Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – Trailer Backup Assist 2.0 Image Client

Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.9
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Version Date: September 30, 2022

FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
February 28, 2017	1.0	**Initial Release**	
June 16, 2017	1.1		
		TBA2-444767/B-Overview	Update Icons
		TBA2-FUR-REQ-249546/B-TBA2 Full Mode Functionality	Update button availability
		TBA2-FUR-REQ-249547/B-TBA2 Lite Mode Functionality	Update functions availibility in Lite Mode.
		TBA2-FUR-REQ-249554/B-TBA2 HMI Display Requirements	Update HMI Requirements
		TBA2-FUR-REQ-249551/B-TBA2 Default Layouts When Error Occurs	Update default layouts
		TBA2-FUR-REQ-249556/B-TBA2 Soft Button Layout Strategy	Update layout strategy
		TBA2-FUR-REQ-249557/B-TBA2 Soft Button Selection Strategy	Update selection strategy
		TBA2-FUR-REQ-249558/B-TBA2 HMI Display Table	Update various table cells
		REQ-259039/A-Signal Mapping	Added new signals.
		TBA2-REQ-249599/B-TBA2 Feature ID Definition	Update table config values.
		TBA2-REQ-249602/B-TrailerBackupAssistMode_St	Update can signal parameters.
		TBA2-REQ-249609/B-TrailerBackupAssistMode_Rq	Update can signal descriptions
		REQ-259082/A-TBA Mode and TRG Mode	New requirement
		457945/A-Requirements	New requirement
		TBA2-REQ-249617/B-TBA Mode	Update mode definition
		TBA2-REQ-249616/B-TRG Mode	Update Mode definition
		REQ-259041/A-TBA2 Setup Mode	New requirement
		TBA2-UC-REQ-249619/B-Start TBA2 Setup Display	Update Usecase
		TBA2-UC-REQ-249620/B-Enter Auto Mode After TBA2 Trailer Calibration Complete	Update Usecase
		TBA2-UC-REQ-249622/B-Cancel During TBA2 Setup	Update usecase
		TBA2-REQ-249677/B-Select A Trailer SD	Update SD
		TBA2-REQ-249678/B-Select Cancel Setup Button SD	Update SD
		TBA2-REQ-249679/B-Over Speed During Setup SD	Update SD
		TBA2-REQ-249625/B-TBA2 Full Mode Definition	Update SD
		TBA2-REQ-249680/B-TBA2 Auto Button Press SD	Update AD
		TBA2-REQ-249681/B-TBA2 Auto Mode Re-Entered SD	Update AD
		TBA2-REQ-249683/B-Left Button Press SD	Update SD
		TBA2-REQ-249684/B-Right Button Press SD	Update SD
		TBA2-REQ-249685/B-Zoom View SD	Update SD
		TBA2-REQ-249686/B-TBA2 Rear Normal View SD	Update AD
		TBA2-REQ-249687/B-Enter TBA2 Lite SD	Update SD
		TBA2-REQ-249691/B-Exit By Hard Button Press SD	Update SD
		TBA2-REQ-249692/B-Ignition Moved Out Of Run SD	Update SD
		REQ-259113/A-Advanced Mode Request	New requirement
		REQ-259114/A-Show Advanced Mode Button On Screen Inactive State	New requirement
		REQ-259115/A-Show Advanced Mode Button On Screen Active State	New requirement
		REQ-259116/A-Show Advanced Mode Button Not Shown On Screen	New requirement
		TBA2-UC-REQ-249657/B-TBA2 Advanced Mode Button Pressed	Update SD
		TBA2-UC-REQ-249658/B-TBA2 Advanced Mode Active	Update SD
		TBA2-UC-REQ-249659/B-TBA2 Advanced Mode Active Button Pressed	Update SD
		REQ-259118/A-Info Button Available	New Requirement
		REQ-259119/A-TBA2 Info PopUp Shown	New Requirement
		REQ-259120/A-Close TBA2 Info PopUp	New Requirement
		REQ-259121/A-TBA2 Info PopUp Text	New Requirement
		UC-REQ-266260/A-Request TRG Straight Back-Up Mode	New Requirement

	UC-REQ-266261/A-Look at ICON Test in TRG Straight Back-Up Mode	New Requirement
	UC-REQ-266262/A-Pull Forward in TRG Straight Back-Up Mode	New Requirement
	UC-REQ-266263/A-Shift to Reverse in TRG Straight Back-Up Mode	New Requirement
	UC-REQ-266264/A-Force Exit TRG Straight Back-Up Mode	New Requirement
	TBA2-REQ-266270/A-Enter Straight Back Up Mode AD	New SD
	TBA2-REQ-266271/A-Straight Back Up Instructions AD	New SD
	TBA2-REQ-266267/A-TRG Enter Straight Back Up SD	New SD
	TBA2-REQ-266268/A-TRG Straight Back Up Force Exit SD	New SD
	TBA2-REQ-266269/A-TRG Straight Back Up Instructions	New SD
	TBA2-444771/B-Appendix: Reference Documents	Added reference material

May 23, 2018	**1.2**	
	TBA2-FUR-REQ-249558/C-TBA2 HMI Display Table	Update HMI Display table
	TBA2-REQ-249685/C-Zoom View SD	Update Seq Diagram for sendZoomOff value

Octobre 22, 2018	**1.3**	
	TBA2-444767/C-Overview	tmertiri: Remove layouts.
	TBA2-444768/B-General Requirements	tmertiri: remove req 249550
	TBA2-FUR-REQ-249555/B-TBA2 HMI Layouts Definitions	tmertiri: Added new values for no button layout
	TBA2-FUR-REQ-249556/C-TBA2 Soft Button Layout Strategy	tmertiri: Added new values for no button layout
	TBA2-FUR-REQ-249558/D-TBA2 HMI Display Table	tmertiri: remove table content. Same info will be provided through excel file.
	TBA2-REQ-330678/A-TBA2 Non Camera Layout	tmertiri: New Requirement
	TBA2-CLD-REQ-249590/B-TBA2 Image Client	tmertiri:updated definition to reflect the dual responsibilities.
	TBA2-IIR-REQ-249591/B-TBA2 Image Server	tmertiri: update req type
	TBA2-CLD-REQ-249592/B-TBA2 Activation Server	tmertiri:No change
	TBA2-CLD-REQ-250973/B-TBA2 Activation Client	tmertiri: update req type
	TBA2-IIR-REQ-249926/B-TBA2 Image Client Interface	tmertiri:Update req type
	TBA2-REQ-249598/B-TBA2 HMI Trailer Views and Instructions	tmertiri: update req type
	TBA2-MD-REQ-249599/C-TBA2 Feature ID Definition	tmertiri: update req type
	TBA2-IIR-REQ-249600/B-TBA2 ImageClient_Rx	tmertiri: update req type
	TBA2-MD-REQ-249601/B-TrailerBackupAssist_St	tmertiri: update req type
	TBA2-MD-REQ-249602/C-TrailerBackupAssistMode_St	tmertiri: update req type
	TBA2-MD-REQ-249603/B-Feature_St	tmertiri: update req type
	TBA2-MD-REQ-249604/B-GearLvrPos_D_Actl	tmertiri: update req type
	TBA2-MD-REQ-249605/B-VehicleSpeed_St	tmertiri: update req type
	TBA2-MD-REQ-249606/B-ParkBrake_St	tmertiri: update req type
	TBA2-IIR-REQ-249607/B-TBA2 ImageClient_Tx	tmertiri: update req type
	TBA2-MD-REQ-249612/B-Feature_Rq	tmertiri: update req type
	TBA2-MD-REQ-249608/B-CancelTrailerBackupAssist_Rq	tmertiri: update req type
	TBA2-MD-REQ-249609/C-TrailerBackupAssistMode_Rq	tmertiri: update req type
	TBA2-MD-REQ-249610/B-Sending of Request and Response for TBA Feature	tmertiri: update req type
	TBA2-444770/C-Functional Definition	tmertiri: removed TBA2 Advance User Mode sections.
	TBA2-445098/B-White Box View	tmertiri:Remove SD 249678
	TBA2-REQ-249676/B-Setup - No Issues SD	tmertiri: Update SD to better reflect the current operation.
	TBA2-REQ-249677/C-Select A Trailer SD	tmertiri: Update SD. Remove TBA2ActivationClient lane. A few other changes
	TBA2-REQ-249679/C-Over Speed During Setup SD	tmertiri:Update SD.
	TBA2-REQ-249687/C-Enter TBA2 Lite SD	tmertiri: Update seq diagram
	TBA2-REQ-249691/C-Exit By Hard Button Press SD	tmertiri: Revise SD. Change signal generation
	TBA2-REQ-249692/C-Ignition Moved Out Of Run SD	tmertiri: Revise SD. Change signal generation
	TBA2-REQ-249693/B-Video Signal Absent SD	tmertiri: Revise SD. Change signal generation
	582131/A-Trailer Settings Related Changes	tmertiri: new paragraph
	REQ-326574/A-Place Sticker SD	tmertiri: new requirement
	REQ-326616/A-Setup Sticker Not Circled	tmertiri: new requirement
	REQ-326617/A-Setup Sticker Not Detected	tmertiri: new requirement

Date	Version		Requirement	Description
			REQ-326676/A-TBA TRG Trailer Selection	tmertiri: new requirement
			TBA2-444771/C-Appendix: Reference Documents	tmertiri: Added new reference
September 3, 2019	**1.4**			
			TBA2-FUR-REQ-249554/C-TBA2 HMI Display Requirements	tmertiri: update reference
			TBA2-FUR-REQ-249556/D-Show TBA2 View	tmertiri: title change and update content
			TBA2-FUR-REQ-249558/E-TBA2 HMI Display Table	tmertiri:update reference name
			TBA2-REQ-330678/B-TBA2 Non Camera Layout	tmertiri:added clarification
			TBA2-REQ-259039/B-Signal Mapping	tmertiri: update configuration name
			TBA2-MD-REQ-249599/D-TBA2 Feature ID Definition	tmertiri: add picture in picture view
			TBA2-MD-REQ-249601/C-TrailerBackupAssist_St	tmertiri:update reference name
			TBA2-MD-REQ-249602/D-TrailerBackupAssistMode_St	tmertiri: Update reference name
			TBA2-444770/D-Functional Definition	tmertiri: structure update
			TBA2-REQ-259082/B-TBA Mode and TRG Mode	tmertiri: structure update
			TBA2-REQ-259041/B-TBA2 Setup Mode	tmertiri: structure update
			TBA2-REQ-249685/D-Zoom View SD	tmertiri: revise SD
			TBA2-REQ-249687/D-Enter TBA2 Lite SD	tmertiri: revise SD
			TBA2-REQ-249690/B-Return Button Press SD	tmertiri: revise SD
			TBA2-REQ-259118/B-Info Button Available	tmertiri: structure update
			TBA2-REQ-259119/B-TBA2 Info PopUp Shown	tmertiri: structure update
			TBA2-REQ-259120/B-Close TBA2 Info PopUp	tmertiri: structure update
			TBA2-REQ-259121/B-TBA2 Info PopUp Text	tmertiri:update reference name
			582131/B-Trailer Settings Related Changes	tmertiri:structure update
			TBA2-REQ-326574/B-Place Sticker SD	tmertiri: structure update
			TBA2-REQ-326616/B-Setup Sticker Not Circled	tmertiri: structure update
			TBA2-REQ-326617/B-Setup Sticker Not Detected	tmertiri: added close condition
			TBA2-FUN-REQ-359527/A-Picture In Picture	tmertiri: new section
			STR-677298/A-Use Cases	tmertiri: new structure
			TBA2-UC-REQ-359516/A-Picture In Picture Activation	tmertiri: new usecase
			TBA2-UC-REQ-359517/A-Standard View	tmertiri: new usecase
			TBA2-UC-REQ-359518/A-PiP View Swapping	tmertiri: new usecase
			STR-677200/A-White Box View	tmertiri: new structure
			STR-677201/A-Activity Diagram	tmertiri: new structure
			TBA2-ACT-REQ-359471/A-Picture In Picture	tmertiri: new diagram
			STR-677202/A-Sequence Diagram	tmertiri: new structure
			TBA2-SD-REQ-359473/A-Picture In Picture	tmertiri: new diagram
			TBA2-444771/D-Appendix: Reference Documents	tmertiri: update references list
March 13, 2020	**1.5**			
			TBA2-SD-REQ-359473/B-Picture In Picture	tmertiri: update configd values with new input from FO
September 22, 2020	**1.6**			
			TBA2-444768/C-General Requirements	tmertiri: make changes due to trailer settings configuration
			TBA2-REQ-396833/A-Trailer Settings Configuration	tmertiri: new req due to Trailer Settings configuration
			TBA2-REQ-396837/A-Trailer Settings Message	tmertiri: new req due to Trailer Settings Configuration changes
			TBA2-FUR-REQ-249556/E-Show TBA2 View	tmertiri: new req due to Trailer Settings configuration
			TBA2-FUR-REQ-249558/F-TBA2 HMI Display Table	tmertiri: new req due to Trailer Settings configuration
September 16, 2021	**1.7**			
			TBA2-MD-REQ-249599/E-TBA2 Feature ID Definition	tmertiri: added Trailer 360 camera views
			TBA2-444770/E-Functional Definition	tmertiri: removing Sticker content. No longer needed.
			TBA2-445098/C-White Box View	tmertiri: remove 249676. Sticker content no longer present
August 1, 2022	**1.8**			
			TBA2-FUR-REQ-249546/C-TBA2 Full Mode Functionality	tmertiri: remove no longer valid views, Rear Split and Zoom
			TBA2-FUR-REQ-249547/C-TBA2 Lite Mode Functionality	tmertiri: remove no longer valid views, Rear Split and Zoom
			TBA2-FUR-REQ-249549/B-TBA2 Interaction via Feature Based Message Protocol	tmertiri: remove no longer valid views, Rear Split and Zoom
			TBA2-FUR-REQ-249556/F-Show TBA2 View	tmertiri: remove no longer valid views, Rear Split and Zoom
			TBA2-FUR-REQ-249557/C-TBA2 Soft Button Selection Strategy	tmertiri: remove no longer valid views, Rear Split and Zoom
			TBA2-REQ-259039/C-Signal Mapping	tmertiri: paragraph simplicaton

	TBA2-IIR-REQ-249591/C-TBA2 Image Server	tmertiri: no content change
	TBA2-MD-REQ-249599/F-TBA2 Feature ID Definition	tmertiri: remove no longer valid views, Rear Split and Zoom
	TBA2-444770/F-Functional Definition	tmertiri: remove zoom view
Septembre 30, 2022	**1.9**	
	TBA2-444770/G-Functional Definition	tmertiri: structure update
	TBA2-FUN-REQ-525057/A-Trailer Settings Related Changes	tmertiri: structure update
	TBA2-REQ-525058/A-Signal Sharing	tmertiri: new req

Table of Contents

1 Overview

Feature Overview

TBA2 is a new feature which combines functionality from the two existing features TRG and TBA described below:

Trailer Reverse Guidance (TRG) is a Driver Assistance feature designed to provide customer with multiple views of the trailer, and overlays projecting trailer position and direction. As a camera system, TRG provides information and driving suggestions via the display in the center stack while the driver controls all vehicle motion. The system simply reacts to the trailer and steering angles or makes suggestions based on those inputs.

TRG is designed to help maneuver a trailer in reverse:

- Provides multiple views of the trailer (including static and dynamic overlays)

- Provides user with active trailer information including: current trailer angle, predicted future trailer angle, and dynamic jackknife warning zones

- Provides a dedicated mode for backing up straight

Trailer Backup Assist (TBA) is a system that allows the driver to continuously command a radius of curvature for the trailer as it is reversed. The system automatically steers the vehicle to achieve the commanded curvature while the driver controls the vehicle speed via the throttle and the brakes.

Trailer Backup Assist automatically steers as driver reverses the vehicle
- The Driver controls trailer trajectory (angle) by using the trailer steering knob.
- The Trailer Backup Assist algorithm determines the vehicle steering angle to achieve the desired trailer trajectory
- The Driver is in control of throttle and brake, while Trailer Backup Assist does the steering
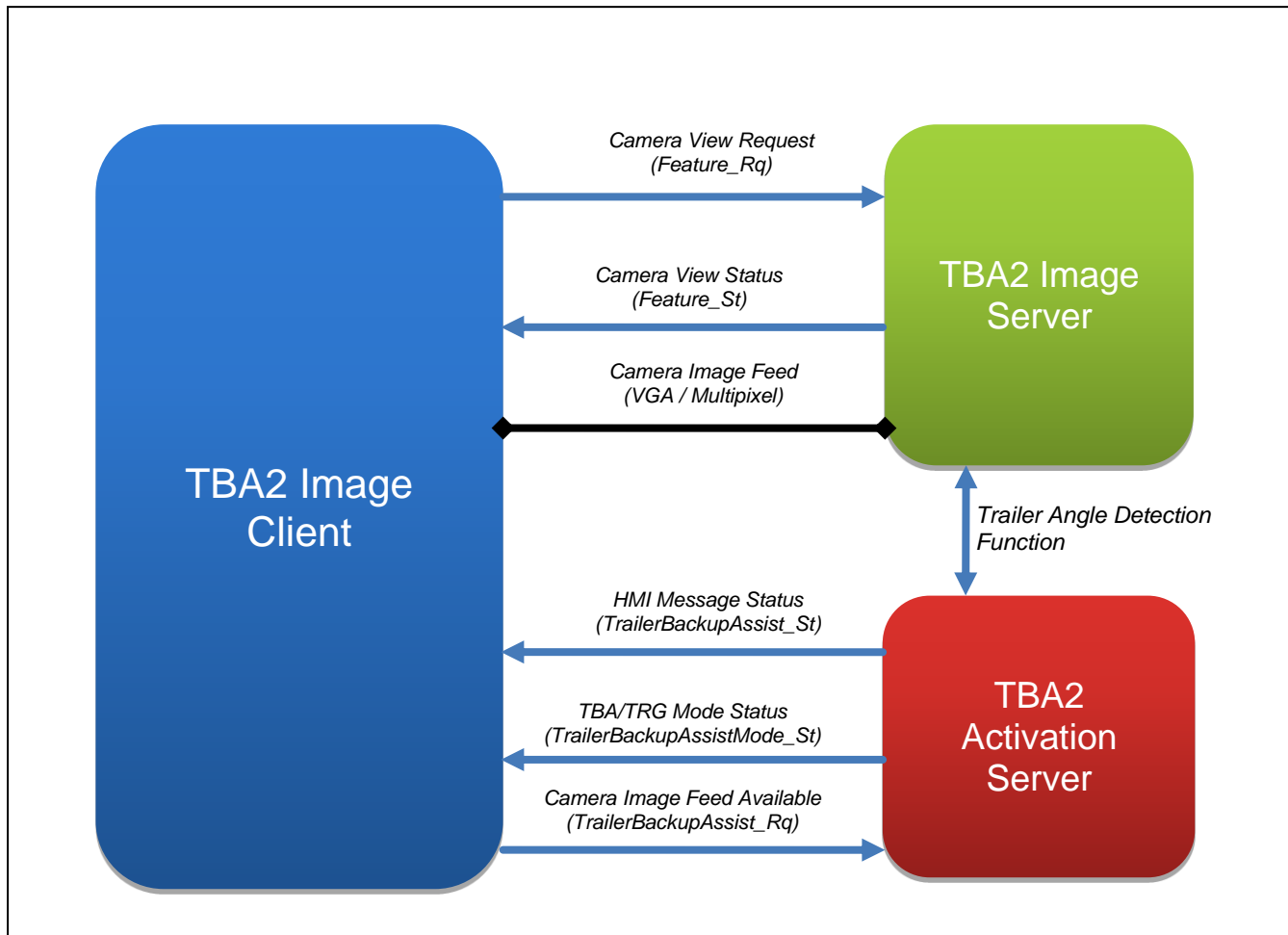
HMI Overview

For a list of HMI layouts, refer to TBA2 HMI documentation.

2 General Requirements

2.1 TBA2-REQ-396833/A-Trailer Settings Configuration

This feature, Trailer Backup Assist 2, is closely related to Trailer Settings. In almost all programs the client serves as an interface to the user for both features, however in some unique programs Trailer Settings Client can reside in other modules. For those programs there is a configuration in this client to tell client that Trailer Settings resides in another module.

There are some changes that TBA2 Client needs to apply when Trailer Settings resides in another module. When client is configurated like this: **Centerstack Settings = 0 AND TBA2 = 1** it means that Trailer Settings feature resides in another module.

A few other changes are located in SYNC4_TBA2_HmiStatus_coding document. Some text layouts are different. Refer to that file for the complete list of changes.

2.2 TBA2-REQ-396837/A-Trailer Settings Message

The client shall not transmit message 0x45C when **Centerstack Settings = 0 AND TBA2 = 1**

2.3 TBA2-FUR-REQ-249544/A-Available TBA2 Modes

Trailer Backup Assist 2 (TBA2) shall provide two levels of functions, TBA2 Full Mode and TBA2 Lite Mode, to serve different types of trailer use cases. Trailer Backup Assist 2 will also provide additional camera views the user can switch to with HMI overlays.

2.4 TBA2-FUR-REQ-249546/C-TBA2 Full Mode Functionality

TBA2 Full Mode shall provide full TBA2 functions that include TBA2 Auto 50/50 View, TBA2 Rear Normal View, TBA2 Rear 360, TBA2 CHMSL View, TBA2 Aux Camera View, TBA2 Auto Button, TBA2 Left button, TBA2 Right button, TBA2 Advanced Mode Button, TBA2 Info Button and TBA2 Exit Button.

Trailer set up process is required for TBA2 Full Mode. Trailer set up provides trailer information that is needed for TBA2 to automatically provide relevant trailer view from different angles through TBA2 Auto Mode.

2.5 TBA2-FUR-REQ-249547/C-TBA2 Lite Mode Functionality

TBA2 Lite Mode shall provide TBA2 functions without TBA2 Auto Mode. TBA2 Lite Mode includes TBA2 Lite 50/50 View, TBA2 Rear Normal View, TBA2 Rear 360, TBA2 CHMSL View, TBA2 Aux Camera View, TBA2 Left button, TBA2 Right button, TBA2 Info Button and TBA2 Exit button.

TBA2 Lite Mode does not require Trailer set up and can therefore be used for a non-conventional trailer, a vehicle with non-conventional brake type or for the customer who opts not to set up a trailer.

2.6 TBA2-FUR-REQ-249548/A-Default TBA2 AutoMode

When TBA2 Full Mode is activated the TBA2 Image Server shall default to Auto On.

2.7 TBA2-FUR-REQ-249549/B-TBA2 Interaction via Feature Based Message Protocol

Feature Base Message Protocol shall be used between TBA2 Image Client and TBA2 Image Server to synchronize and communicate the current camera view display (360, Normal) of TBA2 views. The Feature Base Message Protocol shall also be used between TBA2 Image Client and TBA2 Image Server to control TBA2 Auto Mode. The HMI Layout used by the TBA2 Image Client shall be determined by the camera view status provided by the TBA2 Image Server in order to ensure the HMI Layout applied by the Image Client is compatible with the Camera View supplied by the Image Server.

2.8 TBA2-FUR-REQ-249554/C-TBA2 HMI Display Requirements

The camera image shall be displayed during TBA2 operation whenever the following conditions are valid:

- A TBA2 Camera View is configured ON in the TBA2 Image Server
- A valid defined value of TrailerBackupAssist_St and TrailerBackupAssistMode_St in SYNC4_TBA2_HmiStatus_Coding.
- Vehicle speed does not exceed the camera display maximum speed.

2.9   TBA2-FUR-REQ-249551/B-TBA2 Default Layouts When Error Occurs

In the event that the value of these signals do not meet the criteria defined per TBA2 HMI layout definitions or that these signals are missing, then the respective soft button strategy layouts shall be displayed in the above scenario.

2.10 TBA2-FUR-REQ-249552/A-TBA2 Image Priority

Trailer Backup Assist 2 event shall be treated with the same screen interruption priorities as defined by H22a Screen Interruption Table.

2.11 TBA2-FUR-REQ-249553/A-Camera Image Priority

Once the camera image has been displayed to user, the image shall be maintained as long as the conditions required to be in the particular camera view are present and shall have highest priority:
- No pop-up screens shall interrupt the video image, except for pop-ups requested by TBA2 Activation Server.
- Media functions (source change, volume control, etc.) shall be available, but shall not interrupt the image view to the user.

2.12 TBA2-FUR-REQ-249555/B-TBA2 HMI Layouts Definitions

2.12.1   TBA2-FUR-REQ-249556/F-Show TBA2 View

TBA2 Camera Views

TBA2 Rear 360 View HMI Layout shall be displayed by the TBA2 Image Client when Feature_St has the encoding of FeatureID =0x081B , Configuration=0x12 TBA2 Rear 360

TBA2 Rear Normal View HMI Layouts shall be displayed by the TBA2 Image Client when Feature_St has the encoding of FeatureID =0x081B , Configuration=0x16 TBA2 Rear Normal

TBA2 50/50 View HMI Layouts shall be displayed by the TBA2 Image Client when Feature_St has the encoding of FeatureID =0x081B , Configuration=0x15 TBA2 50/50

TBA2 CHMSL View HMI Layouts shall be displayed by the TBA2 Image Client when Feature_St has the encoding of FeatureID =0x081B , Configuration=0x13 TBA2 CHMSL

TBA2 Aux View HMI Layouts shall be displayed by the TBA2 Image Client when Feature_St has the encoding of FeatureID =0x081B , Configuration=0x14 TBA2 Aux

This portion is applicable if Centerstack Settings = 0 AND TBA2 = 1
TBA2 Normal Rear view – no soft buttons shall be displayed when TrailerBackupAssist_St has a value of 0x04, 0x1A-0x1F
TBA2 Rear normal view with soft buttons shall be displayed when TrailerBackupAssist_St has a value of 0x05-0x19, 0x20-0x3F

Show TBA2 (H36s) View
A TBA2 view should be shown when a TBA2 Camera View is showing and 'Show TBA2 (H36s) View' is set to Yes in the Sync4_TBA2_HmiStatus_Coding document. A Non Camera Layout can be shown over a camera view per TBA2-REQ-330678-TBA2 Non Camera Layout.

2.12.2   TBA2-FUR-REQ-249557/C-TBA2 Soft Button Selection Strategy

Button location on screen is defined in the HMI spec H36s TBA2

When TrailerBackupAssistMode_St has a value of 0x1 TbaActive, 0x2 TbaSetup, 0x5 TbaActiveExpertAvail or 0x6 TbaActiveExpertActive

The available soft buttons to be shown if the requirements to show the soft button are met are:

TBA2 50/50 View Button, TBA2 Rear Normal View Button, TBA2 Rear 360 Button, TBA2 CHMSL View Button, TBA2 Aux Camera View Button, TBA2 Auto Button, TBA2 Left button, TBA2 Right button, TBA2 Advanced Mode Button and TBA2 Info Button.

When TrailerBackupAssistMode_St has a value of 0x3 TbaOffTrgSetup or 0x4 TbaOffTrgActive

The available soft buttons to be shown if the requirements to show the soft button are met are:

TBA2 50/50 View Button, TBA2 Rear Normal View Button, TBA2 Rear 360 Button, TBA2 CHMSL View Button, TBA2 Aux Camera View Button, TBA2 Auto Button, TBA2 Left button, TBA2 Right button, TBA2 Exit Button and TBA2 Info Button.

2.12.3 TBA2-FUR-REQ-249558/F-TBA2 HMI Display Table

The table provided in SYNC4_TBA2_HmiStatus_Coding is the summary of HMI layouts defined by TrailerBackupAssist_St and TrailerBackupAssistMode_St signals. For exact graphics for icons and layouts, please refer to the SYNC4_TBA2_HmiStatus_Coding document.

When Centerstack Settings = 0 AND TBA2 = 1, use the Variant 2 of the table.

2.13 TBA2-REQ-330678/B-TBA2 Non Camera Layout

		Vehicle Conditions			
TrailerBackupAssist_St	**TrailerBackupAssistMode_St**	**Camera Status**	**Vehicle Speed**	**Gear Lever Select**	**TBA2 Screen Layout**
0x14 | 0x15 | 0x16 | 0x18 | 0x20 | 0x21 | 0x22 | 0x24 | 0x25 | 0x2B | 0x37	0x1 - TbaActive 0x2 - TbaSetup 0x3 TbaOffTrgSetup 0x4 TbaOffTrgActive 0x5 - TbaActiveExpertAvail 0x6 - TbaActiveExpertActive	Don't Care	Don't Care	Not Reverse	TBA2 Non-Camera Layout
All values with HMI text defined	All values with HMI text defined	Camera View Showing	Don't Care	Reverse	Camera Screen Overlay
All values with HMI text defined except 0x14, 0x15, 0x16, 0x18, 0x20 , 0x21, 0x22, 0x24, 0x25, 0x2B, 0x37	All values with HMI text defined	Camera View Showing	Speed < 10 kph	Not Reverse	Camera Screen Overlay
All values with HMI text defined	All values with HMI text defined	Camera View Showing	Speed >= 10kph	Not Reverse	TBA2 Non-Camera Layout

For all other cases no TBA2 view should be shown.

3 Architectural Design

3.1 TBA2-REQ-259039/C-Signal Mapping

The table below gives the map of logical names used throughout this SPSS documentation and the actual signal name in the CAN database. The respective encodings follow in the subsequent paragraphs.

Logical Signal Name	CAN Signal Name	Config
TrailerBackupAssist_St	TrlrAidMsgTxt_D2_Rq	Trailer Aid Signal Source = 01
TrailerBackupAssistMode_St	TrlrAidEnbl_D2_Stat	Trailer Aid Signal Source = 01
TrailerBackupAssistMode_Rq	TrlrAidMde_D_Rq	Trailer Aid Signal Source = 01 or 02
TrailerBackupAssist_St	TrlrRvrseMsgTxt_D2_Rq	Trailer Aid Signal Source = 02
TrailerBackupAssistMode_St	TrlrRvrseEnbl_D2_Stat	Trailer Aid Signal Source = 02

3.2 TBA2-CLD-REQ-249590/B-TBA2 Image Client

Responsibility:
The TBA2 Image Client is an interface of the TBA2 feature. The TBA2 Image Client is responsible for displaying Trailer images and providing some user interface based on the input from TBA2 Image Server.

Both Activation and Setup of TBA2 requires hand-shaking with the TBA2 Activation Client in order to synchronize proper HMI display to the user between the two image clients.

Review the implementation guide/static view/block diagram to locate the TBA2 Image Client object.

TBA Image Client is also responsible for coordination with TBA Activation server to setup the feature for use.

3.3 TBA2-IIR-REQ-249591/C-TBA2 Image Server

Responsibility:
The TBA2 Image Server is responsible for determination of views provided to TBA2 Image Client.

3.4 TBA2-CLD-REQ-249592/B-TBA2 Activation Server

Responsibility:
The TBA2 Activation Server is responsible for determining the instructions and TBA2 Status to the TBA2 Image Client and TBA2 Activation Client for display to the TBA2 feature user.

3.5 TBA2-CLD-REQ-250973/B-TBA2 Activation Client

Responsibility:
The TBA2 Activation Client is responsible for coordinating with the TBA2 Activation Server to setup the feature for use.

3.6 TBA2-IIR-REQ-249926/B-TBA2 Image Client Interface

3.6.1 TBA2-REQ-249598/B-TBA2 HMI Trailer Views and Instructions

Refer to requirement number 249558.

3.6.2 TBA2-MD-REQ-249599/F-TBA2 Feature ID Definition

The below table defines the Feature ID information related to the Feature Based Message Protocol command and control method for TBA2 (Note: Some of 0x81B is used in the Rear View Camera feature).

Feature Name	Feature ID	Config Number	Config Value
Camera Showing	0x081B	0x00	Off
		0x01	Front
		0x02	Rear
		0x03	Remote
		0x04	Rear 360°
		0x05	Rear Normal
		0x06	Rear Split
		0x07	Front 360°
		0x08	Front Normal
		0x09	Front Split
		0x0A	~~Rear Zoom~~
		0x0B	CHMSL
		0x0C	CHMSL Zoom
		0x0D	Aux
		0x0E	TRG
		0x0F	TRG Rear Normal
		0x10	Straight Back Up Mode
		0x11	~~TBA2 Rear Split~~
		0x12	TBA2 Rear 360
		0x13	TBA2 CHMSL
		0x14	TBA2 Aux
		0x15	TBA2 50/50
		0x16	TBA2 Rear Normal
		0x37	TBA2 TRAILER360
		0x38	TBA2 TRAILERREARNORMAL
		0x39	TBA2 TRAILERINTERIOR_VIEW1
		0x3A	TBA2 TRAILERINTERIOR_VIEW2
		0x3B	TBA2 TRAILERLEFT
		0x3C	TBA2 TRAILERRIGHT
TRG Zoom In	0x0820	0x00	Off
		0x01	Level 1 (Not used)
		0x02	Level2 (Not Used)
		0x03	Level3
TRG Pan Button	0x0823	0x01	Left Press
		0x00	Right Press
TRG Button Enable	0x0824	0x00	Disable Left
		0x01	Disable Right
		0x02	Enable Left
		0x03	Enable Right
TRG Auto Mode	0x0825	0x00	Off
		0x01	On

			0x02	Not Available
TBA2 Auto Mode	0x0826		0x00	Off
			0x01	On
			0x02	Not Available
TBA2 Pan Button	0x0827		0x01	Left Press
			0x00	Right Press
TBA2 Button Enable	0x0828		0x00	Disable Left
			0x01	Disable Right
			0x02	Enable Left
			0x03	Enable Right
TBA2 Zoom In	0x0829		0x00	Off
			0x01	Level 1 (Not used)
			0x02	Level2 (Not Used)
			0x03	Level3
Picture In Picture	0x082A		0x00	Standard View
			0x01	Picture In Picture View
			0x02	Swap

3.6.3   TBA2-IIR-REQ-249600/B-TBA2 ImageClient_Rx

3.6.3.1   TBA2-MD-REQ-249601/C-TrailerBackupAssist_St

Message Type: status

This signal is used to inform the TBA2 HMI what the current set up and backup maneuver instruction is. Each encoding of this signal will map to a specific set up or maneuver instruction. See the latest version of the SYNC4_TBA2_HmiStatus_Coding document maintained by the Driver Assistance feature group for the specific details of each "message" (Message1 – Message 63 listed below).

Name	Literals	Value	Description
Type	-	-	-
	NoMessage	0x00	
	Message1	0x01	
	Message2	0x02	
	Message3	0x03	
	Message4	0x04	
	Message5	0x05	
	Message6	0x06	
	Message7	0x07	
	Message8	0x08	
	Message9	0x09	
	Message10	0x0A	
	Message11	0x0B	
	Message12	0x0C	
	Message13	0x0D	
	Message14	0x0E	
	Message15	0x0F	
	Message16	0x10	
	Message17	0x11	
	Message18	0x12	
	Message19	0x13	
	Message20	0x14	

Message21	0x15	
Message22	0x16	
Message23	0x17	
Message24	0x18	
Message25	0x19	
Message26	0x1A	
Message27	0x1B	
Message28	0x1C	
Message29	0x1D	
Message30	0x1E	
Message31	0x1F	
Message32	0x20	
Message33	0x21	
Message34	0x22	
Message35	0x23	
Message36	0x24	
Message37	0x25	
Message38	0x26	
Message39	0x27	
Message40	0x28	
Message41	0x29	
Message42	0x2A	
Message43	0x2B	
Message44	0x2C	
Message45	0x2D	
Message46	0x2E	
Message47	0x2F	
Message48	0x30	
Message49	0x31	
Message50	0x32	
Message51	0x33	
Message52	0x34	
Message53	0x35	
Message54	0x36	
Message55	0x37	
Message56	0x38	
Message57	0x39	
Message58	0x3A	
Message59	0x3B	
Message60	0x3C	
Message61	0x3D	
Message62	0x3E	
Message63	0x3F	

3.6.3.2   TBA2-MD-REQ-249602/D-TrailerBackupAssistMode_St

Message Type: status

This signal is used to communicate the mode for the combined TBA2 feature. Encoding 0x1 – 0x2 and 0x5-0x6 indicates TBA mode and 0x3-0x4 indicates TRG mode. Within TBA Mode states 0x5 and 0x6 are used to activate TBA Advanced Mode. See the latest version of the SYNC4_TBA2_HmiStatus_Coding document maintained by the Driver Assistance feature group for the specific details of each state.

TBA Status	Description
0x0 - Inactive	TBA off/inactive

0x1 - TbaActive	TBA active
0x2 - TbaSetup	TBA setup and calibration drive
0x3 - TbaOffTrgSetup	TBA off, with TBA software controlling HMI for TRG setup
0x4 - TbaOffTrgActive	TBA off, with TBA software controlling HMI for TRG
0x5 - TbaActiveExpertAvail	TBA active, with Expert Mode available (Advanced Mode)
0x6 - TbaActiveExpertActive	TBA active, with Expert Mode enabled (Advanced Mode)
0x7 - NOT_USED	--

3.6.3.3 TBA2-MD-REQ-249603/B-Feature_St
Message Type: Status

Represents the current status of a feature (feature selected, feature setting, etc.).

Included Parameters:
FeatureID
Configuration
PersIndex

Name	Literals	Value	Description
FeatureID	-	-	Active feature number
		0x0000 – 0xFFFF	
Configuration	-	-	Active configuration value
		0x0000 – 0xFFFF	
PersIndex	-	-	Indicates which personality profile is active
	PERS_1	0x0	
	PERS_2	0x1	
	PERS_3	0x2	
	PERS_4	0X3	
	VEHICLE	0X4	
	Not Used	0x5	
	Not Used	0x6	
	Not Used	0x7	

3.6.3.4 TBA2-MD-REQ-249604/B-GearLvrPos_D_Actl
Message Type: Status

Vehicle status signal for the Gear Lever Position on an automatic transmission vehicle.

Name	Literals	Value	Description
Type	-	-	-
	Park	0x0	
	Reverse	0x1	
	Neutral	0x2	
	Drive	0x3	
	Sport_DriveSport	0x4	

Low	0x5	
First	0x6	
Second	0x7	
Third	0x8	
Fourth	0x9	
Fifth	0xA	
Sixth	0xB	
Undefined_Treat_as_Fault	0xC	
Undefined_Treat_as_Fault1	0xD	
Unknown_Position	0xE	
Fault	0xF	

3.6.3.5 TBA2-MD-REQ-249605/B-VehicleSpeed_St

Message Type: Status

Status used to indicate vehicle speed.

Name	Literals	Value	Description
Type	-	-	Indicates vehicle speed. Unit: kph Resolution:0.01 Offset:0
	kph	0x0 to 0xFFFF	

3.6.3.6 TBA2-MD-REQ-249606/B-ParkBrake_St

Message Type: Status

Signal used to indicate the Parking Brake status.

Name	Literals	Value	Description
Type	-	-	-
	Inactive	0x0	
	Active	0x1	

3.6.4 TBA2-IIR-REQ-249607/B-TBA2 ImageClient_Tx

3.6.4.1 TBA2-MD-REQ-249612/B-Feature_Rq

Message Type: Request

Represents the request to command a feature change (select new feature, change feature setting, query features, etc.).

Included Parameters:
Operation
FeatureID
Configuration
PersIndex

Name	Literals	Value	Description
Operation	-	-	Type of operation being requested
	Null	0x0	
	Query	0x1	

	Set	0x2	
	Upload	0x3	
	Restore	0x4	
	Copy	0x5	
	NotUsed	0x6 – 0x7	
FeatureID	**-**	**-**	Feature number being requested
		0x0000 – 0xFFFF	
Configuration	**-**	**-**	Configuration value being requested
		0x0000 – 0xFFFF	
PersIndex	**-**	**-**	Indicates which personality profile is being accessed
	PERS_1	0x0	
	PERS_2	0x1	
	PERS_3	0x2	
	PERS_4	0X3	
	VEHICLE	0X4	
	Not Used	0x5	
	Not Used	0x6	
	Not Used	0x7	

3.6.4.2   TBA2-MD-REQ-249608/B-CancelTrailerBackupAssist_Rq

Message Type: Request

The signal is used to deactivate the Trailer Backup Assist2 feature in the event the camera feed is missing. The signal is sent from the Trailer Backup Assist 2 Image Client to the Trailer Backup Assist 2 Activation Server when the Trailer Backup Assist 2 feature is activated (TrailerBackupAssist_St >=4) but the Trailer Backup Assist 2 Image Client does not detect a Rear Camera video feed from Trailer Backup Assist 2 Image Server. The TBA 2 Image Client shall broadcast this value until the TBA 2 feature is deactivated (TrailerBackupAssist_St < 4).

Name	Literals	Value	Description
Type	-	-	-
	Null	0x0	
	Cancel	0x1	

3.6.4.3   TBA2-MD-REQ-249609/C-TrailerBackupAssistMode_Rq

The TBA2 feature will include an Advanced Mode which can be requested by the user and is communicated to the TBA2 Activation Server through the following signal:

Encoding	Description
0x0 NotRequested	No mode change requested
0x1 Mode1	Mode1 toggle requested
0x2 Mode2	Mode2 toggle requested
0x3 Mode3	Mode3 toggle requested

3.6.5 TBA2-MD-REQ-249610/B-Sending of Request and Response for TBA Feature

Requirement, IFS-MMCAN-FUR-REQ-015114-Sending of Request and Response (TcSE ROIN-66252-1), is not valid for the either Trailer Backup Assist (TBA) or Trailer Reverse Guidance (TRG) features. Request signals used for TBA and TRG shall behave similar to status signals such that the current state of the signal is always a valid condition (they will not revert to "inactive" automatically).

4 Functional Definition

4.1 TBA2-REQ-259082/B-TBA Mode and TRG Mode

4.1.1 Requirements

4.1.1.1 TBA2-REQ-249617/B-TBA Mode

TBA Mode is defined when TrailerBackupAssistMode_St is equal to 0x1 TbaActive, 0x2 TbaSetup, 0x5 TbaActiveExpertAvail, or 0x6 TbaActiveExpertActive.

4.1.1.2 TBA2-REQ-249616/B-TRG Mode

TRG Mode is defined when TrailerBackupAssistMode_St is equal to 0x3 TbaOffTrgSetup or 0x4 TbaOffTrgActive.

4.2 TBA2-REQ-249618/A-TBA2 Setup

4.2.1 Requirements

4.2.1.1 TBA2-REQ-259041/B-TBA2 Setup Mode

TBA2 Setup Mode is defined when HMI Layout 'TBA2 Normal Rear view – no soft buttons' should be shown.

4.2.2 Use Cases

4.2.2.1 TBA2-UC-REQ-249619/B-Start TBA2 Setup Display

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TBA2 Setup has begun for a trailer in TBA2 Setup Mode (from the TBA2 Activation Client)
Scenario Description	Driver selects to set up a trailer as TBA2 trailer (from the TBA2 Activation Client)
Post-conditions	The vehicle leaves from current screen to a TBA2 view.
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with Camera server E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.2.2.2 TBA2-UC-REQ-249620/B-Enter Auto Mode After TBA2 Trailer Calibration Complete

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • Driver calibrates trailer correctly
Scenario Description	Customer completes trailer calibration
Post-conditions	• TBA2 Setup and Calibration complete • TBA2 Full mode automatically is activated • The vehicle displays TBA2 Full Mode 50/50 View image if TBA2 Lite 50/50 View was previously displayed
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module

	E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.2.2.3 TBA2-UC-REQ-249621/A-Enter TBA2 Default View after Trailer is Detected

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • The driver presses TRG button at RVC view for TRG Mode or Presses the TBA Knob for TBA Mode • The driver selects a trailer at message center • The vehicle searches for trailer template
Scenario Description	Vehicle identifies trailer template
Post-conditions	• TBA2 Default TBA2 View is automatically is activated • The vehicle displays TBA2 Auto Mode 50/50 View image if TBA2 Lite 50/50 View was previously displayed
List of Exception Use Cases	E1 – Vehicle is no longer in RUN/START E2 – Loss of communication with Camera server E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.2.2.4 TBA2-UC-REQ-249622/B-Cancel During TBA2 Setup

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TBA2 is active
Scenario Description	Driver cancels TBA2 Setup.
Post-conditions	The vehicle displays TBA2 Lite Mode or camera default mode
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.2.3   White Box View

4.2.3.1   TBA2-REQ-249662/A-Select Trailer AD
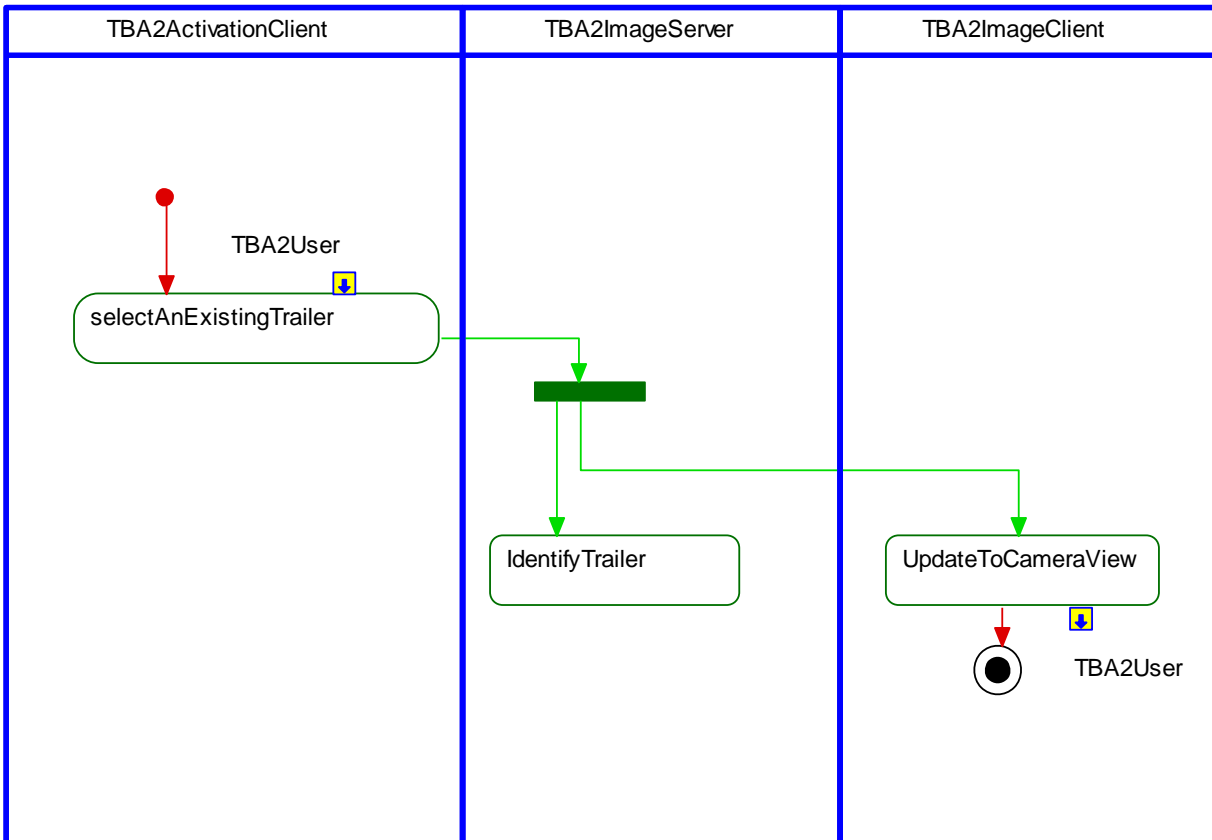
4.2.3.2 *TBA2-REQ-249663/A-Setup New Trailer AD*
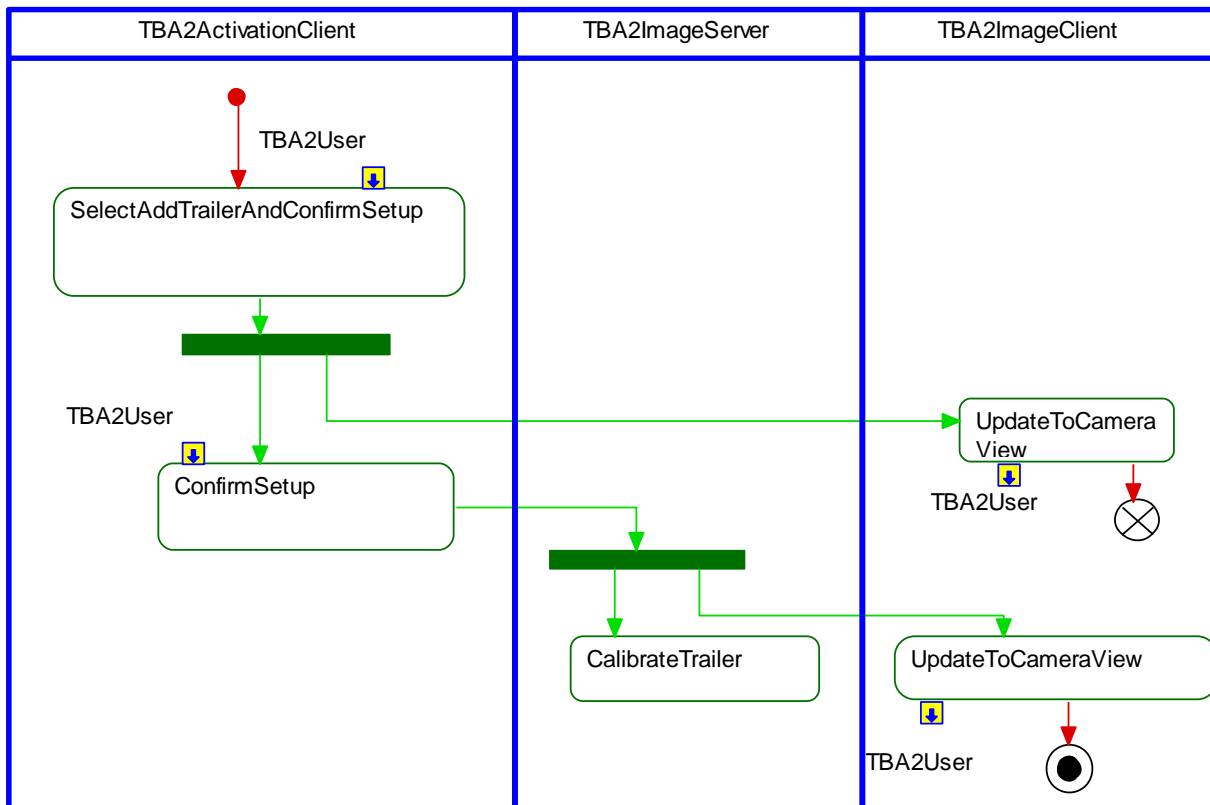
4.2.3.3 *TBA2-REQ-249664/A-Cancel Button During Setup AD*

4.2.3.4   TBA2-REQ-249677/C-Select A Trailer SD

Lifelines: TBA2User, :TBA2ImageServer, TBA2Activation Server, :TBA2ImageClient

- Users() Input → isTBAorTRGMode()

alt
- [Select Exisiting Trailer] selectAnExistingTrailer()
- [Setup New Trailer] setupNewTrailer()

alt
- [TBA Mode]
  - TrlrAidEnbl_D2_Rq(0x1 ActivateTBA)
  - TrailerBackupAssistMode_St(0x2 TbaSetup)
  - TrailerBackupAssistMode_St(0x2 TbaSetup)
  - transmitDefaultTBAView()
  - Feature_St(FeatureID= 081B [CameraShowing], Configuration =TBD, PersIndex= Vehicle)
  - UpdateToCameraView()
  - *ImageServer will determine what view to display*
  - UpdateView()
  - TrailerBackupAssistMode_St(0x1 TbaActive)
  - TrailerBackupAssistMode_St(0x1 TbaActive)
  - wasTBA2LiteActive()

- [TBA2 Lite Previously Active]
  - transmitTBA2AutoMode()
  - Feature_St(FeatureID= 081B [CameraShowing], Configuration = 15 [TBA2 50/50], PersIndex= Vehicle)
  - Feature_St(FeatureID= 0x826 [TBA2 Auto Mode], Configuration = 01 [On], PersIndex=
  - UpdateToCameraView()
  - UpdateView()

- [TRG Mode]
  - TrlrAidEnbl_D2_Rq(0x2 ActivateTRG)
  - TrailerBackupAssistMode_St(0x3 TRGSetup)
  - TrailerBackupAssistMode_St(0x3 TRGSetup)
  - transmitDefaultTBAView()
  - Feature_St(FeatureID= 081B [CameraShowing], Configuration =TBD, PersIndex= Vehicle)
  - UpdateToCameraView()
  - UpdateView()
  - TrailerBackupAssistMode_St(0x4 TRGActive)
  - TrailerBackupAssistMode_St(0x4 TRGActive)
  - wasTBA2LiteActive()

4.2.3.5 TBA2-REQ-249679/C-Over Speed During Setup SD

4.3 TBA2-REQ-249624/A-TBA2 Full Mode

4.3.1 Requirements

4.3.1.1 TBA2-REQ-249625/B-TBA2 Full Mode Definition

TBA2 Full mode is defined by two Feature ID: Camera Showing (0x081B) and TBA2 Auto Mode (0x0826).
TBA2 Image Client shall display TBA2 Full Mode when 0x081B has value of 0x15 and 0x0826 has value of 0x01 or 0x00.

4.3.2 Use Cases

4.3.2.1 TBA2-UC-REQ-249626/A-Deactivate TBA2 Auto Mode When Available

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TBA2 Auto Mode has been activated

Scenario Description	Driver presses Auto button
	      or
	Driver presses Left button
	      or
	Driver presses Right button

Post-conditions	TBA2 leaves out Auto mode and moves to TBA2 regular view , TBA2 Right view or TBA2 Left view pending on which button is pressed
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.3.2.2 TBA2-UC-REQ-249627/A-Driver Request TBA2 Auto Mode

| Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TBA2 is not at TBA2 Lite view • TBA2 Auto mode is deactivated
Scenario Description	Driver presses the Auto button
Post-conditions	• TBA2 Auto Mode is activated • The vehicle displays TBA2 Auto Mode image
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.3.2.3 TBA2-UC-REQ-249628/A-Re-enter TBA2 Auto Mode in the Same Ignition Cycle

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • Driver leaves Auto Mode • Driver does not turn off ignition

| **Scenario Description**	Driver presses 50/50 View button in other camera mode
Post-conditions	• TBA2 Auto Mode is automatically activated • The vehicle displays TBA2 Auto Mode image
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

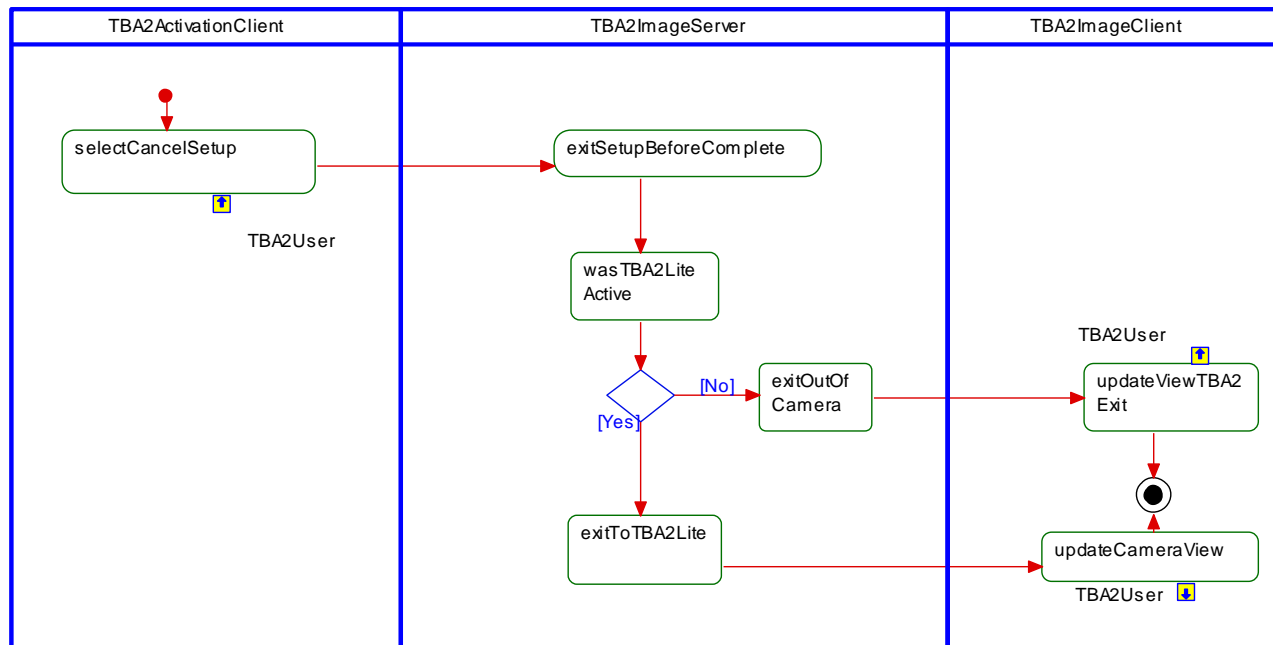### 4.3.3 White Box View

4.3.3.1 TBA2-REQ-249665/A-Driver Selected TBA2 Auto Mode View AD
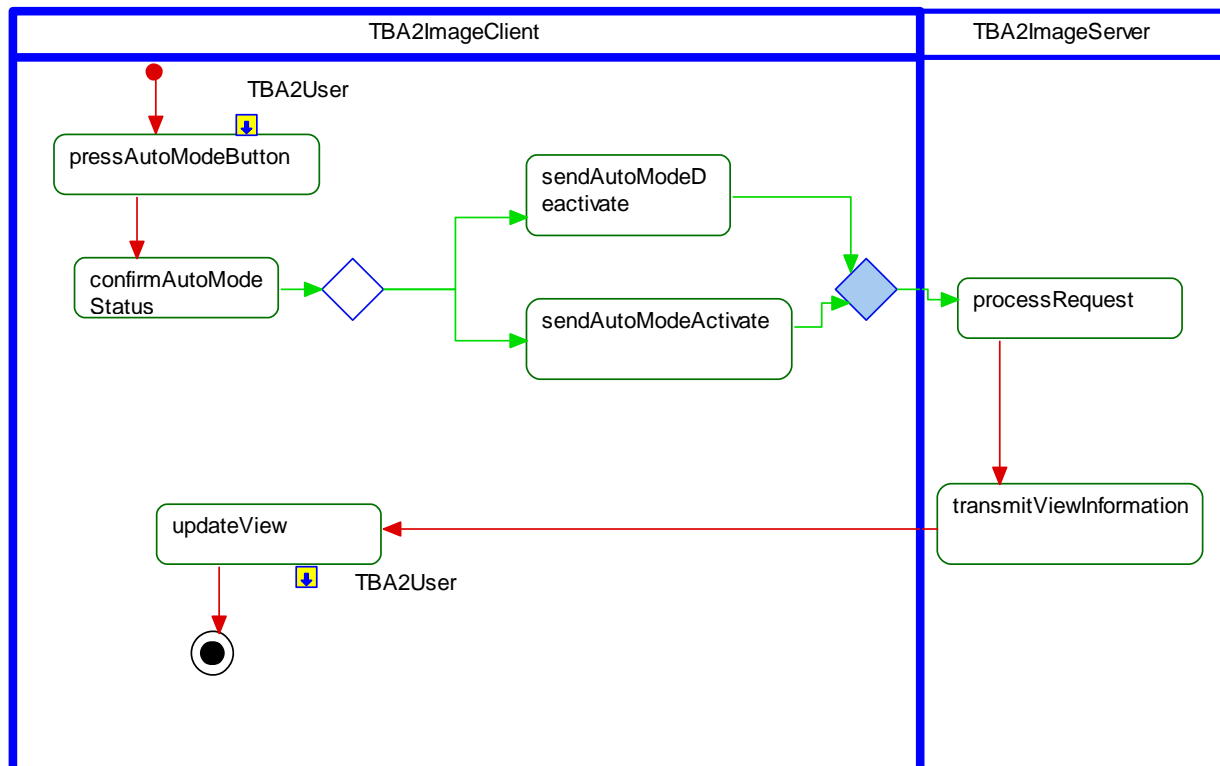
4.3.3.2   *TBA2-REQ-249666/A-Re-enter Auto Mode Same Ignition Cycle AD*

4.3.3.3 *TBA2-REQ-249680/B-TBA2 Auto Button Press SD*

```
TBA2User              :TBA2ImageClient              :TBA2ImageServer

   userInput()
   ─────────────────────▶
                        pressAutoModeButton()
                        ┐
                        ◀┘

                        confirmAutoModeStatus()
                        ┐
                        ◀┘

        ┌alt──────────────────[Auto Currently Off]──────────────────────┐
        │                                                                │
        │               sendAutoModeActivate()                           │
        │               ┐                                                │
        │               ◀┘                                               │
        │               Feature_Rq(Operation = Set, FeatureID=826[TBA2 Auto
        │               Mode], Configuration = 01[On], PersIndex=Vehicle)
        │               ─────────────────────────▶                      │
        │                                  processRequest()              │
        │                                  ┐                             │
        │                                  ◀┘                            │
        │                                  transmittViewInformation()    │
        │                                  ┐                             │
        │  Feature_St(Operation = Set, FeatureID=826[TBA2 Auto  ◀┘       │
        │  Mode], Configuration = 01[On], PersIndex=Vehicle)             │
        │               ◀─────────────────────────                      │
        │- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - │
        │                    [Auto Currently On]                         │
        │               sendAutoModeActivate()                           │
        │               ┐                                                │
        │               ◀┘                                               │
        │               Feature_Rq(Operation = Set, FeatureID=826[TBA2 Auto
        │               Mode], Configuration = 00[Off], PersIndex=Vehicle)
        │               ─────────────────────────▶                      │
        │                                  processRequest()              │
        │                                  ┐                             │
        │                                  ◀┘                            │
        │                                  transmittViewInformation()    │
        │                                  ┐                             │
        │  Feature_St(Operation = Set, FeatureID=826[TBA2 Auto  ◀┘       │
        │  Mode], Configuration = 00[Off], PersIndex=Vehicle)            │
        │               ◀─────────────────────────                      │
        └────────────────────────────────────────────────────────────────┘

                        updateCameraView()
                        ┐
                        ◀┘
                UpdateView()
   ◀─────────────────────
```

4.3.3.4 TBA2-REQ-249681/B-TBA2 Auto Mode Re-Entered SD

```
        TBA2User              :TBA2ImageC            :TBA2ImageS
                                   lient                 erver

         userInput()
        ─────────────────────────▶

                              selectTBA2 50 50 View()
                                    ◀─┐
                                      │
                                Feature_Rq(Operation = Set, FeatureID=081B
                                [CameraShowing], Configuration = 16[TBA2 50 50],
                                PersIndex=Vehicle)
                                    ──────────────────────▶

                                                 ignitionStayedOn()
                                                       ◀─┐
                                                         │

                                                 TrailerSelected()
                                                       ◀─┐
                                                         │

      ┌alt┐                  [Auto On Previously]
      │
      │                                          sendAutoModeON()
      │                                                ◀─┐
      │                                                  │
      │         Feature_St(Operation = Set, FeatureID=081B [CameraShowing],
      │                 Configuration = 16[TBA2 50 50], PersIndex=Vehicle)
      │                                    ◀──────────────────────
      │
      │         Feature_St(Operation = Set, FeatureID=826 [TBA2 Auto Mode],
      │                 Configuration = 01[TBA2 50 50], PersIndex=Vehicle)
      │                                    ◀──────────────────────
      │─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ [Auto Off Previously]─ ─ ─ ─ ─ ─ ─ ─
      │                                          sendAutoModeOff()
      │                                                ◀─┐
      │                                                  │
      │         Feature_St(Operation = Set, FeatureID=081B [CameraShowing],
      │                 Configuration = 16[TBA2 50 50], PersIndex=Vehicle)
      │                                    ◀──────────────────────
      │
      │         Feature_St(Operation = Set, FeatureID=826 [TBA2 Auto Mode],
      │                 Configuration = 00[OFF], PersIndex=Vehicle)
      │                                    ◀──────────────────────
      └─────────────────────────────────────────────────────────

                               updateCameraView()
                                     ◀─┐
                                       │
                     UpdateView()
        ◀──────────────────────
```

4.4 TBA2-REQ-249695/A-TBA2 Left/Right View Transition

4.4.1 Requirements

4.4.2 Use Cases

4.4.2.1 *TBA2-UC-REQ-249629/A-Request TBA2 Far Left View*

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is in Run/Start • TBA2 is showing Left view
Scenario Description	Driver Presses Left button
Post-conditions	The vehicle displays far Left view The vehicle disables Left button on TBA2 far Left view
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.4.2.2 *TBA2-UC-REQ-249630/A-Request TBA2 Left View at Far Left View*

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TBA2 is showing far Left view
Scenario Description	Driver presses Right button
Post-conditions	• The vehicle displays Left view • The vehicle enables Left button on TBA2 view
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.4.2.3 *TBA2-UC-REQ-249631/A-Request TBA2 Far Right View*

| **Actors**	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TBA2 is showing Right view
Scenario Description	Driver Presses Right button
Post-conditions	The vehicle displays far Right view The vehicle disables Right button on TBA2 far Right view
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.4.2.4   TBA2-UC-REQ-249632/A-Request Right View at Far Right View

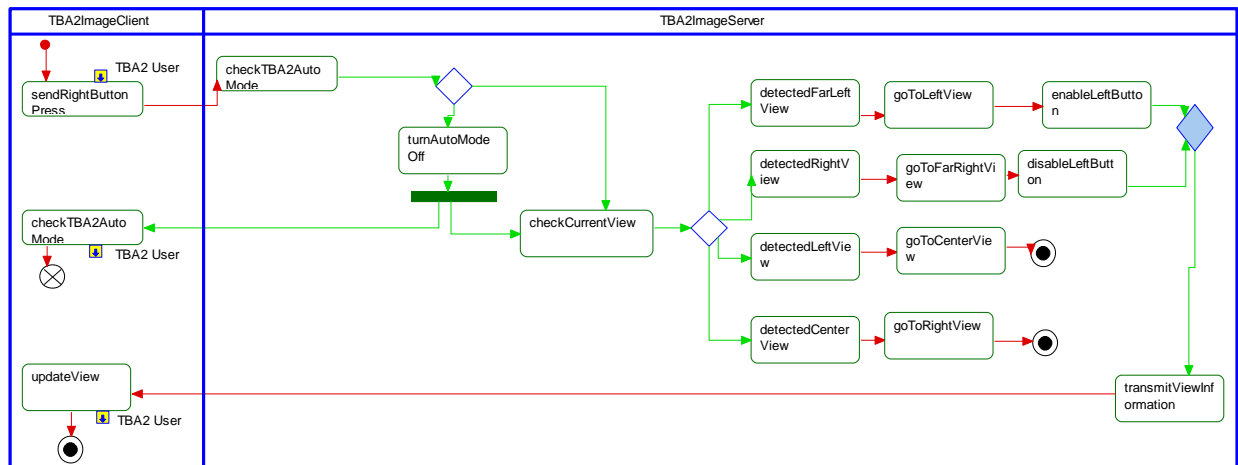| Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TBA2 is showing far Right view
Scenario Description	Driver presses Left button
Post-conditions	• The vehicle displays right view • The vehicle enables Right button on TBA2 view
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.4.2.5   TBA2-UC-REQ-249633/A-Request TBA2 Left View

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TBA2 is engaged (Camera Showing: TBA2 50/50 View) • TBA2 is not showing far Left view
Scenario Description	Drivers presses the Left button
Post-conditions	The vehicle displays next view to left
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with Camera server (IPMB module) E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.4.2.6   TBA2-UC-REQ-249634/A-Request TBA2 Right View

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TBA2 is engaged • TBA2 is not showing far Right view
Scenario Description	Driver presses the right button
Post-conditions	The vehicle displays next view to right
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.4.3   White Box View
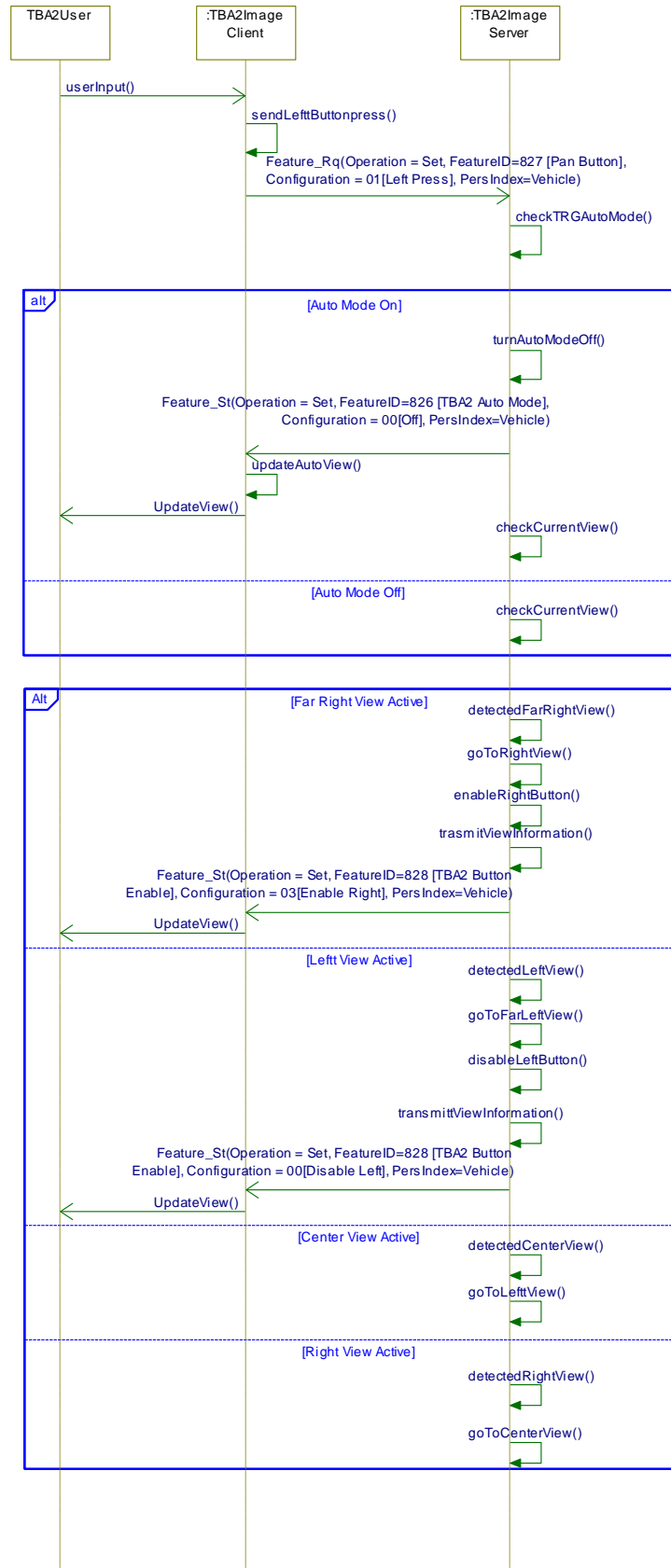
4.4.3.1   *TBA2-REQ-249667/A-TBA2 Left View Requested AD*
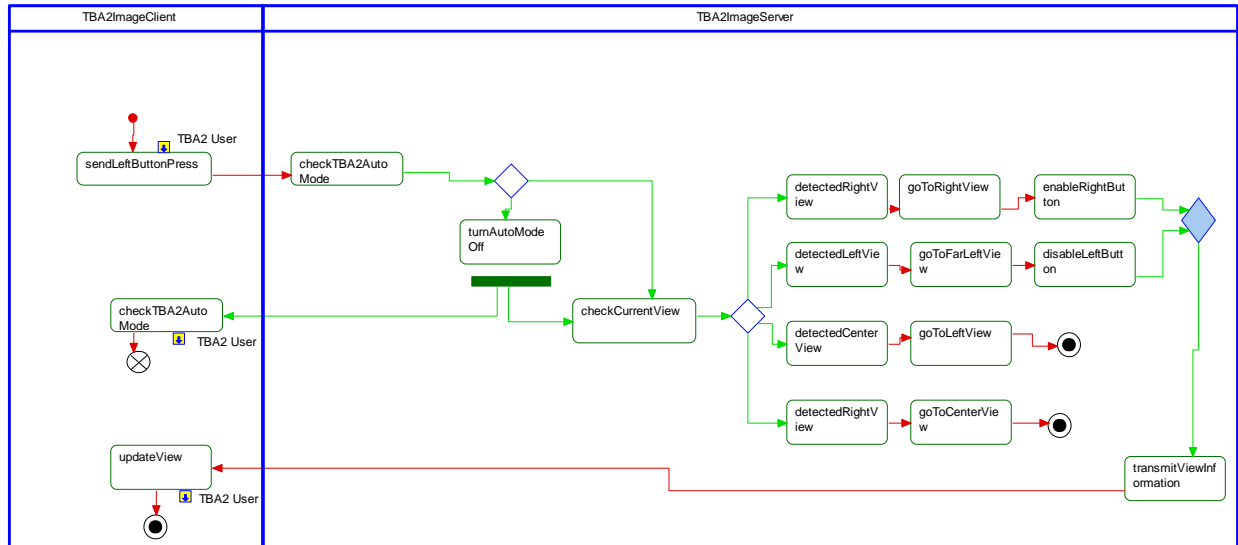
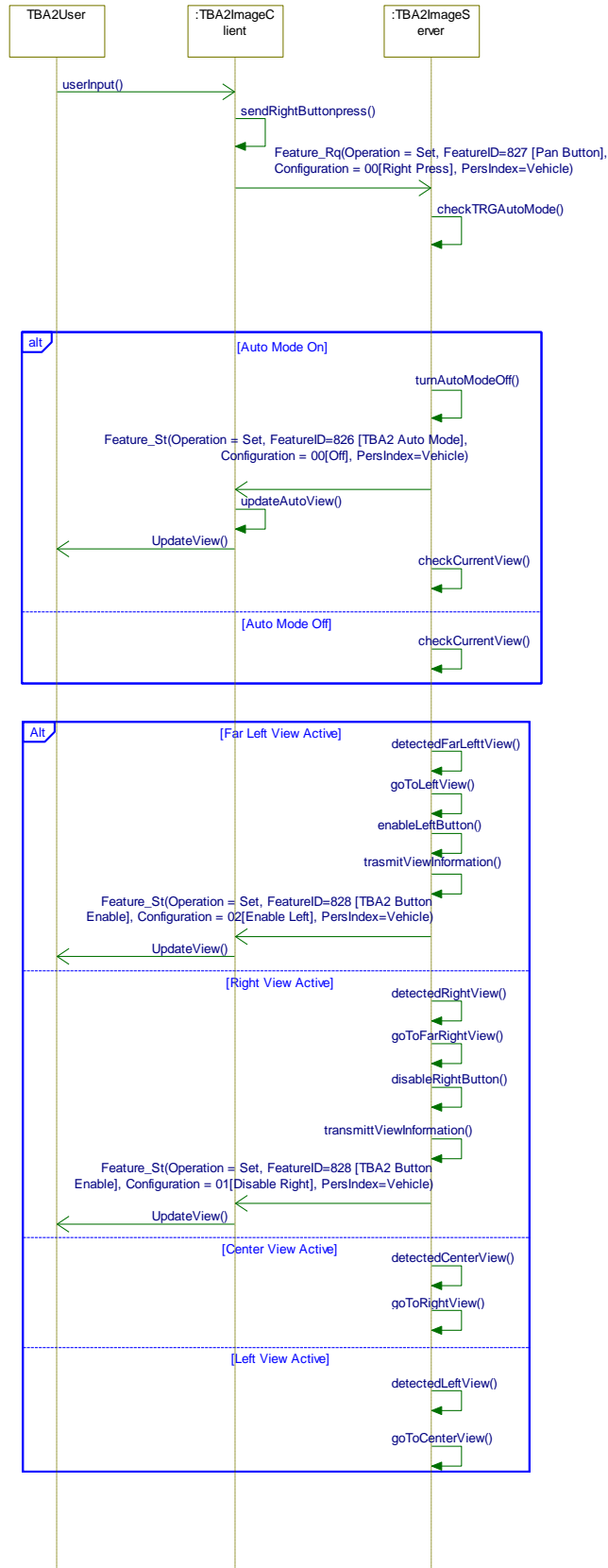#### 4.4.3.2   *TBA2-REQ-249668/A-TBA2 Right View Requested AD*

4.4.3.3   TBA2-REQ-249683/B-Left Button Press SD

Participants: TBA2User, :TBA2ImageClient, :TBA2ImageServer

- TBA2User → :TBA2ImageClient: userInput()
- :TBA2ImageClient: sendLefttButtonpress()
- :TBA2ImageClient → :TBA2ImageServer: Feature_Rq(Operation = Set, FeatureID=827 [Pan Button], Configuration = 01[Left Press], PersIndex=Vehicle)
- :TBA2ImageServer: checkTRGAutoMode()

alt

[Auto Mode On]
- :TBA2ImageServer: turnAutoModeOff()
- :TBA2ImageServer → :TBA2ImageClient: Feature_St(Operation = Set, FeatureID=826 [TBA2 Auto Mode], Configuration = 00[Off], PersIndex=Vehicle)
- :TBA2ImageClient: updateAutoView()
- :TBA2ImageClient → TBA2User: UpdateView()
- :TBA2ImageServer: checkCurrentView()

[Auto Mode Off]
- :TBA2ImageServer: checkCurrentView()

Alt

[Far Right View Active]
- :TBA2ImageServer: detectedFarRightView()
- :TBA2ImageServer: goToRightView()
- :TBA2ImageServer: enableRightButton()
- :TBA2ImageServer: trasmitViewInformation()
- :TBA2ImageServer → :TBA2ImageClient: Feature_St(Operation = Set, FeatureID=828 [TBA2 Button Enable], Configuration = 03[Enable Right], PersIndex=Vehicle)
- :TBA2ImageClient → TBA2User: UpdateView()

[Leftt View Active]
- :TBA2ImageServer: detectedLeftView()
- :TBA2ImageServer: goToFarLeftView()
- :TBA2ImageServer: disableLeftButton()
- :TBA2ImageServer: transmittViewInformation()
- :TBA2ImageServer → :TBA2ImageClient: Feature_St(Operation = Set, FeatureID=828 [TBA2 Button Enable], Configuration = 00[Disable Left], PersIndex=Vehicle)
- :TBA2ImageClient → TBA2User: UpdateView()

[Center View Active]
- :TBA2ImageServer: detectedCenterView()
- :TBA2ImageServer: goToLefttView()

[Right View Active]
- :TBA2ImageServer: detectedRightView()
- :TBA2ImageServer: goToCenterView()

4.4.3.4   TBA2-REQ-249684/B-Right Button Press SD

4.5   TBA2-REQ-249638/A-TBA2 Rear Normal View

4.5.1   Requirements

4.5.1.1   *TBA2-REQ-249639/A-Additional Camera Views*

AUX view is equivalent in every aspect to Rear View in this SPSS. Anywhere where Rear View is mentioned in the below section, Test Case, Sequence, Activity Diagram or elsewhere, is applicable to AUX view as well.

Same for TBA2 Rear 360, TBA2 Rear Split, TBA2 CHMSL, and TBA2 Aux Wireless.

4.5.2   Use cases

4.5.2.1   **TBA2-UC-REQ-249640/A-Request TBA2 Rear Normal View**

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TBA2 is activated
Scenario Description	Driver presses TBA2 Rear Normal Button.
Post-conditions	The vehicle displays TBA2 rear normal view
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.5.3   White Box View

4.5.3.1   **TBA2-REQ-249670/A-Enter Rear Normal View AD**
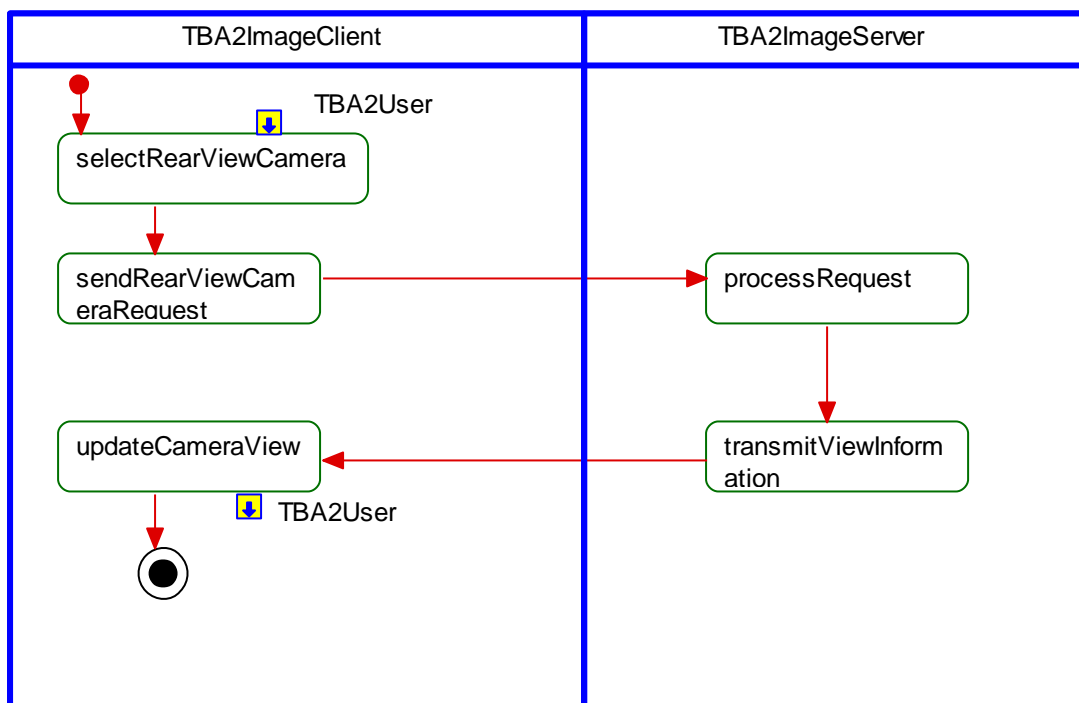
4.5.3.2 *TBA2-REQ-249686/B-TBA2 Rear Normal View SD*
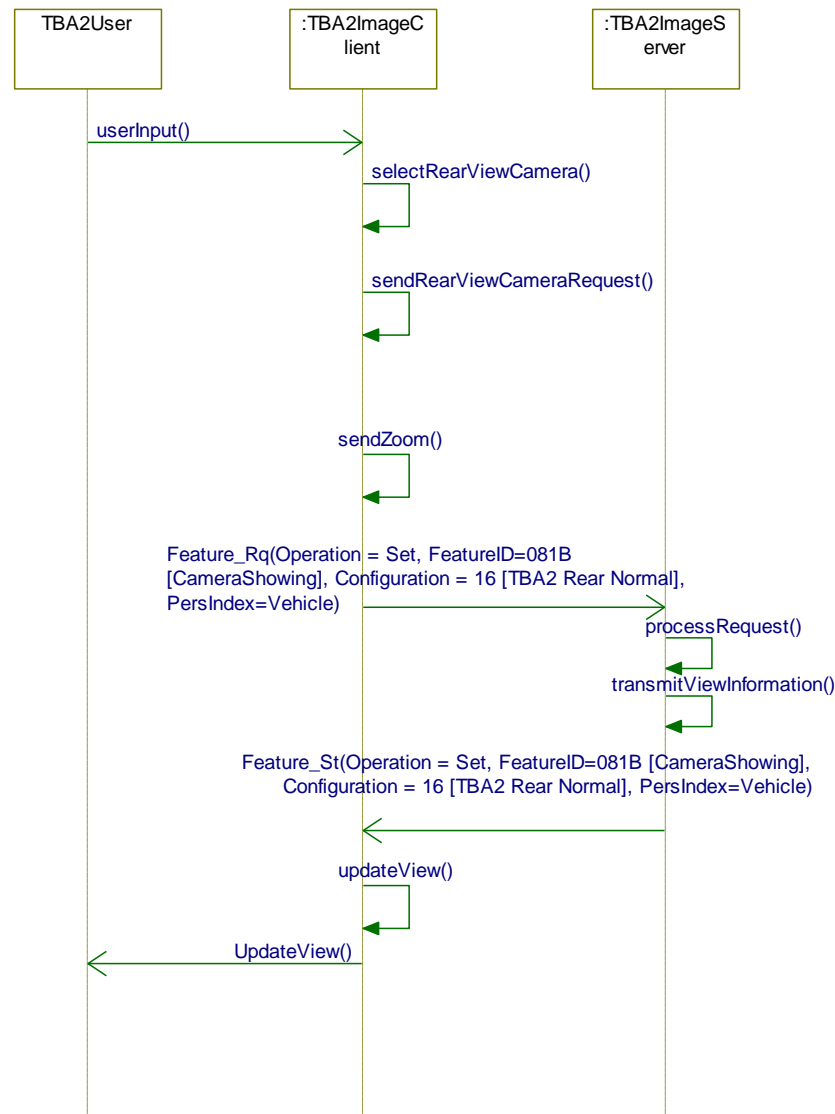
4.6 TBA2-REQ-249641/A-TBA2 Lite View

4.6.1 Requirements

4.6.1.1 *TBA2-REQ-249646/B-TBA2 Lite Mode Definition*

TBA2 Lite mode is defined by two Feature ID: Camera Showing (0x081B) and TBA2 Auto Mode (0x826).
TBA2 Image Client shall display TBA2 Lite Mode when 0x081B has value of 0x15 and 0x826 has value of 0x02 Not Available.

4.6.2 Use Cases

4.6.2.1 *TBA2-UC-REQ-249647/A-Enter TBA2 Lite*

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • The vehicle displays RVC image

Scenario Description	Driver presses TRG button
Post-conditions	The vehicle displays TBA2 Lite Mode
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with Camera server E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.6.3   White Box View

4.6.3.1   TBA2-REQ-249671/A-Enter TRG Lite AD

4.6.3.2   TBA2-REQ-249687/D-Enter TBA2 Lite SD
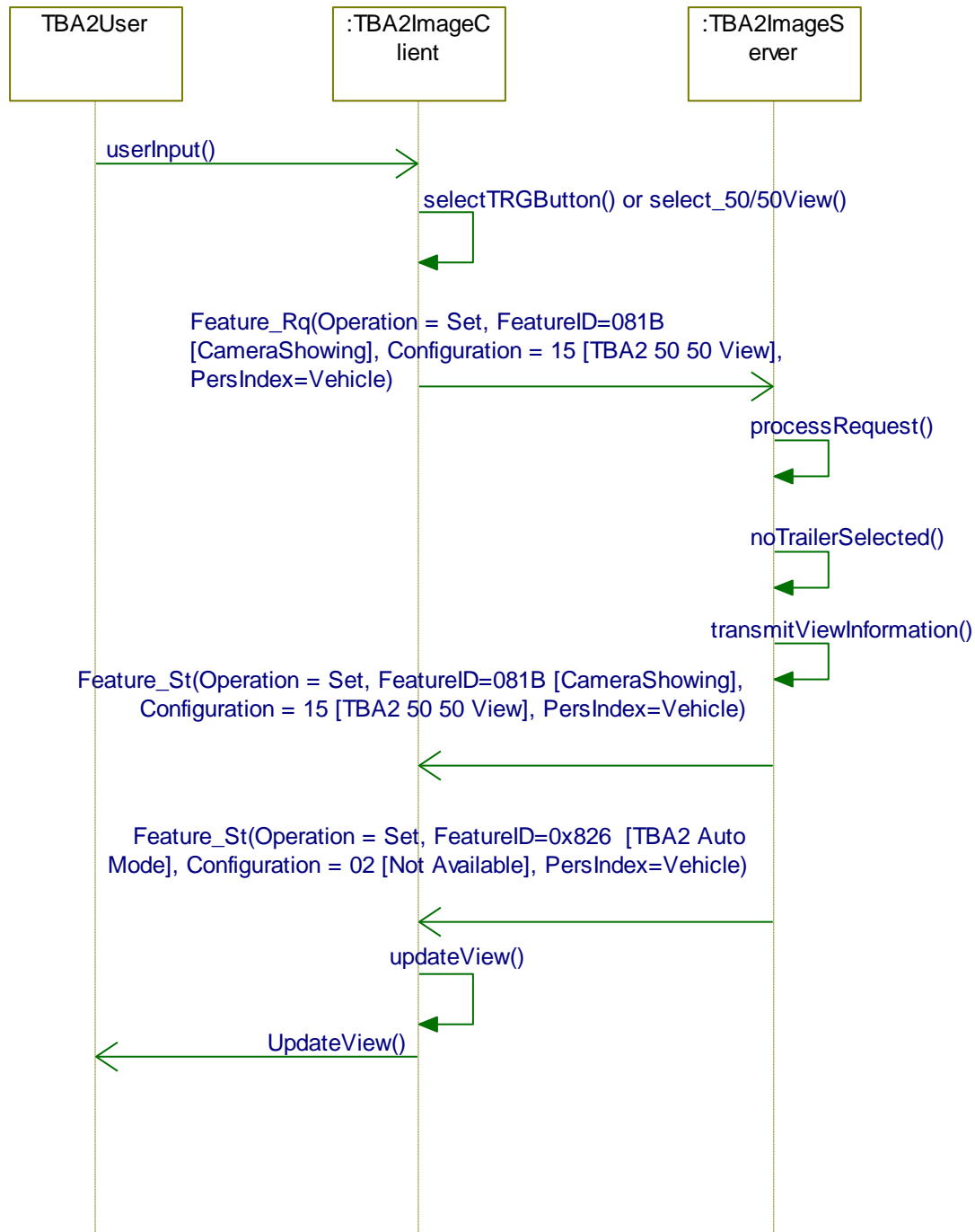
4.7   TBA2-REQ-249642/A-TBA2 Exit

4.7.1   Requirements

4.7.1.1   *TBA2-REQ-249643/A-Cancel Trailer Backup Assist 2 when Camera Feed is Missing*

In the event the camera feed is missing, the Trailer Backup Assist 2 Image Client shall set CancelTrailerBackupAssist_Rq to the value of 0x01 for the duration of TrailerBackupAssist_St >= 0x4 . Once TrailerBackupAssist_St is <4 , CancelTrailerBackupAssist_Rq shall be set to 0x0_Null again

4.7.1.2   *TBA2-REQ-249644/A-Trailer Backup Assist Maximum Speed*

Trailer Backup Assist has no maximum or minimum speed defined for the TBA2 Image Client. This parameter is a calibration value inherent to the TBA2 Activation Server and shall not be determined by the TBA2 Image Client as it may change through development of the feature and depending on vehicle program or market. The TBA2 Image Client shall not set CancelTrailerBackupAssist_Rq for maximum or minimum speed.

4.7.2   Use Cases

4.7.2.1   *TBA2-UC-REQ-249648/A-Exit TBA2 Feature by Pressing Hard Button*

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run TBA2 is activated
Scenario Description	Driver presses TBA hard button
Post-conditions	The vehicle returns to non-TBA2 behavior
List of Exception Use Cases	E1 – Vehicle not in Run E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.7.2.2   *TBA2-UC-REQ-249649/A-Exit TBA2 Feature by Pressing Return Button*

Actors Pre-conditions	Vehicle Occupant • Ignition status is Run/Start • TBA2 is activated
Scenario Description Post-conditions	Driver presses Return button on any TBA2 view The vehicle returns to non-TBA2 behavior
List of Exception Use Cases Interfaces	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present G-HMI Vehicle System Interface

4.7.2.3   *TBA2-UC-REQ-249650/A-Exit TBA2 - Over Speed Detected*

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • Gear Position Status is not reverse • TBA2 is activated
Scenario Description	Driver drives above TBDkph
Post-conditions	The Activation Server requests to exit TBA2

List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.7.2.4 TBA2-UC-REQ-249651/A-Vehicle Not in RUN/START

Actors	Vehicle Occupant
Pre-conditions	Same as normal usage use case
Scenario Description	Driver moves the ignition out of Run/Start
Post-conditions	The vehicle returns to non-TBA2 behavior
List of Exception Use Cases	N/A
Interfaces	G-HMI Vehicle System Interface

4.7.2.5 TBA2-UC-REQ-249652/A-Loss of communication with IPMB Module

Actors	Vehicle Occupant
Pre-conditions	Same as normal usage use case
Scenario Description	Driver attempts to do something in TBA2 and APIM has lost communication with IPMB
Post-conditions	The vehicle shows camera view, without any overlays
List of Exception Use Cases	N/A
Interfaces	G-HMI Vehicle System Interface

4.7.2.6 TBA2-UC-REQ-249653/A-Valid Camera Video Signal not present

| Actors	Vehicle Occupant
Pre-conditions	Same as normal usage use case
Scenario Description	Driver attempts to do something in TBA2 and APIM is not receiving valid video
Post-conditions	The vehicle returns to non-TBA2 behavior
List of Exception Use Cases	N/A
Interfaces	G-HMI Vehicle System Interface

4.7.3 White Box Views

4.7.3.1 TBA2-REQ-249672/A-TBA2 Exit By Hard Button Press AD
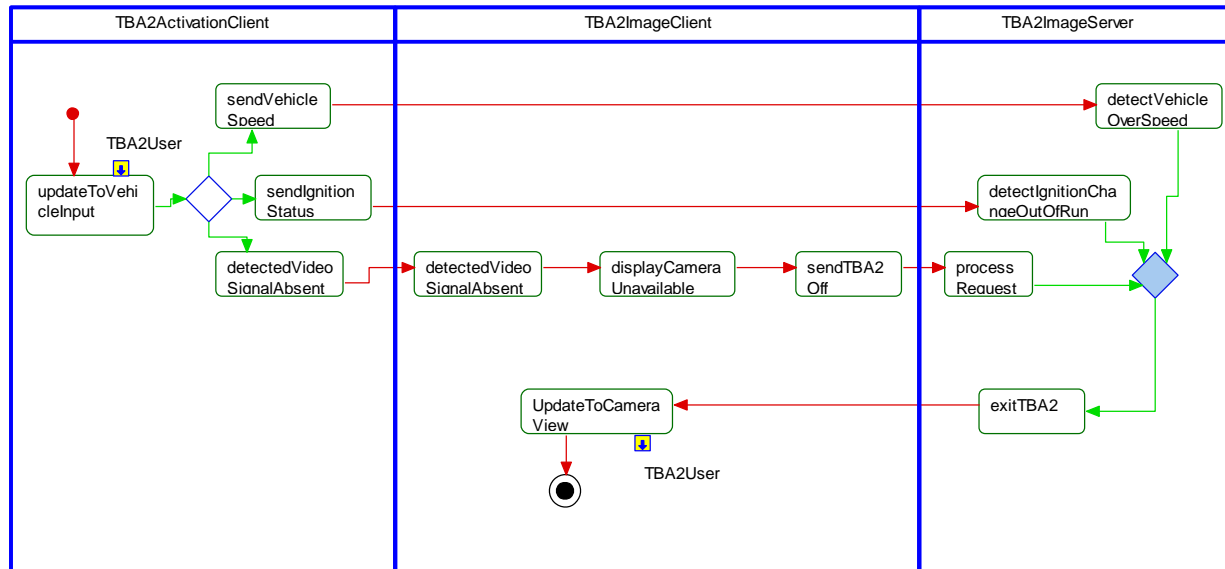
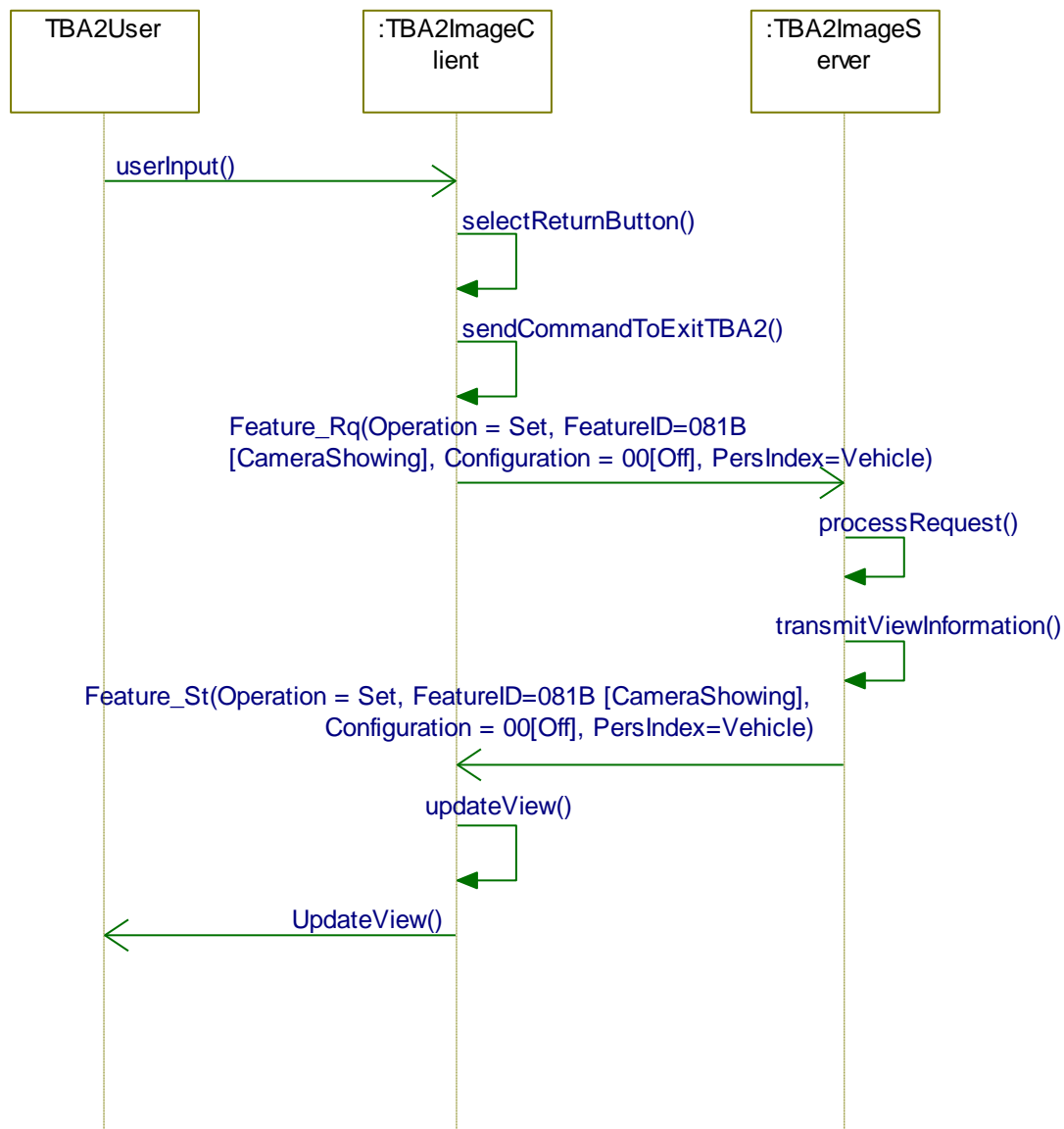#### 4.7.3.2 TBA2-REQ-249673/A-TBA Exit By Change In Vehicle Input AD

4.7.3.3 TBA2-REQ-249674/A-TBA2 Exit By Loss Of Communication AD
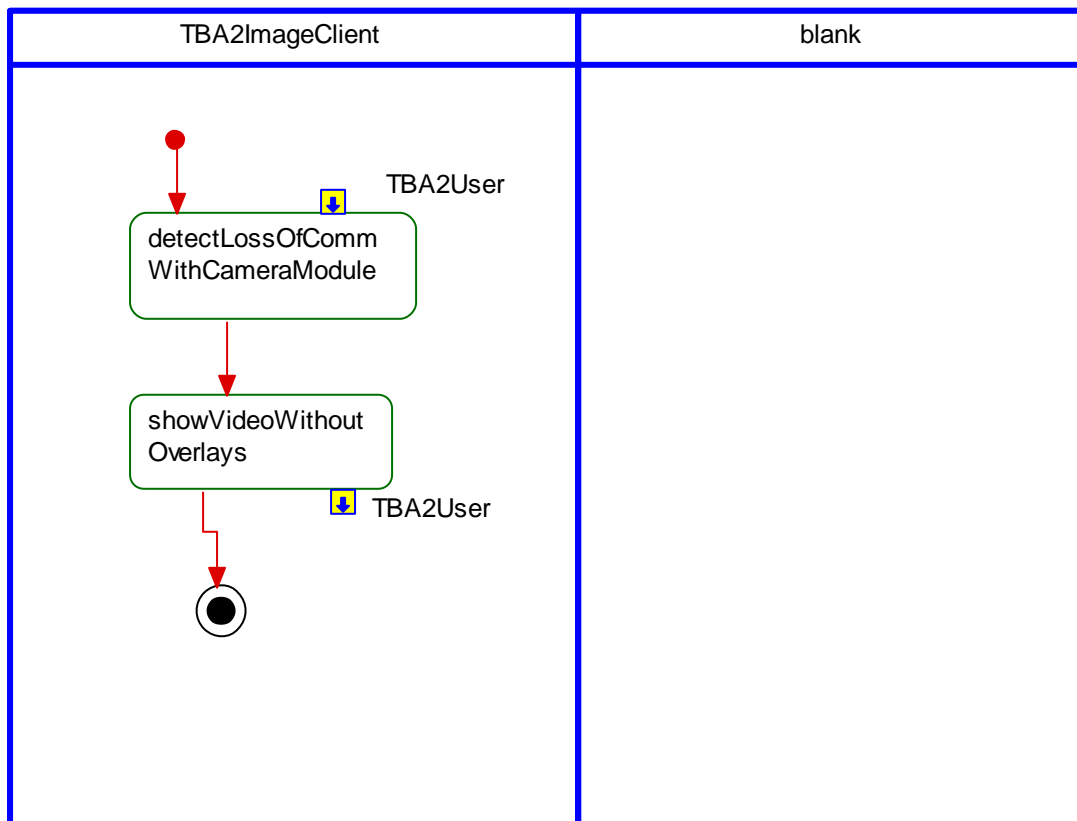
4.7.3.4 TBA2-REQ-249675/A-TBA2 Exit By Return Press AD
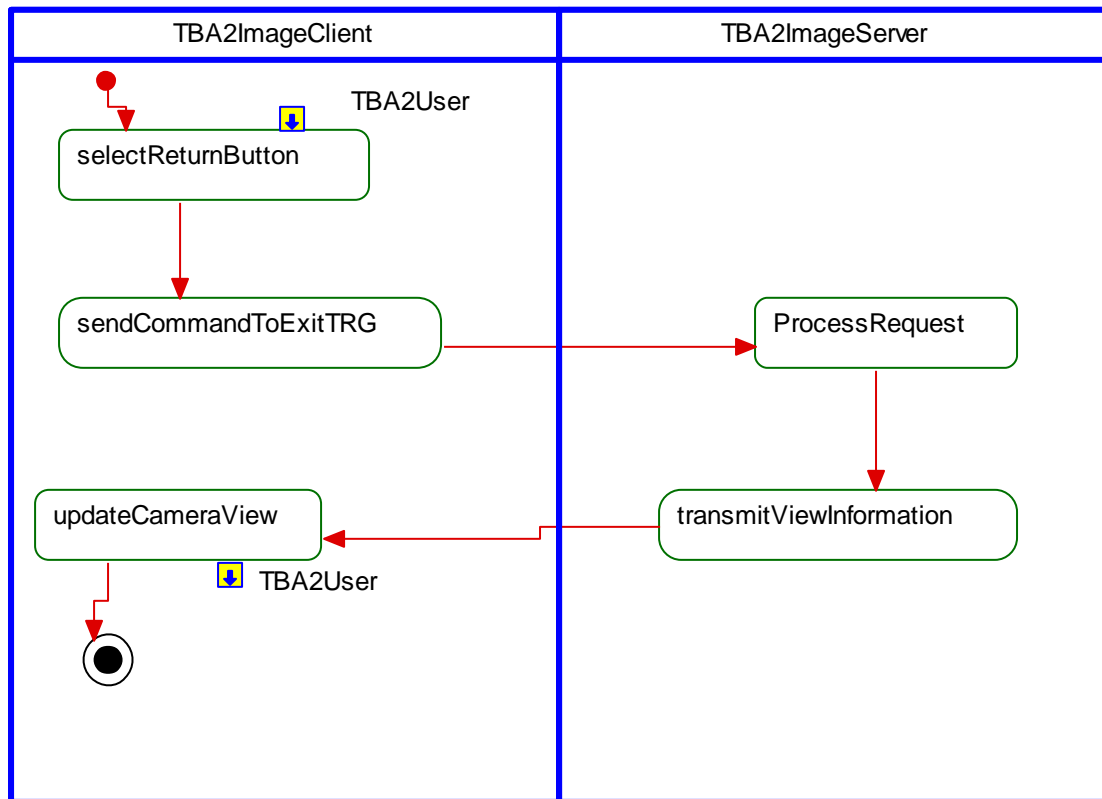
4.7.3.5 TBA2-REQ-249688/A-Over Speed Detected SD

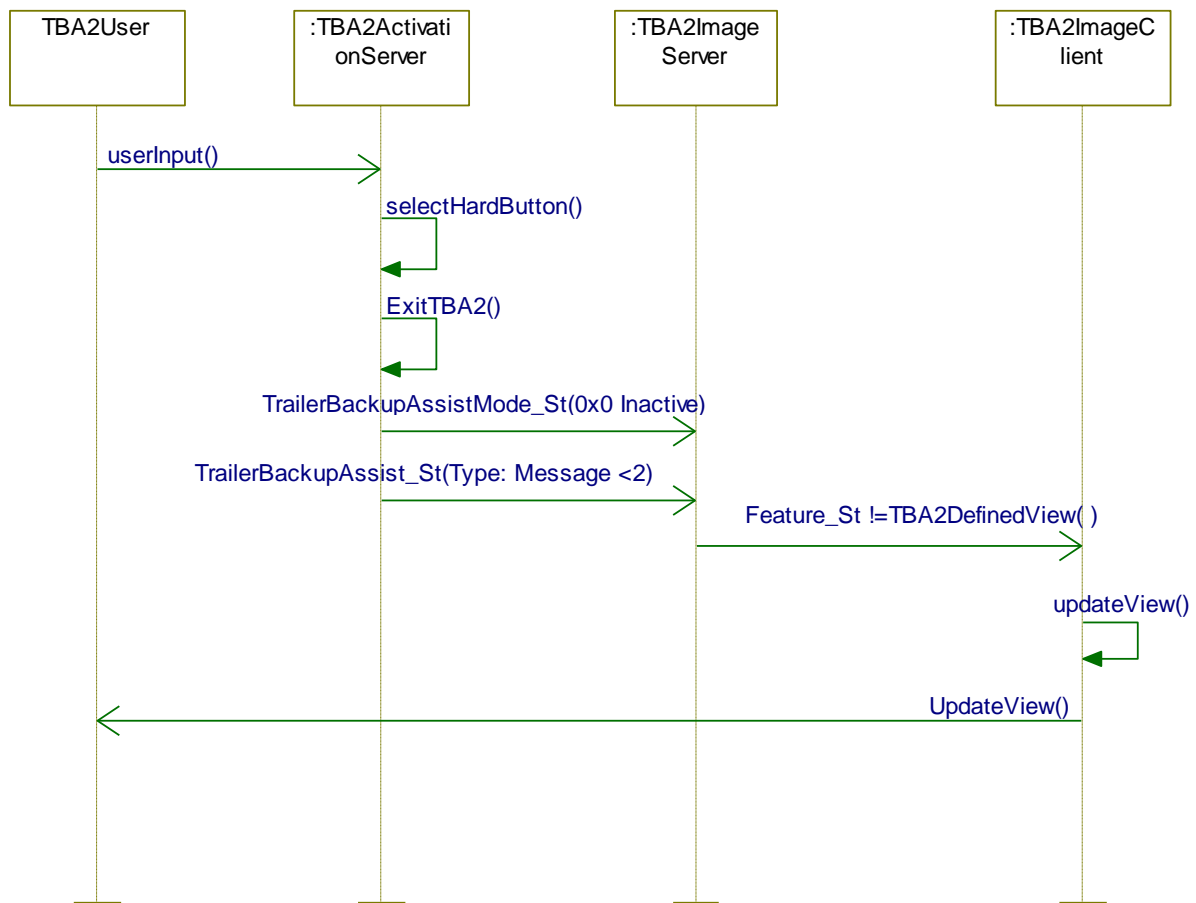### 4.7.3.6 TBA2-REQ-249689/A-Loss Of Communication SD
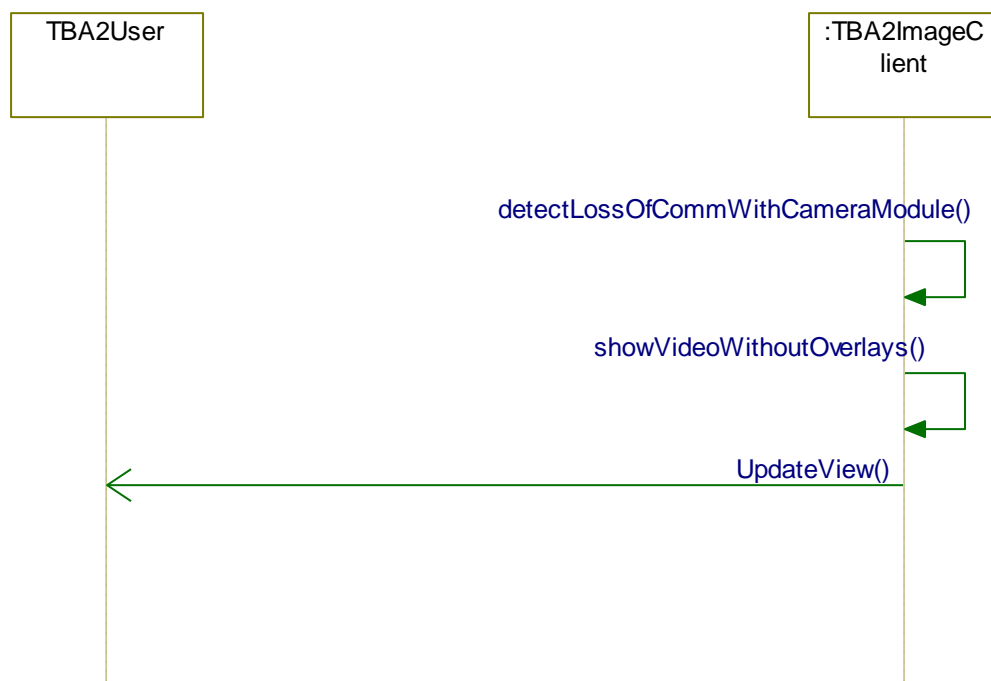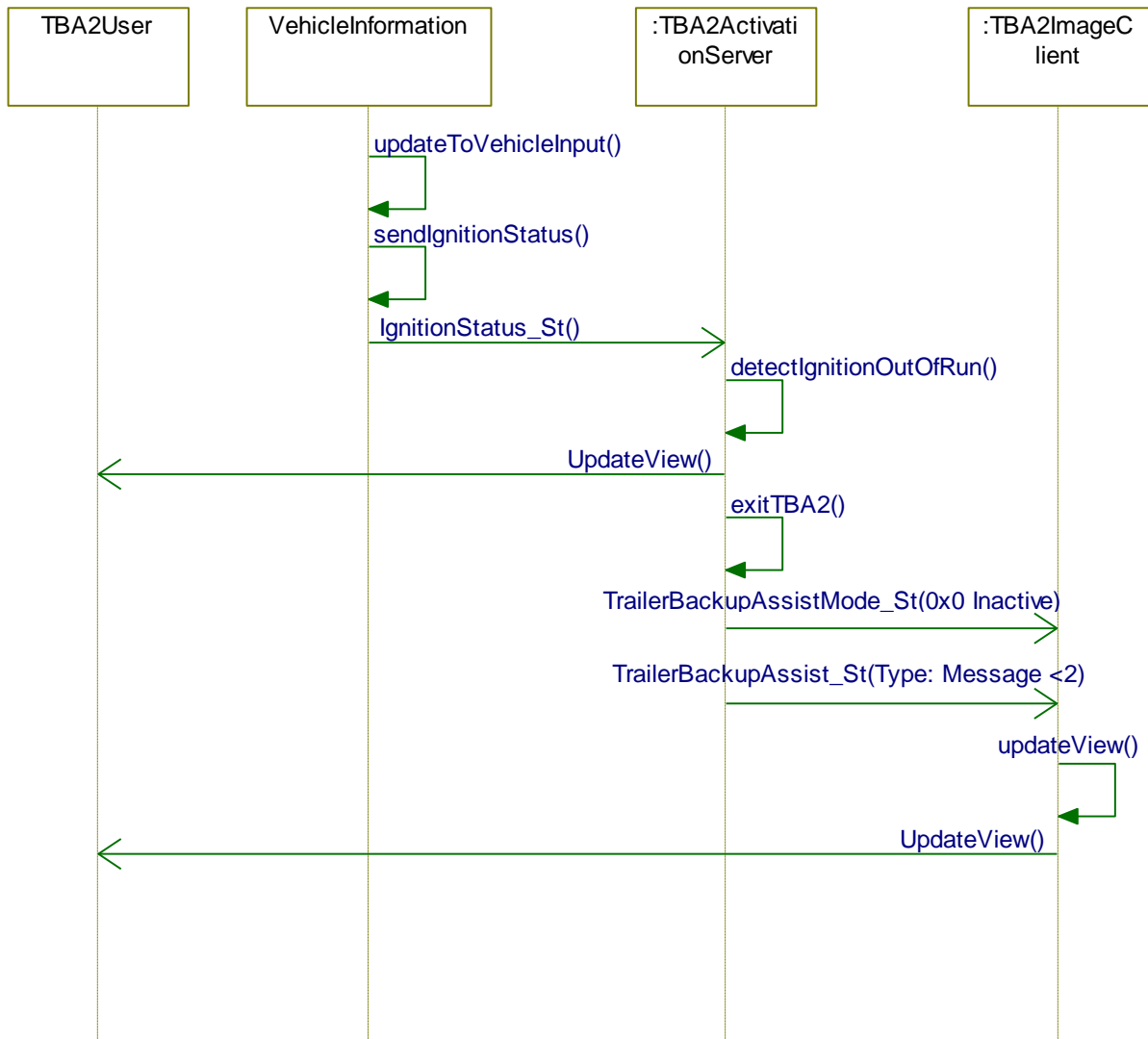
4.7.3.7 TBA2-REQ-249690/B-Return Button Press SD

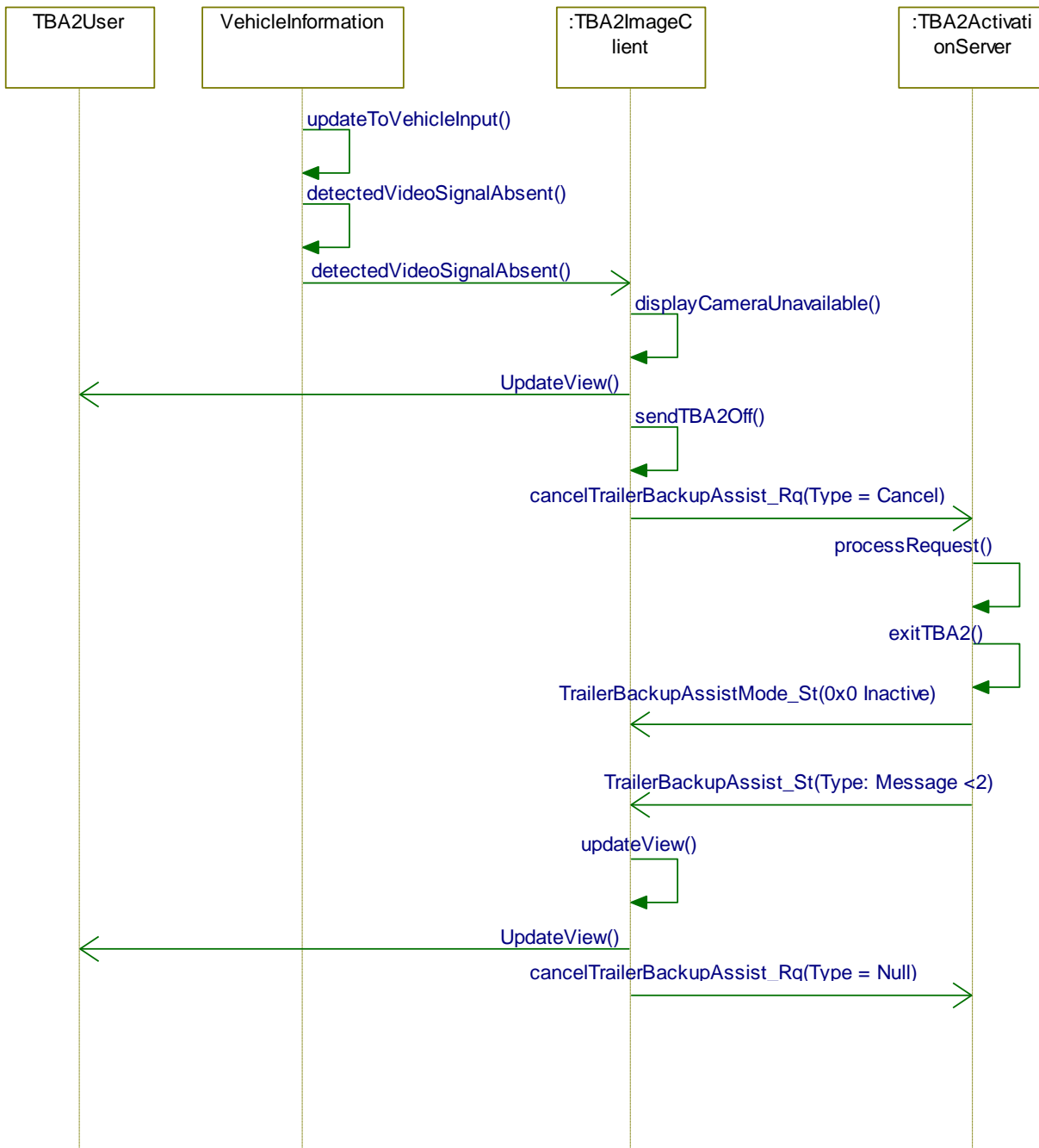### 4.7.3.8 TBA2-REQ-249691/C-Exit By Hard Button Press SD

4.7.3.9 TBA2-REQ-249692/C-Ignition Moved Out Of Run SD

FILE:TRAILER BACKUP ASSIST 2.0 IMAGE CLIENT SPSS V1.9 SEP 30, 2022

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4.7.3.10 *TBA2-REQ-249693/B-Video Signal Absent SD*

4.8   TBA2-REQ-259117/A-TBA2 Info Button and Info PopUp

4.8.1   Requirements

4.8.1.1   *TBA2-REQ-259118/B-Info Button Available*

The TBA2 Info Button should be shown on the display and available to be pressed by the user only when the vehicle is in Park. Refer to HMI spec H36s for more details. If [No TBA2 Info Button] is defined by *TBA2-FUR-REQ-249558/B-TBA2 HMI Display Table* for given values of TrailerBackupAssist_St and TrailerBackupAssistMode_St, then no Info Button should be shown.

4.8.1.2 _TBA2-REQ-259119/B-TBA2 Info PopUp Shown_

The TBA2 Info Pop-Up should be shown when TrailerBackupAssist_St transitions to 0x32 (Message 50) or when the user presses the TBA2 Info Button

4.8.1.3 _TBA2-REQ-259120/B-Close TBA2 Info PopUp_

The TBA2 Info Pop-Up should be closed when TrailerBackupAssist_St transitions from 0x32 (Message 50), when the user presses the Ok button to dismiss the pop-up or when the vehicle is NOT in Park.

If [No TBA2 Info Button] is defined by _TBA2-FUR-REQ-249558/B-TBA2 HMI Display Table_ for given values of TrailerBackupAssist_St and TrailerBackupAssistMode_St then no PopUp should be shown on screen.

4.8.1.4 _TBA2-REQ-259121/B-TBA2 Info PopUp Text_

The text shown in the Pop-up is defined in the document SYNC4_TBA2_HmiStatus_Coding.

4.9   TBA2-REQ-266258/A-TRG Straight Back Up Mode Button

4.9.1   Straight Back Up Mode Button

The Straight back-Up Mode Button should be should be shown only when
- TrailerBackupAssistMode_St == 0x4_TbaOffTrgActive

4.9.2   Use Cases

4.9.2.1   *UC-REQ-266260/A-Request TRG Straight Back-Up Mode*

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • Requirements to show straight backup mode button are met
Scenario Description	Driver presses the TRG Straight Back Up button
Post-conditions	The vehicle displays TRG straight back up view
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.9.2.2   *UC-REQ-266261/A-Look at ICON Test in TRG Straight Back-Up Mode*

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TRG Straight Back Up is activated
Scenario Description	TRG determines steering wheel correction to back trailer straight
Post-conditions	The vehicle displays "Follow [name of icon] to back up straight"
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.9.2.3   UC-REQ-266262/A-Pull Forward in TRG Straight Back-Up Mode

Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TRG Straight Back Up is activated
Scenario Description	TRG determines that driver no longer can correct trailer back to straight without driving forward
Post-conditions	The vehicle displays "Pull forward to straighten"
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.9.2.4   UC-REQ-266263/A-Shift to Reverse in TRG Straight Back-Up Mode

| Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TRG Straight Back Up is activated
Scenario Description	TRG determines driver can now back trailer straight
Post-conditions	The vehicle displays "Shift into Reverse to continue"
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.9.2.5   UC-REQ-266264/A-Force Exit TRG Straight Back-Up Mode

| Actors	Vehicle Occupant
Pre-conditions	• Ignition status is Run/Start • TRG Straight Back Up is activated
Scenario Description	Trailer angle is too great for Straight Back Up Mode
Post-conditions	The vehicle exits from Straight Back Up to display TRG view
List of Exception Use Cases	E1 – Vehicle is not in Run/Start E2 – Loss of communication with IPMB module E3 – Valid camera video signal not present
Interfaces	G-HMI Vehicle System Interface

4.9.3 White Box Views

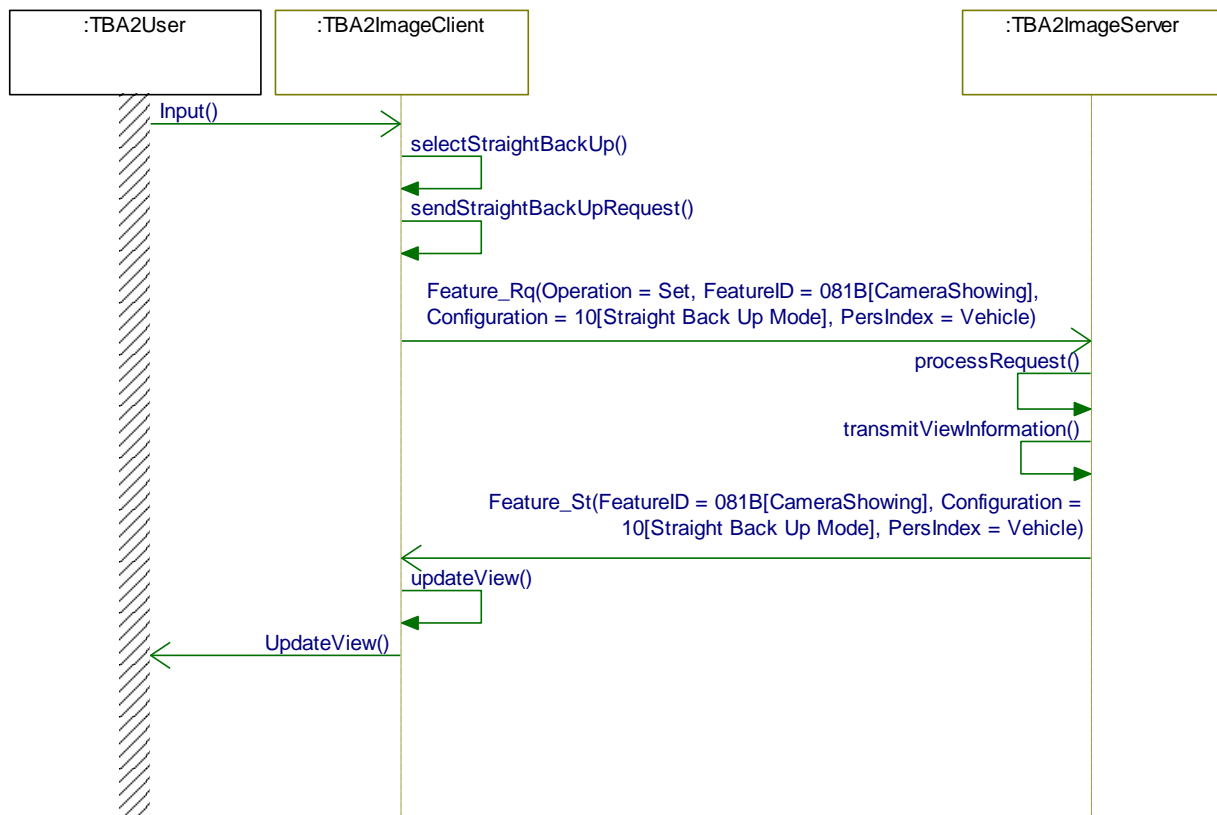### 4.9.3.1 TBA2-REQ-266270/A-Enter Straight Back Up Mode AD
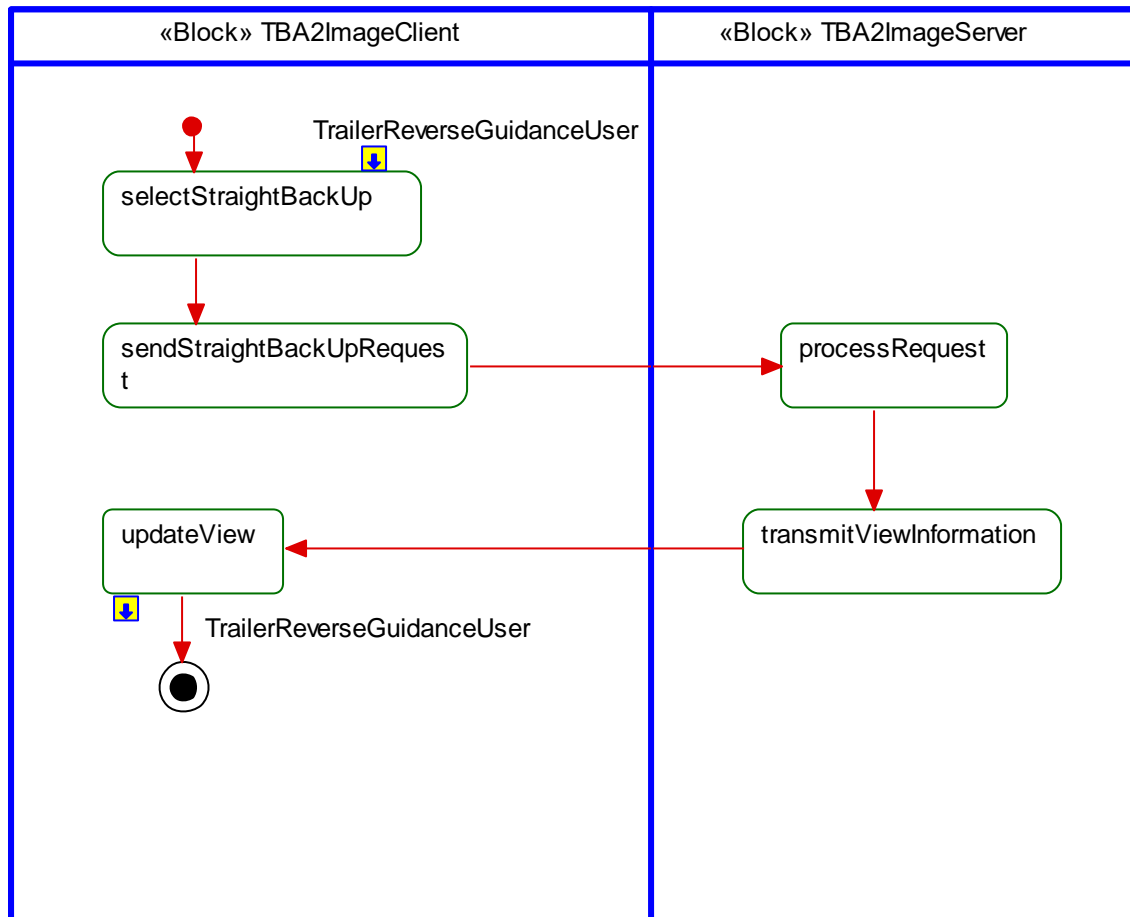
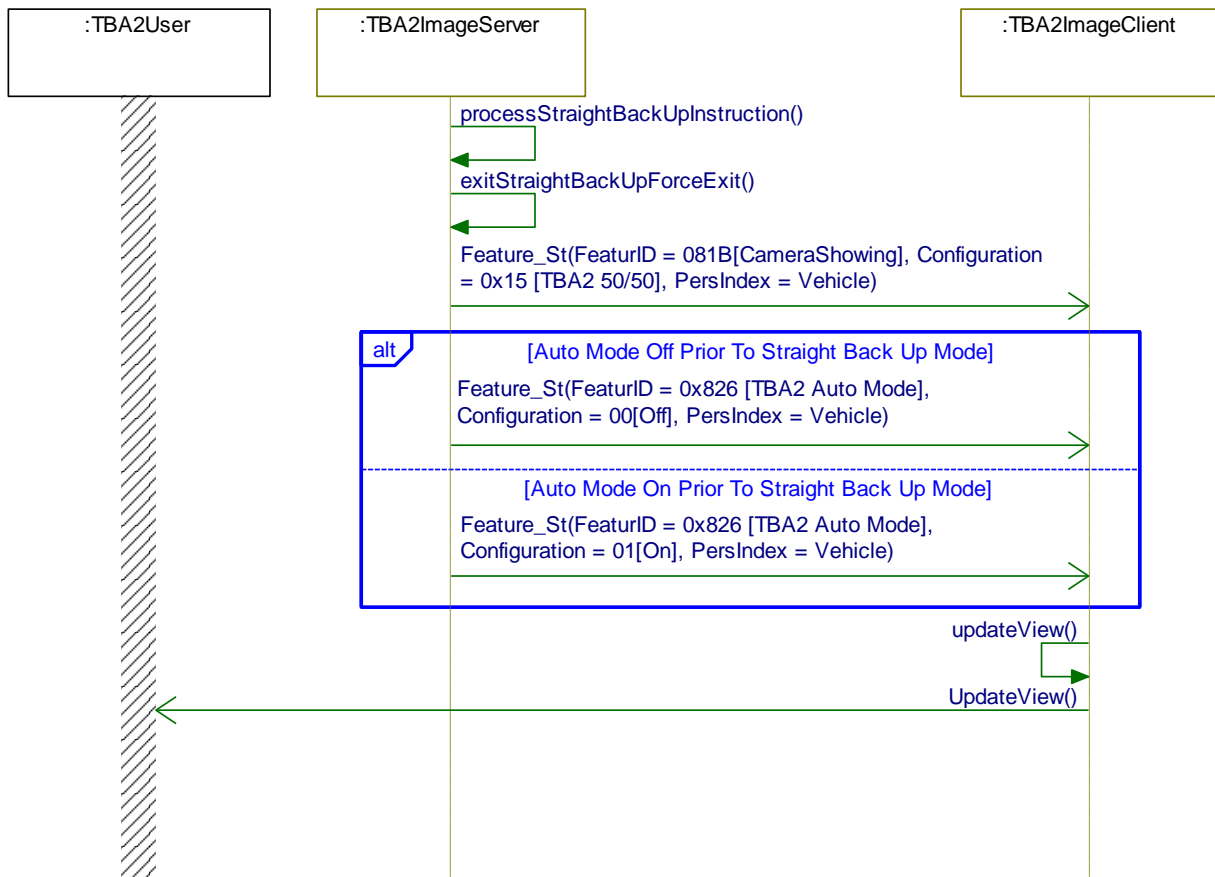### 4.9.3.2 TBA2-REQ-266271/A-Straight Back Up Instructions AD
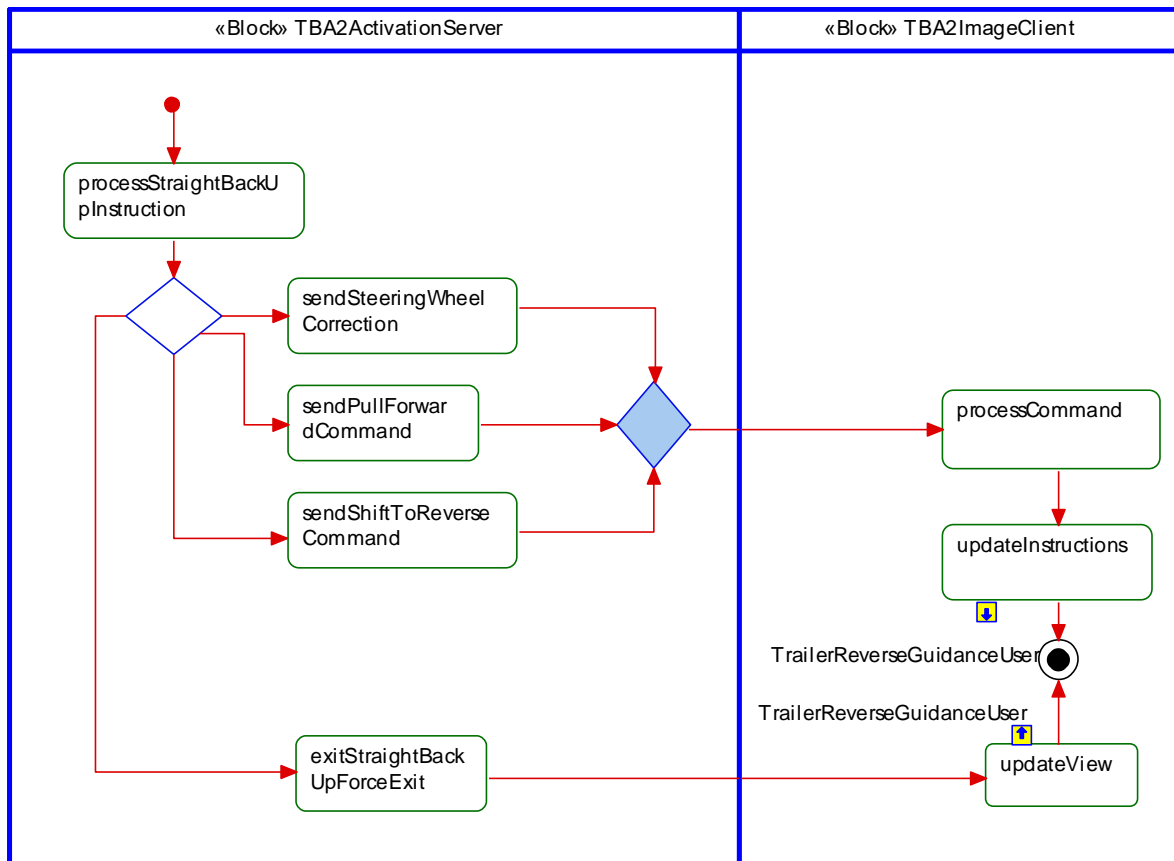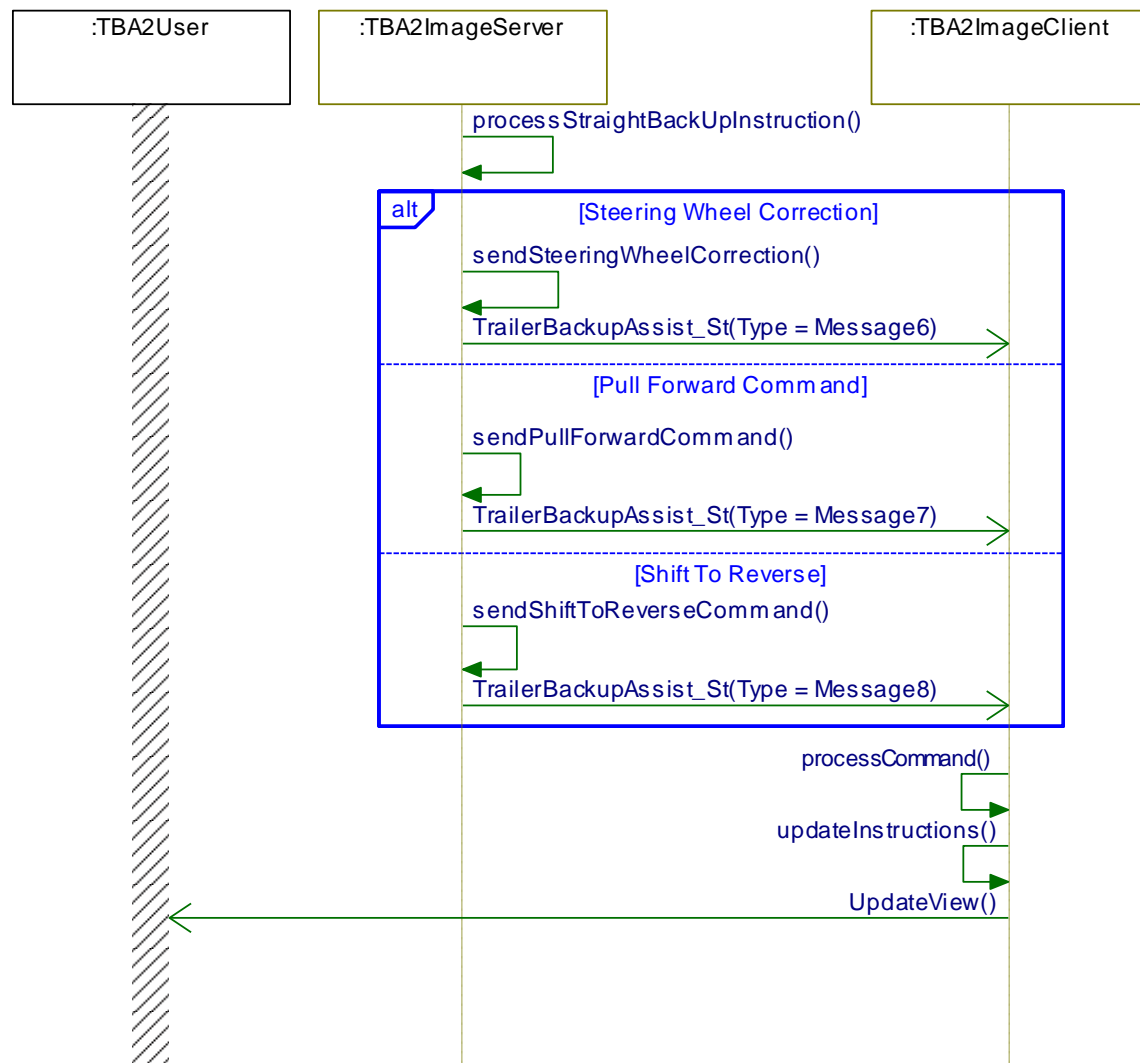
4.9.3.3 TBA2-REQ-266267/A-TRG Enter Straight Back Up SD

4.9.3.4 TBA2-REQ-266268/A-TRG Straight Back Up Force Exit SD

:TBA2User   :TBA2ImageServer   :TBA2ImageClient

processStraightBackUpInstruction()

exitStraightBackUpForceExit()

Feature_St(FeaturID = 081B[CameraShowing], Configuration = 0x15 [TBA2 50/50], PersIndex = Vehicle)

alt [Auto Mode Off Prior To Straight Back Up Mode]

Feature_St(FeaturID = 0x826 [TBA2 Auto Mode], Configuration = 00[Off], PersIndex = Vehicle)

[Auto Mode On Prior To Straight Back Up Mode]

Feature_St(FeaturID = 0x826 [TBA2 Auto Mode], Configuration = 01[On], PersIndex = Vehicle)

updateView()

UpdateView()

4.9.3.5 *TBA2-REQ-266269/A-TRG Straight Back Up Instructions*

4.10 TBA2-FUN-REQ-359527/A-Picture In Picture

4.10.1 Use Cases

4.10.1.1 *TBA2-UC-REQ-359516/A-Picture In Picture Activation*

Actors	Vehicle Occupant
Pre-conditions	Ignition status is Run/Start PiP soft button is available.
Scenario Description	Driver presses PiP button.
Post-conditions	The vehicle displays the PiP view.
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with Camera server E3 – Valid camera video signal not present
Interfaces	Vehicle System Interface

4.10.1.2 TBA2-UC-REQ-359517/A-Standard View

| Actors	Vehicle Occupant
Pre-conditions	Ignition status is Run/Start. Client is displaying PiP view. Standard View soft button is available.
Scenario Description	Driver presses Standard View Soft Button
Post-conditions	The vehicle displays the Standard view.
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with Camera server E3 – Valid camera video signal not present
Interfaces	Vehicle System Interface

4.10.1.3 TBA2-UC-REQ-359518/A-PiP View Swapping

| Actors	Vehicle Occupant
Pre-conditions	Ignition status is Run/Start Swap soft button is available.
Scenario Description	Driver presses swap button.
Post-conditions	The vehicle display swaps between Standard and PiP view displays.
List of Exception Use Cases	E1 – Vehicle not in RUN/START E2 – Loss of communication with Camera server E3 – Valid camera video signal not present
Interfaces	Vehicle System Interface

4.10.2 White Box View

4.10.2.1 Activity Diagram

4.10.2.1.1 TBA2-ACT-REQ-359471/A-Picture In Picture
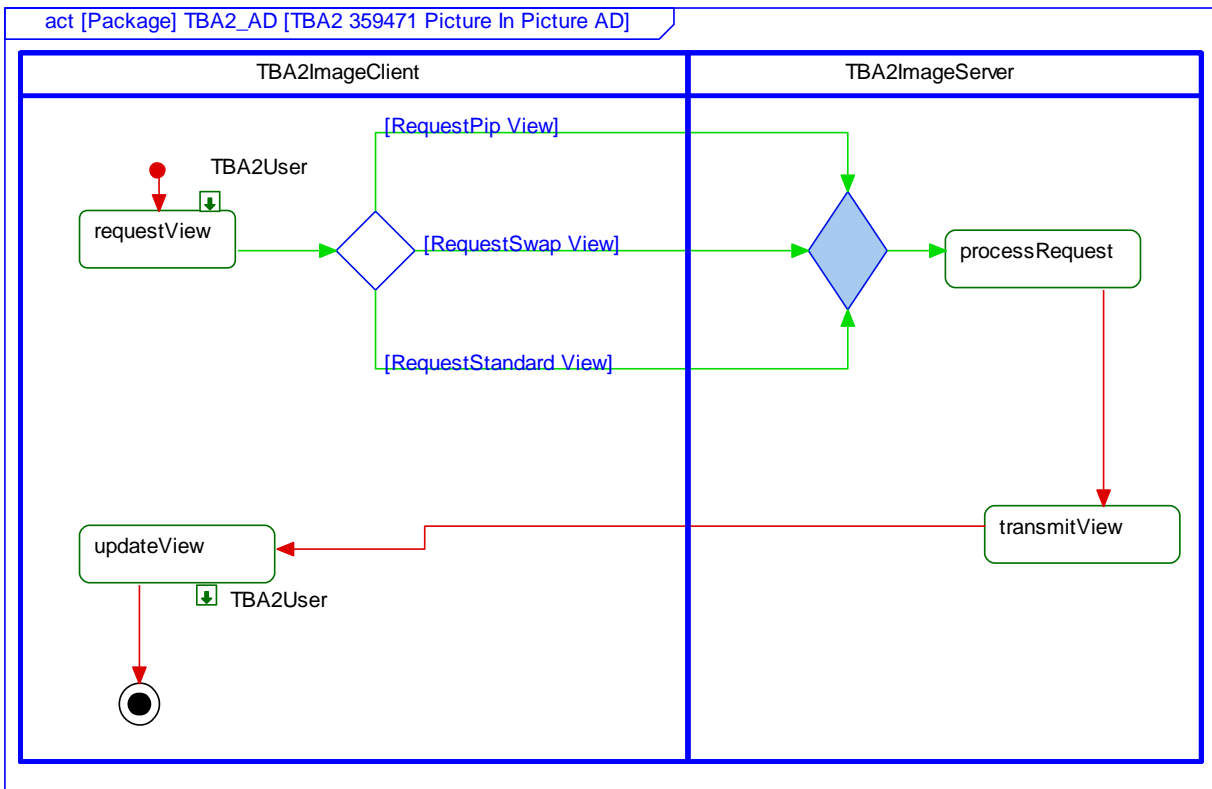
4.10.2.2 Sequence Diagram

4.10.2.2.1 TBA2-SD-REQ-359473/B-Picture In Picture
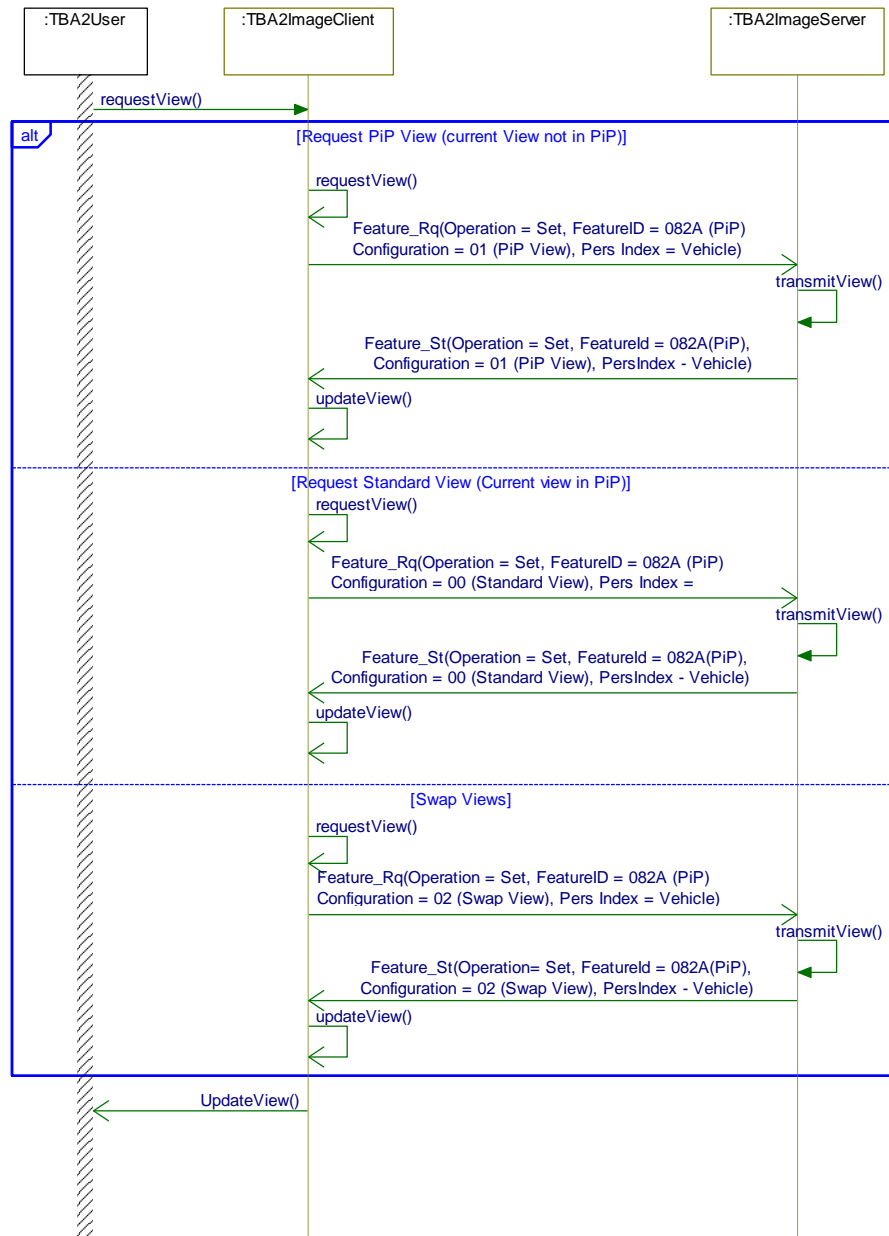
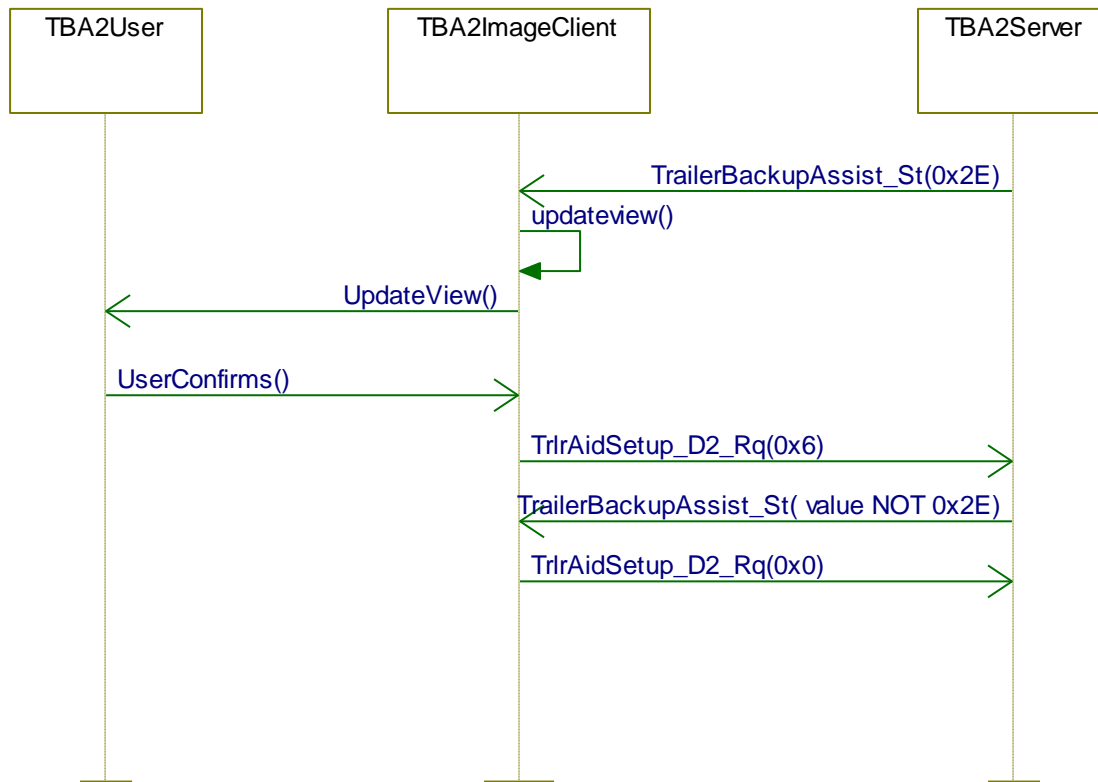## 4.11 TBA2-FUN-REQ-525057/A-Trailer Settings Related Changes

4.11.1 TBA2-REQ-525058/A-Signal Sharing

Signals used in TBA2 feature could be used by other features. However, the servers of the features know what is intended for their feature by the various parameters that client transmits.

To not "confuse" the features or the servers, Client shall keep track of what feature triggers certain sequences and shall answer with the parameters that the particular feature that triggered the sequence, needs to see answers.

4.11.2 TBA2-REQ-326574/B-Place Sticker SD

Sequence Diagram works for Both 0x2E (Place sticker now) and 0x2F (Setup Complete Return to Trailer settings).

Sequence diagram messages:

- TrailerBackupAssist_St(0x2E) — TBA2Server to TBA2ImageClient
- updateview() — TBA2ImageClient
- UpdateView() — TBA2ImageClient to TBA2User
- UserConfirms() — TBA2User to TBA2ImageClient
- TrlrAidSetup_D2_Rq(0x6) — TBA2ImageClient to TBA2Server
- TrailerBackupAssist_St(value NOT 0x2E) — TBA2Server to TBA2ImageClient
- TrlrAidSetup_D2_Rq(0x0) — TBA2ImageClient to TBA2Server

5 Appendix: Reference Documents

Reference #	Document Title
1	SYNC4_TBA2_HmiStatus_Coding v1.0
2	HMI spec H36s TBA2
3	
4	
5	