Low Power Radio To Gateway Communications Specification

Contents

Packet Format

The RF24 packets have a header byte and then data. The data format will have the following in order:

Name	Size (bytes)	Type
Type	1	Unsigned Char
Sub-type	1	Unsigned Char
Data Size	2	Unsigned Short
Status	1	Unsigned Char
Number of Items	1	Unsigned Char
Data Items List	Subjective	Subjective

Status Codes

Status codes will be a subset of the status codes detailed in OEMan Communications Specifications document.

Data Items

A data item consists of a type byte and an identifier. All items will be transferred in little endian. These are identified as the following:

Name	ID (1 byte)	Data	
String	1	Data Length (1 byte, Unsigned Char)	String Data
Char	2	1 byte	
Unsigned Char	3	1 byte	
Short	4	2 bytes	
Unsigned Short / Word	5	2 bytes	
Integer	6	4 bytes	
Unsigned Integer	7	4 bytes	
Long	8	8 bytes	

Unsigned Long	9	8 bytes
Long Long	10	16 bytes
Unsigned Long Long	11	16 bytes
Float	12	4 bytes
Time	13	7 bytes

Time Data Type

Each column represents a single byte.

Year	Month	Date	Hour Of Day	Minute	Second	Day of Week
The current year minus 2000.	1-12 (Jan = 1, Dec = 12)	1 - 31	0 - 23	0 - 59	0 - 59	1 - 7 (Sun = 1)

Requests

The following section covers Diffie-Hellman key exchange as well as request types specified in the OEMan Communications Specification. Requests are all given in packet order.

Time Synchronisation

Due to the clocks going out of synchronisation by about 15 seconds over 5 days sometimes the time may need to be synchronized. Each registered node should be sent the current time at least once per week.

Example Packet

Header ID: ‘T’/0x54

Data Size (17 bytes)	Status	Items	Data
0x1400	0x00	0x01	<table><tr><td>Type</td><td>Public Integer</td></tr><tr><td>0x0D</td><td>0x0f040e10231103 2015 - April - 14 - 16:35:17 - Tuesday</td></tr></table>

Key Exchange

Key exchange will have a header ID ‘X’/0x58 and the status should be success. It is currently planned for nodes and the gateway to use Diffie-Hellman in order to establish the key to use in all encryption between a certain node and the gateway. This request should be from the node to the gateway, but it would also be possible to implement the same functionality from the gateway to the node. This may be useful if the gateway wishes for the node to re-establish its public key.

All other requests and responses should be encrypted/decrypted with the appropriate combined public/private integer pair via AES-128. The combination will be calculated with the following values:

Keys

Modulus (prime number):
‘CATMajorProjectG’ / 0x4341544D616A6F7250726F6A65637447

Generator (primitive root of modulus):
6 / 0x06

Exponent (private key):
Any number that is randomly generated and is persistent (at least until the next key exchange).

Request

For requesting the recipient’s public integer, the originator will send its own public key. The recipient should associate the received public key with the originator for future encryption and decryption.

Response

The recipient will send its own public integer. The originator will then associate the received public key with the recipient for future encryption and decryption.

Example Request

Header ID: ‘X’/0x58

Data Size (17 bytes)	Status	Items	Data
0x1400	0x00	0x01	<table><tr><td>Type</td><td>Public Integer</td></tr><tr><td>0x0B</td><td>0x1023456789ABCDEF0123456789ABCDEF</td></tr></table>

Example Response

Success

Header ID: ‘x’/0x78

Data Size (20 bytes)	Status	Items	Data
0x1400	0x00	0x01	<table><tr><td>Type</td><td>Public Integer</td></tr><tr><td>0x0B</td><td>0xFEDCBA9876543210FEDCBA9876543210</td></tr></table>

Failure

Header ID: ‘x’/0x78. Some error such as general failure 0x01

Data Size	Status	Items	Data
0x00	0x01	0x00	Null

Register Node

Register node will have the header ID ‘R’/0x52 and the status should be Success. The node will continue to request a Node ID until one is successfully returned. This request is from the Node to the Gateway.

Request

For requesting a Node ID no data items will be specified.

Response

The server will respond with either 1 or 0 data items, if the status is Success then the Node ID data item is expected. The header ID should be ‘r’/0x72.

Example Request

Header ID: ‘R’/0x52

Data Size (2 bytes)	Status (1 byte)	Items (1 byte)	Data
0x0000	0x00	0x00	Null

Example Response

Success

Header ID: ‘r’/0x72. Assumed assigned Node ID 10.

Data Size (2 bytes)	Status	Items	Data
0x0300	0x00	0x01	<table><tr><td>Type</td><td>ID</td></tr><tr><td>0x05</td><td>0x0A00</td></tr></table>

Failure

Header ID: ‘r’/0x72. Some error such as general failure 0x01

Data Size	Status	Items	Data
0x00	0x01	0x00	Null

Register Attribute

Register attribute will have the header ID ‘A’/0x41 and the status should be Success. The node will continue to request a attempt a registration until a successful acknowledge is received.

Request

The data items for registering an attribute to the Gateway are as follows:

Order	Name	Type
0	Node ID	Unsigned Short

1	Group ID	Unsigned Short
2	Attribute ID	Unsigned Short
3	Attribute Number	Unsigned Short
4	Attribute Default Value	Variable

Response

The response will contain the same data items as the request and if it is successfully registered then the response should have the status code Success, otherwise the Node will continue to request registration. The header ID should be ‘a’/0x61.

Post Attribute Value

The header ID for posting is ‘P’/0x50.

Request

Requests are sent with the status code set as Success. The following data items are included:

Order	Name	Type
0	Node ID	Unsigned Short
1	Group ID	Unsigned Short
2	Attribute ID	Unsigned Short
3	Attribute Number	Unsigned Short
4	Attribute Value	Variable

Response

Due to the low power nature of the system retries might not be a good idea here. However if there were a response it would contain at least items 0-3 of the request and should have the status code set as Success. The header ID would be ‘p’/0x70.

Request Value From Node

For smart nodes requests may be made to the node for an attribute value.

Request

The format of the request from the Gateway should be as follows with the header ID ‘P’/0x50:

Order	Name	Type
0	Node ID	Unsigned Short
1	Group ID	Unsigned Short
2	Attribute ID	Unsigned Short
3	Attribute Number	Unsigned Short

Response

The response from the node will have the header ID ‘p’/0x70 and the status code will be Success if it has succeeded. If it has succeeded the data items will contain the attribute value as the final element, otherwise it will not. The layout is as follows:

Order	Name	Type
0	Node ID	Unsigned Short
1	Group ID	Unsigned Short
2	Attribute ID	Unsigned Short
3	Attribute Number	Unsigned Short
4	Attribute Value	Variable