

**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 CONFIDENTIALF**

**Revision History**

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|  | 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 |
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|  | 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 |

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# 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.

## 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

## 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.

1. Wait 2.3\* seconds with only tail lights ON (including front and rear side markers)
2. Left turn light on vehicle and trailer will flash on and off 6\* times
3. Right turn light on vehicle and trailer will flash on and off 6\* times
4. Brake lights on vehicle and trailer will turn ON for 4.5\* seconds
5. Reverse lights on vehicle and trailer will turn ON for 4.5\* seconds\*
6. Rear Fog Lights on trailer will turn ON for 4.5\* seconds\*\*
7. Wait 2.3\* seconds with only tail lights ON (including front and rear side markers)
8. Turn off all tail lights (including front and rear side markers)

                     9.1 Turn off license plate lights

                     9.2 Wait 2.3 seconds\*

1. 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*

## Logical Block Diagram



## 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 |

# Architectural Design

## 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.

## 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.

## 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.

## TLT-IIR-REQ-368115/B-TrailerLightCheckInterfaceClient\_Rx

### 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 |

### 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 |

### 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 |

## TLT-IIR-REQ-368118/A-TrailerLightCheckInterfaceClient\_Tx

### 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 |

## 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

## 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 |

# General Requirements

## 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.

## 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.

## 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.

# Functional Definition

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

### Requirements

#### 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.

#### 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.

#### 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.

#### 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

### Use Cases

#### 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 |

#### 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 |

### White Box View

#### Activity Diagrams

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

Activity Diagram



#### Sequence Diagrams

##### 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



##### 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



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

### Requirements

#### 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.

#### 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 TestEnded to indicate to the user that the Trailer Light Check sequence has been stopped.

#### 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

#### 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.

### Use Cases

#### 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 |

#### 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 |

#### 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 |

### White Box View

#### Activity Diagrams

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

Activity Diagram



#### Sequence Diagrams

##### 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



##### 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



##### 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



# Appendix: Reference Documents

|  |  |
| --- | --- |
| Reference # | Document Title |
| 1 | AppLink Client SPSS |
| 2 |  |
| 3 |  |
| 4 |  |
| 5 |  |
| 6 |  |
| 7 |  |
| 8 |  |
| 9 |  |
| 10 |  |
| 11 |  |
| 12 |  |
| 13 |  |
| 14 |  |
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| 16 |  |
| 17 |  |