

# EnOcean light tower

2018.03.16  
TW TDC FAE  
Evelyn

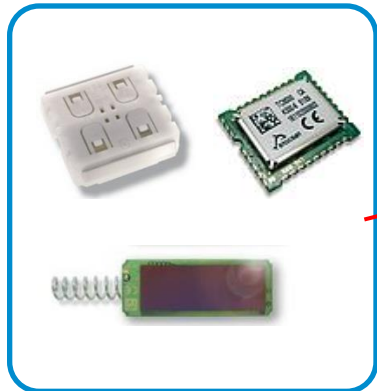
- Overview of EnOcean communication technology
- ERP (EnOcean Radio Protocol)
- ESP (EnOcean Serial Protocol)
- EnOcean light sensor
- Development tools

※ This pdf file explains brief concepts of EnOcean wireless module and serial between a transmitter and a receiver.

※ Please refer detail information in user manuals of each products.

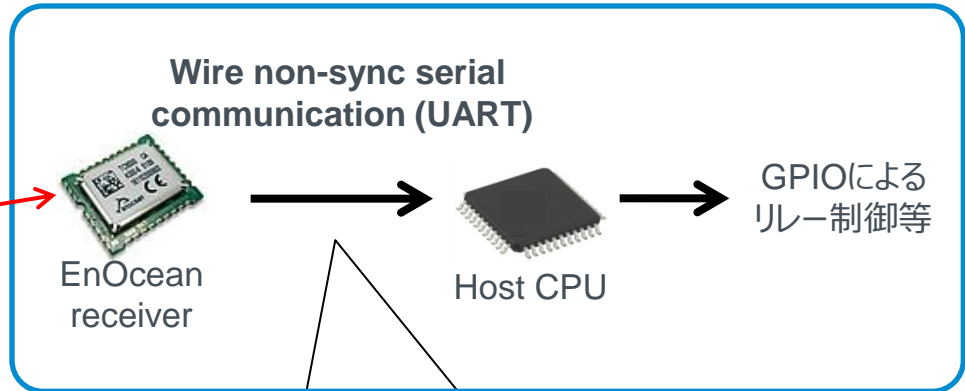
# EnOcean use case and protocol

Energy harvesting  
Sensor node (Batteryless)



Wireless communication

Receiver



## EnOcean Radio Protocol (ERP)

\* Standard: ERP2

Device contains the protocol which Uses ID and min. data to transmit data several times

## EnOcean Serial Protocol (ESP)

\* Standard: ESP3

Define TX RSSI, telegram and data contents

At host side, it is possible to use EnOcean FW developing in different applications.

# ERP(EnOcean Radio Protocol)

# What is ERP?

○ERP ( EnOcean Radio Protocol ) is one of EnOcean wireless protocol on sensor nodes as TX. It is ERP2 now. ERP2 defines PHY layer, data link layer, and network layer.

Layer	Data Unit	Description	Status
7. Application	Data		Not part of this specification
6. Presentation			Not part of this specification
5. Session			Not part of this specification
4. Transport	Segment		Not part of this specification
3. Network	Packet	Sub-Telegram Timing, Media Access CSMA-CA (LBT)	Defined
2. Data Link	Frame	Sub-Telegram structure, Hash Algorithms, Header Compression	Defined
1. Physical	Bit	Frequency, Modulation, Preamble, Sync, Coding, Length	Defined

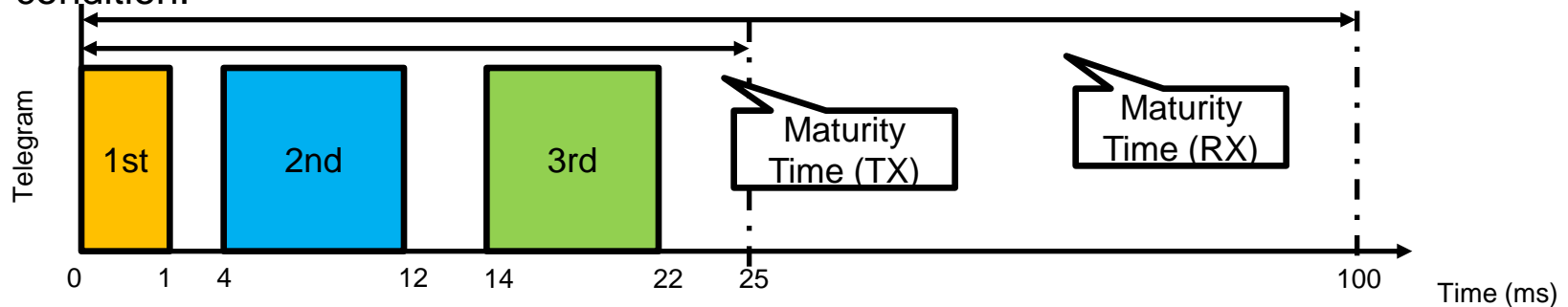
ERP content  
Frequency : 928 MHz  
Baud rate : 125kbps  
Modulation : FSK

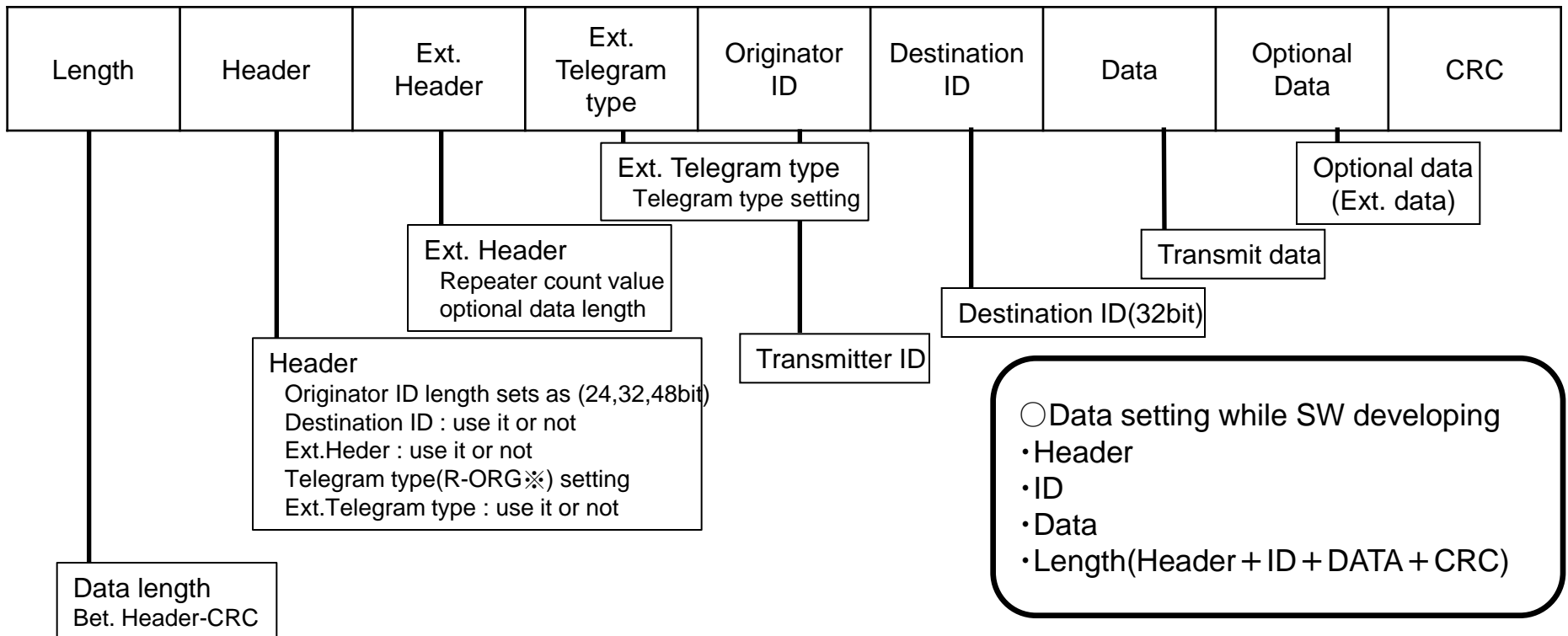
※ARIB STD T108 standard

- Sub-G telegram transmits at most 3 times to avoid interference between telegrams.
- TX and RX will be defined transmit duration in own maturity time.
  - TX : transmit data at 3 times (Max.) within **25ms**

sub Telegram	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>
allocation of time	0 or 1	4 - 12	14 - 22

- RX : When data transmits, it will receive data within 100ms. (this is one repeater condition.)





※Radio Organization number for EnOcean radio telegram types : EnOcean Telegram

# DolphinView example

Telegram Log

View: Radio Serial Autoscroll Autoselect Clear log Log directory Telegram count: 237 0 237

Direction	Port	Time	ID	RORG	Data	Status	dBm	Subtel	DestinationID	Se
→	COM3	19:32:25.772	04001162	4BS	00 00 78 08	00	-70	3	FFFFFFFF	
→	COM3	19:32:37.723	0028E83C	RPS	80	00	-45	2	FFFFFFFF	
→	COM3	19:32:39.471	0028E83C	RPS	00	00	-45	2	FFFFFFFF	
→	COM3	19:34:10.824	04001162	4BS	00 00 77 08	00	-68	3	FFFFFFFF	

<u>Radio Telegram</u>	byte[10]	A5 00 00 77 08 04 00 11 62 00
RORG	0xA5	4BS
Data	byte[4]	00 00 77 08
TxID	0x04001162	
Status	0b0000 0000	0x00
Repeater Level	0b.... ..00	Original telegram

<u>Radio Telegram</u>	byte[7]	F6 80 00 28 E8 3C 00
RORG	0xF6	RPS
Data	byte[1]	80
TxID	0x0028E83C	
Status	0b0000 0000	0x00
Repeater Level	0b.... ..00	Original telegram
Type	0b...0 ....	U1S/U2S
Generation	0b..0. ....	1 Generation
Checksum type	0b0... ....	Checksum



ERP2 Telegram : byte[9]

22 04 01 7D 89 00 00 4B 08

Source ID

Data

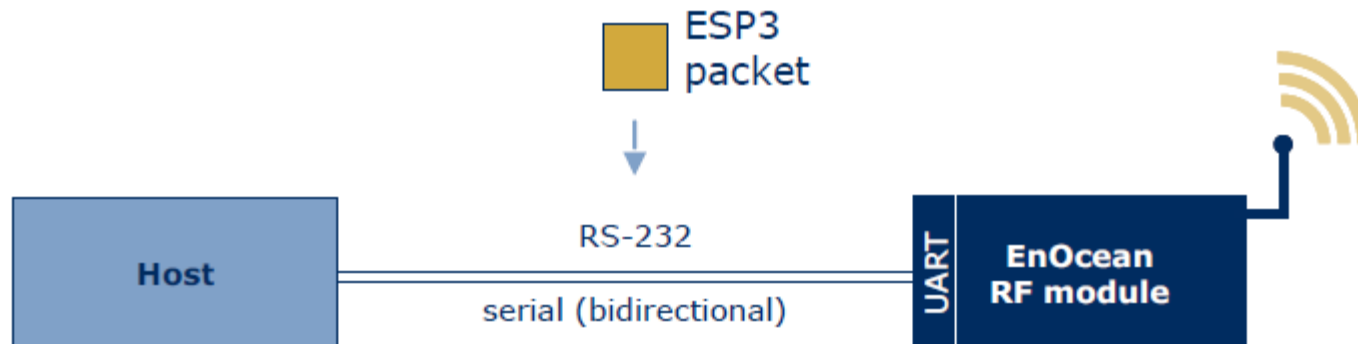
Header (0x22 : 0010 0010)

Address control(001)	:	0x01 Source ID 32-bit, Broadcast
Extended Header available(0)	:	0x00 No extended header
Telegram type(0010)	:	0x02 4BS telegram(0xA5)

# ESP(EnOcean Serial Protocol)

# What is ESP ?

- ESP (EnOcean Serial Protocol) is a one of EnOcean protocol between RX and host CPU, It is ESP3.0 now
- EnOcean module uses UART between TX and RX.



## < UART spec >

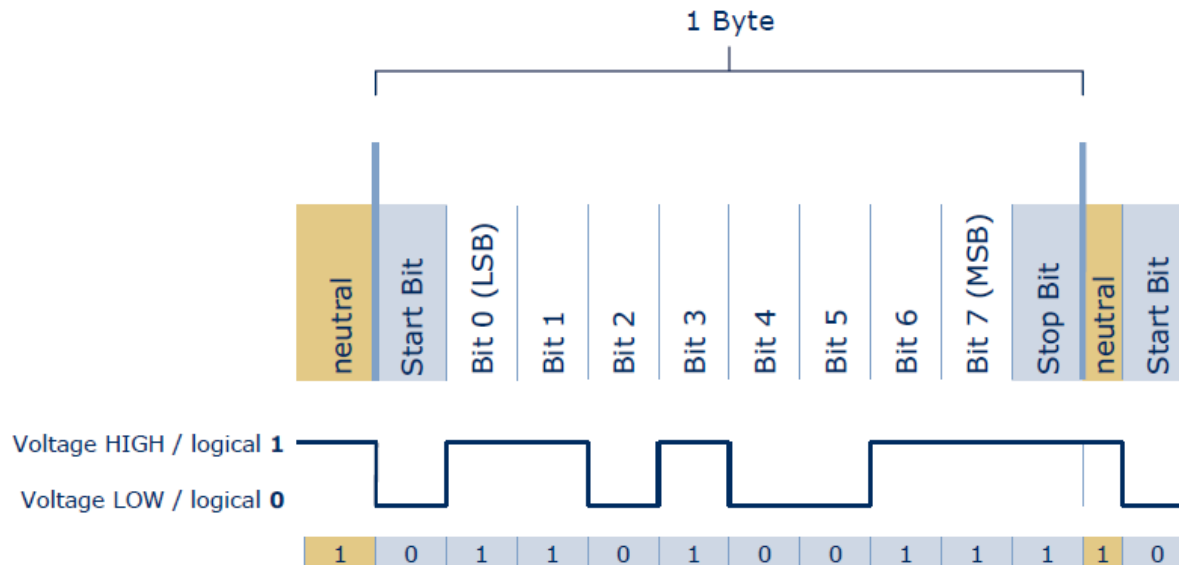
Bit rate : 57600bps

Data length : 8 bits

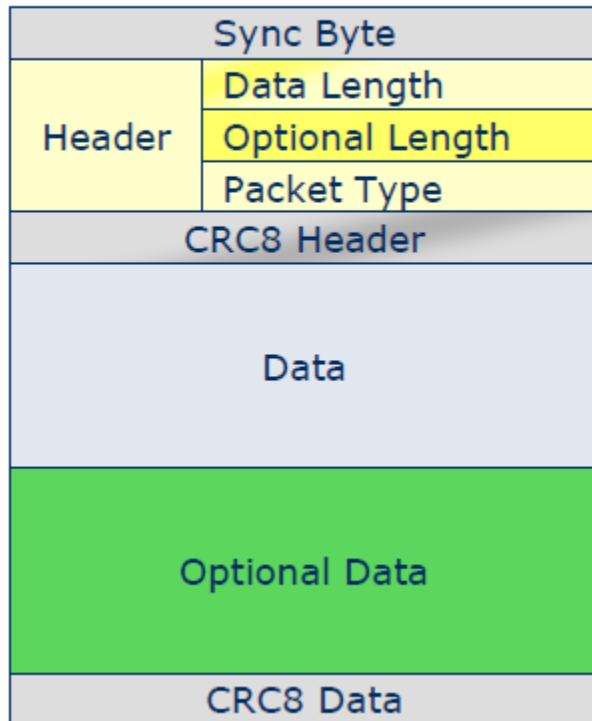
Parity bit : no

Start bit : 1 bit (logical 0)

Stop bit : 1 bit (logical 1)



## ESP3 Packet



Sync Byte : 1 byte(0x55)

Header : 4 byte

-Data Length : 2 byte

-Optional Length : 1 byte

-Packet Type : 1 byte

CRC8 Header : 1 byte

Data : 1~x byte(variable)

Optional Data : 0~y byte(variable)

CRC8 Data : 1 byte

Packet Type :

RADIO\_ERP1

RESPONSE

RADIO\_SUB\_TEL

EVENT

COMMOM\_COMMAND

·

·

Optional Data :

Sub Telegram Number

Destination ID

RSSI※

·

·

※Received Signal Strength Indication

# DolphinView example

Telegram Log

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→	COM3	19:34:10.824	04001162	4BS	00 00 77 08	00	-68	3	FFFFFFFF	

ESP3 Packet      byte[19]      55 00 0A 02 0A 9B 22 04 00 11 62 00 00 77 08 9D 03 46 EA

Type              0x0A              Advanced

Data              byte[10]          22 04 00 11 62 00 00 77 08 9D

OptionalData      byte[2]            03 46

ESP3 Packet      byte[16]          55 00 07 02 0A 0A 20 00 28 E8 3C 80 56 02 2D E9

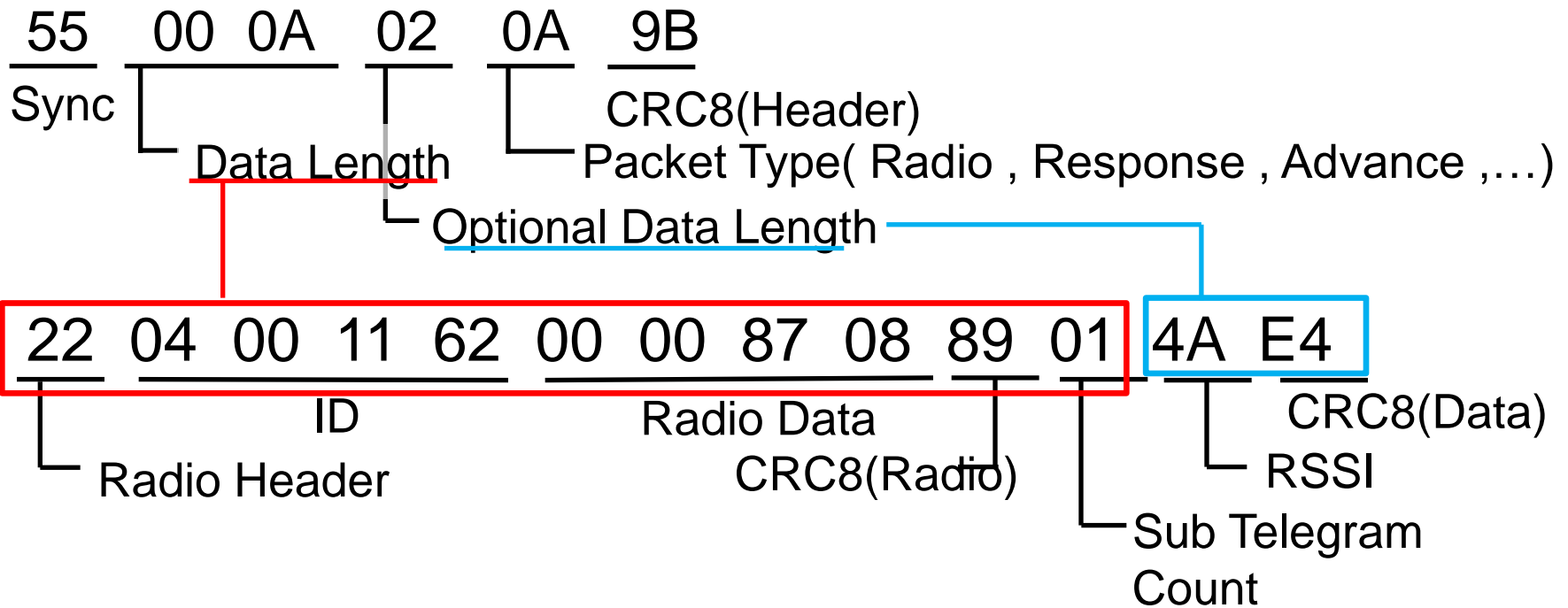
Type              0x0A              Advanced

Data              byte[7]            20 00 28 E8 3C 80 56

OptionalData      byte[2]            02 2D

# Receiver data explanation

ESP3 Packet : byte[19]



# EnOcean light sensor



# EnOcean light tower

## EnOcean light sensor



# ERP2 command



## Event summary

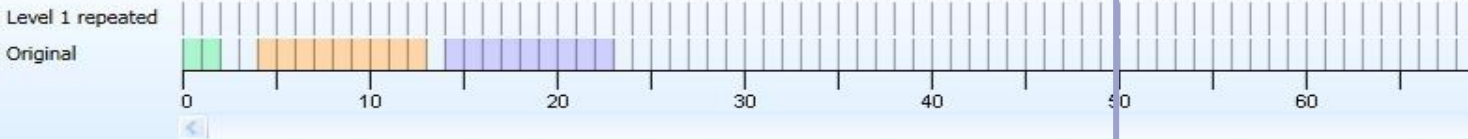
**Timestamp** 16:56:32.928 2018-03-13  
**Direction** Incoming  
**Gateway** COM133

## ERP2 Telegram

**byte[14]** 2F 07 04 01 69 43 01 00 32 2F 00 00 41 00  
**Header** byte[6] 2F 07 04 01 69 43  
**Address Control** 0x01 SourceID 32-bit, Broadcast  
**Extended Header availa** 0x00 No extended header  
**Telegramtype** 0x0F Extended Telegram Type available  
**Extended Teleram type** 0x07 Generic Profiles Complete data (0xB2)  
**Originator-ID** 0x04016943  
**Data** byte[8] 01 00 32 2F 00 00 41 00

## Subtelegram Timing [milliseconds]

Recommended timing slots for new products: ■ 1st subtelegram ■ 2nd subtelegram ■ 3rd subtelegram



## Telegram Log

View: Radio Serial Autoscroll Autoselect Clear log Log directory

Direction	Port	Date Time	ID	RORG	Data	OptionalData	Status	dBm
→	COM133	2018-03-13 16:56:27.1	0401691F	GP_CD	01 00 04 2F 10 00 00 00	00	00	-50
→	COM133	2018-03-13 16:56:32.1	04016943	GP_CD	01 00 32 2F 00 00 41 00	00	00	-52
→	COM133	2018-03-13 16:56:37.1	0401691F	GP_CD	01 00 05 2F 02 00 00 00	00	00	-50
→	COM133	2018-03-13 16:56:42.1	04016943	GP_CD	01 00 33 2F 00 00 10 00	00	00	-53
→	COM133	2018-03-13 16:56:47.1	0401691F	GP_CD	01 00 06 1F 22 00 00 00	00	00	-50

Byte	Header	Ext. Telegram type	Originator ID				FW Version	Packet type/ Action mode	Packet index	Tx Type/ Battery voltage	Lighting condition			
	2F	07	04	01	69	43	01	11	32	2F	00	00	41	00
bit	8	8	32				8	4/4	8	4/4	8	8	8	8

# Light tower message

	Lighting condition			
Byte	00	00	41	00
bit	8	8	8	8
	第一燈 Red	第二燈 Orange	第三燈 Green	第四燈 Blue

41 means 4/1: MSB(4bit)/LSB(4bit)

0x0	Lights off or no connection
0x1	Fast blink
0x2	Blinking medium speed
0x3	Slow flashing
0x4	Lighting up

MSB: Most Significant Bit  
LSB: Least Significant Bit



# ERP2 command detail explanation

	item	bit	contents
①	Header	8bit	0x2F Fixed
②	Ext.Telegramtype	8bit	0x07 Fixed
③	Originator ID	32bit	Unique value
④	FW Version	8bit	Firmware version
⑤	Packet type	4bit	0x0 A packet for determining blinking
⑥	Action mode ※	4bit	0x0 Normal mode 0x1 Eco mode
⑦	Packet index	8bit	After resetting, it is judged how many times transmission is done By pressing reset button, Count reset upon reaching 0xFF
⑧	Transmission type	4bit	0x1 Periodical transmission 0x2 Lighting condition change
⑨	Battery voltage(＊)	4bit	0x0 Under 2.0V (judge changing battery or not) 0x1 More than 2.0V ~ Under 2.5V 0x2 More Than 2.5V ~ Under 3.0V 0x3 More Than 3.0V ~ Under 3.7V 0x4 More Than 3.7V 0x5-0xE Reserved 0xF Unmeasured
⑩	Lighting 第一燈	8bit	0x0 Lights off or No connection
	Lighting 第二燈	8bit	0x1 Fast blink
	Lighting 第三燈	8bit	0x2 Blinking medium speed
	Lighting 第四燈	8bit	0x3 Slow flashing 0x4 Lighting up
⑪	CRC	8bit	MSB(4bit)/LSB(4bit) CRC8 hashtag

# Development tools



## ○ Dolphin V4 API

The API (Application Programming Interface) enables you to quickly develop your application software.

## ○ Dolphin V4 Suite

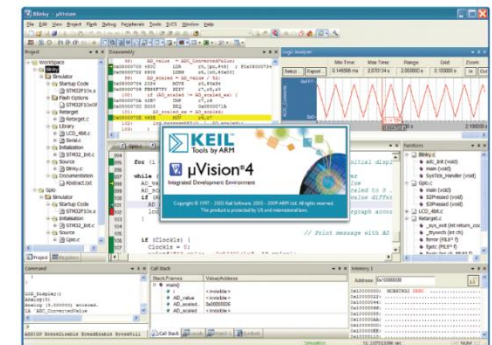
The EnOcean Dolphin V4 Suite software is a graphical user interface allowing easy configuration and programming

## ○ DolphinView

EnOcean DolphinView visualizes and interprets EnOcean radio telegrams. It receives messages via USB and shows telegram content and interprets EnOcean Equipment Profiles (EEP).

## ○ Keil's developing tool (μVision)

μVision can use Dolphin V4 Software to modify original firmware on coding, combine and writing while developing.



# How to get technical information ?

○Detail EnOcean information can be get on

URL: <http://www.enocean.com/jp/knowledge-base/>



Products Applications Technology Support About Us

The screenshot shows the EnOcean website's knowledge base with several technical documents highlighted by red boxes and callouts:

- ESP3** callout points to **EnOcean Serial Protocol ESP3 (PDF)**.
- ERP2** callout points to **EnOcean Radio Protocol 2 (PDF)**.
- Enhanced Security** callout points to **Security of EnOcean Radio Networks (PDF)**.
- Remote Management** callout points to **Remote Management (PDF)**.
- Smart Acknowledge** callout points to **Smart Acknowledge (PDF)**.
- EEP** callout points to **EnOcean Equipment Profiles EEP 2.6.4 (PDF)**.
- GP (Alliance Members Only)** callout points to **Generic Profiles 1.0 (accessible for EnOcean Alliance Members only)**, **Generic Profiles 1.0 Appendix (accessible for EnOcean Alliance Members only)**, and **Generic Profiles 1.0 Abstract (PDF)**.

# How to get development tools ?

- Dolphin V4 API · Dolphin V4 Suite · DolphinView Advanced
  - You can get free EnOcean SW by register on EnOcean website.

URL : <http://www.enocean.com/jp/download/>

- Keil's developing tool ( $\mu$ Vision)
  - Hardware: ARM based agent
  - Software: ARM based agent

( you can get free information while compile size limitation<2kB on website)

URL : <http://www.keil.com/c51/>

- References:

[https://www.enocean.com/fileadmin/redaktion/support/dolphinv4-api/enocean\\_serial\\_protocols.html](https://www.enocean.com/fileadmin/redaktion/support/dolphinv4-api/enocean_serial_protocols.html)



