Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – Off-Road Status IOD

APIM Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.0

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Version Date: August 23, 2019

FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
August 23, 2019	1.0	Initial Release	

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1 Overview

The Off-Road Status IoD (information on demand) feature displays various driver information elements related to the Off-Road Status of the vehicle on the Centerstack HMI. See the HMI Spec for details of how this is displayed.

1.1 Terminology and Abbreviations

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

Term	Description
ABS	Anti-Lock Braking System
APIM	Accessory Protocol Interface Module
BCM	Body Control Module
CHCM	Chassis Control Module
FNV2	Fully Networked Vehicle Architecture
IOD	Information On Demand
ORTA	Off-Road Turn Assist
PCM	Powertrain Control Module
TPMS	Tire Pressure Monitoring System

2 Architectural Design

2.1 ORIOD-CLD-REQ-358482/A-Off-Road Status Interface Client

The Off-Road Status Interface Client (OffRoadStatusInterfaceClient) is responsible for receiving various vehicle data elements of the Off-Road Status IOD feature and displaying them via the HMI to the user.

2.2 ORIOD-CLD-REQ-358483/A-Off-Road Status Server

The Off-Road Status Server (OffRoadStatusServer) is responsible for reporting the status of the various vehicle data elements related to the Off-Road Status IOD feature.

2.3 Physical Mapping of Classes

The table below shows an example of how the logical classes that make up the Off-Road Status IOD 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)
OffRoadStatusInterfaceClient	APIM
OffRoadStatusServer	BCM/PCM/ABS/CHCM

2.4 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
StabilizerBarConnect_St	StabBarCnnctLamp_D_Rq
FrontELocker_St	FrontDiffLckLamp_D_Rq
RearELocker_St	RearDiffLckLamp_D_Rq
OffRoadTurnAssistMode_St	OrtaMde_D_Ind
OffRoadTurnAssistMessage_Rq	OrtaMsgTxt_D_Rq
DriveMode4x2_St	Awd2wdLamp_D_RqDsply
DriveMode4x4Auto_St	AwdAutoLamp_D_RqDsply
DriveMode4x4Hi_St	AwdHiLamp_D_RqDsply
DriveMode4x4Lo_St	AwdLoLamp_D_RqDsply
TirePressureLeftFront_St	Tire_Press_LF_Stat
TirePressureRightFront_St	Tire_Press_RF_Stat
TirePressureLeftRear_St	Tire_Press_LR_OLR_Stat
TirePressureRightRear_St	Tire_Press_RR_ORR_Stat
TirePressureInnerLeftRear_St	Tire_Press_ILR_Stat
TirePressureInnerRightRear_St	Tire_Press_IRR_Stat
TirePressureDataLeftFront_St	Tire_Press_LF_Data
TirePressureDataRightFront_St	Tire_Press_RF_Data
TirePressureDataLeftRear_St	Tire_Press_LR_OLR_Data
TirePressureDataRightRear_St	Tire_Press_RR_ORR_Data
TirePressureDataInnerLeftRear_St	Tire_Press_ILR_Data
TirePressureDataInnerRightRear_St	Tire_Press_IRR_Data

Table: Logical name/CAN signal mapping

2.5 ORIOD-IIR-REQ-358484/A-OffRoadStatusInterfaceClient _Rx

2.5.1 MD-REQ-358485/A-StabilizerBarConnect_St

Message Type: Status

This signal is used to report the status of Stabilizer Bar indication

Name	Literals	Value	Description
StabilizerBarConnect_St	-	-	This provides the Stabilizer Bar indication status
	Off	0x00	
	On	0x01	
	Slow_Flash	0x02	
	Fast_Flash	0x03	

2.5.2 MD-REQ-358488/A-FrontELocker_St

Message Type: Status

This signal is used to report the status of Front Differential Lock Lamp

Name	Literals	Value	Description
FrontELocker_St	-	-	This provides the status of Front eLocker indication
	Off	0x0	
	On	0x1	
	Flash	0x2	
	Triggered	0x3	

2.5.3 MD-REQ-358489/A-RearELocker_St

Message Type: Status

The signal is used to report the status of Rear Differential Lock Lamp

Name	Literals	Value	Description
RearELocker_St	-	-	The status of Rear eLocker indication
	Off	0x0	
	On	0x1	
	Flash	0x2	
	Not_Used	0x3	

2.5.4 MD-REQ-358486/A-OffRoadTurnAssistMode_St

Message Type: Status

The signal is used to report the status of the Off-Road Turn Assist Mode

Name	Literals	Value	Description
OffRoadTurnAssistMode_St	-	-	The status of the Off-Road Turn Assist Mode
	Off	0x0	
	StandbyLeft	0x1	
	StandbyRight	0x2	

	ActiveLeft	0x3	
	ActiveRight	0x4	
	NotUsed_1	0x5	
	NotUsed_2	0x6	
	Faulty	0x7	

2.5.5 MD-REQ-358954/A-OffRoadTurnAssistMessage_Rq

Message Type: Request

The signal is used to request the Off-Road Turn Assist Message Text

Name	Literals	Value	Description
OffRoadTurnAssistMessage_Rq	-	-	This requests the Off-Road Turn Assist Message Text
	NoMessage	0x0	
	Message1	0x1	
	Message2	0x2	
	Message3	0x3	
	Message4	0x4	
	Message5	0x5	
	Message6	0x6	
	Message7	0x7	
	Message8	0x8	
	Message9	0x9	
	Message10	0xA	
	Message11	0xB	
	Message12	0xC	
	Message13	0xD	
	Message14	0xE	
	Message15	0xF	

2.5.6 MD-REQ-358955/A-DriveMode4x2_St

Message Type: Status

The signal is used to report the status of 4x2 Drive Mode

Name	Literals	Value	Description
DriveMode4x2_St	-	-	The status of 4x2 Drive Mode indication
	Off	0x0	
	On	0x1	
	Flash	0x2	
	Not_Used	0x3	

2.5.7 MD-REQ-358956/A-DriveMode4x4Auto_St

Message Type: Status

The signal is used to report the status of 4x4 Auto Drive Mode

Name	Literals	Value	Description
DriveMode4x4Auto_St	-	-	The status of 4x4 Auto Drive Mode indication

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	Off	0x0	
	On	0x1	
	Flash	0x2	
	Not_Used	0x3	

2.5.8 MD-REQ-358957/A-DriveMode4x4Hi_St

Message Type: Status

The signal is used to report the status of 4x4 High Drive Mode

Name	Literals	Value	Description
DriveMode4x4Hi_St	-	-	The status of 4x4 High Drive Mode indication
	Off	0x0	
	On	0x1	
	Flash	0x2	
	Not_Used	0x3	

2.5.9 MD-REQ-358958/A-DriveMode4x4Lo_St

Message Type: Status

The signal is used to report the status of 4x4 Low Drive Mode

Name	Literals	Value	Description
DriveMode4x4Lo_St	-	-	The status of 4x4 Low Drive Mode indication
	Off	0x0	
	On	0x1	
	Flash	0x2	
	Not_Used	0x3	

2.5.10 MD-REQ-361383/A-TirePressureLeftFront_St

Message Type: Status

Signal indicating the left front tire pressure status.

Name	Literals	Value	Description
Type	-	-	Left front tire pressure status
	Unknown	0x0	
	Normal	0x1	
	Low	0x2	
	Fault	0x3	
	Alert	0x4	

2.5.11 MD-REQ-361384/A-TirePressureRightFront_St

Message Type: Status

Signal indicating the right front tire pressure status.

Name	Literals	Value	Description
Type	-	-	Right front tire pressure status
	Unknown	0x0	
	Normal	0x1	

	Low	0x2	
	Fault	0x3	
	Alert	0x4	

2.5.12 MD-REQ-361385/A-TirePressureLeftRear_St

Message Type: Status

Signal indicating the left rear tire pressure status.

Name	Literals	Value	Description
Type	-	-	Left rear tire pressure status
	Unknown	0x0	
	Normal	0x1	
	Low	0x2	
	Fault	0x3	
	Alert	0x4	

2.5.13 MD-REQ-361386/A-TirePressureRightRear_St

Message Type: Status

Signal indicating the right rear tire pressure status.

Name	Literals	Value	Description
Type	-	-	Right rear tire pressure status
	Unknown	0x0	
	Normal	0x1	
	Low	0x2	
	Fault	0x3	
	Alert	0x4	

2.5.14 MD-REQ-361387/A-TirePressureInnerLeftRear_St

Message Type: Status

Signal indicating the inner left rear tire pressure status.

Name	Literals	Value	Description
Type	-	-	Inner left rear tire pressure status
	Unknown	0x0	
	Normal	0x1	
	Low	0x2	
	Fault	0x3	
	Alert	0x4	

2.5.15 MD-REQ-361388/A-TirePressureInnerRightRear_St

Message Type: Status

Signal indicating the inner right rear tire pressure status.

Name	Literals	Value	Description
Type	-	-	Inner right rear tire pressure status

	Unknown	0x0	
	Normal	0x1	
	Low	0x2	
	Fault	0x3	
	Alert	0x4	

2.5.16 MD-REQ-361389/A-TirePressureDataLeftFront_St

Message Type: Status

Status used to indicate pressure of the left front tire.

Name	Literals	Value	Description
Type	-	-	Indicates left front tire pressure Unit: kilopascal Resolution:1 Offset:0
	kilopascal	0x0 to 0xFFFD	

2.5.17 MD-REQ-361390/A-TirePressureDataRightFront_St

Message Type: Status

Status used to indicate pressure of the right front tire.

Name	Literals	Value	Description
Type	-	-	Indicates right front tire pressure Unit: kilopascal Resolution:1 Offset:0
	kilopascal	0x0 to 0xFFFD	

2.5.18 MD-REQ-361391/A-TirePressureDataLeftRear_St

Message Type: Status

Status used to indicate pressure of the left rear tire.

Name	Literals	Value	Description
Type	-	-	Indicates left rear tire pressure Unit: kilopascal Resolution:1 Offset:0
	kilopascal	0x0 to 0xFFFD	

2.5.19 MD-REQ-361392/A-TirePressureDataRightRear_St

Message Type: Status

Status used to indicate pressure of the right rear tire.

Name	Literals	Value	Description
Type	-	-	Indicates right rear tire pressure Unit: kilopascal Resolution:1 Offset:0
	kilopascal	0x0 to 0xFFFD	

2.5.20 MD-REQ-361393/A-TirePressureDataInnerLeftRear_St

Message Type: Status

Status used to indicate pressure of the inner left rear tire.

Name	Literals	Value	Description
Type	-	-	Indicates inner left rear tire pressure Unit: kilopascal Resolution:1 Offset:0
	kilopascal	0x0 to 0xFFFD	

2.5.21 MD-REQ-361394/A-TirePressureDataInnerRightRear_St

Message Type: Status

Status used to indicate pressure of the inner right rear tire.

Name	Literals	Value	Description
Type	-	-	Indicates inner right rear tire pressure Unit: kilopascal Resolution:1 Offset:0
	kilopascal	0x0 to 0xFFFD	

3 General Requirements

3.1 ORIOD-REQ-358498/A-Powermode States

The OffRoadStatusInterfaceClient shall only allow the functionality defined by this feature/SPSS when the IgnitionStatus_St = Run/Start, and the touch screen display is On. If the powermode is in any other state, the gray driveline icon is shown.

3.2 ORIOD-REQ-359127/A-Off-Road Status Feature Configuration

The OffRoadStatusInterfaceClient shall have a configurable parameter to determine whether the vehicle supports the Off-Road Status IoD.

- If the parameter indicates the vehicle supports the Off-Road Status IoD, then all of the functionality and signals defined in this SPSS shall be supported, and the Off-Road Status IoD shall be made available to the user.
- If the parameter indicates the vehicle does not support Off-Road Status IoD, then none of the functionality defined in this SPSS shall be supported, and the Off-Road Status IoD shall not be made available to the user.

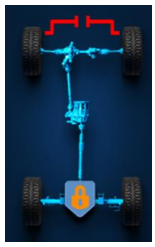
4 Functional Definition

4.1 ORIOD-FUN-REQ-358490/A-Display Off-Road Status - Stabilizer Bar

4.1.1 Requirements

4.1.1.1 ORIOD-REQ-358491/A-Stabilizer Icon Mapping

The OffRoadStatusInterfaceClient shall display the icon states as mapped according to the table below:

StabilizerBarConnect_St	Off-Road Status – Stabilizer Bar Icon State (Example Graphic)
0x0 Off (Inactive)	Blank (Stabilizer Bar icon not displayed)
0x1 On (Active – Amber)	
0x2 Slow_Flash (Active - Red)	
0x3 Fast_Flash (Active - Gray)	

Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states and graphics, please refer to the graphical assets and HMI specifications.

4.1.2 Use Cases

4.1.2.1 ORIOD-UC-REQ-358495/A-Display Off-Road Status - Stabilizer Bar

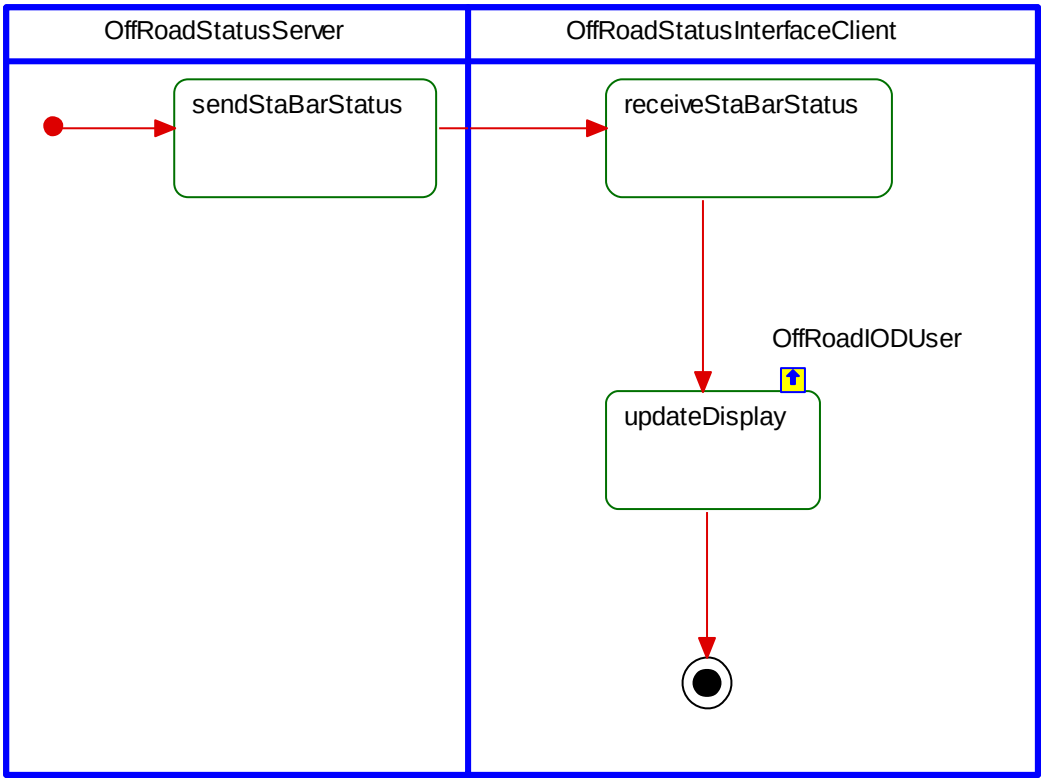
Actors	OffRoadStatusInterfaceClient, OffRoadStatusServer
Pre-conditions	Powermode conditions are met
Scenario Description	The user selects the Off-Road Status IOD on the OffRoadStatusInterfaceClient

Post-conditions	The OffRoadStatusInterfaceClient displays the Stabilizer Bar Status as part of the Off-Road Status IOD
List of Exception Use Cases	
Interfaces	CAN, G-HMI

4.1.3 White Box Views

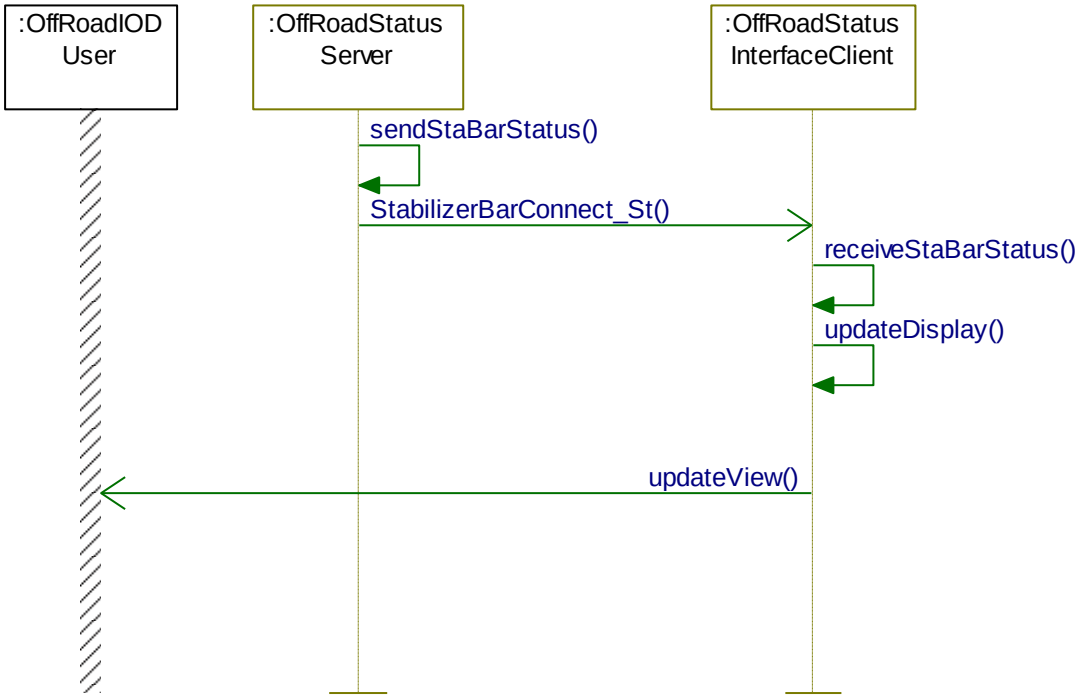
4.1.3.1 Activity Diagrams

4.1.3.1.1 ORIOD-ACT-REQ-358496/A-Display Off-Road Status - Stabilizer Bar



4.1.3.2 Sequence Diagrams

4.1.3.2.1 ORIOD-SD-REQ-358497/A-Display Off-Road Status - Stabilizer Bar



4.2 ORIOD-FUN-REQ-359128/A-Display Off-Road Status - eLocker

4.2.1 Requirements

4.2.1.1 ORIOD-REQ-359129/A-Independent eLocker Icon State Combinations

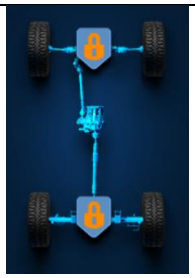
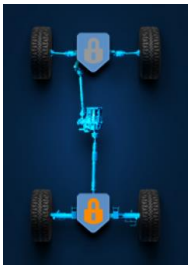
The Front and Rear eLocker are independent of each other. Hence, there could be several combinations of the eLocker icon status that can be displayed based on the individual FrontELocker_St and RearELocker_St signals.

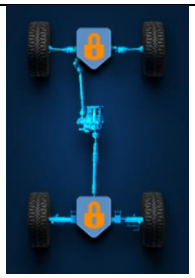
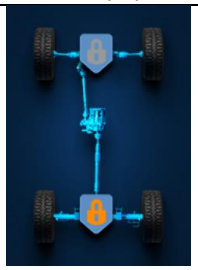
4.2.1.2 ORIOD-REQ-359130/A-eLocker Icon Mapping

The OffRoadStatusInterfaceClient shall display the icon states as mapped according to the tables below:

RearELocker_St	Previous State of RearELocker_St	Off-Road Status – Rear eLocker Icon State (Example Graphic)
0x0 Off (Inactive)	X (Don't Care)	Blank (Rear eLocker icon not displayed)
0x1 On (Active – Amber)	X (Don't Care)	

0x2 Flash (Active – Gray)	X (Don't Care)	
0x3 Not_Used (Active - Amber)	0x1 On	
0x3 Not_Used (Active - Gray)	0x0 Off OR 0x2 Flash	

FrontELocker_St	**Previous State of FrontELocker_St**	**Off-Road Status – Front eLocker Icon State (Example Graphic)**
0x0 Off (Inactive)	X (Don't Care)	Blank (Front eLocker icon not displayed)
0x1 On (Active – Amber)	X (Don't Care)	 (ignore the rear elocker state in the example)
0x2 Flash (Active – Gray)	X (Don't Care)	

		(ignore the rear elocker state in the example)
0x3 Triggered (Active - Amber)	0x1 On	 (ignore the rear elocker state in the example)
0x3 Triggered (Active - Gray)	0x0 Off OR 0x2 Flash	 (ignore the rear elocker state in the example)

Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states and graphics, please refer to the graphical assets and HMI specifications.

4.2.2 Use Cases

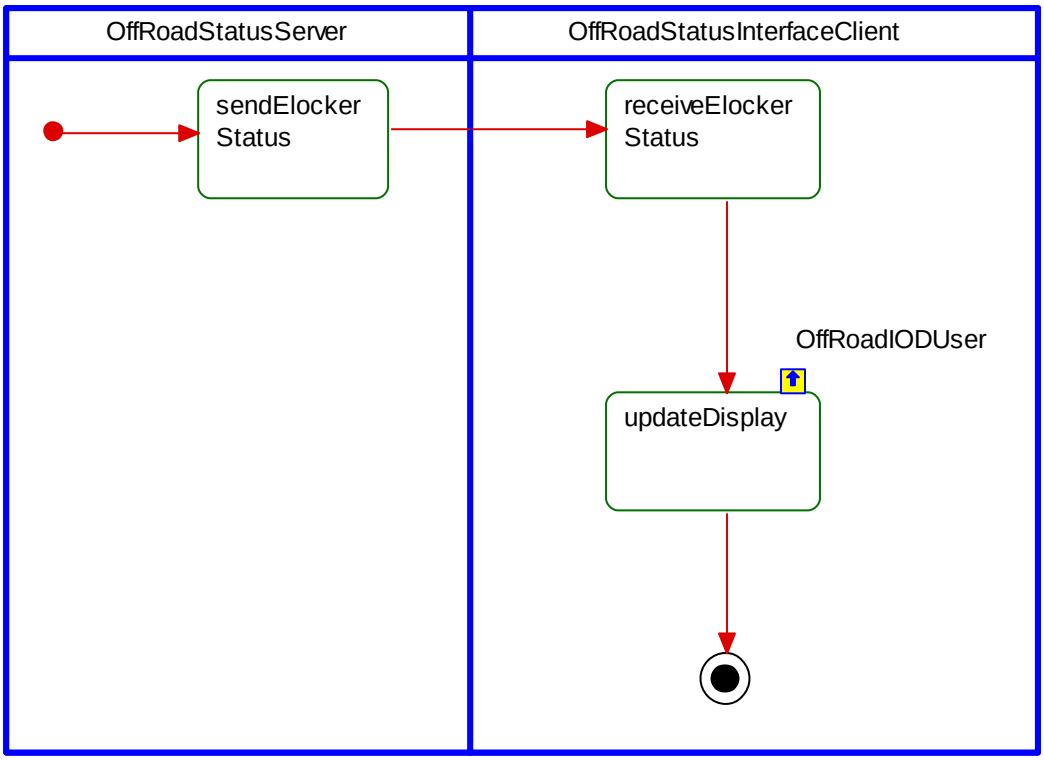
4.2.2.1 ORIOD-UC-REQ-359133/A-Display Off-Road Status - eLocker

Actors	OffRoadStatusInterfaceClient, OffRoadStatusServer
Pre-conditions	Powermode conditions are met
Scenario Description	The user selects the Off-Road Status IOD on the OffRoadStatusInterfaceClient
Post-conditions	The OffRoadStatusInterfaceClient displays the eLocker Status as part of the Off-Road Status IOD
List of Exception Use Cases	
Interfaces	CAN, G-HMI

4.2.3 White Box Views

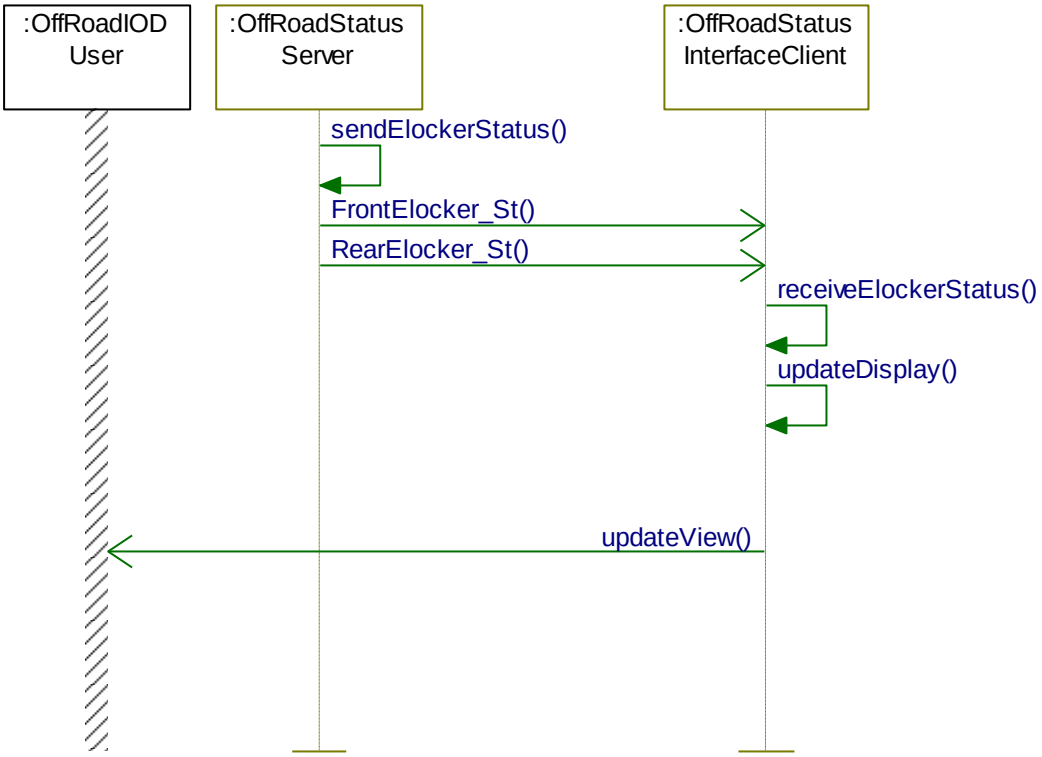
4.2.3.1 Activity Diagrams

4.2.3.1.1 ORIOD-ACT-REQ-359134/A-Display Off-Road Status - eLocker



4.2.3.2 Sequence Diagrams

4.2.3.2.1 ORIOD-SD-REQ-359135/A-Display Off-Road Status - eLocker



4.3 ORIOD-FUN-REQ-359136/A-Display Off-Road Status - Turn Assist

4.3.1 Requirements

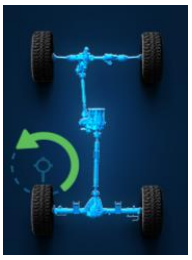
4.3.1.1 ORIOD-REQ-359137/A-Off-Road Turn Assist Icon States

If OffRoadTurnAssistMode_St is set to StandbyLeft or StandbyRight, both of the counter-clockwise and clockwise arrow icons shall be displayed and shown in an inactive state in accordance with the HMI specification. If OffRoadTurnAssistMode_St is set to ActiveLeft, only the left counter-clockwise arrow icon shall be displayed and shown in an active state in accordance with the HMI specification. If OffRoadTurnAssistMode_St is set to ActiveRight, only the right clockwise arrow shall be displayed and shown in an active state in accordance with the HMI specification.

4.3.1.2 ORIOD-REQ-359138/A-Off-Road Turn Assist Icon Mapping

The OffRoadStatusInterfaceClient shall display the icon states as mapped according to the tables below:

OffRoadTurnAssistMessage_Rq	OffRoadTurnAssistMode_St	Off-Road Status – Turn Assist Icon State (Example Graphic)
Message_3 (0x3)	X (Don't Care)	Blank (Turn Assist icon not displayed)
No_Message (0x0)	0x0 Off OR 0x5 – 0x7 (NotUsed/Faulty)	Blank (Turn Assist icon not displayed)

No_Message (0x0)	0x1 StandbyLeft OR 0x2 StandbyRight	
No_Message (0x0)	0x3 ActiveLeft	
No_Message (0x0)	0x4 ActiveRight	
All Other Cases		Blank (Turn Assist icon not displayed)

Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states and graphics, please refer to the graphical assets and HMI specifications.

4.3.2 Use Cases

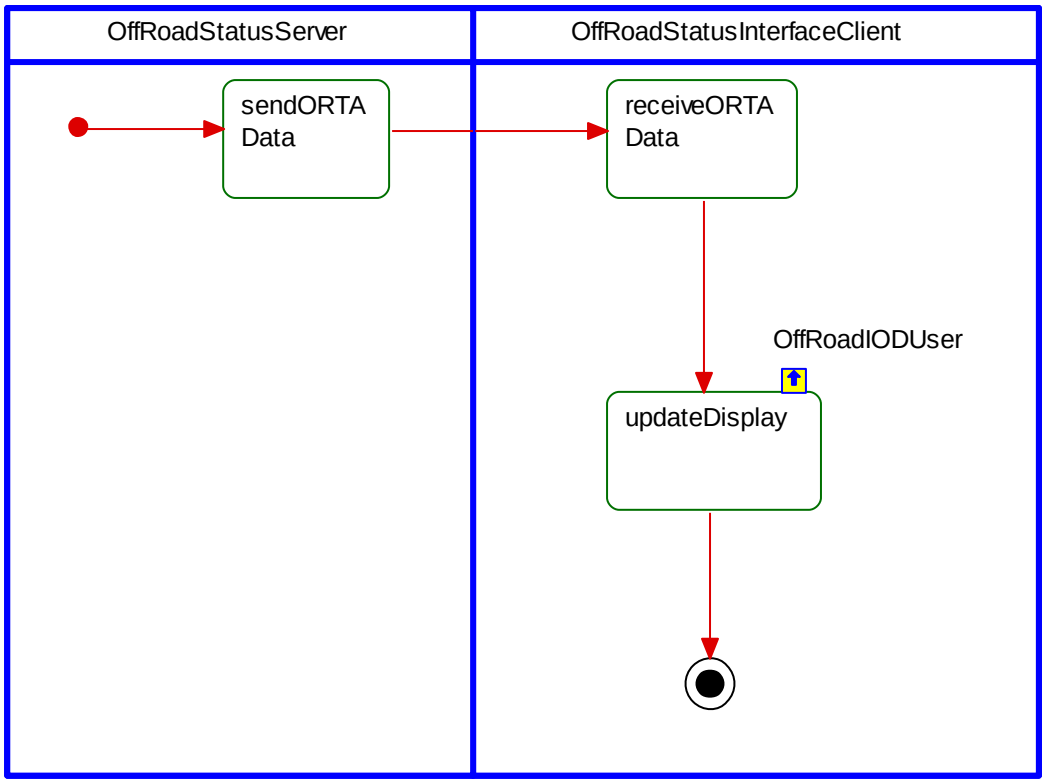
4.3.2.1 ORIOD-UC-REQ-359141/A-Display Off-Road Status - Turn Assist

Actors	OffRoadStatusInterfaceClient, OffRoadStatusServer
Pre-conditions	Powermode conditions are met
Scenario Description	The user selects the Off-Road Status IOD on the OffRoadStatusInterfaceClient
Post-conditions	The OffRoadStatusInterfaceClient displays the Off-Road Turn Assist Status as part of the Off-Road Status IOD
List of Exception Use Cases	
Interfaces	CAN, G-HMI

4.3.3 White Box Views

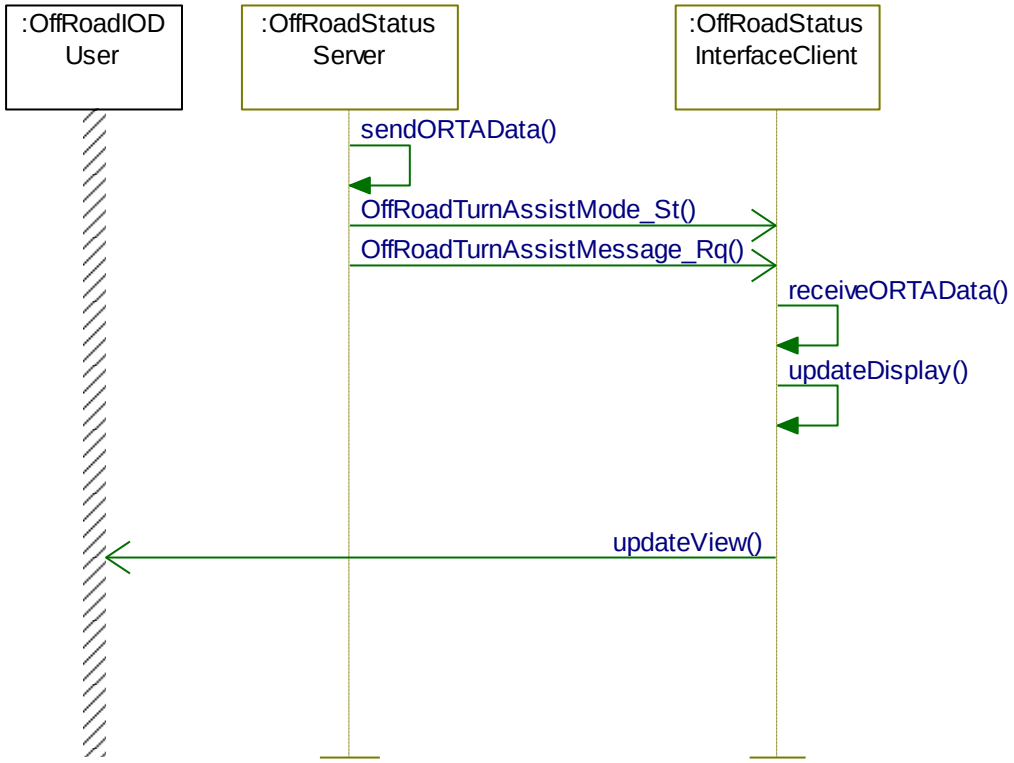
4.3.3.1 Activity Diagrams

4.3.3.1.1 ORIOD-ACT-REQ-359142/A-Display Off-Road Status - Turn Assist



4.3.3.2 Sequence Diagrams

4.3.3.2.1 ORIOD-SD-REQ-359143/A-Display Off-Road Status - Turn Assist



4.4 ORIOD-FUN-REQ-359144/A-Display Off-Road Status - Driveline Mode

4.4.1 Requirements

4.4.1.1 ORIOD-REQ-359146/A-Off-Road Driveline Mode Icon Mapping

The OffRoadStatusInterfaceClient shall display the icon states as mapped according to the table below:

DriveMode4x2_St	DriveMode4x4Auto_St	DriveMode4x4Hi_St	DriveMode4x4Lo_St	**Off-Road Status – Driveline Mode Icon State (Example Graphic)**
0x0 Off	0x0 Off	0x0 Off	0x0 Off	Blank (Driveline Mode icon grayed out)
0x1 On	0x0 Off	0x0 Off	0x0 Off	

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X (Don't Care)	0x1 On	X (Don't Care)	X (Don't Care)	
X (Don't Care)	X (Don't Care)	0x1 On	X (Don't Care)	
X (Don't Care)	X (Don't Care)	X (Don't Care)	0x1 On	
All other cases (e.g. Message Missing)				Blank (Driveline Mode icon grayed out)

Note: The icon state appearances and corresponding graphics referenced above are for example purposes only. For further details on icon states and graphics, please refer to the graphical assets and HMI specifications.

4.4.2 Use Cases

4.4.2.1 ORIOD-UC-REQ-359149/A-Display Off-Road Status - Driveline Mode

Actors	OffRoadStatusInterfaceClient, OffRoadStatusServer
Pre-conditions	Powermode conditions are met
Scenario Description	The user selects the Off-Road Status IOD on the OffRoadStatusInterfaceClient
Post-conditions	The OffRoadStatusInterfaceClient displays the Off-Road Driveline Mode Status as part of the Off-Road Status IOD

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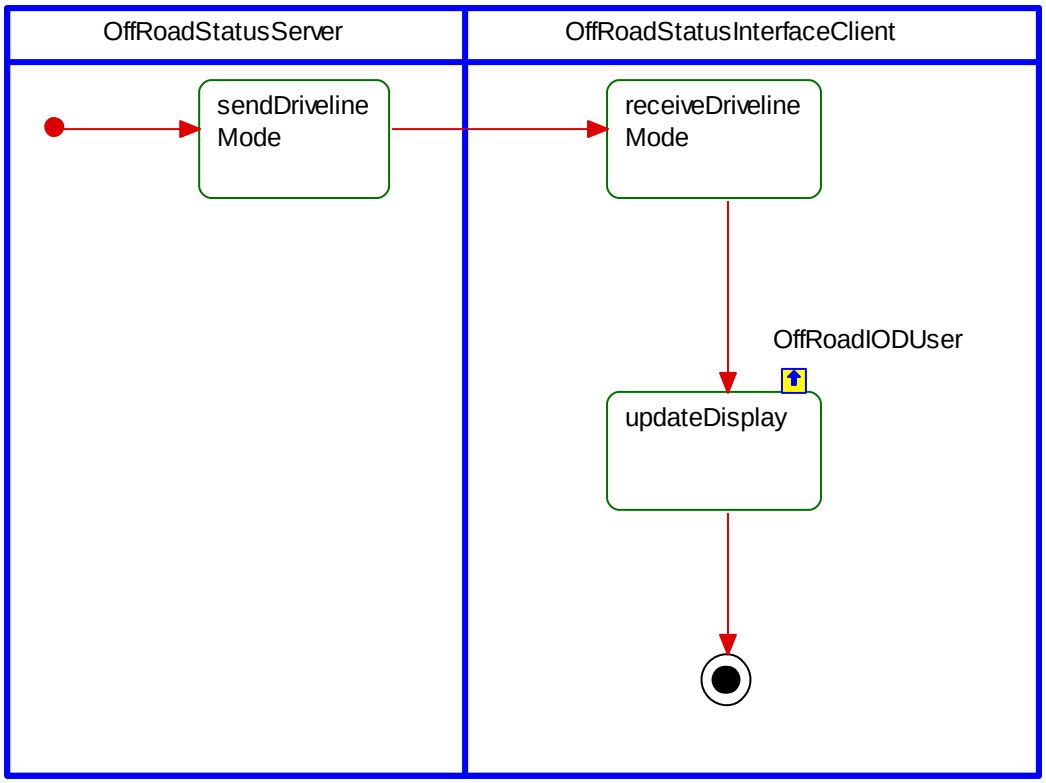
List of Exception Use Cases	
Interfaces	CAN, G-HMI

4.4.3 White Box Views

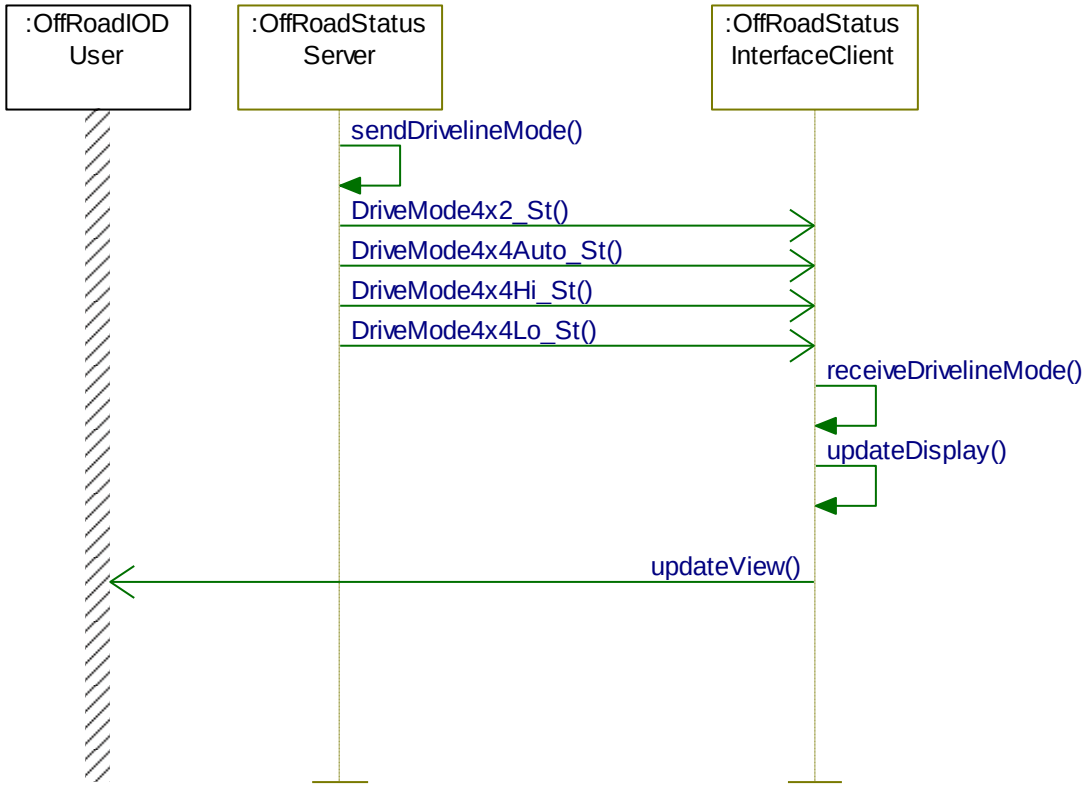
4.4.3.1 Activity Diagrams

4.4.3.1.1 ORIOD-ACT-REQ-359150/A-Display Off-Road Status - Driveline Mode



4.4.3.2 Sequence Diagrams

4.4.3.2.1 ORIOD-SD-REQ-359151/A-Display Off-Road Status - Driveline Mode



4.5 ORIOD-FUN-REQ-359152/A-Display Off-Road Status - Tire Pressure

4.5.1 Requirements

4.5.1.1 ORIOD-REQ-359153/A-Tire Pressure Warning Precondition

The tire pressure data (value and units) in the Off-Road Status IoD is to be displayed only when at least one of the low tire pressure warning status signals is set to Low or Alert (e.g. TirePressureLeftFront_St = Low.) The tire(s) graphic with the low pressure is/are to be highlighted according to the HMI specification. The tire pressure data and units are not displayed if all tires are within the normal pressure range. (i.e. Not a single low tire pressure warning active)

4.5.1.2 ORIOD-REQ-359154/A-Displaying Tire Pressure Values

The OffRoadStatusInterfaceClient shall display the Tire Pressure values as specified in the TPMS Information on Demand SPSS.

4.5.1.3 ORIOD-REQ-361397/A-Powermode Conditions

The OffRoadStatusInterfaceClient shall only allow the functionality defined by this feature/SPSS when the IgnitionStatus_St = Run/Start, and the touch screen display is On.

If IgnitionStatus_St != Run/Start, the OffRoadStatusInterfaceClient shall display dashes (ex. “- - -”) in place of any TPMS data.

4.5.1.4 ORIOD-REQ-361400/A-Missing Message Strategy

If any of the signals defined in this SPSS (used for displaying any TPMS data) become unavailable or missing from the bus for more than 5 seconds, the OffRoadStatusInterfaceClient shall display dashes (ex. “- - -”) in place of the corresponding TPMS data values with a “normal” status (no warning).

4.5.2 Use Cases

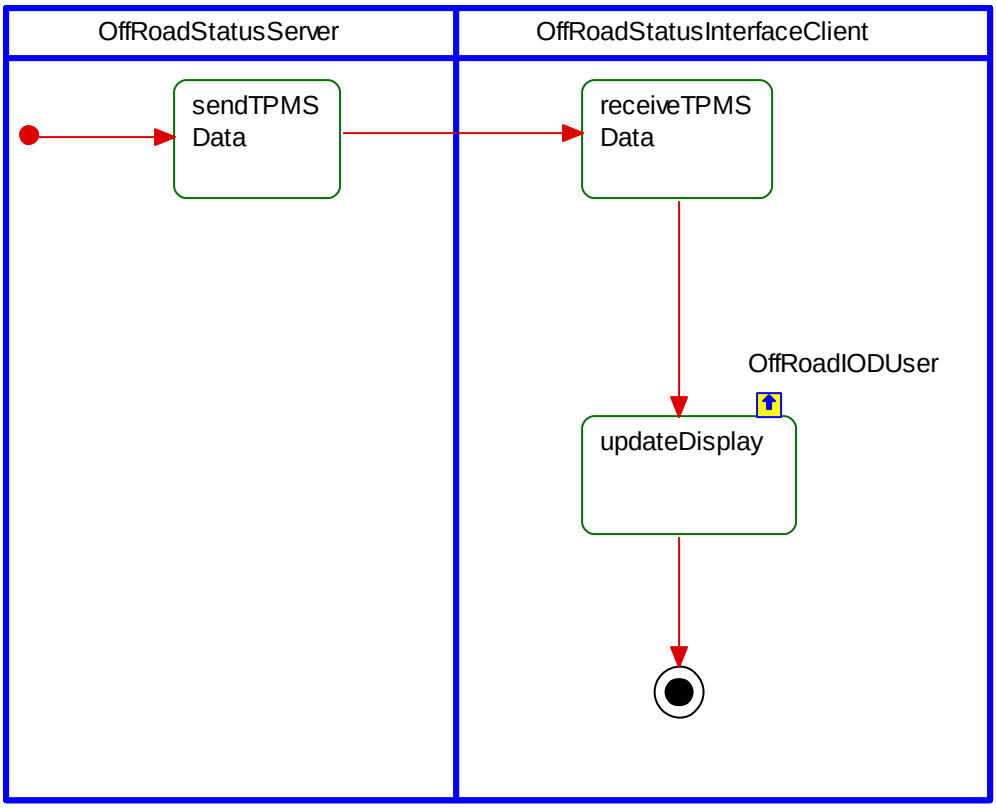
4.5.2.1 ORIOD-UC-REQ-359157/A-Display Off-Road Status - Tire Pressure

Actors	OffRoadStatusInterfaceClient, OffRoadStatusServer
Pre-conditions	Powermode conditions are met
Scenario Description	The user selects the Off-Road Status IOD on the OffRoadStatusInterfaceClient
Post-conditions	The OffRoadStatusInterfaceClient displays the Tire Pressure Status as part of the Off-Road Status IOD
List of Exception Use Cases	
Interfaces	CAN, G-HMI

4.5.3 White Box Views

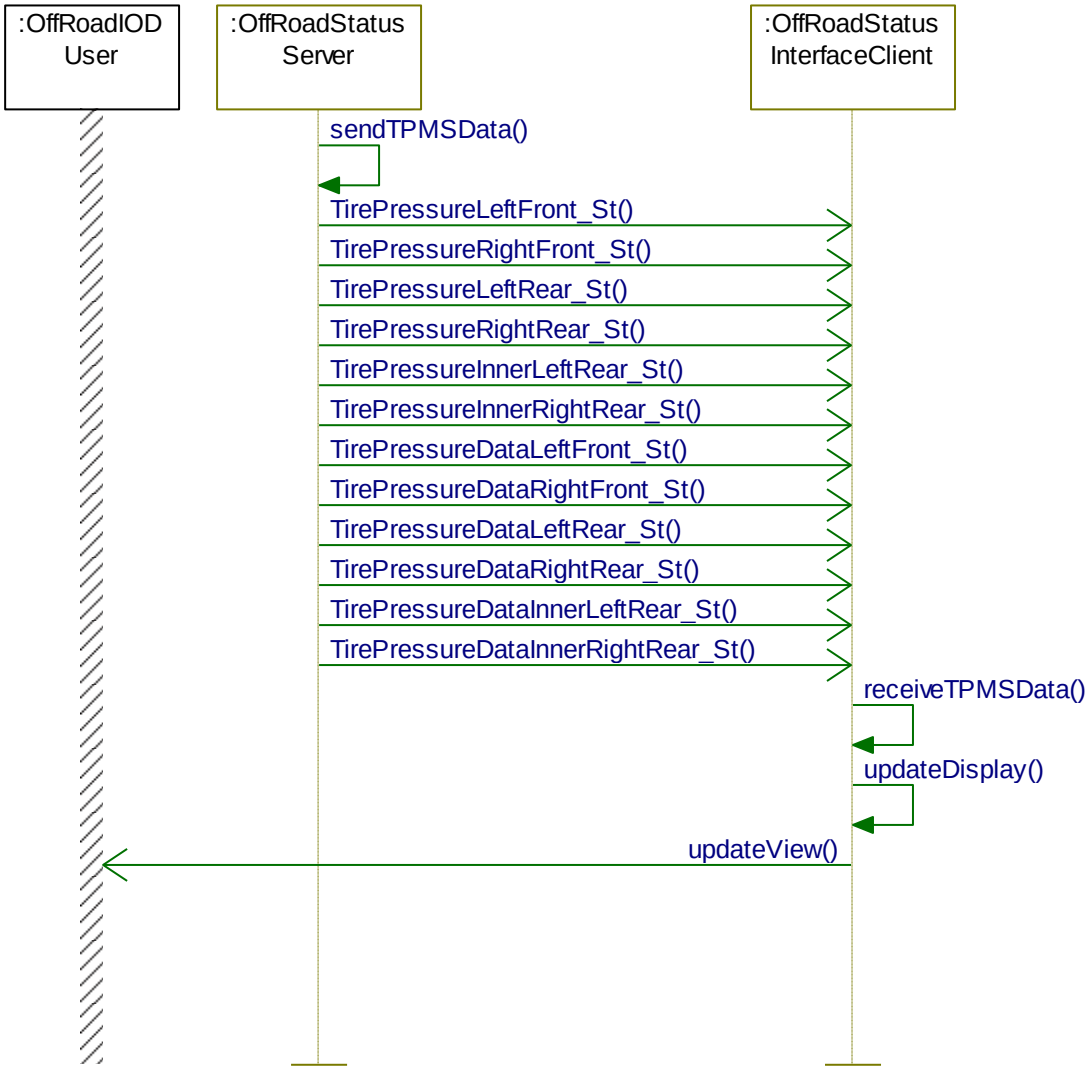
4.5.3.1 Activity Diagrams

4.5.3.1.1 ORIOD-ACT-REQ-359158/A-Display Off-Road Status - Tire Pressure



4.5.3.2 Sequence Diagrams

4.5.3.2.1 ORIOD-SD-REQ-359159/A-Display Off-Road Status - Tire Pressure



5 Appendix: Reference Documents

Reference #	Document Title
1	TPMS Information on Demand SPSS
2	
3	
4	
5	
6	
7	
8	
9	
10	

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