

Intelligente Verkeers Regel Installatie (iVRI) – Fase 2

Deliverable 3f: Test specifications

FAT test specification ITS-CLA



Datum: 17 november 2016
Versie: 1.0

1 Voorwoord

In mei 2016 is opdracht verstrekt door het Ministerie van Infrastructuur en Milieu via het Beter Benutten Vervolg (BBV) programma aan vijf VRA leveranciers om de in fase 1 opgeleverde iVRI architectuur, te bouwen en te testen in samenwerking met applicatiebouwers.

Dit document is onderdeel van Deliverable 3f van de afgesproken leverdelen in de opdrachtverstrekking en beschrijft de FAT test specificatie voor de TLC.

Dit document is tot stand gekomen door samenwerking van de vijf leveranciers in de werkgroep bestaande uit:

Koos van Vliet



Edwin Henning



Jaap Zee



Michel Huisman



NB. De rest van dit document is geschreven in het Engels om internationale uitwisseling te ondersteunen.

The rest of this deliverable has been written in English to facilitate international exchange.

DOCUMENT CONTROL SHEET

Document versions:

Version	Date	Author	Comment
0.86	18-10-2016	WG T&C	Draft for internal review
0.9	27-10-2016	WG T&C	Processed review comment on 0.86
1.0	17-11-2016	WG T&C	Processed review comment on 0.9

Approval:

	Who	Date	Version
Prepared			
Reviewed			
Approved			

Publication level: Public

Version filename: iVRI2_deliverable_3f FAT test specification ITS-CLA V1_0

CONTENT

1	Voorwoord	2
2	Introduction	6
2.1	System overview	6
2.2	Document overview	6
2.2.1	<i>Purpose</i>	6
2.2.2	<i>Document structure</i>	6
2.3	Advise for the reader	6
3	References	7
3.1	Normative	7
3.2	Informative	7
4	Acronyms, abbreviations and concepts	8
5	Test setup	9
5.1	Introduction	9
5.2	Device under test	9
5.3	TLC Facilities test tool	9
5.4	IVERA test tool	9
5.5	V-Log 3.0 test tool	9
5.6	Test intersection	9
6	Test execution	10
6.1	Introduction	10
6.2	Structure	10
6.3	Execution	10
6.4	Test case notation format	10
6.5	Remarks / actions	11
6.6	Test Readiness Review	11
7	Test verification	12
7.1	Introduction	12
7.2	Levels of verification	12
8	Test scenarios	13
8.1	Introduction	13
8.2	TLC-FI	13
8.2.1	<i>ITS-CLA controls the intersection</i>	13
8.2.1.1	Power up of the ITS-CLA and the TLC.	13
8.2.1.2	Change the intersection state	14
8.2.1.3	Change the signal group state.	15
8.2.1.4	Change outputs.	15
8.2.1.5	Change variables.	15
8.2.1.6	Obtain updates of TLC State Objects.	16
8.2.1.7	Signalgroup predictions.	17
8.2.2	<i>Handover</i>	18
8.2.2.1	The TLC requests the ITS-CLA to handover control.	18
8.2.3	<i>Exceptions</i>	18
8.2.3.1	ITS-CLA de-registers from TLC.	18

8.2.3.2	TLC de-registers the ITS-CLA session (soft-restart, revoke authorization).	19
8.2.3.3	Disconnect of the ITS-CLA.	19
8.2.3.4	Configuration mismatch.	20
8.2.3.5	The TLC doesn't follow ITS-CLA control requests	20
8.2.3.6	Time shift of TLC	21
8.2.3.7	Communication disruption (physical).	22
8.3	IVERA-APP	23
8.3.1	<i>Protocol</i>	23
8.3.1.1	Establish an IVERA-APP connection.	23
8.3.1.2	Login on the IVERA-APP interface.	23
8.3.1.3	Mandatory objects.	24
8.3.1.4	Object attributes.	24
8.3.1.5	Object read.	25
8.3.1.6	Object read range.	25
8.3.1.7	Object write.	26
8.3.1.8	Object write range.	26
8.3.1.9	Trigger-events	27
8.3.1.10	Group access rights	27
8.3.2	<i>Exceptions</i>	27
8.3.2.1	User login with non-valid credentials.	27
8.3.2.2	No access rights.	28
8.4	V-Log 3.0	29
8.4.1.1	Connection setup.	29
8.4.1.2	Message availability and message syntax.	29
APPENDIX 1: Requirements traceability		30
APPENDIX 2: Use cases traceability		36

2 Introduction

This document describes the FAT test specification for the ITS Control Application (ITS-CLA). An ITS-PRA or ITS-CRA application is not separately tested since an ITS-CLA application covers the functionality of these applications as well.

2.1 System overview

The iTLC architecture defines several interfaces of the iTLC. Figure 1 shows these interfaces. See [Ref 1] for a detailed architecture description.

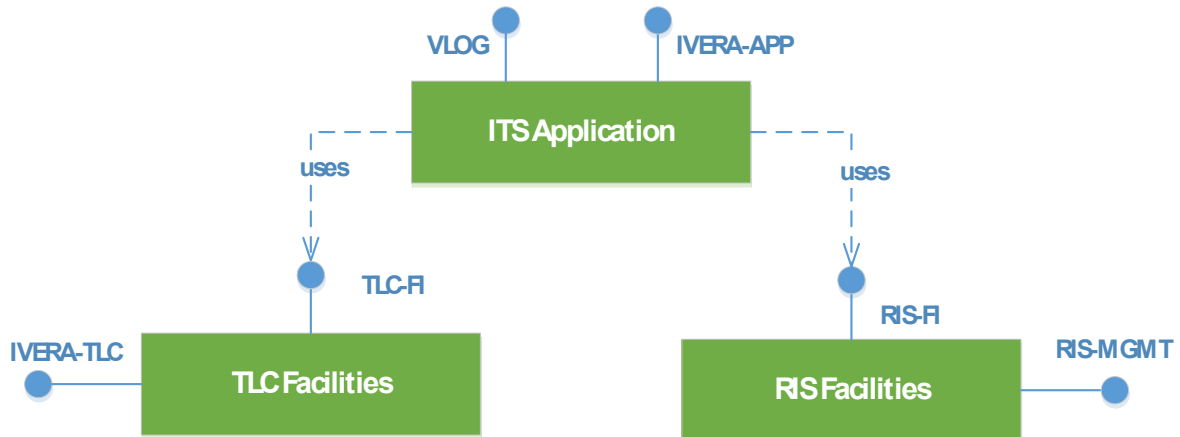


Figure 1 System overview

2.2 Document overview

2.2.1 Purpose

This document provides specifications for the testing of the ITS-CLA. This document is a part of a set of test specifications, which together form deliverable 3f. See [Ref 7] for the description of the iVRI test strategy.

2.2.2 Document structure

Chapter 3 contains references to normative and informative documents.

Chapter 4 explains acronyms and used definitions and concepts.

Chapter 5 outlines the test setup

Chapter 6 outlines guidelines for the execution of the test scenarios.

Chapter 7 outlines guidelines for the interpretation of the test output.

Chapter 8 outlines the formal specification of the test cases.

2.3 Advise for the reader

It is advised that the reader has taken knowledge of the iTLC Architecture as described in [Ref 1].

3 References

3.1 Normative

ID	Reference
[Ref 1]	<i>Beter Benutten Vervolg, project iVRI, Deliverable F, iTLC Architecture, v1.2</i>
[Ref 2]	<i>Beter Benutten Vervolg, project iVRI, Deliverable G2, IRS TLC Facilities Interface v1.2, jan 2016</i>
[Ref 3]	<i>Beter Benutten Vervolg, project iVRI – fase 2, Deliverable 1ab IDD Generic Facilities Interface v1.1, nov 2016</i>
[Ref 4]	<i>Beter Benutten Vervolg, project iVRI – fase 2, Deliverable 1ab IDD TLC Facilities Interface v1.1, nov 2016</i>
[Ref 5]	<i>Beter Benutten Vervolg, project iVRI – fase 2, Deliverable 1d IRS security v1.0, aug 2016</i>
[Ref 6]	<i>Beter Benutten Vervolg, project iVRI – fase 1, Deliverable G3, IRSIDD IVERA 4.00, v2.0 sep 2016</i>

3.2 Informative

ID	Reference
[Ref 7]	<i>Beter Benutten Vervolg, project iVRI – fase 2, Deliverable 3f iVRI test strategy v1.1, nov 2016</i>

4 Acronyms, abbreviations and concepts

Acronyms and abbreviations

C-ITS	Cooperative ITS functionality for exchange of data between in-vehicle and or road side devices making use of either cellular or short range wireless communication
FAT	Factory Acceptance Test
IDD	Interface Design Description
IRS	Interface Requirements Specification
iTLC (Dutch iVRI)	Intelligent TLC performing traffic light controller and C-ITS functions and providing access to these functions for ITS applications
ITS	Intelligent Transport Systems
ITS Station	Functional entity specified by the ITS station reference architecture (see [Ref 1])
IVERA	Management protocol for traffic light controllers in the Netherlands
IVERA-APP	Management protocol for ITS applications.
RIS	See R-ITS-S
RIS-FI	R-ITS-S Facilities Interface
R-ITS-S	Roadside ITS Station, responsible for C-ITS functionality within a geographical area.
TLC	Traffic Light Controller; controls the signal of one or more intersections
TLC-FI	Traffic Light Controller Facilities Interface
TLS	Transport Layer Security
V-Log	Traffic Data log

Concepts

ITS Application	An application which supports one or more ITS use-cases. Range of possible ITS Applications include an ITS Control Application
ITS Control Application	A Traffic Control Application (ITS-CLA) which uses TLC- and/or RIS-interfaces
RIS Facilities	Component providing RIS Facilities to users (internal and/or external). Includes amongst others: <ul style="list-style-type: none">• Access to information stored in the LDM• Services to trigger C-ITS messages
TLC Facilities	Component providing facilities of a TLC to users (internal and/or external). Includes amongst others: <ul style="list-style-type: none">• Access to information from the TLC• Services to trigger actuators

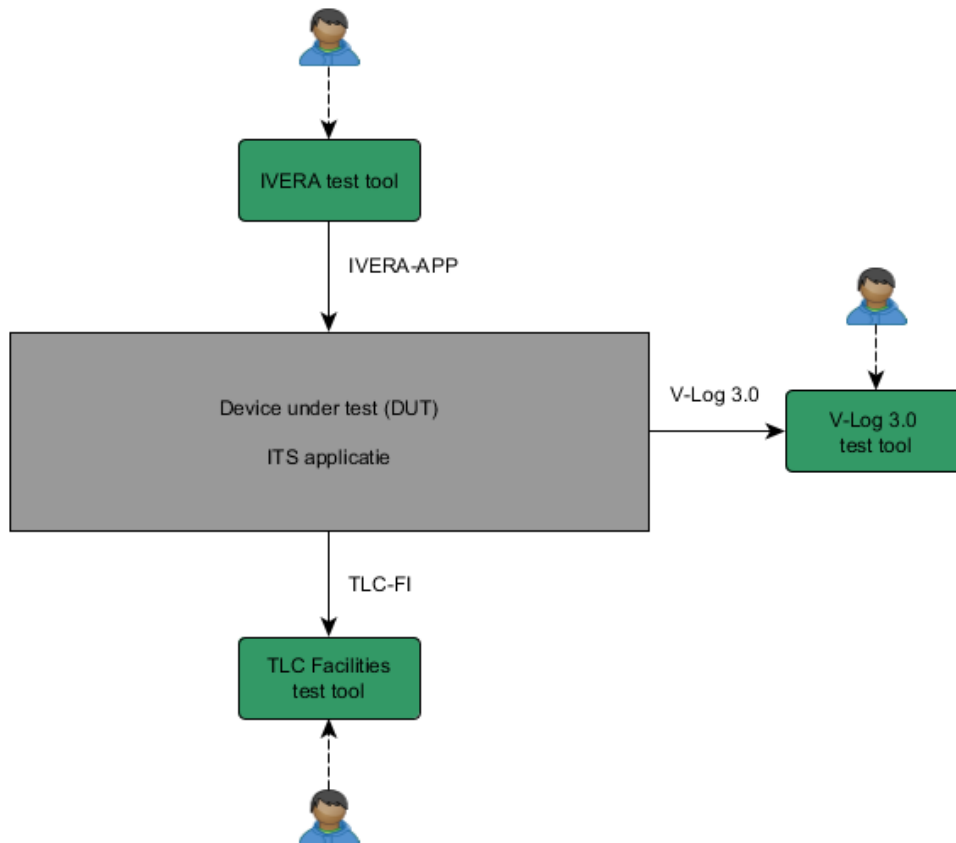
5 Test setup

5.1 Introduction

This chapter outlines the test setup.

5.2 Device under test

The device under test (DUT) is an iVRI compliant ITS-CLA that implements the TLC-FI, IVERA-APP and V-Log 3.0 interfaces. This ITS-CLA should be a full functional application which is able to operate autonomously within an iVRI environment.



5.3 TLC Facilities test tool

To perform tests on the TLC-FI, a software test tool that acts like a TLC should be used. It is possible to use a TLC with a well-known TLC-FI, but this is not advised because of the limited monitoring/debugging options.

5.4 IVERA test tool

To perform tests on the IVERA-APP interface, a software tool is needed. In this document this tool is called the IVERA test tool.

5.5 V-Log 3.0 test tool

To verify V-Log 3.0 data, a software tool is needed. In this document this tool is called the V-Log 3.0 test tool.

5.6 Test intersection

The ITS-CLA is configured for the test intersection, specified in [Ref 7].

6 Test execution

6.1 Introduction

This chapter provides guidelines for the execution of the test scenarios specified in this document.

6.2 Structure

During a test the Device Under Test (DUT) is subjected to the documented test cases. This test specification is structured as follows:

- Test specification
 - o Test scenario(s)
 - Test case(s)
 - Test step(s)

6.3 Execution

The tests are executed in the documented order. No alternations should be made to the device under test (the ITS-CLA) during the test, unless explicitly documented.

The results are documented per test step.

A test step has passed if the pass criteria has been met.

A test step has failed if the pass criteria has not been met.

A test case has passed if all test steps have passed.

A test scenario has passed if all test cases have passed.

6.4 Test case notation format

The following format is used to specify the test cases and document the test results.

Test Case:			
ID:			
Objective:			
Pre-conditions:			
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Actions <u>Verify</u>		
2.			
3.			
Tested by:		Date:	

- Test case: A short description of the test case.
- ID: A unique ID
- Objective: The objective of the test case.
- Pre-conditions: The pre-conditions before the test case is executed.
- STEP:
- DESCRIPTION: A description of the actions to be executed and a description of the items to be verified.
- PASS/FALL: The test result.
- REMARKS/ACTIONS: Remarks and action related to the test results.
- Tested By: Person who executed the test case.
- Date: The date at which the test case was executed.

6.5 Remarks / actions

A remark shall be documented if:

- If the test step does not meet the pass criteria;
- If the test step cannot be executed;
- If the test is interrupted;
- If the test results are unusable;

6.6 Test Readiness Review

A Test Readiness Review (TRR) is held to verify readiness for formal ITS-CLA type testing. The conditions are:

- The test configuration as specified in chapter 5 is available.
- A release version of the ITS-CLA software is loaded on the DUT.
- The test intersection is configured in the ITS-CLA.
- The pre-conditions as documented in the test scenarios/test cases are met.
- The pre-test table is filled in

Before testing:

Software release:			
DUT:			
Pre-conditions met:			
Tested by:		Date:	

After testing

Software release:			
DUT:			
General PASS/FAIL:			
Remarks			
Actions			
Tested by:		Date:	

7 Test verification

7.1 Introduction

This chapter provides guidelines how to interpret the test output.

7.2 Levels of verification

The test setup supports three levels of verification.

1)	The TLC simulator, IVERA or V-Log test tool displays the current status. The tester uses this information to verify if the ITS-CLA has published the correct information on the related interface.
2)	When the test tooling supports diagnostic counters, the tester uses this information to verify if the right amount of data/messages is exchanged.
3)	When the test tooling supports diagnostic loggings, the tester can perform a detailed analysis of the exchanged protocol data by reviewing the log file.

Where possible verification is done using level 1.

8 Test scenarios

8.1 Introduction

This chapter describes the test scenarios and the test cases per scenario. The test scenarios are divided into three sections. (TLC-FI, IVERA-APP and V-Log 3.0)

It is assumed that a console or some form of log functionality is available in the DUT to analyze and verify the result of the test actions. In test cases where the DUT has to perform an action or trigger an event it is assumed that a command line interface is available.

If specific functionality is not implemented by the DUT the related test case(s) or steps may be skipped. Also if a test case cannot be executed or verified (i.e. no command line interface available), the test case(s) or steps may be skipped. If a test case or test step is not executed or verified this must be indicated in the field: Remarks/Actions.

Because the level of functionality can differ per ITS-CLA application, it is not always possible to describe how a test step should be executed exactly on a particular ITS-CLA. It is assumed that the tester has knowledge of the ITS-CLA and knows how to interpret the test steps to be executed.

8.2 TLC-FI

8.2.1 ITS-CLA controls the intersection

Normal behavior of an ITS control application which is in control of the intersection. After power up of the ITC-CLA and the TLC, a connection shall be established between the ITS-CLA and the TLC. Authentication and the configuration check succeeds. The ITS-CLA is in control of the intersection.

8.2.1.1 Power up of the ITS-CLA and the TLC.

Test Case:	Power up of the ITS-CLA and the TLC.
ID:	SC1.CLA.01.HA
Objective:	Verify that the ITS-CLA and the TLC start up correctly, and afterwards, the ITS-CLA is in control of the intersection.
Pre-conditions:	A valid network configuration between TLC and ITS-CLA is in place. The ITS-CLA is switched off and the TLC is in standby state. A user of type "Control" is configured in the ITC-CLA.

STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Switch on the ITS-CLA.		
2.	Verify that within 60 seconds the ITS-CLA forces the state of the TLC to change from Standby/SwitchOn to Switchon/Amber. (60 seconds is the "NotConfigured timeout" as specified in [Ref 4])		
3.	Verify that within 5 seconds the ITS-CLA forces the state of the TLC to change from SwitchOn/Amber to AllRed. (5 seconds is the "StartControl timeout" as specified in [Ref 4])		
4.	Verify that after the maximum clearing time the ITS-CLA forces the state of the TLC to change to Control.		
5.	Verify that the ITS-CLA time is the current UTC time.		
Tested by:		Date:	

8.2.1.2 Change the intersection state

Test Case:	Change the intersection state		
ID:	SC1.CLA.02.HA		
Objective:	Verify that both the ITS-CLA and the TLC can change the intersection state and the ITC-CLA behaves correctly.		
Pre-conditions:	The ITS-CLA is in control of the intersection. The intersection state is "Control".		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Change the intersection state request of the ITS-CLA to AmberFlashing.		
2.	Verify that the state of the TLC will change to AmberFlashing via AllRed.		
3.	Change the intersection state of the ITS-CLA to Control.		
4.	Verify that the state of the TLC will change to Control via respectively Amber and Allred.		
Tested by:		Date:	

8.2.1.3 Change the signal group state.

Test Case:	Changing the signal group state.		
ID:	SC1.CLA.03.HA		
Objective:	Verify that the ITS-CLA is able to change the signal group state.		
Pre-conditions:	The ITS-CLA is in control of the intersection. The signal group is in state StopAndRemain.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Change the signalgroup state of "fc02". (respect minimal signal phase and timing and clearing times)		
2.	Verify that the signalgroup "fc02" changes to the requested state.		
Tested by:		Date:	

8.2.1.4 Change outputs.

Test Case:	Change outputs.		
ID:	SC1.CLA.04.HA		
Objective:	Verify that the ITS-CLA is able to change outputs.		
Pre-conditions:	The ITS-CLA is in control of the intersection. The output value of "exclOutputB" is "0".		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Change the output value of "exclOutputB" from "0" to "71"		
2.	Verify that the output value of "exclOutputB" in the TLC changes to "71".		
3.	Change the output value of "exclOutputB" to 0.		
4.	Verify that the output value of "exclOutputB" in the TLC changes to "0".		
Tested by:		Date:	

8.2.1.5 Change variables.

Test Case:	Change variables.		
ID:	SC1.CLA.05.HA		
Objective:	Verify that the ITS-CLA is able to change variables.		

Pre-conditions:	The ITS-CLA is in control of the intersection.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Change the value and lifetime of variable “varA” from “0” to “5”.		
2.	Verify that that the value of “varA” changes to value “5” and keeps this value for the duration of the lifetime.		
Tested by:		Date:	

8.2.1.6 Obtain updates of TLC State Objects.

Test Case:	Obtain updates of TLC State Objects.		
ID:	SC1.CLA.06.HA		
Objective:	Verify that the ITS-CLA obtains updates of TLC State Objects.		
Pre-conditions:	The ITS-CLA is in control of the intersection.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Change the state of detector “d5” from “Unoccupied” to “Occupied” and vice versa.		
2.	Verify in the ITS-CLA that the detector state of detector “d5” changes to the requested detector state.		
3.	Change the faultstate of a detector to each of the possible values. (Possible values are: None, TooLongUnoccupied, TooLongOccupied, Flutter and HardwareError.)		
4.	Verify in the ITS-CLA that the detector faultstate changes to the requested state.		
5.	Change the swico state of a detector to each of the possible values. (Possible values are: NoSwico, SwicoOff, SwicoOn.)		
6.	Verify in the ITS-CLA that the detector swico state changes to the requested state. And verify that the state of the detector changes according to the swico state.		
7.	Send a pre-defined speed detection event from detector “ds2” to the ITS-CLA with the characteristics below. - speed = 25		

	- Length = 10		
8.	Verify that the message arrives at the ITS-CLA and that its contents match with the contents of the send message.		
9.	Send a pre-defined SpecialVehicleEvent to the ITS-CLA with the characteristics as specified below: <ul style="list-style-type: none"> - Announcement = Check-in - Vehicle = Bus - SG = fc02 - distToStopline = 1500 - lineNr = 102 - journeyCat = PublicJourney - punctuality = OnTime - punctualityTime = 0 - Status = Driving - speed = 30 - Length = 12 		
10.	Verify that the message arrives at the ITS-CLA and that its contents match the contents of the pre-defined message that was send.		
Tested by:		Date:	

8.2.1.7 Signalgroup predictions.

Test Case:	Signalgroup predictions.		
ID:	SC1.CLA.07.HA		
Objective:	Verify that the ITS-CLA sends signalgroup predictions.		
Pre-conditions:	The ITS-CLA is in control of the intersection.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Verify that the ITS-CLA sends signalgroup predictions (time+state).		
2.	Verify the consistency between prediction of the current state and the current requested state.		
Tested by:		Date:	

8.2.2 Handover

8.2.2.1 The TLC requests the ITS-CLA to handover control.

Test Case:	The TLC requests the ITS-CLA to handover control.		
ID:	SC2.CLA.01.HA		
Objective:	Verify if the ITS-CLA cooperates effectively to realize an application control handover by the TLC.		
Pre-conditions:	The ITS-CLA is in control of the intersection and supports cleared handover.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Initiate a handover request to the ITS-CLA.		
2.	Verify that the ITS-CLA has acknowledged the handover request by releasing Control of the intersection within the EndControl timeout. (180 seconds)		
Tested by:		Date:	

8.2.3 Exceptions

8.2.3.1 ITS-CLA de-registers from TLC.

Test Case:	ITS-CLA de-registers from TLC.		
ID:	SC1.CLA.01.EXC		
Objective:	Verify that the ITS-CLA voluntary and gracefully ends a session with the TLC.		
Pre-conditions:	The ITS-CLA is in control of the intersection.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Initiate a de-register in the ITS-CLA		
2.	Verify that the ITS-CLA has send a de-register request.		
3.	Verify that the ITS-CLA closes the socket/session.		
Tested by:		Date:	

8.2.3.2 TLC de-registers the ITS-CLA session (soft-restart, revoke authorization).

Test Case:	TLC de-registers the ITS-CLA session (soft-restart, revoke authorization)		
ID:	SC1.CLA.02.EXC		
Objective:	Verify that the ITS-CLA gracefully ends a session with the TLC.		
Pre-conditions:	The ITS-CLA is in control of the intersection.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Initiate a de-register of the ITS-CLA by causing a revoke authorization resulting in a soft-restart of the TLC.		
2.	Verify that the ITS-CLA is aware of the restart (de-register) request. (The connection will be closed anyway by the TLC.)		
3.	Verify that the ITS-CLA follows the back off procedure. (connect retries)		
4.	Verify that the ITS-CLA reconnects to the TLC and normal power up procedure is followed. Resulting that the ITS-CLA is in control of the intersection.		
Tested by:		Date:	

8.2.3.3 Disconnect of the ITS-CLA.

Test Case:	Hard TLC disconnect from ITS-CLA		
ID:	SC1.CLA.03.EXC		
Objective:	Verify that the ITS-CLA follows back off procedure.		
Pre-conditions:	The ITS-CLA is in control of the intersection.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Power off the TLC.		
2.	Verify that the ITS-CLA follows the back off procedure. (connect retries)		
3.	Power on the TLC.		
4.	Verify that the ITS-CLA reconnects to the TLC and normal power up procedure is followed. Resulting that the ITS-CLA is in control of the intersection.		
Tested by:		Date:	

8.2.3.4 Configuration mismatch.

Test Case:		Configuration mismatch	
ID:		SC1.CLA.04.EXC	
Objective:		Verify the correct behavior of the ITS-CLA if the configuration does not match.	
Pre-conditions:		A valid network configuration between TLC and ITS-CLA is in place. The ITS-CLA is switched off and the TLC is in standby state. The configuration of the ITS-CLA does not match with the TLC because it is configured with an invalid intersection name: "TINT8" instead of "TINT1".	
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Switch on the ITS-CLA.		
2.	Verify that the ITS-CLA is not ready to control and switches to the error state.		
3.	Resolve the configuration mismatch.		
4.	Verify that the ITS-CLA leaves the error state.		
5.	Verify that the ITS-CLA will follow the normal startup procedure and gets in control of the intersection.		
Tested by:		Date:	

8.2.3.5 The TLC doesn't follow ITS-CLA control requests

Test Case:		The TLC doesn't follow ITS-CLA control requests	
ID:		SC1.CLA.05.EXC	
Objective:		Verify the correct behavior of the ITS-CLA if control requests are not followed.	
Pre-conditions:		The ITS-CLA is in control of the intersection.	
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	In the TLC stop sending responses to the ITS-CLA requests.		
2.	Verify that the ITS-CLA logs the request errors.		
3.	Verify that the ITS-CLA will end control of the intersection by a pre-defined method. (handover, offline or deregister)		

Tested by:		Date:	
-------------------	--	--------------	--

8.2.3.6 Time shift of TLC

Test Case:	Time shift of TLC.		
ID:	SC1.CLA.06.EXC		
Objective:	Functional behavior of the ITS-CLA is independent of the TLC's UTC time.		
Pre-conditions:	The ITS-CLA is in control of the intersection.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	In the TLC, change the UTC time. (current time + 01.25.43 [hh:mm:ss])		
2.	<u>Verify</u> that there is no change in behavior of the ITS-CLA.		
Tested by:		Date:	

8.2.3.7 Communication disruption (physical).

Test Case:	Communication disruption (Physical).		
ID:	SC1.CLA.07.EXC		
Objective:	The ITS-CLA is robust against communication disruptions caused by network (hardware) failure.		
Pre-conditions:	The ITS-CLA is in control of the intersection.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Disconnect and restore the Ethernet connection within the alive check interval (5 seconds, 2*2,5).		
2.	Verify that the ITS-CLA continues normal operation without fatal errors.		
3.	Disconnect the Ethernet connection for more than the alive check interval (5 seconds, 2*2,5).		
4.	Verify that the ITS-CLA deregisters, it terminates the connection and then tries to reconnect using the follows back-off procedure.		
5.	Restore the Ethernet connection.		
6.	Verify that the communication is restored, the ITC-CLA reconnects and receives back control, of the intersection.		
Tested by:		Date:	

8.3 IVERA-APP

In this scenario basic functionality of the IVERA-APP interface will be tested. The tests cover basic functionality needed for normal operation. It is not intended to test all IVERA requirements. For all tests a TCP/IP based (terminal) tool is available for communication and verifying the results.

8.3.1 Protocol

8.3.1.1 Establish an IVERA-APP connection.

Test Case:	Establish an IVERA-APP connection.		
ID:	SC1.IVA.01.HA		
Objective:	Verify that an IVERA client (IVERA test tool) is able to connect to the ITS-CLA.		
Pre-conditions:	The IP address and port number of the ITS-CLA IVERA-APP interface are known.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Establish a connection (using the IVERA test tool) with the ITS-CLA. Use the IP address of the ITS-CLA and the port number where the IVERA-APP interface is available.		
2.	Verify that the connection is accepted by the ITS-CLA.		
Tested by:		Date:	

8.3.1.2 Login on the IVERA-APP interface.

Test Case:	Login on the IVERA-APP interface.		
ID:	SC1.IVA.02.HA		
Objective:	Verify that the ITS-CLA accepts a login with valid credentials.		
Pre-conditions:	A connection with the ITS-CLA has been established. Login credentials for all login levels are known.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Login with valid credentials. (e.g: User: "iKantonnier", Password: "K.nt.nn..r".		
2.	Verify that the login is accepted.		
Tested by:		Date:	

8.3.1.3 Mandatory objects.

Test Case:	Mandatory objects.		
ID:	SC1.IVA.03.HA		
Objective:	Verify that all mandatory objects are available and can be read by the IVERA client.		
Pre-conditions:	A session with the ITC-CLA is established. (connected and logged in)		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Query the object dictionary.		
2.	<u>Verify</u> that all mandatory objects are present. (Mandatory objects are: TLC.I, TLC, APPID, APPIFLOC, APPVER and APPVER.I)		
Tested by:		Date:	

8.3.1.4 Object attributes.

Test Case:	Object attributes.		
ID:	SC1.IVA.04.HA		
Objective:	Verify that the static properties of object attributes are according IVERA specification. See [Ref 6]		
Pre-conditions:	A session with the IVERA-APP is established. (connected and logged in)		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	For all available objects query its attributes.		
2.	<u>Verify</u> for each object response that the attribute properties match the IVERA specification. (Note: Add a copy of the logfile to the test report to show which objects have been verified.)		
Tested by:		Date:	

8.3.1.5 Object read.

Test Case:	Object read.		
ID:	SC1.IVA.05.HA		
Objective:	Verify that IVERA objects produce valid output by testing at least one (mandatory) object.		
Pre-conditions:	A session with the IVERA-APP is established. (connected and logged in)		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	For the object "APPVER" query the complete object content.		
2.	<u>Verify</u> for the object response that the syntax is valid according to its object specification/attributes.		
Tested by:		Date:	

8.3.1.6 Object read range.

Test Case:	Object read range.		
ID:	SC1.IVA.06.HA		
Objective:	Verify that IVERA objects produce valid output according to their range by testing at least one (mandatory) object.		
Pre-conditions:	A session with the IVERA-APP is established. (connected and logged in)		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	For the object "APPVER" query the object contents by: <ul style="list-style-type: none"> - One index - Index range - One name - Name range 		
2.	<u>Verify</u> for the object response that the syntax is valid according to its object specification/attributes.		
3.	<u>Verify</u> for this object that the response covers the queried range.		
Tested by:		Date:	

8.3.1.7 Object write.

Test Case:	Object write		
ID:	SC1.IVA.07.HA		
Objective:	Verify that IVERA objects correctly react to changes written to them by testing at least one (mandatory) object.		
Pre-conditions:	A session with the IVERA-APP is established. (connected and logged in as administrator)		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	For the object "ITSAPP" write changes with respect to the object's specification.		
2.	<u>Verify</u> for the object response that the syntax is valid according to its object specification/attributes.		
Tested by:		Date:	

8.3.1.8 Object write range.

Test Case:	Object write range.		
ID:	SC1.IVA.08.HA		
Objective:	Verify that IVERA objects correctly react to changes written to them by testing at least one (mandatory) object.		
Pre-conditions:	A session with the IVERA-APP is established. (connected and logged in as administrator)		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	For the object "ITSAPP" write changes with respect to the object's specification via: <ul style="list-style-type: none"> - One index - Index range - One name - Name range 		
2.	<u>Verify</u> that the syntax of the response is according to its object specification.		

8.3.1.9 Trigger-events

Test Case:	Trigger events		
ID:	SC1.IVA.09.HA		
Objective:	Trigger events are send when applicable.		
Pre-conditions:	A session with the IVERA-APP is established. (connected and logged in)		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Trigger an event in the ITS-CLA which in turn triggers an IVERA event.		
2.	Verify that the event is received in the terminal tool.		

8.3.1.10 Group access rights

Test Case:	Group access rights		
ID:	SC1.IVA.10.HA		
Objective:	Access of objects is restricted by group policy		
Pre-conditions:	A session with the IVERA-APP is established.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	For each group (login level) read and write all objects if permitted by the group policy.		
2.	Verify that the objects can be read and written.		

8.3.2 Exceptions

8.3.2.1 User login with non-valid credentials.

Test Case:	User login with non-valid credentials.		
ID:	SC1.IVA.01.EXC		
Objective:	Verify correct behavior and response when a user attempts to login with non-valid credentials.		
Pre-conditions:	A connection with the ITS-CLA has been established.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS

1.	Login with non-valid credentials. See the table below for the user/password combinations.		
2.	Verify that the access to the interface is denied with the correct error response.		
3.	Repeat step 1 and 2 for all combinations listed in the table below.		

Username	Password	Comment
iWronguser	iL0gin4You!	Wrong username
iAdmin	iWrongpassword	Wrong password
iWronguser	iWrongpassword	Wrong username and password

8.3.2.2 No access rights.

Test Case:	No access rights		
ID:	SC1.IVA.02.EXC		
Objective:	Verify the IVERA-APP behavior when a user attempts to read/write an object for which it has no access rights.		
Pre-conditions:	User "iWereld" with limited access rights is logged in.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Write to the object "TLC". (Current user has no access rights to write this object.)		
2.	Verify that the request is not executed and the correct error response is given.		

8.4 V-Log 3.0

For all V-Log test cases, it is assumed that at least a TCP/IP terminal tool is available that is capable of capturing the V-Log stream. It is recommended that a V-Log monitoring tool is available for parsing and validating messages and real-time crc calculation.

8.4.1.1 Connection setup.

Test Case:	Connection setup.		
ID:	SC1.VLG.01.HA		
Objective:	Verify that V-log is available at TCP/IP port 7001 and that only one concurrent connection is allowed.		
Pre-conditions:	A valid network configuration is in place. The ITS-CLA is operational and generates V-Log events.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Connect with the TCP/IP monitor tool to the V-Log port.		
2.	Verify that the connection is established and V-Log stream starts.		
3.	Initiate a second connection to the V-Log port.		
4.	Verify that the second connection is refused and that the existing V-Log stream continues.		

8.4.1.2 Message availability and message syntax.

Test Case:	Message availability and message syntax.		
ID:	SC1.VLG.02.HA		
Objective:	Verify that a V-Log message is available in correct syntax. Note: only one sample is verified.		
Pre-conditions:	A connection with the V-LOG interface is established.		
STEP	DESCRIPTION	PASS / FAIL	REMARKS/ACTIONS
1.	Set detector d2 from “unoccupied” to “occupied”.		
2.	Verify that a detector message is present in the V-Log stream with the correct detector ID and status.		

APPENDIX 1: Requirements traceability

This section provides a statement of the compliance of this test specification with the Beter Benutzen Vervolg, project iVRI, Deliverable G2, IRS TLC Facilities Interface v1.2, jan 2016 (see [Ref 2])

The following statements are made for compliance with a requirement:

- C = Covered
- P = Partially covered
- N = Not covered

A list of sections in this document in which the requirement is supported is listed and a comment describing the compliance statement.

Requirement	Compliance	Sections	Comments
IRS-TLCFI-TIME-001	C	8.2.1.1	
IRS-TLCFI-PROT-001	C	8.2.1.1	Implicit.
IRS-TLCFI-PROT-002	N		There has been decided to have all communication use TLS. This means non-secure access is impossible.
IRS-TLCFI-PROT-003	C	8.2.1.1	
IRS-TLCFI-COM-001	C	8.2.1.1	Implicit.
IRS-TLCFI-COM-002	C	8.2.1.1	
IRS-TLCFI-COM-003	N		Not applicable to ITS-A.
IRS-TLCFI-COM-004	N		An ITS-A cannot provide an update interval. Not supported by TLC-FI.
IRS-TLCFI-COM-005	P	8.2.1.1	Filtering based on type and subset of object ids. Other filters as proposed in IRS-TLCFI-

			COM-005 are not supported in TLC-FI.
IRS-TLCFI-COM-006	N		No pre-defined filters supported by TLC-FI
IRS-TLCFI-REG-001	C	8.2.1.1	Registration denied is out of scope for an ITS-A (is TLC behaviour)
IRS-TLCFI-REG-002	N		Not applicable to ITS-A
IRS-TLCFI-REG-003	N		No priority levels
IRS-TLCFI-REG-004	C	8.2.3.1	
IRS-TLCFI-REG-005	C	8.2.3.2	
IRS-TLCFI-REG-006	C	8.2.3.3	
IRS-TLCFI-REG-007	C		Not applicable to ITS-A
IRS-TLCFI-ICA-REG-001	C	8.2.1.1	Implicit
IRS-TLCFI-ICA-AD-001	C	8.2.1.1	Implicit
IRS-TLCFI-ICA-AD-002	C	8.2.1.1	Scope is ITS-A behaviour only
IRS-TLCFI-ICA-AD-003	C	8.2.3.2	Scope is ITS-A behaviour only
IRS-TLCFI-ICA-AD-004	C	8.2.3.1	Scope is ITS-A behaviour only
IRS-TLCFI-ICA-AD-005	N		Not applicable for ITS-A
IRS-TLCFI-ICA-AD-006	N		Not applicable to ITS-A
IRS-TLCFI-ICA-AD-007	N		Not applicable to ITS-A
IRS-TLCFI-TIF-OD-001	N		Not applicable to ITS-A
IRS-TLCFI-TIF-OD-002	N		Not applicable to ITS-A
IRS-TLCFI-TIF-OD-003	N		Not applicable to ITS-A

IRS-TLCFI-TIF-OD-004	N		Not applicable to ITS-A
IRS-TLCFI-TIF-OD-005	N		Not applicable to ITS-A
IRS-TLCFI-TIF-OD-006	N		Not applicable to ITS-A
IRS-TLCFI-TIF-OM-001	N		Not supported by TLC-FI
IRS-TLCFI-TIF-OM-002	C	8.2.1.1	Implicit
IRS-TLCFI-TIF-OM-003	C	8.2.1.1	Implicit
IRS-TLCFI-TIF-OM-004	N		Not supported by TLC-FI
IRS-TLCFI-TIF-OT-001	C	8.2.1.1 8.2.1.1 8.2.1.3 8.2.1.48.2.1.5 8.2.1.6 8.2.1.7	
IRS-TLCFI-TIF-OT-002	N		Not applicable to ITS-A
IRS-TLCFI-TIF-OT-003	P	8.2.1.1 0	The ITS-CLA is not informed of a higher priority request
IRS-TLCFI-TIF-OT-004	P	8.2.1.1 8.2.1.3 8.2.1.7	Object doesn't contain: <ul style="list-style-type: none"> - Internal signal group state (including format) - Reason for deviation from external state - Fault state (deadlock, lamps) - Special function variables and status Meta: <ul style="list-style-type: none"> - Type (vehicle, bicycle, pedestrian, tram) - Related detectors

IRS-TLCFI-TIF-OT-005	C	8.2.1.1 8.2.1.3 8.2.1.7	
IRS-TLCFI-TIF-OT-006	C	8.2.1.7	Scope is ITS-A behaviour only
IRS-TLCFI-TIF-OT-007	P	8.2.1.6	Object doesn't contain: Meta: Type NoSwico is also present. Time of inactive also present.
IRS-TLCFI-TIF-OT-008	C	8.2.1.6	
IRS-TLCFI-TIF-OT-009	C	8.2.1.6	Scope is ITS-A behaviour only NoSwico is also present. Time of inactive state is also present.
IRS-TLCFI-TIF-OT-010	C	8.2.1.4	Scope is ITS-A behaviour only NoSwico is also present. Time of inactive also present.
IRS-TLCFI-TIF-OT-011	C	8.2.1.5	
IRS-TLCFI-TIF-OT-012	P	8.2.1.1	Objects don't provide: - Intersection topology data - ITS Application status (security concern) - TLC Capability classes
IRS-TLCFI-QA-PERF-001	N		Not a requirement for testing, just a definition
IRS-TLCFI-QA-PERF-002	N		Not applicable to ITS-A
IRS-TLCFI-QA-PERF-003	N		Not applicable to ITS-A
IRS-TLCFI-QA-PERF-004	N		Not applicable to ITS-A
IRS-TLCFI-QA-PERF-005	N		Not applicable to ITS-A

IRS-TLCFI-QA-PERF-006	N		Latency's not verified in FAT
IRS-TLCFI-QA-PERF-007	N		Latency's not verified in FAT
IRS-TLCFI-QA-AVAIL-001	C	8.2.3.7	
IRS-TLCFI-QA-AVAIL-002	N		Not supported by TLC-FI
IRS-TLCFI-QA-AVAIL-003	C	8.2.3.6	
IRS-TLCFI-QA-AVAIL-004	N		Relative ticks are independent of UTC.
IRS-TLCFI-QA-EVO-001	N		Not applicable to ITS-A
IRS-IVERA-01	C	N.A.	
IRS-IVERA-02	C	N.A.	
IRS-IVERA-03	C	N.A.	
IRS-IVERA-04	C	8.3.1.3	
IRS-IVERA-05	C	N.A.	
IRS-IVERA-06	C	N.A.	
IRS-IVERA-07	C	N.A.	
IRS-IVERA-08	C	8.3.1.1	
IRS-IVERA-09	C	8.3.1.9	
IRS-IVERA-10	C		
IRS-IVERA-11	C		
IRS-IVERA-12	C	8.3.1.3	
IRS-IVERA-13	C	8.3.1.2	
IRS-IVERA-14	C		
IRS-IVERA-15	C	N.A.	Covered through verifies

IRS-IVERA-16	C		Covered through verifies
--------------	---	--	--------------------------

APPENDIX 2: Use cases traceability

This section provides traceability of the use cases that are defined in the documents iVRI2_del_1ab_IDD_Generic-FI_v1.0 and iVRI2_del_1a_IDD_TLC-FI_v1.0. This can be used to see whether all defined use cases are tested.

The following statements are made for coverage of the given use cases:

- C = Covered
- P = Partially covered
- N = Not covered

A list of sections in this document in which the requirement is supported is listed and a comment describing the compliance statement.

Use case	Compliance	Sections	Comments
8.1 [Ref 3]	C	8.2.1.1	
8.2 [Ref 3]	P	8.2.3.1	Happy flow only
8.3 [Ref 3]	C	8.2.3.2	
8.4 [Ref 3]	C	8.2.1.1 8.2.3.7	
9.1 [Ref 3]	P	8.2.3.7	ID2 Not covered in FAT (no stress tests). ID3 Not applicable to ITS-A
9.2 [Ref 3]	C	8.2.1.1 8.2.3.2 8.2.3.7	ID1, ID2, ID5, ID6 Not applicable to ITS-A
9.3 [Ref 3]	N		Not applicable to ITS-A.
9.4 [Ref 3]	N		ID1 informational ID2 not covered in FAT
9.5 [Ref 3]	P	8.2.3.4 0	Implicit. Limited coverage.
7.1 [Ref 4]	C	8.2.1.1	

7.2 [Ref 4]	C	8.2.1.2 8.2.1.3 8.2.1.4 8.2.1.7	
7.3 [Ref 4]	C	8.2.2.1	Scope is ITS-A behaviour only
7.4 [Ref 4]	C		ITS-A goes offline. (stays registered)
7.5[Ref 3]	C		No scope for ITS-A
7.6 [Ref 4]	C	0 0	Exception 2 only happy flow.
7.7 [Ref 4]	C	8.2.1.3	
7.8 [Ref 4]	C	8.2.1.4	Scope is ITS-A behaviour only
7.9 [Ref 4]	C		
7.10 [Ref 4]	C	8.2.1.1 8.2.1.6	
7.11 [Ref 4]	C	8.2.1.1	
7.12 [Ref 4]	C	8.2.1.7	
7.13 [Ref 4]	C	8.2.1.5	
8.1 [Ref 4]	C	8.2.3.7	
8.2 [Ref 4]	P	8.2.3.7	Implicit
8.3 [Ref 4]	C	8.2.3.6	
8.4 [Ref 4]	C	8.2.3.2	ID2 is not applicable to ITS-A