ST G3-PLC Hybrid solution

Introduction

The goal of this document is to provide a detailed description of the ST PowerLine Communication (PLC) platforms equipped with the G3-PLC Hybrid PLC&RF protocol, hereafter called G3 platforms.

This document contains only the information related to the G3-PLC protocol implementation and its related features, so no other protocols or general-purpose interfaces are described herein.

This document does not contain any description of the G3 platforms themselves, with the exception of any information required to interface the platform.

The document mainly describes the external host interface operations, describing the sequence charts and the communication protocol between the host and the platforms. This host interface protocol is used to handle the communication from/to one external host (PC, embedded system, microcontroller, microprocessor…) and the G3 platforms.

The document also covers the G3 Hybrid profile added to the G3-PLC protocol, thanks to which the G3 platform can communicate over the powerline or through the air depending on the conditions.

The last part of this document describes the protocol information base (PIB) used to configure the G3 protocol implementation and the platform itself.

The ST PLC platforms that support G3-PLC protocol stack are STCOMETxx, STCOMxx (hereafter named STCOM(ET)) and ST8500 part numbers.

1 Document conventions

Table 1. **List of abbreviations**

Acronym	Description
6LoWPAN	IPv6 over Low power Wireless Personal Area Network
8PSK	Octonary Phase Shift Keying
ACK	Acknowledge
ADP	Adaptation Layer
AES-GCM	Galois Counter Mode
ASK	Amplitude Shift Keying
BOOT	Bootstrap Layer
Bps	bit per second
BPSK	Binary Phase Shift Keying
CEN-A	CENELEC A Band spanning from 9kHz to 95kHz
CEN-B	CENELEC B Band, spanning fomr 95kHz to 125kHz
COORD	Coordinator, also referred as PAN Coordinator
CSMA	Carrier Sense Multiple Access
CRC	Cycle Redundancy Check
DBG	Debug
DEV	Device, also referred as PAN Device
DLL	Data Link Layer
EAP-PSK	Extensible Authentication - Pre-Shared Key protocol
EUI64	64bit Extended Unique Identifier
FCH	Frame Control Header
FCS	Frame Check Sequence
FEC	Forward Error Correction
FEM	Front End Module
FCC	Federal Communication Commission
FSK	Frequency Shift Keying
GMK	Group Master Key
GPIO	General Purpose Input/Output
GxFSK	Gaussian Filtered (x order) Frequency Shift Keying
HW	Hardware
IB	Information Base
ICMPv6	Internet Control Message Protocol version 6
IPv6	Internet Protocol version 6
IRQ	Interrupt Request
ITU-T	Telecommunication Union – Telecommunication Standardization Bureau
JTAG	Joint Test Action Group
LBA	LoWPAN Bootstrapping Agent
LED	Ligth Emitting Diode

Acronym	Description
LQI	Link Quality Indicator
MAC	Medium Access Control Layer
MLME	Mac Layer Management Entity
MOL	Maximum Output Level
MTU	Maximum Transfer Unit
MSDU	Mac Layer Service Data Unit
NACK	Negative Acknowledge
NAI	Network Access Identifier
NSDU	Network Layer Service Data Unit
NVM	Non Volatile Memory
OFDM	Ortogonal Frequency Division Multiplexing
OOK	On-Off Keying
OTP	One Time Programmable memory
PAN	Personal Area Network
PHY	Physical Layer
PIB	Protocol Information Base
PLC	PowerLine Communication
PLME	Phy Layer Management Entity
PSD	Power Spectral Density
RF	Radio Frequency
RFC	Request for Comments (RFC)
RS	Reed-Solomon
RSSI	Received Signal Strength Indicator
RTE	Real-Time Engine
SAP	Service Access point
SDO	Standard Definition Organization
SMPS	Switch Mode Power Supply
SNR	Signal to Noise Ration
SoC	System on Chip
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver Transmitter
UDP	User Datagram Protocol
XTAL	Cristal

2 Hardware interface description

ST G3 platform interface exports the following functionalities:

- Reset interface though HW RESET pin to synchronize the power on sequence
- Host interface through UART in order to send and receive commands between host and G3 platform
- Debug Trace interface through UART in order to get information about the occurring events inside the G3 stack implementation
- Visual information though two GPIO typically connected to LEDs. LED0 shows if the code is running and LED1 shows if the node is registered to one G3-PLC network
- Optional external serial flash interface through SPI in order to store the G3-PLC stack images and to save non-volatile data (see Section 5.1)
- Optional band filtering selection through one GPIO to switch coupling circuit and fit G3-PLC CENELEC or G3-PLC FCC bandplans

For the host interface the selected HW interface is a 2-wires UART that uses two lines: TxD, RxD.

The default parameters for the UART communication after power-on or reset are:

- Baud Rate 115200 bps (default baud rate)
- Data Bits: 8 bits
- Stop Bits: 1
- Parity: None
- Hardware Handshake: None

The initial baud rate can also be changed by sending a proper host Interface message request to the platform.

Table 2. Host Interface UART Baudrates

Value
9600
14400
19200
38400
57600
115200
230400
460800
921600

For the Debug Trace interface, the selected HW interface is a 2-wires UART that uses one lines: TxD.

The parameters for the UART communication after power on-or reset are:

- Baud Rate 230400 bps (default baud rate)
- Data Bits: 8 bits
- Stop Bits: 1
- Parity: None
- Hardware Handshake: None

2.1 Platform HW interface configuration

The G3-PLC implementation supports two device families: STCOM(ET) and ST8500. This section describes the details of the HW interface for those two families.

Table 3. **STCOM(ET) HW interface description**

Function	#Config	Pins	Pin name	Peripheral	Comments
Host Interface	-	12	USART0_TXD	UART0 TX	
		13	USART0_RXD	UART0 RX	
Reset	-	9	RESETn	HW Reset	
SPI Flash	-	10	SPI0_MISO	SPI0 MISO	Optional feature for NVM
		11	SPI0_MOSI	SPI0 MOSI	
		9	SPI0_SCLK	SPI0 SCLK	
		8	SPI0_SSn	SPI0 SSn	
Band Filter select	-	-	-	-	Not available, user option
Trace port	All	21	GPIO01_2	UART1 RX	Rx is optional (future needs)
		20	GPIO01_1	UART1 TX	
Alive LED	All		GPIO08_0	GPIO	
Registered LED	All		GPIO08_1	GPIO	

Table 4. **ST8500 HW interface description**

Function	#Config	Pins	Pin name	Peripheral	Comments
Host Interface	-	32	GPIO00_4	UART0 RX	
		31	GPIO00_5	UART0 TX	
Reset	-	27	RESETn	HW Reset	
SPI Flash	-	54	GPIO01_0	SPI1 SCLK	Optional feature
		53	GPIO01_1	SPI1 MOSI	
		52	GPIO01_2	SPI1 SSn	
		51	GPIO01_3	SPI1 MISO	
Band Filter select	-	47	GPIO01_7	GPIO	
Trace port	0x00 or 0xFF	36	GPIO00_0	UART1 RX	Rx is optional (future needs)
		35	GPIO00_1	UART1 TX	
	0x01	50	GPIO01_4	UART2 RX	
		49	GPIO01_5	UART2 TX	
Alive LED	0x00 or 0xFF	50	GPIO01_4	GPIO	
	0x01	45	GPIO03_0		Also noted as BOOT0 pin
Registered LED	0x00 or 0xFF	49	GPIO01_5	GPIO	
	0x01	43	GPIO03_2		Also noted as BOOT2 pin

2.2 RF interface description

The G3 platform can be connected to the S2-LP sub-1GHz RF transceiver to extend G3-PLC communication creating an hybrid network exploiting both PLC and RF media.

This section describes the HW interface from the G3 platform to the RF transceiver.

On ST8500 platform the RF interface is enabled only if Trace port is configured to 0x01 (in 0x00 configuration there are conflicts on GPIO00_0 and GPIO00_1 pins). If no NVM is attached to the ST8500 the RF interface is enabled by default.

On STCOM(ET) platform the RF interface is enabled by default.

Table 5. STCOM(ET) HW interface to S2-LP

STCOMET Pin	STCOMET Pin name	STCOMET Peripheral	S2-LP Pin	S2-LP Pin Name	S2-LP Pin Description
113	GPIO07_4	SPI1 CS	19	CSn	SPI chip select
112	GPIO07_5	SPI1 MOSI	17	SDI	SPI slave data input
111	GPIO07_6	SPI1 MISO	16	SDO	SPI slave data output
110	GPIO07_7	SPI1 CLK	18	SCLK	SPI slave clock input
114	GPIO07_3	GPIO	20	GPIO0(1)	Configured to output IRQ
117	GPIO07_0	GPIO	6	SDN	Shutdown input pin

1. *The S2-LP GPIO configured to output IRQ can be changed using RF configuration command (see Section 8.25)*

Table 6. ST8500 HW interface to S2-LP

ST8500 Pin	ST8500 Pin name	ST8500 Peripheral	S2-LP Pin	S2-LP Pin Name	S2-LP Pin Description
34	GPIO00_2	SPI2 CS	19	CSn	SPI chip select
35	GPIO00_1	SPI2 MOSI	17	SDI	SPI slave data input
33	GPIO00_3	SPI2 MISO	16	SDO	SPI slave data output
36	GPIO00_0	SPI2 CLK	18	SCLK	SPI slave clock input
48	GPIO01_6	GPIO	20	GPIO0(1)	Configured to output IRQ
29	GPIO00_7	GPIO	6	SDN	Shutdown input pin

1. *The S2-LP GPIO configured to output IRQ can be changed using RF configuration command (see Section 8.25)*

3 Message Format

Table 7. **Host Interface Command Messages Formats**

Request Message Format										
Synchro Field		Control Field		Security Field		Message Payload Field			Check	
0x16	0x16	CMD_ID	MSG_LEN	SEC_MODE	COUNTER	MSG0	...	MSGLEN-1	TAG	CRC
2 Bytes		1 Byte	2 Bytes	1 Byte	4 Bytes	MSG_LEN Bytes			0/8 Bytes	2 Bytes
Confirm and Indication Message Format										
Synchro Field		Control Field		Security Field		Message Payload Field			Check	
0x16	0x16	CMD_ID	MSG_LEN	SEC_MODE	COUNTER	Error Code	MSG1 ...	MSGLEN-1	TAG	CRC
2 Bytes		1 Byte	2 Bytes	1 Byte	4 Bytes	1 Byte	MSG_LEN-1 Bytes		0/8 Bytes	2 Bytes

Each field has the following meaning:

- The Synchro Field is 2 bytes long used to align the command start.
- The Control Field contains the Command ID as described in Section 8.2 and the Message Payload Field Length.
- The Security Field is set to 0 for cleartext messages while, for ciphered messages, the security field contains information on the security mode for the message itself (see Table 10) and the counter of the message
- The Error Code (EC) field is present in the confirm and indication messages only and indicates if the previous received host interface command has been correctly processed or one error occurred (see Section 5.4).
- The Message Payload Field contains the information exchanged within the message.
- The Check Field contains an authentication tag in case of enabled security on the interface and a CRC field that is a 16 bits Cycle Redundancy Check (CRC16) evaluated on the overall message bytes (from the Synchro field to the last byte of the tag field if present).

The structure of each command consists of a fixed header part of 10 bytes (for requests) or 11 bytes (for responses), and a variable part of payload followed by an authentication tag of 8 bytes in case of secured host interface plus a 2 bytes check field.

For both Request and Confirm/Indication message formats, when the security is used the Control and Security fields are the Additional Authenticated Data, the Error (if any) and Message Payload fields are the ciphered part.

The maximum message size (including header and CRC) can be up to 1636 bytes for the requests and 1648 bytes for the responses.

Each field greater than one byte that does not represent a bit/bytes mask uses the little-endian format.

3.1 CRC Evaluation

In order to detect erroneous message frames, a CRC is used.

Table 8. **CRC parameters**

Parameter	Value
Type	CRC-16-CCITT
Width	16 bits
Poly	x16 + x12 + x5 + 1 (0x1021)
Initial Value	0x0000
Final XOR	0x0000
Data Reflection	No
CRC Reflection	No

3.1.1 Example of CRC-16 evaluation

The CRC-16 is evaluated on the first 10 Bytes of the message as the last two are filled with the CRC itself. The result of the CRC-16 operation is the 16-bit value 0x21BC, which is inserted in the last two bytes of the message (in little endian format).

Table 9. CRC-16 evaluation example

Synchro Field		Control Field			Reserved Field					Check	
0x16	0x16	0x04	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x32	0xE1
2 Bytes		1 Bytes	2 Bytes		5 Bytes					2 Bytes	

3.2 Secure Host Interface

The G3-PLC solution embeds the capability to provide secure communication between the host and the platform itself.

There are 3 operation mode defined by the security levels.

Table 10. Security level information

Value	Meaning
0	Cleartext
1	Security with AES-GCM on Get/Set commands
2	Security with AES-GCM on all commands (except Table 11)

Value 0 has no security that means the platform may receive commands that are not encrypted nor authenticated (clear-text). In this case, the COUNTER field in the messages is ignored and the tag field is not present.

Value 1 enables security only for G3-LIB-GET/SET commands. These messages must be ciphered and authenticated to be executed and the related answer are secured. The COUNTER field has a meaning only for these commands that also contain a tag field.

Value 2 enables security for all the messages. All the messages must be encrypted and authenticated. The COUNTER field must be used for all the commands that also contain a tag field.

The configuration of level of the security is done:

- In the ST8500 using the bit 14..15 of the OTP section “User Security bits” (OTP_SEC_MODE)
- In the STCOMET/STCOM secure host interface is not supported

Once configured, the device starts with the configure mode after each POR or hardware reset and requires an initialization phase if not in cleartext.

The selected authenticated encryption mode is AES-GCM based on 128-bit key called UART_KEY.

The UART_KEY is derived by performing an AES-128-ECB encryption to 128-bits random initiated data (RAND_INIT) using as key a 128-bit key (OTP_KEY) pre-shared between the host and the G3 platform.

In the G3 platform, the OTP_KEY is stored:

- For the ST8500, in the OTP section under the “User specific words”
- For the STCOMET/STCOM secure host interface is not supported

The initialization phase is comprised of a sequence of message exchanges between the Host and the G3 Platform. This sequence, which may take place after the Host receives `HOSTIF-HW-RESET.Confirm` or whenever the Host decides it’s necessary to reset the HI Security status, can be described as follows:

- The Host sends to the G3 Platform the request to begin the HI Security initialization: `HOSTIF-SEC-INIT.Request(TYPE1)`. The TYPE parameter is used to distinguish among different phases of the Security protocol.

- The G3 Platform responds to the Host with the data to actually implement Security: `HOSTIF-SEC-INIT.Confirm(TYPE1, RAND_INIT, RAND_H, RAND_S)`. RAND_INIT is a 128-bits random number, while RAND_H and RAND_S are 64-bits random numbers. RAND_H is used by the host to create the host side initialization vector IV_H concatenating a 32-bits counter (COUNTER_H). The counter is initialized at zero and incremented by one each time the host sends a message to the G3 platform. Similarly, the RAND_S is used by the G3 platform to create the IV_S concatenating a 32-bits counter (COUNTER_S). The counter is initialized at zero and incremented by one each time the G3 platform sends a message to the host. COUNTER_H and COUNTER_S are used to provide an anti-reply mechanism.
- At this point the Host sends a new `HOSTIF-SEC-INIT.Request`, but this time it is encrypted with IV_H and UART_KEY. The message is structured this way: `SEC(HOSTIF-SEC-INIT.Request(TYPE2, RAND_M))`. RAND_M is a 128-bits random number.
- Now, to conclude the setup of the HI Security, the G3 Platform responds sending this message: `SEC(HOSTIF-SEC-INIT.Confirm(TYPE2, RAND_M))`. This message is encrypted with IV_S and UART_KEY and contains the same random number RAND_M. This message is then validated by the Host.

When the G3 Platform detects that COUNTER_S is going to roll-over, a new message is sent to the Host, `HOSTIF-SEC-INIT.Confirm(TYPE0)`. At this point the host can request to start again the initialization sequence described above.

On the other hand, when the Host notices that COUNTER_H is going to roll-over, it can directly send the request to start again the initialization sequence. In this case, the G3_Platform stop sending G3 specific messages to the Host while the new security negotiation process is still undergoing.

After this initialization phase, all the secured commands can be exchanged on the UART.

Figure 1. G3-PLC secure host interface initialization sequence

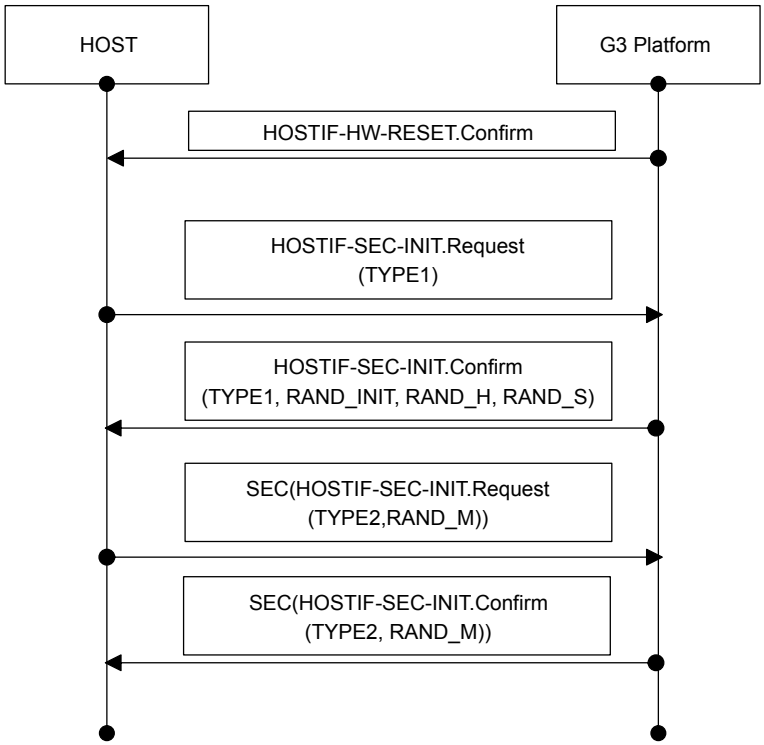


Figure 2 and Figure 3 depict message sequences in case of frame counter roll-over

Figure 2. **G3-PLC message sequence in case of host frame counter roll-over**

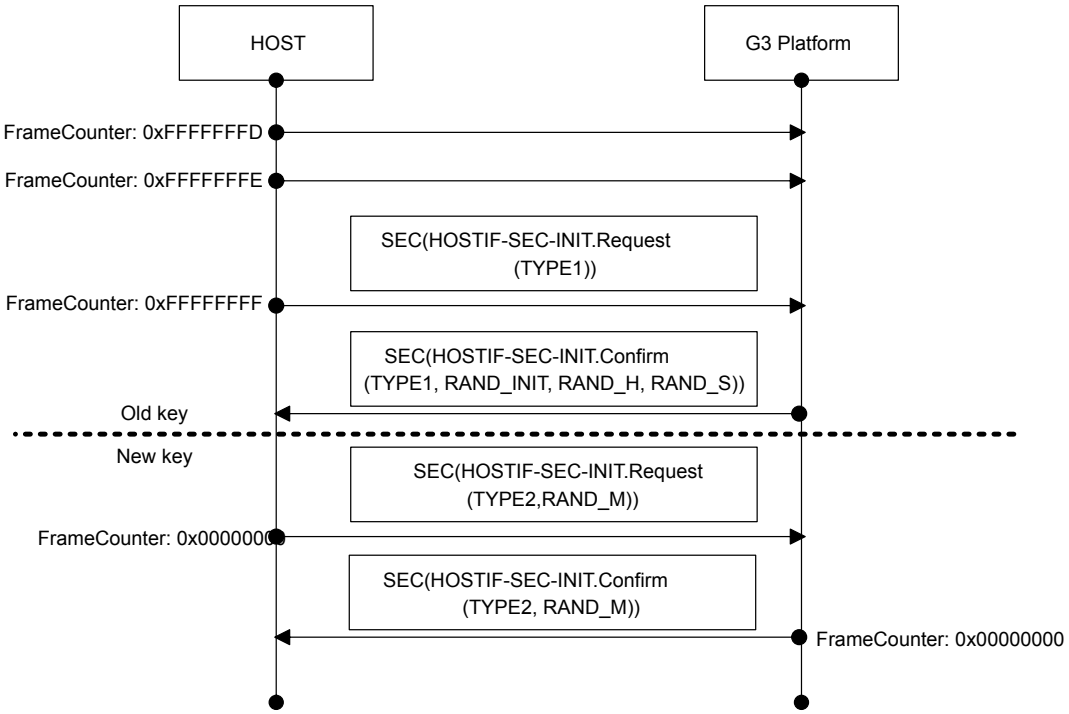
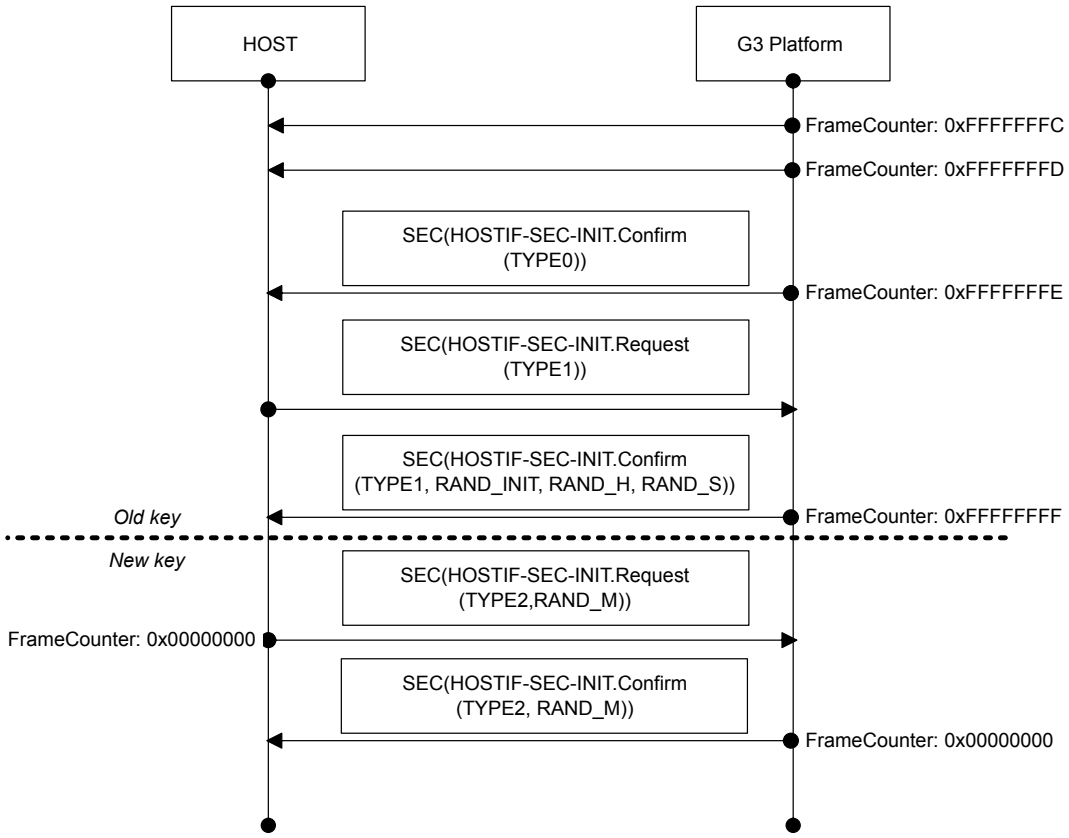


Figure 3. **G3-PLC message sequence in case of G3 platform frame counter roll-over**



In case a message is received without the correct security context, the appropriate error could be raised (as listed in Section 5.6) or the message is silently discarded.

In any case, few messages can be always exchanged in cleartext.

Table 11. Cleartext Commands

ID	Name	Direction
0x00	HOSTIF-HWRESET.Request	Host to G3 platform
0x01	HOSTIF-HWRESET.Confirm	G3 platform to Host
0x08	HOSTIF-RESETSTATE.Request	Host to G3 platform
0x09	HOSTIF-RESETSTATE.Confirm	G3 platform to Host
0x0B	HOSTIF-TESTSET.Confirm	G3 platform to Host
0xFF	ERROR.Indication	G3 platform to Host

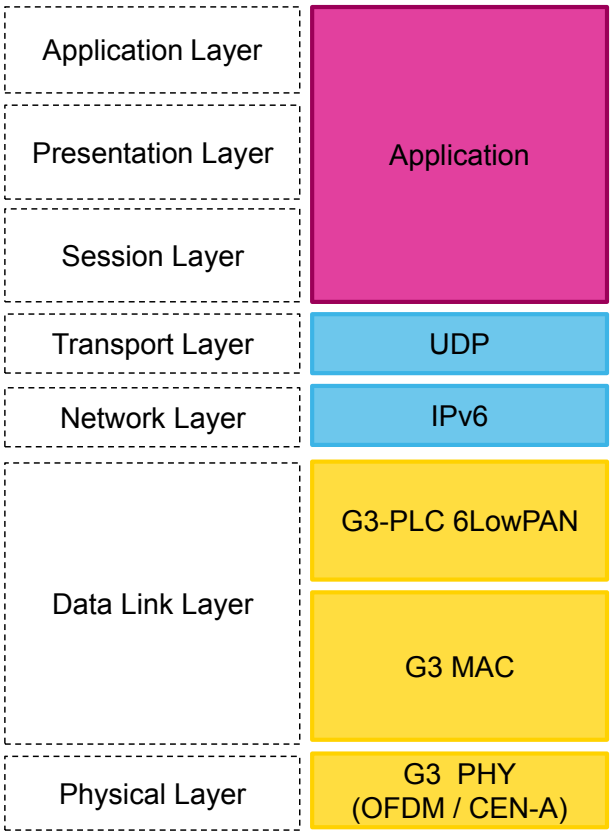
4 G3-PLC Functional Overview

The G3-PLC protocol is specified by the G3-PLC Alliance and standardized under the ITU-T SDO within the Recommendations G.9901 (PSD and frequency band plans) and G.9903 (functional protocol specification).

4.1 Protocol stack architecture and partitioning

The G3-PLC protocol stack follows the ISO/OSI layering model as shown in Figure 4. The G3-PLC focus its definition on lower layers: Physical layer (PHY) and Data Link layer (DLL).

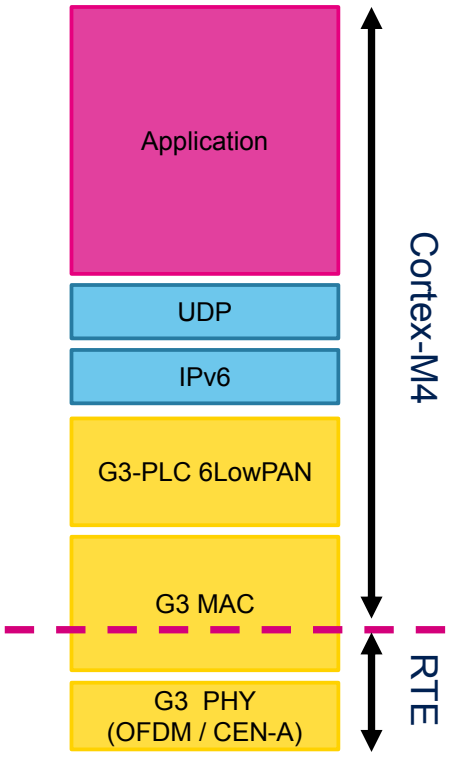
Figure 4. G3-PLC protocol stack reference model



Data Link Layer is logically composed by two sub-layers, Medium Access Control (MAC) sub-layer and IPv6 Adaptation (ADP) sub-layer. MAC Layer is based on IEEE 802.15.4 wireless protocol, whereas the ADP Layer is based on 6LoWPAN RFCs. On top of the ADP sub-layer only the IPv6 protocol can be used. The currently most widely used applications require UDP Layer, but supporting the TCP transport protocol would also be possible.

The ST implementation of the G3-PLC protocol is divided into two different parts each referring to one platform engine, Cortex-M4 or RTE, as in Figure 5:

Figure 5. **Firmware separation reference model**



A specific software module, called G3LIB, allows configuring the G3-PLC library. The G3LIB module provides the implementation dependent functionalities required to properly run the protocol library as well as the Information Base (IB) to configure and control the entire protocol behavior.

Among with the standard layers, G3-PLC solution also implements a Bootstrap application compliant with the EAP-PSK specification.

4.2 RF extension

The G3 platform can be connected to an RF transceiver to extend G3-PLC communication. This creates a hybrid network providing the following benefits:

- Communication between two nodes can occur indifferently on one of the two media (PLC or RF) depending on the quality of the signal. The choice of the best medium is performed internally by the G3-PLC firmware, so it is completely transparent for the final application
- Possibility to extend the security at MAC level, already used in G3-PLC communication, also on the RF medium
- In case of communication failure, the communication between two nodes can occur on the second medium
- Flexibility, the S2-LP device can be configured from Host (for example modulation, datarate, frequency)

In order to extend G3-PLC communication some modules have been modified or added as shown in Figure 6.

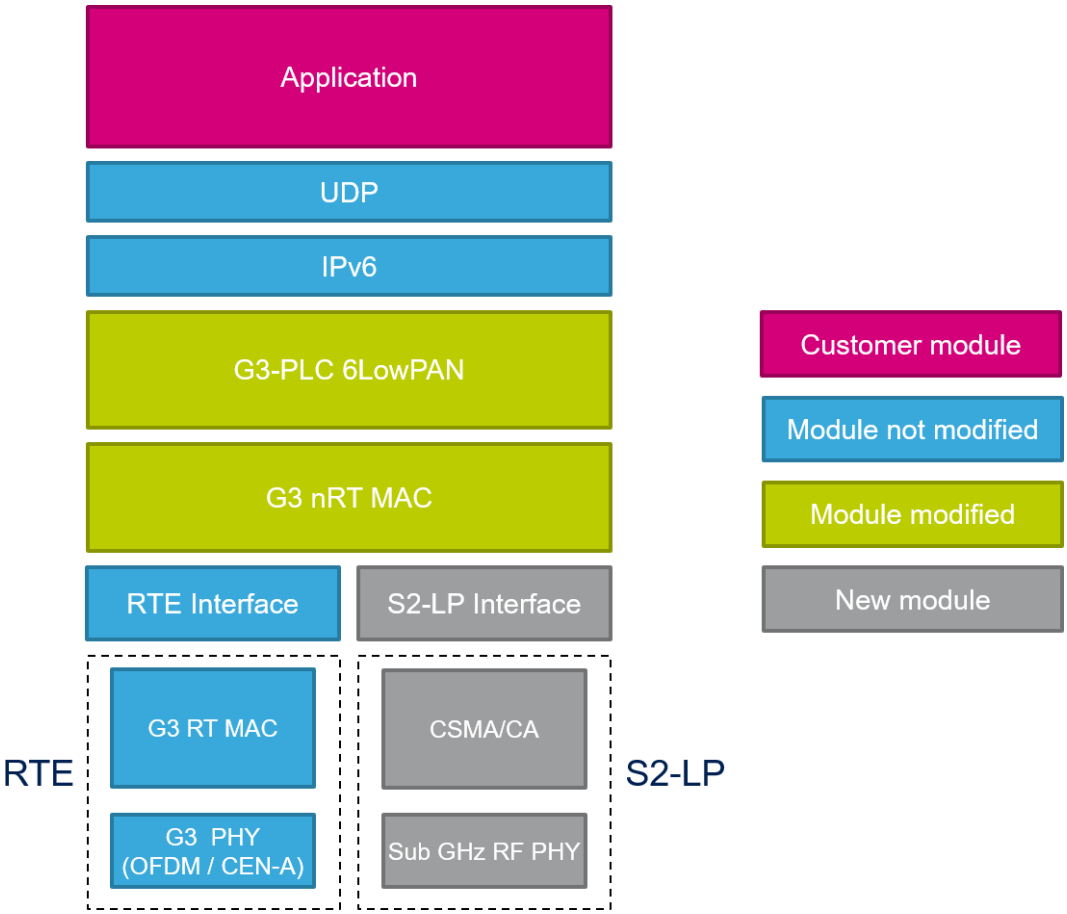
The upper layers such as UDP and Ipv6 are left untouched because, for network and application layers, the selection and handling of the RF medium is totally transparent.

On the contrary, both the 6LoWPAN and MAC non Real-time layers have been modified.

The modifications in 6LoWPAN modules involve mainly the routing algorithm and the procedure to discover and join a new PAN. Moreover, the use of a backup medium is possible when transmitting 6LoWPAN data.

The MAC Real-time module has been adapted to support transmission and receiving on both physical media; the MAC module is able interface either the RTE inside the G3 Platform either the S2-LP device, using a new interface module created to handle the S2-LP RF transceiver from the G3 Platform.

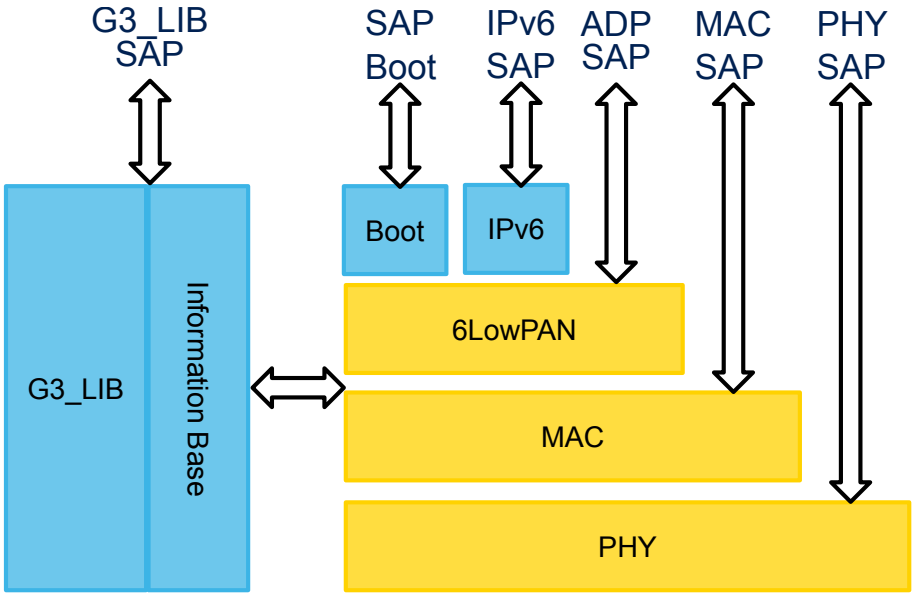
Figure 6. **Firmware modules modifications to support RF**



4.3 Access Point

The G3 platform exports the access to all the protocol layers; the user can decide which layer can be accessed as depicted in Figure 7.

Figure 7. **G3-PLC solution access point**



The G3 platform operating mode has to be configured through G3LIB-SWRESET (8.37) command.

The following rules apply in selecting the access point:

- The user can decide one of the following access modes: PHY only (only PHY Layer works), MAC (PHY and MAC Layers work together), ADP (PHY, MAC and 6LoWPAN work together) or IPv6 (PHY, MAC, 6LoWPAN and IPv6/UDP work together)
- The user can decide to enable Bootstrap application, which can be combined to ADP or IPv6

Table 12. G3 platform modes

Label	Value	Description
HI_PHY_MODE	0	Platform configured to have access to PHY Layer
HI_MAC_MODE	1	Platform configured to have access to MAC Layer
HI_ADP_MODE	2	Platform configured to have access to ADP Layer
HI_BOOT_MODE	3	Platform configured to have access to BOOT Layer
HI_IPV6_ADP_MODE	4	Platform configured to have access to IPv6 Layer without BOOT Layer access
HI_IPV6_BOOT_MODE	5	Platform configured to have access to IPv6 Layer and BOOT Layer

4.4 Debug traces

The G3 platform has the possibility to output UART traces information on the events that are occurring inside the protocol stack. This information can be used to fine tune the solution, perform advanced testing and debug issues in the laboratory. It is possible to decide what modules and level of information need to be traced. The following tables show the format of the traces, the definition of the modules (32-bit bitmask) and the priorities.

Table 13. Debug Trace Format

Label	Len	Value	Description
Start Byte	1	0xC3	The first byte of a debug trace
Len	1	4-255	Length of the trace content
Trace Word	4	-	The type of the trace
Buffer	0-251	-	Optional buffer for traces that need it
End Byte	1	0xB4	The last byte of a debug trace

Table 14. Debug traces info

Label	#bit	Description
Reserved	0..6, 22,23, 29..31	Not used
PHY data	7	Trace data at PHY layer
PHY debug	8	Trace detailed information at PHY Layer
PHY info	9	Trace high level information at PHY Layer
RTEI debug	10	Trace detailed information on the Cortex<->RTE interface
RTEI info	11	Trace high level information on the Cortex<->RTE interface
MAC data	12	Trace data at MAC layer
MAC debug	13	Trace detailed information at MAC Layer
MAC info	14	Trace high level information at MAC Layer
ADP data	15	Trace data at ADP layer
ADP debug	16	Trace detailed information at ADP Layer

Label	#bit	Description
ADP info	17	Trace high level information at ADP Layer
BOOT debug	18	Trace detailed information at BOOT Layer
BOOT info	19	Trace high level information at BOOT Layer
G3LIB info	20	Trace information regarding the G3-PLC stack configuration
RTEWDG debug	21	Trace information regarding the status of Cortex<->RTE interface
GENERIC	24	Trace information on the generic platform event
HI	25	Trace information on the host interface
HI data	26	Trace data commands on the host interface
IPv6	27	Trace information at Ipv6/UDP layers
APP	28	Trace information at application layer
RF	29	Trace information about RF interface

Table 15. Debug traces priority

Label	Value	Description
INFO	0	All the traces are output
WARN	1	Only high-level information is output
FAIL	2	Only critical information is output

The `HOSTIF-TRACE.Request/Confirm` messages are used to configure the tracing modules and the priority of the output.

Through the configuration options of the trace module, the logging of the traces on the external flash can be activated. On the external flash a header is written at the beginning of each sector to help with the reconstruction of the flow of the traces. The range of external flash sectors that can be used to log traces is [13, 22]. The header's format is described in the following table.

Table 16. Debug Trace External Flash Header

Label	Len	Description
Tag	4	The tag of the log, always the same (0xDEADBEEF in le, thus found as 0xEF 0xBE 0xAD 0xDE)
Count	4	The count of the sectors, used to order the logs

Traces logged on the external flash never span over a sector limit, so when a trace doesn't completely fit on the current sector, it is written on the next one, after the sector header.

Note: On the ST8500 the traces output is disabled in case the JTAG port is locked through the setting of the proper security bit in the OTP memory.

5 Operation and message flow

This paragraph contains the description of the operation and the message flow sequences for the implemented functionalities on the G3-PLC host interface.

The selected hardware model brings the flexibility to allow simultaneously sending and receiving commands to and from the ST G3 platform. However, the application on the host controller must take care of the constraints imposed by the G3-PLC protocol itself and by the HW design.

Two main operations models are present in the G3-PLC solution: asynchronous indication and request/confirm transaction.

Asynchronous indications are used to inform about events that occur in the modem from PLC activities (i.e. data reception) or from other sources. Those events are not driven by the external host.

Request/confirm transactions are instead driven by the external host. For each request command (i.e. data transmission) a confirm command with the result or status of the operation is sent to the external host (i.e. confirm of the data transmission)

Sometimes a command request may contain errors or can be corrupted on the hardware lines. If those errors can be detected, the G3 platform issues an error response message. In some cases, the error cannot be detected so after the reception of the first synch character the ST G3 platform sets a timeout of 5 seconds. If the request command is not completed within this timeout, the G3 platform issues an error indication message (see Section 8.124) and starts to wait for the next two synchronization characters of a new message. This timeout mechanism allows the external host and the G3 platform to re-synchronize themselves in case of disturbance in the communication.

5.1 Non-volatile memory (NVM) operations

G3-PLC solution supports the storage of relevant parameters in an external connected SPI Flash. This optional feature may be used to enhance the flexibility of the stack providing additional features and an easy way to apply specific configuration that depends on the application scenario. For this purpose, sectors 30 and 31 of the external SPI flash are used. Each time a write should be done that requires a change from bit ‘0’ to bit ‘1’ a sector swap it is performed otherwise the same sector is used to store the change.

This feature is available only if the external SPI flash is connected to the G3 platform.

This mechanism is called NVM and it is divided in three section: generic (GEN), PLC, PLC for coordinator (PLCC), RF.

The NVM structure for each section is reported in the following tables.

Table 17. G3-PLC GEN NVM section

Label	Len	Offset	Description
MARKER	4	0	Identifier of start of the GEN section 0xBB0000BB
VERSION	2	4	The version of the GEN section (0x0004 for the current version)
LEDCONF	1	6	The configuration of the LED as in Section 2.1
TRACECOM	1	7	The COM port to be used to output the trace as in section Section 2.1
TRACEFILTER	4	8	The filtering to be applied to the trace
RESERVED	12	12	Not used in this version

Table 18. G3-PLC PLC NVM section

Label	Len	Offset	Description
MARKER	4	0	Identifier of start of the PLC section 0xBB1111BB
VERSION	2	4	The version of the PLC section (0x0004 for the current version)
HIMODEBPDEVT	1	6	Bitmask that represent: b0: G3-PLC device type (0 DEV, 1 COORD)

Label	Len	Offset	Description
			b1..b3: G3-PLC bandplan (0 CEN-A, 1 CEN-B, 3 FCC) b4..b7: G3-PLC Host Interface mode (see Table 26)
CONFIG	1	7	Test and general configuration bitmask (1 disable – 0 enable): b0: not used in this version b1: not used in this version b2: use fast restore b3: apply NVM PLC attributes
RSV1	8	8	Not used in this version
FC	4	16	macFrameCounter value to be applied at the next start-up
LG_SN	2	20	adpLOADngSequenceNumber to be applied at the next start-up
PAD	2	22	Pad bytes (0xFF)
LG_SN_extra	4	24	Each bit in the mask represent the increase of 0x400 in the LG_SN field for the next start-up
FC_extra	4	28	Each bit in the mask represent the increase of 0x400 in the FC field for the next start-up
RSV3	2	32	Not used in this version
CRC	2	34	CRC evaluated to the FC_SN, LG_SN and PAD fields
PANID	2	36	The latest configured PAN ID
SHORTADDR	2	38	The latest configured Short Address
ACTIVEKEYIDX	1	40	The latest configured Active Key Index
RSV2	1	41	Not used in this version
Key0Free	1	42	Key0 free indication (0: key0 present, other: key not preset)
Key0	16	43	The Key0 (if present otherwise all 0xFF)
Key1Free	1	59	Key1 free indication (0: key1 present, other: key not preset)
Key1	16	60	The Key1 (if present otherwise all 0xFF)
PANCPREFIX1	8	76	The #1 Prefix to be set when starting the PANCoordinator
PANCPREFIX2	8	84	The #2 Prefix to be set when starting the PANCoordinator
ATTRIBUTES	436	92	Flexible section to manage attribute configuration at startup. Attribute is in the form ATTRIBUTE_ID: 4 bytes INDEX: 2 bytes LEN: 1 byte (0xFF is not a valid length since it is the default value VALUE: LEN bytes long

Table 19. G3-PLC PLCC NVM section

Label	Len	Offset	Description
MARKER	4	0	Identifier of start of the PLCC section 0xBB2222BB
VERSION	2	4	The version of the PLCC section (0x0004 for the current version)
RESERVED	2	6	Not used in this version
ISNOTCONNECTED	150	8	Each bit indicates if a specific node index is already connected
HASH	1200	158	Hash evaluated on a specific node

Table 20. **G3-PLC RF NVM section**

Label	Len	Offset	Description
MARKER	4	0	Identifier of start of the PLCC section 0xBB3333BB
VERSION	2	4	The version of the RF section
RESERVED	2	6	Reserved for future use
RADIO_BASEFREQ	4	8	Specify the base carrier frequency (in Hz)
RADIO_MODSELECT	1	12	Specify the modulation (0x70 No Mod, 0x00 2-FSK, 0x10 4-FSK, 0xA0 G2FSK with BT = 0.5, 0x20 G2FSK with BT = 1, 0xB0 G4FSK with BT = 0.5, 0x30 G4FSK with BT = 1, 0x50 ASK OOK, 0x60 POLAR)
RADIO_DATARATE	4	13	Specify the data rate expressed in bps
RADIO_FREQDEV	4	17	Specify the frequency deviation expressed in Hz
RADIO_BANDWIDTH	4	21	Specify the channel filter bandwidth expressed in Hz
RADIO_CSBLANKING	1	25	Prevent data to be received if the RSSI level on the air is below the RSSI threshold
RADIO_XTALFREQ	4	26	Set the XTAL frequency
RADIO_RSSIGAIN	1	30	Set the RSSI filter gain
POWERDBM	1	31	Power Amplifier value to write expressed in dBm (0 is -31 dBm, 45 is 14 dBm). In case FEM is enabled, the gain of an external PA may be added
PKT_CRCMODE	1	32	Set the CRC type (0x00 No CRC, 0x20 8 bits, 0x40 16 bits poly 0x8005, 0x60 16 bits poly 0x1021, 0x80 24 bits, 0xA0 32 bits)
PKT_ENFEC	1	33	Enable the FEC/Viterbi
PKT_ENWHITENING	1	34	Enable the data whitening
PKT_ENINTERLEAVING	1	35	Enable the interleaving of 802.15.4g packet
IRQGPIOPIN	1	36	Specify the S2LP GPIO pin used to route the interrupt flag
MCU_CLKENABLE	1	37	Enable the S2LP Clock Output (0x00 Disabled, 0x01 Enabled)
MCU_CLKGPIOPIN	1	38	Specify the S2LP GPIO pin used to export S2LP Clock
MCU_CLKXORATIO	1	39	Set the S2LP clock output XO prescaler
MCU_CLKRCORATIO	1	40	Set the S2LP Clock Output RCO prescaler
MCU_CLKCLOCKCYCLES	1	41	Set the S2LP ExtraClockCycles
EXTSMPSENABLE	1	42	Enable the external SMPS (0x00 Disabled, 0x01 Enabled)
FEM_ENABLED	1	43	Enable the S2LP GPIO signals to control the Front End Module (0x00 Disabled, 0x01 Enabled)
FEM_CSDGPIOPIN	1	44	Specify the S2LP GPIO pin to control CSD
FEM_CPSGPIOPIN	1	45	Specify the S2LP GPIO pin to control CPS
FEM_CTXGPIOPIN	1	46	Specify the S2LP GPIO pin to control CTX
FEM_TXBYPASS	1	47	Enable the FEM TX Bypass Mode (0x00 Disabled, 0x01 Enabled)

In case of misconfiguration, the sectors 30 and 31 may be erased thanks to `HOSTIF-SFLASH.Request/Confirm` commands and the next reset or power-off/on rebuilds the structure of the NVM with the clean default state.

5.2 G3 platform initialization

This section describes how to correctly initialize and configure the G3 Platform, highlighting the differences between the following use cases:

- The storage of parameters in the NVM is available (SPI Flash available)
- The storage of parameters in the NVM is not available (SPI flash not available)

Three basic parameters must be configured in all the nodes for a proper network operation: platform mode, device type and bandplan. These parameters can be configured though the G3LIB-SWRESET.Request/Confirm message transaction (see Section 8.37 and Section 8.38)

5.2.1 Platform initialization with NVM

During the startup after the HW reset, the last configuration applied to the G3 platform before the reset of the device is restored from the NVM: platform mode, device type and bandplan parameters are read from the external SPI Flash and configured again in the G3 Platform.

Also, the attributes used for security (macFrameCounter) and routing (adpLOADngSN) are read from the NVM and configured back into the device.

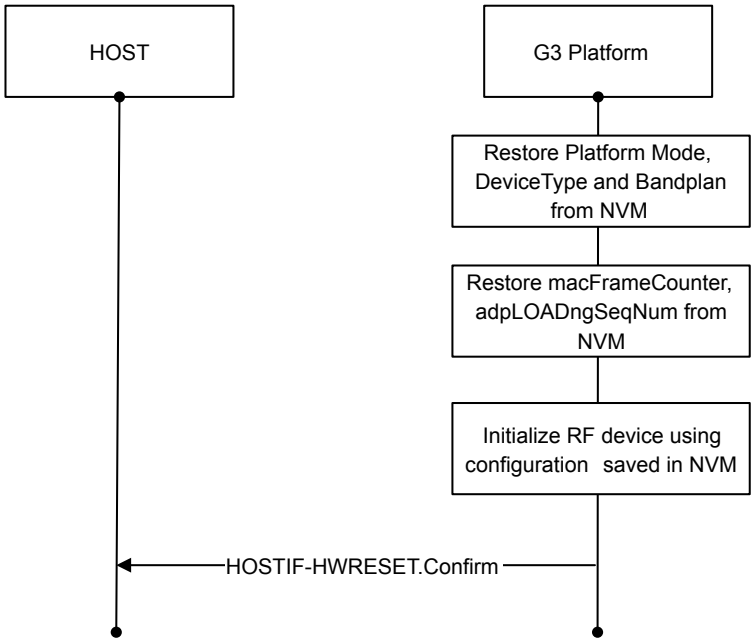
If the RF device is detected it is initialized applying the settings stored into the NVM (see Section 5.2.4 for more details).

As soon as the initialization operations are completed, the G3 platform sends the `HOSTIF-HWRESET.Confirm` message to the Host to confirm the successful startup.

To check the device configuration, the Host can issue a `HOSTIF-DBGTOOL.Request` command with the DBG_INFO parameter (see Section 8.21 and Section 8.22).

The bootstrap procedure (as specified in Section 5.4) may automatically start based on the operating mode.

Figure 8. G3 Platform initialization (with NVM)



5.2.2 Platform initialization without NVM

When the G3 platform is started the following sequence takes place:

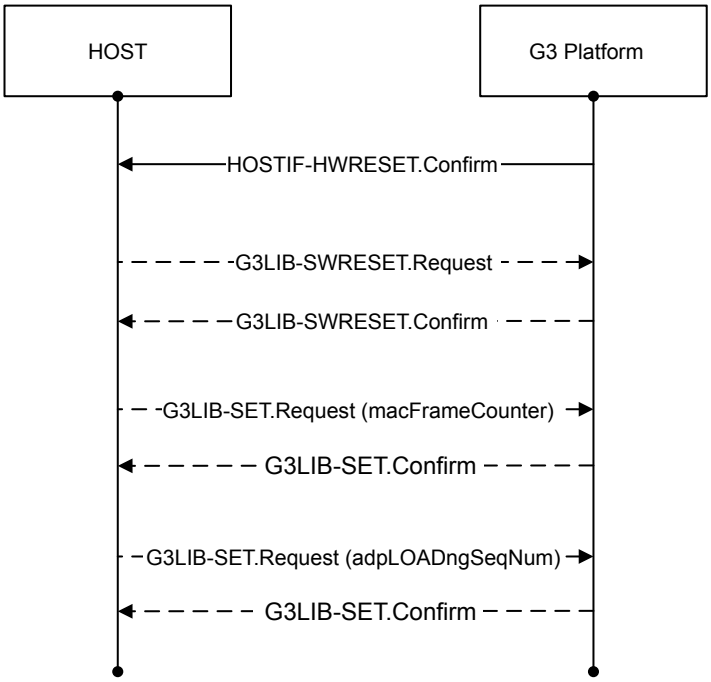
- The G3 platform sends the `HOSTIF-HWRESET.Confirm` message to the Host, in order to confirm the successful startup
- The G3 platform is started in HI_ADP_MODE, with Device type and operating in CEN-A bandplan
- The host can configure the G3 platform sending a `G3LIB-SWRESET.Request` message, specifying the DeviceType, Bandplan and Mode parameters.
- The host should restore the macFrameCounter attribute, used for MAC security, sending a G3LIB-SET.Request message. The value of the counter may be higher with respect to the last one used.
- The host should restore the adpLOADngSequenceNumber attribute, used for ADP routing, sending a `G3LIB-SET.Request` message. The value of the counter may be higher with respect to the last one used.
- If the RF device is detected the host should configure it sending a `HOSTIF-RFCONFIGSET.Request` message containing all the requested parameters. If this message is not sent from the Host, the G3 platform initializes the RF device with default parameters (see Section 5.2.4 for more details).

The Host has to periodically read the values of macFrameCounter and adpLOADngSequenceNumber attributes from the G3 platform, using `G3LIB-GET.Request` message.

Note: During the G3 platform initialization, the Host has to increment and restore those attributes (as described above) in order to respect the security requirements mandates by the G3-PLC specification.

To check the device configuration the Host can issue a `HOSTIF-DBGTOOL.Request` command with the DBG_INFO parameter (see Section 8.21 and Section 8.22).

Figure 9. G3 Platform initialization (without NVM)



5.2.3 Bootstrap parameters initialization

Once the initialization of the G3 platform is completed the host has to configure the bootstrap related parameters.

If the node is configured as PAN coordinator the parameters to configure are the following:

bootServerIdS:

this attribute contains the IdS, the server ID used by the EAP-PSK protocol to uniquely identify the server in the network. This attribute has to be set reversing the byte order

bootServerIdSLen:

this attribute contains the length in byte of the IdS attribute

macKeyTable:

this attribute contains the keys to provide ciphering at MAC layer

adpActiveKeyIndex:

the active GMK in the key table

adpEAPPSKKey:

this attribute contains the default Pre-Shared Key (PSK).

By default, the IdS is initialized with the device EUI64 address (byte reversed).

If the NVM is available macKeyTable and adpActiveKeyIndex attributes are restored from their last configuration applied to the G3 platform before the reset.

By default, the PSK is initialized with the following value: {0xAB, 0x10, 0x34, 0x11, 0x45, 0x11, 0x1B, 0xC3, 0xC1, 0x2D, 0xE8, 0xFF, 0x11, 0x14, 0x22, 0x04}.

If the node is configured as device the parameters to configure are the following:

adpEAPPSKKey:

this attribute contains the Pre-Shared Key (PSK) used by the EAP-PSK protocol to authenticate the node in the network

adpEAPPSKIdP:

this attribute contains the IdP, the peer ID used by the EAP-PSK protocol to uniquely identify one node in the network. This attribute has to be set reversing the byte order

adpEAPPSKIdPLen:

this attribute contains the length in byte of the IdP attribute

By default, the PSK is read from OTP device area. If not present in this area (all zeros), it is initialized with the following default value: {0xAB, 0x10, 0x34, 0x11, 0x45, 0x11, 0x1B, 0xC3, 0xC1, 0x2D, 0xE8, 0xFF, 0x11, 0x14, 0x22, 0x04}

By default, the IdP is initialized with the device EUI64 address (byte reversed)

5.2.4 RF device initialization

The Table 21 shows the default values used to initialize the RF device when no NVM is available.

When the NVM is available the RF NVM section is initialized with the values reported in Table 21.

If the RF device is configured with different parameters from the Host, and the NVM is available, the NVM is updated with the new parameters, which will be used to restore the RF configuration at the following startup.

Table 21. RF device initialization default values

#Bytes	Label	Default Value	Description
4	RADIO_BASEFREQ	863100000	Specifies the base carrier frequency (in Hz)
1	RADIO_MODSELECT	0x00	Specifies the modulation (0x70 No Mod, 0x00 2-FSK, 0x10 4-FSK, 0xA0 G2FSK with BT = 0.5, 0x20 G2FSK with BT = 1, 0xB0 G4FSK with BT = 0.5, 0x30 G4FSK with BT = 1, 0x50 ASK OOK, 0x60 POLAR)
4	RADIO_DATARATE	50000	Specifies the data rate expressed in bps
4	RADIO_FREQDEV	12500	Specifies the frequency deviation expressed in Hz
4	RADIO_BANDWIDTH	100000	Specifies the channel filter bandwidth expressed in Hz
1	RADIO_CSBLANKING	0x01	Prevents data to be received if the RSSI level on the air is below the RSSI threshold
4	RADIO_XTALFREQ	50000000	Set the XTAL frequency
1	RADIO_RSSIGAIN	14	Set the RSSI filter gain
1	POWERDBM	35	Power Amplifier value to write expressed in dBm (0 is -31 dBm, 45 is 14 dBm). In case FEM is enabled, the gain of an external PA may be added
1	PKT_CRCMODE	0x20	Set the CRC type (0x00 No CRC, 0x20 8 bits, 0x40 16 bits poly 0x8005, 0x60 16 bits poly 0x1021, 0x80 24 bits, 0xA0 32 bits)
1	PKT_ENFEC	0x01	Enable the FEC/Viterbi
1	PKT_ENWHITENING	0x01	Enable the data whitening
1	PKT_ENINTERLEAVING	0x01	Enable the interleaving of 802.15.4g packet
1	IRQGPIOPIN	0x00	Specify the S2LP GPIO pin used to route the interrupt flag
1	MCU_CLKENABLE	0x00	Enable the S2LP Clock Output (0x00 Disabled, 0x01 Enabled)
1	MCU_CLKGPIOPIN	0xFF	Specify the S2LP GPIO pin used to export S2LP Clock
1	MCU_CLKXORATIO	0xFF	Set the S2LP clock output XO prescaler (divided by 1 or by ½, ¼, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256)

#Bytes	Label	Default Value	Description
1	MCU_CLKRCORATIO	0xFF	Set the S2LP Clock Output RCO prescaler (divided by 1 or by 1/128)
1	MCU_CLKCLOCKCYCLES	0xFF	Set the S2LP ExtraClockCycles exported before switching to Standby state (0, 128, 256, 512)
1	EXTSMPSENABLE	0x00	Enable the external SMPS (0x00 Disabled, 0x01 Enabled)
1	FEM_ENABLED	0x00	Enable the S2LP GPIO signals to control the Front End Module (0x00 Disabled, 0x01 Enabled)
1	FEM_CSDGPIOPIN	0xFF	Specify the S2LP GPIO pin to control CSD
1	FEM_CPSGPIOPIN	0xFF	Specify the S2LP GPIO pin to control CPS
1	FEM_CTXGPIOPIN	0xFF	Specify the S2LP GPIO pin to control CTX
1	FEM_TXBYPASS	0x00	Enable the FEM TX Bypass Mode (0x00 Disabled, 0x01 Enabled)

Table 22 shows examples of HOSTIF-RFCONFIGSET and HOSTIF-RFCONFIGGET format, composed using the default values in Table 21. They can be used as a reference to configure RF device from the Host.

Table 22. RF device initialization message exchange example

Label	Content
HOSTIF-RFCONFIGSET.Req	16 16 18 28 00 00 00 00 00 00 60 DC 71 33 00 50 C3 00 00 D4 30 00 00 A0 86 01 00 01 80 F0 FA 02 0E 23 A0 00 01 01 00 00 FF FF FF FF 00 00 FF FF FF 00 29 C2
HOSTIF-RFCONFIGSET.Conf	16 16 19 02 00 00 00 00 00 00 00 00 58 EF
HOSTIF-RFCONFIGGET.Req	16 16 1A 00 00 00 00 00 00 00 97 42
HOSTIF-RFCONFIGGET.Conf	16 16 1B 29 00 00 00 00 00 00 00 60 DC 71 33 00 50 C3 00 00 D4 30 00 00 A0 86 01 00 01 80 F0 FA 02 0E 23 A0 00 01 01 00 00 FF FF FF FF 00 00 FF FF FF 00 A8 95

5.3 G3-PLC profile selection between coordinator and device

G3-PLC mandates the node to operate in one of the following two configurations: coordinator or device.

Coordinator is the PAN initiator and acts as authentication and association server for the devices. For each PAN there is one single coordinator. All the other operating nodes inside the network are devices.

From data traffic point of view, coordinator and devices act in the same way. They behave differently only during the network formation process.

ST G3-PLC solution is unique between coordinator and device. The node can be configured to play the role of the coordinator or of the device using the `G3LIB-SWRESET.Request/Confirm` messages transaction.

The PLC network is identified by a 16-bit wide PAN ID. The PAN ID is configured in the coordinator and saved in the IB macPANID (see Table 9). Each node is identified by a unique short address in the network. The short address is saved in the macShortAddress attribute (see Table 174).

The coordinator PAN ID can be configured with the `G3ADP-NETWORK-START.Request/Confirm` messages if the platform mode is HI_ADP_MODE or HI_IPV6_ADP_MODE or with the Bootstrap messages (see Section 5.4) if the platform mode is HI_BOOT_MODE or HI_IPV6_BOOT_MODE.

If available, the configured PAN ID is also saved in the NVM (see Section 5.1). In case of platform in BOOT mode, after the reset, the coordinator node starts the network formation using the previously configured PAN ID. If the external host decides to change the macPANID attribute through `G3LIB-SET.Request/Confirm` messages transaction, this also modifies the value in the NVM taking effect at the next reset. The default configuration uses the 0x781D value as PAN ID.

The coordinator short address is by default 0x0000. It is also possible to change the macShortAddress attribute and, as for the PAN ID, the new value is saved in the NVM and used at the next reset.

Some specific usage of G3-PLC (i.e., smart metering and AMR/AMI deployment) may have a preferred way of communication, for which the communication occurs between devices and the coordinator but not between two devices. In this scenario, the route establishment to the coordinator (through the selected bootstrap agent) after the association acts a key role in the network topology definition. If the coordinator short address is different from the default 0x0000, all the devices must be pre-configured indicating in the adpCoordShortAddress attribute the new value of the coordinator short address.

The device selects the PAN ID during the bootstrap phase and its short address is assigned by the coordinator during the association.

If present, the device also saves those parameters (PAN ID and short address) in the NVM. Those may be used after one reset in order to perform a fast restore. In this starting mode the device may automatically restore the network configuration parameters without performing a new association.

It has to be noticed that switching the profile from device to coordinator (or vice versa) does not affect the NVM content for the PAN ID and the short address values. Care must therefore be taken, especially when switching from the device profile to the coordinator one because the PAN ID and the short address the platform in coordinator mode uses can be the results of a previous association done by the platform when it was in device mode.

5.4 Bootstrap Operations

The G3-PLC solution embeds a bootstrap application which goal is to:

- Easily register to one of the available PANs for device nodes
- Setup a new PAN and handle the incoming registration requests from devices (for PAN coordinator devices)

The bootstrap application is running when the G3 platform mode is HI_BOOT_MODE or HI_IPV6_BOOT_MODE.

5.4.1 Bootstrap Device

The goal of the device bootstrap application is to search for available PANs and to register to one of them.

The bootstrap application is launched automatically if the G3 platform starts up in HI_BOOT_MODE or HI_IPV6_BOOT_MODE. Otherwise, after the mode change, the host has to initiate the bootstrap application sending the `G3BOOT-DEV-START.Request` command.

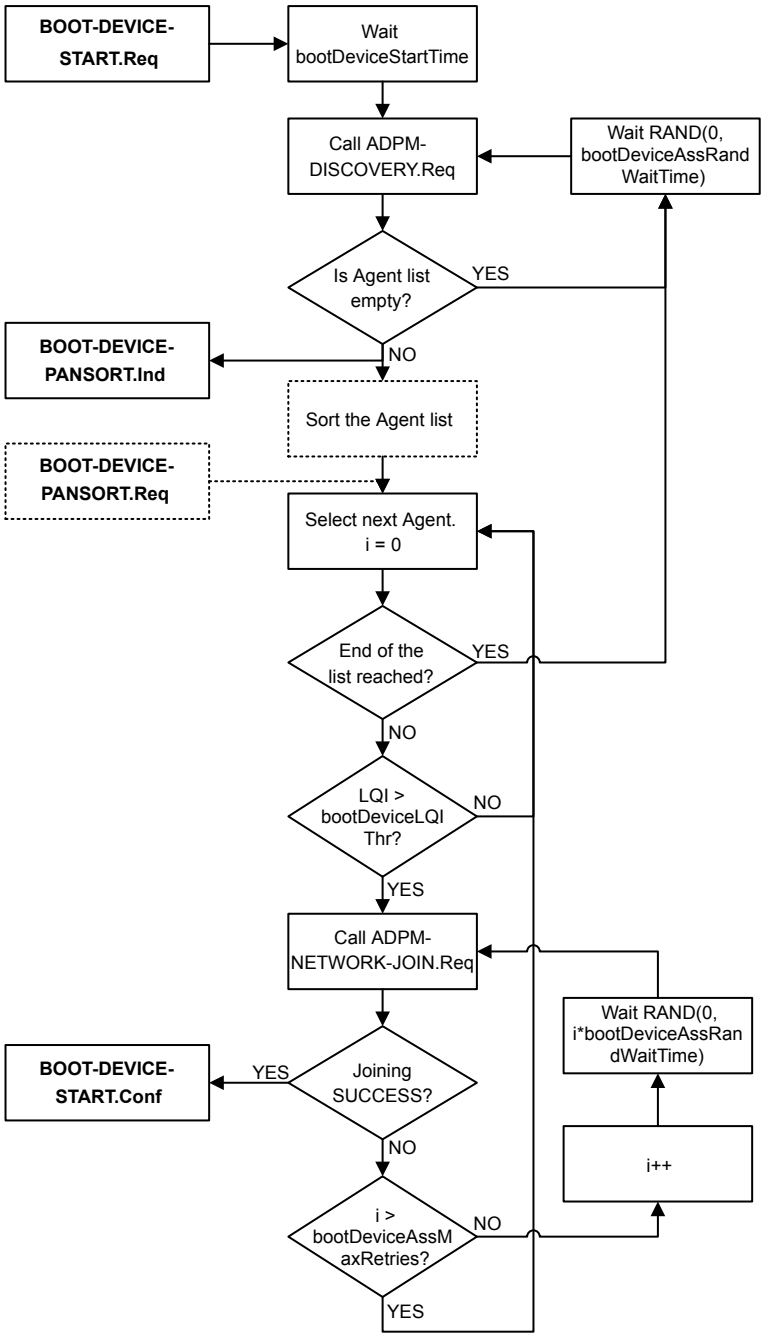
The bootstrap application carries out the following phases:

1. Discovery phase, in which the device performs an active scan to get all the available agents in the network. The agents list is sent to the Host within the G3BOOT-DEV-PANSORT.Indication message. If no PANs are detected the discovery phase is repeated again.
2. Sorting phase, which goal is to order the list of agents.
3. The Host may send to the G3-PLC solution the sorted list of agents using the G3BOOT-DEV-PANSORT.Request.
4. If the latter command is not received in time (programmable value through the bootDevicePANSortTimeout attribute) the bootstrap application automatically sorts the agents list based on the Route Cost to the PAN Coordinator.
5. Joining phase. The device tries to join the PAN through the first agent of the list.
6. If the joining ends successfully, a `G3BOOT-DEV-START.Confirm` message is generated: the Host is informed about the 16bit address assigned and the PANId.
7. If the joining is not successful, the device will try again with the same agent. If the device is not able to join the PAN after bootDeviceAssociationMaxRetries attempts, it will repeat the process with the next agent of the list.
8. If the device is not able to complete the joining with any agent of the sorted list, the bootstrap application starts again from the Discovery phase.

The detailed flow of bootstrap device application is represented in Figure 10.

A registered device can leave the network calling the `G3BOOT-DEV-LEAVE.Request` from the Host. Besides, a registered device can also be kicked from the network from the PAN Coordinator, in this case the Host is informed through a `G3BOOT-DEV-LEAVE.Indicaiton` message.

Figure 10. **Bootstrap device application flow**



5.4.2 Bootstrap PAN Coordinator

The bootstrap application for PAN Coordinator provides the following features:

- Possibility to create a new PAN with custom parameters
- Possibility to stop the server at any time
- Handle multiple registration of new devices at the same time
- EAP-PSK server implementation to support the authentication and the registration of new devices
- Possibility to remove (kick) a device from the network

The bootstrap server is launched automatically if the G3 platform starts up in HI_BOOT_MODE or HI_IPV6_BOOT_MODE. Otherwise the host has to initiate the bootstrap server sending the `G3BOOT-SRV-START.Request` command, once the platform mode is switched to BOOT.

The bootstrap server starts with the Discovery phase, in which the device performs an active scan to get if other PANs are already installed.

- If no PANs are detected, the new PAN is started, and the application moves to the Listening phase.
- If other PANs are detected, the new PAN is installed anyway if the attribute bootServerForcePANStart is true, otherwise the bootstrap application is stopped, and actions are required at network setup level in order to guarantee that two PANs can coexist in the same area.

When the discovery phase ends, the G3BOOT-SRV-START.Confirm is sent to the host. If the PAN has started, the bootstrap server enters in the listening phase, in which it listens to the `ADPM-LBP.indications` from the ADP Layer. During this phase the bootstrap application handles the incoming registration requests from new devices in parallel to the normal data and control planes operations.

The detailed flow of bootstrap server is represented in Figure 11.

The `G3BOOT-SRV-START.Request` commands accepts the following parameters:

PANId:

the PAN identification 16-bit value

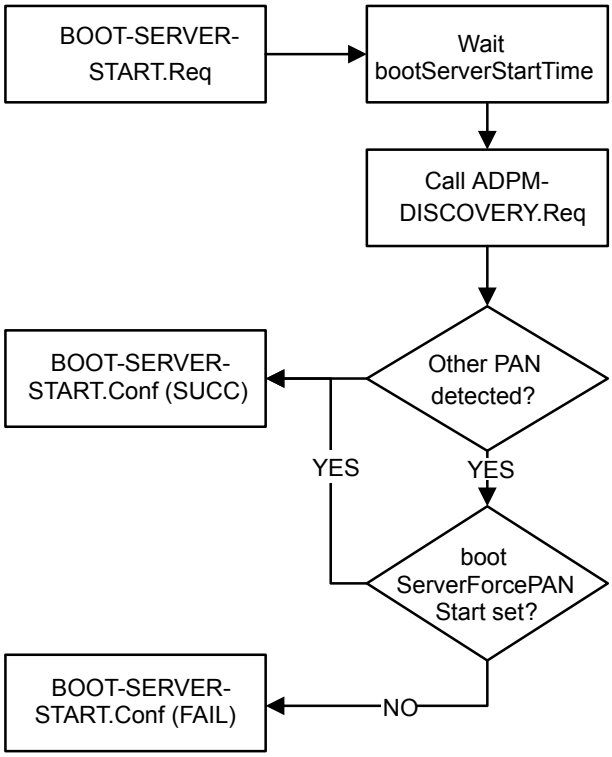
ServerAddress:

the 16-bit short address of the coordinator node (typically 0x0000, if user configure a different value, all the other nodes in the network must be configured in order to have the adpCoordShortAddress attribute equal to the ServerAddress)

If the bootstrap server is launched automatically during the device startup, those attributes are initialized to the values read from the NVM (also see Section 5.3 , in case of switch from device to coordinator the PANId and ServerAddress may have unexpected values).

If instead the bootstrap server is initiated by the Host, those parameters can be chosen by the external entity.

Figure 11. Bootstrap PANC application flow



During the listening phase the Bootstrap server handles the incoming registration requests from new devices carrying out the EAP-PSK transaction as specified in G3-PLC specifications (see Figure 12).

The Bootstrap server also takes care of errors handling during EAP-PSK handshake, for example if the messages are not formatted correctly, or if they are received in a wrong order, or if they contain wrong security parameters. In those cases, a Decline message is sent to the device which is not allowed to join the network.

As soon as the bootstrap server receives the EAP-PSK Msg #2 from a Device, a `G3BOOT-SRV-GETPSK.Indication` is generated and sent to the Host. It contains the EUI64 and the IdP of the device that is attempting to join the PAN.

The Host has to reply with the `G3BOOT-SRV-SETPSK.Request` message, which contains the following information:

ExtendedAddress:

the EUI64 of the device that is attempting to join the PAN

PSK:

the Pre Shared Key to be used from the EAP-PSK server to exchange the next messages with the device

ShortAddress:

the 16bit address to be assigned to the device once the message exchange will be completed without errors

If the latter command is not received in time (programmable value through the bootServerPSKGetTimeout attribute) the bootstrap server will use the default PSK value stored in adpEAPPSKKey and will assign the short address sequentially starting from 0x0001. This internal algorithm keeps also track of the registered devices and the corresponding assigned 16bit addresses in the NVM (see Section 5.1). Hence, if the device attempting to join the network is already known to the Bootstrap server, the same 16bit address is assigned to the device (also after a restart of the coordinator node).

However, if the NVM is not available on the G3 platform the Host has to take care of 16bit address assignment and to track which devices are registered to the PAN, maintaining the same short address across multiple registrations.

If the ShortAddress in the `G3BOOT-SRV-SETPSK.Request` message is set to 0xFFFF, a Decline message is sent to the device that is attempting to join the PAN. Thus, the device will not be accepted within the network.

As soon as the bootstrap server receives the last EAP-PSK message (Msg #4) from a Device, it replies with the Success message to conclude the registration transaction. At this point in time the `G3BOOT-SRV-JOIN.Indication` message is sent to the Host, to inform it about the successful registration of a new device.

This message contains the following information:

ExtendedAddress:

the EUI64 of the device that successfully joined the PAN

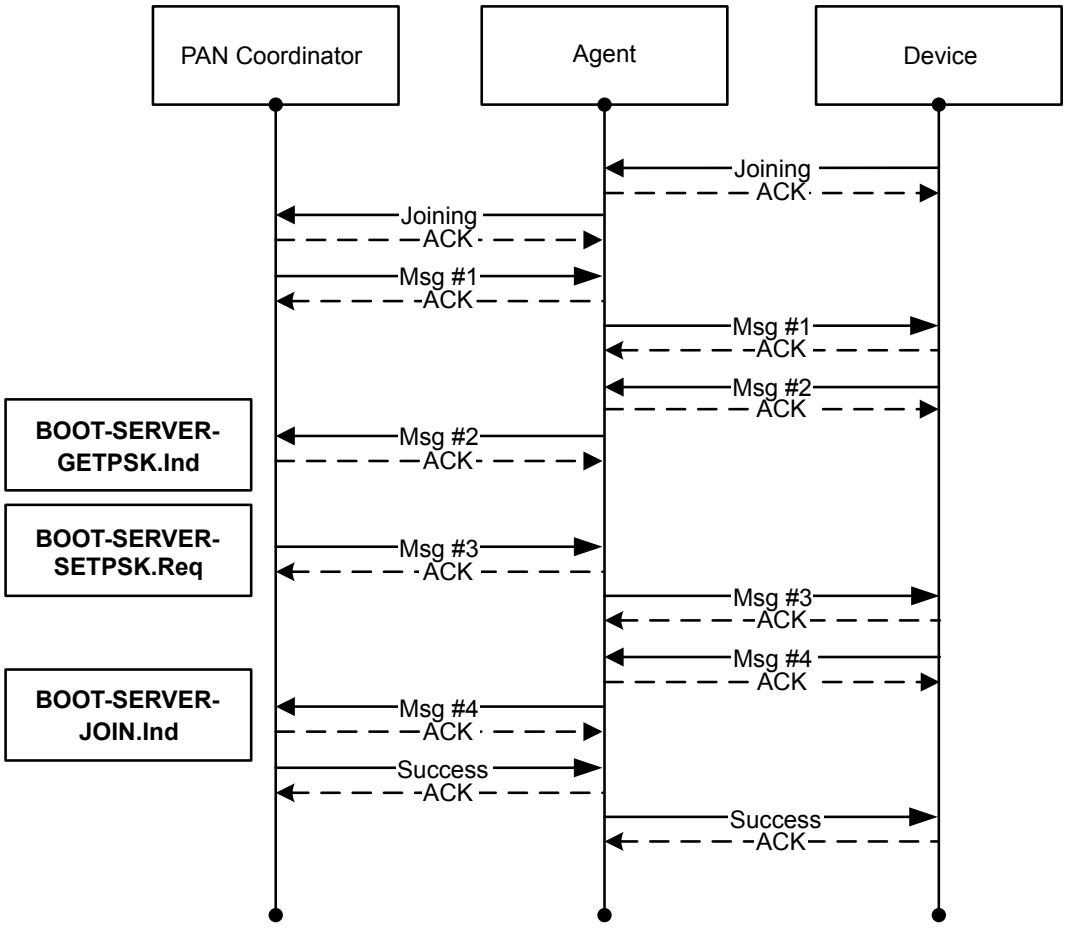
ShortAddress:

the 16bit assigned to the device

The host can remove any registered device from the network at any time calling the `G3BOOT-SRV-KICK.Request` command, which accepts as parameters the EUI64 of the device and its 16bit address.

In case one device leaves the network by itself, the host is informed through the `G3BOOT-SRV-LEAVE.Indication` that contains the EUI64 of the device.

Figure 12. **Bootstrap PANC handling of new devices**

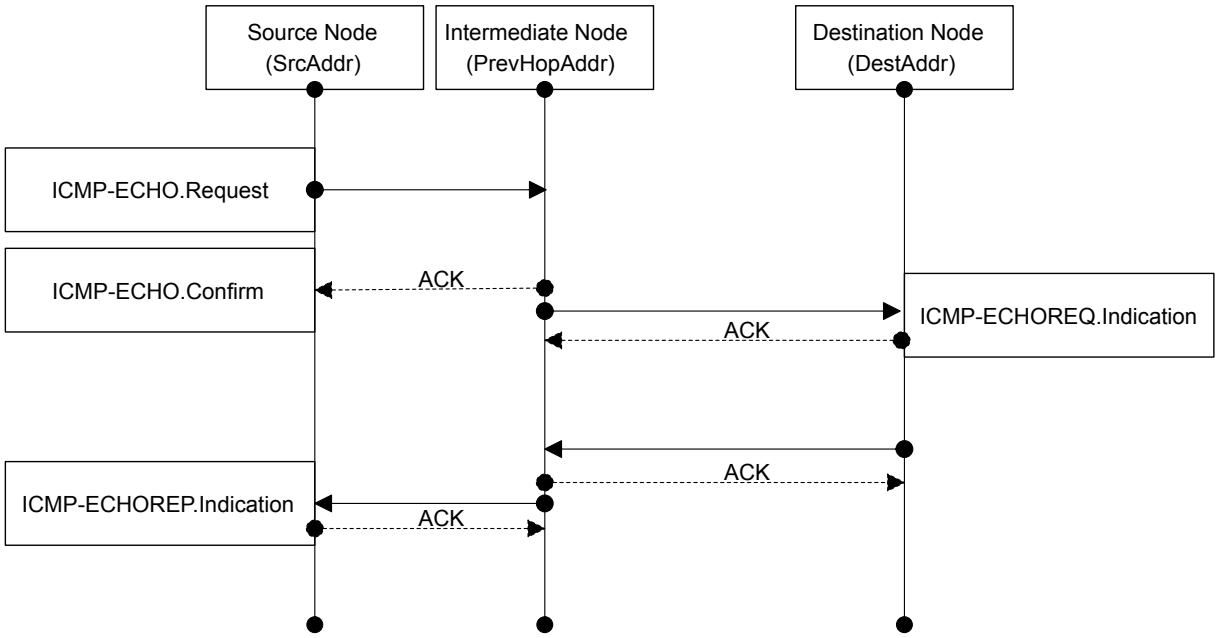


5.5 IPv6 operations

The IPv6 operations are divided in ICMPv6 ECHO operations, UDP data transmission and UDP data reception.

The ICMPv6 ECHO operations are used to ping a specific node in the network. External host can use the `G3ICMP-ECHO.xxx` commands (see Section 8.120 , Section 8.121 , and Section 8.123).

Figure 13. **ICMPv6 sequence chart**



The UDP operations are used to transmit and receive datagrams between two nodes on specific ports. In order to perform a UDP data exchange, the external host must configure a UDP “connection” on both transmitter and receiver nodes.

The UDP connection on the transmitter node can be configured in the following ways:

1. The external host can configure the connection by specifying the remote address and both the source and destination ports numbers to be used. In the `UDP-DATA.Request` the external host can set the RemoteAddr field to all zeros; the datagram will be sent to the remote address configured in the UDP connection, using the UDP ports defined in the connection
2. The external host can configure the connection by specifying the ports numbers to be used (remote address filled with all zeros). In the `UDP-DATA.Request` the external host has to set the RemoteAddr field to the IPv6 address destination of the datagram; the datagram will be sent to the remote address specified in the `UDP-DATA.Request`, using the UDP ports defined in the connection
3. The external host can configure the connection by specifying the source port number (remote address and destination port filled with zeros). In the `UDP-DATA.Request` the external host has to set the RemoteAddr field to the IPv6 address destination of the datagram and the DestPort to the UDP destination port of the datagram; the datagram will be sent to the remote address and to the destination port specified in the `UDP-DATA.Request`, using the UDP source ports defined in the connection

The UDP connection on the receiver node can be configured in the following ways:

1. If RemotePort is set to zero, the connection accepts the incoming UDP packet regardless of the value of source port in the UDP header
2. If RemotePort is set to a specific port number, it is checked against the source port number in the received packet. If the two port numbers match the packet is accepted
3. If RemoteAddr is all zeros, the connection accepts the incoming UDP packet regardless of the value of the IPv6 source address
4. If RemoteAddr is set to a specific IPv6 address, it is checked against IPv6 source address in the received packet. If the two addresses match the packet is accepted

Note: The LocalPort has always to be set to a value different from zero (LocalPort set to zero means that the connection is not used). The LocalPort number is checked against the destination port number in the received packet.

Each connection is identified by a ConnID. It is possible to set up to 10 different connections.

After the connection configuration the external host can use the `G3UDP-DATA.xx` commands (see Section 8.113 , Section 8.114 and Section 8.115) to transmit and receive data.

Figure 14 shows an example for which the remote note has a server available on the local port 0x1122. For each incoming data from an Originator Node, the external host configure a node specific connection. Since the connections are parsed in a sequential way, the generic listen connection is set at the highest value, so the node specific connections are parsed first when a data is incoming. In this way the ConnID is used to discriminate the originator.

Figure 14. First example of UDP sequence chart

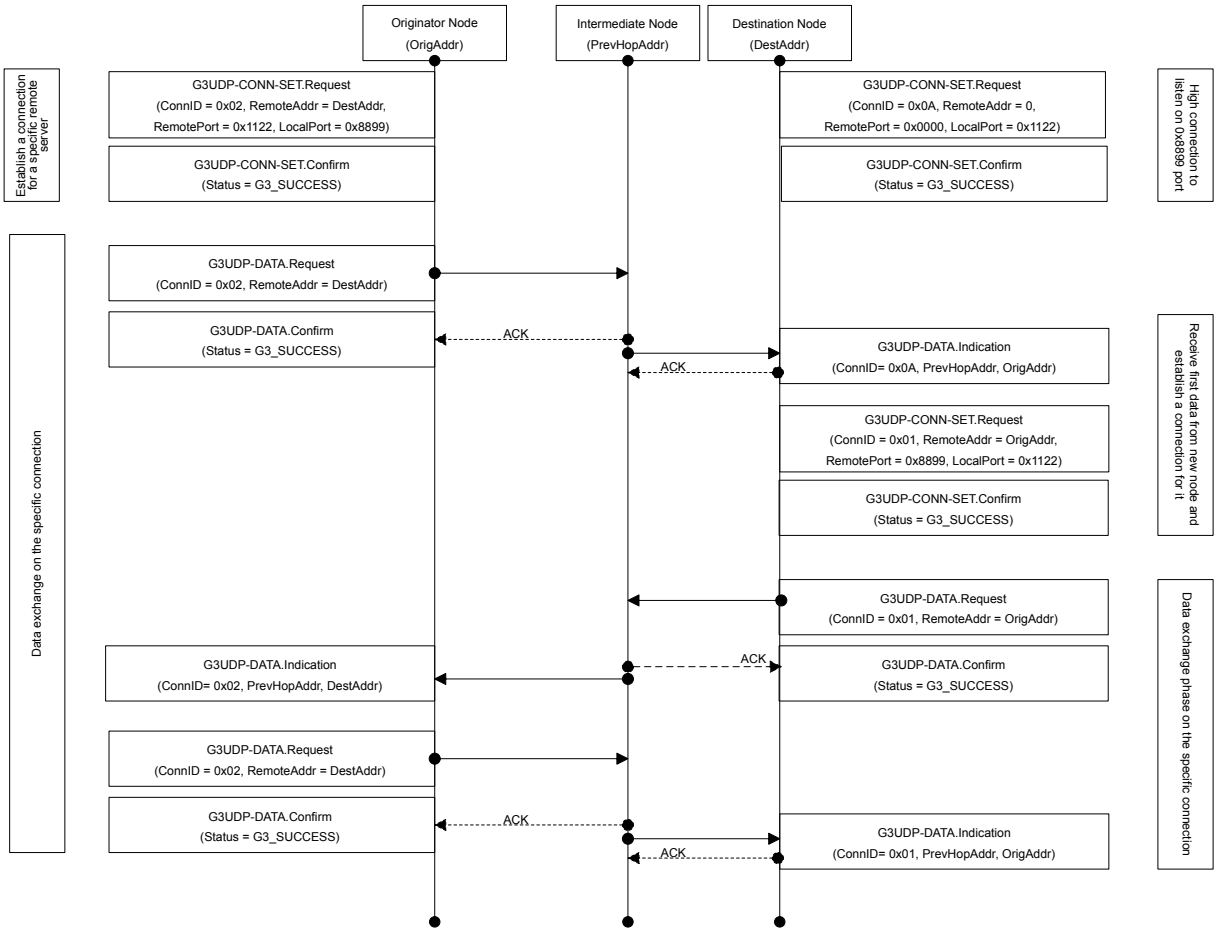
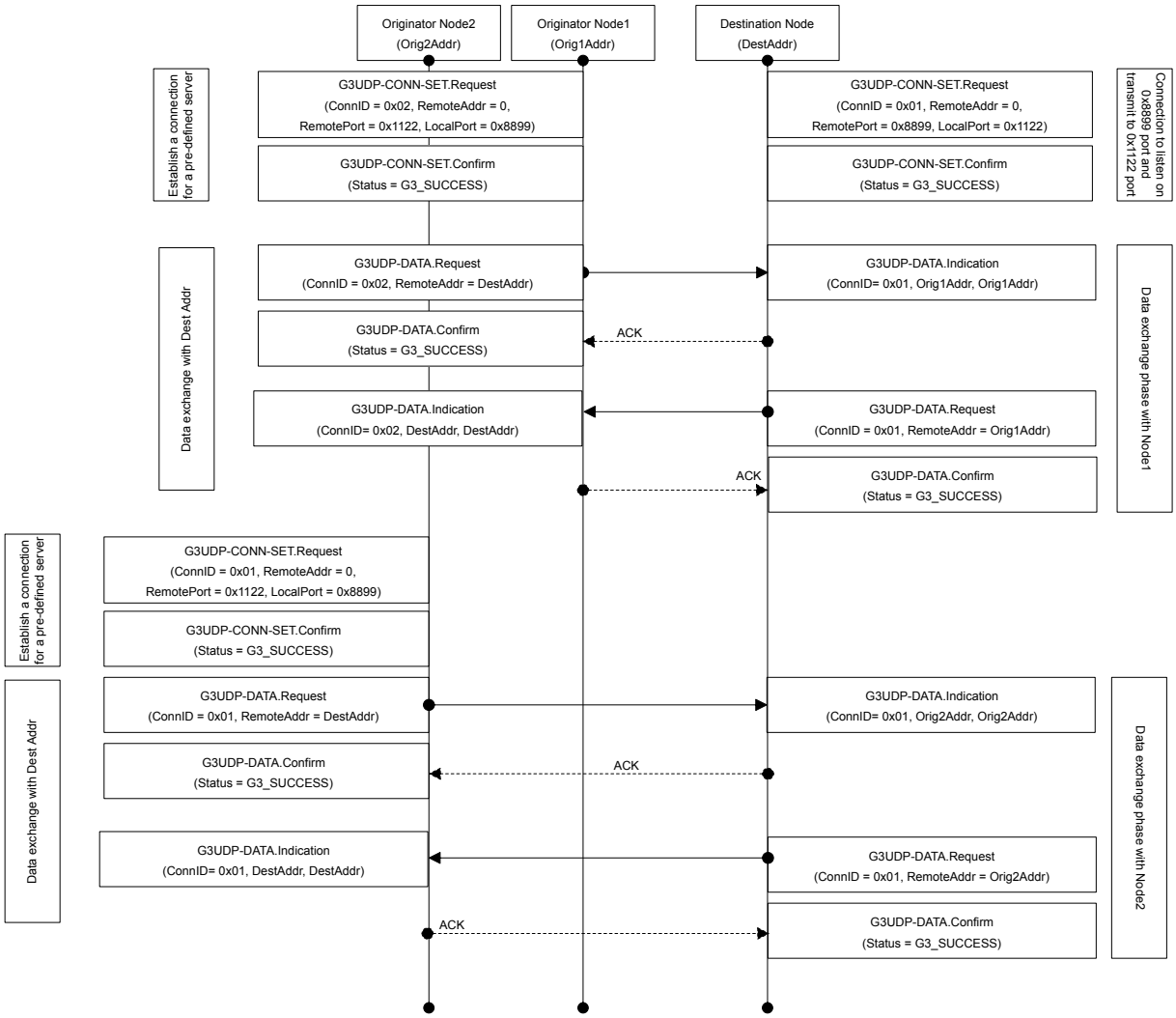


Figure 15 shows a different example for which the remote node has a server available on the local port 0x1122 with the knowledge of the pre-defined remote port 0x8899. Different originator nodes must open a connection with the same local port. The server may use the same connection to communicate with both the nodes just changing the RemoteAddr field in the `G3UDP-DATA.Request` command.

The example also shows the usage of RemoteAddr field with all zeros in the connection establishment for the originator. In this case, it is mandatory to use the RemoteAddr field equal to DestAdd in the `G3UDP-DATA.Request` while in the first example it is optional and may be substitute with all zeros (the connection was established to a specific node). On the contrary, in this second example the originator may use the same connection to talk with different servers listening on the same ports.

Figure 15. **Second example of UDP sequence chart**



5.6 Unicast Route Discovery

The G3-PLC solution allows performing a Route Discovery in unicast, in case the Next Hop to reach a given destination is already known.

The `G3ADP-ROUTEDISCOVERY.Request` command (Section 8.84) accepts the following parameters:

- DstAddr
- MaxHops
- NextHop
- MediaType

In case the NextHop is set to 0xFFFF the Route Discovery will follow the standard flow, as described in the G3-PLC specifications. Therefore, the RREQ with destination DstAddr, generated by the G3 platform, will be broadcasted in the PAN.

On the other hand, if the NextHop is different from 0xFFFF the RREQ with destination DstAddr, generated by the G3 platform, will be transmitted in unicast to NextHop using the selected MediaType.

The evolution of the `G3ADP-ROUTEDISCOVERY.Request` command described in this section should be used carefully and it is primarily intended to speed up the recovery of PAN Coordinator after a shutdown event.

Indeed, the G3 platform when configured in PAN Coordinator profile could have many valid entries in its routing table due to normal operations. In case a reboot is needed for the device, or if it is powered off, on the next reboot the PAN Coordinator has to rebuild its routing table discovering again all the routes that were previously installed.

That process takes a large amount of time and network resources, as each RREQ is normally broadcasted and propagated from all the devices registered to the PAN. In this scenario performing a Route Discovery in unicast can be useful.

To do that the Host has to periodically read and store in its memory the content of PAN Coordinator routing table; then when a shutdown event occurs and the Boot Server is started again, for each entry previously contained in the routing table the Host has to send a `G3ADP-ROUTEDISCOVERY.Request` command, setting DstAddr and NextHop parameters accordingly to the routing table content before the shutdown event.

The process above speeds up the PAN Coordinator routing table reconstruction in addition to save network bandwidth.

5.7 RF operations

5.7.1 Media configuration

5.7.1.1 MAC layer filtering

The Host has the possibility to apply filtering rules acting at MAC layer on one or both available interfaces (PLC, RF) using peChannelConfig PIB bitmask, which is defined as follows:

- Bit 0: enable the PLC communication within the G3 Network
- Bit 1: enable the PLC point-to-point MAC communication (64-bit src and dest addresses)
- Bit 2: enable the RF communication within the G3 Network
- Bit 3: enable the RF point-to-point MAC communication (64-bit src and dest addresses)

The media configuration can be applied at runtime.

If the MAC layer receives a frame on a disabled interface the frame is dropped; if the MAC layer receives a frame on an enabled interface the frame is processed.

In order to consider MAC frames with 64bit src and dest addresses as point-to-point, the b4 of macOptionalFeatures PIB attribute has to be set, as explained in Section 5.8 . If that bit is not set the MAC frames with 64bit src and dest addresses are processed as regular MAC frames within the G3 Network.

It is possible either to entirely disable one of the two media (i.e. 0x00000003 - enable PLC interface and drop all frames coming from RF interface) either to have mixed settings (i.e. 0000000B - use PLC within G3 Network, allow RF point-to-point communication).

Given that the filtering is applied at MAC layer the two PHY layers (PLC, RF) remain active and running.

5.7.1.2 PHY interfaces enabling and disabling

It is also possible to disable one of the two interfaces (PLC, RF) at PHY level; using the following PIBs the corresponding PHY services are completely stopped:

macDisablePLC:

disable PLC interface

rfDisablePHY:

disable RF interface

5.7.2 Adaptive Carrier Sense

The RF interface uses the carrier sense functionality to detect if any RF signal is being received; the detection is based on the measured RSSI value.

The carrier sense is asserted when the measured RSSI is above the Carrier Sense threshold and is de-asserted when the RSSI falls 3 dB below the same threshold.

The same approach is adopted by the CSMA to detect the channel state before transmitting a frame.

Rx and CSMA have independent Carrier Sense thresholds, which are periodically tuned from G3 Platform based on the background noise measured on the RF interface.

The G3 Platform approach is to keep RX Carrier Sense threshold low (10 dB above the background noise) in order to reach good sensitivity levels; the TX Carrier Sense threshold is configured to a higher level (30 dB above the background noise).

As shown in Figure 16 this algorithm can be configured by the Host through the following PIBs:

rfRSSINoiseInterval:

Time interval (in secs) between two consecutive background noise measurements

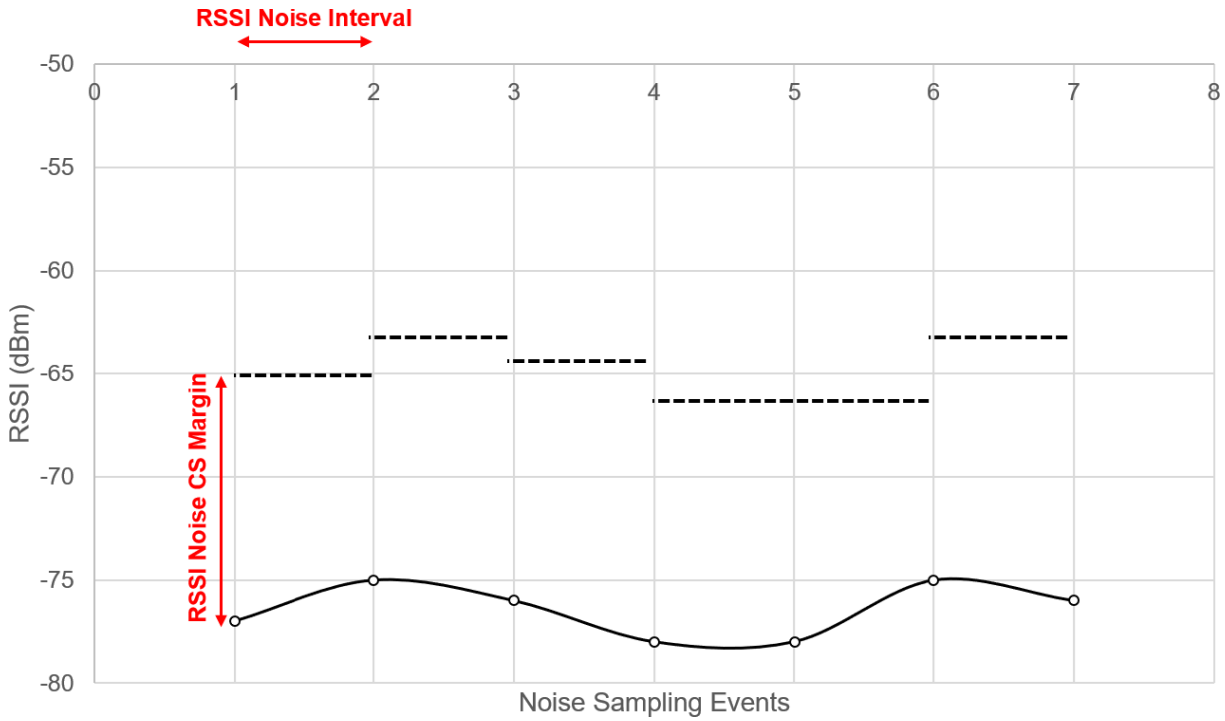
rfRSSINoiseMarginRX:

The margin (in dB), to be added to last background noise measurement, when adapting Carrier Sense threshold used in RX

rfRSSINoiseMarginTX:

The margin (in dB), to be added to last background noise measurement, when adapting Carrier Sense threshold used by CSMA in TX

Figure 16. Adaptive Carrier Sense



5.8 Concurrent point-to-point communication with a peer node not belonging to the G3-PLC network

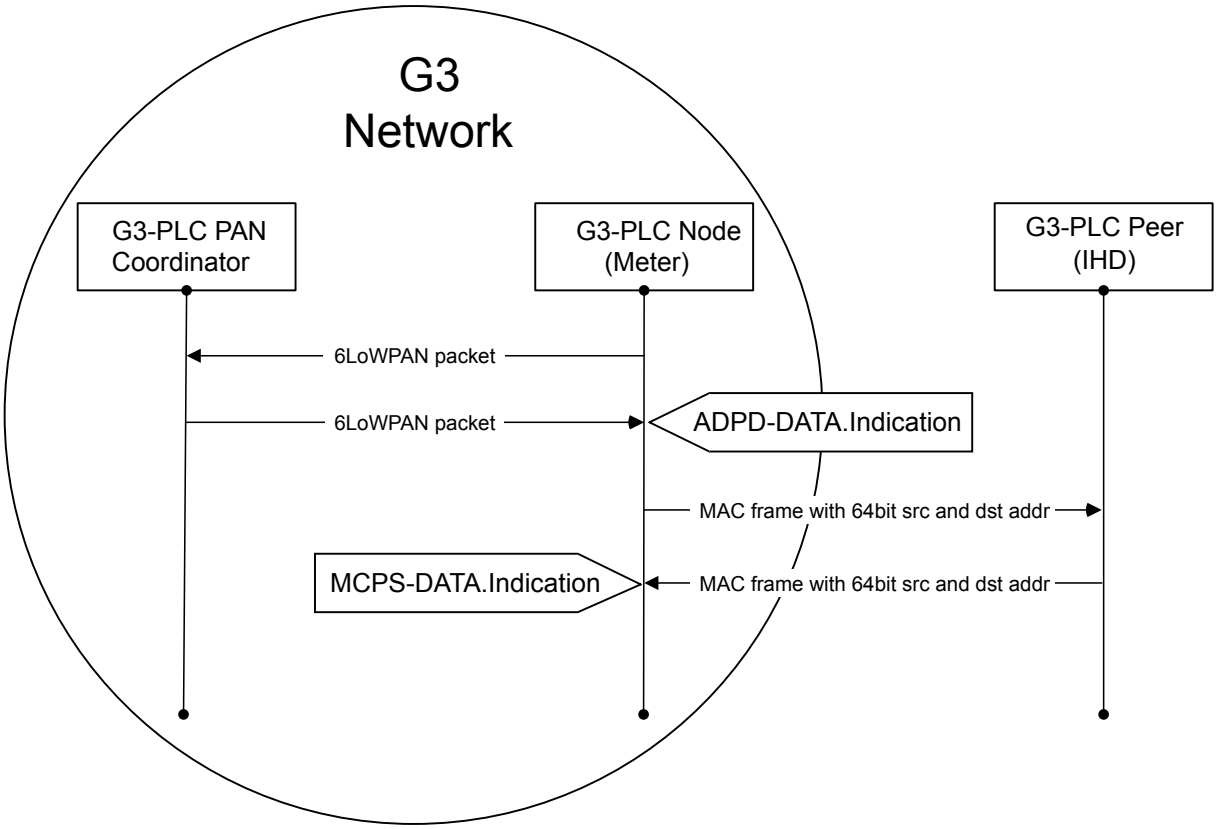
When the G3-PLC node is registered to a PAN it is able to communicate with the PAN Coordinator and with the other nodes belonging to this G3-PLC network.

At the same time, it is possible to establish a peer-to-peer communication with a peer node not belonging to the PAN, directly exploiting MAC communication with extended addresses (64bit).

A common use case for this feature in Smart Metering scenario is when a meter has to communicate both with the PAN coordinator and, in parallel, with an In-Home Display (IHD). This scenario is depicted in Figure 17.

A prerequisite for the peer to peer communication is that the G3-PLC node is aware of the 64 bit address of the peer and vice versa.

Figure 17. **Example of point-to-point communication**

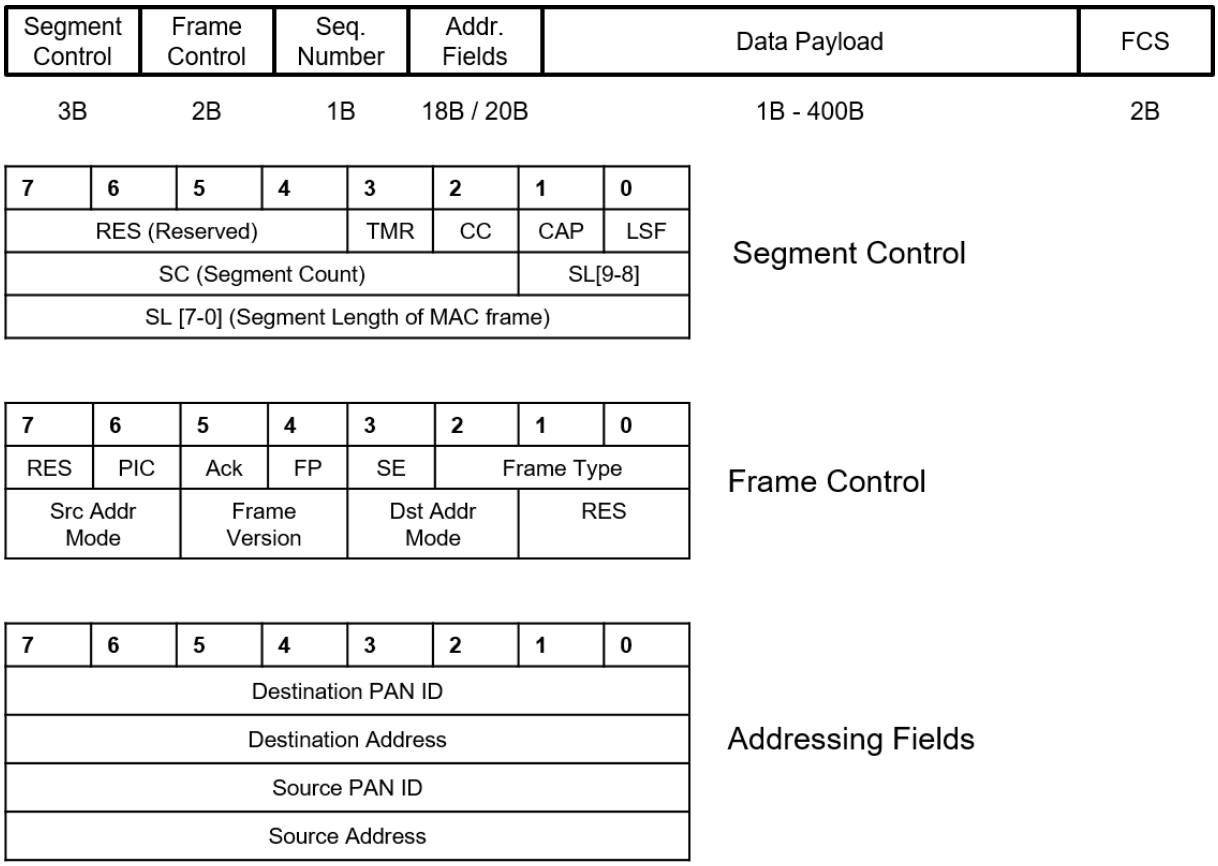


The operations that the G3-PLC node has to perform to establish a communication with a peer device are the following:

1. On the G3-PLC node, the b4 (MAC_OPTIONALFEATURES_EXPEXTADDRS) of macOptionalFeatures PIB attribute has to be set
2. The G3-PLC node sends a MAC frame to the peer device calling the MAC primitive MCPS-DATA.Request with the following parameters:
   - SRC_ADDRMODE = 0x03 (64 bits extended address)
   - DST_ADDRMODE = 0x03 (64 bits extended address)
   - DST_PANID = 0xFFFF, broadcast
   - DST_ADDR = 64 bits destination address of the peer device
   - MSDULEN = length (in byte) of the MSDU (up to 400, better to use up to 100 bytes in order to avoid segmentation on the peer node)
   - MSDU = the payload to be sent
   - MSDUHANDLE = any
   - TXOPTIONS = with or without ACK
   - SECURITYLEVEL = 0 (no security is allowed with extended address)
   - KEYINDEX = 0 (don’t care)
   - QOS = normal priority
   - MEDIATYPE = any
3. As soon as the G3-PLC Node receives a correctly formatted MAC frame from the peer device (with 64 bits source and destination addresses) the MCPS-DATA.Indication is issued to the host

To establish a peer-to-peer communication with the G3-PLC Node, the peer device has to send frames following the G3-PLC standard MAC format, as described in Section 5.8 .

Figure 18. MAC Frame format in peer to peer communication



The fields must be set following the below rules:

- RES fields must be equal to 0
- TMR must be equal to 0 (Tone Map not requested)
- CC must be equal to 0 (no more segments to send)
- CAP must be equal to 0 (normal priority)
- LSF must be equal to 1 when the last segment is sent
- SC starts with 0 and it is increased at each sub-sequent segment
- SL is the length (in bytes) of the current segment
- PIC field is set to 1 when Destination and Source PAN IDs have the same value. In such case only Destination PAN ID field is present and Source PAN ID is assumed to be the same.
- FP must be equal to 0
- SE must be equal to 0
- Frame Type must be equal to 1 (DATA)
- Frame Version must be equal to 0
- SrcAddr Mode and Dst Addr Mode must be equal to 0x3
- FCS is evaluated over the entire frame using the same algorithm described in Section 3.1

The G3-PLC node can handle segmentation (using LSF, SC and SL fields) to support frames up to 400 bytes (4 segments in CEN-A, 2 in FCC, 10 in CEN-B and 4 using RF channel).

To simplify the use of this peer-to-peer communication, it's convenient to transmit up to 100 bytes of payload. In this way SC is always fixed at 0 and LSF is always set to 1.

5.9 PHY PLC maximum transfer unit (MTU)

The G3 solution can be configured to work at PHY layer only. Using this configuration, it is possible to send raw data on the channel.

The following table shows the MTU (using the full tone-mask and tone-map setting) according to the various bandplans, on PLC channel.

Table 23. PHY MTU (in bytes)

Bandplan	Mode	Robust	BPSK	QPSK	8PSK
CEN-A	Differential	133	235	235	226
	Coherent	121	239	230	230
CEN-B	Differential	54	235	239	235
	Coherent	46	203	235	235
FCC (1RS block)	Differential	247	239	235	239
	Coherent	247	239	239	230
FCC (2RS blocks)	Differential	494(1)	478(1)	470(1)	478(1)
	Coherent	494(1)	478(1)	478(1)	460(1)

1. *Limited to 400 bytes by implementation to be consistent with MAC MTU*

5.10 Sniffer mode

The G3 platform can be configured in sniffer mode, in order to detect all the packets in the network (or at least in a part of it, in which the transmitted packets arrive at the G3 platform with a signal quality good enough to be decoded). In sniffer mode all the frames detected on PLC interface are exported to the Host.

Two configurations are possible:

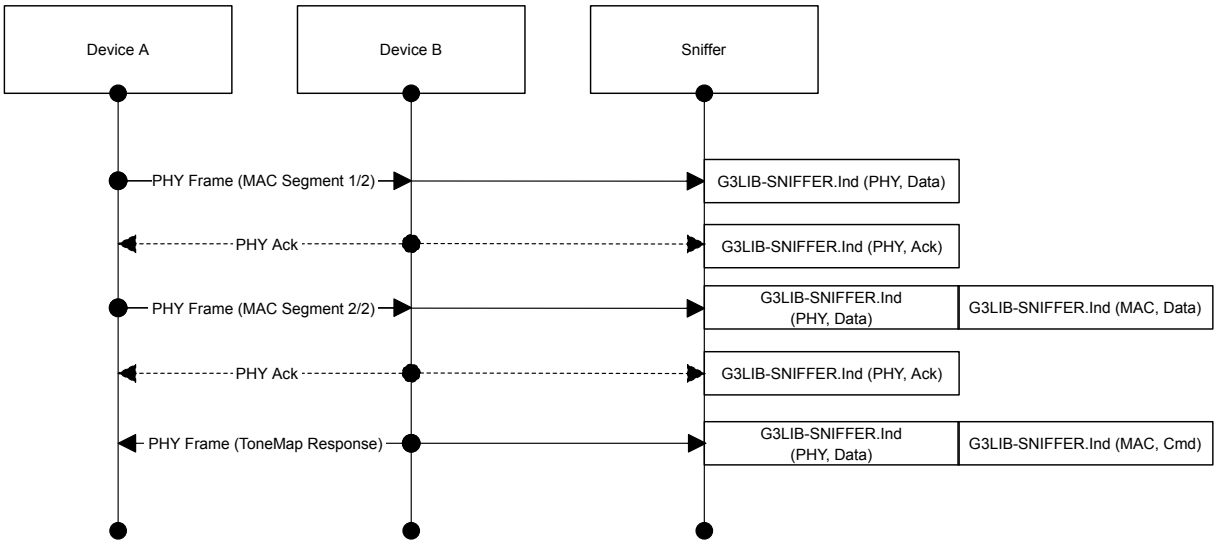
- Simple sniffer – The G3 platform is configured in HI_PHY_MODE. It sends to the Host `G3PHY-DATA.indication`, `G3PHY-ACK.indication` and `G3PHY-RF.indication` messages
- Combined sniffer (see Section 5.10.1)

5.10.1 Combined sniffer

In order to simplify the Host processing required to reconstruct the network packet starting from the PHY layer frame (i.e. reassembly, deciphering), a combined sniffer mode has been implemented in the G3 platform. Using the combined sniffer mode in addition to the PHY layer frames detected on PLC and RF interfaces, reassembled and decrypted MAC frames are also sent to the Host, as explained in Figure 19.

In combined mode, the sniffer sends the detected frames through G3LIB-SNIFFER.Indication message (Section 8.44).

Figure 19. **Combined sniffer example**



5.10.2 Initialization sequence

The initialization sequence required to configure the G3 platform in Simple Sniffer mode is the following:

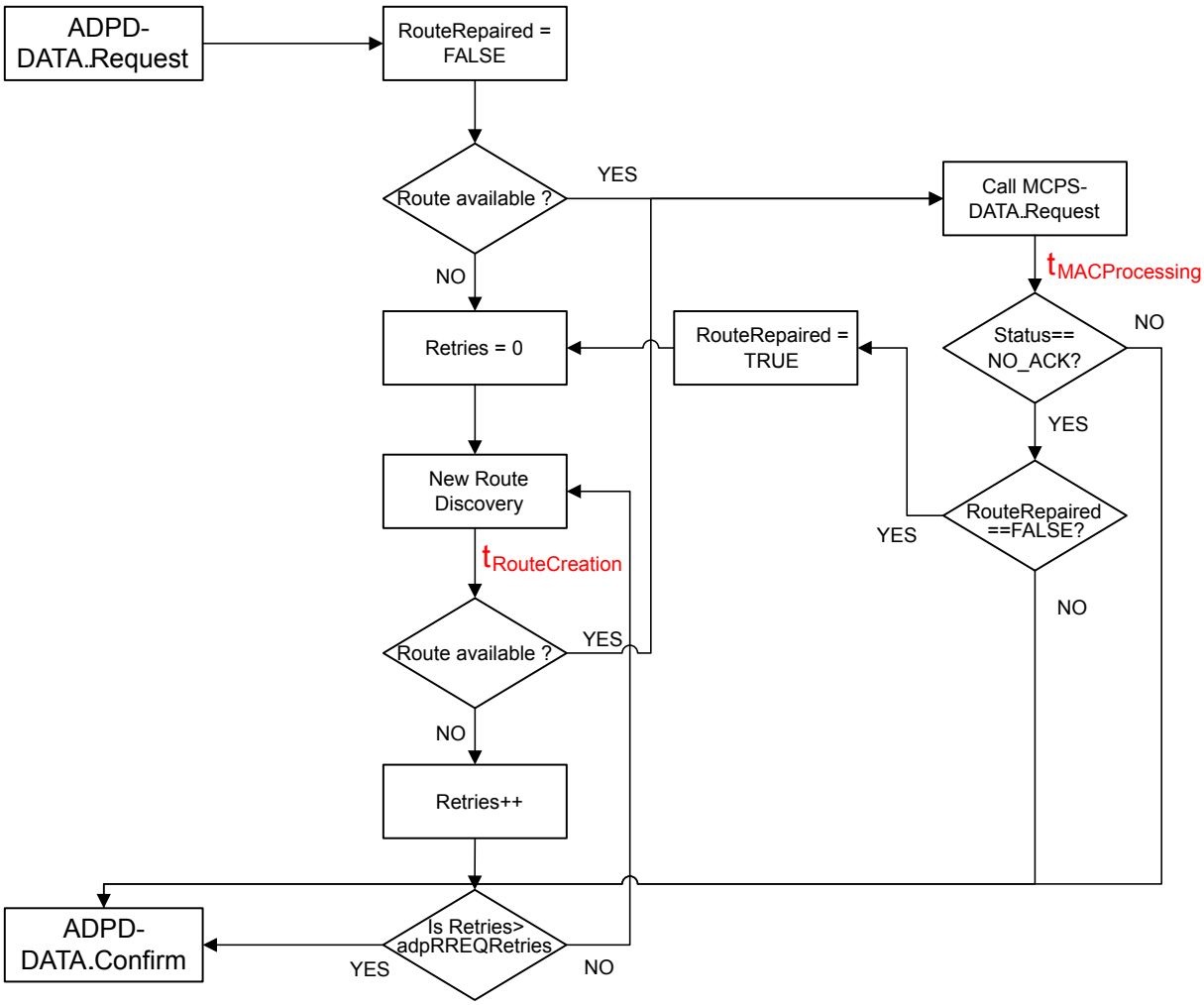
1. `G3LIB-SWRESET.Request` (select the desired Bandplan, G3 Platform mode to HI_PHY_MODE and type Device)
2. `HOSTIF-BAUDRATESET` (optional, it can be used to get Host Interface working at higher data rate)
3. `G3LIB-SET.Request` (configure PHY layer PIBs as phyToneMask if needed)
4. `HOSTIF-RFCONFIGSET` (optional, it is not needed if the RF interface configuration is stored in NVM)

In order to configure the G3 platform in Combined Sniffer mode, in addition to the above commands, the following steps have to be added:

1. `G3LIB-SET.Request` (set peSnifferMode PIB to 0x01)
2. `G3LIB-SET.Request` (configure macKeyTable PIB adding the GMK)

5.11 Maximum time to receive ADPD-DATA.Confirm

Figure 20. **ADP Data Request flow chart**



When the host transmits data to the G3-PLC platform through the ADPD-DATA.Request command, it must wait for the corresponding confirm for the right amount of time.

Figure 20 shows the main blocks of ADP data processing inside the G3-PLC platform (consider that in the example above there are several simplifications such us the ADP fragmentation not considered, the ADP processing time ignored, etc.).

When transmitting data to the platform different scenarios can occur:

- The route to the final destination is valid and already installed in the platform routing table
  - The ADP frame is sent to the MAC layer and it is successfully sent at the first attempt **(best case)**

$$t_{Confirm} = t_{MACProcessing}$$

  - The ADP frame is sent to the MAC layer but no acknowledgment is received. A Route Repair takes place, and the frame is successfully sent at the second attempt

$$t_{Confirm} = t_{RouteCreation} + 2 \times t_{MACProcessing}$$

  - The ADP frame is sent to the MAC layer but no acknowledgment is received. A Route Repair takes place, but the frame transmission fails also at the second attempt

$$t_{Confirm} = t_{RouteCreation} + 2 \times t_{MACProcessing}$$

- The route has to be built with a new Route Discovery
  - The Route Discovery fails

$$t_{Confirm} = t_{RouteCreation}$$

  - After the Route Discovery, the ADP frame is sent to the MAC layer and it is successfully sent at the first attempt

$$t_{Confirm} = t_{RouteCreation} + t_{MACProcessing}$$

  - After the Route Discovery, the ADP frame is sent to the MAC layer but no acknowledgment is received. A Route Repair takes place and the frame is successfully sent at the second attempt **(worst case)**

$$t_{Confirm} = 2 \times t_{RouteCreation} + 2 \times t_{MACProcessing}$$

  - After the Route Discovery, the ADP frame is sent to the MAC layer but no acknowledgment is received. A Route Repair takes place but the frame transmission fails also at the second attempt **(worst case)**

$$t_{Confirm} = 2 \times t_{RouteCreation} + 2 \times t_{MACProcessing}$$

The time for route creation is defined as follows:

$$t_{RouteCreation} = (2 \times adpNetTraversalTime)(adpRREQRetries + 1)$$

The MAC processing time is much more difficult to define as all the following aspects must be considered:

- Internal state of MAC queues (i.e., if the queues are free the MAC transmission can start immediately, otherwise it has to be queued)
- Time of access to the channel: the CSMA algorithm can take up to several seconds (even more in crowded networks) to start the transmission. It mainly depends on the probability of finding the channel busy
- Retransmissions of the MAC frames when the acknowledge is not received

For the sake of simplicity we can assume the MAC processing as follows (which must be increased in crowded networks):

$$t_{MACProcessing} = 5\,s$$

6 Host Interface Error Codes

Each Confirm/Indication message, sent from the G3 platform to the host, contains at least the Error Code as payload. The Error Code shows the status of the transaction on the Host Interface, reporting errors in case the request message has been wrongly detected. This error code reports only the information related to the fact that the G3 platform was able to correctly detect and parse the request message, not about the final status of the request itself.

Table 24. Error Code field

Error Code value	Meaning
0x00	Success
0x01	Wrong CRC on received command
0x02	Wrong Synchro field
0x03	Wrong Length field
0x04	Wrong Command ID field
0x05	HW reset is being to be performed by internal HW watchdog
0x06	HW reset is being to be performed due to an error in the RTE that cannot be recovered
0x07	HW reset is being to be performed due to the lack of activity in the RTE
0x08	Timeout Expired on received command
0x09	Wrong security mode
0x0A	Error on authentication
0x0B	Wrong command received in the current state
0x0C	Error occurred during initialization

7 Result codes and Enumerations

The Confirm/Indication messages may contain the status code of the operation, which was previously started with its corresponding request.

Table 25. Status and Results codes

Value	Symbol	Description
0x00	G3_SUCCESS	Operation completed successfully
0x01	G3_WRONG_CRC	Wrong CRC
0x02	G3_WRONG_MSG_LEN	Length field in the message header has a wrong value
0x03	G3_WRONG_CMD_ID	Command ID not supported
0x04	G3_WRONG_MODE	Mode not supported
0x05	G3_NOT_EXPECTED	The received command is not expected
0x06	G3_WRONG_STATE	The received command is not correct in the current state
0x07	G3_WRONG_TRX_STATE	Wrong transceiver state
0x08	G3_NOT_ACCEPTABLE	The requested operation cannot be performed in the current operation mode
0x09	G3_WRONG_TX_POWER	Wrong TX Power value
0x0A	G3_WRONG_MOD_SCHEME	Wrong Modulation Scheme value
0x0B	G3_WRONG_MOD_TYPE	Wrong Modulation Type value
0x0C	G3_WRONG_PREEMPHASIS	Wrong Pre-emphasis value
0x0D	G3_WRONG_TONEMAP	Wrong Tonemap value
0x0E	G3_WRONG_TONEMASK	Wrong Tonemask value
0x0F	G3_WRONG_FCH	Wrong FCH
0x10	G3_WRONG_VALUE_LEN	The length of value for the specified attribute is not in the supported range
0x11	G3_WRONG_TEST_MODE	The test mode given is not supported
0x12	G3_QUEUE_FULL	Error on queue management
0x13	G3_DATA_LIMIT_REACHED	The data passed as input to RTE exceeds the supported limit
0x14	G3_RESERVERD_CMD_ID	The Command ID given is reserved
0x15	G3_RTE_INTERFACE_TIMEOUT	Operation aborted due to a RTE timeout
0x16	G3_TEST_FAILED	Activation or deactivation of the test is not possible
0x17	G3_TEST_NOT_ACTIVE	Deactivation not possible because a test is not active
0x18	G3_TEST_ALREADY_ACTIVE	Activation not possible because a test is already active
0x19	G3_TEST_NOT_IMPLEMENTED	Activation not possible because the test is not implemented yet
0x1A	G3_TEST_NOT_IDLE	Activation not possible because the system is not idle
0x1B	G3_TEST_NOT_ACCEPTABLE	Received command cannot be managed when test is active
0x1C	G3_FAILED	The requested operation is failed
0x1D	G3_TX_BUSY	The transmitted is busy
0x1E	G3_RX_BUSY	The receiver is busy
0x1F	G3_CS_IDLE	Carrier sense is idle
0x20	G3_CS_BUSY	Carrier sense is busy
0x21	G3_PREVIOUS_REQUEST_FAILED	The current operation cannot be completed as the previous request failed

Value	Symbol	Description
0x22	G3_NO_INDICATION	An expected Indication is missing
0x23	G3_PLME_CS_CONF_TMR_EXP	Transmission failed because the RTE did not receive the PLME_CS.Confirm()
0x24	G3_PLME_SET_TRX1_KO	Transmission failed because the RTE received the first PLME_SET_TRX_STATE.Confirm() with un unexpected result
0x25	G3_PLME_SET_TRX1_TMR_EXP	Transmission failed because the RTE did not receive the first PLME_SET_TRX_STATE.Confirm()
0x26	G3_PLME_SET_TRX2_KO	Transmission failed because the RTE received the second PLME_SET_TRX_STATE.Confirm() with un unexpected result
0x27	G3_PLME_SET_TRX2_TMR_EXP	Transmission failed because the RTE did not receive the second PLME_SET_TRX_STATE.Confirm()
0x28	G3_PLME_SET_TRX3_KO	Transmission failed because the RTE received the third PLME_SET_TRX_STATE.Confirm() with un unexpected result
0x29	G3_PLME_SET_TRX3_TMR_EXP	Transmission failed because the RTE did not receive the third PLME_SET_TRX_STATE.Confirm()
0x2A	G3_PLME_SET_KO	Transmission failed because the RTE received the PLME_SET.Confirm() with un unexpected result
0x2B	G3_PLME_SET_TMR_EXP	Transmission failed because the RTE did not receive the PLME_SET.Confirm()
0x2C	G3_PD_DATA_CONF_FAILED	Transmission failed because the RTE received the PLME_SET.Confirm() with un unexpected result
0x2D	G3_PD_DATA_CONF_TMR_EXP	Transmission failed because the RTE did not receive the PD_DATA.Confirm()
0x2E	G3_SEGMENT_DISCARDED	The RTE discarded the last segment due to some errors on the transmission of the previous one
0x2F	G3_WRONG_VALUE	The value for the specified attribute is not in the supported range
0x30	G3_WRONG_ATTR_NUM	The number of attributes given is out of the supported range
0x31	G3_WRONG_DT	Wrong DT type
0x32	G3_ACTION_NOT_IMPLEMENTED	The required recovery action is not implemented
0x33	G3_ACTION_UNKNOWN	The required recovery action is unknow
0x34	G3_DT_ACKREQ_MISMATCH	The indicated value for filed DT does not match the bit AckReq in PSD
0x35	G3_PLME_GET_CONF_TMR_EXP	Reception failed on RTE
0x36	G3_PD_ACK_CONF_FAILED	Reception failed on RTE
0x37	G3_PD_ACK_REQ_TMR_EXP	Reception failed on RTE
0x38	G3_RX_NACK	Received NACK after macMaxFrameRetries attempt of transmission
0x39	G3_ERR_SEG_COUNT	Error in SC field of MAC header
0x3A	G3_ERR_SEG_ID	Error in SC field of MAC header
0x3B	G3_ERR_SEG_CC	Error in SC field of MAC header
0x3C	G3_ERR_SEG_AR	Error in SC field of MAC header
0x3D	G3_TX_QUEUE_TO_SHORT	The RTE didn’t accept the segment because the data queue is to short to manage the transmission of the frame
0x3E	G3_NO_EARLIER_SEG	The RTE didn't accept the segment because it didn't receive the previous one
0x3F	G3_ERR_SEQ_NUM	Error in SN field of MAC header
0x40	G3_INTERNAL_ERROR	RTE internal error
0x41	G3_SEGMENT_TOO_LATE	The RTE didn’t accept the segment because it is hasn't been received in time for the TX
0x42	G3_WRONG_TWORSBLOCKS	Wrong TwoRSBlocks value
0x43	G3_NOT_IDLE	Required operation cannot be performed because RTE is not IDLE

Value	Symbol	Description
0x44	G3_WRONG_BAND	Wrong band
0x45	G3_NOT_SUPPORTED_BAND	Not supported band
0x46	G3_NOT_ACCEPTABLE_LEN	The length of the frame is not acceptable
0x47	G3_PLC_DISABLED	The RTE didn’t accept the frame to because PLC is disabled
0x48	G3_PHY_NOT_READY	The requested action can’t be accepted by the PHY
0x49	G3_WRONG_LEN	Wrong length
0x4A	G3_BANDSETOK_ATTRSETKO	Bandplan set ended with success, but the default PHY setting hasn't been restored
0x60	G3_BUSY	The requested operation was not successfully completed beacuse the stack is in busy state
0x61	G3_INVALID_IPv6_FRAME	A wrong IPv6 frame has been provided
0x62	G3_INVALID_QOS	Invalid QoS
0x63	G3_BAD_CCM_OUTPUT	The security processing has been attempted on an outgoing frame and it failed because the security engine produced erroneous output
0x64	G3_ROUTE_ERROR	The requested operation has failed due to a routing failure on the sending device
0x65	G3_BT_TABLE_FULL	An attempt to send a broadcast frame or member mode multicast has failed due to the fact that there is no room in the BTT
0x66	G3_FRAME_NOT_BUFFERED	An frame transmission has failed due to insufficient buffering available
0x67	G3_STARTUP_FAILURE	An ADPM-NETWORK-START.request has failed to start a network
0x68	G3_NOT_PERMITTED	An ADPM-NETWORK-JOIN.request has been disallowed
0x69	G3_UNKNOWN_DEVICE	The device addressed in the parameter list is not accepted
0x6A	G3_SENDING_DATA_ERROR	The requested operation has failed because the lower layers were not able to successfully send the frame
0x6B	G3_PARAMETER_ERROR	Error while setting or retrieving a parameter
0x6C	G3_WRONG_DEVICE_TYPE	The requested operation has failed because of a wrong adpDeviceType for the specified operation
0x6D	G3_ADD_EVENT_ERROR	An attempt to add an event to internal FSM faild
0x6E	G3_GET_EVENT_ERROR	An attempt to get an event from internal FSM failed
0x6F	G3_MALLOC_FAIL	Memory buffer management error
0x70	G3_RTEIPC_ERROR	Error on nRT - RTE interface
0x71	G3_WRONG_MEDIA_TYPE	Wrong Media Type value
0x72	G3_UNAVAILABLE_MEDIA_TYPE	The medium selected for the next transmission is not available
0x73	G3_DUTY_CYCLE_ERR	The data frame cannot be transmitted over the RF interface due to Duty Cycle limitation
0x74	G3_DISABLED_MEDIA_TYPE	The media type selected for the transmission is disabled
0x75	G3_RF_DISABLED	The frame cannot be accepted as the RF PHY layer is disabled
0xDB	G3_COUNTER_ERROR	The frame counter of the received frame is invalid
0xDC	G3_IMPROPER_KEY_TYPE	The key applied on the received frame is not allowed to be used with that frame type
0xDD	G3_IMPROPER_SECURITY_LEVEL	The security level does not meet the minimum required security level
0xDE	G3_UNSUPPORTED_LEGACY	The received frame was purportedly secured using security based on IEEE Std 802154-2003, and such security is not supported by this standard

Value	Symbol	Description
0xDF	G3_UNSUPPORTED_SECURITY	The security purportedly applied by the originator of the received frame is not supported
0xE0	G3_BEACON_LOSS	The beacon was lost following a synchronization request
0xE1	G3_CHANNEL_ACCESS_FAILURE	A transmission could not take place due to activity on the channel
0xE2	G3_DENIED	The GTS request has been denied by the PAN coordinator
0xE3	G3_DISABLE_TRX_FAILURE	The attempt to disable the transceiver has failed
0xE4	G3_SECURITY_ERROR	Cryptographic processing of the received secured frame failed
0xE5	G3_FRAME_TOO_LONG	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
0xE6	G3_INVALID_GTS	The requested GTS transmission failed because the specified GTS either did not have a transmit GTS direction or was not defined
0xE7	G3_INVALID_HANDLE	A request to purge an MSDU from the transaction queue was made using an MSDU handle that was not found in the transaction table
0xE8	G3_INVALID_PARAMETER	A parameter in the primitive is either not supported or is out of the valid range
0xE9	G3_NO_ACK	No acknowledgment was received after macMaxFrameRetries
0xEA	G3_NO_BEACON	A scan operation failed to find any network beacons
0xEB	G3_NO_DATA	No response data were available following a request
0xEC	G3_NO_SHORT_ADDRESS	The operation failed because a 16-bit short address was not allocated
0xED	G3_OUT_OF_CAP	A receiver enable request was unsuccessful because it could not be completed within the CAP
0xEE	G3_PAN_ID_CONFLICT	A PAN identifier conflict has been detected and communicated to the PAN coordinator
0xEF	G3_REALIGNMENT	A coordinator realignment command has been received
0xF0	G3_TRANSACTION_EXPIRED	The transaction has expired and its information was discarded
0xF1	G3_TRANSACTION_OVERFLOW	There is no capacity to store the transaction
0xF2	G3_TX_ACTIVE	The transceiver was in the transmitter enabled state when the receiver was requested to be enabled
0xF3	G3_UNAVAILABLE_KEY	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
0xF4	G3_UNSUPPORTED_ATTRIBUTE	A SET/GET request was issued with the identifier of a PIB attribute that is not supported
0xF5	G3_INVALID_ADDRESS	A request to send data was unsuccessful because neither the source address parameters nor the destination address parameters were present
0xF6	G3_ON_TIME_TOO_LONG	A receiver enable request was unsuccessful because it specified a number of symbols that was longer than the beacon interval
0xF7	G3_PAST_TIME	A receiver enable request was unsuccessful because it could not be completed within the current superframe and was not permitted to be deferred until the next superframe
0xF8	G3_TRACKING_OFF	The device was instructed to start sending beacons based on the timing of the beacon transmissions of its coordinator, but the device is not currently tracking the beacon of its coordinator
0xF9	G3_INVALID_INDEX	An attempt to write to a PIB attribute that is in a table failed because the specified table index was out of range
0xFA	G3_LIMIT_REACHED	A scan operation terminated prematurely because the number of PAN descriptors stored reached an implementation-specified maximum
0xFB	G3_READ_ONLY	A SET/GET request was issued with the identifier of an attribute that is read only

Value	Symbol	Description
0xFC	G3_SCAN_IN_PROGRESS	A request to perform a scan operation failed because the MLME was in the process of performing a previously initiated scan operation
0xFD	G3_SUPERFRAME_OVERLAP	The device was instructed to start sending beacons based on the timing of the beacon transmissions of its coordinator, but the instructed start time overlapped the transmission time of the beacon of its coordinator

8 Command Message Description

The Host Interface protocol provides the access to each layer SAP of the G3-PLC specification. It's possible to get the access to each layer depending on the value of G3 platform operation mode that the user can configure. Additional commands are provided for the G3 stack configuration and platform management.

Table 26. List of Commands and associated IDs

Command	ID	Mode	Description
HOSTIF-HWRESET.Request	0x00	ALL	Perform a hardware reset of the platform. Reset can be performed also through the RESET pin
HOSTIF-HWRESET.Confirm	0x01	ALL	
HOSTIF-MODESET.Request	0x02	ALL	Change the mode of the platform
HOSTIF-MODESET.Confirm	0x03	ALL	
HOSTIF-MODEGET.Request	0x04	ALL	Get the current operating mode of the platform
HOSTIF-MODEGET.Confirm	0x05	ALL	
HOSTIF-BAUDRATESET.Request	0x06	ALL	Change the UART host interface baudrate of the platform
HOSTIF-BAUDRATESET.Confirm	0x07	ALL	
HOSTIF-RESETSTATE.Request	0x08	ALL	Reset the host interface state flushing all the messages in the internal queue
HOSTIF-RESETSTATE.Confirm	0x09	ALL	
HOSTIF-TESTSET.Request	0x0A	ALL	Request to enter in a PLC test or to exit
HOSTIF-TESTSET.Confirm	0x0B	ALL	
HOSTIF-TESTGET.Request	0x0C	ALL	Request to get the status of the current PLC test
HOSTIF-TESTGET.Confirm	0x0D	ALL	
HOSTIF-SFLASH.Request	0x0E	ALL	Perform an operation on the external SPI Flash if connected to the G3 platform
HOSTIF-SFLASH.Confirm	0x0F	ALL	
HOSTIF-NVM.Request	0x10	ALL	Perform an operation on the external Non-Volatile Memory if an external SPI Flash is connected to the G3 platform
HOSTIF-NVM.Confirm	0x11	ALL	
HOSTIF-TRACE.Request	0x12	ALL	Change the configuration of the trace module
HOSTIF-TRACE.Confirm	0x13	ALL	
HOSTIF-DBGTOOL.Request	0x14	ALL	Perform information and debug operation on the G3 platform
HOSTIF-DBGTOOL.Confirm	0x15	ALL	
HOSTIF-SEC-INIT.Request	0x16	ALL	Request operation for the secure host interface
HOSTIF-SEC-INIT.Confirm	0x17	ALL	Indicate security material or confirm security operation
HOSTIF-RFCONFIGSET.Request	0x18	ALL	Configure RF device parameters (Radio, Packet format, CSMA, Power)
HOSTIF-RFCONFIGSET.Confirm	0x19	ALL	
HOSTIF-RFCONFIGGET.Request	0x1A	ALL	Get current RF device parameters (Radio, Packet format, CSMA, Power)
HOSTIF-RFCONFIGGET.Confirm	0x1B	ALL	
HOSTIF-HWCONFIG.Request	0x1C	ALL	Request G3 platform HW configuration
HOSTIF-OTP.Request	0x1D	ALL	Perform an operation on the OTP device area
HOSTIF-OTP.Confirm	0x1E	ALL	
HOSTIF-HWCONFIG.Confirm	0x1F		Request G3 platform HW configuration
G3LIB-GET.Request	0x20	ALL	Get the value of one attribute

Command	ID	Mode	Description
G3LIB-GET.Confirm	0x21	ALL	Get the value of one attribute
G3LIB-SET.Request	0x22	ALL	Set the value of one attribute
G3LIB-SET.Confirm	0x23	ALL	
G3LIB-SWRESET.Request	0x24	ALL	Perform a software reset of the platform and change the PLC configuration
G3LIB-SWRESET.Confirm	0x25	ALL	
G3LIB-TESTMODEENABLE.Request	0x26	ALL	Enable or disable a testmode
G3LIB-TESTMODEENABLE.Confirm	0x27	ALL	
G3LIB-EVENTNOTIFICATION.Indication	0x28	ALL	Indication of a particular event occurred in the G3 platform that requires the host to be informed
G3LIB-MULTIPLEGET.Request	0x29	ALL	Request the read of multiple entries from one table
G3LIB-MULTIPLEGET.Confirm	0x2A	ALL	
G3LIB-SNIFFER.Indication	0x2B	PHY only	Frame detected in Sniffer Combined mode
G3PHY-DATA.Request	0x40	PHY only	Data transmission at PHY Layer
G3PHY-DATA.Confirm	0x41	PHY only	
G3PHY-DATA.Indication	0x42	PHY only	Data reception at PHY Layer
G3PHY-ACK.Request	0x43	PHY only	ACK transmission at PHY Layer
G3PHY-ACK.Confirm	0x44	PHY only	
G3PHY-ACK.Indication	0x45	PHY only	ACK reception at PHY Layer
G3PHY-RF.Request	0x46	PHY only	Raw data transmission on RF interface
G3PHY-RF.Confirm	0x47	PHY only	
G3PHY-RF.Indication	0x48	PHY only	Raw data reception on RF interface
G3PHY-SETTRXSTATE.Request	0x4A	PHY only	Put the PHY in transmission or reception state
G3PHY-SETTRXSTATE.Confirm	0x4B	PHY only	
G3PHY-CS.Request	0x4C	PHY only	Get the status of the channel (busy/free)
G3PHY-CS.Confirm	0x4D	PHY only	
G3MAC-DATA.Request	0x60	MAC only	Data transmission at MAC Layer
G3MAC-DATA.Confirm	0x61	MAC only	
G3MAC-DATA.Indication	0x62	MAC only	Data reception at MAC Layer
G3MAC-BCNNOTIFY.Indication	0x63	MAC only	Beacon reception at MAC Layer
G3MAC-RESET.Request	0x68	MAC only	Reset the MAC Layer
G3MAC-RESET.Confirm	0x69	MAC only	
G3MAC-SCAN.Request	0x6A	MAC only	Perform an active scan
G3MAC-SCAN.Confirm	0x6B	MAC only	
G3MAC-COMMSTATUS.Indication	0x6C	MAC only	Indicate a wrong/unexpected data reception
G3MAC-START.Request	0x6D	MAC only	Start a PAN
G3MAC-START.Confirm	0x6E	MAC only	
G3ADP-DATA.Request	0x80	ADP/BOOT	Data transmission at ADP Layer
G3ADP-DATA.Confirm	0x81	ADP/BOOT	
G3ADP-DATA.Indication	0x82	ADP/BOOT	Data reception at ADP Layer
G3ADP-DISCOVERY.Request	0x83	ADP/IPv6	Perform a PAN discovery procedure
G3ADP-DISCOVERY.Confirm	0x84	ADP/IPv6	

Command	ID	Mode	Description
G3ADP-NETSTART.Request	0x85	ADP/IPv6	Start a PAN (coordinator only)
G3ADP-NETSTART.Confirm	0x86	ADP/IPv6	
G3ADP-NETJOIN.Request	0x87	ADP/IPv6	Join a PAN (device only)
G3ADP-NETJOIN.Confirm	0x88	ADP/IPv6	
G3ADP-NETLEAVE.Request	0x89	ADP/IPv6	Leave the current PAN (device only)
G3ADP-NETLEAVE.Confirm	0x8A	ADP/IPv6	
G3ADP-NETLEAVE.Indication	0x8B	ADP/IPv6	Indicate that the node has left the PAN after a kick from coordinator (device only)
G3ADP-RESET.Request	0x8C	ADP/BOOT/IPv6	Reset the ADP Layer
G3ADP-RESET.Confirm	0x8D	ADP/BOOT/IPv6	
G3ADP-NETSTATUS.Indication	0x92	ADP/BOOT/IPv6	Indicate a wrong/unexpected data reception
G3ADP-ROUTEDISCOVERY.Request	0x93	ADP/BOOT/IPv6	Perform a manual route discovery
G3ADP-ROUTEDISCOVERY.Confirm	0x94	ADP/BOOT/IPv6	
G3ADP-PATHDISCOVERY.Request	0x95	ADP/BOOT/IPv6	Perform a path discovery
G3ADP-PATHDISCOVERY.Confirm	0x96	ADP/BOOT/IPv6	
G3ADP-LBP.Request	0x97	ADP/IPv6	LBP data transmission at ADP Layer (coordinator only)
G3ADP-LBP.Confirm	0x98	ADP/IPv6	
G3ADP-LBP.Indication	0x99	ADP/IPv6	LBP data reception at ADP Layer (coordinator only)
G3ADP-ROUTEOVER-DATA.Request	0x9A	ADP/BOOT	Data transmission at ADP without the default routing
G3ADP-ROUTEDELETE.Request	0x9B	ADP/BOOT/IPv6	Delete a route
G3ADP-ROUTEDELETE.Confirm	0x9C	ADP/BOOT/IPv6	
G3BOOT-SRV-START.Request	0xB0	BOOT/IPv6	Start the bootstrap server (coordinator only)
G3BOOT-SRV-START.Confirm	0xB1	BOOT/IPv6	
G3BOOT-SRV-STOP.Request	0xB2	BOOT/IPv6	Stop the bootstrap server (coordinator only)
G3BOOT-SRV-STOP.Confirm	0xB3	BOOT/IPv6	
G3BOOT-SRV-LEAVE.Indication	0xB4	BOOT/IPv6	Indicate a node has left the PAN (coordinator only)
G3BOOT-SRV-KICK.Request	0xB5	BOOT/IPv6	Kick a device from the network (coordinator only)
G3BOOT-SRV-KICK.Confirm	0xB6	BOOT/IPv6	
G3BOOT-SRV-JOIN.Indication	0xB7	BOOT/IPv6	Indicate a node has joint the PAN (coordinator only)
G3BOOT-DEV-START.Request	0xB8	BOOT/IPv6	Start a bootstrap client (device only)
G3BOOT-DEV-START.Confirm	0xB9	BOOT/IPv6	
G3BOOT-DEV-LEAVE.Request	0xBA	BOOT/IPv6	Ask the node to leave the current PAN (device only)
G3BOOT-DEV-LEAVE.Confirm	0xBB	BOOT/IPv6	
G3BOOT-DEV-LEAVE.Indication	0xBC	BOOT/IPv6	Indicate the node has left the PAN (device only)
G3BOOT-DEV-PANSORT.Indication	0xC1	BOOT/IPv6	Get the list of LBA (device only)
G3BOOT-DEV-PANSORT.Request	0xC2	BOOT/IPv6	Provide the ordered list of LBAs to be used to bootstrap (device only)
G3BOOT-DEV-PANSORT.Confirm	0xC3	BOOT/IPv6	
G3BOOT-SRV-GETPSK.Indication	0xC4	BOOT/IPv6	Get IdP and EUI64 of the device joining the PAN (coordinator only)

Command	ID	Mode	Description
G3BOOT-SRV-GETPSK.Request	0xC5	BOOT/IPv6	Provide the PSK and the short address to be assigned to the device (coordinator only)
G3BOOT-SRV-GETPSK.Confirm	0xC6	BOOT/IPv6	
G3UDP-DATA.Request	0xD0	IPv6	Transmit data at UDP Layer
G3UDP-DATA.Confirm	0xD1	IPv6	
G3UDP-DATA.Indication	0xD2	IPv6	Receive data at UDP Layer
G3UDP-CONN-SET.Request	0xD3	IPv6	Register a new communication socket handler over UDP
G3UDP-CONN-SET.Confirm	0xD4	IPv6	
G3UDP-CONN-GET.Request	0xD5	IPv6	Get the UDP communication socket handler
G3UDP-CONN-GET.Confirm	0xD6	IPv6	
G3ICMP-ECHO.Request	0xD7	IPv6	Transmit ECHO request data at ICMPv6 layer
G3ICMP-ECHO.Confirm	0xD8	IPv6	Confirm the ECHO request ICMPv6 data transmission
G3ICMP-ECHOREP.Indication	0xD9	IPv6	Receive the ECHO reply data at ICMPv6 Layer
G3ICMP-ECHOREQ.Indication	0xDF	IPv6	Receive the ECHO request data from ICMPv6 Layer
ERROR.Indication	0xFF	ALL	Notification of one Host Interface error

8.1 HOSTIF-HWRESET.Request

This message doesn't contain any payload.

8.2 HOSTIF-HWRESET.Confirm

Table 27. HOSTIF-HWRESET.Confirm message payload field description

#Bytes	Label	Values	Description
1	OTP_SEC_MODE	Table 10	The security mode of the platform configured in OTP

8.3 HOSTIF-MODESET.Request

Deprecated command; the platform mode has to be selected through `G3LIB-SWRESET` (Section 8.37) command.

8.4 HOSTIF-MODESET.Confirm

Deprecated command; the platform mode has to be selected through `G3LIB-SWRESET` (Section 8.37) command.

8.5 HOSTIF-MODEGET.Request

Deprecated command; the platform mode has to be selected through `G3LIB-SWRESET` (Section 8.37) command.

8.6 HOSTIF-MODEGET.Confirm

Deprecated command; the platform mode has to be selected through `G3LIB-SWRESET` (Section 8.37) command.

8.7 HOSTIF-BAUDRATESET.Request

Table 28. HOSTIF-BAUDRATESET.Request message payload field description

#Bytes	Label	Values	Description
4	BAUDRATE	Table 2	The baudrate to be used after the confirm command reception

8.8 HOSTIF-BAUDRATESET.Confirm

Table 29. HOSTIF-BAUDRATESET.Confirm message payload field description

#Bytes	Label	Values	Description
1	RESULT	Table 25	The operation result (G3_SUCCESS)
4	BAUDRATE	Table 2	The baudrate used after the reception of this command

Note: The new baudrate takes effect immediately after the G3 platform has sent the last byte of the `HOSTIF-BAUDRATESET.Confirm` message.

8.9 HOSTIF-RESETSTATE.Request

This message doesn't contain any payload

8.10 HOSTIF-RESETSTATE.Confirm

This message doesn't contain any payload

8.11 HOSTIF-TESTSET.Request

Table 30. HOSTIF-TESTSET.Request message payload field description

#Bytes	Label	Values	Description
1	TESTTYPE	Table 31	The type of test
Var	TESTPAR	Table 32, Table 33, Table 34, Table 35	Based on the TESTTYPE field the content of the message changes.

Table 31. G3 platform test type mode

Label	Value	Description
HI_TEST_NONE	0	Exit from functional test
HI_TEST_DATA_RATE	1	Perform a Data Rate test (PHY, MAC, ADP, APP UDP, PHY RF modes)
HI_TEST_INFINITELOOP	2	Enter in an infinite loop (no payload)
HI_TEST_SECURE_HI	3	Provide security material to test secure host interface
HI_TEST_RF	4	RF interface test (Continuous wave, PN9)

Table 32. G3-PLC test type parameter for PHY Data Rate test (TESTTYPE = 1)

#Bytes	Label	Value	Description
1	MODE	0	PHY Data Rate test mode
1	RXTXCONF	0-2	0: platform in RX 1: platform in TX 2: platform in TX (random delay between 0 and the value specified in DELAY field)
4	NBPACKETS	0x0-0xFFFFFFFF	The number of packets to be sent (valid only if RXTXCONF is not 0)
4	DELAY	0x0-0xFFFFFFFF	The interpacket time in ms (valid only if RXTXCONF is not 0)
Var	G3PHYDATAREQ	Table 99	The PD-DATA.Request to be used for TX

Table 33. G3-PLC test type parameter for MAC Data Rate test (TESTTYPE = 1)

#Bytes	Label	Value	Description
1	MODE	1	MAC Data Rate test mode
1	RXTXCONF	0-2	0: platform in RX 1: platform in TX 2: platform in TX (random delay between 0 and the value specified in DELAY field)
4	NBPACKETS	0x0-0xFFFFFFFF	The number of packet to be sent (valid only if RXTXCONF is not 0)
4	DELAY	0x0-0xFFFFFFFF	The interpacket time in ms (valid only if RXTXCONF is not 0)
1	SRC_ADDRMODE	0, 2, 3	Source Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
1	DST_ADDRMODE	0, 2, 3	Destination Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	DST_PANID	-	Destination PAN ID
8	DST_ADDR	-	Destination address (set to 0 the unused bytes)
2	MSDULEN	0-400	MSDU Length
400	MSDU	-	MSDU (set to 0 the unused bytes)
1	MSDUHANDLE	0x0-0xFF	MSDU handle returned in the G3MAC-DATA.Confirm
1	TXOPTIONS	0x0-0xFF	TX option bit mask b0: 0 ACK not requested, 1 ACK requested b1-7: not used
1	SECURITYLEVEL	0, 5	Security Level 0: no security 5: ENC-MIC32
1	KEYINDEX	0, 1	The MAC key index (valid only if SECURITYLEVEL is 5)
1	QOS	0, 1	Quality Of Service for channel access priority 0: Normal priority 1: High priority

#Bytes	Label	Value	Description
1	MEDIATYPE	0x00 – 0x03	The channel over which the frame has to be transmitted (0x00 PLC, 0x01 RF, 0x02 PLC 1st option, 0x03 RF 1st option)

Table 34. G3-PLC test type parameter for ADP Data Rate test (TESTTYPE = 1)

#Bytes	Label	Value	Description
1	MODE	2, 3	ADP Data Rate test mode
1	RXTXCONF	0-2	0: platform in RX 1: platform in TX 2: platform in TX (random delay between 0 and the value specified in DELAY field)
4	NBPACKETS	0x0-0xFFFFFFFF	The number of packets to be sent (valid only if RXTXCONF is not 0)
4	DELAY	0x0-0xFFFFFFFF	The interpacket time in ms (valid only if RXTXCONF is not 0)
Var	G3ADPDATAREQ	Table 122	The ADPD-DATA.Request to be used for TX

Table 35. G3-PLC test type parameter for APP UDP Data Rate test (TESTTYPE = 1)

#Bytes	Label	Value	Description
1	MODE	4, 5	ADP Data Rate test mode
1	RXTXCONF	0-2	0: platform in RX 1: platform in TX 2: platform in TX (random delay between 0 and the value specified in DELAY field)
4	NBPACKETS	0x0-0xFFFFFFFF	The number of packets to be sent (valid only if RXTXCONF is not 0)
4	DELAY	0x0-0xFFFFFFFF	The interpacket time in ms (valid only if RXTXCONF is not 0)
1	CMDID	-	APP UDP command ID
16	DESTADDR	-	The IPv6 destination address
2	DATALEN	0-1500	The UDP payload length
0-1500	DATA	-	The UDP payload

Table 36. G3-PLC test type parameter for PHY RF Data Rate test (TESTTYPE = 1)

#Bytes	Label	Value	Description
1	MODE	6	PHY RF Data Rate test mode
1	RXTXCONF	0-2	0: platform in RX 1: platform in TX 2: platform in TX (random delay between 0 and the value specified in DELAY field)
4	NBPACKETS	0x0-0xFFFFFFFF	The number of packet to be sent (valid only if RXTXCONF is not 0)
4	DELAY	0x0-0xFFFFFFFF	The interpacket time in ms (valid only if RXTXCONF is not 0)
Var	G3PHYRFREQ	Table 105	The PHY-RF.Request to be used for TX

Table 37. G3-PLC test type parameter for Secure Host Interface (TESTTYPE = 3)

#Bytes	Label	Value	Description
1	SECMODE	0-2	Set the G3 platform security mode (Table 10)

#Bytes	Label	Value	Description
16	KEY	-	The OTP_KEY value

Table 38. G3-PLC test type parameter for RF interface test (TESTTYPE = 4)

#Bytes	Label	Value	Description
1	SIGNALTYPE	0-1	RF interface signal type (0x00 Continuous wave, 0x01 PN9 Sequence)

8.12 HOSTIF-TESTSET.Confirm

This message doesn't contain any payload

8.13 HOSTIF-TESTGET.Request

This message doesn't contain any payload

8.14 HOSTIF-TESTGET.Confirm

Table 39. HOSTIF-TESTGET.Confirm message payload field description

#Bytes	Label	Values	Description
4	NBPACKETS	-	The number of transmitted or received packets
4	NBBYTES	-	The number of transmitted or received bytes
4	DURATION	-	The duration in ms of the test

8.15 HOSTIF-SFLASH.Request

Table 40. HOSTIF-SFLASH.Request message payload field description

#Bytes	Label	Values	Description
1	OPERATION	Table 41	The operation to perform on the external SPI Flash
2	SIZE	0-256	The size of the payload
4	ADDRESS	0x0-0xFFFFFFFF	The address for the current operation
0..256	PAYLOAD	-	The payload (no payload for ERASE and READ, the bytes to write for WRITE)

Table 41. G3 platform sFlash operation

Label	Value	Description
ERASE	0	Erase one sector of the external SPI Flash
READ	1	Read bytes from the external SPI Flash
WRITE	2	Write bytes on the external SPI Flash

8.16 HOSTIF-SFLASH.Confirm

Table 42. HOSTIF-SFLASH.Confirm message payload field description

#Bytes	Label	Values	Description
0..256	PAYLOAD	-	The read buffer for READ, no payload for ERASE and WRITE

8.17 HOSTIF-NVM.Request

Table 43. HOSTIF-NVM.Request message payload field description

#Bytes	Label	Values	Description
1	OPERATION	Table 44	The operation to perform on the external SPI Flash
1	SECTION	Table 45	The section for the operation (not relevant for ERASE)
2	OFFSET	0-1024	The offset from the start of the section (not relevant for ERASE) *Note: Real maximum value depends on the size of the section*
2	SIZE	0-1024	The data size for the requested operation (not relevant for ERASE)
0-1024	DATA	-	The data to be written (relevant only for WRITE)

Table 44. G3 platform NVM operation

Label	Value	Description
ERASE	0	Erase the full NVM
READ	1	Read bytes from the external SPI Flash
WRITE	2	Write bytes on the external SPI Flash

Table 45. G3 platform NVM section types

Label	Value	Description
GEN	1	Generic section
PLC	2	PLC section
PLCC	3	PLC for Coordinator section

8.18 HOSTIF-NVM.Confirm

Table 46. HOSTIF-NVM.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
2	SIZE	0-1024	The data size (different from 0 only if previous request was a READ operation)
0-1024	DATA	-	The data read from the NVM (relevant only for READ)

8.19 HOSTIF-TRACE.Request

Table 47. HOSTIF-TRACE.Request message payload field description

#Bytes	Label	Values	Description
1	CONTROL	Table 48	The operation to be done for the trace module
4	DATA_1	-	The format depends on the specific operation
4	DATA_2	-	The format depends on the specific operation

Table 48. G3 platform Trace operation in CONTROL field

Label	Value	Description
HI_TRC_SET_FILTER	5	Apply filter on debug traces: DATA_1 = Modules Filter as in Table 13 and Table 14 DATA_2 = Priority Filter as in Table 15

8.20 HOSTIF-TRACE.Confirm

This message doesn't contain any payload

8.21 HOSTIF-DBGTOOL.Request

Table 49. HOSTIF-DBGTOOL.Request message payload field description

#Bytes	Label	Values	Description
1	CONTROL	Table 50	The operation to be done for the DBG info module
N	INFO	-	See details in below tables. INFO length can be extended in future versions.

Table 50. G3 platform DBG tool operation (CONTROL field)

Label	Value	Description
HI_DBG_INFO	0	Get generic information on the G3 platform. No INFO field is required for this operation
HI_DBG_USART_TRC_CONF	1	USART trace configuration operation. INFO field description in Table 51
HI_DBG_LED_CONF	2	LED configuration operation. INFO field description in Table 52
RESERVED	3..255	Reserved for future use

Table 51. DBG USART trace configuration operation INFO field

#Bytes	Label	Value	Description
4	USART_NUM	0x00, 0x01, 0xFF	Specify the USART for the trace output, see Section 2.1

Table 52. DBG LED configuration operation INFO field

#Bytes	Label	Value	Description
4	LED_CONFIG	0x00, 0x01, 0xFF	Specify the LED GPIO configuration, see Section 2.1

8.22 HOSTIF-DBGTOOL.Confirm

Table 53. HOSTIF-DBGTOOL.Confirm message payload field description

#Bytes	Label	Values	Description
4	G3INFO	-	BandPlan DeviceType Framework version number
4	LIBVER		G3-PLC library stack implementation version number
4	RTEVER	-	G3-PLC RTE stack implementation version number
8	MACADDR	-	The 64-bits EUI-64 (MAC Address)
4	SFLASHID	-	The ID of the external SPI external Flash (0xFFFFFFFF if none)
1	USARTNUM	0x00, 0x01, 0xFF	The trace UART configuration information
1	LEDCONF	0x00, 0x01, 0xFF	The LED configuration information
1	PLATFORMTYPE	-	The Platform type: 0x00: INVALID 0x01: STCOMET/STCOM 0x02: ST8500 0xFF: Not specified
1	RFCONNECT	0x00, 0x01	RF connected (0x01), RF not connected (0x00)
1	PLATFORMMODE	0-5	The platform mode as defined in Table 12
2	PANID	0x0000 – 0xFFFF	The current value of the G3 PAN ID
2	SHORTADDR	0x0000 – 0xFFFF	The current value of the G3 Short Address

8.23 HOSTIF-SEC-INIT.Request

Table 54. HOSTIF-SEC-INIT.Request message payload field description

#Bytes	Label	Values	Description
1	Type	0-2	The type of the Sec-Init message exchange phase
16	RAND_M	Random	A 128-bits random number

8.24 HOSTIF-SEC-INIT.Confirm

Table 55. HOSTIF-SEC-INIT.Confirm message payload field description

#Bytes	Label	Values	Description
1	Type	0-2	The type of the Sec-Init message exchange phase
16	RAND_INIT	Random	A 128-bits random number used to derive the UART_KEY
8	RAND_H	Random	A 64-bits random number used to create IV_H
8	RAND_S	Random	A 64-bits random number used to create IV_S
16	RAND_M	Random	A 128-bits random number

8.25 HOSTIF-RFCONFIGSET.Request

Table 56. HOSTIF-RFCONFIGSET.Request message payload field description

#Bytes	Label	Values	Description
4	RADIO_BASEFREQ	412900000 - 527100000, 825900000 - 1056000000	Specifies the base carrier frequency (in Hz)
1	RADIO_MODSELECT	0x70, 0x00, 0x10, 0xA0, 0x20, 0xB0, 0x30, 0x50, 0x60	Specifies the modulation (0x70 No Mod, 0x00 2-FSK, 0x10 4-FSK, 0xA0 G2FSK with BT = 0.5, 0x20 G2FSK with BT = 1, 0xB0 G4FSK with BT = 0.5, 0x30 G4FSK with BT = 1, 0x50 ASK OOK, 0x60 POLAR)
4	RADIO_DATARATE	100 - 250000	Specifies the data rate expressed in bps
4	RADIO_FREQDEV	-	Specifies the frequency deviation expressed in Hz
4	RADIO_BANDWIDTH	1100 - 800100	Specifies the channel filter bandwidth expressed in Hz
1	RADIO_CSBLANKING	0x00 – 0x01	Prevents data to be received if the RSSI level on the air is below the RSSI threshold
4	RADIO_XTALFREQ	48000000 -52000000	Set the XTAL frequency
1	RADIO_RSSIGAIN	0 – 15	Set the RSSI filter gain
1	POWERDBM	0 - 45	Power Amplifier value to write expressed in dBm (0 is -31 dBm, 45 is 14 dBm). In case FEM is enabled, the gain of an external PA may be added
1	PKT_CRCMODE	0x00, 0x20, 0x40, 0x60, 0x80, 0xA0	Set the CRC type (0x00 No CRC, 0x20 8 bits, 0x40 16 bits poly 0x8005, 0x60 16 bits poly 0x1021, 0x80 24 bits, 0xA0 32 bits)
1	PKT_ENFEC	0x00 – 0x01	Enable the FEC/Viterbi
1	PKT_ENWHITENING	0x00 – 0x01	Enable the data whitening
1	PKT_ENINTERLEAVING	0x00 – 0x01	Enable the interleaving of 802.15.4g packet
1	IRQGPIOPIN	0x00 – 0x03	Specify the S2LP GPIO pin used to route the interrupt flag
1	MCU_CLKENABLE	0x00 – 0x01	Enable the S2LP Clock Output (0x00 Disabled, 0x01 Enabled)
1	MCU_CLKGPIOPIN	0x00 – 0x03	Specify the S2LP GPIO pin used to export S2LP Clock
1	MCU_CLKXORATIO	0x00, 0x02, 0x04, 0x06, 0x08, 0x0A, 0x0C, 0x0E, 0x10	Set the S2LP clock output XO prescaler (divided by 1 or by ½, ¼, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256)
1	MCU_CLKRCORATIO	0x00, 0x01	Set the S2LP Clock Output RCO prescaler (divided by 1 or by 1/128)
1	MCU_CLKCLOCKCYCLES	0x00, 0x20, 0x40, 0x60	Set the S2LP ExtraClockCycles exported before switching to Standby state (0, 128, 256, 512)
1	EXTSMPSENABLE	0x00 – 0x01	Enable the external SMPS (0x00 Disabled, 0x01 Enabled)
1	FEM_ENABLED	0x00 – 0x01	Enable the S2LP GPIO signals to control the Front End Module (0x00 Disabled, 0x01 Enabled)
1	FEM_CSDGPIOPIN	0x00 – 0x03	Specify the S2LP GPIO pin to control CSD
1	FEM_CPSGPIOPIN	0x00 – 0x03	Specify the S2LP GPIO pin to control CPS
1	FEM_CTXGPIOPIN	0x00 – 0x03	Specify the S2LP GPIO pin to control CTX
1	FEM_TXBYPASS	0x00 – 0x01	Enable the FEM TX Bypass Mode (0x00 Disabled, 0x01 Enabled)

8.26 HOSTIF-RFCONFIGSET.Confirm

Table 57. HOSTIF-RFCONFIGSET.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The result of the mode set operation

8.27 HOSTIF-RFCONFIGGET.Request

This message doesn't contain any payload

8.28 HOSTIF-RFCONFIGGET.Confirm

Table 58. HOSTIF-RFCONFIGGET.Confirm message payload field description

#Bytes	Label	Values	Description
4	RADIO_BASEFREQ	412900000 - 527100000, 825900000 - 1056000000	Specifies the base carrier frequency (in Hz)
1	RADIO_MODSELECT	0x70, 0x00, 0x10, 0xA0, 0x20, 0xB0, 0x30, 0x50, 0x60	Specifies the modulation (0x70 No Mod, 0x00 2-FSK, 0x10 4-FSK, 0xA0 G2FSK with BT = 0.5, 0x20 G2FSK with BT = 1, 0xB0 G4FSK with BT = 0.5, 0x30 G4FSK with BT = 1, 0x50 ASK OOK, 0x60 POLAR)
4	RADIO_DATARATE	100 - 250000	Specifies the data rate expressed in bps
4	RADIO_FREQDEV	-	Specifies the frequency deviation expressed in Hz
4	RADIO_BANDWIDTH	1100 - 800100	Specifies the channel filter bandwidth expressed in Hz
1	RADIO_CSBLANKING	0x00 – 0x01	Prevents data to be received if the RSSI level on the air is below the RSSI threshold
4	RADIO_XTALFREQ	48000000 -52000000	Set the XTAL frequency
1	RADIO_RSSIGAIN	0 – 15	Set the RSSI filter gain
1	POWERDBM	0 - 45	Power Amplifier value to write expressed in dBm (0 is -31 dBm, 45 is 14 dBm). In case FEM is enabled, the gain of an external PA may be added
1	PKT_CRCMODE	0x00, 0x20, 0x40, 0x60, 0x80, 0xA0	Set the CRC type (0x00 No CRC, 0x20 8 bits, 0x40 16 bits poly 0x8005, 0x60 16 bits poly 0x1021, 0x80 24 bits, 0xA0 32 bits)
1	PKT_ENFEC	0x00 – 0x01	Enable the FEC/Viterbi
1	PKT_ENWHITENING	0x00 – 0x01	Enable the data whitening
1	PKT_ENINTERLEAVING	0x00 – 0x01	Enable the interleaving of 802.15.4g packet
1	IRQGPIOPIN	0x00 – 0x03	Specify the S2LP GPIO pin used to route the interrupt flag
1	MCU_CLKENABLE	0x00 – 0x01	Enable the S2LP Clock Output (0x00 Disabled, 0x01 Enabled)
1	MCU_CLKGPIOPIN	0x00 – 0x03	Specify the S2LP GPIO pin used to export S2LP Clock
1	MCU_CLKXORATIO	0x00, 0x02, 0x04, 0x06, 0x08, 0x0A, 0x0C, 0x0E, 0x10	Set the S2LP clock output XO prescaler (divided by 1 or by ½, ¼, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256)
1	MCU_CLKRCORATIO	0x00, 0x01	Set the S2LP Clock Output RCO prescaler (divided by 1 or by 1/128)
1	MCU_CLKCLOCKCYCLES	0x00, 0x20, 0x40, 0x60	Set the S2LP ExtraClockCycles exported before switching to Standby state (0, 128, 256, 512)

#Bytes	Label	Values	Description
1	EXTSMPSENABLE	0x00 – 0x01	Enable the external SMPS (0x00 Disabled, 0x01 Enabled)
1	FEM_ENABLED	0x00 – 0x01	Enable the S2LP GPIO signals to control the Front End Module (0x00 Disabled, 0x01 Enabled)
1	FEM_CSDGPIOPIN	0x00 – 0x03	Specify the S2LP GPIO pin to control CSD
1	FEM_CPSGPIOPIN	0x00 – 0x03	Specify the S2LP GPIO pin to control CPS
1	FEM_CTXGPIOPIN	0x00 – 0x03	Specify the S2LP GPIO pin to control CTX
1	FEM_TXBYPASS	0x00 – 0x01	Enable the FEM TX Bypass Mode (0x00 Disabled, 0x01 Enabled)

8.29 HOSTIF-HWCONFIG.Request

Table 59. HOSTIF-HWCONFIG.Request message payload field description

#Bytes	Label	Values	Description
1	Type	0x00 – 0x05	The configuration type to be applied (See Table 60)
1	Payload Len	0x00 – 0xFF	The length of the configuration data
Payload Len	Payload	-	The configuration data (see Table 61, Table 62, Table 63, Table 64)

Table 60. HOSTIF-HWCONFIG Types

Label	Value	Description
GPIO Config	0	Configure GPIO port in G3 Platform (See Table 61)
GPIO Write	1	Write bit on a given GPIO pin (See Table 62)
GPIO Read	2	Read bit on a given GPIO pin (See Table 63)
UART Baudrate Config	3	Configure Host Interface UART baudrate (See Table 64)
S2LP Register Write	4	Write a S2LP register (Table 65)
S2LP Register Read	5	Read a S2LP register (Table 66)
Reserved	6 … 255	Reserved for future use

Table 61. HOSTIF-HWCONFIG.Req - GPIO_03 Config (ST8500) payload

#Bytes	Label	Value	Description
1	PORT	0x03	On ST800 the available GPIO port is GPIO_03 (0x03). On STCOM(ET) this feature is disabled.
1	PIN	0x08, 0x10, 0x20, 0x40, 0x80	0x08 - Pin 3, 0x10 - Pin 4, 0x20 - Pin 5, 0x40 - Pin 6, 0x80 - Pin 7
1	MODE	0x00 – 0x05	0x00 - GP_IN, 0x01 - GP_OUT, 0x02 - GP_IN_PU, 0x03 - GP_IN_PD, 0x04 - GP_OUT_OD, 0x05 - GP_OUT_OD_PU

Table 62. HOSTIF-HWCONFIG.Req - GPIO_03 Write (ST8500) payload

#Bytes	Label	Value	Description
1	PORT	0x03	On ST800 the available GPIO port is GPIO_03 (0x03). On STCOM(ET) this feature is disabled.
1	PIN	0x08, 0x10, 0x20, 0x40, 0x80	0x08 - Pin 3, 0x10 - Pin 4, 0x20 - Pin 5, 0x40 - Pin 6, 0x80 - Pin 7

#Bytes	Label	Value	Description
1	VALUE	0x00 – 0x01	Set or clear the selected GPIO pin

Table 63. HOSTIF-HWCONFIG.Req - GPIO_03 Read (ST8500) payload

#Bytes	Label	Value	Description
1	PORT	0x03	On ST800 the available GPIO port is GPIO_03 (0x03). On STCOM(ET) this feature is disabled.
1	PIN	0x08, 0x10, 0x20, 0x40, 0x80	0x08 - Pin 3, 0x10 - Pin 4, 0x20 - Pin 5, 0x40 - Pin 6, 0x80 - Pin 7

Table 64. HOSTIF-HWCONFIG.Req - UART Baudrate Config payload

#Bytes	Label	Value	Description
4	BAUDRATE	Table 2	The Host Interface UART baudrate to be used afterwards

Table 65. HOSTIF-HWCONFIG.Req – S2LP Register Write payload

#Bytes	Label	Value	Description
1	ADDR	0x00 – 0xFD	S2LP register addres
1	LEN	0x01 – 0xFF	The number of bytes to be written
LEN	DATA	-	The data to be written

Table 66. HOSTIF-HWCONFIG.Req – S2LP Register Read payload

#Bytes	Label	Value	Description
1	ADDR	0x00 – 0xFD	S2LP register addres
1	LEN	0x01 – 0xFF	The number of bytes to be read

8.30 HOSTIF-HWCONFIG.Confirm

Table 67. HOSTIF-HWCONFIG.Confirm message payload field description

#Bytes	Label	Values	Description
1	Status	-	The operation result (G3_SUCCESS, G3_FAILED)
1	Type	0x00 – 0x03	The configuration type applied (See Table 60)
1	Payload Len	0x00 – 0xFF	The length of the configuration data
Payload Len	Payload	-	The configuration data (see Table 68, Table 69, Table 70)

8.30.1 HOSTIF-HWCONFIG.Conf - GPIO_03 Config (ST8500) payload

This type does not include payload (Payload Len = 0)

8.30.2 HOSTIF-HWCONFIG.Conf - GPIO_03 Write (ST8500) payload

This type does not include payload (Payload Len = 0)

Table 68. **HOSTIF-HWCONFIG.Conf - GPIO_03 Read (ST8500) payload**

#Bytes	Label	Value	Description
1	VALUE	0x00 – 0x01	The selected GPIO pin value

Table 69. **HOSTIF-HWCONFIG.Conf - UART Baudrate Config payload**

#Bytes	Label	Value	Description
4	BAUDRATE	Table 2	The Host Interface UART baudrate to be used afterwards

Note: The new baudrate takes effect immediately after the G3 platform has sent the last byte of the HOSTIF-HWCONFIG.Confirm message

8.30.3 HOSTIF-HWCONFIG.Conf - S2LP Register Write payload

This type does not include payload (Payload Len = 0)

Table 70. **HOSTIF-HWCONFIG.Conf - S2LP Register Read payload**

#Bytes	Label	Value	Description
1	LEN	0x01 – 0xFF	The number of bytes read
LEN	DATA	-	The content of the register

8.31 HOSTIF-OTP.Request

Table 71. **HOSTIF-OTP.Request message payload field description**

#Bytes	Label	Values	Description
1	OPERATION	0/1	The operation 0: Read 1: Write
1	REGION	0..2	The region 0: User Security field 1: PE Key field 2: User data / Additional Key field
N	PAYLOAD	-	The payload N = 0 for Read operation N = 4 for User Security field write operation (32-bits word should be in the form of 0x0000HHHH, the two most significant bytes should be zero) N = 16 for User data field write operation N = 32 for PE Key field write operation

8.32 HOSTIF-OTP.Confirm

Table 72. **HOSTIF-OTP.Confirm message payload field description**

#Bytes	Label	Values	Description
1	OPERATION	0/1	The operation 0: Read 1: Write

#Bytes	Label	Values	Description
1	REGION	0..2	The region 0: User Security field 1: PE Key field 2: User data / Additional Key field
1	STATUS	0..3	The operation result 0: OK 1-2: Not OK 3: Wrong region specified
N	PAYLOAD	-	The payload N = 0 for write operation N = 4 for User Security field read operation N = 16 for User data field read operation N = 32 for PE Key field read operation

8.33 G3LIB-GET.Request

Table 73. G3LIB-GET.Request message payload field description

#Bytes	Label	Values	Description
4	ID	-	The attribute ID
2	INDEX	-	The entry index (in case the attribute is a table)

8.34 G3LIB-GET.Confirm

Table 74. G3LIB-GET.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATE	Table 25	The operation result
4	ID	-	The attribute ID
2	INDEX	-	The entry index (in case the attribute is a table)
2	LEN	0x0–0xFFFF	The length of the VALUE field
Var	VALUE	-	The value of the attribute (little endian format for integer numbers)

8.35 G3LIB-SET.Request

Table 75. G3LIB-SET.Request message payload field description

#Bytes	Label	Values	Description
4	ID	-	The attribute ID
2	INDEX	-	The entry index (in case the attribute is a table). If the special index 0xFFFF is given, the entry within the table is automatically selected with the following criteria: • If an entry for the same address is found, it will be replaced

#Bytes	Label	Values	Description
			• The first available entry is selected
2	LEN	0x0-0xFFFF	The length of the VALUE field
Var	VALUE	-	The new value of the attribute (little endian format for integer numbers)

8.36 G3LIB-SET.Confirm

Table 76. G3LIB-SET.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATE	Table 25	The operation result
4	ID	-	The attribute ID
2	INDEX	-	The entry index (in case the attribute is a table).

8.37 G3LIB-SWRESET.Request

Table 77. G3LIB-SWRESET.Request message payload field description

#Bytes	Label	Values	Description
1	BANDPLAN	0,1,3	0: use G3 Cenelec-A bandplan 1: use G3 Cenelec-B bandplan 3: use G3 FCC bandplan
1	DEVICETYPE	0,1	0: use the platform as Device 1: use the platform as Coordinator
1	PLATFORMMODE	0-5	The platform mode as defined in Table 12

8.38 G3LIB-SWRESET.Confirm

Table 78. G3LIB-SWRESET.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
1	BANDPLAN	0,1,3	0: use G3 Cenelec-A bandplan 1: use G3 Cenelec-B bandplan 3: use G3 FCC bandplan
1	DEVICETYPE	0,1	0: the platform is used as Device 1: the platform is used as Coordinator
1	PLATFORMMODE	0-5	The platform mode as defined in Table 12

8.39 G3LIB-TESTMODEENABLE.Request

Table 79. G3LIB-TESTMODEENABLE.Request message payload field description

#Bytes	Label	Values	Description
1	ID	-	Reserved for future use

8.40 G3LIB-TESTMODEENABLE.Confirm

Table 80. G3LIB-TESTMODEENABLE.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.41 G3LIB-EVENTNOTIFICATION.Indication

Table 81. G3LIB-EVENTNOTIFICATION.Indication message payload field description

#Bytes	Label	Values	Description
1	TYPE	Table 82	The type of event indicated by the platform
Var	INFO	-	Information communicated by the platform. This field depends on TYPE field as specified in the below tables

Table 82. G3 Platform event type values

Label	Value	Description	INFO
RTEError(1)	0	Generic platform error	Not Available
GMKUpdate(2)	1	The macKeyTable has been updated	Not Available
ContextTableUpdate(2)	2	The adpContectTable has been updated	Not Available
GroupTableUpdate(2)	3	The adpGroupTable has been updated	Not Available
ActiveKeyIndexUpdate(2)	4	The adpActiveKeyIndex attribute has been updated	Not Available
ShortAddrUpdate(2)	5	The macShortAddress has been updated	Not Available
PANIdUpdate(2)	6	The macPANId has been updated	Not Available
ToneMapTx	7	A MAC ToneMap Response message has been sent	Table 84
ToneMapRx	8	A MAC ToneMap Response message has been received	Table 84
RouteUpdate	9	The adpRoutingTable has been updated	Table 85
PathRequestRx	10	An ADP Path Request message has been received	Table 86
ThermalEvent	11	Thermal event occurred	Table 87
SurgeEvent	12	Surge protection mechanism event occurred	No payload
RTEWarningEvent	13	RTE warning was generated, details can be seen on debug trace port	No payload
RTEPollingError(1)	14	Error in periodic communication between Cortex core and RTE	No Payload
BootMaxRetries	15	Bootstrap application reaches max retries for the specific agent	Table 88
RTEBandMismatch	16	Bandplan configured in RTE is not the expected one	Table 89
PHYQualityRX	17	Get PHY quality information on rx frames	Table 90

Label	Value	Description	INFO
PHYQualityTx	18	GET PHY quality information on tx frames	Table 91
ExtAddrUpdate(2)	19	The MAC extended address has been updated	Not Available

1. *This event is exported to the Host through the `ERROR.Indication` message (Section 8.124)*
2. *This Event is used internally by the G3 Platform to update the NVM (see Section 5.1) and it is not exported to the Host*

The following tables report the details related to the events specified above.

Table 83. Event Indication Info: Error event

#Bytes	Label	Values	Description
1	ERROR_TYPE	0	0: RTE ERROR, Error occurred in the Real-Time Engine

Table 84. Event Indication Info: ToneMapTx and ToneMapRx

#Bytes	Label	Values	Description
1	ADDR_MODE	2-3	2: 16-bits short address 3: 64-bits extended address
2	ADDR_PANID	0x0000 – 0xFFFF	PAN ID of the neighbor node
8	ADDR	-	Address of the neighbor node If ADDR_MODE is 2, only first two bytes are relevant

14	TONEMAP	-	Tone Map message. The message structure depends on the bandplan:
			union{
			MAC_TMRespPay_CEN_t CEN_TMRspPayload;
			MAC_TMRespPay_FCC_t FCC_TMRspPayload;
			};
			Where:
			typedef struct
			{
			uint8_t PayModSch : 1;
			uint8_t Mod : 2;
			uint8_t TxGain : 4;
			uint8_t TxRes : 1;
			uint8_t TM05 : 6;
			uint8_t Res : 2;
			uint8_t LQI;
			PHY_CENATXCoeff_t TXCoeff; // 3 bytes set to zero
			uint8_t Rsv;
			uint16_t FCS;
			} MAC_TMRespPay_CENA_t;
			And:
			typedef struct
			{
			uint8_t Mod : 3;
			uint8_t TxGain : 4;
			uint8_t TxRes : 1;

#Bytes	Label	Values	Description

			uint8_t ToneMap[TM_SIZE]; // 3 bytes
			uint8_t LQI;
			PHY_FCCTXCoeff_t TXCoeff; // 6 bytes set to zero
			uint8_t Res : 7;
			uint8_t PayModSch : 1;
			uint16_t FCS;
			} MAC_TMRespPay_FCC_t;

Table 85. Event Indication Info: RouteUpdate

#Bytes	Label	Values	Description
2	DST_ADDR	0x0000 – 0xFFFF	Destination address
2	NEXT_HOP	0x0000 – 0xFFFF	The next hop address
2	ROUTE_COST	0x0000 – 0xFFFF	The route cost
1	HC_WL	0x0000 – 0xFFFF	Bit 0..3: Hop count Bit 4..7: Weak link count
2	VALID_TIME	0x0000 – 0xFFFF	The remaining lifetime of this entry in minutes
1	ORIGINATOR	0-1	0: route update from a request generated by the node itself 1: route update from a request generated by the endpoint node

Table 86. Event Indication Info: PathRequestRx

#Bytes	Label	Values	Description
2	PREQ_LEN	0-0xFFFF	The length of the next fields. This field can be used to detect how many hop infos are present
1	PREQ_TYPE	0xFC	PREQ message code
2	PREQ_DST	0x0000-0xFFFF	The destination of the PREQ message
2	PREQ_ORIG	0x0000-0xFFFF	The originator of the PREQ message
4	PREQ_EXTDATA	0x0-0xF	4 bits containing the MetricType. Other bits are reserved
N	PREQ_HOPINFOS	-	Hop info structures. For each hop a structure is generated. Each structure has the following information: typedef struct { uint16_t Address; uint8_t Reserved : 2; uint8_t MTx : 1; uint8_t MRx : 1; uint8_t PhaseDiff : 3; uint8_t MNS : 1; uint8_t LinkCost; } LOADng_PREX_Hop_Info_t;

Table 87. Event Indication Info: Thermal event

#Bytes	Label	Values	Description
1	THERMAL_INFO	0x00 – 0x08	0x0: No thermal warnings or errors 0x1: Line Driver thermal error 0x2: SoC thermal error 0x4: Line Driver thermal warning 0x8: SoC thermal warning

Table 88. Event Indication Info: BootMaxRetries event

#Bytes	Label	Values	Description
2	PAN_ID	0x0000 – 0xFFFF	The PAN ID used during the bootstrap process
1	LQI	0x00 – 0xFF	The 8-bit Link Quality of LBA
2	LBA_ADDR	0x0000 – 0xFFFF	The short address of the LBA used for the bootstrap process that reached the maximum number of attempts
2	ROUTE_COST	0x0000 – 0xFFFF	The estimated route cost

Table 89. Event Indication Info: RTEBandMismatch event

#Bytes	Label	Values	Description
1	RTE_BAND	0x00 – 0x03	The Bandplan configured in the Real Time Engine

Table 90. Event Indication Info: PHYQualityRX event

#Bytes	Label	Values	Description
1	MODE	0,2,3	The address mode of the node that has sent the packet 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	PAN_ID	0-0xFFFF	The PAN ID of the node that has sent the packet
8	SRC_ADDR	-	The address of the node that has sent the packet. In case of short address, only the last 2 bytes have meaningful value
72	SNRCARRIERS	0x00–0x3F	The SNR value per each carrier in the following range 0x00: -10dB 0x3F: +53dB For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used
1	PHASEDIFF	0x0-0x5	The phase differential in multiple of 60 degrees
1	MODTYPE	0-3	Payload Modulation Type (0: Robust, 1: xBPSK, 2: xQPSK, 3: x8PSK)
1	MODSCHEME	0-1	Payload Modulation Scheme (0: Differential, 1: Coherent)
3	TONEMAP	-	ToneMap field
1	DT	0,1	Delimiter type: 0x00: start of frame without response expected 0x01: start of frame with response (ACK) expected
1	TWORSBLOCK	0,1	0: two RS blocks used

#Bytes	Label	Values	Description
			1: one RS block used
1	LQI	0x00-0xFF	The link quality indicator 0x00: -10 dB 0xFF: +53.75dB
72	NOISEPOWER	0x00-0xFF	The estimation in dBuV of the noise power for each carrier For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used
72	SIGNALPOWER	0x00-0xFF	The estimation in dBuV of the signal power for each carrier For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used

Table 91. Event Indication Info: PHYQualityTX event

#Bytes	Label	Values	Description
1	MODE	0,2,3	The address mode of the destination node 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	PAN_ID	0-0xFFFF	The PAN ID of the destination node
8	DST_ADDR	-	The destination address node. In case of short address, only the last 2 bytes have meaningful value
72	SIGNALPOWER	0x00-0xFF	The transmitted signal power in dBuV for each carrier For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used

8.42 G3LIB-MULTIPLEGET.Request

This message is used to get multiple entries from table IBs. Related confirm contains as much as possible entries based on the maximum supported command message length and table size.

Table 92. G3LIB-MULTIPLEGET.Request message payload field description

#Bytes	Label	Values	Description
4	ID	-	The attribute ID. Supported ID are the table ones
2	INDEX	-	The start index. Related confirm contains entries starting from this index

8.43 G3LIB-MULTIPLEGET.Confirm

Table 93. G3LIB-GET.Confirm message payload field description

#Bytes		Label	Values	Description
Entry 1	1	STATE	Table 25	The operation result for the first entry
	4	ID	-	The attribute ID
	2	INDEX	-	The entry index
	2	LEN	0x0–0xFFFF	The length of the VALUE field for this specific entry

#Bytes		Label	Values	Description
	Var	VALUE	-	The value of the entry
…	…	…	…	…
Entry N	1	STATE	Table 25	The operation result for the N-th entry
	4	ID	-	The attribute ID
	2	INDEX	-	The entry index
	2	LEN	0x0–0xFFFF	The length of the VALUE field for this specific entry
	Var	VALUE	-	The value of the entry

8.44 G3LIB-SNIFFER.Indication

Table 94. G3LIB-SNIFFER.Indication message payload field description

#Bytes	Label	Values	Description
1	FRAMETYPE	0x00-0x04	The frame type captured by the sniffer: • PHY layer – Data Frame: 0x00 • PHY layer – Ack Frame: 0x01 • MAC layer – Beacon Frame: 0x02 • MAC layer – Data Frame: 0x03 • MAC layer – Command Frame: 0x04 • PHY layer – RF Frame: 0x05 • MAC layer – RF Ack Frame: 0x06 • Unknown frame: 0xFF
4	TIMESTAMP	-	Free running timestamp in ms
2	PAYLOADLEN	-	The length of following PAYLOAD field
Var	PAYLOAD	-	The payload of the detected frame: • PHY DATA (Table 101) • PHY ACK (Table 104) • MAC BEACON (Table 95) • MAC DATA (Table 96) • MAC CMD (Table 97) • PHY RF (Table 107) • MAC RF ACK (Table 98)

Table 95. The G3LIB-SNIFFER.Indication MAC Beacon payload description

#Bytes	Label	Values	Description
1	SRC_ADDRMODE	0,2,3	Source Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	SRC_PANID	-	Source PAN ID
8	SRC_ADDR	-	Source address
1	DST_ADDRMODE	0,2,3	Destination Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address

#Bytes	Label	Values	Description
2	DST_PANID	-	Destination PAN ID
8	DST_ADDR	-	Destination address
1	MEDIATYPE	0x00-0x01	The media over which the frame has been received
1	LQI	0x00-0xFF	The link quality indicator
1	BSN	0x00-0xFF	Beacon Sequence Number
2	RC_COORD	-	The route cost to the coordinator

Table 96. The G3LIB-SNIFFER.Indication MAC Data payload description

#Bytes	Label	Values	Description
1	SRC_ADDRMODE	0,2,3	Source Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	SRC_PANID	-	Source PAN ID
8	SRC_ADDR	-	Source address
1	DST_ADDRMODE	0,2,3	Destination Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	DST_PANID	-	Destination PAN ID
8	DST_ADDR	-	Destination address
1	MEDIATYPE	0x00-0x01	The media over which the frame has been received
1	LQI	0x00-0xFF	The link quality indicator
1	DSN	0x00-0xFF	Data Sequence Number
1	SECURITYLEVEL	0,5	Security Level 0: no security 5: ENC-MIC32
1	KEYINDEX	0,1	The MAC key index (valid only if SECURITYLEVEL is 5)
1	QOS	0,1	Quality Of Service for channel access priority 0: Normal priority 1: High priority
2	MSDULEN	0-400	MSDU Length
Var	MSDU	-	MSDU

Table 97. The G3LIB-SNIFFER.Indication MAC Command payload description

#Bytes	Label	Values	Description
1	SRC_ADDRMODE	0,2,3	Source Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	SRC_PANID	-	Source PAN ID

#Bytes	Label	Values	Description
8	SRC_ADDR	-	Source address
1	DST_ADDRMODE	0,2,3	Destination Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	DST_PANID	-	Destination PAN ID
8	DST_ADDR	-	Destination address
1	MEDIATYPE	0x00-0x01	The media over which the frame has been received
1	LQI	0x00-0xFF	The link quality indicator
1	CMD_FRAME_ID	0x07, 0x0A	0x07: Beacon Request 0x0A: Tone Map Response
Var	CMD_PAYLOAD	-	The Command Frame payload

Table 98. The G3LIB-SNIFFER.Indication MAC RF Ack payload description

#Bytes	Label	Values	Description
1	SRC_ADDRMODE	0,2,3	Source Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	SRC_PANID	-	Source PAN ID
8	SRC_ADDR	-	Source address
1	DST_ADDRMODE	0,2,3	Destination Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	DST_PANID	-	Destination PAN ID
8	DST_ADDR	-	Destination address
1	LQI	0x00-0xFF	The link quality indicator
1	ACK_VALUE	0x00, 0x01	0x00: Positive acknowledgment 0x01: Negative acknowledgment

8.45 G3PHY-DATA.Request

Table 99. G3PHY-DATA.Request message payload field description

#Bytes	Label	Values	Description
1	TXPOWER	0x0-0x20	The transmission power (0x20: MOL, Maximum Output Level, 0x0: MOL - 32dB
1	MODTYPE	0-3	Payload Modulation Type (0: Robust, 1: xBPSK, 2: xQPSK, 3: x8PSK)
1	MODSCHEME	0-1	Payload Modulation Scheme (0: Differential, 1: Coherent)
24	PREEMPHASIS	0	Pre-emphasis value (should be set to 0)
3	TONEMAP	-	ToneMap field. Maximum value can be: 0x00003F: for Cenelec-A bandplan

#Bytes	Label	Values	Description
			0x00000F: for Cenelec-B bandplan 0xFFFFFF: for FCC bandplan
1	DT	0,1	Delimiter type: 0x00: start of frame without response expected 0x01: start of frame with response (ACK) expected
1	TWORSBLOCK	0,1	0: use two RS blocks 1: use one RS block
2	LEN	-	The length of the PAYLOAD field
Var	PAYLOAD	-	The payload of the frame to be transmitted

8.46 G3PHY-DATA.Confirm

Table 100. G3PHY-DATA.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
1	CSTHRESHOLDEV	-	The number of events that triggers the current control algorithm during the frame transmission
1	TXPOWERBEGIN	0x0-0x20	The transmission power at the begin of the frame transmission (set through the G3PHY-DATA.Request)
1	TXPOWEREND	0x0-0x20	The transmission power at the end of the frame transmission
1	THERMALWARNING	0x00-0x08	Indicate if a thermal warning occurs during the transmission: 0x0: No thermal warnings or errors 0x1: Line Driver thermal error 0x2: SoC thermal error 0x4: Line Driver thermal warning 0x8: SoC thermal warning

8.47 G3PHY-DATA.Indication

Table 101. G3PHY-DATA.Indication message payload field description

#Bytes	Label	Values	Description
72	SNRCARRIERS	0x00–0x3F	The SNR value per each carrier in the following range 0x00: -10dB 0x3F: +53dB For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used
1	PHASEDIFF	0x0-0x5	The phase differential in multiple of 60 degrees
1	MODTYPE	0-3	Payload Modulation Type (0: Robust, 1: xBPSK, 2: xQPSK, 3: x8PSK)
1	MODSCHEME	0-1	Payload Modulation Scheme (0: Differential, 1: Coherent)
3	TONEMAP	-	ToneMap field
1	DT	0,1	Delimiter type: 0x00: start of frame without response expected

#Bytes	Label	Values	Description
			0x01: start of frame with response (ACK) expected
1	TWORSBLOCK	0,1	0: two RS blocks used 1: one RS block used
1	LQI	0x00-0xFF	The link quality indicator 0x00: -10 dB 0xFF: +53.75dB
72	NOISEPOWER	0x00-0xFF	The estimation in dBuV of the noise power for each carrier For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used
72	SIGNALPOWER	0x00-0xFF	The estimation in dBuV of the signal power for each carrier For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used
2	LEN	-	The length of the PAYLOAD field
Var	PAYLOAD	-	The payload of the received frame

8.48 G3PHY-ACK.Request

Table 102. G3PHY-ACK.Request message payload field description

#Bytes	Label	Values	Description
2	FCS	0x0-0xFFFF	The FCS to be inserted in the ACK
1	DT_SSCA	-	Bits 0..2: Delimiter Type (2: ACK, 3: NACK) Bit 3: Subsequent segment collision avoidance (0:no, 1:yes) Bits 4..7: reserved, set to 0
1	CRC5_8	-	The CRC5 (less 5 significant bits) for Cenelec-A bandplan or CRC8 for FCC bandplan

8.49 G3PHY-ACK.Confirm

Table 103. G3PHY-ACK.Confirm message payload field description

#Bytes	Label	Values	Description
1	RESULT	Table 25	The operation result

8.50 G3PHY-ACK.Indication

Table 104. G3PHY-ACK.Indication message payload field description

#Bytes	Label	Values	Description
2	FCS	0x0-0xFFFF	The FCS received in the ACK
1	DT_SSCA	-	Bits 0..2: Delimiter Type (2: ACK, 3: NACK) Bit 3: Subsequent segment collision avoidance (0:no, 1:yes) Bits 4..7: reserved
1	CRC5_8	-	The CRC5 (less 5 significant bits) for Cenelec-A bandplan or CRC8 for FCC bandplan

8.51 G3PHY-RF.Request

Table 105. G3PHY-RF.Request message payload field description

#Bytes	Label	Values	Description
2	LEN	1 - 512	The length of the PAYLOAD field
Var	PAYLOAD	-	The payload of the frame to be transmitted

8.52 G3PHY-RF.Confirm

Table 106. G3PHY-RF.Confirm message payload field description

#Bytes	Label	Values	Description
1	RESULT	Table 25	The operation result

8.53 G3PHY-RF.Indication

Table 107. G3PHY-RF.Indication message payload field description

#Bytes	Label	Values	Description
1	RSSI	0x00 – 0xFF	The received signal power in steps of 1 dB, from 0 (-146 dBm) to 255 (109 dBm)
1	NOISE	0x00 – 0xFF	The measured background noise in steps of 1 dB, from 0 (-146 dBm) to 255 (109 dBm)
2	LEN	1 - 512	The length of the PAYLOAD field
Var	PAYLOAD	-	The payload of the frame to be transmitted

8.54 G3PHY-SETTRXSTATE.Request

Table 108. G3PHY-SETTRXSTATE.Request message payload field description

#Bytes	Label	Values	Description
1	TRXSTATE	0x09,0x0A	0x09: set the platform in TX 0x0A: set the platform in RX

8.55 G3PHY-SETTRXSTATE.Confirm

Table 109. G3PHY-SETTRXSTATE.Confirm message payload field description

#Bytes	Label	Values	Description
1	RESULT	Table 25	The operation result

8.56 G3PHY-CS.Request

This message doesn't contain any payload

8.57 G3PHY-CS.Confirm

Table 110. G3PHY-CS.Confirm message payload field description

#Bytes	Label	Values	Description
1	RESULT	Table 25	The operation result

8.58 G3MAC-DATA.Request

Table 111. G3MAC-DATA.Request message payload field description

#Bytes	Label	Values	Description
1	SRC_ADDRMODE	0,2,3	Source Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
1	DST_ADDRMODE	0,2,3	Destination Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	DST_PANID	-	Destination PAN ID
0,2,8	DST_ADDR	-	Destination address
2	MSDULEN	0-400	MSDU Length
0-400	MSDU	-	MSDU
1	MSDUHANDLE	0x0-0xFF	MSDU handle returned in the G3MAC-DATA.Confirm
1	TXOPTIONS	0x0-0xFF	TX option bit mask b0: 0 ACK not requested – 1 ACK requested b1-7: not used
1	SECURITYLEVEL	0,5	Security Level 0: no security 5: ENC-MIC32
1	KEYINDEX	0,1	The MAC key index (valid only if SECURITYLEVEL is 5)
1	QOS	0,1	Quality Of Service for channel access priority 0: Normal priority 1: High priority
1	MEDIATYPE	0x00 – 0x03	The channel over which the frame has to be transmitted (0x00 PLC, 0x01 RF, 0x02 PLC 1st option, 0x03 RF 1st option)

8.59 G3MAC-DATA.Confirm

Table 112. G3MAC-DATA.Confirm message payload field description

#Bytes	Label	Values	Description
1	MSDUHANDLE	0x0-0xFF	MSDU handle used in the G3MAC-DATA.Request

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
4	TIMESTAMP	-	Free running timestamp in ms
1	MEDIATYPE	0x00 – 0x01	The channel over which the frame has been transmitted

8.60 G3MAC-DATA.Indication

Table 113. G3MAC-DATA.Indication message payload field description

#Bytes	Label	Values	Description
1	SRC_ADDRMODE	0,2,3	Source Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	SRC_PANID	-	Source PAN ID
0,2,8	SRC_ADDR	-	Source address
1	DST_ADDRMODE	0,2,3	Destination Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	DST_PANID	-	Destination PAN ID
0,2,8	DST_ADDR	-	Destination address
2	MSDULEN	0-400	MSDU Length
0-400	MSDU	-	MSDU
1	DSN	0x0-0xFF	Destination Sequence Number
4	TIMESTAMP	-	Free running timestamp in ms
1	SECURITYLEVEL	0,5	Security Level 0: no security 5: ENC-MIC32
1	KEYINDEX	0,1	The MAC key index (valid only if SECURITYLEVEL is 5)
1	QOS	0,1	Quality Of Service for channel access priority 0: Normal priority 1: High priority
72	SNRCARRIERS	0x00–0x3F	The SNR value per each carrier in the following range 0x00: -10dB 0x3F: +53dB For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used
1	PHASEDIFF	0x0-0x5	The phase differential in multiple of 60 degrees
1	MODTYPE	0-3	Payload Modulation Type (0: Robust, 1: xBPSK, 2: xQPSK, 3: x8PSK)
1	MODSCHEME	0-1	Payload Modulation Scheme (0: Differential, 1: Coherent)
3	TONEMAP	-	ToneMap field
1	DT	0,1	Delimiter type:

#Bytes	Label	Values	Description
			0x00: start of frame without response expected 0x01: start of frame with response (ACK) expected
1	TWORSBLOCK	0,1	0: two RS blocks used 1: one RS block used
1	LQI	0x00-0xFF	The link quality indicator 0x00: -10 dB 0xFF: +53.75dB
72	NOISEPOWER	0x00-0xFF	The estimation in dBuV of the noise power for each carrier For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used
72	SIGNALPOWER	0x00-0xFF	The estimation in dBuV of the signal power for each carrier For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used
1	MEDIATYPE	0x00-0x01	The medium over which the frame has been received

8.61 G3MAC-BCNNOTIFY.Indication

Table 114. G3MAC-BCNNOTIFY.Indication message payload field description

#Bytes	Label	Values	Description
2	PANID	-	PAN ID of the received beacon
2	LBA_ADDR	-	The 16-bit short address of the LBA
2	RC_COORD	-	The route cost from the LBA to the coordinator
72	SNRCARRIERS	0x00–0x3F	The SNR value per each carrier in the following range 0x00: -10dB 0x3F: +53dB For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used
1	PHASEDIFF	0x0-0x5	The phase differential in multiple of 60 degrees
1	MODTYPE	0-3	Payload Modulation Type (0: Robust, 1: xBPSK, 2: xQPSK, 3: x8PSK)
1	MODSCHEME	0-1	Payload Modulation Scheme (0: Differential, 1: Coherent)
3	TONEMAP	-	ToneMap field
1	DT	0,1	Delimiter type: 0x00: start of frame without response expected 0x01: start of frame with response (ACK) expected
1	TWORSBLOCK	0,1	0: two RS blocks used 1: one RS block used
1	LQI	0x00-0xFF	The link quality indicator 0x00: -10 dB 0xFF: +53.75dB
72	NOISEPOWER	0x00-0xFF	The estimation in dBuV of the noise power for each carrier For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used

#Bytes	Label	Values	Description
72	SIGNALPOWER	0x00-0xFF	The estimation in dBuV of the signal power for each carrier For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used
1	MEDIATYPE	0x00-0x01	The medium over which the frame has been received

8.62 G3MAC-RESET.Request

Table 115. G3MAC-RESET.Request message payload field description

#Bytes	Label	Values	Description
1	SETDEFAULTPIB	0,1	Set MAC PIB to the default value 0: maintain the current PIB values 1: reset the PIB values to their default

8.63 G3MAC-RESET.Confirm

Table 116. G3MAC-RESET.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.64 G3MAC-SCAN.Request

Table 117. G3MAC-SCAN.Request message payload field description

#Bytes	Label	Values	Description
1	SCANTYPE	1	Type of scan procedure 1: Active scan (the only supported type)
1	SCANDURATION	0x0-0xFF	Duration of the scan procedure in seconds

8.65 G3MAC-SCAN.Confirm

Table 118. G3MAC-SCAN.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
1	SCANTYPE	1	Type of scan procedure 1: Active scan (the only supported type)

8.66 G3MAC-COMMSTATUS.Indication

Table 119. G3MAC-COMMSTATUS.Indication message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
1	SRC_ADDRMODE	0,2,3	Source Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	SRC_PANID	-	Source PAN ID
0,2,8	SRC_ADDR	-	Source address
1	DST_ADDRMODE	0,2,3	Destination Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	DST_PANID	-	Destination PAN ID
0,2,8	DST_ADDR	-	Destination address
1	SECURITYLEVEL	0,5	Security Level 0: no security 5: ENC-MIC32
1	KEYIDMODE	-	The MAC Key ID mode
1	KEYINDEX	0,1	The MAC key index (valid only if SECURITYLEVEL is 5)
1	LQI	0x00-0xFF	The link quality indicator 0x00: -10 dB 0xFF: +53.75dB
72	SNRCARRIERS	0x00–0x3F	The SNR value per each carrier in the following range 0x00: -10dB 0x3F: +53dB For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used
1	MEDIATYPE	0x00-0x01	The medium over which the frame has been received

8.67 G3MAC-START.Request

Table 120. G3MAC-START.Request message payload field description

#Bytes	Label	Values	Description
2	PANID	-	The PAN ID to be used to form the new network

8.68 G3MAC-START.Confirm

Table 121. G3MAC-START.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.69 G3ADP-DATA.Request

Table 122. G3ADP-DATA.Request message payload field description

#Bytes	Label	Values	Description
2	NDULEN	0-1500	The NSDU length
1	NSDUHANDLE	0x0-0xFF	NSDU handle returned in the G3ADP-DATA.Confirm
1	DISCOVERYROUTE	0,1	Discovery the route option 0: do not discover the route 1: discover the route if not present or in case of repair
1	QOS	0,1	Quality Of Service for channel access priority 0: Normal priority 1: High priority
0-1500	NSDU	-	The IPv6 packet

8.70 G3ADP-DATA.Confirm

Table 123. G3ADP-DATA.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
1	NSDUHANDLE	0x0-0xFF	NSDU handle used in the G3ADP-DATA.Request
1	NEXTHOPMEDIUM	0x00-0x01	The medium over which the frame has been transmitted to the Next Hop (valid only in Route Over transmissions)

8.71 G3ADP-DATA.Indication

Table 124. G3ADP-DATA.Indication message payload field description

#Bytes	Label	Values	Description
2	NDULEN	0-1500	The NSDU length
1	PREVHOP_ADDRMODE	0,2,3	Previous hop Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	PREVHOP_PANID	-	Previous hop PAN ID
0,2,8	PREVHOP_ADDR	-	Previous hop address

#Bytes	Label	Values	Description
1	LQI	0x0-0xFF	The link quality indicator 0x00: -10 dB 0xFF: +53.75dB
1	PHASEDIFF	0x0-0x5	The phase differential in multiple of 60 degrees
1	MODTYPE	0-3	Payload Modulation Type (0: Robust, 1: xBPSK, 2: xQPSK, 3: x8PSK)
1	MODSCHEME	0-1	Payload Modulation Scheme (0: Differential, 1: Coherent)
3	TONEMAP	-	ToneMap field
1	BC0NUM	0-6	The number of BC0 field (0 if unicast reception)
0-6	BC0	-	List of Broadcast Sequence Numbers
1	PREVHOPMEDIUM	0x00-0x01	The medium on which the frame has been received from the Next Hop (valid only in Route Over transmissions)
0-1500	NSDU	-	The received IPv6 packet

8.72 G3ADP-DISCOVERY.Request

Table 125. G3ADP-DISCOVERY.Request message payload field description

#Bytes	Label	Values	Description
1	DURATION	0x0-0xFF	Duration of the discovery procedure in seconds

8.73 G3ADP-DISCOVERY.Confirm

Table 126. PAN Descriptor structure

Label	Len	Description
PanID	2	The 16-bit PAN identifier
LinkQuality	1	The 8-bit Link Quality of LBA
LBAAddress	2	The 16/bit short address of a device in this PAN to be used as the LBA by the associating device
RouteCost	2	The estimated route cost
MEDIATYPE	1	The medium over which the PAN Descriptor has been received

Table 127. G3ADP-DISCOVERY.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
1	PANCOUNT	0-64	The number of PAN descriptors
0-8* PANCOUNT	PANDESCRLIST	-	List of PAN descriptors (format in Table 126)

8.74 G3ADP-NETSTART.Request

Table 128. G3ADP-NETSTART.Request message payload field description

#Bytes	Label	Values	Description
2	PANID	-	The PAN ID to be used to form the new network

8.75 G3ADP-NETSTART.Confirm

Table 129. G3ADP-NETSTART.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.76 G3ADP-NETJOIN.Request

Table 130. G3ADP-NETJOIN.Request message payload field description

#Bytes	Label	Values	Description
2	PANID	-	The PAN ID of the network to join
2	LBA_ADDR	-	The 16-bit short address of the LBA to be used to join the network
1	MEDIATYPE	0x00-0x01	The available medium to the bootstrap agent

8.77 G3ADP-NETJOIN.Confirm

Table 131. G3ADP-NETJOIN.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
2	NETWORKADDR	-	The 16-bit short address assigned to this node (0xFFFF if not joint)
2	PANID	-	The joined network PAN ID

8.78 G3ADP-NETLEAVE.Request

This message doesn't contain any payload.

8.79 G3ADP-NETLEAVE.Confirm

Table 132. G3ADP-NETLEAVE.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.80 G3ADP-NETLEAVE.Indication

This message doesn't contain any payload.

8.81 G3ADP-RESET.Request

This message doesn't contain any payload.

8.82 G3ADP-RESET.Confirm

Table 133. G3ADP-RESET.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.83 G3ADP-NETSTATUS.Indication

Table 134. G3ADP-NETSTATUS.Indication message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
1	SRC_ADDRMODE	0,2,3	Source Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	SRC_PANID	-	Source PAN ID
0,2,8	SRC_ADDR	-	Source address
1	DST_ADDRMODE	0,2,3	Destination Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	DST_PANID	-	Destination PAN ID
0,2,8	DST_ADDR	-	Destination address
1	SECURITYLEVEL	0,5	Security Level 0: no security 5: ENC-MIC32
1	KEYIDMODE	-	The MAC Key ID mode
1	KEYINDEX	0,1	The MAC key index (valid only if SECURITYLEVEL is 5)
1	LQI	0x00-0xFF	The link quality indicator 0x00: -10 dB 0xFF: +53.75dB
72	SNRCARRIERS	0x00–0x3F	The SNR value per each carrier in the following range 0x00: -10dB 0x3F: +53dB For Cenelc-A bandplan only the first 36 values are used. For Cenelc-B bandplan only the first 16 values are used

8.84 G3ADP-ROUTEDISCOVERY.Request

Table 135. G3ADP-ROUTEDISCOVERY.Request message payload field description

#Bytes	Label	Values	Description
2	DSTADDR	-	The 16 bits short address of the final destination node
1	MAXHOPS	1-15	The maximum number of hops
2	NEXTHOP	0x0000 – 0xFFFF	The Next Hop - if already known - to which the RREQ will be transmitted. If the NextHop is set to the 0xFFFF the standard procedure will take place
1	MEDIATYPE	0x00-0x01	The NextHop media type (ignored if NextHop is 0xFFFF)

8.85 G3ADP-ROUTEDISCOVERY.Confirm

Table 136. G3ADP-ROUTEDISCOVERY.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
2	DSTADDR	-	The 16 bits short address of the final destination node
2	NEXTHOP	-	The 16 bits short address of the next hop
2	ROUTECOST	0x0000 – 0xFFFF	The computed route cost to reach the final destination
1	HOPCNT / WEAKLINK	-	Bit 0..3: Hop count, Bit 4..7: Weak link count
2	VALIDTIME	0x0000 – 0xFFFF	The remaining time for which the routing entry to the final destination is valid
1	MEDIATYPE	0x00-0x01	The next hop media type

8.86 G3ADP-PATHDISCOVERY.Request

Table 137. G3ADP-PATHDISCOVERY.Request message payload field description

#Bytes	Label	Values	Description
2	DSTADDR	-	The 16 bits short address of the final destination node
1	PATHMETRICTYPE	1-15	The metric type to be used for link and rout cost evaluation during this path discovery: 0: hop count 14: capacity metric type 15: G3 composite metric type

8.87 G3ADP-PATHDISCOVERY.Confirm

Table 138. G3ADP-PATHDISCOVERY.Confirm message payload field description

#Bytes	Label	Values	Description
2	DSTADDR	-	The 16 bits short address of the final destination node
1	STATUS	Table 25	The operation result
2	PATHMETRICTYPE_RSV	-	Bitmask: b0..3: PATHMETRICTYPE as specified in the request

#Bytes	Label	Values	Description
			b4..15: reserved
2	ORIG	-	The 16 bits short address of the originator node
0-120	HOP_INFO	-	List of the hop info. Each hop info has the structure reported in Table 139

Table 139. Path discovery hop info field

#Bytes	Label	Values	Description
2	ADDR	-	The 16 bits short address the hop
1	RSV_MNS	-	Bitmask: b0..1: Reserved b2: MTx (Medium over which a PREQ/PREP message should be transmitted) b3: MRx (Medium over which a PREQ/PREP message has been received) b4..6: Phase differential b7: MNS (0: metric supported by the node, 1: metric is not supported by the node)
1	LINKCOST	0x0-0xFF	The link cost for this hop

8.88 G3ADP-LBP.Request

Table 140. G3ADP-LBP.Request message payload field description

#Bytes	Label	Values	Description
1	DST_ADDRMODE	0,2,3	Destination Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	DST_PANID	-	Destination PAN ID
0,2,8	DST_ADDR	-	Destination address
2	NDULEN	0-400	The LBP NSDU length
0-400	NSDU	-	The LBP control packet message
1	NSDUHANDLE	0x0-0xFF	NSDU handle returned in the G3ADP-LBP.Confirm
1	MAXHOPS	1-15	The maximum number of hops
1	DISCOVERYROUTE	0,1	Discovery the route option 0: do not discover the route 1: discover the route if not present or in case of repair
1	QOS	0,1	Quality Of Service for channel access priority 0: Normal priority 1: High priority
1	SECURITYENABLED	0,1	Security enabled flag 0: security disabled 1: security enabled
1	MEDIATYPE	0x00-0x01	The next hop media type (valid if LOADng is disabled or if the destination is an EUI64 address)

8.89 G3ADP-LBP.Confirm

Table 141. G3ADP-LBP.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
1	NSDUHANDLE	0x0-0xFF	NSDU handle used in the G3ADP-LBP.Request
1	MEDIATYPE	0x00-0x01	The medium over which the frame has been transmitted

8.90 G3ADP-LBP.Indication

Table 142. G3ADP-LBP.Indication message payload field description

#Bytes	Label	Values	Description
1	SRC_ADDRMODE	0,2,3	Source Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	SRC_PANID	-	Source PAN ID
0,2,8	SRC_ADDR	-	Source address
2	NDULEN	0-400	The LBP NSDU length
0-400	NSDU	-	The received LBP control packet message
1	LQI	0x00-0xFF	The link quality indicator 0x00: -10 dB 0xFF: +53.75dB
1	SECURITYENABLED	0,1	Security enabled flag 0: message received without security 1: message received with security
1	MEDIATYPE	0x00-0x01	The previous hop media type (valid if LOADng is disabled or if the destination is an EUI64 address)

8.91 G3ADP-ROUTEOVER-DATA.Request

Table 143. G3ADP-DATA.Request message payload field description

#Bytes	Label	Values	Description
2	NDULEN	0-1500	The NSDU length
1	NSDUHANDLE	0x0-0xFF	NSDU handle returned in the G3ADP-DATA.Confirm
1	NEXTHOP_ADDRMODE	0,2,3	Next hop Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	NEXTHOP _PANID	-	Next hop PAN ID
0,2,8	NEXTHOP _ADDR	-	Next hop address

#Bytes	Label	Values	Description
1	ACKREQ	0,1	Acknowledgement request flag 0: ACK not required 1: ACK required
1	QOS	0,1	Quality Of Service for channel access priority 0: Normal priority 1: High priority
1	NEXTHOPMEDIA	0x00-0x01	The medium over which the frame has to be transmitted to the Next Hop
0-1500	NSDU	-	The IPv6 packet

8.92 G3ADP-ROUTEDELETE.Request

Table 144. G3ADP-ROUTEDELETE.Request message payload field description

#Bytes	Label	Values	Description
2	FINAL_DSTADDR	-	Final destination address for which the route should be deleted

8.93 G3ADP-ROUTEDELETE.Confirm

Table 145. G3ADP-ROUTEDELETE.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
2	FINAL_DSTADDR	-	Final destination address for which the route has been deleted

8.94 G3BOOT-SRV-START.Request

Table 146. G3BOOT-SRV-START.Request message payload field description

#Bytes	Label	Values	Description
2	SRVADDR	-	The 16-bits short address of the server
2	PANID	-	The PAN ID of the network to start
1	REQTYPE	0,1	Request Type: 0: Normal start 1: Fast Restore start

8.95 G3BOOT-SRV-START.Confirm

Table 147. G3BOOT-SRV-START.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.96 G3BOOT-SRV-STOP.Request

This message doesn't contain any payload.

8.97 G3BOOT-SRV-STOP.Confirm

Table 148. G3BOOT-SRV-STOP.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.98 G3BOOT-SRV-LEAVE.Indication

Table 149. G3BOOT-SRV-LEAVE.Indication message payload field description

#Bytes	Label	Values	Description
8	EXTENDEDADDR	-	The extended address of the node that has left the network

8.99 G3BOOT-SRV-KICK.Request

Table 150. G3BOOT-SRV-KICK.Request message payload field description

#Bytes	Label	Values	Description
8	EXTENDEDADDR	-	The extended address of the node to be kicked from the network
2	SHORTADDR	-	The short address of the node to be kicked from the network

8.100 G3BOOT-SRV-KICK.Confirm

Table 151. G3BOOT-SRV-KICK.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.101 G3BOOT-SRV-JOIN.Indication

Table 152. G3BOOT-SRV-JOIN.Confirm message payload field description

#Bytes	Label	Values	Description
8	EXTENDEDADDR	-	The extended address of the node that has joint the network
2	SHORTADDR	-	The short address of the node that has joint the network

8.102 G3BOOT-SRV-GETPSK.Indication

Table 153. G3BOOT-SRV-GETPSK.Indication message payload field description

#Bytes	Label	Values	Description
8	EXTENDEDADDR	-	The extended address of the node that is joining the network
1	IDP_LEN	1-36	The length of the EAP peer NAI (IdP)
36	IDP	-	The EAP peer NAI (IdP) – only first IDP_LEN bytes are useful

8.103 G3BOOT-SRV-SETPSK.Request

Table 154. G3BOOT-SRV-SETPSK.Request message payload field description

#Bytes	Label	Values	Description
8	EXTENDEDADDR	-	The extended address of the node that is joining the network
16	PSK	-	The PSK to be used for the EAP-PSK exchange with the device identified by EXTENDEDADDR
2	SHORTADDR	0-7FFF, 0xFFFF	The short address to be assigned to the device identified by EXTENDEDADDR. If it set the 0xFFFF the device is refused

8.104 G3BOOT-SRV-SETPSK.Confirm

Table 155. G3BOOT-SRV-SETPSK.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.105 G3BOOT-DEV-START.Request

Table 156. G3BOOT-DEV-START.Request message payload field description

#Bytes	Label	Values	Description
1	REQTYPE	0,1	Request Type: 0: Normal start 1: Fast Restore start

8.106 G3BOOT-DEV-START.Confirm

Table 157. G3BOOT-DEV-START.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
2	NETWORKADDR	-	The assigned 16-bit short address (0xFFFF if not joint)
2	PANID	-	The joint PAN ID

8.107 G3BOOT-DEV-LEAVE.Request

This message doesn't contain any payload.

8.108 G3BOOT-DEV-LEAVE.Confirm

Table 158. G3BOOT-DEV-LEAVE.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.109 G3BOOT-DEV-LEAVE.Indication

This message doesn't contain any payload.

8.110 G3BOOT-DEV-PANSORT.Indication

Table 159. G3BOOT-DEV-PANSORT.Indication message payload field description

#Bytes	Label	Values	Description
1	PANCOUNT	0-64	The number of PAN descriptors
0-8* PANCOUNT	PANDESCRLIST	-	List of PAN descriptors (format in Table 126)

8.111 G3BOOT-DEV-PANSORT.Request

Table 160. G3BOOT-DEV-PANSORT.Request message payload field description

#Bytes	Label	Values	Description
1	PANCOUNT	0-64	The number of PAN descriptors
0-8* PANCOUNT	PANDESCRLIST	-	List of PAN descriptors (format in Table 126

8.112 G3BOOT-DEV-PANSORT.Confirm

Table 161. G3BOOT-DEV-PANSORT.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.113 G3UDP-DATA.Request

Table 162. G3UDP-DATA.Request message payload field description

#Bytes	Label	Values	Description
1	HANDLE	0x0-0xFF	Handle returned in the G3UDP-DATA.Confirm
1	CONNID	0x0-0xFF	The ID of the connection to be used to send data

#Bytes	Label	Values	Description
16	DESTADDR	-	The IPv6 destination address (if set to all 0s the RemoteAddress and RemotePort of the UDP connection are used)
2	DESTPORT	0x0 – 0xFFFF	The UDP destination port (if set to 0 the RemotePort of the UDP connection is used)
2	DATALEN	0-1500	The UDP payload length
0-1500	DATA	-	The UDP payload

8.114 G3UDP-DATA.Confirm

Table 163. G3UDP-DATA.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
1	HANDLE	0x0-0xFF	The handle used in the G3UDP-DATA.Request
1	NEXTHOPMEDIUM	0x00-0x04	The medium over which the frame has been transmitted to the Next Hop

8.115 G3UDP-DATA.Indication

Table 164. G3UDP-DATA.Indication message payload field description

#Bytes	Label	Values	Description
1	PREVHOP_ADDRMODE	0,2,3	Previous hop Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	PREVHOP_PANID	-	Previous hop PAN ID
0,2,8	PREVHOP_ADDR	-	Previous hop address
1	LQI	0x0-0xFF	The link quality indicator 0x00: -10 dB 0xFF: +53.75dB
1	PHASEDIFF	0x0-0x5	The phase differential in multiple of 60 degrees
1	MODTYPE	0-3	Payload Modulation Type (0: Robust, 1: xBPSK, 2: xQPSK, 3: x8PSK)
1	MODSCHEME	0-1	Payload Modulation Scheme (0: Differential, 1: Coherent)
3	TONEMAP	-	ToneMap field
1	BC0NUM	0-6	The number of BC0 field (0 if unicast reception)
0-6	BC0	-	List of Broadcast Sequence Numbers
1	PREVHOP_MEDIA	0x00-0x01	The medium on which the frame has been received from the Previous hop
1	CONNID	0x0-0xFF	The ID of the connection on which data has been received
16	SRCADDR	-	The 16 bytes IPv6 source address
2	SRCPORT	-	The UDP source port
16	DSTADDR	-	The 16 bytes IPv6 destination address
2	DSTPORT	-	The UDP destination port
2	DATALEN	0-1500	The UDP payload length

#Bytes	Label	Values	Description
0-1500	DATA	-	The UDP payload

8.116 G3UDP-CONN-SET.Request

Table 165. G3UDP-CONN-SET.Request message payload field description

#Bytes	Label	Values	Description
1	CONNID	0x0-0xA	The ID assigned to this specific connection
16	REMOTEADDR	-	The 16 bytes IPv6 remote address. If all 0s accept data from any source
2	REMOTEPORT	-	The UDP remote port. If 0 accept data from any port
2	LOCALPORT	-	The UDP local port used to transmit data

8.117 G3UDP-CONN-SET.Confirm

Table 166. G3UDP-CONN-SET.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result

8.118 G3UDP-CONN-GET.Request

Table 167. G3UDP-CONN-GET.Request message payload field description

#Bytes	Label	Values	Description
1	CONNID	-	The ID of the connection

8.119 G3UDP-CONN-GET.Confirm

Table 168. G3UDP-CONN-REG.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
1	CONNID	0x0-0xFF	The ID assigned to this specific connection
16	REMOTEADDR	-	The 16 bytes IPv6 remote address. If all 0s accept data from any source
2	REMOTEPORT	-	The UDP remote port. If 0 accept data from any port
2	LOCALPORT	-	The UDP local port used to transmit data

8.120 G3ICMP-ECHO.Request

Table 169. G3ICMP-ECHO.Request message payload field description

#Bytes	Label	Values	Description
16	DESTADDR	-	The 16 bytes IPv6 remote destination address
1	HANDLE	0x0-0xFF	Handle returned in the G3ICMP-ECHO.Confirm
2	DATALEN	0-1500	The ECHO request payload length
0-1500	DATA	-	The ECHO request payload

8.121 G3ICMP-ECHO.Confirm

Table 170. G3ICMP-ECHO.Confirm message payload field description

#Bytes	Label	Values	Description
1	STATUS	Table 25	The operation result
1	HANDLE	0x0-0xFF	The handle used in the G3ICMP-ECHO.Request
1	NEXTHOPMEDIUM	0x00-0x04	The medium over which the frame has been transmitted to the Next Hop

8.122 G3ICMP-ECHOREP.Indication

Table 171. G3ICMP-ECHOREP.Indication message payload field description

#Bytes	Label	Values	Description
1	PREVHOP_ADDRMODE	0,2,3	Previous hop Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	PREVHOP_PANID	-	Previous hop PAN ID
0,2,8	PREVHOP_ADDR	-	Previous hop address
1	LQI	0x0-0xFF	The link quality indicator 0x00: -10 dB 0xFF: +53.75dB
1	PHASEDIFF	0x0-0x5	The phase differential in multiple of 60 degrees
1	MODTYPE	0-3	Payload Modulation Type (0: Robust, 1: xBPSK, 2: xQPSK, 3: x8PSK)
1	MODSCHEME	0-1	Payload Modulation Scheme (0: Differential, 1: Coherent)
3	TONEMAP	-	ToneMap field
1	BC0NUM	0-6	The number of BC0 field (0 if unicast reception)
0-6	BC0	-	List of Broadcast Sequence Numbers
1	PREVHOP_MEDIA	0x00-0x01	The medium on which the frame has been received from the Previous hop
16	SRCADDR	-	The 16 bytes IPv6 remote source address
2	DATALEN	0-1500	The received ECHO request payload length
0-1500	DATA	-	The received ECHO request payload

8.123 G3ICMP-ECHOREQ.Indication

Table 172. G3ICMP-ECHOREQ.Indication message payload field description

#Bytes	Label	Values	Description
1	PREVHOP_ADDRMODE	0,2,3	Previous hop Address Mode 0: no source address 2: 16 bits short address 3: 64 bits extended address
2	PREVHOP_PANID	-	Previous hop PAN ID
0,2,8	PREVHOP_ADDR	-	Previous hop address
1	LQI	0x0-0xFF	The link quality indicator 0x00: -10 dB 0xFF: +53.75dB
1	PHASEDIFF	0x0-0x5	The phase differential in multiple of 60 degrees
1	MODTYPE	0-3	Payload Modulation Type (0: Robust, 1: xBPSK, 2: xQPSK, 3: x8PSK)
1	MODSCHEME	0-1	Payload Modulation Scheme (0: Differential, 1: Coherent)
3	TONEMAP	-	ToneMap field
1	BC0NUM	0-6	The number of BC0 field (0 if unicast reception)
0-6	BC0	-	List of Broadcast Sequence Numbers
1	PREVHOP_MEDIA	0x00-0x01	The medium on which the frame has been received from the Previous hop
16	SRCADDR	-	The 16 bytes IPv6 remote source address
2	DATALEN	0-1500	The received ECHO request payload length
0-1500	DATA	-	The received ECHO request payload

8.124 ERROR.Indication

Table 173. ERROR.Indication message payload field description

#Bytes	Label	Values	Description
0-1024	DATA	-	Additional data

Note: This message may be also sent before the internal Watchdog or error routines perform a HW reset.

9 G3 Protocol Information Base

Table 174. G3Protocol Information Base

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
BOOT_DEVICE_DISCOVERY_TIME	0x00001000	x	0x0010	0x0010	0x0010	RW	0x0000	0xFFFF	2	bootDeviceDiscoveryTime: The duration in seconds of the active scan performed by internal bootstrap application protocol
BOOT_DEVICE_RESERVED1	0x00001001		0x00	0x00	0x00	RW	0x00	0x00	1	bootDeviceReserverd1: Unused attribute
BOOT_DEVICE_RESERVED2	0x00001002		0x00	0x00	0x00	RW	0x00	0x00	1	bootDeviceReserverd2: Unused attribute
BOOT_DEVICE_RESERVED3	0x00001003		0x00	0x00	0x00	RW	0x00	0x00	1	bootDeviceReserverd3: Unused attribute
BOOT_DEVICE_RESERVED4	0x00001004		0x00	0x00	0x00	RW	0x00	0x00	1	bootDeviceReserverd4: Unused attribute
BOOT_DEVICE_RESERVED5	0x00001005		0x00	0x00	0x00	RW	0x00	0x00	1	bootDeviceReserverd5: Unused attribute
BOOT_DEVICE_RESERVED6	0x00001006		0x00	0x00	0x00	RW	0x00	0x00	1	bootDeviceReserverd6: Unused attribute
BOOT_DEVICE_LQI_THRESHOLD	0x00001007	x	0x0034	0x0034	0x0034	RW	0x0000	0xFFFF	2	bootDeviceLQIThreshold: The LQI value below which the received PAN descriptors are ignored by internal bootstrap protocol
BOOT_DEVICE_START_WAIT_TIME	0x00001008	x	0x0004	0x0004	0x0004	RW	0x0000	0xFFFF	2	bootDeviceStartWaitTime: The time (in seconds) that the internal bootstrap application waits before starting the discovery process after the reset
BOOT_DEVICE_OPTIONS	0x00001009	x	0x00000001	0x00000001	0x00000001	RW	0x00000000	0xFFFFFFFF	4	bootDeviceOptions: 32-bit bitmask to define some options in the bootstrap process b0: start a route discovery process to the coordinator just after the network join b1: reserved b2: emulate Linky bootstrap
BOOT_DEVICE_ASSOCIATIONMAXRETRIES	0x0000100A	x	0x05	0x05	0x05	RW	0x01	0xFF	1	bootDeviceAssociationMaxRetries: the number of times the internal bootstrap application tries to associate with the same LBA
BOOT_DEVICE_ASSOCIATIONRANDWAITTIME	0x0000100B	x	0x02	0x02	0x02	RW	0x00	0xFF	1	bootDeviceAssociationRandWaitTime: the random time window before the internal bootstrap application trying to attempt to the same LBA

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
BOOT_DEVICE_ASSOCIATIONALTPAN	0x0000100C	x	0x01	0x01	0x01	RW	0x00	0x01	1	bootDeviceAssociationAltPan: Indicate if the internal bootstrap application may start the joining procedure for any PAN (1) or only the first found (0)
BOOT_DEVICE_LASTUSEDLBA	0x0000100D	x	0xFFFF	0xFFFF	0xFFFF	RW	0x0000	0xFFFF	2	bootDeviceLastUsedLBA: The 16-bits Short Address of the last used LBA
BOOT_DEVICE_PROCESS_STATE	0x0000100F	x	0x00	0x00	0x00	RW	0x00	0xFF	1	bootDeviceProcessState: Indicates the state of the bootstrap process
BOOT_SERVER_START_WAIT_TIME	0x00001010	x	0x0004	0x0004	0x0004	RW	0x0000	0xFFFF	2	bootServerStartWaitTime: The time (in seconds) that the internal bootstrap serverapplication waits before starting the discovery process after the reset
BOOT_SERVER_DEFAULT_MAX_HOPS	0x00001011	x	0x000E	0x000E	0x000E	RW	0x0000	0xFFFF	2	bootServerDefaultMaxHops: The default MaxHops value used in LBP messages sent from the internal bootstrap server application
BOOT_SERVER_DISCOVERY_TIME	0x00001012	x	0x0010	0x0010	0x0010	RW	0x0000	0xFFFF	2	bootServerDiscoveryTime: The duration in seconds of the active scan performed by internal bootstrap server application protocol
BOOT_SERVER_FORCE_PAN_START	0x00001013	x	0x0001	0x0001	0x0001	RW	0x0000	0xFFFF	2	bootServerForcePanStart: If True (0x01) force the start of the bootstrap server (LBS), without taking into account the beacon caught during the discovery
BOOT_SERVER_IDS	0x00001014	x	0x00…00	0x00…00	0x00…00		0x00…00	0xFF…FF	36	bootServer_ID_S: the NAI
BOOT_SERVER_IDS_LEN	0x00001015	x	0x00	0x00	0x00		0x00	0x24	1	bootServer_ID_S: the NAI length
BOOT_DEVICE_PANSORT_TIMEOUT	0x00001016	x	0x0BB8	0x0BB8	0x0BB8	RW	0x0000	0xFFFF	2	bootDevicePANSortTimeout: The time (in milliseconds) that the internal bootstrap application waits for the external host the device PAN description sorting results before sorting by itself the descriptors
BOOT_SERVER_PSKGET_TIMEOUT	0x00001017	x	0x03E8	0x03E8	0x03E8	RW	0x0000	0xFFFF	2	bootServerPSKGetTimeout: The time (in milliseconds) that the internal bootstrap server application waits for the external host to send the PSK to be used for the joining node before starting to use the default one
BOOT_SERVER_JOININGIGNORETIME	0x00001018		0x01F4	0x01F4	0x01F4	RW	0x0000	0xFFFF	2	bootServerJoiningIgnoreTime: After the first Joining message from an LBD, ignore the following ones for the duration of this time (in milliseconds)

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
BOOT_SERVER_JOININGTABLEENTRYTTL	0x00001019	x	0x28	0x28	0x28	RW	0x0000	0x03FF	2	bootServerJoiningTableEntryTTL: Time (in seconds) after which an entry in the Joining Table is considered expired and may be reused by the server to allow other parallel joining procedures
ADP_SECURITYLEVEL_ID	0x00000000	x	0x05	0x05	0x05	RW	0x00	0x05	1	adpSecurityLevel standard defined G3 attribute
ADP_PREFIXTABLE_ID	0x00000001	x	NA	NA	NA	NA	NA	NA		adpPrefixTable standard defined G3 attribute
ADP_BROADCASTLOGTABLEENTRYTTL_ID	0x00000002	x	0x3C	0x3C	0x3C	RW	0x0001	0xFFFF	2	adpBroadcastLogTableEntryTTL standard defined G3 attribute
ADP_METRICTYPE_ID	0x00000003	x	0x0F	0x0F	0x0F	RW	0x00	0x0F	1	adpMetricType standard defined G3 attribute
ADP_LOWLQIVALUE_ID	0x00000004	x	0x00	0x00	0x00	RW	0x00	0xFF	1	adpLowLQIValue standard defined G3 attribute
ADP_HIGHLQIVALUE_ID	0x00000005	x	0xFF	0xFF	0xFF	RW	0x00	0xFF	1	adpHighLQIValue standard defined G3 attribute
ADP_RREPWAIT_ID	0x00000006	x	0x04	0x04	0x04	RW	0x00	0xFF	1	adpRREPWait Attribute. standard defined G3 attribute. If set to zero the randomization based on hop count and adpRREPWaitTime takes place
ADP_CONTEXTINFORMATIONTABLE_ID	0x00000007	x	NA	NA	NA	NA	NA	NA		adpContextInformationTable standard defined G3 attribute
ADP_COORDSHORTADDRESS_ID	0x00000008	x	0x00	0x00	0x00	RW	0x0000	0x7FFF	2	adpCoordShortAddress standard defined G3 attribute
ADP_RLCENABLED_ID	0x00000009	x	0x00	0x00	0x00	RW	0x00	0x01	1	adpRLCEnabled standard defined G3 attribute
ADP_ADDREVLINKCOST	0x0000000A	x	0x00	0x00	0x00	RW	0x00	0x7F	1	adpAddRevLinkCost standard defined G3 attribute
ADP_BROADCASTLOGTABLE_ID	0x0000000B	x	NA	NA	NA	NA	NA	NA		adpBroadcastLogTable standard defined G3 attribute
ADP_ROUTINGTABLE_ID	0x0000000C	x	NA	NA	NA	NA	NA	NA		adpRoutingTable standard defined G3 attribute
ADP_UNICASTRREQGENENABLE_ID	0x0000000D	x	0x01	0x01	0x01	RW	0x00	0x01	1	adpUnicastRREQGenEnable standard defined G3 attribute
ADP_GROUPTABLE_ID	0x0000000E	x	NA	NA	NA	NA	NA	NA		adpGroupTable standard defined G3 attribute
ADP_MAXHOPS_ID	0x0000000F	x	0x0E	0x0E	0x0E	RW	0x01	0x0E	1	adpMaxHops standard defined G3 attribute

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ADP_DEVICETYPE_ID	0x00000010	x	0x00	0x00	0x00	RW	0x00	0x02	1	adpDeviceType standard defined G3 attribute. The value can be changed through a G3LIB-SWRESET.Request command.
ADP_NETTRAVERSALTIME_ID	0x00000011	x	0x14	0x14	0x14	RW	0x01	0xFF	1	adpNetTraversalTime standard defined G3 attribute
ADP_ROUTINGTABLEENTRYTTL_ID	0x00000012	x	0x0168	0x0168	0x0168	RW	0x0001	0xFFFF	2	adpRoutingTableEntryTTL standard defined G3 attribute
ADP_KR_ID	0x00000013	x	0x00	0x00	0x00	RW	0x00	0x1F	1	adpKr standard defined G3 attribute
ADP_KM_ID	0x00000014	x	0x00	0x00	0x00	RW	0x00	0x1F	1	adpKm standard defined G3 attribute
ADP_KC_ID	0x00000015	x	0x00	0x00	0x00	RW	0x00	0x1F	1	adpKc standard defined G3 attribute
ADP_KQ_ID	0x00000016	x	0x0A	0x0A	0x0A	RW	0x00	0x32	1	adpKq standard defined G3 attribute
ADP_KH_ID	0x00000017	x	0x04	0x04	0x04	RW	0x00	0x1F	1	adpKh standard defined G3 attribute
ADP_RREQRETRIES_ID	0x00000018	x	0x01	0x01	0x01	RW	0x00	0x0A	1	adpRREQRetries standard defined G3 attribute
ADP_RREQRERRWAIT_ID	0x00000019	x	0x1E	0x1E	0x1E	RW	0x00	0xFF	1	adpRREQRERRWait standard defined G3 attribute
ADP_WEAKLQIVALUE_ID	0x0000001A	x	0x28	0x28	0x28	RW	0x00	0xFF	1	adpWeakLQIValue standard defined G3 attribute
ADP_KRT_ID	0x0000001B	x	0x00	0x00	0x00	RW	0x00	0x1F	1	adpKrt standard defined G3 attribute
ADP_SOFTVERSION_ID	0x0000001C	x	0x00000000	0x00000000	0x00000000	RO	0x00000000	0xFFFFFFFF	4	adpSoftVersion standard defined G3 attribute
ADP_SNIFFERMODE_ID	0x0000001D	x	0x00	0x00	0x00	RW	0x00	0x01	1	adpSnifferMode standard defined G3 attribute
ADP_BLACKLISTTABLE_ID	0x0000001E	x	NA	NA	NA	NA	NA	NA		adpBlacklistTable standard defined G3 attribute
ADP_BLACKLISTTABLEENTRYTTL_ID	0x0000001F	x	0x000A	0x000A	0x000A	RW	0x0000	0xFFFF	2	adpBlacklistTableEntryTTL standard defined G3 attribute
ADP_MAXJOINWAITTIME_ID	0x00000020	x	0x14	0x14	0x14	RW	0x0001	0x03FF	2	adpMaxJoinWaitTime standard defined G3 attribute
ADP_PATHDISCOVERYTIME_ID	0x00000021	x	0x28	0x28	0x28	RW	0x01	0xFF	1	adpPathDiscoveryTime standard defined G3 attribute
ADP_ACTIVEKEYINDEX_ID	0x00000022	x	0x00	0x00	0x00	RW	0x00	0x01	1	adpActiveKeyIndex standard defined G3 attribute
ADP_DESTINATIONADDRESSSET_ID	0x00000023	x	NA	NA	NA	NA	NA	NA		adpDestinationAddressSet standard defined G3 attribute

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ADP_DEFAULTCOORDROUTEENABLED	0x00000024	x	0x01	0x01	0x01	RW	0x00	0x01	1	adpDefaultCoordRouteEnabled standard defined G3 attribute
ADP_RREQFWDTHR_ID	0x00000025	x	0x00007834	0x00007834	0x00007834	RW	0x00000000	0xFFFFFFFF	4	adpRREQFwdThr: FwdThresholds for RREQ forward
ADP_RREQFWDTIME_ID	0x00000026	x	0x01F405DC	0x01F405DC	0x01F405DC	RW	0x00000000	0xFFFFFFFF	4	adpRREQFwdTime: FwdTimes for RREQ forward
ADP_DISABLEDEFAULTROUTING_ID	0x000000F0	x	0x00	0x00	0x00	RW	0x00	0x01	1	adpDisableDefaultRouting standard defined G3 attribute
ADP_DATAGRAMTAG_ID	0x00000090		0x00	0x00	0x00	RW	0x0000	0xFFFF	2	adpDatagramTag Attribute: Define the DatagramTag for fragmentation dispatch. Increased by one for each transmission
ADP_BRDSEQNUM_ID	0x00000091		0x00	0x00	0x00	RW	0x00	0xFF	1	adpBroadcastSeqNumber Attribute: Define the SequenceNumber for broadcast dispatch. Increased by one for each broadcast transmission
ADP_ENABLEHDRCOMPR_ID	0x00000092	x	0x01	0x01	0x01	RW	0x00	0x01	1	adpEnableHeaderCompression: set to 1 to enable the IPv6 header compression (default), set to 0 to disable the IPv6 header compression
ADP_EAPPSKRAND_ID	0x00000093	x	0x00…00	0x00…00	0x00…00	RW	0x00…00	0xFF…FF	16	adpEAPPSKRand Attribute: it allows using a custom value for RAND_P or RAND_S
ADP_EAPPSKKEY_ID	0x00000094	x	0x00…00	0x00…00	0x00…00	WO	0x00…00	0xFF…FF	16	adpEAPPSKKey Attribute: it contains the EAP-PSK attribute used for bootstrap
ADP_EAPPSKIDP_ID	0x00000095	x	0x00…00	0x00…00	0x00…00	RW	0x00…00	0xFF…FF	36	adpEAPPSKIdP Attribute: it contains the IdP (device NAI) attribute used for bootstrap. *Note: If this attribute has to be set as the MAC extended address, a byte swapping is required.*
ADP_EAPPSKIDPLEN_ID	0x00000096	x	0x00	0x00	0x00	RW	0x00	0x24	1	adpEAPPSKIdPLen Attribute: it contains the actual length of the IdP attribute
ADP_MAXREKEYINGWAITTIME_ID	0x00000097	x	0x0708	0x0708	0x0708	RW	0x0000	0xFFFF	2	adpMaxRekeyingWaitTime Attribute: rekeying timeout (in seconds) for LBD
ADP_LOADngSEQNUM_ID	0x00000098	x	0x0000	0x0000	0x0000	RW	0x0000	0xFFFF	2	adpLOADngSeqNum: The sequence number used by LOADng routing algorithm. It is incremented every time a RREQ or RREP message is genearated

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ADP_OPTIONALFEATURES_ID	0x00000099	x	0x000001D0	0x000001D0	0x000001D0	RW	0x00000000	0xFFFFFFFF	4	adpOptionalFeatures: Field mask to control optional features provided by the ADP Layer where: Bit 0 – Allow Invalid Hops Left: if 6LoWPAN frame with HopsLeft > adpMaxHops is received, simply decrement HopsLeft without setting it to adpMaxHops Bit 1 – Multicast FW Disabled: disable the forward of multicast packets Bit 2 – NoAck: send IPv6 data with NO_ACK option at MAC level Bit 3 – RREQ FW Disabled: if 1 the forwarding of LOADng RREQ messages in broadcast is disabled Bit 4 – RERR if HopsLeft expires: if 1 sends a RERR when receiving a packet and Hops Left is == 0 Bit 5 – Discovery Route Cost parameter: configure how to compute the RouteCost of the PAN Descriptors during discovery Bit 6 – Disable PANID conflict notification on Bootstrap: if 1 disable the MAC-COMM-STATUS.Indication notification (and the related ADP notification) during the device bootstrap (not for coordinator profile) in case of PAN ID conflict Bit 7 – Blacklist Table for data: if 1 add to blacklist the next hop also when a Data transmission fails (in addition to RREP tx failures) Bit 8 – Blacklist Table for unicast RREQ: Set to 1 to blacklist the next hop also when a Unicast RREQ transmission fails (in addition to RREP tx failures)
ADP_REASSEMBLYTIMEOUT_ID	0x0000009A	x	0x28	0x28	0x28	RW	0x0A	0x3C	1	adpReassemblyTimeout: when this time (in seconds) expires, if the entire packet has not been reassembled, the existing fragments are discarded
ADP_RETXTIMEFORCHBUSY_ID	0x0000009B	x	0x038E	0x01F4	0x038E	RW	0x0000	0xFFFF	2	adpRetransmissionDelayforChannelBusy: specify the delay (in ms) for the ADP retransmission of one packet when the MAC report Channel Access Busy error

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ADP_HOPSFORDELAYFRAGN_ID	0x0000009C	x	0x03	0x03	0x03	RW	0x01	0x0E	1	adpHopsForDelayFragN: specify the number of hops for which the FragN fragments are delayed
ADP_DELAYFRAGN_ID	0x0000009D	x	0x0226	0x004B	0x0226	RW	0x0000	0xFFFF	2	adpDelayFRAGN: specify the delay (in ms) for which the ADP waits before sending the FragN fragments if the endpoint is adpHopsForDelayFragN far away from the node
ADP_DELAYFRAGNBROAD_ID	0x0000009E	x	0x07D0	0x0200	0x07D0	RW	0x0000	0xFFFF	2	adpDelayFRAGNBroad: specify the delay (in ms) for which the ADP waits before sending the FragN fragments if the transmission is for a multicast (broadcast) destination
ADP_ROUTINGTABLE_BYSHORTADDR_ID	0x0000009F	x	NA	NA	NA	NA	NA	NA		adpRoutingTable Attribute standard defined G3 attribute - index is used as short address
ADP_ROUTINGTABLE_VALIDENTRY_ID	0x000000A0	x	NA	NA	NA	NA	NA	NA		adpRoutingTable Attribute standard defined G3 attribute but the entry returned is the next one valid
ADP_UNICASTRXFRAGCNT_ID	0x000000A1	x	0x00	0x00	0x00	RW	0x00000000	0xFFFFFFFF	4	adpUnicastRxFragCounter: counter of received unicast fragments
ADP_UNICASTTXFRAGCNT_ID	0x000000A2	x	0x00	0x00	0x00	RW	0x00000000	0xFFFFFFFF	4	adpUnicastTxFragCounter: counter of transmitted unicast fragments
ADP_UNICASTFWFRAGCNT_ID	0x000000A3	x	0x00	0x00	0x00	RW	0x00000000	0xFFFFFFFF	4	adpUnicastFwFragCounter: counter of forwarded unicast fragments
ADP_UNICASTINDCNT_ID	0x000000A4	x	0x00	0x00	0x00	RW	0x00000000	0xFFFFFFFF	4	adpUnicastIndicationCounter: counter of unicast ADP indication
ADP_MCASTRXFRAGCNT_ID	0x000000A5	x	0x00	0x00	0x00	RW	0x00000000	0xFFFFFFFF	4	adpMulticastRxFragCounter: counter of received multicast fragments
ADP_MCASTTXFRAGCNT_ID	0x000000A6	x	0x00	0x00	0x00	RW	0x00000000	0xFFFFFFFF	4	adpMulticastTxFragCounter: counter of transmitted multicast fragments
ADP_MCASTFWFRAGCNT_ID	0x000000A7	x	0x00	0x00	0x00	RW	0x00000000	0xFFFFFFFF	4	adpMulticastFwFragCounter: counter of forwarded multicast fragments
ADP_MCASTINDFRAGCNT_ID	0x000000A8	x	0x00	0x00	0x00	RW	0x00000000	0xFFFFFFFF	4	adpMulticastIndicationCounter: counter of multicast fragments used for indication
ADP_MCASTFWTHRESHOLDS1_ID	0x000000A9	x	0x050A6464	0x050A6464	0x050A6464	RW	0x00000000	0xFFFFFFFF	4	adpMulticastFwThr1: thresholds for multicast forward
ADP_MCASTFWTHRESHOLDS2_ID	0x000000AA	x	0x00000505	0x00000505	0x00000505	RW	0x00000000	0x0000FFFF	4	adpMulticastFwThr2: thresholds for multicast forward

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ADP_RETRYFORCHBUSY_ID	0x000000AB	x	0x0002	0x0002	0x0001	RW	0x0000	0x000A	2	adpRetranmissionForChannelBusy: Number of retransmission attempts before declaring a failure in case of channel busy)
ADP_RREQRXCNT_ID	0x000000AC	x	0x00	0x00	0x00	RW	0x00000000	0xFFFFFFFF	4	adpRREQRxCnt: Number of received RREQs
ADP_RREQFWDCNT_ID	0x000000AD	x	0x00	0x00	0x00	RW	0x00000000	0xFFFFFFFF	4	adpRREQFwdCnt: Number of forwarded RREQs
ADP_RREQOVERWRITECNT_ID	0x000000AE	x	0x00	0x00	0x00	RW	0x00000000	0xFFFFFFFF	4	adpRREQOverwriteCnt: Number of overwrited RREQs when forwarding a RREQ
ADP_RSV1_ID	0x000000AF		0x00	0x00	0x00	RO	0x00	0x00	1	Reserved for future use
ADP_RSV2_ID	0x000000B0		0x00	0x00	0x00	RO	0x00	0x00	1	Reserved for future use
ADP_HOPSDELAYFRAGNRF_ID	0x000000B1		0x02	0x02	0x02	RW	0x01	0x0E	1	adpHopsDelayFragNRF: the transmission of FRAGN fragments is delayed (only on the Originator) if the final destination is at least adpHopsDelayFragNRF hops distant
ADP_DELAYFRAGNRF_ID	0x000000B2		0x0226	0x0226	0x0226	RW	0x0000	0xFFFF	2	adpDelayFragNRF: specify the delay in milliseconds for which the transmission of FRAGN fragments is delayed
ADP_WEAKLQIVALUE_RF_ID	0x000000B3		0x28	0x28	0x28	RW	0x00	0xFF	1	adpWeakLQIValue_RF Attribute
ADP_LOWLQIVALUE_RF_ID	0x000000D0	X	0x00	0x00	0x00	RW	0x00	0xFE	1	adpLowLQIValue_RF: the low LQI value defines the LQI value, used in metric computation, below which a link to a neighbor is considered as an unreliable RF link
ADP_HIGHLQIVALUE_RF_ID	0x000000D1	X	0xFE	0xFE	0xFE	RW	0x00	0xFE	1	adpHighLQIValue_RF: the high LQI value defines the LQI value, used in metric computation, above which a link to a neighbor is considered as a reliable RF link
ADP_KQ_RF_ID	0x000000D2	x	0x0A	0x0A	0x0A	RW	0x00	0x32	1	adpKq_RF: A weight factor for LQI to calculate link cost
ADP_KH_RF_ID	0x000000D3	x	0x04	0x04	0x04	RW	0x00	**0x1F**	**1**	**adpKh_RF: A weight factor for hop to calculate link cost**
ADP_KRT_RF_ID	0x000000D4	X	0x00	0x00	0x00	RW	0x00	0x1F	1	adpKrt_RF: A weight factor for the number of active routes in the routing table to calculate link cost

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ADP_KDC_RF_ID	0x000000D5	x	0x0A	0x0A	0x0A	RW	0x00	0x32	1	adpKdc_RF: A weight factor for duty cycle to calculate link cost
ADP_USEBACKUPMEDIA_ID	0x000000D6	x	0x01	0x01	0x01	RW	0x00	0x01	1	adpUseBackupMedia: Controls if retransmission can use the backup medium in case of transmission failure
MAC_RESERVED1_ID	0x00000040		0x00	0x00	0x00	RO	0x00	0x00	1	Reserved by ITU-T
MAC_MAXBE_ID	0x00000047	x	0x08	0x08	0x08	RW	0x00	0x0E	1	macMaxBE standard defined G3 attribute
MAC_BSN_ID	0x00000049		RAND	RAND	RAND	RW	0x00	0xFF	1	macBSN standard defined G3 attribute
MAC_DSN_ID	0x0000004C		RAND	RAND	RAND	RW	0x00	0xFF	1	macDSN standard defined G3 attribute
MAC_MAXCSMABACKOFFS_ID	0x0000004E	x	0x32	0x32	0x32	RW	0x00	0x64	1	macMaxCSMABackoffs standard defined G3 attribute
MAC_MINBE_ID	0x0000004F	x	0x03	0x03	0x03	RW	0x00	0x0E	1	macMinBE standard defined G3 attribute
MAC_PANID_ID	0x00000050	x	0xFFFF	0xFFFF	0xFFFF	RW	0x0000	0xFFFF	2	macPanId standard defined G3 attribute
MAC_PROMISCUOUSMODE_ID	0x00000051		0x00	0x00	0x00	RO	0x00	0x01	1	macPromiscuousMode standard defined G3 attribute
MAC_SHORTADDRESS_ID	0x00000053	x	0xFFFF	0xFFFF	0xFFFF	RW	0x0000	0xFFFF	2	macShortAddress standard defined G3 attribute
MAC_MAXFRAMERETRIES_ID	0x00000059	x	0x05	0x05	0x05	RW	0x00	0x32	1	macMaxFrameRetries standard defined G3 attribute
MAC_TIMESTAMPSUPP_ID	0x0000005C		0x01	0x01	0x01	RW	0x00	0x01	1	macTimeStampSupport standard defined G3 attribute
MAC_SECURITYENABLED_ID	0x0000005D	x	0x01	0x01	0x01	RO	0x00	0x01	1	macSecurityEnabled standard defined G3 attribute
MAC_KEYTABLE_ID	0x00000071	x	NA	NA	NA	NA	NA	NA		macKeyTable standard defined G3 attribute
MAC_FRAMECOUNTER_ID	0x00000077	x	0x00000000	0x00000000	0x00000000	RW	0x00000000	0xFFFFFFFF	4	macFrameCounter standard defined G3 attribute
MAC_DUPLICATEDETECTIONTTL_ID	0x00000078	x	0x03	0x03	0x03	RW	0x00	0xFF	1	macDuplicateDetectionTTL standard defined G3 attribute
MAC_HIGHPRIORITYWS_ID	0x00000100	x	0x07	0x07	0x07	RW	0x01	0x07	1	macHighPriorityWindowSize standard defined G3 attribute
MAC_TXDATAPACKETCOUNT_ID	0x00000101		0x00000000	0x00000000	0x00000000	RW	0x00000000	0xFFFFFFFF	4	macTxDataPacketCount standard defined G3 attribute
MAC_RXDATAPACKETCOUNT_ID	0x00000102		0x00000000	0x00000000	0x00000000	RW	0x00000000	0xFFFFFFFF	4	macRxDataPacketCount standard defined G3 attribute

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MAC_TXCMDPACKETCOUNT_ID	0x00000103		0x00000000	0x00000000	0x00000000	RW	0x00000000	0xFFFFFFFF	4	macTxCmdPacketCount standard defined G3 attribute
MAC_RXCMDPACKETCOUNT_ID	0x00000104		0x00000000	0x00000000	0x00000000	RW	0x00000000	0xFFFFFFFF	4	macRxCmdPacketCount standard defined G3 attribute
MAC_CSMAFAILCOUNT_ID	0x00000105		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macCSMAFailCount standard defined G3 attribute
MAC_CSMANOACKCOUNT_ID	0x00000106		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macCSMAnoACKCount standard defined G3 attribute
MAC_RXDATABROADCASTCOUNT_ID	0x00000107		0x00000000	0x00000000	0x00000000	RW	0x00000000	0xFFFFFFFF	4	macRxDataBroadcastCount standard defined G3 attribute
MAC_TXDATABROADCASTCOUNT_ID	0x00000108		0x00000000	0x00000000	0x00000000	RW	0x00000000	0xFFFFFFFF	4	macTxDataBroadcastCount standard defined G3 attribute
MAC_BADCRCCOUNT_ID	0x00000109		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macBadCRCCount standard defined G3 attribute
MAC_NEIGHBORTABLE_ID	0x0000010A	x	NA	NA	NA	NA	NA	NA		macNeighborTable standard defined G3 attribute
MAC_RESERVED2_ID	0x0000010B		0x00	0x00	0x00	RO	0x00	0x00	1	reserved and not used
MAC_CSMAFAIRNESSLIMIT_ID	0x0000010C	x	0x19	0x19	0x19	RW	0x00	0xFF	1	macCSMAFairnessLimit standard defined G3 attribute
MAC_TMRTTL_ID	0x0000010D	x	0x0A	0x0A	0x0A	RW	0x01	0xFF	1	macTMRTTL standard defined G3 attribute
MAC_POSTABLEENTRYTTL_ID	0x0000010E	x	0xFF	0xFF	0xFF	RW	0x01	0xFF	1	macPOSTableEntryTTL standard defined G3 attribute
MAC_RCCOORD_ID	0x0000010F	x	0x0000 (PANC), 0x7FFF (DEVICE)	0x0000 (PANC), 0x7FFF (DEVICE)	0x0000 (PANC), 0x7FFF (DEVICE)	RW	0x0000	0xFFFF	2	macRCCoord standard defined G3 attribute
MAC_TONEMASK_ID	0x00000110	x	0x000000000FFFFFFFF	0xFFFFFFFFFFFFFFFFFF	0x000000000FFFFFFFF	RW	0x0000000000000000	0x000000000FFFFFFFF (CENA), 0xFFFFFFFFFFFFFFFFFF (FCC)	9	macToneMask standard defined G3 attribute
MAC_BCNRANDWINLEN_ID	0x00000111	x	0x0C	0x0C	0x0C	RW	0x01	0xFF	1	macBeaconRandomizationWindowLengh standard defined G3 attribute
MAC_A_ID	0x00000112	x	0x08	0x08	0x08	RW	0x03	0x14	1	macA standard defined G3 attribute
MAC_K_ID	0x00000113	x	0x05	0x05	0x05	RW	0x01	0xFF	1	macK standard defined G3 attribute

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MAC_MINCWATTEMPTS_ID	0x00000114	x	0xFF	0xFF	0xFF	RW	0x01	0xFF	1	macMinCWAttempts standard defined G3 attribute
MAC_CENELECLEGACYMODE_ID	0x00000115		0x01	0x01	0x01	RW	0x00	0x01	1	macCENELECLegacyMode standard defined G3 attribute
MAC_FCCLEGACYMODE_ID	0x00000116		0x01	0x01	0x01	RW	0x00	0x01	1	macFCCLegacyMode standard defined G3 attribute
MAC_BROADCASTMAXCWENABLE_ID	0x0000011E	x	0x00	0x00	0x00	RW	0x00	0x01	1	macBroadcastMaxCWEnable standard defined G3 attribute
MAC_TRANSMITATTEN_ID	0x0000011F	x	0x00	0x00	0x00	RW	0x00	0x19	1	macTransmitAtten standard defined G3 attribute
MAC_POSTABLE_ID	0x00000120	x	NA	NA	NA	NA	NA	NA		macPOSTable standard defined G3 attribute
MAC_EXTENDEDADDRESS_ID	0x00003000	x	NA	NA	NA	RW	NA	NA	8	aExtendedAddress: The EUI-64 address of the node. This is automatically filled at power-on but it can be overwritten by the external host
MAC_RESERVED3_ID	0x00003001		0x00	0x00	0x00	RO	0x00	0x00	1	not used
MAC_TRXSTATENOTCORRECT_ID	0x00003002		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macTrxStateNotCorrect: Counter of discarded frame for RTE state not correct
MAC_PSDUTOLONG_ID	0x00003003		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macPsduToLong: Counter of discarded frame for PDU too long
MAC_INVALIDFRAMETYPE_ID	0x00003004		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInvalidFrameType D: Counter of discarded frame for Invalid Frame Type field
MAC_INVALIDFRAMEVERSION_ID	0x00003005		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInvalidFrameVersion: Counter of discarded frame for invalid Frame Version field
MAC_INVALIDDAM_ID	0x00003006		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInvalidDAM: Counter of discarded frame for invalid Destination Address Mode
MAC_INVALIDSAM_ID	0x00003007		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInvalidSAM: Counter of discarded frame for invalid Source Address Mode
MAC_INVALIDPANID_ID	0x00003008		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInvalidPanID: Counter of discarded frame for invalid PanID
MAC_INVALIDSHORTADDR_ID	0x00003009		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInvalidShortAddr: Counter of discarded frame for invalid Short Address
MAC_INVALIDEXTADDR_ID	0x0000300A		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInvalidExtAddr: Counter of discarded frame for invalid Extended Address

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MAC_INVALIDBEACON_ID	0x0000300B		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInvalidBeacon: Counter of discarded frame for invalid Beacon
MAC_INVALIDDATACMD_ID	0x0000300C		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInvalidDataCmd: Counter of discarded frame for invalid Command
MAC_INTERNALSTATENOTCORRECT_ID	0x0000300D		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInternalStateNotCorrect: Counter of discarded frame for invalid state of MAC at data indication
MAC_FRAMEDISCARDED_ID	0x0000300E		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macFrameDiscarded Counter of discarded frame for any of the above reason
MAC_ACKTRXSTATENOTCORRECT_ID	0x0000300F		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macAckTrxStateNotCorrect: Counter of discarded ACK frames for PHY State not correct
MAC_ACKNOTCORRECT_ID	0x00003010		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macAckNotCorrect: Counter of discarded ACK frames for wrong FCH received
MAC_ACKINTSTATENOTCORRECT_ID	0x00003011		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macAckIntStateNotCorrect: Counter of discarded ACK frames for invalid state of the MAC
MAC_ACKCRCNOTEXPECTED_ID	0x00003012		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macAckCrcNotExpected: Counter of discarded ACK frames for invalid CRC expected
MAC_ACKDISCARDED_ID	0x00003013		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macAckDiscarded: Counter of total discarded ACK frames
MAC_CSAMSEED_ID	0x00003014	x	RAND	RAND	RAND	RW	0x00000000	0xFFFFFFFF	4	macCSMASeed: Seed value in function that generates random numbers for CSMA/CA
MAC_INVALIDFRAMEPENDING_ID	0x00003015		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInvalidFramePending: Counter of discarded frame for invalid Frame Pending field detected
MAC_INVALIDPIC_ID	0x00003016		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macInvalidPIC: Counter of discarded frame for invalid PIC field detected
MAC_PSDUTOOSHORT_ID	0x00003017		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	macPsduTooShort: Counter of discarded frame for PDU too short
MAC_CNTFIXDT_ID	0x00003018		0x00000000	0x00000000	0x00000000	RW	0x00000000	0xFFFFFFFF	4	macCntFixDT: Bits 31-29 represent a DT value that must be used by MAC to compose an FCH passed to PHY

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MAC_DISABLEPLC_ID	0x00003019	x	0x00	0x00	0x00	RW	0x00	0x01	1	macDisablePLC: This attribute indicates if modem is enabled (0) or disabled (1). When the modem is disabled all counters managed by MAC are frozen, counters managed by PHY are not frozen
MAC_STARTLOWERINGRETRIES_ID	0x0000301A	x	0x02	0x02	0x02	RW	0x00	0x0A	1	macStartLoweringRetries: Indicate at which MAC retransmission the lowering modulation mechanism starts. The value 0 indicates that the mechanism is disabled.
MAC_TIMERWABEND_ID	0x0000301B		0x00000000	0x00000000	0x00000000	RRST	0x00000000	0xFFFFFFFF	4	macTimerWABEnd: Counter of number of times nothing was received from phy after the channel was sensed busy
MAC_DONTSENDNACK_ID	0x0000301C		0x00	0x00	0x00	RW	0x00	0x01	1	macDontSendNACK: Disable the sending of NACK frames
MAC_ENABLECCTT230_ID	0x0000301D		0x00	0x00	0x00	RW	0x00	0x01	1	macEnableCCTT230: If this attribute is set to 1 is enabled the feature indicated in CCTT230
MAC_SNRDBROBO_ID	0x00003280	x	0x08	0x08	0x08	RW	0x00	0x3F	1	macSNRdBROBO: tone map algorithm threshold for ROBO
MAC_SNRDBDBPSK_ID	0x00003281	x	0x0D	0x0D	0x0D	RW	0x00	0x3F	1	macSNRdBDBPSK: tone map algorithm threshold for xBPSK
MAC_SNRDBDQPSK_ID	0x00003282	x	0x10	0x10	0x10	RW	0x00	0x3F	1	macSNRdBDQPSK: tone map algorithm threshold for xQPSK
MAC_SNRDBD8PSK_ID	0x00003283	x	0x14	0x14	0x14	RW	0x00	0x3F	1	macSNRdBD8PSK: tone map algorithm threshold for x8PSK
MAC_RXBCNLASTSCAN_ID	0x00003284		0x00	0x00	0x00	RO	0x00000000	0xFFFFFFFF	4	macRXBeaconReceivedFromLastScan: Number of received beacon in the last active scan
MAC_MODULATIONCONTROL_ID	0x00003285		0x000000FF	0x000000FF	0x000000FF	RW	0x00000000	0xFFFFFFFF	4	macModulationControl: Field mask to control the modulation used by the MAC Layer where, Bit [0..3]: defines the modulation to be used for the data transmission (0: ROBO, 1: DBPSK or BPSK, 2: DQPSK or QPSK, 3: D8PSK or 8PSK, F use neighbor table), Bit [4..7]: defines the modulation scheme inside the tone map response message (0: ROBO, 1: DBPSK or BPSK, 2: DQPSK or QPSK, 3: D8PSK or 8PSK, F use the internal algorithm),

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
										Bit 8: if 1 force a scheme selection in the tone map response. Scheme is selected through bit 9, Bit 9: controlled by bit 8: 0 for differential 1 for coherent, Bit [10..11]: defines the modulation to be used for the broadcast data transmission (0: ROBO, 1: DBPSK or BPSK, 2: DQPSK or QPSK, 3: D8PSK or 8PSK), Bit 12: defines the modulation scheme to be used for broadcast transmission (0: differential, 1: coherent), Bit 13: if set to 1 force the scheme for unicast data transmission specified in Bit 14, Bit 14: controlled by bit 13: 0 for differential 1 for coherent Bit [15..31]: not used
MAC_OPTIONALFEATURES_ID	0x00003286		0x00000008	0x00000008	0x00000008	RW	0x00000000	0x000003FF	4	macOptionalFeatures: Field mask to control optional features provided by the MAC Layer where: Bit 0: if 1 enable the TMR bit in the tone map response Bit 1: if 1 send the ToneMap Response message cyphered Bit 2: if 1 set the TMR bit also if the source address is 64bit Bit 3: set the ToneMap Response priority (0: Normal priority, 1: High priority) Bit 4: if 1 export the MAC frames with both 64 bit src and dst addresses through the MCPS-DATA-EXTADDR.ind Bit 5: if 1 ignore beacon request frames and do not reply to them Bit 6: if 1 do not send ToneMapResponse frames Bit 7: if 1 do not invoke MLME-COMM-STATUS.Indication for PAN_ID_CONFILCT

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
										Bit 8: if 1 do not invoke MLME-COMM-STATUS.Indication for security errors (COUNTER_ERROR, SECURITY_ERROR, UNAVAILABLE_KEY, UNSUPPORTED_SECURITY, IMPROPER_KEY_TYPE) Bit 9: if 1 do not invoke MLME-COMM-STATUS.Indication for other errors Bit10-32: reserved
MAC_TMRMMODULATIONCONTROL_ID	0x00003287		0x00003F00	0xFFFFFF00	0x00000F00	RW	0x00000000	0xFFFFFFFF	4	macTMRModulationControl: Field mask to control the modulation used by the MAC Layer during data transmission when TMR bit is set, whre: Bit [0..2]: defines the modulation to be used to the first data transmission (0: ROBO, 1: DBPSK or BPSK, 2: DQPSK or QPSK, 3: D8PSK or 8PSK) Bit 3: defines the modulation scheme to be used to the first data transmission (when TMR bit is set) (0: differential, 1: coherent) Bit [4..6]: defines the number of negative step with respect to maximum tx power (only negative values of TxGain) Bit 7: defines the TxRes(0: 3 dB, 1: 6 dB) Bit [8..31]: defines the tone map field
MAC_TMRMINNUMCARRIER_ID	0x00003288	x	0x0C	0x0C	0x0C	RW	0x06	0x48	1	macTMRMinNumCarrier: minimum number of carrier that the must be used when selecting a modulation in the tone map response algorithm
MAC_SNRDBSUPERROBO_ID	0x00003289		0xFF	0xFF	0xFF	RW	0x00	0xFF	1	macSNRdBSuperROBO: tone map algorithm threshold for SuperROBO
MAC_MAXTXPOWER_ID	0x0000328A	x	0x20	0x20	0x20	RW	0x00	0x20	1	macMaxTxPower: default value for the maximum power applied to data
MAC_DATATXTIMEOUT_ID	0x0000328B	x	0x28	0x28	0x28	RW	0x00	0xB4	1	macDataTxTimeout: timeout (in seconds) for a MCPS-DATA.confirm generation
MAC_DEVICETABLE_ID	0x0000328C	x	NA	NA	NA	NA	NA	NA		macDeviceTable: the MAC device table
MAC_NEIGHBORTABLE_BYSHORT_ID	0x0000328D	x	NA	NA	NA	NA	NA	NA		macNeighborTable: standard defined G3 attribute, index is used as short address

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
MAC_NEIGHBORTABLE_VALIDENTRY_ID	0x0000328E	x	NA	NA	NA	NA	NA	NA		macNeighborTable standard defined G3 attribute but the entry returned is the next one valid
MAC_SNRDB_USEDIFF8PSK_ID	0x0000328F	x	0x0F	0x0F	0x0F	RW	0x00	0x3F	1	macSNRdBUseDiff8PSK: indicates the number of dB with respect to the macSNRdBD8PSK threshold to force the tone map algorithm to ask for differential scheme
MAC_POSTABLE_VALIDENTRY_ID	0x00003290	x	NA	NA	NA	NA	NA	NA	4	macPOSTable: standard defined G3 attribute but the entry returned is the next one valid
MAC_NEIGHBORTABLE2015_ID	0x00003291	x	NA	NA	NA	NA	NA	NA		macNeighborTable: standard defined G3 attribute (returned in 2015 standard version format)
MAC_NEIGHBORTABLE2015_BYSHORT_ID	0x00003292	x	NA	NA	NA	NA	NA	NA		macNeighborTable: standard defined G3 attribute (returned in 2015 standard version format)
MAC_NEIGHBORTABLE2015_VALIDENTRY_ID	0x00003293	x	NA	NA	NA	NA	NA	NA		macNeighborTable: standard defined G3 attribute (returned in 2015 standard version format) but the entry returned is the next one valid
MAC_IMPULSIVENOISELOWERING_ID	0x00003294	x	0x00	0x01	0x00	RW	0x00	0x03	1	macImpulsiveNoiseLowering: Specify how many modulation steps the modem has to lower the selection of the modulation in the tone map algorithm when an impulsive noise is detected on the channel
MAC_DELAYTXAFTERTMR_ID	0x00003295	x	0x00000046	0x00000019	0x0000008C	RW	0x00000000	0xFFFFFFFF	4	macDelayTxAfterTMR: specify how many ms the MAC layer has to wait before sending the next data frame if the previous one has the TMR bit set
MAC_TMRLQILIMITS_ID	0x00003296	x	0x000000FF	0x000000FF	0x000000FF	RW	0x00000000	0x0000FFFF	4	macTMRLQILimits: upper limit (b0…b7) and lower limit (b8…b15) for LQI value to be inserted in ToneMapResponse frame
MAC_DEVICETABLE_BYSHORT_ID	0x00003297	x	NA	NA	NA	NA	NA	NA		macDeviceTable Attribute ID, index is used as short address
MAC_DEVICETABLE_VALIDENTRY_ID	0x00003298	x	NA	NA	NA	NA	NA	NA		macDeviceTable Attribute ID but the entry returned is the next one valid

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MAC_ACKTIMEOUT_RF_ID	0x00003299	x	0x19	0x19	0x19	RW	0x0A	0xFF	1	macAckTimeout_RF Attribute ID: maximum time (in ms) within which the complete reception of an ACK frame is expected. After this time a retransmission is carried out
MAC_MAXBACKOFFTIME_RF_ID	0x0000329A	x	0x06	0x06	0x06	RW	0x01	0x32	1	macMaxBackoffTime_RF Attribute ID: maximum backoff time (in ms) for RF transmission 1st attempt (not done from S2LP CSMA)
MAC_POSTABLE_VALIDENTRY_RF_ID	0x0000329B	x	NA	NA	NA	NA	NA	NA	4	macPOSTableValidEntry_RF: macPOSTable_RF standard defined G3 attribute, but the entry returned is the next one valid
MAC_DEVICETABLE_BYSHORT_RF_ID	0x0000329C	x	NA	NA	NA	NA	NA	NA	8	macDeviceTableByShortAddr_RF: macDeviceTable_RF standard defined G3 attribute but the index is used as short address
MAC_DEVICETABLE_VALIDENTRY_RF_ID	0x0000329D	x	NA	NA	NA	NA	NA	NA	8	macDeviceTableValidEntry_RF: macDeviceTable_RF standard defined G3 attribute but the entry returned is the next one valid
MAC_DSN_RF_ID	0x00000200		RAND	RAND	RAND	RW	0x00	0xFF	1	macDsn_RF Attribute ID
MAC_MAXBE_RF_ID	0x00000201		0x00	0x00	0x00	RO	0x00	0x00	1	macMaxBE_RF Attribute ID (not available in the current release)
MAC_MAXCSMABACKOFFS_RF_ID	0x00000202		0x00	0x00	0x00	RO	0x00	0x00	1	macMaxCSMABackoffs_RF Attribute ID (not available in the current release)
MAC_MAXFRAMERETRIES_RF_ID	0x00000203	x	0x05	0x05	0x05	RW	0x00	0x32	1	macMaxFrameRetries_RF Attribute ID
MAC_MINBE_RF_ID	0x00000204		0x00	0x00	0x00	RO	0x00	0x00	1	macMinBE_RF Attribute ID (not available in the current release)
MAC_TIMESTAMPSUPPORTED_RF_ID	0x00000205		0x00	0x00	0x00	RO	0x00	0x00	1	macTimestampSupported_RF Attribute ID
MAC_DEVICETABLE_RF_ID	0x00000206	x	NA	NA	NA	RO	NA	NA		macDeviceTable_RF Attribute ID
MAC_FRAMECOUNTER_RF_ID	0x00000207	x	0x00	0x00	0x00	RW	0x00	0xFFFFFFFF	4	macFrameCounter_RF Attribute ID
MAC_DUPLICATEDETECTIONTTL_RF_ID	0x00000208	x	0x03	0x03	0x03	RW	0x00	0xFF	1	macDuplicateDetectionTTL_RF Attribute ID
MAC_COUNTEROCTETS_RF_ID	0x00000209		0x04	0x04	0x04	RO	0x01	0x04	1	macCounterOctets_RF Attribute ID
MAC_RETRYCOUNT_RF_ID	0x0000020A		0x00	0x00	0x00	RO	0x00	0xFFFFFFFF	4	macRetryCount_RF Attribute ID
MAC_MULTIPLERETRYCOUNT_RF_ID	0x0000020B		0x00	0x00	0x00	RO	0x00	0xFFFFFFFF	4	macMultipleRetryCount_RF Attribute ID

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MAC_TXFAILCOUNT_RF_ID	0x0000020C		0x00	0x00	0x00	RO	0x00	0xFFFFFFFF	4	macTxFailCount_RF Attribute ID
MAC_TXSUCCESSCOUNT_RF_ID	0x0000020D		0x00	0x00	0x00	RO	0x00	0xFFFFFFFF	4	macTxSuccessCount_RF Attribute ID
MAC_FCSERRORCOUNT_RF_ID	0x0000020E		0x00	0x00	0x00	RO	0x00	0xFFFFFFFF	4	macFcsErrorCount_RF Attribute ID (not available in the current release)
MAC_SECURITYFAILURE_RF_ID	0x0000020F		0x00	0x00	0x00	RO	0x00	0xFFFFFFFF	4	macSecurityFailure_RF Attribute ID
MAC_DUPLICATEFRAMECOUNT_RF_ID	0x00000210		0x00	0x00	0x00	RO	0x00	0xFFFFFFFF	4	macDuplicateFrameCount_RF Attribute ID
MAC_RXSUCCESSCOUNT_RF_ID	0x00000211		0x00	0x00	0x00	RO	0x00	0xFFFFFFFF	4	macRxSuccessCount_RF Attribute ID
MAC_NACKCOUNT_RF_ID	0x00000212		0x00	0x00	0x00	RO	0x00	0xFFFFFFFF	4	macNackCount_RF Attribute ID
MAC_EBRPERMITJOINING_RF_ID	0x00000213		0x00	0x00	0x00	RO	0x00	0x01	1	macEbrPermitJoining_RF Attribute ID
MAC_EBRFILTERS_RF_ID	0x00000214		0x00	0x00	0x00	RO	0x00	0x01	1	macEbrFilters_RF Attribute ID
MAC_EBRATTRIBUTELIST_RF_ID	0x00000215		0x00	0x00	0x00	RO	0x00	0x01	1	macEbrAttributeList_RF Attribute ID
MAC_BEACONAUTORESPOND_RF_ID	0x00000216		0x01	0x01	0x01	RO	0x00	0x01	1	macBeaconAutoRespond_RF Attribute ID
MAC_USEENHANCEDBEACON_RF_ID	0x00000217		0x01	0x01	0x01	RO	0x00	0x01	1	macUseEnhancedBeacon_RF Attribute ID
MAC_EBHEADERIELIST_RF_ID	0x00000218		0x00	0x00	0x00	RO	0x00	0x01	1	macEbHeaderIeList_RF Attribute ID (not available in the current release)
MAC_EBPAYLOADIELIST_RF_ID	0x00000219		0x00	0x00	0x00	RO	0x00	0x01	1	macEbPayloadIeList_RF Attribute ID (not available in the current release)
MAC_EBFILTERINGENABLED_RF_ID	0x0000021A		0x00	0x00	0x00	RO	0x00	0x01	1	macEbFilteringEnabled_RF Attribute ID
MAC_EBSN_RF_ID	0x0000021B		RAND	RAND	RAND	RW	0x00	0xFF	1	macEbsn_RF Attribute ID
MAC_EBAUTOSA_RF_ID	0x0000021C	x	0x01	0x01	0x01	RO	0x00	0x02	1	macEbAutoSa_RF Attribute ID
MAC_POSTABLE_RF_ID	0x0000021D	x	NA	NA	NA	RW	NA	NA		macPOSTable_RF Attribute ID
MAC_OPERATINGMODE_RF_ID	0x0000021E		0x01	0x01	0x01	RO	0x01	0x02	1	macOperatingMode_RF Attribute ID: The RF operating mode as defined in clause 20.3 of [IEEE 802.15.4v] (not available in the current release)
MAC_CHANNELNUMBER_RF_ID	0x0000021F		0x00	0x00	0x00	RO	0x00	0x1C6F	2	macChannelNumber_RF Attribute ID: The channel number as defined in cause 10.1.2.8 of [IEEE 802.15.4v] to be used for channel scanning and data transmission (not available in the current release)

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MAC_DUTYCYCLEUSAGE_RF_ID	0x00000220	x	0x00	0x00	0x00	RO	0x00	0x64	1	macDutyCycleUsage_RF Attribute ID: Current usage of maximum allowed duty cycle in percent over the current sliding-window measurement period, i.e. (t_on / macDutyCycleLimit_RF) * 100
MAC_DUTYCYCLEPERIOD_RF_ID	0x00000221	x	0x0E10	0x0E10	0x0E10	RW	0x3C	0x1C20	2	macDutyCyclePeriod_RF Attribute ID: Duration of the measurement period in seconds, e.g. 3600 seconds as default for [ETSI EN 303 204]
MAC_DUTYCYCLELIMIT_RF_ID	0x00000222	x	0x005A	0x005A	0x005A	RW	0x01	0x1C20	2	macDutyCycleLimit_RF Attribute ID: Duration of the allowed transmission time in seconds, e.g. 2,5%/10% of 3600 seconds as default for [ETSI EN 303 204]
MAC_DUTYCYCLETHRESHOLD_RF_ID	0x00000223	x	0x5A	0x5A	0x5A	RW	0x00	0x64	1	macDutyCycleThreshold_RF Attribute ID: Duty cycle threshold for stopping RF transmissions
MAC_RESERVED4_ID	0x00000224		0x00	0x00	0x00	RO	0x00	0x00	1	not used
PHY_PHYCRCERRPKTCOUNT_ID	0x00004000		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	phyCRCErrPacketCount: Counter of received packet with error detected by FCH CRC5 or CRC8
PHY_PHYCRCFAILPKTCOUNT_ID	0x00004001		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	phyCRCFailPacketCount: Counter of received packet with a correct FCH CRC5 or CRC8 but with error on some other fields
PHY_PHYLASTRCVPKTMODE_ID	0x00004002		NA	NA	NA	RO	0x00	0x08	1	phyLastReceivedPacketMode: Last Received Mode (0 – ROBO; 1 – DBPSK; 2 – DQPSK; 3 – D8PSK; 4 – BPSK; 5 – QPSK; 6 – 8PSK; 7 – 16QAM; 8 : Super-ROBO)
PHY_PHYZCPERIOD_ID	0x00004003		NA	NA	NA	RO	0x0000	0xFFFF	2	phyZCPeriod: Measured mains period in tens of uSec. If 0xFFFF the measurement is not available
PHY_LOCALPDCLASTRXPKT_ID	0x00004004		0xFF	0xFF	0xFF	RO	0x00	0xFF	1	phyLastReceivedPacketLocalPDC: The local PDC evaluated during the last packet reception
PHY_PHYISFIXEDPDC_ID	0x00004005		0x00	0x00	0x00	RW	0x00	0x01	1	phyIsFixedPDC: PDC has a fixed value specified by phyPDCValue attribute (0 – PDC has not the fixed value, 1 – PDC has a fixed value)
PHY_PHYPDCVALUE_ID	0x00004006		0x00	0x00	0x00	RW	0x00	0xFF	1	phyPDCValue: The Value of the PDC field in PHY FCH

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PHY_PHYRSFAILPKTCOUNT_ID	0x00004007		0x00000000	0x00000000	0x00000000	RR ST	0x00000000	0xFFFFFFFF	4	phyRSFailPacketCount: Counter of received packet with errors that can't be corrected by Reed-Solomon
PHY_PHYLASTRCVPKTRSSTATUS_ID	0x00004008		NA	NA	NA	RO	0x00	0x03	1	phyLastReceivedPacketRSStatus: Last received packet status returned by Reed-Solomon block (0 – no errors, 1 – corrected errors, 2 or 3 – errors detected but not corrected)
PHY_PHYLASTRCVPKTDT_ID	0x00004009		NA	NA	NA	RO	0x00	0x03	1	phyLastReceivedPacketDT: Last received Delimiter Type value
PHY_PHYLASTRCVPKTPDC_ID	0x0000400A		NA	NA	NA	RO	0x00	0xFF	1	phyLastReceivedPacketPDC: Last received Phase Detector Counter value
PHY_PHYLASTRCVPKTTM_ID	0x0000400B		NA	NA	NA	RO	0x000000	0xFFFFFF	3	phyLastReceivedPacketTM: Last received Tone Map value
PHY_PHYFREECHANNELTIME_ID	0x0000400C		NA	NA	NA	RO	0x0000000000000000	0xFFFFFFFFFFFFFFFF	8	phyFreeChannelTimestamp: Timestamp at which the channel becomes free
PHY_PHYTXPOWEROVERRIDE_ID	0x0000400D		0x0000	0x0000	0x0000	RW	0x0000	0xFFFF	2	phyTXPowerOverride: manually override TxPower by forcing digital attenuation and pre-driver gain
PHY_PHYLASTRXVALIDFCH_ID	0x0000400E		NA	NA	NA	RO	NA	NA	9	phyLastRxValidFrameFCH: FCH of last valid frame received
PHY_PHYLASTTXFCH_ID	0x0000400F		NA	NA	NA	RO	NA	NA	9	phyLastTxFCH: Last FCH transmitted
PHY_PHYAGCRESETTIMEOUT_ID	0x00004010		NA	NA	NA	RW	0x00000000	0xFFFFFFFF	4	phyAgcResetTimeout: Number of SYNCP preamble symbols without any preamble detection after which the AGC is reset. This number is regularly changed to a random value between phyAgcResetTimeoutMin and phyAgcResetTimeoutMax.
PHY_PHYCENELECLEGACYMODE_ID	0x00004011	x	0x01	0x01	0x01	RW	0x00	0x01	1	phyCENELECLegacyMode: 0 (Elementary interleaving, interleaver parameters are not swapped), 1 (Full Block interleaving, interleaver parameters are swapped)
PHY_PHYRSFILTERDISABLED_ID	0x00004012	x	0x00	0x00	0x00	RW	0x00	0x01	1	phyRSFilterDisabled: Disabled the RS Filter: 0 filter active, 1 filter not active
PHY_PHYTHRPCS_ID	0x00004013	x	0x0000E9A2	0x00011476	0x0000DA6F	RW	0x00000000	0x0001FFFF	4	phyThrPcs: Carrier sense threshold on one SYNCP

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
PHY_PHYZCDELAYCOMP_ID	0x00004014	x	NA	NA	NA	RW	NA	NA	4	phyZCDelayCompensation: The delay in µs between the zero crossing of powerline AC and the zero crossing at ZC_IN pin
PHY_PHYTONEMASK_ID	0x00004015	x	0x000000000FFFFFFFF	0xFFFFFFFFFFFFFFFFFF	0x000000000FFFFFFFF	RW	0x0000000000000000	0x000000000FFFFFFFF (CENA), 0xFFFFFFFFFFFFFFFFFF (FCC)	9	phyToneMask: Define the tone mask used during symbol formation
PHY_PHYFCCLEGACYMODE_ID	0x00004016	x	0x01	0x01	0x01	RW	0x00	0x01	1	phyFCCLegacyMode: The same of macFCCLegacyMode - only FCC
PHY_PHYTHRSYNCP_ID	0x00004017	x	0x0001D345	0x000194F7	0x0001C000	RW	0x00000000	0x0001FFFF	4	phyThrSyncP: Threshold for SyncP detection in the frame synchronizer - only FCC
PHY_PHYTHRSYNCM_ID	0x00004018	x	0x2000	0x2000	0x2000	RW	0x0000	0x7FFF	2	phyThrSyncM: Threshold for SyncM detection in the frame synchronizer - only FCC
PHY_PHYPREAMBLELENGTH_ID	0x00004019		0x00	0x00	0x00	RW	0x00	0x01	1	phyPreambleLength: Number of SyncP in the transmitted preamble - 0: 8 SyncP; 1: 12 SyncP - only FCC
PHY_LASTRECEIVEDPACKETAGC_ID	0x0000401A		NA	NA	NA	RO	0x00	0xFF	1	phyLastReceivedPacketAGC: Value of AGC gain during last reception - only FCC
PHY_PHYAGCDISABLED_ID	0x0000401B		0x00	0x00	0x00	RW	0x00	0x01	1	phyAGCDisabled: Indication if AGC is active or not - 0: AGC active; 1: AGC not active - only FCC
PHY_PHYPGAGAIN_ID	0x0000401C		0x08	0x08	0x08	RW	0x00	0xFF	1	phyPGAGain: Value of gain applied when phyAGCDisabled is 1 - only FCC
PHY_PHYCURRENTAGC_ID	0x0000401D		NA	NA	NA	RO	0x00	0xFF	1	phyCurrentAGC: Current value of AGC. It is updated at OFDM symbol time - only FCC
PHY_PHYLASTRCVPKTFL_ID	0x0000401E		NA	NA	NA	RO	0x0000	252 (CENA), 511 (FCC)	2	phyLastReceivedPacketFL: Last received FL value
PHY_PHYACKTXPOWER_ID	0x0000401F	x	0x20	0x20	0x20	RW	0x00	0x20	1	phyAckTxPower: Tx power for ACK

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
PHY_PHYPOWERESTTRIM_ID	0x00004020	x	0x0000	0x0000	0x0000	RW	NA	NA	2	phyPowerEstTrim: Offset correction factor for the estimator of signal and noise power. It is expressed in dBµV (default is 0x0000). The value is represented as a signed fixed point with 8 bits of fractional part, to be able to trim from +127dBµV to -127dBµV with resolution of 1/256 of dBµV - only CEN
PHY_PHYCURRENTSENSEMAXTHR_ID	0x00004021	x	0x0F08	0x0F0F	0x0F08	RW	0x0000	0xFFFF	2	phyCurrentSenseMaxThreshold: Current sense threshold that, if exceeded, reduces transmission power in steps of 1dB. The values correspond to the following voltages (V) on pin CSF of the device: 0x0: 0.505 0x1: 0.565 0x2: 0.625 0x3: 0.685 0x4: 0.745 0x5: 0.800 0x6: 0.885 0x7: 0.970 0x8: 1.055 0x9: 1.140 0xA: 1.600 0xB: 1.740 0xC: 1.880 0xD: 2.020 0xE: 2.160 0xF: 2.300 (= default). If the value is > 0xF, the current control strategy is disabled
PHY_PHYISFIXEDDT_ID	0x00004022		0x00	0x00	0x00	RW	0x00	0x01	1	phyIsFixedDT: DT has a fixed value specified by phyDTValue attribute - only CEN
PHY_PHYDTVALUE_ID	0x00004023		0x00	0x00	0x00	RW	0x00	0x01	1	phyDTValue: The Value of the DT field in PHY FCH - only CEN
PHY_PHYLDVCC_ID	0x00004024	x	0x0F	0x0F	0x0F	RW	0x0A	0x12	1	phyLDVcc: LD voltage supply to be used for TXPower management
PHY_BKGNESTNORM1_ID	0x00004025		NA	NA	NA	RO	NA	NA	14 4	phyBkgnEstNorm1: Mantissa and exponent of the normalized background noise
PHY_PHYTHERMALSTATUS_ID	0x00004026	x	NA	NA	NA	RO	0x00	0x44	1	phyThermalStatus: Thermal status -The bits 0-3 reports the status of the line driver temperature sensor(0: T < 70°C; 1: 70°C = T < 100°C;2: 100°C = T < 125°C; 3: 125°C = T < 170°C; 4: T >= 170°C). The bits 4-7 report the status of the low voltage temperature sensor (0: T < 100°C; 1: 100°C = T < 115°C; 2: 115°C = T < 125°C; 3: 125°C = T < 135°C; 4: T >= 135°C

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
PHY_PHYCURRENTSPIKE_ID	0x00004027	x	0x000100CF	0x000F001F	0x00010079	RW	0x00010001	0xFFFFFFFF	4	phyCurrentSenseSpikesFilter: this attribute impacts the current control strategy by filtering current spikes with duration less than its value, expressed in front-end clock cycles (clock frequency for CEN-A and FCC is 38.4MHz). Bits 0-15 set CC_NSTC_SPIKES for current control. Bits 31-16 set CC_NSTC_SPIKES (on STCOMET) or CC_NSTC_SPIKES_SURGE (on ST8500) for surge protection. Minimum value admitted for each of these two values is 1.
PHY_PHYPASELECT_ID	0x00004028	x	0x03	0x03	0x03	RW	0x00	0x03	1	phyPowerAmplifierSelect: Select one, both or neither Power Amplifiers when transmitting. Bit 0 enables/disables PA1, while bit 1 enables/disables PA2.
PHY_PHYDIGSCALINGFACT_ID	0x00004029	x	0x0000D998	0x0001999A	0x0001CCCD	RW	NA	NA	4	phyDigitalScalingFactor: Multiplicative factor to be applied on IFFT outputs.
PHY_PHYSTATICPREEMPHASIS	0x0000402A	x	NA	NA	NA	RW	0xFF	0xFF	72	phyStaticPreemphasis: Multiplicative factor (fractional) used to reduce the transmit amplitude for each carrier. For CENA only the last significative 36 bytes are used
PHY_PHYMINSYNCPVARIANCE	0x0000402B	x	0xFFE6ABCD	0xFFE89653	0xFFE89653	RW	0x80008000	0x7FFFFFFF	4	phyMinSyncPVariance: Minimum value of variance required to enable syncP detection for the specific symbol.
PHY_PHYMINLINEARPGA	0x0000402C	x	0x06	0xFF	0xFF	RW	0x00	0xFF	1	phyMinLinearPg: Minimum AGC gain to activate algorithm that disables syncP detection for the symbols with low variance. The value of AGC gain is represented in a similar way to attribute phyLastReceivedPacketAGC. *Note: In order to have syncP detection always enable, set to 0x00FF.*
PHY_PHYAGCRESETTIMEOUTMIN	0x0000402D	x	0x000036EE	0x000036EE	0x000036EE	RW	0x00000000	0xFFFFFFFF	4	phyAgcResetTimeoutMin: Minimum number of SYNCP preamble symbols without any preamble detection after which the AGC is reset. It should be <= phyAgcResetTimeoutMax. See also phyAgcResetTimeout.

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
PHY_PHYAGCRESETTIMEOUTMAX	0x0000402E	x	0x00004F59	0x00004F59	0x00004F59	RW	0x00000000	0xFFFFFFFF	4	phyAgcResetTimeoutMax: Maximum number of SYNCP preamble symbols without any preamble detection after which the AGC is reset. It should be >= phyAgcResetTimeoutMin. See also phyAgcResetTimeout.
PHY_NOISELOWMEAN_ID	0x0000402F		NA	NA	NA	RO	NA	NA	2	phyNoiseLowMean: Mantissa and exponent of present background noise power estimation.
PHY_NOISEHIGHMEAN_ID	0x00004030		NA	NA	NA	RO	NA	NA	2	phyNoiseHighMean: Mantissa and exponent of present impulsive noise power estimation.
G3_LIB_PEFWVERSION_ID	0x00003200	x	PE_FW_VERSION	PE_FW_VERSION	PE_FW_VERSION	RO	PE_FW_VERSION	PE_FW_VERSION	4	peFWVersion: build version
G3_LIB_PEPROTOVERSION_ID	0x00003201	x	0x00	0x03	0x00	RW	0x00	0x03	4	G3_LIB Attribute peProtocolVersion: store the value of the bandplan used. It can be #G3_LIB_G3PLC_CENA, #G3_LIB_G3PLC_CENB or #G3_LIB_G3PLC_FCC
G3_LIB_PECHANNELCONFIG_ID	0x00003202	x	0x0000000F if RF device is detected, 0x00000003 if not detected	0x0000000F if RF device is detected, 0x00000003 if not detected	0x0000000F if RF device is detected, 0x00000003 if not detected	RW	0x00000000	0x0000000F	4	Bitmask to configure communication channels in G3 Library Bit 0: enable the PLC communication within the G3 PAN Bit 1: enable the PLC point-to-point MAC communication (64bit src and dest addresses) Bit 2: enable the RF communication within the G3 PAN Bit 3: enable the RF point-to-point MAC communication (64bit src and dest addresses) Bit 4..31: reserved for future use
G3_LIB_PEMODE_ID	0x00003203	x	0x03	0x03	0x03	RW	0x00	0x03	1	peMode: define the working mode of the library (#G3_LIB_PEMODE_PHY or #G3_LIB_PEMODE_MAC or G3_LIB_PEMODE_ADP or G3_LIB_PEMODE_BOOT
G3_LIB_PEOPTIONS_ID	0x00003204	x	0x00000000	0x00000000	0x00000000		0x00000000	0xFFFFFFFF	4	peOptions: bitmask to enable or disable options Bit 0: enable RTE debuginfo Bit 1..31: not used

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
G3_LIB_PECURRENTTIME_ID	0x00003205		NA	NA	NA		NA	NA	8	peCurrentTime: 64-bits counter since the power-on
G3_LIB_PEMEMPOOLMAXALLOCS_ID	0x00003206		0x00000000	0x00000000	0x00000000		0x00000000	0xFFFFFFFF	4	peMemPoolMaxAllocs: internal buffer pool allocation
G3_LIB_PEOPTIONS_ID	0x00003204	x	0x00000000	0x00000000	0x00000000	RW	0x00000000	0x00000003	4	peOptions: bitmask to enable or disable options Bit 0: enable RTE debuginfo Bit 1: disable G3-PLC Specification "post-2017" features Bit 2..31: not used
G3_LIB_PECURRENTTIME_ID	0x00003205		NA	NA	NA	RO	NA	NA	8	peCurrentTime: 64-bits counter since the power-on
G3_LIB_PEMEMPOOLMAXALLOCS_ID	0x00003206		0x00000000	0x00000000	0x00000000	RW	0x00000000	0xFFFFFFFF	4	peMemPoolMaxAllocs: internal buffer pool allocation
G3_LIB_PEMEMPOOLCURRALLOCS_ID	0x00003207		0x00000000	0x00000000	0x00000000	RO	0x00000000	0xFFFFFFFF	4	peMemPoolCurrAllocs: internal buffer pool allocation
G3_LIB_PETOTALSIGNALPOWER_ID	0x00003208		0x7B	0x7B	0x7B	RW	0x00	0xFF	1	peTotalSignalPower: total signal power at the output of the device characterized when MAC_MAXTXPOWER_ID is configured to the maximum (0x20)
G3_LIB_PEEVENTINDICATION_ID	0x00003209	x	0x1F873	0x1F873	0x1F873	RW	NA	NA	8	peEventIndication: bitmask to enable (set to 1) the notification of a single event. Each bit corresponds to one event as below: Bit 0: enable error notification Bit 1: enable GMK update notification Bit 2: enable the notification of a new context assignment Bit 3: enable the notification of a new group id configuration Bit 4: enable the notification of the active key change Bit 5: enable the notification of the short address change Bit 6: enable the notification of the PAN ID change Bit 7: enable the notification of the thermal event

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
										Bit 8: enable the notification of the transmission of a MAC Tone Map Response frame Bit 9: enable the notification of the reception of a MAC Tone Map Response frame Bit 10: enable the notification of the installation/update of a route in the routing table Bit 11: enable the notification of the reception of a PREQ message Bit 12: enable the notification of the surge event Bit 13: enable the notification of warning from RTE Bit 14: enable the notification of error for RTE polling from Cortex Bit 15: enable the notification of maximum attempts during bootstrap using same LBA Bit 16: enable the notification of mismatch between RTE and Cortex bandplan Bit 17: enable the notification of the PHY RX quality info Bit 18: enable the notification of the PHY TX quality info Bits [19..63]: not used
G3_LIB_PEPOLLRTEINTERVAL_ID	0x0000320A		0x00000FA0	0x00000FA0	0x00000FA0		0x000001F4	0xFFFFFFFF	4	pePePollRTEInterval: interval time (in ms) to poll RTE
G3_LIB_PEPOLLRTETIMEOUT_ID	0x0000320B		0x00001F40	0x00001F40	0x00001F40		0x000003E8	0xFFFFFFFF	4	pePePollRTETimeout: time (in ms) to declare a failure in the poll of RTE
G3_LIB_PEPOLLRTEEXPNUM_ID	0x0000320C		0x00000005	0x00000005	0x00000005		0x00000000	0xFFFFFFFF		pePePollRTEExprNum: the number of consecutive time the RTE expiration should occur before doing the reset
G3_LIB_PERSV1_ID	0x0000320D		0x00	0x00	0x00	RO	0x00	0x00	1	Reserved for future use
G3_LIB_PESNIFFERMODE_ID	0x0000320E	x	0x00	0x00	0x00	RW	0x00	0x01	1	peSnifferMode: this attribute is taken into account only in PHY mode. 0x00 Simple PHY mode, 0x01 PHY MAC combined mode

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
G3_LIB_RTEFWVERSION_ID	0x00003100	x	RTE_FW_VERSION	RTE_FW_VERSION	RTE_FW_VERSION		RTE_FW_VERSION	RTE_FW_VERSION	4	The RTE firmware version
G3_LIB_RTEPROTOVERSION_ID	0x00003101	x	NA	NA	NA		NA	NA	4	The RTE protocol version
G3_LIB_RTEDRQUEUESIZE_ID	0x00003102		0x01	0x01	0x01		NA	NA	1	The number of Rx Packets that could be handled by the PD-DATA.Request primitive in PHY mode or by the RTMACDATA.Request primitive in MAC mode
G3_LIB_RTETXPACKETCOUNT_ID	0x00003103		0x00000000	0x00000000	0x00000000		0x00000000	0xFFFFFFFF	4	Statistical counter of transmitted Packet by the Real Time Engine. This could be the number of transmitted frames by the PHY Layer or the number of transmitted segment by the Real Time part of the MAC
G3_LIB_RTERXPACKETCOUNT_ID	0x00003104		0x00000000	0x00000000	0x00000000		0x00000000	0xFFFFFFFF	4	Statistical counter of correct received Packet by the Real Time Engine. This could be the number of received frames at PHY Layer or the number of received segment by the Real Time part of the MAC
G3_LIB_RTEMODE_ID	0x00003105	x	0x00	0x00	0x00		0x00	0x01	1	G3_LIB Working Mode of RTE (#G3_LIB_RTEMODE_MAC or #G3_LIB_RTEMODE_PHY)
G3_LIB_RTECAPABILITIES_ID	0x00003106		NA	NA	NA		NA	NA	4	Reserved for RTE future use
G3_LIB_RTEVALIDATIONTEST_ID	0x00003107		0x00	0x00	0x00		0x00	0x01	1	Indication if a PHY validation test is in progress
G3_LIB_RTERESERVED1_ID	0x00003108		NA	NA	NA		NA	NA	1	Reserved for RTE future use
G3_LIB_RTEGPIO_ID	0x00003109		0x00	0x00	0x00		NA	NA	4	Export TX and RX events to custom GPIOs bits 0..2: GPIO_TX_SEL_GROUP Selects the GPIO group where to direct the output of TX event (0 disable the indication). STCOMET: 1: GPIO5 2: GPIO6 3: GPIO7 4: GPIO8 5: GPIO9 6: GPIO10 ST8500: 1: GPIO0 2: GPIO1 3: GPIO2 4: GPIO3 bits 3..5: GPIO_TX_SEL_PIN Selects the GPIO pin of the group chosen with GPIO_TX_SEL_GROUP field where to direct the output of TX event. Has no effect if GPIO_TX_SEL_GROUP is 0. bits 6..7 Reserved

Name	ID	R	Default CENA	Default FCC	Default CENB	P	Min	Max	L	Comment
										bits 8..10 GPIO_RX_SEL_GROUP Selects the GPIO group where to direct the output of RX event.(0 to disable the indication). STCOMET: 1: GPIO5 2: GPIO6 3: GPIO7 4: GPIO8 5: GPIO9 6: GPIO10 ST8500: 1: GPIO0 2: GPIO1 3: GPIO2 4: GPIO3 bits 11..13 GPIO_RX_SEL_PIN Selects the GPIO pin of the group chosen with GPIO_RX_SEL_GROUP field where to direct the output of RX event. Has no effect if GPIO_RX_SEL_GROUP is 0. bits 14..31 Reserved
RF_RSSINOISEINTERVAL	0x00005000	x	0x012C	0x012C	0x012C	RW	0x000A	0x3840	2	Time interval (in secs) between two consecutive background noise measurements
RF_RSSINOISEMARGINRX	0x00005001	x	0x0A	0x0A	0x0A	RW	0x01	0x3C	**1**	rfRSSINoiseMarginRX: The margin (in dB), to be added to last background noise measurement when setting RSSI threshold used in RX
RF_DISABLEPHY	0x00005002	x	0x00	0x00	0x00	RW	0x00	0x01	1	rfDisablePHY: Disable RF PHY Tx and Rx (RF transceiver is shutdown)
RF_RSSINOISEMARGINTX	0x00005003	x	0x1E	0x1E	0x1E	RW	0x01	0x3C	1	rfRSSINoiseMarginTX: The margin (in dB), to be added to last background noise measurement when setting CS threshold used by CSMA in TX

9.1 Tables entry description

This section contains the description of the entry structures for each table

Table 175. POS table entry structure

Label	Len	Description
ShortAddress	2	Short address of the device
LQI	1	Forward LQI
POSValidTime	1	Validity time

Table 176. RF POS table entry structure

Label	Len	Description
ShortAddress	2	Short address of the device
FwdLQI	1	Link quality indicator computed as the exponentially weighted moving average (EWMA) of the LQI derived from the received packets from this neighbor using a smoothing factor of 1/8
RevLQI	1	Link quality indicator computed as the exponentially weighted moving average (EWMA) of the LQI derived from RLQ-IEs received from this neighbor using a smoothing factor of 1/8
DutyCycle	1	Duty cycle usage of the neighbor in percent as reported via the last received LI-IE
FwdPowerOffset	1	TX output power offset used for transmissions from this device to the neighbor node. The value is propagated to the neighbor via the LI-IE
RevPowerOffset	1	TX output power offset used for transmissions from the neighbor node to this device. The value is received from the neighbor via the LI-IE
POSValidTime	1	Remaining time in minutes until when this entry is considered valid

Table 177. Device table entry structure

Label	Len	Description
PanID	2	The PAN ID of the node
ShortAddress	2	Short address of the node
LastRcvFrameCnt	4	Last received frame counter

Table 178. Neighbor table entry structure

Label	Len	Description
ShortAddress	2	Short address of the node
TxRes/TxGain/Mod	1	Bit 0..2: Modulation Bit 3..6: TxGain Bit7: TxRes
ToneMap	3	ToneMap
ReverseLQI	1	Reverse LQI
TxCoeff	6	Tx coefficients
PayModScheme/PhaseDiff	1	Bit 0..2: Phase Differential Bit 3: Payload Modulation Scheme Bit 4..7: not used
TMRValidTime	1	Validity time

Table 179. Neighbor table entry structure 2015 format

Label	Len	Description
ShortAddress	2	Short address of the node
TxRes/TxGain/Mod	1	Bit 0..2: Modulation Bit 3..6: TxGain Bit7: TxRes
ToneMap	3	ToneMap
ReverseLQI	1	Reverse LQI
TxCoeff	6	Tx coefficients
PayModScheme/PhaseDiff	1	Bit 0..2: Phase Differential Bit 3: Payload Modulation Scheme Bit 4..7: not used
TMRValidTime	1	Validity time of the tone map information
EntryValidTime	1	Validity time of the entry

Table 180. Routing table entry structure

Label	Len	Description
DestAddr	2	Short address of the final destination node
NextHop	2	Short address of the next hop
RouteCost	2	Route cost
HopCnt/WeakLink	1	Bit 0..3: Hop count Bit 4..7: Weak link count
ValidTime	2	Validity time
MediaType	1	The medium to be used to transmit to the Next Hop

Table 181. Black list table entry structure

Label	Len	Description
ShortAddress	2	Short address of the blacklisted node
ValidTime	2	Validity time
MediaType	1	The medium of the blacklisted neighbor

Table 182. Broadcast Log table entry structure

Label	Len	Description
ShortAddress	2	Short address of the broadcast message originator node
SeqNum	1	Sequence number of the broadcast message
ValidTime	2	Validity time

Table 183. Context Information table entry structure

Label	Len	Description
CID/C	1	Bit 0..3: CID – context identifier Bit 4: C

Label	Len	Description
		Bit 5..7: not used
ValidLifeTime	2	Validity time
ContextLen	1	Length of the context (in bits)
Context	Var	The context

Note: The maximum Context field length is 16 bytes. The Context field returned during the get of one entry is always 16 bytes length but only the first ContextLen bits are valid and must be considered.

Table 184. Prefix table entry structure

Label	Len	Description
PrefixLen	1	The length of the prefix (in bits)
L/A	1	Bit 0: L Bit 1: A Bit 2..7: not used
ValidLifeTime	4	Validity time of the entry
PrefLifeTime	4	Validity time of the prefix
Prefix	Var	The prefix

Note: The maximum Prefix field length is 16 bytes (128 bits). The Prefix field returned during the get of one entry is always 16 bytes length (only PrefixLen first bits are valid).

Table 185. Group table entry structure

Label	Len	Description
Group	2	The group number

Table 186. Destination Address table entry structure

Label	Len	Description
ShortAddress	2	The Short address of the additional device for which the connectivity is provided

9.2 Tables number of entries

This section contains the number of entries for each table.

Table 187. Number of entries for each table

Table	Number of entries
POS table	1200
Device table	1200
Neighbor table	1200
Routing table	1200
Black list table	64
Broadcast Log table	64
Context Information table	16

Table	Number of entries
Prefix table	4
Group table	64
Destination Address table	16

10 Secure Host Interface Cryptographic examples

This section includes an example of the activation and use of the secure host interface.

All the field are written with hexadecimal format considering the left byte as the byte zero (for buffers) or the first transmitted byte (for commands)

10.1 Secure Host interface initialization sequence exchange

Given the following parameters:

Table 188. HOST-IF-SEC-INIT parameters

Label	Content
OTP_KEY:	ab 10 34 11 45 11 1b c3 c1 2d e8 ff 11 14 22 04
RAND_INIT:	a2 dc 2f 28 34 e0 0b a3 1c 80 f2 32 0a 25 98 9e
RAND_H	99 a6 77 36 f6 a4 44 67
RAND_S:	bc c3 a5 2f 22 57 df 97

The derived key is:

Table 189. HOST-IF-SEC-INIT derived key

Label	Content
UART_KEY:	06 e4 4b 53 c3 1a 7f 20 78 dd 58 85 b9 17 34 63

And the full initialization message sequence is

Table 190. HOST-IF-SEC-INIT message exchange example

Label	Content
type1-req:	16 16 16 01 00 00 00 00 00 00 01 64 1d
type1-conf:	16 16 17 22 00 00 00 00 00 00 00 01 a2 dc 2f 28 34 e0 0b a3 1c 80 f2 32 0a 25 98 9e 99 a6 77 36 f6 a4 44 67 bc c3 a5 2f 22 57 df 97 76 27
type2-req:	16 16 16 11 00 02 00 00 00 00 e9 09 05 79 82 a5 30 5d f5 1b ff fc 61 bc 30 2c 4d a2 f3 66 9e 83 a7 32 d5 d0 1a
type2-conf:	16 16 17 12 00 02 00 00 00 00 00 e4 ed cd 15 36 31 73 0e 8b 37 4d 40 9a 5c 39 24 1b 54 fe 0b 21 4a 66 8c 9b 1b ac

10.2 Encrypted commands

Given the following parameters:

Table 191. Secure host interface message exchange parameters

Label	Content
UART_KEY:	06 e4 4b 53 c3 1a 7f 20 78 dd 58 85 b9 17 34 63
IV:	bc c3 a5 2f 22 57 df 97 01 00 00 00
REQUEST UNENCRYPTED-PAYLOAD:	50 00 00 00 00 00
CONFIRM UNENCRYPTED-PAYLOAD:	00 50 00 00 00 00 00 02 00 ff ff

The message exchange is:

Table 192. Secure Host Interface message exchange example

Label	Content
G3LIB-GET.Rquest	16 16 20 06 00 02 01 00 00 00 50 2d 42 5d ea 91 fc be b2 ff 78 bb 9c f5 3b ad
G3-LIB-GET.Confirm	16 16 21 0c 00 02 01 00 00 00 00 21 8e f0 04 51 5f 32 e7 68 da e6 19 31 c3 27 1f 2e b8 97 0c 1b

Revision history

Table 193. **Document revision history**

Date	Version	Changes
01-Apr-2021	1	Initial release.

Contents

List of figures

List of tables