Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – Trailer Light Check

APIM Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.1

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Version Date: February 2, 2021

FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
October 29, 2019	**1.0**	**Initial Release**	
February 2, 2021	**1.1**		
	STR-619024/B-Feature Operation		ndecia: Updated overview with inclusion of Rear Fog Light step for ECE homologated markets
	TLT-IIR-REQ-368115/B-TrailerLightCheckInterfaceClient_Rx		ndecia: updated to add new preconditions status signal variant which has trailer disconnected value
	MD-REQ-400967/A-LightTestPreConditions2_St		ndecia: New variant of preconditions status signal added with updated literal name for value 0x7
	STR-700109/B-Logical Signal Mapping		ndecia: updated to add new preconditions status signal variant which has trailer disconnected value
	STR-700110/B-General Requirements		ndecia: updated structure to add 403898
	TLT-REQ-403898/A-Light Test Preconditions Status Signal Variants		Ndecia: New general requirement that captures behavior of when to use the new variant of the preconditions status signal
	TLT-REQ-368125/B-Updating HMI for Preconditions Not Met		ndecia: modified the error condition to include the literal value for TrailerNotConnected from the new variant of the preconditions status signal
	TLT-REQ-368894/B-Updating HMI for Preconditions Not Met During Light Test		ndecia: modified the error condition to include the literal value for TrailerNotConnected from the new variant of the preconditions status signal

Table of Contents

1 Overview

The Trailer Light Check feature will allow the vehicle user to independently visually check the light operation of a towed trailer. Upon activation of the feature the vehicle and trailer lights will illuminate in a particular sequence to help the user confirm all lights are operational.

1.1 Feature Assumptions

Assumptions and constraints listed below are representative of current strategies and may be subject to change:

Assumptions

- The trailer light function feature will utilize existing hardware on the vehicle, no new hardware will be required
- Vehicle is FNV2 architecture
- Vehicle has Ford factory/dealer installed tow package

Constraints

- Battery SOC level with battery not supported (engine off)
- Vehicle ignition state
- Vehicle stationary status
- Attached trailer with lights

1.2 Feature Operation

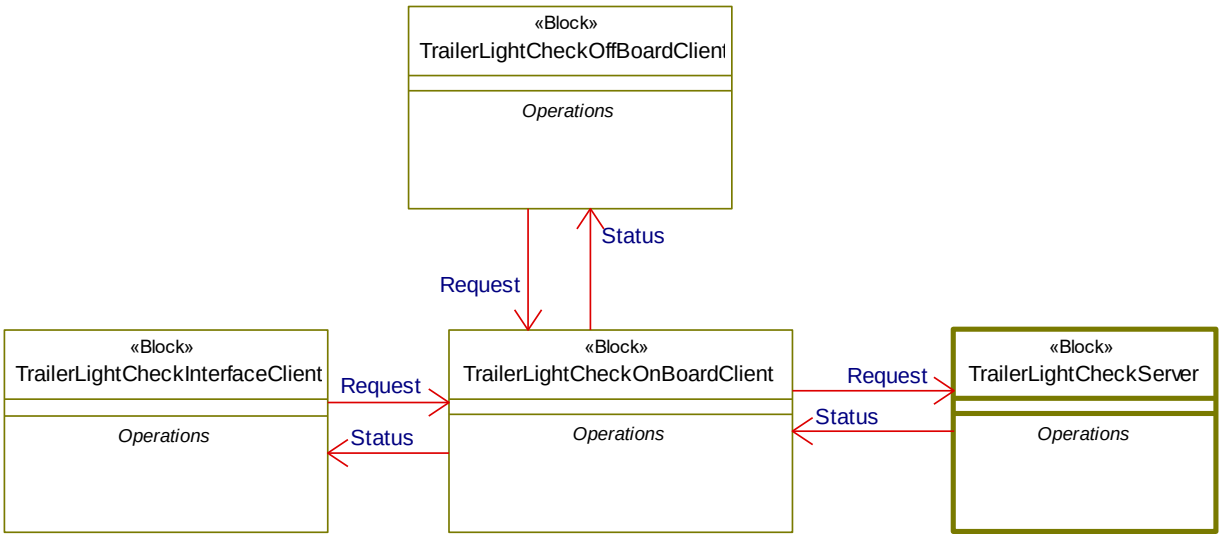
Upon activation of feature through the In-Vehicle HMI or through a mobile device, the vehicle and trailer lights will illuminate in the sequence described below:

1. Tail lights (including front and rear side markers) will turn ON and remain on through test sequences 1-7
   1.1 Turn on license plate lights.
2. Wait 2.3* seconds with only tail lights ON (including front and rear side markers)
3. Left turn light on vehicle and trailer will flash on and off 6* times
4. Right turn light on vehicle and trailer will flash on and off 6* times
5. Brake lights on vehicle and trailer will turn ON for 4.5* seconds
6. Reverse lights on vehicle and trailer will turn ON for 4.5* seconds*
7. Rear Fog Lights on trailer will turn ON for 4.5* seconds**
8. Wait 2.3* seconds with only tail lights ON (including front and rear side markers)
9. Turn off all tail lights (including front and rear side markers)
   9.1 Turn off license plate lights
   9.2 Wait 2.3 seconds*
10. Repeat steps 1-8 for 5* times or until user exits out

** Duration for each step, and sequence timeout, is for reference only as this is internally managed by the Trailer Light Check Server.*

***Note: Rear fog lights are only activated in ECE homologated markets*

1.3 Logical Block Diagram



1.4 Terminology and Abbreviations

The following table lists terminologies that are used in this document along with a brief description.

Term	Description
APIM	Application Protocol Interface Module
BCM	Body Control Module
CCS	Customer Connectivity Settings
ECG	Enhanced Central Gateway
FNV	Fully Networked Vehicle
FTCP	Ford Telematics Communication Protocol
HMI	Human Machine Interface
ITRM	Integrated Trailer Module
SDN	Service Delivery Network
TCU	Telematics Control Unit

2 Architectural Design

2.1 TLT-CLD-REQ-350313/A-Trailer Light Check Interface Client

The Trailer Light Check Interface Client is responsible for sending requests to the Trailer Light Check OnBoard Client and updating the in-vehicle user of information received from the Trailer Light Check OnBoard Client.

2.2 TLT-CLD-REQ-342925/A-Trailer Light Check On-Board Client

The Trailer Light Check OnBoard Client is responsible for relaying information between the Trailer Light Check Server and the Trailer Light Check Off-Board Client.

2.3 TLT-CLD-REQ-342926/A-Trailer Light Check Server

The Trailer Light Check Server is responsible for containing the logic to assess and report whether the feature's preconditions have been met and for processing the request from the Client(s) to start or stop the test.

2.4 TLT-IIR-REQ-368115/B-TrailerLightCheckInterfaceClient_Rx

2.4.1 MD-REQ-342931/B-LightTestPreConditions_St

Message Type: Status

This signal contains the status of Trailer Light Check preconditions.

Name	Literals	Value	Description
LightTestPreConditions_St	-	-	
	Null	0x00	Initial Value
	IgnitionNotOn	0x01	Ignition is not in RUN
	TailLightsOn	0x02	Taillights are already ON
	BattSocLessThan75Percent	0x03	Battery state of charge is below threshold
	PreconditionsPassed	0x04	All preconditions have been met
	InteractionPresent	0x05	Interaction from another feature is present
	NotStationary	0x06	Vehicle is in motion
	Error	0x07	General error

2.4.2 MD-REQ-400967/A-LightTestPreConditions2_St

Message Type: Status

This signal contains the status of Trailer Light Check preconditions.

Name	Literals	Value	Description
LightTestPreConditions2_St	-	-	
	Null	0x00	Initial Value
	IgnitionNotOn	0x01	Ignition is not in RUN
	TailLightsOn	0x02	Taillights are already ON
	BattSocLessThan75Percent	0x03	Battery state of charge is below threshold
	PreconditionsPassed	0x04	All preconditions have been met

	InteractionPresent	0x05	Interaction from another feature is present
	NotStationary	0x06	Vehicle is in motion
	TrailerNotConnected	0x07	Trailer Not Connected

2.4.3 MD-REQ-342933/A-LightTest_St

Message Type: Status

This signal contains the status of the Light Test.

Name	Literals	Value	Description
LightTest_St	-	-	
	Null	0x0	Initial Value
	TestCompleted	0x1	Test completed after timeout
	TestEnded	0x2	Test ended by user or Server
	TestInProgress	0x3	Test still in progress

2.5 TLT-IIR-REQ-368118/A-TrailerLightCheckInterfaceClient_Tx

2.5.1 MD-REQ-350068/B-OnBoardLightTest_Rq

Message Type: Request

This signal requests to start or stop a Light Test.

Name	Literals	Value	Description
OnBoardLightTest_Rq	-	-	
	Null	0x0	Initial Value
	StopTest	0x1	Stop request
	StartTest	0x2	Start request
	TestEndAck	0x3	Test End acknowledgement

2.6 Logical Signal Mapping

The CAN signals mentioned throughout this document shall refer to the CAN signal's logical name. The logical names shall be mapped to their actual CAN signal names. Please use the table below to perform the mapping. The InfoCAN database file is the master file for the actual CAN signal names. Note: There may be cases where the actual CAN signal name is used in this documentation.

Logical Name	CAN Signal Name
LightTestPreconditions_St	TlghtTestPrecnd_D_Stat
LightTestPreconditions2_St	TlghtTestPrecnd_D2_Stat
LightTest_St	TlghtTest_D_Stat
OnBoardLightTest_Rq	TlightTest_D_Mnu

Table: Logical name/CAN signal mapping

2.7 Physical Mapping of Classes

The table below shows an example of how the logical classes that make up the Trailer Light Check feature may be mapped into physical modules. This mapping example is specific to the FNV2 architecture and does not necessarily carryover to other carlines or vehicle architectures.

Logical Class	Physical Module (ECU)
TrailerLightCheckOnBoardClient	ECG
TrailerLightCheckServer	BCM
TrailerLightCheckOffBoardGateway	TCU
TrailerLightCheckOffBoardClient	SDN / FP
TrailerLightCheckInterfaceClient	APIM

3 General Requirements

3.1 TLT-REQ-369325/A-Trailer_Light_Check Configuration_Parameter

The Trailer Light Check Interface Client shall have a configurable parameter to determine whether the Trailer Light Check feature is to be supported. Refer to the Infotainment Diagnostic Specification for further details.

3.2 TLT-REQ-369388/A-Trailer_Light_Check AppLink_Requirements

The Trailer Light Check Interface Client shall also be responsible for implementing AppLink-based requirements related to the Trailer Light Check feature. For further details, see the AppLink Client SPSS.

3.3 TLT-REQ-403898/A-Light_Test Preconditions_Status Signal_Variants

The Trailer Light Check Interface Client shall have a configurable parameter to determine which variant of the Light Test Preconditions status signal to use. Variant 1 shall indicate for the client to use the existing LightTestPreconditions_St signal, while Variant 2 shall indicate for the client to use the new LightTestPreconditions2_St signal. For the physical name associated with the new logical signal, please refer to the Logical Signal Mapping section.

Note: For the purposes of this document, these signals are functionally equivalent as the only difference is a change to the literal name for value 0x7 of the signal. As such, all references to LightTestPreconditions_St in the functional requirements sections of this document shall also be applicable when configured for Variant 2.

4 Functional Definition

4.1 TLT-FUN-REQ-368121/A-Start Test

4.1.1 Requirements

4.1.1.1 TLT-REQ-368122/A-Sending the Start Test Request

The Trailer Light Check Interface Client shall send the OnBoardLightTest_Rq set to StartTest when the user has selected to start the Trailer Light Check via the In-Vehicle HMI. After a period of 1s, the OnBoardLightTest_Rq shall be set back to Null.

4.1.1.2 TLT-REQ-368123/A-Updating HMI For Test In Progress

The Trailer Light Check Interface Client shall update the HMI when receiving the LightTest_St set to TestInProgress to indicate to the user that the Trailer Light Check sequence has begun.

4.1.1.3 TLT-REQ-368124/A-Updating HMI for Completed Test

The Trailer Light Check Interface Client shall update the HMI when receiving the LightTest_St set to TestCompleted to indicate to the user that the Trailer Light Check sequence has completed.

4.1.1.4 TLT-REQ-368125/B-Updating HMI for Preconditions Not Met

The Trailer Light Check Interface Client shall update the HMI when receiving the LightTestPreconditions_St set to any of the following values below to indicate to the user that the Trailer Light Check preconditions have not been met:

- IgnitionNotOn
- TailLightsOn
- BattSocLessThan75Percent
- InteractionPresent
- NotStationary
- Error / TrailerNotConnected

4.1.2 Use Cases

4.1.2.1 TLT-UC-REQ-342936/A-User Starts Light Test

Actors	Trailer Light Check User, Trailer Light Check Off-Board Client, Trailer Light Check Server, Trailer Light Check OnBoard Client
Pre-conditions	All Trailer Light Check preconditions are met
Scenario Description	User selects to start a Light Test from their mobile device
Post-conditions	Light Test has been started and completed after timeout
List of Exception Use Cases	E1 – Light Test Preconditions Not Met
Notes	
Interfaces	HMI, FCI

4.1.2.2 TLT-UC-REQ-342940/A-Light Test Preconditions Not Met

Actors	Trailer Light Check User, Trailer Light Check Off-Board Client, Trailer Light Check Server, Trailer Light Check OnBoard Client
Pre-conditions	One or more of the Trailer Light Check preconditions are not met
Scenario Description	User attempts to select to start a Light Test from their mobile device
Post-conditions	Light Test has not been started and HMI is presented to the User to indicate which precondition was not met

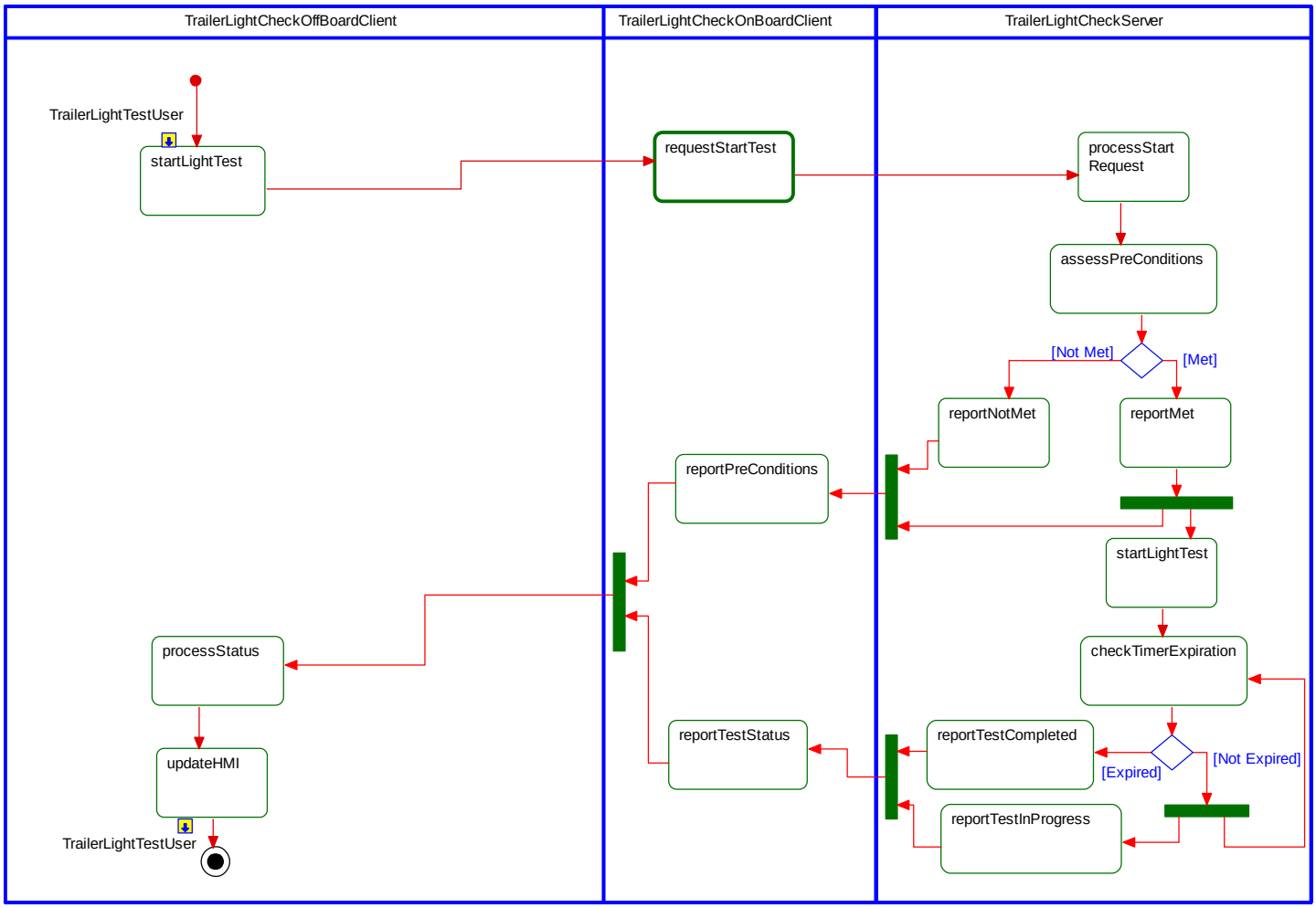
List of Exception Use Cases	
Notes	
Interfaces	HMI, FCI

4.1.3 White Box View

4.1.3.1 Activity Diagrams

4.1.3.1.1 TLT-ACT-REQ-342937/A-User Starts Light Test

Activity Diagram



4.1.3.2 Sequence Diagrams

4.1.3.2.1 TLT-SD-REQ-342938/A-User Starts Light Test

Scenarios

Normal Usage

User makes selection to start Light Test

Constraints

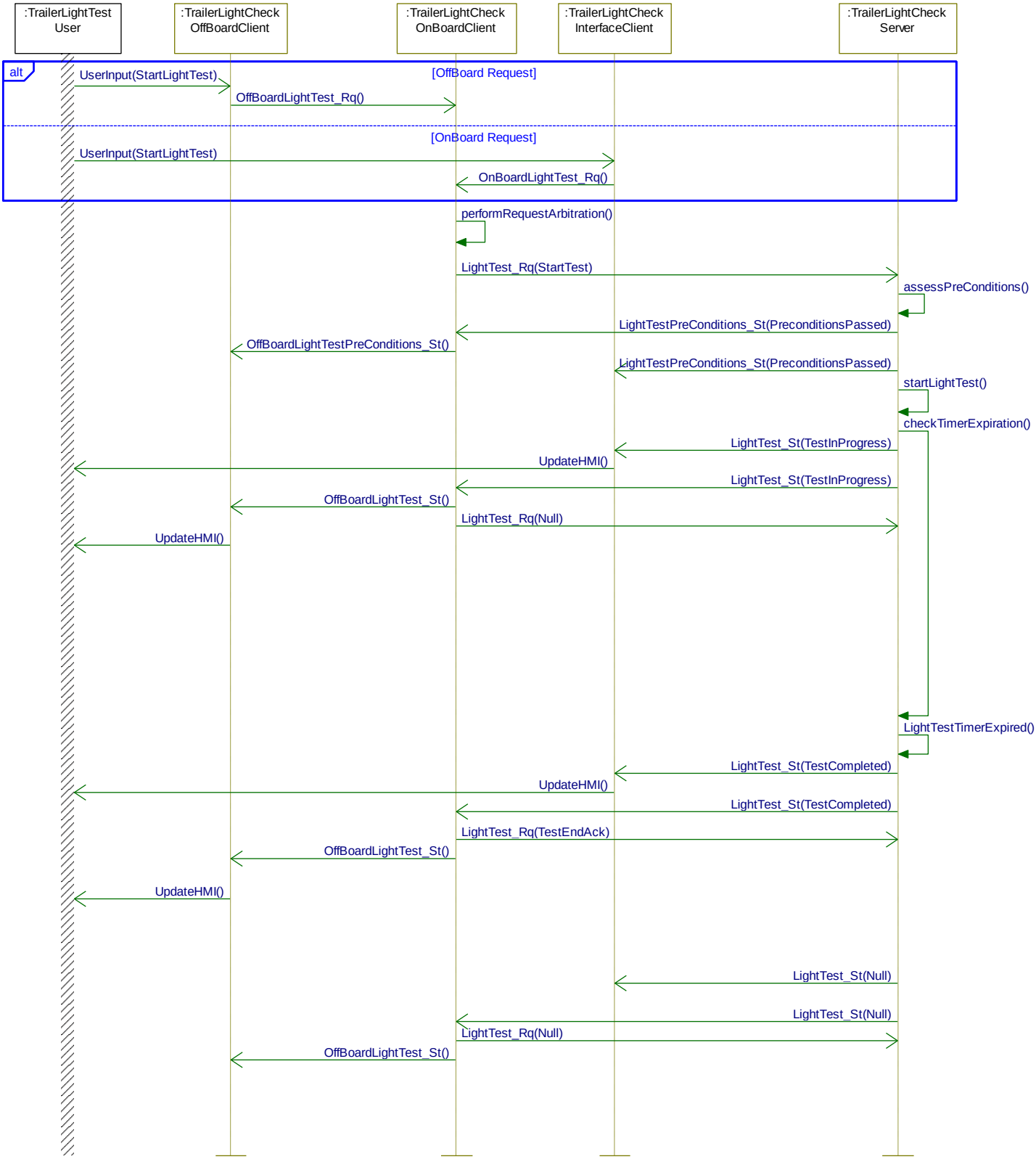
Pre-condition

All Light Test preconditions have been met

Post-condition

Light Test has completed and HMI indicated to the user

Sequence Diagram



4.1.3.2.2 TLT-SD-REQ-342948/A-PreConditions Not Met

Scenarios

Normal Usage

User makes selection to start Light Test

Constraints

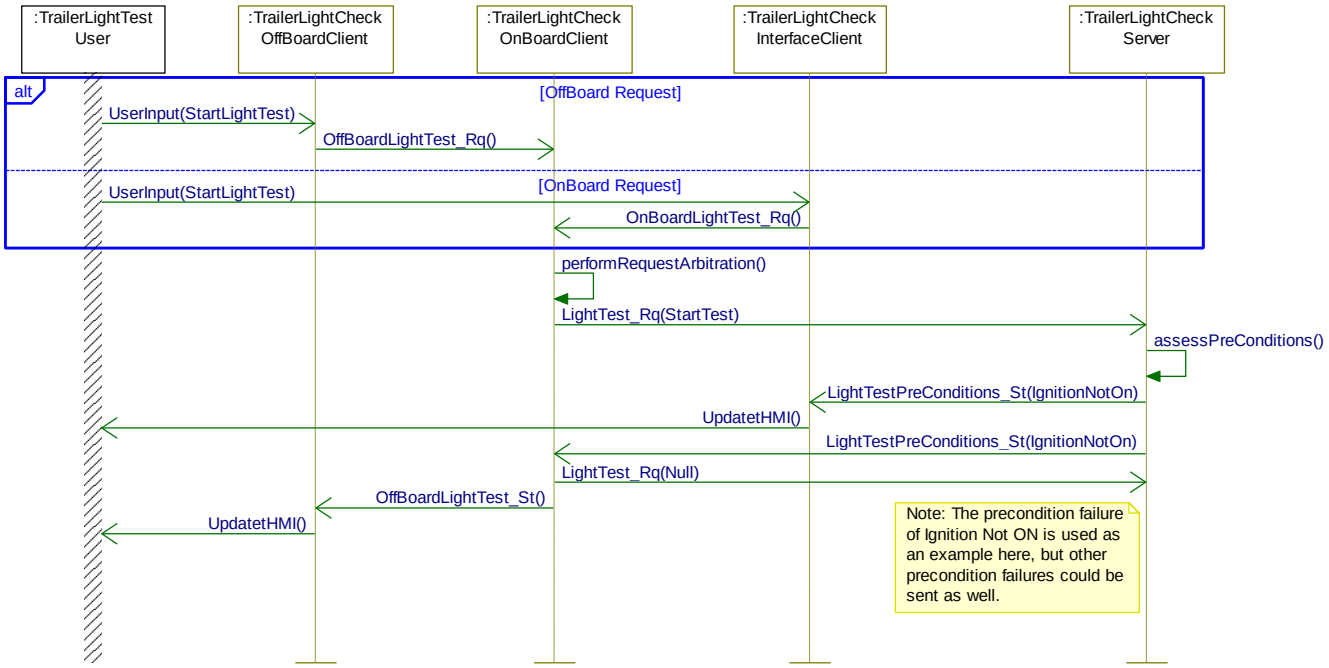
Pre-condition

One or more of the Light Test preconditions have not been met

Post-condition

Light Test has not started and HMI indicated to the user that preconditions are not met

Sequence Diagram



4.2 TLT-FUN-REQ-368891/A-Stop Test

4.2.1 Requirements

4.2.1.1 TLT-REQ-368892/A-Sending the Stop Test Request

The Trailer Light Check Interface Client shall send the OnBoardLightTest_Rq set to StopTest when the user has selected to stop the Trailer Light Check via the In-Vehicle HMI. After a period of 1s, the OnBoardLightTest_Rq shall be set back to Null.

4.2.1.2 TLT-REQ-368893/A-Updating HMI for Test Ended

The Trailer Light Check Interface Client shall update the HMI when receiving the LightTest_St set to Test Ended to indicate to the user that the Trailer Light Check sequence has been stopped.

4.2.1.3 TLT-REQ-368894/B-Updating HMI for Preconditions Not Met During Light Test

The Trailer Light Check Interface Client shall update the HMI when receiving the LightTestPreconditions_St, during a test in progress, set to any of the following values below to indicate to the user that the Trailer Light Check preconditions have not been met:

- IgnitionNotOn
- TailLightsOn
- BattSocLessThan75Percent
- InteractionPresent
- NotStationary
- Error / TrailerNotConnected

4.2.1.4 TLT-REQ-368895/A-Updating HMI for Unexpected Test Termination During Light Test

The Trailer Light Check Interface Client shall update the HMI to indicate to the user that the Trailer Light Check sequence has unexpectedly terminated when receiving the LightTest_St set to Null, after previously reported as TestInProgress without ever transitioning to TestCompleted or TestEnded prior to being set to Null.

4.2.2 Use Cases

4.2.2.1 TLT-UC-REQ-342943/B-User Stops Light Test

Actors	Trailer Light Check User, Trailer Light Check Off-Board Client, Trailer Light Check Server, Trailer Light Check OnBoard Client
Pre-conditions	Light Test is currently in progress
Scenario Description	User selects to stop a Light Test from their mobile device
Post-conditions	Light Test has been stopped and user has been notified via the HMI
List of Exception Use Cases	
Notes	
Interfaces	HMI, FCI

4.2.2.2 TLT-UC-REQ-342944/A-Light Test Preconditions Not Met During Light Test

Actors	Trailer Light Check User, Trailer Light Check Off-Board Client, Trailer Light Check Server, Trailer Light Check OnBoard Client
Pre-conditions	Light Test is in progress
Scenario Description	One or more of the preconditions are no longer met during an in progress Light Test
Post-conditions	Light Test has been stopped and HMI is presented to the User to indicate which precondition was not met
List of Exception Use Cases	
Notes	
Interfaces	HMI, FCI

4.2.2.3 TLT-UC-REQ-350413/A-Unexpected Test Termination

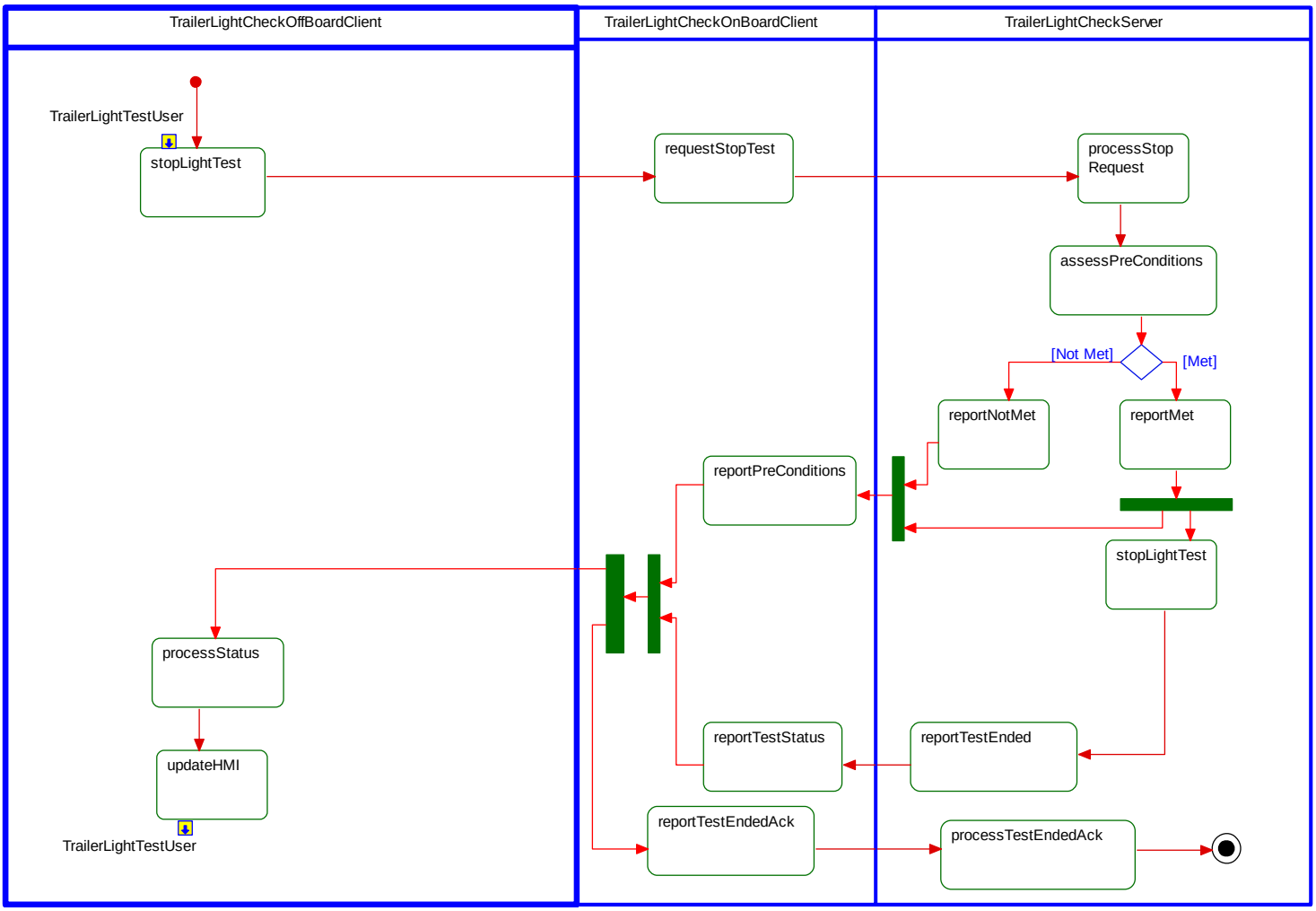
Actors	Trailer Light Check User, Trailer Light Check Off-Board Client, Trailer Light Check Server, Trailer Light Check OnBoard Client
Pre-conditions	Light Test is in progress
Scenario Description	An unexpected termination of the test occurred
Post-conditions	Light Test has been terminated and HMI is presented to the User to indicate the test was terminated unexpectedly
List of Exception Use Cases	
Notes	
Interfaces	HMI, FCI

4.2.3 White Box View

4.2.3.1 Activity Diagrams

4.2.3.1.1 TLT-ACT-REQ-342945/A-User Stops Light Test

Activity Diagram



4.2.3.2 Sequence Diagrams

4.2.3.2.1 TLT-SD-REQ-342946/A-User Stops Light Test

Scenarios

Normal Usage

User makes selection to stop Light Test

Constraints

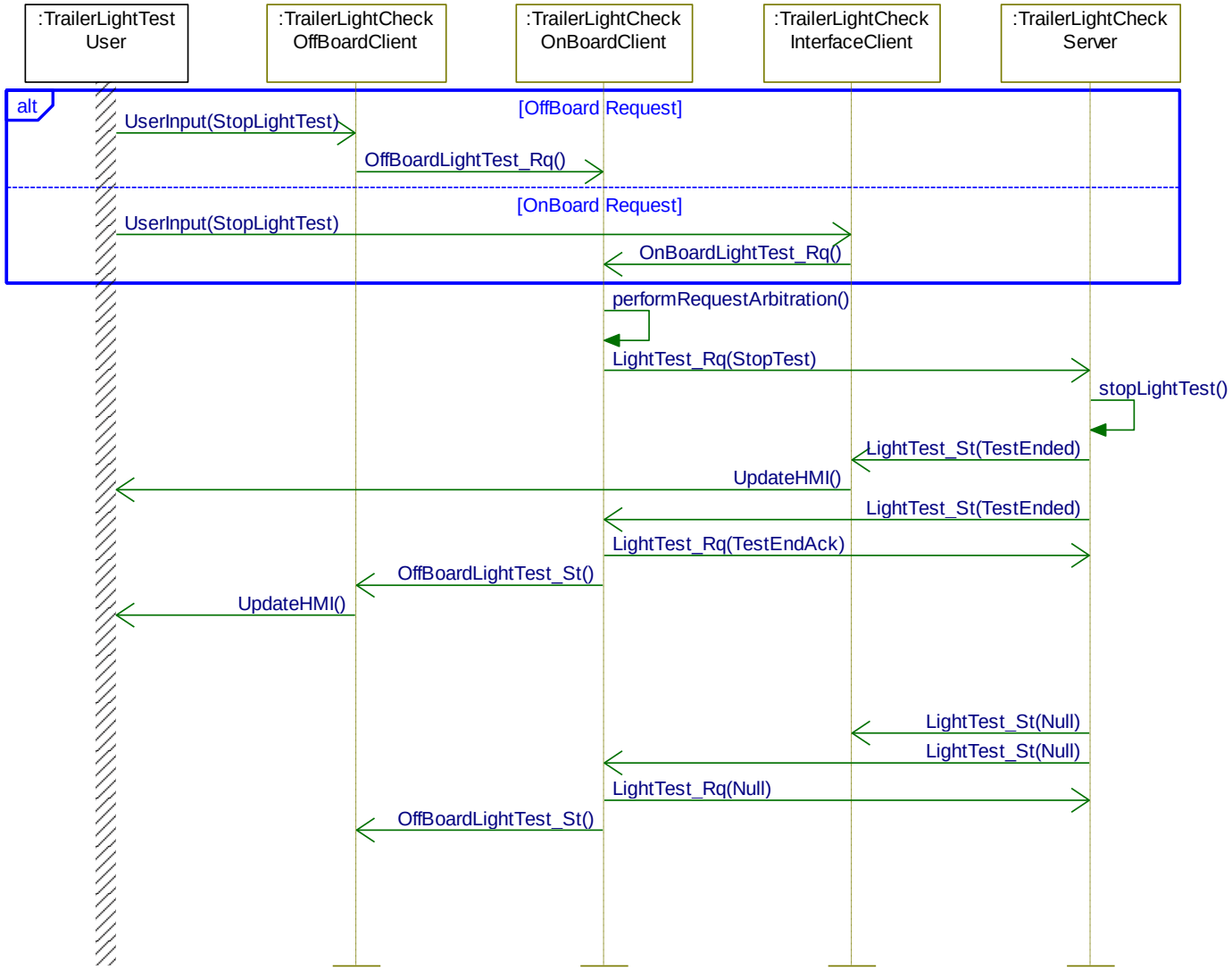
Pre-condition

Light Test is currently in progress

Post-condition

Light Test has been stopped by the User

Sequence Diagram



4.2.3.2.2 TLT-SD-REQ-350414/A-Light Test Preconditions Not Met During Light Test

Scenarios

Normal Usage

The Preconditions are no longer met during a test in progress

Constraints

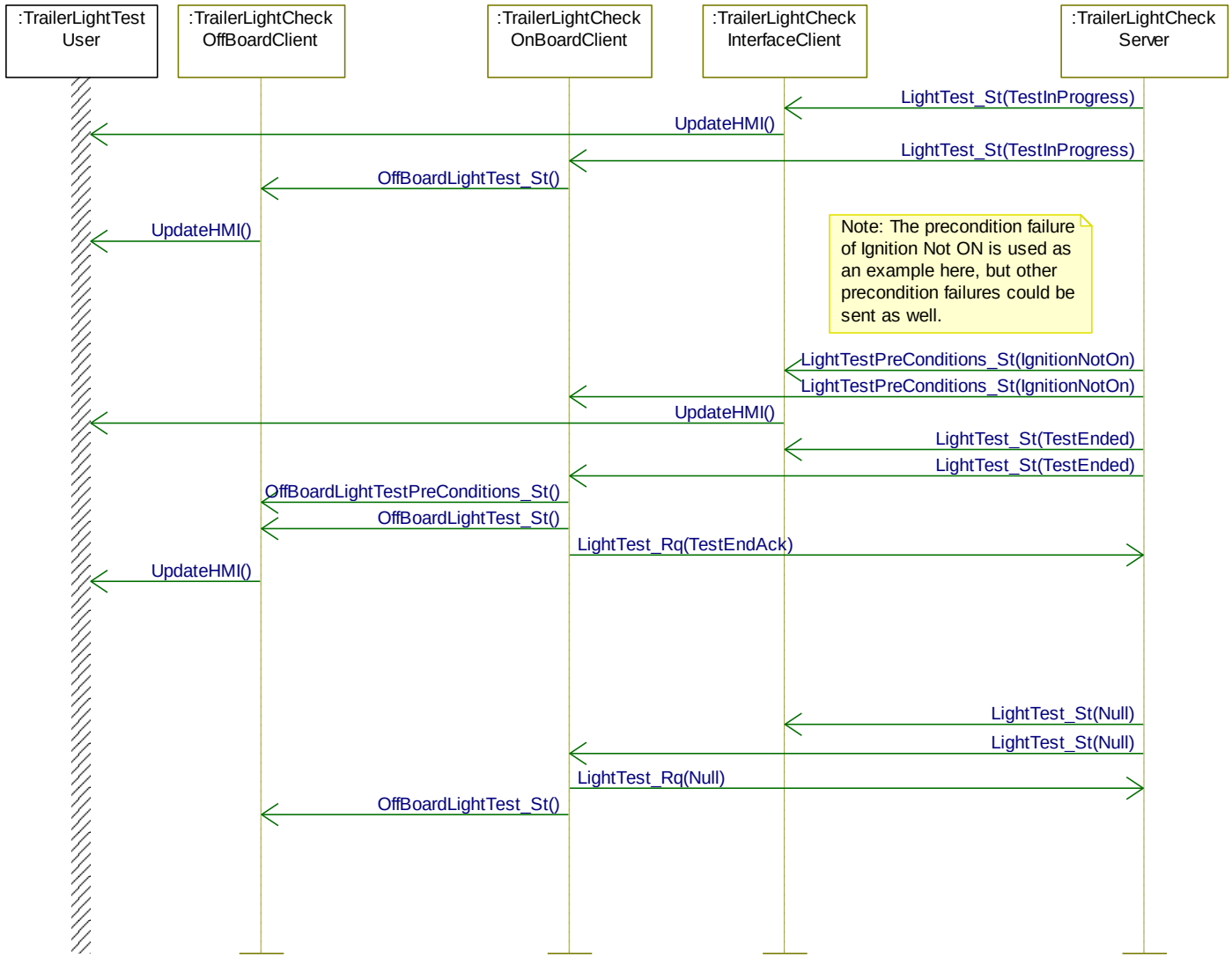
Pre-condition

Light Test is currently in progress

Post-condition

Light Test has been stopped by the Trailer Light Check Server

Sequence Diagram



4.2.3.2.3 TLT-SD-REQ-350415/A-Unexpected Termination During Light Test

Scenarios

Normal Usage

An unexpected termination of the test occurred during a test in progress

Constraints

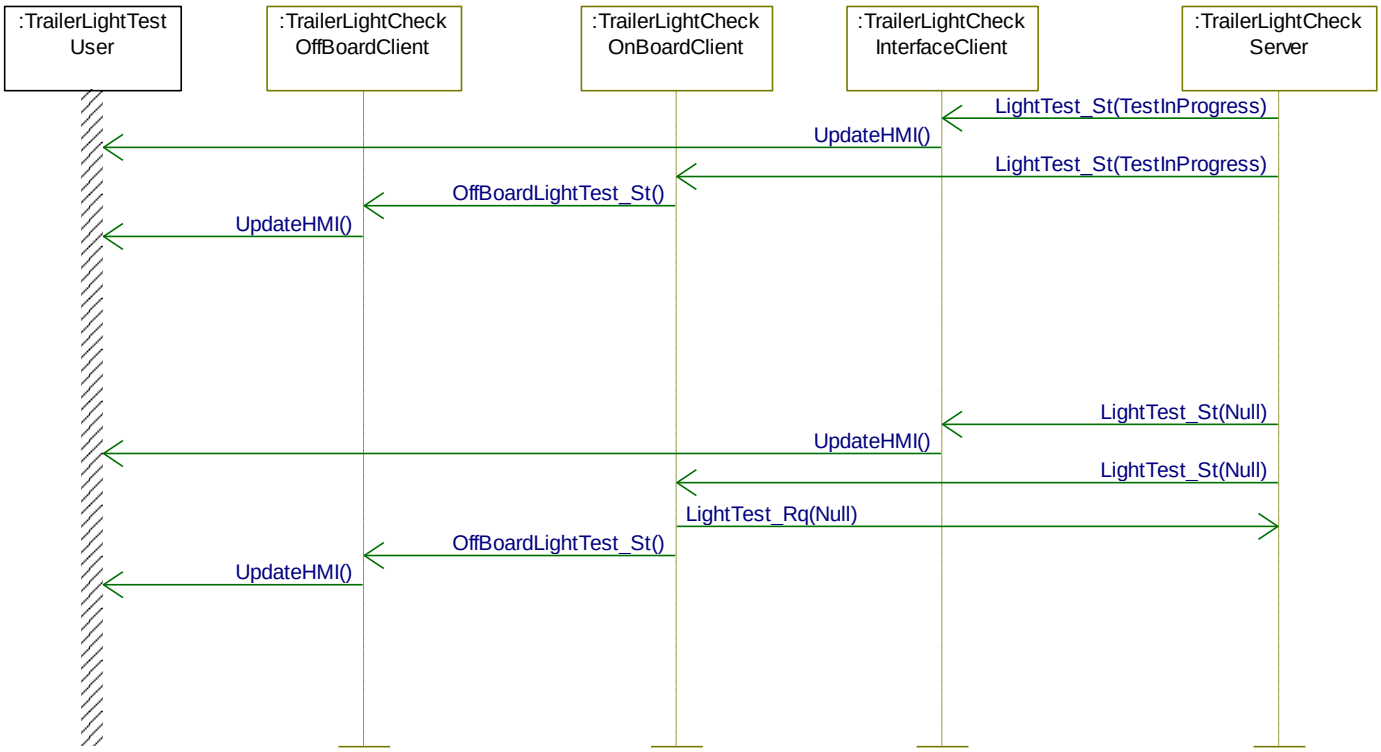
Pre-condition

Light Test is currently in progress

Post-condition

Light Test has been terminated unexpectedly

Sequence Diagram



5 Appendix: Reference Documents

Reference #	Document Title
1	AppLink Client SPSS
2	
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