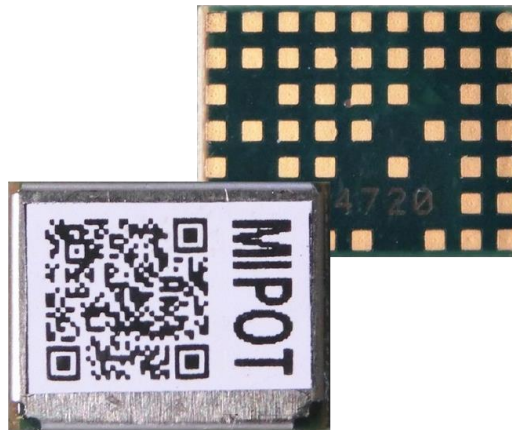


Wireless Protocol Modules MiP Series

32001505DEU

Stand Alone LoRa™ Modem

Command Reference



Description

This document provides list of commands that the 32001505DEU implement and the description of their use.

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I. Communication interface: SPI/UART

SPI/UART interface allows Host both to configure the module and to exchange LoRa radio frame data messages.

I.1 Byte Order

Multiple byte values are transmitted in little endian order with least significant byte first (LSB).

I.2 Message Structure

The structure of the messages is the following:

HEADER	CMD	LENGTH	PAYLOAD (n Bytes)	CHECKSUM
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Where:

HEADER	=	0xAA
CMD	=	Command code to the module, see the following table
LENGTH	=	Payload length
Checksum	=	2's complement on one byte of the sum of all preceding bytes

Each command from the host invokes an answer from the module in the same format.

The answer to the host has the CMD field equal to host request OR 0x80.

2. Command Set Description

List of the implemented command:

Command (CMD)	Value	Description
RESET_CMD	0x30	Module software reset
FACTORY_RESET_CMD	0x31	Restore EEPROM to factory default values
EEPROM_WRITE_CMD	0x32	Write EEPROM parameter
EEPROM_READ_CMD	0x33	Read EEPROM parameter
GET_FW_VERSION_CMD	0x34	Get firmware version
GET_SERIALNO_CMD	0x35	Get serial number
TX_MSG_CMD	0x50	Transmission of radio message
TX_MSG_IND	0x52	Indication of radio message transmission
RX_MSG_IND	0x53	Indicate radio message reception
SET_AES_KEY_CMD	0x58	Write EEPROM parameter AES encryption key
SET_IV_CMD	0x59	Write EEPROM parameter IV for encryption

2.1 RESET_CMD (0x30)

This command performs a module Reset.

When a valid reset request is received, the module replies immediately to the host microcontroller.

All communication interfaces will be disabled during the reset procedure.

Host: 0xAA, 0x30, 0x00, 0x26

Reply: 0xAA, 0xB0, 0x00, 0xA6

2.2 FACTORY_RESET_CMD (0x31)

This command restores EEPROM factory default values.

Host: 0xAA, 0x31, 0x00, 0x25

Reply: 0xAA, 0xB1, 0x01, Status, checksum

Status: 0x00: Success

A value different from 0: error

2.3 EEPROM_WRITE_CMD (0x32)

This command performs an EEPROM data write. For Addresses and Data values see “Module Configuration” section.

Host: 0xAA, 0x32, Length, Start Address, <Data>, checksum

Reply: 0xAA, 0xB2, 0x01, EEWriteStatus, checksum

Note: Data outside allowed range will not be stored in EEPROM and the current value will not be modified. If the variable to be updated has the same value of the new one then the EEPROM will not be updated in order to minimize memory write cycles.

EEWriteStatus: 0x00: Success

0x01: Invalid address

2.4 EEPROM_READ_CMD (0x33)

This command reads EEPROM data. For Addresses and Data values see “Module Configuration” section.

Host: 0xAA, 0x33, 0x02, Start Address, Number of bytes, checksum

Reply: 0xAA, 0xB3, Length, Status, Data, checksum

Status: 0x00: Success, Data contains EEPROM values

0xFF: failure, Data is empty and Length is equal to 1

2.5 GET_FW_VERSION_CMD (0x34)

Get 32-bit firmware version.

Host: 0xAA, 0x34, 0x00, 0x22

Reply: 0xAA, 0xB4, 0x04, FWV0, FWV1, FWV2, FWV3, checksum

FWV0, FWV1, FWV2, FWV3: Firmware version

2.6 GET_SERIALNO_CMD (0x35)

Get unique 32-bit Serial Number.

Host: 0xAA, 0x35, 0x00, 0x21

Reply: 0xAA, 0xB5, 0x04, SN0, SN1, SN2, SN3, checksum
SN0, SN1, SN2, SN3: 32-bit Mipot Serial Number.

2.7 TX_MSG_CMD (0x50)

This command performs the transmission of a radio frame.

Host: 0xAA, 0x50, Length, <MsgPayload>, checksum

Reply: 0xAA, 0xD0, 0x01, Status, checksum

2.8 TX_MSG_IND (0x52)

This command indicates the end of a transmission session.

Module: 0xAA, 0x52, 0x05, Status, checksum

Status: 0x00 = success

A value different from zero means that an error has occurred.

2.9 RX_MSG_IND (0x53)

This command indicates the reception of radio frames.

Module: 0xAA, 0x53, Length, Status, RssiLSB, RssiMSB, SNR, <Payload>, checksum

Status: 0x00 = success

Values different from zero are reserved.

RssiLSB/MSB: 16-bit Rssi Value expressed in dBm

SNR: 8-bit Signal-to-Noise Ratio

Payload: Data Message

2.10 SET_AES_KEY_CMD (0x58)

This command performs an EEPROM data write.

Host: 0xAA, 0x58, 0x10, <AESKey>, checksum

Reply: 0xAA, 0xD8, 0x01, Status, checksum

AESKey: 16 bytes in Little Endian Order. Needed for Application encryption customization.

This key is used only when AppEnAES parameter is set to 1.

Status: 0x00 = success

Values different from zero are reserved.

2.11 SET_IV_CMD (0x59)

This command performs an EEPROM data write.

Host: 0xAA, 0x59, 0x10, <InitVector>, checksum
Reply: 0xAA, 0xD9, 0x01, Status, checksum
InitVector: 16 bytes in Little Endian Order. Needed for Application encryption customization. This key is used only when AppEnAES parameter is set to 1.
Status: 0x00 = success
Values different from zero are reserved.

3. Module Configuration

Multiple byte values are expressed in little endian order with least significant byte first (LSB).

3.1 Internal DATA (Read Only)

The module implements on-board network AES encryption with an internal key (not accessible to the host microcontroller). If the host microcontroller needs to customize the encryption at application level, it has to enable this feature by setting AppEnAES parameter to 1 and write AESKey through SET_AES_KEY_CMD (0x58).

Parameter	Description	Values Range	Default	Notes
AESKey	16 bytes AES key	0-255 for all 16 bytes	0 for all 16 bytes	Used at application level (Write Only Variable)
InitVect	16 bytes initialization vector	0-255 for all 16 bytes	0 for all 16 bytes	Used at application level (Write Only Variable)

Parameter	Description	Notes
SerialNumber0	Byte 0 SN	Serialization at 32 bits
SerialNumber1	Byte 1 SN	
SerialNumber2	Byte 2 SN	
SerialNumber3	Byte 3 SN	
FwVersion0	Byte 0 FW Version	Firmware version
FwVersion1	Byte 1 FW Version	
FwVersion2	Byte 2 FW Version	
FwVersion3	Byte 3 FW Version	

3.2 LoRa stack parameters

Parameter	Description	Address	Range	Default	Notes
Power	Power expressed in dBm	0x00	2 - 14	14	Power expressed in dBm
Frequency	Channel frequency selection	0x01	0 - 74	2	Check frequency index table
Bandwidth	TX bandwidth	0x02	0 - 2	0	0 = 125 kHz 1 = 250 kHz 2 = 500 kHz
Spreading Factor	Spreading factor expressed in chips	0x03	6 - 12	10	6 = 64 chips 7 = 128 chips 8 = 256 chips 9 = 512 chips 10 = 1024 chips 11 = 2048 chips 12 = 4096 chips
Code Rate	Code rate	0x04	1 - 4	1	1 = 4/5 2 = 4/6 3 = 4/7 4 = 4/8

3.3 Frequency index table

Index		Index		Index		Index	
0	868.075	20	868.575	40	869.075	60	869.575
1	868.100	21	868.600	41	869.100	61	869.600
2	868.125	22	868.625	42	869.125	62	869.625
3	868.150	23	868.650	43	869.150	63	869.650
4	868.175	24	868.675	44	869.175	64	869.675
5	868.200	25	868.700	45	869.200	65	869.700
6	868.225	26	868.725	46	869.225	66	869.725
7	868.250	27	868.750	47	869.250	67	869.750
8	868.275	28	868.775	48	869.275	68	869.775
9	868.300	29	868.800	49	869.300	69	869.800
10	868.325	30	868.825	50	869.325	70	869.825
11	868.350	31	868.850	51	869.350	71	869.850
12	868.375	32	868.875	52	869.375	72	869.875
13	868.400	33	868.900	53	869.400	73	869.900
14	868.425	34	868.925	54	869.425	74	869.925
15	868.450	35	868.950	55	869.450		
16	868.475	36	868.975	56	869.475		
17	868.500	37	869.000	57	869.500		
18	868.525	38	869.025	58	869.525		
19	868.550	39	869.050	59	869.550		

3.4 Module parameters

Parameter	Description	Address	Range	Default	Notes
DataIndicate Timeout	Interval between data indicate low and data transmission	0x05	1-255	5	Expressed in ms
Uart Baudrate	Serial communication baud rate	0x06	0: 9600 1: 19200 2: 38400 3: 57600 4: 115200	4	115200
AppEnAES	Application AES key enable / disable	0x07	0 - 1	0	0 = disabled 1 = enabled

4. Revision History

Revision	Date	Description
0.1	13.05.2021	Preliminary