MELANGE SYSTEMS PVT LTD

LoRaWAN™ API Documentation

For TarangMini™ SMxx

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Contents

1. TarangMini™

Melange Systems TarangMini™ family of RF modules provide a common footprint which can host multiple platforms, including TarangNet™ (Point to Point, Point to Multi-point), Pretty mesh™ (for mesh network), 6LoWPAN and LoRaWAN™. These modules are designed to address the unique needs of low-power, low-cost wireless sensor and control networks. TarangMini™ modules support both AT and API interface to the host. Both have their own unique use cases.

2. LoRaWAN™ Network Stack for TarangMini™

LoRaWAN™ defines the communication protocol and system architecture for the network while the LoRa® physical layer enables the long-range communication link. The protocol and network architecture have the most influence in determining the battery lifetime of a node, the network capacity, the quality of service, the security, and the variety of applications served by the network.

3. API Interface

API mode is a frame-based protocol that allows you to direct data on a packet basis. From Transmitting Side, the host packages the data with needed information, such As Start Byte, Packet Length, Packet Type, command ID and Payload. Also, at receiving Side, the Destination node accepts the data with information such as Start Byte, Packet Length, Packet Type and Pay load. API Mode allows the user greater flexibility and increased reliability in some cases.

3.1. Module Configuration Commands

3.1.1. Generic Configuration Command Format

Start Byte (1 byte)	Packet Length (1 byte)	Packet Type (1 byte)	Read/Write (1 byte)	Command ID (2 byte)	Value / Payload (Optional)
0x2B	Packet Length excluding Start Byte	0x02	00 Read 01 Write		

3.1.2. Generic Configuration Command Response Format

Start Byte (1 byte)	Packet Length (1 byte)	Packet Type (1 byte)	Command ID (2 byte)	Execution Status (1 byte)	Value (Optional)
0x2B	Packet Length excluding Start Byte	0x82		00 Success 01 Invalid Parameter 02 Invalid Command ID	

3.1.3. List of Supported Configuration Commands

Sl.No	API Command	Command ID	R/W
1	Restore Defaults	00 00	W
2	Restart Module	00 01	W
3	Flash Write	00 02	W
4	Serial Baudrate	00 03	R/W
5	Device EUI Read	00 04	R
6	Application EUI	00 05	R/W
7	Application Key Read	00 06	R
8	Network Key Read	00 07	R
9	Network Connection Type Read	00 08	R
10	Network ID	00 09	R/W
11	Module Hardware Version Read	00 0A	R
12	Firmware Version Read	00 0B	R
13	Adaptive Data Rate	00 0C	R/W
14	Confirm Message	00 0D	R/W
15	Port Number	00 0E	R/W
16	Device Network Address Read	00 10	R
17	Transmission Acknowledgement	00 11	R/W
18	Confirm Message Retries	00 12	R/W
19	Default Data Rate	00 13	R/W
20	Sleep Time	00 14	R/W
21	Wake Time	00 15	R/W
22	Uplink Counter Read	00 16	R
23	Sleep Mode	00 17	R/W
24	Device Class	00 18	R/W
25	Downlink Acknowledgement Mode	00 19	R/W
26	Multicast Application Key	00 1A	R/W
27	Multicast Network Key	00 1B	R/W
28	Multicast Address	00 1C	R/W
29	OTAA Maximum Retry	00 1D	R/W
30	Production Hardware Version Read	00 1E	R
31	Production Make Date Read	00 1F	R
32	Max Output Power	00 20	R/W
33	RSSI and SNR Read	00 30	R
34	Channel Data Rate Read	00 31	R
35	Join Status Read	00 32	R
36	Set LoRaWAN KEYs (AppKey, NwkKey, DevAddress, Network connection type)	00 58	W

3.2. Module Communication Commands

3.2.1. Generic Uplink Command & Response Format

Communication Type	API Packet Structure			
	Start Byte (1 byte)	**Packet Length (1 byte)**	**Packet Type (1 byte)**	**Payload**
UP Link	0x2B	2 + Payload Bytes	0x04	
API ACK	0x2B	0x03	0x81	00
API NACK	0x2B	0x03	0x81	01
API BUSY	0x2B	0x03	0x81	02
API ERROR	0x2B	0x03	0x81	03

3.2.2. Generic Downlink Command Format

Communication Type	API Packet Structure				
	Start Byte (1 byte)	**Packet Length (1 byte)**	**Packet Type (1 byte)**	**Port Number (1 byte)**	**Payload**
Unicast DOWN Link	0x2D	3 + Payload Bytes	0x80	0x01	
Multicast DOWN Link	0x2D	3 + Payload Bytes	0x83	0x01	

3.2.3. Module Start-up Serial Message

Start Byte (1 byte)	**Packet Length (1 byte)**	**Packet Type (1 byte)**	**Payload (14 byte)**
0x2B	0x10	0x05	0x 4C 6F 52 61 57 41 4E 2D 53 54 41 52 54 FF

4. API Commands Description

4.1. Restore Defaults (W)

This command restores module configuration to factory default settings

Command: 2B 05 02 00 00 00
Response: 2B 05 82 00 00 00
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 00
[RX] - 2B 05 82 00 00 00
```

4.2. Restart Module (W)

This command restarts the module

Command: 2B 05 02 00 00 01
Response: 2B 05 82 00 01 00
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 01
[RX] - 2B 05 82 00 01 00
[RX] - 2B 10 05 4C 6F 52 61 57 41 4E 2D 53 54 41 52 54 FF 2B 03 85 00
```

4.3. Flash Write (W)

This command saves the module configuration to flash

Command: 2B 05 02 00 00 02
Response: 2B 05 82 00 02 00
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 02
[RX] - 2B 05 82 00 02 00
```

4.4. Serial Baudrate (R/W)

This command enables the user to set or read the module serial Baudrate.

Command: 2B 05 02 00 00 03
Response: 2B 06 82 00 03 00 XX
Payload: 1 Byte
Supported Baudrate list in bps: 0x00(1200), 0x01(2400), 0x02(4800), 0x03(9600), 0x04(19200), 0x05(38400), 0x06(57600), 0x07(115200)
Default Value: 0x03(9600)
Example:

- Read module serial Baudrate:
  ```
  [TX] - 2B 05 02 00 00 03
  [RX] - 2B 06 82 00 03 00 03
  ```
- Set module serial Baud rate to 9600 bps:
  ```
  [TX] - 2B 06 02 01 00 03 03
  [RX] - 2B 05 82 00 03 00
  ```

4.5. Device EUI Read (R)

This command reads the module Device EUI.

Command: 2B 05 02 00 00 04
Response: 2B 0D 82 00 04 00 3C C1 F6 05 XX XX XX XX
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 04
[RX] - 2B 0D 82 00 04 00 3C C1 F6 05 12 34 56 78
```

4.6. Application EUI (R/W)

This command enables the user to set or read the module Application EUI.

Command: 2B 05 02 00 00 05
Response: 2B 0D 82 00 05 00 XXXXXXXXXXXXXXXX
Payload: 8 Byte
Example:

- Read module Application EUI:
  ```
  [TX] - 2B 05 02 00 00 05
  [RX] - 2B 0D 82 00 05 00 34 56 78 90 98 76 54 32
  ```
- Set module Application EUI):
  ```
  [TX] - 2B 0D 02 01 00 05 34 56 78 90 98 76 54 32
  [RX] - 2B 05 82 00 05 00
  ```

4.7. Application Key Read (R)

This command reads the module Application Key.

Command: 2B 05 02 00 00 06
Response: 2B 15 82 00 06 00 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 06
[RX] - 2B 15 82 00 06 00 00 11 22 33 44 55 66 77 88 99 AA BB CC DD EE FF
```

4.8. Network Key Read (R)

This command reads the module Network Key.

Command: 2B 05 02 00 00 07
Response: 2B 15 82 00 07 00 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 07
[RX] - 2B 15 82 00 07 00 00 11 22 33 44 55 66 77 88 99 AA BB CC DD EE FF
```

4.9. Network Connection Type Read (R)

This command reads the module Network connection type.

Command: 2B 05 02 00 00 08
Response: 2B 06 82 00 08 00 XX
Payload: NA
Supported Network connection type list: 0x00(ABP), 0x01(OTAA).
Default Value: 0x00(ABP)
Example:

```
[TX] - 2B 05 02 00 00 08
[RX] - 2B 06 82 00 08 00 00
```

4.10. Network ID (R/W)

This command enables the user to set or read the module Network ID.

Command: 2B 05 02 00 00 09
Response: 2B 09 82 00 09 00 XXXXXXXX
Payload: 4 Byte
Example:

- Read the module Network ID:

```
[TX] - 2B 05 02 00 00 09
[RX] - 2B 09 82 00 09 00 00 00 00 00
```

- Set module Network ID:

```
[TX] - 2B 09 02 01 00 09 11 22 33 44
[RX] - 2B 05 82 00 09 00
```

4.11. Module Hardware Version Read (R)

This command reads the module Hardware Version.

Command: 2B 05 02 00 00 0A
Response: 2B XX 82 00 0A 00 XXXXXXXXXXXXXXXX
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 0A
[RX] - 2B 0D 82 00 0A 00 53 4D 32 30 4C 52 30 33
```

4.12. Firmware Version Read (R)

This command reads the module Firmware version.

Command: 2B 05 02 00 00 0B
Response: 2B XX 82 00 0B 00 XXXXXXXXXXXXXXXX
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 0B
[RX] - 2B 29 82 00 0B 00 4C 6F 52 61 57 41 4E 5F 43 41 5F 33 5F 31 5F 30
5F 50 72 6F 64 75 63 74 69 6F 6E 5F 30 35 30 36 32 30 31 38
```

4.13. Adaptive Data Rate (R/W)

This command enables the user to set or read the Adaptive Data Rate status.

Command: 2B 05 02 00 00 0C
Response: 2B 06 82 00 0C 00 XX
Payload: 1 Byte
Supported Payload List: 0x00 (Disable), 0x01 (Enable)
Default Value: 0x00(Disable)
Example:

- Read Adaptive Data Rate Status:

```
[TX] - 2B 05 02 00 00 0C
[RX] - 2B 06 82 00 0C 00 00
```

- Set Adaptive Data Rate to Disabled Mode:

```
[TX] - 2B 06 02 01 00 0C 00
[RX] - 2B 05 82 00 0C 00
```

4.14. Confirm Message (R/W)

This command enables the user to set or read Confirm Message parameter.

Command: 2B 05 02 00 00 0D
Response: 2B 06 82 00 0D 00 XX
Payload: 1 Byte
Supported Payload list: 0x00(Disable), 0x01(Enable)
Default Value: 0x00(Disable)

Example:

- Read Confirm Message Setting Status:
  ```
  [TX] - 2B 05 02 00 00 0D
  [RX] - 2B 06 82 00 0D 00 00
  ```
- Disable Confirm Message:
  ```
  [TX] - 2B 06 02 01 00 0D 00
  [RX] - 2B 05 82 00 0D 00
  ```

4.15. Port Number (R/W)

This command enables the user to set or read the module Port Number.

Command: 2B 05 02 00 00 0E
Response: 2B 06 82 00 0E 00 XX
Payload: 1 Byte
Default Value: 0x02
Example:

- Read module Port Number:
  ```
  [TX] - 2B 05 02 00 00 0E
  [RX] - 2B 06 82 00 0E 00 02
  ```
- Set module Port Number to 02:
  ```
  [TX] - 2B 06 02 01 00 0E 02
  [RX] - 2B 05 82 00 0E 00
  ```

4.16. Device Network Address Read (R)

This command reads the module Device Network Address.

Command: 2B 05 02 00 00 10
Response: 2B 09 82 00 10 00 XXXXXXXX
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 10
[RX] - 2B 09 82 00 10 00 22 33 44 55
```

4.17. Transmission Acknowledgement (R/W)

This command enables setting or reading the status of the transmission acknowledgement for the uplinks. Enabling this will provide an UART acknowledgement for every uplink

Command: 2B 05 02 00 00 11
Response: 2B 06 82 00 11 00 XX
Payload: 1 Byte
Supported Payload list: 0x00(Disable), 0x01(Enable)
Default Value: 0x00(Disable)
Example:

- Read transmission acknowledgement acknowledgement setting status
  ```
  [TX] - 2B 05 02 00 00 11
  [RX] - 2B 06 82 00 11 00 00
  ```
- Enable acknowledgement for every transmission:
  ```
  [TX] - 2B 06 02 01 00 11 01
  [RX] - 2B 05 82 00 11 00
  ```

4.18. Confirm Message Retries (R/W)

This command enables the user to set or read the number of Confirm Message Retries.

Command: 2B 05 02 00 00 12
Response: 2B 06 82 00 12 00 XX
Payload: 1 Byte
Default Value: 0x03
Example:

- Read Confirm Message Retries:
  ```
  [TX] - 2B 05 02 00 00 12
  [RX] - 2B 06 82 00 12 00 03
  ```
- Set Confirm Message Retries to four:
  ```
  [TX] - 2B 06 02 01 00 12 04
  [RX] - 2B 05 82 00 12 00
  ```

4.19. Default Data Rate (R/W)

This command enables the user to set or read the Default Data Rate parameter.

Command: 2B 05 02 00 00 13
Response: 2B 06 82 00 13 00 XX
Payload: 1 Byte
Supported Payload list: 0x00(SF12), 0x01(SF11), 0x02(SF10), 0x03(SF09), 0x04(SF08), 0x05(SF07)
Default Value: 0x00(SF12)
Example:

- Read Default Data Rate parameter:
  ```
  [TX] - 2B 05 02 00 00 13
  [RX] - 2B 06 82 00 13 00 00
  ```

- Set Default Data Rate to SF11
  ```
  [TX] - 2B 06 02 01 00 13 01
  [RX] - 2B 05 82 00 13 00
  ```

4.20. Sleep Time (R/W)

This command enables the user to set or read the Sleep Time parameter (in Seconds).

Command: 2B 05 02 00 00 14
Response: 2B 07 82 00 14 00 XXXX
Payload: 2 Byte
Default Value: 0x00 14
Example:

- Reading the configured Sleep Time interval:
  ```
  [TX] - 2B 05 02 00 00 14
  [RX] - 2B 07 82 00 14 00 00 14
  ```

- Set Sleep Time to 20 Seconds:
  ```
  [TX] - 2B 07 02 01 00 14 00 14
  [RX] - 2B 05 82 00 14 00
  ```

4.21. Wake Time (R/W)

This command enables the user to set or read Wake Time parameter (in Seconds).

Command: 2B 05 02 00 00 15
Response: 2B 07 82 00 15 00 XXXX
Payload: 2 Byte
Default Value: 0x00 14
Example:

- Read the Wake Time parameter:
  ```
  [TX] - 2B 05 02 00 00 15
  [RX] - 2B 07 82 00 15 00 00 14
  ```

- Set Wake Time interval to 20 Seconds
  ```
  [TX] - 2B 07 02 01 00 15 00 14
  [RX] - 2B 05 82 00 15 00
  ```

4.22. Uplink Counter Read (R)

This command reads the module Uplink Counter.

Command: 2B 05 02 00 00 16
Response: 2B 09 82 00 16 00 XXXXXXXX
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 16
[RX] - 2B 09 82 00 16 00 00 00 00 01
```

4.23. Sleep Mode (R/W)

This command enables the user to set or read the Sleep Mode configuration.

Command: 2B 05 02 00 00 17
Response: 2B 06 82 00 17 00 XX
Payload: 1 Byte
Supported Payload list: 0x00(No Sleep), 0x01(Pin Asserted Sleep), 0x02(Periodic Sleep)
Default Value: 0x00(No Sleep)
Example:

- Read the Sleep Mode parameter value:
  ```
  [TX] - 2B 05 02 00 00 17
  [RX] - 2B 06 82 00 17 00 00
  ```

- Set the Sleep Mode to pin asserted sleep:
  ```
  [TX] - 2B 06 02 01 00 17 01
  [RX] - 2B 05 82 00 17 00
  ```

4.24. Device Class (R/W)

This command enables the user to set or read LoRaWAN Device Class operation.

Command: 2B 05 02 00 00 18
Response: 2B 06 82 00 18 00 XX
Payload: 1 Byte
Supported Payload list: 0x00(Class C), 0x01(Class A)
Default Value: 0x00 (Class C)
Example:

- Read the class of operation device is set
  ```
  [TX] - 2B 05 02 00 00 18
  [RX] - 2B 06 82 00 18 00 00
  ```

- Set device class to Class A operation
  ```
  [TX] - 2B 06 02 01 00 18 01
  [RX] - 2B 05 82 00 18 00
  ```

4.25. Downlink Acknowledgement Mode (R/W)

This command enables the user to set or read mode of downlink acknowledgement to Network Server (Applicable only to Class C mode of operation).

Command: 2B 05 02 00 00 19
Response: 2B 06 82 00 19 00 XX
Payload: 1 Byte
Supported Payload list: 0x00 (Immediate ACK), 0x01 (ACK with next packet)
Default Value: 0x01 (ACK with next packet)
Example:

- Read Downlink ACK Mode:
  [TX] - 2B 05 02 00 00 19
  [RX] - 2B 06 82 00 19 00 01

- Set Downlink Acknowledgement mode to Immediate ACK
  [TX] - 2B 06 02 01 00 19 00
  [RX] - 2B 05 82 00 19 00

4.26. Multicast Application Key (R/W)

This command enables the user to set or read the module Multicast Application Key.

Command: 2B 05 02 00 00 1A
Response: 2B 15 82 00 1A 00 XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX
Payload: 16 Bytes
Example:

- Read Multicast Application Key:
  [TX] -2B 05 02 00 00 1A
  [RX] -2B 15 82 00 1A 00 AA BB CC DD EE FF 00 11 22 33 44 55 66 77 88 99
- Set Multicast Application Key:
  [TX] - 2B 15 02 01 00 1A AA BB CC DD EE FF 00 11 22 33 44 55 66 77 88 99
  [RX] - 2B 05 82 00 1A 00

4.27. Multicast Network Key (R/W)

This command enables the user to set or read module Multicast Network Key.

Command: 2B 05 02 00 00 1B
Response: 2B 15 82 00 1B 00 XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX
Payload: 16 Byte
Example:

- Read Multicast Network Key:
  [TX] -2B 05 02 00 00 1B
  [RX] -2B 15 82 00 1B 00 AA BB CC DD EE FF 00 11 22 33 44 55 66 77 88 99
- Set Multicast Network Key:
  [TX] -2B 15 02 01 00 1B AA BB CC DD EE FF 00 11 22 33 44 55 66 77 88 99
  [RX] -2B 05 82 00 1B 00

4.28. Multicast Address (R/W)

This command enables the user to set or read module Multicast Address.

Command: 2B 05 02 00 00 1C
Response: 2B 09 82 00 1C 00 XX XX XX XX
Payload: 4 Byte
Example:

- Read Multicast Address:
  [TX] - 2B 05 02 00 00 1C
  [RX] - 2B 09 82 00 1C 00 00 00 00 00
- Set Multicast Address:
  [TX] - 2B 09 02 01 00 1C 11 22 33 44
  [RX] - 2B 05 82 00 1C 00

4.29. OTAA Maximum Retry (R/W)

This command enables the user to set or read the Maximum Retry attempt for the joining message in OTAA mode.

Command: 2B 05 02 00 00 1D
Response: 2B 06 82 00 1D 00 XX
Payload: 1 Byte
Default Value: 0xFF(Infinite retransmission)
Example:

- Read OTAA Maximum Retry:
  [TX] - 2B 05 02 00 00 1D
  [RX] - 2B 06 82 00 1D 00 FF
- Set OTAA Maximum Retry to 0:
  [TX] - 2B 06 02 01 00 1D 05
  [RX] - 2B 05 82 00 1D 00

Note: This feature is recommended only for sleep mode enabled modules. In the API example retry count is set to 5. If 5 retries are unsuccessful module will send a join error message "2B 03 85 01" and goes back to sleep. For retrying again HOST MCU must wake the module up and issue restart command. Up on successfully joining to network module will issue "2B 03 85 00".

Note: If the Retry value is 0xFF it will retry infinitely.

4.30. Production Hardware Version Read (R)

This command reads the Production Hardware Version.

Command: 2B 05 02 00 00 IE
Response: 2B XX 82 00 IE 00 XXXXXXXXXXXXXXXX
Payload: NA
Example:

[TX]-2B 05 02 00 00 1E
[RX]-2B 16 82 00 1E 00 53 4D 32 35 4C 52 30 31 5F 32 36 30 35 32 30 31 38

4.31. Production Make Date Read (R)

This command reads Production Make Date.

Command: 2B 05 02 00 00 IF
Response: 2B XX 82 00 IF 00 XXXXXXXXXXXXXXXX
Payload: NA
Example:

```
[TX] -2B 05 02 00 00 1F
[RX] -2B 15 82 00 1F 00 30 5F 32 36 30 35 32 30 31 38 31 34 30 34 33 30
```

4.32. Max Output Power (R/W)

This command enables the user to set or read Max Output Power of the module. Please refer the hardware documentation to map these values to corresponding power index. Note: This API has impact only on SM25xx Series modules

Command: 2B 05 02 00 00 20
Response: 2B 06 82 00 20 00 XX
Payload: 1 Byte
Supported Payload list: 0x00 - 0x08
Default Value: 0x08
Example:

- Read Max Output Power:

```
[TX] - 2B 05 02 00 00 20
[RX] - 2B 06 82 00 20 00 08
```

- Set Max Output Power:

```
[TX] - 2B 06 02 01 00 20 05
[RX] - 2B 05 82 00 20 00
```

4.33. RSSI and SNR Read (R)

This command reads the RSSI and SNR values of the last received packet (in ASCII format).

Command: 2B 05 02 00 00 30
Response: 2B XX 82 00 30 00 XXXXXXXXXXXXXXXX
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 30
[RX] - 2B 0D 82 00 30 00 2D 31 30 32 2C 31 39
```

Note: 2D 31 30 32 2C 31 39 corresponds to the RSSI and SNR value -102, 19 (ASCII format)

4.34. Channel Data Rate Read (R)

This command reads the Channel Data Rate of next transmission.

Command: 2B 05 02 00 00 31
Response: 2B 06 82 00 31 00 XX
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 31
[RX] -2B 06 82 00 31 00 00
```

Note: In this example 00 (SF12) is the data rate in which next transmission will happen.

4.35. Join Status Read (R)

This command reads the Join Status in OTAA mode.

Command: 2B 05 02 00 00 32
Response: 2B 06 82 00 32 00 XX
Payload: NA
Example:

```
[TX] - 2B 05 02 00 00 32
[RX] - 2B 06 82 00 32 00 01
```

Note: In this example 01 is the response when the device is joined to LoRaWAN network.

4.36. Set LoRaWAN KEYs (AppKey, NwkKey, DevAddress, Network connection type) (W)

This command enables user to set the LoRaWAN KEYs.

Command: 2B 2A 02 01 00 58 XXXXXXXXXXXX
Response: 2B 05 82 00 58 00
Payload: NA
Example:

```
[TX]-2B 2A 02 01 00 58 0A 86 02 56 97 45 4A 23 20 24 A8 58 39 A3 45 23
     20 46 43 90 52 19 03 74 11 35 13 4A 64 A9 9A 22 00 00 12 5F 00
[RX] - 2B 05 82 00 58 00
[RX] - 2B 10 05 4C 6F 52 61 57 41 4E 2D 53 54 41 52 54 FF
```

Note: In this example keys are configured with the following values:

```
AppKey          - 0A 86 02 56 97 45 4A 23 20 24 A8 58 39 A3 45 23
NwkKEY          - 20 46 43 90 52 19 03 74 11 35 13 4A 64 A9 9A 22
DevAddres       - 00 00 12 5F
Nwk Conn Type   - 00(ABP)
```

5. Generic Examples

5.1. Activation By Personalization (ABP) Configuration

- Restore Defaults

  [TX] - 2B 05 02 00 00 00
  [RX] - 2B 05 82 00 00 00

- EXIT/Restart

  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00

- LoRaWAN Parameter Configuring

  [TX] - 2B 2A 02 01 00 58 0A 86 02 56 97 45 4A 23 20 24 A8 58 39 A3 45 23
  20 46 43 90 52 19 03 74 11 35 13 4A 64 A9 9A 2200 00 12 5F00
  [RX] - 2B 05 82 00 58 00
  [RX] - 2B 10 05 4C 6F 52 61 57 41 4E 2D 53 54 41 52 54 FF

Note: AppKey - 0A 86 02 56 97 45 4A 23 20 24 A8 58 39 A3 45 23
NwkKEY - 20 46 43 90 52 19 03 74 11 35 13 4A 64 A9 9A 22
DevAddres - 00 00 12 5F
Nwk Conn Type – 00 (ABP)

- API ACK enable/disable (01 - enable)

  [TX] - 2B 06 02 01 00 11 01
  [RX] - 2B 05 82 00 11 00

- Flash Write/save parameters

  [TX] - 2B 05 02 00 00 02
  [RX] - 2B 05 82 00 02 00

- EXIT/Restart

  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00

- UP Link Command

  [TX] - 2B 0B 04 01 02 03 04 05 06 07 08 09
  [RX] - 2B 03 81 00

Note: Once uplink command is issued module may respond back with any of the following replies.

2B 03 81 00 - ACK received
2B 03 81 01 - NACK (no ack received)
2B 03 81 02 - Uplink busy
2B 03 81 03 - Uplink buffer is more than the allowed limit

- Downlink API

  [RX] - 2B 06 80 01 01 02 03

5.2. Over-The-Air Activation (OTAA) Configuration

- Restore Defaults

  [TX] - 2B 05 02 00 00 00
  [RX] - 2B 05 82 00 00 00

- EXIT/Restart

  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00

- LoRaWAN Parameter Configuring

  [TX] - 2B 2A 02 01 00 58 0A 86 02 56 97 45 4A 23 20 24 A8 58 39 A3 45 23
  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01
  [RX] - 2B 05 82 00 58 00
  [RX] - 2B 10 05 4C 6F 52 61 57 41 4E 2D 53 54 41 52 54 FF

Note: AppKey - 0A 86 02 56 97 45 4A 23 20 24 A8 58 39 A3 45 23
Nwk Conn Type – 01(OTAA)

- API ACK enable/disable (01 - enable)

  [TX] - 2B 06 02 01 00 11 01
  [RX] - 2B 05 82 00 11 00

- Flash Write/save parameters

  [TX] - 2B 05 02 00 00 02
  [RX] - 2B 05 82 00 02 00

- EXIT/Restart

  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00

- UP Link Command

  [TX] - 2B 0B 04 01 02 03 04 05 06 07 08 09
  [RX] - 2B 03 81 00

Note: Once uplink command is issued module may respond back any of the with following replies.

2B 03 81 00 - ACK received
2B 03 81 01 - NACK (no ack received)
2B 03 81 02 - Uplink busy
2B 03 81 03 - Uplink buffer is more than the allowed limit

- Downlink API

  [RX] - 2B 06 80 01 01 02 03

Note: **2B 03 85 00** command will be serially transmitted after module attaches with the gateway.

5.3. Sleep Mode

Note: Three sleep modes are configurable on the modules

- Sleep Mode(0- No Sleep)
  [TX] - 2B 06 02 01 00 17 00
  [RX] - 2B 05 82 00 17 00
- Sleep Mode(1- External Pin Interrupt)
  [TX] - 2B 06 02 01 00 17 01
  [RX] - 2B 05 82 00 17 00
- Sleep Mode(2- Periodic)
  [TX] - 2B 06 02 01 00 17 02
  [RX] - 2B 05 82 00 17 00

Note: **2B 03 84 00** command will be serially transmitted before module goes to sleep.
Note: **2B 03 84 01** command will be serially transmitted after module wakes up from sleep.

a. Periodic Sleep Mode Configuration:

- Sleep mode periodic write
  [TX] - 2B 06 02 01 00 17 02
  [RX] - 2B 05 82 00 17 00
- Device Sleep Time write
  [TX] - 2B 07 02 01 00 14 01 2C
  [RX] - 2B 05 82 00 14 00
- Device Wake Time write
  [TX] - 2B 07 02 01 00 15 00 14
  [RX] - 2B 05 82 00 15 00
- Device Write Flash/save parameters
  [TX] - 2B 05 02 00 00 02
  [RX] - 2B 05 82 00 02 00
- EXIT/Restart
  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00

Note: **Device Sleep Time** is the time device remain in sleep mode.
Note: **Device Wake Time** is the time device remain in wake up mode.

Note: 01 2C, 00 14 are the corresponding **Device Sleep Time** and **Device Wake Time** in seconds (hex format).

b. Pin Asserted Sleep Mode Configuration

- Sleep mode write (configure as pin assert sleep)
  [TX] - 2B 06 02 01 00 17 01
  [RX] - 2B 05 82 00 17 00
- Device Write Flash/save parameters
  [TX] - 2B 05 02 00 00 02
  [RX] - 2B 05 82 00 02 00
- EXIT/Restart
  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00

Note: Pin 13 has to be HIGH for module to wake up (**2B 03 84 01**) and Pin 13 should be LOW for module to go to sleep (**2B 03 84 00**).

c. No Sleep Mode

- Sleep mode disable
  [TX] - 2B 06 02 01 00 17 00
  [RX] - 2B 05 82 00 17 00
- Device Write Flash/save parameters
  [TX] - 2B 05 02 00 00 02
  [RX] - 2B 05 82 00 02 00
- EXIT/Restart
  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00

5.4. LoRaWAN Class Select

Presently two classes are supported by the stack

- Class C (00)
  [TX] - 2B 06 02 01 00 18 00
  [RX] - 2B 05 82 00 18 00
- Class A (01)
  [TX] - 2B 06 02 01 00 18 01
  [RX] - 2B 05 82 00 18 00

a. LoRaWAN Class C Selection

- Selecting Class C
  [TX] - 2B 06 02 01 00 18 00
  [RX] - 2B 05 82 00 18 00
- Device Write Flash/save parameters
  [TX] - 2B 05 02 00 00 02
  [RX] - 2B 05 82 00 02 00
- EXIT/Restart
  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00

b. LoRaWAN Class A Selection

- Selecting Class A
  [TX] - 2B 06 02 01 00 18 01
  [RX] - 2B 05 82 00 18 00
- Device Write Flash/save parameters
  [TX] - 2B 05 02 00 00 02
  [RX] - 2B 05 82 00 02 00
- EXIT/Restart
  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00

5.5. LoRaWAN Downlink acknowledgment mode selection

This API is only applicable to Class C mode of operation.

- **Selecting Immediate ACK Transmit**
  Note: In this mode after a successful downlink immediately ACK will be transmitted
  [TX] - 2B 06 02 01 00 19 00
  [RX] - 2B 05 82 00 18 00

- Device Write Flash/save parameters
  [TX] - 2B 05 02 00 00 02
  [RX] - 2B 05 82 00 02 00
- EXIT/Restart
  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00

- **Selecting transmission of ACK with next packet**
  Note: In this mode after successful downlink ACK will be transmitted with next uplink packet
  [TX] - 2B 06 02 01 00 19 01
  [RX] - 2B 05 82 00 18 00

- Device Write Flash/save parameters
  [TX] - 2B 05 02 00 00 02
  [RX] - 2B 05 82 00 02 00

- EXIT/Restart
  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00

5.6. Multicast Downlink

- Multicast AppKey Updating
  [TX] - 2B 15 02 01 00 1A 6A 93 79 92 55 00 08 84 49 47 42 78 32 79 02 75
  [RX] - 2B 05 82 00 1A 00

- Multicast NwkKey Updating
  [TX] - 2B 15 02 01 00 1B 12 10 41 4A 62 27 91 02 93 33 29 43 55 03 54 58
  [RX] - 2B 05 82 00 1B 00

- Multicast Address Updating
  [TX] - 2B 09 02 01 00 1C 00 00 01 07
  [RX] - 2B 05 82 00 1C 00

- Device Write Flash/save parameters
  [TX] - 2B 05 02 00 00 02
  [RX] - 2B 05 82 00 02 00

- EXIT/Restart
  [TX] - 2B 05 02 00 00 01
  [RX] - 2B 05 82 00 01 00