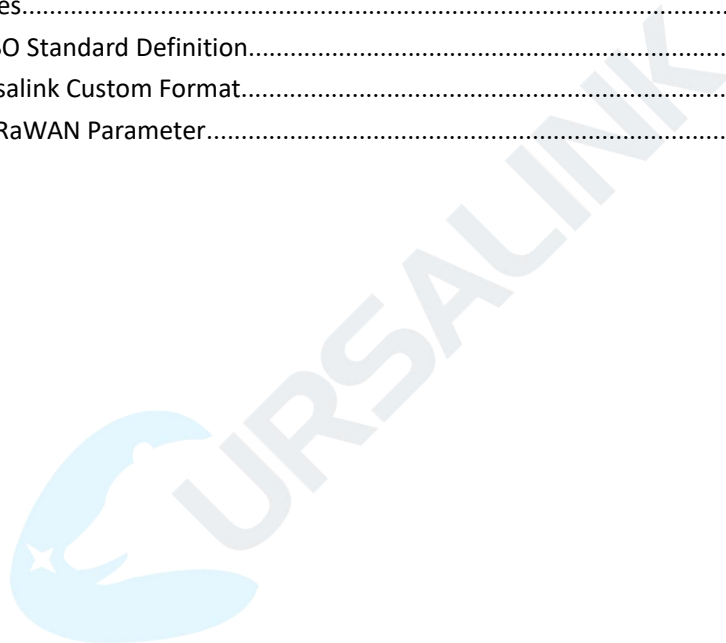


EM500-SWL Payload Structure

V1.0

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1. Uplink Payload Structure

An uplink message can be sent from EM500-SWL to gateway. Also, the EM500-SWL sends different sensor data in different frames. In order to do that, all data must be prefixed with two bytes:

Data Channel: Uniquely identifies each sensor in the EM500-SWL across frames, e.g. "Water Level 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	Water Level Sensor

Uplink Packet Example

Frame N: Regular uplink (Water Level)

03 77 02 00		
Channel	Type	Value
03 (Water Level Sensor)	77 (Water Level)	02 00 => 00 02 = 02 (2 cm)

Frame N+1: Battery level changes uplink.

01 75 64		
Channel	Type	Value
01 (Battery)	75 (Battery Level)	64 =100 means 100%

Frame N+2:

Content will be reported each time when device reboots: 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 perform some actions on that device.

Note: the application port of EM500-SWL is 85.

1 Byte	2 Bytes	1 Byte	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 20mins (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
Water Level Sensor	3319	77	2	1
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 77 6b 00		
Channel	Type	Value
03	77 means water level	6b 00 => 00 6b = 107 means 107 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

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

---End---