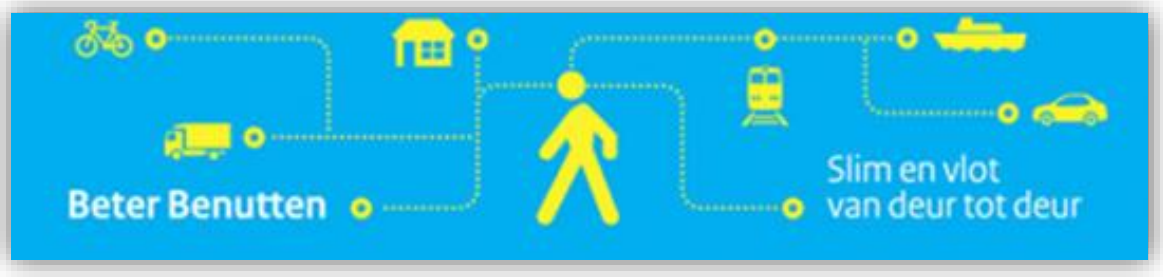
Innovatief Partnership

Talking Traffic

InterOperability RIS+TLEX

Cluster 1

Date	*09-03-2018*
Version	*2.0*
Company	Vialis
Cluster	*1*
Work package	*1*



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 IOP test specificatie voor de RIS+TLEX.

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

dynniq energising mobility

Royal HaskoningDHV Enhancing Society Together

swarco

Vialis Wij maken infrastructuur intelligent

SWECO

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	Comments	Checked / Approved by
0.1	20-06-2017	Rob Thijssen	Initial version IOP	
0.2	29-06-2017	Rob Thijssen	Adjusted version	
0.3	05-07-2017	Rob Thijssen	Internal review comments implemented	
0.4	10-07-2017	Rob Thijssen	External review comments implemented	
0.5	11-07-2017	Rob Thijssen	Testcases updated	
1.0	19-07-2017	Rob Thijssen	External review comments (partialy) implemented	
1.1	06-09-2017	Rob Thijssen	KeyPoint review comments (partialy) implemented	
1.2	07-12-2017	Mark Klarenbeek	KeyPoint review comments implemented, compatible with RIS-FI version 1.1	
1.3	26-01-2018	Mark Klarenbeek	Compatible with RIS-FI version 1.2	
1.4	01-03-2018	Mark Klarenbeek	Review comments implemented. Vialis logo updated. Many tests are obsolete and have been removed. This is due to them already being tested in 🕮 13. The ID's of the tests are mentioned so they will not be used for future tests.	
1.5	08-03-2018	Mark Klarenbeek	Review comments implemented	
2.0	09-03-2018	Mark Klarenbeek	Final	

CONTENT

2 Introduction

This document describes the Interoperability Test (IOP) of the Roadside ITS Station (RIS) in combination with the TLEX. order to verify the interoperability of/between the RIS and TLEX. In order to thoroughly test this, it is recommended to execute the RIS STD again on a test environment where actual system components are used, instead of simulated system components.

Because the TLEX is not connected to an actual Cluster 2 source, and the used intersection is not an actual intersection, no 'live' data can be used to feed the TLEX. Therefore, a C2 exerciser is used.

2.1 System overview

The iTLC architecture as shown in Figure 1 combines the ability to control traffic lights and the ability to communicate to ITS stations such as cars, busses etc.

Since not everything is covered in this RIS+TLEX IOP, the system(components) relevant for this IOP document have been highlighted green.

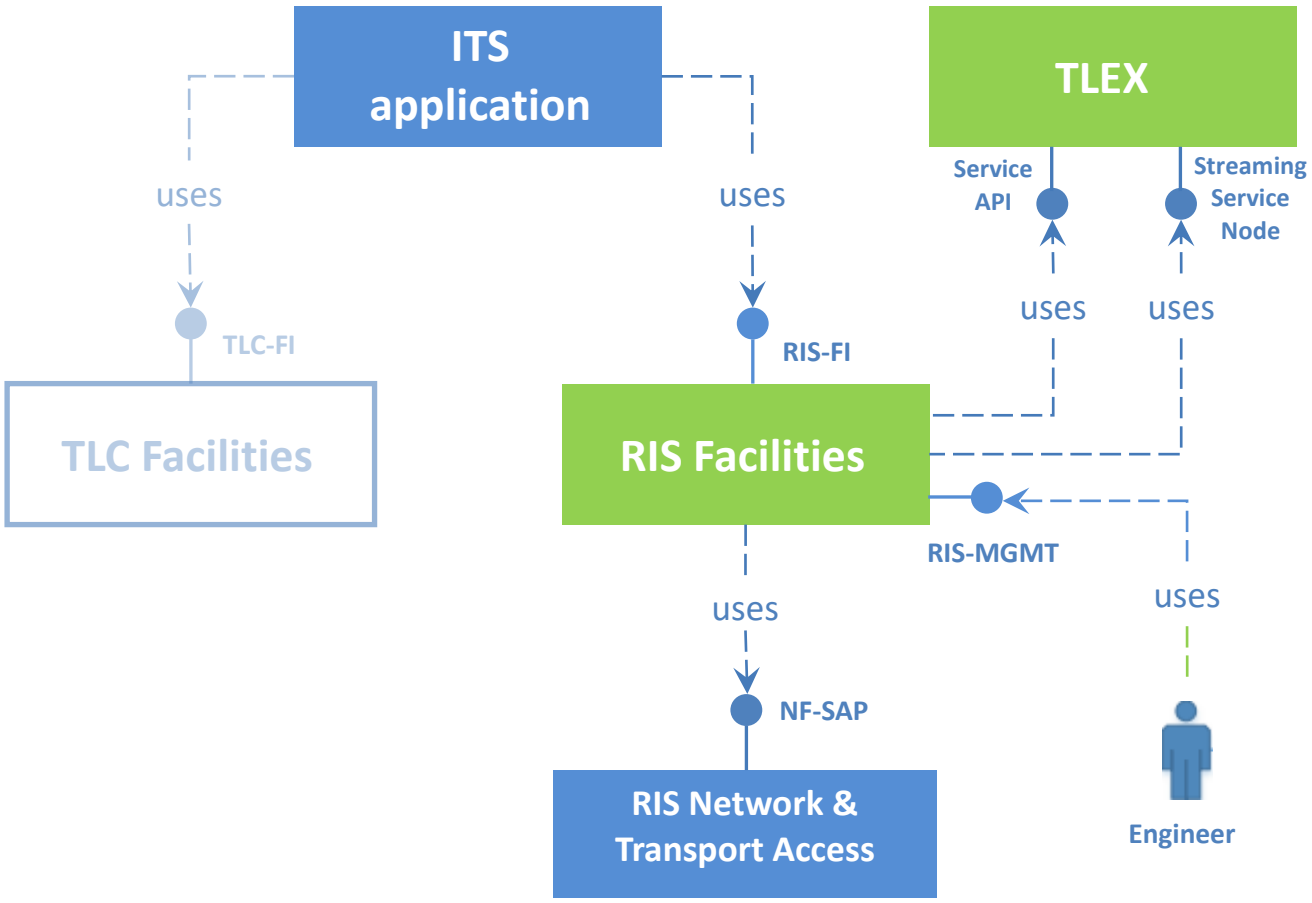


Figure 1: RIS in the iTLC system overview

It allows (external) ITS applications to control or monitor traffic lights via the TLC-FI interface. It also allows ITS applications to monitor or inform ITS stations via the RIS-FI interface. See 🕮 5 for an overview of the iTLC architecture.

The RIS can communicate with other ITS stations in the neighbourhood via C-ITS messages. The information received from ITS stations and the information received from ITS applications via the RIS-FI, is used to assemble a local view on the traffic situation.

Real time data from and to the iTLC is communicated through the RIS to TLEX data exchange point (overnamepunt), which enables data exchange between cluster 1 and cluster 2. See 🕮 4 for a description of the exchange point.

2.2 Scope

The scope of this document is limited to the the highlighted parts in Figure 1. The following is covered in the tests described in this document:

- The RIS functionality
- The RIS-FI interface
- The TLEX interface (4G/LTE, connected ITS)

The test cases described in this document are taken from the RIS STD. The IOP is ideally executed under different circumstances as the STD. During STD execution, data can be modified to be erroneous as documented in test cases. For this IOP, those test cases are not present as it is difficult in a situation in which actual systems or system components are used, to force erroneous situations to occur, other than pulling the network connection or the power connector. Therefore, it is recommended to first execute the STD, and then execute the IOP (which is the same as the STD, without the test cases that are not possible) afterwards.

2.3 Document overview.

2.3.1 Purpose

This document provides specifications for interoperability testing of the RIS+TLEX.

The suite of tests for the cluster one tests of TT is defined in the 🕮 6 *IPS-TT STP Cluster 1*. The document describes which software systems in cluster 1 are tested and to which document the systems have to comply.

Note: As the development is still ongoing this document is subject to change.

2.3.2 Document Structure

Following is the document structure:

Chapter 3 contains references to normative and informative documents

Chapter 4 explains acronyms and used definitions and concepts

Chapter 5 outlines the required test setup

Chapter 6 outlines guidelines for the execution of the test scenarios and the structure of the tests

Chapter 7 outlines the formal specification of the test cases

Appendix A contains the requirements traceability

Appendix B contains an overview for entering the test results

2.4 Advise for reader

The reader should be acquainted with the normative requirements (*§3.1*) before reading the test specification.

3 References

3.1 Normative

Ref.	Specification	Version	Date/Year
🕮 1	Beter Benutten Vervolg, project iVRI, Deliverable G1: IRS RIS-FI	1.2	27-01-2016
🕮 2	Beter Benutten Vervolg, project iVRI, Deliverable 1ab: IDD Generic-FI	1.1	02-12-2016
🕮 3	Beter Benutten Vervolg, project iVRI, Deliverable 1b: IDD RIS-FI	1.2	01-12-2017
🕮 4	SWARCO iVRI Overnamepunt v2.2 20170929	2.2	29-09-2017
🕮 5	Beter Benutten Vervolg, project iVRI, Deliverable F, iTLC Architecture, v1.2	1.2	27-01-2016
🕮 6	IPS-TT STP Cluster 1	1.4	06-10-2017
🕮 8	RFP Talking Traffic 1.1 Bijlage 7-Intersection Topology Format	1.2	20-06-2017
🕮 9	IRS Security v1.1	1.1	13-10-2016

3.2 Informative

Ref.	Specification	Version	Date/Year
🕮 10	Beter Benutten Vervolg, project iVRI, Deliverable 3f: Test strategy	1.2	6-12-2016
🕮 11	RFP Talking Traffic 1.1 Beter Benutten	1.1	1-07-2016
🕮 12	ETSI TS 102 894-2 v1.2.1	1.2.1	2014-09
🕮 13	IPS-TT RIS STD – v2.0 final	2.0	22-02-2018

4 Acronyms and abbreviations

Item	Description
CAM	Cooperative Awareness Message
BBV	Beter Benutten Vervolg: Program for standardization of interfaces with TLCs for connected and cooperative functionality
DENM	Decentralized Environmental Notification Message.
ETSI	European Telecommunications Standards Institute
IDD	Interface Design Description.
IRS	Interface Requirements Specification
iTLC	Intelligent TLC performing traffic light controller functions and allowing for ITS applications.
IOP Test	Interoperability Test
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
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.
C-ITS	ITS messages broadcasted over the 5GHz radio band supporting GeoNetworking, as specified by ETSI.
MAP	Message to convey the current road topology to road-users, often used in conjunction with SPAT
OWASP	Non-profit organisation dedicated to secure software development.
RIS	Roadside ITS Station
RIS-FI	RIS Facilities Interface
RIS-MGMT	RIS Management Interface
SPAT	Signal Phase and Timing (message providing traffic light information).
TLS	Transport Layer Security
TTCN-3	Testing and Test Control Notation Version 3
ITS Station	Functional entity specified by the ITS station reference architecture (see ETSI EN 302 665, V1.1.1)
ITS-A	ITS Application
ITS-CLA	ITS Control Application
ITS-CRA	ITS Consumer Application
ITS-PRA	ITS Provider Application
TLEX	Traffic Light EXchange platform, broker for exchanging C-ITS messages between cluster one and two
Talking Traffic	Partnership of service providers within the framework of the Call, aimed at the development and operation of Services to implement Use Cases
SSM	Signal Status Message; the state of a priority request.
SRM	Signal Request Message; a priority request.
JSON	JavaScript Object Notation
Wireshark	Network protocol analyser tool
DSRC	Dedicated Short Range Communication message set (defined in SAE J2735:2016)
GeoNetworking	Network layer protocol that provides packet routing in an ad hoc network based on geographic location, used in the IEEE 802.11p
IEEE 802.11p	IEEE standard for adding wireless access in vehicular environments to the WIFI protocol (WIFI-P), base of the ETSI ITS-G5
WIFI-P	The IEEE 802.11p protocol
LDM	Local Dynamic Map, holds the overall view on the traffic state in the area that the Roadside ITS Station (RIS) covers
NMAP	Network Mapper, is an open source tool for network exploration and security auditing.

5 Test Setup

5.1 Introduction.

This section describes the test setup and is an advisory on the test environment.

5.2 Test setup

The device under test is the combination of the RIS+TLEX, as defined in figure 2. Because both the RIS and the TLEX need to be stimulated, exercisers are being used.

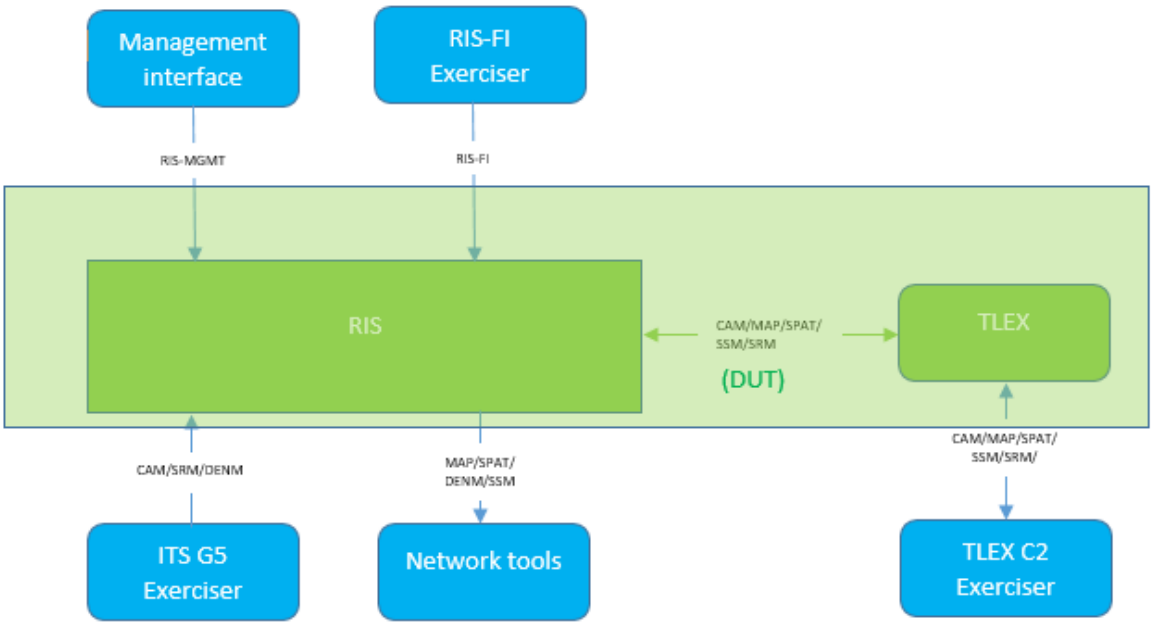


Figure 2: Test setup

For testing session disconnection during (soft) reset it must be possible to do an actual (soft) reset of the RIS.

Prior to the test, TLS certificates need to be available and deployed on the RIS.

5.2.1 RIS-FI exerciser

For testing the RIS-FI interface a RIS-FI Exerciser is required. This is a non-standard software component able to communicate via the RIS-Interface and has functionality to test the interface.

The RIS-FI exerciser can:

- connect to a RIS using the RIS-FI interface
- maintain a connection to the RIS (implements the required state machine)
- connect using TLS 1.2
- update the RIS-FI protocol version in JSON message for testing version control
- send a customised JSON message
- Implement the full RIS-FI
- revoke the session with the RIS.
- enable / disable the keep alive mechanism

Optional the RIS-FI Exerciser can:

- show and / or log received RIS-FI messages
- The RIS-FI exerciser will act as one of the following ITS Application (ITS-A) types:
  - ITS-CRA, ITS Consumer Application
  - ITS-PRA, ITS Provider Application

5.2.2 TLEX Test Domain

The exchange point TLEX provides a test domain for each vendor (see 🕮 4) to test his RIS against. The RIS exchanges received C-ITS messages with the TLEX.

5.2.3 TLEX C2 Exerciser

The TLEX point is the bridge between the clusters 1 and 2 (see 🕮 11) parties. To test if the RIS has correctly exchanged C-ITS messages to the TLEX, a TLEX C2 Exerciser is needed. This Exerciser receives and sends messages to the RIS and acts as a cluster 2 broker.

The TLEX C2 Exerciser can:

- Receive and send C-ITS messages from and to the RIS via the TLEX interface

Optional the TLEX C2 Exerciser can:

- Log exchanged messages

5.2.4 Management Interface

As mentioned in (🕮 5) the RIS-MGMT (Roadside ITS Station Management) interface is mandatory for the RIS, but not specified. The vendor has to provide the details of the interface and the required access codes.

The RIS maintains several log files containing errors and significant events about the operation of the RIS. At least the following is logged:

- registration attempts and result
- role switches
- SPAT-performance (SPAT data availability)
- information about transmitted and received ITS-G5 messages (may contain message content as well)

These log files can be accessed by using the Management Entity.

5.2.5 C-ITS exerciser

The C-ITS exerciser is capable of sending CAM, SRM and DENM messages to the RIS via the connected network in order to emulate the NF-SAP shown in Figure 1: RIS in the iTLC system overview.

The C-ITS exerciser can:

- Generate CAM, SRM and DENM messages

Optional the C-ITS exerciser can:

- Log exchanged messages

5.2.6 Network tools

Monitoring of the messages transmitted by the RIS (MAP, SPAT and SSM) can be done by using a network protocol analyser like Wireshark for which plugins are available to decode the C-ITS messages.

The following tools are used for verifying network traffic and security auditing

Tool	URL	Description
Wireshark	https://www.wireshark.org/	Network protocol analyser
nmap	https://nmap.org/	Nmap ("Network Mapper") is an open source tool for network exploration and security auditing.

Table 1: Network tools

5.2.7 Test Automation Tools

With the use of automated testing tools test cases can be executed in a predefined timely matter. It is also more convenient to test exceptions and timing behavior.

The ETSI provides ITS tests for the GeoNetworking (ITS-G5), described in the TTCN-3 language (Testing and Test Control Notation Version 3), available at the following location:

http://forge.etsi.org/websvn/listing.php?repname=ITS.ITS&

This can be used as a base for creating automated tests in which the RIS-FI exerciser, C-ITS exerciser and the TLEX C2 Exerciser functionality can be combined.

Especially the tests described in *7.4.1 Additional Case: Performance tests* can best be done using automated tests.

Note: Multiple tests are available where objects have a lifetime which is of effect for the next step of the test case. These can be best done using automated testing. If no automated testing is done, assure, prior to starting the test, that the test can be performed within the configured time frame.

5.3 Test configuration

5.3.1 Topology format

The topology is provided by an external source in the format described in 🕮 *8 Talking Traffic 1.1, Appendix 7: Intersection Topology Format*. It cannot be configured through the RIS-FI interface but the RIS has to be able to import the configuration file.

The configuration has to be mapped to the **Intersection** object which describes the topology of an intersection in the RIS. The vendor has to deliver the details on how to configure the initial topology in the RIS.

The RIS topology file will be provided with the STD.

5.3.2 Test intersection topology

The intersection topology used in the test cases is taken from 🕮 *12 iVRI test strategy v1.2* from *Appendix B,* which is referred to as TINT1.

Following is an overview of the topology:

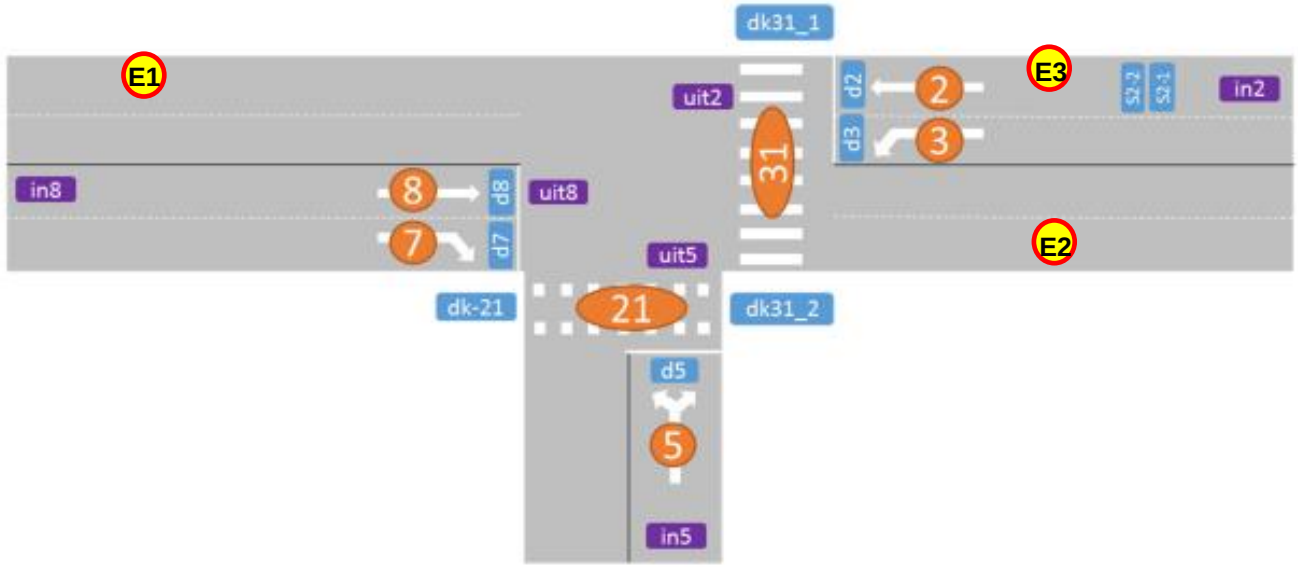


Figure 3: Test intersection topology

The defined paths (roads) are connected in the following way:

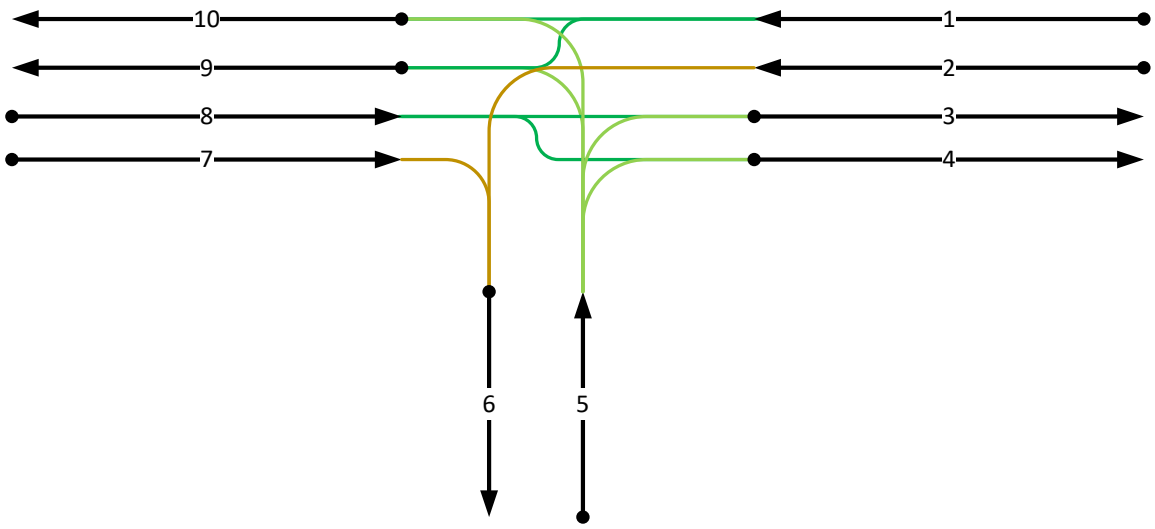


Figure 4: Intersection paths and connections

The paths are about 200 meters long and the following path connections are made:

- 1 to 10 and 9
- 2 to 6
- 5 to 10, 9, 3 and 4
- 7 to 6
- 8 to 3 and 4

For testing of event positions the following are allocated on the intersection:

Reference	Type	Description
E1	eventPosition	E1 is 100 meter to the left from the intersection centre on path 10, indicated in Figure 3: Test intersection
T1	trace	T1 contains two paths: P1 starts 50 meters before E1 until E1 P2 starts from E1 until 10 meters after E1
T2	trace	T2 contains two paths: P1 start 150 meters before E1 until E1 P2 start from E1 until 100 meters after E1
E2	eventPosition	E2 is 20 meter to the right from the intersection centre on path 4 indicated on Figure 3: Test intersection
T3	trace	T2 contains two paths: P1 start 150 meters before E2 until E2 P2 start from E2 until 100 meters after E2
E3	eventPosition	E3 is 100 meter to the right from the intersection centre on path 1 indicated on Figure 3: Test intersection
T4	trace	T2 contains three paths: P1 start 150 meters before E3 until E3 P2 start from E3 until 50 meters after E3 P3 start from P2 until 20 meters after P2

Table 2: Events reference

For mapping vehicles on the topology absolute GPS coordinates are required and will be provided in the topology file.

Note: WGS84 coordinates will be provided after the configuration is available.

5.3.3 User accounts

In table 3 the user accounts that will be used during the tests are given.

User	Password	Application Type
Provider1	Pr.v.d.r1	Provider
Provider2	12345678901234567890123456789O	Provider
Provider3	My.p@ssw0rd4	Provider

Consumer1	Password1	Consumer
Consumer2	Password2	Consumer
Consumer3	L0gin4You!	Consumer

Table 3: RIS user accounts

Following are the default **RegistrationRequest** fields if not provided in the test:

version := {1,2,0},

uri := "http://www.<your_company>/tester" or http://www.<ip>:<port>

5.3.4 Default network ports

The default network ports of the RIS are given in the table below.

Facilities	Port
RIS Facilities (TLS)	12001
RIS Facilities (no security)	12501

Table 4: Default network protocol ports

These are not mandatory and can differ from the actual implementation. If ports other than default are used, note them in the test results.

5.3.5 Messages defaults

For generating CAM messages the following default values will be used, unless stated otherwise in the test case (units as defined in 📖12):

generationDeltaTime = calculated from current system time stationType = StationType_passengerCar_(5) referencePosition = TINT1 Intersection reference position. altitude.altitudeValue = unavailable(800001) heading: o headingValue = 2700 (270 degrees) o headingConfidence = 10 (1 degree) speed: o speedValue =1250 (12,5 m/s) o speedConfidence = 5 (cm/s) driveDirection = forward(0) vehicleLength: o vehicleLengthValue =50 (5 meter), o vehicleLengthConfidenceIndication = noTrailerPresent (0) vehicleWidth = 20 (2 meter) longitudinalAcceleration: o longitudinalAccelerationValue = unavailable (161) o longitudinalAccelerationConfidence = unavailable (102) curvature: o curvatureValue = unavailable(30001) o curvatureConfidence = unavailable (7) curvatureCalculationMode = unavailable (2) yawRate: o yawRateValue = straight (0) o yawRateConfidence = unavailable (8) vehicleRole = default(0) exteriorLights = 00000000 pathHistory[0] = referencePosition

Table 5 : Default CAM values

For generating SRM messages the following default values will be used, unless stated otherwise in the test case (units as defined in 📖12):

timeStamp = calculated from current system time second = calculated from current system time sequenceNumber = 1

requests[0]:
- request
  - id.region = TINT1 Intersection region
  - id.id = TINT1 Intersection id
  - requestID = 100
  - requestType = priorityRequest(1)
  - inboundLane = { lane = 1 }
- minute = calculated from current system time + 10s
- second = calculated from current system time + 10s
- duration = 0

requestor:
- id.stationID = identical to stationID of the CAM
- type.role = basicVehicle(0)
- type.subrole = requestSubRoleUnKnown(0)

Table 6 SRM defaults

For all C-ITS messages goes that, if not specified in the test, the mandatory fields have to be added and default values have to be provided.

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. The tests are organized by interface and use case as follows:

- Test scenarios
  - Interface
    - Use Case(s)
      - Test case(s)
        - Test step

Procedures already tested in a use case, are assumed to be known and functional and can be used as a pre-condition of a test case in another use case.

The following test scenarios are defined under test scenarios:

Interface	Paragraph	Description
TLEX	§ 7.2	Defines the basic tests to establish and maintain the connection with the TLEX by the RIS
RIS-FI	§ 7.3	The functional use cases described in 🕮 3 §8 are used. Optional test cases are added to verify functionality not covered in the use cases, but which are closely related to the topic.
Generic-FI	§ 7.4	The RIS-FI is built upon the Generic-FI. Functionality from the generic-FI, not already covered in the RIS-FI tests, are handled in this section. The functional use cases are taken from 🕮 2 §8. Additional Performance and security tests are added.

Table 7 : Test scenarios overview

Where possible, test steps are added for verifying compliance to:

- 🕮 5 iTLC Architecture
- 🕮 10 IRS security

6.3 Assumptions and constraints

Most of the tests are done with a limited number of objects in the LDM of the RIS. It is not necessary to have a large number of objects in the LDM for testing the RIS-FI interface object content. Performance tests are designed to use the maximum number of entities as described in the IRS.

6.4 Execution

The tests are executed in the documented order. No alternations should be made to the device under test (the RIS) 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.

6.5 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			
2			
3			
4			
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 : Number of the step.
- DESCRIPTION : A description of the actions to be executed and a description of the items to be verified.
- PASS/FAIL : The result of the test is either PASS or FAIL
- REMARKS/ACTIONS : Remarks and actions related to the test results. In case of a FAIL the actual result can be logged as also the registration number of the issue that is discovered & logged during the test.
- Tested by : Person who executed the test case.
- Date : The date at which the test case was executed.

6.6 Conventions

Throughout the test case different text styles are used.

Actions are presented in bold and underscored as follows:

Verify an empty result is returned with a subscription id, different than the previous one

Note the received **subscription** ID: _____

Object names are presented in bold and shown in the font that is shown in the following example:

The **VehicleRole** is **publicTransport**

6.6.1 Connected

For the “Beter Benutten” project the RIS has to comply to the connected method for exchanging messages. In this case, all tests have to be done using a connection to the TLEX service.

The C-ITS messages send by the RIS are verified at the TLEX C2 Exerciser and messages send by an ITS Station are send by TLEX C2 Exerciser.

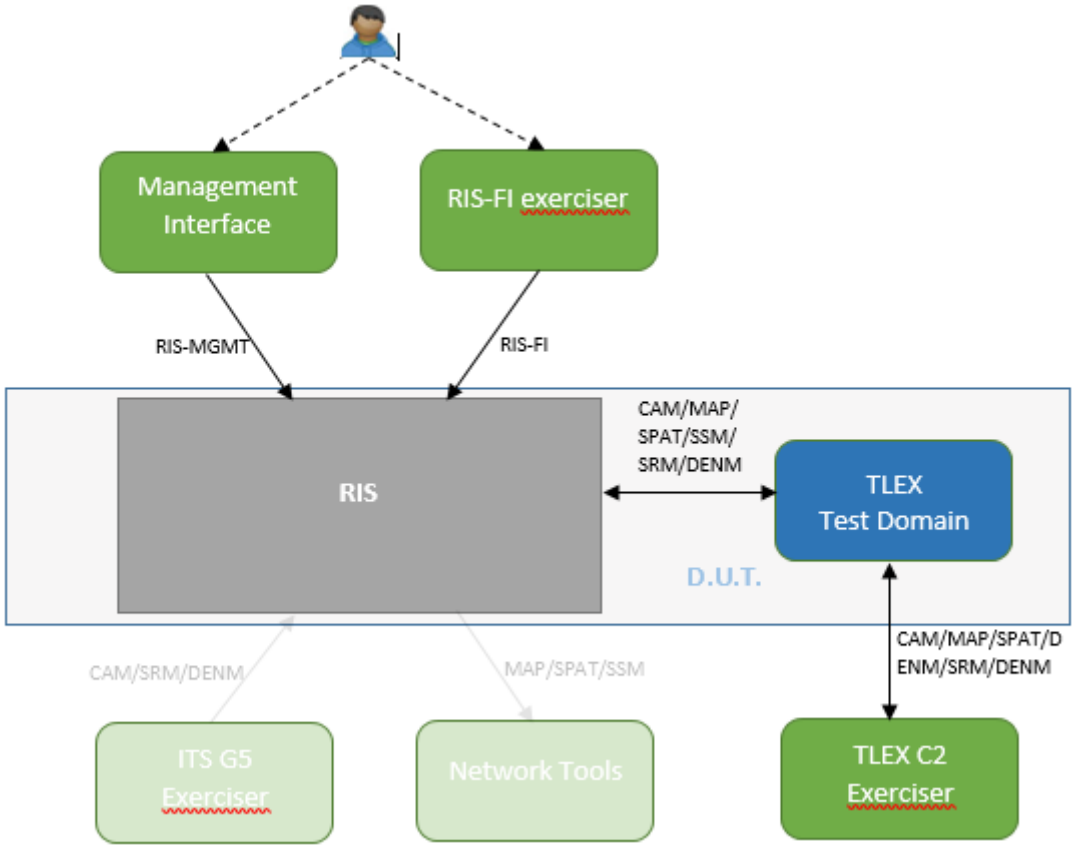


Figure 5: Connected test setup

7 Test scenarios

7.1 Registration

Fill in the following information about the DUT below, prior to executing the tests:

Vendor	
Product name	
Product code	
Software Versions	
RIS Compliance	[ ] Connected [ ] Hybrid Connected [ ] Cooperative [ ] Hybrid Cooperative

Table 8 : Device Under Test registration

7.2 TLEX

7.2.1 Use Case: Establish sessions with TLEX

7.2.1.1 *Test case: Connect to TLEX SinglePlex*

Test case:	Connect to TLEX SinglePlex		
ID:	TLEX.UC1.1		
Objective:	Verify that the TLEX Exerciser is able to connect to the TLEX streaming service and is able to send SPAT data		
Pre-conditions	A test **domain** is available in the TLEX and a **tlcIdentifier** has been configured for TINT1 The TLEX C2 Exerciser (Broker) and the RIS are configured with the assigned test **domain** and have network access to the Streaming Service API and the Streaming Service Node of the TLEX		
STEP	**DESCRIPTION**	**PASS/FAIL**	**REMARKS/ACTIONS**
1	Connect the TLEX C2 Exerciser (Broker) to the TLEX using TLS and a **SinglePlex** session and the configured **tlcIdentifier**		
2	**Verify** that the Exerciser is connected and stays connected for at least 5 minutes		
3	Connect the RIS to the TLEX using TLS and a **SinglePlex** session		
4	**Verify** that the RIS is connected and stays connected for at least 5 minutes		
5	**Verify** the RIS sends SPAT messages		
6	**Verify** the Exerciser receives SPAT messages		
Tested by:		**Date:**	

7.2.1.2 *Test case: Connect to TLEX MultiPlex*

Test case:	Connect to TLEX MultiPlex		
ID:	TLEX.UC1.2		
Objective:	Verify that the TLEX Exerciser is able to connect to the TLEX streaming service and is able to send SPAT data		
Pre-conditions	A test **domain** is available in the TLEX and a **tlcIdentifier** has been configured for TINT1 The TLEX C2 Exerciser (Broker) and the RIS are configured with the assigned test **domain** and have network access to the Streaming Service API and the Streaming Service Node of the TLEX		
STEP	**DESCRIPTION**	**PASS/FAIL**	**REMARKS/ACTIONS**
1	Connect the TLEX C2 Exerciser (Broker) to the TLEX using TLS and a **MultiPlex** session and the configured **tlcIdentifier**		

2	**Verify that** the Exerciser is connected and stays connected for at least 5 minutes		
3	Connect the RIS to the TLEX using TLS and a **MultiPlex** session		
4	**Verify that** the RIS is connected and stays connected for at least 5 minutes		
5	**Verify** the RIS sends SPAT messages		
6	**Verify** the Exerciser receives SPAT messages		
Tested by:		**Date:**	

7.2.2 Use Case: Connection recovery

7.2.2.1 *Test case: Connection recovery*

Test case:	Connection recovery		
ID:	TLEX.UC2.1		
Objective:	Verify the RIS re-establishes the connection with TLEX after it has been disconnected, because it lost its network connection		
Pre-conditions	The TLEX is up and running and the RIS is connected/logged on to the TLEX		
STEP	**DESCRIPTION**	**PASS/FAIL**	**REMARKS/ACTIONS**
1	Disconnect the RIS by pulling the network cable		
2	**Verify** the network connection has been lost		
3	Connect the network cable		
4	**Verify** the RIS has regained its network connection.		
5	Have the RIS log on to the TLEX.		
6	**Verify** the RIS has successfully logged on to the TLEX.		
Tested by:		**Date:**	

7.2.2.2 *Test case: Connection recovery after a power cycle.*

Test case:	Connection recovery		
ID:	TLEX.UC2.2		
Objective:	Verify the RIS re-establishes the connection after it has had a power cycle.		
Pre-conditions	The TLEX is up and running and the RIS is connected/logged on to the TLEX		
STEP	**DESCRIPTION**	**PASS/FAIL**	**REMARKS/ACTIONS**
1	Disconnect the RIS by pulling the power plug and plug the power plug back in.		
2	**Verify** the RIS has restarted successfully.		
3	**Verify** the RIS has successfully logged on to the TLEX.		
Tested by:		**Date:**	

7.3 RIS-FI

7.3.1 Use Case: Monitoring of traffic

7.3.1.1 *Test Case: Reception of ITS Station events*

Test case:	Reception of ITS Station events		
ID:	RISFI.UC1.1		
Objective:	Verify that ITS Station events are received (CAM), the data is validly mapped onto the intersection and that updated vehicle positions are received by the ITS applications. The generated vehicles drive in opposite direction and have to be spotted on several points in the lanes. Refer to Figure 3 for the used references on the topology regarding positions.		
Pre-conditions	The RIS is running and registered to the TLEX		
STEP	**DESCRIPTION**	**PASS/FAIL**	**REMARKS/ACTIONS**
1	Subscribe to ITS station events by sending a **SubscribeObjects** method and subscribing to **ItsStation** of type **RISObjectType** with filter condition "**matches** != null"		
2	**Verify** an empty result is returned (because no stations exist in the LDM) along with a subscription id.		
3	Generate two vehicle CAM messages at TLEX side with the following specifications: Vehicle 1: • Positioned on lane 1 towards the signal group (SG) fc02, just after the start of the lane path • The **stationType** is **passengerCar (5)** • The **role** is **default (0)** • The **heading** is pointing towards the signal group • The **speed** value is 1250 (12,5 m/s) Vehicle 2: • Positioned on lane 8 towards the SG fc08, just after the start of the lane path • The **stationType** is **motorcycle (4)** • The **role** is **safetyCar (7)**		

	• The **heading** is pointing towards the signal group • The **speed** value is 1194 (11,94 m/s)		
4	**Verify** that the **subscription** receives two **NotifyObjects** and that they are received within 500 ms		
5	**Verify** that the data shown in the **NotifyObjects** corresponds to the generated CAM messages.		
6	**Verify** that each **ItsStation** is mapped correctly on the intersection, e.g. **distance**, **lane**, **offset**, etc.		
7	Update the position of Vehicle 2 so that the vehicle is on lane 3. Send a CAM message for this new position.		
8	**Verify** that the data shown in the **NotifyObjects** corresponds to the generated CAM messages.		
9	**Verify** that the **ItsStation** is mapped correctly on the intersection, e.g. **distance**, **lane**, etc.		
10	**Verify** that the response is received within 500 ms of sending the CAM message.		
Tested by:		**Date:**	

7.3.2 Use Case: Bus priority handling based on SRM

7.3.2.1 *Test case: SRM and SSM handling*

Test case:	Public transport SRM and SSM handling
ID:	RISFI.UC3.1
Objective:	The RIS receives information about busses in the neighborhood via Cooperative Awareness Messages (CAM) and Signal Request Messages (SRM). An ITS-A can, based upon this information, request for priority at the TLC facilities to give way to these busses
Pre-conditions	The RIS is up and running The ITS-PRA is registered to the RIS The RIS is registered to the TLEX. All CAM/SRM/SSM messages are sent and received through the TLEX server.

STEP	DESCRIPTION	PASS/FAIL	REMARKS/ACTIONS
1	Subscribe to **PrioritizationRequest** events by sending a **SubscribeObjects** method with type **PrioritizationRequest** with filter condition "**role** == **publicTransport**"		
2	**Verify** a result is returned containing only a subscription id		
3	Subscribe to **ItsStation** events by sending a **SubscribeObjects** method with type **ItsStation** with filter condition "**matches** != null"		
4	**Verify** a result is returned containing only a subscription id		
5	As long as the test is running every 1.5 seconds generate a vehicle CAM message with the following specifications: • Positioned on lane 8 towards the SG fc08 just after the start of the lane path • **StationID** is 7007 • **StationType** is **bus (6)** • **VehicleRole** is **publicTransport (1)** • **exteriorLights is "00010000" (rightTurnSignalOn (3))** • **Heading** is pointing towards the signal group • **speed** value is 1400 (14 m/s) • **PublicTransport** ○ **embarkationStatus is false**		

	○ **ptActivation.PtActivationType is 3** ○ **ptActivation.PtActivationData.lineNr** is 5 ○ **rest of ptActivation.PtActivationData is 0** Generate a single SRM message containing the following specification: • **sequenceNumber** is 5 • **request** ○ **RequestID** is 104 ○ **requestType is priorityRequest (1)** ○ **inBoundLane** is connection 6 • **requestor** ○ **id.stationID** is 7007 ○ **type.role** is publicTransport(1) ○ **type.subrole** is requestSubRole1 (1), -- bus ○ **type.request** is requestImportanceLevel2(2) ○ **routeName** is "T101" ○ **transitStatus** is doorOpen 00010000 (3) ○ **transitSchedule** is -60 • **minute** corresponds to current time + 10s • **second** corresponds to current time + 10s • **duration**: This field must be omitted		
6	**Verify** that a **NotifyObjects** is received for the **subscription** for a **ItsStation** object		
7	**Verify** that the data shown in the **NotifyObjects** corresponds to the generated CAM message**.** (Beware of the **turn** field which must be right(3).		
8	**Verify** that a **NotifyObjects** is received for the **subscription** for a **PrioritizationRequest** object**.**		
9	**Verify** that the correct data is shown in the **PrioritizationRequest** object for fc08 corresponding to the CAM and the SRM message. Among the other fields, especialy verify the <OPT> fields: **signalGroup** is TINT1_fc08, **routeName** is "T101", **TransitStatus**.**loading** is false, **TransitStatus**.**anANDAuse** is false, **TransitStatus**.**aBikeLoad** is false,		

	TransitStatus.doorOpen is true, **TransitStatus.charging** is false, **TransitStatus.atStopLine** is false, **punctuality** is -60, **importance** is 2.		
10	**Verify** that the responses are received within 500 ms of sending the CAM and SRM messages		
11	Send an **UpdateObjects** method with an update for the **ActivePrioritization** object with the following minimum specifications: ○ **Id** is (7007_104) ▪ **prioritizations** as follow ▪ **sequenceNumber is 5** ▪ **priostate** is granted (4)		
12	**Verify** an empty **updateObjects** result is returned		
13	**Verify** an SSM message is broadcasted		
14	**Verify** the SSM message contains the data configured at step 5		
15	**Verify** a notification has been received for the **itsStation** subscription that contains expired[] set to id 7007		
16	**Verify** a notification has been received for the **prioritizationRequest** subscription that contains expired[] set to id 7007_104, 73s after the SRM is sent		
17	Send a **RequestObjects** method with **filter** for **type ActivePrioritization**		
18	**Verify** an empty result is returned from the **RequestObjects**		
Tested by:		**Date:**	

7.3.3 Use Case: Create an ItsEvent

7.3.3.1 *Test Case: Create a single ItsEvent*

Test case:	Create a single ItsEvent		
ID:	RISFI.UC4.1		
Objective:	Verify that DENM messages are sent once when no repetition interval is set		
Pre-conditions	The RIS is up and running The RIS is registered to the TLEX		
STEP	**DESCRIPTION**	**PASS/FAIL**	**REMARKS/ACTIONS**
1	Send a **CreateEvents** with an **ItsEvent** with the following specification: • **eventType** is **adverseWeatherCondition-ExtremeWeatherCondition (17)** • **eventSubType** is 0 • **validityDuration** is 15 • **relevanceDistance** is 400.0 • **trafficDirection** is **upstreamTraffic (1)** • **For eventPosition is** use **E1** described in *Table 2: Events reference* • For **traces** use trace **T1** described in *Table 2: Events reference* • **detectionTime** is current time Send the CreateEvents method to the RIS		
2	**Verify** a result is returned with a subscription ID for the defined event		
3	**Verify** a DENM message has been broadcasted once to TLEX		
4	**Verify** on the TLEX side that this information has been received.		
5	**Verify** that the content of the DENM message corresponds to the data in the **createEvents** object		
Tested by:		**Date:**	

7.3.4 Use Case: Update an ItsEvent

7.3.4.1 *Test Case: Update two events*

Test case:	Update two events
ID:	RISFI.UC5.1
Objective:	Verify two DENM messages are updated based on an **UpdateObjects** message with updates for all fields or for a single field for 2 events
Pre-conditions	The RIS is up and running. The ITS-PRA is registered to the RIS The RIS is registered to the TLEX. All DENM messages are sent through the TLEX server.

STEP	DESCRIPTION	PASS/FAIL	REMARKS/ACTIONS
1	Create a **CreateEvents** with two **ItsEvents** with the following specification: Event 1: • The **eventType** is **trafficCondition (1)** • The **eventSubType** is 0 • The **validityDuration** is 15 • The **relevanceDistance** is 400.0 • The **trafficDirection** is **upstreamTraffic (1)** • The **repetitionInterval** is 3000 • For **eventPosition** use E1 described in *Table 2: Events reference* • For **traces** use T1 described in *Table 2: Events reference* Event 2: • The **eventType** is **humanPresenceOnTheRoad (12)** • The **eventSubType** is 1 • The **validityDuration** is 10 • The **relevanceDistance** is 600.0 • The **trafficDirection** is **upstreamTraffic (1)** • The **repetitionInterval** is 1000 • For **eventPosition** use E2 described in *Table 2: Events reference*		

	• For **traces** use T3 described in *Table 2: Events reference* For both events the following applies: • The **Timestamp** for both are set to the current time Send the **CreateEvents** method to the RIS		
2	**Verify** a result is returned with a subscription ID for each defined event ID 1: _____ ID 2: _____		
3	**Verify** that DENM messages are broadcasted to TLEX		
4	**Verify** that the content of the DENM messages corresponds to the data in the **createEvents** object		
5	**Verify** this information is sent to the TLEX.		
6	**Verify** on the TLEX side that this information has been received only once per event.		
7	Send after 5 seconds an **UpdateObjects** with the following specifications: Event 1 update (ID 1): • The **eventType** is **wrongWayDriving (14)** • The **eventSubType** is 2 • The **validityDuration** is 30 • The **relevanceDistance** is 1010.0 • The **trafficDirection** is **downstreamTraffic (2)** • The **repetitionInterval** is 1500 • For **eventPosition** use E1 described in *Table 2: Events reference* • For **traces** use T2 described in *Table 2: Events reference* Event 2 update (ID 2): • The **eventType** is **dangerousSituation (99)** • The **eventSubType** is 3 • The **validityDuration** is 28 • The **relevanceDistance** is 1500.0 • The **trafficDirection** is **allTrafficDirections (0)** • The **repetitionInterval** is 1200 • For **eventPosition** use E3 described in *Table 2: Events reference*		

	• For **traces** use T4 described in *Table 2: Events reference* For both events the following applies: • The **detectionTime** for both are set to the current time		
8	**Verify** an empty **updateObjects** result is returned		
9	**Verify** that DENM messages are broadcasted with the updated **repetitionInterval**		
10	**Verify** the DENM contents are changed to the updated values in the **ObjectStateUpdate**		
11	**Verify** this information is sent to the TLEX.		
12	**Verify** on the TLEX side that this information has been received only once per event.		
13	Send after 5 seconds an **UpdateObjects** with the following specifications: Event 1 update (ID 1): • The **repetitionInterval** is 500 Event 2 update (ID 2): • The **repetitionInterval** is 1000		
14	**Verify** an empty **updateObjects** result is returned		
15	**Verify** that DENM messages are broadcasted with the updated **repetitionInterval to TLEX**		
16	**Verify** on the TLEX side that this information has been received only once per event.		
17	**Verify** that after the **validityDuration** (from step 9) no DENM are transmitted for the specific events		
Tested by:		**Date:**	

7.3.5 Use Case Inform on the signalling status

7.3.5.1 *Test Case: Inform on the signalling status*

Test case:	Inform on the signaling status
ID:	RISFI.UC8.1
Objective:	Verify a **SignalGroup** object can be updated as a whole with the **UpdateObjects** method. The **SignalGroup** object can be retrieved through the **NotifyObject** method and the updated **SignalGroup** data is present in the related SPAT message. Verify MAP content.
Pre-conditions	The RIS is up and running and doesn't have a connection with a TLC. The ITS-PRA is registered to the RIS The RIS is registered to the TLEX. All SPAT/MAP messages are sent through the TLEX server.

STEP	DESCRIPTION	PASS/FAIL	REMARKS/ACTIONS
1	**Verify** SPAT messages are transmitted between every 1 and 10 seconds with the **IntersectionStatusObject,** set to the value **noValidSPATisAvailableAtThisTime (13)**		
2	**Verify** MAP messages are broadcasted every hour containing the intersection configuration of the RIS **Verify** the MAP message objects matches the intersection configuration.		
3	Subscribe to **SignalGroup** events by sending a **SubscribeObjects** method with object type **SignalGroup (4)**		
4	**Verify** a result is returned containing only a subscription id and the current status of the signalgroups		

5	Send an **UpdateObjects** method with an update for **IntersectionState** with the following specifications:
	
	• **Ids** is intersection ID (TINT1)
	  ○ **manualControlIsEnabled** is false,
	  ○ **stopTimeIsActivated** is false,
	  ○ **failureFlash** is false,
	  ○ **preemptIsActive** is false,
	  ○ **signalPriorityIsActive** is false,
	  ○ **fixedTimeOperation** is false,
	  ○ **trafficDependentOperation** is **true**,
	  ○ **standbyOperation** is false,		

	○ **failureMode** is false, ○ **off** is false		
6	Send an **UpdateObjects** method with an update for **SignalGroup** with a ticks value clearly different from the ticks value received in the Alive message from the RIS itself with the following minimum specifications: • **Id** is (TINT1_fc02) ○ **state** is **PermissiveMovementAllowed (5)** ○ **predictions** are as follows: ▪ [0] • **state** is **PermissiveMovementAllowed (5)** • **minEnd** is UpdateObjects.Ticks + 20000 • **maxEnd** is UpdateObjects.Ticks + 20300 • **likelyEnd** is UpdateObjects.Ticks + 20200 • **confidence** is 50 • **next** is UpdateObjects.Ticks + 40100 ▪ [1] • **state** is **PermissiveClearance (7)** • **startTime** is UpdateObjects.Ticks + 20200 • **minEnd** is UpdateObjects.Ticks + 40000 • **maxEnd** is UpdateObjects.Ticks + 40300 • **likelyEnd** is UpdateObjects.Ticks + 40100 • **confidence** is 50 ○ **validityDuration** is 15 ○ **speedProfiles** are as follows: ▪ [0] • **type** is **greenwave(1)** • **distance** is 30 • **speed** is 13.8 ▪ [1] • **type** is **greenwave(1)** • **distance** is 100 • **speed** is 19.4 ○ **reason** is **weather(6)**		

	• **Id** is (TINT1_fc03)
	  ○ **state** is **StopAndremain (3)**
	  ○ **predictions** are as follows:
	  ▪ **state** is **StopAndremain** (3)
	  ▪ **minEnd** is UpdateObjects.Ticks + 15000
	  ○ **validityDuration** is 15
	  ○ **reason** is **bridgeOpen (4)**
	
	• **Id** is (TINT1_fc05)
	  ○ **state** is **StopAndremain (3)**
	  ○ **predictions** are as follows:
	  ▪ **state** is **StopAndremain (3)**
	  ▪ **minEnd** is UpdateObjects.Ticks + 25100
	  ▪ **maxEnd** is null
	  ▪ **likelyEnd** is UpdateObjects.Ticks + 25300
	  ▪ **confidence** is 50
	  ○ **validityDuration** is 15
	  ○ **reason** is **tunnelClosure (8)**
	
	• **Id** is (TINT1_fc07)
	  ○ **state** is PermissiveMovementAllowed **(5)**
	  ○ **predictions** are as follows
	  ▪ **state** is **PermissiveMovementAllowed (5)**
	  ▪ **minEnd** is UpdateObjects.Ticks + 20000
	  ▪ **maxEnd** is UpdateObjects.Ticks + 20300
	  ▪ **likelyEnd** is UpdateObjects.Ticks + 20100
	  ▪ **confidence** is 50
	  ○ **validityDuration** is 15
	  ○ **speedProfiles** are as follows:
	  ▪ The **type** is **ecoDrive(2)**
	  ▪ The **distance** is 20
	  ▪ The **speed** is 30.5		

	• **Id** is (TINT1_fc08)
	  ○ **state** is PermissiveMovementAllowed **(5)**
	  ○ **predictions** are as follows:
	  ▪ **state** is **PermissiveMovementAllowed (5)**
	  ▪ **minEnd** is UpdateObjects.Ticks + 20000
	  ▪ **maxEnd** is UpdateObjects.Ticks + 20030
	  ▪ **likelyEnd** is null
	  ▪ **Confidence** is null
	  ○ **validityDuration** is 15
	  ○ **speedProfiles** as follows:
	  ▪ **type** is **none(0)**
	  ▪ **distance** is 0
	  ▪ **speed** is 0.0
	  ○ **reason** is **vehiclePlatoonPriority(12)**
	
	• **Id** is (TINT1_21)
	  ○ **state** is **StopAndremain (5)**
	  ○ **predictions** are as follows:
	  ▪ **state** is **StopAndremain (5)**
	  ▪ **minEnd** is UpdateObjects.Ticks + 30000
	  ○ **validityDuration** is 15
	
	• **Id** is (TINT1_31)
	  ○ **state** is **StopAndremain (5)**
	  ○ **predictions** are as follows:
	  ▪ **state** is **Unavailable (0)**
	  ▪ **minEnd** is null
	  ○ **validityDuration** is 15
	
	Ticks value in the **UpdateObjects** method: _____
	
	Timestamp in the **UpdateObjects** method: _____		

7	**Verify** an empty result is returned		

8	**Verify** the response is received within 100 ms		
9	**Verify** that the received SignalGroup **Notification** corresponds to the previous SignalGroup update		
10	**Verify** SPAT messages are transmitted with the data corresponding to the data in the **SignalGroup** update.		
11	**Verify** that, after the **validityDuration** has expired**,** SPAT messages are transmitted with signalgroup states are set to unavailable, no predictions, no speedprofiles, no reason.		
Tested by:		**Date:**	

7.4 Generic-FI

7.4.1 Additional Case: Performance tests

For the performance tests multiple applications have to connect to the RIS and must be able to communicate concurrent at the same time. Preferable an automated test is used here.

7.4.1.1 *Test Case: C-ITS message performance*

Test case:	C-ITS message performance
ID:	GENFI.UC5.1
Objective:	Verify 250 ITS-G5 messages can be processed per second and can lead to an update or additional object 100 SRM messages are generated and 220 vehicles will drive over the intersection
Pre-conditions	The RIS is up and running ITS-CRA1 is registered to the RIS as **Consumer1** and ITS-CRA2 is registered to the RIS as **Consumer2** (see Table 3: RIS user accounts) The RIS is registered to the TLEX. All CAM/SRM/SSM/SPAT messages are send and received through the TLEX.

STEP	DESCRIPTION	PASS/FAIL	REMARKS/ACTIONS

1	For 220 vehicles multiple CAM messages (4 positions) have to be prepared on the TLEX side with the following specification:
	• All vehicles have the following specifications (and defaults from § 5.3.5):
	  ○ The **stationType** is **passengerCar (5)**
	  ○ The **role** is **default (0)**
	  ○ The **speed** value is random between 1000 (10.00 m/s) and 2000 (20.0 m/s)
	• On each of the following lanes 44 vehicles are approaching
	  ○ Lanes 1, 2, 5, 7, 8
	• All the vehicles will follow the following path
	  ○ **Position 1:** Before the lane (not mapped)
	  ○ **Position 2:** On the lane (mapped)
	  ○ **Position 3:** Middle of the intersection (mapped) between lanes
	  ○ **Position 4:** Over the intersection (mapped)
	  ▪ Lane 1 drives to 10
	  ▪ Lane 2 drives to 6		

	▪ Lane 8 drives to 3 ▪ Lane 7 drives to 6 ▪ For path 5 (SG5) the following accounts ▪ 11 vehicles drive to path 10 ▪ 11 vehicles drive to path 9 ▪ 11 vehicles drive to path 3 ▪ 11 vehicles drive to path 4 • For 5 vehicles on each of the 5 lanes generate 4 SRM messages (so 100 in total) are prepared on the TLEX side: ○ Where **IntersectionReferenceID** is TINT1 ○ Where **RequestID** is unique for each vehicle ○ Where **PriorityRequestType** is for each position ▪ Position 1 **priorityRequest (1)** ▪ Position 2 **priorityRequestUpdate (2)** ▪ Position 3 **priorityRequestUpdate (2)** ▪ Position 4 **priorityCancellation (3)** ○ Where **inBoundLane** is the lane the vehicle is on		
2	Subscribe ITS-CRA1 to **PrioritizationRequest** by sending a **SubscribeObjects** method and subscribing to **PrioritizationRequest**		
3	**Verify** a result is returned with a subscription id		
4	Subscribe ITS-CRA2 to ITS station events by sending a **SubscribeObjects** method and subscribing to **ItsStation** of type **RISObjectType** with filter condition "**matches** != null"		
5	**Verify** a result is returned with a subscription id		
6	**Send the following messages 1 second after each other:** • The CAM messages of **Position 1** and the SRM • The CAM messages of **Position 2** and the SRM • The CAM messages of **Position 3** and the SRM • The CAM messages of **Position 4** and the SRM		
7	**Verify** ITS-CRA1 received 100 **NotifyObjects** corresponding to the generated SRM		
8	**Verify** ITS-CRA2 received 660 **NotifyObjects** corresponding to the generated CAM messages. (220 do not result in a Notify as these are not matched on the map)		

9	**Verify** each vehicle generated at **Position 2, 3** and **4** is mapped and contain the fields **intersection**, **lane**, , **distance** and **offset**		
10	**Verify** that the notifications are received within maximum latency allowed by TLEX of sending the messages		
Tested by:		**Date:**	

APPENDIX A: Requirements traceability.

This section provides a statement of the compliance of this test specification with the following specifications:

- 🕮 2 IRS RIS-FI
- 🕮 2 Generic-FI
- 🕮 4 SWARCO iVRI Overnamepunt v2.2 20170929
- 🕮 5, iTLC Architecture (not covered in IRS or Generic)
- 🕮 9 IRS Security v1.1

A requirement traceability linking tests back to the RFP can be found in section 5.5 of 🕮 6 IPS-TT STP Cluster 1.

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
IRSIDD_RISFI_GEN_001	C		Already covered in RIS STD.
IRSIDD_RISFI_GEN_002	C		Already covered in RIS STD.
IRSIDD_RISFI_PROT_001	C		Already covered in RIS STD.
IRSIDD_RISFI_PROT_002	C	7.2, 7.4	
IRSIDD_RISFI_PROT_003	C		Already covered in RIS STD.
IRSIDD_RISFI_PROT_004	N		IP communication is asynchronous. No need to do further testing.
IRSIDD_RISFI_SEC_001	C		Already covered in RIS STD.
IRSIDD_RISFI_REG_001	C		Already covered in RIS STD.
IRSIDD_RISFI_REG_002	C		Already covered in RIS STD.
IRSIDD_RISFI_REG_003	C		Already covered in RIS STD.
IRSIDD_RISFI_REG_004	C		Already covered in RIS STD.
IRSIDD_RISFI_REG_005	N		Not supported in the IDD, hence not tested.
IRSIDD_RISFI_REG_006	C		Already covered in RIS STD.

Requirement	Compliance	Sections	Comments
IRSIDD_RISFI_REG_007	C		Already covered in RIS STD.
IRSIDD_RISFI_REG_008	N		IDD does not support priority level, hence this is not tested.
IRSIDD_RISFI_LDM_DD_001	C		Verified with all tests that cover the RIS-FI objects
IRSIDD_RISFI_LDM_DD_002	N		IDD does not support priority level, hence this is not tested.
IRSIDD_RISFI_LDM_DD_003	C		Covered by ObjectID fields in the IDD. These are verified in the tests
IRSIDD_RISFI_LDM_DD_004	C	7.2, 7.4	Mandatory and optional fields are covered in multiple tests
IRSIDD_RISFI_LDM_DD_005	C	7.2, 7.4	Covered by all tests
IRSIDD_RISFI_LDM_DT_001	P	7.2	Covered in multiple tests In vehicle Information not covered.
IRSIDD_RISFI_LDM_DT_002	C		Already covered in RIS STD.
IRSIDD_RISFI_LDM_DT_003	C		Already covered in RIS STD.
IRSIDD_RISFI_LDM_DT_004	C	7.3.5.1	
IRSIDD_RISFI_LDM_DT_005	C	7.3.2.1, 7.3.5	
IRSIDD_RISFI_LDM_DT_006	N		In vehicle Information not covered.
IRSIDD_RISFI_LDM_DT_007	C	7.3.5	
IRSIDD_RISFI_LDM_DT_008	N		DetectionArea object not present in IDD. No coverage.
IRSIDD_RISFI_LDM_DT_009	N		Items not according to IDD.
***IRSIDD_RISFI_LDM_DT_010**	N		DrivingLane not according to IDD, therefor not testable.

Requirement	Compliance	Sections	Comments
IRSIDD_RISFI_LDM_DPRV_001	C		Already covered in RIS STD.
IRSIDD_RISFI_LDM_DPRV_002	C	7.3.4	
IRSIDD_RISFI_LDM_DPRV_003	N		Not supported in the IDD, hence not tested.
IRSIDD_RISFI_LDM_DPRV_004	C		Already covered in RIS STD.
IRSIDD_RISFI_LDM_DCONS_001	C		Already covered in RIS STD.
IRSIDD_RISFI_LDM_DCONS_002	C		Already covered in RIS STD.
IRSIDD_RISFI_LDM_DCONS_003	N		Ordering data results not supported in IDD, hence no coverage.
IRSIDD_RISFI_LDM_DCONS_004	N		Query of LDM not supported in IDD, hence no coverage
IRSIDD_RISFI_LDM_DCONS_005	N		Query of LDM not supported in IDD, hence no coverage
IRSIDD_RISFI_LDM_DCONS_006	P	7.3.2.1	No coverage for periodic notifications.
IRSIDD_RISFI_LDM_DCONS_007	C		Already covered in RIS STD.
IRSIDD_RISFI_LDM_DCONS_008	C	7.3.2.1	
IRSIDD_RISFI_LDM_DCONS_009	N		Query of LDM not supported in IDD, hence no coverage
IRSIDD_RISFI_LDM_DCONS_010	N		IDD does not support priorities for subscriptions: no coverage
IRSIDD_RISFI_LDM_MAINT_001	C		Already covered in RIS STD.
IRSIDD_RISFI_LDM_STOR_001	N		Not covered. Part of ETSI ITS G5 specifications.
IRSIDD_RISFI_LDM_G5_001	C		Already covered in RIS STD.

Requirement	Compliance	Sections	Comments
IRSIDD_RISFI_LDM_G5_002	C	7.3.2.1	
IRSIDD_RISFI_LDM_G5_003	C	7.3.5.1	
IRSIDD_RISFI_LDM_G5_004	N		In vehicle Information not covered.
IRSIDD_RISFI_LDM_TOPO_001	P		Already covered in RIS STD.
IRSIDD_RISFI_LDM_TOPO_002	P		Only status of an intersection can be changed according to the IDD.
IRSIDD_RISFI_SVC_001	C		Already covered in RIS STD.
IRSIDD_RISFI_SVC_002	P		Already covered in RIS STD.
IRSIDD_RISFI_QA_SCAL_001	C		Already covered in RIS STD.
IRSIDD_RISFI_QA_SCAL_002	C		Already covered in RIS STD.
IRSIDD_RISFI_QA_SCAL_003	C		Already covered in RIS STD.
IRSIDD_RISFI_QA_SCAL_004	C		Already covered in RIS STD.
IRSIDD_RISFI_QA_PERF_001	C	7.3.5.1	
IRSIDD_RISFI_QA_PERF_002	P	7.4.1.1	IDD does not support priorities for subscriptions: no coverage
IRSIDD_RISFI_QA_PERF_003		7.4.1.1	
IRSIDD_RISFI_QA_AVAIL_001	C		Already covered in RIS STD.
IRSIDD_RISFI_QA_AVAIL_002	N		Not supported in IDD
IRSIDD_RISFI_QA_EVO_001	N		Not testable for first iteration
IRS_SEC_GEN_001	N		Not applicable, private network, external factor
IRS_SEC_GEN_002	N		Not applicable, tests Road side cabinet locks
IRS_SEC_GEN_003	N		Not applicable, tests Road side cabinet locks

Requirement	Compliance	Sections	Comments
IRS_SEC_GEN_004	Y	7.4	
IRS_SEC_GEN_005	Y	7.4	
IRS_SEC_GEN_006	Y		Already covered in RIS STD.
IRS_SEC_GEN_007	N		Not applicable, tests illegal access to local (wired and wireless) networks
IRS_SEC_GEN_009	Y		Already covered in RIS STD.
IRS_SEC_GEN_013	N		Not applicable, operational scope
IRS_SEC_GEN_014	N		Not applicable, development scope
IRS_SEC_GEN_015	N		Not applicable, project scope
IRS_SEC_GEN_016	N		Not applicable, operational scope
IRS_SEC_GEN_017	Y		Already covered in RIS STD.
IRS_SEC_GEN_018	Y		Already covered in RIS STD.
IRS_SEC_RIS_001	Y		Already covered in RIS STD.
IRS_SEC_RIS_002	Y		Already covered in RIS STD.
IRS_SEC_RIS_003	Y		Already covered in RIS STD.
IRS_SEC_RIS_004	Y		Already covered in RIS STD.
IRS_SEC_RIS_005	Y		Already covered in RIS STD.
IRS_SEC_RIS_006	Y		Already covered in RIS STD.
IRS_SEC_RIS_007	N		Wifi-p is not covered in the type test
iTLC Architecture 9.3.4.4, Minimum logging	Y		Already covered in RIS STD.

Requirement	Compliance	Sections	Comments
iTLC Architecture 9.3.1.1, Authentication, registration-failures	Y		Already covered in RIS STD.
iTLC Architecture 9.3.4.1, Configuration, Management Entity	Y		Already covered in RIS STD.
TLEX	Y	**7.2.1.1, 7.2.1.2, 7.2.2.1, 7.2.2.2**	

APPENDIX B: Test result overview

Here an overview of all the test cases are given so an overview can be created of the passed and failed tests

Used C-ITS mode:

[ ] Connected [ ] Hybrid Connected

[ ] Cooperative [ ] Hybrid Cooperative

Test Case	Pass / Fail	Notes
7.2.1.1		
7.2.1.2		
7.2.2.1		
7.2.2.2		
7.3.1.1		
7.3.2.1		
7.3.3.1		
7.3.4.1		
7.3.5.1		
7.4.1.1		