

3.5.3.9 DSC-start service request

Upon receipt of a DSC-start service request, if the CPDLC-air-ASE is in the *IDLE* state, the CPDLC-air-ASE shall:

- a) create an AircraftPDUs APDU with a StartDownMessage APDU element containing:
 - 1) the abstract value “dsc” as the mode; and
 - 2) the *CPDLC/IC Data* parameter as the *ICDownlinkMessage*;
- b) invoke D-START request with:
 - 1) the DSC-start service *Facility Designation* parameter value as the D-START *Called Peer ID* parameter value;
 - 2) the DSC-start service *Aircraft Address* parameter value as the D-START *Calling Peer ID* parameter value;
 - 3) the DSC-start service *CPDLC Message Set Version Number* parameter value if specified by the CPDLC-user as the D-START *DS-User Version Number* parameter value;
 - 4) the DSC-start service *Security Required* parameter value if specified by the CPDLC-air-user or otherwise the abstract value “no security” as the D-START *Security Requirements* parameter value;
 - 5) the D-START *Quality of Service* parameters set as follows:
 - i) if provided, the DSC-START service *Class of Communication* parameter value as the D-START *QOS Routing Class* parameter value;
 - ii) the abstract value of “high priority flight safety messages” as the D-START *QOS Priority* parameter value; and
 - iii) the abstract value of “low” as the D-START *QOS Residual Error Rate* parameter value; and
 - 6) the APDU as the D-START *User Data* parameter value;
- c) set DSC to the abstract value “true”;
- d) start timer t_{start} ; and
- e) enter the *START-REQ* state.

3.5.3.10 CPDLC-message service request

3.5.3.10.1 Upon receipt of a CPDLC-message service request and the *CPDLC/IC Data* parameter contains a CPDLC message, if the CPDLC-air-ASE is in the *DIALOGUE* state, the CPDLC-air-ASE shall:

- a) create an AircraftPDUs APDU with an *ICDownlinkMessage* APDU element based on the CPDLC-message service *CPDLC/IC Data* parameter;

- b) invoke D-DATA request with the APDU as the D-DATA *User Data* parameter value; and
- c) remain in the *DIALOGUE* state.

3.5.3.10.2 Upon receipt of a CPDLC-message service request and the *CPDLC/IC Data* parameter contains a CPDLC message, if the CPDLC-air-ASE is in the *END* state and DSC has the abstract value “false”, the CPDLC-air-ASE shall:

- a) create an AircraftPDUs APDU with an ICDownlinkMessage APDU element based on the CPDLC-message service *CPDLC/IC Data* parameter;
- b) invoke D-DATA request with the APDU as the D-DATA *User Data* parameter value; and
- c) remain in the *END* state.

3.5.3.11 CPDLC-end service response

3.5.3.11.1 Upon receipt of a CPDLC-end service response, if the CPDLC-air-ASE is in the *END* state, and the CPDLC-end service *Result* parameter has the abstract value “accepted”, and DSC has the abstract value “false”, the CPDLC-air-ASE shall:

- a) create an AircraftPDUs APDU with an ICDownlinkMessage APDU element based on the CPDLC-end service *CPDLC/IC Data* parameter;
- b) invoke D-END response with:
 - 1) the APDU as the D-END *User Data* parameter value; and
 - 2) the abstract value “accepted” as the D-END *Result* parameter value; and
- c) enter the *IDLE* state.

3.5.3.11.2 Upon receipt of a CPDLC-end service response, if the CPDLC-air-ASE is in the *END* state, and the CPDLC-end service *Result* parameter has the abstract value “rejected”, and DSC has the abstract value “false”, the CPDLC-air-ASE shall:

- a) create an AircraftPDUs APDU with an ICDownlinkMessage APDU element based on the CPDLC-end service *CPDLC/IC Data* parameter;
- b) invoke D-END response with:
 - 1) the APDU as the D-END *User Data* parameter value; and
 - 2) the abstract value “rejected” as the D-END *Result* parameter value; and
- c) enter the *DIALOGUE* state.

3.5.3.12 DSC-end service request

Upon receipt of a DSC-end service request, if the CPDLC-air-ASE is in the *DIALOGUE* state and DSC has the abstract

value “true”, the CPDLC-air-ASE shall:

- a) create an AircraftPDUs APDU with an ICDownlinkMessage APDU element based on the DSC-end service *CPDLC/IC Data* parameter;
- b) invoke D-END request with the APDU as the D-END *User Data* parameter value; and
- c) enter the *END* state.

3.5.3.13 CPDLC-user-abort service request

Upon receipt of a CPDLC-user-abort service request, if the CPDLC-air-ASE is not in the *IDLE* state, the CPDLC-air-ASE shall:

- a) stop any timer;
- b) if the CPDLC-user-abort service *Reason* parameter is provided, create an AircraftPDUs APDU with a CPDLCUserAbortReason APDU element based on the CPDLC-user-abort service *Reason* parameter;
- c) if the CPDLC-user-abort service *Reason* parameter is not provided, create an AircraftPDUs APDU with a CPDLCUserAbortReason [undefined] APDU element;
- d) invoke D-ABORT request with:
 - 1) the D-ABORT *Originator* parameter set to the abstract value “user”; and
 - 2) the APDU as the D-ABORT *User Data* parameter value;
- e) if DSC has the abstract value “true”, set DSC to the abstract value “false”; and
- f) enter the *IDLE* state.

3.5.3.14 D-ABORT indication

3.5.3.14.1 Upon receipt of a D-ABORT indication, if the CPDLC-air-ASE is not in the *IDLE* state, and the D-ABORT *Originator* parameter is “user”, and the D-ABORT *User Data* parameter contains a GroundPDUs [CPDLCUserAbortReason] APDU, the CPDLC-air-ASE shall:

- a) stop any timer;
- b) if the CPDLC-air-user is an active user, invoke CPDLC-user-abort service indication with the APDU contained in the D-ABORT *User Data* parameter as the CPDLC-user-abort service *Reason* parameter value;
- c) if DSC has the abstract value “true”, set DSC to the abstract value “false”; and
- d) enter the *IDLE* state.

3.5.3.14.2 Upon receipt of a D-ABORT indication, if the CPDLC-air-ASE is not in the *IDLE* state, and the D-ABORT *Originator* parameter is “provider”, and the D-ABORT *User Data* parameter is provided, and the D-ABORT *User Data* parameter contains a GroundPDUs [CPDLCProviderAbortReason] APDU, the CPDLC-air-ASE shall:

- a) stop any timer;
- b) if the CPDLC-air-user is an active user, invoke CPDLC-provider-abort service indication with the D-ABORT *User Data* parameter as the CPDLC-provider-abort service *Reason* parameter value, if provided;
- c) if DSC has the abstract value “true”, set DSC to the abstract value “false”; and
- d) enter the *IDLE* state.

3.5.3.15 D-P-ABORT indication

Upon receipt of a D-P-ABORT indication, if the CPDLC-air-ASE is not in the *IDLE* state, the CPDLC-air-ASE shall:

- a) stop any timer;
- b) if the CPDLC-air-user is an active user, invoke CPDLC-provider-abort service indication with the CPDLC-provider-abort service *Reason* parameter set to the abstract value “communication-service-failure”;
- c) if DSC has the abstract value “true”, set DSC to the abstract value “false”; and
- d) enter the *IDLE* state.

3.5.4 CPDLC-air-ASE exception handling

3.5.4.1 A timer expires

If a CPDLC-air-ASE detects that a timer has expired, that CPDLC-air-ASE shall:

- a) interrupt any current activity;
- b) create an AircraftPDUs APDU with a CPDLCProviderAbortReason [timer-expired] APDU message element;
- c) invoke D-ABORT request with:
 - 1) the abstract value “provider” as the D-ABORT *Originator* parameter value; and
 - 2) the APDU as the D-ABORT *User Data* parameter value;
- d) if the CPDLC-air-user is an active user, invoke CPDLC-provider-abort service indication with the abstract value “timer-expired” as the CPDLC-provider-abort service *Reason* parameter value;

- e) if DSC has the abstract value "true", set DSC to the abstract value "false"; and
- f) enter the *IDLE* state.

3.5.4.2 Unrecoverable system error

If a CPDLC-air-ASE has an unrecoverable system error, the CPDLC-air-ASE should:

- a) stop any timer;
- b) create an AircraftPDUs APDU with a CPDLCProviderAbortReason [undefined-error] APDU message element;
- c) invoke D-ABORT request with:
 - 1) the abstract value "provider" as the D-ABORT *Originator* parameter value; and
 - 2) the APDU as the D-ABORT *User Data* parameter value;
- d) if the CPDLC-air-user is an active user, invoke CPDLC-provider-abort service indication with the abstract value "undefined-error" as the CPDLC-provider-abort service Reason parameter value;
- e) if DSC has the abstract value "true", set DSC to the abstract value "false"; and
- f) enter the *IDLE* state.

3.5.4.3 Invalid PDU

3.5.4.3.1 If the *User Data* parameter of a D-END confirmation with the *Result* parameter set to the abstract value "rejected", or the *User Data* parameter of a D-START confirmation with the *Result* parameter set to the abstract value "accepted", or the *User Data* parameter of a D-START indication, a D-DATA indication or a D-END indication does not contain a valid PDU, the CPDLC-air-ASE shall:

- a) stop any timer;
- b) create an AircraftPDUs APDU with a CPDLCProviderAbortReason [invalid-PDU] APDU message element;
- c) invoke D-ABORT request with:
 - 1) the abstract value "provider" as the D-ABORT *Originator* parameter value; and
 - 2) the APDU as the D-ABORT *User Data* parameter value;
- d) if the CPDLC-air-user is an active user, invoke CPDLC-provider-abort service indication with the abstract value "invalid-PDU" as the CPDLC-provider-abort service Reason parameter value;
- e) if DSC has the abstract value "true", set DSC to the abstract value "false"; and
- f) enter the *IDLE* state.

3.5.4.3.2 If the *User Data* parameter of a D-START confirmation with the *Result* parameter set to the abstract value “rejected (permanent)”, or a D-END confirmation with the *Result* parameter set to the abstract value “accepted” is not a valid PDU, then the CPDLC-air-ASE shall:

- a) stop any timer;
- b) if the CPDLC-air-user is an active user, invoke CPDLC-provider-abort service indication with the CPDLC-provider-abort service *Reason* parameter set to the abstract value “invalid-PDU”;
- c) if DSC has the abstract value “true”, set DSC to the abstract value “false”; and
- d) enter the *IDLE* state.

3.5.4.4 Protocol error

3.5.4.4.1 If the *User Data* parameter of a D-START indication, D-START confirmation, D-DATA indication or D-END indication is a valid PDU; however, it is not a PDU for which action is described within a given state in 3.5.3, the CPDLC-air-ASE shall:

- a) stop any timer;
- b) create an AircraftPDUs APDU with a CPDLCProviderAbortReason [protocol-error] APDU message element;
- c) invoke D-ABORT request with:
 - 1) the abstract value “provider” as the D-ABORT *Originator* parameter value; and
 - 2) the APDU as the D-ABORT *User Data* parameter value;
- d) if the CPDLC-air-user is an active user, invoke CPDLC-provider-abort service indication with the abstract value “protocol-error” as the CPDLC-provider-abort service *Reason* parameter value;
- e) if DSC has the abstract value “true”, set DSC to the abstract value “false”; and
- f) enter the *IDLE* state.

3.5.4.4.2 If the *User Data* parameter of a D-END confirmation is a valid PDU; however, it is not a permitted PDU as defined in 3.5.3, the CPDLC-air-ASE shall:

- a) stop any timer;
- b) if the D-END *Result* parameter is set to the abstract value “rejected”, then:
 - 1) create an AircraftPDUs APDU with a CPDLCProviderAbortReason [protocol-error] APDU message element; and
 - 2) invoke D-ABORT request with:
 - i) the abstract value “provider” as the D-ABORT *Originator* parameter value; and

- ii) the APDU as the D-ABORT *User Data* parameter value;
- c) if the CPDLC-air-user is an active user, invoke CPDLC-provider-abort service indication with the abstract value "protocol-error" as the CPDLC-provider-abort service *Reason* parameter value;
- d) if DSC has the abstract value "true", set DSC to the abstract value "false"; and
- e) enter the *IDLE* state.

3.5.4.4.3 Upon receipt of a DS primitive for which there are no instructions in 3.5.3 (i.e. the primitive was not expected or was expected under other conditions or with other parameter values), the CPDLC-air-ASE shall:

- a) stop any timer;
- b) create an AircraftPDUs APDU with a CPDLCProviderAbortReason [protocol-error] APDU message element;
- c) if a dialogue exists, invoke D-ABORT request with:
 - 1) the abstract value "provider" as the D-ABORT *Originator* parameter value; and
 - 2) the APDU as the D-ABORT *User Data* parameter value;
- d) if the CPDLC-air-user is an active user, invoke CPDLC-provider-abort service indication with the abstract value "protocol-error" as the CPDLC-provider-abort service *Reason* parameter value;
- e) if DSC has the abstract value "true", set DSC to the abstract value "false"; and
- f) enter the *IDLE* state.

3.5.4.5 D-START confirmation Result parameter or Reject Source parameter not as expected

If a D-START confirmation *Result* parameter has the abstract value of "rejected (transient)" or if the *Reject Source* parameter has the abstract value of "DS-provider", the CPDLC-air-ASE shall:

- a) stop any timer;
- b) if the CPDLC-air-user is an active user, invoke CPDLC-provider-abort service indication with the CPDLC-provider-abort service *Reason* parameter set to the abstract value "communication-service-error";
- c) if DSC has the abstract value "true", set DSC to the abstract value "false"; and
- d) enter the *IDLE* state.

3.5.4.6 D-START indication Quality of Service parameter not as expected

If a D-START indication QOS *Priority* parameter does not have the abstract value of "high priority flight safety messages", or if the QOS *Residual Error Rate* parameter does not have the abstract value of "low", or if the QOS *Routing Class* parameter does not have one of the abstract values specified in Table 3-13 (see 3.6.2.2), the CPDLC-air-

ASE shall:

- a) stop any timer;
- b) create an AircraftPDUs APDU with a CPDLCProviderAbortReason [invalid-QOS-parameter] APDU message element;
- c) invoke D-ABORT request with:
 - 1) the abstract value “provider” as the D-ABORT *Originator* parameter value; and
 - 2) the APDU as the D-ABORT *User Data* parameter value;
- d) if DSC has the abstract value “true”, set DSC to the abstract value “false”; and
- e) enter the *IDLE* state.

3.5.4.7 Expected PDU missing

If the *User Data* parameter of a D-START indication or confirmation, a D-DATA indication, or a D-END indication or confirmation does not contain a PDU, the CPDLC-air-ASE shall:

- a) stop any timer;
- b) create an AircraftPDUs APDU with a CPDLCProviderAbortReason [expected-PDU-missing] APDU message element;
- c) invoke D-ABORT request with:
 - 1) the abstract value “provider” as the D-ABORT *Originator* parameter value; and
 - 2) the APDU as the D-ABORT *User Data* parameter value;
- d) if the CPDLC-air-user is an active user, invoke CPDLC-provider-abort service indication with the abstract value “not-permitted-PDU” as the CPDLC-provider-abort service *Reason* parameter value;
- e) if DSC has the abstract value “true”, set DSC to the abstract value “false”; and
- f) enter the *IDLE* state.

3.5.4.8 D-START Security Requirements parameter not as expected

Note.— This section applies to the case when the D-START Security Requirements parameter does not meet the local security policy.

Upon receipt of a D-START indication with the *Security Requirements* parameter not consistent with the local security policy, or upon receipt of a D-START confirmation with the *Security Requirements* parameter not equal to the value that was set in the D-START request, the CPDLC-air-ASE shall:

- a) stop all timers;

- b) if the dialogue with the peer is still open:
 - 1) create an AircraftPDUs APDU with a CPDLCProviderAbortReason [communication-service-failure] APDU message element; and
 - 2) invoke D-ABORT request with:
 - i) the abstract value “provider” as the D-ABORT *Originator* parameter value; and
 - ii) the APDU as the D-ABORT *User Data* parameter value;
- c) if the CPDLC-air-user is active, invoke CPDLC-provider-abort service indication with the abstract value “communication-service-failure” as the CDPLC-provider-abort service *Reason* parameter value;
- d) if DSC has the abstract value “true”, set DSC to the abstract value “false”; and
- e) enter the *IDLE* state.

3.5.5 CPDLC-ground-ASE protocol description

3.5.5.1 Introduction

3.5.5.1.1 If no actions are described for a CPDLC service primitive when a CPDLC-ground-ASE is in specific state, then the invocation of that service primitive shall be prohibited while the CPDLC-ground-ASE is in that state.

3.5.5.1.2 Upon receipt of a PDU, if no actions are described for the arrival of that PDU when a CPDLC-ground-ASE is in a specific state, then that PDU is considered not permitted and exception handling procedures as described in 3.5.6.4 shall apply.

3.5.5.1.3 If a PDU is received that cannot be decoded, then exception handling procedures as described in 3.5.6.3 for invalid PDU shall apply.

3.5.5.1.4 If a PDU is not received when one is required, then exception handling procedures as described in 3.5.6.3 shall apply.

3.5.5.1.5 The states defined for the CPDLC-ground-ASE are the following:

- a) IDLE;
- b) START-REQ;
- c) START-IND;
- d) DIALOGUE;
- e) END; and
- f) FORWARD.

3.5.5.1.6 The CPDLC-ground-user is an active user from the time:

- a) the CPDLC-ground-user invokes the CPDLC-start service request until it:
 - 1) receives a CPDLC-start service confirmation with the Result parameter equal to the abstract value “rejected”; or
 - 2) receives a CPDLC-end service confirmation with the Result parameter equal to the abstract value “accepted”; or
 - 3) invokes a CPDLC-user-abort service request; or
 - 4) receives a CPDLC-user-abort service indication; or
 - 5) receives a CPDLC-provider-abort service indication; or
- b) the CPDLC-ground-user receives the CPDLC-start service indication until it:
 - 1) invokes a CPDLC-start service response with the Result parameter set to the abstract value “rejected”; or
 - 2) receives a CPDLC-end service confirmation with the Result parameter equal to the abstract value “accepted”; or
 - 3) invokes a CPDLC-user-abort service request; or
 - 4) receives a CPDLC-user-abort service indication; or
 - 5) receives a CPDLC-provider-abort service indication; or
- c) the CPDLC-ground-user receives the DSC-start service indication until it:
 - 1) invokes a DSC-start service response with the Result parameter equal to the abstract value “rejected”; or
 - 2) invokes a CPDLC-user-abort service request; or
 - 3) receives a CPDLC-user-abort service indication; or
 - 4) receives a CPDLC-provider-abort service indication; or
- d) the CPDLC-ground-user invokes the CPDLC-forward service request until it:
 - 1) receives a CPDLC-forward service confirmation; or
 - 2) invokes a CPDLC-user-abort service request; or
 - 3) receives a CPDLC-user-abort service indication; or
 - 4) receives a CPDLC-provider-abort service indication.

3.5.5.1.7 On initiation, the CPDLC-ground-ASE shall be in the *IDLE* state.