

ProLink LoRaWAN EndNode Modem HCI Specification (US915)

Specification Version 2.1

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Revision History

Version	Note
0.1	Created, Initial Version Reference: WiMOD LoRaWAN EndNode Modem HCI Spec V1.14
0.2	Reference: WiMOD LoRaWAN EndNode Modem HCI Spec V1.22 Chapter 2.1.1 updated for Radio Stack Configuration
0.3	Chapter 4 updated
0.4	Reference: WiMOD LoRaWAN EndNode Modem HCI Spec V1.26
1.0	Reference: WiMOD LoRaWAN EndNode Modem HCI Spec V2.0 Update for LoRaWAN v1.0.4
1.1	Document renamed Reference: WiMOD LoRaWAN EndNode Modem HCI Spec V2.2 Reference: RP002-1.0.1 LoRaWAN® Regional Parameters document (LoRa Alliance®).
2.0	Valid from firmware V3.0, Build Count 194 Document renamed to support the ProLink LoRaWAN FW Reference: ProLink LoRaWAN EndNode Modem HCI Spec Reference: RP002-1.0.1 LoRaWAN® Regional Parameters document (LoRa Alliance).
2.1	Chapter 2.1.1 updated for clarification regarding default setting

Aim of this Document

This document describes the ProLink LoRaWAN^{®1} EndNode Modem Host Controller Interface (HCI) protocol which is part of the ProLink LoRaWAN[®] EndNode Modem firmware. This firmware can be used in combination with the WiMOD LoRa[®] radio module family.

¹ LoRa[®] is a registered trademark of Semtech Corporation. LoRaWAN[®] is a registered trademark of the LoRa Alliance[®].

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1. Introduction

1.1 Overview

This document is an extension to the ProLink LoRaWAN® EndNode Modem HCI document [1], covering the changes included in the ProLink LoRaWAN® EndNode Modem firmware for US 902-928MHz ISM Band.

Note that if this region is selected the LoRaWAN® stack will disable any duty cycle restrictions automatically. In this case, the “Duty Cycle Control” option available under the “Radio Stack Configuration” (see [1]) refers to the adjustment of the time between two consecutive uplink (in the same frequency) to 20s, in case the end-device is configured to use less than 50 hopping channels.

2. Appendix

2.1 LoRaWAN® Multi Band Support

2.1.1 Radio Band Indices

Index	Band Description	Comments
2	US 915 MHz	Default setting if several bands available in the binary file (e.g. MBAND FW)

2.1.2 US 915 MHz Band

2.1.2.1 Data Rate Indices

Index	Data Rate / Spreading Factor	Bandwidth	Indicative physical bit rate [bit/s]
0	LoRa / SF10	125 kHz	980
1	LoRa / SF9	125 kHz	1760
2	LoRa / SF8	125 kHz	3125
3	LoRa / SF7	125 kHz	5470
4	LoRa / SF8	500 kHz	12500
8	LoRa / SF12	500 kHz	980
9	LoRa / SF11	500 kHz	1760
10	LoRa / SF10	500 kHz	3900
11	LoRa / SF9	500 kHz	7000
12	LoRa / SF8	500 kHz	12500
13	LoRa / SF7	500 kHz	21900

2.1.2.2 Uplink Channel Indices

Index	Frequency Channel	Comments
0 - 7	902.3 - 903.7 MHz (in steps of 200 kHz)	Data Rates 0 - 3 / Sub-band Mask1: Bit 0
8 - 15	903.9 - 905.3 MHz (in steps of 200 kHz)	Data Rates 0 - 3 / Sub-band Mask1: Bit 1
16 - 23	905.5 - 906.9 MHz (in steps of 200 kHz)	Data Rates 0 - 3 / Sub-band Mask1: Bit 2
24 - 31	907.1 - 908.5 MHz (in steps of 200 kHz)	Data Rates 0 - 3 / Sub-band Mask1: Bit 3
32 - 39	908.7 - 910.1 MHz (in steps of 200 kHz)	Data Rates 0 - 3 / Sub-band Mask1: Bit 4
40 - 47	910.3 - 911.7 MHz (in steps of 200 kHz)	Data Rates 0 - 3 / Sub-band Mask1: Bit 5
48 - 55	911.9 - 913.3 MHz (in steps of 200 kHz)	Data Rates 0 - 3 / Sub-band Mask1: Bit 6
56 - 63	913.5 - 914.9 MHz (in steps of 200 kHz)	Data Rates 0 - 3 / Sub-band Mask1: Bit 7
64 - 71	903.0 - 914.2 MHz (in steps of 1.6 MHz)	Data Rates 4 / Sub-band Mask2: Bits 0-7

2.1.2.3 Downlink Channel Indices

Index	Frequency Channel	Comments
0 - 7	923.3 - 927.5 MHz (in steps of 600 kHz)	Data Rates 8 - 13
8 - 15	923.3 - 927.5 MHz (in steps of 600 kHz)	Data Rates 8 - 13
16 - 23	923.3 - 927.5 MHz (in steps of 600 kHz)	Data Rates 8 - 13
24 - 31	923.3 - 927.5 MHz (in steps of 600 kHz)	Data Rates 8 - 13
32 - 39	923.3 - 927.5 MHz (in steps of 600 kHz)	Data Rates 8 - 13
40 - 47	923.3 - 927.5 MHz (in steps of 600 kHz)	Data Rates 8 - 13
48 - 55	923.3 - 927.5 MHz (in steps of 600 kHz)	Data Rates 8 - 13
56 - 63	923.3 - 927.5 MHz (in steps of 600 kHz)	Data Rates 8 - 13
64 - 71	923.3 - 927.5 MHz (in steps of 600 kHz)	Data Rates 8 - 13
128	923 300 000Hz	Default Frequency for Rx2 Default Data Rate: 8

2.2 Proprietary LoRa® Communication Support

This section describes the physical radio parameters valid for the proprietary LoRa® communication in the US 902-928MHz ISM Band:

- **Frequency**
903 MHz, 904.6 MHz, 906.2 MHz, 907.8 MHz, 909.4 MHz, 911 MHz, 912.6 MHz and 914.2 MHz
- **Data rate**
From SF7BW500 (21.9kbps) to SF8BW500 (12.5kbps)
- **Transmission Power**
Maximum of +20dBm EIRP is allowed

2.2.1 Default Radio Configuration

The following table lists the default configuration for the specific default parameters for US 902-928MHz ISM Band.

Parameter	Value US915
Modulation	0 = LoRa®
RF Carrier Frequency	903 MHz
Signal Bandwidth	2 = 500 kHz
Spreading Factor	8 = SF8
Error Coding	1 = 4/5
Power Level	7 = 7 dBm

2.3 List of Abbreviations

FW	Firmware
HCI	Host Controller Interface
LR	Long Range
LoRa	Long Range
RAM	Random Access Memory
RF	Radio Frequency
RSSI	Received Signal Strength Indicator
RTC	Real Time Clock
SLIP	Serial Line Internet Protocol
SNR	Signal to Noise Ratio
UART	Universal Asynchronous Receiver/Transmitter
WiMOD	Wireless Module by IMST

2.4 List of References

[1] ProLink_LoRaWAN_EndNode_Modem_HCI_Spec.pdf.

3. Regulatory Compliance Information

The use of radio frequencies is limited by national regulations. The applicable regulation requirements are subject to change. IMST GmbH does not take any responsibility for the correctness and accuracy of the aforementioned information. National laws and regulations, as well as their interpretation can vary with the country. In case of uncertainty, it is recommended to contact either IMST's accredited Test Center or to consult the local authorities of the relevant countries.

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