Annex 7A
(informative)
UMT configuration examples (informative)

7A.1 OAM over UMT use case, UMT-unaware end points

1.1.1 Introduction

This example illustrates OAM communication between a Manager M and a Station S carried over UMT that traverses multiple L2 bridges (see Figure 7A-1). Both the Manager and the Station are UMT-unaware. The bridge X nearest to the Manager M is UMT-aware, and so is the bridge Y nearest to the Station S. There can be numerous other bridges between the bridges X and Y; those bridges may or may be not UMT-aware.

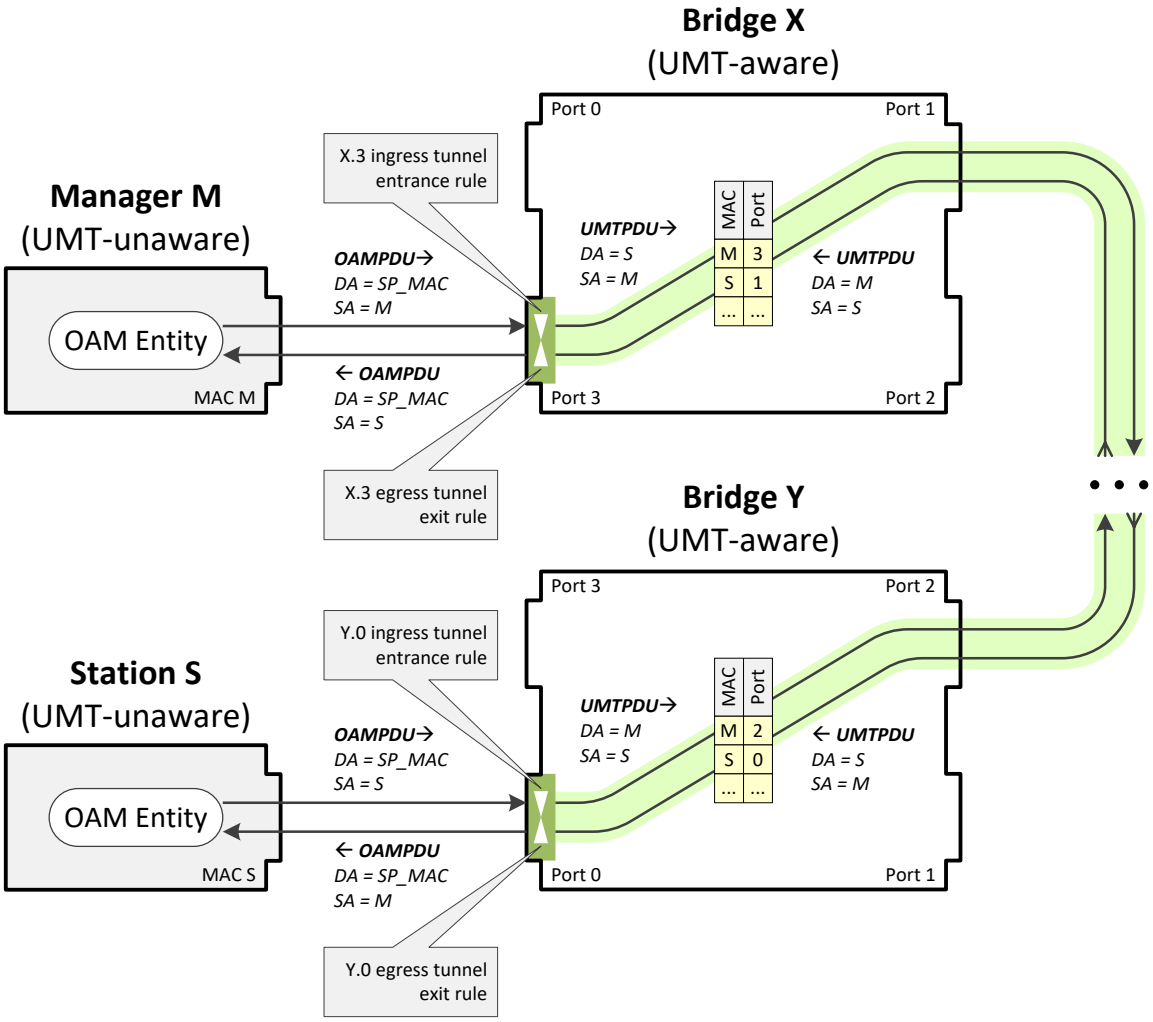

Figure 7A-1—UMTPDU format

In Figure 7A-1, the Manager M, station S, Bridges X and Y have MAC addresses M, S, X, and Y respectively. For simplicity, it is assumed that all ports in a given device use the same MAC address, but this is not a requirement.

Furthermore, it is assumed that Bridges X and Y, as well as all intermediate bridges, have already populated their forwarding tables with entries for MAC addresses M and S. These entries may be created dynamically by a MAC learning function or be provisioned statically by the NMS.

1.1.2 UMT provisioning to establish tunnels

Since the Manager M is not directly connected to the managed Station S, the OAM messages need to be carried over UMTPDUs. Therefore, before the Manager M and the Station S are able to exchange OAM messages, two UMT tunnels need to be provisioned:

- A forward UMT tunnel from bridge X, port 3 to bridge Y, port 0.
- A reverse UMT tunnel from bridge Y, port 0 to bridge X, port 3.

The establishement of each UMT tunnel involves provisioning of two rules - one to configure the UMT tunnel entrance point and one to configure the UMT tunnel exit point.

To establish a UMT tunnel from Manager M to Station S, the following rules are provisioned:

- A UMT tunnel entrance rule at the ingress of Bridge X, port 3
- A UMT tunnel exit rule at the egress of Bridge Y, port 0

To establish a UMT tunnel from Station S to Manager M, the following rules are provisioned:

- A UMT tunnel entrance rule at the ingress of Bridge Y, port 0
- A UMT tunnel exit rule at the egress of Bridge X, port 3

Each rule is provisioned using a separate *UMT_CONFIG* message. The contents of all four messages required to establish two UMT tunnles for bidirectional communication for the network segment illustrated in Figure 7A-1 are shown below.

1.1.2.1 Addition of tunnel entrance rule at the ingress of Bridge X, port 3

The UMT tunnel entrance rule at the ingress of Bridge X, port 3 is shown in Table 7A-1. This rule converts an OAMPDU into a UMTPDU in the receive path of port 3. The conversion replaces the destination MAC address value (*SP_DA*) with the MAC address of Station S and replaces the Slow Protocol Ethertype (`SP_type`) with the UMT Ethertype (`UMT_type`).

Table 7A-1 — Tunnel entrance rule at the ingress of Bridge X, port 3

Conditions	Actions
1. DA == SP_DA 2. ETH_TYPE_LEN == SP_type 3. SP_SUBTYPE == OAM_subtype	1.CHANGE(DA, S) 2.CHANGE(ETH_TYPE_LEN, UMT_type)
NOTE: SP_type – Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4) UMT_type – Ethertype value identifying UMTPDUs (see 5.1) OAM_subtype – Subtype value identifying OAMPDUs (see IEEE Std 802.3, 57A.4) SP_DA – Destination MAC address associated with Slow Protocols (see IEEE Std 802.3, 57A.3) S – MAC address of Station S.	

Table 7A-2 provides the contents of a UMT_CONFIG UMTPDU that provisions the rule shown in Table 7A-1.

Table7A-2 — Contents of UMT_CONFIG message

Field	Subfield	Value	Description
DestinationAddress	n/a	X	*UMT_CONFIG* UMTPDU directed to bridge X
SourceAddress	n/a	any	Source address of a device that issued the *UMT_CONFIG* UMTPDU
LengthType	n/a	0xA8-C8	Ethertype value identifying UMTPDUs (see 5.1)
Subtype	n/a	0x00	UMTPDU carrying *UMT_CONFIG* message
MsgCode	*MsgType*	0x0	This message is a Request (see Table 7-1)
	RequestCode	0x1	Request to add a rule (see Table 7-1)
MsgSequence	n/a	0x00	This request consists of a single message
PortInstance	*PortIndex*	3	The rule is to be provisioned for port #3
	Direction	1	The rule is to be provisioned for the receive path (i.e., an ingress rule)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x01	Compare *DST_ADDR* field (see Table 6-2)
	Value	0x01-80-C2-00-00-02	IEEE 802.3 Slow_Protocols_Multicast address (see IEEE Std 802.3, 57A.3)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x06	TLV length is 6 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x03	Compare *ETH_TYPE_LEN* field (see Table 6-2)
	Value	0x88-09	Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x05	TLV length is 5 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	??	Compare *SP_SUBTYPE* field (see Table 6-2)
	Value	0x03	Slow Protocol Subtype value for OAM (see IEEE Std 802.3, 57A.4)
RuleTLV (action)	*Type*	0xAC	This is an action TLV (see Table 7-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x01	Modify *DST_ADDR* field (see Table 6-2)

Field	Subfield	Value	Description
	Value	S	Set Station S MAC address as the destination for resulting UMTPDUs.
RuleTLV (action)	*Type*	0xAC	This is an action TLV (see Table 7-3)
	Length	0x06	TLV length is 6 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x03	Modify *ETH_TYPE_LEN* field (see Table 6-2)
	Value	0xA8-C8	Set Ethertype to be equal to UMT_Ethertype in the resulting UMTPDUs.
RuleTLV (termination)	*Type*	0x00	This is a termination (end-of-rule) TLV (see Table 7-3)
	Length	0x04	TLV length is 4 octets
	Operation	0x00	Filled with zeros when not used (see Table 7-3 note)
	FieldCode	0x00	

1.1.2.2 Addition of tunnel exit rule at the egress of Bridge Y, port 0

The UMT tunnel exit rule at the ingress of Bridge Y, port 0 is shown in Table 7A-3. This rule converts a UMTPDU into an OAMPDU in the transmit path of port 0. The conversion replaces the destination MAC address of Station S with the MAC address used for Slow Protocol xPDUs (`SP_DA`) and replaces the UMT Ethertype (`UMT_type`) with the Slow Protocol Ethertype (`SP_type`).

Table 7A-3 — Tunnel exit rule at the egress of Bridge Y, port 0

Conditions	Actions
1. DA == S 2. ETH_TYPE_LEN == UMT_type 3. UMT_SUBTYPE == OAM_Subtype	1. CHANGE(DA, SP_DA) 2. CHANGE(ETH_TYPE_LEN, SP_type)

NOTE:

`SP_type` – Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4)
`UMT_type` – Ethertype value identifying UMTPDUs (see 5.1)
`OAM_Subtype` – Subtype value identifying OAM payload (see Table 5-1)
`SP_DA` – Destination MAC address associated with Slow Protocols (see IEEE Std 802.3, 57A.3)
`S` – MAC address of Station S.

Table 7A-4 provides the contents of a UMT_CONFIG UMTPDU that provisions the rule shown in Table 7A-3.

Table7A-4 — Contents of UMT_CONFIG message

Field	Subfield	Value	Description
DestinationAddress	n/a	Y	*UMT_CONFIG* UMTPDU directed to bridge Y
SourceAddress	n/a	any	Source address of a device that issued the *UMT_CONFIG* UMTPDU
LengthType	n/a	0xA8-C8	Ethertype value identifying UMTPDUs (see 5.1)
Subtype	n/a	0x00	UMTPDU carrying *UMT_CONFIG* message
MsgCode	*MsgType*	0x0	This message is a Request (see Table 7-1)
	RequestCode	0x1	Request to add a rule (see Table 7-1)
MsgSequence	n/a	0x00	This request consists of a single message
PortInstance	*PortIndex*	0	The rule is to be provisioned for port #0
	Direction	0	The rule is to be provisioned for the transmit path (i.e., an egress rule)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x01	Compare *DST_ADDR* field (see Table 6-2)
	Value	S	The dstination address is equal to MAC address of Station S.
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x06	TLV length is 6 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x03	Compare *ETH_TYPE_LEN* field (see Table 6-2)
	Value	0xA8-C8	UMT Ethertype value (see 5.1)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x05	TLV length is 5 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x1A	Compare *UMT_SUBTYPE* field (see Table 6-2)
	Value	0x03	UMT Subtype identifying OAM payload (see Table 5-1)
RuleTLV (action)	*Type*	0xAC	This is an action TLV (see Table 7-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x01	Modify *DST_ADDR* field (see Table 6-2)
	Value	0x01-80-C2-00-00-02	IEEE 802.3 Slow_Protocols_Multicast address (see IEEE Std 802.3, 57A.3)
RuleTLV	*Type*	0xAC	This is an action TLV (see Table 7-3)

Field	Subfield	Value	Description
(action)	*Length*	0x06	TLV length is 6 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x03	Modify *ETH_TYPE_LEN* field (see Table 6-2)
	Value	0x88-09	Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4)
RuleTLV (termination)	*Type*	0x00	This is a termination (end-of-rule) TLV (see Table 7-3)
	Length	0x04	TLV length is 4 octets
	Operation	0x00	Filled with zerous when not used (see Table 7-3 note)
	FieldCode	0x00	

1.1.2.3 Addition of UMT tunnel entrance rule at the ingress of Bridge Y, port 0

The UMT tunnel entrance rule at the ingress of Bridge Y, port 0 is shown in Table 7A-5. This rule converts an OAMPDU into a UMTPDU in the receive path of port 0. The conversion replaces the destination MAC address value (*SP_DA*) with the MAC address of Manager M and replaces the Slow Protocol Ethertype (`SP_type`) with the UMT Ethertype (`UMT_type`).

Table 7A-5 — UMT tunnel entrance rule at the ingress of Bridge Y, port 0

Conditions	Actions

`4. DA == SP_DA`
`5. ETH_TYPE_LEN == SP_type`
`6. SP_SUBTYPE == OAM_subtype`
	`3.CHANGE( DA, M )`
	`4.CHANGE( ETH_TYPE_LEN, UMT_type )`

NOTE: `SP_type` – Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4) `UMT_type` – Ethertype value identifying UMTPDUs (see 5.1) `OAM_subtype` – Subtype value identifying OAMPDUs (see IEEE Std 802.3, 57A.4) `SP_DA` – Destination MAC address associated with Slow Protocols (see IEEE Std 802.3, 57A.3) `S` – MAC address of Manager M.	

Table 7A-6 provides the contents of a UMT_CONFIG UMTPDU that provisions the rule shown in Table 7A-5.

Table7A-6 — Contents of UMT_CONFIG message

Field	Subfield	Value	Description
DestinationAddress	n/a	Y	*UMT_CONFIG* UMTPDU directed to bridge Y
SourceAddress	n/a	any	Source address of a device that issued the *UMT_CONFIG* UMTPDU
LengthType	n/a	0xA8-C8	Ethertype value identifying UMTPDUs (see 5.1)
Subtype	n/a	0x00	UMTPDU carrying *UMT_CONFIG* message
MsgCode	*MsgType*	0x0	This message is a Request (see Table 7-1)
	RequestCode	0x1	Request to add a rule (see Table 7-1)
MsgSequence	n/a	0x00	This request consists of a single message
PortInstance	*PortIndex*	3	The rule is to be provisioned for port #3
	Direction	1	The rule is to be provisioned for the receive path (i.e., an ingress rule)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x01	Compare *DST_ADDR* field (see Table 6-2)
	Value	0x01-80-C2-00-00-02	IEEE 802.3 Slow_Protocols_Multicast address (see IEEE Std 802.3, 57A.3)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x06	TLV length is 6 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x03	Compare *ETH_TYPE_LEN* field (see Table 6-2)
	Value	0x88-09	Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x05	TLV length is 5 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	??	Compare *SP_SUBTYPE* field (see Table 6-2)
	Value	0x03	Slow Protocol Subtype value for OAM (see IEEE Std 802.3, 57A.4)
RuleTLV (action)	*Type*	0xAC	This is an action TLV (see Table 7-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x01	Modify *DST_ADDR* field (see Table 6-2)
	Value	M	Set manager M MAC address as the destination for resulting UMTPDUs.

Field	Subfield	Value	Description
RuleTLV (action)	*Type*	0xAC	This is an action TLV (see Table 7-3)
	Length	0x06	TLV length is 6 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x03	Modify *ETH_TYPE_LEN* field (see Table 6-2)
	Value	0xA8-C8	Set Ethertype to be equal to UMT_Ethertype in the resulting UMTPDUs.
RuleTLV (termination)	*Type*	0x00	This is a termination (end-of-rule) TLV (see Table 7-3)
	Length	0x04	TLV length is 4 octets
	Operation	0x00	Filled with zerous when not used (see Table 7-3 note)
	FieldCode	0x00	

1.1.2.4 Addition of UMT tunnel exit rule at the egress of Bridge X, port 3

The UMT tunnel exit rule at the ingress of Bridge X, port 3 is shown in Table 7A-7. This rule converts a UMTPDU into an OAMPDU in the transmit path of port 3. The conversion replaces the destination MAC address of Manager M with the MAC address used for Slow Protocol xPDUs (`SP_DA`) and replaces the UMT Ethertype (`UMT_type`) with the Slow Protocol Ethertype (`SP_type`).

Table 7A-7 — UMT tunnel exit rule at the egress of Bridge X, port 3

Conditions	Actions
4. DA == M 5. ETH_TYPE_LEN == UMT_type 6. UMT_SUBTYPE == OAM_Subtype	3. CHANGE(DA, SP_DA) 4. CHANGE(ETH_TYPE_LEN, SP_type)
NOTE: `SP_type` – Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4) `UMT_type` – Ethertype value identifying UMTPDUs (see 5.1) `OAM_Subtype` – Subtype value identifying OAM payload (see Table 5-1) `SP_DA` – Destination MAC address associated with Slow Protocols (see IEEE Std 802.3, 57A.3) `M` – MAC address of Manager M.	

Table 7A-8 provides the contents of a *UMT_CONFIG* UMTPDU that provisions the rule shown in Table 7A-7.

Table7A-8 — Contents of UMT_CONFIG message

Field	Subfield	Value	Description
DestinationAddress	n/a	X	*UMT_CONFIG* UMTPDU directed to bridge X
SourceAddress	n/a	any	Source address of a device that issued the *UMT_CONFIG* UMTPDU
LengthType	n/a	0xA8-C8	Ethertype value identifying UMTPDUs (see 5.1)
Subtype	n/a	0x00	UMTPDU carrying *UMT_CONFIG* message
MsgCode	*MsgType*	0x0	This message is a Request (see Table 7-1)
	RequestCode	0x1	Request to add a rule (see Table 7-1)
MsgSequence	n/a	0x00	This request consists of a single message
PortInstance	*PortIndex*	3	The rule is to be provisioned for port #3
	Direction	0	The rule is to be provisioned for the transmit path (i.e., an egress rule)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x01	Compare *DST_ADDR* field (see Table 6-2)
	Value	M	The dstination address is equal to MAC address of Manager M.
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x06	TLV length is 6 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x03	Compare *ETH_TYPE_LEN* field (see Table 6-2)
	Value	0xA8-C8	UMT Ethertype value (see 5.1)
RuleTLV (condition)	*Type*	0xCO	This is a condition TLV (see Table 7-3)
	Length	0x05	TLV length is 5 octets
	Operation	0x11	Comparison for equality (see Table 6-1)
	FieldCode	0x1A	Compare *UMT_SUBTYPE* field (see Table 6-2)
	Value	0x03	UMT Subtype identifying OAM payload (see Table 5-1)
RuleTLV (action)	*Type*	0xAC	This is an action TLV (see Table 7-3)
	Length	0x0A	TLV length is 10 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x01	Modify *DST_ADDR* field (see Table 6-2)
	Value	0x01-80-C2-00-00-02	IEEE 802.3 Slow_Protocols_Multicast address (see IEEE Std 802.3, 57A.3)
RuleTLV	*Type*	0xAC	This is an action TLV (see Table 7-3)

Field	Subfield	Value	Description
(action)	*Length*	0x06	TLV length is 6 octets
	Operation	0xCE	Change (replacement) of a field (see Table 6-3)
	FieldCode	0x03	Modify *ETH_TYPE_LEN* field (see Table 6-2)
	Value	0x88-09	Slow Protocol Ethertype value (see IEEE Std 802.3, 57A.4)
RuleTLV (termination)	*Type*	0x00	This is a termination (end-of-rule) TLV (see Table 7-3)
	Length	0x04	TLV length is 4 octets
	Operation	0x00	Filled with zerous when not used (see Table 7-3 note)
	FieldCode	0x00	

1.1.3 UMT provisioning to delete tunnels

The deletion of a UMT tunnel involves the deletion of rules that control UMT tunnel entrance and UMT tunnel exit Therefore, to delete a tunnel from Manager M to Station S, the following rules are removed:

- UMT tunnel entrance rule at the ingress of Bridge X, port 3
- UMT tunnel exit rule at the egress of Bridge Y, port 0

To delete a UMT tunnel from Station S to Manager M, the following rules are removed:

- UMT tunnel entrance rule at the ingress of Bridge Y, port 0
- UMT tunnel exit rule at the egress of Bridge X, port 3

Each rule deletion is provsioned using a separate *UMT_CONFIG* UMTPDU. The contents of all four messages required to delete two tunnels for bidirectional communication for the network segment illustrated in Figure 7A-1 are shown below.

1.1.3.1 Deletion of UMT tunnel entrance rule at the ingress of Bridge X, port 3

The contents of a *UMT_CONFIG* UMTPDU that deletes the UMT tunnel entrance rule at the ingress of Bridge X, port 3 is identical to the *UMT_CONFIG* UMTPDU shown in Table 7A-2, with the exception of the value of the field *MsgCode*, subfield *RequestCode*, which in case of rule deletion has the value of 0x2 (see Table 7-1).

1.1.3.2 Deletion of UMT tunnel exit rule at the egress of Bridge Y, port 0

The contents of a *UMT_CONFIG* UMTPDU that deletes the UMT tunnel exit rule at the egress of Bridge Y, port 0 is identical to the *UMT_CONFIG* UMTPDU shown in Table 7A-4, with the exception of the value of the field *MsgCode*, subfield *RequestCode*, which in case of rule deletion has the value of 0x2 (see Table 7-1).

1.1.3.3 Deletion of UMT tunnel entrance rule at the ingress of Bridge Y, port 0

The contents of a *UMT_CONFIG* UMTPDU that deletes the UMT tunnel entrance rule at the ingress of Bridge Y, port 0 is identical to the *UMT_CONFIG* UMTPDU shown in Table 7A-6, with the exception of the value of the field *MsgCode*, subfield *RequestCode*, which in case of rule deletion has the value of 0x2 (see Table 7-1).

1.1.3.4 Deletion of UMT tunnel exit rule at the egress of Bridge X, port 3

The contents of a *UMT_CONFIG* UMTPDU that deletes the UMT tunnel exit rule at the egress of Bridge X, port 3 is identical to the *UMT_CONFIG* UMTPDU shown in Table 7A-8, with the exception of the value of the field *MsgCode*, subfield *RequestCode*, which in case of rule deletion has the value of 0x2 (see Table 7-1).