

Wi-SUN module for B-Route, Enhanced HAN

BP35C0-J11 B-Route Communication

Version 1.0.1

Overview

This document describes procedures and command usage examples when performing B-Route communication using the Wi-SUN module BP35C0-J11.

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1. Futures

The features of this module are described below:

- One-hop relay communication via relay, allows for extended wireless communication range
- Sleeping-device (Low power consumption) mode enables battery-powered operation
- Dual-mode with simultaneous operation of B-route (handset) and enhanced-HAN (base unit)
- Compatible with firmware OTA update function
- Robust security PANA authentication, AES encryption
- Utilizes a 920MHz band radio frequency that is well-known for its diffraction characteristics
- Able to control the protocol stack function in a binary command communication via UART

- Network configuration

Item	Contents
B-route terminal maximum number of connections	1 set
HAN maximum number of devices connected	17 sets (if incl. B-route, will be 16-sets)
Maximum number of relays	1 Hop

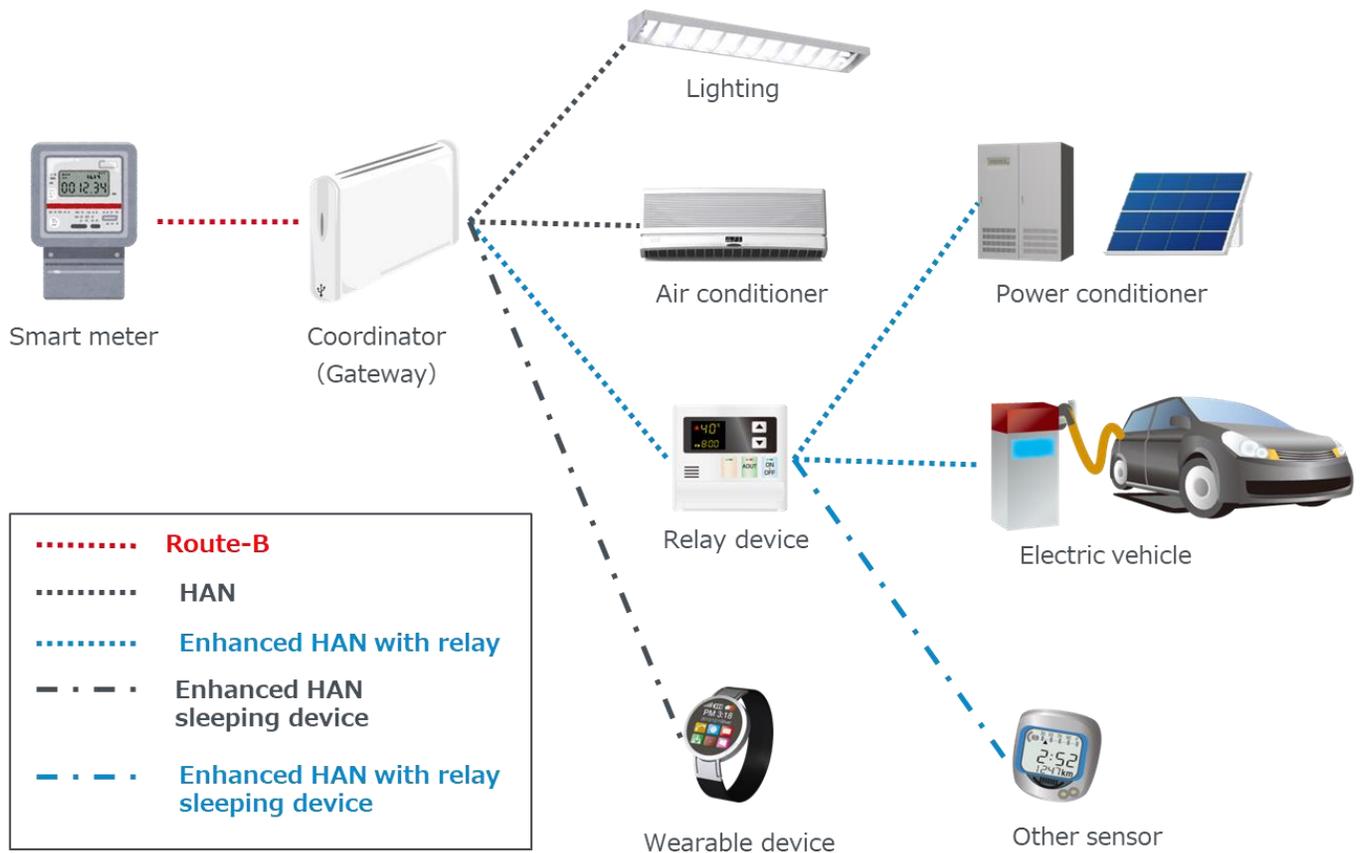


Figure 1. Network Configuration Example

2. Application Configuration:

Describes the application configuration for communication with the Smart meter described in this Application note.

To connect this module with the smart meter, the user must implement the module control application and the ECHONET-Lite application (HEMS Controller).

Lower layer connections are performed by the module control application, and the connection with the smart meter is done by using the ECHONET-Lite application.

Detailed specification of the ECHONET-Lite Application section is available from the ECHONET Consortium.

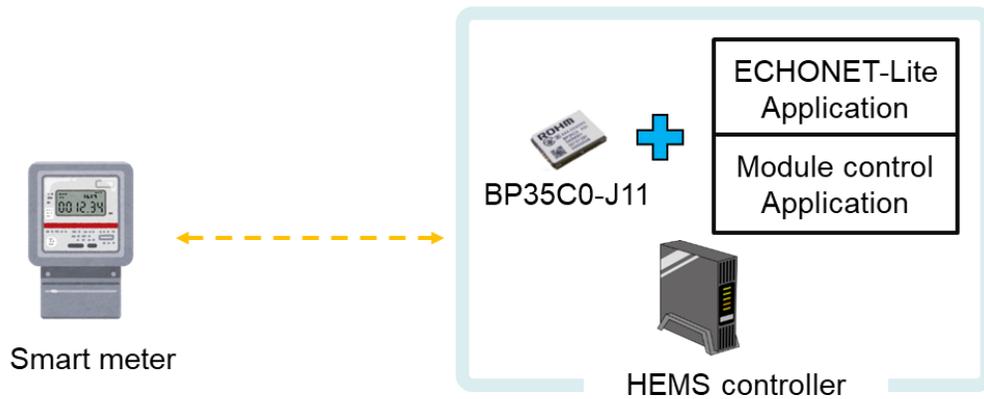


Figure 2. Application Configuration

Please refer 'bp35c0-j11 Start up manual' when developing and confirming the application.

3. Pre-preparation

In order to establish a connection with the Electricity Smart Meter, you will need a B-route Authentication ID and password. Please apply for a B-route connection to the electricity company or other meter installer or HEMS service provider in advance and obtain a B-route authentication ID and password. Please contact your power company or HEMS service provider for details on how to apply. (see Figure 3 and Figure 4.) From: article HEMS-smart meter B-route (low voltage power meter) Operational guidelines.

https://www.meti.go.jp/committee/kenkyukai/shoujo/smart_house/pdf/009_s03_00.pdf

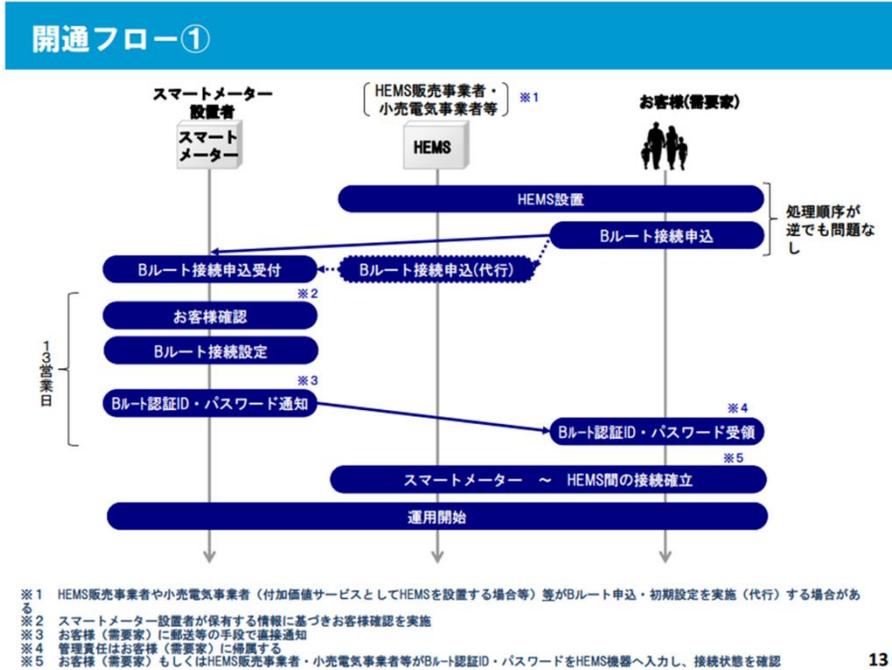


Figure 3. Basic operating flow of smart meter B-route: at opening

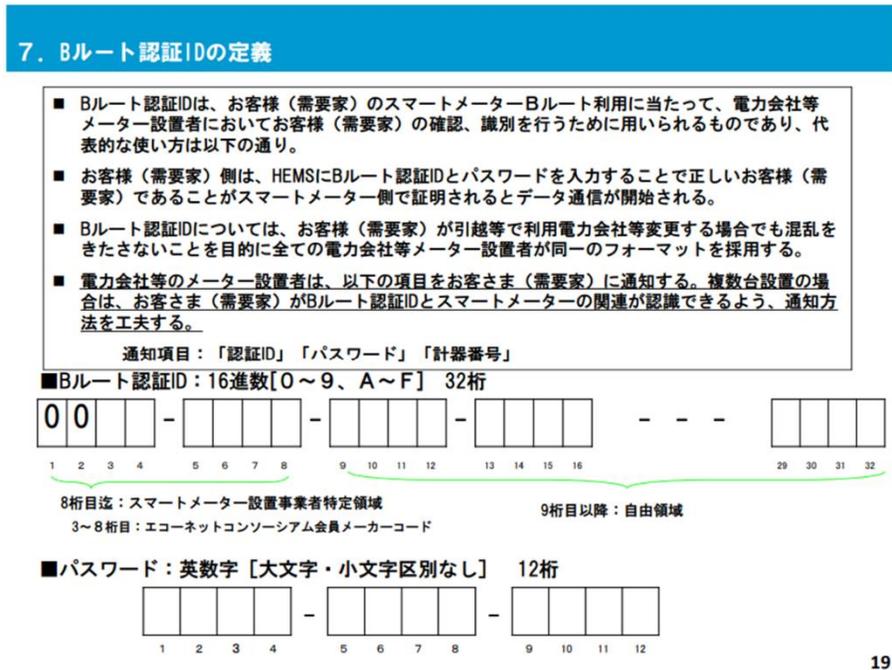


Figure 4. B-route authentication ID and password contents allocated by power company, etc.,

4. Sequence

This chapter explains the command sequence from controlling UART IF of BP35C0-J11 to communicating with a power smart meter.

The connection is made using the B-route authentication ID and password distributed by the power company.

The module performs an active scan with the last 8 characters of the B-route authentication ID specified in the Pairing ID to find the channel on which the connected power smart meter is operating. Set the channel of the power smart meter that responds to the active scan to the module and make a connection to the power smart meter.

Once the connection is complete, save the channel on the smart meter. After the connection is made, the power data is sent and received.

* By maintaining and setting the channel of the power smart meter in the host application after pairing, it is possible to connect without active scanning the next time you connect.

* If the module is operated with Dual mode, it can be connected to the smart meter as a B-route end device.

The overall flow is briefly as follows.

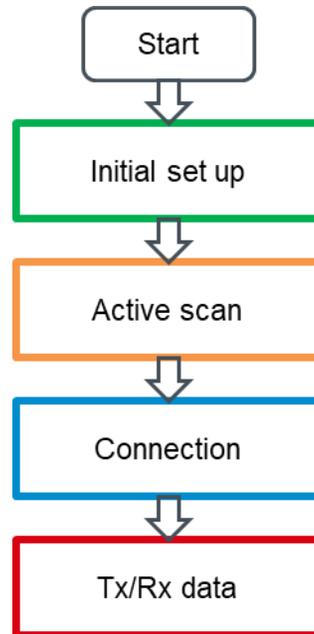


Figure 5. Flow of the entire application

The details of sequence are listed on the next page.

Pairing sequence

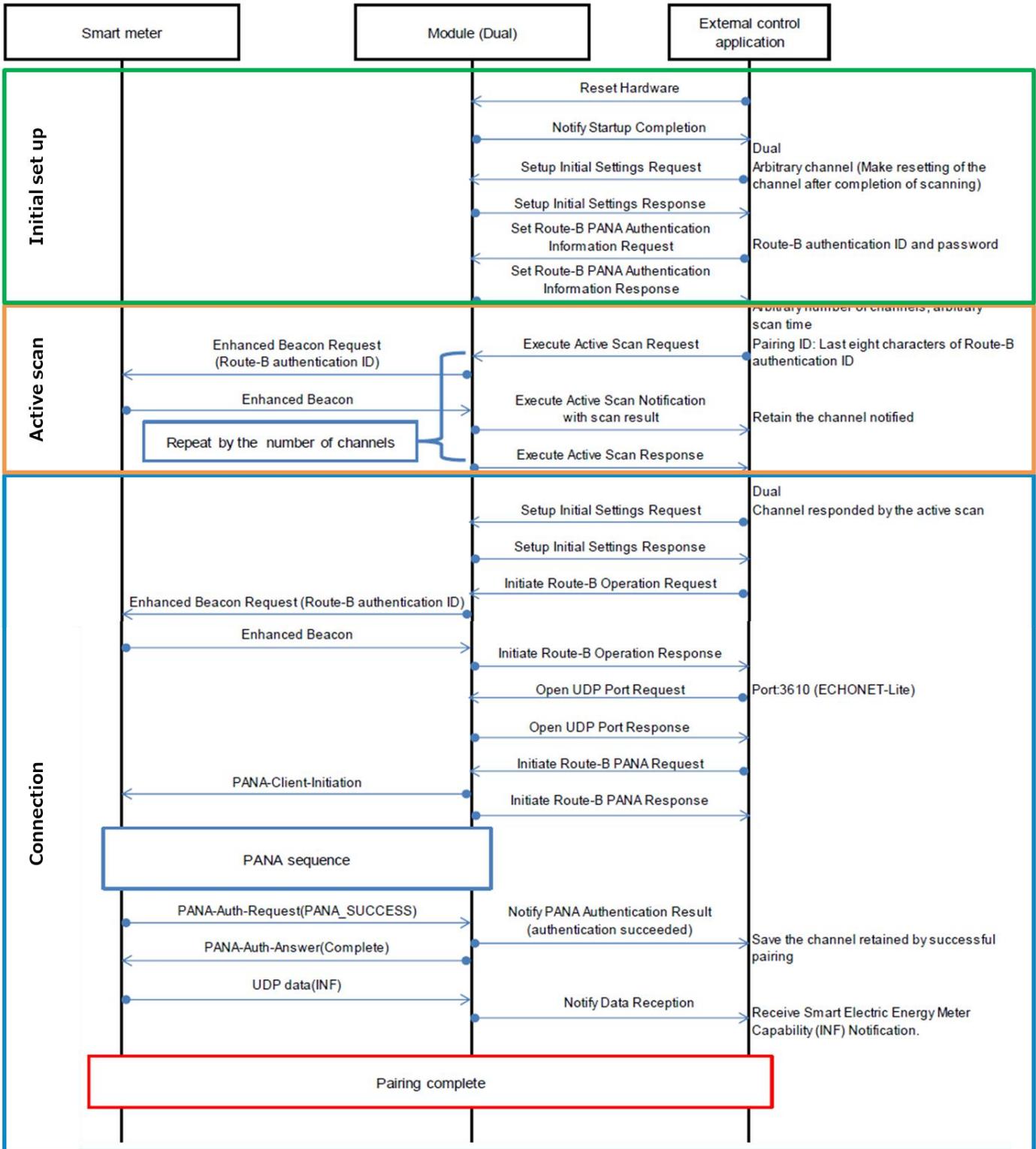


Figure 6. B-route pairing sequence

Data transmission sequence

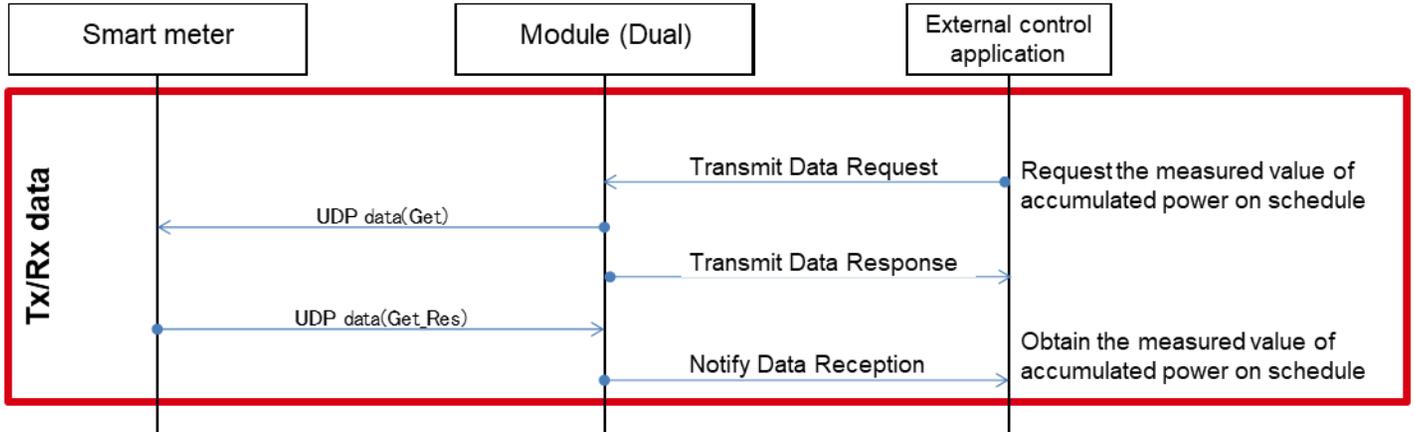


Figure 7. B-route data Send/Receive sequence

5. Command

Use the sequence command log to explain the sequence of connections to the Power smart meter and the commands used in the data transmission sequence. For more detailed command specifications, see the J11 UART-IF command specification.

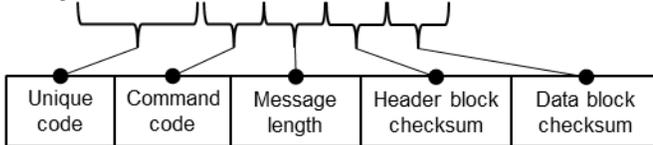
5.1 Initial setting

Highlighted Color in the table: **command code**, command data block, **ECHONET Lite**

No.	Command name	UART command sample
F1	Reset Hardware Request	D0 EA 83 FC 00 D9 00 04 04 16 00 00
F2	Notify Startup Completion	D0 F9 EE 5D 60 19 00 04 03 91 00 00
F3	Set Initial Settings Request	D0 EA 83 FC 00 5F 00 08 03 A0 00 09 05 00 04 00
F4	Set Initial Settings Response	D0 F9 EE 5D 20 5F 00 05 03 98 00 01 01
F5	Set Route-B PANA Authentication Information Request	D0 EA 83 FC 00 54 00 30 03 BD 09 D4 30 30 31 31 32 32 33 33 34 34 35 35 36 36 37 37 38 38 39 39 41 41 42 42 43 43 44 44 45 45 46 46 30 31 32 33 34 35 36 37 38 39 41 42
F6	Set Route-B PANA Authentication Information Response	D0 F9 EE 5D 20 54 00 05 03 8D 00 01 01

F1: Reset Hardware Request [command: 0x00D9]

[F1 UARTCommand] D0 EA 83 FC **00 D9** 00 04 04 16 00 00

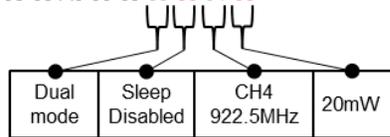


F2: Notify Startup Completion [command: 0x6019]

[F2 UARTCommand] D0 F9 EE 5D **60 19** 00 04 03 91 00 00

F3: Set Initial Settings Request [command: 0x005F, Operation mode: 0x05, HAN sleep function setting: 0x00, channel: 0x04, Transmission power: 0x00]

[F3 UARTCommand] D0 EA 83 FC **00 5F** 00 08 03 A0 00 09 **05 00 04 00**



F4: Set Initial Settings Response [command: 0x205F, Response result: 0x01]

[F4 UARTCommand] D0 F9 EE 5D **20 5F** 00 05 03 98 00 01 01

F5: Set Route-B PANA Authentication Information Request

[command: 0x0054,

Route-B Authentication ID: 0x303031313232333333343435353636373738383939414142424343444445454646,

Password: 0x303132333435363738394142]

* Route-B Authentication ID: Convert "00112233445566778899AABBCCDDEEFF" to hexadecimal as an ASCII code

* Password: Convert "0123456789AB" to hexadecimal as an ASCII code

[F5 UARTCommand] D0 EA 83 FC **00 54** 00 30 03 BD 09 D4 30 30 31 31 32 32 33 33 34 34 35 35 36 36 37 37 38 38 39 39 41 41 42 42 43 43 44 44 45 45 46 46 **30 31 32 33 34 35 36 37 38 39 41 42**

F6: Set Route-B PANA Authentication Information Response [command: 0x2054, Response result: 0x01]

[F6 UARTCommand] D0 F9 EE 5D **20 54** 00 05 03 8D 00 01 01

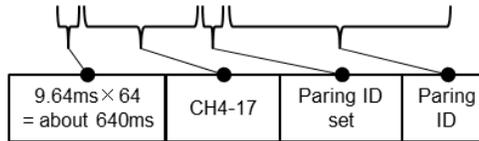
5.2 Active scan

Highlighted Color in the table: **command code**, command data block, **ECHONET Lite**

No.	Command name	UART command sample
F7	Execute Active Scan Request	D0 EA 83 FC 00 51 00 12 03 9C 04 1D 06 00 03 FF F0 01 43 43 44 44 45 45 46 46
F8	Execute Active Scan Result Notification (no response)	D0 F9 EE 5D 40 51 00 06 03 AB 00 05 01 04
	Execute Active Scan Result Notification (with response)	D0 F9 EE 5D 40 51 00 12 03 B7 06 BA 00 0C 01 00 50 C2 FF FE DC 28 22 BC DE DE
F9	Execute Active Scan Response	D0 F9 EE 5D 20 51 00 05 03 8A 00 01 01

F7: Execute Active Scan Request [command: 0x0051, Scan time: 0x06, Scan channel: 0x0003FFF0, ID setting: 0x01, Pairing ID: 0x4343444445454646]

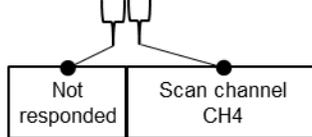
* Pairing ID: Convert the last 8 characters of Route-B authentication ID "00112233445566778899AABBCCDDEEFF" to hexadecimal as ASCII code [F7 UARTCommand] D0 EA 83 FC **00 51** 00 12 03 9C 04 1D **06 00 03 FF F0 01 43 43 44 44 45 45 46 46**



F8: Execute Active Scan Result Notification (no response) [command: 0x4051, Scan result: 0x01, Channel: 0x04]

* Receive as many channels as you require (smart meter responds with ch12.)

[F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 05 01 04

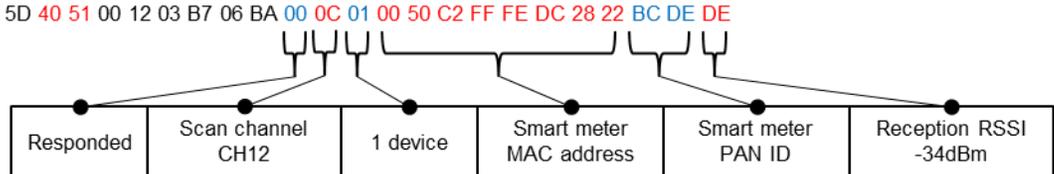


F8: Execute Active Scan Result Notification (with response) [command: 0x4051, Scan result: 0x00 or 01, Channel: 0x04-11,

Number of scans: 0x01, MAC address: 0x0050C2FFFEDC2822, PAN ID: 0xBCDE, RSSI: 0xDE]

* Receive as many channels as you require (smart meter responds with ch12.)

[F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 06 01 05
 [F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 07 01 06
 [F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 08 01 07
 [F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 09 01 08
 [F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 0A 01 09
 [F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 0B 01 0A
 [F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 0C 01 0B
 [F8 UARTCommand] D0 F9 EE 5D **40 51** 00 12 03 B7 06 BA **00 0C 01 00 50 C2 FF FE DC 28 22 BC DE DE**



[F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 0E 01 0D
 [F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 0F 01 0E
 [F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 10 01 0F
 [F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 11 01 10
 [F8 UARTCommand] D0 F9 EE 5D **40 51** 00 06 03 AB 00 12 01 11

F9: Execute Active Scan Response [command: 0x2051, Response result: 0x01]

[F9 UARTCommand] D0 F9 EE 5D **20 51** 00 05 03 8A 00 01 01

5.3 B-route Connection

Highlighted Color in the table: **command code**, command data block, **ECHONET Lite**

No.	Command name	UART command sample
F10	Set Initial Settings Request (using scan results)	D0 EA 83 FC 00 5F 00 08 03 A0 00 11 05 00 0C 00
F11	Set Initial Settings Response	D0 F9 EE 5D 20 5F 00 05 03 98 00 01 01
F12	Initiate Route-B operation Request	D0 EA 83 FC 00 53 00 04 03 90 00 00
F13	Initiate Route-B operation Response	D0 F9 EE 5D 20 53 00 11 03 98 06 BA 01 0C BC DE 00 50 C2 FF FE DC 28 22 DE
F14	Open UDP Port Request	D0 EA 83 FC 00 05 00 06 03 44 00 28 0E 1A
F15	Open UDP Port Response	D0 F9 EE 5D 20 05 00 05 03 3E 00 01 01
F16	Initiate Route-B PANA Request	D0 EA 83 FC 00 56 00 04 03 93 00 00
F17	Initiate Route-B PANA Response	D0 F9 EE 5D 20 56 00 05 03 8F 00 01 01
F18	Notify PANA Authentication Result	D0 F9 EE 5D 60 18 00 0D 03 A9 04 36 01 00 50 C2 FF FE DC 28 22
F19	Notify Data Reception (INF)	D0 F9 EE 5D 60 18 00 38 03 C4 0E 1C FE 80 00 00 00 00 00 02 50 C2 FF FE DC 28 22 0E 1A 0E 1A BC DE 00 02 DE 00 19 10 81 00 01 02 88 01 05 FF 01 73 01 EA 0B 07 DF 08 1F 15 1E 00 00 00 0D AC

F10: Set Initial Settings Request [command: 0x005F, Operation mode: 0x05, HAN sleep function setting: 0x00, channel: 0x0C, Transmission power: 0x00]

* Change to CH12 that received a response from smart meter

[F10 UARTCommand] D0 EA 83 FC **00 5F** 00 08 03 A0 00 11 05 00 0C 00

F11: Set Initial Settings Response [command: 0x205F, Response result: 0x01]

[F11 UARTCommand] D0 F9 EE 5D **20 5F** 00 05 03 98 00 01 01

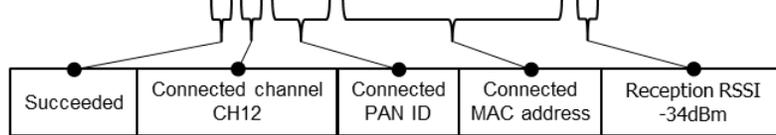
F12: Initiate Route-B operation Request [command: 0x0053]

[F12 UARTCommand] D0 EA 83 FC **00 53** 00 04 03 90 00 00

F13: Initiate Route-B operation Response [command: 0x2053, Response result: 0x01, Channel: 0x0C, PAN ID: 0xBCDE, MAC address: 0x0050C2FFFE DC2822, RSSI: 0xDE]

* Connect to the smart meter address with CH12

[F13 UARTCommand] D0 F9 EE 5D **20 53** 00 11 03 98 06 BA 01 0C BC DE 00 50 C2 FF FE DC 28 22 DE



F14: Open UDP Port Request [command: 0x0005, UDP port number: 0x0E1A]

* ECHONET-Lite UDP port 3610 = 0x0e1a

[F14 UARTCommand] D0 EA 83 FC **00 05** 00 06 03 44 00 28 0E 1A

F15: Open UDP Port Response [command: 0x2005, Response result: 0x01]

[F15 UARTCommand] D0 F9 EE 5D **20 05** 00 05 03 3E 00 01 01

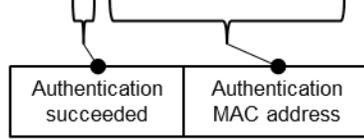
F16: Initiate Route-B PANA Request [command: 0x0056]

[F16 UARTCommand] D0 EA 83 FC **00 56** 00 04 03 93 00 00

F17: Initiate Route-B PANA Response [command: 0x2056, Response result: 0x01]

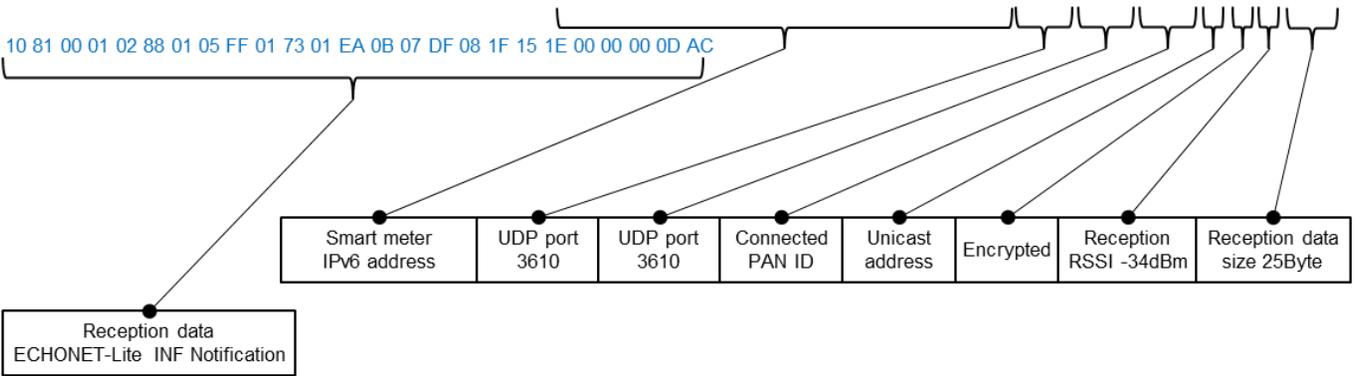
[F17 UARTCommand] D0 F9 EE 5D **20 56** 00 05 03 8F 00 01 01

F18: Notify PANA Authentication Result [command: 0x6028, PANA result: 0x01, MAC address: 0x0050C2FFEDC2822]
 [F18 UARTCommand] D0 F9 EE 5D 60 28 00 0D 03 A9 04 36 01 00 50 C2 FF FE DC 28 22



* At F18, the connection to smart meter is complete. ECHONET-Lite communication with smart meter continues after this.

F19: Notify Data Reception [command: 0x6018, Source IPv6 address: 0xFE80000000000000250C2FFEDC2822, Source port number: 0x0E1A, Destination port number: 0x0E1A, Source PAN ID: 0xBCDE, Destination address type: 0x00, Encryption: 0x02, RSSI: 0xDE, Reception data size: 0x0019, Reception data: 0x1081000102880105FF017301EA0B07DF081F151E000000DAC]
 [F19 UARTCommand] D0 F9 EE 5D 60 18 00 38 03 C4 0E 1C FE 80 00 00 00 00 00 02 50 C2 FF FE DC 28 22 0E 1A 0E 1A BC DE 00 02 DE 00 19

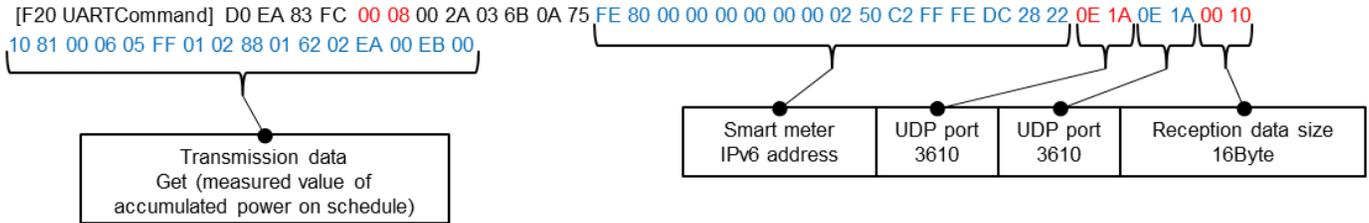


5.4 Data transmission

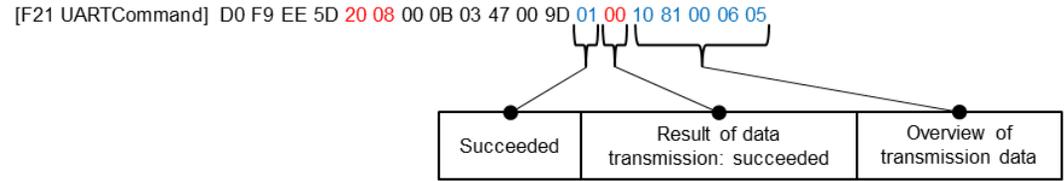
Highlighted Color in the table: **command code**, command data block, **ECHONET Lite**

No.	Command name	UART command sample
F20	Transmit Data Request (Get)	D0 EA 83 FC 00 08 00 2A 03 6B 0A 75 FE 80 00 00 00 00 00 02 50 C2 FF FE DC 28 22 0E 1A 0E 1A 00 10 10 81 00 06 05 FF 01 02 88 01 62 02 EA 00 EB 00
F21	Transmit Data Response	D0 F9 EE 5D 20 08 00 0B 03 47 00 9D 01 00 10 81 00 06 05
F22	Notify Data Reception (Get_Res)	D0 F9 EE 5D 60 18 00 45 03 D1 10 8D FE 80 00 00 00 00 00 02 50 C2 FF FE DC 28 22 0E 1A 0E 1A 22 A9 00 02 CB 00 26 10 81 00 06 02 88 01 05 FF 01 72 02 EA 0B 07 E2 0A 02 0E 1E 00 00 03 73 AF EB 0B 07 E2 0A 02 0E 1E 00 00 01 6A 72

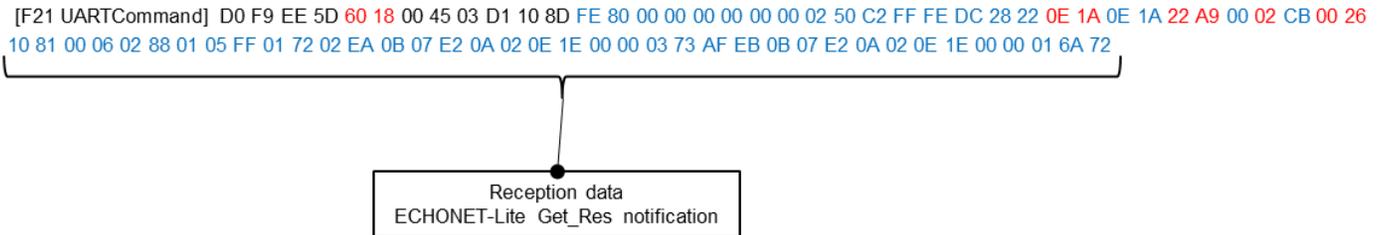
F20: Transmit Data Request [command: 0x0008, Destination IPv6 address: 0xFE80000000000000250C2FFEDC2822, Source port number: 0x0E1A, Destination port number: 0x0E1A, Transmission data size: 0x0010, Transmission data: 1081000605FF010288016202EA00EB00]



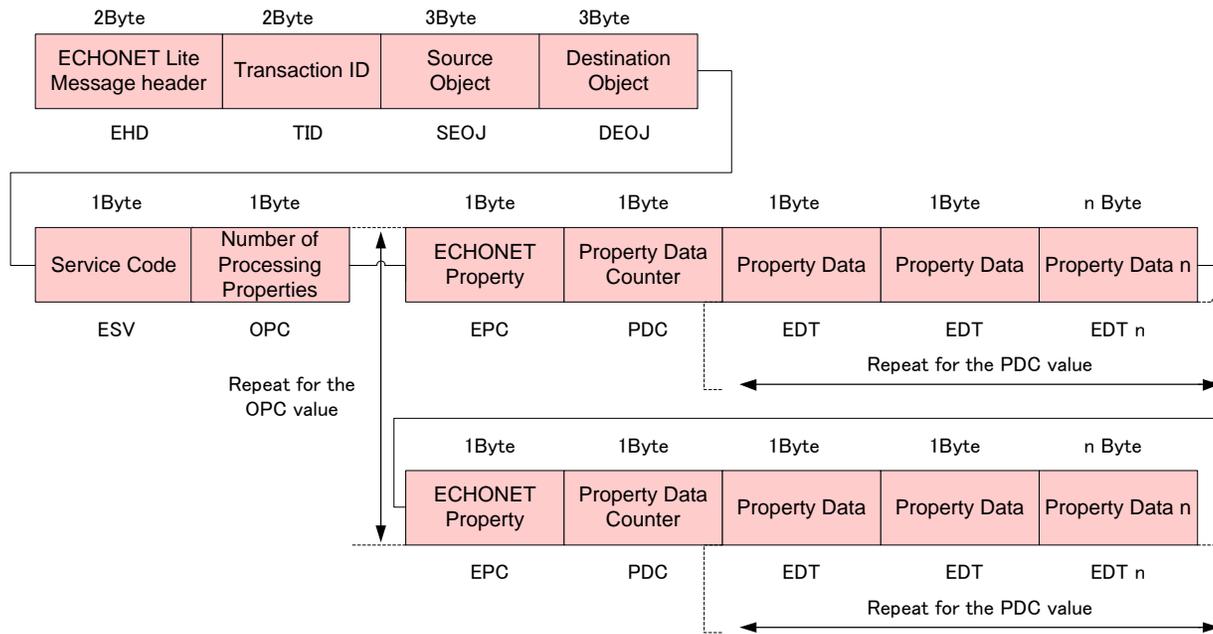
F21: Transmit Data Response [command: 0x2008, Response result: 0x01, Result of data transmission: 0x00, Overview of transmission data: 0x1081000605]



F22: Notify Data Reception [command: 0x6018, Source IPv6 address: 0xFE80000000000000250C2FFEDC2822, Source port number: 0x0E1A, Destination port number: 0x0E1A, Source PAN ID: 0x22A9, Destination address type: 0x00, Encryption: 0x02, RSSI: 0xCB, Reception data size: 0x0026, Reception data: 0x1081000602880105FF017202EA0B07E20A020E1E00000373AFEB0B07E20A020E1E000016A72]



※ ECHONET-Lite Payload structure (see ECHONET-Lite specifications for details.))



6. List of terms

Terms	Definition
HEMS	Home Energy Management System
B-route	Wi-SUN communication profile between smart energy meter and HEMS
Enhanced HAN	Wi-SUN communication profiles between HEMS and home appliances
ECHONET Lite	Communication protocol formulated by the ECHONET consortium. Smart House Control Protocol and Sensor NET Protocol
PANA	Protocol for carrying Authentication for Network Access
OTA	Over The Air

7. List of reference materials

No.	Document Name
1	Wi-SUN Profile for ECHONET Lite (Revision 2v08)
2	HEMS-Smart meter B-route (low-pressure power meter) operational guidelines
3	JJ-300.10 Home network communication Interface for ECHONET Lite (IEEE802.15.4/4g/4e 920MHz radio frequency)
4	Application communication Interface Specification for low-voltage power smart meter/HEMS controller (for ECHONET members only)
5	J11 Protocol Stack Function manual
6	J11 UART IF Command specification
7	BP35C0-J11 start up manual

8. Troubleshooting

For troubleshooting information, refer to the J11 UART command specification.

The "J11 UART IF Command Specification" can be downloaded from the following support page:

Wi-SUN Enhanced HAN + B-route support page (ISB Co., Ltd.)

<https://wisun.isb.co.jp/enhan/wer0/>

9. Revision history

Ver.	Date	Revised content (supported firmware Ver.)
1.0.0	March 1, 2019	First edition (040001030000158A)
1.0.1 (Rev.001)	May 20, 2020	Format change (040001030000158A)

Notes

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