



Mplify Standard

Mplify 167

**Broadband Access E-Line Test and Certification
Requirements**

April 2026

Disclaimer

© Mplify Alliance 2026. All Rights Reserved.

The information in this publication is freely available for reproduction and use by any recipient and is believed to be accurate as of its publication date. Such information is subject to change without notice and Mplify Alliance (Mplify) is not responsible for any errors. Mplify does not assume responsibility to update or correct any information in this publication. No representation or warranty, expressed or implied, is made by Mplify concerning the completeness, accuracy, or applicability of any information contained herein and no liability of any kind shall be assumed by Mplify as a result of reliance upon such information.

The information contained herein is intended to be used without modification by the recipient or user of this document. Mplify is not responsible or liable for any modifications to this document made by any other party.

The receipt or any use of this document or its contents does not in any way create, by implication or otherwise:

- a) any express or implied license or right to or under any patent, copyright, trademark or trade secret rights held or claimed by any Mplify member which are or may be associated with the ideas, techniques, concepts or expressions contained herein; nor
- b) any warranty or representation that any Mplify members will announce any product(s) and/or service(s) related thereto, or if such announcements are made, that such announced product(s) and/or service(s) embody any or all of the ideas, technologies, or concepts contained herein; nor
- c) any form of relationship between any Mplify member and the recipient or user of this document.

Implementation or use of specific Mplify standards, specifications, or recommendations will be voluntary, and no Member shall be obliged to implement them by virtue of participation in Mplify Alliance. Mplify is a global alliance of network, cloud, cybersecurity, and enterprise organizations working together to accelerate the AI-powered digital economy through standardization, automation, certification, and collaboration. Mplify does not, expressly or otherwise, endorse or promote any specific products or services.

Table of Contents

1	List of contributing members	1
2	Abstract	1
3	Terminology and abbreviations	2
4	Compliance Levels	3
5	Numerical Prefix Conventions	3
6	Introduction	4
6.1	Scope.....	4
6.2	Out of Scope	4
7	Test Topology	6
8	Test and Certification Requirements for Broadband Access E-Line Services	6
8.1	Broadband Access E-Line - OVC Service Attributes Test and Certification Requirements 6	
8.2	Broadband Access E-Line - OVC End Point at UNI Service Attributes Test and Certification Requirements	10
8.3	Broadband Access E-Line - Operator UNI Service Attributes Test and Certification Requirements	11
8.4	Broadband Access E-Line - ENNI Service Attributes, Common Attributes and Multilateral Attributes Test and Certification Requirements.....	13
9	References	15

List of Figures

Figure 1 - Example of Broadband Access E-Line Service test topology	6
---	---

List of Tables

Table 1 - Terminology.....	3
Table 2 - Abbreviations.....	3
Table 3 - Numerical Prefix Conventions.....	4
Table 4 - Broadband Access E-Line - OVC End Point at ENNI Service Attributes Test and Certification Requirements	8
Table 5 – Broadband Access E-Line - OVC End Point at ENNI Service Attributes Test and Certification Requirements	10
Table 6 – Broadband Access E-Line - OVC End Point at a UNI Service Attributes Test and Certification Requirements	11
Table 7 - Broadband Access E-Line - Operator UNI Service Attributes Test and Certification Requirements.....	13
Table 8 – Broadband Access E-Line - ENNI Service Attributes, Common Attributes and Multilateral Attributes Test and Certification Requirements	14

1 List of contributing members

The following members of Mplify participated in the development of this document and have requested to be included in this list.

- AT&T

2 Abstract

This document sets out test requirements for Broadband Access E-Line Services. The test requirements are based on the requirements laid out in MEF 140 [20]. The document is designed to be used by service providers (including subscriber service providers and operator service providers) and technology product vendors for the purposes of designing test environments and/or preparing for certification of their ability to deliver MEF 140-compliant Broadband Access E-Line services.

3 Terminology and abbreviations

Term	Definition	Reference
Broadband Access E-Line	Operator Access Services which adapt Access E-Line Services defined in MEF 51.1 [16] to the characteristics of Broadband Access Networks.	MEF 140
Broadband Access E-LAN	Operator Access Services which adapt Access E-LAN Services defined in MEF 51.1 to the characteristics of Broadband Access Networks.	MEF 140
Broadband Access Network	A network that transports data using one of the following access technologies: DOCSIS, PON, or satellite.	This document
Broadband Access Network Operator	The administrative entity that provides a Broadband Access Network.	This document
Broadcast Frame	An Ethernet Frame in which the destination MAC address is ff:ff:ff:ff:ff:ff (hexadecimal)	This document
Carrier Ethernet Services	Technology-agnostic layer-2 services that can be consumed directly by the enterprise or used between access, transit, and retail service providers for backhaul, cloud access, or multi-provider end-to-end services for seamless on-net and off-net connectivity.	This document
Ethernet Interface	One or more of the physical interfaces specified in Table A1-4 in MEF 61.1.1 [18].	This document
External Network Network Interface	The interfaces across which two Network Operators connect	Adapted from MEF 4 [14]
Multicast Frame	An Ethernet Frame in which the least significant bit of the first byte of the destination MAC address is 1.	This document
Priority Tagged Service Frame	A Service Frame in which the two bytes following the Source Address have the value 0x8100 and the corresponding C-Tag VLAN ID field has the value 0x000.	Adapted from MEF 10.4 [12]
Service	A connectivity service defined in this document MEF 6.3 [17], MEF 51.1 or MEF 140.	This document
Service Frame	An IEEE Std 802.3™ Ethernet Frame exchanged between a Service Provider and a Subscriber across a UNI.	Adapted from MEF 10.4
Unicast Frame	An Ethernet Frame in which the least significant bit of the first byte of the destination MAC address is 0.	This document
Untagged Service Frame	A Service Frame in which the two bytes following the Source Address do not have the value 0x8100 nor the value 0x88a8.	Adapted from MEF 10.4
VLAN Tagged Service Frame	A Service Frame in which the two bytes following the Source Address have the value 0x8100 and the corresponding C-Tag VLAN ID has a value that is not 0x000.	Adapted from MEF 10.4

Table 1 - Terminology

Abbreviation	Definition	Reference
DOCSIS	Data over Cable Service Interface Specification	CableLabs® documents [1][2]
EI	External Interface	MEF 26.2 [13]
ENNI	External Network to Network Interface	MEF 26.2
EVC	Ethernet Virtual Connection	MEF 10.4
OVC	Operator Virtual Connection	MEF 26.2
PON	Passive Optical Network	ITU-T documents [9][10][11]
UNI	User Network Interface	MEF 10.4
IEEE Std 802.3™	A generic reference to the IEEE Ethernet standard used when referring to attributes of Ethernet that do not vary across versions from IEEE Std 802.3™-2012 [4] through IEEE Std 802.3™-2018 [6].	This document

Table 2 - Abbreviations

4 Compliance Levels

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 (RFC 2119 [7], RFC 8174 [8]) when, and only when, they appear in all capitals, as shown here. All key words must be in bold text.

Items that are **REQUIRED** (contain the words **MUST** or **MUST NOT**) are labeled as **[Rx]** for required. Items that are **RECOMMENDED** (contain the words **SHOULD** or **SHOULD NOT**) are labeled as **[Dx]** for desirable. Items that are **OPTIONAL** (contain the words **MAY** or **OPTIONAL**) are labeled as **[Ox]** for optional.

5 Numerical Prefix Conventions

This document uses the prefix notation to indicate multiplier values as shown in Table 3.

Decimal		Binary	
Symbol	Value	Symbol	Value
K	10 ³	Ki	2 ¹⁰
M	10 ⁶	Mi	2 ²⁰
G	10 ⁹	Gi	2 ³⁰
T	10 ¹²	Ti	2 ⁴⁰
P	10 ¹⁵	Pi	2 ⁵⁰
E	10 ¹⁸	Ei	2 ⁶⁰
Z	10 ²¹	Zi	2 ⁷⁰
Y	10 ²⁴	Yi	2 ⁸⁰

Table 3 - Numerical Prefix Conventions

6 Introduction

MEF 140 describes how a Broadband Access Network, defined as a network that transports data using one of the following access technologies — DOCSIS, PON, or satellite — can be used to deliver Carrier Ethernet Services. One differentiating characteristic of these Broadband Access Networks is that they can share management and resources of the access connection between a variety of traffic types and multiple Subscribers. This is different than traditional Carrier Ethernet Services which are usually based on dedicated access connections.

MEF 140 has been introduced to define Broadband Access E-Line and E-LAN requirements. This document will serve as the corresponding Certification and Test Requirements so that service providers or third-party test vendors can use it as a reference to test and certify Broadband Access E-Line services.

6.1 Scope

Testing and certification criteria within this document apply only to Broadband Access E-Line services. Because of the complexity to orchestrate testing and certification of Access E-LAN services due to the need to test traffic from UNI to UNI in addition to ENNI to UNI, MEF 91 [19] only defines test requirements for Access E-Line services. For the same reasons, this document only focuses on Broadband Access E-Line.

Test and Certification requirements are grouped as follows:

- OVC Service Attributes
- OVC End Point at ENNI Service Attributes
- OVC End Point at UNI Service Attributes
- Operator UNI Service Attributes
- ENNI Attributes (including Common, Service and Operator Multilateral Attributes)

6.2 Out of Scope

Control and management protocols such as E-LMI, Link OAM, Service OAM UNI-MEG, Service OAM ENNI-MEG, Test MEG or protection mechanisms that may be operating at the external interfaces are out of scope for Certification of Broadband Access E-Line Services. The deployment and verification of these protocols can be handled between subscribers, service providers and operators. Where reasonable, this

document highlights what can be tested for the corresponding Service Attributes, even if the test results do not influence the outcome of certification.

7 Test Topology

This section provides the recommended topology for testing and certification of Broadband Access E-Line Services as covered in this document.

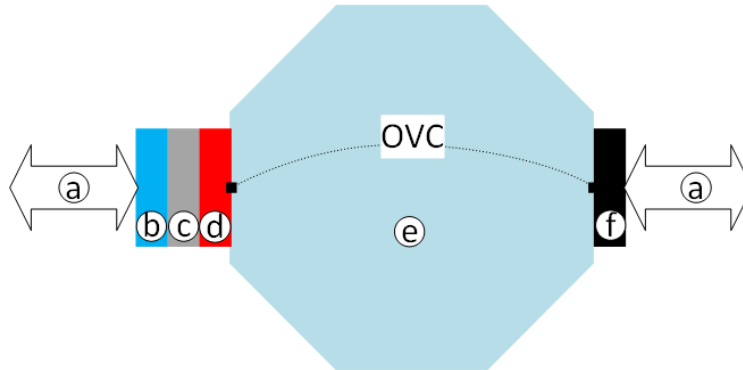


Figure 1 - Example of Broadband Access E-Line Service test topology

a) Test Traffic b) Subscriber UNI, c) an equipment which converts the Operator UNI physical interface into the Subscriber UNI physical interface, d) Operator UNI, e) Operator’s Network, f) ENNI

In Broadband Networks, the Operator UNI may be a separate end point from the Subscriber UNI, and an equipment, such as a cable modem for example in cable-TV/DOCSIS networks, translates the Operator UNI service into a Subscriber UNI service. The inner working of such equipment is dependent upon the Broadband Network technology used and is beyond the scope of MEF 140 and this document. The test equipment used on the UNI side of a Broadband Access E-Line service is connected in the same manner as a Subscriber UNI and the behavior of the Operator UNI will be inferred from what is perceived through the Subscriber UNI.

8 Test and Certification Requirements for Broadband Access E-Line Services

The following subsections describe test requirements to certify conformance of a Broadband Access E-Line service with MEF 140.

8.1 Broadband Access E-Line - OVC Service Attributes Test and Certification Requirements

An OVC is an association of OVC End Points located at the External Interfaces (UNIs and ENNIs) representing the logical connection between those End Points. The Service Attributes that describe the properties of an OVC independent of location are the OVC Service Attributes.

Table 4 lists the OVC Service Attributes and the allowed values for Broadband Access E-Line as defined in MEF 140 [R2]. Where applicable it refers to other standards such as MEF 51.1 if the governing requirement is further described.

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description
1	OVC ID	Per MEF 51.1	Not testable		A unique identifier within the Operator’s network for the OVC as specified in section 12.1 of MEF 26.2

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description								
2	OVC Type	<i>Point-to-Point</i>	MEF 51.1 [R9]	●	Broadband Access E-Line MUST be Point-to-Point								
3	OVC End Point List	Two endpoint identifiers	MEF 51.1 [R10]	●	Broadband Access E-Line MUST have one OVC End Point at an ENNI and one OVC End Point at a UNI								
4	Maximum Number of UNI OVC End Points	1	MEF 51.1 [R16]	●	MUST be 1 for Broadband Access E-Line								
5	Maximum Number of ENNI OVC End Points	1	MEF 51.1 [R17]	●	MUST be 1 for Broadband Access E-Line								
6	OVC Maximum Frame Size	≥1526	MEF 26.2 [R40]	●	At least 1526 Bytes								
7	OVC CE-VLAN ID Preservation	<i>Preserve or Strip</i>	MEF 140 Section 8.1.1 [R10], [R11]	●	<p>Only the UNI to ENNI case is affected by the value of the OVC CE-VLAN ID Preservation Service Attribute. Per MEF 140 [R10] when the value of the <i>OVC CE-VLAN ID Preservation Service Attribute = Preserve</i> the relationships between the ingress frame format at UNI and the corresponding egress frame format at ENNI MUST be as specified in MEF 140 Table 13:</p> <table border="1" data-bbox="992 611 1385 705"> <thead> <tr> <th>Ingress frame format</th> <th>Egress frame format</th> </tr> </thead> <tbody> <tr> <td>UT</td> <td>ST</td> </tr> <tr> <td>CT</td> <td>ST/CTI</td> </tr> <tr> <td>PT</td> <td>ST/PT</td> </tr> </tbody> </table> <p>Per MEF 140 [R11], when the value of the <i>OVC CE-VLAN ID Preservation Service Attribute = Strip</i> then egress frame at ENNI corresponding to an ingress frame at UNI MUST include an S-Tag and no C-Tag.</p> <p>For a precise definition of the frame formats, refer to MEF 140 section 8.1.1.</p>	Ingress frame format	Egress frame format	UT	ST	CT	ST/CTI	PT	ST/PT
Ingress frame format	Egress frame format												
UT	ST												
CT	ST/CTI												
PT	ST/PT												
8	OVC CE-VLAN PCP Preservation	MEF 140 Section 7.1	MEF 26.2 [R45], [R46]	●	<p>MEF 26.2 [R45], [R46] applies for ENNI ingress to UNI egress traffic.</p> <p>For UNI ingress to ENNI egress traffic, when <i>Enabled</i> then the egress frame corresponding to ingress frame MUST retain CE-PCP value of the ingress frame in the egress frame. When <i>Enabled</i>, then the OVC CE-VLAN ID Preservation Service Attribute MUST NOT be <i>Strip</i>.</p>								
9	OVC CE-VLAN DEI Preservation	MEF 140 Section 7.1	MEF 26.2 [R47], [R48]	●	<p>MEF 26.2 [R45], [R46] applies for ENNI ingress to UNI egress traffic.</p> <p>For UNI ingress to ENNI egress traffic, when <i>Enabled</i> then the egress frame corresponding to ingress frame MUST retain CE-DEI value of the ingress frame in the egress frame. When <i>Enabled</i>, then the OVC CE-VLAN ID Preservation Service Attribute MUST NOT be <i>Strip</i>.</p>								
10	OVC S-VLAN PCP Preservation	Not Applicable	MEF 26.2 [R49]		Not Applicable. Per MEF 26.2 [R49] the requirement is applicable when OVC frame ingress and egress interfaces are both ENNI type.								
11	OVC S-VLAN DEI Preservation	Not Applicable	MEF 26.2 [R50]		Not Applicable. Per MEF 26.2 [R50] the requirement is applicable when OVC frame ingress and egress interfaces are both ENNI type.								
12	OVC List of Class of Service Names	≥1 other than <i>Discard</i>	Not testable		At least one CoS Name other than Discard								
13	OVC Service Level Specification	MEF 140 Section 8.1.2	MEF 140 [D1], [D2]	○	<p>If the value is <i>None</i>, then do not perform any checks of presence of four delay metrics nor Frame Loss Ratio in the Service Level Specification.</p> <p>If, however, the value is not <i>None</i>, then Broadband Access Operator SHOULD support the four delay metrics (Frame Delay, Frame Delay Range, Mean Frame Delay and Inter-Frame Delay Variation) [D1] as well as Frame Loss Ratio metric [D2] as specified in MEF 26.2, in the Service Level Specification.</p>								
14	OVC Unicast Frame Delivery	MEF 140 Section 8.1.3.1	MEF 140 [D3], [R12], [O1], [O2]	●	<p>The MAC Bridging behavior in Broadband Access Networks, specifically related to MAC learning and flooding of unicast frames, might be different than as specified in IEEE Std 802.1Q™-2018 [3]. For example, in some cases the Ethernet Service cannot become operational until an Ethernet Frame is received from the Subscriber at the UNI in the Broadband Access Network. Ref. MEF 140 Chapter 6.2 As a result of this behavior, it is allowed to discard Unicast frames from ENNI to UNI if the connection has not been established first by the UNI.</p> <p>Value SHOULD be <i>Deliver Unconditionally</i> [D3].</p> <p>If the value is <i>Deliver Conditionally</i> MEF 140 [O1], then -Unicast ingress frames at UNI End Point of an OVC to egress ENNI OVC End Point MUST be delivered unconditionally [R12], and -Unicast ingress frames at ENNI End Point of an OVC MAY be discarded by the Operator's Network if the destination is an unknown (e.g., not yet learned or aged-out, etc.) MAC address [O2]</p>								
15	OVC Broadcast Frame Delivery	MEF 140 Section 8.1.3.2	MEF 140 [D5], [O3], [O4], [R13]	●	<p>The MAC Bridging behavior in Broadband Access Networks, specifically related to MAC learning and flooding of unicast frames, might be different than as specified in</p>								

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description
					<p>IEEE Std 802.1Q™-2018. For example, in some cases the Ethernet Service cannot become operational until an Ethernet Frame is received from the Subscriber at the UNI in the Broadband Access Network. Ref. MEW 140 Chapter 6.2 As a result of this behavior, it is allowed to discard Broadcast frames from ENNI to UNI if the connection has not been established first by the UNI.</p> <p>The Network Operator SHOULD support a value of <i>Deliver Unconditionally</i> [D5] for broadcast frames. In such case delivery behavior should follow requirement as in MEF 51.1 [R13].</p> <p>The Network Operator MAY support a value of <i>Deliver Conditionally</i> for broadcast frames [O3] with the condition that:</p> <ul style="list-style-type: none"> - ingress broadcast frames at UNI End Point of an OVC to egress ENNI OVC End Point MUST be delivered unconditionally MEF 140 [R13]. - ingress broadcast frames at ENNI End Point of an OVC MAY be discarded by the Operator's Network [O4].
16	OVC Multicast Frame Delivery	MEF 140 Section 8.1.3.3	MEF 26.2 Section 12.14.1	○	<p>Value could be any of MEF 26.2 values, i.e. <i>Deliver Unconditionally, Deliver Conditionally, Discard</i></p> <p>If the operator is delivering multicast conditionally, test that the multicast frames are delivered. It is allowed to discard Multicast frames from ENNI to UNI if the connection has not been established first by the UNI.</p> <p>The Network Operator MAY support a value of <i>Deliver Conditionally</i> for multicast frames [O3] with the condition that:</p> <ul style="list-style-type: none"> - multicast ingress frames at UNI End Point of an OVC to egress ENNI OVC End Point MUST be delivered unconditionally MEF 140 R13. - multicast frames at ENNI End Point of an OVC MAY be discarded by the Operator's Network [O4].
17	OVC Available MEG Level	MEF 140 Section 8.1.4	MEF 140 [R14]	●	<p>The OVC Availability MEG Level MUST be <i>None</i> or an integer value between 0 and 6 (inclusive). It specifies the lowest MEG Level available for the Service Provider or SOAM Super Operator.</p> <p>The test should validate whether the frames which have MEG level higher or equal to the value specified by this service attribute are passing through the Broadband Operator's Network.</p>
18	OVC L2CP Address Set	MEF 140 Section 8.1.5	MEF 140 [O5], [O6]	○	<p>The value of the OVC L2CP Address Set Service Attribute (if L2CP is allowed) MAY be <i>CTA</i> [O5], <i>CTB</i>, <i>CTB-2</i>, or <i>Other</i> [O6].</p> <p>Test whether L2CP frames with specified MAC addresses Pass or are Discarded as per Table 6 in MEF 45.1 [15].</p>
19	OVC Bandwidth Profile Algorithm Type	MEF 140 Section 9.2	MEF 140 [R42]	●	<p>The allowed values of this Service Attribute are <i>Token Bucket, Interval Averaging, Other, and None</i>.</p>
20	Ingress ENNI to Egress UNI	MEF 140 [R9]	MEF 140 [R9]	●	<p>For Broadband Access E-Line, when the ingress OVC End Point is located at an ENNI and egress OVC End Point is located at a UNI, the relationships between the format of the frame at the ingress ENNI and the corresponding frame at the egress UNI MUST be as specified in MEF 140 Table 12.</p>

Table 4 - Broadband Access E-Line - OVC End Point at ENNI Service Attributes Test and Certification Requirements

OVC for a Broadband Access E-Line Service associates exactly one OVC End Point at each External Interface (UNI or ENNI) in an Operator Service. The OVC End Point is a “container” for OVC Service Attributes that can vary from External Interface to External Interface. Every Operator Service has at least one ENNI. Requirement MEF 140 [R3] and Table 5 describes the service attributes and test requirements in this regard.

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description
21	OVC End Point Identifier	MEF 51.1	Not Testable		A unique identifier within the Operator's network for the OVC End Point at the ENNI
22	OVC End Point External Interface Type	MEF 51.1	MEF 51.1	●	Value = <i>ENNI</i>

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description
23	OVC End Point External Interface Identifier	MEF 51.1	Not Testable		The value of the End Point External Interface Identifier Service Attribute MUST be an Operator ENNI Identifier Service Attribute value per Section 13.1. of MEF 26.2: "a string used to allow the SP/SO and Operator to uniquely identify the ENNI for operations purposes".
24	OVC End Point Role	MEF 51.1	Not Testable		Value = <i>Root</i>
25	OVC End Point Map	MEF 140 Section 8.2.3	MEF 140 [R15] MEF 26.2 [R139], [R140]	●	W140 R15: The value of the OVC End Point Map MUST be an S-VLAN ID value. This is equivalent to mandating that the value of the OVC End Point Map at an ENNI be of Form E as defined in section 16.5.1 in MEF 26.2. MEF 26.2 R139: All ingress EI Frames received at an ENNI with an S-Tag VLAN ID value that is equal to the value of the OVC End Point Map for an OVC End Point located at that ENNI are mapped to that OVC End Point. MEF 26.2 R140: All egress EI Frames at the ENNI that map to the OVC End Point have an S-Tag VLAN ID value that is equal to the value of the OVC End Point Map for that OVC End Point. The test should validate that ingress EI frames with an S-VLAN corresponding to the End Point Map are mapped to the OVC End Point and EI frames with an S-VLAN different than the S-VLAN in the OVC End Point Map are NOT mapped to the OVC End Point.
26	OVC End Point Class of Service Identifier	MEF 51.1	MEF 26.2 [R167]	●	<i>F = S-tag PCP</i> The way that a Class of Service Name is determined for ingress ENNI Frames at an ENNI as specified in MEF 26.2 Table 30 Handling of the frames belonging to a particular Class of Service is out of scope of this document.
27	OVC End Point Color Identifier	MEF 140 section 8.2.1	MEF 140 [O7]	○	(F, M) per MEF 26.2 Some Broadband Access Network Operators do not support color markings on frames and the Interval Averaging Bandwidth Profiles defined in MEF 140 for Broadband Access E-Line and Broadband Access E-LAN Services do not include a color-aware mode and do not declare a color for EI Frames. For Broadband Access E-Line and Broadband Access E-LAN Services, recommendations [D5] and [D12] in MEF 51.1 MAY NOT apply. If BWP method used for the OVC is Interval Averaging, then this Service Attribute should be treated as if were Color Blind and color identifier testing does not apply. If an algorithm other than Interval Averaging is used for Bandwidth Profiles then Color Identifier Map testing may apply.
28	OVC End Point Egress Map	MEF 26.2 [R201]	MEF 26.2 [R201]	●	The specification of the content of the S-Tag PCP and DEI values for egress ENNI Frames towards the Service Provider Network. Testing of OVC End Point Egress Map Service Attribute behavior should be based on MEF 26.2 Table 41.
29	OVC End Point Egress Equivalence Class Identifier	MEF 140 Section 7.2	Not Testable		Per MEF 26.2, this is the mechanism that allows an Egress Equivalence Class Name to be determined for an egress EI Frame. Per MEF 26.2, it has to be a triple of the form <F, M, P> where the value of F is a field in the egress EI Frame, M is a mapping between each possible value of the field F and an Egress Equivalence Class Name, and P is map between L2CP types and Egress Equivalence Class Names
30	Ingress Bandwidth Profile per OVC End Point	MEF 140 Section 7.2	Not Testable		Value has to be "Disabled" only
31	Egress Bandwidth Profile per OVC End Point	MEF 140 Section 7.2	Not Testable		Value has to be "Disabled" only
32	Ingress Bandwidth Profile per Class of Service Name	MEF 140 Section 9.2 [R40], [R41], [R42]	MEF 140 Section 9.2, Section 9.3 [R43], [R44], [R45], [R46], [R48], [R49], [D6], [D7]	●	The value of this Service Attribute is either None or Bandwidth Profile parameters as specified in section 9: - Per MEF 140 [R40], A Bandwidth Profile Flow MUST be specified using one of the following criteria: 1. all ingress External Interface (EI) Frames that map to a given Class of Service Name, that map to a given OVC End Point, and that are not discarded by [R101] in MEF 26.2.
33	Egress Bandwidth Profile per Egress Equivalence Class Name	MEF 140 Section 9.2 [R40], [R41], [R42]	MEF 140 Section 9.2, Section 9.3 [R43], [R44], [R45], [R46],	●	The value of this Service Attribute is either None or Bandwidth Profile parameters as specified in section 9: - Per W140 [R40], A Bandwidth Profile Flow MUST be specified using one of the following criteria:

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description
			[R48], [R49], [D6], [D7]		2.all egress External Interface (EI) Frames that have a given Egress Equivalence Class Name, that map to a given OVC End Point, and that are not discarded by [R101] in MEF 26.2.
34	OVC End Point Aggregation Link Depth	MEF 140 Section 7.2	Not Tested		1 to # of ENNI Phy Links per MEF 51.1
35	OVC End Point Source MAC Address Limit	MEF 140 Section 7.2	MEF 26.2 Section 16.15	●	Disabled or (N, τ)
36	OVC End Point MIP	MEF 140 Section 8.2.2	Not Testable	○	“Enabled” or “Disabled” value is permitted
37	OVC End Point MEP List	MEF 140 Section 8.2.2	MEF 51.1 [D9], [D10]	○	Per MEF 140 [D9], the list contains at least one Up MEP Per MEF 140 [D10], the list contains at least one Down MEP

Table 5 – Broadband Access E-Line - OVC End Point at ENNI Service Attributes Test and Certification Requirements

8.2 Broadband Access E-Line - OVC End Point at UNI Service Attributes Test and Certification Requirements

Since Broadband Access E-Line is an Access Service, there must be at least one UNI. Table 6 describes the OVC End Point at UNI service attributes test and certification requirements.

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description
38	OVC End Point Identifier	MEF 26.2 Section 16.1	Not Testable		*A unique identifier within the Operator’s network for a specific OVC at the UNI. Specified in MEF 26.2 Table 30.
39	OVC End Point External Interface Type	MEF 51.1 Section 7.4	Not Testable		By definition, the value is ‘UNI’
40	OVC End Point External Interface Identifier	MEF 26.2 Section 16.3 [R134]	Not Testable		Identifier value must be an Operator UNI Identifier Service Attribute value per MEF 26.2 Section 16.3
41	OVC End Point Role	MEF 26.2 Section 16.4	Not Testable		Value is <i>Root</i>
42	OVC End Point Map	MEF 140 Section 8.2.3.2	MEF 140 [R16], [R17], [R18], [R19], [R20], [R21], [R22], [R23], [R24], [R25], [R26], [R27], [R28], [R29], [R30], [R31], [R32], [O8]	●	Per [R16] of MEF 140, the value of the OVC End Point Map Service Attribute MUST be one of the following values: -List of C-VLAN IDs in the range 1...4094 (consistent with MEF 26.2 Form U), MEF 140 [R17], [R18], [R19], [R20], [R21], [R22] -All indicating that all Service Frames, Untagged, Priority Tagged, and VLAN Tagged are mapped to the OVC End Point, MEF 140 [R23], [O8] -All-NP indicating that all Untagged and VLAN Tagged Service Frames are mapped to the OVC End Point (i.e., not Priority Tagged Service Frames), MEF 140 [R24], [R25], [R26], [R27], [O8] -UT/PT indicating that only Untagged and Priority Tagged Service Frames are mapped to the OVC End Point, MEF [140] [R28], [R30], [R31], [R32] and -UT indicating that only Untagged Service Frames are mapped to the OVC End Point MEF 140 [R29], [R30], [R31], [R32]
43	OVC End Point Class of Service Identifier	OVC EP, C-Tag PCP, or DSCP per MEF 51.1	MEF 26.2 [R171]	●	The mechanism that allows a Class of Service Name to be determined for an ingress Service Frame <F, M, P> Note that [R171] of MEF 26.2 mandates F be based on one of the following for an OVC End Point at a UNI: OVC EP, C-Tag PCP, or DSCP, i.e. F = OVC EP or F = C-Tag PCP Or F = DSCP

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description
44	OVC End Point Color Identifier	MEF 140 Section 7.3 and Section 8.2.1	MEF 51.1 [D5], [D12]	○	Optional. Per MEF 140 [O7] recommendations [D5] and [D12] in MEF 51.1 MAY not apply. If this Service Attribute is specified, then it should be presented as a 2-tuple <F,M>, see Section 8.2.1 of MEF 140. The value of F should be C-Tag DEI to identify color. Interval Averaging Bandwidth Profile does not include a color-aware mode and do not declare a color for EI frames.
45	OVC End Point Egress Map	MEF 140 Section 7.3	Not Testable		No additional constraints from MEF 51.1
46	OVC End Point Egress Equivalence Class Identifier	MEF 140 Section 7.3	Not Testable		No additional constraints from MEF 51.1
47	Ingress Bandwidth Profile per OVC End Point	MEF 140 Section 7.3	Not Testable		'Disabled' only
48	Egress Bandwidth Profile per OVC End Point	MEF 140 Section 7.3	Not Testable		'Disabled' only
49	Ingress Bandwidth Profile per Class of Service Name	MEF 140 Section 9	MEF 140 [R40], [R41], [R42]	●	Per MEF 140 [R40], A Bandwidth Profile Flow MUST be specified in such a way that all ingress External Interface (EI) Frames that have a given Class of Service Name, that map to a given OVC End Point, and that are not discarded by [R101] in MEF 26.2 are assigned to a Bandwidth Profile Flow. One or more Bandwidth Profile Flows are assigned to an envelope. The parameters of an envelope for Token Bucket BWP Algorithm are defined in MEF 26.2 Table 30. The parameters of an envelope for Interval Averaging BWP Algorithm are defined in MEF 140 Section 9.3 and behavior is defined in MEF 140 Section 9.4.
50	Egress Bandwidth Profile per Egress Equivalence Class Name	MEF 140 Section 9	MEF 140 [R40], [R41], [R42]	●	Per MEF 140 [R40], A Bandwidth Profile Flow MUST be specified in such a way, that all egress External Interface (EI) Frames that have a given Egress Equivalence Class Name, that map to a given OVC End Point, and that are not discarded by [R101] in MEF 26.2 are assigned to a Bandwidth Profile Flow. One or more Bandwidth Profile Flows are assigned to an envelope. The parameters of an envelope for Token Bucket BWP Algorithm are defined in MEF 26.2 Table 30. The parameters of an envelope for Interval Averaging BWP Algorithm are defined in MEF 140 Section 9.3 and behavior is defined in MEF 140 Section 9.4.
51	OVC End Point Aggregation Link Depth	MEF 140 Section 7.3	Not Applicable		Not applicable per MEF 51.1
52	OVC End Point Source MAC Address Limit	MEF 140 Section 7.3	MEF 26.2 [D14]	○	Disabled or (N, τ) per MEF 51.1
53	OVC End Point MIP	MEF 140 Section 8.2.2	MEF 140 8.2.2	●	If the network operator does not support SOAM, then the value of this Service Attribute must be <i>Disabled</i> . If the value of this Service Attribute is <i>Enabled</i> then the test may be performed to verify MIP at the OVC End Point.
54	OVC End Point MEP List	MEF 140 Section 8.2.2	MEF 140 8.2.2	●	If the network operator does not support SOAM, then the value of this Service Attribute must be <i>Disabled</i> . If the value of this Service Attribute is <i>Enabled</i> then the test may be performed to verify MEP at the OVC End Point.

Table 6 – Broadband Access E-Line - OVC End Point at a UNI Service Attributes Test and Certification Requirements

8.3 Broadband Access E-Line - Operator UNI Service Attributes Test and Certification Requirements

Broadband Access E-Line services must include at least one UNI. Since MEF 51.1 does not impose any constraints on the values of the Operator UNI Service Attributes specified in MEF 26.2, MEF 140 compares Operator UNI Service Attributes for Broadband Access E-Line with the

requirements in MEF 26.2. Table 7 below describes the test requirements of Operator UNI Service Attributes.

If the Operator UNI is not associated with the same physical interface as the Subscriber UNI (see Figure 7 in MEF 140), then the Operator UNI physical layer Service Attributes tests cannot be performed at the Operator UNI. The mapping from the Operator UNI to the Subscriber UNI will be used as a proxy for the behavior of the Operator UNI. This is denoted by a [*] next to the value in the certification applicability column.

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description
55	Operator UNI Identifier	MEF 140 Section 7.4	Not Testable		A string that is unique across the Operator CEN as specified in Table 25 of MEF 26.2 and MEF 26.2 [R86], [R87], [R88]
56	Operator UNI Physical Layer	MEF 140 Section 8.3.1	MEF 26.2 [R89], [R90]	● [*]	A subset of the PHYs listed in IEEE Std. 802.3 – 2012 for each physical link as specified in Table 25 of MEF 26.2 [R89]. Testing of the underlying broadband transport technology is out of scope for this document. . Physical layer must support full duplex [R90] MEF 140 [R33] and [R34] define a requirement, that specify arrival time of bits of the service frames at the Operator UNI and correctness of the frame build. MEF 140 [R35] define that if Operator UNI Physical layer is one or more interfaces in MEF 61.1.1 Table A-4, then the following four Service Attributes must confirm to the requirements in MEF 26.2
57	Operator UNI Synchronous Mode ¹	MEF 140 Section 8.3.1	Not testable	○ [*]	MEF 26.2 Table 25 The specification of which physical links can be used as a frequency synchronization reference. A list of items, one for each physical link, where each item can equal either <i>Enabled</i> or <i>Disabled</i>
58	Operator UNI Number of Links ¹	MEF 140 Section 8.3.1	Not testable	○ [*]	MEF 26.2 Table 25 The number of physical links at the UNI Value is a strictly positive integer
59	Operator UNI Link Aggregation ¹	MEF 140 Section 8.3.1	Not Testable	○ [*]	MEF 26.2 Table 25 <i>None, 2-Link Active/Standby, All Active, or Other</i>
60	Operator UNI Port Conversation ID to Aggregation Link Map ¹	MEF 140 Section 8.3.1	Not Testable	○ [*]	No other constraints than in MEF 26.2 Table 25 The mapping of Port Conversation IDs to physical links
61	Operator UNI Service Frame Format	MEF 140 Section 8.3.1 [R36]	MEF 26.2 [R101]	● [*]	Ethernet MAC Frame conforming to Clause 3 of IEEE 802.3-2012 as specified in Table 25 of MEF 26.2. Note Passive NTU (aka, ‘wires-only’) testing requirement is not addressed in this document
62	Operator UNI Maximum Service Frame Size	MEF 140 Section 7.4	MEF 26.2 [R102]	● [*]	Integer number ≥1522 as specified in Table 25 of MEF 26.2
63	Operator UNI Default CE-VLAN ID	MEF 140 Section 8.3.3	Not Applicable		Not used
64	Operator UNI Maximum Number of OVC End Points	MEF 140 Section 7.4	MEF 26.2 Table 25	●	Integer number ≥1
65	Operator UNI Maximum Number of CE-VLAN IDs per OVC End Point	MEF 140 Section 7.4	MEF 26.2 Table 25	●	A strictly positive integer as specified in Table 25 of MEF 26.2
66	Operator UNI Ingress Bandwidth Profile per UNI	MEF 140 Section 8.3.2	Not Testable		Disabled
67	Operator UNI Egress Bandwidth Profile per UNI ³	MEF 140 Section 8.3.2	Not Testable		Disabled
68	Operator UNI Link OAM ¹	MEF 140 Section 7.4	Not Testable	○ [*]	Enabled or Disabled as specified in Table 7 of MEF 140
69	Operator UNI MEG ¹	MEF 140 Section 7.4	Not Testable	○ [*]	Enabled or Disabled as specified in Table 7 of MEF 140
70	Operator UNI LAG Link MEG ¹	MEF 140 Section 7.4	Not Testable	○ [*]	Enabled or Disabled as specified in Table 7 of MEF 140
71	Operator UNI E-LMI ¹	MEF 140 Section 7.4	Not Testable		Disabled Only
72	Operator UNI Token Share	MEF 140 Section 7.4	Not Testable	○ [*]	Enabled or Disabled as specified in Table 7 of MEF 140

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description
73	Operator UNI Envelopes	MEF 140 Section 9	MEF 140 Section 9		A list of 3-tuples (envelopeId, envelopeMaxIr, envelopeIrTime) which are described in MEF 140 [R43]. A sum of the bpfCir values for all Bandwidth Profile Flows in an Interval Averaging Bandwidth Profile Envelope MUST be less than or equal to the value of envelopeMaxIr for the Interval Averaging Bandwidth Profile Envelope MEF 140 [R44]. For Bandwidth Profile Flow contained in an Interval Averaging Bandwidth Profile Envelope, the value of the Bandwidth Profile Flow's bpfMaxIr MUST be greater than or equal to the value of its bpfCir MEF 140 [R45]
74	Operator UNI L2CP Address set	MEF 140 Section 8.1.5	MEF 45.1 [R3A], [R4A] and additional		CTA (C-Tag Aware), CTB (C-Tag Blind), CTB-2 (C-Tag Blind, Option 2) and 'Other'
75	Operator UNI L2CP Peering	MEF 140 Section 7.4	MEF 45.1 [R10]		The L2CP Peering service attribute value MUST be an empty list (the test much check that there is no peering taken place for the MAC addresses mentioned in MEF 45.1 [R10])

Table 7 - Broadband Access E-Line - Operator UNI Service Attributes Test and Certification Requirements

¹: Control and management protocols such as E-LMI, Link OAM, Service OAM UNI-MEG, Service OAM ENNI-MEG, Test MEG or protection mechanisms that may be operating at the external interfaces are outside the scope of the Broadband Access E-line certification program. The deployment and verification of these protocols are to be handled between subscriber/service provider/operator.

8.4 Broadband Access E-Line - ENNI Service Attributes, Common Attributes and Multilateral Attributes Test and Certification Requirements

Table 8 describes the test requirements of Broadband Access E-Line ENNI Service Attributes, Common Attributes and Multilateral Attributes Test and Certification Requirements.

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description
76	Operator ENNI Identifier	MEF 140 Section 7.5.2	Not Tested		A string that is unique across the ENNIs of the Operator CEN as specified in Table 24 of MEF 26.2
77	S-VLAN ID Control	MEF 140 Section 7.5.2	Not Tested		Full or Partial as specified in Table 24 of MEF 26.2
78	Maximum Number of OVCs	MEF 140 Section 7.5.2	Not Tested		A strictly positive integer as specified in Table 24 of MEF 26.2
79	Maximum Number of OVC End Points per OVC	MEF 140 Section 8.4.1	Not Testable		Value = 1. MEF 140 Section 8.4.1
80	ENNI Token Share	MEF 140 Section 7.5.2	Not Tested		Enabled or Disabled as specified in Table 24 of MEF 26.2
81	ENNI Envelopes	MEF 140 Section 7.5.2 And Section 9.3	MEF 26.2 [R84], [R85]	●	List of 3-tuples <envelopeId, envelopeMaxIr, envelopeIrTime >
82	ENNI Peering Identifier	MEF 140 Section 7.5.1	Not Testable		A string that is unique across all of the ENNIs between the Operator Network as specified in Table 3 of MEF 26.2
83	ENNI Physical Layer	MEF 140 Section 7.5.1	MEF 26.2 [R5], [R6], [R7]	●	A subset of the PHYs as specified in Table 3 of MEF 26.2
84	ENNI Frame Format	MEF 140 Section 7.5.1	MEF 26.2 [R8], [R9], [R10]	●	Ethernet MAC Frame as specified in Table 3 of MEF 26.2
85	ENNI Number of Links ¹	MEF 140 Section 7.5.1	Not Tested		A strictly positive integer as specified in Table 3 of MEF 26.2
86	ENNI Link Aggregation ¹	MEF 140 Section 7.5.1	Not Tested		None, 2-Link Active/Standby, All Active, or Other as specified in Table 3 of MEF 26.2
87	ENNI Port Conversation ID to Aggregation Link Map ¹	MEF 140 Section 7.5.1	Not Tested		See IEEE Std. 802.1AX – 2014 as specified in Table 3 of MEF 26.2
88	ENNI MEG ¹	MEF 140 Section 7.5.1	Table 3 of MEF 26.2	○	Enabled or Disabled as specified in Table 3 of MEF 26.2
89	ENNI LAG Link MEG ¹	MEF 140 Section 7.5.1	Not Tested		Enabled or Disabled as specified in Table 3 of MEF 26.2

Index	Service Attributes	Service Reference	Test Requirements	Certification applicability ● = Required ○ = Desirable	Summary Description
90	ENNI Link OAM ¹	MEF 140 Section 7.5.1	Not Tested		Enabled or Disabled as specified in Table 3 of MEF 26.2
91	ENNI L2CP Peering ²	MEF 45 Section 8.2	Not tested		The L2CP Peering service attribute value MUST be an empty list, or a list of entries identifying protocols to be Peered where each entry consists of {Destination Address, Protocol Identifier} or {Destination Address, Protocol Identifier, Link Identifier}
92	ENNI Tagged L2CP Frame Processing	MEF 45 Section 8.3	MEF 45.1 [D2]	●	An ENNI Tagged L2CP Frame Processing Service Attribute SHOULD be 802.1 compliant
93	ENNI Maximum Frame Size	MEF 51 Section 8.4	MEF 26.2 [R27]	●	≥1526 Bytes (The maximum length ENNI Frame in bytes that can be reliably processed as specified in Table 5 of MEF 26.2)

Table 8 – Broadband Access E-Line - ENNI Service Attributes, Common Attributes and Multilateral Attributes Test and Certification Requirements

¹: Control and management protocols such as E-LMI, Link OAM, Service OAM UNI-MEG, Service OAM ENNI-MEG, Test MEG or protection mechanisms that may be operating at the external interfaces are outside the scope of Broadband Access E-Line certification program. The deployment and verification of these protocols are to be handled between subscriber/service provider/operator.

²: Protocols not in list are either Passed to OVC or Discarded based on the Destination Address. L2CP Peering cannot be tested because filtered frames can be discarded or peered.

9 References

- [1] Cable Television Laboratories CM-SP-MULPIv3.1-I25-230419, *Data-Over-Cable Service Interface Specifications DOCSIS® 3.1 – MAC and Upper Layer Protocols Interface Specification*, April 2023. Copyright © Cable Television Laboratories, Inc. 2013–2023.
- [2] Cable Television Laboratories CM-SP-MULPIv4.0-I07-230503, *Data-Over-Cable Service Interface Specifications DOCSIS® 4.0 – MAC and Upper Layer Protocols Interface Specification*, May 2023. Copyright © Cable Television Laboratories, Inc. 2019–2023.
- [3] IEEE Std 802.1Q™-2018, *Bridges and Bridged Networks*, May 2018. Copyright © 2018 by The Institute of Electrical and Electronics Engineers, Inc. All rights reserved.
- [4] IEEE Std 802.3™-2012, IEEE Standard for *Ethernet*, August 2012. Copyright © 2012 by The Institute of Electrical and Electronics Engineers, Inc. All rights reserved.
- [5] IEEE Std 802.3™-2015, IEEE Standard for *Ethernet*, September 2015. Copyright © 2016 by The Institute of Electrical and Electronics Engineers, Inc. All rights reserved.
- [6] IEEE Std 802.3™-2018, IEEE Standard for *Ethernet*, June 2018. Copyright © 2018 by The Institute of Electrical and Electronics Engineers, Inc. All rights reserved.
- [7] Internet Engineering Task Force RFC 2119, *Key words for use in RFCs to Indicate Requirement Levels*, March 1997.
- [8] Internet Engineering Task Force RFC 8174, *Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words*, May 2017.
- [9] ITU-T G.983.1, *Broadband optical access systems based on Passive Optical Networks (PON)*, January 2005. Copyright © ITU 2005. All Rights Reserved.
- [10] ITU-T G.984.1, *Gigabit-capable passive optical networks (GPON): General characteristics*, March 2008. Copyright © ITU 2009. All Rights Reserved.
- [11] ITU-T G.987.1, *10-Gigabit-capable passive optical networks (XG-PON): General requirements*, March 2016. Copyright © ITU 2016. All Rights Reserved.
- [12] MEF 10.4, *Subscriber Ethernet Services Attributes*, December 2018.
- [13] MEF 26.2, *External Network Network Interface (ENNI) and Operator Services Attributes*, August 2016.
- [14] MEF 4, *Metro Ethernet Network Architecture Framework – Part 1: Generic Framework*, May 2004

- [15] MEF 45.1, *Layer 2 Control Protocols in Ethernet Services*, December 2018.
- [16] MEF 51.1, *Operator Ethernet Service Definitions*, December 2018.
- [17] MEF 6.3, *Subscriber Ethernet Service Definitions*, November 2019
- [18] MEF 61.1.1, *Amendment to MEF 61.1: UNI Access Link Trunks, IP Addresses, and Mean Time to Repair Performance Metric*, July 2022
- [19] MEF 91, *Carrier Ethernet Test Requirements*, March 2021
- [20] MEF 140, *Broadband Access E-Line and Broadband Access E-LAN Service Definitions*, May 2025