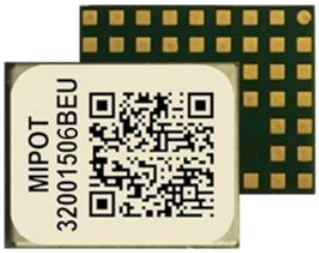
Wireless Protocol Modules MiP Series 32001506BEU

Stand Alone LoRaWAN™ modem with MCU

Command Reference



Description

This document provides the list of commands that the 32001506BEU module implements and the description of their use.

The 32001506BEU is based on STM32WL55 dual core Arm® Cortex-M4/Cortex-M0+ microcontroller.

Contents

1. Communication interface

The **32001506BEU** is a module where the core Arm Cortex-M0+ is used exclusively for radio management and radio protocol implementation while the core Arm Cortex-M4 is fully available for user application. In this scenario the Arm Cortex-M4 configures and operates the radio part controlled by the Arm Cortex-M0+. The communication interface between cores is the STM32WL55's internal block named Inter-Processor Communication Controller (IPCC).

1.1. IPCC – Inter-Processor Communication Controller (only for 32001506BEU)

IPCC is an ST Microcontroller proprietary inter-core communication controller. For details please refer to "*RM0453 Reference manual - STM32WL5x advanced Arm®-based 32-bit MCUs with sub-GHz radio solution*".

IPCC communication is based on a common RAM memory area shared between Cortex-M4 and Cortex-M0+. In 32001506BEU such area is 1 kB wide starting from address 0x20008000 to address 0x200083FF and is used for bidirectional data exchange between cores.

The communication between the Cortex-M4 and Cortex-M0+ cores is performed with the same communication protocol defined for the physical SPI/I^2C/UART channels used into 32001505BEU module and is internally managed through transmit/receive interrupts.

Protocol messages are written/read to/from IPCC buffers located inside shared RAM area.

A simple Arm Cortex-M4 application template may be provided as basic reference to implement IPCC communication with Arm Cortex-M0+ core.

2. Communication protocol

2.1. Byte Order

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

2.2. Message Structure

The structure of the messages is the following:

HEADER	CMD	LENGTH	PAYLOAD (n Bytes)	CHECKSUM

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.

2.3. Message Types

There are three types of messages:

Commands: sent from the user application running on the M4 core to the radio stack running on the M0+ core to request an information or an action.

Replies: sent from the radio stack to the user application as direct reply to a command, their command code is equal to the host request (<cmd> OR 0x80).

Indications: messages sent from the radio stack to the user application that are sent without prior action from the host, triggered by events on the radio interface. (E.g.: a received transmission).

3. 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
GET_DEV_EUI	0x36	Get Factory-Stored DevEUI
JOIN_CMD	0x40	Network Join Command
JOIN_IND	0x41	Join result indication
GET_ACTIVATION_STATUS_CMD	0x42	Get activation status command
SET_APP_KEY_CMD	0x43	Set Application Key
SET_APP_SESSION_KEY_CMD	0x44	Set Application Session Key
SET_NWK_SESSION_KEY_CMD	0x45	Set Network Session Key
TX_MSG_CMD	0x46	Transmission of a LoRa Radio Message
TX_MSG_CONFIRMED_IND	0x47	Indication of a LoRa Radio Confirmed Transmission
TX_MSG_UNCONFIRMED_IND	0x48	Indication of a LoRa Radio Unconfirmed Transmission
RX_MSG_IND	0x49	Indication of a LoRa Radio Message Reception
GET_SESSION_STATUS_CMD	0x4A	Get the session status
SET_NEXT_DR_CMD	0x4B	Set next data rate command
SET_BATTERY_LVL_CMD	0x50	Set the Battery Level
GET_BATTERY_LVL_CMD	0x51	Get the Battery Level
SET_UPLINK_CNT_CMD	0x52	Set Uplink Counter
GET_UPLINK_CNT_CMD	0x53	Get Uplink Counter
SET_DOWNLINK_CNT_CMD	0x54	Set Downlink Counter
GET_DOWNLINK_CNT_CMD	0x55	Get Downlink Counter
SET_CH_PARAMETERS_CMD	0x57	Set Channel Parameters
GET_CH_PARAMETERS_CMD	0x58	Get Channel Parameters
LINK_CHECK_REQUEST_CMD	0x60	Validate the network connectivity
LINK_CHECK_REQUEST_IND	0x61	Indication of the link margin and gateways count
DEVICE_TIME_REQUEST_CMD	0x62	Requests network time and date

DEVICE_TIME_REQUEST_IND	0x63	Indication of GPS epoch time frame reception
RESET_ABP_CMD*	0x64	Renegotiate ABP join
RESET_ABP_IND*	0x65	Indication on the ABP renegotiation
REKEY_OTAA_CMD*	0x66	Renegotiate OTAA join
REKEY_OTAA_IND*	0x67	Indication on the OTAA renegotiation

3.1. 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

3.2. FACTORY_RESET_CMD (0x31)

This command performs the recovery of EEPROM default values. This command is allowed only when the module is idle state (network activation has not been performed yet).

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

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

Status: 0x00: success
0xFF: error

3.3. EEPROM_WRITE_CMD (0x32)

This command performs the EEPROM data write. This command is allowed only when module is in idle state (network activation has not been performed yet). For Address and Data table see Module Configuration section.

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

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

Note: Data outside allowed range will not be stored in EEPROM and current value will not be modified.

If the variable to be updated has the same value of the new one, the EEPROM will not be updated in order to minimize memory writing cycles.

EEWriteStatus: 0x00: success
0x01: Data address outside range
0x02: LoRaMac not in idle state

3.4. EEPROM_READ_CMD (0x33)

This command performs the EEPROM data read. For Address and Data table see Module Configuration section.

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

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

Status: 0x00: success, Data contains EEPROM values
0xFF: failure, Data is empty and Length is equal to 1

3.5. GET_FW_VERSION_CMD (0x34)

Get 32bit firmware version.

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

Reply: 0xAA, 0xB4, 8, FWV0, FWV1, FWV2, FWV3, cks

FWVn: FW version

3.6. GET_SERIALNO_CMD (0x35)

Get Mipot 32bit Serial Number.

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

Reply: 0xAA, 0xB5, 0x04, SN0, SN1, SN2, SN3, cks

SNn: Serial number

3.7. GET_DEVEUI_CMD (0x36)

Get DevEUI provided by Mipot.

Host: 0xAA, 0x36, 0x00, 0x20

Reply: 0xAA, 0xB5, 0x08, <DevEUI>, cks

DevEUI: 8 bytes containing Mipot EUI.

3.8. JOIN_CMD (0x40)

This command performs the network activation.

There are two types of activation:

OTAA (Over the Air Activation): End device must follow a join procedure to obtain dynamic keys.

ABP (Activation by personalization): End device Address and Session keys are preset.

Host: 0xAA, 0x40, 0x01, Mode, cks

Reply: 0xAA, 0xC0, 0x01, Status, cks

Mode: 0 = Activation by personalization (ABP)
1 = Over the air activation (OTAA)

Status: 0x00: success
0x01: invalid parameter
0x02: module is busy

3.9. JOIN_IND (0x41)

This command indicates the result of OTAA join procedure.

Module: 0xAA, 0x41, 0x01, Status, cks

Status: 0x00: success

A value different from zero means that an error has occurred

3.10. GET_ACTIVATION_STATUS_CMD (0x42)

This command gets the module activation status.

Host: 0xAA, 0x42, 0x00, 0x14

Reply: 0xAA, 0xC2, 0x01, Status, cks

Status: 0x00: Not activated
0x01: Joining
0x02: Joined
0x03: MAC error

3.11. SET_APP_KEY_CMD (0x43)

This command performs the EEPROM data write.

Host: 0xAA, 0x43, 0x10, <AppKey>, cks

Reply: 0xAA, 0xC3, 0x00, cks

AppKey: 16 bytes in Little Endian Order. Needed for OTAA procedure.

3.12. SET_APP_SESSION_KEY_CMD (0x44)

This command performs the EEPROM data write.

Host: 0xAA, 0x44, 0x10, <AppSKey>, cks

Reply: 0xAA, 0xC4, 0x00, cks

AppSKey: 16 bytes in Little Endian Order. Needed for APB procedure.

3.13. SET_NWK_SESSION_KEY_CMD (0x45)

This command performs the EEPROM data write.

Host: 0xAA, 0x45, 0x10, <NwkSKey>, cks

Reply: 0xAA, 0xC5, 0x00, cks

NwkSKey: 16 bytes in Little Endian Order. Needed for APB procedure.

3.14. TX_MSG_CMD (0x46)

This command performs the transmission of a radio frame.

In case of Reliable data Transmission (Confirmed Frames) if the module doesn't receive an acknowledgment, it will perform a data rate adaptation

In case of Unreliable data Transmission (Unconfirmed Frames) the module will transmit the frames N times according to "Unconfirmed TX Repetition Number" EEPROM parameter.

Host: 0xAA, 0x46, Length, Options, Port, <MsgPayload>, cks

Reply: 0xAA, 0xC6, 0x01, Status, cks

Options: 0bxxxxxxx0 = Unreliable Data Transmission
0bxxxxxxx1 = Reliable Data Transmission

Port: Port Number, from 1 to 223

MsgPayload: Data to transmit. The maximum allowed data length depends upon set data rate

Status: 0x00: success
0x01: Device busy
0x02: Device not Activated
0x03: Channel Blocked by duty-cycle
0x04: Port number not supported
0x05: Length not supported
0x06: End Node in silent state
0x07: Error

3.15. TX_MSG_CONFIRMED_IND (0x47)

This command indicates that a confirmed radio frame transmission has been performed.

Module: 0xAA, 0x47, 0x05, Status, DataRate, TxPower, AckReceived, NbRetries, cks

Status: 0x00 = success
A value different from zero means that an error has occurred.

Data Rate: 0 = SF12/125 kHz
1 = SF11/125 kHz
2 = SF10/125 kHz
3 = SF9/125 kHz
4 = SF8/125 kHz
5 = SF7/125 kHz
6 = SF7/250 kHz
7 = FSK

TxPower: 1 = 14 dBm
2 = 11 dBm
3 = 8 dBm
4 = 5 dBm
5 = 2 dBm

AckReceived: 0 = No Ack received
1 = Ack received

NbRetries: Number of transmissions

3.16. TX_MSG_UNCONFIRMED_IND (0x48)

This command indicates that an unconfirmed radio frame transmission has been performed.

Module: 0xAA, 0x48, 0x03, Status, DataRate, TxPower, cks

Status: 0x00 = success
A value different from zero means that an error has occurred.

Data Rate: 0 = SF12/125 kHz
1 = SF11/125 kHz
2 = SF10/125 kHz
3 = SF9/125 kHz
4 = SF8/125 kHz
5 = SF7/125 kHz
6 = SF7/250 kHz
7 = FSK

TxPower: 1 = 14 dBm
2 = 11 dBm
3 = 8 dBm
4 = 5 dBm
5 = 2 dBm

3.17. RX_MSG_IND (0x49)

This command indicates that a radio frame has been received.

Module: 0xAA, 0x49, Length, Status, MsgType, MulticastFlag, RxDataRate, RxSlot, FramePending, AckReceived, RxData, RssiLSB, RssiMSB, SNR, Port, Payload, cks

Status: 0x00 = success

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

MsgType: Message type:

0 = UNCONFIRMED

1 = CONFIRMED

2 = MULTICAST (Reserved for future usage)

3 = PROPRIETARY

MulticastFlag: (Reserved for future usage)

0 = No Multicast

1 = Multicast message

RxDataRate: 0 = SF12/125 kHz

1 = SF11/125 kHz

2 = SF10/125 kHz

3 = SF9/125 kHz

4 = SF8/125 kHz

5 = SF7/125 kHz

6 = SF7/250 kHz

7 = FSK

RxSlot: RxSlotValue

0 = Rx window 1

1 = Rx window 2

FramePending: Frame Pending status:

0 = no downlink Frame Pending

1 = downlink Frame Pending

AckReceived: Indicates if an Ack is received:

0 = No Ack received

1 = Ack Received

RxData: Indicates if data is available:

0 = No data available

1 = Data available

Rssi: 16-bit Rssi Value expressed in dBm

SNR: 8-bit Signal-to-Noise Ratio (for FSK SNR = 0)

Port: Port Number, from 1 to 223

Payload: Data Message

Payload is optional: if the module receives an Ack from the server after a reliable data transmission, the module will transmit a RX_MSG_IND command without the Payload field.

3.18. GET_SESSION_STATUS_CMD (0x4A)

This command gets the module current status.

Host: 0xAA, 0x4A, 0x00, cks

Reply: 0xAA, 0xCA, 0x01, status, cks

Status: 0x00 = Idle
0x01 = Busy (LoRa session sunning)
0x02 = Device not activated
0x03 = Delayed (LoRa session paused due to Duty-Cycle)

3.19. SET_NEXT_DR_CMD (0x4B)

This command will set next transmission DR.

Host: 0xAA, 0x4B, 0x01, DataRate, cks

Reply: 0xAA, 0xCB, Status, cks

Data Rate: 0 = SF12/125 kHz
1 = SF11/125 kHz
2 = SF10/125 kHz
3 = SF9/125 kHz
4 = SF8/125 kHz
5 = SF7/125 kHz
6 = SF7/250 kHz
7 = FSK

Status: 0x00 = success
A value different from zero means that an error has occurred.

3.20. SET_BATTERY_LEVEL_CMD (0x50)

This command will set the battery level required for DevStatusReq frame used in LoRaWAN class A protocol.

Host: 0xAA, 0x50, 0x01, BatteryLevel, cks

Reply: 0xAA, 0xD0, 0x00, 0x86

BatteryLevel: 0 = The end-device is connected to an external power source
1…254 = The battery level, 1 being at minimum and 254 being at maximum
255 = The end-device was not able to measure battery level.

3.21. GET_BATTERY_LVL_CMD (0x51)

This command will get the battery level value.

Host: 0xAA, 0x51, 0x00, 0x05

Reply: 0xAA, 0xD1, 0x01, BatteryLevel, cks

BatteryLevel: 0 = The end-device is connected to an external power source
1…254 = The battery level, 1 being at minimum and 254 being at maximum

3.22. SET_UPLINK_CNT_CMD (0x52)

This command will set the uplink counter in RAM memory.

Host: 0xAA, 0x52, 0x04, UplinkCnt0, UplinkCnt1, UplinkCnt2, UplinkCnt3, cks

Reply: 0xAA, 0xD2, 0x00, 0x84

UplinkCnt: 32-bit Uplink Counter.

3.23. GET_UPLINK_CNT_CMD (0x53)

This command will get the uplink counter from RAM memory.

Host: 0xAA, 0x53, 0x00, 0x03

Reply: 0xAA, 0xD3, 0x04, UplinkCnt0, UplinkCnt1, UplinkCnt2, UplinkCnt3, cks

UplinkCnt: 32-bit Uplink Counter.

3.24. SET_DOWNLINK_CNT_CMD (0x54)

This command will set the downlink counter in RAM memory.

Host: 0xAA, 0x54, 0x04, DownlinkCnt0, DownlinkCnt1, DownlinkCnt2, DownlinkCnt3, cks

Reply: 0xAA, 0xD4, 0x00, 0x82

DownlinkCnt: 32-bit Downlink Counter.

3.25. GET_DOWNLINK_CNT_CMD (0x55)

This command will get the downlink counter from RAM memory.

Host: 0xAA, 0x55, 0x00, 0x01

Reply: 0xAA, 0xD5, 0x04, DownlinkCnt0, DownlinkCnt1, DownlinkCnt2, DownlinkCnt3, cks

DownlinkCnt: 32-bit Downlink Counter.

3.26. SET_CH_PARAMETERS _CMD (0x57)

This command will set channel parameters and enable/disable optional channels. Ch0, Ch1, Ch2 are the three default Channels and cannot be modified. Channels from 3 to 15 are customizable by the user and are disabled in the default configuration.

Host: 0xAA, 0x57, 0x07, ChIdx, Freq0, Freq1, Freq2, Freq3, DrRange, ChStatus, cks

Reply: 0xAA, 0xB7, 0x01, Status, cks

ChIdx: Channel index from 3 to 15.

Freqx: Frequency expressed in Hz, where Freq0 is LSB and Freq3 is MSB.

For example, 867500000 Hz = 0x33B4FFE0, Freq0 = 0xE0, Freq1 = 0xFF, Freq2 = 0xB4, Freq3 = 0x33.

DrRange: Data Rate range. Data Rate Max is most significant nibble, and Data Rate min in less significant nibble.

DR_MAX: from 0 to 7

DR_MIN: from 0 to 7

ChStatus: 0x00 = Disabled

0x01 = Enabled

Status: 0x00: success,

0xF0: failure, ChanneIdx Out of Range

0xF1: failure, DrRange Out of Range

0xF2: failure, Frequency Out of Range

0xF3: failure, DrRange and Frequency Out of Range

0xF4: failure, MAC Busy

3.27. GET_CH_PARAMETERS_CMD (0x58)

This command will get channel parameters.

Host: 0xAA, 0x58, 0x01, ChIdx, cks

Reply: 0xAA, 0xD8, 0x06, Freq0, Freq1, Freq2, Freq3, DrRange, ChStatus, cks

ChIdx: Channel index from 0 to 15.

Freqx: Frequency expressed in Hz, where Freq0 is LSB and Freq3 is MSB.

For example, 867500000 Hz = 0x33B4FFE0, Freq0 = 0xE0, Freq1 = 0xFF, Freq2 = 0xB4, Freq3 = 0x33.

DrRange: Data Rate range. Data Rate Max is most significant nibble, and Data Rate min in less significant nibble.

DR_MAX: from 0 to 7

DR_MIN: from 0 to 7

ChStatus: 0x00 = Disabled

0x01 = Enabled

3.28. LINK_CHECK_REQUEST_CMD (0x60)

This command will start a link check with available gateways.

Host: 0xAA, 0x60, 0x01, 0x01, cks

Reply: 0xAA, 0xE0, 0x00, cks

3.29. LINK_CHECK_REQUEST_IND (0x61)

This command indicates the link margin and the available gateways count.

Module: 0xAA, 0x61, 0x02, Margin, GW_Cnt, cks

Margin: 0-254 link margin in dB of the last successfully received Link_Check_CMD

GW_Cnt Number of available gateways in range

3.30. DEVICE_TIME_REQUEST_CMD (0x62)

This command requests the network time and date

Host: 0xAA, 0x62, 0x01, 0x01, cks

Reply: 0xAA, 0xE2, 0x00, cks

3.31. DEVICE_TIME_REQUEST_IND (0x63)

This command indicates the link margin and the available gateways count.

Module: 0xAA, 0x63, 0x05, Epoch0, Epoch1, Epoch2, Epoch3, Epoch4, cks

Epoch0-3: Seconds since Epoch

Epoch4: Fractional seconds

3.32. RESET_ABP_CMD (0x64)*

This command will renegotiate the ABP join.

Host: 0xAA, 0x64, 0x01, 0x01, cks

Reply: 0xAA, 0xE4, 0x01, Status, cks

Status: 0x00: success,
0x01: fail

3.33. RESET_ABP_IND (0x65)*

This command indicates the server LoRaWAN version.

Module: 0xAA, 0x65, 0x01, LR_ver, cks

LR_ver: LoRaWAN version supported by server

3.34. REKEY_OTAA_CMD (0x66)*

This command will renegotiate the OTAA join.

Host: 0xAA, 0x66, 0x01, 0x01, cks

Reply: 0xAA, 0xE6, 0x01, Status, cks

Status: 0x00: success,
0x01: fail

3.35. REKEY_OTAA_IND (0x67)*

This command indicates the server LoRaWAN version.

Module: 0xAA, 0x67, 0x01, LR_ver, cks

LR_ver: LoRaWAN version supported by server

*Implemented but not tested (for LoRaWAN Specifications 1.1 Network Server Only)

4. Module Configuration

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

Parameter	Description	Values Range	Default	Notes
AppKey	Application Key	0-255 for all 16 bytes	0 for all 16 bytes	Used in OTAA (Write Only Variable)
NwkSKey	Network Session Key	0-255 for all 16 bytes	0 for all 16 bytes	Used in ABP (Write Only Variable)
AppSKey	Application Session Key	0-255 for all 16 bytes	0 for all 16 bytes	Used in ABP (Write Only Variable)

4.1. Internal DATA (Read Only)

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	Fw Version
FwVersion1	Byte 1 FW Version	
FwVersion2	Byte 2 FW Version	
FwVersion3	Byte 3 FW Version	
DevEUI0	Byte 0 Dev EUI	64 bit -Extended Unique Identifier
DevEUI1	Byte 1 Dev EUI	
DevEUI2	Byte 2 Dev EUI	
DevEUI3	Byte 3 Dev EUI	
DevEUI4	Byte 4 Dev EUI	
DevEUI5	Byte 5 Dev EUI	
DevEUI6	Byte 6 Dev EUI	
DevEUI7	Byte 7 Dev EUI	

4.2. LoRa stack parameters

Parameter	Description	Address	Range	Default	Notes
Customer DevEUI	Customer 64 bit Extended Unique Identifier	0x00-0x07	0-255 for all 8 bytes	all 0	
AppEUI	64 bit Application Extended Unique Identifier	0x08-0x0F	0-255 for all 8 bytes	all 0	Used in OTAA
DevAddr	32 bit Device Address	0x10-0x13	0-255 for all 4 bytes	all 0	Used in ABP
Class	LoRaWAN Class	0x20	0: A 1: B 2: C	0	
DR/SF	LoRa Datarate/Spreading Factor setting	0x21	0: SF12/125 kHz 1: SF11/125 kHz 2: SF10/125 kHz 3: SF9/125 kHz 4: SF8/125 kHz 5: SF7/125 kHz	0	Used for next uplink transmission. This value may change automatically
Tx Power	Tx Power level	0x22	0: 14 dBm 1: 12 dBm 2: 10 dBm 3: 8 dBm 4: 6 dBm 5: 4 dBm 6: 2 dBm 7: 0 dBm	0	Used for next uplink transmission. This value may change automatically
ADR	Enable/Disable Adaptive Datarate	0x23	0: Disabled 1: Enabled	1	Automatic data rate adaptation allowed
Duty Cycle control	Enable/Disable duty cycle control	0x24	0: Disabled 1: Enabled	1	Should be disabled only for test purposes
Unconfirmed TX Repetition number	Number of uplink messages repetitions (unconfirmed messages only)	0x25	0-15	0	

Enable Customer EUI	Enable/Disable customer EUI	0x26	0: Disable 1: Enable	0	
RX2 Data Rate	RX2 Window Datarate	0x27	0: SF12/125 kHz 1: SF11/125 kHz 2: SF10/125 kHz 3: SF9/125 kHz 4: SF8/125 kHz 5: SF7/125 kHz 6: SF7/250 kHz 7: FSK	0	
RX2 Frequency	RX2 Window frequency	0x28-0x2B	From 863000000 to 870000000 Hz	869525000 Hz	
LinkCheck Timeout	RESERVED	0x2C-0x2D			
Public Network Enable	Enable public/private network sync word	0x2E	0: Private network 1: Public network	0	

4.3. Module parameters

Parameter	Description	Address	Range	Default	Notes
DataIndicate Timeout	Inerval between DataIndicate low and data transmission	0x80	1-255	5	Expressed in ms
Uart Baudrate	Serial communication baudrate	0x81	0: 9600 1: 19200 2: 38400 3: 57600 4: 115200	4: 115200	

5. Revision History

Revision	Date	Description
0.1	18.01.2021	Preliminary
0.2	17.03.2021	Updated Commands
0.3	28.04.2021	Actual Version
0.4	12/07/2022	-Added FACTORY_RESET_CMD (0x31) -Corrected default value for “Unconfirmed TX Repetition Number” -Corrected default value for “RX2 Frequency” -Corrected default value for “Public Network Enable” -Corrected examples for commands from 0x60 to 0x67 -Fixed formatting
1.0	20/09/2022	Added 32001506BEU dual core and IPCC descriptions