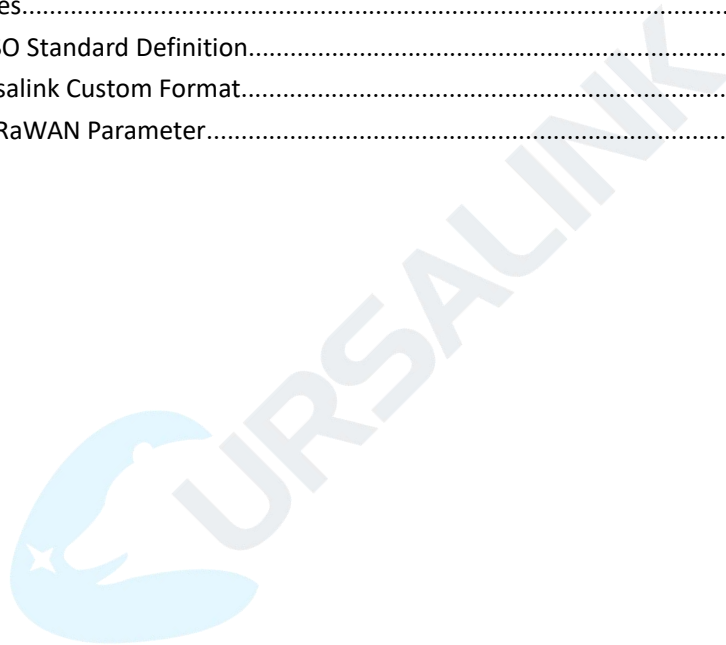


# EM500-UDL Payload Structure

## V1.0

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## 1. Uplink Payload Structure

An uplink message can be sent from EM500-UDL to gateway. Also, EM500-UDL sends different data in different frames, which requires all data must be prefixed with two bytes:

**Data Channel:** Uniquely identifies each sensor in the EM500-UDL across frames, e.g. "Ultrasonic Sensor".

**Data Type:** Identifies the data type in the frame, e.g. "Battery Level".

The device can send multiple data at one time by using following payload structure:

1 Byte	1 Byte	N Bytes	1 Byte	1 Byte	M Bytes	1 Byte	...
Channel1	Type1	Data1	Channel2	Type2	Data2	Channel 3	...

Channel ID	Description
1	Battery
2	Reserved
3	Ultrasonic Sensor

## Uplink Packet Example

Frame N: Regular uplink (Distance/Level)

03 82 1e 00		
Channel	Type	Value
03 (Ultrasonic Sensor)	82 (Distance)	1e 00 => 00 1e = 30 (30 mm = 0.03 m)

Frame N+1: Battery capacity changes uplink.

01 75 5a		
Channel	Type	Value
01 (Battery)	75 (Battery Level)	5a = 90 means 90%

Frame N+2:

Contents reported after reboot each time: Ursalink Custom Format Version + SN + Hardware Version + Software Version + Class Type

ff 0b ff ff 01 01					
Channel	Type	Value	Channel	Type	Value
ff=255	0b = 11 (Device Restart Notification)	ff (Reserved)	ff=255	01 = 1 (Custom Format Version)	01 = 1 (Version 1)

ff 16 61 26 a1 08 75 05 00 35		
Channel	Type	Value
ff=255	16 = 22 (Device SN)	61 26 a1 08 75 05 00 35

ff 09 01 00 ff 0a 01 01					
Channel	Type	Value	Channel	Type	Value
ff = 255	09 (Hardware Version)	0100 (V1.0)	ff = 255	0a (Software Version)	0101 (V1.1)

ff 0f 00		
Channel	Type	Value
ff = 255	0f (Class Type)	00 (Class A)

## 2. Downlink Payload Structure

A downlink message can be sent from gateway to sensor in order to execute some actions on that device.

**Note:** the application port of EM500-UDL is 85.

1 Byte	2 Bytes	1 Byte1	1 Byte	2 Bytes	1 Byte
Channel1	Data1	0xff (Reserved)	Channel2	Data2	0xff (Reserved)

### Downlink Packet Example

Frame N: Set the data reporting interval as 20 mins (1200s).

ff 03 b0 04		
Channel	Type	Value
ff = 255	03 (Set Reporting Interval )	b0 04 => 04 b0 = 1200 (second)

### 3. Data Types

#### 3.1 IPSO Standard Definition

Data Types conform to the IPSO Alliance Smart Objects Guidelines, which identifies each data type with an "Object ID" . However, as shown below, a conversion is made to fit the Object ID into a single byte.

DATA\_TYPE = IPSO\_OBJECT\_ID - 3200

Type	IPSO	Hex	Data Size	Data Resolution per Bit
Distance	3330	82	2	1 mm
Battery	3317	75	1%	1%

#### Example:

Frame N

01 75 5a		
Channel	Type	Value
01	75 means battery level	5a = 90 means 90%

Frame N+1

03 82 1e 00		
Channel	Type	Value
03	82 means distance	1e 00 => 00 1e = 30 means 30 cm

#### 3.2 Ursalink Custom Format

Type	Type ID	Data Size	Data Resolution (per bit)
Ursalink Custom Format Version	1	1	0x01
Data Collection Interval	2	2	1s
Data Reporting Interval	3	2	1s
LoRa Channel Mask	5	3	ID (1B) + Value (2B) ID: 1~6

Debug Level	7	1	Bit0: info Bit1: debug Bit2: warn Bit3: err
Hardware Version	9	2	0110 => 0x01 0x10
Software Version	10	2	0110 => 0x01 0x10
Device Restart Notification	11	1	0xff reserved
Device Power Off Notification	12	1	0xff reserved
Class Type	15	1	00: Class A
Device SN (8 Bytes)	22	8	6410908243750001 => 0x6410908243750001

### 3.3 LoRaWAN Parameter

<b>DevEUI</b>	24E124 + 2 <sup>nd</sup> to 11 <sup>th</sup> digits of SN e.g. SN = 61 26 a1 01 84 96 00 41 Then Device EUI = 24E124126a101849
<b>AppEUI</b>	24e124+c0002a0001
<b>Appport</b>	0x55
<b>NetID</b>	0x010203
<b>DevAddr</b>	The 5 <sup>th</sup> to 12 <sup>th</sup> digits of SN e.g. SN = 61 26 a1 01 84 96 00 41 Then DevAddr = a1018496
<b>AppKey</b>	5572404c696e6b4c6f52613230313823
<b>NwkSKey</b>	5572404c696e6b4c6f52613230313823
<b>AppSKey</b>	5572404c696e6b4c6f52613230313823

---End---