

ZigBee PRO Network Processor

Accelerate your ZigBee Development

Applications

- ZigBee™ systems
- Home/Building automation
- Industrial control and monitoring
- Low power wireless sensor networks
- Set-top boxes and remote controls
- Automated Meter Reading

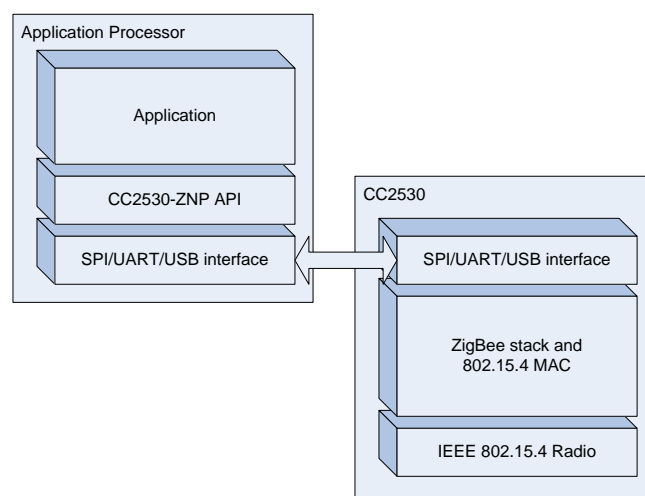
Description

The **CC2530-ZNP** is a cost-effective, low power, ZigBee Processor that provides full ZigBee functionality with a minimal development effort.

In this solution, the ZigBee PRO stack runs on a CC2530 ZigBee SoC and the application runs on an external microcontroller. The **CC2530-ZNP** handles all the ZigBee protocol tasks, and leaves the resources of the application microcontroller free to handle the application.

This makes it easy for users to add ZigBee to new or existing products at the same time as it provides great flexibility in choice of microcontroller.

CC2530-ZNP interfaces to any microcontroller through an SPI, UART or USB interface. For example, it can be combined with an MSP430 or Stellaris ARM Cortex-M3 microcontroller.



Key Features

- All the powerful features of the ZigBee PRO system-on-chip with a simplified application interface.
- SPI, UART or USB interface to application processor with SPI speeds up to 4 MHz.
- Designed for low power operation when using SPI interface with maximum time spent in low power mode when using SPI interface.
- Access to 12-bit analog-to-digital converter, GPIO pins, non-volatile memory

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References

- [R1] CC253X User Guide. <http://www.ti.com/litv/pdf/swru191>
- [R2] CC2530 Datasheet. <http://www.ti.com/lit/gpn/cc2530>
- [R3] CC2531 Datasheet. <http://www.ti.com/lit/gpn/cc2531>
- [R4] CC259x Datasheet. <http://www.ti.com/lit/gpn/cc2591>

Acronyms

API	Application Programming Interface
AREQ	Asynchronous Request
CTS	Clear To Send
FCS	Frame Check Sequence
POLL	Poll request
RPC	Remote Procedure Call
RTS	Ready To Send
SOF	Start Of Frame
SPI	Serial Peripheral Interface bus
SREQ	Synchronous request
AF	ZigBee Application Framework
ZDO	ZigBee Device Object

1 Pin configuration

The figure below shows how an application processor interfaces with the CC2530.

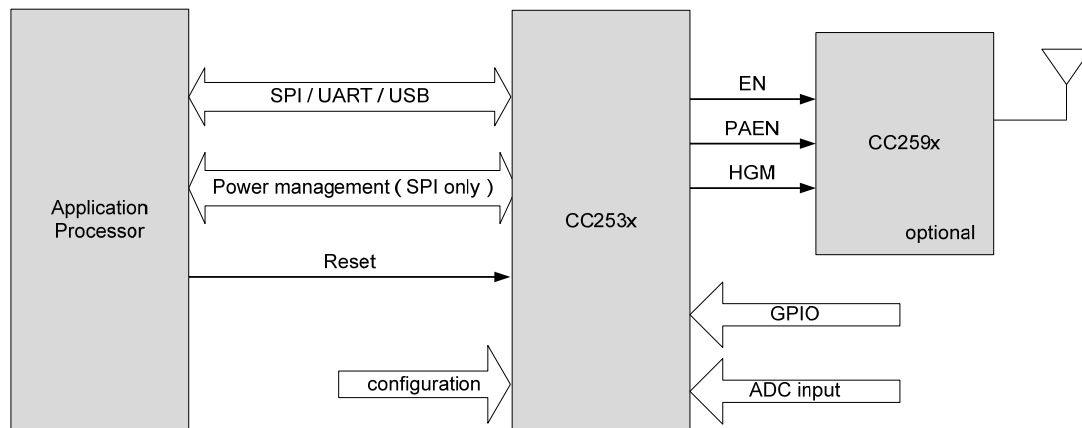


Figure 1 CC2530 Interface

1.1 Network processor signals

The CC2530-ZNP uses the following signals for the hardware interface

- **MISO/RX, MOSI/TX, SS/CTS, C/RTS:** These are the standard signals used for SPI or UART communication. See 2.1.3 (for SPI) and 2.2.3 (for UART) for details.
- **SRDY:** This signal is asserted by the CC2530 for power management and transaction control when using SPI transport. The application processor can use a regular GPIO pin to poll the status of this signal, or connect it to a GPIO with edge configurable interrupt capability. See 2.1.3 for details
- **MRDY:** This signal is asserted by the application processor for power management and transaction control when using SPI transport. This is typically hardwired to SS/CT pin and does not have to be controlled by a separate GPIO from the application processor. See 2.1.3 for details.
- **RESET:** This signal is used by the application processor to reset the CC2530.
- **PAEN, EN, HGM:** These signals are used to control the CC259x PA/LNA and should be connected to the appropriate pins on the CC259x. See [R4] for details on the CC259x.
- **CFG0, CFG1:** These two signals are used to configure the CC2530-ZNP. The CC2530-ZNP reads these signals at power up and configures its operation accordingly. See section 4.2.1 for details.
- **GPIO0-3:** These pins can be configured as general purpose I/O or, for some pins, as ADC inputs. See 3.1.7 for details.

2 CC2530-ZNP physical Interface

The CC2530-ZNP supports SPI, UART or USB interface to the application processor.

2.1 SPI Transport

2.1.1 Configuration

The following SPI configuration is supported:

- SPI slave.
- Clock speed up to 4 MHz.
- Clock polarity 0 and clock phase 0 on CC2530.
- Bit order MSB first.

2.1.2 Frame Format

SPI transport uses the general frame format described in 2.3.

2.1.3 Signal Description

The following standard SPI signals are used:

- SCK: Serial clock.
- SS: Slave select.
- MOSI/TX: Master-output slave-input data.
- MISO/RX: Master-input slave-output data.

The following additional signals are required for SPI transaction handling and power management:

- MRDY: Master ready, an active low signal. This signal is set by the application processor when it has data ready to send to the CC2530. This signal can either be controlled independently or it can be hardwired to the slave select signal. The scenarios in this document assume MRDY is hardwired to SS.
- SRDY: Slave ready, a bi-modal signal. This signal is set by the CC2530 when it is ready to receive or send data. When asserted low, it indicates the CC2530 is ready to receive data. When asserted high during an SPI POLL or SREQ transaction it indicates the CC2530 is ready to send data. When asserted high during an SPI AREQ transaction it indicates the CC2530 is done receiving data.

2.1.4 Signal Operation

The signals operate according to the following rules:

1. The application processor initiates a transaction by setting MRDY low and then waits for SRDY to go low.
2. The application processor shall never set MRDY high to end a transaction before all bytes of the frame have been transferred.
3. When receiving a POLL or SREQ, the CC2530 shall set SRDY high when it has data ready for the application processor.
4. When receiving an AREQ, the CC2530 shall set SRDY high when all bytes of the frame have been received.

2.1.5 Protocol Scenarios

2.1.5.1 AREQ Command

The following figure shows an AREQ command sent from the application processor to the CC2530.

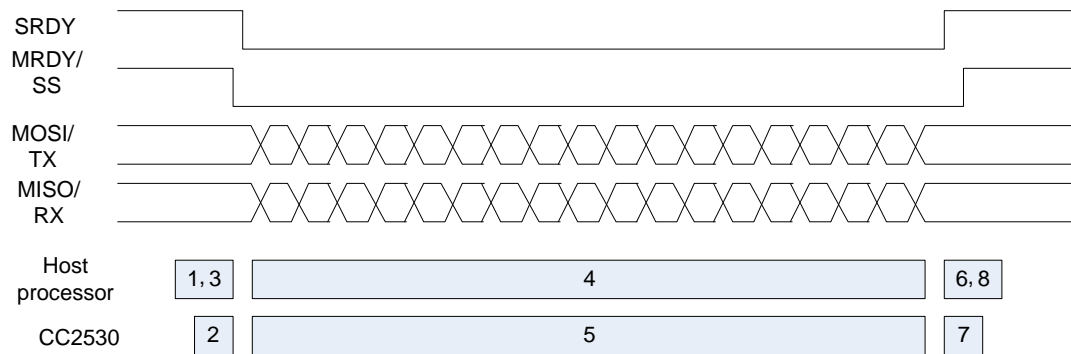


Figure 2 AREQ Command

The following sequence of events occurs on the application processor and CC2530:

1. Application processor has an AREQ frame to send. Set MRDY low and wait for SRDY to go low.
2. CC2530 receives falling edge of MRDY. When ready to receive data set SRDY low.
3. Application processor reads SRDY low. Start data transmission.
4. Application processor transmits data until frame is complete.
5. CC2530 receives data until frame is complete.
6. Application processor waits for SRDY to go high.
7. CC2530 receives complete frame and sets SRDY high.
8. Application processor reads SRDY high. Set MRDY high.

2.1.5.2 POLL Command

The following figure shows a POLL command sent from the application processor to the CC2530-ZNP.

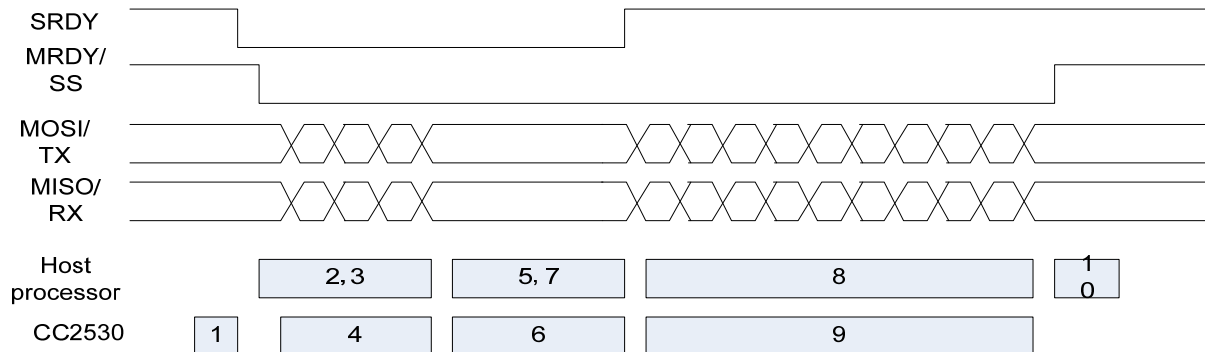


Figure 3 POLL command

The following sequence of events occurs on the application processor and CC2530:

1. CC2530 has an AREQ frame to send. When ready to receive data set SRDY low.
2. Application processor detects SRDY low and sets MRDY low. Prepare POLL command and start data transmission.
3. Application processor transmits data until frame is complete.
4. CC2530 receives data until frame is complete.
5. Application processor waits for SRDY to go high.
6. CC2530 prepares AREQ frame for transmission. When ready to transmit set SRDY high.
7. Application processor reads SRDY high. Start data reception.
8. Application processor receives data until frame is complete.
9. CC2530 transmits data until frame is complete.
10. Application processor receives complete frame. Set MRDY high.

2.1.5.3 SREQ Command

The following figure shows a SREQ command sent from the application processor to the CC2530-ZNP.

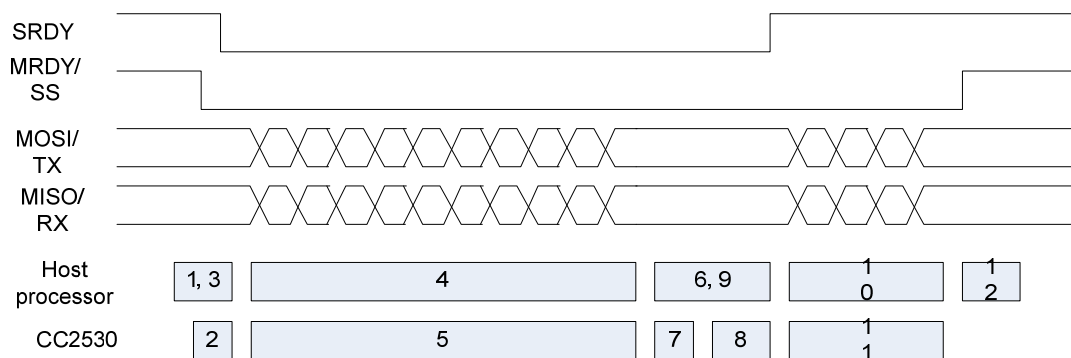


Figure 4 SREQ command

The following sequence of events occurs on the application processor and CC2530-ZNP:

1. Application processor has an SREQ frame to send. Set MRDY low and wait for SRDY to go low.
2. CC2530 receives falling edge of MRDY. When ready to receive data set SRDY low.
3. Application processor reads SRDY low. Start data transmission.
4. Application processor transmits data until frame is complete.
5. CC2530 receives data until frame is complete.
6. Application processor waits for SRDY to go high.
7. CC2530 processes SREQ command and executes function
8. CC2530 prepares SRSP frame. When ready to transmit data set SRDY high.
9. Application processor reads SRDY high. Start data reception.
10. Application processor receives data until frame is complete.
11. CC2530 transmits data until frame is complete.
12. Application processor receives complete frame. Set MRDY high.

2.2 UART Transport

2.2.1 Configuration

The following UART configuration is supported:

- Baud rate: 115200
- Hardware (RTS/CTS) flow control.
- 8-N-1 byte format.

2.2.2 Frame Format

UART transport frame format is shown in the following figure. The left-most field is transmitted first over the wire.

Bytes: 1	3-253	1
SOF	General format frame	FCS

Figure 5 UART Transport Frame Format

SOF: Start of frame indicator. This is always set to 0xFE.

General frame format: This is the general frame format as described in 2.3.

FCS: Frame-check sequence. This field is computed as an XOR of all the bytes in the general format frame fields.

Shown below is a C example for the FCS calculation:

```
unsigned char calcFCS(unsigned char *pMsg, unsigned char len)
{
    unsigned char result = 0;
    while (len--)
```

```

{
    result ^= *pMsg++;
}
return result;
}

```

2.2.3 Signal Description

The following standard UART signals are used:

- TX: Transmit data.
- RX: Receive data.
- CT: Clear to send.
- RT: Ready to send.
- The MRDY and SRDY signals are not used with UART transport.

2.2.4 Signal Operation

UART transport sends and receives data asynchronously. Data can be sent and received simultaneously and the transfer of a frame can be initiated at any time by either the application processor or the CC2530.

2.3 General Frame Format

The general frame format is shown in the following figure. The left-most field is transmitted first over the wire. For multi-byte fields, the lowest order byte is transmitted first.

Bytes: 1	2	0-250
Length	Command	Data

Figure 6 General Frame Format

Length: The length of the data field of the frame. The length can range from 0-250.

Command: The command of the frame.

Data: The frame data. This depends on the command field and is described for each command in Section 3.

2.3.1 Command Field

The command field is constructed of two bytes. The bytes are formatted as shown in the following figure. The Cmd0 byte is transmitted first.

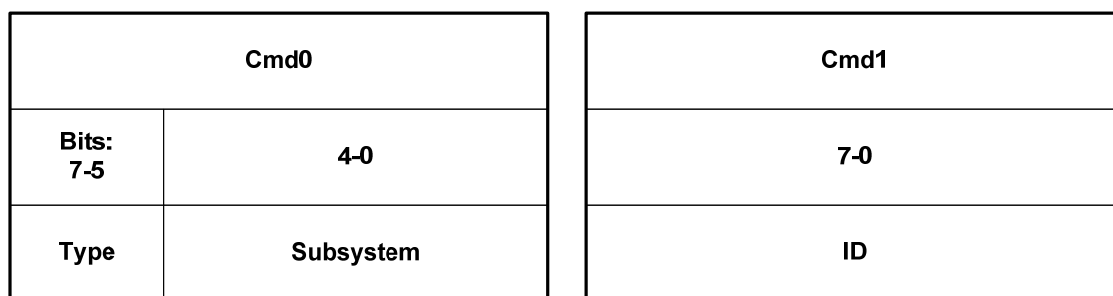


Figure 7 Command Field

Type: The command type has one of the following values:

- 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. Values are shown below:

Subsystem Value	Subsystem Name
0	Reserved
1	SYS interface
2	Reserved
3	Reserved
4	AF interface
5	ZDO interface
6	Simple API interface
7-32	Reserved

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

3 CC2530-ZNP software command interface

The following subsections describe the CC2530 software command interface. They are subdivided into the following categories

- The SYS interface provides the application processor with a low level interface to the CC2530 hardware and software. The CC2530 functions that are accessible over this interface include the ADC (analog-to-digital converter), NV memory, GPIO pins and the hardware random number generator.
- The Configuration interface allows the application processor to configure various parameters of the CC2530 device.
- The Simple API interface is a simplified ZigBee interface that can be used to quickly create simple ZigBee compliant networked applications. It allows for easy device configuration, network formation, binding and data transfer.
- The AF and ZDO interfaces feature the complete ZigBee interface and can be used to create a full range of ZigBee compliant applications. The AF (Application Framework) interface allows the application processor to register its application with the CC2530 and send and receive data. The ZDO (ZigBee Device Object) interface provides various ZigBee management functions like device and service discovery.

In all the message formats shown below, the left-most field is transmitted first over the wire. For multi-byte fields, the lowest order byte is transmitted first.

3.1 SYS interface

3.1.1 SYS_RESET_REQ

3.1.1.1 Description

This command is issued by the application processor to reset the CC2530 device. The reset is achieved through an internal watchdog reset on the CC2530. Note that the hardware reset interface is recommended over using this interface.

3.1.1.2 Usage

AREQ:

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

Type – 1 byte – This 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.

3.1.2 SYS_RESET_IND

3.1.2.1 Description

This command is generated by the CC2530 device automatically immediately after a reset.

3.1.2.2 Usage

AREQ:

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

1	1	1
MajorRel	MinorRel	HwRev

Reason – 1 byte – One of the following values indicating the reason for the reset.

Resolution	Value
Power-up	0x00
External	0x01
Watch-dog	0x02

TransportRev – 1 byte – Transport protocol revision. This is set to value of 2.

Product – 1 byte – Product ID. This is set to value of 1.

MajorRel – 1 byte – Major release number.

MinorRel – 1 byte – Minor release number.

HwRev – 1 byte – Hardware revision number.

3.1.3 SYS_VERSION

3.1.3.1 Description

This command is issued by the application processor to request for the CC2530 software version information.

3.1.3.2 Usage

SREQ:

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

SRSP:

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

TransportRev – 1 byte – The transport protocol revision number. This is set to value of 2.

Product – 1 byte – Product ID. This is set to value of 2.

MajorRel – 1 byte – Software major release number.

MinorRel – 1 byte – Software minor release number.

HwRev – 1 byte – Chip hardware revision.

3.1.4 SYS_OSAL_NV_READ

3.1.4.1 Description

This command is used by the application processor to read an item stored in the CC2530 NV memory. The command accepts an attribute ID value and returns the value for that attribute ID.

3.1.4.2 Usage

SREQ:

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

Id – 2 bytes – The attribute id of the NV item. It can take one of the following values

NV Item	Size	Value
ZP_NV_APP_ITEM_1	2 bytes	0x0F01
ZP_NV_APP_ITEM_2	2 bytes	0x0F02
ZP_NV_APP_ITEM_3	2 bytes	0x0F03
ZP_NV_APP_ITEM_4	2 bytes	0x0F04
ZP_NV_APP_ITEM_5	16 bytes	0x0F05
ZP_NV_APP_ITEM_6	16 bytes	0x0F06

Offset – 1 byte – Number of bytes offset from the beginning or the NV value.

SRSP:

1	1	1	1	1	0-16
Length = 0x02-0x12	Cmd0 = 0x61	Cmd1 = 0x08	Status	Len	Value

Status – 1 byte – See 3.6 for a listing of the status values.

Len – 1 byte – The length of the NV value.

Value – 0-16 bytes – The value of the NV item.

3.1.5 SYS_OSAL_NV_WRITE

3.1.5.1 Description

This command is used by the application processor to write to an NV item in the CC2530 NV memory.

3.1.5.2 Usage

SREQ:

1	1	1	2	1	1	0-16
Length = 0x04-0x14	Cmd0 = 0x21	Cmd1 = 0x09	Id	Offset	Len	Value

Id – 2 bytes – The attribute id of the NV item. It can take one of the following values

NV Item	Size	Value
ZP_NV_APP_ITEM_1	2 bytes	0x0F01
ZP_NV_APP_ITEM_2	2 bytes	0x0F02
ZP_NV_APP_ITEM_3	2 bytes	0x0F03
ZP_NV_APP_ITEM_4	2 bytes	0x0F04
ZP_NV_APP_ITEM_5	16 bytes	0x0F05
ZP_NV_APP_ITEM_6	16 bytes	0x0F06

Offset – 1 byte - Number of bytes offset from the beginning or the NV value.

Len – 1 byte – Length of the NV value.

Value – 0-128 bytes – Value of the NV item.

SRSP:

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

Status – 1 byte – See xxx 3.6 for a listing of the status values.

3.1.6 SYS_ADC_READ

3.1.6.1 Description

This command is used by the application processor to read from the CC2530-ZNP ADC (analog-to-digital converter).

3.1.6.2 Usage

SREQ:

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

Channel – 1 byte – The following channels are available.

Channel	Value
AIN0	0x06
AIN1	0x07
AIN0-1 (differential input)	0x0B
Temperature Sensor	0x0E
Voltage Reading	0x0F

Resolution – 1byte – The resolution of the ADC conversion. It can be 7-bit, 9-bit, 10-bit or 12-bit.

Resolution	Value
7-bit	0x00
9-bit	0x01
10-bit	0x02
12-bit	0x03

SRSP:

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

Value – 2 bytes – Value of the ADC conversion based on the specified information. This is a signed value in two's complement representation. Depending on the resolution of the conversion, the appropriate number of lowest order bits should be ignored. For example, for a 7-bit resolution, the lowest 9 bits should be ignored.

3.1.7 SYS_GPIO

3.1.7.1 Description

This command is used by the application processor to configure the accessible GPIO pins on the CC2530-ZNP device. There are four accessible GPIO pins (GPIO0-3) on the CC2530-ZNP device.

3.1.7.2 Usage

SREQ:

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

Operation - 1 byte - The type of operation to perform on the GPIO pins. It can take following values:

Operation	Value	Description
Set direction	0x00	Configures the direction of the GPIO pins. A value of 0 in a bit position configures the corresponding GPIO pin as an Input while a value of 1 configures it as Output.
Set Input mode	0x01	Configures the Input mode of the GPIO pins. A value of 1 in a bit position configures the corresponding GPIO into a tri-state mode. Otherwise, the corresponding bit in the higher-order nibble is examined and a 1 in that position configures the GPIO as a pull-down while a 0 configures it as pull-up.
Set	0x02	A value of 1 in a bit position will set the corresponding GPIO pin (writes a 1).
Clear	0x03	A value of 1 in a bit position will clear the corresponding GPIO pin (writes a 0).
Toggle	0x04	A value of 1 in a bit position will toggle the corresponding GPIO pin.
Read	0x05	Reads the GPIO pins.

Value – 1 byte – Each bit position in this field contains the requested value for one of the four GPIO pins. Note that only the four lower order bits are used except when the requested operation is a “set input mode”, in which case the whole byte is used.

SRSP:

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

Value – 1 byte – The value after the requested operation is performed.

Note: When the device is in sleep mode, the GPIO pins maintain their output value and I/O mode.

3.1.8 SYS_TEST_RF

3.1.8.1 Description

This command is used by the application processor to configure the CC2530-ZNP device RF test modes. The test modes configure the frequency and transmit power of the CC2530-ZNP device and transmit either an unmodulated carrier or a carrier modulated with pseudo-random data or configure the radio for receive mode.

3.1.8.2 Usage

AREQ:

1	1	1	1	2	1
Length = 0x04	Cmd0 = 0x41	Cmd1 = 0x40	Test mode	Frequency	TxPower

Test mode – 1 byte - The type of test mode to configure the CC2530-ZNP device. It can take one of the following values:

Test mode	Description
0x00	The CC2530-ZNP device will transmit unmodulated carrier with the specified frequency and transmit power
0x01	The CC2530-ZNP device will transmit pseudo-random data with the specified frequency and transmit power
0x02	The CC2530-ZNP device will have the radio placed in receive mode on the specified frequency.

Frequency – 2 bytes – The frequency of operation. The valid range is from 0 to 1023. The CC2530-ZNP device will set to (2048 + frequency) MHz.

TxPower – 1byte – The RF transmit power is determined by this parameter as described in Table 1 of [R2]. This parameter is ignored in test mode 0x02.

Note that executing this command will leave the radio in a different configuration than is needed for regular operation. It is expected that the device will have to be reset before it can be used again for regular RF operations.

3.1.9 SYS_TEST_LOOPBACK

3.1.9.1 Description

This command is used by the application processor to test the physical interface to the CC2530-ZNP.

3.1.9.2 Usage

SREQ:

1	1	1	variable
Length = variable	Cmd0 = 0x21	Cmd1 = 0x41	Test data

Test data – variable bytes – This data will be returned by CC2530-ZNP in the response.

SRSP:

1	1	1	variable
Length = variable	Cmd0 = 0x61	Cmd1 = 0x41	Test data

Test data – variable bytes – The Test data from the request is returned.

3.2 Configuration interface

The CC2530-ZNP device has several parameters that can be configured by the application processor. These configuration parameters are stored in non volatile memory on the CC2530-ZNP device and their values persist across a device reset.

The configuration parameters are divided into “network-specific” and “device-specific” parameters. The “network-specific” configuration parameters should be set to the same value for all CC2530-ZNP devices in a ZigBee network to ensure proper network operation. The “device-specific” parameters can be set to different values on each device. These parameters are listed in detail in 3.2.3 and 3.2.4.

When the CC2530-ZNP device powers up, it reads two of the configuration parameters immediately. These are the `STARTOPT_CLEAR_CONFIG` bit (part of the `ZCD_NV_STARTUP_OPTION` parameter) and the `ZCD_NV_LOGICAL_TYPE` parameters. Any modification of these parameters will require a CC2530-ZNP device reset before they can take effect.

The rest of the configuration parameters are read when the CC2530-ZNP device starts operation of the ZigBee stack (when the `ZB_START_REQUEST` is issued).

Each of the configuration parameters has a default value that is used if it is not explicitly configured. It is possible to erase all the configuration settings and restore the device to this initial configuration by setting the `STARTOPT_CLEAR_CONFIG` bit option. This is useful if it is necessary to bring the CC2530-ZNP device configuration to a known state.

3.2.1 ZB_READ_CONFIGURATION

3.2.1.1 Description

This command is used to read the value of a configuration parameter from the CC2530-ZNP device.

3.2.1.2 Usage

SREQ:

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

ConfigId – 1 byte – Specifies the identifier for the configuration property.

SRSP:

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

Status – 1 byte – See 3.6 for a listing of the status values.

ConfigId – 1 byte – Specifies the identifier for the configuration property.

Len – 1 byte – Specifies the size of the Value buffer in bytes.

Value – 0-128 bytes – A buffer to hold the configuration property.

3.2.2 ZB_WRITE_CONFIGURATION

3.2.2.1 Description

This command is used to write a configuration parameter to the CC2530-ZNP device.

3.2.2.2 Usage

SREQ:

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

ConfigId – 1 byte – The identifier for the configuration property

Len – 1 byte – Specifies the size of the Value buffer in bytes.

Value – 1-128 bytes – The buffer containing the new value of the configuration property

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x66	Cmd1 = 0x05	Status

Status – 1 byte – See 3.6 for a listing of the status values.

3.2.3 Device specific configuration parameters

3.2.3.1 ZCD_NV_STARTUP_OPTION

Configuration ID: 0x0003; Size: 1byte; Default value: 0

This parameter controls the device startup options. This is a bit mask of the following values

Bit position	7-2	1	0
Description	Reserved	STARTOPT_CLEAR_STATE	STARTOPT_CLEAR_CONFIG

- STARTOPT_CLEAR_CONFIG – If this option is set, the device will overwrite all the configuration parameters (except this one) with the “default” values that it is programmed with. This is used to erase the existing configuration and bring the device into a known state.

Note:

The STARTOPT_CLEAR_CONFIG bit is read by the CC2530-ZNP device immediately when it powers up after a reset.

When the configuration parameters are restored to defaults, the ZCD_NV_STARTUP_OPTION itself is not restored except for clearing the STARTOPT_CLEAR_CONFIG bit.

- **STARTOPT_CLEAR_STATE** – If this option is set, the device will clear its previous network state (which would exist if the device had been operating on a network prior to the reset). This is typically used during application development. During regular device operation, this flag is typically not set, so that an accidental device reset will not cause loss of network state.

Notes:

The CC2530-ZNP device has two kinds of information stored in non-volatile memory. The configuration parameters (listed in this section) and network state information.

The configuration parameters are configured by the user before start of ZigBee operation.

The network state information is collected by the device after it joins a network and creates bindings etc. (at runtime). This is not set by the application processor. This information is stored so that if the device were to reset accidentally, it can restore itself without going through all the network joining and binding process again.

If the application processor does not wish to continue operating in the previous ZigBee network, it needs to instruct the CC2530-ZNP device to clear the network state information and start again based on the configuration parameters. This is done by setting the STARTOPT_CLEAR_STATE bit in the startup option.

3.2.3.2 ZCD_NV_LOGICAL_TYPE

Configuration ID: 0x0087; Size: 1byte; Default value: 0x00

This is the logical type of the device in the ZigBee network. This can be set to a COORDINATOR (0x00), ROUTER (0x01) or ENDDEVICE (0x02).

Note:

This parameter is read by the CC2530-ZNP device immediately when it powers up after a reset.

3.2.3.3 ZCD_NV_POLL_RATE

Configuration ID: 0x0024; Size: 2byte; Default value: 2000

If this parameter is set to a non-zero value, a CC2530-ZNP device that is configured as an end-device will wake up periodically with this duration to check for data with its parent device. This value is specified in milliseconds and can range from 1 to 65000.

If this parameter is set to zero, the device will not automatically wake up to poll for data. Instead, an external trigger or an internal event (for example, via a software timer event) can be used to wake up the device.

3.2.3.4 ZCD_NV_QUEUED_POLL_RATE

Configuration ID: 0x0025; Size: 2bytes; Default value: 100

When an end-device polls for data with its parent and finds that it does have data, it can poll again with a shorter duration in case there is more data queued for it at its parent device. This value is specified in milliseconds. This feature can be turned off by setting this value to zero.

3.2.3.5 ZCD_NV_RESPONSE_POLL_RATE

Configuration ID: 0x0026; Size: 2byte; Default value: 100

When an end-device sends a data packet, it can poll again with a shorter duration, specified by this parameter, if the application is expecting to receive an application level packet in response. This value is specified in milliseconds. This feature can be turned off by setting the value to zero.

Note: The setting of the queued and response poll rates has to be done with caution if the device is sending and receiving at the same time or if the device is sending data too fast.

If the device is sending data too fast, setting a queued poll rate with a higher duration than the sending rate will cause the poll event to be continuously rescheduled to the future. Then the device will never poll for data with its parent and consequently it may miss any packets destined for it.

3.2.3.6 ZCD_NV_POLL_FAILURE_RETRIES

Configuration ID: 0x0029; Size: 1byte; Default value: 2.

The number of times an end-device will fail when communicating with its parent before invoking the rejoin mechanism to find and join a new parent.

3.2.3.7 ZCD_NV_INDIRECT_MSG_TIMEOUT

Configuration ID: 0x002B; Size: 1byte; Default value: 7

The amount of time (in seconds) that a router or coordinator device will buffer messages destined to their end-device child nodes. It is recommended that this is at least greater than the poll rate (ZCD_NV_POLL_RATE) to ensure that end-device will have a chance to wakeup and poll for the data.

3.2.3.8 ZCD_NV_APS_FRAME_RETRIES

Configuration ID: 0x0043; Size: 1bytes; Default value: 3

The number of retransmissions performed on a data packet at the application layer if the packet was transmitted with the end-to-end acknowledgement option enabled.

3.2.3.9 ZCD_NV_APS_ACK_WAIT_DURATION

Configuration ID: 0x0044; Size: 2bytes; Default value: 3000

The amount of time (in milliseconds) a device will wait transmitting a packet with end-to-end acknowledgement option set for the acknowledgement packet to arrive from the destination device. If the acknowledgement packet is not received by this time, the sending device will assume a failure and attempt a retransmission.

Note: This is recommended to be set to approximately the expected round trip time for the packet. Note that if the destination (or source) device is an end-device, the round trip time for the packet will include an additional delay up to the poll duration. This is in addition to the delay normally caused by the network.

3.2.3.10 ZCD_NV_BINDING_TIME

Configuration ID: 0x0046; Size: 2bytes; Default value: 8000

The amount of time (in milliseconds) a device will wait for a response to a binding request.

3.2.3.11 ZCD_NV_USERDESC

Configuration ID: 0x0081; Size: 17bytes; Default value: "CC2530-ZNP x....." (dots represent the device IEEE address)

An optional user-defined data (up to 16bytes) that can be configured in a CC2530-ZNP device so that it can easily identified or described later. The first byte is the length of the user descriptor data and must not be greater than 16.

3.2.4 Network specific configuration parameters

3.2.4.1 ZCD_NV_PANID

Configuration ID: 0x0083; Size: 2bytes; Default value: 0xFFFF

This parameter identifies the ZigBee network. This should be set to a value between 0 and 0x3FFF. Networks that exist in the same vicinity must have different values for this parameter. It can be set to a special value of 0xFFFF to indicate “don’t care”.

3.2.4.2 ZCD_NV_CHANLIST

Configuration ID: 0x0084; Size: 4bytes; Default value: 0x00000800

This parameter is a bit mask of the channels on which this network can operate (note that multiple channels can be selected). Multiple networks that exist in the same vicinity are encouraged to have different values.

If multiple channels are selected, the coordinator will pick one of the channels for network operation. First, an energy scan is performed on each channel and those channels with a high energy level are discarded. Then, the coordinator determines the number of existing ZigBee networks on each of the remaining channels and picks the one with the fewest networks. For routers and end-devices, the device will simply scan all the selected channels until it finds the ZigBee network.

3.2.4.3 ZCD_NV_PRECFGKEY

Configuration ID: 0x0062; Size: 16bytes; Default value: [0x00, 0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x07, 0x08, 0x09, 0x0A, 0x0B, 0x0C, 0x0D, 0x0E, 0x0F]

This is used for securing and un-securing packets in the network, if security is enabled for the network.

3.2.4.4 ZCD_NV_PRECFGKEYS_ENABLE

Configuration ID: 0x0063; Size: 1byte; Default value: TRUE

If security functionality is enabled, there are two options to distribute the security key to all devices in the network.

If this parameter is true, the same security key is assumed to be pre-configured in all devices in the network.

If it is set to false, then the key only needs to be configured on the coordinator device. In this case, the key is distributed to each device upon joining by the coordinator. This key distribution will happen in the “clear” on the last hop of the packet transmission and this constitutes a brief “period of vulnerability” during which a malicious device can capture the key. Hence it is not recommended unless it can be ensured that there are no malicious devices in the vicinity at the time of network formation.

3.2.4.5 ZCD_NV_SECURITY_MODE

Configuration ID: 0x0064; Size: 1byte; Default value: 0

This parameter determines if security is used or not in this network. It can be set to 0 (to turn off security) or 1 (to turn on security).

3.2.4.6 ZCD_NV_BCAST_RETRIES

Configuration ID: 0x002E; Size: 1byte; Default value: 2.

The maximum number of retransmissions that a device will attempt when trying to transmit a broadcast packet. The typical range is from 1 through 3.

3.2.4.7 ZCD_NV_PASSIVE_ACK_TIMEOUT

Configuration ID: 0x002F; Size: 1byte; Default value: 5

The amount of time (in units of 100milliseconds) a device will wait before retransmitting a broadcast packet. The retransmission will not happen if the node hears that each of its neighbor nodes have all transmitted that packet.

3.2.4.8 ZCD_NV_BCAST_DELIVERY_TIME

Configuration ID: 0x0030; Size: 1byte; Default value: 30.

The maximum amount of time (in units of 100ms) that it can take for a broadcast packet to propagate through the entire network. This includes time for all retransmissions.

Note: This parameter must be set with caution. It must be set to a value of at least

$(ZCD_NV_BCAST_RETRIES + 1) * ZCD_NV_PASSIVE_ACK_TIMEOUT$

To be safe, the actual value should be higher than the above minimum by about 500ms or more.

3.2.4.9 ZCD_NV_ROUTE_EXPIRY_TIME

Configuration ID: 0x002C; Size: 1byte; Default value: 60.

The amount of time (in seconds) for which a route must be idle (i.e. no packets are transmitted on that route) before that routing entry is marked as expired. An expired entry may be deleted if the table is full and the space is needed for another new routing entry.

This can be set to a special value of 0 to turn off route expiry. In this case, route entries are not expired.

3.3 Simple API interface

The Simple API interface is intended to present a simplified ZigBee API to the application developer. The complete ZigBee interface is provided via the AF and ZDO interfaces. But since the majority of the applications do not use the full feature set available in ZigBee, this simplified interface is an easy way for the developer to begin ZigBee application development. It contains the necessary interface to commission a ZigBee network, perform bindings between devices and send and receive data.

3.3.1 ZB_APP_REGISTER_REQUEST

3.3.1.1 Description

This command enables the application processor to register its application with the CC2530-ZNP device.

3.3.1.2 Usage

SREQ:

1	1	1	1	2	2	1
Length = variable	Cmd0 = 0x26	Cmd1 = 0x0A	AppEndPoint	AppProfileID	DeviceId	DeviceVersion

1	1	2 x Input commands	1	2 x Output commands
Unused	InputCommandsNum	InputCommandsList	OutputCommandsNum	OutputCommandsList

AppEndPoint – 1 byte – Specifies the endpoint of the device. This should be in the range of 1 through 240 and should be set to same value for all devices in the network.

AppProfileID – 2 bytes – Specifies the profile id of the application. This should be set to same value to all devices in the network. This number is assigned by the ZigBee Alliance.

DeviceId – 2 bytes – This is an application-specific identifier. It identifies the device type within the particular profile id. This is not used by the ZigBee stack in any way other than to identify itself when requested.

DeviceVersion – 1 byte – This is an application-specific identifier. It identifies the version of the device. This is not used by the ZigBee stack in any way other than to identify itself when requested.

Unused – 1 byte – Unused parameter.

InputCommandsNum – 1 byte – Specifies the number of Input commands that this application will process.

InputCommandsList – variable – List of input command identifiers that are processed by this application. Each command identifier is 2 bytes long.

OutputCommandsNum – 1 byte – Specifies the number of Output commands that this application will generate.

OutputCommandsList – variable – List of output command identifiers that are generated by this application. Each command identifier is 2 bytes long.

Note:

It is mandatory that the application register itself with the CC2530-ZNP device after every reset if it wishes to use the simple API interface. The AppEndPoint and AppProfileId fields should be populated with the same values for all devices in the network.

This list of input and output commands are only used by the ZigBee stack when performing binding. If the binding feature is not used, these may be ignored.

The DeviceId and DeviceVersion are not used by the ZigBee stack and may be ignored.

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x66	Cmd1 = 0x0A	Status

Status – 1 byte – See 3.6 for a listing of the status values.

3.3.2 ZB_START_REQUEST

3.3.2.1 Description

This command starts the ZigBee stack in the CC2530-ZNP device. When the ZigBee stack starts, the device reads the programmed configuration parameters and operates accordingly. After the start request process completes, the device is ready to send, receive, and route network traffic.

3.3.2.2 Usage

SREQ:

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

SRSP:

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

3.3.3 ZB_START_CONFIRM

3.3.3.1 Description

This command is issued by the CC2530-ZNP device to return the results from a ZB_START_REQUEST command.

3.3.3.2 Usage

AREQ:

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

Status – 1 byte – See 3.6 for a listing of the status values.

3.3.4 ZB_PERMIT_JOINING_REQUEST

3.3.4.1 Description

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

3.3.4.2 Usage

SREQ:

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

Destination – 2 bytes – 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 byte – 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:

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

Status – 1 byte – See 3.6 for a listing of the status values.

3.3.5 ZB_BIND_DEVICE

3.3.5.1 Description

This command is used to create or delete a 'binding' to another device on the network. Once bound, an application can send messages to a device by referencing the commandId for the binding. This command can also be issued with a NULL destination address (set to all zeros). In that case, a binding will be established with another device that is in the Allow Bind mode.

3.3.5.2 Usage

SREQ:

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

Create – 1 byte – TRUE to create a binding, FALSE to remove a binding.

CommandId – 2 bytes – The identifier of the binding.

Destination – 8 bytes – Specifies the 64-bit IEEE address of the device to bind to. Set to NULL if the destination address is unknown and instead the destination device is set to Allow Bind mode.

SRSP:

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

3.3.6 ZB_BIND_CONFIRM

3.3.6.1 Description

This command is issued by the CC2530-ZNP device to return the results from a ZB_BIND_DEVICE command.

3.3.6.2 Usage

AREQ:

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

CommandId – 2 bytes – The command ID of the binding being confirmed.

Status – 1 byte – See 3.6 for a listing of the status values.

3.3.7 ZB_ALLOW_BIND

3.3.7.1 Description

This command puts the device into the Allow Binding Mode for a given period of time. This allows a peer device to establish a binding with this device (in the Allow Binding Mode) by issuing the zb_BindDevice with a destination address of NULL.

3.3.7.2 Usage

SREQ:

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

Timeout – 1 byte – 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 indefinitely.

SRSP:

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

3.3.8 ZB_ALLOW_BIND_CONFIRM

3.3.8.1 Description

This command is issued by the CC2530-ZNP device when it responds to a bind request from a remote device.

3.3.8.2 Usage

AREQ:

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

Source – 2 bytes – Contains the address of the device attempted to bind to this device.

3.3.9 ZB_SEND_DATA_REQUEST

3.3.9.1 Description

This command initiates transmission of data to another device in the network. This command can only be issued after the application processor has registered its application using the ZB_APP_REGISTER_REQUEST and the device has successfully created or joined a network.

3.3.9.2 Usage

SREQ:

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

Destination – 2 bytes – The destination address of the data packet. It can be one of the following values:

Address	Description
0 – 0xFFF7	16-bit short address of the destination device
0xFFFC	Group of all routers and coordinator
0xFFFD	Group of all devices with receiver turned on
0xFFFE	This is the binding address and should be used when a binding entry has been previously created for this particular CommandId. The destination address will be determined from the binding table by the CC2530-ZNP
0xFFFF	Broadcast group of all devices in the network

CommandId – 2 bytes – The command ID to send with the message. If the binding address is used for destination, this parameter also indicates the binding to use.

Handle – 1 byte – A handle used to identify the send data request.

Ack – 1 byte – TRUE if requesting acknowledgement from the destination.

Radius – 1 byte – The max number of hops the packet can travel through before it is dropped.

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

Data – 0-84 bytes – Data.

SRSP:

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

3.3.10 ZB_SEND_DATA_CONFIRM

3.3.10.1 Description

This command is issued by the CC2530-ZNP device to return the results from a ZB_SEND_DATA_REQUEST command.

3.3.10.2 Usage

AREQ:

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

Handle – 1 byte – Specifies the handle.

Status – 1 byte – See 3.6 for a listing of the status values.

3.3.11 ZB_RECEIVE_DATA_INDICATION

3.3.11.1 Description

This callback is called asynchronously by the CC2530-ZNP device when it has received a packet from a remote device.

3.3.11.2 Usage

AREQ:

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

Source – 2 bytes – Specifies the short address of the peer device that sent the data.

Command – 2 bytes – The command ID associated with the data.

Len – 2 bytes – Specifies the number of bytes in the Data parameter.

Data – Array of bytes – The data sent by the peer device

3.3.12 ZB_GET_DEVICE_INFO

3.3.12.1 Description

This command retrieves a Device Information Property.

3.3.12.2 Usage

SREQ:

1	1	1	1
Length = 0x01	Cmd0 = 0x26	Cmd1 = 0x06	Param

Param – 1 byte – The identifier of the device information. It can take one of the following values:

Parameter	Size	Description
0	1 byte	Device state
1	8 bytes	Device IEEE address
2	2 bytes	Device short address
3	2 bytes	Short address of the parent device
4	8 bytes	IEEE address of the parent device
5	1 byte	Channel on which the ZigBee network is operating
6	2 bytes	PAN ID of the ZigBee network
7	8 bytes	Extended PAN Id of the ZigBee network

SRSP:

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

Param – 1 byte – The identifier of the requested device information.

Value – 8 byte – The value of the requested device information. This is always 8bytes in length even though the actual value may be smaller in size.

3.3.13 ZB_FIND_DEVICE_REQUEST

3.3.13.1 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

SearchKey – 8 bytes – Specifies the value to search on.

SRSP:

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

3.3.14 ZB_FIND_DEVICE_CONFIRM

3.3.14.1 Description

This command is issued by the CC2530-ZNP device to return the results from a `ZB_FIND_DEVICE_REQUEST` command.

3.3.14.2 Usage

AREQ:

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

SearchType – 1 byte – The type of search that was performed.

SearchKey – 2 bytes – Value that the search was executed on.

Result – 8 bytes – The result of the search.

3.4 AF Interface

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

3.4.1 AF_REGISTER

3.4.1.1 Description

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

3.4.1.2 Usage

SREQ:

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

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
AppDeviceld	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 (2bytes each)
AppNumOutClusters	1	Specifies the number of Output cluster Ids following in the AppOutClusterList
AppOutClusterList	32	Specifies the list of Output Cluster Ids (2bytes each)

SRSP:

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).

3.4.2 AF_DATA_REQUEST

3.4.2.1 Description

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

3.4.2.2 Usage

SREQ:

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

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:

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).

3.4.3 AF_DATA_REQUEST_SRC_RTG

3.4.3.1 Description

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

3.4.3.2 Usage

SREQ:

1	1	1	2	1
Length = 0x0B-0xFF	Cmd0 = 0x24	Cmd1 = 0x02	DstAddr	DestEndpoint

1	2	1	1	1	1	2N	1	0-128
SrcEndpoint	ClusterID	TransID	Options	Radius	Relay Count (N)	RelayList	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.
Relay Count	1	Specifies the number of devices in the relay list for source routing
Relay List	2N	List of relay devices on the source routing path. For each device, it contains 2 bytes short address for each device.
Len	1	Length of the data.
Data	0-128	0-128 bytes data

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x64	Cmd1 = 0x02	Status

Attributes:

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

3.4.4 AF_INTER_PAN_SET_PARAM

3.4.4.1 Description

This command is used by the App processor to set the inter-pan or intra-pan channel and pan id.

3.4.4.2 Usage

SREQ:

1	1	1	1	1	2
Length = 0x04	Cmd0 = 0x24	Cmd1 = 0x03	Channel Type	Channel	Pan ID

Attributes:

Attribute	Length (byte)	Description
Parameter Type	1	Parameter type: Inter-pan (0) or intra-pan (1)
Channel	1	Channel for inter-pan. If parameter type is specified as intra-pan, this field is not used.
Pan ID	2	Pan ID for inter-pan. If parameter type is specified as intra-pan, this field is not used.

SRSP:

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

Attributes:

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

3.4.5 AF_DATA_CONFIRM

3.4.5.1 Description

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

3.4.5.2 Usage

AREQ:

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

3.4.6 AF_INCOMING_MSG

3.4.6.1 Description

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

3.4.6.2 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.

3.5 ZDO Interface

This interface allows the application processor to issue commands to the ZDO layer in the CC2530-ZNP. The result of the command execution will be conveyed to the application processor via the corresponding callback message.

3.5.1 ZDO_NWK_ADDR_REQ

3.5.1.1 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. The response message listed below only indicates whether or not the message was received properly.

3.5.1.2 Usage

SREQ:

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.						
ReqType	1	Value that the search was executed on.						
		<table><tr><th>Type</th><th>Value</th></tr><tr><td>Single Device response</td><td>0x00</td></tr><tr><td>Extended, include associated devices</td><td>0x01</td></tr></table>	Type	Value	Single Device response	0x00	Extended, include associated devices	0x01
		Type	Value					
		Single Device response	0x00					
Extended, include associated devices	0x01							
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:

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).

3.5.2 ZDO_IEEE_ADDR_REQ

3.5.2.1 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.

3.5.2.2 Usage

SREQ:

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.						
ReqType	1	Value that the search was executed on.						
		<table><tr><th>Type</th><th>Value</th></tr><tr><td>Single Device response</td><td>0x00</td></tr><tr><td>Extended, include associated devices</td><td>0x01</td></tr></table>	Type	Value	Single Device response	0x00	Extended, include associated devices	0x01
		Type	Value					
		Single Device response	0x00					
Extended, include associated devices	0x01							
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:

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).

3.5.3 ZDO_NODE_DESC_REQ

3.5.3.1 Description

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

3.5.3.2 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).

3.5.4 ZDO_POWER_DESC_REQ

3.5.4.1 Description:

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

3.5.4.2 Usage

SREQ:

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:

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).

3.5.5 ZDO_SIMPLE_DESC_REQ

3.5.5.1 Description

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

3.5.5.2 Usage

SREQ:

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:

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).

3.5.6 ZDO_ACTIVE_EP_REQ

3.5.6.1 Description

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

3.5.6.2 Usage

SREQ:

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:

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).

3.5.7 ZDO_MATCH_DESC_REQ

3.5.7.1 Description

This command is generated to request the device match descriptor.

3.5.7.2 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 (2bytes each)
NumOutClusters	1	Specifies the number of IDs in the OutClusterList.
OutClusterList	0-32	Contains the output cluster IDs (2bytes each)

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).

3.5.8 ZDO_COMPLEX_DESC_REQ

3.5.8.1 Description

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

3.5.8.2 Usage

SREQ:

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:

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).

3.5.9 ZDO_USER_DESC_REQ

3.5.9.1 Description

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

3.5.9.2 Usage

SREQ:

1	1	1	2	2
Length = 0x04	Cmd0 = 0x25	Cmd1 = 0x08	DstAddr	NWKAddrOfInterest

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Specifies destination NWK address.
NWKAddrOfInterest	2	Specifies NWK address of the device the query is intended for.

SRSP:

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).

3.5.10 ZDO_DEVICE_ANNCE

3.5.10.1 Description

This command will cause the CC2530 ZNP device to issue a “Device announce” broadcast packet to the network. This is typically used by an end-device to announce itself to the network.

3.5.10.2 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).

3.5.11 ZDO_USER_DESC_SET

3.5.11.1 Description

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

3.5.11.2 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).

3.5.12 ZDO_SERVER_DISC_REQ

3.5.12.1 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'.

3.5.12.2 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).

3.5.13 ZDO_END_DEVICE_BIND_REQ

3.5.13.1 Description

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

3.5.13.2 Usage

SREQ:

1	1	1	2	2	1
Length = 0x09-0x49	Cmd0 = 0x25	Cmd1 = 0x20	DstAddr = 0x0000	LocalCoordinator	Endpoint

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

Attributes:

Attribute	Length (byte)	Description
DstAddr	2	Destination address is always 0x0000.
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 (2bytes each)
NumOutClusters	1	Specifies the number of IDs in the OutClusterList.
OutClusterList	0-32	Contains the output cluster IDs (2bytes each)

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).

3.5.14 ZDO_BIND_REQ

3.5.14.1 Description

This command is generated to request a Bind.

3.5.14.2 Usage

SREQ:

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

1	8	1
DstAddrMode	DstAddress	DstEndpoint

Attributes:

Attribute	Length (byte)	Description																		
DstAddr	2	Specifies the network address of the device to send message.																		
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 binding destination address mode: <table> <tr> <th>Mode</th><th>Value</th><th>Description</th></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>	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
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																		
DstAddress	8	Binding destination IEEE address. The field is 8-bytes long. However, depending on the value of the DstAddrMode field, only lowest order 2 bytes could be significant. Not to be confused with DstAddr.																		
DstEndpoint	1	Specifies the binding destination endpoint.																		

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).

3.5.15 ZDO_UNBIND_REQ

3.5.15.1 Description

This command is generated to request an UnBind

3.5.15.2 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 network address of the device to send 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: <table border="1"> <thead> <tr> <th>Mode</th><th>Value</th><th>Description</th></tr> </thead> <tbody> <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> </tbody> </table>	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
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																		
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).

3.5.16 ZDO_MGMT_NWK_DISC_REQ

3.5.16.1 Description

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

3.5.16.2 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.																																						
ScanChannels	4	<div>Specifies the Bit Mask for channels to scan:</div> <table><tr><th>Channel</th><th>Value</th></tr><tr><td>NONE</td><td>0x00000000</td></tr><tr><td>ALL_CHANNELS</td><td>0x07FFF800</td></tr><tr><td>CHANNEL 11</td><td>0x00000800</td></tr><tr><td>CHANNEL 12</td><td>0x00001000</td></tr><tr><td>CHANNEL 13</td><td>0x00002000</td></tr><tr><td>CHANNEL 14</td><td>0x00004000</td></tr><tr><td>CHANNEL 15</td><td>0x00008000</td></tr><tr><td>CHANNEL 16</td><td>0x00010000</td></tr><tr><td>CHANNEL 17</td><td>0x00020000</td></tr><tr><td>CHANNEL 18</td><td>0x00040000</td></tr><tr><td>CHANNEL 19</td><td>0x00080000</td></tr><tr><td>CHANNEL 20</td><td>0x00100000</td></tr><tr><td>CHANNEL 21</td><td>0x00200000</td></tr><tr><td>CHANNEL 22</td><td>0x00400000</td></tr><tr><td>CHANNEL 23</td><td>0x00800000</td></tr><tr><td>CHANNEL 24</td><td>0x01000000</td></tr><tr><td>CHANNEL 25</td><td>0x02000000</td></tr><tr><td>CHANNEL 26</td><td>0x04000000</td></tr></table>	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
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																																							
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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	Specifies the scanning time. Valid range is 0-14.																																						
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).

3.5.17 ZDO_MGMT_LQI_REQ

3.5.17.1 Description

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

3.5.17.2 Usage

SREQ:

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:

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).

3.5.18 ZDO_MGMT_RTG_REQ

3.5.18.1 Description

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

3.5.18.2 Usage

SREQ:

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:

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).

3.5.19 ZDO_MGMT_BIND_REQ

3.5.19.1 Description

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

3.5.19.2 Usage

SREQ:

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).

3.5.20 ZDO_MGMT_LEAVE_REQ

3.5.20.1 Description

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

3.5.20.2 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).

3.5.21 ZDO_MGMT_DIRECT_JOIN_REQ

3.5.21.1 Description

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

3.5.21.2 Usage

SREQ:

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:

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).

3.5.22 ZDO_MGMT_PERMIT_JOIN_REQ

3.5.22.1 Description

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

3.5.22.2 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).

3.5.23 ZDO_MGMT_NWK_UPDATE_REQ

3.5.23.1 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.

3.5.23.2 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)																		
DstAddrMode	1	Destination address mode: <table> <tr> <th>Mode</th><th>Value</th><th>Description</th></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>	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
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																		

ChannelMask	4	A bitmap indicating which channels are to be scanned:	
		Channel	Value
		NONE	0x00000000
		ALL_CHANNELS	0x07FFF800
		CHANNEL 11	0x00000800
		CHANNEL 12	0x00001000
		CHANNEL 13	0x00002000
		CHANNEL 14	0x00004000
		CHANNEL 15	0x00008000
		CHANNEL 16	0x00010000
		CHANNEL 17	0x00020000
		CHANNEL 18	0x00040000
		CHANNEL 19	0x00080000
		CHANNEL 20	0x00100000
		CHANNEL 21	0x00200000
		CHANNEL 22	0x00400000
		CHANNEL 23	0x00800000
		CHANNEL 24	0x01000000
		CHANNEL 25	0x02000000
		CHANNEL 26	0x04000000
ScanDuration	1	Specifies the MAC scan duration. Valid range is 0-14.	
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 = 0x37	Status

Attributes:

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

3.5.24 ZDO_STARTUP_FROM_APP

3.5.24.1 Description

This command starts the device in the network.

3.5.24.2 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

3.5.25 ZDO_AUTO_FIND_DESTINATION

3.5.25.1 Description

This function will issue a Match Descriptor Request for the requested endpoint outputs. This message will generate a broadcast message. Note that there is no response to the host processor for this message. If there is a successful response to the match descriptor request packet, the binding table on the device will be automatically updated.

3.5.25.2 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 Match Descriptor request for.

3.5.26 ZDO_SET_LINK_KEY

3.5.26.1 Description

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

3.5.26.2 Usage

SREQ:

1	1	1	2	8	16
Length = 0x01	Cmd0 = 0x45	Cmd1 = 0x23	ShortAddr	IEEEaddr	LinkKeyData

Attributes:

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

SRSP:

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

Attributes:

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

3.5.27 ZDO_REMOVE_LINK_KEY

3.5.27.1 Description

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

3.5.27.2 Usage

SREQ:

1	1	1	8
Length = 0x01	Cmd0 = 0x45	Cmd1 = 0x24	IEEEaddr

Attributes:

Attribute	Length (byte)	Description
IEEEaddr	8	Specifies the extended (IEEE) address of the device.

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x24	Status

Attributes:

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

3.5.28 ZDO_GET_LINK_KEY

3.5.28.1 Description

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

3.5.28.2 Usage

SREQ:

1	1	1	8
Length = 0x01	Cmd0 = 0x45	Cmd1 = 0x25	IEEEAddr

Attributes:

Attribute	Length (byte)	Description
IEEEAddr	8	Specifies the extended (IEEE) address of the device.

SRSP:

1	1	1	1	8	16
Length = 0x19	Cmd0 = 0x65	Cmd1 = 0x25	Status	IEEEAddr	LinkKeyData

Attributes:

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

3.5.29 ZDO_NWK_ADDR_RSP

3.5.29.1 Description

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

3.5.29.2 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 short addresses (2 bytes each) of the 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.

3.5.30 ZDO_IEEE_ADDR_RSP

3.5.30.1 Description

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

3.5.30.2 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 short addresses (2 bytes each) 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.

3.5.31 ZDO_NODE_DESC_RSP

3.5.31.1 Description

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

3.5.31.2 Usage

AREQ:

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

1	1	1	2
LogicalType/ ComplexDesc Available/ UserDescAvail able	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	<div>Logical Type: Bit 0-2</div> <table><tr><th>Description</th><th>Value</th></tr><tr><td>ZigBee Coordinator</td><td>0</td></tr><tr><td>ZigBee Router</td><td>1</td></tr><tr><td>ZigBee End Device</td><td>2</td></tr></table> <div>ComplexDescriptorAvailable: Bit 4– Indicates if complex descriptor is available for the node NodeFrequencyBand – Bit 5-7 – Identifies node frequency band capabilities</div>	Description	Value	ZigBee Coordinator	0	ZigBee Router	1	ZigBee End Device	2
Description	Value									
ZigBee Coordinator	0									
ZigBee Router	1									
ZigBee End Device	2									
APSFlags/FrequencyBand	1	<div>- APSFlags – Bit 0-4 – Node Flags assigned for APS. For V1.0 all bits are reserved.</div> <div>- NodeFrequencyBand – Bit 5-7 – Identifies node frequency band capabilities</div>								

MacCapabilitiesFlags	1	Capability flags stored for the MAC	
		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	

3.5.32 ZDO_POWER_DESC_RSP

3.5.32.1 Description

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

3.5.32.2 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	Device 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

3.5.33 ZDO_SIMPLE_DESC_RSP

3.5.33.1 Description

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

3.5.33.2 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 (2 bytes each) supported.
NumOutClusters	1	The number of output clusters in the OutClusterList.
OutClusterList	0-32	List of output cluster IDs (2 bytes each) supported.

3.5.34 ZDO_ACTIVE_EP_RSP

3.5.34.1 Description

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

3.5.34.2 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 (1 byte each) on this device.

3.5.35 ZDO_MATCH_DESC_RSP

3.5.35.1 Description

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

3.5.35.2 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

3.5.36 ZDO_COMPLEX_DESC_RSP

3.5.36.1 Description

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

3.5.36.2 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.

3.5.37 ZDO_USER_DESC_RSP

3.5.37.1 Description

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

3.5.37.2 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.

3.5.38 ZDO_USER_DESC_CONF

3.5.38.1 Description

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

3.5.38.2 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.

3.5.39 ZDO_SERVER_DISC_RSP

3.5.39.1 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.

3.5.39.2 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:																
		<table><tr><th>Bit Number</th><th>Assignment</th></tr><tr><td>0</td><td>Primary Trust Center</td></tr><tr><td>1</td><td>Backup Trust Center</td></tr><tr><td>2</td><td>Primary Binding Table Cache</td></tr><tr><td>3</td><td>Backup Binding Table Cache</td></tr><tr><td>4</td><td>Primary Discovery Cache</td></tr><tr><td>5</td><td>Backup Discovery Cache</td></tr><tr><td>6– 15</td><td>Reserved</td></tr></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
		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																	

3.5.40 ZDO_END_DEVICE_BIND_RSP

3.5.40.1 Description

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

3.5.40.2 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).

3.5.41 ZDO_BIND_RSP

3.5.41.1 Description

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

3.5.41.2 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).

3.5.42 ZDO_UNBIND_RSP

3.5.42.1 Description

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

3.5.42.2 Usage

AREQ:

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).

3.5.43 ZDO_MGMT_NWK_DISC_RSP

3.5.43.1 Description

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

3.5.43.2 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.																		
NetworkList	List	<p>Array of NetworkList items. NetworkListCount contains the number of items in this table:</p> <table> <tr> <th>Name</th><th>Size</th><th>Description</th></tr> <tr> <td>PAN ID/Extended PAN ID</td><td>2 bytes</td><td>PAN ID of the neighbor device</td></tr> <tr> <td>Logical Channel</td><td>1 byte</td><td>The current logical channel occupied by the network.</td></tr> <tr> <td>Stack Profile / ZigBee Version</td><td>1 byte</td><td> 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. </td></tr> <tr> <td>Beacon Order / Super frame Order</td><td>1 byte</td><td> BeaconOrder: bits 3-0 SuperframeOrder: bits 7-4 </td></tr> <tr> <td>Permit Joining</td><td>1 byte</td><td>Permit joining flag</td></tr> </table>	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
Name	Size	Description																		
PAN ID/Extended PAN ID	2 bytes	PAN ID of the neighbor device																		
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Beacon Order / Super frame Order	1 byte	BeaconOrder: bits 3-0 SuperframeOrder: bits 7-4																		
Permit Joining	1 byte	Permit joining flag																		

3.5.44 ZDO_MGMT_LQI_RSP

3.5.44.1 Description:

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

3.5.44.2 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.																								
StartIndex	1	Where in the total number of entries this response starts.																								
NeighborLqiListCount	1	Number of entries in this response.																								
NeighborLqiList	Variable	<p>Array of NeighborLqiList items. NeighborLQICount contains the number of items in this table.</p> <table> <tr> <th>Name</th><th>Size</th><th>Description</th></tr> <tr> <td>ExtendedPanID</td><td>8 bytes</td><td>Extended PAN ID of the neighbor device</td></tr> <tr> <td>ExtendedAddress</td><td>8 bytes</td><td>Network extended address</td></tr> <tr> <td>NetworkAddress</td><td>2 bytes</td><td>Device short address</td></tr> <tr> <td>DeviceType/ RxOnWhenIdle/ Relationship</td><td>1 byte</td><td>DeviceType: bits 1-0 RxOnWhenIdle: bits 3-2 Relationship: bits 6-4</td></tr> <tr> <td>PermitJoining</td><td>1 byte</td><td>PermitJoining: bits 1-0</td></tr> <tr> <td>Depth</td><td>1 byte</td><td></td></tr> <tr> <td>LQI</td><td>1 byte</td><td></td></tr> </table>	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	
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																									

3.5.45 ZDO_MGMT_RTG_RSP

3.5.45.1 Description

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

3.5.45.2 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.												
RoutingTableList	variable	<p>Array of RtgList items. RtgListCount contains the number of items in this table.</p> <table> <tr> <th>Name</th><th>Size</th><th>Description</th></tr> <tr> <td>Destination Address</td><td>2 bytes</td><td>Network destination address</td></tr> <tr> <td>Status</td><td>1 byte</td><td> Route status: bits 2-0 0x00 Active 0x01 Discovery Underway 0x02 Discovery Failed 0x03 Inactive 0x04 – 0x07 Reserved </td></tr> <tr> <td>Next Hop</td><td>2 bytes</td><td>Next hop network address</td></tr> </table>	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
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												

3.5.46 ZDO_MGMT_BIND_RSP

3.5.46.1 Description

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

3.5.46.2 Usage

AREQ:

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	<p>An array of BindList items. BindListCount contains the number of items in this table.</p> <table> <tr> <th>Name</th><th>Size</th><th>Description</th></tr> <tr> <td>SrcAddr</td><td>8 bytes</td><td>Binding Entry's source IEEE address</td></tr> <tr> <td>SrcEndpoint</td><td>1 byte</td><td>Binding Entry's source endpoint</td></tr> <tr> <td>ClusterID</td><td>1 byte</td><td>Message ID in binding table</td></tr> <tr> <td>DstAddrMode</td><td>1 byte</td><td>Address mode for binding entry's destination address</td></tr> <tr> <td>DstAddr</td><td>8 bytes</td><td>Binding Entry's destination IEEE address</td></tr> <tr> <td>DstEndpoint</td><td>1 byte</td><td>Binding Entry's destination endpoint. For V1.1, this field is only present when the DestAddrMode is 64-bits extended address.</td></tr> </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.
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.																					

3.5.47 ZDO_MGMT_LEAVE_RSP

3.5.47.1 Description

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

3.5.47.2 Usage

AREQ:

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).

3.5.48 ZDO_MGMT_DIRECT_JOIN_RSP

3.5.48.1 Description

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

3.5.48.2 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).

3.5.49 ZDO_MGMT_PERMIT_JOIN_RSP

3.5.49.1 Description

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

3.5.49.2 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).

3.5.50 ZDO_STATE_CHANGE_IND

3.5.50.1 Description

This callback message indicates the ZDO state change.

3.5.50.2 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.																							
		Name	Description	DEV_HOLD	Initialized - not started automatically	DEV_INIT	Initialized - not connected to anything	DEV_NWK_DISC	Discovering PAN's to join	DEV_NWK_JOINING	Joining a PAN	DEV_NWK_REJOIN	ReJoining a PAN, only for end devices	DEV_END_DEVICE_UNAUTH	Joined but not yet authenticated by trust center	DEV_END_DEVICE	Started as device after authentication	DEV_ROUTER	Device joined, authenticated and is a router	DEV_COORD_STARTING	Started as Zigbee Coordinator	DEV_ZB_COORD	Started as Zigbee Coordinator	DEV_NWK_ORPHAN	Device has lost information about its parent
		Name	Description																						
		DEV_HOLD	Initialized - not started automatically																						
		DEV_INIT	Initialized - not connected to anything																						
		DEV_NWK_DISC	Discovering PAN's to join																						
		DEV_NWK_JOINING	Joining a PAN																						
		DEV_NWK_REJOIN	ReJoining a PAN, only for end devices																						
		DEV_END_DEVICE_UNAUTH	Joined but not yet authenticated by trust center																						
		DEV_END_DEVICE	Started as device after authentication																						
		DEV_ROUTER	Device joined, authenticated and is a router																						
		DEV_COORD_STARTING	Started as Zigbee Coordinator																						
		DEV_ZB_COORD	Started as Zigbee Coordinator																						
DEV_NWK_ORPHAN	Device has lost information about its parent																								

3.5.51 ZDO_END_DEVICE_ANNCIE_IND

3.5.51.1 Description

This callback indicates the ZDO End Device Announce.

3.5.51.2 Usage

AREQ:

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

3.5.52 ZDO_MATCH_DESC_RSP_SENT

3.5.52.1 Description

This callback indicates that Match Descriptor Response has been sent.

3.5.52.2 Usage

AREQ:

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 (2 bytes each) that matched.
NumOutClusters	1	The number of output clusters in the OutClusterList.
OutClusterList	0-32	List of output cluster IDs (2 bytes each) that matched.

3.5.53 ZDO_STATUS_ERROR_RSP

3.5.53.1 Description

This message is the default message for error status.

3.5.53.2 Usage

AREQ:

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

Attributes:

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

3.5.54 ZDO_SRC_RTG_IND

3.5.54.1 Description

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

3.5.54.2 Usage

AREQ:

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

Attributes:

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

3.5.55 ZDO_MSG_CB_REGISTER

3.5.55.1 Description

This command registers for a ZDO callback.

3.5.55.2 Usage

SREQ:

1	1	1	2
Length = 0x02	Cmd0 = 0x25	Cmd1 = 0x3E	ClusterID

Attributes:

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

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x3E	Status

Attributes:

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

3.5.56 ZDO_MSG_CB_REMOVE

3.5.56.1 Description

This command removes a registration for a ZDO callback.

3.5.56.2 Usage

SREQ:

1	1	1	2
Length = 0x02	Cmd0 = 0x25	Cmd1 = 0x3F	ClusterID

Attributes:

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

SRSP:

1	1	1	1
Length = 0x01	Cmd0 = 0x65	Cmd1 = 0x3F	Status

Attributes:

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

3.5.57 ZDO_MSG_CB_INCOMING

3.5.57.1 Description

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

3.5.57.2 Usage

AREQ:

1	1	1	2	1	2
Length = 0x09-Max MTU length	Cmd0 = 0x45	Cmd1 = 0xFF	SrcAddr	WasBroadcast	ClusterID

1	1	2	0 - Max MTU length
SecurityUse	SeqNum	MacDstAddr	Data

Attributes:

Attribute	Length (byte)	Description
SrcAddr	2	Short address (LSB-MSB) of the source of the ZDO message.
WasBroadcast	1	This field indicates whether or not this ZDO message was broadcast.
ClusterID	2	The ZDO Cluster Id of this message.

SecurityUse	1	N/A – not used.
SeqNum	1	The sequence number of this ZDO message.
MacDstAddr	2	The MAC destination short address (LSB-MSB) of the ZDO message.
Data	0 - Max MTU length.	The data that corresponds to the Cluster Id of the message.

3.6 Return Values

The status parameter that is returned from the CC2530-ZNP device may take one of the following values:

Name	Value
ZSuccess	0x00
ZFailure	0x01
ZInvalidParameter	0x02
ZMemError	0x10
ZBufferFull	0x11
ZUnsupportedMode	0x12
ZMacMemError	0x13
zdoInvalidRequestType	0x80
zdoInvalidEndpoint	0x82
zdoUnsupported	0x84
zdoTimeout	0x85
zdoNoMatch	0x86
zdoTableFull	0x87
zdoNoBindEntry	0x88
ZSecNoKey	0xa1
ZSecMaxFrmCount	0xa3
ZApsFail	0xb1
ZApsTableFull	0xb2
ZApsIllegalRequest	0xb3
ZApsInvalidBinding	0xb4
ZApsUnsupportedAttrib	0xb5
ZApsNotSupported	0xb6
ZApsNoAck	0xb7
ZApsDuplicateEntry	0xb8
ZApsNoBoundDevice	0xb9
ZNwkInvalidParam	0xc1
ZNwkInvalidRequest	0xc2
ZNwkNotPermitted	0xc3
ZNwkStartupFailure	0xc4
ZNwkTableFull	0xc7
ZNwkUnknownDevice	0xc8
ZNwkUnsupportedAttribute	0xc9
ZNwkNoNetworks	0xca
ZNwkLeaveUnconfirmed	0xcb
ZNwkNoAck	0xcc
ZNwkNoRoute	0xcd

4 Miscellaneous

4.1 CC2530-ZNP power-up procedure

The recommended power-up procedure is as follows:

1. Application processor and CC2530 power up.
2. Application processor sets CC2530 RESET_N pin low, holding CC2530 in reset.
3. The application processor sets the optional CC2530 CFG0 and CFG1 pins (if these pins are controlled by the application processor).
4. The application processor initializes its UART or SPI interface.
5. The application processor sets CC2530 RESET_N pin high and CC2530 starts operation.
6. Application processor receives the SYS_RESET_IND message using the POLL command. When SPI transport is used CC2530 will set SRDY low to indicate the message is available and the application processor should retrieve the message.
7. The application processor receives the SYS_RESET_IND message.

If the CC2530-ZNP device was configured as an end-device (and using SPI transport), it will automatically enter low power state after the application processor retrieves the SYS_RESET_IND command from the CC2530.

The CC2530-ZNP can also be reset when the application processor sends a SYS_RESET_REQ message. However, resetting CC2530 with the RESET_N pin is recommended because it is faster and more reliable.

4.2 CC2530-ZNP default configuration

4.2.1 IAR project configuration

The CC2530-ZNP IAR project that is included in the ZStack software package has two project configurations – CC2530-ZNP and CC2531-ZNP. As the name indicates, the configurations are intended for use with the CC2530 and CC2531 (USB) chips.

4.2.2 Configuration pins

The CC2530-ZNP project reads the two hardware configuration pins at powerup and configures itself accordingly.

The CFG0 pin is used to indicate the presence (if pin is high) or absence of the 32khz crystal connected to the CC2530-ZNP. This is the sleep crystal that is used to maintain accurate timing when the device is in sleep mode. The advantage of using this instead of the internal 32kHz oscillator is that it typically provides faster wakeup time for sleep and a lower power consumption during this time. If this crystal is not populated, then the CC2530 can use the internal RC oscillator.

If the CFG1 pin is high, the CC2530-ZNP will use the SPI transport mode in the main pin configuration listed below. Otherwise, it will use the UART transport mode in the alternate pin configuration listed below. The pin-out diagram of the CC2530 can be found in [R2].

4.2.2.1 Main pin configuration

CC2530-ZNP signal	CC2530 PIN	CC2530 NAME	Direction (on C2530)
SS / CT	6	P1_4	In
SCLK / RT	5	P1_5	In / Out

MOSI / TX	38	P1_6	In / Out
MISO / RX	37	P1_7	Out / In
RESET	20	RESET_N	In
MRDY	16	P0_3	In
SRDY	15	P0_4	Out
PAEn	9	P1_1	Out
En	7	P1_3	Out
HGM	12	P0_7	Out
CFG0	8	P1_2	In
CFG1	36	P2_0	In
GPIO0	19	P0_0	Configurable
GPIO1	18	P0_1	Configurable
GPIO2	13	P0_6	Configurable
GPIO3	11	P1_0	Configurable

4.2.2.2 Alternate pin configuration

CC2530-ZNP signal	CC2530 PIN	CC2530 NAME	Direction (on C2530)
SS / CT	15	P0_4	In
SCLK / RT	14	P0_5	In / Out
MOSI / TX	16	P0_3	In / Out
MISO / RX	17	P0_2	Out / In
RESET	20	RESET_N	In
MRDY	38	P1_6	In
SRDY	37	P1_7	Out
PA_En	9	P1_1	Out
LNA_En	6	P1_4	Out
HGM	12	P0_7	Out
CFG0	8	P1_2	In
CFG1	36	P2_0	In
GPIO0	19	P0_0	Configurable
GPIO1	18	P0_1	Configurable
GPIO2	13	P0_6	Configurable
GPIO3	11	P1_0	Configurable

4.2.2.3 USB pin configuration

This is only available when used with the CC2531 chip. In this configuration, the CC2530-ZNP will use the USB transport with the alternate pin configuration. The pin-out of the CC2531 can be found in the datasheet [R3].

5 General Information

5.1 Document History

Table 1: Document History

Revision	Date	Description/Changes
1.0	2010-01-17	Initial version

6 Address Information

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Italy 800 79 11 37
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Russia +7 (0) 95 363 4824
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	Korea	080-551-2804
	Malaysia	1-800-80-3973
	New Zealand	0800-446-934
	Philippines	1-800-765-7404
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