



Technical Specification

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MEF UNI Type II - Approved Draft 2

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1. Abstract

This document describes the UNI Type II technical specification for a Metro Ethernet Network. This technical specification addresses the E-LMI protocol. The E-LMI protocol is based on ITU-T Q.933, Q.36 and other relevant recommendations as well as Frame Relay Local Management Interface (FR-LMI) Implementation Agreement document defined by the Frame Relay Forum and related ITU-T recommendations.

The E-LMI procedures and protocol are used for enabling auto configuration of the CE to support Metro Ethernet services. The E-LMI protocol also provides UNI and EVC status information to the CE. The UNI and EVC information enables automatic configuration of CE operation based upon the Metro Ethernet Network configuration.

2. Terminology

BPDU	Bridge Protocol Data Unit
CE	Customer Equipment
CIR	Committed Information Rate
CRC	Cyclic Redundancy Check
E-Line	Ethernet Line Service
E-LAN	Ethernet LAN Service
EVC	Ethernet Virtual Connection
GARP	Generic Attribute Registration Protocol
GRE	Generic Routing Encapsulation
IETF	Internet Engineering Task Force
ITU	International Telecommunication Union
LAN	Local Area network
LACP	Link Aggregation Control Protocol
MAC	Media Access Control
MEF	Metro Ethernet Forum
MEN	Metro Ethernet Network
OAM	Operations, Administration and Maintenance
PIR	Peak Information Rate
QoS	Quality of Service
SLA	Service Level Agreement

SLS	Service Level Specification
STP	Spanning Tree Protocol
Subscriber	The organization purchasing and/or using Ethernet Services. Alternate term: Customer
UNI	User to Network Interface
User Network Interface	The demarcation point between the responsibility of the Service Provider (UNI N) and the responsibility of the Subscriber (UNI C).

3. Scope

The E-LMI protocol is based on the relevant IEEE Ethernet standards, ITU-T frame relay standards, Frame Relay Forum implementation agreements, and Metro Ethernet Forum technical specifications and contributions (see the list of references in Section 6).

The E-LMI protocol is used for enabling the CE to request and receive status and service attributes information from the MEN so that it can configure itself to access Metro Ethernet services. The Metro Ethernet Forum has defined a complete set of service attributes and associated parameters of Ethernet services observable from User Network Interface to User Network Interface ([3], [6]). This technical specification specifies the E-LMI to contain EVC and UNI status information and UNI and EVC information sufficient to allow the CE to auto-configure itself.. Although E-LMI is based to a large extent on the Frame Relay LMI, unlike the Frame Relay LMI, E-LMI does not manage the link between the CE and the MEN. E-LMI assumes that this is accomplished by other means such as the link management function in IEEE 802.3ah. [12].

The means by which the E-LMI capability is activated on the CE and/or the MEN is beyond the scope of this technical specification. The E-LMI technical specification is not intended to deal with operation, administration and maintenance procedures on the UNI.

4. Compliance Levels

The key words "**MUST**", "**MUST NOT**", "**REQUIRED**", "**SHALL**", "**SHALL NOT**", "**SHOULD**", "**SHOULD NOT**", "**RECOMMENDED**", "**MAY**", and "**OPTIONAL**" in this document are to be interpreted as described in [4]. All key words must be in upper case, bold text.

5. E-LMI Messages, Protocol and Procedures

5.1 E-LMI Scope

The E-LMI protocol has a local significance on the UNI between the MEN and the CE. The scope of the E-LMI protocol is shown in Figure 1.

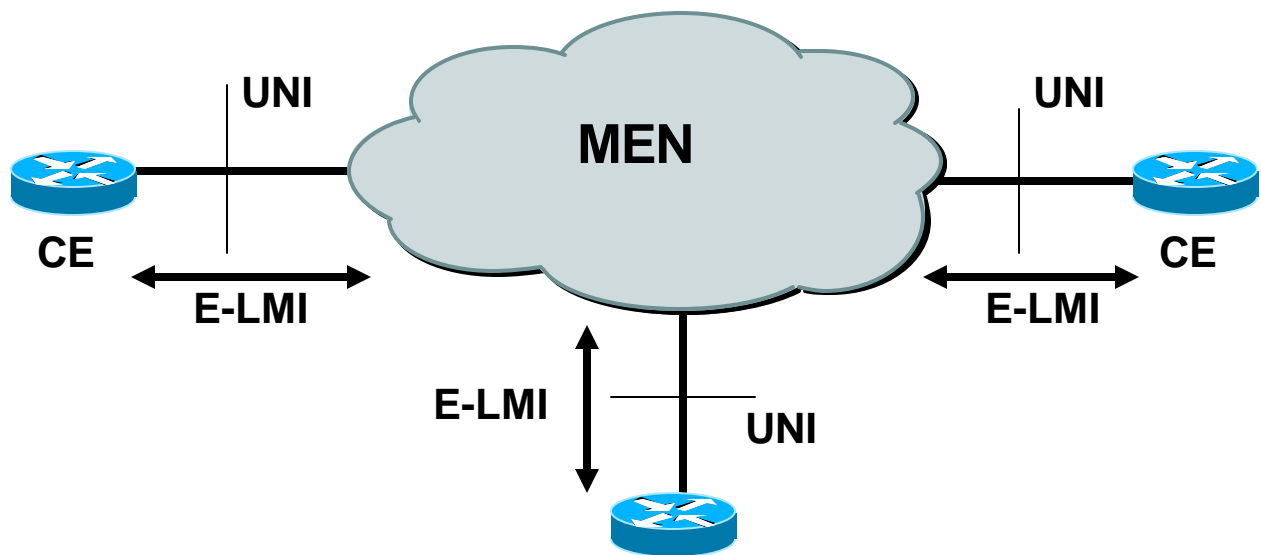


Figure 1 – E-LMI Scope

The E-LMI section of the UNI Type II technical specification defines the protocol and procedures that conveys the information that allows auto configuration of the CE. The E-LMI protocol also provides the means for notification of the status of an Ethernet Virtual Connection. In particular, the E-LMI protocol includes the following procedures:

1. Notification to the CE of the addition of an EVC;
2. Notification to the CE of the deletion of an EVC;
3. Notification to the CE of the availability state of a configured EVC (Active, Not Active, or Partially Active);
4. Communication of UNI and EVC attributes to the CE.

The mechanisms internal to the MEN for determining the information that is carried by E-LMI is beyond the scope of this Technical Specification. The E-LMI messages are transferred across the UNI using Ethernet frames (as defined in Section 5.2).

Figure 2 illustrates the E-LMI protocol message flow between the Metro Ethernet Network and the CE from the perspective of the CE device.

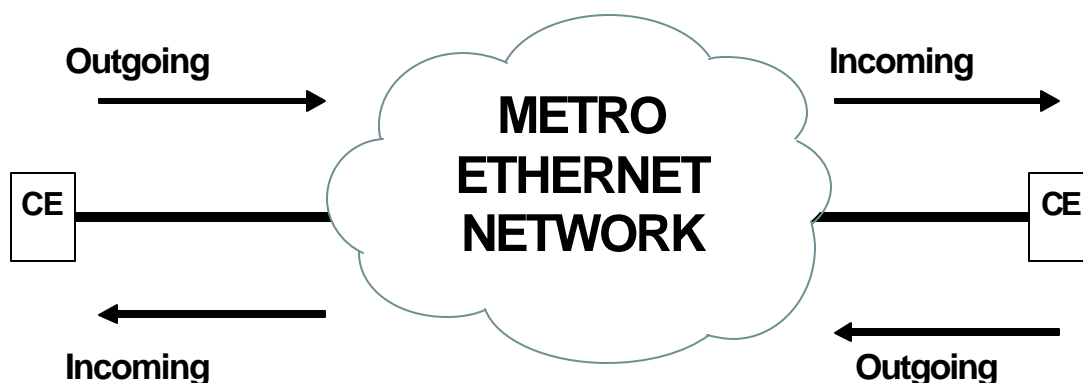


Figure 2 – E-LMI Protocol message flow

5.2 E-LMI Framing Mechanism

In order to transfer E-LMI messages between the CE and the MEN, a framing or encapsulation mechanism is needed. This section describes the framing mechanism defined for transferring E-LMI messages across the Ethernet UNI interface between the CE and MEN. The E-LMI frame structure is based on the IEEE 802.3 basic untagged MAC-frame format.¹

The E-LMI messages are encapsulated inside Ethernet frames and the E-LMI framing structure is presented in Figure 3. When the E-LMI message is less than 46 octets, pad octets with value 0x00 are added such that the E-LMI PDU is 46 octets long.

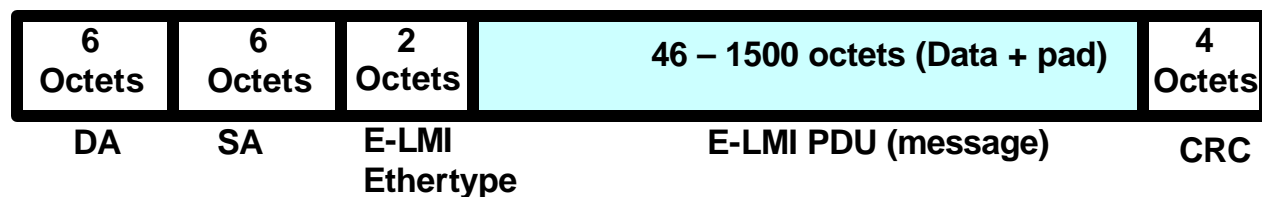


Figure 3 – E-LMI Framing structure

Editor Note 1: We have agreed that the E-LMI protocol will be identified by a well known MAC address (and possibly) in combination with an Ethertype. It is time to send a liaison to IEEE 802.1 asking their advice on this issue.

The source address **SHALL** be the MAC address of the sending station or port.

¹ The E-LMI technical specification is intended to be compatible with all IEEE 802 MACs.

5.3 E-LMI Status Information

The E-LMI protocol provides the E-LMI UNI status and EVC status information to the CE.

5.3.1 E-LMI UNI status (Operational/Not Operational)

The UNI is defined to be in the “Not Operational” state when the CE-VLAN ID/EVC Map is empty. The UNI is defined to be in the “Operational” state when the CE-VLAN ID/EVC Map contains at least one entry, i.e., the UNI is in at least one EVC. The UNI can be in one of the following states:

- Operational
- Not Operational

If the UNI is in “Not Operational” state, no data Service Frames **SHALL** be sourced by the MEN and any ingress data Service Frames **SHALL** be discarded by the MEN. The same procedure will be applied to any tunneled Layer 2 Control Protocols. All other Layer 2 Control Protocols will continue to operate as normal.

5.3.2 EVC Status (New, Active, Not Active, Partially Active, Deleted)

When an EVC is “New,” it has just been added to the CE-VLAN ID/EVC Map. When the EVC is “New,” it can be either in the “Active” or “Not Active” state. ~~When an EVC is “Deleted,” it has just been removed from the CE-VLAN ID/EVC Map.~~ When an EVC is “Active,” it is in the CE-VLAN ID/EVC Map and fully operational between the UNIs in the EVC. When an EVC is “Not Active,” it is in the CE-VLAN ID/EVC Map but not capable of transferring traffic among any of the UNIs in the EVC. The status “Partially Active” is applicable for Multipoint-to-Multipoint EVCs. When a Multipoint-to-Multipoint EVC is “Partially Active,” it is in the CE-VLAN ID/EVC Map, it is capable of transferring traffic among some but not all of the UNIs in the EVC. Table 1 details the possible combinations of ~~“Deleted”~~, “New”, “Active”, and “Not Active” ~~and “Partially Active”~~ for a “Point-to-Point EVC. Table 2 details the possible combinations of ~~“Deleted”~~, “New”, “Active”, “Not Active” and “Partially Active” for a “Multipoint-to-Multipoint EVC.

New	Active	Not Active
✓	✓	
✓		✓
	✓	
		✓

Table 1 – Possible Status Combinations for a Point-to-Point EVC

New	Active	Not Active	Partially Active
✓	✓		
✓		✓	
✓			✓
	✓		
		✓	
			✓

Table 2 – Possible Status Combinations for a Multipoint-to-Multipoint EVC

5.4 E-LMI Service Attributes and Parameters

In order to enable the auto configuration of the Customer Edge (CE) equipment, a certain set of service attributes (and parameters) have to be provided by the service provider's network. This section identifies the service attributes that will be provided to the CE for the auto configuration based upon the MEN network configuration. The service attributes supported in this specification include a subset of the service attributes defined by Metro Ethernet Forum. The Metro Ethernet Forum has defined a set of service attributes and associated parameters of Ethernet services observable from User Network Interface to User Network Interface ([3], [6]). This technical specification specifies the E-LMI to contain EVC and UNI status information and UNI and EVC information sufficient to allow the CE to auto-configure itself. However, the use of TLV coding will allow this protocol to be easily extended to all service attributes.

The following is the list of the key E-LMI service attributes that are provided to the CE attached to the UNI.

5.4.1 CE-VLAN ID/EVC Map

At each UNI there is an association of CE-VLAN IDs and EVCs. For more information related to this service attribute see Section 7.6 of [3].

5.4.2 Bandwidth Profile

A bandwidth Profile is characterization of the lengths and arrival times for a sequence of Service Frames at the UNI. Ingress bandwidth profile service attributes defined ([3], Section 7.10) specify the ways that Bandwidth Profiles can be applied to subscriber Service Frames. In this version of the E-LMI document, only ingress Bandwidth Profiles are defined; egress Bandwidth Profiles are beyond the scope of this document. The following ingress Bandwidth Profiles are defined:

- Ingress Bandwidth Profile per UNI
- Ingress Bandwidth Profile per EVC
- Ingress Bandwidth Profile per CoS Identifier

5.4.2.1 *Ingress Bandwidth Profile Parameters*

An ingress Bandwidth Profile is specified by the following traffic parameters ([6]):

- Committed Information Rate (**CIR**)
- Excess Information Rate (**EIR**)
- Committed Burst Size (**CBS**)
- Excess Burst Size (**EBS**)
- Coupling Flag (**CF**)
- Color Mode (**CM**)

5.4.2.2 *Ingress Bandwidth Profile per Ingress UNI*

This Bandwidth Profile applies to all Service Frames mapped to the UNI.

5.4.2.3 *Ingress Bandwidth Profile per EVC*

This Bandwidth Profile applies to all Service Frames mapped to a particular EVC at the UNI.

5.4.2.4 *Ingress Bandwidth Profile per CoS*

This Bandwidth Profile applies to all Service Frames mapped to a particular CoS instance.

5.5 E-LMI Messages

The following are the two messages defined for the E-LMI protocol:

- STATUS and
- STATUS ENQUIRY

5.5.1 General Message Format and Information Element Coding

This section describes the E-LMI message format and message information elements which are included in the E-LMI messages (STATUS and STATUS ENQUIRY messages).

Every message of the E-LMI protocol **SHALL** consist of the following parts:

- a) Protocol Version

- b) Message Type
- c) Report Type
- d) Other information elements.

The E-LMI message parts a), b), and c) are common to all the E-LMI messages and **SHALL** always be present. Each message **MAY** have additional information elements. The E-LMI message organization is shown in Figure 4.

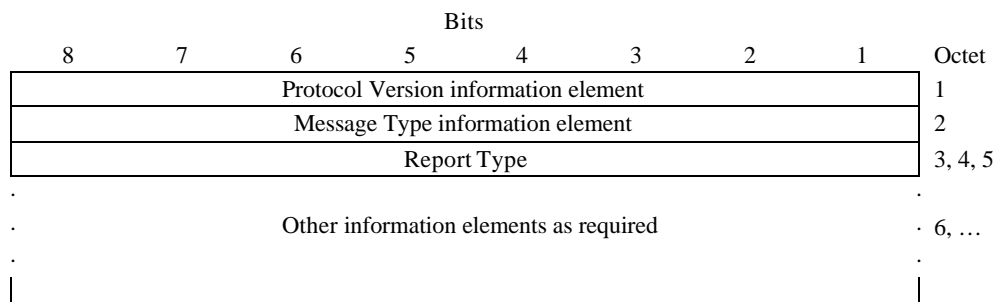


Figure 4 – General E-LMI message organization example

Relative to Figure 4, the octets of an E-LMI message are transmitted from top to bottom, and the bits of each octet are transmitted from left to right.

Unless specified otherwise, a particular information element **MUST** be present only once in a given message.

The information elements used for the E-LMI protocol are shown in Table 3.

Information element	Information element identifier	Section Reference
Protocol version	Not applicable	5.5.3.1
Message type	Not applicable	5.5.3.2
Report Type	0 1 0 1 0 0 0 1	5.5.3.3
E-LMI Sequence Numbers	0 1 0 1 0 0 1 0	5.5.3.4
UNI	0 1 0 1 0 0 1 1	5.5.3.6
EVC Status	0 1 0 1 0 1 0 0	5.5.3.8
CE-VLAN ID/EVC Map	0 1 0 1 0 1 0 1	5.5.3.5
EVC Parameters	0 1 0 1 0 1 1 0	5.5.3.7

Table 3 – Information Elements

The values of the sub-information elements used for the E-LMI protocol are shown in Table 4.

Sub-information element	Information element identifier
Bandwidth Profile	0 0 0 0 1 0 0 1
EVC Map Entry	0 0 0 0 1 0 1 1
UNI Identifier	0 0 0 0 1 1 1 1

Table 4 – Sub-information Elements

The coding of the information elements other than Protocol Version and Message Type is as follows:

- The information elements, other than Protocol Version and Message Type, which are used with the E-LMI protocol, are of variable length. There is a particular order of appearance for each information element in a message. The code values of the variable length information element identifiers are assigned in numerical order according to the actual order of appearance of each information element in a message. This allows a receiver to detect the presence or absence of a particular information element without scanning through the entire message.
- When the description of the information elements contains reserve bits, these spare bits **SHALL** be set to "0".
- The second octet of a variable length information element indicates the total length of the contents starting with octet 3. It is the binary coding of the number of octets of the contents, with bit 1 as the least significant bit.
- Each octet of a variable length information element is numbered in the figures.
- An octet group is a self-contained entity; it contains one or more octets. For E-LMI information elements, the internal structure of an octet group is described as follows: The first octet of an octet group is identified by a number (N) in the figures. The subsequent octets are identified as N.1, N.2, N.3, ... in the figures.
- When a field extends over more than one octet, the order of bit values progressively decreases as the octet number increases. The least significant bit of the field is represented by the lowest numbered bit of the highest-numbered octet of the field.

5.5.2 E-LMI STATUS and STATUS ENQUIRY Messages

5.5.2.1 STATUS

The STATUS message is sent by the MEN to the CE in response to a STATUS ENQUIRY message to indicate the status of EVCs or for the exchange of E-LMI sequence numbers. Optionally, it **MAY** be sent at any time to indicate the status of a single EVC.

Optionally the STATUS message can include EVC Service Attributes and Parameters. (See Section 5.5.3.7.) This additional information enables automatic configuration of CE devices based upon the network configuration. This information is not included in the optional asynchronous status message (Type of Report equal to Single EVC Asynchronous Status).

The STATUS messages are sent using the E-LMI framing mechanism defined in Section 5.2. The structure of the STATUS message is presented in Figure 5.

Message Type: STATUS		Direction: MEN to CE	
Significance: Local			
Information element	Reference	Type	Length
Protocol Version	5.5.3.1	M	1
Message Type	5.5.3.2	M	1
Report Type	5.5.3.3	M	3
E-LMI Sequence Numbers	5.5.3.4	O (Note 1)	4
UNI	5.5.3.6	O (Note 2)	Up to 120
EVC Status (Note 3,7)	5.5.3.8	O (Note 4)	5 (Note 3)
CE-VLAN ID/EVC Map (Note 6, 7)	5.5.3.5	O (Note 5)	Depending on the number of VLAN IDs(Note 6)
EVC Parameters (Note 6,7)	5.5.3.7	O (Note 5)	Up to 69 (Note 6)

NOTE 1 – Mandatory if the **Type of Report** is *Full Status* or *E-LMI Check* or *Full Status Continued*. Not included in the optional asynchronous status message (**Report Type** equal to *Single EVC Asynchronous Status*).

NOTE 2 – Included in the case of a full status to indicate the status and parameters of UNI.

NOTE 3 – Included if the Type of Report is *Full Status*. In this case a STATUS message contains the status information elements of all EVCs on the UNI. . There is one information element for each Ethernet Virtual Connection configured on that UNI. The EVC Status information elements are arranged in the message in ascending order of EVC Reference IDs; the EVC with the lowest EVC rference ID is first, the second lowest EVC Reference ID is second, and so on. (See Section 5.5.3.5 for a description of the EVC Reference ID.) If all information elements cannot be sent in a single Ethernet frame, more STATUS messages **MUST** be sent with Type of Report *Full Status Continued*. The asynchronous STATUS message can contain a Single EVC Status information element.

NOTE 4 – Mandatory if the report type information element indicated *full status* or *single EVC asynchronous status* and the UNI has EVCs configured.

NOTE 5 – Included in the case of a *full status* message to report parameters and mappings to CE. The conditions when they are included are specified in the procedures.

NOTE 6 – This information element can be repeated in the STATUS message for each EVC on the UNI.

NOTE 7 – The following three information elements to a specific EVC **MUST** appear in the following order when present: EVC Status, CE-VLAN/EVC Map, and EVC Parameters .

Figure 5 – STATUS message

Figure 6 displays the information elements that are carried in the STATUS message for each Type of Report information element value.

Information Element	Report Type Information Element Value			
	Full Status	E-LMI Check	Single EVC Asynchronous Status	Full Status Continued
E-LMI Sequence Numbers	X	X		X
UNI	X			
EVC Status	X		X	X
CE-VLAN ID/EVC Map	X			X
EVC Parameters	X			X

Figure 6 – Relationship between the Type of Report and Information Elements in the STATUS message

5.5.2.2 STATUS ENQUIRY

This message is sent by the CE to request the status of all EVCs, or to verify E-LMI sequence numbers. Sending a STATUS message in response to a STATUS ENQUIRY message is mandatory. The structure of the STATUS ENQUIRY message is presented in Figure 7.

Message type: STATUS ENQUIRY Direction: CE to MEN			
Significance: Local			
Information element	Reference	Type	Length
Protocol Version	5.5.3.1	M	1
Message type	5.5.3.2	M	1
Report Type	5.5.3.3	M	3
E-LMI Sequence Numbers	5.5.3.4	M	4

Figure 7 – STATUS ENQUIRY message

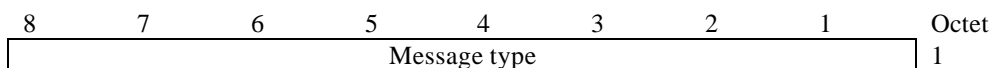
5.5.3 E-LMI Message Elements

5.5.3.1 Protocol Version

This one-octet field indicates the version supported by the CE and MEN. This field **SHALL** contain the value 0x01 to claim compliance with Version 1 of this protocol.

5.5.3.2 Message Type

The purpose of the message type is to identify the function of the E-LMI message being sent. The message type is the second part of every message. The message type is coded as shown in Figure 8 and Figure 9. Bit 8 is reserved for possible future use as an extension bit.


Figure 8 – Message type

Bits								Message Type
8	7	6	5	4	3	2	1	
0	1	1	1	1	1	0	1	– STATUS
0	1	1	1	0	1	0	1	– STATUS ENQUIRY

Figure 9 – E-LMI Message types

The following sub-sections define the structure and values of all information elements that are used for E-LMI STATUS and STATUS ENQUIRY messages.

5.5.3.3 Report Type Information Element

The purpose of the Report Type information element is to indicate the type of enquiry requested when included in a STATUS ENQUIRY message or the contents of the STATUS message. The length of this information element is 3 octets. See Figure 10.

8	7	6	5	4	3	2	1	Octet
Report Type information element identifier								
0	1	0	1	0	0	0	1	1
Length of Report Type contents (always = 0x01)								2
Type of report								3
<i>Type of report (octet 3)</i> Bits <u>8765 4321</u> 0000 0000 Full status (status of the UNI and all EVCs on the UNI) 0000 0001 E-LMI Check 0000 0010 Single EVC Asynchronous Status 0000 0011 Full status continued (status of the UNI and all EVCs on the UNI does not fit within a single Ethernet frame) NOTE 1 – The STATUS ENQUIRY message cannot send the single EVC asynchronous status in the Report Type information element. All other values are reserved.								

Figure 10 – Report Type Information Element

5.5.3.4 E-LMI Sequence Numbers Information Element

The purpose of the E-LMI Sequence Numbers information element is to exchange sequence numbers between the network and the CE on a periodic basis. This allows each protocol entity to

detect if it has not received messages and to acknowledge receipt of messages to the other entity. It also allows detection of E-LMI process restart. The length of this information element is 4 octets. See Figure 11.

8	7	6	5	4	3	2	1	Octet
E-LMI Sequence Numbers information element identifier								
0	1	0	1	0	0	1	0	1
Length of E-LMI Sequence Numbers contents (=0x02)								2
Send sequence number								3
Receive sequence number								4
<i>Send sequence number (octet 3)</i> The current send sequence number of the originator of the message. It is binary encoded. <i>Receive sequence number (octet 4)</i> The send sequence number received in the last received message. It is binary encoded.								

Figure 11 – E-LMI Sequence Numbers Information Element

5.5.3.5 CE-VLAN ID/EVC Map Information Element

The purpose of the CE-VLAN ID/EVC Map information element is to convey how CE VLAN IDs are mapped to specific EVCs. The maximum number of bytes needed to carry this information element depends on the number of VLAN IDs mapped to an EVC. The length of this information element is $(7 + 2 \times \text{Number of VLAN IDs})$ octets. When the number of octets needed exceeds 255, this information element can be repeated for the same EVC.

See Figure 12 for detailed structure of the CE-VLAN ID/EVC Map information element. The EVC Reference ID in Figure 12 is a shorthand method of referring to an EVC. It allows the CE to correlate information received in the CE-VLAN ID/EVC Map IE, the EVC Parameters IE (Section 5.5.3.7) and the EVC Status Information Element (Section 5.5.3.8) to the same EVC. It is a binary encoded number in the range 0 – 65,535.

8	7	6	5	4	3	2	1	Octet
CE-VLAN ID/EVC Map information element identifier								1 (Note 1)
0	1	0	1	0	1	0	1	
Length of CE-VLAN ID/EVC Map information element								2
EVC Reference ID								3
EVC Reference ID – continue								4
Reserve 0	Last IE (Note 2)	CE-VLAN ID/EVC Map Sequence #						5
Reserve 0					Untagged /Priority Tagged (Note 4)	Default EVC (Note 3)		6
EVC Map Entry Sub-Information element identifier								7
0	0	0	0	1	0	1	1	
Length of EVC Map Entry contents								8
CE VLAN ID								9 (Note 5)
CE VLAN ID – continue								9.1
<p>NOTE 1 – If the CE-VLAN ID/EVC Map information content is greater than 255 octets, the information element will be sent in multiple CE-VLAN ID/EVC Map information elements.</p> <p><i>EVC Reference ID (octet 3 and 4)</i> Contains the Value of EVC Reference ID which is binary encoded. The EVC Reference ID is only significant at the local UNI.</p> <p><i>Sequence # (Octet 5, bits 6 to 1)</i> Sequence number of the IE segment. It starts with one for the first segment IE in the message and increments by 1 for subsequent IE segments in the message. It is used to check the order of multiple IE segments in a status message.</p> <p>NOTE 2 - If the “Last IE Bit” (Octet 5, bit 7) is set to 1, it indicates that this is the last (or only one) CE-VLAN ID/EVC Map information element segment.</p> <p>If the “Last IE Bit” is set to 0, it indicates that CE-VLAN ID/EVC Map is carried in more than one information element and this segment is not the last CE-VLAN ID/EVC Map information element segment.</p> <p>NOTE 3 – If “Default EVC” bit is set to 1, it indicates that all CE-VLAN IDs that are not specifically addressed are mapped to this EVC Reference ID. Only zero or one EVC can be identified as a Default EVC on the UNI. The “Default EVC” bit has significance only if <i>CE-VLAN ID/EVC Map Type</i> is equal to “General Bundling” (see UNI information element octet 3). It MUST be set to 0 when it is not significant.</p> <p>NOTE 4 – If “Untagged/Priority Tagged” bit is set to 1, it indicates that this EVC Map Entry identifies the CE VLAN ID for Untagged/Priority. The “Untagged/Priority tagged” bit has significance only if <i>CE-VLAN ID/EV Map Type</i> is not equal to “All to one Bundling” (see UNI information element octet 3). It MUST be set to 0 when it is not significant.</p> <p><i>CE VLAN ID (octet 9 and 9.1)</i> Value of CE VLAN ID. It is binary encoded.</p> <p>NOTE 5 – CE-VLAN ID octet sub-group (octets 9 and 9.1) can be repeated to map multiple CE-VLAN-IDs to an EVC. Both octets MUST be in the same EVC Map Entry sub-information element.</p>								

Figure 12 – CE-VLAN ID/EVC Map Information Element

5.5.3.6 UNI Information Element

The purpose of the UNI information element is to convey the status and other relevant UNI service attributes of the UNI as defined in [3]. This information element cannot be repeated in a STATUS message. The length of this information element depends on the number and size of UNI Identifier sub-information elements. The current maximum length of this information element is 120 octets. See Figure 13.

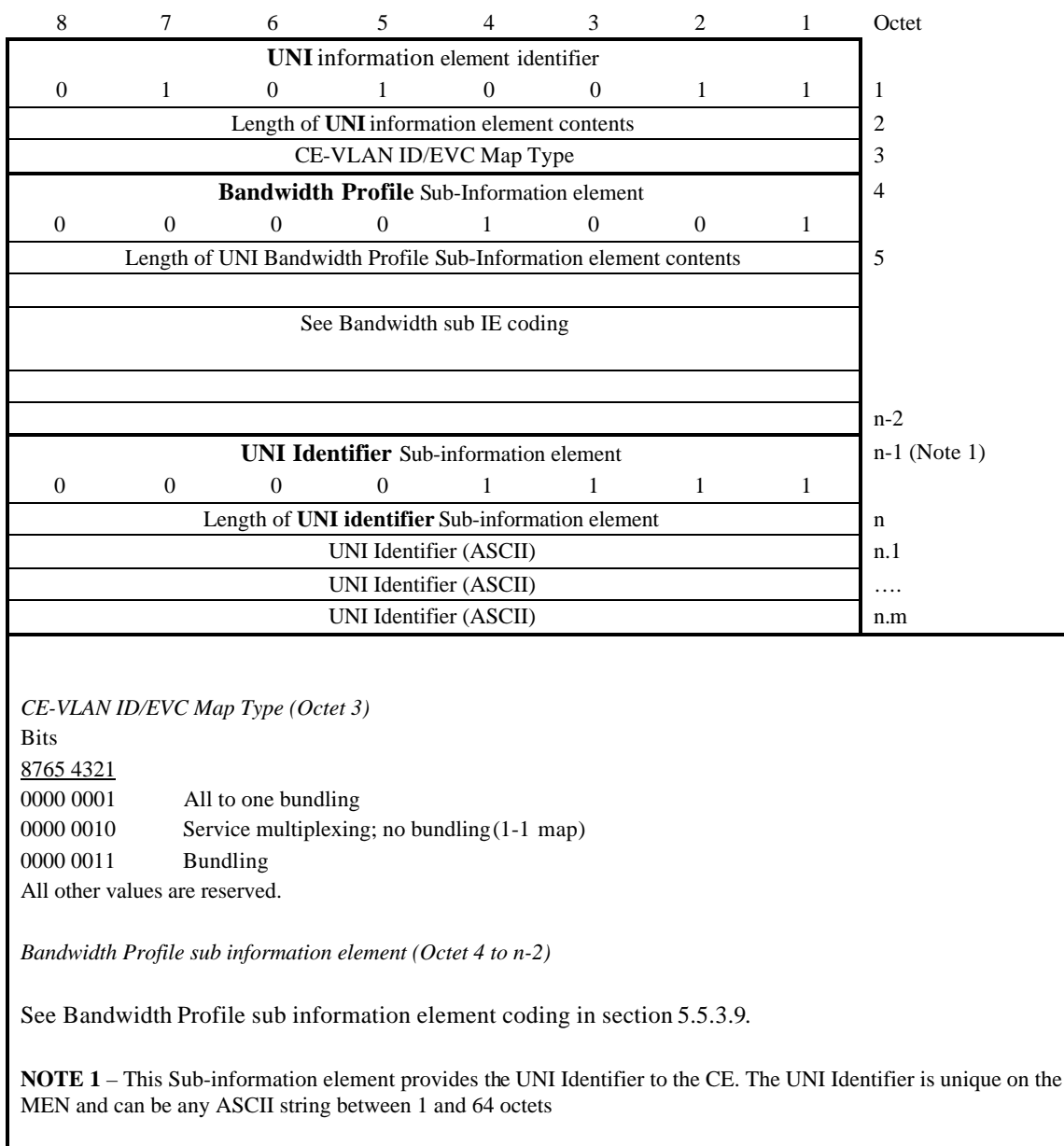


Figure 13 – UNI Status Information Element

5.5.3.7 EVC Parameters Information Element

The purpose of the EVC parameters information element is to convey the service attributes of an existing EVC on the UNI. This information element can be repeated, as necessary, in a STATUS message to indicate the service attributes of all configured EVCs on the UNI. The EVC Parameters Information Element **MUST** be sent for a given EVC in the next Full Status Message when:

- The E-LMI protocol first starts and the EVC has been provisioned,
- There is a change in any of the information conveyed by the EVC Parameter Information Element, or
- The EVC first has the “New” status.

Furthermore, the EVC Parameters Information Element for each existing EVC **MUST** be sent periodically every N_{EVC_Parm} Full Status Messages. (See Section 5.5.3.7.)

The current maximum length of this information element is 73 octets. See Figure 14.

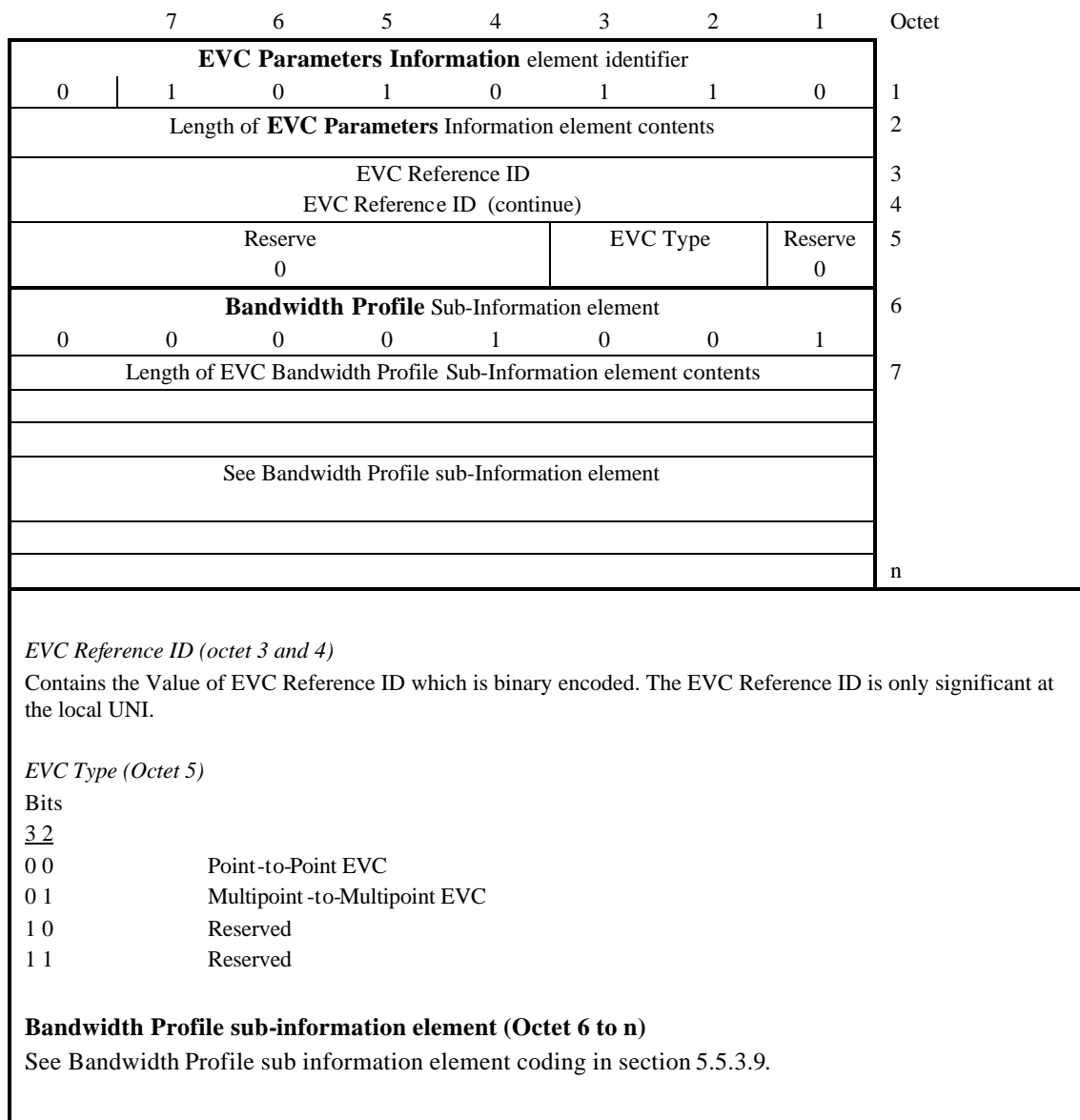


Figure 14 – EVC Parameters Information Element

5.5.3.8 EVC Status Information Element

The purpose of the EVC Status information element is to convey the status of a specific EVC on the UNI. This information element can be repeated, as necessary, in a STATUS message to indicate the status of all configured EVCs on the UNI.

The length of this information element is 5 octets, See Figure 15.

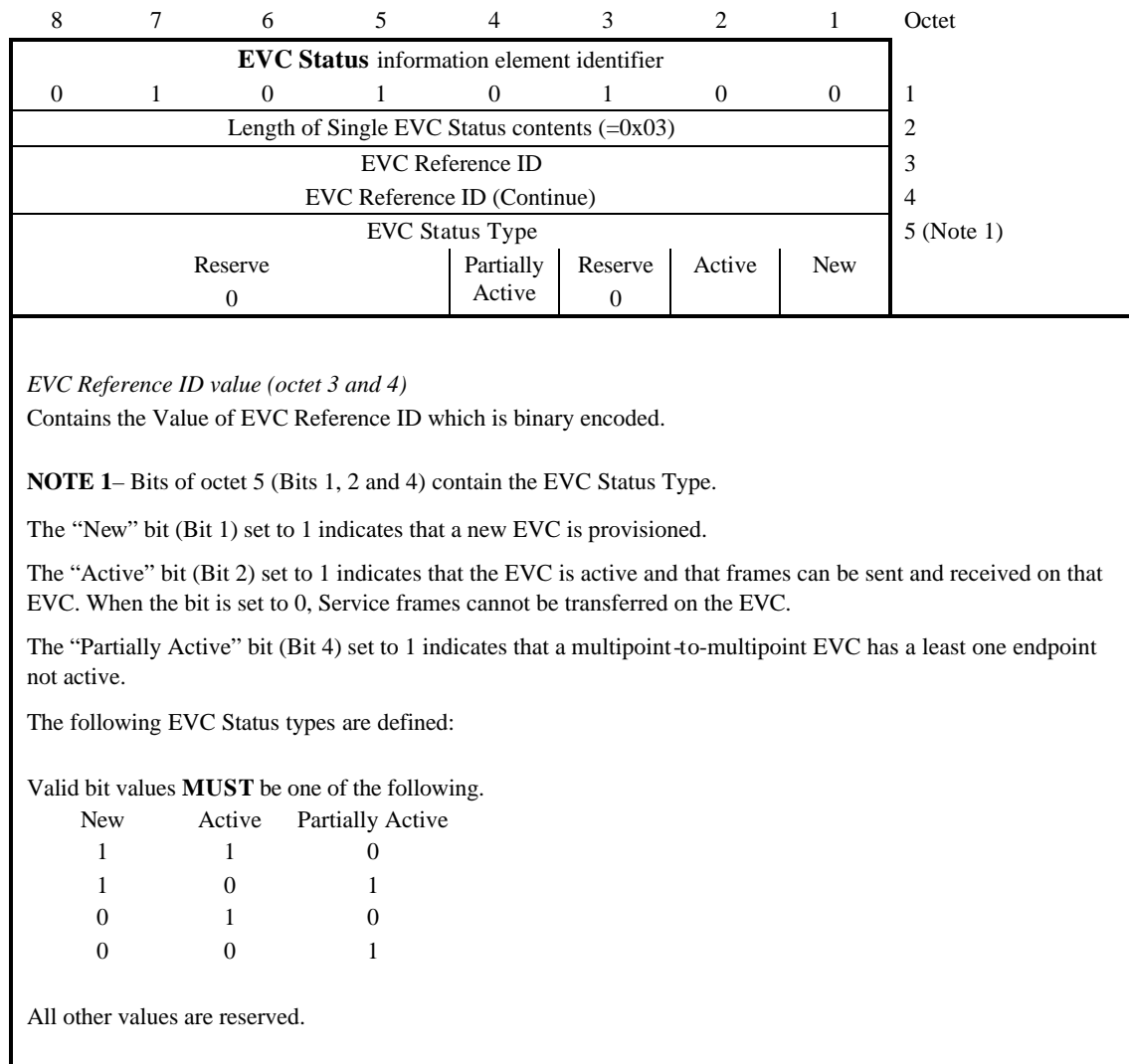


Figure 15 – EVC Status Information Element

5.5.3.9 Bandwidth Profile Sub-information Element

The purpose of the Bandwidth Profile sub-information Element is to convey the characterization of the length and arrival for a sequence of the Service Frames at the UNI. This information element is included in the UNI and EVC parameters Information elements. It can be repeated, up to eight times in an EVC parameters Information element.

The length of this information element is 14 octets, See Figure 15.

Bandwidth Profile Sub-Information element								1 (Note 1)
0	0	0	0	1	0	0	1	
Length of Bandwidth Profile Sub-Information element contents								2
Reserve 0				CM	CF	Per CoS bits (Note 2)		3
CIR Magnitude								4 (Note 3)
CIR Multiplier (Note 4)								4.1
CIR Multiplier (Continue)								4.2
CBS Magnitude								5 (Note 3)
CBS Multiplier (Note 5)								5.1
EIR Magnitude								6 (Note 6)
EIR Multiplier (Note 8)								6.1
EIR Multiplier (Continue)								6.2
EBS Magnitude								7
EBS Multiplier (Note 8)								7.1
user_prio rity bits 111	user_prio rity bits 110	user_prio rity bits 101	user_prio rity bits 100	user_prio rity bits 011	user_prio rity bits 010	user_prio rity bits 001	user_prio rity bits 000	8

NOTE 1 – The bandwidth Profile information elements can be repeated up to 8 times in the EVC Parameters IE and appear one time in the UNI IE.

Per CoS bit (Octet 3)

Bit

1 user_priority bit values are significant

0 user_priority bits are ignored and not processed

NOTE 2 – When this sub-information element appears in the UNI IE, this bit is set to 0. When this sub-information appears in the EVC Parameters, tf this bit is set to zero, then the Bandwidth Profile is a per-EVC Bandwidth Profile.

Coupling Flag bit (Octet 3)

Bit

2

0 Coupling Flag is not set

1 Coupling Flag is set

Color Mode Flag bit (Octet 3)

Bit

3

0 Color Mode Flag is not set

1 Color Mode Flag is set

Committed Information Rate (CIR) (Octet group 4)

NOTE 3 – If the **EVC Bandwidth Profile** has both CIR and CBS traffic parameters is set to 0, the multiplier will be coded as zero.

NOTE 4 – Octets 4.1 and 4.2 represent CIR multiplier value in binary. CIR = (CIR multiplier) * 10^(CIR magnitude) [Kbps].

Committed Burst Size (CBS) (Octet group 5)

NOTE 5 – Octet 5.1 represent the CBS multiplier value. $CBS = (CBS \text{ multiplier}) * 10^{(CBS \text{ magnitude})}$ [Kbytes].

Excess Information Rate (EIR) (Octet group 6)

NOTE 6 – If the EIR multiplier and magnitude are set to all 1's, it is assumed that EIR is set to the UNI link rate and EBS is an arbitrarily large number such that it is larger than any Service Frame.

NOTE 7– Octet 6.1 and 6.2 represent EIR multiplier value in binary. $EIR = (EIR \text{ multiplier}) * 10^{(EIR \text{ magnitude})}$ [Kbps].

Excess Information Rate (EBS) (Octet group 7)

NOTE 8 - Octet 12.1 represent the EBS multiplier. $EBS = (EBS \text{ multiplier}) * 10^{(EBS \text{ magnitude})}$ [Kbytes]

User priority bits (Octet 8)

Each bit identifies a user_priority value.

Figure 16 – Bandwidth Profile Sub-information Element

5.6 E-LMI Procedures

The E-LMI procedures are characterized by a set of E-LMI messages that will be exchanged at the UNI. The E-LMI procedures are modeled on the existing FR-LMI (Frame relay Local Management Interface) procedures.

MORE DETAILS WILL BE PROVIDED.

5.6.1 Protocol Detection

Editor Note 2: This section will cover procedures when either the network or the CE does not support the E-LMI.

5.6.2 Periodic polling

This section will provide the details of the polling procedure.

MORE DETAILS WILL BE PROVIDED

5.6.3 E-LMI Sequence Numbers Verification

The purpose of this procedure is to allow network and the CE to exchange message sequence numbers and thus verify the reception of messages.

MORE DETAILS WILL BE PROVIDED

5.6.4 Reporting new EVCs

The EVC reporting procedure is used to notify the CE about a new EVC.

MORE DETAILS WILL BE PROVIDED

5.6.4.1 *Reporting the availability of an EVC*

5.6.5 Sending the EVC Parameter Information Element

Editor Note 3: We will include the details of when the EVC Parameter Information Element must be sent including defining the parameter N_{EVC_Parm} .

5.6.6 EVC Asynchronous Status Report

The MEN is using the EVC Asynchronous Status Report procedure to report to the CE the change of the EVC status.

MORE DETAILS WILL BE PROVIDED

5.6.7 EVC Management Procedures

This procedure is used to report all needed service attributes that cannot be accommodate in one Ethernet frame.

MORE DETAILS WILL BE PROVIDED

5.6.8 Error conditions

This section deals with the detection of the error conditions on the MEN and CE sides.

MORE DETAILS WILL BE PROVIDED

5.6.8.1 *MEN operation errors*

5.6.8.2 *CE operation errors*

5.6.9 System parameters

This section summarizes the acceptable values for the configurable parameters.

MORE DETAILS WILL BE PROVIDED

5.6.10 Handling of error conditions

This section provides general rules required by each implementation to facilitate the orderly treatment of error conditions.

MORE DETAILS WILL BE PROVIDED

5.6.10.1 *Message too short*

5.6.10.2 *CE-VLAN ID error (inside UNI and EVC information elements)*

5.6.10.2.1 *Invalid Default Bundling EVC Id in the UNI information element*

5.6.10.2.2 *EVC ID procedural errors*

5.6.10.3 *Message type errors*

5.6.10.4 *General Information Element errors*

5.6.10.4.1 *Information element out of sequence*

5.6.10.4.2 *Duplicated Information Elements*

5.6.10.5 *Mandatory Information Element errors*

5.6.10.5.1 *Mandatory Information Element missing*

5.6.10.5.2 *Mandatory Information Element content error*

5.6.10.6 *Non-mandatory Information Element errors*

5.6.10.6.1 *Unrecognized Information Element*

5.6.10.6.2 *Non-mandatory Information Element content error*

5.6.10.6.3 *Unexpected recognized Information Element*

5.6.10.7 *Handling of data link exceptions of the E-LMI channel*

5.6.10.7.1 *Data link failure*

5.6.11 Optional bidirectional network procedures

This is a place holder. This issue will not be addressed in the initial version of the E-LMI.

5.6.12 Handling IEEE 802.3ah OAM loopback

MORE DETAILS WILL BE PROVIDED

5.7 Example: calculation of maximum number of UNI and EVC Information Elements per STATUS message

MORE DETAILS WILL BE PROVIDED

5.8 E-LMI State Machines

The E-LMI state machines are intended to complement, not replace or substitute the narrative description contained in the previous sections.

MORE DETAILS WILL BE PROVIDED

5.8.1 CE State Machine

5.8.2 MEN State Machine

6. References

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