
None

SRSP:

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

1	16

SecurityLevel	PreConfigKey

Attributes:

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. Bit0 is used for the first item (IEEEAddress), bit1 for the second item (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.
IEEEAddr	8	IEEE address of the device
ScanChannels	4	This represents a bit-mask of channels to be scanned when starting the device.
PanID	2	Specifies the Pan ID to start or join. Set to 0xFFFF to select a PAN after scanning.
SecurityLevel	1	This specifies the network messaging security level, zero disables security.
PreConfigKey	16	This specifies the pre-configured security key.

3.10.1.3 UTIL_SET_PANID

Description:

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

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:

SREQ:

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

Attributes:

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:

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

Attributes:

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:

Attribute	Length (byte)	Description
SubsystemID	2	Subsystem ID of the expected layer See table below
Action	1	0: Disable, 1: Enable

Subsystem ID of the expected layer

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

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

Attributes:

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:

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:

SREQ:

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

Attributes:

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:

SREQ:

Byte: 1	1	1	8	1	1
Length = 0x0A	Cmd0 = 0x25	Cmd1 = 0x00	IEEEAddress	ReqType	StartIndex

Attributes:

Attribute	Length (byte)	Description
IEEEAddress	8	64 bit IEEE address of the device. Value that the search was executed on.
ReqType	1	<table><tr><td>Type</td><td>Value</td></tr><tr><td>Single Device response</td><td>0x00</td></tr><tr><td>Extended, include associated devices</td><td>0x01</td></tr></table>
StartIndex	1	Starting index into the list of children. This is used to get more of the list if the list is too large for one message.

SRSP:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x00	Status

Attributes:

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	<table><tr><td>Type</td><td>Value</td></tr><tr><td>Single Device response</td><td>0x00</td></tr><tr><td>Extended, include associated devices</td><td>0x01</td></tr></table>
StartIndex	1	Starting index into the list of children. This is used to get more of the list if the list is too large for one message.

SRSP:

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

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:

1	1	1	2	2
Length = 0x04	Cmd0 = 0x25	Cmd1 = 0x02	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:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x02	Status

Attributes:

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:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x03	Status

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

Attributes:

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:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x05	Status

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	1	1	2	2	2
Length = 0x08-0x48	Cmd0 = 0x25	Cmd1 = 0x06	DstAddr	NwkAddrOfInterest	ProfileID

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:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x06	Status

Attributes:

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:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x07	Status

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:

1	1	1	2	2
Length = 0x04	Cmd0 = 0x25	Cmd1 = 0x08	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:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x08	Status

Attributes:

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:

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.
Capabilites	1	Specifies MAC capabilities 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:

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:

1	1	1	2	2	1	0-16
Length = 0x05-0x15	Cmd0 = 0x25	Cmd1 = 0x0B	DstAddr	NWKAddrOfInterest	Len	UserDescriptor

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:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x0B	Status

Attributes:

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:

SREQ:

1	1	1	2
Length = 0x02	Cmd0 = 0x25	Cmd1 = 0x0C	ServerMask

Attributes:

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

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x0C	Status

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:

1	1	1	2	2	1
Length = 0x09-0x49	Cmd0 = 0x25	Cmd1 = 0x20	DstAddr	LocalCoordinator	Endpoint

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

Attributes:

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:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x20	Status

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	1	1	2	8	1	2
Length = 0x10-0x17	Cmd0 = 0x25	Cmd1 = 0x21	DstAddr	SrcAddress	SrcEndpoint	ClusterID

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.
DstAddrMode	1	Specifies destination address mode {table below}
DstAddress	8/2	Binding destination IEEE address. Not to be confused with DstAddr.
DstEndpoint	1/0	Specifies the binding destination endpoint. It is used only when DstAddrMode is 64 bits extended address

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

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x21	Status

Attributes:

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

3.12.1.15 ZDO_UNBIND_REQ

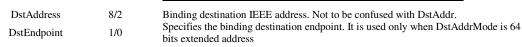**Description:**

This command is generated to request an UnBind

Usage:

SREQ:

1	1	1	2	8	1	2
Length = 0x10-0x17	Cmd0 = 0x25	Cmd1 = 0x22	DstAddr	SrcAddress	SrcEndpoint	ClusterID

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.
DstAddrMode	1	Specifies 64 bit Binding destination address mode:

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

Attribute	Length (byte)	Description
DstAddress	8	Specifies 64 bit Binding destination IEEE address. Not to be confused with DstAddr.
DstEndpoint	1	Specifies the binding destination endpoint

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x22	Status

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:

1	1	1	2	4	1	1
Length = 0x08	Cmd0 = 0x25	Cmd1 = 0x30	DstAddr	ScanChannels	ScanDuration	StartIndex

Attributes:

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

Specifies the Bit Mask for channels to scan:

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

Attribute	Length	Description
ScanChannels	4	(see table above)
ScanDuration	1	Specifies the scanning time.
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:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x30	Status

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:

Byte: 1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x31	Status

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
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:

Byte: 1	1	1	2	1
Length = 0x03	Cmd0 = 0x25	Cmd1 = 0x33	DstAddr	StartIndex

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies the network address of the device being queried.
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:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x33	Status

Attributes:

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:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x34	Status

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

Attributes:

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:

1	1	1	2	1	1
Length = 0x04	Cmd0 = 0x25	Cmd1 = 0x36	DstAddr	Duration	TCSignificance

Attributes:

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

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x36	Status

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:

1	1	1	2	1	4
Length = 0x0B	Cmd0 = 0x25	Cmd1 = 0x37	DstAddr	DstAddrMode	ChannelMask

1	1	2
ScanDuration	ScanCount	NwkManagerAddr

Attributes:

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:

ChannelMask	4	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

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
NwkManagerAddr	2	Indicates the NWK address for the device with the Network Manager bit set in its Node Descriptor

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x36	Status

Attributes:

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

3.12.1.24 ZDO_STARTUP_FROM_APP

Description:

This command starts the device in the network.

Usage:

SREQ:

1	1	1	2
Length = 0x01	Cmd0 = 0x25	Cmd1 = 0x40	StartDelay

Attributes:

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

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x40	Status

Attributes:

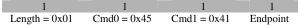| Attribute	Length (byte)	Description
Status	1	0x00 – Restored network state 0x01 – New network state 0x02 – Leave and not Started

3.12.1.25   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:

1	1	1	1
Length = 0x01	Cmd0 = 0x45	Cmd1 = 0x41	Endpoint

Attributes:

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

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

AREQ:

1	1	1	1	8	2
Length = 0x0D-0x53	Cmd0 = 0x45	Cmd1 = 0x80	Status	IEEEAddr	NwkAddr

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:

1	1	1	1	8	2
Length = 0x0D-0x53	Cmd0 = 0x45	Cmd1 = 0x81	Status	IEEEAddr	NwkAddr

1	1	0-70
StartIndex	NumAssocDev	AssocDevList

Attributes:

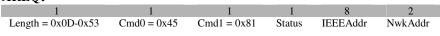| Attribute	Length (byte)	Description
Status	1	This field indicates either SUCCESS or FAILURE.
IEEEAddr	8	64 bit IEEE address of source device.
NwkAddr	2	Specifies the short network address of responding device.
StartIndex	1	Specifies the starting index into the list of associated devices for this report.
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.

3.12.2.3   ZDO_NODE_DESC_RSP

Description:

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

Usage:

AREQ:

1	1	1	2	1	2
Length = 0x12	Cmd0 = 0x45	Cmd1 = 0x82	SrcAddr	Status	NwkAddr

1	1	1	2
LogicalType/ ComplexDescAvailable/ UserDescAvailable	APSFlags/ FrequencyBand	MACCapabilityFlags	ManufacturerCode

1	2	2	2	1
MaxBufferSize	MaxTransferSize	ServerMask	MaxOutTransferSize	DescriptorCapabilities

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	The message's source network address.
Status	1	This field indicates either SUCCESS or FAILURE.
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 if complex descriptor is available for the node NodeFrequencyBand – Bit 5-7 – Identifies node frequency band capabilities

APSFlags/FrequencyBand	1	- APSFlags – Bit 0-4 – Node Flags assigned for APS. For V1.0 all bits are reserved. - NodeFrequencyBand – Bit 5-7 – Identifies node frequency band capabilities

Capability flags stored for the MAC

MacCapabilitiesFlags	1	**Description**	**Value**
		CAPINFO_DEVICETYPE_RFD	0x00
		CAPINFO_ALTPANCOORD	0x01
		CAPINFO_DEVICETYPE_FFD	0x02
		CAPINFO_POWER_AC	0x04
		CAPINFO_RCVR_ON_IDLE	0x08
		CAPINFO_SECURITY_CAPABLE	0x40
		CAPINFO_ALLOC_ADDR	0x80

ManufacturerCode	2	Specifies a manufacturer code that is allocated by the ZigBee Alliance, relating to the manufacturer to the device.
MaxBufferSize	1	Indicates size of maximum NPDU. This field is used as a high level indication for management.
MaxInTransferSize	2	Indicates maximum size of Transfer up to 0x7fff (This field is reserved in version 1.0 and shall be set to zero).

ServerMask	2	Bit 0 - Primary Trust Center
		    1 - Backup Trust Center
		    2 - Primary Binding Table Cache
		    3 - Backup Binding Table Cache
		    4 - Primary Discovery Cache
		    5 - Backup Discovery Cache

MaxOutTransferSize	2	Indicates maximum size of Transfer up to 0x7fff (This field is reserved in version 1.0 and shall be set to zero).
DescriptorCapabilities	1	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:

AREQ:

1	1	1	2	1	2
Length = 0x07	Cmd0 = 0x45	Cmd1 = 0x83	SrcAddr	Status	NwkAddr

1	1
CurrentPowerMode/AvailablePowerSources	CurrentPowerSource/CurrentPowerSourceLevel

Attributes:

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:

AREQ:

1	1	1	2	1	2	1
Length = 0x06-4E	Cmd0 = 0x45	Cmd1 = 0x84	SrcAddr	Status	NwkAddr	Len

1	2	2	1
Endpoint	ProfileID	DeviceID	DeviceVersion

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

Attributes:

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.
DeviceVersion	1	Defined as the following format 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:

AREQ:

1	1	1	2	1	2	1
Length = 0x06-0x53	Cmd0 = 0x45	Cmd1 = 0x85	SrcAddr	Status	NwkAddr	ActiveEPCount

0-77
ActiveEPList

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.
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:

1	1	1	2	1	2	1
Length = 0x06-0x53	Cmd0 = 0x45	Cmd1 = 0x86	SrcAddr	Status	NwkAddr	MatchLength

0-77
MatchList

Attributes:

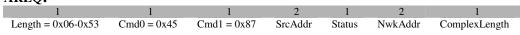| Attribute	Length (byte)	Description
SrcAddr	2	The message's source network address.
Status	1	This field indicates either SUCCESS or FAILURE.
NWKAddr	2	Device's short address that this response describes.
MatchLength	1	The count of endpoints on the remote device that match the request criteria
MatchList	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:

1	1	1	2	1	2	1
Length = 0x06-0x53	Cmd0 = 0x45	Cmd1 = 0x87	SrcAddr	Status	NwkAddr	ComplexLength

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).
Server Mask	2	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 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:

1	1	1	2	1
Length = 0x03	Cmd0 = 0x45	Cmd1 = 0xA0	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).

3.12.2.13 ZDO_BIND_RSP

Description:

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

Usage:

AREQ:

1	1	1	2	1
Length = 0x03	Cmd0 = 0x45	Cmd1 = 0xA1	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).

3.12.2.14 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	1	1	2	1	1	1
Length = 0x06-0x4E	Cmd0 = 0x45	Cmd1 = 0xB0	SrcAddr	Status	NetworkCount	StartIndex

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 NetworkList items. NetworkListCount contains the number of items in this table

NetworkList	List			

Name	Size	Description
PAN ID/Extended PAN ID	2 bytes	PAN ID of the neighbor device
Logical Channel	1 byte	The current logical channel occupied by the network.
Stack Profile / ZigBee Version	1 byte	StackProfile: bits 3-0 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 frame Order	1 byte	BeaconOrder: bits 3-0 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	1	1	2	1	1	1
Length = 0x06-0x48	Cmd0 = 0x45	Cmd1 = 0xB1	SrcAddr	Status	NeighborTableEntries	StartIndex

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.

		Where in the total number of entries this response starts.
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

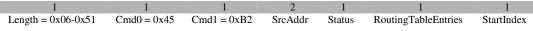| Name	Size	Description
ExtendedPanID	8 bytes	Extended PAN ID of the neighbor device
ExtendedAddress	8 bytes	Network extended address
NetworkAddress	2 bytes	Device short address
DeviceType/ RxOnWhenIdle/ Relationship	1 byte	DeviceType: bits 1-0 RxOnWhenIdle: bits 3-2 Relationship: bits 6-4
PermitJoining	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	1	1	2	1	1	1
Length = 0x06-0x51	Cmd0 = 0x45	Cmd1 = 0xB2	SrcAddr	Status	RoutingTableEntries	StartIndex

1	0-75
RoutingTableListCount	RoutingTableListRecords

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	Source address of the message.
Status	1	This field indicates either SUCCESS or FAILURE.
RoutingTableEntries	1	Total number of entries available in the device.
StartIndex	1	Where in the total number of entries this response starts.
RoutingTableListCount	1	Number of entries in this response.
		An array of RtgList items. RtgListCount contains the number of items in this table.
RoutingTableList	0-75	

Name	Size	Description
Destination Address	2 bytes	Network destination 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 |

3.12.2.18 ZDO_MGMT_BIND_RSP

Description:

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

Usage:

AREQ:

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

1	0-75
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.
BindTableList	List	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.

3.12.2.19 ZDO_MGMT_LEAVE_RSP

Description:

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

Usage:

AREQ:

Byte: 1	1	1	2	1
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:

1	1	1	2	1
Length = 0x03	Cmd0 = 0x45	Cmd1 = 0xB5	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).

3.12.2.21 ZDO_MGMT_PERMIT_JOIN_RSP

Description:

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

Usage:

AREQ:

1	1	1	2	1
Length = 0x03	Cmd0 = 0x45	Cmd1 = 0xB6	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).

3.12.2.22 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:

AREQ:

1	1	1	1

Length = 0x01   Cmd0 = 0x45   Cmd1 = 0xC0   State

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:

AREQ:

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.
Capabilites	1	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 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:

Byte: 1	1	1	2
Length = 0x04-0x44	Cmd0 = 0x45	Cmd1 = 0xC2	NwkAddr

1	0-32	1	0-32
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 = 0xC2	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).