Data Link Services (DLS)
Recovery Plan

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Approved by	**Massimo Garbini** Managing Director	**Date** 17/10/2016	**Signature** Signed
Reviewed by	**Nicolas Warinsko** Deputy Managing Director Director Technical and Operations	**Date** 17/10/2016	**Signature** Signed
Prepared by	**Mariagrazia La Piscopia** Deputy Director Technical and Operations DP Planning Manager	**Date** 17/10/2016	**Signature** Signed

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1. Introduction

European Commission requested SDM to extract from Deployment Programme (DP) Strategic View *Addendum 1 – DLS Implementation Strategy towards Initial Trajectory Information Sharing (hereinafter Addendum 1)* – a dedicated "*Recovery Plan* to implement the necessary technological upgrades that will ensure a stable and reliable ATN/VDL Mode 2 service".

For this purpose, **in full consistency with the *Addendum 1,*** the SDM has elaborated a comprehensive ***DLS Recovery Plan*** *(hereinafter Recovery Plan)* **to implement datalink capability as a step towards AF6**.

In this perspective, taking into consideration the high level principles concerning the DLS implementation outlined in the *Addendum 1* as well as the outcomes of the ELSA study[1], the *Recovery Plan* aims at identifying the **relevant actors, milestones and next activities needed to be undertaken in order to achieve the full DLS implementation in Europe**, avoiding inappropriate investments.

According to the *Addendum 1*, the *Recovery Plan* is focused on the ATN COM domain and Airborne domain, corresponding to the Families into the DP:

- "A/G and G/G Multi Frequency DL Network in defined European Service Areas";
- "ATN B1 capability in Multi Frequency environment in aircraft domain";
- "ATN B1 based services in ATSP domain".

[1] VDL Mode 2 Measurement, Analysis and Simulation Campaign elaborated by the ELSA Consortium and programme partnership

2. Overview

The ***Recovery Plan*** **represents an extract of the SDM Action Plan** in the *Addendum 1* that aims at focusing on the concrete and relevant **activities required to be undertaken in the ground and airborne domains** in order to achieve, in the right sequence, a synchronized DLS deployment in Europe.

SDM considered the compliance to Commission Implementaing Regulation (EU) No 310/2015 as the main driver of the *Recovery Plan*. Nevertheless, due to the additional technological upgrades required to meet ELSA's recommendations, there is a risk that some ground implementation projects would be completed slightly beyond the deadline for ground DLS.

In the light of above there is a need to guide stakeholders towards the most appropriate deployment approach and connect at same time to the upcoming co-funding opportunities under the CEF programme. In the present *Recovery Plan*, the term "stakeholders" is used to refer to the actors concerned by the implementation of DLS, including aircraft operators, air navigation service providers, operators for data link communications, manufacturers of the systems and/or its components.

The DLS *Recovery Plan* has been structured in the following paths:

- **Path I – Implementation of the DLS transitional solution:** aims at identifying the deployment activities needed to meet EU (IR) 2015/310 and ELSA's recommendations, focusing in particular on the envisaged transitional solutions (Model B or Model C with Multi-frequency (MF)). Path I focuses on the next steps necessary to guide stakeholders in setting up targeted implementation projects *(hereinafter IPs)* ensuring optimisation of the investments already made**.**

- **Path II – Preparatory activities towards the target solution:** aims at identifying the steps towards the envisaged target solution (Model D), through the implementation of ELSA's recommendations in order to grant the required performance needed to achieve full AF6 implementation**.**

Implementing projects under paths I and II may be presented as proposals, coordinated by the SDM, under the common projects category of the CEF Transport calls for proposals (refer to chapter 5).

3. DLS implementation projects

3.1 Path I – Implementation of the DLS transitional solution

3.1.1 Objective and SDM Role

Path I aims at providing a **precise guidance to the stakeholders** required to implement DLS, regarding what and with whom, in the Airborne and Ground Domain.

Specifically, **this section provides an overview of the steps to be undertaken by the stakeholders to implement the transitional short term solution, Model B or Model C with MF**.

SDM Role in Path I

Facilitate:

- through a proactive and direct involvement of all the relevant stakeholders to ensure a coordinated submission of required DLS implementation projects;
- through direct support to EASA and NM in providing the relevant set of information enabling end to end certification processes and the performance monitoring of the technical capabilities.

3.1.2 Implementation Projects – Airborne domain

According to the *Addendum 1*, the SDM incentivizes the upgrade to the "best in class" avionics configurations which are considered as the set of airborne equipment necessary to comply with the ATN/VDL2 performance expectations in multi-frequency (MF) environment.

Following the ELSA recommendations, the SDM strongly **encourages setting up implementation projects (IPs) focused on the upgrade to ATN B1 multi frequency avionics successfully assessed "best in class" by ELSA study, including those projects related to the upgrade of Avionics for ATN B1 Services that will be included in the best in class, after a successful testing**.

The following table provides a recap of the expected IP projects:

Airborne domain – Implementation projects

What	When
Upgrade to ATN B1 multi frequency avionic successfully assessed "best in class" by ELSA study	By 2020
Upgrade to ATN B1 multi frequency avionic not tested against "best in class" criteria in ELSA, subject to demonstration of equivalent minimum level of performance as part of the proposal or commitment to demonstrate equivalent minimum level of performance prior to implementation	By 2020

Fig. 1 – Implementation projects in the Airborne domain

Implementation projects need to be focused only on the upgrade of the avionics to reach the due performance levels in a MF environment and not on the procurement of the full required equipment.

Specifically, the following two cases are possible:

1) the upgrade to **ATN B1 MF "best in class" avionics**;
2) the upgrade to **ATN B1 MF not yet tested against "best in class" criteria defined by ELSA study**[2].

In the light of above, the present paragraph aims at providing indications on a list of tasks that are expected to be included in the IP for the two above mentioned cases.

As already outlined the following aspects are expected to be considered as **prerequisites for both cases**:

- the IP submitted has to be focused on ATS provision;
- the DLS avionics must be already installed in on-board systems of the aircraft.

The following IP template provides a list of tasks that, at least, shall be undertaken in order to ensure the "best in class" upgrade. In particular, the IP shall highlight the stakeholders' commitment to ensure that the ATN B1 multi frequency avionics is or will be tested against "best in class" criteria defined in ELSA. In this direction, the IP template includes a specific task, *Task 0*, aiming at ensuring the performance of testing activities on the avionics to demonstrate equivalent minimum level of performance in a MF environment prior to implementation. In case of avionics tested as "best in class" by ELSA or before start of the IP, *Task 0 will be reported as already "achieved".* This provision is fully consistent with the ELSA study where it is

[2] See Annex 3

highlighted the need to continue testing efforts beyond the lifespan of study itself to cover both newly emerging avionics configurations as well as other existing configurations.

Upgrade to ATN B1 multi frequency avionics to "best in class"		
Project Leader	Airspace Users	
Project Contributors	Manufactures and/or Testing Company *(if needed)*	
Project's Tasks		
Number	**Title**	**Description**
Task 0[3]	**Testing of ATN B1 MF avionics not yet tested**	*Testing of ATN B1 MF avionics against "best in class" criteria in ELSA, subject to demonstration of equivalent minimum level of performance as part of the proposal or commitment to demonstrate equivalent minimum level of performance prior to implementation.*
Task 1	**Project Management**	*Project Management activities in order to ensure the necessary equipment of the impacted fleet and contribute to end to end certification as necessary*
Task 2	**Equipment procured**	*Procurement of all necessary hardware and software components required for the upgrade*
Task 3	**Aircraft equipped**	*Installation and integration in onboard systems of all aircraft in the respective fleet*
Task 4	**Procedures and training available**	*Elaboration and approval process of operational and pilot procedures and training packages (also the revision of current procedures to avoid unnecessary avionics reset has to be considered)*
Task 5	**Training completed**	*Training activities attended by crews focus on the use of the equipment*

Moreover, according to ELSA study, it is worth highlighting that an effective end to end certification process for both ground and air components should be defined and implemented. SDM intends to support the body that will be established/empowered to perform the pan-European ATN/VDL2 end to end certification in accordance with ELSA's Recommendation ref. "Network_Oversight 03"[4], as outlined in the paragraph 4.1 of the present document.

3.1.3 Implementation Projects – Ground domain

According to *Addendum 1*, **implementation projects should be focused on the deployment/upgrade towards multi frequency networks at Country/Region level**. This first deployment/upgrade represents an intermediate step to be achieved at Country or Region level, towards the achievement of the Target solution, Model D, as outlined in Path II.

[3] Tasks 1 to 6 are subject to Task 0 outcome. In order to further optimise testing effort, Task 0 of several IPs may be regrouped into a specific IP dedicated to testing for which manufacturers and/or testing company could be contributors.

[4] See Annex 2

The following table provides a recap of the expected IP:

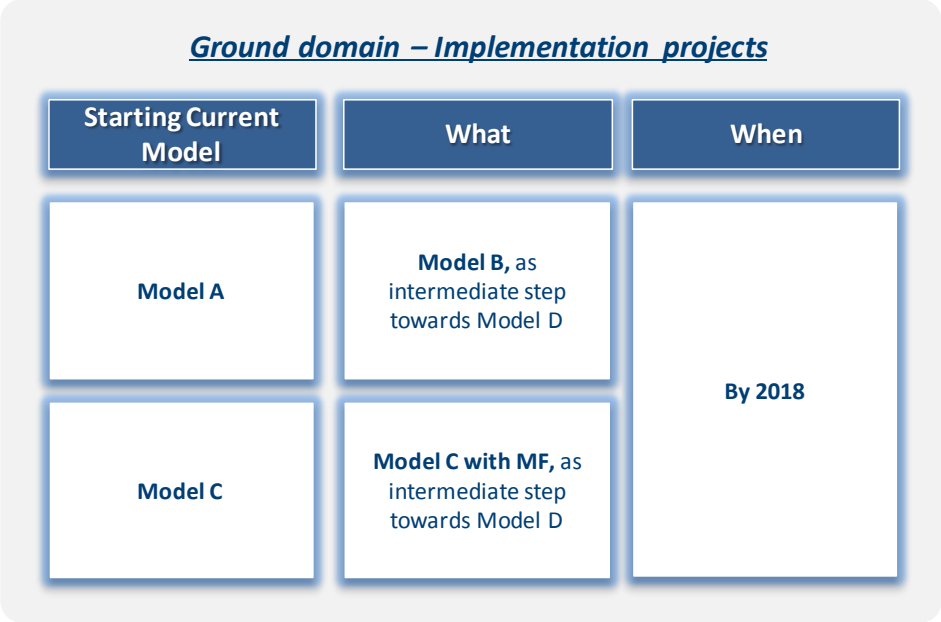


Fig. 2 – Implementation projects in the Ground domain

Proposals should be prepared by:

- Countries/Regions that have already implemented (or started implementing) Model A;
- Countries/Regions that have already implemented (or started implementing) Model C

Two types of IP proposals related to Family "A/G and G/G Multi Frequency DL Network in defined European Service Areas" could be envisaged:

- **IP proposal type 1**: consisting in the transition from Model A to Model B;
- **IP proposal type 2:** consisting in the transition from Model C to Model C with Multi frequency.

Both type of IP proposals require an up to date status of DLS implementation to set the starting point from where the IP should lead to Model B (type 1) or Model C with Multi Frequency (type 2). The DLS implementation status per Country included in *Addendum 1* provides an update by June 2016. In its role as *DLS implementation Project Manager*, SDM will closely work with every ANSP and Communication Service Providers to further refine on a case by case basis the DLS implementation status per Country by the time of IP start.

Whilst the update of DLS implementation status will be performed on a per Country basis, **SDM recommends the set up of multi-stakeholder/cross Countries projects in order to facilitate the early integration among involved stakeholders (ANSPs, Communication Service Providers).** The Communication Service Providers are expected to be fully involved in the projects', as Project Contributors as necessary.

Moreover, according to ELSA study, it is worth highlighting that an effective end to end certification process for both ground and air components should be defined and implemented. SDM intends to support the body that will be established/empowered to perform the pan-European ATN/VDL2 end to end certification in

accordance with ELSA's Recommendation ref. "Network_Oversight 03"[5], as outlined in the paragraph 4.1 of the present document.

3.1.3.1 IP type 1 - From Model A to Model B

Prerequisites:

1. the Implementation project has to be focused on ATS provision;
2. the country/Region, submitting the IP, has already implemented Model A;
3. Availability of the fifth frequency for VDL M2[6].

The following IP template provides a list of tasks that, at least, shall be undertaken in order to ensure the transition from Model A to Model B:

IP type 1 – From Model A to Model B		
Project Leader	ANSP/ANSPs or CSP/CSPs[7]	
Project Contributors	ANSP/ANSPs or CSP/CSPs	
Project's Tasks		
Number	**Title**	**Description**
1	*Project Management*	*Project management activities (including planning, execution, monitoring, control and closing) to ensure the achievement of the required performance levels.* *It is also expected that the monitoring results will be provided according to the timelines and mechanisms defined by SDM. Specifically, relevant data on the performance level are expected to be coordinated and provided to the Network Manager to ensure a proper performance monitoring.* *Furthermore, a contribute to end to end certification process, as necessary, is expected*
2	*A/G network design*	*According to the SDM Guidelines and bilateral coordination, for each RF network, it is expected the definition of the new MF VGS configuration starting from the existing one:* • *En-route layer definition: identifying the VGS to be upgraded to the en-route frequency to cover the airspace defined by IR and ANSPs requirements* • *TRM layer definition: identifying the VGS to be upgraded to the GND frequency to cover the airspace defined by ANSPs (relevant airports are expected to be considered also to discharge AOC from other frequencies)*

[5] See Annex 2

[6] The addition of the 5th VDL frequency over the current 4 VDL frequency allocation shall be fostered at ICAO FMG Allotment plan level. The next ICAO FMG meeting will be held in November 2016 and a decision is foreseen) NOTE : the VDL frequency allotment plan will be discussed at next FMG meeting -14-16 Nobvember 2016)

[7] CSPs could lead such IPs, with ANSPs as contributors. However, their leadership should be justified by the fact that it facilitates defragmentation of implementation. Therefore, an IP led by a CSP could be submitted only if addressing at least 2 countries and if ANSPs of the addressed countries (at least 2) are project contributors.

IP type 1 – From Model A to Model B		
Project Leader	ANSP/ANSPs or CSP/CSPs[7]	
Project Contributors	ANSP/ANSPs or CSP/CSPs	
Project's Tasks		
Number	**Title**	**Description**
		• *Coordination with neighbour's countries avoiding overlap of coverage is required.*
3	*G/G network design (if needed)*	*According to the SDM Guidelines, the following activities are expected to be performed:* • *reconfiguration or upgrade of the existing ATN networks* • *reconfiguration or upgrade of the G/G data distribution network* • *Coordination with neighbors' Countries simplifying the ATN chain (for example, limiting the number of ATN A/G routers) and facilitating the data exchanges*
4	*Support systems design (if needed)*	*According to the SDM Guidelines, the following activities are expected to be performed:* • *Upgrade of performance monitoring system including the support to the Performance monitoring function* • *Upgrade of network management system* • *Upgrade of recording system*
5	*Interfaces design (if needed)*	*According to the SDM Guidelines, the following activities are expected to be performed:* • *reconfiguration or upgrade of existing internal interfaces (including front-end processors)* • *reconfiguration or upgrade of existing external interfaces*
6	*Infrastructure deployment*	*Implementation of the all the elements designed in the previous tasks for DLS systems upgrade to MF reaching Model B (This task includes testing).*
7	*Operational acceptance*	*After the infrastructure deployment and the related technical verification of the new systems, the Operational acceptance, including final testing, has to be performed by the ANSPs in order to evaluate the new systems introduction in operation checking.*
8	*Operational transition*	*Considering the current Model A already in operation, an operational transition plan has to be produced in order to guarantee the continuity of service in transition forward Model B.*
9	*Analysis of the future evolution to Model D*	*In order to facilitate the achievement of the target model in accordance to SDM Addendum 1, this task aims at identifying the evolution of the implemented model towards model D in full coordination with the SDM.*

3.1.3.2 IP type 2 – From Model C to Model C with MF

Prerequisites:

1. The Implementation project has to be focused on ATS provision;
2. The country/Region, submitting the IP, have already implemented Model C;
3. Availability of the fifth frequency for VDL M2 (the addition of the 5th VDL frequency over the current 4 VDL frequency allocation shall be fostered at ICAO FMG Allotment plan level. The next ICAO FMG meeting will be held in November 2016 and a decision is foreseen)

The following IP template provides a list of tasks that shall, at least, be undertaken in order to ensure the transition the transition from Model C to Model C with MF:

IP type 2 – From Model C to Model C with MF		
Project Leader	ANSP/ANSPs or CSP/CSPs[8]	
Project Contributors	ANSP/ANSPs or CSP/CSP	
Project's Tasks		
Number	**Title**	**Description**
1	*Project Management*	*Project management activities (including planning, execution, monitoring, control and closing) to ensure the achievement of the required performance levels.* *It is also expected that the monitoring results will be coordinated and provided according to the timelines and mechanisms defined by SDM. Specifically, relevant data on the performance level are expected to be coordinated and provided to the Network Manager to ensure a proper performance monitoring* *Furthermore, a contribute to end to end certification process, as necessary, is expected*
2	*A/G network design*	*According to the SDM Guidelines and bilateral coordination, it is expected the definition of the new MF VGS configuration starting from the existing one:* • *En-route layer definition: identifying the VGS to be upgraded with the en-route frequency to cover the airspace defined by IR and ANSPs requirements* • *TRM layer definition: identifying the VGS to be upgraded to the GND frequency to cover the airspace defined by ANSPs (relevant airports are expected to be considered also to discharge AOC from other frequencies)* • *Coordination with neighbour's Countries to minimise the coverage overlap and to consider the common interoperability aspects (choose of frequencies).*

[8] CSPs could lead such IPs, with ANSPs as contributors. However, their leadership should be justified by the fact that it facilitates defragmentation of implementation. Therefore, an IP led by a CSP could be submitted only if addressing at least 2 countries and if ANSPs of the addressed countries (at least 2) are project contributors.

IP type 2 – From Model C to Model C with MF		
Project Leader	ANSP/ANSPs or CSP/CSPs[8]	
Project Contributors	ANSP/ANSPs or CSP/CSP	
Project's Tasks		
Number	**Title**	**Description**
		• *Coordination with CSPs to optimize A/G network*
3	*G/G network design (if needed)*	*According to the SDM Guidelines, the following activities are expected to be performed:* • *reconfiguration or upgrade of the existing ATN networks* • *reconfiguration or upgrade of the G/G data distribution network* • *Coordination with neighbors' countries simplifying the ATN chain (for example, limiting the number of ATN A/G routers) and facilitating the data exchanges (interconnection aspects)*
4	*Support systems design (if needed)*	*According to the SDM Guidelines, the following activities are expected to be performed:* • *Upgrade of performance monitoring system including the support to the Performance monitoring function* • *Upgrade of network management system* • *Upgrade of recording system*
5	*Interfaces design (if needed)*	*According to the SDM Guidelines, the following activities are expected to be performed:* • *reconfiguration or upgrade of existing internal interfaces(including front-end processors)* • *reconfiguration or upgrade of existing external interfaces in cooperation with CSPs*
6	*Infrastructure deployment*	*Upgrade implementation of the DLS systems, according to SDM Guidelines. (This task includes testing).*
7	*Operational acceptance*	*After the infrastructure deployment and the enclosed technical verification of the new systems, the Operational acceptance, including final testing, has to be performed by the ANSPs in order to evaluate the introduction in operation of the new systems.*
8	*Operational transition*	*Considering the current Model C already in operation, an operational transition plan has to be produced in order to guarantee the continuity of service in transition forward Model C with MF.*
9	*Analysis of the future evolution to Model D*	*In order to facilitate the achievement of the target model in accordance to SDM Addendum 1, this task aims at identifying the evolution of the implemented model towards model D in full coordination with the SDM.*

3.2 Path II - Preparatory activities towards the target solution

3.2.1 Objective and SDM role

Path II aims at providing an overall deployment picture, through the **identification of the activities that are expected to be addressed towards the implementation of the target solution enabling to reach Initial Trajectory Information Sharing** according to DP 2016 *Addendum 1*.

For this purpose, in order to enable the full achievement of the European Target Solution, Model D by 2022, the following activities are expected to be performed:

- **Identification of the Service Areas;**
- **Design of the system architecture** at Service Area and European level.

Moreover, as part of the architecture definition, the following points have to be addressed:

- Identification of improvements on legacies DL infrastructures;
- Use of PENS to connect G/G (BIS) routers;
- IoP improvements of the ATN DL Networks operated by different entities.

SDM Role in Path II

- **Manage** the overall set-up, and coordinate the above mentioned activities as project manager working in close cooperation with the stakeholders involved.
- **Close coordination, through the relevant working arrangements**, with Network Manager, EASA, SJU and EDA as necessary actors within the project towards the target DLS deployment model.

3.2.2 Implementation Project in support to SDM activities

European wide nature of DLS makes it a perfect candidate to be provided as a common service, i.e. distributed provision of the service through a limited number of service areas, based on common and interoperable infrastructures (e.g. PENS/NewPENS), under a single governance. **SDM, supported by stakeholders, decided to base its DLS Strategy on a distributed service provision with a single governance. Such governance is still to be defined.**

With regard to Path II the stakeholders are encouraged to elaborate a multi stakeholders project, that will specifically define an European Common DLS Governance and support the SDM in the previous steps to identify the Service Areas and the design of the required system architecture at Service Area and European level. Therefore, SDM will support the elaboration of the details of a multi-stakeholders project proposal taking into consideration the tasks below:

- Support to SDM in Service Design and Technical architecture definition;
- Support to SDM in elaboration of a Business Case for the target solution;
- Analysis of the Services to be provided by the new Model;
- Definition of a European Common DLS Governance.

4. Other required activities

4.1 End to end Certification

According to ELSA study, one of the major lessons learnt is that implementations of the standard as well as interfaces between sub-systems are essential for overall system performance. There is a need to guarantee that any subsystem deployment or introduction will not degrade the overall VDL2 performance. Even if procedures exist for individual system constituents, it is needed to have a holistic approach including all system constituents. A continuous oversight is also required, ensuring that existing validation procedures and means are coordinated and complemented where needed, as well as reviewed for effectiveness

Therefore, the definition and implementation of an effective data link end-to-end system certification process, including both ground and air components, is recommended. SDM intends to support the body that will be established/empowered to perform the pan-European ATN/VDL2 end to end certification in accordance with ELSA's Recommendation ref. "Network_Oversight 03"[9]. To this end, in order to contribute to both end to end certification and continuous oversight definition and implementation, the SDM has inserted under Tasks 1 "Project Management" of all the IPs in airborne and ground domains proposed in this Recovery Plan, relevant provisions for the implementing partners.

4.2 Performance Monitoring and Spectrum Coordination

Moreover, as recommended by ICAO, a frequency coordination among States is required in the allocation of VDL2 frequencies. This task is allocated to the Network Manager (NM) Radio Frequency Function (RFF) in accordance with Commission Implementing Regulation (EU) No 677/2011. To improve the current situation, additional coordination is needed between the CSPs, ANSPs, Implementing Function and NM-RFF on RF spectrum use and plans, in accordance with ELSA's Recommendation ref. "Network_Oversight 02"[10]

Specifically, the following activities are expected to be performed:

- ensure continuous RF and performance monitoring (channel capacity, uplink collisions avoidance, co-site interference avoidance …) of the entire system comprising airborne equipment, ground equipment and the operation thereof;
- ensure the RF needs and spectrum usage aspects are regularly assessed and coordinated with the stakeholders and the NM-RFF in accordance with the ICAO standard.

[9] See Annex 2
[10] See Annex 2

SDM Role
The above mentioned activities are not under SDM remit. Nevertheless, they are considered essential enablers to a successful DLS deployment and operation. SDM will interface with and provide support to the bodies to be established/empowered to lead these activities through dedicated working arrangements and facilitate their execution. Subject to final decision of the European Commission, SDM intends to engage with EASA and NM on these matters.

5. Supporting the Recovery plan under the CEF guidelines for preparing IP proposals

Through this activity, SDM will ensure the alignment of the proposals for DLS related implementation projects submitted in response to CEF Transport Calls for proposals with the content of this Recovery Plan in order to ensure timely DLS implementation in accordance with ELSA's recommendations.

The objectives of the activity related to the Call submission scrutiny are the following:

- Supporting the Stakeholders in aligning the candidate DLS related implementation projects to be submitted in the framework of the 2016 CEF Transport Calls for Proposals with the DP in general (AF6's families description) and this Recovery Plan in particular;
- Supporting the Stakeholders through the overall implementation projects' submission process, which consists of elaboration of the Application Forms Part A, B, C, D and their supporting documents, uploading the documents to the TENtec system and proposals submission;
- Supporting the NSAs in their role to advise CEF Committee Members when required to endorse the proposals prior to their submission to INEA by SDM, in particular for DLS related implementation projects:
    - SDM support to NSAs is without prejudice to SDM and NSAs respective roles and responsibilities. It builds on the experience gained through the early implementation of the Memorandum of Understanding (MoU) between SDM and the NSA Coordination Platform, the key roles played by Members States in the previous CEF Transport Calls and the execution of the subsequent Specific Grant Agreements for Implementation projects;
    - The overall objective of SDM support to NSAs is to improve the alignment between the IPs submitted by stakeholders to CEF Transport Calls through SDM with the National Performance Plans and, once awarded, that these IPs are executed in accordance with the endorsed plan (contents, planning, budget).

6. Working together in the Recovery Plan

6.1 SDM role

As already stated in *Addendum 1* and supported by the operational stakeholders, it is SDM ambition to lead the execution of the *Data-Link Services Implementation Strategy Towards Initial Trajectory Information Sharing*, in particular this *Recovery Plan*, combining the strength and opportunities from its 3 roles:

- **As SESAR Deployment Manager[11];**
- **As DLS implementation project manager[12];**
- **As SESAR deployment Framework Partnership Coordinator[13].**

As SESAR Deployment Manager:

- We are the **unique reference for PCP implementation planning and monitoring**, therefore in the best position to embed this *Recovery Plan* into the wider picture of AF6 and PCP implementation both from the planning and the realization perspectives, ensuring smooth recovery towards DLS and then continue towards PCP AF6's objectives; applying to the implementation projects stemming from this *Recovery Plan* the same principles of gaps targeting, monitoring, coordination and synchronization;
- We have been raised as an **acknowledged centre of expertise.** Since its establishment in December 2014, SDM has established an AF6 team of ANSPs and Airspace Users experts. Combined with a recently appointed DLS implementation project manager, this team stands ready to steer *Recovery Plan* successful achievement;
- We identify and manage risks to implementation, in particular those stemming from industrialization phase. In the case of DLS, ELSA has identified critical actions in this phase, in particular to strengthen the concept of "best in class avionic" and it is SDM intention to turn them into risks and monitor their timely execution by the relevant stakeholders, supporting them as needed;
- We have developed a unique model of **results oriented interactions with all ATM stakeholders**, in particular the operational stakeholders through the Stakeholders' Consultation Platform as well as SESAR Joint Undertaking, Network Manager, EDA, NSAs and Manufacturing Industry through Cooperative Working Arrangements as required per Regulation (EU) No 409/2013. Our network is further reinforced by other Working Arrangement signed or being developed with EASA. All these connections have already been activated to enable stakeholders' support to *Data-Link Services Implementation Strategy Towards Initial Trajectory Information Sharing* and will continue to be for the purpose of the execution of this *Recovery Plan*.

On top of SDM skills, being **DLS implementation project manager** enables SDM to play a more active role from the management level into the implementation level for what concerns DLS related projects being:

- **Architect**: overall set-up, steering and coordination of the technical approach through:

[11] Regulation (EU) No 409/2013, article 9
[12] In compliance with ELSA's recommendation Network_Oversight 01", subject to mandate by the European Commission
[13] Framework Partnership Agreement (FPA, art.1.1.1, II.1.3)

- Identification of homogeneous service area starting from thorough analysis of the current situation in EU States;
- Definition of the target ground architecture per service area in cooperation with the local stakeholders;
- Interconnection of sub-networks within each service area to achieve a European distributed network and a European common approach;
- Updated CBA and expected contribution to SES performance objectives[14].

This role of Architect will not be performed in isolation. Building on its wide range of connections with stakeholders, **SDM will set-up ad-hoc DLS working arrangements to "work together"**[15].

In his role of architect, SDM will also address specifically the **interoperability at global level** through its coordination with the US FAA and in compliance with ICAO's Global Air Navigation Plan[16].

- **Facilitator**: **SDM is acting as a facilitator,** through a proactive and direct involvement of all the relevant stakeholders to ensure a coordinated submission of required DLS implementation projects;
- **Precursor:** stimulate establishment of a single European DLS governance taking advantage of SDA model.

In order to measure progress of SDM's activities as DLS Implementation Project Manager and also measure actual added value of SDM with regards to DLS implementation, SDM shall set some performance indicators and report regularly to European Commission and the stakeholders on them.

As SESAR deployment Framework Partnership Coordinator:

- We have this unique opportunity to **bridge between the role of DLS implementation project manager and being the coordinator of a cluster of DLS related projects**;
- We intend to connect Data-Link Services Implementation Strategy Towards Initial Trajectory Information Sharing, in particular this *Recovery Plan*, with **immediate co-funding opportunities**;
- We will translate this *Recovery Plan* into a cluster of DLS related projects required to be submitted by the relevant stakeholders through 2016 CEF Transport Calls as needed to get this plan timely and fully completed, **reinforcing the regulatory leverage of the Regulation (EU) No 2015/310 with the leverage of a dedicated DLS grant agreement with the European Commission**.

6.2 Interfaces with other relevant Bodies

In addition to its wide range of connections with stakeholders, SDM will establish **a Data Link Steering Group by the end of 2016**[17] in order to work together with relevant Bodies and coordinate the activities necessary to adequately face the specific opportunities and risks in this *Recovery Plan* and, beyond, in *Data-Link Services Implementation Strategy Towards Initial Trajectory Information Sharing*.

[14] See chapter 6.4
[15] See chapter 6.2
[16] See chapter 5.3

This group will build on existing bilateral and multilateral working arrangements whilst establishing a common "forum" to work together on DLS and AF6 implementation. The Steering Group will be chaired by the SESAR Deployment Manager. All other details regarding management, participation, meetings, etc. will be defined in the dedicated Terms of References (ToRs).

The SDM will also make intensive use of the **Cooperative Arrangements** established in accordance with Commission Implementing Regulation (EU) No 409/2013 to liaise on a bilateral basis with:

- **The Network Manager (NM),** so as to set-up the relevant mechanisms to enable the NM to ensure continuous RF and performance monitoring of the entire system comprising airborne equipment, ground equipment and the operation and to ensure the RF needs and spectrum usage aspects are regularly assessed and coordinated with the stakeholders and the NM-RFF in accordance with the ICAO standard;
- **SESAR Joint Undertaking (SJU),** with the aim of ensuring a full support in the validation of the identified Service Areas and their respective technical architectures according to the Action Plan;
- **European Defence Agency (EDA),** in order to ensure coordination with the relevant Military authorities, avoiding any adverse impact on national and collective defense capabilities**;**
- **European Aviation Safety Agency (EASA)**, as in accordance with the ELSA Study it would be the relevant organisation able to ensure the definition and implementation of an end-to-end system certification process, for both ground and air components;
- **Standardisation Organisations (ESOs) and EUROCAE,** in order to establish a continuous monitoring of the standardization/regulatory processes and activities, facilitating and increasing the implementation of technical standards, maximizing interoperability, safety and quality;
- **National Supervisory Authorities (NSAs),** in order to keep them informed of the activities performed to enable the coordinated and synchronized DLS and AF6 implementation, and in case to support them in DLS safety oversight in full coordination with EASA.

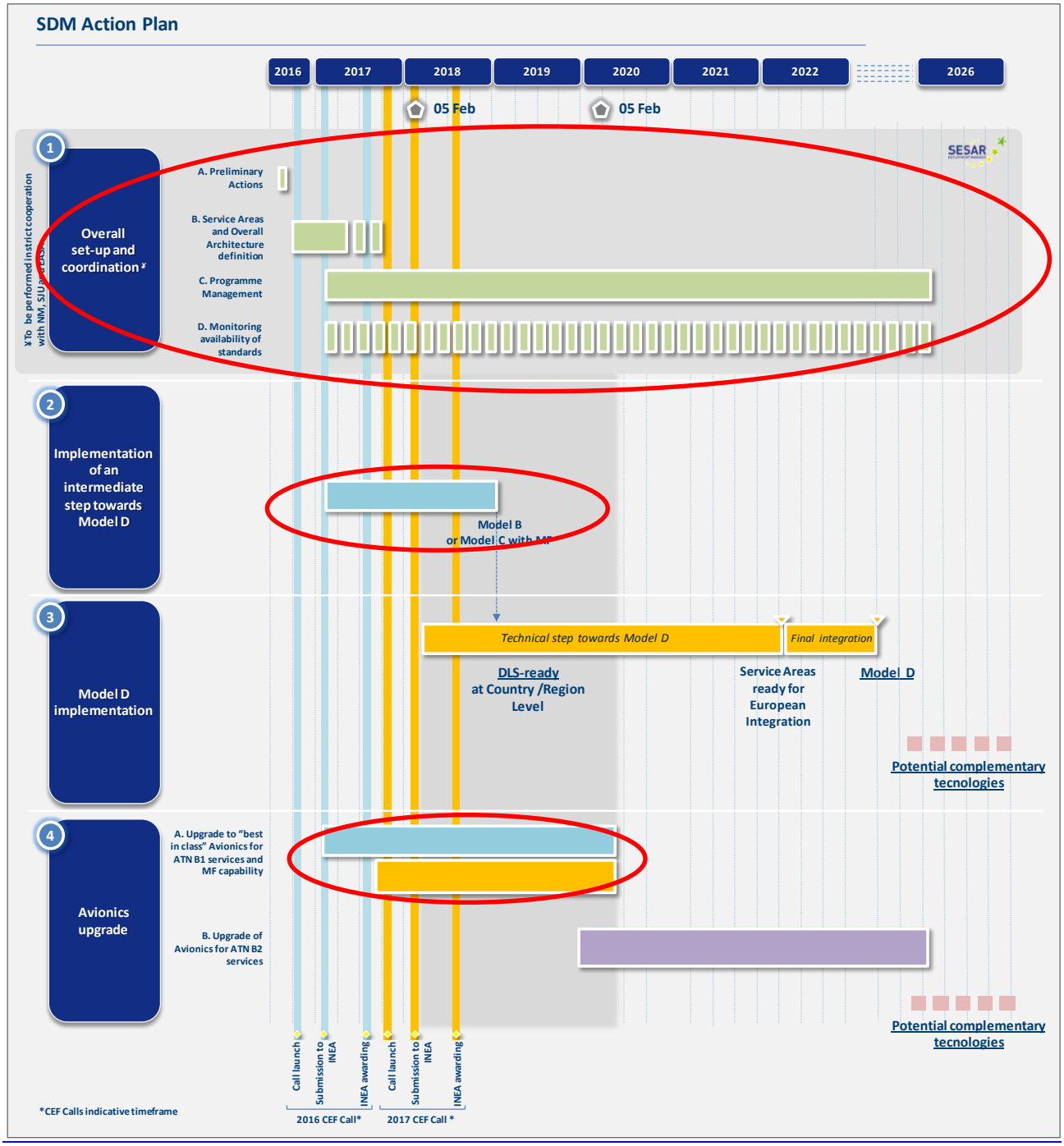
6.3 Cost Benefit Analysis and Performance

Qualitatively, DLS is acknowledged as an essential enabler to SESAR operational concept so to most SESAR related benefits and contribution to performance increase. In order to demonstrate the overall benefits to be drawn from the investments already made and those still required to ensure DLS provision based through VDL Mode 2, SDM will perform a revised DLS CBA in conjunction with PCP CBA. Starting from existing DLS CBA, it will provide an update, mainly to reflect the new costs stemming from ELSA's recommendations and also consider DLS essential contribution to PCP AF6's related benefits that cannot materialize if DLS not implemented. For the purpose of this Recovery Plan, SDM cannot go beyond such qualitative statement. However, SDM shall further refine this approach and better quantify associated costs and benefits.

Annex 1: SDM Action plan

This annex illustrates on which streams (or part of them) of the Action Plan of *Addendum 1* this *Recovery Plan* focuses (red circles). In a nutshell, this Recovery Plan is on DLS implementation by 2018 (ground) and 2020 (airborne)[18] through implementation projects to be submitted as a consistent DLS cluster, whilst undertaking also preparatory activities for the following step going from DLS to Initial Trajectory Information Sharing by 2025 (ground) and 2026 (airborne).

[18] In accordance to Regulation (EU) No 2015/310, the implementation deadlines are 5 February 2018 for the ground and 5 February 2020 for the airborne.


SDM Action Plan
2016
2017
2018
2019
2020
2021
2022
2026
05 Feb
05 Feb
SESAR
1
Overall set-up and coordination ¥
A. Preliminary Actions
B. Service Areas and Overall Architecture definition
C. Programme Management
D. Monitoring availability of standards
¥ To be performed in strict cooperation with NM, SJU and ESSP
2
Implementation of an intermediate step towards Model D
Model B
or Model C with MF
3
Model D implementation
Technical step towards Model D
Final integration
DLS-ready at Country /Region Level
Service Areas ready for European Integration
Model D
Potential complementary tecnologies
4
Avionics upgrade
A. Upgrade to "best in class" Avionics for ATN B1 services and MF capability
B. Upgrade of Avionics for ATN B2 services
Potential complementary tecnologies
Call launch
Submission to INEA
INEA awarding
Call launch
Submission to INEA
INEA awarding
2016 CEF Call*
2017 CEF Call *
*CEF Calls indicative timeframe

Annex 2: ELSA recommendations vs SDM Recovery Plan

For sake of clarity, the following table summarizes the traceability of ELSA recommendations into SDM *Recovery Plan* activities.

ELSA Rec. ID	ELSA recommendation	Reference in the document	Note
Ground 01	Use a dedicated channel for transmissions at the airport in areas with high traffic levels in en-route	Path I	
Ground 02	Progressively implement additional VDL2 frequencies in accordance with the traffic level	Path I, Path II	
Ground 03	Optimise the en-route VGS network coverage	Path I, Path II	
Ground 04	Use the CSC as common control channel only, unless traffic level is very low	Path I	
Ground 05	Implement ELSA recommended protocol optimisation: limit the AVLC frame size	Path II	
Ground 06	Ensure the availability of a fifth VDL2 frequency (at a minimum)	Path I	It depends from ICAO FMG
Ground 07	Favour alternative communications means for AOC, with a priority to the airport domain	Path II	Complementary technologies are envisaged as from 2025, taking over part of the increased data traffic out of VDL Mode 2 and Extending VDL Mode 2 lifespan.
Ground 08	Implement the MF VDL2 target technical solution: in each Service area, one single RF network that operates reserved VDL frequencies supporting two-GSIF channels	Path I, Path II	2016 CEF Transport Calls is considered the first step towards the European target solution
Ground 09	Fix the unbounded retry issue in certain VGSs	Path I	
Ground 10	Fix the Clear Request issue	Path I	
Ground 11	Optimise the Disconnect Mode management	Path I	
Avionics 01	Upgrade of avionics to the “best in class” performance	Path I, Path II	
Avionics 02	Update the pilot procedures to avoid unnecessary avionics reset	Path I	
Standard 01	Define and implement an effective datalink end-to-end system certification process (including both ground and air components) and reference material for the ground network infrastructure (MOPS-like)	4.1	
Standard 02	Include the selected interoperability improvements and clarifications in the relevant standards, and implement the resulting changes	6.2	

ELSA Rec. ID	ELSA recommendation	Reference in the document	Note
Standard 03	Include updates for MF interoperability in the relevant standards	6.2	
Network_Oversight 01	Establish/empower a pan-European air/ground datalink implementing function having appropriate steering responsibilities	6.1	SDM role (SDM proposal)
Network_Oversight 02	Establish/empower a pan-European ATN/VDL2 performance monitoring and spectrum coordination function	4.2, 6.2	NM role (SDM proposal)
Network_Oversight 03	Establish/empower a pan-European ATN/VDL2 end-to end certification and oversight function for validating (ground and airborne) sub-systems' acceptability	4.1, 6.2	EASA role (SDM proposal)

Annex 3: ELSA Interoperability Test Details

For sake of clarity, Annex 3 includes the following paragraphs extracted from ELSA Studies: *C - ELSA interoperability test details* and the *D "Best in class" Avionics identified within ELSA*.

C - ELSA interoperability test details

The objective of the ELSA interoperability tests activities was to stress avionics and to assess their multi-frequency operations in a representative European Airspace using representative testing platform[19].

The aim of the testing platform was to reproduce a fully representative RF environment to the tested avionics (i.e. Systems under test or SUTs), in order to analyse and measure its performances and its ability to maintain the end to end CPDLC connection with the ground network in a loaded traffic environment (i.e. like in core Europe end of 2015).

The testing platform was providing, in real-time, the SUT with the simulated aircraft GPS position (i.e. using the appropriate interface, here the A429 bus) according to a defined flight-plan. The testing platform was connected to the SUT VDR using the appropriate RF cables and attenuators. The Testing platform was also providing the computed RF signal that the SUT should experience at each position using adaptive radio transceivers. The RF signal level was computed according to a RF propagation model[20].

The RF propagation model realistically simulates RF physical behaviours, and finely imitates phenomena that may be experienced at aircraft antenna level:

- Free-space /multipath propagation, large scale fading (two ray model)
- Channel sensing per emulated entity (CSMA, TDMA)
- Antenna gain, signal strength levels, noise estimation, Signal-to-Noise Ratio (SNR)
- Bit Error Rate (BER), Frame Error Rate (FER), Reed-Solomon correction effects

While doing the virtual flight inside the simulation the SUT was CPDLC connected to the ground network and was doing VDL2 handovers between seen ground stations according to the variation of the uplink SQPs.

In addition to the SUT virtual flight, all VDL2 traffic (i.e. Aircraft & ground network) of the European airspace area was simulated inside the testing platform environment. In the scope of ESLA, this traffic was extracted from the typical days in 2015 (December and April), in addition to the forecasted traffic for the periods 2018 and 2025.

This traffic was generated by the emulated flights surrounding the SUT and by the emulated ground network (cf. D10 Annex B, C, D, M and N). Flight information were extracted from the typical days VDL2 logs. E.g. a peak of 1,170 simultaneously active aircraft over Europe is reached. These simulation activities required approximately 230 hours of cumulated executions, corresponding to 116,000 hours of virtual flights and nearly 33 million exchanged messages.

[19] Made of computing servers and radio transceivers, connected to the avionics bench using VHF and A429 interfaces
[20] Used as the model of reference for all European and U.S. VHF data link capacity studies since 2004.

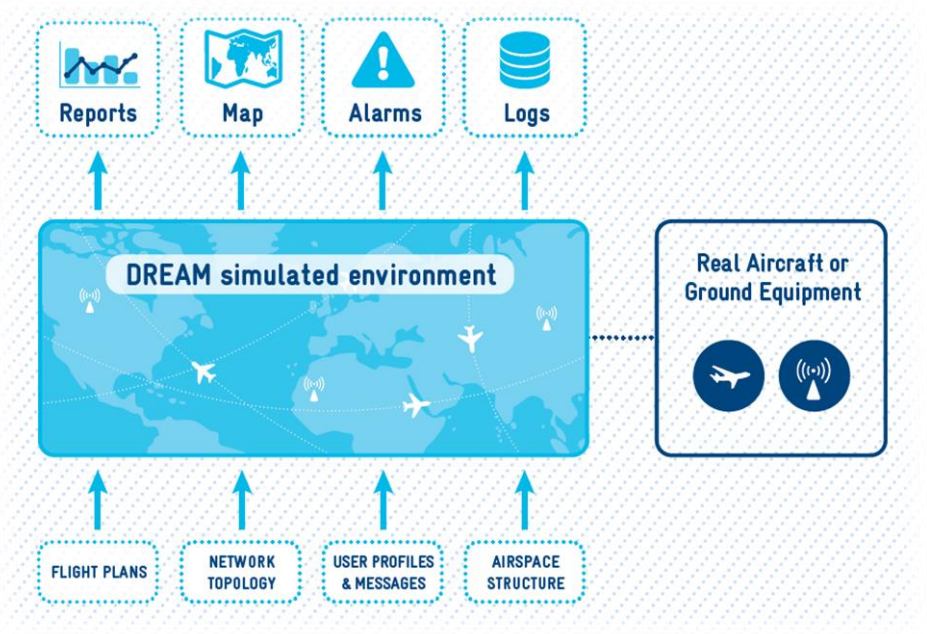


Figure 1 ALTYS DREAM Testing Platform, functional diagram (from D10)

The interoperability tests activity performed between representative avionics benches and the test platform allowed to test a wide scope of functions on the avionics side – starting from the lowest physical layer with the VDR RF tests, the VDL2 MF tests in a representative environment and scenarios, virtual flight tests and ending by end-to-end CPDLC tests.

In addition to the typical flight some extra unitary tests were exercised. These tests allowed to verify aircraft behaviour in situations not always experienced during the simulation (or to reproduce the detected issues).

Note that the unitary tests and the simulation environment were done using the last standard release[21] as the targeted baseline to validate. The avionics were supposed to be compliant with this baseline.

These unitary tests (cf. D10 Annex I to K) were covering the different protocol levels as follows:

- VDL2 level
    - VDL2 physical layer tests (VDR RF tests) in order to assess the VDR decoding and capture performance in loaded environment (e.g. High CU, High traffic load) and in abnormal situations (e.g. collided PDUs, truncated PDUs). Check the VDR implementation for the different correction algorithms (e.g. Header FEC, Reed Solomon). Check the performance of the burst detection algorithm. Check the VDR sensitivity and SQP scale implementation. Compare the VDR performance for the different VDL2 frequencies. Check the multi-frames decoding and the bit-stuffing implementations. Check the impact of the D08PSK constellation offset.
    - VDL2 Link and Handover management tests in order to assess the handover performance and behaviour.
    - VDL2 disconnect management (e.g. DISC, DM, N2)

[21] RTCA DO-178B or C whenever applicable, ED-12B, European Commission regulation and the applicable protocol standards (ARINC 631 and 750, EUROCAE ED92ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

- VDL2 MF tests based on the "EUROCONTROL VDL2-MF test cases" document[22] covering all the VDL2 MF methodologies - FSL (Frequency Support List, air and ground), GRAIHO (Ground Requested Air Initiated Handover), Auto-tune commands included in LE and HO responses, Air-ground transition (FSL-based), Ground-air transition (FSL-based)
- Verify the VDL frequency scan behaviour and its impact on the end to end performance

- ATN Stack
  - X25 handover between CSPSs
  - ATN disconnect management (e.g. X25 Clear Request, IDRP loss, ESIS management)
- Application level
  - CM/PM-CPDLC communication with ATC centre
  - Provider Abort scenarios
  - Long delays scenarios
- Protocols timer's, counter's & finite state machine's implementation compliance and behaviours analysis
- **The list of interoperability tests (including MF) performed within ELSA were:**

Table 1 List of ELSA interoperability tests.

Test Reference	Purpose	Covered Standards
AVP_CPDLC_NOCOMM	Identify if the SUT is able to re-establish a CPDLC connection after the previous connection was stopped.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_CPDLC_Delayed_uplinks	Check SUT CPDLC robustness - message latency	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_CPDLC_03	Check SUT CPDLC robustness - CPDLC V2 support	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_CPDLC_04	Check SUT CPDLC robustness - CPDLC V2 support	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

[22] Draft document circulated by Eurocontrol

Test Reference	Purpose	Covered Standards
AVP_CPDLC_SC214	Check SUT CPDLC robustness - CPDLC V2 support	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_CPDLC_Simult_Dialogues	Check SUT CPDLC robustness - Simult. Dialogues with same type	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_CPDLC_NO_CM	Check SUT TP4 robustness - No CM	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_CPDLC_high_CU	To check that the SUT is able to maintain a CPDLC connection in a high-CU environment	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_IDRP_CM_logon	To check if the Airborne System is able to send a CM-logon without IDRP.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_IDRP_loss	To check that the Airborne System is able to manage IDRP connection loss.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_TP4_01	Check SUT TP4 robustness - Unknown address	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_CNF	Retrieve SUT values : N2 T1min T1max T1exp T3min T3max T3exp (impact on the results of LE/HO tests)	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_TG1	Start the SUT with no VGS available. How many time does the SUT listen on 1	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO

Test Reference	Purpose	Covered Standards
	frequency before switching to alt. Freq ?	and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_ATN_Router_list	ATN router number limit	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_ ATN_Router_choice	Router choice	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_T1_T3_low_CU	Get T1 and T3 timers when CU is low (approx. 6%)	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_T1_T3_high_CU	Get T1 and T3 timers when CU is high (approx. 80%)	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_TG2	Get TG2 value for a station the SUT is not connected to.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_HO_TG2	Delay between last received PDU from GS#1 and attempt to switch to GS#2	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_LE_TG2	Delay between last received PDU from GS#1 and attempt to switch to GS#2	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_station_switches	VDL2 station switches	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

Test Reference	Purpose	Covered Standards
AVP_VDL2_TG5	Determine TG5	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_X25_availability_preference	Behaviour against a X25 service supported (or not)	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_X25_availability_mngt	VDL2 X25 availability mngt	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_X25_availability_update	VDL2 X25 availability update	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_GRAIHO_Frequencies	GRAIHO support	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_GRAIHO_mngt	GRAIHO support on same frequency	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_GIHO	GIHO support	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_GIHO_ERR	Behavior against GIHO from another DSP	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_LCR	Check is SUT supports LCR in response to LE-CMD or HO-CMD	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO

Test Reference	Purpose	Covered Standards
		and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_Services_preference	Check how the SUT manages GSIF with different available services (ACARS-only vs. ATN-only)	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_HO_SQP	SQP threshold before switch	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_PECT_Limit	PECT size threshold	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_corrupted_frames	Corrupted AVLC frames management	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_corrupted_GSIF	Corrupted GSIF management	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_START_01	Delay between GSIF reception and LE_REQ transmission	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_START_02	Delay between XID reception and LE_REQ transmission	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_START_03	Behavior while receiving 2 GSIF from the preferred and the alternative DSP	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

Test Reference	Purpose	Covered Standards
AVP_VDL2_START_04	Behavior while receiving 4 GSIF from the preferred DSP	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_X25_01	Test SUT "Back off timer" management (in DATA transfer state)	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_X25_02	Test SUT timer "T21" management	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_X25_03	Test classic reconnection scenario (ground clearing then accepting reconnection attempts)	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_SILENT_DISC	VDL2 Silent DISC	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_HO_SYSTEM_MASK_01	HO is done when the masked DLS addresses are identical (even if one starts with 1 and the other with 0).	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_HO_SYSTEM_MASK_02	LE is done when the masked DLS addresses are NOT identical (even if both start with 2).	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_SNDCF_MI_01	To check that the Airborne System is able to handle a response (CALL-CONFIRM) with M/I bit set to 0 when its request (CALL-REQUEST) contains a M/I bit set to 1.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_SNDCF_MI_01	To check that the Airborne System is able to handle a response (CALL-CONFIRM) with M/I bit set to 1 when its request (CALL-REQUEST)	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO

Test Reference	Purpose	Covered Standards
	contains a M/I bit set to 0.	and ATN SARPS, VDL2 Technical Manual
AVP_Attenuation	Evaluate receiver performance by generating VDL2 bursts with incremental software attenuation	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_Attenuation	Evaluate receiver performance by generating VDL2 bursts with incremental software attenuation	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_INVALID_CRC_11	Check VDL2 checksum implementation	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_INVALID_CRC_12	Check VDL2 checksum implementation	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_Bit_Stuffing_21	Check bit stuffing implementation	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_Bit_Stuffing_22	Check bit stuffing implementation	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_BAD_LEN_31	TL1…TL17 implementation Length too short vs. real length sent over the channel	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_BAD_LEN_32	TL1…TL17 implementation Length too short (e.g. DATA having a length of 8 bytes)	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

Test Reference	Purpose	Covered Standards
AVP_BAD_LEN_33	TL1…TL17 implementation Send 2 separated frames with a short delay, where the first one indicates a length too long and verify if the AC is able to detect the second frame	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_BAD_LEN_34	TL1…TL17 implementation Send data with Length null having DATA followed by correct data just after	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_BAD_LEN_41	TL1…TL17 implementation Change 2 bits the receiver should be able to detect but not to correct with a ratio of 25%	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_BAD_LEN_42	TL1…TL17 implementation Change 1 bit, the receiver should be able to correct with a ratio of 100%	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_D08PSK_OFFSET_5	Phase offset	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_REED_SOLOMON_6	Validate the RS (255,249) correction capability, this code is capable of correcting up to three octets for data blocks of 249 octets.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_REED_SOLOMON_7	Invalid RS where the receiver is not able to correct	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_Endurance_Test_8	10000 messages with the highest transmission rate	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_Concatenate_RF_SIGNAL_9	Decrease time space between two messages	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO

Test Reference	Purpose	Covered Standards
		and ATN SARPS, VDL2 Technical Manual
AVP_Multi_Frame_10	Generate incremental size of multi-frame	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_SNR_131	Incremental SNR level	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_SNR_132	Incremental SNR level, fixed attenuation of 10 dB	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_TG2_LE	Check TG2 Value and verify VDL2 LE 2 VGS are available: 1 SITA GS1, 1 ARINC GS2	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_ ATN_Router_list	XID with a 25-entry "ATN Router list"	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_SILENT_DISC	Check DM uplink management	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_START_01	Check VDL2 Link Establishment mean time	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_START_02	Check VDL2 Link Establishment mean time	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

Test Reference	Purpose	Covered Standards
AVP_VDL2_START_3	Check VDL2 Link Establishment management	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_START_4	Check VDL2 Link Establishment management	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_T1_T3_low_CU	Check Airborne System "Retransmission timer" (T1) and "Link initialisation timer" (T3) calculation (low CU).	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_T1_T3_high_CU	Check Airborne System "Retransmission timer" (T1) and "Link initialisation timer" (T3) calculation (high CU).	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_TG1	Check TG1 implementation	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_TG2	Check TG2 implementation	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_LCR	LCR Management	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_Corrupted_AVLC_frames	Corrupted frames rejected with FRMR	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_PECT_Limit	Check PECT table limit	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO

Test Reference	Purpose	Covered Standards
		and ATN SARPS, VDL2 Technical Manual
AVP_X25_01	ISO8208 reconnection mean time	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_X25_02	Check ISO8208 "T21" timer (200 s)	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_X25_03	Classic ISO8208 reconnection	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
SNDCF_MI_01	Ground answer M/I=0 for a downlink M/I=1	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
SNDCF_MI_02	Ground answer M/I=1 for a downlink M/I=0	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_X25_availability_update	Update GSIF and set ATN Router NETs to null	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_X25_availability_preference	ATN preferred if available	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_X25_availability_mngt	ATN preferred if available	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

Test Reference	Purpose	Covered Standards
AVP_VDL2_Services_preference	ATN only vs. AOA only	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_ACARS_General_Response_Disable	ATN Maintained if AOA failed	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_IDRP_loss	Check IDRP loss management	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_no_IDRP	Check ATN connection without IDRP	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_GRAIHO	Check GRAIHO implementation	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_GRAIHO_mgmt	Check GRAIHO management	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_Corrupted_GSIF	Validate GSIF parameters values check	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_TP4_50conn	Check TP4 connection management	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_CPDLC_Delayed_uplinks	Delayed CPDLC uplinks	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO

Test Reference	Purpose	Covered Standards
		and ATN SARPS, VDL2 Technical Manual
AVP_CPDLC_DM62	Generate DM62	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_GIHO_ERR	GIHO from alt. DSP	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_GIHO	GIHO from pref. DSP	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_FSL	GSIF with FSL	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_CPDLC_no_CM	Check if CPDLC can start without CM	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_ACARS_disable	ACARS notified as disable by the current station	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
AVP_VDL2_System_Mask	Check how the avionics handles the System Mask when identifying DSP.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_AFSL_1_1	TP_EUR_12: Verify that following loss of communication on the current frequency while the aircraft is airborne, the aircraft performs the frequency recovery procedure, and selects a frequency/VGS pair from an airborne FSL and performs a Handoff to the	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

Test Reference	Purpose	Covered Standards
	VGS on the selected frequency.	
TC_AFSL_1_2	TP_ADD_XX: Verify that following loss of communication on the current frequency while the aircraft is airborne, and no FSL is available, the aircraft reverts to the CSC and selects a station to which to perform a Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_AFSL_2_1	TP_ADD_XX: Verify that following loss of communication on the CSC while the aircraft is airborne, and only a ground FSL is available, the aircraft does not select a frequency from the ground FSL.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_AFSL_2_2	TP_EUR_13: Verify that following loss of communication on the current frequency while the aircraft is airborne, and only a ground FSL is available, the aircraft reverts to the CSC and selects a station to which to perform a Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_AFSL_3	TP_ADD_XX: Verify that following loss of communication on the current frequency while the aircraft is airborne, and failure to handoff to a VGS/Freq from the air FSL, the aircraft reverts to the CSC and selects a station to which to perform a Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_AFSL_4	TP_EUR_23: Verify that following a transition from ground to air, after performing a Handoff to a VGS on an airborne frequency, and then receiving an uplink DISC frame while TG5 is still running, the aircraft selects another frequency/VGS pair from an airborne FSL, and performs a successful Handoff to the VGS on the selected frequency.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_AFSL_5	TP_EUR_24: Verify that following a transition from ground to air, after performing a Handoff to a VGS on an airborne frequency, and then receiving an uplink DISC frame while TG5 is still running, if no further frequency/VGS pair is available in an airborne FSL, the aircraft reverts to the CSC performs a successful Link	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

Test Reference	Purpose	Covered Standards
	Establishment.	
TC_AFSL_6	TP_EUR_23: Verify that following a transition from ground to air, after performing a Handoff to a VGS on an airborne frequency, and then receiving an uplink DISC frame while TG5 is still running, the aircraft selects another frequency/VGS pair from an airborne FSL, and performs a successful Handoff to the VGS on the selected frequency.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_GFSL_1_1	TP_EUR_15: Verify that following start-up while on the ground, the aircraft selects a frequency/VGS pair from the Ground FSL, and performs a successful Link Establishment or Handoff on the ground frequency.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_GFSL_2	TP_EUR_17: Verify that on start-up while on the ground, if the aircraft fails to establish a successful link with any entry in the ground FSL, the aircraft reverts to the CSC, performs a successful Link Establishment, and remains on that frequency without any further attempt to transfer to the ground frequency.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_GFSL_3_1	TP_EUR_19: Verify that after a transition from the air to the ground, the aircraft selects a frequency/VGS pair from a ground FSL, and performs a successful Handoff on the ground frequency.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_GFSL_3_2	TP_EUR_20: Verify that after a transition from the air to the ground, if the aircraft fails to establish a successful link with any frequency/VGS in the ground FSL, the aircraft reverts to the CSC, performs a successful Link Establishment, and remains on that frequency without any further attempt to transfer to the ground frequency.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_GFSL_3_3	TP_ADD_XX: Verify that after a transition from the air to the ground, and the aircraft performs a successful Handoff to a ground frequency and VGS from a ground FSL, if the new link on the ground subsequently fails, the aircraft reverts to the CSC, performs a	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

Test Reference	Purpose	Covered Standards
	successful Link Establishment, and remains on that frequency without any further attempt to transfer to the ground frequency.	
TC_TFSL_1_1	TP_EUR_18: Verify that after establishing a link on a dedicated ground frequency, upon becoming airborne the aircraft selects a frequency/VGS pair from an airborne FSL, and performs a successful Handoff to the VGS on the selected frequency.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_TFSL_2_1	TP_EUR_21: Verify that following a transition from air to ground, after performing a Handoff to a VGS on a dedicated ground frequency, and then receiving an uplink DISC frame while TG5 is still running, the aircraft selects another frequency/VGS pair from a ground FSL, and performs a successful Handoff to the VGS on the selected frequency.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_TFSL_2_2	TP_ADD_XX: Verify that when the aircraft fails to handoff to a frequency/VGS pair selected from a ground FSL it will select another frequency/VGS pair and perform a successful handoff to the selected VGS.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_TFSL_3	TP_EUR_22: Verify that following a transition from air to ground, after performing a Handoff to a VGS on a dedicated ground frequency, and then receiving an uplink DISC frame while TG5 is still running, if no further frequency/VGS pair is available in a ground FSL, the aircraft reverts to the CSC performs a successful Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_TFSL_4_1	TP_EUR_24: Verify that following a transition from ground to air, after performing a Handoff to a VGS on an airborne frequency, and then receiving an uplink DISC frame while TG5 is still running, if no further frequency/VGS pair is available in an airborne FSL, the aircraft reverts to the CSC performs a successful Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

Test Reference	Purpose	Covered Standards
TC_TFSL_4_2	TP_ADD_XX: Verify that when the aircraft fails to handoff to a frequency/VGS pair selected from an air FSL it will select another frequency/VGS pair and perform a successful handoff to the selected VGS.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_HO_1	TP_EUR_2: Verify correct system behaviour under normal conditions when an Autotune command is included in the XID_RSP_HO following an Air-Initiated Handoff.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_HO_2_1	TP_EUR_7: Verify that when the aircraft receives an Autotune parameter on the CSC, and all subsequent downlink XID_CMD_HO on the Autotuned frequency are lost, the aircraft continues to attempt to send the XID_CMD_HO using normal re-transmission procedures, and eventually reverts to the CSC and performs successful a Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_HO_2_2	TP_EUR_14: Verify that following loss of communication on the current frequency while the aircraft is airborne, and no FSL is present, the aircraft reverts to the CSC and selects a station to which to perform a Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_HO_3	TP_EUR_8: Verify that when the aircraft receives an Autotune parameter on a non-CSC frequency, and all subsequent downlink XID_CMD_HO on the Autotuned frequency are lost, the aircraft continues to attempt to send the XID_CMD_HO using normal re-transmission procedures, and eventually reverts to the CSC and performs a successful Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_HO_4	TP_EUR_9: Verify that when the aircraft receives an Autotune parameter on the CSC, and all subsequent uplink XID_RSP_HO on the Autotuned frequency are lost, the aircraft continues to attempt to send the XID_CMD_HO using normal re-transmission procedures, and eventually reverts to the CSC and performs successful a Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

Test Reference	Purpose	Covered Standards
TC_HO_5	TP_EUR_5: Verify that in the event of loss of an XID_RSP_HO carrying the Autotune command the existing link is maintained until expiry of TG5 on the ground, and that the aircraft re-attempts the air-initiated handoff in accordance with published procedures.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_HO_6	TP_EUR_10: Verify that when the aircraft receives an Autotune parameter on a non-CSC frequency, and all subsequent XID_RSP_HO on the autotuned freq are lost, the aircraft continues to attempt to send XID_CMD_HO using normal re-transmission procedures, and eventually reverts to the CSC and performs a successful Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_LE_1	TP_EUR_1: Verify correct system behaviour under normal conditions when an Autotune command is included in the XID_RSP_LE following Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_LE_2	TP_ADD_XX: Verify that following receipt of an Autotune included in an XID_RSP_LE, and the subsequent Handoff on the new frequency fails, the aircraft reverts to the CSC and selects a station to perform Link Establishment.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_GRAIHO_1	TP_EUR_3: Verify correct system behaviour under normal conditions when an Autotune command is included in an XID_CMD_HO (P=0) forming a Ground Requested Air-Initiated Handoff.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_GRAIHO_5	TP_EUR_6: Verify that in the event of loss of the XID_CMD_HO (P=0) carrying the Autotune command the existing link is maintained and that the ground re-attempts the Autotune in accordance with published procedures.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_GRAIHO_6	TP_EUR_4: Verify that following a successful Autotune, upon encountering falling SQP, the aircraft selects an alternative VGS from its PECT on the same frequency, and performs a successful Air-Initiated Handoff.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

Test Reference	Purpose	Covered Standards
TC_CLR_1	TP_ADD_XX: To verify that if the aircraft rejects an Autotune delivered in an XID_RSP_LE with a downlink XID_CMD_LCR (P=0) the existing link is maintained.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_CLR_2	TP_ADD_XX: To verify that if the aircraft rejects an Autotune delivered in an XID_RSP_LE with a downlink XID_CMD_LCR (P=0) the existing link is maintained.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual
TC_CLR_3	TP_ADD_XX: To verify that if the aircraft rejects an Autotune delivered in a GRAIHO with a downlink XID_CMD_LCR (P=0) the existing link is maintained.	ARINC 631 and 750, EUROCAE ED092, ED110B, ED120, ICAO and ATN SARPS, VDL2 Technical Manual

"Best in class" Avionics identified within ELSA

The "best in class" datalink avionics components identified by ELSA are:

1. "Best in class" data link management units
   - AIRBUS:
     - FANS B+ ATSU CSB8.3.
   - Honeywell:
     - MkII+ CMU upgrade from -501 and -521 to -522,
     - EPIC CMF upgrade to Block 3.xx or later,
     - B787 CMF upgrade to BPV3,
     - B777 CMF upgrade to BPv17A BLE.
   - Rockwell Collins:
     - CMU-900 upgrade to CMU Core software 815-5679-505 (refer to CMU-900 Service Information Letter 15-1).

2. "Best in class" VDR units
   - Honeywell
     - RTA-50D PN 965-1696-0F1,
     - RTA-44D PN 064-50000-2052 or with service bulletin SB23-1570 installed,
     - EPIC avionics fitted with mod D or greater for the VDR element.
   - Rockwell Collins
     - VHF-920: P/N 822-1250-002w/SB16 or 822-1250-020w/SB17,
     - VHF-2100: P/N 822-1287-101/180w/SB7 or 822-1287-121/141,
     - VHF-2200 P/N 822-2763-020 or VHF-2200 P/N 822-2763-050.

Equipage data is only available for aircraft on the white list, because airspace users need to report their data when registering their aircrafts for the white list. Otherwise there is no reporting obligation.

About 40% of all flights are ATN-equipped according to EUROCONTROL, and about 30% of the ATN-equipped aircraft are on the white list.

The White List is composed of a few different configurations, 92.5% of which are using AIRBUS, Honeywell or Rockwell Collins avionics.

32.5% of the aircraft on the white list already have "best in class" versions and the remaining 60%[23] of the AIRBUS, Honeywell or Rockwell Collins avionics-equipped fleet on the White List are affected by the upgrade as follows:

- 29% by the AIRBUS CSB8.3 upgrade,
- 19% by the Honeywell RTA-44D upgrade to solve the reset issue,
- 12% by Honeywell CMU/CMF upgrades,
- 18% by the Rockwell Collins CMU upgrade.

[23] Counting as "1" aircraft that needs both VDR and CMU upgrades.