

G3-PLC

Serial Command Specification

Target Device
R9A06G037

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1. Handling of Unused Pins

Handle unused pins in accordance with the directions given under Handling of Unused Pins in the manual.

- The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

The state of the product is undefined at the moment when power is supplied.

- The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed.
In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

- The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

- When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal.
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1. Introduction

This manual explains about specifications of Serial Command used for controlling the system compliant with the G3-PLC standard in CPX3 (R9A06G037). Hereinafter, this system referred to as G3-PLC system.

Figure 1-1 shows G3-PLC system overview.

User can realize various services of G3-PLC system by using commands defined in this manual.

The scope of this manual is G3 Block in Figure 1-1. Please refer to reference document [7] in Table 1-2 for detailed of System Block.

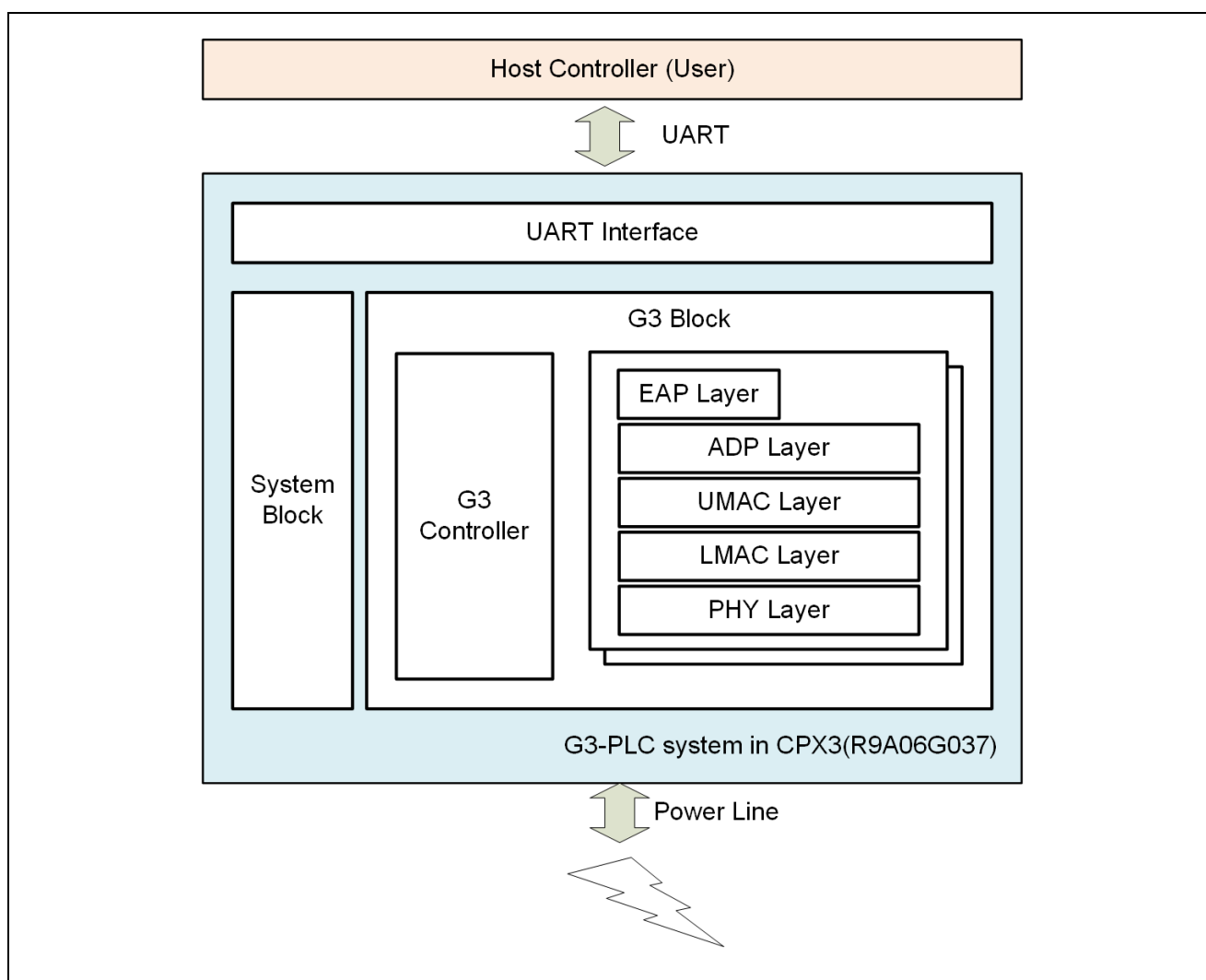


Figure 1-1 G3-PLC System Overview

The detail of G3-PLC system is described in section 2. The specification of common part of command is described in section 3. The specification of each command is described from section 4 and the following sections.

1.1 Abbreviations and Anonyms

Table 1-1 List of Abbreviations and Anonyms

Abbreviation	Full Form
ADP	Adaptation
EAP	Extensible Authentication Protocol
LBA	LoWPAN Bootstrapping Agent
LBD	LoWPAN Bootstrapping Device
LBP	LoWPAN Bootstrapping Protocol
LBS	LoWPAN Bootstrapping Server
LMAC	Lower MAC
MAC	Media Access Control
PAN	Personal Area Network
UMAC	Upper MAC
SAP	Service Access Point

1.2 Reference

Table 1-2 List of Reference

- [1] IEEE Computer Society, "IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - , " Part 15.4: Wireless Medium Access (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (WPANs), 2006.
- [2] G3PLC Alliance, "Narrowband OFDM PLC specifications for G3-PLC networks," Mar 2017.
- [3] ITU-T G.9901, Narrowband orthogonal frequency division multiplexing power line communication transceivers, 2014.
- [4] ITU-T G.9903, "Narrowband orthogonal frequency division," 2014.
- [5] RFC6282 Hui, J; Thubert, P, "Compression Format for IPv6 Datagrams over IEEE 802.15.4-Based Networks," IETF, RFC6282, 2011.
- [6] CPX3 related document, "Serial Boot Operating Manual," Renesas Electronics Corporation, 2016.
- [7] CPX3 related document, "System Block Serial Command Specifications," Renesas Electronics Corporation, 2016.

2. Overview

2.1 G3-PLC System Configuration

Figure 2-1 shows G3-PLC system configuration. G3-PLC system includes several blocks. Each block provides Service Access Point (SAP) accessible through UART Interface. User can realize various functions of each block by accessing these SAPs.

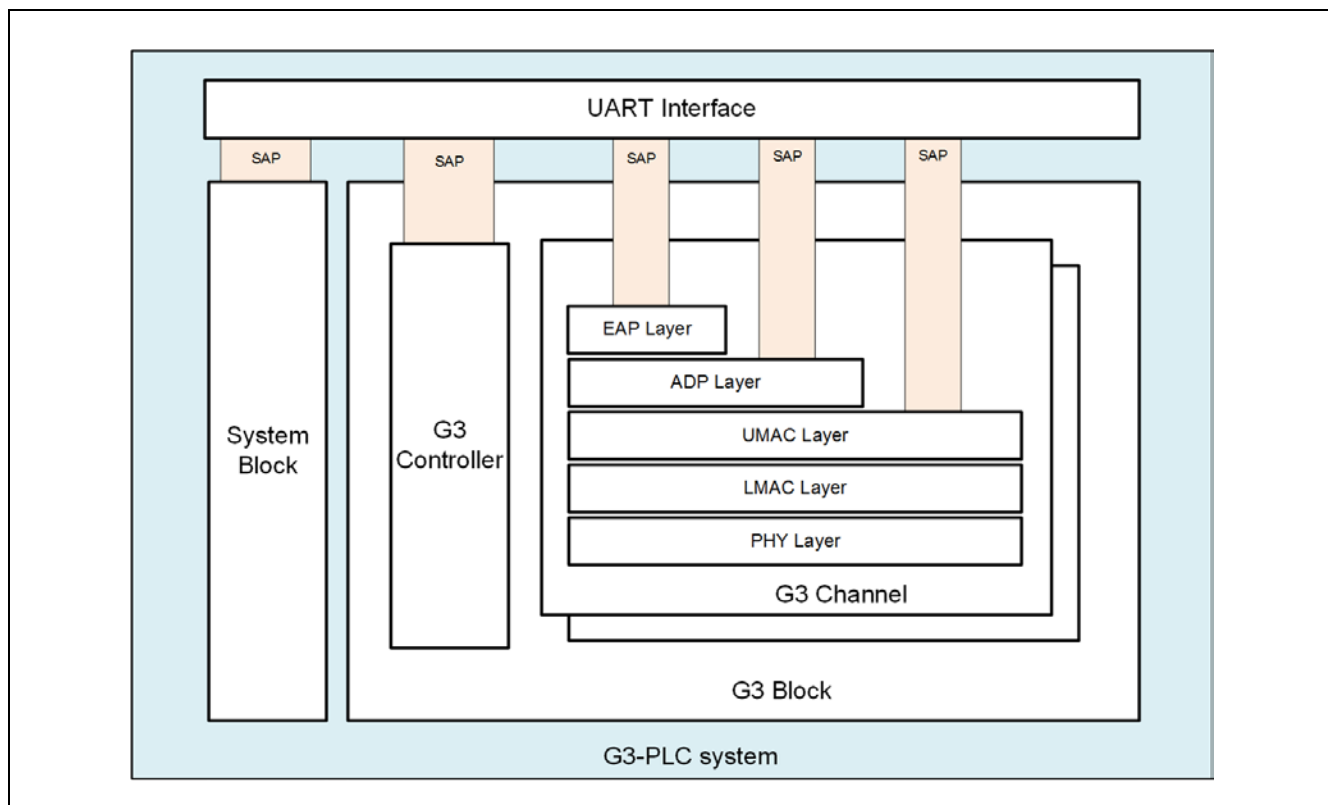


Figure 2-1 G3-PLC System Configuration Diagram

2.2 SAP of G3-PLC System

2.2.1 SAP Access Specification

Command for accessing SAP is categorized into 3 access types: "Request", "Confirm" and "Indication".

Table 2-1 shows each access type, and Figure 2-2 shows an image of relationship between each SAP access type.

Table 2-1 SAP Access Type

Access type	Description
Request	Request to Host Controller.
Confirm	Response to Request from G3-PLC system.
Indication	Notification from G3-PLC system.

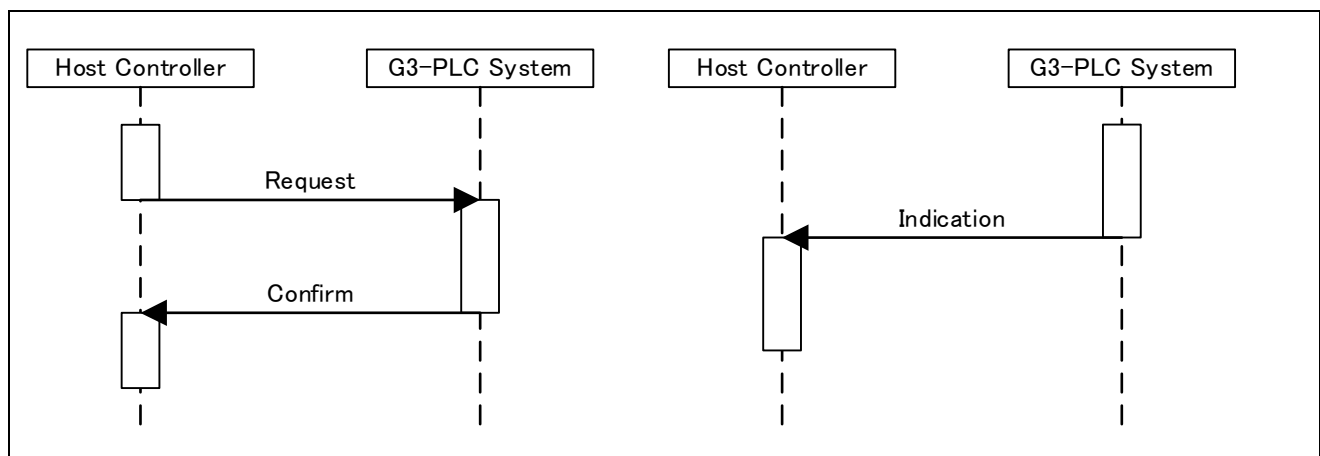


Figure 2-2 SAP Access Type Overview

2.2.2 SAP Limitation

When "Request" type service primitive is called, do not call the same service primitive until the corresponding "Confirm" type performs communication. As an exception, only ADPD-DATA.request can perform communication of ADPD-DATA.request without waiting for ADPD-DATA.confirm.

2.2.3 G3 Block SAP

Table 2-2 shows a list of functions which are provided by SAP of G3 Controller.

Table 2-2 G3 Controller Function List

SAP	Function Name	SAP Access Type (V:Exist -: Not exist)			Description
		Req uest	Con firm	Indic ation	
SAP of G3 Controller	G3-INIT	V	V	-	Request of G3 Channel initialization.
	G3-DEINIT	V	V	-	Request of G3 Channel deinitialization.
	G3-GETCONFIG	V	V	-	Request of obtaining G3 Configuration Parameter.
	G3-SETCONFIG	V	V	-	Request of setting G3 Configuration Parameter.
	G3-CLEARINFO	V	V	-	Request of erasing statistics and log.
	G3-GETINFO	V	V	-	Request of obtaining statistics and log.
	G3-DUMP	V	V	V	Request to start dumping and obtaining dump log.
	G3-DUMP-ABORT	V	V	-	Request of aborting dump request.
	G3-EVENT	-	-	V	Notification of G3 Channel event.

Table 2-3 shows a list of functions which are provided by SAP of G3 Channel.

Available functions of SAP of G3 Channel in Table 2-3 are different by G3 Channel configuration which is specified by user. Refer to section 2.3 for details.

Table 2-3 G3 Channel Function List

SAP	Function Name	SAP Access Type (V: Exist, -: Not exist)			Description
		Req uest	Con firm	Indic ation	
SAP of EAP Layer	EAPM-RESET	V	V	-	Request of resetting EAP Layer.
	EAPM-START	V	V	-	Request of enabling transmission/reception of LBP message.
	EAPM-GET	V	V	-	Request of obtaining EAP IB Attribute.
	EAPM-SET	V	V	-	Request of setting EAP IB Attribute
	EAPM-NETWORK	V	V	-	Request of transmission request of kick processing and GMK-related processing.
	EAPM-SETCLIENTINFO	V	V	-	Request of transmission request of operating client information.
	EAPM-NETWORK-JOIN	-	-	V	Notification that Peer participates in PAN.
	EAPM-NETWORK-LEAVE	-	-	V	Notification that Peer secedes from PAN.
	EAPM-NEWDEVICE	-	-	V	Notification that the following cases occurred. PAN device which is not registered in eapClientInformation sends a request of joining PAN. EAPM-NETWORK.request is called for a PAN device which is not registered in eapClientTable.
	EAPM-EAP-KEY	-	-	V	Notification of a key generated in the process of EAP-PSK.

SAP of ADP Layer	ADPD-DATA	V	V	V	Request of data transmission. Notification of data reception.
	ADPM-RESET	V	V	-	Request of resetting ADP Layer and the lower layer.
	ADPM-DISCOVERY	V	V	-	Request of searching PAN.
	ADPM-NETWORK-START	V	V	-	Request of starting PAN.
	ADPM-NETWORK-JOIN	V	V	-	Request of participating in PAN.
	ADPM-NETWORK-LEAVE	V	V	V	Request of seceding from PAN. Notification of seceding from PAN.
	ADPM-GET	V	V	-	Request of obtaining ADP IB Attribute.
	ADPM-SET	V	V	-	Request of setting ADP IB Attribute
	ADPM-ROUTE-DISCOVERY	V	V	-	Request of searching route.
	ADPM-PATH-DISCOVERY	V	V	V	Request of searching network path. Notification of reception of the path discovery request message to oneself.
	ADPM-LBP	V	V	V	Request of transmitting LBP message. Notification of reception of LBP message.
	ADPM-NETWORK-STATUS	-	-	V	Notification of reception of MLME-COMM-STATUS.indication.
	ADPM-BUFFER	-	-	V	Notification of the state change of the internal data transmission buffer.
	ADPM-KEY-STATE	-	-	V	Notification that GMK-related processing request is granted.
	ADPM-ROUTE-ERROR	-	-	V	Notification of reception route error packet.
	ADPM-EAP-KEY	-	-	V	Notification of a key generated in the process of EAP-PSK.
	ADPM-FRAME-COUNTER	-	-	V	Notification of reception of the MLME-FRAMECOUNT.indication.
	ADPM-ROUTE-UPDATE	-	-	V	Notification of update of route table.
	ADPM-LOAD-SEQ-NUM	-	-	V	Notification of LOADng sequence number.
	ADPM-RREP	-	-	V	Notification of receiving RREP message or notification of transmitting RREP message as originator.
SAP of UMAC Layer	MCPS-DATA	V	V	V	Request of data transmission. Notification of data reception.
	MLME-RESET	V	V	-	Request of resetting UMAC Layer and the lower layer.
	MLME-GET	V	V	-	Request of obtaining MAC PIB Attribute.
	MLME-SET	V	V	-	Request of setting MAC PIB Attribute
	MLME-SCAN	V	V	-	Request of searching PAN.
	MLME-START	V	V	-	Request of constructing PAN.
	MLME-BEACON-NOTIFY	-	-	V	Notification of receiving beacon response.
	MLME-COMM-STATUS	-	-	V	Notification of communications status.
	MLME-FRAMECOUNT	-	-	V	Notification of frame counter.
	MLME-TMR-RECEIVE	-	-	V	Notification of receiving tone map response.
	MLME-TMR-TRANSMIT	-	-	V	Notification of transmitting tone map response.

2.3 G3 Configuration Mode

G3 Channel provides various functions compliant with the G3-PLC standard.

User can specify G3 Channel configuration as shown in Figure 2-3 when user initialize to G3 Channel by using G3-INIT function. Hereinafter, the index of G3 Channel configuration is called as G3 Configuration Mode.

Functions of SAP of G3 Channel which can be accessed by user are different by G 3 Channel Mode. The availability of functions by each G3 Configuration Mode is described in the following section.

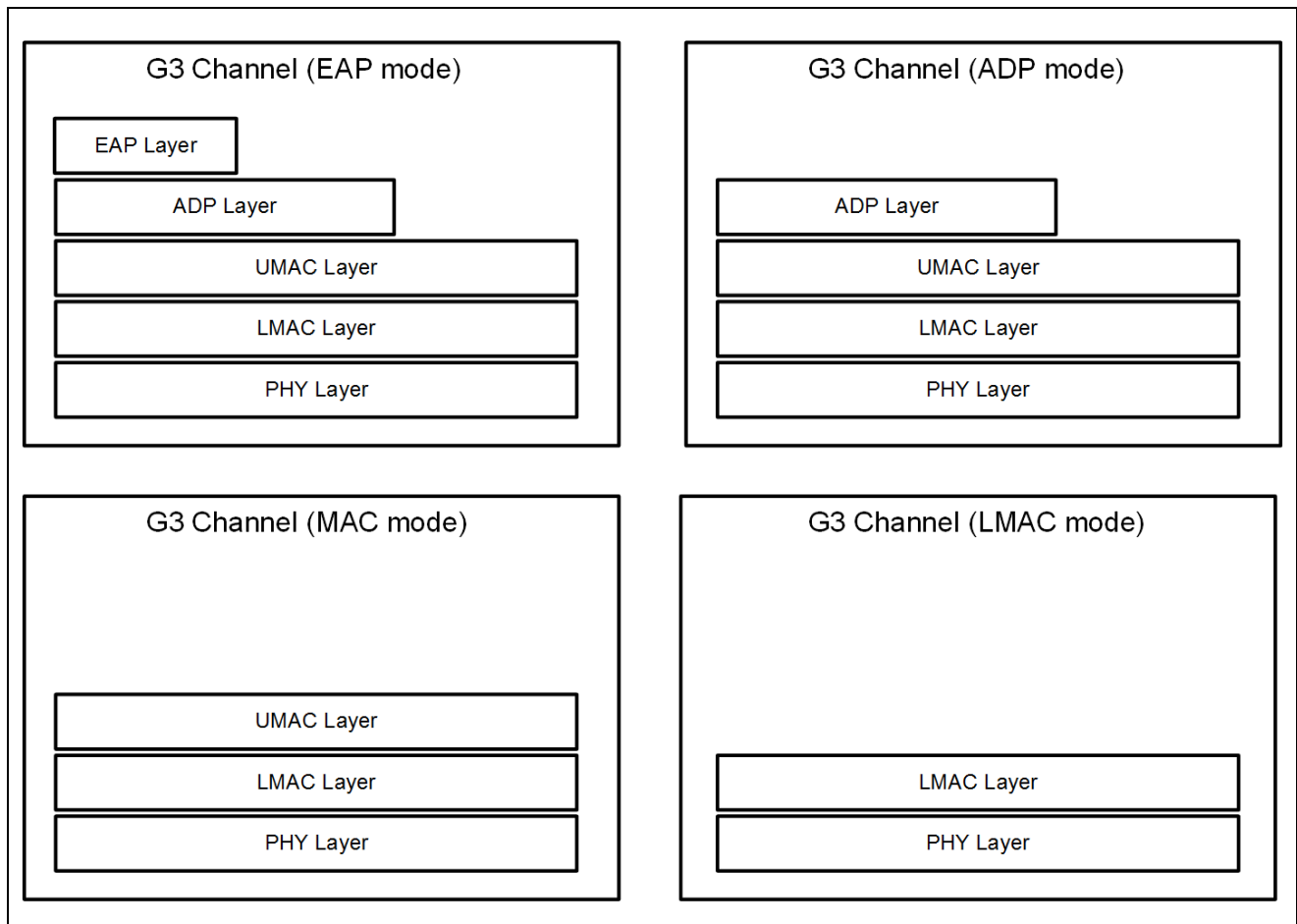


Figure 2-3 G3 Channel Configurations by G3 Channel Mode

2.3.1 MAC mode of G3 Configuration Mode

Table 2-4 shows a list of functions availability in the case of MAC mode.

Table 2-4 List of function availability for MAC mode

SAP	Function Name	Description	Availability (V: Enable, -:Disable)
SAP of G3 Controller	G3-INIT	Request of G3 Channel initialization.	V
	G3-DEINIT	Request of G3 Channel deinitialization.	V
	G3-GETCONFIG	Request of obtaining G3 Configuration Parameter.	V
	G3-SETCONFIG	Request of setting G3 Configuration Parameter.	V
	G3-CLEARINFO	Request of erasing statistics and log.	V
	G3-GETINFO	Request of obtaining statistics and log.	V
	G3-DUMP	Request to start dumping and obtaining dump log.	V
	G3-DUMP-ABORT	Request of aborting dump request	V
	G3-EVENT	Notification of G3 Channel event.	V
SAP of UMAC Layer	MCPS-DATA	Request of data transmission. Notification of data reception.	V
	MLME-RESET	Request of resetting UMAC Layer and the lower layer.	V
	MLME-GET	Request of obtaining MAC PIB Attribute.	V
	MLME-SET	Request of setting MAC PIB Attribute	V
	MLME-SCAN	Request of searching PAN.	V
	MLME-START	Request of constructing PAN.	V
	MLME-BEACON-NOTIFY	Notification of receiving beacon response.	V
	MLME-COMM-STATUS	Notification of communications status.	V
	MLME-FRAMECOUNT	Notification of frame counter.	V
	MLME-TMR-RECEIVE	Notification of receiving tone map response.	V
	MLME-TMR-TRANSMIT	Notification of transmitting tone map response.	V

2.3.2 ADP mode of G3 Configuration Mode

Table 2-5 shows a list of functions availability in the case of ADP mode.

Table 2-5 List of function availability for ADP mode

SAP	Function Name	Description	Availability (V: Enable, -:Disable)
SAP of G3 Controller	G3-INIT	Request of G3 Channel initialization.	V
	G3-DEINIT	Request of G3 Channel deinitialization.	V
	G3-GETCONFIG	Request of obtaining G3 Configuration Parameter.	V
	G3-SETCONFIG	Request of setting G3 Configuration Parameter.	V
	G3-CLEARINFO	Request of erasing statistics and log.	V
	G3-GETINFO	Request of obtaining statistics and log.	V
	G3-DUMP	Request to start dumping and obtaining dump log.	V
	G3-DUMP-ABORT	Request of aborting dump request	V
	G3-EVENT	Notification of G3 Channel event.	V
SAP of ADP Layer	ADPD-DATA	Request of data transmission. Notification of data reception.	V
	ADPM-RESET	Request of resetting ADP Layer and the lower layer.	V
	ADPM-DISCOVERY	Request of searching PAN.	V
	ADPM-NETWORK-START	Request of starting PAN.	V
	ADPM-NETWORK-JOIN	Request of participating in PAN.	V
	ADPM-NETWORK-LEAVE	Request of seceding from PAN. Notification of seceding from PAN.	V
	ADPM-GET	Request of obtaining ADP IB Attribute.	V
	ADPM-SET	Request of setting ADP IB Attribute	V
	ADPM-ROUTE-DISCOVERY	Request of searching route.	V
	ADPM-PATH-DISCOVERY	Request of searching network path. Notification of reception of the path discovery request message to oneself.	V
	ADPM-LBP	Request of transmitting LBP message. Notification of reception of LBP message.	V
	ADPM-NETWORK-STATUS	Notification of reception of MLME-COMM-STATUS.indication.	V
	ADPM-BUFFER	Notification of the state change of the internal data transmission buffer.	V
	ADPM-KEY-STATE	Notification that GMK-related processing request is granted.	V
	ADPM-ROUTE-ERROR	Notification of reception route error packet.	V
	ADPM-EAP-KEY	Notification of a key generated in the process of EAP-PSK.	V
	ADPM-FRAME-COUNTER	Notification of reception of the MLME-FRAMECOUNT.indication.	V
	ADPM-ROUTE-UPDATE	Notification of update of route table.	V
	ADPM-LOAD-SEQ-NUM	Notification of LOADng sequence number.	V
	ADPM-RREP	Notification of receiving RREP message or notification of transmitting RREP message as originator.	V

SAP of UMAC Layer	MCPS-DATA	Request of data transmission. Notification of data reception.	-
	MLME-RESET	Request of resetting UMAC Layer and the lower layer.	-
	MLME-GET	Request of obtaining MAC PIB Attribute.	V
	MLME-SET	Request of setting MAC PIB Attribute	V
	MLME-SCAN	Request of searching PAN.	-
	MLME-START	Request of constructing PAN.	-
	MLME-BEACON-NOTIFY	Notification of receiving beacon response.	V
	MLME-COMM-STATUS	Notification of communications status.	-
	MLME-FRAMECOUNT	Notification of frame counter.	-
	MLME-TMR-RECEIVE	Notification of receiving tone map response.	V
	MLME-TMR-TRANSMIT	Notification of transmitting tone map response.	V

2.3.3 EAP mode of G3 Configuration Mode

Table 2-6 shows a list of functions availability in the case of EAP mode.

Table 2-6 List of function availability for EAP mode

SAP	Function Name	Description	Availability (V: Enable, -:Disable)
SAP of G3 Controller	G3-INIT	Request of G3 Channel initialization.	V
	G3-DEINIT	Request of G3 Channel deinitialization.	V
	G3-GETCONFIG	Request of obtaining G3 Configuration Parameter.	V
	G3-SETCONFIG	Request of erasing statistics and log.	V
	G3-CLEARINFO	Request of obtaining statistics and log.	V
	G3-GETINFO	Request of obtaining G3 statistics and log information.	V
	G3-DUMP	Request to start dumping and obtaining dump log.	V
	G3-DUMP-ABORT	Request of aborting dump request	V
	G3-EVENT	Notification of G3 Channel event.	V
SAP of EAP Layer	EAPM-RESET	Request of resetting EAP Layer.	V
	EAPM-START	Request of enabling transmission/reception of LBP message.	V
	EAPM-GET	Request of obtaining EAP IB Attribute.	V
	EAPM-SET	Request of setting EAP IB Attribute	V
	EAPM-NETWORK	Request of transmission request of kick processing and GMK-related processing.	V
	EAPM-SETCLIENTINFO	Request of transmission request of operating client information.	V
	EAPM-NETWORK-JOIN	Notification that Peer participates in PAN.	V
	EAPM-NETWORK-LEAVE	Notification that Peer secedes from PAN.	V
	EAPM-NEWDEVICE	Notification that the following cases occurred. PAN device which is not registered in eapClientInformation sends a request of joining PAN. EAPM-NETWORK.request is called for a PAN device which is not registered in eapClientTable.	V
SAP of ADP Layer	EAPM-EAP-KEY	Notification of a key generated in the process of EAP-PSK.	V
	ADPD-DATA	Request of data transmission. Notification of data reception.	V
	ADPM-RESET	Request of resetting ADP Layer and the lower layer.	V
	ADPM-DISCOVERY	Request of searching PAN.	V
	ADPM-NETWORK-START	Request of starting PAN.	V
	ADPM-NETWORK-JOIN	Request of participating in PAN.	V
	ADPM-NETWORK-LEAVE	Request of seceding from PAN. Notification of seceding from PAN.	V
	ADPM-GET	Request of obtaining ADP IB Attribute.	V
	ADPM-SET	Request of setting ADP IB Attribute	V

	ADPM-ROTUE-DISCOVERY	Request of searching route.	V
	ADPM-PATH-DISCOVERY	Request of searching network path. Notification of reception of the path discovery request message to oneself.	V
	ADPM-LBP	Request of transmitting LBP message. Notification of reception of LBP message.	-
	ADPM-NETWORK-STATUS	Notification of reception of MLME-COMM-STATUS.indication.	V
	ADPM-BUFFER	Notification of the state change of the internal data transmission buffer.	V
	ADPM-KEY-STATE	Notification that GMK-related processing request is granted.	V
	ADPM-ROUTE-ERROR	Notification of reception route error packet.	V
	ADPM-EAP-KEY	Notification of a key generated in the process of EAP-PSK.	V
	ADPM-FRAME-COUNTER	Notification of reception of the MLME-FRAMECOUNT.indication.	V
	ADPM-ROUTE-UPDATE	Notification of update of route table.	V
	ADPM-LOAD-SEQ-NUM	Notification of LOADng sequence number.	V
	ADPM-RREP	Notification of receiving RREP message or notification of transmitting RREP message as originator.	V
SAP of UMAC Layer	MCPS-DATA	Request of data transmission. Notification of data reception.	-
	MLME-RESET	Request of resetting UMAC Layer and the lower layer.	-
	MLME-GET	Request of obtaining MAC PIB Attribute.	V
	MLME-SET	Request of setting MAC PIB Attribute	V
	MLME-SCAN	Request of searching PAN.	-
	MLME-START	Request of constructing PAN.	-
	MLME-BEACON-NOTIFY	Notification of receiving beacon response.	V
	MLME-COMM-STATUS	Notification of communications status.	-
	MLME-FRAMECOUNT	Notification of frame counter.	-
	MLME-TMR-RECEIVE	Notification of receiving tone map response.	V
	MLME-TMR-TRANSMIT	Notification of transmitting tone map response.	V

2.4 G3 Configuration Parameter

G3 Channel requires several initialization parameters for resetting each layer which in the G3 Channel. Hereinafter, these initialization parameters are called as G3 Configuration Parameter. Table 2-7 shows a list of G3 Configuration Parameter.

Table 2-7 G3 Configuration Parameter List

Parameter Name	Length	Valid value	Description
bandPlan	1byte	0x00-0x03	Band plan. 0x00: CENELEC A 0x01: CENELEC B 0x02: ARIB 0x03: FCC
extendedAddress	8byte	Any	The 64- bit self extended address.
psk	16byte	Any	Self PSK.
extendIDFlag	1byte	0x00-0x01	Whether or not extendID is used. 0x00: extendID is not used 0x01: extendID is used ExtendID is used by Japan route B.
extendIDPeerLength	1byte	0-36	Valid data length of extendID of PAN device. (Byte unit). This member is used only if extendIDFlag is 0x01. Otherwise, this member is not required.
extendIDPeer	36byte	Any	ExtendID of PAN device. If data length is less than 36 byte, set a value in left-justified, and fill in 0 data into the remaining block till 36 byte. This member is used only if extendIDFlag is 0x01. Otherwise, this member is not required.
extendIDCoordLength	1byte	0-36	Valid data length of extendID of PAN coordinator (Byte unit). This member is used only if extendIDFlag is 0x01. Otherwise, this member is not required.
extendIDCoord	36byte	Any	ExtendID of PAN coordinator. If data length is less than 36 byte, set a value in left-justified, and fill in 0 data into the remaining block till 36 byte. This member is used only if extendIDFlag is 0x01. Otherwise, this member is not required.

G3 Configuration Parameter is set by using G3-SETCONFIG function. Number of G3 Configuration Parameter should be set is different by G3 Configuration Mode of the G3 Channel. Refer to section 0 in details.

User should send G3-SETCONFIG command before sending each layer's reset command (MLME-RESET, ADPM-RESET, EAPM-RESET). Refer section 2.5.2 for G3 Channel startup sequence detail.

2.5 Startup of G3 Channel

2.5.1 State Transition

Figure 2-4 shows a state transition diagram of each G3 Channel. G3 Channel has several internal states. Table 2-8 shows each state details and available functions in each state.

After G3-PLC system bootup, which means that after System Block sent SYSTEM-BOOTUP.indication command, G3 Channel state is G3 Channel Uninitialize State, and this state can accept only G3-INIT.request. In G3 Channel Initialized State can accept all G3 Controller's functions and each layer's reset request, MLME-RESET, ADPM-RESET and EAPM-RESET. In G3 Channel Idle State can accept all functions.

The following sections describe the recommended sequences for changing G3 Channel state.

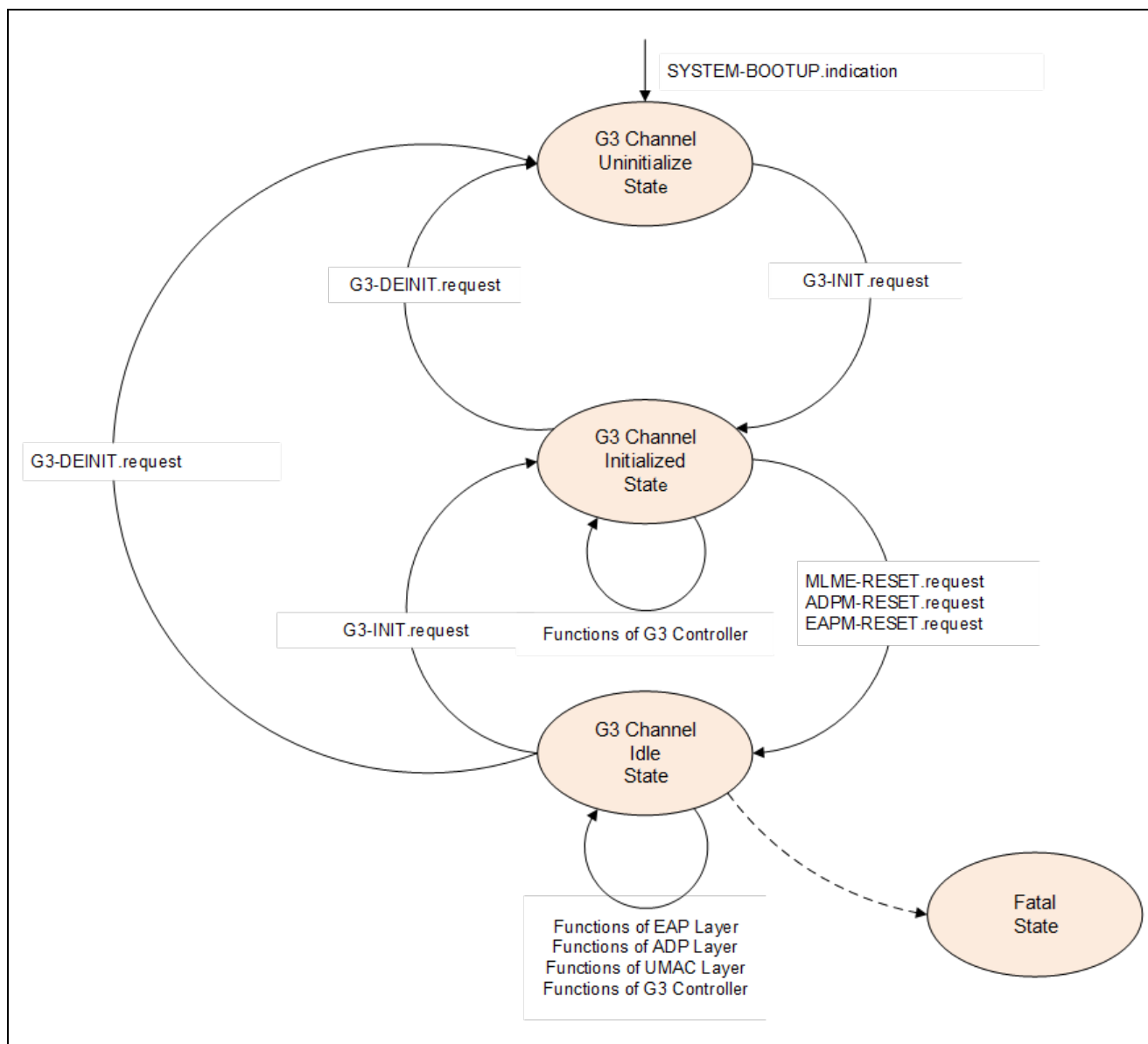


Figure 2-4 G3 Channel State Transition Diagram

Table 2-8 Available Functions of G3 Channel in each Internal State

State Name	Descriptions	Available Functions (-: All function is disable)		
		System Block	G3 Controller	G3 Channel
G3 Channel	State after G3-PLC system bootup	All function	G3-INIT	-

Uninitialize State	(State after System Block sent SYSTEM-BOOTUP.indication command,).			
G3 Channel Initialized State	State after constructed G3 Channel.	All function	All function	MLME-RESET ADPM-RESET EAPM-RESET
G3 Channel Idle State	State after reset G3 Channel	All function	All function	All function
Fatal state	G3 Channel in fatal state.	-	-	-

2.5.2 Startup Sequence

Figure 2-5 shows the chart diagram of G3 Channel startup sequence.

User should set G3 Configuration Parameter by sending G3-SETCONFIG.request command before sending reset request command of the G3 Channel.

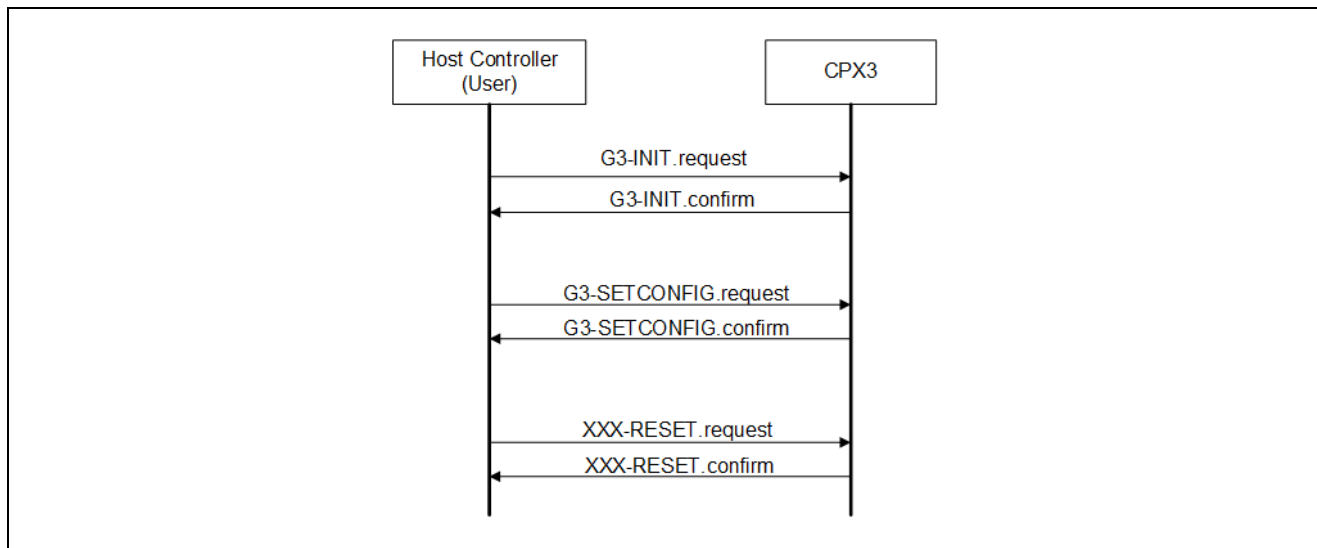


Figure 2-5 G3 Channel Startup Sequence Chart Diagram

2.5.3 Restart Sequence

Figure 2-6 shows the chart diagram of G3 Channel restart sequence after resetting G3 Channel.

User should send reset command if G3 Channel executed any function already. The rest sequence after sending reset command is same as the startup sequence in section 2.5.2.

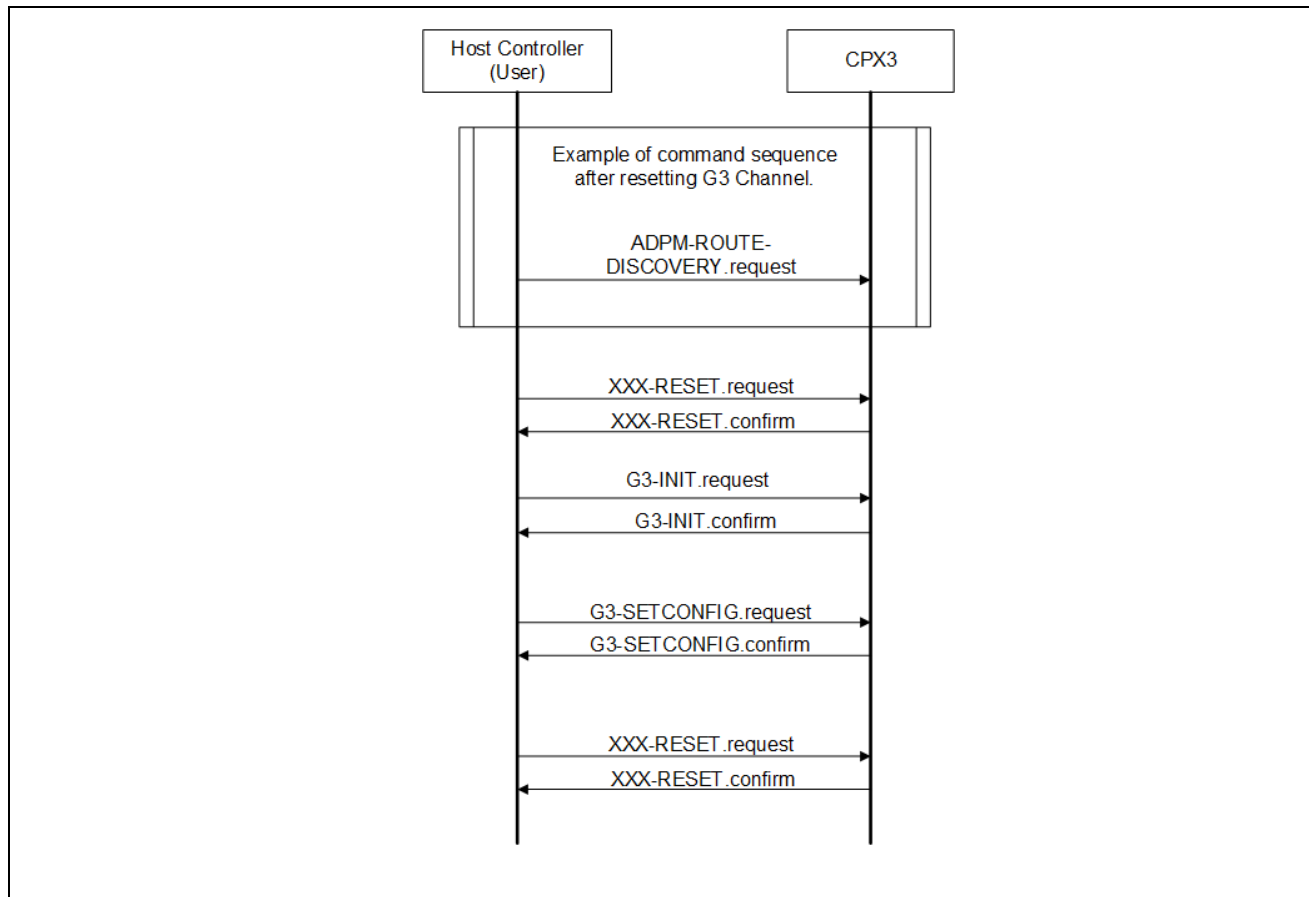


Figure 2-6 G3 Channel Reset Sequence Chart Diagram

2.5.4 End Sequence

Figure 2-7 shows the chart diagram of G3 Channel end sequence.

User should send reset command if G3 Channel executed any function already, before sending G3-DEINIT.request command. .

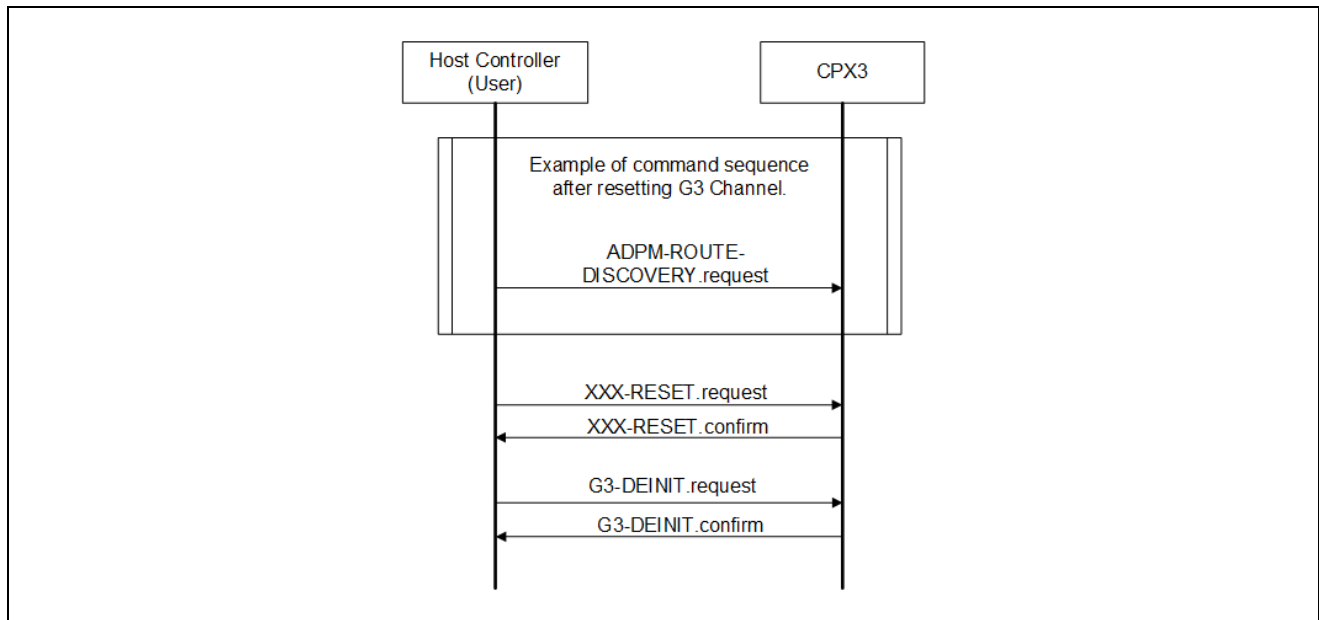


Figure 2-7 G3 Channel End Sequence Chart Diagram

When multi G3 Channels are running, User should end from the G3 Channel which initialized later, such as Figure 2-9.

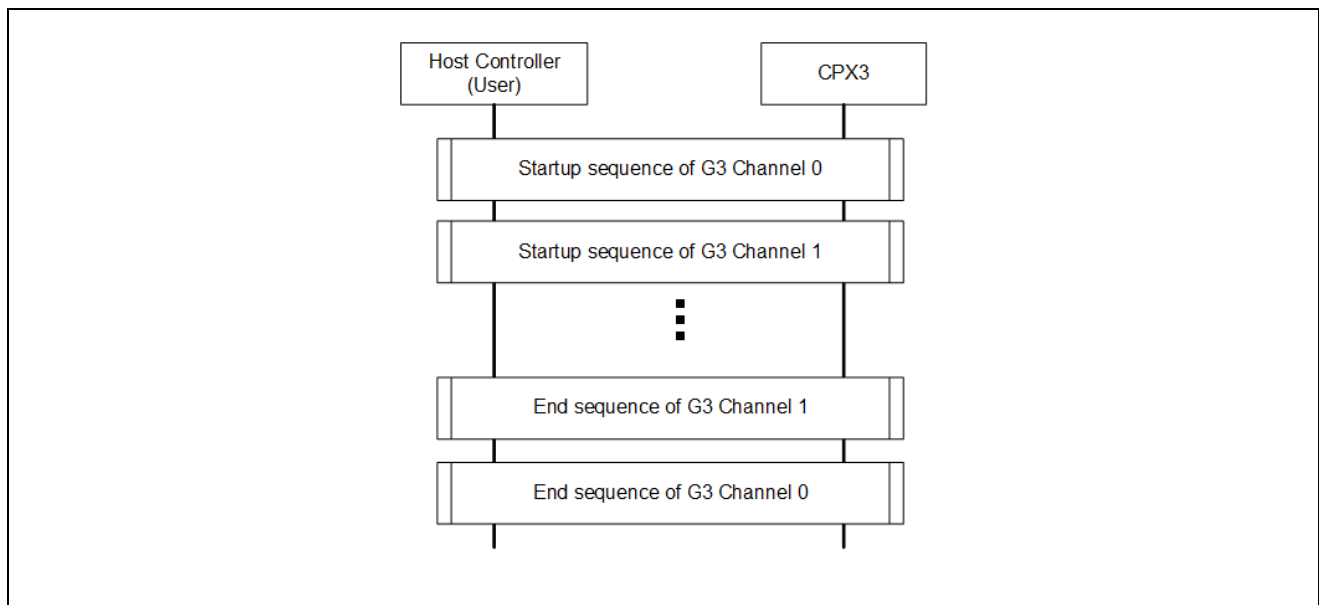


Figure 2-8 Example of Multi G3 Channel End Sequence Chart Diagram

2.6 Example of G3-PLC System Configuration

User can use two individual G3 Channels at once. Of course, user can use one G3 Channel only.

User can initialize each G3 Channel by different G3 Configuration Mode. Figure 2-9 shows an example of G3-PLC system configuration which G3 Channel 0 is initialized in EAP mode and G3 Channel 1 is initialize in MAC mode.

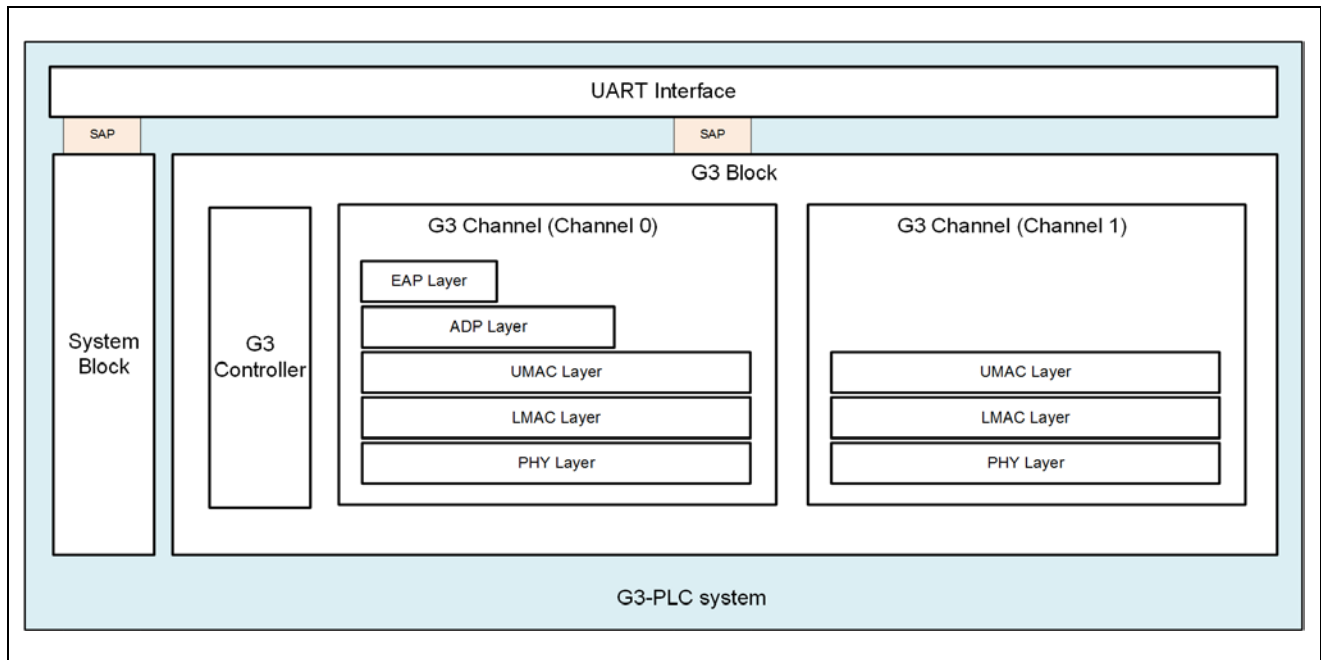


Figure 2-9 Example of G3-PLC system Configuration (G3 Channel 0: EAP mode, G3 Channel 1: MAC mode)

3. Command Specification in Common Part

3.1 UART Communication Setting

Table 3-1 shows the setting of UART communication with Host Controller.

Table 3-1 UART Communication Setting

Item	Setting
Communication method	Full-duplex asynchronous communication.
Bit rate	507,352.94bps (recommendation). Bit rate depends on CPX3 bootup setting. Please refer to reference document [6] in Table 1-2 for detailed.
Data bit length	8 bit
Parity check	Not available.

3.2 Command Format

3.2.1 Command Packet Format

In order to ensure robustness, the stream of command is encapsulated in HDLC-type packets which include a 2byte header and 4byte CRC. All data is encapsulated between a starting flag-byte 0x7E and ending flag-byte 0x7E.

Figure 3-1 and Table 3-2 shows command packet format.

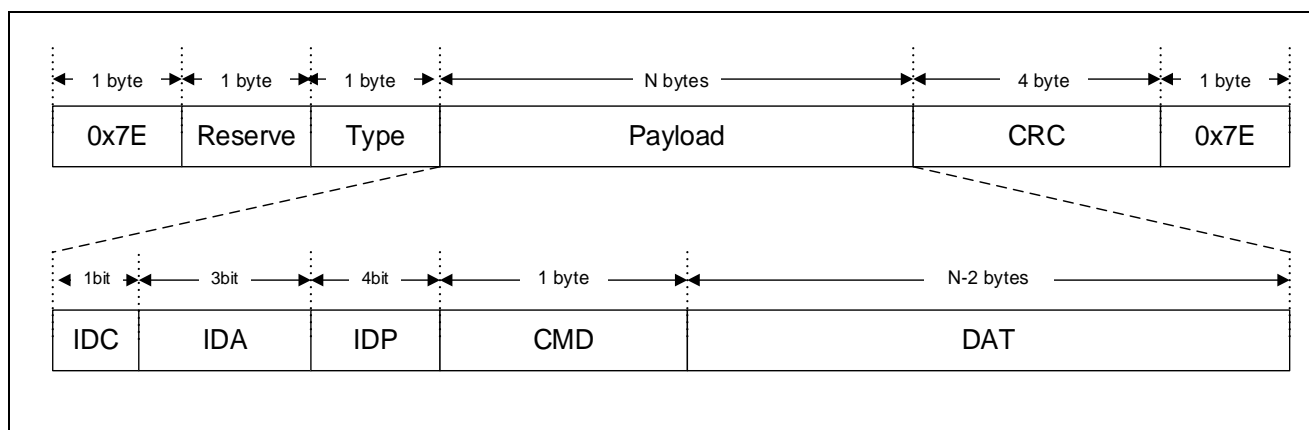


Figure 3-1 Command Packet Format Diagram

Table 3-2 Command Packet Format Table

	S-CODE	Header		Payload					CRC	S-CODE
		Reserve	TYPE	IDC	IDA	IDP	CMD	DAT		
Value	0x7E	0x00	-	-	-	-	-	-	-	0x7E
Length	1byte	1byte	1byte	1bit	3bit	4bit	1byte	N-2byte	4byte	1byte
Notes	-	-	-	-	-	-	-	-	Big Endian	-

3.2.2 HDLC Escape Sequence

If any of the intermediate data characters has the value 0x7E, it is preceded by an escape byte 0x7D, followed by a byte derived from XORing the original character with byte 0x20. The same is done if there is a 0x7D within the character stream. An example of such case is shown here.

Msg to Tx:	0x01	0x02	0x7E	0x03	0x04	0x7D	0x05	0x06
Actual Tx sequence:	0x01	0x02	0x7D 0x5E	0x03	0x04	0x7D 0x5D	0x05	0x06
			Escape sequence			Escape sequence		

3.2.3 CRC Calculation

The 32 bit CRC at end of the frame covers both 'Header' and 'Payload' fields. The CRC is calculated over the original data to be transmitted i.e. before byte stuffing of escape sequences described above is performed. CRC calculation is The input polynomial $M(x)$ is formed as a polynomial whose coefficients are bits of the data being checked (the first bit to check is the highest order coefficient and the last bit to check is the coefficient of order zero). The Generator polynomial for the CRC is $G(x)=x^{32}+x^{26}+x^{23}+x^{22}+x^{16}+x^{12}+x^{11}+x^{10}+x^8+x^7+x^5+x^4+x^2+x+1$. The remainder $R(x)$ is calculated as the remainder from the division of $M(x) \cdot x^{32}$ by $G(x)$. The coefficients of the remainder will then be the resulting CRC.

Table 3-3 shows CRC setting.

Table 3-3 CRC Setting

Item	Setting
Width	32bit (CRC-32)
Polynomial	0x4C11DB7
Shift Direction	Left
Initial Value	0
Output XOR	0x00000000
Finalization	Not bit inversion.

3.2.4 Detail of Command Packet Format

(1)S-Code

S-CODE is the packet synchronization delimiter to identify the start and end point of packet. S-CODE is always 0x7E.

(2)Reserve

This field is reserved for future use.

(3)TYPE

This field indicates access target block of G3-PLC system as shown in Table 3-4.

Table 3-4 Definition of TYPE

TYPE	description
0x00	System Block
0x01	G3 Block
0x02-0xFF	Reserve

(4)CRC

Refer the section 3.2.3.

(5)IDC

This field indicates G3 Channel index as shown in Table 3-5.

Table 3-5 Definition of IDC

IDC	description
0x0	Channel 0
0x1	Channel 1

(6)IDA

This field indicates access type of SAP as shown in Table 3-6.

Table 3-6 Definition of IDA

IDA	description
0x0	Request
0x1	Confirm
0x2	Indication
0x3 - 0x7	Reserve

(7)IDP

This field indicates access target layer of G3 Block as shown in Table 3-7.

Table 3-7 Definition of IDP

IDP	description
0x0	G3 Controller
0x1	Reserve
0x2	Reserve
0x3	UMAC Layer
0x4	ADP Layer
0x5	EAP Layer
0x6-0xF	Reserve

(8)CMD

This field indicates command id. Command id of each command is described from section 4 and the following sections.

(9)DAT

This is a field where parameter corresponding to the command which is indicated by CMD is specified. Refer from section 4 and the following sections for details of DAT format which correspond to each command.

4. Command Specification for G3 Controller

This section explains about details of command specification for G3 Controller.

Table 4-1 shows a command list of G3 Controller.

Availability of these functions by each G3 Configuration Mode is described in section 2.3.

Table 4-1 G3 Controller Command List

Command Name	Command ID	SAP Access type (-:Disable, V:Enable)			Description
		Request	Confirm	Indication	
G3-INIT	0x00	V	V	-	Request of G3 Channel initialization.
G3-DEINIT	0x01	V	V	-	Request of G3 Channel deletion.
G3-GETCONFIG	0x02	V	V	-	Request of obtaining G3 Configuration Parameter.
G3-SETCONFIG	0x03	V	V	-	Request of setting G3 Configuration Parameter.
G3-CLEARINFO	0x14	V	V	-	Request of erasing statistics and log.
G3-GETINFO	0x15	V	V	-	Request of obtaining statistics and log.
G3-DUMP	0x18	V	V	V	Request to start dumping and obtaining dump log.
G3-DUMP-ABORT	0x19	V	V	-	Request of aborting dump request.
G3-EVENT	0x20	-	-	V	Notification of G3 Channel event.

4.1 G3-INIT

4.1.1 G3-INIT.request

This command is used to initialize G3 Channel. Refer section 2.5 for G3 Channel startup sequence and restart sequence detail.

If G3 Controller received this command in G3 Channel Initialized State or G3 Channel Idle State, G3 Controller tries to initialize newly G3 Channel after deinitialized the G3 Channel (G3 Controller calls G3-DEINIT.request process internally).

Table 4-2 shows this command format. IDC of this command is specified channel index for target G3 Channel to initialize, and g3mode of this command parameter is specified G3 Configuration Mode. DAT parameters of this command are different by specified G3 Configuration Mode.

Table 4-2 G3-INIT.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x0	
CMD	1byte	0x00	
DAT		DAT parameters are different by G3 Configuration Mode.	

(1)DAT parameters of G3-INIT.request for MAC mode

Parameter Name	Length	Valid value	Description
DAT			
g3mode	1byte	0x03	G3 Configuration Mode index for MAC mode.
neighbourTableSize	2byte	0-1536	The number of neighbour table.
deviceTableSize	2byte	0-1536	The number of device table.
panDescriptorNum	2byte	1-128	The number of PAN which can be obtained by MLME-SCAN.

(2)DAT parameters of G3-INIT.request for ADP mode

Parameter Name	Length	Valid value	Description
DAT			
g3mode	1byte	0x04	G3 Configuration Mode index for ADP mode.
neighbourTableSize	2byte	0-1536	The number of neighbour table.
deviceTableSize	2byte	0-1536	The number of device table.
panDescriptorNum	2byte	1-128	The number of Pan which can be obtained by ADPM-DISCOVERY.
routeTableSize	2byte	0-2048	The number of route table.
adpdBuffNum	2byte	1-4	The number of internal buffer stages which is used for data transmission by ADPD_DATA.
routeType	1byte	0x00, 0x01	Specification of memory allocation by route type for application. 0x00: Normal route. 0x01: Japan route B.

(3)DAT parameters of G3-INIT.request for EAP mode

Parameter Name	Length	Valid value	Description
DAT			
g3mode	1byte	0x05	G3 Configuration Mode index for EAP mode.
neighbourTableSize	2byte	0-1536	The number of neighbour table.
deviceTableSize	2byte	0-1536	The number of device table.
panDescriptorNum	2byte	1-128	The number of Pan which can be obtained by

				ADPM-DISCOVERY.
routeTableSize	2byte	0-2048		The number of route table.
adpdBuffNum	2byte	1-4		The number of internal buffer stages which is used for data transmission by ADPD_DATA.
routeType	1byte	0x00, 0x01		Specification of memory allocation by routing type for application. 0x00: Normal route. 0x01: Japan route B.
eapLbpBuffNum	2byte	1-128		The number of elements in the LBP message buffer. Maximum number of EAP-PSK (Join) process which can be run in parallel.
eapCinfoTableNum	2byte	1-2048		The number of eapClientInfoTable entry.

4.1.2 G3-INIT.request Recommended Setting

Recommended settings of G3-INIT.request parameter for Coordinator, Peer, and MAC mode device are described in Table 4-3, Table 4-4, and Table 4-5.

Table 4-3 Recommended setting for Coordinator

Use case	Normal route use	Japan B route use
Number of network node	N	N (Normally N = 1)
G3-INIT.request DAT parameter		
g3mode	0x05	0x05
neighbourTableSize	min(N,1536)	min(N,1536)
deviceTableSize	min(N,1536)	min(N,1536)
panDescriptorNum	Any	Any
routeTableSize	min(N,2048)	0
adpdBuffNum	2	2
routeType	0x00	0x01
eapLbpBuffNum	CENELEC A: min(N,8) ARIB, FCC: min(N,32)	min(N,8)
eapCinfoTableNum	min(N,2048)	min(N,2048)

Table 4-4 Recommended setting for Peer

Use case	Normal route use	Japan B route use
Number of network node	N	N (Normally N = 1)
G3-INIT.request DAT parameter		
g3mode	0x04	0x04
neighbourTableSize	min(N,1536)	min(N,1536)
deviceTableSize	min(N,1536)	min(N,1536)
panDescriptorNum	Any	Any
routeTableSize	min(N, 2048)	0
adpdBuffNum	2	2
routeType	0x00	0x01

Table 4-5 Recommended setting for MAC mode device

Use case	Ordinary use	Promiscuous mode use only
Number of network node	N	N
G3-INIT.request DAT parameter		
g3mode	0x03	0x03
neighbourTableSize	min(N,1536)	0
deviceTableSize	min(N,1536)	0
panDescriptorNum	Any	0

4.1.3 G3-INIT.confirm

This command is used to send notification as response to G3-INIT.request.

Table 4-6 shows this command format.

Table 4-6 G3-INIT.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x0	
CMD	1byte	0x00	
DAT			
status	1byte	Refer Table 4-23.	Status code <i>R_G3_STATUS_SUCCESS</i> : · Succeed <i>R_G3_STATUS_INVALID_PARAMETER</i> : · Called with invalid parameter <i>R_G3_STATUS_INSUFFICIENT_MEMSIZE</i> : · Memory size is insufficient for the request execution. <i>R_G3_STATUS_INVALID_STATE</i> · Memory busy state by G3-DUMP request process.
failedLayer	1byte	0x00-0x05	If status code was not <i>R_G3_STATUS_SUCCESS</i> , this field set information which layer failed to initialize. 0x00: G3 Controller 0x01: Reserved 0x02: LMAC Layer 0x03: UMAC Layer 0x04: ADP Layer 0x05: EAP Layer

4.2 G3-DEINIT

4.2.1 G3-DEINIT.request

This command is used to deinitialize the G3 Channel. Refer section 2.5.4 for G3 Channel end sequence. Table 4-7 shows this command format.

Table 4-7 G3-DEINIT.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x0	
CMD	1byte	0x01	
DAT	Not available.		

4.2.2 G3-DEINIT.confirm

This command is used to send notification as response to G3-DEINIT.request. Table 4-8 shows this command format.

Table 4-8 G3-DEINIT.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x0	
CMD	1byte	0x01	
DAT			
	status	1byte	Refer Table 4-23. Status code <i>R_G3_STATUS_SUCCESS</i> : · Succeed. <i>R_G3_STATUS_UNINITIALIZED_STATE</i> : · Called when G3 Channel Uninitialize State.

4.3 G3-GETCONFIG

4.3.1 G3-GETCONFIG.request

This command is used to send a request of obtaining G3 Configuration Parameter of G3 Channel.
Table 4-9 shows this command format.

Table 4-9 G3-GETCONFIG.request Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4 bit	0x0	
CMD	1byte	0x02	
DAT	Not available.		

4.3.2 G3-GETCONFIG.confirm

This command is used to send notification as response to G3-GETCONFIG.request.
Table 4-10 shows this command format.
DAT parameters of this command are different by G3 Configuration Mode.

Table 4-10 G3-GETCONFIG.confirm Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4 bit	0x0	
CMD	1byte	0x02	
DAT		DAT parameters are different by G3 Configuration Mode.	

(1)DAT parameter of G3-GETCONFIG.confirm for MAC mode

Parameter Name	Length	Valid value	Description
DAT			
status	1byte	Refer Table 4-23.	Status code <i>R_G3_STATUS_SUCCESS</i> : · Succeed. <i>R_G3_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified.
g3mode	1byte	0x03	G3 Configuration Mode index for MAC mode.
bandPlan	1byte	0x00-0x03	The set value of BandPlan. 0x00: CENELEC A 0x01: CENELEC B 0x02: ARIB 0x03: FCC
reserved	4byte	0x00000000	Reserve area.
extendedAddress	8byte	Any	The set value of self 64-bit extended address.
padding	91byte	All 0	This field is filled 0 data.

(2)DAT parameter of G3-GETCONFIG.confirm for ADP & EAP mode

Parameter Name	Length	Valid value	Description
DAT			
status	1byte	Refer Table 4-23.	Status code <i>R_G3_STATUS_SUCCESS</i> : · Succeed. <i>R_G3_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified.
g3mode	1byte	0x04-0x05	G3 Configuration Mode index. 0x04: ADP mode 0x05: EAP mode
bandPlan	1byte	0x00-0x03	The set value of BandPlan. 0x00: CENELEC A 0x01: CENELEC B 0x02: ARIB 0x03: FCC
reserved	4byte	0x00000000	Reserve area.
extendedAddress	8byte	Any	The set value of self 64-bit extended address.
psk	16 byte	Any	The set value of self PSK.
extIDFlg	1byte	0x00-0x01	The set value of extendID flag. 0x00: extendID is not used 0x01: extendID is used
extIDPeerLength	1byte	0-36	The set value of valid data length of Peer's extendID (Byte unit). If extendIDFlg is 0, this field is filled 0 data.
extIDPeer	36 byte	Any	The set value of Peer's extendID. If data length is less than 36 byte, set a value in left-justified, and fill in 0 data into the remaining block till 36 byte. If extendIDFlg is 0, this field is filled 0 data.
extIDCoordLength	1byte	0-36	The set of value of valid data length of Coordinator's extendID (Byte unit). If extendIDFlg is 0, this field is filled 0 data.
extIDCoordinator	36 byte	Any	The set value of Coordinator's extendID. If data length is less than 36 byte, set a value in left-justified, and fill in 0 data into the remaining block till 36 byte. If ExtendIDFlg is 0, this field is filled 0 data.

4.4 G3-SETCONFIG

4.4.1 G3-SETCONFIG.request

This command is used to set G3 Configuration Parameter of G3 Channel. G3 Configuration Parameters set by this command not reflect until send each layer's reset command (MLME-RESET, ADPM-RESET, EAPM-RESET). Refer section 2.5.2 for G3 Channel startup sequence detail.

Table 4-11 shows this command format.

DAT parameters of this command are different by G3 Configuration Mode.

Table 4-11 G3-SETCONFIG.request Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4 bit	0x0	
CMD	1byte	0x03	
DAT		DAT parameters are different by G3 Configuration Mode.	

(1) DAT parameter of G3-SETCONFIG.request for MAC mode

Parameter Name	Length	Valid value	Description
DAT			
g3mode	1byte	0x03	G3 Configuration Mode index for MAC mode.
bandPlan	1byte	0x00-0x03	Band plan. 0x00: CENELEC A 0x01: CENELEC B 0x02: ARIB 0x03: FCC
reserved	4byte	0x00000000	Reserve area.
extendedAddress	8byte	Any	Self 64-bit extended address.

(2) DAT parameter of G3-SETCONFIG.request for ADP & EAP mode

Parameter Name	Length	Valid value	Description
DAT			
g3mode	1byte	0x04	G3 Configuration Mode index for ADP mode. In EAP mode, this parameter set 0x04 as the same.
bandPlan	1byte	0x00-0x03	Band plan. 0x00: CENELEC A 0x01: CENELEC B 0x02: ARIB 0x03: FCC
reserved	4byte	0x00000000	Reserve area.
extendedAddress	8byte	Any	Self 64-bit extended address.
psk	16byte	Any	Self PSK.
extIDFlag	1byte	0x00-0x01	Whether or not extendID is used. 0x00: extendID is not used 0x01: extendID is used ExtendID is used by Japan route B.
extIDPeerLength	1byte	0-36	Valid data length of extendID of PAN device. (Byte unit). This member is used only if extendIDFlag is 0x01. Otherwise, this member is not required.

4. Command Specification for G3 Controller

	extIDPeer	36byte	Any	<p>ExtendID of PAN device.</p> <p>If data length is less than 36 byte, set a value in left-justified, and fill in 0 data into the remaining block till 36 byte.</p> <p>This member is used only if extendIDFlag is 0x01. Otherwise, this member is not required.</p>
	extIDCoordLength	1byte	0-36	<p>Valid data length of extendID of PAN coordinator (Byte unit).</p> <p>This member is used only if extendIDFlag is 0x01. Otherwise, this member is not required.</p>
	extIDCoord	36byte	Any	<p>ExtendID of PAN coordinator.</p> <p>If data length is less than 36 byte, set a value in left-justified, and fill in 0 data into the remaining block till 36 byte.</p> <p>This member is used only if extendIDFlag is 0x01. Otherwise, this member is not required.</p>

4.4.2 G3-SETCONFIG.confirm

This command is used to send notification as response to G3-SETCONFIG.request.
Table 4-12 shows this command format.

Table 4-12 G3-SETCONFIG.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x0	
CMD	1byte	0x03	
DAT			
status	1byte	Refer Table 4-23.	Status code <i>R_G3_STATUS_SUCCESS</i> : · Succeed <i>R_G3_STATUS_UNINITIALIZED_STATE</i> : · Called when G3 Channel Uninitialize State. <i>R_G3_STATUS_INVALID_REQUEST</i> : · Called when G3 Channel LMAC mode. <i>R_G3_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified.

4.5 G3-CLEARINFO

4.5.1 G3-CLEARINFO.request

This command is used to clear statistics and log data of the G3 Channel. Refer section 9 for details of statistics and log.

Table 4-13 shows this command format.

Table 4-13 G3-CLEARINFO.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x0	
CMD	1byte	0x14	
DAT			
infoTypeBit	1byte	-	Bitmap for clearing data type. (TRUE: clear / FALSE: not clear) bit0: statistics bit1: log bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved If all bits were FALSE, all data type are cleared.
Reserved	1byte	0x00	Reserved area.

4.5.2 G3-CLEARINFO.confirm

This command is used to send notification as response to G3-CLEARINFO.request.
Table 4-14 shows this command format.

Table 4-14 G3-CLEARINFO.confirm Command Format

Field		Length	Valid value	Description
IDC		1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA		3bit	0x1	
IDP		4bit	0x0	
CMD		1byte	0x14	
DAT				
	status	1byte	Refer Table 4-23.	Status code <i>R_G3_STATUS_SUCCESS</i> : · Succeed <i>R_G3_STATUS_UNINITIALIZED_STATE</i> : · Called when uninitialized state.

4.6 G3-GETINFO

4.6.1 G3-GETINFO.request

G3-GETINFO.request command used to obtain statistics or log. Each G3 Layer is recording each statistics and log data, and this command gets the data separately. Also, each G3 layer's statistics data can be get by each layer's IB get command by index unit. Refer section 9 for details of statistics and log.

Table 4-15 shows this command format.

Table 4-15 G3-GETINFO.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x0	
CMD	1byte	0x15	
DAT			
infoType	1byte	0x00-0x01	Type of obtaining data. 0x00: statistics 0x01: log
infoLayer	1byte	0x00-0x05	Target layer 0x00: Reserved 0x01: LMAC Layer (DSP) 0x02: Reserved 0x03: UMAC Layer 0x04: ADP Layer 0x05: EAP Layer

4.6.2 G3-GTETINFO.confirm

This command is used to send notification as response to G3-GETINFO.request.
Table 4-16 shows this command format.

Table 4-16 G3-GETINFO.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x0	
CMD	1byte	0x15	
DAT			
status	1byte	Refer Table 4-23.	Status code <i>R_G3_STATUS_SUCCESS</i> : · Succeed. <i>R_G3_STATUS_UNINITIALIZED_STATE</i> : · Called when uninitialized state. <i>R_G3_STATUS_INVALID_PARAMETER</i> : · Called with invalid parameter
infoType	1byte	0x00-0x01	Type of obtained data. 0x00: statistics 0x01: log
infoLayer	1byte	0x00-0x05	Target layer. 0x00: Reserved 0x01: LMAC Layer (DSP) 0x02: Reserved 0x03: UMAC Layer 0x04: ADP Layer 0x05: EAP Layer
length	2byte	=< 1024	Size of obtained data (byte unit).
info	length byte	-	Obtained data. Refer section 9 in detailed.

4.7 G3-DUMP

4.7.1 G3-DUMP.request

This command is used to send a request to start dumping and obtaining dump log of G3 Channel. Table 4-17 shows this command format.

Refer section 12 for details of G3-DUMP specification.

Table 4-17 G3-DUMP.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x0	
CMD	1byte	0x18	
DAT			
maxDmpLen	4byte	0x00001018-0x00100000 (Byte)	Maximum dump length in Byte. This length must be multiple of 4. If maxDmpLen > internal dump buffer size, G3CTRL try to dump up to internal dump buffer size.
timeOut	4byte	0-0x00083126 (msec).	Time to wait for a dump trigger(msec). After the time elapse, dump starts automatically.
dmpMode	1byte	0-1	It specifies a mode of dump. 0: AGC enable mode. 1: Hold AGC mode. A gain is adjusted at the beginning of the dump and the gain is fixed till dump finish.
reserved	3byte	-	Reserved for the future.
segmentLen	2byte	1-1024 (Byte)	Dump data segment length in Byte. Dump data is segmented, and each segment is notified by G3-DUMP.indication in order from the top. If (Maximum dump length/segmentLen > 1024), returns error.
segmentInterval	4byte	Any (msec).	Interval time (msec) to send next segment data of dump data. G3-DUMP.indication is issued at intervals of this time after G3-DUMP.confirm.

4.7.2 G3-DUMP.confirm

This command is used to send notification as response to G3-DUMP.request. Table 4-18 shows this command format.

Refer section 12 for details of G3-DUMP specification.

Table 4-18 G3-DUMP.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1

IDA	3bit	0x1	
IDP	4bit	0x0	
CMD	1byte	0x18	
DAT			
status	1byte	Refer Table 4-23.	Status code <i>R_G3_STATUS_SUCCESS</i> : · Succeed. <i>R_G3_STATUS_INVALID_REQUEST</i> · Other dump process runs already <i>R_G3_STATUS_NO_RESPONSE</i> · No response from G3 Channel. <i>R_G3_STATUS_UNINITIALIZED_STATE</i> : · Called when G3 Channel Uninitialize State. <i>R_G3_STATUS_REQUEST_FAILED</i> · Dump procces was failed. <i>R_G3_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified. If status is not <i>R_G3_STATUS_SUCCESS</i> , other member values are set 0.
result	1byte	0-1	Dump result. 0: Data is dumped after finding a trigger. 1: Data is dumped after a time out. (A trigger is not found)
segmentNum	2byte	0-1023	Number of segmented dump data. G3-DUMP.indication will be issued this number times.
segmentLen	2byte	-	Dump data segment length. Dump data is segmented, and each segment is notified by G3-DUMP.indication in order from the top.
segmentInterval	4byte	-	Interval time of each segment data notification (msec). G3-DUMP.indication is issued at intervals of this time after G3-DUMP.confirm.
dmpLen	4Byte	-	Dump data length.

4.7.3 G3-DUMP.indication

This command is used to send notification when segmented dump log data is received. Table 4-19 shows this command format.

Refer section 12 for details of G3-DUMP specification.

Table 4-19 G3-DUMP.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x0	
CMD	1byte	0x18	
DAT			

	seqNum	2byte	0-1023	Sequence number of segmented dmp data. This number starts from 0, and increments by one.
	endFlg	1byte	0-1	End code of dump data. 0: Not end data 1: End data
	segmentLen	2byte	1-1024	Segmented dump data length in Byte.
	dmpData	dmpLen byte	-	Segmenttted dump data

4.8 G3-DUMP-ABORT

4.8.1 G3-DUMP-ABORT.request

This command is used to send a request of aborting dump request of G3 Channel. Table 4-20 shows this command format.

Refer section 12 for details of G3-DUMP specification.

Table 4-20 G3-DUMP-ABORT.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x0	
CMD	1byte	0x19	
DAT	Not available.		

4.8.2 G3-DUMP-ABORT.confirm

This command is used to send notification as response to G3-DUMP-ABORT.request. Table 4-21 shows this command format.

Refer section 12 for details of G3-DUMP specification.

Table 4-21 G3-DUMP-ABORT.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x0	
CMD	1byte	0x19	
DAT			
	status	uint8_t	Refer Table 4-23. Status code <i>R_G3_STATUS_SUCCESS</i> : · Succeed. <i>R_G3_STATUS_INVALIDED_REQUEST</i> : · Called when running other G3 channel's dump process. <i>R_G3_STATUS_UNINITIALIZED_STATE</i> : · Called when G3 Channel Uninitialize State. <i>R_G3_STATUS_IF_FATAL_ERROR</i> : · Failed deinitialize process by OS or DSP function execution error.

4.9 G3-EVENT

4.9.1 G3-EVENT.indication

This command is used to notify G3 Event was occurred in G3 channel.

Table 4-22 shows a list of G3 Event. Table 4-22 shows this command format.

Table 4-22 G3-EVENT.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x0	
CMD	1byte	0x20	
DAT			
eventCode	1byte	0x01	Notify that the request command was discarded by G3 Controller for the following reasons. · Invalid parameters set in command header field. · Disable command by the state of G3 Channel. · Disable command by the G3 Configuration Mode of G3 Channel. Confirm command corresponding to the request command will not be sent.
length	2byte	0x0002	Size of param (byte unit).
param	2byte	Any	Discarded command header information as the following. (IDA<<12) (ADP<<8) CMD

4.10 G3 Controller Status Code

Table 4-23 shows a list of status code of G3 Controller.

Table 4-23 G3 Controller Status Code List

Status code	Value	Description
R_G3_STATUS_SUCCESS	0x00	The requested operation was completed successfully.
R_G3_STATUS_INVALID_REQUEST	0x80	Invalid parameter was specified.
R_G3_STATUS_INSUFFICIENT_MEMSIZE	0xA0	Memory size is insufficient for the request execution.
R_G3_STATUS_NO_RESPONSE	0xA4	No response for request command from G3 unit
R_G3_STATUS_UNINITIALIZED_STATE	0xA5	G3 Channel state is already G3 Channel Uninitialize State.
R_G3_STATUS_REQUEST_FAILED	0xA6	Request was failed.
R_G3_STATUS_INVALID_PARAMETER	0xE8	A parameter in the primitive is either not supported or is out of the valid range.
R_G3_STATUS_INVALID_STATE	0xFD	G3 channel state is in invalid state.

5. Command Specification for UMAC Layer

This section explains about details of command specification of UMAC Layer.

Table 5-1 shows a command list of UMAC Layer.

Availability of these functions by each G3 Configuration Mode is described in section 2.3.

Table 5-1 UMAC Layer Command List

Command	Command ID	SAP Access type (-:Disable, V:Enable)			Description
		Request	Confirm	Indication	
MCPS-DATA	0x00	V	V	V	Request of data transmission. Notification of data reception.
MLME-RESET	0x01	V	V	-	Request of resetting UMAC Layer and the lower layer.
MLME-GET	0x02	V	V	-	Request of obtaining MAC PIB Attribute.
MLME-SET	0x03	V	V	-	Request of setting MAC PIB Attribute
MLME-SCAN	0x04	V	V	-	Request of searching PAN.
MLME-START	0x05	V	V	-	Request of constructing PAN.
MLME-BEACON-NOTIFY	0x06	-	-	V	Notification of receiving beacon response.
MLME-COMM-STATUS	0x07	-	-	V	Notification of communications status.
MLME-FRAMECOUNT	0x08	-	-	V	Notification of frame counter.
MLME-TMR-RECEIVE	0x09	-	-	V	Notification of receiving tone map response.
MLME-TMR-TRANSMIT	0x0A	-	-	V	Notification of transmitting tone map response.

5.1 MCPS-DATA

5.1.1 MCPS-DATA.request

Table 5-2 shows this command format.

Table 5-2 MCPS-DATA.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x3	
CMD	1byte	0x00	
DAT			
srcAddrMode	1byte	0,2,3	The source addressing mode for this primitive and subsequent MPDUs. This value can take one of the following values: 0x00 = no address (addressing fields omitted, see clause 7.2.1.1.8 of [IEEE 802.15.4]) 0x01 = Reserved by ITU-T 0x02 = 16-bit short address 0x03 = 64-bit extended address.
dstAddrMode	1byte	0,2,3	The destination addressing mode for this primitive and subsequent MPDUs This value can take one of the following values: 0x00 = no address (addressing fields omitted, see clause 7.2.1.1.6 of [IEEE 802.15.4]) 0x01 = Reserved by ITU-T 0x02 = 16-bit short address 0x03 = 64-bit extended address.
dstPanId	2byte	0-0xFFFF	The 16-bit PAN identifier of the entity to which the MSDU is being transferred. NOTE - PAN identifier value is logically ANDed with 0xFCFF.
dstAddr	8byte	0-0xFFFF (dstAddrMode=0x02) 0-0xFFFFFFFFFFFFFFFF (dstAddrMode=0x03)	The individual device address of the entity to which the MSDU is being transferred.
msduLength	2byte	≤aMaxMACPayloadSize	The number of octets contained in the MSDU to be transmitted by the MAC sublayer entity.
msduHandle	1byte	0x00-0xFF	The handle associated with the MSDU to be transmitted by the MAC sublayer entity.
txOptions	1byte	0-0x01	The 3 bits (b0, b1, b2) indicate the transmission options for this MSDU. For b0: 0: unacknowledged transmission. 1: acknowledged transmission Bits b1 and b2 are reserved by ITU-T and shall be set to zero.
securityLevel	1byte	0x00 and 0x05	The security level to be used as described in clause 9.3.8.
keyIdMode	1byte	0x01	The mode used to identify the key to be used. This parameter is ignored if the SecurityLevel parameter is set to 0x00.

	keySource	8byte	-	Not used.
	keyIndex	1byte	0x00-0x01	The index of the key to be used (see clause 9.3.8).
	qualityOfService	1byte	0x00-0x01	The QOS (quality of service) parameter of the MSDU to be transmitted by the MAC sublayer entity This value can take one of the following values: 0 = normal priority 1 = high priority
	msdu	msduLength byte	-	MSDU to transmit.

5.1.2 MCPS-DATA.confirm

Table 5-3 shows this command format.

Table 5-3 MCPS-DATA.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x3	
CMD	1byte	0x00	
DAT			
msduHandle	1byte	0-0xFF	The handle associated with the MSDU being confirmed.
status	1byte	Refer Table 5-22.	Status code. <i>R_G3MAC_STATUS_SUCCESS</i> : • Succeed. <i>R_G3MAC_STATUS_COUNTER_ERROR</i> : • Frame counter reached the limit <i>R_G3MAC_STATUS_UNSUPPORTED_SECURITY</i> : • Unsupported securityLevel was specified. <i>R_G3MAC_STATUS_CHANNEL_ACCESS_FAILURE</i> : • Did not transmit due to the activity on the channel. <i>R_G3MAC_STATUS_SECURITY_ERROR</i> : • Cryptographic processing failed. <i>R_G3MAC_STATUS_FRAME_TOO_LONG</i> : • Frame length is greater than aMaxPHYPacketSize. • Transaction is too large to fit in the CAP or GTS. <i>R_G3MAC_STATUS_INVALID_PARAMETER</i> : • Invalid parameter was specified. <i>R_G3MAC_STATUS_NO_ACK</i> : • No acknowledgement received. <i>R_G3MAC_STATUS_OUT_OF_CAP</i> : • Called when there's no room in the internal buffer. <i>R_G3MAC_STATUS_INVALID_STATE</i> : • Called when UMAC is invalid state. <i>R_G3MAC_STATUS_UNAVAILABLE_KEY</i> : • Unavailable key was specified. <i>R_G3MAC_STATUS_LML_NO_RESPONSE</i> : • No response from LMAC layer. <i>R_G3MAC_STATUS_LML_ABORTED</i> : • DATA transmission abort by timeout as success. <i>R_G3MAC_STATUS_LML_ABORT_ERROR</i> : • DATA transmission abort by timeout as failure.
timestamp	4byte	0-0xFFFFFFFF	The time, in symbols, at which the data were transmitted. The value of this parameter will be considered

5. Command Specification for UMAC Layer

				valid only if the value of the status parameter is R_G3MAC_STATUS_SUCCESS; if the status parameter is not equal to R_G3MAC_STATUS_SUCCESS, the value of the Timestamp parameter shall not be used for any other purpose.
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5.1.3 MCPS-DATA.indication

Table 5-4 shows this command format.

Table 5-4 MCPS-DATA.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x3	
CMD	1byte	0x00	
DAT			
srcAddrMode	1byte	0,2,3	The source addressing mode for this primitive and subsequent MPDUs. This value can take one of the following values: 0x00 = no address (addressing fields omitted, see clause 7.2.1.1.8 of [IEEE 802.15.4]) 0x01 = Reserved by ITU-T 0x02 = 16-bit short address 0x03 = 64-bit extended address.
srcPanId	2byte	0-0xFFFF	The 16-bit PAN identifier of the entity to which the MSDU is being transferred. NOTE - PAN identifier value is logically ANDed with 0xFCFF.
srcAddr	8byte	0-0xFFFF (srcAddrMode=0x02) 0-0xFFFFFFFFFFFFFFFF (srcAddrMode=0x03)	The individual device address of the entity to which the MSDU is being transferred.
dstAddrMode	1byte	0,2,3	The destination addressing mode for this primitive and subsequent MPDUs This value can take one of the following values: 0x00 = no address (addressing fields omitted, see clause 7.2.1.1.6 of [IEEE 802.15.4]) 0x01 = Reserved by ITU-T 0x02 = 16-bit short address 0x03 = 64-bit extended address.
dstPanId	2byte	0-0xFFFF	The 16-bit PAN identifier of the entity to which the MSDU is being transferred. NOTE - PAN identifier value is logically ANDed with 0xFCFF.
dstAddr	8byte	0-0xFFFF (dstAddrMode=0x02)	The individual device address of the entity to which the MSDU is being transferred.

			0-0xFFFFFFFFFFFFFFFF (dstAddrMode=0x03)	
msduLength	2byte		≤aMaxMACPayloadSize	The number of octets contained in the MSDU to be transmitted by the MAC sublayer entity.
msdu	msduLength byte	-		MSDU to reception.
msduLinkQuality	1byte	0x00-0xFF		LQI value measured during reception of the MSDU.
dsn	1byte	0x00-0xFF		Sequence number with the MSDU to be transmitted.
timestamp	4byte	0-0xFFFFFFFF		The time, in symbols, at which the data were transmitted. The value of this parameter will be considered valid only if the value of the status parameter is SUCCESS; if the status parameter is not equal to SUCCESS, the value of the Timestamp parameter shall not be used for any other purpose.
securityLevel	1byte	0x00 and 0x05		The security level to be used as described in clause 9.3.8.
keyIdMode	1byte	0x01		The mode used to identify the key to be used (see clause 9.3.8). This parameter is ignored if the SecurityLevel parameter is set to 0x00.
keySource	8byte	-		Not used.
keyIndex	1byte	0x00-0x01		The index of the key to be used (see clause 9.3.8).
qualityOfService	1byte	0x00-0x01		The QOS (quality of service) parameter of the MSDU to be transmitted by the MAC sublayer entity This value can take one of the following values: 0 = normal priority 1 = high priority
estimatedMod	Refer Table 5-5	Any		Estimated modulation type for route cost computation. Refer Table 5-5.
estimatedTonemap	3byte	-		Estimated Tonemap for route cost computation
receivedMod	Refer Table 5-5	Any		Received modulation type based on Table 5-5 for route cost computation PMS, Modulation and PhaseDifferential fields are available on this field.
receivedTonemap	3byte	-		Received Tonemap for route cost computation
RSSIdb	1byte	Any		RSSI (Received Signal Strength Indicator) in dB.

Table 5-5 NeighborMod Parameter

Parameter Name	Byte	bit	Description
PMS	1Byte	1	Payload Modulation Scheme 0: Differential 1: Coherent The coherent scheme is optional.
PhaseDifferential		3	The phase difference between the AC phase of the local node and the neighbour node
Reserved		1	
Modulation		3	Defines the modulation type to use for communicating with the device. 0x00: ROBO or ROBO_coherent 0x01: DBPSK or BPSK 0x02: DQPSK or QPSK 0x03: D8PSK or 8PSK (N/A for ARIB) 0x04-0x7 : reserved

5.2 MLME-RESET

5.2.1 MLME-RESET.request

Table 5-6 shows this command format.

Table 5-6 MLME-RESET.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x3	
CMD	1byte	0x01	
DAT			
setDefaultPIB	1byte	TRUE or FALSE	If TRUE, the MAC sublayer is reset, and all MAC PIB attributes are set to their default values. If FALSE, the MAC sublayer is reset, but all MAC PIB attributes retain their values prior to the generation of the MLME-RESET.request primitive. This parameter shall be set TRUE for first call after G3-INIT.

5.2.2 MLME-RESET.confirm

Table 5-7 shows this command format.

Table 5-7 MLME-RESET.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x3	
CMD	1byte	0x01	
DAT			
status	1byte	Refer Table 5-22.	Status code <i>R_G3MAC_STATUS_SUCCESS</i> : · Succeed. <i>R_G3MAC_STATUS_INVALID_STATE</i> : · Called when UMAC is invalid state. <i>R_G3MAC_STATUS_IF_NO_RESPONSE</i> : · No response from LMAC layer.

5.3 MLME-GET

5.3.1 MLME-GET.request

This command is used to send a request of obtaining MAC PIB Attribute value of MAC layer.

When MAC PIB Attribute is table type, specify an index of a table which you want to obtain for parameter `pibAttributeIndex` to acquire a value. Refer to section 5.13 for details of MAC PIB Attribute.

Table 5-8 shows this command format.

Table 5-8 MLME-GET.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x3	
CMD	1byte	0x02	
DAT			
pibAttributeld	2byte	Refer to section 5.13.	The identifier of the PIB attribute to read
pibAttributeIndex	2byte	Refer to section 5.13.	The index within the table of the specified PIB attribute to read. This parameter is valid only for MAC PIB attributes that are tables; it is ignored when accessing PHY PIB attributes.

5.3.2 MLME-GET.confirm

This primitive is used to send notification as response to MLME-GET.request.
Table 5-9 shows this command format.

Table 5-9 MLME-GET.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x3	
CMD	1byte	0x02	
DAT			
status	1byte	Refer Table 5-22.	Status code <i>R_G3MAC_STATUS_SUCCESS</i> : · Succeed. <i>R_G3MAC_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified. <i>R_G3MAC_STATUS_SECURITY_ERROR</i> : · IB of madKeyTable was specified. <i>R_G3MAC_STATUS_INVALID_INDEX</i> : · A value out of the range was specified for AttributeIndex. <i>R_G3MAC_STATUS_NO_SHORT_ADDRESS</i> : · IB of macNeighbourTableByShortAddr was specified with a short address which does not register in the table. <i>R_G3MAC_STATUS_UNSUPPORTED_ATTRIBUTE</i> : · Unsupported IB was specified. <i>R_G3MAC_STATUS_IF_NO_RESPONSE</i> : · No response from LMAC layer. <i>R_ADP_STATUS_IF_NO_RESPONSE</i> : · No response from ADP layer.
pibAttributeId	2byte	Refer to section 5.13.	The identifier of the PIB attribute to read
pibAttributeIndex	2byte	Refer to section 5.13.	The index within the table of the specified PIB attribute to read. This parameter is valid only for MAC PIB attributes that are tables.
pibAttributeValue	23byte	Refer to section 5.13.	The value of the indicated PIB attribute that was read. The value is set a left-aligned in 23 byte length data.

5.4 MLME-SET

5.4.1 MLME-SET.request

This command is used to send a request of setting MAC PIB Attribute value of MAC layer.

When MAC PIB Attribute is table type, specify an index of a table which you want to set for parameter PibAttributeIndex to set a value. Refer to section 5.13 for details of MAC PIB Attribute.

Table 5-10 shows this command format.

Table 5-10 MLME-SET.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x3	
CMD	1byte	0x03	
DAT			
pibAttributeld	2byte	Refer to section 5.13.	The identifier of the PIB attribute to write
pibAttributeIndex	2byte	Refer to section 5.13.	The index within the table of the specified PIB attribute to write. This parameter is valid only for MAC PIB attributes that are tables; it is ignored when accessing PHY PIB attributes.
pibAttributeValue	Refer to section 5.13.		The value to write to the indicated PIB attribute.

5.4.2 MLME-SET.confirm

This command is used to send notification as response to MLME-SET.request.

Table 5-11 shows this command format.

Table 5-11 MLME-SET.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x3	
CMD	1byte	0x03	
DAT			
status	1byte	Refer Table 5-22.	Status code <i>R_G3MAC_STATUS_SUCCESS</i> : ·Succeed. <i>R_G3MAC_STATUS_INVALID_PARAMETER</i> : ·Invalid parameter was specified. <i>R_G3MAC_STATUS_INVALID_INDEX</i> : ·A value out of the range was specified for attribute index. <i>R_G3MAC_STATUS_UNSUPPORTED_ATTRIBUTE</i> : ·Unsupported IB was specified. <i>R_G3MAC_STATUS_READ_ONLY</i> : ·Read only IB was specified. <i>R_G3MAC_STATUS_INVALID_STATE</i> :

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				<ul style="list-style-type: none"> • Called when UMAC is invalid state. <i>R_G3MAC_STATUS_IF_NO_RESPONSE:</i> <ul style="list-style-type: none"> • No response from LMAC layer. <i>R_ADP_STATUS_IF_NO_RESPONSE:</i> <ul style="list-style-type: none"> • No response from ADP layer. <i>R_EAP_STATUS_IF_NO_RESPONSE:</i> <ul style="list-style-type: none"> • No response from EAP layer.
	pibAttributeId	2byte	Refer to section 5.13.	The identifier of the PIB attribute to write
	pibAttributeIndex	2byte	Refer to section 5.13.	The index within the table of the specified PIB attribute to write. This parameter is valid only for MAC PIB attributes that are tables.

5.5 MLME-SCAN

5.5.1 MLME-SCAN.request

Table 5-12 shows this command format.

Table 5-12 MLME-SCAN.request Command Format

Field		Length	Valid value	Description
IDC		1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA		3bit	0x0	
IDP		4bit	0x3	
CMD		1byte	0x04	
DAT				
	scanDuration	1byte	0x01-0xFF	A value in second. This used to define the length of time to spend scanning for active scan.

5.5.2 MLME-SCAN.confirm

Table 5-13 shows this command format.

Table 5-13 MLME-SCAN.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x3	
CMD	1byte	0x04	
DAT			
status	1byte	Refer Table 5-22.	Status code. <i>R_G3MAC_STATUS_SUCCESS</i> : · Succeed. <i>R_G3MAC_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified. <i>R_G3MAC_STATUS_NO_BEACON</i> : · No beacons were received. <i>R_G3MAC_STATUS_OUT_OF_CAP</i> : · Called when there's no room in the internal buffer. <i>R_G3MAC_STATUS_SCAN_IN_PROGRESS</i> : · Called when a previously scan request operation is performing. <i>R_G3MAC_STATUS_INVALID_STATE</i> : · Called when UMAC is invalid state.
panCount	1byte	0-0xFF	Count of detected PanList
panList	Refer Table 5-14. (The number of table entry = panCount)		Detected PanList which formed as PANDescriptor table shown in Table 5-14. The number of PANDescriptor table entry is panCount.

Table 5-14 PANDescriptor Parameter

Parameter Name	Type	Range	Description
panId	uint16_t	0-0xFFFF	The PAN identifier as specified in the received beacon frame.
address	uint16_t	0-0xFFFF	The short address as specified in the received beacon frame.
linkQuality	uint8_t	0-0xFF	The LQI at which the network beacon was received. Lower values represent lower LQI
rcCoord	uint16_t	0-0xFFFF	The estimated route cost from LBA to the coordinator. It is used by the associating device to select LBA and PAN.

5.6 MLME-START

5.6.1 MLME-START.request

Table 5-15 shows this command format.

Table 5-15 MLME-START.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x3	
CMD	1byte	0x05	
DAT			
panId	2byte	0-0xFFFF	The PAN identifier to be used by the device.

5.6.2 MLME-START.confirm

Table 5-16 shows this command format.

Table 5-16 MLME-START.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x3	
CMD	1byte	0x05	
DAT			
status	1byte	Refer Table 5-22.	Status code. <i>R_G3MAC_STATUS_SUCCESS</i> : ·Succeed. <i>R_G3MAC_STATUS_INVALID_PARAMETER</i> : ·Invalid parameter was specified. <i>R_G3MAC_STATUS_NO_SHORT_ADDRESS</i> : ·Called when a short address is not allocated. <i>R_G3MAC_STATUS_INVALID_STATE</i> : ·Called when UMAC is invalid state.

5.7 MLME-BEACON-NOTIFY

5.7.1 MLME-BEACON-NOTIFY.indication

Table 5-17 shows this command format.

Table 5-17 MLME-BEACON-NOTIFY.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x3	
CMD	1byte	0x06	
DAT			
phaseDiff	1byte	0-5	The phase difference between the AC phase of the Rx node and the Tx node
panDescriptor	Refer Table 5-14. (The number of table entry = 1)		The PANDescriptor for the received beacon.

5.8 MLME-COMM-STATUS

5.8.1 MLME-COMM-STATUS.indication

Table 5-18 shows this command format.

Table 5-18 MLME-COMM-STATUS.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x3	
CMD	1byte	0x07	
DAT			
panId	2byte	0-0xFFFF	The 16-bit PAN identifier of the entity to which the MSDU is being transferred. NOTE - PAN identifier value is logically ANDed with 0xFCFF.
srcAddrMode	1byte	0,2,3	The source addressing mode for this primitive and subsequent MPDUs. This value can take one of the following values: 0x00 = no address (addressing fields omitted, see clause 7.2.1.1.8 of [IEEE 802.15.4]) 0x01 = Reserved by ITU-T 0x02 = 16-bit short address 0x03 = 64-bit extended address.
srcAddr	8byte	0-0xFFFF (srcAddrMode=0x02) 0-0xFFFFFFFFFFFFFFFF (srcAddrMode=0x03)	The individual device address of the entity to which the MSDU is being transferred.
dstAddrMode	1byte	0,2,3	The destination addressing mode for this primitive and subsequent MPDUs This value can take one of the following values: 0x00 = no address (addressing fields omitted, see clause 7.2.1.1.6 of [IEEE 802.15.4]) 0x01 = Reserved by ITU-T 0x02 = 16-bit short address 0x03 = 64-bit extended address.
dstAddr	8byte	0-0xFFFF (dstAddrMode=0x02) 0-0xFFFFFFFFFFFFFFFF (dstAddrMode=0x03)	The individual device address of the entity to which the MSDU is being transferred.
status	1byte	Refer Table 5-22.	Status code. <i>R_G3MAC_STATUS_COUNTER_ERROR</i> : · Received frame's frame counter was invalid. <i>R_G3MAC_STATUS_SECURITY_ERROR</i> : · Decryption processing of received frame failed. <i>R_G3MAC_STATUS_ALTERNATE_PANID_DETECTION</i> : · Received frame which source PANID or destination PANID is different with own PANID. · Received frame which source PANID or destination PANID is 0xFFFF.

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				<i>R_G3MAC_STATUS_UNAVAILABLE_KEY</i> : ·Unavailable key was specified.
	securityLevel	1byte	0x00 and 0x05	The security level to be used as described in clause 9.3.8.
	keyIdMode	1byte	0x01	The mode used to identify the key to be used (see clause 9.3.8). This parameter is ignored if the SecurityLevel parameter is set to 0x00.
	keySource	8byte	-	Not used.
	keyIndex	1byte	0x00-0x01	The index of the key to be used (see clause 9.3.8).

5.9 MLME-FRAMECOUNT

5.9.1 MLME-FRAMECOUNT.indication

Table 5-19 shows this command format.

Table 5-19 MLME-FRAMECOUNT.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x3	
CMD	1byte	0x08	
DAT			
frameCounter	4byte	-	Value of macFrameCounter.

5.10 MLME-TMR-RECEIVE

5.10.1 MLME-TMR-RECEIVE.indication

This command is used to notification of receiving tone map response. This command's enable/disable depends on the setting value of macTmrIndEnable of MAC PIB. The default value of macTmrIndEnable is FALSE(command disable).

Table 5-20 shows this command format.

Table 5-20 MLME-TMR-RECEIVE.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x3	
CMD	1byte	0x09	
DAT			
srcAddr	2byte	-	Source short address of received tone map response

5.11 MLME-TMR-TRANSMIT

5.11.1 MLME-TMR-TRANSMIT.indication

This command is used to notification of tone map response transmission. This command's enable/disable depends on the setting value of macTmrIndEnable of MAC PIB. The default value of macTmrIndEnable is FALSE(command disable).

Table 5-21 shows this command format.

Table 5-21 MLME-TMR-TRANSMIT.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x3	
CMD	1byte	0x0A	
DAT			
dstAddrMode	1byte	2-3	The destination addressing mode for this primitive and subsequent tone map response. This value can take one of the following values: 0x02 = 16-bit short address 0x03 = 64-bit extended address.
dstAddr	8byte	Any	Destination short address of tone map response. If dstAddrMode==0x2, dstAddr[2:7] is invalid.
pms	1byte	0-1	Payload Modulation Scheme 0: Differential 1: Coherent
mod	1byte	0-3	Defines the modulation type to use for communicating with the device. 0x00: ROBO or ROBO_coherent 0x01: DBPSK or BPSK 0x02: DQPSK or QPSK 0x03: D8PSK or 8PSK (N/A for ARIB) 0x04-0x7 : reserved

5.12 MAC Status Code

Table 5-22 shows a list of status codes of MAC Layer.

Table 5-22 MAC Status Code List

Status code	Value	Description
R_G3MAC_STATUS_SUCCESS	0x00	The requested operation was completed successfully. For a transmission request, this value indicates a successful transmission.
R_G3MAC_STATUS_COUNTER_ERROR	0xDB	The frame counter purportedly applied by the originator of the received frame is invalid.
R_G3MAC_STATUS_IMPROPER_KEY_TYPE	0xDC	The key purportedly applied by the originator of the received frame is not allowed to be used with that frame type according to the key usage policy of the recipient.
R_G3MAC_STATUS_IMPROPER_SECURITY_LEVEL	0xDD	The security level purportedly applied by the originator of the received frame does not meet the minimum security level required/expected by the recipient for that frame type.
R_G3MAC_STATUS_UNSUPPORTED_LEGACY	0xDE	The received frame was purportedly secured using security based on IEEE Std 802.15.4-2003, and such security is not supported by this standard.
R_G3MAC_STATUS_UNSUPPORTED_SECURITY	0xDF	The security purportedly applied by the originator of the received frame is not supported.
R_G3MAC_STATUS_CHANNEL_ACCESS_FAILURE	0xE1	A transmission could not take place due to activity on the channel, i.e., the CSMA-CA mechanism has failed.
R_G3MAC_STATUS_SECURITY_ERROR	0xE4	Cryptographic processing of the received secured frame failed.
R_G3MAC_STATUS_FRAME_TOO_LONG	0xE5	Either a frame resulting from processing has a length that is greater than aMaxPHYPacketSize or a requested transaction is too large to fit in the CAP or GTS.
R_G3MAC_STATUS_INVALID_HANDLE	0xE7	A request to purge an MSDU from the transaction queue was made using an MSDU handle that was not found in the transaction table.
R_G3MAC_STATUS_INVALID_PARAMETER	0xE8	A parameter in the primitive is either not supported or is out of the valid range.
R_G3MAC_STATUS_NO_ACK	0xE9	No acknowledgment was received after macMaxFrameRetries.
R_G3MAC_STATUS_NO_BEACON	0xEA	A scan operation failed to find any network beacons.
R_G3MAC_STATUS_NO_DATA	0xEB	No response data were available following a request.
R_G3MAC_STATUS_NO_SHORT_ADDRESS	0xEC	The operation failed because a 16-bit short address was not allocated.
R_G3MAC_STATUS_OUT_OF_CAP	0xED	A receiver enable request was unsuccessful because it could not be completed within the CAP.
R_G3MAC_STATUS_ALTERNATE_PANID_DETECTION	0xEE	A PAN identifier conflict has been detected and communicated to the PAN coordinator.
R_G3MAC_STATUS_UNAVAILABLE_KEY	0xF3	The key purportedly used by the originator of the received frame is not available or, if available, the originating device is not known or is blacklisted with that particular key.
R_G3MAC_STATUS_UNSUPPORTED_ATTRIBUTE	0xF4	A SET/GET request was issued with the identifier of a PIB attribute that is not supported.
R_G3MAC_STATUS_INVALID_ADDRESS	0xF5	A request to send data was unsuccessful because

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		neither the source address parameters nor the destination address parameters were present.
R_G3MAC_STATUS_INVALID_INDEX	0xF9	An attempt to write to a MAC PIB attribute that is in a table failed because the specified table index was out of range.
R_G3MAC_STATUS_LIMIT_REACHED	0xFA	A scan operation terminated prematurely because the number of PAN descriptors stored reached an Implementation specified maximum.
R_G3MAC_STATUS_READ_ONLY	0xFB	A SET/GET request was issued with the identifier of an attribute that is read only.
R_G3MAC_STATUS_SCAN_IN_PROGRESS	0xFC	A request to perform a scan operation failed because the MLME was in the process of performing a previously initiated scan operation.
R_G3MAC_STATUS_INVALID_STATE	0xFD	UMAC is in invalid state
R_G3MAC_STATUS_NO_RESPONSE	0xFF	No response from UMAC or below
R_G3MAC_STATUS_LML_ABORTED	0xC0	DATA transmission abort by timeout as success (time out time is define PIB macXXXTxTimeout)
R_G3MAC_STATUS_LML_NO_ACK	0xC1	No acknowledge was received on LMAC or below (the status never issued above MAC)
R_G3MAC_STATUS_LML_CSMA_FAILURE	0xC2	CSMA/CA failure (too many backoff) on LMAC or below (the status never issued above MAC)
R_G3MAC_STATUS_LML_BUFFER_FULL	0xC4	Buffer for frame transmission full on LMAC or below (the status never issued above MAC)
R_G3MAC_STATUS_LML_INVALID_REQ	0xC5	Invalid request received on LMAC or below (the status never issued above MAC)
R_G3MAC_STATUS_LML_TOO_FEW_SC	0xC6	Too few sub-carriers for a transmission
R_G3MAC_STATUS_LML_ABORT_ERROR	0xCD	DATA transmission abort by timeout as failure (time out time is define PIB macXXXTxTimeout)
R_G3MAC_STATUS_LML_NO_RESPONSE	0xCE	no response from LMAC or below
R_G3MAC_STATUS_LML_FAILURE	0xCF	unknown error occur on LMAC or below
R_G3MAC_STATUS_INSUFFICIENT_MEMSIZE	0xA0	error caused by allocated memory is not enough
R_G3MAC_STATUS_IF_NO_RESPONSE	0xA1	Request failure caused by no response from lower layer.

5.13 MAC PIB Attribute

5.13.1 MAC PIB Attribute Compliant for G.9903

Table 5-23 shows a list of MAC PIB Attribute compliant for G.9903.

Table 5-23 MAC PIB Attribute List Compliant for G.9903

Attribute	ID	Type	R W	Range	Description	Default
macAckWaitDuration	0x0040	uint8_t	rw	0x0-0xFF	It specifies the offset time of Ack Wait Duration from the beginning of CFS in symbol.	0
macMaxBE	0x0047	uint8_t	rw	0-20	Maximum value of back-off exponent. It should always be greater than macMinBE	8
macBSN	0x0049	uint8_t	rw	0x0-0xFF	Beacon frame sequence number	random
macDSN	0x004C	uint8_t	rw	0x0-0xFF	Data frame sequence number	random
macMaxCSMABackoffs	0x004E	uint8_t	rw	0x0-0xFF	Maximum number of back-off attempts	50
macMinBE	0x004F	uint8_t	rw	0-20	Minimum value of back-off exponent	3
macPanId	0x0050	uint16_t	rw	0x0-0xFFFF	PAN ID	0xFFFF
macPromiscuousMode	0x0051	uint8_t	rw	TRUE - FALSE	Promiscuous mode. FALSE:promiscuous mode off TRUE(or except 0):promiscuous mode on Refer section 10 for detailed.	FALSE
macShortAddress	0x0053	uint16_t	rw	0x0-0xFFFF	Device short address	0xFFFF
macMaxFrameRetries	0x0059	uint8_t	rw	0-10	Maximum number of retransmission	5
macTimeStampSupported	0x005C	uint8_t	r	-	MAC frame time stamp support enable	TRUE
macSecurityEnabled	0x005D	uint8_t	rw	TRUE - FALSE	Security enabled FALSE:security disabled TRUE(or except 0):security enabled.	TRUE
macKeyTable	0x0071	table	w	-	This attribute holds GMK keys required for MAC layer ciphering. The attribute can hold two 16-byte keys. The row index corresponds to the key identifier value. For security reason, the key entries cannot be read, only written or deleted. Refer Table 5-28.	Empty

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macDeviceTable	0x0073	table	rw	-	A table of DeviceDescriptor entries, each indicating a remote device with which this device securely communicates. Write accesses are process to clear the entry. If AttributeIndex equal to macDeviceTableSize, All entries are cleared. Refer Table 5-27.	Empty
macFrameCounter	0x0077	uint32_t	rw	0x00000000-0xFFFFFFFF	The outgoing frame counter for this device	0x00000000
macHighPriorityWindowSize	0x0100	uint8_t	rw	0x01-0x07	The high priority contention window size in number of slots. Default value is 7'saSlotTime	7
macTxDataPacketCount	0x0101	uint32_t	r	0-0xFFFFFFFF	Statistic counter of successfully transmitted unicast MSDUs	0
macRxDataPacketCount	0x0102	uint32_t	r	0-0xFFFFFFFF	Statistic counter of successfully received unicast MSDUs	0
macTxCmdPacketCount	0x0103	uint32_t	r	0-0xFFFFFFFF	Statistic counter of successfully transmitted command packets	0
macRxCmdPacketCount	0x0104	uint32_t	r	0-0xFFFFFFFF	Statistic counter of successfully received command packets	0
macCSMAFailCount	0x0105	uint32_t	r	0-0xFFFFFFFF	Counts the number of times the CSMA back-offs reach macMaxCSMABackoffs	0
macCSMAAckCount	0x0106	uint32_t	r	0-0xFFFFFFFF	Counts the number of times an ACK is not received while transmitting a unicast data frame (The loss of ACK is attributed to collisions)	0
macRxDataBroadcastCount	0x0107	uint32_t	r	0-0xFFFFFFFF	Statistic counter of successfully received broadcast frames	0
macTxDataBroadcastCount	0x0108	uint32_t	r	0-0xFFFFFFFF	Statistic counter of the number of broadcast frames sent	0
macBadCRCCount	0x0109	uint32_t	r	0-0xFFFFFFFF	Statistic counter of the number of frames received with bad CRC	0
macNeighbourTable	0x010A	table	rw	-	The neighbour table defined in clause 9.3.7.2 of [G3PLC Alliance, March 2017]. Refer Table 5-26.	Empty

macCSMAFairnessLimit	0x010C	uint8_t	rw	(2 × (macMaxBE - macMinBE)) - 255	Channel access fairness limit. Specifies how many failed back-off attempts, back-off exponent is set to minBE	25
macTMRTTL	0x010D	uint32_t	rw	0-255	Maximum time to live of tone map parameters entry in the neighbour table in minutes	10
macPOSTableEntryTTL	0x010E	uint32_t	rw	0-255	Maximum time to live for an entry in the neighbour table in minutes	255
macRCCoord	0x010F	uint16_t	rw	0-65535	Route cost to coordinator to be used in the beacon payload as RC_COORD	0x7FFF
macToneMask	0x0110	uint8_t[9]	rw	0x0-0xFFFFFFFF FFFFFFFFFFFF	Defines the tone mask to use during symbol formation. It is stored in big-endian as follows: TM[0] = sc[71] (MSB) - sc[64] (LSB) TM[1] = sc[63] (MSB) - sc[56] (LSB) TM[2] = sc[55] (MSB) - sc[48] (LSB) TM[3] = sc[47] (MSB) - sc[40] (LSB) TM[4] = sc[39] (MSB) - sc[32] (LSB) TM[5] = sc[31] (MSB) - sc[24] (LSB) TM[6] = sc[23] (MSB) - sc[16] (LSB) TM[7] = sc[15] (MSB) - sc[8] (LSB) TM[8] = sc[7] (MSB) - sc[0] (LSB) sc[0] is a sub-carrier of the lowest frequency.	0x00000000 FFFFFFFF for the CENELEC A bandplan; 0x00000000 00000000 for the CENELEC B bandplan; 0x00003FFFF FFFFFFFF for the ARIB bandplan; 0xFFFFFFFF FFFFFFFF for the FCC bandplan
macBeaconRandomizationWindowLength	0x0111	uint8_t	rw	0-255	Duration time in seconds for beacon randomization.	12
macA	0x0112	uint8_t	rw	3 to 20	This parameter controls the adaptive CW linear decrease	8
macK	0x0113	uint8_t	rw	1- macCSMAFairnessLimit	Rate adaptation factor for channel access fairness limit	5
macMinCWattempts	0x0114	uint8_t	rw	0-0xFF	Number of consecutive attempts while using minimum CW	10
macCENELECLegacyMode	0x0115	uint8_t	r	0-255	This read only attribute indicates the capability of the node. See Table 9-16.of	1

5. Command Specification for UMAC Layer

					[G3PLC Alliance, April 2015]	
macFCCLegacyMode	0x0116	uint8_t	r	0-255	This read only attribute indicates the capability of the device. See Table 9-17 of [G3PLC Alliance, April 2015]	1
macBroadcastMaxCWenable	0x011E	uint8_t	rw	TRUE - FALSE	If enabled, MAC uses maximum contention window for transmitting normal priority broadcast packets	FALSE
macTransmitAtten	0x011F	uint8_t	rw	0-25	Attenuation of the output level in dB	0
macPOSTable	0x0120	table	rw	-	The POS table.	empty

5.13.2 MAC PIB Attribute Renesas Original

Table 5-24 shows a list of MAC PIB Attribute Renesas original.

Table 5-24 MAC PIB Attribute RENESAS Original List

Attribute	ID	Type	R W	Range	Description	Default
macCoherentTransmission	0x0800	uint8_t	rw	0-2 for CENELEC and FCC, 0 for ARIB	0: Only differential modulation scheme shall be set in tone map response. 1: Only coherent modulation scheme shall be set in tone map response. 2: Either different or coherent modulation scheme may be set in tone map response.	0
macNeighbourTableSize	0x0801	uint16_t	r	0-0x600	The number of elements for POS and Neighbour table entries (neighbourTableSize = POS Table + macMinNeighbourTableEntries)	-
macDeviceTableSize	0x0802	uint16_t	r	0-0x600	The total number of macDeviceTable.	-
macValidNeiTableEntries	0x0804	uint16_t	r	0-0x600	Indicates the number of valid Neighbour Table Entries.	0
macValidDevTableEntries	0x0805	uint16_t	r	0-0x600	Indicates the number of valid Device Table Entries.	0
macNeighbourTableByShortAddr	0x0806	table	rw	-	Case of MLME-GET: MLME-GET.confirm return the Neighbour Entry which is corresponding to given short address by PIBAttributeIndex. If entry is not found, MLME-GET.confirm return NO_SHORT_ADDRESS. Case of MLME-SET: If entry(PIBAttributeIndex) is found, over write PIBAttributeValue to the entry. Else if the entry is not found, write PIBAttributeValue to the index which is empty index or oldest index(if all entry valid). Refer Table 5-26.	-
macKeyValidate	0x0807	table	rw	-	Indication of whether the Key is valid for each key index of IBAttributeIndex. A value of TRUE(or except 0) indicates that the Key is valid, while a value of FALSE indicates that the Key is invalid. Refer Table 5-29.	Empty
macExtAddress	0x0808	uint8_t[8]	r	0-0xFFFFFFFFFFFFFFFF	The 64-bit address of the coordinator through which the device is associated.	0
macSoftVersion	0x0809	table	r	-	Refer Table 5-30.	-
macUnicastDataTxTimeout	0x080A	uint8_t	rw	1-255	Timeout period in seconds for unicast MCPS-DATA.request.	30

5. Command Specification for UMAC Layer

macBroadcastDataTxTimeout	0x080B	uint8_t	rw	1-255	Timeout period in seconds for broadcast MCPS-DATA.request.	30
macBeaconRequestTxTimeout	0x080C	uint8_t	rw	1-255	Timeout period in seconds for Sending of Beacon Request Frame	30
macTxGain	0x080D	uint8_t	rw	0-21	Attenuate level from Maximum Tx Power setting in dB 0 : Maximum output level (MOL) n : MOL-ndB	0
macFrameCountIndicationInterval	0x080E	uint32_t	rw	0-0xFFFFFFFF	Interval of MLME-FRAMECOUNT.indication 0: off other if(++macFrameCounter % macFrameCountIndicationInterval) == 0 MLME-FRAMECOUNT.indication callback	0
macDeviceTableByShortAddr	0x080F	table	r	-	MLME-GET.confirm returns the DeviceTable Entry which is corresponding to given short address by PIBAttributeIndex. If entry is not found, MLME-GET.confirm returns NO_SHORT_ADDRESS. Refer Table 5-27.	-
macNeighbourIndexByShortAddr	0x0810	uint16_t	r	0-0xFFFF	MLME-GET.confirm returns the index of Neighbour table entry which is corresponding to given short address by PIBAttributeIndex. If entry is not found, MLME-GET.confirm returns NO_SHORT_ADDRESS.	-
macDeviceIndexByShortAddr	0x0811	uint16_t	r	0-0xFFFF	MLME-GET.confirm returns the index of Device table entry which is corresponding to given short address by PIBAttributeIndex. If entry is not found, MLME-GET.confirm returns NO_SHORT_ADDRESS.	-
macValidPosTableEntries	0x0812	uint16_t	r	0-0x600	Indicates the number of POS Table Entries which is posValidTime > 0.	0
macPosTableByShortAddr	0x0813	table	rw	0-0xFFFF	Case of MLME-GET: MLME-GET.confirm return the POS table Entry which is corresponding to given short address by PIBAttributeIndex. If entry is not found, MLME-GET.confirm return NO_SHORT_ADDRESS. This IB may include that posValidTime=0 entry. Case of MLME-SET:	-

5. Command Specification for UMAC Layer

					If entry(PIBAAttributeIndex) is found, over write PIBAttributeValue to the entry. Else if the entry is not found, write PIBAttributeValue to the index which is empty index or oldest index(if all entry valid).	
macTmrIndEnable	0x0814	uint8_t	rw	TRUE - FALSE	If TRUE, MAC enabled issue MLME-TMR-RECEIVE.indication and MLME-TMR-TRANSMIT.indication	FALSE
macKeepModRetryNum	0x0815	uint8_t	rw	0x00-0xFF	If 0, keep the modulation during MAC retransmission. (This is for testing purpose.) If N, decrease modulation during MAC retransmission from retry count=N Then last retransmission use robust modulation.	4
macNeiUpdateAfterRetransmit	0x0816	uint8_t	rw	TRUE - FALSE	If TRUE, update modulation of the related neighbour after retransmission successful.	TRUE
macCommStatusIndMask	0x0817	uint8_t	rw	0x00-0xFF	Bit mask to control MLME-COMM-STATUS.indication per status. 0: issued the status 1:no issuer the status bit0: COUNTER_ERROR bit1:SECURITY_ERROR bit2:ALTERNATE_PANID_DETECTION bit3:UNAVAILABLE_KEY ex) 0x06: SECURITY_ERROR and ALTERNATE_PANID_DETECTION are masked	0x00
macTMRReqLeadTimeBeforeTTL	0x0818	uint32_t	rw	0-255	0:TMR=1 set only when TMRValidTime expired. >0: TMR=1 set when (TMRValidTime – macTMRReqLeadTimeBeforeTTL) expired. This variable should be lower than macTMRReqLeadTimeBeforeTTL.	0
macMinNeiTableEntries	0x0819	uint16_t	rw	0-macNeighbourTableSize	This defines the minimum number of neighbour table entries which are stored in the neighbour table. The Neighbour table and POS table share the same entries in the Neighbour Table, if the Neighbour table is fully populated then macMinNeighbourTableEntries defines the minimum number of neighbour table elements. If the table is not fully populated then all POS elements and / or Neighbour	macNeighbourTableSize

5. Command Specification for UMAC Layer

					table elements are kept.	
macOffsetSnr	0x081A	int8_t	rw	-128 to 127	The offset value for SNR of subcarriers in dB. This value is used for generating tone map response only.	CENELEC A:-3 CENELEC B:-3 ARIB:-6 FCC:-6
macThreshCarrierNum	0x081B	uint8_t	rw	0-255	The threshold of the number of subcarriers. This value is used for generating tone map response.	CENELEC A:12 CENELEC B:8 ARIB:18 FCC:24
macThreshToneNumPerMap	0x081C	uint8_t	rw	0-255	The threshold of tones(subcarrier) number for judging whether the tonemap active or not. If "valid tone number" >= macThreshToneNumPerMap, the tonemap use as active. If macThreshToneNumPerMap = 0, tonemap of tonemap response is always full active. This value is used for generating tone map response.	CENELEC A:2 CENELEC B:1 ARIB:1 FCC:1
macThreshSnrDifferential	0x081D	int8_t	rw	-32.0 to 31.75	The threshold of snr of subcarriers in dB per modulation types of differential. The modulation type is indicated by index. index0:ROBO index1:DBPSK index2:DQPSK index3:D8PSK(except ARIB) The resolution is 0.25dB. 0x10 : 4.0dB 0x01: 0.25dB 0x80: -32dB This value is used for generating tone map response.	CENELEC A ROBO:1.5 DBPSK:3.75 DQPSK:7 D8PSK:9.75 CENELEC B ROBO:4 DBPSK:15.25 DQPSK:17.25 D8PSK:19.75 ARIB ROBO:1.5 DBPSK:3.25 DQPSK:6.5 FCC ROBO:1.5 DBPSK:3.5 DQPSK:7.25 D8PSK:11
macThreshSnrCoherent	0x081E	int8_t	rw	-32.0 to 31.75	The threshold of snr of subcarriers in dB per modulation types of coherent. The modulation type is indicated by index. index0:ROBO(C) index1:BPSK index2:QPSK index3:8PSK The resolution is 0.25dB. 0x10 : 4.0dB 0x01: 0.25dB 0x80: -32dB This value is used for generating tone map response.	CENELEC A ROBO(C):1.75 BPSK:2.75 QPSK:5 8PSK:8.75 CENELEC B ROBO(C):5.25 BPSK:17 QPSK:17.25 8PSK:19.5 FCC ROBO(C): 1.5 BPSK:2.75

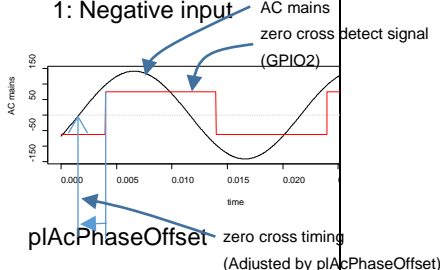
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						QPSK:6.25 8PSK:9.25									
macDisableBeacon	0x0821	uint8_t	rw	TRUE - FALSE	If TRUE, disable beacon transmission after receiving beacon request.	FALSE									
macDisableTmRes	0x0822	uint8_t	rw	TRUE - FALSE	If TRUE, disable tonemap response transmission after receiving beacon request.	FALSE									
macRefRSSIdB	0x0823	uint8_t	rw	any	This value is optimum value of RSSI for CPX3.	160									
macDisableTxGainTmr	0x0824	uint8_t	rw	TRUE - FALSE	If FALSE, enable adjust TxGain on tonemap response.	TRUE									
macStatistics	0x0850	table	r	-	Statistics information of upper mac layer. The structure of each elements are defined as "uint8_t[4]" This information does not cleared by MLME-RESET. If user wants to clear the info, it should be call G3-CLEARINFO or G-INIT. Refer Table 5-31.	Empty									
pITxPower	0x8340	uint8_t	rw	0 to 21	The base power related to a PLC board. It is chosen so that the spectrum of the transmitted signal with maximum TxGain or pITxAckGain can comply with the spectrum regulation.	CENELEC A:12 CENELEC B:12 ARIB:18 FCC:18									
pITxFilterScale	0x8341	uint16_t	rw	0x0000 - 0xFFFF	It is a scaling factor for transmission signal which applied at the outputinput of the digital filter embedded in CPX3. It is specified with pITxPower.	CENELEC A:0x0E31 CENELEC B:0x0FED ARIB:0x01C9 FCC:0x0268									
pITxDigitalPreambleGain	0x8342	int8_t	rw	-18 to 30	It is a scaling factor for Preamble signal applied to the signal output from IFFT. It is specified with pITxPower.	CENELEC A:28 CENELEC B:28 ARIB:25 FCC:25									
pITxDigitalGain	0x8343	int8_t	rw	-18 to 30	It is a scaling factor for a packet signal after preamble applied to the signal output from IFFT. IT is specified with pITxPower.	CENELEC A:25 CENELEC B:25 ARIB:22 FCC:22									
pITxEnbPolarity	0x8344	uint8_t	rw	0-1	It specifies the polality of Tx enable signal (TxEnb) for a Tx driver outside CPX3. 0: <table><tr><td></td><td>Tx driver on</td><td>Tx driver off</td></tr><tr><td>TxEnb (GPIO14)</td><td>Low</td><td>High</td></tr></table> 1: <table><tr><td></td><td>Tx driver</td><td>Tx driver</td></tr></table>		Tx driver on	Tx driver off	TxEnb (GPIO14)	Low	High		Tx driver	Tx driver	0
	Tx driver on	Tx driver off													
TxEnb (GPIO14)	Low	High													
	Tx driver	Tx driver													

5. Command Specification for UMAC Layer

					<table><tr><td></td><td>on</td><td>off</td></tr><tr><td>TxEnb (GPIO14)</td><td>High</td><td>Low</td></tr></table>		on	off	TxEnb (GPIO14)	High	Low	
	on	off										
TxEnb (GPIO14)	High	Low										
plTxWaitTime	0x8345	uint8_t	rw	0-100	Specify time to wait after TXEN in usec. Value: 0 to 100 (0usec to 100usec)	0						
plTxBreak	0x8346	uint8_t	rw	Only 0xFF and 0x07(GPIO7) are valid.	It specifies the GPIO number which is used for force-stopbreaking of transmission in such a case case of as overload of Tx driver. 0xFF: Tx abortBreak is not used. Other: GPIO number (Only 0x07 is valid) The polarity of TxBreak signal (currently only GPIO7 is valid) is: Low: Tx is stopped. High: Normal Tx.	0xFF						
plTxAckGain	0x8347	uint8_t	rw	0-21	Specifies the transmission gain for ACK frame in dB. 0 : Maximum output level (MOL) n : MOL-ndB [n=3,6,9,12,15,18,21] Other values: Not used. (It is available for each of 2 channels)	0						
plSATTCtrlDisable	0x8348	uint8_t	rw	0-1	It specifies the usage of the step attenuator. 0: Use SATT 1: Not use SATT	0						
plAcPhaseOffset	0x8349	int16_t	rw	-10000 to 10000	This offset is used to adjust the mismatch between the actual zero cross timing and the rising/falling (it can be selected by 'plZcdInPolarity') edge of zero cross signal (GPIO2) produced by a zero cross detector. Unit is usec. In case that the delay from the zero cross timing of AC mains to the edge of the signal input to CPX3 (GPIO2) is 1ms, plAcPhaseOffset should be set -1000 (0xfc18).	0						
plStatistics	0x834A	uint32_t	rw	any	One of the following 7 values is read. Which element to be read is specified by Index parameter of SET/GET request as follows, 0: stats_num_frames_snd 1: stats_num_frames_rcv	0						

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					2: stats_num_synchm 3: stats_num_fch_ok 4: stats_num_fch_error 5: status_num_machdr_error 6: status_num_fcs_error 7: num_overwrite (A lack of processing) 8: stats_num_ack_snd 9: stats_num_nack_snd 10: stats_num_ack_rcv 11: stats_num_nack_rcv	
plTxRxDisable	0x834B	uint8_t	rw	0-1	This parameter used to disable/enable Tx and Rx together. To disable Tx, plTxFilterScale will be set to 0 internally and also TXEN signal set to be always disable. To disable Rx, plRxFilterScale will be set to 0 internally. 0: Enable Tx and Rx 1: Disable Tx and Rx plTxFilterScale or plRxFilterScale which is set during disabling of Tx and Rx will be restored when Tx and Rx are enabled again.	0
plZcdInPolarity	0x834D	uint8_t	rw	0-1	It specifies the polarity of zero cross detect signal input to zero cross input (GPIO2). 0: Normal input 1: Negative input  <p>Normal input case</p>	0
plTPgaCAj	0x834F	uint8_t	rw	0-7	It specifies a setting of TPGACAJ register. TPGACAJ register is used to adjust current of TX PGA inside CPX3. When a CPX3 is used without an external power amplifier, it is necessary to set the register.	0
plSATTPolarity	0x8350	uint8_t	rw	0-1	It specifies a polarity of SATT (Step Attenuator) control signal. 0: negative logic Low: SATT on High: SATT off 1: positive logic Low: SATT off High: SATT on	1

5.13.3 MAC Table Definition for MAC IB Attribute

(1) macPosTable

Table 5-25 shows parameter of macPosTable. The number of entry of this table is depended on macNeighbourTableSize in G3-INIT.request parameter.

Table 5-25 macPosTable Parameter

Parameter Name	Type	Description
shortAddress	uint8_t[2]	The MAC Short Address of the node which this entry refers to.
fwdLqi	uint8_t	Link Quality Indicator which updated upon reception of Data packet from related neighbour
posValidTime	uint8_t[4]	Remaining time in minutes until when this entry is considered valid. Every time an entry is created, it is set to macPosTableEntryTTL. When it reaches zero, this entry is no longer valid in the table and may be removed.

(2) macNeighbourTable

Table 5-26 shows parameter of macNeighbourTable. The number of entry of this table is depended on G3-INIT.request parameter.

Table 5-26 macNeighbourTable Parameter

Parameter Name	Type	Bit	Description
txGain	uint8_t	4	Desired Transmitter gain specifying how many gain steps are requested.
txRes		1	Defines the Tx Gain resolution corresponding to one gain step. 0 : 6 dB 1 : 3 dB
rsv		3	Reserved
shortAddress	uint8_t[2]	-	The MAC Short Address of the node which this entry refers to.
tonemap	uint8_t[3]	-	The Tone Map parameter defines which frequency sub-band can be used for communication with the device. A bit set to 1 means that the frequency sub-band can be used, and a bit set to 0 means that frequency sub-band shall not be used.
pms	uint8_t	1	Payload Modulation Scheme 0: Differential 1: Coherent The coherent scheme is optional.
phaseDiff		3	The phase difference between the AC phase of the local node and the neighbour node
rsv		1	Reserved
modType		3	Defines the modulation type to use for communicating with the device. 0x00: ROBO or ROBO coherent 0x01: DBPSK or BPSK 0x02: DQPSK or QPSK 0x03: D8PSK or 8PSK (N/A for ARIB) 0x04-0x7 : reserved
tmrValidTime	uint8_t[4]	-	Remaining time in minutes until which the Tone Map Response parameters in the neighbour table are considered valid. - When an entry is created, this value shall be set to the default value. - When it reaches 0, a tone map request may be issued if data is sent to this device. Upon successful receipt of a tone map response, this value is set to macTMRRTTL

revLQI	uint8_t	-	Link Quality Indicator
txCoeff	uint8_t[6]	-	Specifies the number of gain steps requested for the tones represented
fwdLQI	uint8_t	-	Link Quality Indicator which updated upon reception of Data packet from related neighbour

(3)macDeviceTable

Table 5-27 shows parameter of macDeviceTable. The number of entry of this table is depended on G3-INIT.request parameter.

Table 5-27 macDeviceTable Parameter

Parameter Name	Type	Description
srcAddr	uint16_t	The 16-bit Short Address of incoming frame.
frameCounter	uint8_t[4]	Record FrameCounter which is included in each incoming secured frame.
updateTime	uint8_t[4]	Record latest time, when receive secured frame from srcAddr.

(4)macKeyTable

Table 5-28 shows parameter of macKeyTable. The number of entry of this table is 2.

Table 5-28 macKeyTable Parameter

Parameter Name	Type	Description
key	uint8_t[16]	128bit key

(5)macKeyValidTable

Table 5-29 shows parameter of macKeyValidTable. The number of entry of this table is 2.

Table 5-29 macKeyValidTable Parameter

Parameter Name	Type	Description
keyState	uint8_t	0:invalid 1:valid

(6)macSoftVersion

Table 5-30 shows parameter of macSoftVersion.

Table 5-30 macSoftVersion Parameter

Parameter Name	Type	Description
macVersion	uint8_t[2]	version for MAC
dspVersion	uint8_t[2]	version for DSP(LMAC and PHY)

(7)macStatistics

Table 5-31 shows parameter of macStatistics.

Table 5-31 macStatistics List

name	index	description
R_G3MAC_STATS_TXDATAPACKETCOUNT	0	The number of successfully transmitted unicast MSDUs
R_G3MAC_STATS_RXDATAPACKETCOUNT	1	The number of successfully received unicast MSDUs
R_G3MAC_STATS_TXCMDPACKETCOUNT	2	The number of successfully transmitted command packets
R_G3MAC_STATS_RXCMDPACKETCOUNT	3	The number of successfully received command packets
R_G3MAC_STATS_CSMAFAILCOUNT	4	The number of the CSMA back-offs reach macMaxCSMABackoffs
R_G3MAC_STATS_CSMANOACKCOUNT	5	The number of an ACK is not received while transmitting a unicast data and cmd frame (The loss of ACK is attributed to collisions)
R_G3MAC_STATS_RXDATABROADCASTCOUNT	6	The number of successfully received broadcast frames
R_G3MAC_STATS_TXDATABROADCASTCOUNT	7	The number of broadcast frames sent
R_G3MAC_STATS_BADCRC	8	The number of frames received with bad CRC
R_G3MAC_STATS_ALL_IN_RECEIVES	9	The number of received all kind of packet from LMAC
R_G3MAC_STATS_ALL_IN_DISCARDS	10	The number of received packet from LMAC discarded y parameter error.
R_G3MAC_STATS_ALL_OUT_TRANSMITS	11	The number of MSDU supplied to the lower layers for transmission.
R_G3MAC_STATS_ALL_OUT_SUCCESS	12	The number of MSDU supplied to the lower layers for transmission as success.
R_G3MAC_STATS_ALL_OUT_FAILURE	13	The number of MSDU supplied to the lower layers for transmission as failure.
R_G3MAC_STATS_ALL_OUT_FAILURE_LR	14	The number of MSDU supplied to the lower layers for transmission as NackRetryOver.
R_G3MAC_STATS_DATA_IN_RECEIVES	15	The number of received MSDU except broadcast.
R_G3MAC_STATS_DATA_IN_RECEIVES_BCAST	16	The number of received MSDU as broadcast.
R_G3MAC_STATS_DATA_IN_REASM_REQDS	17	The number of received MSDU segment reassembled.
R_G3MAC_STATS_DATA_IN_REASM_DISCARDS	18	The number of received MSDU segment discard.
R_G3MAC_STATS_DATA_IN_REASM_OKS	19	The number of received MSDU segment reassembled successfully.
R_G3MAC_STATS_DATA_IN_DISCARDS_DEVICETABLE	20	The number of received MSDU discarded by device table's filter.
R_G3MAC_STATS_DATA_IN_DISCARDS_SECURITY	21	The number of received MSDU discarded by decrypt error.
R_G3MAC_STATS_DATA_IN_DELIVERS_UNICAST	22	The number of received MSDU unicast packets successfully delivered.
R_G3MAC_STATS_DATA_IN_DELIVERS_BCAST	23	The number of received MSDU broadcast packets successfully delivered.
R_G3MAC_STATS_DATA_OUT_TRANSMITS	24	The number of MSDU unicast data packet supplied to the lower layers for transmission.
R_G3MAC_STATS_DATA_OUT_TRANSMITS_BCAST	25	The number of MSDU broadcast data packet supplied to the lower layers for transmission.
R_G3MAC_STATS_DATA_OUT_RETRANSMISSION	26	the number of MSDU unicast data packet supplied to the lower layers only for retransmission
R_G3MAC_STATS_DATA_OUT_SUCCESS	27	The number of MSDU unicast data packet supplied to the lower layers for transmission as success.

R_G3MAC_STATS_DATA_OUT_FAILURE	28	The number of MSDU broadcast data packet supplied to the lower layers for transmission as success.
R_G3MAC_STATS_DATA_OUT_BCAST_SUCCESS	29	The number of MSDU unicast data packet supplied to the lower layers for transmission as failure.
R_G3MAC_STATS_DATA_OUT_BCAST_FAILURE	30	The number of MSDU broadcast data packet supplied to the lower layers for transmission as failure.
R_G3MAC_STATS_CMD_IN_BCNREQ	31	The number of received MAC beacon request packet.
R_G3MAC_STATS_CMD_IN_BCN	32	The number of received MAC beacon packet.
R_G3MAC_STATS_CMD_IN_TMREQ	33	The number of received MSDU packet with tmr=1.
R_G3MAC_STATS_CMD_IN_TMRES	34	The number of received MAC tonemap response packet.
R_G3MAC_STATS_CMD_OUT_BCNREQ_TRANSMITS	35	The number of MAC beacon request packet supplied to the lower layers for transmission.
R_G3MAC_STATS_CMD_OUT_BCNREQ_SUCCESS	36	The number of MAC beacon request packet supplied to the lower layers for transmission as success.
R_G3MAC_STATS_CMD_OUT_BCNREQ_FAILURE	37	The number of MAC beacon request packet supplied to the lower layers for transmission as failure.
R_G3MAC_STATS_CMD_OUT_BCN_TRANSMITS	38	The number of MAC beacon packet supplied to the lower layers for transmission.
R_G3MAC_STATS_CMD_OUT_BCN_SUCCESS	39	The number of MAC beacon packet supplied to the lower layers for transmission as success.
R_G3MAC_STATS_CMD_OUT_BCN_FAILURE	40	The number of MAC beacon packet supplied to the lower layers for transmission as failure.
R_G3MAC_STATS_CMD_OUT_TMRES_TRANSMITS	41	The number of MAC tonemap response packet supplied to the lower layers for transmission.
R_G3MAC_STATS_CMD_OUT_TMRES_SUCCESS	42	The number of MAC tonemap response packet supplied to the lower layers for transmission as success.
R_G3MAC_STATS_CMD_OUT_TMRES_FAILURE	43	The number of MAC tonemap response packet supplied to the lower layers for transmission as failure.
R_G3MAC_STATS_MCPS_DATA_REQD	44	The number of received MCPS-DATA.request
R_G3MAC_STATS_MCPS_DATA_SUCCESS	45	The number of received MCPS-DATA.confirm as success
R_G3MAC_STATS_MCPS_DATA_FAILURE	46	The number of received MCPS-DATA.confirm as failure
R_G3MAC_STATS_MCPS_DATA_FAILURE_NOACK	47	The number of received MCPS-DATA.confirm as failure which status is NOACK.
R_G3MAC_STATS_MCPS_DATA_FAILURE_CSMAFAILURE	48	The number of received MCPS-DATA.confirm as failure which status is CSMA FAILURE
R_G3MAC_STATS_MCPS_DATA_FAILURE_LMLABORT	49	The number of received MCPS-DATA.confirm as failure which status is timeout by maxXXXDataTxTimeout.
R_G3MAC_STATS_MCPS_DATA_IND	50	The number of issued MCPS-DATA.indication
R_G3MAC_STATS_MCPS_TMR_RECEIVE_IND	51	The number of issued MLME-TMR_RECEIVE.indication
R_G3MAC_STATS_MCPS_TMR_TRANSMIT_IND	52	The number of issued MLME-TMR_TRANSMIT.indication
R_G3MAC_STATS_MCPS_SUCCESS_UC_ROBUST	53	The number of transmission success in unicast with robust modulation.
R_G3MAC_STATS_MCPS_SUCCESS_UC_BPSK	54	The number of transmission success in unicast with BPSK modulation.
R_G3MAC_STATS_MCPS_SUCCESS_UC_QPSK	55	The number of transmission success in unicast with QPSK modulation.
R_G3MAC_STATS_MCPS_SUCCESS_UC_8PSK	56	The number of transmission success in unicast with 8PSK modulation.
R_G3MAC_STATS_MCPS_FAILURE_UC_ROBUST	57	The number of transmission failure in unicast

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		with robust modulation.
R_G3MAC_STATS_MCPS_FAILURE_UC_BPSK	58	The number of transmission failure in unicast with BPSK modulation.
R_G3MAC_STATS_MCPS_FAILURE_UC_QPSK	59	The number of transmission failure in unicast with QPSK modulation.
R_G3MAC_STATS_MCPS_FAILURE_UC_8PSK	60	The number of transmission failure in unicast with 8PSK modulation.
R_G3MAC_STATS_MCPS_SUCCESS_CSMA_NPCW3	61	The number of transmission success with back-off exponent of Normal contention window size = 3 (1~8)
R_G3MAC_STATS_MCPS_SUCCESS_CSMA_NPCW4	62	The number of transmission success with back-off exponent of Normal contention window size = 4
R_G3MAC_STATS_MCPS_SUCCESS_CSMA_NPCW5	63	The number of transmission success with back-off exponent of Normal contention window size = 5
R_G3MAC_STATS_MCPS_SUCCESS_CSMA_NPCW6	64	The number of transmission success with back-off exponent of Normal contention window size = 6
R_G3MAC_STATS_MCPS_SUCCESS_CSMA_NPCW7	65	The number of transmission success with back-off exponent of Normal contention window size = 7
R_G3MAC_STATS_MCPS_SUCCESS_CSMA_NPCW8	66	The number of transmission success with back-off exponent of Normal contention window size = 8
R_G3MAC_STATS_MCPS_SUCCESS_CSMA_NPCW9	67	The number of transmission success with back-off exponent of Normal contention window size = 9
R_G3MAC_STATS_MCPS_SUCCESS_CSMA_NPCW10	68	The number of transmission success with back-off exponent of Normal contention window size = 10
R_G3MAC_STATS_MCPS_FAILURE_CSMA_NPCW3	69	The number of transmission failure with back-off exponent of Normal contention window size = 3
R_G3MAC_STATS_MCPS_FAILURE_CSMA_NPCW4	70	The number of transmission failure with back-off exponent of Normal contention window size = 4
R_G3MAC_STATS_MCPS_FAILURE_CSMA_NPCW5	71	The number of transmission failure with back-off exponent of Normal contention window size = 5
R_G3MAC_STATS_MCPS_FAILURE_CSMA_NPCW6	72	The number of transmission failure with back-off exponent of Normal contention window size = 6
R_G3MAC_STATS_MCPS_FAILURE_CSMA_NPCW7	73	The number of transmission failure with back-off exponent of Normal contention window size = 7
R_G3MAC_STATS_MCPS_FAILURE_CSMA_NPCW8	74	The number of transmission failure with back-off exponent of Normal contention window size = 8
R_G3MAC_STATS_MCPS_FAILURE_CSMA_NPCW9	75	The number of transmission failure with back-off exponent of Normal contention window size = 9
R_G3MAC_STATS_MCPS_FAILURE_CSMA_NPCW10	76	The number of transmission failure with back-off exponent of Normal contention window size = 10
	77-82	Reserved.

6. Command Specification of ADP Layer

This section explains about details of command specification of ADP Layer.

Table 6-1 shows a command list of ADP Layer.

Availability of these functions by each G3 Configuration Mode is described in section 2.3.

Table 6-1 ADP Layer Command List

Command	Command ID	SAP Access type (-:Disable, V:Enable)			Description
		Request	Confirm	Indication	
ADPD-DATA	0x00	V	V	V	Request of data transmission. Notification of data reception.
ADPM-RESET	0x01	V	V	-	Request of resetting ADP Layer and the lower layer.
ADPM-DISCOVERY	0x02	V	V	-	Request of searching PAN.
ADPM-NETWORK-START	0x03	V	V	-	Request of starting PAN.
ADPM-NETWORK-JOIN	0x04	V	V	-	Request of participating in PAN.
ADPM-NETWORK-LEAVE	0x05	V	V	V	Request of seceding from PAN. Notification of seceding from PAN.
ADPM-GET	0x06	V	V	-	Request of obtaining ADP IB Attribute.
ADPM-SET	0x07	V	V	-	Request of setting ADP IB Attribute
ADPM-ROUTE-DISCOVERY	0x08	V	V	-	Request of searching route.
ADPM-PATH-DISCOVERY	0x09	V	V	V	Request of searching network path. Notification of reception of the path discovery request message to oneself.
ADPM-LBP	0x0A	V	V	V	Request of transmitting LBP message. Notification of reception of LBP message.
ADPM-NETWORK-STATUS	0x0B	-	-	V	Notification of reception of MLME-COMM-STATUS.indication
ADPM-BUFFER	0x0C	-	-	V	Notification of the state change of the internal data transmission buffer.
ADPM-KEY-STATE	0x0D	-	-	V	Notification that GMK-related processing request is granted.
ADPM-ROUTE-ERROR	0x0E	-	-	V	Notification of reception route error packet.
ADPM-EAP-KEY	0x0F	-	-	V	Notification of a key generated in the process of EAP-PSK.
ADPM-FRAME-COUNTER	0x10	-	-	V	Notification of reception of the MLME-FRAMECOUNT.indication.
ADPM-ROUTE-UPDATE	0x11	-	-	V	Notification of update of route table.
ADPM-LOAD-SEQ-NUM	0x12	-	-	V	Notification of LOADng sequence number.
ADPM-RREP	0x13	-	-	V	Notification of receiving RREP message or notification of transmitting RREP message as

					originator.
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6.1 ADPD-DATA

6.1.1 ADPD-DATA.request

This command is used to send request of data transmission.

Unlike other command, this command can send the next request without waiting for confirm. ADP Layer has internal buffer for data transmission by ADPD-DATA.request. As long as there is room in this internal buffer, this primitive is able to be called continuously.

The number of stages of the internal buffer is determined by a parameter of adpdBuffNum specified by G3-INIT.request. Refer to section 5.1.1 for details. In addition, status of the internal buffer is notified as ADPM-BUFFER.indication. Refer to section 7.13 for details.

Table 6-2 shows this command format.

Table 6-2 ADPD-DATA.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x4	
CMD	1byte	0x00	
DAT			
nsduLength	2byte	40-1280	The size of the NSDU, in bytes
nsdu	nsduLength byte	-	The NSDU to transmit.
nsduHandle	1byte	0x00-0xFF	The handle of the NSDU to transmit. This parameter is used to identify in the ADPD-DATA.confirm primitive which request it is concerned with. It can be randomly chosen by the application layer.
discoverRoute	1byte	TRUE/FALSE	If TRUE, a route discovery procedure will be performed prior to sending the frame if a route to the destination is not available in the routing table. If FALSE, no route discovery is performed.
qualityOfService	1byte	0x00-0x01	The requested quality of service (QoS) of the frame to send. Allowed values are: 0x00 = normal priority 0x01 = high priority

6.1.2 ADPD-DATA.confirm

This command is used to send notification as response to ADPD-DATA.request.
Table 6-3 shows this command format.

Table 6-3 ADPD-DATA.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x4	
CMD	1byte	0x00	
DAT			
status	1byte	Refer Table 6-38.	Status code. <i>R_ADP_STATUS_SUCCESS</i> : · Succeed. <i>R_ADP_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified. <i>R_ADP_STATUS_INVALID_IPV6_FRAME</i> : · Format of IPv6 header is incorrect. <i>R_ADP_STATUS_ROUTE_ERROR</i> : · Route is not found. <i>R_ADP_STATUS_INVALID_REQUEST</i> : · Called before starting PAN (Coordinator) · Called before joining PAN (Peer) <i>R_ADP_STATUS_REQ_QUEUE_FULL</i> : · Called when there's no room in the internal buffer. <i>R_ADP_STATUS_TIMEOUT</i> : · Data transfer processing times out. <i>R_ADP_STATUS_INSUFFICIENT_MEMSIZE</i> : · Called when there's no enough memory allocated to transmission. <i>R_ADP_STATUS_IF_NO_RESPONSE</i> : · No response from MAC layer. <i>Status of MCPS-DATA.confirm</i> : · Refer Table 5-3.
nsduHandle	1byte	0x00-0xFF	The handle of the NSDU confirmed by this command function.

6.1.3 ADPD-DATA.indication

This command is used to send notification when self-addressed data (including Multicast) is received.
Table 6-4 shows this command format.

Table 6-4 ADPD-DATA.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x00	
DAT			
nsduLength	2byte	0-1280	The size of the NSDU, in bytes
nsdu	nsduLength byte	-	The received NSDU
linkQualityIndicator	1byte	0x00-0xFF	The value of the link quality during the receipt of the frame.

6.2 ADPM-RESET

6.2.1 ADPM-RESET.request

This command is used to send a request of resetting ADP Layer.

Table 6-5 shows this command format.

Table 6-5 ADPM-RESET.request Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x4	
CMD	1byte	0x01	
DAT	Not available.		

6.2.2 ADPM-RESET.confirm

This command is used to send notification as response to ADPM-RESET.request.

Table 6-6 shows this command format.

Table 6-6 ADPM-RESET.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x4	
CMD	1byte	0x01	
DAT			
status	1byte	Refer Table 6-38.	Status code <i>R_ADP_STATUS_SUCCESS</i> : · Succeed. <i>R_ADP_STATUS_INVALID_REQUEST</i> : · Called while ADPM-RESET processing is ongoing. <i>R_ADP_STATUS_FAILED</i> : · Failed to obtain timer resource. <i>R_ADP_STATUS_CONFIG_ERROR</i> : · G3 Configuration parameter is invalid. <i>R_ADP_STATUS_IF_NO_RESPONSE</i> : · No response from MAC layer. <i>Status of MLME-RESET.confirm</i> : · Refer Table 5-7.

6.3 ADPM-DISCOVERY

6.3.1 ADPM-DISCOVERY.request

This command is used to send request of searching existing PAN.

Table 6-7 shows this command format.

Table 6-7 ADPM-DISCOVERY.request Command Format

Field		Length	Valid value	Description
IDC		1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA		3bit	0x0	
IDP		4bit	0x4	
CMD		1byte	0x02	
DAT				
	duration	1byte	1-255	The number of seconds the active scan shall last.

6.3.2 ADPM-DISCOVERY.confirm

This command is used to send notification as response to ADPM-DISCOVERY.request.

The number of PAN which is discovered within time specified by parameter duration of ADPM-DISCOVERY.request is notified as PANCount and PAN information of PANCount is notified as PANDescriptor. Table 5-14 shows PANDescriptor parameter.

The maximum number of PAN which can be obtained is determined by parameter specified by G3-INIT.request. Refer to section 4.1.1 for details.

Table 6-8 shows this command format. Table 5-14 shows PANDescriptor parameter.

Table 6-8 ADPM-DISCOVERY.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x4	
CMD	1byte	0x02	
DAT			
status	1byte	Refer Table 6-38.	Status code <i>R_ADP_STATUS_SUCCESS</i> : · Succeed <i>R_ADP_STATUS_INVALID_PARAMETER</i> : · Called with invalid parameter <i>R_ADP_STATUS_NO_BEACON</i> : · No beacons are received. <i>R_ADP_STATUS_INVALID_REQUEST</i> : · Called when ADPM-RESET is not succeeded. · Called while ADPM-DISCOVERY is being processed. <i>R_ADP_STATUS_FAILED</i> : · Failed to obtain timer resource. <i>R_ADP_STATUS_IF_NO_RESPONSE</i> : · No response from MAC layer. <i>Status of MLME-SCAN.confirm</i> · Refer Table 5-13.
PANCount	1byte	0x00-0x80 (maximum number is specified with G3-INIT.request)	The number of entries in the PANDescriptor.
PANDescriptor	Refer to Table 5-14. (The number of table entry = PANCount)		The PAN ID and LBA operating in the POS of the device.

6.4 ADPM-NETWORK-START

6.4.1 ADPM-NETWORK-START.request

This command is used to send request of starting PAN.

This command is enabled only when adpDeviceType which is ADP IB Attribute is set as PAN Coordinator.

Table 6-9 shows this command format.

Table 6-9 ADPM-NETWORK-START.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x4	
CMD	1byte	0x03	
DAT			
panId	2byte	0x0000-0xFFFF	The PAN ID of the network to create; determined at the application level. NOTE – Set panId value will be logically ANDed with 0xFCFF.

6.4.2 ADPM-NETWORK-START.confirm

This command is used to send notification as response to ADPM-NETWORK-START.request.

Table 6-10 shows this command format.

Table 6-10 ADPM-NETWORK-START.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x4	
CMD	1byte	0x03	
DAT			
status	1byte	Refer Table 6-38.	Status code <i>R_ADPM_STATUS_SUCCESS</i> : · Succeed. <i>R_ADPM_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified. <i>R_ADPM_STATUS_INVALID_REQUEST</i> : · Called when ADPM-RESET does not succeed. · Called while ADPM-DISCOVERY is being processed. · Called when adpDeviceType of IB Attribute is not PAN coordinator. · Called after PAN has already started. <i>R_ADPM_STATUS_FAILED</i> : · G3 Configuration parameter is invalid. <i>R_ADPM_STATUS_IF_NO_RESPONSE</i> : · No response from MAC layer. <i>Status of MLME-START.confirm</i> :

				· Refer Table 5-16.
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6.5 ADPM-NETWORK-JOIN

6.5.1 ADPM-NETWORK-JOIN.request

This command is used to send request of joining PAN.

This command is enabled only when adpDeviceType, which is ADP IB Attribute, is set as PAN device.

Table 6-11 shows this command format.

Table 6-11 ADPM-NETWORK-JOIN.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x4	
CMD	1byte	0x04	
DAT			
panId	2byte	0x0000-0xFFFF	The 16-bit PAN identifier of the network to join. NOTE - PANId value must be logically ANDed with 0xFCFF.
lbaAddress	2byte	0x0000-0x7FFF	The 16-bit short address of the device acting as a LoWPAN bootstrap agent as defined in Annex E.

6.5.2 ADPM-NETWORK-JOIN.confirm

This command is used to send notification as response to ADPM-NETWORK-JOIN.request.

Table 6-12 shows this command format.

Table 6-12 ADPM-NETWORK-JOIN.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x4	
CMD	1byte	0x04	
DAT			
status	1byte	Refer Table 6-38.	Status code <i>R_ADP_STATUS_SUCCESS</i> : · Succeed. <i>R_ADP_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified. <i>R_ADP_STATUS_NOT_PERMITTED</i> : · Received Decline packer from EAP Coordinator. <i>R_ADP_STATUS_INVALID_REQUEST</i> : · Called while ADPM-DISCOVERY processing is ongoing. · Called when ADPM-NETWORK-JOIN is being processed. · Called when it has already joined PAN. · Called when adpDeviceType of IB Attribute is

6. Command Specification of ADP Layer

				<p>not PAN device.</p> <p><i>R_ADP_STATUS_INSUFFICIENT_MEMSIZE:</i></p> <ul style="list-style-type: none"> • Called when there's no enough memory allocated to transmission. <p><i>R_ADP_STATUS_TIMEOUT:</i></p> <ul style="list-style-type: none"> • Processing to join PAN has not completed within time specified with adpMaxJoinWaitTime of IB Attribute. <p><i>R_ADP_STATUS_FAILED:</i></p> <ul style="list-style-type: none"> • Failed to obtain timer resource. • ExtID of LBS is invalid. <p><i>R_ADP_STATUS_REQ_QUEUE_FULL:</i></p> <ul style="list-style-type: none"> • Called when there is no room in the internal buffer. <p><i>R_ADP_STATUS_IF_NO_RESPONSE:</i></p> <ul style="list-style-type: none"> • No response from MAC layer. <p><i>Status of MCPS-DATA.confirm:</i></p> <ul style="list-style-type: none"> • Refer Table 5-3. <p><i>Status of MLME-SET.confirm:</i></p> <ul style="list-style-type: none"> • Refer Table 5-11.
	networkAddress	2byte	0x0001-0x7FFF, 0xFFFF	The 16-bit network address that was allocated to the device. If the allocation fails, this address is equal to 0xFFFF.
	panId	2byte	0-0xFFFF	<p>The 16-bit address of the PAN of which the device is now a member.</p> <p>NOTE - PANId value is logically ANDed with 0xFCFF.</p>

6.6 ADPM-NETWORK-LEAVE

6.6.1 ADPM-NETWORK-LEAVE.request

This command is used to send a leave request to the PAN Coordinator which the peer is connected to. This command is enabled only when `adpDeviceType`, which is ADP IB Attribute, is set as PAN device. Table 6-13 shows this command format.

Table 6-13 ADPM-NETWORK-LEAVE.request Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x4	
CMD	1byte	0x05	
DAT	Not available.		

6.6.2 ADPM-NETWORK-LEAVE.confirm

This command is used to send notification as response to ADPM-NETWORK-LEAVE.request. Table 6-14 shows this command format.

Table 6-14 ADPM-NETWORK-LEAVE.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x4	
CMD	1byte	0x05	
DAT			
status	1byte	Refer Table 6-38.	Status code <i>R_ADPM_STATUS_SUCCESS</i> : · Succeed. <i>R_ADPM_STATUS_INVALID_REQUEST</i> : · Called before joining PAN. <i>R_ADPM_STATUS_REQ_QUEUE_FULL</i> : · Called when there is no room in the internal buffer. <i>R_ADPM_STATUS_IF_NO_RESPONSE</i> : · No response from ADP layer.

6.6.3 ADPM-NETWORK-LEAVE.indication

This command is used to send notification when a self-addressed LBP message which request secession from joined PAN from PAN coordinator to PAN device is received.

Table 6-15 shows this command format.

Table 6-15 ADPM-NETWORK-LEAVE.indication Command Format

Field	Size	Valid value	Description
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IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x05	
DAT	Not available.		

6.7 ADPM-GET

6.7.1 ADPM-GET.request

This command is used to send a request of obtaining ADP IB Attribute value of ADP Layer.

When ADP IB Attribute is table type, specify an index of a table which you want to obtain for parameter AttributeIndex to acquire a value. Refer to section 6.22 for details of ADP IB Attribute.

Table 6-16 shows this command format.

Table 6-16 ADPM-GET.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x4	
CMD	1byte	0x06	
DAT			
aibAttributeld	1byte	Refer to section 6.22.	The identifier of the IB attribute to read
aibAttributeIndex	2byte	Refer to section 6.22.	The index within the table of the specified IB attribute to read. This parameter is valid only for IB attributes that are tables.

6.7.2 ADPM-GET.confirm

This command is used to send notification as response to ADPM-GET.request.

Table 6-17 shows this command format.

Table 6-17 ADPM-GET.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x4	
CMD	1byte	0x06	
DAT			
status	1byte	Refer Table 6-38.	Status code <i>R_ADPM_STATUS_SUCCESS</i> : · Succeed. <i>R_ADPM_STATUS_UNSUPPORTED_ATTRIBUTE</i> : · Unsupported IB Attribute ID was specified. <i>R_ADPM_STATUS_INVALID_INDEX</i> : · A value out of the range was specified for AttributeIndex. <i>R_ADPM_STATUS_INVALID_PARAMETER</i> : · A value out to the range is specified. <i>R_ADPM_STATUS_ROUTE_ERROR</i> : · IB of adpRoutingTableByAddr was specified with a short address which does not regist in the table. <i>Status of MLME-GET.confirm</i> : · Refer Table 5-9.
aibAttributeld	1byte	Refer to section 6.22.	The identifier of the PIB attribute to read

	aibAttributeIndex	2byte	Refer to section 6.22.	The index within the table of the specified PIB attribute to read. This parameter is valid only for ADP IB attributes that are tables.
	aibAttributeValue	37byte	Refer to section 6.22.	The value of the indicated ADP IB attribute that was read. The value is set a left-aligned in 37 byte length data.

6.8 ADPM-SET

6.8.1 ADPM-SET.request

This command is used to send a request of setting IB Attribute value of ADP Layer.

When IB Attribute is table type, specify an index of a table which you want to set for parameter AttributeIndex to set a value. Refer to section 6.22 for details of ADP IB Attribute.

Table 6-18 shows this command format.

Table 6-18 ADPM-SET.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x4	
CMD	1byte	0x07	
DAT			
aibAttributeld	1byte	Refer to section 6.22.	The identifier of the PIB attribute to write
aibAttributeIndex	2byte	Refer to section 6.22.	The index within the table of the specified IB attribute to be written. This parameter is valid only for IB attributes that are tables
aibAttributeValue		Refer to section 6.22.	The value to write.

6.8.2 ADPM-SET.confirm

This command is used to send notification as response to ADPM-SET.request.

Table 6-19 shows this command format.

Table 6-19 ADPM-SET.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x4	
CMD	1byte	0x07	
DAT			
status	1byte	Refer Table 6-38.	Status code <i>R_ADP_STATUS_SUCCESS</i> : ·Succeed. <i>R_ADP_STATUS_UNSUPPORTED_ATTRIBUTE</i> : ·Unsupported IB Attribute ID was specified. <i>R_ADP_STATUS_INVALID_INDEX</i> : ·A value out of the range was specified for AttributeIndex. <i>R_ADP_STATUS_INVALID_PARAMETER</i> : ·A value out to the range was specified. <i>R_ADP_STATUS_READ_ONLY</i> : ·Read-only IB Attribute ID was specified. <i>R_ADP_STATUS_INVALID_REQUEST</i> : ·Called at the invalid state. <i>Status of MLME-SET.confirm</i> : ·Refer Table 5-11.

	aibAttributeId	1byte	Refer to section 6.22.	The identifier of the PIB attribute to write
	aibAttributeIndex	2byte	Refer to section 6.22.	The index within the table of the specified PIB attribute to write. This parameter is valid only for ADP PIB attributes that are tables.

6.9 ADPM-ROUTE-DISCOVERY

6.9.1 ADPM-ROUTE-DISCOVERY.request

This command is used to send a request of route search.
Table 6-20 shows this command format.

Table 6-20 ADPM-ROUTE-DISCOVERY.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x4	
CMD	1byte	0x08	
DAT			
dstAddress	2byte	0x0000-0x7FFF	The short unicast destination address of the route discovery.
maxHops	1byte	0x01-0x0E	This parameter indicates the maximum number of hops allowed for the route discovery.

6.9.2 ADPM-ROUTE-DISCOVERY.confirm

This command is used to send notification as response to ADPM-ROUTE-DISCOVERY.request.
Table 6-21 shows this command format.

Table 6-21 ADPM-ROUTE-DISCOVERY.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x4	
CMD	1byte	0x08	
DAT			
status	1byte	Refer Table 6-38.	Status code <i>R_ADP_STATUS_SUCCESS</i> : · Succeed. <i>R_ADP_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified. <i>R_ADP_STATUS_ROUTE_ERROR</i> : · Route is not found. <i>R_ADP_STATUS_INVALID_REQUEST</i> : · Called while ADPM-RESET is being processed. · Called while ADPM-ROUTE-DISCOVERY is being processed. · Called when LOADng is disabled. <i>R_ADP_STATUS_REQ_QUEUE_FULL</i> : · Called when there is no room in the internal buffer. <i>R_ADP_STATUS_TIMEOUT</i> : · Data transfer processing timed out.

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				<i>R_ADP_STATUS_IF_NO_RESPONSE:</i> · No response from ADP layer. <i>Status of MCPS-DATA.confirm:</i> · Refer Table 5-3.
	dstAddr	2byte	0-0x7FFF	The short unicast destination address of the route discovery.

6.10 ADPM-PATH-DISCOVERY

6.10.1 ADPM-PATH-DISCOVERY.request

This command is used to send a request of searching network path.

Table 6-22 shows this command format.

Table 6-22 ADPM-PATH-DISCOVERY.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x4	
CMD	1byte	0x09	
DAT			
dstAddr	2byte	0x0000-0x7FFF	The short unicast destination address of the path discovery.
pathMetricType	1byte	Any.	The metric type to be used for the path discovery.

6.10.2 ADPM-PATH-DISCOVERY.confirm

This command is used to send notification as response to ADPM-PATH-DISCOVERY.request.

Path information to and from a destination (forward path, reverse path) is obtained. It is possible to obtain path information of number of pathTableEntries.

Figure 6-1 shows an example when there are 3 nodes; Node A, Node B and Node C and ADPM-PATH-DISCOVERY.request is sent from Node A to Node C.

Table 6-23 shows this command format. Table 6-24 shows PathTable parameter.

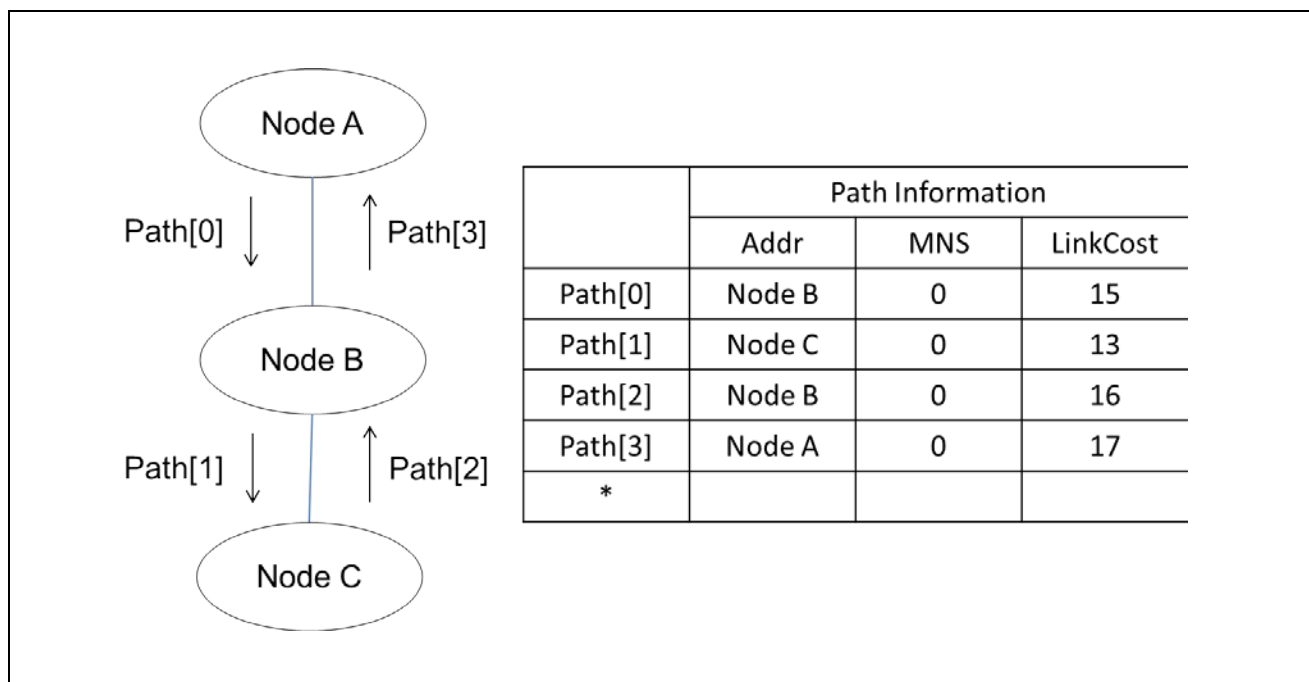


Figure 6-1 ADPM-PATH-DISCOVERY Execution Example

Table 6-23 ADPM-PATH-DISCOVERY.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x4	
CMD	1byte	0x09	
DAT			
dstAddr	2byte	0-0x7FFF	The short unicast destination address of the path discovery.
status	1byte	Refer Table 6-38.	Status code <i>R_ADP_STATUS_SUCCESS</i> : • Succeed <i>R_ADP_STATUS_INVALID_PARAMETER</i> : • Invalid parameter was specified. <i>R_ADP_STATUS_ROUTE_ERROR</i> : • Route could not be found. <i>R_ADP_STATUS_INCOMPLETE_PATH</i> : • Path to a destination disappeared. <i>R_ADP_STATUS_ALREADY_IN_PROGRE</i> <i>SS</i> :

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				<ul style="list-style-type: none"> • Called while ADPM-PATH-DISCOVERY is being processed. <i>R_ADP_STATUS_INVALID_REQUEST:</i> • Called while ADPM-RESET is being processed. • Called when LOADng is disabled. <i>R_ADP_STATUS_REQ_QUEUE_FULL:</i> • Called when there is no room in the internal buffer. <i>R_ADP_STATUS_TIMEOUT:</i> • Data transfer processing timed out. <i>R_ADP_STATUS_IF_NO_RESPONSE:</i> • No response from ADP layer. <i>Status of MCPS-DATA.confirm:</i> • Refer Table 5-3.
	pathMetricType	1byte	Any.	The metric type to be used for the path discovery.
	origAddr	2byte	0-0x7FFF	originator address
	pathTableEntries	1byte	2-30	The result of the request for PIB attribute information.
	pathTable	Refer to Table 6-24. (The number of table entry = pathTableEntries)		Table constituted of all the information contained in the received PREP message starting from PathMetricType.

Table 6-24 PathTable Parameter

Member	Length	Valid value	Description
pathAddress	2byte	0-0x7FFF	16-bit address of the last node on the path.
mns	1byte	0x00, 0x80	Metric not supported field by the last node on the forward path. 0x00 : The metric is supported by the node 0x80 : The metric is not supported by the node
linkCost	1byte	0-0xFF	Link cost of the last node on the path.

6.10.3 ADPM-PATH-DISCOVERY.indication

This command is used to send notification when a path discovery message that specified self-address as the destination address is received.

Table 6-25 shows this command format.

Table 6-25 ADPM-PATH-DISCOVERY.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x09	
DAT			
orgAddr	2byte	0-0x7FFF	originator address

6.11 ADPM-LBP

6.11.1 ADPM-LBP.request

This command is used to send a request of transmitting LBP message.

Table 6-26 shows this command format.

Table 6-26 ADPM-LBP.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x4	
CMD	1byte	0x0A	
DAT			
dstAddrType	1byte	0x02-0x03	The type of destination address contained in the DstAddr parameter. The allowed values are: 0x02 = 2 Byte address (LBA or LBS address) 0x03 = 8 Byte address (LBD address).
dstAddr	8byte	Any	16-bit address of LBA or LBS or 64 bit address (extended address of LBD).
nsduLength	2byte	0-1280	The size of the NSDU, in bytes.
nsdu	nsduLength byte	-	The NSDU to send.
nsduHandle	1byte	0x00-0xFF	The handle of the NSDU to transmit. This parameter is used to identify in the ADPM-LBP.confirm primitive which request it is concerned with. It can be randomly chosen by the application layer.
maxHops	1byte	0x01-0x0E	The number of times the frame will be repeated by network routers.
discoveryRoute	1byte	TRUE/FALSE	If TRUE, a route discovery procedure will be performed prior to sending the frame if a route to the destination is not available in the routing table. If FALSE, no route discovery is performed.
qualityOfService	1byte	0x00-0x01	The requested quality of service (QoS) of the frame to send. Allowed values are: 0x00 = standard priority 0x01 = high priority
securityEnabled	1byte	TRUE/FALSE	If TRUE, this parameter enables the MAC layer security for sending the frame.

6.11.2 ADPM-LBP.confirm

This command is used to send notification as response to ADPM-LBP.request.
Table 6-27 shows this command format.

Table 6-27 ADPM-LBP.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x4	
CMD	1byte	0x0A	
DAT			
status	1byte	Refer Table 6-38.	Status code <i>R_ADP_STATUS_SUCCESS</i> : · Succeed. <i>R_ADP_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified. <i>R_ADP_STATUS_ROUTE_ERROR</i> : · Route was not found. <i>R_ADP_STATUS_INVALID_REQUEST</i> : · Called while ADPM-RESET is being processed. · Called while adpDeviceType of IB Attribute is not PAN coordinator. · Called before PAN has not started. <i>R_ADP_STATUS_REQ_QUEUE_FULL</i> : · Called when there is no room in the internal buffer. <i>R_ADP_STATUS_TIMEOUT</i> : · Data transfer processing timed out. <i>R_ADP_STATUS_INSUFFICIENT_MEMSIZE</i> : · Called when there's no enough memory allocated to transmission. <i>R_ADP_STATUS_IF_NO_RESPONSE</i> : · No response from ADP layer. <i>Status of MCPS-DATA.confirm</i> : · Refer Table 5-3.
nsduHandle	1byte	0-0xFF	The handle of the NSDU confirmed by this primitive.

6.11.3 ADPM-LBP.indication

This command is used to send notification when LBP message is received.
Table 6-28 shows this command format.

Table 6-28 ADPM-LBP.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x0A	
DAT			
srcAddr	2byte	0-0xFFFF	16-bit address of the LBA. When directly communicating with the LBD (using extended addressing), this field is set to 0xFFFF.
nsduLength	2byte	0-1280	The size of the NSDU, in bytes.
nsdu	nsduLength byte	-	The received NSDU.
linkQualityIndicator	1byte	0x00-0xFF	The value of the link quality during reception of the frame.
securityEnabled	1byte	TRUE/FALSE	TRUE if the frame was received with a security level greater or equal to adpSecurityLevel, FALSE otherwise.

6.12 ADPM-NETWORK-STATUS

6.12.1 ADPM-NETWORK-STATUS.indication

This command is used to send notification when MLME-COMM-STATUS.indication is received from UMAC layer.

Table 6-29 shows this command format.

Table 6-29 ADPM-NETWORK-STATUS.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x0B	
DAT			
status	1byte	Refer Table 5-22.	Status code. <i>Status of MLME-COMM-STATUS.indication:</i> ·Refer Table 5-18.
PANID	2byte	0-0xFFFF	The 16-bit PAN identifier of the entity to which the MSDU is being transferred. NOTE - PAN identifier value is logically ANDed with 0xFCFF.
srcAddrMode	1byte	0,2,3	The source addressing mode for this primitive and subsequent MPDUs. This value can take one of the following values: 0x00 = no address (addressing fields omitted, see clause 7.2.1.1.8 of [IEEE 802.15.4]) 0x01 = Reserved by ITU-T 0x02 = 16-bit short address 0x03 = 64-bit extended address.
srcAddr	8byte	0-0xFFFF (srcAddrMode=0x02) 0-0xFFFFFFFFFFFFFFFF (srcAddrMode=0x03)	The individual device address of the entity to which the MSDU is being transferred.
dstAddrMode	1byte	0,2,3	The destination addressing mode for this primitive and subsequent MPDUs This value can take one of the following values: 0x00 = no address (addressing fields omitted, see clause 7.2.1.1.6 of [IEEE 802.15.4]) 0x01 = Reserved by ITU-T 0x02 = 16-bit short address 0x03 = 64-bit extended address.
dstAddr	8byte	0-0xFFFF (dstAddrMode=0x02) 0-0xFFFFFFFFFFFFFFFF (dstAddrMode=0x03)	The individual device address of the entity to which the MSDU is being transferred.
securityLevel	1byte	0x00 and 0x05	The security level to be used as described in clause 9.3.8.
keyIdMode	1byte	0x01	The mode used to identify the key to be used (see clause 9.3.8). This parameter is ignored if the SecurityLevel parameter is set to 0x00.
keySource	8byte	—	Not used.

	keyIndex	1byte	0x00-0x01	The index of the key to be used (see clause 9.3.8).
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6.13 ADPM-BUFFER

6.13.1 ADPM-BUFFER.indication

This command is used to send notification when state of internal buffer for data transmission by ADPD-DATA.request is changed.

The number of stages of the internal buffer is determined by a parameter of adpdBuffNum specified by G3-INIT.request. Refer to section 5.1.1 for details.

Table 6-30 shows this command format.

Table 6-30 ADPM-BUFFER.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x0C	
DAT			
bufferReady	1byte	TRUE/FALSE	TRUE: modem is ready to receipt more ADPD-DATA.request. FALSE: modem is not ready, stop sending data frame.

6.14 ADPM-KEY-STATE

6.14.1 ADPM-KEY-STATE.indication

This command is used to send PAN device notification when processing request related to GMK sent from PAN coordinator is granted. However, this command is notified as keyState is 0x01 only in a sequence of joining PAN.

Table 6-31 shows this command format.

Table 6-31 ADPM-KEY-STATE.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x0D	
DAT			
keyIndex	1byte	0x00-0x01	The index of the key associated to the keyState
keyState	1byte	0x00-0x02	0x0: GMK received from EAP-Coordinator 0x1: GMK activated from EAP-Coordinator 0x2: GMK removed from EAP-Coordinator

6.15 ADPM-ROUTE-ERROR

6.15.1 ADPM-ROUTE-ERROR.indication

This command is used to send notification when route error packet is received.

Table 6-32 shows this command format.

Table 6-32 ADPM-ROUTE-ERROR.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x0E	
DAT			
unreachableAddress	2byte	0-0x7FFF	unreachable address

6.16 ADPM-EAP-KEY

6.16.1 ADPM-EAP-KEY.indication

This command is used to send notification when a key is generated in the process of EAP-PSK.
Table 6-33 shows this command format.

Table 6-33 ADPM-EAP-KEY.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x0F	
DAT			
type	1byte	0x00-0x05	0x0:PSK 0x1:AK 0x2:KDK 0x3:TEK 0x4:MSK 0x5:EMSK Now supported MSK only
length	1byte	0x10-0x40	length of the key in byte
key	64byte	-	key

6.17 ADPM-FRAME-COUNTER

6.17.1 ADPM-FRAME-COUNTER.indication

This command is used to send notification when MLME-FRAMECOUNT.indication is received from UMAC Layer.

Table 6-34 shows this command format.

Table 6-34 ADPM-FRAME-COUNTER.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x10	
DAT			
frameCounter	4byte	-	frame counter

6.18 ADPM-ROUTE-UPDATE

6.18.1 ADPM-ROUTE-UPDATE.indication

This command is used to send notification when route table is updated. This command's enable/disable depends on the setting value of adpRouteIndEnable of ADP IB. The default value of adpRouteIndEnable is FALSE(command disable).

Table 6-35 shows this command format.

Table 6-35 ADPM-ROUTE-UPDATE.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x11	
DAT			
dstAddr	2byte	-	Destination short address of updated route entry.

6.19 ADPM-LOAD-SEQ-NUM

6.19.1 ADPM-LOAD-SEQ-NUM.indication

This command is used to send notification when the adpLoadSeqNumber of ADP IB is matched the following calculation formula with the exception that adpLoadSeqNumIndicationInterval of ADP IB is 0. The default value of adpLoadSeqNumIndicationInterval is 0 and this command is disabled.

$$(++\text{adpLoadSeqNumber} \% \text{adpLoadSeqNumIndicationInterval}) == 0$$

Table 6-36 shows this command format.

Table 6-36 ADPM-LOAD-SEQ-NUM.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x12	
DAT			
adpLoadSeqNumber	2byte	-	LOADng router sequence number.

6.20 ADPM-RREP

6.20.1 ADPM-RREP.indication

This command is used to send notification when received RREP message or transmitted RREP message as originator. This command's enable/disable depends on the setting value of adpRrepIndEnable of ADP IB. The default value of adpRrepIndEnable is FALSE(command disable).

Example)

In the following network case which DevC sends RREP to DevA via DevB.

For DevC, the indication will issue when transmission success RREP to DevB.

For DevA and DevB, the indication will issue when receive RREP from DevC.

DevA (RREP destination) <- DevB <- DevC (RREP originator)

Table 6-37 shows this command format.

Table 6-37 ADPM-RREP.indication Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x4	
CMD	1byte	0x13	
DAT			
rrepOriginator	2byte	-	Originator address of RREP
rrepDestination	2byte	-	Destination address of RREP

6.21 ADP Layer Status Code

Table 6-38 shows a list of status codes of ADP layer.

In addition to this, ADP layer may return lower layer status code described in section 5.12.

Table 6-38 ADP Layer Status Code List

Status code	Value	Description
R_ADP_STATUS_SUCCESS	0x00	Processing completely success
R_ADP_STATUS_INVALID_PARAMETER	0xE8	Error during parameter check of SAP
R_ADP_STATUS_NO_BEACON	0xEA	No beacon received during ADPM-DISCOVERY.
R_ADP_STATUS_UNSUPPORTED_ATTRIBUTE	0xF4	A SET/GET request was issued with the identifier of a PIB attribute that is not supported.
R_ADP_STATUS_INVALID_INDEX	0xF9	An attempt to write to a IB attribute that is in a table failed because the specified table index was out of range.
R_ADP_STATUS_READ_ONLY	0xFB	A SET/GET request was issued with the identifier of an attribute that is read only.
R_ADP_STATUS_INVALID_REQUEST	0x80	Received invalid request.
R_ADP_STATUS_INVALID_IPV6_FRAME	0x82	Error during syntax check of IPv6.
R_ADP_STATUS_ROUTE_ERROR	0x83	Request failure caused by Route failure.
R_ADP_STATUS_NOT_PERMITTED	0x84	LBD received decline packet from LBS during Bootstrap sequence.
R_ADP_STATUS_TIMEOUT	0x86	Request failure caused by timeout.
R_ADP_STATUS_ALREADY_IN_PROGRESS	0x87	Received duplicated ADPM-PATH-DISCOVERY.
R_ADP_STATUS_INCOMPLETE_PATH	0x88	PATH-DISCOVERY error on intermediate node.
R_ADP_STATUS_REQ_QUEUE_FULL	0x92	Request could not accepted caused by internal queue full.
R_ADP_STATUS_FAILED	0x93	Some error occur during process.
R_ADP_STATUS_CONFIG_ERROR	0x95	ADPM-RESET process failure caused by G3-SetConfig parameter.
R_ADP_STATUS_INSUFFICIENT_MEMSIZE	0xA0	Error caused by allocated memory is not enough.
R_ADP_STATUS_IF_NO_RESPONSE	0xA2	Request failure caused by no response from lower layer.

6.22 ADP IB Attribute

6.22.1 ADP IB Attribute Compliant for G.9903

Table 6-39 shows a list of ADP IB Attribute compliant for G.9903.

Table 6-39 ADP IB Attribute Compliant for G.9903 List

Attribute	Identifier	Type	RW	Range	Description	Default
adpSecurityLevel	0x00	uint8_t	rw	See Table 9-22 Clause 7.6.2.2.1 of [IEEE 802.15.4]	The minimum security level to be used for incoming and outgoing Adaptation frames, as described in clause 9.4.3.3.x of [G3PLC Alliance, April 2015]	5 (ENC-MI C-32)
adpPrefixTable	0x01	table	rw	-	Contains the list of prefixes defined on this PAN. Note that it is assumed that the link local IPv6 address exists independently and is not affected by the prefixes defined in the prefix table. Refer Table 6-41.	Empty
adpBroadcastLogTableEntryTTL	0x02	uint16_t	rw	1-65535	Maximum time to live of an adpBroadcastLogTable entry (in minutes).	2
adpMetricType	0x03	uint8_t	rw	0x00-0x0F	Metric type to be used for routing purposes. 0x0E is CENELEC_A only.	0x0F
adpLowLQIValue	0x04	uint8_t	rw	0-255	Defines the LQI value, used in metric computation, below which a link to a neighbour is considered as an unreliable link. This value shall be lower than adpHighLQIValue	0
adpHighLQIValue	0x05	uint8_t	rw	0-255	The high LQI value defines the LQI value, used in metric computation, above which a link to a neighbour is considered as a reliable link. This value is greater than adpLowLQIValue.	255

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adpRREPWait	0x06	uint8_t	rw	0-255	An RREP shall be generated after a delay of adpRREPWait seconds after either the arrival of the first RREQ or the transmission of the latest RREP. adpRREPWait shall be strictly less than adpNetTraversalTime	4
adpContextInformationTable	0x07	table	rw	-	Contains the context information associated to each CID extension field. Table 6-42.	Empty
adpCoordShortAddress	0x08	uint16_t	rw	0x0000 -0x7FFF	Defines the short address of the coordinator	0x0000
adpRLCEnabled	0x09	uint8_t	rw	FALSE/TRUE	Enables the sending of RLCREQ frame by the device	FALSE
adpAddRevLinkCost	0x0A	uint8_t	rw	0x00-0xFF	It represents an additional cost to take into account a possible asymmetry in the link (See Annex B of [G3PLC Alliance, April 2015])	0
adpBroadcastLogTable	0x0B	table	r	-	Contains the broadcast log table, see clause 9.4.2.2 and clause 9.4.4.2.2.1. of [G3PLC Alliance, April 2015]. Refer Table 6-43.	Empty
adpRoutingTable	0x0C	table	rw	-	Contains the routing table. Refer Table 6-44.	Empty
adpUnicastRREQGenEnable	0x0D	uint8_t	rw	FALSE/TRUE	If TRUE, the RREQ shall be generated with its "unicast RREQ" flag set to '1'. If FALSE, the RREQ shall be generated with its "unicast RREQ" flag set to '0'.	TRUE
adpGroupTable	0x0E	table	rw	-	Contains the group addresses to which the device belongs. Refer Table 6-45.	Empty
adpMaxHops	0x0F	uint8_t	rw	0x01-0x0E	Defines the maximum number of hops to be used by the routing algorithm.	8
adpDeviceType	0x10	uint8_t	rw	0-2	Defines the type of device connected to the modem: 0: PAN device	2

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					1: PAN coordinator 2: Not defined (read only)	
adpNetTraversalTime	0x11	uint16_t	rw	1-255	Maximum time that a packet is expected to take to reach any node from any node in seconds.	20
adpRoutingTableEntryTTL	0x12	uint16_t	rw	1-65535	Maximum time-to-live of a routing table entry (in minutes).	360
adpKr	0x13	uint8_t	rw	0-31	A weight factor for ROBO to calculate link cost.(See Annex B of [G3PLC Alliance, April 2015])	0
adpKm	0x14	uint8_t	rw	0-31	A weight factor for modulation to calculate link cost.(See Annex B of [G3PLC Alliance, April 2015])	0
adpKc	0x15	uint8_t	rw	0-31	A weight factor for number of active tones to calculate link cost.(See Annex B of [G3PLC Alliance, April 2015])	0
adpKq	0x16	uint8_t	rw	0-50	A weight factor for LQI to calculate route cost.(See Annex B of [G3PLC Alliance, April 2015])	10
adpKh	0x17	uint8_t	rw	0-31	A weight factor for hop to calculate link cost.(See Annex B of [G3PLC Alliance, April 2015])	4
adpRREQRetries	0x18	uint8_t	rw	Any	The number of RREQ retransmission in case of RREP reception time out.	0
adpRREQWait	0x19	uint8_t	rw	Any	The number of seconds to wait between two consecutive RREQ generations.	30
adpWeakLQIValue	0x1A	uint8_t	rw	Any	The weak link value defines the LQI value below which a link to a neighbour is considered as a weak link. A value of 52 represents an SNR of 3 dB.	52
adpKrt	0x1B	uint8_t	rw	Any	A weight factor for the number of active routes in the routing table to calculate	0

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					link cost.(See Annex B of [G3PLC Alliance, April 2015])	
adpSoftVersion	0x1C	table	r	-	The software version. Refer Table 6-48.	-
adpSnifferMode	0x1D	uint8_t	rw	0-1	not support	0
adpBlacklistTable	0x1E	table	rw	-	Contains the list of the blacklisted neighbours	Empty
adpBlacklistTableEntryTTL	0x1F	uint16_t	rw	0-65535	Time to live of a blacklisted neighbour set entry in minutes. Refer Table 6-46.	10
adpMaxJoinWaitTime	0x20	uint16_t	rw	1-1023	Network joint timeout in seconds for LBD.	20
adpPathDiscoveryTime	0x21	uint16_t	rw	1-255	Timeout for path discovery in seconds	40
adpActiveKeyIndex	0x22	uint8_t	rw	0-1	Index of the active GMK to be used for data transmission.	0
adpDestinationAddressSet	0x23	table	rw	-	Contains the list of the addresses of the device for which this LOADng router is providing connectivity. Refer Table 6-47.	Empty
adpDefaultCoordRouteEnabled	0x24	uint8_t	rw	FALSE/TRUE	If TRUE, the adaptation layer adds a default route to the coordinator after successful completion of the bootstrapping procedure. If FALSE no default route will be created.	FALSE
adpDisableDefaultRouting	0xF0	uint8_t	rw	FALSE/TRUE	If TRUE, the default routing (LOADng) is disabled. If FALSE, the default routing (LOADng) is enabled. See clause 9.4.3 of [G3PLC Alliance, April 2015].	FALSE

6.22.2 ADP IB Attribute Renesas Original

Table 6-40 shows a list of ADP IB Attribute Renesas original.

Table 6-40 ADP IB Attribute RENESAS Original List

Attribute	Identifier	Length	Read only	Range	Description	Default
adpLoadSeqNumber	0x30	uint16_t	rw	Any	LOADng router sequence number. When the same short address is always allocated to a PAN device, it is recommended to preserve the LOADng router sequence number after the G3-PLC node has been powered off.	0
adpRouteTableByAddr	0x31	table	r	-	ADPM-GET.confirm returns the Route Table which is corresponding to given short address by aibAttributeIndex. If entry is not found, ADPM-GET.confirm status returns as ROUTE ERROR. Refer Table 6-44.	0
adpRouteTableSize	0x32	uint16_t	r	0-0xFFFF	The total number of Route table size.	-
adpValidRtableEntries	0x33	uint16_t	r	0-0xFFFF	Indicates the number of valid Route Table Entries.	0
adpRouteIndexByAddr	0x34	uint16_t	r	0-0xFFFF	ADPM-GET.confirm return the index of Route Table entry which is corresponding to given short address by aibAttributeIndex. If entry is not found, ADPM-GET.confirm status return as ROUTE ERROR.	-
adpRouteIndEnable	0x35	uint8_t	rw	FALSE/TRUE	If TRUE, ADP enabled issue ADPM-ROUTE-UPDATE.indication	FALSE
adpLoadSeqNumIndicationInterval	0x36	uint16_t	rw	0-0xFFFF	interval of ADPM-LOAD-SEQUENCE.indication 0: off other	0

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					if(++adpLoadSeqNum % adpLoadSeqNumIndicationInterval) == 0 ADPM-LOAD-SEQ- NUM.indication callback	
adpBeaconIndEnable	0x37	uint8_t	rw	FALSE/TRUE	If TRUE, ADP enabled issue MLME-BEACON-N OTIFY.indication.	FALSE
adpBuffIndDisable	0x38	uint8_t	rw	FALSE/TRUE	If TRUE, ADP disabled issue ADPM-BUFFER.ini dication	FALSE
adpRrepIndEnable	0x3A	uint8_t	rw	FALSE/TRUE	If TRUE, ADP enabled issue ADPM-RREP.indic ation.	FALSE
adpDataType	0x40	uint8_t	rw	0-1	0: IPV6 no compression 1: IPHC compression as defined in [RFC6282 Hui, J; Thubert, P, 2011]	1
adpEnableDataTrans	0x41	uint8_t	rw	FALSE/TRUE	FALSE: Disable MCPS-DATA.req TRUE: Enable MCPS-DATA.req	TRUE
adpDisableRelay	0x42	uint8_t	rw	FALSE/TRUE	FALSE: Normal mode TRUE: Disable forwarding Relay packet with mesh header and RREQ. This setting is benefit for end of Pan like Coordinator or Gateway.	FALSE
adpStatistics	0x50	table	r	-	Statistics information of adaptation layer. The structure of each elements are defined as "uint8_t[4]". This information does not cleared by ADPM-RESET. If user wants to clear the info, it should be call G3-CLEARINFO or G3-INIT. Refer Table 6-49.	Empty

6.22.3 ADP Table Definition for ADP IB Attribute

(1)adpPrefixTable

Table 6-41 shows parameter of adpPrefixTable. The number of entry of this table is 4.

Table 6-41 adpPrefixTable Parameter

Parameter Name	Type	Description
prefixLength	uint8_t	Number of leading bits in the prefix that are valid. The value ranges from 0 to 128.
prefix	uint8_t[16]	the source prefix 64bit address. It shall be pre-set to use the prefix instead of LINKLOCAL Prefix(0xFE80::/64)
L	uint8_t	1-bit on-link flag (not used in ADP)
A	uint8_t	1-bit autonomous address-configuration flag (not used in ADP)
validLifetime	uint8_t[4]	Length of time in seconds during which the prefix is valid for the purpose of on-link determination
preferredLifetime	uint8_t[4]	Length of time in seconds during which addresses generated from the prefix remain preferred (not used in ADP)

(2)adpContextInformationTable

Table 6-42 shows parameter of adpContextInformationTable. The number of entry of this table is 16.

Table 6-42 adpContextInformationTable Parameter

Parameter Name	Type	Description
compressionFlag	uint8_t	Indicates if the context is valid for use in compression. 0:invalid 1:valid
contextLength	uint8_t	Indicates the length of the carried context (up to 128-bit contexts may be carried).
context	uint8_t[16]	Corresponds to the carried context used for compression/decompression purposes.
validLifeTime	uint16_t	Remaining time in minutes during which the context information table is considered valid. It is updated upon reception of the advertised context.

(3)adpBroadcastLogTable

Table 6-43 shows parameter of adpBroadcastLogTable. The number of entry of this table is 128 for route type=0x00 (Normal route). The number of entry of this table is 4 for route type=0x01 (Japan route B).

Table 6-43 adpBroadcastLogTable Parameter

Parameter Name	Type	Description
srcAddr	uint16_t	The 16-bit source address of a broadcast packet. This is the address of the broadcast initiator.
seqNumber	uint8_t	The sequence number contained in the BC0 header.
validTime	uint16_t	The remaining time to live of this entry in the broadcast log table, in minutes.

(4)adpRouteTable

Table 6-44 shows parameter of adpRouteTable. The number of entry of this table is depended on G3-INIT.request parameter.

Table 6-44 adpRouteTable Parameter

Parameter Name	Type	Description
R_dest_Addr	uint16_t	Address of the destination.
R_next_Addr	uint16_t	Address of the next hop on the route towards the destination.
R_metric	uint16_t	Cumulative link cost along the route towards the destination.
R_hop_count	uint8_t	Number of hops of the selected route to the destination.
R_weak_link_count	uint8_t	Number of weak link to destination. It ranges from 0 to adpMaxHops.
validTime	uint16_t	The remaining time to live of this entry in the broadcast log table, in minutes.

(5)adpGroupTable

Table 6-45 shows parameter of adpGroupTable. The number of entry of this table is 16.

Table 6-45 adpGroupTable Parameter

Parameter Name	Type	Description
validState	uint8_t	0: Invalid(default) other: Valid
memberAddr	uint16_t	The 16-bit group addresses to which the device group

(6)adpBlacklistTable

Table 6-46 shows parameter of adpBlacklistTable. The number of entry of this table is 16.

Table 6-46 adpBlacklistTable Parameter

Parameter Name	Type	Description
B_neighbour_address	uint16_t	The 16-bit address of the blacklisted neighbour.
validTime	uint16_t	Remaining time in minutes until which this entry in the blacklisted neighbour table is considered valid.

(7)adpDestinationAddressSet

Table 6-47 shows parameter of adpDestinationAddressSet. The number of entry of this table is 10.

Table 6-47 adpDestinationAddressSet Parameter

Parameter Name	Type	Description
validState	uint8_t	0: Invalid(default) other: Valid
dstAddr	uint16_t	the address of a destination node attached to this LOADng router and for which this LOADng router provides connectivity

(8)adpSoftVersion

Table 6-48 shows parameter of adpSoftVersion.

Table 6-48 adpSoftVersion

Parameter Name	Type	Description
adpVersion	uint8_t[2]	version for ADP
macVersion	uint8_t[2]	version for MAC
dspVersion	uint8_t[2]	version for DSP(LMAC and PHY)

(9)adpStatistics

Table 6-49 shows parameter of adpStatistics.

Table 6-49 adpStatistics List

name	index	description
R_ADP_STATS_LOWPAN_IN_RECEIVES	0	The number of received ADP 6LoWPAN datagrams (include LBP, LOADng)
R_ADP_STATS_LOWPAN_IN_HDR_ERRORS	1	The number of received 6LoWPAN datagrams discarded due to errors in the headers for ADP packets

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R_ADP_STATS_LOWPAN_IN_MESH_RECEIVES	2	The number of received 6LoWPAN datagrams with a MESH header.
R_ADP_STATS_LOWPAN_IN_MESH_FORWDS	3	The number of received 6LoWPAN datagrams requiring mesh forwarding
R_ADP_STATS_LOWPAN_IN_MESH_DELIVERS	4	The number of received 6LoWPAN datagrams delivered locally.
R_ADP_STATS_LOWPAN_IN_REASM_REQDS	5	The number of received 6LoWPAN fragments reassembled.
R_ADP_STATS_LOWPAN_IN_REASM_FAILS	6	The number of failed reassembled 6LoWPAN fragments.
R_ADP_STATS_LOWPAN_IN_REASM_OKS	7	The number of 6LoWPAN packets successfully reassembled.
R_ADP_STATS_LOWPAN_IN_COMP_REQDS	8	The number of received 6LoWPAN datagrams requiring header decompression.
R_ADP_STATS_LOWPAN_IN_COMP_FAILS	9	The number of received 6LoWPAN datagrams where header decompression failed.
R_ADP_STATS_LOWPAN_IN_COMP_OKS	10	The number of received 6LoWPAN datagrams where header decompression was successful.
R_ADP_STATS_LOWPAN_IN_DISCARDS	11	The number of received 6LoWPAN datagrams discarded due to errors in the processing (include LBP, LOADng).
R_ADP_STATS_LOWPAN_IN_DISCARDS_SECURITY	12	The number of received 6LoWPAN datagrams discarded by securityLevel.
R_ADP_STATS_LOWPAN_IN_DISCARDS_BCAST_TBL	13	The number of received 6LoWPAN datagrams discarded by Broadcast log tables.
R_ADP_STATS_LOWPAN_IN_DISCARDS_GROUP_TBL	14	The number of received 6LoWPAN datagrams discarded by Group tables.
R_ADP_STATS_LOWPAN_IN_DISCARDS_IPV6_BFULL	15	The number of received 6LoWPAN datagrams discarded by full of ipv6 buffer.
R_ADP_STATS_LOWPAN_IN_DISCARDS_LBP_BFULL	16	The number of received 6LoWPAN datagrams discarded by full of lbp buffer.
R_ADP_STATS_LOWPAN_IN_DISCARDS_RELAY_BFULL	17	The number of received 6LoWPAN datagrams discarded by full of relay buffer.
R_ADP_STATS_LOWPAN_IN_DELIVERS	18	The number of received ADP IPv6 packets successfully delivered.
R_ADP_STATS_LOWPAN_IN_DELIVERS_UNICAST	19	The number of received ADP IPv6 unicast packets successfully delivered .
R_ADP_STATS_LOWPAN_IN_DELIVERS_MULTICAST	20	The number of received ADP IPv6 multicast packets successfully delivered .
R_ADP_STATS_LOWPAN_OUT_REQUESTS	21	The number of sent ADP IPv6 packets supplied by the IPv6 layer.
R_ADP_STATS_LOWPAN_OUT_COMP_REQDS	22	The number of sent IPv6 packets for which header compression was attempted.
R_ADP_STATS_LOWPAN_OUT_COMP_FAILS	23	The number of sent IPv6 packets for which header compression failed.
R_ADP_STATS_LOWPAN_OUT_COMP_OKS	24	The number of sent IPv6 packets for which header compression was successful.
R_ADP_STATS_LOWPAN_OUT_FRAG_REQDS	25	The number of sent IPv6 packets that required fragmentation.
R_ADP_STATS_LOWPAN_OUT_FRAG_FAILS	26	The number of sent IPv6 packets discarded due to failed fragmentation.
R_ADP_STATS_LOWPAN_OUT_FRAG_OKS	27	The number of sent IPv6 packets successfully fragmented.
R_ADP_STATS_LOWPAN_OUT_FRAG_CREATEES	28	The number of IPv6 packets generated as a result of fragmentation.
R_ADP_STATS_LOWPAN_OUT_MESH_HOP_LIMIT_EXCEEDS	29	The number of 6LoWPAN datagrams dropped because the MESH hop limit was exceeded.

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R_ADP_STATS_LOWPAN_OUT_MESH_NO_ROUTES	30	The number of 6LoWPAN datagrams with a MESH header dropped because of missing forwarding information.
R_ADP_STATS_LOWPAN_OUT_MESH_REQUESTS	31	The number of 6LoWPAN datagrams to be sent requiring MESH header encapsulation. Covers only local encapsulations.
R_ADP_STATS_LOWPAN_OUT_MESH_FORWDS	32	The number of 6LoWPAN datagrams to be forwarded.
R_ADP_STATS_LOWPAN_OUT_MESH_TRANSMITS	33	The number of 6LoWPAN datagrams that have a MESH header.
R_ADP_STATS_LOWPAN_OUT_DISCARDS	34	The number of ADP 6LoWPAN datagrams to be sent but discarded due to processing limitations.
R_ADP_STATS_LOWPAN_OUT_TRANSMITS	35	The number of ADP 6LoWPAN datagrams supplied to the lower layers for transmission.
R_ADP_STATS_LOWPAN_OUT_SUCCESS	36	The number of ADP 6LoWPAN datagrams supplied to the lower layers for transmission as success.
R_ADP_STATS_LOWPAN_OUT_FAILURE	37	The number of ADP 6LoWPAN datagrams supplied to the lower layers for transmission as failure.
R_ADP_STATS_LOWPAN_OUT_FAILURE_NO_ACK	38	The number of ADP 6LoWPAN datagrams supplied to the lower layers for transmission as failure status No Ack.
R_ADP_STATS_LOWPAN_OUT_IPV6_TRANSMITS	39	The number of ADP 6LoWPAN IPv6 datagrams supplied to the lower layers for transmission.
R_ADP_STATS_LOWPAN_OUT_IPV6_SUCCESS	40	The number of ADP 6LoWPAN IPv6 datagrams supplied to the lower layers for transmission as success.
R_ADP_STATS_LOWPAN_OUT_IPV6_FAILURE	41	The number of ADP 6LoWPAN IPv6 datagrams supplied to the lower layers for transmission as failure.
R_ADP_STATS_LOWPAN_OUT_RELAY_TRANSMITS	42	The number of ADP 6LoWPAN forwarding datagrams supplied to the lower layers for transmission.
R_ADP_STATS_LOWPAN_OUT_RELAY_SUCCESS	43	The number of ADP 6LoWPAN forwarding datagrams supplied to the lower layers for transmission as success.
R_ADP_STATS_LOWPAN_OUT_RELAY_FAILURE	44	The number of ADP 6LoWPAN forwarding datagrams supplied to the lower layers for transmission as failure.
R_ADP_STATS_LOWPAN_IN_LBP_RECEIVES	45	The number of received LBP packets
R_ADP_STATS_LOWPAN_IN_LBP_DISCARDS	46	The number of received LBP packets discarded due to errors in the processing.
R_ADP_STATS_LOWPAN_OUT_LBP_DISCARDS	47	The number of LBP 6LoWPAN datagrams to be sent but discarded due to processing limitations.
R_ADP_STATS_LOWPAN_OUT_LBP_REQUESTS	48	The number of sent LBP IPv6 packets supplied by the IPv6 layer.
R_ADP_STATS_LOWPAN_OUT_LBP_TRANSMITS	49	The number of LBP 6LoWPAN datagrams supplied to the lower layers for transmission.
R_ADP_STATS_LOWPAN_OUT_LBP_SUCCESS	50	The number of LBP 6LoWPAN datagrams supplied to the lower layers for transmission as success.
R_ADP_STATS_LOWPAN_OUT_LBP_FAILURE	51	The number of LBP 6LoWPAN datagrams supplied to the lower layers for transmission as failure.
R_ADP_STATS_EAPPSK_SUCCESS	52	The number of success count of EAP-PSK (include Join and Gmktransmission during Rekey)

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R_ADP_STATS_EAPPSK_FAILURE_MSG3_MACS	53	The number of mismatch count of MACS on eap message 3
R_ADP_STATS_EAPPSK_FAILURE_MSG3_EAX	54	The number of mismatch count of EAX on eap message 3
R_ADP_STATS_EAPPSK_FAILURE_MSG3_PCH	55	The number of error count of PCH on eap message 3
R_ADP_STATS_LOWPAN_IN_LOADNG_RECEIVES	56	The number of received LOADNG packets.
R_ADP_STATS_LOWPAN_IN_LOADNG_RECEIVES_RREQ	57	The number of received LOADNG RREQ packets.
R_ADP_STATS_LOWPAN_IN_LOADNG_RECEIVES_RREP	58	The number of received LOADNG RREP packets.
R_ADP_STATS_LOWPAN_IN_LOADNG_RECEIVES_RERR	59	The number of received LOADNG RERR packets.
R_ADP_STATS_LOWPAN_IN_LOADNG_RECEIVES_PREQ	60	The number of received LOADNG PREQ packets.
R_ADP_STATS_LOWPAN_IN_LOADNG_RECEIVES_PREP	61	The number of received LOADNG PREP packets.
R_ADP_STATS_LOWPAN_IN_LOADNG_DISCARDS	62	The number of received LOADNG packets discarded due to errors in the processing.
R_ADP_STATS_LOWPAN_IN_LOADNG_DISCARDS_BY_BLACKLIST	63	The number of received LOADNG packets discarded by blacklisted neighbour tables.
R_ADP_STATS_LOWPAN_OUT_LOADNG_DISCARDS	64	The number of LOADNG packets to be sent but discarded due to processing limitations.
R_ADP_STATS_LOWPAN_OUT_LOADNG_REQUESTS_RREQ	65	The number of generated LOADNG RREQ packets.
R_ADP_STATS_LOWPAN_OUT_LOADNG_REQUESTS_RREQ_REPAIR	66	The number of generated LOADNG RREQ packets as repair.
R_ADP_STATS_LOWPAN_OUT_LOADNG_REQUESTS_PREQ	67	The number of generated LOADNG PREQ packets.
R_ADP_STATS_LOWPAN_OUT_LOADNG_TRANSMITS	68	The number of sent LOADNG packets supplied to the lower layers for transmission.
R_ADP_STATS_LOWPAN_OUT_LOADNG_SUCCESS	69	The number of sent LOADNG packets supplied to the lower layers for transmission as success.
R_ADP_STATS_LOWPAN_OUT_LOADNG_FAILURE	70	The number of sent LOADNG packets supplied to the lower layers for transmission as failure.
R_ADP_STATS_LOWPAN_OUT_LOADNG_FAILURE_NOACK	71	The number of sent LOADNG packets supplied to the lower layers for transmission as failure which status is NoAck.
R_ADP_STATS_LOWPAN_OUT_LOADNG_FAILURE_NOACK_RREQ	72	The number of sent LOADNG packets supplied to the lower layers for transmission as failure which status is NoAck for unicastRREQ.
	73-78	Reserved.

7. Command Specification for EAP Layer

This section explains about details of command specification of EAP Layer.

Table 7-1 shows a command list of EAP Layer.

Availability of these functions by each G3 Configuration Mode is described in section 2.3.

Table 7-1 EAP Layer Command List

Command Name	Command ID	SAP Access type (-:Disable, V:Enable)			Description
		Request	Confirm	Indication	
EAPM-RESET	0x00	V	V	-	Request of resetting EAP Layer.
EAPM-START	0x01	V	V	-	Request of enabling transmission/reception of LBP message.
EAPM-GET	0x02	V	V	-	Request of obtaining EAP IB Attribute.
EAPM-SET	0x03	V	V	-	Request of setting EAP IB Attribute
EAPM-NETWORK	0x04	V	V	-	Request of transmission request of kick processing and GMK-related processing.
EAPM-SETCLIENTINFO	0x05	V	V	-	Request of transmission request of operating client information.
EAPM-NETWORK-JOIN	0x06	-	-	V	Notification that Peer participates in PAN.
EAPM-NETWORK-LEAVE	0x07	-	-	V	Notification that Peer secedes from PAN.
EAPM-NEWDEVICE	0x08	-	-	V	Notification that the following cases occurred. PAN device which is not registered in eapClientInformation sends a request of joining PAN. EAPM-NETWORK.request is called for a PAN device which is not registered in eapClientTable.
EAPM-EAP-KEY	0x09	-	-	V	Notification of a key generated in the process of EAP-PSK.

7.1 EAPM-RESET

7.1.1 EAPM-RESET.request

This command is used to send a request of resetting EAP layer.
Table 7-2 shows this command format.

Table 7-2 EAPM-RESET.request Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x5	
CMD	1byte	0x00	
DAT	Not available.		

7.1.2 EAPM-RESET.confirm

This command is used to send notification as response to EAPM-RESET.request.
Table 7-3 shows this command format.

Table 7-3 EAPM-RESET.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x5	
CMD	1byte	0x00	
DAT			
	status	1byte	Refer Table 7-18. Status code <i>R_EAP_STATUS_SUCCESS</i> : · Succeeded. <i>R_EAP_STATUS_CONFIG_ERROR</i> : · G3 Configuration parameter is invalid. <i>R_EAP_STATUS_INVALID_REQUEST</i> : · Called at the invalid state.

7.2 EAPM-START

7.2.1 EAPM-START.request

This command is used to send a request of enabling processing of transmitting/receiving LBP message with ADP Layer.

Table 7-4 shows this command format.

Table 7-4 EAPM-START.request Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x5	
CMD	1byte	0x01	
DAT	Not available.		

7.2.2 EAPM-START.confirm

This command is used to send notification as response to EAPM-START.request.

Table 7-5 shows this command format.

Table 7-5 EAPM-START.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x5	
CMD	1byte	0x01	
DAT			
	status	1byte	Refer Table 7-18. Status code <i>R_EAP_STATUS_SUCCESS</i> : · Succeeded. <i>R_EAP_STATUS_INVALID_REQUEST</i> : · EAPM-START.request has already succeeded.

7.3 EAPM-GET

7.3.1 EAPM-GET.request

This command is used to send a request of obtaining EAP IB Attribute value of EAP layer.

When EAP IB Attribute is table type, specify an index of a table which you want to obtain for parameter AttributeIndex to acquire a value. Refer to section 7.12 for details of EAP IB Attribute.

Table 7-6 shows this command format.

Table 7-6 EAPM-GET.request Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x5	
CMD	1byte	0x02	
DAT			
eibAttributeld	1byte	Refer to section 7.12.	The identifier of the IB attribute to read
eibAttributeIndex	2byte	Refer to section 7.12.	The index within the table of the specified IB attribute to read. This parameter is valid only for IB attributes that are tables.

7.3.2 EAPM-GET.confirm

This command is used to send notification as response to EAPM-GET.request.
Table 7-7 shows this command format.

Table 7-7 EAPM-GET.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x5	
CMD	1byte	0x02	
DAT			
status	1byte	Refer Table 7-18.	Status code <i>R_EAP_STATUS_SUCCESS</i> : · Succeeded. <i>R_EAP_STATUS_UNSUPPORTED_ATTRIBUTE</i> : · Unsupported IB Attribute ID was specified. <i>R_EAP_STATUS_INVALID_INDEX</i> : · A value out of the range was specified for AttributeIndex.
eibAttributeId	1byte	Refer to section 7.12.	The identifier of the PIB attribute to read
eibAttributeIndex	2byte	Refer to section 7.12.	The index within the table of the specified PIB attribute to read. This parameter is valid only for EAP IB attributes that are tables.
eibAttributeValue	66byte	Refer to section 7.12.	The value of the indicated EAP IB attribute that was read. The value is set a left-aligned in 66 byte length data.

7.4 EAPM-SET

7.4.1 EAPM-SET.request

This command is used to send a request of setting EAP IB Attribute value of EAP layer.

When EAP IB Attribute is table type, specify an index of a table which you want to set for parameter AttributeIndex to set a value. Refer to section 7.12 for details of EAP IB Attribute.

Table 7-8 shows this command format.

Table 7-8 EAPM-SET.request Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x5	
CMD	1byte	0x03	
DAT			
eibAttributeId	1byte	Refer to section 7.12.	The identifier of the PIB attribute to write
eibAttributeIndex	2byte	Refer to section 7.12.	The index within the table of the specified IB attribute to be written. This parameter is valid only for IB attributes that are tables
eibAttributeValue		Refer to section 7.12.	The value to write.

7.4.2 EAPM-SET.confirm

This command is used to send notification as response to EAPM-SET.request.

Table 7-9 shows this command format.

Table 7-9 EAPM-SET.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x5	
CMD	1byte	0x03	
DAT			
status	1byte	Refer Table 7-18.	Status code <i>R_EAP_STATUS_SUCCESS</i> : ·Succeeded. <i>R_EAP_STATUS_UNSUPPORTED_ATTRIBUTE</i> : ·Unsupported IB Attribute ID was specified. <i>R_EAP_STATUS_INVALID_INDEX</i> : ·A value out the range was specified for AttributeIndex. <i>R_EAP_STATUS_INVALID_PARAMETER</i> : ·Value out of the range was specified. <i>R_EAP_STATUS_READ_ONLY</i> : ·Read-only IB Attribute ID was specified. <i>R_EAP_STATUS_INVALID_REQUEST</i> : ·Called at the invalid state. <i>R_EAP_STATUS_CONFIG_ERROR</i> : ·There is a conflict in configuration setting.

7. Command Specification for EAP Layer

				<i>R_EAP_STATUS_IF_NO_RESPONSE:</i> · No response from ADP layer. <i>R_ADP_STATUS_IF_NO_RESPONSE:</i> · No response from MAC layer.
	eibAttributeId	1byte	Refer to section 7.12.	The identifier of the PIB attribute to write
	eibAttributeIndex	2byte	Refer to section 7.12.	The index within the table of the specified PIB attribute to write. This parameter is valid only for EAP PIB attributes that are tables.

7.5 EAPM-NETWOK

7.5.1 EAPM-NETWORK.request

This command is used to send a request of executing processing which is specified by parameter “cmdld” to a PAN device. This processing is realized by transmitting/reception LBP messages.

Table 7-10 shows this command format.

Table 7-10 EAPM-NETWORK.request Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x5	
CMD	1byte	0x04	
DAT			
gmklld	1byte	0-1	The index of GMK for the request.
cmdld	1byte	1-3	Command Id of the request. 1:Kick 2:GMK transmission 3:GMK activation
reqHandle	1byte	0-0xFF	The handle of the request by this primitive.
extendedAddress	8byte	0x0000000000000000- 0xFFFFFFFFFFFFFFFF	ExtendedAddress of the destination.

7.5.2 EAPM-NETWORK.confirm

This command is used to send notification as response to EAPM-NETWORK.request.

Table 7-11 shows this command format.

Table 7-11 EAPM-NETWORK.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x5	
CMD	1byte	0x04	
DAT			
status	1byte	Refer Table 7-18.	Status code <i>R_EAP_STATUS_SUCCESS</i> : ·Succeeded. <i>R_EAP_STATUS_INVALID_REQUEST</i> : ·Called at the invalid state. <i>R_EAP_STATUS_INVALID_PARAMETER</i> : ·Value out of the range was specified. <i>R_EAP_STATUS_TIMEOUT</i> : ·Processing timed out. <i>R_EAP_STATUS_REQ_QUEUE_FULL</i> : ·Called when there was no room in internal buffer. <i>R_EAP_STATUS_EAP_PSK_IN_PROGRESS</i> :

7. Command Specification for EAP Layer

				<ul style="list-style-type: none"> ·EAP-PSK processing is in progress to a target Peer. <p><i>R_EAP_STATUS_BLACKLISTED_DEVICE:</i></p> <ul style="list-style-type: none"> ·Called for Peer which is registered in eapClientInfoTable with accessControl=1. <p><i>R_EAP_STATUS_EAP_PSK_FAILURE:</i></p> <ul style="list-style-type: none"> ·Failed to execute EAP-PSK processing. <p><i>Status of ADPM-LBP.confirm:</i></p> <ul style="list-style-type: none"> ·Status code other than ADP_SUCCESS was notified from ADP layer.
	reqHandle	1byte	0x00-0xFF	The handle of the request by this primitive.
	extendedAddress	8byte	0x0000000000000000-0xFFFFFFFFFFFFFFFF	extendedAddress of the destination

7.6 EAPM-SETCLIENTINFO

7.6.1 EAPM-SETCLIENTINFO.request

This command is used to send a request of registering client information to eapClientInfoTable of EAP IB Attribute or invalidating client information.

Client information is registered in free entry of eapClientInfoTable. However, if there already exists an entry of the same extended address, information is updated by overwriting the entry. If there is no free entry, client information is registered by overwriting the oldest entry. Size of eapClientInfoTable is different by specified routeType in G3-INIT.request with EAP mode.

To invalidate client information, invalidation processing is executed to entry of specified extended address.

When EAPM-NEWDEVICE.indication is notified, processing after that can be continued by registering client information of extended address which has been notified using this command. Refer to section 7.9.1 for details of EAPM-NEWDEVICE.indication.

Table 7-12 shows this command format.

Table 7-12 EAPM-SETCLIENTINFO.request Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x0	
IDP	4bit	0x5	
CMD	1byte	0x05	
DAT			
validFlag	1byte	TRUE/FALSE	TRUE: validate for the extendedAddress FALSE: invalidate for the extendedAddress. If the case, other parameter is ignored.
extendedAddress	8byte	0x0000000000000000-0xFFFFFFFFFFFFFFFF	extendedAddress of the destination
accessControl	1byte	0,other	0:give permission for the extendedAddress other: black listed
networkAddress	2byte	0x0000-0x7FFF	Short address be allocated the extendedAddress during EAP-PSK on bootstrap
PSK	16byte	Any	PSK(pre shared key) for EAP-PSK
extIdFlag	1byte	TRUE/FALSE	TRUE: indicated ExtId exist. When japan route B mode is used, this flag shall always be TRUE. FALSE: indicated ExtId does not exist. When route A mode is used, this flag shall always be FALSE.
length	1byte	1-36	Valid data length of extID.
id	36byte	Any	ExtId. This parameter is used for Japan route B only. If data length is less than 36byte, set a value in left-justified. Fill in other data length with 0 data.

7.6.2 EAPM-SETCLIENTINFO.confirm

This command is used to send notification as response to EAPM-SET-CLIENTINFO.request.
Table 7-13 shows this command format.

Table 7-13 EAPM-SETCLIENTINFO.confirm Command Format

Field	Length	Valid value	Description
IDC	1bit	0x0-0x1	Corresponding G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x1	
IDP	4bit	0x5	
CMD	1byte	0x05	
DAT			
status	1byte	Refer Table 7-18.	Status code <i>R_EAP_STATUS_SUCCESS</i> : · Succeeded. <i>R_EAP_STATUS_INVALID_PARAMETER</i> : · Invalid parameter was specified. <i>R_EAP_STATUS_INVALID_REQUEST</i> : · Called while EAPM-RESET.request was failed. <i>R_EAP_STATUS_CONFIG_ERROR</i> : · There is a conflict in configuration setting.
extendedAddress	8byte	0x0000000000000000-0xFFFFFFFFFFFFFFFF	extendedAddress of the destination
attributeIndex	2byte	Refer to section 7.12	The index within the table of the specified PIB attribute to write. This parameter is valid only for EAP PIB attributes that are tables.

7.7 EAPM-NETWORK-JOIN

7.7.1 EAPM-NETWORK-JOIN.indication

This command is used to send notification when new PAN device joins PAN.

Table 7-14 shows this command format.

Table 7-14 EAPM-NETWORK-JOIN.indication Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x5	
CMD	1byte	0x06	
DAT			
status	1byte	Refer Table 7-18.	Status code <i>R_EAP_STATUS_SUCCESS</i> : ·Join request process completely succeeded. <i>R_EAP_STATUS_TIMEOUT</i> : ·Join request process failed by timeout. <i>R_EAP_STATUS_EAP_PSK_FAILURE</i> : ·Join request process failed by EAP-PSK process error. <i>R_EAP_STATUS_JOIN_DISCARD</i> : ·Join request discard cause from eapDisableJoin==1 or conflict with network request(Kick, Rekeying). <i>Status of ADPM-LBP.confirm</i> : ·Refer Table 6-27.
extendedAddress	8byte	0x0000000000000000-0xFFFFFFFFFFFFFFFF F	ExtendedAddress of the destination
lbaAddress	2byte	0x0000-0x7FFF	LBA address. If LBD joined as direct, this address set CoordShortAddress

7.8 EAPM-NETWORK-LEAVE

7.8.1 EAPM-NETWORK-LEAVE.indication

This command is used to send notification when a joined PAN device secedes from PAN.
Table 7-15 shows this command format.

Table 7-15 EAPM-NETWORK-LEAVE.indication Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x5	
CMD	1byte	0x07	
DAT			
extendedAddress	8byte	0x0000000000000000- 0xFFFFFFFFFFFFFFFF	ExtendedAddress who leave from the PAN.

7.9 EAPM-NEWDEVICE

7.9.1 EAPM-NEWDEVICE.indication

This command is used to send notification when any processing is required for PAN device which is not registered in eapClientInfoTable of EAP IB Attribute.

This command is notified in the following two conditions.

- When a PAN device which is not registered in eapClientInformation sends a request of joining PAN.
- When EAPM-NETWORK.request is called for a PAN device which is not registered in eapClientTable.

Table 7-16 shows this command format.

Table 7-16 EAPM-NEWDEVICE.indication Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x5	
CMD	1byte	0x08	
DAT			
extendedAddress	8byte	0x0000000000000000- 0xFFFFFFFFFFFFFFFF	ExtendedAddress who requested join for the PAN.

7.10 EAPM-EAP-KEY

7.10.1 EAPM-EAP-KEY.indication

This command is used to send notification when a key is generated in the process of EAP-PSK. This command's enable/disable depends on the setting value of eapKeyIndEnable of EAP IB. The default value of adpRrepIndEnable is FALSE (command disable).

Table 7-17 shows this command format.

Table 7-17 EAPM-EAP-KEY.indication Command Format

Field	Size	Valid value	Description
IDC	1bit	0x0-0x1	Target G3 Channel. 0x0: Channel 0 0x1: Channel 1
IDA	3bit	0x2	
IDP	4bit	0x5	
CMD	1byte	0x09	
DAT			
extendedAddress	8byte	0x0000000000000000-0xFFFFFFFFFFFFFFFF	ExtendedAddress who requested join for the PAN.
type	1byte	0x00-0x05	0x0:PSK 0x1:AK 0x2:KDK 0x3:TEK 0x4:MSK 0x5:EMSK Now supported MSK only
length	1byte	0x10-0x40	length of the key in byte
key	64byte	-	key

7.11 EAP Layer Status Code

Table 7-18 shows a list of status codes of EAP layer.

In addition to this, EAP layer may return lower layer status code described in section 6.21 and section 5.12.

Table 7-18 EAP Status Code List

Status code	Value	Description
R_EAP_STATUS_SUCCESS	0x00	Processing completely success.
R_EAP_STATUS_INVALID_PARAMETER	0xE8	Error during parameter check of SAP.
R_EAP_STATUS_UNSUPPORTED_ATTRIBUTE	0xF4	A SET/GET request was issued with the identifier of a PIB attribute that is not supported.
R_EAP_STATUS_INVALID_INDEX	0xF9	An attempt to write to a IB attribute that is in a table failed because the specified table index was out of range.
R_EAP_STATUS_READ_ONLY	0xFB	A SET/GET request was issued with the identifier of an attribute that is read only.
R_EAP_STATUS_INVALID_REQUEST	0x80	Received invalid request.
R_EAP_STATUS_FAILED	0x93	Some error occur during process.
R_EAP_STATUS_CONFIG_ERROR	0x95	EAPM-RESET process failure caused by G3-SetConfig parameter.
R_EAP_STATUS_EAP_PSK_IN_PROGRESS	0x98	EAPM-NETWORK could not accept caused by requested 64bit address still be processing.
R_EAP_STATUS_BLACKLISTED_DEVICE	0x99	Request finished as blacklisted
R_EAP_STATUS_EAP_PSK_FAILURE	0x9A	EAP-PSK process failed by error
R_EAP_STATUS_REQ_QUEUE_FULL	0x9B	Request could not accepted caused by internal queue full.
R_EAP_STATUS_TIMEOUT	0x9C	Request failure caused by timeout
R_EAP_STATUS_JOIN_DISCARD	0x9D	Join request discard cause from eapDisableJoin==1 or conflict with network request(Kick Rekeying)
R_EAP_STATUS_INSUFFICIENT_MEMSIZE	0xA0	Error caused by allocated memory is not enough.
R_EAP_STATUS_IF_NO_RESPONSE	0xA3	Request failure caused by no response from lower layer.

7.12 EAP IB Attribute

7.12.1 EAP IB Attribute Renesas Original

Table 7-19 shows a list of EAP IB Attribute Renesas original.

Table 7-19 EAP IB Attribute Renesas Original List

Attribute	Identifier	Type	RW	Range	Description	Default
eapGMK	0x00	table	w	Any	Write-only 16 byte GMK. Refer Table 7-20.	All Zero
eapActiveKeyIndex	0x01	uint8_t	rw	0-1	Index of the active GMK to be used for data transmission.	0
eapCoordShortAddress	0x02	uint16_t	rw	0x0000-0x7FFF	Defines the short MAC address of the coordinator	0
eapCinfoTableEntries	0x03	uint16_t	r	0-0xFFFF	entries for Client information table	depend on initial setup
eapClientInfoTable	0x04	table	rw	-	Client information table. Refer Table 7-21 and Table 7-22.	Empty
eapJoinWaittimeSec	0x05	uint16_t	rw	0-1024	Time to live of a EAP-PSK buffer while EAP-PSK Join from Peer.	180
eapJoinGmkId	0x06	uint8_t	rw	0-1	Index of GMK for EAP-PSK when eapActiveKeyIndex is set, this value is also set same value.	0
eapDisableJoin	0x07	uint8_t	rw	TRUE/ FALSE	FALSE:EAP accept join request depend on client information table	FALSE
eapEapPskRetryNum	0x08	uint8_t	rw	0-8	Retry number when coordinator received key mismatch	0
eapNwkWaittimeSec	0x09	uint16_t	rw	0-1024	Time to live for EAPM-NETWORK.request	180
eapOnetimeClientInfo	0x0A	uint8_t	rw	TRUE/ FALSE	FALSE: keep client information after EAPM-NETWORK-JOIN.indication and EAPM-NETWORKconfirm TRUE: remove client information after EAPM-NETWORK-JOIN.indication and EAPM-NETWORKconfirm	FALSE
eapKeyIndEnable	0x0B	uint8_t	rw	TRUE/ FALSE	If TRUE, EAP enabled issue EAPM-EAP-KEY.indication	FALSE
eapSoftVersion	0x10	uint16_t	r	-	The software version.	-
eapStatistics	0x50	table	r	-	Statistics information of EAP module. The structure of each elements are defined as "uint8_t[4]" This information does not cleared by EAPM-RESET.	Empty

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					If user wants to clear the info, it should be call G3-CLEARINFO or G3-INIT. Refer Table 7-23.	
--	--	--	--	--	--	--

7.12.2 EAP Table Definition for EAP IB Attribute

(1)eapGMK

Table 7-20 shows parameter of eapGMK. The number of entry of this table is 2.

Table 7-20 eapGMK Parameter

Parameter Name	TYPE	Range	Description
GMK	uint8_t[16]	Any	GMK value

(2)eapClientInfoTable

Table 7-21 shows parameter of eapClientInfoTable for routeType = 0x00 (Normal route). Table 7-22 shows parameter of eapClientInfoTable for routeType = 0x01 (Japan route B). The number of entry of this table is depended on G3-INIT.request parameter.

Table 7-21 eapClientInfoTable Parameter for Normal Route

Parameter Name	TYPE	Range	Description
validFlg	uint8_t	TRUE/FALSE	TRUE: valid about the index FALSE: invalidate about the index
extendedAddress	uint8_t [8]	0x0000000000000000-0xFFFFFFFFFFFFFFFF	extendedAddress of the destination
accessControl	uint8_t	0,other	0:give permission for the extendedAddress Other: black listed
networkAddress	uint16_t	0x0000-0x7FFF	Short address be allocated the extendedAddress during EAP-PSK on bootstrap
PSK	uint8_t[16]	Any	PSK(pre shared key) for EAP-PSK
extIdFlg	uint8_t	TRUE/FALSE	TRUE: indicated ExtId exist. When japan route B mode is used, this flag shall always be TRUE. FALSE: indicated ExtId does not exist. When normal route mode is used, this flag shall always be FALSE.

Table 7-22 eapClientInfoTable Parameter for Japan Route B

Parameter Name	TYPE	Range	Description
validFlg	uint8_t	TRUE/FALSE	TRUE: valid about the index FALSE: invalidate about the index
extendedAddress	uint8_t [8]	0x0000000000000000-0xFFFFFFFFFFFFFFFF	extendedAddress of the destination
accessControl	uint8_t	0,other	0:give permission for the extendedAddress Other: black listed
networkAddress	uint16_t	0x0000-0x7FFF	Short address be allocated the extendedAddress during EAP-PSK on bootstrap
PSK	uint8_t[16]	Any	PSK(pre shared key) for EAP-PSK
extIdFlg	uint8_t	TRUE/FALSE	TRUE: indicated ExtId exist. When japan route B mode is used, this flag shall always be TRUE. FALSE: indicated ExtId does not

7. Command Specification for EAP Layer

			exist. When normal route mode is used, this flag shall always be FALSE.
length	uint8_t	1-36	The length of id in byte. For Japan routeB, this parameter shall always be 36(ID_P)
id	uint8_t[36]	Any	ID_P for Japan route B

(3)eapStatistics

Table 7-23 shows parameter of eapStatistics.

Table 7-23 eapStatistics List

name	index	description
R_EAP_STATS_LBP_IN_RECEIVES	0	The number of received LBP packet from ADP
R_EAP_STATS_LBP_IN_RECEIVES_JOINREQ	1	The number of received LBP join request packet
R_EAP_STATS_LBP_IN_RECEIVES_LEAVE	2	The number of received LBP leave request packet
R_EAP_STATS_LBP_IN_DISCARD	3	The number of received LBP packet discarded due to errors in processing
R_EAP_STATS_LBP_OUT_TRANSMITS	4	The number of LBP supplied to the ADP layers for transmission.
R_EAP_STATS_LBP_OUT_SUCCESS	5	The number of LBP supplied to the ADP layers for transmission as success.
R_EAP_STATS_LBP_OUT_FAILURE	6	The number of LBP supplied to the ADP layers for transmission as failure.
R_EAP_STATS_EAPPSK_SUCCESS	7	The number of success count of EAP-PSK (include Join and Gmktransmission during Rekey)
R_EAP_STATS_EAPPSK_FAILURE_MSG2_MACP	8	The number of mismatch count of MACP on eap message 2
R_EAP_STATS_EAPPSK_FAILURE_MSG4_EAX	9	The number of mismatch count of EAX on eap message 4
R_EAP_STATS_EAPPSK_FAILURE_MSG4_PCH	10	The number of error count of PCH on eap message 4
R_EAP_STATS_NEWDEVICE	11	The number of Issued EAPM-NEWDEVICE.indication
R_EAP_STATS_JOIN_SUCCESS	12	The number of Issued EAPM-NETWORK-JOIN.indication as success
R_EAP_STATS_JOIN_FAILURE	13	The number of Issued EAPM-NETWORK-JOIN.indication as failure
R_EAP_STATS_JOIN_DISCARD	14	The number of Issued EAPM-NETWORK-JOIN.indication as discard
R_EAP_STATS_KICK_SUCCESS	15	The number of success count of Kick
R_EAP_STATS_KICK_FAILURE	16	The number of failure count of Kick
R_EAP_STATS_GMKTRANS_SUCCESS	17	The number of success count of GMK transmission during Rekey
R_EAP_STATS_GMKTRANS_FAILURE	18	The number of failure count of GMK transmission during Rekey
R_EAP_STATS_GMKACTIVATE_SUCCESS	19	The number of success count of GMK activation during Rekey
R_EAP_STATS_GMKACTIVATE_FAILURE	20	The number of failure count of GMK activation during Rekey
R_EAP_STATS_INVALIDQUEUE	21	The number of detect invalid queue
	22-27	Reserved.

8. Sample Sequences

This section explains about some basic sample sequences.

8.1 Setup as Coordinator

Example of sequences when setting up as Coordinator is as follows.

1. Constructing G3 Channel with G3 Configuration Mode as EAP mode (G3-INIT)
2. Set G3 Configuration Parameter of ADP Layer (G3-SETCONFIG)
3. Reset ADP Layer (ADPM-RESET)
4. Reset EAP Layer (EAPM-RESET)
5. Set a device type of ADP Layer as PAN coordinator (ADPM-SET)
6. Set GMK to EAP Layer (EAPM-SET)
7. Search an existing PAN (ADPM-DISCOVERY)
8. Start PAN with a PANId different from existing PAN (ADPM-NETWORK-START)
9. Enable processing of transmitting/receiving LBP message between EAP Layer and ADP Layer (EAPM-START)

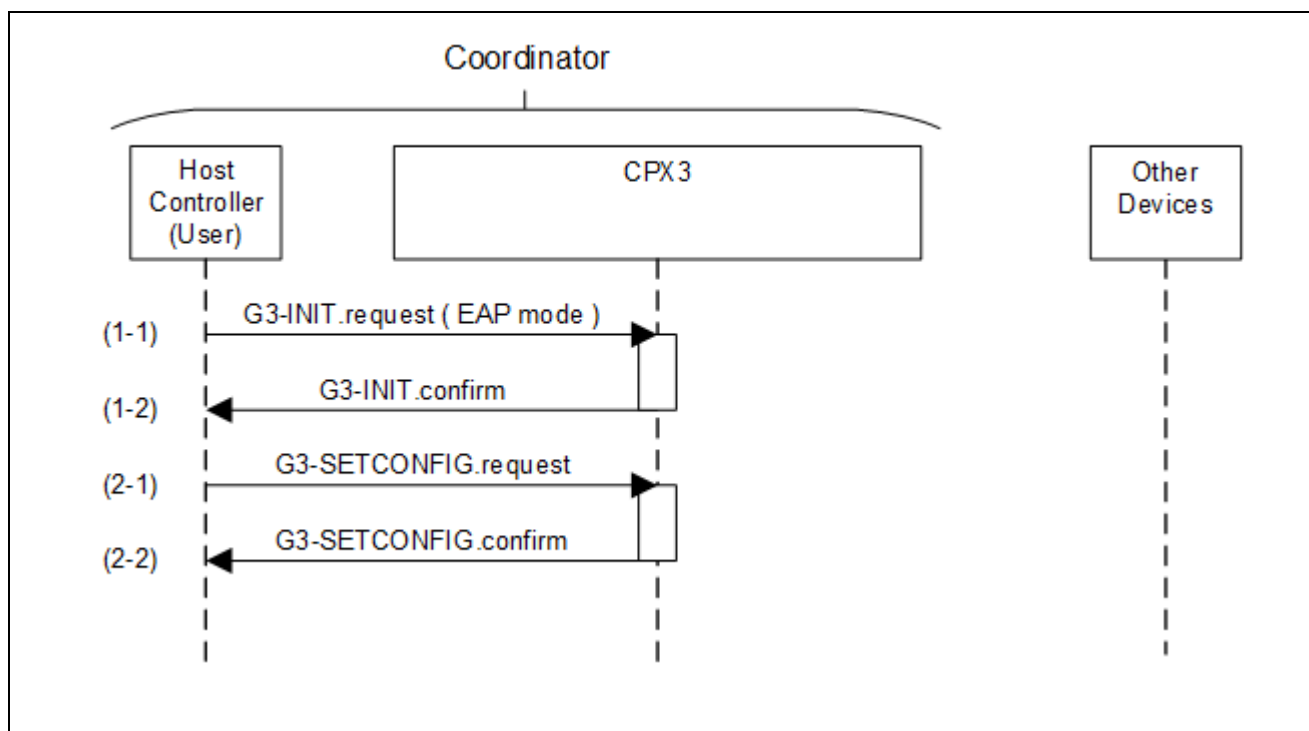


Figure 8-1 Example of setup sequence of Coordinator (Step 1 to 2)

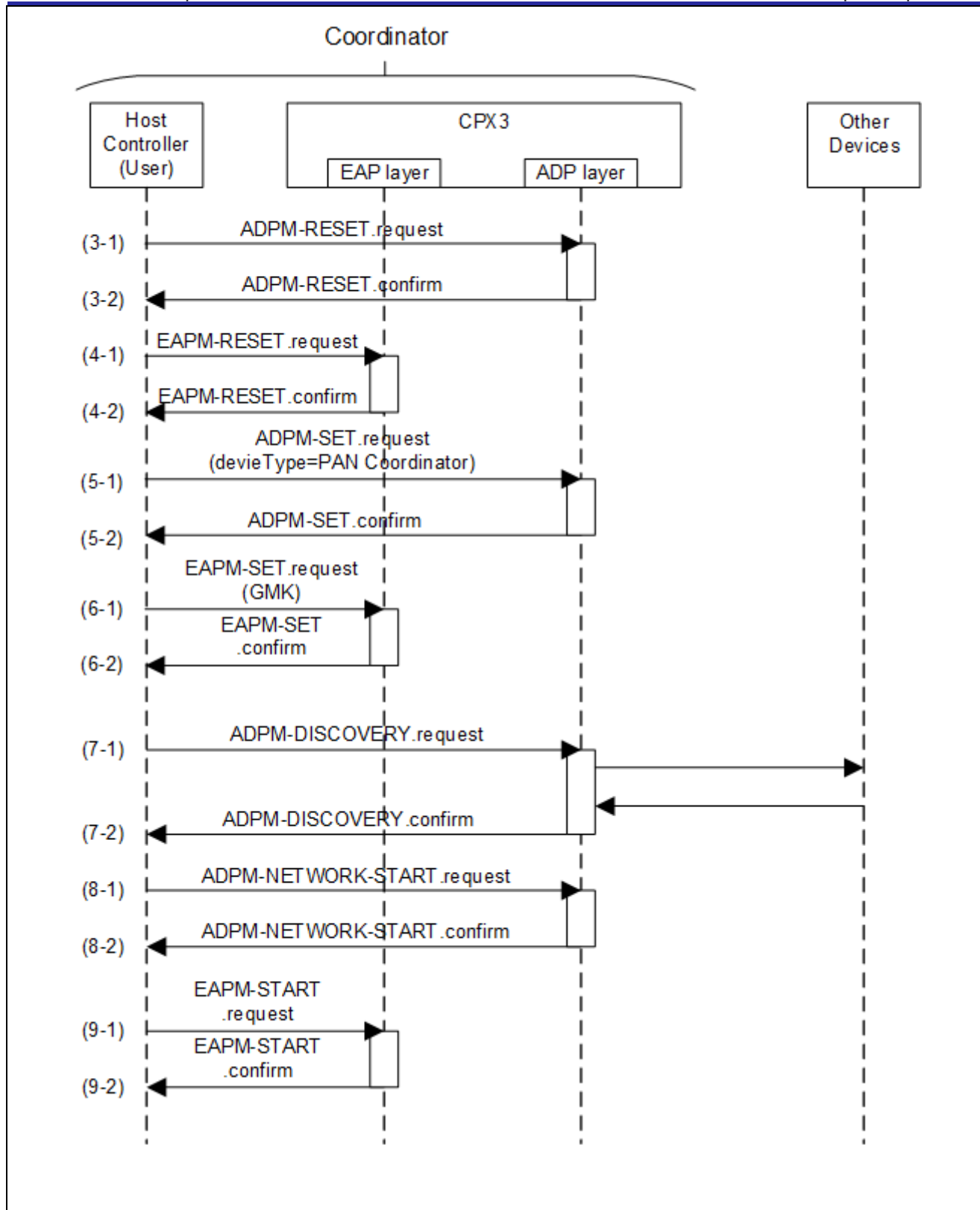


Figure 8-2 Example of setup sequence of Coordinator (Step 3 to 9)

8.2 Setup as Peer

Example of sequences when setting up as Peer is as follows.

1. Constructing G3 Channel with G3 Configuration Mode as ADP mode (G3-INIT)
2. Set G3 Configuration Parameter of ADP Layer (G3-SETCONFIG)
3. Reset ADP Layer (ADPM-RESET)
4. Set a device type of ADP Layer as PAN device (ADPM-SET)

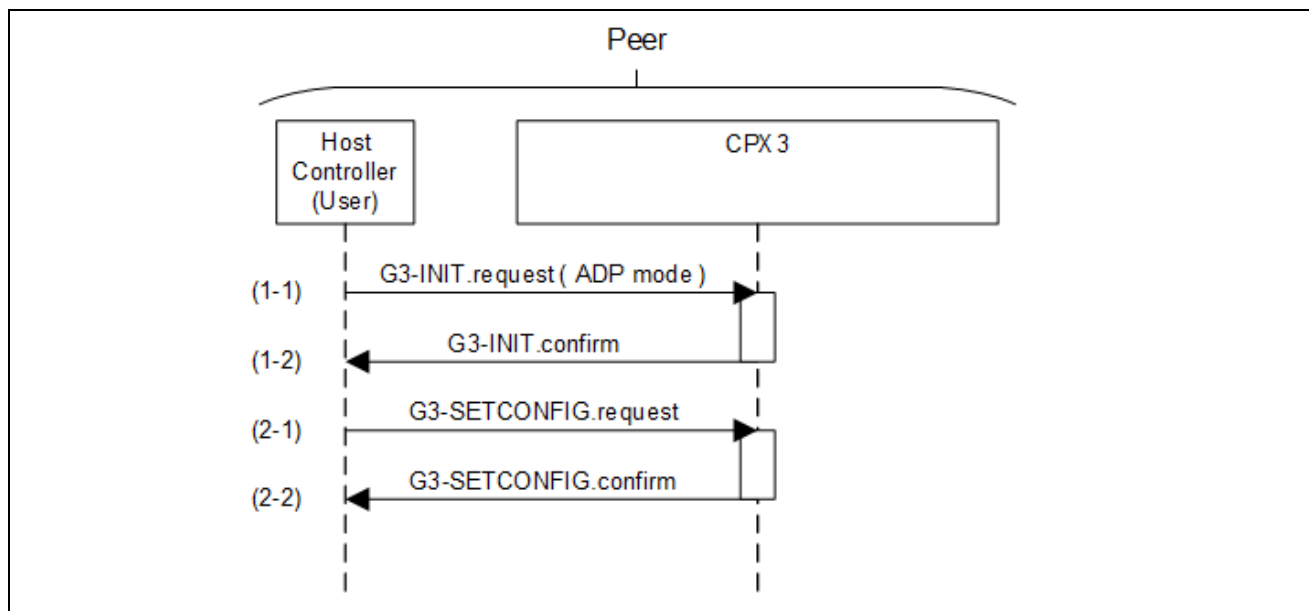


Figure 8-3 Example of setup sequence of Peer (Step 1 to 2)

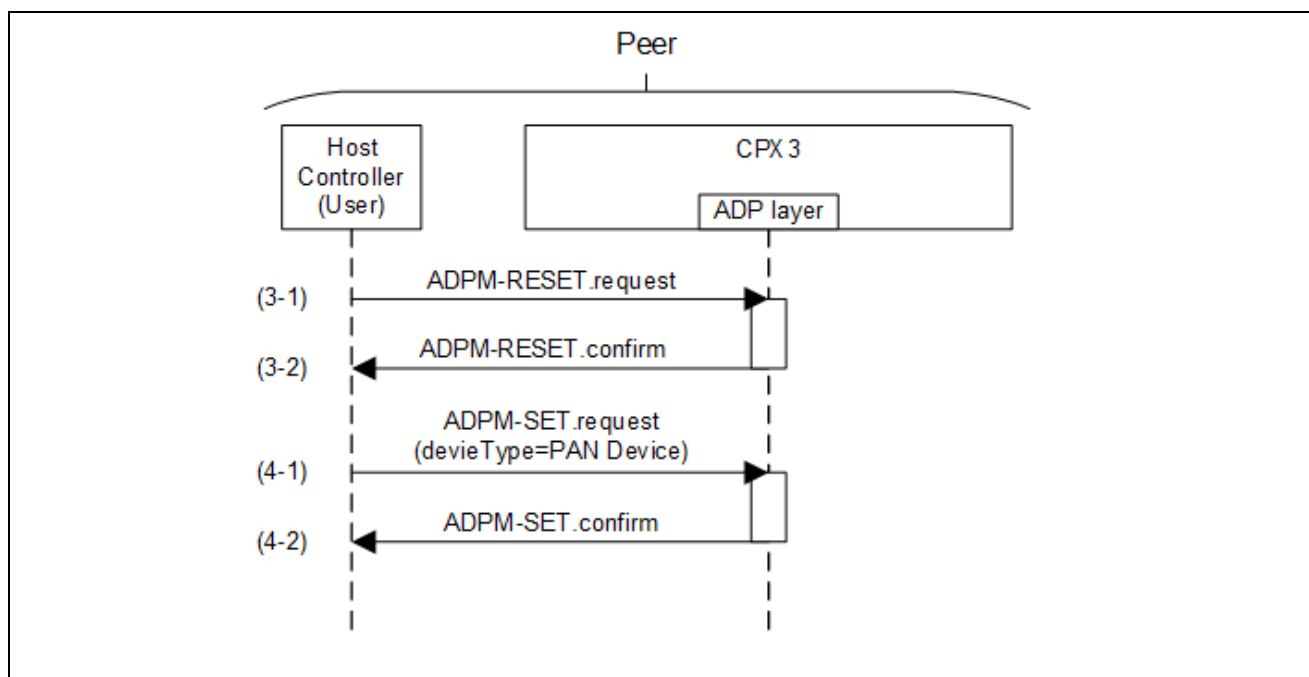


Figure 8-4 Example of setup sequence of Peer (Step 3 to 4)

8.3 Joining PAN

Example of sequences when Coordinator grants a request of joining PAN which Peer has sent to Coordinator is shown below.

1. Peer: Search existing PAN (ADPM-DISCOVERY)
2. Peer: Send a request of joining PAN (ADPM-NETWORK-JOIN)
3. Coordinator: EAPM-NEWDEVICE.indication is notified.
4. Coordinator: Register client information of Peer which will join PAN from the notified information (EAPM-SET-CLIENTINFO)
5. (Peer: ADPM-EAP-KEY.indication and ADPM-KEY-STATE.indication are notified)
6. When EAP-PSK processing completes, ADPM-NETWORK-JOIN.confirm will be notified to Peer and EAPM-NETWORK-JOIN.indication will be notified to Coordinator.

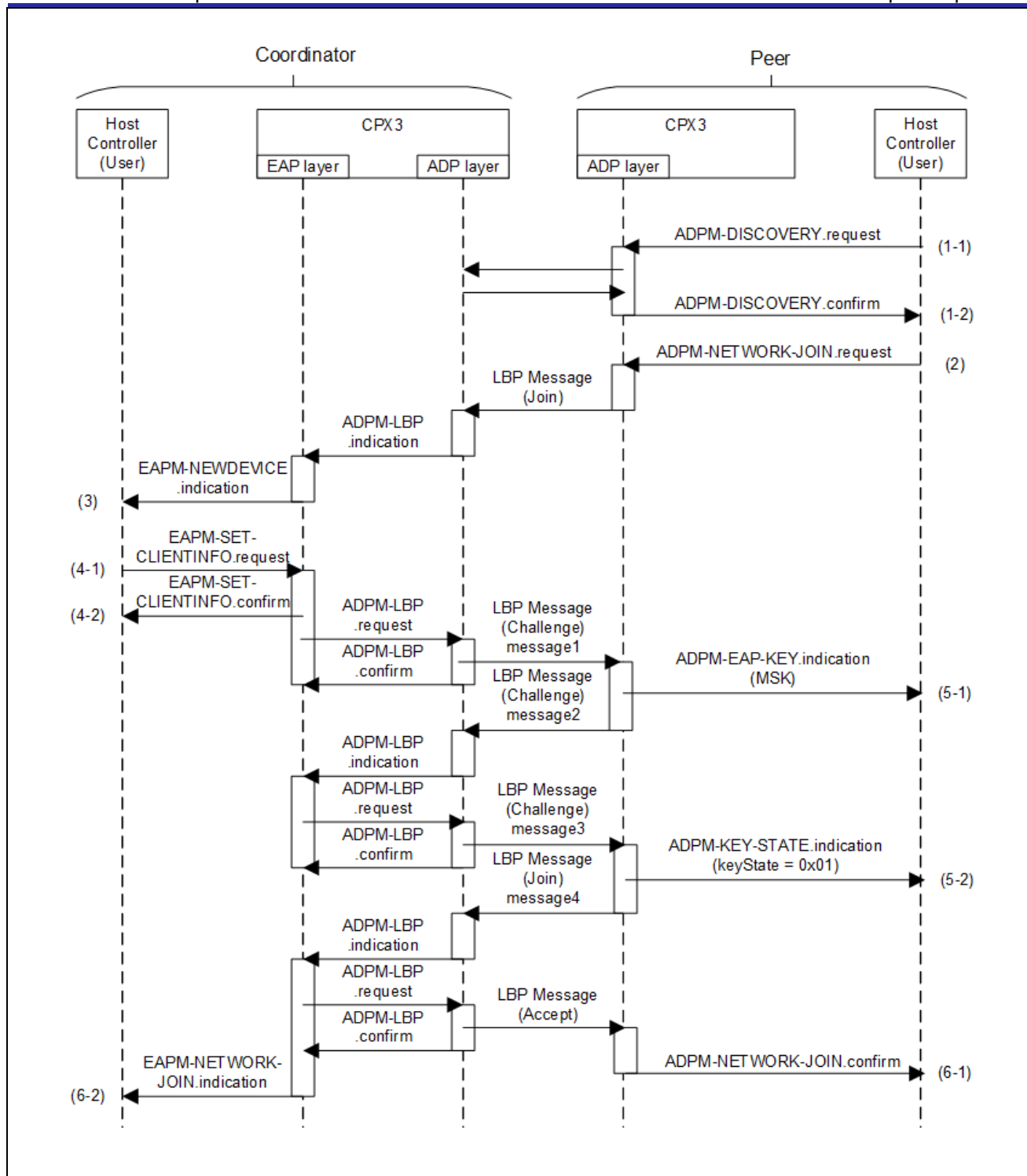


Figure 8-5 Example of sequence to join PAN

8.4 Rekey

Example of sequences when changing GMK in PAN is shown below.

1. Set a new GMK to non-active entry (EAPM-SET)
2. Distribute the new GMK to all Peer in PAN (EAPM-NETWORK)
3. Set ID of GMK which is distributed when a request of joining PAN is received while processing of activating GMK is in progress (EAPM-SET)
4. Execute activating processing of the new GMK to all Peer in PAN (EAPM-NETWORK)
5. Execute activating processing of the new GMK to Coordinator itself (EAPM-SET)

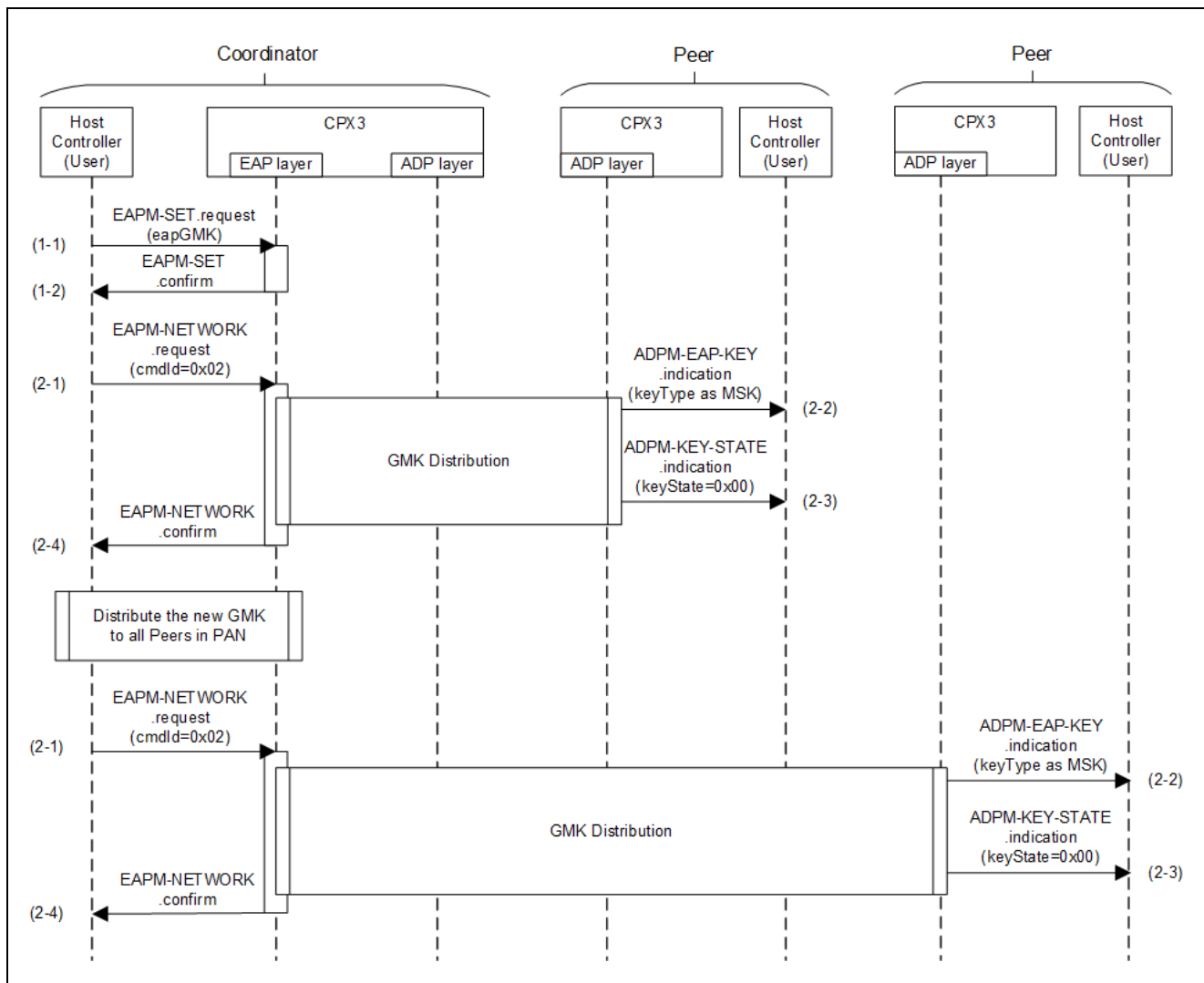


Figure 8-6 Example of sequences of Rekey (Step 1 to 2)

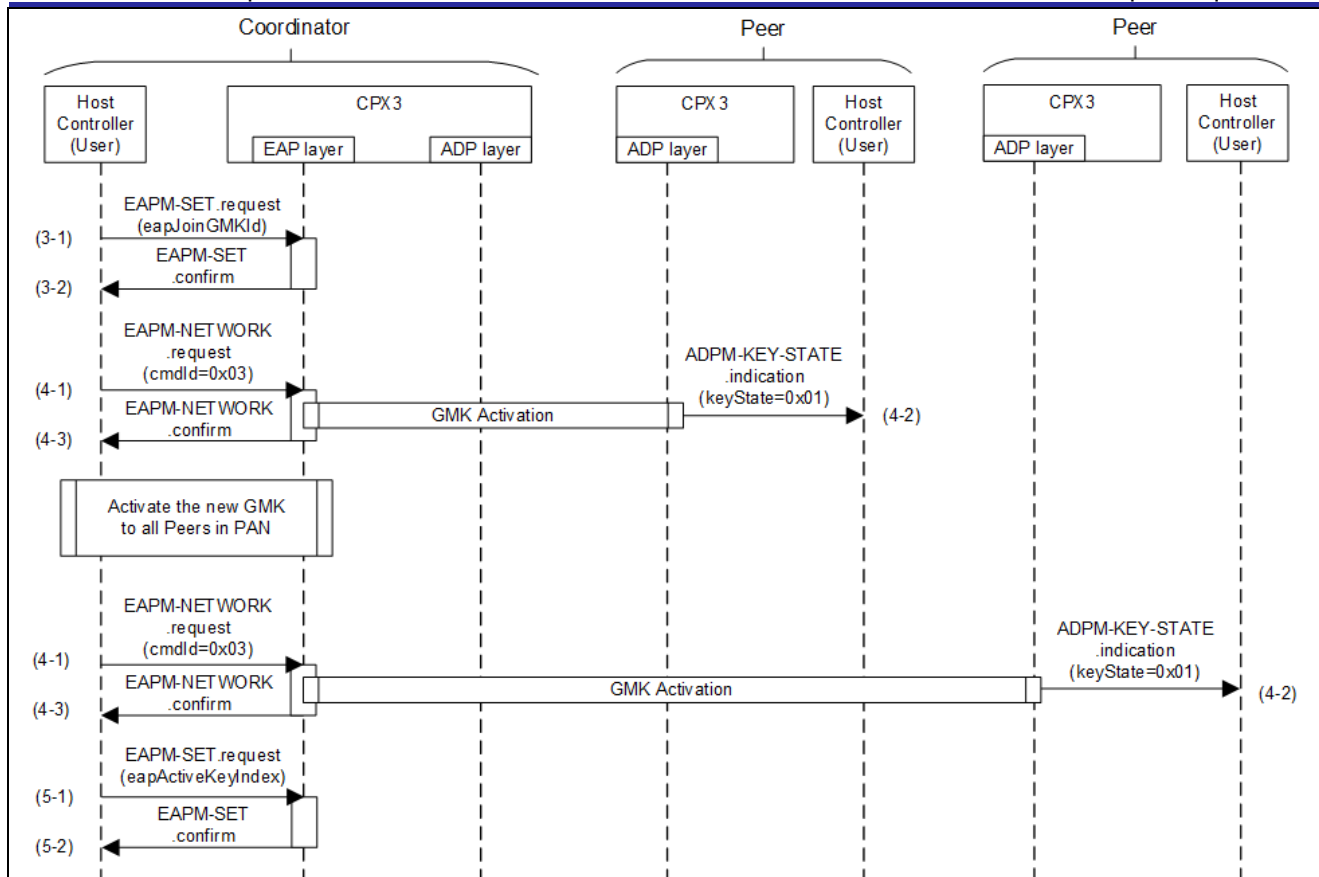


Figure 8-7 Example of sequences of Rekey (Step 3 to 5)

8.5 Peer Leaving a PAN

Example of sequences when Peer leaves a PAN is shown below.

1. Peer: Send Coordinator a leave request (ADPM-NETWORK-LEAVE)
2. Coordinator: Once it's received the leave request from Peer, it executes leave processing and will notify EAPM-NETWORK-LEAVE.indication.

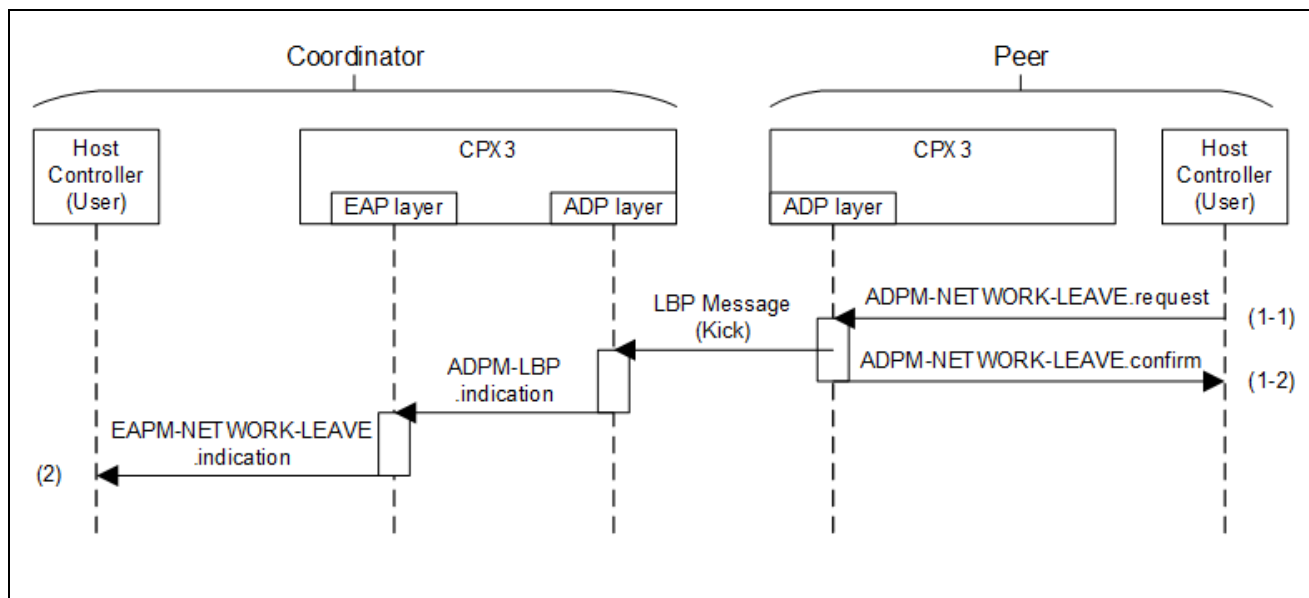


Figure 8-8 Example of sequences of Peer's removal from a PAN

8.6 Leave Request sent by a PAN Coordinator to a Peer

Example of sequences when Coordinator sends a leave request to a Peer is shown below.

1. Coordinator: Send Peer a leave request from PAN (EAPM-NETWORK)
2. Peer: Once it has received a leave request from Coordinator, it executes the leave processing and will notify ADPM-NETWORK-LEAVE.indication.

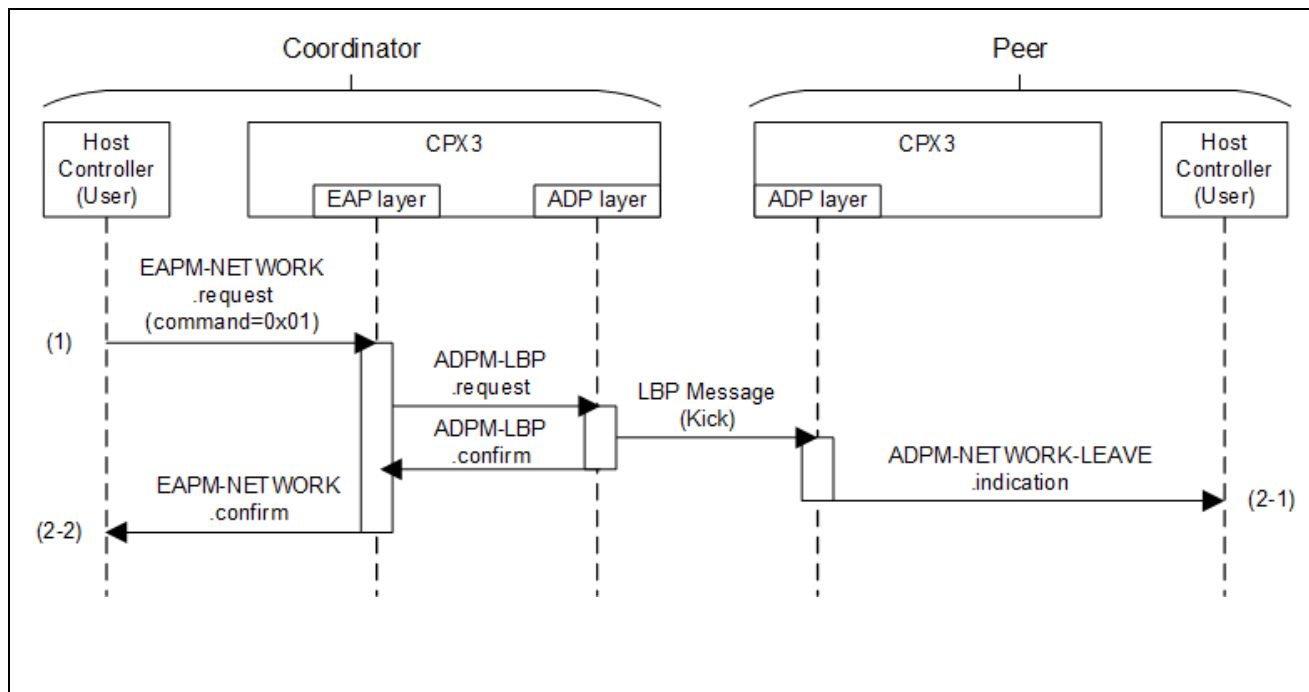


Figure 8-9 Example of sequences when Coordinator sends Peer a request of removal from a PAN

9. Annex for statistics and log

This section explains statistics and log. Each G3 Channel has statistics and log by each layer. Table 9-1 shows the list of statistics and log of G3 Channel in detail.

Table 9-2 shows the accessibility of statistics and log of G3 Channel. User can get or clear these data by G3 Block SAP commands. G3-GETINFO command can get each layer's statistics data or log data. Each layer's IB get command, MLME-GET, ADPM-GET and EAPM-GET is able to get each layer's statistics data by index unit. Statistics and log data are not cleared by each layer's reset command, MLEM-RESET, ADPM-RESET and EAPM-RESET. User can explicitly clear these data by G3-CLEARINFO command. G3-INIT command clears each layer's statistics data and log data except LMAC Layer (DSP). Refer Table 9-2 in detail.

Table 9-1 Statistics and log List

type	layer	overview	parameter detailed
statistics	LMAC Layer (DSP)	Each layer's statistics data. Data construction is described in section 9.1.	Refer in Section 9.2
	UMAC Layer		
	ADP Layer		
	EAP Layer		
log	LMAC Layer (DSP)	Each layer's trace log data. Data construction is described in section 9.3.	Refer in Section 9.4
	UMAC Layer		
	ADP Layer		
	EAP Layer		

Table 9-2 Accessibility of statistics and log

type	layer	availability by G3 Configuration Mode (V: Valid, -: Invalid)			Get command	Clear command
		MAC Mode	ADP Mode	EAP Mode		
statistics	LMAC Layer (DSP)	V	V	V	G3-GETINFO	G3-CLEARINFO
	UMAC Layer	V	V	V	G3-GETINFO MLME-GET	G3-INIT, G3-CLEARINFO
	ADP Layer	-	V	V	G3-GETINFO, ADPM-GET	
	EAP Layer	-	-	V	G3-GETINFO, EAPM-GET	
log	LMAC Layer (DSP)	V	V	V	G3-GETINFO	G3-CLEARINFO
	UMAC Layer	V	V	V		G3-INIT, G3-CLEARINFO
	ADP Layer	-	V	V		
	EAP Layer	-	-	V		

9.1 Statistics Construction

Figure 9-1 shows the construction of statistics. The number of statistics parameter and the meaning of parameter are different in each layer. Refer Table 9-1 in detailed.

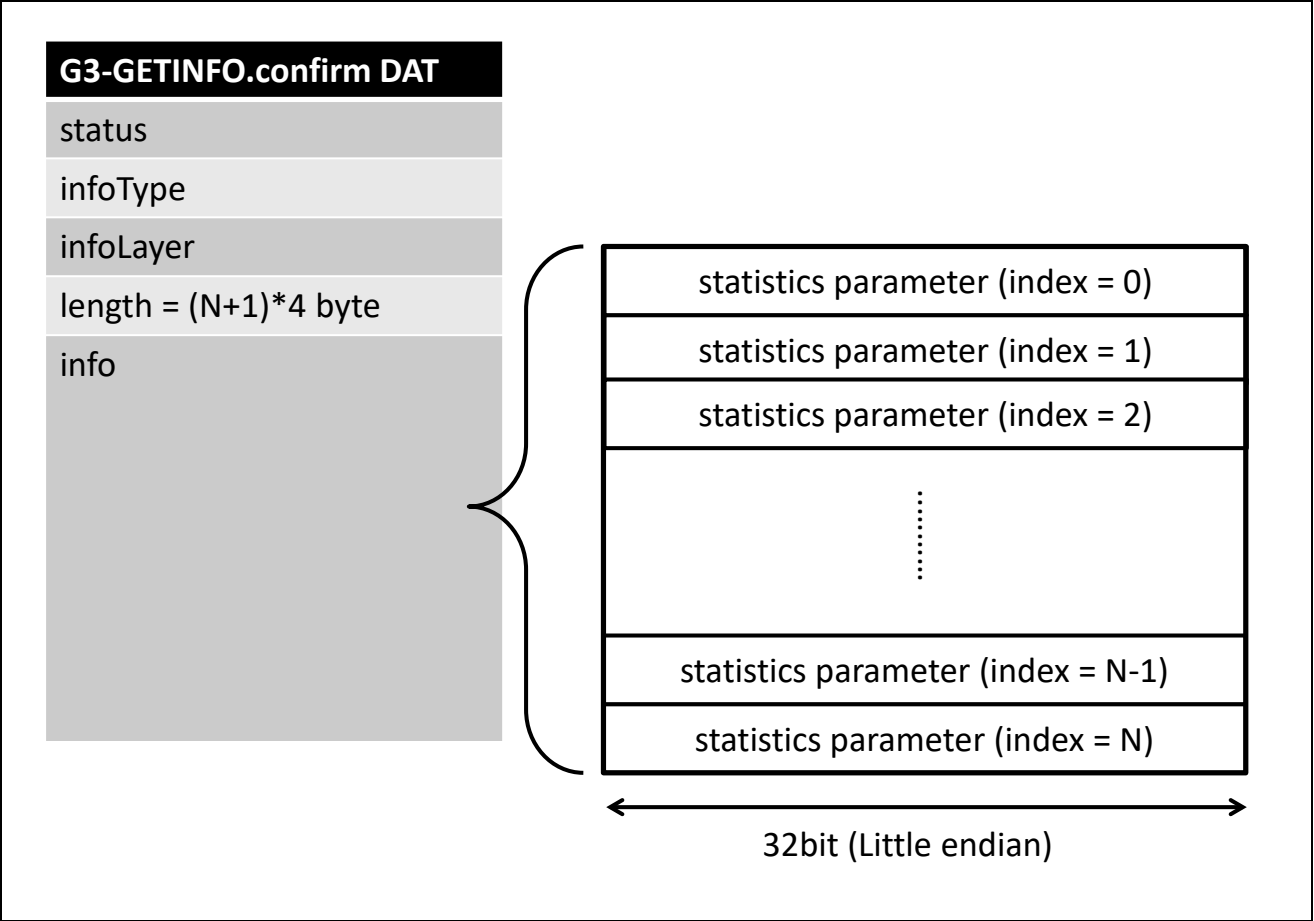


Figure 9-1 Statistics Construction Diagram

9.2 Statistics Parameter

9.2.1 LMAC Layer (DSP) Statistics Parameter

Table 9-3 shows LMAC Layer (DSP) statistics parameter detailed.

Table 9-3 LMAC Layer (DSP) Statistics Parameter List

index	description
0	It indicates how many packets (except ACK and NACK) have been sent since the firmware was initialized.
1	It indicates how many packets (except ACK and NACK) have been received since the firmware was initialized. It includes packets whose FCH were OK. It includes packets with both FCS OK and FCS NG.
2	It indicates how many times synchronizations have been established.
3	It indicates how many packets whose FCHs (CRC code for PHY layer) were OK have been received.
4	It indicates how many packets whose FCHs were NG have been received. The following equation is satisfied; $\text{num_fch_ok} + \text{num_fch_error} = \text{num_syncm}$
5	It indicates how many packets whose MAC headers are incorrect have been received. In case that a lack of data size for a MAC header or data in a MAC header is not within the range of the value, a MAC header error is detected.
6	It indicates how many packets whose FCSs are NG have been received. Even in case of MAC header error, if FCS is OK then num_fcs_error is not incremented.
7	It indicates how many times overwrites of input PCM buffer happened. When a lack of processing power, an overwrite happens.
8	It indicates how many ACK packets have been sent.
9	It indicates how many NACK packets have been sent
10	It indicates how many ACK packets have been received.
11	It indicates how many NACK packets have been received

9.2.2 UMAC Layer Statistics Parameter

Refer Table 5-31.

9.2.3 ADP Layer Statistics Parameter

Refer Table 6-49.

9.2.4 EAP Layer Statistics Parameter

Refer Table 7-23.

9.3 Log Construction

Figure 9-2 shows log data construction. Log data is the ringed trace log which consisting pair of timeStamp and parameter. Each layer's log info length is shown in Table 9-4. Each layer's timeStamp value is shown in Table 9-5. Each layer's parameter value is shown in the following section.

When the log data was written, the position of write pointer for the next log was overwritten as 0 data.

Log data is written from top address. When reached to the end address, the write pointer returns to the top address, and the log data is overwritten as shown in Figure 9-3.

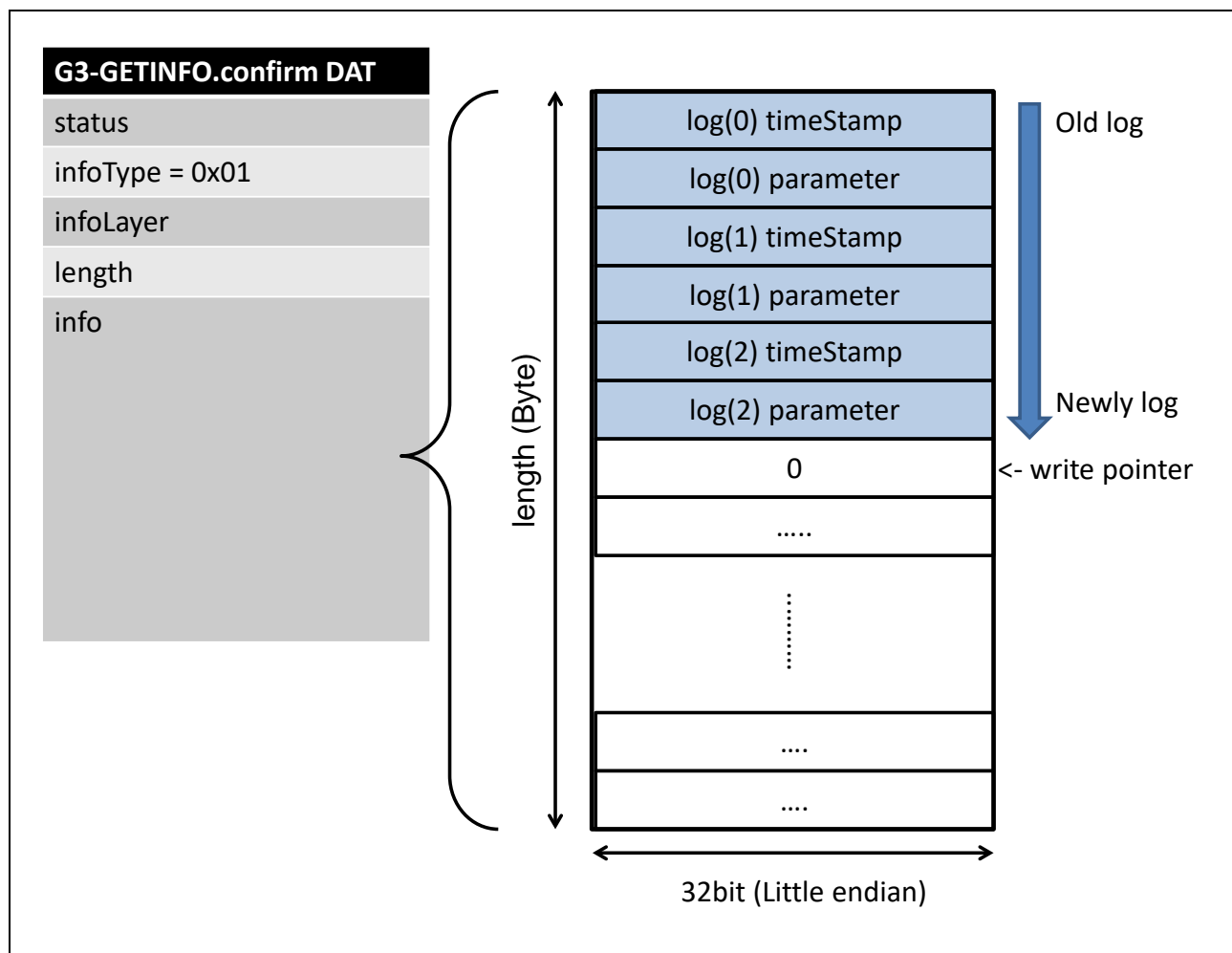


Figure 9-2 Log Construction Diagram

Table 9-4 Log Info Length

Layer	Log info length
LMAC Layer (DSP)	1024 Byte
UMAC Layer	1024 Byte
ADP Layer	
EAP Layer	

Table 9-5 TimeStamp value

Layer	TimeStamp value
LMAC Layer (DSP)	4MHz free-run counter in DSP.

UMAC Layer	Milli second scale system time which counting from G3-PLC system boot
ADP Layer	
EAP Layer	

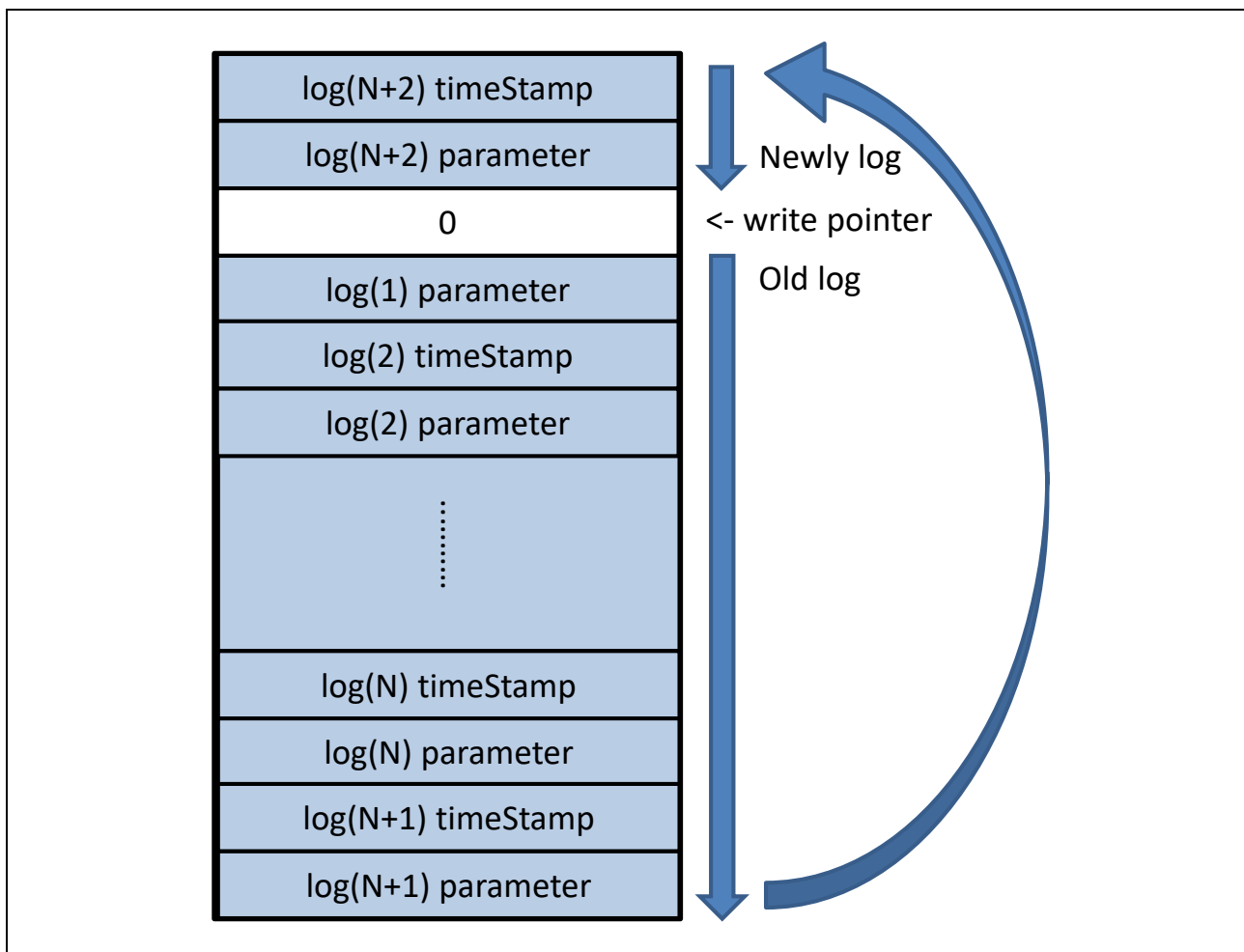


Figure 9-3 Log Data Overlap

9.4 Log Parameter

9.4.1 LMAC Layer (DSP) Log Parameter

Figure 9-4 and Table 9-6 shows log parameter construction and each field. Log parameter details are shown in Table 9-7.

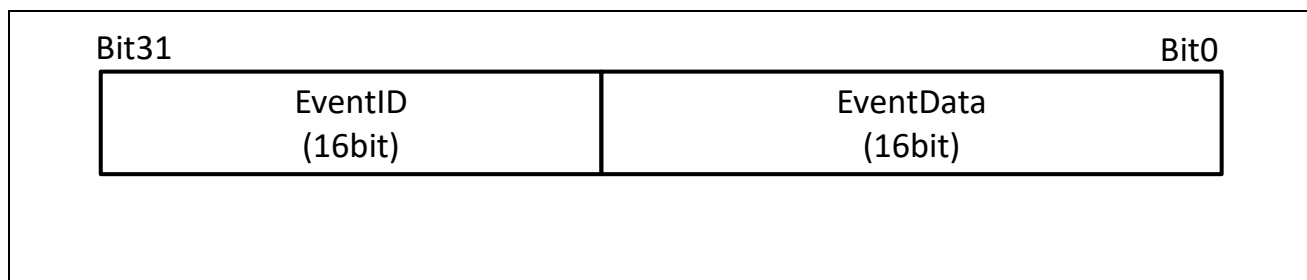


Figure 9-4 Log Parameter Construction Diagram

Table 9-6 Log Parameter Field Details

Field	Length	Description
EventID	16bit	It indicates which event happened. Events which are stored at a log filed are as follows: - Request received from ARM - Indication transmitted to ARM - CSMA/CA status transition.
EventData	16bit	Supplemental data corresponding to the event.

Table 9-7 LMAC Layer (DSP) LogID and LogData Field Details

EventID	Description	EventData
0x0001	PHY status change	It indicates the state of PHY Layer 0x0002: TX_0 0x0003: TX_1 0x0004: TX_2 0x0005: TX_S1S2 0x0006: TX_3 0x000A: RX_1 0x000B: RX_2 0x000C: RX_3 0x000D: RX_S1S2 0x000E: RX_6 0x000F: RX_7
0x0002	CSMA/CA status change	It indicates the status of LMAC Layer 0x0000: IDLE 0x0001: ACK 0x0002: CIFS 0x0003: CFS 0x0004: HIGH_PRI 0x0005: NORM_PRI 0x0006: EIFS 0x0007: ACK_REQ 0x0008: STOP
0x0003	Segmentation status change	It indicates the status of Segmentation 0x0000: IDLE 0x0001: START_TX

		0x0002: WAIT_SET 0x0003: BACKOFF 0x0004: WAIT_TX 0x0005: WAIT_RX 0x0006: WAIT_ACK
0x0200	DSP-INIT.request	bandPlan of the DSP-INIT.request.
0x1200	DSP-INIT.confirm	status of the DSP-INIT.confirm
0x0201	DSP-DEINIT.request	0
0x1201	DSP-DEINIT.confirm	status of the DSP-DEINIT.confirm
0x0202	DSP-RESET.request	0
0x1202	DSP-RESET.confirm	status of the DSP-RESET.confirm
0x0203	DSP-GET.request	paramID of the DSP-GET.request
0x1203	DSP-GET.confirm	status of the DSP-GET.confirm
0x0204	DSP-SET.request	paramID of the DSP-SET.request
0x1204	DSP-SET.confirm	status of the DSP-SET.confirm
0x0205	DSP-DATA.request	handle of the DSP-DATA.request
0x1205	DSP-DATA.confirm	status of the DSP-DATA.request
0x2205	DSP-DATA.indication	CRC of received packet.
0x2206	DSP-ACK.indication	DT of received ACK
0x0207	DSP-TXABORT.request	handle of the DSP-TXABORT.request.
0x1207	DSP-TXABORT.confirm	status of the DSP-TXABORT.request
0x02F0	DSP-TEST.request	0
0x12F0	DSP-TEST.confirm	status of the DSP-TEST.confirm
0x22F0	DSP-TEST.indication	0
0x02F1	DSP-DUMP.request	0
0x12F1	DSP-DUMP.confirm	0

9.4.2 UMAC/ADP/EAP Layer Log Parameter

Figure 9-5 and Table 9-8 shows log parameter construction and each field. Log parameter details are shown in Table 9-9.

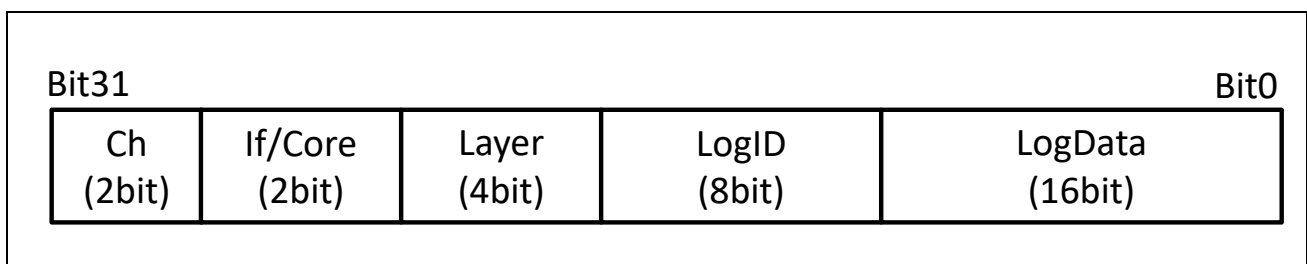


Figure 9-5 Log Parameter Construction Diagram

Table 9-8 Log Parameter Field Details

Field	Length	Description
Ch	2bit	G3 Channel information. 0: Channel 0 1: Channel 1
If/Core	2bit	Interface information. 0: Core (Undefined) 1: If
Layer	4bit	Layer Information 0x03: UMAC Layer 0x04: ADP Layer

		0x05: EAP Layer
LogID	8bit	Log data id.
LogData	16bit	Log data.

Table 9-9 UMAC/ADP/EAP Layer LogID and LogData Field Details

LogID	LogData
0x00	Function ID of the request called by user or G3 controller. (Not include request called by upper layer)
0x01	Command ID and error status code of the request which failed to process. (Include request called by upper layer) High 8bit: Request command ID Low 8bit: Error status code
0x02	Function ID of the confirm or the indication to user.
0x03	Function ID of the callback called by lower layer which failed to enqueue.
0x04	Function ID of the callback which failed to buffer copy.
0x05	Function ID of the request which failed by timed out for response.

10. Annex for macPromiscuous Mode

The G3 Channel which initialized in UMAC mode as G3 Configuration Mode can be operated in promiscuous mode by MAC PIB Attribute setting. Refer the G3-PLC specifications for details of macPromiscuous mode. The MAC PIB Attribute which activated / deactivated promiscuous mode is macPromiscuousMode in Table 5-23.

The behavior of this promiscuous mode depends on availability of GMK and PAN ID(refer Table 10-1). This UMAC layer can use GMK and PAN ID from another G3 Channel automatically when macPromiscuousMode is set as True(1), if the another channel is active as MAC or more upper mode.

This section describes recommended sequence for G3 Channel working in promiscuous mode when another G3 Channel is working.

10.1 Start Sequence as macPromiscuous Mode

Figure 10-1 shows the recommended startup sequence as mac promiscuous mode.

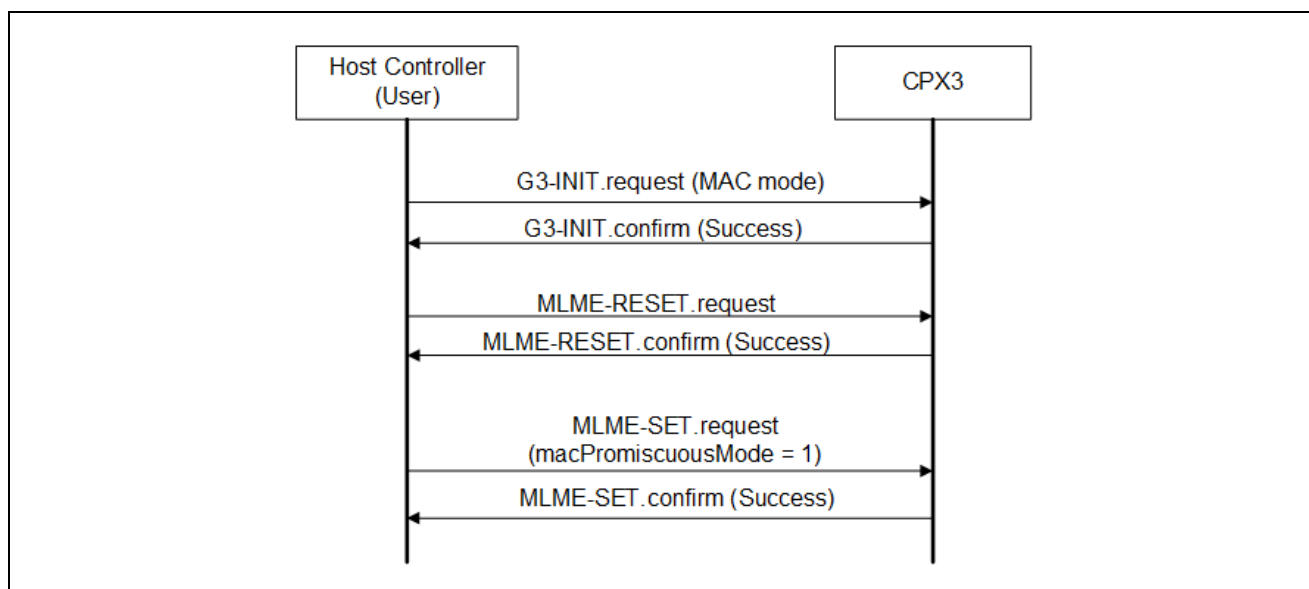


Figure 10-1 Start Sequence as MAC Promiscuous Mode

10.2 End Sequence as macPromiscuous Mode

Figure 10-2 shows the recommended end sequence as mac promiscuous mode.

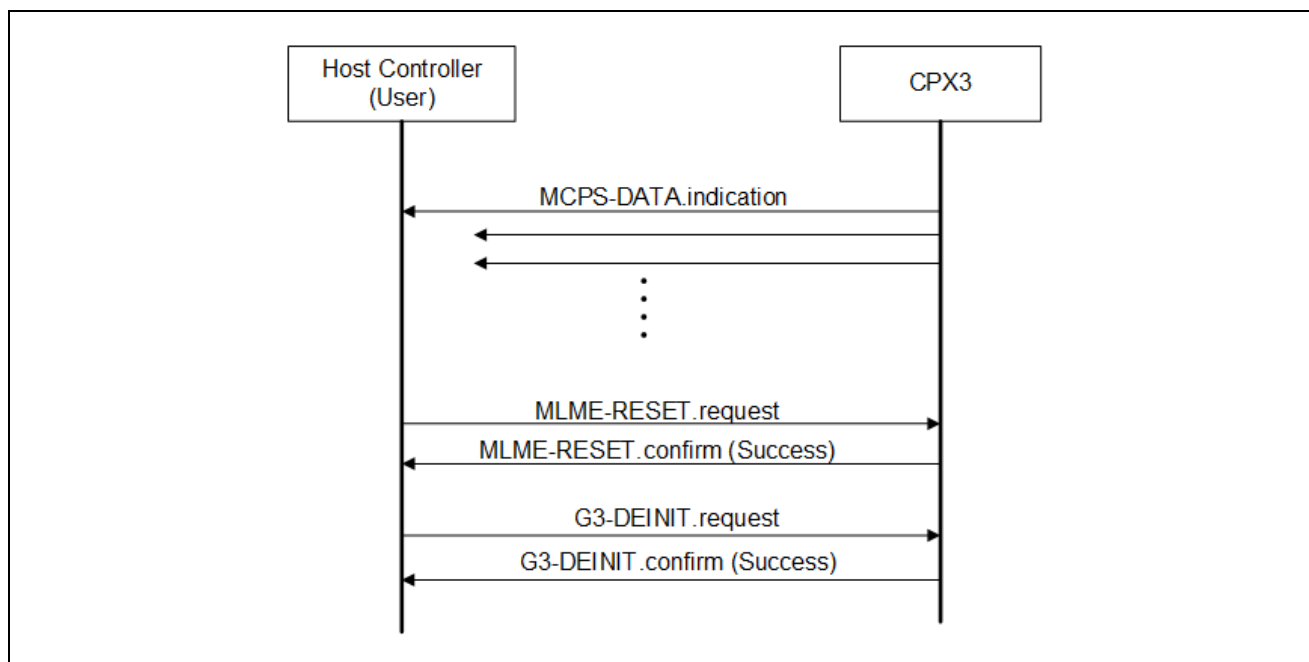


Figure 10-2 End Sequence for Mac Promiscuous Mode

10.3 Restart Sequence as Normal Mode

Figure 10-3 shows the restart sequence for the G3 channel which was working as promiscuous mode to restart as normal mode.

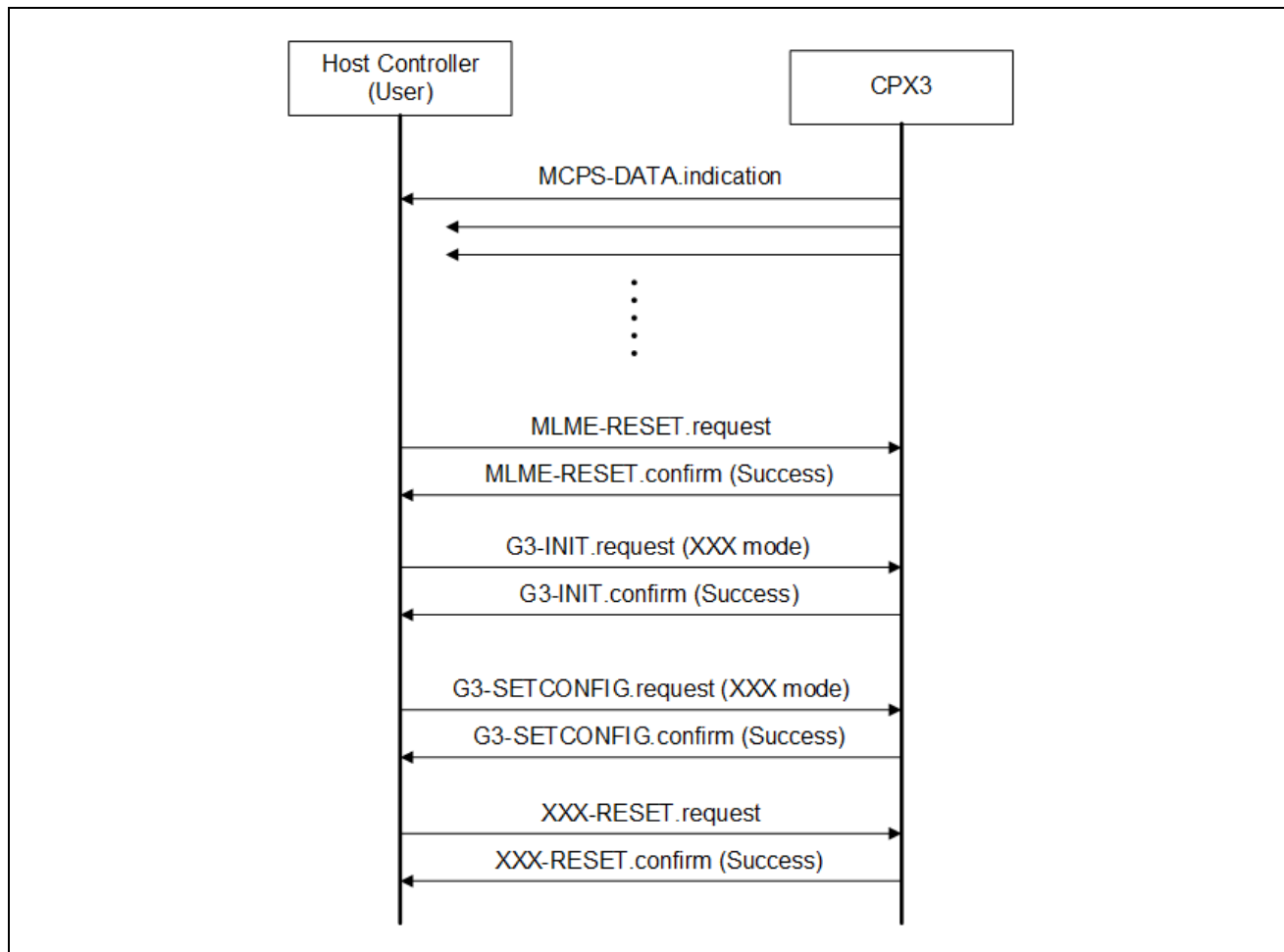


Figure 10-3 Restart Sequence as Normal Mode

10.4 MCPS-DATA.indication on promiscuous mode

Table 10-1 Case of MCPS-DATA.indication on promiscuous mode

received packet			Internal parameter		
Dst PanId	segment	secured	PanId = 0xFFFF, key = empty	PanId = PAN_A, key = empty	PanId = PAN_A, key = valid
PAN_B	none	non secured	V	-	-
PAN_B	exist	non secured	V	-	-
PAN_B	none	secured	-	-	-
PAN_B	exist	secured	-	-	-
PAN_A	none	non secured	V	V	V
PAN_A	exist	non secured	V	V	V
PAN_A	none	secured	-	-	V
PAN_A	exist	secured	-	-	V

V :MCPS-DATA.indication issued

- :discard

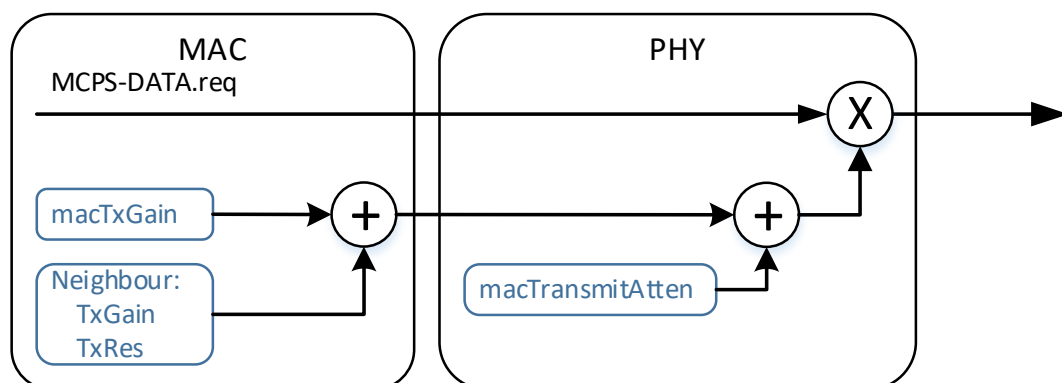
11. Annex for Behavior base on IB setting

11.1 Limiting the output level

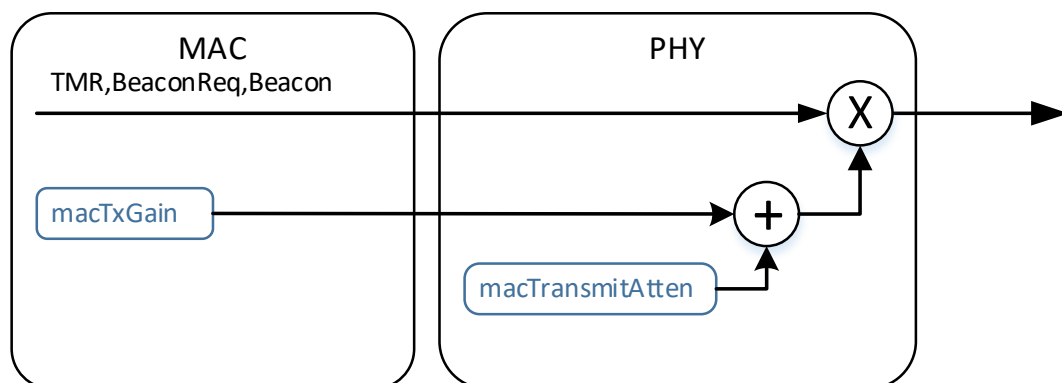
Table 11-1 related IB for output level

Attribute	ID	Type	RW	Range	Description	Default
macTransmitAtten	0x0117	uint8_t	rw	0-25	Attenuation of the output level in dB	0
macTxGain	0x080D	uint8_t	rw	0-21	Specifies the transmission gain for ACK frame in dB. 0 : Maximum output level (MOL) n : MOL-ndB	0
pITxAckGain	0x8347	uint8_t	rw	0-21	Specifies the transmission gain for ACK frame in dB. 0 : Maximum output level (MOL) n : MOL-ndB	0

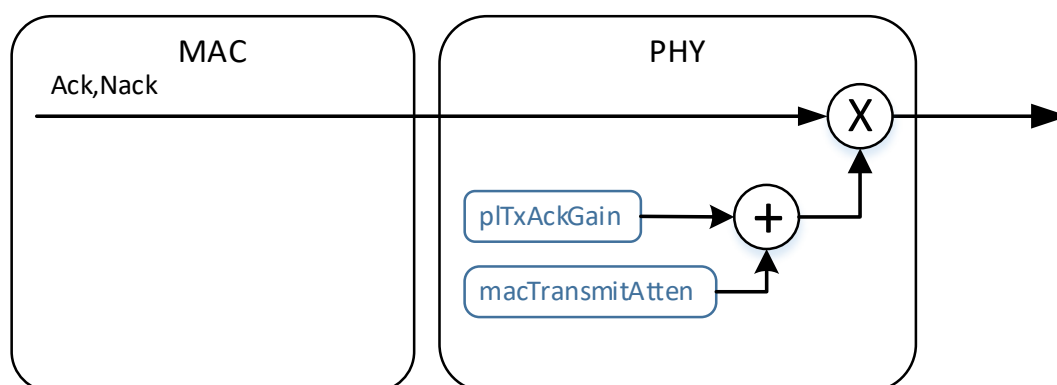
11.1.1 Data packet by MCPS-DATA.request



11.1.2 TMR, BeaconReq, Beacon



11.1.3 Ack/Nack

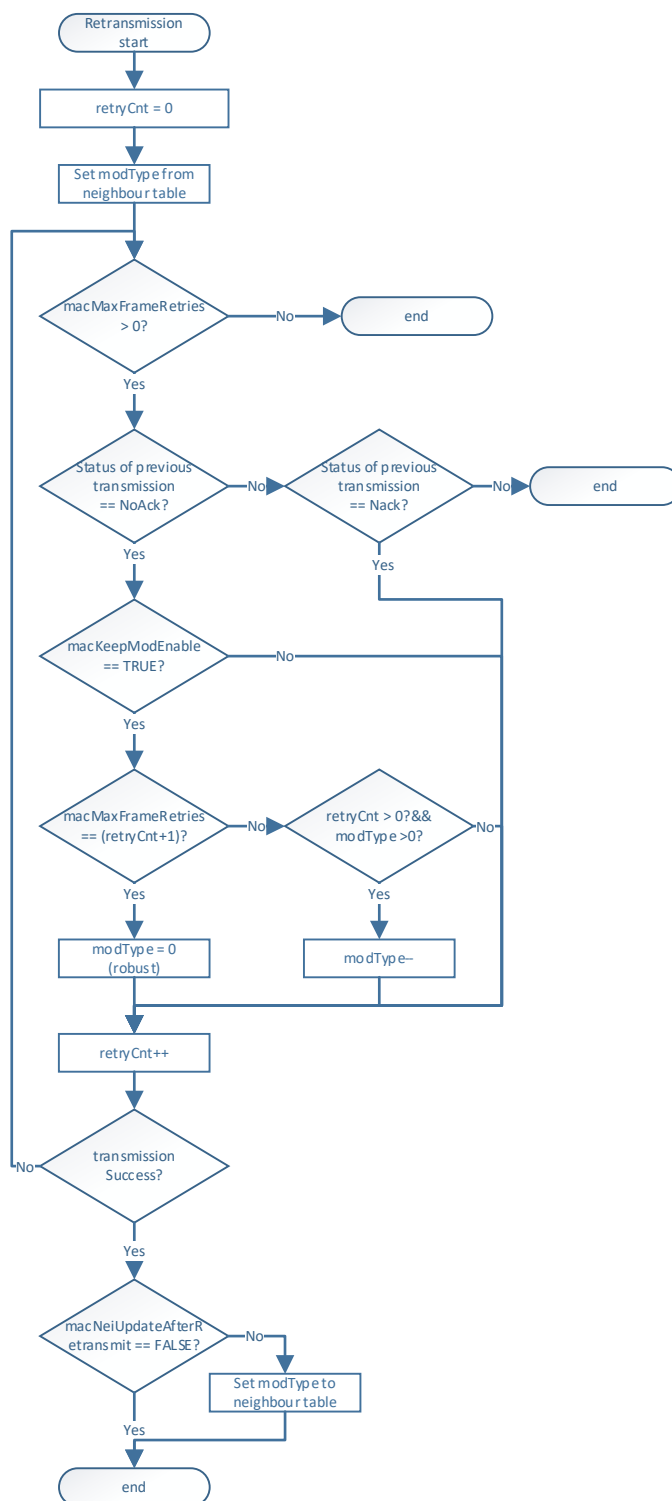


11.2 Modulation for retransmissions

Table 11-2 related IB for retransmission

Attribute	ID	Type	RW	Range	Description	Default
macKeepModRetryNum	0x0815	uint8_t	rw	0x00-0xFF	If 0, keep the modulation during MAC retransmission. (This is for testing purpose.) If N, decrease modulation during MAC retransmission from retry count=N Then last retransmission use robust modulation.	4
macNeiUpdateAfterRetransmit	0x0816	uint8_t	rw	TRUE - FALSE	If TRUE, update modulation of the related neighbour after retransmission successful.	TRUE

11.2.1 Retransmission mechanism

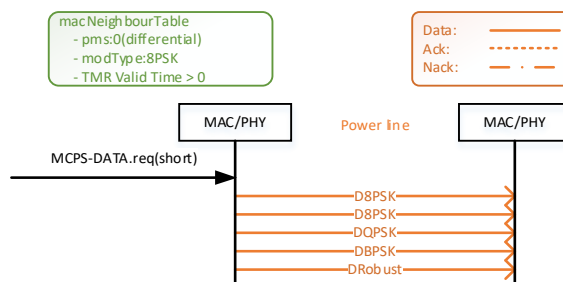


11.2.2 Example sequence about retransmission

(1) Short length data (no segmentation)

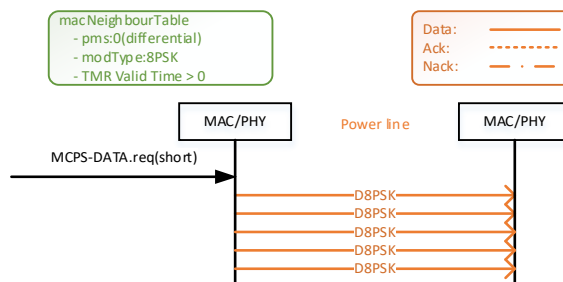
Normal reducing the modulation

- macKeepModRetryNum = 2
- macMaxFrameRetries = 4



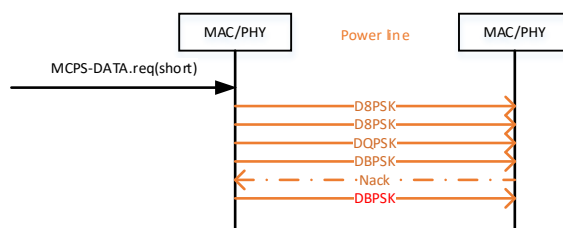
Keep modulation by “macKeepModRetryNum = 0”

- macKeepModRetryNum = 0
- macMaxFrameRetries = 4



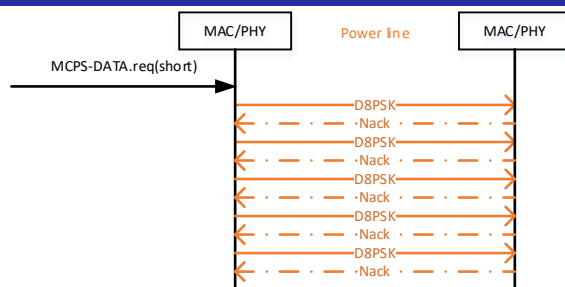
Nack receiving before last retransmission

- macKeepModRetryNum = 2
- macMaxFrameRetries = 4



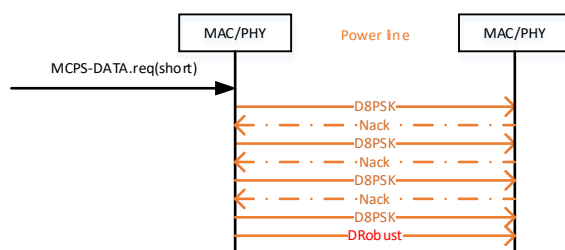
All Nack receiving

- macKeepModRetryNum = 2
- macMaxFrameRetries = 4



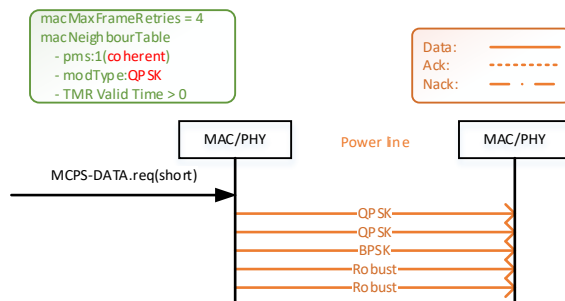
NoAck after Nack

- macKeepModRetryNum = 2
- macMaxFrameRetries = 4



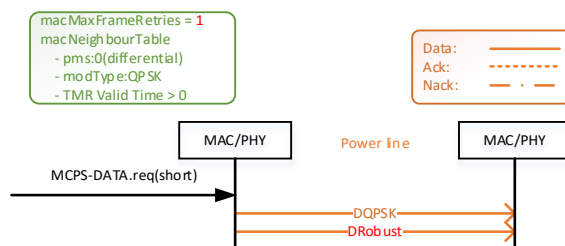
Coherent case

- macKeepModRetryNum = 2
- macMaxFrameRetries = 4



Short length data (no segmentation)

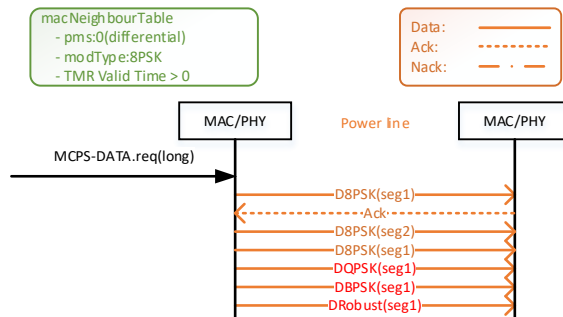
- macKeepModRetryNum = 2
- macMaxFrameRetries = 1



(2) Long length data (segmentation)

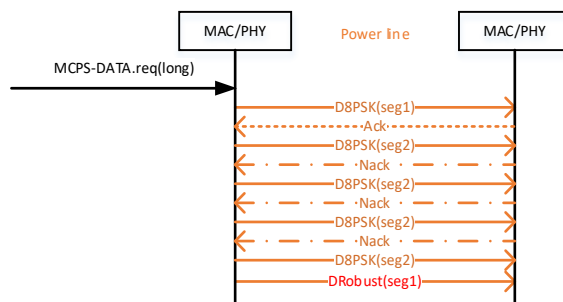
Normal retransmission with segmentation

- macKeepModRetryNum = 2
- macMaxFrameRetries = 4



Nack receiving

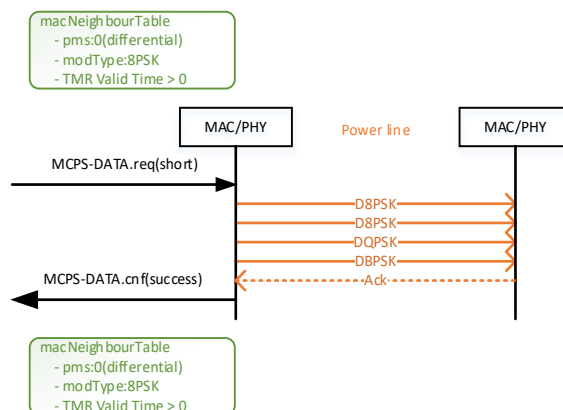
- macKeepModRetryNum = 2
- macMaxFrameRetries = 4



(3) Neighbour table after retransmission success

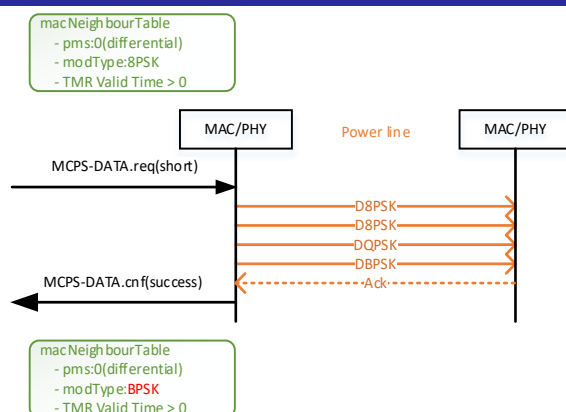
macNeiUpdateAfterRetransmit = FALSE

- macKeepModRetryNum = 2
- macMaxFrameRetries = 4



macNeiUpdateAfterRetransmit = TRUE(default)

- macKeepModRetryNum = 2
- macMaxFrameRetries = 4



11.3 update(overwrite) mechanism of NeighbourTable and POS table

This memory allocation of neighbour table and POS table is shared with same memory. There are priority between neighbour table and POS table. The priority of neighbour table is higher than POS table. Figure 11-1 shows that updating mechanism of neighbour table and POS table when receive tonemap-response. Figure 11-2 shows that updating mechanism POS table when receive data packet.

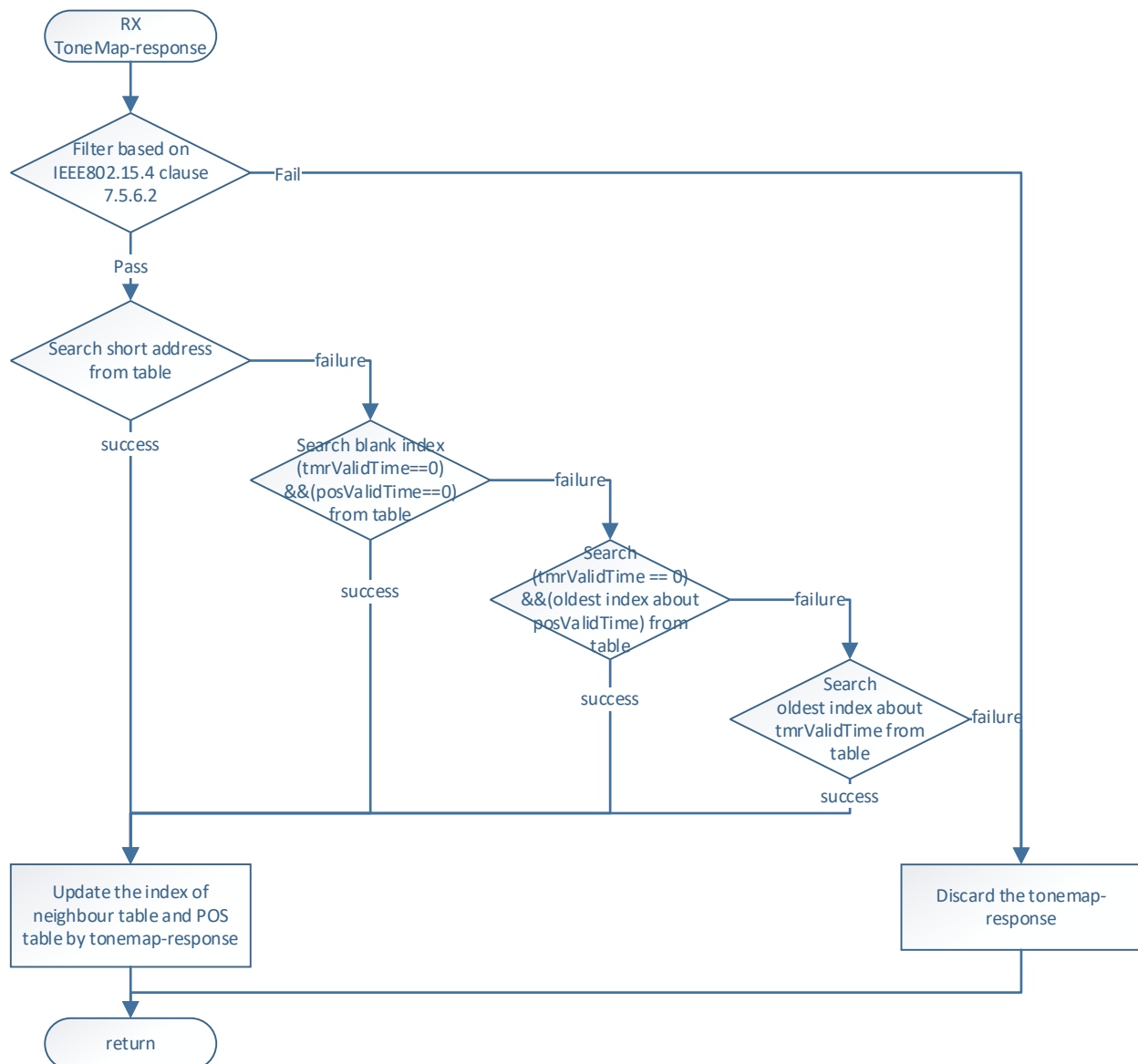


Figure 11-1 Rx tonemap response

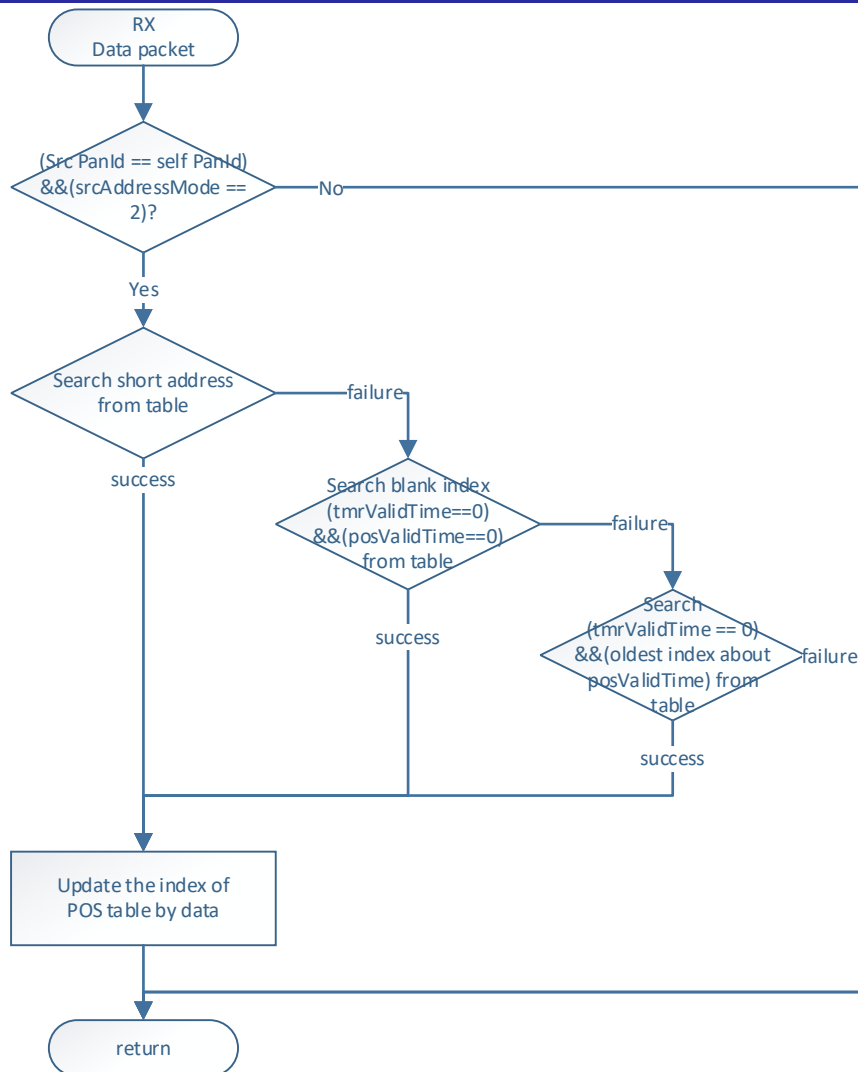


Figure 11-2 Rx Data

12. Annex for G3-DUMP Specification

12.1 G3-DUMP Function

12.1.1 Trigger Timeout

G3-DUMP waits preamble of PLC signal as a trigger till specified timeout. When detects a trigger, G3-DUMP starts dump. If does not detect a trigger till timeout time, G3-DUMP starts dump at that time. When specified timeout is 0, G3-DUMP start dump immediately without waiting trigger. User can know whether timeout is occurred by using result member in G3-DUMP.confirm.

Figure 12-1 shows mechanism of trigger and timeout of G3-DUMP.

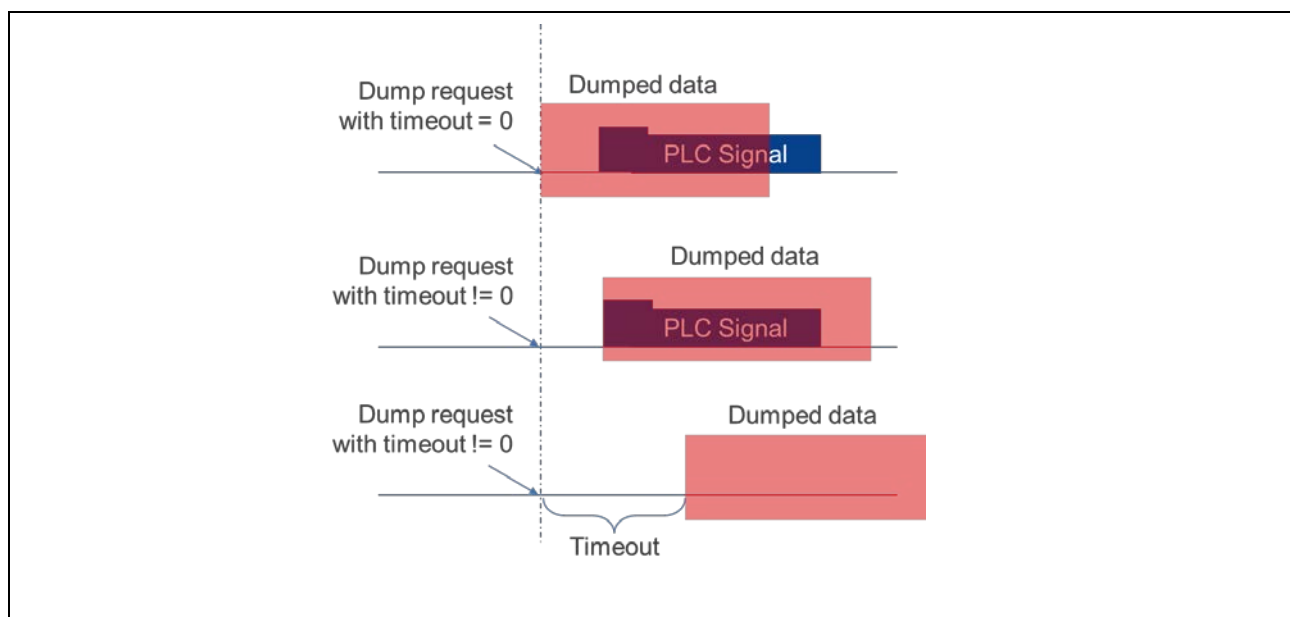


Figure 12-1 G3-DUMP Trigger and Timeout Mechanism

12.1.1 Dump Mode

G3-DUMP has AGC enable mode and Hold AGC mode as dump mode.

In AGC enabled mode, dump is executed with AGC function is available. In Hold AGC mode, dump is executed with the fixed gain which is adjusted when trigger detection.

Hold AGC mode is suitable for the measurement of small noise. Hold AGC mode scales up the small noise to suitable measurement size.

Figure 12-2 shows mechanism of dump mode of G3-DUMP.

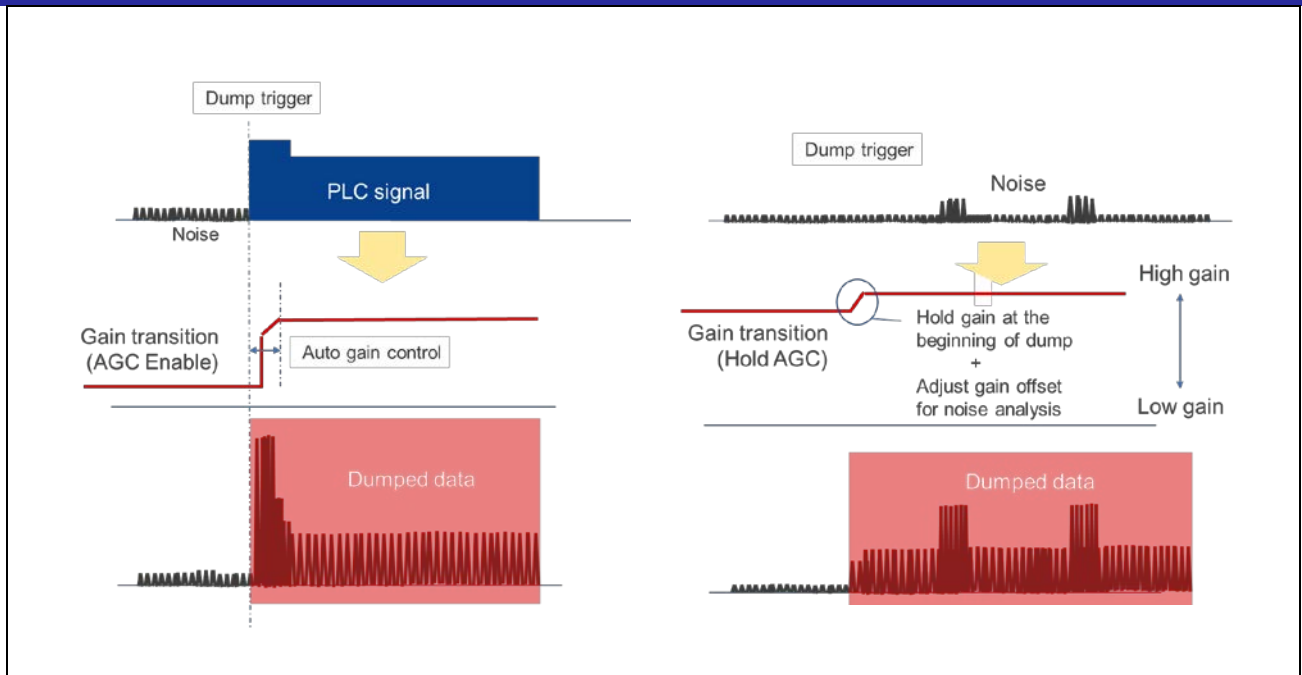


Figure 12-2 G3-DUMP Mode Mechanism

12.2 G3-DUMP Sequence

12.2.1 G3-DUMP Sequence

Figure 12-3 shows G3-DUMP sequence of success case. In success case, G3-DUMP.indication command is invoked after G3-DUMP.confirm command. If dump data length exceeds user specified segmentLen in G3-DUMP.request, G3-DUMP.indication is invoked at multiple with user specified segmentInterval periodic.

If G3-DUMP was failed, user receives only G3-DUMP.confirm with status != R_G3_STATUS_SUCCESS.

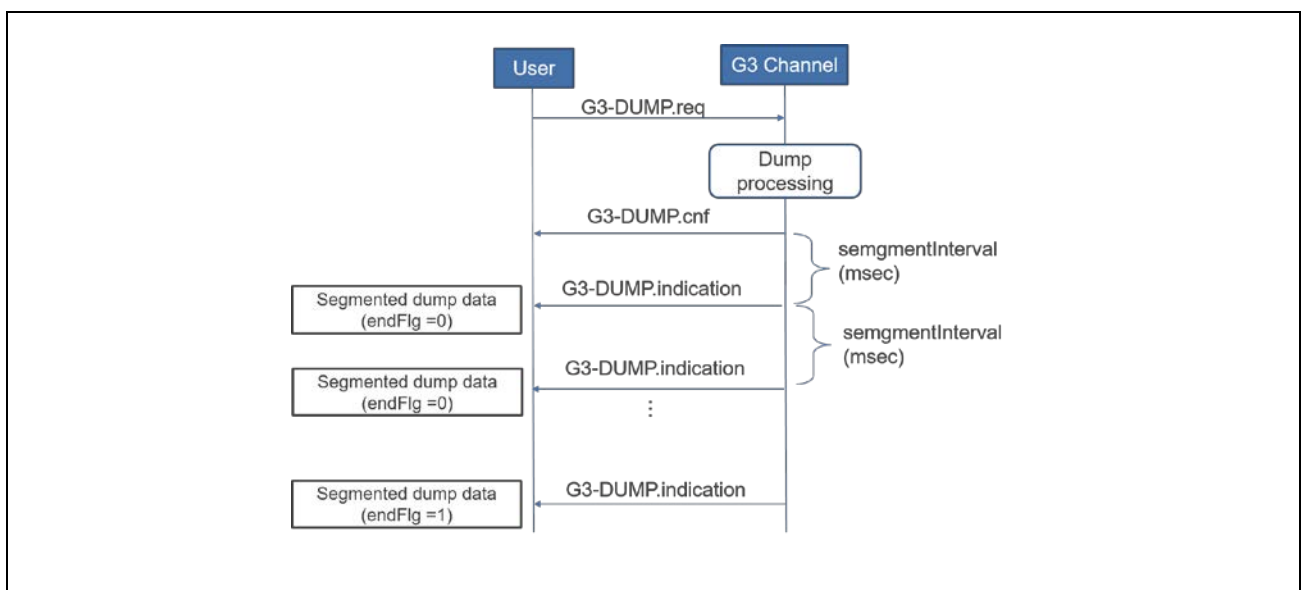


Figure 12-3 G3-DUMP Sequence (Success)

12.2.2 G3-DUMP-ABORT sequence

Figure 12-4 shows G3-DUMP-ABORT sequence.

G3-DUMP process is stop after G3-DUMP-ABOET.request is accepted, so subsequently, G3-DUMP.confirm or G3-DUMP.indication command are not invloked.

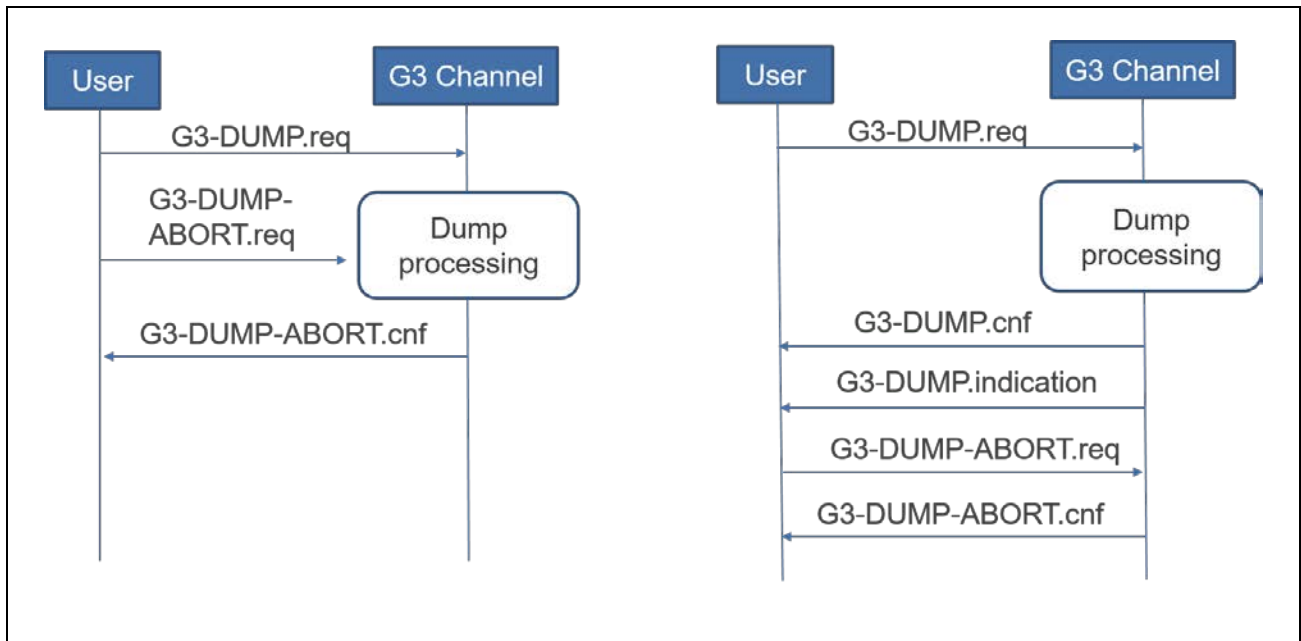


Figure 12-4 G3-DUMP-ABORT sequence

Revision History

Date	Revision	Section	Substance
Sep. 10, 2015	0.10		First edition issued.
Sep. 28, 2015	0.11	3.2.3	Revised the description. Table 3-3: Shift Direction (Right -> Left)
		6.11.2	Added the following entries in Table 5-24. plTxAckGain plSATTCtrlDisable plAcPhaseOffset plStatistics
		7.11.3	Added newly section for ADPM-LBA.indication.
		7.20.1	Revised the description in Table 6-38. adpSecurityLevel:Type (uint8_t[16] -> uint8_t)
Dec. 02, 2015	0.20	-	Changed the format of table number of figure number.
		2.2, 2.3	Added the following functions information. G3-DEINIT G3-CLEARINFO G3-GETINFO
		2.4	Updated the G3 Configuration parameter list description.
		2.5	Updated the G3Channel state transition diagram and description.
		4	Updated some commands filed name and description. Changed the following command parameter. SYSTEM-VERSION.confirm
		5	Updated some commands filed name and description. Update G3 Controller status code description.. Added the following command information G3-DEINIT G3-CLEARINFO G3-GETINFO
		6	Updated some commands filed name and description. Updated MAC status code and MAC PIB attribute list. Added the following information. macKeyValidTable macStatistics
		7	Updated some commands filed name and description. Updated ADP Layer status code and ADP IB attribute list. Updated the following information. adpPrefixTable adpContextInformationTable Added the following information. adpStatistics
		8	Updated some commands filed name and description. Updated EAP Layer status code and EAP IB attribute list. Added the following information. eapStatistics
		10	Added newly section.
		11	Added newly section.
Dec. 15, 2015	0.30	6	Updated some commands filed name and description.
		6.10, 7.18, 8.10	Updated each layer's status code.
Jan. 29, 2016	0.40	6.1	Described the valid value for parameters which were T.B.D.
		6.1	Added the section for statistics parameter detailed.
Feb. 08,	0.41	5.5.1	Updated the description of infoTypeBit in G3-CLEAR

2016			INFO.request.
Mar. 02, 2016	0.42	2, 4	Added the following function's description. ·SYSTEM-REBOOT-REQUEST ·SYSTEM-CLEARINFO ·SYSTEM-GETINFO
		4,5,6,7,8	Updated each confirm command's status description.
		5.1	Updated G3-INIT.request command's parameter range.
		5.5	Updated G3-CLEARINFO.request command's parameter range.
		5.8	Updated G3 Controller status code.
Mar. 15, 2016	0.43	2.2.2	Updated SAP Limitation.
		3.2	Changed command packet format. (IDC length changed 2bit to 1bit, IDA length changed 2bit to 3bit)
		-	Changed IDC and IDA length each command format.
		7.4.1	Updated panId Valid value.
		7.5.1	Updated panId Valid value. Updated lbaAddress Valid value.
		7.9	Updated dstAddress Valid value.
		7.10	Updated dstAddr, origAddr, pathAddress Valid value. Updated pathMetricType valid value.
		7.15	Updated unreachableAddress Valid value.
		7.18	Updated ADP Layer Status Code.
		7.19	Updated adpMtricType range.
Mar. 28, 2016	0.44	7.10	Updated EAP Layer Status Code.
		7.4.2 7.10.2	Updated the following function's status description. ·ADPM-NETWORK-START.confirm ·ADPM-PATH-DISCOVERY.confirm
		7.20	Updated the following IBs range description. ·adpBroadcastLogTableEntryTTL ·adpMaxHops ·adpNetTraversalTime ·adpRoutingTableEntryTTL ·adpMaxJoinWaitTime ·adpPathDiscoveryTime
		6.11.3	Added macSoftVersion Table. Updated macStatistics Table.
		8.10	Added the following status. ·R_EAP_STATUS_JOIN_DISCARD
Jul. 04, 2016	0.45	11	Added System Block's statistics and log description.
		-	Removed System Block SAP information
		2.5.4	Updated end sequence description.
		3.1	Updated UART Communication Setting description.
		4.3.2	Changed parameter name extAddress to extendedAddress. Changed g3mode valid value range for ADP & EAP mode.
		4.11	Update G3-EVENT.indication command format description.
		5.11.2	Updated List description.
		6.4.2	Updated status description.
		6.19.1	Modified adpNetTraversalTime length uint8_t to uint16_t. Modified adpRoutingTableEntryTTL length uint32_t to uint16_t. Changed adpKrt valid value range. Modified adpPathDiscoveryTime length uin8_t to uint16_t.
		6.19.2	Changed adpLoadSeqNumber valid value range.
		7.11.1	Modified eapGMK RW information. Changed attribute name eapPSKWaittimeSec to eapJoinWaittimeSec, and changed type uint8_t to uint8_t[2], and changed default value. Added eapDisableJoin attribute newly.

			Added eapEapPskRetryNum attribute newly. Added NwkWaittimeSec attribute newly.
		7.11.2	Added eapGMK description newly. Updated eapClientInfoTable description. Updated eapStatistics.
		8.4	Updated rekey sequences diagram.
		9	Updated LMAC Layer (DSP) information. Updated LMAC Layer (IF) information.
Jul. 06, 2016	0.46	4.1.1	Updated G3-INIT.request DAT parameter's valid value.
		4.1.2	Added new section.
		5.11.3 6.19.3 7.11.2	Updated statistics list table description.
Jul. 07, 2016	0.47	2, 5, 6	Added the following commands information. MLME-TMR-RECEIVE.indication MLME-TMR-TRANSMIT.indication ADPM-ROUTE-UPDATE.indication
		5.3.2 5.5.2 6.7.2 7.3.2	Updated command format description.
		5.13.1	Updated MAC PIB list. Added macTransmitAtten Added macBroadcastMaxCWEnable Updated macAckWaitDuration Updated macTMRTTL
		5.13.2	Updated MAC PIB list. Added macDeviceTableByShortAddr Added macNeighbourIndexByShortAddr Added macDeviceIndexByShortAddr Added macTmrIndEnable Added macCommStatusIndMask
		5.13.3	Updated macNeighbourTable
		6.11.3	Updated command description.
		6.20.1	Updated ADP IB list. Added adpDestinationAddressSet Updated adpRoutingTableEntryTTL Updated adpKq Updated adpKh
		6.20.2	Updated ADP IB list. Added adpRouteIndexByAddr Added adpRouteIndEnable
		6.20.3	Added adpDestinationAddressSet
Jul. 19, 2016	0.48	6.20.1	Updated ADP IB list. Added adpDefaultCoordRouteEnabled
Aug. 03, 2016	0.49	5.13.2	Updated MAC PIB Attribute RENESAS Original List Updated macTxGain Updated plTxPower Updated plTxDigitalPreambleGain Updated plTxDigitalGain Updated plStatistics Added plTxAlarm Added plZcdInPolarity
		6.20.3(6)	Changed the number of entry of adpBlacklistTable.
Sep. 07, 2016	0.50	2, 6	Added ADPM-LOAD-SEQ-NUM.indication command information.
		4.1.1	Updated G3-INIT.request DAT parameters valid value
		4.1.2	Updated G3-INIT.request recommended setting
		5.1.2	Modified MCPS-DATA.confirm DAT parameters valid value

		5.1.3	Modified MCPS-DATA.indication DAT parameters valid value
		5.4.2	Updated MLME-SET.confirm status
		5.13.2	Updated MAC PIB Attribute RENESAS Original List Updated macUnicastDataTxTimeout default value Updated macBroadcastDataTxTimeout default value Updated macBeaconRequestTxTimeout default value
		6.21.2	Updated ADP IB Attribute RENESAS Original List Added adpLoadSeqNumIndicationInterval
		6.21.3	Updated adpBroadcastLogTable Parameter description.
Oct. 04, 2016	1.00	5.2.1	Updated MLME-RESET,request:setDefaultPIB description.
		5.11,1	Modified MLME-TMR-TRANSMIT.indication command format.
		5.13	Updated MAC PIB Attribute Updated macNeighbourFilterMode description Updated plTxPower description Updated plTxFilterScale description Updated plTxDigitalPreambleGain description Updated plTxEnbPolarity description Updated plTxBreak description Updated plAcPhaseOffset description Updated plTxRxDisable description Updated plTxAlarm description Updated plZcdInPolarity description Updated macDeviceTable description.
Feb 13, 2017	1.01	2.3.2	Modified MLME-BEACON-NOTIFY's availability.
		2.3.3	Modified MLME-BEACON-NOTIFY's availability.
		2.5.1	Modified explanation of G3-PLC system bootup.
		5.1.3	Modified msduLinkQuality's description. Modified estimatedMod's valid value and description. Added Table 5-5.
		5.7.1	Modified panDescriptor's length, valid value and description.
		5.11.1	Modified dstAddrMode's valid value.
		5.13.2	Modified following IBs. macNeighbourTableByShortAddr(RW, description) plTxBreak(description) plAcPhaseOffset(description) Added following IBs. macKeepModEnable macNeiUpdateAfterRetransmit
		5.13.3	Updated macStatistics List.
		6.3.2	Modified PANCount's length and valid value. Modified PANdscriptor's length and valid value.
		6.5.1	Modified panId's valid value.
		6.5.2	Modified panId's description.
		6.10.2	Modified pathTable's length and valid value in command DAT.
		6.21.2	Added adpBeaconIndEnable
		6.21.3	Updated adpStatistics List.
		7.11.1	Modified eapCoordShortAddress's range.
Feb.20, 2017	1.02	4.1.1 (3)	Modified eapLbpBuffNum's description.
Apr.13, 2017	1.03	6.21.2	Added adpBuffIndDisable.
		7.11.2	Added eapOnetimeClientInfo
Apr. 14, 2017	1.04	5.7.1	Updated MLME-BEACON-NOTIFY.indication command parameter.
		5.12	Added R_G3MAC_STATUS_LML_TOO_FEW_SC.
		5.13.1	Changed following IB's name. macNeighbourTableEntryTTL -> macPOSTableEntryTTL Changed following IB's ID.

			macBroadcastMaxCWEnable macTransmitAtten Added following IB. macPOSTable
		5.13.2	Changed following IB's ID. macThreshCarrierNum macThreshToneNumPerMap Updated following IBs macNeiUpdateAfterRetransmit (Default value) macNeighbourTableSize (range and description) macDeviceTableSize (range) macValidNeiTableEntries (range) macValidDevTableEntries (range) plTxPower (Default value) plTxFilterScale (Default value) plTxDigitalPreambleGain (Default value) plTxDigitalGain (Default value) plStatistics (range and description) Added following IBs. macValidPosTableEntries macPosTableByShortAddr macKeepModRetryNum macTMRReqLeadTimeBefTTL macMinNeiTableEntries macOffsetSnr macThreshSnrDifferential macThreshSnrCoherent plTPgaCAj Removed following IBs. macWeakCarrierSnr macKeepModEnable macFullTonemapForTmr macNeighbourFilterMode
		5.13.3	Added macPosTable. Updated macNeighbourTable. Updated macStatistics.
		6.21.1	Changed following IB's name. adpRREQRERRWait -> adpRREQWait
Apr. 20, 2017	1.05	513.2	Modified macThreshToneNumPerMap (default value).
		6.5.2	Modified ADPM-NETWORK-JOIN.confirm (panId's description).
		7.11.1	Modified following IBs. eapJoinGmkId (range, description, default value) eapOnetimeClientInfo (range, description, default value) eapNwkWaittimeSec (default value)
May. 12, 2017	1.06	6.4.1	Modified ADPM-NETWORK-START.request (panId's range)
May. 18, 2017	1.07	2	Updated Table2-3 (Added ADPM-RREP command). Updated Table2-6 (Added ADPM-RREP command). Updated Table2-7 (Added ADPM-RREP command).
		6	Updated Table7-1 (Added ADPM-RREP command).
		6.20	Added ADPM-RREP command section.
		6.22.2	Added following IB. adpRrepIndEnable
		7.1.1	Moded following IB. eapOnetimeClientInfo(Description's typo)
May. 29, 2017	1.08	9.2	Updated Table 9-3.

		9.3	Added Table 9-4.
		9.4	Updated Table 9-8.
Aug. 31, 2017	1.09	5.13.2	Updated following IB. macOffsetSnr (changed default value)
		6.23.1	Updated following IB. adpRoutingTableEntryTTL (changed default value)
		7.7.1	Updated Table 7-14 (Added status detailed description of EAPM-NETWORK-JOIN.indication)
Oct. 16, 2017	1.10	2.2	Updated Table 2-3 (Added EAPM-EAP-KEY command) Updated Table 2-6 (Added EAPM-EAP-KEY command)
		7	Updated Table 7-1 (Added EAPM-EAP-KEY command)
		7.10	Added EAPM-EAP-KEY section
		7.12.1	Added following IB. eapKeyIndEnable
May. 08, 2018	1.11	2.2.3 2.3 4	Updated Table Added G3-DUMP, G3-DUMP-ABORT command
		4.1.3	Updated G3-INIT.confirm command Added R_G3_STATUS_INVALID_STATE in status
		4.7	Added section for G3-DUMP command
		4.8	Added section for G3-DUMP-ABORT command
		4.10	Added R_G3_STATUS_REQUEST_FAILED
		5.1.3	Updated MCPS-DATA.indication command Added recievedMod, receivedTonemap and RSSIdb member.
		5.12	Modified status code name R_G3MAC_STATUS_PAN_ID_CONFLICT -> R_G3MAC_STATUS_ALTERNATE_PANID_DETECTION
		5.13.2	Added the following IBs. macDisableBeacon macDisableTmres macRefRSSIdB macDisableTxGainTmr plSATTPolarity Updated the following IB. macOffsetSnr (Default value) Removed the following IB. plTxAlarm Updated the following IB. macOffsetSnr (default value) macThreshCarrierNum (default value) macThreshToneNumPerMap (default value) macThreshSnrDifferential (default value) macThreshSnrCoherent (default value)
		7.7.1	Updated status of EAPM-NETWORK-JOIN.indication command.
		11	Added new section for G3-DUMP specification
July 09, 2018	1.12	4.1.2	Modified Table4-3's Number of network node, Table4-4's Number of network node.
		11	Added section11.

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Serial Command Specification

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