

# LINK 2000+ Programme

## CM & CPDLC Generic Interop Test Plan for Air Navigation Service Providers

Network Management

**EUROCONTROL**

**Link2000+ Programme**

**CM & CPDLC Generic Interoperability Test Plan  
for Air Navigation Service Providers**

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# 1. Scope

## 1.1 Scope of the document

This document provides guidelines for Air Navigation Service Providers (ANSPs) on ATN Upper Layers and CM & CPDLC end-to-end interoperability testing. The document may be used during the validation process of ANSPs LINK2000+ services ground implementation before it is set in an operational environment.

The document details the Interoperability tests proposed to be performed between an ANSP ground implementation Test and development system (System Under Test, SUT) and the EEC Data link Test Facility real avionics pallet and simulated avionics tool.

However, ANSPs could also perform these tests against real avionics or air test tools they may have contracted for the purpose of their ground implementation validation.

## 1.2 Document overview

The document includes the following headlines:

- Chapter 1 introduces the document,
- Chapter 2 depicts the test configurations used to perform validation tests,
- Chapter 3 provides the test procedures descriptions, and
- Chapter 4 provides a traceability matrix that illustrates allocation of test identifiers to ED-110B requirements.

## 1.3 Reference documents

[1] Interoperability Requirements Standard for Aeronautical Telecommunication Network Baseline 1, ED-110B, December 2007. (EUROCAE)

[2] EUROCONTROL Specification on Data Link Services – SPEC-0116

## 1.4 Terminology

<b>ABIS</b>	Airborne Boundary Intermediate System
<b>ACM</b>	ATC Communications Management
<b>ADEP</b>	Airport Departure
<b>ADES</b>	Airport Destination
<b>AGTS</b>	Air Ground Test System
<b>AMC</b>	ATC Microphone Check
<b>AMIC</b>	Application Message Integrity Check
<b>ATC</b>	Air Traffic Control
<b>ATN</b>	Aeronautical Telecommunication Network
<b>ATSU</b>	Air Traffic Service Unit
<b>CM</b>	Context Management
<b>CMU</b>	Communication Management Unit
<b>CMDU</b>	Color Multipurpose Display Unit
<b>CPDLC</b>	Controller Pilot Data Link Communications
<b>DLIC</b>	Data Link Initiation Capability
<b>EEC</b>	EUROCONTROL EXPERIMENTAL CENTRE
<b>ES</b>	End System
<b>ETD</b>	Estimated Time of Departure
<b>LACK</b>	Logical Acknowledgment
<b>MCDU</b>	Multi-Function Control and Display Unit
<b>MIN</b>	Message Identification Number
<b>MRN</b>	Message Reference Number
<b>RTC</b>	Real Test Configuration
<b>STC</b>	Simulated Test Configuration
<b>SUT</b>	System Under Test
<b>TC</b>	Test Configuration
<b>VDL-M2</b>	VHF Digital Link Mode 2
<b>VDR</b>	VHF Data Radio

**VHF**

Very High Frequency

## 2. Test configurations

The tests described throughout this document deal with two kinds of configuration, which mainly differ from the airborne equipment.

The first one, the Real Test Configuration (RTC) uses real airborne equipment systems whereas the second one, the Simulated Test Configuration (STC) uses a simulated airborne system.

For both configurations, the ground equipment is made of the ANSP System Under Test (SUT). For each configuration, additional items (aircraft or ground system) may be added in case of special functions to exhibit.

The following chapters describe such test configurations using the EEC datalink Test Facility.

### 2.1 RTC – Real Test Configuration

This configuration aims at validating operational test situations in lab environment.
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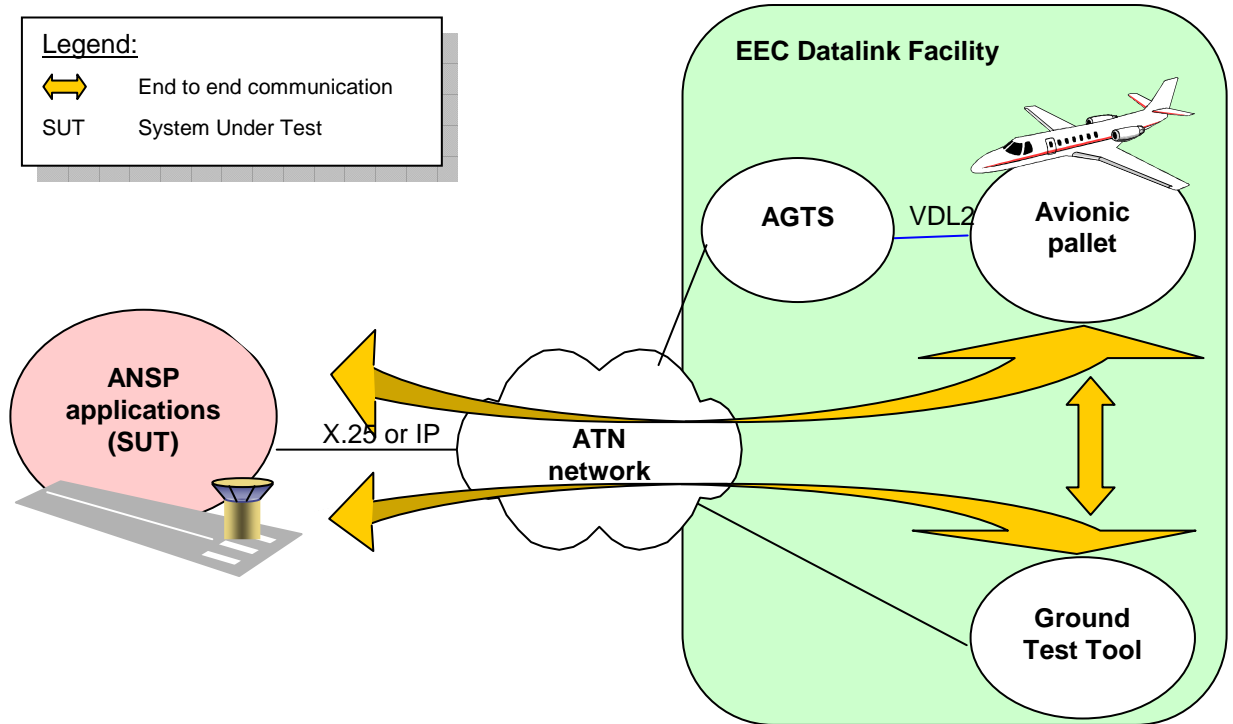
This configuration is composed of the following elements:

- an avionics pallet providing real avionic equipments: it is mainly composed of a Communication Management Unit (CMU), a Multi-Function Control and Display Unit (MCDU) and a VHF Data Radio (VDR) for air/ground communication;
- the ground data link ANSP system under test (SUT identified as GND1)
- a set of ATN routers to build the ATN topology, and
- an ATN/VDL-M2 equipment (ARINC AGTS) to emulate a real ATN/VDL-M2 environment.

This configuration permits to perform tests with only one aircraft. An extension of this configuration may provide an additional ground system to test 3-peers scenarios (e.g. frequency transfers/ACM). Such additional ground system is a simulated one, identified as GND2.

The following picture depicts such configuration, describing the Ground Datalink ANSP system connected to the EEC test facility platform:

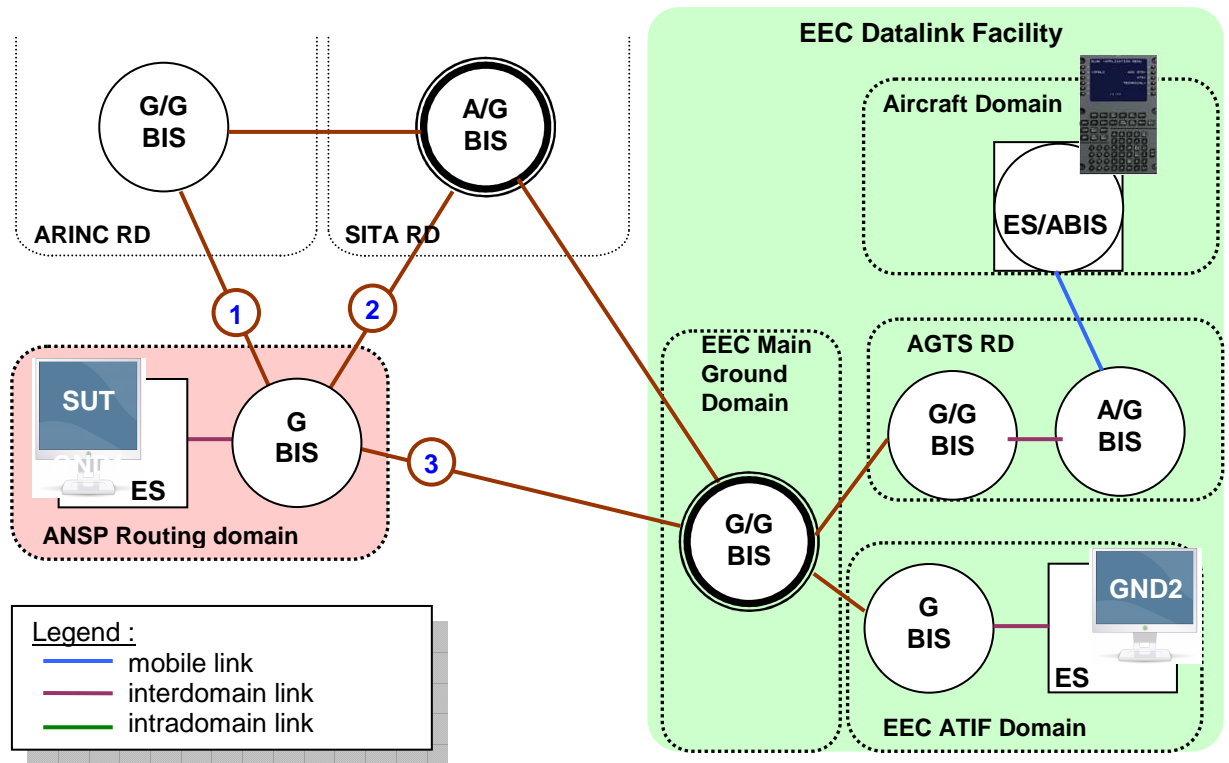




**Figure 1: Real Test Configuration global view**

In test descriptions, the SUT is identified as GND1 and the Ground Test Tool as GND2.

The following picture depicts the ATN topology, describing the Ground Data link ANSP system connected to the EEC test facility platform:



**Figure 2: ATN routing topology for Real Test Configuration**

There are two ways to connect ANSP's ATN systems and EEC's ATN systems together.

- First option is to directly establish an adjacency between **the G/G BIS** of EEC Main Ground Domain and the ANSP's G/G BIS. This option is represented in the figure 2 by the link number 3.

- Second option is to ask the ACSP to add policy rules in order to allow the **G/G BIS** of EEC Main Ground Domain to route information to **ANSP** routing domain. If an additional ATC ground system at EEC side is required, policy rules have to be added in order to allow ANSP's ATN equipments to send information to EEC routing domains. If the ANSP uses SITA as ACSP it is described in the figure by the link number 2. If it uses ARINC as ACSP, the link number 1 must be considered.

## 2.2 STC – Simulated Test Configuration

This configuration aims at validating error test situations that cannot be realized when using real equipments.

This configuration is composed of the following elements:

- A data link airborne testing tool allowing to simulate one or two aircrafts (identified as AIRCRAFT1 and AIRCRAFT2),
- the ground data link ANSP system under test (identified as GND1), and
- a set of ATN routers to build the ATN topology.

This configuration allows performing tests with many aircrafts. An extension of this configuration may be to provide an additional ground system to test 3-peers scenarios (e.g. for frequency transfers / ACM). Such additional ground system is a simulated one, identified as GND2.

The following picture depicts such configuration, describing the Ground Data link ANSP system connected to the EEC test facility platform:

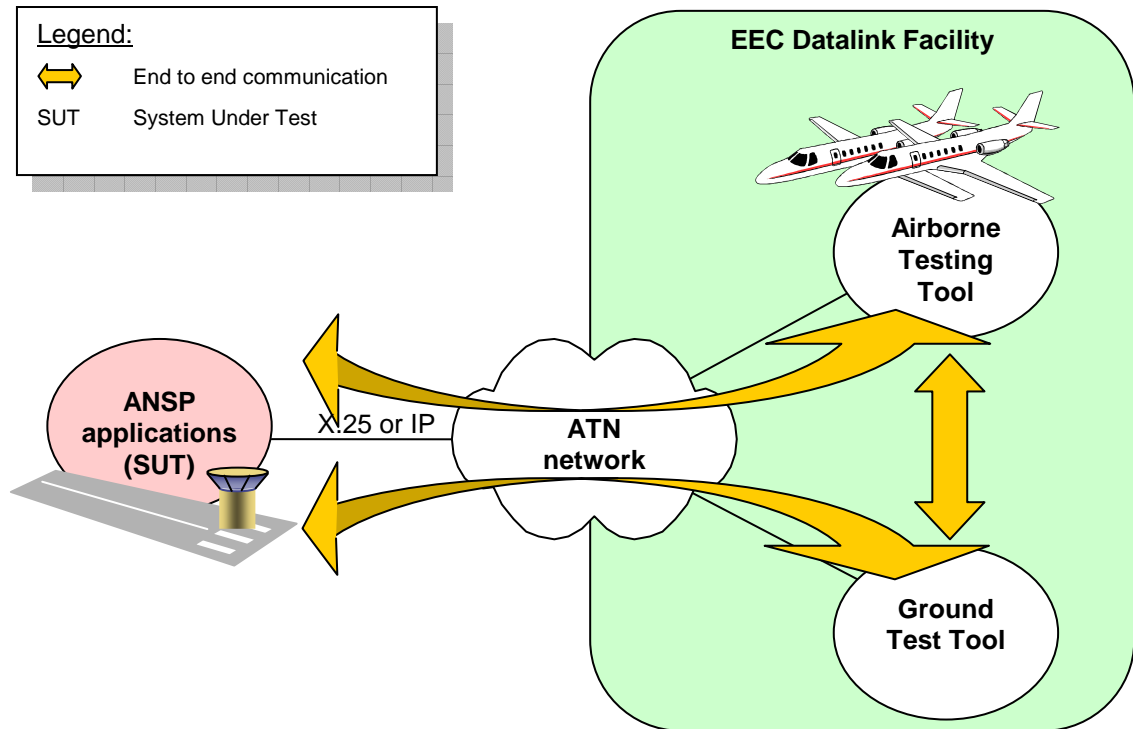
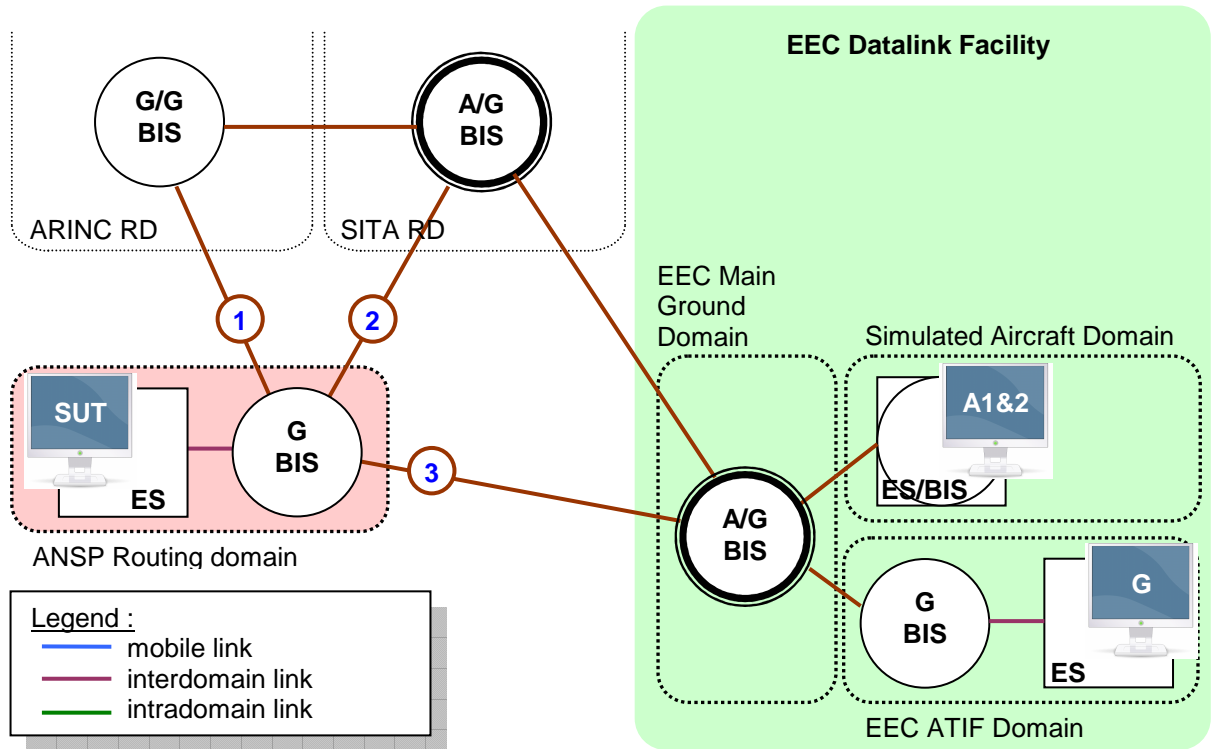


Figure 3: Simulated Test Configuration global view

The following picture depicts the ATN topology, describing the Ground Data link ANSP system connected to the EEC test facility platform:



**Figure 4: ATN routing topology for Simulated Test Configuration**

As introduced in the comment of "figure 2", there are two main ATN routing options. Refer to *Figure 2: ATN routing topology for Real Test Configuration* for more information. The main difference between figure 2 and 4 is that a Testing Tool is used to simulate aircrafts. The main ProATN router at EEC is used as an Air Ground router, A/G BIS.

### 3. Description of the test cases

Test cases described in this section are organised in two sections:

- tests executed in Real Test configuration (RTC), and
- tests executed in Simulated Test configuration (STC).

The first sub-section contains operational tests related to CM and CPDLC applications, including service oriented tests (DLIC, ACL, ACM and AMC).

The second sub-section contains CPDLC tests executed using simulated Airborne Test System. It allows covering erroneous situations that cannot be processed using real avionic systems.

#### 3.1 Tests using Real Test Configuration

##### 3.1.1 Tests for CM Application

###### 3.1.1.1 CM-logon: nominal case

<b>Identifier:</b>	CM_N010		
<b>Purpose:</b>	The purpose of the test is to check the Ground System correctly handles the CM-logon service.		
<b>ED110B Requirements</b>	3.1.3.2.1.1/3.1.3.2.1.2.3/3.1.3.2.1.2.4		
<b>Configuration:</b>	RTC		
<b>Preamble:</b>	It is assumed that AIRCRAFT1 is authorized to logon to GND1. As required by ED-110B, the logon request shall provide the optional ADEP and ADES fields.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	ENTER	AIRCRAFT1 sends a CM-logon request to GND1.
2	GND1	VERIFY	Check GND1 receives the CM-logon indication from AIRCRAFT1.
3	GND1	ENTER	GND1 responds with a positive CM-logon response to AIRCRAFT1
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives an accepted CM-logon confirmation message providing supported applications by GND1.
<b>Postamble:</b>		Check on air and ground side that AIRCRAFT1 appears logged on GND1.	

### 3.1.1.2 CM-logon: rejected response

<b>Identifier:</b>	CM_N020		
<b>Purpose:</b>	The purpose of the test is to check the Ground System correctly generates a negative CM-logon-response.		
<b>ED110B Requirements</b>	4.1.4		
<b>Configuration:</b>	RTC		
<b>Preamble:</b>	The Ground System is configured in order to reject the logon request from AIRCRAFT1 (for instance, AIRCRAFT1 not authorized to logon).		
<b>Steps:</b>			
<b>No</b>	<b>SYSTEM</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	ENTER	AIRCRAFT1 sends a CM-logon request to GND1.
2	GND1	VERIFY	Check the GND1 receives the CM-logon indication from AIRCRAFT1.
3	GND1	ENTER	GND1 responds with a rejected CM-logon response to AIRCRAFT1.
4	AIRCRAFT1	VERIFY	Check no application information is transmitted.
<b>Postambule:</b>	Check AIRCRAFT1 is not logged on GND1.		

### 3.1.1.3 CM-contact: successful

<b>Identifier:</b>	CM_N030		
<b>Purpose:</b>	The purpose of this test is to check the Ground System correctly handles the CM-contact service.		
<b>Configuration:</b>	RTC with a second ground centre, identified as GND2.		
<b>ED110B Requirements</b>	4.1.1.2.1/4.1.1.2.2/4.1.4		
<b>Preamble:</b>	AIRCRAFT1 is logged on GND1. It is assumed AIRCRAFT1 is authorized to logon to GND2. CM-Contact request message is triggered upon events based on local conditions. To perform this test, GND1 is configured to match such local conditions.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the CM-contact request to AIRCRAFT1 to reach GND2 system.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CM-contact indication from GND1.
3	AIRCRAFT1	ENTER	AIRCRAFT1 sends a CM-logon request to GND2.
4	GND2	VERIFY	Check GND2 receives a CM-logon indication from AIRCRAFT1.
5	GND2	ENTER	GND2 responds with a CM-logon response to AIRCRAFT1 providing supported application information.
6	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CM-logon confirmation from GND2 providing supported application information.
7	AIRCRAFT1	ENTER	AIRCRAFT1 sends a successful CM-contact response to GND1.
8	GND1	VERIFY	Check GND1 receives a successful CM-contact confirmation from AIRCRAFT1.
<b>Postambule:</b>	Check AIRCRAFT1 is logged on GND2.		

### 3.1.1.4 CM-contact: not successful

<b>Identifier:</b>	CM_N040		
<b>Purpose:</b>	The purpose of the test is to check the Ground System correctly handles an unsuccessful CM-contact response.		
<b>ED110B Requirements</b>	4.1.1.2.1/4.1.1.2.2/4.1.4		
<b>Configuration:</b>	RTC with another (next) Ground System, identified as GND2.		
<b>Preamble:</b>	AIRCRAFT1 is logged on GND1. It is assumed AIRCRAFT1 is authorized to logon to GND2. It is assumed GND2 system is not ATN connected. CM-Contact request message is triggered upon events based on local conditions. To perform this test, GND1 is configured to match such local conditions.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the CM-contact request to AIRCRAFT1 to reach GND2 system.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CM-contact indication from GND1.
3	AIRCRAFT1	ENTER	AIRCRAFT1 sends a CM-logon request to GND2.
4	AIRCRAFT1	WAIT	Termination of the <i>tLogon</i> timer value.
5	AIRCRAFT1	ENTER	AIRCRAFT1 sends an unsuccessful CM-contact response to GND1.
6	GND1	VERIFY	Check GND1 receives an unsuccessful CM-contact confirmation from AIRCRAFT1.
<b>Postamble:</b>	Check AIRCRAFT1 is not logged on GND2 but is still logged on GND1.		

### 3.1.1.5 CM-Abort

<b>Identifier:</b>	CM_N050		
<b>Purpose:</b>	The purpose of this test is to check the Ground System correctly handles a CM-abort indication.		
<b>ED110B Requirements</b>	3.1.2.6.1		
<b>Configuration:</b>	RTC		
<b>Preamble:</b>	It is assumed AIRCRAFT1 is authorized to logon to GND1. As required by ED-110B, the logon request shall provide the optional ADEP and ADES fields.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	ENTER	AIRCRAFT1 sends a CM-logon request to GND1.
2	GND1	WAIT	GND1 does not reply to CM-logon request.
3	AIRCRAFT1	VERIFY	On expiry of <i>tts Logon</i> timer if implemented or <i>tLogon</i> timer, check AIRCRAFT1 sends a CM-Abort request to GND1.
4	GND1	VERIFY	Check GND1 receives the CM-abort indication from AIRCRAFT1.
<b>Postamble:</b>	Check AIRCRAFT1 is not logged on GND1.		
<b>Comments:</b>			

### 3.1.2 Tests for CPDLC Application

#### 3.1.2.1 CPDLC Connection handling

##### 3.1.2.1.1 CPDLC connection: accepted

<b>Identifier:</b>		CPDLC_N010	
<b>Purpose:</b>		The purpose of this test is to verify the Ground System correctly handles the CPDLC connection procedure with a logged aircraft. In this test, the request is accepted. This test also includes the CPDLC message exchanges allowing to consider CPDLC enabled (assignment of the Ground System as CDA, provision of the unit name of the R-ATSU).	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>		3.3.5.4.2.1/3.3.5.4.2.2	
<b>Preamble:</b>		AIRCRAFT1 is logged on GND1 (c.f. test CM_N010).	
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send a CPDLC-start request to AIRCRAFT1 (no CPDLC message element provided).
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-start indication (no CPDLC message element provided) from GND1.
3	AIRCRAFT1	ENTER	Send an accepted CPDLC-start response to GND1.
4	GND1	VERIFY	Check GND1 receives the accepted CPDLC-start confirmation from AIRCRAFT1.
5	AIRCRAFT1	ENTER	Send the DM99 CURRENT DATA AUTHORITY message to GND1.
6	GND1	VERIFY	Check GND1 receives the DM99 CURRENT DATA AUTHORITY message from AIRCRAFT1.
7	GND1	ENTER	Send the UM227 LACK message to AIRCRAFT1 to acknowledge DM99 CURRENT DATA AUTHORITY message.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message from GND1 acknowledging the DM99 CURRENT DATA AUTHORITY message.
9	AIRCRAFT1	ENTER	Send the DM89 MONITORING [unitName] [frequency] message to GND1
10	GND1	VERIFY	Check GND1 receives the DM89 MONITORING [unitName] [frequency] message from AIRCRAFT1.
11	GND1	ENTER	Send the UM227 LACK message to AIRCRAFT1 to acknowledge the DM89 MONITORING [unitName] [frequency] message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message from GND1 acknowledging the DM89 MONITORING [unitName] [frequency] message.
13	GND1	ENTER	Send the UM183 'CURRENT ATC UNIT facility designation, facility name, facility function' message to AIRCRAFT1.
14	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM183 'CURRENT ATC UNIT facility designation, facility name, facility function' message.
15	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM183 'CURRENT ATC UNIT facility designation, facility name, facility function' message.
16	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM183 'CURRENT ATC UNIT facility designation, facility name, facility function' message.
17	GND1	VERIFY	Check AIRCRAFT1 appears as logged on and CPDLC connected to GND1 on air and ground monitoring system.
<b>Postamble:</b>			



<b>Comments:</b>	<ul style="list-style-type: none"><li>- It is assumed that required local conditions (ASSUME input...) are met to consider CPDLC enabled.</li><li>- Some implementations do not require a LACK to UM183</li><li>- Actions described from steps #9 to #12 are not mandatory to reach the CPDLC enabled status.</li></ul>
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### 3.1.2.1.2 CPDLC connection: rejected

<b>Identifier:</b>	CPDLC_N020		
<b>Purpose:</b>	The objective of this test is to check the Ground System correctly handles the CPDLC connection procedure when it is rejected by the Aircraft.		
<b>Configuration:</b>	RTC		
<b>ED110B Requirements:</b>	3.3.5.4.2.1/3.3.5.4.2.2		
<b>Preamble:</b>	AIRCRAFT1 is NOT logged on GND1 when the test is executed (AIRCRAFT1 is in the CPDLC Inhibited state). However It is assumed AIRCRAFT1 previously logged on GND1 (and then logged off) so that its CPDLC application address is known from the ground system.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the CPDLC-start request to AIRCRAFT1 (no CPDLC message element provided).
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-start request indication from GND1 (no CPDLC message element provided).
3	AIRCRAFT1	ENTER	Send the rejected CPDLC-start response to GND1, including a CPDLC message containing the concatenation of message element DM62 ERROR [errorInformation] with the choice (2) followed by message element DM98 'AIRCREW HAS INHIBITED CPDLC'.
4	GND1	VERIFY	Check GND1 receives the rejected CPDLC-start confirmation message from AIRCRAFT1 including a CPDLC message containing the concatenation of message element DM62 ERROR [errorInformation] with the choice (2) followed by message element DM98 'AIRCREW HAS INHIBITED CPDLC'.
5	GND1	VERIFY	Check CPDLC connection with AIRCRAFT1 remains closed.
<b>Postamble:</b>			

### 3.1.2.2 ACL Service

#### 3.1.2.2.1 Aircrew initiated exchange

##### 3.1.2.2.1.1 Dialogue type : 'level'

<b>Identifier:</b>		CPDLC_N030	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly handles a 'level' type dialogue. This ACL dialogue is initiated by airborne side.	
<b>ED110B Requirements</b>		4.4.3.2	
<b>Configuration:</b>		RTC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	AIRCRAFT1	ENTER	Send the DM6 REQUEST [level] message to GND1.
2	GND1	VERIFY	Check GND1 receives the DM6 REQUEST [level] message from AIRCRAFT1.
3	GND1	ENTER	Send UM227 LACK message to acknowledge DM6 REQUEST [level] message.
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message, acknowledging DM6 REQUEST [level] message.
5	GND1	ENTER	Send UM20 CLIMB TO [level] to AIRCRAFT1 in response to DM6 REQUEST [level] message.
6	AIRCRAFT	VERIFY	Check AIRCRAFT1 receives UM20 CLIMB TO [level] in response to DM6 REQUEST [level] message.
7	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge UM20 CLIMB TO [level] message.
8	GND1	VERIFY	Check GND1 receives DM100 LACK message, acknowledging UM20 CLIMB TO [level] message.
9	AIRCRAFT1	ENTER	Send DM0 WILCO message in response to UM20 CLIMB TO [level] message.
10	GND1	VERIFY	Check GND1 receives DM0 WILCO message in response to UM20 CLIMB TO [level] message.
11	GND1	ENTER	Send UM227 LACK message to acknowledge the DM0 WILCO message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message, acknowledging the DM0 WILCO message.
<b>Postamble:</b>		Check this 'level' type dialogue appears as closed on air and ground display systems.	
<b>Comments:</b>		The 'level' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.	

**3.1.2.2.1.2 Dialogue type: 'speed'**

<b>Identifier:</b>		CPDLC_N040	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly handles a 'speed' level type dialogue. This ACL dialogue is initiated by airborne side and uses the STANDBY message.	
<b>ED110B Requirements</b>		4.4.3.2	
<b>Configuration:</b>		RTC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	AIRCRAFT1	ENTER	Send the DM18 REQUEST [speed] message to GND1.
2	GND1	VERIFY	Check GND1 receives the DM18 REQUEST [speed] message from AIRCRAFT1.
3	GND1	ENTER	Send UM227 LACK message to acknowledge DM18 REQUEST [speed] message.
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message, acknowledging DM18 REQUEST [speed] message.
5	GND1	ENTER	Send UM1 STANDBY message in response to DM18 REQUEST [speed] message.
6	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM1 STANDBY message in response to DM18 REQUEST [speed] message.
7	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge UM1 STANDBY message.
8	GND1	VERIFY	Check GND1 receives DM100 LACK message acknowledging the UM1 STANDBY message.
9	GND1	ENTER	Send UM106 MAINTAIN [speed] to AIRCRAFT1 in response to DM18 REQUEST [speed] message.
10	AIRCRAFT	VERIFY	Check AIRCRAFT1 receives UM106 MAINTAIN [speed] in response to DM18 REQUEST [speed] message.
11	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge UM106 MAINTAIN [speed] message.
12	GND1	VERIFY	Check GND1 receives DM100 LACK message, acknowledging UM106 MAINTAIN [speed] message.
13	AIRCRAFT1	ENTER	Send DM0 WILCO message in response to UM106 MAINTAIN [speed] message.
14	GND1	VERIFY	Check GND1 receives DM0 WILCO message in response to UM106 MAINTAIN [speed] message.
15	GND1	ENTER	Send UM227 LACK message to acknowledge the DM0 WILCO message.
16	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message, acknowledging the DM0 WILCO message.
<b>Postamble:</b>		Check the 'speed' dialogue appears as closed on air and ground display systems.	
<b>Comments:</b>		The 'speed' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO.	

**3.1.2.2.1.3 Dialogue type: 'route'**

<b>Identifier:</b>		CPDLC_N050	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly handles a 'route' type dialogue. The airborne side initiates this ACL dialogue.	
<b>ED110B Requirements</b>		4.4.3.2	
<b>Configuration:</b>		RTC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	AIRCRAFT1	ENTER	Send the DM22 REQUEST DIRECT TO [position] message to GND1.
2	GND1	VERIFY	Check GND1 receives the DM22 REQUEST DIRECT TO [position] message from AIRCRAFT1.
3	GND1	ENTER	Send UM227 LACK message to acknowledge DM22 REQUEST DIRECT TO [position] message.
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message, acknowledging DM22 REQUEST DIRECT TO [position] message.
5	GND1	ENTER	Send UM74 PROCEED DIRECT TO [position] to AIRCRAFT1 in response to DM22 REQUEST DIRECT TO [position] message.
6	AIRCRAFT	VERIFY	Check AIRCRAFT1 receives UM74 PROCEED DIRECT TO [position] in response to DM22 REQUEST DIRECT TO [position] message.
7	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge UM74 PROCEED DIRECT TO [position] message.
8	GND1	VERIFY	Check GND1 receives DM100 LACK message, acknowledging UM74 PROCEED DIRECT TO [position] message.
9	AIRCRAFT1	ENTER	Send DM0 WILCO message in response to UM74 PROCEED DIRECT TO [position] message.
10	GND1	VERIFY	Check GND1 receives DM0 WILCO message in response to UM74 PROCEED DIRECT TO [position] message.
11	GND1	ENTER	Send UM227 LACK message to acknowledge the DM0 WILCO message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message, acknowledging the DM0 WILCO message.
<b>Postamble:</b>		Check the 'route' type dialogue is closed.	
<b>Comments:</b>		The 'route' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.	

**3.1.2.2.1.4 Concatenated message elements**

<b>Identifier:</b>			CPDLC_N060
<b>Purpose:</b>			The purpose of this test is to check that Ground System correctly handles messages conveying concatenated message elements.
<b>Configuration:</b>			RTC
<b>ED110B Requirements:</b>			3.3.7.3.2/3.3.7.3.3
<b>Preamble:</b>			AIRCRAFT1 is logged on and CPDLC connected to GND1.
<b>Steps:</b>			
No	SYSTEM	Action	Description
1	AIRCRAFT1	ENTER	Send the CPDLC-message request providing the following concatenated content: DM9 REQUEST CLIMB TO [level] + DM18 REQUEST [speed].
2	GND1	VERIFY	Check GND1 receives the CPDLC-message indication providing the following: DM9 REQUEST CLIMB TO [level] + DM18 REQUEST [speed].
3	GND1	ENTER	Send the UM227 LACK message to AIRCRAFT1 to acknowledge DM9 REQUEST CLIMB TO [level] + DM18 REQUEST [speed] message.
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message from GND1 acknowledging the DM9 REQUEST CLIMB TO [level] + DM18 REQUEST [speed] message.
5	GND1	ENTER	Send the UM20 CLIMB TO [level] + UM106 MAINTAIN [speed] in response to the DM9 REQUEST CLIMB TO [level] + DM18 REQUEST [speed] message.
6	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM20 CLIMB TO [level] + UM106 MAINTAIN [speed] message.
7	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge the UM20 CLIMB TO [level] + UM106 MAINTAIN [speed] message.
8	GND1	VERIFY	Check GND1 receives the DM100 LACK acknowledging the UM20 CLIMB TO [level] + UM106 MAINTAIN [speed] message.
9	AIRCRAFT1	ENTER	Send the DM0 WILCO message in response to the UM20 CLIMB TO [level] + UM106 MAINTAIN [speed] message.
10	GND1	VERIFY	Check GND1 receives the DM0 WILCO message in response to the UM20 CLIMB TO [level] + UM106 MAINTAIN [speed] message.
11	GND1	ENTER	Send the UM227 LACK message to acknowledge the DM0 WILCO message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM0 WILCO message.
<b>Postamble:</b>			Check on both sides the CPDLC dialogue appears as closed on air and ground display systems.
<b>Comments:</b>			The dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.

### 3.1.2.2.2 Controller initiated exchange

#### 3.1.2.2.2.1 Dialogue type: 'level'

<b>Identifier:</b>	CPDLC_N070		
<b>Purpose:</b>	The purpose of the test is to check the Ground System correctly handles a 'level' type dialogue. This ACL dialogue is initiated by ground side.		
<b>ED110B Requirements</b>	4.4.3.3		
<b>Configuration:</b>	RTC		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM19 MAINTAIN [level] message to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM19 MAINTAIN [level] message from GND1.
3	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge UM19 MAINTAIN [level] message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM19 MAINTAIN [level] message.
5	AIRCRAFT1	ENTER	Send the DM1 UNABLE message in response to UM19 MAINTAIN [level] message.
6	GND1	VERIFY	Check GND1 receives the DM1 UNABLE message in response to UM19 MAINTAIN [level] message.
7	GND1	ENTER	Send UM227 LACK message to acknowledge DM1 UNABLE message.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM1 UNABLE message.
<b>Postamble:</b>			
Check the 'level' type dialogue appears as closed on air and ground display systems.			
<b>Comments:</b>			
The 'level' type dialogue could also be completed with the DM0 WILCO response instead of the DM1UNABLE. This dialogue could also be lengthened using the DM2 STANDBY.			

**3.1.2.2.2 Dialogue type: 'speed'**

<b>Identifier:</b>		CPDLC_N080	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly handles a 'speed' type dialogue with the use of standby message. The Ground System initiates this ACL dialogue.	
<b>ED110B Requirements</b>		4.4.3.3	
<b>Configuration:</b>		RTC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send the UM106 MAINTAIN [speed] message to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM106 MAINTAIN [speed] message from GND1.
3	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge UM106 MAINTAIN [speed] message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM106 MAINTAIN [speed] message.
5	AIRCRAFT1	ENTER	Send the DM2 STANDBY message in response to UM106 MAINTAIN [speed] message.
6	GND1	VERIFY	Check GND1 receives the DM2 STANDBY message in response to UM106 MAINTAIN [speed] message.
7	GND1	ENTER	Send the UM227 LACK message to acknowledge the DM2 STANDBY message.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM2 STANDBY message.
9	AIRCRAFT1	ENTER	Send the DM1 UNABLE message in response to UM106 MAINTAIN [speed] message.
10	GND1	VERIFY	Check GND1 receives the DM1 UNABLE message in response to UM106 MAINTAIN [speed] message.
11	GND1	ENTER	Send UM227 LACK message to acknowledge DM1 UNABLE message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM1 UNABLE message.
<b>Postamble:</b>		Check the 'speed' type dialogue appears as closed on air and ground display systems.	
<b>Comments:</b>		This 'speed' type dialogue could also be completed with the DM0 WILCO response instead of the DM1 UNABLE.	



**3.1.2.2.3 Dialogue type : 'route'**

<b>Identifier:</b>		CPDLC_N090	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly handles a 'route' type dialogue. This ACL dialogue is initiated by ground side.	
<b>ED110B Requirements</b>		4.4.3.3	
<b>Configuration:</b>		RTC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM74 PROCEED DIRECT TO [position] message to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM74 PROCEED DIRECT TO [position] message from GND1.
3	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge the UM74 PROCEED DIRECT TO [position] message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM74 PROCEED DIRECT TO [position] message.
9	AIRCRAFT1	ENTER	Send the DM1 UNABLE message in response to UM74 PROCEED DIRECT TO [position] message.
10	GND1	VERIFY	Check GND1 receives the DM1 UNABLE message in response to UM74 PROCEED DIRECT TO [position] message.
11	GND1	ENTER	Send UM227 LACK message to acknowledge DM1 UNABLE message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM1 UNABLE message.
<b>Postamble:</b>		Check this 'route' type dialogue appears as closed on air and ground display systems.	
<b>Comments:</b>		The 'route' type dialogue could also be completed with the DM0 WILCO response instead of the DM1 UNABLE. This dialogue could also be lengthened using the DM2 STANDBY.	

## 3.1.2.2.2.4 Dialogue type : 'heading'

<b>Identifier:</b>	CPDLC_N100		
<b>Purpose:</b>	The purpose of the test is to check the Ground System correctly handles a 'heading' type dialogue. This ACL dialogue is initiated by ground side.		
<b>ED110B Requirements</b>	4.4.3.3		
<b>Configuration:</b>	RTC		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM190 FLY HEADING [degrees] to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM190 FLY HEADING [degrees] message from GND1.
3	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge the UM190 FLY HEADING [degrees] message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM190 FLY HEADING [degrees] message.
9	AIRCRAFT1	ENTER	Send the DM0 WILCO message in response to the UM190 FLY HEADING [degrees] message.
10	GND1	VERIFY	Check GND1 receives the DM0 WILCO message in response to the UM190 FLY HEADING [degrees] message.
11	GND1	ENTER	Send UM227 LACK message to acknowledge DM0 WILCO message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM0 WILCO message.
<b>Postamble:</b>		Check this 'heading' type dialogue appears as closed on air and ground display systems.	
<b>Comments:</b>		The 'heading' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.	

## 3.1.2.2.5 Dialogue type : 'time'

<b>Identifier:</b>	CPDLC_N110		
<b>Purpose:</b>	The purpose of the test is to check the Ground System correctly handles a 'time' type dialogue. This ACL dialogue is initiated by ground side.		
<b>ED110B Requirements</b>	4.4.3.3		
<b>Configuration:</b>	RTC		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM51 CROSS [position] AT [time] message to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM51 CROSS [position] AT [time] message from GND1.
3	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge UM51 CROSS [position] AT [time] message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM51 CROSS [position] AT [time] message.
9	AIRCRAFT1	ENTER	Send the DM0 WILCO message in response to UM51 CROSS [position] AT [time] message.
10	GND1	VERIFY	Check GND1 receives the DM0 WILCO message in response to UM51 CROSS [position] AT [time] message.
11	GND1	ENTER	Send UM227 LACK message to acknowledge DM0 WILCO message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM0 WILCO message.
<b>Postamble:</b>		Check this 'time' type dialogue appears as closed on air and ground display systems.	
<b>Comments:</b>		The 'time' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.	

## 3.1.2.2.6 Dialogue type : 'instruction'

<b>Identifier:</b>	CPDLC_N120		
<b>Purpose:</b>	The purpose of the test is to check the Ground System correctly handles an 'instruction' type dialogue. This ACL dialogue is initiated by ground side.		
<b>ED110B Requirements</b>	4.4.3.3		
<b>Configuration:</b>	RTC		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM123 SQUAWK [code] message to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM123 SQUAWK [code] message from GND1.
3	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge UM123 SQUAWK [code] message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM123 SQUAWK [code] message.
9	AIRCRAFT1	ENTER	Send the DM0 WILCO message in response to UM123 SQUAWK [code] message.
10	GND1	VERIFY	Check GND1 receives the DM0 WILCO message in response to UM123 SQUAWK [code] message.
11	GND1	ENTER	Send UM227 LACK message to acknowledge DM0 WILCO message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM0 WILCO message.
<b>Postamble:</b>		Check this 'instruction' type dialogue appears as closed on air and ground display systems.	
<b>Comments:</b>		The 'instruction' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.	

### 3.1.2.3 AMC Service

<b>Identifier:</b>		CDPLC_N130	
<b>Purpose:</b>		The goal of this test is to check that the Ground System is able to broadcast the ATC Microphone Check message to aircrafts in charge.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>		4.5	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send the UM157 CHECK STUCK MICROPHONE [frequency].
2	AIRCRAFT1	VERIFY	Check the airborne system receives the UM157 CHECK STUCK MICROPHONE [frequency] message.
3	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge the UM157 CHECK STUCK MICROPHONE [frequency] message.
4	GND1	VERIFY	Check ground system receives the DM100 LACK acknowledging the UM157 CHECK STUCK MICROPHONE [frequency] message.
<b>Comments:</b>		Some implementations may use UM183 instead of UM157 as described in ED110B. Some implementations do not require LACK when sending the UM157 CHECK STUCK MICROPHONE [frequency] message. In that case, steps #3 and #4 are not executed.	
<b>Postamble:</b>		Check the UM157 appears as closed on air and ground display systems.	

### 3.1.2.4 ACM service

#### 3.1.2.4.1 Internal transfer: nominal case

<b>Identifier:</b>			CPDLC_N140
<b>Purpose:</b>			The goal of this test is to perform an internal transfer of frequency (from T-Sector to R-Sector).
<b>Configuration:</b>			RTC
<b>ED110B Requirements:</b>			4.3.7
<b>Preamble:</b>			AIRCRAFT1 is logged on and CPDLC connected to GND1.
<b>Steps:</b>			
No	System	Action	Description
1	GND1 (T-sector)	ENTER	Send the <i>transfer instruction</i> message to AIRCRAFT1 to identify the next sector for control.
2	AIRCRAFT	VERIFY	Check AIRCRAFT1 receives the transfer instruction message identifying the next sector for control.
3	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the transfer instruction message.
4	GND1 (T-sector)	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the transfer instruction message.
5	AIRCRAFT1	ENTER	Send the DM0 WILCO in response to the transfer instruction message.
6	GND1 (T-Sector)	VERIFY	Check GND1 receives the DM0 WILCO message in response to the transfer instruction message.
7	GND1 (T-Sector)	ENTER	Send the UM227 LACK message to acknowledge the DM0 WILCO message.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK acknowledging the DM0 WILCO message.
9	AIRCRAFT1	ENTER	Send DM89 MONITORING [unitName] [frequency] to confirm unit name and frequency assignment.
10	GND1 (R-Sector)	VERIFY	Check GND1 receives the DM89 MONITORING [unitName] [frequency] confirming unit name and frequency assignment.
11	GND1 (R-Sector)	ENTER	Send the UM227 LACK message to acknowledge DM89 MONITORING message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging DM89 MONITORING [unitName] [frequency] message.
<b>Comments:</b>			The transfer instruction message element may be UM117 CONTACT [unitName] [frequency] or UM120 MONITOR [unitName] [frequency].
<b>Postamble:</b>			Check all CPDLC dialogues with GND1 appear as closed for AIRCRAFT1.

## 3.1.2.4.2 Internal transfer with open air/ground initiated pending dialogs

<b>Identifier:</b>		CPDLC_N150	
<b>Purpose:</b>		The goal of this test is to perform an internal transfer of frequency (from T-Sector to R-Sector) with open air/ground initiated dialogs.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>		4.3.7	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send the UM20 CLIMB TO [level] to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM20 CLIMB TO [level] message.
3	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge the UM20 CLIMB TO [level] message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK acknowledging UM20 CLIMB TO [level] message.
5	AIRCRAFT1	ENTER	Send the DM18 REQUEST [speed] to GND1.
6	GND1	VERIFY	Check GND1 receives DM18 REQUEST [speed] message.
7	GND1	ENTER	Send the UM227 LACK to acknowledge the DM18 REQUEST [speed] message.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives UM227 LACK acknowledging the DM18 REQUEST [speed] message.
9	GND1 (T-sector)	ENTER	Send the transfer instruction message to AIRCRAFT1 to identify the next sector for control.
10	AIRCRAFT	VERIFY	Check AIRCRAFT1 receives the transfer instruction message identifying the next sector for control.
11	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the transfer instruction message.
12	GND1 (T-sector)	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the transfer instruction message.
13	AIRCRAFT1	ENTER	Send the DM0 WILCO in response to the transfer instruction message.
14	GND1 (T-Sector)	VERIFY	Check GND1 receives the DM0 WILCO message in response to the transfer instruction message.
15	GND1 (T-Sector)	ENTER	Send the UM227 LACK message to acknowledge the DM0 WILCO message.
16	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK acknowledging the DM0 WILCO message.
17	AIRCRAFT1	ENTER	Send DM89 MONITORING [unitName] [frequency] to confirm unit name and frequency assignment.
18	GND1 (R-Sector)	VERIFY	Check GND1 receives the DM89 MONITORING [unitName] [frequency] confirming unit name and frequency assignment.
19	GND1 (R-Sector)	ENTER	Send the UM227 LACK message to acknowledge DM89 MONITORING message.
20	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging DM89 MONITORING [unitName] [frequency] message.
21	AIRCRAFT1	ENTER	Send the DM0 WILCO message in response to UM20 CLIMB TO [level] message (c.f. step #1).
22	GND1	VERIFY	Check GND1 receives DM0 WILCO message in response to UM20 CLIMB TO [level] message.
23	GND1	ENTER	Send the UM227 LACK message to acknowledge the DM0 WILCO message.
24	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM0 WILCO message.
25	GND1	ENTER	Send the UM106 MAINTAIN [speed] in response to DM18 REQUEST [speed] message (c.f. step #5).

26	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM106 MAINTAIN [speed] in response to DM18 REQUEST [speed] message.
27	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge the UM106 MAINTAIN [speed].
28	GND1	VERIFY	Check GND1 receives the DM100 LACK acknowledging the UM106 MAINTAIN [speed] message.
29	AIRCRAFT1	ENTER	Send the DM0 WILCO in response to UM106 MAINTAIN [speed] message.
30	GND1	VERIFY	Check GND1 receives DM0 WILCO message in response to UM106 MAINTAIN [speed] message.
31	GND1	ENTER	Send UM227 LACK to acknowledge the DM0 WILCO message.
32	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging DM0 WILCO message.
<b>Comments:</b>			The transfer instruction message element may be UM117 CONTACT [unitName] [frequency] or UM120 MONITOR [unitName] [frequency]. From steps #21, processing of pending dialogues can continue. The 'speed' and 'level' type dialogues could also be completed with the DM1 UNABLE response instead of the DM0 WILCO.
<b>Postamble:</b>			Check the 'speed' and 'level' type dialogues appear as closed on air and ground display systems.



3.1.2.4.3 Internal transfer with CPDLC next sector set to OFF

<b>Identifier:</b>			CPDLC_N160
<b>Purpose:</b>			The goal of this test is to perform an internal transfer of frequency from T-Sector to R-Sector, when R-Sector has CPDLC set to "OFF".
<b>Configuration:</b>			RTC
<b>ED110B Requirements:</b>			4.3.7/3.3.7.2.4/3.3.7.2.5
<b>Preamble:</b>			AIRCRAFT1 is logged on and CPDLC connected to GND1.
<b>Steps:</b>			
No	System	Action	Description
1	GND1 (T-sector)	ENTER	Send the <i>transfer instruction</i> message to AIRCRAFT1 to identify the next sector for control. This message is concatenated with the message element UM183 'NEXT SECTOR CPDLC NOT IN USE UNTIL NOTIFIED – USE VOICE'.
2	AIRCRAFT	VERIFY	Check AIRCRAFT1 receives the transfer instruction message identifying the next sector for control, concatenated with the message element UM183 'NEXT SECTOR CPDLC NOT IN USE UNTIL NOTIFIED – USE VOICE'.
3	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the transfer instruction message.
4	GND1 (T-sector)	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the transfer instruction message.
5	AIRCRAFT1	ENTER	Send the DM0 WILCO in response to the transfer instruction message.
6	GND1 (T-Sector)	VERIFY	Check GND1 receives the DM0 WILCO message in response to the transfer instruction message.
7	GND1 (T-Sector)	ENTER	Send the UM227 LACK message to acknowledge the DM0 WILCO message.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK acknowledging the DM0 WILCO message.
9	AIRCRAFT1	ENTER	Send the DM18 REQUEST [speed] message to GND1 (R-Sector).
10	GND1	VERIFY	Check GND1 receives DM18 REQUEST [speed] message.
11	GND1	ENTER	Send the concatenation of message element UM159 ERROR [errorInformation] with the choice (2) followed by the message element UM183 'CPDLC NOT AVAILABLE AT THIS TIME – USE VOICE' in response to the DM18 REQUEST [speed] message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the message element UM159 ERROR [errorInformation] with the choice (2) followed by the message element UM183 'CPDLC NOT AVAILABLE AT THIS TIME – USE VOICE' in response to the DM18 REQUEST [speed] message. Check this dialogue is closed.
<b>Comments:</b>			The transfer instruction message element may be UM117 CONTACT [unitName] [frequency] or UM120 MONITOR [unitName] [frequency].
<b>Postamble:</b>			Check CPDLC dialogues appear as closed on air and ground display systems.

## 3.1.2.4.4 Internal transfer from T-Sector not using CPDLC to R-Sector using CPDLC

<b>Identifier:</b>	CPDLC_N170		
<b>Purpose:</b>	The goal of this test is to perform an internal transfer of frequency from T-Sector not using CPDLC to R-Sector using CPDLC.		
<b>Configuration:</b>	RTC		
<b>ED110B Requirements:</b>	4.3.9		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	ENTER	AIRCRAFT1 sends the DM89 MONITORING [unitname][frequency] to GND1 (R-sector).
2	GND1 (R-sector)	VERIFY	Check GND1 receives the DM89 MONITORING [unitname][frequency] message.
3	GND1 (R-sector)	ENTER	Send the UM227 LACK to acknowledge the DM89 MONITORING [unitName] [frequency] message.
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK acknowledging the DM89 MONITORING [unitName] [frequency].
5	AIRCRAFT1	ENTER	Send the DM18 REQUEST [speed] message to GND1 (R-Sector).
6	GND1	VERIFY	Check GND1 receives the DM18 REQUEST [speed] message.
7	GND1	ENTER	Send UM0 UNABLE to AIRCRAFT1.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM0 UNABLE message.
9	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge UM0 UNABLE.
10	GND1	VERIFY	Check GND1 receives the DM100 LACK acknowledging the UM0 UNABLE.
<b>Postamble:</b>		Check this CPDLC dialogue appears as closed on both sides.	

3.1.2.4.5 External transfer: nominal case

<b>Identifier:</b>		CPDLC_N180	
<b>Purpose:</b>		The goal of this test is to perform a transfer of frequency from T-ATSU to R-ATSU. The System Under Test (Ground System) is the T-ATSU.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>		3.3.5.6.2/3.3.7.5.2/3.3.7.6.2.3/4.3.4	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1. It is assumed the logon transfer has already been processed for AIRCRAFT1.	
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM160 NEXT DATA AUTHORITY message to AIRCRAFT1, identifying the next facility (R-ATSU).
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM160 NEXT DATA AUTHORITY message identifying the next facility centre.
3	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM160 NEXT DATA AUTHORITY message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM160 NEXT DATA AUTHORITY message.
5	GND1	ENTER	Send the CPDLC-end request providing the <i>transfer instruction</i> message element.
6	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-end indication providing the transfer instruction message element.
7	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the transfer instruction message element.
8	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the transfer instruction message element.
9	AIRCRAFT1	ENTER	Send the accepted CPDLC-end response providing the DM0 WILCO message element to GND1.
10	GND1	VERIFY	Check the GND1 receives the accepted CPDLC-end confirmation providing the DM0 WILCO message element. Check it is not possible to send uplink message to AIRCRAFT1.
<b>Comments:</b>		Between steps #4 and #5, AIRCRAFT1 should have successfully been CPDLC connected to R-ATSU. The transfer instruction message element may be UM117 CONTACT [unitName] [frequency] or UM120 MONITOR [unitName] [frequency].	
<b>Postamble:</b>		Check on both sides the CPDLC connection between GND1 and AIRCRAFT1 is closed. A connection between R-ATSU and AIRCRAFT1 should exist.	

3.1.2.4.6 External transfers with air initiated pending dialogs

<b>Identifier:</b>		CPDLC_N190	
<b>Purpose:</b>		The goal of this test is to check that Ground System correctly handles an external frequency transfer with a pending air initiated dialog.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>		4.3.6.1.1.2/3.3.7.5.2/3.3.7.6.2.3/4.3.4	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1. It is assumed the logon transfer has already been processed for AIRCRAFT1.	
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM160 NEXT DATA AUTHORITY message to AIRCRAFT1, identifying the next facility (R-ATSU).
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM160 NEXT DATA AUTHORITY message identifying the next facility centre.
3	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM160 NEXT DATA AUTHORITY message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM160 NEXT DATA AUTHORITY message.
5	AIRCRAFT1	ENTER	Send the DM18 REQUEST [speed] message to GND1.
6	GND1	VERIFY	Check GND1 receives the DM18 REQUEST [speed] message.
7	GND1	ENTER	Send the concatenation of message element UM159 ERROR [errorInformation] with the choice (2) followed by message element UM183 'REQUEST AGAIN WITH NEXT UNIT' in response to the DM18 REQUEST [speed] message.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM159 ERROR [errorInformation] with the choice (2) followed by message element UM183 'REQUEST AGAIN WITH NEXT UNIT' in response to the DM18 REQUEST [speed] message.
9	GND1	ENTER	Send the CPDLC-end request providing the transfer instruction message element.
10	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-end indication providing the message of transfer instruction.
11	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the message of transfer instruction.
12	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the message of transfer instruction.
13	AIRCRAFT1	ENTER	Send the accepted CPDLC-end response providing the DM0 WILCO message element to GND1.
14	GND1	VERIFY	Check the GND1 receives the accepted CPDLC-end confirmation providing the DM0 WILCO message element.
<b>Comments:</b>		<p>The message of transfer instruction may be UM117 CONTACT [unitName] [frequency] or UM120 MONITOR [unitName] [frequency].</p> <p>At step #9, an event triggered the frequency transfer processing. As there is an air initiated pending dialog, it must be closed before performing the frequency transfer action. ED-110B provides 4 ways to resolve the pending dialogue:</p> <ul style="list-style-type: none"> <li>• the message element UM0 UNABLE, or</li> <li>• the message element UM237 REQUEST AGAIN WITH NEXT UNIT, or</li> <li>• the message element UM183 'REQUEST AGAIN WITH NEXT UNIT', or</li> <li>• the concatenation UM159+UM183 as described in the test.</li> </ul>	
<b>Postamble:</b>		Check no more CPDLC connection exists between GND1 and AIRCRAFT1	

3.1.2.4.7 External transfer: refused

<b>Identifier:</b>		CPDLC_N200	
<b>Purpose:</b>		The goal of this test is to test that Ground System correctly handles an external frequency transfer procedure that is refused by aircrew. It also demonstrates that ACL dialogue is still possible after the frequency transfer failure. The System Under Test (Ground System) is the T-ATSU.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>		4.3.4	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1. It is assumed the logon transfer has already been processed for AIRCRAFT1.	
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send the UM160 NEXT DATA AUTHORITY message to AIRCRAFT1, identifying the next facility (R-ATSU).
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM160 NEXT DATA AUTHORITY message identifying the next facility centre.
3	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM160 NEXT DATA AUTHORITY message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM160 NEXT DATA AUTHORITY message.
5	GND1	ENTER	Send the CPDLC-end request providing the message of transfer instruction.
6	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-end indication providing the transfer instruction message element.
7	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the message of transfer instruction.
8	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the message of transfer instruction.
9	AIRCRAFT1	ENTER	Send the rejected CPDLC-end response providing the DM1 UNABLE message element to GND1.
10	GND1	VERIFY	Check the GND1 receives the rejected CPDLC-end confirmation providing the DM1 UNABLE message element.
11	GND1	ENTER	Send the UM20 CLIMB TO [level] to AIRCRAFT1.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM20 CLIMB TO [level] message.
13	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM20 CLIMB TO [level] message.
14	GND1	VERIFY	Check GND1 receives the DM100 LACK acknowledging the UM20 CLIMB TO [level] message.
15	AIRCRAFT1	ENTER	Send the DM0 WILCO message is response to UM20 CLIMB TO [level] message.
16	GND1	VERIFY	Check GND1 receives the DM0 WILCO message in response to UM20 CLIMB TO [level] message.
17	GND1	ENTER	Send the UM227 LACK message to acknowledge the DM0 WILCO message.
18	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM0 WILCO message.

<b>Comments:</b>	Between steps #4 and #5, AIRCRAFT1 should have successfully been CPDLC connected to R-ATSU (because R-ATSU designated as NDA). The transfer instruction message element may be UM117 CONTACT [unitName] [frequency] or UM120 MONITOR [unitName] [frequency]. The 'level' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.
<b>Postamble:</b>	Check the 'level' type dialogue appears as closed on air and ground display systems. Check AIRCRAFT1 is still connected to GND1.

### 3.1.2.4.8 External transfer with *ttr* timer expiry

<b>Identifier:</b>		CPDLC_N205	
<b>Purpose:</b>		The goal of this test is to test that Ground System correctly handles an external frequency transfer procedure that fails because of air <i>ttr</i> timer expiry. It also demonstrates that ACL dialogue is still possible after the frequency transfer failure. The System Under Test (Ground System) is the T-ATSU.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>		4.3.4/4.2.1.3.7	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1. It is assumed the logon transfer has already been processed for AIRCRAFT1.	
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send the UM160 NEXT DATA AUTHORITY message to AIRCRAFT1, identifying the next facility (R-ATSU).
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM160 NEXT DATA AUTHORITY message identifying the next facility centre.
3	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM160 NEXT DATA AUTHORITY message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM160 NEXT DATA AUTHORITY message.
5	GND1	ENTER	Send the CPDLC-end request providing the message of transfer instruction.
6	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-end indication providing the transfer instruction message element.
7	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the message of transfer instruction.
8	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the message of transfer instruction.
9	AIRCRAFT1	WAIT	Wait for expiry of air <i>ttr</i> timer.
10	AIRCRAFT1	VERIFY	Check AIRCRAFT1 sends a rejected CPDLC-End response providing a CPDLC downlink message containing the concatenation of message elements DM62 (ERROR (2)) plus DM98 (AIR SYSTEM TIMEOUT). Check the dialogue is closed.
12	GND1	VERIFY	Check GND1 receives the rejected CPDLC-End confirmation providing the concatenation of DM62 (ERROR (2)) plus the DM98 (AIR SYSTEM TIMEOUT). Check the dialogue is closed.
13	GND1	ENTER	Send the UM20 CLIMB TO [level] to AIRCRAFT1.
14	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM20 CLIMB TO [level] message.
15	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge the UM20 CLIMB TO [level] message.
16	GND1	VERIFY	Check GND1 receives the DM100 LACK acknowledging UM20 CLIMB TO [level] message.
17	AIRCRAFT1	ENTER	Send the DM0 WILCO in response to UM20 CLIMB TO [level] message.
18	GND1	VERIFY	Check GND1 receives the DM0 WILCO in response to UM20 CLIMB TO [level] message.
19	GND1	ENTER	Send the UM227 LACK to acknowledge the DM0 WILCO message.
20	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK acknowledging the DM0 WILCO message.

<b>Comments:</b>	Between steps #4 and #5, AIRCRAFT1 should have successfully been CPDLC connected to R-ATSU. The transfer instruction message element may be UM117 CONTACT [unitName] [frequency] or UM120 MONITOR [unitName] [frequency]. The 'level' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.
<b>Postambule:</b>	Check the 'level' type dialogue appears as closed on air and ground display systems. Check AIRCRAFT1 is still CPDLC connected to GND1.



**3.1.2.4.9 External transfer with change of NDA (datalink equipped)**

<b>Identifier:</b>	CPDLC_N210		
<b>Purpose:</b>	The goal of this test is the Ground System behaviour when the next centre changes before an external transfer. In this test, the next centre is datalink equipped.		
<b>Configuration:</b>	RTC		
<b>ED110B Requirements:</b>	4.3.3.2/4.3.3.3/4.3.4		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1. It is assumed the logon transfer has already been processed for AIRCRAFT1.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM160 NEXT DATA AUTHORITY message to AIRCRAFT1, identifying the next facility (R-ATSU1).
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM160 NEXT DATA AUTHORITY message identifying the next facility centre.
3	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM160 NEXT DATA AUTHORITY message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM160 NEXT DATA AUTHORITY message.
5	GND1	ENTER	Send a new UM160 NEXT DATA AUTHORITY message to AIRCRAFT1, identifying the new next facility (R-ATSU2).
6	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the new UM160 NEXT DATA AUTHORITY message identifying the new next facility centre.
7	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM160 NEXT DATA AUTHORITY message.
8	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM160 NEXT DATA AUTHORITY message.
9	GND1	ENTER	Send the CPDLC-end request providing the message of transfer instruction.
10	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-end indication providing the transfer instruction message element.
11	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the message of transfer instruction.
12	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the message of transfer instruction.
13	AIRCRAFT1	ENTER	Send the accepted CPDLC-end response providing the DM0 WILCO message element to GND1.
14	GND1	VERIFY	Check the GND1 receives the accepted CPDLC-end confirmation providing the DM0 WILCO message element.
<b>Comments:</b>	From step #5, an event is triggered to indicate that next centre has changed. The transfer instruction message element may be UM117 CONTACT [unitName] [frequency] or UM120 MONITOR [unitName] [frequency].		
<b>Postamble:</b>	Check AIRCRAFT1 is no more connected to GND1.		

**3.1.2.4.10 External transfer with change of NDA (not datalink equipped)**

<b>Identifier:</b>		CPDLC_N220	
<b>Purpose:</b>		The goal of this test is to check the Ground System behaviour when the next centre changes before an external transfer. In this test, the next centre is not datalink equipped (or is not using datalink).	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>		4.3.3.2/4.3.3.3/4.3.4	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1. In this test, the former next centre is a data link one.	
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM160 NEXT DATA AUTHORITY message to AIRCRAFT1, identifying the next facility (R-ATSU1).
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM160 NEXT DATA AUTHORITY message identifying the next facility centre.
3	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM160 NEXT DATA AUTHORITY message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM160 NEXT DATA AUTHORITY message.
5	GND1	ENTER	Send a new UM160 NEXT DATA AUTHORITY message to AIRCRAFT1, identifying the new next facility (R-ATSU2). As this next centre is not datalink equipped (or is not using datalink), the UM160 NEXT DATA AUTHORITY is filled in with the choice [noFacility] to cancel the NDA indications.
6	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the new UM160 NEXT DATA AUTHORITY message cancelling the NDA indications.
7	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM160 NEXT DATA AUTHORITY message.
8	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM160 NEXT DATA AUTHORITY message.
9	GND1	ENTER	Send the CPDLC-end request providing the message of transfer instruction.
10	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-end indication providing the message of transfer instruction.
11	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the message of transfer instruction.
12	GND1	VERIFY	Check GND1 receives the DM100 LACK message to acknowledge the message of transfer instruction.
13	AIRCRAFT1	ENTER	Send the accepted CPDLC-end response providing the DM0 WILCO message element to GND1.
14	GND1	VERIFY	Check the GND1 receives the accepted CPDLC-end confirmation providing the DM0 WILCO message element.
<b>Comments:</b>		At step #5, an event is triggered to indicate that next centre has changed. The message of transfer instruction may be UM117 CONTACT [unitName] [frequency] or UM120 MONITOR [unitName] [frequency].	
<b>Postamble:</b>		Check AIRCRAFT1 is no more CPDLC connected to GND1.	

**3.1.2.4.11 External transfer with NDA not yet sent**

<b>Identifier:</b>		CPDLC_N230	
<b>Purpose:</b>		The goal of this test is to check Ground System behaviour when an external frequency transfer is triggered whereas the message identifying the next authority has not been sent yet. The System Under Test (Ground System) is the T-ATSU.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>		4.3.3.4/4.3.4	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1. It is assumed the logon transfer has already been processed for AIRCRAFT1.	
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	VERIFY	The frequency transfer is triggered, check the UM160 NEXT DATA AUTHORITY has not been sent yet.
2	GND1	ENTER	Send the UM160 NEXT DATA AUTHORITY message to AIRCRAFT1, identifying the next facility (R-ATSU) from the frequency transfer request message.
3	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM160 NEXT DATA AUTHORITY message identifying the next facility centre.
4	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM160 NEXT DATA AUTHORITY message.
5	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM160 NEXT DATA AUTHORITY message.
6	GND1	ENTER	Send the CPDLC-end request providing the message of transfer instruction.
7	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-end indication providing the message of transfer instruction.
8	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the message of transfer instruction.
9	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the message of transfer instruction.
10	AIRCRAFT1	ENTER	Send the accepted CPDLC-end response providing the DM0 WILCO message element to GND1.
11	GND1	VERIFY	Check the GND1 receives the accepted CPDLC-end confirmation providing the DM0 WILCO message element.
<b>Comments:</b>		The message of transfer instruction may be UM117 CONTACT [unitName] [frequency] or UM120 MONITOR [unitName] [frequency].	
<b>Postamble:</b>		Check AIRCRAFT1 is no more CPDLC connected to GND1.	

3.1.2.4.12 CPDLC disabling/enabling

<b>Identifier:</b>		CPDLC_N240	
<b>Purpose:</b>		The goal of this test is to check that Ground System correctly handles the capability to switch a sector ON/OFF for CPDLC support.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>		3.3.7.2.1/3.3.7.2.2/3.3.7.2.3	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1. The sector is turned ON for CPDLC.	
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send the UM183 'CPDLC NOT IN USE – VOICE ONLY UNTIL NOTIFIED' to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM183 'CPDLC NOT IN USE – VOICE ONLY UNTIL NOTIFIED' message.
3	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge the UM183 'CPDLC NOT IN USE – VOICE ONLY UNTIL NOTIFIED' to AIRCRAFT1 message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK acknowledging the UM183 'CPDLC NOT IN USE – VOICE ONLY UNTIL NOTIFIED' message.
5	AIRCRAFT1	ENTER	Send the DM18 REQUEST [speed] to GND1.
6	GND1	VERIFY	Check GND1 receives the DM18 REQUEST [speed].
7	GND1	ENTER	As CPDLC is turned OFF, send the concatenation of message element UM159 ERROR [errorInformation] with the choice (2) followed by message element UM183 'CPDLC NOT AVAILABLE AT THIS TIME – USE VOICE' to AIRCRAFT1.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the concatenation of message element UM159 ERROR [errorInformation] with the choice (2) followed by message element UM183 'CPDLC NOT AVAILABLE AT THIS TIME – USE VOICE'.
9	GND1	ENTER	Send the UM183 'CPDLC NOW IN USE' to AIRCRAFT1.
10	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM183 'CPDLC NOW IN USE'.
11	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge the UM183 'CPDLC NOW IN USE'.
12	GND1	VERIFY	Check GND1 receives the DM100 LACK acknowledging the UM183 'CPDLC NOW IN USE' message.
13	GND1	ENTER	Send the UM183 'CURRENT ATC UNIT facility designation, facility name, facility function' message to AIRCRAFT1.
14	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM183 'CURRENT ATC UNIT facility designation, facility name, facility function' message.
15	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge the UM183 'CURRENT ATC UNIT facility designation, facility name, facility function' message.
16	GND1	VERIFY	Check GND1 receives the DM100 LACK acknowledging the UM183 'CURRENT ATC UNIT facility designation, facility name, facility function' message.
17	AIRCRAFT1	ENTER	Send the DM18 REQUEST [speed] to GND1.
18	GND1	VERIFY	Check GND1 receives the DM18 REQUEST [speed].
19	GND1	ENTER	Send the UM227 LACK to acknowledge the DM18 REQUEST [speed] message.
20	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK acknowledging the DM18 REQUEST [speed] message.
21	GND1	ENTER	Send the UM106 MAINTAIN [speed] message to AIRCRAFT1 in response to DM18 REQUEST [speed].
22	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM106 MAINTAIN [speed] message in response to DM18 REQUEST [speed].

23	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge the UM106 MAINTAIN [speed] message.
24	GND1	VERIFY	Check GND1 receives the DM100 LACK acknowledging the UM106 MAINTAIN [speed] message.
25	AIRCRAFT1	ENTER	Send the DM0 WILCO message in response to UM106 MAINTAIN [speed] message.
26	GND1	VERIFY	Check GND1 receives the DM0 WILCO in response to UM106 MAINTAIN [speed] message.
27	GND1	ENTER	Send UM227 LACK to acknowledge DM0 WILCO message.
28	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM0 WILCO.
<b>Comments:</b>			The 'speed' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.
<b>Postamble:</b>			Check the 'speed' type dialogue appears as closed on air and ground display systems.

### 3.1.2.5 CPDLC Timers

#### 3.1.2.5.1 CPDLC timer: ground *ttr* timer

<b>Identifier:</b>		CPDLC_N250	
<b>Purpose:</b>		The purpose of this test is to check that Ground System correctly implements requirements related to the <i>ttr</i> timer.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements</b>		4.2.1.3.1/4.2.1.3.2/4.2.1.3.5/4.2.1.3.6/4.2.1.3.8	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1. As the test focuses on <i>ttr</i> timer, the steps related to LACK messages exchange will not be detailed.	
<b>Steps:</b>			
No	SYSTEM	Action	Description
1	AIRCRAFT1	ENTER	Send the DM9 REQUEST CLIMB TO [level] to GND1.
2	GND1	VERIFY	Check GND1 receives the DM9 REQUEST CLIMB TO [level] from AIRCRAFT1. Check GND1 starts <i>ttr</i> timer.
3	GND1	ENTER	Send the UM1 STANDBY to AIRCRAFT1 in response to DM9 REQUEST CLIMB TO [level].
4	GND1	VERIFY	Check GND1 restarts <i>ttr</i> timer.
5	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives UM1 STANDBY message in response to DM9.
6	GND1	ENTER	Send UM20 CLIMB TO [level] message to AIRCRAFT1 in response to DM9 REQUEST CLIMB TO [level].
7	GND1	VERIFY	Check GND1 stops <i>ttr</i> timer.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives UM20 CLIMB TO [level] message in response to DM9.
9	AIRCRAFT1	ENTER	Send DM0 WILCO in response to UM20 CLIMB TO [level].
10	GND1	VERIFY	Check GND1 receives DM0 WILCO in response to UM20 CLIMB TO [level].
11	AIRCRAFT1	ENTER	Send the DM10 REQUEST DESCENT TO [level] to GND1.
12	GND1	VERIFY	Check GND1 receives the DM10 REQUEST DESCENT TO [level]. Check GND1 starts <i>ttr</i> timer.
13	GND1	WAIT	Do not respond to DM10 REQUEST DESCENT TO [level].
14	GND1	ENTER	Upon expiry of the <i>ttr</i> timer, check GND1 automatically sends the CPDLC uplink message containing the concatenation of message element UM159 ERROR (error information) with the choice (2) followed by the message element UM183 'ATC TIMEOUT – REPEAT REQUEST'.
15	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the message containing the concatenation of message element UM159 ERROR (error information) with the choice (2) followed by the message element UM183 'ATC TIMEOUT – REPEAT REQUEST' in response to the DM10 REQUEST DESCENT TO [level].
<b>Postamble:</b>		Check all AIRCRAFT1 CPDLC dialogues with GND1 are closed.	
<b>Comments:</b>		The 'level' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO.	

3.1.2.5.2 CPDLC timer: ground *tts* timer

<b>Identifier:</b>		CPDLC_N260	
<b>Purpose:</b>		The purpose of this test is to check that Ground System correctly implements requirements related to the <i>tts</i> timer.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>		4.2.1.4.2/4.2.1.4.3/4.2.1.4.4/4.2.1.4.5/4.2.1.4.6/4.2.1.4.8	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send the UM19 MAINTAIN [level] message to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM19 MAINTAIN [level] message.
3	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge the UM19 MAINTAIN [level] message.
4	GND1	VERIFY	Check GND1 receives the DM100 acknowledging the UM19 MAINTAIN [level] message.
4	AIRCRAFT1	WAIT	Wait up to termination of <i>tts</i> timer (do not respond to UM19 message).
6	GND1	VERIFY	Upon termination of the <i>tts</i> timer, check the controller is indicated the required response has not been received within the required time.
<b>Postamble:</b>		Check the 'level' type dialogue appears as closed on air and ground display systems.	

3.1.2.5.3 CPDLC timers: air *ttr* timer

<b>Identifier:</b>		CPDLC_N270	
<b>Purpose:</b>		The purpose of this test is to check that Ground System correctly handles the reception of error message on airborne <i>ttr</i> timeout.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>			
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send the UM19 MAINTAIN [level] message to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM19 MAINTAIN [level] message.
3	AIRCRAFT1	ENTER	Send the DM100 LACK to acknowledge the UM19 MAINTAIN [level] message.
4	GND1	VERIFY	Check GND1 receives the DM100 acknowledging the UM19 MAINTAIN [level] message.
4	AIRCRAFT1	WAIT	Wait up to termination of <i>ttr</i> timer (do not respond to UM19 message).
6	AIRCRAFT1	ENTER	Upon termination of the <i>ttr</i> timer, send the DM62 ERROR [errorInformation] with the choice (2) followed by message element DM98 'AIR SYSTEM TIMEOUT'.
7	GND1	VERIFY	Check GND1 receives the DM62 ERROR [errorInformation] with the choice (2) followed by message element DM98 'AIR SYSTEM TIMEOUT' in response to UM19 MAINTAIN [level]. Check the dialogue is closed.
<b>Postamble:</b>		Check the 'level' type dialogue appears as closed on air and ground display systems.	

### 3.1.2.6 CPDLC and TP4 connections

#### 3.1.2.6.1 TP4 Keepalives

<b>Identifier:</b>		CPDLC_N280	
<b>Purpose:</b>		To check that once a CPDLC connection is established, both CPDLC and TP4 connections are maintained, even without any application exchanges. To verify that TP4 AK TPDUs are sent at the expected time intervals, dependent on the remote Inactivity Time, in the absence of transfer of DT TPDUs.	
<b>Configuration:</b>		RTC	
<b>ED110B Requirements:</b>			
<b>ICAO Doc. 9705 Ed.2 Req.</b>		5.5.2	
<b>ES DLS Requirements:</b>		B.2.5.1/B.2.5.2	
<b>Preamble:</b>		AIRCRAFT is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1.		WAIT	After the CPDLC connection has been established, wait for a period of 10 minutes - period longer than the value of the inactivity timer - without sending any CPDLC application messages neither downlink nor uplink.
2.	AIRCRAFT	VERIFY	Check that GND1 is still displayed as Current Data Authority
3.	GND1	VERIFY	From ground ES Upper layers traces check that CPDLC and TP4 connections are still established
4.	GND1	VERIFY	From ground ES Upper layers traces check that TP4 ACK PDUs have been exchanged as per TP4 Window Time expected interval.
<b>Postamble:</b>			
<b>Comment:</b>		A monitoring tool may be set up on the test Facility in order to capture the uplink and downlink traffic checked during post-analysis.	



### 3.1.2.6.2 CPDLC messages and TP4 Acknowledgment

<b>Identifier:</b>	CPDLC_N290		
<b>Purpose:</b>	To check that once a CPDLC connection is established, a TP4 ACK TPDU is sent by the ground within the required interval following successful receipt of a downlink TP4 DT TPDU conveying a CPDLC message.		
<b>Configuration:</b>	RTC		
<b>ED110B Requirements:</b>			
<b>ICAO Doc. 9705 Ed.2 Req.</b>	5.5.2		
<b>ES DLS Requirements:</b>	B.2.5.1/B.2.5.2		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1.	GND1	ENTER	Send the UM20 CLIMB TO [level] message to AIRCRAFT1.with request for a LACK.
2.	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM20 CLIMB TO [level] message and sends the LACK message back to it
3.	GND1	VERIFY	From ground ES Upper Layers traces, check that a TP4 ACK TPDU has been sent in the required interval to acknowledge the TP4 DT TPDU conveying the CPDLC downlink LACK message.
<b>Postamble:</b>			
<b>Comment:</b>	A monitoring tool may be set up on the test Facility in order to capture the uplink and downlink traffic to be checked during post-analysis.		

## 3.2 Tests using Simulated Test Configuration

### 3.2.1 Tests for CPDLC Application

#### 3.2.1.1 CPDLC connection handling

##### 3.2.1.1.1 CPDLC connection ending with pending dialog

<b>Identifier:</b>		CPDLC_S010	
<b>Purpose:</b>		The objective of this test is to verify the Ground System correctly handles the CPDLC-end service when a pending dialog exists.	
<b>ED-110B requirements</b>		3.3.5.6.1	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send the CPDLC-end request to AIRCRAFT1.
2	AIRCRAFT1	ENTER	Send the DM6 REQUEST [level] message to GND1.
3	GND1	VERIFY	Check GND1 receives the DM6 REQUEST [level] message and does not respond it.
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-end indication from GND1.
5	AIRCRAFT1	ENTER	Send the rejected CPDLC-end response to GND1.
6	GND1	VERIFY	Check GND1 receives the rejected CPDLC-end confirmation from AIRCRAFT1.
7	GND1	ENTER	Send the UM20 CLIMB TO [level] message to AIRCRAFT1.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM20 CLIMB TO [level] message from GND1.
9	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM20 CLIMB TO [level] message.
10	AIRCRAFT1	ENTER	Send the DM0 WILCO message to GND1 in response to the UM20 CLIMB TO [level] message.
11	GND1	VERIFY	Check GND1 receives the DM0 WILCO message in response to the UM20 CLIMB TO [level] message.
12	GND1	ENTER	Send the UM227 LACK message to AIRCRAFT1 to acknowledge the DM0 WILCO message.
13	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM0 WILCO message.
<b>Postamble:</b>		Check the 'level' type dialogue appears as closed on air and ground display systems.	
<b>Comments:</b>		The 'level' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.	

3.2.1.1.2 CPDLC connection: aborted (user)

<b>Identifier:</b>			CPDLC_S020
<b>Purpose:</b>			The goal of this test is to demonstrate that Ground System correctly handles CPDLC user abort primitive. The test deals with both ground and air initiated user aborts.
<b>Configuration:</b>			STC, with two aircrafts.
<b>ED110B Requirements:</b>			3.3.5.9.1/4.2.3.1/4.2.3.2
<b>Preamble:</b>			AIRCRAFT1 and AIRCRAFT2 are logged on and CPDLC connected to GND1.
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM183 'CONTROLLER TERMINATED CPDLC' message then send the CPDLC-user-abort request using the 'commanded-termination' value (5) as abort reason.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM183 'CONTROLLER TERMINATED CPDLC' message; check AIRCRAFT1 receives the CPDLC-user-abort indication with the 'commanded-termination' value (5) as abort reason.
3	GND1	VERIFY	Check CPDLC connection with AIRCRAFT1 is closed.
4	AIRCRAFT2	ENTER	Send the CPDLC-user-abort request using the 'commanded-termination' value (5) as abort reason.
5	GND1	VERIFY	Check GND1 receives the CPDLC-user-abort indication providing the 'commanded-termination' value (5) as abort reason.
6	GND1	VERIFY	Check the CPDLC connection with AIRCRAFT2 is closed.
<b>Postamble:</b>			Check the GND1 CPDLC connections with both aircrafts are closed.
<b>Comments:</b>			Steps from #1 to #3 describe ground initiated user abort procedure. Steps from #4 to #6 describe air initiated user abort procedure. After step #6, as the air initiated abort request provides the 'commanded-termination' (5) abort reason, Ground System shall not attempt to automatically re-establish a CPDLC connection with AIRCRAFT2.

3.2.1.1.3 CPDLC connection: aborted (provider)

<b>Identifier:</b>			CPDLC_S030
<b>Purpose:</b>			The goal of this test is to demonstrate that a CPDLC-provider-abort is correctly handled by Ground System.
<b>Configuration:</b>			STC
<b>ED110B Requirements:</b>			3.3.5.9.4
<b>Preamble:</b>			AIRCRAFT1 is logged on and CPDLC connected to GND1.
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send a CPDLC-start request to AIRCRAFT1.
2	AIRCRAFT	VERIFY	Check AIRCRAFT1 receives the CPDLC-start indication from GND1. Do not respond to the request.
3	GND1	VERIFY	Once the <i>tStart</i> timer fired, check GND1 receives the CPDLC-provider-abort indication message. Check CPDLC connection with AIRCRAFT1 remains closed.
<b>Postamble:</b>			Check CPDLC connection with AIRCRAFT1 is still closed.

### 3.2.1.1.4 Failed CPDLC connection termination

<b>Identifier:</b>	CPDLC_S040		
<b>Purpose:</b>	The objective of this test is to verify the Ground System correctly handles the <i>t-CPDLC-end</i> timer in termination phase.		
<b>ED-110B requirements</b>	4.2.1.5.2		
<b>Configuration:</b>	STC		
<b>Preamble:</b>	As implementation of the <i>t-CPDLC-end</i> timer is a local matter, this test is relevant only if the Ground System implements such timer. ED-110B recommends a value of 6 minutes for <i>t-CPDLC-end</i> timer. AIRCRAFT1 is logged on and CPDLC connected to GND1.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the CPDLC-end request to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-end indication from GND1.
3	AIRCRAFT	ENTER	(No action) Do not respond to the CPDLC-end indication message from GND1.
4	GND1	WAIT	Wait <i>t-CPDLC-end</i> minutes (no action).
5	GND1	ENTER	Send the CPDLC-user-abort (undefined) message to AIRCRAFT1.
6	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-user-abort indication (undefined) from GND1.
<b>Postamble:</b>	Check the CPDLC connection between AIRCRAFT1 and GND1 is closed.		

### 3.2.1.2 CPDLC message checks

#### 3.2.1.2.1 Timestamp error: time latency

<b>Identifier:</b>	CPDLC_S060		
<b>Purpose:</b>	The purpose of this test is to check Ground System behaviour that meets a message latency problem.		
<b>ED-110B requirements</b>	3.3.4.1.4		
<b>Configuration:</b>	STC		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	ENTER	Send the DM6 REQUEST [level] message. This message header is filled with a time stamp indicating a difference of more than 40 seconds with the GND1 current time.
2	GND1	VERIFY	Check the GND1 receives the DM6 REQUEST [level] message from AIRCRAFT1.
3	GND1	ENTER	Send the CPDLC uplink message containing the concatenation of message element UM159 ERROR (2) followed by the message element UM183 'DOWNLINK DELAYED – USE VOICE' in response to the DM6 REQUEST [level] message.
5	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the concatenation of message element UM159 ERROR (2) followed by the message element UM183 'DOWNLINK DELAYED – USE VOICE' in response to the DM6 REQUEST [level] message. Check CPDLC dialogue is closed.
<b>Postamble:</b>	Check on both sides the CPDLC 'level' type dialogue is closed.		

3.2.1.2.2 Timestamp error: future time

<b>Identifier:</b>		CPDLC_S070	
<b>Purpose:</b>		This test allows checking that Ground System correctly handles reception of a downlink message that indicates a future time greater than 2 seconds from the current time.	
<b>ED-110B requirements</b>		3.3.4.1.5	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1. Change the system time of the airborne testing tool workstation so that it indicates a future time greater than 2 seconds from the GND1 ground system..	
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	ENTER	Send the DM6 REQUEST [level] message. This message header is filled with a time stamp indicating a difference of more than 2 seconds from the GND1 current time.
2	GND1	VERIFY	Check GND1 receives the DM6 REQUEST [level] message.
3	GND1	ENTER	Send a CPDLC uplink message containing the concatenation of message element UM159 (ERROR (error information)) with the choice (2) followed by message element UM183 (DOWNLINK TIMESTAMP INDICATES FUTURE TIME).
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the concatenation of message element UM159 (ERROR (error information)) with the choice (2) followed by message element UM183 (DOWNLINK TIMESTAMP INDICATES FUTURE TIME). Check CPDLC dialogue is closed.
<b>Postambule:</b>		Check on both sides the CPDLC 'LEVEL' type dialogue is closed.	

3.2.1.2.3 Message set error (unsupported message)

<b>Identifier:</b>		CPDLC_S080	
<b>Purpose:</b>		This test checks Ground System correctly rejects a downlink message that is not in the LINK2000+ CPDLC message set.	
<b>ED-110B requirements</b>		3.3.7.6.1.1	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	ENTER	Send the DM7 REQUEST BLOCK [level] TO [level] message.
2	GND1	VERIFY	Check the GND1 receives the DM7 REQUEST BLOCK [level] TO [level] message from AIRCRAFT1.
3	GND1	ENTER	Send the UM162 SERVICE UNAVAILABLE to AIRCRAFT1.
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives UM162 SERVICE UNAVAILABLE.
<b>Postambule:</b>		Check on both sides the CPDLC 'level' type dialogue is closed.	

## 3.2.1.2.4 Concatenation error: more than 2 concatenated message elements

<b>Identifier:</b>	CPDLC_S100		
<b>Purpose:</b>	The purpose of this test is to check that reception of a downlink concatenated message with more than 2 message elements is correctly rejected by Ground System.		
<b>Configuration:</b>	STC		
<b>ED110B Requirements:</b>	3.3.7.3.1		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1.		
<b>Steps:</b>			
<b>No</b>	<b>SYSTEM</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	ENTER	Send the CPDLC-message request providing the following concatenated content: DM18 REQUEST [speed] + DM65 DUE TO WEATHER + DM66 DUE TO AIRCRAFT PERFORMANCE.
2	GND1	VERIFY	Check GND1 receives the CPDLC-message indication providing the following: DM18 REQUEST [speed] + DM65 DUE TO WEATHER + DM66 DUE TO AICRAFT PERFORMANCE.
3	GND1	ENTER	Send the CPDLC-message request providing the concatenation of message element UM159 ERROR (error information) with the choice (2) followed by message element UM183 'DOWNLINK MESSAGE REJECTED – SEND 2 ELEMENTS MAX.'
5	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-message indication providing the concatenation of message element UM159 ERROR (error information) with the choice (2) followed by message element UM183 'DOWNLINK MESSAGE REJECTED – SEND 2 ELEMENTS MAX.' Check CPDLC dialogue is closed.
<b>Postamble:</b>		Check the dialogue is closed on air and ground display systems.	

### 3.2.1.2.5 Concatenation error: invalid concatenation

<b>Identifier:</b>		CPDLC_S110	
<b>Purpose:</b>		The purpose of this test is to verify that reception of a downlink concatenated message with invalid concatenation is correctly rejected by Ground System.	
<b>Configuration:</b>		STC	
<b>ED110B Requirements:</b>		3.3.7.3.8.2.1	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	AIRCRAFT1	ENTER	Send the CPDLC-message request providing the following concatenated content: DM9 REQUEST CLIMB TO [level] + DM10 REQUEST DESCENT TO [level].
2	GND1	VERIFY	Check GND1 receives the CPDLC-message indication providing the following: DM9 REQUEST CLIMB TO [level] + DM10 REQUEST DESCENT TO [level].
3	GND1	ENTER	Send the CPDLC-message request providing the concatenation of message element UM159 ERROR (error information) with the choice (3) followed by the message element UM183 'ELEMENT COMBINATION REJECTED – USE VOICE' in response to the DM9 REQUEST CLIMB TO [level] + DM10 REQUEST DESCENT TO [level].
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-message indication providing the concatenation of message element UM159 ERROR (error information) with the choice (3) followed by the message element UM183 'ELEMENT COMBINATION REJECTED – USE VOICE'.
<b>Postamble:</b>		Check on both sides the CPDLC dialogue is closed.	

## 3.2.1.2.6 Message composition error: duplicated message identifier

<b>Identifier:</b>	CPDLC_S120		
<b>Purpose:</b>	The objective of this test is to check that Ground System correctly handles the reception of a CPDLC message that uses the same message identification number as a previously received downlink message (dialogue still open).		
<b>ED-110B requirements</b>			
<b>Configuration:</b>	STC		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1. From the Air Simulated Tool, disable the automatic increment of the message ID number. The operator will have to fill in the MIN field with desired value.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	ENTER	Send the DM6 REQUEST [level] message to GND1.
2	GND1	VERIFY	Check the GND1 receives the DM6 REQUEST [level] message from AIRCRAFT1.
3	GND1	ENTER	Send the UM227 LACK message to acknowledge the DM6 REQUEST [level] message.
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM6 REQUEST [level] message.
5	AIRCRAFT1	ENTER	Send the DM18 REQUEST [speed] message to GND1 with the same message id number as sent in step #1.
6	GND1	VERIFY	Check the GND1 receives the DM18 REQUEST [speed] message from AIRCRAFT1.
7	GND1	ENTER	Send the CPDLC-user-abort request to AIRCRAFT1 providing the (2) "duplicate-message-identification-number" abort reason. Check CPDLC connexion with AIRCRAFT1 is closed.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-user-abort indication providing the (2) "duplicate-message-identification-number" abort reason. Check CPDLC connexion is closed.
<b>Postamble:</b>	Check on both sides CPDLC connexion is closed. From the Air Simulated Tool, enable the automatic message ID number increment.		



## 3.2.1.2.7 Message composition error: invalid message reference number

<b>Identifier:</b>			CPDLC_S125
<b>Purpose:</b>			The objective of this test is to check that Ground System correctly handles the reception of a CPDLC message that uses an invalid message reference number (i.e. does not identify any message identification number currently in use).
<b>ED-110B requirements</b>			
<b>Configuration:</b>			STC
<b>Preamble:</b>			AIRCRAFT1 is logged on and CPDLC connected to GND1.
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send the UM123 SQUAWK [code] message to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM123 SQUAWK [code] message from GND1.
3	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge UM123 SQUAWK [code] message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging UM123 SQUAWK [code] message.
5	AIRCRAFT1	ENTER	Send DM0 WILCO message with a MRN that does not identify any uplink message identification number.
6	GND1	VERIFY	Check GND1 receives the DM0 WILCO.
7	GND1	SEND	Check GND1 sends an UM159 ERROR [errorInformation] with the choice (0).
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM159 ERROR [errorInformation] with the choice (0) in response to the DM0 WILCO (c.f. step #5).
9	AIRCRAFT1	ENTER	Send the DM0 WILCO in response to the UM123 SQUAWK [code] message.
10	GND1	VERIFY	Check GND1 receives the DM0 WILCO in response to the UM123 SQUAWK [code] message.
11	GND1	ENTER	Send the UM227 LACK to acknowledge the DM0 WILCO message.
12	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK acknowledging the DM0 WILCO message.
<b>Postamble:</b>			Check the squawk dialogue appears as closed on air and ground display systems.
<b>Comments:</b>			The squawk dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.

**3.2.1.2.8 Open dialogues of same type (airborne initiated)**

<b>Identifier:</b>	CPDLC_S128		
<b>Purpose:</b>	The objective of this test is to verify the Ground System correctly handles reception of a downlink request whereas another same type dialogue is still pending. This test deals with airborne initiated dialogs.		
<b>ED-110B requirements</b>	3.3.8.1.1/3.3.8.1.1.1		
<b>Configuration:</b>	STC		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1. When two downlink requests pertain to the same type, ED-110B states that Ground System may reject the first request or second one. This test describes the rejection of the first request.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	ENTER	Send the DM6 REQUEST [level] message to GND1.
2	GND1	VERIFY	Check the GND1 receives the DM6 REQUEST [level] message from AIRCRAFT1.
3	GND1	ENTER	Send the UM227 LACK message to acknowledge the DM6 REQUEST [level] message.
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM6 REQUEST [level] message.
5	AIRCRAFT1	ENTER	Send the DM9 REQUEST CLIMB TO [level] message to GND1.
6	GND1	VERIFY	Check the GND1 receives the DM9 REQUEST CLIMB TO [level] message from AIRCRAFT1.
7	GND1	ENTER	As two level-type dialogs are requested, the GND1 rejects the first one sending the concatenation of message element UM159 ERROR (2) followed by message element UM183 'TOO MANY LEVEL REQUESTS – EXPECT ONLY ONE REPLY'. Check the first level type dialogue appears as closed on both display systems.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the concatenation of message element UM159 ERROR (2) followed by message element UM183 'TOO MANY LEVEL REQUESTS – EXPECT ONLY ONE REPLY' in response to the DM6 REQUEST [level] message. Check this dialogue is closed.
<b>Comments:</b>	The second dialogue (DM9) is not closed and may be continued.		

<b>Identifier:</b>	CPDLC_S130		
<b>Purpose:</b>	The objective of this test is to verify the Ground System correctly handles reception of a downlink request whereas another same type dialogue is still pending. This test deals with airborne initiated dialogs.		
<b>ED-110B requirements</b>	3.3.8.1.1/3.3.8.1.1.2		
<b>Configuration:</b>	STC		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1. When two downlink requests pertain to the same type, ED-110B states that Ground System may reject the first request or second one. This test describes the rejection of the second request.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	ENTER	Send the DM6 REQUEST [level] message to GND1.
2	GND1	VERIFY	Check the GND1 receives the DM6 REQUEST [level] message from AIRCRAFT1.
3	GND1	ENTER	Send the UM227 LACK message to acknowledge the DM6 REQUEST [level] message.
4	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging the DM6 REQUEST [level] message.
5	AIRCRAFT1	ENTER	Send the DM9 REQUEST CLIMB TO [level] message to GND1.
6	GND1	VERIFY	Check the GND1 receives the DM9 REQUEST CLIMB TO [level] message from AIRCRAFT1.
7	GND1	ENTER	As two level-type dialogs are requested, the GND1 rejects the second one sending the concatenation of message element UM159 ERROR (2) followed by message element UM183 'TOO MANY LEVEL REQUESTS – EXPECT ONLY ONE REPLY'. Check the second level type dialogue is closed.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the concatenation of message element UM159 ERROR (2) followed by message element UM183 'TOO MANY LEVEL REQUESTS – EXPECT ONLY ONE REPLY' in response to the DM9 REQUEST CLIMB TO [level] message. Check this dialogue is closed.
<b>Comments:</b>	The first dialogue (DM6) is not closed and may be continued.		

### 3.2.1.2.9 Open dialogues of same type (ground initiated)

<b>Identifier:</b>		CPDLC_S140	
<b>Purpose:</b>		The objective of this test is to verify the Ground System correctly handles reception of a downlink request whereas another same type dialogue is still pending. The first dialogue is a ground initiated one.	
<b>ED-110B requirements</b>		3.3.8.1.1.3	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM20 CLIMB TO [level] message to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM20 message.
3	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM20 CLIMB TO [level] message.
4	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM20 CLIMB TO [level] message.
5	AIRCRAFT1	ENTER	Send the DM6 REQUEST [level] message to GND1.
6	GND1	VERIFY	Check the GND1 receives the DM6 REQUEST [level] message from AIRCRAFT1.
7	GND1	ENTER	As two level-type dialogs are requested, one from the ground and the second from the air system, the GND1 rejects the second one sending the concatenation of message element UM159 (2) + UM183 ((dialogue type) REQUEST REJECTED - REPLY TO LEVEL UPLINK FIRST). Check this dialogue is closed.
8	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the concatenation of message element UM159 (ERROR (error information)) with the choice (2) followed by message element UM183 ((dialogue type) REQUEST REJECTED - REPLY TO LEVEL UPLINK FIRST). Check this dialogue is closed.
<b>Comments:</b>		The first dialogue (UM20) is not closed and may be continued.	

### 3.2.1.2.10 Application Message Integrity Check (AMIC)

#### 3.2.1.2.10.1 Validation failure on connection phase

<b>Identifier:</b>		CPDLC_S141	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly handles the downlink abort message upon detection of a checksum validation failure (invalid 24-bit address) from air side during the connection phase.	
<b>ED110B Requirements</b>		3.3.5.1.1/3.3.6.1	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on GND1.	
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	AIRCRAFT1	CHANGE	From airborne side, configure an invalid flight id for AIRCRAFT1.
2	GND1	ENTER	Send a CPDLC-start request to AIRCRAFT1 (no CPDLC message element provided).
3	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-start indication (no CPDLC message element provided) from GND1: check the message validation failure is detected and a notification is sent to the pilot.
4	AIRCRAFT1	ENTER	Send a CPDLC-user-abort to GND1 with abort reason set to validation failure.
5	GND1	VERIFY	Check GND1 receives a CPDLC-Provider-abort indication
<b>Variant:</b>		Same test may be performed with the airborne side configured with an: <ul style="list-style-type: none"> <li>- Invalid Ground Facility Designator</li> <li>- Invalid Flight ID</li> <li>- Invalid Abstract Syntax</li> </ul>	
<b>Postamble:</b>		Check AIRCRAFT1 is not connected to GND1.	

**3.2.1.2.10.2 Air initiated exchanges**

*3.2.1.2.10.2.1 Invalid 24-bit address*

<b>Identifier:</b>		CPDLC_S142	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly detects a checksum validation failure (invalid 24-bit address) for an air-initiated exchange.	
<b>ED110B Requirements</b>		3.3.5.1.1/3.3.6.1	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	AIRCRAFT1	CHANGE	From airborne side configure AIRCRAFT1 with an invalid 24-bit address.
2	AIRCRAFT1	ENTER	Send the DM6 REQUEST [level] message to GND1.
3	GND1	VERIFY	Check GND1 receives the DM6 REQUEST [level] message from AIRCRAFT1.
4	GND1	VERIFY	Check the message validation failure is detected and a notification is sent to the controller.
5	GND1	ENTER	Send a CPDLC-user-abort to AIRCRAFT1 with validation failure abort reason.
6	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-user-abort indication with validation failure abort reason .
<b>Postamble:</b>		Check on both sides the CPDLC connection is closed. Restore AIRCRAFT1 24 bits address.	

*3.2.1.2.10.2.2 Invalid ground facility designator*

<b>Identifier:</b>		CPDLC_S143	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly detects a checksum validation failure (invalid ground facility designator) for an air initiated exchange.	
<b>ED110B Requirements</b>		3.3.5.1.1/3.3.6.1	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1.	AIRCRAFT1	CHANGE	From airborne side configure AIRCRAFT1 with an invalid ground facility designator.
2.	AIRCRAFT1	ENTER	Send the DM6 REQUEST [level] message to GND1.
3.	GND1	VERIFY	Check GND1 receives the DM6 REQUEST [level] message from AIRCRAFT1.
4.	GND1	VERIFY	Check the message validation failure is detected and a notification is sent to the controller.
5.	GND1	ENTER	Send a CPDLC-user-abort to AIRCRAFT1 with validation failure abort reason.
6.	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-user-abort indication with validation failure abort reason.
<b>Postamble:</b>		Check on both sides the CPDLC connection is closed. Restore AIRCRAFT1 configured ground facility designator value.	

3.2.1.2.10.2.3 Invalid flight id

<b>Identifier:</b>		CPDLC_S144	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly detects a checksum validation failure (invalid flight id) for an air-initiated exchange.	
<b>ED110B Requirements</b>		3.3.5.1.1/3.3.6.1	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1.	AIRCRAFT1	CHANGE	From airborne side configure AIRCRAFT1 with an invalid Flight ID.
2.	AIRCRAFT1	ENTER	Send the DM6 REQUEST [level] message to GND1.
3.	GND1	VERIFY	Check GND1 receives the DM6 REQUEST [level] message from AIRCRAFT1.
4.	GND1	VERIFY	Check the message validation failure is detected and a notification is sent to the controller.
5.	GND1	ENTER	Send a CPDLC-user-abort to AIRCRAFT1 with validation failure abort reason.
6.	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-user-abort indication with validation failure abort reason.
<b>Postamble:</b>		Check on both sides the CPDLC connection is closed. Restore AIRCRAFT1 configured Flight ID.	

3.2.1.2.10.3 Ground initiated exchanges

3.2.1.2.10.3.1 Invalid 24-bit address

<b>Identifier:</b>		CPDLC_S145	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly handles the downlink abort message upon detection of a checksum validation failure (invalid 24-bit address) from air side.	
<b>ED110B Requirements</b>		3.3.5.1.1/3.3.6.1	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	AIRCRAFT1	CHANGE	From airborne side configure AIRCRAFT1 with an invalid 24-bit address.
2	GND1	ENTER	Send the UM106 MAINTAIN [speed] message to AIRCRAFT1.
3	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM106 MAINTAIN [speed] message from GND1: check the message validation failure is detected and a notification is sent to the pilot.
4	AIRCRAFT1	ENTER	Send a CPDLC-user-abort to GND1 with validation failure abort reason.
5	GND1	VERIFY	Check GND1 receives the CPDLC-user-abort indication with validation failure abort reason.
<b>Postamble:</b>		Check the CPDLC connection is closed on both sides. Restore AIRCRAFT1 24-bits address	

3.2.1.2.10.3.2 Invalid ground facility designator

<b>Identifier:</b>		CPDLC_S146	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly handles the downlink abort message upon detection of a checksum validation failure (invalid ground facility designator) from air side.	
<b>ED110B Requirements</b>		3.3.5.1.1/3.3.6.1	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	AIRCRAFT1	CHANGE	From airborne side configure an invalid ground facility designator.
2	GND1	ENTER	Send the UM106 MAINTAIN [speed] message to AIRCRAFT1.
3	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM106 MAINTAIN [speed] message from GND1: check the message validation failure is detected and a notification is sent to the pilot.
4	AIRCRAFT1	ENTER	Send a CPDLC-user-abort to GND1 with validation failure abort reason.
5	GND1	VERIFY	Check GND1 receives the CPDLC-user-abort indication with validation failure abort reason.
<b>Postamble:</b>		Check the CPDLC connection is closed on both sides. Restore AIRCRAFT1 configured ground facility designator value.	



3.2.1.2.10.3.3 Invalid flight id

<b>Identifier:</b>		CPDLC_S147	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly handles the downlink abort message upon detection of a checksum validation failure (invalid flight id) from air side.	
<b>ED110B Requirements</b>		3.3.5.1.1/3.3.6.1	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	AIRCRAFT1	CHANGE	From airborne side configure an invalid Flight ID.
2	GND1	ENTER	Send the UM106 MAINTAIN [speed] message to AIRCRAFT1.
3	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM106 MAINTAIN [speed] message from GND1: check the message validation failure is detected and a notification is sent to the pilot.
4	AIRCRAFT1	ENTER	Send a CPDLC-user-abort to GND1 with validation failure abort reason.
5	GND1	VERIFY	Check GND1 receives the CPDLC-user-abort indication with validation failure abort reason.
<b>Postamble:</b>		Check the CPDLC connection is closed on both sides. Restore AIRCRAFT1 configured Flight ID value.	

3.2.1.2.10.4 Validation failure on release phase

<b>Identifier:</b>		CPDLC_S148	
<b>Purpose:</b>		The purpose of the test is to check the Ground System correctly handles the downlink abort message upon detection of a checksum validation failure (invalid 24-bit address) from air side during the release phase.	
<b>ED110B Requirements</b>		3.3.5.1.1/3.3.6.1	
<b>Configuration:</b>		STC	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1.	
<b>Steps:</b>			
No	System	Action	Description
1	AIRCRAFT1	CHANGE	From airborne side, configure an invalid flight id for AIRCRAFT1.
2	GND1	ENTER	Send a CPDLC-start request to AIRCRAFT1 (no CPDLC message element provided).
3	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the CPDLC-start indication (no CPDLC message element provided) from GND1: check the message validation failure is detected and a notification is sent to the pilot.
4	AIRCRAFT1	ENTER	Send a CPDLC-user-abort to GND1 with abort reason set to validation failure.
5	GND1	VERIFY	Check GND1 receives a CPDLC-Provider-abort indication
<b>Variants:</b>		Same test may be performed with the airborne side configured with an: <ul style="list-style-type: none"> <li>- Invalid Ground Facility Designator</li> <li>- Invalid Flight ID</li> <li>- Invalid Abstract Syntax</li> </ul>	
<b>Postamble:</b>		Check AIRCRAFT1 is not connected to GND1.	

### 3.2.1.3 CPDLC Timers

#### 3.2.1.3.1 CPDLC timer: ground *tr* timer (option 1)

<b>Identifier:</b>	CPDLC_S150		
<b>Purpose:</b>	The goal of this test is to check that Ground System correctly implements requirements related to the <i>tr</i> timer. From steps #1 to #10, the test describes a nominal case of <i>tr</i> timer management. From step #11 to the end, the test describes an error case of <i>tr</i> timer management (no response until termination of <i>tr</i> timer).		
<b>Configuration:</b>	STC		
<b>ED110B Requirements</b>	4.2.1.2.2/4.2.1.2.3/4.2.1.2.4/4.2.2.4		
<b>Preamble:</b>	<p>As ED-110B states that implementation of <i>tr</i> timer is a local matter, this test is applicable only if the Ground System implements the <i>tr</i> timer.</p> <p>When <i>tr</i> timer is implemented ED110-B requires upon expiry of the timer to notify the sender. Upon <i>tr</i> timer expiry two options may be retained on the ground:</p> <ol style="list-style-type: none"> <li>1- The ground implementation keeps the dialogue open upon <i>tr</i> expiry and accepts further closure response received within the <i>tts</i> delay.</li> <li>2- The ground implementation immediately closes the dialogue upon <i>tr</i> expiry and rejects a further closure response.</li> </ol> <p>The present test case describes option 1 scenario.</p> <p>AIRCRAFT1 is logged on and CPDLC connected to GND1.</p>		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM20 CLIMB TO [level] (LACK is required) to AIRCRAFT1
2	GND1	VERIFY	Check <i>tr</i> timer is started.
3	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM20 CLIMB TO [level] message.
4	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge UM20 CLIMB TO [level] message.
5	GND1	VERIFY	Check GND1 receives DM100 LACK message acknowledging the UM20 CLIMB TO [level] message.
6	GND1	VERIFY	Check <i>tr</i> timer is cancelled.
7	AIRCRAFT1	ENTER	Send DM0 WILCO in response to UM20.
8	GND1	VERIFY	Check GND1 received the DM0 WILCO message in response to UM20.
9	GND1	ENTER	Send UM227 LACK message to acknowledge DM0 WILCO.
10	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 message in response to DM0 WILCO.
11	GND1	ENTER	Send the UM23 DESCEND TO [level] (LACK is required) to AIRCRAFT1.
12	GND1	VERIFY	Check <i>tr</i> timer is started.
13	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM23 DESCEND TO [level] message.
14	AIRCRAFT1	WAIT	No action (do not respond) before at least the duration of the <i>tr</i> timer.
15	GND1	VERIFY	At the end of the <i>tr</i> timer, check GND1 notifies the controller of no reception of DM100 LACK
16	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM23 DESCEND TO [level] message.

17	GND1	VERIFY	Check GND1 receives DM100 LACK message acknowledging the UM23 DESCEND TO [level] message.
18	AIRCRAFT1	ENTER	Send DM0 WILCO in response to UM23.
19	GND1	VERIFY	Check GND1 receives the DM0 WILCO in response to DM23 message.
20	GND1	ENTER	Send UM227 LACK message to acknowledge the DM0 WILCO message.
21	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 LACK message acknowledging DM0 WILCO message.
<b>Postamble:</b>			Check the 'level' dialogue type is closed on airborne and ground sides.
<b>Comment:</b>			At step #17, ED-110B indicates that DM100 LACK may be forwarded or ignored by the ground system.

**3.2.1.3.2 CPDLC timer: ground *tr* timer (option 2)**

<b>Identifier:</b>	CPDLC_S151		
<b>Purpose:</b>	The goal of this test is to check that Ground System correctly implements requirements related to the <i>tr</i> timer. From steps #1 to #10, the test describes a nominal case of <i>tr</i> timer management. From step #11 to the end, the test describes an error case of <i>tr</i> timer management (no response until termination of <i>tr</i> timer).		
<b>Configuration:</b>	STC		
<b>ED110B Requirements</b>	4.2.1.2.2/4.2.1.2.3/4.2.1.2.4/4.2.2.4		
<b>Preamble:</b>	<p>As ED-110B states that implementation of <i>tr</i> timer is a local matter, this test is applicable only if the Ground System implements the <i>tr</i> timer.</p> <p>When <i>tr</i> timer is implemented ED110-B requires upon expiry of the timer to notify the sender. Upon <i>tr</i> timer expiry two options may be retained on the ground:</p> <ol style="list-style-type: none"> <li>1- The ground implementation keeps the dialogue open upon <i>tr</i> expiry and accepts further closure response received within the <i>tts</i> delay.</li> <li>2- <i>The ground implementation immediately closes the dialogue upon <i>tr</i> expiry and rejects a further closure response.</i></li> </ol> <p>The present test case describes option 2 scenario.</p> <p>AIRCRAFT1 is logged on and CPDLC connected to GND1.</p>		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send the UM20 CLIMB TO [level] (LACK is required) to AIRCRAFT1
2	GND1	VERIFY	Check <i>tr</i> timer is started.
3	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM20 CLIMB TO [level] message.
4	AIRCRAFT1	ENTER	Send DM100 LACK message to acknowledge UM20 CLIMB TO [level] message.
5	GND1	VERIFY	Check GND1 receives DM100 LACK message acknowledging the UM20 CLIMB TO [level] message.
6	GND1	VERIFY	Check <i>tr</i> timer is cancelled.
7	AIRCRAFT1	ENTER	Send DM0 WILCO in response to UM20.
8	GND1	VERIFY	Check GND1 received the DM0 WILCO message in response to UM20.
9	GND1	ENTER	Send UM227 LACK message to acknowledge DM0 WILCO.
10	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM227 message in response to DM0 WILCO.
11	GND1	ENTER	Send the UM23 DESCEND TO [level] (LACK is required) to AIRCRAFT1.
12	GND1	VERIFY	Check <i>tr</i> timer is started.
13	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM23 DESCEND TO [level] message.
14	AIRCRAFT1	WAIT	No action (do not respond) before at least the duration of the <i>tr</i> timer.
15	GND1	VERIFY	At the end of the <i>tr</i> timer, check GND1 notifies the controller of no reception of DM100 LACK and closes the dialogue
16	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM23 DESCEND TO [level] message.
17	GND1	VERIFY	Check GND1 receives DM100 LACK message acknowledging the UM23 DESCEND TO [level] message and ignores it.
18	AIRCRAFT1	ENTER	Send DM0 WILCO in response to UM23.

19	GND1	VERIFY	Check GND1 receives the DM0 WILCO in response to DM23 message.
20	GND1	VERIFY	Check UM159 ERROR [Unrecognised Message Reference Number] message is automatically sent by GND1 in response to DM0 WILCO message.
21	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM159 ERROR [Unrecognised Message Reference Number] message in response to DM0 WILCO message.
<b>Postamble:</b>			Check the 'level' dialogue type is closed on airborne and ground sides.
<b>Comment:</b>			

### 3.2.1.3.3 CPDLC timers/LACK management

<b>Identifier:</b>		CPDLC_S175	
<b>Purpose:</b>		The purpose of this test is to check that Ground System correctly handles the receipt of an operational response before acknowledgement message from the uplink clearance.	
<b>Configuration:</b>		STC	
<b>ED110B Requirements:</b>			
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1. Under Air Simulated Tools, disable the option, which automatically sends a LACK.	
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1	GND1	ENTER	Send UM20 CLIMB TO [level] message to AIRCRAFT1.
2	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives UM20 CLIMB TO [level]
3	AIRCRAFT1	ENTER	Send DM0 WILCO in response to UM20 CLIMB TO [level].
4	GND1	VERIFY	Check GND1 receives DM0 WILCO in response to UM20 CLIMB TO [level] and check the CPDLC dialogue is closed.
5	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM20 CLIMB TO [level] message.
6	GND1	VERIFY	Check GND1 receives the DM100 LACK message acknowledging the UM20 CLIMB TO [level] and check GND1 discards the DM100 LACK (DM100 LACK is received after the operational message response).
<b>Postamble:</b>		Under Air Simulated Tools, enable the option, which automatically sends a LACK (if needed) when AIRCRAFT1 receives an uplink message. Check the 'level' type dialogue is closed on airborne and ground sides.	
<b>Comment:</b>		The 'level' type dialogue could also be completed with the DM1 UNABLE response instead of the DM0 WILCO. This dialogue could also be lengthened using the DM2 STANDBY.	

### 3.2.1.4 AMC Service

<b>Identifier:</b>		CDPLC_S180	
<b>Purpose:</b>		The goal of this test is to check that the Ground system is able to broadcast the ATC Microphone Check message to all aircrafts in charge. This test is performed with two aircrafts.	
<b>Configuration:</b>		STC with two simulated aircrafts	
<b>ED110B Requirements:</b>		4.5	
<b>Preamble:</b>		AIRCRAFT1 and AIRCRAFT2 are already logged on and CPDLC connected to GND1	
<b>Steps:</b>			
No	System	Action	Description
1	GND1	ENTER	Send the UM157 Check Stuck Microphone [frequency] to all aircrafts in charge.
2a	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM157 CHECK STUCK MICROPHONE [frequency] message.
2b	AIRCRAFT2	VERIFY	Check AIRCRAFT2 receives the UM157 CHECK STUCK MICROPHONE [frequency] message.
3a	AIRCRAFT1	ENTER	Send the DM100 LACK message to acknowledge the UM157 CHECK STUCK MICROPHONE [frequency] message.
3b	AIRCRAFT2	ENTER	Send the DM100 LACK message to acknowledge the UM157 CHECK STUCK MICROPHONE [frequency] message.
4	GND1	VERIFY	Check ground system receives 2 DM100 LACK acknowledging the uplink messages.
<b>Postamble:</b>		Check all UM157 dialogues appear as closed on air and ground display systems.	
<b>Comments:</b>		Some implementations may use UM183 instead of UM157 as described in ED110B. Some implementations do not require LACK when sending the UM157 CHECK STUCK MICROPHONE [frequency] message. In this case, steps #3 to #4 are not executed.	

### 3.2.1.5 CPDLC and TP4 connections

#### 3.2.1.5.1 TP4 Window time and TP4 Inactivity Timer

<b>Identifier:</b>	CPDLC_S190		
<b>Purpose:</b>	To verify that the TP4 connection serving a CPDLC connection is terminated following a period of inactivity when no TP4 TPDU are received on the ground. To verify that an appropriate warning is issued at the controller HMI when the TP4 connection serving CPDLC is lost.		
<b>Configuration:</b>	STC		
<b>ICAO Doc. 9705 Ed.2 Req.</b>	5.5.2		
<b>ED110B Requirements:</b>			
<b>ES DLS Requirements:</b>	B.2.5.1 / B.2.5.2/ B.2.5.6		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1.		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1.	AIRCRAFT1	ENTER	Immediately after TP4 ACK TPDU have been sent/received following DM99 CDA message and UM227 LACK message exchanges - disable the sending of all outgoing PDUs at TP4 level.
2.		WAIT	Wait for a period of time corresponding to the TP4 inactivity timer value (6 minutes as per ES DLS recommendations),
3.	AIRCRAFT1	VERIFY	Verify that TP4 AK TPDU have been received at the expected intervals from GND1 during the TP4 inactivity timer period.  Verify that a DR TPDU has been received from GND1 immediately after the TP4 inactivity timer period.
4.	GND1	VERIFY	Verify on the controller HMI that the CPDLC connection with AIRCRAFT1 is notified as being lost when the DR TPDU is issued.
5.	AIRCRAFT1	VERIFY	Check that the TP4 connection is disconnected, that the CPDLC connection is aborted and that GND1 is not anymore CDA.
<b>Postamble:</b>			On the air system re-enable the sending of outgoing TP4 PDUs
<b>Comment:</b>			A monitoring tool may be set up on the test Facility in order to capture the uplink and downlink traffic checked during post-analysis.

## 3.2.1.5.2 TP4 Retransmissions

<b>Identifier:</b>	CPDLC_S195		
<b>Purpose:</b>	To verify that retransmissions of an uplink TP4 DT TPDU are made at expected intervals when no TP4 AK PDUS are received in response from the Air. To verify that an appropriate warning is issued at the controller HMI when the TP4 connection serving CPDLC is lost		
<b>Configuration:</b>	STC		
<b>ICAO Doc. 9705 Ed.2 Req.</b>	5.5.2		
<b>ED110B Requirements:</b>			
<b>ES DLS Requirements:</b>	A.2.1.1/B.2.5.1 / B.2.5.2/ B.2.5.6		
<b>Preamble:</b>	AIRCRAFT1 is logged on and CPDLC connected to GND1		
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1.	AIRCRAFT1	ENTER	Immediately after TP4 ACK TPDU have been sent/received following DM99 CDA message and UM227 LACK message exchanges - disable the sending of all outgoing PDUs at TP4 level.
2.	GND1	ENTER	Send the UM20 CLIMB TO LEVEL [level] message to AIRCRAFT1.
3.	AIRCRAFT1	VERIFY	Check AIRCRAFT1 receives the UM20 CLIMB TO LEVEL [level] message from GND1.
4.	AIRCRAFT1	VERIFY	During a period of 6 minutes corresponding to the value of the TP4 inactivity timer:  - Verify that up to a maximum of 7 ground TP4 DT PDUs retransmissions occur – with the interval between each retransmission doubling in accordance with the TP4 retransmission algorithm.  - Verify that 6 minutes after the last TP4 ACK PDUs exchanges, a DR TPDU is received from GND1.
5.	GND1	VERIFY	Verify on the controller HMI that the CPDLC connection with AIRCRAFT1 is notified as being lost when the DR TPDU is issued.
6.	AIRCRAFT1	VERIFY	Check that the TP4 connection is disconnected, that the CPDLC connection is aborted and that GND1 is not anymore CDA.
<b>Postamble:</b>			
On the air system re-enable the sending of outgoing TP4 PDUs			
<b>Comment:</b>			
A monitoring tool may be set up on the test Facility in order to capture the uplink and downlink traffic checked during post-analysis.			



3.2.1.5.3 TP4 Disconnect

<b>Identifier:</b>		CPDLC_S200	
<b>Purpose:</b>		To verify that the TP4 connection is terminated following receipt of a downlink TP4 DR TPDU. To verify that an appropriate warning is issued at the controller HMI when the TP4 connection serving CPDLC is lost.	
<b>Configuration:</b>		STC	
<b>ICAO Doc. 9705 Ed.2 Req.</b>		5.5.2	
<b>ED110B Requirements:</b>			
<b>ES DLS Requirements:</b>		B.2.5.1 / B.2.5.2/ B.2.5.6	
<b>Preamble:</b>		AIRCRAFT1 is logged on and CPDLC connected to GND1	
<b>Steps:</b>			
<b>No</b>	<b>System</b>	<b>Action</b>	<b>Description</b>
1.	AIRCRAFT1	ENTER	At ATN router command line interface, generate a TP4 Disconnect request on the TP4 connection associated to the CPDLC connection with the ground system
2.	GND1	VERIFY	Verify on the controller HMI that the CDA CPDLC connection is lost with the aircraft
3.	AIRCRAFT1	VERIFY	Check a DC TPDU is received on the air side
4.	AIRCRAFT1	VERIFY	Check that the TP4 connection is disconnected, that the CPDLC connection is aborted and that GND1 is not anymore CDA.
<b>Comment:</b>		A monitoring tool may be set up on the test Facility in order to capture the uplink and downlink traffic checked during post-analysis.	

### 4. Traceability Matrix

The goal of the document is not to cover every ED110B requirements but to provide minimal test cases coverage, which guarantees a satisfying interoperability between a Ground System and an avionic system in the Link2000+ scope.

	CM_N010	CM_N020	CM_N030	CM_N040	CM_N050	CPDLC_N010	CPDLC_N020	CPDLC_N030	CPDLC_N040	CPDLC_N050	CPDLC_N060	CPDLC_N070	CPDLC_N080	CPDLC_N090	CPDLC_N100	CPDLC_N110	CPDLC_N120	CPDLC_N130	CPDLC_N140	CPDLC_N150	CPDLC_N160	CPDLC_N170	CPDLC_N180	CPDLC_N190	CPDLC_N200	CPDLC_N205	CPDLC_N210	CPDLC_N220	CPDLC_N230	CPDLC_N240	CPDLC_N250	CPDLC_N260	CPDLC_N270	CPDLC_S010	CPDLC_S020	CPDLC_S030	CPDLC_S040	CPDLC_S050	CPDLC_S060	CPDLC_S070	CPDLC_S080	CPDLC_S100	CPDLC_S110	CPDLC_S120	CPDLC_S125	CPDLC_S130	CPDLC_S140	CPDLC_S141 to CPDLC_S147	CPDLC_S150	CPDLC_S175	CPDLC_S180			
3.1.2.6.1				X																																																		
3.1.3.2.1.1	X																																																					
3.1.3.2.1.2.3	X																																																					
3.1.3.2.1.2.4	X																																																					
3.3.4.1.4																																							X															
3.3.4.1.5																																																						
3.3.5.1.1																																																						
3.3.5.4.2.1						X																																																
3.3.5.4.2.2						X																																																
3.3.5.6.1																																																						
3.3.5.6.2																						X																																
3.3.5.9.1																																																						
3.3.5.9.4																																																						
3.3.6.1																																																						
3.3.7.2.1																																																						
3.3.7.2.2																																																						
3.3.7.2.3																																																						
3.3.7.2.4																						X																																
3.3.7.2.5																						X																																
3.3.7.3.1																																																						
3.3.7.3.2											X																																											
3.3.7.3.3											X																																											
3.3.7.3.8.2.1																																																						
3.3.7.5.2																							X	X																														
3.3.7.6.1.1																																																						



