# Management Messages

## Management Message Format

The format of Management Messages is based on the standard Ethernet frame format, with a unique Ethertype assigned to HomePlug. HomePlug AV has a different Ethertype assignment than the Ethertype assigned to HomePlug 1.0.1. Management Messages are used for station-to-station control communication, but also may be used for control messages to and from a Higher Layer Entity (HLE). The Ethernet format enables messages to HLEs across an Ethernet network.

Table 11‑1 shows the structure of the Management Message (MM).

Table 11‑1: Management Message Format

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (bits) | Definition |
| ODA | 0 - 5 | 48 | Original Destination Address |
| OSA | 6 - 11 | 48 | Original Source Address |
| VLAN Tag | 12 - 15 | 32 | IEEE 802.1Q VLAN Tag (optional) |
| MTYPE | 16 - 17 | 16 | 0x88e1 (IEEE-assigned Ethertype)  Note: 0x88 is transmitted in the least-significant octet and 0xe1 is transmitted in the most-significant octet in conformance with IEEE 802.3. |
| MMV | 18 | 8 | Management Message Version |
| MMTYPE | 19 - 20 | 16 | Management Message Type |
| FMI | 21 | 4 | Fragmentation Management Information –  4 MSBs are Number of Fragments (NF\_MI) of the MMENTRY  0x00 = MMENTRY is not Fragmented  0x01 = MMENTRY is Fragmented into two parts  0x02 = MMENTRY is Fragmented into three parts, and so on |
| 4 | 4 LSBs are Fragment Number (FN\_MI) of the MMENTRY  0x00 = First or Only Fragment  0x01 = Second Fragment, and so on |
| 22 | 8 | Fragmentation Message Sequence Number (FMSN) |
| MMENTRY | - | Var | Management Message Entry Data |
| MME PAD | - | 0 - 46 | MME PAD |

### Original Destination Address (ODA)

As with HomePlug AV, the Original Destination Address (ODA) is a 48-bit address of the HomePlug GREEN PHY station that is the ultimate destination of this Management Message. The address format follows the corresponding fields described in the IEEE 802-2001 [4] standard. Messages with an ODA other than the station’s MAC address are delivered to the appropriate P1 or H1 interface.

### Original Source Address (OSA)

As with HomePlug AV, the Original Source Address (OSA) is a 48-bit address of the HomePlug GREEN PHY station that is the original source of this Management Message. The address format follows the corresponding fields described in the IEEE 802-2001 [4] standard.

### VLAN Tag

The VLAN Tag field, if present, contains four octets, as in IEEE 802.1Q [11], Clause 9 for Ethernet-encoded Tag Protocol ID.

### MTYPE

MTYPE shall be set to the IEEE-assigned Ethertype value of 0x88e1. The format of the MTYPE field follows the format of the Type/Length field described in the IEEE 802.3 standard [12]. This IEEE-assigned Ethertype may be used by future revisions of this specification and/or other specifications defined by the HomePlug Powerline Alliance. The Management Message Version (MMV) may be used to distinguish related messages defined in different specifications.

### Management Message Version (MMV)

Management Message Version (MMV) is a 1-octet field that indicates the specification version used to interpret the Management Message.

* All messages defined in HomePlug AV specification Version 1.0 shall have the MMV field set to 0x00.
* All messages defined in HomePlug AV specification Version 1.1 shall have the MMV field set to 0x01.
* All messages defined in HomePlug GREEN PHY specification Version 1.0 shall have the MMV field set to 0x01.

All other values of the MMV field are reserved. Implementation based on HomePlug AV specification Version 1.0 shall discard all Management Messages with MMV not equal to 0x00. It is optional for implementations based on HomePlug AV specification Version 1.1 to interoperate with implementations based on HomePlug AV specification Version 1.0. It is mandatory for implementations based on HomePlug GREEN PHY specification Version 1.0 to interoperate with implementations based on HomePlug AV specification Version 1.1. Implementations based on HomePlug AV specification Version 1.1 shall discard all Management Messages with MMV greater than 0x01.

Future revisions of this specification or specifications based on this one addressing other applications may use this field to interpret messages defined in more than one specification.

### Management Message Type (MMTYPE)

Management Message Type (MMTYPE) is a 2-octet field that defines the Management Message that follows. Table 11‑5 lists the various Management Message Types.

* The two LSBs of MMTYPE indicate that the message is a Request, Confirm, Indication, or Response (see Table 11‑2).
* The three MSBs of the MMTYPE indicate the category to which the Management Message belongs, as shown in Table 11‑3.

Table 11‑2: Interpretation of Two LSBs of MMTYPE

|  |  |  |
| --- | --- | --- |
| MMTYPE Two LSB Value | Type | Description |
| 0b00 | REQ | Management Message Request |
| 0b01 | CNF | Management Message Confirm |
| 0b10 | IND | Management Message Indication |
| 0b11 | RSP | Management Message Response |

Table 11‑3: Interpretation of Three MSBs of MMTYPE

|  |  |  |
| --- | --- | --- |
| MMTYPE  Three MSB Value | Type | Description |
| 0b000 | STA – Central Coordinator | Management Messages exchanged between STA and CCo |
| 0b001 | Proxy Coordinator | Management Messages exchanged with the Proxy Coordinator |
| 0b010 | Central Coordinator – Central Coordinator | Management Messages exchanged between neighboring CCos |
| 0b011 | STA – STA | Management Messages exchanged between two Stations |
| 0b100 | Manufacturer Specific | Management Message defined by the AV/GP chip manufacturers for exchanging manufacturer dependent control information across the H1 interface. |
| 0b101 | Vendor Specific | Management Message defined by either the AV/GP chip manufacturer or AV/GP product vendor for exchanging chip or product implementation dependent control information across the H1 interface and/or over the powerline (i.e., between stations). |
| 0b110 - 0b111 | Reserved | Reserved for future use |

### Fragment Management Information

The Number of Fragments (NF\_MI), Fragment Number (FN\_MI), and Fragmentation Message Sequence number (FMSN) fields enable transmission of management information (i.e., MMENTRY) using multiple management messages in instances where all the management information cannot fit in a single management message. The maximum size of management messages transmitted using multi-network broadcasting (refer to Section 5.4.3.1) is limited to 502 octets. For transmissions to STAs associated with the same AVLN, the maximum size of the management message is limited to 1518 octets (including VLAN Tag). Management information that can be fit in a single management message shall not be fragmented.

Below is a complete list of MMTYPEs that may be fragmented:

* CC\_LINK\_INFO.CNF
* CC\_LINK\_INFO.IND
* CC\_HANDOVER\_INFO.IND
* CC\_DISCOVER\_LIST.CNF
* CC\_DISCOVER\_LIST.IND
* CC\_SET\_TEI\_MAP.IND
* CP\_PROXY\_APPOINT.REQ
* CM\_CONN\_INFO.CNF
* CM\_NW\_STATS.CNF

The NF\_MI field indicates the number of management messages into which the management information is fragmented. A value of 0x0 indicates no fragmentation. A value of 0x1 indicates that the management information is fragmented across two management messages, and so on. The NF\_MI field shall remain constant across all management messages that carry fragments of the same management information.

The FN\_MI field indicates the fragment number of the management information contained within the management message. A value of 0x0 indicates the first or only fragment. A value of 0x1 indicates the second fragment and so on.

The FMSN field is initialized to zero and incremented by one when Management information has to be fragmented at the transmitter, regardless of the destination address or the type/version of the management message. The FMSN field shall be set to 0x00 in management messages that do not have to be fragmented. FMSN shall remain constant across all management messages that carry fragments of the same management information.

For Fragmentation purposes, the MMENTRY is treated as an octet stream. Each management message carrying fragmented MMENTRY shall contain the ODA, OSA, MTYPE, MMV, MMTYPE, and FMI fields followed by a fragment of the MMENTRY. The first fragment of the MMENTRY shall contain octets of the MMENTRY starting with the least-significant octet, and so on. When MMENTRY is fragmented, all fragments except the last one shall be of the maximum possible length.

Figure 11‑1 shows fragmentation of a MMENTRY into three management messages. The receiver shall use the {ODA, OSA, MMV, MMTYPE, FMSN} tuple to uniquely identify fragments belonging to the same management information.

Due to the non-reliable nature of the powerline medium, it is possible to have scenarios where the receiver will not receive all fragments of a Management Information successfully. Reception of an out-of-order fragment indicates a lost fragment and shall cause the receiver to discard all fragments of the Management Information. If all received fragments of a Management Information are in order and one or more fragments are pending to be received, the receiver should wait for a minimum of FragMMI\_ReassemblyTimeOut duration before declaring a reassembly failure.



Figure ‑: Illustration of Fragmentation of a MMENTRY

### Management Message Entry Data (MME)

The format of Management Message Entry Data (message) depends on the MMTYPE with which it is associated. Table 11‑4 shows prefix conventions used when naming the Management Messages.

Table 11‑4: Prefix Conventions when Naming Management Messages

| Prefix | Description |
| --- | --- |
| CC | The message is between the Connection Manager (CM) and CCo. |
| CM | The message is between the CM and CM. |
| CP | The message is between the CCo and PCo. |
| PH | The message is between the PCo and Hidden station (HSTA). |
| NN | The message is between Neighbor Coordinators (NCos). |

Some Management Messages are intended for use only by the HomePlug AV or HomePlug GREEN PHY Control Plane, and are not allowed over the H1 interface. The “From H1 Interface” and “To H1 Interface” columns in Table 11‑5 indicate whether the MME can be received from or transmitted to the HLE (or bridged from another network) via the H1 interface, respectively. The interpretation of the values in this column is as follows:

Yes ⎯ Indicates the message can be received or transmitted across the H1 Interface. The message can also be exchanged between stations over the Powerline.

No ⎯ Indicates the message shall not be received from and shall not be transmitted to the H1 Interface. The message can be exchanged between stations over the Powerline.

Only ⎯ Indicates the message can only be received from or transmitted to the H1 interface. The message shall never be transmitted over the powerline.

Some MMEs that are transmitted over the powerline can be generated by both the HLE (and transmitted to STA through the H1 interface) and by the Control Plane of the STA. When responses to such MMEs are received by the STA, there is ambiguity about whether the MME has to be sent to the HLE or to the Control Plane. Details about how such ambiguities are resolved is beyond the scope of this specification.

The optional/mandatory nature of the Management Messages depends on the STA Capabilities. Table 11‑5 shows the optional/mandatory requirements for MMEs based on the CCo Capability (refer to Section 7.4.3.1) of the station. This table is intended to provide guidelines to implementers on the Mandatory MMEs that need to be implemented based on the CCo Capabilities of the station.

The interpretation of each of the columns in this table is as follows:

* Req. L-2 CCo TX ⎯ Transmit requirement for a Level-2 CCo capable station acting as a CCo and as STA in an AVLN.
* Req. L-2 CCo RX ⎯ Receive requirement for a Level-2 CCo capable station acting as a CCo and as STA in an AVLN.
* Req. L-1 CCo TX ⎯ Transmit requirement for a Level-1 CCo capable station without QoS support acting as a CCo and as STA in an AVLN.
* Req. L-1 CCo RX ⎯ Receive requirement for a Level-1 CCo capable station without QoS support acting as a CCo and as STA in an AVLN.
* Req. L-0 CCo TX ⎯ Transmit requirement for a Level-0 CCo capable station acting as a CCo and as STA in an AVLN.
* Req. L-0 CCo RX ⎯ Receive requirement for a Level-0 CCo capable station acting as a CCo and as STA in an AVLN.

A value of “M” in these columns indicates that the requirement is Mandatory. A value of “O” indicates that the requirement is Optional. A value of “X” indicates that a station should never transmit/receive the corresponding MME. Reception of an MME that is not supported by the station shall cause the station to respond with a CM\_MME\_ERROR.IND message (refer to Section 11.5.32).

The “NEK Encrypted” column indicates whether the corresponding MME is encrypted using NEK (i.e., PHY Block Body Encryption) by the transmitter (refer to Section 5.4.2) when sent over the powerline medium. A value of “Always” in this column indicates that the transmitter shall encrypt the MME. Furthermore, receivers shall discard such MMEs if they are transmitted in clear text. A value of “Never” in this column indicates that the MME shall never be NEK encrypted. A value of “Both” indicates that there are some instances where the MME is transmitted without NEK Encryption and other instances where the MME is transmitted with NEK Encryption. The NEK Encrypted column applies only to instances where MMEs are not transmitted as part of CM\_ENCRYPTED\_PAYLOAD.IND MME.

The nominal priority settings for the Management Messages is PLID = 0x02. Further recommendations for priority settings for CM\_CHAN\_EST.IND and CM\_TM\_UPDATE.IND are presented in Section 5.2.6.5.

As with HomePlug AV, HomePlug GREEN PHY allows two groups of MMTYPE values for Manufacturer-Specific and Vendor-Specific extensions to the MMEs defined within this specification. Manufacturer-Specific MMEs are only allowed across the H1 Interface and can be used as a way to implement H1 primitives. Manufacturer-Specific MMEs do not contain a way to identify the HLE that sent the MME and, hence, may limit their usability.

Vendor-Specific MMEs always include the Organizationally Unique Identifier (OUI) for the Vendor, enabling them to be uniquely identified. These can be exchanged across the H1 interface as well as over the powerline. STAs can use the CM\_STA\_CAP MMEs to determine the OUI of other STAs in the network.

Table 11‑5: Management Message Type (Note there is a Table 11-5b)

| MMTYPE Base Value | Interpretation | From  H1 Interface | To  H1 Interface | Req.  L-2 CCo  TX | Req.  L-2 CCo  RX | Req.  L-1 CCo  TX | Req.  L-1 CCo  RX | Req.  L-0  CCo  TX | Req.  L-0 CCo  RX | NEK Encrypted  By PHY |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Station – Central Coordination |  |  |  |  |  |  |  |  |  |
| 0x0000 | CC\_CCO\_APPOINT.REQ  (See Note #1) | Yes | No | M | M | M | M | M | M | Always |
| CC\_CCO\_APPOINT.CNF (See Note #1) | No | Yes | M | M | M | M | M | M | Always |
| 0x0004 | CC\_BACKUP\_APPOINT.REQ | No | No | O | O | O | O | O | O | Always |
| CC\_BACKUP\_APPOINT.CNF | No | No | O | O | O | O | O | O | Always |
| 0x0008 | CC\_LINK\_INFO.REQ | Yes | No | M | M | M | M | M | X | Always |
| CC\_LINK\_INFO.CNF | No | Yes | M | M | M | M | X | M | Always |
| CC\_LINK\_INFO.IND (See Note #3) | No | No | O | O | O | O | X | X | Always |
| CC\_LINK\_INFO.RSP (See Note #3) | No | No | O | O | O | O | X | X | Always |
| 0x000C | CC\_HANDOVER.REQ (See Note #4) | No | No | M | M | M | M | M | M | Always |
| CC\_HANDOVER.CNF (See Note #4) | No | No | M | M | M | M | M | M | Always |
| 0x0010 | CC\_HANDOVER\_INFO.IND  (See Note #4) | No | No | M | M | M | M | M | M | Always |
| CC\_HANDOVER\_INFO.RSP (See Note #4) | No | No | M | M | M | M | M | M | Always |
| 0x0014 | CC\_DISCOVER\_LIST.REQ | Yes | No | M | M | M | M | M | M | Always |
| CC\_DISCOVER\_LIST.CNF | No | Yes | M | M | M | M | M | M | Always |
| CC\_DISCOVER\_LIST.IND | No | No | M | M | M | M | M | M | Always |
| 0x0018 | CC\_LINK\_NEW.REQ (See Note #2) | No | No | M | M | M | M | M | X | Always |
| CC\_LINK\_NEW.CNF (See Note #2) | No | No | M | M | M | M | X | M | Always |
| 0x001C | CC\_LINK\_MOD.REQ (See Note #2) | No | No | M | M | M | M | M | X | Always |
| CC\_LINK\_MOD.CNF (See Note #2) | No | No | M | M | M | M | X | M | Always |
| 0x0020 | CC\_LINK\_SQZ.REQ (See Note #5) | No | No | O | O | O | O | X | O | Always |
| CC\_LINK\_SQZ.CNF (See Note #5) | No | No | O | O | O | O | O | X | Always |
| 0x0024 | CC\_LINK\_REL.REQ (See Note #2) | No | No | M | M | M | M | M | X | Always |
| CC\_LINK\_REL.IND (See Note #2) | No | No | M | M | M | M | X | M | Always |
| 0x0028 | CC\_DETECT\_REPORT.REQ  (See Note #6) | No | No | O | O | O | O | X | O | Always |
| CC\_DETECT\_REPORT.CNF (See Note #6) | No | No | O | O | O | O | O | X | Always |
| 0x002C | CC\_WHO\_RU.REQ | Yes | No | M | M | M | M | M | M | Both |
| CC\_WHO\_RU.CNF | No | Yes | M | M | M | M | M | M | Both |
| 0x0030 | CC\_ASSOC.REQ | No | No | M | M | M | M | M | M | Both |
| CC\_ASSOC.CNF | No | No | M | M | M | M | M | M | Both |
| 0x0034 | CC\_LEAVE.REQ | No | No | M | M | M | M | M | M | Both |
| CC\_LEAVE.CNF | No | No | M | M | M | M | M | M | Both |
| CC\_LEAVE.IND | No | No | M | M | M | M | M | M | Both |
| CC\_LEAVE.RSP | No | No | M | M | M | M | M | M | Both |
| 0x0038 | CC\_SET\_TEI\_MAP.REQ | No | No | O | M | O | M | O | M | Both |
| CC\_SET\_TEI\_MAP.IND | No | No | M | M | M | M | M | M | Both |
| 0x003C | CC\_RELAY.REQ (See Note #7) | No | No | O | O | O | O | O | O | Both |
| CC\_RELAY.IND (See Note #7) | No | No | O | O | O | O | O | O | Both |
| 0x0040 | CC\_BEACON\_RELIABILITY.REQ | No | No | M | M | M | M | M | M | Always |
| CC\_BEACON\_RELIABILITY.CNF | No | No | M | M | M | M | M | M | Always |
| 0x0044 | CC\_ALLOC\_MOVE.REQ | No | No | O | M | O | M | O | X | Always |
| CC\_ALLOC\_MOVE.CNF | No | No | M | O | M | O | X | O | Always |
| 0x0048 | CC\_ACCESS\_NEW.REQ | No | No | O | O | O | O | O | X | Always |
| CC\_ACCESS\_NEW.CNF | No | No | O | O | O | O | X | O | Always |
| CC\_ACCESS\_NEW.IND | No | No | O | O | O | O | O | X | Always |
| CC\_ACCESS\_NEW.RSP | No | No | O | O | O | O | X | O | Always |
| 0x004C | CC\_ACCESS\_REL.REQ | No | No | O | O | O | O | O | X | Always |
| CC\_ ACCESS\_REL.CNF | No | No | O | O | O | O | X | O | Always |
| CC\_ ACCESS\_REL.IND | No | No | O | O | O | O | O | O | Always |
| CC\_ ACCESS\_REL.RSP | No | No | O | O | O | O | O | O | Always |
| 0x0050 | CC\_DCPPC.IND (See Note #8) | No | No | O | M | O | M | O | M | Always |
| CC\_DCPPC.RSP (See Note #8) | No | No | M | O | M | O | M | O | Always |
| 0x0054 | CC\_HP1\_DET.REQ | No | No | M | M | M | M | M | M | Always |
| CC\_HP1\_DET.CNF | No | No | M | M | M | M | M | M | Always |
| 0x0058 | CC\_BLE\_UPDATE.IND | No | No | O | M | O | M | O | X | Always |
| 0x005C – 0x1FFC | Reserved for future use |  |  |  |  |  |  |  |  |  |
|  | Proxy Coordinator |  |  |  |  |  |  |  |  |  |
| 0x2000 | CP\_PROXY\_APPOINT.REQ (See Note #9) | No | No | O | O | O | O | O | O | Always |
| CP\_PROXY\_APPOINT.CNF (See Note #9) | No | No | O | O | O | O | O | O | Always |
| 0x2004 | PH\_PROXY\_APPOINT.IND (See Note #9) | No | No | O | O | O | O | O | O | Both |
| 0x2008 | CP\_PROXY\_WAKE.REQ (See Note #9) | No | No | O | O | O | O | O | O | Always |
| 0x200C – 0x3FFC | Reserved for future use |  |  |  |  |  |  |  |  |  |
|  | CCo – CCo |  |  |  |  |  |  |  |  |  |
| 0x4000 | NN\_INL.REQ | No | No | M | M | X | X | X | X | Never |
| NN\_INL.CNF | No | No | M | M | X | X | X | X | Never |
| 0x4004 | NN\_NEW\_NET.REQ | No | No | M | M | X | X | X | X | Never |
| NN\_NEW\_NET.CNF | No | No | M | M | X | X | X | X | Never |
| NN\_NEW\_NET.IND | No | No | M | M | X | X | X | X | Never |
| 0x4008 | NN\_ADD\_ALLOC.REQ | No | No | M | M | X | X | X | X | Never |
| NN\_ADD\_ALLOC.CNF | No | No | M | M | X | X | X | X | Never |
| NN\_ADD\_ALLOC.IND | No | No | M | M | X | X | X | X | Never |
| 0x400C | NN\_REL\_ALLOC.REQ | No | No | M | M | X | X | X | X | Never |
| NN\_REL\_ALLOC.CNF | No | No | M | M | X | X | X | X | Never |
| 0x4010 | NN\_REL\_NET.IND | No | No | M | M | X | X | X | X | Never |
| 0x4014 – 0x5FFC | Reserved for future use | - |  |  |  |  |  |  |  |  |
|  | Station – Station |  |  |  |  |  |  |  |  |  |
| 0x6000 | CM\_UNASSOCIATED\_STA.IND | No | Yes | M | M | M | M | M | M | Never |
| 0x6004 | CM\_ENCRYPTED\_PAYLOAD.IND | Yes | Yes | M | M | M | M | M | M | Both |
| CM\_ENCRYPTED\_PAYLOAD.RSP | Yes | Yes | M | M | M | M | M | M | Both |
| 0x6008 | CM\_SET\_KEY.REQ | Yes | Yes | M | M | M | M | M | M | Always |
| CM\_SET\_KEY.CNF | Yes | Yes | M | M | M | M | M | M | Always |
| 0x600C | CM\_GET\_KEY.REQ | Yes | Yes | M | M | M | M | M | M | Never |
| CM\_GET\_KEY.CNF | Yes | Yes | M | M | M | M | M | M | Never |
| 0x6010 | CM\_SC\_JOIN.REQ | No | No | M | M | M | M | M | M | Never |
| CM\_SC\_JOIN.CNF | No | No | M | M | M | M | M | M | Never |
| 0x6014 | CM\_CHAN\_EST.IND | No | No | M | M | M | M | M | M | Both |
| 0x6018 | CM\_TM\_UPDATE.IND | No | No | O | M | O | M | O | M | Both |
| 0x601C | CM\_AMP\_MAP.REQ | Yes | No | O | M | O | M | O | M | Always |
| CM\_AMP\_MAP.CNF | No | Yes | M | O | M | O | M | O | Always |
| 0x6020 | CM\_BRG\_INFO.REQ  (See Note #10) | Yes | No | O | M | O | M | O | M | Always |
| CM\_BRG\_INFO.CNF (See Note #10) | No | Yes | M | M | M | M | M | M | Always |
| 0x6024 | CM\_CONN\_NEW.REQ  (See Note #2) | No | No | M | M | M | M | M | M | Always |
| CM\_CONN\_NEW.CNF (See Note #2) | No | No | M | M | M | M | M | M | Always |
| 0x6028 | CM\_CONN\_REL.IND (See Note #2) | No | No | M | M | M | M | M | M | Always |
| CM\_CONN\_REL.RSP (See Note #2) | No | No | M | M | M | M | M | M | Always |
| 0x602C | CM\_CONN\_MOD.REQ (See Note #2) | No | No | M | M | M | M | M | M | Always |
| CM\_CONN\_MOD.CNF (See Note #2) | No | No | M | M | M | M | M | M | Always |
| 0x6030 | CM\_CONN\_INFO.REQ | Yes | No | M | M | M | M | M | M | Always |
| CM\_CONN\_INFO.CNF | No | Yes | M | M | M | M | M | M | Always |
| 0x6034 | CM\_STA\_CAP.REQ | Yes | No | M | M | M | M | M | M | Both |
| CM\_STA\_CAP.CNF | No | Yes | M | M | M | M | M | M | Both |
| 0x6038 | CM\_NW\_INFO.REQ | Yes | No | M | M | M | M | M | M | Always |
| CM\_NW\_INFO.CNF | No | Yes | M | M | M | M | M | M | Always |
| 0x603C | CM\_GET\_BEACON.REQ | Yes | No | M | M | M | M | M | M | Always |
| CM\_GET\_BEACON.CNF | No | Yes | M | M | M | M | M | M | Always |
| 0x6040 | CM\_HFID.REQ | Yes | No | M | M | M | M | M | M | Both |
| CM\_HFID.CNF | No | Yes | M | M | M | M | M | M | Both |
| 0x6044 | CM\_MME\_ERROR.IND | No | Yes | M | M | M | M | M | M | Both |
| 0x6048 | CM\_NW\_STATS.REQ | Yes | No | M | M | M | M | M | M | Always |
|  | CM\_NW\_STATS.CNF | No | Yes | M | M | M | M | M | M | Always |
| 0x604C | CM\_LINK\_STATS.REQ | Yes | No | M | M | M | M | M | M | Always |
|  | CM\_LINK\_STATS.CNF | No | Yes | M | M | M | M | M | M | Always |
| 0x6050 – 7FFC | Reserved for future use | - |  |  |  |  |  |  |  |  |
|  | Manufacturer Specific |  |  |  |  |  |  |  |  |  |
| 0x8000 – 0x9FFC | Manufacturer Specific Messages | Only | Only |  |  |  |  |  |  | - |
|  | Vendor Specific |  |  |  |  |  |  |  |  |  |
| 0xA000 – 0xBFFC | Vendor-Specific Messages | Yes | Yes |  |  |  |  |  |  | Both |

Notes:

1. CC\_CCO\_APPOINT.REQ is generated by HLE. It is mandatory for stations to be able to receive this message from H1 interface and pass it to the CCo. Similarly, it is mandatory for all stations to be able to receive CC\_CCO\_APPOINT.CNF from any station in the AVLN and pass it to the HLE.
2. Refer to Section 5.2.3 for details.
3. Optional when the station does not support Soft Handover (refer to Section 7.5). Mandatory if it does.
4. Support for Hard Handover is Mandatory (refer to Section 7.5).
5. Optional if the station does not support Squeeze/De-Squeeze procedure (refer to Section 5.2.3.8.1). Mandatory if it does.
6. Optional if the station does not support Detect-and-Report procedure (refer to Section 5.2.5). Mandatory if it does.
7. Optional if the station does not support the Proxy Networking procedure (refer to Section 7.7). Mandatory if it does.
8. Optional if the station does not support simultaneous participation in more than one network (refer to Section 5.5.4.1).
9. Optional if the station does not support Proxy Networking (refer to Section 7.7). Mandatory if it does.
10. Any STA can request bridging information by using CM\_BRG\_INFO.REQ. It is mandatory for all stations to respond with CM\_BRG\_INFO.CNF. It is mandatory that all bridges periodically generate CM\_BRG\_INFO.CNF (refer to Section 5.3).

### MME PAD

Management Messages shall be at least 60 octets long. MME PAD is a variable-length field that shall be present in Management Messages whose length, excluding the MME-PAD (i.e., from ODA to MMENTRY), is less than 60 octets. When MME PAD is present, its length shall be chosen to be the smallest possible value to ensure that the Management Message length, including the MME PAD (i.e., from ODA to MME PAD), is equal to 60 octets.

### MME Support of HomePlug GREEN PHY

HomePlug GP stations support only a subset of MMEs supported by HomePlug AV 1.1 Level-0 CCOs. Table 11-5b shows the MMEs supported by GP and AV 1.1 Level-0 CCo capable device. The interpretation of “From H1”, “To H1” and “NEK Encrypted by PHY” columns is the same as described in Section 11.1.8. The interpretation of the remaining columns is as follows:

* Req L-0 CCo TX - Transmit requirement for a HomePlug AV 1.1 Level-0 CCo capable device acting as a CCo in an AVLN
* Req L-0 CCo RX – Receive requirement for a HomePlug AV 1.1 Level-0 CCo capable device acting as a CCo in an AVLN
* Req L-0 STA TX - Transmit requirement for a HomePlug AV 1.1 Level-0 CCo capable device acting as a STA in an AVLN
* Req L-0 STA RX – Receive requirement for a HomePlug AV 1.1 Level-0 CCo capable device acting as a STA in an AVLN
* Req HPGP CCo TX - Transmit requirement for a GP device acting as a CCo in an AVLN
* Req HPGP CCo RX – Receive requirement for a GP device acting as a CCo in an AVLN
* Req HPGP STA TX - Transmit requirement for a GP device acting as a STA in an AVLN
* Req HPGP STA RX – Receive requirement for a GP device acting as a STA in an AVLN

All Green PHY devices are CCo capable. In networks comprising both HomePlug AV 1.1 stations and HomePlug GP stations, HomePlug GP stations may receive MMEs that they do not support. In such instances, HomePlug GP stations shall send a CM\_MME\_ERROR.IND MME with the ReasonCode Field of that MME set to 0x00 – indicating that the MME is not supported.

Table 11-5b: Comparison of Management Message Types for HomePlug AV (STA and L0 CCo) vs. HomePlug GREEN PHY (STA and CCo)

| MMTYPE Base Value | Interpretation | From  H1 | To  H1 | Req.  L-0  CCo  TX | Req.  L-0 CCo  RX | Req.  L-0  STA  TX | Req.  L-0 STA  RX | Req. HPGP CCo  TX | Reg. HPGP CCo  RX | Req. HPGP  STA  TX | Reg. HPGP  STA  RX | NEK Encrypted  By  PHY |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Station – Central Coordination |  |  |  |  |  |  |  |  |  |  |  |
| 0x0000 | CC\_CCO\_APPOINT.REQ  (See Note #1) | Yes | No | X | M | M | X | X | M | M | X | Shall |
| CC\_CCO\_APPOINT.CNF (See Note #1) | No | Yes | M | X | X | M | M | X | X | M | Shall |
| 0x0004 | CC\_BACKUP\_APPOINT.REQ | No | No | O | X | X | O | O | X | X | O | Shall |
| CC\_BACKUP\_APPOINT.CNF | No | No | X | O | O | X | X | O | O | X | Shall |
| 0x0008 | CC\_LINK\_INFO.REQ | Yes | No | X | X | M | X | X | X | X | X | Shall |
| CC\_LINK\_INFO.CNF | No | Yes | X | X | X | M | X | X | X | X | Shall |
| CC\_LINK\_INFO.IND (See Note #3) | No | No | X | X | X | X | X | X | X | X | Shall |
| CC\_LINK\_INFO.RSP (See Note #3) | No | No | X | X | X | X | X | X | X | X | Shall |
| 0x000C | CC\_HANDOVER.REQ (See Note #4) | No | No | M | X | X | M | M | X | X | M | Shall |
| CC\_HANDOVER.CNF (See Note #4) | No | No | X | M | M | X | X | M | M | X | Shall |
| 0x0010 | CC\_HANDOVER\_INFO.IND  (See Note #4) | No | No | M | X | X | M | M | X | X | M | Shall |
| CC\_HANDOVER\_INFO.RSP (See Note #4) | No | No | X | M | M | X | X | M | M | X | Shall |
| 0x0014 | CC\_DISCOVER\_LIST.REQ | Yes | No | M | M | M | M | M | M | M | M | Shall |
| CC\_DISCOVER\_LIST.CNF | No | Yes | M | M | M | M | M | M | M | M | Shall |
| CC\_DISCOVER\_LIST.IND | No | No | X | M | M | X | X | M | M | X | Shall |
| 0x0018 | CC\_LINK\_NEW.REQ (See Note #2) | No | No | X | X | M | X | X | X | X | X | Shall |
| CC\_LINK\_NEW.CNF (See Note #2) | No | No | X | X | X | M | X | X | X | X | Shall |
| 0x001C | CC\_LINK\_MOD.REQ (See Note #2) | No | No | X | X | M | X | X | X | X | X | Shall |
| CC\_LINK\_MOD.CNF (See Note #2) | No | No | X | X | X | M | X | X | X | X | Shall |
| 0x0020 | CC\_LINK\_SQZ.REQ (See Note #5) | No | No | X | X | X | O | X | X | X | X | Shall |
| CC\_LINK\_SQZ.CNF (See Note #5) | No | No | X | X | O | X | X | X | X | X | Shall |
| 0x0024 | CC\_LINK\_REL.REQ (See Note #2) | No | No | X | X | M | X | X | X | X | X | Shall |
| CC\_LINK\_REL.IND (See Note #2) | No | No | X | X | X | M | X | X | X | X | Shall |
| 0x0028 | CC\_DETECT\_REPORT.REQ  (See Note #6) | No | No | X | X | X | O | X | X | X | O | Shall |
| CC\_DETECT\_REPORT.CNF (See Note #6) | No | No | X | X | O | X | X | X | O | X | Shall |
| 0x002C | CC\_WHO\_RU.REQ | Yes | No | X | M | M | X | X | M | M | X | Both |
| CC\_WHO\_RU.CNF | No | Yes | M | X | X | M | M | X | X | M | Both |
| 0x0030 | CC\_ASSOC.REQ | No | No | X | M | M | X | X | M | M | X | Both |
| CC\_ASSOC.CNF | No | No | M | X | X | M | M | X | X | M | Both |
| 0x0034 | CC\_LEAVE.REQ | No | No | X | M | M | X | X | M | M | X | Both |
| CC\_LEAVE.CNF | No | No | M | X | X | M | M | X | X | M | Both |
| CC\_LEAVE.IND | No | No | M | X | X | M | M | X | X | M | Both |
| CC\_LEAVE.RSP | No | No | X | M | M | X | X | M | M | X | Both |
| 0x0038 | CC\_SET\_TEI\_MAP.REQ | No | No | X | M | O | X | X | M | O | X | Both |
| CC\_SET\_TEI\_MAP.IND | No | No | M | X | X | M | M | X | X | M | Both |
| 0x003C | CC\_RELAY.REQ (See Note #7) | No | No | O | X | O | O | O | X | O | O | Both |
| CC\_RELAY.IND (See Note #7) | No | No | X | O | O | O | X | O | O | O | Both |
| 0x0040 | CC\_BEACON\_RELIABILITY.REQ | No | No | M | X | X | M | O | X | X | O | Shall |
| CC\_BEACON\_RELIABILITY.CNF | No | No | X | M | M | X | X | O | O | X | Shall |
| 0x0044 | CC\_ALLOC\_MOVE.REQ | No | No | X | X | O | X | X | X | X | X | Shall |
| CC\_ALLOC\_MOVE.CNF | No | No | X | X | X | O | X | X | X | X | Shall |
| 0x0048 | CC\_ACCESS\_NEW.REQ | No | No | X | X | O | X | X | X | X | X | Shall |
| CC\_ACCESS\_NEW.CNF | No | No | X | X | X | O | X | X | X | X | Shall |
| CC\_ACCESS\_NEW.IND | No | No | X | X | O | X | X | X | X | X | Shall |
| CC\_ACCESS\_NEW.RSP | No | No | X | X | X | O | X | X | X | X | Shall |
| 0x004C | CC\_ACCESS\_REL.REQ | No | No | X | X | O | X | X | X | X | X | Shall |
| CC\_ ACCESS\_REL.CNF | No | No | X | X | X | O | X | X | X | X | Shall |
| CC\_ ACCESS\_REL.IND | No | No | X | X | X | O | X | X | X | X | Shall |
| CC\_ ACCESS\_REL.RSP | No | No | X | X | O | X | X | X | X | X | Shall |
| 0x0050 | CC\_DCPPC.IND (See Note #8) | No | No | X | M | O | X | X | O | O | X | Shall |
| CC\_DCPPC.RSP (See Note #8) | No | No | M | X | X | O | O | X | X | O | Shall |
| 0x0054 | CC\_HP1\_DET.REQ | No | No | M | X | X | M | M | X | X | M | Shall |
| CC\_HP1\_DET.CNF | No | No | X | M | M | X | X | M | M | X | Shall |
| 0x0058 | CC\_BLE\_UPDATE.IND | No | No | X | X | O | X | X | X | X | X | Shall |
| 0x005C | CC\_BCAST\_REPEAT.IND | Yes | No |  |  |  |  | O | X | X | O | Shall |
| CC\_BCAST\_REPEAT.RSP | No | Yes |  |  |  |  | X | O | O | X | Shall |
| 0x0060 | CC\_MH\_LINK\_NEW.REQ  (see Note# 11) | No | No |  |  |  |  | X | X | X | X | Shall |
| CC\_MH\_LINK\_NEW.CNF  (see Note# 11) | No | No |  |  |  |  | X | X | X | X | Shall |
| 0x0064 | CC\_ISP\_DetectionReport.IND  (see Note# 12) | No | No |  |  |  |  | X | M | M | X | Shall |
| 0x0068 | CC\_ISP\_StartReSync.REQ  (see Note# 12) | No | No |  |  |  |  | M | X | X | M | Shall |
| 0x006C | CC\_ISP\_FinishReSync.REQ  (see Note# 12) | No | No |  |  |  |  | X | M | M | X | Shall |
| 0x0070 | CC\_ISP\_ReSyncDetected.IND  (see Note# 12) | No | No |  |  |  |  | X | M | M | X | Shall |
| 0x0074 | CC\_ISP\_ReSyncTransmit.REQ  (see Note# 12) | No | No |  |  |  |  | M | X | X | M | Shall |
| 0x0078 | CC\_POWERSAVE.REQ | No | No |  |  |  |  | X | M | O | X | Shall |
| CC\_POWERSAVE.CNF | No | No |  |  |  |  | M | X | X | O | Shall |
| 0x007C | CC\_POWERSAVE\_EXIT.REQ | No | No |  |  |  |  | X | M | O | X | Shall |
| CC\_POWERSAVE\_EXIT.CNF | No | No |  |  |  |  | M | X | X | O | Shall |
| 0x0080 | CC\_POWERSAVE\_LIST.REQ | No | No |  |  |  |  | X | M | O | X | Shall |
| CC\_POWERSAVE\_LIST.CNF | No | No |  |  |  |  | M | X | X | M | Shall |
| 0x0084 | CC\_STOP\_POWERSAVE.REQ | No | No |  |  |  |  | O | O | O | O | Shall |
| CC\_STOP\_POWERSAVE.CNF | No | No |  |  |  |  | O | O | O | O | Shall |
| 0x0088 – 0x1FFC | Reserved for future use | - | - |  |  |  |  |  |  |  |  |  |
|  | Proxy Coordinator |  |  |  |  |  |  |  |  |  |  |  |
| 0x2000 | CP\_PROXY\_APPOINT.REQ (See Note #9) | No | No | O | X | X | O | O | X | X | O | Shall |
| CP\_PROXY\_APPOINT.CNF (See Note #9) | No | No | X | O | O | X | X | O | O | X | Shall |
| 0x2004 | PH\_PROXY\_APPOINT.IND (See Note #9) | No | No | X | X | O | O | X | X | O | O | Both |
| 0x2008 | CP\_PROXY\_WAKE.REQ (See Note #9) | No | No | X | X | O | O | X | X | O | O | Shall |
| 0x200C – 0x3FFC | Reserved for future use | - | - |  |  |  |  |  |  |  |  |  |
|  | CCo – CCo |  |  |  |  |  |  |  |  |  |  |  |
| 0x4000 | NN\_INL.REQ | No | No | X | X | X | X | X | X | X | X | Never |
| NN\_INL.CNF | No | No | X | X | X | X | X | X | X | X | Never |
| 0x4004 | NN\_NEW\_NET.REQ | No | No | X | X | X | X | X | X | X | X | Never |
| NN\_NEW\_NET.CNF | No | No | X | X | X | X | X | X | X | X | Never |
| NN\_NEW\_NET.IND | No | No | X | X | X | X | X | X | X | X | Never |
| 0x4008 | NN\_ADD\_ALLOC.REQ | No | No | X | X | X | X | X | X | X | X | Never |
| NN\_ADD\_ALLOC.CNF | No | No | X | X | X | X | X | X | X | X | Never |
| NN\_ADD\_ALLOC.IND | No | No | X | X | X | X | X | X | X | X | Never |
| 0x400C | NN\_REL\_ALLOC.REQ | No | No | X | X | X | X | X | X | X | X | Never |
| NN\_REL\_ALLOC.CNF | No | No | X | X | X | X | X | X | X | X | Never |
| 0x4010 | NN\_REL\_NET.IND | No | No | X | X | X | X | X | X | X | X | Never |
| 0x4014 – 0x5FFC | Reserved for future use | - | - |  |  |  |  |  |  |  |  |  |
|  | Station – Station |  |  |  |  |  |  |  |  |  |  |  |
| 0x6000 | CM\_UNASSOCIATED\_STA.IND | No | Yes | X | X | M | M | M | M | M | M | Never |
| 0x6004 | CM\_ENCRYPTED\_PAYLOAD.IND | Yes | Yes | M | M | M | M | M | M | M | M | Both |
| CM\_ENCRYPTED\_PAYLOAD.RSP | Yes | Yes | M | M | M | M | M | M | M | M | Both |
| 0x6008 | CM\_SET\_KEY.REQ | Yes | Yes | M | M | M | M | M | M | M | M | Shall |
| CM\_SET\_KEY.CNF | Yes | Yes | M | M | M | M | M | M | M | M | Shall |
| 0x600C | CM\_GET\_KEY.REQ | Yes | Yes | M | M | M | M | M | M | M | M | Never |
| CM\_GET\_KEY.CNF | Yes | Yes | M | M | M | M | M | M | M | M | Never |
| 0x6010 | CM\_SC\_JOIN.REQ | No | No | M | M | M | M | M | M | M | M | Never |
| CM\_SC\_JOIN.CNF | No | No | M | M | M | M | M | M | M | M | Never |
| 0x6014 | CM\_CHAN\_EST.IND | No | No | M | M | M | M | M | X | M | X | Both |
| 0x6018 | CM\_TM\_UPDATE.IND | No | No | O | M | O | M | X | X | X | X | Both |
| 0x601C | CM\_AMP\_MAP.REQ | Yes | No | O | X | X | M | O | X | X | O | Shall |
| CM\_AMP\_MAP.CNF | No | Yes | X | O | M | X | X | O | O | X | Shall |
| 0x6020 | CM\_BRG\_INFO.REQ  (See Note #10) | Yes | No | O | M | O | M | O | M | O | M | Shall |
| CM\_BRG\_INFO.CNF (See Note #10) | No | Yes | M | M | M | M | M | M | M | M | Shall |
| 0x6024 | CM\_CONN\_NEW.REQ  (See Note #2) | No | No | M | M | M | M | X | X | X | X | Shall |
| CM\_CONN\_NEW.CNF (See Note #2) | No | No | M | M | M | M | X | X | X | X | Shall |
| 0x6028 | CM\_CONN\_REL.IND (See Note #2) | No | No | M | M | M | M | X | X | X | X | Shall |
| CM\_CONN\_REL.RSP (See Note #2) | No | No | M | M | M | M | X | X | X | X | Shall |
| 0x602C | CM\_CONN\_MOD.REQ (See Note #2) | No | No | M | M | M | M | X | X | X | X | Shall |
| CM\_CONN\_MOD.CNF (See Note #2) | No | No | M | M | M | M | X | X | X | X | Shall |
| 0x6030 | CM\_CONN\_INFO.REQ | Yes | No | M | M | M | M | X | X | X | X | Shall |
| CM\_CONN\_INFO.CNF | No | Yes | M | M | M | M | X | X | X | X | Shall |
| 0x6034 | CM\_STA\_CAP.REQ | Yes | No | M | M | M | M | M | M | M | M | Both |
| CM\_STA\_CAP.CNF | No | Yes | M | M | M | M | M | M | M | M | Both |
| 0x6038 | CM\_NW\_INFO.REQ | Yes | No | M | M | M | M | M | M | M | M | Shall |
| CM\_NW\_INFO.CNF | No | Yes | M | M | M | M | M | M | M | M | Shall |
| 0x603C | CM\_GET\_BEACON.REQ | Yes | No | M | M | M | M | O | O | O | O | Shall |
| CM\_GET\_BEACON.CNF | No | Yes | M | M | M | M | O | O | O | O | Shall |
| 0x6040 | CM\_HFID.REQ | Yes | No | M | M | M | M | M | M | M | M | Both |
| CM\_HFID.CNF | No | Yes | M | M | M | M | M | M | M | M | Both |
| 0x6044 | CM\_MME\_ERROR.IND | No | Yes | M | M | M | M | M | M | M | M | Both |
| 0x6048 | CM\_NW\_STATS.REQ | Yes | No | M | M | M | M | M | M | M | M | Shall |
|  | CM\_NW\_STATS.CNF | No | Yes | M | M | M | M | M | M | M | M | Shall |
| 0x604C | CM\_LINK\_STATS.REQ | Yes | No | M | M | M | M | M | M | M | M | Shall |
| CM\_LINK\_STATS.CNF | No | Yes | M | M | M | M | M | M | M | M | Shall |
| 0x6050 | CM\_ROUTE\_INFO.REQ | Yes | No |  |  |  |  | O | O | O | O | Shall |
| CM\_ROUTE\_INFO.CNF | No | Yes |  |  |  |  | O | O | O | O | Shall |
| CM\_ROUTE\_INFO.IND | No | Yes |  |  |  |  | O | O | O | O | Shall |
| 0x6054 | CM\_UNREACHABLE.IND | No | Yes |  |  |  |  | O | O | O | O | Shall |
| 0x6058 | CM\_MH\_CONN\_NEW.REQ  (See Note# 11) | No | No | - | - |  |  | X | X |  |  | Shall |
| CM\_MH\_CONN\_NEW.CNF  (See Note# 11) | No | No | - | - |  |  | X | X |  |  | Shall |
| 0x605C | CM\_EXTENDED\_TONEMASK.REQ  (See Note# 11) | No | No | - | - |  |  | X | X |  |  | Shall |
| CM\_EXTENDED\_TONEMASK.CNF  (See Note# 11) | No | No | - | - |  |  | X | X |  |  | Shall |
| 0x6060 | CM\_STA\_IDENTIFY.REQ | Yes | No | - | - |  |  | M | M | M | M | Shall |
| CM\_STA\_IDENTIFY.CNF | No | Yes | - | - |  |  | M | M | M | M | Shall |
| CM\_STA\_IDENTIFY.ND | No | Yes | - | - |  |  | M | M | M | M | Shall |
| CM\_STA\_IDENTIFY.RSP | Yes | No | - | - |  |  | M | M | M | M | Shall |
| 0x6064 | CM\_SLAC\_PARM\_REQ | Yes | Yes |  |  |  |  | O | O | O | O | Never |
| 0x6068 | CM\_SLAC\_PARM.CNF | Yes | Yes |  |  |  |  | O | O | O | O | Never |
| 0x606C | CM\_START\_ATTEN\_CHAR.IND | Yes | Yes |  |  |  |  | O | O | O | O | Never |
| 0x6070 | CM\_ATTN\_CHAR.IND | Yes | Yes |  |  |  |  | O | O | O | O | Never |
|  | CM\_ATTN\_CHAR.RSP | Yes | Yes |  |  |  |  | O | O | O | O | Never |
| 0x6074 | CM\_PKCS\_CERT.REQ | Yes | Yes |  |  |  |  | O | O | O | O | Never |
|  | CM\_PKCS\_CERT.CNF | Yes | Yes |  |  |  |  | O | O | O | O | Never |
|  | CM\_PKCS\_CERT.IND | Yes | Yes |  |  |  |  | O | O | O | O | Never |
|  | CM\_PKCS\_CERT.RSP | Yes | Yes |  |  |  |  | O | O | O | O | Never |
| 0x6078 | CM\_MNBC\_SOUND.IND | Yes | Yes |  |  |  |  | O | O | O | O | Never |
| 0x607C | CM\_VALIDATE.REQ | Yes | Yes |  |  |  |  | O | O | O | O | Never |
|  | CM\_VALIDATE.CNF | Yes | Yes |  |  |  |  | O | O | O | O | Never |
| 0x6080 | CM\_SLAC\_MATCH.REQ | Yes | Yes |  |  |  |  | O | O | O | O | Never |
|  | CM\_SLAC\_MATCH.CNF | Yes | Yes |  |  |  |  | O | O | O | O | Never |
| 0x6084 | CM\_SLAC\_USER\_DATA.REQ | Yes | Yes |  |  |  |  | O | O | O | O | Both |
|  | CM\_SLAC\_USER\_DATA.CNF | Yes | Yes |  |  |  |  | O | O | O | O | Both |
| 0x6088 – 7FFC | Reserved for future use | - | - |  |  |  |  |  |  |  |  |  |
|  | Manufacturer Specific |  |  |  |  |  |  |  |  |  |  |  |
| 0x8000 – 0x9FFC | Manufacturer Specific Messages | Only | Only |  |  |  |  |  |  |  |  | - |
|  | Vendor Specific |  |  |  |  |  |  |  |  |  |  |  |
| 0xA000 – 0xBFFC | Vendor-Specific Messages | Yes | Yes |  |  |  |  |  |  |  |  | Both |

***Notes:***

1. CC\_CCO\_APPOINT.REQ is generated by HLE. It is mandatory for stations to be able to receive this message from H1 interface and pass it to the CCo. Similarly, it is mandatory for all stations to be able to receive CC\_CCO\_APPOINT.CNF from any station in the AVLN and pass it to the HLE.
2. Refer to Section 5.2.3 for details.
3. Optional when the station does not support Soft Handover (refer to Section 7.5). Mandatory if it does.
4. Support for Hard Handover is Mandatory (refer to Section 7.5).
5. Optional if the station does not support Squeeze/De-Squeeze procedure (refer to Section 5.2.3.8.1). Mandatory if it does.
6. Optional if the station does not support Detect-and-Report procedure (refer to Section 5.2.5). Mandatory if it does.
7. Optional if the station does not support the Proxy Networking procedure (refer to Section 7.7). Mandatory if it does.
8. Optional if the station does not support simultaneous participation in more than one network (refer to Section 5.5.4.1).
9. Optional if the station does not support Proxy Networking (refer to Section 7.7). Mandatory if it does.
10. Any STA can request bridging information by using CM\_BRG\_INFO.REQ. It is mandatory for all stations to respond with CM\_BRG\_INFO.CNF. It is mandatory that all bridges periodically generate CM\_BRG\_INFO.CNF (refer to Section 5.3).
11. These MMEs are defined for IEEE 1901. However, they are not required to be supported by HomePlug GREEN PHY devices.
12. These MMEs are defined for IEEE 1901. These are required to be supported by HomePlug GREEN PHY devices. See section 14.1.2.

## Station - Central Coordination (CCo)

### CC\_CCO\_APPOINT.REQ

The CC\_CCO\_APPOINT.REQ message is used to appoint a STA in the AVLN as a CCo and also to un-appoint an existing CCo from being a user-appointed CCo.

Table 11‑6: CC\_CCO\_APPOINT.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet  Number | Field Size (Octets) | Definition |
| ReqType | 0 | 1 | Request Type  0x00 = request to appoint a STA with the indicated MAC Address as a user-appointed CCo  0x01 = request to un-appoint the existing CCo from being a user-appointed CCo.  0x02 = request to un-appoint the existing CCo from being a user-appointed CCo and to transfer CCo functionality to a new user-appointed CCo.  0x03 – 0xFF = reserved |
| MACAddr | –- | 0 or 6 | MAC address of the STA that is appointed or un-appointed as a user-appointed CCo  This field shall only be present when Request Type is set to 0x00 or 0x02. |

### CC\_CCO\_APPOINT.CNF

The CC\_CCO\_APPOINT.CNF message is sent in response to a received CC\_CCO\_APPOINT.REQ message.

Table 11‑7: CC\_CCO\_APPOINT.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet  Number | Field Size  (Octets) | Definition |
| Result | 0 | 1 | Results codes for ReqType = 0x00 (refer to Table 11‑6)  0x00 = success, the user-appointed STA has accepted the handover request.  0x01 = failure, the user-appointed STA has rejected the handover request.  0x02 = failure, unknown user-appointed STA  0x03 = failure, the current CCo is already a user-appointed CCo. CCo functionality cannot be handed over until the current CCo is un-appointed as a user-appointed CCo.  Results codes for ReqType = 0x01 (refer to Table 11‑6)  0x04 = success, the existing CCo is un-appointed as a user appointed CCo  0X05 = success, the existing CCo is not a user-appointed CCo  0x06 = failure, other reasons  Results codes for ReqType = 0x02 (refer to Table 11‑6)  0x07 = success, the existing CCo is un-appointed. The new STA is appointed as a user appointed CCo  0x08 = Failure, unknown user-appointed STA. The existing CCo continues to operate as a user appointed CCo  0x09 - 0xFF = reserved |

### CC\_BACKUP\_APPOINT.REQ

The CC\_BACKUP\_APPOINT.REQ message is sent by the CCo to a STA to request the STA to become a Backup CCo, or sent to an existing Backup CCo to release its duty as a Backup CCo.

Table 11‑8: CC\_BACKUP\_APPOINT.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet  Number | Field Size  (Octets) | Definition |
| Appoint/Release | 0 | 1 | 0x00 = appoint  0x01 = release  0x02 – 0xFF = reserved |

### CC\_BACKUP\_APPOINT.CNF

The CC\_BACKUP\_APPOINT.CNF message is sent by a STA to the CCo in response to a received CC\_BACKUP\_APPOINT.REQ message.

Table 11‑9: CC\_BACKUP\_APPOINT.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet  Number | Field Size  (Octets) | Definition |
| Result | 0 | 1 | 0x00 = accepted  0x01 = failed, feature not supported  0x02 = failed, other reason  0x03 - 0xFF = reserved |

### CC\_LINK\_INFO.REQ

The CC\_LINK\_INFO.REQ message is sent by a STA to the CCo to request the CSPEC and BLE information of all active Global Links in the AVLN. The message field for this MME is NULL.

### CC\_LINK\_INFO.CNF

The CC\_LINK\_INFO.CNF message is sent by the CCo in response to a received CC\_LINK\_INFO.REQ message. The message contains the CSPEC with CM-to-CCo QoS and MAC parameters and BLE information of all active Global Link(s) in the AVLN.

Table 11‑10: CC\_LINK\_INFO.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet  Number | Field Size  (Octets) | Definition |
| Num | 0 | 1 | Number of GlobalLinkInfo fields to follow (=N).  0x00 = no GlobalLinkInfo present  0x01 = one GlobalLinkInfo field  0x02 = two GlobalLinkInfo fields, and so on |
| GlobalLinkInfo[1] | - | Var | Link information of the first Global Link |
| … | … | … | … |
| GlobalLinkInfo[N] | - | Var | Link information of the last Global Link |

Table 11‑11: Format of LinkInfo[ ] Field

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet  Number | Field Size  (Octets) | Definition |
| CID | 0 - 1 | 2 | Connection Identifier of the Link (refer to Section 5.2.1.4.2) |
| STEI | 2 | 1 | TEI of the source STA. |
| DTEI | 3 | 1 | TEI of the sink STA. |
| LID-F | 4 | 1 | Link ID of the Forward Link.  A value of 0x00 is used to indicate that this field is invalid. |
| LID-R | 5 | 1 | Link ID of the Reverse Link.  A value of 0x00 is used to indicate that this field is invalid. |
| CSPEC | - | Var | CM-to-CCo Connection Specification in both forward (if any) and reverse (if any) links. |
| Forward Link BLE | - | Var | BLE of the Forward (refer to Section 11.2.16.5)  This field is only present when the LID-F exists. |
| Reverse Link BLE | - | Var | BLE of the Reverse Link (refer to Section 11.2.16.5)  This field is only present when the LID-R exists. |

### CC\_LINK\_INFO.IND

The CC\_LINK\_INFO.IND message is sent by a CCo to either a new CCo (during soft handover, refer to Section 7.5) or a Backup CCo (as part of CCo failure recovery, refer to Section 7.5) to provide the CSPEC with CM-to-CCo QOS and MAC parameters, and BLE information of the Global Link(s) that are active within the AVLN.

The format of this message is the same as the CC\_LINK\_INFO.CNF message in Section 11.2.6.

### CC\_LINK\_INFO.RSP

The **CC\_LINK\_INFO.RSP** message is sent by the new CCo or Backup CCo to the current CCo to confirm the reception of the **CC\_LINK\_INFO.IND** message.

The message field for this message is NULL.

### CC\_HANDOVER.REQ

The CC\_HANDOVER.REQ message is sent by the current CCo to another STA in the network to request the STA to become the new CCo.

Table 11‑12: CC\_HANDOVER.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| Soft/Hard | 0 | 1 | 0x00 = soft handover  0x01 = hard handover  0x02 – 0xFF = reserved |
| Reason | 1 | 1 | 0x00 = user-appointed  0x01 = CCo-selection process  0x02 = current CCo is leaving the network.  0x03 – 0xFF = reserved |

### CC\_HANDOVER.CNF

The CC\_HANDOVER.CNF message is sent in response to a received CC\_HANDOVER.REQ message.

Table 11‑13: CC\_HANDOVER.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet  Number | Field Size  (Octets) | Definition |
| Result | 0 | 1 | 0x00 = STA accepts the request to become the new CCo.  0x01 = STA rejects the Soft handover request to become the new CCo.  0x02 = STA rejects any handover request to become the new CCo.  0x03 - 0xFF = reserved. |

### CC\_HANDOVER\_INFO.IND

The CC\_HANDOVER\_INFO.IND message is sent by the current CCo to the new CCo during the handover process. This message is also sent by the current CCo to the Backup CCo to enable recovery from CCo failure.

Table 11‑14: CC\_HANDOVER\_INFO.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| RSC | 0 | 1 | Reason Code indicating the reason for sending CC\_HANDOVER\_INFO.IND Message  0x00 = handover in progress.  0x01 = update of network information to Backup CCo to enable CCo failure recovery.  0x02-0xFF = reserved |
| BackupCCo | 1 | 1 | TEI of the Backup CCo (no Backup CCo if set to 0x00) |
| Num | 2 | 1 | Number of STAInfo[ ] fields to follow (=N).  0x00 = no STAInfo present  0x01 = one STAInfo field  0x02 = two STAInfo fields, and so on |
| STA\_Info[1] | 3 - 11 | 9 | Information of the first STA. |
| … |  |  |  |
| STA\_Info[N] | - | 9 | Information of the last STA. |

Table 11‑15: Format of STA\_Info[ ] Field

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| TEI | 0 | 1 | TEI of the STA. |
| MACAddr | 1 - 6 | 6 | MAC address of the STA. |
| Status | 7 | 1 | Status of STA  0x00 = associated, but not authenticated  0x01 = authenticated  0x02 = 0xFF = reserved |
| PTEI | 8 | 1 | TEI of the PCo responsible for the STA (set to 0x00 to indicate there is no PCo for the STA) |

### CC\_HANDOVER\_INFO.RSP

The CC\_HANDOVER\_INFO.RSP message is sent by the new CCo or Backup CCo to the current CCo to confirm the reception of the CC\_HANDOVER\_INFO.IND messages. The message field for this MME is Null.

### CC\_DISCOVER\_LIST.REQ

The CC\_DISCOVER\_LIST.REQ message is sent by a STA to request the Discovered STA List and Discovered Network List of another STA.

The message field for this message is Null.

Although this message is typically sent by the CCo to a STA in the AVLN, any STA in the AVLN should be able to send this message to another STA in the AVLN and obtain the corresponding CC\_DISCOVER\_LIST.CNF.

### CC\_DISCOVER\_LIST.CNF

The CC\_DISCOVER\_LIST.CNF message is sent by a STA in response to a received CC\_DISCOVER\_LIST.REQ message to report its Discovered STA List and Discovered Network List.

Table 11‑16: CC\_DISCOVER\_LIST.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| NumStation | 0 | 1 | Number of STAs discovered (=M).  0x00 = none  0x01 = one  0x02 = two, and so on |
| StationInfo[1] | - | 12 | Information about the first STA discovered (see Table 11‑17). |
| … |  |  |  |
| StationInfo[M] | - | 12 | Information about the last STA discovered (see Table 11‑17). |
| NumNetwork | - | 1 | Number of networks discovered (=N). |
| NetworkInfo[1] | - | 13 | Information about the first network discovered (see Table 11‑18) |
|  | … | … |  |
| NetworkInfo[N] | - | 13 | Information about the last network discovered (see Table 11‑18). |

Table 11‑17: Format of StationInfo [ ]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Field | Octet Number | Bit Number | Field Size (Octets) | Definition |
| MACAddr | 0 - 5 |  | 6 | MAC address of the discovered STA |
| TEI | 6 |  | 1 | TEI of the discovered STA |
| SameNetwork | 7 |  | 1 | 0x00 = the discovered STA is associated with a different network.  0x01 = the discovered STA is associated with the same network.  0x02 – 0xFF = reserved |
| SNID/Access | 8 |  | 1 | Short Network Identifier of the network of the discovered STA.  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| Reserved | 9 | 0 | 1 bit | Reserved |
| CCo Capability |  | 1-2 | 2 bits | This field contains the CCo capability. The interpretation of these bits is the same as in Section 4.4.3.15.4.6.2. |
| Proxy Networking Capability |  | 3 | 1 bit | This field contains the PCo capability. The interpretation of this bit is the same as in Section 4.4.3.15.4.6.3. |
| Backup CCo Capability |  | 4 | 1 bit | This field contains the Backup CCo capability. The interpretation of this bit is the same as in Section 4.4.3.15.4.6.4. |
| CCo Status |  | 5 | 1 bit | This field contains the CCo Status. The interpretation of this bit is the same as in Section 4.4.3.15.4.6.5. |
| PCo Status |  | 6 | 1 bit | This field contains the PCo Status. The interpretation of this bit is the same as in Section 4.4.3.15.4.6.6 |
| Backup CCo Status |  | 7 | 1 bit | This field contains the Backup CCo Status. The interpretation of this bit is the same as in Section 4.4.3.15.4.6.7 |
| Signal Level | 10 |  | 1 | 0x00 = information not available  0x01 = signal level is > -10 dB, but ≤ 0 dB (relative to full transmit power, -50 dBm/Hz)  0x02 = signal level is > -15 dB, but ≤ -10 dB  0x03 = signal level is > -20 dB, but ≤ -15 dB  …  0x0E = signal level is > -75 dB, but ≤ -70 dB  0x0F = signal level is ≤ -75 dB  0x10 – 0xFF = reserved |
| Average BLE | 11 |  | 1 | Average BLE. The Format is defined in Section 4.4.1.5.2.10. Average BLE may be estimated based on Discover Beacon reception. This field shall be set to zero if not provided. Providing a non-zero value is optional. |

Table 11‑18: Format of NetworkInfo[ ]

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| NID | 0 - 6 | 7 | Network Identifier  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |
| SNID/Access | 7 | 1 | Short Network Identifier of the network of the discovered STA.  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| HM | 8 | 1 | The two LSBs of this field contain the Hybrid Mode of the AVLN. The interpretation of these bits is the same as in Section 4.4.3.2. |
| NumSlots | 9 | 1 | Number of Beacon Slots  0x00 = one Beacon Slot, and so on  0x08 - 0xFF = reserved |
| CoordinatingStatus | 10 | 1 | Coordinating Status of the CCo.  0x00 = unknown  0x01 = Non-Coordinating Network  0x02 = Coordinating, Group status unknown  0x03 = Coordinating Network in the same Group as this CCo  0x04 = Coordinating Network not in the same Group as this CCo  0x05 – 0xFF = reserved |
| Offset | 11 - 12 | 2 | Offset between the Beacon Region of the discovered network and the Beacon Region of the STA’s own network. Units are AllocationTimeUnit.  0x0000 = zero or in the same Group  0x0001 = one AllocationTimeUnit, and so on |

### CC\_DISCOVER\_LIST.IND

The CC\_DISCOVER\_LIST.IND message shall be sent by a STA to the CCo in an unsolicited manner whenever the STA discovers a new network. The format of the MMENTRY for this field is the same as the MMENTRY for CC\_DISCOVER\_LIST.CNF.

### CC\_LINK\_NEW.REQ

The CC\_LINK\_NEW.REQ message is sent by the initiating STA to the CCo to request connection setup in the CFP.

Table 11‑19: CC\_LINK\_NEW.REQ Message

| Field | Octet Number | Field Size (Octets) | Definition |
| --- | --- | --- | --- |
| Init.MAC Addr | 0 - 5 | 6 | MAC address of the STA initiating the Connection |
| Term. MAC Addr | 6 - 11 | 6 | MAC address of the terminating STA(s) |
| CID | 12 - 13 | 2 | Connection Identifier |
| CSPEC | - | Var | Connection Specification |
| Forward Link Bit Loading Estimates | - | 1 | Number of Intervals (N) |
| - | 2 | Interval #1 End Time |
| - | 1 | Interval #1 BLE |
| … |  |  |
| - | 2 | Interval #N End Time |
| - | 1 | Interval #N BLE |
| Reverse Link Bit Loading Estimates | - | 1 | Number of Intervals (K) |
| - | 2 | Interval #1 End Time |
| - | 1 | Interval #1 BLE |
| … |  |  |
| - | 2 | Interval #K End Time |
| - | 1 | Interval #K BLE |

Note: The Connection Identifier (CID) serves as a unique identifier for the request.

#### Initiating MAC Address

Initiating MAC Address indicate the 48-bit Ethernet address of the power line station that is initiating the Connection.

#### Terminating MAC Address

Terminating MAC Address indicate the 48-bit Ethernet address of the power line station(s) that are at the terminating side of the Connection.

#### Connection Identifier

The CID serves as a unique identifier for the request. Interpretation of this field is the same as in Section 5.2.1.4.2.

#### Connection Specification

The interpretation of this field is the same as in Section 7.8.1.

#### Forward Link and Reverse Link Bit Loading Estimates

These fields indicate the Bit loading estimates of the corresponding Links based on channel adaptation.

Forward Link Bit Loading Estimates shall only be present when any of the following conditions is satisfied:

* The Connection has a Global Forward Link , or
* The Connection has a Local Forward Link and a Global Reverse Link. Further, the traffic in the Local Forward Link is intended to be transmitted as part of Reverse SOF (i.e., Bidirectional Bursts) during CFP of the Global Reverse Link.

Similarly, Reverse Link Bit Loading Estimates shall only be present when any of the following conditions is satisfied:

* The Connection has a Global Reverse Link, or
* The Connection has a Local Reverse Link and a Global Forward Link. Further, the traffic in the Local Reverse Link is intended to be transmitted as part of Reverse SOF (i.e., Bidirectional Bursts) during CFP of the Global Forward Link.

##### Number of Intervals

Number of Intervals indicates the number of intervals in which Bit Loading Estimates are presented. A value of 0x00 indicates that no Bit Loading Estimates are available.

##### Interval End Time # 1–N

Interval End Time indicates the end time of the corresponding Bit Loading Estimate interval in multiples of AllocationTimeUnit. End Times are measured with respect to the Beacon Period Start Time. Thus, a value of 0x0000 indicates that the end time is the same as Beacon Period start time.

When BLE for multiple intervals is present, intervals shall be present in ascending order of time. Thus, the first interval shall be the closest to the Beacon Period Start Time and so on. Furthermore, intervals shall be non-overlapping and shall cover the entire Beacon Period. Therefore, the end time of the last interval shall be greater than or equal to the length of the Beacon Period.

##### Bit Loading Estimate # 1–N

Bit Loading Estimate indicates the PHY data rate that can be supported in the corresponding Interval. The interpretation of this field is the same as in Section 4.4.1.5.2.10.

### CC\_LINK\_NEW.CNF

The CCo sends the CC\_LINK\_NEW.CNF message to the initiating STA and terminating STA(s) of a Connection to confirm the completion of establishment of the Global Links associated with the Connection.

Table 11‑20: CC\_LINK\_NEW.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| CID | 0 - 1 | 2 | Connection ID (refer to Section 5.2.1.4.2) |
| GLID-F | 2 | 1 | Newly assigned GLID for the Forward Link (refer to Section 5.2.1)  A value of 0x00 is used to indicate that this field is invalid. |
| GLID-R | 3 | 1 | Newly assigned GLID for the Reverse Link  A value of 0x00 is used to indicate that this field is invalid. |
| Result | 4 | 1 | Indicates the Result of the Connection Setup Request  0x00 = success  0x01 = failure – unsupported CSPEC or insufficient bandwidth  0x02 = failure – maximum number of links allocated per station already established  0x03 = failure – lack of CCo resources, try again later  0x04 = failure – link already established using the connection ID  0x05 = failure due to other reason  0x06 - 0xFF = reserved |
| Proposed CSPEC | - | Var | Proposed CSPEC indicating the CSPEC that the CCo is currently capable of supporting.  This field is only present when Result is set to 0x01. When this field is present and a valid Proposed CSPEC is not included, this field shall be 2 octets long, with a value of 0x0000 (i.e., CSPEC\_LEN = 0x0000). When a valid Proposed CSPEC is included, the interpretation of this field is the same as in Section 7.8.1. |

#### Result

Result indicates the outcome of the request, according to the codes in Table 11‑20. If the CCo does not support some of the optional QoS parameters sent in the request’s CSPEC, or if there is insufficient bandwidth available to admit the connection, then result 0x01 is used. In this case, the CCo has the option of returning a proposed CSPEC that indicates supported options and available bandwidth.

#### Proposed CSPEC

The CCo has the option of sending a proposed CSPEC when Result = 0x01. The Proposed CSPEC should indicate a CSPEC that, if included in a new request, the CCo can currently grant. If no Proposed CSPEC is included when Result = 0x01, then this field shall be 2 octets long, with the value 0x0000.

### CC\_LINK\_MOD.REQ

The CC\_LINK\_MOD.REQ message is sent by either the initiating STA or the terminating station of a Connection to the CCo to request modification of Global Link(s).

Table 11‑21: CC\_LINK\_MOD.REQ Message

| Field | Octet Number | Field Size  (Octets) | Definition |
| --- | --- | --- | --- |
| CID | 0 - 1 | 2 | Connection ID (refer to Section 5.2.1.4.2) |
| Modified CSPEC | - | Var | Modified CSPEC containing the (complete) new CSPEC that is requested for the Connection. The interpretation of this field is the same as in Section 7.8.1. |
| Forward Link Bit Loading Estimates | - | Var | Bit Loading Estimates for the Forward Link  The format of this field is the same as that of the corresponding field in Section 11.2.15.  This field is only present when the Forward for the Connection (if any) is a Global Link. |
| Reverse Link Bit Loading Estimates | - | Var | Bit Loading Estimates for the Reverse Link  The format of this field is the same as that of the corresponding field in Section 11.2.15. This field is only present when the Reverse Link for the Connection (if any) is a Global Link. |

### CC\_LINK\_MOD.CNF

The CC\_LINK\_MOD.CNF message is sent by the CCo to the STAs involved in a Connection to notify them that the reconfiguration of the CFP Link(s) has been completed successfully or failed.

Table 11‑22: CC\_LINK\_MOD.CNF Message

| Field | Octet Number | Field Size  (Octets) | Definition |
| --- | --- | --- | --- |
| CID | 0 - 1 | 2 | Connection ID (refer to Section 5.2.1.4.2) |
| Result | 2 | 1 | Indicates the result of the Connection modify request.  0x00 = success  0x01 = failed, Proposed CSPEC field is present  0x02 - 0xFF = reserved |
| Proposed CSPEC | - | Var | Proposed CSPEC indicating the CSPEC that the CCo is currently capable of supporting.  This field is only present when Result is set to 0x01. When this field is present and a valid Proposed CSPEC is not included, this field shall be 2 octets long, with a value of 0x0000 (i.e., CSPEC\_LEN = 0x0000). When a valid Proposed CSPEC is included, the interpretation of this field is the same as in Section 7.8.1. |

### CC\_LINK\_SQZ.REQ

Table 11‑23: CC\_LINK\_SQZ.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Bit Number | Definition |
| CID | 0 - 1 | 2 | Connection ID (refer to Section 5.2.1.4.2) |
| Modified CSPEC | - | Var | Modified CSPEC containing the (complete) new CSPEC that is requested for the Connection. The interpretation of this field is the same as in Section 7.8.1. |

### CC\_LINK\_SQZ.CNF

Table 11‑24: CC\_LINK\_SQZ.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| CID | 0-1 | 2 | Connection ID (refer to Section 5.2.1.4.2) |
| Result | 2 | 1 | Indicates the result of the Connection modify request.  0x00 = success  0x01 = failed, Proposed CSPEC field is present  0x02 - 0xFF = reserved |
| Proposed CSPEC | - | Var | Proposed CSPEC indicating the CSPEC that the CM is currently capable of supporting.  This field is only present when Result is set to 0x01. When this field is present and a valid Proposed CSPEC is not included, this field shall be 2 octets long, with a value of 0x0000 (i.e., CSPEC\_LEN = 0x0000). When a valid Proposed CSPEC is included, the interpretation of this field is the same as in Section 7.8.1. |

### CC\_LINK\_REL.REQ

The CC\_LINK\_REL.REQ message is sent by a STA to the CCo to request release of the Global Links associated with a Connection.

Table 11‑25: CC\_LINK\_REL.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| CID | 0 - 1 | 2 | Connection Identifier (refer to Section 5.2.1.4.2) |
| TEI | 2 | 1 | TEI of STA requesting release of Link. This may be the Station that has initiated the Connection, Station(s) that are at the terminating end of a Connection or another station within the AVLN (refer to Section 5.2.3.4.1). |
| Reason Code | 3 | 1 | Reason for Connection Termination  0x00 = normal release  0x01 = CSPEC violation, Violated CSPEC field is present  0x02 – 0xFF = reserved |
| Violated CSPEC | - | Var | Violated CSPEC indicating the CSPEC that are violated.  This field is only present when Reason Code is set to 0x01. When this field is present and a valid Violated CSPEC is not included, this field shall be 2 octets long, with a value of 0x0000 (i.e., CSPEC\_LEN = 0x0000). When a valid Violated CSPEC is included, the interpretation of this field is the same as in Section 7.8.1. |

### CC\_LINK\_REL.IND

The CC\_LINK\_REL.IND message is sent by the CCo to the initiating STA and terminal station(s) of a Connection to indicate release of the Global Links associated with a Connection. The message is generated in response to the corresponding CC\_LINK\_REL.REQ. The CCo may also generate this message in an unsolicited manner when an existing Connection is terminated due to insufficient bandwidth, violation of the CSPEC, or at the request of another station within the AVLN.

***Note***: The ability to initiate a connection teardown by a station that is not part of the Connection (i.e., neither the initiating station nor the terminating station(s)) is intended to provide flexibility for higher layer protocols like UPnP in managing the AVLN.

Table 11‑26: CC\_LINK\_REL.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| CID | 0 - 1 | 2 | Connection Identifier (refer to Section 5.2.1.4.2) |
| Releasing Station MAC Address | 2 - 7 | 6 | This field contains the MAC Addresses of the station that initiated the release of the Connection. |
| Reason Code | 8 | 1 | Reason for Connection Termination  0x00 = normal release  0x01 = CSPEC violation, Violated CSPEC field is present  0x02 = insufficient bandwidth, Proposed CSPEC field is present  0x03 = requested by another station within the AVLN that is not part of the Connection  0x04 – 0xFF = reserved |
| Proposed CSPEC | - | Var | Proposed CSPEC indicating the CSPEC that the CCo is currently capable of supporting.  This field is only present when Reason Code is set to 0x01. When this field is present and a valid Proposed CSPEC is not included, this field shall be 2 octets long, with a value of 0x0000 (i.e., CSPEC\_LEN = 0x0000). When a valid Proposed CSPEC is included, the interpretation of this field is the same as in Section 7.8.1. |
| Violated CSPEC | - | Var | Violated CSPEC indicating the fields of the CSPEC that are violated.  This field is only present when Reason Code is set to 0x02. When this field is present and a valid Violated CSPEC is not included, this field shall be 2 octets long, with a value of 0x0000 (i.e., CSPEC\_LEN = 0x0000). When a valid Violated CSPEC is included, the interpretation of this field is the same as in Section 7.8.1. |

### CC\_DETECT\_REPORT.REQ

The CC\_DETECT\_REPORT.REQ message is sent by the CCo to request a STA to perform the detect-and-report procedure (refer to Section 5.2.5). The time interval(s) during which the STA shall listen for and detect ongoing transmissions are identified by one or more GLID fields in the message, together with the schedules in the Beacon. The amount of time in which the STA shall detect for ongoing transmissions is specified by the Duration field, in units of Beacon Periods.

Table 11‑27: CC\_DETECT\_REPORT.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Duration | 0 | 1 | Amount of time to detect for ongoing transmissions, in units of number of Beacon Periods.  0x00 = zero Beacon Periods,  0x01 = one Beacon Period, and so on |
| NumGLID | 1 | 1 | The number of GLID fields in this message (=N). The maximum value for this field is 8.  0x00 = none  0x01 = one, and so on |
| GLID[1] | 2 | 1 | The first GLID to perform the detect-and-report procedure. |
| ... | … | … | ... |
| GLID[N] | N+1 | 1 | The last GLID to perform the detect-and-report procedure. |

### CC\_DETECT\_REPORT.CNF

The CC\_DETECT\_REPORT.CNF message is sent by a STA to report to the CCo the results of the detect-and-report procedure. This message shall be sent by the STA that has received a CC\_DETECT\_REPORT.REQ message after the STA has finished detecting for ongoing transmissions for the specified amount of time. The message contains the number of GLIDs where detection was performed and the type(s) of Frame Controls detected in the time intervals specified by the GLIDs.

If, for a particular GLID, the detection results are different in different Beacon Periods, the types of all Frame Controls that are detected over the entire detection duration should be reported.

Table 11‑28: CC\_DETECT\_REPORT.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| NumGLID | 0 | 1 | Number of GLIDInfo() in this message (=N).  0x00 = none  0x01 = one, and so on |
| GLIDInfo[1] | 1 - 6 | 6 | Information about the first GLID (see Table 11‑29) |
| ... | … | … | ... |
| GLIDInfo[N] | - | 6 | Information about the last GLID (see Table 11‑29) |

Table 11‑29: Format of GLIDInfo( )

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| GLID | 0 | 1 | GLID corresponding to this GLIDInfo[ ]. |
| CFDetected | 1 | 1 | 0x00 = (HomePlug AV or Hybrid) Contention-free Frame Controls are not detected.  0x01 = (HomePlug AV or Hybrid) Contention-free Frame Controls are detected.  0x02 – 0xFF = reserved |
| CSMADetected | 2 | 1 | 0x00 = (HomePlug AV or Hybrid) Contention-based Frame Controls are not detected.  0x01 = (HomePlug AV or Hybrid) Contention-based Frame Controls are detected.  0x02 – 0xFF = reserved |
| HP1Detected | 3 | 1 | 0x00 = HomePlug 1.0.1 Frame Controls are not detected.  0x01 = HomePlug 1.0.1 (not including HomePlug Hybrid) Frame Controls are detected.  0x02 – 0xFF = reserved |
| OthersDetected | 4 | 1 | 0x00 = other unknown types of transmissions are not detected.  0x01 = other unknown types of transmissions are detected.  0x02 – 0xFF = reserved |
| Signal Level | 5 | 1 | 0x00 = information not available  0x01 = signal level is > -10 dB, but ≤ 0 dB (relative to full transmit power, -50 dBm/Hz)  0x02 = signal level is > -15 dB, but ≤ -10 dB  0x03 = signal level is > -20 dB, but ≤ -15 dB  …  0x0E = signal level is > -75 dB, but ≤ -70 dB  0x0F = signal level is ≤ -75 dB  0x10 – 0xFF = reserved |
| Average BLE | 6 | 1 | Average BLE. The Format is defined in Section 4.4.1.5.2.10. Average BLE may be estimated based on Discover Beacon reception. This field shall be set to zero if not provided. Providing a non-zero value is optional. |

### CC\_WHO\_RU.REQ

This MME is used to request the identity of the AVLN from the CCo.

Table 11‑30: CC\_WHO\_RU.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size | Definition |
| NID | 0 - 6 | 7 | NID of network being queried. This is necessary to avoid confusion if the STA can hear two CCos with the same TEI.  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |

### CC\_WHO\_RU.CNF

This MME provides the identity of the AVLN and the MAC address of the CCo.

Table 11‑31: CC\_WHO\_RU.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| NID | 0 - 6 | 7 | NID of network being queried.  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The 2 MSBs shall be set to 0b00. |
| CMAC | 7 - 12 | 6 | CCo's MAC Address |
| HFID | 13 - 76 | 64 | ASCII value of Human Friendly ID (HFID) of AVLN (64 chars, max) |

### CC\_ASSOC.REQ

Association requests are used to obtain TEI leases, so that a STA may be allocated time in a Beacon Period by the CCo that grants the TEI lease, and so that unicast communications may be used (otherwise, any MPDU sent to the STA must be broadcast and receivers must use the ODA to determine the intended recipient). A CC\_ASSOC.REQ message may only be sent to a CCo, either directly or by relaying through a proxy.

Table 11‑32: CC\_ASSOC.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| ReqType | 0 | 1 | 0x00 = indicates whether this is a new request.  0x01 = indicates that this is a renewal request.  0x02 – 0xFF = reserved |
| NID | 1 - 7 | 7 | Network ID of the network with which the sender wants to associate.  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |
| CCo Capability | 8 | 1 | The two LSBs of this field contain the STA’s CCo capability. The interpretation of these bits is the same as in Section 4.4.3.15.4.6.2. The six MSBs of this field shall be set to 0b000000. |
| Proxy Networking Capability | 9 | 1 | 0x00 = STA does not support Proxy Networking.  0x01 = STA fully supports Proxy Networking.  0x02 – 0xFF = reserved |

#### Req Type

Req Type is the type of the association request. It is used with an established AVLN for an Unassociated STA to join (0x00) or for an associated STA to renew its TEI lease (0x01). The rest of the values are reserved.

#### NID

Network ID (NID) of the network with which the sender wants to associate (refer to Section 4.4.3.1). The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. Since all STAs always have an NID (even if it is based on a newly generated, random NMK), the requester will always have an NID to use.

#### CCo Capability

The two LSBs of this field contain the STA’s CCo capability. The interpretation of these bits is the same as in Section 4.4.3.15.4.6.2. The six MSBs of this field are set to 0b000000. One of its uses is to determine which of two Unassociated STAs should become the CCo when they first form an AVLN. Refer to Section 7.4.1.

#### Proxy Networking Capability

This field indicates whether proxy networking is supported (0x01) or not supported (0x00). Refer to Section 7.7.

### CC\_ASSOC.CNF

Table 11‑33: CC\_ASSOC.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Result | 0 | 1 | Indicates success or failure (see Table 11‑34). |
| NID | 1 - 7 | 7 | Network ID  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |
| SNID | 8 | 1 | Short Network Identifier  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs shall be set to 0x0. |
| STA TEI | 9 | 1 | TEI assigned to the STA (Valid if Result = “Success”) |
| Lease Time | 10 - 11 | 2 | Length of time for which TEI is valid, in minutes |

#### Result

Table 11‑34: Result Field Interpretation

|  |  |
| --- | --- |
| Result Value | Interpretation |
| 0x00 | Success – The STA is successfully associated and remaining field in the MME are valid |
| 0x01 | Failure due to temporary resource exhaustion, try again later. |
| 0x02 | Failure due to permanent resource exhaustion |
| 0x03 | Failure due to other reason |
| 0x04 - 0xFF | Reserved |

A TEI is supplied only when the value of Result is 0x00. 0x01, and 0x02 are used when the CCo has run out of TEIs. 0x03 is used for all other failure conditions and the rest of the values are reserved.

#### NID

NID of the network of the sender (refer to Section 4.4.3.1). The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00.

#### SNID

The four LSBs are set to the Short Network ID (SNID) of the sender’s network. Refer to Section 4.4.3.1. The four MSBs are set to 0x0.

#### STA TEI

The STA TEI field is set to the TEI value assigned to the new STA or HSTA. This field is valid only if the Result field is “Success STA”. TEI values are shown in Table 7‑1.

#### Lease Time

Lease Time is the length of time, in minutes, for which the TEI is valid. Permitted values of Lease Time are between 0x0001 and 0xFFFF. The value 0x0000 is reserved.

Table 11‑35:Lease Time Field

|  |  |
| --- | --- |
| Lease Time Value | Interpretation |
| 0x0000 | Reserved |
| 0x000F | = 15 Minutes: The default lease time for a STA that is associated but not authenticated. |
| 0x0B40 | = 48 hours: The default lease time for a STA that has successfully authenticated. |
| 0xFFFF | = ~45.51 Days: The maximum value of the lease time parameter. |

### CC\_LEAVE.REQ

This message is sent by a station when it determines to leave the network. This may be because the STA is being powered down or because the user has instructed the STA to leave.

Table 11‑36: CC\_LEAVE.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Reason | 0 | 1 | Reason for the Disassociation  0x00 = user request  0x01 = power down  0x02 – 0xFF = reserved |

### CC\_LEAVE.CNF

The CCo shall send this message in response to a CC\_LEAVE.REQ message (refer to Section 11.2.30). The message field for the MME is NULL.

### CC\_LEAVE.IND

The CCo will send this message to a STA that is being asked to leave the AVLN.

Table 11‑37: CC\_LEAVE.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Reason | 0 | 1 | Reason for the Disassociation  0x00 = user request  0x01 = TEI Lease Expired  0x02 = CCo shutting down due to a neighboring network with the same NID  0x03 – 0xFF = reserved |
| NID | 1 - 7 | 7 | Network ID.  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |

### CC\_LEAVE.RSP

The STA receiving the CC\_LEAVE.IND shall send this message to acknowledge receipt of the CC\_LEAVE.IND message. This is the last message for which the STA may use the TEI that it had been assigned. After sending this message, the STA shall cease all communication with the AVLN except for possibly restarting the association and authentication process. The message field for this MME is NULL.

### CC\_SET\_TEI\_MAP.REQ

The CC\_SET\_TEI\_MAP.REQ MME is sent to the CCo by an authenticated STA to request that the CCo send it a complete TEI\_MAP of the AVLN. The message must be encrypted with the NEK. The message field for this MME is NULL.

### CC\_SET\_TEI\_MAP.IND

The CC\_SET\_TEI\_MAP.IND MME is sent by the CCo to notify one or more STAs of any changes to the (TEI, MAC address) mapping. The message must be encrypted with the NEK when sent to authenticated STAs in the AVLN. When it is sent to a newly associated STA that is not authenticated, it shall be sent unencrypted.

Table 11‑38. CC\_SET\_TEI\_MAP.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Mode | 0 | 1 | Mode (refer to Section 11.2.35.1) |
| Num | 1 | 1 | Number of STAs Mapped by This Message  0x00 = invalid,  0x01 = one Station, and so on |
| TEI\_1 | 2 | 1 | TEI of STA\_1 |
| Addr\_1 | 3 -8 | 6 | MAC address of STA\_1 |
| Status\_1 | 9 | 1 | Status of STA\_1  0x00 = associated, but not authenticated  0x01 = authenticated  0x02 – 0xFF = reserved |
| … | … | … | … |
| TEI\_n | - | 1 | TEI of STA\_n |
| Addr\_n | - | 6 | MAC address of STA\_n |
| Status\_n | - | 1 | Status of STA\_n  0x00 = associated, but not authenticated  0x01 = authenticated  0x02 = disassociated  0x03 – 0xFF = reserved |

#### Mode

Mode identifies the purpose of this particular message, which is either to provide the current TEI-MAC Address Map in its entirety or to update particular entries.

Table 11‑39: Mode Field Interpretation

|  |  |
| --- | --- |
| Result Value | Interpretation |
| 0x00 | Update Entire STA (TEI-MAC address) Mapping Typically unicast to a new STA when it joins the AVLN. |
| 0x01 | Add new STA entries. Typically sent to all STAs in the AVLN to notify them of the arrival of new STAs. |
| 0x02 | Delete existing STA entries. Typically sent to all STAs in the AVLN to notify them of the departure of STAs from the AVLN. |
| 0x03 – 0xFF | Reserved |

### CC\_RELAY.REQ

The CC\_RELAY.REQ message is used to request a PSTA or PCo to forward an unencrypted MME to a final STA. The TEI and MAC address of the final STA are given as fields in the CC\_RELAY.REQ message.

Upon receiving this message, the PSTA shall extract the Payload field, encapsulate it in a CC\_RELAY.IND message and send it to the final destination STA.

If the PSTA has advertised in its Discover Beacon that it does not support Proxy Networking, it shall discard the CC\_RELAY.REQ MME without acting upon it.

Table 11‑40: CC\_RELAY.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| FDA | 0 - 5 | 6 | MAC address of the final destination STA |
| FTEI | 6 | 1 | TEI of the final destination STA |
| Len | 7 - 8 | 2 | Length of Payload in octets  0x00 = zero octets  0x01 = one octet, and so on |
| Payload | - | Var | Unencrypted MME that is destined for the final destination STA. |

#### FDA

The FDA field is the MAC address of the final destination STA that shall receive the MME in the Payload field.

#### FTEI

The FTEI field is the TEI of the final destination STA that shall receive the MME in the Payload field. If this field is equal to the broadcast TEI, the PSTA shall use broadcast when relaying the MME in the Payload field.

#### Len

The Len field indicates the length of the MME in the Payload field, in octets.

#### Payload

The Payload field contains an unencrypted MME that is destined for the final destination STA.

### CC\_RELAY.IND

The CC\_RELAY.IND message is used to forward an MME that was originally transmitted by an original source STA to a final destination STA.

If the STA has advertised in its Discover Beacon that it does not support Proxy Networking, it shall discard the CC\_RELAY.IND MME without acting upon it.

Table 11‑41: CC\_RELAY.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| OSA | 0 - 5 | 6 | MAC address of the original source STA that transmitted the Payload. |
| OTEI | 6 | 1 | TEI of the original source STA |
| Len | 7 - 8 | 2 | Length of Payload in octets.  0x00 = zero octets  0x01 = one octet, and so on |
| Payload | - | Var | MME that was transmitted by the original source STA and is being forwarded to final destination STA. |

#### OSA

The OSA field is the MAC address of the original source STA that transmitted the MME in the Payload field. This field is obtained from the MSDU that was transmitted by the original source STA.

#### OTEI

The OTEI field is the TEI of the original source STA that transmitted the MME in the Payload field. This field is obtained from the MPDU that was transmitted by the original source STA.

#### Len

The Len field indicates the length of the MME in the Payload field, in octets.

#### Payload

The Payload field contains the MME that was transmitted by the original source STA and is destined for the final destination STA. The MME in the Payload field must be unencrypted.

### CC\_BEACON\_RELIABILITY.REQ

CC\_BEACON\_RELIABILITY.REQ is used by the CCo to obtain the detection reliability of Central Beacon from other station(s) within the AVLN. The message field for this message is NULL. Beacon detection reliabilities can be used by the CCo for functions such as:

* Determining the persistence of the Persistent Schedule.
* Determining whether the Beacon has to be relocated to a different part of the AC line cycle.
* Determining whether the CCo function has to be handed over to a different station in the Network.

### CC\_BEACON\_RELIABILITY.CNF

CC\_BEACON\_RELIABILITY.CNF is generated by a station in response to the corresponding CC\_BEACON\_RELIABILITY.REQ (refer to Section 11.2.38). This message may also be generated in an unsolicited manner when a station observes poor Beacon detection.

Each station shall continuously monitor its CCo’s Beacon reliability and report the reliability statistics using CC\_BEACON\_RELIABILITY.CNF. Beacon Reliability statistics shall be reset when a CC\_BEACON\_RELIABILITY.CNF is transmitted in response to a CC\_BEACON\_RELIABILITY.REQ.

Table 11‑42: CC\_BEACON\_RELIABILITY.CNF

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| NBP | 0 - 1 | 2 | Number of Beacon Periods  0x00 = zero Beacon Periods  0x01 = one Beacon Period, and so on |
| NMB | 2 - 3 | 2 | Number of Missed Beacons  0x00 = zero missed Beacons  0x01 = one missed Beacon, and so on |

#### Number of Beacon Periods (NBP)

Number of Beacon Periods (NBP) indicates the duration in multiples of Beacon Periods over which the Beacon detection reliability statistics were collected.

#### Number of Missed Beacons (NMB)

Number of Missed Beacons (NMB) indicates the number of Beacons missed in the duration indicated by the NBP field.

### CC\_ALLOC\_MOVE.REQ

The CC\_ALLOC\_MOVE.REQ message is sent from a STA to the CCo to request that the allocation of an existing Link be moved to a different position within the AC line cycle. Either the originating or terminating STA of a unicast Connection may request either the Forward or Reverse Link (or both) to be moved.

A station shall not send a CC\_ALLOC\_MOVE.REQ more than once every five seconds for a particular Connection.

This message should be sent in response to channel conditions. It should not be sent as a result of changing QoS requirements (i.e. changes in the CSPEC).

Table 11‑43: CC\_ALLOC\_MOVE.REQ Message

| Field | Octet Number | Field Size (Octets) | Definition |
| --- | --- | --- | --- |
| CID | 0 - 1 | 2 | Connection ID |
| GLID-F | 2 | 1 | GLID for the Forward Link  b7: 0 = no Global Link present in this direction  or no change is requested on this Global Link.  1 = Global Link present in this direction  b0-b6: seven LSBs of assigned GLID if b7 = 1 |
| GLID-R | 3 | 1 | GLID for the Reverse Link  b7: 0 = no Global Link present in this direction  or no change is requested on this Global Link.  1 = Global Link present in this direction  b0-b6: seven LSBs of assigned GLID if b7 = 1 |
| Forward Link Bit Loading Estimates | - | Var | Bit Loading Estimates for the Forward Link  The format of this field is the same as that of the corresponding field in Section 11.2.15  This field is only present when GLID-F field contains a valid Global Link Identifier. |
| Reverse Link Bit Loading Estimates | - | Var | Bit Loading Estimates for the Reverse Link  The format of this field is the same as that of the corresponding field in Section 11.2.15  This field is only present when GLID-R field contains a valid Global Link Identifier. |

### CC\_ALLOC\_MOVE.CNF

The CC\_ALLOC\_MOVE.CNF is sent from the CCo to a STA in response to a CC\_ALLOC\_MOVE.REQ. This message indicates the CCo’s response to the request. Should the request be accepted, the allocation is moved by changing the schedule announced in the Beacon.

Note: Schedule changes occur asynchronously to the transmission of this message. Therefore, the schedule may be updated before this message is received by the requesting station.

Table 11‑44: CC\_ALLOC\_MOVE.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| CID | 0 - 1 | 2 | Connection ID |
| Result | 2 | 1 | Result  0x00 = request accepted.  0x01 = request rejected. Feature not supported  0x02 = request rejected. No suitable allocation available.  0x03 – 0xFF = reserved |

### CC\_ACCESS\_NEW.REQ

The CC\_ACCESS\_NEW.REQ message is sent by a Gateway STA to its In-Home CCo to request for resource to set up a CFP Connection with the Access CCo.

Table 11‑45: CC\_ACCESS\_NEW.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| STEI | 0 | 1 | Specifies the TEI of the Gateway STA that initiates the CFP Connection |
| DTEI | 1 | 1 | Specifies the TEI of the Access CCo that terminates the CFP Connection |
| DAddr | 2 - 7 | 6 | Specifies the MAC address of the Access CCo that terminates the CFP Connection |
| LLID | 8 | 1 | Specifies the Local Link ID (LLID) of the CFP Connection. It is assigned locally by the initiating STA |
| CSPEC | - | Var | Specifies the QoS requirements of the CFP Connection |
| BLE | - | Var | Specifies the Bit Loading Estimates between the source and destination STAs (i.e., between the Gateway STA and the Access CCo) with respect to the AC line cycle.  The format of this field is the same as the “Forward Link Bit Loading Estimates” field in  Table 11‑19. |

### CC\_ACCESS\_NEW.CNF

The CC\_ACCESS\_NEW.CNF message is sent by an In-Home CCo to a Gateway STA in its In-Home Network in response to a CC\_ACCESS\_NEW.REQ message. The CC\_ACCESS\_NEW.REQ message contains a result code indicating the outcome of the request.

Table 11‑46: CC\_ACCESS\_NEW.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Result | 0 | 1 | Specifies the Outcome of the Request  0x00 = the request is successful and the In-Home CCo. In this case, the forward and reverse GCID, StartTime, EndTime, and ChanEst fields are present in the message.  0x01 = the request is rejected because the In-Home CCo cannot support the request with its existing share of resource.  0x02 – 0xFF = reserved |
| LLID | 1 | 1 | The LLID field in the CC\_ACCESS\_NEW.CNF message is copied from the same field in the CC\_ACCESS\_NEW.REQ message. |
| GCID-F | 2 | 1 | Present if the Result field is 0x00. When present, it is the GLID assigned (if any) to the forward CFP Link by the In-Home CCo. The MSB is set to 1 to indicate a GLID is assigned, and is set to 0 to indicate a GLID is not assigned for this direction. The least-significant seven bits represent the least-significant 7 bits of the GLID if one is assigned. |
| ChanEstF | 3 | 1 | Present if the Result field is 0x00. When present, this field is valid if a GLID is assigned for this direction.  0x00 = channel estimation need not be performed in this direction.  0x01 = channel estimation must be performed in this direction.  0x02 – 0xFF = reserved |
| GCID-R | 4 | 1 | Present if the Result field is 0x00. When present, it is the GLID assigned (if any) to the reverse CFP Link by the In-Home CCo. The most-significant bit is set to 1 to indicate a GLID is assigned, and is set to 0 to indicate a GLID is not assigned for this direction. The least-significant 7 bits represent the least-significant 7 bits of the GLID if one is assigned. |
| ChanEstR | 5 | 1 | Present if the Result field is 0x00. When present, this field is valid if a GLID is assigned for this direction.  0x00 = channel estimation need not be performed in this direction.  0x01 = channel estimation must be performed in this direction.  0x02 – 0xFF = reserved |

### CC\_ACCESS\_NEW.IND

The CC\_ACCESS\_NEW.IND message is sent by a Gateway STA to the Access CCo to notify the Access CCo that a CFP has been secured from its In-Home Network.

Table 11‑47: CC\_ACCESS\_NEW.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Result | 0 | 1 | Specifies the reason for sending this message:  0x00 = the Gateway STA is able to obtain an allocation from its In-Home CCo to use for a CFP Connection (specified by the LLID field) between the Gateway STA and the Access CCo. In this case, the forward and reverse GCID, StartTime, EndTime, and ChanEst fields are present in the message.  0x01 = the Gateway STA is unable to obtain an allocation from its In-Home CCo.  0x02 – 0xFF = reserved |
| LLID | 1 | 1 | Specifies the LLID of the CFP Connection. It is assigned locally by the initiating STA |
| GCID-F | 2 | 1 | Present if the Result field is 0x00. When present, it is the GLID assigned (if any) to the forward CFP Link by the In-Home CCo. The MSB is set to 1 to indicate a GLID is assigned, and is set to 0 to indicate a GLID is not assigned for this direction. The least-significant seven bits represent the least-significant 7 bits of the GLID if one is assigned. |
| ChanEstF | 3 | 1 | Present if the Result field is 0x00. When present, this field is valid if a GLID is assigned for this direction.  0x00 = channel estimation need not be performed in this direction.  0x01 = channel estimation must be performed in this direction.  0x02 – 0xFF = reserved |
| GCID-R | 4 | 1 | Corresponding fields for the Reverse Link. This field is similar to the GLID-F field. |
| ChanEstR | 5 | 1 | Corresponding fields for the Reverse Link. This field is similar to the ChanEstF field. |
| NID | 6-11 | 6 | Present if the Result field is 0x00. When present, it specifies the network ID of the In-Home Network who owns the CFP allocation.  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |

### CC\_ACCESS\_NEW.RSP

The CC\_ACCESS\_NEW.RSP message is sent by the Access CCo to the Gateway STA to confirm whether the CFP secured by the Gateway STA is acceptable. The CC\_ACCESS\_NEW.RSP MMENTY is also sent by the Gateway STA to its In-Home CCo to confirm whether the CFP secured is acceptable.

Table 11‑48: CC\_ACCESS\_NEW.RSP Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Result | 0 | 1 | Specifies whether the CFP is acceptable to the Access CCo:  0x00 = the Access CCo accepts the proposed CFP.  0x01 = the Access CCo rejects the proposed CFP because it conflicts with its other schedule.  0x02 = the Access CCo-initiated Neighbor Network Coordination, Resend CC\_LINK\_NEW.REQ after one second.  0x03 – 0xFF = reserved |
| LLID | 1 | 1 | The LLID field in the CC\_ACCESS\_NEW.CNF message is copied from the same field in the CC\_ACCESS\_NEW.IND message. |
| GCID-F | 2 | 1 | The Forward Global Link ID (GLID-F) field is copied from the same field in the CC\_ACCESS\_NEW.IND message. |
| GCID-R | 3 | 1 | The Reverse Global Link ID (GLID-R) field is copied from the same field in the CC\_ACCESS\_NEW.IND message. |
| BLE-F | - | Var | Specifies the bit loading estimation of the Forward Link  The format of this field is the same as the “Forward Link Bit Loading Estimates” field in  Table 11‑19 |
| BLE-R | - | Var | Specifies the bit loading estimation of the Reverse Link  The format of this field is the same as the “Reverse Link Bit Loading Estimates” field in  Table 11‑19. |

### CC\_ACCESS\_REL.REQ

The CC\_ACCESS\_REL.REQ message is sent by the Gateway STA to its In-Home CCo to release the CFP it secured earlier for its communication with the Access CCo. Before sending this message, the Gateway STA must have already sent the CC\_ACCESS\_REL.IND message to the Access CCo and received the CC\_ACCESS\_REL.RSP message as a response.

Table 11‑49: CC\_ACCESS\_REL.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Cause | 0 | 1 | Indicates the reason for the release of the CFP:   * 0x00 = normal release * 0x01 – 0xFF = reserved |
| GCID-F | 1 | 1 | Has the same meaning as GLID-F in Section ‎11.2.44. |
| GCID-R | 2 | 1 | Has the same meaning as GLID-R in Section 11.2.44. |

### CC\_ACCESS\_REL.CNF

The CC\_ACCESS\_REL.CNF message is sent by an In-Home CCo to its Gateway STA in response to a received CC\_ACCESS\_REL.REQ message.

Table 11‑50: CC\_ACCESS\_REL.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Result | 0 | 1 | Specifies the outcome of the release request.  0x00 = the request is accepted.  0x01 – 0xFF = reserved |
| GCID-F | 1 | 1 | The GLID-F field is copied from the same field in the CC\_ACCESS\_NEW.REQ message. |
| GCID-R | 2 | 1 | The GLID-R field is copied from the same field in the CC\_ACCESS\_NEW.REQ message. |

### CC\_ACCESS\_REL.IND

The CC\_ACCESS\_REL.IND message is sent from the In-Home CCo to the Gateway STA, or from the Gateway STA to the Access CCo, to indicate that the CFP allocated to the Gateway STA is to be released.

Table 11‑51: CC\_ACCESS\_REL.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Cause | 0 | 1 | Has the same meaning as the corresponding fields in the CC\_ACCESS\_REL.REQ message. |
| GCID-F | 1 | 1 | Has the same meaning as the corresponding fields in the CC\_ACCESS\_REL.REQ message. |
| GCID-R | 2 | 1 | Has the same meaning as the corresponding fields in the CC\_ACCESS\_REL.REQ message. |

### CC\_ACCESS\_REL.RSP

The CC\_ACCESS\_REL.RSP message is sent from the Gateway STA to the In-Home CCo, or from the Access CCo to the Gateway STA, in response to a received CC\_ACCESS\_REL.IND message.

Table 11‑52: CC\_ACCESS\_REL.RSP Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Result | 0 | 1 | Has the same meaning as the corresponding fields in the CC\_ACCESS\_REL.RSP message. |
| GCID-F | 1 | 1 | Has the same meaning as the corresponding fields in the CC\_ACCESS\_REL.RSP message. |
| GCID-R | 2 | 1 | Has the same meaning as the corresponding fields in the CC\_ACCESS\_REL.RSP message. |

### CC\_DCPPC.IND

The CC\_DCPPC.IND message is sent by a station to the CCo to indicate that the station uses a different receive PHY clock correction during the CP than this network, identified by the SNID. The CC\_DCPPC.IND message is also used to indicate when a station changes from using a different PHY Receive Clock Correction to using the correct PHY Receive Clock Correction for the network. The interpretation of the Different CP PHY Clock Flag (DCPPCF) field is the same as the corresponding Different CP PHY Clock Flag (DCPPCF) field in Section 4.4.1.5.2.19 Also, refer to Sections 4.4.3.10 and 5.5.4.1.

Reception of a CC\_DCPPC.IND message shall cause the CCo to respond with a corresponding CC\_DCPPC.RSP message.

Table 11‑53: CC\_DCPPC.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| DCPPCF | 0 | 1 | 0x00 = same CP PHY Clock  0x01 = different CP PHY Clock  0x02 = 0xFF = reserved |

### CC\_DCPPC.RSP

The CC\_DCPPC.RSP message is sent by the CCo in response to the corresponding CC\_DCPPC.IND message. The message field for this MME is NULL.

### CC\_HP1\_DET.REQ

The CC\_HP1\_DET.REQ message is a request for the CCo to the station(s) to provide statistics on the detected HomePlug 1.0.1 and HomePlug 1.1 transmissions. The message field for this message is NULL.

### CC\_HP1\_DET.CNF

The CC\_HP1\_DET.CNF message contains the HomePlug 1.0.1 and HomePlug 1.1 detection statistics. This message is generated in response to a corresponding CC\_HP1\_DET.REQ. This message may also be generated by AV or GREEN PHY stations in an unsolicited manner when HomePlug 1.0.1 and/or HomePlug 1.1 transmissions are detected. The message field for this message is shown in Table 11‑54. HomePlug 1.0.1/1.1 detection statistics shall be reset when a CC\_HPI\_DET.CNF is transmitted in response to a CC\_HPI\_DET.REQ.

Table 11‑54: CC\_HP1\_DET.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| NBP | 0 - 1 | 2 | Number of Beacon Periods over which statistics were collected  0x0000 = zero Beacon Periods  0x0001 = one Beacon Period, and so on |
| NHP1.0 | 2 - 3 | 2 | Number of HomePlug 1.0.1 transmissions detected  0x0000 = zero  0x0001 = one, and so on |
| NHP1.1 | 4 - 5 | 2 | Number of HomePlug 1.1 transmission detected  0x0000 = zero  0x0001 = one, and so on |

### CC\_BLE\_UPDATE.IND

The CC\_BLE\_UPDATE.IND message is sent from the STA that is the source of a Global Link to the CCo to provide the latest Bit Loading Estimates. CC\_BLE\_UPDATE.IND may be transmitted by the Source of the Global Link any time it observes significant changes to the BLEs. Reception of CC\_BLE\_UPDATE.IND shall cause the CCo to update the Bit Loading Estimates for the Global Link and the duration of CF allocation accordingly.

Table 11‑55: CC\_BLE\_UPDATE.IND Message

| Field | Octet Number | Field Size (Octets) | Definition |
| --- | --- | --- | --- |
| GLID | 0 | 1 | Global Link Identifier of the Global Link whose Bit Loading Estimates are updated. |
| Bit Loading Estimates | - | Var | Bit Loading Estimates for the Global Link  The format of this field is the same as that of the Forward Link Bit Loading Estimate field defined in Section 11.2.15. |

### CC\_BCAST\_REPEAT.IND (GREEN PHY)

**CC\_BCAST\_REPEAT**.IND is sent by the CCo to provide a STA with the BMRAT, which is a list of STEIs for which the STA is responsible for retransmitting PBs for broadcast MPDUs received with a STEI in the BMRAT.

Table 11‑56: CC\_BCAST\_REPEAT.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| NumEntries | 0 | 1 | Number of entries = L  0x00 = None,  0x01 = One, and so on. |
| STEI[0] | 1 | 1 | STEI[0] of broadcast or multicast MPDUs where the PBs are to be retransmitted |
| STEI[1] | 2 | 1 | STEI[1] of broadcast or multicast MPDUs where the PBs are to be retransmitted |
| ... |  |  |  |
| STEI[L-1] | L | 1 | STEI[L-1] of broadcast or multicast MPDUs where the PBs are to be retransmitted |

### CC\_BCAST\_REPEAT.RSP (GREEN PHY)

CM\_BR\_REPEAT.RSP message is sent by the STA to confirm the reception of the CM\_BR\_REPEAT.IND message.

### CC\_POWERSAVE.REQ (GREEN PHY)

The CC\_POWERSAVE.REQ message is sent by a STA to the CCo to request to go into Power Save.

Table 11‑57: CC\_POWERSAVE.REQ Message

| Field | Octet Number | Field Size (Octets) | Definition |
| --- | --- | --- | --- |
| PSS | 0 | 1 | Power Save Schedule requested  The format of the Power Save Schedule is shown in Table 4-103 |

### CC\_POWERSAVE.CNF (GREEN PHY)

The CC\_POWERSAVE.CNF message is sent by the CCo in response to the corresponding **CC\_POWERSAVE.REQ**. This message indicates whether the CCo accepted or rejected the request to enter Power Save mode. This message also includes the Power Save State Identifier and the list of all STAs (including CCo) in Power Save mode and their Power Save Schedules.

Table 11‑58: CC\_POWERSAVE.CNF Message

| Field | Octet Number | Field Size (Octet) | Definition |
| --- | --- | --- | --- |
| Result | 0 | 1 | Result  0x00 = Accept  0x01 = Reject  0x02-0xFF = Reserved |
| PSSI | 1 | 1 | Power Save State Identifier  Refer to Section 4.4.3.15.4.15.5 |
| NumTEI | 1 | 1 | Number of STAs in Power Save mode (=N)  0x00 = 0  0x01 = 1, and so on. |
| TEI[1] | - | 1 | TEI of station in Power Save mode |
| PSS[1] | - | 1 | Power Save Schedule of TEI[1]  The format of the Power Save Schedule is shown in Table 4-103. |
| … |  |  |  |
| TEI[N] | - | 1 | TEI of station in Power Save mode |
| PSS[N] | - | 1 | Power Save Schedule of TEI[N]  The format of the Power Save Schedule is shown in Table 4-103. |

### CC\_POWERSAVE\_EXIT.REQ (GREEN PHY)

The CC\_POWERSAVE\_EXIT.REQ message is sent by a STA to the CCo to indicate that it has exited the Power Save mode. The message field for this MME is NULL.

### CC\_POWERSAVE\_EXIT.CNF (GREEN PHY)

The CC\_POWERSAVE\_EXIT.CNF message is sent by the CCo to confirm that it has received the corresponding CC\_POWERSAVE\_EXIT.REQ message. This message also includes the Power Save State Identifier and the list of all STAs (including the CCo) in Power Save mode and their Power Save Schedules.

Table 11‑59: CC\_POWERSAVE\_EXIT.CNF Message

| Field | Octet Number | Field Size (Octet) | Definition |
| --- | --- | --- | --- |
| PSSI | 1 | 1 | Power Save State Identifier  Refer to Section 4.4.3.15.4.15.5 |
| NumTEI | 1 | 1 | Number of STAs in Power Save mode (=N)  0x00 = 0  0x01 = 1, and so on. |
| TEI[1] | - | 1 | TEI of station in Power Save mode |
| PSS[1] | - | 1 | Power Save Schedule of TEI[1]  The format of the Power Save Schedule is shown in Table 4-103. |
| … |  |  |  |
| TEI[N] | - | 1 | TEI of station in Power Save mode |
| PSS[N] | - | 1 | Power Save Schedule of TEI[N]  The format of the Power Save Schedule is shown in Table 4-103. |

### CC\_POWERSAVE\_LIST.REQ (GREEN PHY)

The CC\_POWERSAVE\_LIST.REQ message is sent by a STA to the CCo to request the list of STAs in Power Save mode. The message field for this MME is NULL.

### CC\_POWERSAVE\_LIST.CNF (GREEN PHY)

The CC\_POWERSAVE\_LIST.CNF message is sent by the CCo in response to the corresponding CC\_POWERSAVE\_LIST.REQ message. This message contains the Power Save State Identifier and the list of all STAs (including CCo) in Power Save mode and their Power Save Schedules.

Table 11‑60: CC\_POWERSAVE\_LIST.CNF Message

| Field | Octet Number | Field Size (Octet) | Definition |
| --- | --- | --- | --- |
| PSSI | 1 | 1 | Power Save State Identifier  Refer to Section 4.4.3.15.4.15.5 |
| NumTEI | 1 | 1 | Number of STAs in Power Save mode (=N)  0x00 = 0  0x01 = 1, and so on. |
| TEI[1] | - | 1 | TEI of station in Power Save mode |
| PSS[1] | - | 1 | Power Save Schedule of TEI[1]  The format of the Power Save Schedule is shown in Table 4-103. |
| … |  |  |  |
| TEI[N] | - | 1 | TEI of station in Power Save mode |
| PSS[N] | - | 1 | Power Save Schedule of TEI[N]  The format of the Power Save Schedule is shown in Table 4-103. |

## Proxy Coordinator (PCo) Messages

### CP\_PROXY\_APPOINT.REQ

The CP\_PROXY\_APPOINT.REQ message is sent by the CCo to a PSTA to promote it to PCo or to a PCo to update the PCo’s information. In both cases, the message contains information about HSTAs for which the PCo shall be responsible.

If the STA has advertised in its Discover Beacon that it does not support Proxy Networking, it should never receive the CP\_PROXY\_APPOINT.REQ MME. If it does receive it, it should send a CP\_PROXY\_APPOINT.CNF message with Result = Failed.

Table 11‑61: CP\_PROXY\_APPOINT.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| ReqType | 0 | 1 | Request Type |
| ReqID | 1 | 1 | Request ID |
| GLID | 2 | 1 | GLID |
| Num HSTA | 3 | 1 | Number of HSTA Information Fields (=N)  0x00 = no hidden STAs information provided.  0x01 = one hidden station information provided, and so on. |
| HSTA SA[1] | 4 - 9 | 6 | MAC address of the first HSTA |
| HSTA TEI[1] | 10 | 1 | TEI of the first HSTA |
| HSTA State[1] | 11 | 1 | State of the first HSTA. |
| ... |  |  |  |
| HSTA SA[N] | - | 6 | MAC address of the last HSTA |
| HSTA TEI[N] | - | 1 | TEI of the last HSTA |
| HSTA State[N] | - | 1 | State of the last HSTA. |

#### ReqType

The ReqType field indicates the different types of request. If the ReqType = Add, the PCo shall send the PH\_PROXY\_APPOINT.IND message to each HSTA in the list.

Table 11‑62: ReqType

|  |  |
| --- | --- |
| ReqType Value | Interpretation |
| 0x00 | “Add”: This MME is used to assign HSTA(s) to the PCo or PSTA. (A PSTA shall become a PCo.) |
| 0x01 | “Delete”: This MME is used to un-assign HSTA(s) from a PCo. (The HSTA(s) may have left the AVLN or been re-assigned to a different PCo.) |
| 0x02 | “Update”: This MME is used to update information about HSTA(s) that is (are) under the control of a PCo. |
| 0x03 | “Shutdown”: This MME is used to un-assign all HSTAs from a PCo and request the PCo to stop being a PCo. |
| 0x04 to 0xFF | Reserved |

#### ReqID

The ReqID field is set by the sender of this MME such that the same value is not recently used between the sender and the receiver of this MME.

#### GLID

The GLID field specifies the GLID value where the PCo shall transmit Proxy Beacons. This field shall be ignored if ReqType field is “Shutdown.”

#### Num HSTA

The Num HSTA field specifies the number of HSTA information fields that are included in this MME.

#### HSTA SA[1] to HSTA SA[N]

The HSTA SA field is the MAC address of the HSTA concerned. This field shall be ignored if ReqType field is “Shutdown.”

#### HSTA TEI[1] to HSTA TEI[N]

The HSTA TEI field is the TEI of the HSTA concerned. This field shall be ignored if ReqType field is “Shutdown.”

#### HSTA State[1] to HSTA STATE[N]

The HSTA State field indicates the state of the HSTA concerned. This field shall be ignored if ReqType field is “Shutdown” or “Delete.”

Table 11‑63: HSTA State

|  |  |
| --- | --- |
| HSTA State Value | Interpretation |
| 0x00 | “Associated”: The HSTA is associated with the AVLN and is assigned a TEI. |
| 0x01 | “Authenticated”: The HSTA is authenticated (and associated) with the AVLN and has obtained the NEK. |
| 0x02 to 0xFF | Reserved |

### CP\_PROXY\_APPOINT.CNF

The CP\_PROXY\_APPOINT.CNF message is sent by a PSTA or PCo to the CCo in response to a received CP\_PROXY\_APPOINT.REQ message.

Table 11‑64: CP\_PROXY\_APPOINT.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| ReqID | 0 | 1 | Request ID |
| Result | 1 | 1 | Result |

#### ReqID

The ReqID field in the CP\_PROXY\_APPOINT.CNF message is copied from the ReqID field in the corresponding CP\_PROXY\_APPOINT.REQ message.

#### Result

Table 11‑65: Result

|  |  |
| --- | --- |
| Result Value | Interpretation |
| 0x00 | Success |
| 0x01 | Failed (no resources or Proxy Networking not supported) |
| 0x02 to 0xFF | Reserved |

### PH\_PROXY\_APPOINT.IND

The PH\_PROXY\_APPOINT.IND message is sent by a PSTA or PCo to an HSTA to indicate that the PCo is responsible for the HSTA. Since the HSTA does not yet know its TEI, the PH\_PROXY\_APPOINT.IND shall be addressed to the broadcast TEI and the HSTA’s MAC address.

Table 11‑66: PH\_PROXY\_APPOINT.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| PCo SA | 0 - 5 | 6 | MAC address of the PCo |
| PCo TEI | 6 | 1 | TEI of the PCo |
| CCo SA | 7 - 12 | 6 | MAC address of the CCo |
| CCo TEI | 13 | 1 | TEI of the CCo |
| GLID | 14 | 1 | GLID where Proxy Beacons will be transmitted. |

#### PCo SA

The PCo SA field specifies the MAC address of the PCo.

#### PCo TEI

The PCo TEI field is set to the TEI of the PCo that shall transmit Proxy Beacons for the new HSTA.

#### CCo SA

The CCo SA field specifies the MAC address of the PCo.

#### CCo TEI

The CCo TEI field specifies the TEI of the CCo.

#### GLID

The GLID field specifies the GLID where the PCo shall transmit Proxy Beacons.

### CP\_PROXY\_WAKE.REQ

The CP\_PROXY\_WAKE.REQ may be sent by a PCo to request exit from Network Power Saving Mode when it detects transmission from HSTA. The Message field for the MME is NULL.

For more information, refer to Section 7.11.

## CCo - CCo

All Management Messages between CCos of Neighbor Networks are unencrypted.

### NN\_INL.REQ and NN\_INL.CNF

Networks List (INL) of another CCo. When a CCo receives an NN\_INL.REQ message, it must reply with an NN\_INL.CNF message. The NN\_INL.REQ and NN\_INL.CNF messages are unencrypted.

Table 11‑67: NN\_INL.REQ and NN\_INL.CNF Message

| Field | Octet Number | Field Size (Octets) | Definition |
| --- | --- | --- | --- |
| MyTEI | 0 | 1 | TEI of the sender of this message (0x00 means invalid) |
| MySNID/Access | 1 | 1 | Short Network Identifier of the sender of this message  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| MyNID | 2 – 8 | 7 | Network Identifier of the sender of this message. This field is Ignored if MyTEI=0x00.  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |
| MyNumAuthSTAs | 9 | 1 | Number of authenticated STAs in the AVLN, including the CCo. |
| MyNumSlots | 10 | 1 | Number of Beacon Slots in the Beacon Region of the sender of this message. This field is Ignored if MyTEI=0x00.  0x00 = one Beacon Slot, and so on  0x08 - 0xFF = reserved |
| MySlotID | 11 | 1 | SlotID where the sender of this message transmits its Beacon. This field is Ignored if MyTEI=0x00.  0x00 = first Beacon Slot, and so on  0x08 - 0xFF = reserved |
| MyCoordStatus | 12 | 1 | Coordinating Status of the Sender  0x00 = unknown  0x01 = Non-Coordinating Network  0x02 = Coordinating, Group status unknown  0x03 = Coordinating Network in the same Group as this CCo  0x04 = Coordinating Network not in the same Group as this CCo  0x05 – 0xFF = reserved |
| NumInfo | 13 | 1 | Number of networks information to follow (=N)  0x00 = none  0x01 = one, and so on |
| SNID/Access\_1 | 14 | 1 | Short Network Identifier of the first network that the sender can detect.  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| NID\_1 | 15 - 21 | 7 | Network Identifier of the first network that the sender can detect.  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |
| NumSlots\_1 | 22 | 1 | Number of Beacon Slots in the Beacon Region of the first network that the sender can detect.  0x00 = one Beacon Slot, and so on  0x08 - 0xFF = reserved |
| SlotID\_1 | 23 | 1 | SlotID where the first network that the sender can detect transmits its Beacon.  0x00 = first Beacon Slot, and so on  0x08 - 0xFF = reserved |
| Offset\_1 | 24 - 25 | 2 | Offset between the Beacon Regions of the sender of this message and the first network that it can detect, measured in units of AllocationTimeUnit. Offset = start time of sender’s Beacon Region minus start time of receiver’s Beacon Region (modulo) Beacon Period.  0x0000 = zero or in the same Group  0x0001 = one AllocationTimeUnit, and so on |
| CoordStatus\_1 | 26 | 1 | Coordinating Status of the Network  0x00 = unknown  0x01 = Non-Coordinating Network  0x02 = Coordinating, Group status unknown  0x03 = Coordinating Network in the same Group as this CCo  0x04 = Coordinating Network not in the same Group as this CCo  0x05 – 0xFF = reserved |
| … | … | … | … |
| SNID/Access\_N | - | 1 | Short Network Identifier of the last network that the sender can detect.  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| NID\_N | - | 7 | Network Identifier of the last network that the sender can detect.  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |
| NumSlots\_N | - | 1 | Number of Beacon Slots in the Beacon Region of the last network that the sender can detect.  0x00 = one Beacon Slot, and so on  0x08 - 0xFF = reserved |
| SlotID\_N | - | 1 | SlotID where the last network that the sender can detect transmits its Beacon.  0x00 = first Beacon Slot, and so on  0x08 - 0xFF = reserved |
| Offset\_N | - | 2 | Offset between the Beacon Regions of the sender of this message and the last network that it can detect, measured in units of AllocationTimeUnit.  0x0000 = zero or in the same Group  0x0001 = one AllocationTimeUnit, and so on |
| CoordStatus\_N | - | 1 | Coordinating Status of the Network  0x00 = unknown  0x01 = Non-Coordinating Network  0x02 = Coordinating, Group status unknown  0x03 = Coordinating Network in the same Group as this CCo  0x04 = Coordinating Network not in the same Group as this CCo  0x05 – 0xFF = reserved |

### NN\_NEW\_NET.REQ

The NN\_NEW\_NET.REQ message is sent by a new CCo to the CCos in its INL to request to set up a new network. The message contains the Beacon Slot number.

The Offset field is set to 0 if the message is sent to a CCo of the same group (i.e., with the same system timing). Otherwise, the Offset field is calculated as the start time of the Beacon Region of the sender minus the start time of the Beacon Region of the receiver.

The NN\_NEW\_NET.REQ message is unencrypted.

Table 11‑68: NN\_NEW\_NET.REQ Message

| Field | Octet Number | Field Size (Octets) | Definition |
| --- | --- | --- | --- |
| MyTEI | 0 | 1 | Proposed TEI of the sender. |
| MySNID/Access | 1 | 1 | Proposed SNID of the sender.  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4. The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| ReqID | 2 | 1 | Request ID. Set by sender so that the same value was not used recently. |
| MyNID | 3-9 | 7 | Proposed NID of the sender.  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |
| MyNumSlots | 10 | 1 | Proposed number of Beacon Slots in the Beacon Region.  0x00 = one Beacon Slot, and so on  0x08 - 0xFF = reserved |
| MySlotID | 11 | 1 | 0x00 – 0x07 = Proposed Slot ID to be used by the sender to transmit its Beacons.  0x00 = first Beacon Slot, and so on  0x08 - 0xFF = reserved |
| Offset | 12-13 | 2 | Time offset between the Beacon Regions of the sender and the receiver, in units of AllocationTimeUnit.  0x0000 = zero or in the same Group  0x0001 = one AllocationTimeUnit, and so on |

### NN\_NEW\_NET.CNF

The NN\_NEW\_NET.CNF message is sent by a CCo to another CCo in response to a received NN\_NEW\_NET.REQ message. If the request is accepted, the Result field shall be set to “successful” and the Information field shall be set to the Beacon Period structure of the sender of this message. In addition, the CCo shall not change its schedule until it receives an NN\_NEW\_NET.IND message from the new CCo. If the request is rejected, the Result field shall be set to “unsuccessful SNID”, “unsuccessful SlotID” or “unsuccessful, not in the same Group”. When the Result is “unsuccessful SNID” or “unsuccessful SlotID”, the Information shall be set to proposed acceptable SNID or SlotID value. The message is unencrypted.

Table 11‑69: NN\_NEW\_NET.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| MyTEI | 0 | 1 | TEI of the sender. |
| MySNID/Access | 1 | 1 | SNID of the sender  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4. The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| ReqID | 2 | 1 | Request ID. Copied from the ReqID field of the NN\_NEW\_NET.REQ message. |
| Result | 3 | 1 | 0x00 = successful (seeTable 11-70)  0x01 = unsuccessful SNID (see Table 11-71)  0x02 = unsuccessful SlotID (see Table 11-72)  0x03 = unsuccessful, not in the same Group (Information field is null)  0x04 – 0xFF = reserved |
| Information | - | Var | Information field. The format of this fields depends on the Result |

Table 11‑70: Format of Information Field when Result = 0x00 (Successful)

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Num | 0 | 1 | Number of Region Types to Follow (=N)  0x00 = zero Region Types  0x01 = one Region Type, and so on |
| Type[1] | 1 | 1 | First Region Type (refer to Section 4.4.3.15.4.3.2.  The four LSBs of this field contain the Region Type (refer to Section 4.4.3.15.4.3.2. The four MSBs shall be set to 0x0. |
| EndTime[1] | 2 - 3 | 2 | End time of first Region Type, in units of AllocationTimeUnit  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |
| … | … | … | … |
| Type[N] | - | 1 | Last Region Type  The four LSBs of this field contain the Region Type (refer to Section 4.4.3.15.4.3.2. The four MSBs shall be set to 0x0. |
| EndTime[N] | - | 2 | End time of last Region Type, in units of AllocationTimeUnit.  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |

Table 11‑71: Format of Information Field when Result = 0x01 (Unsuccessful SNID)

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Num | 0 | 1 | Number of Proposed SNIDs to follow (=N)  0x00 = none  0x01 = one, and so on |
| SNID[1] | 1 | 1 | First SNID Proposed  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0. |
| … | … | … | … |
| SNID[N] | - | 1 | Last SNID Proposed  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0. |

Table 11‑72: Format of Information Field when Result = 0x02 (Unsuccessful SlotID)

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Num | 0 | 1 | Number of proposed SlotIDs to Follow (=N)  0x00 = None,  0x01 = One and so on. |
| SlotID[1] | 1 | 1 | First SlotID Proposed  0x00 = first Beacon Slot, and so on  0x08 - 0xFF = reserved |
| … | … | … | … |
| SlotID[N] | N | 1 | Last SlotID Proposed  0x00 = first Beacon Slot, and so on  0x08 - 0xFF = reserved |

### NN\_NEW\_NET.IND

The NN\_NEW\_NET.IND message is sent by the new CCo (which sent the NN\_NEW\_NET.REQ message) to the CCo’s in its INL to confirm whether the request to set up a new network is successful or canceled.

If at least one NN\_NEW\_NET.CNF message with a Result field not equal to Success is received, the new CCo will send a NN\_NEW\_NET.IND message with Status field equal to Cancel to networks in its INL that have replied with a NN\_NEW\_NET.CNF message with Result field equal to Success.

Alternatively, if the NN\_NEW\_NET.CNF messages received all have the Result field equal to Success; the new CCo will send an NN\_NEW\_NET.IND message with Status field equal to Go to all the CCo’s in its INL. The NN\_NEW\_NET.IND message is unencrypted.

Table 11‑73: NN\_NEW\_NET.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| MyTEI | 0 | 1 | Proposed TEI of the sender |
| MySNID/Access | 1 | 1 | Proposed SNID of the Sender  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| ReqID | 2 | 1 | Request ID. Copied from the ReqID field of the NN\_NEW\_NET.REQ message |
| Status | 3 | 1 | 0x00 = go  0x01 = cancel  0x02 – 0xFF = reserved |

### NN\_ADD\_ALLOC.REQ

The NN\_ADD\_ALLOC.REQ message is sent by a CCo to other CCo’s in its INL to request to share additional bandwidth. The message contains the proposed schedules to be used by the CCo. Each schedule is specified by a start time and an end time, using the start time of the sender’s Beacon Region as a reference. The NN\_ADD\_ALLOC.REQ message is unencrypted.

Table 11‑74: NN\_ADD\_ALLOC.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| MyTEI | 0 | 1 | TEI of the Sender |
| MySNID/Access | 1 | 1 | SNID of the Sender  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| ReqID | 2 | 1 | Request ID. Set by sender so that the same value was not used recently. |
| MySlotID | 3 | 1 | 0x00 – 0x07 = proposed Slot ID to be used by the sender to transmit its Beacons.  0x00 = first Beacon Slot, and so on  0x08 - 0xFF = reserved |
| Offset | 4 - 5 | 2 | Time offset between the Beacon Regions of the sender and the receiver, in units of AllocationTimeUnit  0x0000 = zero or in the same Group  0x0001 = one AllocationTimeUnit, and so on |
| Num | 6 | 1 | Number of Schedules to Follow  0x00 = none  0x01 = one and so on |
| StartTime\_1 | 7 - 8 | 2 | Start time of the first schedule being requested, in units of AllocationTimeUnit  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |
| EndTime\_1 | 9 - 10 | 2 | End time of the first schedule being requested, in units of AllocationTimeUnit  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |
| … | … | … | … |
| StartTime\_n | - | 2 | Start time of the last schedule being requested, in units of AllocationTimeUnit  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |
| EndTime\_n | - | 2 | End time of the last schedule being requested, in units of AllocationTimeUnit  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |

### NN\_ADD\_ALLOC.CNF

The NN\_ADD\_ALLOC.CNF message is sent by a CCo to another CCo in response to a received NN\_ADD\_ALLOC.REQ message. The message is unencrypted.

Table 11‑75: NN\_ADD\_ALLOC.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| MyTEI | 0 | 1 | TEI of the sender. |
| MySNID/Access | 1 | 1 | SNID of the sender.  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| ReqID | 2 | 1 | Request ID. Copied from the ReqID field of the NN\_ADD\_ALLOC.REQ message. |
| Result | 3 | 1 | Result  0x00 = success  0x01 = failure  0x02 - 0xFF = reserved |

### NN\_ADD\_ALLOC.IND

The NN\_ADD\_ALLOC.IND message is sent by a CCo (which sent the NN\_ADD\_ALLOC.REQ message) to the CCo’s in its INL to confirm whether the bandwidth request is successful or canceled. If at least one NN\_ADD\_ALLOC.CNF message with a Result field not equal to Success is received, the CCo will send an NN\_ADD\_ALLOC.IND message with Status field equal to Cancel to all its neighbors that have replied with a NN\_ADD\_ALLOC.CNF message with Result field equal to Success.

Alternatively, if the NN\_ADD\_ALLOC.CNF messages received all have the Result field equal to Success; the CCo will send an NN\_ADD\_ALLOC.IND message with Status field equal to Go to all the CCo’s in its INL.

The NN\_ADD\_ALLOC.IND message is unencrypted.

Table 11‑76: NN\_ADD\_ALLOC.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| MyTEI | 0 | 1 | TEI of the sender. |
| MySNID/Access | 1 | 1 | SNID of the sender.  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| ReqID | 2 | 1 | Request ID. Copied from the ReqID field of the NN\_ADD\_ALLOC.REQ message. |
| Status | 3 | 1 | 0x00 = go  0x01 = cancel  0x02 – 0xFF = reserved |

### NN\_REL\_ALLOC.REQ

The NN\_REL\_ALLOC.REQ message is sent by a CCo to the CCos of its INL to request to release part or all of its Reserved Regions. The message contains the schedules to be released. Each schedule is specified by a start time and an end time, using the start time of the CCo’s Beacon Region as a reference. The NN\_REL\_ALLOC.REQ message is unencrypted.

Table 11‑77: NN\_REL\_ALLOC.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| MyTEI | 0 | 1 | TEI of the sender. |
| MySNID/Access | 1 | 1 | SNID of the Sender  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| ReqID | 2 | 1 | Request ID  Set by sender so that the same value was not used recently. |
| MySlotID | 3 | 1 | 0x00 – 0x07 = proposed Slot ID to be used by the sender to transmit its Beacons.  0x00 = first Beacon Slot, and so on  0x08 - 0xFF = reserved |
| Offset | 4 - 5 | 2 | Time offset between the Beacon Regions of the sender and the receiver, in units of AllocationTimeUnit.  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |
| Num | 6 | 1 | Number of Schedules to Follow  0x00 = none  0x01 = one, and so on |
| StartTime\_1 | 7 - 8 | 2 | Start time of the first schedule to be released, in units of AllocationTimeUnit.  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |
| EndTime\_1 | 9 - 10 | 2 | End time of the first schedule to be released, in units of AllocationTimeUnit.  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |
| … | … | … | … |
| StartTime\_n | - | 2 | Start time of the last schedule to be released, in units of AllocationTimeUnit.  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |
| EndTime\_n | - | 2 | End time of the last schedule to be released, in units of AllocationTimeUnit.  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |

### NN\_REL\_ALLOC.CNF

The NN\_REL\_ALLOC.CNF message is sent by a CCo to another CCo in response to a received NN\_REL\_ALLOC.REQ message. The message is unencrypted.

Table 11‑78: NN\_REL\_ALLOC.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| MyTEI | 0 | 1 | TEI of the sender. |
| MySNID/Access | 1 | 1 | SNID of the Sender  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| ReqID | 2 | 1 | Request ID. Copied from the ReqID field of the NN\_REL\_ALLOC.REQ message. |
| Result | 3 | 1 | Result  0x00 = success  0x01 = failure  0x02 – 0xFF = reserved |

### NN\_REL\_NET.IND

The NN\_REL\_NET.IND message is sent by a CCo to the CCo’s of its INL to release all its Reserved Regions and shut down the network. The NN\_REL\_NET.IND message is unencrypted.

Table 11‑79:NN\_REL\_NET.IND Message

| Field | Octet Number | Field Size (Octets) | Definition |
| --- | --- | --- | --- |
| MyTEI | 0 | 1 | TEI of the sender. |
| MySNID/Access | 1 | 1 | SNID of the Sender  The four LSBs of this field contain the SNID (refer to Section 4.4.1.4). The four MSBs of this field shall be set to 0x0 if the network is in-home, or 0x1 if it is an Access network. The Access field in HomePlug AV delimiters (refer to Section 4.4.1.3) can be used to determine whether a network is an in-home or an Access network. |
| ReqID | 2 | 1 | Request ID  Set by sender so that the same value was not used recently. |
| SlotID | 3 | 1 | Slot ID used by the sender to transmit its Beacons.  0x00 = first Beacon Slot, and so on  0x08 - 0xFF = reserved |
| Offset | 4 - 5 | 2 | Time offset between the Beacon Regions of the sender and the receiver, in units of AllocationTimeUnit.  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |
| Num | 6 | 1 | Number of Schedules to Follow  0x00 = none  0x01 = one and so on |
| StartTime\_1 | 7 - 8 | 2 | Start time of the first schedule reserved, in units of AllocationTimeUnit.  0x0000 = zero or in the same Group  0x0001 = one AllocationTimeUnit, and so on |
| EndTime\_1 | 9 - 10 | 2 | End time of the first schedule reserved, in units of AllocationTimeUnit.  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |
| … | … | … | … |
| StartTime\_n | - | 2 | Start time of the last schedule reserved, in units of AllocationTimeUnit.  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |
| EndTime\_n | - | 2 | End time of the last schedule reserved, in units of AllocationTimeUnit.  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on |

## Station – Station

### CM\_UNASSOCIATED\_STA.IND

Table 11‑80: CM\_UNASSOCIATED\_STA.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| NID | 0 - 6 | 7 | **Network ID**  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |
| CCo Capability | 7 | 1 | **CCo Capability**  The two LSBs of this field contain the STA’s CCo capability. The interpretation of these bits is the same as in Section 4.4.3.15.4.6.2. The six MSBs of this field shall be set to 0b000000. |

### CM\_ENCRYPTED\_PAYLOAD.IND

The CM\_ENCRYPTED\_PAYLOAD.IND MME exists in two forms. In the standard form, it carries an encrypted payload used by the key distribution protocols described in this specification. However, when PID is 0x04, the fields marked “Encrypted Payload” in Table 11‑81 are not processed by the MAC; the entire MME is simply passed uninterpreted to and from the Higher Layer Entity (HLE). Also, the 16-octet field ordinarily used to carry the IV shall be used to carry an Universally Unique Identifier (UUID).

Note: The HLE may use the PEKS for its own purposes in this case.

Table 11‑81. CM\_ENCRYPTED\_PAYLOAD.IND Message

| Field | Octet Number | Field Size (Octets) | Definition |
| --- | --- | --- | --- |
| PEKS | 0 | 1 | Payload Encryption Key Select (**Unencrypted**)  The four LSBs of this field contain the PEKS. The four MSBs shall be set to 0x0. |
| AVLN Status | 1 | 1 | AVLN status of source. (**Unencrypted**) |
| PID | 7 | 1 | Protocol ID (**Unencrypted**) |
| PRN | 8 - 9 | 2 | Protocol Run Number (**Unencrypted**) |
| PMN | 10 | 1 | Protocol Message Number (**Unencrypted**) |
| IV or UUID | - | 16 | AES encryption Initialization Vector or Universally Unique Identifier (UUID) when PID=0x04 (**Unencrypted**) |
| Len | - | 2 | Length of MM, in octets (**Unencrypted**) |
| RF | - | 0-15 | Random Filler: A random number (between 0 and 15) of random filler octets included in Encrypted Payload to make position of Protocol fields unpredictable (**Encrypted Payload**) – not present when PID=0x04. |
| MM or HLE Payload | - | Var | MM (Management Message – refer to Section 11.1) can be any legal Management Message except CM\_ENCRYPTED\_PAYLOAD.IND (**Encrypted Payload**) – uninterpreted HLE payload when PID=0x04. |
| CRC | - | 0 or 4 | Checksum on MME (**Encrypted Payload**) – not present when PID=0x04. |
| PID | - | 0 or 1 | Protocol ID (**Encrypted Payload**) – not present when PID=0x04. |
| PRN | - | 0 or 2 | Protocol Run Number (**Encrypted Payload**) – not present when PID=0x04. |
| PMN | - | 0 or 1 | Protocol Message Number (**Encrypted Payload**) – not present when PID=0x04. |
| Padding | - | 0 - 15 | To adjust size of Encrypted Payload to 128 bit boundary (**Encrypted Payload**) – not present when PID=0x04. |
| RFLen |  | 0 or 1 | 0x00 – 0x0F = Length of Random Filler (Bit numbers are before encryption and after decryption). (**Encrypted Payload**)  0x10 – 0xFF = reserved - not present when PID=0x04. |

#### Payload Encryption Key Select (PEKS)

Payload Encryption Key Select (PEKS) is the Index of the Encryption Key used for encrypting MME Payloads. It is not to be confused with the EKS, which appears in the FC to identify the Encryption Key used for PBBs (segments). This field is 4 bits long. Except for PEKS=0x0 or 0xF, it is only unambiguous when it is associated with the MAC address of the STA on the other end of the Link (i.e., the transmitter uses the ODA to resolve the PEKS; the receiver uses the OSA to resolve the PEKS). A PEKS=0xF indicates No Key (i.e., the payload is not encrypted).

Table 11‑82: Payload Encryption Key Select Interpretation

|  |  |
| --- | --- |
| AVLN Status Value | Interpretation |
| 0x0 | Destination STA’s DAK (AES 128 bit key) |
| 0x1 | NMK known to STA (AES 128 bit key) |
| 0x2 – 0xE | Identifies TEKs (AES 128 bit keys) |
| 0xF | No KEY (used when the requested Encryption Key is not provided or the payload is sent in the clear) |

#### AVLN Status

The AVLN Status field specifies the current association status and capabilities of the sending station.

Table 11‑83: AVLN Status Interpretation

|  |  |
| --- | --- |
| AVLN Status Value | Interpretation |
| 0x00 | Unassociated and Level-0 CCo Capable. |
| 0x01 | Unassociated and Level-1 CCo Capable |
| 0x02 | Unassociated and Level-2 CCo Capable |
| 0x03 | Unassociated and Level-3 CCo Capable |
| 0x04 | Associated with an AVLN but not PCo Capable |
| 0x05 | Associated with an AVLN and PCo Capable |
| 0x06-0x7 | Reserved |
| 0x08 | CCo of an AVLN |
| 0x09 – 0xFF | Reserved |

#### Protocol ID (PID)

The Protocol ID (PID) field identifies the purpose of the protocol that is being transmitted in the encryption payload. Except when PID=0x04, the PID appears twice within the message, once in the unencrypted portion of the message and once in the encrypted portion of the message. For more information, refer to Section 7.10.8.

Table 11‑84: Protocol ID Interpretation

|  |  |
| --- | --- |
| PID Value | Interpretation |
| 0x00 | Authentication request by new STA. |
| 0x01 | Provision authenticated STA with new NEK by CCo |
| 0x02 | Provision STA with NMK using DAK |
| 0x03 | Provision STA with NMK using UKE |
| 0x04 | HLE protocol |
| 0x05 – 0xFF | Reserved |

#### Protocol Run Number (PRN)

The Protocol Run Number (PRN) field contains a random number that was generated at the beginning of this particular run and is used to distinguish between different runs of the same protocol. Except when PID=0x04, the PRN appears twice within the message, once in the unencrypted portion of the message and once in the encrypted portion of the message.

#### Protocol Message Number (PMN)

The Protocol Message Number (PMN) field is a sequential counter of the number of messages within the current protocol run, including this one. Except when PID=0x04, the PMN appears twice within the message, once in the unencrypted portion of the message and once in the encrypted portion of the message.

#### Initialization Vector (IV) or Universally Unique Identifier (UUID)

When PID=0x04, this field is a 128-bit universally unique identifier (UUID). Otherwise, it is the Initialization Vector (IV) used for AES-128. Refer to Section 7.10.8.

#### Length (Len)

The length field indicates the length in octets of the encapsulated Management Message (i.e., not including the other seven fields in the encrypted portion). When PID=0x04, it is the length in octets of the HLE Payload.

#### Random Filler (RF)

Between 0 and 15 octets of random data are placed in the Random Filler (RF) field. This field is not present when PID=0x04.

#### Management Message (MM) or HLE Payload

When PID=0x04, this field takes up all of the MME after the Len field, and is not interpreted by the STA. Otherwise, it contains the MAC Management Message encapsulated and encrypted in the CM\_ENCRYPTED\_PAYLOAD.IND MME. Only the CM\_ENCRYPTED\_PAYLOAD.IND MME is not allowed as the encapsulated MME.

#### Cyclic Redundancy Check (CRC)

The Cyclic Redundancy Check (CRC) is the CRC-32 described in Section 4.2.1. It shall cover the Encapsulated MM Entry. The CRC field is not present when PID=0x04.

#### Protocol ID (PID - Encrypted)

The PID encrypted field shall exactly match the value of the PID field in the unencrypted part of the MME. This field is not present when PID=0x04.

#### Protocol Run Number (PRN - Encrypted)

The PRN encrypted field shall exactly match the value of the PRN field in the unencrypted part of the MME. This field is not present when PID=0x04.

#### Protocol Message Number (PMN - Encrypted)

The PMN encrypted field shall exactly match the value of the PMN field in the unencrypted part of the MME. This field is not present when PID=0x04.

#### Padding - Encrypted

Padding is between 0 and 15 octets of random data as needed to bring the total length of the encrypted portion of the MME to a multiple of 128 bits for AES-128 encryption. Its length is determined by the length of the RF and the MM fields. This field is not present when PID=0x04.

#### RF Length (RFLen - Encrypted)

RF Length indicates the length of the Random Filler in octets, and is a uniform random number between 0 and 15. This field is not present when PID=0x04.

### CM\_ENCRYPTED\_PAYLOAD.RSP

Table 11‑85: CM\_ENCRYPTED\_PAYLOAD.RSP Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Result | 0 | 1 | Result |
| PID | 1 | 1 | Protocol ID |
| PRN | 2 - 3 | 2 | Protocol Run Number |

#### Result

This message is never sent to indicate success. If the CM\_ENCRYPTED\_PAYLOAD.IND is successful, the message embedded in it is the one that could provoke a response that would generally be embedded in another CM\_ENCRYPTED\_PAYLOAD.IND message. This message will indicate either a failure to correctly receive the MME or an aborted protocol run. Since either side of the protocol run may abort, this message may be sent by the same STA that sent the CM\_ENCRYPTED\_PAYLOAD.IND MME.

Table 11‑86: Result Field Interpretation

|  |  |
| --- | --- |
| Result Value | Interpretation |
| 0x00 | Success. (never used) |
| 0x01 | Failure |
| 0x02 | Abort |
| 0x03 – 0xFF | Reserved |

### CM\_SET\_KEY.REQ

The CM\_SET\_KEY.REQ message usually is embedded within the encrypted payload of a CM\_ENCRYPTED\_PAYLOAD.IND message. However, it may be sent by a CCo without being embedded to a STA as the first message in the NEK key distribution protocol to update the NEK. It may also be sent by the HLE over the H1 interface without being embedded to the CL to change the NMK.

Table 11‑87: CM\_SET\_KEY.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Key Type | 0 | 1 | Key Type |
| My Nonce | 1 - 4 | 4 | Random number that will be used to verify next message from other end; in encrypted portion of payload. |
| Your Nonce | 5 - 8 | 4 | Last nonce received from recipient; it will be used by recipient to verify this message; in encrypted portion of payload. |
| PID | 9 | 1 | Protocol for which Set Key is asserted  Note: This is included since MMEs are not always in an encrypted payload)  Refer to Section 11.5.2.3 for information. |
| PRN | 10 - 11 | 2 | Protocol Run Number (refer to Section 11.5.2.4) |
| PMN | 12 | 1 | Protocol Message Number (refer to Section 11.5.2.5) |
| CCo Capability | 13 | 1 | The two LSBs of this field contain the STA’s CCo capability. The interpretation of these bits is the same as in Section 4.4.3.15.4.6.2. The six MSBs of this field are set to 0b000000 |
| NID | 14 – 20 | 7 | Network ID to be associated with the key distributed herein. The 54 LSBs of this field contain the NID (refer to Section 3.4.3.1). The two MSBs shall be set to 0b00. |
| NewEKS | 21 | 1 | New Encryption Key Select or New Payload Encryption Key Select depending upon value of Key Type  The four LSBs of this field contain the PEKS (refer to Section 11.5.2.1) or EKS (refer to Section 4.4.1.5.2.8). The four MSBs shall be set to 0x0. |
| NewKEY | var | 0 or 16 | New Key (none or 128-bit AES Key) |

#### Key Type

The Key Type field appears in many different MMEs and Primitives. In all cases, the values are the same, although not all values are permitted in all messages. Interpretation of this field is defined in Table 11-88. The following restrictions apply for the Key Type for the CM\_SET\_KEY.REQ message.

* Key Types DAK and HASH KEY are never permitted.
* Key Type NEK, Nonce-only, and TEK are not permitted when this MME is passed across the H1 interface.
* Key Type NEK is only allowed across the PHY interface if it is embedded in a CM\_ENCRYPTED\_PAYLOAD.IND message as described in Section 7.10.4; otherwise, the message received from the PHY interface shall be ignored.
* Key Type TEK is only allowed across the PHY interface if it is embedded in a CM\_ENCRYPTED\_PAYLOAD.IND message as described in Section 7.10.3.4; otherwise, the message received from the PHY interface shall be ignored.
* Key Type NMK is only allowed across the PHY interface if it is embedded in a CM\_ENCRYPTED\_PAYLOAD.IND message as described in Section 7.10.3; otherwise, the message received from the PHY interface shall be ignored.

Table 11‑88: Key Type Interpretation

|  |  |
| --- | --- |
| Key Type Value | Interpretation |
| 0x00 | DAK (AES-128) (never used) |
| 0x01 | NMK (AES-128) |
| 0x02 | NEK (AES-128) |
| 0x03 | TEK (AES-128) |
| 0x04 | HASH KEY (Random-3072) |
| 0x05 | Nonce Only (no key) |
| 0x06 – 0xFF | Reserved |

#### NID

When Key Type = NMK, the NID field holds the NID to associate with the NMK, and the Security Level of the NMK shall be set to the SL of the NID in the CM\_SET\_KEY.REQ message. This SL must be compatible with the key distribution method used (refer to Section 7.10.3.1). Normally, the NID will match the sender’s NID.

#### New\_EKS

New EKS holds the EKS or the PEKS value associated with the key that is being set.

### CM\_SET\_KEY.CNF

Table 11‑89. CM\_SET\_KEY.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Result | 0 | 1 | 0x00 = success  0x01 = failure  0x02 – 0xFF = reserved |
| My Nonce | 1 – 4 | 4 | Random number that will be used to verify next message from other end; in encrypted portion of payload. |
| Your Nonce | 5 – 8 | 4 | Last nonce received from recipient; it will be used to by recipient to verify this message; in encrypted portion of payload. |
| PID |  | 1 | Protocol for which Set Key is confirmed  Note: This is included since MMEs are not always in an encrypted payload.  Refer to Section 11.5.2.3 for more information. |
| PRN |  | 2 | Protocol Run Number (refer to Section 11.5.2.4) |
| PMN |  | 1 | Protocol Message Number (refer to Section 11.5.2.5) |
| CCo Capability |  | 1 | The two LSBs of this field contain the STA’s CCo capability. The interpretation of these bits is the same as in Section 4.4.3.13.4.6.2. The six MSBs of this field are set to 0b000000 |

### CM\_GET\_KEY.REQ

The CM\_GET\_KEY.REQ message usually is embedded within the encrypted payload of a CM\_ENCRYPTED\_PAYLOAD.IND message. However, it is also sent unencrypted as the first message in the UKE key distribution protocol to generate a TEK.

Table 11‑90: CM\_GET\_KEY.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Request Type | 0 | 1 | Request Type  0x00 = direct  0x01 = relayed  0x02 - 0xFF = reserved |
| Requested Key Type | 1 | 1 | Requested Key Type  Interpretation of this field is the same as in Section 11.5.4.1. |
| NID | 3 - 9 | 7 | Network ID of transmitter or NID of AVLN that transmitter wishes to join.  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |
| My Nonce | 10 - 13 | 4 | Random number that will be used to verify next message from other end (Required for all methods) |
| PID | 14 | 1 | Protocol ID |
| PRN | 15-16 | 2 | Protocol Run Number |
| PMN | 17 | 1 | Protocol Message Number |
| HASH KEY | 18–var | var | Hash Key is present only when Requested Key Type is HASH KEY. |

#### Request Type

Request Type indicates whether or not the request is relayed through a proxy.

#### Requested Key Type

The Requested Key Type field indicates the type of key requested. Interpretation of this field is defined in Table 11-90. The following restrictions apply for the Key Type for the CM\_GET\_KEY.REQ message.

* Key Types DAK, TEK, and Nonce Only are never permitted.
* Only Key Types NEK and HASH KEY are permitted over the PHY interface.
* Key Type NEK is only allowed across the PHY interface if it is embedded in a CM\_ENCRYPTED\_PAYLOAD.IND message as described in Section 7.3.3; otherwise, the message received from the PHY interface shall be ignored.
* Only Key Type NMK is permitted across the H1 interface.

#### NID

The NID field is the Network ID of the AVLN that the STA wants to join.

### CM\_GET\_KEY.CNF

The CM\_GET\_KEY.CNF message usually is embedded within the encrypted payload of a CM\_ENCRYPTED\_PAYLOAD.IND message. However, it is also sent unencrypted as the second message in the UKE key distribution protocol to generate a TEK.

Table 11‑91: CM\_GET\_KEY.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| Result | 0 | 1 | Result  0x00 = key granted  0x01 = request refused  0x02 = unsupported method/key type  0x03 - 0xFF = reserved |
| Requested KeyType | 1 | 1 | Requested Key Type  Interpretation of this field is the same as in Section 11.5.4.1. |
| My Nonce | 2 - 5 | 4 | Random number that will be used to verify next message from other end; in encrypted portion of payload. |
| Your Nonce | 6 - 9 | 4 | Last nonce received from recipient; it will be used to by recipient to verify this message; in encrypted portion of payload. |
| NID | 10 - 16 | 7 | Network ID of STEI STA  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |
| EKS | 17 | 1 | EKS or PEKS value depending upon Key Type  The four LSBs of this field contain the PEKS (refer to Section 11.5.3.11) or EKS (refer to Section 4.4.1.5.2.8). The four MSBs shall be set to 0x0. If nonce-only, set to 0x0F |
| PID | 18 | 1 | Protocol ID |
| PRN | 19 - 20 | 2 | Protocol Run Number |
| PMN | 21 | 1 | Protocol Message Number |
| Key | 22 - var | var | Encryption or Hash Key |

#### Requested Key Type

The Requested Key Type field indicates the type of key requested. Interpretation of this field is defined in Table 11-91. The following restrictions apply for the Key Type for the CM\_GET\_KEY.CNF message.

* Key Types DAK, TEK, and Nonce Only are never permitted.
* Only Key Types NEK and HASH KEY are permitted across the PHY interface.
* Key Type NEK is only allowed across the PHY interface if it is embedded in a CM\_ENCRYPTED\_PAYLOAD.IND message as described in Section 7.3.3; otherwise, the message received from the PHY interface shall be ignored.
* Only Key Type NMK is permitted across the H1 interface.

### CM\_SC\_JOIN.REQ

Table 11‑92: CM\_SC\_JOIN.REQ Message

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Field** | **Octet Number** | **Bit Number** | **Field Size**  **(Bits)** | **Definition** |
| CCo Capability | 0 | 0 – 1 | 2 | The two LSBs of this field contain the STA’s CCo capability. The interpretation of these bits is the same as in Section 4.4.3.13.4.6.2. |
| RSVD |  | 2-7 | 6 | Reserved |

### CM\_SC\_JOIN.CNF

Table 11‑93: CM\_SC\_JOIN.CNF Message

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Field | Octet Number | Bit Number | Field Size  (Bits) | Definition |
| NID | 0 | 0 - 7 | 56 | Network ID  The 54 LSBs of this field contain the NID (refer to Section 4.4.3.1). The two MSBs shall be set to 0b00. |
| AVLN Status | 7 | 0 | 1 | 0b0 = not authenticated with an AVLN  0b1 = authenticated with an AVLN |
| CCo Capability |  | 1 – 2 | 2 | The two LSBs of this field contain the STA’s CCo capability. The interpretation of these bits is the same as in Section 4.4.3.13.4.6.2. |
| Proxy Network Capability |  | 3 | 1 | 0b0 = does not support Proxy Networking  0b1 = fully supports Proxy Networking |
| Backup CCo Capability |  | 4 | 1 | 0b0 = STA does not support Backup CCo function  0b1 = STA supports Backup CCo function |
| CCo Status |  | 5 | 1 | 0b0 = STA is not the CCo  0b1 = STA is the CCo |
| PCo Status |  | 6 | 1 | 0b0 = STA is not a PCo  0b1 = STA is a PCo |
| Backup CCo Status |  | 7 | 1 | 0b0 = STA is not a Backup CCo  0b1 = STA is a Backup CCo |

### CM\_CHAN\_EST.IND

A STA uses this MME to send a new Tone Map to another STA. The STA receiving this MME should use the new Tone Map on subsequent transmissions.

Notes:

1. The Tone Map field might not be present in the CM\_CHAN\_EST.IND message. A NEWTMI\_AV value of 0x000 indicates the message was sent to update the interval information or to "refresh" the list of valid TMIs (i.e., keep them from becoming stale).
2. The (NTMI\_AV, TMI\_AV[0], … , TMI\_AV[L-1]) fields in CM\_CHAN\_EST.IND indicate the list of Tone Maps that are valid at the receiver (i.e., the STA that generated the CM\_CHAN\_EST.IND message). This list contains the set of Tone Maps that the receiver is expecting the transmitter to use subsequent to reception of this Management Message.
   * 1. The receiver can still be required to decode MPDUs received with a TMI\_AV that is not contained in the valid Tone Map list. For example, if the CM\_CHAN\_EST.IND contains a new Tone Map, TmiAvNew, that is intended to replace an existing Tone Map, TmiAvOld, the valid Tone Map list will not contain TmiAvOld. It is recommended the receiver keep the Tone Map associated with TmiAvOld until the transmitter starts using TmiAvNew or TmiAvOld becomes stale
     2. The list shall also include the Default Tone Map Index.
     3. A transmitter shall discontinue use of Tone Maps that are not included in the valid Tone Map list. If the valid Tone Map list is empty (i.e., NTMI = 0x00) the transmitter shall restart the initial channel estimation process (refer to Section 5.2.6.1.1).
3. The (NINT, {ET[0], TMI\_AV[0]}, … , {ET[M-1], TMI\_AV[M-1]}) fields indicate intervals of time where each of the Tone Maps needs to be used. These intervals must cover the entire nominal Beacon Period length (i.e., 33.33 ms. or 40 ms. for 60/50 Hz). Therefore, the end time of the last interval shall be greater than or equal to the length of the Beacon Period.
4. This message can be quite long, as the TMD (Tone Map Data) field is 4b x 917 tones = 458.5 octets long (binary encoding) when the default Tone Mask is used. When all carriers are turned on, Tone Map Data is 4b x 1155 tones = 577.5 octets long (binary encoded).
5. INT\_TMI\_AV = 0xFF indicates an Unusable Interval.
6. INT\_TMI\_AV = 0xFE indicates that an AC line cycle adapted Tone Map is not available for a particular Interval.

Table 11‑94: CM\_CHAN\_EST.IND Message

| Field | Octet Number | Field Size  (Bits) | Definition |
| --- | --- | --- | --- |
| MaxFL\_AV | 0 - 1 | 16 | Maximum FL\_AV that the receiver is capable of receiving, in multiples of 1.28 μsec. |
| RIFS\_AV\_OneSym | 2 | 8 | Response Interframe Spacing for MPDUs with one OFDM Symbol |
| RIFS\_AV\_TwoSym | 3 | 8 | Response Interframe Spacing for MPDU with two OFDM Symbols |
| RIFS\_AV\_G2Sym | 4 | 8 | Response Interframe Spacing for MPDUs with more than two OFDM Symbols |
| RESPT | 5 | 8 | Response Type  0x00 –Default Tone Map transmitted as part of Initial Channel Estimation  0x01 – others  0x02-0xFF – reserved |
| MAXTM | 6 | 8 | Maximum number of Channel Adapted Tone Maps that the receiver can support on this channel (i.e., from the destination STA of this message to this station that generated this message). This number does not include any of the ROBO Tone Maps.  0x00 = zero,( i.e., receiver is currently not capable of generating any Tone Maps)  0x01 = one, and so on |
| CP\_TMI\_AV | 7 | 8 | TMI\_AV of Default Tone Map for Use in the CP  The five LSBs of this field contain the TMI\_AV (refer to Section 4.4.1.5.2.13. The three MSBs shall be set to 0b000.  HomePlug GREEN PHY stations shall set this field to one of the ROBO Tone Maps. |
| SCL\_CP | 8 | 8 | Sound Control during Contention Period  0x00 = transmitter should send Sound MPDUs in intervals without an AC line cycle adapted Tone Map.  0x01 = transmitter should send MPDUs modulated using Default Tone Map in intervals without an AC line cycle adapted Tone Map.  0x02 – 0xFF = reserved |
| SCL\_CFP | 9 | 8 | Sound Control during Contention Free Period  0x00 = transmitter should send Sound MPDUs in intervals without an AC line cycle adapted Tone Map.  0x01 = transmitter should send MPDUs modulated using Default Tone Map in intervals without an AC line cycle adapted Tone Map.  0x02 – 0xFF = reserved |
| NTMI\_AV | 10 | 8 | Number of entries in the Valid TMI\_AV List – L  0x00 = zero  0x01 = one, and so on up to MAX\_TONE\_MAPS |
| TMI\_AV[0] | 11 | 8 | TMI\_AV #0  The five LSBs of this field contain the TMI\_AV (refer to Section 4.4.1.5.2.13. The three MSBs shall be set to 0b000. |
| **...** |  |  |  |
| TMI\_AV[L-1] | - | 8 | TMI\_AV #L-1  The five LSBs of this field contain the TMI\_AV (refer to Section 4.4.1.5.2.13. The three MSBs shall be set to 0b000. |
| NINT | - | 8 | Number of Intervals – M  0x00 = zero  0x01 = one, …, 0x20 = 32.  0x21 – 0xFF = reserved |
| ET[0] | - | 16 | End Time of first interval, in multiples of AllocationTimeUnit  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on  The start time of the first interval is the same as Beacon Period Start Time. |
| INT\_TMI\_AV[0] | - | 8 | 0x00 – 0x1F = TMI\_AV of the AC line cycle adapted Tone Map for use in first interval  0xFF, 0xFE = refer to the notes above.  0x20 - 0xFD = reserved |
| **...** | - |  |  |
| ET[M-1] | - | 16 | End Time of last interval, in multiples of AllocationTimeUnit  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on  The start time of the Mth interval is the same as the end time of (M-1)th interval. |
| INT\_TMI\_AV[M-1] | - | 8 | 0x00 - 0x1F = TMI\_AV of the AC line cycle adapted Tone Map for use in last interval  0xFF, 0xFE = refer to the notes above.  0x20 - 0xFD = reserved |
| NEWTMI\_AV | - | 8 | TMI\_AV of the attached Tone Map  The five LSBs of this field contain the TMI\_AV (refer to Section 4.4.1.5.2.13. The three MSBs shall be set to 0b000.  A value of 0x00 shall indicate that no new Tone Map is contained in this message. In such cases, the remainder of the fields in this message are not present. |
| CPF | - | 8 | CP Flag for the new Tone Map  0x00 = shall not be applied in the CP  0x01 = may be applied in the CP  0x02-0xFF = reserved |
| FECTYPE | - | 8 | FEC Type/Code Rate |
| GIL | - | 8 | Guard Interval Length |
| CBD\_ENC | - | 8 | Carrier Bit Loading Data Encoding  0x00 = Carrier Bit Loading Data with Binary Encoding  0x01 = Carrier Bit Loading Data with Run Length Encoding  0x02-0xFF = reserved |
| CBD\_LEN | - | 16 | Number of Carrier Bit Loading Data entries - N  0x000 = none  0x001 = one and so on. |
| CBD[0] | - | 4 | Carrier Bit Loading Data [0] |
| … |  |  |  |
| CBD[N-1] | - | 4 | Carrier Bit Loading Data [N-1] |
| PAD | - | 4 | Optional 4-bit pad to make the CM\_CHAN\_EST.IND message an integral number of octets |

#### MaxFL\_AV

MaxFL\_AV indicates the maximum value of the FL\_AV that the receiver is capable of receiving, in multiple of 1.28 μsec. MaxFL\_AV shall be a value in the range 0x07A2 to 0x0FFF, inclusive.

Note: A value of 0x07A2 indicates MaxFL\_AV of 2501.12 μsec.

#### RIFS\_AV\_OneSym

RIFS\_AV\_OneSym indicates the Response Interframe Spacing to be used for unicast MPDU transmissions with negotiated TMs (i.e., TMI\_AV in the range 0b00100 – 0b11111) containing one OFDM Symbol. The interpretation of this field is shown in Table 11-95.

#### RIFS\_AV\_TwoSym

RIFS\_AV\_TwoSym indicates the Response Interframe Spacing to be used for unicast MPDU transmissions with negotiated TMs (i.e., TMI\_AV in the range 0b00100 – 0b11111) containing two OFDM Symbol. The interpretation of this field is shown in Table 11-95.

#### RIFS\_AV\_G2Sym

RIFS\_AV\_G2Sym indicates the Response Interframe Spacing to be used for unicast MPDU transmissions with negotiated TMs (i.e., TMI\_AV in the range 0b00100 – 0b11111) containing more than two OFDM Symbols. The interpretation of this field is shown in Table 11-95.

All ROBO modulated MPDUs shall use a Response Interframe Spacing of RIFS\_AV\_default.

Table 11‑95: RIFS\_AV, RIFS\_AV\_OneSym, and RIFS\_AV\_TwoSym Interpretation

|  |  |
| --- | --- |
| RIFS\_AV\_OneSym, RIFS\_AV\_TwoSym, RIFS\_AV\_G2Sym Value | Interpretation |
| 0x00 – 0x17 | Reserved |
| 0x18 – 0x7D | Response Interframe Spacing, in multiples of 1.28 μsec |
| 0x7E – 0xFF | Reserved |

#### FEC Type/Code Rate (FECTYPE)

The FEC Type/Code Rate is an 8-bit field that indicates the FEC type and code rate for the corresponding Tone Map.

Table 11‑96: FEC Type/Code Rate Interpretation

|  |  |
| --- | --- |
| FECTYPE Value | Interpretation |
| 0x00 | ½ rate Turbo Convolution Encoder coding |
| 0x01 | 16/21 rate Turbo Convolution Encoder coding (not required for GREEN PHY) |
| 0x02 - 0xFF | Reserved |

#### Guard Interval Length (GIL)

The Guard Interval Length (GIL) field is an 8-bit field that encodes the length of the guard interval used on symbols transmitted using this Tone Map. Three GI lengths are supported, as in Table 11-97.

Table 11‑97: Guard Interval Length Interpretation

|  |  |
| --- | --- |
| GIL Value | Length of Guard Interval |
| 0x00 | GI417 |
| 0x01 | GI567 |
| 0x02 | GI3534 |
| 0x03 - 0xFF | Reserved |

#### Carrier Bit Loading Data Encoding (CBD\_ENC)

The Carrier Bit Loading Encoding (CBD\_ENC) field is an 8-bit field that indicates the encoding used for presenting the modulation level for all unmasked carriers.

Table 11‑98: CBD\_ENC Interpretation

|  |  |
| --- | --- |
| CBD\_ENC Value | Interpretation |
| 0x00 | Binary Encoding is used |
| 0x01 | Run Length Encoding is used |
| 0x02- 0xFF | Reserved |

#### Carrier Bit Loading Data (CBD)

Carrier Bit Loading Data contains a list of Modulation Types for every unmasked carrier. The format of the data may be Binary Encoding or Run Length Encoding.

##### Binary Encoding (CBD\_ENC=0x00)

In Binary Encoding, each 4-bit Modulation Type field indicates the modulation of each unmasked carrier, starting from the lowest frequency carrier. The total number of entries shall equal the total number of unmasked carriers. Masked carriers are not included.

Table 11‑99: Interpretation of Modulation Type

|  |  |
| --- | --- |
| Modulation Type | Interpretation |
| 0x0 | Empty Tone (refer to Section 3.5.1).  Empty tones are not modulated with data. |
| 0x1 | BPSK |
| 0x2 | QPSK |
| 0x3 | 8-QAM |
| 0x4 | 16-QAM |
| 0x5 | 64-QAM |
| 0x6 | 256-QAM |
| 0x7 | 1024-QAM |
| 0x8 - 0xF | Reserved |

##### Run Length Encoding (CBD\_ENC=0x01)

Run Length Encoding can be applied to the Binary Encoded Tone Map Data to reduce the number of octets required to indicate modulation information on each unmasked carrier.

***Note:*** CBD\_LEN is equal to the total number of nibbles after Run Length Encoding has been applied.

Run Length Encoding is applied starting from the lowest frequency unmasked carrier. For each run of one or more carriers that use the same modulation, there will be an entry that provides the modulation and the length of the run. The entry may be one, two, or three nibbles long. The first nibble will always have its most-significant bit equal to zero. Any additional nibbles in the entry will always have their most-significant bit equal to one.

The first nibble indicates the Modulation Type, as shown in Table 11-100 If the next unmasked carrier has a different modulation, then this ends the entry. If only the next unmasked carrier has the same modulation, then this also ends the entry (and the next carrier’s modulation is encoded in the same way, using the binary encoding). If there are K adjacent unmasked carriers with the same modulation, and 2<K<11, then the next nibble encodes the run length as shown in Table 11-101.

If there are K adjacent unmasked carriers with the same modulation, and 10<K<75, then the next two nibbles encode the run length as shown in Table 11-101.

If the run length is greater than 74, then another entry is used to encode the remaining carrier modulations in the run.

Table 11‑100: Single Nibble Run Length Interpretation

|  |  |
| --- | --- |
| Single Nibble Run Length Value | Interpretation |
| 0x8 | Run length = 3 |
| 0x9 | Run length = 4 |
| 0xA | Run length = 5 |
| 0xB | Run length = 6 |
| 0xC | Run length = 7 |
| 0xD | Run length = 8 |
| 0xE | Run length = 9 |
| 0xF | Run length = 10 |

Table 11‑101: Two Nibble Run Length Interpretation

|  |  |
| --- | --- |
| Two Nibble Run Length Value | Interpretation |
| 0x88 | Run length = 11 |
| 0x89 | Run length = 12 |
| 0x8A | Run length = 13 |
| … | … |
| 0xFE | Run length = 73 |
| 0xFF | Run length = 74 |

### CM\_TM\_UPDATE.IND

The Tone Map Update Indication message is used to modify a subset of unmasked carriers of a Tone Map. The updated Tone Map is assigned a new Tone Map Index. The index of the tone to update field in CBUD[0..N-1] is the index of the unmasked carrier, where the first unmasked carrier is index 0, and the maximum index value is the total number of unmasked carriers minus one. An index value i corresponds to the i+1 unmasked carrier entry of the Carrier Bit Loading Data (CBD) in the Channel Estimation Indication (refer to Section 11.5.10.8.1).

Notes:

1. This index does not include masked carriers.
2. The (NTMI\_AV, TMI\_AV[0], … , TMI\_AV[L-1]) fields indicate the list of Tone Maps that are valid at the receiver (refer to Section 11.5.12).
3. The (NINT, {ET[0], INT\_TMI\_AV[0]}, … , {ET[M-1], INT\_TMI\_AV[M-1]}) fields indicate intervals of time where each of the Tone Maps needs to be used (refer to Section 11.5.10).
4. Tone Map Update Indication is intended for Tone Map updates only when the size of this message is smaller than a Channel Estimation Indication.
5. INT\_TMI\_AV = 0xFF indicates an Unusable Interval.
6. INT\_TMI\_AV = 0xFE indicates that an AC line cycle adapted Tone Map is not available for a particular Interval.
7. The Old Tone Map (i.e., OLD TMI\_AV) used to generate the updated Tone Map (i.e., New TMI\_AV) might or might not be invalidated by the receiver. In all cases, the list of valid Tone Maps shall be used by the transmitter to determine which Tone Maps are invalidated.

Table 11‑102: Tone Map Update Information

| Field | Octet Number | Field Size (Bits) | Definition |
| --- | --- | --- | --- |
| CP\_TMI\_ | 0 | 8 | TMI of Default Tone Map  The five LSBs of this field contain the TMI\_AV (refer to Section 4.4.1.5.2.13. The three MSBs shall be set to 0b000. |
| NTMI\_AV | 1 | 8 | Number of entries in the Valid TMI\_AV List – L  0x00 = zero  0x01 = one and so on up to MAX\_TONE\_MAPS |
| TMI\_AV [0] | 2 | 8 | TMI\_AV #0  The five LSBs of this field contain the TMI\_AV (refer to Section 4.4.1.5.2.13. The three MSBs shall be set to 0b000. |
| **...** |  |  |  |
| TMI\_AV [L-1] | - | 8 | TMI\_AV #L-1  The five LSBs of this field contain the TMI\_AV (refer to Section 4.4.1.5.2.13. The three MSBs shall be set to 0b000. |
| NINT | - | 8 | Number of Intervals – M  0x01 = one, , …, 0x20 = 32  0x21 – 0xFF = reserved |
| ET[0] | - | 16 | End Time of first interval, in multiples of AllocationTimeUnit  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on  The start time of the first interval is the same as Beacon Period Start Time. |
| INT\_TMI\_AV [0] | - | 8 | 0x00 – 0x1F = TMI\_AV of Tone Map for use in first interval  0xFF, 0xFE = refer to the notes above  0x20 - 0xFD = reserved |
| **...** |  |  |  |
| ET[M-1] | - | 16 | End Time of last interval, in multiples of AllocationTimeUnit  0x0000 = zero  0x0001 = one AllocationTimeUnit, and so on  The start time of the Mth interval is the same as the end time of (M-1)th interval. |
| INT\_TMI\_AV [M-1] | - | 8 | 0x00 – 0x1F = TMI\_AV of Tone Map for use in first interval  0xFF, 0xFE = refer to the notes above.  0x20 - 0xFD = reserved |
| OLD TMI\_AV | - | 8 | TMI\_AV of the Tone Map to update  The 5 LSBs of this field contain the TMI\_AV (refer to Section 4.4.1.5.2.13). The three MSBs shall be set to 0b000. |
| NEW TMI\_AV | - | 8 | TMI\_AV of the Tone Map resulting after updates.  The 5 LSBs of this field contain the TMI\_AV (refer to Section 4.4.1.5.2.13. The three MSBs shall be set to 0b000.  A value of 0x00 shall indicate that no new Tone Map is contained in this message. In such cases, the remainder of the fields in this message are not present and the OLD TMI\_AV field shall be ignored. |
| CPF | - | 8 | CP Flag for the new Tone Map  0x00 = shall not be applied in the CP  0x01 = may be applied in the CP  0x02-0xFF = reserved |
| FECTYPE | - | 8 | New FEC Type/Code Rate |
| GIL | - | 8 | New Guard Interval Length |
| CBUD\_LEN | - | 16 | Number of the Carrier Bit Loading Update Data Entries - N  0x0000 = no CBUD field (i.e., only changes to FEC type & guard interval length)  0x0001 = one CBUD field, and so on. |
| CBUD[0] | - | 16 | Carrier Bit Loading Update Data [0]  b0 - b11 = index of tone to update  b12 - b15 = modulation type (refer to Table 11-99) |
| … |  |  |  |
| CBUD[N-1] | - | 16 | Carrier Bit Loading Update Data [N-1]  b0 - b11 = index of tone to update  b12 - b15 = modulation type (refer to Table 11-99)\_ |

### CM\_AMP\_MAP.REQ

A STA uses this MME to send a new amplitude map to another STA. The STA receiving this MME shall adjust the amplitude of each unmasked carrier according to the new amplitude map and its amplitude map on all subsequent transmissions. Each 4-bit AMDATA field indicates the TX Amplitude Reduction of each unmasked carrier, starting from the lowest frequency carrier. The total number of entries shall equal the total number of unmasked carriers. Note that masked carriers are not included. The interpretation of the 4-bit AMDATA field for each unmasked carrier is shown in Table 3‑24. The default value for AMDATA for each unmasked carrier is 0b0000 (no reduction).

Reception of a CM\_AMP\_MAP.REQ message shall cause the STA to respond with a CM\_AMP\_MAP.CNF message.

Table 11‑103: Amplitude Update Indication

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Bits) | Definition |
| AMLEN | 0 - 1 | 2 | Number of Amplitude Map Data Entries – N  0x0000 = zero  0x0001 = one, and so on |
| AMDATA[0] | - | 4 | Amplitude Map Data – First Unmasked Carrier |
| … | … |  | … |
| AMDATA[N-1] | - | 4 | Amplitude Map Data – Last Unmasked Carrier |

### CM\_AMP\_MAP.CNF

A STA shall generate a CM\_AMP\_MAP.CNF message in response to the corresponding CM\_AMP\_MAP.REQ.

Table 11‑104: CM\_AMP\_MAP.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| ResType | 0 | 1 | Response Type  0x00 = success  0x01 = failure  0x02 - 0xFF = reserved |

### CM\_BRG\_INFO.REQ

CM\_BRG\_INFO.REQ is a request to provide Bridging Information. The message field for this MME is NULL.

### CM\_BRG\_INFO.CNF

The CM\_BRG\_INFO.CNF message contains the set of stations to which the current station is acting like a bridge.

Table 11‑105: Bridging Information Response

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| BSF | 0 | 1 | Bridging Station Flag  0x00 = this station does not perform bridging functions and the remaining fields are not valid.  0x01 = this station does perform bridging functions and the remainder of the fields are valid.  0x02 – 0xFF = reserved |
| BIVF | - | Var | Indicates the Number of Stations for which the station is bridging. The format of this field is shown in Table 11-106) . |

Table 11‑106: Bridging Information Variable Field (BIVF)

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| BTEI | 0 | 1 | STEI of the Bridge |
| NBDA | 1 | 1 | Number of Bridged Destinations = L  0x00 = none  0x01 = one, and so on |
| BDA[0] | 2 - 7 | 6 | Bridged Destination Address |
| ... | … | … | … |
| BDA[L-1] | - | 6 | Bridged Destination Address - (L-1) |

#### Bridge TEI (BTEI)

The Bridge TEI field is the STEI of the AV Bridge that is sending the Bridging Information Response message.

#### Number of Bridge Destination Addresses (NBDA)

The Number of Bridge Destination Addresses field corresponds to the number of BDA fields included in the message.

#### Bridged Destination Address [i] (BDA[i])

The Bridged Destination Address [i] field carries the 48-bit address of the *i*th station to which the station is bridging.

### CM\_CONN\_NEW.REQ

The CM\_CONN\_NEW.REQ message is a request from the station that is initiating the Connection to the terminating station(s) to add a new Connection.

Table 11‑107: CM\_CONN\_NEW.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Octet Number | Field Size (Octets) | Description |
| CID | 12 - 13 | 2 | Connection Identifier of the Connection being negotiated (refer to Section 5.2.1.4.2) |
| CSPEC | - | Var | Connection Specification of the new Connection. The interpretation of this field is the same as in Section 7.8.1. |
| Classifier Rule Set | - | Var | Classifier Rule Set to identify packets belonging to the connection. The format of this field is described in Section 6.3.  This field shall always be present. When there is no reverse link, the Number of Classifier Rules shall be set to 0x00 to indicate that there is no classifier rule.  When there is a reverse link, a valid Classifier Rule Set shall be present. |

### CM\_CONN\_NEW.CNF

The CM of the terminating STA of a Connection sends the CM\_CONN\_NEW.CNF message to indicate whether the corresponding CM\_CONN\_NEW.REQ was accepted or not.

Table 11‑108: CM\_CONN\_NEW.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Octet Number | Field Size (Octets) | Description |
| CID | 0 - 1 | 2 | Connection ID of the Connection being negotiated (refer to Section 5.2.1.4.2) |
| LLID-R | 2 | 1 | Reverse Local Link ID  This field shall be set to 0x00, if the Reverse Link is not present. |
| Result | 3 | 1 | Specifies the result of the Connection request.  0x00 = success  0x01 = failure – Classifier Rule Set cannot be supported  0x02 = failure – Classifier resources are not available  0x03 = failure – Maximum connection limit of the STA is reached  0x04 = failure – other. In this case, a Proposed CSPEC may be present  0x05 – 0xFF = reserved |
| Proposed CSPEC | - | Var | Proposed CSPEC indicating the CSPEC that the CM is currently capable of supporting.  This field is only present when Result is set to 0x04. When this field is present and a valid Proposed CSPEC is not included, this field shall be 2 octets long with a value of 0x0000 (i.e., CSPEC\_LEN = 0x0000). When a valid Proposed CSPEC is included, the interpretation of this field is the same as in Section 7.8.1. |

### CM\_CONN\_REL.IND

TheCM\_CONN\_REL.IND message is used to indicate the release of a Connection. This message is sent to all stations that are part of the Connection.

Table 11‑109: CM\_CONN\_REL.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Octet Number | Field Size (Octets) | Description |
| CID | 0 - 1 | 2 | Connection ID of the Connection being released (refer to Section 5.2.1.4.2). |
| Reason Code | 2 | 1 | Specifies the Cause of the Release  0x00 = normal release  0x01 = release due to violation of CSPEC, Violated CSPEC field is present  0x02 – 0xFF = reserved |
| Violated CSPEC | - | Var | Violated CSPEC indicating the fields of the CSPEC that are violated.  This field is only present when Reason Code is set to 0x01. When this field is present and a valid Violated CSPEC is not included, this field shall be 2 octets long, with a value of 0x0000 (i.e., CSPEC\_LEN = 0x0000). When a valid Violated CSPEC is included, the interpretation of this field is the same as in Section7.8.1. |

### CM\_CONN\_REL.RSP

The CM\_CONN\_REL.RSP message is transmitted in response to the corresponding CM\_CONN\_REL.IND message. This message indicates successful release of a Connection.

Table 11‑110: CM\_CONN\_REL.RSP Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Octet Number | Field Size (Octets) | Description |
| CID | 0 - 1 | 2 | Connection ID of the Connection that is released (refer to Section 5.2.1.4.2). |

### CM\_CONN\_MOD.REQ

The CM\_CONN\_MOD.REQ message is used to initiate Connection reconfiguration. It contains a proposal for the revised CSPEC.

Table 11‑111: CM\_CONN\_MOD.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Octet Number | Field Size (Octets) | Description |
| CID | 0 - 1 | 2 | Local Connection ID of the Connection being negotiated (refer to Section 5.2.1.4.2). |
| Modified CSPEC | - | Var | Modified CSPEC containing the (complete) new CSPEC that is requested for the Connection. The interpretation of this field is the same as in Section 7.8.1. |

### CM\_CONN\_MOD.CNF

The CM\_CONN\_MOD.CNF message indicates whether the corresponding CM\_CONN\_MOD.REQ was successful.

Table 11‑112: CM\_CONN\_MOD.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Octet Number | Field Size (Octets) | Description |
| CID | 0-1 | 2 | Connection ID of the Connection being negotiated (refer to Section 5.2.1.4.2) |
| Result | 2 | 1 | Result of the Connection Modification Request  0x00 = success  0x01 = failed, Proposed SCPED field is present  0x02 – 0xFF = reserved |
| Proposed CSPEC | - | Var | Proposed CSPEC indicating the CSPEC that the CM is currently capable of supporting.  This field is only present when Result is set to 0x01. When this field is present and a valid Proposed CSPEC is not included, this field shall be 2-octets long with a value of 0x0000 (i.e., CSPEC\_LEN = 0x0000). When a valid Proposed CSPEC is included, the interpretation of this field is the same as in Section 7.8.1. |

### CM\_CONN\_INFO.REQ

The **CM\_CONN\_INFO.REQ** message is a request to provide the information on ongoing Connections that are either initiated or terminated at the STA. This message can be sent by any STA in the AVLN to any other STA.

Table 11‑113: CM\_CONN\_INFO.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Octet Number | Field Size (Octets) | Description |
| ReqType | 0 | 1 | Request Type  0x00 = request to provide information for all active Connections  0x01 = request to provide information for a Connection with the specified CID  0x02 = request to provide information for a Connection to which the specified Global Link belongs  0x03 - 0xFF = reserved |
| CID | 1 - 2 | 2 | Connection Identifier of the Connection for which the Connection information is requested.  This field is only valid when ReqType is set to 0x01. |
| GLID | 3 | 1 | Global Link Identifier for which the associated Connection information is requested  This field is only valid when ReqType is set to 0x02. |

### CM\_CONN\_INFO.CNF

The CM\_CONN\_INFO.CNF message is generated in response to the corresponding CM\_CONN\_INFO.REQ. CM\_CONN\_INFO.CNF contains the information about the source, destination, connection identifier, link identifiers and CSPEC of the Connection(s).

For Connections with only local links, the CSPEC shall include CM-to-CM QoS and MAC Parameters for both forward (if any) and reverse (if any) links.

For Connection that are initiated by the STA and containing Global Links, the CSPEC shall include CM-to-CM and CM-to-CCo QoS and MAC Parameters for both forward (if any) and reverse (in any) links.

For Connections that are not initiated by the STA and containing Global Links, the CSPEC shall include CM-to-CM QoS and MAC parameters for both forward (if any) and reverse (in any) links.

Table 11‑114: CM\_CONN\_INFO.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Octet Number | Field Size | Description |
| NumConn | 7 | 1 | Number of Connections = N  0x00 = no active connections or Unknown Connection Identifier or Unknown GLID  0x01 = one ConnInfo Field,  0x02 = two ConnInfo Fields, and so on |
| ConnInfo[1] | - | Var | Connection Information |
| … |  |  |  |
| ConnInfo[N] | - | Var | Connection Information |

Table 11‑115: Format of ConnInfo

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Octet Number | Field Size | Description |
| CID | 0 - 1 | 2 | Connection Identifier of the Link (refer to Section 5.2.1.4.2) |
| STEI | 2 | 1 | TEI of the source STA. |
| DTEI | 3 | 1 | TEI of the sink STA. |
| LID-F | 4 | 1 | Link ID of the Forward Link.  A value of 0x00 is used to indicate that this field is invalid. |
| LID-R | 5 | 1 | Link ID of the Reverse Link.  A value of 0x00 is used to indicate that this field is invalid. |
| CSPEC | - | Var | Connection Specification |

### CM\_STA\_CAP.REQ

The CM\_STA\_CAP.REQ message is a request to provide the station capabilities. The message field for this management message is NULL.

### CM\_STA\_CAP.CNF

The CM\_STA\_CAP.CNF message is generated in response to the corresponding CM\_STA\_CAP.REQ.

Table 11‑116: CM\_STA\_CAP.CNF Message

| Field | Octet Number | Field Size  (Octets) | Definition |
| --- | --- | --- | --- |
| AVVersion | 0 | 1 | HomePlug AV Version. AV 1.1 and GREEN PHY stations shall set this field to 0x00. Other values are reserved. |
| MACAddr | 1 - 6 | 6 | MAC Address |
| OUI | 7 - 9 | 3 | Organizationally Unique Identifier |
| AutoConnect | 10 | 1 | Auto Connect Capability  0x00 = Auto Connect Service not supported  0x01 = Auto Connect Service supported  0x02 - 0xFF = reserved |
| Smoothing | 11 | 1 | Smoothing Capability  0x00 = Smoothing Service not supported  0x01 = Smoothing Service supported  0x02 - 0xFF = reserved |
| CCoCapability | 12 | 1 | CCo Capability  The two LSBs of this field contain the STA’s CCo capability. The interpretation of these bits is the same as in Section 4.4.3.15.4.6.2. The six MSBs of this field are set to 0b000000 |
| ProxyCapable | 13 | 1 | Proxy Capability  0x00 = not capable of being a Proxy Coordinator  0x01 = capable of being a Proxy Coordinator  0x02 - 0xFF = reserved |
| BackupCCo | 15 | 1 | Backup CCo-capable  0x00 = Backup CCo capability not supported  0x01 = Backup CCo capability supported  0x02 - 0xFF = reserved |
| SoftHandOver | 16 | 1 | Soft Hand Over Support  0x00 = Soft Handover not supported  0x01 = Soft Hand Over supported  0x02 - 0xFF = reserved |
| TwoSymFC | 17 | 1 | Two Symbol Frame Control  0x00 = not supported  0x01 = supported  0x02 - 0xFF = reserved |
| MaxFL\_AV | 18 - 19 | 2 | Maximum value of FL\_AV that the station is capable of supporting in multiples of 1.28 μsec.  0x00 = zero  0x01 = 1.28 μsec, and so on |
| HomePlug1.1Cap | 20 | 1 | Ability to Support Enhanced Coexistence with HomePlug 1.1  0x00 = not capable of supporting HomePlug 1.1 coexistence  0x01 = capable of supporting HomePlug 1.1 coexistence  0x02 – 0xFF = reserved |
| HomePlug1.0Interop | 21 | 1 | HomePlug 1.0.1 Interoperability  0x00 = not capable of interoperating with HomePlug 1.0.1  0x01 = capable of interoperating with HomePlug 1.0.1 |
| RegulatoryCap | 22 | 1 | Capability of Operating in Various Regulatory Domains  0x00 = North America only  0x01 - 0xFF = reserved |
| Bidirectional Bursting | 23 | 1 | Bidirectional Bursting Capability  0x00 = not capable of supporting Bidirectional Bursts  0x01 = capable of supporting Bidirectional Bursting. Only supports CFP Bidirectional Bursts ending with SACK  0x02 = capable of supporting Bidirectional Bursting. Supports CFP Bidirectional Bursts that either end with a SACK or a Reverse SOF.  0x03-0xFF = reserved |
| ImplementationVer | 24 - 25 | 2 | Implementation Version  This field is defined by the chip and/or product manufacturers. It is intended to facilitate interoperability testing. |

### CM\_NW\_INFO.REQ

The CM\_NW\_INFO.REQ message is a request to provide the list of AVLNs to which the STA is a member and the relevant information about the AVLN. The message field for this management message is NULL.

### CM\_NW\_INFO.CNF

CM\_NW\_INFO.CNF message is generated in response to the corresponding CM\_NW\_INFO.REQ.

Table 11‑117: CM\_NW\_INFO.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| NumNWs | 0 | 1 | Number of AVLNs that the STA is a member i.e., Associated and Authenticated = N  0x00 = not a member of any AVLN  0x01 = member of one AVLN and so on.  If STA is member of multiple networks, NWINFO[0] contains the information about the AVLN whose PHY Clock the STA is tracking (refer to Section 5.5.4.1). |
| NWINFO[0] | - | Var | Network Information of the first AVLN (refer to Table 11-118) |
| … |  |  |  |
| NWINFO[N-1] | - | Var | Network Information of the last AVLN (refer to Table 11-118) |

Table 11‑118: NWINFO Field Format

| Field | Octet Number | Field Size  (Octets) | Definition |
| --- | --- | --- | --- |
| NID | 0 - 6 | 7 | Network Identifier  The least-significant 54 bits of this field contains the NID of the AVLN. The remaining 2 bits are set to 0b00. |
| SNID | 7 | 1 | Short Network Identifier  The least-significant 4 bits of this field contains the Short Network Identifier. The remaining 4 bits are set to 0x0 |
| TEI | 8 | 1 | Terminal Equipment Identifier of the STA in the AVLN |
| StationRole | 9 | 1 | Role of the station in the AVLN  0x00 = STA  0x01 = Proxy Coordinator  0x02 = CCo  0x03 – 0xFF = reserved |
| CCo\_MACAddr | 10 - 15 | 6 | MAC Address of the CCo of the network. |
| Access | 16 | 1 | Access Network  0x00 = This NID corresponds to an in-home network  0x01 = This NID corresponds to an Access Network  0x02 - 0xFF = reserved |
| NumCordNWs | 17 | 1 | Number of Neighbor Networks that are coordinating with the AVLN  0x00 = none (Un-Coordinated mode)  0x01 = one Coordinating network, and so on |

### CM\_GET\_BEACON.REQ

The CM\_GET\_BEACON.REQ message is a request to provide the Beacon Payload field of a recently received Central Beacon or Proxy Beacon (if station cannot hear the Central Beacon) of an AVLN to which the STA is a member.

Table 11‑119: CM\_GET\_BEACON.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| NID | 0 - 6 | 7 | Network Identifier of the AVLN  The least-significant 54 bits of this field contains the NID. The remaining two bits are set to 0b00. |

### CM\_GET\_BEACON.CNF

The CM\_GET\_BEACON.CNF message is generated in response to the corresponding CM\_GET\_BEACON.REQ. The format and interpretation of the fields in this message are same as shown in Table 4-52 “Beacon Payload Field” and Table 4-52b “Assignment of Previoulsy Reserved Beacon Payload Fields for GREEN PHY” except tjat the Octet Pad and Beacon Payload Check Sequence fieldsare not included.

### CM\_HFID.REQ

The CM\_GET\_HFID.REQ message is a request to provide the Human Friendly Identifier of a STA or an AVLN.

Table 11‑120: CM\_HFID.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| ReqType | 0 | 1 | Request Type  0x00 = request to provide the manufacturer-set HFID of the STA  0x01 = request to provide the user-set HFID of the STA  0x02 = request to provide the HFID of the Network, whose network identifier is contained in the NID field  0x03 = request to set the user-set HFID of the STA to the value indicated in the HFID field  0x04 = request to set the HFID of the Network, whose network identifier is contained in the NID field, to the value indicated in the HFID field.  0x05 - 0xFF = reserved  Note: This message must be sent to the CCo of an AVLN to set the HFID of the Network |
| NID | - | 0 or 6 | Network Identifier  The least-significant 54 bits of this field contains the NID. The remaining two bits are set to 0b00.  This field is only present when ReqType is set to 0x02 or 0x04. |
| HFID | - | 0 or 64 | Human Friendly Identifier  This field is only present when ReqType is set to 0x03 or 0x04. |

### CM\_HFID.CNF

The CM\_HFID.CNF message is generated in response to the corresponding CM\_HFID.REQ.

Table 11‑121: CM\_HFID.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| ResType | 0 | 1 | Response Type  0x00 - 0x04 = success, with value indicating the Request’s Req Type  0xFF = failure  0x05 - 0xFE = reserved |
| HFID | - | 0 or 64 | Human Friendly Identifier of the STA or AVLN  This field is always present. When Res Type is fail, the current value is returned. |

### CM\_MME\_ERROR.IND

CM\_MME\_ERROR.IND message shall be generated by a station upon the reception of MME that it does not support. This message may also be generated in response to the reception of a supported MME with invalid MME field(s).

Table 11‑122: CM\_MME\_ERROR.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| ReasonCode | 0 | 1 | Reason Code  0x00 = MME not Supported  0x01 = supported MME with invalid MME fields  0x02 = unsupported feature  0x03 - 0xFF = reserved |
| RX\_MMV | 1 | 1 | Management Message Version of the received MME |
| RX\_MMTYPE | 2-3 | 2 | Management Message Type of the received MME |
| InvalidByteOffset | 4-5 | 2 | Byte Offset of first or only invalid field in MME. This field is only valid when the Reason Code is set to 0x01.  0x00 = first Octet of the MME  0x01 = second Octet of the MME, and so on. |

### CM\_NW\_STATS.REQ

The CM\_NW\_STATS.REQ message is a request to provide the network statistics. The message field for this management message is NULL.

### CM\_NW\_STATS.CNF

The CM\_NW\_STATS.CNF message is generated in response to the corresponding CM\_NW\_STATS.REQ. This message contains the list of all associated and authenticated STAs in the AVLN and the physical layer data rates to all those stations.

Table 11‑123: CM\_NW\_STATS.CNF Field Format

| Field | Octet Number | Field Size  (Octets) | Definition |
| --- | --- | --- | --- |
| NumSTAs | 7 | 1 | Number of AV STAs in the AVLN = L  0x00 = None,  0x01 = One, and so on. |
| DA[0] | - | 6 | MAC Address of the STA – 0 |
| AvgPHYDR\_TX[0] | - | 1 | Average PHY Data Rate in Mega Bits per second from STA to DA[0].  0x00 = unreachable/unknown  0x01 = 1 Mbps, and so on |
| AvgPHYDR\_RX[0] | - | 1 | Average PHY Data Rate in Mega Bits per second from DA[0] to STA.  0x00 = unreachable/unknown  0x01 = 1 Mbps, and so on |
| … |  |  |  |
| DA[L-1] | - | 6 | MAC Address of STA – (L-1) |
| AvgPHYDR\_TX[L-1] | - | 1 | Average PHY Data Rate in Mega Bits per second from STA to DA[L-1].  0x00 = unreachable/unknown,  0x01 = 1 Mbps, and so on |
| AvgPHYDR\_RX[L-1] | - | 1 | Average PHY Data Rate in Mega Bits per second from DA[L-1] to STA.  0x00 = unreachable/unknown  0x01 = 1 Mbps, and so on |

### CM\_LINK\_STATS.REQ

CM\_LINK\_STATS.REQ is a request to provide statistics for a Link that is associated with a Connection, or for Priority based Links or Management Links.

Table 11‑124: CM\_LINK\_STATS.REQ Message

| Field | Octet Number | Field Size  (Octets) | Definition |
| --- | --- | --- | --- |
| ReqType | 0 | 1 | Request Type  0x00 = reset statistics for the corresponding Link  0x01 = get statistics for the corresponding Link  0x02 = get and reset statistics for the corresponding Link  0x03 - 0xFF = reserved |
| ReqID | 1 | 1 | Request Identifier  The ReqID field is set by the sender of this MME such that the same value is not recently used between the sender and the receiver of this MME. Request ID is used to bind this request with the corresponding response. |
| NID | 2-8 | 7 | Network Identifier of the STA(s) whose Connection statistics are being requested.  The least-significant 54 bits of this field contains the NID. The remaining 2 bits are set to 0b00. |
| LID | 9 | 1 | Link Identifier  This field is valid only when the Mgmt\_Flag is set to 0x00. |
| TLFlag | 10 | 1 | Transmit Link Flag  0x00 = transmit Link  0x01 = receive Link  0x02 - 0xFF = reserved |
| Mgmt\_Flag | 11 | 1 | Management Link  0x00 = not management Link  0x01 = management Link  0x02 - 0xFF = reserved |
| DA/SA | 12-17 | 6 | Indicate the Destination MAC Address when TLFlag is set to 0x00.  Indicate the Source Mac Address when TLFlag is set to 0x01. |

### CM\_LINK\_STATS.CNF

CM\_LINK\_STATS.CNF is generated in response to the corresponding CM\_LINK\_STATS.REQ.

Table 11‑125: CM\_CONN\_STATS.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| ReqID | 0 | 1 | Request Identifier copied from the corresponding request |
| ResType | 1 | 1 | Response Type  0x00 = success  0x01 = failure  0x02 - 0xFF = reserved |
| LinkStats | - | Var | Link Statistics for the Link. The format of this field depends on whether the Link is a “Transmit Link” or a “Receive Link” as shown in Table 11-126 and Table 11-127. |

Table 11‑126: LinkStats Field Format for Transmit MFS

| Field | Octet Number | Field Size  (Octets) | Definition |
| --- | --- | --- | --- |
| BeaconPeriodCnt | 0 - 1 | 2 | Counter indicating the number of Beacon Periods over which Link statistics are collected  0x00 = zero  0x01 = one Beacon Period  0x02 = two Beacon Periods, and so on  Note: The statistics collection may begin in the middle of a Beacon Period. In such cases, the partial Beacon Period is counted as the first Beacon Period. |
| Tx\_NumMSDUs | 2 - 5 | 4 | Number of MSDUs Received from HLE  0x00000000 = none  0x00000001 = one, and so on |
| Tx\_Octets | 6 - 9 | 4 | Number of Octets of MSDU Payload Received from HLE  0x00000000 = none  0x00000001 = one octet, and so on |
| Tx\_NumSegs | 10 - 13 | 4 | Number of Segments That were Generated  0x00000000 = none  0x00000001 = one, and so on |
| Tx\_NumSeg\_Suc | 14 - 17 | 4 | Number of Segments That were successfully delivered.  0x00000000 = none  0x00000001 = one, and so on |
| Tx\_NumSeg\_Dropped | 18 - 21 | 4 | Number of Segments that were Dropped  0x00000000 = none  0x00000001 = one, and so on |
| Tx\_NumPBs | 22 - 25 | 4 | Number of PBs Handed Over to the PHY for Transmission  0x00000000 = None  0x00000001 = one, and so on |
| Tx\_NumMPDUs | 26 - 29 | 4 | Number of MPDUs That were Transmitted  0x00000000 = none  0x00000001 = one, and so on |
| Tx\_NumBursts | 30 - 33 | 4 | Number of Bursts That were Transmitted  0x00000000 = zero  0x00000001 = one, and so on |
| Tx\_NumSACKs | 34 - 37 | 4 | Number of MPDUs that were successfully acknowledged (i.e., SACK with MFSRsp set to ACK).  0x00000000 = none  0x00000001 = one, and so on |
| NumLatBins | 38 | 1 | Number of Bins in which Latency Information is Collected = N  0x00 = not available, In this case, the reminder of the fields are not present.  0x01 = invalid  0x02 = two latency bins  0x03 = three latency bins and so on. |
| LatBinGran | 39 | 1 | Granularity of Latency Bin.  0x00 = one Beacon Period  0x01 = one millisecond  0x02 = two milliseconds  0x03 = and so on |
| LatBin(0) | 40 - 43 | 4 | Number of PBs successfully transmitted with a latency in the range [0 to LatBinGran]  0x00000000 = none  0x00000000 = one, and so on |
| LatBin(1) | - | 4 | Number of PBs successfully transmitted with a latency in the range (LatBinGran to 2\* LatBinGran)  0x00000000 = none  0x00000001 = one, and so on |
| … |  |  |  |
| LatBin[N] | - | 4 | Number of PBs Successfully Transmitted with a Latency  > LatBinGran\*(N-1)  0x00000000 = none  0x00000001 = one, and so on |

Table 11‑127: LinkStats Field Format for Receive MFS

| Field | Octet Number | Field Size  (Octets) | Definition |
| --- | --- | --- | --- |
| BeaconPeriodCnt | 0 - 1 | 2 | Counter indicating the number of Beacon Periods over which Link statistics are collected  0x00 = none  0x01 = one Beacon Period  0x02 = two Beacon Periods and so on.  Note: The statistics collection may begin in the middle of a Beacon Period. In such cases, the partial Beacon Period is counted as the first Beacon Period. |
| Rx\_NumMSDUs | 2 - 5 | 4 | Number of MSDUs Successfully Received  0x00000000 = none  0x00000001 = one, and so on |
| Rx\_Octets | 6 - 9 | 4 | Number of Octets of MSDU Payload Successfully Received  0x00000000 = none  0x00000001 = one octet, and so on |
| Rx\_NumSeg\_Suc | 10 - 13 | 4 | Number of Segments that were successfully received.  0x00000000 = none  0x00000001 = one, and so on |
| Rx\_NumSeg\_Missed | 14 - 17 | 4 | Number of Segments that were missed.  0x00000000 = none  0x00000001 = one, and so on |
| Rx\_NumPBs | 18 - 21 | 4 | Number of PBs that were handed over from the PHY to the MAC.  0x00000000 = none  0x00000001 = one, and so on |
| Rx\_NumBursts | 22 - 25 | 4 | Number of Bursts That were Transmitted  0x00000000 = zero,  0x00000001 = one, and so on |
| Rx\_NumMPDUs | 26 - 29 | 4 | Number of MPDUs That were Received.  0x00000000 = none  0x00000001 = one, and so on |
| NumICV\_FAILS | 30 - 33 | 4 | Number of Received MAC Frame for which ICV Failed  0x00000000 = none  0x00000001 = one, and so on |

### CM\_STA\_IDENTIFY.REQ (GREEN PHY)

The CM\_STA\_IDENTIFY.REQ message is a request to provide the STA identification information. The message field for this management message is NULL.

### CM\_STA\_IDENTIFY.CNF (GREEN PHY)

The CM\_STA\_IDENTIFY.CNF message is generated in response to the corresponding CM\_STA\_IDENTIFY.REQ. This message contains the GREEN PHY Capability and/or the version of HomePlug AV supported.

Table 11‑128: CM\_STA\_IDENTIFY.CNF Field Format

| Field | Octet Number | Field Size  (Octets) | Definition |
| --- | --- | --- | --- |
| GREEN PHY Capability | 0 | 1 | GREEN PHY Capability of the station  0x00 – STA is not GREEN PHY Capability  0x01 – STA is HomePlug GREEN PHY 1.0 Capable  0x02-0xFF -- Reserved |
| Power Save Capability | 1 | 1 | Power Save Capability of the station  0x00 – STA has no Power Save Capability  0x01 – STA is Power Save Capable  0x02-0xFF -- Reserved |
| GP Preferred Allocation Capability | 2 | 1 | GP Preferred Allocation Capability of the station  0x00 – STA has no Capability to respect GP Preferred Allocation  0x01 – STA has Capability to respect GP Preferred Allocation  0x02-0xFF -- Reserved |
| Repeating and Routing Capability | 3 | 1 | Repeating and Routing Capability of the station  0x00 – STA has no Capability for Repeating and Routing  0x01 – STA has Capability for Repeating and Routing  0x02-0xFF -- Reserved |
| HomePlug AV Version | 4 | 1 | Version of HomePlug AV supported by the station  0x00 – HPAV 1.1 station  0x01 – 0xFE Reserved for future use  0xFF – Not a HPAV Station |
| EFL | 5 | 1 | Extended Fields Length  0x00 = No Extended Field  0x01 = 1 Octet extended Field, and so on |
| EF | - | Var | Extended Fields  Extended Fields enable extensions to the contents of this MME. This field is expected to be used by future versions of HomePlug AV and Green PHY.  This field is ignored by Green PHY 1.0 stations |

### CM\_STA\_IDENTIFY.IND (GREEN PHY)

The CM\_STA\_IDENTIFY.IND message is sent from a GREEN PHY Station or a Station supporting versions of HomePlug AV greater than 1.1 that has just associated and authenticated with a CCo to convey its GREEN PHY Station Type or the version of HomePlug AV to the CCo.

The format of this message is the same as the CM\_STA\_IDENTIFY.CNF message in Section 11.5.38.

### CM\_STA\_IDENTIFY.RSP (GREEN PHY)

The CM\_STA\_IDENTIFY.RSP message is sent by the CCo to the STA to confirm the reception of the CM\_STA\_IDENTIFY.IND message.

The message field for this message is NULL.

### CM\_ROUTE\_INFO.REQ (GREEN PHY)

The **CM\_ROUTE\_INFO**.REQ message is a request to provide the distant vector information. The message field for this management message is NULL.

### CM\_ROUTE\_INFO.CNF (GREEN PHY)

**CM\_ROUTE\_INFO**.CNF is generated in response to the corresponding **CM\_ROUTE\_INFO**.REQ and provides the requesting STA information from the LRT. This message shall contain an entry for every STA identified in the TEI Map except itself.

Table 11‑129: CM\_ROUTE\_INFO.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| NumEntries | 0 | 1 | Number of entries = L  0x00 = None,  0x01 = One, and so on. |
| UDTEI[0] | 1 | 1 | Ultimate destination TEI[0] for the MAC Frame |
| RDR[0] | 2 | 1 | RDR for UDTEI[0] from the LRT, which indicates the data rate from the STA sending this message to the UDTEI[0] |
| RNH[0] | 3 | 1 | RNH for UDTEI[0] from the LRT, which indicates the number of hops from the STA sending this message to the UDTEI[0]  0x00 = direct communication (1 hop)  0x01 = 2 hops, and so on |
| UDTEI[1] | 4 | 1 | Ultimate destination TEI[1] for the MAC Frame |
| RDR[1] | 5 | 1 | RDR for UDTEI[1] from the LRT, which indicates the data rate from the STA sending this message to the UDTEI[1] |
| RNH[1] | 6 | 1 | RNH for UDTEI[1] from the LRT, which indicates the number of hops from the STA sending this message to the UDTEI[1]  0x00 = direct communication (1 hop)  0x01 = 2 hops, and so on |
| ... |  |  |  |
| UDTEI[L-1] | 3L+1 | 1 | Ultimate destination TEI[L-1] for the MAC Frame |
| RDR[L-1] | 3L+2 | 1 | RDR for UDTEI[L-1] from the LRT, which indicates the data rate from the STA sending this message to the UDTEI[L-1] |
| RNH[L-1] | 3L+3 | 1 | RNH for UDTEI[L-1] from the LRT, which indicates the number of hops from the STA sending this message to the UDTEI[L-1]  0x00 = direct communication (1 hop)  0x01 = 2 hops, and so on |



#### Route Data Rate (RDR[i])

The Route Data Rate (RDR) is encoded using the same method as used for the BLE (see Section 4.4.1.5.2.10), except that the rate encoded as **0x00** shall be used to indicate an unreachable UDTEI. A UDTEI shall be reported as unreachable to a neighbor if either no path to that UDTEI is known, or if the neighbor is the next STA in the path to that UDTEI (split horizon with poison reverse). Thus any RDR that is less than or equal to the RDR encoded as **0x01** shall be reported as **0x01**.

### CM\_ROUTE\_INFO.IND (GREEN PHY)

CM\_ROUTE\_INFO.IND message has the same format as **CM\_ROUTE\_INFO**.CNF and is sent to other STAs in the AVLN when there is a significant change in the LRT information. This message shall include an entry for every entry in the LRT that changed significantly and may include an entry for every STA identified in the TEI Map except itself.

### CM\_UNREACHABLE.IND (GREEN PHY)

**CM\_UNREACHABLE**.IND is generated when a STA becomes unreachable. It is sent if the STA was reachable directly but is no longer directly reachable, or in response to receipt of a **CM\_UNREACHABLE**.IND MME from the STA that is the current Next TEI for the now unreachable STA. This message shall contain an entry for every newly unreachable STA.

Table 11‑130: CM\_ROUTE\_INFO.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| UnrchTS | 0-3 | 4 | Value of the NTB when the STA was found unreachable |
| NumEntries | 4 | 1 | Number of entries = L  0x00 = reserved,  0x01 = One, and so on. |
| UDTEI[0] | 5 | 1 | Unreachable ultimate destination TEI[0] |
| UDTEI[1] | 6 | 1 | Ultimate destination TEI[1] for the MAC Frame |
| ... |  |  |  |
| UDTEI[L-1] | L+5 | 1 | Ultimate destination TEI[L-1] for the MAC Frame |



#### Unreachable Time Stamp (UnrchTS)

The 32-bit Unreachable Time Stamp (UnrchTS) Time Stamp field is the value of the NTB at the STA that first reported the newly unreachable STA as unreachable. It is copied verbatim by all STAs that generate a new **CM\_UNREACHABLE**.IND MME because of receiving a **CM\_UNREACHABLE**.IND MME.

### CM\_SLAC\_PARM.REQ (GREEN PHY)

CM\_SLAC\_PARM.REQ is generated by the HLE of an PEV to request the parameters for the SLAC protocol from the EVSE(s). The format of this message is shown in Table below.

Table 11‑131: CM\_SLAC\_PARM.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| APPLICATION\_TYPE | 0 | 1 | Application Type  0x00 : PEV-EVSE Association  0x01-0xFF: Reserved |
| SECURITY\_TYPE | 1 | 1 | Security in M-Sound Messages  0x00: No Security  0x01: Public Key Signature  0x02-0xFF: Reserved |
| RunID | 2-9 | 8 | Run identifier of sender |
| CipherSuiteSetSize | 10 | 1 | **Cipher Suite Set Size**  Number of supported cipher suites N.  This field is only present when SECURITY\_TYPE = 0x01 |
| CipherSuite [1] | 11-12 | 2 | **Cipher Suite 1**  First supported cipher suite.  This field is only present when SECURITY\_TYPE = 0x01 |
| … | … | … | … |
| CipherSuite [N] | Var | 2 | **Cipher Suite N**  Nth supported cipher suite.  This field is only present when SECURITY\_TYPE = 0x01 |



#### APPLICATION TYPE

This field identifies the context in which the SLAC process is being carried out. If the value is 0x00, then it is being used for PEV-EVSE matching. All other values are reserved. his field indicates the MAC address of the GP STA(s) with which the STA should initiate the SLAC Process. If this MAC Address is set to the broadcast address (i.e., **0xFFFFFFFFFFFF**), the STA shall initiate the SLAC process with all of the GP STAs in the network using broadcast MPDUs.

#### SECURITY TYPE

This field indicates whether the sender prefers Secure SLAC for PEV-EVSE matching. If the value is 0x00, Secure SLAC is not desired, if the value is 0x01, Secure SLAC is requested. All other values are reserved.

#### RUN IDENTIFIER

This field is a value generated by the sender, unique for the sender. This field shall be chosen to be as unique as possible for each SLAC protocol run.

#### CIPHER SUITE SET SIZE

This field is an unsigned integer that specifies the number of cipher suites listed in the remainder of the message. If Secure SLAC is supported, this field shall be set to 0x01 (i.e., one Cipher Suite supported). Values of Cipher Suite set size greater than 1 are reserved for future use.

#### CIPHER SUITE [1] to CIPHER SUITE [N]

This field indicates a cipher suite supported by the sender and which may be used by another station sending signed messages to it or requesting encrypted messages from it.

PEVs and EVSEs that support secure SLAC shall set Cipher Suite to 0x00 to indicate that they support the following suite,

• ECDSA-with-SHA256 for signature (RFC 5754)

• Specify enveloped data using ephemeral-static ECDH key agreement algorithm for AES-128 key, dhSinglePass-stdDH-sha256kdf-scheme and id-aes128-wrap algorithm (RFC 5753),

• Specify enveloped data encryption using id-aes128-CBC (RFC 3565)

Note: The underlying cryptographic algorithms used in Cipher Suite 0x00 are required in SEP 2.0 (i.e., ECC Cipher Suite).

### CM\_SLAC\_PARM.CNF (GREEN PHY)

**CM\_SLAC\_PARM.CNF** is generated by the HLE of a EVSE GP STA in response to the corresponding **CM\_SLAC\_PARM.REQ**. During the SLAC Process, a GP STA shall transmit M-SOUND MPDUs to a target GP STA (i.e., M-SOUND\_TARGET) so that the target GP STA can measure the attenuation profile (ATTEN\_PROFILE) of the received signal. The format of this MME is as shown in Table 11-132.

Table 11‑132: CM\_SLAC\_PARM.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| M-SOUND\_TARGET | 0-5 | 6 | Indicates the MAC address of the GP STA with which the STA shall initiate the Signal Level Attenuation Characterization Process. |
| NUM\_SOUNDS | 6 | 1 | Indicates the number of M-SOUND MPDUS transmitted by the GP STA during the Signal Level Attenuation Characterization Process. |
| Time\_Out | 7 | 1 | Indicates the amount of time within which the GP STA will complete the transmission of SOUND MPDUs during the Signal Level Attenuation Characterization Process. The time is in multiples of 100 msec.  0x00 – 0 msec  0x01 – 100 msec  0x02 – 200 msec, and so on. |
| RESP\_TYPE | 8 | 1 | Indicates whether the recipient of the SOUND MPDUs shall communicate the signal attenuation characteristic profile data to the HLE or another GP STA.  0x00 – HLE of the STA  0x01 – Another GP STA  0x02 – 0xFF – Reserved |
| FORWARDING\_STA | 9-14 | 6 | Indicates the MAC address of the GP STA to which the STA(s) participating in the SLAC Process shall forward the signal attenuation characteristic profile data. This field is valid only if RESP\_TYPE is set to 0x01 |
| APPLICATION\_TYPE | 15 | 1 | Application Type  0x00 : PEV-EVSE Association  0x01-0xFF: Reserved |
| SECURITY\_TYPE | 16 | 1 | Security in M-Sound Messages  0x00: No Security  0x01: Public Key Signature  0x02-0xFF: Reserved |
| RunID | 11-18 | 8 | Run identifier of sender |
| CipherSuite | 19-20 | 2 | **Cipher Suite**  Selected cipher suite.  This field is only present when SECURITY\_TYPE = 0x01 |

#### M-SOUND\_TARGET

This field indicates the MAC address of the GP STA(s) with which the STA should initiate the SLAC Process. If this MAC Address is set to the broadcast address (i.e., **0xFFFFFFFFFFFF**), the STA shall initiate the SLAC process with all of the GP STAs using multi-network broadcast MPDUs.

#### NUM\_SOUNDS

This field indicates the maximum number of M-SOUND MPDUs transmitted by the STA during the SLAC Process.

#### Time\_Out

This field indicates the time within which the STA completes transmit of SOUND MPDUs during the SLAC Process. The time is represented here in multiples of 100 msecs.

#### RESP\_TYPE

This field indicates the behavior of the GP STA(s) participating in the SLAC Process upon processing the M-SOUND MPDUs. The GP STA shall transmit the Signal Level Attenuation Profile data obtained from processing the M-SOUND MPDUs to the HLE if the field is set to **0x00** or to another GP STA if the field is set to **0x01**.

#### FORWARDING\_STA

This field is set to the MAC address of the GP STA to which the STA(s) participating in the SLAC process shall transmit the Signal Level Attenuation Profile data to. This field is valid only when the **RESP\_TYPE** is set to **0x01**.

#### APPLICATION TYPE

This field identifies the context in which the SLAC process is being carried out. If the value is 0x00, then it is being used for PEV-EVSE matching. All other values are reserved.

#### SECURITY TYPE

This field indicates whether the sender supports Secure SLAC for PEV-EVSE matching. If the SECURITY\_TYPE in **CM\_SLAC\_PARM.REQ** is set to 0x00, then this field shall be set to 0x00. If the SECURITY\_TYPE in **CM\_SLAC\_PARM.REQ** is set to 0x01 (i.e.., public key signature), and the Green PHY station supports one of the Cipher Suites provided in the **CM\_SLAC\_PARM.REQ**, then this field shall be set to 0x01.

#### RUN IDENTIFIER

RUN IDENTIFIER in this message shall be copied from the corresponding field in **CM\_SLAC\_PARM.REQ**.

#### CIPHER SUITE

If the SECURITY\_TYPE is set to 0x01 (i.e., public key signature), then this field shall be set to 0x0000.

### CM\_START\_ATTEN\_CHAR.IND (GREEN PHY)

A Green PHY STA that initiates a SLAC shall transmit **CM\_START\_ATTEN\_CHAR.IND** to indicate to the target STAs (i.e., indicated by the SOUND\_TARGET in the preceding **CM\_SLAC\_PARM.CNF**) that the SLAC Process is starting. This MME is generated in response to a **CM\_SLAC\_PARM.CNF**. This message shall be transmitted in multi-network broadcast mode. The Green PHY STA shall transmit this MME multiple times to increase the probability of reception of this MME by all the STAs in the network. The format of this MME is shown in Table 11-133

Table 11‑133: CM\_START\_ATTEN\_CHAR.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| APPLICATION\_TYPE | 0 | 1 | Application Type  0x00 : PEV-EVSE Association  0x01-0xFF: Reserved |
| SECURITY\_TYPE | 1 | 1 | Security in M-Sound Messages  0x00: No Security  0x01: Public Key Signature.  0x02-0xFF: Reserved |
| ACVarField | - | var | Attenuation Characteristics Variable Field |

#### APPLICATION TYPE

This field identifies the context in which the SLAC process is being carried out. Its interpretation is the same as in 11.5.45.1.

#### SECURITY TYPE

This field indicates whether or not Secure SLAC is used, as in 11.5.45.2.

#### ACVarField

If Security Type = 0x01, then it is CMS-formatted signed contents, with the contents given in Table XXX below. If Security Type = 0x00, then it is the contents given in Table 11-134 below without CMS formatting.

Table 11‑134: CM\_START\_ATTEN\_CHAR.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| NUM\_SOUNDS | 0 | 1 | Indicates the number of SOUND MPDUS transmitted by the GP STA during the Signal Level Attenuation Characterization Process. |
| Time\_Out | 1 | 1 | Indicates the amount of time within which the GP STA will complete the transmission of SOUND MPDUs during the Signal Level Attenuation Characterization Process. The time is in multiples of 100 msec.  0x00 – 0 msec; 0x01 – 100 msec; 0x02 – 200 msec, and so on. |
| RESP\_TYPE | 2 | 1 | Indicates whether the recipient of the SOUND MPDUs shall communicate the signal attenuation characteristic profile data to the HLE or another GP STA.  0x00 – HLE of the STA  0x01 – Another GP STA  0x02 – 0xFF - Reserved |
| FORWARDING\_STA | 3 – 8 | 6 | Indicates the MAC address of the GP STA to which the STA(s) participating in the SLAC Process shall forward the signal attenuation characteristic profile data. This field is valid only if RESP\_TYPE is set to 0x01 |
| RunID | 11-18 | 8 | Run identifier of sender |

#### NUM\_SOUNDS

The interpretation of this field is same as 11.5.46.2. It shall be set to the same value as indicated in NUM\_SOUNDS field of the corresponding **CM\_SLAC\_PARM.CNF** MME.

#### Time\_Out

The interpretation of this field is same as 11.5.46.3. It shall be set to the same value as indicated in Time\_Out field of the corresponding **CM\_SLAC\_PARM.CNF** MME. The recipient(s) of this MME shall start a timer that is set to Time\_Out duration (refer to Section 5.2.9).

#### RESP\_TYPE

The interpretation of this field is same as in 11.5.46.4. It shall be set to the same value as indicated in **RESP\_TYPE** field of the corresponding **CM\_SLAC\_PARM.CNF** MME.

#### FORWARDING\_STA

The interpretation of this field is same as in 11.5.46.5. It shall be set to the same value as indicated in **FORWARDING\_STA** field of the corresponding **CM\_SLAC\_PARM.CNF** MME.

#### RUN IDENTIFIER

This field shall be copied from the corresponding **CM\_SLAC\_PARM.CNF** message.

### CM\_ ATTEN\_CHAR.IND (GREEN PHY)

**CM \_ATTEN\_CHAR.IND** is transmitted by M-SOUND\_TARGET STA(s) (i.e., EVSEs) in the SLAC Process. A GP Station processes the received M-SOUND MPDUs and builds a signal attenuation profile. As soon as it receives NUM\_SOUNDS SOUND MPDUs as described in **CM\_START\_ATTEN\_CHAR.IND** or the timer maintained by the STA expires, the EVSE shall transmit **CM \_ATTEN\_CHAR.IND** to the PEV**.** Table 11-Y1 describes the various fields in the message.

Table 11‑135: CM\_ ATTEN\_CHAR.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| APPLICATION\_TYPE | 0 | 1 | Application Type  0x00 : PEV-EVSE Association  0x01-0xFF: Reserved |
| SECURITY\_TYPE | 1 | 1 | Security in M-Sound Messages  0x00: No Security  0x01: Public Key Signature.  0x02-0xFF: Reserved |
| ACVarField | - | var | Attenuation Characteristics Variable Field |

#### APPLICATION TYPE

This field identifies the context in which the SLAC process is being carried out. Its interpretation is the same as in 11.5.45.1.

#### SECURITY TYPE

This field indicates whether or not Secure SLAC is used, as in 11.5.45.2.

#### ACVarField

This field contains the actual attenuation characteristic values. If Security Type = 0x01, then it is CMS-formatted signed contents, with the contents given in Table 11-Y2 below. If Security Type = 0x00, then it is the contents given in Table 11-Y2 below without CMS formatting.

Table 11-136: CM\_ ATTEN\_CHAR.IND ACVarField Contents

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| SOURCE\_ADDRESS | 0 – 5 | 6 | The MAC Address of the GP STA initiating the SLAC Process |
| R**unID** | 6-13 | 8 | The run identifier of the station that sent the M-Sounds |
| SOURCE\_ID | 14-30 | 17 | The unique identifier of the station that sent the M-Sounds |
| RESP\_ID | 31-47 | 17 | The unique identifier of the station that is sending this message |
| NumSounds | 48 | 1 | Number of M-Sounds used in generating the ATTEN\_PROFILE  0x00 – No M-Sounds were received  0x01 – 1 M-Sound was received, and so on |
| ATTEN\_PROFILE | - | var | Signal level attenuation profile |

#### SOURCE\_ADDRESS

This field contains the MAC address of the GP STA initiating the SLAC Process.

#### RUN IDENTIFIER

This field contains the Run Identifier given in the **CM\_START\_ATTEN\_CHAR.IND** message by the GP STA initiating the SLAC Process.

#### SOURCE IDENTIFIER

This field contains the unique identifier of the GP STA initiating the SLAC Process. If Secure SLAC is used for PEV-EVSE matching, this shall be the VIN of the PEV, as used in the public key certificate of the PEV. Otherwise it shall be all zeroes.

#### RESPONDER IDENTIFIER

This field contains the unique identifier of the GP STA initiating the SLAC Process. If Secure SLAC is used for PEV-EVSE matching, this shall be the unique, assigned identification number of the EVSE, as used in the public key certificate of the EVSE. Otherwise it shall be all zeroes.

#### NumSounds

Number of M-Sounds (NumSounds) field indicates the number M-Sounds that were received and processed for generating the ATTEN\_PROFILE.

An EVSE that receives a **CM\_START\_ATTEN\_CHAR.IND** but fails to receive any M-Sounds that can be used for generating the ATTEN\_PROFILE shall send **CM\_ATTEN\_CHAR.IND** message with NumSounds set to zero. This will enable the PEV to determine that the EVSE failed to provide a valid ATTEN\_PROFILE due to lack of M-Sounds, and take appropriate action. PEV shall ignore the ATTEN\_PROFILE field when NumSounds is set to 0x00.

#### ATTEN\_PROFILE

This field contains the signal level attenuation profile between the GP STA whose MAC address is described in **SOURCE\_ADDRESS** and the GP STA transmitting this MME.

The GP station divides the set of unmasked carriers (as described in Section 3.6.7) into groups of sixteen carriers, starting from the carrier with lowest frequency. For each group, the average attenuation of the carrier in the group is provided. Depending on the number of unmasked carriers, the last group may have lesser than 16 carrier. In such cases, the average attenuation shall be computed only on the available unmasked carriers within the last group.

The format of ATTEN\_PROFILE is shown in Table 11-137.

Table 11‑137: ATTEN\_PROFILE field format

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| NumGroups | 6 | 1 | Number of Groups (=N)  0x00 = 0 Octets, 0x01 = 1 Octet, and so on |
| AAG[1] | - | 1 | Average Attenuation of Group – 1  0x00 = 0dB, 0x01 = 1dB, 0x02 = 2 dB and so on. |
| … |  |  |  |
| AAG[N] | - | 1 | Average Attenuation of Group – N  0x00 = 0dB, 0x01 = 1dB, 0x02 = 2 dB and so on. |

### CM\_ ATTEN\_CHAR.RSP (GREEN PHY)

**CM \_ATTEN\_CHAR.RSP** is transmitted by the PEV in response to the corresponding **CM\_ATTEN\_CHAR.IND** from the EVSE. Table 11-138 describes the various fields in the message.

Table 11‑138: CM\_ ATTEN\_CHAR.RSP Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| APPLICATION\_TYPE | 0 | 1 | Application Type  0x00 : PEV-EVSE Association  0x01-0xFF: Reserved |
| SECURITY\_TYPE | 1 | 1 | Security in M-Sound Messages  0x00: No Security  0x01: Public Key Signature.  0x02-0xFF: Reserved |
| ACVarField | - | var | Attenuation Characteristics Variable Field |

#### APPLICATION TYPE

This field identifies the context in which the SLAC process is being carried out. Its interpretation is the same as in 11.5.45.6.

#### SECURITY TYPE

This field indicates whether or not Secure SLAC is used, as in 11.5.45.7.

#### ACVarField

This field contains the response. If Security Type = 0x01, then it is CMS-formatted signed contents, with the contents given in Table 11-139 below. If Security Type = 0x00, then it is the contents given in Table 11-139 below without CMS formatting.

Table 11‑139: CM\_ ATTEN\_CHAR.CNF ACVarField Contents

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| SOURCE\_ADDRESS | 0 – 5 | 6 | The MAC Address of the GP STA initiating the SLAC Process |
| RunID | 6-13 | 8 | The run identifier of the station that sent the M-Sounds |
| SOURCE\_ID | 14-30 | 17 | The unique identifier of the station that sent the M-Sounds |
| RESP\_ID | 31-47 | 17 | The unique identifier of the station that is sending this message |
| Result | - | var | 0x00 – Success  0x01-0xFF - Reserved |

#### SOURCE\_ADDRESS

This field contains the MAC address of the GP STA initiating the SLAC Process.

#### RUN IDENTIFIER

This field contains the Run Identifier given in the **CM\_START\_ATTEN\_CHAR.IND** message by the GP STA initiating the SLAC Process.

#### SOURCE IDENTIFIER

This field contains the unique identifier of the GP STA initiating the SLAC Process. If Secure SLAC is used for PEV-EVSE matching, this shall be the VIN of the PEV, as used in the public key certificate of the PEV. Otherwise it shall be all zeroes.

#### RESPONDER IDENTIFIER

This field contains the unique identifier of the GP STA initiating the SLAC Process. If Secure SLAC is used for PEV-EVSE matching, this shall be the unique, assigned identification number of the EVSE, as used in the public key certificate of the EVSE. Otherwise it shall be all zeroes.

### CM\_ PKCS\_CERT.REQ (GREEN PHY)

**CM\_PKCS\_CERT.REQ** is optional for PEVs and EVSEs, mandatory if public key certificates are supported. It is used to request a public key certificate of the target named by the MAC address parameter. The rest of its parameters describe the ciphersuites that the sender supports.

Table 11‑13140: CM\_ PKCS\_CERT.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| Target MAC | 0 - 5 | 6 | **Target MAC address**  Unicast MAC address of the station for which the public key certificate is desired. |
| CipherSuiteSetSize | 6 | 1 | **Cipher Suite Set Size**  Number of supported cipher suites N. |
| CipherSuite1 | 7-8 | 2 | **Cipher Suite 1**  First supported cipher suite. |
| … | … | … | … |
| CipherSuiteN | Var | 2 | **Cipher Suite N**  Nth supported cipher suite. |

### CM\_ PKCS\_CERT.CNF (GREEN PHY)

**CM\_PKCS\_CERT.CNF** is optional for PEVs and EVSEs, mandatory if public key certificates are supported. It is used to respond to a request for a public key certificate of the target named by the MAC address parameter in the **CM\_PKCS\_CERT.REQ**.

Table 11‑14132: CM\_ PKCS\_CERT.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| Target MAC | 0 - 5 | 6 | **Target MAC address**  MAC address of the station for which the public key certificate is provided. |
| Status | var | 1 | **Status of Confirmation**  0x00 =Success; certificate included  0x01 = Failure; certificate of unsupported ciphersuite type  0x02 = Failure; PKCS not supported  0x03-0xFF = Reserved |
| CipherSuite | var | 2 | **Cipher Suite**  Cipher suite of certificate. |
| CertLength | var | 2 | **Certificate Length**  Unsigned integer length in octets of certificate that follows 0x0000=0, 0x0001=1, etc. |
| Certificate Package | var | var | **Certificate Package**  Certificate of target MAC using named cipher suite, encoded using RFC 5246 encoding as null signed message. Optionally include certificate list and CRL lists as needed. |

### CM\_ PKCS\_CERT.IND (GREEN PHY)

**CM\_PKCS\_CERT.IND** is optional for PEVs and EVSEs, mandatory if public key certificates are supported. It is used to provide a public key certificate of the target named by the MAC address parameter in the request.

Table 11‑14133: CM\_ PKCS\_CERT.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| Target MAC | 0 - 5 | 6 | **Target MAC address**  MAC address of the station for which the public key certificate is provided. |
| CipherSuite | var | 2 | **Cipher Suite**  Cipher suite of certificate. |
| CertLength | var | 2 | **Certificate Length**  Unsigned integer length in octets of certificate that follows 0x0000=0, 0x0001=1, etc. |
| Certificate Package | var | var | **Certificate Package**  Certificate of target MAC using named cipher suite, encoded using RFC 5246 encoding as null signed message. Optionally include certificate list and CRL lists as needed. |

### CM\_ PKCS\_CERT.RSP (GREEN PHY)

**CM\_PKCS\_CERT.RSP** is generated in response to the corresponding **CM\_PKCS\_CERT.IND** when ODA in the **CM\_PKCS\_CERT.IND** is a unicast MAC Address.

**CM\_PKCS\_CERT.RSP** is optional for PEVs and EVSEs, mandatory if public key certificates are supported. It is used to respond optionally to **CM\_PKCS\_CERT.IND** message holding a public key certificate of the target named by the MAC address parameter in the indication.

Table 11‑14134: CM\_ PKCS\_CERT.RSP Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| Target MAC | 0 - 5 | 6 | **Target MAC address**  MAC address of the station for which the public key certificate is provided. |
| Status | var | 1 | **Status of Response**  0x00 = Success; certificate accepted  0x01 = Failure; certificate of unsupported ciphersuite type  0x02 = Failure; PKCS not supported  0x03-0xFF = Reserved |
| CipherSuiteSetSize | var | 0 or 1 | **Cipher Suite Set Size**  Number of supported cipher suites N. |
| CipherSuite1 | var | 0 or 2 | **Cipher Suite 1**  First supported cipher suites. |
| … | … | … | … |
| CipherSuiteN | var | 0 or 2 | **Cipher Suite N**  Nth supported cipher suites. |

### CM\_ MNBC\_SOUND.IND (GREEN PHY)

**CM\_MNBC\_SOUND.IND** is used as part of SLAC protocol to estimate the attenuation profile of a transmission from an PEV at EVSEs.

Table 11‑14135: CM\_ MNBC\_SOUND.IND Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| APPLICATION\_TYPE | 0 | 1 | Application Type  0x00 : PEV-EVSE Association  0x01-0xFF: Reserved |
| SECURITY\_TYPE | 1 | 1 | Security in M-Sound Messages  0x00: No Security  0x01: Public Key Signature.  0x02-0xFF: Reserved |
| MSVarField | - | var | M-Sound Variable Field |

#### APPLICATION TYPE

This field identifies the context in which the SLAC process is being carried out. Its interpretation is the same as in 11.5.45.6.

#### SECURITY TYPE

This field indicates whether or not Secure SLAC is used, as in 11.5.45.7.

#### MSVarField

This field contains the sender information. If Security Type = 0x01, then it is CMS-formatted signed contents, with the contents given in Table XXX below. If Security Type = 0x00, then it is the contents given in Table XXX below without CMS formatting.

Table 11‑14136: CM\_ MNBC\_SOUND.IND Message MSVarField Contents

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| Sender ID | 1 - 17 | 17 | **Sender’s Identification**  If APPLICATION\_TYPE=0x00 then Sender ID is PEV’s VIN code. |
| Cnt | 18 | 1 | **Countdown Counter**  Countdown counter for number of Sounds remaining; 0x00=0, 0x01=1, etc. |
| RunID | 19-34 | 16 | **Run Identifier**  This value shall be the same as the one sent in the CM\_START\_ATTEN\_CHAR.IND message by this sender. |
| Rnd | 35-50 | 16 | **Random Value**  Random value |

#### SENDER IDENTIFIER

This field contains the unique identifier of the GP STA sending the M-Sound. If Secure SLAC is used for PEV-EVSE matching, this shall be the VIN of the PEV, as used in the public key certificate of the PEV. Otherwise it shall be all zeroes.

#### CNT

This field contains a count-down counter. Its value shall be less than the value of NUM\_SOUNDS given in the **CM\_START\_ATTEN\_CHAR.IND** message, and shall be decremented on each M-Sound sent. It indicates the number of M-Sound messages remaining to be sent.

#### RUN IDENTIFIER

This field contains the Run Identifier given in the **CM\_START\_ATTEN\_CHAR.IND** message by the GP STA initiating the SLAC Process.

#### RND

This field contains a random value.

### CM\_VALIDATE.REQ (GREEN PHY)

**CM\_VALIDATE.REQ** is used in PEV-EVSE association as part of out-of-band Validation (refer Section 13.8.1.4).

Table 11‑14137: CM\_VALIDATE.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| SignalType | 0 | 1 | **Signal Type**  0x00 = PEV S2 toggles on CPLT line  0x01-0xFF = reserved for future use |
| VRVarField | 1-var | var | **Validate Request Variable Field** |

Table 11‑14138: VRVarField when SignalType is set to 0x00

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| Timer | 1 | 1 | **Timer Value**  0x00 = 100ms  0x01 = 200msec, and so on |
| Result | 2 | 1 | **Result Code**  0x00 = Not Ready  0x01 = Ready  0x02 = Success  0x03 = Failure |

### CM\_VALIDATE.CNF (GREEN PHY)

**CM\_VALIDATE.CNF** is used in PEV-EVSE association as part of out-of-band Validation (refer Section 13.8.1.4).

Table 11‑14139: CM\_VALIDATE.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| SignalType | 0 | 1 | **Signal Type**  0x00 = PEV S2 toggles on CPLT line  0x01-0xFF = reserved for future use |
| VCVarField | 2-var | var | **Validate Confirm Variable Field** |

Table 11‑140: VCVarField when SignalType is set to 0x00

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| ToggleNum | 1 | 1 | **Number of detected Toggle Sequences**  0x00 = No detected toggle  0x01 = 1  0x02 = 2, and so on |
| Result | 2 | 1 | **Result Code**  0x00 = Not Ready  0x01 = Ready  0x02 = Success  0x03 = Failure |

### CM\_SLAC\_MATCH.REQ (GREEN PHY)

**CM\_SLAC\_MATCH.REQ** is mandatory for PEVs and EVSEs, optional otherwise. It is used by the PEV to indicate to an EVSE that it is connected to it through a charging cordset. It may be signed or unsigned.

Table 11‑151: CM\_SLAC\_MATCH.REQ Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| APPLICATION\_TYPE | 0 | 1 | **Application Type**  0x00 : PEV-EVSE Association  0x01-0xFF: Reserved |
| SECURITY\_TYPE | 1 | 1 | **Security in M-Sound Messages**  0x00: No Security  0x01: Public Key Signature.  0x02-0xFF: Reserved |
| MVFLength | 2-3 | 2 | **Match Variable Field Length**  Unsigned integer length in octets of variable field that follows 0x0000=0, 0x0001=1, etc. |
| MatchVarField | - | var | **Match Variable Field**  Interpretation depends on SECURITY\_TYPE  Unencrypted, unsigned contents if SECURITY\_TYPE = 0x00  CMS formatted message if SECURITY\_TYPE=0x01 |

#### APPLICATION TYPE

This field identifies the context in which the SLAC process is being carried out. Its interpretation is the same as in 11.5.45.1.

#### SECURITY TYPE

This field indicates whether or not Secure SLAC is used, as in 11.5.45.2.

#### MVFLength

This field is an unsigned integer indicating the length of the Match Variable Field.

#### Match Variable Field

This field contains the SLAC match information. If Security Type = 0x01, then it is CMS-formatted signed contents signed with the PEV’s signing key, with the contents given in Table 11-152 below. If Security Type = 0x00, then it is the contents given in Table 11-152 below without CMS formatting.

Table 11‑152: Content of CM\_SLAC\_MATCH.IND Var Field

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| PEV ID | 1 - 17 | 17 | **PEV Identification**  VIN code of PEV |
| PEV MAC | 18-23 | 6 | **PEV MAC**  MAC address of PEV |
| EVSE ID | 23-40 | 17 | **EVSE Identification**  EVSE identification number |
| EVSE MAC | 41-46 | 6 | **EVSE MAC**  MAC address of EVSE |
| RunID | 47-62 | 16 | **Run Identifier**  Identifier given by PEV in the CM\_STAR\_ATTEN\_CHAR.IND message |

### CM\_ SLAC\_MATCH.CNF (GREEN PHY)

**CM\_SLAC\_MATCH.CNF** is mandatory for PEVs and EVSEs, optional otherwise. It is used to indicate that an PEV and an EVSE have been matched. It may be signed or unsigned.

Table 11‑141: CM\_ SLAC\_MATCH.CNF Message

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| APPLICATION\_TYPE | 0 | 1 | Application Type  0x00 : PEV-EVSE Association  0x01-0xFF: Reserved |
| SECURITY\_TYPE | 1 | 1 | Security in M-Sound Messages  0x00: No Security  0x01: Public Key Signature.  0x02-0xFF: Reserved |
| MVFLength | 2-3 | 2 | **Match Variable Field Length**  Unsigned integer length in octets of variable field that follows 0x0000=0, 0x0001=1, etc. |
| MatchVarField | - | var | **Match Variable Field**  Interpretation depends on SECURITY\_TYPE  Unencrypted, unsigned contents if SECURITY\_TYPE = 0x00  CMS formatted message if SECURITY\_TYPE=0x01 |

#### APPLICATION TYPE

This field identifies the context in which the SLAC process is being carried out. Its interpretation is the same as in 11.5.45.6.

#### SECURITY TYPE

This field indicates whether or not Secure SLAC is used, as in 11.5.45.7.

#### MVFLength

This field is an unsigned integer indicating the length of the Match Variable Field.

#### Match Variable Field

This field contains the SLAC match information. If Security Type = 0x01, then it is CMS-formatted enveloped contents encrypted with the PEV’s public key, whose contents are CMS-formatted signed contents signed with the EVSE’s signing key, with the contents given in Table 11-154 below. If Security Type = 0x00, then it is the contents given in Table 11-154 below without CMS formatting.

Table 11‑142: Content of CM\_SLAC\_MATCH.CNF Var Field

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size  (Octets) | Definition |
| PEV ID | 1 - 17 | 17 | **PEV Identification**  VIN code of PEV |
| PEV MAC | 18-23 | 6 | **PEV MAC**  MAC address of PEV |
| EVSE ID | 23-40 | 17 | **EVSE Identification**  EVSE identification number |
| EVSE MAC | 41-46 | 6 | **EVSE MAC**  MAC address of EVSE |
| RunID | 47-62 | 16 | **Run Identifier**  Identifier given by PEV in the CM\_STAR\_ATTEN\_CHAR.IND message |
| NID | 63-70 | 8 | **Network ID**  NID of matching EVSE |
| NMK | 71-86 | 16 | **Network Membership Key**  NMK of matching EVSE if content type is encrypted, all zeroes otherwise. |

* + 1. **CM\_SLAC\_USER\_DATA.REQ (GREEN PHY)**

The **CM\_SLAC\_USER\_DATA.REQ** is generated by the HLE of a GP to carry user data related to SLAC. User data is carried in fields call TLVs (Type, Length and Value).

**Table 11‑155: CM\_SLAC\_USER\_DATA.REQ Message**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field** | **Octet Number** | **Field Size**  **(Octets)** | **Definition** |
| Broadcast\_TLV | 0 | 3 | Octets 0 and 1 are set to 0x0200  Octet 2 is:  0x00 = Send the MME using unicast,  0x01 = Send the MME using within the AVLN broadcast  0x02 = Send the MME using multi-network broadcast |
| TLVs | 3 | Var | TLVs – May be empty. |
| End\_of\_data\_TLV | 3 + length(Var) | 2 | Set to 0x0000 (i.e. TLV\_TYPE=0 and TLV\_STR\_LEN=0) |



#### Broadcast\_flag

The user data may need to be sent as Multi-Network Broadcast. In such cases, the MAC needs to know that this message has to be sent as Multi-Network broadcast as the typical behavior of the MAC is to send any broadcast MSDUs or unicast MSDUs as broadcast or unicast within the AVLN. Essentially, this field enables the MAC to route the packet to the proper queue.

#### User\_data\_TLVs

The TLVs Field contains zero or more user defined TLVs.

**Table 11-156:** **TLVs Field**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field** | **Octet Number** | **Field Size**  **(Octets)** | **Definition** |
| TLV\_1 | 0 | 2 + TLV\_STR\_LEN\_1 | First TLV. May only be the only TLV in the TLVs Field. |
|  | … |  |  |
| TLV\_N |  | 2 + TVL\_STR\_LEN\_N | Last TLV. N maybe 1 or more. |

##### TLV

**Table 11-157: TLV Field**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field** | **Octet Number** | **Field Size** | **Definition** |
| TLV\_TYPE | 0-1 | 7-bits | Set to 127. |
| TLV\_STR\_LEN | 9-bits | Length of TLV information string field |
| TLV\_INFO\_STR | 3 | TVL\_STR\_LEN | Sequence of TVL\_STR\_LEN octets. |

##### TLV\_TYPE

The TLV\_TYPE field for organizationally defined TLVs is always set to 127. The values 0-126 are reserved.

##### TLV\_STR\_LEN

The TLV\_STR\_LEN field is set to the number of octets in the TLV\_INFO\_STR field. For organizationally defined TLVs TLV\_STR\_LEN field is 4 octets (OUI + SUBTYPE) plus the number of octets in INFO\_STR. See below.

##### TLV\_INFO\_STR

**Table 11-158: TLV\_INFO\_STR Field**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field** | **Octet Number** | **Field Size**  **(Octets)** | **Definition** |
| OUI | 0 | 3 | organizationally unique identifier (OUI) |
| SUBTYPE | 3 | 1 | organizationally defined subtype |
| INFO\_STR | 4 | TVL\_STR\_LEN - 4 | organizationally defined information string |

###### OUI

The OUI field shall contain the organization’s OUI as defined in Clause 9 of IEEE 802 [4].

###### Subtype

The organizationally defined subtype field contains a unique subtype value assigned by the defining organization. Defining organizations are responsible for maintaining listings of organizationally defined subtypes in order to assure uniqueness.

###### INFO\_STR

The organizationally defined information string is a sequence of octets that is interpreted as the defining organization desires.

##### End\_of\_data\_TLV

The End\_of\_data\_TLV field is a two octet all zero TLV that is used to mark the end of the sequence of TLVs in the MME.

* + 1. **CM\_SLAC\_USER\_DATA.CNF (GREEN PHY)**

CM\_SLAC\_USER\_DATA.CNF is generated by the HLE of a GP STA in response to the CM\_SLAC\_USER\_DATA.REQ received from the MAC of the STA.

The format of CM\_SLAC\_USER\_DATA.CNF is the same as CM\_SLAC\_USER\_DATA.REQ (see 11.5.59). The Broadcast\_flag is set to the same value as was received in the CM\_SLAC\_USER\_DATA.REQ.

## Manufacturer-Specific Messages

Manufacturer-specific messages are messages used by equipment manufacturers to implement the primitives at the H1, M1, or other interfaces. The format and use of manufacturer-specific messages are manufacturer dependent.

The difference between manufacturer-specific and vendor-specific messages (Section 11.7) is that manufacturer-specific messages shall never be transmitted over the powerline.

## Vendor-Specific Messages

Vendor-specific messages are used by implementers of STAs (“vendors”) to enhance the functionality of the system when exchanged between STAs designed by the same vendor. The first three octets of the Vendor-Specific Management Message Entry shall contain the IEEE-assigned OUI as described in reference [4]. The bit and octet order of the OUI here and elsewhere in this specification is identical to the bit and octet order of the MAC address as described in Section 4.1.2. The remaining fields in these messages are defined by the vendor.

Vendor-specific messages may be transmitted over the powerline.

Table 11‑143: Vendor-Specific MME Fields

|  |  |  |  |
| --- | --- | --- | --- |
| Field | Octet Number | Field Size (Octets) | Definition |
| OUI | 0 – 2 | 3 | Organizationally Unique Identifier |
| Vendor Defined | - | Var | Vendor defined |