Research & Vehicle Technology
"Infotainment Systems Product Development"

Feature – One Pedal Drive

APIM Infotainment Subsystem Part Specific Specification (SPSS)

Version 1.0
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FORD CONFIDENTIAL

Revision History

Date	Version	Notes	
May 14, 2019	1.0	Initial Release	

Table of Contents

1 Overview

The One-Pedal Drive feature enables the user to operate the speed of the vehicle via a single pedal. The driver can both increase the vehicle speed as well as decrease the vehicle speed by pressing or releasing the accelerator pedal. This means that the brakes will be automatically engaged once the driver releases the accelerator pedal.

1.1 Feature Operation

To activate the One-Pedal Drive feature, the user would navigate to the settings menu where the setting is located and then touch on the setting soft-button. Once the indication of the soft-button transitions to the ON state, the feature is active and operation of the vehicle can be done solely via the accelerator pedal.

1.2 Feature Assumptions

The activation of One-Pedal Drive feature is dependent on certain vehicle pre-conditions and the status of other related features (e.g Cruise Control).

1.3 Logical Block Diagram
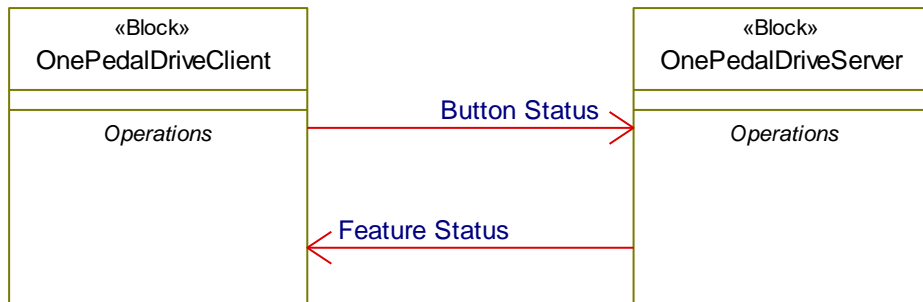
1.4 Terminology and Abbreviations

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

Term	Description
APIM	Accessory Protocol Interface Module
IPC	Instrument Panel Cluster
OPD	One-Pedal Drive
PCM	Powertrain Control Module

2 Architectural Design

2.1 OPD-CLD-REQ-346132/A-One-Pedal Drive Client

The One-Pedal Drive Client is responsible for sending the status of the soft-button pressed state to the One-Pedal Drive Server. The One-Pedal Drive Client is also responsible for informing the user of the status of the soft-button indication state and any error condition indication states.

2.2 OPD-CLD-REQ-346133/A-One-Pedal Drive Server

The One-Pedal Drive Server is responsible for receiving the state of the soft-button status from the One-Pedal Drive client and assessing all preconditions and feature interaction conditions to determine when to activate the One-Pedal Drive feature while updating the feature display status message accordingly.

2.3 Physical Mapping of Classes

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

Logical Class	Physical Module (ECU)
OnePedalDriveClient	APIM
OnePedalDriveServer	PCM
MessageCenterClient	APIM
MessageCenterServer	IPC

2.4 OPD-IIR-REQ-346134/A-OnePedalDriveClient _Rx

2.4.1 MD-REQ-346135/A-OPDDisplay_St

Message Type: Status

This signal is used to update the status of the One-Pedal Drive activation display state

Name	Literals	Value	Description
OPDDisplay_St	-	-	A status message indicating the activation display state of the One-Pedal Drive feature
	Off	0x00	
	On	0x01	
	Suspended	0x02	
	Faulty	0x03	

2.4.2 MCv3-MD-REQ-347052/A-MCEventNotification_Rq

Message Type: Status

This method is used from MessageCenter Server to inform MessageCenter Client that a Message Center notification update occurred.

Name	Literals	Value	Description
MsgID	-	-	

	ID	0x00 – 0x7FF	The "Message ID" parameter is used to indicate which MessageCenter notification is updated (see lookup table for more information)
MsgStatus	-	-	"MsgStatus" is used to indicate actual status of MessageCenter events.
	Invalid	0x0	"Invalid" is used if data of this message is invalid e.g. if no data is available e.g. at startup or if no MessageCenter notification is active. As well as MsgID, HighlightedChoice and DynamicData1 to 3 do not have valid information.
	Activate	0x1	"Activate" (new warning) is used if a MessageCenter notification is set to active (-> allocated).
	Update	0x2	"Update" (old warning) is used if a MessageCenter notification, which was "Active" before, shall be shown again. Including data update.
	Deactivate	0x3	"Deactivate" is used if an active MessageCenter notification is set to inactive (->deallocated).
HighlightedChoice	-	-	"Highlighted Choice" is used to indicate the highlighted choice
	NoChoice	0x0	"NoChoice" is used if no choice element is highlighted
	Choice1	0x1	
	Choice2	0x2	"Choice 1-7" is used if one of choice 1 to 7 is highlighted.
	…	…	
	Choice7	0x7	
DynamicData1	-	-	Dynamic Data 1 with up to 2 Bytes
	RAW	2 Byte	
DynamicData2	-	-	Dynamic Data 2 with up to 2 Bytes
	RAW	2 Byte	
DynamicData3	-	-	Dynamic Data 3 with up to 2 Bytes
	RAW	2 Byte	

2.5 OPD-IIR-REQ-346137/A-OnePedalDriveClient _Tx

2.5.1 MD-REQ-346139/A-OPDButton_St

Message Type: Status

The signal is used to update the status of the One-Pedal Drive soft-button pressed state

Name	Literals	Value	Description
OPDButton_St	-	-	The status of the soft-button pressed state for the One-Pedal Drive feature
	NotPressed	0x0	
	Pressed	0x1	

2.5.2 MD-REQ-346138/A-OPDButtonFault_St

Message Type: Status

The signal is used to update the status of the One-Pedal Drive soft-button fault state

Name	Literals	Value	Description
OPDButtonFault_St	-	-	The status of the soft-button fault state for the One-Pedal Drive feature

	NotFaulted	0x0	
	Faulted	0x1	

2.5.3   MCv3-MD-REQ-347049/A-MCPresentation_St

Message Type: Status

This method is used from MessageCenter Client to MessageCenter Server to indicate current display status for an active Message Center notification.

Name	Literals	Value	Description
MsgID	-	-	
	MsgID	0x0 – 0x7FF	The "MsgID" parameter is used to indicate which Message Center notification status is updated. (see lookup table for more information)
MsgStatus	-	-	
	0x0	Invalid	Is used to state out that MsgID & PresentationStatus do not have valid information
	0x1	Valid	Is used to state out that MsgID & PresentationStatus do have valid information
PresentationStatus	-	-	The "PresentationStatus" parameter is used to indicate the current status of a Message Center notification. It is also used to indicate if a chime shall be played or stopped.
	Inactive	0x0	"Inactive" is used if the status is unknown (e.g. at startup while booting).
	ActiveGranted	0x1	"ActiveGranted" (new warning) is used to indicate that an active Message Center notification is presented via car HMI.
	UpdateGranted	0x2	"UpdateGranted" (old warning) is used to indicate that an updated Message Center notification is presented via car HMI.
	Deactivated	0x3	"Deactivated" is used to indicate that a Message Center notification is discarded from the car HMI.
	NotUsed_1	0x4	Reserved for future extensions
	NotUsed_2	0x5	
	NotUsed_3	0x6	
	NotUsed_4	0x7	

2.5.4   MCv3-MD-REQ-347050/A-MCConfirmationSelection_Ind

Message Type: Indication

This method is used from the MessageCenter Client to the MessageCenter Server to indicate which type of confirmation/selection the user made on the currently granted Message Center notification.

Name	Literals	Value	Description
MsgID	-	-	
	MsgID	0x0 – 0x7FF	The "MsgID" parameter is used to indicate which Message Center notification was selected by the user (see lookup table for more information).
MsgStatus	-	-	
	Invalid	0x0	Is used to state out that MsgID & SelectionStatus do not have valid information

	Valid	0x1	Is used to state out that MsgID & SelectionStatus do have valid information
SelectionStatus	-	-	The SelectionStatus is used to indicate if a warning is confirmed via OK input or if a selection has been choosen.
	OK	0x0	"OK" is used to indicate that the user confirmed an OK input.
	Choice1	0x1	"Choice1-7" is used to indicate that the user made a selection on a choice element.
	Choice2	0x2	
	…	…	
	Choice7	0x7	

3   General Requirements

3.1   OPD-REQ-346334/A-Feature Setting Soft Button Handling

The One-Pedal Drive feature setting soft button shall be treated as a momentary push button. When the user presses anywhere in the touch zone of the soft button, the One-Pedal Drive client shall set the value of the OPDButton_St signal to the Pressed value. This button press signal shall be sent for as long as the user keeps the soft button pressed. When the user releases the soft button, the One-Pedal Drive client shall set the value of the OPDButton_St signal back to the NotPressed value.

3.2   OPD-REQ-352137/A-Feature HMI Notifications

The One-Pedal Drive HMI has message notifications/pop-ups which require the use of the functions and interfaces defined in the Message Center Client v3 SPSS. These notifications/pop-ups occur when the HMI has to indicate additional information to the user such as when the One-Pedal Drive feature is in a suspended of faulted state. For additional detail, please refer to the One Pedal Drive HMI specs and the Message Center Client v3 SPSS.

4 Functional Definition

4.1 OPD-FUN-REQ-346140/A-Activating One-Pedal Drive Feature Setting

4.1.1 Requirements

4.1.1.1 *OPD-REQ-346141/A-Feature Activation Indication*

When the One-Pedal Drive Feature is in the Inactive/Off state, the user pressing and releasing the soft-button will generate a Pressed and NotPressed event which is then processed by the One-Pedal Drive Server. If all preconditions are met, the Server will update the status of the OPDDisplay_St signal from Off to On. The One-Pedal Drive Client shall then update the indication status of the feature setting to reflect that the feature is now On/Active.

4.1.2 Use Cases

4.1.2.1 *OPD-UC-REQ-346145/A-Activating One-Pedal Drive Feature Setting*

Actors	User, One-Pedal Drive Client, One-Pedal Drive Server
Pre-conditions	One-Pedal Drive Feature is Off/Inactive
	The One-Pedal Drive Server assesses all feature preconditions are met
Scenario Description	User presses on the One-Pedal Drive feature setting
Post-conditions	The One-Pedal Drive feature is activated
List of Exception Use Cases	One-Pedal Drive Feature Setting Suspended
	One-Pedal Drive Feature Setting Faulty
Interfaces	HMI

#### 4.1.2.2 *OPD-UC-REQ-352138/A-One-Pedal Drive Feature Setting Suspended*

Actors	User, One-Pedal Drive Client, One-Pedal Drive Server
Pre-conditions	One-Pedal Drive Feature is Off/Inactive
	The One-Pedal Drive Server assesses all feature preconditions are not met
Scenario Description	User presses on the One-Pedal Drive feature setting
Post-conditions	The One-Pedal Drive feature setting indicates the setting is On, but feature will not be activated/resumed until the suspending condition is resolved
List of Exception Use Cases	
Interfaces	HMI

4.1.3   White Box View

4.1.3.1   OPD-ACT-REQ-346146/A-Activating One-Pedal Drive Feature Setting
Activity Diagram
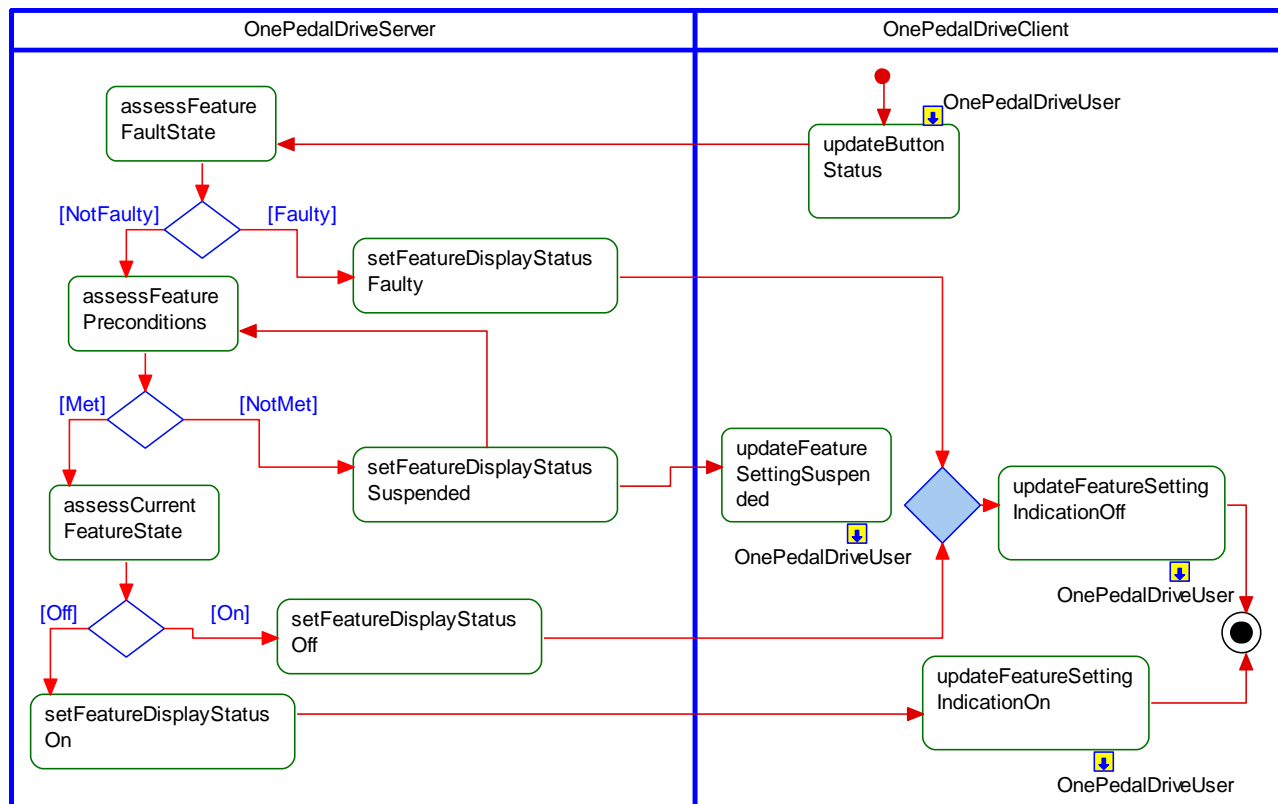
4.1.3.2   OPD-SD-REQ-346147/A-Activating One-Pedal Drive Feature Setting
Scenarios
 Normal Usage
User presses and releases the feature setting soft button
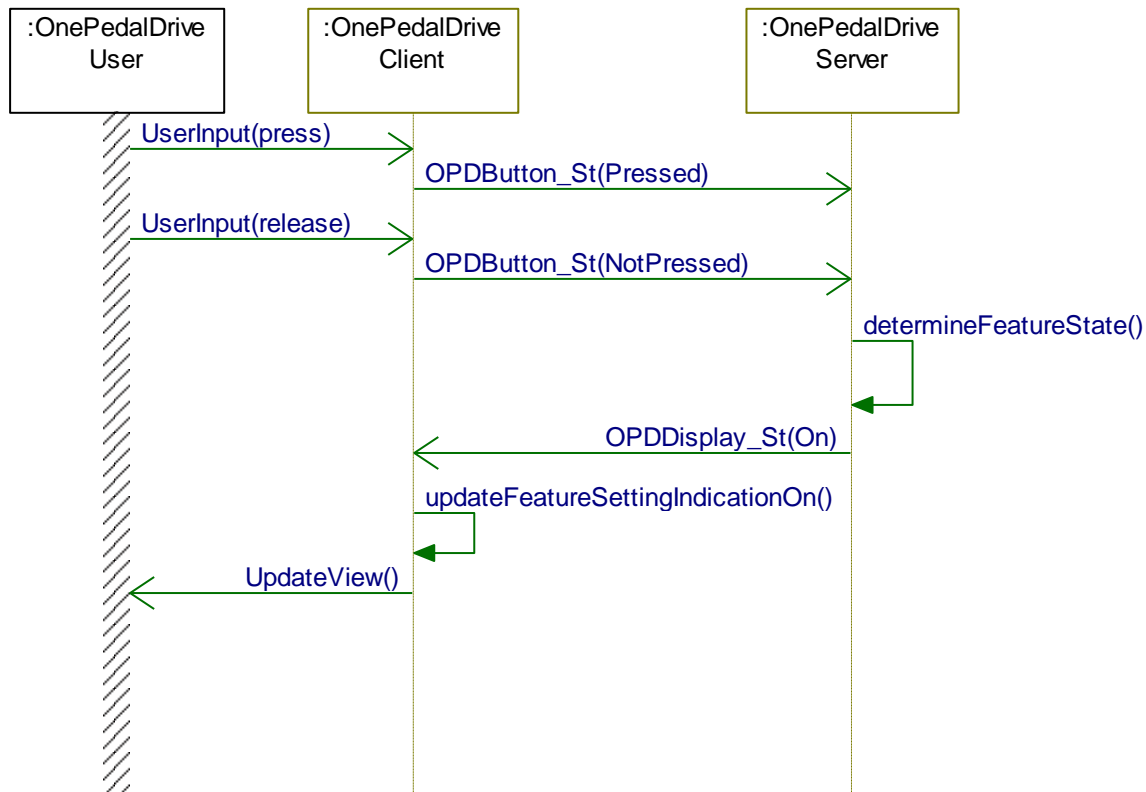**Constraints**
 Pre-condition
One-Pedal Drive feature setting is Off
 Post-condition
One-Pedal Drive feature setting is On

Sequence Diagram

4.2 OPD-FUN-REQ-346337/A-Deactivating One-Pedal Drive Feature Setting

4.2.1 Requirements

4.2.1.1 *OPD-REQ-346338/A-Feature Deactivation Indication*

When the One-Pedal Drive Feature is in the Active/On state, the user pressing and releasing the soft-button will generate a Pressed and NotPressed event which is then processed by the One-Pedal Drive Server. If all preconditions are met, the Server will update the status of the OPDDisplay_St signal from On to Off. The One-Pedal Drive Client shall then update the indication status of the feature setting to reflect that the feature is now Off/Inactive. If the Server updates the status of OPDDisplay_St to Suspended or Faulty, the Client likewise shall update the indication status of the feature setting to reflect that the feature is Suspended or Off/Inactive.

4.2.2 Use Cases

4.2.2.1 *OPD-UC-REQ-346339/A-Deactivating One-Pedal Drive Feature Setting*

Actors	User, One-Pedal Drive Client, One-Pedal Drive Server
Pre-conditions	One-Pedal Drive Feature is On/Active
	The One-Pedal Drive Server assesses all feature preconditions are met
Scenario Description	User presses on the One-Pedal Drive feature setting
Post-conditions	The One-Pedal Drive feature is deactivated
List of Exception Use Cases	One-Pedal Drive Feature Setting Faulty
Interfaces	HMI

4.2.3   White Box View

4.2.3.1   OPD-SD-REQ-346342/A-Deactivating One-Pedal Drive Feature Setting

Scenarios
    Normal Usage
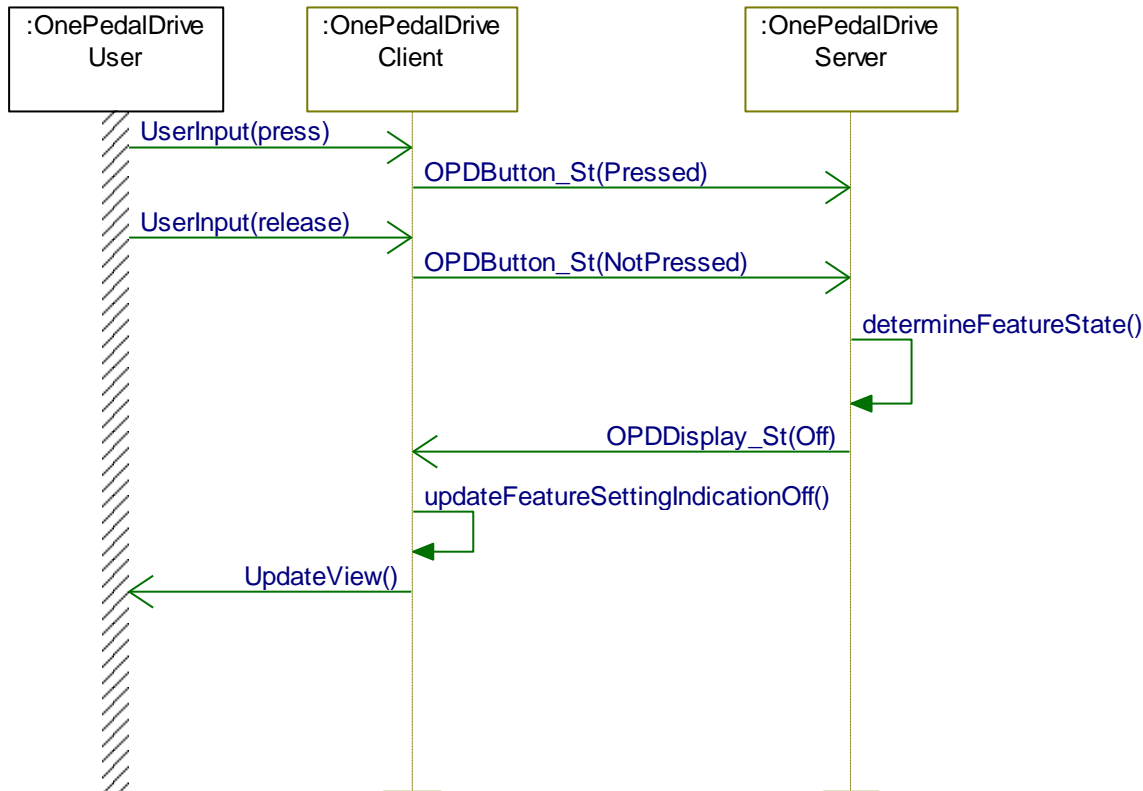User presses and releases the feature setting soft button
Constraints
    Pre-condition
One-Pedal Drive feature setting is On
    Post-condition
One-Pedal Drive feature setting is Off
Sequence Diagram

4.3   OPD-FUN-REQ-346343/A-One-Pedal Drive Feature Error Handling

4.3.1   Requirements

4.3.1.1   OPD-REQ-346142/A-Feature Activation Failure

Whether the One-Pedal Drive Feature is in the On or Off state, the user pressing and releasing the soft-button will generate a Pressed and NotPressed event which is then processed by the One-Pedal Drive Server. If the Server fails to update the status of the OPDDisplay_St signal, the One-Pedal Drive Client shall not update the indication status of the feature setting.

4.3.1.2   OPD-REQ-346143/A-Soft Button Handling Fault

The initial value of the OPDButtonFault_St shall be set to the NotFaulted state. If the One-Pedal Drive Client detects a fault or failure, of the soft button handling component or of the One-Pedal Drive Client in general, that prevents the user from interacting with the feature setting (e.g. failure to register touch input, persistent contact or "stuck button" condition, etc.) then the Client shall set the OPDButtonFault_St signal to Faulted. Otherwise, the value of the signal shall be set to NotFaulted when the Client and touch input component are functioning normally.

4.3.1.3   *OPD-REQ-346144/A-Display Indication Updated when Feature Status is Suspended*

When the One-Pedal Drive Client receives a request to display the corresponding Message Center notification via the MCEventNotification_Rq method, the Client shall update the display HMI to indicate to the user that One-Pedal Drive feature activation has been suspended.

4.3.1.4   *OPD-REQ-346336/A-Display Indication Updated when Feature Status is Faulty*

When the One-Pedal Drive Client receives a request to display the corresponding Message Center notification via the MCEventNotification_Rq method, the Client shall update the display HMI to indicate to the user that One-Pedal Drive feature is faulted.

If the OPDDisplay_St signal is missing per the conditions defined in the Infotainment Diagnostic Specification, the Client shall indicate the setting as off and likewise update the display HMI to indicate to the user that One-Pedal Drive feature is faulted.

4.3.2   Use Cases

4.3.2.1   OPD-UC-REQ-346335/A-One-Pedal Drive Feature Setting Faulted

Actors	User, One-Pedal Drive Client, One-Pedal Drive Server
Pre-conditions	One-Pedal Drive Feature is either On or Off
Scenario Description	One-Pedal Drive Server determines feature is Faulted
Post-conditions	User is informed of the Fault condition and the One-Pedal Drive feature is deactivated until the condition clears
List of Exception Use Cases	
Interfaces	HMI

5 Appendix: Reference Documents

Reference #	Document Title
1	Infotainment Diagnostic Specification
2	One Pedal Drive HMI Specification
3	Message Center Client v3 SPSS
4	
5	
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