



June 30, 2000

T10/00-XXX revision 0

To: John Lohmeyer, chairperson, T10
From: Bob Snively
Date: June 2, 2000
Subject: Draft of Annex D, FCP-2 revision 5

This document contains a draft of Annex D to be included in FCP-2, revision 5, based on T10/00-137r5.

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Annex D Error detection and recovery action examples

(Informative) [Draft, based on T10/00-137r5]

D.1 Introduction

This annex diagrams various error detection and recovery procedures for SCSI devices conforming to this profile.

Table D.1 - Diagram Drawing Conventions

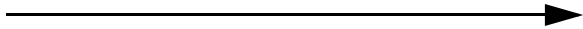

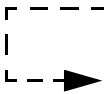
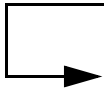

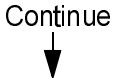
Drawing Convention	Meaning
	Acknowledged or Unacknowledged Frame
	Acknowledgement Frame
	Time-out value exceeded, caused transmission of IU or ELS
	IU or ELS received is processed to transmit IU or ELS
	Frame lost or dropped
	Error detection complete. Operation continues with specified Error Recovery.

Figure D.1 - Lengthy FCP_CMND or Lost ACK

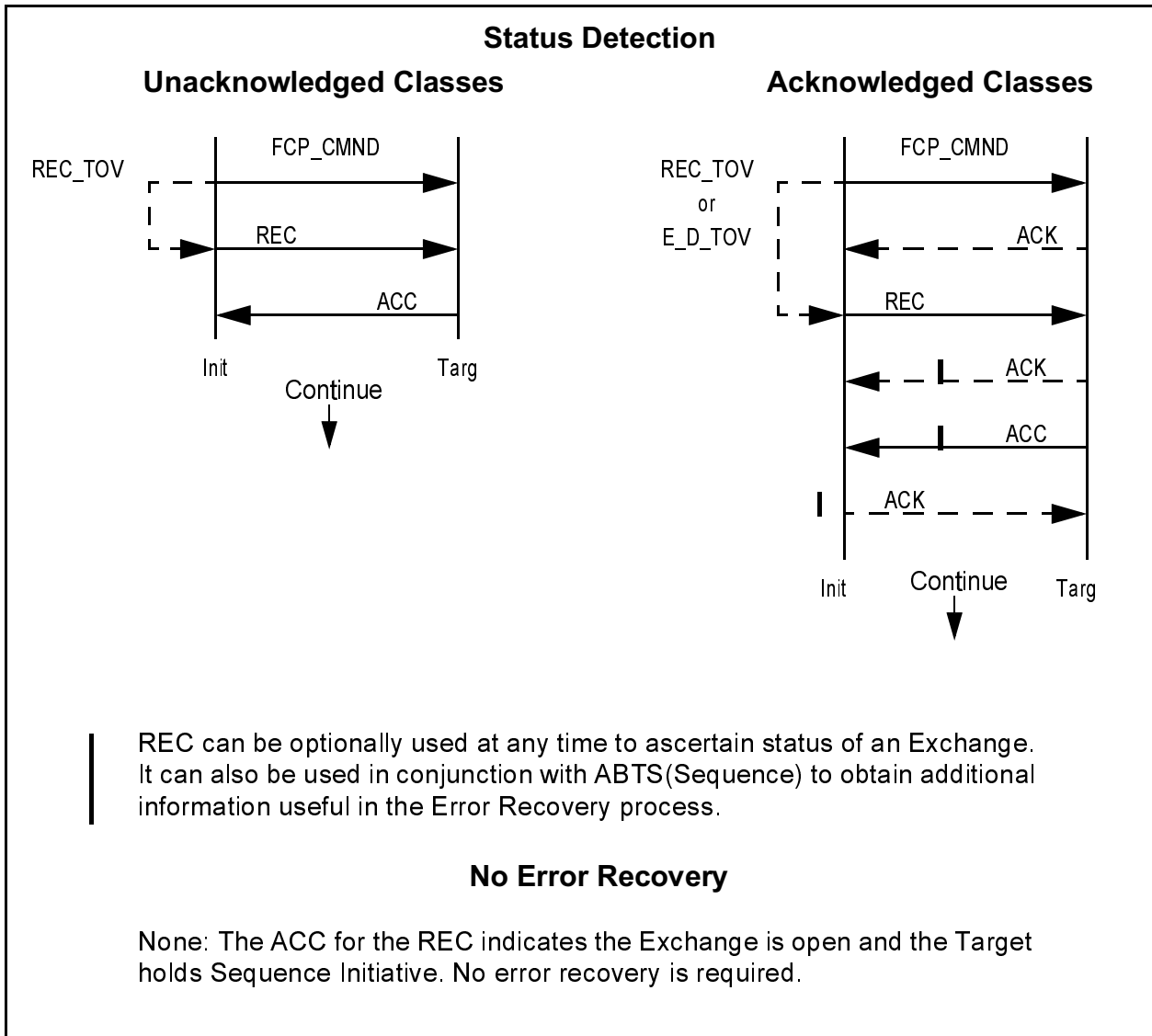


Figure D.2 - FCP_CMND Lost, Unacknowledged Classes

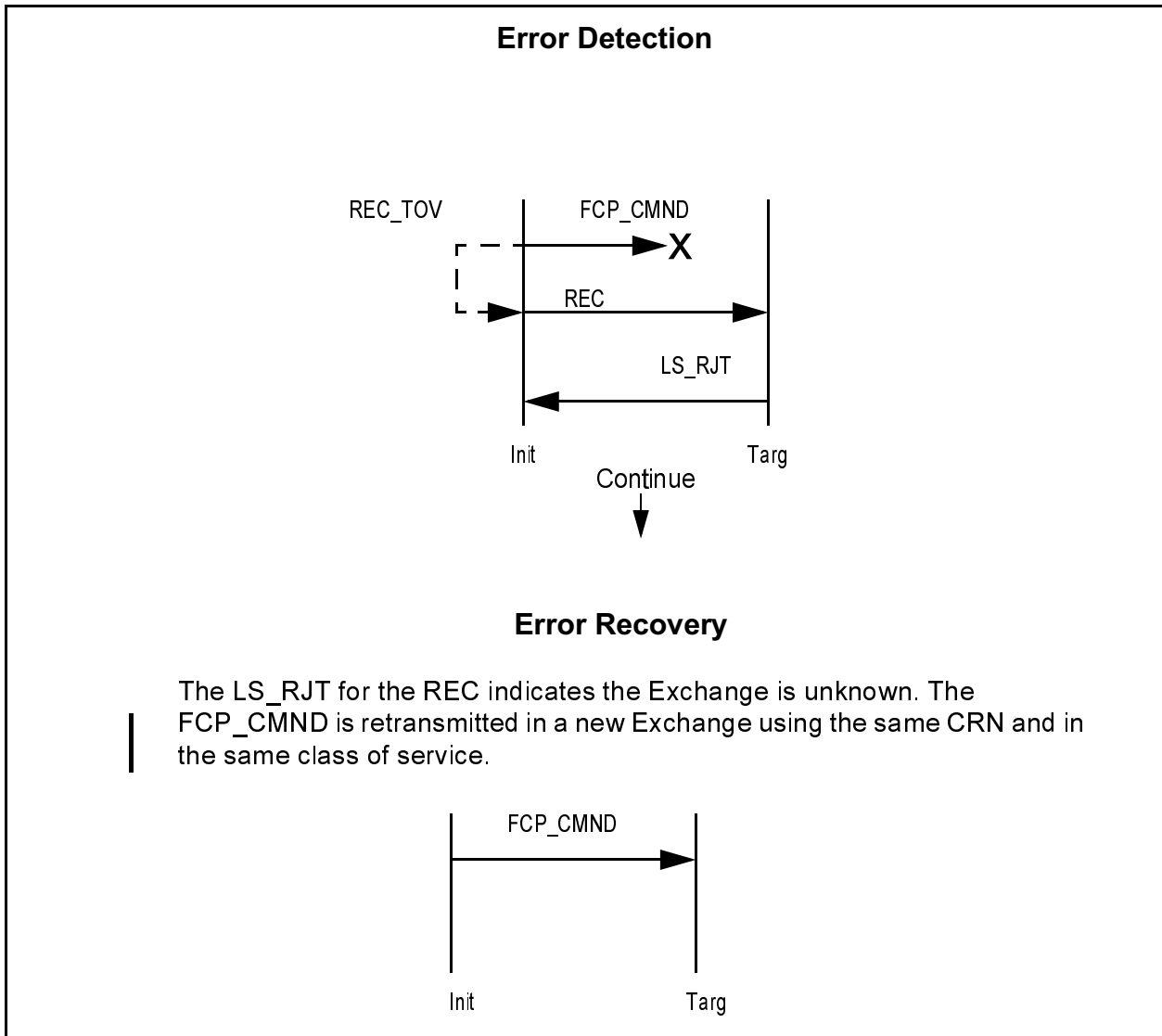


Figure D.3 - FCP_CMND Lost, Acknowledged Classes

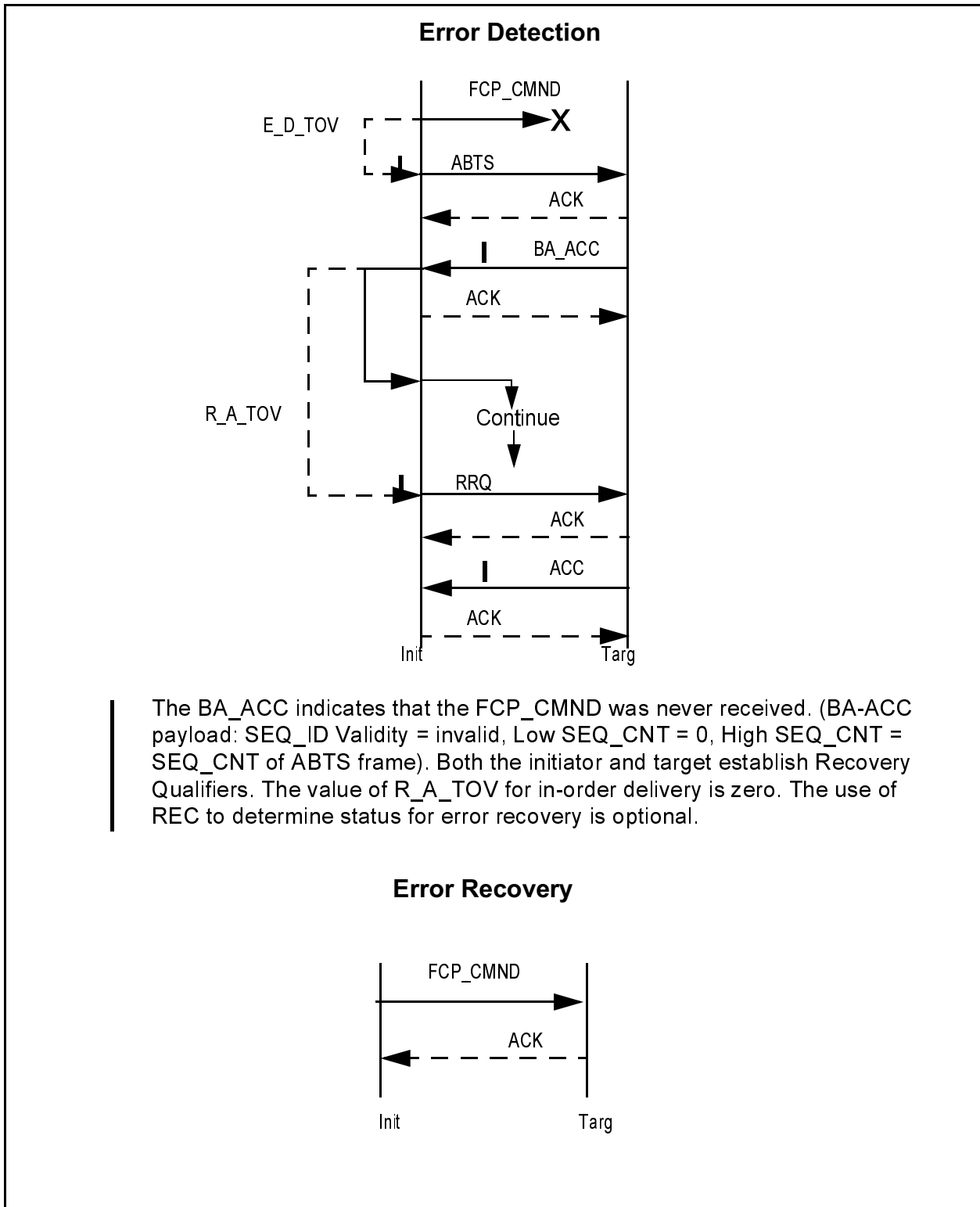
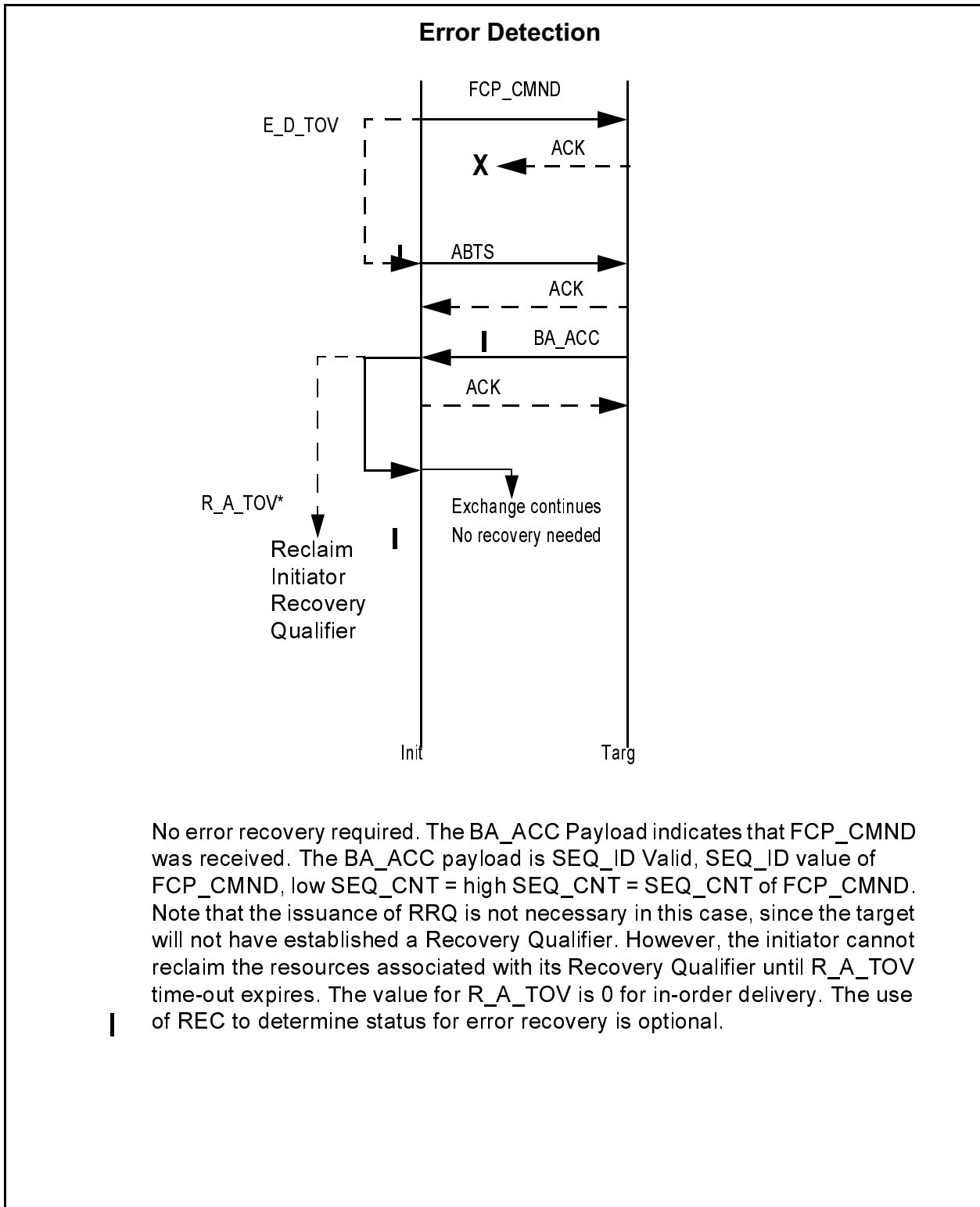


Figure D.4 - FCP_CMND Acknowledgement Lost, Acknowledged Classes



No error recovery required. The BA_ACC Payload indicates that FCP_CMND was received. The BA_ACC payload is SEQ_ID Valid, SEQ_ID value of FCP_CMND, low SEQ_CNT = high SEQ_CNT = SEQ_CNT of FCP_CMND. Note that the issuance of RRQ is not necessary in this case, since the target will not have established a Recovery Qualifier. However, the initiator cannot reclaim the resources associated with its Recovery Qualifier until R_A_TOV time-out expires. The value for R_A_TOV is 0 for in-order delivery. The use of REC to determine status for error recovery is optional.

Figure D.5 - FCP_XFER_RDY Lost, Unacknowledged Classes

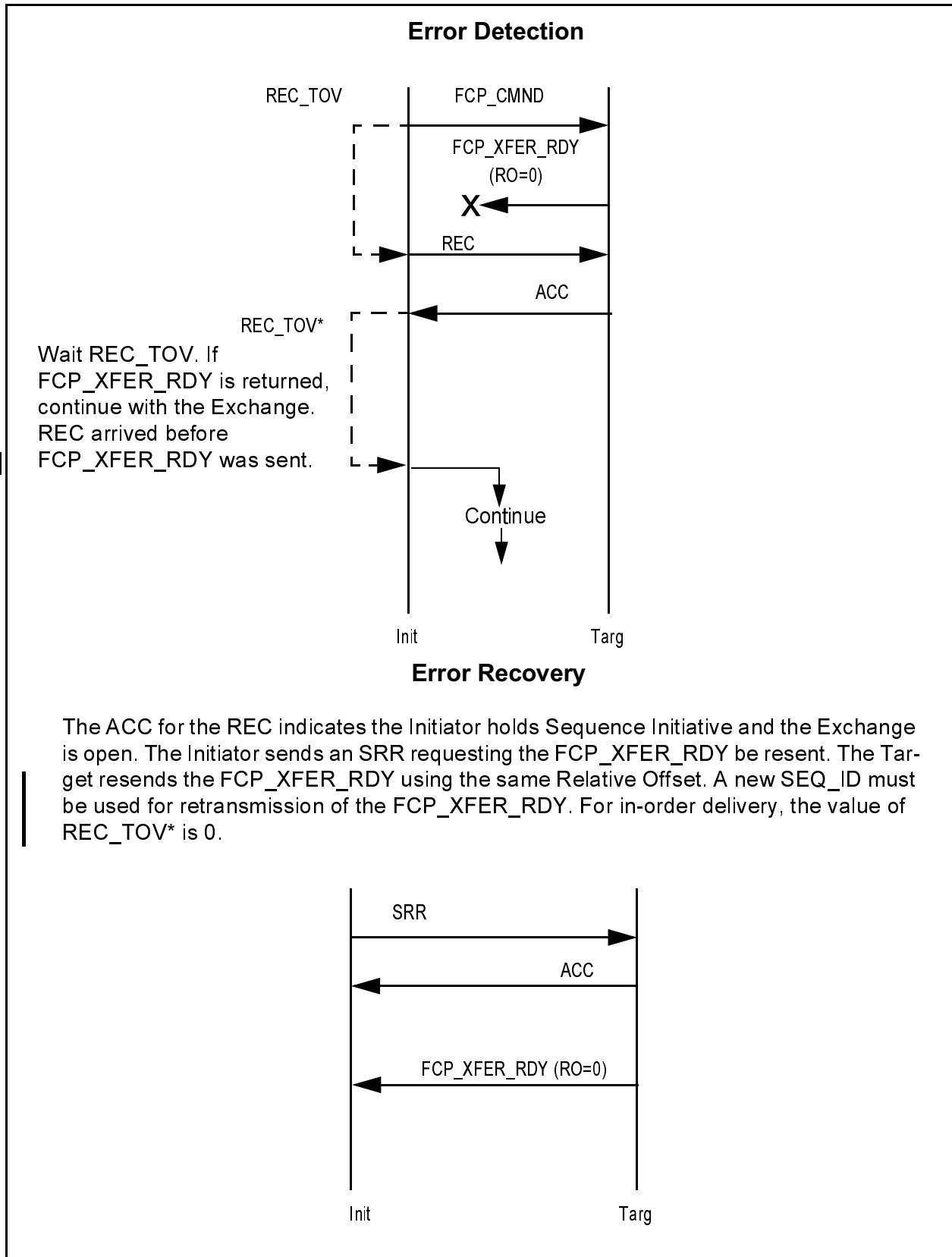
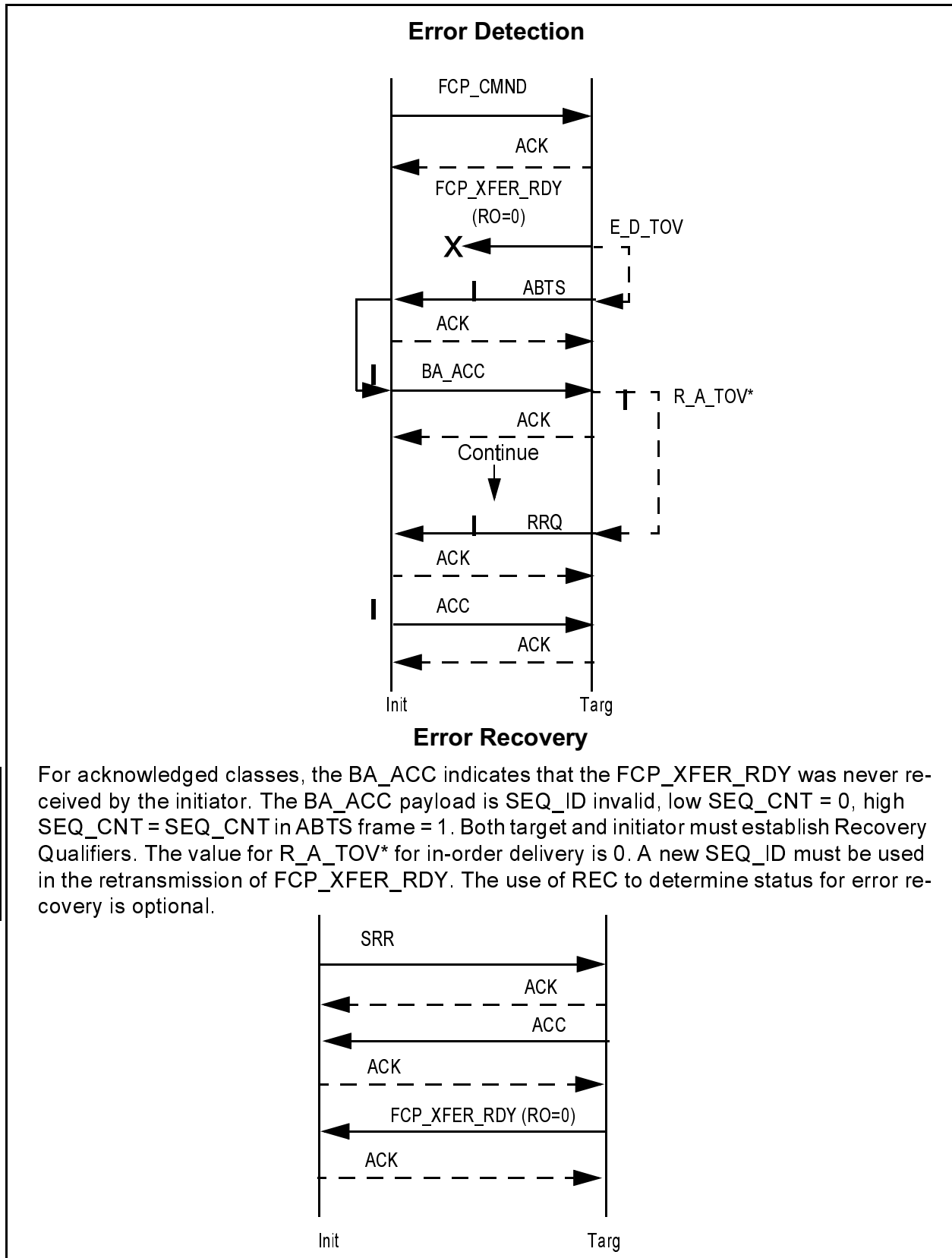


Figure D.6 - FCP_XFER_RDY Lost, Acknowledged Classes



For acknowledged classes, the BA_ACC indicates that the FCP_XFER_RDY was never received by the initiator. The BA_ACC payload is SEQ_ID invalid, low SEQ_CNT = 0, high SEQ_CNT = SEQ_CNT in ABTS frame = 1. Both target and initiator must establish Recovery Qualifiers. The value for R_A_TOV* for in-order delivery is 0. A new SEQ_ID must be used in the retransmission of FCP_XFER_RDY. The use of REC to determine status for error recovery is optional.

Figure D.7 - FCP_XFER_RDY Received, ACK Lost, Acknowledged Classes

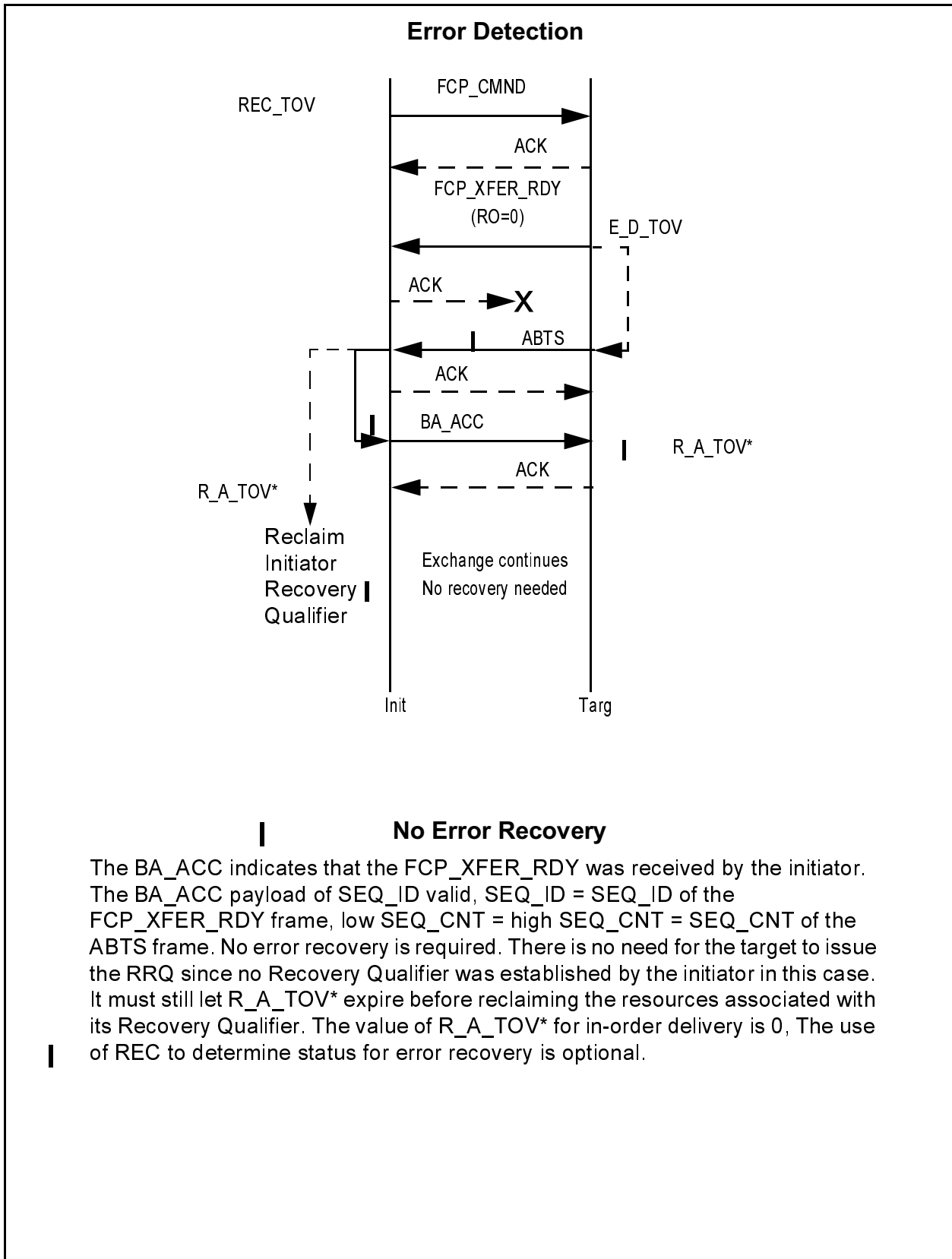


Figure D.8 - FCP_RSP Lost, FCP_CONF not requested, Unacknowledged Classes

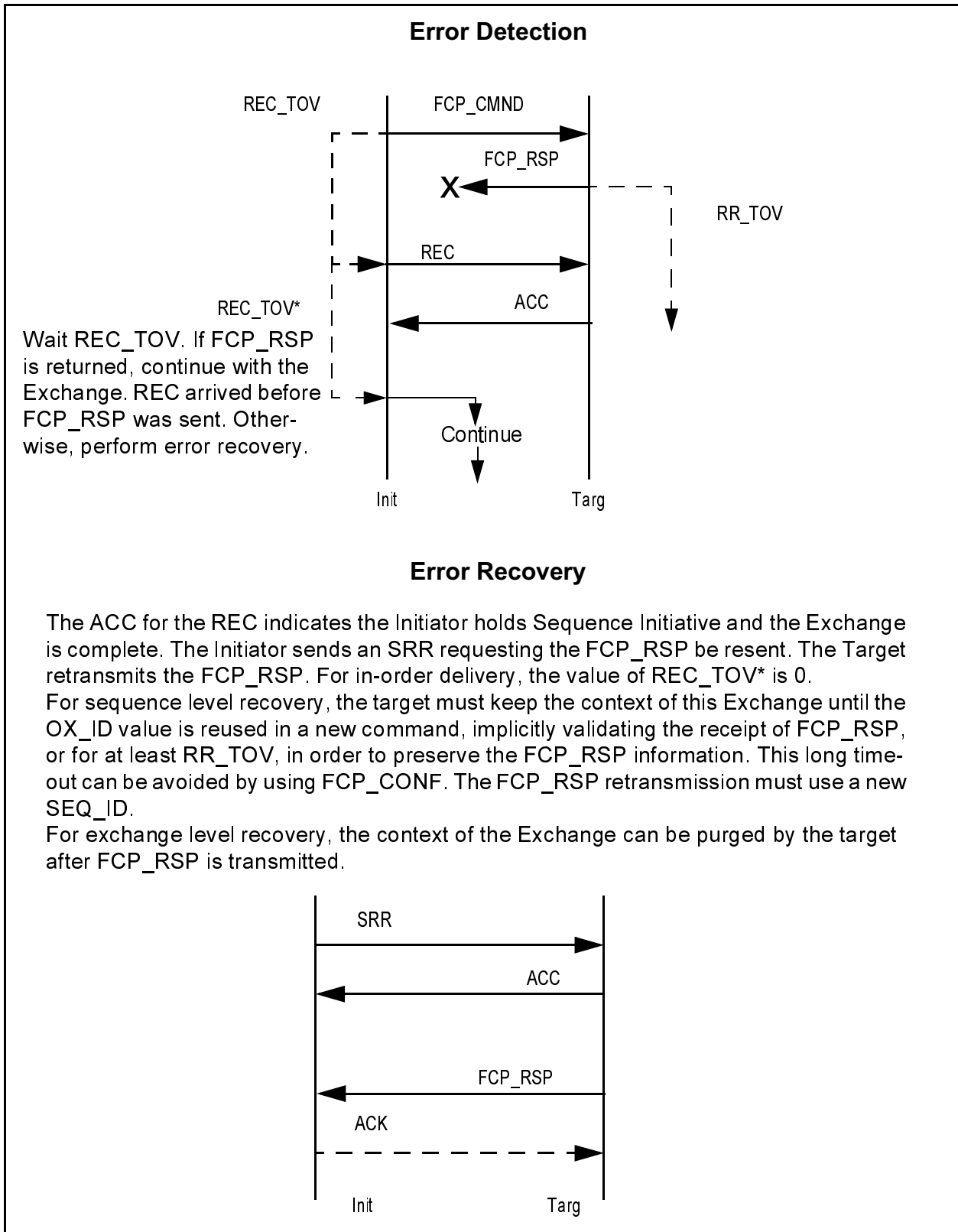
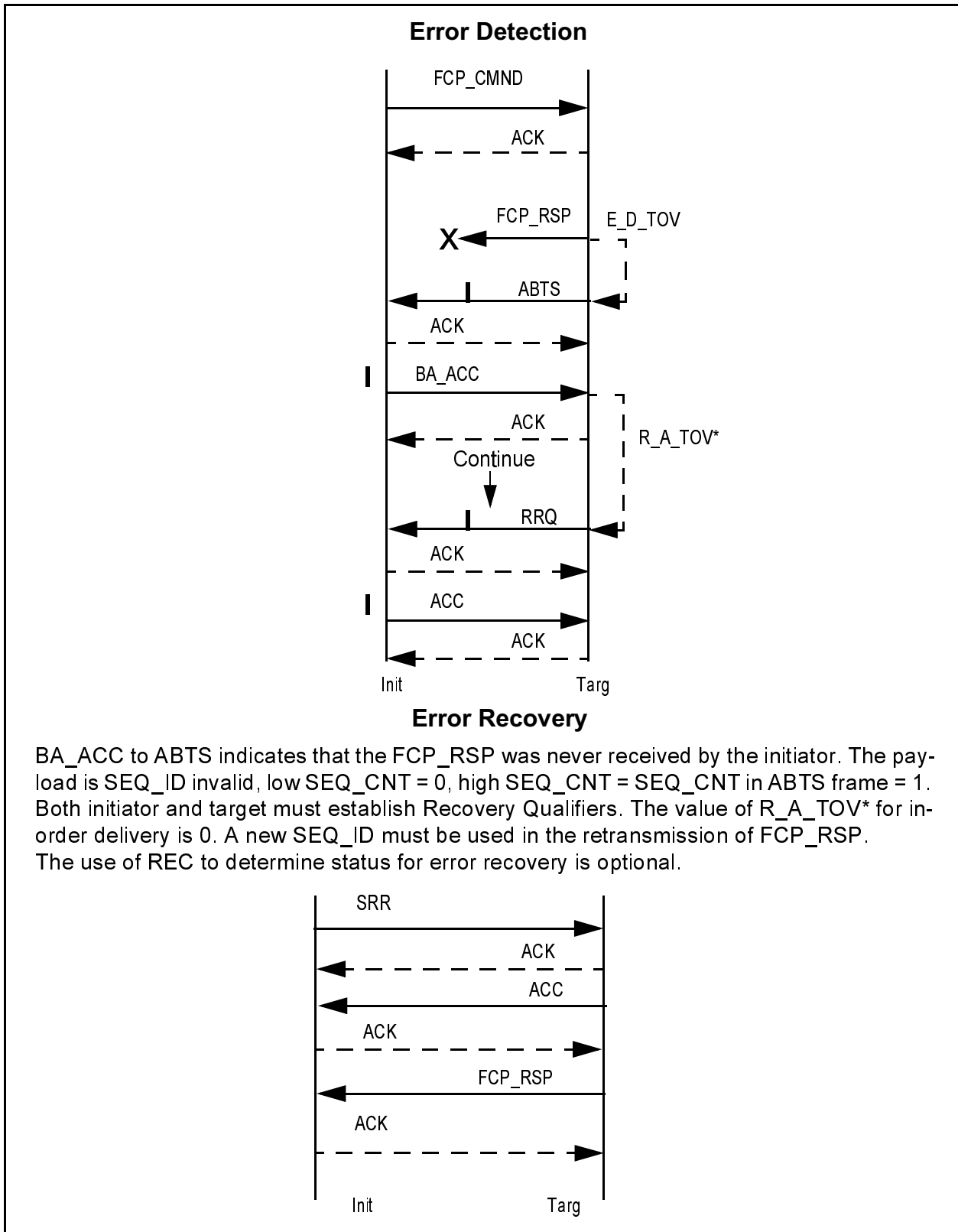


Figure D.9 - FCP_RSP Lost, FCP_CONF not requested, Acknowledged Classes



BA_ACC to ABTS indicates that the FCP_RSP was never received by the initiator. The payload is SEQ_ID invalid, low SEQ_CNT = 0, high SEQ_CNT = SEQ_CNT in ABTS frame = 1. Both initiator and target must establish Recovery Qualifiers. The value of R_A_TOV* for in-order delivery is 0. A new SEQ_ID must be used in the retransmission of FCP_RSP. The use of REC to determine status for error recovery is optional.

Figure D.10 - FCP_RSP Lost after Read Command, FCP_CONF not requested, Acknowledged Classes

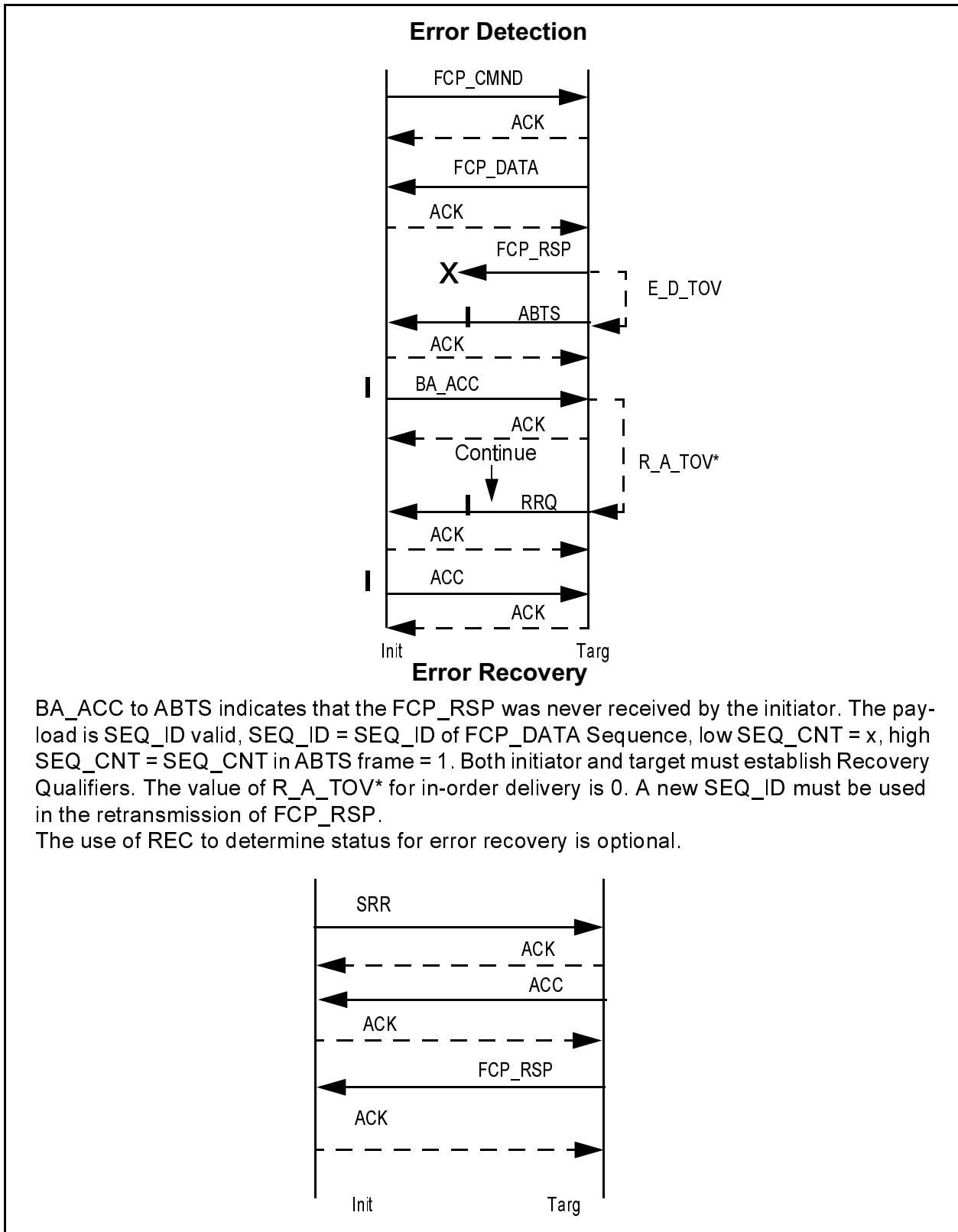


Figure D.11 - FCP_RSP Received, ACK Lost, Acknowledged Classes, Example 1

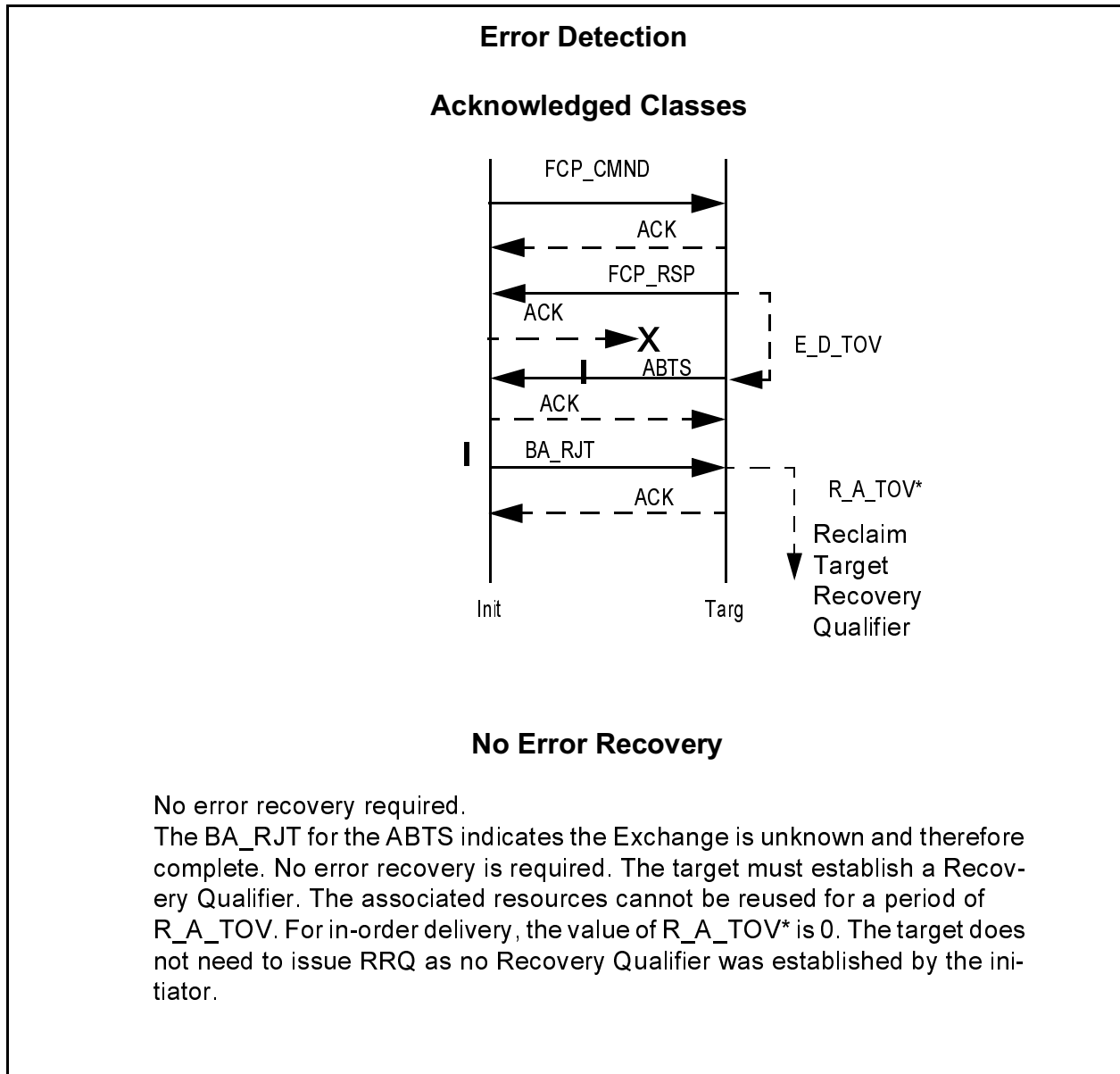


Figure D.12 - FCP_RSP Received, ACK Lost, Acknowledged Classes, Example 2

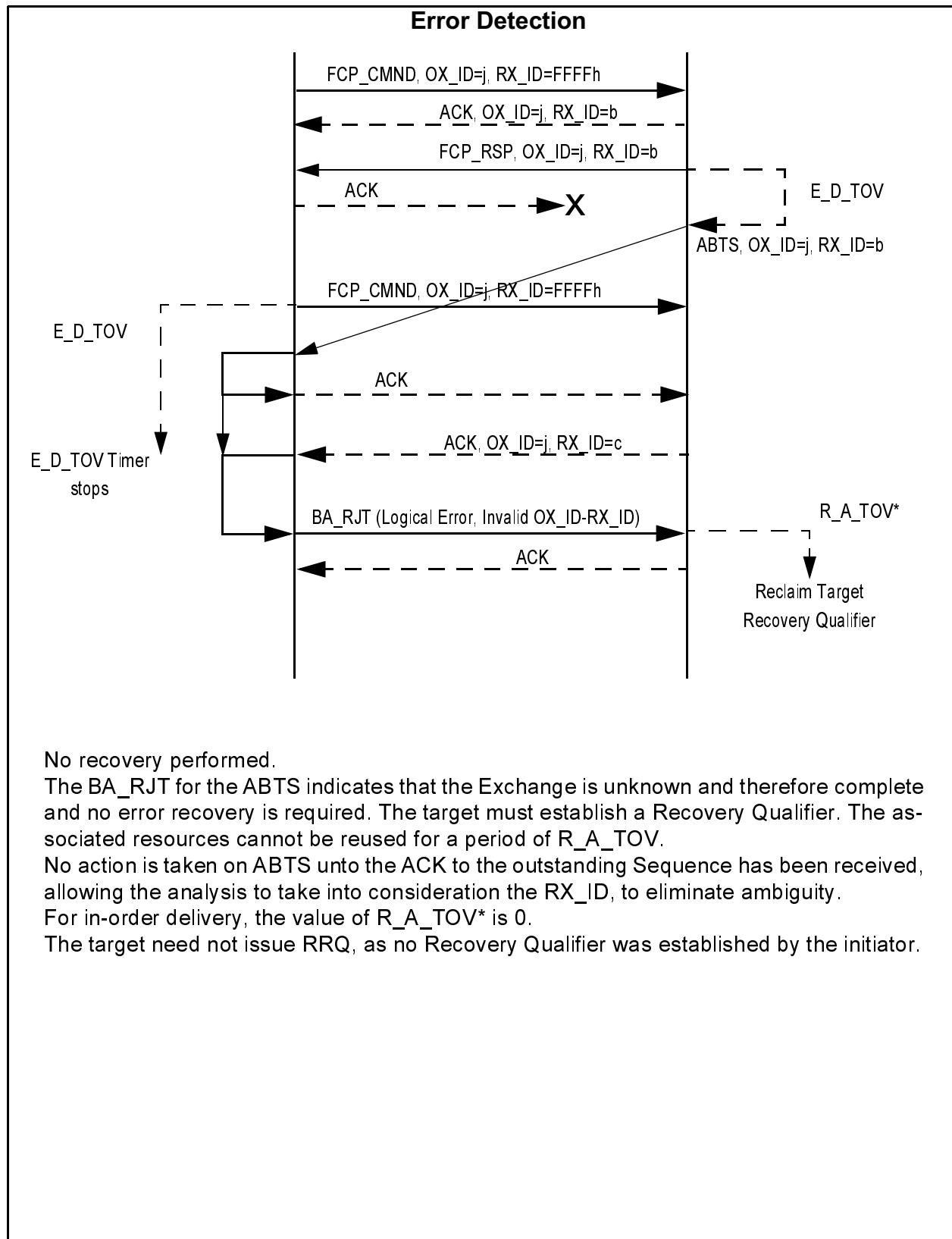


Figure D.13 - Lost Write Data, Last Frame of Sequence, Unacknowledged Classes

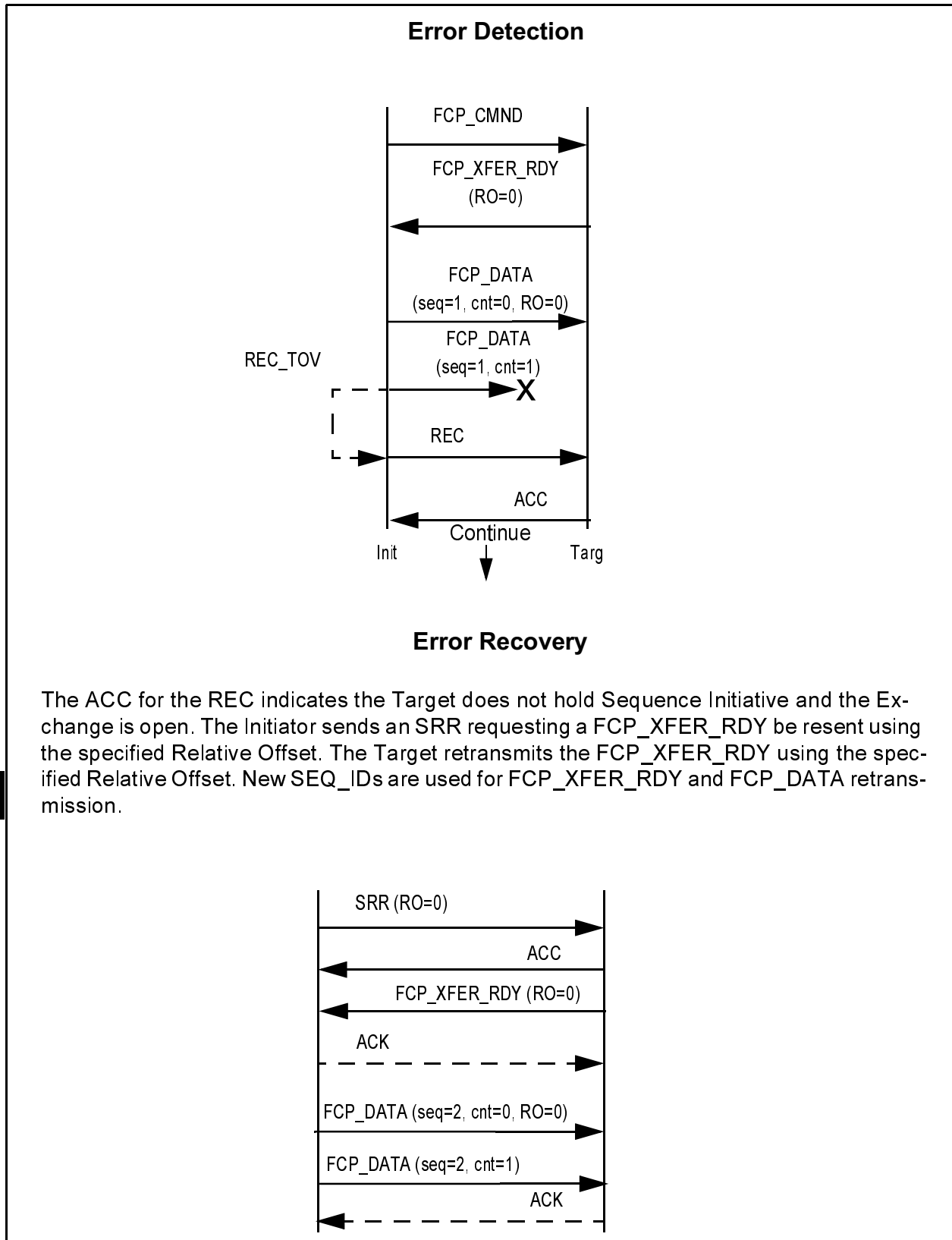
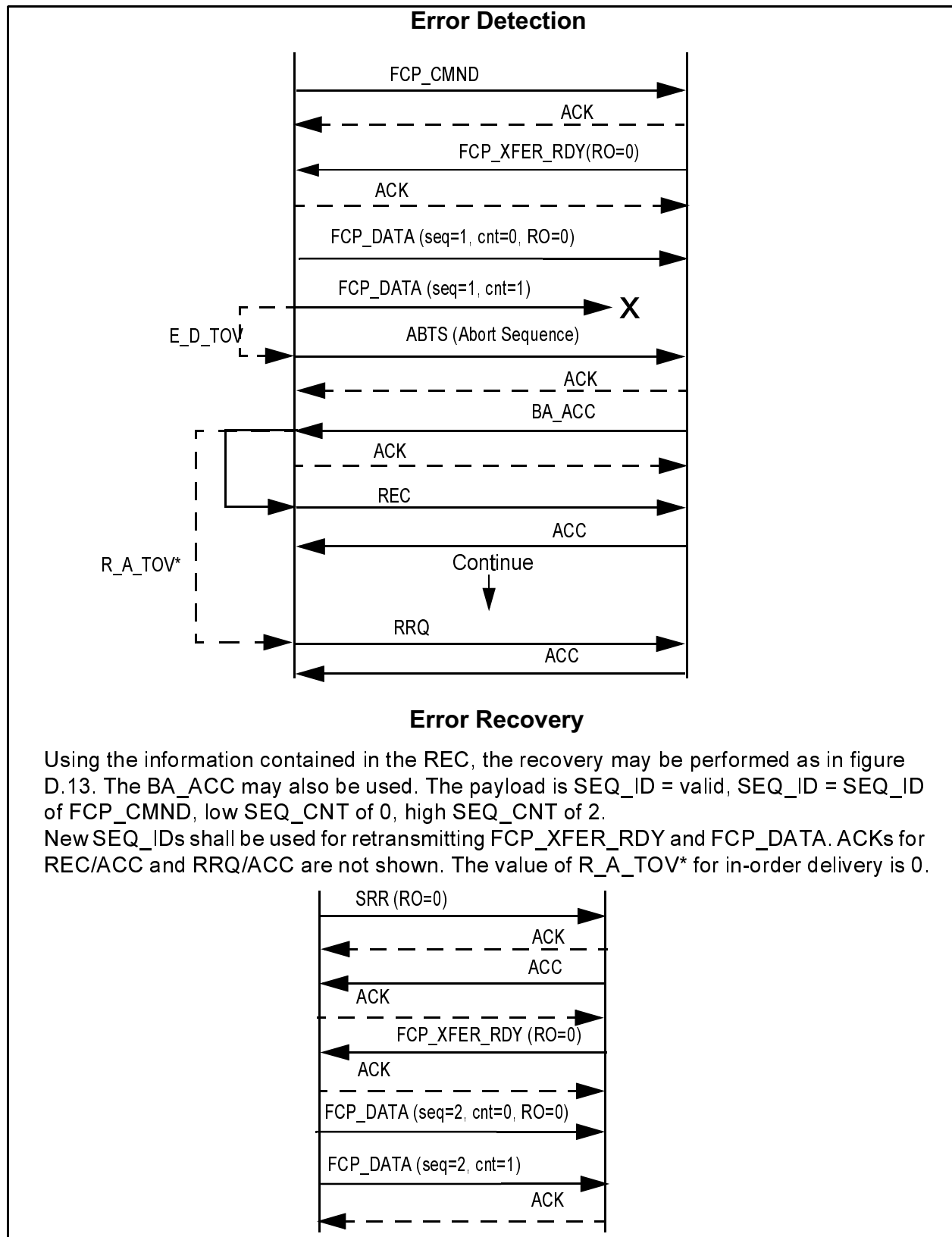


Figure D.14 - Lost Write Data, Last Frame of Sequence, Acknowledged Classes



Using the information contained in the REC, the recovery may be performed as in figure D.13. The BA_ACC may also be used. The payload is SEQ_ID = valid, SEQ_ID = SEQ_ID of FCP_CMND, low SEQ_CNT of 0, high SEQ_CNT of 2. New SEQ_IDs shall be used for retransmitting FCP_XFER_RDY and FCP_DATA. ACKs for REC/ACC and RRQ/ACC are not shown. The value of R_A_TOV* for in-order delivery is 0.

Figure D.15 - Lost Write Data, Not Last Frame of Sequence, Unacknowledged Classes

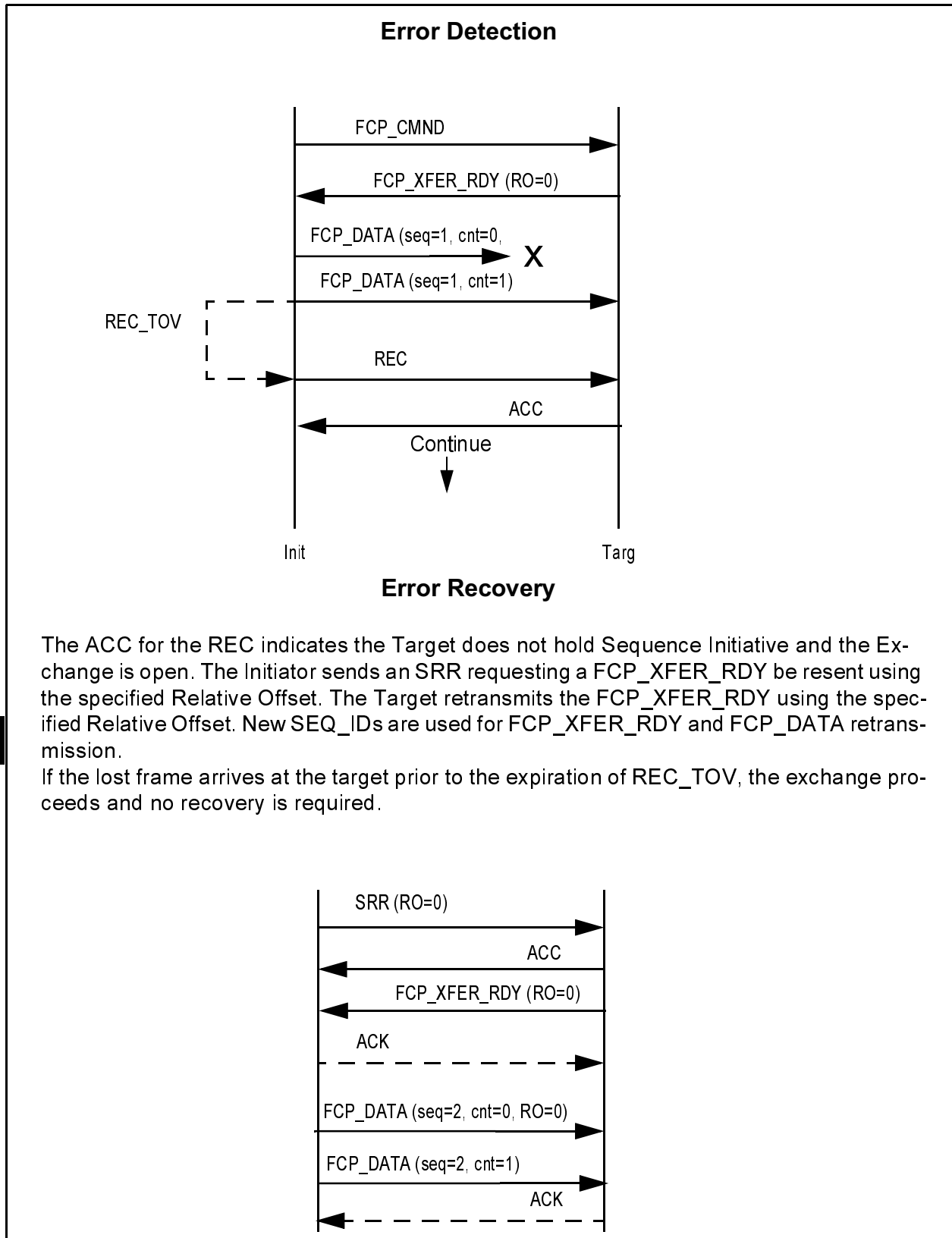


Figure D.16 - Lost Write Data, Not Last Frame of Sequence, Acknowledged Classes

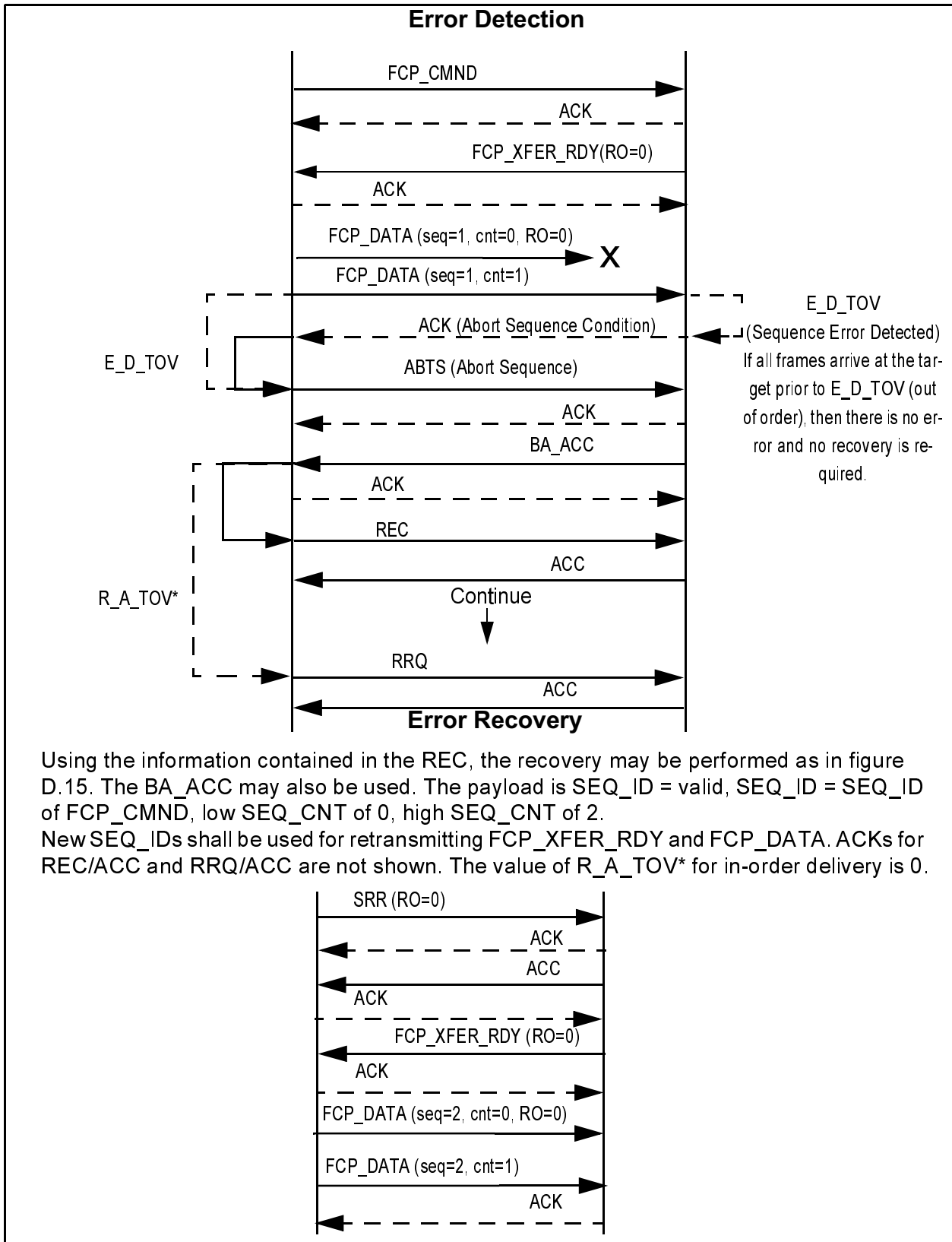


Figure D.17 - Lost Read Data, Last Frame of Sequence, Unacknowledged Classes

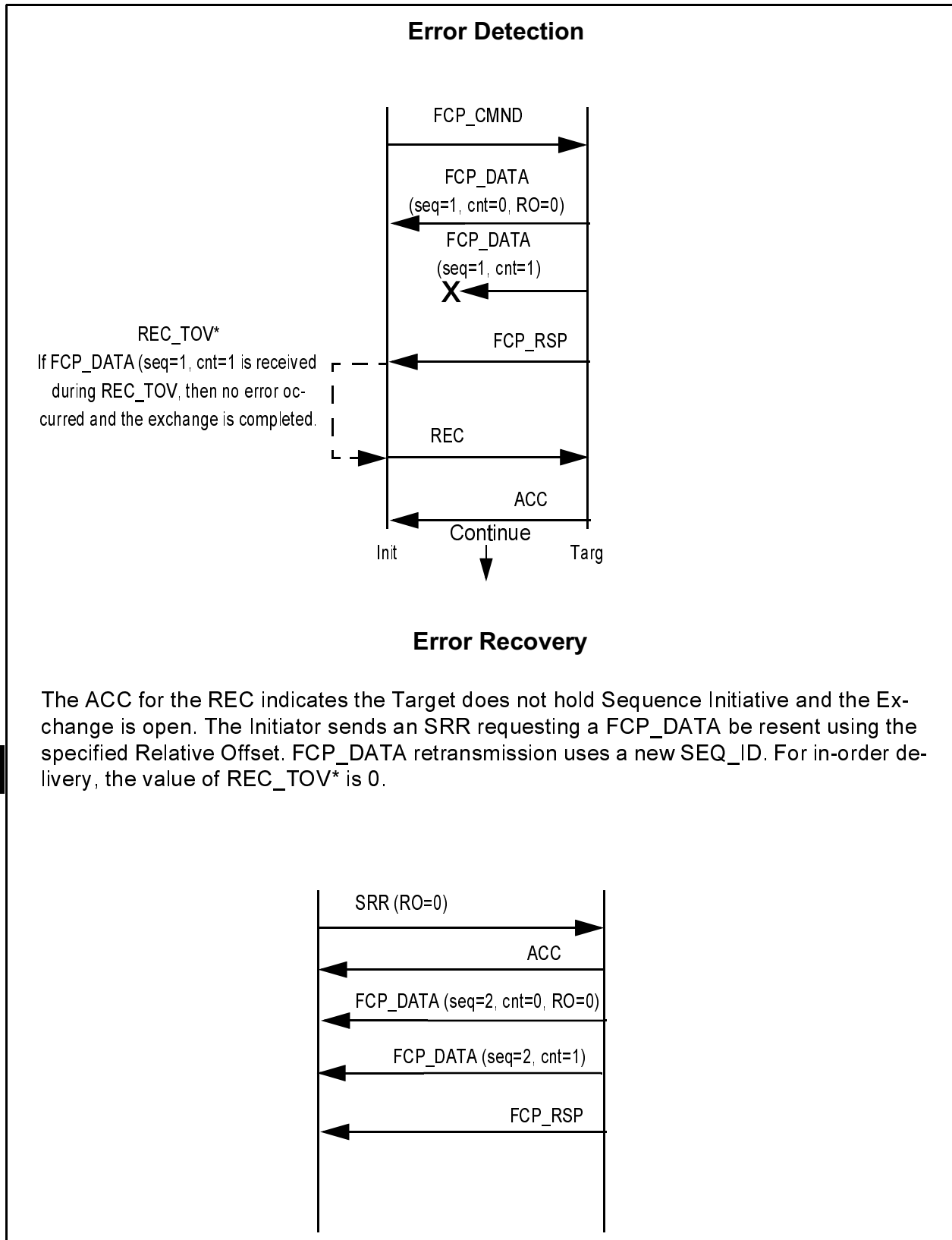


Figure D.18 - Lost Read Data, Last Frame of Sequence, Acknowledged Classes

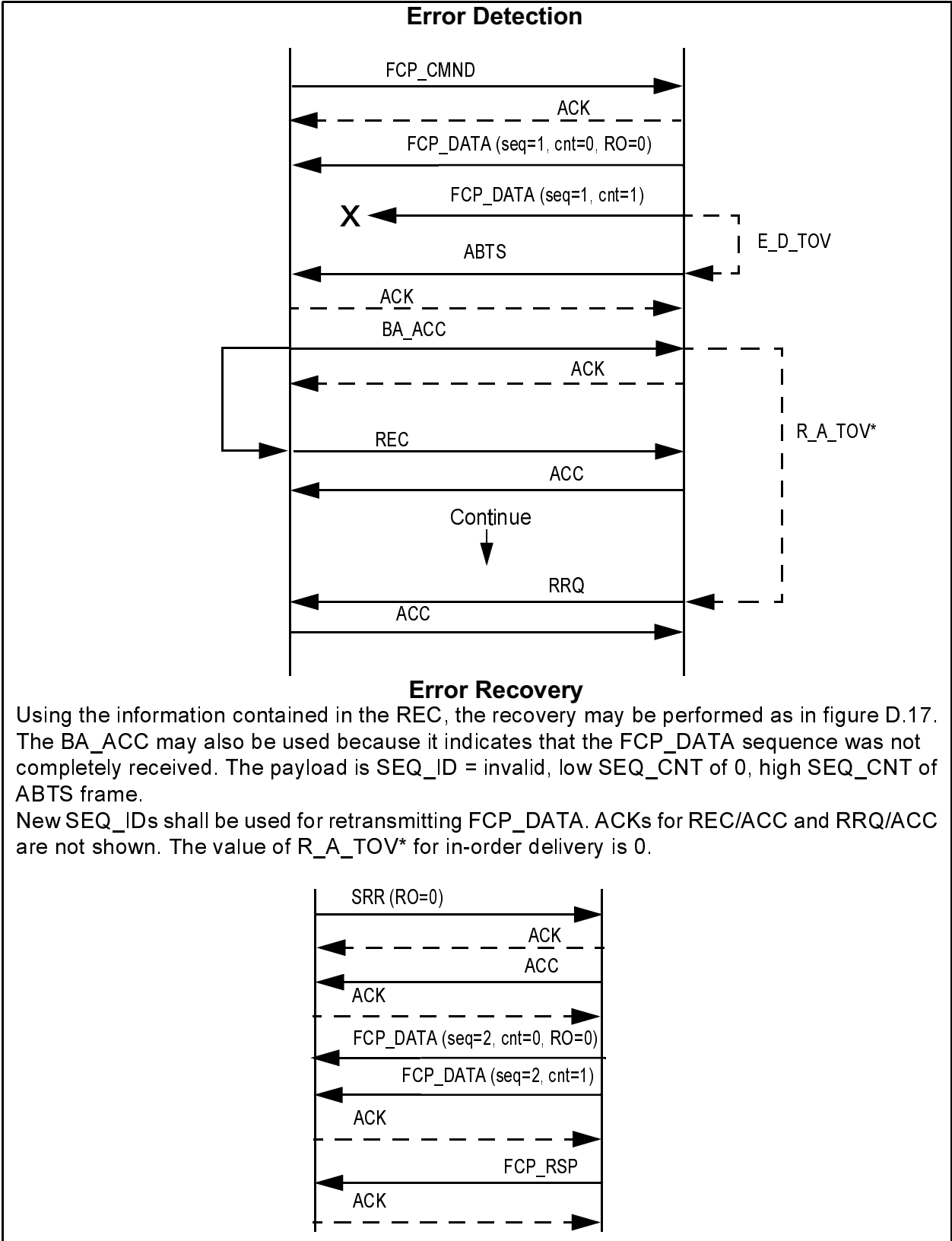


Figure D.19 - Lost Read Data, Not Last Frame of Sequence, Unacknowledged Classes

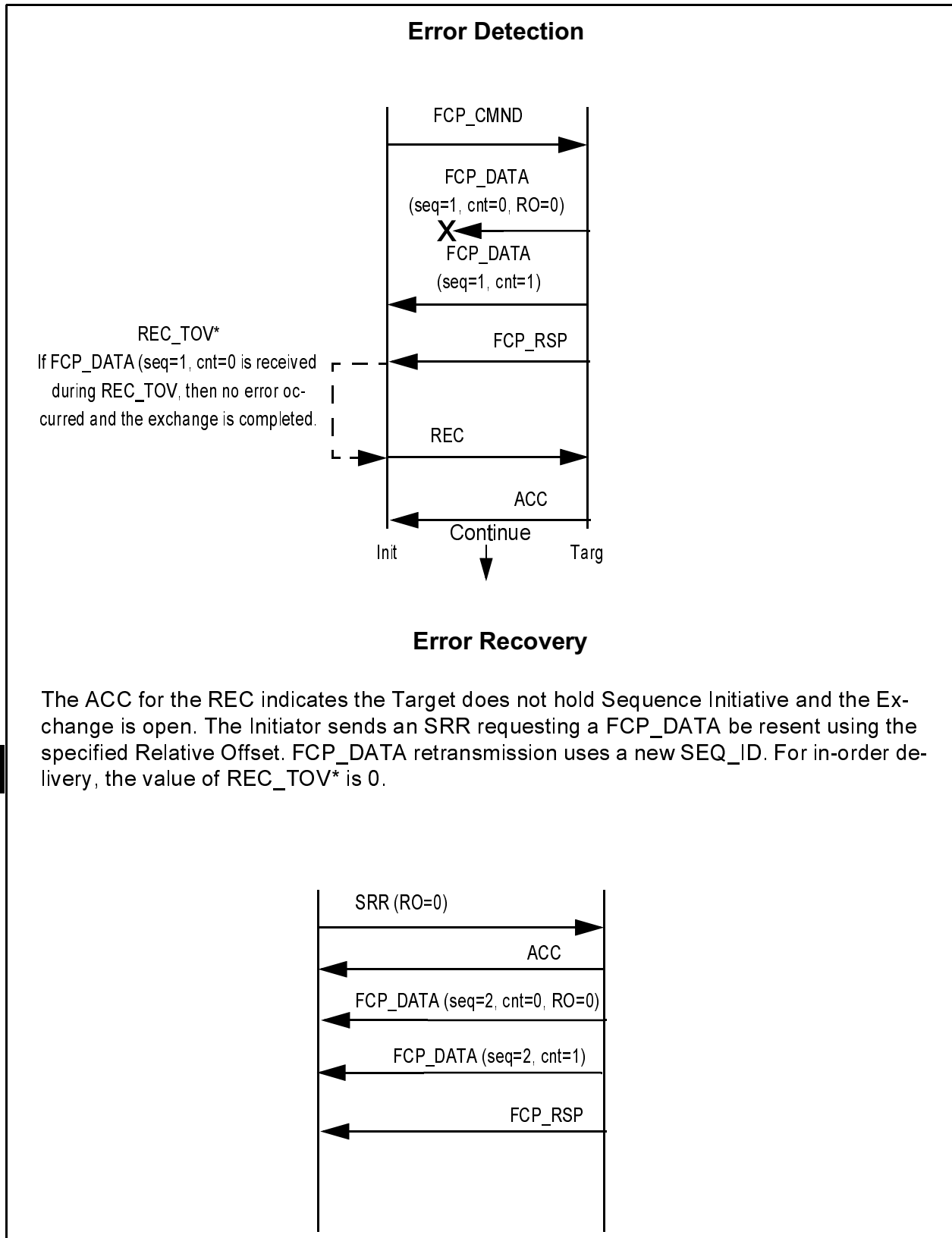


Figure D.20 - Lost Read Data, Not Last Frame of Sequence, Acknowledged Classes

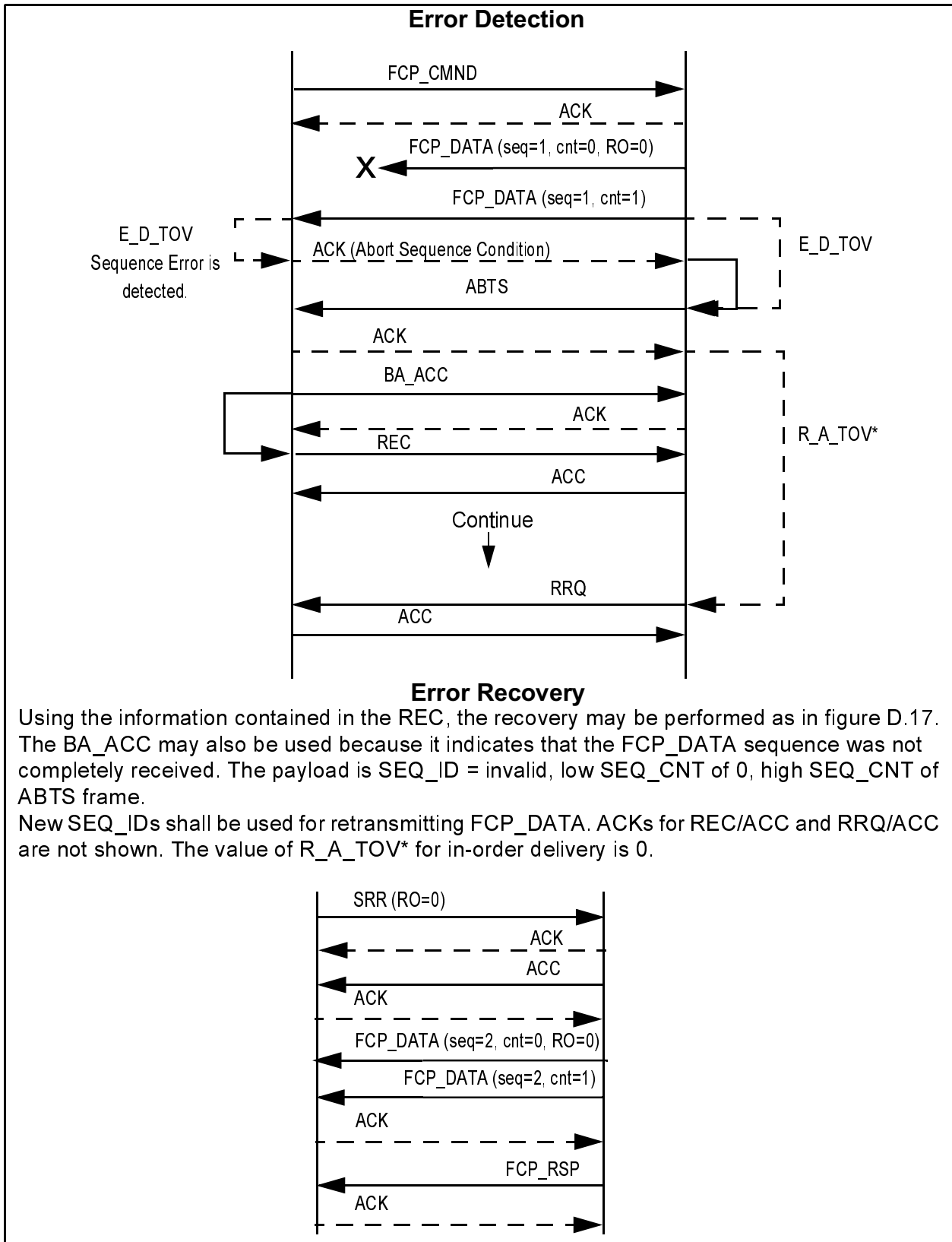


Figure D.21 - ACK Lost on Read (Acknowledged Classes)

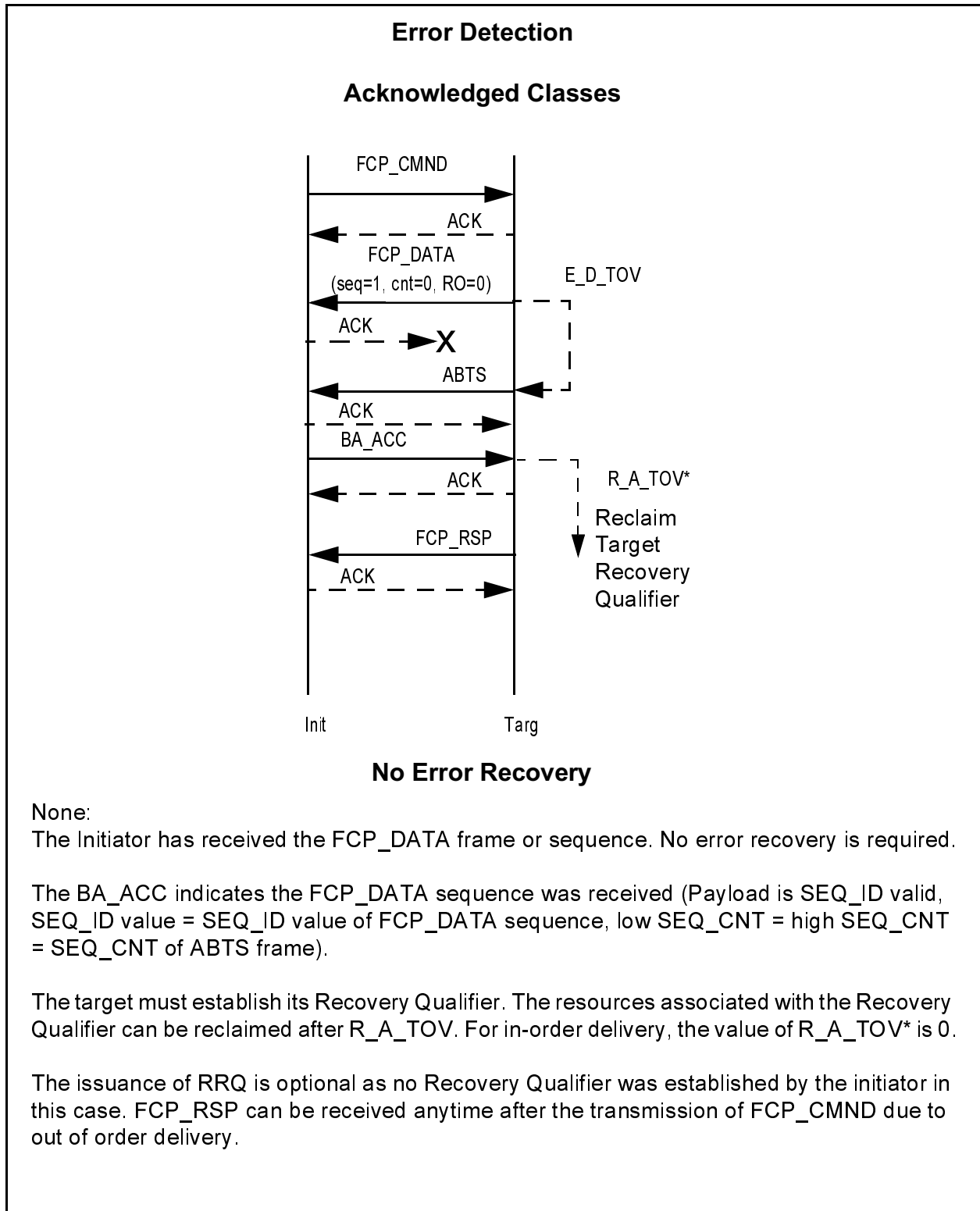


Figure D.22 - ACK Lost on Write (Acknowledged Classes)

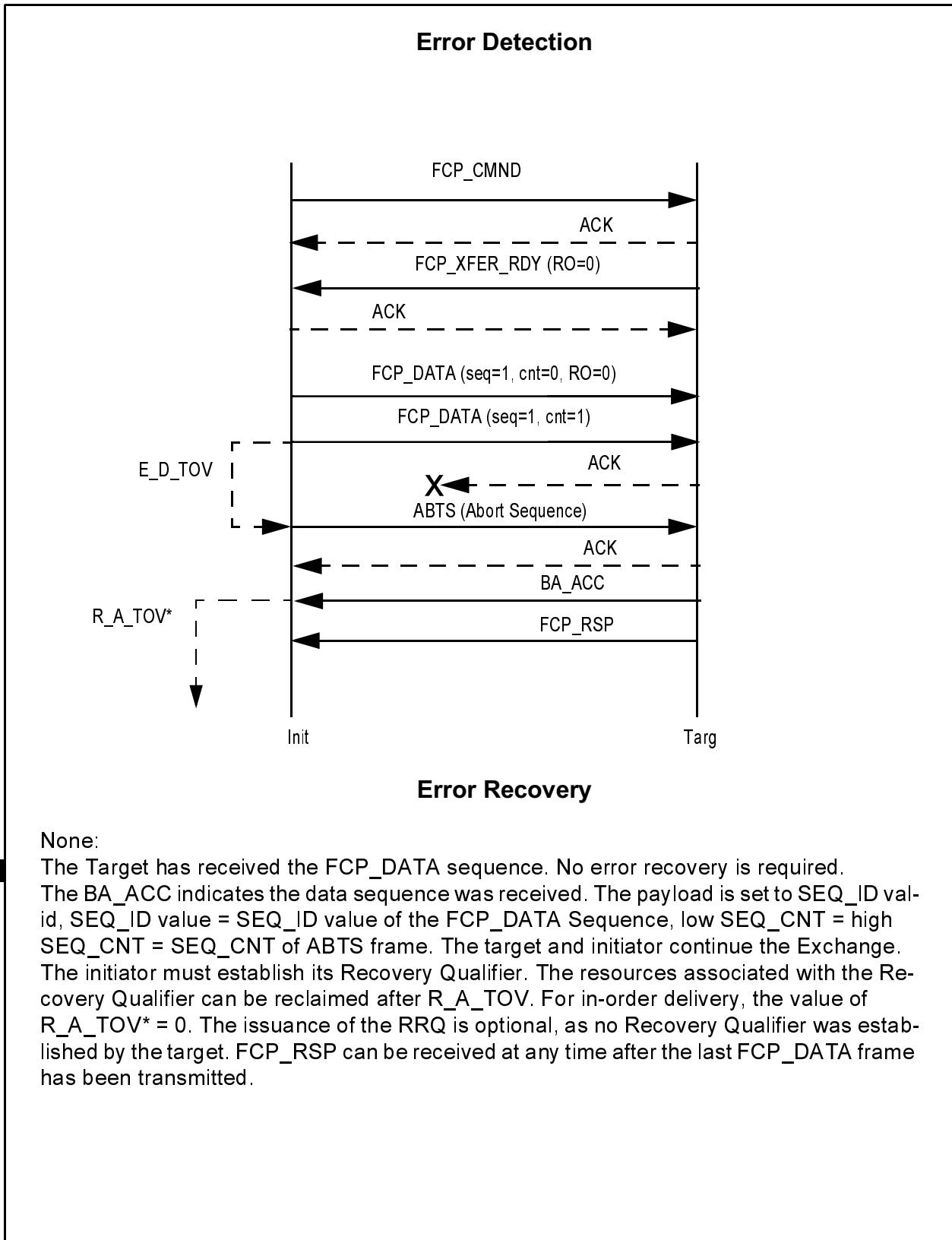


Figure D.23 - FCP_CONF Lost, Unacknowledged Classes

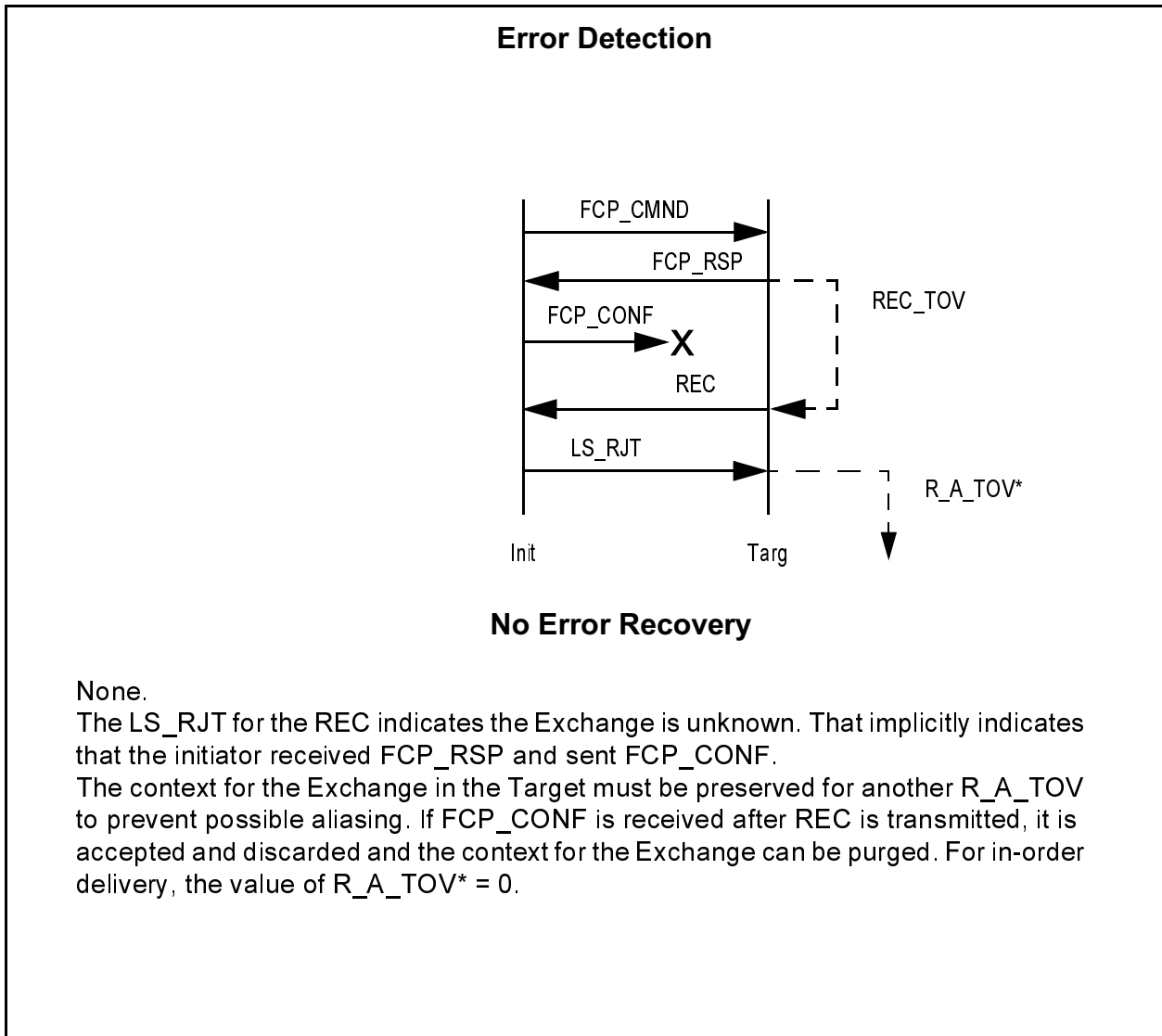


Figure D.24 - FCP_CONF Lost, Acknowledged Classes

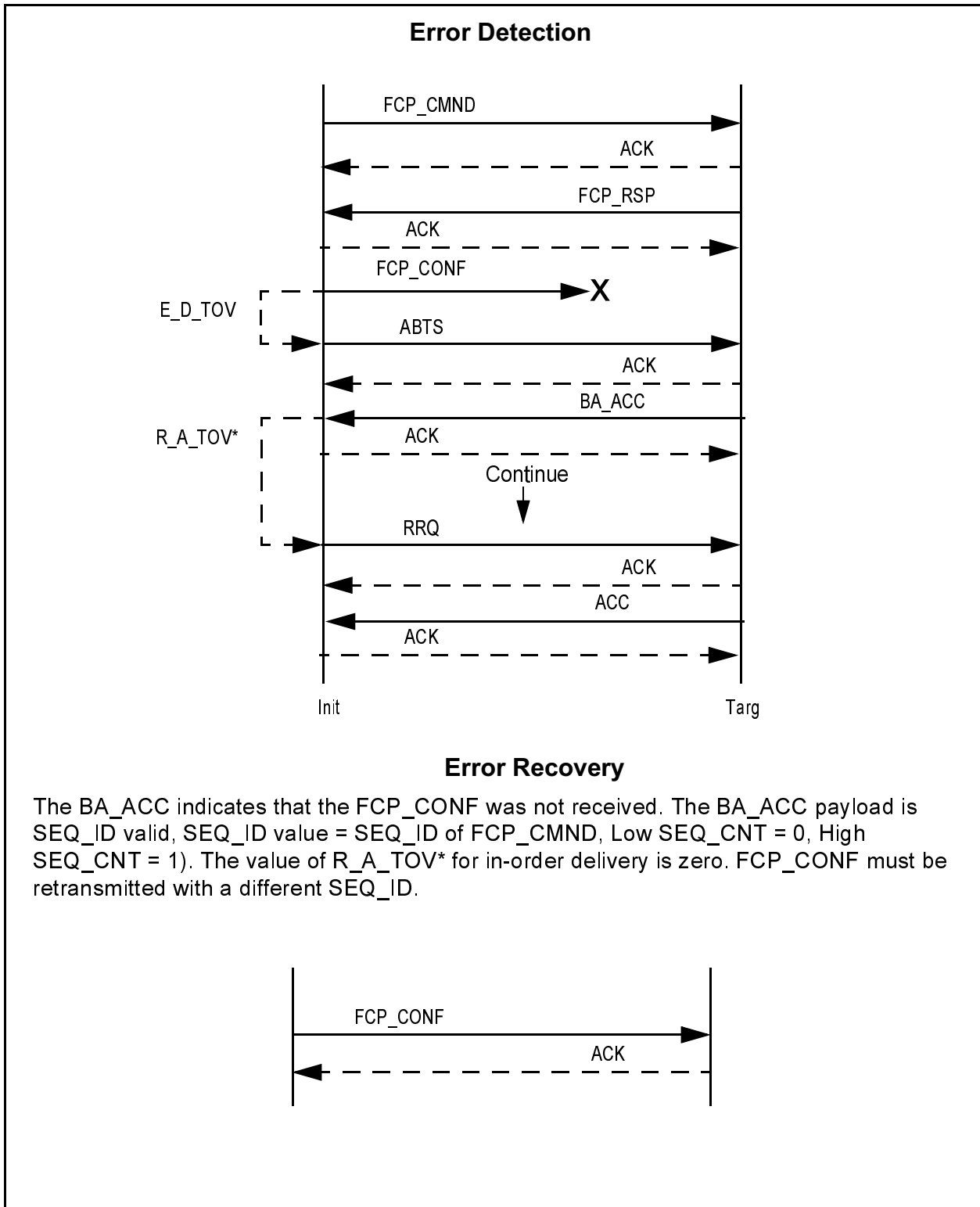


Figure D.25 - ACK lost on FCP_CONF, Acknowledged Classes

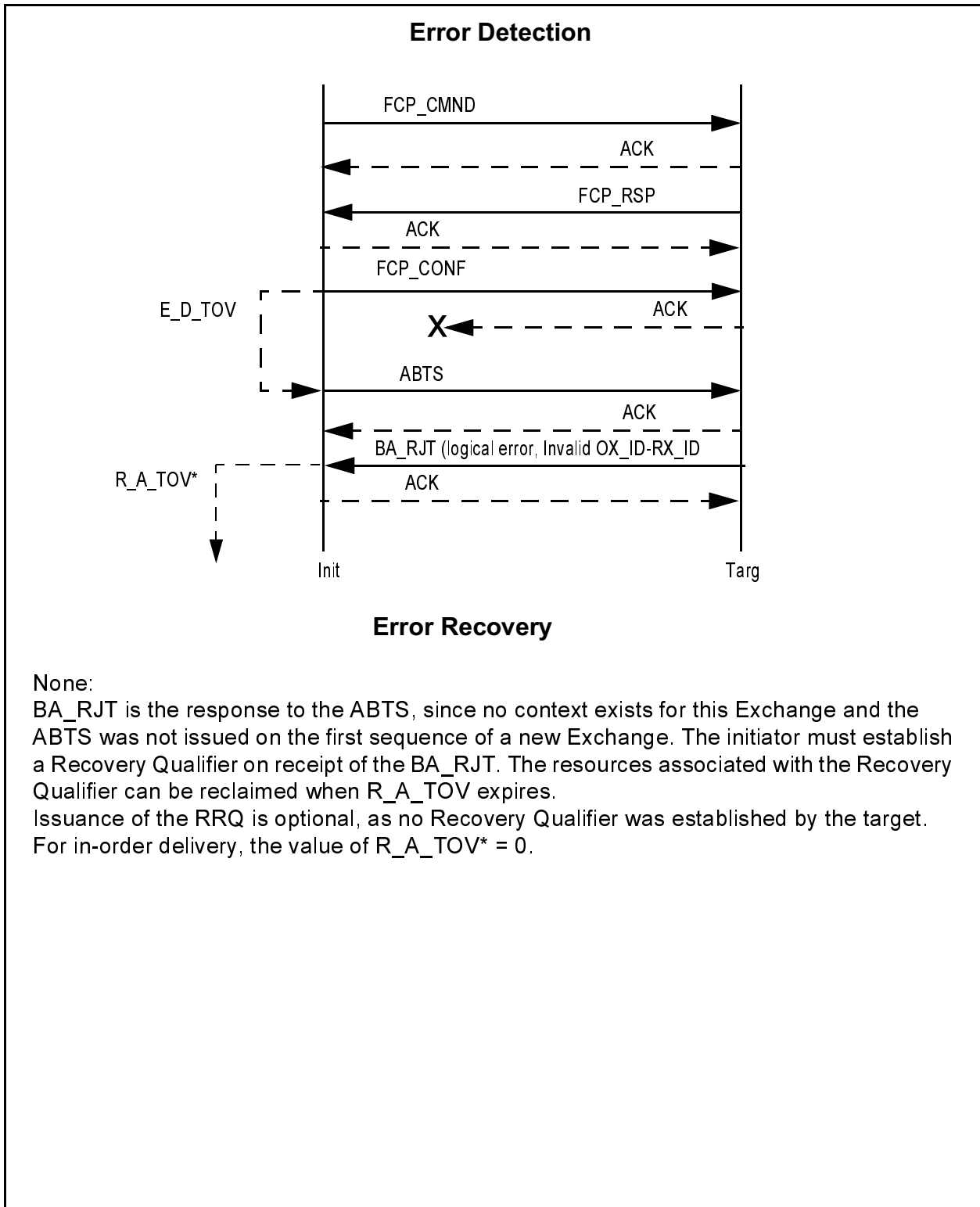
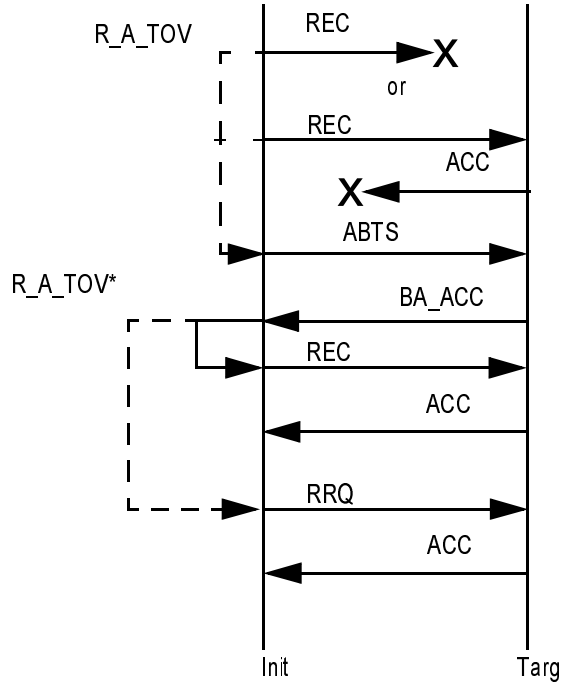


Figure D.26 - REC or REC Response Lost, Unacknowledged Classes

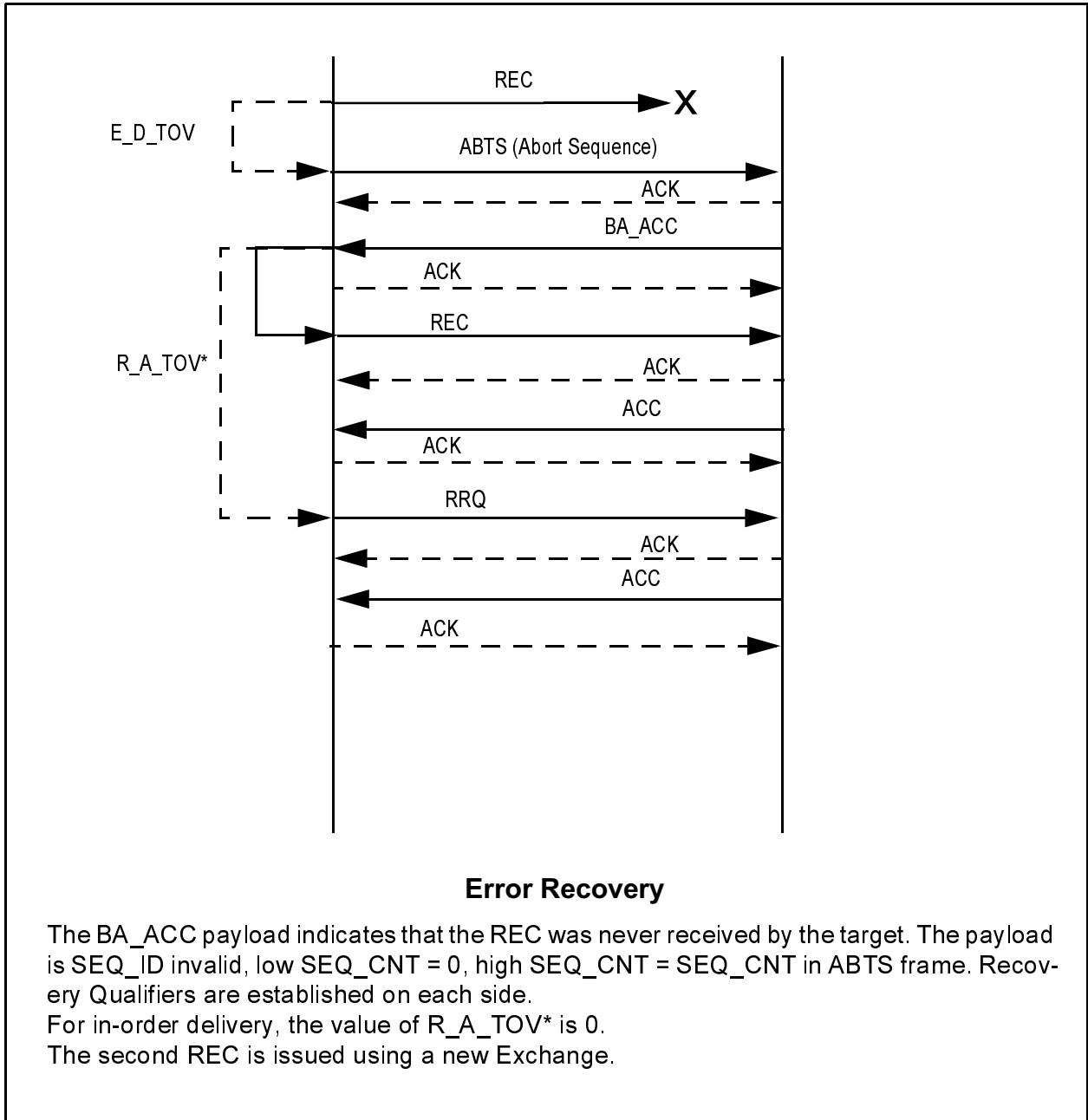


For the case of the REC never having been received, the BA_ACC payload will be SEQ_ID invalid, low SEQ_CNT = 0, high SEQ_CNT = SEQ_CNT of ABTS = 1.

For the case of the ACC response to REC never having been received, the target would view the ABTS as having been issued on a new Exchange. The BA_ACC payload will be SEQ_ID invalid, low SEQ_CNT = high SEQ_CNT = SEQ_CNT of ABTS.

In both cases, a Recovery Qualifier will be established. The second REC is issued in a new Exchange. For in-order delivery, the value of R_A_TOV* is 0

Figure D.27 - REC Lost, Acknowledged Classes



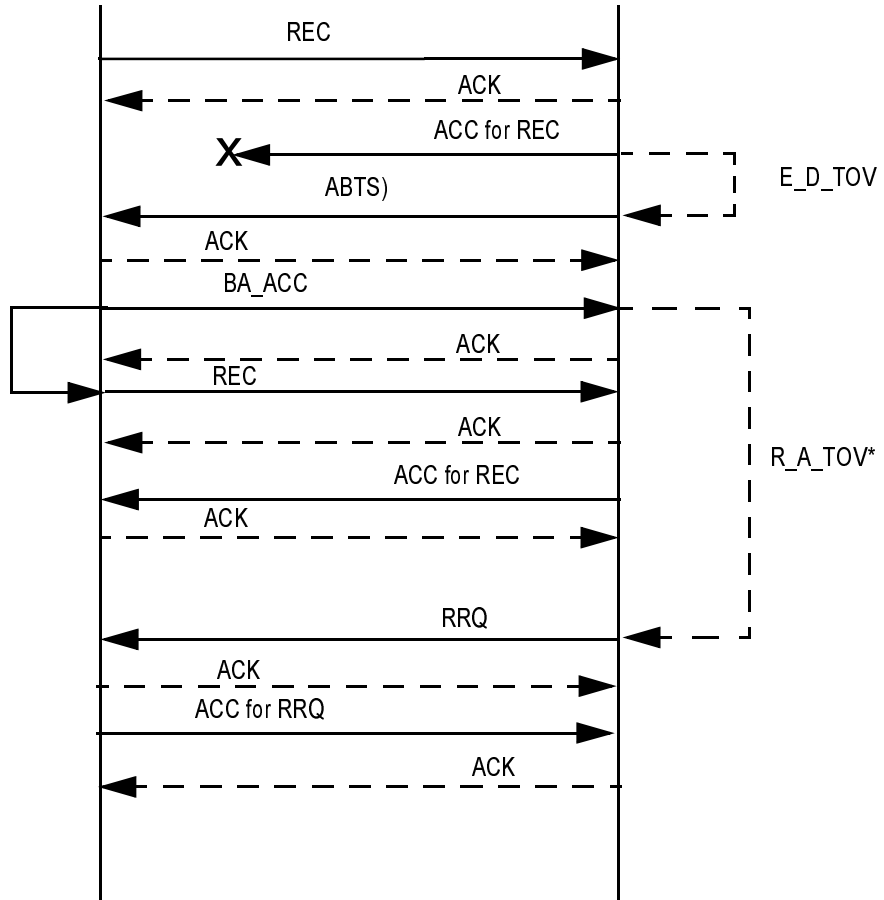
Error Recovery

The BA_ACC payload indicates that the REC was never received by the target. The payload is SEQ_ID invalid, low SEQ_CNT = 0, high SEQ_CNT = SEQ_CNT in ABTS frame. Recovery Qualifiers are established on each side.

For in-order delivery, the value of R_A_TOV* is 0.

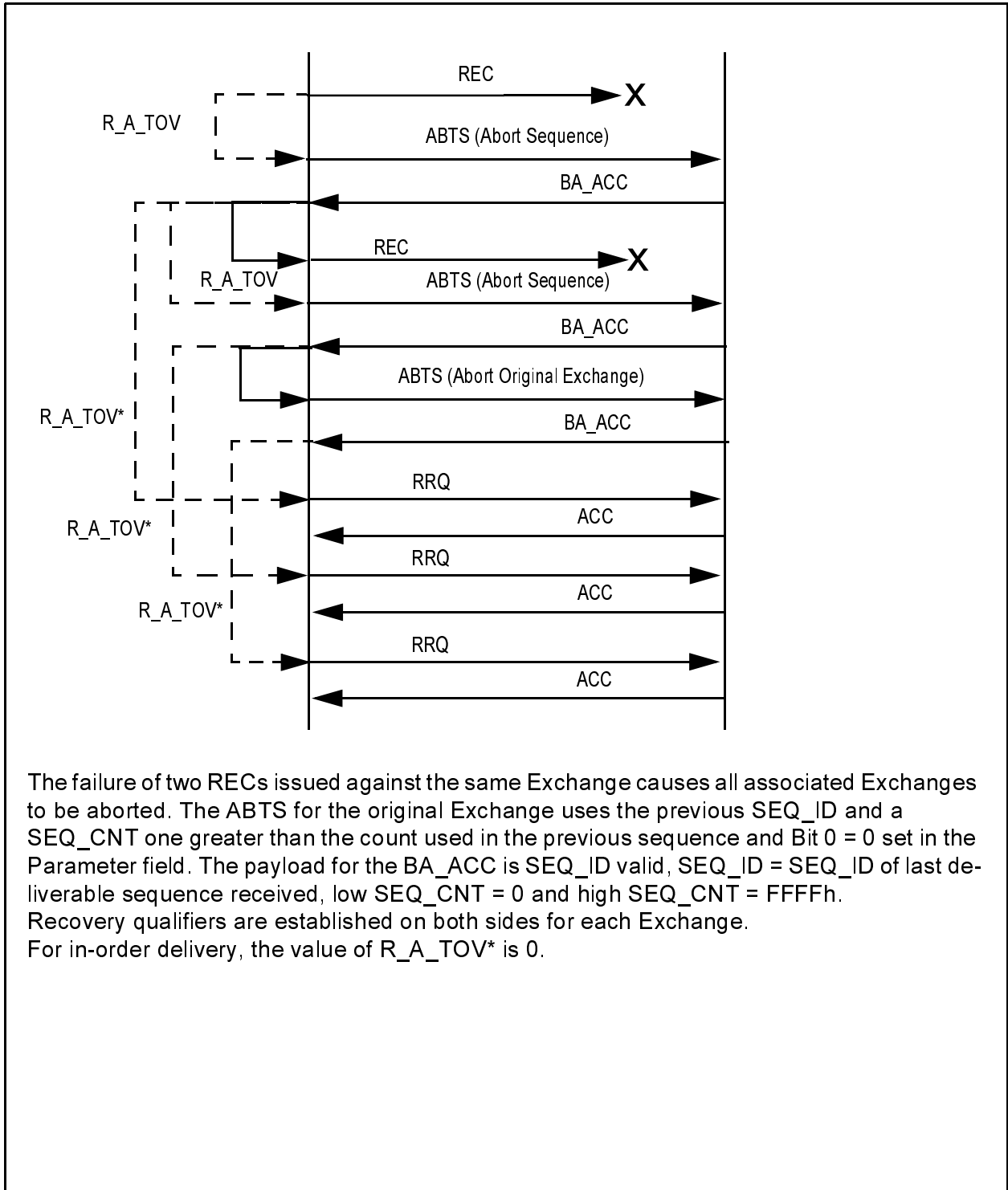
The second REC is issued using a new Exchange.

Figure D.28 - REC Response Lost, Acknowledged Classes



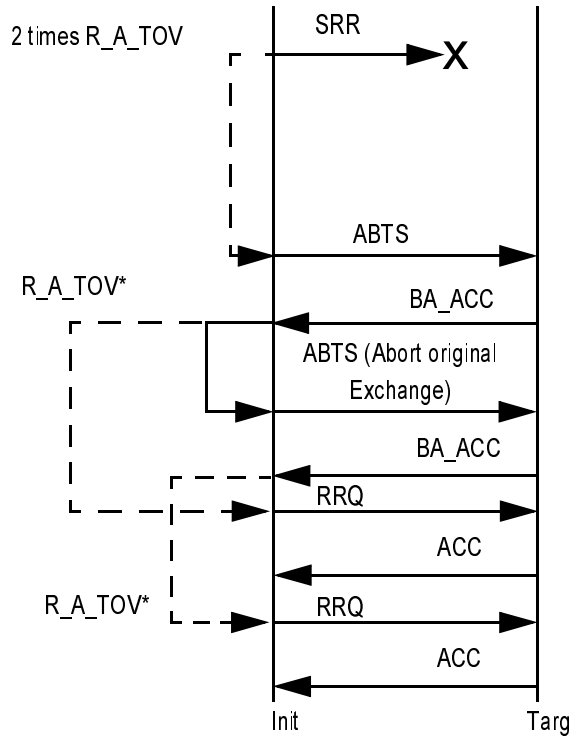
The BA_ACC payload indicates that the ACC was never received by the initiator. The payload is SEQ_ID invalid, low SEQ_CNT = 0, high SEQ_CNT = SEQ_CNT in ABTS frame. After responding to the ABTS, the initiator reissues the REC in a new Exchange. Recovery Qualifiers are established on each side. For in-order delivery, the value of R_A_TOV* is 0.

Figure D.29 - Two RECs Lost, Unacknowledged Classes, Abort the original exchange



The failure of two RECs issued against the same Exchange causes all associated Exchanges to be aborted. The ABTS for the original Exchange uses the previous SEQ_ID and a SEQ_CNT one greater than the count used in the previous sequence and Bit 0 = 0 set in the Parameter field. The payload for the BA_ACC is SEQ_ID valid, SEQ_ID = SEQ_ID of last deliverable sequence received, low SEQ_CNT = 0 and high SEQ_CNT = FFFFh. Recovery qualifiers are established on both sides for each Exchange. For in-order delivery, the value of R_A_TOV* is 0.

Figure D.30 - SRR Lost, Unacknowledged Classes, Abort original exchange

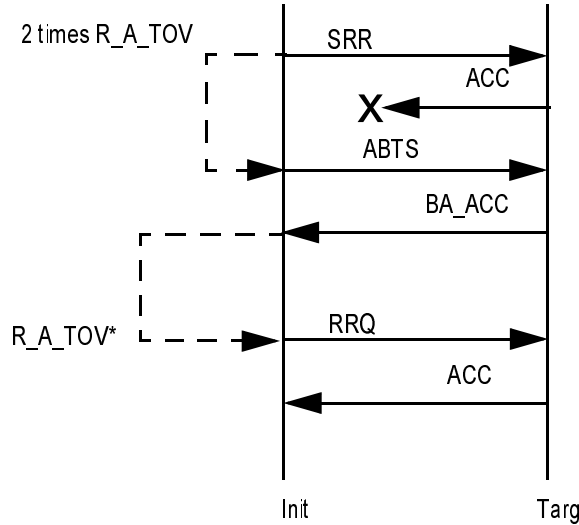


The payload for the BA_ACC associated with the ABTS of the SRR is SEQ_ID valid, low SEQ_CNT = 0, high SEQ_CNT = SEQ_CNT of the ABTS frame.

The ABTS for the original Exchange uses the previous SEQ_ID and a SEQ_CNT one greater than the count used in the previous Sequence and Bit 0 = 0 in the Parameter field. The payload for the BA_ACC associated with the ABTS for the original Exchange is SEQ_ID valid, the SEQ_ID = SEQ_ID of the last deliverable Sequence of the original Exchange received, low SEQ_CNT = 0, and high SEQ_CNT = FFFFh.

Recovery Qualifiers are established on both sides for each Exchange. For in-order delivery, the value of $R_A_TOV^*$ is 0.

Figure D.31 - SRR Response Lost, Unacknowledged Classes



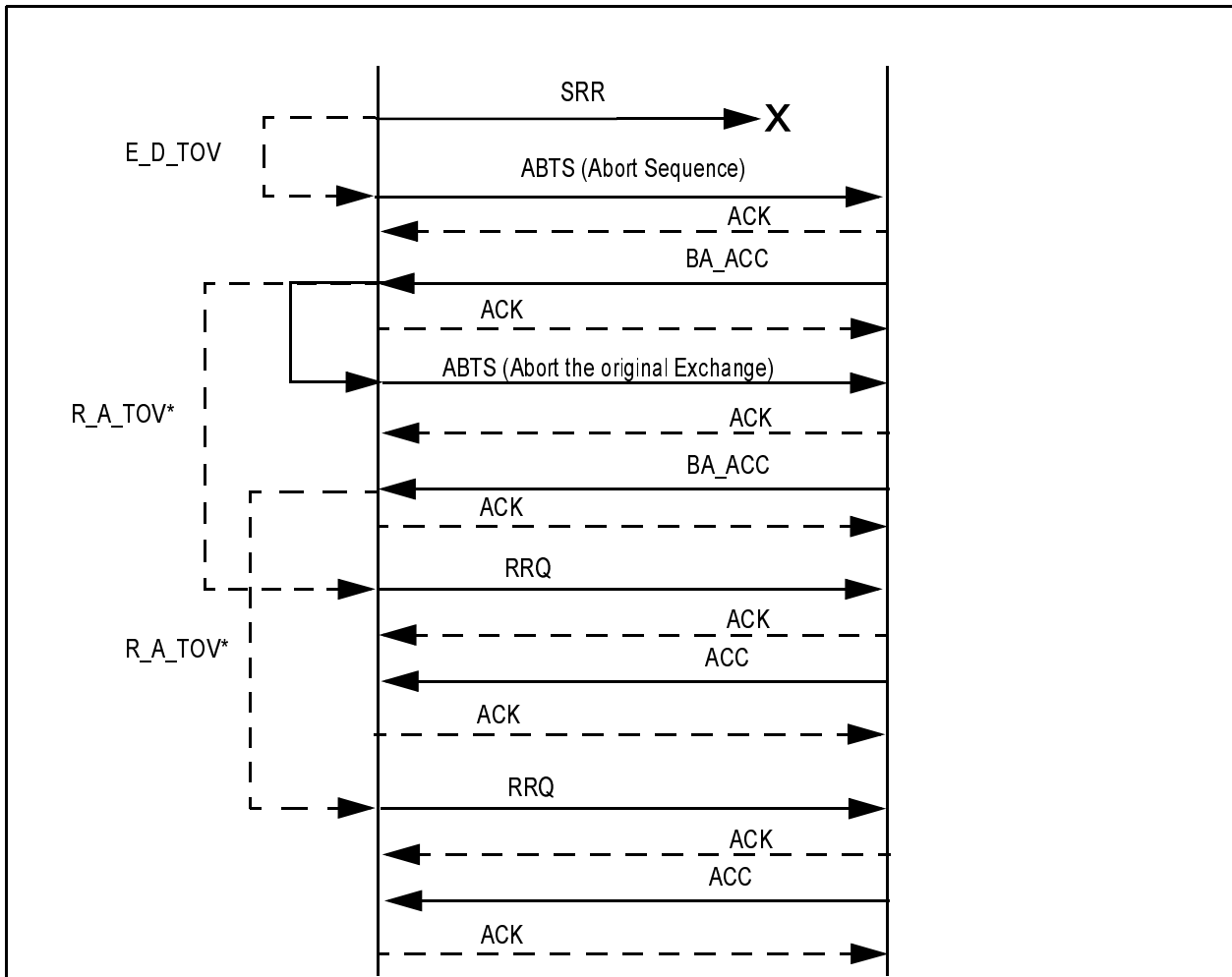
If the SRR Exchange is unknown to the Recipient, the Exchange was completed and the context purged. The payload for the BA_ACC is SEQ_ID invalid, low SEQ_CNT = 0, high SEQ_CNT = FFFFh. Recovery Qualifiers are established on both sides.

If the SRR Exchange is still known to the Recipient, the payload for the BA_ACC is SEQ_ID valid, SEQ_ID = SEQ_ID of the SRR, low SEQ_CNT = high SEQ_CNT = SEQ_CNT of the ABTS frame. Since no Recovery Qualifier is established, RRQ need not be issued. The Recovery Qualifier is established on the initiator side and must be timed out for R_A_TOV.

For in-order delivery, the value of R_A_TOV* is 0.

In either case, the original Exchange need not be aborted.

Figure D.32 - SRR Lost, Acknowledged Classes

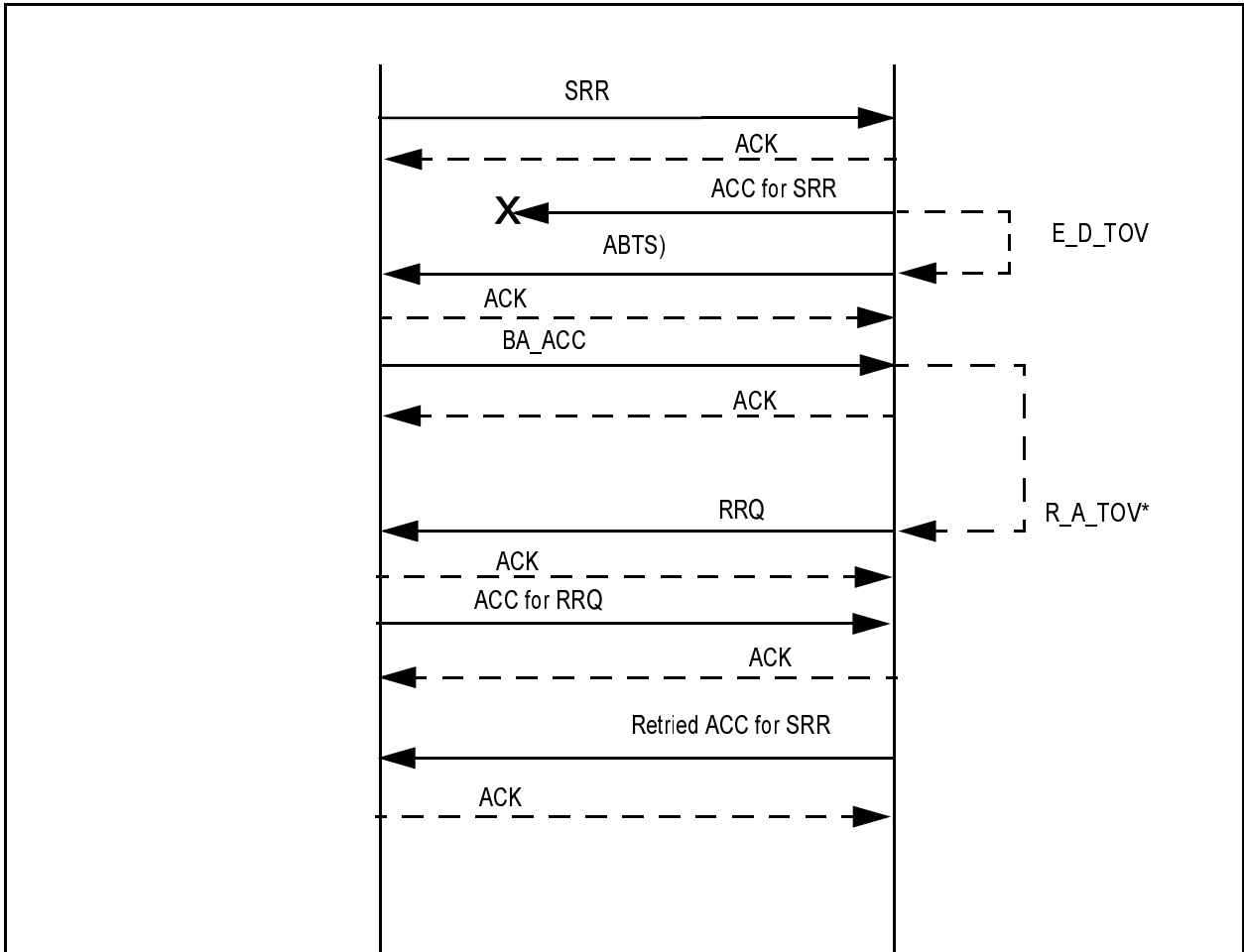


Since the ABTS on the SRR is on a new Exchange, Recovery Qualifiers must be established. The BA_ACC payload indicates SEQ_ID invalid, low SEQ_CNT = 0, and high SEQ_CNT = SEQ_CNT of the ABTS.

An error on an SRR is a second error and the original Exchange is also aborted. SRR is not retried.

For in-order delivery, the value of R_A_TOV* is 0.

Figure D.33 - SRR Response Lost, Acknowledged Classes



The BA_ACC of the ABTS associated with the SRR indicates that the ACC for the SRR was not received and will be discarded if it is later received. The BA_ACC payload indicates SEQ_ID invalid, low SEQ_CNT = 0, and high SEQ_CNT = SEQ_CNT of the ABTS. The retry of the ACC for SRR is issued with a new SEQ_ID. Recovery Qualifiers are established on each side. For in-order delivery, the value of R_A_TOV* is 0.