Augmented Reality (AR)

(F003774)

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Person	Role	Email Confirmation	Date

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Important Note

You need to use the RE specification macros provided by the “RE_SpecificationMacroTemplate.dotm” (refer to “Utilities” on page “Specification Templates” in the RE Wiki) to allow seamless VSEM import of the specification content. **Use only these RE specification macros to create requirements** in this specification. Refer to “How to use the Specification Templates” on how to enable and use the macros and the requirements templates in this specification.

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1 INTRODUCTION

1.1 Document Purpose

The Feature Implementation Specification (FIS) specifies the deployment of the logical functions of a feature to an electrical architecture. The FIS specifies all interactions between the ECUs of the electrical architecture required for the feature including the technical signals and the interfaces. It also gives interface and integration requirements, which are specific to the feature for the electrical architecture.

To get more information about the concept of feature, function and component level abstraction refer to the Ford RE Wiki.

1.2 Document Scope

This FIS describes the deployment of the feature <Feature> to the following electrical architecture(s):

Electrical Architecture Name	Owner	Reference
e.g. CGEA1.3		<Add VSEM Link>

Table 1-1: Electrical Architecture(s) referenced in this document

1.3 Document Audience

The FIS is authored by <Author's Name / Role>. All Stakeholders, i.e., all people who have a valid interest in the feature implementation should read and, if possible, review the FIS. It needs to be guaranteed, that all stakeholders have access to the currently valid version of the FIS.

1.3.1 Stakeholder List

For the latest list of stakeholder of the feature and their influence refer to <Put VSEM Link here>.

List of Stakeholders

Name	CDSID /phone	Stake	Contact date	Elicitation response	Review worksheet	Review meeting
Bentley, Sonya (S.D.)	sbentle5	Systems Engineering Manager	11/23/2019	Accepted	Yes	Yes
Yousif, Meisam (M.L.)	myousif	Feature Owner Supervisor	11/23/2019	Accepted	Yes	Yes
Abdelhamid, Mahmoud (M.)	mabdelh1	Feature Owner Lead	11/23/2019	Accepted	Yes	Yes
Alsamarai, Ahmed (A.)	aalsamar	Feature Owner (co-lead)	8/17/2020	Accepted	Yes	Yes
Flores, Luis (L.A.)	lflore70	Feature Owner (co-lead)	8/17/2020	Accepted	Yes	Yes
Ahmed, Fahd	fahmed2	AR Feature Champion / AR Planning Lead	2/10/2021	Accepted	Yes	Yes
Kessler, Chris	ckessle8	Global AR Marketing Lead for Ford and Lincoln	01/25/2021	Accepted	Yes	Yes
King, Anthony (A.G.)	aking6	AR module Product owner Supervisor	8/17/2020	Accepted	Yes	Yes
Langkamp, Ulf (U.K.)	ulangkam	AR module Product owner Engineer	7/31/2020	Accepted	Yes	Yes
Nachtegall, Debbie (D.E.)	dnachte1	AR ECU D&R - Hardware	8/07/2020	Accepted	Yes	Yes
Keerthivasan, Venkataraman	vkeerth5	AR ECU D&R – Hardware	6/24/2021	Accepted	Yes	Yes

List of Stakeholders

Name	CDSID /phone	Stake	Contact date	Elicitation response	Review worksheet	Review meeting
Vootkuri, ChandraSekhar (C.R.)	cvootkur	AR ECU D&R - Software	8/04/2020	Accepted	Yes	Yes
Lazalde, Eric (E.)	elazald1	HMI lead for the core interaction on the panoramic displays- HHDD	2/4/2021	Accepted	Yes	Yes
To, Curtis (C.S.)	cto3	HMI Supervisor, Customer Experience	8/26/2020	Accepted	Yes	Yes
Khanafer, Dima (D.)	dkhanafe	HMI Engineer, Customer Experience	8/26/2020	Accepted	Yes	Yes
Von hausen, Christian (C.)	cvonhaus	HMI Engineer, Customer Experience	8/26/2020	Accepted	Yes	Yes
Van Moen, Lidia	lvanmoen	Core Hardware Engineer / ADAS FWC Camera	9/01/2020	Accepted	Yes	Yes
Zaragoza, Claudia	czarago1	Core Hardware Engineer / FIR Camera	10/29/2020	Accepted	Yes	Yes
Saini, Akriti (A.)	asaini10	Core Hardware Engineer / AR Camera	01/19, 2021	Accepted	Yes	Yes
Rahtz, Timothy (T.A.)	trahtz	AR Nav product owner	12/03/2020	Accepted	Yes	Yes
Check, Laura	lburek	IVI/Phoenix Product Owner	8/18/2020	Accepted	Yes	Yes
White, Melissa	mwhite35	Manufacturing point of contact	9/16/2020	Accepted	Yes	Yes
Civiero, Christian	ccivier1	ASO SME for AR	8/17/2020	Accepted	Yes	Yes
Gehrke, Mark	mgehrke2	GTDS #22423 Lead for FIR Camera Project	10/26/2020	Accepted	Yes	Yes
Hiskens, David	dhiskens	GTDS #22423 Co-Lead for FIR Camera Packaging	9/01/2020	Accepted	Yes	Yes
Diedrich, Jonathan (J.)	jdiedris	GTDS #22423 Co-Lead for FIR Camera Calibration	11/16/2020	Accepted	Yes	Yes
Cauvet, Colleen	ccauvet	GTDS #30199 Lead for (Thermally Enhanced Night vision Features)	8/28/2020	Accepted	Yes	Yes
Dutta, Arun	adutta2	GTDS #30199 Engineer for (Thermally Enhanced Night vision Features)	9/10/2020	Accepted	Yes	Yes
Hurley, Collin	churle15	GTDS #30199 Engineer for (Thermally Enhanced Night vision Features)	9/11/2020	Accepted	Yes	Yes
Farrell, David (D.E.)	dfarre13	Functional Safety SE Lead	9/28/2020	Accepted	Yes	Yes
Dean, Shawn (S.)	sdean44	Functional Safety SE Engineer	9/28/2020	Accepted	Yes	Yes
Balachandran, Vignesh	vbalach4	Functional safety EESE Lead	1/14/2021	Accepted	Yes	Yes
Foresto, Marco (M.P.)	mforesto	Functional architecture	1/14/2021	Accepted	Yes	Yes
Perkins, Steve (S.)	sperki50	Functional architecture	10/21/2020	Accepted	Yes	Yes
Becerra, Alejandro (JABS.)	jbecer16	Feature MBSE Modeler	8/20/2020	Accepted	Yes	Yes
Ortiz Anguiano, Alejandro	aortizan	Feature MBSE Supervisor	8/17/2020	Accepted	Yes	Yes

List of Stakeholders

Name	CDSID /phone	Stake	Contact date	Elicitation response	Review worksheet	Review meeting
Mahmood, Hamid	hmahmoo3	Pre-PS IVI – CoOps Supervisor	10/12/2020	Accepted	Yes	Yes
Rahman, Moshiur	mrahma29	Pre-PS IVI – CoOps Engineer	8/20/2020	Accepted	Yes	Yes
Caballero, Fernando (F.)	fcabal11	FMA Coach Engineer	10/09/2020	Accepted	Yes	Yes
Buchanan, Alan (A.D.)	abuchan1	FMA Coach Lead	1/14/2021	Accepted	Yes	Yes
Fayad, Omar (O.)	ofayad	AR Cybersecurity Requirements	9/11/2020	Accepted	Yes	Yes
Raparthi, Satya (S)	srapart1	AR Cybersecurity Requirements	1/22/2021	Accepted	Yes	Yes
Childers, Chad (C.B)	cchilde1	AR Cybersecurity TARA modeling	9/21/2020	Accepted	Yes	Yes
Kalash, Mohammad (M.)	mkalash	ADAS customer experience	10/28/2020	Accepted	Yes	Yes
Aaron Mills	amills2	AR/DAT point of contact	11/04/2020	Accepted	Yes	Yes
Nath, Nitendra (N.)	nnath	AR/DAT point of contact	8/21/2020	Accepted	Yes	Yes
Sripinyo, Peter (P.P.)	psripiny	Power Mode - Software	2/26/2021	Accepted	Yes	Yes
Affeldt, Matthew (M.D.)	maffeldt	VSEM DAT point of contact	11/05/2020	Accepted	Yes	Yes
Cheng, Gail (L.G.)	gcheng	VSEM IVI point of contact	11/18/2020	Accepted	Yes	Yes
Sun, Jayla	Jsun55	IVI FVSS development engineer	1/17/2021	Accepted	Yes	Yes
Obeidat, Omar (O.A.)	oobeida2	AR GPS (GNSS) Location	10/20/2020	Accepted	Yes	Yes
Schein, Jamey (J.)	jschein2	AR Navigation point of contact	11/17/2020	Accepted	Yes	Yes
Medl, Chris (C.)	cmedl	AR Navigation point of contact	1/19/2021	Accepted	Yes	Yes
Olzewski, Chet	colzewsk	SIM Engineer	6/24/2021	Accepted	Yes	Yes

1.4 Document Organization

1.4.1 Document Context

Refer to the Specification Structure page in the Ford RE Wiki to understand how the FIS relates to other Ford Requirements Documents and Specifications.

1.4.2 Document Structure

The structure of this document is explained below:

Section 1 – Introduction – Giving an explanation how to use this document including responsibilities and the scope of the document. Additionally it contains the revision history and a list of unsettled but known issues

that have to be consolidated in future versions. It explains the terminology and gives a clarification of the definitions, concepts and abbreviations used in the document.

Section 2 – Feature Implementation Description – Giving an overview of the platform and listing assumptions, constraints or dependencies

Section 3 – Feature Implementation Architecture – Describing 3 Architecture Views:

- Functional Architecture – Showing the logical architecture of functions
- Physical Architecture – Showing the physical architecture (first of all the E/E Architecture), which the Logical Functions get allocated to.
- Software Architecture – Showing the software architecture relevant for the feature (for features with in-house development only)
- Function Deployment – Presenting the allocation of logical functions and signals to the electrical and other components

Section 4 – Deployment Specific Modeling –Modeling techniques providing additional detail on e.g. interface behavior

Section 5 – Deployment Specific Requirements – Deployment specific requirements for ECUs, Network Communication, and Process

Section 6 – List of Open Concerns

Section 7 – Revision History

Section 8 – Appendix - Presenting additional data mainly in a tabular form, e.g., a data dictionary

1.5 Document Conventions

1.5.1 Requirements Templates

Refer to "How to use the Specification Templates" on how to use the specification templates and the VBA macros to create/edit the requirements in the specifications.

The VBA macro enable the import of the specification to VSEM (refer to "How to import specifications into VSEM as separate requirements").

1.5.1.1 Identification of requirements

The unique requirement ID given in the headline of any requirement follows the requirement throughout the development process. The requirement ID format follows a well-defined syntax.

All identifiers in an FIS shall be composed of 4 parts:

- A leading prefix, which indicates the type of requirement (R=Requirement, UC=Use Case, SC=Scenario, …)
- A prefix, which indicates the abstraction level (F=Feature, FNC=Function, CMP = component).
- Followed by a name, indicating the scope, which the requirement belongs to (e.g. feature or function name)
- Ending with the actual requirement number

Example:

R_CMP_LockArbitrator_00004	This is the fourth requirement on component level for the function Lock Arbitrator.

1.5.1.2 Requirements Attributes

Additionally attributes can be added to each requirement. This helps to classify requirements. A list of available attributes is given in the RE Wiki.

1.6 References

1.6.1 Ford Documents

The list of all Ford internal documents, which are directly related.

Reference	Title	Doc. ID	Revision	Document Location
NA				

Table 1-2: Ford internal Documents

1.6.2 External Documents and Publications

The list of external documents could include books, reports and online sources.

Reference	Document / Publication
N/A	

Table 1-3: External documents and publications

1.7 Glossary

1.7.1 Definitions

Definition	Description

Table 1-4: Definitions used in this document

1.7.2 Abbreviations

Abbr.	Stands for	Description
ADAS	Advanced Driver Assistant System	
APIM PHOENIX	Accessory Protocol Interface Module (Phoenix Domain Controller)	SYNC
AR feature	Augmented Reality feature – Scope of this document	
AR-CAM, ARC	Augmented Reality Camera (visible)	
ARM (AR-ECU)	Augmented Reality Electronic Control Unit (New Hardware)	
BCM	Body Control Module	
CAM	Camera	
ECG	Enhanced Central Gateway	
FIR-CAM	Far Infrared Camera	
FNV3	Fully Networked Vehicle-3; Allows different vehicle domains with a standard interface to allow them to work together.	

Abbr.	Stands for	Description
FOV	Field of view	
GNSS	Global Navigation Satellite System	
GPS	Global Positioning System (the US GNSS system)	
HHDD	High Head Down Display (Panoramic Display), External display for AR content	
HMI	Human-Machine Interface	
MVP	Minimum viable product	
OEM	Original Equipment Manufacturer	
OTA	Over the Air Updates	
PDB	Power Distribution Box	
POC	Proof of concept	
POI	Point of Interest	
TCU	Telematics Control Unit	

Table 1-5: Abbreviations used in this document.

2 FEATURE IMPLEMENTATION OVERVIEW

2.1 Description

2.2 Input Requirements/Documents

Reference (Reference as listed in ch. "References")	**Section/Requirement**	**Description**	**Derived Requirement** (optional – reference to requirement in ch. "Feature Implementation Requirements")
Feature/Function Requirements			
Feature document V2.1			
Function document V2.1			
Ford Engineering Standards			
Legal Regulations			
Industry Standards			
Other Sources			
Camera Gain for Augmented Reality Background Transition Point V1.1			
FIR MVP Requirement V4.4			

Table 1-6: Input Requirements/Documents

2.3 Lessons Learned

N/A.

3 FEATURE IMPLEMENTATION ARCHITECTURE

3.1 Functional Architecture

3.1.1 Description

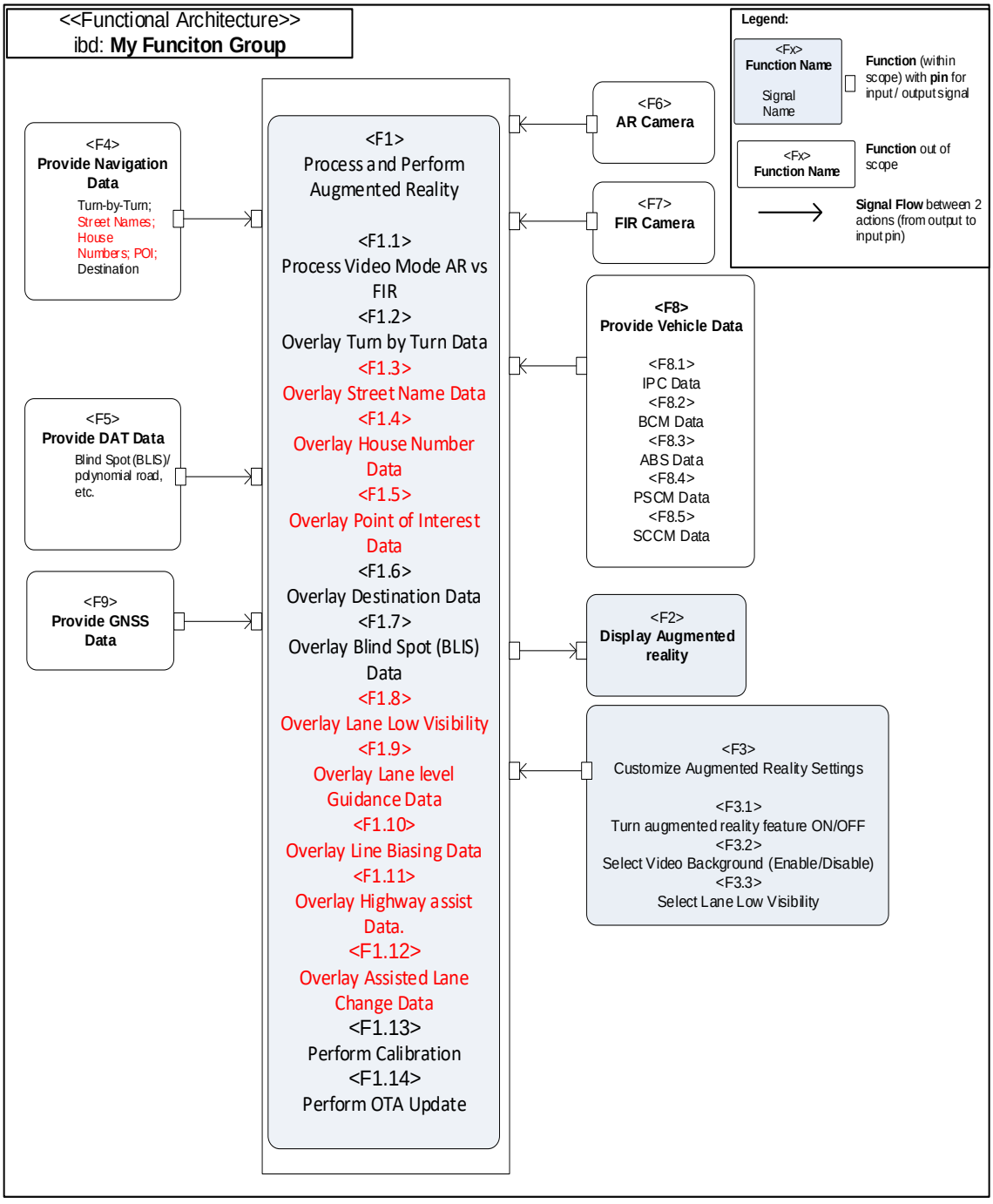


Figure 3-1: Functional Architecture

3.1.2 Function List

The augmented reality AR feature has the following function groups (for the highlighted functions see the comment for each use case).

Fu-Group 1- Process and Perform Augmented Reality – AR ECU

1- Process Video Mode AR Camera vs FIR Camera. (MVP variant).
2- Overlay Turn by Turn Data. (MVP variant).
3- Overlay Street Name Data. TBD for MVP variant, currently not available due to Google signal availability, pending ongoing discussions for alternative map supplier.
4- Overlay House Number Data. TBD for MVP variant, currently not available due to Google signal availability, pending ongoing discussions for alternative map supplier.
5- Overlay Point of Interest Data. TBD for MVP variant, currently not available due to Google signal availability, pending ongoing discussions for alternative map supplier.
6- Overlay Destination Data. (MVP variant).
7- Overlay Blind Spot (BLIS) Data. (MVP variant).
8- Overlay Lane Low Visibility Data. MVP+ variant (ongoing discussion with CIED team if it can be moved to MVP or post <J1>).
9- Overlay Lane level Guidance Data. MVP+ variant (ongoing discussion with CIED team if it can be moved to MVP) or post <J1>, currently not available from Google – pending discussion with alternative map supplier and getting data from ADAS.
10- Overlay Line Biasing Data. MVP+ variant (ongoing discussion with CIED team if it can be moved to MVP or post <J1>)
11- Overlay Highway assist Data. Far variant (ongoing discussion with CIED team if it can be moved to MVP, MVP+, or post <J1>)
12- Overlay Assisted Lane Change. Far variant (ongoing discussion with CIED team if it can be moved to MVP, MVP+, or post <J1>)
13- Perform Calibration. (MVP variant).
14- Perform OTA Update. (MVP variant).

Fu-Group 2- Display Augmented Reality – HHDD (MVP variant).

Fu-Group 3- Customize Augmented Reality Settings- HMI- IVI/SYNC (MVP variant).

1- Select AR Feature.
2- Select Video Background.
3- Select Lane Low Visibility. MVP+ variant (ongoing discussion with CIED team if it can be moved to MVP or post <J1>).

Fu-Group 4- Provide Navigation data – IVI/SYNC. (MVP variant).
Fu-Group 5- Provide DAT related data – DAT. (MVP variant).
Fu-Group 6- Provide AR Camera Data – AR Camera. (MVP variant).
Fu-Group 7- Provide FIR Camera Data – FIR Camera. (MVP variant).
Fu-Group 8- Provide Vehicle Data. (MVP variant).
Fu-Group 9- Provide GNSS Data. (MVP variant).

The following functions from the Global Feature & Function List are referenced in this Feature Implementation Specification:

Function ID	Function Name	Function Description
F1	Process and Perform Augmented Reality	Process the received data and Perform the AR overlay functions required by the feature.
F1.1	Process Video Mode	Process video mode AR camera vs FIR camera
F1.2	Overlay Turn by Turn Data	Turn by turn Data received from NAV will be overlaid on the video feed from the cameras.
F1.3	Overlay Street Name Data	Street names Data received from NAV will be overlaid on the video feed from the cameras.
F1.4	Overlay House Number Data	House numbers Data received from NAV will be overlaid on the video feed from the cameras.
F1.5	Overlay Point of Interest (POI) Data	POIs Data received will be overlaid on the video feed from the cameras.
F1.6	Overlay Destination Data	Destination icons Data received from NAV will be overlaid on the video feed from the cameras.
F1.7	Overlay Blind Spot Data	BLIS warning will be rendered spatially correct to the neighboring lane.
F1.8	Overlay Lane Low Visibility	Lane Low Visibility Data received will be overlaid on the video feed from the cameras.
F1.9	Overlay Lane level Guidance Data	Lane level Guidance Data received will be overlaid on the video feed from the cameras.
F1.10	Overlay Line Biasing Data.	Line Biasing Data received will be overlaid on the video feed from the cameras.
F1.11	Overlay Highway assist Data.	Highway assist Data received will be overlaid on the video feed from the cameras.
F1.12	Overlay Assisted Lane Change	Assisted Lane Change Data received will be overlaid on the video feed from the cameras.
F1.13	Perform Calibration	Perform calibration for AR/FIR cameras.
F1.14	Perform OTA Update	Receive and perform OTA updates.
F2	Display Augmented Reality	Display the AR video to the HHDD display (TBT, POI, Street Name, House Number, Destination, and Blind Spot)
F3	Customize AR Settings	Provide the user the ability to customize the feature.
F3.1	Select AR Feature	Turn AR feature (ON/OFF)
F3.2	Select Video background	Select video background (Enable/Disable)
F3.3	Select Lane Low Visibility	Turn Lane Low Visibility feature (ON/OFF)
F4	Provide Navigation Data	Provide the required data from NAV to support the overlay functions.
F5	Provide DAT Data	Provide the required data from DAT to support the overlay functions.
F6	Provide AR Camera Data	Provide the video feed from AR camera.
F7	Provide FIR Camera Data	Provide the video feed from FIR camera.
F8	Provide Vehicle Data	Provide the required vehicle data from different ECUs.
F8.1	Provide IPC Data	Provide fuel level status
F8.2	Provide BCM Data	Provide ignition status
F8.3	Provide ABS Data	Provide vehicle speed status
F8.4	Provide PSCM Data	Provide steering angle status
F8.5	Provide SCCM Data	Provide turn light signal status
F9	Provide GNSS Data	Provide GNSS data

Table 3-1: List of Functions

3.1.3 Signal List

3.2 Physical Architecture

3.2.1 E/E Architecture

3.2.1.1 E/E Architecture Variants

E/E Architecture Variant Name	Variant Description	Variant Condition (optional)
FNV3		

3.2.1.1.1 E/E Architecture “FNV3”

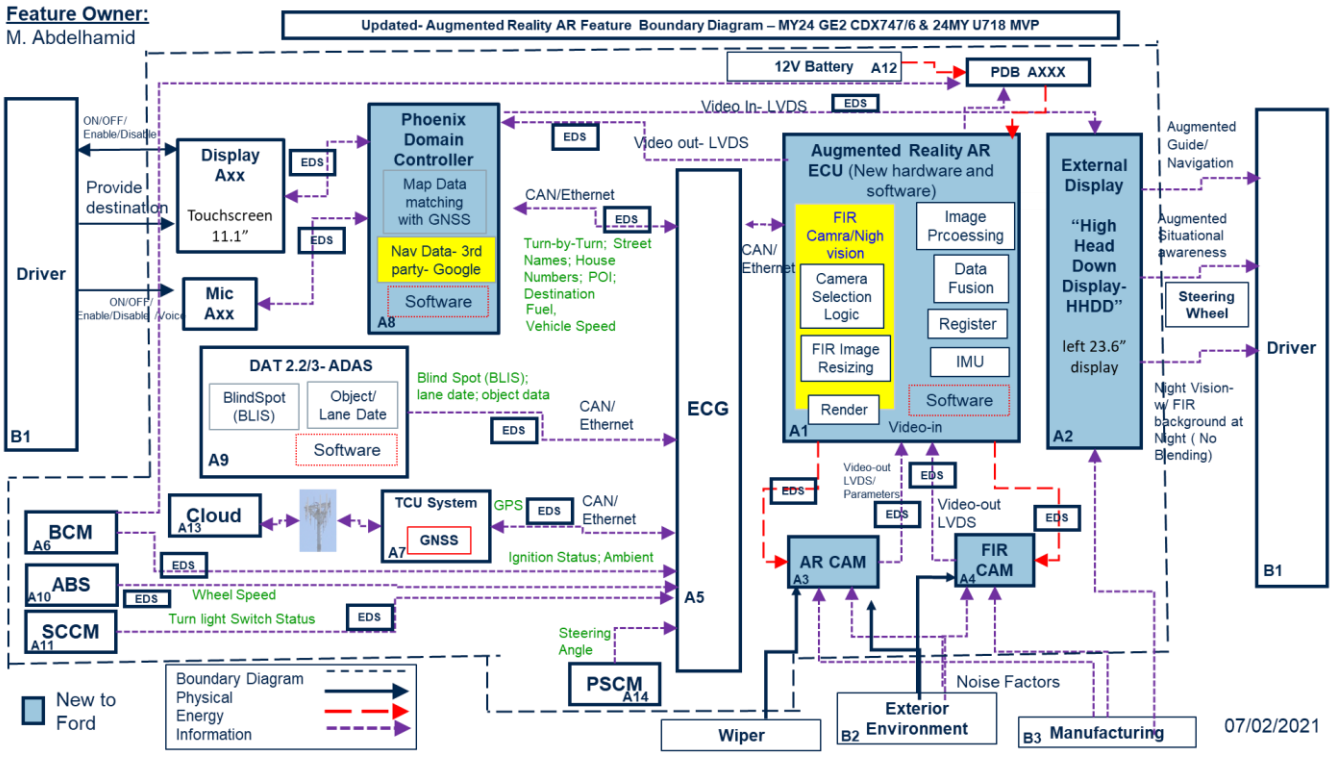


Figure 3-2 E/E Architecture

3.2.1.2 E/E Components

Component Name	**Description**
APIM_CDC	Domain Controller includes Instrument Panel cluster (IPC)
ADAS	Driver Assistance Technologies
TCU	Telematics Control Unit
ECG	Gateway module to transfer messages between communication buses
ARM (AR ECU)	Augmented Reality Module
HHDD	High Head Down Display
AR Camera	Augmented Reality Camera
FIR Camera	Far Infra-Red Camera
BCM	Body Control Module
ABS	Anti-lock Braking System
SCCM	Steering Control Column Control Module.
PSCM	Primary/Secondary Power Steering Control Module

Table 3-2: Electrical Components

3.2.1.3 E/E Connections

Connection Name	**Connection Type**	**Protocol** Only if 'Connection Type' is "Network"/"RF-Digital"	**Description**	**Allocated Messages** Only if 'Connection Type' is "Network"/"RF-Digital"	**Connected Nodes**
HS3-CAN	Network	CAN (High Speed)	High Speed CAN bus	…	ARM-APIM_CDC APIM_CDC-ARM IPC-ARM
FD3-CAN	Network	CAN FD	FD CAN Bus		ADAS-ECG-ARM SCCM-ECG-ARM PSCM-ECG-ARM
FD2-CAN	Network	CAN FD	FD CAN Bus		TCU-ECG-ARM
FD1-CAN	Network	CAN FD	FD CAN Bus		BCM-ECG-ARM
EN01	Network	Ethernet (MQTT)	Ethernet network Bus		ADAS-ECG-ARM
EN04	Network	Ethernet (MQTT)	Ethernet network Bus		TCU-ECG-ARM
EN07	Network	Ethernet (MQTT)	Ethernet network Bus		APIM_CDC-ECG-ARM
LVDS	Digital	I2C			ARM-AR Camera
LVDS	Digital	I2C			ARM-FIR Camera
LVDS	Analog	n/a			AR Camera-ARM
LVDS	Analog	n/a			FIR Camera-ARM
LVDS	Analog	n/a			ARM-APIM_CDC
LVDS	Analog	n/a			APIM_CDC-HHDD

Table 3-3: E/E Connections

3.2.1.4 Signal List

3.3 Function Deployment

3.3.1 Deployment Variants

Deployment Variant Name	Variant Description	Variant Condition (optional)
FNV3		

3.3.1.1 Deployment “Augmented Reality Feature”

This deployment variant shows the feature functions allocation.

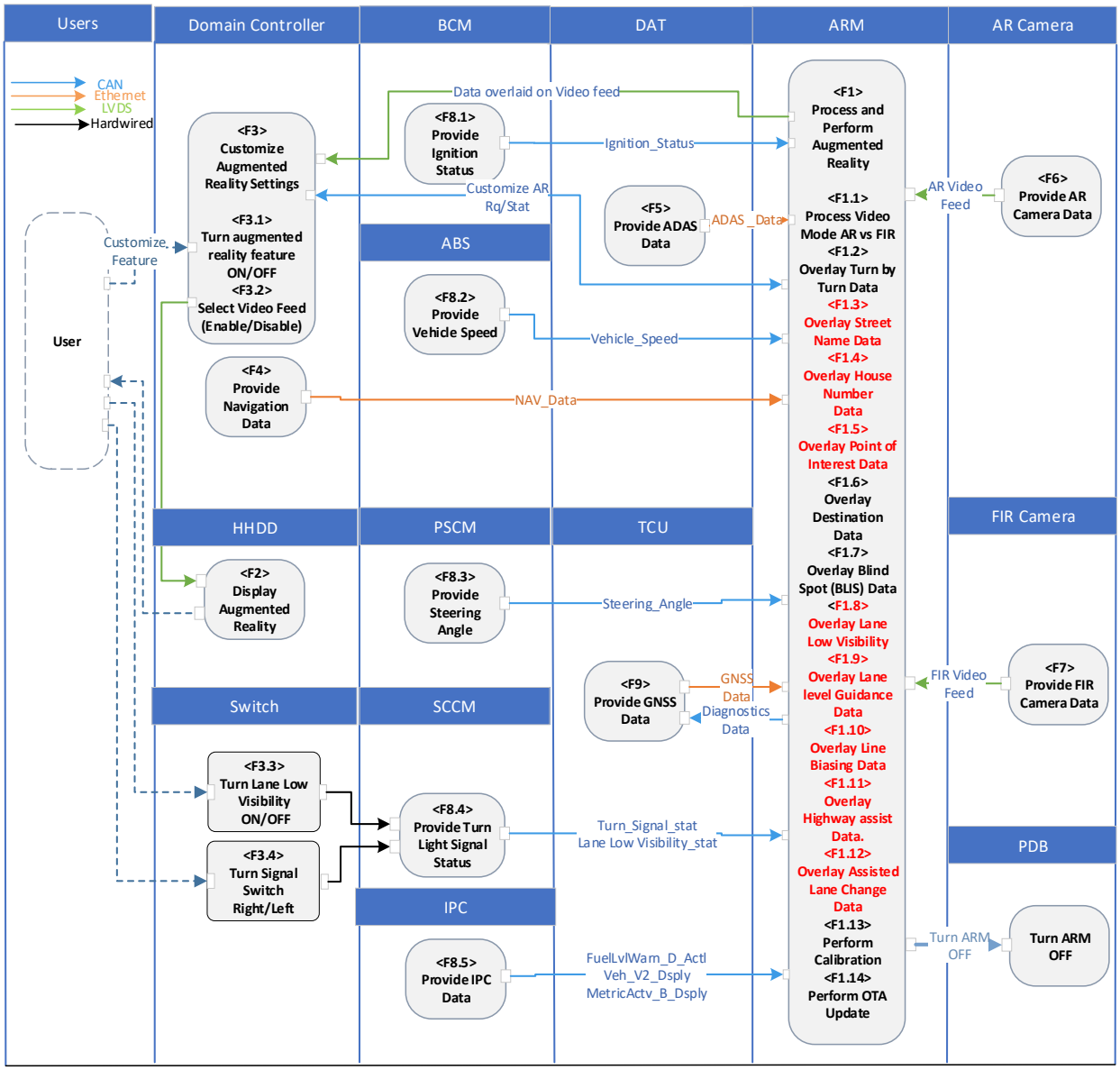


Table 3-3: Deployment Diagram

3.3.2 Function Allocation

Component	Technology Function Name	Logical Function Name
Phoenix Domain Controller	Select AR Feature	Select AR Feature
	Select Video background	Select Video background
	Select Lane Low Visibility (Voice Command)	Select Lane Low Visibility
	Provide Navigation Data	Provide Navigation Data
	Control Display Augmented Reality	Control Display Augmented Reality
ARM	Process Video Mode AR Camera vs FIR Camera	Process Video Mode AR Camera vs FIR Camera
	Overlay Turn by Turn Data	Overlay Turn by Turn Data
	Overlay Point of Interest Data	Overlay Point of Interest Data
	Overlay Street Name Data	Overlay Street Name Data
	Overlay House Number Data	Overlay House Number Data
	Overlay Destination Data	Overlay Destination Data
	Overlay Blind Spot (BLIS) Data	Overlay Blind Spot (BLIS) Data
	Overlay Lane Low Visibility	Overlay Lane Low Visibility
	Overlay Lane level Guidance Data	Overlay Lane level Guidance Data
	Overlay Line Biasing Data.	Overlay Line Biasing Data.
	Overlay Highway assist Data.	Overlay Highway assist Data.
	Overlay Assisted Lane change Data.	Overlay Assisted Lane Change Data.
	Perform Calibration	Perform Calibration
	Perform OTA Update	Perform OTA Update
	Get DAT Data	Get DAT data
	Get Vehicle Data	Get Vehicle data
	Get GNSS Data	Get GNSS data
	Get Nav Data	Get Navigation Data
AR Camera	Provide AR Camera Video Feed	Provide AR Camera Video Feed
FIR Camera	Provide FIR Camera Video Feed	Provide FIR Camera Video Feed
DAT	Provide DAT Data	Provide DAT Data
TCU	Provide GNSS Data	Provide GNSS Data
BCM	Provide Vehicle Data	Provide Vehicle Data
SCCM	Provide Vehicle Data	Provide Vehicle Data
ABS	Provide Vehicle Data	Provide Vehicle Data
PSCM	Provide Vehicle Data	Provide Vehicle Data

Table 3-4: Function Allocation Table (Basic)

Component		Technology Function Name	TSR	
Name	ASIL		ID	ASIL
Phoenix Domain Controller	QM	Select AR Feature		QM
		Select Video background		QM
		Select Lane Low Visibility (Voice Command)		QM
		Provide Navigation Data		QM
		Control Display Augmented Reality		QM
ARM	QM	Process Video Mode AR vs FIR Camera		QM
		Overlay Turn by Turn Data		QM
		Overlay Point of Interest Data		QM
		Overlay Street Name Data		QM
		Overlay House Number Data		QM
		Overlay Destination Data		QM
		Overlay Blind Spot (BLIS) Data		QM
		Overlay Lane Low Visibility		QM
		Overlay Lane level Guidance Data		QM
		Overlay Line Biasing Data.		QM
		Overlay Highway assist Data.		QM
		Overlay Lane change assist Data.		QM
		Get DAT Data		QM
		Get Vehicle Data		QM
		Get GNSS Data		QM
		Get Nav Data		QM
AR Camera	QM	Provide AR Camera Video Feed		QM
FIR Camera	QM	Provide FIR Camera Video Feed		QM
BCM	QM	Provide Vehicle Data		QM
SCCM	QM	Provide Vehicle Data		QM
ABS	QM	Provide Vehicle Data		QM
PSCM	QM	Provide Vehicle Data		QM

Table 3-5: Function Allocation Table (Functional Safety Extension)

4 FEATURE IMPLEMENTATION MODELING

4.1 Component Interaction Diagrams

4.1.1 Scenario: “System Startup / Shutdown”

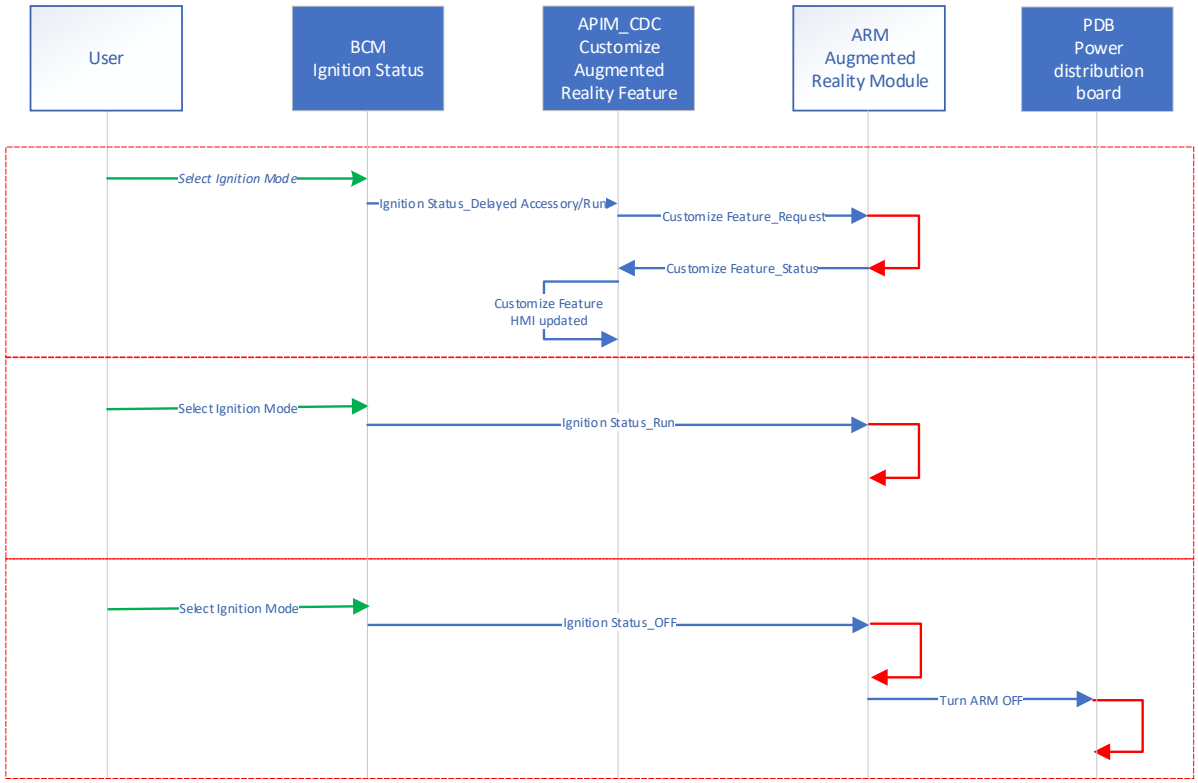


Figure 4-1: Scenario “System Startup / Shutdown”

4.1.2 Scenario: “Customize Augmented Reality Feature”

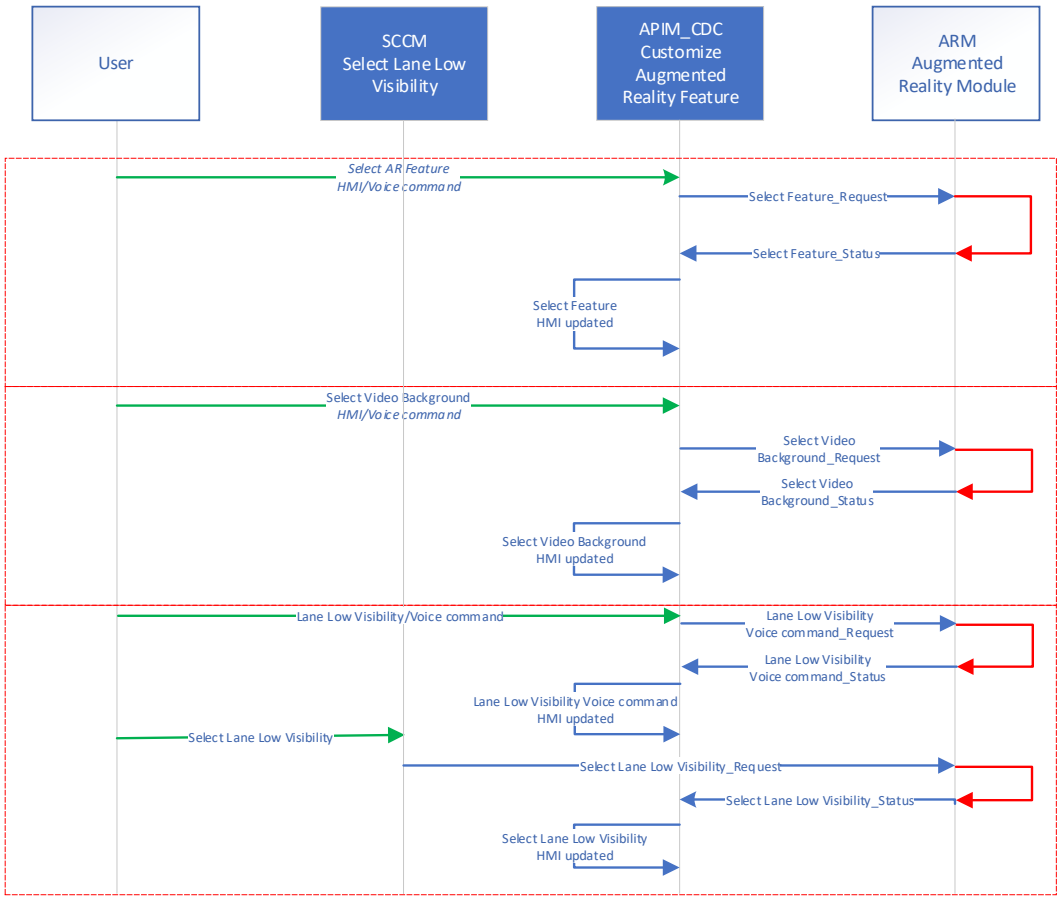


Figure 4-2: Scenario “Customize Augmented Reality Feature”

4.1.3 Scenario: “Process and Perform Augmented Reality”

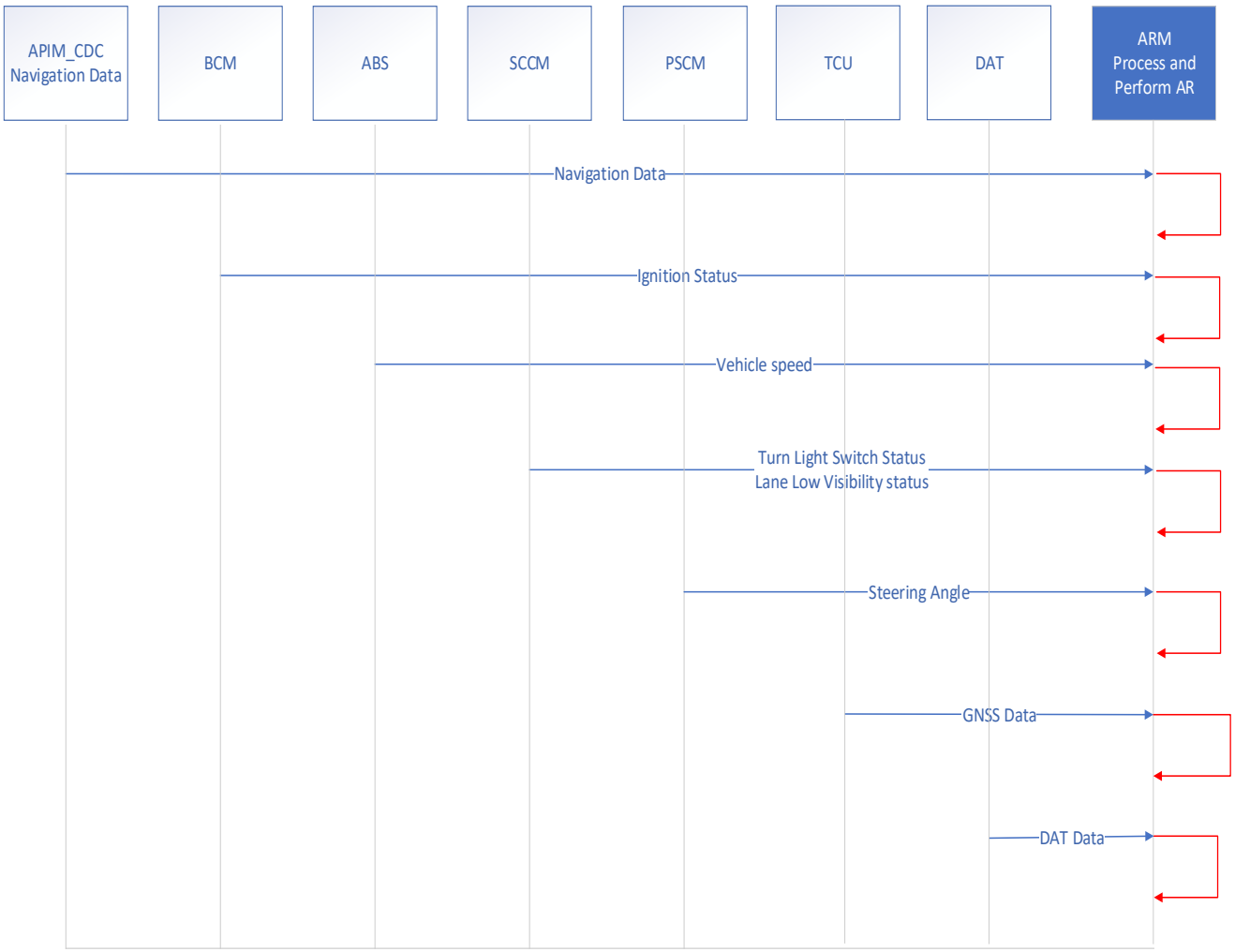


Figure 4-3: Scenario “Process and Perform Augmented Reality”

4.1.4 Scenario: “Process Video mode”

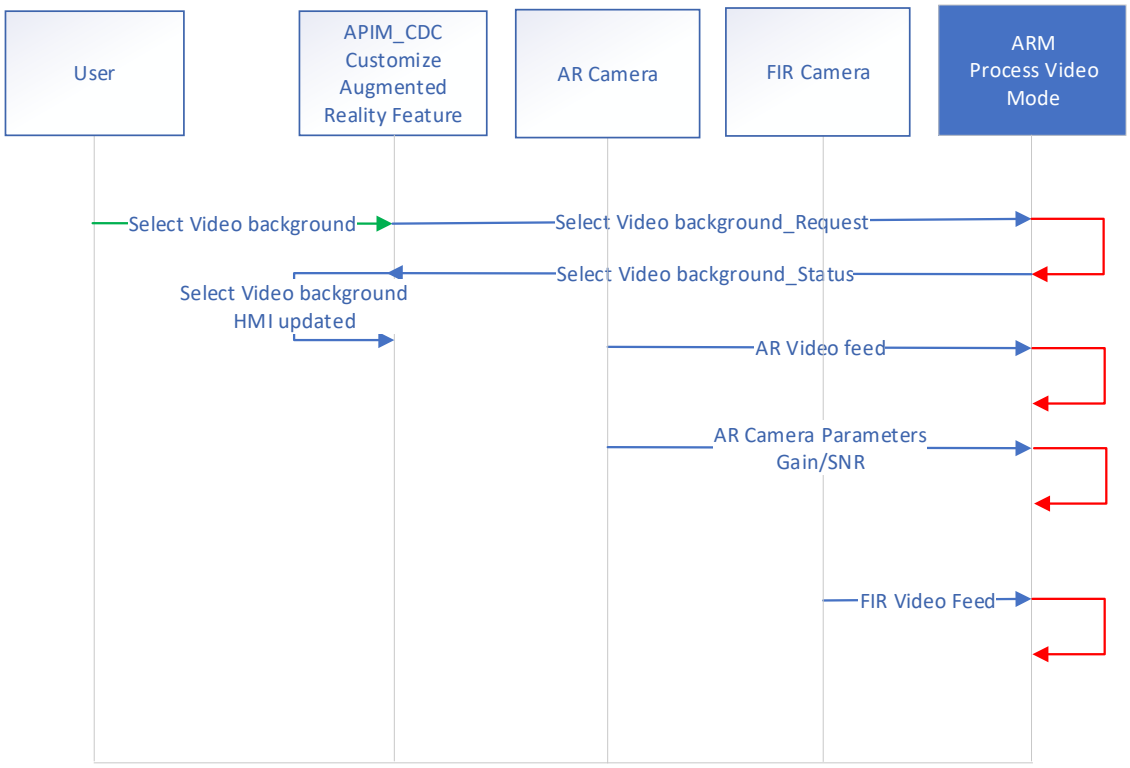


Figure 4-4: Scenario “Process Video mode”

The process shall follow the following steps (refer to FIR MVP Requirement v4.4 and Camera Gain for Augmented Reality Background Transition Point for more details)

Step1: Initial Checks
When the ARM recognizes a signal for the need to show an AR event on screen, the ARM shall first check if the following are true:
1- The ARM shall verify that the vehicle is equipped and configured to use the FIR camera
2- The ARM shall verify that the FIR camera is functioning
3- The ARM shall verify that the user has set the AR camera selection setting to Enable
If any of these requirements are not met, then the standard visible AR camera shall be used instead.

Step2: Decision to Use FIR Camera
The ARM shall determine which camera to use based on the following values.
1- AR camera’s gain
2- AR camera’s integration time
3- Time of Day (this information is already provided to the ARM for navigation use cases)
4- Vehicle Heading Information (this information is already provided to the ARM for navigation use cases)

Step3: History of Camera Frame Parameters

A rolling history of the AR camera parameters shall be stored over the course of the drive. This history is used to mitigate noise.

a- Short Term Frame Parameter History
The ARM shall hold a rolling memory of camera parameters from the last **60 frames** over the past **60**

seconds from before the AR event trigger has been received. These values are recorded at a periodic rate of **1 Hz / frame per second.**

1. The periodic sampling rate shall be configurable between **1 Hz and 60 Hz**
2. The number of sets of frame parameters to save in the short-term parameter history shall be configurable between **1 and 500.**
3. The time window for the short-term frame parameter history shall be configurable between **1 second and 120 seconds.**
   The maximum time window shall be limited by the rate of sampling for the camera parameters and the number of stored sets of frame parameters

b- Long Term Frame Parameter History
The ARM shall hold a rolling memory of camera parameters from the last **60 frames** over the past **5 minutes** previous to the short-term parameter history. These values are recorded at a periodic rate of **0.2 Hz / frame per second (or 12 frames per minute)**.

1. The periodic sampling rate shall be configurable between **0.01667 Hz (1 frame per minute) and 60 Hz**
2. The number of sets of frame parameters to save in the short-term parameter history shall be configurable between **1 and 500**
3. The time window for the long-term frame parameter history shall be configurable between **5 minutes and 10 minutes.**
   The maximum time window shall be limited by the rate of sampling for the camera parameters and the number of stored sets of frame parameters

c- Camera Parameter History Retention
After key off, the ARM shall clear the short term history.
The ARM shall clear the long-term history after **6 minutes**. The time to clear the long-term history shall be configurable between **1 and 15 minutes**.

Step 4: Decision Logic
If the values for the gain and integration time are equal to or below the set thresholds that correlate to the SNR value reduction from optimal of **15% from optimal** dB with a tolerance of **+/- 5% from optimal** dB, then the FIR camera shall be selected as the background for the AR event. The optimal value shall be selected based on the procedure outlined in (**Camera Gain for Augmented Reality Background Transition Point for more details v1.1).**
If these values are above the set thresholds, then the standard visible AR camera shall be used instead. The values used for this decision are based on one of the following situations below.

1- Situation 1: Full Parameter History Log
The values for gain and integration time shall be chosen based on the average values over the short term history. If these values are greater or smaller compared to the average value over the long term history by [tolerance range(s)], then the average between the long term and short term averages shall be used as the final decision values.

2- Situation 2: Partially Filled Parameter History Log
The ARM shall choose the camera for AR as in Situation 1 but with a limited decision set.

1. If the camera parameters indicate that the AR camera would be chosen.

3- Situation 3: Empty Long-Term History Log with Partial/Full Short-Term History
The values for gain and integration time shall be chosen based on the average values over the short-term history.

1. If the AR camera is chosen, the ARM shall check to make sure that the vehicle is not driving into the sun using the time of day and GPS bearing
2. If the vehicle is driving East, North East, or South East between 6:00AM and 9:00AM in the morning, then the FIR camera shall be chosen for AR events
   a. The beginning and end times for this time window shall be configurable between 5:00AM and 10:00AM
3. If the vehicle is driving West, North West, or South West between 6:00PM and 9:00PM in the evening, then the FIR camera shall be chosen for AR events
   a. The beginning and end times for this time window shall be configurable between 5:00PM and 10:00PM

Step 5: Decision Timing
The camera background choice shall be made within **50 ms,** of the trigger for an AR event (timing should match AR camera).

4.1.5 Scenario: “Display Augmented Reality”

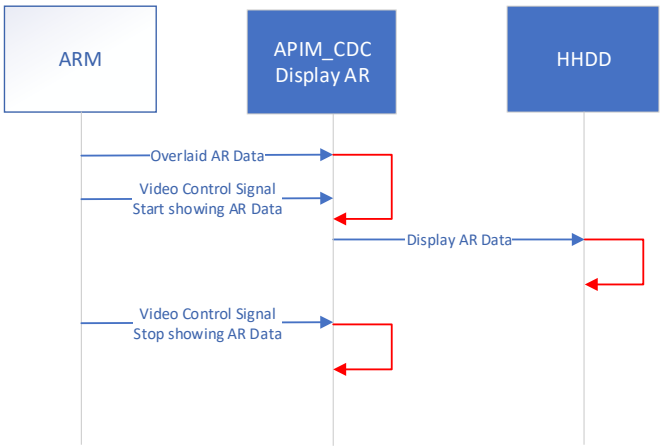


Figure 4-5: Scenario “Display Augmented Reality”

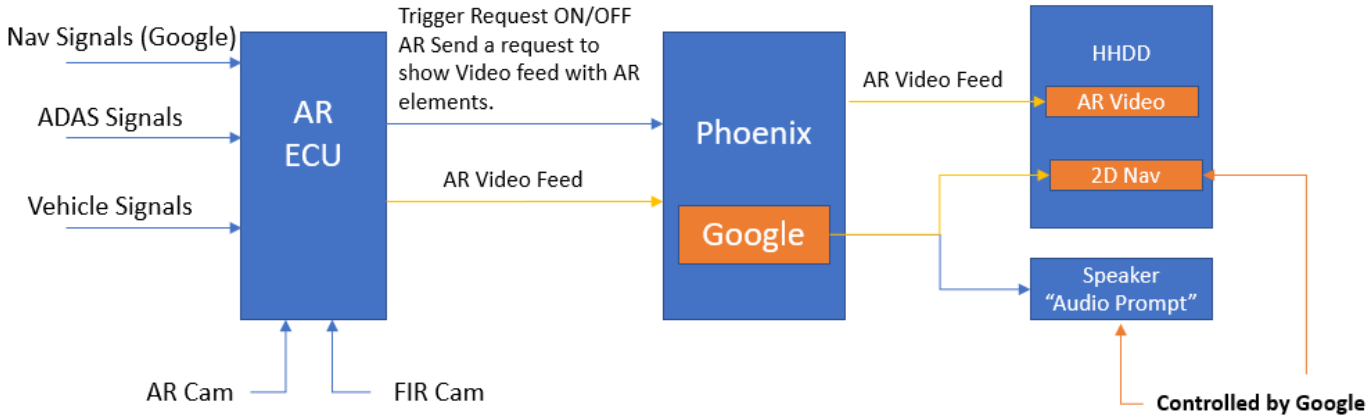


Figure 4-6: “Display Augmented Reality Control Process”

4.2 Component Interface Behavior Diagrams

#Hint: For complex (application level) interface protocols a protocol state machine would be more appropriate than a bunch of sequence diagrams to illustrate the interactions between components. So, this section would typically show a (protocol) state machine.

5 FEATURE IMPLEMENTATION REQUIREMENTS

5.1 Functional Safety

5.1.1 ASIL Decomposition of Technical Safety Requirements

The Augmented Reality Feature is QM. See Functional Safety (section 6) in the feature document.

Input TSR		
Decomposition Rationale		
Method for Decomposition		
TSR 1 after Decomposition	**TSR ID**	
	TSR Title	
	ASIL	
	Rationale	
	Satisfied by	
TSR 2 after Decomposition	**TSR ID**	
	TSR Title	
	ASIL	
	Rationale	
	Satisfied by	
TSR for Independence *Note: should consider commonly used input, output and processing* *Note: additional row should be added if additional requirements for Independence are necessary*	**TSR ID**	
	TSR Title	
	ASIL	
	Rationale	

Table 5-1: ASIL Decomposition Table

5.2 Requirements on Components

5.2.1 ARM (AR ECU)

5.2.1.1 Technology Function “Process and Perform Augmented Reality”

5.2.1.1.1 Function Interfaces

5.2.1.1.1.1 Inputs

Highlighted signals currently not available due to Google signal availability, pending ongoing discussions for alternative map supplier.

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*
Activate AR Feature	AugRealtyFeat_B_Rq		Ethernet	
Activate Lane Low Visibility	LaneVisblLo_B_Rq		Ethernet	
Select video Mode	VideoFeed_B_Rq		Ethernet	
Navigation Status	TBD		Ethernet	
Vehicle Data	TBD		CAN	See section 5.2.1.2.1.1
lane count info	TBD		Ethernet	
Speed limit value	TBD		Ethernet	
Route geometry	TBD		Ethernet	
Elevation data / 3D Road Geometry	TBD		Ethernet	
Distance to next maneuver	TBD		Ethernet	
Maneuver intersection geo location	TBD		Ethernet	
Maneuver street name	TBD		Ethernet	
Maneuver phases from navigation system	TBD		Ethernet	
Road network geometry and topology (roundabout geometry)	TBD		Ethernet	
Following maneuver info	TBD		Ethernet	
Road links street names	TBD		Ethernet	
Buildings position and address	TBD		Ethernet	
House number via navigation predicted route for Inactive route	TBD		Ethernet	
House number via voice command for Inactive route	TBD		Ethernet	
House number via voice command for active route	TBD		Ethernet	
Name of building/business	TBD		Ethernet	
Define common houses	TBD		Ethernet	
Destination position and address	TBD		Ethernet	
Distance to destination	TBD		Ethernet	
Road restrictions (e.g. school, no entry, etc.)	TBD		Ethernet	
Points of interest info: location, type, description	TBD		Ethernet	
Conditional signals (for conditional POIs)	TBD		Ethernet	
Footprint, number of levels, for façade highlighting	TBD		Ethernet	
POI_ Voice Command (Active Route)	TBD		Ethernet	
POI_ Voice Command (Inactive Route)	TBD		Ethernet	

DAT Status	TBD		CAN	
Current lane position/direction	ServiceLaneData ServicePredPathDataService CBZData ServiceInPathData ServiceLightsData ServiceSignData		Ethernet	
Ego vehicle in-lane offset				
HD lanes block				
Lane markings type				
Height Map/Elevation				
Target lane position/direction				
Object collision warning signal	ServicePedestrianData ServiceRoadTargetsData		Ethernet	
Distance to object				
Object position				
Object size				
BLIS_Right_Status	SodAlrtRight_D_Stat		HS3-CAN	
BLIS_Left_Status	SodAlrtLeft_D_Stat		HS3-CAN	
GNSS Data	TBD		Ethernet	
AR Video Feed	TBD		FPD-Link III	
FIR Video Feed	TBD		FPD-Link III	
AR Camera Gain	TBD		I2C	
AR Camera Integration Time	TBD		I2C	

Table 5-2: Input Signal mappings of Function "Process and Perform Augmented Reality"

5.2.1.1.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
Overlaid Data			FPD-Link III	
Video Control Signal	ARVidTrgr_B_Rq		Ethernet	
AR feature status	AugRealtyFeat_B_Stat		Ethernet	
Lane Low Visibility Status	LaneVisblLo_B_Stat		Ethernet	
Video Mode Status	VideoFeed_B_Stat		Ethernet	
Turn ARM OFF	AugRealtyMdule_B_Rq		HS3-CAN	

Table 5-3: Output Signal mappings of Function "Process and Perform Augmented Reality"

5.2.1.1.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-4: Parameter mappings of Function "Process and Perform Augmented Reality"

5.2.1.1.1.4 Interface Requirements

###R_CMP_AR_00056### ARM Video Interface to APIM_CDC

The ARM shall have the video interface to APM_CDC through LVDS connection / FBD-Link III

End of Requirement

###R_CMP_AR_00057### ARM Interface to AR Camera

The ARM shall have the interface to AR camera through LVDS connection / FBD-Link III to receive the following from AR camera.

- Resolution: 1920px x 1080px
- FoV: ~99.6 degrees H x 54.6 degrees V (+- 3-degree angular tolerance)
- Frame Rate = 30 Hz
- RGB visible image data
- Gain
- Integration time

End of Requirement

###R_CMP_AR_00058### ARM Interface to FIR Camera

The ARM shall have the interface to FIR camera through LVDS connection / FBD-Link III to receive the following from FIR camera.

- Resolution: 640 x 368 px
- Frame Rate = 30 Hz
- FoV: ~65±5°H x 47.5±5°V
- Black and white thermal image data
- FIR thermal data from camera. Images appear in grayscale based on thermal signature.
- pixel clock 12.5MHz
- data rate(FWD channel) = (bits per pixel, assuming dual stream)*(frame resolution)*(FPS) = (8+14)*(640*468)*30 = 155443200 bits per second
- data rate (BWD channel) = I2C in 1Mhz
- data format RAW 8/RAW 14
- number of bits RAW 8= 8bits, RAW 14= 14bits

End of Requirement

###R_CMP_AR_00059### ARM Ethernet Interface

The ARM shall have Ethernet (SOA) interface with the following ECU's through ECG.

1- APIM_CDC.
2- TCU
3- IPMA(ADAS)

End of Requirement

###R_CMP_AR_00060### ARM CAN Interface

The ARM shall communicate on CAN Bus with the following ECU's through ECG.

1- BCM.
2- ABS.
3- APIM_CDC.
4- IPMA(ADAS)
5- PSCM.
6- SCCM.

7- PDB

End of Requirement

5.2.1.1.2 Function Requirements

All Function Requirements related to Process and Perform Augmented Reality from Function Specification (ID_F003774) are Valid.

Requirement ID (of Logical Function)	**Requirement Title**	**Modification**	**Requirement ID** (of Technology Function)	**Comment**
R_CMP_AR_00001		Added		
R_CMP_AR_00002		Added		
R_CMP_AR_00003		Added		
R_CMP_AR_00004		Added		
R_CMP_AR_00005		Added		
R_CMP_AR_00006		Added		
R_CMP_AR_00007		Added		
R_CMP_AR_00008		Added		
R_CMP_AR_00009		Added		
R_CMP_AR_00010		Added		
R_CMP_AR_00011		Added		
R_CMP_AR_00012		Added		
R_CMP_AR_00013		Added		
R_CMP_AR_00014		Added		

Table 5-5: Component Specific Requirements

Requirement ID (of Logical Function)	**Requirement Title**	**Comment**
…		

Table 5-6: Inherited Requirements

5.2.1.1.2.1 Component Specific Requirements

###R_CMP_AR_00001### ARM Diagnostics DTC

The ARM shall set A DTC for the following events

1- AR camera or FIR camera fault
2- Loss of communication and invalid data
3- Calibration failure
4- Stuck image from AR Camera or FIR camera
5- AR or FIR Camera swap
6- AR or FIR Image Quality below threshold (>2 missing consecutive frame rate out of 30 fps)
7- AR or FIR camera blocked or dead pixels

End of Requirement

###R_CMP_AR_00002### Reading AR/FIR Camera ID

The ARM shall read and verify the (AR and FIR) camera IDs.

End of Requirement

###R_CMP_AR_00003### AR Configuration DID

The ARM shall have a DID to allow it to be configurable for different AR feature configurations.
0 x 0 == OFF
0 x1 == ON with No FIR Camera (if vehicle is not equipped with FIR camera)
0 x 2 = ON with FIR Camera (if vehicle is equipped with FIR camera)

End of Requirement

###R_CMP_AR_00004### AR Store Data Analytic DID

The ARM shall have a DID to allow to store a data analytic required for the augmented reality feature.

Data Element (Variable)	Data Element Description	Purpose	Value/Opportunity	Current Data Type (If known)	Current Data Source (If known)	Priority
Overlay Blind Spot (BLIS)	To tell if the AR feature function BLIS is activated by the ADAS system prompts and turn signals	- See if the AR feature is activated with the prompts from Navigation System, to **improve customer satisfaction** and **reduce warranty** claims, we can verify the correct operation of the AR feature	- customer satisfaction - warranty	CAN signal (TBD)	ARM, DAT, SCCM	High
Overlay Lane Biasing	To tell if the AR feature function Lane Biasing is activated by the ADAS system prompts	- See if the AR feature is activated with the prompts from ADAS System, to **improve customer satisfaction** and **reduce warranty** claims, we can verify the correct operation of the AR feature	- customer satisfaction - warranty	(TBD)	ARM, DAT	High
Overlay Lane Change Assist	To tell if the AR feature function Lane Change Assist is activated by the Navigation and ADAS system prompts	- See if the AR feature is activated with the prompts from Navigation and ADAS System, to **improve customer satisfaction** and **reduce warranty** claims, we can verify the correct operation of the AR feature	- customer satisfaction - warranty	(TBD)	ARM, APIM DAT	High

Overlay Highway Assist	To tell if the AR feature function Highway Assist is activated by the ADAS system prompts	- See if the AR feature is activated with the prompts from ADAS System, to **improve customer satifaction** and **reduce warranty** claims, we can verify the correct operation of the AR feature	- customer satisfaction - warranty	(TBD)	ARM, DAT	High

End of Requirement

###R_CMP_AR_00005### AR Video Trigger

The ARM shall provide overlaid data with trigger signal (ARVidTrgr_B_Rq) to APIM to request start or stop display AR video content on HHDD.

End of Requirement

###R_CMP_AR_00006### ARM OTA Capability

The ARM shall be capable to receive fast OTA.

End of Requirement

###R_CMP_AR_00007### ARM Activate/Deactivate AR Feature

ARM shall receive AR feature activation signal request (AugRealtyFeat_B_Rq) from APIM_CDC and shall send back a status signal (AugRealtyFeat_B_Stat)
ARM shall activate the feature and send status signal (AugRealtyFeat_B_Stat = 0x01) when (AugRealtyFeat_B_Rq = 0x01)
ARM shall de-activate the feature and send status signal (AugRealtyFeat_B_Stat = 0x00) when (AugRealtyFeat_B_Rq = 0x00)

End of Requirement

###R_CMP_AR_00008### ARM Enable/Disable Video Mode

ARM shall receive video mode activation signal request (VideoFeed_B_Rq) from APIM_CDC and shall send back a status signal (VideoFeed_B_Stat). The ARM shall follow the selection process of the camera based on the steps described in section 4.1.4.
ARM shall Enable the video mode (VideoFeed_B_Stat = 0x01) when (VideoFeed_B_Rq = 0x01)
ARM shall disable the video mode (VideoFeed_B_Stat = 0x01) when (VideoFeed_B_Rq = 0x00)

End of Requirement

###R_CMP_AR_00009### ARM Activate/Deactivate Lane Low Visibility

ARM shall receive lane low visibility activation signal request (ARLanLowVis_B_Rq) from APIM_CDC and shall send back a status signal (ARLanLowVis_B_Stat)
ARM shall activate the lane low visibility (ARLanLowVis_B_Stat = 0x01) when (ARLanLowVis_B_Rq = 0x01)
ARM shall disable the lane low visibility (ARLanLowVis_B_Stat = 0x00) when (ARLanLowVis_B_Rq = 0x00)

(MVP+ variant - ongoing discussion with CIED team if it can be moved to MVP or post <J1>)

End of Requirement

###R_CMP_AR_00010### Video Feed- Resolution

The ARM sall crop the AR camera FoV to 85% of the native view such that the proximity of environmental objects would appear more realistic to the driver. The ARM shall send the video feed to Phoenix domain controller with resolution(1155x650px @30Hz).

End of Requirement

###R_CMP_AR_00011### ARM processing Latency

The ARM processing latency shall be ≤ (50ms).

End of Requirement

###R_CMP_AR_00012### ARM Powering Capability AR and FIR Cameras

The ARM shall be able to provide power (Target = 12.5V, Range = 8-16 Volt) to the AR camera and FIR camera.

End of Requirement

###R_CMP_AR_00055### FIR Cameras Image Manipulation

The ARM shall be able to provide FIR Image Manipulation. The FIR image shall be cropped and then up sampled as described below.

1- The FIR image shall be cropped at the bottom so that the vehicle's engine hood occupies no more than 10% of the final image. The amount of cropping from the bottom of the image shall be configurable between 0 and 200 pixels
2- The FIR image shall be cropped at the top so that the sky occupies no more than 10% of the final image when the vehicle is on level ground. The amount of cropping from the top of the image shall be configurable between 0 and 200 pixels.
3- The cropped FIR image shall be up sampled so that the new increased height matches the AR window.

End of Requirement

###R_CMP_AR_00013### ARM Video Rendering Priority

ARM shall render the augmented data with No overlap of objects in front of host vehicle with the rendering priority shown below.

Feature	HMI Priority
Night Vision (Background)	1
Lane Low Visibility	2
BLIS	3
Highway Assist	4
Lane Biasing	4
Assisted Lane Change	4
Lane Level Guidance	4

Destination	5
House Number	6
POI	6
Street Name	7

The concurrent display of AR features (i.e., show turn-by-turn maneuver with blind spot) is allowed and integral to the system communication to the driver.

User actions that result in information being presented in the area of the augmented camera view (e.g., accommodations menu) will hide the augmented camera view.

End of Requirement

###R_CMP_AR_00014### Rendering Font/Text Size

The ARM shall render the text that supported for all languages and Language 's font shall be consistent with Ford's regulated "Ford Antenna" - Ford Latin Characters, non-Latin other fonts. For Lincoln vehicle Latin characters- "Madera" font shall be used.

The text size shall not change based on the speed for the 2D names. For the 3D names, the text size shall change with distance to target as long as it is within Regulation (TBD)

The text position shall not be configurable for the 2D names. For the 3D text is geolocated and scales with proximity.

End of Requirement

###R_CMP_AR_00061### Wiper Motion Removal from Video Feed

The ARM shall show no wiper motion in the displayed AR video feed (in case the wiper is working and within AR camera FOV).

End of Requirement

###R_CMP_AR_00062### ARM Operation Modes

The ARM shall operate with full functionality if the latest known status is Normal or Factory Key OFF Load (KOL) Modes following the table below.

3.4.5 Determine KOL Mode

KOL_Mode is a simple combination of Ignition_Status, LifeCycMde_D_Actl and Sleep_Mode.

Rqm't Num.	Ignition_Status	LifeCycMde_D_Actl	Sleep_Mode	KOL_Mode
R: 3.4.2-1	RUN | START | ACC	Don't care	Don't care	NORMAL
R: 3.4.2-2	OFF	FACTORY	Don't care	FACTORY
R: 3.4.2-3	OFF	TRANSPORT	Don't care	TRANSPORT
R: 3.4.2-4	OFF	NORMAL	NORMAL	NORMAL
R: 3.4.2-5	OFF	NORMAL	HIBERNATE	HIBERNATE
R: 3.4.2-6	OFF	NORMAL	CRITICAL_BATT	CRITICAL_BATT

End of Requirement

###R_CMP_AR_00081### ARM Perform Calibration - EOL

The ARM shall be able to perform EOL calibration for AR and FIR cameras.

End of Requirement

###R_CMP_AR_00082### ARM Perform Calibration - Service

The ARM shall be able to perform service calibration for AR and FIR cameras.

End of Requirement

5.2.1.2 Technology Function “Get Vehicle Data”

5.2.1.2.1 Function Interfaces

5.2.1.2.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*
Get Vehicle Data	FuelLvlWarn_D_Actl		HS3-CAN	
	Veh_V2_Dsply		HS3-CAN	
	MetricActv_B_Dsply		HS3-CAN	
	Ignition_Status		HS3-CAN	
	Remote_Start_Status		HS3-CAN	
	Parklamp_Status		HS3-CAN	
	Day_Night_Status		HS3-CAN	
	Litval		HS3-CAN	
	Dimming_Lvl		HS3-CAN	
	CrashEvnt_D_Stat		HS3-CAN	
	FogLghtFrontOn_B_Stat		HS3-CAN	
	VehOverGnd_V_Est		HS3-CAN	
	VehYawComp_W_Actl		HS3-CAN	
	VehRolComp_W_Actl		HS3-CAN	
	VehLatComp_A_Actl		HS3-CAN	
	VehLongComp_A_Actl		HS3-CAN	
	WhlFl_W_Meas		HS3-CAN	
	WhlFr_W_Meas		HS3-CAN	
	WhlRl_W_Meas		HS3-CAN	
	WhlRr_W_Meas		HS3-CAN	
	StePinComp_An_Est		HS3-CAN	
	StePinCompAnEst_D_Qf		HS3-CAN	
	TurnLghtSwtch_D_Stat		HS3-CAN	

Table 5-8: Input Signal mappings of Function “Get Vehicle Data”

5.2.1.2.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*

Table 5-9: Output Signal mappings of Function "Get Vehicle Data"

5.2.1.2.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-10: Parameter mappings of Function "Get Vehicle Data"

5.2.1.2.1.4 Interface Requirements

5.2.1.2.2 Function Requirements

All Function Requirements related to Provide Vehicle Data from Function Specification (ID_F003774) are valid.

Requirement ID (of Logical Function)	**Requirement Title**	**Modification**	**Requirement ID** (of Technology Function)	**Comment**

Table 5-11: Component Specific Requirements

Requirement ID (of Logical Function)	**Requirement Title**	**Comment**
…		

Table 5-12: Inherited Requirements

5.2.1.2.2.1 Component Specific Requirements

5.2.1.3 Technology Function "Get GNSS Data"

5.2.1.3.1 Function Interfaces

5.2.1.3.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*
Latitude	Location Services		Ethernet	
Longitude				
Height				
Moving direction				
Calculated speed				

VDOP				
HDOP				
PDO				

Table 5-13: Input Signal mappings of Function "Get GNSS Data"

5.2.1.3.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*

Table 5-14: Output Signal mappings of Function "Get GNSS Data"

5.2.1.3.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-15: Parameter mappings of Function "Get GNSS Data"

5.2.1.3.1.4 Interface Requirements

5.2.1.3.2 Function Requirements

All Function Requirements related to Provide GNSS Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	**Requirement Title**	**Modification**	**Requirement ID** (of Technology Function)	**Comment**

Table 5-16: Component Specific Requirements

Requirement ID (of Logical Function)	**Requirement Title**	**Comment**
…		

Table 5-17: Inherited Requirements

5.2.1.3.2.1 Component Specific Requirements

5.2.1.4 Technology Function “Get DAT Data”

5.2.1.4.1 Function Interfaces

5.2.1.4.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** *(Optional)*
Current lane position/direction	ServiceLaneData ServicePredPathDataService CBZData ServiceInPathData ServiceLightsData ServiceSignData		Ethernet	
Ego vehicle in-lane offset				
HD lanes block				
Lane markings type				
Height Map/Elevation				
Target lane position/direction				
Object collision warning signal	ServicePedestrianData ServiceRoadTargetsData		Ethernet	
Distance to object				
Object position				
Object size				
BLIS_Right_Status	SodAlrtRight_D_Stat		FD3-CAN	
BLIS_Left_Status	SodAlrtLeft_D_Stat		FD3-CAN	

Table 5-18: Input Signal mappings of Function “Get DAT Data”

5.2.1.4.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*

Table 5-19: Output Signal mappings of Function “Get DAT Data”

5.2.1.4.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-20: Parameter mappings of Function “Get DAT Data”

5.2.1.4.1.4 Interface Requirements

5.2.1.4.2 Function Requirements

All Function Requirements related to Provide DAT Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	**Requirement Title**	**Modification**	**Requirement ID** (of Technology Function)	**Comment**

NA				

Table 5-21: Component Specific Requirements

Requirement ID (of Logical Function)	**Requirement Title**	**Comment**
NA		

Table 5-22: Inherited Requirements

5.2.1.4.2.1 Component Specific Requirements

5.2.2 APIM_CDC (Phoenix)

5.2.2.1 Technology Function “Customize Augmented Reality Settings”

5.2.2.1.1 Function Interfaces

5.2.2.1.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*
Ar feature status	ARFetSta_B_Stat		Ethernet	
Lane Low Visibility Status	ARLanLowVis_B_Stat		Ethernet	
Video Mode Status	ARVidMod_B_Stat		Ethernet	

Table 5-73: Input Signal mappings of Function “Customize Augmented Reality Settings”

5.2.2.1.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
Activate AR Feature	ARFetSta_B_Rq		Ethernet	
Activate Lane Low Visibility	ARLanLowVis_B_Rq		Ethernet	
Select video Mode	ARVidMod_B_Rq		Ethernet	

Table 5-24: Output Signal mappings of Function “Customize Augmented Reality Settings”

5.2.2.1.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-25: Parameter mappings of Function “Customize Augmented Reality Settings

5.2.2.1.1.4 Interface Requirements

###R_CMP_AR_00025### APIM_CDC Video Interface to ARM

The APIM_CDC shall receive the video feed from ARM through LVDS connection / FBD-LinkIII with resolution 1155 x 650pix at 30Hz frame rate.

End of Requirement

###R_CMP_AR_00063### APIM_CDC Video Interface to HHDD

The APIM_CDC shall have the video interface to HHDD through LVDS connection / FBD-LinkIII with resolution 1155 x 650pix at 30Hz frame rate.

End of Requirement

###R_CMP_AR_00064### APIM_CDC Ethernet Interface to ARM

The APIM_CDC shall communicate with ARM on Ethernet (SOA) interface through ECG.

End of Requirement

###R_CMP_AR_00065### APIM_CDC CAN Interface to ARM

The APIM_CDC shall communicate with ARM through CAN interface.

End of Requirement

5.2.2.1.2 Function Requirements

All Function Requirements related to Customize Augmented Reality (ID_F003774) are Required.

Requirement ID (of Logical Function)	**Requirement Title**	**Modification**	**Requirement ID** (of Technology Function)	**Comment**
R_CMP_AR_00015		Added		
R_CMP_AR_00016		Added		
R_CMP_AR_00017		Added		
R_CMP_AR_00018		Added		
R_CMP_AR_00019		Added		

Table 5-26: Component Specific Requirements

Requirement ID (of Logical Function)	**Requirement Title**	**Comment**
…		

Table 5-27: Inherited Requirements

5.2.2.1.2.1 Component Specific Requirements

###R_CMP_AR_00066### APIM_CDC Operation Modes

The APIM_CDC shall operate with full functionality to support the AR feature if the latest known status is Normal or Factory Key OFF Load (KOL) Modes following the table below.

3.4.5 Determine KOL Mode

KOL_Mode is a simple combination of Ignition_Status, LifeCycMde_D_Actl and Sleep_Mode.

Rqm't Num.	Ignition_Status	LifeCycMde_D_Actl	Sleep_Mode	KOL_Mode
R: 3.4.2-1	RUN | START | ACC	Don't care	Don't care	NORMAL
R: 3.4.2-2	OFF	FACTORY	Don't care	FACTORY
R: 3.4.2-3	OFF	TRANSPORT	Don't care	TRANSPORT
R: 3.4.2-4	OFF	NORMAL	NORMAL	NORMAL
R: 3.4.2-5	OFF	NORMAL	HIBERNATE	HIBERNATE
R: 3.4.2-6	OFF	NORMAL	CRITICAL_BATT	CRITICAL_BATT

End of Requirement

###R_CMP_AR_00015### APIM-CDC Diagnostics DTC

APIM-CDC module shall do the following events:

1- Set A DTC for loss of communication and invalid data
2- Set a DTC for Stuck image
3- Monitor Published ARM DTC's

End of Requirement

###R_CMP_AR_00054### APIM-CDC Configuration DID

The APIM-CDC shall have a DID to allow it to be configurable for different AR feature configurations
0 x 0 == OFF
0 x1 == ON with No FIR Camera (if vehicle is not equipped with FIR camera)
0 x 2 = ON with FIR Camera (if vehicle is equipped with FIR camera)

End of Requirement

###R_CMP_AR_00016### APIM-CDC DID – Store Data Analytic

APIM-CDC Module shall have a DID to allow to store a data analytic required for the augmented reality feature:

Connected Vehicle Data Analytics. Request to capture listed data below:

- How many times, out of all the times the Augmented Reality feature is triggered, does the user select the touch screen "Off" soft button on the Augmented Reality setting menu?
  - If the user does select the "Off" soft button on the Augmented Reality feature menu, how many times per drive cycle, hours in operation, per week, month, year?
- How many times does the user select the touch screen "On" soft button on the Augmented Reality setting menu?
  - If the user does select the "On" soft button on the Augmented Reality feature menu, how many times per drive cycle, hours in operation, per week, month, year?

- How many times, out of all the times the Augmented Reality feature is triggered, does the user select the Voice Command "Turn AR-Off (TBD)" option from the Augmented Reality voice menu?
  - If the user does select the "Turn AR-Off (TBD)" Voice Command option from the Augmented Reality voice menu, how many times per drive cycle, hours in operation, per week, month, year?
- How many times does the user select the Voice Command "Turn AR-On (TBD)" option from the Augmented Reality voice menu?

- If the user does select the “Turn AR-On (TBD)” Voice Command option from the Augmented Reality voice menu, how many times per drive cycle, hours in operation, per week, month, year?

- How many times, out of all the times the Augmented Reality feature is triggered, does the user select the touch screen “Disable” automatic camera selection soft button on the Augmented Reality setting menu?
  - If the user does select the “Disable” automatic camera selection soft button on the Augmented Reality feature menu, how many times per drive cycle, hours in operation, per week, month, year?
- How many times does the user select the touch screen “Enable” automatic camera selection soft button on the Augmented Reality setting menu?
  - If the user does select the “Enable” automatic camera selection soft button on the Augmented Reality feature menu, how many times per drive cycle, hours in operation, per week, month, year?

- How many times, out of all the times the Augmented Reality feature is triggered, does the user select the Voice Command “Disable Automatic Camera (TBD)” option from the Augmented Reality voice menu?
  - If the user does select the “Disable Automatic Camera (TBD)” Voice Command option from the Augmented Reality voice menu, how many times per drive cycle, hours in operation, per week, month, year?
- How many times does the user select the Voice Command “Enable Automatic Camera (TBD)” option from the Augmented Reality voice menu?
  - If the user does select the “Enable Automatic Camera (TBD)” Voice Command option from the Augmented Reality voice menu, how many times per drive cycle, hours in operation, per week, month, year?

Data Element Prioritized Opportunities Worksheet

Purpose: To work through the Technical details and elements to identify information and journeys that can be developed to help gather information in order to add value and gain opportunity with corporate initiatives.

Data Element Details						**Data**				
Prioritized Data Elements	**Use-Case Description**	**Can it Self-Detect?**	**Can it Self-Report?**	**Can it Self-Correct?**	**Function Definition**	**Allocated Source ECU (proposed)**	**Signal Name (where Applicable)**	**Identified DIDs (where applicable)**	**Identified DTCs (where applicable)**	**Identified Other Data Types**
AR Menu Active	How often does the driver turn On/Off the feature? How many times per drive cycle, hours in operation, per week, month, year?	Yes	Yes	N/A	On activation/deactivation signal event trigger, record snapshot information including global time, and AR DTC information	Sender: APIM Receiver: ARM	CAN signal (ARFetSta_B_Rq)	New DID needs to be added to record AR Feature switch status	AR status invalid DTC.	N/A
AR Voice Command to Activate/Deactivate	How often does the driver turn On/Off the feature? How many times per drive cycle, hours in operation, per	Yes	Yes	N/A	On activation/deactivation signal event trigger, record snapshot information including global time, and AR DTC information	Sender: APIM Receiver: ARM	CAN signal (ARFetSta_B_Rq)	New DID added to record AR Feature voice command status?	AR status invalid DTC.	N/A

	week, month, year?									
AR Mode Menu Enable/Disable	How often does the driver turn Enable/Disable automatic camera selection? How many times per drive cycle, hours in operation, per week, month, year?	Yes	Yes	N/A	On mode signal event trigger, record snapshot information including global time, and AR DTC information	Sender: APIM Receiver: ARM	CAN signal (ARVidMod_B_Rq)	New DID added to record AR Feature switch mode?	AR mode invalid DTC.	N/A
AR Voice Command to Enable/Disable AR mode	How often does the driver turn Enable/Disable automatic camera selection? How many times per drive cycle, hours in operation, per week, month, year?	Yes	Yes	N/A	On mode signal event trigger, record snapshot information including global time, and AR DTC information	Sender: APIM Receiver: ARM	CAN signal (ARVidMod_B_Rq)	New DID added to record AR Feature voice command mode?	AR mode invalid DTC.	N/A
AR Low Lane Visibility voice command	How often does the driver turn AR Low Lane Visibility by voice command? How many times per drive cycle, hours in operation, per week, month, year, etc.? What drive modes do turn the feature On in? How fast are they going when they activate/deactivate the feature? Are the wipers	Yes	Yes	N/A	On mode signal event trigger, record snapshot information including global time, speed, lateral acceleration, selectable drive mode, wiper speed, and AR DTC information	Sender: APIM Receiver: ARM	CAN signal (ARLanLowVis_B_Rq)	New DID added to record AR Feature voice command mode?	AR mode invalid DTC.	N/A

	on Wipe High when the feature is activated?									
AR Low Lane Visibility contextually triggered push button	How often does the driver turn AR Low Lane Visibility by contextually triggered menu? How many times per drive cycle, hours in operation, per week, month, year, etc.? What drive modes do turn the feature On in? How fast are they going when they activate/deactivate the feature? Are the wipers on Wipe High when the feature is activated?	Yes	Yes	N/A	On mode signal event trigger, record snapshot information including global time, speed, lateral acceleration, selectable drive mode, wiper speed, and AR DTC information	Sender: SCCM (APIM) Receiver: ARM	CAN signal (ARLanLowVis_B_Rq)	New DID added to record AR Feature voice command mode?	AR mode invalid DTC.	N/A

End of Requirement

###R_CMP_AR_00017### APIM – CDC HMI Settings

APIM-CDC Module shall allow the driver to select the AR settings if KOL is in Normal mode or Factory mode.

End of Requirement

###R_CMP_AR_00018### APIM_CDC HMI Latency

The APIM HMI latency shall be ≤ (5 ms).

End of Requirement

###R_CMP_AR_00019### APIM_CDC Voice Command- TBD for MVP- voice commands NOT supported by Google- pending discussion

The APIM_CDC shall be able to activate the following functions (Table below) through the voice command.

Voice Command	Suggested Voice Command	Rationale	Route Active	No Route Active
Turn Augmented Reality Feature On or OFF	"Turn AR On" Turn AR OFF	On (default) - augmented camera view will be presented to the driver contextually during vehicle operation. OFF - No augmented camera view will be presented to the driver at anytime during vehicle operation.	Yes	Yes
Select AR Video Mode Enable/Disable (Only If vehicle is equipped with FIR Camera)	Enable AR Video Mode Disable AR Video Mode	Enable (default) – The AR feature shall switch automatically between the AR and FIR camera based on the level of environmental lights. Disable – the AR feature shall use AR visible camera only	Yes	Yes
Activate House Numbers	"Show me House Numbers"	1- With navigation routing enabled, house can be treated like a destination location POI. House number to be triggered by navigation as with any destination. 2- With navigation routing disabled, a series of 4 house numbers on the drive when approaching target house. Require the vehicle speed to be below 25 MPH or below current residential speed limit.	Yes	Yes
Activate Point of Interset (POI)	"Show me *POIs specified by Navigation System (e.g.,* Gas Stations; Restaurants, Pharmacies; Coeffe Shops, Repair Shops, etc.)	POIs are shown as received from the navigation system. Any POIs active in the navigation system are shown in the AR view according to near navigation / destination specifications. All POI related driver voice commands are received and actioned upon by the navigation system. 1. Voice commands ”Show me all the pharmacies around” “Show me restaurants”: work with Route and No Route active. 2. Near NAV: only show preferred or history POIs when AR screen is triggered because NAV route is active “Google”.	Yes	Yes
Activate Low Lane Visibility	"Help me see"	Visual imagery to show the most likely path for the driver (i.e., navigation without a route set).	Yes	Yes

Pending CIED definition of experience

Street Names	"Show me Street Names"		TBD	TBD

End of Requirement

5.2.2.2 Technology Function “Provide Navigation data”

5.2.2.2.1 Function Interfaces

5.2.2.2.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*

Table 5-88: Input Signal mappings of Function “Provide Navigation data”

5.2.2.2.1.2 Outputs

Highlighted signals currently not available due to Google signal availability, pending ongoing discussions for alternative map supplier.

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
Navigation Status	TBD		Ethernet	
Vehicle Data	TBD		Ethernet	
lane count info	TBD		Ethernet	
Speed limit value	TBD		Ethernet	
Route geometry	TBD		Ethernet	
Elevation data / 3D Road Geometry	TBD		Ethernet	
Distance to next maneuver	TBD		Ethernet	
Maneuver intersection geo location	TBD		Ethernet	
Maneuver street name	TBD		Ethernet	
Maneuver phases from navigation system	TBD		Ethernet	
Road network geometry and topology (roundabout geometry)	TBD		Ethernet	
Following maneuver info	TBD		Ethernet	
Road links street names	TBD		Ethernet	
Buildings position and address	TBD		Ethernet	
House number via navigation predicted route for Inactive route	TBD		Ethernet	
House number via voice command for Inactive route	TBD		Ethernet	
House number via voice command for active route	TBD		Ethernet	
Name of building/business	TBD		Ethernet	
Define common houses	TBD		Ethernet	

Destination position and address	TBD		Ethernet	
Distance to destination	TBD		Ethernet	
Road restrictions (e.g. school, no entry, etc.)	TBD		Ethernet	
Points of interest info: location, type, description	TBD		Ethernet	
Conditional signals (for conditional POIs)	TBD		Ethernet	
Footprint, number of levels, for façade highlighting	TBD		Ethernet	
POI_ Voice Command (Active Route)	TBD		Ethernet	
POI_ Voice Command (Inactive Route)	TBD		Ethernet	

Table 5-29: Output Signal mappings of Function "Provide Navigation data"

5.2.2.2.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-30: Parameter mappings of Function "Provide Navigation data"

5.2.2.2.1.4 Interface Requirements

5.2.2.2.2 Function Requirements

All Function Requirement related to Provide Navigation Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	**Requirement Title**	**Modification**	**Requirement ID** (of Technology Function)	**Comment**
R_CMP_AR_00020		Added		
R_CMP_AR_00021		Added		

Table 5-31: Component Specific Requirements

Requirement ID (of Logical Function)	**Requirement Title**	**Comment**
…		

Table 5-32: Inherited Requirements

5.2.2.2.2.1 Component Specific Requirements

###R_CMP_AR_00020### APIM_CDC Navigation Data Latency

The APIM_CDC Navigation Data latency shall be ≤ (10 ms).

End of Requirement

###R_FNC_AR_00021### APIM_CDC Navigation Data Accuracy

The APIM_CDC Navigation Data accuracy shall be ≤ 1 m

End of Requirement

5.2.2.3 Technology Function “Display Augmented Reality”

5.2.2.3.1 Function Interfaces

5.2.2.3.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*
Overlaid Data	TBD		FPD-Link III	
Video Control Signal	ARVidTrgr_B_Rq		Ethernet	

Table 5-33: Input Signal mappings of Function “Display Augmented Reality”

5.2.2.3.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
HHDD Data	TBD		FPD-Link III	

Table 5-94: Output Signal mappings of Function “Display Augmented Reality”

5.2.2.3.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-35: Parameter mappings of Function “Display Augmented Reality”

5.2.2.3.1.4 Interface Requirements

5.2.2.3.2 Function Requirements

All Function Requirement related to Display Augmented Reality from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	**Requirement Title**	**Modification**	**Requirement ID** (of Technology Function)	**Comment**
R_CMP_AR_00022		Added		
R_CMP_AR_00023		Added		
R_CMP_AR_00024		Added		
R_CMP_AR_00025		Added		
R_CMP_AR_00026		Added		

Table 5-36: Component Specific Requirements

Requirement ID (of Logical Function)	**Requirement Title**	**Comment**
…		

Table 5-37: Inherited Requirements

5.2.2.3.2.1 Component Specific Requirements

~~###R_CMP_AR_00022### Display Augmented Reality On ignition RUN~~

~~The APIM-CDC shall send the video to the HHDD while ignition status = run.~~

End of Requirement

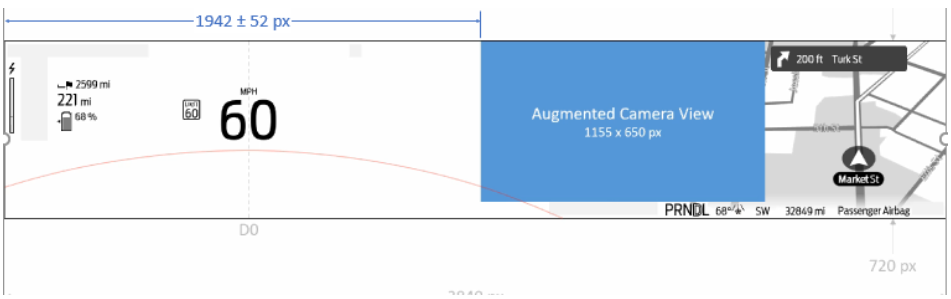
###R_CMP_AR_00023### Display Augmented Reality Location on HHDD

The APIM-CDC shall display the video feed that includes the overlaid information on HHDD as:

a- The left edge of the augmented camera view shall be 1942 ± 52 pixels from the left edge of the display.

b- The location of AR video shall be outside the steering Wheel zone.

.



End of Requirement

###R_CMP_AR_00024### Display Augmented Reality Resolution

The APIM-CDC shall send the video to the HHDD with the resolution of 1155 x 650pix @ 30Hz.

End of Requirement

###R_CMP_AR_00026### APIM_CDC Display Latency

The APIM_CDC shall show the video on HHDD with latency shall be ≤ (5 ms) from receiving the request to show/remove the video from ARM.

End of Requirement

###R_CMP_AR_00053### APIM_CDC Display Global Alert and Warning Events

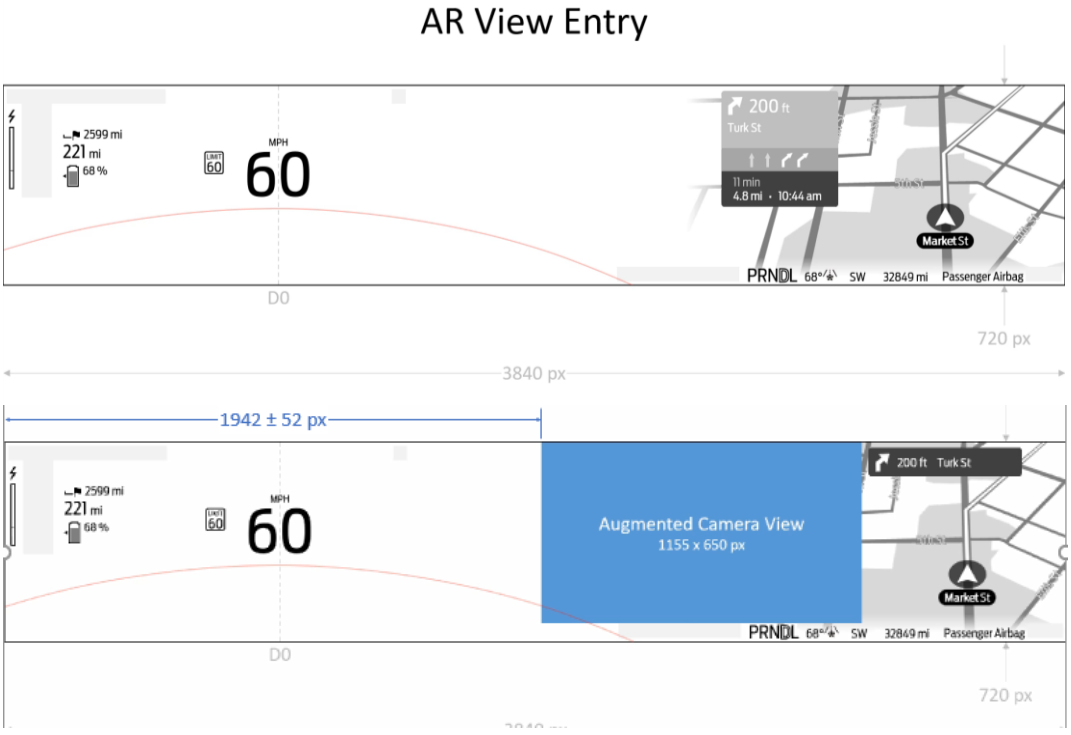
The APIM_CDC shall hide all AR view if Global Alert (in the LINE OF SIGHT location of the display) and Warning messages (in the PERIPHERAL location of the display) is triggered.

End of Requirement

###R_CMP_AR_00078### APIM_CDC Display Control

The APIM_CDC shall receive the requested start or stop display AR video from ARM and respond as below:

a- Start showing the video received from ARM on HHDD when (ARVidTrgr_B_Rq=0x01).
b- Stop showing the video when (ARVidTrgr_B_Rq=0x00).
c- Coordinate the fade in and out transition between AR video and 2D map as shown below.
d- Coordinate the AR video with 2D MAP voice prompt.



End of Requirement

###R_CMP_AR_00079### APIM_CDC HMI Settings

The APIM_CDC shall have the following settings (see HMI requirements in Feature Document) :

a- AR ON/OFF.
b- Video background select Enable/Disable.
c- Lane Low visibility ON/OFF.
d- AR Camera fault text message
e- FIR Camera fault text message

End of Requirement

5.2.3 DAT

5.2.3.1 Technology Function “Provide DAT Data”

5.2.3.1.1 Function Interfaces

5.2.3.1.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*

Table 5-38: Input Signal mappings of Function “Provide DAT Data”

5.2.3.1.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
Current lane position/direction	ServiceLaneData ServicePredPathDataService CBZData ServiceInPathData ServiceLightsData ServiceSignData		Ethernet	
Ego vehicle in-lane offset				
HD lanes block				
Lane markings type				
Height Map/Elevation				
Target lane position/direction				
Object collision warning signal	ServicePedestrianData ServiceRoadTargetsData		Ethernet	
Distance to object				
Object position				
Object size				
BLIS_Right_Status	SodAlrtRight_D_Stat		FD3-CAN	
BLIS_Left_Status	SodAlrtLeft_D_Stat		FD3-CAN	

Table 5-109: Output Signal mappings of Function “Provide DAT Data”

5.2.3.1.1.3 Parameters

Logical Parameter Name	Technical Parameter Name	Mapping Details *(Conditional)*	Method	Method Details

Table 5-110: Parameter mappings of Function "Provide DAT Data"

5.2.3.1.1.4 Interface Requirements

###R_CMP_AR_00067### IPMA(ADAS) Ethernet Interface to ARM

The IPMA shall communicate with ARM on Ethernet (SOA) interface through ECG.

End of Requirement

###R_CMP_AR_00068### IPMA(ADAS) CAN Interface to ARM

The IPMA shall communicate with ARM on CAN bus through ECG.

End of Requirement

5.2.3.1.2 Function Requirements

All Function Requirement related to Provide DAT Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	Requirement Title	Modification	Requirement ID (of Technology Function)	Comment
R_CMP_AR_00027		Added		
R_CMP_AR_00028		Added		
R_CMP_AR_00029		Added		

Table 5-41: Component Specific Requirements

Requirement ID (of Logical Function)	Requirement Title	Comment
…		

Table 5-42: Inherited Requirements

5.2.3.1.2.1 Component Specific Requirements

###R_CMP_AR_00027### Required DAT Signals Latency

The signal latency shall be ≤ (25) ms.

End of Requirement

###R_CMP_AR_00028### DAT Signal Accuracy

Provide DAT Data function shall provide the polynomial signals (up to 50m) with the accuracy limits shown below

Δ guide#1 lat vs road < 100mm

Δ guide#1 long vs ego < 250mm

Δ guide#2 lat vs road < 150mm

Δ lead long vs marker < 250mm

Δ marker lat vs lead < 150mm

End of Requirement

###R_CMP_AR_00029### DAT Data Frequency

The DAT Data frequency shall be ≤ (25 ms / 5 Hz).

End of Requirement

5.2.4 TCU

5.2.4.1 Technology Function “Provide GNSS Data”

5.2.4.1.1 Function Interfaces

5.2.4.1.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*

Table 5-38: Input Signal mappings of Function “Provide GNSS Data”

5.2.4.1.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
Latitude	Location Services		Ethernet	
Longitude				
Height				
Moving direction				
Calculated speed				
VDOP				
HDOP				
PDO				

Table 5-129: Output Signal mappings of Function “Provide GNSS Data”

5.2.4.1.1.3 Parameters

Logical Parameter Name	Technical Parameter Name	Mapping Details *(Conditional)*	Method	Method Details

Table 5-130: Parameter mappings of Function "Provide GNSS Data"

5.2.4.1.1.4 Interface Requirements

###R_CMP_AR_00069### TCU Ethernet Interface to ARM

The TCU shall communicate with ARM on Ethernet (SOA) interface through ECG.

End of Requirement

5.2.4.1.2 Function Requirements

All Function Requirement related to Provide GNSS Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	Requirement Title	Modification	Requirement ID (of Technology Function)	Comment
R_CMP_AR_00030		Added		
R_CMP_AR_00031		Added		
R_CMP_AR_00032		Added		

Table 5-41: Component Specific Requirements

Requirement ID (of Logical Function)	Requirement Title	Comment
…		

Table 5-42: Inherited Requirements

5.2.4.1.2.1 Component Specific Requirements

###R_CMP_AR_00030### GNSS Data Latency

The GNSS Data latency shall be ≤ (100ms).

End of Requirement

###R_CMP_AR_00031### GNSS Data Accuracy

The GNSS Data accuracy shall be ≤ 1 m

End of Requirement

###R_CMP_AR_00032### GNSS Data Frequency

The GNSS Data frequency shall be ≤ (1000 msec / 1Hz).

End of Requirement

5.2.5 AR Camera

5.2.5.1 Technology Function “Provide AR Camera Data”

5.2.5.1.1 Function Interfaces

5.2.5.1.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*

Table 5-43: Input Signal mappings of Function “Provide AR Camera Data”

5.2.5.1.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
AR Video Feed			FPD-Link III	
AR Camera Gain			I2C	
AR Camera Integration Time			I2C	

Table 5-44: Output Signal mappings of Function “Provide AR Camera Data”

5.2.5.1.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-145: Parameter mappings of Function “Provide AR Camera Data”

5.2.5.1.1.4 Interface Requirements

###R_CMP_AR_00034### AR Camera Data Port

The AR Camera shall provide the video feed on FPD-Link III to ARM.

End of Requirement

5.2.5.1.2 Function Requirements

All Function Requirement related to Provide AR Camera Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	**Requirement Title**	**Modification**	**Requirement ID** (of Technology Function)	**Comment**
R_CMP_AR_00033		Added		
R_CMP_AR_00034		Added		
R_CMP_AR_00035		Added		
R_CMP_AR_00036		Added		
R_CMP_AR_00037		Added		

Table 5-46: Component Specific Requirements

Requirement ID (of Logical Function)	**Requirement Title**	**Comment**
…		

Table 5-47: Inherited Requirements

5.2.5.1.2.1 Component Specific Requirements

###R_CMP_AR_00033### AR Camera ID

The AR Camera shall provide a unique ID to ARM

End of Requirement

###R_CMP_AR_00035### AR Camera Data Parameters

The AR camera shall provide the Input video feed to the ARM according to the following parameters:

- Resolution: 1920px x 1080px
- FoV: ~99.6 degrees H x 54.6 degrees V (+- 3 degree angular tolerance)
- Frame Rate = 30 Hz
- RGB visible image data
- Gain
- Integration time

End of Requirement

###R_CMP_AR_00036### AR Camera Data Fault Conditions

The AR camera shall provide fault conditions (No Signal, Short Circuit, Open Circuit, Missing Video Signal, and Frozen Image) to the ARM.

End of Requirement

###R_CMP_AR_00037### AR Camera Data Latency

The AR Camera Data latency shall be ≤ (10ms).

End of Requirement

###R_CMP_AR_00079### AR Camera Packaging

The AR Camera shall be packaged as below:

a) Within a 6-inch distance to the DAT (FWC) camera
b) Within a 5% FOV to the DAT (FWC) camera.
c) AR camera misalignment in the vehicle do to mechanical tolerances shall be:
   Roll < ± 2.0 degrees
   Pitch < ± 1.0 degrees
   Yaw < ± 2.0 degrees

End of Requirement

5.2.6 FIR Camera

5.2.6.1 Technology Function “Provide FIR Camera Data”

5.2.6.1.1 Function Interfaces

5.2.6.1.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*

Table 5-48: Input Signal mappings of Function “Provide FIR Camera Data”

5.2.6.1.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
FIR Video Feed			FPD-Link III	

Table 5-49: Output Signal mappings of Function “Provide FIR Camera Data”

5.2.6.1.1.3 Parameters

Logical Parameter Name	Technical Parameter Name	Mapping Details *(Conditional)*	Method	Method Details

Table 5-50: Parameter mappings of Function "Provide FIR Camera Data"

5.2.6.1.1.4 Interface Requirements

###R_CMP_AR_00039### AR FIR Camera Port – if Vehicle is equipped with FIR Camera

The FIR Camera shall provide the Input video feed on LVDS FPD-Link III to ARM.

End of Requirement

5.2.6.1.2 Function Requirements

All Function Requirement related to Provide FIR Camera Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	Requirement Title	Modification	Requirement ID (of Technology Function)	Comment
R_CMP_AR_00038		Added		
R_CMP_AR_00039		Added		
R_CMP_AR_00040		Added		
R_CMP_AR_00041		Added		
R_CMP_AR_00042		Added		

Table 5-151: Component Specific Requirements

Requirement ID (of Logical Function)	Requirement Title	Comment
…		

Table 5-52: Inherited Requirements

5.2.6.1.2.1 Component Specific Requirements

###R_CMP_AR_00038### FIR Camera ID

The FIR Camera shall provide a unique ID to ARM

End of Requirement

###R_CMP_AR_00040### AR FIR Camera Parameters if Vehicle is equipped with FIR Camera

The FIR Camera shall provide the Input video feed to the ARM according to the following parameters:

- Resolution: 640 x 368 px
- Frame Rate = 30 Hz
- FoV: ~65±5°H x 47.5±5°V
- Black and white thermal image data
- FIR thermal data from camera. Images appear in grayscale based on thermal signature.
- pixel clock 12.5MHz
- data rate(FWD channel) = (bits_per_pixel, assuming dual stream)*(frame resolution)*(FPS) = (8+14)*(640*468)*30 = 155443200 bits per second
- data rate(BWD channel) = I2C in 1Mhz
- data format RAW 8/RAW 14
- number of bits RAW 8= 8bits, RAW 14= 14bits

End of Requirement

###R_CMP_AR_00041### AR FIR Camera Fault Conditions if Vehicle is equipped with FIR Camera

The FIR camera shall provide fault conditions (No Signal, Short Circuit, Open Circuit, Missing Video Signal, and Frozen Image) to the ARM.

End of Requirement

###R_CMP_AR_00042### FIR Camera Data Latency

The FIR Camera Data latency shall be ≤ (10ms).

End of Requirement

###R_CMP_AR_00080### FIR Camera Packaging

The FIR Camera shall be packaged as below:

a) Within 6" in X and Y, and 2" in depth maximum separation to the AR camera for full blending AR vs FIR images, if the packaging of FIR allows that (Note- this is Not the current case for FIR camera in CDX747)
b) If AR and FIR Camera packaging not within full blending, the FIR camera shall be packaged TBD distance to allow for partial/selective blending.
c) FIR camera misalignment in the vehicle due to mechanical tolerances shall be:
   Roll < ± 2.0 degrees
   Pitch < ± 1.0 degrees
   Yaw < ± 2.0 degrees

End of Requirement

5.2.7 Phoenix Domain Controller-IPC

5.2.7.1 Technology Function “Provide Vehicle Data”

5.2.7.1.1 Function Interfaces

5.2.7.1.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*

Table 5-58: Input Signal mappings of Function “Provide Vehicle Data”

5.2.7.1.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
Vehicle Data	FuelLvlWarn_D_Actl		HS3-CAN	
	Veh_V2_Dsply		HS3-CAN	
	MetricActv_B_Dsply		HS3-CAN	

Table 5-59: Output Signal mappings of Function “Provide Vehicle Data”

5.2.7.1.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-60: Parameter mappings of Function “Provide Vehicle Data”

5.2.7.1.1.4 Interface Requirements

###R_CMP_AR_00070### IPC CAN Interface to ARM

The Phoenix Domain Controller-IPC shall communicate with ARM on CAN bus.

End of Requirement

5.2.7.1.2 Function Requirements

All Function Requirement related to Provide Vehicle Data from Function Specification (ID_F003774) are Required.

Requirement ID	**Requirement Title**	**Modification**	**Requirement ID**	**Comment**

(of Logical Function)			(of Technology Function)	
R_CMP_AR_00043		Added		
R_CMP_AR_00044		Added		

Table 5-61: Component Specific Requirements

Requirement ID (of Logical Function)	**Requirement Title**	**Comment**
…		

Table 5-162: Inherited Requirements

5.2.7.1.2.1 Component Specific Requirements

###R_CMP_AR_00043### IPC Data Latency

The IPC Data latency shall be ≤ (1000ms).

End of Requirement

###R_CMP_AR_00044### IPC Data Frequency

The IPC Data frequency shall be ≤ (1000ms)

End of Requirement

5.2.8 BCM

5.2.8.1 Technology Function “Provide Vehicle Data”

5.2.8.1.1 Function Interfaces

5.2.8.1.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*

Table 5-63: Input Signal mappings of Function “Provide Vehicle Data”

5.2.8.1.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
Vehicle Data	Ignition_Status		FD1-CAN	
	Remote_Start_Status		FD1-CAN	
	Parklamp_Status		FD1-CAN	
	Day_Night_Status		FD1-CAN	
	Litval		FD1-CAN	
	Dimming_Lvl		FD1-CAN	
	CrashEvnt_D_Stat		FD1-CAN	
	FogLghtFrontOn_B_Stat		FD1-CAN	

Table 5-64: Output Signal mappings of Function "Provide Vehicle Data"

5.2.8.1.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-65: Parameter mappings of Function "Provide Vehicle Data"

5.2.8.1.1.4 Interface Requirements

###R_CMP_AR_00071### BCM CAN Interface to ARM

The BCM shall communicate with ARM on CAN bus through ECG.

End of Requirement

5.2.8.1.2 Function Requirements

All Function Requirement related to Provide Vehicle Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	**Requirement Title**	**Modification**	**Requirement ID** (of Technology Function)	**Comment**
R_CMP_AR_00045		Added		
R_CMP_AR_00046		Added		

Table 5-66: Component Specific Requirements

Requirement ID (of Logical Function)	**Requirement Title**	**Comment**
…		

Table 5-177: Inherited Requirements

5.2.8.1.2.1 Component Specific Requirements

###R_CMP_AR_00045### BCM Data Latency

The BCM Data latency shall be ≤ (1000ms).

End of Requirement

###R_CMP_AR_00046### BCM Data Frequency

The BCM Data frequency shall be ≤ (1000ms).

End of Requirement

5.2.9 ABS

5.2.9.1 Technology Function “Provide Vehicle Data”

5.2.9.1.1 Function Interfaces

5.2.9.1.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*

Table 5-68: Input Signal mappings of Function “Provide Vehicle Data”

5.2.9.1.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
Vehicle Data	VehOverGnd_V_Est		FD1-CAN	
	VehYawComp_W_Actl		FD1-CAN	
	VehRolComp_W_Actl		FD1-CAN	
	VehLatComp_A_Actl		FD1-CAN	
	VehLongComp_A_Actl		FD1-CAN	
	WhlFl_W_Meas		FD1-CAN	
	WhlFr_W_Meas		FD1-CAN	
	WhlRl_W_Meas		FD1-CAN	
	WhlRr_W_Meas		FD1-CAN	

Table 5-69: Output Signal mappings of Function "Provide Vehicle Data"

5.2.9.1.1.3 Parameters

Logical Parameter Name	Technical Parameter Name	Mapping Details *(Conditional)*	Method	Method Details

Table 5-70: Parameter mappings of Function "Provide Vehicle Data"

5.2.9.1.1.4 Interface Requirements

###R_CMP_AR_00072### ABS CAN Interface to ARM

The ABS shall communicate with ARM on CAN bus through ECG.

End of Requirement

5.2.9.1.2 Function Requirements

All Function Requirement related to Provide Vehicle Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	Requirement Title	Modification	Requirement ID (of Technology Function)	Comment
R_CMP_AR_00047		Added		
R_CMP_AR_00048		Added		

Table 5-71: Component Specific Requirements

Requirement ID (of Logical Function)	Requirement Title	Comment
…		

Table 5-72: Inherited Requirements

5.2.9.1.2.1 Component Specific Requirements

###R_CMP_AR_00047### ABS Data Latency

The ABS Data latency shall be ≤ (10ms).

End of Requirement

###R_CMP_AR_00048### ABS Data Frequency

The ABS Data frequency shall be ≤ (20ms (50 Hz)).

End of Requirement

5.2.10 PSCM

5.2.10.1 Technology Function “Provide Vehicle Data”

5.2.10.1.1 Function Interfaces

5.2.10.1.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*

Table 5-73: Input Signal mappings of Function “Provide Vehicle Data”

5.2.10.1.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*
Vehicle Data	StePinComp_An_Est		FD3-CAN	
	StePinCompAnEst_D_Qf		FD3-CAN	

Table 5-74: Output Signal mappings of Function “Provide Vehicle Data”

5.2.10.1.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-75: Parameter mappings of Function “Provide Vehicle Data”

5.2.10.1.1.4 Interface Requirements

###R_CMP_AR_00073### PSCM CAN Interface to ARM

The PSCM shall communicate with ARM on CAN bus through ECG.

End of Requirement

5.2.10.1.2 Function Requirements

All Function Requirement related to Provide Vehicle Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	Requirement Title	Modification	Requirement ID (of Technology Function)	Comment
R_CMP_AR_00049		Added		
R_CMP_AR_00050		Added		

Table 5-76: Component Specific Requirements

Requirement ID (of Logical Function)	Requirement Title	Comment
…		

Table 5-77: Inherited Requirements

5.2.10.1.2.1 Component Specific Requirements

###R_CMP_AR_00049### PSCM Data Latency

The PSCM Data latency shall be ≤ (20ms).

End of Requirement

##R_CMP_AR_00050### PSCM Data Frequency

The PSCM Data frequency shall be ≤ (20ms (50 Hz)).

End of Requirement

5.2.11 SCCM

5.2.11.1 Technology Function “Provide Vehicle Data”

5.2.11.1.1 Function Interfaces

5.2.11.1.1.1 Inputs

Logical Signal Name	Technical Signal Name	Mapping Details *(Conditional)*	Subscriber Interface	Connection (*Optional)*

Table 5-78: Input Signal mappings of Function “Provide Vehicle Data”

5.2.11.1.1.2 Outputs

Logical Signal Name	Technical Signal Name	Mapping Details *(Conditional)*	Publisher Interface	Connection *(Optional)*
Vehicle Data	TurnLghtSwtch_D_Stat		FD3-CAN	

Table 5-79: Output Signal mappings of Function "Provide Vehicle Data"

5.2.11.1.1.3 Parameters

Logical Parameter Name	Technical Parameter Name	Mapping Details *(Conditional)*	Method	Method Details

Table 5-80: Parameter mappings of Function "Provide Vehicle Data"

5.2.11.1.1.4 Interface Requirements

###R_CMP_AR_00074### SCCM CAN Interface to ARM

The SCCM shall communicate with ARM on CAN bus through ECG.

End of Requirement

5.2.11.1.2 Function Requirements

All Function Requirement related to Provide Vehicle Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	Requirement Title	Modification	Requirement ID (of Technology Function)	Comment
R_CMP_AR_00051		Added		
R_CMP_AR_00052		Added		

Table 5-81: Component Specific Requirements

Requirement ID (of Logical Function)	Requirement Title	Comment

Table 5-82: Inherited Requirements

5.2.11.1.2.1 Component Specific Requirements

###R_CMP_AR_00051### SCCM Data Latency

The SCCM Data latency shall be ≤ (1000 ms).

End of Requirement

##R_CMP_AR_00052### SCCM Data Frequency

The SCCM Data frequency shall be ≤ (1000ms).

End of Requirement

5.2.12 PDB

5.2.12.1 Technology Function “Turn ARM OFF”

5.2.12.1.1 Function Interfaces

5.2.12.1.1.1 Inputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Subscriber Interface**	**Connection** (*Optional)*
Turn AR ECU OFF	AugRealtyMdule_B_Rq		HS3-CAN	

Table 5-78: Input Signal mappings of Function “Turn ARM OFF”

5.2.12.1.1.2 Outputs

Logical Signal Name	**Technical Signal Name**	**Mapping Details** *(Conditional)*	**Publisher Interface**	**Connection** *(Optional)*

Table 5-79: Output Signal mappings of Function “Turn ARM OFF”

5.2.12.1.1.3 Parameters

Logical Parameter Name	**Technical Parameter Name**	**Mapping Details** *(Conditional)*	**Method**	**Method Details**

Table 5-80: Parameter mappings of Function “Turn ARM OFF”

5.2.12.1.1.4 Interface Requirements

###R_CMP_AR_00075### PDB CAN Interface to ARM

The PDB shall communicate with ARM on CAN bus through ECG.

End of Requirement

5.2.12.1.2 Function Requirements

All Function Requirement related to Provide Vehicle Data from Function Specification (ID_F003774) are Required.

Requirement ID (of Logical Function)	**Requirement Title**	**Modification**	**Requirement ID** (of Technology Function)	**Comment**

Table 5-81: Component Specific Requirements

Requirement ID (of Logical Function)	**Requirement Title**	**Comment**
…		

Table 5-82: Inherited Requirements

5.2.12.1.2.1 Component Specific Requirements

###R_CMP_AR_00076### PDB to Power ON ARM

The PDB shall power ON ARM if the latest known Key OFF Load (KOL) is in Normal or Factory Mode following the table below.

3.4.5 Determine KOL Mode

KOL_Mode is a simple combination of Ignition_Status, LifeCycMde_D_Actl and Sleep_Mode.

Rqm't Num.	Ignition_Status	LifeCycMde_D_Actl	Sleep_Mode	KOL_Mode
R: 3.4.2-1	RUN | START | ACC	Don't care	Don't care	NORMAL
R: 3.4.2-2	OFF	FACTORY	Don't care	FACTORY
R: 3.4.2-3	OFF	TRANSPORT	Don't care	TRANSPORT
R: 3.4.2-4	OFF	NORMAL	NORMAL	NORMAL
R: 3.4.2-5	OFF	NORMAL	HIBERNATE	HIBERNATE
R: 3.4.2-6	OFF	NORMAL	CRITICAL_BATT	CRITICAL_BATT

End of Requirement

###R_CMP_AR_00077### PDB to Power OFF ARM

The PDB shall power OFF ARM if AugRealtyMdule_B_Rq=0x00 is received from ARM or after (TBD)sec from ignition status OFF.

End of Requirement

5.3 Requirements on Connections

5.3.1 Networks

5.3.1.1 “CAN Bus xxx”

5.3.1.1.1 Protocol Requirements

5.3.1.1.2 Electrical Requirements

5.3.1.2 “LIN Bus xxx”

5.3.1.2.1 Protocol Requirements

5.3.1.2.1.1 Schedule Table

5.3.1.2.2 Electrical Requirements

5.3.1.3 “Ethernet xxx”

5.3.2 HW I/Os

5.3.2.1 “HW I/O xxx”

5.4 Requirements on Development Process

6 OPEN CONCERNS

ID	Concern Description	e-Tracker Reference	Status	Solution
1	AR Camera SNR value of **TBD** dB with a tolerance of **TBD** dB		Open	
2	All Navigation signals		Open	
3	Timer to shot of ARM by PDB		Open	
4	Text size shall change with distance to target as long as it is within Regulation (TBD)		Open	
5	All Voice Commands		Open	

Table 6-1: Open Concerns

7 REVISION HISTORY

Revision	Date	Description	Approved by	Responsible
1.0	4/21/2021	Initial Release		mabdelh1

1.1	7-12-2021	The following section were updated on the document:
		• 3.1 Functional Architecture.
		• 3.2 Physical Architecture.
		• 3.3 Function Deployment
		• 4.1 Component Interaction Diagrams
		• 5.2 Requirements on Components:
		  ○ Deleted/replaced requirement- #4, #22.
		  ○ Modified requirements: #1, #7, #8, #9, #10, #13, #16, #17, #23, #24, #25, #29, #30, #35, #40.
		  ○ New Requirements: #53, , #54, #55, #56, #57, #58, #59, #60, #61, #62, #63, #64, #65, #66, #67, #68, #69, #70, #71, #72, #73, #74, #75, #76, #77, #78, #79, #80, #81, #82.
		• 6 Open Concerns
		• 7 Revision History
				aalsamar

8 APPENDIX

8.1 Data Dictionary

8.1.1 Logical Signals

8.1.2 Logical Parameters

8.1.3 Technical Signals

###TSG_Augmented Reality_00001### AugRealtyFeat_B_Rq

Signal request to turn the feature ON or OFF. The user will select to turn the feature ON or OFF by a selection menu option through APIM screen or a voice command.

ASIL		QM
Init Default Value		<Default value after reset / initialization on sender side>
Encoding Type Name		<If you reuse an existing encoding type, fill in the Encoding Type Name here and delete fields below. Otherwise leave the Encoding Type Name field blank and fill in relevant fields below>
Note: An encoding is either discrete or continuous. Delete fields below which are not needed,		
Value (Continuous Encoding)	Min Value	
	Max Value	
	Resolution	
	Offset	
Value (Discrete Encoding)	0x0	AR Feature OFF
	0x1	AR Feature ON
	…	…
Unit		

###TSG_Augmented Reality_00002### VideoFeed_B_Rq

Signal request to select video feed source. The user will select the video feed from AR camera or keep it automatic based on certain camera parameters.

ASIL	QM
Init Default Value	<Default value after reset / initialization on sender side>
Encoding Type Name	<If you reuse an existing encoding type, fill in the Encoding Type Name here and delete fields below. Otherwise leave the Encoding Type Name field blank and fill in relevant fields below>

Note: An encoding is either discrete or continuous. Delete fields below which are not needed,		
Value (Continuous Encoding)	Min Value	
	Max Value	
	Resolution	
	Offset	
Value (Discrete Encoding)	0x0	Video Mode Disabled
	0x1	Video Mode Enabled
	…	
Unit		

###TSG_Augmented Reality_00003### LaneVisblLo_B_Rq

Signal request to turn the Lane Low Visibility feature ON or OFF. The user will select to turn the feature ON or OFF by a selection switch on steering wheel or a voice command.

ASIL	QM
Init Default Value	<Default value after reset / initialization on sender side>
Encoding Type Name	<If you reuse an existing encoding type, fill in the Encoding Type Name here and delete fields below. Otherwise leave the Encoding Type Name field blank and fill in relevant fields below>
Note: An encoding is either discrete or continuous. Delete fields below which are not needed,	
Value (Continuous Encoding)	Min Value
	Max Value
	Resolution
	Offset
Value (Discrete Encoding)	0x0
	0x1
	…
Unit	

0x0	Lane Low Visibility OFF
0x1	Lane Low Visibility ON
…	…

###TSG_Augmented Reality_00004### AugRealtyFeat_B_Stat

Augmented Reality ECU repot the feature status to the user through APIM to HHDD screen.

ASIL	QM
Init Default Value	<Default value after reset / initialization on sender side>
Encoding Type Name	<If you reuse an existing encoding type, fill in the Encoding Type Name here and delete fields below. Otherwise leave the Encoding Type Name field blank and fill in relevant fields below>

Note: An encoding is either discrete or continuous. Delete fields below which are not needed,		
Value (Continuous Encoding)	Min Value	
	Max Value	
	Resolution	
	Offset	
Value (Discrete Encoding)	**0x0**	AR Feature OFF
	0x1	AR Feature ON
Unit		unitless

###TSG_Augmented Reality_00005### ARVidMod_B_Stat

Augmented Reality ECU repot the video feed selection status to the user through APIM to HHDD screen.

ASIL		QM
Init Default Value		<Default value after reset / initialization on sender side>
Encoding Type Name		<If you reuse an existing encoding type, fill in the Encoding Type Name here and delete fields below. Otherwise leave the Encoding Type Name field blank and fill in relevant fields below>
Note: An encoding is either discrete or continuous. Delete fields below which are not needed,		
Value (Continuous Encoding)	Min Value	
	Max Value	
	Resolution	
	Offset	
Value (Discrete Encoding)	0x0	Video Mode Disabled
	0x1	Video Mode Enabled
	…	
Unit		

###TSG_Augmented Reality_00006### LaneVisblLo_B_Stat

Augmented Reality ECU repot the Lane Low Visibility select status to the user through APIM to HHDD screen.

ASIL		QM
Init Default Value		<Default value after reset / initialization on sender side>
Encoding Type Name		<If you reuse an existing encoding type, fill in the Encoding Type Name here and delete fields below. Otherwise leave the Encoding Type Name field blank and fill in relevant fields below>
Note: An encoding is either discrete or continuous. Delete fields below which are not needed,		
Value	Min Value	

(Continuous Encoding)	Max Value	
	Resolution	
	Offset	
Value (Discrete Encoding)	0x0	Lane Low Visibility OFF
	0x1	Lane Low Visibility ON
	…	…
Unit		

###TSG_Augmented Reality_00007### AugRealtyMdule_B_Rq

Augmented Reality ECU request the PDB to turn the ARM ECU OFF.

ASIL		QM
Init Default Value		<Default value after reset / initialization on sender side>
Encoding Type Name		<If you reuse an existing encoding type, fill in the Encoding Type Name here and delete fields below. Otherwise leave the Encoding Type Name field blank and fill in relevant fields below>
Note: An encoding is either discrete or continuous. Delete fields below which are not needed,		
Value (Continuous Encoding)	Min Value	
	Max Value	
	Resolution	
	Offset	
Value (Discrete Encoding)	0x0	ARM OFF
	0x1	ARM ON
	…	…
Unit		

###TSG_Augmented Reality_00007### ARVidTrgr_B_Rq

Augmented Reality ECU request the PDB to turn the ARM ECU OFF.

ASIL		QM
Init Default Value		<Default value after reset / initialization on sender side>
Encoding Type Name		<If you reuse an existing encoding type, fill in the Encoding Type Name here and delete fields below. Otherwise leave the Encoding Type Name field blank and fill in relevant fields below>
Note: An encoding is either discrete or continuous. Delete fields below which are not needed,		
Value	Min Value	
	Max Value	

(Continuous Encoding)	Resolution	
	Offset	
Value (Discrete Encoding)	0x0	Video Trigger OFF
	0x1	Video Trigger ON
	…	…
Unit		

8.1.3.1 GSDB Signals

8.1.3.2 HW I/Os

8.1.3.3 Diagnostic Interfaces

8.1.3.3.1 DTCs

###<DTC_<ID>>### <DTC Name>

<Some Description of the DTC.
Refer to VSEM document "Diagnostic Fault Coverage and DTC Numbers Design Consideration", what to fill into the attributes below>

Test Period Time	
Test Run Criteria,	
Enable Criteria (EC)	
Applicable	
FailureTypeBytes	
Test Period Time	
Test Run Criteria,	

8.1.3.3.2 DIDs

8.1.4 Technical Parameters

8.1.5 Mappings

8.1.6 Technical Interfaces

8.1.6.1 AIS Interfaces

8.1.6.1.1 Publisher Interfaces

8.1.6.1.2 Subscriber Interfaces

8.1.6.2 AUTOSAR Ports

8.1.7 Messages/APIs

8.1.7.1 CAN Bus “<Bus Name>”

###<MSG_MessageID### MessageName

CAN ID	Transmission Mode	Period	Signal Names	Transmitter(s)	Receiver(s)

8.1.7.2 LIN Bus “<Bus Name>”

8.1.7.3 AUTOSAR Interfaces

8.1.7.4 SOA Service Contracts

###<ServiceContractID>### Service Contract Name

<Service contract purpose/behavior>

Messaging Pattern	Frequency (For Data Broadcast Only)	Message Data Element(s) (Must Match GPB) or applicable CAN signal	Description of Data Element(s)	Topic Name
Choose an item.		GBP Data element / CAN Signal name 1	Detailed encoding of data element 1	
		…		
		GBP Data element / CAN Signal name 1	Detailed encoding of data element 3	

8.1.8 Encoding Types

Document ends here.